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PORTLAND CANAL MINING DIVISION.

PRELIMINARY REPORT BY

WM. FLEET ROBERTSON, Provincial Mineralogist.

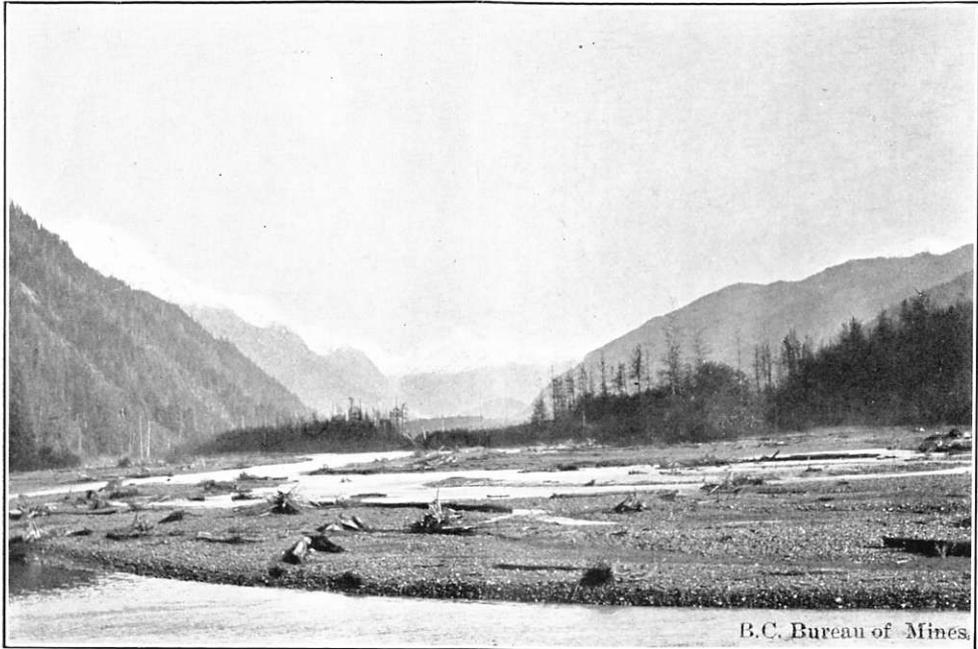
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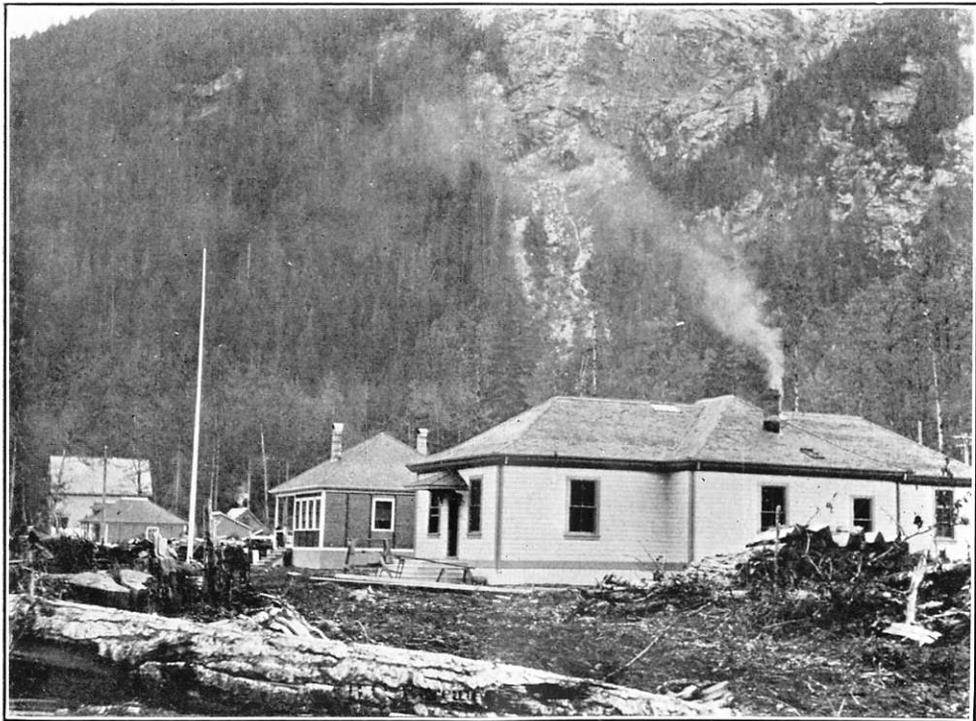


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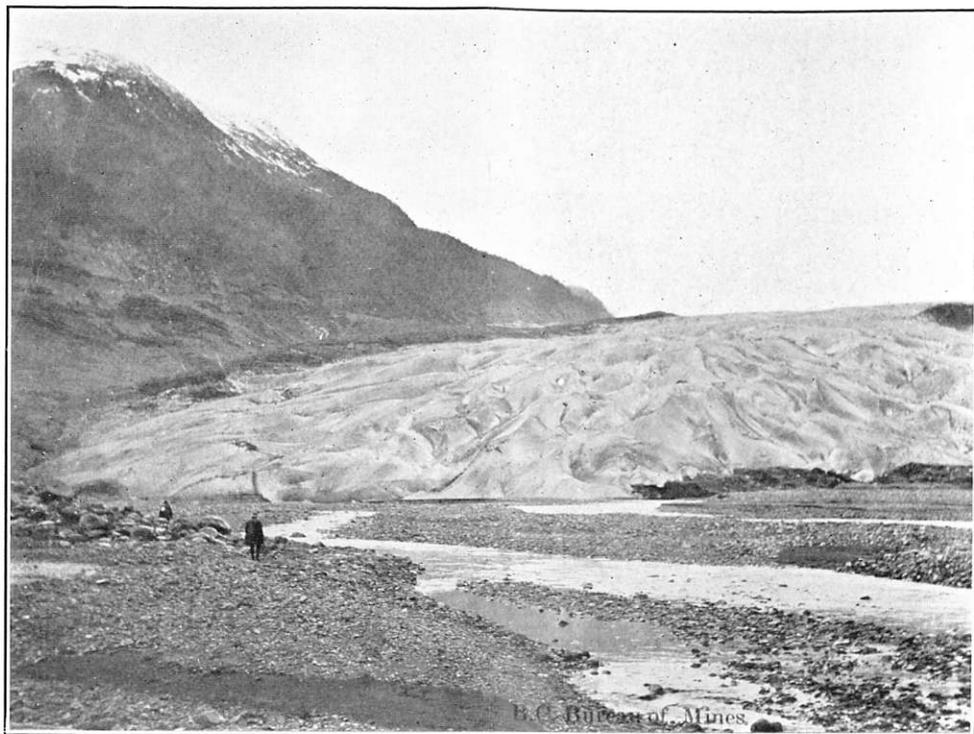


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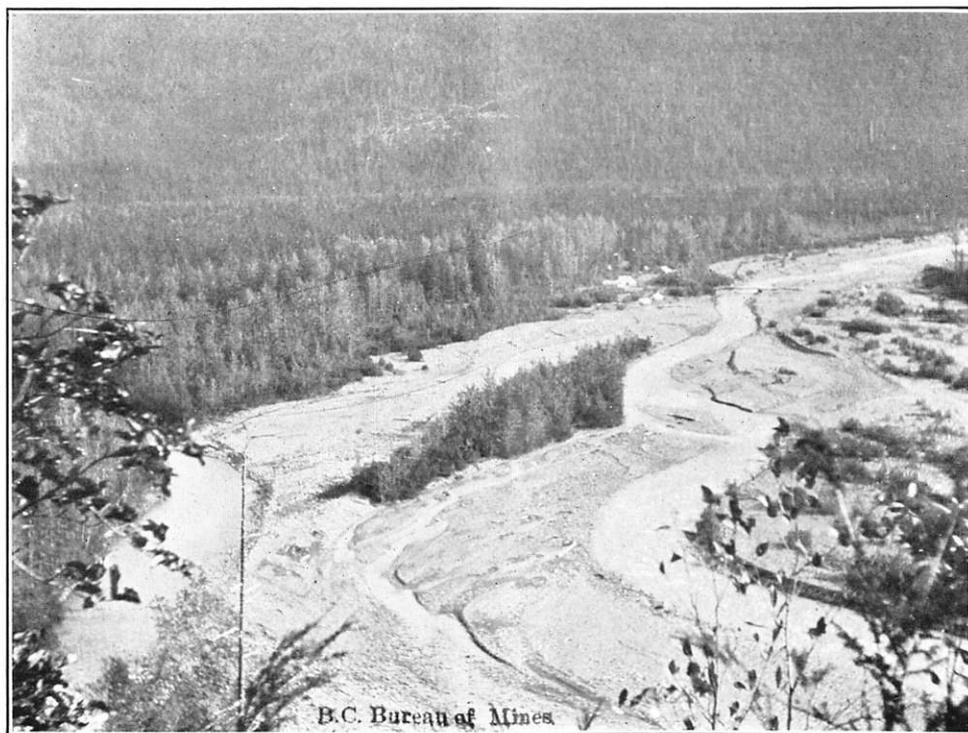
Looking up Bear River from bridge near Stewart.



