REPORT ON THE

ATLIN PLACER CAMP

J.M. BLACK

1953

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ATLIN PLACER CAMP

*** C O N T E N T S ***

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APPENDIX A

One work book is retained in Victoria File No. 3500 - Atlin

Notes on Methods of Compilation

1. SOURCES

(a) Gold Commissioner's reports - used since 1899, consist of a description of property and of work done plus an estimate of the value of production.

(b) Operator's and owner's reports - in use since 1925. These are the most reliable and complete source of information because they give the actual production and its value.

(c) Summary production sheets. In use since 1926. These are the statistician's work sheets and their total is the figure shown in the Annual Report. They are, however, incorrect in some instances. Operator's returns were often received after their compilation and were thus omitted. These figures are shown in purple in the work book, and have been included with the other returns.

2. GOLD VALUES

The fineness of gold is sometimes given in the operator's returns. The values are shown in square brackets in the work book. From these values the average value of the gold from each creek was determined as follows - (Previous to 1932).

Ruby Creek	-	$16.25
Wright Creek	-	16.25
Boulder Creek	-	15.50
Pine Creek	-	16.25
Birch Creek	-	16.00
McKee Creek	-	16.75
O'Donnell River	-	16.25
Spruce Creek	-	16.75
Otter Creek	-	16.25
Squaw Creek	-	16.00
Willow River	-	16.25
Graham Creek	-	16.25
Slate (Wilson) Cr-		16.25
Gold Run Creek	-	16.00

The values since 1931 are shown in the accompanying table.

These values are used to calculate either values from ounces or vice versa. The calculated figure is shown on the sheets in brown, the figure given by the G.C. or operator, in black.

3. WORK BOOK

The work book contains the detailed listing of creek, operator, source of information, production in ounces, value per ounce, and value of production. All available information is shown. No calculations have been made for value or other figures not actually given in the return concerned.

4. DISCREPANCIES

The production figures given in the Minister of Mines Annual Reports are, and have been since 1924, given in crude ounces. Before that date they were given in fine ounces. Therefore a calculation has to be make to increase these values to crude ounces (at $16 per ounce instead of $20 per fine ounce).

Individual buyers of gold - e.g. Louis Schulz, Isaac Matthews, J.W. Noland, paid much less for the gold than its true value. Assuming the production in ounces to be correct we have changed the values per ounce to agree with the value determined from the fineness of the gold for that creek.

5. ABBREVIATIONS

The following abbreviations have been used in the work book:

M.M. - Information from the Mines Annual Report
G.C. - Information from the Gold Commissioner's Report
S. - Information in Summary production sheets from letters from Louis Schulz, hotel operator
M. - Information in Summary production sheets from I. Matthews, Storekeeper
A.O. - Assay office return (Summary production sheets).
CBC, RB, BM - Bank Returns
O - Information from operators returns

Notes by J.A. Gower,
May, 1948.

A T L I N P L A C E R C A M P

CHAPTER I.

INTRODUCTION

Placer gold has been mined in the Atlin Camp every year since the discovery of placer deposits in 1898. The total value of gold mined in the camp is about $15,000,000.

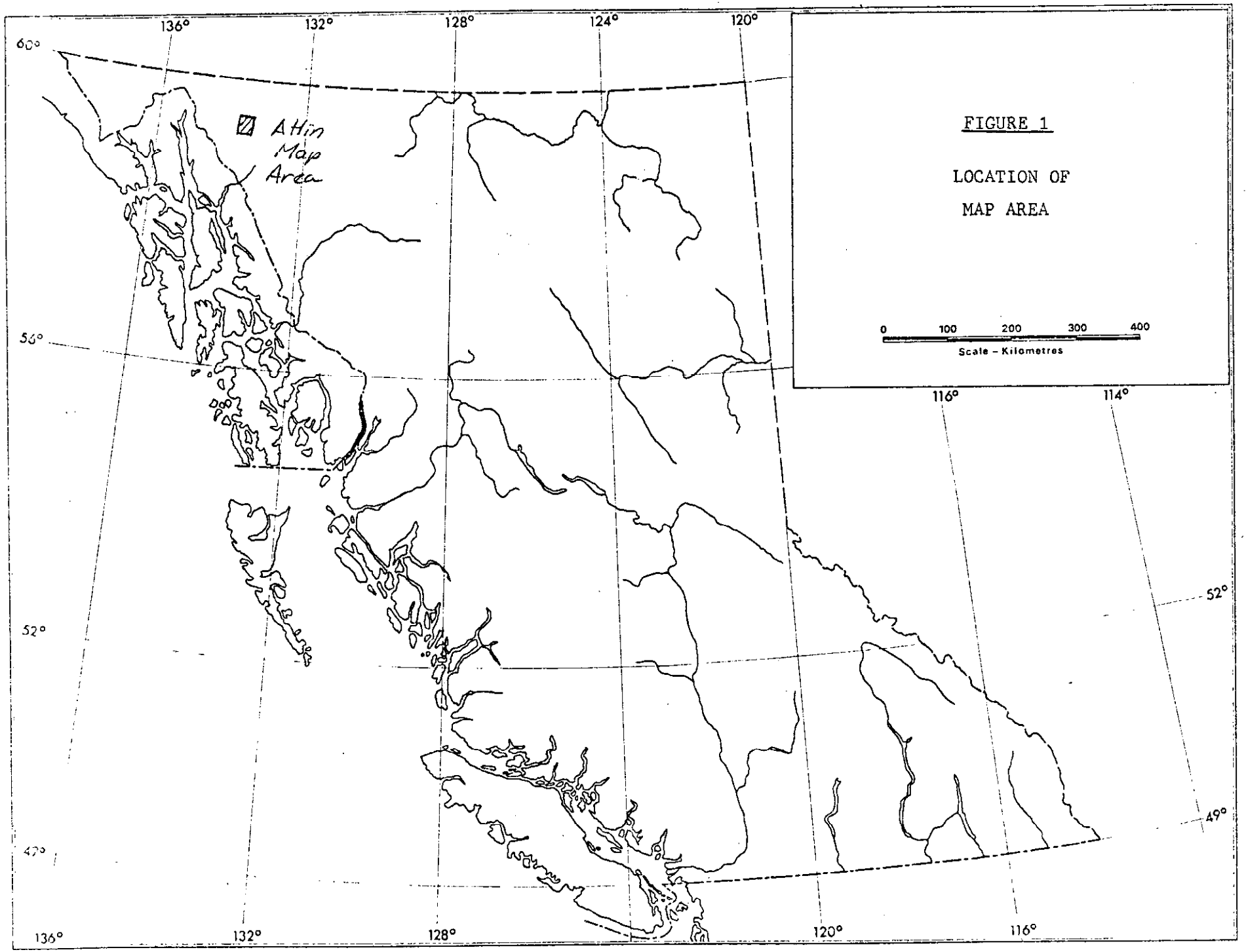
The area was examined to determine (1) the extent and origin of the placer deposits and (2) the source of the placer gold and if possible the location of lode deposits.

The area described in this report includes most of the area east of Atlin Lake, in which placer gold deposits have been found. Deposits in the valleys of O'Donnel River and its tributaries were not examined. However, the total production from the O'Donnel placers is less than that from any one of eight major creeks described herein.

The preservation of the placer deposits in this area, which has been glaciated, is the result of a complex series of events and is discussed in detail.

LOCATION AND ACCESS

The Atlin Placer area, comprising about 200 square miles of mountainous country, is in Atlin Mining Division, in northwestern British Columbia (see figure 1). The area is east of Atlin which is centrally located on the east side of Atlin Lake. The area trends northeastward and


136°
132°
128°
124°
120°
116°
114°
60°
56°
52°
49°
47°
AHim Map Area
FIGURE 1
LOCATION OF MAP AREA
0 100 200 300 400
Scale - Kilometres

is about 17 miles long and 12 miles wide. Most of the area is drained by McKee and Pine Creeks; the remainder is drained by Fourth of July Creek and two smaller creeks.

Atlin is the only populated centre in the area; in its stores most supplies can be purchased. Discovery on Pine Creek has only two permanent residents and Halfway, a settlement, about midway between Atlin and Discovery is abandoned. Other permanent residents live on Spruce and McKee Creeks. In the early summer months of most seasons, placer miners live on Birch, Boulder, Ruby and Wright Creeks.

Atlin, since 1949, has had a road connecting it with Jakes Corners on the Alaska Highway in Yukon Territory. This road is open all year except for short periods when some of the hills are iced over. From Jakes Corners another road goes to Carcross, Y.T. The Alaska Highway extends from Dawson Creek, B.C., to Whitehorse, Y.T., and beyond to Alaska and is open all year. Both Carcross and Whitehorse are on the White Pass and Yukon Railway line, which extends from Skagway to Whitehorse. Skagway is the terminus for several coastal lines.

Whitehorse is provided with good airplane service from Vancouver Edmonton, and Seattle. Planes for charter trips are available at Atlin, Whitehorse and Lower Post on Dease River.

Most freight to the area, goes by boat to Skagway, thence by train to Carcross and thence by truck or bus to Atlin. Some passengers travel by the same route. Alternatively passengers can fly to Whitehorse and go from there to Atlin by plane or car.

Within the area roads extend to all the placer creeks. The roads are in good condition except in the eastern part of the area. Cracker Creek is not connected to the road system.

PREVIOUS GEOLOGICAL WORK

The camp and the surrounding area was mapped by Gwillim* in 1899 and 1900 and a report with accompanying map was published in 1901. The placer deposits and lode deposits have been examined by officers of the British Columbia Department of Mines; the most comprehensive of their reports are in the Annual Reports of the Minister of Mines for the years 1900, 1904, 1932 and 1936. Some lode deposits of the area were described by Cairnes (1910) and by Cockfield (1925).

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* Geological Survey of Canada., Pub. No. 743, 1901.

FIELD WORK

In the summer of 1948 the writer spent nearly two months mapping mostly in the eastern part of the area. Position was obtained by resection and by pace and compass traverses. Aerial photographs were taken of the area by the RCAF in 1948, and from the photographs the British Columbia Department of Lands prepared a map on a scale of 1 inch to ½ mile, showing form lines. The photographs and map were available to the writer in 1950 when six weeks were spent completing the mapping of the area. Contours, based on barometric readings were added to the map. The field work was supplemented by examination of then sections of rocks. The manuscript for this bulletin was written in 1951 and 1952.

ACKNOWLEDGMENTS

The writer wishes to thank A.E. Roddis, Gold Commissioner for aid during the work and Mr. and Mrs. N. Forbes, Mrs. Hodges, O. Olsen and N. Fisher for the use of cabins. The placer miners in the area discussed the deposits and their development. Efficient assistance in the field was rendered in 1948 by W. Holyk and in 1950 by J.A. Gower.

HISTORY

It is reported by Gwillim that gold was discovered in paying quantities on Pine Creek by Miller and McLaren in January 1898. The fact that the journey to the area (and the discovery) was made in the middle of winter suggests that the discovers, possessed information that lead them to the creek and the deposit. The knowledge of the occurrence may have been general and possibly was not considered worth investigating until 1898 after the richness of the Klondike fields had became apparent and had aroused the interest of thousands of prospectors. The news of the discovery on Pine Creek reached Victoria in August 1898 and thousands of prospectors made their way to the new field. In the autumn of 1898 several thousand miners were living in a tent camp which extended along Pine Creek from Atlin for over six miles to Discovery. That same season most of the other placer creeks were discovered, many leases were applied for, and many claims were recorded.

Most of the shallow easily worked gravel deposits were worked out in the next few seasons by holders of individual claims and leases. The difficulty of working deeper ground and disposing of tailings on 100 foot claims forced many miners to leave the camp. This made it possible for those who remained to group several claims or leases to be worked together. It

became practical to arrange for a water supply in order that the deposits could be worked on a large scale. Shortly after the beginning of the century dredges were installed near the head of Spruce Creek and on Pine Creek, but neither dredge operation was successful. The Pine Creek deposit was the first to be worked successfully on a large scale; a shovel operation and later a hydraulic operation were both successful. The other creeks except Spruce and Otter, have been hydrauliced successfully. Production declined gradually as the shallow ground was worked out, until in 1930 it was only one-tenth as much as it was in 1898.

After 1930 the increased purchasing power of gold and later devaluation of the dollar caused renewed activity in the camp. At this time production from a shovel operation on Spruce Creek and from underground mining of deeply buried placer deposits of this creek increased the production from the camp and the dollar value of the gold recovefed in 1936 was as high as some of the best years near the beginning of the century.

In more recent years, production has declined because of the decreased purchasing power of gold and because the most ascessible deposits have been worked. Production from the deeply buried deposit of central Spruce Creek is the most important single item in the production and the years when this deposit is not worked on large scale the production is low.

ATLIN MINING DIVISION - TABLE I

	Number of Lots	Weight of Gold	Range of Gold Fineness	Numerical Average	Fineness for Conversion factor	Conversion value
Boulder Creek	6	6,911	743-794	774	774	$16.25
McKee Creek	4	1,764	831-834	833	833	17.45
O'Donnel River	6	248	805-807	806	806	16.65
Otter Creek	7	2,533	807-812	808½	808½	16.65
Pine Creek	1	467	806-818	812	812	17.05
Ruby Creek	5	1,616	800-808	805	805	16.65
Spruce Creek	26	35,115	809-890	841½	841½	17.45
Squaw Creek	1	276	834	834	834	17.45
Wright Creek	6	1,016	802-814	806	806	16.65
				*Numerical average-	813	17.05
Birch Creek			Use Dist. Avg.		813	17.05
Bull Creek			"		813	
Burdette Creek			"		813	
Chehalis (Lincoln) Creek			"		*813	
Consolation Creek			"		813	
Cracker Creek			"		813	
Davenport Dreek			"		813	
Dominion Creek			"		813	
Feather Creek			"		813	
Fox Creek			"		813	
Gold Run Creek			"		813	
Graham Creek			"		813	
Horse Creek			"		813	
Jamieson Creek			"		813	
Little Spruce Creek			"		813	
Rose Creek			"		813	
Slate (Wilson) Creek			"		813	
Snake Creek			"		813	
Volcanic Creek			"		813	
Willow Creek			"		813	

GENERAL DESCRIPTION

CHAPTER II.

Atlin Area is east of Atlin Lake, altitude 2,200 feet, the largest lake in British Columbia and is drained by Pine Creek and its tributaries by McKee Creek and by three small streams. The wide valley of Pine Creek and some other major valleys separate several mountain masses of the area.

Over most of the area the local relief is 2,000 to 2,500 feet. This is exceeded near Atlin Lake in the south where the mountains rise 3,500 feet above the level of the lake. Towards the southeast the general level rises to over 4,000 feet above which the intervalley high ground rises less than 1,000 feet. The maximum relief is about 4,000 feet.

The mountains are generally rounded except where cirques have been formed on northern slopes. Most of the summits are between 4,500 and 5,000 feet though a few peaks are over 6,000 feet. According to Bostock* the area is part of Teslin Plateau, the southernmost part of the Yukon Plateau. The only indication of plateau features within the area is a rough concordance of the top of most of the mountains and a considerable width of some of the ridges.

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* Geological Survey of Canada., Mem. 247, p. 65.

