

PRELIMINARY REPORT II
ON THE GEOLOGY OF
THE TORRENS RIVER, B.C. COAL LICENSES

Prepared for Mr. W. Filipek
of Edmonton, Alberta

By:

Dr. Alois Pribyl, Chief Geologist of the
Geological and Geotechnical Institute of
the Czechoslovak Academy of Sciences,
Prague, Czechoslovakia

License #3886, #3889
#3890, #3891
#3893, #3894
#3895, #3896
#3897, #3898

N.T.S. Map Reference Nos.
Jarvis Lakes (93-I/1E)
Narraway River (93-I-8E)

OPEN FILE

**GEOLOGICAL BRANCH
ASSESSMENT REPORT**

Edmonton, Alberta, Canada
September 1, 1979

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~~CONFIDENTIAL~~

TABLE OF CONTENTS

Introduction	Page 1
Location	Page 1
Access	Page 2
Physiography	Page 2
Scope of Work	Page 2
Certificate	Page 3 & 4
Structural Geology	Page 5
Stratigraphy	Page 6
Coal Seams	Page 8
Chemical Analysis of Surface Samples	Page 11
Conclusions and Recommendations	Page 19
Preliminary Calculation of Coal Reserves	Page 21
Bibliography	Page 23
Geological Maps & Cross-Sections	Back Folder

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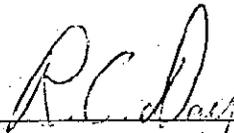
Prepared for Mr. W. Filipek
of Edmonton, Alberta

BY:



Dr. Alois Příbyl, Chief Geologist of the
Geological and Geotechnical Institute of
the Czechoslovak Academy of Sciences,
Prague, Czechoslovakia

and



Robin C. Day, B. Sc. (Conc. in Geology)
Freelance Prospecting Geologist of
Edmonton, Alberta

Edmonton, Alberta, Canada
September 1, 1979

Introduction

In the summer of 1978, Dr. A. Pribyl and Mr. R. Day were requested by Mr. W. Filipek of Edmonton, Alberta to prepare a 2nd preliminary geological map and report on the Torrens River, B. C. coal licenses held by Mr. W. Filipek. During the month of August 1979, the authors obtained more data from the field to render this preliminary report more accurate.

Location

The Torrens River Coal licenses cover 10 sections of land and are located on 1:50,000 topographic maps Jarvis Lakes (93-I/IE) and Narraway River (93-I-8E). These licenses lay mostly in the Torrens River drainage basin bounded to the southeast by the Alberta - B.C. provincial border. These licenses are:

License #3886	93-I-1	Block I	Units	31,32,21,22
License #3889	93-I-1	Block I	Units	41,42,51,52
License #3890	93-I-1	Block I	Units	43,44,53,54
License #3891	93-I-1	Block I	Units	45,46,55,56
License #3893	93-I-1	Block I	Units	63,64,73,74
License #3894	93-I-1	Block I	Units	65,66,75,76
License #3895	93-I-1	Block I	Units	67,68,77,78
License #3896	93-I-1	Block I	Units	85,86,95,96
License #3897	93-I-1	Block I	Units	87,88,97,98
License #3898	93-I-8	Block A	Units	7,8,17,18

Access

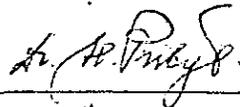
Access in this area is possible by helicopter from the Sherman Meadows forestry airstrip located approximately 110 miles southwest of the town of Grande Prairie, Alberta, on the Wapiti Road. A road exists on the south and north side of the Torrens River from the airstrip to within one mile of the property.

Physiography

Elevations range from 3700' to 8000' at Mt. Minnes. Treeline is at 5800' and forest cover consists mainly of mature spruce.

Scope of Work

The undersigned acknowledge herewith that they agree with all opinions and recommendations included in this second preliminary report on the Torrens River, B.C. Coal licenses. They would like to express their gratitude to Mr. W. Filipek from Edmonton, Alberta, who has supplied them with valuable references, reports and information.