B. C. Government Mining Recorder's Office and Court House—Stewart.



Foot of Glacier—the source of Bitter Creek.



Bitter Creek at junction of Bear River—from Mt. Dolly.

PORTLAND CANAL MINING DIVISION.

PRELIMINARY REPORT BY WM. FLEET ROBERTSON, PROVINCIAL MINERALOGIST.

The large number of mining claims staked and the amount of development and prospecting taking place in the district comprising the drainage area of the Portland canal influenced the Provincial Government in making this area into a separate mining division, subtracting it from the area formerly contained and included in the Skeena Mining Division.

The Portland Canal Mining Division came into legal existence by Order in Council on August 1st, 1910, with the Mining Recorder's office in the town of Stewart, at the head of Portland canal. The notice appearing in the Official Gazette of July 21st, 1910, gives the official description of the boundaries of the new Division, which may, however, be summarised as "the drainage area of all streams, in British Columbia, flowing into the Portland canal."

While the history of mining in the district only began this fall, prospecting has been going on steadily and quietly for ten or twelve years, and the district has been twice visited by the Provincial Assayer, whose reports have been published by this Department—the last in 1909—so that the writer confined his attention this season to seeing what had been done on the more developed claims and on those which report credited with more nearly approaching the production stage. The time available for the inspection was limited, and the season at which it had to be made—in October—was so late in the year that many of the claims at higher altitudes were covered with snow, while on others work had been temporarily abandoned for the winter, so that, but comparatively few of the many claims recorded and partially developed could be inspected; consequently this preliminary report must be taken, not as a complete review of the camp, but as an impression gained from a short visit and the inspection of a few claims.

The Portland Canal Camp cannot, as yet, be taken as proven, for, although some prospecting has been going on for years, the great majority of the claims have been staked within the past couple of years, and consequently have not and could not have had sufficient development done on them to prove their value. Only two or three of the older claims have done serious development, and of these, at least one property has shown by such that ore is present in quantity and quality sufficient to justify its being called a mine, and to guarantee extraction from present development for at least two years. On other properties where the actual development is slight, the work done by Nature has exposed such an amount of mineral as to give considerable hope for future development.

The camp contains a large number of properties from the prospect workings of which exceptionally high assays have been obtained, giving rise to unwarranted hopes and statements which cannot be borne out on a strict examination. The camp justifies reasonable expectations, for the development done, without exaggeration by well-intending though injudicious friends whose wild statements nearly "killed with kindness" the best endeavours of legitimate workers.

The reports circulated in the newspapers of a "mountain of gold" were of course unjustified and did the whole camp much harm, but apparently did not originate with the prospectors. There was, however, some small foundation for the reports; a very large ledge of quartz had been located, containing small gold values—the ledge is large and the values obtained justify further prospecting—that is all that is claimed for it by the locators.

Portland inlet and its inner extension, known as Portland canal, form a great continuous fiord or arm of the sea, extending from the Pacific ocean, at Dixon entrance, in a northerly direction for about 110 miles, and so almost penetrating the Coast range of mountains—a granite range which follows the entire coast-line of British Columbia, and extends northwards into Alaska. This is the only arm of the sea so cutting the mountain range, although the range is cut elsewhere by certain rivers flowing westward from the interior, notably the Stikine, Skeena, and Fraser rivers, the latter two having already been utilised as railway locations.

The Portland canal for its entire length forms the International boundary—the land to the westward belonging to Alaska, while that to the east is in British Columbia. From the head of the canal this boundary-line follows northerly along the summit of the range of mountains between the Bear and Salmon rivers for a distance of about ten miles, to Mount Dolly; thence striking in a north-westerly direction, crosses the Salmon river some 14 miles from its mouth, leaving the watershed of Bear river and of the headwaters of Salmon river in British Columbia, while the lower part of Salmon river is in Alaska.

The importance of this arm, from a mining point of view, is that it gives deep seawater navigation to, and so renders easily accessible, a district in which the granites of the Coast range came in contact with the sedimentary formations lying to the eastward and farther inland. This region of contact extends for the whole length of the Coast range and, from its geological features, forms a zone of *probable mineralisation*, as has been repeatedly pointed out in these reports and is here again emphasized.

That this conclusion—which is sometimes considered by the prospector as academic, but is really based upon the wide observations of geologists—is borne out by facts, is demonstrated on this eastern border of the Coast range by the mineral discoveries at White Horse and vicinity, in the Yukon, on Unuk river, as noted in reports of United States geologists; at Portland Canal Camp; on the Telkwa and the Zymoetz (Copper river) rivers and vicinity of Hazelton; at Tatlayoko lake, and, possibly, farther south in the Similkameen District and Steamboat mountain. None of these localities have been thoroughly prospected, all of them have shown good mineral prospects, many promise exceedingly well for the amount of development done, and a few have developed mines already.

The zone of contact on the western side of the Coast range is marked as mineralised by the Britannia Mine, at Howe sound; probably on Texada island and other islands between Vancouver Island and the mainland, but in the more northerly stretch of the British Columbia coast it is, for the most part, submerged by the ocean.

A second zone of contact, probably with another, although similar, and parallel granitic uplift, accounts for the mineralisation found on Vancouver Island and in the Queen Charlotte islands.

The steep-sided depression occupied by the Portland canal and its northerly extension of some twenty miles, the valley of Bear river, represents a tremendous earth-cleft, of which the Canal is to-day the submerged portion, while the Bear river valley has been recently, geologically speaking, filled in to its present level by the detritus from the numerous glaciers, formerly undoubtedly of enormous extent, but to-day represented by comparatively small remnants which head every creek and crown the surrounding hills.

The receding and diminishing of these ice-fields and glaciers, while traceable in many parts of the Province, is particularly noticeable in the Portland Canal district, possibly because more recent. The grinding effect of the ice-fields is in evidence over the whole district, and, with the help of other agencies of Nature, has so worn down the mountains that to-day but a remnant of the original uplift is left; and the present surface, with its veins and dykes, was not the surface at the time of formation, but represents a deep-seated irregular

section of the rock formations—how deep below the original surface is a matter of conjecture ; but certain it is that the present manifestation of vein formation represents only the deep-seated roots of the old veins, and that this cutting-down action has been so recent and continuous as to leave no surface zone of oxidation—a fact it would be well for prospectors, etc., from the South and Interior to note—although there may be a surface enrichment, particularly in gold, in some of the more porous veins or fissures of mineralisation.

The geology of the Bear River district may be generalised as follows, subject to certain exceptions and variations which will be fully demonstrated in the detailed map and report of Mr. R. G. McConnell, of the Geological Survey, who, with a party, spent the summer of 1910 in making a detailed geological study of the field.

The earth-cleft referred to as forming the valley of Bear river was probably accompanied by considerable movement, and, although the line of the cleft is covered by the valley filling, its effect is noted in the contrasting geological formation of the east and west sides of the valley.

The west side of the valley is essentially and fundamentally of plutonic and volcanic origin, granites on the lower part of the valley, changing to a dark igneous rock—probably a diabase—farther up the river and showing in the wash from the higher elevations, not visited, fragments of volcanic agglomerates.

This igneous mass has been but little cut by dykes, but the diabase is scamed in all directions by small stringers of white quartz, very sparsely mineralised, while at intervals more important east and west cross-fissurings occur, frequently quartz-filled, and sometimes important lenses or chutes of ore occur, as is demonstrated in several partially developed properties.

The geological formation of the east side of the valley is essentially and fundamentally an argillite, a sedimentary deposit, cut by intrusions of greenstone, and numerous dykes, both basic and acidic, are in evidence, the former being the larger and more plentiful, and seemingly the older, the latter the more recent—apparently in places cutting the older dykes, and also the vein-fissures ; these latter are probably connected in some way with an underlying granitic batholith, and seemingly are associated with the silicification which is apparently responsible for the mineralisation found. The dyke systems and lines of fissuring on the east side of the valley seem to nearly conform to the bedding planes of the argillite, and have a course approximately north and south, or roughly parallel with Bear river valley.

