

OPEN FILE

GEOLOGICAL REPORT ON THE COAL BEARING AREAS
FROM BROWN'S RIVER TO CAMPBELL RIVER.

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October 30th, 1922.

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**GEOLOGICAL BRANCH
ASSESSMENT REPORT**

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* Please refer to
COALFILE Report #694
for details on the
boreholes in this
report.

INTRODUCTION

This report is on the coal bearing rocks on the east coast of Vancouver Island, from Brown's River north to Campbell River. It deals with their distribution, structure and economic value.

The field work was done during the months of June, July and 10 days in August in co-operation with Mr. J. D. MacKenzie of the Geological Survey of Canada. The field maps used were the four inch to one mile maps of the Canadian Collieries (Dunsmuir) Limited and all traverses were Brunton compass and pacing. The accompanying map was compiled by the Western Lumber Co. and from surveys made while in the field.

The writer is very much indebted to Mr. MacKenzie for his assistance and advice during the summer. He also wished to thank Mr. Filberg and Mr. Stevens of the Comox Logging Co. for maps supplied and facilities for camping and moving camping equipment while in that area.

SUMMARY.

There is in the district covered several promising coal fields. All the areas have been considered and all outcrops of seams and Bore Holes taken into account in making the estimates of the Coal Reserves.

The Quinsam Area is worthy of some exploration, and several Bore Holes put down along the Campbell River Road from Echo Lake to Snake Lake would give very valuable information as regards the actual coal in the field.

The Iron River Area is another area worth looking into but several miles of drill road will have to be built to prospect it.

The Campbell River Area is worthy of some attention. Holes put down above the 50th show coal in two Bores over 3' and two with coal over 1' and under 3'. Two holes were blanks.

The Tsolum Area also has prospects. There is a good outcrop of coal on the Tsolum and the overlying measures appear very regular. It would be easy to get at as the Comox Logging have grades all through the area.

GENERAL DESCRIPTION.

The area in question is a part of the east coast Lowland of Vancouver Island. It forms a narrow strip from 6 to 12 miles wide from Brown's River north to Campbell River and is that area which is underlain by the Cretaceous Rocks of the Nanaimo Series.

The Lowland has small relief as compared with the rest of the Island. The greater portion is under 800 feet elevation, while none is over 2000 feet. The country rises in a gentle slope from the Gulf of Georgia westward to where it meets with the old Upland of Pre-Cretaceous times. Here there is an abrupt change in the topography of the country. The gentle slope of the Lowland gives place to steep abrupt slopes as high as 30° - 40° and the creeks become typical mountain streams with innumerable falls.

There are two pronounced hills in the area, Constitution Hill to west of Headquarters and an old Pre-Cretaceous promontory that has been ~~shaped~~^{uncovered} in the northern portion of the field extending from Campbell Lake southwards to Loon Lake. The latter divides the area into two with a small connecting link at Loon Lake. It also lies along the axis of an anticline as the beds dip away from it on both sides.

There are five main streams flowing across the Lowland. They all rise in the mountains and have rather high gradients till they reach the Lowland. Here however with few exceptions they have a low gradient and very little erosive power. The result is that it is only near the old land that they have power enough to cut through the overlying drift, carry it away and expose the bed rock. Towards the sea in all cases the underlying bed rock is covered with gravel wash.

The streams with the exception of the Tsolum could all be used for developing hydro-electric power. The Brown and Oyster both have a large drainage basin and a constant flow but are handicapped in having no large lakes to act as natural storage basins. The Quinsam and Campbell River however have a constant flow and a splendid chain of lakes that could be utilized for storage.

The area is drift covered in nearly all parts and supports very good timber. There are three companies logging in the area, the Comox Logging with offices at Headquarters, the International Timber Co. with headquarters at Campbell River and MacDonal & Murphy with camp about eight miles south of Campbell River. The two former are logging on a large scale. The Comox Logging are logging at rate of 10 acres per working day.

GENERAL GEOLOGY.

