

PART C.

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

BY

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SUMMARY.

Active interest in this district has been largely confined to gold properties, both lode and placer, and in these branches of the mining industry important expansion took place during the year.

The producing lode-gold properties in the Cariboo district—namely, Cariboo Gold Quartz Mining Company, Limited, and Island Mountain Mines Company, Limited—increased their respective rates of milling during the year, the rate at the former being now 150 tons daily and at the latter about 100 tons daily. Inauguration of dividend payments at the rate of 10 per cent. per annum commencing January 1st, 1936, was announced on November 19th by Cariboo Gold Quartz Mining Company, Limited. The results secured by these companies may be considered a sound argument for further well-directed development at other points within the Barkerville gold belt.

In the Omineca Mining Division activities took place on the Zymoetz river; in the vicinity of Usk; at several points on Hudson Bay mountain, near Smithers; on Dome and Grouse mountains, near Telkwa; in Whitesail Lake area; and at Aiken lake, where the most northerly lode-mining operation in this district is carried on by the Consolidated Mining and Smelting Company of Canada, Limited.

Individual owners were particularly active developing their properties and making small shipments of ore, the quantity in one case reaching a car-load (from *Glacier Gulch*, Smithers).

In placer-mining a marked growth of activity, reflected in the output, featured the year and there is every indication of a sustained increase. The two major operations now in progress—namely, those of Consolidated Gold Alluvials of B.C., Limited, and Bullion Placers, Limited—exemplify respectively the largest "deep-lead" and the largest hydraulic enterprise in the Province. Cedar creek witnessed a revival of activity and there seems reason to believe that this deposit, unique in many ways, is not yet exhausted.

While placer activity centred mainly in the Cariboo district, in the Omineca Mining Division the Manson section was busier than for some years past. Other points at which work was carried on were: Two Brothers Lake area; McConnell creek; McDougall river; Lorne, Hankin, and Sauchi creeks. In the Manson section developments on Vital and Slate creeks and on the Germansen river give every promise of continued activity next year.

New discoveries of promise made this and last year in the Cariboo district at points very close to, if not actually on, existing transportation routes emphasize the possibilities such regions still afford to the prospector. In this connection close scrutiny for both lode gold and placer is advised in the strip of country embracing the contact of the Precambrian and Mesozoic rocks extending between Wingdam and Spanish mountain.

It is stated that English interests have acquired the entire holdings of Lowhee Mining Company, Limited, which consist largely of placer properties, although certain lode-mineral holdings are included.

A Placer-mining Training Camp was conducted by the Department of Mines during the summer at Long bar on the Fraser river near Quesnel.

Rumours of an important discovery of tin in the northern part of this Mineral Survey District were in circulation in the Province and in London during the early summer. Close investigation proved, however, that such rumours had no foundation in fact.

Coal-mining was carried on at the Bulkley Valley Colliery; at the Aveling property on the Telkwa river; and on Hudson Bay mountain.

The writer desires to express his cordial thanks for the co-operation and hospitality extended by prospectors and mine operators in the conduct of his work.

Production from this district for the year is as follows: Ore, 74,830 tons; gold, lode, 36,096 oz.; silver, 7,177 oz.; lead, 8,227 lb.; zinc, 1,712 lb.; placer gold, 13,151 oz.

LODE-GOLD DEPOSITS.

HIXON CREEK AREA.

Quartz veins occur in this area, and in the case of the properties described they are mainly developed in igneous rock at or near the contact of the latter with schistose sediments.

The formation on Hixon creek consists of alternate bands of greenstone and schistose sediments. At some points there is evidence of low gold values in the greenstone in the region of the contact, raising the question as to whether sections of the greenstone can be economically mined. Further investigation is necessary to determine the possibilities of this type of mineralization.

This company is a reorganization of an old company of the same name **Quesnelle Quartz Mining Co., Ltd.** incorporated in the seventies. The authorized capital is \$600,000, divided into 2,400,000 shares of a par value of 25 cents each. The registered office is 1000 Hall Building, Vancouver, and the president is Newton J. Ker. The property consists of six Crown-granted claims—*Morrison Location, Stewart Location, Washburn Location, Washburn Lateral*, and also Lot 55G and Lot 56G.

The property is situated on Hixon creek, about $4\frac{1}{2}$ miles distant from the Prince George-Quesnel highway, and can now be reached by motor-car. The slopes of Hixon Creek valley are timbered and the rock formations are largely covered by gravel terraces at elevations much above the creek. The creek has cut down to a depth of about 200 feet below the plateau-level and, at about creek-level, rock formation and quartz veins are exposed.

The formation consists of bands of highly altered kaolinized rock interstratified with schistose sediments and phyllites. Within the first mentioned are numerous quartz veins, mineralized with pyrite, varying in size from an inch or less to several feet in width. Quartz veins also follow the contact of the highly altered rock with the sediments. Underground workings show that the deeply oxidized and kaolinized rock gradually passes at depth into greenstone; the zone of oxidation extending to about 100 feet below the creek-level. It is evident that the rock formations were deeply weathered in Tertiary times and that secondary enrichment took place in the quartz veins. Commercial gold values only occur in some of the quartz veins. The greenstone is a highly altered rock, possibly diorite, originally intruded in the form of sills. About 2 miles down-stream a stock of augite syenite outcrops at the falls on the creek, and granodiorite outcrops 2 miles up-stream in the creek-valley.

After incorporation in the seventies the original company carried out a large part of the existing underground work and erected a stamp-mill. Old records show apparently that 239 tons of ore was milled, averaging \$20.91, with gold valued at \$20.67 per ounce. Operations were suspended in the late eighties, shaft-workings allowed to fill with water, and for nearly fifty years until 1933 they remained in that condition.

An option on the property was secured in 1918 by Chas. F. Law and later in 1929 by Cariboo Lode Mines, Limited, but on each occasion little was done other than clearing out adits. Interest was revived in 1932 following the discovery by B. Briscoe of some rich quartz stringers, and the property was optioned by R. W. Alward, M.L.A., and J. H. Johnson. Pits were sunk on the quartz stringers to where the ore pinched and 8 tons was shipped, yielding 7 oz. gold and 3 oz. silver. The option was allowed to lapse. In 1933 the present company was organized, plant was installed, comprising a 50-horse-power Diesel-engine-operated air-compressor, 18-horse-power gasoline-engine, hoist and pump, and the main shaft, sunk close to the creek on the left bank to a depth of 207 feet, was unwatered and development commenced. This working shows that the decomposed rock at the surface gradually becomes less oxidized in depth and at 100 feet merges into greenstone, which continues to the bottom. From the main shaft, levels known as Nos. 1 to 4 are driven at depths of 25, $97\frac{1}{2}$, $145\frac{1}{2}$, and 196 feet respectively. Workings are driven on No. 4 level to points respectively 458 feet north-west and 115 feet south-east of the shaft, following the immediate proximity of the contact, although the latter is not exposed at all points.

The schistose sediments strike generally north 40 degrees west. The prevailing dip is north-east at steep angles, but is occasionally south-west. The result of this development was to disclose a large number of fairly closely spaced quartz veins striking almost entirely north-easterly with varying but steep dip. In a few instances quartz veins follow the schist-greenstone contact for a limited distance. The width of the veins varies from a few inches up to 6 feet, and nine of them are from 2 feet to 4 feet in width. In the north-west working twenty-six such veins were cut, and in the south-east working three were cut, of which one near the face is 4 feet in width. Wherever the contact is exposed these veins are seen to terminate abruptly at it. Many of the veins have frozen walls. Only two veins to date have been followed in a direction away from the contact, in one case 52 feet and in another 24 feet. These workings were not sampled, but it is understood that the results were not encouraging. The greenstone in the immediate vicinity of the contact only is kaolinized, evidently owing to the percolation of surface waters. A few feet away from the contact the greenstone shows hydrothermal alteration and appears as a well-mineralized green-coloured chloritic rock intersected by quartz veinlets. Quite a diversity of minerals is exemplified in the veins and rock formations immediately adjacent thereto. Those observed at different points are pyrite, chalcopyrite, galena, sphalerite, arsenopyrite, molybdenite, native gold, native silver (in the form of wire silver), and a chocolate-coloured mineral of rare occurrence in the district, which was identified by the Provincial Assayer as silicate of iron. The last two minerals mentioned are obviously secondary, the former being found in a cavity in one of the veins.

The following samples were taken from the veins in the north-west working at the respective distances given from the shaft:—

At 60 feet, across 2.2 feet. Assay: Gold, 0.02 oz. per ton.

At 150 feet, across 6 inches. Assay: Gold, trace.

At 162 feet, across 3.2 feet. Assay: Gold, trace.

At 170 feet, across 4.5 feet. Assay: Gold, trace.

At 250 feet, across 2 feet. Assay: Gold, 0.08 oz. per ton.

At 265 feet, across 6 inches. Assay: Gold, 0.02 oz. per ton.

At 290 feet, across 1.5 feet. Assay: Gold, 0.10 oz. per ton.

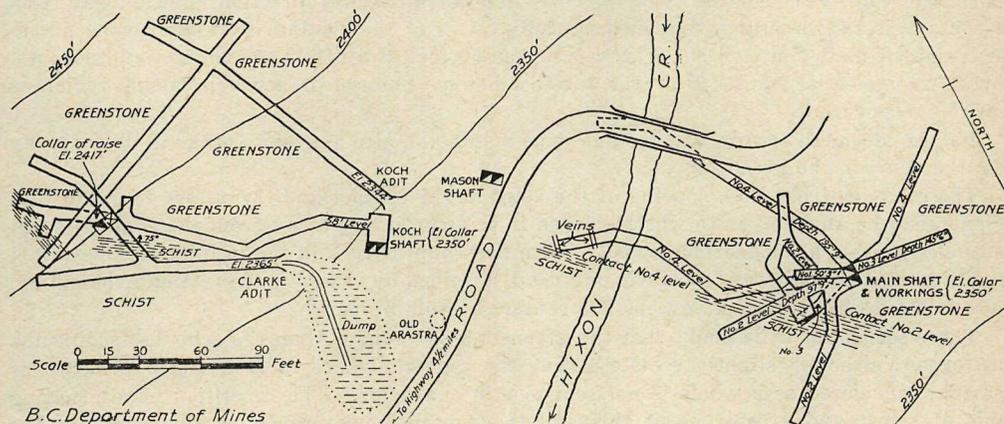
At 299 feet, across 2.6 feet. Assay: Gold, 0.02 oz. per ton.

At 324 feet, across 2 feet. Assay: Gold, 0.02 oz. per ton.

At 356 feet, across 2 feet. Assay: Gold, 0.10 oz. per ton.

At 440 feet, across 4 feet. Assay: Gold, 0.20 oz. per ton.

The following sample was taken in the south-east working from a vein 6 inches wide, 90 feet south-east of shaft:—Assay: Gold, 0.30 oz. per ton.



Quesnelle Quartz Mining Co. Plan of Workings as in 1934.

No. 3 level is driven wholly in greenstone. In the east drift from the shaft close to the latter a steeply dipping fairly well-mineralized quartz vein about 6 feet wide is exposed, striking north 38 degrees east and cut diagonally by the working. A sample taken across a width of 4 feet assayed: Gold, 0.04 oz. per ton.

On No. 2 level the greenstone-schist contact was reached 25 feet west of the shaft. At this point a shallow winze and a short raise follow one quartz vein 18 inches in width and two adjoining parallel stringers each about 3 inches in width. These strike north-easterly and their continuation is intercepted by the more easterly of two parallel north branch workings, which also exposes another quartz vein on its east side 6 feet in width striking north-east. A sample taken at this point across 6 feet assayed: Gold, 0.04 oz. per ton. On the west side of the working opposite the last-mentioned vein, a sample was taken across a width of 5 feet, being mainly oxidized greenstone with a little quartz. This sample assayed: Gold, 0.5 oz. per ton.

On No. 1 level, wholly in highly oxidized greenstone, a vein 6 feet in width, striking north-east, is cut 12 feet from the shaft. A sample taken across this width assayed traces of gold only.

The other workings, consisting of the old Koch shaft and Koch adit, and new Clarke adit, are on the right bank of the creek about 230 feet north-westerly from the main shaft.

The westerly working from the Koch adit cuts some well-mineralized quartz veins in oxidized greenstone within the first 90 feet of its length, but samples taken from these veins showed no values. For the last 66 feet this working is in schist which passes into graphitic schist near the face.

The north-westerly working from the Koch shaft is driven entirely in schist, in the immediate vicinity of the contact of the latter with oxidized greenstone. Although lagging prevents thorough inspection, there is evidence of quartz veins on the east side of the working. The face has entered graphitic schist. Near the face a short crosscut west discloses a quartz stringer in the schist, one of the very few examples on this property of the occurrence of a vein in the schist.

The Clarke adit is a recent working chiefly in schist, except where it enters oxidized greenstone in the region immediately below the raise shown on the plan. The purpose of this adit was to explore the region immediately below the bench-ground 60 feet above the adit on which rich stringers were discovered in 1932. Near the top of the raise a quartz vein 4 feet in width is exposed in which free gold was found. These veins did not prove to be continuous.

The veins exposed to date, with quite unimportant exceptions, occur *in the greenstone* at or close to the greenstone-schist contact. Wherever the contact is actually exposed, they are seen to terminate abruptly at it and do not extend into the schist. The strike of the veins is generally north-easterly, and while there is some evidence of quartz several feet in width paralleling the contact for a short distance at some points, there is no evidence of persistence of a contact-vein. The continuity of the veins in a north-easterly direction, that is away from the contact, is yet to be investigated more fully. One of the original workings to the north-west from the main shaft on No. 4 level is driven 50 feet away from the contact and does not show any commercial veins. However, the face has not entered the most promising region as shown by recent work.

Values, although erratic, are good at some points and also appear to occur in places away from the veins in the greenstone.

The comparatively close spacing of the veins at the contact and the values found in that region raise the question as to whether, even if vein-continuity away from the contact is not eventually proven, a considerable width of vein and country-rock in the vicinity of the contact constitutes commercial ore. Such can only be determined by careful and systematic sampling. There is more than one schist-greenstone contact on this property.

There seems but little doubt that the greenstone is younger than the schistose sediments. The former, although slightly schistose near the contact, where there is much evidence of shearing, considered as a whole is not schistose in character. The repetition of alternating bands of schist and greenstone at this and the neighbouring properties suggests that the greenstone was injected in the form of sills. There is much in the nature of these veins to suggest that they have filled cooling fractures formed in the greenstone, and the possibility must be borne in mind that such fissures may only have formed in the vicinity of the contact with the cold sedimentary formations.

Whether this is the case or not, operations to date undoubtedly indicate the schist-greenstone contact as the most promising region.

**Cariboo Gold
Drop.**

This group consists of a number of claims owned by Valentin Witt and associates, of Prince George. It is situated about 12 miles south-east of the property of Quesnelle Quartz Mining Company, between Terry and Canyon creeks, in the broken hilly country typical of the Fraser plateau. The chief showings lie at an elevation of about 3,750 feet in well-timbered, gently sloping ground falling away more sharply on the south.

The property is reached by a trail from Hixon creek, about 12 miles in length, which branches south from the latter about 1 mile above Quesnelle Quartz Mining Company's property, and leads via Pedley lake across the North fork of Terry creek near its junction with the main creek. The trail, over which horses may be taken for a distance of about 8 miles, crosses Terry creek several times. The remaining distance of 4 miles to the property is followed by an indifferent foot-trail. If any work is to be done at this property, about 5 miles of the trail will require relocation. The property is distant in an air-line about 4 miles north-east of Swede mountain, lying north of Canyon creek.

The formation consists of intercalated schistose argillites and quartzites which strike from north 77 degrees west to north 57 degrees west and dip 45 to 60 degrees south-westerly. Conformably overlying this formation is a flow or large sill of pyroxenite in immediate contact with quartzites. Evidence of schistose structure and shearing diminish in the igneous rock away from the contact, and it assumes a more granular texture. The contact coincides very closely with the topographic features, the more resistant sedimentary formation weathering less rapidly than the igneous rock and forming the brow of a hillside, so that the ground falls away more steeply where it is underlain by the igneous rock. The slope of the hillside is about 30 degrees.

Three quartz veins have been exposed to date and some evidence obtained of others. The widths of the veins are respectively 15 inches, 6½ feet, and 35 feet or more. All these veins have free walls and occur close to the contact of the sedimentary formation and igneous rock; the first-mentioned vein is in the sediments and the last two in the igneous rock. The two largest veins show little or no sulphide, but the smallest vein is fairly well mineralized with pyrite. In all cases assays of samples taken failed to disclose any gold values.

The property is believed to have been staked last year by the owners.

At elevation 3,700 feet close to the top of the slope mentioned above, on the *Blue Quartz* claim, a pit is sunk to a depth of 8 feet, following a quartz vein 15 inches in width, with free walls, mineralized with pyrite. This vein coincides in dip and strike with the enclosing argillites, which strike north 42 degrees west and dip 55 degrees south-west. The vein is displaced at the bottom of the pit by a fault, strike north 72 degrees west, with vertical dip. A sample taken from this vein assayed: Gold, *nil*.

About 750 yards from this pit, south 77 degrees east at 3,950 feet elevation, a large quartz vein apparently wholly in sheared and fractured pyroxenite (strike, so far as can be determined from exposures, north 77 degrees west, dip 40 degrees south-west) is exposed by one open-cut and natural agencies for a length of 110 feet. The hanging-wall of the vein is well exposed, but the foot-wall side is obscured by vegetation. The contact between pyroxenite and quartzite occurs 100 feet north of the most westerly exposure. An open-cut 39 feet in length across this vein indicates a quartz-exposure 45 feet in width, as quartz extends beyond the open-cut, but the true vein-width may be less than 45 feet. The vein, showing little oxidation and no sulphides, outcrops strongly 55 feet north-west and the same distance south-east of this open-cut. A sample taken from the open-cut across 45 feet assayed: Gold, *nil*. Distant 123 feet south 62 degrees east from this open-cut, a shear-zone in pyroxenite 6½ feet in width is exposed along the strike by a trench 6 feet deep and 33 feet in length. The filling consists of sheared pyroxenite and seams of quartz, one 2 feet wide on the hanging-wall and another 2½ feet wide on the foot-wall, strike north 58 degrees east, dip 55 degrees south-east. This vein shows much oxidation, but no sulphides were observed. Three samples taken, one of the most oxidized parts of the vein and two others across the full vein-width at different points, yielded negative results in gold.

WHITES LANDING AREA.

Within the area enclosed by the large westerly bend of the Fraser river down-stream from Whites Landing the existence of numerous large quartz veins has been reported, but only the *Cougar* group, situated in the northern part of this region, has been examined to date. This

section is largely covered by dense vegetation and the geology obscured, but the rocks exposed consist of intercalated volcanics and sediments intruded by a large stock about 6 miles east of the mouth of the Blackwater river. The eastern portion of this stock exemplifying various types of batholithic rock is exposed immediately west of Pre-emption Lot 3211.

This group comprises eight claims and is owned by a private syndicate, the **Cougar.** Cougar Mining Syndicate, of 501 Crown Building, Vancouver. The property adjoins the left bank of the Fraser river, about 6 miles down-stream from Whites Landing. The topography is hilly broken country covered with timber, underbrush, and vegetation, which obscures rock-exposures to such an extent that it is likely that only by chance would a vein-outcrop be discovered in such a region.