This generalisation applies to the valley of the Bear river below American creek, whether it will be found applicable to the country back of the first range of hills and surrounding the heads of the smaller tributary streams, at altitudes of from 3,000 to 4,000 feet, cannot be stated from personal observation.

On this eastern slope the, at present, more important properties, such as the Portland Canal Mining Company, the *Stewart, Main Reef, Jumbo*, and many others, lying south of Bitter creek, seem to be all located upon the one general zone of fissuring, which is continuous for at least four or five miles, and in this the veins are found. Sometimes the vein formation is represented by a single quartz vein, while farther along it presents four or more veins ; the transition from one to more veins is not shown by the work done, nor yet is it exposed by the valley of Glacier creek, which cuts across and into the formation to a depth of some 1,500 feet, although the latter does demonstrate the veins to continue to that depth. At the present stage of prospecting and development this one main zone of fissuring seems to contain all the more important ore showings, although it is premature to conclude that it is the only zone on this hillside.

While this general fissure continues, as stated, for such a great distance, and the vein formation in it is at least seemingly nearly continuous, as far as demonstrated, the veins being

more or less mineralised throughout, still it does not follow that for all this distance the mineralisation is sufficiently intense to form profitable ore; such could not be expected and does not occur, but there are parts in these veins in which the amount of mineral in the vein occurs in sufficient quantity to render it workable ore. It is as yet too early in the development to say whether the ore occurs in chutes, chimneys, or some other form, but the tunnel workings of the Portland Canal Mining Company have demonstrated that the "pay-ore," first proved on the surface, extends downward along a defined "pitch" which would seem to mark the northern end of an ore-chute, while the tunnels have not as yet at their faces reached the limit of the body of "pay-ore" to the south. By the term "ore-chute" it is not intended to imply a body of solid ore, but a portion of the length of the vein sufficiently heavily mineralised to be profitably workable.

The chances are that mineralisation, generally similar in character, although varying as to quantity, occurs throughout this main fissure. The character of this mineralisation is best demonstrated by the actual extraction of the only producing mine—the Portland Canal Mining Company's—described later, and may be summarised briefly as iron-sulphides carrying gold and silver, galena carrying silver and some gold, and a small quantity of zinc-blende carrying small silver and still smaller gold values. These are essentially the ores upon which the values of the properties will probably be based, although, particularly in the upper or surface workings, specimens of exceedingly rich silver-sulphides and oxides, with also native silver and possibly gold, have been found.

In the opinion of the writer, this portion of the camp will be comparatively low-grade concentrating propositions from \$10 to \$20 ore, the high-grade minerals being difficult to concentrate and not sufficient in quantity to dispense with this process.

SHIPPING FACILITIES.

Seldom in British Columbia has the truth been so clearly demonstrated as at Stewart, that the value of an ore-body is dependent upon the facility of getting its contents to market, and still more seldom have the facilities been so quickly obtained. Portland canal affords a land-locked waterway by which any vessel may approach the town of Stewart, where the tidal mud-flats offer proper holding-ground for pile wharves; this has been taken advantage of, and a pile wharf, with a pile approach from the shore, a mile long, is now nearing completion; while a local railway company has built a splendid railway dock and approach, over a mile long, and has equipped it with standard-gauge tracks. The same company has about completed a railway grade up the valley of Bear river to the mouth of American creek—a distance of approximately fifteen miles—and could, should it desire to push matters, easily have the rails laid over this length before snow falls. A locomotive and a number of cars are now on the ground ready for use, and rails have been laid from the landing as far as the railway-station.

The valley of Bear river on the flat will average about half a mile wide, being rather more than this near its mouth; its course is nearly straight, and it rises at an almost uniform grade—about 500 feet in fifteen miles. The valley bottom is gravel, permitting of cheap railway construction, while the first nine miles of the railway-grade contains one tangent of four and a half miles in length and many shorter ones. The hills rise abruptly from the valley, affording the best of opportunities for aerial tramways, with ample room on the flat for requisite mill-sites.

The tributary streams are all too steep to admit of railway construction up them; an exception to this rule is, however, presented in Bitter creek, up which a railway might easily be built for a distance of from six to seven miles, or possibly to the foot of the glacier, with aerial tributaries from the side creeks. Bitter creek valley is really a branch extension of the

river valley, and is similarly filled with detritus from the glacier. The Provincial Government has built a waggon-road, with necessary bridges, from Stewart up the river valley, as far as and across Bitter creek, over which two stages travel daily each way. A further extension of this road as far up as American creek, including a bridge across Bear river, was under construction this autumn and promised to be completed before snow falls.

Steamer service is maintained from Seattle, Victoria, Vancouver, and Prince Rupert twice a week by the G. T. P. Railway, their fine boats having gone right through to Stewart during the summer months, but in the winter a transfer of passengers and freight is made at Prince Rupert to a small steamer, which serves as a tender to the larger ones. The Union S.S. Co. runs its steamer "Camosun" from Vancouver through to Stewart direct without transfer, making a round trip each week. Beside these regular steamers, several coasting and freight boats make Stewart a place of call but at irregular intervals.

TOWN OF STEWART.

The townsite of Stewart occupies the middle portion of the gravel flat at the head of the canal, and is platted to cover a considerable portion of the tidal flats which it is thought might eventually be filled in. The town contains three good hotels—much better than one would expect to find in so new a town—and innumerable boarding-houses; there are several exceedingly well-equipped and stocked stores supplying all the necessities and many of the luxuries of life and requisites for mining or prospecting. There are a number of office buildings occupied by brokers, real-estate agents, etc. The town has its own newspaper, two competent assayers, two doctors, and a well-equipped hospital. There are several good private houses and many temporary structures; but the population is as yet essentially composed of men who board out.

Of public buildings, there is the Provincial Government Mining Recorder's office, a Land Registry office, Court-house and lock-up. The Dominion Government maintains a post-office, and the town hopes soon to be connected with the outside world by telegraph, the Government now having a construction gang at work building a branch line of wire in from the Yukon line between Hazelton and Telegraph creek.

In addition to the Stewart townsite, the railway company has platted a townsite adjoining it on the east, where is located its depot and freight-sheds, etc.; the lots of this other townsite have not yet been placed on the market.

Interest in the Portland Canal Camp at present naturally centres in the operations of the Portland Canal Mining Company, N.P.L., since the development of this company's property is the furthest advanced and it is the only company as yet in a position to make shipments. The company is a local organization, with head office at Duncan, V. I., the president being Mr. C. H. Dickey, of Duncan. The capital of the company is \$1,000,000, divided into shares of a par value of 25 cents. The operations of the company at the property are in charge of Mr. W. J. Elmendorf as engineer and general manager, with Mr. N. C. Sheridan as mine superintendent, while Mr. Otto Abeling has been responsible for the construction and equipment of the concentrator. The company owns some twelve claims and fractions, viz.: *Gipsy, Extension, Herbert, Mayflower, Mosquito, Richard II., Barney, Sadie, Eclipse, Little Joe, Little Joe Fraction, and Lucky Seven*, all adjoining and situated on the hill forming the eastern slope of Bear river and the southern slope of Glacier creek valleys. Serious development work has as yet been confined to the *Lucky Seven* and *Little Joe* mineral claims.

As has already been noted, the mineralisation on these claims is along the line of a great fractured zone which runs in a general north and south direction, about parallel with Bear river, not only for the length of this group of claims, but continues, both to the north and

south, through a number of other claims. This zone is of variable and not clearly defined width, but is in places several hundred feet across, and runs through an argillite formation, conforming, at least very nearly, to both the strike and dip of the argillite. Within this zone the argillite has been more or less crushed, and presents, when cemented together by the quartz-vein matter, a brecciated mass. Within this zone there are a number of comparatively small felsitic dykes, running with the fissure, apparently injections after the formation of the fissure, and these dykes seem to be present wherever important mineralisation has taken place. Through this general zone of crushing, siliceous infiltration has taken place, the solution naturally following certain channels which the crushing had rendered more open—lines of least resistance to the flow of the solution—and these channels of silicification now form the quartz veins in which the mineral is found.

On the *Lucky Seven* and *Little Joe* the silicification seems to be confined to one main vein, as far as present development shows. In the earlier stages there were supposed to be two veins, but the management now considers the second vein as merely an offshoot of the main vein.

Mine.—The mine workings are at an elevation of about 2,400 feet above sea-level, and consist of three tunnels with connecting raises, as shown on accompanying plan.

