CANADA

DEPARTMENT OF MINES AND RESOURCES

MINES, FORESTS AND SCIENTIFIC SERVICES BRANCH

GEOLOGICAL SURVEY OF CANADA

PAPER 48-5

GEOLOGY AND MINERAL DEPOSITS OF AIKEN LAKE MAP-AREA, BRITISH COLUMBIA

(REPORT, MAP, AND FIGURE)

BY

J. E. ARMSTRONG AND E. F. ROOTS

OTTAWA

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(Preliminary Account)

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CONTENTS

Illustrations

GEOLOGY AND MINERAL DEPOSITS OF

AIKEN LAKE MAP-AREA, BRITISH COLUMBIA

INTRODUCTION

Aiken Lake map-area occupies an area of about 2,640 square miles in the Cassiar district of north-central British Columbia, between latitudes 56 and 57 degrees and longitudes 125 and 126 degrees.

Aiken Lake, in the west-central part of the area, may be reached by a winter tractor road, 95 miles long, from Germansen Landing on Omineca River. A fair motor road extends about 185 miles south from Germansen Landing, via Fort St. James, to Vanderhoof on the Prince Rupert branch of the Canadian National Railways. The northeastern part of the area is accessible from Summit Lake, 40 miles by road from Prince George, by means of Crooked, McLeod, Parsnip, and Finlay Rivers. Except during extreme low water, Ingenika River, which crosses the northern part of the area, is navigable for small river boats as far west as Wrede Creek. The area may be conveniently serviced, through several suitable lakes, by charter aircraft based at Fort St. James.

The first geological work in the area was done in 1893 by McConnell,[1] who mapped the northeastern part adjacent to Finlay River Valley as well as a strip of country bordering Omineca River, just south of the map-area. In 1927, Dolmage[2] examined the geology of Finlay River Valley, the lower part of Ingenika River Valley, including the Ferguson lead-zinc property, and traversed the abandoned Royal North West Mounted Police trail that crosses the central part of the map-area, following the valleys of Mesilinka and Tutizika Rivers and Hornway Creek. An examination of several mineral prospects in the vicinity of Uslika and Aiken Lakes was conducted in 1939 by Douglas Lay[3] of the British Columbia Department of Mines.

Systematic mapping of the areal geology was commenced in 1945 by J.E. Armstrong[4], and continued by the writer in 1946 and 1947.

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[1] McConnell, R.G.: Report on an Exploration of the Finlay and Omineca Rivers; Geol. Surv., Canada, Ann. Rept. 1894, vol. VII, pt. C. (1896).

[2] Dolmage, V.: Finlay River District, British Columbia; Geol. Surv., Canada, Sum. Rept. 1927, pt. A, p. 19 (1928)

[3] Lay, D.: Aiken Lake Area; B.C. Dept. of Mines, Bull. No. 1, 1940.

[4] Armstrong, J.E.: Aiken Lake (South Half), British Columbia; Geol. Surv., Canada, Paper 46-11, 1946.

The writer is indebted to officials of various mining companies for many courtesies extended, particularly to Mr. E. Bronlund of the Consolidated Mining and Smelting Company of Canada, Limited, and Mr. J. W. Burton of Springer Sturgeon Gold Mines, Limited; to officials of Central British Columbia Airways; and to several prospectors.

R. L. Christie, E.C. Halstead, and R.D. White ably assisted in the field work in 1945; J.O. Wheeler, R. L. Christie, P. E. Olson, W. H.Dow, and L. G.Dickinson in 1946; and J. O. Wheeler, R. B. Campbell, J.R.B. Billingsley, and A. E. Aho in 1947.

PHYSICAL FEATURES

The Rocky Mountain Trench, here occupied by Finlay River, crosses the extreme northeast corner of the map-area. The remainder of the area lies within the Omineca Mountain system, and is characterized by irregular, deeply dissected mountain units and broken massifs with little tendency toward well-defined ranges. The relief averages about 3,500 feet.

The mountains bordering the Rocky Mountain Trench exhibit bold, rounded summits and smooth ridges only slightly modified by alpine glaciation. The effects of glacial sculpturing become increasingly conspicuous toward the southwest, producing in the southwest corner of the map-area an extremely rugged, intensely glaciated topography. The continental ice-sheet of Pleistocene time covered all parts of the map-area, depositing erratics at elevations up to 7,600 feet. The overall direction of ice movement was to the east and northeast.

The map-area lies entirely within the Finlay River watershed, and the main streams flow east or southeast. Owing, however, to the characteristic land forms produced by asymmetrical glaciation, the drainage of the tributary streams within the mountain masses is predominantly to the northeast.

Above timber-line, which is about 5,500 feet above sea-level, bedrock is well exposed, but at lower elevations, slopes and valley floors are deeply mantled with glacial drift and colluvium, and rock outcrops are chiefly confined to stream canyons.

GENERAL GEOLOGY

SUMMARY STATEMENT

Consolidated formations within the map-area range in age from Proterozoic to Tertiary, and comprise a great variety of sedimentary volcanic, metamorphic, and intrusive types.

A thick, folded succession of regionally metamorphosed rocks of Late Proterozoic age strikes northwest across the central part of the area. This succession, the Ruby group, is overlain by the Ingenika group of Lower Cambrian age, which underlies almost all of the northern third of the map-area. Near the eastern border, these rocks have been further altered by processes of granitization and metamorphism.

An assemblage of volcanic and sedimentary rocks of Palaeozoic, and possibly Triassic, age occupies a belt 10 to 15 miles wide extending from the southeast corner of the map-area northwest to the head of Lay Creek. Similar rocks outcrop in the extreme southwest corner of the map-area. Parts of this general assemblage are lithologically similar to, and may be structurally correlated with, rocks that have been classified as Cache Creek; other parts are lithologically similar to rocks of the late Palaeozoic, Asitka group of the adjoining McConnell Creek map-area to the west; and some other formations may be of Upper Triassic age, and form part of the Takla group.

The Palaeozoic, and possibly later, assemblage is overlain, without apparent angular discordance, by the Takla group, a thick, folded succession of volcanic and minor sedimentary rocks of Upper Triassic and Jurassic ages.

Intrusive bodies range in composition from dunite and pyroxenite to granite and syenite. The most abundant are of Upper Jurassic or Lower Cretaceous age.

A conglomerate body, of probable Lower Cretaceous age, the Uslika formation, is apparently faulted into position in older rocks east and north of Uslika Lake.

Conglomerate of the Sifton formation of Upper Cretaceous or Paleocene age is found in Finlay River Valley in the northeastern corner of the map-area, and a band of conglomerate, sandstone, shale, and coal of probable post-Paleocene age outcrops west of Uslika Lake.

Unconsolidated deposits of Pleistocene and Recent ages cover the lower slopes and valley floors in all parts of the area.

TABLE OF FORMATIONS

Era	Period or epoch	Formation and thickness (feet)	Lithology
Cenozoic	Recent		Stream deposits, talus, soil
	Pleistocene		Glacial and fluvioglacial deposits
	Probable post-Paleocene		Conglomerate, sandstone, shale, and coal
Mesozoic or Cenozoic	Relations not known		
	Upper Cretaceous or Paleocene	Sifton formation	Conglomerate
	Relations not known		
Mesozoic	Probably Lower Cretaceous	Uslika formation 5,500	Conglomerate, minor argillite
	Erosional interval		
	Upper Jurassic or Lower Cretaceous	Omineca intrusions	Granodiorite, in part gneissic; quartz diorite, quartz monzonite; granite; minor syenite, diorite, and gabbro
			Diorite, in part gneissic; appinite, monzonite, gabbro; minor hornblendite, granodiorite. May be in part of same age as Trembleur intrusions
			Hornblendite and pyroxenite. May be in part of same age as Trembleur intrusions
	Intrusive contact		
	Upper Triassic and Jurassic	Takla group (12,000?)	Andesitic flows and breccias; minor basaltic flows; tuff, agglomerate, shale, conglomerate, limestone
	Erosional interval		
	Pre-Lower Jurassic		Granodiorite

Palaeozoic (?) and Mesozoic	Relations of Tremblour intrusions to Takla group and to pre-Lower Jurassic granodiorite not known		
	Post-Middle Permian, pre-Upper Triassic (?)	Tremblour intrusions (?)	Pyroxenite, hornblendite, minor peridotite, dunite, and serpentine. May be post-Takla
	Intrusive Contact		
	Pennsylvanian (?) and Permian	Cache Creek group 8,000 (?)	Andesitic and basaltic flows, tuffs, breccias, agglomerate; minor argillite, slate, chert
			Argillite, slate, ribbon chert, greenstone; minor tuff, limestone
	Relations of Cache Creek group to post-Lower Cambrian group not known; may be in part of same age. The Cache Creek and Ingenika groups are separated by an erosional interval.		
	Post-Lower Cambrian. Probably includes rocks of Takla and pre-Takla ages	18,000 (?)	Tuff, andesitic flows, argillite, sandstone, limestone, conglomerate
Palaeozoic	Relations not known		
	Lower Cambrian	Ingenika group 18,000 (?)	Quartz-chlorite schist, crystalline limestone, sericite schist, quartzite, quartzitic conglomerate, phyllite Feldspathic quartzite, granitoid gneiss, quartz-mica-feldspar schist, minor chloritoid schist, skarn, and pegmatite
	Possible erosional interval		
Proterozoic	Late Proterozoic	Ruby group 12,000	Quartz-mica schist, quartzite, garnetiferous schist Feldspathic quartzite, granitoid gneiss, quartz-mica-feldspar schist, minor pegmatite
	Post-Lower Cambrian; may be Tertiary		Dacite, feldspar porphyry, granitic dykes, sills, and stocks
	Post-Lower Cambrian		Granodiorite, aplite

SURFICIAL ROCKS

Ruby Group

The rocks of the Ruby group are exposed in an irregular belt 4 to 8 miles wide extending diagonally across the map-area from Osilinka River on the east border to Wrede Creek on the west. They, and those of the overlying Ingenika group, are folded into two fairly open northwesterly trending anticlinoria, each about 15 miles wide. Similar rocks outcrop in an area of about 12 square miles southeast of Ingenika Cone. The group comprises at least 12,000 feet of quartz-mica schists, micaceous quartzites, and quartzites; it is characteristically exposed around and has been named after, the Ruby group of mineral claims north of Osilinka River.

The most abundant rock is a golden brown to grey, relatively coarse-grained quartz-mica schist consisting chiefly of quartz and muscovite, with more or less plentiful biotite. Minor members of the group represent all gradations from quartz-mica schist through micaceous quartzite to relatively pure quartzite. For the most part these rocks probably represent metamorphosed sedimentary strata. Schistosity was observed to be approximately parallel with the limbs and crests of the major bedding structures, but cuts across many of the smaller folds.

The age of these rocks is unknown beyond the fact that they underlie less intensely metamorphosed rocks of Lower Cambrian age. The Ruby group is separated from rocks of known Lower Cambrian age by nearly 10,000 feet of apparently conformable strata in which varied rock types indicate changing conditions of deposition. It is, therefore, probably of Late Proterozoic age. In the Cariboo region to the south, lithologically similar rocks in comparable structural relations have been mapped as Proterozoic.

Ingenika Group

The Ingenika group, named from its characteristic development in the mountains south of Ingenika River, consists of not less than 18,000 feet of interbedded quartz-chlorite schist and phyllite, crystalline limestone, sericite schist, quartzite, quartzitic conglomerate, and slate. The group underlies almost all of the northern third of the map-area.

Fine-grained, thinly bedded, schistose and phyllitic rocks consisting chiefly of quartz and chlorite compose more than 60 per cent of this assemblage south of Ingenika River. North of the river, limestone and quartzite are more abundant, but relatively complex folding and faulting renders any estimate of rock thicknesses or of proportions of lithological types of little value. The limestone occurs in large lenticular bodies, which attain a maximum thickness of more than 4,000 feet. The typical limestone is blue-grey to creamy, highly crystalline, poorly bedded, and in many places contains persistent zones of sugary or sheared, buff-coloured rock consisting of recrystallized calcite and abundant sericite. Beds of conglomerate up to 200 feet thick containing rounded quartz pebbles about one-third inch in diameter in a siliceous matrix are found in the lower and middle parts of the group. Remarkably pure, fine-grained, white quartzite outcrops on Ingenika Cone as a distinctive horizon marker about 500 feet thick in the mountains east of Polly Creek. Chlorite is a characteristic mineral of all the rocks except the limestone, conglomerate, and quartzite.

At several localities within the map-area, grey to blue-grey, sericitic phyllites and schists of this group produce, upon weathering, a characteristic encrustation of soluble salts. A sample of this efflorescent material from the mountains south of Mesilinka River was examined by Dr. E. Poitevin of the Section of Mineralogy, Geological Survey, who reported on it as follows:

"This sample is composed of water soluble and insoluble portions. The insoluble portion, which is small, is mainly calcite (lime carbonate). The soluble portion is composed mainly of nitor (nitrate of potash) and of appreciable amounts of lime sulphate. The glassy nitrate of potash grains were examined under the microscope, and have all the optical properties of niter."

The walls of the canyon of a small creek flowing into the Mesilinka about 7 miles east of Jackpine Lake are coated with a white crystalline salt. The salt has formed to a depth of about 2 inches on vertical surfaces, and has accumulated on a few protected ledges to a depth of nearly 2 feet. Samples of these salts and their source rocks were analysed by Mr. R.J.C. Fabry of the Section of Mineralogy, Geological Survey, who reported as follows:

"Sample 32R, (salt from silver-brown weathered schist).
$MgSO_4$ and $CaSO_4$ with some water. In acid solution shows some iron.

"Sample 33R, (source rock of Sample 32R).

SiO_2	59.46
Al_2O_3	14.15
Fe_2O_3	4.44
FeO	3.58
CaO	0.66
MgO	3.54
K_2O	2.24
Na_2O	1.88
$H_2O(+)$	2.37
$H_2O(-)$	0.38
TiO_2	0.68
MnO_2	0.02
CO_2	6.79
SO_3	0.26
S	0.29
	100.74
Less O/S	0.11
	100.63

"Sample 34R (salt from blue-grey phyllitic or talcose schist), similar to 32R, but calcium is more abundant than magnesium.
"Sample 35R (source rock for sample 34R)

SiO_2	44.45
Al_2O_3	30.15
Fe_2O_3	3.27
FeO	3.66
CaO	0.42
MgO	2.98
K_2O	6.12
Na_2O	1.06
$H_2O(+)$	4.93
$H_2O(-)$	0.79
TiO_2	0.84
MnO	tr.
CO_2	none
SO_3	0.89
S	0.12
	99.68
Less O/S	0.04
	99.64

"Sample 36R (from exposed points of grey-brown schist) mainly basic ferric suphate.

"Sample 57R (bulk sample, chiefly from rocks similar to sample 33R). A quantitative analysis shows this to be a sulphate of magnesium and lime when in aqueous solution. However, in acid solution lime can also be detected.