The property is reached by following the wagon-road from Strathnaver on the highway to Whites Landing, a distance of about 6 miles. Thereafter a trail, over which horses can be taken, although it is at some points somewhat difficult to follow, leads a further 7 miles to the property.

There are only a few rock-exposures in the immediate vicinity of the showing, which is a large, sparsely mineralized quartz-vein between thickly bedded argillites on the foot-wall and a sheared igneous rock of dioritic type on the hanging-wall. Exposures are insufficient to determine the origin of the dioritic rock. Argillites are also exposed at several points on the left bank of the river.

The vein was discovered, it is stated, by an Indian while hunting, and was subsequently staked by G. C. Colebank, by whom it was optioned to the present owners.

The surface showing is 1,500 feet south-east of and 200 feet above the river, and consists of a large quartz vein exposed mainly down its dip for a distance of 117 feet, chiefly by natural agencies. The vein, strike north 12 degrees west, dip from 20 to 35 degrees south-westerly, varies from 5 to 17 feet in width. It shows evidence of oxidation and is sparingly mineralized, and the walls are free. The minerals observed are pyrite, chalcopyrite, and a little malachite and azurite. A sample taken across a width of 6 inches, including the most heavily mineralized portions of the vein, assayed: Gold, trace; silver, 0.20 oz. per ton; copper, trace. Samples taken at two other points across 16 feet and 5 feet respectively, representing the full vein-width exposed at these points assayed: Gold, trace.

HANSARD AREA.

There appear to be a number of quartz veins, of varying width up to many feet in one case, on the Bowron river, south-west of Hansard. The fact that on the *Dawn* group low gold values were found seems to justify further prospecting in this region.

This group consists of six claims owned by J. F. Wilson, of Hansard. The **Barbara Ellen.** property is situated on the left bank of Bowron river, about 4½ miles distant in an air-line south-west of Hansard, and is reached by motor-boat from Hansard via Fraser and Bowron rivers, the distance by water being from 10 to 12 miles. The ground is gently sloping, broken up by numerous small gullies, heavily timbered, and covered by vegetation.

The formation of the region consists of schistose argillites, quartzites, and limestone. The essential feature of the property is a large, partly exposed quartz vein possibly 24 feet wide, with free walls, which, so far as can be ascertained, coincides in strike and dip with the enclosing schistose argillites. The strike of the latter varies from north 65 degrees west to north 47 degrees west and the dip is about 45 degrees north-easterly. At one place the vein shows a bunched mineralization of pyrite, chalcopyrite, and sphalerite.

The vein is in part sheared and the crushed quartz of the sheared parts has been considered a possible source of silica. Although some samples proved to be very pure, it is apparent that the presence of sulphides in part of the vein would prevent production of any appreciable tonnage of high-grade material.

The surface showings are situated about 400 yards above the mouth of a small creek flowing south-westerly into Bowron river. On the left bank of this creek, at or near creek-level, is an open-cut 51 feet in length on a bearing north 73 degrees east. This open-cut drains part of the underground workings and exposes the foot-wall of the vein. Stripping at the end of this cut on the north side indicates a vein-width of possibly 24 feet. On the opposite side of the creek, distant 52 feet on a bearing north 27 degrees west from the end of the open-

cut, a pit, caved at the time of examination, is stated to have been sunk a few feet and to have disclosed some quartz. A few feet up-stream from this pit stripping shows a small vein.

Most of the underground workings were inaccessible at the time of examination as they are situated at such a low level that they are flooded by the creek at every freshet. It was, however, possible to inspect a working driven close to the foot-wall for a distance of 23 feet.

This group, consisting of several claims owned by E. Messmer, of Hansard, and immediately adjoining the *Barbara Ellen* group, is situated on the left bank of the Bowron river and is reached by motor-boat from Hansard. The showings are about 2 miles up-stream from those of the *Barbara Ellen*.

The ground is covered with dense timber and vegetation. The showings are situated a short distance above the mouth and on the banks of a small creek flowing south-westerly into Bowron river. The creek cuts through interbedded schistose limestone and argillites. The rock formations have been stripped for a distance of 70 yards on the left bank and a further 30 yards on the right bank. Numerous small stringers of quartz and siderite with pyrite occurring in the schistose limestone generally follow the bedding-planes, although some cut across them. A sample taken from one such stringer, 3 inches in width, assayed: Gold, 0.04 oz. per ton.

In view of this gold value some further prospecting in the region seems justified in the hope that larger veins of more marked gold content may be discovered.

USK AREA.

The types of lode-gold deposits in this area consist of quartz veins in which copper minerals are not present in pronounced amounts such as those of Omineca Gold Quartz Mines, Limited (*Dardanelle* group), and Columario Consolidated Gold Mines, Limited; and quartz veins in which copper minerals are present to a marked extent such as those of the *Lucky Luke* and *Cordillera* groups.

In the case of the property of Nicholson Creek Mining Corporation, another type of quartz vein is exemplified in which the mineralization consists essentially of pyrite and molybdenite.

This company, incorporated in the State of Washington, holds sixty-nine claims, covering an area of about 6 square miles between Lowrie and Nicholson creeks, both large creeks flowing south-easterly in a parallel direction into the Skeena river, in the more immediate vicinity of Usk. While there are various mineral-showings at different points in this area, some of which doubtless have not been examined by the Resident Engineer, two sections seem to be of chief interest: (1) The one including the *Diadem* showings (copper-showings containing low precious-metal values, described at length in the 1928 and 1930 Annual Reports); and (2) the other adjacent to Molybdenum creek (northward-flowing tributary of Nicholson creek) and its tributaries, which at present engages the attention of this corporation and is the subject of this report.

The present camp of the corporation is situated on the right bank of Molybdenum creek at an elevation of somewhat over 1,500 feet, and is reached by a motor-road from Usk 2 miles in length, followed by about 4 miles of recently constructed good tractor-road. The country in the vicinity of Molybdenum creek is rugged, precipitous in places, and covered with dense timber and underbrush.

Considering the geology of the area covered by this corporation's property as a whole, it may be described as one underlain by the Lower Jurassic volcanics of the Hazelton series, intruded at various points by stocks of batholithic rock, mainly granodiorite. In one of the latter are situated the surface showings under immediate investigation, and also the adit now being driven to probe the region below these showings. There are some grounds for inferring that the eastern flank of the Coast Range batholith is situated east of this region, in which case the company's property lies in a roof-pendant area.

The type of deposit under investigation consists of shear-zones in much-fractured batholithic rock, mainly granodiorite. The filling consists of well-mineralized quartz veins and sheared granodiorite. The quartz veins vary in width from a few inches up to 4 feet in one case and are well mineralized with pyrite and molybdenite. The sheared batholithic rock is more or less pyritized, and the region of shearing in most cases extends considerably beyond

the walls of the quartz veins. In some places the unshered batholithic rock is pyritized and in others the pyrite replaces the ferromagnesian silicates only. Heavy gouge is developed on the planes of shearing and the quartz veins exhibit much evidence of post-mineral movement. Commercial possibilities are obviously confined to the quartz veins.

The shear-zones were found to recur over an *observed* horizontal range of about 425 feet and over a vertical range of about 1,800 feet. They vary in strike from a few degrees west of north to north-west and dip at varying angles, but mainly steeply north-east. Lamprophyre dykes intrude the batholithic rock.

The *Diadem* was originally owned by A. Baxendale, who carried out preliminary prospecting and development work in 1923 and prior to that year. Subsequently the ownership passed to Buckley Shannon, who after continued prospecting bonded the property in 1928 to Canadian-American Consolidated Mining Company, Limited, which company did a small amount of hand-mining, and made during that year two trial shipments of $\frac{1}{2}$ ton each, the average assay being: Gold, 0.02 oz. per ton; silver, 1.6 oz. per ton; copper, 5.8 per cent.; as recorded in the Annual Report for 1928.

In 1929 the property was optioned by R. E. Doan, who transferred the option to the American Copper Mines, Limited, in 1930. This company installed an air-compressor plant and erected camp buildings beside the railway about 2 miles east of Usk. Two adits about 4,000 feet apart a short distance above the railway were started and by the end of December had been driven 132 and 930 feet respectively. Work was suspended in 1931.

Activities were commenced by the present company in 1934, and a tractor-trail about $3\frac{1}{2}$ miles in length was constructed to a camp-site on Molybdenum creek where buildings were erected. During 1935 a plant comprising two 36-42-horse-power semi-Diesel Petter engines, each running a Gardner air-compressor of 220 cubic feet of free air per minute capacity, was installed, additions made to camp buildings, and headway made with an adit started in the right bank of Molybdenum creek. (Refer to Annual Reports for the years 1923, 1928, 1930, 1931, and 1934.)

The surface showings examined are situated either in the bed of Molybdenum creek, or on the sides of the creek-valley, or in tributaries of this creek. Molybdenum creek flows north-easterly, almost parallel to the crosscut adit now being run on a bearing south 37 degrees 41 minutes west, in the right bank of the creek. At or about 1,200 feet from the portal of the adit, in the region more immediately above the face, as viewed on August 5th last, four well-mineralized outcrops are exposed, of which three are situated east and one west of Molybdenum creek. The three former veins are named by the management No. 3, No. 4, and No. 5, respectively, the first being nearest to the portal of the adit. The vein on the west side of the creek is considered by the management as being possibly the faulted portion of vein No. 4, and is described in this report as vein No. 4A. No. 2 vein outcrops 160 feet north of No. 3, and No. 1 vein 325 feet north of No. 2. The outcrops of these two latter are markedly weaker than the others. South of the foregoing, farther up-stream, four additional shear-zones are exposed in the bed of the creek within a belt of country a few hundred feet in width, containing outcrops of granodiorite and volcanic roof-rocks. One of the shear-zones is well mineralized, but little has been done to expose them.

Distant possibly 3,500 feet south-west of the portal of the adit at the head of a tributary of Molybdenum creek flowing in on the west, is exposed by natural agencies, by far the largest shear-zone observed. Its full width has not been ascertained, but it may be 20 feet or more. There are several quartz-seams within this shear-zone well mineralized with pyrite and molybdenite.

Distant possibly 750 feet south-west of the last-mentioned shear-zone, on the divide between Nicholson and Lowrie creeks at an elevation of about 1,800 feet above the adit, another shear-zone is exposed, 13 feet in width, wherein quartz-seams are well mineralized with pyrite and molybdenite.

The outcrop of vein No. 3 is uncovered for a few feet in length only on the right bank of Molybdenum creek at an elevation of 300 feet above the adit. This is a strong showing having a width of 4 feet of quartz well mineralized with pyrite and molybdenite, the latter occurring mainly on the hanging-wall, strike north 26 degrees west, dip 70 degrees north-east. The shear-zone apparently continues south-eastwards, but continuity north-westwards is not evident. A sample taken across 4 feet assayed: Gold, 0.02 oz. per ton; molybdenum, 0.08 per cent.

The outcrop of vein No. 4, elevation 350 feet above the adit, is situated on the right bank of Molybdenum creek at its junction with Calhoun creek. The width of the shear-zone is 4 feet, of which 1.5 feet of quartz on the hanging-wall is very heavily mineralized with pyrite and molybdenite. It strikes north 11 degrees west and dips 57 to 72 degrees north-east. A sample taken across 1.5 feet assayed: Gold, *nil*; molybdenum, 0.21 per cent. This outcrop may be the north-westward continuation of vein No. 5, the outcrop of the latter on Calhoun creek being distant 375 feet measured along the strike, or these may be two closely adjacent shear-zones.

The outcrop of vein No. 5 is exposed in the bed of Calhoun creek at an elevation of 475 feet above the adit. A quartz vein 2½ feet in width, well mineralized with pyrite and molybdenite, occurs on the hanging-wall of the shear-zone, which strikes north 6 degrees west to north 11 degrees west and dips 65 degrees north-easterly. The total width of the shear-zone at the point of exposure is 8 feet, but the width apparently increases south-east of this point. A sample taken across 2½ feet assayed: Gold, trace; molybdenum, 0.2 per cent.

Vein No. 4A is a well-mineralized outcrop, elevation 375 feet above the adit, just above the junction of Calhoun and Molybdenum creeks, on the left bank of the latter immediately adjacent to the creek. Its continuity is not clear, but this shear-zone is close to veins Nos. 4 and 5. The width of the shear-zone is 6 feet, of which 4 feet is well mineralized with pyrite and molybdenite. The strike is apparently north 51 degrees west; the dip is not obvious, but it is either steep to the north-east or vertical. The following samples were obtained:—No. 1, taken across 4 feet, assayed: Gold, trace; molybdenum, 0.15 per cent. No. 2, taken of selected ore, assayed: Gold, *nil*; molybdenum, 0.21 per cent. Samples taken of the mineralized sections of the large shear-zone mentioned as being exposed at the head of a tributary flowing in from the west side of Molybdenum creek, likewise samples taken from the shear-zone situated on the divide between Lowrie and Nicholson creeks, assayed: Gold, trace.

The underground working is an adit being run on a bearing south 37 degrees 41 minutes west, at elevation 1,533 feet (bearing and elevation are as determined by F. Nash, B.C.L.S.), in the right bank of Molybdenum creek to probe the region below the surface showings above described. On August 5th this adit had reached a length of 1,178 feet and is driven wholly within sheared and fractured batholithic rock consisting of granodiorite and more acid phases. The batholithic rock is cut at several points by lamprophyre dykes of a maximum width of 9 feet. The granodiorite is markedly fractured in a north-east direction, the fractures dipping mainly south-east, occasionally north-west, and pronouncedly sheared in a north-west direction. It is within these shear-zones that well-mineralized quartz veins are developed at points on the surface, as described above. In the adit, however, such quartz veins as are exposed are chiefly only a few inches in width, although one sparsely mineralized quartz-lens was observed of a maximum width of 1.5 feet. The adit had at this time, however, only just entered the region beneath the surface outcrops. At points 560.5 to 585 feet from the portal a pyritized shear-zone was penetrated which may be the downward continuation of vein No. 1. A sample across this width assayed: Gold, *nil*. South-west of this, a width of 65 feet shows shearing. At 806 feet from the portal another shear-zone was penetrated. A sample across this width assayed: Gold, trace. At 895 to 909 feet another shear-zone was penetrated. A sample across this width assayed: Gold, trace. This shear-zone may be the downward continuation of the one containing vein No. 2. At 855 feet from the portal a well-mineralized quartz vein was cut, 3 inches in width. A sample of this vein assayed: Gold, *nil*; molybdenum, 0.42 per cent. A sample taken between points 577 and 582 feet from the portal representing the best mineralized portion of the shear-zone in this region assayed: Gold, *nil*.

On October 1st the adit was again examined, the face being on that date 1,445 feet from the portal in granodiorite. At about 1,200 feet from the portal a sparsely mineralized shear-zone about 2 feet in width was cut, and at 1,250 feet from the portal a branch drive had been run south-easterly a distance of about 60 feet.

In this region now under investigation well-mineralized quartz veins occur in many shear-zones extending over a considerable vertical and horizontal range. In view of the dense vegetation, quite possibly others will be discovered in addition to those already known. At the time of examination in August last, development did not disclose whether the quartz veins were likely to prove continuous or lens-like in character. All the quartz veins exhibit a striking similarity in the character of mineralization—essentially pyrite and molybdenite. A consid-

erable number of samples taken over a fairly extensive horizontal and vertical range failed to disclose upon assay other than very low gold values. This fact, considered in conjunction with the character of mineralization, suggests that temperature conditions may have been too high for the deposition of commercial gold values.

PEACE RIVER AREA.

Mount Selwyn.

Mount Selwyn is situated on the right bank of the river between Quartz and Selwyn creeks, about 12 miles down-stream from Finlay forks. It is distant about 95 miles from Hudson Hope and about 180 miles from Prince George. It may be readily reached via the Peace river from Hudson Hope or via the Crooked, Pack, Parsnip, and Peace rivers from Summit lake (32 miles north of Prince George) by motor-boat. Alternatively, the Peace river near Mount Selwyn affords a good landing for aeroplanes. The mountain is wholly contained in the Omineca Mining Division.

The mountain rises steeply from the edge of the Peace river to an elevation of 6,220 feet. At an elevation of 3,750 feet a spur runs out in a north-westerly direction for a distance of about 1½ miles from the main mountain mass. This spur lies between Quartz creek on the west and the Peace river on the east, the latter flowing easterly round the northern extremity and south-easterly on the east side of the spur. It is this spur which has for some years past been the subject of attention and controversy, owing to the alleged gold content of the quartzite-beds, of which it is in large measure composed. The Peace River Mining and Milling Company, Limited, holds a large number of claims covering practically the entire spur, and extending to the main mountain mass where in this region quartzite-beds are also exposed.

The spur previously referred to can be conveniently examined by ascending a steep trail from the right bank of the Peace river opposite the Wicked river (the mountain-slope in this region is between 30 and 40 degrees, and cliff-like in places), and also by following a trail from Quartz creek. The former route leads across the quartzite-beds; the latter follows very nearly the strike of the beds.

The spur, which is well covered with timber, is seen to consist chiefly of beds of white and cream-coloured quartzite. A prominent feature of the landscape viewed from the Peace river is the outcrop of the broad band of quartzite-beds, many hundreds of feet in width along the full length of the ridge, and extending to the junction with the main mountain mass on the east side of the spur. On this side of the spur the quartzite-beds first outcrop in the form of a row of cliffs or bluffs at 800 feet above the Peace river (elevation of the latter at this point as determined by aneroid and checked against Canadian Pacific Railway survey bench-mark in the vicinity was found to be 1,900 feet above sea-level). At this point the quartzites are seen to be immediately underlain by limestone and conglomerate. In the region opposite the mouth of the Wicked river, greenish-coloured schists of apparently sedimentary origin outcrop at the base. At this point the latter are intruded by a lamprophyre sill about 20 inches in width. The latter is not schistose in character and was therefore presumably injected after the deformation of the sediments.

The quartzite-beds strike north-west and dip into the mountain south-west at angles varying from 40 to 70 degrees. The underlying schists have similar strike and dip. On the *Una* mineral claim, near the junction of the spur with the main mountain mass, the quartzites are overlain at one point by green-coloured schists. The former again outcrop prominently on the main mountain mass in the region mentioned, although the strike changes to north-easterly and dip to north-westerly, possibly due to faulting. Save as mentioned above, quartzites outcrop continuously on the ridge and also at the falls on Quartz creek, which occur on the *Three in One* mineral claim about 1 mile above the mouth of the creek at elevation 2,125 feet.

The quartzite-beds are white and buff in colour and contain numerous quartz veinlets which are chiefly in the form of a network, but in places follow the bedding-planes of the quartzites. In places the quartzites are intensely altered and consist largely of crystalline quartz; the passage from quartzite to quartz being possibly due to intense metamorphism. Most samples of the quartzite show specks of ferric oxide, and in many samples small crystals of pyrite can be discerned with the aid of a glass. At one point a small seam a few inches in width was found which was well mineralized with pyrite, and at another point a very small seam of galena was pointed out by Mr. MacAllister (who was present as representing the

Peace River Mining and Milling Company). Considering the quartzite-beds as a whole, however, the percentage of sulphides present is obviously very low.

