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GROUND HOG

COAL SURVEY

REPORT BY J. M. BLACK, P. ENG.

REPORT WRITTEN FOR DILLINGHAM CORPORATION ON GROUND HELD BY COASTAL COAL CO. LTD., FIELDWORK by R.A. BEST - JULY-SEPTEMBER 1968. (ACCOMPANIED BY FIELD COMPILATION SHEET).

GROUND HOG COAL SURVEY

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INTRODUCTION

Anthracite coal is known to accur over a large area near the headwaters of the Skeena River. This area is generally referred to as the Ground Hog area after a prominent range of that name. This area is not outlined on maps and its geologic boundaries have not been determined. It is about 1500 to 2000 square miles in extent. Its center is about 135 miles north and a little west of Hazelton.

The area is not accessible by road and this lack of easy access has hindered intensive exploration of it.

In recent years Japan has become an importer of large tonnages of coking coal. Exploration of the Ground Hog area was undertaken this season with the hope that, in addition to anthracite, large reserves of coking coal might be found.

Inasmuch as exploration of high ground in the area, expecially in remote parts, has been difficult, it was reasoned that good possibilities existed for the discovery of seams, possibly less deformed than those found hitherto. Also that areas might be found where seams could be cheaply mined. With these objectives, it was decided to use a helicopter to provide easy access to all parts of the area.

This report is based largely on notes prepared by Prof. R. V. Best of the University of British Columbia who was in charge of a field party that surveyed the area. Prof. Best has proposed the subdivision used in this report

and prepared the map and sections that accompanies it. His notes have been supplemented by those of the writer, who examined all the air photos of the area and made many flights across it and a few ground traverses.

FIELD PARTY

A party of eight was in the field for nine weeks. It comprised a chief (R.V. Best), an assistant chief (B. Woodsworth), each of whom are experienced in sedimentary and coal geology; a junior geologist and a junior mining engineer, a prospector, two assistants, and a cook.

John Boyd, a coal mining consultant from Pittsburg; R. W. Jenkins, Manager of Mining for Dillingham Corporation; and the writer were consultants for the exploration program.

A camp was established at Kluayaz Lake and this was the base of operations for the program. It was supplied by fixed wing aircraft. A helicopter was stationed at this camp to transport personnel for daily traverses and also to establish fly-camps where required. The camp was supplied with apparatus to conduct standard coking tests on coal in order that no delay would occur in determining if coking coals existed in the field.

GENERAL CHARACTER OF AREA

The area is shown on the accompanying map. It comprises mountain ranges up to 7500 feet in altitude separated by wide mature valleys at 3500 to 4000 feet in altitude. It is at the height of land between three major river systems, namely the Nass, Skeena and Stikine. These rivers are generally well adjusted and flow in wide flat valleys.

The valley bottoms have many grassy meadows and these support abundant game. The valley slopes are well timbered up to about 5000 to 5500 feet.

GENERAL GEOLOGY

The entire area is underlain by rocks of the Bowser assemblage of Upper Jurassic to Lower Cretaceous age. No other rocks were seen in the survey. It is proposed to divide the assemblage into four units. This differs from previous divisions. The four units were recognized during the survey, which was more extensive than any hitherto. The distribution of the four units explains the location of the known coal seams. The outline of the four units is generalized and simplified; a map on a smaller scale would be much more complex. Faults are numerous but have been omitted from the four mile map because they would almost completely hide the geology.

The four units are Lower Conglomerate, Lower Shale, Upper Shale and Upper Conglomerate. They grade into each other and the boundaries between them are drawn arbitrarily. They are described below starting with the oldest.

LOWER CONGLOMERATE

This unit comprises predominantly coarse clastics, mostly thick sandstones and thick conglomerates. These contain pebbles of black chert. These are interbedded with some thin bedded sandstone, siltstones and shales. The sandstone in part is dirty or near greywacke in composition.

