GEOLOGY OF SWEENY ANTHRACITE PROSPECT
NTS Sheets 104 A & H
July 1985 and August 1985
by: John Stones

R-SWEENY 85A

OPEN FILE

GEOLOGY OF THE SWEENY ANTHRACITE PROSPECT

Licenses 8054-8067, 8071-8072
in the Cassiar Land District
Centered on 57°N 129°20'W

NTS Sheets 104 A & H

CONFIDENTIAL

CONFIDENTIAL

CONFIDENTIAL FILE

Licenses owned by:

Esso Resources Canada Limited
237 Fourth Avenue S.W.
Calgary, Alberta
T2P 0H6

ESSO

714

ESSO RESOURCES CANADA LIMITED

Exploration Department

ESSO PLAZA 237 FOURTH AVENUE SOUTHWEST
CALGARY, CANADA T2P 0H6

R. A. F. WILKINSON
Vice-President and General Manager

1986 04 14

File: SS13085

REGISTERED MAIL

Ministry of Energy, Mines & Petroleum
Resources - Parliament Buildings
VICTORIA, B.C.
V8V 1X4

Attention: Paul Hagan - Coal Administrator

Dear Sir:

Re: Sweeny Coal Licences 8054-8067 inclusive, 8071, 8072
Cassiar Land District

The referenced Coal Licences are due for renewal on April 19th and June 19th. Esso Resources Canada Limited hereby serves notice that the Coal Licences will not be renewed.

Thank you for your assistance and consideration with these licences. A surrender memo signed by an Attorney for Esso Resources Canada Limited and the original Coal Licences will be returned to you in a short time.

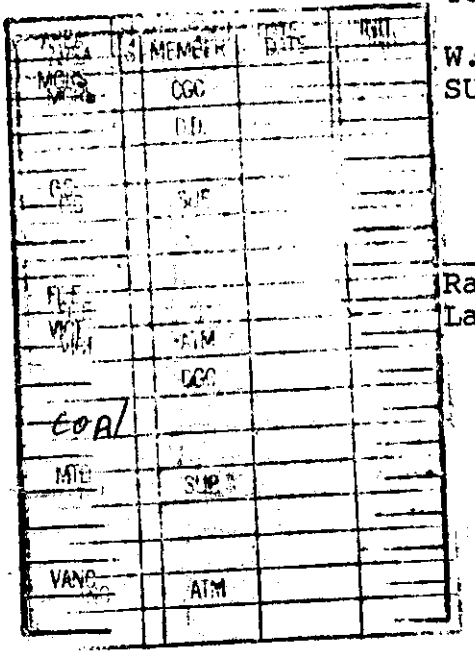
Two copies of our exploration reports outlining costs incurred are enclosed.

Yours very truly,

W. R. Morris, Supervisor
SURFACE RIGHTS SECTION

Ralph A. Parks
Land Agent

RAP/bmm
Enclosures



ESSO RESOURCES CANADA LIMITED

Oil Sands and Coal Department

ESSO PLAZA 237 FOURTH AVENUE SOUTHWEST
CALGARY, CANADA T2P 0H6
(403) 237-3737
Telex: 03821025

86 07 07

Mr. A. Matheson
Coal Resource Geologist
Geological Survey Branch
Parliament Buildings
Victoria, B.C.
V8V 1X4

Dear Alex:

SUBJECT: Sweeny Anthracite Prospect NTS 104 A & H

Further to our recent telephone conversation I contacted Dr. Jim Allan our coal petrographer at Esso Research for the additional information you requested on reflectance data in the Sweeny report.

A total of 25 reflectance measurements were taken on each sample. Normally 50 readings are taken but Dr. Allan feels that additional measurements will not significantly change the standard deviation.

Listed below are the reflectance values and their corresponding standard deviations.

SAMPLE	MEAN MAXIMUM REFLECTANCE	STANDARD DEVIATION
004	2.57 %	0.21
007A	3.24 %	0.08
007B N/A	-	-
007C	2.92 %	0.17
*008	2.96 %	0.16
010	2.56 %	0.19

. . . /2

LOG NO: 86 7 9 U 3
ACTION: Alex
FILE NO:

* Please note that the reflectance value on the Sweeny map should be 2.96 % instead of 3.67 %.

I trust this information will fulfill your request. If there are any further questions please do not hesitate to call.

Yours sincerely,

J.F. Stones

JFS:tmc

0498k:13

GEOLOGY OF THE SWEENY ANTHRACITE PROSPECT

Licenses 8054-8067, 8071-8072
in the Cassiar Land District
Centered on 57°N 129°20'W

NTS Sheets 104 A & H

Licenses owned by:

Esso Resources Canada Limited
237 Fourth Avenue S.W.
Calgary, Alberta
T2P 0H6

Work Completed Between July 1985 and August 1985

John Stones
Project Geologist
Esso Resources Canada Limited

Submitted: April 1, 1986

J.A. Stones

(403) 237 2578

Al Peach

0273k

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INTRODUCTION

This report is a brief summary of the 1985 field mapping conducted on the Sweeny anthracite prospect. The prospect licenses are located in the Cassiar District of northwestern, British Columbia. Mapping at a scale of 1:10 000 was completed from July 27 to August 21, 1985 to assess the coal potential of the Sweeny license area along Konigus Creek.

The mapping crew consisted of eight Esso geologists, one cook and one pilot who were based at the Bell II Services gas station on Highway 37. Exploration mapping was supported by a Hughes 500D helicopter stationed in the field camp. A total of 26 traverses were completed along the slopes and valley surrounding Konigus Creek. General reconnaissance mapping at 1:50 000 was also completed north, south and east of the license area.

No economic coal seams were discovered during the course of mapping. The total cost of the Sweeny program was $130,721.

No further exploration work or reconnaissance mapping is recommended in the Sweeny area.

CONCLUSIONS/RECOMMENDATIONS

Because of the complex structure, rapid facies changes and the lack of economic coal seams in the McEvoy Unit, no further work is recommended on the Sweeny licenses or the surrounding areas.

Some good semi-anthracite to anthracitic coals were found, however most of the occurrences were carbonaceous mudstone. All the seams are laterally discontinuous due to the complex folding and faulting and because of the rapid lateral facies changes inherent to this coastal fluvial interface. The thickest seam discovered during the 1985 summer field season was JFS-010 which is east of the Sweeny license area. The true thickness of this seam is 1.57 metres.

It appears that the thickest coals occur further east in a more fluvial dominated environment where periods of deposition were much longer. This is the Mount Klappan Area.

SWEENY ANTHRACITE PROSPECT

104 A & H

LOCATION — The prospect lies 210 road kilometres from the port of Stewart and 550 kilometres from Prince Rupert. NTS Map sheets 104 A&H Figure 1. Latitude 57° N and 129° 20' W longitude. Figure 2

OWNER — These licenses are currently held by Esso Resources.