Dr. Alois Příbyl, Chief Geologist of
the Geological and Geotechnical Institute
of the Czechoslovak Academy of Sciences,
Prague, Czechoslovakia

and



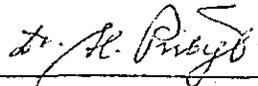
Robin C. Day, B. Sc. (Conc. in Geology)
Freelance Prospecting Geologist of
Edmonton, Alberta

Certificate

I, Alois Příbyl of Prague, Czechoslovakia, hereby certify that:

- 1) I am the Chief Geologist of the Geological and Geotechnical Institute of the Czechoslovak Academy of Sciences, Prague, Czechoslovakia.
- 2) I am a graduate of the Charles University of Prague with a doctorate degree of RNDr (Rerum Naturalium Doctoris), which was received in 1951 in Geology, Petrology and Palaeontology and later received a D. Sc. degree in 1963.
- 3) I am a member of the Society of Mineralogy and Geology in Czechoslovakia, The Palaeontological Society of Great Britain, The Palaeontological Society of the U.S.A., etc.
- 4) I have practised my profession as a geologist for more than 35 years.
- 5) I have published to date over 340 geological and palaeontological books and papers which were published in various languages (Czech, German, Russian, English, etc.)
- 6) I have no direct or indirect interest, nor do I expect to have any interest in the Torrens River, B. C. coal licenses held by Mr. W. Filipek, or in any of his mineral claims.
- 7) This second report and included recommendations are based on a personal examination of the coal licenses mentioned during the period between August 1 and August 17, 1979.

Dated this 1st day of September, 1979



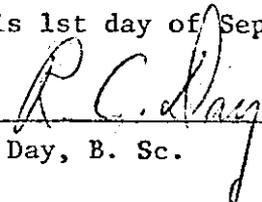
Dr. A. Příbyl

Certificate

I, Robin C. Day, of Edmonton, Alberta hereby certify that:

- 1) I am a graduate of the University of Alberta with a B. Sc.
(Concentration in Geology) obtained in 1975.
- 2) I have been practising as a freelance prospecting geologist for four (4) years.
- 3) I have experience mapping in Paleozoic rocks north of the Peace River, freelance consulting for gravel resources in the Edmonton area, placer mining on Burwash Creek Yukon, prospecting for Base metals in the Yukon Plateau, gold/silver in Northern and Southern B.C., industrial minerals (asbestos) in Northern B. C. and mapping coal in north eastern B.C. coal belt.
- 4) I have no direct or indirect interest, nor do I expect to have any interest in the Torrens River, B.C., coal licenses held by Mr. W. Filipek, or in any of his mineral claims.
- 5) This second report and included recommendations are based on a personal examination of the above coal licenses during August 1 to August 17, 1979.

Dated this 1st day of September, 1979



Robin C. Day, B. Sc.

The Geology of the Torrens River, B.C. Coal Licenses

1) Structural Geology:

Complex faulting and folding with northwest strikes are the main structural features of this area. A thrust fault/overthrust bounds the licensed area to the northeast, which has been interpreted as a low angle to bedding overthrust of the Shaly Beds and the Lower Nikinassin over the anticlinal Lower Commotion Formation (Gates Member) in Black Creek. This overthrust induced a contemporaneous normal fault and parasitic folds in the anticlinorium of the underlying Lower Commotion. This normal fault may be seen in Black Creek. The Middle Commotion (Hulcross Member) and the Upper Commotion (Boulder Creek Member) have been thrust off. Parasitic folding can be seen on the limbs of the Torrens Ridge anticlinarium in Black Creek and Wolverine Creek as well. The Shaly Beds have deformed plastically and the overlying Lower Nikanassin is characterized by tight chevron folding with many small parasitic folds on the limbs which give the bedding an intricately crenulated appearance from a distance. The structures may plunge as much as 6° - 12° to the northwest. In Wolverine Creek, the Gates Member of the Commotion Formation is bounded to the southwest by the Lower Nikanassin Formation which forms the hanging wall in a low angle to bedding overthrust on the southwest limb of an anticline. Two synclines with at least coal seams 1 and 2 outcrop in Wolverine Creek. Although outcrop is scarce in Black Creek, the general style of folding is thought to be similar to folding in Wolverine Creek.

