BRITISH COLUMBIA DEPARTMENT OF MINES

Hon. W. A. McKenzie, Minister.

Robt. Dunn, Deputy Minister. J. D. Galloway, Provincial Mineralogist.

J. Dickson, Chief Inspector of Mines.

BULLETIN No. 1, 1930

REPORT ON THE TAKU RIVER AREA, ATLIN MINING DIVISION, NORTH-WESTERN MINERAL SURVEY DISTRICT

BY

J. T. MANDY, Resident Mining Engineer

SUBMITTED BY

JOHN D. GALLOWAY, Provincial Mineralogist

PRINTED BY
AUTHORITY OF THE LEGISLATIVE ASSEMBLY.

VICTORIA, B.C.:
Printed by Charles F. Banfield, Printer to the King's Most Excellent Majesty.
1930.

Prince Rupert, nearest Commercial Centre to Taku Mining Area.

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

SIR,—I beg to submit herewith a report on the Taku River area, Atlin Mining Division, by J. T. Mandy, Resident Mining Engineer, North-western District (No. 1).

This report describes in detail the important features of this mineralized area which is now attracting much attention. It is considered that this report is of sufficient interest to the public to warrant issuing it as a special bulletin.

I have the honour to be,
Sir,
Your obedient servant,

JOHN D. GALLOWAY,
Provincial Mineralogist.

Bureau of Mines,
Victoria, B.C., January 9th, 1930.

REPORT ON THE TAKU RIVER AREA, ATLIN MINING DIVISION, NORTH-WESTERN MINERAL SURVEY DISTRICT.

By J. T. Mandy, Resident Mining Engineer (Headquarters, Prince Rupert).

INTRODUCTION.

The Taku river is the drainage-channel for about 5,000 square miles of the north-western section of British Columbia. The river and its tributaries occupy the next important drainage-trough of the Pacific slope north of the Stikine river.

The mouth of the Taku river is about 140 miles north-westerly of the Stikine River mouth. It empties into the head of Taku inlet about 25 miles north-east of Juneau, Alaska, and about 320 miles north of Prince Rupert, British Columbia. The British Columbia-Alaska boundary crosses the river about 20 miles from its mouth, throwing the important extent of the area in Canadian territory east of the Alaskan Panhandle. The area is reached by direct and frequent steamship connection from Prince Rupert or Vancouver to Juneau, and thence by launch and river-boat up the Taku river.

Recent mineral discoveries in the Taku River region give promise of the dawn of a new and important mining area. The interest aroused by these discoveries in mining circles and amongst the general public has resulted in many inquiries for information regarding the territory. To meet this situation it would seem that the best interests of that region and all those seeking information can be served by the incorporation of all available data in the form of a special bulletin.

In this report the Taku River area is necessarily treated in only a general way. More detailed attention is given to that part which lies east of the Alaska-Canadian boundary-line, and especially that area through which passes the eastern contact margin of the Coast Range granodiorite batholith. Geological inference and practical experience in the older mineral areas to the south have definitely established the economic importance of the mineral potentialities of the eastern contact margin of the batholith. The concrete evidence that these economic mineral potentialities extend northward in no uncertain manner through the contact-zone in the Taku River area is of great importance to the future development of British Columbia's northland.

The section especially embraced by this report, and in which it would seem the best opportunities for important mineral discoveries exist, is situated east of the International boundary between latitude 58° 35′ to 58° 50′ north and longitude 133° 10′ to 133° 40′ west, approximately 300 square miles in extent. This section forms part of the Atlin Mining Division, North-western Mineral Survey District (No. 1).

In view of a possible misleading interpretation that may be placed on statements appearing in the press, it must be stressed that the Taku River area is totally unsurveyed geologically and no geological maps exist relative to the area. Unfortunately the Geological Survey of Canada has hitherto not been able to extend its work to the Taku River trough. The nearest area in which geological survey work has been carried out is in the Stikine River area, lying about 140 miles southerly. In the British Columbia Minister of Mines' Annual Report for the year 1923 is the first recorded opinion relative to the mineral potentialities of the district. Now that the region has shown definite promise of important ore-bodies, it is hoped the Geological Survey of Canada will take steps to systematically map the area, and correlate its rock formations with those of the southerly lying Stikine River area.

The area is as yet unserved by roads or trails, but is very easily accessible by water route from seaboard. The nearest settlements are Atlin, about 143 miles north of the mouth of the Taku river, and Juneau, Alaska, about 30 miles by water route south-westerly. An efficient transportation system has been inaugurated by the Taku River Transportation and Trading Company. This was made necessary by the 1929 discoveries and the development operations undertaken by the Alaska Juneau Gold Mining Company and the United Eastern Mining Company in the vicinity of the Tulsequah river, the most important tributary near the contact-margin zone. This transportation system emanates from Juneau by launch to the mouth of the Taku river.

and thence by river-boat to the mouth of the Tulsequah river. With good connections and tidal conditions over the Taku River bar, it is possible to make the journey from Juneau to the mouth of the Tulsequah river in one day.

The situation of the area on the westerly fringe of the Interior plateau or dry belt excludes severe or abnormal climatic influences. To the west the high altitudes and extensive ice-fields of the Coast range assume the role of a watershed and obviate any excessive precipitation in the bordering region to the eastward. Field observation indicates that rain and snow precipitation is moderate, considerably less than in the coast area to the west, and decreases steadily to the east. The timbered areas are comparatively free from underbrush. The winters are cold and dry, the summers moderately warm and sunny. About the beginning of November, slush-ice begins to form in the Taku river, and navigation is impeded by about November 15th. Towards the beginning of May the lowlands are reported to be free of snow and river navigation becomes possible again.

The topography of the country embodies generally those topographic features which are common with other parts of the Pacific slope and the eastern contact areas of the Coast Range batholith. The terrain is, however, in general, not so rugged and rough as that of the Kitsault, Bear, and Salmon River valleys in the Alice Arm and Portland Canal sections to the southward.

The Taku River area east of the International boundary is well supplied with game. Moose frequent the neighbourhood of the Tulsequah river and the slough and bench areas northward along the Taku river towards Atlin. Geese frequent the slough areas and are reported to nest in these localities. The large slough area west of the confluence of the Tulsequah river with the Taku river is an outstanding beaver region, featured by innumerable dams and colony houses. Black and brown bear are often seen along the river-banks. In the higher altitudes mountain-goat abound.

The operators and prospectors of the area, through their courtesy, hospitality, interest, and co-operation, greatly facilitated the work of examination.

HISTORY.

Despite the fact that the region is so favourably situated geologically and is so easily accessible, it was not until the spring of 1929 that its mineral potentialities attracted warranted attention. A small amount of prospecting, emanating from Atlin, for placer gold had been carried out in earlier years in the upper reaches of the Taku river, above the confluence of the Inklin and Nakina rivers. Stories are now told of lode-mineral finds in that section, made by the old-time placer prospectors, who, as is the way with placer-gold miners, paid little attention to them. During the past season several aeroplane expeditions were launched in the effort to relocate these reported discoveries. In 1925 some placer-gold leases were taken up in the Nakina River area by Kansas City interests. These were, however, not further prospected or developed.

A limited interest in the lode-mineral possibilities of the area was first germinated by the discovery several years ago, by W. Kirkham, of Juneau, of copper-zinc-lead ore about 8 miles above the confluence of the Tulsequah and Taku rivers. This discovery resulted in the staking of the *Tulsequah Chief* group. In 1923 this property was bonded to the Alaska Juneau Gold Mining Company, which did about 60 feet of unsuccessful tunnelling and relinquished the option. The property was examined in that year by George A. Clothier, at that time Resident Mining Engineer for the North-western District. In the Annual Report for 1923 he very definitely pointed out the favourable potentialities of the property and of the area in general. This is the first recorded official statement relative to the mineral potentialities of the Taku River region. To Mr. Clothier, of the British Columbia Department of Mines, must be given the credit for having first definitely recorded the mineral possibilities of the area and for having attracted attention to them.

In 1928 a syndicate represented by W. A. Eaton and Dan J. Williams, of Juneau, again optioned the *Tulsequah Chief*. These operators, after aligning the two zones of the deposit, turned the old Alaska Juneau tunnel to the left and within a short distance penetrated No. 1 zone carrying good-grade ore over an exceptionally promising width. In the spring of 1929 this syndicate bonded the property to the United Eastern Mining Company, of Los Angeles, which has attacked it very energetically, efficiently, and with exceptionally promising results.

This development attracted the attention of prospectors to the promise of the area. In the early part of May, 1929, a group of eight Juneau business-men grubstaked V. Manville, also of

Taku River, British Columbia. Tulsequah River entering on Left.
1. Tulsequah, Proposed Townsite. 2. Manville Group. 3. South Fork of Taku River.

Juneau, for a projected lengthy exploration trip into the Taku River area. After only about two weeks in the field, Manville discovered an exceptionally imposing surface outcrop of copper-zinc-lead ore, near the confluence of the Tulsequah and Taku rivers, and staked the *Big Bull* and other claims, now known as the *Manville* group. Almost immediately, competition arose between outstanding mining corporations for the acquisition of this property. This culminated in July in the extraordinary situation of three companies submitting an unlimited number of sealed bids, which were opened on a stipulated date. These negotiations resulted in the Alaska Juneau Gold Mining Company acquiring a working option on a 55-per-cent. interest in the property for $75,000, which involved a cash-down payment of $25,000.

The *Manville* discovery and subsequent deal, coupled with the promising development of the *Tulsequah Chief* under the direction of J. B. Stapler, of the United Eastern Mining Company, finally attracted the attention of prospectors and brought the mineral potentialities of the Taku River area into the limelight. Towards the latter part of the 1929 season, prospectors began to arrive in the country. It should be clearly understood, however, that there was no rush or stampede such as was pictured by the daily press. In September, when the area was examined, not more than forty prospectors were in the territory. Most of these were congregated around the mouth of the Tulsequah river. Only very desultory prospecting had been carried out by these men, mainly in the lower altitudes. Several interesting further discoveries had been made, however.

SUMMARY AND CONCLUSIONS.

The achievement by active exploration and development, and the comparative ease and rapidity of results attending more or less cursory prospecting effort, portends a promising future for the region. A very small section of the area has as yet been only skimmed. A large extent of geologically favourable virgin territory, equally as promising as that in which ore-bodies of economic importance have already been discovered, awaits the prospector's pick. During one brief season the Taku River section has produced one semi-developed mine, one exceptionally promising new find, and several other interesting discoveries.

An important and favourable feature of the area is that the geology and the already discovered ore-bodies show promise of mineral occurrences of size. Although high-grade ores of the precious metals are not to be expected, the discoveries and geology indicate that the area harbours low-grade base-metal ore-bodies carrying appreciable supporting values in gold and silver. Such a combination does not unduly excite the imagination into hazardous calculations of unwarranted millions. The problem of developing the Taku ore-bodies into profitable production will call for skilled, careful, and conservative handling. The character of the main discoveries is, however, of the type that indicates appreciable tonnage mines necessitating metallurgical expansion and the employment of much labour. These are factors that tend towards stability and expansion of operations, with a widespread influence on the future prosperity of British Columbia's north-west and the industrial development of the coastal area in general. It is in this light that the successful development of the complex sulphide deposits of the Taku River area is of the utmost importance.