Weathering agencies have broken down the quartzite-beds on the side of the spur fronting the Peace river, forming two large talus-slopes of blocky material.

No underground development, apart from a few shallow shafts, has been done by the holding company; therefore sampling can only be done on the surface. About 1922 a 3-rail surface gravity tramway was constructed from an experimental plant on the bank of the river to the first outcrop of the quartzite-beds (800 feet above the river, as previously mentioned). This tramway apparently was not subsequently used. It formed a convenient "marker" from which to measure distances to points at which samples were taken. It crosses the northerly area of the *Badger* claim and enters the *North Star* claim 400 feet from the north-east corner on the east side-line extending almost to the centre of the claim.

Sampling by Resident Engineer in 1935.—It was considered that chip-sampling of the individual masses of quartzite forming the talus-slopes, systematically carried out, should give a fair sample of the deposit. Accordingly, samples taken during the present year were mainly from talus-slopes. In 1928 four samples were taken of the quartzite-beds in place at various points on the summit of the spur. The following is a description of samples taken in 1935:—

Samples taken from talus-slope on *North Star* claim:—

Sample 2519B, elevation 2,500 feet, across 50 feet (125 feet to 175 feet east of tramway); 500 feet from east claim boundary assayed a trace in gold.

Sample 2521B, elevation 2,450 feet, across 50 feet (0 feet to 50 feet east of tramway), assayed a trace in gold.

Sample 2522B, elevation 2,450 feet, across 50 feet (300 to 350 feet east of tramway), assayed a trace in gold.

Sample 2523B, elevation 2,450 feet, across 50 feet (550 to 600 feet east of tramway), assayed a trace in gold.

Sample 2524B, elevation 2,500 feet, across 50 feet (550 to 600 feet east of tramway), assayed a trace in gold.

The following sample was taken from the talus-slope on the *Selwyn* claim:—

Sample 2529B, elevation 2,900 feet, across 200 feet (near south-east corner), assayed *nil* in gold.

The following samples were taken of material in place:—

Sample 2527B, across seam in quartzites 11 inches in width, elevation 2,700 feet, close to upper end of tramway (at this point a value of \$3.20 per ton in gold was reported to have been obtained by Mr. MacAllister), assayed a trace in gold.

Sample 2528B, selected mineral from a well-pyritized seam a few inches in width, approximately 200 feet north-west of tramway at elevation 2,715 feet, assayed a trace in gold.

Sample 2530B, quartzite-beds representing a width of 30 feet taken just above upper end of tramway, elevation 2,700 to 2,730 feet, assayed *nil* in gold.

Sample 2531B: This sample was handed in by Cowper Rochfort and was taken by him from a shallow shaft on the lower portion of the ridge of the spur, where he stated that good values might be expected. Assayed *nil* in gold.

During the season of 1935 the Consolidated Mining and Smelting Company of Canada undertook an examination of Mount Selwyn, and the Resident Engineer for No. 2 Mineral Survey District was invited to be present. He was on the ground for four days during the examination and took nine samples as a check against part of the extensive sampling by the Consolidated Company. Eight samples were taken on the *North Star* claim and one on the *Selwyn* claim.

The Consolidated Mining and Smelting Company took 217 samples on the *North Star* claim, 40 on the *Una* claim, and 58 on the *Selwyn* claim. Of the 217 samples taken on the *North Star* claim, 165 were from talus material, 36 from a 360-foot section across the strike of the quartzite-beds, and 16 from shorter sections across the quartzites. The 58 samples from the *Selwyn* claim were taken from talus material. The 40 samples taken from the *Una* claim represented a continuous section of 400 feet across the quartzites.

The rejects of these samples were sent by Consolidated Mining and Smelting Company to the Department of Mines at Victoria. The Provincial Assayer quartered down each sample separately, combining the quarters into a bulk sample. The bulk sample was thoroughly

mixed and ground. Several assays were made, yielding only a slight trace of gold. The bulk sample, weighing 70 lb., was sent to the Department of Mines, Ottawa, for an amalgamation test to make certain that any free gold which might occur widely disseminated in the quartzites had not been missed in assaying. The following report from the Department of Mines, Ottawa, shows that the bulk sample contained only a faint trace of gold:—

“The average assay of eight assay-ton samples was: Gold, 0.0007 oz. per ton.

“A barrel amalgamation test was made as requested. The gold in the mercury used was determined before and after amalgamation of the sample. The assay result of the gold amalgamated was 0.004 oz. per ton of sample, or 14 cents per ton with gold figured at \$35 per ounce. This small amount of gold was very probably picked up in the mill in which the sample was amalgamated or in the hydraulic classifier used to separate the mercury from the pulp. The assay of the amalgamation tailing was a faint trace of gold, similar to what was obtained from an assay-ton of the original sample.

“The conclusion is that the sample submitted contains less than 2.5 cents gold per ton with gold figured at \$35 an ounce.”

The results of this year's sampling prove that there is no justification for inferring that the quartzite-beds carry gold values.

PLACER DEPOSITS.

WINGDAM DEPOSIT.

Although placer deposits of post-Glacial age occur in this area, it is the buried deposits that are of major importance. In the case of the latter these are the pre-Glacial channel of Lightning creek lying at a depth of 165 feet, and another deposit of unique type and proved extent lying at a depth of 120 feet.

It is noteworthy that the area includes the contact between the Precambrian and the Mesozoic rocks. The rocks bordering the contact from this point south-eastwards to Spanish mountain are invested with particular interest because of the importance of the placer deposits associated with them.

This company was incorporated in 1930 for the purpose of acquiring and developing the leases on Lightning creek held by Lightning Creek Gold Mines, Consolidated Gold Alluvials Limited (formerly Lightning Creek Gold Gravels and Drainage Company, of B.C., Ltd. Limited). These leases were consolidated into one group in 1896 by private Act, conferring special rights (chapter 56 of 1896), and cover about 21 miles of Lightning creek in the vicinity of Wingdam. *La Fontaine* mine, 1½ miles below Stanley, on Lightning creek, was also acquired by the present company. The capital is 2,500,000 shares of a par value of \$1 each. The company's base of operation is Wingdam, distant 30 miles from Quesnel on the Quesnel-Barkerville road, and plant and camp buildings are situated at this point.

Wingdam is situated close to the edge of the south-western limb of an anticline into which the Precambrian Cariboo series is folded. The actual contact of the latter series with the unconformably-overlying Mesozoic argillites occurs on Lightning creek, about ¼ miles downstream from Wingdam. The rocks of the Cariboo series in this region consist of argillites, quartzites, and conglomerates. On the left bank of Lightning creek, about half a mile downstream from No. 1 shaft, quartzites and conglomerates of the Cariboo series are intruded by quartz-feldspar dykes. It is evident that intrusion took place prior to the jointing in the Precambrian rocks, because the jointing passes through the dykes.

On Mosquito creek, about 3 miles below Wingdam, Mesozoic argillites are intruded by hornblende diorite. Mineralized quartz veins occur in the rocks of the Precambrian Cariboo series exposed on Pinegrove creek, Ramos creek, on the left bank of Lightning creek below Wingdam, and in the Melvin shaft. Similar veins are also exposed in the Mesozoic rocks on Lightning creek above Mosquito creek and in the hydraulic pit of Slade-Cariboo Placers, Limited. There is therefore abundant evidence of a source for the formation of Tertiary bed-rock placer deposits.

In the immediate vicinity of Wingdam, Lightning creek is contained in a steep narrow valley, and 1 mile below Wingdam enters a canyon some miles in length. Immediately above and below Wingdam it is evident that the creek crosses and recrosses its buried pre-Glacial channel, the bed-rock of which has been proved by drilling to lie at a depth of about 165 feet below the creek.

Below the mouth of Mosquito creek, however, the evidence supports the view that in Tertiary times Lightning creek may have occupied an entirely different channel from that of the course of the present creek, which flows north-westerly from this point. Above Wingdam the valley gradually widens to one of subdued relief and great width at Beaver Pass House. Up-stream from the latter point the valley again becomes narrow and steep at and above Stanley.

Apart from the superficial post-Glacial placer concentrations, two distinct types of placer deposits occur on the company's property in immediate proximity to Wingdam: (a.) A deposit of possibly inter-Glacial age, underlying the top boulder-clay, and occurring at a depth of 120 feet below the surface. This consists of highly auriferous washed gravels, in which are many large boulders and pieces of slide-rock of purely local origin, while some of the smaller boulders are not local. Up to the present the workings and Keystone-drilling have not revealed a *false bed-rock underlying this deposit*, which is believed to be quite unique in this district. It has been extensively mined, and particulars of sampling carried out by the writer, including further details, are given later in this report. It has proved far more important than there was formerly any reason to suppose. The gold, which is fairly coarse, is flat and well worn. (b.) The bed-rock gravels of the pre-Glacial channel which lie buried at a depth of about 165 feet below the creek. These were originally the main objective of this company, upon which vigorous effort has been concentrated for the past two years on the extensive preliminary work necessary for the safe mining of these gravels. No mining has been done and first-hand information as to the values therein has been ascertained only by the large amount of Keystone-drilling. High values are reported by the management and it may be stated that general considerations justify the view that good bed-rock values are quite possible.

At *La Fontaine* mine the pre-Glacial channel of Lightning creek lying at a depth of 125 feet below the creek was extensively mined in the years 1903 to 1907, but values were then found to be too low to yield a profit.

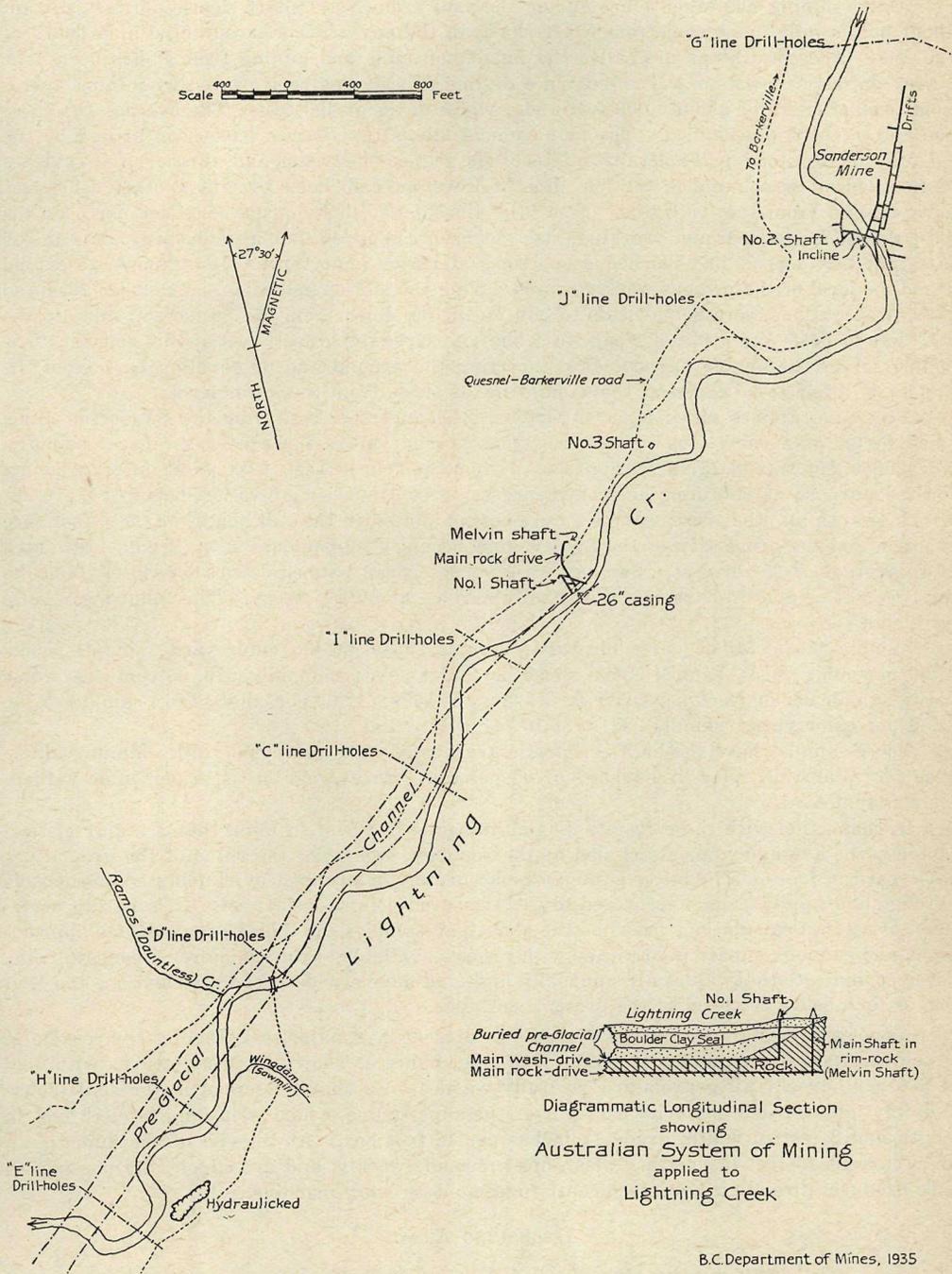
Shortly after incorporation of Lightning Creek Gold Gravels and Drainage Company, Limited (the name of this company was changed to Lightning Creek Gold Mines, Limited, in 1929), mining operations commenced with the driving of a drainage-adit (the site of which is unknown to the writer), which was continued, according to the 1899 Annual Report, a distance of 1,500 feet and subsequently abandoned in favour of shaft-sinking. Four shafts were sunk, and much Keystone-drilling was carried out under the management of C. H. Unverzagt. A branch drive from one of these shafts, now known as No. 1 shaft (depth 195 feet, of which the upper 103 feet are in gravels and the remainder in rim-rock), was run southwards a distance of 115 feet, breaking into the channel-gravels at this point. Unfortunately, at the time of breaking through, water and gravels came in with a rush, causing subsidence of the gravels and suspension of operations in this working at that time. No actual mining of gravels took place until 1933, when, following the completion of the necessary preparations started in 1931, No. 2 shaft (depth 130 feet) was reconditioned and unwatered, and mining of the pay-gravels encountered at a depth of 120 feet was commenced. In the fall of 1933 it was decided to resume the former attempt to mine bed-rock gravels from No. 1 shaft, and with this end in view a method of mining suggested by the N. C. Janssen Drilling Company, of Seattle, was adopted. This involves sinking, by way of preliminary, a steel casing, 26 inches in diameter, to, and somewhat below, bed-rock in the vicinity of the shaft which it is desired subsequently to sink or from which to mine if the shaft has already been sunk. In this casing (the bottom of which is perforated to permit ready inflow of water) is placed a deep-well pump, which pumps bed-rock waters to surface, likewise such waters in superincumbent deposits as are free to percolate downwards to bed-rock. In the autumn of 1933 a 26-inch casing was put down by the N. C. Janssen Drilling Company, under contract, close to the creek, 142 feet south of No. 1 shaft, and bedrock was reached at 175 feet 7 inches, and drilling was continued to afford a sump a further 12½ feet in bed-rock. Subsequently, the casing was apparently perforated not only at the bottom, but also, for reasons that are not clear, at a depth of 132 feet. The result was that fine material passed into the pump-well, choking the pump. Following the control of management by English interests in 1934, application of the Australian method of deep-lead placer-mining (subsequently described in this report) was decided upon. Refer to Annual Reports for 1899, 1902, 1904 to 1920 (inclusive), 1922 to 1933 (inclusive), also Geological Survey Summary Report, Part A, 1933.

In 1934 much headway was made with the extensive preliminary development necessary to the application of the mining method mentioned. Meanwhile an extensive campaign of Keystone-drilling to delimit the buried channel was carried out. In addition, a Crossley-Diesel power plant of 560-horse-power capacity was installed and in operation by the end of the year. The above programme was continued during the present year, and mining of the inter-Glacial run from No. 2 shaft produced such favourable results, both as to values and extent, that it became evident that plans might be advisedly made for more active mining of this deposit. All mining operations received a very serious set-back in August of this year, when a disastrous fire almost totally destroyed the power plant. A Diesel engine to serve temporarily was procured from Vancouver and a new power plant was put in operation early in November, when once again former activities were resumed.

Under the Australian system of mining, a main shaft is sunk (as shown in sketch) in solid rim-rock on one side of the valley to such a depth that, allowing for a rock-drive from a crosscut from the bottom of the shaft up-stream and down-stream $1\frac{1}{2}$ miles, the minimum thickness of rock-cover over the drive will be 40 feet. This drive, known as the "main rock-drive," is run approximately below the centre line of the buried channel, and from it raises or drill-holes are put up at frequent intervals to "bleed" or drain the channel-gravels. An interval of time, depending on local conditions, must be allowed for draining. From the shaft a "main wash-drive" is run at the level of the bed-rock of the buried channel, and this main wash-drive is also run up- and down-stream in the drained gravels, and from either side of it lateral gravels are mined much on the "retreating long-wall" system followed in coal-mining. About 400 horse-power should be provided for each main shaft. The average value of wash in Victoria, Australia, is given as a trifle over $1\frac{1}{4}$ oz. of gold per square fathom, and costs of mining as 64 shillings per square fathom. The square fathom (36 square feet) is used as a unit instead of the cubic yard, which is customary in this Province. In Victoria, Australia, values are apparently confined to a depth of 3 feet of gravels immediately overlying bed-rock, and 1 foot in thickness in the latter. Assuming the workings are one set high—that is approximately 2 yards—in order to clean a square fathom of bed-rock, approximately 8 to 10 cubic yards of ground must be removed. From the cost point of view the system described must show to best advantage when the buried channel is not only long, but wide, because in such cases overhead and indirect charges will be at the minimum. It is obvious that a long stretch of pay-gravel in the buried channel must be proved beforehand by drilling, in order that the cost of the preparatory sinking and drifting for drainage may be distributed over a large yardage of gravel mined subsequently. The presence of a superincumbent water-tight seal (in this country usually afforded by boulder-clay) is necessary so that there is no active percolation of surface waters through the unconsolidated materials overlying bed-rock, so that bed-rock gravels may be effectively drained and quasi-fluid pressure shall not develop therein.

Irrespective of the question of cost, this system of mining is, so far as is known, the only one that can safely be adopted in the case of many buried *creek*-channels where other methods of mining are inapplicable.

In conformity with the adoption of the Australian system of mining, therefore, an instream shaft, known formerly as the "Jones" shaft, sunk many years ago to a depth of 140 feet entirely in rim-rock save for the first 20 feet, has been enlarged and continued to a total depth of 280 feet. This shaft, 15 by 6 feet in the clear, is now known as the "Melvin" shaft and has four compartments. From it a branch drive has been run southerly under the buried channel, and from this point it is to be extended up-stream and down-stream, constituting the "main rock-drive" of the Australian system. Drainage will be established by boring holes up into the gutter at intervals of 100 feet. This drive is 62 feet below another drive run recently south-east from No. 1 shaft, a distance of about 170 feet close to the buried channel, and from a point near its end long holes were drilled into the channel, using an ordinary drifter with specially made long steel. It is understood that some coarse gold was found in the material forced out by the pressure through one of these holes. In view of the known subsidence of gravels previously in this region, it was deemed safest to defer the idea of mining at this point until drainage had been completed through the main rock-drive by pumping from the Melvin shaft. No. 1 shaft is 195 feet in depth, of which the upper 103 feet are in gravels and the remainder in rim-rock. Many years ago a drive was run southerly to the channel-



B.C. Department of Mines, 1935

Consolidated Gold Alluvials of B.C., Ltd. Plan of Workings from Company's Map. Underground Workings are shown in Heavy Lines.

gravels a distance of about 115 feet at a level 9 feet above and somewhat west of the drive recently run.

