PR-PINEPASS 75(1)

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PAN OCEAN OIL LTD.

PINE PASS COAL PROJECT

N. E. BRITISH COLUMBIA

N.T.S. 93 - P - 5, 93 - O - 8, 93 - O - 9

COAL LICENCES 2905 - 2962, 3560 - 3591

VOLUME I

584

PREPARED BY:

PAUL DYSON CONSULTANTS
CALGARY, ALBERTA

OCT. 1975

PR-PINE PASS - 75 (1) A

NTS 930/8, 9, 93P/5.

COAL ACT

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

Exploration & Development Work Report Cover Sheet

Property name: ______ Coal Map No. 930/8, 9, 93P/5.

Location: South of Pine River Land District Peace River

Coal Licence No.(s) 2905-2962, 3560-3591.

Licensee: Pan Ocean Oil Ltd.

Operator: I.P. Dyson Consultants Ltd.

Title of Report: Pine Pass Coal Project

Period covered by Report: Sept 1974 to Oct 1975

Category of work covered in report

Geological Mapping		$ 17,920.00
Surveys:	Geophysical	
	Geochemical	
	Other	
Road Construction		4,728.50
Surface work		
Underground work		
Drilling		167,996.00
Logging		35,052.00
Sampling		
Testing		
Reclamation		8,897.00
Other work		101,080.00

Total value of work reported $ 335,674.08

Comments:

Value of work approved $ 335,674.08

Signature: A.R.C. James Date Nov 24/75

Senior ~~Coal~~ Inspector of mines

Accepted: [signature] Date Nov 26/75

Chief Gold Commissioner
Mineral Resources Branch

(To be prepared in duplicate: Original to be filed with report
Duplicate to be filed on Plan of Operations file)

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PR-PINE PASS 75(1)A.

CONFIDENTIAL

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PINE PASS COAL PROJECT

NORTHEAST BRITISH COLUMBIA

(1974 - 1975)

VOLUME I

GEOLOGY

Prepared for: Pan Ocean Oil Ltd.
Calgary, Alberta

by: Paul Dyson Consultants
Calgary, Alberta

October 1975

ABSTRACT

During the period 1974 - 1975 additional exploration was carried on in the Pine Pass Area.

The main objective of this phase of the exploration was to test the coal bearing sequences of Gething formation at widely scattered locations across the tract of coal licences.

Ten boreholes were completed at widely spaced locations using a helicopter for both servicing and moving the drill rigs. Simultaneously with this program, additional surface mapping was carried out.

Results from the program indicate that the main potential for a economical coal seam lies within the upper portion of the Gething formation. In particular, one seam averaging about twelve feet in thickness was found to give particularly good yields of exceptional low ash, low to medium volatile coal. The coal seams found in the lower portion of the Gething formation were generally dirty and laterally discontinuous. It was concluded that portions of the licence block were not prospective and recommendations are made to relinquish approximately one third of the licences. It is further recommended that additional work be carried out to ascertain in detail the quality of the low ash seam and to assess its mineable extent.

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I. INTRODUCTION

This report describes the exploration work carried out on behalf of Pan Ocean Oil Ltd. in the Pine Pass coal area of northeast British Columbia in 1974 and 1975. Pan Ocean held ninety coal licences under the Coal Act of British Columbia at the time of the exploration. These licences were numbered 2905 to 2962 inclusive and 3560 to 3591 inclusive (see Fig. 75/3).

The exploration was a continuation of that work carried out in 1973 which was fully described in the report "Pine Pass Coal Project, Northeast British Columbia (Phase I)" by Paul Dyson Consultants dated June 1973. This earlier report is attached to this one and should be considered as an introduction to the 1974 - 1975 exploration. All maps, sections and diagrams for this earlier report are prefixed by the number "73" to differentiate them from those prepared for the present report. The analytical data and borehole data has been detached and inserted in the appropriate volume of the present report.

It should be noted that the 1973 report, henceforth referred to as "Dyson - 1973" was filed as a "work commitment report" for the licence block which corresponded with those coal licences now numbered 2905 to 2962. The area covered by coal licences 3560 to 3591 was not an integral part of the acreage block for which that report was compiled. However, it is almost surrounded by the licences for which the 1973 report was written and the text of the 1973 report does, in general, describe the features of this block as well.

I. <u>INTRODUCTION</u> (Cont'd.)

The present report contains only very brief sections on location, access, regional geology, etc. as these are fully described in the 1973 report for those persons unfamiliar with the area.

II. GEOLOGY

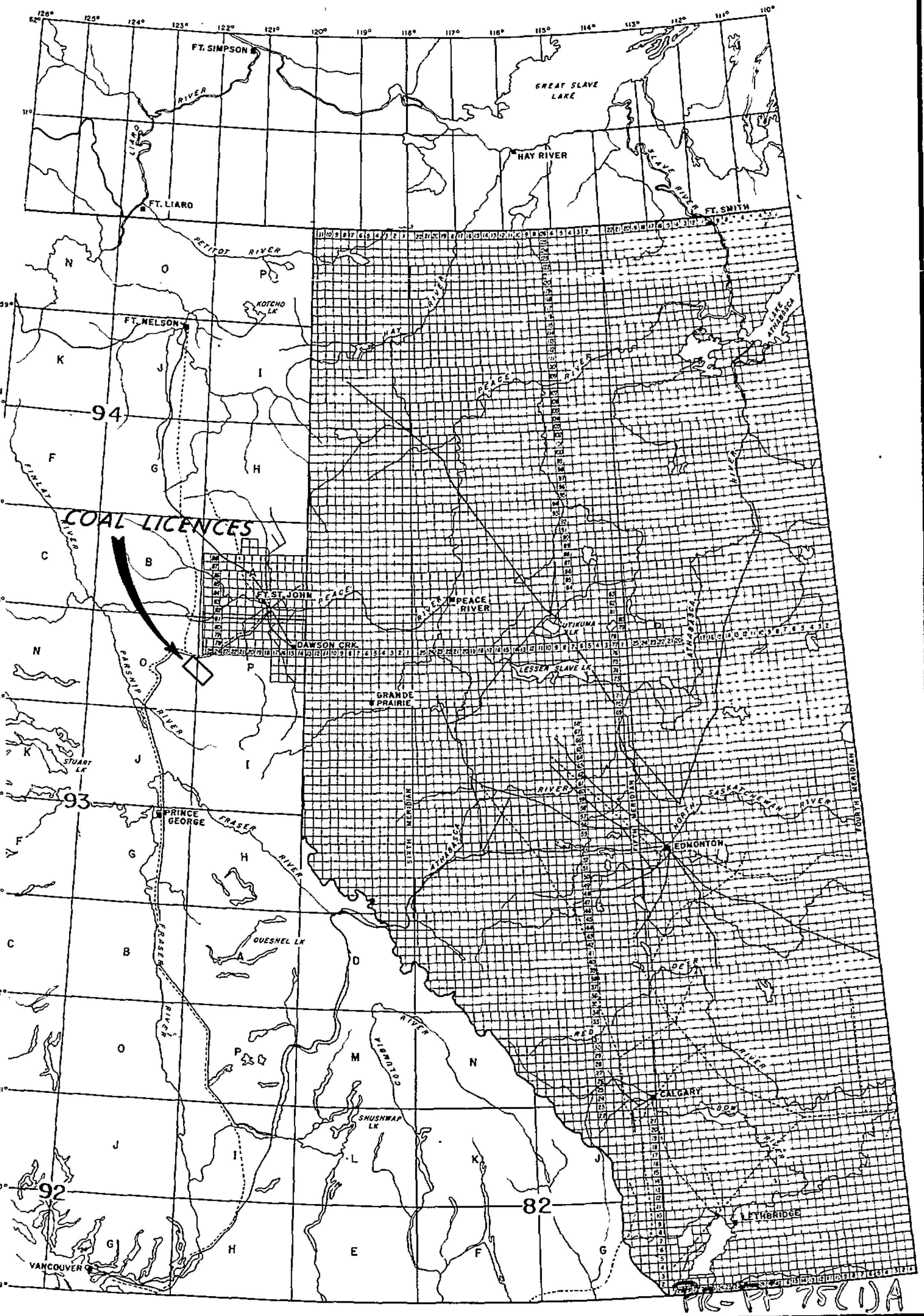
The regional geology, both stratigraphic and structural, has been discussed in Section II(a) of the previous report (Dyson - 1973). This data is not repeated and those persons unfamiliar with the area should make reference to this report which is attached. Some additional comments on the geology follow.

(a) Stratigraphy

Limited additional stratigraphic data was obtained from the current drill program . No full section of the Gething formation was drilled. However, typical rocks of the Cadomin formation were identified in the field in proximity to some of the drill sites. It is deduced that a true stratigraphic thickness for the Gething formation of between 1500 feet and 2000 feet is realistic.

Detailed correlation of the Gething formation within the licence areas is very difficult. This difficulty is caused by the complex and rapid facies changes that are taking place together with the lack of rock exposure. No thick sections of Gething formation at outcrop can be measured.

This complex pattern of facies changes is illustrated on the Stratigraphic Fence Diagram (Fig. 75/5). This interpretation is the best available at this time but may be subject to revision as additional data becomes available.



PAN OCEAN OIL LTD.

PINE PASS COAL PROJECT
NORTHEAST BRITISH COLUMBIA

LOCATION MAP

0 90
SCALE : 1 INCH = 90 MILES

PAUL DYSON CONSULTANTS

Figure 75/1

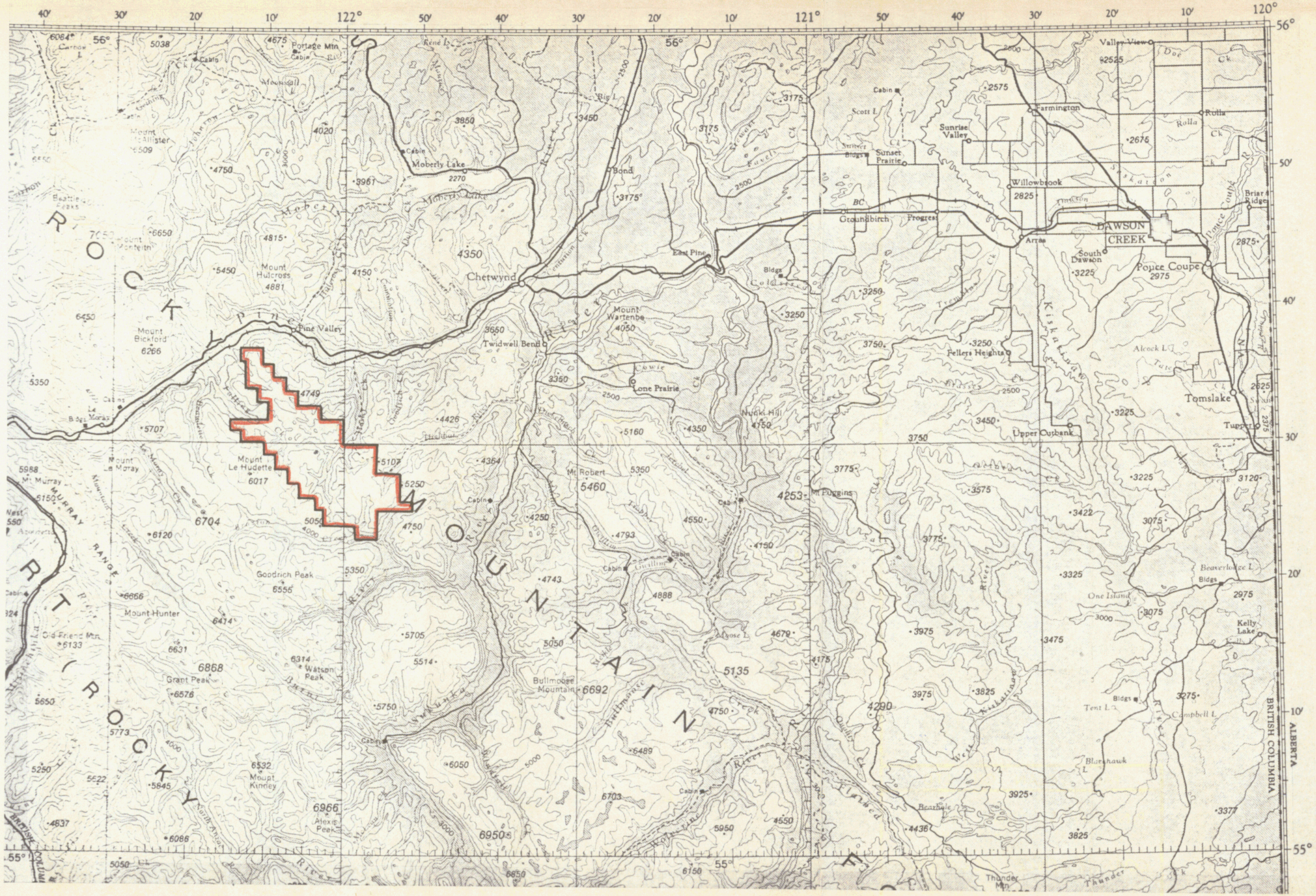


Figure 75/2

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PR-PP 75(1)A

PAN OCEAN OIL LTD.

PINE PASS COAL PROJECT

NORTHEAST BRITISH COLUMBIA

COAL LICENCE LOCATIONS

SCALE : 1 INCH = 8 MILES

PAUL DYSON CONSULTANTS

II. GEOLOGY (Cont'd.)

The possibility of locating coal seams within the Gates formation in this area has been raised from time to time. Careful examination of Gates formation outcrops both at Falls Mountain immediately to the north and at isolated outliers of Gates formation has failed to reveal any sign of coal. Exploration has consequently been concentrated on the Gething formation.

(b) Structure

As can be seen from the Field Data Map (Fig. 75/4) much of the area has been subjected to intense folding and faulting. In those areas where the folding and/or faulting are most severe as apparent from the limited outcrop, there is not believed to be any mining potential. In general, this area of severe structural complexity lies along the west side of Falling Creek, at the headwaters of Falling Creek and throughout the upper drainage of Hasler Creek

The possibility that much of the rest of the area has similar structure that is masked by poor exposure must be considered. The limited drilling and outcrop information in the Johnsen Creek, lower Hasler Creek area, and Highhat areas does, however, suggest that this area may well be less complex.

III. EXPLORATION PROGRAM

(a) Objectives

The 1974-1975 exploration program was designed to assess the distribution and thickness of coal seams throughout coal licences held by Pan Ocean. The initial 1973 program had limited itself to drilling a very small area where the access was simple. As explained in the previous report "Dyson - 1973", this program had failed to locate a coal seam which appeared to be highly prospective for development. In accordance with the recommendations made in this report it was decided to carry out a widespread drilling program. The drill holes would be located not principally in the hope of immediately locating a mineable block of coal, but primarily to test the stratigraphy of the Gething formation across the whole licence block. The primary concern would be to drill holes perpendicular to the bedding in what would be believed to be unfaulted rock sequences. Hopefully, the results of these drill holes would indicate those areas where the future exploration could be concentrated with the objective of finding a reserve of mineable coal of a suitable grade.

(b) Field Methods

The majority of the outcrops within the area had been mapped during the 1972-1973 field programs. Outcrops are very scarce in the area as can be seen from the Field Data Map (Fig. 75/4) which it is believed shows the majority of the outcrops present on the coal licences.

A series of drill sites were selected based on the existing geological information and the means of access to these sites was considered. In the Fall of 1974, it was decided to drill a limited number of initial drill holes close to existing roads. The first drill site (DH74-1) was selected within 100 yards of an existing road, however, while this hole was being drilled some difficulties were encountered with obtaining the necessary government approvals to continue the program and the program was abandoned after the completion of this hole.

A further nine holes were planned for the summer of 1975 at widely spaced locations. It was decided to carry out the program utilizing a helicopter for both moving and servicing the drills. It was believed that such a program would be competitive in cost in view of the lengths of road required to reach the wider scattered drill sites. Furthermore, reclamation would become an insignificant part of the program rather than a major problem. The equipment used consisted of

(b) Field Methods (Cont'd.)

two Longyear No. 38 diamond drills supported by a Gazelle helicopter. The drills were contracted from Canadian Longyear Ltd. and the helicopter from CanWest Aviation Ltd. This combination of two drills with each drill working two ten hour shifts and a Gazelle helicopter proved to be most satisfactory.

The personnel involved usually consisted of two to three geologists plus two field assistants. These persons were employed in keeping the drilling data including core logging fully up to date and doing additional local field mapping whenever helicopter availability made it possible.

All the drill core was hauled to a central camp located on the Hart Highway approximately twenty five miles west of Chetwynd. The geological and drill personnel were all based at this point.

All the drill holes were logged mechanically with Gamma Ray Neutron and Side Wall Density logs using a helicopter transportable unit from Roke Oil Enterprises Ltd.

(c) Drill Site Location

The reasons behind the location of the drill sites can be summarized as follows:

(i) 74-1 - This drill site, as previously mentioned, was located close to an existing road. Two coal seams approximately eight feet thick with a sandstone unit between them were found on the road. The drill was

(c) Drill Site Location (Cont'd.)

set up to drill through these seams with the purpose of establishing the stratigraphic positions of the seams and at the same time obtaining unweathered samples for analysis.

(ii) 75-2 - This hole was originally part of the 1974 program but access to the location was not completed prior to abandonment of the program. The location was selected to test the thickness of Moosebar formation in this portion of the licence block.

(iii) 75-3 - This hole was located on the top of a ridge which appeared to be composed of essentially flat lying beds of the Gething formation. A normal section for this area would be penetrated.

(iv) 75-4 - This location on the west side of Falling Creek was set up to drill a section of the Gething formation which had been recognized dipping to the west in an apparently structurally continuous block.

(v) 75-5 - This hole located to the west of 75-3 was drilled at an angle into what was assumed to be a structurally undisturbed block of Gething formation.

(vi) 75-6 - This hole immediately to the west of 75-4 was designed to provide overlapping with the 75-4 hole so as to complete the Upper Gething section of this location.

(c) Drill Site Locations (Cont'd.)

(vii) 75-7 - The outcrop of the Cadomin formation which underlies the Gething formation had been located in this area. The location was picked with the purpose of drilling the hole approximately 1000 feet deep to this Cadomin formation. A complete unfaulted section of Lower Gething would thus be available.

(viii) 75-8 - This hole was set up to test the upper portion of the Gething formation in an area to the northwest of Hasler Creek.

(ix) 75-9 - This hole to the immediate south of Hasler Creek was similarly located to test the Upper Gething formation.

(x) 75-10 - This hole on Johnsen Creek was located to spud in the Moosebar formation and to test the Upper Gething formation immediately underlying.

IV. EXPLORATION RESULTS

The drill program consisted of the ten holes mentioned above totalling 9,139 feet, the deepest being 1,183 feet (75-8) and the shallowest being 498 feet (75-9). The geology of each hole is discussed under Section IV(a) and the coals are discussed under IV(b). Detailed data for all the boreholes, i.e. written core description, plotted lithological log, Gamma Ray Neutron and Side Wall Density log, may be found in Volume III. Similarly, details of the coal quality for those coals tested will be found in Volume II.

(a) Geology

The results of each borehole are illustrated on a cross section and discussed separately as follows:

(i) 74-1

This hole failed to locate the two seams which had been apparent in outcrop adjacent to the drill site. Numerous thin coaly stringers were present in the Gething formation at this location, but the core showed abundant fractures and anomalous dips. The section was believed to be faulted and not representative of the Gething formation in this area. The hole was abandoned at a depth of 745 feet.

(a) Geology (Cont'd.)

(ii) 75-2 Cross Section AA' Fig. 75/6

This hole was set up on an outcrop of Moosebar formation. It had been hoped to reach the Gething formation within a few hundred feet, however, the Moosebar appeared to be faulted and the hole was abandoned at a depth of 968 feet while still in Upper Moosebar formation.

(iii) 75-3 Cross Section BB' Fig. 75/7

This hole penetrated a continuous section of Gething formation and was drilled to a depth of 897 feet before being abandoned for mechanical reasons. It had been hoped to reach the Cadomin formation at this location.

(iv) 75-4 Cross Section CC' Fig. 75/9

This hole was drilled to test what was apparently an unfaulted section of Gething formation. The hole commenced in Gething formation and was completed at a depth of 1,087 feet which was close to the mechanical capability of the drill. A continuous section of the Gething formation was penetrated although neither the top nor bottom of the formation was present in the hole. Information from this hole prompted the drilling of 75-6.

(v) 75-5 Cross Section DD' Fig. 75/10

This hole was set up in what was believed to be the lower portion of the Gething formation. It failed to reach

(a) Geology (Cont'd.)

the Cadomin formation which underlies the Gething formation which was drilled to a total depth of 1,138 feet.

(vi) 75-6 Cross Section CC' Fig. 75/9

This hole was set up so as to overlap 74-4. It commenced in the Moosebar formation and was drilled to a depth of 938 feet. The lower 500 feet appears to be common to both 75-4 and 75-6.

(vii) 75-7 Cross Section B' and B" Fig. 75/8

As mentioned in Section III(a), this hole was set up in the hope of reaching the Cadomin formation which had been observed at outcrop. The hole was drilled to 1,127 feet but did not reach the Cadomin formation. It is felt that the Cadomin must be within 100 feet of the base of the hole, but the mechanical capability of the drill did not permit the drilling of a deeper hole.

(viii) 75-8 Cross Section EE' Fig. 75/11

This hole was intended to intersect the Moosebar-Gething contact, however, approximately 100 feet of drift was present at this location and the first bedrock penetrated by the hole was approximately 75 feet below the Moosebar-Gething contact. The upper coal bearing zones of the Gething formation were penetrated the the hole was abandoned at a depth of 1,183 feet

(a) Geology (Cont'd.)

(ix) 75-9 Cross Section GG' Fig. 75/12

This hole was set up as a further test of the Upper Gething formation and appears to reach bedrock at a horizon very close to the Moosebar-Gething contact. The upper part of the Gething was penetrated prior to abandoning the hole at a depth of 498 feet.

(x) 75-10 Cross Section HH' Fig. 75/13

This hole commenced in the Moosebar formation and was drilled so as to penetrate the upper 250 feet of the Upper Gething before being abandoned at a total depth of 558 feet.

In summary, all the holes with the notable exception of 74-1 provided valuable geological information for the evaluation of the coal licences held by Pan Ocean. Even Hole 75-2, which was drilled wholly within the Moosebar formation, gave valuable data regarding the structure in that portion of the acreage. The correlation of the geology and the boreholes is difficult. The stratigraphic fence diagram (75/5)is believed to be the most likely correlation based on an assessment of the detailed lithology of the logs. An excellent correlation exists between Holes 75-4, 75-6, 75-8, 75-9 and 75-10. The correlation to Holes 75-3, 75-5 and 75-7 and indeed between these holes themselves, is less clear. No doubt,alternate correlations might well be developed by other geologists.

(b) Coal

The primary objective of the exploration program was to locate coal seams which would have the potential for being profitably mined. While ever changing technologies do not permit fixed parameters to be used, the objective was in general to locate a good grade coal seam thicker than 5 feet.

The drill program allows some general conclusions to be drawn regarding the distribution of coal within the Gething formation.

Firstly, the upper 300 feet of the Gething formation usually contains at least two coal zones thicker than 5 feet and up to 20 feet thick. With the possible exception of the southern portion of the acreage (75-5), these coal zones are present wherever the upper portion of the Gething formation was drilled (75-4, 75-6, 75-8, 75-9 and 75-10). The coals which are sometimes present in the lower portion of the Gething do not appear to have significant lateral extent due to rapid facies variations within this part of the formation. An example of this is the almost total absence of the coal zone which is present from 875' to 910' in 75-4 the nearest hole which penetrates the same interval (75-8). Other seams where developed in the Lower Gething appear to be either thin or dirty. This observation is in agreement with the information being assembled at the Sukunka coal project.

(b) Coal (Cont'd.)

The best coal seam is undoubtedly in the Upper Gething formation. It seems likely that the low ash coal found in 75-4, 75-6, 75-8, 75-9 and 75-10 is in general correlative. These holes are not closely spaced (except 75-4 and 75-6) and detailed correlation is tentative. Further drilling will be needed in the Hasler Creek-Johnsen Creek area to fully define the correlation. The fence diagram (Fig. 75/5) suggests that Hole 75-5 may have penetrated the seam correlative with this low ash coal seam. If indeed this correlation is correct, the seam has deteriorated significantly to the south.

This section of the report does not discuss the quality of the coal. A discussion of the coal quality together with all the results of analyses made on coal recovered from both the 1975 and 1973 drill programs is included as Volume II.

V. CONCLUSIONS

It is concluded that the only coal seams which are worth exploring are those which lie within the upper 400 feet of the Gething formation. Analytical results (see Volume II) show a coal seam averaging about 8 feet in thickness to have an exceptional low ash content. While the Free Swelling Index is low, the coal does appear to have potential as a blending product.

This coal seam is probably present over a large portion of the north eastern half of the Pan Ocean coal licences. Present drilling is very widely spaced, but sufficient data has been assembled to indicate that in excess of 200 million tons of low ash raw coal is present concentrated in the Johnsen Creek-Hasler Creek area.

The mineability of these reserves is an unknown factor, however, limited outcrop information does suggest that a large portion of the prospective area may well have structural dips below 30°. This being the case, the possibility for the recovery of sufficient coal to support an underground mine undoubtedly exists. In view of the possible recoverable reserves of very low ash coal, additional exploration is certainly warranted in this area.

Drilling and surface mapping has shown much of the remainder of the acreage to have only very minimal potential for development. This conclusion is based on the absence of upper coal bearing zones

V. CONCLUSIONS (Cont'd.)

of the Gething formation and/or the structural complexity of the area (see Fig. 75/4). These areas are not worthy of further exploration.

VI. RECOMMENDATIONS

Recommendations for this project fall into two broad categories - firstly, renewal or surrender of licences, and, secondly, additional exploration.

(a) Licences

Based on the conclusions given above, certain of the licences should be surrendered and the remainder should be maintained for a further term. The Coal Licence Map (Fig. 75/3) shows the total area licenced and indicates those licences which should be surrendered as soon as possible. They are: 2905 to 2909, 2931 to 2940, 2953 to 2962, 3561 to 3564 and 3568 to 3569.

(b) Additional Work

The primary objective of any additional work should be to establish without doubt the quality of the coal present in the low ash seam present in the Hasler Creek-Johnsen Creek area (75-8, 75-9 and 75-10).

It is recommended that bulk samples be obtained from this seam at at least one location and preferably at two locations. Should the budget permit, some additional drilling to test the continuity of this seam between the existing holes should be completed.

(b) Additional Work (Cont'd.)

It is not believed that additional surface data is available, but any that can be obtained as a result of road building, etc. should be recorded.

The only portion of the acreage block not evaluated is the Highhat Creek area. It is possible that additional survey data could be obtained in this area.

I. P. Dyson, P. Geol.

VII. ACKNOWLEDGEMENTS

The completion of the program would have been impossible without the help and co-operation of the technical personnel and contractors.

The drilling program was carried out by Canadian Longyear Ltd. of Vancouver. The foreman, Mr. Elmer Russel, made every effort to maintain an efficient drilling program despite an initial series of mechanical problems with one drill.

The helicopter services were provided by Canwest Aviation Ltd. of Calgary. The helicopter was piloted by Mr. John Pridie who provided efficient and safe service.

Logging of the drill holes was conducted by Roke Oil Enterprises Ltd. of Calgary. Mr. Lance Rainey, the field engineer, carried out his duties most efficiently. Additionally, his general help with the program was greatly appreciated.

The camp was based at Willow Flates on the Hart Highway west of Chetwynd. Mrs. Alice Tricker provided excellent foods for all the crew.

The reclamation program was carried out by Mr. Jim Smith of Chetwynd. He did an excellent job to the satisfaction of the B.C. Forestry officials.

The geological crew consisted of geologists, Mr. Greg Germscheid, Mr. Rory Hankel and Dr. Ali Chowdry. Overall supervision was provided by Mr. Paul Dyson.

SELECTED REFERENCES

No new publications exist for this area. The "Selected References" given in Dyson - 1973 are believed to be essentially complete.

PINE PASS COAL PROJECT

NORTHEAST BRITISH COLUMBIA

(PHASE I)

Prepared for: Pan Ocean Oil Ltd.
Calgary, Alberta.

By: Paul Dyson Consultants.
Calgary, Alberta.

June 1973.