The lowest, or No. 3 tunnel, is the working tunnel, the tramway therefrom going directly to the bunkers at the upper terminal of the aerial tramway. This tunnel, in October, 1910, was in about 500 feet, and follows in on the vein, which is mineralised all the way; but what is considered pay-ore was only struck at about 100 feet in, from which point it apparently continues to the face, although the tunnel in a couple of places seems, in the driving, to have run away from the ore. From this level a raise has been put up to the No. 2 tunnel, and this acts as an ore-chute from the upper levels.

The No. 2 tunnel is about 55 feet vertically higher than No. 3, the vein dipping at an angle of about 30 degrees, and was in about 200 feet, with a raise being put up to the No. 1 tunnel, and which, in October, was almost through. At about 25 feet in from the portal the tunnel entered on pay-ore, in which it has continued to the face.

The No. 1 tunnel is about 40 feet higher than No. 2, and has been driven about 180 feet and developing pay-ore for its entire length, the face being in such ore. At one point in the driving the tunnel was deflected to the right and ran out of the ore-chute, but, upon being brought back to the original course, picked up the ore again.

Above the No. 1 tunnel several open cuts, sunk on the outcrop, have disclosed pay-ore, indicating that this ore-chute continues for at least 350 feet to the south of the portal of No. 1 tunnel. The development work on this ore-chute, as stated, would seem to indicate an ore-chute at least 350 feet long, developed below the outcrops, along the plane of the vein for a distance of about 400 feet; the thickness of the pay-ore has been estimated by the management as averaging about 5 feet; this figure being, in the opinion of the writer, under the mark, rather than over it. Should the ore-chute prove to be as long in the tunnels as the open cuts directly above them seem to indicate, this would argue an amount of ore, from present development, sufficient to keep the present mill busy for three years. The faces of all the tunnels were found to be in ore which was apparently richer than the average of the ore-chute.

The monthly average assay for September of the face of No. 2 tunnel is reported as being: Gold, \$5.20; silver, 61 oz.; lead, 2.5 per cent.; and of face of No. 3 tunnel, about, gold, \$4; silver, 15 oz.; lead, 4 per cent. These values vary from month to month, and are quoted merely as an indication of the grade of ore met with.

The ore mined and milled consists of iron-sulphides and galena, both carrying gold and silver, with a small quantity of zinc-blende and occasionally some copper-pyrites, all contained in a quartz gangue and mixed with fragments of argillite.

Specimens of the higher sulphides and oxides of silver and of metallic silver are frequently seen in the vein in all the levels, and, though of interest, are not taken into account by the management, nor is any special attempt made to save them. The mine depends entirely on the iron-sulphides and galena for its ore values, which are stated to be in the neighbourhood of \$12 a ton of ore. The ore is conveyed from the mine to the mill by an aerial tramway of the Bleichart system.

All mining has as yet been hand drilling, but the company was engaged in laying, and had nearly completed, a pipe-line from the mill to the mine for the conveyance of compressed air, and when this is completed an equipment of power-drills will be installed in the mine. The compressor was on the ground all ready to be set up at the mill, where it will be driven by water-power.

The mine is provided with good and substantial cook- and bunk-houses and other buildings, including a house for the mine superintendent.

The development accomplished by the mine workings covers but a small part of the main fissure contained within the company's property, in other portions of which important surface showings of ore have been found, but these have, for the time being, been left dormant, pending the development in the mine workings.

Of these minor developments, one, however, deserves special mention; it is located some distance, about 1,000 feet, to the north of the mine workings and on the same vein, but, owing to the contour of the hill, at a considerable lower elevation, and is so situated that ore mined there could, with slight expense, be delivered to the present tramway for transmission to the mill. At this point the main vein outcrops strongly and is heavily mineralised; it is further developed by a short tunnel in which the mineralisation of the vein is satisfactory. This development would seem to indicate another ore-chute, easy of exploitation, but requires further development to show its extent and ultimate value; it, however, gives ground for the belief that between this point and the mine other ore-chutes will eventually be developed.

Mill.—The company had, in October, just about completed a concentrating-mill for the treatment of the ores from the mine; this mill is situated in the Bear river valley, at the mouth of Glacier creek, the lower terminal of the aerial tramway being some 2,200 feet lower than the upper terminal. The mill building is a substantially framed structure, sheathed with double boarding with paper between, built on the lowest slope of the hill. The mill consists of a receiving-chute capable of holding 75 tons of ore and a bin holding 175 tons. From this latter the ore is fed through a challenge gate to a 6-inch by 16-inch Sturtevant crusher, which reduces the ore to 1 inch size. The crusher discharges on to a rubber belt-conveyor, set with a slight fall, which conveys the ore to another bin holding 175 tons of crushed ore. From the crushed-ore bin the ore is fed by an Allis-Chalmers roll-feed automatic feeder to a set of slow-running Allis-Chalmers 12-inch by 24-inch rolls, from which it passes to No. 1 elevator, is thus raised to the top of the mill, and is discharged into a revolving trommel, with 5 mm. screen. The oversize from the trommel is returned by a chute to the second rolls, the discharge going to a second trommel which is fitted with two panels of 2 mm. screen and one panel of 3 mm. The oversize from this trommel goes direct to 5 mm. jig, and the 3 mm. screenings to the 3 mm. jig. The 2 mm. screenings go to a classifier, which separates out the 2 mm. and 1 mm. sizes, which go respectively to the 2 mm. and 1 mm. jigs, while the overflow passes on to four suspended iron conical settlers, which in turn distribute their product, the first to a Wilfley table, the second to an Overstrom table, and the third and fourth each to a Frue vanner. The overflow from these settlers passes on to a series of large settling-tanks on a lower floor. The middlings from the 5 and 3 mm. jigs go to the second, a finer, set of rolls; thence to the second elevator. The middlings from 1 and 2 mm. jigs go to a 10-foot Lane mill, and after recrushing, pass on to No. 2 elevator.

All these recrushed middlings are then elevated to the top of the mill and discharged into a third trommel, the oversize from which is returned for recrushing, and the screenings go to the classifier, so entering the process again. The tailings from all the jigs and tables, being sufficiently clean, go to the tailings-dump. The concentrates from the jigs and tables discharge by gravity into receiving-bins on the lower floor.

The capacity of the crushing, screening, and elevating part of the mill is 100 tons of ore a day; the installation of jigs and tables now in place is for 50 tons only, but provision has been made for doubling this as soon as it is required, so that, while now the mill as a whole has a nominal capacity of 50 tons, this could be doubled at a comparatively small expense. In the construction of the mill the very best and most efficient construction has been employed, and the machines are of the most modern type.

To accompany this report a flow sheet has been prepared to show graphically the process of concentration employed.

An electric-light dynamo to be driven by water-power was being installed, which would light the mill and other surrounding buildings.

Concentration effected.—The concentrating plant was only started about October 1st, and when visited by the writer, some ten days later, was only being “tuned up” on a low-grade feed, so that no definite final results as to the ultimate percentage of saving, the average assay of tailings, or the rate of concentration could be obtained. The work being done, therefore, represents only the “first try,” and, as this was good, better results may be expected after adjustment.*

The rate of concentration will be approximately from 3 to $3\frac{1}{2}$ tons of ore into 1 ton of concentrates; these concentrates consist of iron-sulphides and galena, collected separately, in what proportion is not yet definitely demonstrated, but a very clean separation between the two was being effected.

The tailings from each of the machines contained but small values in gold and silver, even with the incomplete adjustment, showing that the process was satisfactory, the separation of the mineral from the gangue being easily and very completely effected.