Active mining has taken place during the year from No. 2 shaft, depth 130 feet, distant about half a mile up-stream from No. 1 shaft, in the pay-gravels encountered at a depth of 120 feet. These workings are called the Sanderson mine and mining from it has been done almost entirely up-stream. The existence of this deposit has been proved by mining operations over a length of about 1,000 feet and a width of about 400 feet. The average thickness has not yet been determined. The management states that values have been proved by the "J" line of Keystone-drill holes distant about 800 feet down-stream, and, further, that evidence of this deposit was found in the "I" line of Keystone-drill holes distant another 2,400 feet down-stream from the "J" line. The "G" line of drill-holes about 300 feet north of the most northerly underground workings has not been completed, but all evidence points to the fact that this deposit has reached proportions of major importance. It is known to extend *below* the level of the present workings, and during the last examination, on October 26th and 27th, preparations were being made to run an incline down from the Sanderson mine to the "J" line of holes and also to deepen No. 2 shaft to serve the lowest level of this deposit. The incline serves the double purpose of prospecting the ground and of enabling cars from the Sanderson mine to be caged at the same point as those from the lower level.

Nine pan-samples were taken on October 26th and 27th last from the Sanderson mine. One-quarter of a cubic foot was as nearly as possible taken in each case. Three samples, Nos. 2565B, 2569B, and 2571B, were procured from the floor of the workings at different points for the purpose of obtaining some evidence as to continuation of values below the present workings. In all other cases samples were cut up and down the full height of the 6-foot face exposed, and the proportion of the total volume occupied by boulders at each point estimated at an average of 35 per cent. Samples were purposely not panned down very closely, and the total weight of gold in each case was finally arrived at by fire assay. The following results were obtained:—

Sample 2563B, \$13.65 per cubic yard; sample 2564B, \$6 per cubic yard; sample 2565B, \$7.80 per cubic yard; sample 2566B, \$9.90 per cubic yard; sample 2567B, 90 cents per cubic yard; sample 2568B, \$8.40 per cubic yard; sample 2569B, \$12.90 per cubic yard; sample 2570B, \$4.50 per cubic yard; sample 2571B, \$5.10 per cubic yard.

These samples have the high arithmetic average of \$7.68 per cubic yard. Making allowance for volume occupied by boulders of 35 per cent., an average of \$4.99 per cubic yard in place is indicated.

In connection with these results it is all-important to bear in mind that a highly critical factor is the average volume occupied by the boulders, and hence the value of the ground per cubic yard *in place*. The latter can *only* be accurately determined by sluicing a considerable yardage and applying gold recovered to the measured volume excavated. It is hardly necessary to say that calculations based on the above pan-samples can only be regarded as approximate, and cannot compare in accuracy with records available to the company. The results do, however, indicate that values are unusually high and have a widespread distribution, and that they extend below the level of the present workings.

Although a certain amount of fine gold is present, the majority is readily recoverable in a well-designed sluice-flume. Its value is \$31 per ounce as shown by Mint returns with gold at \$35 per ounce. All gravels are carefully washed on a shaking screen in the shaft-house and only minus 1-inch material passes over the sluice-flume, which is in duplicate, 72 feet in length and 2 feet in width, grade 12 inches per 12-foot box. At the end of the flume is an undercurrent 16 feet in length. Clean-ups are made weekly, and are effected by passing all riffle products through a Lorentsen centrifugal gold-recovery machine.

HYDRAULIC AREA.

This company is a private one, with R. F. Sharpe as president and manager and registered offices in 501 Vancouver Block, Vancouver. The property, including a number of leases covering the well-known *Bullion* mine, is the largest hydraulic enterprise in the Province. It is situated on the South fork of the Quesnel river and is reached by a branch road, 1½ miles in length, from the Williams Lake—Likely road, the distance being about 60 miles from Williams Lake.

The geology of the region consists of Mesozoic rocks intruded at numerous points by batholithic stocks and tongues. Quartz veins are of frequent occurrence in the region.

The type of deposit is a large buried river-channel, in size 1,000 to 1,500 feet wide at the top, 200 to 300 feet wide at the bottom, and 400 feet deep, immediately adjacent and parallel to the South fork of the Quesnel river. The bed-rock of the channel is 170 feet above the river, so that ideal dump facilities for hydraulicicking exist. The direction of flow is the same as that of the South fork and the bed-rock gradient is about 1 per cent. The character of the channel is steep-walled and gorge-like. As seen in the *Bullion* pit, the formation exposed is greenstone intruded by syenite. The filling consists of coarse gravels containing boulders overlying bed-rock. These are overlain by a stratum of boulder-clay on which rests fine gravel, the latter being overlain by another stratum of boulder-clay. The age of the channel, as inferred from fossil evidence, is Pleistocene. The average value from top to bottom, as computed from hydraulicicking about 12,000,000 cubic yards in the past, is 10 cents per cubic yard with gold at \$20.67 per ounce, or nearly 17 cents per cubic yard with gold at the present price, but the values in the up-stream section of the channel, the length of which is probably very considerable, still remain unproven. From Dancing Bill gulch this channel has been piped out for a length of about half a mile up-stream to within about 800 feet of the South Fork pit—another hydraulic pit opened up many years ago transverse to the direction of flow on Black Jack gulch from the South Fork river. In the South Fork pit bed-rock is not exposed, but the right rim of the channel can be plainly seen, and 1,600 feet farther up Black Jack gulch there is evidence of the left rim, whereas only 800 feet away the face of the *Bullion* pit shows both rims very much closer together; therefore a widening of the channel immediately up-stream from the *Bullion* pit is to be expected. Beyond the South Fork pit the up-stream continuation is not definitely known, but it may be the channel discovered at the *Little Joe* mine, 2 miles farther up-stream. (See Annual Report for 1932.) A large yardage of gravels still remains available for hydraulicicking from the present *Bullion* pit, the sluice-flume being placed in a tunnel driven from the South Fork valley through the right rim of the older channel, connecting with the pit.

Originally the property was worked for many years by a Chinese company, and in 1892 it was acquired by the late J. B. Hobson and passed into the possession of the Consolidated Cariboo Hydraulic Mining Company, incorporated in 1897. Under the management of the late J. B. Hobson, the property was developed and equipped as an hydraulic one of large proportions. Up to the year 1905, under this management, \$1,233,936.51 was recovered from 12,000,000 cubic yards, but the enterprise was not a success financially owing to the insufficient supply of water available from the three mentioned sources of supply. Because of this assigned reason for lack of success, the property was acquired by the Guggenheim Exploration Company in 1906 with the view of developing the fourth water right, Spanish lake. This scheme was, at considerable expense, only partly carried out and in 1907 operations were suddenly suspended. Subsequently, except for very brief periods of resumption in 1914 and 1921, nothing was done until 1926, and in the interim, flumes, ditches, and equipment generally decayed from long disuse. In 1926 and 1927 it was reopened by Messrs. Ross, Holland, and Ulch, who partly repaired the water systems they used and piped off some of the bed-rock gravels left by earlier operations. In 1928 Carinelle Placers, Limited, acquired the property, and under the management of Norman C. Stines connected the sluice-tunnel (previously driven by the late J. B. Hobson in the left bank of the South fork) by upraise with the pit, renovated the water systems, hydraulicicked, and subsequently suspended operations in 1929. In 1930 the property was operated by the Quatsino Copper Gold Company; in 1931 by the B.C. Hydraulics, Limited; and in 1932 by Hireen Placers, Limited. In 1933 Bullion Placers, Limited, acquired the property, and in 1934 directive control passed to English interests, who, retaining R. F. Sharpe as manager, initiated the schemes for rendering additional water available, devised by the late Chas. H. Stewart, of the firm of Alexr. Hill and Stewart, consulting engineers. (Refer to Annual Reports, 1900 to 1906 (inclusive), 1910, 1911, 1918, 1921, 1922, 1926 to 1933 (inclusive), also Geological Survey Report, 1932, Part A 1.)

Material changes in the system of hydraulicicking were also put into effect in 1934, consisting essentially in the simultaneous employment of two monitors; one at the top of the pit with 5-inch nozzle under a head of 85 feet to commence with, and the other in the floor of the pit with 9-inch nozzle under a head of 380 feet. This arrangement minimized the danger from

caves, but involved much relaying of pipe, construction of two new penstocks, and renewal of 13 miles of ditches. As the result, it was possible to pipe off some 400,000 cubic yards of gravels that year. The arrangement permits sixteen hours of continuous piping each day, the remaining eight hours being devoted to drilling and blasting boulders and general repairs.

In connection with the schemes for rendering additional supplies of water available, the one connecting Polley, Bootjack, and Morehead lakes has been first put into effect. Bootjack Lake outlet has been deepened to 12 feet, with a new control-gate, and Morehead Lake outlet has been deepened, thus permitting withdrawal of greater amounts of water from these lakes than has hitherto been possible. By utilizing 30 per cent. of the total Polley Lake water to develop electric power at a plant situated on Quesnel lake, where a head of 600 feet is obtained, 500 electrical horse-power is generated at this point. This is transmitted to a pumping plant at Polley lake, where 70 per cent. of the total water is pumped over a divide 80 feet in height to flow into Morehead lake, where it is then controlled by the main water system. This renders available an additional 13,000 gallons per minute as the pump has a capacity of 10,000 gallons per minute under a 95-foot head. In connection with the utilization of Spanish Lake water rights amounting to 5,000 cubic feet per minute, the scheme contemplated is to lift Spanish Lake water over a low divide to Summit lake, whence it is to be piped across Poquette pass, reaching the South Fork pit at a much higher elevation for piping than under the scheme contemplated by previous operators. About 2,000 horse-power is required to lift the water over the divide mentioned (a vertical height of 173 feet). Of this amount, some 1,700 horse-power is obtained from the water in its subsequent descent without encroaching upon its value for piping. The net result will be, it is stated, to obtain a piping-head greatly superior to that obtained under the scheme formerly contemplated and the great advantage resulting from a much shorter ditch-line. It is not proposed, however, to put this scheme into immediate effect.

As a result of the additional water rendered available, the management computes the yardage piped during the present year as 696,974 cubic yards, determined from careful surveys of the pit-face before and after the season's operations, which were curtailed by early severe weather. As determined by measurements made by the Water Rights Branch of the Department of Lands, the average amount of water flowing in the company's main supply-ditch this year was 2,600 miners' inches, which was the amount used in hydraulicking. The management estimates that a total of approximately 17,000,000 tons of water was used during the year, which did an estimated hydraulic water-duty of 23.1 tons per cubic yard.

What is believed to be the largest monitor on this Continent was installed this year, having a 10-inch nozzle, under a head of 380 feet, with an intake 18 inches in diameter. The yardage piped with this monitor in the pit, and another with 5-inch nozzle on top of the bank, was about 400 cubic yards per hour. Boulders are entirely disposed of by blasting, one eight-hour shift per day being reserved for that purpose. On an average 243 boulders (about 120 tons) are blasted per day and about one-third of a stick of powder is used per boulder. It is the opinion of the management that such a method is preferable at this property to any mechanical means for removal of boulders. In spite of every precaution large caves occur and cause delays.

The sluice-flume, which is 1,500 feet in length and of cross-sectional dimensions 6 by 4 feet, is contained in a 10- by 10-foot tunnel, electrically lighted, which enters the pit from the South Fork valley. The grade of the lower 900 feet is $5\frac{1}{2}$ per cent. and of the upper part 4 per cent. Riffles used are partly block riffles and partly steel rails. It is proposed to replace block riffles with steel rails finally.

The character of the gold is both coarse and fine.

At the time of examination in October, preparations were being made to drill the South Fork pit to obtain bed-rock contours and some idea of values. It is planned to install two large monitors in this pit as well as the two monitors previously mentioned in the *Bullion* pit. The South Fork monitors will be utilized for piping gravels above the floor of the pit only (the floor of the pit is believed to be about 80 feet above bed-rock). Finally, as the South Fork pit advances, a sluice-tunnel will be run from the river to enable bed-rock gravels to be hydraulicked. Before, however, hydraulicking can be commenced in this pit, renovation of the Morehead ditch and flume and installation of additional pipe-lines is necessary.

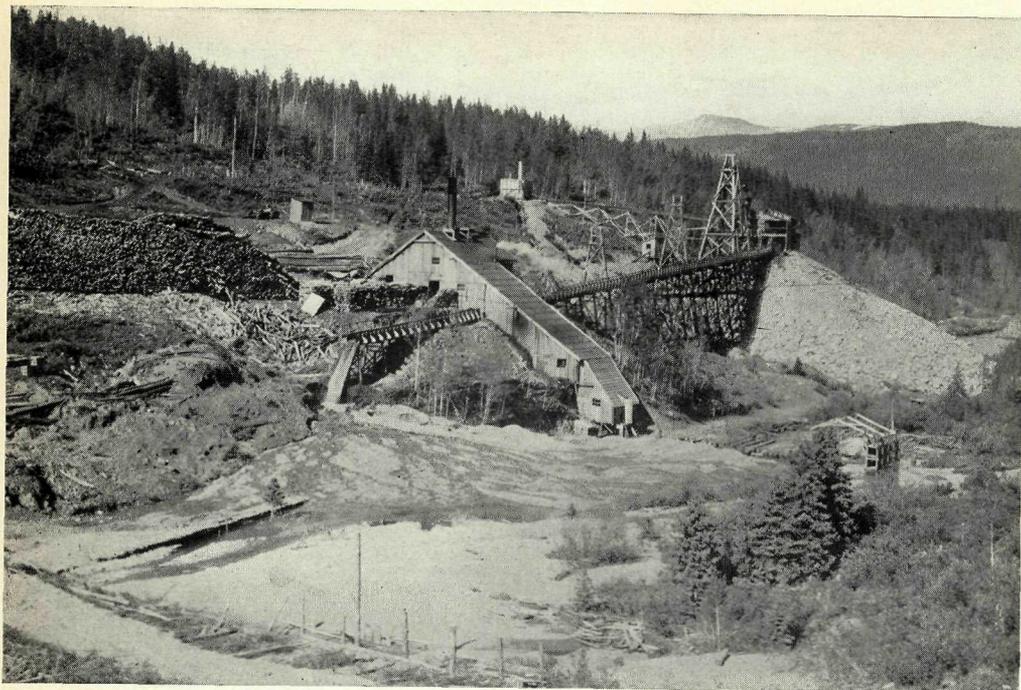
To meet the demands for better pit-lighting a new lighting plant was installed.



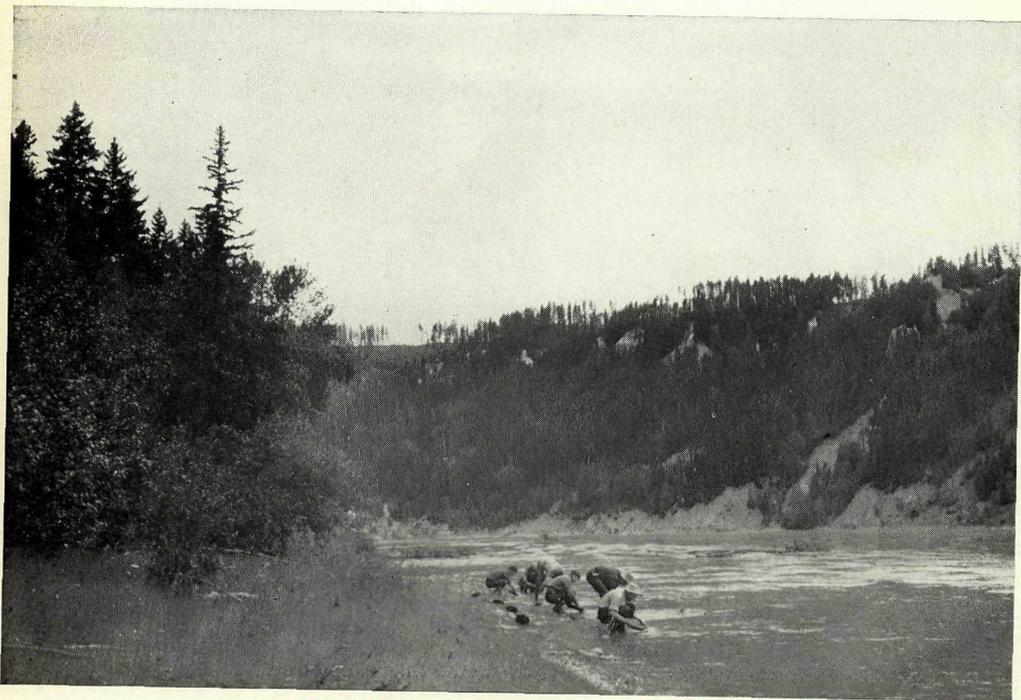
Road-making by Consolidated Mining and Smelting Co. of Canada, Slate Creek, Manson Area.



Cedar Creek Hydraulic Mines, Ltd. Drag-line Scraper dumping on to Screen at Head of Sluice-boxes.



Drag-line Operation of Consolidated Mining and Smelting Co. of Canada, Slate Creek, Manson Area.



Placer Training Camp on Fraser River North of Quesnel. Trainees panning on River-bank.

It is anticipated by the management that next year it will be possible to hydraulic close to 1,000,000 cubic yards.

HIXON CREEK AREA.

The feature of this area is the remarkable extent to which the deep Tertiary weathering has been preserved, and hence the proved absence of ice-erosion. Terry creek at one point flows over a kaolinized mass of granitic and schistose rock-detritus, which is an uncommon feature.

The placer deposits on the low-lying benches in this area worked by the early miners may have been rock-bench deposits of Tertiary age, but criteria are now entirely obscured. The discovery made some years ago by E. Hann and J. Strbac on lease No. 2118, now being investigated, is probably of this type.

The types of deposit exemplified on the property described below are post-Glacial concentrations and buried pre-Glacial channel-segments.

Hixon Creek This company was incorporated in 1934, with an authorized capital of 50,000 preference shares of a par value of \$1 each and 1,900,000 ordinary shares of a par value of 50 cents each. The president is General J. Duff Stuart and the registered office of the company is Stock Exchange Building, Vancouver.
(Cariboo)
Gold, Ltd.

The property consists of thirteen placer-mining leases situated on Hixon creek, covering upwards of 4½ miles of the bed of the creek and extensive bench-ground on the right bank. The property is reached by a branch road 4½ miles in length, which leaves the highway at a point 41 miles south of Prince George and, reaching Hixon creek in 2 miles, follows the creek throughout the property.

Hixon creek, flowing westerly, has cut a wide and somewhat deep valley in the Fraser plateau in the region under description. In the central part the depth of the valley is 200 feet, with an increase down- and decrease up-stream. The creek-gradient in this part is 2 per cent. In places the creek flows over bed-rock and at other points over gravel, and there are falls 90 feet in height at the lower end of the property. The ground is densely timbered and rock-exposures are not numerous away from the creek. On the right bank are extensive gravel benches. About 3 miles above the falls a tributary known as Little Hixon creek, or the North fork, flows in from the north.

