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# OPEN FILE

PRELIMINARY EVALUATION
OF THE
ASH RIVER AREA
COAL PROSPECT

IN THE

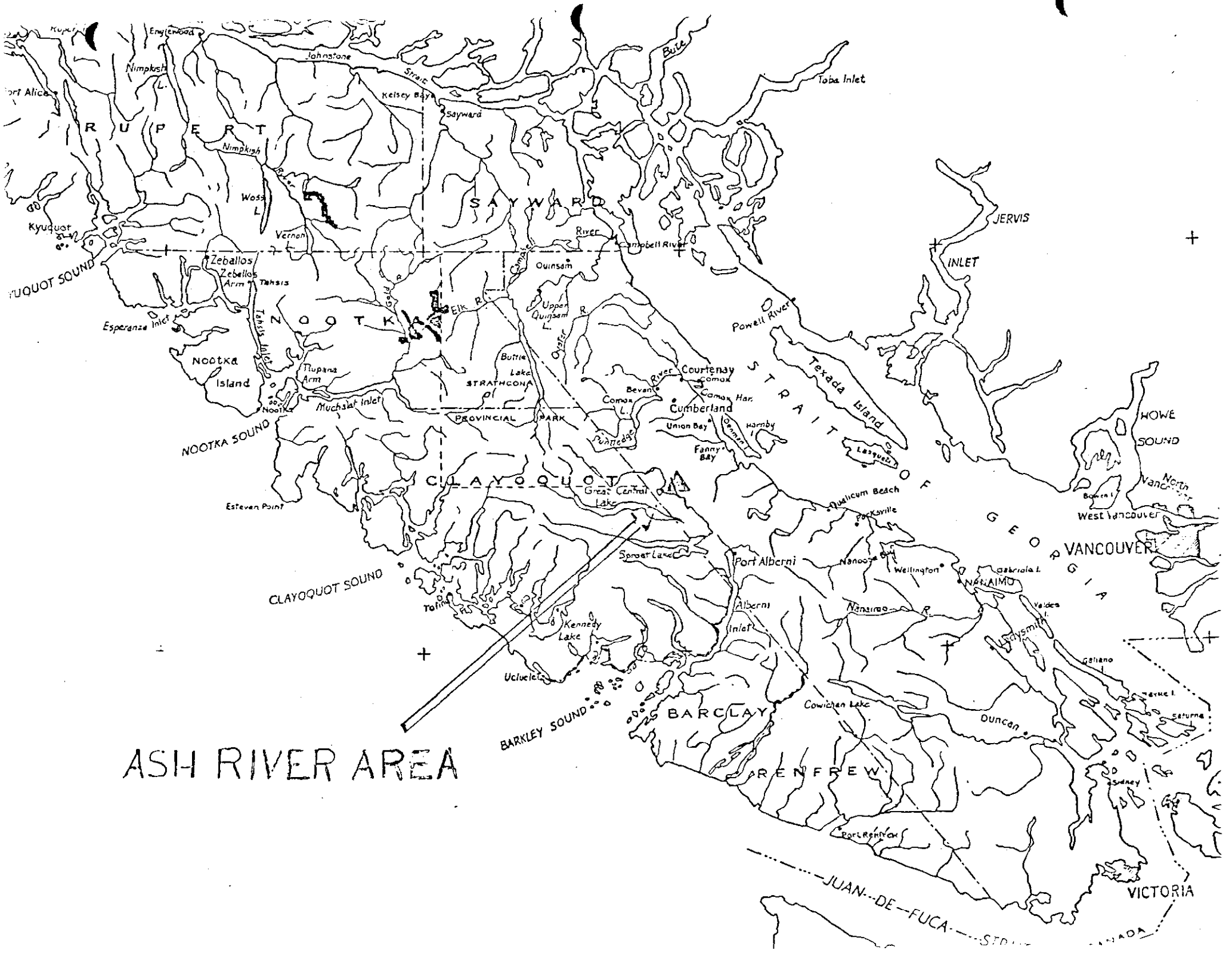
ALBERNI BASIN
VANCOUVER ISLAND
BRITISH COLUMBIA

