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PROGRESS REPORT
On the
EXAMINATION
of the
BRITANNIA MINE

June 16,1922

Schofield

Britannia Beach, B.C.

June 16th, 1922.

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EXAMINATION OF THE - BRITANNIA MINE

HOWE SOUND, B.C.

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Contents

LIST OF PLANS ACCOMPANYING THIS REPORT.

1.	Geological Plan -	Fairview	250 Level	Bound together.
2.	" "	"	500 "	
3.	" "	"	600 "	
4.	" "	"	700 "	
5.	" "	"	850 "	
6.	" "	Jane, Fairview & Bluff	1000 Level	Bound together.
7.	" "	Fairview & Bluff	1200 Level	
8.	" "	Fairview & Bluff	1400 Level	
9.	" "	Fairview & Bluff	1600 Level	
10.	" "	Bluff	1800 Level	
11.	" "	Bluff	2200 Level	
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13.	" "	Empress	1050 Level	
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15.	" "	Empress & Victoria	1600 Level	
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18.	" "	Victoria	2000 Level	

Five (5) Cross sections of Fairview.

Seven(7) Cross sections of Bluff.

One (1) Cross section of Victoria.

One (1) Glass model of victoria.

In addition - 50 Mineral Claims are geologically surveyed.

PROGRESS REPORT

on the

BRITANNIA MINES - HOWE SOUND, B.C.

General: Summary and Conclusions

1. The Bluff, Fairview, Empress, and Victoria mines are located in the same shear zone whose general direction is N.75 deg.W. to N.70 deg.W. The shear planes dip 70 deg. to the south.

2. The ore bodies of these mines are restricted to this shear zone.

3. The green schist generally mottled as in the Fairview is the most favorable rock for mineralization.

10. This green schist is a sheared porphyry intrusive into the slates. The silver schist is a very highly sheared quartz porphyry.

5. No trace of mineralization was seen in the unsheared porphyry or in the granite, hence areas of such rocks are not considered to be of value from a mining standpoint.

4. The slates as a rule do not favor ore bodies. The exceptions to this are the occurrences of ore on the Jane and on the Daisy Claims. However, in the Fairview, where east and west veins approach the slates, they are cut off completely.

6. The Bluff, Fairview, Empress, and Victoria mines are structurally similar. The ore bearing green schist in each mine coming to a point or nose to the west.

7. This nose has a hanging wall and foot wall of slates. The nose in the Bluff-Fairview plunges or pitches to the southwest at an angle between 30 and 45 degrees.

7. The plunge or pitch of the nose in the Empress and Victoria mines cannot be determined from the present state of development, but it is probably to the west

8. The metal content of the Empress and Victoria is usually high towards the nose. In the Bluff the high metal content is within 5-600 feet from the nose.

9. The ore and rock in the nose is usually highly siliceous.

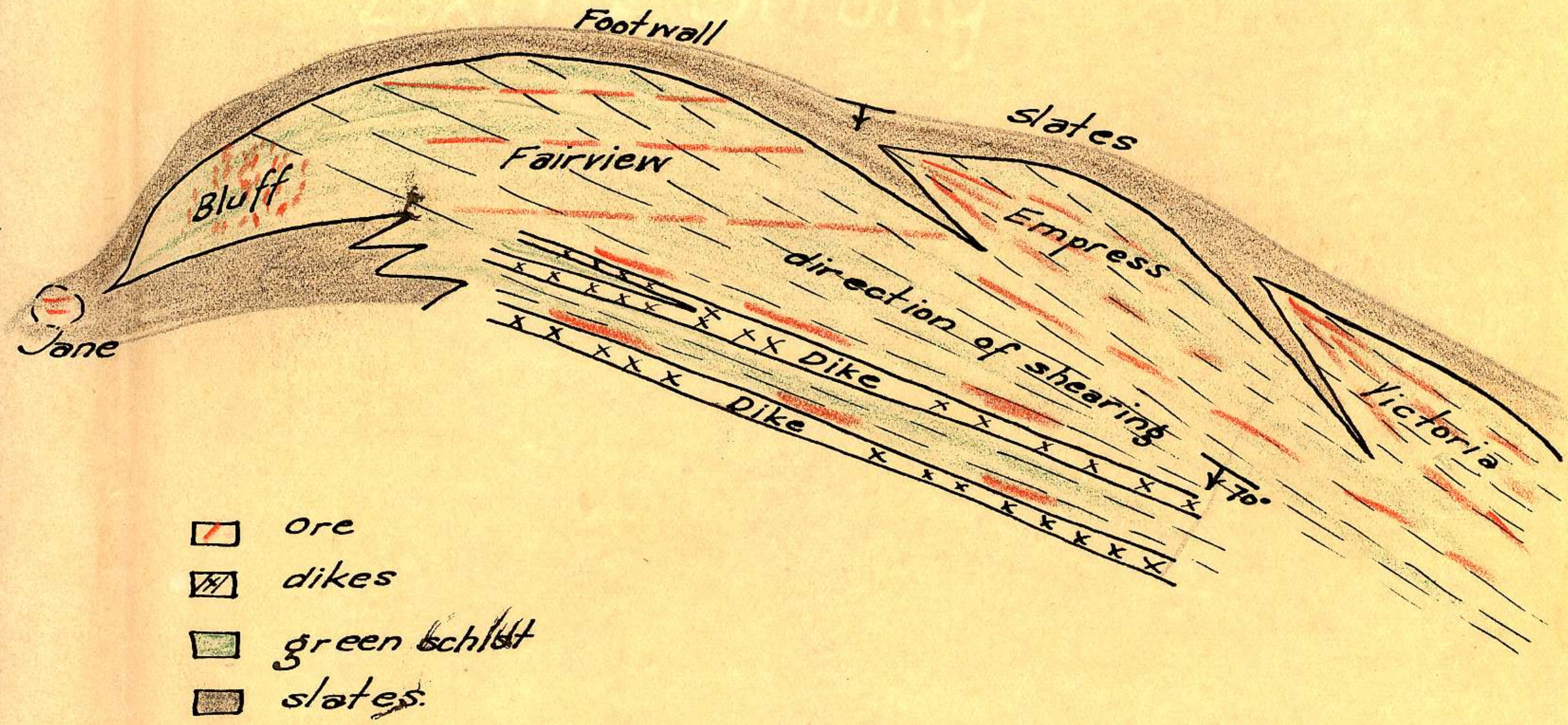
10. All the mines have a foot wall of the same belt of slates which has been followed underground from the Jane to the Victoria.

6. The Jane ore bodies occur in the slates (includes some quartzites) just above the plunging nose of the Bluff so that the Jane and the Bluff Mines are considered to be related and that the plunge of the Bluff ore body will govern the plunge or pitch of the Jane.

(The accompanying is a diagram to illustrate some of the points covered above.)

Diagram for illustration only-
(not drawn to scale)

-Plan-



Conclusions regarding the possibility of Ore in depth.

1. The Bluff and Fairview mines are structurally linked so that the pitch of the Bluff Ore body governs to a large extent the pitch of the mineralization in the Fairview veins.

2. The Bluff ore body pitches approximately 45 deg. to the south-west so that the ore bodies in the continuation of the Fairview will probably pitch in the same direction.

3. In the diamond drilling in the Fairview on the 2200 Level to the west, the geological structure points to the conclusion that D.D. ~~2.~~3-22.-13 cuts ore which resembles the Bluff type. The main Bluff ore-body is considered to be father to the southwest. The exact location where the Bluff ore body intersects the horizon of the 2200 Level cannot be determined because the plunge of the nose which holds the Bluff ore body has not been definitely determined by the present workings.

The determination of the presence and extent of the Bluff ore body at the horizon of the 2200 Level since it is striking approximately for the line of the 2700 tunnel, is of first importance in planning the explanation of the whole Britannia Mineral zone from the 2700 Level.

3. From an examination of the cross sections of the Fairview mine, it can be seen that the ore bodies are usually strong where the slate foot wall dips 45 deg. - 60 deg. to the south and diminish in size where the foot wall approaches vertically. Also where the foot-wall is vertical the shear zone is narrow and the intensity of shearing greater. This is shown by the presence of the silver schists in a zone occupied on a higher level by green schists which are ore bearing(see sections 32500 & 33000). The size of the hanging wall dikes also diminish where the shear zone is narrow. Hence there is an apparent relationship among the size of the ore bodies, the intensity of shearing and the size of the hanging wall dikes.

Since the area around the Britannia Mine is the northern limb of a shallow syncline, the southern limb of which outcrops in the vicinity of Deek's gravel pit south of Britannia Beach, the dip of the formations must flatten at depth so that in all probability the footwall in the Fairview mine will resume its 45 deg. dip. There are no facts which will aid us in the determination of the point where this flatening will take place but following the Bluff ore body down the pitch will permit the exploration of the Fairview Zone in depth with the least possible cost.

Diamond drilling from the 2200 Level to explore the ground below this level is considered to be advisable.

5. There is nothing in the character or the association of the ore minerals or the gangue which point to the possibility that the ores of the Britannia Mines should not continue in depth.

6. There is a possibility that the ore shoots in the Jane Mine may continue in depth but ore bodies in the slates are generally irregular and difficult to follow. However, the position of the known ore bodies in the Jane in the slates just above the plunging nose of the Bluff ore body, makes it likely that other ore bodies similar to the Jane may occur in the same relative position. At least, the best chance lies there.