The chief ore occurrences so far discovered are a low-grade complex of copper, zinc, lead, and iron sulphide mineralization. The factor of values in these deposits, particularly that of the *Tulsequah Chief*, is somewhat intricate. If carelessly scrutinized, misleading impressions can occur. Widths and mineral distribution that may have an important bearing on mining methods and the value of ore mined are involved questions in the matter. These associated conditions will be extended under a later heading. For the purpose of this summary it can be taken that the values contained in the ore-shoots as they were developed at the time of examination are as follows:—*Tulsequah Chief:* Gold, 0.1 oz. to the ton; silver, 3.5 oz. to the ton; copper, 1.75 per cent.; lead, 0.6 per cent.; zinc, 6 per cent. *Manville* group: Gold, 0.12 oz. to the ton; silver, 6 oz. to the ton; copper, 2 per cent.; lead 1 per cent.; zinc, 15 per cent.

It is unfortunate that, with the present status of the zinc market, little profit, if any, can be expected from the content of this metal in the ore. Whether this condition will improve or not, it is evident that should appreciable production of this metal materialize from the Taku deposits, the problem of its profitable marketing must inevitably be met by the establishment of zinc-lead smelting and refining facilities on seaboard and close at hand. With the zinc-lead content of so many smaller deposits of the North-west awaiting the deciding factor of stable tonnage that will materialize such a metallurgical facility, the possible influence of the Taku deposits on the expansion of the coastal mining industry is profound.

Considered from a concentration and separation aspect, it would seem that, although the problem is intricate, the ores should offer no refractory difficulty. A clean separation of metallic sulphides, delivering three and possibly four products, should be economically achieved. It is not possible as yet to establish from available data any definite ratio between the precious-metal content and that of the base metals. The important indication in this respect, however, is that neither the gold nor appreciable silver values are contained in the zinc sulphides. Judged from assay results, it would seem that the gold, with some silver, is associated with the copper sulphide, with an occasional indication of some gold content in the pyrite. Some of the silver value would probably have to go with the zinc. The bulk of the silver, however, seems to be associated with both the copper and lead sulphides. An occasional exceptionally high gold-silver assay with low copper, lead, and zinc value indicates the possible presence of a gold-silver-telluride or other rare mineral rich in the precious metals.

In considering the concentration and separation of these ores, it is of importance to note that the problem will be considerably eased by the expert experience of the Bunker Hill and Sullivan Mining and Concentration Company, one of the leading silver-lead-zinc mining and smelting companies of the world. This company, through its affiliation with the Treadwell Yukon Mining Company, is associated with the Alaska Juneau Mining Company in the development of the *Manville* and other groups in the Taku area. Working on a somewhat similar ore in the *Errington* mines, Sudbury, Ontario, the Treadwell Yukon Company is reported to have evolved, with comparative success, a process giving high extraction and clean products of copper, zinc, lead, and iron sulphides, at a reported cost of $1.50 a ton of ore treated, on a 320-ton mill-capacity basis. The appreciable quantity of barite indicated in the gangue of the Taku ores may also be recovered profitably as a by-product.

Should the *Tulsequah Chief* and *Manville* ore-bodies show economic extent and be developed to the stage warranting mill-construction, an ideal condition exists for mutual co-operation on the part of the two companies concerned. One centrally located mill of large capacity, situated near the confluence of the Taku and Tulsequah rivers, and jointly operated, would be of decidedly mutual benefit. The proportionate division of construction cost, the capacity increase, the cutting of overhead and staff costs, etc., should not only be reflected in decreased milling costs, but would also be carried proportionately right through the operations, with favourable effect on the grade of ore it would be possible to mine profitably.

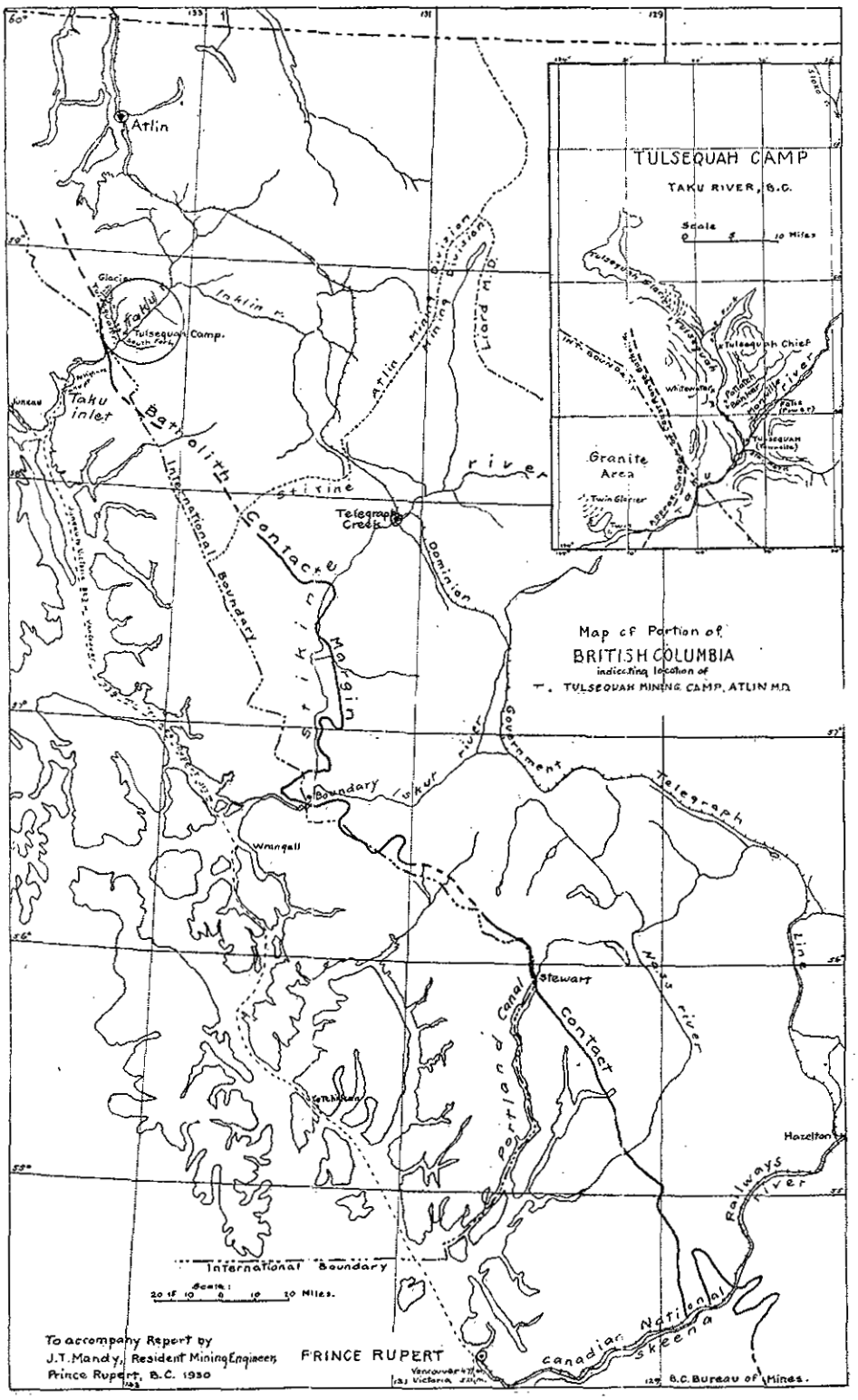
Were such a mill open also to the reception of custom ore, many prospects and smaller operations that might materialize would be assisted in their initial exploration and possibly brought into a continuous small tonnage production. In the profitable operation of low-grade, complex base-metal ore-bodies such as are indicated in the Taku discoveries these considerations of economy are of the utmost importance. Not only are they sometimes a deciding factor in the profit of individual properties, but also in the success of the mining industry in low-grade base-metal areas.

TRANSPORTATION AND ACCESSIBILITY.

The Taku River region is conveniently accessible by water route during the summer season. Improved river transportation facilities are being planned by the Taku River Transportation and Trading Company. Road and trail facilities are being considered by the British Columbia Department of Mines and the Department of Public Works. Surveys for routes and location of these facilities were carried out during the past season. Through the instrumentality of the Minister of Mines, arrangements were made whereby Customs clearance was obtained at Juneau, Alaska, for passengers and baggage for aeroplane transportation into the Taku River area. During the coming season augmented aeroplane transportation by Western Canada Airways from a conveniently situated port is being planned. The Barrington Transportation Company, of Wrangell, Alaska, also plans to operate a transportation system on the Taku in 1930.

River navigation on the Taku is open from about the beginning of May to the middle of November. Between that period navigation is impeded by ice. During part of the winter, dog-team transportation over the frozen river is possible. It cannot be definitely said as yet whether horse and sleigh winter transportation over the river-ice is feasible.

The region is reached by the regular Canadian National or Canadian Pacific Steamship service from Prince Rupert or Vancouver to Juneau, Alaska. From Juneau the 75-horse-power gasoline-launch "Amy," with equipment of scows for carrying freight, operates to a float-house transfer-station at Taku point, at the south side of the mouth of the Taku river, a distance of about 30 miles. The "Amy" makes this run about twice a week and takes about five hours on


TULSEQUAH CAMP
TAKU RIVER, B.C.
Scale
10 Miles
Atlin
Atlin Mining Division
Liard M.D.
Inklin R.
Glacier
Tulsequah Camp.
Taku inlet
Juneau
Batholith
Stikine river
Granite Area
Twin Glacier
Tulsequah Chief
Whitewater
Tulsequah (Cominco)
Telegraph Creek
International Boundary
Contact
Margin
Dominion
Map of Portion of
BRITISH COLUMBIA
indicating location of
TULSEQUAH MINING CAMP, ATLIN M.D.
Boundary
Iskut river
Government
Telegraph
Wrangell
Stewart
Portland Canal
Contact
Nass river
Hazelton
Skeena River
Railways
Canadian National
International Boundary
Scale:
20 15 10 5 0 10 20 30 Miles.
To accompany Report by
J.T. Mandy, Resident Mining Engineer,
Prince Rupert, B.C. 1930
PRINCE RUPERT
Vancouver
Victoria
B.C. Bureau of Mines.

the trip. This service is operated jointly by the United Eastern Mining Company and the Alaska Juneau Gold Mining Company to serve their mining-development operations up the river. Gasoline-launches can also be hired at Juneau for a moderate fee for special trips to the mouth of the Taku river.