BY

MICHELE P. CURCIO
AND
STEVE GARDNER

MAY 1977

772


ASH RIVER AREA
RUPERT
SAYWARD
NOOTKA
CLAYOQUOT
BARCLAY
RENFREW
VANCOUVER
Johnstone Strait
Kelsey Bay
Sayward
Toba Inlet
Nimpkish L.
Nimpkish River
Woss L.
Vernon
Kyuquot
Zeballos
Zeballos Arm
Tahsis
Tahsis Inlet
Esperanza Inlet
Nootka Island
Nootka
Tlupana Arm
Muchalat Inlet
NOOTKA SOUND
Gold R.
Elk R.
Campbell River
Quinsam
Upper Quinsam L.
Oyster R.
Butrie Lake
STRATHCONA PROVINCIAL PARK
Courtenay
Comox
Cumberland
Comox L.
Bevans
Comox Har.
Union Bay
Denman I.
Hornby
Fanny Bay
Powell River
Texada Island
Lasqueti
JERVIS INLET
HOWE SOUND
Vancouver
North Vancouver
West Vancouver
Bowen I.
STRAIT OF GEORGIA
Qualicum Beach
Parksville
Nanoose
Wellington
Gabriola I.
NANAIMO
Port Alberni
Alberni Inlet
Nanaimo R.
Great Central Lake
Sproat Lake
Esteven Point
CLAYOQUOT SOUND
Tofino
Kennedy Lake
Ucluelet
BARKLEY SOUND
Cowichan Lake
Duncan
Galiano
Saturna
Sidney
Port Renfrew
JUAN DE FUCA STRAIT
VICTORIA

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MAPS AND FIGURES

# INTRODUCTION

Coal played an important part in the Bristish Columbia and Canadian economy during the years 1875 to 1964.

Most of the mining occurred in the Nanaimo and Cumberland coal fields on the east side of Vancouver Island.

During the past two years coal exploration has resumed on Vancouver Island, and the work has been confined to the Comox Basin, which contain the older coal deposits. This basin extends from the fiftieth parallel in the north, south to Mud Bay. The width at the basin along this line from the Strait of Georgia to the Beaufort Range is approximately 10 miles wide.

On the West side of the Beaufort Range, the Comox and Nanaimo deposits occur over an area of approximately 120 square miles.

The occurance of coal outcrops in the northerly one third of the area, would suggest that coal seams of economic importance may be evident.

In consideration of the proximity to tidewater, the absence of any infrastructure requirements, and availability of labour on the Island, the area warrants some exploration in order to evaluate the potential coal reserves.

PHOTOGRAPH 1 - View of the northern part of Alberni Valley (Ash River Area) looking south. Elsie Lake in foreground.

## ABSTRACT

The coal fields on Vancouver Island have yielded approximately 72,000,000 tons; two-thirds of this was mined in the Nanaimo Area, and one-third was mined in the Cumberland Area.

The coal from the Nanaimo Area occurred in the younger Nanaimo Series, and the coal from the Cumberland Field in the older Comox sediments.

Coal depositions within both sedimentation periods were lagoonal in origin. At least three cyclothems produced coal seams of economic importance, the largest of which is usually located in the lowest member of the sediments which lie unconformably on the basalts of the Triassic or Jurassic era.

The basin that is evident on the West Flank of the Beaufort Range appear to have been a continuity of the sedimentary deposits which flowed through the Comox Lake Trench.

Both the Comox and the Nanaimo Series are evident in this area, which suggests an approximate aggregate thickness at 2500 feet of sedimentation in the basin. (Clapp-McKenzie, 1922.)

Due to the coal mining activities on the Eastern portion of Vancouver Island, no exploration was conducted in the area, except for geologic mapping, by several geologists from the late 1800's to present.

Preliminary indications by geologists and a visual examination of the area by the authors has led to the conclusion that the area is an elongated syncline complicated by some faulting.

## LOCATION AND PHYSIOGRAPHY

The Alberni basin comprises an area of approximately 120 square miles located on the west side of Vancouver Island at about mid-Island. (Map Number 1.) It is essentially an elongated valley bounded on both sides by the Beaufort Mountains. These mountains form the backbone of the Vancouver Island and attain heights of five to six thousand feet above sea level. The floor of the valley is gently tilted along its length to the south, where it descends to the elevation of sea level at Alberni Inlet. At its northern extent, which is about 20 miles from Port Alberni, the valley floor lies at approximately 1400 feet above sea level.