This unit becomes thinner bedded and finer grained towards the top where it grades into the overlying unit. Near the top it includes a few minor coal seams. It is 1000 to 1500 feet thick and its base is not exposed in the area mapped. It is non-marine.

This unit outcrops along the east limit of the area, on the slopes of Kluatantan and Kluayetz valleys and also in Duti and Tzahny valleys.

Because of strong deformation many beds are intricately folded and locally dip in all directions. However, the unit appears to dip gently southwestwards and as shown on section may underlie, at depth, the whole area.

LOWER SHALES

Many shale beds are interbedded with coal seams, which include all the thicker seams known, some as much as 10 and 12 feet thick. Interbedded with the shales are many sandstone beds. This sandstone is also dirty and is in part greywacke. Most of these beds are non-marine and appear to be lenticular and not continuous for great distances. However, included in this unit are some marine sandstones, grey shales and shell coquinas.

Rapid changes in the members of this unit along strike make it difficult to correlate seams or sections especially where, as in parts, it has been strongly deformed. Some of the shales have been changed to slates.

The estimated thickness of this unit is 1500 to 2500 feet. It is not resistant to erosion and is mostly exposed in valley bottoms and the lower slopes of valleys. It has a wide distribution in the southern part of the map area and along the Kluatantan and Kluayetz valleys. It is also exposed over large areas of moderately high ground in the southeastern part of the area.

THE UPPER SHALES

This unit grades gradually upward from the lower shales. It is similar but is characterized by a lack of coal seams. It contains many sandstone beds and siltstones and also some limy beds and concretion that contain fossil plants.

This is the thickest of the four units. Near Devils Claw Mountain, where the entire thickness of this unit is exposed, it is about 4500 feet thick. Further north, on the first nose north of Kluakaz Creek and where its base is not exposed it is more than 3500 feet thick. It is also well exposed south of the mouth of Tahsedle Creek. It has the most extensive distribution of any of the units and underlies most of the southwestern two-thirds of the area.

THE UPPER CONGLOMERATE

This unit comprises conglomerate beds 50 to 200 feet thick with vari-colored pebbles - black, green, yellow, brown, white etc. These are subangular to rounded. Interbedded with the conglomerates are sandstone beds up to 50 feet thick and some shales. Some of these are carbonaceous but do not include any real coal.

This sequence outcrops along the ridge that extends in both directions from Mount Gunanoot. An outlier of it is on top of Devils Claw Mountain. At least 1000 feet is exposed. This unit is resistant to erosion and forms prominent bluffs and rugged topography.

AGE

Abundant fossil flora and fauna show that the two lower units and most and possibly all of the third are of Upper Jurassic age. The fossils are both marine and non-marine indicating fluctuating conditions. Possibly the uppermost part of the upper shales and the upper conglomerate unit may be of Lower Cretaceous age.

STRUCTURE

This entire Bowser assemblage has been intensely deformed as demonstrated by folds, faults and cleavage. Many of the folds and faults are small but are repeated many times and locally the structure is extremely complex (see photos attached). On air photos and from the air many drag folds of many sizes are obvious.

Symmetrical folds occur but assymmetric ones are more common. They are generally overturned to the northeast. Chevron folds are common in belts such as across Panorama Lake and across Kluayaz and Tzahny creeks.

Elsewhere as at the east side of Lonesome and Moss Mountains, as many as five recumbent folds or nappes are stacked one above another.

Associated with the tighter folds are flow cleavage and thrust faults. In the less closely folded areas, high angle normal and reverse faults with displacement of about 100 feet occur about every half mile.

Joints are abundant and have a great many attitudes. One set (N20°E, vertical) is so strongly developed just north of Panorama Lake that it has a distinct topographic expression.

The lower units have been deformed more than the upper ones, and the lower shale unit has been especially deformed and crumpled. The coal beds have been intensely deformed and squeezed and to some extent mixed with the enclosing beds. Some of the shale beds have been changed to slate.