At Taku point transfer is made to a shallow-draught, 60-horse-power gasoline river-boat and freight-barges of the Taku River Transportation and Trading Company. This equipment runs from the mouth of the river to the proposed townsite of Tulsequah, B.C., at the junction of the Tulsequah and Taku rivers, about 26 miles. Between seven and eight hours is required for this stretch of the journey. The International boundary-line is crossed at about 20 miles north-east of Taku point. If an overnight wait is necessary to catch high tide for the crossing of the bar at the mouth of the Taku river, comfortable accommodation and good meals can be procured at De Vighne's camp, 6 miles up the river from Taku point.

A United States Customs official is located on the float-house at Taku point. No Canadian Customs port has as yet been established on the boundary. To facilitate Customs matters during the 1929 season, however, a Canadian Customs official was located at Juneau, Alaska, and attended to the clearance of passengers, freight, boats, and aeroplanes bound for Canadian territory up the Taku river. Meals could generally be procured for 75 cents at the Taku Point float-house and for $1 a meal at Tulsequah, where general supplies can be procured from the Taku River Transportation and Trading Company's store, operated by William Strong.

From Tulsequah, B.C., the *Manville* group, situated about 3 miles up a winding slough, is reached by small river-boats powered with outboard motors. Freighting and transportation by water up the turbulent Tulsequah river needs special equipment. For the United Eastern Mining Company's operation on the *Tulsequah Chief*, 8¾ miles up the Tulsequah river, freighting is handled by the Taku River Transportation and Trading Company. This is accomplished by a 36-foot open river-boat powered with one 10-horse-power and one 12-horse-power outboard motor. It is stated that the United Eastern freighting costs 4 cents a pound from Juneau to the warehouse on the Tulsequah river and that of the Alaska Juneau Mining Company $15 a ton from Juneau to the *Manville* camp.

For prospecting parties and extended exploration trips a small shallow-draught river-boat, powered with not less than a 6-horse-power outboard motor, is an essential part of the equipment. A boat specially designed with a movable frame for the motor that can be hoisted and lowered to conform to the depth of water is constructed at Juneau for $60 to $75. A suitable river-boat embodying the same features could be manufactured at one of the many boat-building establishments at Prince Rupert for probably less money. To avoid customs duty, provisions and other equipment can be procured at Prince Rupert, the nearest Canadian port at rail-head, and taken through Alaskan territory in bond.

PHYSICAL FEATURES.

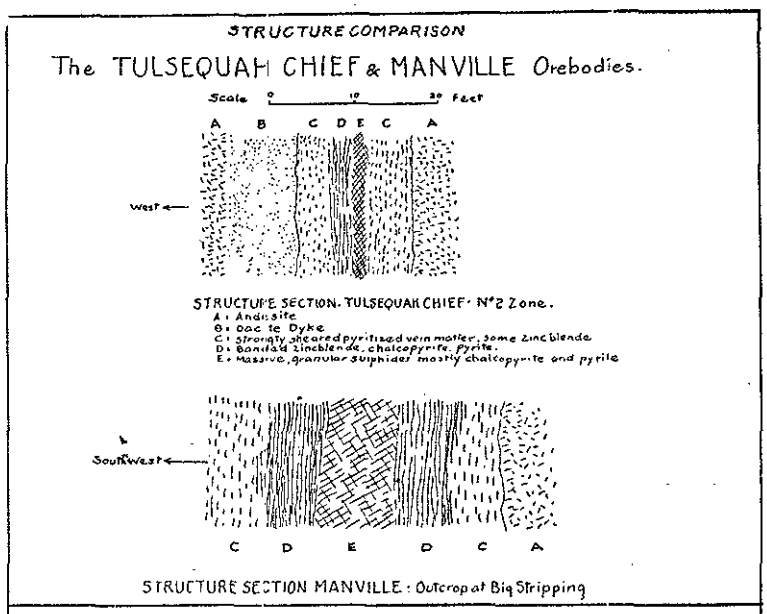
Steep wooded slopes rise abruptly from the valleys to bare, precipitous peaks from 5,000 to 8,000 feet in altitude. Sittakanay mountain (7,050 feet), on the south side of the South fork of the Taku river, and Mount Lester Jones (8,000 feet), south of King Salmon creek, are outstanding on the landscape. Detached remnants from the receded ice-mass fill several glacial cirques of the higher altitudes. On account of the steeply abrupt rock-slopes to the peaks, timber-line is low—2,000 to 2,500 feet altitude.

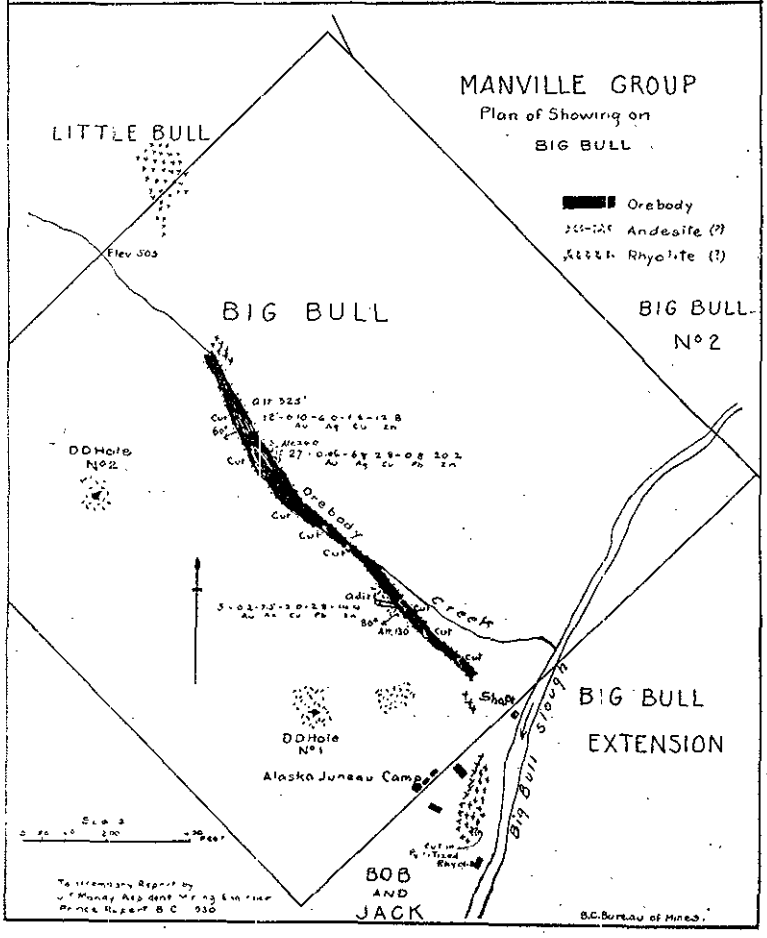
Water-power.

No appreciable sources of water-power were observed in the area. Several small streams would, however, offer seasonal sources of power. There is a possibility that the upper reaches of some of the chief streams may, upon investigation, produce sufficient power for all-the-year-around utility. The United Eastern Mining Company has applied for a power concession on the East fork of the Tulsequah river, and the Alaska Juneau Company is contemplating utilizing the power from a waterfall on the east side of the Taku river.

Taku River.

The physical features of the Taku river are typical of the larger glacier-fed streams of the North Pacific area that have cut their way through the Coast range to the sea. Large quantities of silt, continuously carried down from the upper reaches, have resulted in numerous bars, sloughs, low-lying islands flooded at high water, and a network of channels. This condition is


STRUCTURE COMPARISON
The TULSEQUAH CHIEF & MANVILLE Orebodies.
Scale 0 10 20 Feet
A B C D E C A
West
STRUCTURE SECTION. TULSEQUAH CHIEF. N°2 Zone.
A. Andesite
B. Dacite Dyke
C. Strongly sheared pyritised vein matter, some zinc blende
D. Banded Zincblende, chalcopyrite, pyrite.
E. Massive, granular sulphides mostly chalcopyrite and pyrite
Southwest
C D E D C A
STRUCTURE SECTION MANVILLE: Outcrop at Big Stripping


MANVILLE GROUP
Plan of Showing on
BIG BULL
Orebody
Andesite (?)
Rhyolite (?)
LITTLE BULL
Elev 503
BIG BULL
BIG BULL N°2
DD Hole N°2
Ore body
Creek
Shaft
DD Hole N°1
Alaska Juneau Camp
Big Bull Slough
BIG BULL EXTENSION
BOB AND JACK
B.C. Bureau of Mines.

particularly pronounced towards the mouth of the river. About 2 miles above Taku point a delta-bar has been formed that can only be crossed by even shallow-draught river-boats at high tide.

From the mouth of the Taku river to the Tulsequah river the river-bed is featured by a very gradual gradient, there being a rise of only 70 feet from sea-level in this distance of 26 miles. At normal water the river in this stretch is consequently not excessively swift and can be easily navigated by small river-boats equipped with 6-horse-power outboard motors.

Above the Tulsequah river the course of the stream rises more steeply and the flow is consequently swifter. It is said to be navigable by small 16-foot outboard-motor powered boats, with the aid of poling and lining in the more rapid stretches, as far as the confluence of the Nakina and Sloko rivers, 31 miles above the mouth of the Tulsequah river.

The low-lying valley-bottom of the Taku river, from its mouth to the junction with the Tulsequah river, is about 2½ miles wide and is generally featured by numerous slough, swamp, and flood areas, with a few interspersed ridges and elevated patches above flood-water mark. For 15 miles up-river from its mouth the stream is distributed through many shallow channels. At about half a mile west of the International boundary the stream is confined for a short distance to a canyon 200 feet wide, with rock banks about 50 feet in height. Beyond the International boundary the stream is again distributed through several shallow channels to beyond the confluence with the Tulsequah.

In the immediate vicinity of the mouth of the river, and west of Taku point, the tongues of the great Norris and Taku glaciers reach to the water's edge. Masses of ice, crumbling from these glaciers, are sometimes drifted by tide and wind 3 or 4 miles up-stream into the mouth of the river, and are a factor to be contended with in navigation, especially at night, and in any construction of piers and wharves that might be undertaken.

Between the river-mouth and the International boundary the tongues of Twin glaciers on the north side, and Wright glacier on the south side, reach to the confines of the valley-bottom. These are features that would have to be considered in any road-building that may be undertaken. East of the International boundary, with the exception of the immense glacier at the head of the Tulsequah river, there are no glaciers with consequential bearing on the area described herein.

Many small streams flow into the Taku from both banks. The most important tributaries are: The Sittakanay river, 3 miles south-west of the International boundary, but having its source and flowing for 9 miles through Canadian territory; the South fork of the Taku river on the east side, 5 miles north-east of the International boundary; the Tulsequah river on the west side, 6 miles north-east of the boundary; King Salmon creek on the east side, 17 miles above the Tulsequah; Inklin river on the east side, 24 miles above the Tulsequah; Sloko and Nakina rivers, 31 miles above the Tulsequah. These tributaries and the subsidiary creeks all offer the best means of access to cross-sectional prospecting of the Taku River area.