2) Stratigraphy:

The coal licenses are underlain by the following Upper Jurassic and lower Cretaceous Formations:

a) Shaly Beds:

These beds are the oldest rocks in the area and outcrop along the east side of Torrens Ridge. They are comprised of dark grey to black shales and siltstones interbedded with thin, finely laminated, dark grey-brown, orange-brown weathering, fine grained and sometimes cross-bedded sandstones of both marine and non-marine origin. In this area the thickness of the Shaly Beds is unknown. These beds are thought to belong to the Lower Nikanassin Formation.

b) Nikanassin Formation:

This formation lies conformably over the Shaly Beds, is over 6000' thick and is characterized by dark grey-brown, fine to medium grained, sometimes ripple marked, carbonaceous, grey buff to brown weathering with thin weathering rinds, quartzitic sandstones from 6" to 3' thick, interbedded with marine and non-marine black, carbonaceous shales 6" to 2' thick.

There are at least five conglomerates in this formation which vary in thickness from 5' to 120'. All of the conglomerates in the Nikanassin Formation are characterized by a predominance of well rounded black chert pebbles from $\frac{1}{4}$ " to 2" which are well cemented in a fine to coarse grained sandy matrix. Numerous thin coal seams 6" - 2' thick are developed throughout the Nikanassin Formation, mainly in the upper part. One coal seam approximately 80' below the Cadomin Formation has a measured thickness of 3' - 5'.
0.9 1.5
Plant fossils in the sandstones above the thin coal seam are poorly preserved and very stick-like and spindly in appearance as opposed to well preserved

plant fossil assemblages in the lower part of the Compton Formation which often show complete ferns, leaves and branches with needles. No mineable coal seams were found to date in the Nikanassin Formation and none are expected as the coal seams were formed in a deltaic environment as opposed to a back water or continental basin environment.

c) Cadomin Formation:

This formation rests unconformably over the Nikanassin Formation, is approximately 80' thick in this area and is comprised predominately of poorly cemented, well rounded quartzite pebbles ranging in size from ½" to 6" in diameter. Well rounded pebbles of black, green and grey chert are also seen. There are some coarse grained, cross-bedded sandstone lenses. The Cadomin Formation is an excellent stratigraphical marker and often outlines the structural geology as a cliff forming unit. No coal seams are present.

d) Gething Formation:

The Gething Formation lies conformably over the Cadomin Formation, is approximately 150' thick in this area and is mainly non-marine sandstone and siltstone with some shales and minor conglomerates. A coal seam is at the top of the formation and is roughly 8' to 10' thick.

e) Moosebar Formation:

This formation rests conformably over the Gething Formation, is 120' to 170' thick and is comprised of grey to tan coloured marine shales with thin siltstones weathering to a rusty maroon colour. The Moosebar Formation outcrops in the nose of an anticline in Wolverine Creek. No coal seams are present.

f) Commotion Formation:

This formation is now divided into four members: the Torrens River Member, the Gates Member, the Hulcross Member and the Boulder Creek Member. The Gates Member of the Lower Commotion Formation is the main coal bearer of this area. Only the lower most Torrens River Member sandstone and the Gates Member are present within the boundary of the licenses. The Middle Commotion, Hulcross Member, and the Upper Commotion, Boulder Creek Member, have been thrust off. The Torrens River Member lies conformably over the Moosebar Formation. This sandstone is at least 40' thick, exhibits much cross-bedding and is thin to thick bedded. The uppermost sandstone bed weathers a blue-grey colour and lies immediately below coal seam #1. The thickness of the remaining part of the Gates Member, in Wolverine Creek is at least 450' with at least the lower five coal seams present.