Conclusions regarding the possibility of ore along the strike of the shear zone to the East of the Victoria:

1. On account of the heavy covering of snow, the surface work on this extension could not be carried out. This exploration will be very much simplified and hastened by the knowledge gained from the examination of the other mines. The following facts are important:

2. All the mines have the same footwall of slates. This footwall should be traced eastwards from the Victoria as carefully as possible since the commercial ore bodies are more frequent close to the footwall.

3. The ore increases in grade as the nose of the deposit is approached, or in other words, to the West. Hence, if low grade ore is exposed or encountered in drilling, the best possibility of finding higher grade ore is towards the West near the nose of the deposit.

4. Exploration should be confined to the shear zone.

Conclusions regarding the extension of the shear zone west of the Bluff:

1. The sheared porphyry (green schist) exposed in the Bluff and Fairview Mines turns in strike from N. 70 degrees W. to the southwest and disappears under a capping of slates as described in the general conclusions. Hence, the extension of the shear zone to the west is to be looked for in a south westerly direction, and as far as the surface is concerned, the ore bearing sheared porphyry will not outcrop on account of its rather rapid plunge under the slates.

2. Examination of the surface west of the Bluff and Jane from the townsite to the top of the hill to the south of the townsite did not reveal a zone of shearing. Also, no shear zone is to be found in the hillside tunnel nor in the diamond drill core driven southwards from the face of this tunnel. This confirms the swing of the strike of the shear zone to the southwest

General Geology

General Statement

In the Britannia region the oldest rocks are the tuffs and agglomerates which occur on Goat Mountain to the north of the Tunnel Camp. These belong to a group of rocks which are known on Texada Island as the Texada formation. Fossils found on Texada Island indicate a Triassic-Jurassic age for this formation. Overlying these volcanic rocks are a series of slates which underlie the Tunnel Townsite and occur at various places in the mine workings.

Intruded parallel to the bedding planes into the slates and possibly into the tuffs is a large number of porphyry sheets which are in the nature of long narrow lenses.

At the close of the Jurassic period, the above mentioned series of rocks were folded into mountain chains striking in a northwesterly direction and intruded by a vast quantity of granite or grano diorite which, at the present time, makes up the greater part of the Coast Range of British Columbia. It is possible that the east and west fissures in the Fairview Mine were formed during this period of folding, although they may have been formed at practically contemporaneous with the shearing.

Following this period of folding came the intrusion of the gabbro dikes which are badly sheared. They are to be seen very readily on the 1200 L.

The formation of the shear zone followed the intrusion of these dikes, and its formation is one of the most important events in the history of the Britannia ore-deposits. The shearing changed the quartz porphyry into the green schist usually mottled as in the Fairview Mine, as well as into the silver schist where the intensity of shearing was very great. The shearing made channels favorable for the penetration and deposition of the ore. One of the most favorable places is at the intersection of this shearing with the east and west fissures in the Fairview Mine. The direction of the shear zone is N. 70 degrees W.- N. 75 degrees W. with a dip of 70 degrees to the south.

Intruded into the shear zone and usually parallel with its strike and dip is a number of diorite dikes which are most abundant in the hanging wall especially in the Fairview Mine.

The period of mineralization followed the intrusion of these dikes. The mineral solutions originated in the cooling stages of the granite batholith and rose along the openings in the shear zone. Ore-bodies were deposited in favorable places either by impregnation of the green schists, by replacement of these schists or by both processes. Silicification was also due to these mineral bearing solutions. It is probable that the solutions which deposited the gypsum and the barite also came in at this time.

During the Cretaceous period which intervened between the Jurassic and the Tertiary, the Britannia area was subject to erosion which no doubt exposed the ore deposits and in part removed the upper portions.

The Tertiary period also was one of erosion which process has continued to the present day. During the Tertiary it is believed that the dark fine-grained-fresh dikes exposed in the Jane Tunnel and in the Finn Crosscut were intruded contemporaneously with the volcanic activity which resulted in the building of Mount Garibaldi, a dormant volcano situated just north of the Britannia area.

The Pleistocene or Glacial period was one of erosion, but the hardpan and drift which covers the bedrock in many places were deposited during this period.

Geological Formations

The formations exposed around Britannia are part of a large inclusion or roof-pendant enclosed in the Coast Range granite. The geological history can be readily arranged in a column as follows:-

Pleistocene	-	Glacial drift - hardpan.
Tertiary	-	Intrusion of lamprophyr dikes.
Jurassic	-	Mineralization - deposition of the ores and gangue.
	-	Intrusion of the diorite dikes (hanging wall dikes).
	-	Formation of the shear zone.
	-	Intrusion of the gabbro dikes.
	-	Intrusion of the granite of the Coast Range batholith.
	-	Folding - formation of the E. & W. fissures of the Fairview Mine.
	-	Intrusion of the quartz porphyry.
	-	Sedimentation - deposition of the slates.
	-	Volcanism - deposition of the tuffs and agglomerates.

The Volcanic tuffs and agglomerates.

These are massive dark grey to black rocks which in many places show their bedded character. As a rule they are very fine grained, the coarser bands being more resistant to the agencies of weathering project somewhat on the surface. The agglomerates consist of particles of volcanic rock sometimes amygdaloidal imbedded in a matrix of finer grained material. The relationship of these rocks to the slates is not definitely known but the information so far obtained places them underneath the slates. The thickness of the volcanic series is unknown but it is at least 3000 - 4000 feet.

The Slates

The slates are usually black in color but in the neighborhood of the mineralized zone they are usually a light grey and are readily confused with the silver schists and sometimes with the green schist. They form the footwall of all the mines and occur also as the hangingwall in the vicinity of the noses of all the mines. The strike and dip of the slates are variable but over a large area the general strike is N.70 deg. W. and the dip 45 deg. to 60 deg. to the south.

On account of the shearing the bedding planes in the vicinity of the ore bodies are almost completely obliterated.

Included under the general heading of slates are bands of argillaceous quartzites which are exposed in the Jane mine and in the section along the incline from Mineral Creek down to the Beach. Some wide bands of chert are also found with the slates and occur in the Armour Tunnel, in the workings of the 3100 Level, as well as along the incline between Mineral Creek and the Beach.

The argillaceous quartzites in the Jane usually carries the mineralization.

The ore bodies in the slates are irregular both in character and distribution. On account of the snow, the ore occurrences on the Daisy claim has not been examined up to the present.

The Quartz Porphyry

The quartz porphyry masses are intruded parallel to the bedding planes of the slates and are thus in the nature of dikes or more likely sills which have been tilted and folded along with the slates during the period of folding which followed this intrusion. Hence the porphyry occurs as long narrow bands or lenses which strike parallel with the slates. These bands vary in width from a few feet to a thousand feet. They are not continuous but come to a point or nose embedded so to speak in the slates. The typical rock is a light grey in color but spotted with white phenocrysts of plagioclase felspar and sometimes quartz.

The name quartz porphyry is used for simplicity although in composition and structure it is more closely allied to a granodiorite porphyry.

The quartz porphyry when sheared turns into a green schist, usually mottled as seen in the Fairview Mine. This green schist is the most favorable rock for ore and the determination of this fact will greatly facilitate the future exploration of the Britannia Mineral Zone.

When the quartz porphyry is severely sheared it turns into a silver schist which is unfavorable for ore deposition. This statement can be proved by examination of the Jackson Stope on the 11th vein. The ore body was large between the 500 - 250 Levels, but did not continue in depth because on the 600 Level and on the lower levels this horizon is composed of silver schists. Also, no ore has been found in the silver schists in any part of the sheared zone.

The facts that the green schist with more intense shearing passes into the silver schist and that the silver schist may pass into the green schist must be borne in mind in the exploration of new territory, both in depth and along the strike.

The unsheared quartz porphyry is unfavorable for the occurrence of ore bodies. No traces of mineralization have been noticed in the unsheared quartz porphyry.

Granite

The granite, or more correctly the grano-diorite, exposed in the vicinity of the Britannia Mine is part of the Coast Range batholith which forms the westerly part of British Columbia.

It is generally massive, of light grey color with occasional pinkish tones. The mineral constituents are plagioclase orthoclase and quartz with minor amounts of hornblende or mica, but sometimes with both hornblende and mica.

Up to the present no tracesof mineralization have been seen in the granite, and as a rule in British Columbia, it is not favorable for ore deposition.

Gabbro Dikes

These dikes are well exposed on the 10th Level, Outside the shear zone in the neighborhood of the No. 2 Shaft, the gabbro dike is a fine-grained massive dark green rock, but where it crosses the shear zone, it has been sheared into a dark greenish black schist. An examination of the geological plan of the 10th Level will show the details of these dikes very clearly.

Diorite Dikes

These dikes are to be found principally in the hanging wall part of the sheared zone. They are composed of a fine-grained mixture of plagioclase and hornblende. As a rule they follow the direction of the shearing both in strike and dip. They split and unite along the strike and down the dip as may be seen in the plans and sections of the Fairview Mine. In some cases small dikes of the same material cross the direction of shearing. In the upper levels these hanging wall dikes are wide but diminish in size in the lower levels. They are not sheared to any extent and underground they may be readily detected by their greenish color and blocky fracture. It is considered that the period of mineralization followed the intrusion of these dikes because in many cases, thin stringers of ore were found penetrating the dikes. Also the ore bodies near the hanging wall of the shear zone are controlled in position and attitude by these dikes. This is an important feature in localization of ore shoots. It is best seen on cross-section through longitude 32000 of the Fairview Mine.

The ore in the vicinity of these dikes is usually highly siliceous and very hard.

Lamprophyr Dikes

These are very narrow dikes which were seen in the Jane Tunnel and in the Finn crosscut. They are very fine grained, and black in color. In contrast to the dikes previously described, they are remarkably fresh and unaltered. Under the microscope, the plagcoclase felspars are clear and glassy. Mica and hornblende are the other mineral constituents. They are considered to be of Tertiary age.

Glacial Drift

The bed rock in places, particularly on the lower slopes of the Valleys is covered with unsorted, unconsolidated material which has been deposited through the agency of ice during the Glacial period. It consists of large and small boulders embedded in gravel, sand and clay. The boulders are composed of the rocks found in place in the Britannia area, but the large ones are composed mainly of granite or grano-diorite.

Structural Geology - Folds and Fissures

Folds:

The noses of the ore bearing zones are in the nature of broad folds which in the Fairview mine plunge at angle from 30 to 45 deg. to the southwest. The accompanying block diagram illustrates the nature of the folds more clearly than description. The plunge of the noses in the Empress and Victoria mines has not yet been determined.

The folds at the Empress and Victoria are similar in character but on a smaller scale

Fissures:

All the veins in the Fairview, Empress and Victoria mines which strike N.70 deg.W. - N.75 deg.W. are related to the great shear zone which strikes N.70 deg.W. - N.75 deg.W. and extends at least from the Reggie claim westward to the Bluff ore body. It dips on an average of 70 deg. to the south. As far as the investigation has gone, the greatest width is about 1000 feet. This zone is the ore bearing zone of all the mines and prospects. The rocks of the shear zone are almost entirely schists, the chief ore bearing member being the green schist which is usually mottled with chlorite.

In the Fairview mine the east and west fissures are related to the folding. The shearing crosses the fissures and at the intersection of the two systems of fissuring occur some of the largest ore bodies in the mine.

STRUCTURAL GEOLOGY

Folds and Fissures

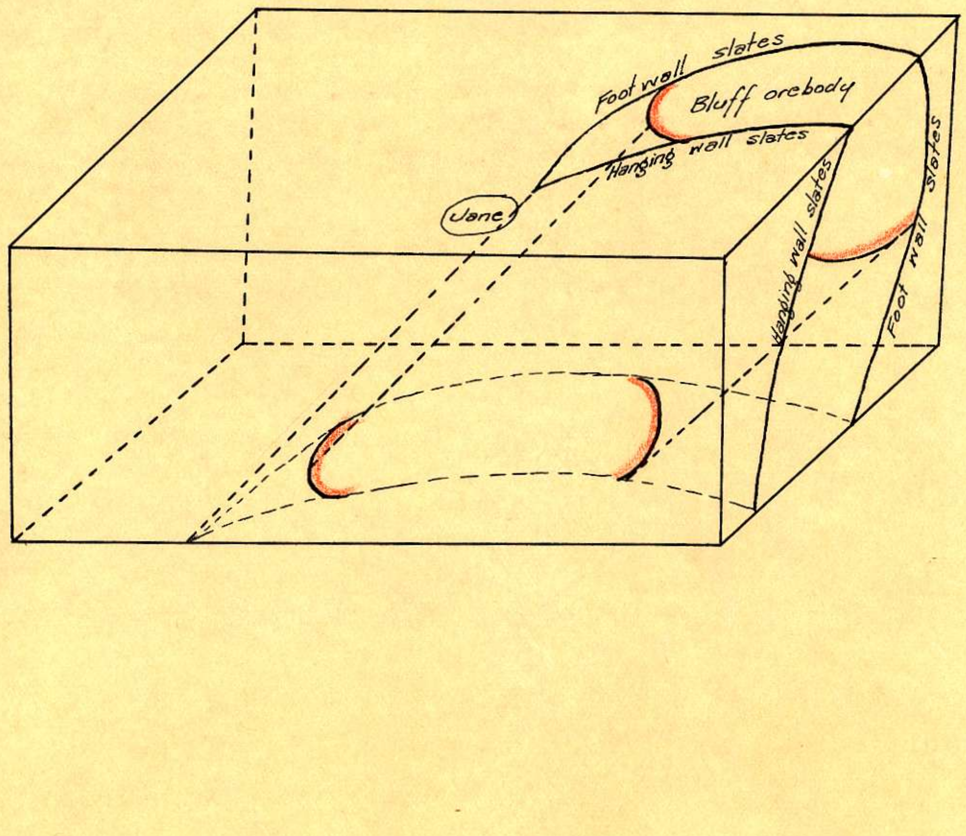
FOLDS

The noses of the ore bearing zones are in the nature of broad folds, which, in the FAIRVIEW mine plunge at an angle from 30° to 45° to the south west.

The accompanying block diagram illustrates the nature of the folds more clearly than description.

The plunge of the noses in the Empress and Victoria mines has not yet been determined.

The folds at the EMPRESS and VICTORIA are similar in character but on a smaller scale.



Economic Geology

Nature of Ores and Gangue

The chief minerals are the primary sulphides chalcopyrite and pyrite. The gangue consists of quartz and silicified schist.

Small amounts of galena and some zinc blende are present in the Bluff ore body.

An interesting occurrence of gypsum is associated with the footwall slates on the 10th Level. The gypsum is in the form of a vein from 15 - 20 feet wide. Gypsum was noticed also associated with the silver schists in the hanging wall of the Fairview Mine.

Relation of Ores to Fissures

The ores are definitely related to the fissures and especially to those which strike N. 70 degrees W. - N. 75 degrees W., and are due to the shearing. Evidently these shear planes furnished the circulation channels for the ascending hot mineralizing solutions which originated during the final cooling stages of the granite. At the intersection of these channels with the east and west fissures in the Fairview Mine, occurs some of the largest ore bodies in the mine.

Relation of the Ores to the Confining Structures.

The mineralizing solutions rising along the shear zone would deposit the ores over a wide area in the shear zone if certain structures had not been present to localize or concentrate the ores within relatively small horizons. These structures in the Britannia area are as follows:

1. The intersection of the shear zone with the E. and W. fissures in the Fairview Mine.

2. Along the footwall of the hanging wall dikes. These dikes acted as barriers to the solutions which rose along them forming ore bodies whose hanging wall are formed by these dikes.

3. The slates in the Bluff ore body form the hanging wall and footwall. The hanging wall and footwall come together above and to the southwest, so that the ore bearing solutions rose along this inverted trough and formed the Bluff ore body. (See sketch)

In the Empress and Victoria, the solutions were concentrated in a similar fashion, but not on so large a scale.

RECOMMENDATIONS

1. In all cases the pitch of the noses of all the mines should be approximately determined since the noses have an important controlling influence on the localization of ore.

2. Exploration to determine the presence of ore bodies below the present Jane Mine should be carried on by means of diamond drilling to the south from the drift to the west of the main Jane Tunnel.

3. D.D.Hole 3. 22. 15 proves the existence of the Bluff ore body in depth. D.D.Hole 3. 22. 15 passes under the Bluff ore body since the Bluff ore body pitches to the southwest(see 2200 Level Plan). The size of this ore body might be more definitely determined in order to find out its value in connection with the driving of the 2700 Level to the Victoria.

4. In order to determine the possibility of the continuation of the Fairview veins in depth,diamond drilling is recommended from the 2200 Level approximately north at an angle of 45 deg. to the horizontal. This would determine also the position and dip of the footwall slates. The hole should be drilled until it penetrates the slates for a distance of 20 feet.

Previous exploration has shown(see Plans and sections) that no commercial ore has been found beyond the footwall slates.

5. Exploration by diamond drilling of the ground between the Bluff body and the Empress on the 1600 Level is recommended,although the geological conditions,on account of the steepness of the footwall slates are not especially favorable. By drilling to the slates valuable information would be gained concerning the dip of these slates.

6. The position of the nose of the Empress mine should be located on the 1600 Level by diamond drilling.

7. The present method of exploring the ore bodies of the Victoria Mine is considered to be most satisfactory. No diamond drilling is recommended.

8. No recommendation regarding the exploration of the country east of the Victoria can be made at this date.

The whole report has been discussed with Mr. Browning.

Stuart J. Schofield

Britannia Beach, B.C., Sept. 9th, 1922.

REPORT ON THE WOODLAND GROUP OF CLAIMS.

Location

The Woodland Group of Claims is situated on the West fork of Seymour and adjoins the Reggie Claim of the Britannia Mining and Smelting Co., Limited on the East. The group consists of the Ash, Fir, Maple, Spruce and Elm Mineral Claims.

Shear Zone

The extent of the shear zone as exposed is shown on the accompanying sketch. It crosses the lower half of the Ash Claim and the northwestern corner of the Fir and was not seen on the other claims of this group. The rock outcrops were sufficient to determine the southern limit of the shear zone with some degree of certainty. Narrow localized shear zones of no commercial value were seen on the claim line between the Spruce and Maple.

The shearing in this section of the zone is not so severe as that seen on the Victoria, Empress and Fairview Claims, although along the valley bottom where there are no rock outcrops the shear zone may be more highly developed, but the claims which cover this ground belong to the Britannia Mining and Smelting Co.

Mineralization

The shear zone where observed was rather extensively mineralized with pyrite, with only small amounts of chalcopyrite. This mineralization was seen in the open cuts and one tunnel on the Ash Claim. No workings on the other claims of this group were found. The mineralization resembles that seen on the grade at the summit on the Fly Claim and is evidently a continuation of the same zone.

Assay Values.

Ash Claim

Tunnel	Cu. %
1 - 20	0.0
20 - 40	Tr.
40 - 60	0.2
60 - 75	0.3
Open Cut No. 1	
1 - 12	0.1
12 - 24	0.1
Open Cut No. 2	
B 1	1.0
B 2	Tr.
B 4	None

Recommendations

The acquisition of the Woodland Group of Claims, except at a purely nominal price, is not recommended for the following reasons:-

1. The assay values as given above are not commercial.
2. The shear zone exposed on the Ash and Fir is in the hanging wall, while the ore in the shear zone is restricted in a large measure to the footwall.
3. The footwall of the shear zone at this point occurs in the Company's property.
4. The shearing as exposed is not highly developed.

(Signed) S. J. Schofield.

Sept. 18, 1920

REPORT ON THE SHEAR ZONE EAST OF THE VICTORIA MINE

The shear zone continues from the Victoria M. C. in an easterly direction to the Reggie and Ash M. C's. as outlined on the accompanying plan.

The average width of the shear zone is 1200 feet. The shearing strikes approximately N. 70° W. and dips on an average 70° to the South. The shear zone may be divided into 3 sections and arranged in order of importance as follows:

I. From the Victoria Mineral Claim to the Fairwest M. C. inclusive.

II. From the Conifer M. C. and Arctic Fir Fr. to the Bee M. C. and the North western part of the Golden Pheasant M. C.

III. From the North eastern part of the Bee M. C. to the Ypres Fr. inclusive.

I. The footwall slates of the Victoria mine hold their strike until they enter the Cycad Fr. where they swing to the southeast forming a large bend on the Cycad Fr. The rocks in this portion (from Victoria M. C. to Cycad M. C.) are schists similar in character to those of the Victoria, Empress and Fairview mines.

The greater part of this portion including all of the area in the vicinity of the footwall is covered with a heavy covering of drift so that no determination of the character or extent of the mineralization was possible. However, from the structure and the presence of the shear zone well developed throughout this portion, it is considered to be of the three, the most favorable for the occurrence of ore-bodies of commercial value.

II. This portion lies between the footwall slates of the Victoria mine passing through the Cycad Fr. and exposed in the tunnel on the Trout Fr. and another band of slates which passes through the Bee and Golden Pheasant Mineral claims in a south easterly direction and is therefore cut at an angle by the shearing which has a general direction of N. 70°W.

The rocks in this portion of the shear zone consist of a complex of quartz porphyry and volcanic rocks sheared into schists. The only exposures of the shear zone showed the presence of the schists similar to those of the Victoria mine but from an examination of the band of rocks outside the shear zone on the mountains to the north and south showed the presence of volcanic rocks as well as quartz porphyry, the latter rock in the shear zone becomes the schist of the Victoria, Empress and Fairview mines.

The volcanic rocks in the shear zone have not as yet been tested for the presence of ore bodies because they do not occur in the other mines. Drill base No. 5 is located on an exposure of schist to test this portion of the shear zone. Hole 6-15-1 6-15-2

III. The shear zone from the Fly M.C. to the Ypres Fr. is fairly well exposed. In this portion the shearing is not well developed except locally and apparently represents a gradual dying out of the shear zone.

The rocks here are a complex of sheared quartz prophyry, volcanics and some slates. Schists similar to those of the Victoria, Empress and Fairview mines were noted only in a few localities.

The mineralisation is mainly iron pyryte with very small amounts of chalcopyrite. The assay values secured from this portion show only a trace of 1% copper.

The rocks in the vicinity of the northern boundary of the shear zone on the Bee, Fly and Golden Wren Mineral Claims are nowhere exposed so that information concerning this part is entirely lacking.

Diamond drilling at the present time in this portion of the shear zone is not recommended.

Recommendations .

First Section:

Drill base No. 1 near northeast corner of the Chicago M. C.

2 holes.

1 Direction N. 5°E. Inclination - 35°.
2 Direction N. 35° E. Inclination - 35°.

Drill base No. 2 near northeast corner of the Hunters Best M. C.

2 holes.

1 Direction N. 5°E. Inclination - 35°.
2 Direction N. 35° E. Inclination - 35°.

Drill base No. 3 on the Wild Rose M. C.

1 Direction N. 5° E. Inclination - 35°.
2 Direction N. 35° E. Inclination - 35°.

Drill base No. 4 on the Fairwest in the Fairwest Tunnel.

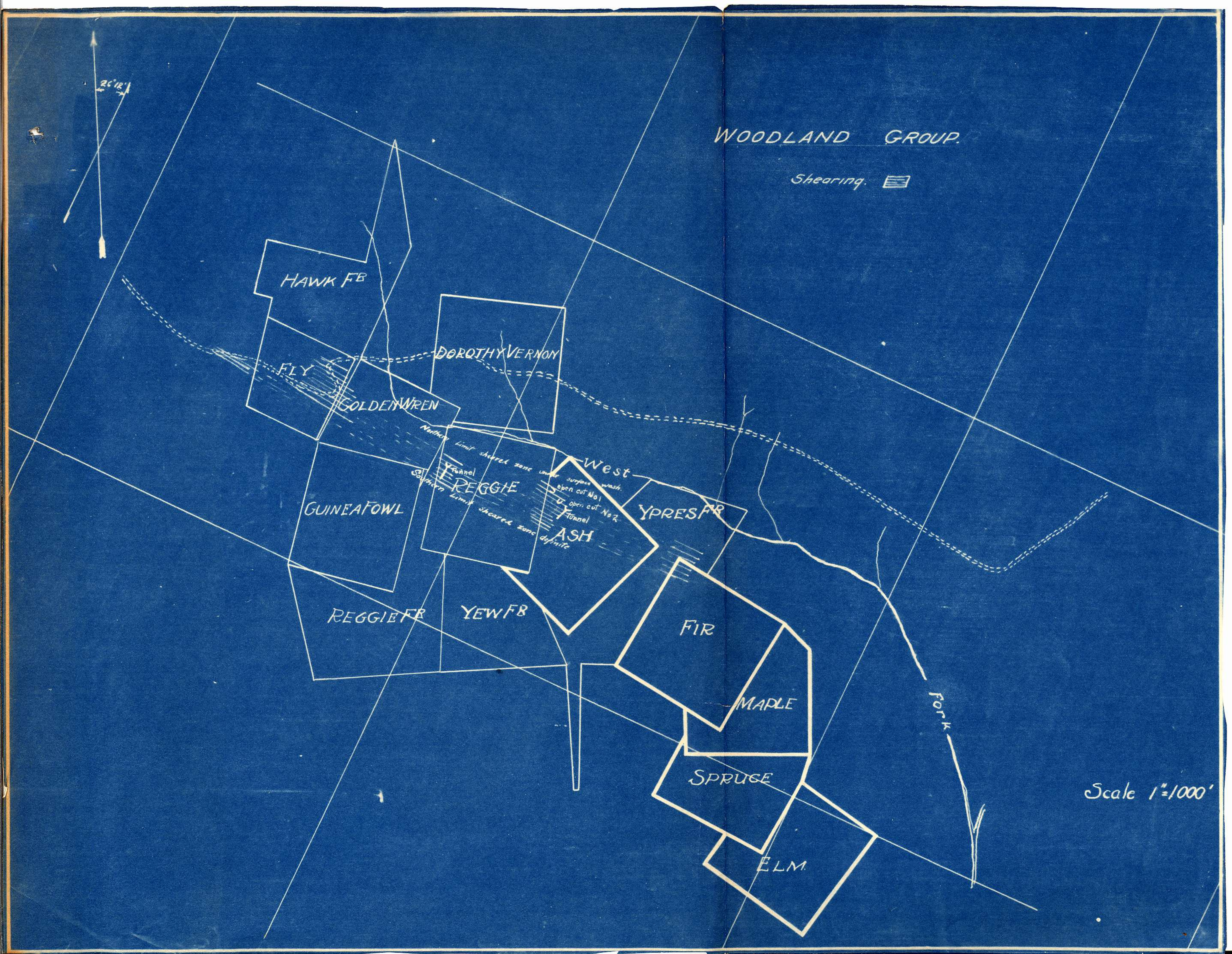
As previously recommended and to continue through the slates since the shear zone will occur beyond the slates.

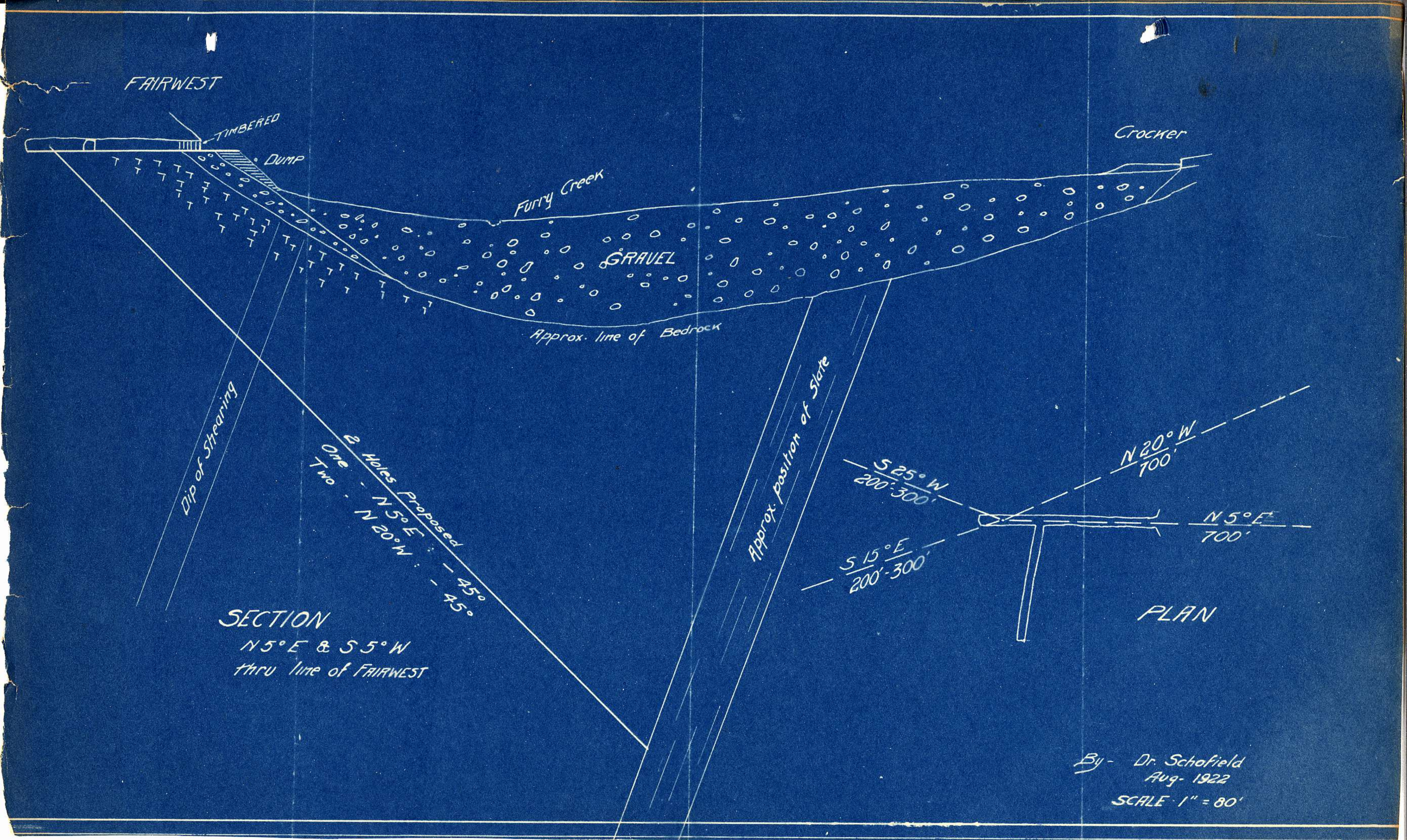
Drill base No. 5 on the Peacock Claim.

2 holes.

1 Diredtion N. 20°E. Inclination - 20°.
2 Direction S. 20°E. Inclination - 10°.

Stuart J. Schofield


WOODLAND GROUP.
Shearing.
26°12'
HAWK Fᴿ
DOROTHY VERNON
FLY
GOLDEN WREN
Northern Limit sheared zone under surface wash.
West
Tunnel
REGGIE
open cut No 1
open cut No 2
Tunnel
Southern Limit sheared zone definite
ASH
YPRES Fᴿ
GUINEAFOWL
REGGIE Fᴿ
YEW Fᴿ
FIR
MAPLE
SPRUCE
ELM
Fork
Scale 1" = 1000'


FAIRWEST
TIMBERED
Dump
Furry Creek
Crocker
GRAVEL
Approx. line of Bedrock
Dip of Shearing
2 Holes Proposed
One - N5°E : -45°
Two - N20°W : -45°
Approx. position of Slate
S 25° W
200'-300'
N 20° W
700'
N 5° E
700'
S 15° E
200'-300'
PLAN
SECTION
N5°E & S5°W
thru line of FAIRWEST
By- Dr. Schofield
Aug- 1922
SCALE 1" = 80'

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Map(s) # 001

[From American Journal of Science, Vol. 239, Oct., 1941, Pp. 701-714]

CASCADIA.

S. J. SCHOFIELD.

ABSTRACT. From field observations and from researches in the literature, the writer has concluded that a land mass now submerged may be postulated to have existed west of the present coast-line of British Columbia and the panhandle of Alaska. (1) During Proterozoic times the eastern shoreline of Cascadia was present in south-west Kootenay. (2) During Palaeozoic times the eastern shoreline had migrated beyond the present coastline of British Columbia. There is a disconformity at the base of the Triassic marked by a conglomerate containing pebbles and cobbles of granite derived from Cascadia. These granite bearing conglomerates occur in Coquihalla, Bridge River, Brittannia, Mount Garibaldi, Stikine River, Cameron Lake, Vancouver Island, Mussel Island, and Gravina Island in the panhandle of Alaska. There are no granites of the pre-Jurassic, post-Archean age recorded in British Columbia. The uplift at the base of the Triassic corresponds to the Appalachian revolution in the eastern United States. (3) According to Phemister a pre-Jurassic granite appears near Topley. The writer believes this intrusion to be of the Archean age. (4) From a study of the pebbles of the cónglomerate, the Archean land mass was composed of mica schist, quartzite, limestone, dolomite, and volcanic rocks intruded by granite. (5) Cascadia disappeared in early or Mid-Tertiary times.

AN ANCIENT CASCADIA OFF WESTERN CANADA.

FROM field observations and from research in the literature the writer has concluded that a land mass now submerged may be postulated to have existed west of the present coast line of British Columbia and of the pan-handle of Alaska in Palaeozoic and Mesozoic times. (J. D. Dana, 1888.)

PRE-JURASSIC GRANITES.

Phemister describes pre-Jurassic granites in the Topley area [T. C. Phemister, Geol. Surv. Canada, Summ. Rept. 1928, p. 50A] and his evidence of age is as follows:

(1): Granite boulders occur in a conglomerate and pink feldspar occurs in a breccia overlying the granite at the base of the volcanic rocks. Fragments of the granite also occur in the overlying volcanics which are probably Jurassic age.

(2): Although specially searched for, no veins or dikes or granite were found traversing the Jurassic rocks.

(3): The well-defined gneissic structure in the granite has not the northwesterly cordilleran strike, but strikes as much as 80 degrees east of north.

(4): The post Jurassic granites stand up, usually as peaks but the pre-Jurassic granites occur in hollows.

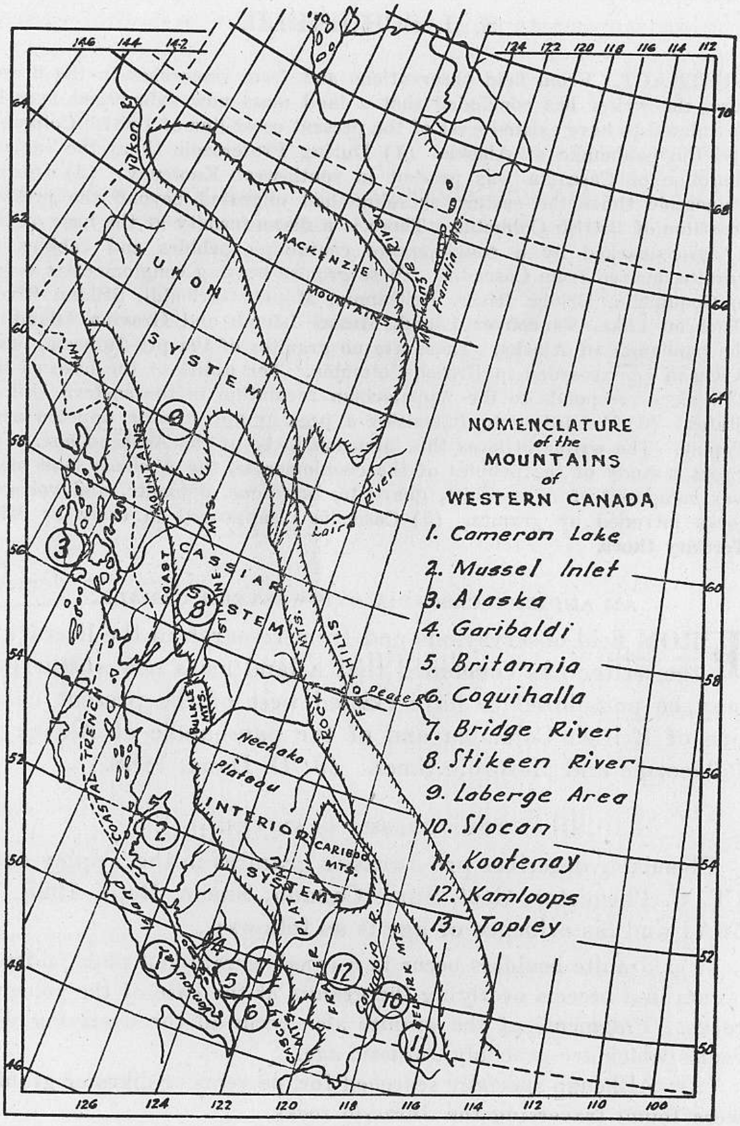
NOMENCLATURE
of the
MOUNTAINS
of
WESTERN CANADA
1. Cameron Lake
2. Mussel Inlet
3. Alaska
4. Garibaldi
5. Britannia
6. Coquihalla
7. Bridge River
8. Stikeen River
9. Laberge Area
10. Slocan
11. Kootenay
12. Kamloops
13. Topley
MACKENZIE MOUNTAINS
Franklin Mts.
Laird River
Peace R.
Nechako Plateau
INTERIOR SYSTEM
CARIBOO MTS.
COAST MOUNTAINS
CASSIAR SYSTEM
BULKLEY MTS.
SELKIRK MTS.

Fig. 1.

The most satisfactory explanation is that the granite is older than the Jurassic rocks and since there is no record of orogenic movements which are necessary for batholithic intrusions in Paleozoic or Triassic times, these granites may, therefore, be pre-Cambrian.

Cameron Lake, Vancouver Island.

The rocks around Cameron Lake, Vancouver Island, consist of volcanic rocks, limestone, and conglomerate belonging to the Vancouver group of Triassic age. The conglomerate consists of pebbles eight inches in diameter composed of schistose basalt, mica schist, and granite or quartz diorite. These rocks are cut by the Coast Range batholith and therefore the granite pebbles could not have been derived from this source. Since there are no igneous intrusions in the Proterozoic or Palaeozoic, it is concluded that the granite from which these Triassic pebbles were derived is Archean in age.

Mussel Inlet, Roderick Island.

According to Dolmage,[1] a highly metamorphosed conglomerate, pebbles of which are composed of limestone up to eight inches in diameter, occurs on the west shore of Mussel Inlet near the south end of Roderick Island. The other pebbles consist of metamorphosed volcanic rock, biotite schist, and an acid plutonic rock composed of quartz, plagioclase, and hornblende, evidently a quartz diorite.

This conglomerate and associated rocks are cut by the Coast Range batholith and the pebbles of granite could not have been derived from the latter but must have come from the old land mass of Cascadia.

The conglomerate and associated rocks are correlated with the Vancouver Group, of Triassic age.

Panhandle of Alaska.

The Triassic rocks of the "Panhandle" of Alaska are described by Chapin[2] as follows:

"The exposed basal member of the series on Gravina Island is a coarse conglomerate that extends along the southwest coast of the island from Conglomerate Point northwestward to Open Bay and

[1] Dolmage, V.: 1921, Geol. Surv. Canada, Summ. Rept., p. 25A.

[2] Chapin, Theodore: 1919, U. S. G. S., Prof. Paper 120, p. 90.

occupies three narrow strips whose continuity is broken by Fivemile Cove, Thompson Cove, and Threemile Cove. The conglomerate is a heavily bedded massive rock. The boulders are essentially of angular coarse-grained granite resembling the granite of Annette Island and the matrix is quartz-feldspar sand presumably derived from the same source as the boulders . . . Thin beds of fossiliferous limestone and black slate with pronounced cleavage occur sparingly . . . The presence of Devonian pebbles in the conglomerate indicates an underlying rock of that age, and on George Arm the supposedly Triassic rocks rest upon Carboniferous rocks. A marked unconformity at the base of the Upper Triassic rocks is thus evident . . . The massive conglomerate was evidently a basal formation and was laid down in comparatively shallow water near the shoreline and derived its materials from the products of land waste. . . . The Triassic rocks of Gravina Island are probably the equivalent of parts of the Vancouver series of Vancouver and Queen Charlotte Islands."

Chapin's statement that the conglomerate containing granite cobbles was laid down in shallow water near the shoreline is significant. He does not define the position of the land mass except that the granite in the cobbles resembles the granite of Annette Island. The age of the granite of Annette Island is not given, but no granites of pre-Triassic age have been recorded in the Coast Range of British Columbia or Alaska. Therefore, it is suggested that these granite pebbles were derived from an old land mass to the west.

Garibaldi Region, North of Howe Sound.

In the Garibaldi region north of Howe Sound, Burwash[3] describes a pre-Coast Range batholith conglomerate, which contains pebbles of granite. The section is as follows:

Britannia Formation	(4)	quartzite and sandstone	500 feet	Triassic
	(3)	slate and sheared porphyrite	2000 feet	
	(2)	massive porphyrite	1500 feet	
	(1)	basal conglomerate (Granite pebbles)	20 feet	

To account for the presence of these pebbles Burwash may be quoted as follows:

"The problem of the granite pebbles also occurs in rocks of similar age in the Coast Range of California, and it has been suggested

[3] Burwash, E. M.: 1918, The Geology of Vancouver and Vicinity, University of Chicago Press, p. 40.

that there was at that time an Archean axis above sea level to the west of the present Coast Range. If that explanation were adopted here, we would have to look to land west of Vancouver Island or to land occupying the line of the present depression between the coast and the island."

The quartzite contains quartz, orthoclase and biotite which form the constituents of a granite, and has been derived from a granitic terrane.

Britannia Beach, Howe Sound.

Leroy[4] describes a conglomerate at Britannia Beach, which contains large and small lenticular and rounded fragments of granite in a quartz feldspar matrix.

The associated quartzite is thoroughly recrystallized and is composed of orthoclase and quartz with small amounts of plagioclase biotite, chlorite and pyrite.

The conglomerate and associated rocks are cut by the Coast Range batholith.

Britannia Area, Howe Sound.

In the Britannia area, James[5] describes arkose and conglomerate containing granite pebbles. This conglomerate is probably Triassic in age and is cut by the Coast Range batholith. The geological column is as follows:

Upper Jurassic. . Coast Range batholith
Triassic. . . . . Goat Mountain formation:
upper part—andesite flows
middle—tuffs, shale
lower part—volcanics, greywacke, conglomerate (granite pebbles)

Britannia formation: shales, arkose

The arkose is essentially impure sandstone resting on basic volcanics. It is composed of irregular grains of quartz, plagioclase, and sericite schist. The quartz forms 50 per cent of the rock. James states:

"The lack of rounding of the grains, the freshness of the plagioclase, and the thickness of the unstratified beds, prove that the material has accumulated rapidly and has been transported a very

[4] Leroy, O. E.: 1905, Geol. Surv. Canada, Pub. 996, p. 15.
[5] James, H. T.: 1929, Geol. Surv. Can. Mem. 158, p. 9.

short distance from its source. It may very well represent a fan or deltaic deposit. The presence of oligoclase and orthoclase in relatively large grains suggests, then, that an appreciable amount of the material was derived from plutonic rocks of the granitic family." . . . "These facts suggest that the lower part of the Britannia formation was deposited very close to a land mass on which was exposed an appreciable amount of batholith rocks of the granitic type. This must mean that the land mass must have existed as such for a considerable time in order that erosion might wear away the covering of the batholithic rocks."

The Goat Mountain formation contains a conglomerate which carries boulders of the granite family, which measure as much as 30 inches across their greatest diameter. The larger boulders are somewhat angular. Attempts to trace the conglomerate laterally were unsuccessful. James says that "the conglomerate is undoubtedly significant containing as it does, blocks of metamorphosed igneous rocks, which indicates the proximity of a deeply eroded land mass at the time of its formation."

Coquihalla, near Hope, B. C.

Cairnes[6] describes a conglomerate of pre-batholithic age containing pebbles of distinctly plutonic rocks resembling diorite or gabbro. The other pebbles are limestone and fine-grained chert bound together by a slaty matrix.

Bridge River Area.

In the Bridge River area, the Noel formation as well as the Hurley formation contains pebbles of granite.[7]

The pebbles of the Noel formation include a great abundance of felsitic rocks in part at least of igneous origin, and a number of coarse-grained, mainly siliceous, granitic rocks. The Noel formation is of Triassic age.

The pebbles of the Hurley formation of Jurassic age are commonly well rounded and are of a variety of rock types, among which greenish volcanic rocks, light coloured felsites and porphyries, dark argillaceous and cherty sediments and a few rocks resembling diorite, are present. There are also many granitic pebbles. In some beds the fragments are argillaceous and the matrix has a gritty base.

[6] Cairnes, C. E.: 1924, Geol. Surv. of Canada, Mem. 139, p. 47.
[7] Cairnes, C. E.: 1937, Geol. Surv. Can. Mem. 213, pp. 14-16.

Mount Lester Jones, Stikine River area.

Between the Stikine river and Taku river is situated Mount Lester Jones, whose geology is described by Kerr.[8] The formations represented contain a conglomerate bed. Among the boulders contained in the conglomerate are many of granite.

The rocks are pre-batholithic in age and resemble the Triassic of the Stikine district.

Laberge Area, Southern Yukon.

In the Laberge area[9] of southern Yukon is exposed a massive conglomerate of Liassic age, 700 feet thick, which consists of closely packed, well rounded boulders varying from two inches to two feet and more in diameter. It is composed predominantly of volcanic porphyries but with abundant granodiorite boulders and occasional limestone and other boulders near the bottom.

According to Cairnes,[10] the granodiorite pebbles are most abundant in the basal conglomerate, which rests unconformably upon the Braeburn limestone of possibly Carboniferous age. Boulders of limestone are very plentiful near the contact. Other pebbles are of fine-grained, greenish volcanic rock and greywacke. The series with which the conglomerate is associated is cut by the Coast Range intrusives so that the pebbles could not have been derived from that source.

Carmacks District, Yukon.

The Laberge series of the Carmacks district of the Yukon is described by Bostock[11] as containing beds of conglomerate which hold pebbles and boulders of granite. The largest observed boulder was one and one-half feet long. They are well rounded, especially the granite, and show no signs of weathering or decomposition prior to their inclusion in the conglomerate. Associated with the conglomerate are light coloured sandstones and grits, 1,500 feet thick, and indirectly derived from a granitic terrain. These rocks occur at Five Fingers rapids. Other conglomerates of the same series contain pebbles comprising quartz from quartz veins, pegmatite, gran-

[8] Kerr, F. A.: 1930, Geol. Surv. Can. Summ. Rept., p. 52A.
[9] Lees, E. J.: 1934, Trans. Roy. Can. Inst. Vol. 20, p. 22.
[10] Cairnes, D. D.: Geol. Surv. Canada, Mem. 5, pp. 30-32.
[11] Bostock, H. S.: 1936, Geol. Surv. Canada, Mem. 189, pp. 21-25.

itic and basic intrusives, andesite porphyry lava, and green metamorphic rocks. The pebbles range up to a maximum size of one foot.

The Laberge series is cut by the Coast Range granite batholith.

Slocan Area West Kootenay District.

In the Slocan area of the West Kootenay district occur conglomerates of Triassic age, described by Cairnes.[12] The lowermost of these conglomerates is a lime bed about a foot thick that carries abundant small fragments of granite and isolated grains of quartz and orthoclase.

Cairnes states:

"The material probably came from the west and was laid down in comparatively shallow water, for from east to west the beds tend to become more massive and coarser textured. Cross-bedding is a notable feature of nearly all members of the series. . . . Plant remains have been found on Rico mountain. Except for these plants, all collections of fossils were of marine-animal organisms obtained from the limestone. . . . The exposures correspond with the change in the character of sedimentation in this direction and may indicate shallower waters in the west. The tuffaceous members are well-bedded rocks and are thought to represent pyroclastic material laid down chiefly on land areas and then transported by erosional processes into the sea."

Southwest Kootenay.

An upper Proterozoic conglomerate bearing granite pebbles is described by Daly[13] from the southwest Kootenay district. The Irene conglomerate contains pebbles and boulders up to a foot or more in diameter comprising for the most part grey vitreous or micaceous quartzite, dolomite, and marble, but there are a few pebbles of phyllite or slate and, more rarely, of biotite granite. Some of the more bouldery masses of the quartzite, and especially of the dolomite, are sub-angular and apparently were not long rolled upon a beach.

The terrain from which the conglomerate was derived was composed of quartzite and dolomite intruded by granite of Archean age. From the size of the boulders, it is concluded that the Archean land mass was of high relief.

[12] Cairnes, C. E.: 1934, Geol. Surv. Canada, Mem. 173, p. 55.
[13] Daly, R. A.: 1915, Geol. Surv. Can. Mem. 38, p. 142.

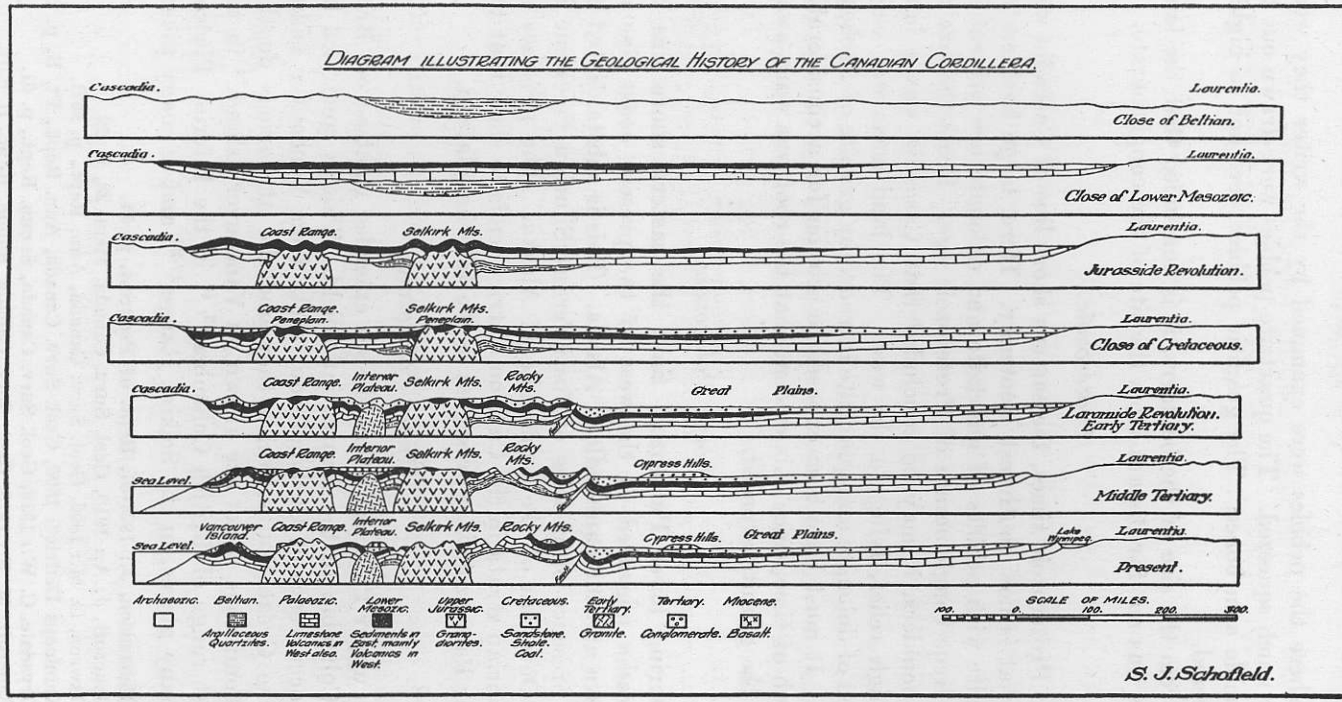

DIAGRAM ILLUSTRATING THE GEOLOGICAL HISTORY OF THE CANADIAN CORDILLERA.
Cascadia.
Laurentia.
Close of Beltian.
Cascadia.
Laurentia.
Close of Lower Mesozoic.
Cascadia.
Coast Range.
Selkirk Mts.
Laurentia.
Jurasside Revolution.
Cascadia.
Coast Range. Peneplain.
Selkirk Mts. Peneplain.
Laurentia.
Close of Cretaceous.
Cascadia.
Coast Range.
Interior Plateau.
Selkirk Mts.
Rocky Mts.
Great Plains.
Laurentia.
Laramide Revolution. Early Tertiary.
Coast Range.
Interior Plateau.
Selkirk Mts.
Rocky Mts.
Cypress Hills.
Laurentia.
Sea Level.
Middle Tertiary.
Vancouver Island.
Coast Range.
Interior Plateau.
Selkirk Mts.
Rocky Mts.
Cypress Hills.
Great Plains.
Lake Winnipeg.
Laurentia.
Sea Level.
Present.
Archaeozic.
Beltian. Argillaceous Quartzites.
Palaeozic. Limestone Volcanics in West also.
Lower Mesozic. Sediments in East, mainly Volcanics in West.
Upper Jurassic. Grano-diorites.
Cretaceous. Sandstone. Shale. Coal.
Early Tertiary. Granite.
Tertiary. Conglomerate.
Miocene. Basalt.
SCALE OF MILES.
100. 0. 100. 200. 300.
S. J. Schofield.

Fig. 2.

Where the pebbles were examined by the writer they were very much squeezed. The quartzite pebbles were drawn out to resemble arm bones. The granitic pebbles were not so highly squeezed.

From the size of the boulders, it is concluded that the land mass was not far distant from the site of the conglomerate.

Proterozoic.

In Proterozoic times, the eastern shore line of Cascadia was in what is now southwest Kootenay. Here, large boulders of granite with pebbles of quartzite and dolomite are present in the Irene conglomerate of Proterozoic age. From the size of the boulders, it may be concluded that Cascadia was a land of high relief, lying to the west. The land mass was composed of dolomite and quartzite intruded by granite of Archean age. It must have been exposed to erosion for a considerable length of time, since it is evident that the roof was worn away and the granite exposed.

Lower Palaeozoic.

During lower Palaeozoic time, the eastern shore line of Cascadia migrated to the west of the present coast line of Alaska and the panhandle of Alaska. This is substantiated by the presence of pebbles of fossiliferous Silurian limestone in the Devonian of the panhandle of Alaska. The presence of Cambrian strata in the Cariboo district tends to show that the lower Palaeozoic is represented in the Interior plateau.

Upper Palaeozoic.

In upper Palaeozoic time the sea extended right across British Columbia to the Laurentian shield. This is confirmed by the occurrence of Carboniferous rocks from Vancouver Island to the Great Plains, which they underlie at various depths. Carboniferous rocks are known on Vancouver Island,[14] in the Coast range of British Columbia,[15, 16] in the Interior Plateau in many places, in the Selkirk Range,[17-20] and at many places

[14] Richardson, J.: 1927-37, Rept. of Progress, p. 54.
[15] Bancroft, J. A.: 1913, Geol. Surv. Canada, Mem. 23, p. 68.
[16] Dawson, G. M.: 1896, Geol. Surv. Canada, Ann. Rept., p. 96B.
[17] Kamloops District: 1895, Geol. Surv. Canada, Ann. Rept., Pt. B, p. 79.
[18] Drysdale, C. W.: 1916, Geol. Surv. Canada, Summ. Rept., p. 61.
[19] Bancroft, M. F.: 1918, Geol. Surv. Canada, Summ. Rept., p. 62B.
[20] Bancroft, M. F.: 1916, Geol. Surv. Canada, Summ. Rept., p. 57.

in the Rocky Mountains. Dawson[21] recognized the extent of the Carboniferous sea in stating that it extended entirely across northern British Columbia and Alaska. Hence it may be concluded that it occupies the whole of British Columbia. Where did all the sediments come from which filled the vast depression termed the Cordilleran geosyncline?