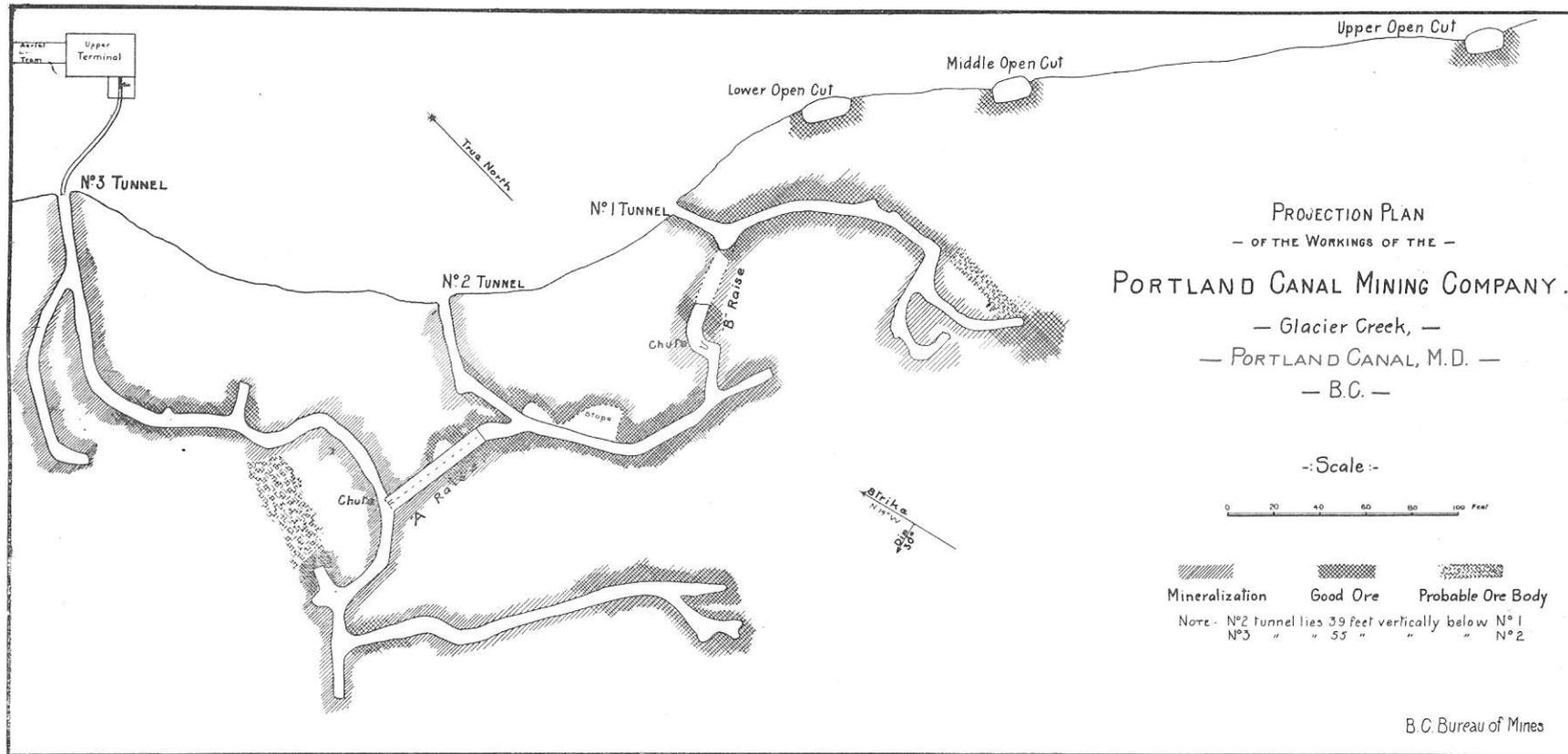
The separation on the Wilfley table was very nearly theoretically perfect, the lines of galena, iron-sulphides, zinc-blende, and tailings on the table being the most clearly defined that the writer has ever seen.

The concentrates being made, from the class of ore being experimented with, ran about as follows: Iron concentrates—gold, from \$8 to \$10; silver, 15 to 20 oz. per ton. Lead concentrates—gold, from \$8 to \$10; silver, from 35 to 45 oz. per ton; lead, from 65 to 75 per cent. No zinc concentrates are saved, as they were found by actual test to contain but low assay values in silver—about $1\frac{1}{2}$ oz. to the ton.

The slime-tanks were not at that time in operation, so that it is not as yet known whether any saving will be made of the small quantities of higher silver-sulphides and oxides which are visible occasionally in the ore and which, from their nature, would slime.

Power Plant.—The company owns a water record on Glacier creek which has been developed to supply all the power necessary for the mine and the mill. The water is taken out of the creek in a rocky canyon at the head of a fall, the intake being well protected by projecting rock from any drift-wood or drift-ice. The intake is for the first few feet in solid rock, when the water enters a flume 3 feet deep by 4 feet wide, built of 2-inch plank with battens, laid on a grade of 1-inch fall in 4 rods. From the intake to the pressure-box the flume

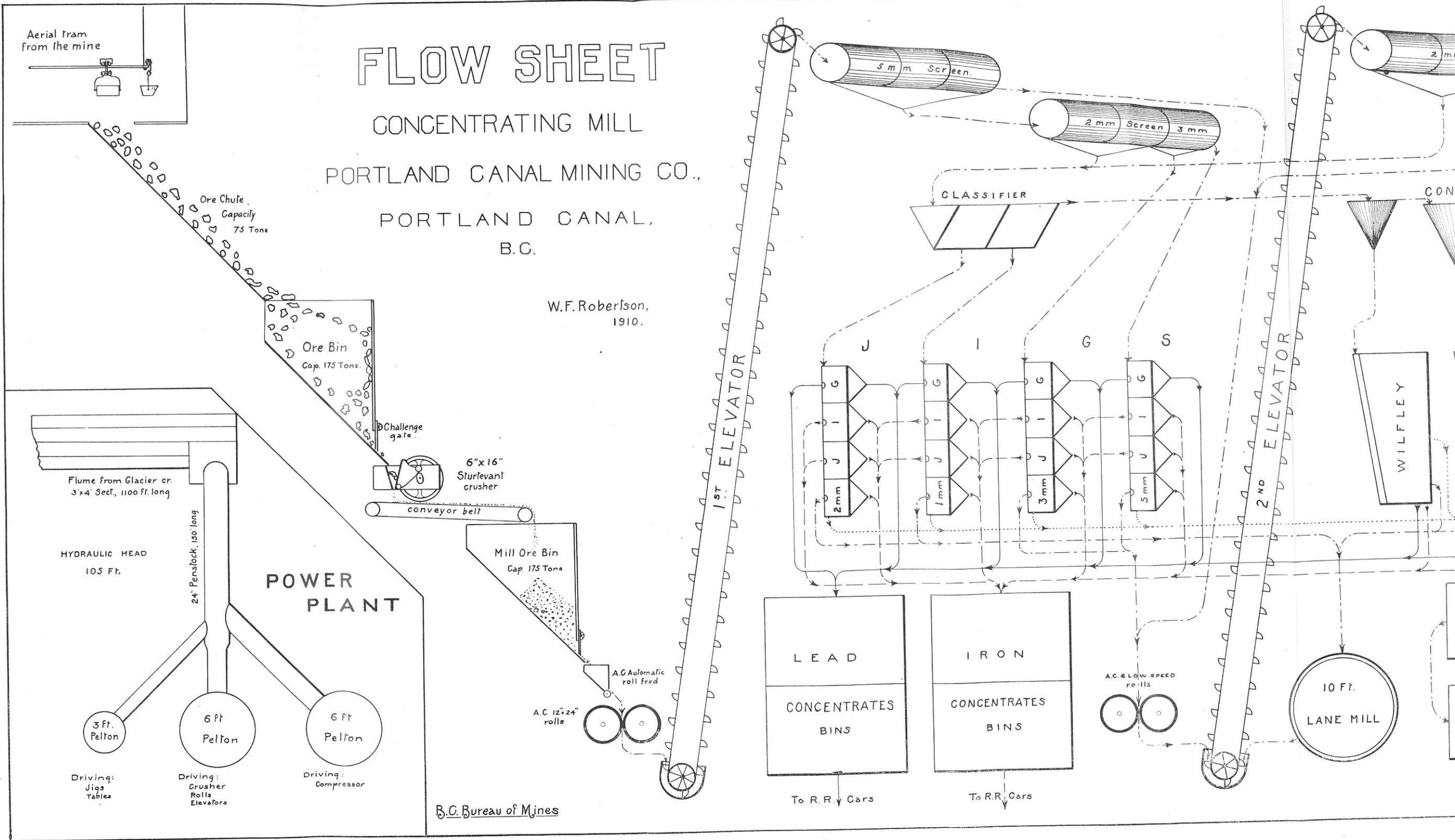
*A letter from the General Manager to the President of the Company, dated Nov. 22nd, received as this goes to press, places the mill feed at that time as about: Gold, \$3.00; silver, 14 oz. to the ton; lead, 3.7%—about \$13.00 ore. “Our extraction at this time is about 80%, but with the Lane mill in operation and several small changes, now completed, we will raise this to 85%, and I think ultimately to 87%.”



FLOW SHEET

CONCENTRATING MILL
PORTLAND CANAL MINING CO.,
PORTLAND CANAL,
B.C.