The study area is confined to the northern one-third of the basin, named the Ash River Area. The Ash River Area is virtually unpopulated and would not be as sensitive environmentally as the remainder of the basin.

The Ash River Area is a block of approximately 22,400 acres, (35 sqaure miles) of basin floor that may contain mineable seams of coal. 26.5 square miles of this block lie within the Newcastle Land District, with the remaining 8.5 square miles falling in the Alberni Land District. The northern end of the block is approximately 25 road miles from tidewater at Port Alberni.

The valley floor in the Ash River Area is gently rolling terrain, with local topographic variations to two hundred feet. It is frequently incised by small creeks and intermittent drainages. These small drainages are tributaries of the Ash River, which is the major drainage channel for the north end of the basin. The Ash River runs in a southerly direction joining the Stamp River about halfway down the valley. The Stamp River eventually flows into the Alberni Inlet.

It is at one fault zone that one outcrop of 7' - 4" of clean coal was observed.

The previous data, examination of site, and the location of other outcrops would imply that coal seams of mineable thickness occur in the sediments. It appears that some of the seams may be extractable by open cut mining methods.

Access in the northern sector of the Alberni Valley is good. A main road runs along the western margin of the valley from Port Alberni to Elsie Lake. Branching out to the east from this main road is a series of closely spaced secondary logging roads that are easily travelled by wheel vehicles. An additional hard-surface road, called the Beaver Creek Road, runs from the Alberni loading area approximately 11 miles northwest to the southern boundary of the property. Approximately 2 miles northwest on a secondary road, the southern most coal outcrop is located on the Ash River.

## PREVIOUS WORK

Previous work in the Ash River Area of the Alberni Valley includes early surveys by the Geological Survey of Canada. The earliest survey on record was carried out by C. H. Clapp in 1911 from Port Alberni to Comox. His sebsequent report, entitled "Geology of the Nanaimo Map Area" (Memoir 51, 1914, G.S.C.) dealt primarily with a Comox-Nanaimo Basin to the east, but information on the Alberni Valley area was scanty. In 1922, J. D. McKenzie wrote a paper entitled "The Coal Measures of Cumberland and Vicinity, Vancouver Island", and, in 1923 he wrote a further summary entitled "Alberni Area, Vancouver Island" for the Geological Survey of Canada.

All of this early work assumed that only the upper cycles of the Nanaimo series occurred in the Alberni Basin. It was not until 1968 when J. E. Muller and D. J. T. Carson published Paper 68 - 50 (G.S.C.) entitled "Geology and Mineral Deposits of the Alberni Map Area, British Columbia (92F)", that this assumption was contested and the existence of Lower Nanaimo Comox Formation in the Alberni Valley was established.

## GENERAL GEOLOGY

The Alberni Basin (shown on Photo Number 1) is an asymmetrical grabben approximately 35 miles long and averaging 4 to 5 miles wide. It is aligned in a north-west to south-east configuration. The basin is bounded on the east by the Beaufort Range, a mountainous ridge of basaltic rocks that are derived from deep-seated volcanic activity in Triassic time. On the west the basin is bounded by these same Triassic volcanics, as well as batholithic granites and granodiorites of the Jurassic and Cretaceous Island Intrusives. From Early Cretaceous through Tertiary time, the basin has been subjected to a number of rapid transgressive and regressive cycles of deposition, resulting in a relatively thick sequence of sedimentary deposits, some of which contain coal measures.

Because the granitic rocks of the Island Intrusives occurred both synchronously and post depositionally to the cyclical sedimentation, the sediments themselves were subjected to normal as well as lateral stresses from the west. A thrusting effect on the confined basin led to a series of major northwest to southeast trending reverse faults, with a minor series of normal cross faulting in a west-south-west to east-north-east configuration. (Map Number 2 - Muller G.S.C.)

The major thrust faults resulted in the formation of several large north-easterly dipping fault blocks that may have undergone minor rotational effects during movement. The strike of the formation is northwest to south-east.

During the recent Pleistocene glaciation, the basin was blanketed by a thin layer of sandy till that seldom exceeds 20 feet thick except for near the margins of the basin, where it has been shed off the steep sided ridges and mountains.