Low-lying benches flank both banks of the creek and were extensively worked by the old-time miners, but these early operators apparently were solely occupied with superficial placer deposits and none of the pre-Glacial channel-remnants indicated as lying buried at various points have been mined.

The rock exposed at the falls is an augite syenite, but up-stream from this point, as determined by examination of outcrops and the underground workings of lode-mineral properties on the creek, the formation consists of alternating bands of schists and greenstone. The latter appears on the surface as a deeply oxidized pink-coloured or red rock, which has in places weathered to residual clay. In it are numerous quartz veins which are indicated as being the source of placer deposits overlying bed-rock or rock benches. It is known from underground workings that the greenstone has been weathered to a depth of at least 100 feet below creek-level. It is apparent that this weathering must have taken place in Tertiary time.

In the upper part of the property the valley is constricted by a large moraine which extends outwards from the plateau on the north side of the valley; above and below this moraine the valley again widens. The creek flows over bed-rock on the south side of the valley at the edge of the moraine, which indicates, therefore, that a pre-Glacial channel lies buried on the north side of the creek in this region and continues on this side for some distance. In the absence of Keystone-drilling no opinion can be formed as to the depth at which the bed-rock of the pre-Glacial channel lies, beyond the fact that it has been proved by hydraulicking that it is below creek-level. About 1 mile down-stream on the Crown-granted mineral claim Lot 52, owned by Quesnelle Quartz Mining Company, Limited, 75 feet above the creek, a rock bench of oxidized greenstone, evidently of considerable extent, dips into the valley-rim and is overlain by gravel banks 125 feet in height. The indications here are that this is the left rim of a pre-Glacial channel-remnant. Whether this is of the same age as that just mentioned cannot be determined from existing exposures. This is the point where B. Briscoe did a considerable amount of testing in 1932 (*see* 1932 Annual Report) and at which hydraulic

operations are now being carried on. The falls are undoubtedly post-Glacial, and there is every indication that a channel lies buried on the south side of the creek in this region. The identity of this channel is entirely a matter of conjecture, inasmuch as there are some grounds for inferring that a large Tertiary river-channel crossed the present Hixon Creek valley immediately up-stream from the falls, and if so Hixon creek must have been tributary to such. If that hypothesis is incorrect, then the channel indicated as lying buried on the south side of the creek in this region must be a pre-Glacial channel of Hixon creek.

On the right bank and 200 feet above the creek, on Lot 52, an extensive flat extends both up- and down-stream immediately north of the Quesnelle Quartz Mining Company's workings and marks the action of the post-Glacial waters of the creek as they cut down to their present level. Superficial post-Glacial placer deposits may be expected to occur at various points on this flat. Nothing is known as to bed-rock values in any of the deeply buried pre-Glacial channel-segments on Hixon creek, but in view of the bed-rock geology there is justification for anticipating that such may prove good.

The low-lying benches flanking both banks of the creek were extensively worked by the early placer-miners.

The property was acquired in 1927 by B. Briscoe, who carried out much preliminary investigation, including the erection of a sawmill and sinking some shallow shafts. In 1930 and 1931 the property was acquired under option successively by Golden Reward Placers, Limited, and by Golden Eagle Mines, Limited, but these companies only operated in a desultory manner, and in 1932 B. Briscoe started hand-mining operations on Lot 52. In 1934 the property was acquired by the present company, which, during that year, commenced building a dam on the creek at the upper end of the property and made good headway with flume and ditch construction for conveyance of water to down-stream points preparatory to hydraulic operations. (Refer to Annual Reports for 1927, 1930, 1931, 1932, and 1933.)

The dam is 116 feet long, 7 feet wide at the crest, and 17 feet wide at the base. The height is 20 feet 5 inches to spillway and 22 feet to crest. It is a rock-filled log crib, back-filled with earth and rock. The flume is partly constructed of wood and partly Dutcher metal flume. The dimensions of the former are 4 feet wide by 2 feet 3 inches high, and of the latter 3 feet 9 inches wide and 2 feet 4 inches deep. The ditch is 5 feet wide in the bottom by 2 feet 6 inches deep, with 1-1 side-slopes. Trestling was necessary at several points to carry the flume over the various gullies.

At the time of examination on October 6th the flume had been completed to and beyond Crown-granted Lot 52. At this point it passes along on top of the plateau on a large flat 200 feet above the creek. A penstock has been constructed on this flat, and pipe-line laid therefrom to a monitor with 6-inch nozzle set up on the rock bench previously mentioned, and hydraulicking had just commenced on the date mentioned. Conditions for hydraulicking at this point are more favourable than at any other point on the company's property. The head available is 125 feet and dumping facilities excellent, as this rock bench is 75 feet above the creek. Immediately west of this point a deep draw trends south down the valley-slope, and a short sluice-flume serves to discharge tailings into this draw, thence to the creek. The continuation of hydraulicking at this point will undoubtedly throw much light on certain conjectured data concerning the bed-rock contour of the channel indicated as lying buried in the valley-rim at this point; for example, the depth to bed-rock. Should it transpire that the latter is below the creek, bed-rock gravels will not of course be available for hydraulicking. To date there is a flat rock bench at this point, dipping very gradually into the valley-slope and down-stream.

Before commencing piping at the last point mentioned, in the course of flume-construction, a certain amount of piping was carried out last year where three prospect-shafts were formerly sunk by B. Briscoe on the north side of the creek and where a pre-Glacial channel-segment is indicated as lying buried, and also on a low-lying rock bench up-stream from this point. It was established that the bed-rock of the buried channel in this region is below creek-level. This year an option was acquired on leases on Little Hixon creek (where a discovery of coarse placer was made in 1932 by A. Nani, described on page 94 of the Annual Report for 1932), held by the Edmonton and British Columbia Mining Syndicate, and some hydraulicking was carried on, but discontinued in view of the more favourable piping conditions obtaining at the point finally selected.

FORT GEORGE CANYON, FRASER RIVER.

Former channels of the Fraser river are exemplified at this point mainly of post-Glacial or inter-Glacial age, with, in addition, one of possibly pre-Glacial age. The placer deposits investigated to date occur on rock benches and on a large bench adjacent to the river, and are of post-Glacial age.

This ground, comprising a number of leases either under application or actually granted, is situated almost entirely on Pre-emption Lots 871 and 1856 (save that up-stream leases extend somewhat west of Pre-emption Lot 871 and a few hundred feet north of Ruby creek), on the west side of the Fraser river, below the Fort George canyon. It is understood that G. F. Baird acquired options from the various owners concerned, and adjoining ground by direct staking. From the survey it seems that in some cases there has been considerable overlapping of leases.

The property is readily reached either from the ranch of P. Holsworth, on Pre-emption Lot 4595A, or from Stone creek (Plettville) by motor-boat. In the first case the distance by motor-road from Prince George is 21 miles, plus a short run across the Fraser river by boat, and in the second case 26 miles by motor and about 3 miles by boat.

Attention was first drawn to placer occurrence in the vicinity of the Fort George canyon by T. Thompson and Seymour Robertson, who staked leases in 1933 on the east side of the canyon near P. Holsworth's ranch (*see* 1933 Annual Report, page 127). The following year a 3-oz. nugget was discovered by R. Cunningham and S. Williams on the west side of the Fraser river, following which H. Porter and associates did a considerable amount of prospecting down-stream from this point and staked the leases now under option.

Rock-exposures, examined on both sides of the Fraser river between Beaverdyke creek and a point about a quarter of a mile below the south-east corner of Pre-emption Lot 871 on the west side of the Fraser river, consist entirely of basaltic lava of presumably Mesozoic age. Rock-exposures on the Maxfield lease close to the Sorenson lease boundary (where the 3-oz. nugget was originally discovered) and on the Newman lease consist of andesitic breccias.

In places the basalt mentioned weathers to a deep-red colour due to the oxidation of the contained iron minerals. Outcrops occur in the vicinity of Red Rock creek (to which the name of this creek is doubtless due) and at the upper end of the Fort George canyon.

These rocks afford little evidence of a local source of a placer deposit. The andesitic breccias mentioned show pyritization, and the basaltic rocks where cut through by Red Rock creek, close to the mouth of the latter, show, in addition to pyritization, some hydrothermal alteration. No quartz veins were observed and no evidence found indicating that local rocks might be appreciably auriferous.

Topographic key features are: (1.) A large triangular low-lying bench rising up-stream to a maximum height of 20 to 25 feet above the river. The position of this is closely delimited by the area east of a line joining the south-east corner of Pre-emption Lot 871 and a point on the river due north of the north-west corner of this lot. The superficial area of the bench is in the neighbourhood of 350 acres. (2.) A slight but extensive depression between a rock ridge on the east and low hills on the west trending more or less parallel to the Fraser river and situated about 200 feet in elevation above the latter. The width of this depression is in the neighbourhood of half a mile, its length is considerable, and in it occur a succession of meadows, muskegs, and ponds. It is covered in part by the Porter, Cowart, Dan Miner, and Newman leases. (3.) About a quarter of a mile below the down-stream end of (1) above, rocks rise gradually from the Fraser river to form a steep bluff up-stream separating the down-stream portion of (1) from (2). Farther up-stream the change in topography from (1) to (2) is less abrupt, and high bench-ground intervenes between these two features of the topography. The higher benches are evidently rock benches overlain by comparatively shallow gravel deposits.

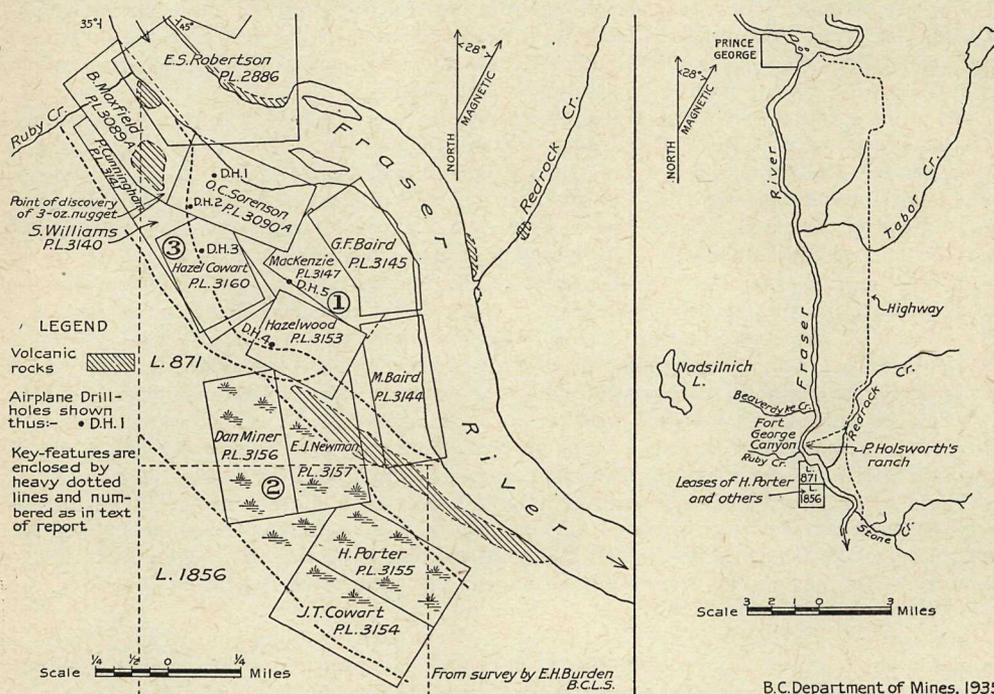
Except in the case of (2) above, the ground is well timbered.

It is evident that in this region the Fraser river occupied, successively, several earlier channels both west and east of its present channel. These are not necessarily all pre-Glacial, but may be of inter-Glacial and post-Glacial age. Topographic key-feature (2) seems to be indicative of the earliest channel occupied by the river in this region. Later channels are indicated by the high-lying rock benches (topographic key-feature (3)) covered with gravel

deposits. It is probable that a former channel underlies the instream part of topographic key-feature (1), because at the up-stream end the *left* rock-rim of such channel is clearly preserved, and is exemplified in the rock-outcrop which immediately fronts the Fraser river a short distance below Ruby creek.

Wherever exposed the gravels overlying rock benches are clearly glacial and probably of local origin. North of this point numerous quartz veins occur on both sides of and adjacent to the Fraser River valley and the glacial drift might for this reason be auriferous. If the river succeeded in cutting through such material to bed-rock, a concentration of placer gold, if any, on bed-rock would result.

During the year F. J. Baird, after carrying out considerable preliminary testing, including sinking of one shaft 27 feet 6 inches deep, installed, it is understood, an Airplane drill and bored five holes on the large triangular bench (topographic key-feature (1)). The depths of these are given as 69 feet (drilled in bottom of the shaft mentioned), 81 feet, 82 feet, and



Fort George Canyon. Leases of H. Porter and Others.

67 feet respectively. It is stated that encouraging values were obtained, justifying further drilling in the expectation that a dredging enterprise might be proved. Bed-rock was reached only in No. 2 hole at 80 feet.

The gravel-covered rock benches constituting topographic key-feature (3) may possibly lend themselves to hydraulicking, Nadsilnich lake situated some miles to the west affording a water-supply, but a more detailed examination of this ground will be necessary before a definite opinion can be expressed on this point. In any case topographic key-features (1) and (2) seem to constitute the major issues.

WEST ROAD (BLACKWATER) RIVER.

While previous discoveries of placer gold have been made on the West Road river, such have not been brought to the attention of the Department, and the one made by E. A. Baity last year, and described below, is believed to be the first coarse placer-gold discovery in the Cariboo district west of the Fraser river, of which there is authentic record.

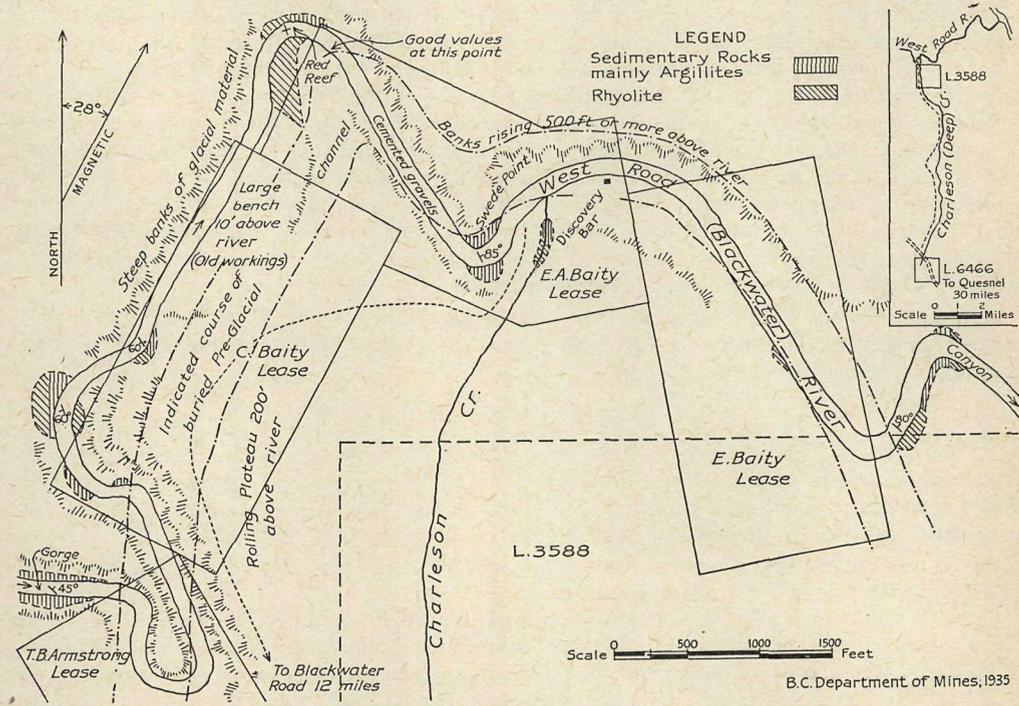
The type of deposit exemplified is that of reconcentrations at certain points on the river due presumably to the latter cutting across its former channel.

Leases of E. A. Baity.

Three leases, owned by E. A. Baity and his sons, of Quesnel, are situated on the West Road (Blackwater) river contiguous to the mouth of Charleson (Deep) creek. The property is reached by following the Blackwater motor-road from Quesnel to Kirkendale's ranch on Pre-emption Lot 6466, a distance of 30 miles; thence by wagon-road, rough in places, a further distance of 12 miles to the property.

In this region the West Road (Blackwater) river follows an extremely tortuous course (as will be seen by reference to sketch-map) and has cut to depths of about 600 feet in the Fraser plateau more immediately adjoining the river. The region is heavily overlain with glacial debris, but rock formations are well exposed at several points on the river-bank and in Charleson creek, which is contained in a steep gorge, the walls of which are about 125 feet in height. It is also to be noted that immediately above the region under description the West Road river is contained in a steep-walled rocky gorge, and below E. Baity's lease it enters a canyon some miles in length.

The rocks consist chiefly of an assemblage of intercalated schistose sediments, which strike north-west and dip both north-east and south-west. Alternating bands of argillites



Leases of E. A. Baity, West Road (Blackwater) River. Pace and Compass Survey.

and rhyolite predominate. No evidence of mineralization was observed in these rocks, but it may be noted that the known buried channel-remnants in Palæozoic rocks, adjacent to the Fraser river, invariably contain placer gold.

Exposed in the bed and banks of the river at two points are well-cemented glacial gravels known locally as "conglomerate." The constituent fragmental material is wholly angular or subangular, showing no evidence of sorting action by water, and is cemented by lime. It is probable that the "conglomerate" is not of pre-Glacial age. It may, however, mark the course of an underlying buried pre-Glacial channel.

The discovery of E. A. Baity was made on a low-lying bench or bar of considerable extent situated immediately down-stream from Charleson creek, and consisted of coarse nuggety gold, mainly well worn, some nuggets showing adhering quartz and also fine gold. The coarsest nugget weighed about 1 dwt. The gold accompanied by small pyrite pebbles was found on a false bed-rock of partly cemented sand. Good values extend right into the bed of the river at

this point, but it is only at low stages of water that this bar can be worked by hand-mining methods.

Other points up-stream on the river at which gold was discovered were: (a.) At the lower end of a small bar at the upper end of a rock point known as "Swede Point," above which the river flows over cemented glacial gravels for a distance of about 500 feet, the conglomerate being also exposed on the right bank of the river at this point. (b.) On a low-lying bench or bar immediately below "Red Reef," so named because the river at this point flows over iron-stained rhyolites. (c.) By very early superficial diggings on the large, low-lying bench which flanks the right bank of the river for a distance of about 1,100 feet on the C. Baity lease. (d.) On the lease of T. B. Armstrong on the right bank of the river immediately below its emergence from a deep rocky gorge to make a remarkable hair-pin bend around a bank of glacial debris.

Owing to high water prevailing at the time of examination, E. A. Baity was only working at point (b) mentioned above. The concentration at this point was decidedly good, warranting further investigation, but it is understood that the point of original discovery offers greater promise.