ABSTRACT

The Pine Pass area of northeast British Columbia has good potential for the development of a coal mine producing metallurgical grade coking coal. This conclusion is based on the probable presence of coal seams thicker than 10 feet consisting of low ash coking coal and the proximity of the area to both rail and existing townsite.

Pan Ocean Oil Ltd., recognizing this potential, acquired 67 coal licences in August 1972. An initial exploration program was carried out on these licences in the fall of 1972 and the first months of 1973. The program consisted of field mapping and an initial drilling program of approximately 3000 feet.

These exploration activities confirmed the presence of low ash metallurgical grade coking coal in the medium volatile range. At the same time the existence of some areas of relatively low structural dip was recognized.

However, no thick (10 feet plus) seams of coal of adequate grade were located. The thicker seams all contained numerous shaly partings in the area that was drilled. It is planned to extend the drilling program to other areas licenced by Pan Ocean in 1973 in an attempt to locate thicker seams of good quality coal.

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73/10	Schematic Structural Cross-Section - Upper Willow Creek (SW-NE) 1" = 100'	In pocket
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Note: Figures 73/5 - 73/11 are in Volume IV.

APPENDICES

1. Borehole Logs (see Volume III)

2. Coal Analyses and Comments (see Volume II)

3. Order-in-Council re Granting of Licences

4. Gamma-Ray Neutron Logs and Density Logs (1"=20') (see Volume III)

I. INTRODUCTION

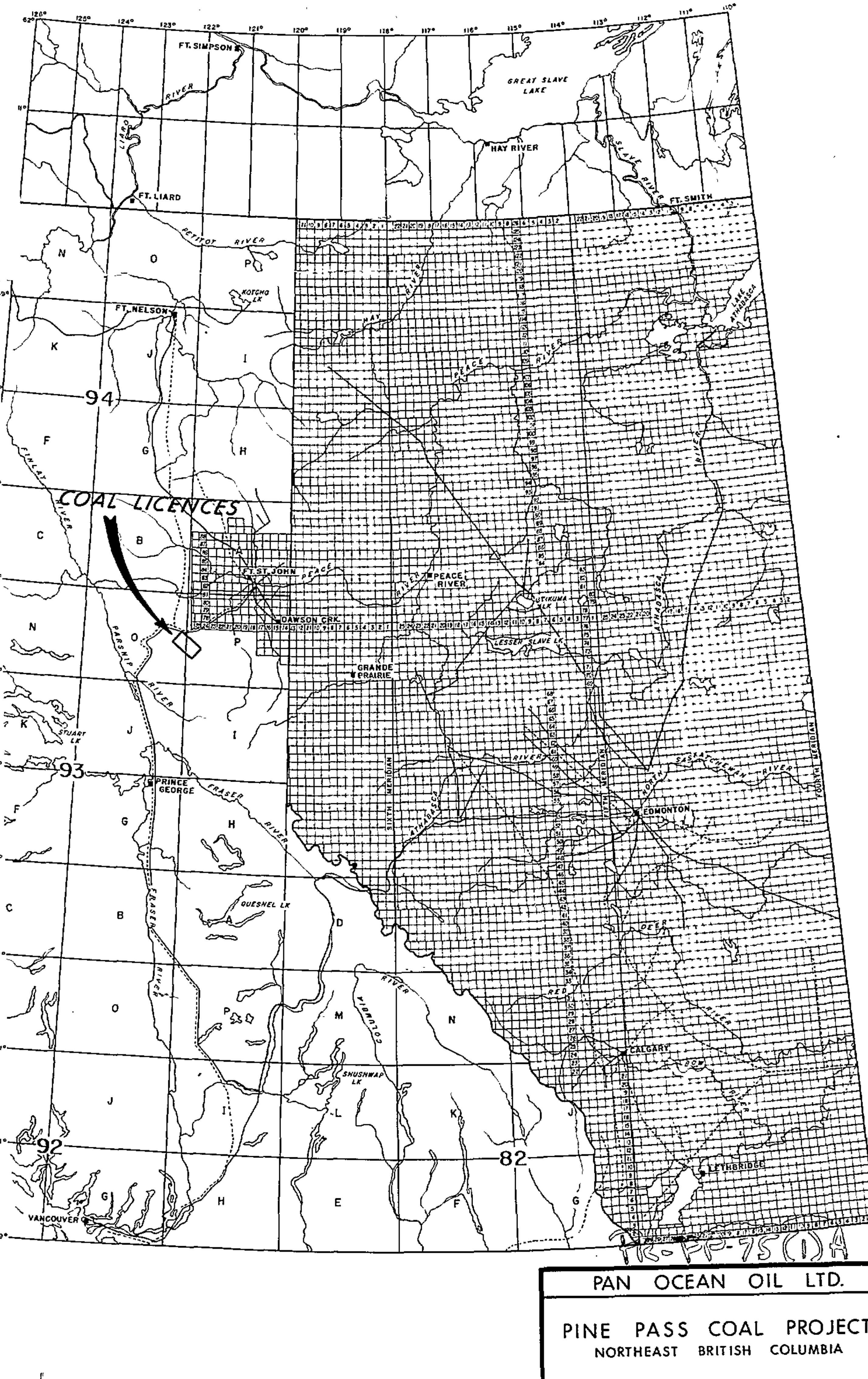
This report describes the initial work carried out by Pan Ocean Oil Ltd. in an attempt to locate an economically viable coal deposit of metallurgical grade coking coal on coal licences acquired in 1972 in northeast British Columbia. The area explored lies immediately south of the Pine Pass in the Foothills belt west of Dawson Creek (Fig. 1).

The report is divided into several main sections: the introduction, the prospect, the exploration program and the conclusions. Numerous maps, figures and tables accompany the report which is designed to present a comprehensive picture of the project from inception to its present stage.

(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 Sukunka and Pine Rivers in northeastern British Columbia. The area is underlain by Lower Cretaceous sediments which contain the potential coal measures under investigation. Specifically, the Gething formation of Lower Cretaceous age was explored for viable coal seams (see Fig. 2 and 3).

The Cretaceous sequence was folded during the Laramide orogeny being deformed into elongate plunging anticlines



PAN OCEAN OIL LTD.

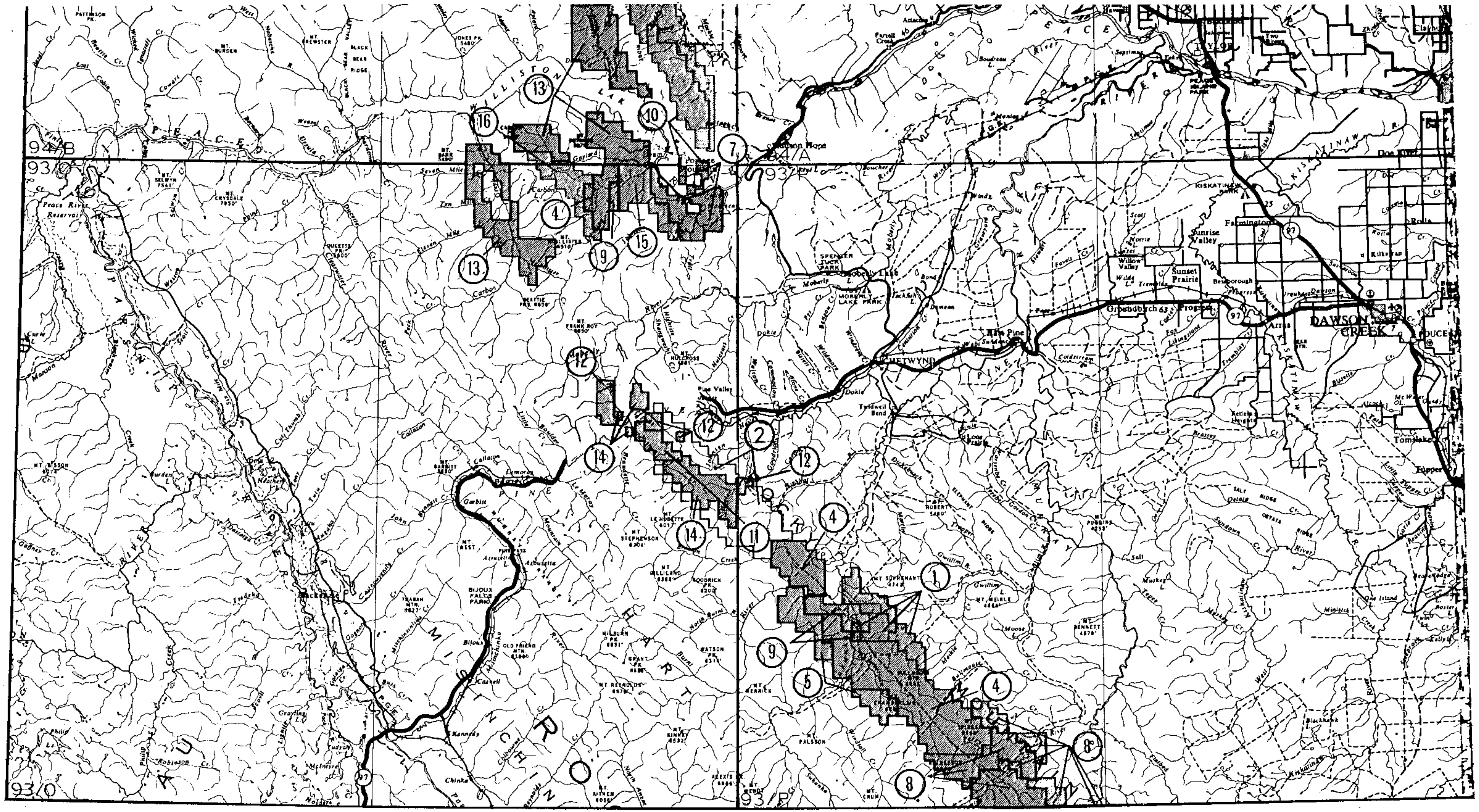
PINE PASS COAL PROJECT
NORTHEAST BRITISH COLUMBIA

LOCATION MAP

SCALE : 1 INCH = 90 MILES

PAUL DYSON CONSULTANTS

Figure 73/1



LEGEND

1. Master Exploration Ltd.
2. Pan Ocean Oil Ltd.
4. Brameda Resources Ltd.
5. Brameda Resources Ltd., Teck Corporation Ltd.
7. Cinnabar Peak Mines Ltd.
8. Denison Mines Ltd.
9. Bow River Resources Ltd.
11. M^c Intyre Porcupine Mines Ltd.
12. Pine Pass Coal Ltd.
13. Utah International Ltd.
14. Canada West Petroleums Ltd.
15. Bow River Resources Ltd., Texacal Resources Ltd.
16. Ayrshire Coal Co. Inc.

PR-PP 75 (1) A

PAN OCEAN OIL LTD.

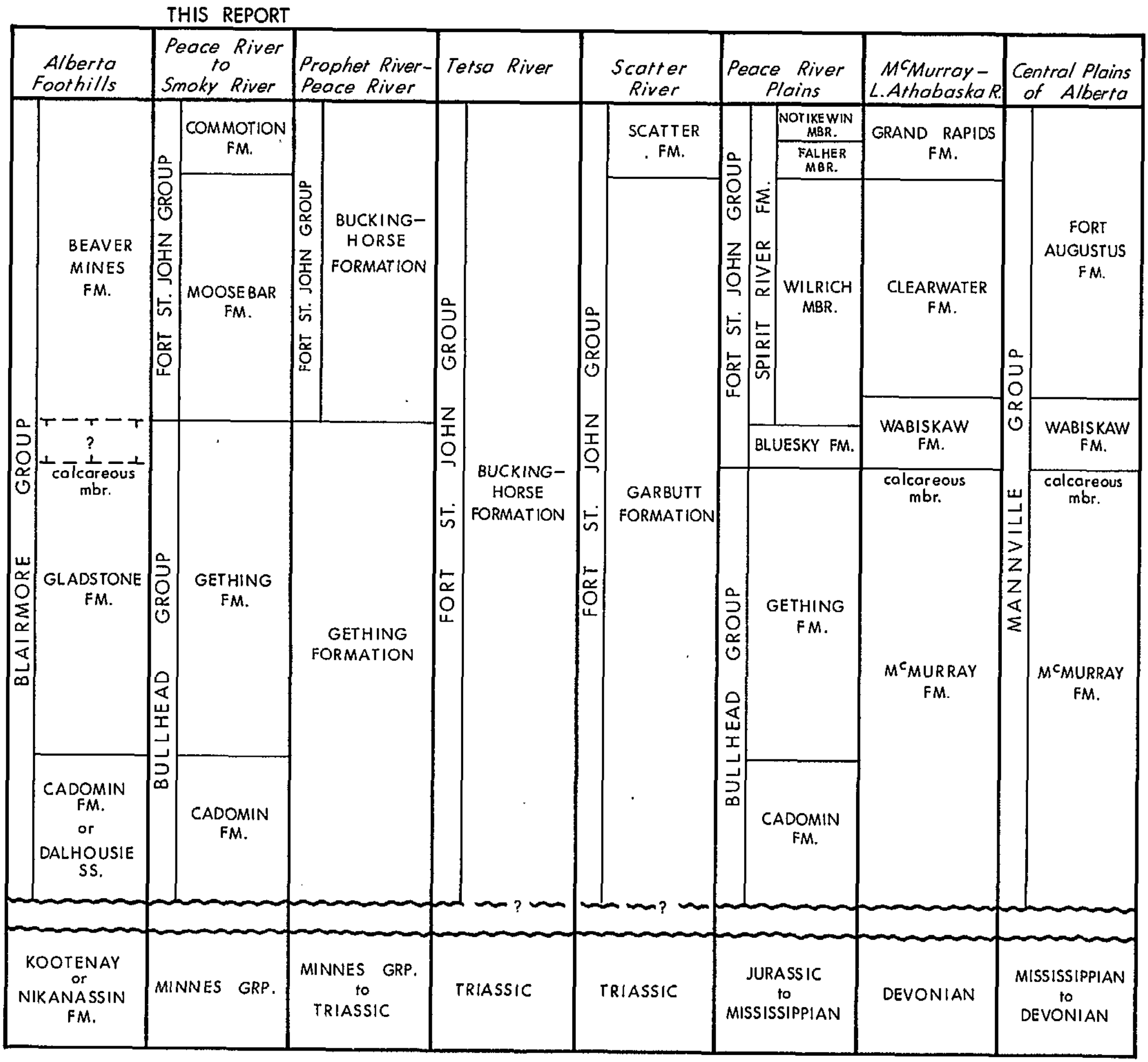
PINE PASS COAL PROJECT
NORTHEAST BRITISH COLUMBIA

COAL LICENCE LOCATIONS

SCALE: 1 INCH = 10 MILES (0–10)

PAUL DYSON CONSULTANTS

Figure 73/4



CORRELATION OF BULLHEAD GROUP IN WESTERN CANADA *Figure 73/2*

TABLE OF FORMATIONS

		Formation or Group	Thickness (feet)	Lithology
Lower Cretaceous		Fort St. John Group (includes Moosebar fm.)	3,000 - 5,000	Dark grey, marine shale with fine grained sandstone.
	Bullhead Group 0-2,500	Gething Formation	1,000 - 3,000 (?)	Fine-grained, cherty to quartzose sandstone; rusty weathering shales; carbonaceous mudstone and coal seams; minor conglomerate.
		Cadomin Formation	100 - 500	Massive chert conglomerate and coarse-grained sandstone; carbonaceous shale, minor coal.
		Regional erosional unconformity; bevels rocks of succeedingly older age northward and eastward.		
		Minnes Group	0 - 6,000	Massive quartzose sandstone; alternating units of fine-grained sandstone and mudstone; minor carbonaceous sediments.
Jurassic		Fernie Formation	500 - 1,000	Calcareous and phosphatic shales; rusty weathering shales; glauconitic siltstone; sideritic shales; thinly interbedded sandstone, shale, and siltstone.

and synclines with associated faulting. This series of en echelon folds and faults has a northwesterly trend. In this area of the Foothills most of the Cretaceous exposures occur in creeks as almost the whole area is covered by vegetation.

The "Foothills" of this region have considerable relief with elevations within the area under consideration varying from lows of approximately 2000 feet above sea level to slightly over 5000 feet above sea level. As the tree line at this latitude is at approximately 5500 feet above sea level, the hills are totally covered with a dense vegetation.

(b) Access

The Hart Highway provides excellent access along the northern side of the area (see Fig. 4). It is an all weather paved highway.

A road passable to pick-ups in good weather extends up Hasler Creek from its junction with the Pine River to a point adjacent to the old Hasler Mine. Other than this, no access was available to vehicular traffic within the area of interest.

During the exploration program additional access was established and will be discussed in that section of the report.

(c) Acknowledgments

The completion of the exploration program would not have been possible without the co-operation of the numerous technical personnel and contractors and the help of numerous local persons.

The staking program was carried out by Burnett Resource Surveys Ltd. of Burnaby, British Columbia, under the supervision of Mr. Dave Zelmer. This company utilized an Alouette II helicopter provided by Canwest Aviation Ltd. piloted by Mr. John Pridie. The crew stayed in Chetwynd.

The field checking of the area was again based in Chetwynd. A helicopter (Bell 47 Series G3B-1) was contracted from Rotoflite Ltd. Field assistance was provided by Mr. Blake Brady, geologist, Mr. Gary Morrison and Mr. Rick Cox, field assistants. The willing co-operation of all the above is gratefully acknowledged.

The drilling program was carried out by Canadian Longyear Ltd. of Vancouver. The foreman was Mr. Elmer Russel who made every endeavour to keep an efficient operation running despite a strike by the diamond drillers. Bulldozers were hired from Roller Bros. Construction Ltd. of Chetwynd who made every effort with excellent personnel but indifferent equipment.

Supervision of the drilling program was aided by Mr. T. Yoon, geologist, who spent approximately three weeks in the field.

(c) Acknowledgments (Cont'd.)

The co-operation of all the above named parties at all times contributed to the completion of the program as did valuable help received in many ways from local people. The assistance of all the above is gratefully acknowledged.

II. PROSPECT

The exploration program was designed to evaluate coal rights acquired from the British Columbia government in 1972. This section of the report explains the thinking behind the development of the prospect and the acquisition of the coal rights.

Details of the prospect are outlined both from a strictly geological point of view and from an economic point of view. Details of the selection of licences and the methods employed for the staking of these licences are described.

(a) Regional Geology

As stated in the Introduction the area under consideration lies within the Foothills belt of northeastern British Columbia. The geology of the area has been mapped at a scale of 1"=4 miles by Muller (1961) and Stott (1961). These two maps are of a reconnaissance nature only.

Regional stratigraphic studies have been made by the Geological Survey of Canada and published as Stott (1968a) and Stott (1971). In addition to this Stott has from time to time given various unpublished papers at several conferences over the past two or three years.

(a) Regional Geology (Cont'd.)

Several localized stratigraphic and mapping projects have been completed within the area - both by the Geological Survey of Canada and by the British Columbia Department of Mines. These are referred to in the Selected References as Hughes (1964), Hughes (1967), McLearn and Kindle (1950), McKechnie (1955) and Spivak (1944).

(i) Stratigraphy

The rocks exposed in the area of the Pan Ocean coal licences range in age from Jurassic to Lower Cretaceous. While the Fernie group of Jurassic age does not directly underlie the coal licences it is shown on the "Table of Formations" (Fig. 3) as it marks the first major lithologic break below the coal measures of the Gething formation.

The Minnes group is not discussed in this report other than to record its presence underlying the Cadomin formation which marks the base of the Bullhead group.

The Bullhead group contains two formations - the coal bearing Gething formation, and its basal conglomeratic unit - the Cadomin formation.

The Gething formation is overlain by the basal formation of the Fort St. John group - the Moosebar formation. This is an excellent lithologic break from the sandy sequence of the Gething

(i) Stratigraphy (Cont'd.)

formation to the predominantly shale sequence of the Moosebar formation.

Full details of the complex and somewhat controversial stratigraphy of the Minnes and Bullhead groups of this area are contained in the literature - Stott (1963) and Hughes (1964).

(ii) Structure

The mapping of the area by Stott (1961) and Muller (1961) is the only complete structural interpretation of the area. As can be seen from these maps, the structure consists of a series of sub-parallel folds and faults generally trending northwest-southeast. It appears from these maps that folding is the predominant feature, however, this may not be so.

The detailed mapping by McKechnie (1955) and Spivak (1944) has indicated many more faults than are shown on the maps of Stott and Muller. This more likely reflects the scale of mapping rather than a basic difference in interpretation.

(b) Coal Potential

The "coal potential", or to put it more explicitly, the potential of the area for the discovery of a viable coal deposit was dependent on three major criteria:

(b) Coal Potential (Cont'd.)

(i) the probable coal seam distribution and likely coal seam thicknesses,

(ii) the probable coal quality,

(iii) the mining potential.

These three factors were considered separately.

(i) Probable Coal Seams

The area under consideration lay between the Pine Pass and the Sukunka River. In general, it was an area of only reconnaissance mapping although some detail was available along the Pine Pass (McKechnie 1955 and Hughes 1967) and in the Hasler Creek area (Spivak 1944). These detailed mapping projects, previously aimed at acquiring knowledge regarding the coals of the area, are most valuable in this respect.

The data in the Spivak (1944) report describes the coals of the Gething formation as they were known at that time adjacent to the Hasler Mine with some references to coals along Willow Creek. Spivak makes reference to the 8' 8" seam at the Hasler mine and to seams apparently up to at least 15 feet thick in the vicinity. Seams exceeding 7 feet were reported on Johnson Creek and up to 5 feet in the Willow Creek drainage.

McKechnie (1955) wrote a comprehensive report describing a drilling program carried out in Willow, Johnson and Hasler Creek drainages. In total almost 50,000 feet of diamond drilling

(b) Coal Potential (Cont'd.)

was carried out between 1946 and 1951 by the Coal Division of the Department of Lands and Forests of the Province of British Columbia. The results of this program were inconclusive but several coal seam intersections thicker than 10 feet were recognized in the drilling.

In 1969 and 1970, Brameda Resources Ltd. and Pine Pass Coal Co. carried out some exploration along the Pine Pass immediately north of the highway. This exploration consisted of surface mapping, a drilling program and an adit. Once again, the existence of coal seams in the Gething formation with thicknesses greater than 10 feet was indicated.

From this information it was concluded that coal seams at least 10 feet thick and possibly close to 20 feet thick do exist in the Gething formation in the Pine Pass area.

(ii) Probable Coal Quality

Coal quality was poorly defined as the old analyses in the Willow Creek and Hasler areas were not primarily designed to make preliminary assessments of the suitability of the coal for the metallurgical market. Nevertheless, some indication of coal quality was obtained from these old analyses and from regional considerations.

(b) Coal Potential (Cont'd.)

The best data in the immediate area was from the Pine Pass Coal Co. project which included the driving of an adit to obtain bulk samples of coal from a 16 foot seam. Data from the coal recovered from the adit is shown on the "Project Map". As can be seen, the coal is of good coking quality (FSI 7+) and it further appears to be amenable to simple washing to reduce the ash below 6%.

Samples from the old Hasler Mine were similarly encouraging as to low ash content and probable coking quality.

Exploration by Brameda Resources Ltd. to the south in the Sukunka area had similarly found a low ash good quality coking coal.

Other parameters such as volatile matter content and sulphur content were similarly satisfactory. Volatiles content was generally recorded at the low end of the medium volatile range and sulphur content was below 0.65%.

The analyses from the drilling report by McKechnie (1955) generally fall within these same parameters, although once again no quantitative coking information was recorded.

It was concluded that the coal of the Gething formation in the Pine Pass area was probably of medium volatile, low sulphur, low ash coking coal which furthermore would be readily amenable to a relatively simple washing process.

(b) Coal Potential (Cont'd.)

(iii) Mining Potential

The mining potential of an area is affected by three main factors:

(a) a suitable mining method,

(b) sufficient recoverable reserves to support a mine, and

(c) an adequate transportation system.

The possibility of mining large volumes of coal in the area by some form of open pit was believed to be limited. This conclusion was reached as maximum seam thicknesses, in general, were expected to be less than 15 feet. Such thicknesses do not permit the removal of large amounts of overburden especially when the coal at shallower levels is probably oxidized. Although a possibility existed for a unique relationship of topography to coal seam and/or tectonic thicknening of the seam, this was largely discounted. Primary consideration was given to possibilities for underground mining methods.

The most significant factor required was an area of relative structural simplicity containing a seam of a thickness suited to the optimum operation of modern mechanized equipment. In general, increases in dip above 15^{o} to 20^{o} cause a rapid decrease in the efficiency of conventional mechanized equipment. Seams of 6 to 10 feet are probably preferred.

(b) Coal Potential (Cont'd.)

The probability of a seam in the above thickness range was established but little information was available on the detailed structure of the area as the only available mapping for most of the area was of a reconnaissance nature only.

However, as reserves in the order of ten million tons of mineable coal were believed to be a reasonable minimum objective*, an area of two to three square miles underlain by a 5 foot seam at suitable inclinations would be adequate. An area with low dip that would permit mining on this scale was well within the probability of the structure of the area.

One of the main advantages of the area was the proximity of the railway, the paved highway and the town of Chetwynd. Most of the prospective area lies less than ten miles from the railway and essentially all of it within twenty miles of the railway. This is a distinct advantage for any coal property as one of the major problems common to many is the need of many tens of miles of new railway. A new mine in the area would likely be within economic trucking distance of the rail.

Similarly the already existing town of Chetwynd connected to the area by all weather paved highway could be used as a townsite for persons working at any mine in the area. (Fig. 4).

* The establishment of this objective is discussed later.

(b) Coal Potential (Cont'd.)

These two factors make considerable difference to the economics of operating a coal mine in the area. Small mines (500,000 tons per year or even less) could well be feasible in the area.

In conclusion, it can be seen that the Pine Pass area had adequate potential for the development of a coal mine producing metallurgical grade coking coal.

(c) Staking Program

Having concluded that the area immediately south of the Pine Pass extending to and including the headwaters of Hasler Creek had the potential of being underlain by viable coal seams of metallurgical grade, it was decided to acquire all the available coal rights.

In order to select the area to be staked certain basic assumptions were made:

(i) Commercial coal seams (i.e. seams thicker than 5 feet) were limited to the Lower Cretaceous Gething formation.

(ii) Seams were unlikely to exceed 10 feet in thickness.

(iii) Seams less than 10 feet in thickness would not lend themselves to surface mining and the prospects were mainly for underground mine development.

(c) Staking Program (Cont'd.)

(iv) Preferred mining areas were those where the dip of the strata was less than 15°.

(v) Overburden should be less than 2 000 feet.

As portions of the apparently prospective area were not geologically mapped, a photogeological interpretation was completed. This interpretation incorporated all the available data both published and unpublished and indicated that an area of approximately 70 square miles was available for staking.

Application was made to the Government of the Province of British Columbia for permission to stake coal licences in the area. As the area was subject to "Reservation of Coal" permission to stake was granted by Order-In-Council No. 1519 dated April 20, 1972 (see Appendix).

The "Coal Act" of the Province of British Columbia requires that two posts be planted in the ground to mark each coal licence that is requested. Following the decision to stake the above 133 coal licences the physical staking was contracted out to Burnett Resource Surveys Ltd. of Burnaby, B. C.

Two bids were received on the staking and this company was chose both on the basis of the bid and its experience in staking coal licences. (The company had staked over 700 coal licences between 1970 and 1972.)

(c) Staking Program (Cont'd.)

The method used was to plot the chosen licences at a scale of 1:50,000 on the existing government topographic maps for the area. The corners of the licences were then transferred to existing aerial photography by the "radial line plot" method. When in the field these corner locations were photo-identified by the crew chief who was very experienced in this procedure.

Tree cover made it essentially impossible to walk to the photo-identified points from the available limited helicopter landing sites. This being the case, it was decided to use an Alouette II helicopter equipped with man hoist to carry out the staking. In this way, the crew chief and "staker" were able to fly direct to the required point and then lower the staker to the ground at the point without having to land the helicopter. The system became most proficient and the crew chief was able to "leap frog" stakers around. This enabled upwards of 25 coal licences to be staked in a day by a four man party. Despite high winds, the staking which commenced on June 12th, was completed by June 20th. The applications for 67 licences were submitted to the British Columbia Government on June 26, 1972. They were subsequently issued as coal licences No's. 2686 to 2752 inclusive. (Fig. 5)

III. EXPLORATION

The granting of the coal licences to Pan Ocean carried with it an obligation to carry out exploratory work on the licences to fulfill a "work commitment". This initial program is assessed in this section of the report.