TABLE OF FORMATIONS

| ERA | PERIOD OR EPOCH | GROUP AND FORMATION | | MAP-UNIT | LITHOLOGY | THICKNESS (FEET) |
|---|---|---|---|---|---|---|
| Cenozoic | Pleistocene and Recent | | | 23 | Till, gravel, sand, silt | |
| | Unconformity | | | | | |
| | | | | 22 | Rhyolitic to dacitic tuff, breccia, ignimbrite | |
| | Relation unknown, perhaps coeval | | | | | |
| | | | | 21 | Hornblende quartz diorite, quartz monzonite, porphyritic dacide, breccia | |
| Mesozoic and Cenezoic | Relations unknown | | | | | |
| | Cretaceous or Tertiary | | | 20 | Sandstone, conglomerate, (may be younger than Tl, Tv) | |
| | Upper Cretaceous and (?) Tertiary | Nanaimo Group | | | | 6,000 - 8,000 |
| Mesozoic | Upper Cretaceous | | Gabriola Formation | 19 | Sandstone, conglomerate, shale | 800 - 1,400 |
| | | | Spray Formation | 18 | Siltstone, shale, fine sandstone | 225 - 950 |
| | | | Geoffrey Formation | 17 | Conglomerate, sandstone | 400 - 700 |
| | | | Northumberland Formation | 16 | Siltstone, shale, fine sandstone | 500 - 1,000 |
| | | | DeCourcy Formation | 15 | Conglomerate, sandstone | 800 - 1,400 |
| | | | Cedar District Formation | 14 | Shale, siltstone, fine sandstone | 1,000 |
| | | * | Extension - Protection | 13 | Sandstone, congomerate, shale, coal | 0 - 1,900 |
| | | | Haslam Formation | 12 | Shale, siltstone, fine sandstone | 280 - 1,000 |
| | | * | Comox Formation | 11 | Sandstone, shale, coal Benson member, mainly conglomerate | 300 - 2,000 |
| | Not known to be in contact | | | | | |
| | Upper Jurassic and/or Lower Cretaceous | 'Tofino Area Greywacke Unit' | | 10 | Greywacke, argillite, conglomerate | several thousand |
| | Nonconformity (also with Nanaimo Group) | | | | | |
| | Middle to Upper Jurassic | Island Intrusions | | 9 | Biotite-hornblende granodiorite, quartz diorite | |

Intrusive contact

## TABLE OF FORMATIONS

The following Table of Formations is a representation of the sequences of formations from Jurassic to Recent time as taken from Paper 68-50, entitled, "Geology and Mineral Deposits of Alberni Map Area, British Columbia" by J. E. Muller and D. J. T. Carson. It is not known where the complete series of the Nanaimo group exists in the study area.

## DESCRIPTION OF FORMATIONS

### The Vancouver Group

The Vancouver Group of Triassic-Lower Jurassic volcanics is chiefly represented in the Alberni basin by Karmutsen Formation. The Karmutsen Formation forms the basinal boundaries, as well as the underlying basement rock, upon which the later sediments were unconformably deposited. Karmutsen basalt is dark greenish grey to black with large amygdules of white to light green feldspar. It occurs in pillowed, brecciated or massive flows. The general theory of basaltic lava outpouring indicates that the pillowed and brecciated zones are the result of submarine extrusions, while the massive, bedded flows are indicative of outpourings after the volcanic pile has been built up above sea level.

### Island Intrusives

The Island Intrusives are granitic batholiths that have been thrust up through the older Vancouver group rocks. In the study area, the intrusives are composes of granodiorites and quartz diorites. Muller and Carson state that the age of the Island Intrusive bodies is always Middle to Last Jurassic. It may be that some of the intrusive bodies occurred into the Cretaceous period. These batholiths upwelling from great depths may provide the basis of the thrust-faulting that the Cretaceous and younger sediments have been subjected to.

### Tofino Area Greywacke Unit

Muller and Carson state that the Tofino Area Greywacke Unit is a

sequence of dark-coloured partly conglomeratic greywacke with minor argillites. This unit has the superficial appearance of volcanic rocks, but there is a faintly visible clastic nature in the hand specimans. If the Greywacke occurred in the Alberni basin area, it has most probably been eroded, because of the younger Nanaimo sediments rest unconformably on the combined succession of Vancouver Group and Island Intrusives.

## The Nanaimo Group

The Nanaimo Group of sediments is Upper Cretaceous and Tertiary in age. It is an alternating succession of clastic continental and marine facies containing several cyclical coal measures. Because of the economic significance of the Nanaimo Group, it will be examined in greater detail and categorized into various formations, starting with the oldest and scaling up to the youngest.