W.F. Robertson,
1910.



is 1,100 feet long; it follows down the north side of the creek for some distance, when it crosses over to the south side on a trestle 100 feet above the creek-bed. The pressure-box is 105 feet above the Pelton wheels, to which the water is conveyed in a wrought-iron penstock 24 inches in diameter and 150 feet long, with suitable branches and valves. The power is developed by two 6-foot and one 3-foot Pelton wheels. One 6-foot wheel drives the main counter-shaft from which is belted the crusher, rolls, Lane mill, and conveyors; the other 6-foot wheel was being held for the compressor. The 3-foot wheel was used exclusively for the jigs and tables, thereby obtaining a steady and constant motion for these machines.

Other Buildings.—The company has erected near the mill a large and very complete boarding-house, kitchen, dining-room, sitting-rooms, and bedrooms for the men; there is also a well-equipped laboratory building with rooms for the assayers. The office contains public and private office rooms and living quarters for the manager. Stable, blacksmith, and carpenter shops have been planned out and will be erected at an early date.

Transportation.—The Portland Canal Short Line Railway has laid out a spur from its main line to directly in front of the concentrator building, so that ore will eventually be loaded direct from the mill into the cars.

In addition to this, there is from the mill a good Government waggon-road to the town of Stewart, distant about three miles and a half; this road is practically level and has a good hard gravel bottom.

All supplies for the mine are received at the mill and taken up on the aerial tramway.

The mine office and various mill offices are connected by telephone and also with an office in Stewart.

The Stewart Mining & Development Company has eight or nine Stewart Mining & Development Co. claims on the north side of Glacier creek at an altitude of about 1,000 feet. The company has been at work for the past three years steadily developing its property by means of tunnels, etc. There has been a great deal of surface work done as well, but this becomes of secondary importance since the veins have been cut by the tunnel workings. There is little doubt but that the same general zone of crushing or fissure upon which the Portland Canal mine ore-body is located passes northward, through the intervening properties, into and through the Stewart claims. In such a crushed zone the mineral-bearing solutions would follow the lines of least resistance, and while in the Portland Canal property these solutions appear to have been confined to one channel, producing one vein, in the Stewart they appear to have produced four veins, all parallel as to strike, though not as to dip, and all contained within the zone of fracture, which here has a width of about 400 feet.

From Glacier creek northward, following the fracture zone, there are a couple of deep and precipitous-sided gulches extending up as far as the cabins of the Stewart Mining Company. In the sides of these gulches Nature has caused exposures of the veins, so that but little work had to be done to prove their general conditions. From the bottom of the deepest of these gulches, on the *George E.* claim, the company has driven a cross-cut tunnel to the east, into the bank, for a distance of about 300 feet, and in so doing has crosscut three veins, known locally, in order of sequence, as No. 1, No. 2, and No. 3 veins—the last being also called the “Green Vein” or “East Vein.” The No. 1 vein was struck at 50 feet in, and on this a drift was run to the right for 60 feet, but does not determine the full size of the fissure or vein, which, however, is more fully exposed in a series of cuts higher up the very steep hillside, and there seems to be a well-defined quartz vein, 2 feet to 4 feet wide, and dipping to the west at an angle of about 55 degrees. The vein contains some heavy sulphides of iron, carrying gold values, but no large body of ore has been encountered.

At 100 feet in from the portal of the tunnel the No. 2 vein was cut, and has been drifted upon for 60 feet on either side of the tunnel. The fissure of this No. 2 vein is from 6 to 7 feet wide, and shows a quartz infiltration and replacement of the fractured argillite carrying more or less mineral.

At 300 feet in from the portal, and 150 feet from No. 2 vein, the No. 3 vein was cut, and its general fissure is about 25 to 30 feet wide, while the dip is nearly vertical. On this vein a drift had been made to the right for 50 feet, while to the left one had been driven for 200 feet, and was still being pushed forward, receiving the greater part of the attention of the management; several crosscuts had been put off from the drift at various points to test the width of the fissure. This vein is similar in general character to the others, but in addition to the quartz-gangue matter there was apparent a considerable quantity of calcite. There were some heavy sulphides visible in the vein-matter, but no commercial body had as yet been struck. There were, however, numerous showings of native silver and of the higher silver-sulphides, which, although they gave great encouragement to the management, were not sufficiently plentiful to constitute ore.

On the west side of the gulch, directly opposite to the mouth of the crosscut tunnel already mentioned, No. 4 vein has been opened up by a tunnel driven in along the vein for some 200 feet. This is a large strong vein and seems to carry a greater percentage of heavy iron-sulphides than was then visible in any of the other veins. This vein dips to the west at a flatter angle than the other veins, and the mineralisation more nearly approaches in character that found on the Portland Company's property, giving rise to the belief that this vein is the continuation of the Portland vein. This belief, however, lacks definite confirmation, and it is not at all improbable but that all the veins are equally continuations of the Portland vein.

The *Little Wonder* mineral claim, being developed by the Portland Portland Wonder. Wonder Mining Company, is situated to the south of the eastern portion of the *George E.* claim of the Stewart Mining Company, and contains within its borders a continuation of the No. 3 vein of the Stewart, which here also is found dipping nearly vertical and is easily traced from the Stewart down Lucky gulch to the *Little Wonder* workings. These workings are only a short distance up the gulch from Glacier creek and at an altitude of 700 feet above sea-level; the No. 2 tunnel has been driven in for about 360 feet, of which the first 150 feet is through slide material. Practically all the work is now being done in this tunnel, from which a raise has been put up to the old workings on No. 1 tunnel.

The vein here is very similar to the same vein on the Stewart, but seems to have been subjected to a severe disturbance and crushing, subsequent to the formation and deposition of the ore in the vein, since small masses and lenses of solid iron-sulphide are encountered showing straight parallel striae, which have been crushed by movement into small lenses covered with "slicken-siding" and occurring in a mass of broken and polished graphitic argillite. This latter movement would appear to be local in character and has so disturbed the vein in the present workings that little can be definitely said about it, beyond the fact that the amount of solid sulphide present in the crushed vein-matter gives reasonable hope that when the crushed portion of the vein has been passed, a more than usual amount of sulphide ore may be looked for.

The development was being carried on by a force of eight men, with Mr. McCrimmon as foreman. Comfortable cabins had been erected, which would enable work to be carried on during the winter. On the dump at the mouth of the tunnel there was a pile containing a number of tons of solid sulphides of iron and lead, from which a rough sample was taken which assayed: Gold, \$16.80; silver, 19.4 oz. to ton; lead, 36.5 per cent.

The *Lulu* mineral claim lies south of the western portion of the *George E.* claim, and undoubtedly contains within its borders some of the veins developed on the Stewart property, but the development has not as yet proceeded far enough to demonstrate what they may there contain. A crosscut tunnel is being driven in from a small gulch, with the intention of crosscutting the ledges, and had proceeded some 180 feet.

BITTER CREEK.

Hartley gulch enters Bitter creek some eight or nine miles from its mouth and about a mile above the foot of the glacier, over which it is necessary to pass to reach the mouth of the gulch. On this gulch, about a mile up from the glacier, James Lydden and partners have staked a couple of groups of claims, the *Old Chum* group on the east side, and the *L. L. & H.* group on the west side of the gulch.

As yet very little work has been done on the properties, and they are only prospects with undetermined futures, but are of interest as indicating promising mineralisation in that vicinity; the great "gold reefs," of which so much has been written this past year, lie on the opposite side of Bitter creek, about two miles farther up. The country rock here is an argillite, somewhat altered and broken up, through which run, in a general east and west direction, crushed zones usually accompanied by dykes and quartz veins, dipping to the south at high angles and carrying varying quantities of white iron-sulphide, galena, and copper-pyrites. On the *Old Chum* group, at an altitude of 3,300 feet, a tunnel has been driven in for about 15 feet in an easterly direction on a crushed zone in the argillite, in which occurs a quartz vein about 4 feet wide, with a heavy gouge on either side, carrying white iron sulphides, galena, and some copper-pyrites. A sample taken completely across this 4 feet of vein exposed, merely as an indication of the surface prospect, gave, upon assay: Gold, \$1; silver, 6.6 oz.

Some 120 feet higher than the tunnel and 150 feet to the south an open cut has been made across a crushed zone, here from 8 to 10 feet wide, and showing a general mineralisation as described, with possibly a larger percentage of copper-pyrites and less galena. From this cut the owners report fair values in gold and copper, with a little silver. The examination of other surface exposures was prevented by a fall of snow which had just set in.

