REPORT ON

NIAMODLACC MOUNTAIN COAL PROSPECT

1970 FIELD SEASON

BY

E. L. SPEELMAN

NORMAN H. URSEL ASSOCIATES LIMITED

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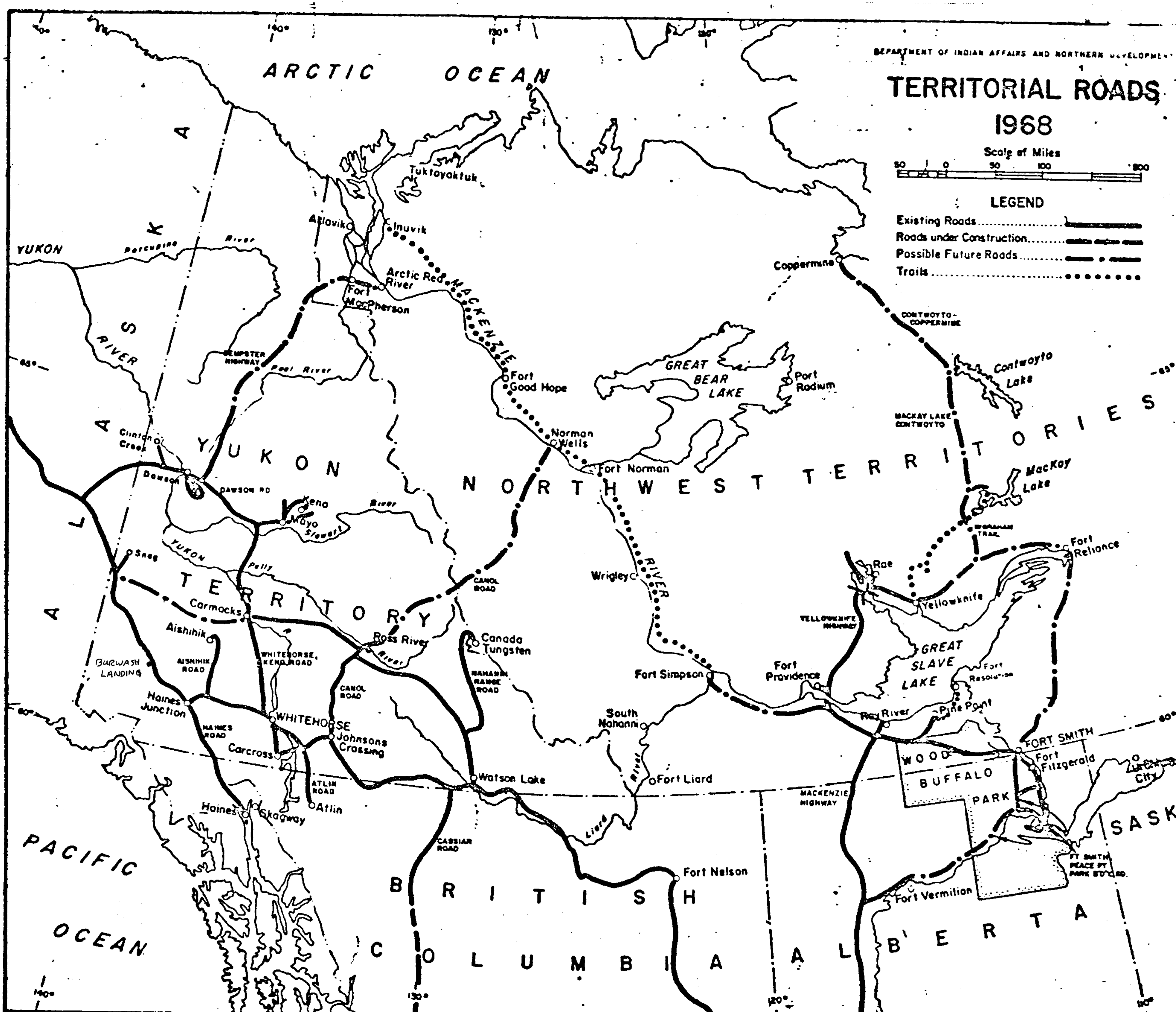


DEPARTMENT OF INDIAN AFFAIRS AND NORTHERN DEVELOPMENT
TERRITORIAL ROADS
1968
Scale of Miles
50 0 50 100 200
LEGEND
Existing Roads
Roads under Construction
Possible Future Roads
Trails
ARCTIC OCEAN
PACIFIC OCEAN
ALASKA
YUKON TERRITORY
NORTHWEST TERRITORIES
BRITISH COLUMBIA
ALBERTA
SASK
Tuktoyaktuk
Aklavik
Inuvik
Arctic Red River
Fort McPherson
MACKENZIE RIVER
Fort Good Hope
Norman Wells
Fort Norman
Wrigley
Fort Simpson
South Nahanni
Fort Liard
Fort Providence
Coppermine
CONTWOYTO-COPPERMINE
Contwoyto Lake
MACKAY LAKE CONTWOYTO
MacKay Lake
INGRAHAM TRAIL
Fort Reliance
Rae
Yellowknife
YELLOWKNIFE HIGHWAY
GREAT SLAVE LAKE
Fort Resolution
Pine Point
Hay River
FORT SMITH
Fort Fitzgerald
Uranium City
WOOD BUFFALO PARK
FT SMITH PEACE PT PARK RD
Fort Vermilion
MACKENZIE HIGHWAY
GREAT BEAR LAKE
Port Radium
YUKON RIVER
Porcupine River
Peel River
DEMPSTER HIGHWAY
Clinton Creek
Dawson
DAWSON RD
Keno
Mayo
Stewart River
Pelly River
Snag
Carmacks
Aishihik
AISHIHIK ROAD
BURWASH LANDING
Haines Junction
HAINES ROAD
WHITEHORSE, KENO ROAD
WHITEHORSE
Johnsons Crossing
Carcross
ATLIN ROAD
Atlin
Haines
Skagway
Ross River
CANOL ROAD
Canada Tungsten
NAHANNI RANGE ROAD
Watson Lake
Liard River
CASSIAR ROAD
Fort Nelson
140°
130°
120°
110°
60°
65°

NIAMODLAOC MOUNTAIN COAL PROSPECT

INTRODUCTION

The Amphitheatre formation occurring in Kluane Ranges area of Southwestern Yukon was prospected for coal seams of mineable thickness during a portion of the 1970 summer field season. Seams reported by the Geological Survey of Canada to occur in the top part of the formation on the lower northwestern slopes of Niamodlaoc Mountain were relocated, and channel samples taken (Locality A, Plate 1). Seams of similar mineable thicknesses were found approximately 2.5 miles to the south (Locality C), also in the upper horizons of the formation. To the west of the latter locality, roughly 780 feet lower down in the section (at Locality D), a seam was discovered whose thickness of 11 (or 14) feet is the highest confirmed for the Amphitheatre formation. A channel sample of the bottom 8 feet was taken.