1. The Benson Basal Conglomerate:

   The Benson Basal Conglomerate member, or its equivalents, is found in most instances within the Nanaimo Group deposition on Vancouver Island. In the Alberni Basin, the Benson Conglomerate rests uncomfortably on the Karmutsen basalts in the western part of the basin. It appears to be at least thirty feet thick and probably thickens to as much as one hundred feet in some locations. It is composed of subangular to well-rounded pebbles, cobbles and boulders of Vancouver Karmutsen volcanic origin, firmly cemented in a greenish matrix derived from volcanic detritus.

   A. In some zones within the Basin where the Nanaimo Group has been deposited on the Comox upper sandstones the Basal Conglomerates are evident.

2. The Comox Formation:

The Comox Formation, together with the Benson Basal Conglomerate, represents the lower part of the first depositional cycle. The Comox Formation consists of alternating beds of conglomerate, sandstone, mudstone and shale with some coal measures. Comox sandstones are usually massive, medium grained, arkosid, and of medium hardness. In many instances they grade into fine grained sandstones with hard siltstone concretions that are calcareously cemented. The mudstones and shales signify a rapid change in deposition to a marginal continental, estuarine or lagoonal environment, ususally responsible for the development of significant carbonaneous-coaly intervals. In the Comox-Cumberland area, the formation contains at least five coal seams, four of which had been mined. In the Campbell River-Quinsam area, the formation containes a minimum of three seams suitable for mining. In the Alberni Basin, present information indicates at least one seam exists near the base of the formation and based on outcrops located, there is a probability that other seams occur stratigraphically higher up in the formation.

3. The Haslam Formation:

The Haslam Formation is the upper part of the first depositional cycle. It consists of a dark sandy shale horizon, and represents the near shore marine transgression of the first cycle. In the Alberni Basin, Muller and Carson report that is is present in minor thicknesses.

4. The Extension-Protection Formation:

The Extension-Protection Formation represents the basal part of the second depositional cycle overlying the Haslam Shale. This formation is a coarse clastic facies where conglomerate, pebbly sandstone and arkosic sandstone are interbedded. The sandstones are commonly

crossbedded and are of a salt and pepper appearance. In the Nanaimo area, this formation contained the Wellington, Newcastle and Douglas seams that yielded millions of tons of coal in past years. In the Chute Creek area south of the Quinsam region, the interbedded sands, shales and conglomerates contain numerous coal stringers and carbonaceous intervals. In the Alberni Basin due to the lack of information we cannot assume the existence of any definite coal occurrences in the Extension-Protection Formation.

5. Cedar District Formation:

   The Cedar District Formation is the marine flow of the second depositional cycle. It consists of thin graded beds (from 1/4 inch to 6 inches) of fine sandstone; siltstone and shale and is inferred by various sources to be a turbidite sequence. (Clapp, Muller.)

6. De Courcy Formation:

   This formation is the lower part of the third cycle of deposition. It consists of coarse clastic sandstones interbedded with conglomerates.

7. Northumberland Formation:

   The Northumberland Formation is a shale-siltstone unit and represents the marine upper part of the third depositional cycle.

8. Geoffrey Formation:

   The Geoffrey Formation is a conglomerate-sandstone unit representing the lower part of the fourth depositional cycle.

9. Spray Formation:

   This information forms the upper part of the fourth depositional cycle. It is shale, siltstone with minor sandstone sequence.

10. Gabriola Formation:

The Gabriola Formation is the highest formation in the Nanaimo group and is believed to contain only a continental sandstone-conglomerate facies. It consists of massive, cross-bedded sandstone with minor shaly layers and thin conglomerate lenses.

In the Alberni Basin, the Nanaimo Group may not exist as a complete sequence. Some of the top members have been eroded during Tertiary time prior to glaciation. Also during Tertiary time, small intrusions of granite rocks penetrated the Nanaimo Group.

These small intrusions added stress to the sediments, causing Tertiary faulting to occur in many areas.