Table of Formations

<u>Period</u>	<u>Formation</u>	<u>Lithology</u>
Recent and Pleistocene	Alluvium	Swamp and river alluvium. Stratified sands and gravels. Till.
	Glacial Deposits	
	Unconformity	
Tertiary	Constitution Hill Sills & Laccoliths	Quartz Diorite-Porphry
	Intrusive Contact	
Upper Cretaceous	Nanaimo Series	Shales with interbedded sandstone and conglomerate.
	Trent River Formation -----	
	Comox Formation -----	Sandstone with shales, con- glomerate, and coal seams.
	Unconformity	
Lower Jurassic	Vancouver Group	Meta Volcanics Argillites (Trap)

DESCRIPTION

Vancouver Group.

The underlying basement rocks are tough, hard, greenish purple fine to visibly crystalline rocks. They include amygdaloids, porphyries, tuffs and agglomerates which have been highly metamorphosed and in part recrystallized. They have in them bands of much altered and metamorphosed bands of argillites which are highly contorted and whose relation with the volcanics is not known. These volcanic rocks have been correlated with the Vancouver volcanics of the Vancouver Group and are found practically all over the Island. They are commonly known as Trap Rock in the district, which name will be used in this report.

Nanaimo Series.

Resting unconformably on the Trap are the rocks of the Nanaimo Series. They have been subdivided into two formations. The Trent River Formation and the Comox Formation.

The Comox Formation is essentially a sandstone formation, the beds of which are thick bedded quartz sandstone with calcareous cement. In the northern portion of the area it has a decided greenish tint but still homogeneous and massive. It has been correlated by Mr. J. D. MacKenzie with the Protection formation of the Nanaimo Area. The coal seams all occur in the Comox and near the base as evidenced by the coal on Anderson Creek, Tsolum, Iron and Quinsam Rivers, all of which showed coal seams within 200 feet of base of measures.

There is in most cases where the base was exposed a conglomerate composed of altered volcanics. This conglomerate fills in the minor hollows that existed in the old pre-cretaceous surface. At only one point in the field on the Iron River near Chute Creek was a basal conglomerate observed.

Overlying the Comox Formation and conformable with it is the Trent River Formation. It is dominately a shale formation. A fine grey clay shale with interbeds of sandstone. The shale is very homogeneous

in color and texture and forms beds up to 40 feet without a break. Fossils of marine origin have been found in the Cumberland Area. The Trent Formation is only exposed in the southern portion of the area. The contact of it with the Comox is concealed in the northern portion but it probably runs about due north from its position on the Tsolum River and out to sea about 3 miles south of Shelter Point. North of Shelter Point a greenish sandstone crops on the shore and is similar to that on the Tsolum and Oyster Rivers, which has been correlated with the Comox Formation.

Tertiary Intrusive Rocks.

After these Cretaceous Strata were laid down and probably during Tertiary times the measures had intruded into them a Laccolith of the cedar tree type. The trunk of which is Constitution Hill to the west of Headquarters. With this intrusion and originating from it, Sills forced their way along between the strata for considerable distance. Anderson Hill is the result of such a Sill. There are also several such Sills in the measures to west of Wolfe Lake. On both sides of the Laccolith the measures have a severe tilt away from it indicating a doming of the overlying strata.

The result of the intrusion was the lowering of the grade of the coal in; and rendering practically useless an area of about 26 square miles between Tsolum River and Brown's River and westward from Headquarters. Seams on both Brown's River and Anderson Creek although good in section and appearance analyze very poor. The following is analysis of coal on Anderson Creek.

	As Received %	Dry Basis %
Moisture - - - - -	1.1	
Volatile Matter -	15.9	16.08
Fixed Carbon - - -	53.3	55.91
Ash - - - - -	27.7	28.01

SUPERFICIAL DEPOSITS.

The whole Lowland is drift covered with very few rock exposures except in the stream beds. The stratified sands and gravels predominate below 700 feet elevation contour. Above this Till forms the superficial soil. Most of the stratified material is a well oxidized coarse to medium sand with some gravel beds.