LOCATION AND ACCESS

Coal prospecting licences have been taken out to cover the following two areas (National Topographic System designation): SEQ 115 G/6 and NEQ 115 G/3. The boundaries of these two areas form the enclosure shown on Figure 1. A portion of the area NEQ 115 G/3 lying southwest of the line drawn in the Duke River Valley is not open for coal leasing and is excluded from the licence area.

From the nearby settlements of Burwash Landing and

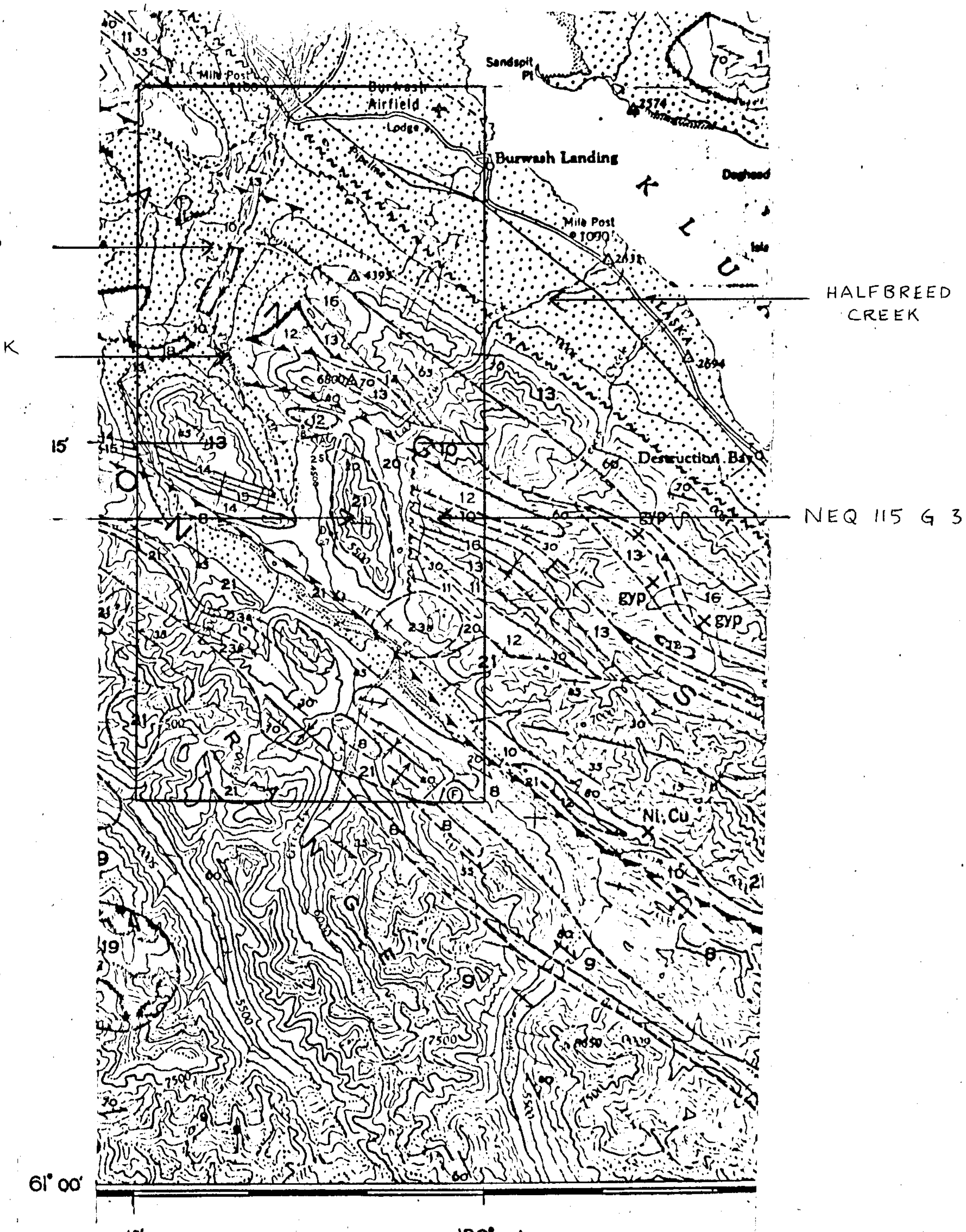


FIGURE 1.