LICENSES — The license area is shown in Figure 3. These licenses were granted April 19, 1985. A list of these licenses is shown in Appendix I.

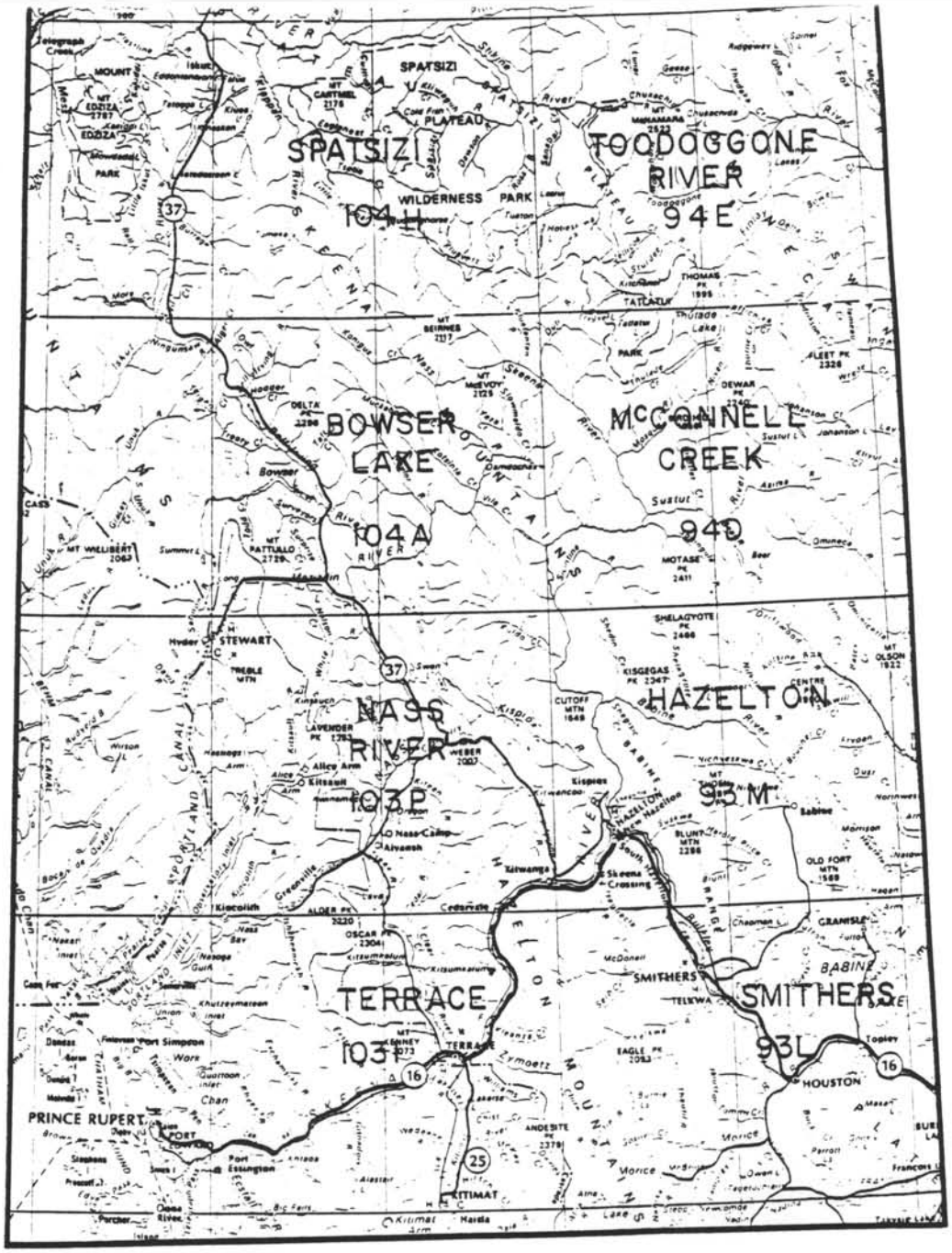
AREA — 16 licenses and 4 units totalling 6 455 hectares.

ACCESS — Highway 37 runs 40 kilometres southwest of the prospect. Access is gained by proceeding northeast along the Bell Irving River by helicopter from Highway 37.

A contract helicopter (Hughes 500D) was supplied by AirLift of Pitt Meadows, B.C.

TOPOGRAPHY — The licenses are located within the Intermontane Belt of British Columbia. Mountainous terrain surrounds the prospect area which lies along the Konigus Creek Valley. Elevations range from 1 829 metres on the highest ridge to 1 036 m along Konigus Creek.

COALFIELD — The prospect is situated 45 kilometres Southwest of the Groundhog coalfield.



ESSO RESOURCES CANADA LIMITED
OIL SANDS, COAL AND MINERALS DEPARTMENT
COAL DIVISION

MAP SHEET INDEX

1:2,500,000

FIGURE 1.