## STRUCTURE

As previously stated, recent evidence points to the continuation of active volcanic activity associated with the Island Intrusives well into the Cretaceous. (Map Number 2.) This instrusive upwelling at the time of deposition of the Lower part of the Nanaimo series of northwest to southeast trending reverse faults that run through the length of the basin. This faulting divides the strata into linear horst; grabben blocks with varying amounts of displacement. Due to thrusting forces from the southwest along the basin (where the main intrusive bodies are located), the general dip of the formation is to the northeast. Dips vary because of some rotational movement of the fault blocks, but generally appear to be in the range of 6 to 15°. The following schematic cross-section across the width of the Basin illustrates the asymmetric appearance and the fault sequences.

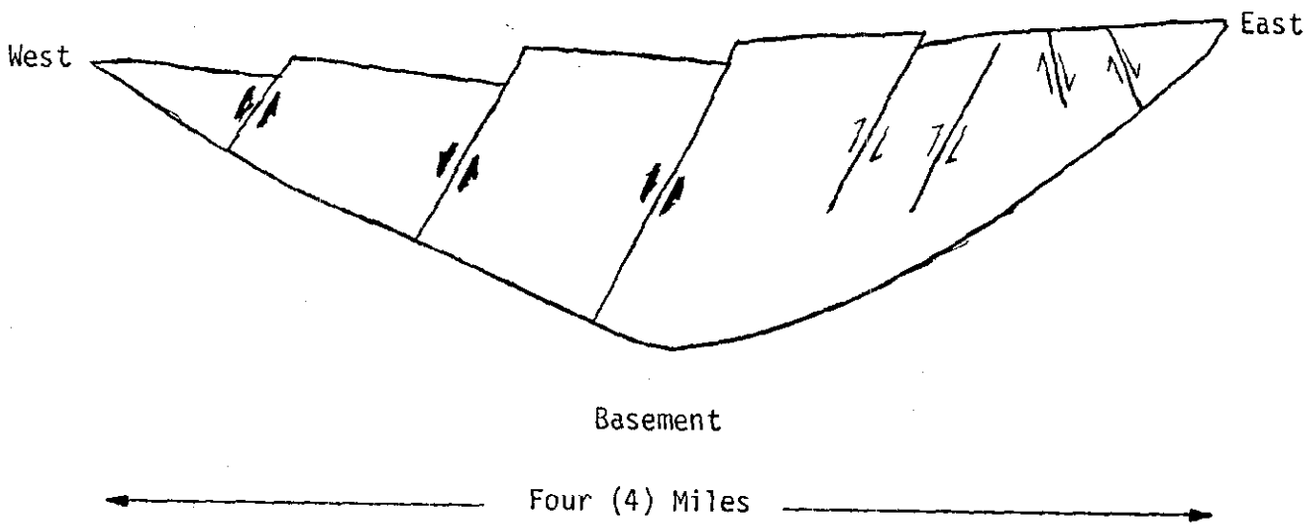

Photo Number 2: Outcrop Number 2 showing seam thickness and sandstone roof. On the bank of unnamed Creek south of Elsie Lake.

## ECONOMIC GEOLOGY

### Coal Occurrences In The Study Area

A total of five (5) different coal outcrops have been recorded from existing old records for the northern part of the Alberni Valley. (Map Number 3.) The outcrops are described in order from north to south:

Outcrop Number 1 - As noted by J. E. Gill and H. A. Rose, August 28, 1922. "This Outcrop is on a southernly flowing tributary of the Ash River which joins same just below Elsie Lake on either Katlum Creek or an unnamed creek 1/4 mile east."

| | |
|---|---|
| Sandstone: Medium grained, quartzose | 2' |
| Coal: Boney | 8" |
| Shale: Carbonaceous with coal bands | 2' |
| Shale: Clayey | 5' |
| Unconformity | |
| Fine grained material | |
| Massive glassy rock and agglomerate | |

Outcrop Number 2 - As noted by M. Curcio and S. Gardner, April 19, 1977. "150 feet upstream from main road bridge crossing first tributary on Ash River going from the east end of Elsie Lake." Formation Strike is N. 18° E. with an easterly dip of 6°.

The outcrop appears on both sides of the creek and appeared to be situated on an easterly trending fault zone. Photo 2 illustrates the thickness of the seam. Cursory analyses revealed the coal contained 0.30% sulfur.

A series of minor cross faults in a west-south-west to east-north-east trend results from basinal uplift through the Cretaceous and also minor Tertiary intrusives. The latter appear as dykes, sills or small loccaliths (Muller). These are generally wrench faults with minor displacements between 10 to 30 feet.