MAP 1177A

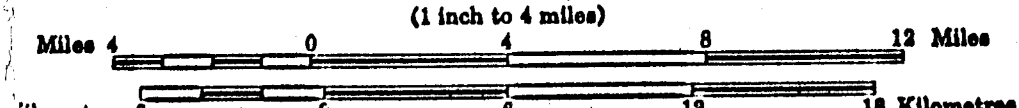
GEOLOGY

KLUANE LAKE

YUKON TERRITORY

Scale 1:253,440

(1 inch to 4 miles)



LEGEND

FORMATIONS OF THE ST. ELIAS MOUNTAINS

CENOZOIC

TERTIARY

PALEOCENE AND LATER

23 — 23a, *porphyritic latite, trachyte, rhyolite;* 23b, *gabbro*

ST. CLARE GROUP

21,22 — 21, *Red-brown basalt and andesite, massive or vesicular agglomerate, breccia, tuff*
22, *Volcanic-boulder gravel and volcanic conglomerate, minor tuff, sandstone, shale, lava*

PALEOCENE OR EOCENE

20 — *AMPHITHEATRE FORMATION: sandstone, sand, conglomerate, gravel, shale, coal*

CRETACEOUS AND(?) TERTIARY

19 — *Icefield Ranges intrusions: alaskite, granite, granodiorite, porphyritic rhyolite; intimately mixed with 17*

MESOZOIC

CRETACEOUS AND(?) EARLIER

18 — *Kluane Ranges intrusions: hornblende-biotite granodiorite, quartz diorite, diorite*

17 — *Migmatized volcanic rock, hornfels, quartz-mica schist, augen gneiss, marble; minor granitic rock. May be in part Palaeozoic*

JURASSIC AND CRETACEOUS

UPPER JURASSIC AND LOWER CRETACEOUS

DEZADEASH GROUP

16 — *Argillite, greywacke and conglomerate with graded bedding, thin limestone bands; banded hornfels near intrusions*

TRIASSIC

UPPER TRIASSIC

MUSH LAKE GROUP

15 — *Thin bedded shaly limestone, calcareous and silty shale*

14 — *Limestone, commonly brecciated; gypsum*

13 — *Basalt and andesite, mainly amygdaloidal, purple and green; minor interbedded shale, argillite, greywacke, silty limestone, chert, conglomerate. May be in part pre-Upper Triassic.*

PERMIAN AND/OR TRIASSIC

12 — *Peridotite, gabbro; minor banded chert*

PERMIAN AND (?) EARLIER

LOWER PERMIAN AND(?) EARLIER

CACHE CREEK GROUP

11 — *Argillite, sandstone, grit, conglomerate, limestone, chert;* 11a, *limestone*

PALAEOZOIC

10 — *[illegible] basic lava, [illegible] cherty tuff, volcanic breccia, chlorite schist; minor greywacke, argillite, limestone. May include some 9 and 13*

DEVONIAN AND/OR MISSISSIPPIAN

9 — *Greenstone, schistose greywacke, quartzite, slate, phyllite; minor sheared conglomerate, marble. May include some of 16*

DEVONIAN

MIDDLE AND UPPER DEVONIAN
KASKAWULSH GROUP

8 — *Marble, argillite; minor phyllite, greenstone*

FORMATIONS OF YUKON PLATEAU

MESOZOIC AND (?) CENOZOIC

MESOZOIC AND (?) EARLY TERTIARY

7 — *Nisling Range alaskite' (includes Rockslide Creek Stock): alaskite, granite, quartz monzonite; minor rhyolite;* **7a**, *rhyolite, fine-grained granite*

6 — *'Nisling Range granodiorite': biotite-hornblende granodiorite; granogabbro, quartz monzonite;* **6a**, *includes many rhyolite dykes*

5 — *Ruby Range batholith (includes granitic rocks in southeast corner): biotite-hornblende granodiorite, quartz monzonite, quartz diorite; minor granodiorite-gneiss*

TRIASSIC AND (?) LATER

4 — *Porphyritic basalt, andesite, latite, rhyolite; related tuff and breccia*

PRE-MESOZOIC (MAINLY)

YUKON COMPLEX

3 | 3b | 3a — *Quartz-chlorite-sericite schist, epidote-actinolite greenschist, quartzite, slate, quartz-mica schist, limestone;* **3a**, *recrystallized limestone;* **3b**, *dunite*

2 — *Quartz-sericite-chlorite schist; minor quartzite*

1 — *Quartz-biotite schist, in places carrying garnet; quartz-feldspar-biotite gneiss, amphibolite; minor recrystallized limestone;* **1a**, *contains many rhyolite dykes and sills*

Drift-covered area . . . .
Bedding (horizontal, inclined, vertical) . . . .
Schistosity, gneissosity (horizontal, inclined, vertical) . . . .
Fault (assumed) . . . .
Thrust fault (teeth in direction of dip; assumed) . . . .
Anticline (normal, overturned) . . . .
Syncline . . . .
Fossil locality . . . . F
Former placer operation (gold) X
Mineral occurrence . . . . ×
Mining property adit (1, Canalask Nickel Mines;
2, Hudson Bay Mining and Smelting Co.) . . . .

Destruction Bay, which are located on the Alaska Highway, the area is accessible by chartered helicopter or by two roads negotiable by caterpillar tractor or 4-wheel drive vehicles. The roads extend south from the Alaska Highway; one follows Ptarmigan Creek and the other Halfbreed Creek. It is 7 to 15 road miles from different portions of the Niamodlaoc Mountain coal prospect area to Alaska Highway at Mile Post 1088, just east of Halfbreed Creek, then 73 miles to Haines Junction, Yukon, then 151 miles to Haines, Alaska. Alternatively, it is 98 miles from Haines Junction to Whitehorse, Yukon, then 99 miles by rail to Skagway, Alaska.

GENERAL GEOLOGY

Reconnaissance geological mapping on a scale of 4 miles to one inch has been done in the area by the Geological Survey of Canada. No topographic map at a larger scale than this is available for the southern licence area, and the topography (500 foot contour intervals) is on the geology map (Figure 1). Some of the structural data obtained during 1970 field work have been added to the map.

Amphitheatre Formation

The clastic unit of interest in the Niamodlaoc Mountain area, containing fossiliferous coal measures in its upper part, is the Amphitheatre formation (Unit 20, Figure 1). Total thickness of this early Tertiary unit is unknown, but at least 1,500 feet of section was traversed in prospecting the stream cut above and below locality D, and from aerial observations made during helicopter reconnaissance flying it is estimated that beneath this at least an additional 1,000 feet of section is present for an estimated minimum total thickness of 2,500 feet.