"A quantitative analysis gave the following results:

CaO	1.78
MgO	6.90
Fe_2O_3	4.60
H_2O	20.18
SO_3	12.22
Insol	54.23
	99.91"

Near the Swannell mineral claims on Swannell River an exposure of dark grey, sheared, argillaceous, pyritized limestone is encrusted to a depth of about one-quarter inch with a pale yellow salt. This salt was analysed by Mr. Fabry who reported it to be "mainly basic iron sulphate with traces of lime and magnesium."

Fossils collected from limestone beds in this group were submitted to Dr. V.J. Okulitch[1] of the University of British Columbia for examination. He reported on them as follows:

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[1] Okulitch, V.J. and Roots, E.F: Lower Cambrian Fossils from the Aiken Lake Area, British Columbia, Trans. Roy Soc, Canada, Vol XLI, Ser.III, Sec. IV, pp 37-46 (1947)

Collection F1R, from a small lens of limestone in chloritic phyllite north of Osilinka River, apparently nearly 9,500 feet above the lowest exposed beds of the Ingenika group in this locality, includes

Ajacicyathus purcellensis Okulitch

A. clarus Vologdin

A. osilinka n.sp.

Coscinocyathis sp.

Dendrocyathus inexpectans n.sp.

Protopharetra rootsi n.sp.

Archaeocyathus sp.

Age: Lower Cambrian, equivalent to the Donald formation of the Dogtooth Mountains, B.C.

Collection F6R, from the large bed of limestone east of Swannell River on Chase Mountain; contains algal remains; similar in appearance to those common in fossils of the Donald formation.

Age: Lower Palaeozoic, probably Lower Cambrian.

Collection F7R, from an open pit on No. 3 vein, Ferguson property, Ingenika Mines, Limited, contains poorly preserved tubes resembling Salterella or Hyolithes.

Age: possibly Lower Cambrian.

Metamorphosed and Granitized Equivalents of Ruby and Ingenika Groups

About 200 square miles of Lower Cambrian and Late Proterozoic formations outcropping on the north side of Mesilinka River Valley between Jackpine Lake and Ingenika Cone have been converted to an assemblage of feldspathic quartzite, granitoid gneiss, quartz-mica-feldspar schist, with minor skarn, chloritoid schist, and pegmatite. At the southwest corner of this area, just east of Jackpine Lake, a small body of granodiorite appears to intrude this assemblage. These altered rocks grade into unaltered types, and structural features of the adjacent schists and quartzites are retained in them. They appear to owe their distinctive composition to granitization processes superimposed on those of regional metamorphism affecting all of the Cambrian and Precambrian rocks. The small stock near Jackpine Lake may represent part of the igneous body responsible for the additional alteration.

Within the granitized area, various rock types have been altered as follows: the quartzites have been recrystallized; there has been a slight but general coarsening of texture and a tendency toward foliation, accompanied by the development of considerable interstitial orthoclase and sodic plagioclase. The quartz-mica schists, in addition to the development of feldspar, are characterized by an almost complete loss of muscovite, a marked increase in the proportion of biotite, and the loss of schistosity. In many places the quartites and quartz-mica schists have been changed to rocks that may best be termed granitoid gneisses. They are essentially fine-grained, slightly foliated rocks composed of quartz, feldspar, and biotite. Garnets, common in the regionally metamorphosed rocks, are almost entirely absent from the more granitized types. Some of the chloritic schists and slates have developed distinct rock types characterized by a decrease of chlorite and sericite, an increase of biotite, and a marked increase of quartz. In some zones, chloritoid schists are well developed. Beds of limestone in the granitized area near the granodiorite body have been converted into a distinctive skarn composed principally of quartz, grossular garnet, tremolite, diopside, and clinozoisite.

A few, small, irregular bodies of orthoclase-muscovite pegmatite were observed. All have sharp, apparently intrusive contacts and are near the granodiorite body near Jackpine Lake.

These granitized rocks are similar to and probably of the same origin and age as types included in the Wolverine complex of the Manson Creek map-area[1]

[1] Armstrong, J.E., and Thurber, J.B.: Manson Creek map-area, British Columbia; Geol. Surv., Canada, Paper 45-9, p.5 (1945).

Post-Lower Cambrian

A thick assemblage of interbedded volcanic and sedimentary rocks outcrops in a belt 6 to 10 miles wide striking northwesterly across the map-area from east of Uslika Lake to the headwaters of Lay Creek. This belt occupies two distinct mountain groups separated by about 20 miles of relatively low country where outcrops are confined to isolated ridges and stream canyons. The rock assemblage, grouped into one map-unit, consists of basaltic and andesitic flows intercalated with tuff, limestone, sandstone, grit, conglomerate, and chert. It appears to include rocks of Takla and pre-Takla age.

The southern mountain group underlain by these rocks lies east of Osilinka River, east and northeast of Uslika Lake, and west of the Osilinka between Vega and May Creeks. The succession in these mountains consists of at least 11,000 feet of strata. The characteristic rocks are fine to very fine-grained, well-bedded, grey-green to green tuffs that weather yellowish green, green, and reddish brown, and impart a conspicuous banded appearance to the outcrops. These tuffs, now composed principally of chlorite, altered plagioclase feldspar, and pyroxene, were probably originally of andesitic or basaltic composition. The uniformly banded tuffs constitute the lowermost 600 feet of the section exposed northeast of Vega Creek. Overlying them are about 400 feet of uniformly banded tuffs with minor, black, slaty argillite, and these in turn are overlain by at least 6,000 feet of banded tuffs, with minor, intercalated, grey-green, massive to porphyritic andesitic or basaltic flows and a few small bodies of gritty arkose and greywacke. Above the highest known flow are about 3,500 feet of uniform, very fine-grained, banded tuffs. The youngest rocks exposed in this section consist of about 800 feet of argillite, grit, and banded tuffs.

In the relatively low area extending northwest from the southern mountain group to the southeast end of Ingenika Range, most outcrops show banded tuffs and intercalated flows. The section exposed on Tutizika River reveals a relatively large proportion of argillaceous rocks. An observed section 4,500 feet thick includes an aggregate of about 1,500 feet of dark grey to black, massive to slaty, calcareous to carbonaceous, argillaceous rocks, interbedded with the tuffs and flows. The highest members in this section are sheared, and local alteration has developed much serpentine in the andesitic rocks and graphitic or ankeritic material in the argillaceous and calcareous sedimentary rocks.

The strata of Ingenika Range, lying between Lay Creek and Swannell River, are, as elsewhere to the southeast, characterized throughout by conspicuous, uniformly banded tuffs, but contain in addition a greater variety of normal sedimentary material. Two typical sections, one in the southeastern and the other in the northwestern parts of the range, are approximately as follows:

Section at Polaris Creek	Approximate thickness (feet)
Uniformly banded tuff, with interbedded, black, slaty argillite	500
Uniformly banded tuff, minor andesitic flows	2,000
Uniformly banded tuff, minor argillite	600
Banded tuff; minor andesitic and basaltic flows	4,500
Blue-grey limestone, red massive tuff, uniformly banded tuff, conglomerate, sandstone, grit, greywacke	1,200

Section at Polaris Creek (cont'd)	Approximate thickness (feet)
Uniformly banded tuff	1,600
Banded tuff, interbedded agglomerate; minor andesitic or basaltic breccia	2,500
Uniformly banded tuff, with intercalated, porphyritic, andesitic flows	4,000
Total	16,900

Section North of Lay Creek, near West Border of Map-area

Intercalated andesite and banded tuff (upper part poorly exposed)	5,000
Banded tuff, grit, limestone, conglomerate	1,500
Basaltic and andesitic flows and breccias, banded tuff	1,200
Conglomerate	40
Serpentine (may be originally a pyroxenite sill)	100
Sandstone, grit, banded tuff, andesitic flows, limestone	550
Uniformly banded tuff; minor narrow bends of limestone; greywacke	1,200
Limestone	200
Banded tuff, with intercalated andesitic flows; greywacke	2,000
Very fine-grained, uniformly banded tuff; minor andesitic flows	1,000
Fine-grained banded tuff and massive andesitic flows	400
Total	13,200

The conglomerate beds exposed in this range consist for the most part of pebbles of banded tuff, black argillite, and brown sandstone or dark brown greywacke in an impure sandy matrix. One of the beds in the northwestern end of the range contains rounded, weathered boulders of syenite or diorite, lithologically distinct from any intrusive body known in the area. This conglomerate is, apparently, a local feature, as no evidence of an unconformity along its equivalent horizon could be found in other parts of the range.

Evidence as to the age of this map-unit is conflicting. The rocks of the southeastern section would appear to be a continuation of the volcanic and sedimentary rocks of the lower part of the Takla group of Upper Triassic or later age as mapped in the Manson Creek[1] and Takla[2] map-areas,

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1 Armstrong, J.E., and Thurber, J.B.: Manson Creek Map-area, British Columbia; Geol. Surv., Canada, Paper 45-9, p. 8(1945); also Map 876A (1946).

2 Armstrong, J.E.: Geol. Surv., Canada, Map 844A, Takla, B.C. (1946).

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except that they contain a greater proportion of banded tuffs as compared with flow rocks, but the only fossils found in them to date, non-diagnostic crinoid stems, are not known in the Upper Triassic rocks of the other two map-areas.

In the Ingenika Range, similar-appearing crinoid stems are abundant in the lower, middle, and upper middle parts of the assemblage. In the lower middle part, thin lenses of limestone and beds of greywacke have yielded corals, bryozoa, sponges, gastropods, and cephalopods. Tentative identification of the more diagnostic of these has indicated ages ranging from Ordovician to Pennsylvanian.

At two places southwest of Swannell River Valley, the contact between rocks of this unit and the underlying Ingenika group is exposed. In both places the rocks near the contact are somewhat sheared, but no angular unconformity or evidence of erosion was observed. The contact may, however, be occupied by a fault parallel or nearly parallel with the bedding.

The rocks of this map-unit are overlain to the southwest by volcanic flows and intercalated sedimentary rocks of the Takla group, from which Upper Triassic and Lower Jurassic fossils have been collected. The division between the two map-units has been difficult to place, as there is little evidence of structural discordance, and individual outcrops of each group are in many instances lithologically similar. In the southern part of the map-area the contact has been placed below a band of conglomerate exposed west of Uslika Lake and on Thane and Vega Creeks, containing pebbles of banded tuff and of intrusive rock not unlike that composing some of the pebbles in one of the bands of conglomerate in the Ingenika Range. In other respects these conglomerates are not at all similar. In the western part of the map-area the two map-units are assumed, provisionally, to be in contact along a fault down Lay Creek Valley.

Although this assemblage forms a distinct lithological and structural map-unit, its great thickness and its diversity of minor rock types, indicating repeated vulcanism and varying conditions of deposition, lead to the inference that its formation occupied a somewhat prolonged period of Palaeozoic and possibly early Mesozoic time.

Cache Creek Group

In the southeastern part of the Aiken Lake map-area rocks of the Cache Creek group comprise an apparently conformable succession of interbedded sedimentary and altered volcanic rocks not less than 8,000 feet thick. Similar rocks are exposed in the valley of Omineca River in the extreme southwest corner of the map-area.

The dominant sedimentary rock is a thin-bedded, grey to black, rusty weathering, carbonaceous argillite. Lens-like bodies, up to 3,000 feet thick, of blue-grey, massive limestone are intercalated with the argillite. Minor sedimentary rocks include thin-bedded, crumpled, ribbon cherts, consisting of contorted beds of blue-grey to creamy chert separated by fine partings of argillite.

Bands of greenstone up to 1,500 feet thick are interbedded with the sedimentary rocks. The greenstones represent chloritized and amphibolitized flows, tuffs, breccias, and agglomerates of original andesitic or basaltic composition.

In the Aiken Lake area, this lithological unit has yielded no diagnostic fossils, but appears to represent the northward extension of similar rocks that contain fossils of Pennsylvanian and Permian age, and have been identified with the Cache Creek group of central British Columbia.

Takla Group

The Takla group was named from its abundant occurrence in the Takla map-area, adjoining the Aiken Lake area to the south.[1]

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[1] Armstrong, J.E.: Geol. Surv., Canada, Map 844A, Takla, B.C. (1946)

In the Aiken Lake area formations of the Takla group comprise more than 12,000 feet of volcanic and minor intercalated sedimentary rocks. They occupy a northwesterly trending belt, up to 10 miles wide, extending from Uslika Lake to Aiken Lake and beyond.

Grey, green, and black, porphyritic and non-porphyritic andesites and basalts predominate. Intercalated with the lavas are coarse, angular breccias and black, grey, and green tuffs. West of Uslika Lake, the lowest part of this assemblage is marked by a bed of conglomerate at least 100 feet thick. The conglomerate is composed of well-rounded pebbles up to 6 inches in diameter of grey granodiorite, diorite, fresh and altered andesite and basalt, serpentine, minor chert, and sedimentary rocks, and many coaly or woody fragments in a grey-green, gritty matrix. At the Vega property the lava exposed underground contains rounded pebbles of similar granodiorite.

Small lenses and narrow, discontinuous beds of dark grey to black, carbonaceous limestone are found at several horizons. The upper part of the section west of Lay Creek contains at least 3,000 feet of interbedded argillite, siltstone, greywacke, and limestone.

Diagnostic fossils were collected from these rocks in two localities only, and identified by F.H. McLearn of the Geological Survey:

(1) Small limestone lens in andesite west of Lay Creek. This lens contains Halobia or Daonella, sp., Juvavites 2 sp., of Triassic, probably Upper Triassic age.

(2) In a ground sluice exposure at Vega camp a specimen of Arnioceras sp. The age of the Arnioceras is the Sinemurian age of the Lower Lias of England, that is, early Lower Jurassic.

Uslika Formation

The Uslika formation, which is well exposed east and north of Uslika Lake, consists of conglomerate not less than 5,500 feet thick. Well-rounded boulders and pebbles up to 10 inches in diameter of a great variety of volcanic rocks, tuffs, fine clastic sediments, cherts, and schists make up some zones; other zones, amounting to about one-third of the total observed thickness, are principally composed of granitic pebbles superficially similar to the various rock types found in the Omineca intrusions; the pebbles of still other zones are chiefly of white vein quartz and chert. The matrix is a grey to brown, sandy to gritty greywacke. In a few zones the pebbles are coated with shiny hematite. The conglomerate is remarkably uniform, the largest sandy or shaly lenses being no more than a few inches thick.