The upper conglomerate unit is much more massive and is competent and has not been crumpled to anything like the same extent as the older units.

With regard to major fold pattern Best states: "It is necessary to over-simplify the major structural trends in order to understand why the coal occurs where it does. The western third of the range between the Nass and Skeena Valleys may be regarded an anticlinal, the eastern two-thirds as broadly synclinal (The Devils Claw Syncline). The Skeena valley as anticlinal on a somewhat smaller scale and the rest of the coal field to the east as broadly synclinal with an upturned edge. This simplification ignores the zones of major thrust faulting and drag folding along the west side of the main river valleys and the local thickening of parts of the section resulting from minor contortion and fault repetition.

The two main synclines are doubly plunging: the western, Devils Claw Syncline is obviously canoe shaped with greatest thickness of youngest beds (Upper Conglomerate) in the vicinity of Kluakaz and Porky creeks. The eastern synclinorium plunges similarly but the northwestern end is cut off by complex faulting along the Spatsizi south of the Kluayetz-Didene junction.

It may be seen that, except for main tributary valleys, the older beds containing coal (Lower Shales) are necessarily restricted in outcrop to the southern and northeastern portions of the area, to the contorted northeastern rim and in lesser amount to the extreme northern portion of the Devils Claw Syncline." (See section AB, CD, EF)

COAL

Many seams were found, some as much as 12 feet thick, and their locations are shown on map. Samples were tested in the field to find out if the coal coked, and none were found to do so. Thirteen were analyzed and the results are shown in Appendix A. Generally they have a relatively high ash and

fixed carbon content and relatively low volatile content. In some the proportion of volatiles is large enough to classify the sample, on an ash free basis, as a medium or even high volatile coal. However, all such samples had very high ash and possibly for this reason, they did not coke.

These results confirmed results published by Buckham, General Survey of Canada, Bulletin 16. The generally high ash content of clean looking coal shows that many mud particles must have been present in the sea when the vegetable matter, that became coal, was accumulating and that these particles accumulated with the vegetable matter. Subsequently deformation has crushed some of the seams and driven off a high proportion of the volatiles.

As the snow disappeared and the structural complexity became obvious and as the results of tests on the coal became known, it became desirable to make an intensive investigation to find out if any major seams occurred in a relatively undisturbed area. For this purpose, areas in which the units of the Bowser assemblage without coal outcrop, were also excluded. However, this left a large area and this was examined carefully. The helicopter was used continuously and landings were made at all dark beds and where coal bloom could be seen. Landings were also made where gently dipping or flat beds could be seen. Landings were also made on creek bars to look for float and if found, traverses were made to try to locate the source of the float. This "Helicopter reconnaissance was conducted at both high and low levels, with flight lines spaced from 1 to 2 miles apart with frequent stops ..... . Likely areas ..... were examined in greater detail on the ground".

Many apparently clean seams were found, but all are non-coking. Areas in which seams have a gentle attitude are of limited extent and generally nearby at a fold or a fault, the attitude becomes steep.

The only area in which seams have a moderate attitude over any considerable area is around McEvoy flats and the eastern end of Devils Claw Mountain where seams dip 15 to 20° southwestward. They are non-coking and dip under the mountain so they cannot be strip-mined.

AREA WEST OF NASS RIVER

On Map 9 - 1957 Geological Survey of Canada, coal is reported to occur west of the Nass River. Near the end of the Ground Hog survey when no worthwhile seams had been found, efforts were transferred to the area west of the Nass. It lies south of Nass Lake and is bounded on the south and southwest by Muckaboo Creek and Konigus Creek.

The helicopter reconnaissance technique with frequent landings was used. The rocks are generally similar to those east of the Nass River but the structure is even more complex. Some coal was found but not in seams that warrant exploration.