Coal Seams

a) Gething Coal Seam

This seam occurs at the top of the Gething Formation. Although it does not outcrop in this area, it can be expected, at depth beneath the Moosebar Formation. The thickness is 8' - 10' in outcrop on adjacent coal licenses.

b) Commotion Coal Seam #1

This coal seam is 12' to 30' thick with an average thickness of 20'; it rests immediately above the Torrens River Member sandstone, outcrops four times by folded repetition in Wolverine Creek and can be seen in Black Creek.

c) Commotion Coal Seam #2

This coal seam is 12' - 15' thick and varies from 15' - 50' above coal seam #1. Coal seams #1 and #2 outcrop in the nose of a syncline on Wolverine Creek where only 15' of sandstone separates them.

d) Commotion Coal Seam #3

This coal seam is from 2' - 5' thick only and lies about 90' above coal seam #2.

e) Commotion Coal Seam #4

This is the thickest coal seam within the licenses area. It may be traced continuously from the Kakwa area in Alberta, to Wolverine Creek in B.C. At this locality, the seam is about 35' thick and a 1' shale parting near the top. Commotion Coal seam #4 lies about 70' above coal seam #3.

f) Commotion Coal Seam #5

This coal seam is 3' - 10' thick, also may be traced from the Kakwa area in Alberta to Wolverine Creek in B.C. and lies approximately 40' above coal seam #4 on Horn Ridge.

Remarks: The Gething coal seam and Commotion coal seams 1, 2, 4 and 5 appear to be mineable. An oxide zone of 10' - 30' should be expected at the outcrop face. The numerical system for the coal seams was borrowed from Denison Mines - Saxon Coal Project - 1976 - 1978. The correlation between the Denison - Cyprus numerical system for coal seams is as follows:

	<u>Denison</u>	<u>Kakwa Mines (Cyprus Anvil)</u>
Commotion Fm.	Coal Seam 5	Coal Seam 7
"	Coal Seam 4	Coal Seam 4
"	Coal Seam 3	
"	Coal Seam 2	Coal Seam 3a
"	Coal Seam 1	Coal Seam 3
Gething Fm.	Gething Coal Seam	Coal Seam 1

Composition and Quality of Coal Seams - Chemical Analysis of Surface Samples

Handwritten initials

FILIPEK HOLDINGS LTD.
TORRENS RIVER
Sample No. 2
Seam No. 1
B.C. Coal License No. 3889 (Wolverine Creek)

<u>PROXIMATE ANALYSIS:</u>	<u>Air-dry Basis</u>	<u>Dry Basis</u>
Ash %	10.48	10.86
R.M.%	3.48	-
V.M.%	20.73	21.48
F.C.%	65.31	67.66
<u>TOTAL SULPHUR %</u>	0.23	0.24

CALORIFIC VALUE:

Cal/gm.	7,220	7,480
BTU/lb.	13,000	13,470

FREE SWELLING INDEX:

N/A

September 21, 1978

CYCLONE ENGINEERING SALES LTD.

B.Y.H. WONG

FILIPEK HOLDINGS LTD.
 TORRENS RIVER
 Sample No. 1
 Seam No. 4
 B.C. Coal License No. 3889 (Wolverine Creek)

<u>PROXIMATE ANALYSIS:</u>	<u>Air-dry Basis</u>	<u>Dry Basis</u>
Ash %	6.11	6.22
R.M.%	1.74	-
V.M.%	22.75	23.15
F.C.%	69.40	70.63
<u>TOTAL SULPHUR %:</u>	0.28	0.28

<u>CALIFORIC VALUE:</u>		
Cal/gm.	7,850	7,990
BTU/lb.	14,130	14,380

FREE SWELLING INDEX: 2½

September 21, 1978

CYCLONE ENGINEERING SALES LTD.

B.Y.H. WONG

*John
 P.H.*

<u>License #3893</u>	Commotion coal seam #5	-	1.82×10^6	L. Tons
	Commotion coal seam #4	-	6.71×10^6	L. Tons
	Commotion coal seam #3	-	not included	
	Commotion coal seam #2	-	2.86×10^6	L. Tons
	Commotion coal seam #1	-	5.07×10^6	L. Tons
	Gething Coal Seam	-	2.27×10^6	L. Tons
			<u>18.73×10^6</u>	L. Tons

The tonnages on License #3893 were calculated on the assumption of general structural continuity between Wolverine and Black Creek. To be conservative, the authors estimate the combined tonnage of licenses #3886 and #3893 to be 65,000,000 to as much as 70,000,000 long tons of raw coal. As much as 12,000,000 to 15,000,000 tons of raw coal may be suitable for open-pit strip mining on the dip slope and two synclines of Wolverine Creek.