On Vega Creek, just west of the conglomerate but not observed in contact with it, about 300 feet of black to dark grey, carbonaceous argillite containing thin beds of fine chert-pebble conglomerate are exposed in what appears to be conformable relations with the main conglomerate body. A collection of fossil plants was made from this locality, and was reported on by W.A. Bell of the Geological Survey as follows:

"Caytoniales
Sagenopteris sp.
Cycadophyta
Nilssonia ? sp. (too poorly preserved to be certain this isnot Taeniopteris sp.)
Conifers
Pagiophyllum=? Elatides curvifolia (Dunker)

Sagenopteris is a common pre-Cretaceous Mespzoic genus, but is also common in the younger Aptian (Lower Cretaceous) and occurs also in the younger Albian (latest Lower Cretaceous). Elatides curvifolia is a common Aptian species; its doubtful identification in this instance is due to the poor preservation of a single specimen. More material from this locality should be gathered if possible. The florule is clearly Mesozoic, and is tentatively considered to be more probably Aptian or Albian than earlier. If as late as Albian, angiosperms should be present and should be carefully sought."

Older rocks outcrop on both sides of the Uslika conglomerate. Wherever observed, the contact of the conglomerate lies along a fault. This fact, together with the abundance of granitic pebbles similar to the rocks of the Omineca intrusions, and of others similar to the various rock types present in the Takla group, has led to the conclusion that the conglomerate probably post-dates the main period of intrusion, and has been downfaulted into older rocks.

Sifton Formation

A body of pale pinkish buff, blue-grey weathering conglomerate about 3 miles long and ½ mile wide outcrops in the floor of the Rocky Mountain Trench in the northeast corner of the map-area. The conglomerate consists of subangular to rounded pebbles, averaging about 1½ inches in diameter, of limestone, sandstone, schist, slate, and quartz, in an impure silty matrix. Water-worn, subangular pebbles and boulders up to 8 inches in diameter of blue-grey or buff-coloured limestone, mostly well bedded, comprise about 70 per cent of the rock. About 15 per cent is composed of pebbles of brownish grey to buff-coloured, medium- to fine-grained, well-bedded, calcareous sandstone. Minor constituents include pebbles of white quartz, blue-grey chert, or highly silicified limestone, and a bright red, soft, sheared rock that may be a ferruginous limestone or slate or a weathered volcanic rock. The matrix of the conglomerate is shaly to silty, highly calcareous, and locally ferruginous.

The conglomerate is roughly sorted, but only local evidences of bedding could be obtained. These indicated a strike south 70 degrees east, trending diagonally across the Rocky Mountain Trench, and a moderately steep dip to the northeast. The conglomerate outcrops on a long, low ridge that trends parallel with the trench. No estimate of the thickness of the conglomerate was obtained.

This conglomerate appears to be part of the belt of clastic sedimentary rocks mapped by McConnell[1] along the floor of the Rocky Mountain Trench from the mouth of the Ingenika northwest to Sifton Pass and beyond. Plant remains collected from these rocks were identified by Sir William Dawson as of upper Laramie age. Upon re-examination, W.A. Bell of the Geological Survey reports that these plants are of Upper Cretaceous or Paleocene age. The northern continuation of this belt, in Kechika River Valley, was examined by M.S. Hedley and S.S. Holland for the British Columbia Department of Mines[2]. They gave the name Sifton formation. They collected plant fossils, which were identified by W.A. Bell as of Upper Cretaceous or possibly Paleocene or Eocene age. No fossils were found in these rocks in the Aiken Lake map-area, but they are regarded as a part, probably an upper part, of the Sustut group of areas to the west.

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[1] McConnell, R.G.: Report on the Exploration of the Finlay and Omineca Rivers; Geol. Surv., Canada, Ann. Rept. 1894, pt. C, p. 35 (1896).

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[2] Hedley, M.S., and Holland, S.S.: Reconnaissance in the area of the Turnagain and Upper Kechika Rivers; Dept. of Mines, Bull. No. 12, p.42 (1941).

Post-Paleocene (?)

On the west side of Osilinka River Valley south of Uslika Lake, a body of conglomerate, sandstone, shale, and coal about a mile long and 300 feet wide is surrounded by andesitic flows, tuffs, and breccias of the Takla group.

Conglomerate, consisting of well-rounded pebbles up to 5 inches in diameter, of light brown granitic rock, black chert, green andesite or tuff, white quartz, brown sandstone, and minor slate, schist, and argillite, in a brownish, sandy to gritty matrix, comprises the largest single unit of this assemblage. The conglomerate is overlain by beds of brown to grey, massive shale; coarse, micaceous sandstone containing many woody fragments; and thin seams of coal and coaly shale. The largest observed coaly seam was 18 inches thick.

Plant remains from an impure sandstone horizon in this series were examined by W.A. Bell, who reported on them as follows:

"Coll. F1R -

Equisetum sp.

Sequoia langsdorfii (Brongniart) Heer

Alnus carpinoides (?) Lesquereux

The florule is too small for judgement as to precise age, but is considered to be Tertiary and probably post - Paleocene."

Post-Paleocene sedimentary rocks in north-central British Columbia are, so far as is known, confined entirely to valley bottoms. The presence of this assemblage in Osilinka Valley may indicate that the valley existed in pre-Tertiary or early Tertiary time. The present valley, however, is believed to be underlain by a fault; brecciated andesitic rocks of the Takla group outcrop immediately east of the Tertiary conglomerates, and it may be that the Tertiary rocks were down-faulted into their present position.

INTRUSIVE ROCKS

Post-Lower Cambrian

An irregular body of granodiorite is exposed east of Jackpine Lake. Transgressive contacts, and local formation of skarn and other typical contact-metamorphic rocks around its borders indicate that this body is at least in part intrusive. However, it occurs in highly metamorphosed gneisses and schists, and the probability of its originating through processes of extreme metamorphism and local re-melting must be considered. This body cuts Lower Cambrian strata.

The only other definitely intrusive rocks found in the Cambrian or Precambrian assemblages are small dykes, sills, and stocks of aplite, dacite, and feldspar porphyry in the vicinity of Jimmay Creek and south of Chase Mountain. These are most abundant in the rocks assigned to the Ruby group, and are lithologically quite distinct from any other intrusive rocks found in the map-area. They are lithologically similar to Tertiary intrusions observed in the Fort Fraser area to the south.[1]

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[1]Armstrong, J.E.: Fort Fraser, West Half; Geol. Surv., Canada, Map 631A (1941).

Pre-Jurassic

Stocks of pink granodiorite, too small to be shown on the map, are exposed along the south fork of Thane Creek. They appear to be overlain unconformably by andesites of the Takla group. Boulders of this granodiorite are found embedded in the lavas exposed by the underground workings at the Vega property.

Tuffs interbedded with the andesites containing fragments of these intrusive rocks have supplied fossils of lower Lower Jurassic age. The intrusions are, therefore, of pre-Jurassic age.

Trembleur Intrusions (?)

Bodies of ultrabasic rock are found in several parts of the map-area At least four bands of serpentinized peridotite, each less than 400 feet wide, cut presumably Cache Creek strata south of Wasi Lake. A band of serpentine 150 feet thick, probably originally a pyroxenite sill, overlies Upper Palaeozoic rocks in the Ingenika Range. An irregular stock about 25 square miles in area in the Ingenika Range east of Polaris Creek is composed of coarse-grained hornblendite and pyroxenite with minor peridotite, dunite, and serpentine. The stock contains small, irregular, apparently intrusive bodies of gabbro. Along its southern border the hornblendite and pyroxenite grade, with addition of plagioclase, into diorite and gabbro.

On the bases of lithology, these ultrabasic bodies have been grouped with the Trembleur intrusions of the Takla and Manson Creek areas to the south, where they are believed to be of pre-Upper Triassic age. However, their age in this area is not known, and the possibility that they are at least in part of the same age as the ultrabasic bodies associated with the Omineca intrusions must be considered.

Omineca Intrusions

The name Omineca intrusions has been applied to the numerous bodies of intrusive rocks of Upper Jurassic or Lower Cretaceous age that are exposed in the Omineca Mountains. These bodies range in size from sills and dykes to batholiths, and in composition from pyroxenite to granite. Granodiorite, quartz diorite, and quartz monzonite are the predominant rock types.

The largest known body of these rocks is the batholith that extends from the Nation Lakes northwest across Manson Creek, Takla, Aiken Lake, and McConnell Creek map-areas. The batholith, generally known as the Hogem batholith, occupies an area of approximately 450 square miles in the southwest part of Aiken Lake map-area. A wide range of rock types is represented in this body, which probably represents a prolonged period of intrusion. The predominent rocks are uniform, medium- to coarse-grained, grey, buff, and pink granodiorite, quartz diorite, and quartz monzonite. Isolated bodies of pink or white granite, up to 20 square miles in area, usually with sharp intrusive contacts, are quite common, and a few small bodies of syenite were observed.

About one-quarter of the exposed batholith is composed of distinct bodies of diorite, gabbro, appinite, and allied rocks. The boundaries of some of these bodies show a uniform gradational change within a few feet from dark green or grey diorite to light grey or buff normal granodiorite and quartz diorite; in other bodies the diorite is sharply intruded by the normal granodiorite. The predominant ferromagnesian mineral in these basic rocks is hornblende.

The stock in the vicinity of Miller and Croydon Creeks is a coarse-grained hornblende diorite or appinite consisting chiefly of dark green hornblende and pink feldspar. Pegmatitic patches, with hornblende crystals up to 8 inches in length, are common in this body, and intrusive breccias, commonly accompanied by abundant epidote, are well developed.

The mountains south of Mesilinka River near the head of Abraham Creek expose a stock of hornblendite about 3 square miles in area, surrounded and cut by a complex assemblage of banded, feldspathic hornblendite, hornblende diorite, appinite, and syenite. Breccias and banded dykes of hornblende-feldspar-epidote rocks are very abundant in this body. The whole assemblage is enclosed in, and intruded by, normal granodiorite. In this vicinity the hornblendite is exposed on the higher peaks and granodiorite is found in the valleys, indicating a possible rude basin-like stratification within a vertical range of 3,500 feet.

North of Tutizzi Lake and south of Mesilinka River, bodies of medium- to coarse-grained hornblendite, with minor pyroxenite, are found along the eastern margin of the Omineca-Cassiar batholith. These bodies are intruded by the granodiorite and diorite of the main part of the batholith. Small stocks of hornblendite and biotite pyroxenite outcrop within the batholith along the extreme west border of the map-area north and south of Miller Creek. Some of these ultrabasic bodies included here may be of the same age as the Trembleur intrusions.

At several localities within the batholith, irregular bodies of quartz diorite and diorite, usually less than 15 square miles in area, have a pronounced gneissic structure. The gneissosity is not oriented uniformly for the different bodies, and bears no obvious relation to the predominant shear zones or fracture patterns cutting the batholith. The bodies of gneiss have sharp contacts, and in some places are definitely intruded by fresher, massive rocks. They may represent assimilated inclusions of pre-batholithic formations, or older, sheared phases of the Omineca intrusions.

The Omineca intrusions cut the Upper Triassic and Lower Jurassic formations of the Takla group. The Lower Cretaceous, Uslika conglomerate near Uslika Lake contains boulders lithologically similar to the rocks of the Omineca intrusions. In the McConnell Creek map-area to the west, the granite rocks are overlain by Upper Cretaceous rocks of the Sustut group. Therefore, the Omineca intrusions are probably of late Jurassic or early Cretaceous age.

STRUCTURAL GEOLOGY

FOLDING

All stratified formations in the map-area have a northwesterly regional trend. Southwest of a line extending down Tucha Creek, the lower part of Pelly Creek Valley, and through Tomias Lake Valley, the Lower Cambrian and Late Proterozoic rocks have been folded into two, fairly open, northwesterly trending anticlinoria, each about 15 miles wide, which may be parts of the same structure displaced by a fault along Mesilinka River Valley. The axial plane of each anticlinorium is inclined to the northwest, so that dips southwest of the crest are in general considerably steeper than those to the northeast. Subsidiary folds, 1,000 to 5,000 feet from crest to crest, whose axes are roughly parallel with that of the major anticlinorium, are characteristically open. The schists of the Ruby group are however commonly minutely crumpled and drag-folded, and in general the Ingenika group strata, although not as minutely crumpled as those of the underlying Ruby group, have been subjected to more intense subsidiary folding on a somewhat larger scale.

The Lower Cambrian and Late Proterozoic rocks of the Butler Range southeast of Ingenika Cone dip northeast, and, apparently, form the southwestern limb of a northwesterly trending, overturned anticline. The axis of the complementary syncline to the west passes along Tomias Lake Valley and crosses Swannell River near the Swannell mineral claims, where intense distortion has resulted in isoclinal folding and pronounced shearing of slaty argillites and impure limestones.

The Lower Cambrian strata of the Russel Range have been folded into a series of anticlines and synclines whose axial planes are inclined to the northeast, culminating in a major overturned anticline immediately east of Pelly Creek. The limestones on the lower, overturned flank of this anticline have been isoclinally folded, and expose many times their true thickness. Elsewhere in the range, relatively competent quartzites, with interbedded quartz-mica and quartz-chlorite schists, reveal bold, steep folds and elongated domes with relatively little small-scale crumpling.

Espee Range and Forres Mountain expose a series of more or less parallel anticlines and synclines that strike more to the west of north than those of the Russel Range, and are truncated by a fault along Pelly Creek Valley.

The post-Cambrian, Palaeozoic formations and those of the Takla group show a general steep dip to the southwest. The Cache Creek argillites exposed near Wasi Lake are characterized by tight, isoclinal drag-folds and much shearing. Elsewhere in the map-area, with the exception of the faulted relations present in upper Lay Creek Valley, the post-Cambrian, Palaeozoic formations appear to be structurally conformable with the strata of the Takla group.

The whole assemblage is tilted 30 to 70 degrees to the southwest, and appears to form the northeastern limb of a large syncline whose axis, partly obliterated by the Omineca-Cassior batholith, lies west of the map-area.

Locally, Takla group rocks show numerous small folds striking at widely different angles to the regional trend.

The Uslika formation has a general northwest trend and a moderately steep southwest dip, but faulted sections on the west side of Osilinka River Valley exhibit a wide range of attitudes.

The Sifton conglomerates strike northwesterly, diagonally across the floor of the Rocky Mountain Trench, and dip 30 to 50 degrees to the northeast. The outcrops of this formation form a long narrow ridge that trends parallel with the longitudinal axis of the trench.

The Tertiary rocks exposed on the west side of Osilinka River Valley south of Uslika Lake strike approximately east, and dip gently to the north.

FAULTING

All of the rock units in the map-area have been dislocated by faulting, and in places faults and shear zones are so numerous that they cannot be represented adequately on the scale of the accompanying map.

The western part of the anticlinorium of Lower Cambrian and Late Proterozoic rocks south of Ingenika River has been displaced a total of nearly 10 miles to the south, relative to the eastern part, by a series of northerly trending faults along Swannell River Valley. These faults strike into, and may be in part a continuation of, a major fault zone down Pelly Creek Valley, which separates the overturned, northerly striking anticline of Russell Range on the east from the more symmetrical series of northwesterly striking anticlines and synclines of Espee Range and Forres Mountain on the west.