(a) Objectives

The initial exploration program for the licences held by Pan Ocean Oil Ltd. had the following technical objectives in mind:

(a) A geological understanding of the distribution of the coal bearing rocks in the area of the licences.

(b) The confirmation of the presence of coal on the licences.

(c) The preliminary delineation of both seam thickness and seam distribution within the coal bearing formation.

(d) The establishment of some initial data regarding coal quality.

(e) An initial assessment of the mining possibilities for the properties.

These objectives were met by the following exploration program. All the available geological data for the area was reassessed to ensure the best possible understanding of the Gething formation.

Following this, a field mapping program was carried out. The objectives of this program were to confirm the reported

(a) Objectives (Cont'd.)

geological structure; to locate coal seams at outcrop if possible; to carry out hand trenching of seams located in order to determine seam thicknesses; and to check access to possible drill sites.

The above field program was followed by a drilling program in one area. The objectives of this drilling program were to test the Gething formation for the presence of possible viable coal seams obtaining, at the same time, unweathered, uncontaminated samples from any such seams for analysis. The drilling would also yield additional structural data.

This report treats the field work stage and the drilling stage of the program as two separate sections.

(b) Field Work

The field work was carried out from Chetwynd. The crew consisted of two geologists and two assistants utilizing a Bell G3B-2 helicopter. The field work was carried out during part of September and October 1972. The work was severely hampered by two early but severe snow storms which split the work into two different spells. The first was from September 16 to September 22 and the second was from October 1 to October 8, 1972. The work was curtailed on both occasions by snow rather than by a sense of completion of the project.

(b) Field Work (Cont'd.)

It quickly became a-parent that there is a general lack of outcrop in the area and that the interpretation of the detailed geology would be time consuming if not impossible from surface mapping. Traversing was essentially limited to the creeks. All the readily traversable tributaries of Hasler, Johnsen and Falling Creek were checked. Some work was also carried out at the headwaters of Willow Creek and on a tributary of the Brazion River. All the data that was recorded has been plotted onto a base map (Fig. 7). As can be seen, the overall interpretation of the geology as shown on the Project Map (Fig. 6) has not been changed. The main reason for this is that further field work will be carried out in 1973 to investigate some of the areas mapped in 1972. In many cases it is not possible at this time to make meaningful changes to the Project Map.

A traverse was made of Hasler Creek beginning east of the Hasler mine westward to approximately the headwaters of Hasler Creek. Except for minor changes in contacts, the mapping near the Hasler mine as shown on Fig. 6 is essentially correct. West of the mine where a broad anticline is indicated within the Gething formation, the beds are actually very highly folded, displayed by tight anticlines and synclines, thus making it unattractive for coal exploration.

(b) Field Work (Cont'd.)

Near the headwaters of Hasler Creek, immediately north of a small lake, a dip slope of resistant beds is overlain by a less resistant unit. This may represent the contact between the Gething and the Moosebar formations. If so, the Gething would occur on the west flank of a syncline, probably with relatively low dips. Large blocks of massive chert conglomerate occur along the creek for a distance of over one half mile. These conglomerate blocks are probably basal Gething or Cadomin formation.

On a side branch of Brazion Creek on the southern block of licences, a five foot coal seam was observed in a predominantly shale/siltstone unit approximately 12 feet above a more resistant, predominantly sandstone unit. All outcrops along Brazion Creek and its tributary appear to be pre-Gething in age.

The Gething formation indicated on the project map (Fig. 6) near the head of a small tributary entering Hasler Creek from the northwest two miles west of the mine proved to be all Moosebar formation except possible Gething formation near the mouth of this tributary.

Traverses of Falling Creek were most unproductive as outcrop in the licence area was very poor. Several strikes and dips were recorded on isolated outcrops believed to belong to the Moosebar formation. At the headwaters of the creek a series of interbedded

(b) Field Work (Cont'd.)

shales, sands and minor coals was assigned to the pre-Gething but this assignment is questionable. More detailed work must be completed to confirm the presence of the coal bearing Gething formation between the pre-Gething rocks and the post-Gething Moosebar formation in this area.

Most emphasis was placed on the area of the divide between Johnsen Creek and Willow Creek for two reasons. An outcrop of coal over 7 feet thick had been reported by Spivak (1944) and thick coal seams were apparently present in the well known well as Texas Gulf Sulphur Sun Falls a-64-B. Furthermore, access to this area for a drilling program would be relatively inexpensive.

The outcrop at the head of Johnsen Creek was hand trenched and found to be approximately 20 feet thick. It did, however, contain almost 3 feet of readily apparent partings. (This presence of these partings was later confirmed by the drilling program).

The structure was confirmed to be essentially a series of west dipping beds with dips generally in the 20° to 30° range. A fault was inferred to exist immediately below the coal outcrop at the headwaters of Johnsen Creek. This fault was later confirmed by the drilling program.

While the field work did not produce the definitive results hoped for, sufficient data was obtained to plan a valid drilling program.

(c) Drilling Program

i) Planning

The objectives of the drilling program were to test the Gething formation for viable coal seams, to obtain unweathered samples of coal for quality control; and to aid in the structural interpretation of the coal licences.

The choice of a location for this initial drilling program was based on several criteria. These were:

(a) An area where the structural dip was below 30°. Such an area might well lend itself to an initial limited mining program should viable coal seams be present.

(b) An area with known coal occurrences.

(c) Good access from existing access road. In this way maximum monies would be expended on drilling rather than on road building.

Bearing these parameters in mind an area on the divide between Willow Creek and Johnsen Creek was chosen. Field work had confirmed the structural dip to be essentially less than 30° and no major faulting or folding had been recognized. From a structural point of view, it was a suitable area. Coal seams had been recognized both at the northwest end of the area and at the southeast end. A well, Texas Gulf Sulphur Sun Falls a-64-B, drilled in 1966, indicated several coal seams in the upper portion of the Gething formation. In fact, the Sonic Log (Fig. 8) indicates two coal seams thicker than 10 feet in the

(c) Drilling Program (Cont'd.)

upper 1200 feet of Gething formation. At the south end of the proposed drilling area a coal seam previously reported by Spivak (1944) as "over 7 feet" had been hand trenched in 1972 and found to be approximately 20 feet thick (see Field Work). While this seam could not be directly correlated to the seams in the TGS well, it did indicate the area to have potential for being underlain by a substantial coal seam.

Access to the area was relatively good by the road built to service the TGS well (Fig. 9). This road was in relatively good repair with the exception of a few washouts at some culverts. New road building would be minimized.

Having decided on the area to be drilled, various alternate drilling methods were available. These ranged from the use of a conventional seismic drill to the use of a diamond drill which retrieves continuous core throughout the interval being drilled. It was decided that the extra costs involved in obtaining a continuous core were well worthwhile when only a limited drilling program was to be undertaken. This method of drilling further ensures that samples of coal recovered are uncontaminated. A frequent problem with other drilling methods - reverse circulation, double-wall drill pipe, etc. - is that the resultant chip samples of coal contain excess ash as a result of chips from non-coal zones being included in the sample. Furthermore, the continuous core enables the top and bottom of the seam and all

(c) Drilling Program (Cont'd.)

partings within the seam to be accurately measured. Bids for this type of drilling were received from three reputable contractors and Canadian Longyear Limited were chosen both on the basis of price and on the basis of experience.

Before proceeding with the upgrading of the road, permission was obtained for a crossing both of the P.G.E. railway and the gas transmission line of Westocast Transmission Ltd. Ploughing of snow for the drill program got underway in mid-January and the drill crew moved in approximately one week later.

ii) Drillhole Summaries

(a) Drillhole No. 1 (H1)

The hole was drilled approximately one half mile up dip and across strike from the TGS test hole (Fig. 9 and 10). Its purpose was to test the seams penetrated by this well and at the same time to provide structural data between the two locations. It was scheduled to be a 1300 foot hole which depth would penetrate the stratigraphic interval equivalent to the 20 foot plus coal intersection found at approximately 2320 feet in the TGS well.

The hole penetrated a portion of the Moosebar formation and entered the Gething formation at *189 feet. A 12 foot coal seam ('C' on Fig. 8) was penetrated from 330 - 342. The only other coal interval thicker than 5 feet found in the

* All depths are measured on the Gamma Ray-Neutron log. There may be minor discrepancies to the depths recorded on the lithologic logs.

(c) Drilling Program (Cont'd.)

hole to a total depth of 1542 feet was a 10 foot seam from 1053 feet to 1063 feet. As can be seen from Fig.8 this seam is tentatively correlated to the thick coal interval at 2320 feet in the TGS well. This correlation is uncertain but likely following a detailed analysis of the logs. In the field the correlation was very indefinite and Drillhole No. 1 was deepened to a total depth of 1542 feet in order to be certain that the stratigraphic interval equivalent to the TGS "thick seam" had been penetrated.

(b) Drillhole No. 2 (H2)

Drillhole No. 2 was drilled along strike to the southeast of No. 1 (Fig. 9). It was drilled to a depth of 602 feet but failed to penetrate any good coal seams. The interval equivalent to Seam 'C' in Drillhole No. 1 had essentially shaled out and a lower coaly interval - 'D' - had developed. Interval 'D' contained numerous partings and could not be classed as an economic seam as it was over 50% partings.

(c) Drillhole No. 3 (H3)

This was the next hole along strike towards the outcrop at the head of Johnsen Creek (Fig. 9). This hole encountered structural problems and faulted from the Gething formation back into the Moosebar formation at a depth of 130 feet. Only 76 feet of Gething formation was penetrated above this fault. This interval is shown separately on Fig. 8 . At a depth of 504 feet the Gething formation was re-entered

(c) Drilling Program (Cont'd.)

and the hole was continued to a total depth of 701 feet. (Fig. 11) No apparent viable coal seam was encountered in this hole. Tentative correlations were made for intervals 'A' to 'D' inclusive.

(d) Drillhole No. 4 (H4)

This hole was located near the thick seam outcrop (20 feet plus) that had been recognized in the creek at the head of Johnsen Creek and was specifically drilled to test this seam. It entered the Gething formation at 118 feet and bottomed at 302 feet. Two coal intervals thicker than 5 feet were encountered (Fig. 8). The upper seam (193 feet to 200 feet), labelled 'B', was the best seam encountered in the drilling program. It is discussed later in the section on coal quality. The lower coaly interval, 'D', was approximately 17 feet thick (265 feet to 282 feet) but contained over 6 feet of partings.

(e) Drillhole No. 5 (H5)

This hole was drilled a few hundred feet southeast of Drillhole No. 2 (Fig. 9). It was drilled at no charge by Canadian Longyear as they accepted responsibility for poor core recovery in Drillhole No. 2. It penetrated only 33 feet of Moosebar formation and was drilled to a total depth of 200 feet in the Gething formation (Fig. 11). As can be seen from the diagrams, it penetrates the Gething formation of the upper fault sheet. Very little coal was present in the hole.

(c) Drilling Program (Cont'd.)

iii) Seam Correlation

The correlation of the coal intervals found in the boreholes proved to be very difficult. A tentative correlation has been made on the basis of lithology and the mechanical logs and is illustrated as Fig. 8 .

This figure shows four coal zones - labelled A - D inclusive - which are present in at least two of the drillholes. Drillhole No. 1 found some other coal zones but these have not been named on the cross-section. A few comments on each of the zones follow:

Zone A

This is the upper coal zone and nowhere does it exceed 4 feet in thickness. It is best developed at the south end of the drilling area but it cannot be considered as an economic target in the area.

Zone B

Zone B can only be recognized as a coal seam in Drillholes No. 3 and No. 4 although an equivalent marker can possibly be recognized in Drillhole No. 5. The seam thickens rapidly from Drillhole No. 3 to Drillhole No. 4 at which location it is 7 feet thick. This intersection which represents a true stratigraphic thickness of approximately 6 feet represents the best coal seam recognized in the drilling program. While only 7 feet thick, it has no partings. The roof of the seam, while not a perfect sandstone, would probably hold up. It is composed of a hard siltstone.

(c) Drilling Program (Cont'd.)

Zone C and Zone D

These two zones are considered together as the comments on one are equally applicable to the other. They both represent coaly zones which vary from zero to over twenty feet in thickness. Usually, however, over 30% of the total zone is represented by partings of shale and siltstone. While neither zone becomes an attractive prospect within the area of the drill program, these zones may improve in other areas nearby. The intervals represent prospective zones within the Upper Gething formation.

Other Zones

Several thin coaly intervals were encountered in Drillhole No. 1 and are shown on the cross-section (Fig. 8). Of these only one - 1053 feet to 1063 feet - is thicker than 4 feet. Above this 10 foot zone of good clean coal are several coaly partings resulting in 13 feet of coal within a 20 foot interval. The cross-section shows this zone to correlate to the thick coal zone in the TGS well. This correlation is believed correct as a thrust fault can be recognized in the TGS well as shown. Unfortunately the coal quality of this seam is disappointing and it is not a major prospect.

iv) Coal Quality

An extensive program of analysis was carried out on the core samples recovered from this program. Core recovery in some cases was very poor and this is noted on the appropriate seam description

(c) Drilling Program (Cont'd.)

(see Appendix). Some comments on the quality of the coals are also contained in the Appendix. They were made by Dr. D.F. Symonds 7, of Coal Science and Minerals Testing of Calgary.

(d) Conclusions

As a result of the exploration program, certain conclusions can be arrived at with respect to the coal potential of the area. These conclusions concern both the probable presence of viable coal seams of suitable quality and the likelihood of being able to mine these same seams.

The presence of coaly zones thicker than 10 feet has been established by the program. Unfortunately, wherever these zones were encountered - at surface or in drillholes - they were characterized by numerous shaly splits making the seam as a whole non-economic.

The only seam encountered in the drilling program that appears to have economic potential is the 'B' seam (Fig. 8). This seam is thicker than 6 feet where last known and seems to be of excellent quality for a low ash metallurgical grade coking coal.

Vast areas held by Pan Ocean are as yet wholly unknown. No firm conclusions can be drawn as to their potential until test holes have been drilled at selected locations. It is not worthwhile to attempt more detailed mapping of the surface in this

(d) Conclusions (Cont'd.)

poorly exposed area until these test holes have been drilled.

From a structural point of view there does not appear to be large (over 5 square miles) flat/low dip areas. However, the potential certainly exists for mineable areas of 2, 3 or 4 square miles which might well be suited for the development of 250,000 to 500,000 tons per annum mines if a suitable seam is present.

There is a yet insufficient data to form any definite conclusions on the merit of the area and exploration should be continued.

(e) Recommendations

As no coal seams which were immediate prospects for development were found in the drilling program carried out in January and February of 1973, it is recommended that other areas of the licence block be tested.

In particular, the band of Gething formation along Falling Creek should be tested for coal as should the Gething formation at the headwaters of Hasler Creek. Some time should be spent on the ground in both these areas in an attempt to locate the contact between the Gething formation and the Moosebar formation so that drillholes may be located most advantageously. At least one stratigraphic test hole to penetrate the Upper Gething formation should be located in each area.

One additional hole should be drilled southeast of the No. 4 drillhole to test the continuation of the 'B' coal seam which is the best prospect located to date.

SELECTED REFERENCES

(e) Recommendations (Cont'd.)

All the above recommendations can be completed within the budget for the 1973-74 program.

June 15, 1973.

I. P. Dyson, P. Geol.

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APPENDIX 3

ORDER-IN-COUNCIL NO. 1519

PROVINCE OF BRITISH COLUMBIA

MINISTRY OF MINES AND PETROLEUM RESOURCES

PROVINCE OF BRITISH COLUMBIA

VICTORIA

COAL ACT

NOTICE

NOTICE is given that pursuant to subsection (2) of Section 17 of the Coal Act and the authority of Order in Council No. 1519, approved on April 20, 1972, the reservation to the Crown of coal in the following described area:-

Commencing at the intersection of 55° 15' parallel of north latitude with 121° 45' meridian of west longitude; thence northerly along said 121° 45' meridian of west longitude to 55° 45' parallel of north latitude; thence westerly along said 55° 45' parallel of north latitude to 122° 30' meridian of west longitude; thence southerly along said 122° 30' meridian of west longitude to 55° 30' parallel of north latitude; thence easterly along said 55° 30' parallel of north latitude to 122° 15' meridian of west longitude; thence southerly along said 122° 15' meridian of west longitude to 55° 15' parallel of north latitude; thence easterly along said 55° 15' parallel of north latitude to 121° 45' meridian of west longitude, being the point of commencement, Peace River Land District:

is cancelled for a period of 30 days commencing May 29, 1972, and that Pan Ocean Oil Ltd. has been granted an exclusive right to select and apply for coal licences in the area during the said period.

Frank Richter

Frank Richter
Minister of Mines and Petroleum Resources

Victoria, B. C.
April 24, 1972

report

THAT Pan Ocean Oil Ltd., duly incorporated under the laws of the Province, has entered into an agreement to develop and operate a coal field in the Peace River Land District and to that end have deposited with the Minister of Finance a performance bond in the sum of $50,000.00:

THAT Pan Ocean Oil Ltd. have satisfied the Minister of Mines and Petroleum Resources that exploration and development of the coal field will proceed forthwith upon approval of this Order;

AND TO RECOMMEND THAT by authority of subsection (2) of Section 17 of the "Coal Act", Chapter 60, Revised Statutes of British Columbia 1960, as amended by Chapter 9, Statutes of British Columbia, 1966, the reservation of coal created by Order in Council No. 281, approved March 4, 1943, in the following described area:

> Commencing at the intersection of 55° 15' parallel of north latitude with 121° 45' meridian of west longitude; thence northerly along said 121° 45' meridian of west longitude to 55° 45' parallel of north latitude; thence westerly along said 55° 45' parallel of north latitude to 122° 30' meridian of west longitude; thence southerly along said 122° 30' meridian of west longitude to 55° 30' parallel of north latitude; thence easterly along said 55° 30' parallel of north latitude to 122° 15' meridian of west longitude; thence southerly along said 122° 15' meridian of west longitude to 55° 15' parallel of north latitude; thence easterly along said 55° 15' parallel of north latitude to 121° 45' meridian of west longitude, being the point of commencement, Peace River Land District:

be cancelled, subject to the observance and performance of the following [illegible]:

(a) [illegible] days after the [illegible] date of cancellation of the reservation, which date shall be the date stated in the notice required by the said Section 17 to be signed by the Minister of Mines and Petroleum Resources and published in the Gazette, Pan Ocean Oil Ltd. shall [illegible] apply for coal licences under the terms of the 'Coal Act', covering such part of the coal field that the Company considers necessary to the proposed operation.

(2)(a) A total of $150,000.00 must be spent on field exploration and development work to the satisfaction of the Minister in the area licensed during the three-year period following issuance of the licence or licences.

(b)(i) If $75,000.00 or more is spent on such work during the first year following issuance of the licence, or licences, the performance bond will be returned, or

(ii) if, on or before the expiry of three years following issuance of the licence, or licences, a total of $150,000.00 has been spent on such work, the performance bond will be returned.

(c) The licensee shall:-

(i) on demand make available to the Minister for examination by officers of the Department copies of all plans of the licence, or licences, and workings thereon, plans showing the position of all drill holes, logs of drill holes, analyses of coal, technical reports and other documents pertaining to the exploration, development or mining of coal within the licensed area.

(ii) on or before the anniversary date of the licence, or licences

(A) supply to the Minister a report by a professional engineer setting out the work done in the previous year, and giving full information on the results of exploration, development or mining, supported by such plans, drill logs, and other illustrations or supporting documents as may be necessary to portray the work done and the results thereof.

(B) supply a statement of the total expenditure on said work and on the principal subdivisions thereof.

AND TO RECOMMEND THAT upon expiration of the 20-day period during which Pan Ocean Oil Ltd. have the exclusive right to select and apply for coal licences, all rights of Pan Ocean Oil Ltd. shall cease and determine, and this order is deemed to be rescinded and automatically cancelled as to those lands which were not at that time staked under the provisions of the Coal Act, and such lands shall immediately fall within and be included in the said reserve established by Order in Council 231/43:

AND TO FURTHER RECOMMEND THAT all coal existing in any lands lying within the boundaries of the said reservation which have or may hereafter become vacant through the expiry or cancellation of any licence or lease issued under the said "Coal Act", shall immediately on such expiry or cancellation fall within and be included in the said reserve.

DATED THIS 20 DAY OF April A.D. 1972

"Frank Richter"

Minister of Mines and Petroleum Resources

APPROVED THIS 20 DAY OF April A.D. 1972

"J. D. Black"

Presiding Member of the Executive Council

EXPLANATION

LOWER CRETACEOUS

FORT ST. JOHN GROUP

- **KCm** COMMOTION FORMATION — Sandstone, brown, quartz, fine grained; minor siltstone, shales and coals in south.
- **KMb** MOOSEBAR FORMATION — Shale, medium to dark gray, minor sandstone

BULLHEAD GROUP

- **KGt** GETHING FORMATION — Coal; sandstone, brown, quartz, fine grained, contains ripple marks, plant material, minor shales and siltstones
- **KCd** CADOMIN FORMATION + OLDER ROCKS — Conglomerate, sandstone, medium to coarse, massive

8.0' Significant Coal Outcrop With Thickness

* 8.0' Significant Coal Occurence With Thickness (Drilled 1946-1950)

NOTE: Geological Data Compiled From All Available Sources Both Published And Unpublished. Photogeological Interpretation Made By V. Zay Smith Associates Ltd.

COAL LICENCES

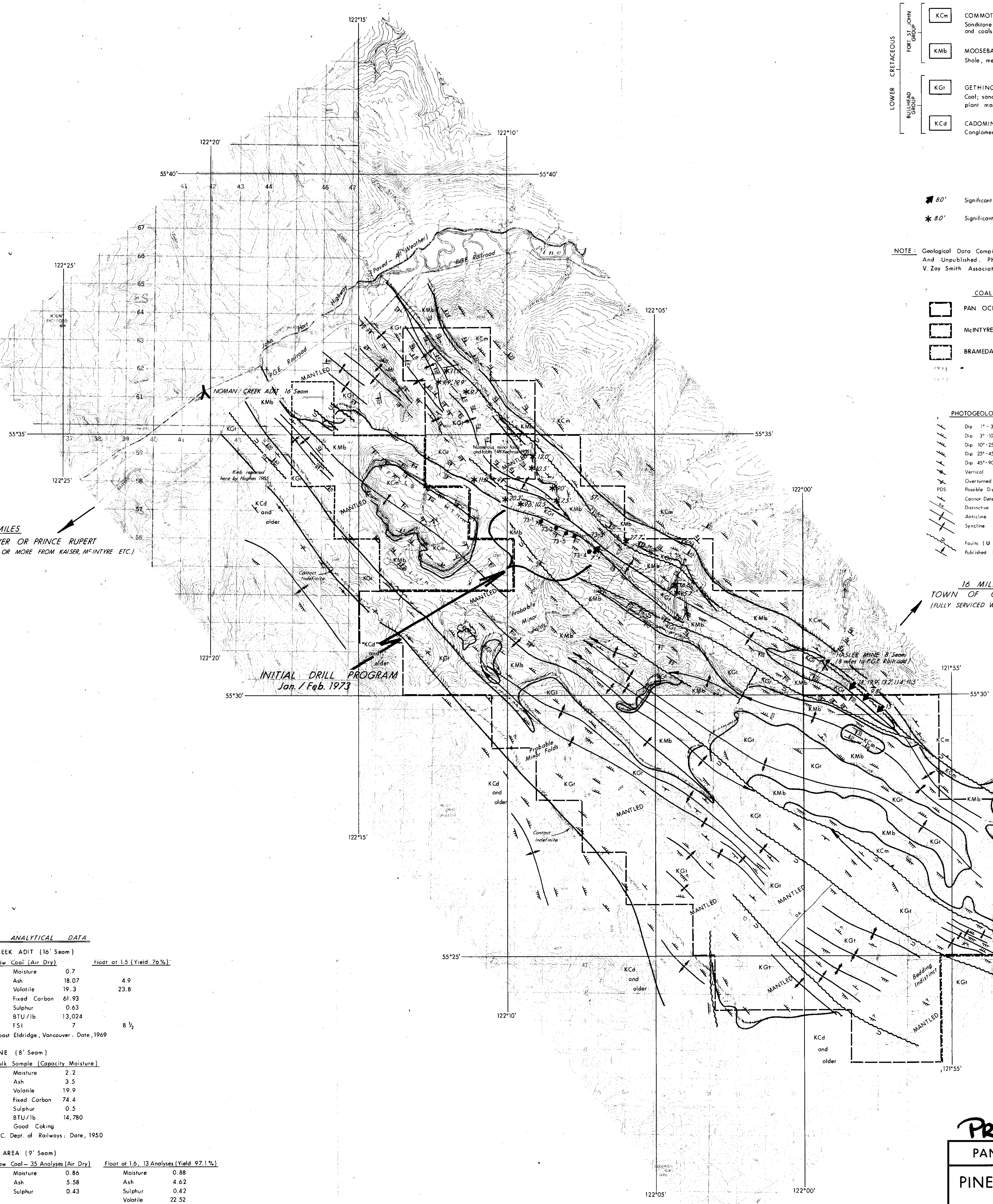
- PAN OCEAN
- McINTYRE MINES
- BRAMEDA

1973

PHOTOGEOLOGY SYMBOLS

- Dip 1° - 3°
- Dip 3° -10°
- Dip 10°-25°
- Dip 25°-45°
- Dip 45°-90°.
- Vertical
- Overturned
- PDS Possible Dip Slope
- Cannot Determine Amount Of Dip
- Distinctive Alignment
- Anticline
- Syncline
- Faults (U indicates up thrown side)
- Published Dips

LG
By MMB.



RELIABLE ANALYTICAL DATA

(a) NOMAN CREEK ADIT (16' Seam)

	Raw Coal (Air Dry)	Float at 1.5 (Yield 76%)
Moisture	0.7	
Ash	18.07	4.9
Volatile	19.3	23.8
Fixed Carbon	61.93	
Sulphur	0.63	
BTU/lb	13,024	
FSI	7	8 ½

Coast Eldridge, Vancouver: Date, 1969

(b) HASLER MINE (8' Seam)

	Bulk Sample (Capacity Moisture)
Moisture	2.2
Ash	3.5
Volatile	19.9
Fixed Carbon	74.4
Sulphur	0.5
BTU/lb	14,780
Good Coking	

B.C. Dept. of Railways: Date, 1950

(c) SUKUNKA AREA (9' Seam)

Raw Coal – 35 Analyses (Air Dry)		Float at 1.6, 13 Analyses (Yield 97.1%)	
Moisture	0.86	Moisture	0.88
Ash	5.58	Ash	4.62
Sulphur	0.43	Sulphur	0.42
		Volatile	22.52
		Fixed Carbon	71.98
		BTU/lb	14,792
		FSI	(9)

Commercial Testing & Engineering, Vancouver: Date, 1970-71

Figure 73/6

584

PR-PP75(2)A

PAN OCEAN OIL LTD.

PINE PASS COAL PROJECT

NORTHEAST BRITISH COLUMBIA

PROJECT MAP

JUNE 1973

SCALE 1:50,000

Contour Interval: 100 Feet

PAUL DYSON CONSULTANTS & HOLDINGS LTD.

PR-PP 75(2)A

PAN OCEAN OIL LTD.