The formation consists of various conglomerates, sandstones, siltstones, and shales and their poorly consolidated to unconsolidated equivalents: gravel, sand, claystone, and clay as well as coaly shale and coal. There is a very rough overall trend of (a) decreasing abundance of unconsolidated clastics, and (b) decreasing abundance of beds of conglomerate (gravel) and coarse-grained sandstone (sand) upwards in the section in favour of the less coarse grained clastics, along with greater abundance and thicknesses of beds of coaly shale and coal. Colours of conglomerate (gravel) and sandstone (sand) are predominantly light (Localities C and D, Plate 1) shades including greys, browns, yellows, and oranges. There are also some pink sandstones and some pale green sandstones. Siltstone, shale, claystone, and clay are often darker shades of grey and brown, but light greys, browns, and yellows are also present.

One of the most common lithologic varieties is a faint buff-weathering, light grey "salt and pepper" sandstone (sand) or conglomerate (gravel). The conglomerates are generally massive. The dark grains, or well-rounded dark pebbles or cobbles are usually volcanic rock, chert, or quartzite. The sandstone (sand) or sandstone matrix of conglomerate (gravel) is both argillaceous and feldspathic, except for some highly feldspathic units which are also noticeably micaceous. In this lithotype, as well as others in the Amphitheatre formation, degree of consolidation or lithification may vary laterally, thus constituting a type of facies change. More local variation of this type is represented by concretions of superior consolidation or lithification.

In addition to the thicker coal seams which have been found (discussed ahead), there are many thin seams and lenses of coal in the upper part of the formation. Relationship (a) (above) notwithstanding, coal is generally found to become progressively harder downsection.

St. Clare Group

A predominantly volcanic unit, the St. Clare Group overlies the Amphitheatre formation. Basalt flows predominate. The typical reddish-brown colour and the flow boundary layering can be seen on Plate 1. Some flows visible on the high cliff faces appear to be greater than 100 feet thick, and some of the thicker flows exhibit well developed columnar jointing. Inspection of talus shows that massive, vesicular, and amygdaloidal varieties of basalt are present. Some specimens have greenish alteration colours.

Maroon agglomerate was noted, and some bright pink to purple material appears to be scoria. The sequence includes several white to light grey units which are probably tuffaceous sandstones.

A few very dark grey layers were seen in high places accessible only by full-support mountain climbing. It was not possible to ascertain by binocular inspection if these were coal seams, or coaly shale, or simply basalt flows appearing dark due to a covering of water, such as the "weeping walls" visible near top of Plate 2-I, left of centre.

The base of the St. Clare Group is placed at the base of the first basalt flow above locality C (Plates 1 and 2-I). The Group is at least 2,000 feet thick.

Tertiary Intrusives

An acid intrusive sill and dikes occur in the section at and below locality D, respectively, and a sill at locality B. These units are too minor to be shown on Figure 1, but they belong to unit 23a, of which a stock is shown southeast of Niamodlaoc Mountain. In the vicinity of both localities D and B these rocks are fine-grained, light grey, with phenocrysts of white feldspar up to 4 mm across, and averaging about 1.5 mm. They are generally fresh, hard rocks, with a buff surface-weathering colour. One small dike was fractured and altered to a softer rock.

At locality D a sill, 3 feet to 6 feet thick, is present in the upper part of a coal seam (Plate 2-II). Several inches of natural "coke" is present at both the upper and lower contacts of the sill. One or more of the dikes lower down in the section may have been a feeder for this sill. Narrow bands of coaly matter follow the margins of some dikes. These coaly envelopes may be condensates of coal entities volatilized during "coking" of portions of coal seams encountered by dike/sill systems.

Structure

Pre-Tertiary stratified rocks in the area, including units of Cretaceous age, occur in tight, northwest-trending folds. The lower Tertiary rocks, the Amphitheatre formation and St. Clare Group, generally exhibit gentle, open folding, with dips less than 30 degrees. Strike measurements, of which only a few are plotted on Figure 1, show considerable variation, and the data are insufficient to determine the trend and pattern of fold axes.

Near the thrust fault lying north of Niamodlaoc Mountain, beds of the Amphitheatre formation are dipping 40 degrees to the northeast. Similarly, it is likely that beds of this formation will also be found to be more steeply inclined in the vicinity of the Duke River thrust lying to the south of the mountain. This is the case elsewhere along this thrust. This interpretation is shown on Figure 2.