A fault along Zygadene Creek Valley has shifted the structures of the southern part of the Russel Range about 5 miles to the east, relative to the northern part.

It is possible that the major arch of the Ingenika and Ruby groups between Osilinka and Mesilinka Rivers represents part of the same structure as the anticlinorium of the same groups north of Mesilinka River, displaced by a large fault along Mesilinka River, Valley. If such faulting took place, it apparently occurred in Cambrian or earlier times, for rocks to the west are not affected.

The post-Cambrian formations are intersected by several, steeply dipping, northwesterly trending faults and shear zones, some of which probably are a northwestern extension of the Manson fault zone as defined in the Manson Creek area[1].

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[1]Armstrong, J.E., and Thurber, J.B.: Manson Creek map-area, B.C.; Geol. Surv., Canada, Paper 45-9, p. 11 (1945).

The Pinchi fault zone[2], a major fault structure extending

[2]Armstrong, J.E.: Northern Part Pinchi Lake Mercury Belt, B.C.; Geol. Surv., Canada, Paper 44-5, (1945).

more than 150 miles northwest from Pinchi Lake near Fort St. James, underlies Omineca River Valley in the extreme southwest corner of the map-area, and forms the contact between the Hogem batholith and Cache Creek formations.

The uppermost members of the rocks underlying the Takla group have been sheared, but in most places there is little evidence of appreciable net movement along the contact. Along the upper part of Lay Creek Valley, however, the formations of the two map-units are structurally discordant, and are in contact along a distinct fault that comes to an end in the shear zone along the lower part of the canyon of Lay Creek.

Little if any faulting has occurred along the west contact of the Hogem batholith, but most of the outlying stocks lie along faults.

Wherever observed, the contact between the Uslika conglomerate and the surrounding older rocks is along a fault, and it seems probable that the conglomerate was down-faulted into its present position. Both the conglomerate and the older rocks have been offset by a fault along Osilinka River Valley through Uslika Lake.

The Rocky Mountain Trench is almost certainly underlain by great faults that bring the formations of the Rocky Mountains on the east into discordant contact with those of the Cassiar Mountains on the west. No direct information on such faulting was obtained, however, in the Aiken Lake map-area.

Many of the faults, particularly those in the Takla group rocks, have acted as channelways for carbonatizing solutions, and their wall-rocks have been altered to buff weathering, ankeritic and siliceous materials.

ECONOMIC GEOLOGY

PLACER DEPOSITS

Placer gold has been found in workable quantities at only two localities within the map-area. Jimmay Creek, a tributary of Osilinka River, has been worked intermittently since 1899, but recovery has never been large. The deposit for the most part appears to represent re-sorted glacial debris, though some gold has been recovered from a buried preglacial channel. Several bars on Ingenika River near Wrede Creek have been worked, but returns have not warranted continuous operations.

It is noteworthy that although the only significant amount of gold recovered to date in the map-area has come from streams eroding the highly metamorphosed Lower Cambrian and Late Proterozoic rocks, no lode gold deposits of importance have been found in these rocks. The younger rocks exposed to the west, in which gold-bearing deposits have been noted, have, on the other hand, produced no known local placer deposits within the map-area, but have supplied much of the glacial material mantling the stream valleys now containing placer gold.

LODE DEPOSITS

The lode deposits in the map-area may be broadly classified on the basis of geological occurrence as follows: (1) deposits in the highly metamorphosed Lower Cambrian and Late Proterozoic schists and limestones; and (2) deposits in or grouped around and apparently related to the Omineca intrusions.

Deposits in Lower Cambrian and Late Proterozoic Rocks

Mineral deposits in the Lower Cambrian and Late Proterozoic rocks are, with the exception of relatively unimportant pyrometasomatic pyrrhotite deposits at the contact of a small stock, typically of the silver, silver-lead, and silver-lead-zinc types.

As noted previously, although the rocks have been subjected to intense metamorphism and local granitization, the only apparently definitely intrusive body of any size is a granodiorite stock east of Jackpine Lake. Along the borders of this body, associated with typical diopside-garnet-tremolite skarn and feldspathized gneissic quartzite, are deposits of pyrrhotite containing minor amounts of pyrite, arsenopyrite, and chalcopyrite. The deposits, as for example those of the Hope group, do not appear to have any commercial significance.

The Ruby prospect on Jimmay Creek is in quartz-mica schists of the Ruby group near small granitic stocks and sills. Here a northeasterly trending, silicified fault zone is erratically mineralized by ruby silver, arsenopyrite, and pyrite. Good silver assays are reported to have been obtained from samples of some parts of the fault zone. Similar minerals have been reported in the Ruby group rocks east of the head of Jimmay Creek. The metallic mineral deposits in the Ingenika group are, with one exception, confined to the limestones or calcareous argillaceous rocks. The largest known deposits are those of the Ferguson group, near Lookout Hill in Ingenika River Valley. Here, thick-bedded, relatively pure limestone, locally highly silicified, has been largely altered to siderite and replaced along bedding planes by crystalline galena and sphalerite, with minor pyrite, pyrargyrite, tetrahedrite, chalcopyrite, and marcasite. The best deposits are confined to four, bed-like bands, 2 to 8 feet thick, which have been traced for about 450 feet down the dip. The mineralized bands average approximately 18 per cent lead, 7 per cent zinc, and 7.5 ounces silver a ton.

At the Onward property, 1¼ miles south and considerably lower stratigraphically than the Ferguson deposits, small, flat-lying, sheet-like bodies of relatively coarse-grained galena and sphalerite are found lying parallel with thinly bedded, silicified, iron-stained limestone.

Mineral deposits of both the fracture-filling and replacement types are found in closely folded and sheared argillites and impure limestones on the Swannell group of claims. Quartz veins and silicified beds, sporadically mineralized with sphalerite, galena, pyrite, and chalcopyrite, occur at frequent intervals across an exposed width of about 450 feet. The best showings are in quartz veins lying parallel with the bedding. Selected samples across a width of 1 foot assay as high as 9 ounces silver a ton, 25 per cent lead, and 27 per cent zinc.

The large bed of limestone forming the crest of the ridge east of the mouth of May Creek contains a vein about 1 foot wide composed almost entirely of fine-grained galena. A representative sample assayed 83.24 per cent lead and 47.69 ounces silver a ton.

The Beverly group, a few miles east of the above showing, includes three exposures of lead-zinc minerals in much folded limestone near a prominent shear or fault zone. The exposures occupy a relatively large area.

The Weber group of claims is located in massive, unaltered limestone south of Oslinka River near Wasi Creek, and contains showings of galena, pyrite, and barite in a strong northwesterly trending fracture zone. Assays on selected samples yielded 10 per cent lead, 4 per cent barite, 2 ounces silver a ton, and a trace of gold.

The Burden group of claims on Swannell River due east of the Ferguson deposit, contain the only known, appreciably mineralized deposit in the Ruby or Ingenika group of rocks, distant from igneous contacts, that is not of the distinctive lead-silver type. The showing is in talcose sericitic schists, and consists essentially of a large quartz vein sparsely mineralized with chalcopyrite.

Deposits Apparently Related to the Omineca Intrusions

Evidence of mineralization is widespread in the upper parts of the Late Palaeozoic formations, in the Takla group rocks, and in the Omineca intrusions, and all of it appears to have some genetic connection with these intrusions. Several metallic mineral deposits are found along the eastern margin of the Hogem batholith, and almost all other known deposits are found close to or along the contacts of small intrusive bodies, which, presumably, were emplaced during the main period of intrusion.

A few deposits are found along shear zones in the intrusive bodies themselves. Types of deposits range from disseminated minerals in the pre-batholithic rocks to normal, fissure-filling quartz veins.

The Hogem batholith contains many shear zones mineralized with pyrite and copper sulphides, but most of such deposits carry no appreciable content of the precious metals. One of the largest of these mineralized shear zones occurs at the head of the east fork of Natetlo Creek. There, closely spaced fractures form a permeable, mineralized zone at least 120 feet wide in medium-grained granodiorite. The fractured rock is sparsely but uniformly mineralized with pyrite, chalcopyrite, and bornite. A representative sample of the mineralized rock assayed 2.02 per cent copper and a trace of gold. The zone also contains five veins, 2 to 10 inches wide, composed almost entirely of pyrite and chalcopyrite. A grab sample of one of the large veins assayed 18.93 per cent copper, 0.01 ounce gold a ton, and 1.31 ounces silver a ton.

The complex of sedimentary and volcanic rocks cut by small intrusive bodies along the west border of the map-area between Mesilinka River and Lay Creek contains several, heavily pyritized bands up to 1,000 feet wide and several miles long. These bands traverse several rock types, but are commonly near a diorite dyke or sill. One of the pyritized bands of this type exposed at the Granite Basin workings contains minute amounts of chalcopyrite, tetrahedrite (?), and magnetite, and is reported to carry up to one-third ounce gold a ton across a width of 30 feet.

Quartz veins are numerous in many parts of the area. Those cutting the Hogem batholith are for the most part barren, and appear to be high-temperature veins grading into quartz-feldspar pegmatite dykes. A large carbonate zone on the Elizabeth group north of Osilinka River in the interior of the batholith contains many quartz veins, some of which carry gold and silver. The nearby "Chief Thomas" vein is 6 to 10 feet wide, at least 300 feet long, and carries chalcopyrite, pyrite, and bornite, with a low content of gold and silver.

Quartz veins are particularly numerous in an area extending northwest from Tutizzi Lake along the west border of the map-area to Lay Creek and continuing into the McConnell Creek map-area to the west as far as Goldway Peak and the headwaters of Wrede Creek. The larger veins are, in general of massive white quartz, barren of sulphides or precious metals. Smaller veins, stringer lodes, and silicified shear zones exhibit wide variations of mineral content. The boss-like quartz body exposed on Porphyry Creek contains pyrite, magnetite, and molybdenite; the nearby Croydon group veins and stockworks contain massive pyrite, chalcopyrite, molybdenite, and magnetite, with fair gold content; the somewhat smaller veins of the Shell group, whose main showings lie just west of the map-area, contain pyrite and chalcopyrite, with considerable gold and, in places, minor magnetite and erythrite. A little cobalt bloom was also observed coating fractures in small quartz veins in hornblende diorite east of Croydon Creek. North of Tutizzi Lake, several of the quartz veins contain crystalline galena, commonly accompanied by chalcopyrite or specular hematite.

The mineral showings on the Vega property occur in intensely faulted and sheared andesites of the Takla group. The andesite contains small pebbles of granodiorite similar to that exposed in small stocks on Thane Creek. Chalcopyrite, pyrite, and bornite are disseminated through the andesite and concentrated along calcite veinlets. The best mineralized body is reported to be about 10 feet wide and 25 feet long, and to average 0.25 ounce gold a ton and 1.5 per cent copper. Elsewhere on the Vega group, carbonatized zones along faults carry small amounts of cinnabar.

The workings on Thane Creek expose a silicified shear zone about 4 feet wide in amphibolitized andesite near the eastern contact of the Hogem batholith. The shear carries pyrite, chalcopyrite, specularite, and magnetite, with a low gold content.

Lenses of pyrite and arsenopyrite up to 50 feet long and 9 feet wide in sheared greenstone near the contact of a sill of granodiorite porphyry are exposed by the Pluto workings. They are reported to carry some gold.

The Late Palaeozoic and, probably, Upper Triassic rocks outcropping in the Ingenika Range contain relatively abundant, disseminated, finely crystalline pyrite, which appears for the most part to be the product of general metamorphism rather than mineralization. Stringers and veins of quartz and calcite are numerous, but most of them are small and discontinuous. In these strata, several distinct types of mineralization are found. All deposits lie near small igneous bodies that appear to be related to the Omineca intrusions. The most widespread type of mineralization is found on the Jupiter, Polaris, and Stranger showings, and consists of highly brecciated quartz-calcite veins or fracture zones associated with much black, lustrous graphite and mineralized with granular pyrite. Some of these veins have been found to carry a fair amount of gold; most of them, however, are narrow and lensy.

A different type of mineralization is represented on the Jupiter property in fissures that are older than the pyrite-bearing fracture zones. These fissures have been healed by quartz-calcite veins mineralized with sphalerite, galena, tetrahedrite, chalcopyrite, and minor pyrite, and contain, in places, as much as 200 ounces of silver a ton. The known veins are for the most part less than a foot wide.

Lens-like replacement bodies of pyrrhotite and pyrite, with some chalcopyrite, occur in the argillite on Polaris Creek near small stocks and dykes of granite and andesite porphyry. These bodies attain a width of 25 feet and a length of several hundred feet, but none has been found to contain appreciable amounts of the precious metals.

DESCRIPTION OF PROPERTIES

(1)[1] INGENIKA GROUP

[1]Numbers, in parantheses, are those of property locations shown on accompanying map.

The Ingenika group consists of eight claims, staked in 1947 by Gust. Ola of Fort Grahame on the south side of Ingenika River Valley near the extreme west border of the map-area. The writer was unable to find the property, but examined specimens taken by Mr. Ola. The showing apparently consists of several outcrops of drusy quartz veins mineralized with pyrite and minor amounts of galena, sphalerite, and free gold. The surrounding region is underlain by micaceous quartzites and phyllites, but a sample taken by Mr. Ola of the rock in which the veins lie is dark green porphyritic andesite. The veins are reported to be as much as 4 feet wide.

The claims also contain extensive outcrops of limonite-hematite gossan, which appears to be quite pure, without trace of rock material or sulphides. Its origin is at present unknown.

(2) FERGUSON GROUP

References: Alcock, F.J.: Lead-Zinc Deposits in Canada: Geol. Surv., Canada, Econ. Geol. Ser. No. 8, pp. 298-300. Dolmage, V.: Finlay River District, B.C.: Geol. Surv., Canada, Sum. Rept. 1927, pt. A, pp. 37-41, (1928) Lay, D.: Ann. Repts, B.C. Minister of Mines, 1926, p.125; 1927, p.160; 1928, pp. 182-183; 1929, p.187; 1930, p.149; 1931, p.76.

The Ferguson property is 1 mile south of Ingenika River, about 16 miles west of its junction with the Finlay. It lies about 35 miles by water from Fort Grahame, and a wagon road 22 miles long connects the property with Finlay River a short distance above Fort Grahame. The nearest convenient supply base on a railway is the city of Prince George, 250 miles to the south.

The deposits were staked in 1917 by J. Ferguson of Prince George, who bonded his claims to the Selkirk Mining Syndicate of Victoria, British Columbia, in 1926. In 1927, Ingenika Mines, Limited, Vancouver, British Columbia, was formed to promote development of the deposits, and a systematic program of surface stripping, trenching, and underground exploration was undertaken. Results obtained by the lowest underground workings were unfavourable, and operations ceased in 1932.