PINE PASS COAL PROJECT

NORTHEAST BRITISH COLUMBIA

COAL LICENCES ACQUIRED IN 1972

(Order In Council 1519)

June, 1973

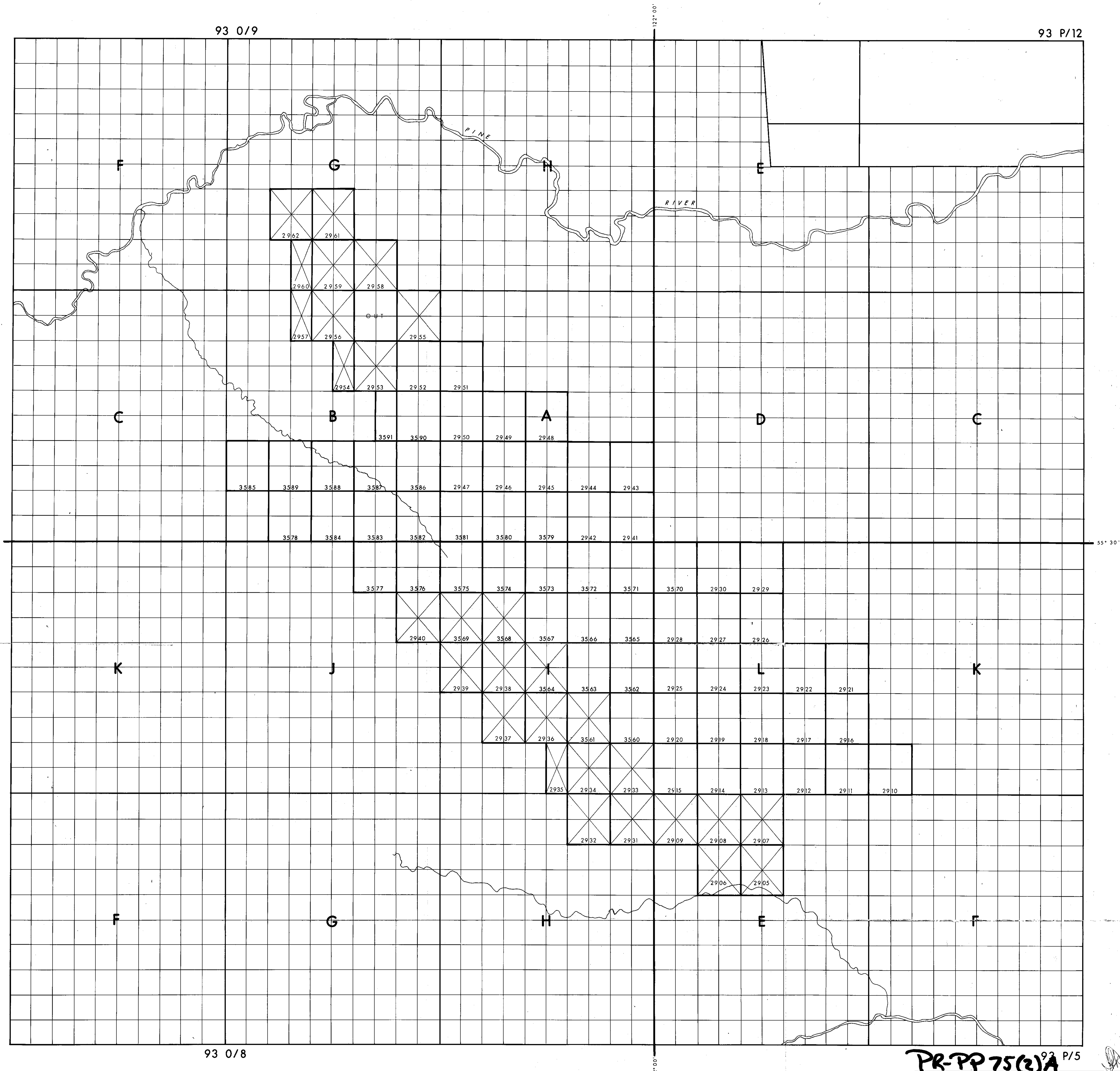
1 : 50,000

SCALE — MILES

PAUL DYSON CONSULTANTS

584

Figure 73/5



LICENCES RECOMMENDED FOR RENEWAL

LICENCES RECOMMENDED FOR SURRENDER

PR-PP 75(2)A

584

Figure 75/3

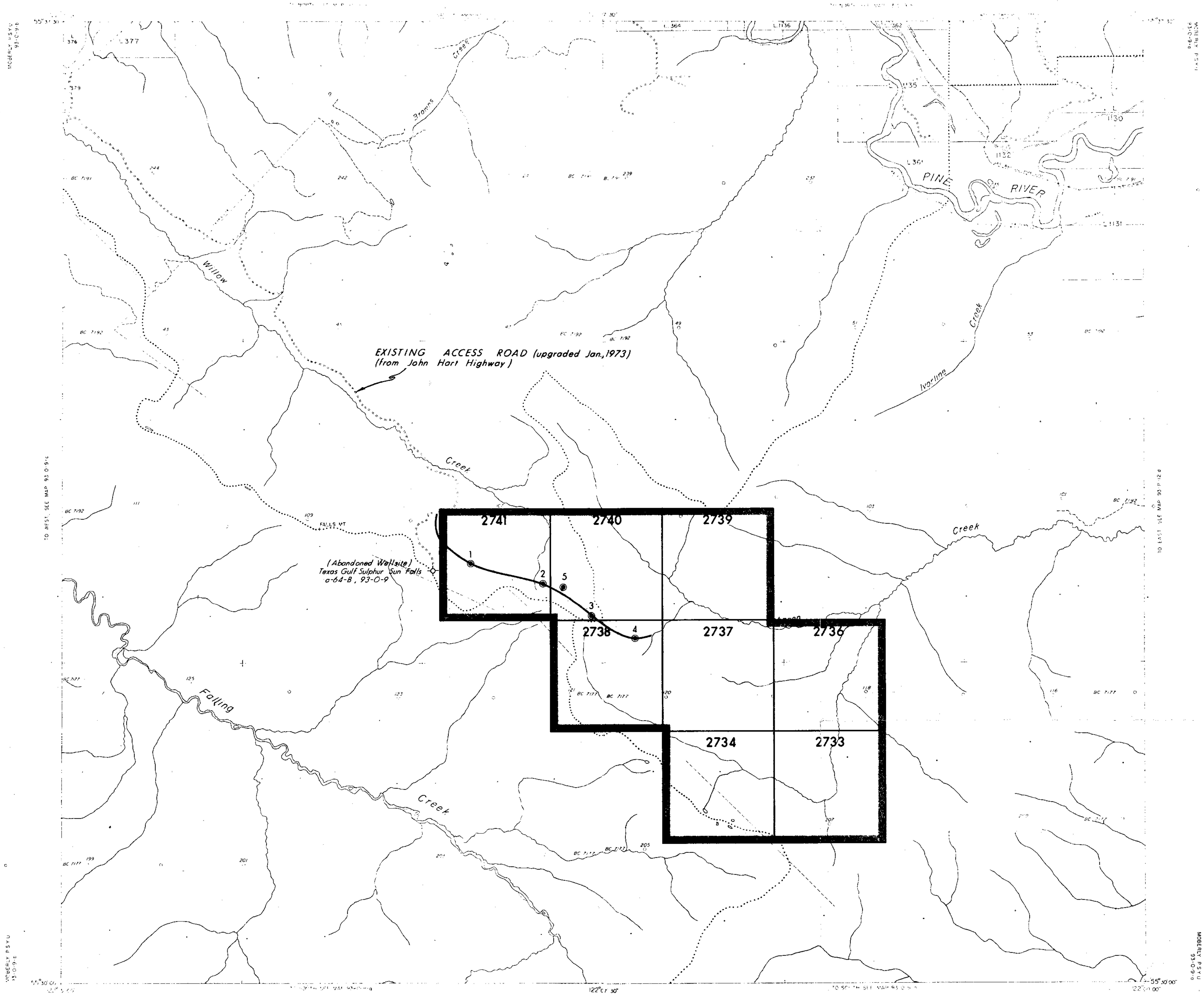
Pan Ocean Oil Ltd.

PINE PASS AREA

PEACE RIVER DISTRICT – BRITISH COLUMBIA

COAL LICENCES

SCALE 1 : 50,000



584 PR-PP75(2)A

LEGEND

Drillsites

New Access Trail

Coal Licences

Figure 73/9

PAN OCEAN OIL LTD.

PINE PASS COAL PROJECT

NORTHEAST BRITISH COLUMBIA

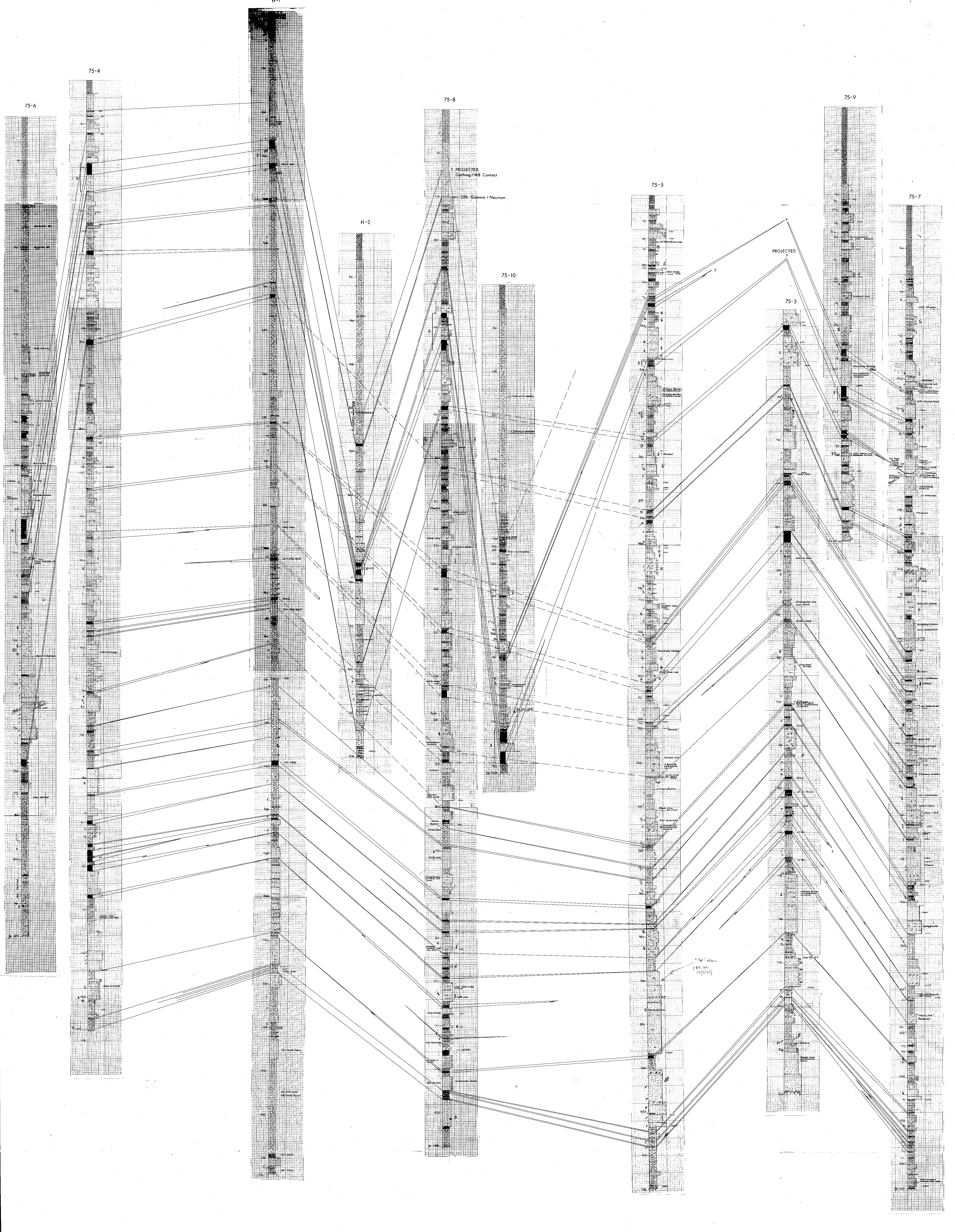
COAL EXPLORATION
INITIAL DRILL PROGRAM

June, 1973

0 1/2 1

SCALE 2 Inches = 1 Mile

PAUL DYSON CONSULTANTS



LEGEND

SANDSTONE	ROOTLETS
SILTSTONE	BIOTURBATION
SHALE / MUDSTONE	SLUMP STRUCTURES
CLEAN COAL	CCC RICHLY CARBONACEOUS / COALY
DIRTY COAL	CC VERY CARBONACEOUS
COAL FRAGMENTS (DETRITAL IN SANDS)	C CARBONACEOUS
INTRACLASTS	EROSIONAL CONTACT
OVERBURDEN	X SIGNIFICANT COAL HORIZON

PR-PP 75(2)A 584

FIGURE 75/5

PAN OCEAN OIL LTD.

PINE PASS COAL PROJECT

NORTHEAST BRITISH COLUMBIA

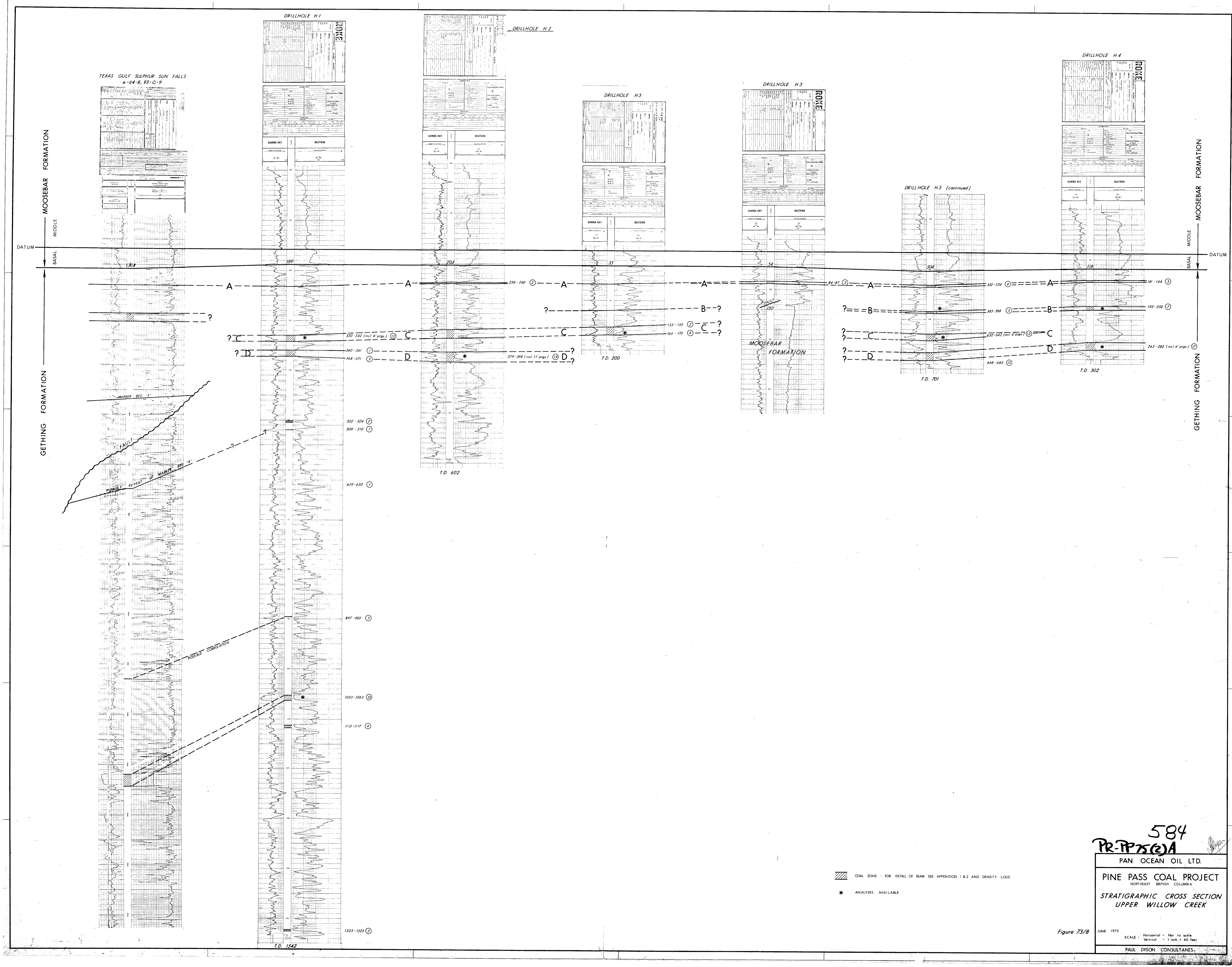
STRATIGRAPHIC FENCE DIAGRAM

(LOOKING NORTHEAST)

Vertical Scale : 1"=30'
Horizontal Scale : N.A.

Date : DEC. 1975

PAUL DYSON CONSULTANTS



COAL ZONE : FOR DETAIL OF SEAM SEE APPENDICES 1 & 2 AND DENSITY LOGS

* ANALYSES AVAILABLE

Figure 73/8

584
PR-PP75(2)A

PAN OCEAN OIL LTD.

PINE PASS COAL PROJECT
NORTHEAST BRITISH COLUMBIA

STRATIGRAPHIC CROSS SECTION
UPPER WILLOW CREEK

JUNE 1973

SCALE : Horizontal - Not to scale
Vertical - 1 inch = 40 feet

PAUL DYSON CONSULTANTS


LEGEND
GATES FORMATION
MOOSEBAR FORMATION
FORT ST. JOHN GROUP
~~GETHING~~ FORMATION
CADOMIN
~~CADOMIN~~ FORMATION ~~& OLDER~~
GETHING
BULLHEAD GROUP
LOWER CRETACEOUS
CROSS-SECTIONS
KNOWN FORMATIONAL BOUNDARIES
PROPERTY BOUNDARY
40°
DIP 40°, HORIZONTAL, VERTICAL
ANTICLINE
SYNCLINE
DRILLHOLE
U
FAULTS ('U' INDICATES UP THROWN SIDE)
55°20'N
122°00'W
55°25'N
PR-PP75(2)A
PAN OCEAN OIL LTD.
PINE PASS COAL PROJECT
NORTHEAST BRITISH COLUMBIA
FIELD DATA MAP
October, 1975
1 : 25,000
0
1/2
1
SCALE — MILES
PAUL DYSON CONSULTANTS
584
Figure 75/4

EXTRA COPY

PR - PINE PASS 78 3)A

OPEN FILE

BORE HOLE DATA.

BOOK ① B - 1975 -

GEOLOGICAL BRANCH
ASSESSMENT REPORT

00584

PR - PINE PASS 75(3)A

PINE PASS COAL PROJECT

NORTHEAST BRITISH COLUMBIA

(1974 - 1975)

VOLUME III

BOREHOLE DATA

Prepared for: Pan Ocean Oil Ltd.
Calgary,Alberta

by: Paul Dyson Consultants
Calgary, Alberta

October 1975

APPENDIX 1

BOREHOLE LOGS

LITHOLOGIC DESCRIPTIONS

PINE PASS COAL PROJECT

Drill Hole No.	H-1
Company:	Pan Ocean Oil Ltd., Calgary, Alberta.
Area:	Willow, Creek, Pine Pass Area, British Columbia.
Driller:	E. Russel, Canadian Longyear Ltd.
Hole Diameter:	NQ 1-63/64
Core Diameter:	1-7/8 - Diamond Drilling
Drilling Period:	January 22, 1973 - January 31, 1973
Total Depth:	1,516 feet
Surface Elevation:	3,695 feet (approximately - unsurveyed)

(feet)		
0 - 24.0		Till.
24.0 - 159.0		Shale, black, marine-origin, massive, some small-scale quartz veinlets, some small-scale slump structure, bedding plane - 20° dipping. 75.0 - fine grained, grey sandstone (4" thick).
159.0 - 166.0		Shale, black, silty, channel-filling, structure, some thin, dark grey siltstone beds.
166.0 - 167.0		Siltstone, grey, some random directed, small-scale quartz veinlets.
167.0 - 187.2		Shale, jet-black, massive.
187.2 - 191.7	(4.5')	Conglomerate, basal. Pebbles - max. diameter - 1/2 inches, dark grey and black chert pebbles. Matrix - silty, mudstone.

MOOSEBAR FORMATION - Marine

GETHING FORMATION - Non-marine

191.7 - 210.0	Shale, black, silty, massive.
210.0 - 241.0	Shale, black, silty, carbonaceous, some thin small-scale quartz veinlets. Bedding plane - approx. 25° dipping.
241.0 - 243.0	Siltstone, coarse grained, grey, sandy.
243.0 - 295.0	Shale, black, some quartz veinlets. 262 - grey, silty, carbonaceous shale layers (2" - 5" thick).
295.0 - 310.5	Shale, black, carbonaceous, some fragments of plant fossils.
310.5 - 313.5	Sandstone, fine grained, grey, shaly. Bedding plane - approx. 20° dipping.

313.5 - 315.0		Shale, black, silty, some fragments of plant fossils.
315.0 - 328.0		Siltstone, dark grey, carbonaceous, sandy, cross-bedded.
328.0 - 331.0		Shale, black, carbonaceous.
331.0 - 341.6	(10.6')	<u>Coal</u>. Some thin shaly layers. 0.3' (337.6 - 337.9) - siltstone, blackish 0.7' (338.4 - 339.1) - shale, black, silty, carbonaceous.
341.6 - 345.0		Shale, black, coaly.
345.0 - 358.0		Shale, black, carbonaceous. 347' - thin carbonaceous, siltstone layers, some small-scale quartz veinlets.
358.0 - 360.0		<u>Coal</u>, shaly.
360.0 - 360.4		Siltstone, shaly, blackish.
360.4 - 364.6	(4.2')	<u>Coal</u>.
364.6 - 368.0		Shale, black, coaly.
368.0 - 370.3		Sandstone, fine grained, grey, some small scale quartz veinlets.
370.3 - 456.0		Shale, black, carbonaceous. 378 - coaly zone (0.5') 406 - coaly zone (0.5')
456.0 - 457.0		Siltstone, muddy, dark grey, cross bedded.
457.0 - 494.0		Shale, black, carbonaceous, some fragments of plant fossils.
494.0 - 495.0	(1.0')	<u>Coal</u>, clean.
495.0 - 508.5		Shale, black, carbonaceous, fossiliferous (plant).
508.5 - 512.6	(4.1')	<u>Coal</u>, clean.
512.6 - 618.5		Shale, black, carbonaceous. 520 - 0.5' coaly zone. 533 - 0.3' coaly zone. 596 - 0.4' coaly zone.

618.5 - 626.0		Sandstone, fine grained, grey, silty. Bedding plane approx. 27° dipping.
626.0 - 654.5		Shale, black, carbonaceous. 628 - 0.2' coaly zone. 637.2 - 0.2' coal, clean. 647.0 - 0.5' siltstone.
654.5 - 656.0	(1.5')	Coal, shaly.
656.0 - 662.0		Shale, black, carbonaceous.
662.0 - 669.0		Shale, black, silty.
669.0 - 671.5		Coaly shale.
671.5 - 721.2		Shale, black, carbonaceous
721.2 - 724.0		Siltstone, dark grey, muddy, many small scale quartz veinlets.
724.0 - 730.0		Shale, black, silty.
730.0 - 751.0		Siltstone, blackish, shaly. cross-bedded, some small scale quartz veinlets.
751.0 - 763.0	(0.5')	Coal, clean.
763.0 - 802.0		Shale, black, carbonaceous, some thin (2" - 3") coaly zones.
802.0 - 808.0		Shale, black, silty, 806.0 - 1.0' siltstone zone.
808.0 - 808.4	(0.4')	Coal.
808.4 - 810.0		Shale, black, carbonaceous.
810.0 - 813.5	(3.5')	Coal, thin shaly layers.
813.5 - 855.5		Shale, black, carbonaceous, some thin silty layers. 829.5 - coal (0.5')
855.5 - 858.0	(2.5')	Coal, shaly zones.
858.0 - 877.5		Shale, black, carbonaceous, some thin coaly layers.
877.5 - 879.5		Shale, coaly.

879.5 - 885.0	Shale, black, carbonaceous.
885.0 - 886.0 (1.0')	Coal.
886.0 - 914.0	Shale, black, carbonaceous.
914.0 - 919.0	Siltstone, carbonaceous, blackish, cross bedded.
919.0 - 930.0	Shale, black, carbonaceous.
930.0 - 949.0	Siltstone, shaly, blackish, cross bedded.
949.0 - 970.0	Shale, black, carbonaceous. 950.6 - coal 0.2'.
970.0 - 974.6	Siltstone, sandy, dark grey, some small scale, chevron folds.
974.6 - 1043.5	Shale, black, carbonaceous, massive, some thin siltstone layers (2" - 3").
1043.5 - 1049.0 (5.5')	Coal, two thin shale layers (0.1' + 0.1') clean.
1049.0 - 1105.0	Shale, black, silty, carbonaceous. 1083 - siltstone (3') 1094 - siltstone (1')
1105.0 - 1106.0 (1.0')	Coal, shaly.
1106.0 - 1110.0	Shale, black, carbonaceous.
1110.0 -1111.5 (1.5')	Coal, shaly
1111.5 - 1117.0	Siltstone, blackish, sandy.
1117.0 - 1143.0	Shale, black, carbonaceous. 1126.5 - 0.5' coal 1130.0 - 0.5' coal 1135.0 - 0.6' coal
1143.0 - 1154.7	Siltstone, dark-grey.
1154.7 - 1160.0	Shale, black, carbonaceous.
1160.0 - 1232.0	Siltstone, shaly, blackish, cross-bedded, hard, small-scale quartz veinlets, some shale layers (0.5' - 1.0').

1232.0 - 1247.0	Shale, black, carbonaceous. 1241' - 0.3' coaly zone. 1245' - 0.5' coal.
1247.0 - 1277.0	Siltstone, shaly, dark-grey, cross-bedded.
1277.0 - 1286.5	Shale, black, carbonaceous, some thin coaly zones (0.1' - 0.2').
1286.5 - 1304.0	Siltstone, sandy, dark-grey, very hard, cross-bedded, some thin, fine-grained grey sandstone layers.
1304.0 - 1334.0	Shale, black, silty, carbonaceous.
1334.0 - 1344.0	Siltstone, blackish, shaly, cross-bedded.
1344.0 - 1349.2	Shale, jet black, carbonaceous.
1349.2 - 1351.0	Sandstone, fine grained, grey.
1351.0 - 1364.0	Shale, black, carbonaceous ,some thin siltstone layers.
1364.0 - 1386.0	Siltstone, dark grey, cross-bedded, some thin, fine-grained layers.
1386.0 - 1495.0	Shale, black, carbonaceous, some thin siltstone and sandstone layers (0.2' - 0.5').
1495.0 - 1499.0	Coaly shale.
1499.0 - 1508.0	Sandstone, fine-grained, dark grey, silty.
1508.0 - 1510.0	Shale, black, carbonaceous.
1510.0 - 1511.5	Coaly shale.
1511.5 - 1516.0	Shale, black, carbonaceous.

Total Depth - 1516.0 feet

PINE PASS COAL PROJECT

Drill Hole No.:	H-2
Company:	Pan Ocean Oil Ltd., Calgary, Alberta.
Area:	Willow Creek, Pine Pass Area, British Columbia.
Driller:	E. Russel, Canadian Longyear Ltd.
Hole Diameter:	NQ 1-63/64
Core Diameter:	1-7/8 - Diamond Drilling
Drilling Period:	February 1, 1973 - February 5, 1973.
Total Depth:	600 feet
Surface Elevation:	4,035 feet (approximately - unsurveyed)

(feet)		
0 - 30.0		Till.
30.0 - 204.5		Shale, black, massive, marine - origin. 94.0 - 1.0' siltstone, grey.
204.5 - 205.7	(1.2')	Conglomerate, basal.

MOOSEBAR FORMATION

GETHING FORMATION

205.7 - 241.0		Shale, black, carbonaceous.
241.0 - 243.4	(2.4')	Coal, shaly.
243.4 - 329.0		Shale, black, carbonaceous. 251 - 2.0' silty zone. 270 - 2.4' silty zone. 273 - 0.4' coaly zone. 292 - 1.0' with small scale, quartz veinlets. 308 - 1.2' with quartz veinlets. 313.2 - 0.5' with quartz veinlets.
329.0 - 331.0		Siltstone, dark grey, shaly.
331.0 - 355.2		Shale, black, carbonaceous. 347.0 - 0.9' coaly zone.
355.2 - 360.5		Siltstone, dark grey, sandy, possible bedding plane - 17° dipping.
360.5 - 377.2		Shale, black, carbonaceous, some fragments of plant fossils. 362.0 - 1.8' silty zone. 374.0 - 1.0' siltstone, cross-bedded.
377.2 - 381.0	(3.8')	Coal.
381.0 - 385.0		Coaly, shale with thin siltstone layers (0.1' + 0.1')
385.0 - 391.0	(6.0')	Coal, clean.
391.0 - 396.5		Shale, black, carbonaceous.
396.5 - 398.0	(1.5')	Coal, shaly.