CONCLUSION

An intensive search for seams of coking coal did not find any. The seams found generally contain high ash, are steeply dipping and would be expensive to mine. It is concluded that the Ground Hog area and the area adjoining to the southwest do not contain minable coal seams.

J. A. Black
Dec 11, 1968

APPENDIX I

ANALYSES OF SAMPLES GROUND HOG AREA

Location on Map	Moisture %	Ash %	Volatiles %	Fixed Carbon %
24	4	35.4	6.2	54.4
24	4	50.0	8.0	38.0
24	6	50.0	7.0	37.0
30	5	38.0	8.5	48.5
37	8	43.4	9.4	39.2
47	12	50.0	19.0	19.0
47	15	67.0	17.0	2.0
47	19	50.0	19.0	12.0
51	11	58.0	14.0	17.0
51	12	46.0	14.0	28.0
51	16	48.6	16.0	18.4
55	5	39.0	8.0	48.0
Prudential Mountain	4	44.0	7.0	45.0

APPENDIX II

20 Color Photographs Illustrating Structures.

GROUNDHOG COAL

Comments by K. E. NORTHCOTE on Report by J. M. BLACK

Not as complete as it could be but acceptable because it evaluates the Groundhog area's potential for coking coal and adds to the knowledge of the geology of that area.

Other companies would question the validity of determining coking quality of coal by testing surface material. Most exploration procedures involve drifting below or beyond exidized zone before ruling out a coal seam as non-coking. However there appears to be other unfavourable properties of the coal, making it unsuitable, e.g. high ash content.

Black states that the Groundhog coals have high ash and fixed carbon content. According to the American Standards Association the fixed carbon content is low.

The report is not as complete as it could be -

(a) Co-ordinates - coal licenses

(b) Not immediately evident who the report was written for.

(c) Cross sections should be marked "diagrammatic" - they are misleading because the structure is much more complex than is shown. (Complexity is discussed in the text - the map is titled "Generalized".