STRUCTURE.

There are not enough rock exposures to give a detailed account of the structure of the area but from what there are it appears that the narrow strip along the coast has been tilted, resulting in a N.E. dip. There are no large faults but on both Brown's River and Dove Creek a normal fault was observed.

The area west of Loon Lake and south of Campbell Lake through which the Quinsam and Iron Rivers flow gives a little better clue as to the structure. Here the measures on the Iron have a N.W. dip while on the Quinsam they have a N.E., indicating a synclinal basin pitching to the north.

COAL BEARING AREAS.

Before discussing the different Coal Bearing Areas it might not be out of place to give the precise meaning of terms that will be met with from now on.

"Actual Coal" - Coal which is known to exist, having been proved in development or borings and the seams correlated. That is, coal that has been proved in ^{three} through dimensions.

"Probable Coal" - Coal which outcrops in two places or has been proved in two bore holes. That is, coal which has been proved in two dimensions.

"Possible Coal" - Coal which outcrops in one place or found in one bore hole but from other conditions may be assumed to extend for a considerable distance. That is, coal that has been proved in

one dimension.

Another point which it may be well to explain is the reasons for subdividing the Area into different Coal Bearing Areas. The main reason for doing so was to give a more precise estimate of the coal possibilities of the area. If it were treated as a whole there would be so much material in the report on the area that it would be hard to segregate the more promising fields. By treating each area separately then those areas with a future are readily seen while the rest may be discarded. The boundaries in all cases have been chosen as far as possible from natural lines such as ridges or thin barren areas in the measures.

The coal estimates have been divided into seams from one ²/₃ foot, three feet and seams over three feet. For tonnages the specific gravity of coal is taken as 1.3.

QUINSAM AREA:

The Quinsam Area is that area to south of lower Campbell Lake to Quinsam River. It is all over 520 feet elevation and below 1100 feet. From the wharf at Campbell River it is 10 miles to the eastern ridge of the area, by road. The road crosses the basin 3 miles south of lower Campbell Lake and is the only road into the area. There are some old cut trails and some blazed trails but they are old now and not very serviceable.

The basin has few outcrops except in the stream beds and what there are are very much weathered. The streams however give some idea of the structure. The basin is part of a pitching syncline with its synclinal axis probably N. and S. There is in it an outcrop of coal $\frac{3}{4}$ mile below middle Quinsam Lake, a section of which is shown on the accompanying blue print and an outcrop analysis as follows.

Sample C11

Approximate Analysis:	As Received %	Dry Basis %
Moisture - - - - -	3.70	-
Volatile Matter -	38.70	40.19
Fixed Carbon - - -	46.82	48.62
Ash - - - - -	10.78	11.19

B.T.U. per lb. of coal 12117.

The following table gives the estimated coal in the Quinsam Area.

<u>Total Area</u> of <u>Nanaimo Series</u>	<u>Total Coal</u> <u>Bearing</u> <u>Area</u>	<u>Number and</u> <u>Thickness</u> <u>of Seams</u>	<u>Actual</u> <u>Coal</u>	<u>Probable</u> <u>Coal</u>	<u>Possible</u> <u>Coal</u>
20.75 Sq. Mls.	8.5 Sq. Mls.	1 Seam 4'	-	-	33,900,000 T.
13250 Acres	5440 Acres	2 " 1' 6"	-	-	25,400,000 T.

Of this however, there is an area of 1 1/2 square miles above the 50th Parallel which has been taken into account and which has been estimated to contain 5,990,000 tons of Possible Coal above 4' and 4,490,000 tons of Possible Coal from 1' to 3'. This then leaves in the Quinsam Area in the E. & N. Land Grant:-

27,910,000 tons of Possible Coal above 3' thick.

20,910,000 " " " " between 1' & 3' thick.