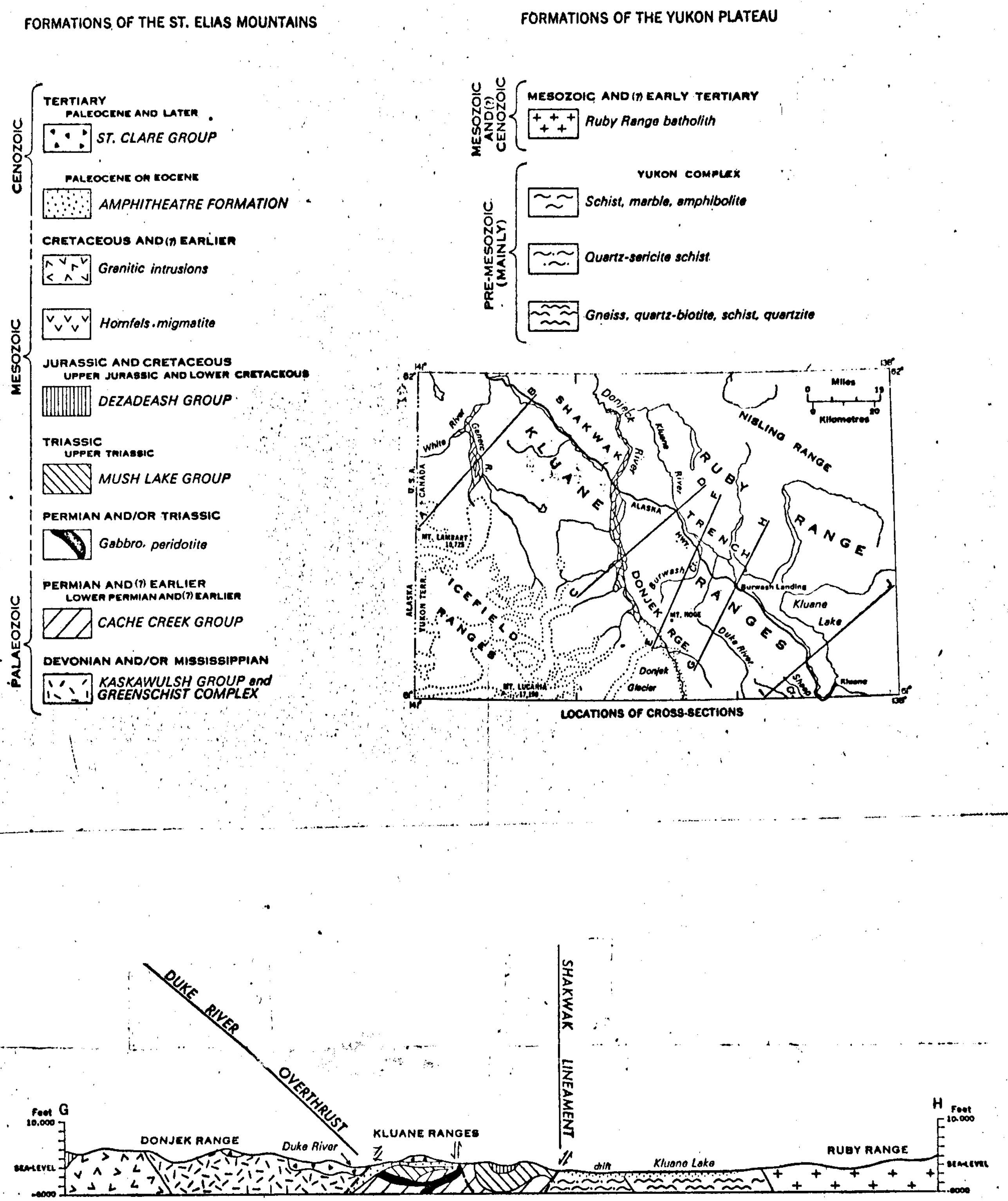


FIGURE 2. SCHEMATIC STRUCTURAL SECTION.

Geological History

The pre-Tertiary rocks were highly folded in late Cretaceous time, and the detritus shed from the mountains formed accumulated along with plant material in non-marine basins to form the Amphitheatre formation during early Tertiary time. A period of volcanic activity then covered the coal measures with several thousand feet of flows and pyroclastics. These lower Tertiary rocks were later compressed into open folds during the period of northeast-acting thrust faulting on the Duke River thrust. The thrust fault to the north of Niamodlaoc Mountain may be a counter-thrust which was active during the same period. The Tertiary acid intrusives which are present as dikes, sills, and stocks in the early Tertiary and older rocks, were emplaced at relatively shallow depth as indicated by their porphyritic texture. These intrusions may have risen from depth along fractures created during the period of faulting. Pleistocene glaciation is largely responsible for the present topography.

PROSPECTING CONDITIONS - EXPOSURE

Although the volcanic rocks capping Niamodlaoc Mountain are very well exposed, the coal measures forming the base are not, except where sharply incised gullies are formed by small streams running off the mountain (see south of locality D, Plate 1 and also Plate 2-I). The slopes rising from these stream cuts are very unstable, and on them earthflow and landslide deposits are common. The upper slopes, and some lower slopes undergoing rapid stream erosion usually expose bedrock of the Amphitheatre formation. The valley of upper Halfbreed Creek on the east side of Niamodlaoc Mountain averages roughly 500 feet greater elevation than that of Ptarmigan Creek on the west side. Equivalent development of stream cut exposures is, therefore, not present on the east side.

LOCALITY A

It is believed that the only coal locality indicated for this area on the Geological Survey of Canada geological reconnaissance map was relocated at locality A (Plates 1 and 3-I, Figure 1), on the south side of a stream cut, a few tens of feet above the stream bed. The local stratigraphic section (Table 1) was here found to be essentially identical to that reported by the Geological Survey of Canada except for a reported one foot of hard and brittle coal which was here found to be one foot of coaly shale, and was therefore not sampled. The 3-foot and 6-foot seams were opened up by hand trenching, and faces prepared for channel sampling. These faces were at least 5 feet from the original coal outcrop surfaces. Standard channel samples of 3 inches by 4 inches were taken across the full width of the seams. The coal in the bottom part of the channel for sample 31/7/70-2 (Plate 3-II) was frozen, and ice veins were present.

TABLE 1

Local Stratigraphic Section at Locality A

Thickness of Unit

Feet	Inches	
		Roof: Shale, coaly, soft.
3	0	Coal, soft and slightly shaly; lower part is hard and brittle. Channel sample 31/7/70-1.
2	6	Shale, dark brown, blocky, soft.
1	0	Shale, coaly, blocky.
2	0	Shale, brown, and light brown clay.
6	6	Sand, light brown, slightly shaly.
0	6	Siltstone, brown, with coaly fragments.
1	0	Shale, alternating light and dark brown, chunky, laminae of black coaly shale in lower one-half.
6	0	Coal, fairly hard, clean, and brittle. Ice in lower part. Channel sample 31/7/70-2.
		Base: Clay, light brown.

LOCALITY AA

Coal seams were also found at locality AA which is on the south side of the next stream gully to the south of locality A (see Plates 1 and 3-I). These are poorly exposed due to active down-slope movement, mainly earthflows and mudslides which not only tend to cover bedrock exposures of coal beds, but also result in differential movement of sizeable detached blocks of bedrock, thus rendering difficult attempts to trace and correlate coal seams. As at locality A, the best exposures were found where the coal seams are near the stream bottom, i.e., in their easternmost exposures. Even here contacts and portions of units are covered, making some stripping necessary.

Some excavation work was done with the object of determining seam thicknesses and securing channel samples. A few inches below the surface moving ground water was encountered, creating springs and indicating that no fresh coal could be obtained. In addition, the coal seams were not coherent, but consisted of blocks easily parted, with subsurface open spaces between cleat surfaces of a few inches up to a foot in width not uncommon. This evidence of movement within the coal seams, due to downslope movement and perhaps also to frost-wedging, introduces uncertainty to any estimates of seam thicknesses and stratigraphic separations. However, it is believed that at least four different seams are present, one about one foot thick, two about three feet thick, and one at least four to five feet thick.