FILIPEK HOLDINGS LTD.
TORRENS RIVER
Sample No. 5
Seam No. 1
B.C. Coal License No. 3893 (Black Creek)

<u>PROXIMATE ANALYSIS:</u>	<u>Air-dry Basis</u>	<u>Dry Basis</u>
Ash %	3.09	3.18
R.M.%	2.80	-
V.M.%	26.32	27.08
F.C.%	67.79	69.74

<u>TOTAL SULPHUR %:</u>	0.25	0.26
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CALIFORIC VALUE:

Cal/gm.	7,870	8.100
BTU/lb.	14,170	14.580

FREE SWELLING INDEX:

2½

September 21, 1978

CYCLONE ENGINEERING SALES LTD.

B.Y.H. WONG

FILIPEK HOLDINGS LTD.
TORRENS RIVER
Sample No. 3
Seam No. 1
B.C. Coal License No. 3889 (Wolverine Creek)

<u>PROXIMATE ANALYSIS:</u>	<u>Air-dry Basis</u>	<u>Dry Basis</u>
Ash %	5.97	6.10
R.M.%	2.22	-
V.M.%	21.47	21.96
F.C.%	70.34	71.94

<u>TOTAL SULPHUR %:</u>	0.40	0.41
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CALORIFIC VALUE:

Cal/gm.	7,770	7,950
BTU/lb.	14,000	14,320

FREE SWELLING INDEX: 1½

August 22, 1979

CYCLONE ENGINEERING SALES LTD.

B.Y.H. WONG

FILIPEK HOLDINGS LTD.

TORRENS RIVER

Sample No. 3a

Seam No. 2

B.C. Coal License No. 3889 (Wolverine Creek)

PROXIMATE ANALYSIS:

Air-dry Basis

Dry Basis

Ash %	6.88	7.05
R.M.%	2.38	-
V.M.%	18.90	19.36
F.C.%	71.84	73.59

TOTAL SULPHUR %

0.38

0.39

CALORIFIC VALUE:

Cal/gm.	7,550	7,730
BTU/lb.	13,600	13,930

FREE SWELLING INDEX:

1

August 22, 1979

CYCLONE ENGINEERING SALES LTD.

B.Y.H. WONG

FILIPEK HOLDINGS LTD.
TORRENS RIVER
Sample No. 3
Seam No. 1
B.C. Coal License No. 3893 (Black Creek)

<u>PROXIMATE ANALYSIS:</u>	<u>Air-dry Basis</u>	<u>Dry Basis</u>
Ash %	4.37	4.56
R.M.	4.18	-
V.M.%	25.79	26.92
F.C.%	65.66	68.52

<u>TOTAL SULPHUR %:</u>	0.21	0.22
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<u>CALORIFIC VALUE:</u>		
Cal/gm.	7,510	7,840
BTU/lb.	13,520	14,110

<u>FREE SWELLING INDEX:</u>	1
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August 22, 1979

CYCLONE ENGINEERING SALES LTD.

B.Y.H. WONG

Conclusions and Recommendations

From data obtained in the 1978 and 1979 field operations and preliminary geological mapping of the Torrens River, B.C. Coal licenses, the authors submit the following conclusions and recommendations to Mr. W. Filipek for his consideration.

- 1) The coal bearing Commotion Formation outcrops are in the southeastern end of the licensed area. Mineable coal seams outcrop in two square miles identified by coal license no.s' 3889 and 3893.
- 2) The preliminary geological mapping should be rendered more detailed by mapping with a pocket altimeter and using 50m survey chains on traverses.
- 3) More thorough trenching and adits are required in the coal seams in Wolverine and Black Creek.
- 4) At least four key cored boreholes will be required to penetrate through the Commotion Formation to the Cadomin Formation at proposed borehole locations to prove the true thickness, extent, quality, orientation and structure of the coal seams at depth in Wolverine and Black Creek. These cored borehole locations are (see geological map):
D.D.H. #1 - License #3889 NTS 92-I-1 Block 1 N.E. Corner of Unit 41
D.D.H. #2 - License #3889 NTS 93-I-1 Block 1 S.W. Corner of Unit 52
D.D.H. #3 - License #3893 NTS 93-I-1 Block 1 S.E. Corner of Unit 63
D.D.H. #4 - License #3893 NTS 93-I-1 Block 1 S.E. Corner of Unit 73