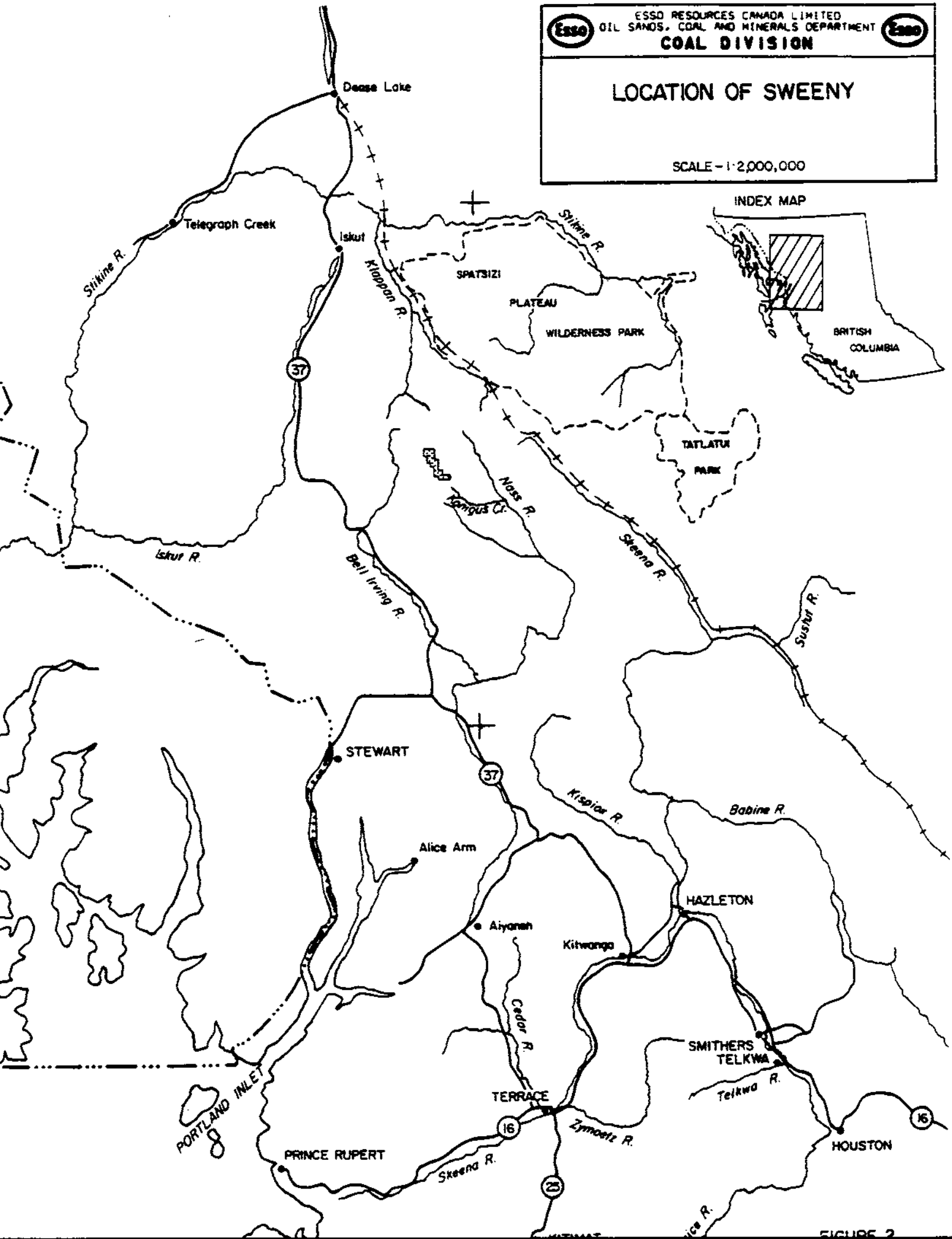

ESSO RESOURCES CANADA LIMITED
OIL SANDS, COAL AND MINERALS DEPARTMENT
COAL DIVISION
LOCATION OF SWEENY
SCALE - 1:2,000,000
INDEX MAP
BRITISH COLUMBIA
Dease Lake
Telegraph Creek
Iskut
Stikine R.
Klappan R.
SPATSIZI
PLATEAU
WILDERNESS PARK
TATLATUI
PARK
Nass R.
Kinaskan Lk.
Iskut R.
Bell Irving R.
Skeena R.
Sustut R.
STEWART
Alice Arm
Kispiox R.
Babine R.
HAZLETON
Aiyansh
Kitwanga
Cedar R.
SMITHERS
TELKWA
Telkwa R.
TERRACE
Zymoetz R.
HOUSTON
PRINCE RUPERT
PORTLAND INLET
37
16
28

FIGURE 2

SWEENY ANTHRACITE PROSPECT

PREVIOUS WORK

Exploration within and around the Groundhog coalfield has been ongoing since the turn of the century, however the remoteness of the area has prohibited development.

Exploration with helicopter support has prompted increased activity in the area since the late 1970's. Previously worked properties have been acquired by a number of companies, most notably Gulf Canada Resources Inc. at Mt. Klappan.

ESSO'S EXPLORATION

Postulating that potentially economic coal seams might exist within unmapped portions of the Bowser Basin; Esso undertook extensive reconnaissance mapping programs in the summers of 1983, 1984 and 1985. Figure 4 shows the original application area. Figure 3 shows the Sweeny licenses that were acquired along Konigus Creek.

1983 - reconnaissance mapping located coal bearing strata in the Sweeny area.

1984 - over 25 000 hectares of land was brought under application followed by mapping at 1:10 000 scale.

1985 - the original Sweeny application was reduced and extended south. The license area granted covers Konigus Creek Valley.

SWEENY

GULF KLAPPAN PROPERTY

SWEENY LICENSES GRANTED IN 1985

SCALE 1:250,000

FIGURE 3

SWEENY
LICENCE APPLICATIONS

GULF KLAPPAN PROPERTY

ORIGINAL SWEENY
LAND APPLICATION

SCALE 1:250,000

F 120.009 A-C

FIGURE 4.

SWEENY ANTHRACITE PROSPECT (continued)

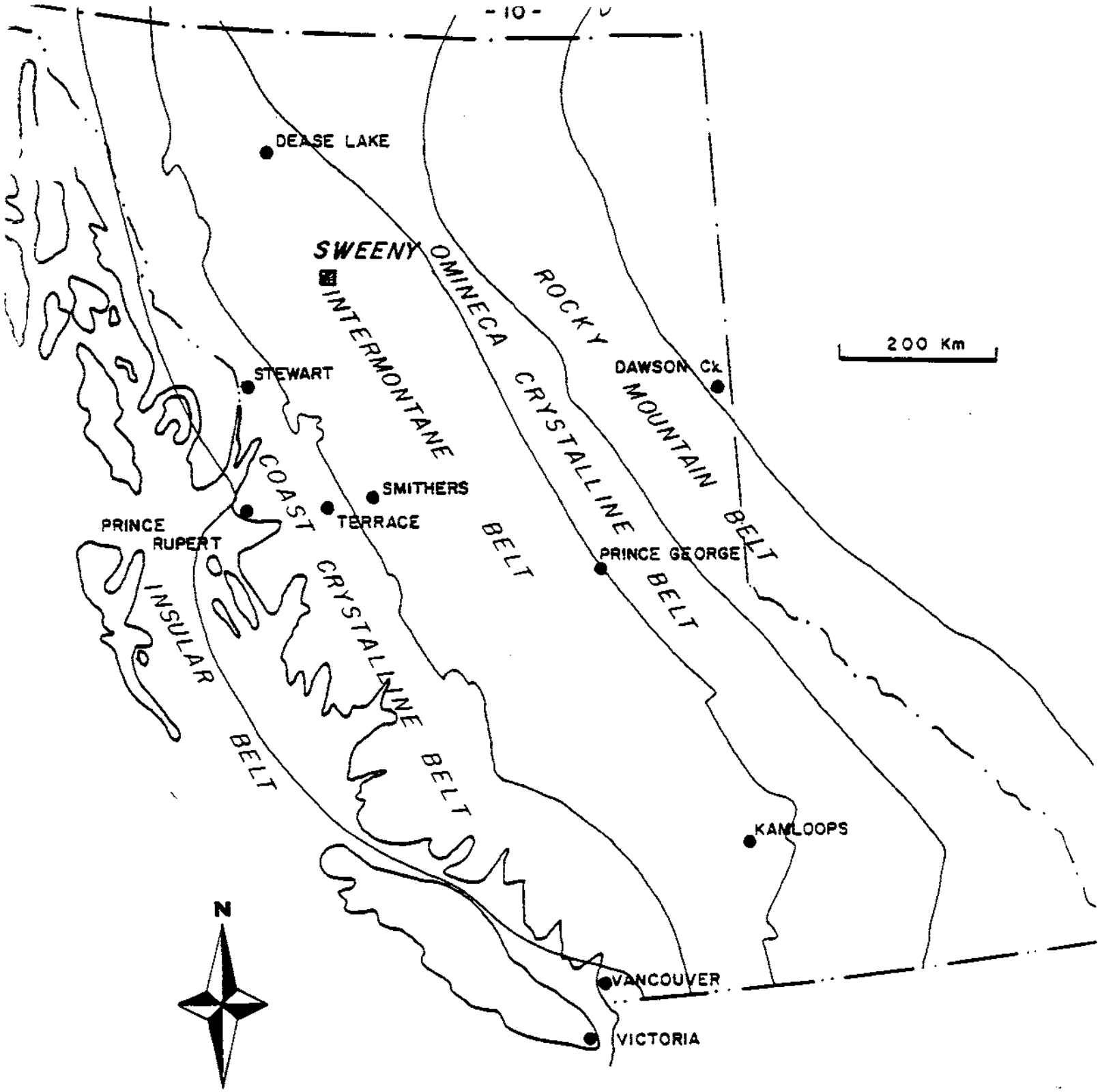
Mapping at 1:10 000 was completed to assess the coal potential of the licenses.

Reconnaissance mapping at 1:50 000 was conducted north, south and east of the Sweeny licenses.

No economic coal seams were discovered.

GEOLOGICAL SETTING

The Sweeny prospect is situated in the northeast corner of the Bowser Basin. The Bowser Basin is an orogenic successor basin in the Intermontane Belt of the Canadian Cordillera (Figure 5). It is bounded by the Omineca Crystalline Belt to the east and the Coast Plutonic Complex to the west. To the north and south it is bounded by the Stikine and Skeena arches respectively. Contained within this basin are a series of marine and continental sediments and volcanics up to 3 500 metres thick of mid Jurassic to late Cretaceous age. Coal bearing sequences are contained within these strata. The area in which the coal measures are most prolific is known as the Groundhog coalfield, situated 45 kilometres east from Sweeny. Paleocurrent measurements indicate deposition prograded west into an open sea from highlands to the north, northeast and south.



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OIL SANDS, COAL AND MINERALS DEPARTMENT
COAL DIVISION

TECTONIC PROVINCES
OF THE
CANADIAN CORDILLERA

FIGURE 5

SWEENY ANTHRACITE PROSPECT (continued)

The overall structural trend in the northern portion of the Bowser Basin is northwest-southeast. A later period of deformation trending northeast-southwest overprints the first producing a highly variable structural style.

STRATIGRAPHY

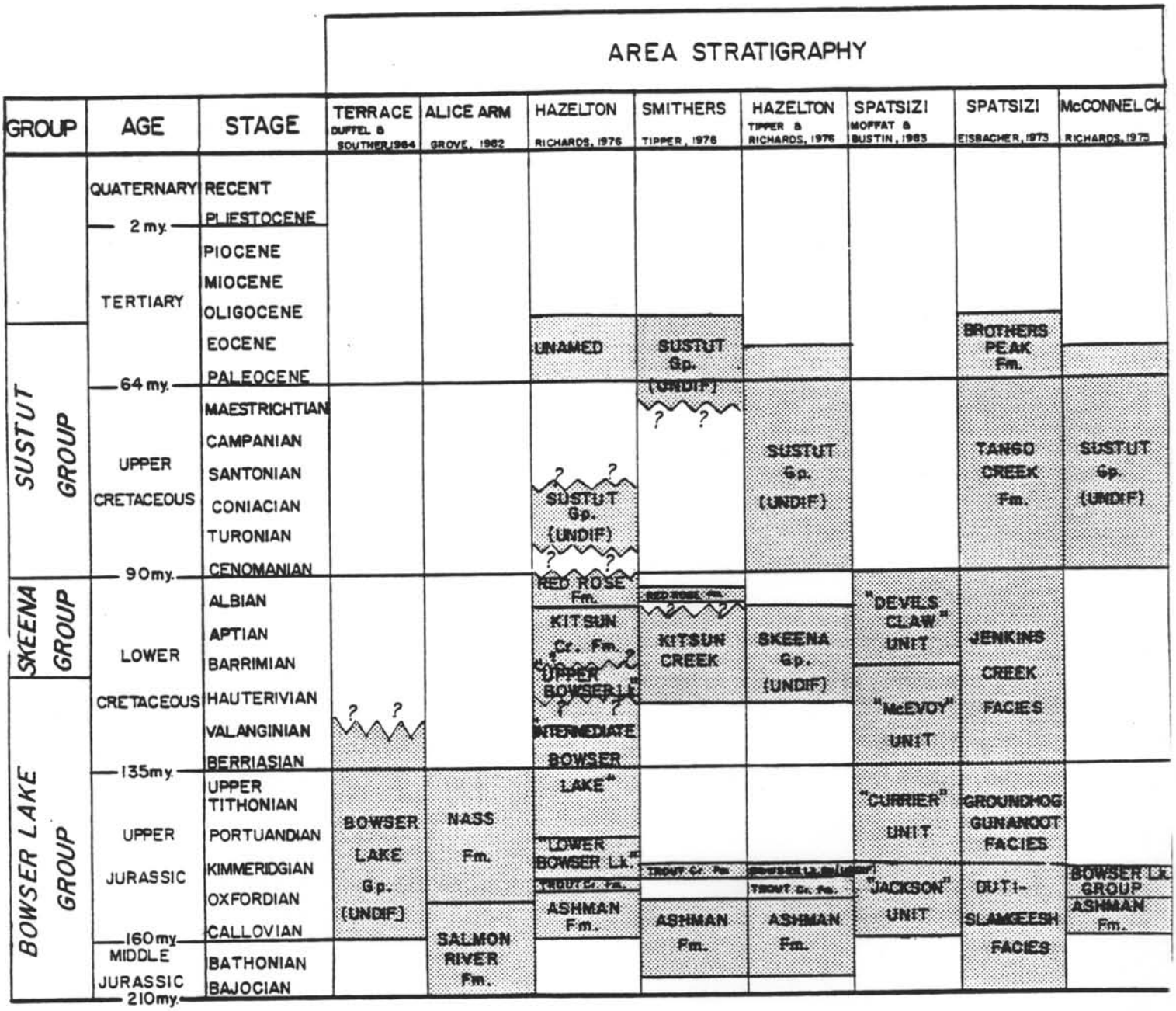
The most recent regional stratigraphy is that defined by Bustin and Moffat in 1983. Their type section includes the Jackson, Currier, McEvoy and Devil's Claw "Units" which are used in this report. Figure 6

Regional Stratigraphy

Jackson - basal unit up to 1800 metres thick, comprised of marine shale, siltstone minor sandstone and conglomerate, equilavent to the Ashman Formation. It is conformably overlain by the Currier.

Currier - late Jurassic in age, between 400 and 600 metres thick, comprised of transitional marine and non-marine fine to coarse grained sandstone, shale, siltstone, and seams of anthracite and meta-anthracite.

McEvoy - consists of dark shale and siltstone, lenticular channel sandtone, thin coal seams, limestone and occassionally conglomerate in the upper portion of the section.



ESSO RESOURCES CANADA LIMITED
OIL SANDS, COAL AND MINERALS DEPARTMENT
COAL DIVISION

BASINAL STRATIGRAPHY

FIGURE-6

SWEENY ANTHRACITE PROSPECT (continued)

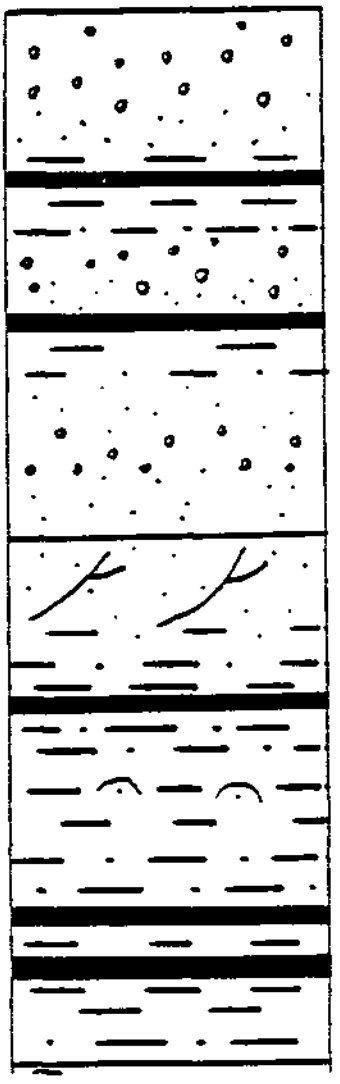
		In the northern part of the basin it is estimated to be 400-600 metres thick. Included in this section are fluvial and lacustrine deposits and at least 1 marine interval in the lower part.
Devil's Claw	-	500 metres of fluvial conglomerate with interbeds of shale, siltstone and sandstone

The study area is situated on a coastal fluvial interface within which two stratigraphic facies are recognized. These are the fluvial and coastal plain environments. The characteristics of each facies is described in Figure 7. Because of the complex structure, rapid lateral facies changes and the lack of widespread marker beds it is very difficult to fit these local stratigraphic facies to the regional stratigraphy. This facies boundary is illustrated on the compilation map included with this report.

Stratigraphic placement of the Sweeny section is based on a rank study of coals in the Currier and McEvoy completed by Bustin. Coal reflectance values from Sweeny grab samples correspond to the McEvoy coals which have a reflectance range of 1.7 to 3.5 Ro Max. The McEvoy Unit is estimated to be about 500 metres thick locally. Coals near the base of the Currier have higher reflectance values ranging from 3.0 to 5.8 Ro Max. The envelope for the Sweeny coals closely corresponds to the McEvoy Unit and overlaps the upper part of the Currier. Figure 8.

GENERALIZED SWEENY

STRATIGRAPHY



FLUVIAL

Chert pebble conglomerate, buff coloured medium - coarse grained sandstone, dark grey siltstone, carbonaceous shale, mudstone and coal. These lithologies are arranged in numerous fining upwards cycles.

COASTAL PLAIN

Coal, orange-brown calcareous siltstone with disarticulated bivalve fossils thinnly bedded mudstone, siltstone and carbonaceous shale, crossbedded medium grained sandstone. Plant fossils occur throughout.

Figure 7

COMPARISON OF R_o MAX DISTRIBUTION IN THE BOWSER BASIN

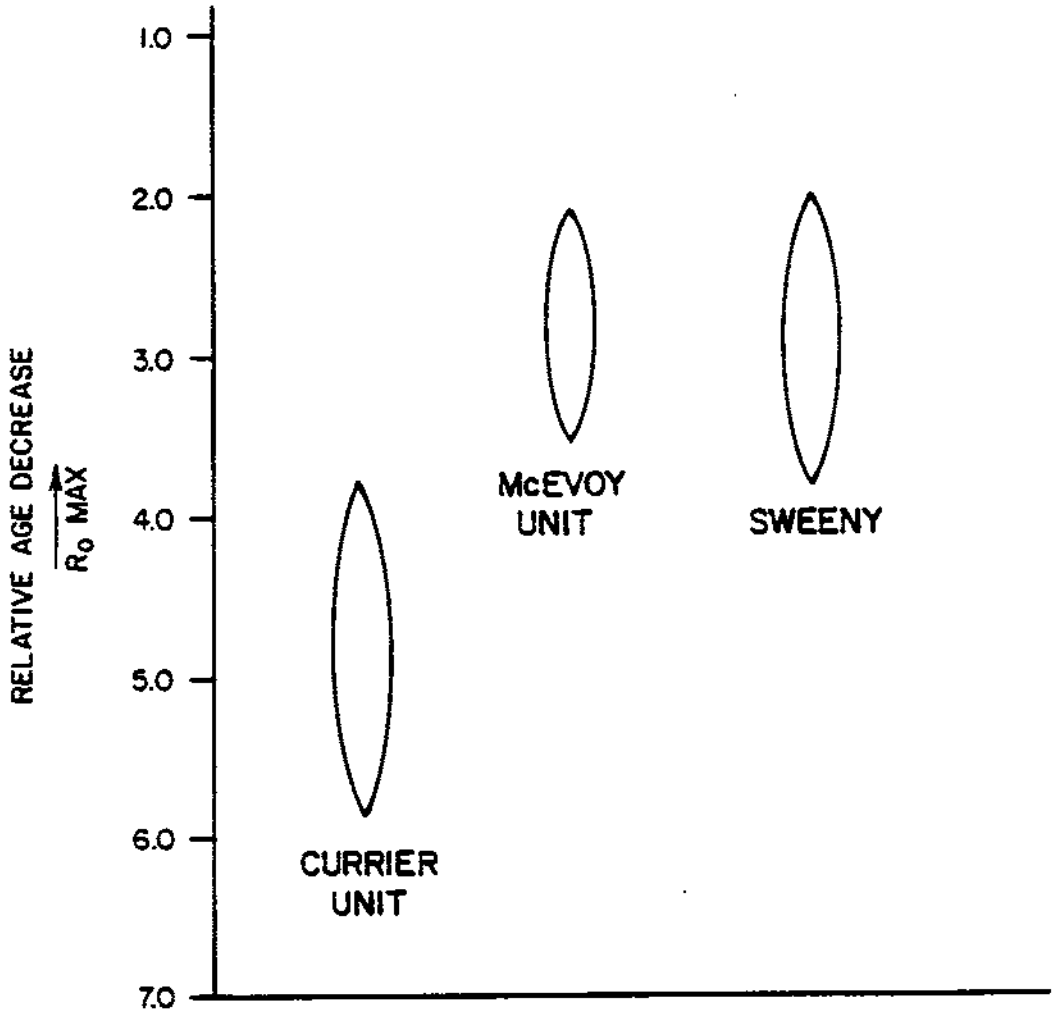


FIGURE 8

Coal

A total of twenty coal seams were found during the mapping program. Only 5 of them occur within the Sweeny license area. All of these seams are isolated discontinuous occurrences of coal and or carbonaceous mudstone. All are less than 1 metre true thickness. The other 13 seams occur on ridges outside of the license area.

Two of these seams exceed 1 metre in apparent thickness. Trench logs for these seams are in Appendix II. These trenches are designated JFS-008, and 010.

The Sweeny coals were deposited along the coastal fluvial interface of a westward prograding shoreline. These coals are identified as limnic and paralic coals based on their associated rock assemblages.

Limnic coals occur in a fluvial environment characterized by repetitive fining upward cycles of basal conglomerate, sandstone, siltstone and mudstone. These coals occur east of Konigus Creek Valley. The coals are discontinuous and change laterally into carbonaceous mudstone.

Paralic coals are typical of the coastal environment found in the area west of Konigus Creek. These coals are associated with interbedded sequences of fine to medium grained sandstone, siltstone, mudstone and orange brown calcareous siltstone. Plant fossils are commonly found throughout the succession. Normally these coals are more continuous and thicker than limnic coals. However, they are not laterally persistent here because of the complex structure and rapid facies changes.

STRUCTURE

The structural pattern of Sweeny is similar to the regional trend described by Bustin and Moffat. The northern part of the Bowser Basin has undergone two phases of folding. The first compression developed folds oriented in a northwest to southeast direction. The second phase produced broad open folds trending northeast to southwest.

Konigus Creek Valley represents a coastal fluvial interface.

It appears the paralic sediments were buckled against the more competent fluvial package to the east by a thrust fault running parallel to Konigus Creek. Figure 9.

Paralic sediments generally occur on the west side of Konigus Creek. These fine grained sandstones, siltstones, coal and mudstone are tightly compressed into chevron and kink style folds. Some of these folds are faulted along the axial plane. The axial trends range from 350 - 360^{o} and plunge south. No thickened or closely spaced seams within a short stratigraphic interval were found.

Coarser grained, more competent fluvial sandstones, conglomerates, siltstones and coals occur on the east side of Konigus Creek. Here the sedimentary beds are broadly folded and laterally continuous, however, the coals are discontinuous due to rapid facies changes to mudstone. The fold axes trend NW-SE at an average of 340^{o} with plunges to the Southeast.

These two structural regimes and the interpretted structural trends are shown on a 1:20 000 compilation map at the back of the report.

SCHEMATIC CROSS SECTION OF LITHOLOGY & STRUCTURE ON SWEENY

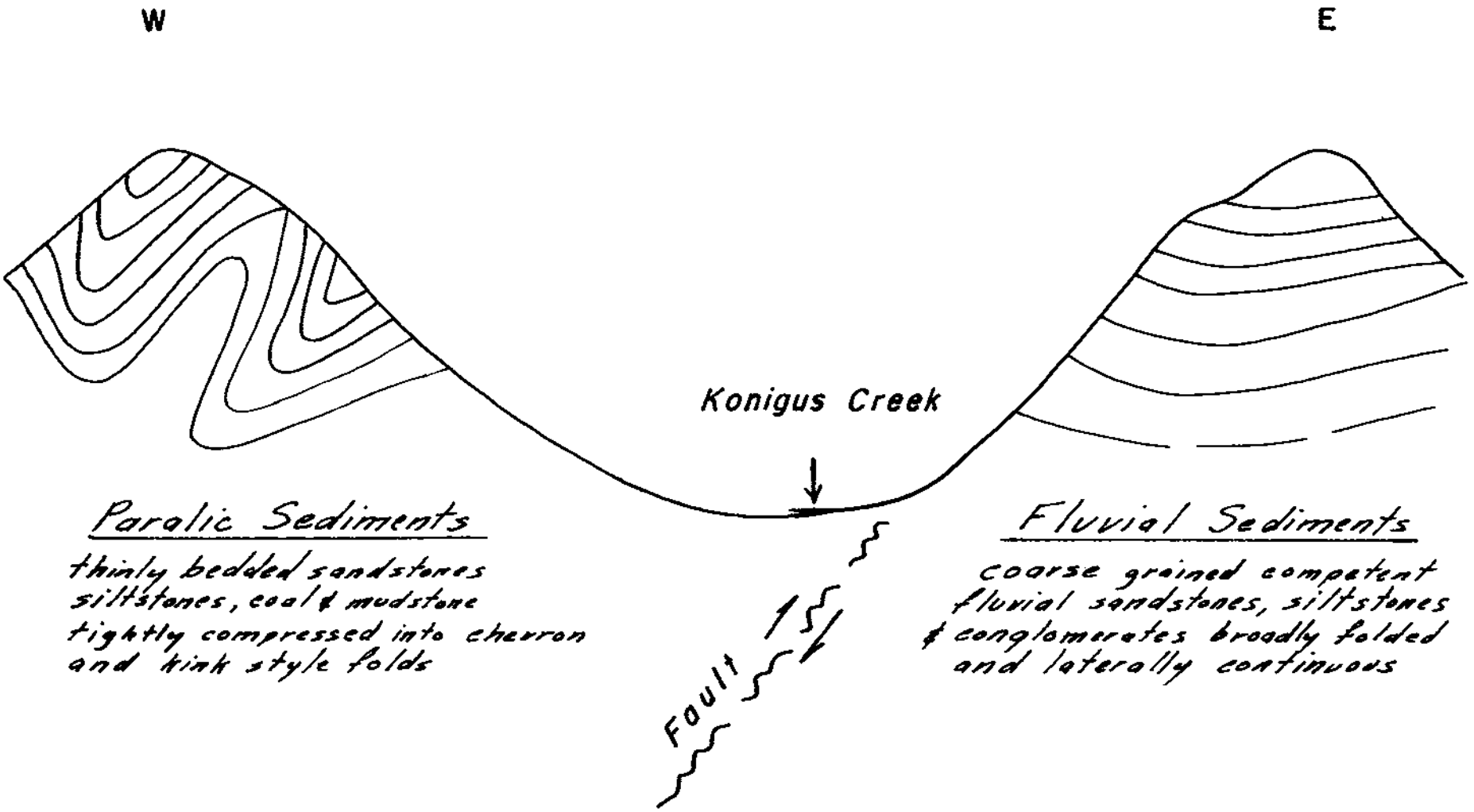


Figure 9

RANK & COAL QUALITY

The mean vitrinite reflectance of these coals ranges from 2.57 to 3.24 Rmax which corresponds to semi-anthracite and anthracite rank.

Six grab samples were collected from hand dug trenches. These samples were submitted to the Esso Research Lab in Calgary for reflectance and proximate analysis. All samples are weathered as demonstrated by the high volatile matter content shown in Table 1 and the physical appearance of the vitrinite in the petrographic samples. Both the measured volatile and moisture content would probably be lower for fresh unweathered samples.

TABLE 1

1985 Grab Sample Analysis

air dried basis

Sample	True Thickness in cm	H_2O%	V.M.%	Ash	Reflectance
JFS - 004	70	5.4	12.8	8.1	2.57
JFS - 007A	22	4.3	9.9	4.2	3.24
JFS - 007B	22	6.7	14.9	8.1	N/A
JFS - 007C	22	4.9	12.4	21.8	2.92
JFS - 008	90	5.1	14.2	18.9	2.96
JFS - 010	157	5.4	13.3	6.5	2.56

TABLE 1

1985 Grab Sample Analysis

air dried basis

Sample	True Thickness in cm	H_2O%	V.M.%	Ash
JFS - 004	70	5.4	12.8	8.1
JFS - 007A	22	4.3	9.9	4.2
JFS - 007B	22	6.7	14.9	8.1
JFS - 007C	22	4.9	12.4	21.8
JFS - 008	90	5.1	14.2	18.9
JFS - 010	157	5.4	13.3	6.5

Sweeny Cost Summary

Sweeny

(July 27 - August 21, 1985) - 26 days

1.	Helicopter Services Hughes 500D	$40,240.00
2.	Helicopter fuel	$ 7,500.00
	Subtotal	$47,740.00
3.	Salaries	$50,000.00
4.	Vehicle rental (2 trucks, 1 crew cab, 1 4 X 4 pickup	$ 2,000.00
5.	Food (10 people)	$ 1,844.50
6.	Fuel (gas) 2 trucks	$ 1,119.12
7.	Accommodation (hotel, basic camp services and rental of one cabin)	$ 2,393.09
8.	Field and Office Supplies (Airphotos, orthoshop, field equipment)	$11,890.27
9.	Propane	$ 963.00
10.	Expediting Services (Jean Black)	$ 2,000.00
11.	Transportation (airfare, moving costs)	$ 6,203.78
12.	Equipment Rentals (tent and freezer)	$ 567.35
13.	Reprographics	$ 1,000.00
14.	Sample Analysis	$ 3,000.00
	TOTAL	$130,721.11

BIBLIOGRAPHY

Bustin, R.M. and Moffat, I (1983): Groundhog Coalfield, Central British Columbia: Reconnaissance Stratigraphy and Structure; Bulletin of Canadian Petroleum Geology, Vol. 31, No. 4 (December 1983), P. 231-245.

Eisbacher, G.H., Deltaic Sedimentation In The Northeastern Bowser Basin, British Columbia; Geological Survey of Canada, Paper 73-33.

Koo, J., The Telkwa, Red Rose, and Klappan Coal Measures in Northwestern British Columbia; British Columbia Department of Mines and Petroleum Resources.

Moffat, I.W. and Bustin, R.M., Superimposed Folding In The Northern Groundhog Coalfield; Evidence For Polyphase Deformation In The Northeastern Corner of the Bowser Basin; In Current Research, Part B, Geological Survey of Canada, Paper 84-1B, P. 255-261, 1984.

STATEMENT OF QUALIFICATIONS

I, John Frederick Stones certify that: I am a graduate of Acadia University, Wolfville, Nova Scotia, with a Bachelor of Science Degree in Geology, 1977. I minored in Mathematics and Economics.

Since graduation I have been employed in minerals and coal exploration in Newfoundland, New Brunswick, Quebec, Ontario, Alberta and British Columbia.

I have been employed by Esso Resources Canada Limited since August 1981 in Calgary as a development geologist on the Byron Creek Project and as a project geologist in the exploration group.

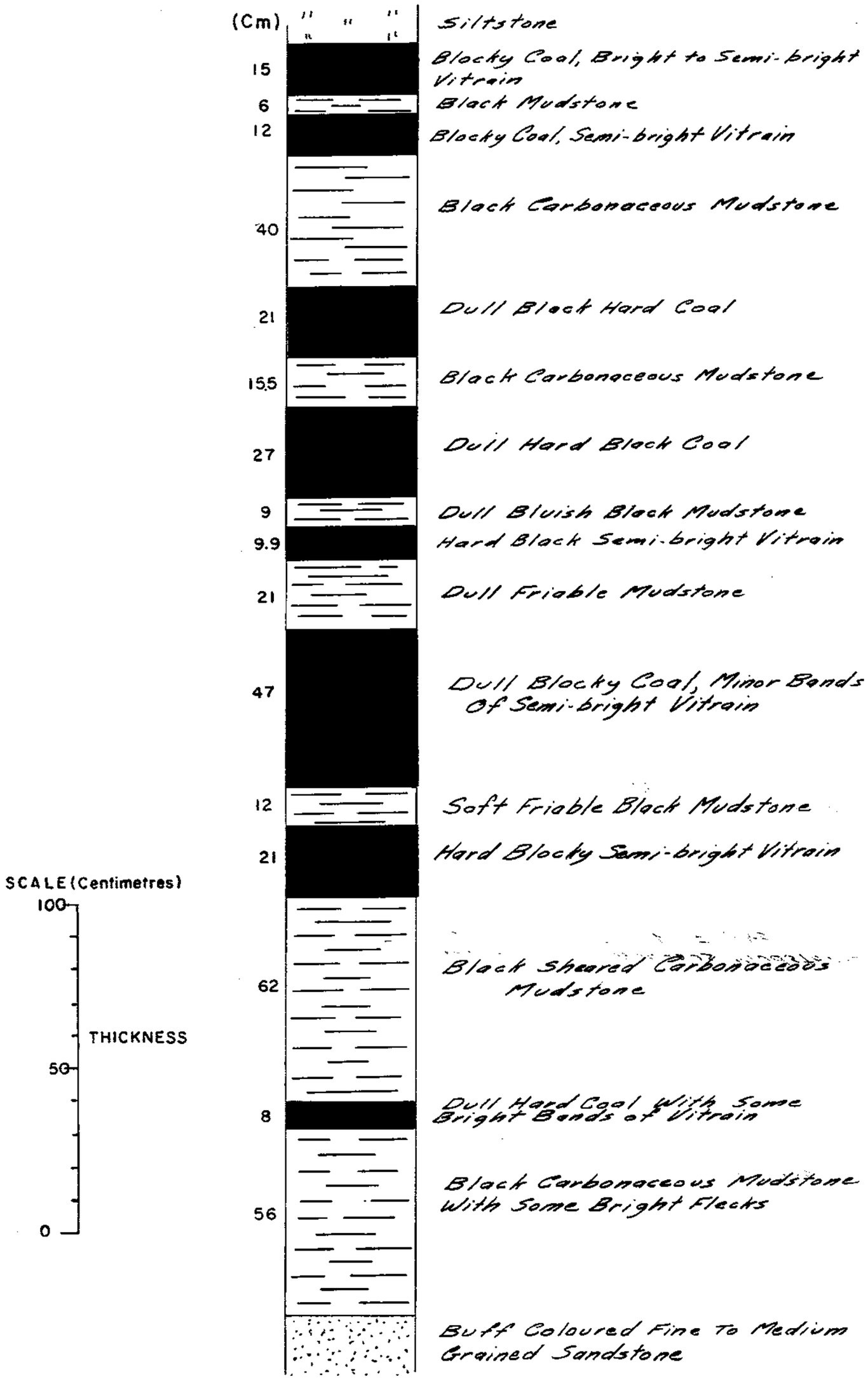
I am a member of the Canadian Society of Petroleum Geologists - Coal Branch and an active member of the Calgary CIM Branch.

J.F. Stones
Coal Project Geologist
Oil Sands and Coal Department

COAL SEAM TRENCH JFS 010

DETAILS: ORIENTATION OF TRENCH 201°; COAL 1.57m/3.82m Interval
STRIKE OF FLOOR ROCK 180°/90°
ROOF ROCK 138°/85° SW

Comment: Trench Situated In Next Valley East Of Konigus Creek



Appendix I

SWEENY LAND APPLICATION (1984)

NTS MAP SHEET	BLOCK	UNITS
104A/14	K:	1) 51-60
		2) 62-70
		3) 73-80
		4) 83-90
		5) 94-100
	L:	1) 51-57
		2) 61-67
		3) 71-76
		4) 81-84
		5) 91-94
104H/3	C:	1) 4-10
		2) 15-20
		3) 25-30
		4) 35-40
		5) 45-50
		6) 56-60
		7) 67-70
		8) 77-80
		9) 89-90
		10) 100

Appendix I

SWEENY LAND APPLICATION (1984)

NTS MAP SHEET	BLOCK	UNITS
104H/3	D:	1) 1- 4
		2) 11-14
		3) 21-24
		4) 31-34
		5) 41-44
		6) 51-54
		7) 61-63
		8) 71-73
		9) 81-84
		10) 91-99
	E:	1) 1-10
		2) 11-20
		3) 21-30
		4) 31-40
		5) 41-50
		6) 51-60
		7) 61-70
		8) 71-80
		9) 81-89
		10) 91-98

Appendix I

SWEENY LAND APPLICATION (1984)

NTS MAP SHEET	BLOCK	UNITS
104H/3	F:	1) 10
		2) 20
		3) 30
		4) 40
		5) 49- 50
		6) 58- 60
		7) 66- 70
		8) 75- 80
		9) 85- 90
		10) 95-100
	K:	1) 5- 10
		2) 15- 20
		3) 25- 30
		4) 35- 40
		5) 45- 50
		6) 55- 60
		7) 69- 70
		8) 80

Appendix I

SWEENY LAND APPLICATION (1984)

NTS MAP SHEET	BLOCK	UNITS
104H/3	L:	1) 1- 6 2) 11-15 3) 21-25 4) 31-34 5) 41-43 6) 51-53 7) 61-63 8) 71-73

APPENDIX I

SWEENY LICENSES GRANTED IN (1985)

NTS MAP SHEET	BLOCK	UNITS
104 H/3	C:	1) 4 2) 5, 6, 15, 16 3) 7, 8, 17, 18 4) 25, 26, 35, 36 5) 27, 28, 37, 38 6) 29, 30, 39, 40 7) 45, 46, 55, 56 8) 47, 48, 57, 58 9) 49, 50, 59, 60
104 A/14	J:	1) 27, 28, 37, 38 2) 29, 30, 39, 40 3) 50
	K:	1) 21, 22, 31, 32 2) 33 3) 41, 42 4) 43, 44 5) 51, 52 6) 53, 54 7) 62 8) 63, 64, 73, 74 9) 83, 84, 93, 94 10) 85, 86, 95, 96

APPENDIX II

129°20'

129°15'

57°00'

56°55'

PARALIC SEDIMENTS - WEST OF THRUST FAULT
Thinly Bedded Sandstones, Siltstones, Coal And Mudstone, Tightly Compressed Into Chevron And Kink Style Folds.

FLUVIAL SEDIMENTS EAST OF THRUST FAULT
Course Grained Competent Fluvial Sandstones, Siltstones And Conglomerates, Broadly Folded And Laterally Continous.

C.L. 8060
C.L. 8059
C.L. 8058
C.L. 8057
C.L. 8056
C.L. 8055
C.L. 8054
C.L. 8067
C.L. 8071
C.L. 8066
C.L. 8065
C.L. 8064
C.L. 8063
C.L. 8062
C.L. 8061
C.L. 8072

JFS 008
COAL 0.90m/0.90m
R 3.67

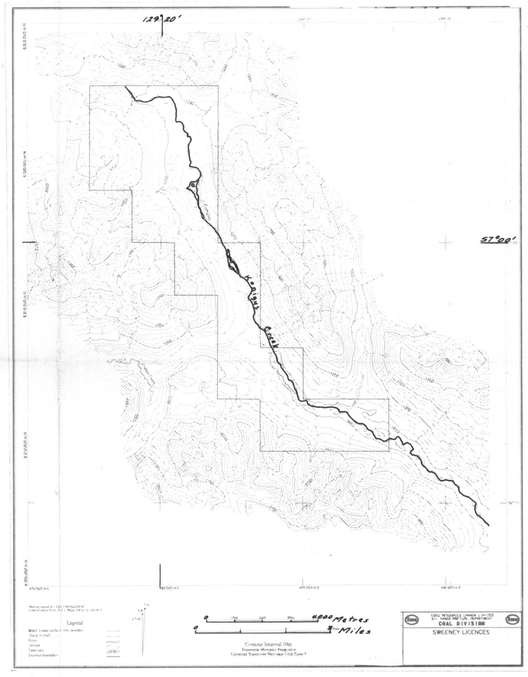
JFS 007
R2.92
COAL 0.21m/0.21m Interval

JFS 003

JFS 010
R2.56
COAL 1.67m/3.82m Interval

JFS 004
COAL 0.70m/0.70m
R2.57

Magnetic Declination
23°



LEGEND

- 53/ DIP & STRIKE
- ▲ COAL (Bloom)
- ■ COAL (<1m) (Apparent Thickness)
- ▬ COAL (>1m) (Apparent Thickness)
- R3.16 MEAN MAXIMUM REFLECTANCE
- THRUST FAULT / BOUNDARY
- SYNCLINAL AXIS
- ANTICLINAL AXIS

Note Re Structure Interpretation From Air Photo And General Reconnaissance Data

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ESSO RESOURCES CANADA
OIL SANDS, COAL DIVISION

SWEENY LICENSES

ESSO FIELD MAPPING 1985

Scale 1:20000
0 500 1000
Metres

NTS 104 A,H DATE JAN. 29 1986
To Accompany A Report By JOHN STONES

MAP No.