Camps are situated at Taku point at the mouth of the river; Bullard's Landing, 4 miles up the river from Taku point; De Vighne's camp, 2 miles beyond Bullard's; at the *West Hill* property, 3 miles south-west of the International boundary; at Tulsequah, B.C., on the west bank of the Taku river, 26 miles from its mouth; and at the *Manville* group, 3 miles north of Tulsequah, B.C.

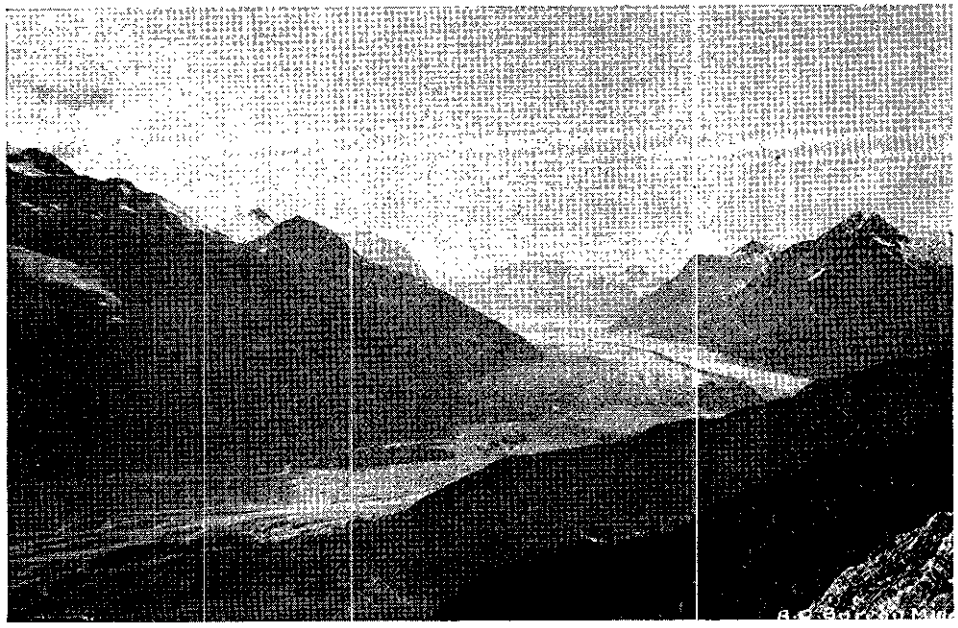
Tulsequah River.

The Tulsequah river is the scene of the most active mineral development at present, with much promising area still available for prospecting. A detailed description may prove of interest.

The main stream has its source in an immense unnamed glacier, 14 miles north-westerly of its junction with the Taku. It is a much more rapid stream than the Taku. For the first 8¾ miles from its mouth to the *Tulsequah Chief* warehouse on the east bank there is a difference in elevation of the river-bed of 95 feet. From that point to the glacier, 5 miles, there is an estimated rise of a further 75 feet, so that the gradient of the main river-bed would average about ¼ per cent. for its entire length. An East fork of the river follows a subsidiary valley for about 10 miles to the north-east.

The bed of the Tulsequah is spread over a width of half a mile and is featured by innumerable shallow, fast-flowing, and continuously changing channels, separated by shifting sand and gravel bars. Navigation by small boats is extremely difficult and dangerous, and even with high-powered outboard motors necessitates frequent poling, lining, incessant pole-sounding

Tulsequah River, approaching Glacier.



Tulsequah River and Glacier. Tulsequah Chief Mine on Right.

for depth, and search for new channels. At low water no particular channel would offer a complete thoroughfare without the necessity of lining and portaging over bar rapids.

The valley of the river varies from ¼ to 1½ miles wide. On the east side a ridged bench margins the river for a distance of about 10 miles from its mouth to the East fork. With the exception of a few places, this is above flood-water mark. At the junction of the Tulsequah and Taku rivers, on the west side, a slough and beaver-dam area 2½ miles wide and 4 miles long is a marked feature.

A remarkable periodical flood condition affecting the Tulsequah river is a matter to be noted by prospectors and operators. This emanates, in all probability, from the dammed-up water of a lake beneath the glacier at the head of the river. Pressure from the accumulating water during the summer months bursts the barrier, with the result that an enormous volume of water is suddenly belched into the valley, causing the river to rise 10 to 15 feet in a matter of two days, with an equally rapid subsidence. This year one of these floods was subsiding at the time of examination (September 1st). They are said to occur annually, at about the same period of the year. After one of these floods the entire formation of the river-bed is changed and totally new channels and bars result.

The *Tulsequah Chief* warehouse and river camp are situated on the east bank of the Tulsequah river, about 8¾ miles from its mouth. The camp of the *Potlatch* group (Sparling) is located about 3 miles up the Tulsequah from its mouth.

GEOLOGIC FEATURES OF THE AREA.

No geological survey party has as yet been into the Taku River area. The nearest region which has been mapped and studied by the Geological Survey of Canada is that of the Stikine river, 140 miles to southward. The accurate classification of the rocks and formations of the area and their correlation with those of other areas would be of great service to operators and prospectors. It is hoped this work will be taken in hand by the Geological Survey of Canada in the near future.

It must be stressed that the rock classification in this preliminary report is based on field identification only. No microscopical determinations have been made. This classification is consequently only approximate and open to revision. Accurate determination of the rocks must await a detailed study with the microscope.

The Coast Range granodiorite batholithic rocks constitute the bulk of the lower area of Taku river, from its mouth to within 5 miles west of the International boundary-line. There the contact crosses the river, striking in a northerly direction, and apparently follows this course about 6 miles west of the Tulsequah river. The rocks east of the contact consist mainly of the older igneous groups, probably Triassic or Jurassic, with some limestone and altered sedimentaries. This series is intruded by younger rhyolite, dacite, and felsite dykes and sills, which in turn are intruded by basic rocks of lamprophyre type.

The igneous rocks of the Tulsequah area are much altered and difficult to identify in the field. They are generally fine-grained and compact, heavily silicified, and in places characterized by widespread development of epidote and other products of alteration. They appear, however, to be of andesitic type. Associated with these are fine-grained interbedded tuffs of light-grey colour. Although a definite brecciated structure was noted in some of the volcanics, they are generally of dense texture and no large areas of coarse fragmentaries were noted. A belt of micaceous schists occurs on the west bank of the Tulsequah, as a probable resultant of metamorphosed sediments.

Argillites and slates are reported by prospectors to occur towards the head of the Tulsequah river. Flanking the east and west sides of Tulsequah glacier, two deep-red coloured mountains of about 5,000 feet altitude, surrounded by the general grey igneous and volcanic rocks of the area, are prominent features of the landscape. This red coloration may have resulted from the oxidation of pyritized argillites; it is, however, significant of a mineralized area and would be well worth prospecting. Up to the time of examination few prospectors had penetrated that distance up the river, and although several attempts had been made, none were met who had actually examined the rocks of this region. Several other zones, heavily discoloured by iron oxides, can be observed in the higher altitudes. These are all well worth immediate prospecting.

Folding and evidence of acute stress is observed near the contact west of the International boundary. Easterly this condition is gradually minimized, and the structure, well defined in certain localities, assumes the more stable and definite character that would be conducive to the

confined circulation of mineralizing solutions and the deposition of sustained ore-bodies. No evidence of acute regional folding was observed in the area adjacent to the Tulsequah river. Major fracturing, accompanied in places by well-defined shearing, has occurred along both a north-easterly and a north-westerly direction.

"Tight" areas are observed in some localities, but adjacent to these are generally areas of well-defined structure. This condition, if due to differences in the rock texture and association, would have a minimizing effect on the regional dispersal of circulating mineral-bearing solutions and would tend to confine structural stresses to certain definite directions. A confined zonal circulation of mineral solutions should result from such a condition, and it is consequently indicative of sustained ore-bodies of good width where conditions for mineral precipitation have been favourable. Prospecting, if intensified in these structurally favourable localities in this area, should result in the discovery of important ore-bodies.

ECONOMIC GEOLOGY.

The region embraces a section of the eastern contact margin of the Coast Range batholith. Within this there are areas of favourable structure. These are prime factors in the deposition of ore-bodies of economic importance. The discoveries already made and the structural conditions affecting the area indicate the probable occurrence of appreciable potential tonnage ore-bodies. These factors, coupled with the already known mineralization, do not promise exceptionally high-grade ore-bodies with restricted widths, nor bonanza values in the precious metals. Isolated occurrences of high-grade silver ores will doubtless be discovered, but these cannot be expected to be a general characteristic of the region.

A low to medium grade general tenor of the ore-bodies with an essentially base-metal mineralization can be expected. This is a factor, however, that tends towards a healthy and prosperous industrial condition. Appreciable base-metal production calls for populous communities, metallurgical expansion, establishment of both foreign and home markets, and, most important of all, the necessary establishment of industries for the manufacture of finished articles for consumption by these markets. The economic influence of a possible appreciable base-metal production from the Taku River area on the industrial future of British Columbia's coastal area is of great importance.

The mineralization of the chief ore-bodies discovered are of two main types:—

1. Copper, zinc, lead, and iron sulphides carrying appreciable gold and silver values, in a barite-calcite-quartz gangue.

2. Antimony and iron sulphides, with very minor quantities of copper, lead, and zinc, but carrying decided gold values, and practically negligible silver contents, in a quartz gangue.

It is possible that these two types of mineralization may merge along the margin of the zones to which they are confined. This is indicated on the *Banker* and *Potlatch* groups, north-west of the *Manville*, where a small amount of stibnite is associated with a characteristic zinc-blende-galena mineralization. On the *Banker* there is also an occurrence of high silver values possibly associated with a grey-copper mineral.

Ore-bodies of Type 1.

The mineralization of the *Tulsequah Chief* and *Manville* ore-bodies belongs to type 1. In these deposits zinc-blende, chalcopyrite, pyrite, with minor quantities of galena, occur in very fine-grained texture. The mineralization is partly massive and partly finely disseminated. The massive sections of the ore-bodies are generally confined to the central portions of the zones and gradually grade to a fine dissemination near the walls. A massive mixture of fine-grained chalcopyrite and pyrite, with a few indistinct bands of very fine-grained zinc-blende, frequently occupies the centre of the zones. With the bands of zinc-blende gradually increasing in width, this central portion of massive chalcopyrite and pyrite gradually grades on both sides into a dense dissemination of very fine-grained zinc-blende with a minor admixture of fine-grained chalcopyrite and pyrite, which gradually diminishes in density towards the walls. A decided banded or relict structure is characteristic of these ore-bodies.

These occurrences are characteristic replacement ore-bodies in shear-zones. In places, generally in the central portions of the zones, the sulphides have totally replaced the sheared rock. Towards the walls the replacement is more or less incomplete, with a dispersal of mineralization in the sheared rock near the walls. Two main directions of fracturing occur, one striking north-easterly and the other north-westerly.