While it can be ascertained that faulting is the major structural factor, some degree of folding may be present, especially along the eastern margins of the basin, where the entire sequence has been thrown up, against the Beaufort Range. This folding may occur in the more incompletents formations, such as the shales or coal sequences, as tight isoclinal folds. On a more general scale, the trend would be toward gently, open synclinal folding due to the trusting effect from the west.

SEDIMENTATION

The Alberni Basin has been subjected to cycles of marine transgression and regression during the Cretaceous-Tertiary ages. During these cycles, a well defined sequence of formations was deposited, from marginal shoreline conglomerate, to estuarine and lagoonal backshore facies, to continental sandstones, and then repeating in a reverse fashion to begin again at the near shore and marine shales and siltstones. It is postulated that the Albernie Basin was connected to the Comox Basin through the break in the Beaufort Range where Comox Lake is now situated (Clapp). In any case, the depositional environment was quite similar, except that the Alberni Basin is more confined.

The third reported outcrop was visited by a number of people, including Mr. George Hannay and R. Strachan.

Outcrop Number 3 - As noted by C. H. Clapp, "Outcrop on unnamed creek about 500' above its confluence with the Ash River and above A.P.L. track Elsie Lake Main Line. It is in Block 74, Newcastle District, 55 chains east of Northeast corner of Block 639. Elevation 1030'.

| | | | |
|---|---|---|---|
| Roof - coarse sandstone | | | 0'0" |
| 1. | Boney coal | 1'7" | 1'7" |
| 2. | Shale | 5" | 2'0" |
| 3. | Boney coal | 1'2" | 3'2" |
| 4. | Shale and bone | 9" | 3'11" |
| 5. | Boney coal | 2'6" | 6'5" |
| 6. | Shale, some bone | 11" | 7'11" |
| 7. | Boney coal | 4' | 11'11" |
| 8. | Coal, some bone | 11" | 12'10" |
| 9. | Bone, some coal | 10" | 13'8" |
| 10. | Coal and bone | 1'2" | 14'10" |
| 11. | Bone and coal | 9" | 15'7" |
| 12. | Shale | 3" | 15'10" |
| 12. | Bone and coal | 4'0" | 19'10" |

Partly concealed by water - floor concealed.
Strike 130°, Dip 15° N.E.

Remarks:

Nearly all of the coal has a brown streak (oxidization) and while all the bands of boney coal contain streaks and lenses of bright, hard coal, on the whole the boney layers will probably run in excess of 20% ash.

George Hannay took a sample from this outcrop to Union Bay, June 1, 1951. The sample was analyzed June 7, 1951, by P. F. Grundy - Lab. No. 51-770.

The analysis on an "As Received Basis" -

| | | |
|---|---|---|
| Moisture | 1.22% | |
| Ash | 29.91% | |
| Volatile Matter | 29.06% | |
| Fixed Carbon | 39.81% | (Dry M.M. Free Basis - 60.5%) |
| Sulfur | 1.07% | |
| Calorific Value | 9548 | B.T.U. - (Dry M.M. Free Basis - 14,250 B.T.U.) |
| F.S.I. | 3 | |

Rank of Coal - High Volatile "A" Bituminous

Outcrop Number 4 - As noted by J. E. Gill and H. A. Rose, August 29, 1922; section in creek; "This outcrop is on a southerly flowing tributary of the Ash River - about 20 chains North and 20 chains West of the Southeast Corner, Block 74, Newcastle District".

Section in creek:
Sandstone, white
Coal, boney and shaley bands up to 4" - 1' 6"
Sandstone, greenish
Congomerate and grit
Strike North 45$^{O}$ West 5$^{O}$ N.E.

This outcrop was partially submerged in the creek waters, and not totally visable.

The fifth outcrop was reported by Dennis Harris in November 1905 road survey from Alberni to Comox.

Outcrop Number 5 - The outcrop is on an unnamed creek about 10 chaines above its junction with the Ash River. It is about 1-3/4 miles west of A.P.L. Camp 1. The Outcrop is in Block 263 Alberni District, 32 chains South and 10 chains East of its northern Northwest Corner.