From observations made during helicopter reconnaissance flying, it is reasonably clear that the coal seams at locality A and those at locality AA may occupy the same stratigraphic interval within the Amphitheatre formation. This opens the possibility that some of the individual seams may be continuous between these two localities.

LOCALITY B

From the air, farther to the northwest of the point of observation of localities A and AA, a wide, dark band is visible on steep slopes on the south side of another west-flowing tributary of Ptarmigan Creek. On the slopes there is a typical development of a series of sub-parallel earthflows lying side by side and elongate downhill. The dark band appears to be the surface trace of a stratigraphic horizon situated roughly 660 ($\pm$ 100) feet lower down in the Amphitheatre formation than the coal beds at localities A and AA.

The band was prospected in the vicinity of locality B (Plate 1, Figure 1). The surface material there is colluvium consisting of coaly mud and small pieces of coaly claystone and shale. The only material present which is consolidated and which may be nearly in place is a series of exposures of porphyritic, acid igneous rock which are situated in the upper part of the dark band, and appear to belong to one sill, at least five feet thick. The base is covered, and the top, which is vesicular and orange-weathering in places, is partly covered. Better exposures of the dark coaly horizons might be found by careful prospecting elsewhere along the band. Alternatively, stripping and trenching will be required to determine how much of the local section is coal, and how much is coaly shale and claystone.

LOCALITY C

As at localities A and AA, coal beds were also found to occur in the upper part of the Amphitheatre formation approximately 2.5 miles to the south at locality C (Plates 1 and 2-I). Two 3-foot seams and one 6-foot seam are positioned in the stratigraphic succession as indicated in Table 2, which is a non-detailed local section. Samples were not taken here, but the local conditions are favourable for doing so, and for exposing the section for detailed observation and measurement.

TABLE 2

Local Section at Locality C

Thickness of Unit (feet)	
	Top covered
3 1/2	Coal
31	Mainly covered, several feet of interlayered coal and coaly shale in lower part.
6	Coal
2 3/4	Covered
1/2	Sandstone, medium-grained, yellow weathering, ledge-forming.
1 3/4	Mudstone, green, light green weathering, chunky.
1	Covered
3 1/4	Coal
Not measured	Sandstone, brown, argillaceous
Not measured	Sand, very coarse grained, white weathering, becomes pale green weathering lower down.

LOCALITY D

A coal seam about 11 (or 14) feet thick was discovered at locality D (Plates 1 and 2-II). Its position in the Amphitheatre formation is roughly 780 (± 100) feet below the seams at locality C. Table 3 is the local measured section. As discussed above, the seam has been intruded by a 3-foot to 6-foot sill, below which there is about 11 feet of coal, and above which there is about 2 to 4 feet of coal. Immediately overlying the upper coal is a thick, hard and competent conglomerate unit. There are a few thin claystone partings in the lower coal, and it is underlain by soft, sandy siltstone.

A two-level bench cut trench(see Plate 4) was driven into the seam in order to obtain channel samples. A channel eight inches wide and four inches deep was removed. From the lower level of the cut a channel length of 66 inches (bottom part frozen) and from the upper level 30 inches was taken to make up sample 27/8/70-5 representing (g) and (i) the lower 96 inches of the lower coal. Only one parting, one inch of claystone, was seen in this lower 8 feet of the seam. At the top of this channel is another parting comprised of claystone and mud, and showing no signs of thermal effects from the sill above. Another channel sample, 27/8/70-4, comprising the three inches of (e) and the lower nine inches of (c), was taken from above the latter parting to test for possible thermal effects. Actually, the 5 to 10 inches of natural "coke" at the lower contact

TABLE 3

Local Stratigraphic Section at Locality D

Thickness of Unit (inches)	
	Roof: Conglomerate, cobbles (predominant) and pebbles well rounded, polymictic, sorting poor to fair, weathers light brown, massive, hard, competent, cliff-forming.
20 to 36, estimated up to 48 in inaccessible places.	Coal, natural "coke" with columnar jointing at base.
36 at creek, increasing to 75 to the southwest, with pinching and swelling.	Intrusive sill, fine-grained, porphyritic, light grey, weathers buff.
8, varies from 5 to 10	(a) Natural "coke" with columnar jointing.
14	(b) Coal, crushed, and baked(?)
12	(c) Coal, thin platy, shiny, with curving fracture(?) boundaries which form overlapping lensoid shapes elongate parallel to layering.
3 to 5	(d) Claystone, coaly, dull dark grey, soft, chunky, may be borderline coal.
3	(e) Coal, hard, bright
1½, up to 5	(f) Claystone, medium brown, moderately hard, chunky, lensing out into admixture of self and light brown mud.
42	(g) Coal, banded, hard, most bands are bright and between 1/8 inch and 1 inch, average less than 1/2 inch, cleats well developed (orientations not measured), yellow to orange resin common, also disseminated white unidentified material common.
1	(h) Claystone, dark brown, moderately hard, chunky.
54	(i) Coal, same as (g), lower part frozen.
	Base: Siltstone, sandy, dark brown, soft, with coaly fragments.

of the sill is the only obviously thermally metamorphosed portion of the lower coal. The 14 inches of crushed coal (b) below this has a slightly "baked" aspect, but the next lower 12 inches of coal (c) does not in its appearance suggest thermal alteration, although its unusual lensoid habit might be a variety of shrinkage fracturing arising from the loss of volatiles by heating, or the structure may be associated with the mechanics of intrusion of the sill. The presence of the overlying crushed coal suggests this latter possibility. Comparison of the volatile matter content of the two channel samples will be one approach to the problem.