IRON RIVER AREA:

The Iron River Area is adjacent and to the south of the Quinsam Area. There are no roads into it, the nearest road being 2 - 3 miles. It is the area between the Quinsam and Iron Rivers and a portion of the Quinsam synclinal basin. To do only development in the area 3 - 4 miles of drill roads would have to be built. The area is similar to the Quinsam in structure and is all above 600 feet and below 1100 feet. There is coal outcropping on both sides of the basin in the Quinsam and Iron Rivers, sections of which are shown on the blue print, and with analysis as follows:-

Quinsam River Coal. Upper Bench.

Approximate Analysis:	As Received %	Dry Basis %
Moisture - - - - -	3.70	-
Volatile Matter -	38.70	40.19
Fixed Carbon - - -	46.82	46.62
Ash - - - - -	10.78	11.19

B.T.U. for Dry Sample 12117.

Quinsam River Coal. Lower Bench.

Approximate Analysis:	As Received %	Dry Basis %
Moisture - - - - -	4.20	-
Volatile Matter -	39.60	41.34
Fixed Carbon - - -	43.92	45.84
Ash - - - - -	12.28	12.82

B.T.U. for Dry Sample 11943.

Iron River Coal. Upper Bench.

Approximate Analysis:	As Received %	Dry Basis %
Moisture - - - - -	5.3	-
Volatile Matter -	34.8	36.73
Fixed Carbon - - -	45.32	47.87
Ash - - - - -	14.58	15.4

B.T.U. for Dry Sample 11025.

Iron River Coal. Lower Bench.

Approximate Analysis:	As Received %	Dry Basis %
Moisture - - - - -	4.85	-
Volatile Matter -	32.25	33.9
Fixed Carbon - - -	44.88	47.16
Ash - - - - -	18.02	18.94

B.T.U. for Dry Sample 10560.

The following table gives in tabulated form the amount of coal in the Iron River Area.

<u>Total Area</u> <u>Nanaimo Series</u>	<u>Total Coal</u> <u>Bearing Area</u>	<u>Number and</u> <u>Size of Seams</u>	<u>Actual</u> <u>Coal</u>	<u>Probable</u> <u>Coal</u>	<u>Possible</u> <u>Coal</u>
2.6 Sq. Mi..	1 Sq. Mi.	1 Seam 4' 10"	-	4,820,000 T.	-
	640 Acres	(1 " 1' 3") (1 " 1' 6")	-	1,250,000 T.	-

CHUTE CREEK AREA.

The Chute Creek Area is to south of the Iron and separated from it by a barren area in the measures along the Iron River. It is rather inaccessible. The Government have a trail from Gooseneck Lake east past middle Quinsam Lake to Iron River $\frac{1}{2}$ mile above Chute Creek.

The area is as yet not fully explored, the southern contact not having been found. The measures are very thin in places and there is a possibility that this area may run south as far as that area Mr. A.C. Lynn and Mr. A.M. McKenzie reported on at the head of the Cruikshank. As far as known the area is over 15 square miles but only the northern portion is coal bearing, and all seams under 2 feet.

Section of one 18" seam shown on blue print, and analysis of same seam given below.

Chute Creek Coal.

Approximate Analysis:	As Received %	Dry Basis %
Moisture - - - - -	4.40	-
Volatile Matter - -	39.40	41.21
Fixed Carbon - - -	47.80	50.00
Ash - - - - -	8.40	8.77

B.T.U. for Dry Sample 12826.

The following table gives estimated coal in area.

<u>Total Area</u> <u>Nanaimo Series.</u>	<u>Total Coal</u> <u>Bearing Area</u>	<u>Number and</u> <u>Thickness</u> <u>of Seams</u>	<u>Actual</u> <u>Coal</u>	<u>Probable</u> <u>Coal</u>	<u>Possible</u> <u>Coal</u>
15 Sq. Mi.	1.5 Sq. Mi.	1 - 1' 6") 1 - 1' 2") 1 - 1' 1")	-	-	4,680,000 T.

CAMPBELL RIVER AREA.

The Campbell River area is the northern part of the coastal strip from Going's Trail to Campbell River. The area is accessible to within 2 - 3 miles of any point from grades of the International Timber Co. railway. It is all under 600 feet elevation. There are few outcrops but from bores put down above the 50th and a seam reported on by Mr. A. M. McKenzie on branch of Cariboo Creek the field has some possibilities.