The nature of the gold, coupled with the fact that it occurs at certain points only at or near river-level, suggests that the placer is due to reconcentration effected by the post-Glacial waters of the river as they cut through a former channel at such points, and from the nature of the reconcentrated gold, and other features, the age of the former channel is indicated as being pre-Glacial. A study of the region indicates that the course of the channel was probably as shown on the accompanying sketch-map. It might be added that the up-stream and down-stream continuation of the channel beyond the points shown is rendered obscure by the very heavy covering of glacial drift. There is no evidence as to the depth at which bed-rock lies, nor can any opinion be formed as to the values overlying bed-rock, inasmuch as recent discoveries are obviously reconcentrations. This ancient channel is, moreover, very deeply buried except on the C. Baity lease, where it can be most easily reached.

Interest centres mainly in the region of the original discovery by E. A. Baity immediately down-stream from Charleson creek, where considerable investigation is warranted, and also immediately below "Red Reef."

WILLOW RIVER AREA.

The types of deposits exemplified down-stream from George creek, on the properties described, consist of remnants of former channels of the river of considerable length, lying buried instream; rock-bench deposits; and deposits in the bed of the river. The two last-mentioned types are indicated as being of post-Glacial age.

It is noteworthy that the early placer-miners rightly regarded this river as approximately delimiting the easterly limit of important placer deposits.

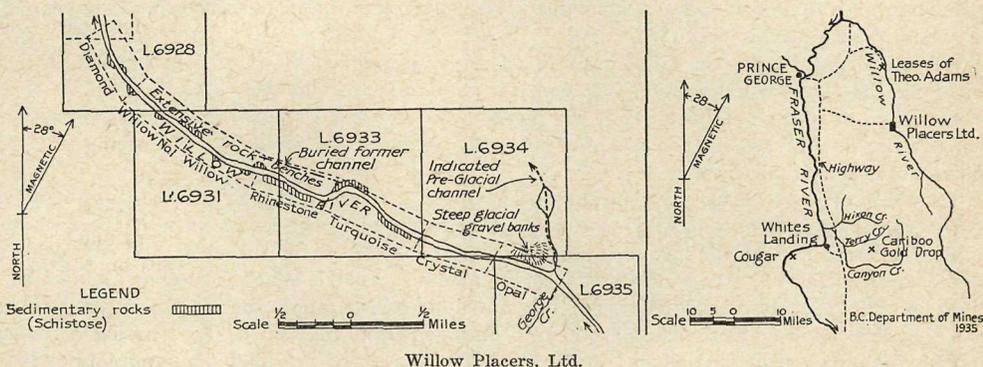
Willow Placers, Ltd. This private company was incorporated for the purpose of operating certain leases on the Willow river, comprising four dredging and six placer-mining leases, covering about 20 miles of the river up-stream from Pre-emption Lot 6925, except 1 mile of the river on Pre-emption Lots 6928 and 6931, which is held by others.

The property is reached by a branch road and trail about 21 miles in length, which leaves the highway immediately south of Tabor creek, 13 miles south of Prince George. A car can be taken for a distance of about 7 miles from the highway; thereafter a rough road, constructed this year by the company for the purpose of taking a power-shovel to the property, leads to the Willow river, at elevation 2,520 feet, via Buckhorn lake, elevation 2,270 feet.

It was only possible to examine that part of the ground lying between Pre-emption Lots 6935 and 6925, as it was on this section that operations were planned.

In the stretch of 5 miles of the river examined, the rocks exposed at various points were seen to consist entirely of schistose sediments, argillites, and quartzites, presumably of Palaeozoic age, intruded at several points on Pre-emption Lots 6925 and 6931 by stocks of granodiorite. Beyond oxidation in the sedimentaries in the vicinity of such intrusives, and a few quartz stringers, no further mineralization was observed, although such may quite possibly be obscured by timber or vegetation.

The river runs either on or close to bed-rock and the greatest depth of gravels overlying bed-rock is probably not over 20 feet. Flanking the right bank of the river in this region are low- and higher-lying gravel-covered benches, on which rock outcrops at various points. These gravel-covered benches extend instream for many hundreds of feet, to a maximum height of 125 feet above river, and there is every indication that they are underlain by rock at no great depth. On the left bank the valley rises more abruptly from the river, although there are a few mainly low-lying benches on this side. Generally the ground is well timbered and covered with vegetation.



Willow Placers, Ltd.

It is indicated by the topography that in this region down-stream from the mouth of George creek, the Willow river in pre-Glacial times occupied a channel considerably east of its present position, a mile or more instream from the latter. The blocking of its former channel by glacial drift (the moraine of George Creek glacier appears to have been an important factor in this connection) caused the river to follow different courses successively west of its former channel until it finally cut the one it now occupies. The pre-Glacial channel lies mainly east of the area under description, but the rock benches mentioned exemplify the successive channels occupied by the river formerly.

Extending throughout the *Rhinstone* lease it is probable that a channel-remnant, both rims of which are preserved, lies buried in the right bank of the river.

Investigation by the company had, at the time of examination, been confined to the gravels of the present river, and to benches immediately contiguous thereto. It is stated by the company that last year a stretch of about 2 miles of the river from the *Opal* lease down-stream was tested by 1,500 or more pan tests, and about eight yardage tests, comprising sluicing and treatment in a centrifugal machine, of quantities varying from 1 cubic yard to 27 cubic yards. Such tests were made on low-lying benches, on river-bars, and in the bed of the river, and it is stated that the average values indicated "pay." The values were stated to occur in the gravels immediately overlying bed-rock, and in the cracks and crevices of the latter, except on the *Opal*, where values were found overlying a false bed-rock in the river.

Owing to the high water prevailing at the time of examination, no pan-testing was possible, but it is known that H. Robinson, owner of the *Willow* lease, has worked on his property by hand for some years with, it is understood, encouraging results.

It is apparent that the mode of placer occurrence exemplified in the ground tested is of post-Glacial age, and that the origin of the gold is glacial material, through which the post-Glacial waters have swept in cutting the successive channels mentioned above. It is also a justifiable anticipation that values may be contained in the gravels overlying the extensive rock benches described as flanking the right bank of the river, in the channel-remnant preserved on the *Rhinstone* lease, and such merit further investigation. The ground appears to be reasonably free from large boulders.

At the time of examination the company was transporting to its property a Ruston power-shovel (operated by gasoline-engine) equipped with caterpillar traction, with bucket of 1/2- to 5/8-cubic-yard capacity. The intention was to work low-lying benches until the river fell sufficiently to work in the bed of the river. It is understood that the shovel reached its destination during the summer, but it is not known what subsequently transpired.

A detailed description of individual leases follows: The *Opal* is the farthest up-stream and extends down-stream from the mouth of George creek, and the others are described as they occur in order down-stream.

On the *Opal* lease a bank of glacial gravels 200 feet in height above the river occurs in the lower central part on the right bank of the river. Up-stream from this a depression in the topography, occupied by a morainal lake, trending north and north-west instream, in all probability indicates the position of the pre-Glacial channel of the Willow river in this region. It is stated that at the lower end of this lease a good concentration of placer occurs in the bed of the river on a false bed-rock. This evidently results from the modern river cutting through the glacial debris at this point.

On the *Crystal* lease the right bank of the river is flanked by extensive benches, 5 to 15 feet above the river, which extend instream for a distance of 500 feet. At the back of these rise morainal hills to a height of about 100 feet above the river. The benches mentioned extend down-stream on the *Turquoise* lease and warrant testing. No rim-rock shows on the river-banks throughout this lease.

On the *Turquoise* lease the benches noted on the *Crystal* continue on the right bank of the river in the upper part of the lease, but are terminated in the lower part by the rock-rim of the river, which rises sharply to a height of 60 or 70 feet above the river and continues to the end of this lease. Above the steep rock-rim an extensive bench, rising gradually to a height of 100 feet above the river, extends down-stream through the adjoining *Rhinestone* lease. Rock is exposed at several points, and the topography markedly suggests that a former channel of the river lies buried in this region. The length of the buried remnant is at least half a mile. On the left bank of the river the rock-rim is continuous in the upper part of the lease save for a gap of about 150 feet. Values are stated to have been obtained in the river-gravels at this point.

On the *Rhinestone* lease the chief feature is the channel-remnant referred to above, which is indicated as lying buried on the right bank of the river, about 300 yards instream. This appears to merit testing, likewise the low-lying bench-ground, which forms the immediate river-frontage. On the left bank of the river the rock-rim is exposed throughout the greater part of this lease and on the right bank the rock-rim rises abruptly to a height of 50 feet, about 100 yards from the down-stream end of the lease.

The *Willow* lease is owned by H. Robinson, who has carried on hand-mining operations for some years past. Gravel-covered rock benches extend from the river's edge instream for many hundreds of feet on the right bank of the river. These benches merge at the down-stream end of the lease in rock ridges, which extend to the river at this point. The schistose sedimentary rocks are iron-stained at this point where they are intruded by small stocks of granodiorite. Judging from the workings, the owner in past years appears to have found the most productive ground immediately adjacent to the river, but extensive testing of bench-ground in cases like this, where there is no water-supply available under gravity, can hardly be carried out by the individual operator.

The *Willow No. 1* lease is owned by Martin Framstad, and comprises, to a great extent apparently, untested bench-ground at a height of about 25 feet above the river.

Two leases held by Theo. Adams, of Prince George, are situated on the left bank of the Willow river at the outlet of the canyon, the upper end of which is situated on Pre-emption Lot 2800. The property is reached by following the Willow River road from Prince George to Six-mile mountain, from which point an indifferent branch road leads to a ranch by the Willow river, a total distance of 19¾ miles from Prince George. In suitable weather a car can be taken this distance. A rough road and trail leads a further 7 miles to the property.

The rock formations consist of argillites and limestone intruded by quartz-feldspar tongues. Just below the canyon a former buried channel is plainly discernible on the right bank of the river lying instream from the latter. The Willow river cuts diagonally across its former channel, which at this point has a bearing of north 30 degrees west. The argillites here contain a large number of quartz veins. It was not possible to cross the river, but from the left bank two old drifts are visible on the other side comparatively close together and situated a short distance above the water, which were possibly run on bed-rock, although this fact cannot be determined without access to them. However, this matter should be investi-

gated, for the question as to whether the bed-rock of the old channel is above or below the present river is important. A small amount of testing on the left bank of the river has been done, and it is stated that a certain amount of encouragement has been secured, but the topography on this side renders the channel less clearly discernible than that on the opposite bank, which merits investigation.

COTTONWOOD RIVER AREA.

The properties described exemplify post-Glacial placer concentrations on false bed-rock and a deeply buried pre-Glacial river-channel.

Claims of F. Norn and Associates. These claims, originally nine in number, are owned by F. Norn and associates, of Quesnel, and are situated on the left bank of the Cottonwood river, immediately adjacent to and west of the Pacific Great Eastern Railway grade, near the eastern boundary of Pre-emption Lots 8593 and 8594 and about 17 miles from Quesnel. The ground after discovery in 1934 was acquired by C. W. Moore, R. Sutton, and E. Sutton, and was, it is understood, restaked that year in the form of three leases with the consent of previous owners. In dry weather a car can be driven over the Pacific Great Eastern Railway grade to within $1\frac{1}{2}$ miles of the claims.

The property covers a terraced bench on the left bank of the river, roughly semicircular in shape, having a river-frontage of about 1,500 feet and extending back from the river to a maximum distance of about 1,500 feet. The lowest bench is about 25 feet above and fronting the river, and as no convenient gravity water-supply lies immediately adjacent, F. Norn and associates had merely seepage-water for their hand-mining operations, which were impeded by this indifferent supply.

The ground is remarkable for the richness of the superficial gravels, which at some points are immediately below the grass-roots and at others are covered with 3 or 4 feet of barren sand. The gold is quite fine, although individual pieces up to 25 cents in value are reported.

The deposits are a false bed-rock type and exemplify post-Glacial concentrations, resulting from the post-Glacial waters cutting through the immense quantity of glacial debris (much of which still remains on the banks of the river) left in this region on the final retreat of ice, the gold being reconcentrated on any false bed-rock material contained in the glacial debris. This class of deposit cannot ordinarily be expected to be other than superficial, except in so far as there may be concentration on one or more false bed-rocks below the uppermost—a fact which seems well worth bearing in mind in the investigation of this property. In this particular case, however, there is every indication that a large pre-Glacial river-channel underlies this ground, quite possibly, it is believed, the down-stream continuation of the buried Tertiary Horsefly river. The right rim of the channel is apparently exposed in the eastern part of the ground under description, but bed-rock probably lies at great depth. An examination of the ground adjoining that under description, staked by J. W. Jones, strongly suggests that this buried ancient river-channel originally flowed north through Ten Mile lake, its course being immediately west of the Pacific Great Eastern Railway grade in this region.

Leases of J. W. Jones and Associates. These leases Nos. 28518 to 28523, inclusive, are situated on an unnamed small creek, which rises near the north end of Ten Mile lake and flows northerly into the Cottonwood river on Pre-emption Lot 8594. The property adjoins on the south and west that immediately above described and is reached by the same road. This creek cuts deeply into glacial sands, gravels, and silts. This fact, coupled with the topography, strongly indicates that it follows very closely the course of a definite channel which is believed to be the northward continuation of the buried Tertiary Horsefly river, which quite possibly originally flowed, via Ten Mile lake, to this point. The extensive deposits of stratified silt (slum), the lower beds of which are partly lithified, exposed in the deep valley of this little creek and on the Cottonwood river in this region, indicate extensive damming during retreat of ice and the formation of temporary glacial lakes in which these deposits were laid down. It is quite impossible to form an opinion as to the depth at which the bed-rock of this channel lies, but it is probably very deep and its gradient low.

So far as is known, no noteworthy superficial concentrations of placer have been found on this ground. Pieces of the stratified-silt beds mentioned, rolling down into the creek, become fashioned by the waters of the latter into fantastic shapes, erroneously thought by some to be fossils. These curious objects were the means of originally drawing attention to the property.

HARRISON CREEK (MANSON SECTION).

Harrison creek flows south-easterly into Kenny creek between Humphrey and Tom lakes, opposite Tom creek.

These leases are situated on Harrison creek, about three-quarters of a mile above the mouth. The property is reached by a branch trail about 2 miles in length from the main Tom Creek-Old Hogem wagon-road, the total distance from Takla Landing being about 22 miles. The region is the steep, densely timbered southern slopes of Vital mountains.

The rocks of the region are intercalated schistose sediments and volcanics of Carboniferous age intruded by numerous stocks of acid batholithic rock. The former contain a multiplicity of quartz veinlets and numerous quartz veins.

The mode of placer occurrence exemplified is a buried pre-Glacial channel-remnant about 1 mile in length, which is plainly indicated topographically as lying buried in the right bank of the creek, and which is being investigated by an adit at the lower end.

The existence of this channel was apparently previously perceived, and many years ago a man named Bodine constructed a dam across the creek and drove an adit into the right bank in this region, but this working is inaccessible. Somewhat down-stream from the old workings, the present owners drove an adit 144 feet in length in the right bank of the creek in the autumn of 1934 in the glacial debris overlying the channel. Although this proved to be above bed-rock, a winze sunk to a depth of 8½ feet at the face of this adit struck the gently sloping left rim of the channel at a depth of 6 feet only. The glacial material overlying the rim contained, it is stated, encouraging values in coarse gold, and a nugget of arquerite weighing about 1½ oz. was also found.

In the part of the valley under investigation the creek is contained in a canyon about half a mile in length, and the adit now being driven is situated below the lower end of the latter. The east wall of the canyon forms the main rock-rim of the valley, rising steeply above the creek for many hundreds of feet. On the west side of the canyon are extensive flats at 25 to 75 feet above the creek in the up-stream part. At the level of the flats the width of the valley from rim to rim is about 850 feet. Down-stream from this point the topography is more broken. The flats terminate abruptly at the head of the canyon, where the creek makes a sharp bend, and above this point the valley widens. Below the adit mentioned the creek enters another shorter canyon. The gradient of the creek in this part as determined by aneroid is 7 per cent.

The adit on the right bank of the creek for the first 50 feet is run on a bearing north 70 degrees west and for the remaining 94 feet on a bearing north 84 degrees west. The bed-rock rim struck in the winze was followed up-stream for a distance of 12 feet and down-stream for 18 feet. The character of the filling is very similar to that on Vital creek, which rises in the same mountain range, flowing north-easterly.

In the buried channel of Vital creek the gravels on bed-rock are free from large boulders and deep enough to permit drifting beneath the glacial debris in which large boulders are found. In the upper part of the glacial debris is a very tight boulder-clay which acts as a seal, preventing the downward circulation of surface waters.

The present workings below the adit cannot be continued without pumping. It seems reasonable to anticipate that the buried channel-gradient will not be less than 4 per cent., and the gentle slope of the rim suggests that bed-rock may not be more than a few feet below the bottom of the winze, so that the present adit, if continued, might reach the bed-rock within 300 feet. Without some predetermined evidence of the exact depth at which bed-rock lies, however, the extension of the adit is wrought with uncertainty. On the other hand, the length of the buried channel-remnant is such that some further attempt to ascertain the depth to bed-rock and values thereon is clearly justified. More especially so, as the channel-filling

contains a considerable amount of clayey material and stands up well, contributing to cheap mining.

Doubtless this channel could be hydraulicked because Harrison creek is a fair-sized stream, and possibilities in this direction should also be investigated.

JIMMAY CREEK, OSILINKA RIVER.

Jimmay creek, as shown on Map No. 1A, published by the Department of Lands, is a tributary of a large unnamed creek flowing into the Osilinka river about 7 miles below Usilka lake. The region is densely timbered and mountainous, but the summits are generally rounded, and the creeks have carved wide valleys terraced with much glacial debris. It is reached by a pack-trail about 51 miles in length from Old Hogem, which is about 40 miles by rough wagon-road from Takla Landing. The Omineca river must be forded at Old Hogem and the Osilinka river about 3 miles above Usilka lake. From Old Hogem northwards the trail follows on the west side of Duck creek, for 16 miles on the eastern flank of the Eastern batholith, which outcrops prominently in this region for many miles in a north-westerly direction. Crossing Duck creek at this point, the trail subsequently follows a north-easterly direction, as shown on Map No. 1A.

Placer was first discovered nearly forty years ago on this creek by Jim May, a pioneer prospector in this region. Map 207A, published by the Geological Survey, furnishes the closely adjacent geology. The rocks exposed along the creek are silicified quartz-muscovite schists, quartz-biotite schists, and quartz-schists, and are presumed to be part of the Precambrian belt which trends north-westerly across the Osilinka and Mesilinka rivers as shown by Map 207A. They are intruded by a granitic dyke and quartz veins are developed in the intruded rocks at a few points. No occurrence of placer, other than in the form of river-bars, is known to occur in regions underlain by these rocks.