398.0 - 418.0		Shale, black, carbonaceous, 400.0 - with quartz veinlets (0.6')
418.0 - 448.0		Siltstone, blackish or dark grey, shaly. 433.0 - 2.0' with quartz veinlets.
448.0 - 506.0		Shale, black, carbonaceous, some plant fossils. 460.0 - 0.5' coaly zone. 464.8 - 0.5' conglomeratic, sedimentary-origin pebbles. 475.2 - 0.1' with quartz veinlets. 491.5 - 0.4' coaly zone.
506.0 - 511.0		Siltstone, dark grey, cross-bedded.
511.0 - 516.5		Shale, black, carbonaceous.
516.5 - 517.0	(0.5')	Coal, shaly.
517.0 - 527.5		Sandstone, fine grained, silty, dark grey, some quartz veinlets. 555.0 - (0.2') and 557.0 (0.4') - conglomeratic zones, angular black shale pebble.
527.5 - 529.0		Shale, black, silty, carbonaceous.
529.0 - 530.2		Sandstone, fine grained, dark grey, conglomeratic, angular shale pebbles. 0.5" - 2.0" thick quartz veinlets.
530.2 - 537.0		Shale, black, carbonaceous, thin sandy layers.
537.0 - 561.0		Siltstone, dark grey, some thin sandy layers.
561.0 - 588.0		Shale, black, carbonaceous. 563.0 - 1.0' with quartz veinlets. 570.0 - coal layers, poor recovery - 10%?
588.0 - 590.0		Coaly shale.
590.0 - 590.6		Shale, black, carbonaceous.

590.6 - 591.0	Coaly shale.
591.0 - 600.0	Shale, black, some coaly layers.

Total Depth - 600 feet.

PINE PASS COAL PROJECT

Drill Hole No.:	H-3
Company:	Pan Ocean Oil Ltd., Calgary, Alberta.
Area:	Willow Creek, Pine Pass Area, British Columbia.
Driller:	E. Russel, Canadian Longyear Ltd.
Hole Diameter:	NQ 1-63/64
Core Diameter:	1-7/8 - Diamond Drilling
Drilling Period:	February 5, 1973 - February 8, 1973
Total Depth:	700 feet
Surface Elevation:	4,035 feet (approximately - unsurveyed)

(feet)

0 - 20.0	Till.
20.0 - 52.2	Shale, black, massive, marine - origin.
52.2 - 53.2 (1.0')	Conglomerate, basal.

MOOSEBAR FORMATION

GETHING FORMATION

53.2 - 75.0	Shale, black, carbonaceous, some plant-fossil fragments. 66.0 - 0.1' coaly zone.
75.0 - 80.0	Siltstone, blackish, cross-bedded, shaly.
80.0 - 82.2	Shale, black, carbonaceous.
82.2 - 85.7 (3.5')	<u>Coal</u>, clean
85.7 - 101.0	Shale, black, carbonaceous. 91.0 - 1.0' siltstone, blackish. 96.0 - 0.5' siltstone, dark grey.
101.0 - 105.0	Siltstone, blackish, shaly, some small-scale, quartz veinlets.
105.0 - 116.0	Shale, black, some small-scale, quartz veinlets.
116.0 - 125.0 (9.0')	Poor recovery. Clay, dark grey, with some pebbles. Fault!

GETHING FORMATION

MOOSEBAR FORMATION

125.0 - 503.0	Shale, black, massive, marine origin, some quartz veinlets.
503.0 - 504.5 (1.5')	Conglomerate, basal.

MOOSEBAR FORMATION

GETHING FORMATION

504.5 - 504.8	(0.3')	Coal, shaly.
504.8 - 519.0		Shale, black, carbonaceous, some fragments of plant fossils.
519.0 - 521.0	(2.0')	Coal, shaly.
521.0 - 532.0		Shale, black, carbonaceous. 529.0 - 1.0' siltstone, dark grey.
532.0 - 536.0	(4.0')	Coal, shaly layers (0.1' + 0.1')
536.0 - 582.5		Shale, black, carbonaceous. 555.0 - 1.5' siltstone, sandy, dark grey.
582.5 - 586.0	(3.6')	Coal, clean.
586.0 - 591.6		Shale, black, carbonaceous.
591.6 - 602.0		Sandstone, fine grained, dark grey, shaly, some small scale, quartz veinlets.
602.0 - 623.8		Shale, black, carbonaceous, some thin coaly layers.
623.8 - 625.8	(2.0')	Coal, shaly layers.
625.8 - 626.7		Shale, black, carbonaceous.
626.7 - 635.0	(8.3')	Coal, clean. 632.2 - 0.8' coaly shale and siltstone.
635.0 - 639.0		Shale, black, carbonaceous
639.0 - 640.5	(1.5')	Coal, shaly.
640.5 - 641.0	(0.5')	Coaly shale.
641.0 - 644.5	(3.5')	Coal.
644.5 - 647.0		Shale, black, carbonaceous.
647.0 - 650.0		Siltstone, blackish, carbonaceous, sandy, some quartz veinlets.
650.0 - 700.0		Shale, black, carbonaceous. 652.2 - 1.0' coaly zone. 676.0 - 2.0' coal, shaly.

Total Depth - 700 feet.

PINE PASS COAL PROJECT

Drill Hole No.:	H-4
Company:	Pan Ocean Oil Ltd., Calgary, Alberta.
Area:	Willow Creek, Pine Pass Area, British Columbia.
Driller:	E. Russel, Canadian Longyear Ltd.
Hole Diameter:	NQ 1-63/64
Core Diameter:	1-7/8 — Diamond Drilling
Drilling Period:	February 10, 1973 - February 12, 1973
Total Depth:	303 Feet
Surface Elevation:	3,988 feet (approximately - unsurveyed)

(feet)

0 - 118	Shale, black and massive. Occasional streaks of very fine to fine sandstone (1" - 2").
118 - 118.5	Conglomerate containing rounded pebbles to 1/2".

MOOSEBAR FORMATION

GETHING FORMATION

118.5 - 127.4	Shale, dark grey to black, silty in part.
127.4 - 128	Coal.
128 - 140	Shale as 118.5 - 127.4.
140 - 144.8	Coal. (Recovery approximately 2.5'). Coal appears bright and low ash. It is possible that not all missing core is coal.
144.8 - 170	Siltstone and silty shale, medium to dark grey to black. Silt content increases with depth.
170 - 173	Ssandstone, medium/light grey, fine/medium grained with occasional carbonaceous partings.
173 - 192	Sandstone, siltstone and shale. Generally dark grey to black, sandstone - very fine grained. Shales tends to be silty. Some horizontal fracturing filled with calcite.
192 - 198	Coal - clean, bright coal. Recovery approximately 5.2'. No partings. Roof appears to be massive siltstone.
198 - 263	Shale, dark grey to black and carbonaceous. Becomes silty in places. Contains thin (up to 1") beds of medium grey, very fine sandstone.
263 - 266.2	Coal.
266.2 - 267.8	Sandstone, medium/light grey, very fine grained.

267.8 - 284	Interval of very poor recovery. Predominantly shale/siltstone with some coal at base.
284 - 284.6	Sandstone, medium/light grey, very fine grained, - numerous thin laminae of silty shale.
284.6 - 285.6	Shale, black, very carbonaceous and fissile.
285.6 - 292	Siltstone, medium/dark grey to black, occasionally shaly and occasionally tending to very fine grained sandstone.
292 - 298	Sandstone, medium grey, very fine grained, cross-bedded with numerous small sedimentary structures.
298 - 303	Shale, medium/dark grey to black, tends to siltstone.

Total Depth - 303 feet.

H-5

PINE PASS COAL PROJECT

Drill Hole No.:	H-5
Company:	Pan Ocean Oil Ltd., Calgary, Alberta.
Area:	Willow Creek, Pine Pass Area, British Columbia.
Driller:	E. Russel, Canadian Longyear Ltd.
Hole Diameter:	NQ 1-63/64
Core Diameter:	1-7/8 - Diamond Drilling
Drilling Period:	February 13, 1973 - February 14, 1973
Total Depth:	202
Surface Elevation:	3,965 feet (approximately - unsurveyed)

(feet)	
0 - 33.6	Shale, black and massive.
33.6 - 34	Conglomerate containing rounded pebbles to 1/4".

MOOSEBAR FORMATION

GETHING FORMATION

34 - 45	Sandstone, medium/light grey, very fine grained interbedded with medium/dark grey siltstone in beds varying from laminae to 1/2". Bedding generally dipping approximately 20^{o} to horizontal.
45 - 50	Shale, black, carbonaceous and massive.
50 - 65	Siltstone, and very fine sandstone, light to medium grey (sandstone) to dark grey (siltstone). Bedding approximately 20^{o} to horizontal.
65 - 75	Shale, black and carbonaceous. Very soft in places.
75 - 93.5	As 50 - 65.
93.5 - 102.3	Sandstone, light/medium grey, very fine/medium grained. Tends to be fractured both along bedding and at right angles to bedding. Calcite filling of fractures.
102.3 - 121.5	Shale, medium/dark grey to black. Silty in part. Coaly streak (3") at 119'.
121.5 - 123.5	Sandstone, medium grey, very fine/fine grained - dip 50^{o} to horizontal.
123.5 - 147.6	Siltstone and shales as above.
147.6 - 152	Shale, black, very carbonaceous, and blocky.
152 - 153.5 (?)	Coal - recovery only about 3" - 4".

153.5 - 168.7	Recovery very poor - some coal.
168.7 - 202	Shale and siltstone as above.

Total Depth - 202 feet

Pine Pass Tables & Logs

(Info. from Canceled. Coal Licence
PR - Pine Pass 75(3)A.

GRENVILLE

GEOLOGICAL BRANCH
ASSESSMENT REPORT

00 534

AGGREGATE AND SEAM THICKNESS OF COAL IN PINE PASS

SAMPLE	FOOTAGE TOTAL	AGGREGATE THICKNESS	THICKEST SEAM
DDH #75-3	0 - 897 feet	44.2 feet	12.2 feet
DDH #75-4	0 - 1087 feet	59.8 feet	17.5 feet
DDH #75-5	0 - 1138 feet	33.5 feet	8.0 feet
DDH #75-6	0 - 938 feet	27.4 feet	20.0 feet

TABLE 1

TABLE 4

% OF VITRINITES TO PSEUDO-VITRINITES

SAMPLE	% VITRINITES	% PSEUDO-VITRINITES	% BANDED VITRINITES
75-4	48.2	17.9	14.5

SUMMARY OF 1/4"x0, V.M., F.S.I. COMPARED TO Ro, V.M.

SAMPLE	FOOTAGE	R.M.	ASH	V.M.	F.C.	F.S.I.	Ro	V.M./ KOTTERS	Ro/ REACTIVES	CALCS. C.S.
75-3 1/4" x 0	18.0 - 23.5	0.7	19.8	18.2	61.3	1				
	197 - 202	1.0	42.9	14.3	41.8	1 1/2				
	254 - 267.3	.8	28.5	1.40	56.7	1/2				
	551.5 - 558	1.1	57.0	10.2	31.7	1/2				
75-4 1/4" x 0	98.0 - 110.0	2.1	7.3	18.6	72.0	1 1/2				
	879.5 - 897	1.1	14.4	16.5	68.0	1 1/2				
	900 - 907	.9	2.4	19.8	76.9	8 1/2	1.36	22	65	65
75-6 1/4" x 0	465 - 481	1.7	5.6	19.6	73.1	1 1/2				

SAMPLE:- DDH #75-4 @ 900'-907'

PELLET NO.:- #4

DATE:- 3/10/75

REFLECTANCE

	1	2	3	4
1	1.30	1.28		
2	1.37	1.35		
3	1.45	1.49		
4	1.47	1.42		
5	1.39	1.34		
6	1.36	1.38		
7	1.33	1.38		
8	1.31	1.27		
9	1.30	1.41		
10	1.41	1.43		
11	1.30	1.33		
12	1.40	1.40		
13	1.31	1.53		
14	1.32	1.38		
15	1.42	1.42		
16	1.34	1.41		
17	1.29	1.43		
18	1.36	1.36		
19	1.24	1.46		
20	1.42	1.33		
21	1.30	1.38		
22	1.35	1.47		
23	1.38	1.26		
24	1.27	1.30		
25	1.20	1.32		

Average Ro = 1.36

Standard Readings

1@	1.02
	1.02
	.00
2@	1.02
	1.03
	.01
3@	1.02
	1.01
	.01
4@	1.02
	1.02
	.00

COMMENTS:

No rotation.

Run By:-

CORRELATION BETWEEN 1973 AND 1975 DRILLING RESULTS

TABLE 5

1973 Programme	Yield %	Moist. %	Ash %	V.M.	F.C.	Sulphur	F.S.I.
H-1 A @ 331-338' Total C.C.	78.5	.9	4.3	21.2	73.4	.74	4 1/2
H-1 B @ 338-341 " "	33.6	.6	9.6	23.4	66.4	.48	8
H-2 C @ 397-399 " "	95.2	1.1	2.5	20.8	75.6	.58	6
H-2 D @ 588-593 " "	21.2	.7	10.5	21.4	67.4	.81	5
1975 Programme							
75-3 18.0-23' Raw Coal	--	.7	19.8	18.2	61.3	--	1
197-202 " "	--	1.0	42.9	14.3	41.8	--	1 1/2
254-267 " "	--	.8	28.5	14.0	56.7	--	1/2
551-558 " "	--	1.1	57.0	10.2	31.7	--	1/2
75-4 98-110 " "	--	2.1	7.3	18.6	72.0	--	1 1/2
879-897 " "	--	1.1	14.4	16.5	68.0	--	1 1/2
900-907 " "	--	.9	2.4	19.8	76.9	--	8 1/2
75-6 465-481 " "	--	1.7	5.6	19.6	73.1	--	1 1/2

CORRELATION & EXPECTED YIELD OF COAL IN 1975 DDH's 4, 6, 8, 9, & 10

TABLE 6

RAW COAL

DDH NO.	DEPTH	R.M.%	ASH%	V.M.%	F.C.	F.S.I.
75-4	95' - 110'	2.1	7.3	18.6	72.0	1 1/2
75-6	465' - 481'	1.7	5.6	19.6	73.1	1 1/2

CLEAN COAL

DDH NO.	DEPTH	FLTS @ S.G.	YIELD %	ASH %	F.S.I.
75-4	95' - 110'	1.60	94.6	4.3	1
75-6	465' - 481'	1.60	97.2	3.7	1/2

DH 75 - 2

0 - 22	Overburden.
22 - 48	Shales: Medium grey; locally silty and laminated; abundantly burrowed; strongly calcareous; BCA 85°; Moonebar shales.
48 - 75	Mudstone/Sandstone: interbedding of the lithologies; sharp and erosional contacts; sands clean; fine grained and laminated making up 25% of total.
75 - 140.5	Mudstone: dark grey; very uniform; little or no coarser fractures; erosional below.
140.5 - 160.5	Sandstone/Mudstone: preponderance of sands over muds; sharp mutual contacts;clean fine grained light grey sands; burrowed; gradational.
160.5 - 221	Mudstones; sequence begins with 1.5' of interbedded sands and shales grading into muds; sandstones constitute about 5% of sequence and often occur as 1" bands. BCA 85°.
221 - 238	Sandstones: light grey, fine grained; initial half 95% sands, rest about 70% sand and 30% muds.
238 - 248	Mudstones: medium grey; about 10% sands, gradational.
248 - 258	Sandstones/Mudstones: 70/30% (dominance of sands).
258 - 263	Mudstones: (95%) rest sands, dispersed.
263 - 287	Mudstones: medium grey; homogenously silty; initial 0.6' fine well laminated sands; muds lacking lamination. BCA 87°.
287 - 288	Sandstone: fine grained/ few ½" thick shaly bands; very gradational.
288 - 293	Mudstones: medium grey; vaguely banded; latter half richly silty sandy.
293 - 294.5	Sands: light grey; fine grained; well laminated (closely spaced).
294.5 - 298	Sandstones/Mudstone: broad interbedding; dominance of muds in lower half.

298 - 302	Mudstones: dark grey; homogenously silty; very few thin sand layers.
302 - 304	Sandstone: light grey; clean;well-sorted, fine grained.
304 - 315	Sandstone: light grey, fine-grained, making up 85% of sequence, rest muds.
315 - 325	Mudstones: subordinate amounts of silts and sands, very gradational below.
325 - 335	Sandstones: light grey; fine grained making up 8% of succession, rest silts and mudstones. BCA 80^{o} at 334.
335 - 344	Mudstone/Sandstone: slight dominance of muds, some gradations into silts.
344 - 345	Sandstone: light grey; fine grained; erosional.
345 - 363	Sandstones/Mudstone: sands 60%, muds 40%.
363 - 382	Mudstone: dark grey; only 3% sands as small lenses; pyritic; gradational.
382 - 386	Siltstones: medium grey; very argillaceous; few streaks of shales as intraclasts; bioturbated; gradational.
386 - 398	Sandstones: medium grey; very fine grained; argillaceous; well laminated; some disturbed lamination; several shaly lenses up to 2" thick.
398 - 406.5	Mudstones: medium grey; distinctive sequence predominanted by shales (90%); extensively burrowed and biogenically obliterated lamination.
406.5 - 411	Sandstones: medium grey; fine grained; uniformly laminated throughout.
411 - 421.5	Sandstones/Mudstone: rapidly alternating bands; sands 85%; rest shales.
421.5 - 426	Mudstones: 95%, sands 5% dispersed as thin layers.
426 - 453	Mudstones: dark grey; homogenous; bottomost 7.5' highly bioturbated with extensive vertical and horizontal burrows; only two lenses of sands, each up to 1". Interval amost exclusively of muds; gradational.

453 - 484	Sandstones/Mudstones: 70% sands, 30% muds; broadly alternating; BCA 80° at 478.
484 - 525.5	Mudstones: 85% mudstone interlayered with sands. Significant sandy intervals at 493 - 493.3; 493.5 - 494; 505 - 505.7 and 507.8 - 508.2.
525.5 - 527	Sandstones: light grey; fine grained; upper few inches with shale stringers and intraclasts; followed by 0.6' homogenous sands lacking lamination, rest well laminated sands with one 3/4" thick shale clast; bottomost 0.5' partially homogenized by organic activity; erosional below. BCA 85°.
527 - 528.7	Mudstone: medium grey; slightly sandy in the middle; gradational.
528.7 - 530	Sandstone: light grey; very fine grained; erosional lower contact.
530 - 827	Mudstones: dark grey; very homogenous and uniform looking; almost entirely devoid of current lamination and coarser terrigenous detritus. Occasional layers contain small scale tubular burrows. Pyrite as specks and blobs. One 0.8' buff grey and brownish band at 780 - 780.5; strongly calcareous. 3" light grey, very fine grained sandstone at 804. Top of this unit highly erosional, bottom though abrupt but not scoured. Whole of sequence otherwise monotonously developed. It is extremely difficult to discern bedding.
827 - 837	Mudstone: This unit represents an arbitrarily cut-off interval merely to emphasize its being affects by tectonic forces, otherwise lithologically it is similar to the preceding sequence. Much polishing and slickensiding is evident with numerous intertwining of calcitic veins.
	- Fault -
837 - 848.5	Sandstones: light grey; fine grained; highly crushed and brecciated zones; abundant polished and slickensided surfaces. Shaly intercalations have served as lubricant zones along which movement has taken place (resulting into variously curved and polished surfaces). Interval 95% sand and seems to represent some higher level of Moosebar formation; abrupt lower contact; highly variable BCA throughout.

848.5 - 858	Mudstone: dark grey; crushed and polished; some silts and fine sands.
858 - 863	Sandstone: light/medium grey; fine grained; crushed.
863 - 870	Mudstone: medium grey; locally broken but not crushed.
870 - 883	Sandstones: fine grained; well laminated; BCA variably between 5 - 10°.
883 - 904	Mudstone: initial 7' has abundant argillaceous very fine grained sandstone; muds medium grey; locally broken up; variable BCA. At 901 - 902 thick calcite veins recementing broken fragments.
904 - 916	Sandstones: medium grey/very fine grained; abundantly laminated; much burrowing; pyrite blobs; some 5 - 7% shale intercalations, strongly calcareous sands; local fracturing and recementing calcite. BCA 30° at 904 and 10° at 915.5.
916 - 948	Sand/Shales: dominantly fine sands interlayered with muds; locally fractured and much calcite veining.
948 - 958	Mudstone: medium grey; little or no silt.
958 - 968	Sands: fine grained; BCA 10°.

T. D.

DH 75 - 3

0 - 5	Sandstone: fine to medium grained; grey; core broken throughout; irregular laminations; sporadic cross-bedding; dominantly quartzitic with supporting cherts and other dark materials; limonitic specks; in lower 2' a 6" interval of light grey sandstone coarser grained than surrounding rock with irregular silt intercalations; non calcareous; gradational; lower contact; BCA 70°.
5 - 14.5	Sandstone: medium to coarse; grey; core broken throughout and shaly zones shattered; shale intraclasts coal stringers; top 5' finer intervals; dominantly lithic with quartz secondary; non calcareous; abrupt lower contact (?); rusty weathering in fractures.
14.5 - 14.9	Coal: durain; appears to be misplaced in core box; check gamma ray-neutron logs.
14.9 - 18	Sandstone: coarse to gritty and in places cross bedded; grey; non calcareous; coal stringers; contact (lower) apparently abrupt.
18 - 23.5	Coal: upper half clarodurain; lower half durain; BCA 80°; recovery 75% (4' of 5.5').
23.5 - 28.5	Mudstone: initial 1.0' dark grey; coal stringers; carbonaceous; remainder medium grey; silty; non calcareous; gradational below.
28.5 - 30.5	Mudstone: medium grey; sporadic silt zones in upper half; calcareous.
30.5 - 38	Siltstone: medium grey; faintly laminated (sporadically); occasional (lower 5') zones of cross-bedded fine sandstone (small scale cross-beds); structurally intact; calcareous; scour and fill structures in lower 2'; erosional contact below.
38 - 46	Sandstone: fine to medium grained; medium grey; series of gradational intervals from fine to medium, silt and shale lenticular intraclasts varying from 1/8" to 1 1/2" in length and maximum of 1/4" in width; very calcareous; limonite weathering along fissures; gradational below; BCA 75°.

46 - 49	Sandstone: fine grained; well laminated; slightly argillaceous; dark grey; calcareous; small scale lamination.
49 - 65	Sandstone: medium grey; medium to coarse grained; ubiquitous cross-bedding; stringers of coal; intraclasts of dark silts; strongly calcareous; quartzitic; erosional contact.
65 - 86	Mudstone: silty; dark grey; non calcareous; silt is both homogenous as well as differentiated into laminations; coal stringer (1") in upper 1'; gradational contact.
86 - 87.5	Coal: clarodurain; bottom 2" is bone coal.
87.5 - 88.5	Mudstone: carbonaceous; coal stringers;
88.5 - 97.5	Mudstone: slightly silty; in places slickensided; medium grey; non-laminated; non calcareous; gradational below.
97.5 - 102.5	Mudstone: initial (top) 3' carbonaceous; dark grey; remainder non calcareous; medium grey; structureless; gradational contact below.
102.5 - 103.5	Siltstone: light grey; non calcareous; non laminated; gradational below.
103.5 - 112	Mudstone: dark grey; lower half sporadically carbonaceous; non laminated; slightly silty; calcareous; gradational below.
112 - 113	Siltstone: light grey; slightly argillaceous; carbonaceous particles; non calcareous; gradational below.
113 - 115	Mudstone: light grey; homogenous; gradational below.
115 - 119	Sandstone (fine) and Siltstone: light grey; calcareous.
119 - 124	Sandstone: light grey; very fine grained; 1' siltstone in centre of unit; cross-bedded and laminated; strongly calcareous; gradational below.
124 - 133	Mudstone/Siltstone: slightly laminated; siltstone to mudstone; medium grey; strongly calcareous; gradational below.

133 - 138	Sandstone: medium grey; fine grained; laminated; profusely cross bedded; calcareous; gradational below.
138 - 140	Mudstone: silty; dark grey; calcareous; fine laminations; carbonaceous intercalations.
140 - 160	Sandstone: medium grey; very fine to fine grained; profusely cross bedded and laminated; strongly calcareous; scour and fill structures; gradational below; BCA 80°.
160 - 176	Mudstone: medium grey to black; very carbonaceous and coal stringers in several horizons; 6" carbonaceous sandstone cross-bedded in first 5'; calcareous except for carbonaceous zones; gradational below.
176 - 187.7	Sandstone: medium grey; fine grained; banded appearance; small scale cross bedded; coal stringers in lower part; 183 - 184.5 is mudstone-siltstone; strongly calcareous throughout; abrupt contact below.
187.7 - 188	Coal - bone coal.
188.8 - 190.5	Mudstone: dark grey; homogenous; gradational below.
190.5 - 192	Coal: durain; gradational below.
192 - 197	Mudstone: dark grey; homogenous; silty in centre; gradational below.
197 - 202	Coal: 0.7' thick - vitrain - broken 0.4' thick - durain 0.8' thick - carbonaceous mudstone 1.3' thick - duravitrain Recovery : 64% (3.2' of 5')
202 - 214	Siltstone and fine sandstone: medium to dark grey; siltstone dominates top half; sandstone dominates lower half; few silty mudstones in top half; several calcite stringers parallel to bedding; few coal stringers; calcareous; gradational below. BCA 85°.

214 - 216.5	Sandstone: light grey; very fine to fine grained; argillaceous banding; calcareous; gradational.
216.5 - 236	Mudstone: medium grey; locally silty; structureless; calcareous; gradational below.
236 - 254.5	Sandstone and Mudstone: interbedded; light grey; very fine sandstone; calcareous; small scale laminations; silty mudstone at base.
254.5 - 267.3	Coal: Recovery - 70% (254.5 to 258) (2.5' of 3.5') .8' durain; 1.7' clarodurain. Lost core 258.0 to 262.0. Recovery 20% (262.0 to 267.0); .5' mudstone, .5' clarodurain and durain. Recovery 100% (267 - 267.3) .3' durain.
267.3 - 333	Mudstone: dark grey; laminations destroyed by biogenic activity and scouring; very disturbed laminations; calcareous; silty zones; brecciated zone at 283' (2" thick); angular shards of mudstone embedded in calcite matrix; very distinctive zone containing much evidence of bioturbation; also carbonaceous fragments coated with calcite (micro.); slight pinkish appearance; BCA 25°; gradational below; slickensided surfaces at intervals of approximately 9" (average); .4' fine, argillaceous sandstone near bottom.
333 - 337	Mudstone: dark grey; core broken (1" to 3"); polished surfaces (slickensided); calcite veins.
337 - 339	Mudstone: grey-brown; mud seam at 337 to 337.6; broken and crumbled for 6"; abrupt below; moist; some-slickensided surfaces; (fault?).
339 - 365.5	Mudstone: medium to dark grey; silty especially bottom 10' and carbonaceous and coaly 355 to 358; BCA 65°; fractured and calcite infilled near 340'; mostly calcareous particularly where silty; gradational below.
365.5 - 373	Sandstones: fine grained, richly argillaceous; mud bands associated with coaly shales; vague laminations; calcareous in sandier sections; non calcareous in muddier sections; gradational below; BCA 65°;

373 - 385.5	Sandstone: very fine grained and some silt layers; medium grey; richly argillaceous; irregular lamination; calcareous; gradational below.
385.5 - 398	Siltstones and Mudstones: dark grey; argillaceous; sparsely laminated; minor fractures infilled with calcite; coal intercalations to bedding; calcareous; evidence of bioturbation; sandy unit (387.7 to 388.2); fine grained; gradational below.
398 - 421.5	Sandstone: medium/light grey; locally fine grained; mostly fine grained; argillaceous; abundantly laminated and cross-laminated; sporadic calcite infillings of hairline fractures; some disturbed lamination and occasional burrows; ripple lamination; BCA 55^{o}; strongly calcareous; transitional below.
421.5 - 425.5	Sandstone: light/medium grey; fine grained; argillaceous; abundantly laminated and cross laminated; strongly calcareous; bioturbations and occasional burrows; gradational below.
425.5 - 433	Siltstone with muddy intervals intermixed; sporadic laminated intervals;lower half dominantly muddy, strongly calcareous; gradational.
433 - 438	Mudstone: medium grey to dark grey; silty; sparse vague lamination; few coaly streaks; strongly calcareous.
438 - 452	Mudstone: dark grey to black; richly carbonaceous and isolated coaly layers; vertical frctures in interval 450 - 450.6; gradational below.
452 - 453	Sandstone: dark grey; abundantly argillaceous (up to 25%); vaguely laminated; richly calcareous; gradational.
453 - 454.5	Coal: dominantly bony with some carbonaceous sandstone.
454.5 - 467.5	Mudstone: dark grey to black; richly carbonaceous; few isolated coaly layers; slickensided at 466; highly argillaceous very fine grained sands at 458.5 - -59.2. Note that only 6.5' core recovered between 456 - 466.