The geological features and mode of occurrence of the *Tulsequah Chief* and *Manville* ore-bodies are similar. The shear-zones occur in what appears to be an interformational sheet of altered pyritized rhyolite in an andesitic country-rock of dense texture. The formation has been subjected to comparatively gentle folding along north-south striking axes. On the *Tulsequah Chief* the shear-zones strike north-easterly and on the *Manville* the zone strikes north-westerly. Whether the *Manville* shear penetrates the andesites to any extent could not be established. On the *Tulsequah Chief*, however, the shear-zones are confined to the light cream-coloured rhyolite and are delimited by the surrounding grey-coloured andesites. On this property the rhyolite appears to plunge in a northerly direction, a feature that gives hope for continuity at depth of the ore-bodies in that direction beyond the vertical projection of their surface pinching at the margin of the rhyolite and andesite contact.

On the *Tulsequah Chief* a very dense-textured and siliceous dyke of dacite type, cutting both the rhyolite and the andesite, may have an important influence on the ore-bodies of that property. No. 2 ore-zone lies in contact with, or closely adjacent to, this dyke on its east side. No. 1 ore-zone strikes at an angle of about 25° to the dyke on its west side and abuts on to it a short distance south of the surface pinching of the zone. Although the age of this dyke in relation to the ore-deposition may be debatable, it would appear from its mode of occurrence to have preceded the formation of the ore.

It would seem that on the *Tulsequah Chief* the stresses have been readily transferred through the rhyolite and then faded against the buffer of tenacious dacite in contact with the dense and tough andesite. The same medium of stress confinement would also have a damming influence on circulating mineral-bearing solutions and prevent a dispersal of values in the area within the scope of that confinement. The probabilities on the *Tulsequah Chief* are, then, that within the confined northward area of the rhyolite and conforming to the northerly plunge of the sheet, higher-grade ore over more restricted widths should occur than to the southward. In the southerly horizon the tendency would be for a dispersal of values over greater widths, and consequently a lower-grade ore.

On the *Manville* no dacite or acid dyke was observed associated with the ore. The rhyolite area, however, appears to spread or fan out in the low-lying ground towards the south-east. In this direction, then, a dispersal of mineralization and lower-grade ore over greater widths than towards the north-west can be expected. Acid dykes cutting the altered rhyolite occur on the *Banker* and *Potlatch* groups, adjoining the *Manville* on the north-west. On account of the heavy overburden covering the low-lying ground in which these showings are situated, and the limited amount of work completed at the time of examination, no relation between them and the ore-bodies could be established.

Basic dykes of lamprophyre type cut both the rhyolite and the andesite and are the youngest rocks of the series. The similarity of these rocks in colour and texture to certain phases of the andesite make their visual determination difficult when they enter the latter. The only effect that these basic dykes seem to have on the ore-bodies is to cause their shattering and impoverishment with included dyke-rock in the areas of intersection. Faulting occurs to a minor degree, generally along north-south striking planes.

The ore-bodies of type 1 are probably medium to low temperature deposits, formed at an appreciable depth below the old surface from sluggishly circulating solutions. Replacement probably emanated from the centre of the zones with lateral temperature segregations. Mineral deposition is probably related to the concluding period of the batholith intrusion.

Ore-bodies of Type 2.

The ore-bodies of this type are characterized by a main metallic mineral content of stibnite, with accompanying pyrite and very minor quantities of galena, in a fine-grained quartzose gangue. This stibnite occurs in massive granular form in reticulated structure in the vein-matter, and also as a fine dissemination of minute needle crystals in the gangue-matter. The pyrite is in fine-grained scattered dissemination through the gangue.

The typical ore-bodies of this type appear to be confined to a diabasic rock, cut by numerous felsite and small quartz-rhyolite dykes. They seem to favour the area somewhat closer to the batholith contact than the ores of type 1. The deposits occur in well-defined replacement shear-zones along the course of felsite dykes. These dykes have probably formed lines of weakness in the surrounding country-rock along which the fracturing and shearing has been readily carried and sustained.

The typical deposits are characterized by a high gold content and abnormally low silver values. Adulteration with arsenic and copper seems to be practically entirely absent. No chalcopyrite or copper carbonates were observed in the mineralization. An assay for arsenic returned *nil* and that for copper showed a trace. These are important factors in connection with the possible economic value of this type of deposit from the standpoint of its antimony content. In the manufacture of pure antimony the presence of arsenic and copper is extremely undesirable. Zinc and lead are also practically entirely absent. From the standpoint of their antimony content, therefore, the characteristic deposits of this type discovered in the Taku region are exceptionally pure. Whether the gold content of these ores is related to the stibnite or to the pyrite is not established.

The antimony market is unfortunately a restricted one and is at present affected by a duty on the metal recently imposed by the United States Senate. The bulk of the world's production, however, comes from the Hunan deposits in China, and the demand is at present reported to be moderate. The apparent purity of the Taku deposits, coupled with their high gold content, may offset the handicaps of an antimoniferous ore. Should they be proved to be of important extent, this type of ore-body may be of economic value. The typical ore-bodies of this type occur on the *Whitewater* group on the west bank of the Tulsequah river, about 4 miles south-west of the *Tulsequah Chief*.

An intermediate type of ore carrying minor quantities of stibnite associated with zinc-blende, galena, arsenopyrite, and some chalcopyrite, occurs on the *Banker* and *Potlatch* groups, adjoining the *Manville* on the north-west. These occurrences are in quartz-filled fractures, with lateral dissemination areas, in an altered rhyolitic rock cut by acid and basic dykes. On the *Banker* the ores are featured by a high silver content, associated probably with the presence of some grey-copper mineral; an appreciable gold content is also present in these ores.

The ore-bodies of type 2 are probably of low temperature origin, formed comparatively near the surface. The structure indicates that they were formed from rapidly circulating solutions covering at least two impulse periods. Although the definite genesis of these deposits could not be established in the field, they are probably related to the final thermal activities of the batholithic intrusion and later in origin than the ore-bodies of type 1.

Mineralization relative to Mining Methods.

Should the complex sulphide ore-bodies of the Taku region ultimately prove to be of commercial extent and grade, their structure and mode of mineral occurrence suggests a method of mining that might be advantageously employed to meet the constantly changing economic aspect of the metal market. The characteristic central segregation of chalcopyrite that apparently occurs over good widths and appreciable lengths in the *Tulsequah Chief* and *Manville* ore-shoots may permit the mining and treating of a good-grade copper-gold ore when the market price for copper is advantageous and that for zinc and silver is not. The ore containing mainly a zinc content, occurring lateral to the chalcopyrite segregations, could be attacked when the market price for zinc became advantageous.

It would seem that on both the *Tulsequah Chief* and the *Manville* the opportunity may prevail to selectively mine an ore containing from 3 to 9 per cent. copper, 0.2 oz. gold to the ton, and 2 oz. silver to the ton, with a reduced content of zinc. In considering this means of meeting the metal-market situation, however, there are many intricate factors to be carefully calculated. In mining selectively for the copper-gold contents a dilution with zinc could not be avoided at any time. The economic point of zinc dilution relative to mining widths and costs, the bearing of this factor on milling practice and costs, the comparative costs of mining methods relative to tonnage production and grade of ore mined, the factor of interest, are all interlocking questions involved in the calculation. The mode of occurrence of the mineralization in the *Tulsequah Chief* and *Manville* ore-bodies, however, suggests the possible economy of such a selective type of mining. The scheme is mentioned as being worthy of consideration on account of its bearing on the ultimate possible profitable operation of the Taku River complex sulphide ore-bodies, should they prove to be of economic extent.

MINERAL PROPERTIES.

The important properties in the area are: The *Tulsequah Chief*, *Manville*, *Big Bull Extension*, *Potlatch* (Sparling), *Banker* (Hill), and *Whitewater*.

PLAN OF WORKINGS

TULSEQUAH CHIEF MINE

TAKU RIVER

ATLIN MINING DIVISION

Scale: 0 5 10 30 40 50 Feet. 80

Legend:

Approximate Walls Zones 1 and 2 — Ore — Dacite Dyke — Basic Dyke — Andesitic Rocks

To accompany Report by J.T. Mandy, Resident Mining Engineer, Prince Rupert, B.C. 1929.

B.C. Bureau of Mines.

TULSEQUAH CHIEF.

(*See* Annual Reports for 1923 and 1928.) This property comprises eighteen surveyed claims. It is situated on the eastern bank of the Tulsequah river, about 8¾ miles north-easterly from its confluence with the Taku. It was originally staked by A. W. Kirkham, of Juneau, Alaska, and bonded to the Alaska Juneau Gold Mining Company in 1923. This company relinquished its option in the same year. In 1928 the property was bonded to Dan J. Williams, W. A. Eaton, of Juneau, and associates. In the spring of 1929 this syndicate bonded the property to the United Eastern Mining Company, of Los Angeles, which has been developing it from that date.

A warehouse and log cabin are located at the landing-point on the Tulsequah River bank. The operating camp is situated on a bench area at altitude 1,050 feet. A crew of thirty to forty men has been continuously employed during the season. The workings are at 1,500 and 1,700 feet altitude. The property is efficiently equipped with a compressor, machine-drills, blowers, and steel-sharpening outfit. A skidway haulage system in two sections, powered by 8- and 10-horse-power gasoline-engines, operates from the warehouse on the river-bank to the camp, and from thence to the portal of the lower tunnel. Operations are being conducted under the personal supervision of J. B. Stapler, general superintendent and manager.

Geologic Features.—The ore occurrence consists of two replacement shear-zones in altered and pyritized rhyolite, in a formation of dense-textured andesitic fragmentaries and flows. No. 1 zone strikes N. 45° E. and No. 2 zone N. 20° E. Both zones show a tendency to an erratic, but generally steep, westerly dip. The two ore-zones are separated by a dacite dyke 8 feet wide, striking parallel to and in contact with No. 2 zone. The rhyolite is exposed in a wedge-shaped outcrop which seems to plunge beneath the andesitic rocks to the northward, about 150 feet north of the open-cut on No. 2 zone at an altitude of 1,865 feet.

Several hundred feet north of this point, and near the falls of Tulsequah creek, at altitude 1,930 feet, an isolated oxidized knob of rhyolite outcrops through an andesite and on the west side of the continuation of the dacite dyke. This outcrop is probably a spur from the northward-plunging rhyolite. Southward, the rhyolite spreads out fan-shape in irregular contact with the andesites and is intruded at intervals by basic dykes. At the Tulsequah River bank (altitude 165 feet) the rhyolite attains a width of several hundred feet, shows several phases of alteration, and is strongly sheared and impregnated with pyrite.