The showings are on a knoll, known locally as Ferguson's Hill, which rises abruptly to an elevation of about 250 feet above the wide terraces on the south bank of Ingenika River. Rock exposures on the valley floor are scarce, and are almost entirely confined to low ridges and knolls near Ferguson's Hill. The largest outcrops are on Lookout Hill, a 500-foot knoll 1 mile south of Ferguson's Hill.

The rocks are blue-grey to cream-coloured crystalline limestones, of the Ingenika group of Lower Cambrian age. In the vicinity of Ferguson's Hill the limestones are in part intensely contorted, and in places are converted into a schistose rock containing a large amount of sericitic material.

In general the bedding strikes about south 80 degrees east and dips northerly at 20 to 40 degrees (See Figure 1A). The beds outcropping on the west end of the hill have been partly to completely silicified and show all gradations from relatively pure limestone to white quartz rock. Subsequent to silicification, the limestone was attacked by iron carbonate solutions. In the highly silicified, finely bedded rock, siderite was deposited along the bedding planes so that the rock now consists of parallel laminae of white quartz 1/10 inch to 2 inches thick separated by layers of dense, brown siderite. In the most heavily mineralized parts quartz and siderite are in about equal proportions. In places it is possible, within a distance of 100 feet, to trace the changes along a single bed from blue-grey crystalline limestone to greyish white massive quartz rock, with faint traces of original bedding, to banded quartz-siderite rock. In the slightly silicified limestone, and to a lesser extent in the highly silicified, massively bedded rock, the siderite was not confined to bedding planes but formed large, irregular masses up to 20 feet in diameter of very coarsely crystalline, nearly pure mineral.

Replacement of the quartz-siderite rock by pyrite, sphalerite, and galena, with lesser amounts of copper and silver sulphides, has formed distinct mineralized zones, which in general follow the bedding. A little sulphide mineralization is also in evidence along joint planes. The four most prominent mineralized zones have been explored by stripping and underground workings.

The lowest zone, known as No. 1 zone, (See Figure 1) outcrops only at the west end of the southward-facing cliffs that form the crest of the hill. Here a body of coarsely crystalline galena 1 to 2 feet thick is found in a 20-foot band of contorted quartz-siderite rock. Where fractured, this rock contains a little pyrite and sphalerite. It has retained the original bedding structures of the limestone that it has replaced, and appears entirely conformable with the overlying and underlying unmineralized limestone. The galena body lies about 6 feet above the base of the quartz-siderite band, and is overlain by 1 to 3 feet of crystalline siderite heavily mineralized with pyrite and, in places, with sphalerite.

Although much deformed in detail, the quartz-siderite rock and the included galena body nevertheless show a uniform overall strike of south 70 degrees east, and dip 25 to 40 degrees northeast. The contacts of the mineralized zone are sharp, and in every observed case are parallel with the bedding.

What is believed to be the No. 1 mineralized zone was encountered in crosscuts from No.4 adit, 80 feet south of the portal (See Figure 1 B). There it appears as discontinous, lens-shaped bodies of siderite, sphalerite, and galena up to 4 feet thick lying conformably along the same horizon, in well-bedded, slightly silicified, blue-grey limestone underlain by sheared, sericitic limestone.

The most important mineralized zones explored to date are Nos. 2 and 3. They are well exposed at the west end of the summit of Ferguson's Hill, and are explored by Nos. 1, 2, and 4 adits. These zones form two parallel bands, 3 to 10 feet wide, heavily replaced by sulphides, and separated by 1 to 8 feet of poorly mineralized rock lying near the middle of a series of beds, with a total stratigraphic thickness of 50 feet, that has been intensely silicified and irregularly replaced by siderite.

The series of beds in which Nos. 2 and 3 mineralized zones are found is much contorted, but an overall uniformity of attitude can be traced, and mineralization seems to have taken place at the same stratigraphic intervals throughout. Wherever observed, the contacts of the sulphide bodies are controlled to a minute degree by the contorted bedding planes of the host rock. As with No. 1 mineralized zone, the most concentrated mineralization has been effective close to the beds that have suffered the most intense silicification, but separated from them by 1 to 5 feet of quartz-siderite rock containing a relatively higher proportion of siderite.

The hi hest mineralized zone, No. 4, lies about 25 feet stratigraphically above the top of No. 3 zone, It outcrops on the summit of the hill, and can be traced down the north slope to the portal of No. 2 adit. The most heavily mineralized body in this zone is from 2 to 8 feet thick. The rocks in which the sulphide body of No. 4 zone is found are highly silicified, but contain relatively less siderite than the host rocks of Nos. 1, 2, and 3 zones.

The mineral composition of all four zones is remarkably uniform. Mineralographic study has indicated the presence of the following minerals, arranged in order of deposition from earliest to latest:

quartz

siderite

arsenopyrite

pyrite

pyrrhotite

magnetite (may be earlier)

sphalerite

chalcopyrite

tetrahedrite (variety freibergite)

galena

pyrargyrite

siderite (and calcite?)

Subsequent supergene alteration has developed considerable limonite, and minor amounts of marcasite, covellite, and malachite.

Sphalerite and galena together constitute more than 90 per cent of the metallic minerals. Pyrite is locally plentiful in bodies up to 2 feet thick, immediately overlying, and replaced by, galena and sphalerite. The only silver-bearing minerals recognized as such, argentiferous tetrahedrite and pyrargyrite, were found to be much more abundant in pyrite-rich specimens than in specimens consisting chiefly of sphalerite or galena. No silver minerals have been identified in specimens of crystalline galena, although spectrographic analyses of apparently pure galena show a moderate silver content.

Some fracturing has followed sulphide deposition, and carbonate solutions have deposited a second generation of siderite, possibly accompanied by calcite, in the fractures so formed.

The tenor of the ore is remarkably uniform. No attempt was made by the writer to sample the individual zones. The management states [1] that the approximate average assay of more than one hundred samples from Nos. 2, 3, and

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[1] Quoted by D. Lay: Ann. Rept., B.C. Minister of Mines, 1930, p. 149.

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4 mineralized zones across a width of 8 feet was: silver, 7 ounces a ton; lead, 15 percent; and zinc, 7.5 per cent.

It is evident that mineralization in these deposits was controlled to a large extent by the structure of the folded limestone beds. In general the mineralized beds strike approximately east and dip north at an angle roughly the same as that of the northern slope of Ferguson's Hill. The underground workings, consisting of four main adits, Nos. 1, 2, 4, and 5, were driven from the north slope of the hill to probe the continuation of these beds at depth. No. 1 adit, whose portal is close to the lowest outcrop of the No. 3 mineralized zone, exposes almost continuous sulphides for a length of 140 feet. A crosscut from this adit shows Nos. 2 and 3 zones to be heavily mineralized across a combined stratigraphic thickness of about 15 feet.

No. 2 adit, at the same level as No. 1, was driven on the lowest exposure of mineralized zone No. 4. This zone has a slightly flatter dip than the hillside, so that its lower parts have been removed by erosion. An eastward-trending drift from this adit, driven just under, and parallel with, the surface of the hill, shows evidence of almost continuous mineralization throughout its length of 70 feet. A crosscut 60 feet long intersects No. 3 mineralized zone, which at this point is about 3 feet wide and contains abundant galena and sphalerite associated with pyrite and pyrargyrite.

No. 4 adit was driven from 85 feet below the level of Nos. 1 and 2 adits. Drifting east and southwest from the portal has exposed Nos. 2 and 3 mineralized zones, which here cannot be accurately distinguished from one another, for a length of 250 feet. Crosscutting 90 feet south from the portal has penetrated a sphalerite deposit that may represent part of No. 1 mineralized zone. Short drifts have followed this zone for 50 feet, and have disclosed two disconnected mineralized lenses each with a maximum width of about 4 feet and a length of 20 feet.

No. 4 adit is connected with No. 1 adit by a raise 130 feet long. For most of its length this raise lies in No. 2 mineralized zone.

No. 5 adit, 80 feet below No. 4, consists of about 600 feet of main crosscut and 80 feet of exploratory workings therefrom. When visited in 1946 and 1947, the portal was caved and the workings could not be examined. It is understood, however, that although beds were penetrated that were believed to represent continuations of the mineralized zones, no appreciable evidence of mineralization was encountered. The dump from this adit contains a considerable amount of sheared, schistose limestone, but no sulphides and relatively little quartz-siderite rock.

The apparently abrupt disappearance of mineralized bodies such as those contained in Nos. 2 and 3 mineralized zones, which between No. 4 adit and the summit of Ferguson's Hill maintain a fairly uniform composition across a width of as much as 200 feet, a thickness of 8 feet or more, and a length of 450 feet down the dip, is surprising. No definite evidence of faulting below the level of No. 4 adit was obtained, although some movement may be indicated by the occurrence of sheared, sericitic or talcose limestone in Nos. 4 and 5 adits and at the surface on the south side of Ferguson's Hill at elevations considerably below the outcrop of No. 1 mineralized zone. It is more probable that mineralization was either not effective in the limestone beds to the level of No. 5 adit, or, if effective to that depth, that the mineralized parts have not been penetrated by the No. 5 adit workings.

From the exposures on and around Ferguson's Hill, it is evident that the mineralized limestone beds are on the whole much more contorted and drag-folded than the unmineralized limestone. Mineralization is best represented where a few individual beds have been greatly thickened by drag-folding. Such deformed beds are well exposed at the summit of Ferguson's Hill and in No. 1 adit along Nos. 2 and 3 mineralized zones, but in No. 4 adit the bedding appears to be much more regular. It may be that only the highly contorted parts of the limestone beds were permeable to mineralizing solutions, and that the contorted structures do not persist to the level of No. 5 adit. Structure-contours on the top of No. 3 mineralized zone show a progressive increase in regularity of the bedding down to the level of No. 4 adit. The known mineralized band in this zone shows a decided northeast rake across the bedding. If the favourable limestone beds and the mineralized band in them are projected to the level of No. 5 adit, the mineralized area would appear to pass to the east of the main crosscut, about 250 feet from the portal, near the point from which four exploratory workings radiate.

Ferguson's Hill as a whole is structurally much more complex than any other known parts of the limestone belt in which it lies. The general structure of the area has not been completely deciphered, but it would appear that Ferguson's Hill lies near the nose of a large drag-fold, plunging to the north, on the west limb of a major anticline that has been overturned to the west. Within any one mineralized zone, the individual mineralized bodies are lens-like, being thickest on the crests of small folds and thinning or pinching on the limbs. There is some indication that the whole west end of the hill represents the crest of an anticline whose axial plane passes through the top of the hill near the outcrop of No. 3 mineralized zone. If this is so, it is possible that lower limestone beds may be mineralized in the vicinity of this anticline.

(3) ONWARD GROUP

Reference: Lay, D.: Ann. Rept., B.C. Minister of Mines, 1928, p. 184, 1930, p.151.

The Onward group lies south of Delkluz Lake, about 1½ miles due south of the Ferguson group. It is owned by Ingenika Mines, Limited, and was explored at the same time as the Ferguson group.

The most important showings on this group are almost at water's edge on the south shore of Delkluz Lake. Here about 25 feet of contorted and brecciated limestone of the Ingenika group has been replaced by quartz and siderite over an area at least 60 feet square. Discontinuous lenses, up to 3 feet thick, composed mainly of galena, sphalerite, and pyrite, occur in the upper part of the exposed section. The largest observed lens is nearly flat-lying; is quite heavily mineralized; and occupies an area about 30 feet long and 20 feet wide. Stripping and trenching in the vicinity have failed to expose any significant extension of this deposit, nor has a total of 210 feet of underground workings, directly beneath the mineralized outcrop, revealed any significant indications of lead-zinc mineralization.

Approximately 1,000 feet south of these workings considerable stripping has been done and a shaft sunk to a depth of about 30 feet in brecciated limestone partly replaced by siderite. The shaft encountered a distinctive, but small, deposit consisting of relatively coarse-grained, dark brown, resinous sphalerite grains and finer grained crystalline galena in a creamy, fine-grained groundmass of calcite. This deposit is unique for the vicinity of the Ferguson and Onward properties in that it is found in a breccia that appears to cut across, rather than follow, the bedding of the limestone.

(4) BURDEN GROUP

References: Dolmage. V.; Geol. Surv., Canada. Sum. Rept. 1927, pt. A, p.35 (1928).
Lay, D.; Ann. Rept., B.C. Minister of Mines, 1928, p. 185.

The Burden group consists of two claims, the Burden and the Ruth B., staked in September 1927 by E.H. Burden of Prince George. They are on the east bank of Swannell River about 5 miles above its confluence with the Ingenika. The property is about 3½ miles due east of the main workings of the Ferguson group.

The mineral showing on the Burden group consists of several irregular masses of white vein quartz in a highly calcareous, talc-sericite schist of the Ingenika group. The quartz is cut by veins and patches of cream-coloured, coarsely crystalline calcite, and contains a few blebs and stringers of pyrite and chalcopyrite.

About 100 feet downstream from the main quartz showing lies a boulder, 2 by 2 by 4 feet, of solid, massive to fine-grained pyrite and chalcopyrite with blebs of white to bluish quartz and minor covellite and bornite. Undoubtedly much of the work done on this property was undertaken with a view to finding the ledge from which the boulder was derived. It seems probable, however, that the boulder has travelled far, as it is well rounded and the quartz in it is quite unlike the milky, opaque variety seen in place on the claims.

(5) SWANNELL GROUP

References: Lay, D.; Ann. Rept., B.C. Minister of Mines, 1927, p. 189; 1928, p. 180; 1929, pp. 184, 430.

The Swannell group of mineral claims is on Swannell River about 1[illegible] miles from its mouth, 3 miles by trail south of Delkluz Lake. The deposits have been known for many years, and have been staked at intervals by various residents of the district. They are at present held by Gust Ola of Fort Grahame.

The showings lie on both banks of Swannell River, which at this point flows easterly through a broad, flaring, drift-covered valley containing few rock outcrops. Very little development work has been done on the showing, and exposures are chiefly the result of erosion on the steep banks of the river, which has cut a trench 10 to 40 feet deep and 60 feet wide.

The mineral deposits occur in dark grey to black, argillaceous schists and slates, interbedded with thin-bedded, blue-grey, impure limestone of the Ingenika group. The rocks are highly sheared and contorted, and, although they have a general northwest strike and a vertical or steep northeast dip, it is probable that such attitudes are those of parallel limbs of isoclinal folds, and that the strata at this point lie near the trough of a major northwesterly trending syncline whose northeast limb is overturned to the southwest. Shearing planes are in general parallel with the limbs of the folds, and much graphitic material has formed along them. The rocks contain numerous veins and stringers of white

quartz, many of which follow partings between bedding planes and have been shattered by shearing movements and intricately folded. The largest of these veins is about 2 feet wide but, due to isoclinal folding, as much as 8 feet of white quartz, separated by thin graphitic partings, is exposed in places.

Three distinct types of mineral deposits have been recognized on the claims. Many of the quartz veins are sparsely mineralized with pyrite, and a few carry small streaks of galena and sphalerite. Some fractures in these veins contain malachite and covellite. Metallic suphides compose no more than 5 per cent of the rock volume of any of the observed veins of this type, and few of the streaks of galena or sphalerite are more than an inch thick. Much of the limited amount of exploratory work done on the claims has been directed toward examining these veins, and one vein, about 20 inches wide, isoclinally folded to a width of about 8 feet, has been shown to have a length of at least 165 feet.

A second, more promising type of deposit is represented by beds of blue-grey, thin-bedded limestone almost completely replaced by quartz, crystalline calcite, sphalerite, galena, and a little pyrite. The original limestone had been contorted into small drag-folds, and these structures have been preserved faithfully during subsequent mineralizing processes, so that original bedding structures can be traced across bodies of nearly solid sulphides. In many specimens the galena is concentrated into distinct bands relatively free from sphalerite, whereas adjacent areas of sphalerite contain little or no galena. Replacement by sulphides is irregular, and inclusions of unaltered limestone are common. The largest deposit of this type is 2 to 4 feet thick, and contains about 40 per cent sulphides. It has been exposed at intervals for a length of 170 feet. A sample of one of the galena-free bands assayed:[1] gold, 0.005 ounce a ton; silver, 0.53 ounce a ton;

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[1]All assays quoted in this report have been made, unless otherwise stated, by the Bureau of Mines, Department of Mines and Resources, Ottawa.

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lead, 1.45 per cent; and zinc, 28.13 per cent. Two selected samples of the best galena-sphalerite ore from different parts of the deposit averaged: gold, 0.02 ounce a ton; silver, 8.14 ounces a ton; copper, 0.05 per cent; lead, 24.64 per cent; and zinc, 27.36 per cent.

The third type of mineral deposit is represented in a single bluff on the north bank of the river. Here, blue-grey limestone, intensely brecciated and silicified, has been mineralized with coarse, granular pyrite and varying amounts of fine crystalline galena and sphalerite. The ore minerals occur in several distinct bands parallel with the bedding, which dips vertically or steeply northeast. The westernmost mineralized band, lying adjacent to rusty, sheared argillite, consists of about 10 feet of bedded, silicified limestone containing approximately 10 per cent metallic sulphides, chiefly coarse, individual grains of pyrite and fine granular sphalerite and galena in thin seams along bedding planes. A representative sample of this material assayed: silver, 0.95 ounce a ton; copper, 0.01 per cent; lead, 4.45 per cent; and zinc, 4.29 per cent. Farther east is a band, 2 to 4 feet thick, of much brecciated limestone almost completely replaced by metallic minerals. Typical samples from this bed consist of approximately 70 per cent coarse granular pyrite, and 10 per cent galena and sphalerite, with minor chalcopyrite, quartz, and iron-bearing carbonate. The pyrite-bearing rock is succeeded to the east by 6 feet of well-bedded, highly contorted, silicified limestone, about 20 per cent of which

has been replaced by fine-grained galena and sphalerite. A sample of a sphalerite-rich band in this deposit assayed: silver, 0.80 ounce a ton; copper, 0.10 per cent; lead, 1.69 per cent; and zinc, 18.5 per cent. East of the contorted galena-sphalerite body is a band about 3 feet thick heavily mineralized with coarse pyrite; this band is in turn succeeded by 4 to 8 feet of highly brecciated, silicified limestone containing coarse pyrite, an iron-bearing carbonate, and fine-grained galena, with a little sphalerite. A selected sample of this material assayed: gold, 0.025 ounce a ton; silver, 0.85 ounce a ton; copper, 0.02 per cent; lead 4.4 per cent; and zinc, 0.25 per cent.

Almost all of the significant mineral showings observed on these claims occur in a 2 0 -. foot section along the river banks. Several prospect pits have been dug in the drift-covered valley floor at various distances back from the river, but few have reached bedrock and no mineral deposit has been encountered.

(6) "PORPHYRY CREEK" WORKINGS

Reference: Lay, D.: Aiken Lake Area; B.C. Dept. of Mines, Bull. No. 1, p. 14 (1940).

"Porphyry Creek" is the local name for a small northern tributary of Miller Creek, situated near the extreme west border of the map-area, about a mile west of Croydon Creek and 10 miles by trail from the west end of Aiken Lake. The claims on this creek were explored by the Consolidated Mining and Smelting Company of Canada, Limited. Workings include open-cuts and an adit 10 feet long.

The mineral occurrences consist of narrow veins and disseminated deposits of pyrite, chalcopyrite, and molybdenite, associated with large masses of white quartz in medium-grained, dark green hornblende diorite of the Omineca intrusions. Stripping and natural erosion have uncovered quartz at intervals over an area 200 feet long and 60 feet wide, but because of the excessive quantity of stream gravels that blanket the deposit, it could not be determined whether the quartz belonged to one large or several smaller bodies. Within the quartz are lensy veins of pyrite and molybdenite up to 4 inches wide, the best exposed of which are traceable for about 20 feet. Stringers of chalcopyrite up to $\frac{1}{2}$ inch wide cut both the quartz and the hornblende diorite, and appear to represent a distinct stage of mineralization. The average sulphide content of the deposit is very low, and assays for precious metals have not been encouraging.

The stream gravels contain boulders of rusty, porous magnetite, which when crushed and panned show a few "colours" of gold.

(7) CROYDON GROUP

Reference: Lay, D.: Aiken Lake Area; B.C. Dept. of Mines, Bull. No. 1, pp. 8-19 (1940).

The Croydon group lies about 9 miles by trail from the west end of Aiken Lake on the lower part of Croydon Creek, a tributary of Miller Creek. The claims are owned and were explored by the Consolidated Mining and Smelting Company of Canada, Limited. Operations ceased when the camp was destroyed by forest fire in 1938. At present, six claims are held in good standing.

The deposits lie in nearly parallel, steeply dipping shear zones in medium-grained hornblende diorite. The shear zones vary in width from a few inches to about 30 feet, and contain lenticular bodies of vein quartz, usually with free walls. The individual quartz bodies are seldom more than 2 feet wide, but an interlacing network of them, separated by thin partings of sheared altered hornblende diorite, in many places occupies the entire width of the shear zone. The sheared hornblende diorite has been largely altered to a soft, green, chloritic material, which in places contains a little serpentine.

The quartz is irregularly mineralized with massive to crystalline pyrite and chalcopyrite. Metallic minerals do not comprise more than about 5 per cent of most of the veins examined, but local concentrations of almost solid sulphides form lenses up to 2 feet wide and 15 feet long. Small amounts of magnetite, molybdenite, gold, and an unidentified soft, silvery mineral accompany the pyrite and chalcopyrite. The ore minerals are confined mainly to the quartz bodies, but in a few places the sheared hornblende diorite is pyritized. Later fractures cutting through the quartz and the ore minerals have been filled with a cream-coloured carbonate mineral, probably calcite.

Exploratory work has been concentrated on four, quartz-filled shear zones that lie within a belt 250 feet wide on the southwest side of Croydon Creek (See Figure 2). Each of the shear zones strikes about north 10 degrees east and dips steeply southeast. The two most easterly of these shear zones are actually parts of the same broader shear zone, and are separated by 5 to 20 feet of sheared rock containing small, erratically distributed quartz lenses. The eastern part of this broad zone is known by the owners as "Vein No. 13", and is visibly mineralized for a length of 270 feet. At its northernmost exposure, the 'vein', or quartz-rich part of the shear zone, is 6 feet wide and contains an aggregate width of 4 feet of rusty, fractured, sparsely mineralized quartz. A sample across 5½ feet at this point assayed: gold, 0.03 ounce a ton; silver, 0.13 ounce a ton; and copper, 0.01 per cent. Southward from this point 'vein No. 13' pinches and swells, and the vein matter consists of a series of lenticular quartz stringers and veinlets, with an average total width of about 2 feet. In places it is abundantly mineralized. A sample of almost solid, massive to granular pyrite from the dump, very similar to that found at, and believed to be from, the central part of this 'vein' assayed: gold, 0.105 ounce a ton; silver, 0.70 ounce a ton; and copper, 0.32 per cent. At the point farthest south on 'vein No. 13' penetrated by underground workings, the quartz-rich part of the shear zone is more than 10 feet wide. A sample across 6½ feet of this, including 4 feet of quartz carrying about 5 per cent sulphides, assayed: gold, 0.005 ounce a ton, silver 0.055 ounce a ton, and copper, 0.05 per cent.

The western part of the broad shear zone that includes 'vein No. 13' also contains, at the outcrop on the creek and in the northernmost underground working southwest of the creek, a network of quartz lenses and veins. This network has been called 'vein No. 12', and has been exposed for 80 feet. Throughout this length the 'vein' is about 10 feet wide, consisting in most places of a central quartz vein 4 to 5 feet wide flanked by lenticular subsidiary veins. A sample across 5 feet at the most northerly face of the underground workings on this 'vein' assayed: gold, 0.035 ounce a ton; silver, 0.28 ounce a ton; and copper, 0.88 per cent. A sample from the same place, taken by D. Lay of the British Columbia Department of Mines, assayed[1]: gold, 0.4 ounce a ton; and copper, 0.9 per cent. A sample across 11 feet

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[1]Lay, D.: Op. cit., p. 11.

CROYDON GROUP

(UNDERGROUND WORKINGS)

Scale in Feet

50 0 50 100

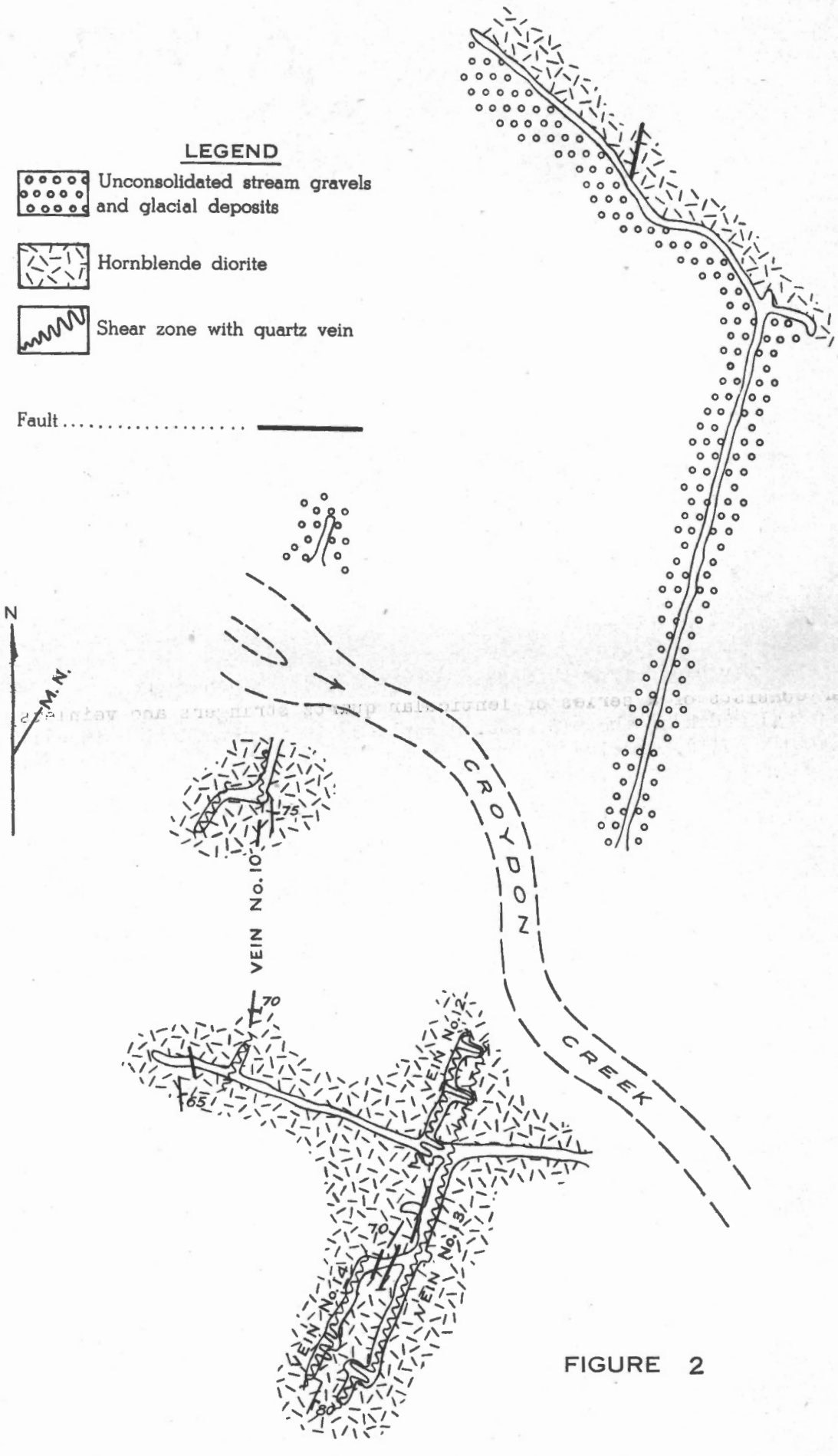

FIGURE 2

GEOLOGICAL SURVEY OF CANADA

CARTOGRAPHY BY THE
DRAFTING AND REPRODUCING DIVISION, 1948.

of the broad shear zone, containing 'vein No. 12' and much of the sheared material between 'vein No. 12' and 'vein No. 13', taken 35 feet south of the above-mentioned face, assayed: gold, 0.02 ounce a ton; silver, 0.28 ounce a ton; and copper, 0.88 per cent. A selected sample from broken rock piled in the drift at this point, consisting of about equal amounts of milky quartz and sulphides, assayed: gold, 0.26 ounce a ton; silver, 1.61 ounces a ton; and copper, 5.86 per cent. The aggregate of lens-like quartz bodies with sheared chloritic partings composing 'vein No. 12' pinches abruptly to a width of about 5 inches, 80 feet south of its outcrop on the west bank. Underground workings farther south along the western side of the broad shear zone have penetrated only sheared, pyritized hornblende diorite.

The next important shear to the west, called 'vein No. 14' is known at present from underground working only. It lies about 35 feet west of the southern part of 'vein No. 13', separated from it by two distinct faults, which have displaced 'vein No. 14' upward and westward with respect to 'vein No. 13'. 'Vein No. 14' is exposed for a total length of 85 feet, and shows a maximum of 3 feet of quartz, though the average width is probably less than 1 foot. A sample across 3 feet of a typical, sparsely mineralized part assayed: gold, 0.005 ounce a ton; silver, 0.045 ounce a ton; and copper, nil.

An adit was driven northward on the northeast side of Croydon Creek approximately on the line of strike of these shear zones in an attempt to pick up the northward continuation of the 'veins' (See Figure 2). The adit penetrated unconsolidated material for 380 feet before reaching smooth, glaciated bedrock. The edge of the bedrock was followed in northwesterly and southeasterly directions for a total distance of 300 feet, but no appreciably mineralized shear zones were encountered.

The mineralized shear zone known as 'vein No. 10' outcrops as a distinct quartz vein 2 feet wide on the southwest bank of Croydon Creek, 250 feet northwest of the outcrops of 'veins Nos. 12 and 13'. The outcropping vein has been followed southerly in underground workings, and has a maximum width of about 3 feet of heavily mineralized quartz. About 45 feet south of the portal it pinches to a gouge 2 inches wide. A crosscut from the south end of the drift that followed the outcropping vein shows the ground immediately west to be much sheared for a width of 12 feet and to contain many small, mineralized, lens-like quartz veins. A grab sample from one of these veins, consisting of white fractured quartz containing massive pyrite and thin sheets of molybdenite, assayed: gold, 0.06 ounce a ton; silver, 0.35 ounce a ton; and copper, 0.71 per cent. This highly sheared band is separated by 10 feet of pyritized, slightly sheared rock from another zone of intense shearing to the west containing a heavily mineralized quartz vein with a maximum width of 4 feet. This vein, forming the western side of the 'vein No. 10' shear zone, has been followed southerly by a drift, from the crosscut mentioned above, for 35 feet to where it pinches to a narrow, gouge-filled shear containing no quartz. A sample across 2 feet of this vein assayed: gold, 0.65 ounce a ton; silver, 0.50 ounce a ton; and copper, 1.78 per cent. Some parts of the vein are relatively rich in molybdenite and magnetite. What may be the southwesterly continuation of the 'vein No. 10' shear zone is penetrated by a crosscut extending 140 feet west from the southern end of 'vein No. 12'. A 20-foot drift driven northward from the crosscut along the 'vein No. 10' shear zone exposes a sparsely mineralized quartz vein about 4 inches wide.

Several shear zones, some containing mineralized quartz veins, occur at intervals along the banks of Croydon Creek within 2,000 feet upstream from those explored by underground workings. Some of them apparently contain considerable magnetite, for areas up to 400 feet wide of strong magnetic attraction have been outlined. A limited amount of trenching and stripping has been done on these shears, but due to excessive sloughing little information can now be gained from the workings.

Preliminary mineralographic studies of samples from the deposits on this property indicate that a large part of the precious metal content is contained in the sulphide minerals. Chalcopyrite seems to be the main gold carrier, and it would appear that for each 1 per cent of copper in the ore, 0.1 to 0.3 ounce of gold is contained in the sulphides. Thus, material from this deposit would require concentration, and relatively higher grade material would be necessary to constitute ore than if the gold were free-milling. Some of the gold, however, is apparently free, as evidenced by a few, irregularly high assays.

The silver is also apparently associated with the sulphides, and in most samples is 10 to 20 times as abundant as gold. The high gold assays, supposedly indicative of free gold in the quartz, are not accompanied by correspondingly high silver assays.

(8) GRANITE BASIN GROUP

Reference: Lay, D.: Aiken Lake Area; B.C. Dept. of Mines, Bull. No. 1, pp. 15-18 (1940).

The Granite Basin group of claims, owned by the Consolidated Mining and Smelting Company of Canada, Limited, covers the south wall of a north-easterly facing cirque draining into Lay Creek, 6 miles by trail from the east end of Aiken Lake. The showings consist of broad, pyritized bands in Takla group andesite and intercalated sedimentary rocks invaded by a variety of small bodies of Omineca intrusions.

The predominant country rock in the immediate vicinity of the main workings is a moderately dark, grey-green, porphyritic andesite with small black hornblende and scattered grey feldspar phenocrysts. This rock is cut by a grey to greenish grey 'diorite porphyry', with hornblende phenocrysts up to one-eighth inch long in a fine-grained matrix. The porphyry closely resembles the andesite, and in places is difficult to distinguish from it. Contacts between the two rocks are in places sharp and definitely intrusive; in other places they appear to be gradational.

Both the andesite and the 'diorite porphyry' are intruded by a medium to light grey or buff-coloured, medium-grained to sugary 'porphyritic diorite' with abundant feldspar phenocrysts and a few hornblende phenocrysts in a light grey, medium-grained matrix. Although individual bodies of this rock were never traced for more than 100 feet or so, the nature of their contacts and outcrop positions would indicate that they may be irregular, sill-like bodies, 50 to 150 feet thick, in the andesites and bedded tuffs.

The andesite, the 'diorite porphyry', and the 'porphyritic diorite' are all cut by well-defined dykes 10 to 100 feet wide of light green feldspar porphyry.

The andesite and the 'diorite porphyry' are generally sparsely mineralized with fine granular pyrite, but may be well mineralized where they are in contact with the 'porphyritic diorite', which is everywhere heavily, though somewhat irregularly, pyritized.

Four pyritized bands are exposed within a horizontal distance of about 2,000 feet, between elevations of 5,150 and 6,000 feet, on the east end of the precipitous south wall of the cirque. They appear to consist mainly of sill-like bodies of 'porphyritic diorite' trending about parallel with the bedding of the tuffs and argillites, which are well exposed farther west on the cirque wall, where they strike northeast and dip 40 to 50 degrees northwest. The most easterly of these bands is split by an unmineralized feldspar porphyry dyke about 60 feet wide, producing, at the crest of the ridge, fine pyritized bands, which have been numbered by the owners 1 to 5 consecutively from east to west. The pyritized bands do not have definite margins, and are not uniformly mineralized. Some heavily pyritized areas, as evidenced by dark, rusty weathering patches on the cirque wall, are as much as 200 feet wide and 400 feet long.

Exploration, consisting of trenches, open-cuts, and two adits totalling 379 feet of underground workings, has been confined largely to the most easterly pyritized band. Most of the workings are in a rusty weathering, intensely fractured, friable rock containing much fine-grained, disseminated pyrite. Minute grains of chalcopyrite, and what appear to be bornite and tetrahedrite, were noted in one specimen, but copper mineralization has nowhere been sufficient to yield a conspicuous copper stain.

It is impossible to assign definite widths to the pyritized bands. Workings crossing the easternmost band are from 10 to 90 feet in length. Mr. E. Bronlund of the Consolidated Mining and Smelting Company reported that encouraging assays had in places been obtained across widths of as much as 45 feet, and that the highest part of the zone carried up to one-third ounce gold a ton across 30 feet. A sample taken by D. Lay of the British Columbia Department of Mines across 40 feet in the upper underground working assayed[1]: gold, 0.2 ounce a ton.

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[1] Lay, D.: op. cit., p.17.

(9, 10) HALQUINN AND RED DYKE GROUPS

The Halquinn and Red Dyke groups were staked in the summer of 1947 by independent prospectors on the "Granite Basin" mineral zone, immediately south of and adjoining the Granite Basin claims. To the writer's knowledge no work was done on them in 1947.

(11) JUPITER GROUP

Reference: Lay, D.: Aiken Lake Area; B.C. Dept. of Mines, Bull. No. 1, 1940, pp. 18-22.)

The Jupiter property is on the northeast side of Lay Creek, 4 miles by trail from the east end of Aiken Lake. It was staked for, and explored by, the Consolidated Mining and Smelting Company of Canada, Limited. No work has been done on the property since 1937.

The wide, flat-bottomed valley of Lay Creek is underlain by andesitic flows with intercalated tuffs, argillites, and impure limestones. In its upper reaches the valley follows a longitudinal fault that brings structurally discordant members of this assemblage into contact; but from the vicinity of the Jupiter property to the junction of Lay Creek with Mesilinka River the rocks are structurally conformable across the entire width of the valley, and the fault appears to merge into an irregular shear zone 300 or more feet wide. Along this fault and shear zone Lay Creek has incised a narrow gorge 9 miles long and as much as 400 feet deep. The fault and shear zone are provisionally placed at the contact between known Takla group rocks on the west and underlying rocks of Takla or possibly pre-Takla age on the east. The Jupiter mineral deposits are exposed near the bottom of the gorge at the junction of Lay Creek with a small tributary stream locally known as Berry Creek. The rocks in the gorge have been considerably altered: the andesites and tuffs to smooth, shiny, chloritic and serpentinized rocks, and much of the argillite to soft, flaky, graphitic material. A small body of blocky, less friable, porphyritic rock of andesitic or dioritic composition, exposed near the portal of the "main adit" and encountered in some of the underground workings, may be intrusive.

Two distinct types of mineral deposits are recognized on the property. One is represented by a brecciated fault zone, striking north and dipping steeply west, cemented by white quartz and cream-coloured calcite, which contains much graphitic material and is sparingly mineralized with pyrite. This fault zone has been called 'vein No. 2' by the owners. The other type of mineral deposit is represented by well-defined fissure veins striking northeast, consisting of quartz and calcite heavily mineralized with sphalerite, tetrahedrite, galena, and minor chalcopyrite, covellite, and pyrrhotite. The two largest of these veins, which strike northeast and lie to the west and east of the 'vein No. 2' fault zone, have been named vein No. 1 and vein No. 3 respectively.

Exploratory work has consisted of hydraulic stripping the steep slopes of Berry Creek Gulch, and of driving two adits, one on each side of Berry Creek. The surface workings are now completely sloughed, but it is understood that the mineral deposits were well exposed within an area of 250 by 140 feet.

The 'main adit' is driven into the west bank of Berry Creek about 50 feet above the level of Lay Creek. It consists of a drift, 795 feet long, on the mineralized, brecciated fault zone ("vein No. 2"), and a total of 813 feet of branch workings that explored subsidiary fault zones and the fissure veins. Vein matter in the fault zone followed by the drift is very lensy. Pyrite is the sole metallic mineral noted, and occurs in part very sparingly disseminated through quartz, in part somewhat more abundantly disseminated through the brecciated, altered wall-rocks, but for the most part as thin stringers and seams with calcite forming a matrix to the fault zone breccia. The fault zone contains much graphitic material; lens-like bodies up to 4 feet wide, consisting almost entirely of soft, impalpable, carbonaceous matter, were noted. The best mineralized section observed was about 100 feet long and in most places less than 2 feet wide. Samples from this fault zone, taken by the owners, are reported[1] to have yielded 0.31 ounce to 7.18 ounces of gold a ton

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[1] Lay, D.: op. cit., p.21,

across widths of 2 to 12 inches. A grab sample taken by the writer in 1946 assayed: gold, 0.132 ounce a ton; silver, 4.75 ounces a ton; copper, 0.06 per cent; and zinc, 0.60 per cent. Microscopic examination of specimens from this deposit has shown no gold; it may be that the pyrite itself is auriferous.

The sphalerite-tetrahedrite-galena deposits, represented by vein No. 1, vein No. 3, and several smaller veins, have a maximum observed width of 1 foot. Vein No. 1 has been followed by a drift for 105 feet, and vein No. 3, on the opposite side of the 'vein No. 2' fault zone, for 60 feet. The very close similarity in width, attitude, and mineralogy of veins No. 1 and No. 3 suggest that they were originally parts of the same vein, dislocated by movement along the 'vein No. 2' fault zone. The walls of all the fissure veins are free, indicating some post-mineral movement.

Typically, veins No. 1 and No. 3 consist of interbanded light brown sphalerite, dark brown sphalerite, and quartz. Cream-coloured calcite and white to dull grey massive quartz fill abundant fractures in the sphalerite, and contain minute grains of chalcopyrite. Tetrahedrite and galena occur as irregular patches in the sphalerite, mainly in the darker variety, and as layers up to 1 inch wide in the sphalerite and along contacts of quartz and sphalerite bands. Some covellite was also observed along these contacts.

Microscopic examination of specimens from veins No. 1 and No. 3 shows the sphalerite to have been fractured, healed by quartz and calcite, and then irregularly replaced by argentiferous tetrahedrite. Later, both the sphalerite and the tetrahedrite, but principally the latter, were replaced by galena. A still later period of fracturing was followed by deposition of a second generation of calcite and a little chalcopyrite. Pyrrhotite was identified as irregular masses in the quartz and in the tetrahedrite near quartz. Its age relative to the other sulphides is unknown.

Microchemical analysis of the galena showed no evidence of silver. The tetrahedrite, however, is the strongly argentiferous variety, freibergite.

Grab samples of veins No. 1 and No. 3 were taken by D. Lay in 1939[1]

[1] Lay, D.: op. cit., pp. 21-22.

and by the writer in 1946. They assayed as follows:

	Gold oz/ton	Silver oz/ton	Copper %	Lead %	Zinc %
Vein No. 1					
1939 sample	0.02	76.3	0.6	0.4	8.8
1946 sample	0.01	91.3	1.01	8.70	30.15
Vein No. 3					
1939 sample	0.02	152.0	1.2	7.5	11.7
1946 sample	0.025	153.78	1.76	3.15	22.16

On the east bank of Berry Creek, an adit 160 feet long has been driven in badly fractured, sheared ground along a brecciated quartz-calcite vein with a maximum width, at the portal, of about 2 feet. The vein is sparingly mineralized with sphalerite, pyrite, galena, and tetrahedrite. As seen in the back of the adit, the vein is lensy and discontinuous, and within 100 feet pinches into small, pod-like bodies of crushed quartz. Except near the portal, little evidence of mineralization was noted.

(12) POLARIS GROUP

Reference: Lay, D.: Aiken Lake Area, North-Central British Columbia; B.C. Dept. of Mines, Bull. No. 1, 1940, pp.22-24.

The Polaris group, staked and explored by the Consolidated Mining and Smelting Company of Canada, Limited, consists of eight claims on Polaris Creek, about a mile above its junction with Lay Creek. The property is reached by a trail, 2½ miles long, from the Jupiter workings.

A short distance upstream from the property, Polaris Creek flows through a rocky gorge that increases in depth to about 300 feet at its junction with Lay Creek. The gorge exposes a complex assemblage of slaty argillite, impure limestone, tuffs, and andesitic flows cut by many small dykes and stocks of acidic to intermediate composition.

Near a small stock of quartz-biotite porphyry, calcareous and cherty, black, slaty argillites are cut by a network of small quartz and quartz-calcite veins. The veins in places are well mineralized with disseminated, banded or blebby pyrite, arsenopyrite, and pyrrhotite, with, perhaps, some chalcopyrite. The network of veins has an observed width of as much as 3 feet; the individual veins, commonly symmetrically banded, reach a maximum width of 4 inches, but are mostly less than 2 inches wide. Remarkably high gold assays are reported to have been obtained from samples across narrow widths of some of these veins, but it is understood that the average gold content across mineable widths did not approach commercial grade.

Also exposed in the Polaris Creek gorge are several lens-like replacement bodies of pyrrhotite, with minor pyrite and chalcopyrite. The largest of these is about 30 feet wide, and is exposed on both sides of the canyon wall for a vertical distance of at least 100 feet. None of these bodies has shown a significant precious metal content.

(13) HOPE GROUP

The Hope group, staked in 1944 by O. Schmidt of Fort St. James, lies at an elevation about 6,800 feet in a col on the crest of the ridge 2½ miles northeast of Jackpine Lake. The claims cover a fracture zone 12 to 25 feet wide and several hundred feet long in uniformly banded quartz-mica-feldspar schist and granitoid gneiss. Most of the fracture zone consists of fragments up to 2 feet in diameter of gneiss and bluish grey, massive quartzite partly to completely replaced by pyrrhotite, pyrite, and arsenopyrite, with very minor chalcopyrite, together with others of solid crystalline sulphides, in a matrix of massive to crystalline pyrrhotite, massive hematite, and earthy, friable limonite. Mineralization appears to be due both to replacement and fracture filling.

In other parts of the deposit bands of crystalline sulphide minerals have formed along the foliation planes of the quartz-mica-feldspar schist, giving the exposures a veined appearance.

Assays of samples from this deposit have indicated only traces of gold and silver.

(14) STRANGER GROUP

The Stranger group, staked in 1929 by H. Ravenal of Fort Grahame, is on Tutizika River about 5½ miles above its confluence with the Mesilinka. Evidence of mineralization consists of a network of narrow, quartz and quartz-calcite veins, sparsely mineralized with pyrite, in a slaty, black, somewhat sheared argillite, which is in part calcareous. The largest single vein noted was about 4 inches wide, but at one place an aggregate width of 2 feet of vein matter was distributed within a width of 10 feet of rock.

Nothing is known of the precious metal content of the veins, but in view of the fact that almost no exploratory work was done and the lease on the claims was allowed to lapse, it is assumed that assay returns were disappointing.

LEAD-COPPER SHOWING NEAR TUTIZZI LAKE

The ridge immediately north of the west end of Tutizzi Lake exposes many quartz veins containing lead and copper minerals. One of the best mineralized of these is exposed in an iron-stained zone about 50 feet wide in medium-grained diorite cutting coarse-grained hornblendite and pyroxenite. It consists of about 3 feet of brecciated, rusty quartz, which in turn contains a more compact quartz vein with a maximum width of 15 inches, heavily mineralized with galena and chalcopyrite. Assays of two grab samples of this material averaged: gold, 0.0075 ounce a ton; silver, 5.05 ounces a ton; copper, 1.44 per cent; and lead, 50.38 per cent. This vein is exposed for a length of about 30 feet.

Quartz veins are numerous in the surrounding area, some attaining a width of 3 feet and a length of several hundred feet. All contain some galena or chalcopyrite, but in general the quantity of sulphides is small, and all the veins sampled gave low gold and silver assays.

(15) CHIEF THOMAS SHOWING

The Chief Thomas showing consists of a single quartz vein in slightly gneissic monzonite exposed on the south side of a peak east of the headwaters of Etschitka Creek at an elevation of 7,500 feet. The vein is 6 to 10 feet wide, at least 350 feet long, and stands vertically. Sulphide minerals are distributed at intervals across the vein, but are most concentrated and continuous along the west side of the vein, where 1 foot of quartz and 18 inches of the adjacent rock are heavily impregnated with malachite and contain many blebs and patches of bornite, chalcopyrite, and pyrite. The largest solid sulphide mass observed was 2 by 8 inches in surface area. Part of the quartz is badly fractured and vuggy, and contains

much dark red to specular hematite. Limonite boxworks are well developed in places.

Only the western contact of the vein is exposed. Here the wall-rock has been converted, for a width of about a foot, to a fine, compact material composed largely of malachite, flanked by 1 to 3 feet of malachite-stained monzonite.

The vein has not been systematically sampled. Two grab samples, free from the larger sulphide blebs, assayed: gold, trace to 0.015 ounce a ton; silver, trace to 0.27 ounce a ton; and about 1 per cent copper.

(16) ELIZABETH GROUP

The Elizabeth group, staked in the autumn of 1946 for the Consolidated Mining and Smelting Company of Canada, Limited, covers a shear zone in quartz monzonite and diorite near the head of the east branch of Etschitka Creek. The zone contains numerous quartz and quartz-carbonate veins, in two intersecting sets, one of which is reported to have provided fairly consistent, but low, assays in gold and silver.

(17) MATETLO COPPER SHOWING

The Matetlo Copper showing is exposed in the precipitous wall of the cirque at the head of the east branch of Matetlo Creek. It consists of a series of fractures and veins carrying iron and copper minerals in quartz monzonite. The fractures are abundant across a width of 120 feet, striking south 50 degrees east, and dipping 85 degrees northeast. Within this zone at least five veins, 6 to 10 inches wide, consist, typically, of coarse-grained crystalline pyrite at the centre, flanked by minor chalcopyrite and pyrite, which, in turn, merge into a quartz-epidote border zone containing disseminated malachite and azurite. A grab sample of nearly solid pyrite-chalcopyrite ore assayed: gold, 0.01 ounce a ton; silver, 1.31 ounces a ton; and copper, 18.93 per cent.

The quartz monzonite between the veins is much fractured; the fractures are filled with thin seams of malachite and azurite, and small grains of malachite appear to be disseminated through the freshly broken rock. A grab sample of this material assayed: gold, trace; silver, 0.03 ounce a ton; and copper, 2.02 per cent.

LEAD SHOWING IN MAY CREEK VALLEY

Near the south end of the ridge east of the confluence of May Creek and Osilinka River, an irregular, pod-shaped vein of solid, crystalline galena replaces slightly banded, dense, flat-lying limestone. It is exposed for only $3\frac{1}{2}$ feet, and has a maximum observed width of 1 foot. The galena shows a slight banding of coarse and fine-grained material parallel with the banding of the limestone that it has replaced. The exposure, however, lies in a rusty, badly weathered area of limestone, and the talus on the west side of the ridge contains abundant blocks of nearly pure galena, some of the larger of which approximate the size of a 1-foot cube.

Assays of the galena show a very uniform lead and silver content, averaging: silver, 45.96 ounces a ton; and lead, 83.53 per cent.

(18) PLUTO GROUP[1]

[1]Reported on by J.E. Armstrong, Geological Survey of Canada.

Reference: Lay, D: Aiken Lake Area, North-Central British Columbia; B.C. Dept. of Mines, Bull. 1, 1940, pp. 26-28.

This property comprises four claims situated on Pluto Creek, a small tributary of Thane Creek. It is 11 miles by pack-trail from Uslika Lake. The property, held by the Consolidated Mining and Smelting Company of Canada, Limited, has been prospected by stripping the surface hydraulically.

Most of the mineral showings are in greenstones of the Takla group within 50 feet of their contact with porphyritic diorite, but a few of minor consequence are in the diorite. Both the greenstones and the diorite are here intensely sheared in a north-northwesterly direction roughly parallel with the contact. Most of the shear planes dip from 60 to 75 degrees to the southwest. They are probably part of a major shear or fault zone that follows Pluto Creek.

The mineral showings comprise lenses of mixed pyrite, arsenopyrite, and minor chalcopyrite along the shear planes. Lenses of the following maximum surface dimensions have been uncovered: 3 by 53 feet; 9 by 30 feet; 25 by 12 feet; 3 by 37 feet; 10 by 50 feet; and 3 by 30 feet. Gold assays up to 0.4 ounce a ton have been reported. Most of the gold is associated with arsenopyrite.

(19) THANE GROUP[1]

[1]Reported on by J.E. Armstrong, Geological Survey of Canada.

Reference: Lay, D: Aiken Lake area, North-Central British Columbia; B.C. Dept. of Mines, Bull. 1, 1940, pp. 28-29.

The Thane group, consisting of four claims, is on Thane Creek about 7 miles above its mouth. It may be reached by a pack-trail, about 12 miles long, which leaves the Germansen Landing - Aiken Lake winter road at Thane Creek crossing $\frac{1}{2}$ mile north of Uslika Lake.

The property straddles the contact of the large granodiorite batholith to the west with Takla group volcanic formations. Many of the andesites along the contact have been altered to green, chloritic and amphibolitic schists, which strike north 70 degrees west and dip 70 degrees northeast. Both shearing and faulting are pronounced in this direction.

The principal deposit is a silicified shear zone about 4 feet wide mineralized with a little pyrite, chalcopyrite, magnetite, and specularite. Low assays in gold have been reported.

20. VEGA GROUP[1]

[1]Reported on by J.E. Armstrong, Geological Survey of Canada.

Reference: Lay, D: Aiken Lake Area, North-Central British Columbia; B.C. Dept. of Mines, Bull. 1, 1940, pp. 25-28.

Introduction

The Vega group of ten claims is situated on Vega Creek about 6 miles above its mouth. It may be reached by a pack-trail about 7 miles long, which leaves the Germansen Landing-Aiken Lake winter road at Thane Creek crossing ½ mile north of Uslika Lake.

Six claims were staked about 1928 for the Consolidated Mining and Smelting Company of Canada, Limited, and during the 10-year period ending in 1938 they were explored by surface stripping and by an adit level from Vega Creek comprising at least 500 feet of underground work. At that time the gold and copper content of the showings were of chief interest.

A little cinnabar was found on the property in 1942, and as a result four more claims were staked and much trenching done in search for mercury ore. The property has been idle since 1944.

Geology

The claims on which the showings occur are mainly underlain by northwesterly trending, steeply dipping, dark green, andesitic flows, breccias, and tuffs of the Takla group. The andesite exposed in the adit contains numerous pebbles and boulders of granodiorite up to several feet in diameter. Minor interbeds of argillite and conglomerate were observed in several trenches, and Lower Jurassic fossils were collected from the argillite.

A major shear or fault zone striking north 15 degrees west and dipping 65 degrees southwest crosses the property several hundred feet west of the adit. This zone has been traced for several miles southeast of Vega Creek. It is characterized by intense shearing and alteration of the andesites to ankeritic carbonates across a width of about 200 feet.

A detailed examination of the underground workings indicated three directions of faulting and shearing, at about north 15 degrees east, north 65 degrees east, and north 75 degrees west respectively, with the fault planes spaced at intervals of about 20 feet. Many of these faults are marked by a few inches to 18 inches of gouge.

Economic Geology

The main gold-copper showings, as exposed in the underground workings, consist of chalcopyrite, pyrite, and minor bornite, either disseminated through the andesite or concentrated along calcite stringers that lie along fractures. No sulphides were seen along the faults, which are apparently post-mineral. Epidote is common throughout the mineral showings. The best body of ore is reported to be about 10 feet wide and at least 25 feet long, and to average 0.25 ounce of gold a ton and 1.5 per cent copper.

About half a mile south of Vega Creek, cinnabar has been found in the carbonatized rocks that lie along the major fault zone previously described crossing the property. The cinnabar occurs as minute stringers along small fractures and as individual specks. Two zones, one 15 feet wide and the other 40 feet wide, are reported to assay one-half pound of mercury a ton.

(21) RUBY GROUP[1]

[1]Reported on by J.E. Armstrong, Geological Survey of Canada.

The Ruby group is on Jimmay Creek (Ruby Creek) about 4 miles above its mouth It may be reached by a good pack-trail 5 miles long, which branches from the Germansen Landing-Aiken Lake winter road at May Creek crossing. The group was staked in 1944 by Bert Goodridge and Hans Hunderi for the Consolidated Mining and Smelting Company of Canada, Limited, and exploratory work, consisting mainly of surface stripping by hydraulicking and bulldozing, was done in 1945 and 1946.

The bedrock exposed in the vicinity of the mineral showings on either side of Jimmay Creek is mainly quartz-mica schists of the Ruby group of Late Proterozoic age. These trend about north 60 degrees west and dip 20 degrees northeast, although locally the attitudes vary greatly due to minor folds and faults. The quartz-mica schists are intruded by stocks and sills of quartz-feldspar porphyry. The mineral showings occur along a zone of intense faulting and shearing that strikes north 35 degrees east and dips about 55 degrees southeast. Branch faults or shears trend north 25 degrees west and north 75 degrees east. All the fault and shear planes have slickensided surfaces coated with graphite, and the rocks themselves have been silicified.

The most important mineral showing lies along the silicified fault zone, and consists of ruby silver, arsenopyrite, and pyrite concentrated along slip planes across widths varying from 10 to 50 feet.

Assays are reported to have shown good silver and a fair gold content. The mineralized zone has been traced for about 200 feet on both sides of Jimmay Creek.

(22) BEVERLEY GROUP

The Beverley group is situated on a limestone ridge on the north side of the valley of Osilinka River about 3 miles east of its junction with May Creek. The original eight claims were staked in October 1946 for the Consolidated Mining and Smelting Company of Canada, Limited, and exploratory work, consisting chiefly of trenching and stripping, was carried on throughout the summer of 1947.

The limestone formation in the vicinity of the showings appears to have been folded into a major anticline striking slightly east of north, plunging northerly at 30 to 40 degrees, and overturned to the west. The mineral showings are on the limbs and crests of minor folds, and appear to be related to fracture cleavage.

The deposit is essentially a replacement of limestone by galena. Within an area of 1,500 by 2,500 feet, or more, most of the exposed outcrops contain a little galena, but several large bands of the limestone are more heavily mineralized. Fine-grained, crystalline galena, in stringers, small patches, or isolated grains, is contained in a groundmass of coarsely crystalline calcite, with some barite and possibly a little dolomite. The stringers of galena, composed of individual, minute grains, are rarely more than 1/8 inch wide and 6 inches long, and appear to follow the bedding. They account for about half of the sulphide material in the rock. Much of the rest of the galena occurs as fine-grained patches or blebs, which also appear to follow the bedding.

A little sphalerite has been observed in some of the exposures and also some secondary lead minerals, principally lead carbonate. The barite formed later than the sulphides, and veins the galena in places.

(23) WEBER GROUP

Reference: Lay, D.; Ann. Rept, B.C. Minister of Mines, 1930, pp. A153.

The Weber group, first staked in 1929 by F. Weber of Fort Grahame, and restaked at intervals since, is on the east side of Wasi Creek about 1½ miles south of its junction with Osilinka River. The mineral deposit on this property consists of a pyrite-galena-sphalerite-barite replacement in limestone along the northeast side of an open fracture that strikes north 30 degrees west and dips 80 degrees northeast. The deposit has been traced at intervals for a length of 150 feet, and is confined to a width of 15 feet. Within it the sulphides occur as disseminated blebs and patches in coarse-grained limestone. They are roughly in the proportion of 60 per cent galena and sphalerite to 40 per cent pyrite.

A sample taken by D. Lay of the British Columbia Department of Mines across 17 feet of this material assayed: gold, 0.02 ounce a ton; silver 1.0 ounce a ton; lead, 1.6 per cent; and zinc, 3.6 per cent.

A grab sample taken by the writer from one of the heavily mineralized bands assayed: gold, trace; silver, 2.00 ounces a ton; lead 10.24 per cent; barite ($BaSO_4$), 4.06 per cent.