"I cannot speak too highly, through the property of the Esquimalt and Nanaimo R.R. Company, of the coal outcroppings in this valley, which has the prospects at some future date, when developed, of materially adding to the welfare of the Newcastly and Alberni districts, the shipping point being Alberni. The coal is hard of good quality and burns freely."

Further indications of coal occurences have been noted during the 1977 survey. There is an abundance of float coal in the Ash River itself, presumably derived from these aforementioned outcrops. There is also float coal in large quantities in the unnamed creek between Outcrops 2 and 3, indicating the presence of an additional outcrop somewhere upstream. However this outcrop was not located.

It is interesting to note that these coal outcrops are all on the same general strike pattern of the Comox formation in this area. It is difficult to forecast whether they would all correlate with each other. However it is our opinion that these outcrops represent more than one coal seam and the seams all occur within the lower most 300 feet of the Comox Formation, just above its unconformity with the Vancouver volcanics.

## SUMMARY

Based on the structural knowledge, the number of outcrops, and the variance of coal thickness recorded, it can be assumed that more than one coal seam exists in tha basin.

All of the coal outcrops located appear to be on parallel strike and dip very gently to the north east. Assuming an average dip along strike of $10^{\circ}$ and a continuity of seam within the top 300 feet of formation it can be calculated that if the assumptions are proven, the zone would contain open pit reserves between 50 and 100 million short tons within a ratio of 10:1.

Earlier analyses of the coal would place this coal in the rank of High Volatile "A" Bituminous coal, which is comparable to other deposits in similar structure on Vancouver Island.

## CONCLUSIONS

1. The Alberni Basin contains sediments of both the Nanaimo and Comox Formations.

2. Outcrops reveal the existence of more than one coal seam in the formations.

3. The Ash River Area, containing 22,400 acres of structure, has the best potential, with the least environmental problems in the Basin.

4. The Ash River Area has good access roadways.

5. The location of the Ash River Area is within 20 miles of tidewater.

6. The coal quality, if commercially extractable, will be a High Volatile "A" Bituminous coal with the possibilities of some coking qualities.

7. If mining were proven feasible, no infrastructure would be required and there is readily available power, water, and labour.

## RECOMMENDATIONS

1. An application for License should be entered with the Provincial Government covering 22,400 acres in the Ash River Area of the Alberni Basin.

2. Preliminary exploration should be conducted to prove the existence of commercially extractable coal seams.

3. Conduct laboratory analyses on the coal samples to evaluate the quality and determine market potential.

4. The recommendations should be carried out as early as possible due to possible governmental restructuring of their license policy.

## EXPLORATION COST PROJECTIONS

### Outline Of Work

1. Starting at the known outcrops, a series of holes on minimum spacing of 1,000 feet, to the eastern limits of the basin. This may vary if only open pit mining reserves are the prime consideration.

2. All the test holes would be conducted on existing roadways, wherever possible.

3. Approximately 25% of the holes yielding coal will be cored for quality information and analyses.

4. All holes will be geophysically logged, utilizing the gamma, resistance, density combination.

5. Mapping and reporting would follow the conclusion of each sections examined.

6. Recommendations and conclusions.

### Cost Projections

| | | | |
|---|---|---|---|
| 1. | Licenses - 22,400 acres at $1.00 per acre | = | $ 22,400.00 |
| * 2. | Exploration requirements under the Coal Mines Act - 22,400 acres at $3.50 per acre | = | 78,400.00 |
| 3. | Contingency for exploration 10% | = | 7,840.00 |
| | TOTAL COST | = | $108,640.00 |

The estimated time involved in exploration and reporting would be approximately three months.

*The exploration is designed to primarily work out the formation that would be considered with existing open pit mining parameters.

Assuming this would be within a distance of about 3,000 feet, based on existing evidence of dip, this would entail approximately 15 test holes, and about 5 core holes. Assuming an average depth of 300 feet, and 3 holes per section, the total drilling would be 4,500 feet of drilling and 1,500 feet involved in the core holes to obtain cores of the coal measures.

Based on our experience on Vancouver Island for similar programs, the costs of drilling, logging, coring with core specialist, and geologic supervision, have been averaging $14.00 per foot all inclusive.

Assuming this program would be in line with others, the cost estimate would be 6,000 x $14.00 = $84,000.00.

All the drilling, logging, and coring would be on a contract basis, subject to the owner's approval.

Supervision and geologic work would be on a per diem rate, acceptable by the owner.