DRAINAGE

The principal valleys are those of Pine, Spruce, Otter, McKee, Birch, Boulder, Wright and Ruby Creeks. Pine valley and its northeastward extension, Surprise Lake valley is the major valley and most of the area is drained by Pine Creek and its tributaries. The other major stream is McKee Creek which drains the southwestern part of the area. The lesser streams flow into Fourth of July Creek or directly into Atlin Lake. The flow in most of the creeks in the summer after the snow has melted declines considerably and shortage of water has been one of the greatest deterents to large-scale hydraulic operations.

Pine Creek heads in Surprise Lake, three-quarters of a mile wide and 15 miles long, the lake provides a nearly uniform flow of water in Pine Creek even in dry summers. For three miles below Surprise Lake, Pine Creek, flows in a drift-filled valley with a gradient of about 30 feet per mile. Below this section, the gradient increases and averages about 80 feet per mile, for 9½ miles to Atlin Lake. Bedrock is exposed in several places and youthful canyons have been cut.

Spruce Creek, the largest tributary of Pine, in its upper reaches also has a gentle gradient, falling about 250 feet in 7 miles or less than 35 feet per mile. Nearer the mouth the gradient increases and is 140 feet per mile for the rest of its length, and for short stretches such as near the mouth of Dominion Creek, is more than 250 feet per mile. Spruce Valley is wide and possibly was formed by a creek that drained a greater area than is drained now by Spruce Creek. In a section of the valley downstream from Dominion Creek, it is entrenched between banks composed mostly of unconsolidated material, more than 100 feet high. There are a few canyons out in bedrock.

Otter Creek, like Spruce Creek, has a gentle gradient below its main fork about 75 feet per mile for 3½ miles and flows in a flat bottomed valley. Near Surprise Lake, the gradient increases to 235 feet per mile and the creek flows between banks of unconsolidated material more than 100 feet high. The main fork of Otter Creek flows northwestward and turns abruptly to flow northeastward into Otter valley. At the turn, only a broad low pass separates it from Spruce valley and from the topography it appears probably that in pre-Glacial times the main fork of Otter flowed into Spruce Creek and helped to make the valley of that creek larger than that of other creeks of similar size. However, the flow in lower Otter valley may not have been much less than it is now, because it seems probable that Snake and Wright Creeks, in preglacial times, flowed into Otter. The lower part of the Valley may have been entrenched towards the end of the Tertiary period.

When gravel deposits near the mouth of this creek were being hydrauliced the volume of water available was increased by diverting water from Wright and Union Creeks to the east, and from Snake Creek to the west through metal and wooden flumes in to Otter Creek.

Wright Creek is one of the smallest of the tributary creeks and flows in a small valley. It has a steep gradient from its head to Surprise Lake and in the lower part of its course is cutting canyons into bedrock.

Ruby Creek is the largest tributary of Pine Creek, north of Surprise Lake. It drains several cirques and steep-walled flat-bottomed valleys. The gradient of its tributaries at the head of the valleys is very high, but from their confluence downstream for 3½ miles decreases to about

275 feet per mile and the creek flows between banks of rock and unconsolidated material as much as 100 feet high.

Boulder Creek, west of Ruby, is much smaller and has a uniform steep gradient of about 365 feet per mile from the dam just below the main fork to Surprise Lake. In part of the lower section, the creek flows between high banks of unconsolidated material. Deposits in this creek have been worked by hydraulicing, but by midsummer and later the flow decreases so that piping is possible for only a few hours a day.

Birch is the smallest of the productive creeks and operations on this creek have also been handicapped by shortage of water. It has a gradient of more than 300 feet per mile and in the lower part of its course is deeply entrenched in unconsolidated material and in bedrock.

McKee Creek, the only creek outside of Pine drainage basin from which any considerable production has come, heads near the source of Spruce Creek, but flows westward directly into Atlin Lake. In its upper reaches down to a dam, the gradient is less than 50 feet per mile. Between the dam, and the mouth of Eldorado Creek a tributary from the south, a distance of about 2¼ miles, the gradient increases to about 250 feet per mile. Below this, for about 1½ miles the gradient is steep, over 500 feet per mile. The gravel on the valley bottom of this section has been hydraulicked. Below the hydrauliced section the creek flows down the slope of Atlin Lake valley and has a gradient of about 200 feet per mile.

GLACIATION

Most of the area has been covered by part of an extensive ice sheet and large amounts of glacial drift and outwash have been deposited in

the valleys. Some of the land forms have been slightly modified. Mountain glaciers formed cirques on north slopes of the highest points and carved some of the points into horns.

Glaciation has destroyed some placer deposits but has associated outwash material protected others from erosion. The results will be discussed in a later chapter.

CLIMATE

The climate is somewhat more moderate than could be expected from the high latitude and the high altitude because of the influence of thee mild coastal climate. Coast Mountains west of the area cause clouds to precipitate much of their moisture, and precipitation in the area is comparatively low especially in the summer. A lack of clouds, both in summer and winter results in many clear bright days.

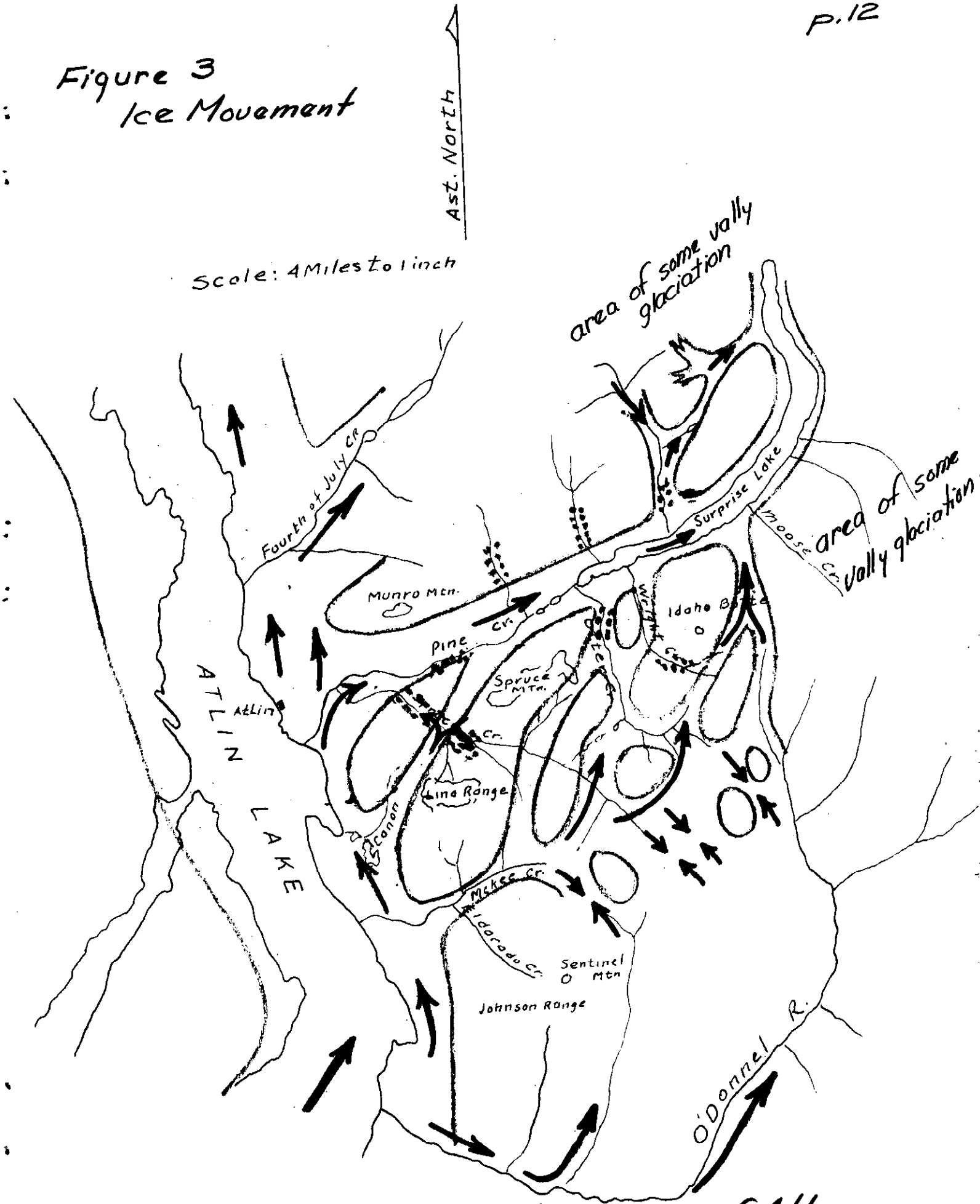
TIMBER

Most of the area is wooded up to an altitude of 3,500 to 4,000 feet. Near Atlin Lake and in the valleys are fair stands of timber some of which is sawn locally into ties and rough lumber. Timber for mining purposes is cut in Spruce valley. Above timber-line buckbrush covers the slopes and the upland surfaces to about 5,000 feet.

WILDLIFE

Game was fairly plentiful but is now scarce. Cariboo were seen on the high ground around the head of Wright Creek, but no other game is scarce. Beaver and other fur bearing animals are trapped but are not

Figure 3
Ice Movement



Direction - Ice movement; Vicinity of Atlin

plentiful. Grouse and ptarmigon are scarce. Fishing is good in Atlin Lake and Fourth of July Creek.

AGRICULTURE

The many hours of sunshine in the summer days promote rapid growth and many of the common vegetables are grown near Atlin Lake and in Spruce, McKee and Pine Valleys.

GENERAL GEOLOGY

Chapter III

INTRODUCTION AND RESUME

The mature upland surface, the result of long continued erosion before glaciation, was not much modified by the movement of the ice, but some outcrops were worn down and others were plucked out and from the glaciated surface comparatively few outcrops projected. Since the glacial period the outcrops have been reduced still farther and many outcrops have been reduced to rubble and most of the upland surfaces are smooth uniform slopes. For this reason the geological contacts shown on Figure 2 are largely assumed and the major sedimentary-volcanic series that underlies much of the area has not been subdivided, though large masses of marble are indicated separately.

The sedimentary volcanic series (units 1 and 2), presumably the oldest group of rocks in the area, comprises largely siliceous and argillaceous beds but marble, volcanic beds and flows and probably also intrusive members are included in it. Much of the northwest part of the area is underlain by a group consisting largely of greenstone (unit 3) which is believed to overlie the first mentioned series.

Intruding rocks of units 1-3 are basic and ultrabasic bodies of great diversity, and intruding the oldest group are granitic bodies. Possibly related to these are numerous dykes that also cut the older rocks.

In some of the creek bottoms are partly consolidated gravel deposits. They are pre-glacial and probably accumulated during the long

continued erosion of the Tertiary period but possible formed only at the end of that period or in an interglacial period. Practically all the gold that has been recovered has come from these gravels or from present stream gravels that contain gold reworked from the pre-glacial gravels. Overlying the placer gravels are fluvioglacial and glacial deposits which are as much as several hundred feet thick.

In the valley of Ruby Creek are lava flows and volcanic scoriae, late glacial in age. Recent deposits are not extensive and the only ones worthy of note are beds of hydromagnesite near Atlin Lake.

Information about the lithological units is summarized in the following table:

ERA	PERIOD	MAP UNIT	LITHOLOGY
	(Recent	9	Hydromagnesite
Cenozoic	(Late Pleistocene	8	Scoriae
	(Late Pleistocene	7	Lava
Tertiary of Early Pleistocene		6	pre-glacial placer gravels
Mesozoic	(Jurassic ?	5	Granitic Intrusives
	(Jurassic ?	4	Basic and Ultrabasic Intrusives
	(Permo-carboniferous	3	Greenstone, minor marble
Palaeozoic	(Permo-carboniferous	2	Marble
	(Permo-carboniferous	1	Quartzite, argillite, marble, greenstone

Map Unit 1 underlies the eastern and southern parts of the area, including high ground at the head of McKee, Spruce, Otter, and Wright creeks and extends down the valley(s) of the last two creeks and across Pine valley. Much of the area underlain by members of this group is mature upland and has few outcrops except in some of the creeks but on most of the

hills quartzite rubble is widespread and may be taken as indicating that the bedrock is also mostly quartzitic.

Quartzites and argillites, together with beds gradational between these two types form most of the unit. In places quartzites predominate and as noted above may form many of the hills, but elsewhere argillite or shale and slate and schistose beds predominate. In still other parts, as near the head of Wright Creek, quartzites or cherts and slaty beds are interbedded in a remarkable uniform sequence repeated many times.

Most of the quartzite is grey and brown but black, blue, yellow, red, and purple beds were also seen. Much of the quartzite is cherty and these beds have a similar diversity of colour. The beds are mostly a few inches thick but more massive members were seen. Some impure quartzite beds are schistose.

In Upper Wright creek cherty beds, interbedded with slaty beds, are mostly from 1 to 2 inches thick. These cherts and the interbedded argillaceous laminae are similar to the ribbon cherts of the Cache Creek series. In a discussion of a similar sequence of beds in the Fort St. James area, Armstrong* concludes that as a result of volcanic activity chert probably formed from rhythmic colloidal precipitation of silica and became interbedded with mud. Observations in the Fort St. James area, and it is probable that a similar hypothesis explains most of the features seen here.

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* Geological Survey of Canada, Mem. 252, pp. 37-39

Cherty beds are also common on the west slope of Monarch Mountain interbedded with marble beds.

The argillites are dark grey to black and are characteristically thin bedded. Some of the beds are also schistose. The schistosity is about parallel to the bedding. Pyrite cubes as much as half an inch across are commonly developed in these argillites.

Greenstones which appear to be interbedded with the sedimentary beds range in colour from grey-green to nearly black. They are considerably altered, largely chloritized and their origin is in doubt. Vesicles and vestiges of pillows were noted, and at one point it appeared that a flow had engulfed blocks of quartzite. Some fragmental material was seen, and it is apparent that the greenstone includes flows and agglomerates. However, much of it is massive and some of the massive material probably is intrusive.

The greenstone is distributed throughout Map Unit 1, for the most part, in minor amounts but the proportion increases as the contact with map unit 3 is approached. No definite contact between the two map units was recognized and the contact was established by excluding from map unit 3 outcrops with a considerable proportion of sedimentary material. During deposition of map unit 1 volcanism and possible associated intrusion was intermittent but the volume of volcanic and intrusive material increased, and finally predominated, and the demarcation between the two units is placed where deposition of sediments practically ceased. Because of the lack of distinguishing features in the greenstone unit and general lack of outcrops, it is not apparent whether the contact is gradational or whether there was an erosion interval after the deposition of the predominantly sedimentary material.

The marble is mostly massive and light grey in colour. Only the larger masses are indicated on Figure 2. Some of them are interbedded with the other members of the unit and the remainder presumable is. It is

not known whether they are all the same age or whether they represent the same group of beds but it is probable that the masses were deposited at several periods during the deposition of map unit No. 1, possibly more abundantly towards the end of the deposition when volcanic activity was becoming more important.

Talc deposits in the valleys of Boulder and Otter Creeks are interbedded with marble beds and probably formed from alteration of dolomitic beds.