Mineralogic Features.—The mineralization of No. 1 and No. 2 zones is very similar. It differs, however, in form of distribution and in grade. Both zones are mineralized with very fine-grained chalcopyrite, zinc-blende, pyrite, and some galena, in a dense quartz-calcite-barite gangue. The chalcopyrite occurs intimately intermixed with pyrite, partly in fine-grained massive development generally towards the centre of the zones, and partly in fine-grained lateral dissemination gradually giving place to an intensifying fine-grained zinc-blende dissemination. The zinc-blende mineralization in turn gradually diminishes laterally in intensity to a comparatively barren sheared margin near the walls. The central chalcopyrite segregation seems to be more generally confined to No. 1 zone, which is consequently perceptibly better in grade, where developed, than No. 2 zone. No. 2 zone is decidedly low in grade where developed and shows a tendency to greater widths, with a consequent tendency to dispersal of mineralization.

Ore-zones and Workings on Surface.—No. 1 ore-zone has been traced on the surface by three open-cuts from an elevation of about 1,680 to 1,805 feet in a horizontal distance of 200 feet. In these workings the zone shows an average width of about 20 feet, assaying: Gold, 0.1 oz. to the ton; silver, 4.7 oz. to the ton; copper, 1.2 per cent.; zinc, 10.1 per cent. This zone strikes N. 45° E. and converges towards a dacite dyke striking N. 20° E., which lies easterly of it. At elevation 1,825 feet, and about 60 feet northerly from the upper open-cut, the rhyolite on the west side of the dacite dyke seems to plunge beneath the andesite and No. 1 zone abuts on the dyke and undergoes a pinching. This condition continues towards the north. In this direction the formation is a "tight" dense andesitic rock. The dacite dyke continues on to northward, cutting the andesite, but a careful examination failed to reveal the continuation of either No. 1 or No. 2 ore-zones in this direction. It would seem that the fracturing and shearing, readily transferred through the rhyolite, have diminished against the buffer of dacite in contact with the tough andesite.

At altitude 1,865 feet, No. 2 zone has been exposed on the surface for a length of about 30 feet, showing ore-widths of from 5 to 15 feet, assaying: Gold, 0.1 oz. to the ton; silver, 1.4 oz. to the ton; copper, 2.7 per cent.; zinc, 7.5 per cent. This zone strikes N. 20° E., has a general

steep westerly dip, and lies adjacent and parallel to the dacite dyke. Surface continuity towards the north is affected adversely by the same conditions governing that of No. 1 zone. About 800 feet to the south of the open-cuts on No. 2 zone, and at altitude 1,025 feet, a wide exposure of pyritized rhyolite has been open-cutted. In places this shows massive fine-grained pyrite similar to the development of that mineral in the upper cuts on No. 1 and No. 2 zones. Zinc and copper mineralization is not evident in these lower cuts. Further work is required to definitely correlate these lower showings with either of the two zones.

Underground Development.—The ore-zones have been explored by A and B level tunnels at altitudes 1,690 feet and 1,500 feet respectively. At the time of examination (September 5th) about 1,400 feet of development had been completed in these two tunnels; 600 feet of this work is crosscutting, of which 175 feet, or about 30 per cent., is lateral work in the ore-zones. Of the 800 feet of drifting, about 500 feet, or 62 per cent., is in ore of promising grade.

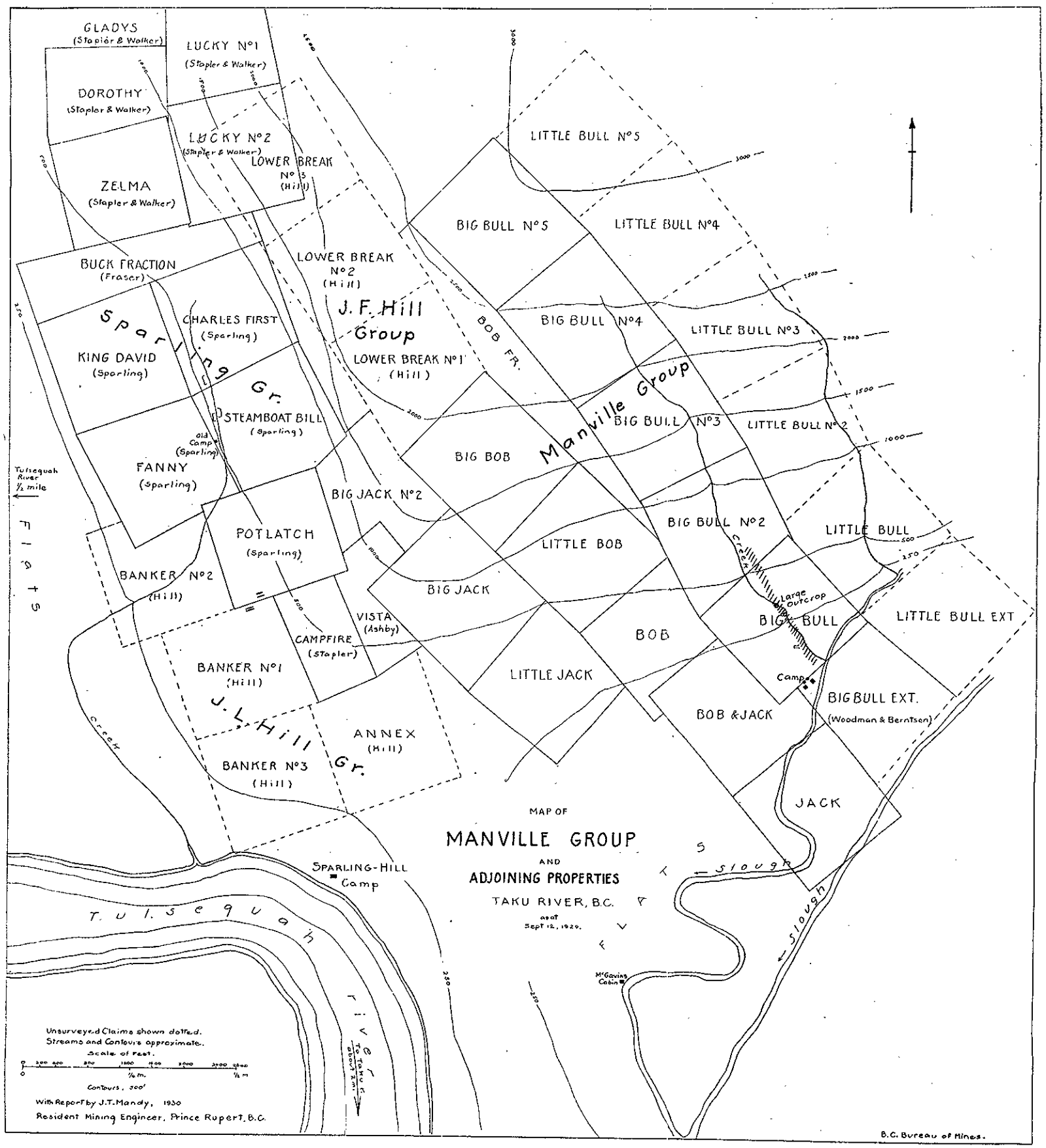
On A level about 160 feet of drifting and 22 feet of crosscutting is on No. 1 zone, westerly of the dacite dyke, and about 170 feet of drifting and 56 feet of crosscutting is on No. 2 zone, easterly of the dyke. No. 1 zone is indicated at this level, carrying fair mineralization. Its width is indicated to average about 9.5 feet, but varying from 30 feet at the southerly end of the drifting to 6 inches at the northerly end, where it enters the tough, dense andesite. It is interesting to note that the pinching of No. 1 zone on A level occurs about 80 feet north of the vertical projection of its surface pinching.

No. 2 zone is indicated on A level carrying only fair mineralization, a decidedly lower-grade ore than No. 1 zone. Its width is indicated to vary from 6 to 24 feet, with an average of about 17 feet. At the time of examination the face of A level drift in No. 2 zone showed pronounced fracturing and shearing, with a development of sericite and kaolin. Both zones show an erratic but generally steep westerly dip on this level.

At the time of examination B level development was entirely on No. 1 zone. A continuation of the crosscut for 125 feet in cherty rhyolite beyond the intersection of No. 1 zone had failed to pick up No. 2 zone in that distance. Of the 700 feet of work completed on this level, 370 feet is drifting and 68 feet is crosscutting on the zone. The work on No. 1 zone on this level shows a decidedly better grade of ore than on A level. The chalcopyrite content in particular shows a marked increase. For appreciable lengths in the drift 2 to 3 feet of a massive fine-grained intermixture of chalcopyrite and pyrite occurs in the zone structure. When examined the drift-face was composed of 3 feet of solid granular chalcopyrite and pyrite and 2 feet well mineralized with chalcopyrite, pyrite, and zinc-blende. No. 1 zone on B level has a steep easterly dip as opposed to the westerly dip on A level. It also shows a tendency to an irregularity of strike along short distances. No. 1 zone is indicated on B level to have a width varying from 3 to 24 feet and averaging 11.5 feet. At the time of examination four diamond-drill holes had penetrated the zones, showing encouraging values and widths at depths up to 180 feet below B level. Deeper level holes were projected for drilling.

Operations on the *Tulsequah Chief* closed for the 1929 season on November 3rd. The total underground development completed during the four months of operation was 1,919 feet of underground exploration and 4,043 feet of diamond-drilling in seven holes. In the face of the many obstacles confronting the management, particularly that of transportation, this is an exceptionally creditable performance. At the close of operations the management reports that the condition of A level drift on No. 2 zone showed no change and small bunches of ore were continuing to occur. A crosscut to the east from No. 1 zone on this level, north of A-1 D1, is reported to have penetrated the dyke and opened 26 feet of good-grade ore in No. 2 zone. B level drift was reported to have continued in good-grade ore, with a fine showing in the face at the conclusion of operations. In that area a crosscut to east through the dacite dyke, started since the examination, is reported to have opened a very encouraging grade of ore in No. 2 zone.