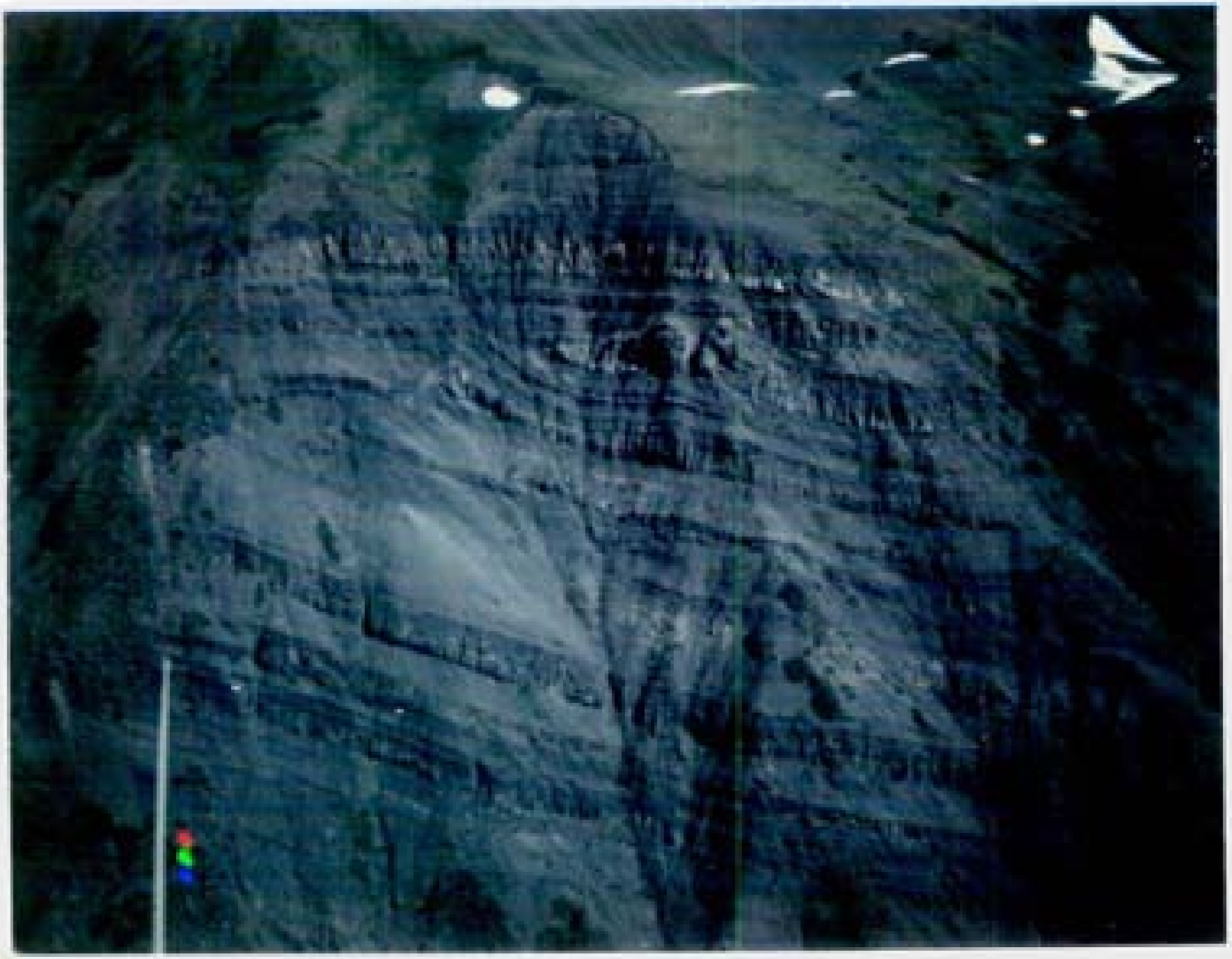
John T. Boyd Associates Report

Adds little to the knowledge of the Groundhog Coalfield as far as geology and useful information is concerned. Does provide some useful general information about coal grades. Collected ten samples under poor conditions and had them analysed. Samples A.D.F. and G. were coal, the balance of the samples carbonaceous shale.

July 30

typical street view of

Muckaloo – Naga junction



(47)

Symmetrical [illegible] at [illegible]
nose [SW] where Butter Ck flows
S to meet the Little Klamath.
North of [illegible], up the Butter valley the
structure becomes more intense

Overturned & recumbent folds viewed head-on in east face of Lonesome Mt. ((from helicopter)
photo centre ~ 5500'

97

Viewed to SE: [redacted]

Overturned fold on 2nd ridge North of Ranger Ck (opposite shallow lake across Kluayatz Ck)

Beds above ~ horizontal, but struct. complicates at edge of main valley of Klutlankan-Kluayatz.

July 19, 1968

97

23a

anticlines & synclines
viewed from S across CK
1st north of Vaingus on E side
of Nass R

K72K341

(97)

Fold in area ~ 8 mi W of mth of Konigus Ck (SW of Konigus) — a typical structure.

July 30 — roll 2

(97)

N 72 K 343

overturned ?
oblique chevron folds
Beirnes ck, 2nd big trib.
west — headwaters — looking
in direction 320 (almost on
strike) from a point
about 2½ mi @ 215° from
Mt Beirnes Peak

July 30- 2011
2

(97)

K72K343

22a

anticline on small draw opp mth Kangaroo Ck

F72K341

(97)

Mt Devils claw
from the south

P72K343

97

31

Structure on w side of valley of 1st southerly tributary of Kanigusek (Approx 3½ mi SSW of mth of K. Ck.)