The age of map units 1 and 2 is not certainly known and no fossils were found by the writer. Gwillem, on the basis of general similarity to the Cache Creek Series, considered that members of the units were Carboniferous in age. The group is also similar to Permo-Carboniferous groups in near-by areas.

Map unit No. 3 forms Spruce Mountain and much of Munro Mountain, and from this high ground extends westward. It consists chiefly of massive greenstone though in part it is slightly schistose. The rocks of this group are fairly resistant to erosion and form the mountains noted above and many of the boulders in the creeks.

The members of this group have not been subdivided, even though there is a considerable diversity in appearance, because alteration makes the origin of many of parts of the group obscure and also because of the scarcity of outcrops.

The colour of the rocks of this unit range from grey-green through many shades of green to dark green. Flow lines are discernible and vestiges of what appeared to be pillow structure were seen, but most of the outcrops do not exhibit such structural features. Possibly only a minor

proportion of the unit consists of flows or tuffs, but possibly some flows are thick and not distinguishable, after alteration, from intrusive bodies. An examination of thin sections indicates that much of the greenstone is of intrusive origin and was a hornblende porphyry. The composition of most members of the group probably ranged between andesitic and basaltic.

A minor part of this unit consists of marble, in bodies most of which are a few feet in extent. The contact of these bodies with greenstone is irregular as if they had been deposited on an irregular surface or as if lava had flowed over an irregular limestone surface. These marble bodies are massive and their attitude was not determined.

The group has been chloritized and in addition much of it has been serpentinized and carbonatized. Some tan coloured rocks have developed, composed of mixtures of serpentine and marble. Epidote is common also.

ULTRABASIC INTRUSIVES

Basic and ultrabasic intrusives are abundant in the northern part of the area. They appear almost to be restricted to the north but this apparent localization may be partly due to a lack of exposures on the uniform slopes of much of the south of the area.

These intrusive rocks are fairly distinctive in appearance, having rough rusty brown to grey surfaces. These rocks disintegrate readily and break down to form a characteristically rough rubble. Fresh surfaces have a mottled appearance, mostly shades of green with dark greens most prevalent.

Alteration of these rocks is largely complete and their original character is not apparent except from an examination of thin sections. From

such an examination it appears that these rocks were characterized by abundant olivine and pyroxene, and many were dunite and pyroxenites though there was a great range in composition and some gabbroic members were seen. Locally magnetite is present in amounts sufficient to cause magnetic anomalies over distances of a few hundred feet. Chromite is present in minor amounts.

Alteration of these rocks is extensive. This has consisted chiefly in the development of serpentine, hornblende, and chlorite; but tremolite and other amphiboles are present, and also talc. Asbestos veinlets are commonly present but mostly are less than one eighth of an inch wide and are widely spaced - generally several inches apart. The widest veinlets of asbestos seen were about one-quarter of an inch and are in the largest intrusive body between Birch and Boulder Creeks.

The fact that most of the known bodies are in the north close to the granitic intrusives suggests that they may have formed from the same magma source. The ultrabasics presumably are older than the granitic bodies because granitic dykes cut the ultrabasic and the older rocks. Ultrabasic rocks within the area now underlain by granitic rocks may have been absorbed during the formation of the younger intrusives.

On the other hand, the ultrabasic intrusives may be considered to be restricted mostly to an area close to Pine Valley and possible localized along or near a synclinal axis or some unknown structural feature close to this valley.

These rocks are younger than those in map units 1, 2, and 3 and are older than minor intrusives that presumable are related to the granitic bodies. They are similar to intrusives in nearby areas which also were intruded prior to nearby granitic masses and may tentatively be correlated with these other ultrabasic and associated intrusives which are considered to be Jurassic in age.

GRANITIC INTRUSIVES

These intrusives which are in the northern and eastern parts of the area are on the margins of masses that extend under extensive areas beyond the map-area. They are massive, grey, and medium to coarse grained; some feldspar phenocrysts are as much as two inches long. The composition varies considerably but most specimens are granitic or quartz dioritic.

Numberous dark lamprophyre dykes cut the granitic bodies. They are particularly abundant at the west end of Munro Mountain and there strike southeastward and dip steeply northeastward.

The age of the granitic intrusives is not certainly known but on the basis of the relationship of similar rocks in nearby areas where the age can be more definitely ascertained, they are probably Jurassic or younger in age.

The placer gravel deposits and the overlying fluvio-glacial and glacial deposits are described fully in Chapter V.

MAP UNITS 7 AND 8

The scoriae and lavas are present only in the valley of Ruby Creek. The outline of the flows indicates that they flowed along the bottom of the valley, and presumably came from some source close to the floor. The individual flows are five to fifteen feet thick. A shaft that was sunk through the lavas opposite the mouth of the valley that leads through to Cracker Creek penetrated 120 feet of flows. Downstream from here the aggregate thickness decreases and possible they thinned out without reaching Surprise Lake. Upstream their aggregate thickness also decreases but because of overburden their extent is not known.

These flows are bluish grey to black, and are vesicular and amygdaloidal. They are fine grained to glassy and are basaltic in composition.

The scoriae form a small isolated cone east of Ruby Creek and also form two fans on the west slope of Ruby Creek with part of the larger one extending across the creek. These fans consist of vesicular and amygdaloidal fragments or bombs, many of which are extremely irregular. Some are several feet across and others are minute particles. Some flows may be present and some tuff.

The scoriae are grey, red, brown, black. In the outlined fans several lines of cinder blocks can be seen radiating from a crater at the top of the mountain between Boulder and Ruby Creeks. Between these lines of large blocks are occasional glacial erratics. These suggest that the thickness of the fans is irregular and in places is thin or non-existent.

The lava lies on unconsolidated deposits, some of which is undisturbed pre-glacial gravel, but elsewhere is glacial till or post-Glacial water-sorted gravel. Because of this and the presence of the lines of undisturbed blocks of scoriae and the undisturbed cone, it is apparent that some and probably much of the volcanic activity and associated deposits is post-Glacial. However, the presence of some erratics on the minor cone suggest that ice had not completely disappeared from the valley before the building of the cone.

POST-GLACIAL DEPOSITS

Post-Glacial deposits are widespread. They include a minor

amount of talus, stream gravels and hydromagnesite beds, and of these only the last have been studied. It occurs in several areas east of Atlin Lake, north of Pine Creek, with a total extent of about 26 acres. The depth of the deposits ranges from a few inches to over six feet. According to Young* the hydromagnesite probably was precipitated in ponds in shallow depressions and inasmuch as the deposits are comparatively free of foreign particles the waters filling the ponds probably seeped under the surface.

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* Geological Survey of Canada, Summary Report, 1915, pp. 56-61.

CHAPTER IV.

STRUCTURAL GEOLOGY

The scarcity of outcrops and the lack of structural features in the greenstone and the intrusive bodies makes it impossible to do more than recognize the major structural feature.

The distribution of map unit 1 is roughly arcuate. Beds on Munro Mountain strike eastward, those near Boulder, Otter, and Wright Creeks strike southward; at the head of Spruce Creek and in McKee valley most of the beds strike westward making it apparent that the arcuate distribution is the result of folding. The beds, as a rule, dip in towards the centre of the arc and therefore it appears that members of the unit are folded into a major syncline. Its axis is near Pine valley and it strikes westward; the fold presumably plunges in that direction.

The bedding for the most part is regular and over considerable areas is nearly monoclinal; where the bedding does not conform to the major structure insufficient information is available to delineate any minor structures. The beds in the southeast, at the head of Wright Creek appear to be on a limb of some other fold. A few contortions, much like dragfolds, were seen in some quartzite beds, but dragfolds are not common.

Most of the marble appears to be in the inner part of the arc which suggests that it may be most abundant in the upper part of unit 1. Likewise the position of map unit 3 which is near the axial plane of the postulated syncline suggests that the bedded members of this unit overlie members of units 1 and 2.

The scarcity of outcrops also makes the recognition of faults uncertain and no major ones were seen. The placer gravel deposit of Spruce Creek, as far as it has been followed, unlike most stream gravel deposits, is notably straight, and this suggests that the creek in which the gravel accumulated was following a line or zone of weakness, possible a fault. The bedrock below the placer deposit has been exposed in the placer workings and is seen to be weathered and decomposed and much clay is present. Some of the clay may be derived from fault gouge but it is not certainly known that it is, and the presence of a fault here could not be definitely ascertained.

CHAPTER V.

PHYSIOGRAPHY, GLACIATION, AND PLACER DEPOSITS

The uplands are part of a mature rolling surface, part of the Yukon Plateau, an extensive area eroded during the Tertiary Period to near base-level.

During this erosion cycle, a well adjusted drainage system developed. Some high ground was a few hundred feet above the general level and a few peaks were possible as much as 1,500 feet above the general level. At that time insoluble minerals in rocks that were being eroded, were moved towards the streams and heavy minerals including gold, magnetite, chromite, wolframite, and possible cassiterite, became concentrated in stream gravels. As the gravels moved downstream the heavy minerals sank through the gravels and became concentrated near and in bedrock.

Towards the end of the Tertiary Period, Atlin Area, with the surrounding areas, was elevated. The uplift, over considerable areas of northwest North America during Pliocene times, according to observation by Dawson* and Brooks** may have been as much as 3,000 feet. The amount in the Atlin area is unknown byt probably was at least a few hundred feet. The uplift caused the rivers and creeks to erode rapidly and cut down into the mature surface especially near their mouths. The streams in the lower parts of their courses, tended to become entrenched. The entrenchment is noticeable in central Spruce Valley where pre-Glacial Spruce Creek cut canyons into the floor of the valley possible more than 200 feet deep.

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* Trans. Roy. Soc. of Canada Vo. 8, Sec. 4, 1890, pp. 16-17.

** U.S.G.S. Prof. Paper No. 45, 1906, p. 294.

The downcutting of the streams caused a reworking of the stream gravel deposits and a reconcentration of gold and other heavy minerals in, on, and near bedrock. At that time gravel deposits probably occured on all the creeks of the area but the gold content must have varied depending on the distance from the source of the gold and on the nature of the creek channel.

GLACIATION

After uplift and renewed erosion, the Ice Age began. Little information has been published about the type, thickness, and extent of the unconsolidated deposits exposed in underground workings or by drill-holes or about glacial striae exposed by workings and the discussion that follows is based largely on observations during field work. Some placer deposits were destroyed by movement of the ice, others were covered by outwash from the ice and thereby were protected from erosion. Consequently, a detailed examination of events during the Ice Age is necessary for an understanding of the distribution of placer deposits in the area.

The area is mountainous, but the effects of glacial sculpturing are much less marked than in the mountains of the high Coast Range to the west. Cirques have been cut on northern slopes at the head of Ruby and Eldorado Creeks and valley glaciers probably formed at the head of some of the other valleys. However, they have not modified to any marked extent the shape of the lower parts of the valleys and some of the valleys do not appear to have been occupied by valley glaciers.

There is little evidence of valley glaciation and probably valley glaciation was not very effective. The reason why valleys of this mountainous area in a high latitude were not intensely glaciated is probably due to a lack of precipitation and abundance of sunshine. Unlike other mountainous areas near the coast no remnants of glaciers remain and at present all the snow melts each summer. Possibly precipitation during the Ice Age did not exceed much present precipitation and little ice accumulated.

However, glacial and fluvioglacial deposits are extensive and in placer are several hundred feet thick. Glacial erratics are fairly scarce but are found on most of the ridges so it is apparent that much of the area was covered, by an ice sheet during the Ice Age. The movement of ice with its load of rock material, to and across the area, and the attendant deposition of debris from meltwater from the ice modified the drainage and covered much of the area with fluvioglacial material.

Striated outcrops are scarce; some striae in Atlin Lake valley west of Johnson Range and in Pine Valley are about parallel to the trend of the valleys. Therefore, it is apparent that during the last stage of the Glacial period ice was moving along the valleys. Moreover the comparative scarcity of erratics suggest that ice that entered the area moved over the ridges and high ground for a comparatively short period only. Possibly during most of the glacial period, the ice was confined to the valleys.

Lee and stoss topography in the western part of the area below an altitude of 3,500 feet is well developed. Outcrops are bare and rounded on their western, southern, and some of their eastern slopes, and have had large blocks plucked out of their northern and some of their eastern slopes. The shaping of the outcrops in Atlin Valley is more pronounced than a slight

smoothing and numerous similar forms have been developed and are apparent in the field and are discernable in aerial photographs. The forms are so well developed that they must be the result of long continued action - possible for most of the glacial period. The lee and stoss topography shows that ice in Atlin Valley moved northward and in the valleys tributary to Atlin Valley, namely the valleys of Pine, Canon, and McKee Creeks, ice moved northeastward. The results of this movement are especially noticeable in the valley that continues from the head of Canon Creek to the head of Little Spruce Creek. This valley which has a U-shaped profile and smoothed and straightened walls, is not the extension of a high valley in which ice could accumulate and it is evident that the ice that moved through must have come from Atlin Valley or Spruce Valley. Spruce Valley and the area to the east was not the gathering ground for ice. Therefore, it appears that ice moved into this high valley between Canon and Little Spruce Creeks from the west - that is, from Atlin Valley.

Additional evidence of the direction in which ice moved was found by Gwillim southeast of this area, where boulders of hornblende granite quite distinctive in appearance have been transported northeastward across a major valley.

The direction of movement of the ice is suggested also by the typed of glacial and fluvioglacial deposits found near and north of Atlin. Near Atlin the deposits consist mainly of gravels, sands, and till, the coarse products of erosion, and presumably have not been transported far from their source. Towards the north the deposits include a greater proportion of the finer products of erosion and near Whitehorse, Y.T., extensive deposits of

silt and clay predominate. The change in type of deposit from coarse near Atlin area to fine farther north shows that the meltwater flowed northward in this part of Atlin Valley and it is probably that it was flowing from the centre of ice accumulation.

To the north in Yukon Territory other effects of glaciation are less noticeable and ice did not reach an area whose southern margin is about 160 miles northwest of Atlin.

The evidence therefore indicates that ice moved northward and eastward from a source somewhere south and west of Atlin. Ice advanced northward in Atlin Valley and lobes of the ice sheet advanced eastward up the creeks tributary to Atlin Valley. At the maximum extent of the ice the lobes probably coalesced to form a sheet that covered the area, except possibly the highest points and ridges. Erratics were left on some of the high ground but their general scarcity suggests that the ice sheet period was of relatively short duration.

The centre from which the ice moved may be presumed to be a mountainous area with heavy precipitation south and west of Atlin Lake. An ice field there, a remnant of a much larger one, has lobes which still reach Atlin Lake and also extend westward to the Pacific Ocean. This centre will be referred to here as the Llewellyn, from the name of the glacier that extends to Atlin Lake. In the early stages of growth of the Llewellyn centre during the Ice Age, ice would flow down into valleys such as Atlin. As ice continued to accumulate the Atlin glacier would thicken, advance and spread out and ice would advance up the valleys tributary to Atlin Valley.

It is important to note that this sequence of events indicates that the ground first occupied by ice is the lowest. This is contrary to the normal sequence in mountainous regions where glaciers form near the highest ground and move towards the low ground. It is believed that the occupation of the low ground first by the ice resulted in some of the placer deposits being covered by fluvioglacial material which later protected them from glaciation.