DISCUSSION

A thick, very well consolidated conglomerate unit immediately overlies the upper coal of the seam at locality D. The sill present there is a very well consolidated roof rock for the lower coal, which, due to the position of the sill, is the portion of the seam which has a mineable thickness. The roughly similar stratigraphic positions within the Amphitheatre formation of the seam at D and the coaly horizons at B opens the possibility that these horizons at these two localities are correlative. If so, then the lithologically similar sills present at both localities are possibly portions of one continuous sill which follows a coal seam.

The horizons containing coal seams near the top of the Amphitheatre formation at localities A, AA, and C are probably correlative, but detailed measured sections would be required to prove this, and detailed work would be required to determine if individual seams are continuous between these localities. The natural exposures are insufficient for this work, and stripping and/or diamond core drilling is required.

The roof rock for both coal seams at locality A is shale. Concerning the possible alteration of coal by oxygenated ground water, it is reasonable to believe that since the period of Pleistocene glaciations the presence of a zone of permafrost, beginning near the ground surface and extending to depths of 200 to 300 feet judging by diamond drilling experience in the Yukon (R. Therrien, pers. com.), would have presented a barrier against circulation of ground water. Prior to Pleistocene glaciation, which was responsible for eroding thousands of feet of bedrock in places, the coal seams may have been below the zone of penetration of oxygenated ground water.

After doing the surface work and subsurface probing required to demonstrate the continuity, thickness, and quality of seams on the west side of the mountain, an important question to ask next is whether mineable thicknesses of coal occur on the east side of Niamodlaoc Mountain. If so, it could be inferred that substantial reserves underlie the mountain, since from the reconnaissance indications that structural style is one of open, gentle folding, there is no particular reason for believing that the position of the mountain relates to thicknesses or continuity of coal seams.

October 6, 1970

Respectfully submitted,
Norman H. Ursel Associates Limited

Edwin L. Speelman

Edwin L. Speelman, B.Sc.

APPENDIX 1

COAL SAMPLE ANALYSES

	Sample Number	Licence Area	
Locality A	NHUA 31/7/70-1	SEQ 115 G 6	Coal
	NHUA 31/7/70-2	SEQ 115 G 6	Coal
Locality AA	NHUA 30/7/70-4	SEQ 115 G 6	Resin
Locality D	NHUA 27/8/70-4	NEQ 115 G 3	Coal
	NHUA 27/8/70-5	NEQ 115 G 3	Coal
	NHUA 27/8/70-2	NEQ 115 G 3	Coke

File 2927-70

Mines Branch
Fuels Research Centre

CANADA
Department
of
Energy, Mines and Resources

Solid Fuels Laboratory

Ottawa August 18, 1970

REPORT OF ANALYSIS

Sample of coal submitted by Norman H. Ursel Associates Ltd.
as per advice dated July 27, 1970.

Date Received.	éa August 7, 1970			
Sample Mark.	31-7-70-1			
Moisture Condition	Equilibrium Moisture	Dry	As Rec'd	Dry
Proximate Analysis				
Moisture. . . . . %	20.1	0.0		
Ash. . . . . %	14.7	18.4		
Volatile Matter. . . . . %	45.8	57.3		
Fixed Carbon (By Difference) . . %	19.4	24.3		
Ultimate Analysis				
Carbon. . . . . %				
Hydrogen. . . . . %				
Sulphur . . . . %	0.1	0.1		
Nitrogen. . . . . %				
Ash. . . . . %				
Oxygen (By Difference). . . . . . %				
Calorific Value. . . . .Btu/lb Gross	7430	9290		

Fusibility of Ash
Initial Deformation Temperature. °F
Softening Temperature. . . . . . °F
Hemispherical Temperature. . . . °F
Fluid Temperature. . . . . °F

Grindability Index, Hardgrove. . .

Screen Analysis
Screen Size

Caking Properties Non Agglomerate.

Remarks Rank (ASTM) Subbituminous "C".

Reported by: D. S. Montgomery

D.S. Montgomery

Dr. D.S. Montgomery,
Head,
Fuels Research Centre.

Distribution: Norman H. Ursel Associates Ltd.
c/o Tintina Air Services
Box 2244
Whitehorse, Yukon (1)

Norman H. Ursel Associates Ltd.
801-85 Richmond St. W.
Toronto 110, Ont.
Attn: Mr. I. Wilson (1)

CANADA

Mines Branch
Fuels Research Centre

Department of Energy, Mines and Resources

File 2928-70

Solid Fuels Laboratory

Ottawa August 18, 1970

REPORT OF ANALYSIS

Sample of coal submitted by Norman H. Ursel Associates Ltd. as per advice dated July 27, 1970.

Date Received	August 7, 1970			
Sample Mark	NHUA-31-7-70-2			
Moisture Condition	Equilibrium Moisture	Dry	As Rec'd	Dry
Proximate Analysis	18.5	0.0		
Moisture %	6.3	7.7		
·h. %	37.6	46.1		
·olatile Matter %	37.6	46.2		
Fixed Carbon (By Difference) %				
Ultimate Analysis				
Carbon %				
Hydrogen %	0.1	0.1		
Sulphur %				
Nitrogen %				
Ash %				
Oxygen (By Difference) %				
Calorific Value Btu/lb Gross	9100	11160		

Fusibility of Ash
- Initial Deformation Temperature °F
- Softening Temperature °F
- Hemispherical Temperature °F
- Fluid Temperature °F

Grindability Index, Hardgrove

Screen Analysis
Screen Size
%
%
%
%
%
%

Caking Properties Non Agglomerate.

Remarks: Rank (ASTM) Subbituminous "B"

Reported by: W J Montgomery

D S Montgomery
Dr. D.S. Montgomery,
Head,
Fuels Research Centre.

Distribution:
Norman H. Ursel Associates Ltd.
c/o Tintina Air Services
Box 2244
Whitehorse, Yukon (1)

Norman H. Ursel Associates Ltd.
801-85 Richmond St. W.
Toronto 110, Ont.
Attn: Mr. I. Wilson (1)

File 3130-70

Mines Branch
Fuels Research Centre

CANADA
Department of Energy, Mines and Resources

Solid Fuels Laboratory

Ottawa Sept. 4, 1970

REPORT OF ANALYSIS

Sample of Hand picked resin submitted by Norman H. Ursel Associates Ltd.