Note NE dipping axial plane(s) (viewed in northerly direction)

97

25°
chevron folding
W of Muckaboo CK
Photo taken looking due W
abt 1 mi SE of Muckaboo Lake

F72K341

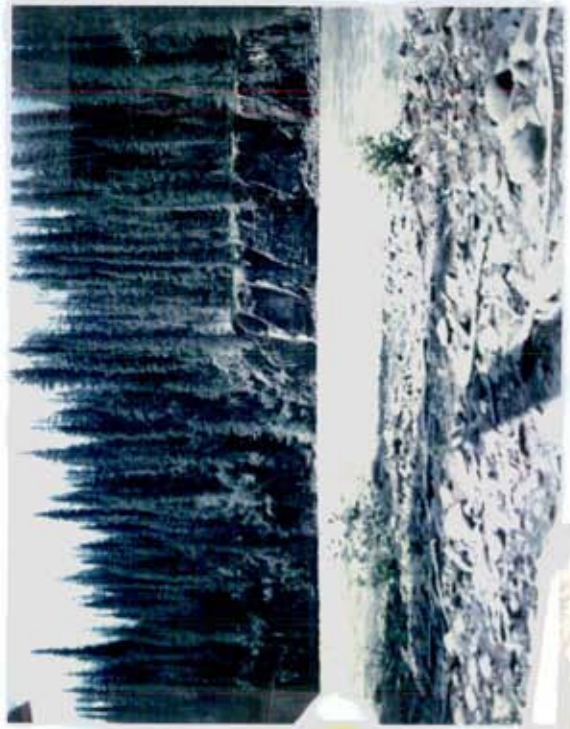
(97)

28b

2nd CK valley SE (on NE side of Muckaboo valley) of the double-lake tributary direction of camera 140°

(97)

gentle a/c crest w
bank Nass R at
Panorama Ck
600' upstream this rolls
over to vertical



aug 30

97

Looking due west across main S. trib of Little Klappan R, where it joins drainage from Tahtsedle–Little Klappan divide (overturned anticline)

NTS 2K 3E?

97

Nose in ck
between Trail cks
& Kobes

97

July 30

LD

Structure on SE side of ridge 2nd north from Ranger Ck (photo from S of small "lake" @ 57°08'N, 128°29⅔'W in direction 340°); example of small fault with abt. 70'-80' displacement.

NE on same ridge at elev. ~5700' a shallow (5°-10° Westerly dip) thrust is probably a bedding plane fault - could not be photographed -

July 17, 1968.

(97)

Tahtsedle West
View along ridge
(ie to SE)
from
Mt. Klappan
(?) same fold as
shows on L. Klappan
nose photo #7

97

M72x343

View in direction 300° from nose of S. fork Ranger Ck, of main ridge separating the two main forks of Ranger Ck.

Gentle anticline beneath camera trends 300° but to s west structure becomes complex (faulting, overturning etc)

July 19, 1968

(97)

[redacted]

View @ 310° [redacted] se E of elk flowing S to Klmayar lake (from 57°04'N, 128°10' W) along strike to overturned syncline on N.W side of valley.

July 17 1968

(97)

MT THULE
Kluayetz
Creek
Fire Flats
Kluatantan
Kluatantan
PRUDENTIAL MTN
MT LAIDLAW
Didene Cr
MT KLAPPAN
Skeena River
SKEENA
RIVER
LONESOME MTN
MT GORDON
OPERATOR MTN
PYRAMID BLUFF
MOSS MTN
TABLE MTN
MT TAYLOR
MT GUNANOOT
McEVOY FLATS
JACKSON FLATS
MT JACKSON
GROUNDHOG PASS
River

97

GENERALIZED GEOLOGICAL MAP
(OMITTING ALL FAULTS AND LOCAL FOLDS) OF
GROUNDHOG COAL FIELD

UPPR CGLS
UPPR SHALES
LWR SHALES
LWR CGLS

COAL q/c EXAMINED
MAJOR FOLD AXES

Scale : Miles

To accompany report by J.A. Roddick, P.Eng. Dec 6, 1962