With continued thickening of the ice of the Llewellyn Ice field, the glaciers that were advancing into the area split and coalesced and probably reached a stage about as indicated on Figure 3. This figure is based on the shape of the valleys and the known distribution of the placer gravel, and may represent the maximum exgent of the ice during much of the Ice Age. The streams at that time probably had more than a normal flow of water and possibly also a greater than normal load of detritus. The advance of the ice disrupted the normal drainage by damming the streams and their tributaries. The effect of the ice dams would be very pronounced. Probably numerous lakes formed behind the ice in the lower parts of the valleys and streams flowing into these lakes would form deltas.

The ice sheet, at its maximum extent, probably covered most of the area, smoothed some slopes and dropped erratics on the high ground. With wasting of the sheet, the comparatively thin cover of ice on the upland surfaces probably disappeared first, by melting and evaporation. As a result the valleys, as before, would be occupied by ice when the uplands were bare and the extent of ice again would be about as indicated on Fig. 3. Therefore, the preglacial drainage would still be disrupted and probably

ice-marginal lakes formed into which streams, swollen by water from the melting ice and loaded with detritus from it, would build deltas.

It is not known whether or not there were several advances of the ice, but it seems unlikely that the ice, here relatively close to the gathering ground, retreated from the area before the final disappearance of the sheet. The presence in valleys north of Surprise Lake Valley of more than one stratum of till suggests the possibility of there having been more than one advance of the ice front. However, these valleys may also have been occupied by glaciers that formed in them and a layer of till may have formed after the advance of ice from each direction.

With disappearance of the ice, the area with nearby areas, probably was uplifted and the streams cut down rapidly through the glacial and fluvioglacial deposits especially in the lower parts of their courses. In places, the present grade is below that of the preglacial grade.

This is a general outline of the probable sequence of events during the Ice Age. A detailed history is given below, with an explanation for the know distribution of the placer deposits shown on Figure 2.

ATLIN VALLEY

Atlin Valley has been glaciated presumably by a glacier moving northward and down from the ice sheet. The movement of this glacier truncated spurs, made the valley U-shaped, and deepened the valley. The lower parts of McKee and Pine Creek valleys were eroded and gravel deposits in them were removed and dispersed. At the same time, the ice in Atlin Valley dammed the waters of the creeks flowing into the valley from the east and

caused several ice-marginal lakes to form. The tributary creeks deposited their detritus in the lakes forming deltaic deposits. Later the deposits in and near Atlin Valley were dispersed as the glacier became wider, but other deposits formed upstream in newly created lakes. The aggregate accumulations of unconsolidated material in one part of McKee Creek Valley is more than 100 feet thick.

The height to which deltaic deposits accumulated may be indicated by terraces south of the valley of McKee Creek. These flat areas, barely discernable, are at an elevation of about 3,500 feet and may represent the remnants of once intrusive, detaic deposits.

Williams Creek, between McKee and Pine Valleys, is post-Glacial origin and no pre-Glacial deposits may be expected along its course.

PINE VALLEY

As Atlin glacier thickened and advanced a lobe or tongue from it moved up Pine Valley, the lowest outlet to the east. In an ice marginal lake east of the advancing lobe detritus was deposited and then, as the lake advanced, was dispersed and the valley bottom was glaciated. Bedrock in a hydraulic cut south of Halfway is glaciated*. The surface of the bedrock slopes indicating that possibly the old channel of Pine Creek at this point is south of the hydraulic cut.

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* Mandy, Minister of Mines, B.C., Ann. Report 1937, p. B44.

Bedrock near the west limits of a large hydraulic cut on the central part of Pine Valley has also been glaciated. This suggests that most of the floor of the valley west of the cut is probably glaciated and that any placer deposits on it have been dispersed. However, the bedrock of the hydraulic cut has not been glaciated and the writer believes that because of the great load of detritus picked up to the west the erosive power of the lake was decreased and it did not erode to bedrock but moved over pre-glacial gravels. These gravels in the western part of the cut are only a few feet thick but towards the east become as much as 40 feet thick. This difference in thickness indicates that the ice eroded less deeply as it moved eastward. Along this section of the valley the glacier straightened and smoothed the slope of Munroe Mountain. Probably it dammed Spruce Creek.

The area in which there are undisturbed gravel deposits extends east of the hydraulic cut for an unknown but comparatively short distance and to the east bedrock is glaciated and till rests on it. The limit of unglaciated bedrock is not known but the probable limits of undisturbed gravel are indicated on Figure 2 JMB. The reason that the glacier here eroded to bedrock east of Discovery is attributed to an influx of ice from Spruce Creek Valley, which could enter Pine Valley through a pass on the northwest slope of Spruce Mountain. Movement of ice on this slope apparently straightened and steepened the slope of Spruce Mountain.

One other section of Tertiary gravel deposits has been found in Pine Valley east of the main section. It is about at the point where a lobe of ice from Spruce Creek presumable flowed into the valley (see figure 2 JMB) and occurs where a ridge of rock on the southern part of an old rim protected the channel from glaciation by a glacier moving northeastwards. This section, known as Gold Run, is covered with about 30 feet of gravel and till.

Pine glacier as it moved up the valley, straightened the walls and made the valley more nearly U-shaped. Probably a glacier flowed down Otter Creek valley to join it and thereby increased its effectiveness as an erosive agent and it eroded more deeply to form the basin occupied by Surprise Lake.

As the glacier moved through the part of Pine Valley now occupied by the lake, it probably glaciated the lower parts of the valleys of the tributary streams and dispersed gravel deposits and dammed the streams causing them to form ice marginal lakes. At the maximum extent of the ice, glaciers probably advanced down these tributary valleys and increased the erosive power of the main glacier. The valley towards the northeast is narrower, and here where the glacier was constricted the effects of glaciation are most marked.

The valley occupied by a main tributary of Cracker Creek from the southwest is glaciated and U-shaped but it does not head in high ground where ice could have accumulated and therefore ice must have moved into it. From the configuration of the ground it appears probably that a lobe from Pine glacier moved up Ruby Valley and through the valley tributary to Cracker into Cracker Valley.

With continued expansion the glacier in Pine Valley thickened and glaciated the upper parts of the valley slopes and subsidiary lobes moved up the valleys of tributary streams. Lobes in the tributary streams also widened and the entire area may have been covered for a comparatively short time by ice.

When wastage of ice exceeded accumulation much till was deposited and then Pine Creek, swollen by meltwater, started to cut through the till and removed much of it from the valley. In some parts of the valley there is more than 70 feet of overburden, of which much is till but over considerable areas the depth of overburden is much less and in places bedrock is exposed. At Gold Run there is about 32 feet of overburden, of which eight feet is till; in the vicinity of the main hydraulic cut, till was largely removed and Tertiary gravels were exposed and some were removed.

Some sections of the new course nearly coincided with the old, as at Discovery. Other sections of the new channel are incised in a rim of the old channel and have formed rock canyons. A narrow canyon west of Discovery and north of the present course, suggests that Pine Creek for a time was diverted through it and probably at that time flowed into Trond Gulch and, on into Fourth of July Creek.

A terrace of stratified sands and gravels more than 50 feet thick extends for about two miles across the valley, at an altitude of 2,500 feet. The upper beds dip gently downstream but the lower beds are covered with debris from above and their attitude is now known. The beds probably formed in a lake dammed behind ice that remained in the lower part of the valley at a late stage in the disappearance of the ice.

Several terraces 10-15 feet high which slope gently downstream north of Halfway, probably are remnants of flood plains left as the creek cut down to its present grade.

SPRUCE CREEK

The course of Spruce Creek where yellow placer gravel accumulated, was relatively straight and may have followed a trace of a major fault. Uplift towards the close of the Tertiary period caused the creek to start eroding rapidly and it became entrenched in a canyon in the lower part of its course. Its upper course has not been explored and little is known about it, but probably it is less deeply incised in bedrock.

The absence of cirque basins on upland ridges near the head of the valley suggests that ice did not accumulate there and that glaciation and glacial and fluvioglacial deposits in the valley resulted from the movement and melting of glaciers that came from outside the valley. The source of the ice was probably the Llewellyn ice field.

Gravel in Lower Spruce Valley was probably dispersed by the glacier that moved up Pine Valley and at the lowest point of the old valley that has been explored just below the end of the known Tertiary gravel, till and varved clays rest on glaciated bedrock. The valley upstream from this point has been filled with a great thickness of bedded sands, gravels, and till. This unconsolidated material covers the pre-glacial gravel for its known length, and extends up the valley to its head.

At the northwest limit of the known extent of the old channel 50 to 100 feet of sand, gravel, and till overlie it, although nearby the new channel is as much as 30 feet below the old one. About 1 mile upstream banks of unconsolidated material are as much as 150 feet high. Near the mouth of Dominion Creek, Spruce Creek flows between banks 100 feet high and the creek bed is underlain by a further 200 feet of unconsolidated material.

Above the banks are five terraces each about 10 feet high and the old channel here was filled, therefore, to a depth of at least 350 feet. The gradient of the Tertiary channel is less than that of the new channel in the section explored and if the same relationship prevails upstream, it appears that the depth of fill upstream must be greater than 350 feet. Little information is available about the depth, but according to T. Matson*, a hole near an old dredge was drilled 350 feet did not reach bedrock.

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* Personal communication

Some of the unconsolidated material appears to have been deposited in a lake that formed behind ice advancing up Spruce Creek, This ice moved over the unconsolidated material and removed some of it, and deposited till. According to O. Millar, more than one pay gravel was found and mined above the Tertiary gravels on central Spruce and possibly during lulls in the advance of the ice, meltwater scoured channels and concentrated gold on stratums of silt or clay.

Glaciers also moved into Spruce Valley from Little Spruce and Dominion Creek Valleys. The ones that moved into Spruce Valley from the valleys to the southwest modified the form of those valleys and made them U-shaped. It is probably, therefore, that pre-glacial gravel in these valleys was dispersed but, according to M. Edwardson*, gold-bearing gravel has been found in Dominion Creek about 2½ miles above its mouth at a depth of 30 feet.

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* Personal communication

The glaciers coalesced to form a glacier that filled the valley and probably three lobes from this glacier continued northeast; one moved down across the slope of Spruce Mountain, another moved up Rant Creek Valley, and a third crossed over to the head of Otter Creek Valley. The lobe that advanced up Rant Creek Valley modified the valley to nearly a U-shaped and continued over to the head of Snake Creek Valley. The lobe that moved into Otter Valley did so only when the ice was near its maximum extent, and probably moved through the valley for a comparatively short period and did not appreciably erode it.

At a late state in the glacial period the glacier in Spruce Valley wasted and deposited a considerable thickness of till, some of which was carried downstream by meltwaters. Southeast of the mouth of Dominion Creek a considerable part of the valley floor is covered with morainal material, some of which is rudely sorted, and kame and kettle topography developed. At this time outwash material was deposited on till in the lower part of the valley.

Stephendyke Gulch, a narrow, dry canyon east of the lower part of Spruce Creek probably was a course followed by Spruce Creek at a time when the lower part of what is now its valley was occupied by ice. This course probably was followed for a comparatively short time and little gravel is present in the gulch.

The course of Spruce Creek is more or less central in the valley. In the upper part of its course Spruce Creek flows between low banks and some gold has been concentrated in and near the channel during erosion since the glacial period. In the lower part of the valley, a canyon has been

cut with banks as much as 150 feet high. Where the new course is across a rim of the old channel the canyon is cut in bedrock, but for the most part the banks are composed of unconsolidated material. In cutting through the fill, the creek has cut more readily into banks on the outside of curves and thus has come to have a course consisting of a series of curves. Near the lower end of the section in which placer gravel is found the new channel is below the old one, and in this part of the creek bed there was a concentration of gold derived from the old channel.

SNAKE CREEK

Upper Snake Creek flows in a U-shaped valley apparently glaciated by ice that came from Spruce Valley, and no preglacial gravel deposits have been found in it and it is probable that they have dispersed.

The lower part of its course is incised mostly in unconsolidated material and appears to be post-glacial in origin and it is not to be expected that pre-glacial gravels occur along its course.

OTTER CREEK

The next placer creek east of Spruce also heads on a broad upland on which there are no cirqes and probably little ice accumulated there.

The movement of the glacier up Pine Valley must have dammed Otter Creek at successively higher points because more than 100 feet of cross-bedded and bedded sands and gravels accumulated. These cover any

pre-glacial gravel that is present and its extent is unknown. Bedrock gravel of the lower part of the valley presumably was dispersed by Pine glacier but the gravel of the upper part of the valley presumably was protected from glaciation. The history during the glacial period like that of Spruce is probably complex because, according to N. Forbes*, at least two gravel beds above bedrock were found to contain gold in quantities worth mining.

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* Personal communication

When the ice sheet wasted, Otter Creek, swollen by meltwater, rapidly cut through the unconsolidated deposits to form its present course. Some gold has been concentrated in gravel of the present creek bed and some of this has been worked.

WRIGHT CREEK

Lobes in Otter and Pine Valleys coalesced and tongues of ice advanced into Wright Creek Valley and at the maximum extent of the ice the ridge between Otter and Wright Creeks was glaciated.

The glacier moving eastward up Pine Valley probably glaciated bedrock at the mouth of Wright Creek and dispersed any accumulation of pre-glacial gravel there. Later, ice from Otter Valley entered Wright Valley via the connecting valley, and together with valley glaciers descending from Idaho Butte, moved down Wright Valley. The movement of the glacier down this part of the valley, which presumably was not deeply entrenched, probably dispersed gravel on bedrock.

A central section of the valley at the maximum extent of the ice was probably crossed by glaciers without being effectively glaciated and the bedrock gravels were undisturbed. These have been worked. Upper Wright Creek Valley is shallow and glaciers probably moved up it and effectively eroded it. Gold has been concentrated since the glacial period from unconsolidated material on the valley slopes and has been recovered from surface gravels near the mouth of Bonanza Creek. Wright Creek is entrenching itself in the lower part of its course and is cutting canyons in bedrock.

East of Wright Creek a mountainous area is drained by creeks flowing in U-shaped valleys. Ice accumulated on the high ground and the movement of this ice, together with ice that moved eastward into the area, down the valleys, effectively eroded the valley bottoms and dispersed preglacial gravels.

VALLEYS NORTH OF PINE CREEK

The valleys north of Pine, head in fairly high ground and the presence of some cirques, especially on northern slopes, shows that ice accumulated there. The main slopes have been smoothed by the movement of the glaciers down the valleys but as a rule they have not been deepened and are not U-shaped. The glacial history of these valleys differs from that of those south of Pine inasmuch as the only ice that moved down the valleys accumulated in them. Lobes of ice from Pine glacier moved up through the lower parts of the valleys but the lobes were climbing up fairly steep slopes, and were loaded with detritus and did not appreciably modify the shape of the valleys.

BIRCH VALLEY

Birch is the smallest of the creeks. Ice in Pine Valley at an early stage of the glacial period dispersed Tertiary deposits near its mouth.

Upstream, behind the ice, sands and gravels accumulated as deltaic deposits in the ice-marginal lakes that formed but some were later dispersed by a lobe that advanced up the valley. However, the Tertiary gravels apparently were untouched. A valley glacier moving down the valley eroded the upper part of the valley but bedrock of the lower part was not glaciated. The present course of Birch Creek follows closely the older course but in a few places it is cutting through a rim of the old channel.

BOULDER VALLEY

Boulder Creek Valley which is somewhat larger than Birch, has a similar history. Bedrock near its mouth presumable glaciated by the glacier moving up Pine Valley but the valley bottom, starting at a point about one mile from Surprise Lake has not been glaciated and the valley is cut into a series of sands, silts interbedded with till resting on pre-glacial gravel. The bedded deposits apparently are deltaic and stream deposits, formed in and near lobes behind Pine glacier ice dam. The till interbedded with them was deposited by glaciers moving over them. Little is known about the extent of the till but according to White* in the lower part of the explored sections there are three till sheets separated by about 15-20 feet of sand and gravel. Upstream two of these disappear and only one is present in pits now being hydraulicked. At the lower end of the steep-walled part of the

valley the unconsolidated material is about 100 feet deep; at the present workings it is about 40 feet deep.

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* McLeod White - personal communication

In the upper workings, decomposed granitic rock is overlain by as much as 20 feet of rusty and brown stratified gravels with sandy lenses. These are overlain by as much as 20 feet of blue grey till, parts of which are slightly stratified. The upper surface of the bedded material is irregular and the thickness of the till and the underlying beds, varies considerably. At the top of the section about ten feet of brown sandy beds are overlain by a few inches of soil.

RUBY VALLEY

This valley is much like the ones west of it, but differs inasmuch as the upper part has been modified by glaciation and is flat-bottomed and U-shaped and the central and lower parts are partly covered with lava and scoriae.

The ground at the head of the valley is the highest in the area and has more also during the glacial period. Numerous cirques on northern slopes at the heads of tributary streams have been formed by ice that accumulated there. Small glaciers formed and flowed together to form a major valley glacier. Movement of the glacier has dispersed pre-glacial gravel deposits in the upper part of the valley.

Tertiary gravel near the mouth was probably removed by the glacier that moved up Pine Valley but the waters of Ruby Creek, dammed behind the ice, deposited sands and gravels on the Tertiary gravels. At a later stage a lobe from Pine glacier moved up Ruby Valley but rode over these deposits and did glaciate bedrock. This lobe split and part of it went up the valley northeast of Ruby Creek and this valley was glaciated and preglacial deposits in it dispersed. The stream in that valley apparently flowed into Ruby Creek but till and volcanic scoriae deposited near Ruby Creek blocked the stream and it now flows north to Cracker Creek. The lobe that moved up the main valley may have been melted by lava flowing down the valley. Lava in the central part of the valley penetrated by a shaft, is 120 feet thick and rests on 20 feet of gravel which is on unglaciated bedrock*.

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* N. Forbes - personal communication

In the lower part of the valley the lava appears to have filled a canyon and is like a tongue. Part of the present channel is east and part is west of the tongue and most banks of the stream consist of stratified sand and gravel which on one bank is overlain by lava. In a few places there is lava in both banks. The banks of the lower part of the valley are as much as 100 feet high, of which the upper 10 to 20 feet is lava. In places the lava is overlain by sand and gravel beds as much as 20 feet thick.

An area, fan-like in shape, with its apex at a crater at the top of a mountain between Boulder and Ruby valleys, is covered with blocks of scoriae. A small cone just east of Ruby Creek apparently is also composed

of this material and after the outpouring of lava violent eruptions from two sources scattered scoriae over the valley and built the cone. There are a few glacial erratics within the sloped area covered by scoriae but they are in local areas that apparently did not get covered so it appears that the eruption followed glaciation and possible happened in historic times.

CRACKER CREEK

Cracker Creek, the next creek to the northeast, is U-shaped. It heads in several cirques and the ice that formed there, together with a lobe of the Pine glacier that entered Cracker Valley from Ruby Creek valley must have effectively glaciated the valley. However, there is no glacial till in the sections of the channel that have been explored; bedrock is covered with gravels, sands and silts, including many rounded boulders. Apparently till deposited by the glacier has been eroded and water-worn material has been deposited. A drift in the central part of the valley has been advanced upstream 1200 feet in the summer of 1948, but had not encountered bedrock in the bottom of the creek. At two points in the drift bedrock on the rom of the old channel was encountered. A small amount of gold had been recovered from coarse gravel on the rims.

MCKEE CREEK

McKee Creek rises in a gently rolling upland near the head of Spruce Creek. The upper part of its valley is broad but the central part is steep-walled. In the lowest part of its course the creek flows down the

slope of Atlin Valley and has not cut a well-defined channel.

The banks of the central part consist of as much as 100 feet of bedded sands and gravels, some of which are crossbedded, silts, and till. The beds dip generally a few degrees westward. Towards the west the unconsolidated material pinches at the east slope of Atlin Valley. Towards the east they become thinner and just above the mouth of Eldorado Creek bedrock is exposed. The depth of overburden in the upper part of the valley is now known.

At the mouth of the canyon, till rests on glaciated bedrock and gold has not been found below this point. Apparently this part of the valley has been glaciated by the glacier that moved down Atlin Valley and presumably this glacier dammed McKee Creek and caused a lake to form in which were deposited the series of sands and gravels. As the glacier in Atlin Valley thickened a lobe from it advanced up McKee Valley but did not erode to bedrock where the thick deposits were. Above the mouth of Eldorado Creek the glacier probably eroded to bedrock and probably all the upper part of the valley has been intensely eroded. No pay gravel has been found. The glacier moving up the valley split and part moved into Dominion Creek and part continued on to Spruce Valley.

Eldorado Creek is cutting a canyon in the glaciated valley slope in the lower part of its course and there is little liklihood of finding gravel deposits there. It heads in a cirque and the ice that formed the cirque glaciated the upper part of its valley.

The glacier deposited till on the sands and gravels, but later when the ice was wasting the creek removed much of the till and some of the underlying material and formed its present channel.

ECONOMIC GEOLOGY

CHAPTER VI.

The placer deposits are the only ones in the area that have been mined successfully; gold, tungsten and sulphide-bearing lodes have been explored, but in recent years only two prospects have been explored, and work in these has been stopped. Other deposits that may become of economic interest include hydromagnesite and talc. Asbestos, chromite and magnetite occur but no bodies in which one of these minerals forms any considerable proportion was seen.

The extent of the known placer deposits is indicated on Figure 2 and the reasons for their preservation have been discussed in Chapter V.

The only place where bedrock, undisturbed by mining operations, could be seen underlying the pre-Glacial deposits, is on Spruce Creek. Here greenstone, rusty in appearance, is soft and its joints are filled with clay and gravel for a depth of as much as several feet. The bedrock has the appearance of having been decomposed by weathering. At some points, the contact with the overlying gravel is stained dark brown almost black.

The gravel deposits that rest on weathered bedrock are characteristically yellow and rusty, and because of these colours are readily distinguished from all the younger gravel and till, which are grey and brown and blue.

The weathered bedrock has not been glaciated, and it is presumed that the yellow gravel immediately overlying it is also pre-Glacial. According to available reports the gravel that has been mined, with the

exception of minor deposits in the upper reaches of some of the valleys, was yellow, and it is presumed that all the more importatnt placer deposits formed prior to the advance of ice.

The yellow gravel is composed mostly of angular and rounded pebbles, cobbles, boulders, quartz, and feldspar grains, cemented by clay and rust. On Boulder Creek some of the boulders are five to six feet in diameter but on Spruce Creek large boulders are uncommon and most of those seen are less than two feet in diameter. The gravel is semi-consolidated and in some workings is unsupported.

The clay clings tenaciously to pebbles, grains and gold nuggets and, in many of the operations on Spruce Creek, some of the gold adhering to clay was washed through sluices. However, most of the tailings from the sluices were saved, and after weathering and consequent disintegration the tailings were again sluiced and much of the gold in them recovered.

The thickness of the yellow gravel deposits is not exposed in underground workings where only about the lowermost four feet is mined, together with about two feet of the bedrock. According to Gwillim* the yellow gravel worked on Pine Creek was four to five feet thick. In the hydraulic pit on Boulder Creek, yellow gravel is as much as 20 feet thick but has an irregular upper surface and probably its average thickness in the upper section of the length worked is about ten feet.

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* Geol. Surv. of Canada, Ann. Report. Part B, Vol. XII, pp. 39-40.

The width of the yellow gravel deposits worked varies widely. In the upper part of Boulder Creek the width is about 100 feet. In Spruce

Creek deep workings near the mouth of Dominion Creek are 150 to 200 feet wide and according to Mandy* the distance between rims in the lowest section worked was 1,200 feet, although the width mined was less than this. The yellow gravel deposit in Pine Valley is the widest; in places the hydraulic pit is 1,000 feet across, and workings extend into the banks for an unknown distance north and south of the pit.

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* Minister of Mines, B.C., Ann. Report. 1936, p. B 50.

Gold is erratically distributed in the deposits but insufficient information is available to plot the higher grade areas or predict their occurrence. In the part of the Spruce Creek deposit that was being worked recently, the highest grade ground was in a comparatively narrow irregular channel, whose limits were not apparent and could be determined only by sampling. Ground on either side of the channel was of considerably lower grade.

The Spruce Creek gravel is generally considered to be the highest grade in the camp. In 1948 the minimum grade being worked at the Noland property was about $10 per yard and some sections of the deposit ran as high as $40 per yard*. Some of the gravel worked by underground methods on the other creeks may have been of a similar high grade. In the deposits worked hydraulically the grade of the gravel worked would be considerably lower, and the lowest grade worked probably approximated fairly closely the cost of operation.

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* Personal communication, L.G. White, manager.

Nuggets in the gravel are generally coarse and little flour gold is recovered by sluices. The largest nugget found weighed 85 ozs. and numerous others, weighing several tens of ounces have been recovered. Many of the nuggets contain a considerable proportion of quartz and are angular or are only slightly rounded and probably are relatively close to their point of origin.

The average fineness of the gold recovered* ranges from 841 3/4 on Spruce Creek to 774 on Boulder Creek; and the average for the camp is 813, which is considerably lower than the average from the province, which has been determined as 861**.

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* B.C. Department of Mines, Bulletin 28, p. 17.

** B.C. Department of Mines, Bulletin 28, p. 8.

Tungsten and tin minerals and minor amounts of platinum and the metals generally associated with it also occur in some of the placer gravel. A sample taken by the writer in 1948 from black sand concentrate from Boulder Creek assayed: tungstic oxide, 52.1 per cent; tin, 12.6 per cent; platinum, 0.08 oz. per ton. A shipment of three tons of this concentrate in 1949 contained tungstic oxide, about 48.5 per cent; tin, about 10 per cent. Black sand concentrate from other creeks has not been saved, but miners who have worked on Ruby Creek report that the black sand from this creek also contained tungsten. Nuggets of wolframite and chromite were seen in the black sand from the Spruce Creek operations.

Gravels of post-Glacial origin have been worked only to a limited extent, chiefly in upper Otter and upper Spruce Creeks. They are

stream gravels, and their thickness is not known because no pits have been made in them recently. Boulders several feet across in these gravels probably represent some of the largest deposited in glacial and fluvioglacial deposits in the valleys. Most of these deposits are low grade, but the gravel on sections of Spruce Creek, below where the present channel cuts the buried Tertiary channel, yielded good returns.

An account of the history of operations on each creek is given here, together with notes on the gravel that has been worked, and for some creeks an estimate is given of the extent of unworked Tertiary gravel.

LODE DEPOSITS

In recent years the only lode deposits that have been explored are quartz veins containing wolframite and gold and minor amounts of other minerals.

Wolframite-bearing veins cross the upper part of Boulder Creek valley and the west slope of the upper part of Ruby Creek valley. Those that have been explored are in Boulder Valley, and according to F.J. Hemsworth* were first explored in 1903, though at that time gold was sought in them. They were extensively explored in the period 1939-42 when considerable underground work was done, and exploration continued in 1950-51.

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* Minister of Mines, B.C., Ann. Rept., 1950, pp. 72-73.

The veins are as much as 25 feet wide but most of those seen are only two to three feet wide. They consist of milky, or glassy or sugary, white quartz, some of which is coarsely crystalline, and of wolframite and minor amounts of pyrite, chalcopyrite, galena, and molybdenite. The veins strike northeastward and dip, mostly at about 45 degrees, northwestward. These veins have only been found in the area underlain by granitic rock.

The only veins explored for their gold content in recent years are on the south slope of Little Spruce Creek. This occurrence has been described by the writer*.

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* Minister of Mines, B.C., Ann. Rept. 1950, pp. 71-72.

IMPERIAL

The property on which most work has been done is known as the Imperial. It consisted of several Crown-granted claims which have reverted to the Crown. It is at the west end of Munro Mountain and the main workings are on the south slope between 3,250 and 3,350 feet elevation. This property was explored in the early days of the camp and at one time a small mill was operated on ore from the property.

A group of closely spread parallel veinlets constitute a vein zone. This was accessible at one point in the underground workings, and there it strikes north 70 degrees west and dips 60 degrees southward. It is about three feet wide and consists of glassy and milky quartz, siderite and pyrite, and contains minor amounts of chalcopyrite, galena and molybdenite. The wallrock is bleached and pyritized greenstone.

Two adits were driven to the vein zone. They are partly caved, but according to Richmond* the vein zone was encountered in each adit and was followed by drifts; the total extent of the underground workings being 440 feet.

LAKEVIEW

The Lakeview property is on the south slope of the ridge between Boulder and Birch Creeks. The claims have been allowed to lapse and no work has been done on the property for many years.

Several quartz veins occupy parallel fractures and constitute a zone several feet wide. It strikes north 15 degrees west and dipt to 70 degrees westward. The quartz is white, milky and in the exposures seen is unmineralized. The wallrock is grey and black, thin-bedded argillites which strike north 70 degrees west and dip 65 degrees southward.

Workings, including an adit 250 feet long now caved at the portal, are between 4,300 and 3,700 feet elevation. The property was examined by Richmond* in 1933, when the adit was open.

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* Minister of Mines, B.C., Ann. Rept., 1933, p. 78.

GOLD HILL

Other workings were seen north of Pine Creek, on the south slopes of the mountain between Birch and Boulder creeks between 4,400 and 3,800 feet elevation. On some posts, that might have been located in recent years, the name Gold Hill is discernible, but the name when the work was done is not known.

A vein zone, comprised of several quartz veinlets, is about 2½ feet wide and strikes northeastward and dips about 70 degrees southeastward. The quartz is mostly unmineralized, but galena, pyrite, and chalcopyrite and siderite are present in minor amounts. The wallrock is greenstone which is bleached and pyritized. The zone has been explored by trenches, shafts, and adits, but the underground workings are not accessible.

South of Pine Creek two properties were found upon which underground work has been done. One of these, the Golden View, has been described by the writer*. It is south of Little Spruce Creek.

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* Minister of Mines, B.C., Ann. Rept., 1950, pp. 71-72.

The other property is north of Little Spruce Creek at the edge of the valley bottom at about 3,200 feet elevation. Its name and history are not known. A quartz vein that strikes eastward and dips steeply southward, is about two feet wide. It consists of milky white quartz and pyrite. It has been explored by several trenches and a shaft of unknown depth.