On the opposite side of the gulch, and adjoining, is the *L. L. & H.* group, the principal work on which could not at the time be reached, as a light fall of snow on the ground rendered the foothold dangerous on the very steep hillside; enough, however, could be seen from near the gulch to show that several strong quartz ledges, running in an east and west direction, cut through the hillside, and that the outcrops exposed on the surface were in places quite heavily mineralised. The owners report from the more advanced workings average assays of over \$20 in gold. A rough sample taken from an outcrop near the gulch, as an indication, gave: Gold, \$6.80; silver, 1 oz.

The *Roosevelt* mineral claim is one of the oldest recorded claims in the camp, and is being developed by a company of which Mr. J. Clew, of Vancouver, is said to be president, and Mr. Baldwin manager. In October the property was not being worked, but was found in charge of a watchman. The property is situated on the north fork of Bitter creek, about a mile up from the main creek and at an altitude of about 1,200 feet. The country rock is an argillite, cut by east and west dykes, parallel with which is a crushed zone from 5 to 10 feet wide, more or less cemented with quartz and containing lenses of iron-sulphides carrying gold values, also a little galena and copper-pyrites. The fissure is regular and apparently continuous where developed, and is filled with crushed country rock, with variable quantities of quartz

and mineral. The development consists of a main tunnel driven into the hillside, at a height of 20 feet above the creek-bed, for a distance of about 75 feet; this tunnel was almost blocked up by the waste from higher prospecting workings and slide and does not as yet exhibit any commercial ore-body.

About 40 feet higher up the steep bank an open cut has been made, from which a tunnel has been started into the hillside on the fissured zone, in all about 20 feet.

Some very good values in gold are reported from the face, but these are uneven and depend on the amount of sulphide in the sample. A rough general sample from the lower tunnel gave: Gold, \$8; silver, 10.4 oz.; copper, 6.6 per cent. About 200 yards down the creek from the tunnel and on the same side of the creek is what is called the "new strike." This is a similar crushed zone in the argillite country rock cemented with quartz, striking east and west, about 10 feet wide and flanked on either side by porphyrite dykes, approximately 20 feet wide, which follow the fissure in as far as could be seen. In the crushed zone the broken country rock predominates, but there occurs near the foot-wall side two streaks, one 12 inches and the other 6 inches wide, of rather strong mineralisation, which were sampled and assayed, giving: Gold, 80 cents; silver, 13.4 oz. per ton. There has been practically no work done on this showing and it has only recently been "faced up" by the couple of men left in charge when the working force was withdrawn, and although the showing at the surface is somewhat indefinite, it is possible a little work might show a considerable improvement.

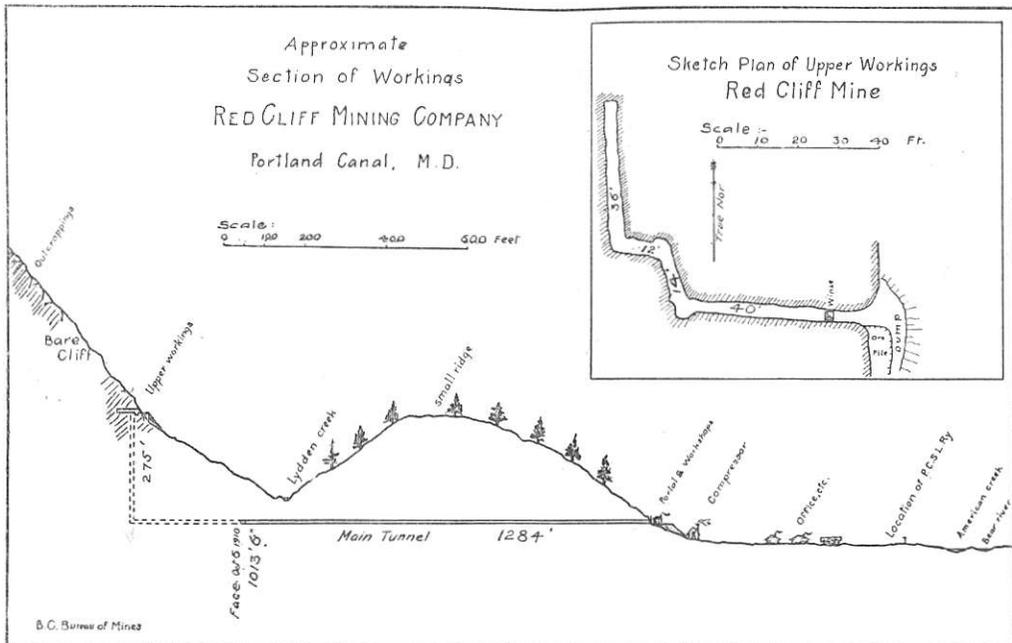
The *Olga* mineral claim, being developed by James McNeill and two
 Olga Mineral men, is situated about three miles and a half up Bitter creek, on the north
 Claim. bank of the creek. The country rock is argillite and is here very much
 altered and disturbed, striking north and south and dipping nearly vertical.

At an elevation of 400 to 500 feet above the creek, and back from the creek about 1,500 feet a tunnel has been driven into a crushed and mineralised zone for some 81 feet in a N. 45° W. direction, with, at 45 feet in, a crosscut to the right of 25 feet and at the face a drift of 10 feet in a northerly direction. The main fissuring appears to be in a general north and south direction with the strike of the strata, which the tunnel about half crosscuts in its course. In the tunnel, on the left side, a number of stringers of mineral seem to be coming out of the wall, which the work done does not fully develop. The mineralisation consists of bands of quartz carrying stringers and bunches of iron and copper pyrites, but to what extent these occur in the zone of crushing is not fully shown by the method of development adopted. A rough general sample taken from the couple of tons of sorted ore at the tunnel mouth gave, upon assay: Gold, \$8.80; silver, 1.8 oz. per ton; copper, 10.1 per cent.

AMERICAN CREEK.

The *Red Cliff* group consists of seven mineral claims—the *Last Chance*,
 Red Cliff Group. *Red Cliff*, *Mt. Lyell*, *Little Pat*, *Montrose*, and *Waterloo*, *Mac Fct.* and *Dot*
Fraction—situated on the west slope of Bear River valley, a short distance
 below American creek. A small creek (Lydden creek) follows the base of the main mountain and is separated from the river by a small hill some 300 or 400 feet in height. The claims and mineral exposures are on the mountain side sloping up from Lydden creek, and have been properly so described, but this mountain is really the western boundary of the Bear River valley at the mouth of American creek. The property is owned by the Red Cliff Mining Company, Ltd., a Vancouver company, with a capital of \$1,500,000, of which, however, according to the company's annual report, \$350,000 of capital stock still remains in the treasury. The president and general manager of the company is A. Erskine Smith, of Vancouver, while E. B. Webster is the superintendent of the mine.

There are several exposures of mineral on the various claims, but the principal development has been upon the *Red Cliff*, and here the company has centred all its energies for the time being, and it is this work which commands present attention. The surface showing, the cause of the present development, was found some 200 feet vertically up the very steep hillside to the west of Lydden creek, where, exposed in a bluff, there is an outcropping vein carrying iron and copper pyrites in a gangue of quartz. Into this exposure a tunnel has been driven, directly into the hillside, in a general south-west direction for from 60 to 70 feet, when a sharp turn was made to the right—a crosscut—for 35 feet. In the tunnel near the portal a winze has been sunk about 10 feet below the tunnel level. This winze and crosscut would appear to be work done since Mr. Carmichael examined the property in 1909. The tunnel and winze are both in ore, but the crosscut is not—the ore-body being apparently to the left and in the line of the main tunnel. The total width of the mineralisation is not disclosed, as it has not been cut through on the left side of the tunnel, but is at least from 12 to 15 feet wide where



developed. This same mineralisation can be seen for a long distance up the hillside in a general S. 30° W. direction, where it has been exposed by open cuts and shots put into the bluff. The mineralisation consists of iron and copper pyrites, occurring in layers in a quartz gangue, carrying gold and silver values.

From the tunnel workings, including a chamber 8 by 10 feet in size at the inner end of the tunnel, a quantity of ore has been placed on the dump, estimated at about 200 tons and running in copper about 5 per cent. A ton and a half of ore from the workings, that had been previously taken down to the company's Vancouver office, was shipped this fall to the Tye smelter and there sampled, yielding, according to the company's annual report: Copper, 8.25 per cent. (dry); silver, 2.44 oz.; and gold, \$5 to ton. It is believed that, as the iron-pyrites carry more than a proportionate amount of the gold present, the ore on the dump will carry higher values in gold than the copper tenure of this sample shipment would argue.

As previously stated, there are other similar outcroppings of ore on the company's property. These occur on about the same break of the hill and appear to be all cutting into the hill, but these have been very slightly developed, the company naturally selecting the exposure on the *Red Cliff* as the most promising superficially for present development.