Estimate of Ore.—At the present early development stage of the *Tulsequah Chief* an estimate of the ore, both with regard to value and tonnage, can only be approached with considerable reserve. With regard to tonnage, the completed work only permits a roughly approximate estimate of indicated ore. A calculation of values, based on gross assay returns, is liable to be extremely misleading, particularly with the inclusion of the zinc factor. What will constitute ore from the standpoint of profit in the eventual possible operation of the *Tulsequah Chief* is yet to be determined. Entering especially into this equation are metal-market conditions, working costs, percentage of metal recovery from metallurgical operation, transportation costs,


GLADYS
(Stapler & Walker)
LUCKY N°1
(Stapler & Walker)
DOROTHY
(Stapler & Walker)
LUCKY N°2
(Stapler & Walker)
LOWER BREAK
N°3
(Hill)
ZELMA
(Stapler & Walker)
BUCK FRACTION
(Fraser)
LOWER BREAK
N°2
(Hill)
J. F. Hill
Group
LOWER BREAK N°1
(Hill)
Sparling Gr.
CHARLES FIRST
(Sparling)
KING DAVID
(Sparling)
STEAMBOAT BILL
(Sparling)
Old Camp
(Sparling)
FANNY
(Sparling)
POTLATCH
(Sparling)
BANKER N°2
(Hill)
BANKER N°1
(Hill)
BANKER N°3
(Hill)
J. F. Hill Gr.
VISTA
(Ashby)
CAMPFIRE
(Stapler)
ANNEX
(Hill)
BIG JACK N°2
BIG JACK
LITTLE JACK
BOB
BOB & JACK
JACK
BIG BOB
LITTLE BOB
BOB FR.
Manville Group
LITTLE BULL N°5
BIG BULL N°5
LITTLE BULL N°4
BIG BULL N°4
LITTLE BULL N°3
BIG BULL N°3
LITTLE BULL N°2
BIG BULL N°2
LITTLE BULL
LITTLE BULL EXT
BIG BULL
Large outcrop
Camp
BIG BULL EXT.
(Woodman & Berntsen)
Tulsequah River ½ mile
Flat
Creek
Creek
Tulsequah River
About 2 mi.
To Taku R.
Slough
Slough
Sparling-Hill Camp
McGavins Cabin
MAP OF
MANVILLE GROUP
AND
ADJOINING PROPERTIES
TAKU RIVER, B.C.
as at
Sept 12, 1929.
Unsurveyed Claims shown dotted.
Streams and Contours approximate.
Scale of Feet.
0 200 400 800 1600 2400 3200 4000
0 ¼ m. ½ m
Contours, 500'
With Report by J.T. Mandy, 1930
Resident Mining Engineer, Prince Rupert, B.C.
B.C. Bureau of Mines.

expenditure necessary to bring the property into profitable production. Relative to these unknown factors is the type, width, and grade of ore that could eventually be mined profitably. At the present stage of development any tonnage estimate is of little practical value and apt to be misleading.

If calculated over their entire widths, the general metal tenor of the ore-zones is low grade, and for appreciable sections either definitely uncommercial or nearly so. On the other hand, restricted sections of these stretches, if mined selectively, may be productive of definitely commercial ore. On A level No. 1 zone is indicated with an average width of 9.5 feet, assaying: Gold, 0.12 oz. to the ton; silver, 4.6 oz. to the ton; copper, 1 per cent.; lead, 0.6 per cent.; zinc, 6 per cent. On A level No. 2 zone is indicated with an average width of 17 feet, assaying: Gold, 0.04 oz. to the ton; silver, 1.5 oz. to the ton; copper, 0.6 per cent.; lead, 0.8 per cent.; zinc, 5 per cent.

At the time of examination No. 1 zone was indicated on B level with an average width of 11.5 feet, assaying: Gold, 0.07 oz. to the ton; silver, 3 oz. to the ton; copper, 2 per cent.; lead, 0.6 per cent.; zinc, 4.5 per cent. A sample taken across 5 feet of the drift face indicates the possibilities of selective mining in this type of ore-body. This assayed: Gold, 0.12 oz. to the ton; silver, 3.7 oz. to the ton; copper, 5.1 per cent.; lead, trace; zinc, 12.2 per cent.

Summary.—The results of development on the *Tulsequah Chief* are decidedly encouraging. It is the outstanding recent mining development in the North-western District. It can be seen, however, that many problems and factors of uncertainty are still to be faced by the operators before a definitely profitable operation is assured. These involve chiefly continuity, grade, and extent of the ore-zones and the ore-shoots in them, mining and milling methods and costs, and metal-market conditions. The mode of occurrence of the ore-bodies and the complex nature of the mineralization in them make these problems somewhat intricate.

Regarding the continuity and grade of the ore-bodies, the indicated northerly plunge of the rhyolite is an important and hopeful factor. If this can be substantiated, higher values over more confined widths can be expected towards the northward, with successively lengthening continuity of the zones on the lower levels in this direction, in conformity to the plunge angle of the rhyolite. More consistent extension of the zones can be expected towards the south within the confines of the rhyolite. Due, however, to the lack of confinement of the stress area in that direction, a dispersal of values over greater widths may be encountered.

The mineralization is concentrated into ore-shoots at intervals in the zones. It would appear that in the area of confinement these ore-shoots are of appreciable length and separated by short stretches of low-grade material. To the southward, however, the ore-shoot concentrations can be expected to occur in a more lenticular form in comparatively extensive areas of low-grade mineralization. Should the results of the present stage of exploration be sustained, the ore occurrence is indicative of an appreciable tonnage operation.

Manville Group.

This property comprises eighteen claims and two fractions. It is situated up a winding slough on the west side of the Taku river near the mouth of the Tulsequah river, about 3½ miles north-east of Tulsequah townsite. The camp is located 50 feet above the bank of the slough on a benched ridge that rises gradually to altitude 1,000 feet and slopes on its west side to the Tulsequah river. The Treadwell Yukon Mining Company is associated with the Alaska Juneau Gold Mining Company in this venture. Including the adjoining *Banker* and *Potlatch* groups recently optioned by the company, the Alaska Juneau holdings in the area comprise thirty-three claims and three fractions.

Geology and Mineralogy.—The ore-body consists of a replacement shear-zone, showing where exposed a width of 36 feet in what appears to be an altered, pyritized rhyolite, in an andesitic country-rock.

The mineralization is a fine-grained mixture of zinc-blende, chalcopyrite, pyrite, and sparse galena, in a dense barytes gangue with some quartz and calcite. The texture of the mineralization is remarkably fine-grained with a decided banded structure. In places where total replacement by massive granular sulphides has occurred the shear-planes of the zone are still plainly preserved in the banded ore structure (relict structure).

The zone has been traced along the banks and bed of a small creek by a series of trenches and stripping for 900 feet from altitude 110 feet at the southerly end to altitude 350 feet at the northerly end. To the southward the zone is covered by heavy silt and clay overburden of the

river-valley bottom at altitude 90 feet. To the northward, from altitude 350 to 400 feet, creek-boulder overburden obscures continuity, but float can be picked up in the creek-bed. At this point the creek swings to the west and further continuity of the zone is covered by heavy overburden. At altitude 600 feet and about 1,200 feet north of the most northerly stripping the pyritized rhyolite formation is exposed in the high bluffs of the ridge. The ore-zone strikes N. 50° W. (mag.) and dips 60° S.

Development.—At altitude 325 feet a 12-foot width (not delimited) is exposed by stripping for a length of 50 feet in the creek-bed. This shows 3 feet of massive granular zinc-blende and chalcopyrite on the foot-wall side; next to this is 4 feet of sheared schistose rhyolite with disseminated sulphides, then 5 feet of massive granular zinc-blende, chalcopyrite, and pyrite in banded structure. A sample across this 12-foot exposure assayed: Gold, 0.10 oz. to the ton; silver, 6 oz. to the ton; copper, 1.6 per cent.; lead, trace; zinc, 12.8 per cent. At this point the zone appears to be striking N. 50° W. and dipping 60° S.

From altitude 275 to 240 feet a stripping in the creek-bed, 90 feet long, exposes a width of ore 27 feet wide, with andesite on the east or foot-wall and the width not delimited on the hanging-wall side; 20 feet of the middle portion of the zone is massive granular sulphides in banded structure, with several feet in the centre of mixed chalcopyrite and pyrite. On either side of this is heavily sheared vein-matter with disseminated mineralization. A sample across 27 feet of this exposure assayed: Gold, 0.06 oz. to the ton; silver, 6.8 oz. to the ton; copper, 2.8 per cent.; lead, 0.8 per cent.; zinc, 20.2 per cent.

At altitude 130 feet, 450 feet southerly of this exposure, a tunnel starting near the hanging-wall had been driven for 30 feet diagonally through the zone into the hanging-wall andesite. On account of the gentle hill-slope it is intended to continue this tunnel until sufficient depth has been gained to allow of safe and useful crosscutting to the zone again, when it will be followed by a drift. At the tunnel portal 3 feet of sheared decomposed mineralized rhyolite lies next to the hanging-wall. This grades into semi-massive granular zinc-blende with admixed chalcopyrite. A sample representing a 5-foot width of the undecomposed portion assayed: Gold, 0.2 oz. to the ton; silver, 7.5 oz. to the ton; copper, 2 per cent.; lead, 2.8 per cent.; zinc, 14.4 per cent.

Eighty feet southerly of the tunnel a small trench exposes the ore-body very much sheared, but showing good mineralization of zinc-blende, chalcopyrite, and pyrite; 150 feet southerly of the tunnel another small trench in low ground exposes the zone showing heavy decomposition.

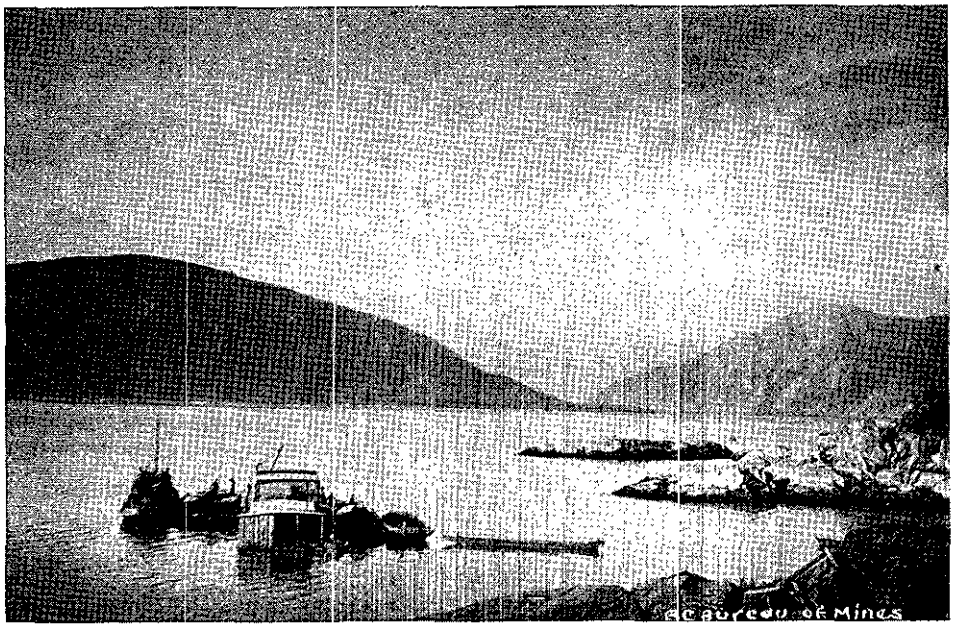
A diamond-drilling campaign for depth exploration is also under way. No. 1 hole was set up at altitude 215 feet, with the hole pointing 60° on a line normal to the strike. At the time of examination 586 feet had been drilled. It is expected to cut the zone at about 700 feet.

Examination of the cores showed a rock formation of altered andesite and interbedded tuffs intruded by basic dykes. The tuffs are generally fine-textured, but a fairly coarse brecciated structure was noticed in some of the core sections. No. 2 drill-hole set-up is at altitude 425 feet, about 400 feet west of the upper exposures.