A rusty bedded quartz vein about one foot wide occurs on the east slope of Otter Creek valley at the point indicated on Figure 2. It is in quartzite and contains micaceous laminae. It strikes southeastward and dips about 45 degrees southwestward. In the walls are vertical quartz stringers which strike parallel to the main vein. Rusty quartz rubble was seen near the south end of the top of the ridge east of Spruce Mountain. Pits here and at the other occurrence mentioned, indicated that work has been done on each of them. Abundant rusty vein quartz was seen on the slope south

of McKee Creek, at the point indicated on Figure 2. Several prospects in ultrabasic rocks near Atlin Lake also have been explored, several of them by underground workings which are not now accessible. The veins seen near them are only a few inches wide and consist mostly of quartz and carbonate. These properties have been described by Richmond*.

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* Minister of Mines, B.C., Ann. Rept., 1933, p. 78.

One vein has been explored for its base-metal and silver content. It is on what was known as the Surprise property, about two miles south of the west end of Surprise Lake and at about 4,400 feet elevation. The property has been described by Cockfield*.

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* Geol. Surv. Canada, Sum. Rept., 1924, p. 23 A.

The work on this property was probably done before 1920 and the main working and adit is now caved. A vein that ranges up to 20 feet wide strikes about north 10 degrees west and dips 70 degrees southwestward. It consists of quartz with minor amounts of galena, pyrite, chalcopyrite, and siderite and cuts across greenstone.

It is probable that the gold on McKee, Spruce, Otter and Wright Creeks came from an area that extends across the upper part of these creeks. This area is underlain by rocks of map units 1 and 2. Likewise, the gold on Birch, Boulder, and Ruby Creeks probably came from an area that extends across the head of these creeks. Much of this area is also underlain by rocks of map units 1 and 2, and it may be inferred that these rocks were suitable for the formation of gold-bearing deposits.

In general, the lodes that have been found and explored are sparsely mineralized and gold is present only in tiny flakes. Most of the veins described are in greenstone, though numerous minor ones occur in ultrabasic bodies.

Deposits in the source areas that could have furnished coarse gold are not exposed. This may be the result of: (1) Lack of out-crops, or (2) the gold-bearing lodes have been eroded in the period when the placer gravel was accumulating. It is probable that both reasons are partly true, and that parts of rich primary deposits exist but have not been found.

Chromite and magnetite occur as grains in the ultrabasic bodies, but no part of any of these bodies in which either mineral formed a major proportion was seen. On the ridge between Birch and Boulder Creeks a local magnetic attraction is effective on a compass over an area several hundred square feet in extent. Magnetite also forms bedded deposits a few feet thick, apparently as a result of replacement of limestone or some inter-bedded sedimentary rock. Associated with the magnetite is garnet. Two such occurrences were found, both on the mountain northeast of Ruby Creek.

NON-METALLIC DEPOSITS

Hydromagnesite forms beds at the surface, within an area that extends for about half a mile east of Atlin. The beds are white and conspicuous in the field and from the air. They have been reported on by Young* who has discussed their origin and Cummings**, who has discussed the tonnage of hydro-magnesite in the deposits.

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* B.C. Dept. Mines, Bulletin 4, pp. 117-119.

** Geol. Surv. Canada, Sum. Rept., 1915, pp. 50-61.

Talc occurs in bodies that contain only minor amounts of other minerals. These bodies are between sedimentary beds and probably the talc bodies are also bedded. They probably formed from replacement of dolomitic beds of the sedimentary series. The talc bodies are exposed in Boulder and Otter Creeks and on the east slope of Otter Creek valley, but have not been explored and their thickness and extent is unknown.

Talc is also common in the ultrabasic bodies, but in these it is only one of several major constituents and is not a probable source of talc.

Asbestos veinlets were referred to in Chapter III. The widest veinlets seen are one-quarter inch wide and widely spaced and most of the veinlets are one-sixteenth inch wide or less.

PLACER PROSPECTS NEAR THE MAP-AREA

The possibility of finding undisturbed pre-glacial placer deposits near the map-area, assuming that the interpretation of the glacial and post-glacial history set forth is correct, may be considered.

Fourth of July Valley and the upper part of O'Donnel Valley, which are the main valleys north and south of the camp respectively, trend in a southwesterly direction as do the main tributary valleys of the lower section of O'Donnel Valley. This is directly towards Atlin Valley and towards the Llewellyn icefield and it may be reasonable expected that lobes of ice advanced up these valleys and, except possibly in a few areas, protected by obstructions, glaciated the valleys and dispersed pre-Glacial deposits. Only a few limited areas of yellow gravel have been found in

O'Donnel Valley and none has been found in Fourth of July Valley, which may be taken as evidence of the effectiveness of the glaciation.

The lower part of O'Donnel River flows in a wide valley, which is also occupied by Pike River, and is only a few tens of feet above Atlin Lake. This wide, low valley presumable also was glaciated by a lobe of ice advancing from the southwest and the pre-Glacial deposits dispersed.

Immediately east of the map-area, peaks are profoundly modified by glaciation; it appears that here valley glaciers were active and, possibly aided by ice that moved from the west, effectively eroded the valleys.

West of Atlin Lake, mountains on which are remnants of glaciers now presumably also had their valleys glaciated by valley glaciers.

To sum up, it may be said that the possibility of finding extensive areas of pre-Glacial placer gravel in and near the Atlin area, apart for the continuation of known deposits, as on Spruce and Otter Creeks, is slight.

PINE CREEK

The first discovery of gold in the camp was in surface gravel in Pine Creek in 1898 near what became the settlement of Discovery. By the next season 640 miners were working the surface gravels of the valley bottom and farther upstream at Gold Run were mining underground, and the total recorded production was 13,828 ounces which is more than was produced in any other season. Many of the miners left at the end of the 1899 season. Ditches to bring water for hydraulic mining were dug in 1900 and were put into use in 1902. A dredge was built at Gold Run in 1903 and was operated in 1904 and

part of 1905, but could not successfully handle boulders encountered. A dam was built at the mouth of Surprise Lake in 1905 to increase its storage capacity and provide more water for hydraulicking. A steam shovel was operated in 1906 and 1907 to handle gravel east of Discovery, and then in 1908 a major hydraulic operation was started. This continued until 1922, and at tne end of that period the main pit had almost the extent it has now.

After suspension of the large scale hydraulic operation in most years only a few underground operations and some sniping was carried on and production generally was much less. A hydraulic operation at the southeast limit of the pit was successful in 1932-1935 and another along the southern limit was successful in 1938 and 1939. In 1940 a company was formed that used a dragline and bulldozers to move gravel along the northern part of the pit to a mobile washing plant. This operation was continued until 1942. Since then production has been low.

A company was formed in 1925 to hydraulic gravel west of the main hydraulic cut and presumed to be in an old channel of Pine Creek. The operation was continued until 1930 and in that period about two million yards of gravel was handled and a 1,500 foot length of bedrock was cleaned but no pay gravel was found.

The grade of bedrock in parts of the pit was too low for sluicing efficiently, and during operations it was necessary to cut ditches into bedrock and sluices were laid in these. Much of the bedrock is soft decomposed serpentinized rock and easily eroded. Intruding this are hard dark green dykes and these project as ribs above the general rock surface.

Preglacial gravel occurs or did occur in the areas outlined in Figure 2, but much of it has been worked in the pit outlined. Yellow gravel is exposed in the banks of the pit and continues for an unknown distance north and south of the pit. Some of it has been drift-mined but the remaining gravel is not being worked. East and west of the main area except at Gold Run till rests on bedrock, some of which is glaciated and much of the remainder presumably is.

Parts of Gold Run have been drift-mined but this section has not been hydraulicked and some sections presumably are of economic interest.

SPRUCE CREEK

The gold production from the gravels of this creek exceeds the combined production from all the other creeks of the camp. Gold was discovered on Spruce Creek a short distance below the mouth of Eureka Creek. After a few years it was realized that as a rule Preglacial gravels of Spruce Creek valley were richer than the other creeks but were covered with a greater depth of overburden and mostly could be worked only by underground methods. The result has been that these gravels have been worked more slowly than that of the other creeks, and after continuous production for more than fifty years production, in 1950 is being continued at a high rate. The ground was so high grade that owners of single claims were able to operate for long periods, with the result that consolidations of holdings to be held by companies took place more slowly than on other creeks.

Hydraulicking was attempted in 1902 and possibly in 1899 but was not successful possibly because of shortage of water, low gradient, and lack of areas for disposal of tailings. A steam shovel was installed in 1905 but its operation was not successful. Hydraulicking was carried on from 1910 to 1914 at the lower end of the valley where it widens out and there is room for tailings, but the material handled consisted of fluvioglacial deposits and only low recoveries were made.

Most of the work done until 1912 was below Discovery and largely consisted of driving slopes into the banks of the present creek to reach the Yellow gravels and driving workings on the old bedrock, and mining the upper two feet of it and about four feet of the gravel. Where the new channel crossed the old, the Yellow gravels were at the surface and could be worked without driving a slope, but these surface gravels were worked out very early. By 1912 much of the bedrock gravel of the old channel below Discovery had been worked and intensive exploration to find the channel upstream from Discovery waa started. However, the pre-glacial channel upstream gradually becomes deeper, and as a bedrock drain was extended up the creek it became feasible to work the gravels found, and in recent years the bulk of the production has come from shaft operations.

A steam shovel and a mobile sluicing plant were installed by a company in 1934 to wash gravel in the present creek bed, tailings from previous operations and the gravel of the pre-glacial channel where it was accessible. The operation was successful and the same company installed another shovel and plant lower down the valley and operated both until 1939 when the limits of the properties that were owned were reached. Another

company installed a shovel and sluicing plant above the other surface operation in 1941 and operated that year and in 1942. These surface operations extended from near the lowest part of the known length of the old channel upstream to about 2,000 feet below Discovery.

The major operation in 1950 is from a shaft about 200 feet deep near the mouth of Dominion Creek. Workings extend about half a mile upstream from the shaft.

Most of the bedrock gravel of the pre-glacial channel within the area outlined on Figure 2 has been mined. A few isolated patches of unmined gravel may occur, but their location and extent is unknown because most of the old workings were not mapped when mined. Possibly younger beds* contain gold in amounts that would make possible its recovery by underground mining, but the location and extent of these is unknown.

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* Mandy, Minister of Mines, B.C., Ann. Rept. 1936

Gold in the deposits overlying the bedrock gravel has only been recovered near the present course of Spruce Creek, and no information is available as to the richness of these deposits in the section that has been mined.

It is improbable that any pre-glacial gravel occurs northwest of the point indicated on Figure 2, because it is probable that the lowest part of Spruce Valley and of Pine Valley at this point was glaciated. Pre-glacial gravel extends upstream beyond the mouth of Dominion Creek an unknown distance. The movement of ice was generally across the upper part of the valley and it is probable that the pre-glacial gravels were undisturbed during glaciation.

Gold occurs in surface gravels near the head of the valley and was found shortly after the discovery of the gold in the lower part of the valley. The surface gravel of the upper valley was worked for many years by individual miners shovelling in to sluices. A dredge was built in 1905 and was operated for a short time in 1905 and 1906 but could not handle successfully large boulders that were encountered. The surface gravels of the upper part of the valley in a section that extends from about two miles to about 3½ miles above the mouth of Dominion Creek were explored in 1941 by numerous holes drilled to a depth of about 30 feet. J. Acheson* who had the holes drilled believes that gold occurs in the gravel in recoverable amounts.

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* Personal communication.

MCKEE CREEK

Yellow gravel was discovered on this creek in 1898 and the next few years many individual operators successfully shovelled in the shallow gravel, but the continuation of gravel lay under a considerable thickness of sand, gravel and till in places more than 100 feet thick. This could only be worked by underground methods or by removing the unconsolidated material. Some underground mining was done but hydraulicking, started in 1903, was most successful and most of the production has come from hydraulic operations. Hydraulicking of the thick deposits was feasible because the section of the creek worked has a fairly steep gradient, and construction of two dams at suitable points provided water storage for period of low run-off. A length of the old channel was worked as indicated on Figure 2. At the upper end of

this section bedrock is covered with material that has been sloughed down from the steep slopes of unconsolidated material, but it appears there the yellow gravels cut out abruptly which suggests that at the upper end of the section bedrock was glaciate.

The upper end of the pit was reached in 1917 and since then exploration to find additional Tertiary gravel north and south of the pit has been carried on. Some of the exploration has been successful, and in a few years recoveries from pits have been as high as in the earlier period, but as a rule the discoveries since 1917 have been much less than before that date.

Underground work has also been done at the margins of the pit.

An effort was made to find yellow gravel above the main hydraulic pit in 1927 and hydraulicking was started east of the mouth of Eldorado Creek in the south bank but the work was not continued and apparently was not successful.

Hydraulicking was continued until 1950. The procedure adopted was to use monitors to wash down the upper parts of the banks of a new part in one year, and the following year sluice the lower material of the banks. In 1950 a pit was started at the western limit of the hydraulic cut in the north bank. At the lower end of the pit till rests on glaciated bedrock. Yellow gravel has not been found below this point and presumably the old channel was glaciated. It is also probable that the upper section of the valley has also been glaciated.

BOULDER CREEK

Gold-bearing gravel was found on this creek in 1898 and the next year hydraulicking was started and was continued until 1910. At the same time underground operations were carried on from slopes and shafts. In 1904 and 1905 the production from this creek was the highest in the camp and presumable came largely from underground operations, because during the 1903 season a shaft was sunk 60 feet to pay-gravel on bedrock. After the successful underground operations were ended about 1907 recoveries were less, though underground and surface work was continued most years.

In 1927 the Consolidated Mining and Smelting Company of Canada, Limited acquired the leases and started to hydraulic about 1,500 feet from Surprise Lake. In the next few years the hydraulic pit was extended upstream, but it was not until 1934 that bedrock was exposed in the pit. Apparently this was on the rim of the old channel and recoveries from bedrock were low. In 1934 and 1935 an underground operation was started, and then in 1936 hydraulicking was started again. This was continued by the company until 1941. Since then the operation has been conducged as a lay, leased from the company by a partnership of six men, and a series of pits now extends up the creek for two miles.

The recovery from the pits in the upper part of the section worked has been less than in the lower pits, and this, together with the reduced duty of water because of decrease of pressure as the dam is approached has caused hydraulicking to be stopped.

The pre-glacialgravel at the southern limit of the area that has been worked is only a few feet thick and is overlain by till. According

to MacLeod White* the pay gravel appears to thin southward and for this reason, and the difficulty of disposing of tailings near the lake, the lower section has not been worked.

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* Personal communication

BIRCH CREEK

Mining by individual started in 1899 and has continued intermittently until now. In 1902 a syndicate started to hydraulic surface gravel and this was continued during most seasons until 1920. The most productive years were from 1908-1913, and in 1913 included the recovery of a 73-oz. nugget. In general the operation was not successful because of lack of water and the fact that most of the operating seasons were very short.

Since 1920 little work has been done, and that only by a few individuals. In 1948 a steam shovel was installed above the upper end of the hydraulic pit but was not ready for operation until after the spring freshette and the operation has not been continued.