467.5 - 468.5	Coal: dominantly durain.
468.5 - 476	Mudstone: dark grey; almost lacking in silts; locally highly carbonaceous; lower 1.5' highly fractured and traversed by calcite veins; gradational.
476 - 477.8	Coal: bony dominantly; some hard durain; gradational.
477.8 - 481	Mudstone: medium grey; sparingly silty; lacking lamination; slickensided; gradational.
481 - 504	Sandstone: medium grey; fine to very fine grained; abundant interlamination of silts and argillaceous matter. Sequence characterized by small scale (½" thick) cross laminated and locally wavy units frequently interleaved by silt and clay grade laminae. Lower 4' show preponderance of argillaceous content; strongly calcareous; transitional below. BCA 55° at 499.
504 - 511	Mudstone: medium grey; homogenously silty; some small scale cross lamination; abundantly calcareous; gradational.
511 - 512	Sandstone: medium grey; very fine grained; small gradational units - fine sand grading upward into silt and mud, laminated bands show some syndepositional disturbance, strongly calcareous, gradational lower contact.
512 - 536	Mudstone: dark grey to black; dominantly richly carbonaceous; several dirty coaly layers; only 60% recovery between 517 - 527 - some larger coaly layers might have been lost, core broken up but no much slickensiding, gradational, BCA 55°.
536 - 538	Coal: predominantly bony, very hard and muddy.
538 - 551.5	Mudstone: medium to dark grey; numerous slickensided surfaces, devoid of silts and lamination, locally coaly especially around 548, non calcareous, transitional, 50% recovery between 548 - 558.
551.5 - 558	Coal Seam: dominantly durain, only 1.8' recovered.
558 - 567	Mudstone: black, richly carbonaceous, initial 1.5' has coaly intervals, gradational, BCA 50°.

567 - 569.5	Sandstone: medium grey, fine grained, argillaceous, coaly lenses, laminated and cross laminated, abundant intertwining of calcitic veins, abrupt below.
569.5 - 570.5	Mudstone: black, highly carbonaceous, slickensided surfaces, gradational.
570.5 - 571.5	Coal: highly slickensided and polished fragments of dirty coal.
571.5 - 574.5	Mudstone (some coal interval seems to have been lost); carbonaceous, polished surfaces, transitional.
574.5 - 580	Mudstone: dark grey, vague sporadic lamination, locally very silty and approaching fine grained sandstone, slightly carbonaceous, BCA 60°.
580 - 581	Coal: mainly bony coal, some durain.
581 - 587	Mudstone: medium grey, homogeneous, gradational.
587 - 598	Mudstone: carbonaceous, initial few inches in coal; recovery 1.5' between 587 - 592 and 1.7' between 592 - 598.
598 - 602	Coal Seam: mostly badly broken up dirty coal, 0.7' recovered.
602 - 628	Mudstone: dark grey to black, locally very carbonaceous, 3 distinct bands - each about 0.8' thick, very fine grained and argillaceous and small scale irregular cross-lamination, the latter calcareous, several zones exhibiting calcite fractures but local. Between 602 - 604 recovery 0.7', bottom 0.8' very carbonaceous, transitional.
628 - 633.5	Carbonaceous mudstone and coal: only about 1.5' recovery. Very little coal recovered and badly fragmented - difficult to assess exact coal interval.
633.5 - 639	Mudstone: initial 2' dark grey, carbonaceous and slickensided, rest competent, richly silty and strongly calcareous, gradational. BCA 50°.
639 - 644	Siltstone/Mudstone: about equal proportion, broadly laminated, strongly calcareous.
644 - 646	Sandstone: medium grey, very fine grained, vague lamination; very argillaceous in last 0.8', strongly calcareous, gradational.

646 - 648	Mudstone: medium grey; initial 0.5' has coaly streaks, rest locally sandy, calcareous, very transitional.
648 - 715	Sandstone: medium grey; dominantly fine grained; locally argillaceous; some brief gradational zones from sands to silts; laminated and prominently cross laminated throughout; few discrete burrows, few shaly zones (up to 0.5') mainly confined to initial half of interval, 0.3' dirty coal band at 703. A vertical fracture (almost parallel to core axis) at 713 - 714. Many microlithological contacts strongly to mildly erosional, strongly calcareous, BCA 60^{o}.
715 - 720	Mudstone: medium grey; slightly silty; 1' sandy unit; very fine grained prominently cross-laminated; richly calcareous, gradational.
720 - 733	Carbonaceous mudstone and coaly zone: Interval 720 - 724 broken up, many polished fragments, recovery about 1.8'. It is a mixture of carbonaceous muds and dirty coal. Rest of sequence black mudstone locally richly carbonaceous. Recovery: 724 - 726 only 1.5', 726 - 729 only 1.3'; gradational.
733 - 737.5	Siltstones: dark grey, highly intermingled with argillaceous matter (10-12%), locally 1/8" thick very fine sand layers, non calcareous, gradational.
737.5 - 738.6	Mudstones: black, very carbonaceous, highly polished surfaces.
738.6 - 741.5	Sandstone: dark grey, very fine grained, abundantly interlayered with argillaceous matter, wavy lamination, calcareous, gradational. BCA 50^{o}.
742.5 - 744	Mudstone: black, highly slickensided and polished, carbonaceous, abrupt and broken contact. Faulted contact.

744 - 777.5	Sandstone: light/medium grey, medium to coarse grained, very siliceous, and bend; dominantly lithic and cherty, non calcareous, mostly cross laminated, locally very coarse grained intervals (some very granular), much local fracturing apparent. Interval 762 - 766 abundantly vuggy - seem to have been caused by fracturing and recementation. Between 752 - 755 fine grained sand fractured and recemented at high angles. BCA 30° rest of interval has about 60° BCA, abrupt contact.
777.5 - 784	Carbonaceous Mudstone: very broken up - only 1' fragmented core - a mixture of black carbonaceous muds and some coal.
784 - 798	Mudstone: medium grey, very silty (homogenously) structureless, carbonaceous and coaly at 789 - 789.5. Non calcareous throughout, getting progressively sandier bottomward.
798 - 804	Siltstone: medium grey, richly argillaceous, some very fine sands in middle, non calcareous, gradational. BCA 60°.
804 - 810	Mudstone/Sandstone: initial half medium grey, dominantly muddy zone with subordinate amounts of very fine sands, grading into dominantly sandy (lithology with abundant shales), well laminated, strongly calcareous throughout.
810 - 837	Mudstone: medium grey, at places vaguely banded; 811 - 819.5 regular silty/fine sandy interlayering slightly carbonaceous at 812, non calcareous 822 - 837, rest calcareous. Lower contact has distinctly fractured look and ensuing sequence i.e. below 837 level, is thought to be repeated above. BCA 65°. Siltstone 834 - 837 - thrust.
837 - 842	Siltstone: medium grey, uniform,argillaceous, non calcareous, fractured at base, slightly sandier bottomward.
842 - 847	Sandstone: light/medium grey; fine grained; abundantly argillaceous, cherty and siliceous, hard, vaguely discernible cross bedding, gradational.

847 - 851	Sandstone: medium grey, prominently cross laminated, fine/medium grained, numerous carbonaceous laminae bottomwards, grading below to coarser lithologies.
851 - 877	Sandstone: medium grey, extremely hard and siliceous, dominantly medium-grained, while siliceous veins along fracture planes, totally non calcareous. Distinctly cherty (98%), minor quartzes as white grains welded into chert "matrix". Many fracture planes exhibit carbonaceous polished surfaces (slippage along carbonaceous planes). Dark grey uniformly on fresh broken surfaces. No argillaceous contact in matrix of sands. BCA 50°.
877 - 897	Sandstone: medium grey, very coarse grained, essentially cherty and siliceous, closely welded together, entirely non calcareous, very similar to above except distinctly coarser, no argillaceous content.

T.D.

DH 75 - 4

0 - 15	No core.
15- 36	Mudstone: medium grey, very silty - as laminae and then well laminated layers, silty content increasing bottomward (5-8%), locally slightly carbonaceous, strongly calcareous, gradational. BCA 85°.
36 - 37	Mudstone: black, very carbonaceous, gradational.
37 - 39.5	Mudstone: medium grey, very vaguely laminated, richly silty, abundant carbonized leaves (revealed on breaking), passage below sudden but not erosional, strongly calcareous. BCA 85°.
39.5 - 43	Sandstone: medium grey, upper half dominantly medium grained with gradational intervals (up to ¼") ranging from clay grade through finely grained sands, laminated but much primary lamination obliterated by intensive burrowing. Lower half has up to 25% argillaceous and silty admixture, ½" coal band at 42.7, non calcareous.
43 - 43.8	COAL - mostly clean .
43.8 - 45.8	Mudstone: dark grey to black, carbonaceous with several thin coaly layers, non calcareous, very gradational below.
45.8 - 47	Siltstone: medium grey, very argillaceous, upper 0.4' has abundant small scale cross lamination, ½" fine grained sandy stringers, lower portion shows some lamination (partially surviving from organic activity), strongly calcareous, imperceptible passage.
47 - 49.5	Mudstone: dark grey, lowerhalf 80% silts and some very fine sands, laminated, upper portion with numerous calcitic hairline streaks (along bedding), calcareous, gradational. BCA 84°.
49.5 - 52	Sandstone: medium grey to brownish grey; initial 0.5' fine grained cross-laminated with coaly laminae at base, grading below to 0.6' of sequence of richly argillaceous silty grading below to medium grained sands (1.4' thick). This latter unit traversed by a vertical fracture - now partially weathered by water action. No movement involved; abrupt and slightly scooped contact, calcareous.

52 - 54.5	Mudstone: medium grey, homogenously silty, structreless, very calcareous, gradational. Vertical to near vertical fracture still continuing in this unit and locally weathered.
54.5 - 59.5	Sandstone: medium grey, fine grained, irregularly laminated, argillaceous laminae and very thin layers, fractured at 56 - 57.5 and thickly calcite encrusted, gradual increase of argillaceous matter, bottomward strongly calcareous.
5b.5 - 70	Mudstone: dark grey to black, initial 2' carbonaceous and has 1" of coal and 2" of sands. Rest richly silty mudstone, vaguely laminated, strongly calcareous, ¼" coal stringers, gradational. BCA 80^{o}.
70 - 70.5	Sandstone: brownish grey, very fine grained, substantially admixed with argillaceous matter, increasing fines bottomwards, calcareous.
70.5 - 82	Mudstone/Sandstone: medium grey, initial half dominantly muddy with 10-12% silts, rest dominantly fine grained sands, well laminated and cross laminated, local isolated burrows, strongly calcareous, abrupt below.
82 - 83	Sandstone: light grey, medium-grained, clean, well sorted, strongly calcareous, vaguely cross laminated, erosional below.
83 - 84	Sandstone: medium grey, very fine grained, very argillaceous, gradational.
84 - 87	Mudstone: medium grey, abundantly silty (local differentation), poorly laminated (sparse), strongly calcareous, abrupt.
87 - 88.5	Sandstone: light grey to medium grey, fine grained, lower half well laminated, slightly argillaceous, strongly calcareous, BCA 80^{o}.
88.5 - 91	Mudstone: medium grey, upper part sparingly silty (homogeneous) lower half containing up to 20% silts and very fine sands, strongly calcareous, gradational.

91 - 96.2	Sandstone: medium grey, fine to very fine grained, sparse wavy lamination, richly argillaceous, lower half up to 30-35% shale, feebly calcareous in shaly zones, otherwise strongly calcareous, abrupt below.
96.2 - 96.5	Sandstone: light grey, fine grained, brownish weathering on fractured surface, non calcareous, abrupt below.
96.5 - 98	Mudstone: medium grey, slightly carbonaceous, devoid of silts, gradational.
98 - 110	Coal Seam : total recovery 5'. Breakdown of intervals as follows:

Footage	Recovery	Lithology
98-100	0.5'	Highly broken up, upper half clarodurain, lower half durain.
100-103	1.0'	Hard coal, mostly durain, 2" hard coal band.
103-108	2.7'	Mostly mushy coal, 1' durain in middle.
108-110	1.3'	Friable shiny coal.

110 - 117	Mudstone: medium grey, initial 5' slightly carbonaceous totally lacking lamination, 0.2' richly carbonaceous and coaly zone at base, rest bottomward getting siltier, non calcareous.
117 - 118	Siltstone: medium grey, irregularly laminated, richly argillaceous, strongly calcareous, very gradational below, some fine sand intercalations in middle. BCA 82°.
118 - 128.5	Mudstone: medium grey, initial 2.5' sparingly silty, middle 4.5' regularly intercalated by ½" to 2" very fine grained ripple laminated sands, some gradation to silts, strongly calcareous very gradational.

128.5 - 129	Mudstone: black, very carbonaceous and coaly bands.
129 - 134	Mudstone: medium grey, richly silty, locally vaguely cross laminated, strongly calcareous, bottom 0.2' polished.
134 - 135	Siltstone: medium grey, richly argillaceous (30%), very calcareous, gradational.
135 - 142	Mudstone: grey to brownish grey, abundant silts (local intervals), vaguely cross laminated in silty zones, richly calcareous, gradational.
142 - 147	Siltstone: brownish grey, richly argillaceous, small scale current lamination, micro-erosional contacts, some micro-slumping, sporadic burrowing, one 2" - 3" vertical dark burrow, bottom 0.5' abundantly argillaceous (25-30%), gradational, strongly calcareous. BCA 85°.
174 - 153	Mudstone/Siltstone: shale/silts intimately associated, slight (overall) dominance of silts, abscure to absent lamination, bottom 1' slightly carbonaceous, strongly calcareous, transitional.
153 - 154.5	Siltstone: brownish grey, richly argillaceous, lamination totally obscure to non-existent, appears to be a paleosoil, rootlet bed, as evidenced by general mottling and the presence of particular carbonaceous matters, normal to bedding. At the top of the unit 1" of fine to medium grained sandstone rich in detrital carbonate grains. Both contacts are sharp and bottom one mildly indented. The whole unit is strongly calcareous and gradational.
154.5 - 162	Mudstone: medium to dark grey, massive, upper sequence strongly calcareous, lowermost foot and one half is non calcareous, gradational.
162 - 165	Sandstone/Siltstone: light to medium grey first foot; very fine grained, small scale ripple cross lamination, laminated shaly bands intervening with erosional contacts on the sandy lens. The remaining sequence is silty and richly argillaceous with 2" of very fine sands embodying carbonaceous laminae. BCA 85°. Strongly calcareous and gradational.

165 - 166.2	Mudstone: homogeneous, patchily calcareous and gradational.
166.2 - 169	Coal Seam: first foot is bony coal with some carbonaceous mudstone at the bottom. The rest is very hard, dirty coal with small durain intervals.
169 - 171	Sandstone: medium to light grey, fine to medium sands with numerous argillaceous silty bands, cross laminated, strongly calcareous, erosional.
171 - 174	Mudstone: mostly homogeneous, a few fine sandy stringers, silty, strongly calcareous or abrupt below.
174 - 175	Sandstone: light grey, fine grained, strongly cross bedded, 2" zone containing fine silty intraclasts, getting finer towards the bottom, strongly calcareous and erosional below.
175 - 189.5	Mudstone: medium grey, abundantly silty 3specially at 176 - 177 and 181 - 185, silty zones, poorly laminated; calcareous from 175 - 186; remaining sequence, i.e. 186 - 189.5 non calcareous and has carbonaceous admixture.
189.5 - 190.5	Siltstone: light medium siltstones, cross laminated with numerous burrows, abundantly argillaceous. BCA 65^{o}. Strongly calcareous, gradational.
190.5 - 197	Mudstone: bottom 1½' richly carbonaceous.
197 - 198	Coal with two 1" sandstone bands in the middle. Note: about 5' interval in density log - much coal lost there.
198 - 204.5	Mudstone: medium to dark grey, brownish grey patches; lower ½' calcareous and locally carbonaceous.
204.5 - 212.5	Siltstone/Mudstone: (alternating bands), locally laminated and cross laminated, some slumping in the small scale laminationa. BCA 80^{o}. light to medium grey, strongly calcareous.
212.5 - 215.5	Mudstone: medium grey, richly silty, highly calcareous, bottom ½' richly carbonaceous.

215.5 - 217	Sandstone: medium grey, wavy small scale cross laminations, medium to fine grained; richly argillaceous; abundant burrows; strongly calcareous; gradational below.
217 - 219	Mudstones: medium to dark grey; locally carbonaceous and calcareous, gradational below.
219 - 220.5	Sandstones: medium grey; very fine grained; highly argillaceous; small scale cross laminations; strongly calcareous. BCA 70^{o}.
220.5 - 225	Mudstones: medium grey; homogenous; uniformly disseminated silts; highly calcareous; bottom 1½' has up to 20% silts; gradational below.
225 - 228	Sandstones: fine; light grey; prominently displaying cross lamination; few coaly fragments; strongly calcareous; transitional in lower units.
228 - 235	Mudstone/Siltstone: medium grey; first half dominantly muddy; remainder dominantly silty; irregularly laminated; 0.5' of very fine grained cross laminated sands; effusively calcareous.
235 - 237	Mudstones: brownish grey; coal shattered slightly weathered (water zone); a few carbonaceous stringers; locally calcareous; gradational below.
237 - 242	Sandstone: medium grey; fine grained; abundant argillaceous content as 2 - 4" bands; obscure to impoverished lamination; gradational below; calcareous; from 237 - 238 non-calcareous.
242 - 243.5	Siltstone: medium grey; very argillaceous, gradational.
243.5 - 262	Sandstone: initial 2' are very fine grained; brownish grey; cross laminated; calcareous; next 3' are fine-grained, widely cross laminated with some disturbed laminations; light to medium grey; (½" thick 3" deep transverse sandstone dike at 245.5); the following 8' are light grey, well washed, fine-grained with cross-laminations. From 256 - 258.5 generally medium sandstones, but some medium to coarse-grained sands. The rest of the sequence is fine to very fine grained; with silt and argillaceous layers; very calcareous and gradational. BCA 70^{o}.

262 - 267	Sandstone: very fine-grained; argillaceous; strongly calcareous.
267 - 269.5	Mudstone: structureless with two 1' very fine-grained sandy layers; calcareous and gradational.
269.5 - 273	Sandstone: fine-grained; medium grey; abundant small-scale cross-lamination with some burrowing; locally argillaceous and silty; gradations below.
273 - 274.2	Mudstone: initially carbonaceous; gradational.
274.2 - 275	Sandstone: light grey to medium grey; central 0.3' fine-grained, the rest very fine-grained with argillaceous lamination; calcareous and gradational.
275 - 277.5	Mudstones: medium grey; abundant, disseminated silts; calcareous; gradational.
277.5 - 279	Sandstones: medium grey to light grey; very fine-grained; abundant small-scale cross-lamination; regular argillaceous layers and laminations throughout; erosional.
279 - 279.8	Sandstone: light grey; medium-grained; abundantly cherty; cross-laminated; some silty laminae; abrupt contacts; very calcareous.
279.8 - 282	Sandstone: initial 1' richly argillaceous siltstones with a large coal stringer along core axis. The remaining is fine-grained laminated and cross-laminated. Numerous silty bands with erosional contacts; some deformation of lamination; strongly calcareous and transitional below.
282 - 286.5	Siltstones: medium grey; argillaceous; up to 15% vague laminations; strongly calcareous; gradational.
286.5 - 292.8	Mudstones: medium grey; very homogenous; with a few local silty bands; strongly calcareous and gradational.
292.8 - 299	Mudstones: initial 1½' and the bottomost 1½' are very coaly and argillaceous. The remainder is slightly silty with occasional carbonaceous interpolations; patchily calcareous; gradational.

299 - 302	Coal Seam: Mostly clarain/durain, 66% recovery (over 6' on density log).
302 - 334	Mudstones: medium to dark; carbonaceous; (first foot carbonaceous, also 307.5 to 308.5 is carbonaceous, at 323 - 324 carbonaceous) structureless throughout; silty units locally, expecially between 327 and 329.5 locally enriched with silts. Patchily calcareous, gradational below.
334 - 334.4	Sandstone: very fine-grained; cross-laminated; slightly argillaceous; calcareous.
334.4 - 340.5	Mudstones: medium to dark grey; calcareous; homogeneously silty; gradational below.
340.5 - 347	Siltstone: medium grey throughout; abundant argillaceous matter in homogenous form. Non-calcareous bottom foot 30% argillaceous matter; gradational below.
347 - 363	Mudstones: with medium grey colour; some silty intervals with homogeneous zones; generally structureless; initial 1½' has fine carbonaceous matter; non-calcareous between 355 to 360; rest strongly calcareous.
363 - 369	Sandstone/Siltstone: medium to brownish grey; 60% silt and 40% sand; some muddy intervals; sand layers at 366.3 - 367.2; strongly calcareous and gradational.
369 - 373.4	Mudstone: highly silty; homogeneously silty; strongly calcareous; gradational.
373.4 - 383	Mudstone: Coaly Zone: sequence is generally carbonaceous and locally grading into dirty coal with the significant layer being 378 - 383, but there is carbonaceous mudstone.
383 - 393	Mudstone/Siltstones: with a slight dominance of muds overall; structureless; non-calcareous.
393 - 403	Sandstone: light to medium grey, very fine grained; abundance of intercalated silty layers; sequence regularly cross-laminated on small-scale; a few burrows - one 4" deep, cylindrical, sand-filled burrow. BCA 80^{o}.

403 - 406	Siltstones: medium grey; abundant argillaceous matter; sparsely laminated; strongly calcareous except lower foot.
406 - 409	Mudstones: medium to dark grey; structureless; non-calcareous; bottom 0.4' richly carbonaceous; highly argillaceous, very fine-grained sandstone.
409 - 412	Coal Seam: first 1.25' is clear coal, the remainder is bony coal and mudstones:
412 - 418	Sandstone: medium-grey; very fine-grained; very argillaceous and up to 15% argillaceous matter in middle 1.5'; sporadically laminated and cross-laminated. Bioturbation at 417, calcareous except initial 1.5'; gradational.
418 - 421	Mudstone: medium grey, silty increasing bottomwards; ¼" thick sily layers; strongly calcareous, gradational.
421 - 425.5	Siltstone: brownish grey; abundantly argillaceous; few sandy bands (very fine-grained); sparse lamination; strongly calcareous; gradational. BCA 80^{o}.
425.5 - 428	Carbonaceous Mudstone/Coal: initial .4' carbonaceous mud, rest dirty coal.
428 - 430.5	Mudstone: grey to rusty (slightly); structureless, calcareous, gradational.
403.5 - 432	Sandstone: originally deposited as alternating sands and silts, subsequently reworked by organisms, hence chaotic lamination and odd intermixing of the lithologies, strongly calcareous, gradational.
432 - 437	Sandstone: grey, fine-grained, abundant argillaceous and silty layers, some closely spaced lamination, local burrowing, lower ½' richly admixed with argillaceous matter, strongly calcareous. BCA 82^{o}.
437 - 440	Siltstone/Mudstone: initial half dominantly silty, rest dominantly muddy, generally structureless, strongly calcareous, gradational.

440 - 441	Sandstone: light/medium grey, lower 0.3' fine-grained, rest very fine-grained (locally approaching silty grade), good small-scale cross laminated units, several discrete burrows and some bioturbation, strongly calcareous, abrupt.
441 - 444.5	Mudstone: brownish grey, generally structureless, few silty stringers bottomwards, strongly calcareous, mottled contact.
444.5 - 445.5	Sandstone: light grey, fine-grained, strongly cross-laminated, some banded silts, erosional, strongly calcareous.
445.5 - 446.5	Siltstone: medium grey, richly argillaceous, mottled lamination, calcareous.
446.5 - 447	Sandstone: very fine grained, silty/muddy bands, strongly calcareous.
447 - 449	Mudstone: medium grey, slightly carbonaceous lower end, strongly calcareous (except lower half), gradational.
449 - 451	Sandstone: medium grey, very fine-grained, argillaceous, chaotic fabrics, erosional, strongly calcareous.
451 - 467.5	Mudstone: medium grey to dark grey, lacking sedimentary structures, locally silty especially at 459 - 462; very fine sands at 455.5 - 457, argillaceous, wavy lamination with numerous "rootlet" type structures (non calcareous sands), bottom 1.5' very carbonaceous muds, gradational, mostly calcareous.
467.5 - 470	Coal Seam: (estimated thickness) about 1' fractured clarodurain recovered.
470 - 472	Siltstone: dark grey, highly argillaceous and embodying fine carbonaceous matter, chaotic lamination, patchily calcareous, transitional.

471 - 473.5	Sandstone: medium/light grey; very fine-grained; initial half very argillaceous, cross laminated, very calcareous, gradational.
473.5 - 479	Mudstone: uniformly grey, abundance of silts - as layers and laminaes (up to 15%), strong calcareous. BCA 55^{o} at 478.5.
479 - 481.5	Sandstone: light grey, upper 2/3 very fine-grained and argillaceous, lower 1/3 fine grained and cleaner, strongly calcareous, gradational.
481.5 - 488	Mudstone: medium to dark grey, locally very silty and slightly carbonaceous, bottom 1.5' has 0.5' dirty coal, gradational.
488 - 510	Sandstone: light/medium grey, dominantly fine-grained, some intervals grading to very fine sands and silts, generally well cross-laminated (small scale) and some intervals with exquisite rippling. Significant muddy/silty band - 494.5 - 497 and 504 - 506. Many isolated burrows and local bioturbation, fractured and healed interval: 501 - 503. Strongly calcareous, very gradational. BCA 75^{o}.
510 - 517	Siltstone: medium grey, gradual increase of argillaceous content bottomward, fracture vertical and recemented by calcite, very calcareous.
517 - 529	Carbonaceous Mudstone and Coal Zone: richly carbonaceous mud. Bony coal:519.5 - 520 and 524 - 527, gradational.
529 - 546	Mudstone: medium to dark grey, abundantly silty (homogeneous) and some isolated silty zones, much carbonaceous matter (revealed in breaking), characteristic calcite impregnation of plant matter (coating), strongly calcareous except 537 - 541, very gradational below.
546 - 553	Siltstone: grey, very argillaceous, bottom 3' has up to 30% shales; very fine sand with collapsed lamination at 547 - 548, strongly calcareous, transitional.

553 - 554	Sandstone: light grey, closely spaced cross-laminated units, abundant hairline calcite (along laminae), fine-grained, strongly calcareous. BCA 45°.
554 - 565.5	Siltstones: medium grey, very argillaceous and locally developing into shales, abundant "whorling" and many large and small burrows, locally some lamination; some sands (very fine grained) notably at 560 - 561.5, slightly fractured; strong calcareous, gradational.
565.5 - 568.5	Sandstone: light grey, fine-grained, intensively laminated and cross-laminated, abundantly burrowed (approaching bioturbation), locally very fine grained, strongly calcareous, erosional.
568.5 - 570	Mudstone/Siltstone: sequence extensively homogenized - presumably by organisms, burrows discernible, whorling, strongly calcareous, erosional.
570 - 572	Sandstone: light/medium grey, fine grained, laminated and cross laminated, burrowing, silty bands, strongly calcareous, erosional.
572 - 573.5	Siltstone: highly argillaceous (20%), erosional.
573.5 - 578	Sandstone: grey, very fine grained, muds about 1.2', some burrowing, very argillaceous throughout, strongly calcareous.
578 - 579	Mudstone: brownish grey, riddled with calcitic hairlines, strongly calcareous.
579 - 582.5	Sandstone: medium grey, very fine grained, very argillaceous, broadly laminated; bottom 1' with good cross lamination but locally badly obliterated by intensive burrowing, strongly calcareous, gradational. BCA 50°.
582.5 - 583	Mudstone: hard, very carbonaceous.
583 - 585	Mudstone: medium grey, abundantly silty, vague lamination, strongly calcareous, gradational below.
585 - 590	Siltstone: medium grey, abundant very fine sands as laminae and layers, strongly calcareous, transitional.