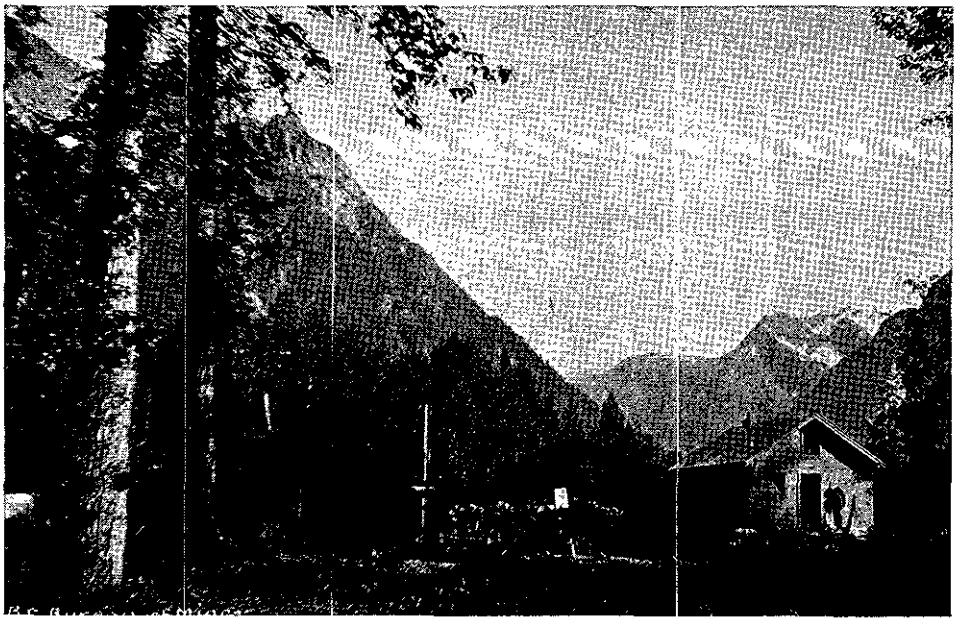
Seven frame buildings for camps, storehouses, etc., were in process of erection. Two Ingersoll 6 by 8, 320-cubic-foot compressors operate two Ingersoll jack-hammer drills each. Ingersoll jack-hammer drills are being used in the underground work and are reported to be giving good results. A glacier-fed waterfall 3½ miles north-east of the camp, on the left bank of the Taku river, will be used for power. Power rights for this stream have been applied for.

Summary.—The surface showing on the *Manville* group is an exceptionally imposing one in width, grade of ore, and structure. With the exception of the absence in the *Manville* of the dacite dyke that is associated with the *Tulsequah Chief*, the two ore occurrences are identical in character. Both are low to medium temperature replacements in shear-zones in rhyolite. Generally, the *Manville* ore-body may develop greater widths than the *Tulsequah Chief*, but there may be a possible tendency for a dispersal of values in the wider areas of the rhyolite that may exist, such as is indicated in the southerly continuity of the *Tulsequah Chief*. Lacking the dacite dyke control or barrier that is a beneficial factor on the *Tulsequah Chief*, this condition on the *Manville* may result in a more pronounced lenticular development of ore-shoots, in conformity to the contact of the enclosing andesitic rocks.

Mineral replacement has been intense and, where conditions are favourable, good-grade ore over minable widths can be expected. The exceptional widths and grade of the surface croppings cannot, however, be expected to be the general character of the ore-deposit. Struc-



Taku River at Mouth.



Tulsequah, Proposed Townsite at Confluence of Tulsequah and Taku Rivers.

tural conditions promise appreciable depth continuity of the ore-body. Sufficient work has, however, not been done to enable any criterion to be formed of ore-shoot attitude, lengths, and intervals.

In the diamond-drilling, whereas the shear-zone may be cut at appreciable depths, disappointments as well as encouragement may be expected with mineralization and grade at intervals of intersection The showing is an exceptionally promising one on surface. It should be remembered, however, that much remains to be proved in depth. Should a fair measure of the present surface indications be sustained, the property should develop into an important appreciable tonnage producer.

Big Bull Extension.

This property consists of one claim adjoining the *Big Bull* claim of the *Manville* group on the south. The north line of this claim lies about 350 feet south of the *Manville* tunnel. The claim covers the slough and the low-lying silt area to the southward. The property was staked by Andrew Berntsen and C. E. Woodman, to cover the possible southerly continuity of the *Manville* ore-zone.

On the north bank of the slough, and just south of the *Manville* line, a small hand churn-drill hole put down from the bottom of a shallow shaft is reported to have penetrated mineralized material. Thirty feet west of this shaft a shallow pit is reported to have exposed solid zone-matter carrying pyrite. On the south side of the slough two shallow shafts through the silt are reported to have picked up oxidized rhyolite material. These workings were all filled with water and could not be examined. It is very probable, however, that the continuation of the *Manville* ore-zone underlies this claim. About 250 feet south-westerly of the churn shaft a small cut has been put into a ridge of silicified pyritized rhyolite. A sample of pyritized rock from the dump assayed: Gold, trace; silver, 0.3 oz. to the ton. This point lies well inside the vertical projection of the extension on the dip of the *Manville* zone. Several other claims have been staked to cover the slough area southerly of the *Manville* group.

Banker Group.

This group was staked in July of 1929 and comprises the *Banker No. 1*, *Banker No. 2*, *Banker No. 3*, *Annex*, *Campfire*, and *Vista* claims. It is owned by J. L. Hill and associates, of Juneau, who bonded the group to the Alaska Juneau Gold Mining Company in September, 1929. The claims are situated on the left bank of the Tulsequah river, about 6 miles southerly from the *Tulsequah Chief*. They adjoin the *Manville* group on the west and the *Potlatch* group on the south. A joint camp for this group and the *Potlatch* group is on the bank of the Tulsequah river at altitude 75 feet.

The showing is at altitude 160 feet, about 100 feet south of the south line of the *Potlatch* group. It consists of a north-west striking, steeply dipping to vertical, silicified zone in what appears to be an altered, dense-textured rhyolite, cut by altered basic dykes. Mineralization consists of zinc-blende, arsenopyrite, galena, and some stibnite, pyrite, pyrrhotite, and possibly a grey-copper mineral, irregularly distributed in quartz veins and stringers 18 to 24 inches in width. A few stringers, 1 to 2 inches in width, sparsely impregnated with grains of pyrrhotite, contain a light-green coloured diffusion that suggests the possible presence of nickel. Zinc-blende is the predominating mineral in the quartz veins and occurs in small bunches and patches of dense texture. The showing was explored by several open-cuts. A sample of the characteristic mineralization, selected from the dumps, assayed: Gold, 0.16 oz. to the ton; silver, 147 oz. to the ton; lead, 8.8 per cent.; zinc, 13.6 per cent. Although nothing of commercial importance was developed in these exposures, in view of the showings on the adjoining *Manville*, the occurrence is worthy of further exploration.

Another group of claims, consisting of *Lower Break No. 1*, *No. 2*, and *No. 3*, adjoining the *Potlatch* on the west and the *Manville* on the north, has been staked by J. L. Hill. This group has also been bonded to the Alaska Juneau Company.

Potlatch Group.

This group comprises the *Potlatch*, *Fanny*, *Steamboat Bill*, *King David*, *Charles First*, and *Buck Fraction* claims. It is owned by Buck Sparling, of Juneau, who bonded the claims to the Alaska Juneau Company in September. The camp is situated on the same site as that of the *Banker* group.

The lower showing is at altitude 170 feet, just north of the south boundary-line, and about 250 feet north-east of the *Banker* open-cuts. This consists of a sheared, silicified zone of undetermined width and attitude, in an altered, somewhat calcareous, rhyolite. The shear-planes strike N. 40° W. and have a vertical, to steep easterly, dip. Mineralization consists of a sparse irregular distribution of zinc-blende, galena, and pyrite in quartz stringers and veinlets. Some epidotization of the calcareous parts of the zone is evident. Light-green coloured diffusion bands associated with pyrrhotite grains, similar to those on the *Banker*, also occur in this showing. A sample from the shaft-dump assayed: Gold, 0.08 oz. to the ton; silver, 3.6 oz. to the ton; lead, trace; zinc, 2.2 per cent.; arsenic, 2.01 per cent.; antimony, trace.

At elevation 625 feet a shear-zone 30 feet wide, in altered rhyolite in contact with andesite, has been open-cutted. Several quartz-filled fractures striking N. 20° W., parallel to the shearing and standing vertical, occur in the zone. The whole zone is more or less sparsely mineralized, but the chief mineralization of the zinc-blende and pyrite is confined to the quartz veins. A sample across the main quartz vein, 13 inches wide, in the shear-zone assayed: Gold, trace; silver, 1 oz. to the ton; zinc, 3.6 per cent. Time was not available for the examination of other showings reported to occur on this property.

Whitewater Group.

This group of eight claims, owned by Art Headman, Ray Walker, and Ray Rice, of Juneau, Alaska, is situated on the right bank of the Tulsequah river, about 4 miles south-west of the *Tulsequah Chief*.

The formation in this area is a fine-grained diabasic rock cut by rhyolite and felsite dykes. The main showing is at altitude 800 feet and consists of four well-defined, parallel shear-zones 3 to 8 feet wide and about 25 feet apart. The zones strike N. 10° E. and dip 60° S. They outcrop on the steep bluff on the west bank of a fair-sized creek. They can be clearly traced down this rock-slope for about 75 feet towards the creek-bottom, where slide-rock obscures further possible continuity. In the face of the canyon on the east side of the creek continuity is not evident. The shear-zones seem to occupy the locations of felsite dykes which have possibly formed lines of weakness in the country-rock and have been subjected to refracturing and shearing. The felsite has generally been completely replaced by a fine-grained quartzose gangue.

Mineralization consists of chiefly stibnite in massive reticulations, and in minute needle-shaped crystals disseminated in the quartz gangue. Fine-grained pyrite is also disseminated through the gangue-matter, with an occasional speck of galena. The outcrops of the zones are very heavily oxidized to limonite and earthy antimony oxide. An average sample across 6 feet of unoxidized vein-matter assayed: Gold, 0.8 oz. to the ton; silver, 0.2 oz. to the ton; copper, *trace; lead, trace; arsenic, nil; antimony, 6 per cent.* This is an exceptionally pure antimony ore, and taking into consideration the high gold content, it would seem that the occurrence is well worth investigation. Attacked from the view-point of the gold content alone, the probability of an antimony penalty would have to be considered. Investigation may, however, show that the absence of adulteration with copper and arsenic would make the antimony content of the ore marketable as well as the gold.

At the time of examination very little work had been done on the property. About 800 feet westerly of the main showing, two smaller shears, carrying similar mineralization, had been located cutting through the banks of a small creek, and during the examination a third shear in this creek, carrying massive stibnite, was discovered. Altogether the structure of the locality is well defined. If the type of ore indicated can be proved to be commercial, the area should be thoroughly prospected and further discoveries should undoubtedly result.

VICTORIA, B.C.:
Printed by Charles F. Banfield, Printer to the King's Most Excellent Majesty.
1930.

500-330-9824