The continuation of the pay gravel southward from the hydraulic cut has been explored by drilling but the results are not known to the writer. If pay gravel does extend southward, disposal of tailings presents a problem.

Above the hydraulic pit some of the gravel has not been worked.

WRIGHT CREEK

Gold was discovered on this creek in 1898, and in the following year a large number of miners worked on the creek. The amount of gold recovered that year was exceeded only by the recovery from Pine Creek. The gold was in general coarser than from the other creeks, but the early work was limited largely to surface gravel and by 1910 most of it had been worked. Then for twenty years production was very low and little work was done.

In 1930 a partnership was formed and the partners set up a hydraulic plant and started to operate in lower central Wright Creek. This work was continued until pay gravel resting on bedrock was exposed in 1936. Since that time only a limited amount of work has been done, mostly shovelling in by individuals, near the mouth of Bonanza Creek.

The creek below the main hydraulic appears not to have been worked. Above the pit much of the surface gravel has been worked, but gold was still being recovered in 1950 from surface gravel, some of which was being washed down to sluices by use of automatic shooters.

OTTER CREEK

Gold was discovered on upper Creek in 1898 in surface gravels, and these were worked in a small way, until about 1916, by shovelling in and by hydraulicking. Exploration of the lower part of the valley started about 1902, but little happened until 1908 when a large-scale hydraulic operation was started. A pit was started east of the course of the present creek near the lake. Here the level of bedrock is below the surface of the

lake, and therefore bedrock was not exposed in the pit until it had been extended southward a considerable distance; 150,000 to 200,000 yards were moved each season by washing down banks 80 to 130 feet high. It is mentioned in Annual Reports of the Minister of Mines that bedrock was exposed in 1916, and the following year most of it was exposed and cleared, and for these two years, recoveries were higher than for the other years of this operation. The cut was continued southward but apparently bedrock was no longer exposed in it, and when the operation was stopped in 1922, only the rim of bedrock supposedly was exposed.

After 1922, underground work was done until 1928 when a new company was organized to start hydraulicking again. In 1929 this company built flumes and ditches to bring water from Union, Wright and Snake Creeks and the following year started to hydraulic the present channel of Otter Creek. A pit was started near where Otter discharges into Pine valley. In 1930 a stratum of gold-bearing gravel was uncovered and in the following year three such strata were encountered, which upstream merged into one. The hydraulicking continued until 1934 when it was stopped, presumably because unprofitable, and underground operations were started by the company which continued the work the next season. Thereafter the property was leased and operated by a group of laymen until 1941. It is apparent from an examination of the record of production that this period was the most productive in the history of the creek.

Since that period some exploratory drilling has been done, and some hydraulicking, but the gravels of the creek have not been worked on an extensive scale. It is apparent that the gravel in bedrock, worked by underground methods, must be comparatively high grade, but that the difficulty of hydraulicking to the bedrock gravel in the lower part of the creek has not been successfully overcome.

The surface gravel on upper Otter has been worked over and in recent years no work has been done there.

RUBY CREEK

Gold was reportedly discovered on this creek in 1899 but the first recorded production is in 1907. In 1909 a company was formed which made preparation to start hydraulicking. A pit was started and by the end of the 1911 season bedrock had been reached and gold-bearing gravel exposed. Hydraulicking continued upstream until 1924 when the upper limit of the ground held was reached. During this period this was one of the most productive creeks in the area, and in 1923 the production was greater than from any other creek. During this period some underground work was done in the lower part of the creek under lava flows and also in the central part of the creek, and the Preglacial gravels were found.

Starting in 1926, another hydraulic operation was started in the lower part of the creek, and the old channel was reworked and the pit widened. This was continued until 1942 when the upper limit of the ground held was again reached. Underground operations were continued also and some work was done most years until 1949.

Opposite the mouth of the valley that extends over to Cracker Creek, a shaft was started in 1920. By 1946 this had penetrated through about 135 feet of lava. In that year a company took over the ground and continued the shaft another 35 feet through gravel to bedrock. In 1947* a drift was driven upstream for about 40 feet and two crosscuts were driven, each about 125 feet long, but gold-bearing preglacial gravel was not found.

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* N. Forbes, personal communication.

The bedrock gravels have been mostly worked out in the lower part of the valley, but in the central part of the valley have only been worked from underground workings and some gravel remains. However, some of the workings are reported to have encountered till on bedrock and pre-glacial gravel is absent in these sections.

CRACKER CREEK

This creek was prospected at the beginning of the century but is not mentioned in reports of the Minister of Mines until 1916 when it was reported as being prospected. Some work was done also in the next two years and then nothing was done until 1932. From then until 1948 some work was done most years, but none of this work was successful in exposing pre-glacial gravel.

The most extensive working done in a period of several years consisted of a drift that extends upstream for about 1,200 feet. The drift encountered rim rock on the east of the channel about 500 feet from the portal and was turned slightly from this rim and encountered the other about 800 feet farther from the portal. The drift was continued for another 200 feet making the total length of the working about 1,500 feet. The face is about 100 feet below the creek and is an unknown distance above bedrock.

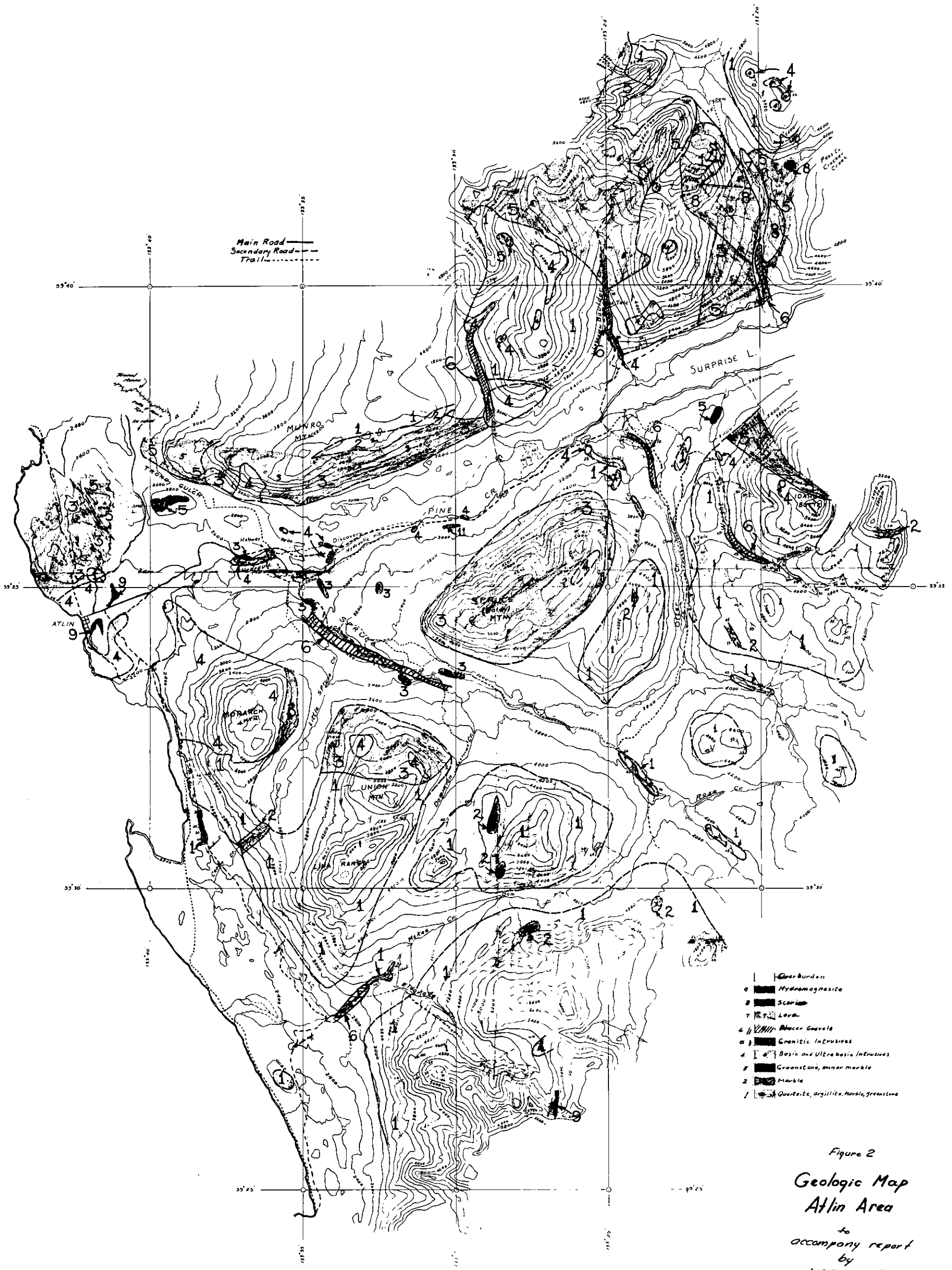

Figure 2

Geologic Map Atlin Area

to accompany report by J. M. Black, 1953

EM-1216-5663

AREA SHEET No. 1 ATLIN MINING DIVISION

Year.				Ruby			Wright			Boulder			Pine			Birch			McKee			Odonnell (Dixie)		
	Oz.	$ per Oz.	Value, $.	Oz.	$ per Oz.	Value, $.	Oz.	$ per Oz.	Value, $.	Oz.	$ per Oz.	Value, $.	Oz.	$ per Oz.	Value, $.	Oz.	$ per Oz.	Value, $.	Oz.	$ per Oz.	Value, $.	Oz.	$ per Oz.	Value, $.
1874																								
1875																								
1876																								
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1894																								
1895																								
1896							695	16.25	10320	445	15.50	6900	2425	16.25	39360	26	16	420	460	16.25	7700	18	16.25	300
1897							3749	16.25	61000	2440	15.50	37800	13823	16.25	225080	144	16	2240	2729	16.25	45750	120	16.25	1950
1898							1068	16.25	17500	1916	15.50	29700	4918	16.25	80000	15	16	240	1739	16.25	29000			
1899																								
1900																								
1901							905	16.25	14700	4900	15.50	76000	4017	16.25	65000	6	"	96	2218	16.25	37200			
1902							-			6030	15.50	93500	5500	16.25	89300				1864	16.25	31250			
1903							100	"	1625	5543	15.50	86000	6946	"	113000	428	"	6850	690	"	11550			
1904							234	"	3800	6962	15.50	108000	6924	"	112500	1038	"	16600	3689	"	61600			
1905							250	"	4050	8575	15.50	133000	5894	"	95500	199	"	3180	1729	"	28900			
1906							361	16.25	5873	3050	15.50	47336	6500	"	105486				2080	"	33550			
1907				103	16.25	1670	543	"	8850	3548	15.50	55000	9870	16.25	160500	378	16	6050	1458	"	24400			
1908				162	16.25	2635	135	"	2200	980	15.50	15200	3006	"	49000	1003	"	16500	1744	"	29200			
1909							192	"	3120	1760	15.50	27285	4160	"	67696	770	"	12300	2100	"	35125			
1910							458	"	7450	645	15.50	10050	4750	16.25	77407	879	"	14025	1857	"	31120			
1911				188	16.25	3050	160	16.25	2600	155	15.50	2480	7650	"	124050	1170	"	18700	1121	16.25	18685			
1912				860	"	14000	121	"	1972	194	"	3000	7460	"	121455	1059	"	16871	1030	"	17248			
1913				2670	"	43500	142	"	2300	129	"	2000	6700	"	108500	1000	"	16050	1670	"	28000			
1914				3944	"	64000	286	"	4650	530	"	8200	4080	"	66400	722	"	11560	2526	"	42160	277	16.25	4500
1915				4220	"	68470	80	"	1300	556	"	8613	3820	"	61997	551	"	8803	1970	"	32960	2250	"	36700
																						820	"	13360
1916				3400	"	55300	50	16.25	810	630	"	9750	2950	16.25	48000	390	16	6245	1600	"	26800	650	"	10560
1917				3380	"	53600	-			1620	"	25200	1300	"	21500	150	"	2400	1400	"	22400	-		-
1918				3840	"	62450	-			2085	"	31105	1655	"	26960	125	"	2000	281	"	4704	92	"	1500
1919				2500	"	40688	74	"	1200	2250	"	34804	1640	"	26632	116	"	1860				238	"	3867
1920				1340	"	21890	44	"	715	780	"	12105	1800	"	29200	171	"	2735				137	"	2225
1921				2900	"	47000	61	"	1000	232	15.50	3600	715	"	11630	47	"	750	24	16.25	400	-		-
1922				3570	"	58000				388	"	6000	924	"	15000	23	"	375	24	"	400	492	"	8000
1923				4189	"	67900				262	"	5016	765	"	12460				-		-	275	"	3500
1924				2900	"	45500	123	"	2000	258	"	4000	924	"	15000	125	"	2000	1075	"	18000	-		-
1925				417	"	6750	74	"	1200	270	"	4186	46	16.25	750	171	"	2780	660	"	11100	38	"	619
1926				182	"	2960	175	16.25	2840	127	"	2120	24	"	390	52	16	830	640	"	10700	16	16.25	260
1927				1199	"	19500	-			333	"	5150	114	"	1850				577	"	9670	22	"	358
1928				972	"	15800	58	"	944	185	"	2860	110	"	1790				300	"	5020	8	"	1300
1929				658	"	10760	67	"	1090	-									244	"	4090	58	"	941
1930				490	"	7960	98	"	1680				102	"	1660				81	"	1355	30	"	487
1931				1645	16.25	26700	66	16.25	1070	-			207	16.25	2370	4	16	64	670	16.25	11200	79	16.25	1281
1932				1193	18.00	20900	68	18.00	1250	6	17.00	105	1018	18.40	18750	-			1000	19.00	19000	139	18.00	2450
1933				767	22.00	17150	69	22.00	1550	136	21.75	2920	2019	22.40	45200	45	22.25	1000				86	22.00	1930
1934				1443	27.10	39108	144	27.10	3900	-			63	27.10	1710	83	26.70	2220				137	27.00	3710
1935				1412	27.00	38000	44	27.50	1215				815	27.50	22500	163	27.10	4420	323	28.50	9200	163	27.50	4500
1936				774	27.60	21380	192	27.85	5360	496	26.00	13100	393	27.00	10850	126	27.10	3420	516	28.50	14700	72	27.50	1985
1937				785	27.60	21650	373	27.00	10300	1129	26.00	30000	528	27.00	14600	277	27.10	7800	164	28.50	4680	41	27.00	1030
1938				721	27.60	19900	1168	27.60	32200	846	26.70	22350	564	27.60	15580	278	27.10	7500	160	28.50	4560	122	27.50	3360
1939				508	28.45	14500	639	28.45	18200	-			1089	28.45	31000	266	28.00	7450	288	29.35	8460	65	28.45	1850
1940				473	30.20	14300	463	30.20	14000	1645	28.90	47500	555	30.20	16750	201	29.80	6000	453	31.20	14100	112	30.20	3380
1941				291	30.20	8800	980	30.20	29600	812	28.90	23450	1267	30.20	38200	126	29.80	3750	502	31.20	15650	77	30.20	2320
1942				782	30.00	23600	152	30.20	4600	842	28.90	24350	1734	30.20	52380	556	29.80	16600	1587	31.20	49500	140	30.20	4220
1943				151	30.20	4550	7	30.20	215	-			101	30.20	3050	-		-	1470	31.20	45900	56	30.20	1690
1944				286	30.20	8650	-		-	856	28.90	24750	150	30.20	4520	3	29.80	90	229	31.20	7150	51	30.20	1540
1945				32	30.20	9680	92	30.20	2886	934	28.90	28700	76	30.20	2300	2	29.80	59	61	31.20	1900	77	30.20	2320
1946				169	28.80	4870	29	28.80	875	744	27.60	20450	48	28.80	1380				58	29.80	1720	120	28.80	3460
				55272		1068053	14729		293944	67811		1174155	134144		2256633	12898		232783	46953		867007	7612		127793