The hill slope at Lydden creek is evidently the location of a heavy snowslide in winter, and the company, apparently realising the futility of attempting any permanent construction work there, started in on the slope of the small hill facing on Bear river, and is now engaged in running a tunnel to pass through a point vertically under the upper development workings. This tunnel is at an elevation of about 275 feet lower than the upper workings, and, according to survey, will require to be driven 1,284 feet to bring it vertically below these workings. The tunnel is being driven straight, 8 by 8 feet in cross-section, and passes under the bed of Lydden creek, leaving some 60 feet of covering, through which very little water was seeping. Below the tunnel mouth is ample height for dump, and at the bottom of the dump, on a small flat, well above Bear river, is the company's camp and plant.

The plant consists of a 10-drill, steam-driven, Canadian Rand air-compressor and a receiver, two 60-horse-power boilers, and an electric-light dynamo, in a suitable house covered with corrugated iron. The other buildings comprise an office, two storehouses, stable, two bunk-houses, and a mess-house, all built of logs, with rubberoid roofs. All these buildings are equipped with electric light, and the blacksmith-shop, compressor building, store, office, and dining-room are connected by local telephone. The tunnel is equipped with a double line of track, using 20 lb. rails, and is a creditable piece of work. The compressor is set on a concrete foundation and is in excellent shape.

The lower tunnel was in, on October 6th, 1,013 feet, and at the rate of progress being made, between 40 and 50 feet a week, should be vertically below the upper workings about the middle of November; one power drill was being used on three shifts. The country rock passed through by the tunnel seems to be similar to the rock exposed around the upper showings and was a dark-coloured igneous rock, probably a diabase, plentifully seamed by small cross-fissurings filled with quartz, but not carrying mineral values.

The company has available in Lydden creek a very fine water-power which could be cheaply utilised, and so dispense with the cutting of cordwood for boiler fires; it is understood that plans to this end have already been prepared.

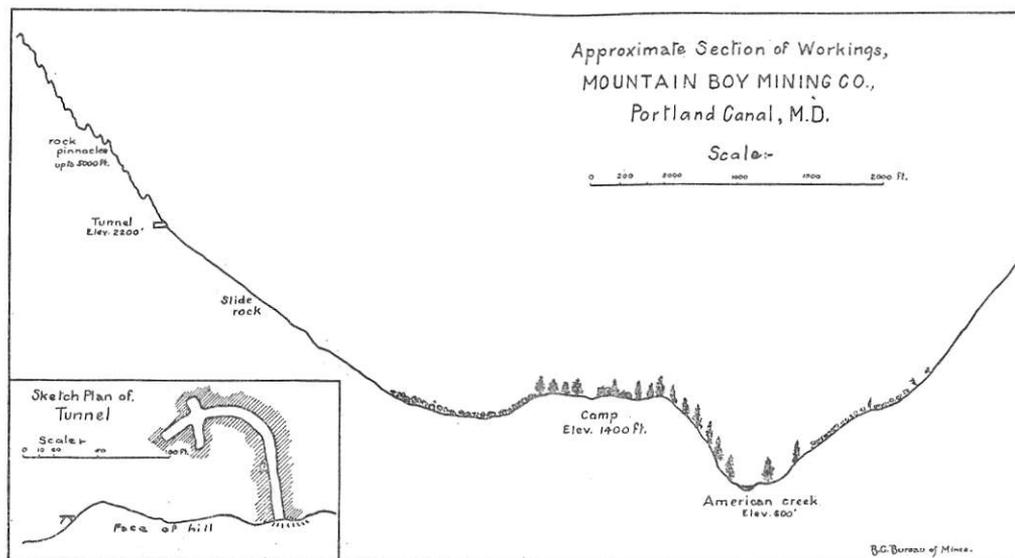
On the *Montrose* claim, in the canyon of Lydden creek—a spot very difficult to get at for initial development—there is an outcropping very similar in mode of occurrence to that on the *Red Cliff*, but differing, in that it has a smaller percentage of copper and a greater of iron pyrites, with correspondingly higher gold values. This showing is extensively exposed by Nature, but very little work has been done on it beyond a few shots in the face of the almost perpendicular side of the canyon. This showing and others exposed at other points on the claims awaits the issue of the development on the *Red Cliff*.

The Mountain Boy Mining Company owns a group of claims which includes the *Mountain Boy*, *Hard Nut*, *Northern Belle*, and others, situated on the south side of American creek, some four miles from the mouth of the creek, at an altitude of about 2,200 feet. The property is at present under bond to the Pacific Coast Exploration Company and is being developed by a force of sixteen men, under the management of Mr. Stanley as foreman. Some development has been done on each of these claims, but at present the work is confined to the *Mountain Boy* claim. The showing being developed is on the face of a bare hill, swept clear by snowslides, between 800 and 900 feet vertical above the small subsidiary valley which runs parallel with American creek and is separated therefrom by a small rolling hill, similarly as at the *Red Cliff*. The cabins are situated on the American creek slope of the small hill, in a bunch of timber, in order to be free from the snowslides, which, in winter, fill the subsidiary valley with snow many feet deep.

From the cabins a trail leads over the small hill into the small valley, from which a switch-back trail runs up the face of the slide for 800 feet vertical to the tunnel on the

Mountain Boy claim. Prospecting cannot be carried on here safely after snow comes, and any permanent workings would have to be put in from the vicinity of the cabin, similarly as has been done at the *Red Cliff*; but would, however, require a much larger tunnel.

The upper tunnel is in about 150 feet with a crosscut of 25 feet and a 10-foot winze. The tunnel was started into the hill in a westerly direction and soon ran through the mineralised zone; it was then swung around nearly 90° to a S. 15° E. direction and continued for about 60 feet, with a crosscut of 25 feet to the east in the mineralised zone. The country rock is a dark, igneous rock, and the ore is found in a crushed zone, partly filled with quartz, in which galena is found in kidneys, in lenses, and in streaks, but at that time had not proved very abundant.



A sample of the galena from the vein gave, upon assay: Gold, trace; silver, 1.2 oz. per ton lead, 72 per cent.

On the *Hard Nut* a tunnel had been driven in about 70 feet on a zone of mineralisation about 11 feet 6 inches wide and somewhat similar in character to the *Mountain Boy*.

On the *Northern Belle* in No. 1 tunnel the mineralised body of quartz with galena is about 18 feet wide, and the tunnel and drifts measure about 32 feet. A sample of the galena ore from this tunnel assayed: Gold, trace; silver, 2.8 oz. to ton; lead, 52.5 per cent.

The No. 2 showing on the property has only been "faced up," and seemingly is on a zone of mineralisation and silicification about 35 feet wide, but is reported by the management as low-grade, giving on an average sample about \$3 a ton.

The Bear River Canyon Mining Co. is developing a group of claims Bear River Canyon situated in the valley about two miles above the mouth of American creek; Mining Co. the group consists of eight claims, including the *Independence*, *Pascoe*, *Kennewich*, and others. The development work seen had been done on the *Independence* claim, where a tunnel had been driven, from slightly above creek-level, into the eastern bank of the river, for a distance of 140 feet in a S. 40° E. direction, starting in on an outcropping of zinc-blende and galena which occurred on the contact of a porphyrite dyke with the argillite country rock. This particular showing of mineral had been mined out in the tunnel, and by a small shaft sunk at the mouth of the tunnel, and is described by the manager, Mr. Falls, as having been a lens of ore tapering in all directions and having a

maximum height of 15 feet, a length of 20 feet, and a thickness of 10 inches. In the roof of the tunnel, at 42 feet in, another lens of ore had been cut and proved to be about 15 feet long by about 4 to 8 inches wide in the middle, tapering away at each end. At 105 feet in on the tunnel, a crosscut had been made to the left for 5 feet. The crushed zone of fissuring continued to the face of the tunnel, but did not exhibit further mineral. From these workings a few tons of mineral had been extracted and was on the dump, consisting of about two-thirds of zinc-blende and one-third galena. A general sample taken of the ore on the dump gave, upon assay: Gold, trace; silver, 17 oz. per ton; lead, 44 per cent.; zinc, 22.6 per cent. On the same strike as the fissure in the tunnel, but on the opposite side of the creek, there are three outcroppings of mineral of similar character, but these have not been developed nor prospected. All work on the claim had been stopped some time in September.

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1910.



Looking up Lydden Creek—from Red Cliff Mine dump.



Looking down American Creek—from Mountain Boy Claim.



Main tunnel and camp of Red Cliff Mine.