5) Further boreholes may be drilled without core and should penetrate through the Gething coal seam only. These holes must be gamma logged. These following borehole locations are subject to change and should only be drilled in accordance with the results of the above cored boreholes. These borehole location are (see map):

B.H.1 License #3889 NTS 93-I-1 Block 1 N.W. Corner of Unit 41

B.H.2 License #3893 NTS 93-I-1 Block 1 S.E. Corner of Unit 41

B.H.3 License #3893 NTS 93-I-1 Block 1 S.E. Corner of Unit 73

B.H.4 License #3893 NTS 93-I-1 Block 1 S.E. Corner of Unit 73

The above mentioned cored Boreholes and non-cored boreholes should establish toe depth and extent of the coal seams under the overthrust to the southwest and to the northwest in the core of Torrens Ridge. Up to seven more boreholes may be drilled along the northeast side of Torrens River at a 45° to the northeast. Drill site locations will vary in accordance to the results of the first eight boreholes:

B.H.5 License #3889 NTS 93-I-1 Block 1 Centre of Unit 63

B.H.6 License #3839 NTS 93-I-1 Block 1 N.E. Corner of Unit 53

B.H.7 License #3894 NTS 93-I-1 Block 1 S.E. Corner of Unit 64

B.H.8 License #3894 NTS 93-I-1 Block 1 S.W. Corner of Unit 64

B.H.9 License #3894 NTS 93-I-1 Block 1 S.E. Corner of Unit 76

B.H.10 License #3896 NTS 93-I-1 Block 1 N.W. Corner of Unit 76

B.H.11 License #3897 NTS 93-I-1 Block 1 S.W. Corner of Unit 86

- 6) We suppose that for securing all the recommendations of all operations of geological exploration the following team of men would be necessary: Two expert geologists and a coal petrologist - technologist at least. In addition, two or three men would also be requested for the other work operations (excavating of trenches and adits). Furthermore, a helicopter and one or two bulldozers and several trucks would be necessary. This work should begin in the early spring of 1980, as soon as the snow is gone.
- 7) Railroad and roads may be built from Dome Creek, B.C., from the C.N. Rail Line, up Jarvis Pass, by Jarvis Lakes, B.C. to Stinking Creek - Torrens River, Alberta. Exploration access is about one mile from the adjoining Denison Mines - Saxon South road and about 1.5 miles from the Kakwa Mines, Horn Ridge Road.

Preliminary Calculation of Coal Reserves

The preliminary calculation of the coal reserves has been calculated for licenses #3889 and #3893 and only up to the boundary of the overthrust. The figures were arrived at by the method of counting centimeter squares and on known coal outcrops.

<u>License #3889</u>	Commotion coal seam #5	- 3.34 x 10 ⁶ L. Tons
	Commotion coal seam #4	- 17.79 x 10 ⁶ L. Tons
	Commotion coal seam #3	- not calculated
	Commotion coal seam #2	- 8.66 x 10 ⁶ L. Tons
	Commotion coal seam #1	- 13.47 x 10 ⁶ L. Tons
	Gething Coal Seam	- 8.73 x 10 ⁶ L. Tons
		<u>51.99 x 10⁶ L. Tons</u>

<u>License #3893</u>	Commotion coal seam #5	-	1.82×10^6	L. Tons
	Commotion coal seam #4	-	6.71×10^6	L. Tons
	Commotion coal seam #3	-	not included	
	Commotion coal seam #2	-	2.86×10^6	L. Tons
	Commotion coal seam #1	-	5.07×10^6	L. Tons
	Gething Coal Seam	-	2.27×10^6	L. Tons
			<u>18.73×10^6</u>	L. Tons

The tonnages on License #3893 were calculated on the assumption of general structural continuity between Wolverine and Black Creek. To be conservative, the authors estimate the combined tonnage of licenses #3886 and #3893 to be 65,000,000 to as much as 70,000,000 long tons of raw coal. As much as 12,000,000 to 15,000,000 tons of raw coal may be suitable for open-pit strip mining on the dip slope and two synclines of Wolverine Creek.