Leases of Frank Martin

Three leases have been staked on Jimmay creek by Frank Martin, of Hazelton, who for some three years past has worked at his property each year. The means of access is given above. In the region covered by the property, Jimmay creek flows on an average south 45 degrees west and occupies a comparatively narrow valley about 175 feet in depth. Although the valley-slopes are largely covered with glacial debris or dense vegetation and timber, silicified schists are exposed at several points at the upper end of the property, where they are intruded by a granitic tongue. At the central part, in the vicinity of the workings, the creek is contained in a gorge, and on the right bank in this region rocks are exposed for a distance of several hundred feet, and are seen to be silicified quartz-muscovite schist, quartz-biotite schist, and quartz-schist in which some quartz veins occur mainly narrow, but one of which is 2½ feet in width. They conform with the schistosity of the enclosing rocks which strike north 10 degrees west and dip south-westerly at an angle of about 65 degrees. The gradient of the creek as determined by aneroid is 5½ per cent. A few low-lying, not very extensive benches flank both banks, some of which are rock.

Placer was first found in the creek-bed at the lower end of the gorge mentioned, but attention is at present directed to a bank of well-washed glacial gravels about 20 feet in height which overlies a low-lying rock bench on the right bank of the creek. Gravels are washed in a sluice-flume set up in the creek, and values are said to be distributed throughout the gravels and are no better on bed-rock than at higher points. The character of the gold is said to be fairly coarse. Pan-samples taken proved rather disappointing, but it is said that bulk samples invariably yield better results. A pit has been dug by shovelling at this point, about 90 by 40 by 20 feet in height. Opposite on the left bank of the creek a low-lying, crescent-shaped bench occurs which extends instream a maximum distance of about 200 feet over a length of about 850 feet. A shallow shaft, now caved, was originally sunk on this bench and a cut 200 feet in length was started from creek-level to apparently drain it, but has not been completed. Behind the bench a depression in the glacial drift 125 feet above the creek probably indicates the course of the underlying pre-Glacial channel in this region.

The occurrence of placer clearly originates from glacial materials through which the post-Glacial waters have carved their present channel. The glacial drift consists largely of local rocks with a certain amount of boulders of batholithic rock.

TUNGSTEN DEPOSITS.

NORTH POINT OF FRASER RIVER.

In this region the formation consists of silicified schists, mainly quartz-muscovite schist, quartz-biotite schist, and quartz-sericite schist, in which occur a number of quartz veins. These veins are in most cases sparingly mineralized with pyrite and some contain in addition galena and sphalerite. They vary in width from a few inches up to several feet and have free walls. On the *Ada* claim, owned by the estate of the late Oscar Eden and developed by an adit and drift therefrom, one vein contains a noteworthy amount of scheelite. This mineral has also been found, although not to the same extent, in a vein on the *Silver* group occurring in similar formation, situated about 1 mile to the west on Averil creek.

Most of the veins exhibit evidence of post-mineral movement, and the two veins in which scheelite occurs also contain considerable amounts of graphite. In no other vein was graphite observed.

Good water transportation is available for quite large craft between the Canadian National Railway at "Hudson's Bay Spur," about 2 miles west of Hansard, and this property, a distance of about 24 miles. In view of this fact and because of the comparatively small expense involved, some additional development on the vein mentioned on the *Ada* seems justified to further test tungsten possibilities.

No commercial possibilities are apparent in so far as gold, silver, or lead contents are concerned.

Although these properties have been previously examined and an account appears in the 1928 Annual Report on pages 191 and 192, they were re-examined this year, in view of the interest evinced at the present time in tungsten properties, and also because additional work had been done in the interim on the *Silver* group.

Ada. This mineral claim, owned by the estate of the late Oscar Eden, is situated contiguous to the eastern boundary of Pre-emption Lot 9606, at the most northerly point and on the right bank of the Fraser river. Low-lying meadow-land flanks the right bank of the Fraser river, extending back for a distance of about 1,500 feet. From this point the valley-rim, covered with dense vegetation and heavily timbered, rises abruptly at an angle of about 40 degrees. The property is readily reached by motor-boat from Hansard, from which it is distant about 25 miles.

The formation consists of silicified quartz-muscovite schist which strikes north 57 degrees west and dips about 60 degrees south-west. Within this host-rock two quartz veins are exposed in the adit on the property. These conform in strike and dip with the planes of schistosity of the enclosing rocks and are from 3½ to 4 feet in width. Mineralization consists of pyrite, galena, and scheelite. The last-mentioned mineral is exposed, as far as is known, in one vein and only in the underground workings.

The veins show evidence of intense post-mineral movement and in one case the amount of graphite present is noteworthy. The schist formation gradually passes into an acid rock of granitic texture towards the face of the underground workings.

The property was originally staked or acquired by the late Oscar Eden, and in 1922 the North Point Mining Company, Limited, was incorporated for its development. This company carried out the underground development described below, and subsequently another company, called the Granite Mining Company, was incorporated for the purpose of operation. No work has, however, been done at this property for more than ten years. It seems evident that the gold-silver-lead possibilities were originally deemed worth investigating as tungsten was not exposed on the surface, nor its extent investigated when found underground.

Surface workings have now entirely caved, but consisted originally of a shallow shaft 15 feet in depth and a drift 30 feet in length. These workings were driven in a vein 5 feet in width composed of quartz, with pyrite and galena. In the 1922 Annual Report it is stated that this drift "shows the vein to be only slightly mineralized." A sample taken in 1928 from a small dump of the most heavily mineralized pieces assayed: Gold, 0.04 oz. per ton; silver, 4.2 per ton; lead, 10 per cent.

As determined by aneroid this year the elevation of the shaft is 310 feet above the river.

To explore the region below the above-mentioned vein an adit has been driven a total distance of 675 feet on a bearing north 48 degrees east at a depth of 210 feet below the collar

of the shaft. Two veins were cut by the adit—one at 372 feet from the portal and the other at the face. Both veins conform in strike and dip with the enclosing quartz-muscovite schist, striking north 57 degrees west and dipping at about 60 degrees south-west. The former is quartz-filled, sparingly mineralized with pyrite, and 3½ to 4 feet wide. To intercept its north-westward continuation a branch crosscut was run a distance of 65 feet on a bearing north 8 degrees east at a point 340 feet from the portal of the main adit, without results. The vein cut at the face of the main adit was followed by a drift for a distance of 33 feet south-east, and the width showing in the drift-face is 4½ feet. The filling consists of intensely sheared material, quartz, scheelite, and graphite. A sample taken across a width of 2 feet at this point assayed: Gold, trace; silver, trace; tungsten, 4.05 per cent. It is evident from a small dump in a shed at the portal of the adit that the small amount of drifting yielded a very encouraging quantity of scheelite. The latter occurs in the form of graphite-coated nodular lumps, due to post-mineral movement, and lends itself readily to sorting by hand. Presumably at the time this mineral was struck the operators were interested only in gold-silver-lead possibilities and did not deem it worth further investigation. This showing appears to merit some further investigation which could be carried out at relatively low cost by hand-mining, because men and material can be transported by motor-boat from Hansard very readily and inexpensively. The advisability of continuing the drift started on the vein in both directions is indicated. A small amount of raising and sinking also seems advisable.

Silver. This group consists of seven claims owned by Fred Peterson, of Prince George. The property is situated on and about 1 mile above the mouth of Averil creek, which flows into the Fraser river on the right bank of the latter about 1 mile east of the eastern boundary of Pre-emption Lot 9606. It is readily reached by motor-boat 24 miles from Hansard. The valley is somewhat deeply incised, affording numerous rock-exposures on the rims near the creek. A short distance from the creek, however, the ground is covered with a thick growth of timber and dense vegetation.

The formation, consisting of silicified quartz-sericite schist and quartz-biotite schist striking from north 77 degrees west to north 52 degrees west and dipping steeply south-west, contains several conforming quartz-filled shear-zones. Of these, only one of possible commercial significance reaches a maximum observed width of 10½ feet and is exposed by surface and underground workings for a distance of 335 feet along its strike. It is filled with quartz-lenses and sheared rock and in the parting seams there is a heavy development of graphite. The quartz is sparingly mineralized chiefly with pyrite, galena, and sphalerite, except in one place where heavy pyrite mineralization occurs. Scheelite was observed at one point in the outcrop, but this mineral has not at present been found in the underground workings.

The shear-zone is cut diagonally by Averil creek at two points, 135 feet apart, and the surface exposures occur at these points immediately above the creek, also at a third point about 100 feet farther south-east on the line of strike. A 9-foot sample of quartz slightly mineralized with pyrite from the 10½-foot shear-zone assayed: Gold, *nil*; silver, *nil*; tungsten, *nil*. Distant 135 feet on a bearing south 70 degrees east, the second outcrop occurs, on which the adit described below has been driven. The third outcrop is about 75 feet above the adit on the steep bank of the creek. While this outcrop is now rather obscured by sloughing, pieces of solid pyrite were observed at this point and also a little scheelite.

The adit, 203.5 feet long, is situated a few feet above creek-level, and for the first 126 feet follows a bearing south 77 degrees east, and for the remaining 77.5 feet a bearing south 72 degrees east. At the face on the north side a crosscut is driven a few feet towards the foot-wall.

The adit follows the hanging-wall of the shear-zone apparently throughout, the succession of mineralized quartz-lenses occurring on that side. These are to a great extent sparingly mineralized with pyrite and sphalerite. The first quartz-lens, 10 feet long, is 30 feet from the portal. Quartz appears at 65 feet from the portal and again at 120 feet, but is not continuous between these points, although it may exist in the foot-wall. The quartz-lens is continuous in the back of the adit between points 120 and 150 feet from the portal. At 160 feet another quartz-lens appears and continues for a length of 35 feet. The widest quartz-lens observed was 3 feet. The face exposes a width of 7 feet on the hanging-wall consisting of pyritized silicified quartz-sericite schist and brecciated material, in which are fragments of quartz

mineralized with pyrite. The average dip of the hanging-wall in the adit is 76 degrees south-west. At the face the foot-wall of the shear-zone is not exposed.

Scheelite, so far as is known, has not been discovered in the adit, although it was observed in the outcrop. As mentioned, the latter is also heavily mineralized with pyrite at one point, but a sample of this assayed: Gold, trace; silver, 0.04 oz. per ton. A sample taken from a quartz-lens at 126 feet from the portal assayed: Gold, *nil*; silver, *nil*. The average amount of galena and sphalerite in the quartz-lenses is obviously low. A sample taken of selected mineral only assayed: Gold, trace; silver, 10 oz. per ton; lead, 11 per cent.

It is suggested that, inasmuch as the general character of this vein is very similar to that on the *Ada* claim described above, and as scheelite has been found at one point, some prospecting might be undertaken along the outcrop of the shear-zone at points farther south-east of the adit, in the hope that this mineral may be found.

NICKEL DEPOSITS.

WILLIAMS LAKE AREA.

This property consists of twelve claims owned by A. W. Haddock and **Williams Group**, associates, of Williams Lake, and is understood to be under option to J. O. Williams. The local name is "Cariboo Nickel." It is situated in immediate proximity to and just north of the road connecting Williams Lake with the Cariboo highway, about 4 miles east of the town of Williams Lake. A car can be driven over a short branch road from the main road to within a few yards of the lowest showing at elevation 2,075 feet (elevation of Williams Lake 1,925 feet). The outcrops are situated on the sparsely timbered range of hills which rises sharply from the main road.

The geology is largely obscured by overburden, and rock-exposures are few, save those in which the mineralization under investigation occurs.

A green-coloured mineral of low nickel content occurs in a rusty, carbonated outcrop. Other minerals present are ankerite, calcite, and pyrite. In addition, pyrrhotite was detected in one sample by the Provincial Mineralogist. The full width of the outcrop is exposed at one point only, but the average width may be considerable. The outcrops can be traced on the surface for a mile or more extending in a north-easterly direction up and across the hillside from the point of lowest exposure. The strike varies from north-east to north 80 degrees east and the dip is north-westerly into the hill. The hanging-wall rock, which is serpentine, is exposed at the south-west end of the property *only*. At this end several open-cuts expose the foot-wall, which is a dark-coloured, silicified, and somewhat pyritized rock of dolomitic appearance. At the north-east end of the property, while the hanging-wall is not apparent, the foot-wall is limestone with serpentine exposed below. These facts therefore indicate that limestone, the thickness of which is indeterminate from present exposures, overlies and underlies by serpentine. Fracturing and shearing, subsequently followed by mineralization, has taken place at the contact of the limestone with the *overlying* serpentine, the zone of fracturing extending into both rocks and trending in a north-easterly direction, and it is this zone that engages attention at the present time. At the south-west end of the property the foot-wall rock has been fractured in a *north-westerly* direction and intensely silicified, the fractures being filled with quartz, and now appearing as sparsely mineralized quartz gash-veins, some of which are of large size. The nearest known intrusive rock is a stock of sheared and serpentinized granodiorite exposed in the Pacific Great Eastern Railway cut immediately east of Williams Lake.

Investigation disclosed the interesting fact that samples of both the overlying and underlying serpentine, taken some distance away from the mineral-zone, contained higher values in nickel than are present in the mineral-zone itself.

A sample of the overlying serpentine, taken at the south-west end of the property, 50 feet from the mineral-zone, assayed: Gold, trace; silver, trace; nickel, 0.23 per cent.; platinum, *nil*.

A sample of the underlying serpentine, taken about 300 feet from the mineral-zone, at the north-east end of the property, assayed: Gold, trace; silver, trace; nickel, 0.2 per cent.; platinum, *nil*. These two samples were taken from points not less than 1 mile apart.

After discovery of the fact that the serpentine was nickeliferous, the Provincial Mineralogist had serpentines from other parts of British Columbia analysed. It was ascertained

that in two or three instances nickel was present to the extent of about 0.2 per cent. The Provincial Mineralogist therefore suggests that serpentines derived from dunites may normally contain a small amount of nickel. Such, therefore, may be the explanation of the presence of nickel in the serpentine at this property, which exists in the form of large sills.

Exposures are at present so meagre that further open-cutting must be carried out before this and other points can be clarified. The average nickel values present in the serpentine cannot be ascertained until the work mentioned has been done.

The property was staked some years ago by A. W. Haddock, whose attention was originally attracted by the large quartz gash-veins mentioned above. Subsequently and recently the attention of the owners was arrested by the green-coloured mineral present in the north-easterly-striking rusty outcrop, which was found to contain nickel.

The surface workings are situated at the south-west end of the property and consist of a number of open-cuts extending north-easterly up the hillside from the lowest exposure at elevation of 2,075 feet. These open-cuts cover a horizontal range of about 1,200 feet and a vertical range of about 300 feet. The overlying serpentine is exposed only at the lowest point, where an open-cut 18 feet in length is run north 45 degrees east following the mineralization, which dips north-west at 53 degrees at this point. This cut also exposes the dark-coloured foot-wall silicified rock which is presumably a silicified limestone. Overlying this is a width of 3 feet of slightly pyritized siliceous material containing a certain amount of transparent green-coloured mineral. Samples across this width of 3 feet assayed: Gold, trace; silver, trace; nickel, 0.15 per cent. This is immediately overlain by a width of 4½ feet of fractured serpentine containing an opaque dull-green material. A sample across this assayed: Gold, trace; silver, trace; nickel, 0.17 per cent. Further open-cutting discloses serpentine on the hanging-wall for 50 feet. The silicified dark-coloured foot-wall rock is well exposed by some open-cuts, and others are in the mineral-zone only.

About 100 feet north-east and 45 feet above this open-cut, another open-cut is run a distance of 15 feet in a direction north 78 degrees east in the foot-wall rock, exposing on the foot-wall a mineralized width of 10 feet. A sample across this width assayed: Gold, trace; silver, 0.4 oz. per ton; nickel, 0.06 per cent. At elevation 2,195 feet, an open-cut, 30 feet in length and 16 feet in height at the face, is run north 48 degrees west in the pyritized silicified foot-wall rock, which contains small quartz veinlets at this point. The face exposes the foot-wall of the mineral-zone containing the green-coloured mineral; also a mineralized width of at least 10 feet at this point. Although the full width could not be sampled owing to its inaccessibility, a sample across 2.5 feet assayed: Gold, trace; silver, trace; nickel, 0.13 per cent. The remaining open-cuts are comparatively small. A sample from the uppermost open-cut in the mineral-zone only, across 3 feet, assayed: Gold, trace; silver, 0.2 oz. per ton; nickel, 0.10 per cent. A sample from an open-cut 750 feet north-east of the lowest working, across 5 feet, assayed: Gold, trace; silver, 0.2 oz. per ton; nickel, 0.17 per cent. A sample taken across 6 feet from outcrop on trail, south-west of the last-mentioned sample, assayed: Gold, trace; silver, trace; nickel, 0.17 per cent. A sample taken across 1.5 feet from a small open-cut 25 feet below the open-cut, 30 feet in length, assayed: Gold, trace; silver, trace; nickel, trace. A sample taken across 12 inches from the open-cut 25 feet above the 30-foot open-cut assayed: Gold, trace; silver, 0.4 oz. per ton; nickel, 0.23 per cent.

The foot-wall rock between points 750 to 1,200 feet north-east of the lowest open-cut shows a development of numerous large quartz gash-veins, one of which reaches a width of 20 feet at one point. These gash-veins are very sparsely mineralized and one shows a little copper-stain and chalcopyrite. The dark-coloured foot-wall rock is exposed by a short open-cut at a point 85 feet vertically below the uppermost cut in the mineral-zone.

The facts indicate that the fracturing at the contact of the overlying serpentine and limestone, while extending into the former, was probably largely confined to the latter. The fractured zone was subsequently mineralized with highly siliceous solutions bearing a certain amount of sulphides, mainly pyrite. The mineralization is chiefly a replacement in limestone. The limestone, which occurs as the foot-wall of the mineral-zone now undergoing investigation, was itself intensely silicified below the foot-wall mentioned at the south-west end of the property, and irregular fractures were developed approximately at right angles to the main mineral-zone. These fractures were filled with quartz very sparsely mineralized, and now appear as gash-veins varying in width from less than an inch to many feet.

The full width of this mineral-zone is exposed at one point only—that is, by the lowest open-cut at the south-west end of the property. Its width is seen to be 7½ feet, including 4½ feet of mineralized and fractured serpentine. At all points north-east of this it is obviously very much wider and may reach an average width of 50 feet or more, but this is not disclosed by surface workings.

It has been determined by analysis that the greenish-coloured mineral contains only a small percentage of nickel and is not garnierite, although a small amount may be present. Chromium was found, which might account for the green colour.

It is not a digression to state that green-coloured minerals, other than malachite, similar in appearance to that found at this property are of quite widespread distribution and have been the subject of considerable attention by this Department. Investigation has shown that in most cases they are chlorite containing no nickel; in others a small amount of nickel is present; more rarely the mineral is mariposite, a mica containing chromium. The green colour of the last mentioned is considered by authorities to be due to chromium.

NON-METALLIC DEPOSITS.

LIME DEPOSIT.

Ritchie Area.

A deposit of essentially calcium carbonate, in pulverulent form, containing about 95 per cent. calcium carbonate, which has been found very useful locally as a dressing for agricultural land, occurs about 1½ miles by road from Ritchie, a flag-station on the Canadian National Railway between Cedarvale and Dorreen.

The entire absence of any admixture of clayey material renders the deposit particularly amenable to handling by any mechanical method of excavation. While no exact calculations of total tonnage can be made owing to lack of development-work, it is probable that some thousands of tons are immediately available for shipment. A motor-road has been constructed to the deposit from Ritchie to meet the local demand for the material and in the hope that a wider market may be created.

This mineral claim has been staked by August Johnson and A. J. Hillyard, of Dorreen, covering the above-mentioned lime deposit, situated about three-quarters of a mile in a direct line south-west of Ritchie. The property is located in a depression in a timbered flat known as "Porcupine Flats," which parallels the Skeena river in this region about 80 feet above the latter. The depression mentioned is bordered on the east by morainal slopes which rise to another flat above Porcupine Flats to the foot of a rocky ridge situated immediately west of the Skeena river. On the west the depression is bordered by morainal hills which rise to the rocky ridge forming the left bank of Lorne creek.

Except for a small circular meadow about 475 feet in diameter occupying the depression, the ground is covered with dense vegetation and timber.

The deposit was first found immediately underlying surface vegetation in the meadow and subsequently in a similar position in regard to the gently rising ground adjoining the meadow on the east and south. A creek of considerable size cuts through the sediments of the Hazelton series, which form an extensive range of hills immediately west of the meadow. Shortly after emerging from the range of hills the creek disappears into the glacial debris which flanks the range and evidently flows under the meadow and, seasonally each year, in the spring and autumn, completely floods the meadow to a depth of several feet. It is evident, therefore, that the depression occupied by the meadow in the glacial debris and immediately adjoining area to the south-east acts as a catchment-basin for water containing calcium carbonate, and, further, that by very slow evaporation the waters become super-saturated with the mineral, so that the deposition of calcium carbonate in pulverulent form takes place within the body of water. The deposit bears none of the characteristics of calcareous tufa. It was noted that the creek mentioned cuts through calcareous argillites immediately before disappearing into glacial debris, so that a local source of the lime is afforded.

Exploration of this property, staked in 1931 by the present owners, consists of several small and shallow pits at various points on the meadow and within an area 300 by 500 feet lying south-easterly. In addition to these, there is one trench of a maximum length of 205

feet, a maximum width of 10 feet, and from 3 to 5 feet deep. The pits indicate the probability that the meadow and area described is underlain by the deposit of lime. The trench affords a very good exposure of the white or cream-coloured deposit, and shows that at this point the latter is immediately overlain by moss and timber, with very little overlying soil. It will be noted that the area lying to the south-east of the meadow lies above water-level and is not overlain by any glacial debris, so that shipments can be made at any time from this region after it has been cleared of timber and vegetation. Development to date affords but little evidence as to the average depth of the deposit; obviously, therefore, no exact calculations as to quantity can be made, but assuming that an area 300 by 300 feet on the south-east side of the meadow is underlain by a wedge-shaped body of the deposit, 30 feet deep at its eastern extremity, and that the material in place occupies 18 cubic feet per ton, then 70,000 to 75,000 tons are indicated as lying above water-level and immediately available.

PROGRESS NOTES.

LODE-GOLD DEPOSITS.

Wells Area.

Cariboo Gold Quartz Mining Co., Ltd.—The rate of milling was increased to 150 tons daily on September 4th. A comprehensive development scheme was also carried forward, including the sinking of two vertical winzes on the 1,500 level, one in the *Rainbow* vein system (formerly "Nos. 5, 6, and 7 vein area") and the other in the *Sanders* vein system (formerly "Rainbow or Sanders" vein area). Both these had reached a depth of 250 feet on October 11th. (Refer to Annual Report for 1934, also to Memoir No. 181, Geological Survey of Canada, 1935.)

Island Mountain Mines Co., Ltd.—During the year the rate of milling was increased to about 100 tons daily and development and diamond-drilling to about 800 feet monthly. Tonnage milled consists of about 60 per cent. from quartz veins and 40 per cent. from the replacement deposit. (Refer to Annual Report for 1934, also to Memoir No. 181, Geological Survey of Canada, 1935.)

Barkerville Area.

Richfield Cariboo Gold Mines, Ltd.—During the year the main adit was advanced about 1,000 feet farther and has now reached a total length of approximately 2,600 feet. Near the face of the main adit some small sulphide-bearing quartz veins were cut. (Refer to Annual Report for 1934, and Memoir No. 181, Geological Survey of Canada, 1935.)

Stanley Area.

Cariboo Gold Syndicate.—This syndicate holds forty-eight mineral claims on Van Winkle mountain, 6 miles from Stanley. A number of "B" veins and one "A" vein are exposed on the flat-topped mountain summit in schistose sediments of the Cariboo series. An adit, the estimated length of which is 1,092 feet, has been started and on October 9th had advanced 25 feet towards its objective, 340 feet below the vein-outcrops.

Usk Area.

Omineca Gold Quartz Mines, Ltd.—This company was incorporated during the year for the purpose of operating the *Dardanelle* group on the *Zymoetz* river. (Refer to Annual Report for 1927.) A force of upwards of forty men was employed in constructing a tractor-trail, an essential preliminary to development, following the north bank of the river from the Terrace-Usk highway to the property, a distance of 12 miles.

Columario Consolidated Gold Mines, Ltd.—This company suspended mining and milling operations in the early summer, which were not subsequently resumed.

Smithers Area.

Glacier Gulch.—Operations were resumed at this property during the year by the owners, who shipped approximately 30 tons of ore. (Refer to Annual Report for 1934.)

Mamie.—The optionees, W. R. Wilson & Sons, continued No. 1 adit, the face of which at 218 feet from the portal showed a vein-width of 3 feet. A sample across 3 feet at this point assayed: Gold, 1 oz. per ton; silver, 4 oz. per ton. (Refer to Annual Report for 1934.)

PLACER DEPOSITS.

Barkerville Area.

Lowhee Mining Co., Ltd.—This company continued hydraulic operations on Lowhee creek, where the face of the pit has reached a point just beyond Watson's gulch. The channel near bed-rock is narrow and V-shaped. Among nuggets recovered during the year was one of galena containing a large amount of gold. It is stated that the entire holdings of this company have been acquired by English interests.

French Creek Hydraulic Placers, Ltd.—This company last year rendered its water rights on Williams creek available to its property on French creek and continued active hydraulic operations throughout the season.

Antler Gold Mines, Ltd.—This company holds a large number of leases on Antler creek, extending down-stream for about 12 miles below Grouse creek. During the year a road from the Barkerville-Bear Lake road to the lower end of the property was built. At this point on a low-lying rock bench a boom-drag-line Diesel shovel, with bucket of 1¼-cubic-yard capacity, was installed, together with screening and washing plant.

Walker Gulch.—This creek immediately before entering Williams Creek valley is contained in a rocky gorge above which its valley widens. The topographic indications suggest that a buried pre-Glacial channel-remnant lies in the right bank of the creek on the south side of the gorge. The depth of the pre-Glacial channel-remnant is unknown. The property covering the above region is owned by E. T. Fitzsimmons, who has installed an hydraulic plant.

Antler Placer Mines, Ltd.—This private company holds leases on upper Antler creek in the vicinity of Sawmill Flat creek, where there is an indication that a former channel of Antler creek lies buried in its left bank. An hydraulic plant was installed last year and operated this year under the direction of Alfred Brown.

Leases of H. Brown and Associates, Nugget Gulch.—A description of this property, on which an option was taken during the year by Consolidated Mining and Smelting Company of Canada, Limited, will be found in the 1933 Annual Report under "Nugget Gulch."

Wells Area.

Queen City Mining Co., Ltd.—This company holds an option on placer-mining leases 608, 2786, and 2787, situated on Eight Mile lake at and near the old *Thistle* pit. A Bucyrus power-shovel with a bucket of ¾-cubic-yard capacity was installed at the property during the year and working in the face of the pit.

Eastman Red Gulch Placers, Ltd.—This is a private company incorporated in 1934 for the purpose of hydraulicking the buried pre-Glacial channel of Red Gulch. The *Oliver, Never Sweat, Alabama*, and *Pay* placer-mining leases, owned by the Lowhee Mining Company, are operated on a royalty basis.

Guyet Placers, Ltd.—Hydraulic operations continued by this private company during the year at its property on Antler creek, an account of which is given in the Annual Reports for 1932 and 1933. Time did not permit of examination this year.

Stanley Area.

Among the hydraulic properties in operation during the year may be mentioned that of L. Ford and R. McDougall on Dragon creek; those of Chinese interests on Slough creek; that of Julius Powell on Coulter creek; the *Cariboo Eagle* on Houseman creek; the *Last Chance* on Last Chance creek; the *Ketch* at the mouth of Devil's canyon; and the property of Magnus Sundberg on Donovan creek.

Beaver Pass Area.

Considerable activity was manifested by individual operators in Beaver Pass, among whom may be mentioned K. K. Langford and H. C. Cameron. Time did not permit of examination of this area this year.

Wingdam Area.

Slade-Cariboo Gold Placers, Ltd.—Hydraulic operations were continued by this company throughout the season and a large yardage piped off. The pit is now about 600 feet in length

and 180 feet in width and trends in a south-easterly direction from Lightning creek. (Refer to Annual Report for 1932.)

Cottonwood House Area.

Leases of J. W. and W. D. Jones and W. H. Stricker.—This property, through which the Quesnel-Barkerville road passes, is distant 2 miles from Cottonwood House. In October a drag-line plant, with bucket of $\frac{1}{2}$ -cubic-yard capacity, was installed, together with screening and washing plant, on the right bank of the Cottonwood river.

Prince George Area.

Nechako Golds, Ltd.—This private company installed a caterpillar boom-drag-line shovel, with bucket of $1\frac{1}{2}$ -cubic-yard capacity, together with screening and washing plant, at its property on the Nechako river at Miworth, 9 miles west of Prince George.

A considerable yardage was treated on the left bank of the river, but operations were subsequently suspended for reasons unknown.

West Road (Blackwater) River.

Lease of T. B. Armstrong and Associates.—Investigation on T. B. Armstrong's lease had only just commenced at the time of examination, but appeared to merit continuation as evidence had been found of placer concentrations on the right bank of the river at the assumed point of intersection with the buried channel.

Hixon Creek Area.

Lease 2118.—Acting for Hixon Mother Lode, Limited, Richard Langdon installed a pump-hydraulic plant on this property during the year. A small drag-line plant was utilized for stacking oversize tailings and the minus 6-inch tailings were disposed of with a dredge-pump.

Hansard Area.

W. H. O'Dell's Dredge.—W. H. and W. C. O'Dell designed and built at Hansard a small dredge 50 feet long by 16 feet wide, equipped with a bucket of "orange-peel" type and operated by a 25-horse-power donkey-engine. This was subsequently towed to a large low-lying bench on the right bank of the McGregor river, about $7\frac{1}{2}$ miles above its mouth, and operations commenced at this point.

Likely Area.

Cedar Creek Hydraulic Mines, Ltd.—This company was incorporated during the year to operate the leases originally owned by the Cedar Creek Mining Company, Limited. (Refer to Annual Report for 1934.) Drag-line operations were continued in the north-western part of the property and systematic prospecting was undertaken in this region with, it is stated, encouraging results.

Moose Syndicate.—It is understood that encouraging results were secured by this syndicate. (Refer to the Annual Report for 1932.)

Quesnel Forks Area.

Property of C. S. Wing.—This property is situated on the left bank of the Quesnel river, 4 miles below Quesnel Forks, and was discovered last year by a Chinaman. A small creek cutting through the mass of glacial debris, which forms a large part of the valley-fill at this point, has effected a rich concentration of fine gold on slum. Two pans taken here by the Resident Engineer yielded gold of a total value of 78 cents. A small hydraulic plant has been installed.

Leases of J. Shaw.—These leases are situated on the South fork of the Quesnel river above Quesnel Forks. Particular interest is attached to this part of the river because of the probable enrichment caused by the post-Glacial waters of the river cutting through the Bullion channel.

Half Mile Creek.—This creek flows into the South fork about half a mile above Quesnel Forks on the north side of the river. Topographic indications strongly suggest that a pre-Glacial channel-remnant of considerable length lies buried in the left bank of this creek. Lease-owners handicapped by the indifferent water-supply are meeting with encouraging results on a rock bench indicated as being the right rim of this buried channel.

Keithley Area.

Placer Engineers, Ltd.—An account of this property will be found in the Annual Report for 1933. Hydraulic operations continued during the year in *China* pit, resulting in the exposure of bed-rock of two channels. One is presumably the pre-Glacial channel of Four Mile creek and the other that of Keithley creek.

Upper Pine Creek.—A new discovery of placer on this creek by G. Baker and A. Peeling is reported.

Pine Creek Mining Co.—Hydraulic operations continued during the year by this company under the direction of B. Boe and a considerable yardage was piped off. The right or west rim of the buried channel is well exposed, but there is as yet no evidence of the left rim, although such may not be very prominent. (Refer to the Annual Report for 1933.)

Harvey Creek.—A general account of this creek and B. Boe's earlier operations will be found in the Annual Reports for 1932 and 1933. During the year it is understood that hydraulic operations commenced above the falls.

McLeod River Area.

Northern Reef Gold Mines, Ltd.—The secretary of this company reports that during the year much further testing of both placer and lode-gold deposits was carried out, and that preparations have been completed for continuous hydraulicking throughout next season. (Refer to Annual Report for 1934.)

Manson Section.

This section comprises the area immediately south of the Omineca river and includes the drainage areas of Silver and Quartz creeks at the west end, and those of the Germansen and Manson rivers at the east end.

Northern Ventures, Ltd.—This company was incorporated during the year. The secretary is T. W. Brown, P.O. Box 1585, Prince Rupert. The property owned consists of five claims and twelve leases situated on Vital creek, and covers the entire section of this creek worked to date. Deciding to abandon drift-mining in favour of hydraulicking, the company commenced active preparations in September with this end in view. (Refer to Annual Report for 1933.)

Yukon Border Placer Golds, Ltd.—This company, under the direction of R. D. Adams, carried out a considerable amount of drilling on Tom and Silver creeks with a tractor 6-inch Keystone drill. After boring fifteen holes on the former creek and eight holes on the latter, the drill was subsequently moved to Old Hogem and transported by scow to Germansen Landing for the purpose of drilling property acquired in the eastern part of the Manson section.

Consolidated Mining and Smelting Co. of Canada, Ltd.—Drag-line operations on this company's property on Slate creek have been impeded by the tightly packed glacial gravels overlying bed-rock, and it was found necessary to drain the pit. A bed-rock drain from a down-stream point approached completion early in September, and the management then anticipated that it would shortly be possible to clean a considerable area of bed-rock. (Refer to Annual Report for 1933.)

Germansen Mines, Ltd.—This company was incorporated in 1934 and acquired the property on the Germansen river formerly owned by Germansen Placers, Limited. Hydraulic operations have proved the down-stream continuation on the right bank of the channel, 50 feet above the river previously hydraulicked and immediately up-stream on the left bank. Farther down-stream a continuation, which may prove extensive, is indicated. Satisfactory values in coarse gold are reported.

Operations of B. McDonald.—B. McDonald was engaged during the year in transporting a caterpillar power-shovel, with a $\frac{7}{8}$ -cubic-yard bucket, from Vanderhoof to his property situated on the Manson river. At the end of the season the shovel had reached a point about 20 miles north of the Nation river.

Leases of S. Young and W. B. Cowan.—These leases are situated on Kenny creek, about $2\frac{1}{2}$ miles below Silver lake, distant 28 miles from Takla Landing. Concentrations of placer were previously worked by earlier operators in shallow gravels overlying rock benches in immediate proximity to the canyon. Encouraging values were found by the present operators

in the bed of the creek at the lower end of the canyon about three-eighths of a mile above Silver creek.

Leases of E. Jones and Associates.—This property, consisting of five leases situated at the lower end of Quartz creek, is 38 miles by trail from Takla Landing. The topography indicates that the pre-Glacial channel of the creek is buried in the right bank, and the investigation of this is proposed. Present operations consist of washing bench-gravels at the mouth of the creek.

Lease of E. Martin.—The placer deposits on this lease, situated about half a mile above the mouth of Quartz creek, consist of post-Glacial concentrations on rock benches above creek-level and in the shallow gravels immediately overlying bed-rock in the creek. Quite coarse gold is found on bed-rock in this region, where the creek is wholly contained in a canyon.

Lease of E. Woods and T. Harrison.—This lease is situated on the Fall river, about half a mile down-stream from Quartz creek. At this point the river makes a turn before entering a rocky gorge and a good concentration is found in the bed of the river.

Leases of Alex. Clark and G. R. Moore.—These leases are situated on Quartz creek and extend within a canyon up-stream from a point about 1½ miles above the mouth of the creek. Work to date chiefly consists of driving an adit and branch therefrom whilst investigating above the mouth of the creek the buried pre-Glacial channel of the creek, which is indicated as lying instream in the right bank.

Leases of H. A. Hagberg.—These leases are situated on Germansen river, 4 miles down-stream from Germansen Mines, Limited. A rock bench, 20 feet above the river on the left bank, overlain by a height of about 75 feet of glacial gravels, exemplifies a former river-channel. A small hydraulic plant is installed. At the lower end of this ground there is evidence of another channel below the present river-level.

Lease of A. L. Ward and J. Bauer.—This lease is situated on the south side of Plug Hat mountain. An hydraulic plant has been installed on bed-rock in what appears to be a former channel of the river immediately instream from the canyon, and considerable headway has been made with the advancement of the pit northwards.

In the eastern part of the Manson section other operators were: E. Dunsmore and associates on Lost creek; E. A. Floyd on Boulder creek; S. Rosetti, A. Hyndman, and E. Moore at different points on the right bank of the Manson river; and Luke Fowler on Blackjack gulch.

GOLD-SILVER-LEAD-ZINC DEPOSITS.

Smithers Area.

Hyland Basin.—A shipment of ore was made to Trail by the owners of this property. (Refer to Annual Report for 1926 and Geological Survey Summary Report, 1924, Part A.)

Topley Area.

Topley and Richfield.—These groups are a restaking of ground formerly held by Topley-Richfield Mining Company, Limited, by the owners, L. B. Warner and A. Chisholm, of Smithers, and R. W. Innes, of Topley. A new discovery was recently made east of the region formerly under development, consisting of a shear-zone several feet in width, in which a well-mineralized quartz vein 2 feet in width contains gold values.

Gold.—A considerable amount of development was carried out by the owners of this property with gratifying results. Gold values were encountered at two points about 300 feet apart in the flat-dipping vein under development, justifying further work. (Refer to Annual Report for 1934.)

SILVER-LEAD-ZINC DEPOSITS.

Smithers Area.

Silver Creek.—Further development of this property, attended by encouraging results, was carried out by the optionees, W. R. Wilson & Sons, in No. 3 adit in the pyrrhotite-sphalerite ore struck in 1926 by British Canadian Silver Corporation. (See Annual Report for 1926, with map, under "Schufer.")

SILVER-COPPER DEPOSITS.

Grouse Mountain Area.

Last Chance.—A new discovery was made on this property this year by one of the owners, J. Oakes, of Telkwa, consisting of a quartz vein varying in width from a stringer to 19 inches, well mineralized with grey copper, chalcopyrite, pyrite, malachite, and azurite, and carrying high silver values. It was the intention of the owners to endeavour to make a shipment this winter.

TUNGSTEN DEPOSITS.

Wells Area.

Hardscrabble.—A small-scale development programme was undertaken on this property by the Columbia Tungsten Company, Limited; office, 61 Broadway, New York, U.S.A. A description of this group will be found in the Annual Report for 1918.