Since the whole of British Columbia was an area of deposition in Upper Palaeozoic time, the presence of Cascadia to the west of British Columbia is a necessity. It is the only place which could yield sufficient sediments for the formation of the rocks of the Cordilleran geosyncline.

The Upper Palaeozoic rocks are composed entirely of limestone and shale with volcanics. Cascadia must have been in a state of old age or peneplanation during these times.

Triassic.

At the close of Upper Palaeozoic time a vertical uplift took place, but that it was not accompanied by folding is shown by the fact that the succeeding Triassic beds have the same strike and dip as the sediments upon which they rest. Triassic time was initiated by a conglomerate which, everywhere except at Kamloops contains many pebbles of granite. The districts where the granite pebbles occur are described above and are now listed:—Cameron lake on Vancouver Island, Panhandle of Alaska[22] Mussel Inlet, Roderick Island, west coast of British Columbia, Garibaldi region, southwest British Columbia. Britannia map-area southwest British Columbia, Coquihalla, southwestern British Columbia, Bridge River, southwestern British Columbia, Mount Lester Jones in northern British Columbia, Slocan, southeastern British Columbia, Southwest Kootenay District, southeastern British Columbia.

That an uplift took place in Cascadia as well as in the whole of British Columbia at the beginning of Triassic time is indicated by the presence of granite pebbles in the conglomerates at the base of the Triassic. The occurrence of land plants in the Slocan area is significant. The uplift was not great, because no non-conformity exists between the Palaeozoic and Triassic deposits. This is brought out by Daly[23]: "At their visible contact both series dip at an angle of 50° to the east-

[21] Dawson, G. M.: 1885, Geol. Surv. Canada, Ann. Rept.
[22] Dolmage, V.: 1921, Geol. Surv. Canada, Summ. Rept., p. 25A.
[23] Daly, R. A.: 1915, Geol. Surv. Canada, Mem. 68, p. 123.

The Triassic of the Rocky Mts consists of a sandstone derived from a granite according to McKenzie G.S.C. Mem 87 p 25 ward with a strike of N 10° W. This correspondence suggests that the Carboniferous beds lay nearly or quite horizontal when the Nicola gravels were deposited." The uplift could not have been important as the same conditions prevail in the older sections. This uplift corresponds to the Appalachian revolution of Eastern North America.

Lower Jurassic.

The presence of granite pebbles in the conglomerate of Liassic age at Lake Laberge, Carmack district, and in the Bridge River area, suggests that Cascadia was uplifted at that time.

Upper Jurassic.

During the Jurasside revolution which took place at the close of the Jurassic period, four great mountain chains appeared in this great basin of sedimentation:

(a): The Vancouver Island/Queen Charlotte Island range. The Coast Range of British Columbia.
(b): The Sierra Nevada range.
(c): The Selkirks and their extension southward into the Bitterroot and Clearwater ranges.
(d): The Alaskides on the northern border of Cascadia.

Cretaceous Record.

Throughout the Cretaceous, these four great mountain chains, together with Cascadia, were areas of erosion, supplying sediments on both flanks of the highland masses. In British Columbia, the mountain chains were elongated in a northwesterly direction, thus separating the Cretaceous sediments into three main basins:

I. Vancouver Island and Queen Charlotte Islands basin (between Cascadia and the Coast Range).
II. The Interior Plateau basin (between the Coast Range and the Columbia-Selkirk range).
III. The Rocky Mountains and the Great Plains basin (between the Selkirk range and the Laurentian highlands).

The granite pebbles, which occur in the Cretaceous formations in the three great basins mentioned above, prove that the granitic cores of the great Jurassic mountain chains were at that time unroofed.

Erosion and sedimentation with a little volcanism continued almost without interruption until the Laramide revolution in early Tertiary time.

Tertiary Record.

In early Tertiary time, orogenic movements of primary importance (the Laramide revolution) affected the whole region of the Cordillera and the Great Plains. The peneplaned surface of the great Jurassic mountains was uplifted, thus starting a new cycle of erosion,[24] while the basins of sedimentation were folded and formed new mountain chains, thus producing mountains for the first time in those parts of the Interior Plateau and the Rocky Mountain region which escaped the folding of the Jurasside revolution.

The folding which took place during the Laramide revolution was accompanied by batholithic intrusions, only very small parts of which have been exposed, so far, by erosion. In the Rocky Mountains, an intrusion of this age has been described by Allan,[25] while numerous small intrusions of the same age occur in the Interior plateau of British Columbia[26] and in the Yukon.[27]

The period following that of compression was at the close of the Oligocene one of tension caused by the sinking of the Pacific basin, thus causing a stretching of the area adjacent to the Pacific coast. The sinking of the Pacific area, either by downwarping or by faulting, marked the last appearance of the Pacific land mass, Cascadia, which sank beneath the waters of the Pacific ocean. On the continent, the stretching of the land mass produced fissures which permitted the outpouring of the vast floods of lava which marked the Miocene of British Columbia, Oregon, and Washington. The volcanoes along the Rainier-Mount Baker line show that the tension was caused by a pull from the Pacific. North of the 49th parallel, the direction changes more to the northwest along the Garibaldi-Nass River line, while in Alaska, the direction of the loci of volcanism is almost east and west; but in all cases these directions correspond to the trend of the coast-line opposite them. The fact that volcanism has been intermittently active along these trends from the Oligocene until the present time, tends to show that

[24] Schofield, S. J.: 1920, Roy. Soc. Can., Sec. 4, p. 61.
[25] Allan, J. A.: 1914, Geol. Surv. Can., Mem. 55.
[26] Brock, R. W.: 1920, Geol. Surv. Can., Summ. Rept., Pt. A.
[27] Cairnes, D. D.: 1912, Geol. Surv. Can., Mem. 31.

the Pacific area has been generally sinking. It appears that the active sinking of the Pacific area is associated with active volcanism in neighbouring coastal areas.

The facts to support the sinking of Cascadia beneath the waters of the Pacific ocean during the Miocene and possibly later periods are as follows:

(1): There is no continental shelf west of Vancouver and Queen Charlotte Islands but a sudden descent from the shores of these islands to ocean deeps.

(2): The Tertiary rocks along the west coast of Vancouver Island dip to the southwest under the Pacific ocean, according to Dolmage,[28] who states: "These rocks are only slightly folded, the strikes are all nearly parallel to the shore, i.e., north 45 to 60 degrees west, and the dips are to the southwest or seawards from 10 to 25 degrees excepting on Grassy and One Tree Islands, where they steepen up to 50 degrees."

(3): The age of the rocks from Vancouver Island northwestward along the coast become progressively older. On Vancouver Island, the oldest known rocks are Upper Triassic in age while, in the Panhandle of Alaska, Carboniferous, Devonian, and Silurian rocks are known. This points to a structural feature which apparently cuts slightly across the strike of the structures.

(4): The long fissures which are marked by volcanoes and lava flows parallel the Pacific coast-line in such a way as to be associated in origin with the down-sinking of a Pacific land mass.

Pleistocene.

The Pleistocene was marked by intense glaciation and depression of the areas adjacent to the Pacific coast at least. The degression of this land area may have resulted in diminished intensity of volcanism, since it would tend to crowd the oceanic and the adjacent continental masses, producing a period of minor compression.

[28] Dolmage, V.: 1920, Geol. Surv. Can., Summ. Rept., p. 17A.

Department of Geology,
University of British Columbia,
Vancouver, B. C.

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BRITISH COLUMBIA
GEOLOGICAL SURVEY
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SCALE 1 INCH = 1000 FT.
LEGEND
Granite
Quartz porphyry
Slate
Volcanics & Porphyry
Volcanics & Slate
Approximate boundary of shear zone
Shear Zone
Approximate Diamond Drill Base
EMPRESS.
WINSTON FR.
LAST CHANCE FR.
VICTORIA.
QUEEN.
TUNNEL
BETA FR.
BANNER
AMY FR.
Victoria Tunnel
CHARMER.
PRINCE FR.
CRACKER JACK
PRINCESS FR.
INDEPENDENT
REO FR.
DERBY FR.
LOYD FR.
CHICAGO
CYRTINA
ROYALIST.
Furry Creek
MILNER FR.
HUNTERS BEST
WILD ROSE
CICADA
MONS.
No.27.
No.28 FR.
WILD ROSE FR.
BELLA FR.
BEE.
STAR FR.
CONIFER FR.
HAWK FR.
EAGLE FR.
ROVER.
YORK.
REGAL.
OTTER FR.
PEARL FR.
FAIR WEST
BEE
CLIO.
DOROTHY VERNON
FURRY FR.
ARTIC FR.
FLY
COLUMBIA FR.
CLIPPER FR.
No.29.
GOLDEN WREN
BEAVER.
PEACOCK
BEE.
TROUT FR.
No.108 FR.
GOLDEN PHEASANT
GUINEA FOWL
REGGIE.
West
COPPER MOUNTAIN No.2
Creek
BASS.
YPRES FR.
ASH
No.107
GUINEA FR.
COPPER MOUNTAIN
PIKE.
GREY FR.
ROCK SLIDE
TUNNEL
N
REGGIE FR.
YEW FR.
PERCH FR.
FIR
ROBERT FR.
B.V. ANNEX
BANK OF VANCOUVER.
Magnetic
CEDAR.
CYPRESS.
WHITE.
MAPLE.
Fork
Seymour
APPROXIMATE NORTHERN BOUNDARY OF SHEAR ZONE
APPROXIMATE SOUTHERN BOUNDARY OF SHEAR ZONE