V.17.
Roll.

Useful Reports

- a) Baykal, D. 1967, Photogeological Report on the Caw Creek Coal Prospect, Alberta (prepared for Export Coking Coals of Alberta Ltd.), pp.1-23 and maps and cross-sections.
- b) Blackstock, W. J. 1970, Preliminary Report on the Kakwa River Coal Lands held by Kakwa Licenses Ltd., prepared by Alcon Engineering Ltd., Calgary, Alberta pp.1-33 and maps. Calgary.
- c) Muraoka, M. 1966, Preliminary Reports of Caw Creek Coal Field, Alberta, Canada, pp.1-27 and maps.
- d) Příbyl, A. 1970, Preliminary Report on the Geology of the Territory between the Kakwa and Torrens Rivers in Northwestern Alberta, Canada (prepared for W. Filipek of Kakwa Mines Ltd.), pp.1-17 and maps, Edmonton.
- e) Příbyl, A. and Vach, J. 1971, Preliminary Report on the Geology of the Territory between the Coal Ridge and Rim Ridge in Northwestern Alberta, Canada (prepared for Coal Ridge Mines Ltd.), pp.1-7 and maps, Edmonton.
- f) Příbyl, A. and team of experts, 1973, Opinion and Recommendations of order magnitude, feasibility study No. 8, 1972 Kakwa Coal Project, Alberta, Notus Exploration Company, Vancouver B.C., pp.1-53 (Geology), 1-29 (mining) part/tests and maps), Prague.
- g) Příbyl, A. and Day, R.C., 1978, a Preliminary report on the Geology of the Torrens Rivers, B.C. coal licenses, prepared for W. Filipek of Edmonton, pp.1-18, geogr. & geol. maps, and cross-sections, Edmonton.

- h) Robertson, D.B. and McFall, E.E. 1972, Progress Reports, Kakwa Coal Project - Notus Exploration Company - Suppl. App. Nos. I-II (Text and Drill Hole Logs), Vancouver.
- i) Pt. III - A report to Notus Exploration Company of the Preparation Analysis and Washing of Seams 3, 3a, and 4 of the Kakwa Coal Project - Birtley Engineering (Canada) Ltd., Calgary, Alberta, pp.1-174.
- j) Vogan, Ross S. 1970, Report on Geology of Kakwa River Coal Project, (prepared for Woods Petroleum of Canada Ltd., Calgary), pp.1-36 and maps.

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- a) Irish, E.J. 1965, Geology of the Rocky Mountain Foothills, Alberta between latitudes $50^{\circ} - 15'$ and $54^{\circ} - 25'$. Geological Survey of Canada, Dept. of Mines and Technical Surveys, Memoir 334, pp.1-241 and maps, Ottawa.
- b) Pearson, G.R. 1960, Evaluation of some Alberta Coal Deposits (Part I - The Wizard Lake District; Part II - the Westlock-Barrhead District; Part III - The Sheep Creek-Wildhay River District); Research Council of Alberta, Preliminary Report 60 - 1, pp.1-61 and map, Edmonton
- c) Spivak, J 1949, Jurassic Sections in Foothills of Alberta and north-western British Columbia; Bull Amer. Assoc. Petrol. Geol. 33, pp.533-546.
- d) Stott, J. 1960, Cretaceous Rocks between SMoky and Pine Rivers, Rocky Mountain Foothills, Alberta and British Columbia; Geological Survey of Canada, Dept. of Mines and Technical Surveys, Paper 68-16, pp.1-62, Ottawa.

Supplements

1. Preliminary Geological map - Scale 12,500
2. Geographical map with location of Licenses.
3. Geological cross-sections:
 - a) cross-section across C'- C' Scale 1:6,250
 - b) cross-section across D'- D' Scale 1:6,250
4. Stratigraphical columns