590 - 595.5	Sandstone: light grey, dominantly fine grained, silty unit at 591 - 592. Sands characterized by ubiquitous ripple drift cross lamination, slight fracturing interval; strongly calcareous, transitional.
595.5 - 598	Siltstone: medium grey, very argillaceous, 0.2' well cross laminated fine sand, bottom 1.5' seemingly whorled and has calcitic hairlines, strongly calcareous, erosional.
598 - 600	Sands: light/medium grey, very fine grained, some shaly intraclasts in upper 0.5', well cross laminated, strongly calcareous, gradational below.
600 - 608	Mudstone: medium grey, abundance of silts, silty layers and laminae, strongly calcareous.
608 - 614.5	Sandstone/Siltstone: dominance of very fine sands, frequently laminated and cross laminated, many burrows; argillaceous silts, strongly calcareous throughout; two 1" thick calcite veins, gradational.
614.5 - 628.5	Mudstone: medium grey to dark grey, one coaly lens mainly structureless, slightly calcareous initial 1.5', rest non calcareous, gradational.
628.5 - 631	Siltstone: medium grey, very argillaceous, vaguely discernible, sparse lamination, moderate to feeble calcareous content. BCA 40^{o}.
631 - 632.7	Coaly/carbonaceous mudstone.
632.7 - 638	Mudstone: medium/dark grey, totally non calcareous, polished fragmented core at 636 - 637. No significant movement, slightly silty, very gradational, carbonaceous.
638 - 642	Mudstone/Sandstone: medium grey, initial 1.5' very silty, non calcareous, mud grading below to veryfine sands, argillaceous and cross laminated. Bottom 0.3' highly silty muds, calcareous, gradational.
642 - 646.5	Sandstone: light grey, dominantly fine grained, has regular small scale cross-laminated units, regular silty/muddy laminae, some slumping and burrowing, bottom 1.25' with abundant argillaceous content, strongly calcareous, gradational.

646.5 - 662	Sandstones: medium grey/dark grey, fine to very fine grained, abundant small scale cross lamination; some intervals grading to silts/muds, local bioturbation, many calcite veins, few thin muddy zones - slightly carbonaceous, strongly calcareous, transitional. BCA 75°. Repetition of facies on a scale (average of 6".
662 - 666	Mudstone: medium/dark grey, locally carbonaceous, silty and 0.3' sandy layers in middle, partially calcareous, gradational.
666 - 668.5	Sandstone: medium/dark grey, very similar to 646.5 - 662 interval, erosional below.
668.5 - 671	Mudstone: medium grey, richly silty, non laminated, strongly calcareous, erosional.
671 - 674	Sandstone: light grey, fine grained, upper 1' beautifully cross-laminated, 0.5' silty mudstone in middle, strongly calcareous, abrupt below.
674 - 683.5	Mudstone: medium grey, very silty, lower 5' have irregular silty banding at places; 0.3' siltstone bands, highly bioturbated at 682. 0.3' slightly carbonaceous band at 678.2', strongly calcareous, erosional lower contact.
683.5 - 686	Sandstone: light grey, fine grained, abundantly cross-laminated, some wavy lamination, 0.2' silty/muddy band, a large calcite filled fracture in initial 1'; bottom 0.3' has many dicrete burrows, strongly calcareous, erosional.
686 - 688	Mudstone/siltstone: medium/dark grey, much burrowing, lower half laminated, numerous calcite veining,strongly calcareous, erosional below.
688 - 689.3	Sandstone: fine-grained, light grey, closely spaced cross-lamination, strongly calcareous, some dislocation of laminae due to fracturing, numerous calcite veins, very gradational.
689.3 - 700	Siltstone/Mudstone: initial half dominantly muddy and 20% silts - dispersed and layers, rest dominantly silty broadly laminated, strongly calcareous, erosional. BCA 60°.
700 - 705.5	Mudstone: dark grey/black, locally very carbonaceous and coaly.

705.5 - 707	Sandstone: dark grey, richly argillaceous, very fine grained, laminae poorly discernible, and locally bioturbated, non calcareous.
707 - 724	Sandstone: light/medium grey, fine to medium grained, locally grading to finer sands, ubiquitous fine coaly shards, small scale cross-lamination, bottom 3' highly silty/argillaceous and rapidly changing lithologies and extensively burrowed, strongly calcareous, very gradational. BCA 80^{o}.
724 - 736.5	Mudstone/Siltstone: rapidly varying lithologies on a scale of incline, intergrading sequence of muds/silts occasionally developing into very fine sands, broad banded look, locally burrowed, overall dominance of muds, strongly calcareous. BCA 60^{o}.
736.5 - 744	Mudstones; medium to dark grey, slightly silty, occasional vague lamination, middle 2' not calcareous, rest very calcareous.
744 - 745	Siltstone/Mudstone: medium grey, alternating sequence of, strongly calcareous.
745 - 747.6	Mudstone: medium grey, silty, slightly banded, calcareous, carbonaceous and coaly in bottom 0.5', gradational.
747.6 - 765	Siltstone/Mudstone: 70% muds, very broad bands grading into very fine sands and silts, local burrowing, bottom 7' more uniform, strongly calcareous. BCA 70^{o}.
765 - 770	Mudstone: medium grey, locally silty, sporadic coaly streaks,,calcareous, gradational.
770 - 772	Carbonaceous and coaly mudstone: less than 50% core recovery.
772 - 791	Mudstone: medium/dark grey, silty (uniformly dispersed), 1' fine sands, argillaceous at 773 - 774, carbonaceous at 779 - 780 and bottomost 1.5' with 0.2' muddy coal, some burrowing in lower 3.5', calcareous, gradational.

791 - 816.5	Sandstone: medium/dark grey, fine to very fine grained, rapidly varying lithologies, much small scale cross-lamination, much burrowing and one large vertical burrow (0.5') penetrating at a base a slumped layer; locallly grading into silts and muddy sequences. Bottomost 3' richly muddy and silty (up to 30%), strongly calcareous, gradational. BCA 80°.
816.5 - 818.5	Mudstone: dark grey/black; initial 0.7' silty and laminated, rest carbonaceous and coaly.
818.5 - 819.5	Coal - mostly clarodurain, bottomost 0.3' carbonaceous mudstone.
819.5 - 848.2	Mudstone: medium/dark grey, 70% silty mudstone, carbonaceous at two levels; distinct very fine grained, locally bioturbated, very argillaceous, cross-laminated sands at 834 - 843. Muds with abundant hairline calcite encrustation along bedding (following carbonaceous matter), strongly calcareous.
848.2 - 851	Coal Seam: (estimated thickness); only few coal fragments (clarodurain) present.
851 - 877	Sandy/silty/muddy lithologies: medium grey, a very distinctive zone with rapidly changing (every inch or so) facies; from fine sands-silts to shales, abundantly cross-laminated (small scale) but many zones bioturbated and lamination obliterated, many slump laminations, bottom 8.5' dominantly muddy, strongly calcareous. BCA 80°.
877 - 879.5	Mudstone: initially some coal (0.3') and some 0.1' in middle, rest black carbonaceous mudstone, gradational.
879.5 - 897	Coal Seam: predominantly clarodurain, 3.5' recovery, 20%.
897 - 900	Mudstone: initial 1' very coaly/carbonaceous, rest slightly carbonaceous black mudstones.
900 - 907	Coal Seam: initial half dominantly vitrain, rest clarodurain, 0.2' durain at base. Recovery 3' : 43%. (Both the coal intervals sampled and bagged separately and intervening mudstone interval excluded and left in box.)

907 - 933.6	Sandstone: medium grey, dominantly very fine grained, rapidly variable lithologies, abundant silty/shaly zones, well cross laminated throughout, few burrows; interval 925 - 932 fine/medium grained sands and its upper half with abundant fine silty/shaly clasts, abundant carbonaceous matter and argillaceous in bottom 1.5', strongly calcareous, gradational. BCA 60^{o}.
933.6 - 938.5	Coal Seam: clarodurain about 1.2' recovered, not sampled.
938.5 - 947	Mudstone: medium/dark grey, abundantly silty, vaguely laminated, abundant localization of calcitic hairlines along carbonaceous intercalations, strongly calcareous, gradational.
947 - 975.7	Mudstones/siltstones: medium grey to black, argillaceous, about 65 - 70% muds locally passing to silts and very fine sands; sandy zones well cross-laminated, slight burrowing; whole sequence characterized by several thin coaly intercalations (less than 1" thick), strongly calcareous, abrupt below.
975.7 - 1020.3	Sandstone: light grey, dominantly medium-grained, mostly well washed and well sorted (within a given interval), coarse grained at 997 - 1008, abundant coaly shards at 947 - 1012. Initial 3' with small intraclasts. Initial 20' with well defined cross lamination, strongly calcareous, Dominantly cherty 80% or more, bottomost 1.5' abundantly argillaceous and medium grey, very abrupt contact.
1020.3 - 1029.2	Mudstone: dark grey/black, two rusty bands (iron enriched), about 3" each, siltier at base, non calcareous throughout. BCA 60^{o}. Abrupt contact.
1029.2 - 1032.2	Sandstone: light/medium grey, fine to medium grained, small scale cross-lamination, 0.1' very fine dark sands in middle, strongly calcareous, gradational.

1032.2 - 1048.5	Sandstone: medium grey, generally fine grained, rapidly intergrading sequence of sands, silts and shales though overall sands remain dominant. Small scale cross-lamination, emphasized throughout by regular silty/shaly intercalations. Many isolated burrows and local partial bioturbation, strongly calcareous.
1048.5 - 1052	Sandstone: fine grained, medium grey, substantially less argillaceous and silty content than the above zone, much bioturbation, strongly calcareous, gradual below.
1052 - 1055	Sandstone/Mudstone: medium grey, initial half fine grained mottled sands richly argillaceous, grading below to dominantly muddy highly bioturbated zone simulating intraclastic lithology, lamination entirely obliterated, strongly calcareous, gradual below.
1055 - 1068	Mudstone: medium grey, slightly sandy and silty, 1' of very argillaceous fine sand, upper interval calcareous, lower 6' non calcareous. BCA 50^{o}.
1068 - 1070	Mudstone/Siltstone: medium grey, about equal proportions, slightly bioturbated, calcareous, gradational.
1070 - 1074	Sandstone: medium grey, very fine grained, has regular small scale cross-lamination, frequent interlamination of silts and shales, calcareous.
1075 - 1087	Mudstones: dark grey to black, little or no silts, structureless, carbonaceous, in lower 3' non calcareous throughout.

T.D.

DH 75 - 5

0 - 16	No core.
16 - 17	Sandstones: fragmented, granular to gritty, siliceous.
17 - 18	Sandstones: brownish grey on weathered surface, very fine grained, argillaceous, strongly calcareous, appear gradational.
18 - 23	Sandstone: brownish grey, mostly fragmentary and weathered, highly argillaceous; frequently intercalated with silty and argillaceous laminae and layers, small scale cross lamination, strongly calcareous; gradually increasing argillaceous content.
23 - 32	Mudstones: medium grey, largely fragmented, little or no silts, bottom 2' dark grey and slightly carbonaceous and embodying hairline calcite along bedding, calcareous throughout. Two distinct 3" bands, rusty and heavier (Fe enriched).
32 - 33	Mudstone: black, shaly, carbonaceous, abrupt below.
33 - 37.5	Sandstone: light/medium grey, fine/medium grained, hard quartzose, 5% cherts, non calcareous, obscure cross lanination, locally shows some gradations (to silts and fine).
37.5 - 39.5	Conglomerate: pebbles 1/8" thick, middle 0.3' silty/shaly with granules.
39.5 - 41.7	Siltstone: medium grey, argillaceous, very vague discontinuous lamination, very argillaceous at base, abrupt, strongly calcareous.
41.7 - 50	Gritstone/fine pebble conglomerate: has sandy zones medium to coarse grained, poorly sorted, calcareous, over 75% cherts, rest quartzes, erosional below.
50 - 58	Mudstones: medium grey, structureless, abundantly silty, 0.4' very fine grained argillaceous bioturbated sandy zone, strongly calcareous, very gradational below. BCA 87^{o}.

DH 75 - 5 (pg. 2)

58 - 61.5	Sandstone/siltstone: intergrading sequence of, some argillaceous content, very small scale ripple cross lamination, strongly calcareous, gradational.
61.5 - 63	Mudstone: medium grey, very silty, vaguely laminated, calcareous, transitional.
63 - 64	Sandstone: brownish grey, vertical fracture and weathered (no structural dislocation), fine grained, strongly calcareous, gradational.
64 - 66.5	Mudstone: dark grey, lower half black, locally very carbonaceous, 2" coal, bottom 6' very silty, strongly calcareous, gradational.
66.5 - 68	Siltstone/mudstone: light/medium grey, very small scale cross lamination, argillaceous bands, very calcareous, gradational.
68 - 79	Mudstone: medium grey/dark grey, local rusty bands, calcareous except dark grey (possibly carbonaceous) bands.
79 - 81	Sandstone: medium grey, very fine grained, slump lamination; highly argillaceous (up to 10%), calcareous, gradational.
81 - 84	Mudstone: black, carbonaceous and coaly, 0.2' very silty in lower half, abrupt below, mainly non calcareous.
84 - 90.5	Sandstones: light grey, medium grained, 0.1' coarse sand at 88'; 0.3' very sandy mudstone (dark grey) at 88.7 with a highly indented contact at top; abrupt lower contact, calcareous.
90.5 - 96.3	Mudstone: black, richly carbonaceous, very gradational.
96.3 - 97.8	Coal: initial half dirty, rest clean coal.
97.8 - 105	Sandstone/mudstone: Broad (1' and over) alternations of very fine cross laminated sand with mudstones (carbonaceous slightly), calcareous, very gradational below.

105 - 123.5	Mudstone: medium grey to dark grey, structureless, non calcareous, carbonaceous at 112 - 113, 115 - 116, 117.7 - 118.5 and 123 - 123.5 - the latter gradational into coal zone.
123.5 - 128	Coal Seam: 50% recovery, not sampled, mostly durain.
128 - 130	Carbonaceous Mudstone: 50% recovery, some coal apparently lost. Much bony coal fragments present.
130 - 133.5	Mudstone: medium grey, very slightly carbonaceous, non calcareous, gradational.
133.5 - 135	Mudstone/sandstone: medium grey, initial half very silty, rest very fine grained, richly argillaceous, sandy with slumped lamination, strongly calcareous.
135 - 137.3	Mudstone: dark grey/black, initial half locally very carbonaceous, lower half very silty and calcareous, gradational.
137.3 - 145	Sandstone/Mudstone: medium grey, very fine grained, rapidly integrating sequence (changes -n scale of inches), silts and muds 30%, much slumped lamination, burrowing, a very large vertical burrow, irregular bioturbated, strongly calcareous, gradational.
145 - 151	Mudstone: medium to dark grey, initial 2' substantially silty, locally slightly carbonaceous, bottom 0.5' very coaly, strongly calcareous, BCA 85^{o}.
151 - 189	Sandstone: light/medium grey, 80% sands - very fine grained intergrading into silts and muds. Characteristically laminated./cross laminated, much slurred and distorted lamination and burrowing - a distinctive slumped laminated unit, strongly calcareous; bottom 2.2' clean, fine grained sands, abrupt below.
189 - 199	Coal/Shale Zone: from 189 - 192.5 durain and bony coal, 0.3' mudstone, rest of sequence has bony coal and 1.5' shale in middle, bottom 1' very carbonaceous and with coaly layers. Difficult to ascertain exact coal intervals due to poor recovery (50%).

199 - 297	Mudstone: medium to dark grey; very silty expecially lower, laminated, burrowed in silty zones, very calcareous, gradational below.
207 - 213	Siltstones: medium grey, regular intervals of very fine argillaceous sands; burrowed zones; micro-erosional contacts; very calcareous; gradational below.
213 - 239	Sandstones: light grey; dominantly medium grained; initial 5' very fine grained; collapse breccia (syndepositional); some fine intraclasts; well cross laminated; bottom 5' dark grey with fine carbonaceous matter (non calcareous); rest very calcareous, erosional below.
239 - 241.3	Gritstone and very coarse sandstone: ill-sorted, bottom half many clay clasts; erosional below..
241.3 - 258	Mudstones: medium to dark grey; 242 - 247 is very fine grained sands alternating with mudstones (calcareous), 253 - 255 black carbonaceous mudstone (non- calcareous); gradational below.
258 - 271	Mudstones: medium grey; silty 258 to 261; 268.5 to 271 muds; mudstones non-calcareous; silty mildly calcareous.
271 - 276	Sandstones: light-medium grey; regularly banded and laminated of muds and silts; sporadic burrows; micro-lithologies have erosional top; very calcareous; below is interbedded.
276 - 293	Mudstones: black; locally carbonaceous; coaly at 283 to 284.5 and 287.5 to 288; iron rich mudstone bank top foot; non calcareous; abrupt below.
293 - 298	Mudstone: very fine sandy and silty; rootlets; presumably paleosoil; non calcareous; gradational below.
298 - 308	Siltstone: medium grey, very argillaceous, two brief sandy zones, calcareous.
308 - 320	Sandstone: medium grey, very fine grained, irregularly laminated, slight mottling, initial 0.2' carbonaceous mudstone, followed by 1.7' of fine grained homogenously argillaceous sands with numerous rootlet like carbonaceous structures (non calcareous), some silty mudstone 316.5 - 318 and 318.3 - 319. Sequence generally calcareous; gradational.

320 - 322	Sandstone: light medium grey, fine grained, abundant small scale cross lamination, sporadic burrowing, slightly argillaceous, strongly calcareous; gradational.
322 - 325	Mudstone: medium grey, very silty, sporadic lamination; strongly calcareous.
325 - 329	Sandstone: light/medium grey, dominantly very fine grained, 0.5' fine sand in middle, several 2" - 3" muddy intercalations; 1" shaly intraclastic zone, generally strongly calcareous, erosional.
329 - 331.5	Mudstones: medium grey, silty, vague interupted lamination, strongly calcareous, very gradational below.
331.5 - 333	Sandstone: medium grey, very fine grained and highly argillaceous, upper half with diffused lamination, lower half prominently laminated and partially burrowed, strongly calcareous; very gradational; BCA 78^{o}.
333 - 334.5	Mudstone: medium grey; very uniform; strongly calcareous; abrupt.
334.5 - 336.5	Sandstone: light grey; fine grained; very calcareous; erosional.
336.5 - 372	Mudstone: Initial 24' medium grey and homogeneously silty, richly calcareous, rest black carbonaceous with local coaly stringers and non calcareous. Iron enriched mudstone (pyritized) at 359 - 359.4, gradational.
372 - 373	Coal: dirty coal, mainly durain.
373 - 390	Mudstone: dark grey to black, initial 2' and between 378 - 380 and in bottom 3' black and carbonaceous and non calcareous; rest silty. At 385 - 386.2 finely cross laminated fine sands with few burrows.
390 - 394	Siltstone: uniformly grey, structureless, non calcareous; gradational.
394 - 400.5	Sandstone/Mudstone: alternating but variable bands of very fine sands and muds, mutually erosional boundaries, burrowing within sandy layers - 55% muds, 0.1' coaly zone at base.

400.5 - 403.5	Sandstone: light grey, medium grained, very clean and well sorted, strongly calcareous, erosional below.
403.5 - 408.5	Mudstone: medium grey, richly silty strongly calcareous, vague distorted lamination, bottom 1.5' black and slightly carbonaceous, abrupt below.
408.5 - 415	Siltstone: light/medium grey, vague rootlet type structures, vague and sporadic lamination but generally structureless, non calcareous. Levee deposits?; abrupt but not erosional.
415 - 434.7	Sandstones: light/medium grey, fine to very fine grained, locally passing to silts and muds (constituting 25% of total), much obliterated intervals, locally fine coaly shards and intraclasts, some slumping and obscured lamination, strongly calcareous, gradational; BCA 80^{o}.
434.7 - 436.5	Mudstone: medium grey to dark grey, sporadically calcareous, gradational.
436.5 - 441	Siltstone: grey, upper part devoid of lamination, rest with some small scale cross lamination, very argillaceous and sandy, strongly calcareous, gradational.
441 - 458.8	Mudstone: medium grey, locally very silty/sandy especially at 442 - 443 where it is abundantly burrowed. Also sandy at 449 - 451 and has small ripple lamination. Carbonaceous 454 - 455.5; mostly strongly calcareous, very gradational.
458.8 - 461	Siltstone: medium grey, richly argillaceous, middle 0.5' very sandy and argillaceous, obscured lamination, strongly calcareous.
461 - 464	Sandstone: medium grey, initial half 50% dark silts, rest light grey clean fine grained sands with small cross-lamination; strongly calcareous; gradational.
464 - 467.5	Mudstone: black, top 1' very silty and strongly calcareous, rest homogeneously carbonaceous and non calcareous; erosional.

467.5 - 473	Sandstone: light grey, medium grained, thin intervals of finer sands - whole sequence characterized by abundant small coaly wisps, poorly laminated, strongly calcareous, erosional; BCA 82°.
473 - 483	Mudstone/Siltstone/Sandstone: alternating sequence of slight overall dominance of muds,,25 - 30% sand in lower half, much burrowing, strongly calcareous, abrupt below.
483 - 489.5	Sandstone: medium grey, series of gradations of fine/medium sands abundant coaly shards, one .3' intraclastic zone, strongly calcareous, erosional.
489.5 - 496	Siltstone/Mudstone/Sandstone: medium grey, initial 2.5' very silty muds, followed by 2' of very fine highly argillaceous sands. Rest argillaceous silts with small sandy intercalations, some burrowing, strongly calcareous, very gradational below.
496 - 506	Sandstone? light/medium grey, fine grained, cross-laminated, occasional burrows, bottom 2.5' has 50% argillaceous content, strongly calcareous.
506 - 517.5	Mudstone: medium grey to black, carbonaceous and coaly at 508 - 509, rest also dark and slightly carbonaceous. Very silty/finely sandy at 512 - 516.5, strongly calcareous, gradational.
517.5 - 535.5	Mudstone/Sandstones: broad bands of the lithologies imperceptibly passing to each other, slight preponderance of muds, much slumping and extensive local burrowing; strongly calcareous; very gradational lower end.
535.5 - 544.5	Sandstone: medium grey, initial 2' very fine grained, finely cross-laminated, rest fine grained, local slumping burrowing and many argillaceous laminations. Bottom 3' has finely broken up coaly matter and sparse carbonaceous laminae. Strongly calcareous throughout; abrupt contact; BCA 85°.
544.5 - 548	Mudstone: black, carbonaceous, non calcareous; very gradational.

548 - 556	Siltstone: medium/dark grey, highly argillaceous, slumping, isolated burrows; some very fine sands, strongly calcareous; gradational.
556 - 560	Mudstone: medium grey, highly silty, initial 1.5' carbonaceous, bottom 1' vaguely banded, abrupt below; strongly calcareous.
560 - 565	Coal Zone: about 1' recovered - initially some highly pulverized coal, rest broken up durain. Difficult to ascertain actual coal thickness.
565 - 568	Mudstone: black, locally carbonaceous, non calcareous; gradational.
568 - 572	Coal Zone: about ½' broken up durain recovered.
572 - 578	Mudstone/Siltstone: initial half muds, rest argillaceous silts, ?coal.
578 - 579.5	Coal/Mudstone Zone: broken up, less than 1' recovered.
579.5 - 582	Siltstone: medium grey, argillaceous, 0.1' coaly/muddy zone lower end, non calcareous.
582 - 604.5	Sandstone: light/medium grey, dominantly medium grained, initial 5' fine grained, generally clean and well-sorted, calcareous, vaguely discernible cross bedding, coaly shards and stringers. Very abrupt lower contact. BCA 85°.
604.5 - 607	Mudstone: black, very carbonaceous with some bony coal, non calcareous, gradational.
607 - 612.2	Sandstone: light/medium grey, initial 1.5' very fine grained and argillaceous, gradational passing to fine grained sands, cross laminated, calcareous, erosional below. Contact with muds below, locally burrowed.
612.2 - 621.5	Mudstone: medium grey, silty, carbonaceous at top and in bottom 1', non calcareous throughout; very gradational.
621.5 - 629	Sandstone: medium grey, very fine grained and very argillaceous especially bottom 1.5', sporadic lamination, calcareous, transitional.

629 - 633.5	Sandstone: light grey, fine grained, some silty intercalations at top, cross-laminated, strongly calcareous, gradational.
633.5 - 636.5	Sandstone/Mudstone: medium-grey, upper half very fine argillaceous sand, lower zone silty mudstone, calcareous, gradational.
636.5 - 665.5	Sandstone: light/medium grey, fominantly medium grained, clean and well sorted, weakly calcareous, cross-bedded, a slumped cross-bedded unit at 643 - 644, two quartzite (white) pebbles, less than ¼" long embedded in sands, short fine sand zones; normal sedimentary lower contact.
665.5 - 667	Conglomerate: commonly 3/4" pebbles of quartzite, cherts, siltstones, etc., middle very sandy and chunks of coal; erosional below. BCA 85^{o}.
667 - 672.5	Sandstone: medium grey, very fine grained, argillaceous, slumping in bottom 1.5', very calcareous, gradational.
672.5 - 686	Siltstone/mudstone: dominance of silts, broad intergrading bands, some ripple lamination in upper 5'; fine sands at 672.5 - 673.5, abruptly high BCA 45^{o} at 683.5 - a fractured and healed zone, strongly calcareous throughout, gradational.
686 - 691	Mudstone: black, locally coaly stringers abound, carbonaceous, a 0.3' rusty band, upper half strongly calcareous, rest non calcareous, gradational.
691 - 703	Siltstone/mudstone: medium grey, silts 80% rest muds at intervals, locally some ripple lamination, 0.2' fine sand stringers, carbonaceous at 698 - 698.5, calcareous; very gradational. BCA 82^{o}.
703 - 711	Sandstone: medium grey, very fine grained, beautiful ripple cross-lamination in upper 2', very argillaceous, strongly calcareous, gradational.

711 - 737	Sandstone: light/medium grey, dominantly fine grained, very fine grained and richly argillaceous at 713 - 727 and this interval characterized by almost total obliteration of sedimentary lamination; rest of sands frequently intercalated with argillaceous layers, especially at 718 - 726.5. In the latter zone much bioturbation, slumping and characteristic micro-erosional contacts, Wispy shaly intraclasts: 726 - 728. Lower 10' well laminated and cross-laminated, between 732 - 733 coarse to very coarse grained sands, very cherty. Bottom 0.5' richly admixed with argillite, feeble to strongly calcareous, gradational.
737 - 745.5	Siltstone: medium grey, 80% silts, rest mud dispersed, central 2' has partially obliterated laminae, strongly calcareous.
745.5 - 749	Coal Zone: dominantly bony coal, mudstone around 747.5 - 748.5.
749 - 768.5	Siltstone: medium grey, very argillaceous, locally passing to very fine grained sands, occasional vague parallel and slightly wavy lamination strongly calcareous. BCA 85^0.
768.5 - 770	Mudstone: medium grey, very silty, gradually passing to sands.
770 - 771.5	Sandstone: medium grey, very fine grained, abundant small scale cross-lamination, slightly argillaceous, strongly calcareous, abrupt.
771.5 - 781	Mudstone: medium/dark grey, slightly carbonaceous in middle 1' and in bottom 1.5', locally silty, entirely non calcareous save 0.1' silty band, very transitional.
781 - 782.5	Sandstone: medium grey, interbedding of very fine sands with silts and muds, well laminated throughout, strongly calcareous.
782.5 - 783.5	Mudstone: black, very carbonaceous, non calcareous.
783.5 - 788	Sandstone: medium grey, very fine grained, some distorted and slump lamination, middle 1' richly silty dark grey mudstone upper 1.5' very calcareous, rest non calcareous, gradational.

788.- 788.5	Mudstone: black, ri hly carbonaceous, gradational.
788.5 - 790	Mudstone: dark grey, very homogenous, non calcareous, gradational.
790 - 794	Sandstone: medium grey, very fine grained, regular argillaceous intercalations, locally well cross laminated, aberrant burrows, upper half non calcareous, rest calcareous. BCA 85°.
794 - 806.5	Siltstone: medium grey, locally muddy, very fine argillaceous sands at 798 - 799; carbonaceous 799.3 - 799.8, bottom 4' non calcareous, rest sporadically calcareous.
806.5 - 811	Sandstone: medium grey, upper 2.5' medium grained with 0.3' very fine sand in 808 - 808.3, lower zone very fine grained argillaceous sand, strongly calcareous, very transitional below.
811 - 813	Mudstone: medium grey, very silty, structureless, decreasing calcareous content bottomward, slightly gradational.
813 - 816	COAL - mostly durain, fragmented (less than 1' recovered).
816 - 826.5	Siltstone/mudstone: medium to dark grey, locally especially at 817 to 818.5 and 821.5 to 822.5; locally laminated; calcite fracture zone at 823.0; strongly calcareous; gradational below.
826.5 - 873	Sandstone: medium grey; fine to very fine grained; slight dominance of fine grained; ubiquitously argillaceous, cross laminated; sporadic burrows; coaly zones: 835.0 to 835.3 and 840.5 to 840.8; gradational below; sporadically calcareous 868 to 870, carbonaceous intercalations.
873 - 889	Mudstones/siltstones: light to dark grey; locally carbonaceous; small stringers of very fine sands with cross lamination and with much burrowing; strongly calcareous save bottom 2'; BCA 80°; gradational below.