Date Received.	Aug. 31, 1970			
Sample Mark.	NHUA-30-7-70-4			
Moisture Condition	As Rec'd	Dry	As Rec'd	Dry
Proximate Analysis				
Moisture. . . . . %		0.00		
Ash. . . . . %		1.76		
Volatile Matter. . . . . %				
Fixed Carbon (By Difference) . . %				
Ultimate Analysis				
Carbon. . . . . %				
Hydrogen. . . . . %				
Sulphur . . . . %				
Nitrogen. . . . . %				
Ash. . . . . %				
Oxygen (By Difference). . . . . . %				
Calorific Value. . . . .Btu/lb Gross				
Fusibility of Ash				
Initial Deformation Temperature. °F				
Softening Temperature. . . . . . °F				
Hemispherical Temperature. . . . °F				
Fluid Temperature. . . . . °F				
Grindability Index, Hardgrove. . .				

Screen Analysis
Screen Size
%
%
%
%
%
%

Solubility 59.9%
Melting Point Range 325 to 375°C

Remarks: Solubility in 70% Benzene, 30% Ethanol

Reported by: W.J. Montgomery,
Head, Solid Fuel Laboratory
W.J. Montgomery

D.S. Montgomery
Dr. D.S. Montgomery,
Head,
Fuels Research Centre.

Distribution: Norman H. Ursel Associates Ltd.
c/o Tintina Air Services
Box 2244
Whitehorse, Yukon (1)

Norman H. Ursel Associates Ltd.
801-85 Richmond St. W.
Toronto 110, Ontario.
Attn: Mr. I. Wilson (1)

CHEMICAL RESEARCH AND ANALYSIS
CONTRACT LABORATORIES

TECHNICAL SERVICE LABORATORIES
DIVISION OF BURGENER TECHNICAL ENTERPRISES LIMITED
355 KING ST. W., TORONTO 2B, ONT., CANADA
TELEPHONE: 362-4248 - AREA 416
CABLE ADDRESS - TECSERV TORONTO

CERTIFICATE OF ANALYSIS

SAMPLE(S) FROM Norman H. Ursel Associates Limited,
Suite 520,
85 Richmond Street West,
Toronto, Ontario.

REPORT NO. T-21302

SAMPLE(S) OF COAL

Sample No. NHUA 27/8/70-4	Air Dried	Dry Basis
Moisture %	4.34	---
Ash %	9.68	10.12
Volatile Matter %	40.67	42.51
Fixed Carbon %	45.31	47.37
Sulphur %	0.40	0.42
B.T.U./pound	11,510	12,032

Samples, Pulps and Rejects discarded after two months

DATE Feb. 9/71 SIGNED [signature]

CTA

REPORT OF ANALYSIS

Sample of coal submitted by N.H. Ursel Associates Ltd as per advice dated Oct. 16, 1970 designated as Channel Sample from Whitehorse Yukon

ate Received. . . . . *Oct 20 1970*

ample Mark. . . . . *NHUA 27-8 70-5*

oisture Condition	~~As Rec'd~~ *Eq Moisture*	~~Dry~~ *Air Dried*	~~As Rec'd~~ *Dry*	Dry
oximate Analysis				
loisture. . . . . %	*13.59*	*6.54*	*0.00*	
sh. . . . . %	*9.07*	*10.31*	*10.74*	
olatile Matter. . . . . %	*35.69*	*39.39*	*42.28*	
ixed Carbon (By Difference) . . %	*39.65*	*43.76*	*46.98*	
timate Analysis				
arbon. . . . . %				
ydrogen. . . . . %				
ulphur . . . . %	*0.35*	*0.38*	*0.41*	
itrogen. . . . . %				
sh. . . . . %				
xygen (By Difference). . . . . . %				
lorific Value. . . . .Btu/lb Gross	*9790*	*10810*	*11600*	

M.M.Free 13160

sibility of Ash
itial Deformation Temperature. °F
ftening Temperature. . . . . . °F
emispherical Temperature. . . . °F
uid Temperature. . . . . °F

84.41

ndability Index, Hardgrove. . .

een Analysis
Screen Size
%
%
%
%
%
%

Non Agglomerating

Moist mmf BTU : 10881

A.S.T.M. Rank Sub-bituminous "A"

arks:

orted by:

Head, Solid F[illegible]

Dr. D.S. Montgomery,
Head,
Fuels Research Centre.

tribution:

REPORT OF ANALYSIS

Sample of coal submitted by N. A. [illegible] Associates Ltd through [illegible]

Date Received.			27/8/70 - 27	
Sample Mark.	13-[illegible] 70			
Moisture Condition	Eq ~~As Rec'd~~ Moisture	Air ~~Dry~~ Dried	Dry ~~As Rec'd~~	Dry
Proximate Analysis				
Moisture. . . . . %	8.55	4.21	0.00	
Ash. . . . . %	16.63	17.41	18.18	
Volatile Matter. . . . . %	14.69	15.38	16.06	
Fixed Carbon (By Difference) . . %	60.13	63.00	65.76	
Ultimate Analysis				
Carbon. . . . . %				
Hydrogen. . . . . %				
Sulphur . . . . %	0.38	0.40	0.42	
Nitrogen. . . . . %				
Ash. . . . . %				
Oxygen (By Difference). . . . . . %				
Calorific Value. . . . .Btu/lb Gross	10010	10480	10940	

M.M.Free 13680

Fusibility of Ash	
Initial Deformation Temperature. °F	
Softening Temperature. . . . . . °F	
Hemispherical Temperature. . . . °F	
Fluid Temperature. . . . . °F	
Grindability Index, Hardgrove. . .	

Screen Analysis

Screen Size

%
%
%
%
%
%

Non Agglomerate

Moist m/m f B.T.U. 12250

A.S.T.M. Rank - High Volatile "C" Bitum[inous]

Remarks:

Reported by: [signature]

Head, Solid [illegible]

Dr. D.S. Montgomery,
Head,
Fuels Research Centre.

Distribution: