PR-MONKMAN-BELCOURT 75(1)A

CONFIDENTIAL FILE

GEOLOGY AND COAL POTENTIAL

OF

BELCOURT-MONKMAN AREA

BRITISH COLUMBIA

Prepared for: Canadian Superior Oil Ltd.
Calgary, Alberta

By: Paul Dyson Consultants
and Holdings Limited
Calgary, Alberta

November 1975

December 15, 1975

McIntyre Mines Limited
Divisional Exploration Office,
Suite 1003, 409 Granville St.,
Vancouver, B.C.
V6C 1T2

Attention: Mr. D. L. McKelvie
Regional Geologist

Dear Sir:

Re: Coal Licences Nos. 3265 to 3278 inclusive
Peace River District

Thank you for your letter of December 8th, 1975 advising us that your Company will not submit an Application to Extend the Term of the subject licences because the results of work performed in 1975 were not satisfactory.

As the licences were issued on December 16th, 1974 for a term of one year, they will expire on December 16th, 1975.

At this time I would draw to your attention the provisions of Section 12(2) of the Coal Act which requires that information and data for any exploration and development work done on the locations is to be submitted to the Department within ninety days following the date of the surrender of the licences.

We will look forward to receiving your reply in compliance with the aforementioned provision on or before March 15th, 1976.

Yours very truly,

A. R. Corner
Administrator for Coal

ARC/dli

cc: McIntyre Mines Limited
P.O. Box 51, Commerce Court West,
Toronto, Ontario
Attention: Mr. D. J. Corbett
Assistant to the Secretary

McINTYRE
MINES LIMITED

DEPT. OF MINES
AND PETROLEUM RESOURCES
Rec'd DEC 30 1975

DEC 24 '75 PM

136536

DEPT. OF MINES
AND PETROLEUM RESOURCES

REFERRED TO | DATE | INITIAL
D.M

DIVISIONAL EXPLORATION OFFICE
SUITE 1003, 409 GRANVILLE ST.
VANCOUVER, B.C. V6C 1T2
TELEPHONE - 604-682-8977
TELEX - 04-507517

December 22, 1975

MR. JAMES

29/12

FILE
FILING CLERK

A. R. Corner,
Adminstrator for Coal,
Department of Mines and Petroleum Resources,
Parliament Buildings,
Victoria, B.C.

Dear Mr. Corner:

The attached report is a summary of the work completed on Coal Licences No. 3265 to 3278, inclusive, during 1975. It is submitted in order to comply with the provisions of Section 12(2) of the Coal Act.

Sincerely,

McINTYRE MINES LIMITED

D. L. McKelvie
Regional Geologist

enc.
DLMcK/nh

Examined

Bob
for filing

93I/7, 8, 10 & 15

PR-M-B 75(1)A

COAL ACT

(Section 19 & B.C. Reg. #436/75)

Exploration & Development Work Report Cover Sheet

Property name: Belcourt-Monkman Coal Map No. 93I/7,8,10 & 15

Location: Belcourt-Monkman Area Land District Peace River

Coal Licence No.(s) 3130-3264

Licensee: McIntyre Mines Limited

Operator: Canadian Superior Oil Ltd.

Title of Report: Geology and Coal Potential of Belcourt-Monkman Area, N.E. B.C.

Period covered by Report: July 28, 1975 - September 10, 1975

Category of work covered in report

Geological Mapping		$47,719.97
Surveys: Geophysical		$ 2,595.00
Geochemical		
Other	Air Photography	$ 5,573.59
Road Construction	Site Preparation, Moving Rig	$ 3,246.00
Surface work		
Underground work		
Drilling	Includes apportioned camp costs	$61,826.27
Logging		
Sampling		$ 4,902.05
Testing		
Reclamation		$ 1,778.00
Other work		
Ancillary Work		$11,390.04
Total costs of work reported	$	139,030.92

Comments:

Value of work approved $ A.R.C. James # 139,030.92

Signature: A.R.C. James, Senior Inspector of Mines Date Jan 28 1976

Accepted: [signature] Date Jan 28/1976

Chief Gold Commissioner
Mineral Resources Branch

Submitted in duplicate: Original to be filed with report
Duplicate to be filed as Plan of Operations (if)

ABSTRACT

Canadian Superior Oil Ltd. carried out an exploration program in 1975 on their jointly owned coal licences in the Belcourt-Monkman area of northeastern British Columbia.

The main objectives were to further map the area geologically and to confirm the suspected coking quality of the coal.

Coal seams exceeding 10 feet in thickness were located in the Gething formation and seams up to 45 feet in thickness were located in the Gates formation. Drilling (three holes) in the Gates formation confirmed the excellent coking quality of the low ash coal. No quality data is yet available for the "Gething" coals.

Preliminary mapping indicates the area to have high potential for the discovery of significant mineable coal reserves.

Some acreage should be relinquished and additional exploration is warranted as budgets permit.

TABLE OF CONTENTS

		pg.
I.	INTRODUCTION	4
	(a) Regional Setting	4
	(b) Access	5
II.	EXPLORATION PROGRAM	6
III.	ACKNOWLEDGEMENTS	9
IV.	GEOLOGY	11
	(a) Stratigraphy	11
	(b) Structure	15
V.	COAL	21
	(a) Seam Distribution and Thickness	21
	(b) Seam Quality	27
VI.	CONCLUSIONS	29
VII.	RECOMMENDATIONS	31
	SELECTED REFERENCES	33
	APPENDICES	follow page 34

ILLUSTRATIONS

Table I	Table of Formations	Page 12
Fig. 1	Location Map 1" - 90 miles	Follows page 4
Fig. 2	Location Map 1" - 15 miles	Follows page 5
Fig. 3	Surface Geology, Kinuseo Creek, 1" - 1000 feet	
Fig. 4	Geophoto Surface Geology, Monkman 1:50,000	
Fig. 5	Geophoto Surface Geology, Belcourt 1:50,000	
Fig. 6	Stratigraphic Cross-section, Belcourt-Monkman	
Fig. 7	Structural Cross-section AA', Kinuseo Creek 1" - 500 feet	
Fig. 8	Structural Cross-section BB', Kinuseo Creek 1" - 500 feet	
Fig. 9	Structural Cross-section CC', Kinuseo Creek 1" - 500 feet	
Fig. 10	Structural Cross-section DD', Five Cabin Syncline 1" - 500 feet	
Fig. 11	Structural Cross-section EE', Onion Syncline, 1" - 500 feet	

Figs. 3 to 11 - see Volume II

APPENDICES

A. Detailed Lithologic Core Descriptions

B. Notes of McIntyre Report (McKelvie 1973)

C. Analytical Data Refer to Confidential Coal Analysis File.

D. Acreage to be Relinquished

I. INTRODUCTION

This report describes the exploration work performed on behalf of Canadian Superior Oil Ltd. in the Monkman Pass area of northeastern British Columbia in 1975. Canadian Superior are the operator for a block of coal licences (#3130 - #3264) in the Monkman-Belcourt area of northeastern British Columbia. This area is approximately 400 miles north northeast of Vancouver and 300 miles west northwest of Edmonton (Fig. 1).

I.a. Regional Setting

The area under consideration lies within the Rocky Mountain Foothills and trends northwesterly along the front of the Rocky Mountains between the Narraway River and the Monkman Pass (Fig. 2). It is underlain by coal bearing Lower Cretaceous sediments. Of interest are strata of the Gates formation and the Gething formation which were explored for potentially economic coal seams.

The Cretaceous sequence was folded during the Laramide orogeny being deformed into elongate plunging anticlines and synclines with associated faulting. This series of en echelon folds and faults has a northwesterly trend. In this area, good exposures of Cretaceous rocks occur along creeks and on slopes and cliffs. Considerable relief exists

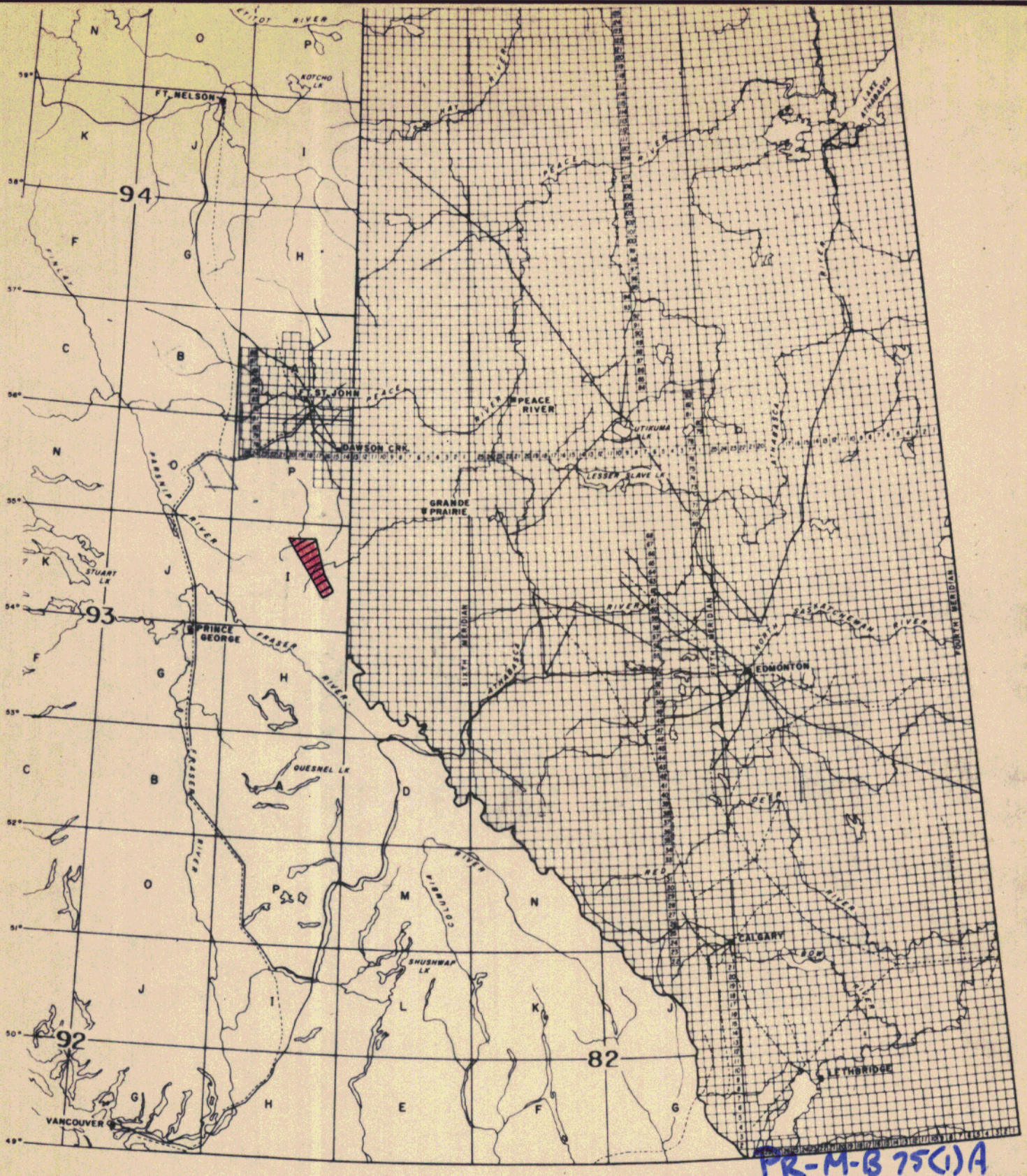
I.a. Regional Setting (Cont'd.)

within the area with elevations varying from 3,000 to 6,000 feet. Because the tree line at this latitude is approximately 5,200 feet, much of the explored area yielded good outcrop information making exploration rewarding.

I.b. Access

The Canadian Superior coal licences are reached by gravel road from Beaverlodge, Alberta, which is approximately 25 miles west of Grande Prairie. The road passes through Elmworth and eventually connects to a B.C. Forestry trunk road. The distance by road from Beaverlodge to the property is approximately 75 miles.

This road parallels Kinuseo Creek and allows direct access to the northern licences. Approximately 3½ miles west of the Stony Lake Ranger Station, the above mentioned road splits and a branch extends south to Red Deer Creek. This road permits access to the central licences. No road access exists for the southern licences, although Denison Mines Ltd. have constructed a road to within two or three miles of the licences in the Saxon area.



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CANADIAN SUPERIOR OIL LTD.

LOCATION MAP

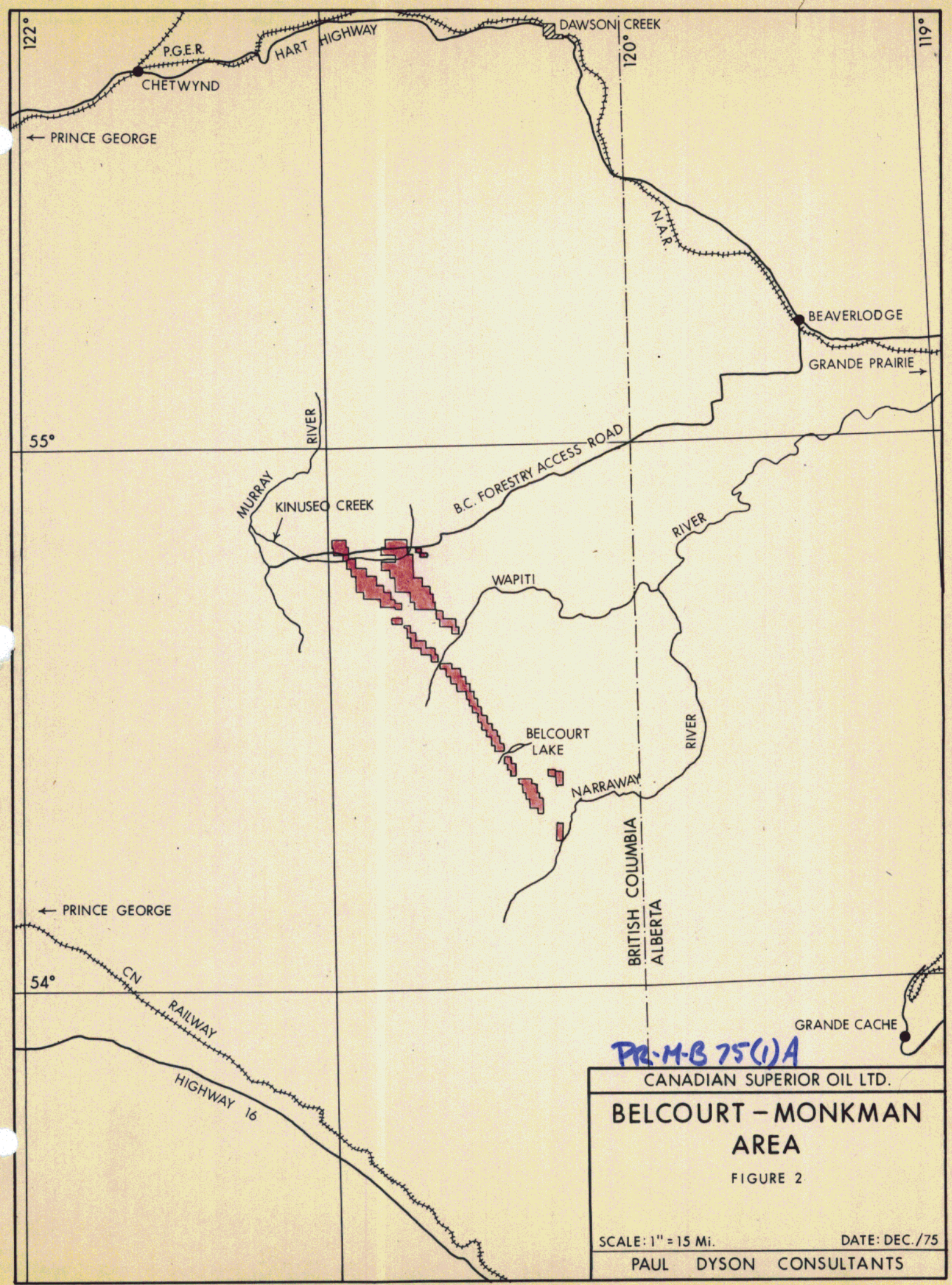
FIGURE 1

BELCOURT – MONKMAN AREA

0 90

SCALE : 1 INCH = 90 MILES

PAUL DYSON CONSULTANTS



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CANADIAN SUPERIOR OIL LTD.

BELCOURT – MONKMAN AREA

FIGURE 2

SCALE: 1" = 15 Mi. DATE: DEC./75

PAUL DYSON CONSULTANTS

II. EXPLORATION PROGRAM

The exploration program carried out by Canadian Superior in 1975 was a logical extension of that work carried out by McIntyre Mines Ltd. in previous years (McKelvie 1973).

It had as its main objectives the confirmation of the suspected coking quality of the coal in the area and the further definition of the distribution of the coal bearing formations throughout the licence block. When the previous work had been carried out the personnel involved had not had the benefit of the knowledge of the more detailed stratigraphy of the area which has become available with each new exploration project in the area.

Basically, the program consisted of the drilling of three test holes and additional field checking of the surface geology. An interpretation of the geology of the total licence block had been made by Geophoto Services Ltd. on behalf of Canadian Superior. This mapping is at a scale of 1:50,000 (Figs. 4 &5). While in detail minor discrepancies were noted, this interpretation of the geology appears to be excellent. For the northern area of the licences, an additional topographic map made for McIntyre at a scale of 1" - 1000' was available. The previous exploration work and

II. EXPLORATION PROGRAM (Cont'd.)

resultant geology of McIntyre was shown on this map. New photography taken by Burnett Resource Surveys Ltd. in 1975 was used to re-plot the McIntyre data accurately onto this base and a revised interpretation has been presented (Fig. 3). It should be noted that good correspondence between the mapped geology and the information from the McIntyre trenches was found.

The field mapping was carried out from a base camp on the main Kinuseo Falls road at Honeymoon Creek. A Bell Series 47-J helicopter was kept at camp. This helicopter was used to position geologists at various locations on the licences for geological traversing. The traversing program was concentrated in the northern area (Fig. 3), but several additional selected key traverses were made on the southern licence areas. These latter traverses were primarily aimed at selecting sites for possible future drilling and adit driving during later development of the area.

The drilling was limited to areas of easy access but of significance from a geological point of view. Three holes were completed at sites which required no new road building - two in the Quintette Anticline area and one in the Five Cabin Syncline.

II. EXPLORATION PROGRAM (Cont'd.)

The coal recovered from these holes was tested to ascertain the coal quality and the structural and stratigraphic data incorporated into the overall interpretation.

The field program was commenced on July 28th and completed on September 10, 1975.

III. ACKNOWLEDGEMENTS

The program was supervised and in part carried out by Paul Dyson Consultants of Calgary, Alberta. Geologists spending time in the field were Dr. A.Chowdry and Mr. R. Hankel together with field assistants Mr. B. Wrightson of Canadian Superior Oil Ltd. and Mr. W. Radant. Mr. Paul Dyson spent approximately one week in the field. The specialized stratigraphic knowledge of Dr. Chowdry is gratefully acknowledged.

Liaison with Canadian Superior was maintained through Mr. G. Hargreaves who offered many valuable suggestions for the geological understanding of the area. Mr. J. Féniak of Canadian Superior supervised the preparation of drillsites prior to the arrival of the drill on the property.

The local representatives of the B.C. Forest Service based at Stony Lake some ten miles east of the field camp, was most co-operative and helpful.

The drill was provided by Tonto Drilling Ltd. of Vancouver. Their foreman, Brian Fraser, made every effort to run an efficient program despite very indifferent equipment.

The helicopter was leased from Rocky Mountain Helicopters Ltd. of Invermere and piloted by Mr. K. Knowles. It provided adequate transportation at reasonable cost in a

III. ACKNOWLEDGEMENTS (Cont'd.)

situation where insufficient hours were flown to justify the minimum on a larger helicopter.

The minor amount of cat work was carried out by Tompkins Contractors of Fort St. John. Mr. Ken Miller, the catskinner , did an excellent job of the drillsite preparation and drill moves. He also carried out the reclamation of the sites to the satisfaction of the B.C. Forest Service.

The camp facilities were provided by Fortier and Associates. The facilities were excellent and the meals good.

Ancilliary equipment supplied by Rentco Equipment Ltd. of Grande Prairie was poor and it is not recommended that additional business be given to this operation.

The help of the various personnel from the above companies to the success of the program is gratefully acknowledged.

IV. GEOLOGY

This report does not discuss the general geology of the foothills of northeast British Columbia, but rather concentrates on a discussion of those formations and structures which have a bearing on the coal potential of the Belcourt-Monkman area.

This section of the report is divided into two sub-sections - "Stratigraphy" and "Structure".

IV.a. Stratigraphy

No detailed stratigraphic analysis of the Cretaceous rocks of the area has been published to date. The basic reference for the area is "Lower Cretaceous Bullhead and Fort St. John Groups, Rocky Mountain Foothills, Alberta and British Columbia" (Stott 1968). This report was the first to explain the relationships of the Lower Cretaceous rocks in the area and it has been the basis for all later work. It should be noted that Stott was among the first to recognize the coal potential of the area. Based on the work of Stott and others, the stratigraphic breakdown is as shown on Table I. The only rock units that are of economic interest are the Gates Member of the Commotion Formation and the Gething formation.

TABLE I

TABLE OF FORMATIONS

Series	Group	Formation	Thickness (ft.)	Lithology
Lower Cretaceous	Fort St. John	Shaftesbury 400-900 — Hasler Fm.	500?-1500	Silty, dark grey marine shale with sideritic concretions; siltstone and sandstone in lower part; minor conglomerate.
		Commotion 1080-1600 — Boulder Creek Member	250-500	Fine-grained, well sorted sandstone; massive conglomerate; non-marine sandstone and mudstone.
		Hulcross Member	150-200	Dark grey marine shale with sideritic concretions.
		Gates Member	800-1100	Fine-grained; marine and non-marine sandstone; conglomerate; coal; shale and mudstone.
		Moosebar	175-225	Dark grey marine shale with sideritic concretions; glauconitic sandstone and pebbles at base.
	Bullhead	Gething	500-750	Fine- to coarse-grained, brown, calcareous, carbonceous sandstone; coal, carbonaceous shale, and conglomerate.
		Cadomin	45-600	Massive conglomerate containing chert and quartzite pebbles.

IV.a. Stratigraphy (Cont'd.)

The initial geological work carried out by McIntyre (McKelvie 1973) concentrated on the Kinuseo Creek area (Fig. 3). The maps in this report do not make any distinction between the members of the Commotion formation and there is even some confusion in distinquishing the Gething formation from the Commotion formation. The new work carried out in 1975 has eliminated this confusion and the new map (Fig. 3) clearly distinquishes the different formations.

Geologists familiar with the stratigraphy of the area were able to distinquish the various members of the Commotion formation and the Moosebar formation and this was the key to the above understanding.

The Boulder Creek member is well exposed at numerous localities such as Duke Mountain, the Five Cabin area, and on Dokken Creek. It is characterized by the massive conglomeratic sandstones and grits with occasional plant remains and thin coaly zones.

The Hulcross Member is usually readily identifiable because of its very well defined thin banding of alternating silts, shales and very fine sandstone. It can be seen in several places such as Duke Mountain, Dokken Creek and the ridges south of Fearless Creek. It is a most characteristic and useful rock unit.

IV.a. Stratigraphy (Cont'd.)

The Gates member is the main coal bearing zone in the area. It is a highly variable sequence of sand, shales and coals. In general, it is more shaley in the upper 300 to 400 feet than in the lower. However, the sequence in the Five Cabin area appears to be finer grained than is typical in the lower portion of the section (Fig. 6). The basal sandstone of the Gates member is charactized by large scale worm burrows (¼ to ½" diameter) which are recognizable at surface from the Belcourt area to the Five Cabin syncline (45 miles). They are also readily recognizable in drill cores and are a most reliable indicator for the basal Gates sandstone.

The Moosebar formation underlies the Gates member of the Commotion formation with a gradational contact. It consists of a series of shales and silts characterized by numerous micro-burrows easily recognized at surface and in drill cores. There has been some confusion in the past in distinquishing the Hulcross Member from the Moosebar formation, but this is unnecessary and should not occur in the future if careful lithologicexaminations are made.

The Gething formation abruptly underlies the Moosebar formation. It consists of a series of sands,

IV.a. Stratigraphy (Cont'd.)

gritstones, conglomerates, minor shales and coal which pass downwards into the conglomerates and gritstones of the Cadomin formation. These two formations appear to interfinger and a sharp distinction between one and the other is not possible on the basis of the data presently available. Some thickness variations for the formations are readily apparent on the surface map (Fig. 3) and on the cross-sections (Figs. 7 to 11). These probably reflect differences in picking the formational contact rather than to differences in basic stratigraphy.

IV.b. Structure

Prior to the mapping carried out by McIntyre (McKelvie 1973) the only published map was a geological map at a scale of approximately 1 inch equals 4 miles published by the Geological Survey of Canada (Stott 1968).

Using the published map of Stott and the McIntyre field data, two new geological maps were made in association with Geophoto Services Ltd. (Fig. 4 and 5). These maps have proved to be an excellent base from which to extend the geological knowledge of the area and very few fundamental discrepancies were noted.

Field traverses were made over much of the Kinuseo area (Fig. 3) and at selected intervals of the remainder of

IV.b. Structure (Cont'd.)

the property. The improved knowledge of the stratigraphy in 1975 enabled many structural features to be better defined and the various structural features of the area are discussed in turn.

IV.b.i Quintette Anticline:
C-93-I-15 Fig. 3, 4, 7, 8 and 9

This major anticlinal features crosses the main Kinuseo Creek road at the northeastern edge of the licence block. An its west side it is paralleled by what is referred to as the Quintette syncline.

The anticline plunges rapidly from north to south (Fig. 9) as its core of Cadomin formation disappears beneath a cover of glacial drift along the Kinuseo Creek. Local outcrops of basal Gates formation sandstone have been recognized in Kinuseo Creek in the axial area and penetrated by drillhole #75-1. Anomalous dips in the basal Gates sandstone were measured where the forestry road crosses Kinuseo Creek. Apart from these dips the structure appears fairly uniform with dips in the 30 to 50^{0} range along the flanks.

The syncline has some minor flexures along the Cadomin outcrop at the north end which are readily apparent photogeologically (Fig. 4). No ground traverses have been made in this area.

IV.b.ii Five Cabin Syncline:
D-93-I-15 Figs. 3, 4 and 10

This major synclinal structure has been mapped in the northwest corner of the licence block. The Boulder Creek member of the Commotion formation is exposed in the axial area at the northern edge of the licence block and the Cadomin formation closes around the south end of the structure immediately north of Kinuseo Creek.

Dips in the syncline are fairly simple on the west dipping east limb with gentle variations in dip from 15° to 40°. This results in large dip slope areas of both Gething formation and Gates formation.

The west side of the structure is more complex with several anomalous dips being recognized on the road that crosses the structure. The drillhole #75-3 confirmed the general structure of the syncline and indicated probable plunge to the southeast.

IV.b.iii Onion Syncline:
K-93-I-10 Figs. 3, 4 and 11

This structure is a major well defined syncline located immediately south of Kinuseo Creek on the west boundary of the property. It is almost wholly defined by a continuous outcrop of Cadomin formation although some structural complexities exist on the west side (Fig. 4). These have not been resolved by detailed traversing as yet.

IV.b.iii Onion Syncline: (Cont'd.)

Some remnants of Shaftesbury formation have been recognized along the axis but the main axial area is underlain by the Hulcross and Boulder Creek members of the Commotion formation.

The syncline appears to be "basinal" with both ends plunging to the centre. This can be seen from the elevation of the Cadomin formation on the cross-section (Fig. 11) compared to the surface trace around the ends of the syncline. Major areas along the flanks are underlain by coal bearing rocks of the Gates member.

IV.b.iv Onion Creek-Mount Belcourt:
A, G-93-I-10; E, F, L-93-I-8 Fig. 4 and 5

A very long west dipping flank of Commotion and Gething formations is recognized all along the western side of the acreage block.

No major faults except for one at a point five miles northwest of Belcourt Lake have been recognized in this flank which generally dips 30° to 50° to the west. It should not be assumed that faulting does not exist along this flank but only detailed mapping and drilling will reveal these minor faults.

IV.b.v Duke Mountain:
B, C-93-I-15 Fig. 3 and 4

Duke Mountain is situated immediately south of Kinuseo Creek on the eastern edge of the property. The Gething and Commotion formations basically form a syncline through the crest of the mountain. The east flank appears to be relatively undisturbed from Cadomin formation through Boulder Creek member with the Cadomin formation probably being a continuation of the Cadomin on the west side of the Quintette syncline.

The east side of Duke Mountain is relatively unmapped as is the south face and more detailed surface work must be completed to solve obvious structural problems.

IV.b.vi Fearless Creek-Wapiti River:
I, J-93-I-10 Fig. 4

This area is basically characterized by fairly intense folding and possible faulting of the coal measures. While certain major structural axes are evident much more detailed surface mapping is required.

IV.b.vii Saxon
F-93-I-8 Fig. 5

A small group of licences cover the end of the Saxon structure under development by Denison Mines Ltd. While the structure appears to be basically synclinal, additional mapping is required to solve the structural problems.

IV.b. Structure (Cont'd.)

The general impression of the licence area is that folding plays a much more prominent role in the structure of the area than does faulting. The area is undoubtedly one in which detailed surface work will more than pay off because of the recognizable mappable units and the generally excellent outcrop.

V. COAL

The knowledge of the coal underlying the coal licences of Canadian Superior is at a very preliminary stage with only three drillholes, limited trenching mostly on Duke Mountain, and general surface mapping completed. The information can in general be considered from two points of view - firstly, seams and secondly, coal quality. These two subjects are treated separately.

V.a. Seam Distribution and Thickness

Coal seams have been recognized at surface in both the Gething and Commotion formations from the extreme south to extreme north of the coal licences. The coals of the two formations can be considered:

V.a.i Gething formation

Coals of the Gething formation have been extensively prospected in the Duke Mountain area and in the Quintette syncline area by McIntyre (McKelvie 1973). This work consisted of trenching using a bulldozer and, as no drilling of the Gething formation has taken place, it provides the only information.

All the trench information for seams more than five feet from McKelvie has been plotted onto the Kinuseo Geological

V.a.i Gething formation (Cont'd.)

Map (Fig. 3). (It should be noted that apparent thicknesses measured by McIntyre were converted to true thicknesses for this map - see Appendix B).

A seam averaging about 13 to 15 feet thick appears to be persistent in the Gething formation in the Quintette and Duke Mountain areas. In view of this substantial thickness of coal, additional work such as drilling will have to be conducted on Gething coals in the near future.

Other thinner seams are frequently reported in the Gething formation, e.g. two seams exceeding five feet in the Five Cabin syncline area (Fig. 3). No seams over five feet thick were seen south of Kinuseo Creek with the exception of the Duke Mountain area, but it should be realized that coal inherently forms poor outcrops. There are prospects for Gething coal throughout the licences but the massive conglomerates of the Gething-Cadomin sequence are not encouraging for the discovery of thick continuous coal seams.

V.a.ii Commotion formation

The coals of the Gates member of the Commotion formation are the main prospect for mining development in the area. They are known from trenching (1973) and drilling (1975) in the Quintette, Five Cabin and Duke Mountain areas,

V.a.ii Commotion formation

and in surface outcrops from the Onion Syncline to Mount Belcourt and the Saxon syncline.

The surface outcrop information can be discussed separately. A surface traverse of that portion of the Saxon syncline within the licence block located a seam in the Gates member apparently thicker than 20 feet. This would be expected in view of the thick seams known on Saxon Ridge. This seam will have to be further explored by either drilling or trenching.

The western outcrop of the Gates member from just south of Belcourt Lake to the area of the Onion Syncline (Fig. 4 and 5) is basically one of good rock exposure. The most spectacular outcrops of coal are on Mount Belcourt itself and nearby peaks where a seam in the lower Gates member consistently exceeds 40 feet in thickness. On Mount Belcourt the seam does not appear to contain any significant (more than one foot) partings and is most impressive. At least two other seams in the ten foot range appear to be present in this area.

To the north of Mount Belcourt the numerous dip slopes often expose coal seams in the Gates member. While the exposures are poor, there appears to be excellent potential for an aggregate coal thickness of 40 to 50 feet

V.a.ii Commotion formation (Cont'd.)

throughout the area. The extension of the "45 foot seam" from Mount Belcourt to the north is uncertain although when last well exposed a few miles north of Mount Belcourt it appears to be getting more shaley. The best prospecting of this long flank would be by a series of widely spaced drillholes to determine the lateral and vertical distribution of individual seams within the Gates member.

Traversing by McIntyre (McKelvie 1973) in the Onion syncline located a 15 foot coal seam on Onion Creek. Its stratigraphic position within the Gates members is unclear from present data and the location was not visited in 1975. Additional work will be needed to verify its presence and relationship to the surrounding rock units.

Surface work in the Five Cabin syncline has failed to recognize significant coal seams within the Gates member. However, the main branch of Five Cabin Creek, where the outcrops are most likely, has not been traversed.

A drillhole - #75-3 - was located close to the axis of the Five Cabin Syncline in the upper portion of the Gates member. It penetrated all the middle and lower Gates member and finished in the Moosebar formation (Figs. 6 and 10 and Appendix A). It penetrated three seams - 11 feet, 9.5 feet and 7 feet - thicker than 5 feet. Perhaps the most

V.a.ii Commotion formation (Cont'd.)

striking feature of this succession was the total absence of the lower thick coal of the Gates member (cf 75-1 on Fig. 6). Whether or not this sequence is typical of the Gates member throughout the Five Cabin Syncline or whether the drillhole struck a locally anomalous area is uncertain. Further drilling will be required to solve this problem.

In the Quintette area, two drillholes were completed in 1975 and these together with the McIntyre trenching give a fair understanding of the coals in that area. Reference to the drillhole information (Appendix A) shows Drillhole 75-1 to penetrate four seams - 8.0 feet, 18.5 feet, 14.0 feet and 12.5 feet - thicker than five feet. These three lower seams are not apparently present in the Five Cabin area. It should be noted that these are intercepted thicknesses and true coal thicknesses would be about 10% less. The only hole drilled in the Quintette syncline (75-2) found most of the Gates member to be eroded. It did, however, penetrate a dirty 9.5 foot coal seam which was probably equivalent to the lower seam penetrated by 75-1.

An outcrop of Gates member coal is present on a seismic line approximately one mile northwest of 75-1. This seam was reported by McIntyre (McKelvie 1973) to be 19.1 feet

V.a.ii Commotion formation (Cont'd.)

thick. From the appearance of the surrounding rocks, it appears likely but by no means certain that this outcrop is equivalent to the "18.5 foot" seam in 75-1.

No good outcrops of Gates member coal were located on Duke Mountain and the only information available on the coal is from the McIntyre trenching program (McKelvie 1973). All the coal thickness more than five feet from this program were plotted onto the Kinuseo geology map (Fig. 3). As can be seen, numerous seams more than five feet thick are present and abundant Gates member coal is undoubtedly present.

In summary, the Gething coals are virtually unknown with the exception of a few outcrops in the northeastern part of the acreage. While they are not considered to be the prime prospect in the area they are deserving of additional work to confirm their thickness.

The Gates coals appear to be very prospective ranging up to 45 feet in thickness in some places and generally being present as several seams more than ten feet in thickness. They warrant major exploration expenditures.

V.b. Seam Quality

During the McIntyre program (McKelvie 1973) numerous "grab" samples were taken from the trenches but in general no coking qualities were found. This is not surprising as all samples were taken from the presumed oxidized zone and they would not be truly representative of the unweathered coal. These results are ignored for the purposes of this report.

The 1975 drilling program tested Gates coal from the Quintette and Five Cabin areas. As this report is written primarily from a geological point of view, no detailed discussed of the analytical results (Appendix C) is made. A few general comments are as follows:

(i) Yield-ash relationships in the seams in the Quintette area are exceptionally good averaging 90% yield at 7.5 ash for all four seams combined at 1.6 S.G. The sample from 75-2 was poor owing to mechanical problems with the drill and may not be truly representative.

In the Five Cabin area the yield ash relationships are not as good. Further work is required here to explain this.

(ii) Volatile matter usually is in the 20% to 23% range which is very acceptable. Some anomalous "volatiles" in the 25% range are found in the Five Cabin area.

V.b. Seam Quality (Cont'd.)

(iii) Sulphur content is most acceptable being everywhere less than 0.5% except in 75-2.

(iv) The Free Swelling Indices are excellent with ranges generally from 7 - 9..

In brief, the coal from the Gates member has all the appearances of an excellent medium volatile, low ash, low sulphur, metallurgical grade coking coal. No data is available for seams in the Gething formation.

VI. CONCLUSIONS

Most of the coal licences operated by Canadian Superior in northeastern British Columbia are underlain by coal measures of either the Gething formation or the Gates formation.

Seams ranging up to 45 feet thick have been recognized in the Gates formation and seams up to 15 feet thick are apparently present in the Gething formation.

The drilling to date has concentrated on the coals of the Gates formation. These coals all appear to be premium quality metallurgical grade coking coals with both low ash and high free swelling indices. No quality data from unweathered coal is available for the Gething coal seams.

The geological field work in the summer of 1975 found some licences to be either not underlain by coal measures or to be totally non-prospective. These licences are sixteen in number and cover approximately 4,600 acres. The detailed descriptions of the licences are appended as Appendix D.

The acreage in general has very high potential for the discovery of large tonnages of coking coal. Exploration has not yet progressed to the stage when any firm ideas on the

VI. CONCLUSIONS (Cont'd.)

potential mineability of the coal can be discussed. However, the long west-dipping flank of coal measures extending from the Belcourt Lake area in the south almost to the Monkman Pass, a distance of 45 miles, must be considered both as a "dip-slope" open pit possibility and as a hydraulic mine prospect. The other areas require additional mapping and drilling to further indicate their mining potential.

The area merits continuing exploration and will undoubtedly be a coal producing region if and when markets develop to the stage that the necessary infrastructure can be economically supported.

VII. RECOMMENDATIONS

It is recommended that Canadian Superior surrender a portion of their acreage. The sixteen licences which were indicated as not being prospective in Section VII should not be renewed.*

Additional exploration should be carried out to define the more prospective areas within the remaining licences. Of necessity, in accordance with the Coal Act, work to the value of approximately $200,000.00 must be expended but these reommendations do not take into account limitations of funds. Rather, the idealized program is suggested and modifications can be made as required by budget restrictions.

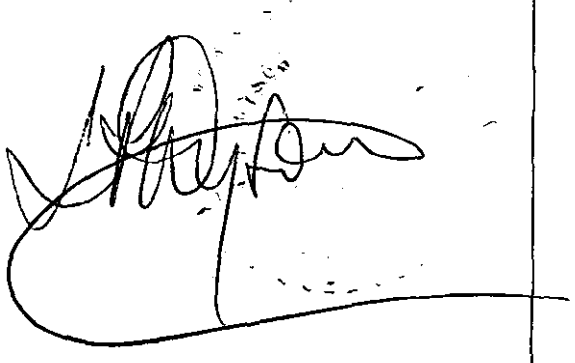
The exploration program should consist of additional surface mapping and drilling. Widespread drilling at locations several miles apart should be undertaken to determine the areas in which coal seams are "best" developed in both the Gates and Gething formations. The word "best" here has both a thickness and quality connotation. This drill program should ensure that the total prospective coal measure sequence is penetrated. The 1975 program has provided enough detail for up to twelve initial worthwhile holes to be located between the Monkman Pass and the Narraway River area.

* They were in fact surrendered in October 1975.

VII. RECOMMENDATIONS (Cont'd.)

Following the completion of or simultaneously with this drill program, detailed surface mapping of areas outside the Monkman Pass (Fig. 3) should be commenced. This additional mapping will require suitable topographic maps for plotting the geological data onto and these maps should be prepared from the new photography flown in 1975. Uncontrolled "form-line" mapping at a scale of 1"-1000' would be adequate at this stage.

When the areas of highest potential had been established, very detailed mapping (1"-400') and drilling together with the taking of bulk samples should be initiated. It is very important that this stage of the program not be undertaken prematurely or else expenditures may well occur in areas which are not the most prospective.



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APPENDIX B

NOTES ON McINTYRE REPORT

(McKelvie 1973)

APPENDIX B

NOTES ON McINTYRE REPORT (McKelvie 1973)

All pertinent facts obtained from the geological report on Monkman Pass coal by McIntyre Porcupine Mines Ltd. (McKelvie, 1973) have been incorporated into this report (see Geological Map Fig. 3 Those facts relating to coal as obtained by McIntyre's trenching operations and section measurements follow in condensed form. It should be noted that certain calculations were undertaken to find the true thicknesses of coal seams measured by McIntyre in the trenches.

For the trenches McIntyre appear to have measured apparent seam thickness and dips along the trench. The calculations were made as follows:

True seam thickness = cosine (difference between trench bearing and seam strike)

× (sine of calculated true dip)

× (measured seam thickness)

TRENCHES

Trench	Bearing	Strike	Measured Dip	True Seam Thickness
T 1	210°	300°	65° SW	13.9
T 2	208°	298°	66° SW	13.8
T 3	209°	299°	26° NE	19.1
T 4	195°	285°	25° NE	19.5
T 5	No measurements taken (excessive erosion).			
T 6	222°	312°	85° NE	14.2
T 7	230°	320°	80° NE	14.4
T 8	217°	307°	45° SW	3.4
T 9	195°	285°	88° SW	8.0
T10	195°	285°	51° NE	14.0
T11	190°	275 - 285°	50 - 60° NE	No clean coal
T12	206°	296°	59° NE	13.8
T13	205°	295°	17° NE	14.3
T14	210°	300°	22° NE	Excessive erosion
T15	230°	320°	65° NE	6.5
T16	215°	305°	45° SW	13.0
T17	195°	315°	40° NE	Excessive erosion
T18	195°	285°	42° SW	14.75

SECTIONS

A).

ON SEAMS MORE THAN TEN FEET
MEASURED APPARENT THICKNESS

Section	Bearing	Strike	App. Dip	* Calc. True Dip	Measured Thickness	True Thickness
A 1	45°	95°	--	65°	15'	8.75'
B 3	106°	132°	--	86°	26.2'	23.5'
B 5	98°	130°	--	88°	10.2'	8.65'
C		No Coal		more than 10'		
D 1	330°	300°	19°	35°	12.0'	6.0'
D 2	325°	300°	16°	34°	12.0'	6.1'
D 6	275°	300°	13°	23°	30.0'	10.6'
D7	275°	312°	--	53°	11.5'	7.3'
E 1	133°	145°	--	--	17.3'	2.9' *
E 2	133°	144°	--	--	10.5'	2.0' *
E 3	133°	145°	--	--	24.8'	4.5' *
F 1	315°	310°	32°	40°	15.0'	9.6'
F 5	280°	310°	40°	56°	23.0'	16.5'
F6	280°	310°	--	45°	11.0'	6.7'
G 1	310°	15°	15°	17°	22.0'	2.7'
G 3	300°	3°	15°	17°	11.0'	1.5'
H 1	255°	300°	32°	39°	26.0'	11.6'
J		No coal		more than 10'		

Note: * computed by McIntyre.

B).

ON SEAMS LESS THAN TEN FEET
MEASURED APPARENT THICKNESS

Section	Bearing	Strike	App. Dip	*Calc. True Dip	Measured Thickness	True Thickness
A 2	45°	98°	68°	75o	2.6'	1.5'
B 1	100°	135°	--	87°	7.5'	6.05'
B 4	123°	140°	--	85°	5.5'	5.24'
C 1	280°	340°	--	--	0.3'	0.2' *
C 2	250°	375°	60°	--	0.5'	0.4' *
C 3	280°	350°	50°	--	2.3'	2.0' *
C 4	280°	330°	55°	--	1.0'	0.8' *
C 5	280°	330°	57°	--	2.6'	2.3' *
C 6	264°	--	--	--	1.5'	1.3' *
C 7	264°	--	--	--	1.6'	1.3' *
C 8	264°	335°	77°	--	0.9'	0.6' *
C 9	264°	335°	82°	--	1.0'	0.8' *
C10	264°	335°	82°	--	0.7'	0.6' *
D 3	10°	300°	40°	42°	3.0'	0.69'
D 5	330°	310°	13°	34°	8.0'	4.2'
D 6	275°	305°	13°	23°	4.0'	1.35'
E 4	133°	158°	--	--	1.0'	0.4' *
E 5	133°	158°	--	--	1.1'	0.4' *
E 6a	100°	140°	--	--	1.3'	0.6' *
E 6b	100°	140°	75°	--	1.4'	0.6' *
E 7	100°	135°	65°	--	1.5'	0.7' *
E 8	100°	150°	60°	--	1.6'	0.9' *

B). (Cont'd.)

Section	Bearing	Strike	App. Dip.	* Calc. True Dip	Measured Thickness	True Thickness
E 9	100°	155°	62°	--	0.8'	0.6' *
E10	100°	162°	65°	--	5.0'	3.9' *
E11	100°	160°	70°	--	4.9'	3.9' *
E12	100°	--	--	--	0.8'	0.5' *
E13	100°	--	83°	83°	1.3'	1.1' *
E14	100°	--	--	--	1.3'	1.3' *
E15	100°	--	--	--	1.4'	1.1' *
E16	100°	--	--	--	2.7'	2.3' *
E17	100°	--	--	--	--	1.6' *
E18	105°	132°	54°	72°	1.1'	0.5' *
F 2	267°	325°	32°	40°	9.0'	3.06'
F 3	260°	315°	--	45°	8.5'	3.48'
F 4	270°	315°	30°	40°	4.0'	1.82'
G 2	310°	15°	15°	17°	22.0'	2.1' *
H 2	95°	130°	45°	60°	6.5'	4.6'
H 2	95°	130°	45°	60°	4.0'	2.8'
H 3	80°	130°	35°	45°	7.0'	3.18'
J 1	175°	128°	34°	42°	2.2'	1.0'
J 2	85°	131°	22°	24°	1.2'	0.34'

Note: * computed by McIntyre

APPENDIX D

ACREAGE TO BE RELINQUISHED

ACREAGE TO BE RELINQUISHED

BELCOURT SHEET (Fig. 5)

Licence No.				Acres
3136	93-I-8	C	62	186.52
3137	"	C	63	186.52
3140	"	F	6	186.37
3150	"	F	68	186.14
3156	"	E	95	186.03
3165	"	L	88	185.70
3130	93-I-7	I	71	185.74

MONKMAN SHEET (Fig. 4)

3175	93-I-10	A	69, 79	370.76
3176	"	A	86	185.32
3169	"	A	22	185.55
3191	"	H	87, 97, 88, 98	739.72
3185	"	G	47, 57, 58	555.19
3186	"	G	59	185.05
3192	"	I	8, 18	369.70
3194	"	J	1, 11	369.70
3208	"	K	5, 15	369.70
			TOTAL DROP	4,633.71

120° 52' 30"

120° 45'

54° 45'

KCb
KCg
KC
KG
KN
KS

NO EXPOSURES

NOT MAPPED

MINOR FAULTING

NOT MAPPED

THESE DIPS ARE DIFFICULT TO INTERPRET

NOT MAPPED

SMALL OUTCROP OF SHAFTESBURY FM IN SYNCLINAL AXIS

LIC. BOUNDARIES not surveyed (approx.)
PUBLISHED DIPS (McINTYRE NOV/1973)
MEASURED DIPS (SUMMER 1975)
ANTICLINE (SHOWING PLUNGE)
SYNCLINE (SHOWING PLUNGE)
LINE OF CROSS SECTION
TRENCH (T-2) or SECTION (M) SHOWING SEAM THICKNESSES >5
ISOLATED COAL OCCURRANCE
DRILLHOLE, COMPLETED
DRILLHOLE, PROPOSED

LOWER CRETACEOUS

- KCb — SHAFTESBURY FM.
- KCb — BOULDER CREEK MBR. — COMMOTION FM. — FT. ST. JOHN GROUP
- KCh — HULCROSS MBR. — COMMOTION FM. — FT. ST. JOHN GROUP
- KCg — GATES MBR. — FT. ST. JOHN GROUP
- KM — MOOSEBAR FM. — FT. ST. JOHN GROUP
- KG — GETHING FM. — BULLHEAD GROUP
- KC — CADOMIN FM. — BULLHEAD GROUP
- KN — NIKANASSIN FM. — BULLHEAD GROUP

PR-M-B 75(E)A

CANADIAN SUPERIOR OIL LTD.

BELCOURT - MONKMAN
SURFACE GEOLOGY
AND
COAL OUTCROPS

FIELD WORK SUMMER 1975 — FIG. 3

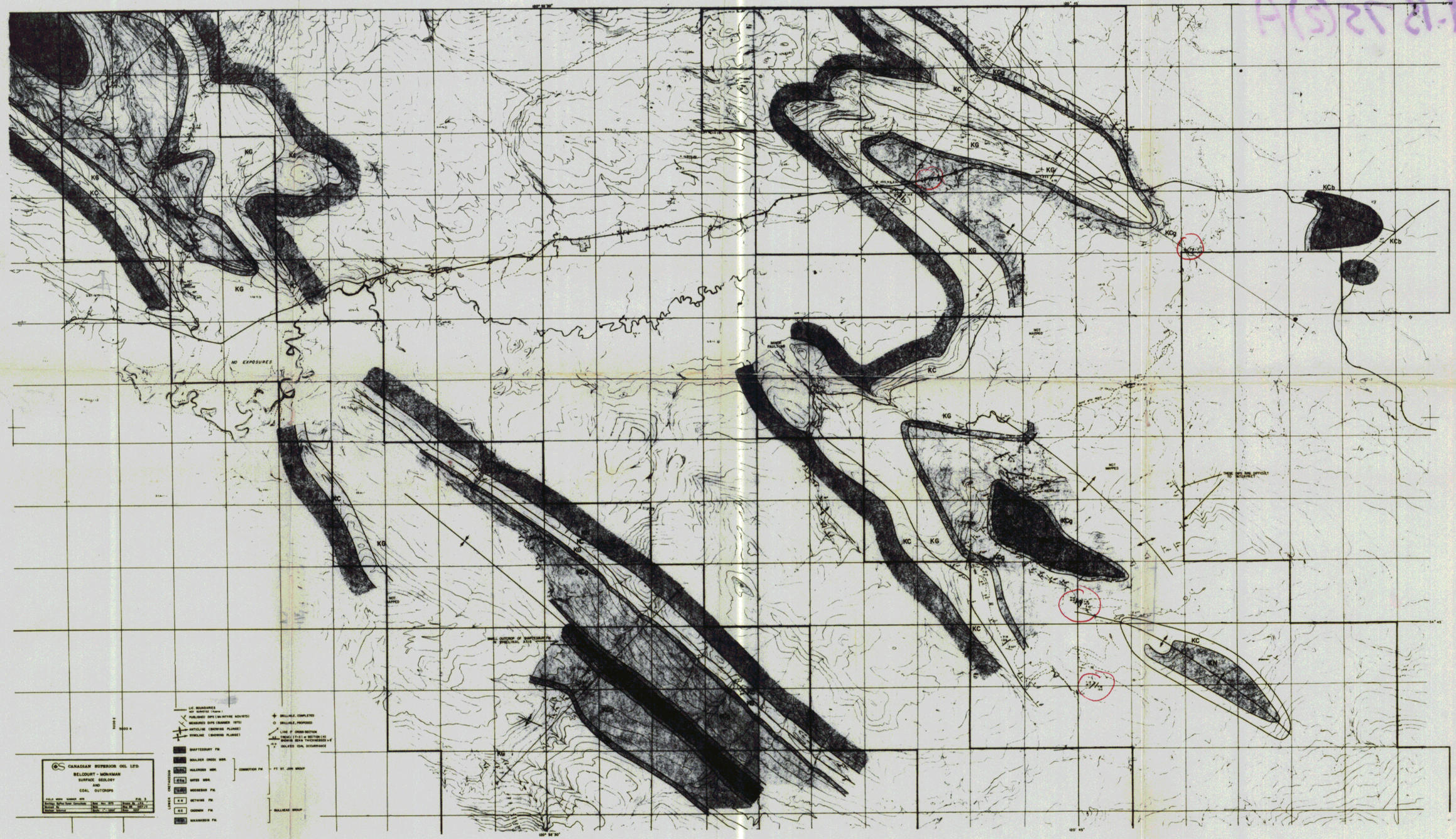
Geology By Paul Dyson Consultants	Date Nov. 1975	Drawn By J.R.S.
Revised By	Date	Map No. 557-2
Contour Interval	Scale 1"=1000'	Base 1500

540

5000 E

5000 N

PR-M-B 75(E)A



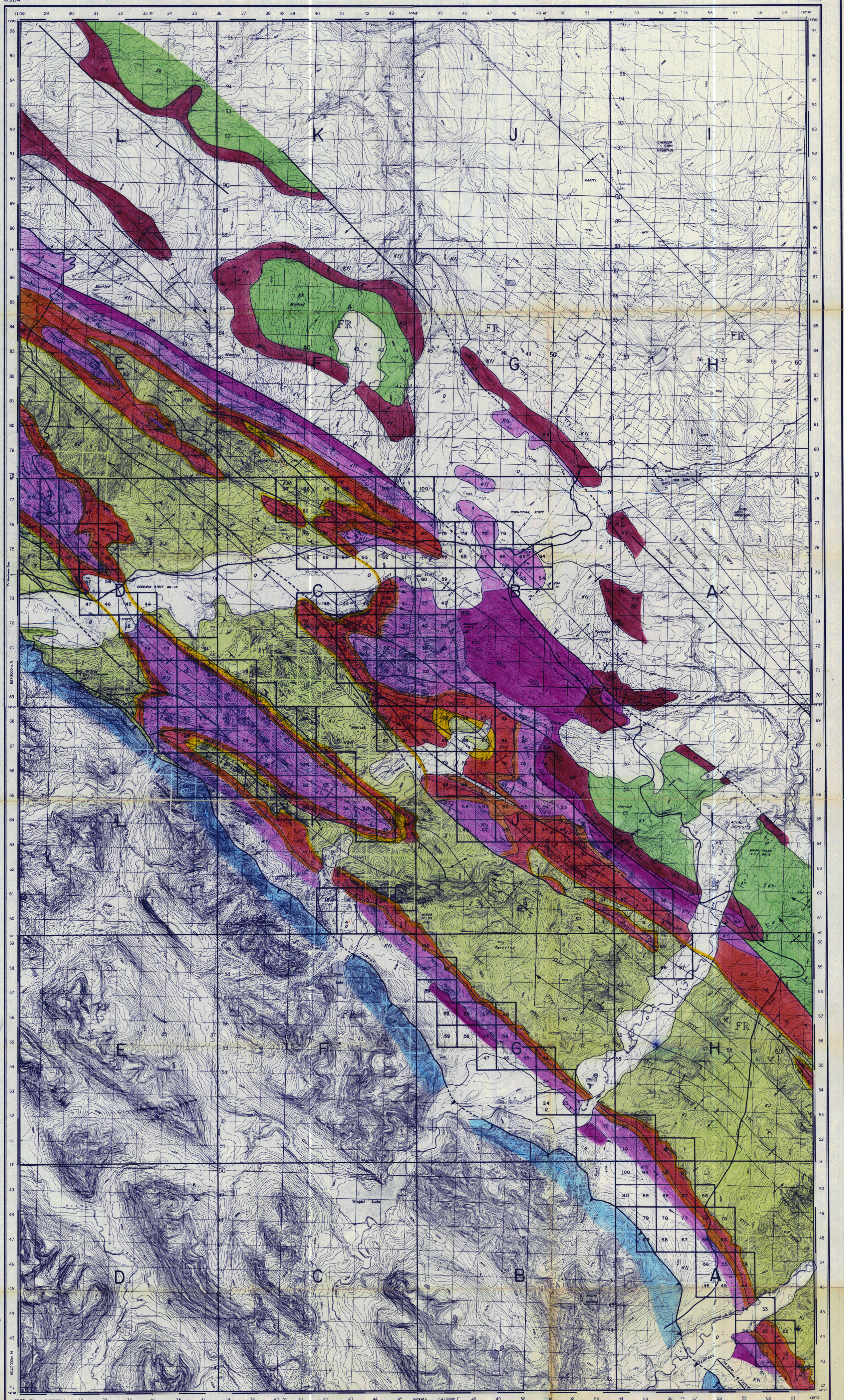
PR-M-B 75(2)A FIG. (3)

540

P/C

93 I/15W

93 I/15E



LEGEND

GEOPHOTO SYMBOLS

QUATERNARY, DRIFT	Q	
KASKAPAU	Kk	
DUNVEGAN	KD	
SHAFTESBURY + KSh	Kfj	
BOULDER		
COMMOTION Co		
THICK COAL → GATES	CO	
MOOSEBAR		
THIN COAL → GETHING	KJ and Kbh	
CADOMIN (CO FOR BASE)		
NIKANASSIN		
PALEOZOICS & TRIASSIC		

GEOPHOTO SYMBOLS

- BEDDING APPEARS HORIZONTAL
- DIP GROUP 1., LESS THAN 3°
- DIP GROUP 2., 3° TO 10°
- DIP GROUP 3, 10° TO 25°
- DIP GROUP 4., 25° TO 45°
- DIP GROUP 5., 45° TO NEARLY VERTICAL

(DIPS IN DEGREES BY A. BROSTOE STUDY 1970)

- BEDDING APPEARS VERTICAL
- OVERTURNED BEDDING
- GENERAL DIP OF BEDS HAVING SUBORDINATE
- DIP AND STRIKE AMOUNT OF DIP CANNOT BE ESTIMATED
- DIP COMPONENT
- FIELD OBSERVED DIP OR COMPONENT
- FAULT NORMAL OR REVERSE
- FAULT, POSITION INDEFINITE
- FAULT, INFERRED
- MAJOR THRUST FAULT, TRIANGLES ON THRUST sh

1 0 1 2 3 Miles

1000 500 0 1000 2000 3000 4000 Metres

540

CANADIAN SUPERIOR OIL LTD.

MONKMAN

COAL LICENCES

GEOPHOTO SURFACE GEOLOGY

Fig. 4

Geology By "Geophoto"	Date Feb. 1975	Drawn By G. Hazal
Revised By G. Hargreaves	Date Dec. 1975	Map № 2332 / 2
Contour Interval	Scale 1:50,000	Base 2332

93 - I - 10 & 15

PR-M-B 75(9A

5. DEC. 1975

MOOSEBAR BY G.E.H., APPROX.

MOOSEBAR RELATIVE TO CD+1000 BY G.E.H.

MOOSEBAR TO BE CONFIRMED

MOOSEBAR, VAGUE THIN; POSITION BASED ON CD+1000

GEOLOGY GENERALIZED FROM A. BROSCOE

664000m. E. 273000m. E. 689000m. E. 289000m. E.

LEGEND

QUATERNARY, DRIFT	Q
KASKAPAU	Kk
DUNVEGAN	KD
SHAFTESBURY + KSh CO,	Kfj
BOULDER COMMOTION Co	
GATES	CO
MOOSEBAR	
GETHING	KJ and Kbh
CADOMIN (CD FOR BASE)	
NIKONASSIN	
PALEOZOICS & TRIASSIC	

THICK COAL

THIN COAL

GEOPHOTO SYMBOLS

- BEDDING APPEARS HORIZONTAL
- DIP GROUP 1, LESS THAN 3°
- DIP GROUP 2, 3° TO 10°
- DIP GROUP 3, 10° TO 25°
- DIP GROUP 4, 25° TO 45°
- DIP GROUP 5, 45° TO NEARLY VERTICAL

(DIPS IN DEGREES BY A. BROSCOE STUDY 1970.)

- BEDDING APPEARS VERTICAL
- OVERTURNED BEDDING
- GENERAL DIP OF BEDS HAVING SUBORDINATE
- DIP AND STRIKE AMOUNT OF DIP CANNOT BE ESTIMATED
- DIP COMPONENT
- FIELD OBSERVED DIP OR COMPONENT
- FAULT, NORMAL OR REVERSE
- FAULT, POSITION INDEFINITE
- FAULT, INFERRED
- MAJOR THRUST FAULT, TRIANGLES ON THRUST s/n

CD+1000 = Coal Horizon by A. BROSCOE (1970)

1 0 1 2 3 Miles

1000 500 0 1000 2000 3000 4000 Metres

CANADIAN SUPERIOR OIL LTD.

BELCOURT

COAL LICENCES

GEOPHOTO SURFACE GEOLOGY

Fig. 5

Geology By "Geophoto"	Date Feb. 1975	Drawn By G. Hozel
Revised By G. Hargreaves	Date Dec. 1975	Map No 2333/2
Contour Interval	Scale 1:50,000	Base 2333

93-1-8

540

PR-M-B 75(2)A

-5. DEC. 1975

FIVE CABIN SYNCLINE

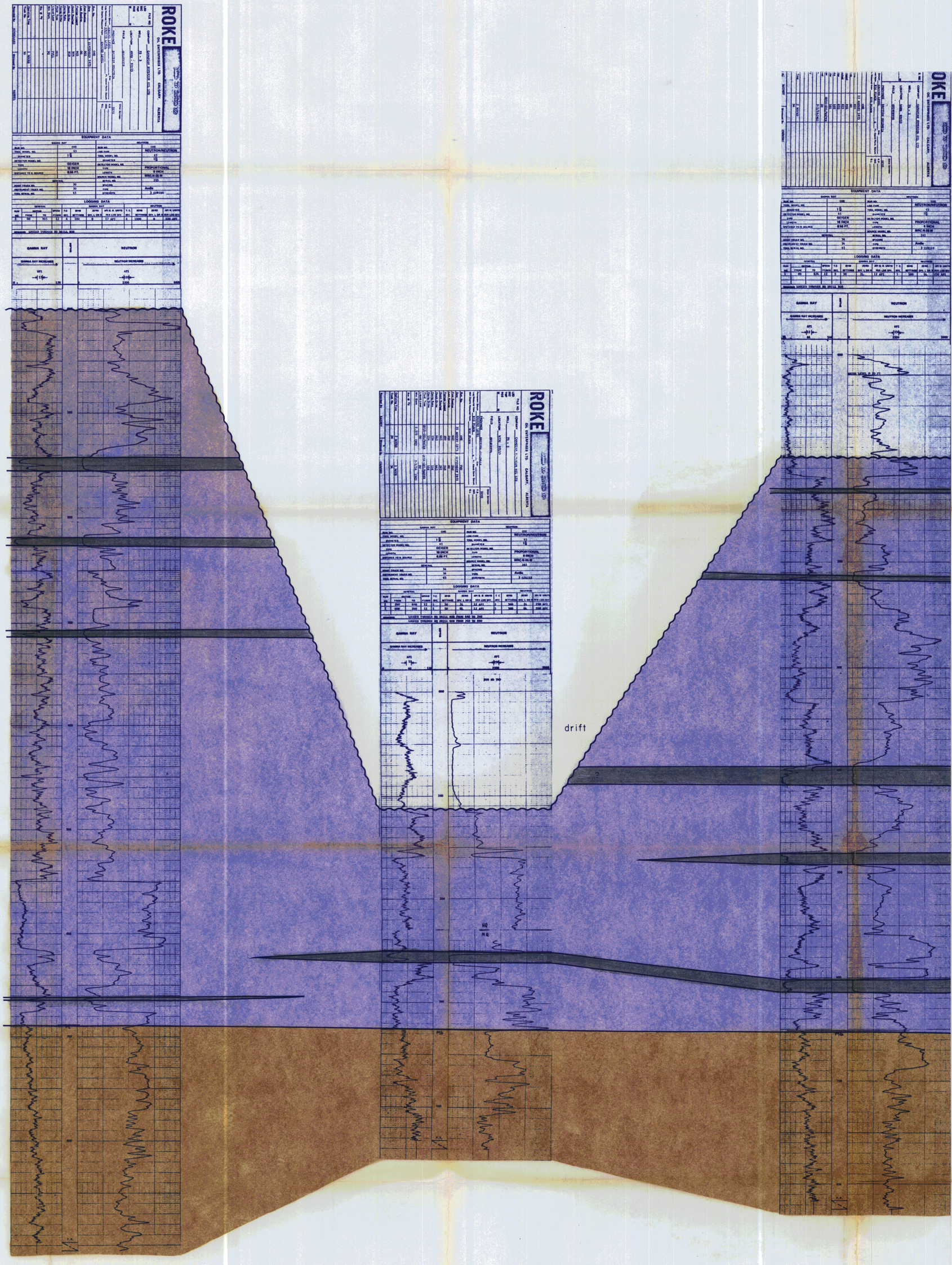
QUINTETTE SYNCLINE

QUINTETTE ANTICLINE

8 miles

2.5 miles

N.W.



540

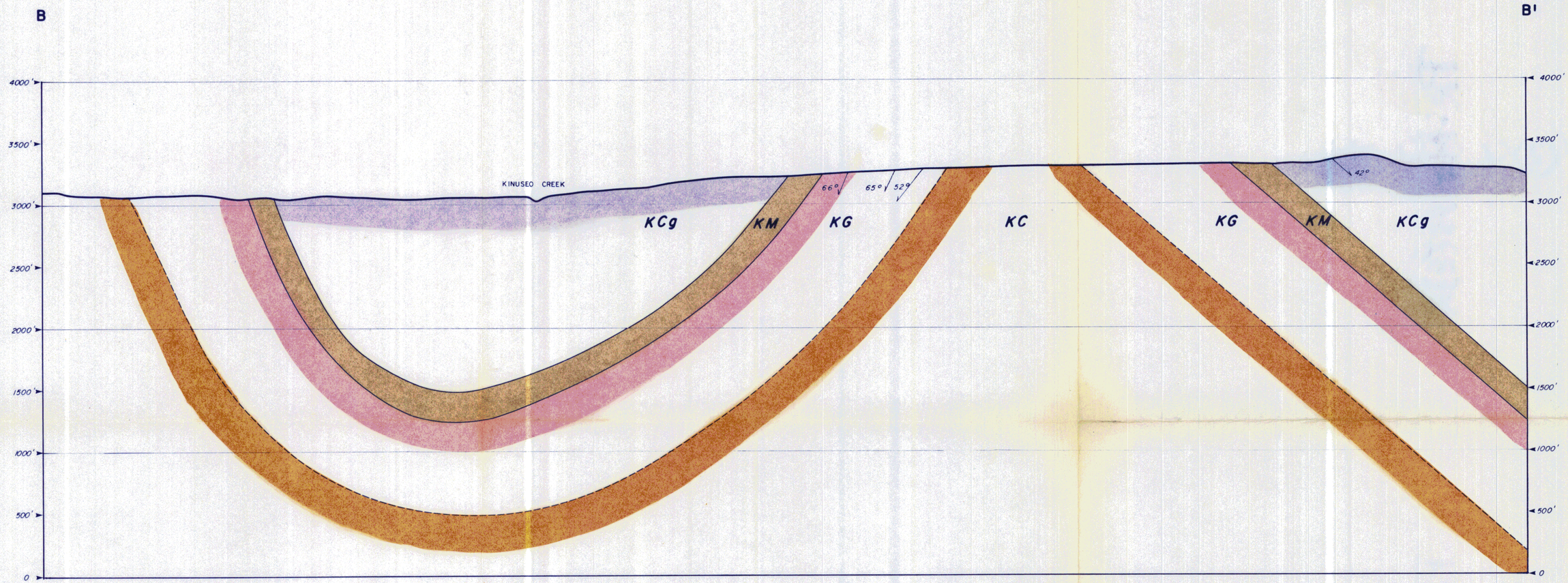
PR-M-B 75(2)A

CANADIAN SUPERIOR OIL LTD.

BELCOURT - MONKMAN
STRATIGRAPHIC CROSS SECTION
COAL CORRELATION

Fig 6.

Geology By G.E. Hargreaves	Date Nov., 1975	Drawn By L.T.
Revised By	Date	Map No 2555 A
Contour Interval	Scale Vert. 1" = 100 Horiz. not to scale	Base



L E G E N D

KS	SHAFTESBURY FM.		FT. ST. JOHN GROUP
KCb	BOULDER CREEK MBR.	COMMOTION FM.	
KCh	HULCROSS MBR.		
KCg	GATES MBR.		
KM	MOOSEBAR FM.		
KG	GETHING FM.		BULLHEAD GROUP
KC	CADOMIN FM.		
KN	NIKANASSIN FM.		

LOWER CRETACEOUS

NOTE

- - - - - - CADOMIN-GETHING CONTACT IS UNCERTAIN.

540

PR-M-B 75(2)A

CANADIAN SUPERIOR OIL LTD.

BELCOURT - MONKMAN AREA

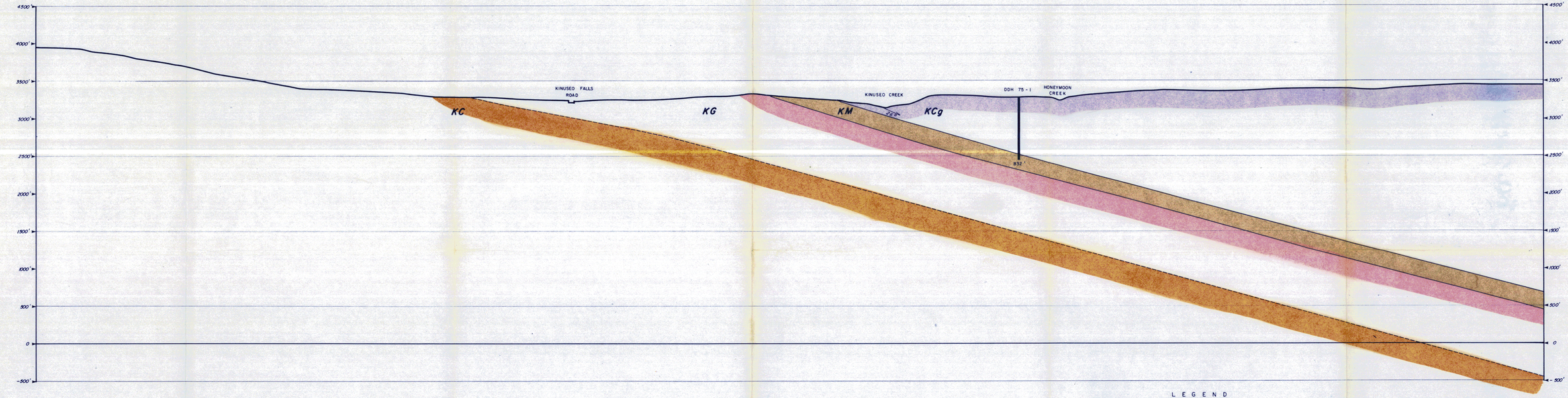
STRUCTURAL CROSS-SECTION

B-B'

FIG. 8.

Geology By P. Dyson	Date Dec. 1975	Drawn By G. Hozoi
Revised By	Date	Map No 2576
Contour Interval	Scale V. 1"-500'	Base

12. DEC. 1975



LEGEND

KS	SHAFTESBURY FM.		
KCb	BOULDER CREEK MBR.	COMMOTION FM.	FT. ST. JOHN GROUP
KCh	HULCROSS MBR.		
KCg	GATES MBR.		
KM	MOOSEBAR FM.		
KG	GETHING FM.	BULLHEAD GROUP	
KC	CADOMIN FM.		
KN	NIKANASSIN FM.		

LOWER CRETACEOUS

NOTE:
- - - - - - - CADOMIN-GETHING CONTACT IS UNCERTAIN

540
PR-M-B 75(2)A

CANADIAN SUPERIOR OIL LTD.

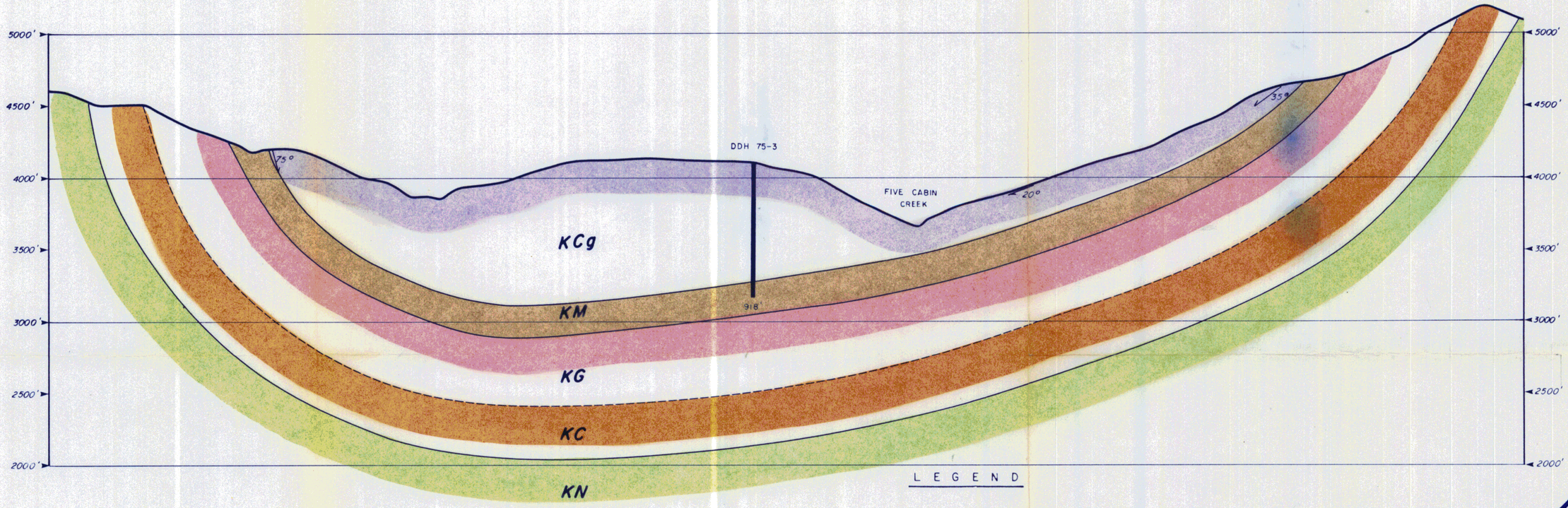
BELCOURT - MONKMAN AREA

STRUCTURAL CROSS-SECTION

C-C'

FIG. 9

Geology By P. Dyson	Date Dec. 1975	Drawn By G. Horzi	
Revised By	Date	Map No 2575	
Contour Interval	Scale V. 1" = 500'	Base	



LEGEND

KS	SHAFTESBURY FM.		FT. ST. JOHN GROUP
KCb	BOULDER CREEK MBR.	COMMOTION FM.	
KCh	HULCROSS MBR.		
KCg	GATES MBR.		
KM	MOOSEBAR FM.		
KG	GETHING FM.		BULLHEAD GROUP
KC	CADOMIN FM.		
KN	NIKANASSIN FM.		

LOWER CRETACEOUS

NOTE

- - - - - - CADOMIN-GETHING CONTACT IS UNCERTAIN

540

PR-MB 75(2)A

CANADIAN SUPERIOR OIL LTD.

BELCOURT - MONKMAN AREA

STRUCTURAL CROSS-SECTION

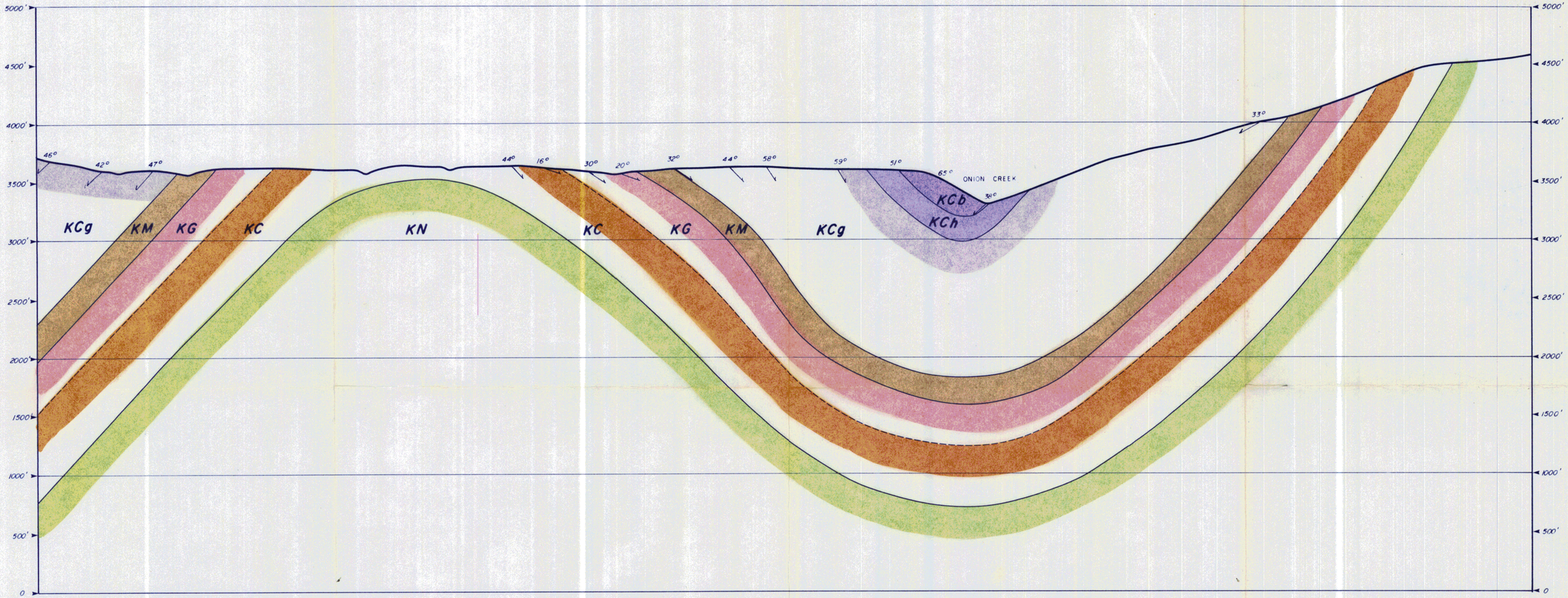
D-D'

FIG. 10

Geology By P. Dyson	Date Dec. 1975	Drawn By G. Hozoi
Revised By	Date	Map № 2574
Contour Interval	Scale v. 1" = 500'	Base

E

E'



LEGEND

LOWER CRETACEOUS	KS	SHAFTESBURY FM.	
	KCb	BOULDER CREEK MBR.	COMMOTION FM. — FT. ST. JOHN GROUP
	KCh	HULCROSS MBR.	
	KCg	GATES MBR.	
	KM	MOOSEBAR FM.	
	KG	GETHING FM.	BULLHEAD GROUP
	KC	CADOMIN FM.	
	KN	NIKANASSIN FM.	

NOTE

– – – – – – CADOMIN - GETHING CONTACT IS UNCERTAIN

540

PR- [redacted] M-B 75(2)A

CANADIAN SUPERIOR OIL LTD.

BELCOURT – MONKMAN AREA

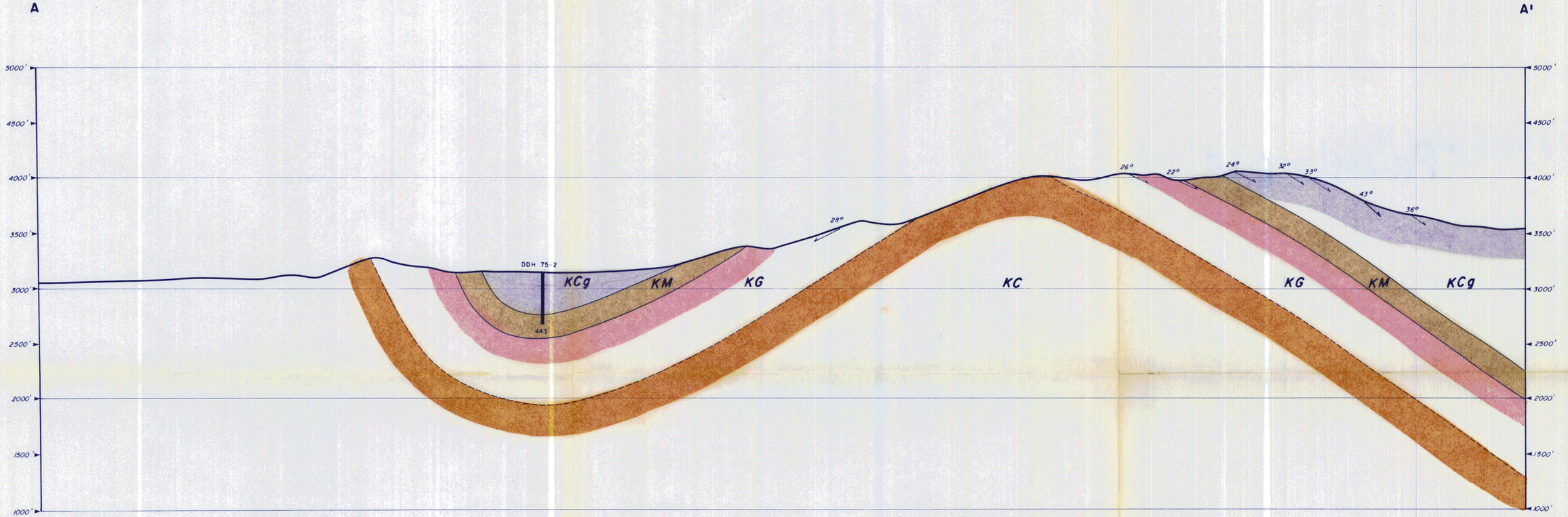
STRUCTURAL CROSS-SECTION

E-E'

FIG. II.

Geology By P. Dyson	Date Dec. 1975	Drawn By G. Hozoi
Revised By	Date	Map No 2573
Contour Interval	Scale Vert. 1" = 500'	Base

12 DEC 1975



LEGEND

KS	SHAFTESBURY FM.		
KCb	BOULDER CREEK MBR.	COMMOTION FM.	FT. ST. JOHN GROUP
KCh	HULCROSS MBR.		
KCg	GATES MBR.		
KM	MOOSEBAR FM.		
KG	GETHING FM.		BULLHEAD GROUP
KC	CADOMIN FM.		
KN	NIKANASSIN FM.		

LOWER CRETACEOUS

NOTE

CADOMIN-GETHING CONTACT IS UNCERTAIN

540

PR-M-B 75(2)A

CANADIAN SUPERIOR OIL LTD.

BELCOURT - MONKMAN AREA

STRUCTURAL CROSS-SECTION

A-A'

FIG. 7.

Geology By P. Dyson	Date Dec. 1975	Drawn By G. Hozai
Revised By	Date	Map No 2577
Contour Interval	Scale V. 1" = 500'	Base

12. DEC. 1975

PR-MONKMAN-BELCOURT 75(3)A

CONFIDENTIAL

APPENDIX A

DETAILED LITHOLOGIC CORE DESCRIPTIONS

DRILLHOLES 75-1, 75-2, 75-3

Logged by: A. Chowdry,
August/September 1974

DDH 75 - 1

0 - 93	Overburden - mostly gravel.
93 - 118	Sandstone/Conglomerates: light grey; sands generaly coarse grained, cherty/quartzose locally well sorted but also exhibiting gradational intervals. Finely pebbly (less than ¼") and gritty at 97 - 107. Bottom 7' medium grained and lighter coloured and calcareous; rest feebly calcareous to non calcareous; much large scale cross bedding; very occasional thin coaly shards. Core fragmented at 95 - 97, 102 - 103 and 106 - 107.
118 - 128	Mudstone: medium to dark grey, very slightly silty, locall 1" - 2" rusty and calcareous bands, very thin carbonaceous layers; coaly/shaly at 122 - 123. Vertically fractured at 127 - 128; mostly non calcareous; gradational below.
128 - 133	Mudstone/Coal: muds dark grey to black, very carbonaceous, middle interval coaly. 50% recovery of entire zone - about 0.8' coal recovered (rest ? lost). Badly fragmented throughout, gradationaly.
133 - 140	Mudstone: medium grey, regular intervals of silts and very fine sands, silts funneled through muds by bioturbation, numerous rusty bands, silty content gradually decreasing towards bottom, slightly calcareous where silty, rest non calcareous, gradational below. BCA 65°.
140 - 141	Mudstone/Sandstone: interbedded muds with very fine sandstone, laminated, micro-erosional contacts, non calcareous, gradational below.
141 - 151	Mudstone: medium grey; little or no silts, very homogeneous look, several 1" rusty bands, generally non calcareous, gradational below.
151 - 162.5	Mudstone: medium grey, few rusty nodules, 1' of distinctly rusty and calcareous mudstone, generally structureless, core much broken up and locally pulverized, non calcareous, transitional.
162.5 - 164	Coal/Mudstone zone: mostly broken up coal with 0.2' of mudstone in middle, gradual below.
164 - 169	Mudstone: medium grey, homogeneously silty and locally very vaguely banded, strongly calcareous throughout, silty content increasing bottomwards.

169 - 171	Siltstone/Mudstone: light/medium grey, about equal proportions, discontinously laminated, very small silty ripples, strongly calcareous, gradual below.
171 - 173	Mudstone: dark grey, slightly carbonaceous, lacking in silts, slightly calcareous, fragmented, gradational.
173 - 174	Mudstone/Siltstone: medium grey; abundant interlayering of silts (1/3 of total), small rusty nodules, wavy to banded appearance, slump lamination in upper half, strongly calcareous, gradual.
174 - 182	Mudstone: medium grey/black, sequence characterized by a broad (1') layering of highly silty and calcareous laminated mudstones with carbonaceous mudstones, non calcareous, gradational.
182 - 183	COAL - clean clarain
183 - 209	Sandstone: Light/medium grey, very fine grained, abundantly argillaceous and silty (30%), interval characterized by wavy/banded laminations caused by regular silt-shale intercalations, much convalute and slump laminations, sporadic burrows, muddy and carbonaceous at 204.5 to 205.5, silty and muddy content increasing towards base, some penecontemporaneous erosion at 208 - 209, strongly calcareous, gradational below. BCA 75°.
209 - 210	Coal/Mudstone zone: mostly bony coal interbedded with highly carbonaceous mudstone.
210 - 218	COAL SEAM 1.5' mostly durain, bottom 0.2' clarain 1.5' mudstone, partially carbonaceous (excluded from sample) 1.0' mixture of durain, friable coal and clarain 1.5' clarain, uniformly clean 1.8' dominantly durain, some 0.4' clarain in middle. 7.3' (91%) recovery
218 - 226.5	Mudstone: dark grey to black, totally devoid of silts, sporadically carbonaceous, structureless, non calcareous, very gradational below.

226.5 - 230	Siltstone: medium grey; argillaceous, few streaks of very fine sands, chaotic appearance due to obliteration of lamination, calcareous, gradational.
230 - 241.5	Mudstone: medium grey, richly silty (20 - 25%), all silty content thoroughly intermixed, structureless, calcareous, very transitional below.
241.5 - 244	Siltstones: medium grey, richly argillaceous, bottomwards getting sandy, very vague and irregular lamination, bottom 1' fractured, calcareous, gradational.
244 - 258	Sandstone: light grey, very fine grained, argillaceous, sporadically laminated (intervening intervals apparently homogenized), bottom 5' generally much cleaner, strongly calcareous, gradational.
258 - 334	Sandstones: light grey; uppermost 12' fine grained with frequent shale lenses (invariably having erosional boundaries with sands), abundant shaly intraclasts. Rest of sands medium to coarse grained, very clean and well sorted in any given interval; quartzose and cherty (30%). Locally coaly shards and core yielding along such planes; many granular and gritty zones; 309 - 310, 319- 327, 328 - 332 (very finely pebbly) and 333 - 334, strongly cross bedded throughout; coarser intervals less calcareous than the finer ones. Lower contact erosional. BCA 75° (average).
334 - 382	Siltstone/Mudstones: light/medium grey, sequence characterized by frequent interbedding of muds and silts with subordinate sands (very fine grained); general banded appearance, some small scale ripple cross lamination; locally much disturbed lamination; sporadic burrows; dominantly silty from 334 - 363; rest predominantly muddy (90%); micro-erosional contacts, strongly calcareous throughout, very gradational lower end. BCA 65°.
382 - 395	Mudstone: dark grey to balck, initial 7' homogeneously silty (less than 10%), rest black and carbonaceous (especially bottomost 3'); very gradational into coal seam.

395 - 413.5	Coal Seam - BCA 70° within the seam.	
	0.5'	Durain, hard coal
	1.5'	Mostly clarain
	0.2'	Mudstone, very carbonaceous
	1.5'	Dominantly clarain
	2.7'	Clarodurain and clarain.
	1.6'	Bands of clarain and durain .
	2.5'	Clarain
	1.2'	Clarain and Durain
	5.0'	Dominantly vitrain, some clarain.
	16.7	(Recovery 90%)
413.5 - 426	Sandstone: light/medium grey; very fine grained, three muddy intervals aggregating 2.5'; irregularly laminated and cross laminated; fine silty intraclasts at 418 - 419.5; mudstones in middle have coaly streaks; feebly calcareous to non calcareous; gradational. BCA 73°.	
426 - 461.5	Sandstones: light grey, fine grained, frequently laminated and low angled, rippled cross lamination, some silty laminae; between 434 - 437 primary sedimentary lamination almost obliterated; shaly intercalation: 427-428.3 and with burrows, calcareous throughout, very gradational below. BCA 70°.	
461.5 - 465	Sandy/Silty Mudstone: medium grey, laminated and banded, silty-sandy content (30%), muddy content increasing rapidly bottomwards, calcareous, very gradational.	
465 - 479	Mudstone: dark grey to black, predominantly carbonaceous especially bottom 1', very gradational into coal seam.	
479 - 493	Coal Seam.	
	1.0'	Vitrain and durain, 1" dirt band in middle.
	3.0'	Clarain
	0.7'	Friable coal.
	1.0'	Clarodurain
	1.0'	Durain with subordinate claradurain
	3.3'	Clarodurain (very clean)
	10.0'	(Recovery 71%)

493 - 509.5	Mudstone: medium grey, initial 2' very sandy, grading into 5' of fine to very fine grained richly argillaceous sands, black and carbonaceous last 3', non calcareous throughout, abrupt lower contact. BCA 70°.
509.5 - 533	Sandstones: light/medium grey; fine/medium grained, generally clean, cherty quartzose, characterized by frequent carbonceous laminae, certain intervals totally homogenized and structureless, good graying burrowed zone at 515 - 516, shaly band at 517.5 to 518, elsewhere sporadic burrows, non calcareous, fining bottomwards.
533 - 553.3	Mudstone/Sandstones: light/medium grey, slight dominance of muds, sequence characterized by frequent broad interbedding of lithologies, generally with abrupt contacts but locally grading from sands to silts to muds, sands very fine grained, well laminated, feebly calcareous, some rusty bands and nodules within muds, distinctive slump unit at 533 - 536; muds non calcareous, abrupt below.
553.3 - 557.5	Sandstones: light grey, quartzose, upper half fine grained, lower half showing gradations from fine to medium with a smattering of coarser grains, vaguely laminated, non calcareous, erosional below.
557.5 - 558.5	Coal/Shale Zone: erosional below.
558.5 - 601.5	Sandstones: light/medium grey, medium (generally) grained, locally layers and laminae of coarse grained sands, about 25 - 30% cherty content; uppermost 10' generally lacking laminations and the bottomost 10'; rest well laminated and cross laminated and has some slightly banded appearance, mostly clean and well sorted; mudstone band at 586.5 to 588 and 589 to 590; non calcareous, abrupt below. BCA 70°.
601.5 - 603	Mudstone: dark grey/black, carbonaceous, upper half silty and sandy stringers, gradational to coal.

603 - 615.5	Coal Seam.
	1.3' Clarain 0.5' Durain 0.7' Clarain 1.0' Durain 0.9' Clarain and durain 0.8' Mudstone with 0.2' sandstone in middle. BCA 70° 3.0' Durain 8.2' (Recovery 70%) Mudstone band excluded from sample.
614.5 - 624.5	Mudstone: dark grey/black, carbonaceous, very fine grained sand intervals, laminated, non calcareous, erosional below.
624.5 - 627.5	Sandstones: light/medium grey; very fine grained, locally bioturbated, slightly argillaceous in lower half, feebly calcareous, gradational.
627.5 - 630	Mudstones: upper half medium grey with rusty bands, lower half light colored and richly silty and calcareous, very gradational below.
630 - 635	Sandstones: light/medium grey, dominantly very fine grained, 0.5' shaly sequence at upper 1.5', very argillaceous and gradational lower end, strongly calcareous.
635 - 636.5	Mudstones: black, slightly carbonaceous, structureless, gradational below.
636.5 - 638.5	Sandstones: medium grey, very fine grained, abundantly argillaceous as laminae and layers (up to 20%), slightly burrowed, calcareous, gradational.
638.5 - 640	Mudstones: dark grey/black, slightly silty in middle, slightly carbonaceous, very abrupt below.
640 - 702	Sandstones: light grey, 640 - 675 generally medium grained, 675 to bottom fine/medium grained, general tendency to fine bottomwards, cherty (15%) very clean and well sorted throughout, upper 20' locally lacking any lamination, much cross bedding, between 672 and 680 very characteristically burrowed, and seems to conform to Basal Gates

640 - 702 (Cont'd.)	horizon (so readily discernible in the field), sporadically calcareous, very gradational below, in this unit the basal cut-off is very arbitrary - it is intended to emphasize the level beyond which the first shale intercalations appear. BCA 70° at 660; BCA 70° at 684.
702 - 766 BCA 70°	Sandstones: fine grained, light grey, very clean, well laminated, strongly calcareous, constituting 80% of sequence, mudstones occur as ¼" and upwards, layers with sharp mutual boundaries, many flame structures; abundant burrowing within shales, shaly element mainly increasing in the lower half, calcareous to non calcareous.
766 - 832	Mudstones/Sandstones: Moosebar Formation sequence generally rapidly interbedded with very fine sands and shales, erosional mutual boundaries, shales abundantly burrowed ranging from pinheads to several mm, significant sand bands between 793 to 795 and 822 to 824.5, sand strongly calcareous, shales feebly calcareous. BCA 70°.

T.D.

DDH 75 - 2

0 - 115	Triconed; overburden; mostly gravel, 1' present (obviously a boulder).
115 - 120.5	Siltstone/Mudstone: medium grey; dominance of muds; very fine sandy stringers; locally laminated; non calcareous; abrupt below.
120.5 - 136.0	Sandstone: light medium grey; fine grained; initial 2' shale stringers; laminated and cross laminated throughout; pronounced carbonaceous laminae sporadic; few burrows in initial 3'; non calcareous; BCA 65°; abrupt below.
136 - 138.5	Mudstone: medium grey; silty especially ypper half; vaguely laminated where silty; few fine sandy stringers lower 1'; thin rusty bands; non calcareous; abrupt.
138.5 - 140.5	Sandstone: light grey; very fine grained; abundant intraclasts in upper ½'; clean; low angle cross lamination; sharp below but not erosional.
140.5 - 144	Siltstone: medium dark grey; clean; non calcareous; abrupt.
144 - 148	Sandstone: light grey; very fine grained; slightly argillaceous; rusty nodules upper half; 146 to 146.8 high dip approximately 80°; non calcareous; abrupt.
148 - 152	Sandstone/Mudstone: upper 2½' very fine grained sands which are structureless and clean; rest muds with sandy intercalations and laminated; rusty bands; gradational.
152 - 157	Sandstone: light grey; medium grained; upper half gradations fine to medium to coarse grained; very clean; cross bedded; 2" rusty band at 156; feebly calcareous; gradational below.
157 - 160	Sandstone: light medium grey; fine to medium grained; abundant shale clasts due to bioturbation' 2" rusty band near top; non calcareous; abrupt.
160 - 179	Sandstone: light grey; medium grained; locally coarse grained; few less than ¼" pebbles; clean; cherty 25%; cross bedded; gradational zones; lower 3' mainly fine grained with less than ½" intervals of coarse sandstone; non calcareous. BCA 70°; gradational.

179 - 256	Sandstone: light grey; fine to medium grained; fairly clean; locally laminated and cross laminated, but mostly homogeneous characterized by intensive bioturbation; patches of mud floating in sand matrix; many large burrows; small scale burrows; lower 18' has 5% argillaceous content thoroughly intermixed; lower 2' medium sand with 35% cherts; at base (3") pebbles maximum diameter 3/4"; at base (1") richly pyritic mudstone; BCA 70°; calcareous; abrupt.
256 - 263	COAL - recovery 20% Upper half, durain, clarain; lower half mostly muddy. Sampled.
263 - 265	Mudstone: black; carbonaceous.
265 - 265.5	COAL
265.5 - 268	Sandstone: medium grey; very fine grained; argillaceous; non calcareous; gradational.
268 - 280	Sandstone/Siltstone: medium grey; interbedded sequence of argillaceous silts and very fine sands; small scale cross lamination; many burrows; non calcareous except lower 2'; BCA 70°; gradational.
280 - 323	Sandstone: light grey; dominantly fine grained; clean; well sorted; laminated, cross laminated zones of intraclasts; 309 - 310, 319.5 - 321.0; quartzitic; strongly calcareous; gradational below.
323 - 328	Sandstone: light grey; medium coarse grained; cross bedded; coaly stringers, shards; mud clasts; strongly calcareous; fining bottomwards.
328 - 373.5	Sandstone: light grey; fine grained; clean, well sorted; upper 20' bioturbated; rest shows cross lamination (low angle); quartzitic; strongly calcareous; gradational.
373.5 - 408	Sandstone/Mudstone: similar to above interval except interbedded silts, muds 10%; shales having typical Moosebar features; calcareous; continuous.
408 - 443	Moosebar shales and sands: 70% shales; 408 - 423 35% sands; 427 to 443 30% sands; burrowed; micro-erosional contacts of sands with muds; calcareous; BCA 75%.

T.D.

DDH 75 - 3

0 - 12	Triconed; overburden; clay and gravel.
12 - 25	Sandstone: light medium grey; fine grained; distinct mottling by argillaceous content, i.e. whirling of laminae; 17½' - 19' dark grey, muddy sandstone, very fine grained; non calcareous; BCA 87°; abrupt below.
25 - 58	Mudstones/dark grey/black; little or no silt; rusty bands; devoid of lamination; 55.5 - 56.5 rust band, heavy; locally carbonaceous; non calcareous; transitional below.
58 - 59	COAL.
59 - 65	Mudstone; black; carbonaceous; coaly layers; clay band at 59.5'; non calcareous; gradational.
65 - 70	Mudstone: dark grey; silty upper 1.5'; slight carbonaceous lower half; non calcareous; gradational.
70 - 75	Siltstone/Mudstone: medium grey; initial half muddy; lower half silty; structureless; non calcareous; very gradational.
75 - 87	Sandstone: medium grey; fine to very fine grained; argillaceous (as discrete layers and admixed matrix) 15%; vaguely laminated; non calcareous; BCA 85°; very gradational.
87 - 94	Sandstone: light grey; places dark grey; carbonaceous admixture; initial 2' fine grained; rest medium grained and dirty; carbonaceous laminae; fine intraclastic zones; non calcareous, very abrupt and polished.
94 - 108	Mudstone: dark grey; structureless; carbonaceous at 98 to 100 and 101 to 103; non calcareous; abrupt below (not erosional).
108 - 111	Sandstone: light grey; fine grained; layers of shales with erosional contacts with sands; sparse shale clasts; cross laminated; passes below by interbedding; non calcareous.

111 - 117	Mudstones: dark grey; homogeneously silty; upper 2' rusty; coal streaks; bottom 1½' has poorly define sand and silt layers with ndoular appearance; non calcareous; abrupt (not erosional).
117 - 120	Sandstone: medium grey, richly muddy 30%; very fine grained; gradational bands; upper half well laminated; lower half flow lamination; patchy calcareous; BCA 85°; interbedded below.
120 - 135	Mudstone/Sandstone: alternating bands; very fine grained sandstone; micro-erosional contacts; some gradational contacts; sporadic burrows; slump lamination at 123; interval appears banded; dominance of muds; patchy calcareous; gradational below.
135 - 146	Mudstone: dark grey; structureless; lower 2' carbonaceous; non calcareous; gradational.
146 - 157	COAL - recovery 95% (10.8' out of 11')

1.0'	Bone coal
1.0'	Durain
2.0'	Clarodurain
0.5'	Friable coal and clarodurain
1.0'	Clarodurain, clarain, ½" fusain.
0.5'	Hard durain, .3' mudstone
0.5'	Clarain
0.8'	Durain
0.5'	Mudstone(carbonaceous) and bone coal
0.4'	Durain
1.0'	Clarain
1.6'	Clarodurain and durain (lower half durain)

All sampled.

157 - 159.5	Mudstone: black; upper half coaly; lower silty; gradational.
159.5 - 208	Sandstone: light/medium grey; dominantly fine grained; upper 10' 15% argillaceous and very fine grained; rest 5% shales interspersed irregularly laminated and cross laminated; clean sands at 187.5 - 190.5, 192.5 to 195.0; lower 12' burrowed; calcareous (strong); abrupt (not erosional); BCA 82°.

208 - 211	Mudstone: medium grey; structureless; silty; calcareous; gradational below.
211 - 216.5	Siltstone/Sandstone: medium grey; very fine sands; obscurely laminated; calcareous; gradational below.
216.5 - 219.5	Sandstone: light grey; fine/medium grained; upper 1' argillaceous and cross laminated; rest clean; calcareous; lower 0.8' muddy;
219.5 - 229	COAL - recovery 95% (9.3' of 9.5') 1.0' Durain (hard) 0.5' Bone coal 0.2' Silty mudstone 1.0' Durain (hard) 6.6' Clarain All sampled.
229 - 231.0	Mudstone: black; ½' coal in middle.
231.0 - 232.5	Sandstone; medium grey; very fine grained; argillaceous top; slight lamination; calcareous; erosional.
232.5 - 234.5	Mudstone/dark grey; upper half silty; lower half carbonaceous; gradational.
234.5 - 239	Sandstone: fine grained; light grey; ½' shale intraclasts (flat); cross bedded; calcareous; erosional below.
239 - 249	Mudstone/Sandstone: medium grey; interbedded; very fine sands; banded; muds dominate; sandy bottom; calcareous; gradational.
249 - 254	Sandstone; medium grey; very fine grained; highly argillaceous bands and matrix (20%); irregular laminated; calcareous; BCA 78°; gradational below.
254 - 261	Mudstone: black, rusty nodules; carbonaceous; coaly top 1½'; non calcareous; gradational.
261 - 269.5	Mudstone/Siltstone: dark grey; 75% muds; mottling zones; bottom 1' fine grained sand stringers; ripple laminations; calcareous; BCA 80°; abrupt below.

269.5 - 271	Sandstone: light grey; very fine grained; strongly calcareous; clean; small scale cross lamination; gradational below.
271 - 281	Mudstone: medium grey; very silty; very fine sand stringers; distinct sandstone band at 278.5 to 279.5 with erosional contacts; calcareous interbedded below.
281 - 288	Sandstone: light grey; fine grained; clean; regular laminations; middle 1' ripple cross laminations emphasized by finely mascerated carbonaceous matter; ½' mud at 284.5; calcareous; BCA 80°; abrupt below.
288 - 303	Mudstone: black; structureless; non calcareous; gradational below.
303 - 308	Siltstone: medium grey; argillaceous; thin very fine sandstone; wzvy lamination; bottom 1' muddy; calcareous; gradational below.
308 - 309.5	Mudstone: black; slightly carbonaceous; non calcareous.
309.5 - 316.5	COAL - recovery 95% (6.8' of 7.0') 3.5' Durain (hard) 2.0' Clarodurain (60%) Durain (40%) 0.3' Friable coal 1.0' Clarain All sampled.
316.5 - 322	Mudstone: dark grey; carbonaceous; top 1' has .3' coal; silty; non calcareous; gradational below.
322 - 331	Siltstone/Mudstone: medium grey; silts dominate; vague lamination; calcareous; 1' coal mudstone at base; gradational below.
331 - 337	Sandstone: medium grey; very fine grained; ; argillaceous 25%; discontinuously laminated; BCA 85°; feebly calcareous; gradational.
337 - 345	Mudstone: medium grey; upper 2' coaly; rest carbonaceous and silty; vague lamination; calcareous where silty; gradational below.
345 - 348	Sandstone: medium grey; very fine grained; argillaceous; closely banded zones gradational.

348 - 353	Mudstone/Siltstone: medium grey; intermixed; rusty nodules in middle; non calcareous; gradational.
353 - 355	Sandstone/Siltstone: interbedded; thixotropic mud movement; calcareous; fractured lower contact.
355 - 383	Mudstone: medium grey; silty (30%); banded slightly; 371' to 374 strongly calcareous; rest feeble calcareous; gradational.
383 - 387.5	Siltstone: medium grey; argillaceous; 384.5 - 385 very fine grained sand; calcareous; very gradational below.
387.5 - 396.5	Sandstone: medium grey; very fine grained; locally silty; argillaceous laminae; muddy at 393 to 394; small scale ripple cross lamination and cross lamination; 2" intraclastic zone near base; calcareous; BCA 85°; scoured bottom contact.
396.5 - 398	Siltstone: medium grey; muddy; laminated; calcareous; gradational.
398. - 404.5	Mudstone: initial 1½' medium grey silty calcareous; rest black carbonaceous; two 3" coal zones; lower 1' silty.
404.5 - 407.5	COAL - recovery 80% Upper 1' wet, muddy coal; lower 2' friable coal.
407.5 - 409	Sandstone: medium grey; initial ½' muddy, fine grained with 2" coal seam; rest clean fine grained; well laminated; non calcareous; abrupt.
409 - 418	Mudstone: black; upper 5' has interbedded coal (35%) with mud; lower 1½' very carbonaceous and coaly;
418 - 428	Siltstone/Mudstone: medium dark grey; upper 2' muddy, rusty broadly banded; lower 2' silty; calcareous throughout; gradational.
428 - 436	Sandstone/Siltstone: medium grey; sands to silts; very fine grained sands; interbedded; lower 4' burrowed; strongly calcareous; BCA 80°; gradational.
436 - 439.5	Mudstone: medium grey; silty; strongly calcareous.
439.5 - 442	Mudstone: upper half coaly; lower half homogeneous; non calcareous; gradational below.

442 - 449	Sandstone: medium grey; very fine grained; argillaceous; coal streaks; flow lamination; weakly calcareous; abrupt.
449 - 450.5	Mudstone: dark grey; carbonaceous; pyrite upper half; non calcareous; gradational.
450.5 - 453	COAL - recovery 95% Upper half, durain (hard); lower half, clarodurain. Not sampled.
453 - 457	Mudstone: 30% dispersed coa; non calcareous; gradational below.
457 - 463	Sandstone: light medium grey; upper 1' very fine grained argillaceous (30%); rest clean fine grained; cross laminated; calcareous; very gradational below; BCA 80°.
463 - 469	Mudstone: upper 1½' silty medium grey; rest dark grey, carbonaceous; lower 1' rusty; abrupt below.
469 - 470	COAL.
470 - 473.5	Mudstone: medium grey; silty; rusty bands; weak calcareous; structureless; gradational below.
473.5 - 475	Siltstones: medium brownish grey; strong calcareous; banded vaguely; burrowed.
475 - 476	Sandstone: light medium grey; fine grained; laminated and cross laminated.
476 - 482	Mudstone: medium grey; silty; strongly calcareous.
482 - 484	COAL.
484 - 487	Mudstone: very silty; medium grey; rootlet-like structures; non calcareous.
487 - 490.5	Siltstone: argillaceous; upper 1½' sandy; structureless; non calcareous; gradational.
490.5 - 504	Sandstone: light/medium grey; very fine grained; cross laminated; argillaceous (20%); muddy bottom lower 1' clean fine grained; non calcareous; abrupt; BCA 80°.

504 - 513	Mudstone: carbonaceous; silty; dark grey; coal stringers; non calcareous; bedding surfaces polished 511 - 513; fractured below. BCA 50°.
513 - 514.5	Siltstone: very fine sandstone; argillaceous; slickensided; BCA 60°; possible fault zone; sheared below.
514.5 - 516	Mudstone: dark grey; silty; slightly carbonaceous; abundant slickensides; sheared below.
516 - 527	Sandstone: medium grey; initial 2½' medium grained and coaly; vague lamination; rest fine grained; argillaceous; cross laminated sandstone and muddy siltstones.
527 - 528.5	Sandstone: cross laminated; coaly; gradational below. BCA 80°.
528.5 - 540	Sandstone: medium grey; very fine grained; bottomwards silty; some mud; laminated; non calcareous; gradational below.
540 - 543	Sandstones: fine to medium grained; medium grey; laminated; argillaceous; non calcareous; gradational.
543 - 550.5	Mudstone: silty; coal streaks; non calcareous.
550.5 - 553	COAL - abrupt below.
553 - 619	Sandstone: light/medium grey; medium grained; coarsens bottomwards; quartzitic; clean well sorted; cross bedded; slight calcareous; BCA 80 to 85°; laminations; abrupt below. Note: Interval 606 - 615 exhibits no laminations, well sorted, fine to medium grained.
619 - 623.5	Mudstone: black; silty; carbonaceous; coaly shards and stringers; structureless for most part; non calcareous; core broken; gradational below.
623.5 - 626.5	Siltstone/Sandstone: medium grey; silts - sands; very argillaceous; very fine grained sands; laminated and wavy laminated; interbedded series of silts and sands; muddy bottomwards; calcareous where silty otherwise non calcareous; gradational below. BCA 75°.

626.5 - 629.5	Mudstones: dark grey; structureless; silty; random and few coaly shards; non calcareous; top 3" soft, crumbly shale; abrupt (but not erosional).
629.5 - 635	Sandstone: light grey; very fine grained; well laminated and some cross lamination; strongly calcareous; erosional below.
635 - 642	Sandstone: light grey; dominantly medium grained; shale intraclasts at 639'; occasional 1" silty band with scoured bottom; few sedimentary structrues; strongly calcareous; erosional below.
642 - 656	Sandstone: medium grey; very fine to fine grained; few large burrows at base; flow lamination and regular lamination; locally medium grained; strongly calcareous; BCA 80°; gradational below.
656 - 659.5	Mudstone/Coal: dark grey/black; muds to coal (70%/30%); lower 1' muds, slightly silty, carbonaceous; coaly stringers; rest similar buth coal zones thicker (up to ½"); non calcareous; transitional below.
659.5-666.5	Siltstone/Mudstone; medium/dark grey; silts -muds (65%/35%); carbonaceous; many plant fragments; coaly shareds; stringers; structureless; silts interbedded with muds with gradational contacts; silts are muddy and muds are silty; non calcareous; transitional.
666.5 - 668	COAL - 95% recovery - Clarain - not sampled.
668 - 671	Mudstone: dark grey; structureless; non calcareous; 4" coal at base; gradational below.
671 - 674	Sandstone: medium grey; very fine grained; silt layers; poorly laminated; plant fragments; weakly calcareous; abrupt (not erosional) below; BCA 65°.
674 - 677.5	Mudstone/COAL: dark grey/black; thin coal (½") seams within muds; muds carbonaceous; slightly silty; non calcareous; coal = 10% of unit; gradational below.
677.5 - 690	Sandstone: light/medium grey; medium grained; locally fine grained; top 5' homogeneous; structureless clean well sorted; rest laminated and cross laminated; carbonaceous laminae sporadic; occasional shale/siltstone layer (1"); non calcareous; gradational below.

690 - 699	Sandstone: medium grey; fine to medium grained; calcareous; laminated; silt layers grading into sands; BCA 75°; gradational below.
699 - 728	Sandstone: light/medium grey; fine to medium grained; few laminations upper half; lower silty layers and more laminations; many large scale burrows; occasional shale clasts floating in sand due to bioturbation; calcareous; BCA 85°.
728 - 774	Sandstone: light grey; dominantly fine grained; upper 5' medium grained; structureless; then 6' laminated, fine grained; rest sporadically laminated and occasional fine carbonaceous material floating in sandy matrix; 755.5 to 755.8 and 764 to 764.4 silty intraclasts and disrupted laminae with erosional contacts with sand; strongly calcareous; BCA 85°.
774 - 828	Sandstone/Mudstone: medium grey and dark grey; sands grading to muds; thick sand zones (very fine grained) alternating with thin mud zones through erosional contacts; shale intraclasts often floating within sand matrix; sands with wavy lamination, regular lamination and cross lamination; sandy zones calcareous; muddy zones non calcareous; muds increasing bottomwards; BCA 80° at 780; BCA 78° at 814; transitional below.
828 - 918	Shales/Sandstones: dark grey, many micro-burrows within shales; shales are 80% of unit; patches of very fine grained sand cross laminated, calcareous; contacts are erosional; the top contact of unit is arbitrary and represents Gates/Moosebar contact below which shales become most predominant; flame structures; shale intraclasts within sandy zones; muds non calcareous to slightly calcareous.

T.D.

PAUL DYSON CONSULTANTS

STRATIGRAPHIC LOG

540

DRILL HOLE DDH 75-1 AREA Kinuseo Creek

COMPANY Canadian Superior Oil Ltd.

COORDINATES 54° 40' 0" N ; 120° 43' 25" W (unsurveyed)

GROUND ELEVATION 3300' + TOTAL DEPTH 832'

MECHANICAL LOGS RUN Gamma Ray/Nuetron; Density

DRILLING METHOD Diamond; wireline

HOLE SIZE HQ DATE OF COMPLETION August 23, 1975

LOGGED BY A. Chowdry

REMARKS Vertical hole

LITHOLOGIC SYMBOLS

Breccia | Conglomerate | Sandstone | Calcareous sandstone | Siltstone

Coal | Sandstone beds with shale partings | Mudstone / Sandstone | Mudstone or massive claystone | Shale

Mudstone / Siltstone | Unexposed

FORMATION	DEPTH	LITHOLOGY	GRAIN SIZE (VFM, F, M, C, VC)	ANGLE OF BEDDING RELATIVE TO BORE HOLE	DESCRIPTION
	80				
	100				
	120				
	140				
	160				
	180				
	200				Dominantly durain 210 to 218; 91% recovery; analyses of composite sample of floats at 1.60 S.G. and Stage 1 froth flotation: Total Yield 81.1%; R.M. 0.7%; ash 11.0%; V.M. 21.9%; F.C. 66.4%; S 0.5%; F.S.I. 7
	220				
	240				
	260				
	280				
	300				
	320				
	340				
	360				
	380				
	400				Dominantly clarain and durain 395 to 413.5; 90% recovery; analysis of composite sample (as above): Total yield 88.8%; R.M. 0.8%; ash 8.0%; V.M. 22.8%; F.C. 68.7%; S 0.22%; F.S.I. 7.
	420				
	440				
	460				Clarodurain and clarain 279 to 473; 71% recovery; analysis of composite sample: Total yield 91.5%; R.M. 0.7%; ash 5.8%; V.M. 22.5%; F.C. 71.0%; A 0.42%; F.S.I. 9.
	480				
	500				
	540				
	540				
	560				
	580				
	600				Clarain and durain 603 to 614.5. 70% recovery: analysis of composite sample: Total yield 94.8%; R.M. 0.6%; ash 6.0%; V.M. 21.9%; F.C. 71.5%; S 0.38%; F.S.I. 8%.
	620				
	640				
	660				
	680				
	700				
	720				Much burrowing within clean, well sorted sand.
	740				
	760				Arbitrary contact of Gates formation and underlying Moosebar formation at 766.
	780				
	800				
	820				
	832				

PR-M-S 75(3)A

PAUL DYSON
CONSULTANTS

STRATIGRAPHIC LOG

540

DRILL HOLE DDH 75-2 AREA Kinuseo Creek

COMPANY Canadian Superior Oil Ltd.

COORDINATES 54° 48' 35" N; 120° 47' 06" W (unsurveyed)

GROUND ELEVATION 3150 + TOTAL DEPTH 443'

MECHANICAL LOGS RUN Gamma Ray/Neutron; Density

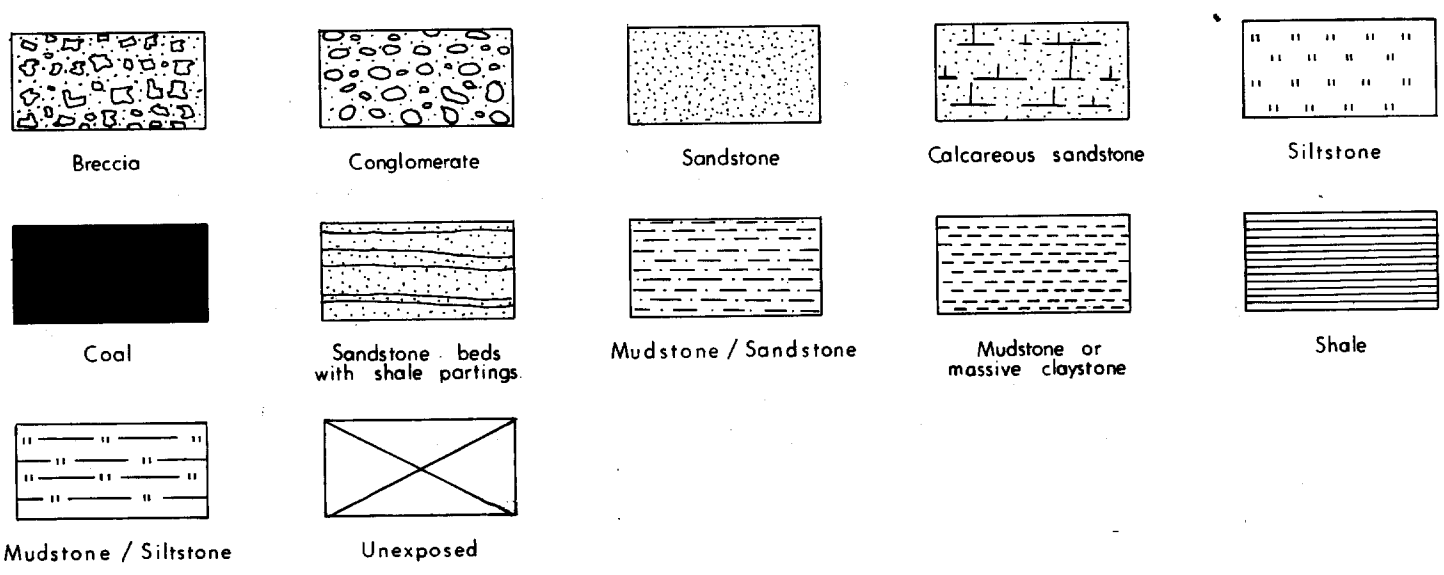
DRILLING METHOD Diamond; wireline

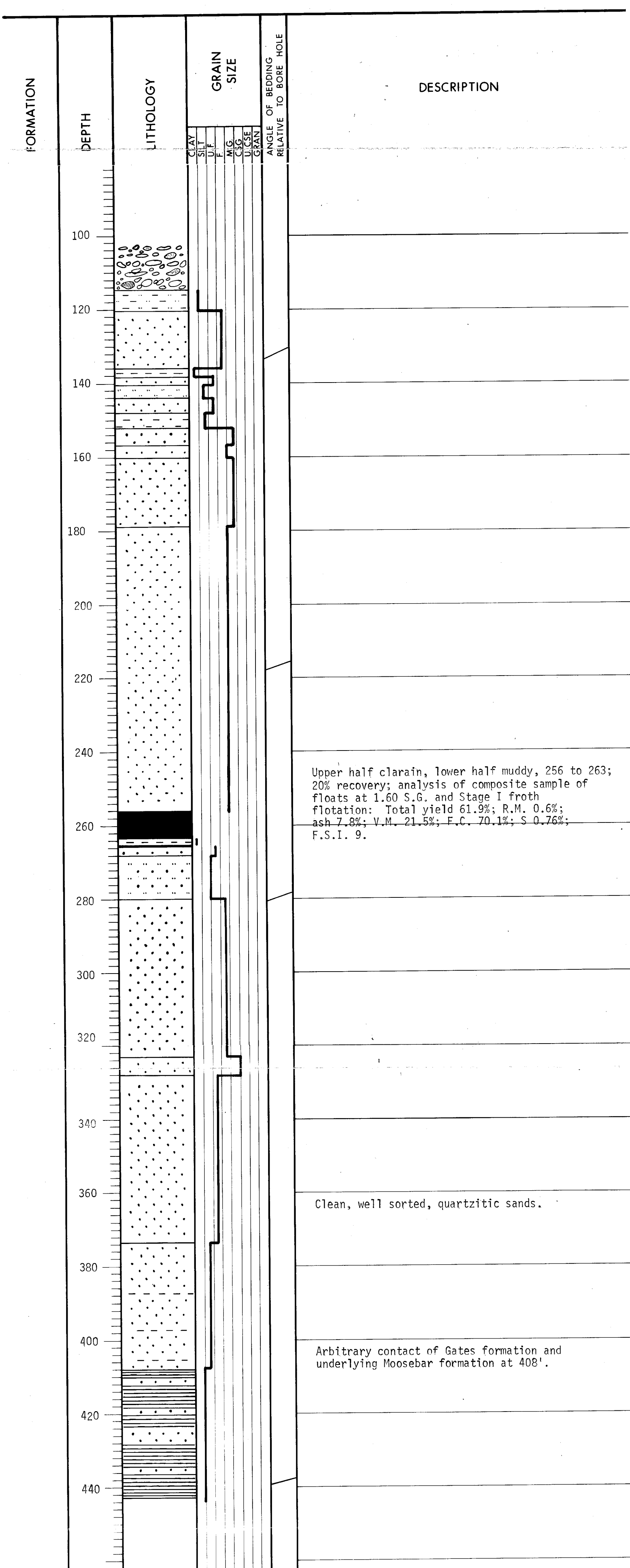
HOLE SIZE HQ to 250'; remainder NQ DATE OF COMPLETION August 30, 1975

LOGGED BY A. Chowdry

REMARKS Vertical hole.

LITHOLOGIC SYMBOLS





PR-M-B 75(3)A

PAUL DYSON CONSULTANTS

STRATIGRAPHIC LOG

540

DRILL HOLE DDH 75-3 AREA Kinuseo Creek

COMPANY Canadian Superior Oil Ltd.

COORDINATES 54° 48' 57" N; 120° 56' 04" W (unsurveyed)

GROUND ELEVATION 4080' ± TOTAL DEPTH 918'

MECHANICAL LOGS RUN Gamma Ray/Neutron; Density

DRILLING METHOD Diamond; Wireline

HOLE SIZE NQ DATE OF COMPLETION September 8, 1975

LOGGED BY A. Choudry

REMARKS Vertical hole

LITHOLOGIC SYMBOLS

Breccia
Conglomerate
Sandstone
Calcareous sandstone
Siltstone
Coal
Sandstone beds with shale partings
Mudstone Sandstone
Mudstone or massive claystone
Shale
Mudstone / Siltstone
Unexposed

FORMATION | DEPTH | LITHOLOGY | GRAIN SIZE | DIP OF BEDDING relative to bore hole | DESCRIPTION

Clarodurain and durain 146 to 157; 95% recovery; analysis of composite sample of floats at 1.60 S.G. and Stage 1 froth flotation: total yield - 72.0%, R.M. 1.0%; Ash 10.4%; V.M. 25.3%; F.C. 63.3%; S 0.33%; F.S.I. 7

~~Clarain and durain 215.5 to 220; 95%~~ recovery; analysis of composite sample (as above); Total yield 81.6%; R.M. 0.9%; Ash 6.0%; V.M. 25.2%; FC 67.9%; S 0.40%; F.S.I. 7

Durain and clarodurain 309.5 to 316.5; 95% recovery; analysis of composite sample: Total yield 70.0%; R.M. 0.8%; Ash 13.9%; V.M. 22.9%; F.C. 62.4%; S 0.38%; F.S.I. 4.

Slickensided and polished surfaces.

Many burrows; shale clasts "floating" in sand matrix due to bioturbation

Arbitrary contact of Gates formation and underlying Moosebar formation at 828.

PR-MB 75(3)A

ROKE OIL ENTERPRISES LTD. CALGARY, ALBERTA

GAMMA RAY NEUTRON LOG

FILE NO.
LSD
SEC
TWP
RGE
W___M

COMPANY CANADIAN SUPERIOR OIL LTD
WELL 75 - 3
LOCATION d89D - 93I15
FIELD QUINTETTE
PROVINCE BRITISH COLUMBIA

540

Other Services: DENS

Permanent Datum GROUND LEVEL Elev.
Log Measured from GROUND LEVEL ___ Ft. Above Perm. Datum
Well Depths Measured from GROUND LEVEL

K.B.
CSG
G.L.

Run. No.	ONE
Date	9 SEPTEMBER 1975
First Reading	905
Last Reading	00
Footage Logged	905
Depth Reached	906
Depth Driller	918
Casing Roke	
Casing Driller	
Fluid Type	MUD
Liquid Level	FULL
Min. Diam.	NQ
Rm @ °F	
Operating Time	2 HOURS
Truck No.	30
Recorded By	SUNDGAARD
Witnessed By	HANKEL

EQUIPMENT DATA

GAMMA RAY		NEUTRON	
RUN NO.	ONE	RUN NO.	ONE
TOOL MODEL NO.	65	LOG TYPE	NEUTRON/NEUTRON
DIAMETER	$1\frac{11}{16}$	TOOL MODEL NO.	65
DETECTOR MODEL NO.		DIAMETER	$1\frac{11}{16}$
TYPE	GEIGER	DETECTOR MODEL NO.	
LENGTH	18 INCH	TYPE	PROPORTIONAL
DISTANCE TO N. SOURCE	8.55 FT.	LENGTH	6 INCH
		SOURCE MODEL NO.	MRC-N-SS-W
GENERAL		SERIAL NO.	265
HOIST TRUCK NO.	30	SPACING	
INSTRUMENT TRUCK NO.	30	TYPE	AmBe
TOOL SERIAL NO.	65	STRENGTH	3 CURIES

LOGGING DATA

GENERAL				GAMMA RAY				NEUTRON			
RUN NO.	DEPTHS FROM	DEPTHS TO	SPEED FT/MIN	T.C. SEC.	SENS SETTINGS	ZERO DIV. L OR R	API G. R. UNITS PER LOG DIV.	T. C. SEC.	SENS SETTINGS	ZERO DIV. L OR R	API N. UNITS PER LOG DIV.
1	00	905	12	4	100	0	17 API	4	1000	0	220 API

REMARKS LOGGED THROUGH NQ DRILL ROD

GAMMA RAY	DEPTHS	NEUTRON
GAMMA RAY INCREASES → API →|17|← 0 170		NEUTRON INCREASES → API →|220|← 0 2200 4400

PR-M-B 75(3)A

ROKE

GAMMA RAY NEUTRON LOG

OIL ENTERPRISES LTD. CALGARY, ALBERTA

FILE NO.

COMPANY CANADIAN SUPERIOR OIL LTD.

WELL 75 - 2

LOCATION b/hr 93/15

FIELD GRIZZLY

PROVINCE BRITISH COLUMBIA

LSD SEC TWP RGE W..... M

Permanent Datum: GROUND LEVEL Elev.

Log Measured from: K.B. 4. Ft. Above Perm. Datum

D.F.

G.L.

Other Services: DENS

Run. No. ONE TWO

Date 31 AUGUST 1975 SEPTEMBER 1975

First Reading 2400 2400

Last Reading 240 000

Footage Logged 2160 2400

Depth Reached 441 241

Depth Driller 440 240

Depth Logger 443 243

Casing Driller 114 114

Casing Logger 114 114

Fluid Type QUIK-GEL/WATER QUIK-GEL/WATER

Liquid Level 60 60

Max. Temp. 2.3/5 (90) 3-1/16 (100)

Rm @ °F

Operating Time

Truck No.

Recorded By RAINEY

Witnessed By CROWLEY

Truck No.	34	34
Operating Time	2 HOURS	1 HOUR

540

EQUIPMENT DATA

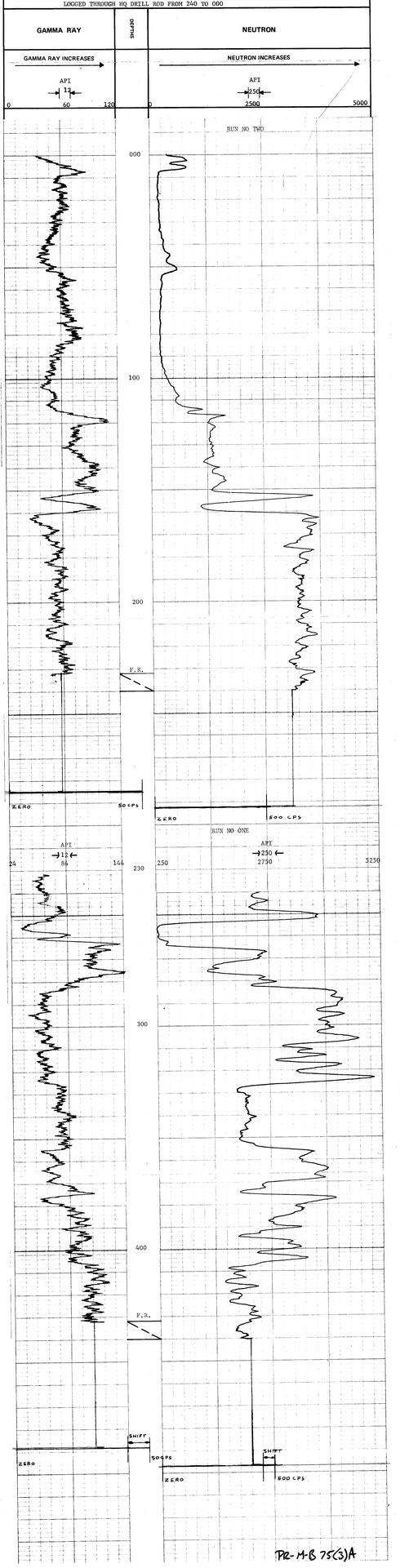
GAMMA RAY		NEUTRON	
RUN NO.	ONE	RUN NO.	ONE
TOOL MODEL NO.		LOG TYPE	NEUTRON/NEUTRON
DIAMETER	1 11/16	TOOL MODEL NO.	65
DETECTOR MODEL NO.	65	DIAMETER	1 11/16
TYPE	GEIGER	DETECTOR MODEL NO.	
LENGTH	18 INCH	TYPE	PROPORTIONAL
DISTANCE TO N. SOURCE	8.55 FT.	LENGTH	6 INCH
		SOURCE MODEL NO.	MRC-N-SS-W
		SERIAL NO.	265
		SPACING	
		TYPE	AmBe
		STRENGTH	3 CURIES

GENERAL	
HOIST TRUCK NO.	34
INSTRUMENT TRUCK NO.	34
TOOL SERIAL NO.	65

LOGGING DATA

GENERAL			GAMMA RAY					NEUTRON			
RUN NO.	DEPTHS FROM	DEPTHS TO	SPEED FT/MIN	T.C. SEC.	SENS SETTINGS	ZERO DIV. L OR R	API G. R. UNITS PER LOG DIV.	T. C. SEC.	SENS SETTINGS	ZERO DIV. L OR R	API N. UNITS PER LOG DIV.
1	240	440	12	5	50	21.	12 API	3	500	11.	250 API
2	000	240	12	5	50	01.	12 API	3	500	01.	250 API

REMARKS LOGGED THROUGH NQ DRILL ROD FROM 440 TO 240
LOGGED THROUGH HQ DRILL ROD FROM 240 TO 000



PR-M-B 75(3)A

ROKE

GAMMA RAY NEUTRON LOG

OIL ENTERPRISES LTD. CALGARY, ALBERTA

FILE NO.	
LSD	
SEC	
TWP	
RGE	
W M	
COMPANY	CANADIAN SUPERIOR OIL LTD
WELL	75 - 1
LOCATION	b68B 93I15
FIELD	QUINTETTE
PROVINCE	BRITISH COLUMBIA
Other Services:	DENS

540

Permanent Datum GROUND LEVEL Elev. ______ K.B. ______

Log Measured from RIG FLOOR 4 Ft. Above Perm. Datum CSG ______

Well Depths Measured from RIG FLOOR G.L. ______

Run. No.	ONE		
Date	23 AUGUST 1975		
First Reading	824		
Last Reading	00		
Footage Logged	824		
Depth Reached	825		
Depth Driller	832		
Casing Roke	102		
Casing Driller	101		
Fluid Type	QUIK-GEL/WATER		
Liquid Level	20		
Min. Diam.	3-1/16(HQ)		
Rm @ °F			
Operating Time	2 HOURS		
Truck No.	34		

Recorded By RAINEY Witnessed By CHOWDRY

EQUIPMENT DATA

GAMMA RAY		NEUTRON	
RUN NO.	ONE	RUN NO.	ONE
TOOL MODEL NO.		LOG TYPE	NEUTRON/NEUTRON
DIAMETER	$1\frac{11}{16}$	TOOL MODEL NO.	65
DETECTOR MODEL NO.	65	DIAMETER	$1\frac{11}{16}$
TYPE	GEIGER	DETECTOR MODEL NO.	
LENGTH	18 INCH	TYPE	PROPORTIONAL
DISTANCE TO N. SOURCE	8.55 FT.	LENGTH	6 INCH
		SOURCE MODEL NO.	MRC-N-SS-W
GENERAL		SERIAL NO.	265
HOIST TRUCK NO.	34	SPACING	
INSTRUMENT TRUCK NO.	34	TYPE	AmBe
TOOL SERIAL NO.	65	STRENGTH	3 CURIES

LOGGING DATA

GENERAL				GAMMA RAY				NEUTRON			
RUN NO.	DEPTHS FROM	DEPTHS TO	SPEED FT/MIN	T.C. SEC.	SENS SETTINGS	ZERO DIV. L OR R	API G. R. UNITS PER LOG DIV.	T. C. SEC.	SENS SETTINGS	ZERO DIV. L OR R	API N. UNITS PER LOG DIV.
1	00	824	12	5	50	2L	12 API	3	500	0L	250 API

REMARKS LOGGED THROUGH HQ DRILL ROD

GAMMA RAY	DEPTHS	NEUTRON
GAMMA RAY INCREASES →		NEUTRON INCREASES →
API →|12|←		API →|250|←
24 84 144		0 2500 5000

PR-MB 75(3)A

ROKE

SIDEWALL DENSILOG

OIL ENTERPRISES LTD. CALGARY, ALBERTA

FILE NO. 540

LSD
SEC
TWP
RGE
W ______ M

COMPANY CANADIAN SUPERIOR OIL LTD

WELL 75 - 3

LOCATION d89D 93I15

FIELD QUINTETTE

PROVINCE BRITISH COLUMBIA

Other Services: GRN

Permanent Datum GROUND LEVEL Elev. ______

Log Measured from GROUND LEVEL ______ Ft. Above Perm. Datum

Well Depths Measured from GROUND LEVEL

K.B. ______
CSG ______
G.L. ______

Run. No.	ONE		
Date	9 SEPTEMBER 1975		
First Reading	900		
Last Reading	00		
Footage Logged	900		
Depth Reached	903		
Depth Driller	918		
Casing Roke			
Casing Driller			
Fluid Type	MUD		
Liquid Level	FULL		
Min. Diam.	NQ		
Operating Time	2-1/2 HOURS		
Truck No.	30		
Recorded By	SUNDGAARD	Witnessed By	HANKEL

GENERAL				GAMMA RAY				SIDEWALL DENSILOG			
RUN NO.	DEPTHS FROM	DEPTHS TO	SPEED FT/MIN	T.C. SEC.	SENS SETTINGS	ZERO DIV.L OR R	API G.R. UNITS PER LOG DIV.	T.C. SEC.	SENS SETTINGS	ZERO DIV.L OR R	CPS/DIV
1	00	900	12					3	1000	1.1R	28.6

REMARKS LOGGED THROUGH NQ DRILL ROD

DENSITY TOOL SERIAL NO 247

DEPTHS

CALIPER (DIAMETER — INCHES)

GAMMA RAY API

CONSIDERATION MUST BE GIVEN TO THE POSITION OF THE DRILL ROD WHEN USING THE BULK DENSITY VALUES

BULK DENSITY (GRAMS/CC)

PR-M.B 75(3)A

ROKE

SIDEWALL DENSILOG

OIL ENTERPRISES LTD. CALGARY, ALBERTA

FILE NO. 540

LSD
SEC
TWP
RGE
W M

COMPANY CANADIAN SUPERIOR OIL LTD

WELL 75 - 2

LOCATION b73C 93I15

FIELD QUINTETTE

PROVINCE BRITISH COLUMBIA

Other Services: GRN

Permanent Datum GROUND LEVEL Elev.

Log Measured from RIG FLOOR 4 Ft. Above Perm. Datum

Well Depths Measured from RIG FLOOR

K.B.
CSG
G.L.

Run. No.	ONE		
Date	31 AUGUST 1975		
First Reading	437		
Last Reading	240		
Footage Logged	197		
Depth Reached	440		
Depth Driller	443		
Casing Roke	114		
Casing Driller	114		
Fluid Type	QUIK-GEL/WATER		
Liquid Level	00		
Min. Diam.	2.375 (NQ)		
Operating Time	2 HOURS		
Truck No.	34		

Recorded By RAINEY Witnessed By CHOWDRY

GENERAL RUN NO.	DEPTHS FROM	DEPTHS TO	SPEED FT/MIN	GAMMA RAY T.C. SEC.	GAMMA RAY SENS SETTINGS	GAMMA RAY ZERO DIV.L OR R	GAMMA RAY API G.R. UNITS PER LOG DIV.	SIDEWALL DENSILOG T.C. SEC.	SIDEWALL DENSILOG SENS SETTINGS	SIDEWALL DENSILOG ZERO DIV.L OR R	SIDEWALL DENSILOG CPS/ DIV
1	240	437	10					3	500	1.6R	19.26

REMARKS LOGGED THROUGH NQ DRILL ROD

DENSITY TOOL SERIAL NO 420

CALIPER (DIAMETER – INCHES)

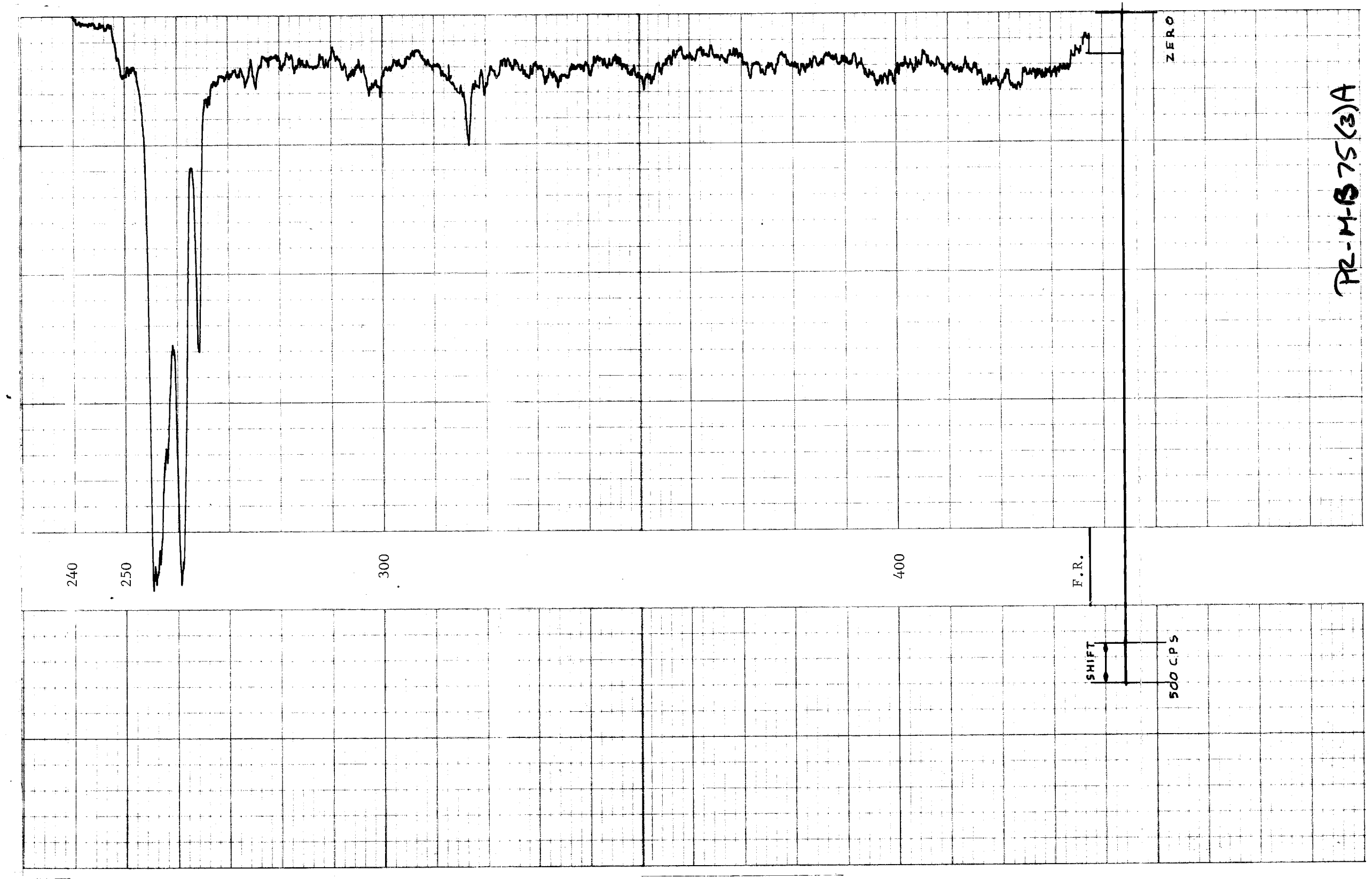
DEPTHS

GAMMA RAY API

CONSIDERATION MUST BE GIVEN TO THE POSITION OF THE DRILL ROD WHEN USING THE BULK DENSITY VALUES

BULK DENSITY (GRAMS/CC)

2.80 2.70 2.60 2.50 2.40 2.30 2.20 2.10 2.00 1.90 1.80 1.70 1.60 1.50 1.40 1.30 1.20 1.10 1.00



PR-M-B 75(2)A

ROKE

SIDEWALL DENSILOG

OIL ENTERPRISES LTD. CALGARY, ALBERTA

FILE NO.	540
LSD	
SEC	
TWP	
RGE	
W ____ M	
COMPANY	CANADIAN SUPERIOR OIL LTD
WELL	75 - 1
LOCATION	b68B 93I15
FIELD	QUINTETTE
PROVINCE	BRITISH COLUMBIA
Other Services:	GRN

Permanent Datum GROUND LEVEL Elev. ______ K.B. ______
Log Measured from RIG FLOOR 4 Ft. Above Perm. Datum CSG ______
Well Depths Measured from RIG FLOOR G.L. ______

Run. No.	ONE		
Date	23 AUGUST 1975		
First Reading	821		
Last Reading	00		
Footage Logged	821		
Depth Reached	824		
Depth Driller	832		
Casing Roke	102		
Casing Driller	101		
Fluid Type	QUIK-GEL/WATER		
Liquid Level	20		
Min. Diam.	3-1/16 (HQ)		
Operating Time	2 HOURS		
Truck No.	34		

Recorded By RAINEY Witnessed By CHOWDRY

GENERAL				GAMMA RAY				SIDEWALL DENSILOG			
RUN NO.	DEPTHS FROM	DEPTHS TO	SPEED FT/MIN	T.C. SEC.	SENS SETTINGS	ZERO DIV.L OR R	API G.R. UNITS PER LOG DIV.	T.C. SEC.	SENS SETTINGS	ZERO DIV.L OR R	CPS/DIV
1	000	821	10					3	500	1.6R	19.26

REMARKS LOGGED THROUGH HQ DRILL ROD

DENSITY TOOL SERIAL NO 420

	DEPTHS	CALIPER (DIAMETER – INCHES)
GAMMA RAY API		CONSIDERATION MUST BE GIVEN TO THE POSITION OF THE DRILL ROD WHEN USING THE BULK DENSITY VALUES
		BULK DENSITY (GRAMS/CC)

PR-HB 75(3)A

PR-MONKMAN-BELCOURT 75(9)A

APPENDIX C

ANALYTICAL DATA

(prepared by Birtley Engineering Canada Ltd.)

DRILLHOLE 75-1

CANADIAN SUPERIOR OIL LTD.

October 3, 1975.

SAMPLE: D 75-1, 210' - 218'

LAB. NO.: 3827

SIZE AND RAW ANALYSES

Size Fr.	Wt. %	Ash %	CUMULATIVE Wt. %	CUMULATIVE Ash %	R.M. %	V.M. %	F.C. %	F.S.I.	S%
1/4" x 28M	92.0	19.2	92.0	19.2	--	--	--	4 1/2	--
28 M x OM	8.0	15.4	100.0	18.9	--	--	--	7	--
HEAD RAW		18.2			0.7	21.1	60.0	6	0.47

SINK-FLOAT ANALYSES

1/4" x 28 Mesh

S. G. FRACTION	Wt. %	Ash %	CUMULATIVE Wt. %	CUMULATIVE Ash %	F.S.I.
- 1.35	41.0	4.3	41.0	4.3	8
1.35 - 1.45	23.8	12.2	64.8	7.2	3
1.45 - 1.60	16.8	26.2	81.6	11.1	1
1.60 - 1.80	9.5	41.4	91.1	14.3	1
+ 1.80	8.9	65.0	100.0	18.8	1

FROTH FLOTATION TEST: 28M x 0

PRODUCT	Wt. %	Ash %	CUMULATIVE Wt. %	CUMULATIVE Ash %	F.S.I.
STAGE I	75.8	10.3	75.8	10.3	8
STAGE II	8.7	15.5	84.5	10.8	7 1/2
TAILS	15.5	40.9	100.0	15.5	1 1/2

CANADIAN SUPERIOR OIL LTD. October 6, 1975.

SAMPLE: D 75-1, 210' - 218'

LAB. NO.: 3827

F.F. Panameters:

Conditioning Time	60 seconds
Reagent	4:1 = Kerosene:MIBC
Dosage Rate	0.48 lb./T
Stage I	1st min. froth
Stage II	2nd min. froth
Pulp Density	10%

COMPOSITE: FLOATS @ 1.60 S.G. + STAGE I

TOTAL YIELD%	R.M. %	ASH %	V.M. %	F.C. %	S %	F.S.I.	P_2O_5
81.1	0.7	11.0	21.9	66.4	0.50	7	

CANADIAN SUPERIOR OIL LTD. October 3, 1975.

SAMPLE: D 75-1, 395'-413.5', 75-1, b-68-B, 93-1-15

LAB. NO.: 3828

SIZE AND RAW ANALYSES

			CUMULATIVE						
Size Fr.	Wt. %	Ash %	Wt. %	Ash %	R.M. %	V.M. %	F.C. %	F.S.I.	S %
1/4" x 28M	90.5	11.7	90.5	11.7	--	--	--	7	--
28M x OM	9.5	12.1	100.0	11.7	--	--	--	7 1/2	--
HEAD RAW		12.5			0.8	21.5	65.2	6 1/2	0.21

SINK-FLOAT ANALYSES

1/4" x 28 Mesh

S. G. FRACTION			CUMULATIVE		
	Wt. %	Ash %	Wt. %	Ash %	F.S.I.
- 1.35	64.4	4.4	64.4	4.4	8
1.35 - 1.45	14.5	12.5	78.9	5.9	1 1/2
1.45 - 1.60	11.6	22.0	90.5	8.0	1
1.60 - 1.80	5.6	33.4	96.1	9.4	1
+ 1.80	3.9	68.4	100.0	11.7	1

FROTH FLOTATION TEST 28M x 0

			CUMULATIVE		
PRODUCT	Wt. %	Ash %	Wt. %	Ash %	F.S.I.
STAGE I	72.9	7.6	72.9	7.6	8
STAGE II	11.1	11.8	84.0	8.2	6
TAILS	16.0	32.8	100.0	12.1	2

CANADIAN SUPERIOR OIL LTD.

October 6, 1975.

SAMPLE: D 75-1, 395'-413.5', 75-1, b-68-B, 93-1-15

LAB. NO.: 3828

F.F. Panameters:

- Conditioning Time .....
- Reagent .....
- Dosage Rate .....
- Stage I .....
- Stage II .....
- Pulp Density .....

} Same As 3827

COMPOSITE: FLOATS @ 1.60 S.G. + STAGE I

TOTAL YIELD%	R.M. %	ASH %	V.M. %	F.C. %	S %	F.S.I.	P_2O_5
88.8	0.8	8.0	22.5	68.7	0.22	7	

CANADIAN SUPERIOR OIL LIMITED

October 6, 1975.

SAMPLE: D75-1, 479' - 493', 75 - 1, b-68-B, 93-1-15

LAB. NO.: 3829

SIZE AND RAW ANALYSES

			CUMULATIVE						
Size. Fr.	Wt. %	Ash %	Wt. %	Ash %	R.M. %	V.M. %	F.C. %	F.S.I.	S %
1/4" x 28M	91.4	9.9	91.4	9.9	--	--	--	8	--
28M x 0M	8.6	9.1	100.0	9.8	--	--	--	8 1/2	--
HEAD RAW		9.6			0.7	21.8	67.9	7 1/2	0.36

SINK-FLOAT ANALYSES

S.G. 1/4" x 28 Mesh

FRACTION CUMULATIVE

	Wt. %	Ash %	Wt. %	Ash %	F.S.I.
- 1.35	74.5	3.3	74.5	3.3	9
1.35 - 1.45	12.4	12.3	86.9	4.6	2
1.45 - 1.60	5.8	23.3	92.7	5.8	1 1/2
1.60 - 1.80	3.2	37.0	95.9	6.8	1
+ 1.80	4.1	73.4	100.0	9.5	1/2

FROTH FLOTATION TEST 28M x 0

			CUMULATIVE		
PRODUCT	Wt. %	Ash %	Wt. %	Ash %	F.S.I.
STAGE I	78.4	5.8	78.4	5.8	8 1/2
STAGE II	11.4	8.5	89.8	6.1	8 1/2
TAILS	10.2	34.0	100.0	9.0	3 1/2

Birtley Engineering
Subsidiary of Great West Steel Industries

CANADIAN SUPERIOR OIL LTD. October 6, 1975.

SAMPLE: D75-1, 479' - 493', 75-1, b-68-B, 93-1-15

LAB. NO.: 3829

F.F. Panameters: Conditioning Time .....
Reagent .....
Dosage Rate .....
Stage I ..... } Same As 3827
Stage II .....
Pulp Density .....

COMPOSITE: FLOATS @ 1.60 S.G. + STAGE I

TOTAL YIELD%	R.M. %	ASH %	V.M. %	F.C. %	S %	F.S.I.	P_2O_5
91.5	0.7	5.8	22.5	71.0	0.42	9	

CANADIAN SUPERIOR OIL LTD. October 6, 1975.

SAMPLE: D 75-1, 603' - 614.5', 75-1, b-68-B, 93-1-15

LAB. NO.: 3830

SIZE AND RAW ANALYSES

			CUMULATIVE						
Size Fr.	Wt. %	Ash %	Wt. %	Ash %	R.M. %	V.M. %	F. C. %	F.S.I.	S %
1/4" x 28M	91.3	7.6	91.3	7.6	--	--	--	8	--
28M x 0M	8.7	6.1	100.0	7.5	--	--	--	8 1/2	--
HEAD RAW		7.7			0.6	22.0	69.7	8 1/2	0.32

SINK-FLOAT ANALYSES

S. G. 1/4" x 28 Mesh

FRACTION CUMULATIVE

	Wt. %	Ash %	Wt. %	Ash %	F.S.I.
- 1.35	81.9	4.5	81.9	4.5	9
1.35 - 1.45	12.0	12.6	93.9	5.5	2 1/2
1.45 - 1.60	3.5	22.9	97.4	6.2	1 1/2
1.60 - 1.80	1.3	29.1	98.7	6.5	1 1/2
+ 1.80	1.3	66.3	100.0	7.2	1/2

FROTH FLOTATION TEST 28M x 0

			CUMULATIVE		
PRODUCT	Wt. %	Ash %	Wt. %	Ash %	F.S.I.
STAGE I	67.9	4.6	67.9	4.6	9
STAGE II	19.3	5.1	87.2	4.7	9
TAILS	12.8	15.6	100.0	6.1	6 1/2

CANADIAN SUPERIOR OIL LTD.

October 6, 1975.

SAMPLE: D 75-1, 603'-614.5', 75-1, b-68-B, 93-1-15

LAB. NO.: 3830

F.F. Panameters: Conditioning Time .....
Reagent .....
Dosage Rate .....
Stage I .....
Stage II .....
Pulp Density .....
} Same As 3827

COMPOSITE: FLOATS @ 1.60 S.G. + STAGE I

TOTAL YIELD %	R.M. %	ASH %	V.M. %	F.C. %	S %	F.S.I.	P_2O_5
94.8	0.6	6.0	21.9	71.5	0.38	8 1/2	

DRILLHOLE 75-2

CANADIAN SUPERIOR OIL LTD.

October 6, 1975.

SAMPLE: D 75-2, 256' - 263'

LAB. NO.: 3918

SIZE AND RAW ANALYSES

			CUMULATIVE						
Size Fr.	Wt. %	Ash %	Wt. %	Ash %	R.M. %	V.M. %	F.C. %	F.S.I.	S %
1/4" x 28M	85.8	28.0	85.8	28.0	--	--	--	5	--
28M x 0M	14.2	15.8	100.0	26.3	--	--	--	9	--
HEAD RAW		29.5			0.6	18.1	51.8	9	0.66

SINK-FLOAT ANALYSES

S. G. 1/4" x 28 Mesh

FRACTION			CUMULATIVE		
	Wt. %	Ash %	Wt. %	Ash %	F.S.I.
- 1.35	53.4	5.3	53.4	5.3	9
1.35 - 1.45	9.0	14.7	62.4	6.7	8 1/2
1.45 - 1.60	3.4	30.8	65.8	7.9	6 1/2
1.60 - 1.80	5.3	41.2	71.1	10.4	6
+ 1.80	28.9	71.2	100.0	28.0	1

FROTH FLOTATION TEST 28M x 0

			CUMULATIVE		
PRODUCT	Wt. %	Ash %	Wt. %	Ash %	F.S.I.
STAGE I	38.3	7.0	38.3	7.0	9
STAGE II	11.5	9.4	49.8	7.6	9
TAILS	50.2	20.5	100.0	14.1	9

CANADIAN SUPERIOR OIL LTD. October 6, 1975.

SAMPLE: D 75-2, 256'- 263'

LAB. NO.: 3918

F.F. Panameters:
- Conditioning Time .....
- Reagent .....
- Dosage Rate ..... Same As 3827
- Stage I .....
- Stage II .....
- Pulp Density ..... 5 %

COMPOSITE: FLOATS @ 1.60 S.G. + STAGE I

TOTAL YIELD %	R.M. %	ASH %	V.M. %	F.C. %	S %	F.S.I.	P_2O_5
61.9	0.6	7.8	21.5	70.1	0.76	9	

DRILLHOLE 75-3

CANADIAN SUPERIOR OIL LTD. October 6, 1975.

SAMPLE: D 7503, 146'-153'

LAB. NO.: 3916

SIZE AND RAW ANALYSES

			CUMULATIVE						
Size Fr.	Wt. %	Ash %	Wt. %	Ash %	R.M. %	V.M. %	F.C. %	F.S.I.	S.%
1/4" x 28M	89.1	25.9	89.1	25.9	--	--	--	8	--
28M x OM	10.9	17.5	100.0	25.0	--	--	--	7 1/2	--
HEAD RAW		26.0			0.8	21.4	51.8	5	0.23

SINK-FLOAT ANALYSES

S. G. 1/4" x 28 Mesh

FRACTION			CUMULATIVE		
	Wt. %	Ash %	Wt. %	Ash %	F.S.I.
- 1.35	46.9	4.8	46.9	4.8	8
1.35 - 1.45	13.7	16.0	60.6	7.3	4 1/2
1.45 - 1.60	10.8	27.6	71.4	10.4	2
1.60 - 1.80	11.4	41.1	82.8	14.6	1
+ 1.80	17.2	70.3	100.0	24.2	1/2

FROTH FLOTATION TEST 28M x 0

			CUMULATIVE		
PRODUCT	Wt. %	Ash %	Wt. %	Ash %	F.S.I.
STAGE I	76.9	9.9	76.9	9.9	8
STAGE II	7.0	17.5	83.9	10.5	7
TAILS	16.1	48.9	100.0	16.7	1

CANADIAN SUPERIOR OIL LTD.

October 6, 1975.

SAMPLE: D7503, 146'-153'

LAB. NO.: 3916

F.F. Panameters:

- Conditioning Time .....
- Reagent .....
- Dosage Rate .....
- Stage I .....
- Stage II .....
- Pulp Density .....

} Same As 3827

COMPOSITE: FLOATS @ 1.60 S.G. + STAGE I

TOTAL YIELD %	R.M. %	ASH %	V.M. %	F.C. %	S %	F.S.I.	P_2O_5
72.0	1.0	10.4	25.3	63.3	0.33	7	

CANADIAN SUPERIOR OIL LTD.

October 6, 1975.

SAMPLE: D-7503, 219.5' - 229 '

LAB. NO.: 3917

SIZE AND RAW ANALYSES

			CUMULATIVE						
Size Fr.	Wt. %	Ash %	Wt. %	Ash %	R.M. %	V.M. %	F.C. %	F.S.I.	S %
1/4" x 28M	90.0	15.0	90.0	15.0	--	--	--	5 1/2	--
28M x OM	10.0	11.4	100.0	14.6	--	--	--	6 1/2	--
HEAD RAW		14.0			0.8	23.5	61.7	7 1/2	0.34

SINK-FLOAT ANALYSES

S. G. 1/4" x 28 Mesh

FRACTION			CUMULATIVE		
	Wt. %	Ash %	Wt. %	Ash %	F.S.I.
- 1.35	66.0	3.5	66.0	3.5	8
1.35 - 1.45	10.0	12.8	76.0	4.7	1 1/2
1.45 - 1.60	5.3	23.8	81.3	6.0	1
1.60 - 1.80	5.8	38.2	87.1	8.1	1
+ 1.80	12.9	56.2	100.0	14.3	1

FROTH FLOTATION TEST 28M x 0

			CUMULATIVE		
PRODUCT	Wt. %	Ash %	Wt. %	Ash %	F.S.I.
STAGE I	84.2	7.6	84.2	7.6	8
STAGE II	7.5	11.7	91.7	7.9	7 1/2
TAILS	8.3	39.6	100.0	10.6	2 1/2

CANADIAN SUPERIOR OIL LTD.

October 6, 1975.

SAMPLE: D-7503, 219.5'-229'

LAB. NO.: 3917

F.F. Panameters:

- Conditioning Time .....
- Reagent .....
- Dosage Rate .....
- Stage I .....
- Stage II .....
- Pulp Density .....

} Same As 3827

COMPOSITE: FLOATS @ 1.60 S.G. + STAGE I

TOTAL YIELD %	R.M. %	ASH %	V.M. %	F.C. %	S %	F.S.I.	P_2O_5
81.6	0.9	6.0	25.2	67.9	0.40	7	

CANADIAN SUPERIOR OIL LTD. October 6, 1975.

SAMPLE: D 7503, 309.5' - 316.5'

LAB. NO.: 3919

SIZE AND RAW ANALYSES

			CUMULATIVE						
Size Fr.	Wt. %	Ash %	Wt. %	Ash %	R.M. %	V.M. %	F.C. %	F.S.I.	S %
1/4" x 28M	90.6	22.8	90.6	22.8	--	--	--	3 1/2	--
28M x 0M	9.4	22.9	100.0	22.8	--	--	--	5	--
HEAD RAW		22.3			0.7	20.5	56.5	3	0.30

SINK-FLOAT ANALYSES

S. G. 1/4" x 28 Mesh

FRACTION			CUMULATIVE		
	Wt. %	Ash %	Wt. %	Ash %	F.S.I.
- 1.35	31.4	6.1	31.4	6.1	7 1/2
1.35 - 1.45	18.4	14.1	49.8	9.1	1
1.45 - 1.60	19.8	25.6	69.6	13.8	1
1.60 - 1.80	25.3	37.7	94.9	20.1	1
+ 1.80	5.1	58.4	100.0	22.1	1

FROTH FLOTATION TEST 28M x 0

			CUMULATIVE		
PRODUCT	Wt. %	Ash %	Wt. %	Ash %	F.S.I.
STAGE I	73.7	15.5	73.7	15.5	6 1/2
STAGE II	7.4	24.0	81.1	16.3	4 1/2
TAILS	18.9	44.7	100.0	21.6	1

CANADIAN SUPERIOR OIL LTD.

October 6, 1975.

SAMPLE: D 7503, 309.5'-316.5'

LAB. NO.: 3919

F.F. Panameters:

- Conditioning Time .....
- Reagent .....
- Dosage Rate .....
- Stage I .....
- Stage II .....
- Pulp Density .....

} Same As 3827

COMPOSITE: FLOATS @ 1.60 S.G. + STAGE I

TOTAL YIELD %	R.M. %	ASH %	V.M. %	F.C. %	S %	F.S.I.	P_2O_5
70.0	0.8	13.9	22.9	62.4	0.38	4	

CANADIAN SUPERIOR OIL LTD.

October 6, 1975.

LAB. NO.	A.D.M.	MOISTURE	ASH	VOL.	F.C.	S.	P_2O_5	F.S.I.
3831 Thick Seam Mt. Belcourt Lower Gates		4.2	6.0	32.2	57.6	0.30		1 1/2
3832 Saxon Syncline Gates			5.0	--	--	0.23	--	2