The following table gives the estimated coal in the area.

<u>Total Area</u> <u>Nanaimo Series</u>	<u>Total Coal</u> <u>Bearing Area</u>	<u>Number and</u> <u>Thickness</u> <u>of Seam</u>	<u>Actual</u> <u>Coal</u>	<u>Probable</u> <u>Coal</u>	<u>Possible</u> <u>Coal</u>
55 Sq. Mi.	34 Sq. Mi.	3'-12'	-	4,680,000 T.	41,700,000 T.
		1' 8"- 3'	-	866,000 T.	45,000,000 T.

Of this however all the probable coal is above the 50th and there are 13 square miles of coal bearing area above the 50th. This reduces the estimated coal in the Campbell River Area within the E. & N. Land Grant to 21 square miles of coal bearing land, giving 43,000,000 tons possible 3' coal and 30,000,000 tons 1 - 3 ft. coal.

OYSTER RIVER AREA.

The Oyster River Area is that area adjacent to and to south of the Campbell River Area. Going's Trail is taken as its northern boundary and it extends south an east and west line about $\frac{1}{2}$ mile above the mouth of Black Creek. The area embraces 30 square miles of Nanaimo Series, none of which is considered coal bearing. There are two places that coal outcrops, 8" on the Oyster and 10" on Cariboo Creek.

TSOLUM AREA.

The Tsolum Area is to the south of Oyster River Area extending southward to an east and west line from head of Wolfe Lake. It is all below 700 feet elevation and most under 400 feet. The Comox Logging Co. have grades through the area to the east of the Tsolum River. The area has more outcrops than usual and from them it appears that the measures are fairly regular with N.E. dip of 4° - 12° and N.W. strike.

The Tsolum River and Black Creek are the only streams of importance in the area. There are no outcrops on Black Creek but the Tsolum towards the Upland has good exposures. There is one coal seam outcrop on the river, a section of which is given on the accompanying blue print.

The following table gives the estimated coal in the field.

<u>Total Area</u> <u>Nanaimo Series</u>	<u>Total Coal</u> <u>Bearing Area</u>	<u>Number and</u> <u>Thickness</u> <u>of Seams</u>	<u>Actual</u> <u>Coal</u>	<u>Probable</u> <u>Coal</u>	<u>Possible</u> <u>Coal</u>
29 Sq. Mi.	18 Sq. Mi.	1 Seam 4'	-	-	75,000,000 T.

BROWN'S RIVER DOVE CREEK AREA.

The Brown's River Dove Creek Area takes in most of that area effected by the Constitution Hill Laccolith. It is low and drift covered except in the eastern side, but the western side is mountainous and has no easy means of access.

The area has over 88 square miles of Cretaceous Rocks but only 10 can be considered as coal bearing. The major portion having been rendered valueless by the intrusion. The measures are well exposed in the west of the area on both Brown and Dove Creek and in Anderson Creek, a tributary of the Brown.

On the Brown there are numerous coal seams outcropping and a number of seams are found in bore holes in the district. Dove Creek has one seam outcropping, a section of which is given in blue print. Also a seam outcrops on Anderson Creek, a section of which is given.

The following table gives the estimated coal in the area.

<u>Total Area</u> <u>Nanaimo Series</u>	<u>Total Coal</u> <u>Bearing Area</u>	<u>Number and</u> <u>Thickness</u> <u>of Seams</u>	<u>Actual</u> <u>Coal</u>	<u>Probable</u> <u>Coal</u>	<u>Possible</u> <u>Coal</u>
		1 Seam 5'	-	-	40,000,000 T.
88 Sq. Mi.	10 Sq. Mi.	Several 1 - 3'	-	-	52,300,000 T.

There are 25 square miles of the area effected by the intrusion but all in the western portion of the field. There also appears to be a ridge of trap crossing the area from N.W. to S.E.