1M-1246-8668

AREA SHEET No. 2 ATLIN MINING DIVISION

Year.	Spruce Oz.	Spruce $ per Oz.	Spruce Value, $.	Offer Oz.	Offer $ per Oz.	Offer Value, $.	Cracker Oz.	Cracker $ per Oz.	Cracker Value, $.	Gold Run Oz.	Gold Run $ per Oz.	Gold Run Value, $.	Fox Oz.	Fox $ per Oz.	Fox Value, $.	Squaw Oz.	Squaw $ per Oz.	Squaw Value, $.	Snake Oz.	Snake $ per Oz.	Snake Value, $.	Jamieson Oz.	Jamieson $ per Oz.	Jamieson Value, $.	Bull Oz.	Bull $ per Oz.	Bull Value, $.
1874																											
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1897																											
1898				48	16.25	780																					
1899	2270	16.75	38000	275	16.25	4470																					
1900	1699	16.75	28400	122	16.25	1980																					
1901	3690	16.75	61900	178	16.25	2900				61	16	975															
1902	—			—						—																	
1903	6231	"	104200	28	16.25	455																					
1904	6349	"	106200																								
1905	6191	"	103500																								
1906	5150	"	86049	244	16.25	3952																					
1907	5068	"	85000	345	"	5500																					
1908	2582	"	43200	269	"	4375																					
1909	3100	"	52055	218	16.25	3545																					
1910	2158	16.75	36110	142	16.25	2305																					
1911	1724	"	28850	154	16.25	2500				—																	
1912	5400	"	90276	110	"	1780				—																	
1913	4500	"	75600	308	"	5000				31	16	500															
1914	3370	"	56370	208	"	3380				62	16	1000															
1915	7700	"	128755	92	"	1490				—																	
1916	6350	16.75	106200	725	"	11800	15	16	240				15		240												
1917	5760	"	96500	580	"	8120							5		80												
1918	3520	"	58870	677	"	11000																					
1919	2180	"	36494	335	"	5440																					
1920	2460	"	41250	620	"	10100																					
1921	2570	16.75	43050																								
1922	2270	"	38000																								
1923	2825	"	45630	549	16.25	8906																					
1924	2550	"	42000	924	"	15000																					
1925	751	"	12560	250	"	4060																					
1926	1087	16.75	17350	590	"	9600										—											
1927	855	"	14300	45	"	730										—											
1928	1219	"	22000	—												437	16	7000									
1929	1166	"	19500	325	"	5280				34	16	545				—											
1930	1767	"	29500	637	"	10350				—						—											
1931	3429	16.75	57400	250	16.25	4060										53	16	850									
1932	3524	19.00	67000	747	18.00	13750										301	18.15	5450									
1933	7086	23.15	164000	307	22.00	6886										600	22.15	13300									
1934	6960	28.00	195000	515	27.00	14000										361	26.70	9650									
1935	7958	28.50	227000	911	27.00	24700										556	27.00	15050	8	26.70	213						
1936	12705	28.50	362000	1179	27.50	32500										276	27.50	7628	3	26.70	80						
1937	14833	28.50	423000	4193	27.50	115800										208	27.60	5746	—								
1938	18367	28.50	522500	1757	27.50	48400										169	27.45	4670	—						18	27.50	495
1939	11613	29.50	346000	454	28.45	12960										94	28.45	2680	15	28.50	430				263	27.50	7348
1940	5747	31.00	179000	433	30.00	13100										5	30.00	151	10	30	300	5	28.50	143	207	30	5200
																						4	30	120			
1941	16759	31.20	523000	133	30.00	4020							8		240	60	30.20	1810				—					
1942	17106	31.20	533000	208	30.20	6280	10	30	300													5	30	150	668	30	18200
1943	7550	31.20	235000	108	30.00	3260	1	30	30																		
1944	6118	31.20	191000																								
1945	8581	31.20	268000													39	30.20	1179									
1946	9705	29.70	303000																								
	262603		6691899	20113		434448	26		570	188		3020	28		560	3158		75150	36		1023	14		413	1268		30430

1M-1246-8668 _____ AREA SHEET No. 3 ATLIN MINING DIVISION

Year.	Slate (Wilson)			Feather (Slate)			Consolation			Burdette			Davenport			Chehalis (Limestone)			Graham			Volcanic			Dominion		
	Oz.	$ per Oz.	Value, $.	Oz.	$ per Oz.	Value, $.	Oz.	$ per Oz.	Value, $.	Oz.	$ per Oz.	Value, $.	Oz.	$ per Oz.	Value, $.	Oz.	$ per Oz.	Value, $.	Oz.	$ per Oz.	Value, $.	Oz.	$ per Oz.	Value, $.	Oz.	$ per Oz.	Value, $.
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1900																											
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1902																											
1903																											
1904																											
1905																			19	16.25	310						
1906	177	16.25	2887																30	16.25	487	25	16	400	15	16	240
1907	405	16.25	6590																								
1908	211		3430																								
1909	117		1910																								
1910	102	16.25	1660																								
1911	71	16.25	1155																								
1912	104		1695																								
1913	142		2300																								
1914	66		1070																								
1915	71		1150																18	16.25	300	62		1000			
1916	15		244							5	16	80	5	16	80	5	16	80	10	16.25	162	15		240			
1917				5	16	80													5	16.25	81						
1918																											
1919	15		250																								
1920	34		560																								
1921	18		300																								
1922	18		300																								
1923																											
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1926																											
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1929																											
1930																											
1931																											
1932	4	18.40	74																								
1933																											
1934																											
1935																											
1936	27	27.40	745	6	27.80	165																					
1937	3	27.66	83				32		880																		
1938	-																										
1939	12	28.50	342																								
1940																											
1941																											
1942																											
1943																											
1944																											
1945																											
1946																											
	1612		27291	11		245	32		880	5		80	5		80	5		80	82		1040	102		1640	15		290

1M-1246-6663 _____ AREA SHEET No. 4 ATLIN MINING DIVISION

Year.	Horse			Willow			Little Spruce			Rose Ck.			Sundry - (Assay office Books, etc.)											
	Oz.	$ per Oz.	Value, $.	Oz.	$ per Oz.	Value, $.	Oz.	$ per Oz.	Value, $.	Oz.	$ per Oz.	Value, $.	Oz.	$ per Oz.	Value, $.	Oz.	$ per Oz.	Value, $.	Oz.	$ per Oz.	Value, $.	Oz.	$ per Oz.	Value, $.
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1876																								
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1896																								
1897																								
1898				172	16 35	2800																		
1899				1002	16 35	16800																		
1900																								
1901				130	16 35	2110																		
1902																								
1903																								
1904																								
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1906																								
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1909																								
1910																								
1911																								
1912																								
1913																								
1914										12	200													
1915										4	800													
1916	12	16	192																					
1917																								
1918																								
1919																								
1920							14	16	225															
1921																								
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1928																								
1929																								
1930																								
1931													2225	16 50	36700									
1932													343	18 70	6400									
1933													315	22 80	7180									
1934													1493	27 50	41100									
1935													744	27 50	20800									
1936													1776	27 95	49600									
1937													157	27 95	4390									
1938													594	27 95	16600									
1939													768	28 85	22200									
1940													1009	30 70	31000									
1941													174	30 70	5340									
1942													381	30 70	11700									
1943													356	30 70	10900									
1944													100	30 70	3070									
1945													39	30 70	1195									
1946													182	29 35	5340									
	12		192	1304		21710	14		225	61		1000	10656		273515									

RECAPITULATION - ATLIN DIST -

1M-1246-9658

AREA SHEET No. 5 MINING DIVISION

TOTALS INCLUDING

Year.	Sheet Totals. Oz.	$ per Oz.	Value, $.	Sundries - from Summ. Rec. sheet. Oz.	$ per Oz.	Value, $.	Adjustments. Oz.	$ per Oz.	Value, $.	Mine Mines Totals. Oz.	$ per Oz.	Value, $.	Oz.	$ per Oz.	Value, $.	Oz.	$ per Oz.	Value, $.	Oz.	$ per Oz.	Value, $.	Oz.	$ per Oz.	Value, $.
1874																								
1875																								
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1895																								
1896																								
1897																								
1898	4229	68580		Same ↓			461	6420		4690	16 60	75000 (1)												
1899	26557	433010					23443	366990		50000	↓	800000												
1900	11471	186820					16629	263180		28100		450000												
1901	16105	260881					2645	39119		18750		300000												
1902	13394	214250					11606	185750		25000		400000												
1903	19966	323680					7534	116320		27500		440000												
1904	25196	408700					7904	121300		33100		530000												
1905	22851	368440					6849	106560		29700		475000												
1906	17552	286260					10348	168740		28900		455000												
1907	21713	353560					3782	54440		25500		408000												
1908	10092	165740					2598	37260		12690		203000												
1909	12417	203036					83	3036		12500		200000												
1910	10991	180127					6209	94873		17200		275000												
1911	12383	202560					1667	23440		14050		225000												
1912	16338	268297					1762	21703		18100		290000												
1913	17569	288250					2131	26750		19700		315000												
1914	18046	295490					2134	26510		20180		322000												
1915	20009	329009					3571	47996		23580		377000												
1916	16849	277135					4351	61865		21200		339000												
1917	14060	231091					5040	73959		19100		305000												
1918	12195	198589					955	21911		13150		220500												
1919	9348	151175					1702	25825		11050		177000												
1920	7400	121005					1260	17595		8660		138600												
1921	6567	107730					2433	36470		9000		144200												
1922	7809	126075					1501	23125		9310		149200												
1923	8690	140512					1100	15988		9790		156500												
1924	8994	147000					406	3325		9400	16 00	150325												
1925	2677	43949					219	3280		2896	↓	49229												
1926	2853	47050					- 246	- 2752		2607		44318												
1927	3145	51558					- 717	- 10282		2428		41276												
1928	3289	56719					- 115	- 2756		3174		53958												
1929	2552	42146					- 144	- 1210		2408		40936												
1930	3205	52892		Same			- 64	505		3141		53397												
1931	6403	105595		8628		144269	- 249	- 167		8384		142529												
1932	8276	148729		8619		155129	- 579	555		8040		155684												
1933	10979	251010		11294		258190	225	7561		11299		267751												
1934	9842	272210		11335		313310	-1664	- 28478		10039		284832												
1935	12353	347798		13097		378598	130	4199		13227	28⁰⁰	382797												
1936	16765	473845		18541		522945	- 118	7281		18423	28⁰⁰	530726												
1937	22586	636061		22793		640451	-1038	- 16526		21483	28⁰⁰	623925												
1938	24270	671518		24864		689118	7	31420		24871	28⁰⁰	719538												
1939	16888	485295		17656		507295	302	26432		17958	30⁰³	583727												
1940	10408	311901		11517		348901	-	12581		11417	31⁰⁰	361482												
1941	21623	669040		21797		674380	615	35207		22712	31⁰³	709587												
1942	23122	715080		23503		726780	- 790	- 7665		22713	31⁴⁶	719115												
1943	9494	293695		9800		303495	14	6/39		9814	31⁰⁰	310734												
1944	7693	287700		7793		240770	33	7007		7826	31⁶³	247777												
1945	9954	311018		9903		318213	21	- 7151		10014	31⁷⁰	317462												
1946	10873	336755		11055		361095	-	- 26991		11055	30⁹⁶	334104												
	627996	12920006		638652		13213221	-2325	202906577		705229		15242303												
							126882																	

INC LIARD

(1) Total value was estimated.

377

ATLIN DIV.

1M-1246-8CC8

Totals Including _____ AREA SHEET No. 6 _____ MINING DIVISION

Year.	Sheet Totals of all columns: Oz.	$ per Oz.	Value, $.	Sundries - from Summ. Prod. Sh. 4 - column: S. Oz.	$ per Oz.	Value, $.	Totals from M.M. tables Oz.	$ per Oz.	Value, $.	Unaccountable Difference Oz.	$ per Oz.	Value, $.	Oz.	$ per Oz.	Value, $.	Oz.	$ per Oz.	Value, $.	Oz.	$ per Oz.	Value, $.	Oz.	$ per Oz.	Value, $.
1874																								
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1896																								
1897																								
1898	4229		68580	Same			75000			6420														
1899	26657		433010				800000			366990														
1900	11471		186820				450600			263180														
1901	16105		260881				300000			39119														
1902	13394		214250				400000			185750														
1903	19966		323680				440000			116320														
1904	25196		408700				530000			121300														
1905	22851		368440				475000			106560														
1906	17552		286260				455000			168740														
1907	21718		353560				408000			54440														
1908	10092		165740				203000			37260														
1909	12417		203036				200000			3036														
1910	10991		180127				275000			94873														
1911	12383		202560				225000			22440														
1912	16338		268297				290000			21703														
1913	17569		288250				315000			26750														
1914	18046		295490				322000			26510														
1915	20009		329004				377000			47996														
1916	16849		277135				338500			61365														
1917	14060		231041				305000			73959														
1918	12195		198589				220500			21911														
1919	9348		151175				177000			25825														
1920	7400		121006				138600			17595														
										INC. LIARD														
1921	6567		107730				144200			36470														
1922	7809		126675				149200			23125														
1923	8690		140512				156500			15988														
1924	8354		147000				150326			3326														
1925	2677		43949				49229			5280														
1926	2853		47060				44318			- 2732														
1927	3145		51558				41276			-10282														
1928	3289		56714				53959			- 2756														
1929	2552		42146				40936			- 1210														
1930	3205		52892	Same			53397			505														
1931	6403		105995	8628		142695	142528			- 167														
1932	8276		148729	3619		155129	155634			555														
1933	10979		251010	11294		258190	265751			7661														
1934	9842		272210	11955		313310	284832			-28478														
1935	12353		347798	13037		378598	382797			4199														
1936	16765		473845	18541		523445	530726			7281														
1937	22586		636061	22743		640451	623025			-16526														
1938	24470		671518	24864		688118	719538			31420														
1939	16888		485295	17656		507295	533727			26432														
1940	12600		317901	11517		348901	361482			12581														
1941	21623		663040	21797		674380	709587			35207														
1942	23122		715080	23503		726780	719115			- 7665														
1943	9444		293695	9800		304595	310734			6139														
1944	7693		237700	7793		240770	247777			7007														
1945	9934		317018	9935		318215	317062			- 1151														
1946	10873		355755	11055		361095	334104			-26991														
	627990		12329906	638652		13213221	15242308			2029087														