889 - 982.5	Sandstone: light grey, initial 15' fine grained, remainder medium grained; clean sands; cross laminated; conglomeratic at 918 to 919; 933 to 934; siltstone at 936.5 to 937; mudstone at 924 to 925; few isolated quartzite pebbles; coaly lenses at 930 to 932; siliceous to calcareous (feebly) throughout, but upper 30' strongly calcareous; 70% quartz and 30% chert; BCA 80^{o}; abrupt contact.
982.5 - 985.5	Mudstone: medium grey; silty; irregularly laminated; slight calcareous gradational below.
985.5 - 988.5	COAL - clarodurain and durain; bottom 1/2' friable.
988.5 - 1002	Mudstone: medium grey; silty; non calcareous to 997; bottom 5' calcareous, gradational below.
1002 - 1067	Sandstone: light grey; dominantly medium grained; brief fine grained intervals; clean sands; cross laminated; locally homogenous intervals; 1038 to 1042 medium to coarse grained and pebbly; 1042 to 1053 and 1062 to 1067 coarse sandstone; abundant coaly stringers; coal band 1½" at 1052.5; initial 5' silty intraclasts and layers; with erosional boundaries; slump lamination at 1013 to 1014.5; calcareous; BCA 78^{o}; erosional below.
1067 - 1075	Mudstone: brownish to dark grey; vaguely banded with silty layers; strongly calcareous; gradational below.
1075 - 1078.5	Sandstone: light to medium grey; very fine grained; cross laminated; slumping; argillaceous layers; strongly calcareous; gradational below.
1078.5 - 1107	Mudstone: black, homogenous; upper 15' carbonaceous with coaly stringers; bottom 6' silty slickensided surfaces 1098 to 1103; but no major displacement involved.
1107 - 1138	Mudstone: dark grey; middle section silty and very fine sandy (especially 1119.5 to 1121); cross laminated; streaks of coal and carbonaceous mudstone in lower 5'; iron enriched band 1123 to 1124; sporadically calcareous especially where silty.

T.D.

DH 75 - 6

0 - 101	Overburden.
101 - 104	Sandstones; light/medium grey; fine to medium grained; core fresh but upper and lower portions broken up and shorn. BCA 40°. Lower half distinctly different sandstone. Interval 101 - 104 is thought to be a loose block and has no evidence of normal contact with the shales below.
104 - 294	Moosebar Formation: medium-grey, sometimes dark grey, uniformly muddy, locally calcareous and darker zones, non calcareous. Mostly devoid of lamination, brief intervals slightly rust grey and very strong calcareous. Highly silty and calcareous at 264 - 267. Bentonitic layers: 126.1 - 126.3, 149.3 - 149.5 and a small stringer 5 inches below it. The largest Bentonite band at 151 - 151.4. All the bands have well defined and erosional contacts with lithologies on either side. Distinctively rusty/grey and highly limy at 263 - 269. Interval 269 - 282 has regular but laterally sometimes discontinuous silty laminations and layers (maximum ¼" thick). Much small-scale burrowing discernible. BCA 75°. Lower contact abrupt but not erosional.
294 - 297	Conglomerate: sequence defining top of Gething formation dominantly in coarse gritstone, granulite grade - one pebble about 1" spherical; uppermost 1' has pea sized pebbles and is the coarsest interval, also calcite veined. In bottom foot, 1" carbonaceous and coaly muddy stringer. Bottom contact highly indented and some material presumably derived from base is incorporated in lower bottom sediments. Conglomerate locally strongly calcareous.
297 - 303	Mudstone: medium grey to brownish grey, very highly silty (15% homogenized silts), generally structureless, strongly calcareous, finely disseminated pyrite as irregular patches, 0.2' band in middle riddled with almost parallel calcite veining, gradational.

303 - 318.5	Mudstone: medium to dark grey; locally very carbonaceous; especially at 311 - 312; calcareous; gradational.
318.5 - 319	Mudstone/Coal: upper half carbonaceous mudstone; remainder coal.
319 - 324.5	Siltstone/Mudstone: medium grey to brownish grey; initial 2' has some very fine sands; laminated, strong calcareous throughout. BCA 80^{o}.
324.5 - 329.5	Sandstone: medium grey; initial 2' very argillaceous - 10 - 15% as layers, rest generally clean; fine grained; cross laminated; a vertical fracture at 327; strongly calcareous; erosional below.
329.5 - 346.8	Mudstone: dark grey; very sandy at 337 - 339.5; calcareous.
346.8 - 350	Coal: about 0.8' recovered, fractured badly; mostly durain.
350 - 352	Mudstone: dark grey to black, very carbonaceous especially upper 1'; abrupt below.
352 - 354	Sandstone: medium grey; initial 0.8' very fine grained; rest fine grained; some argillaceous laminae in lower half; well laminated and cross laminated throughout; very calcareous; lower contact abrupt.
354 - 357	Mudstone: dark grey to black; very carbonaceous; slightly slickensided, otherwise structureless; non calcareous; gradational.
357 - 358.5	Mudstone: brownish grey, very silty; vaguely laminated; strongly calcareous; gradational. BCA 60^{o}.
358.5 - 370	Carbonaceous Mudstone/Coaly Zone: mostly black; abundant polished surfaces; much coaly zones; especially at 362 - 370 but only 20% recovery in this interval; gradational.
370 - 372.5	Mudstone: black; slightly carbonaceous; coaly stringers; non calcareous.

372.5 - 377	Sandstone: medium grey; dominantly very fine grained and locally approaching silt grade; richly argillaceous (10%); locally well laminated; abrupt but not erosional lower contact.
377 - 396.7	Mudstone: dark grey, very thin silty zones; structureless; much polishing and slickensiding; patchily calcareous; fractured contact.
396.7 - 404	Mudstone: initial 3' heavy and rusty weathering (after exposure to atmosphere and rain for few days); rest medium to dark grey; vaguely laminated; lower half locally carbonaceous; rusty zone strongly calcareous; rest patchily. Brecciated at 396.7 - 397, erosional below.
404 - 405	Sandstone: medium grey; very fine grained; some discontinuous carbonaceous laminae, strongly calcareous; erosional. BCA 80°.
405 - 407.5	Mudstone: medium grey; very slightly silty; non laminated; carbonaceous at 407 - 407.5; strongly calcareous; gradational.
407.5 - 409.5	Sandstone: medium grey; upper 1' very fine grained; lower half very silty and argillaceous; 0.6' mudstone in middle, slight burrowing; discontinuous lamination, strongly calcareous, gradational.
409.5 - 411	Mudstone/Siltstone: brownish grey, about equal proportions, structureless, 1" fine grained sandy band at base, strongly calcareous, abrupt.
411 - 411.5	Mudstone: black, hightly carbonaceous, coaly stringers, abrupt below.
411.5 - 427.2	Sandstone/Siltstone: medium grey, dominantly very fine grained and very argillaceous (10 - 15%), abundantly laminated, silts also argillaceous and may constitute one third of total interval, few inches of fine sands 2.5' above the base, locally slightly burrowed and large discrete burrows, strongly calcareous throughout, very transitional below.
427.2 - 429	Sandstone: light/medium grey, initial half medium grained, rest fine grained, clean, mostly homogeneous, strongly calcareous, gradational.

429 - 450	*Siltstone/Silty Sandstones (very fine grained)* and silty mudstones, all lithologies imperceptibly blending into one another, fine sands at 440 - 440.2; 440.7 - 441; and 442 - 442.5. Apart from the latter zones there are smaller *stringers of fine sands at various intervals.* Fine sand generally devoid of lamination and many exhibit mottled and bioturbated features. Small scale slumped lamination, strongly calcareous, gradational. BCA 60°. Core fractured and calcite encrusted at 436 - 437.8.
450 - 459	Sandstone: light medium grey; very fine to medium in layers; top half very fine laminated; lower half medium with some intraclasts of silt; shattered 455 ' to 457'; BCA 55°, strongly calcareous.
459. - 465	Mudstones: medium grey; silty, slickensided, non calcareous.
465 - 486	COAL - Clarodurain and durain intervals.

Recovery:

465 - 467	.2	
467 - 470	.3	
470 - 473	.3	
473 - 477	1.7	
477 - 481	1.0	
481 - 483.5	nil	
483.5 - 484.5	.4	(mostly mudstone)
484.5 - 486	.8	(50% mudstone)

% recovery: 4.7' / 19' = 25%
<u>Note:</u> Interval 484.5 to 486 has "not" been sampled.

486 - 490	Siltstone/Sandstone (very fine grained); light medium grey; middle 18" very fine; argillaceous sandstone; remainder is very argillaceous siltstone; calcareous; gradational.
490 - 497	Mudstones: grey/black; silty, no structure; strong calcareous save bottom 1' gradational.
497 - 497.5	<u>COAL</u>
497.5 - 500.5	Mudstone: dark grey; carbonaceous, coal stringers; bottom 1' calcareous, abrupt lower contact.

500.5 - 507.5	Sandstones: light medium grey; initial 1.5' very fine grained; rest fine to medium grained; well cross laminated; large silty intraclasts; coaly laminations near bottom; fracturing and calcite veining throughout; strong calcareous, abrupt below.
507.5 - 512.5	Mudstones: medium dark grey; sand and silt intercalations especially top 2.5'; locally carbonaceous; strongly calcareous; gradational; BCA 60°.
512.5 - 518	Sandstones: light medium grey; middle 2' fine grained; rest very fine grained; argillaceous; abundantly small scale cross lamination; strong calcareous; gradational.
518 - 532	Mudstone: dark grey to black; slightly silty; some sandy layers; carbonaceous and bone coal 524 to 527'; silty/sandy areas calcareous; abrupt below.
532 - 534.5	Sandstone: medium grey; very fine grained; some silt laminations; fracture at 534'; strong calcareous; abrupt below.
534.5 - 535.8	Mudstone: black, structureless; slightly calcareous; abrupt below.
535.8 - 544	Sandstone: medium grey; very fine grained; argillaceous; discontinuous laminations; strong calcareous; abrupt.
544 - 552.8	Mudstones: brownish grey (first 3'), rest black; locally carbonaceous especially bottom 4'; silty layers and areas; sporadically calcareous, continuous below.
552.8 - 555.5	COAL/Mudstones: 554.5 to 555.2 mudstone zone.
555.5 - 558	Mudstone: dark grey, locally carbonaceous, gradational.
558 - 564	Mudstones: medium grey, very silty, a stringer of very fine sand, strongly calcareous, gradational.
564 - 568	Sandstones: medium grey, very fine grained, highly argillaceous (10-15%), strongly calcareous, gradational.

568 - 574	Mudstones: medium/dark grey, very silty and locally sandy, strongly calcareous.
574 - 618	Sandstones: medium grey, very fine grained and abundantly argillaceous (15%) and evenly dispersed throughout as laminae and layers. Abundant wavy parallel to cross lamination, much burrowing locally, sporadic fracturing, bottom 1.5' highly fractured and recemented. BCA variable, steepest angle at 605' - BCA 20°, strongly calcareous.
618 - 678	Sandstones: light grey, predominantly medium grained, generally clean and well washed, very characteristic is the recurrence of very thin coaly layers along with rock movements occurred and hence the fragmentary nature of sandstones. Some zones incorporate abundant large to medium shaly/silty intraclasts. Interval 665.5 - 671 coarse to very coarse grained; at 671 - 673 and 676 - 678 granular to gritty and very finely pebbly conglomerate; mostly strongly calcareous, siliceous 673 - 676; abrupt and erosional lower contact. Variable BCA 40°.
	Repeat of section ? fault/fold.
678 - 713	Sandstones: light grey, generally clean, fine grained from 678 - 690, medium grained 690 - 700, rest medium to very coarse grained and locally finely pebbly, abundant fine coaly intercalations along which slippage took place, whole interval identical to above. Lower contact sharp and erosional. Bottom 0.5' has some ¼" to ½" long pebbles. Variable BCA 20° - 40°.
713 - 716	Sandstones: medium to dark grey, very fine grained, wavy to irregular lamination, argillaceous 15 - 20%, appears to have a finely powdered carbonaceous matter intermittently mixed with the matrix. BCA 45 - 50°.
716 - 737	Mudstone: dark grey, homogeneous, slightly silty, sparingly calcareous, gradational.
737 - 764	Coal/Mudstone: This interval has 40 - 50° BCA; many muddy bands notably at 750.5 - 753. Much of coal dirty, gradational, seam not sampled.

764 - 938 Mudstones: generally dark grey, locally very carbonaceous and thin coaly layers; very finely sandy at 812 - 823; 870 - 875; 890 - 893. Also silty at places. BCA at 764 - 777 generally at 50° but rest of sequence at 10 - 15°. Because of very high angle it is apparently disproportionately represented. Many rusty weathering zones, silty/sandy zones to well cross laminated and laminated, strongly calcareous throughout.

T. D.

DH 75 - 7

0 - 74	Triconed
74 - 90	Mudstone: dominantly dark grey, at two levels brief sandstone zones but badly weathered, some black muds with abundant coalified plant debris, mostly non calcareous, very gradational.
90 - 96	Mudstone/Coaly Zone: initial 1.5' very carbonaceous and with considerable coaly layers, rest black carbonaceous muds. Less than 50% recovery in entire zone.
96 - 106.5	Mudstone: initial 5' medium grey, very slightly silty and middle 1' very carbonaceous, remainder very silty (25 - 30%) and 0.5' very fine sandstone. Lower 3' very calcareous, rest mainly non calcareous, very transitional.
106.5 - 112	Sandstone: light/medium grey, fine to very fine grained, abundantly cross-laminated, loca-ly richly argillaceous especially middle 1' and bottom 1', locally slight obliteration of laminae due to burrowing, strongly calcareous, transitional. BCA 75°.
112 - 127.5	Mudstone: dominantly black, carbonaceous and coaly stringers throughout, very silty in lower 2' and strongly calcareous, rest non calcareous, structureless, very gradational.
127.5 - 137	Sandstone/Mudstone: light/medium grey; broadly alternating (up to 1.5') bands of very fine sands and silty muds, some disturbance and penecontemporaneous disturbance of laminae, very few isolated burrows, strongly calcareous throughout, gradational. BCA 75°.
137 - 145	Mudstone: medium to dark grey, lower half abundantly silty and thin very fine sand layers, strongly calcareous, gradational.
145 - 148	Sandstones: light/medium grey, very fine-grained, much argillaceous intercalations, some burrowing, bottom 1.3' very silty, calcareous.
148 - 155.5	Mudstone: medium grey, silty (up to 30%), structureless, calcareous.

155.5 - 164	Coal/Carbonaceous Mudstone: very dirty coal interlayers with muds.
164 - 175.5	Mudstone: initial 5' medium grey and silty (homogenously), 1.5' black slightly carbonaceous muds, remainder at base richly silty and sandy (very fine), locally laminated, mostly strongly calcareous, gradational.
175.5-179.5	Coaly mudstone: black, upper half dominantly coaly and very dirty, rest richly carbonaceous muds, gradational.
179.5 - 183	Mudstone: black, initial half silty and medium grey, remainder black and locally very carbonaceous, gradual.
183 - 197	Sandstone: medium grey, very fine grained, highly argillaceous, initial 7' has up to 30% silty/shaly content. Interval 190 - 195 has peculiar dendritic patterns, apparently caused by local slumping and compaction - much bioturbation and obliteration of small scale cross-lamination. Bottom 2' incorporates several shaly layers, strongly calcareous.
197 - 203.5	Siltstones: dark grey to black, argillaceous (15-20%), bottom 2' has regular and fine sand layers, strongly calcareous, shattered bottom contact.
203.5 - 208	Sandstone: medium grey, initial 1.5' broken up, rest of sand fine grained and characterized by regular recurrance of carbonaceous laminae and occasional coaly lens, strongly calcareous, bottom shattered along coaly intercalations. BCA 55°.
208 - 211.5	Siltstone: dark grey, richly argillaceous, seem to have been bioturbated, strongly calcareous, gradational.
211.5 - 212.5	Sandstone: medium grey, fine grained, finely broken up carbonaceous matter, similar to 203.5 - 208 interval, calcareous, erosional below.

212.5 - 223	Mudstone: dark grey to black, a completely shattered and recemented zone (breccia) at 213 - 214, very carbonaceous and 0.3' bony coal in 214 - 218; rest sparingly carbonaceous.
223 - 248	Sandstones: medium grey, very fine grained, initial 6' have 30% silty/argillaceous content, rest relatively clean, abundant small scale cross-lamination, sporadic burrowing, a vertical fracture at top, bottom 2' also very argillaceous, strongly calcareous, transitional.
248 - 251.5	Coal/Mudstone: less than 50% recovery, gradational.
251.5 - 256	Sandstone/Siltstone: medium grey, initial half very fine sands, richly argillaceous, laminated, rest silty, gradational.
256 - 267	Mudstone: dark grey, muddy/sandy at 262.5 - 264.5, initial half sporadically calcareous, rest non calcareous.
267 - 281	Sandstone: medium grey to brownish grey, initial 8' very fine grained, frequent argillaceous lamination, ubiquitous cross lamination and wavy, remainder fine grained and cleaner, strongly calcareous, gradational. BCA 60^o.
281 - 289	Mudstones: medium to dark grey, locally slightly rusty looking and occasionally nodular (defined by rusty blotches), non calcareous, bottom 1' richly silty (30 - 35%), homogenously mixed, very gradational.
289 - 300	Sandstones: brownish grey, fine to very fine grained, initial 4' with abundant argillaceous matter, uniformly mixed and generally impoverished in lamination, rest cleaner, laminated at intervals, occasional small burrowing - one very large (3" deep 2" wide) burrow, strongly calcareous. BCA 65^o.
300 - 307	Sandstone: light grey, medium grained, clean and mostly siliceous, dominantly cherty, a fracture in middle, bottom 2' fine/medium grained and strongly calcareous, fining lower end, fractured at base.

307 - 311.5	Sandstones: medium grey, fine grained, cross laminated lower end very fine grained, interval throughout traversed by calcite veins, much shearing and healing. BCA in this zone abruptly changes - it appears some dislocation has taken place. Bottom 2" brecciated, calcareous, abrupt polished contact. BCA 30°.
311.5 - 316.2	Siltstones: medium grey, initial 1' very muddy, rest regularly argillaceous, and has parallel to ripple lamination, upper 1' broken up and partially calcite encrusted, strongly calcareous, interbedding below. BCA 45°.
316.2 - 333.5	Sandstone: light/medium grey, initial 10' very fine grained, locally well laminated, argillaceous, rest fine grained and lighter coloured; interval 325.5 - 333.5 intermittently broken up and has extensive calcite veining; BCA 10°; strongly calcareous, discontinuous below. Some dislocation along this zone.
333.5 - 352.5	Mudstone/Coal Zone: black; fragmented, stringers and zones of coal; recovery 333.5 to 348: 35%; 348 - 352.5: silty mudstone, sporadically calcareous; gradational below.
352.5 - 356.2	Siltstones: medium grey, argillaceous; initial half carbonaceous; appears paleosoil lithology; laminations rare; non calcareous; gradational below.
356.2 - 374.5	Sandstones: very fine grained; light grey; argillaceous (25%) laminated; great amount of bioturbation and burrowing; carbonaceous at 368.0 to 368.5; calcareous; BCA 78°.
374.2 - 377	Sandstones: fine grained/ medium grey; ripple, carbonaceous laminations; abrupt below; calcareous.
377 - 387	Mudstones/Siltstones: initial 5' argillaceous siltstones; thin layers of sand; rest is black mudstones; carbonaceous; upper part calcareous; lower not; gradational below.
387 - 398.5	Sandstones: mediy grey; very fine grained; argillaceous (30%); very silty; small scale cross and ripple laminations; locally burrowed; BCA 80°; calcareous; gradational.

298.5 - 399.5	COAL: clarodurain; gradational to -
399.5 - 400.2	Mudstone: black; carbonaceous; abrupt below.
400.2 - 403	Siltstones/Sandstones: very fine grained; argillaceous; laminated; calcareous, very gradational.
403 - 405.5	Siltstones: light grey; argillaceous; laminated; calcareous; very gradational.
405.5 - 414	Mudstones: medium grey to black; very silty especially at 410 to 412; carbonaceous bottom 2.5'; upper half sparsely calcareous, below not; gradational.
414 - 420	Sandstones: brownish grey; very fine grained; very silty especially bottom 2.0'; laminated; cross laminated; calcareous; gradational.
420 - 427.2	Sandstones: medium grained; light grey; clean looking; uniformly cross laminated; few silt intraclasts in bottom 1.0'; strongly calcareous; few burrows; abrupt; erosional below.
427.2 - 428.5	Mudstones: black; carbonaceous, gradational.
428.5 - 444.5	Sandstones: light grey; fine grained to 439; rest medium grained; clean; uniformly cross laminated; silty in middle; initial 3.0' has 20% mud content; slump lamination; pccasional silty intraclasts; strong calcareous except initial 3.0'; BCA 80^{o}; abrupt below.
444.5 - 448.5	Mudstones: dark grey; silty and fine sands; poorly laminated; non calcareous; lower end carbonaceous; gradational;1.0' coal at 446.
448.5 - 472.5	Sandstones: medium grey; very fine grained; locally fine grained (few inches thick); interlaminated silts; muds; cross laminated; slumps; 0.5' carbonaceous mudstones at 461; BCA 75^{o}; calcareous; gradational below.
472.5 - 473.8	Mudstones: coaly, black, gradational.
473.8 - 497	Sandstones/Siltstones: medium dark grey; very fine grained; argillaceous; much carbonaceous intermixed material; laminated; top. 9.0' non calcareous, rest calcareous; abrupt below.

497 - 499	Sandstones: light grey; clean; medium; cross laminated; calcareous; abrupt.
499 - 514	Sandstones: medium grey; very fine grained; argillaceous; silty bands; cross laminated; calcareous; 511 to 512 fine, silty intraclasts; erosional below.
514 - 524	Mudstones: medium to dark grey; silty and very fine sands at 516.6 to 518; carbonaceous; structureless; non calcareous; gradational below.
524 - 525.5	COAL: durain, recovery 90%.
525.5 - 542	Sandstones: light to medium grey; initial 1' argillaceous into 1.5' medium grained clean sandstones; rest very fine grained; and very argillaceous; 533 to 536 fine to medium clean sands; cross laminated; calcareous; gradational below; BCA 75^{o}.
542 - 547	Sandstones: medium grey; very fine grained; silty; carbonaceous and plant debris; argillaceous (highly); few laminations; intial 1.2' muddy; calcareous; gradational below.
547 - 550	Mudstones: black; carbonaceous; non calcareous; gradational.
550 - 554.6	Sandstones: very fine grained; silty; medium dark grey; rootlet-like structures; argillaceous; siliceous; lower calcareous; gradational.
554.6 - 559	Sandstones: light grey; upper half fine clean; lower very fine argillaceous; laminated; strongly calcareous; gradational.
559 - 561	COAL/Carbonaceous Mudstone: gradational below.
561 - 574	Siltstones/Mudstone: 50/50; very fine sandstone at 568.5 to 570; lower 2.5' coaly, carbonaceous; calcareous where sandy and silty; gradational.
574 - 577.8	Sandstones: medium grey; medium grained; argillaceous (slightly); poorly cross laminated; calcareous; abrupt.

577.8 - 592	Mudstones/Siltstones: 50/50; dark grey; muds carbonaceous; sandy layers 579 to 581; calcareous in patches; gradational.
592 - 600	Sandstones: fine grained; medium grey; argillaceous in middle; initial 2.5' bioturbation; strongly calcareous; very transitional below.
600 - 607.5	Sandstones: light grey; clean; medium grained; cross laminated; well sorted; strongly calcareous; abrupt below.
607.5 - 610.5	Siltstone/Mudstone: medium grey; irregular laminations; strongly calcareous; gradational.
610.5 - 617	Mudstone: black; coaly; carbonaceous stringers; locally silty; sandy at 612 to 613.5; patchy calcareous; gradational.
617 - 624	Sandstone: medium grey; very fine grained; cross laminated; top 1.5' silty; middle 1.0' muddy with coal; strongly calcareous; gradational; BCA 50^{o}.
624 - 626.4	Mudstones: black; carbonaceous; gradational.
626.4 - 632	Sandstone: fine grained, meidum grey; silty; argillaceous; laminated; calcareous. BCA 65^{o}.
632 - 633.5	Carbonaceous Mudstones: silty; transitional below.
633.5 - 638	Sandstones: light grey; medium grained; well sorted; cross laminated; clean; bottom 1.5' intraclasts of silt; argillaceous; strongly calcareous; abrupt below.
638 - 644	Sandstones: medium grey; initial 3.0' very fine grained, argillaceous, cross laminated; rest medium grained cleaner; strongly calcareous; erosional below.
644 - 652	Mudstones: medium dark grey; initial 1.5' carbonaceous; rest silty; no lamination; calcareous; gradational.
652 - 655	Sandstones: very fine grained; medium grey; small scale cross lamination; 2" lenses of burrowed sandstones (sand infilled) vertical large burrows; strongly calcareous; gradational.

655 - 659	Mudstones: medium grey; silty (20%); calcareous; gradational.
659 - 664	Mudstones: black; initial 2.0' coaly; rest carbonaceous; gradational.
664 - 668.5	Siltstones/Mudstones: initial 1.5' dark grey siltstones with rootlets into 1.5' very fine grained laminated argillaceous sandstones; few burrows; rest mudstones; non calcareous.
668.5 - 669.5	COAL - durain and clarodurain.
669.5 - 694	Sandstones: medium grey; dominantly very fine grained; intercalations of silts; cross laminated; some areas homogenous; burrowing; silty intraclasts; few pebbles 689; broad interbedding transitional below; strongly calcareous. BCA 75^{o}.
694 - 714	Sandstone: medium to coarse grained, light grey; very clean; well sorted; cross bedded; cherty (30%); pebbles isolated maximum 1" x 1.5" generally ¼" diameter; 708.5 to 710.5 very pebbly and granular; siliceous; abrupt below.
714 - 720	Sandstone: medium grey; very fine grained; argillaceous especially top 4'; few laminations; calcareous; gradational.
720 - 729.3	Sandstone: light grey; fine grained; clean; cross laminated; well sorted; lower 5' very fine argillaceous intraclasts; strongly calcareous; abrupt.
729.3 - 732	Mudstones: dark grey to black; upper half carbonaceous; lower half silty; gradational.
732 - 736.5	Sandstones: medium grey; medium grained; clean; obscurely cross laminated; mild calcareous; gradational.
736.5 - 742	Mudstones/Siltstones: 67/33; calcareous; gradational.
742 - 779.5	Sandstones: light grey; medium grained; clean; well sorted in any interval; obscurely cross laminated; cherty 40%; siliceous; pebbles at 770.5; 778 to 779.5; middle 5' sparsely dispersed coaly shards; BCA 75^{o}; abrupt below.

779.5 - 783	Siltstone/Mudstone: upper 2.5' siltstone; argillaceous; rest mudstone; abrupt below; calcareous.
783 - 787	COAL - durain, recovery 25%.
787 - 791	Mudstones: dark grey to black; lower silty; carbonaceous; non calcareous; gradational below.
791 - 793	Sandstones: medium grey; very fine grained; argillaceous; calcareous; gradational.
793 - 798	Mudstones: dark grey; silty; argillaceous; non calcareous; gradational.
798 - 804	Siltstones: medium grey; argillaceous; non laminated; calcareous; abrupt.
804 - 821	Sandstone: medium grey; fine grained; small scale cross lamination; clean; calcareous; transitional below.
821 - 836.5	Sandstones: medium grey; medium grained; lower 10' abundant pebbles and granular zones; argillaceous; abrupt; BCA 80°.
836.5 - 865	Silty Mudstones: medium to dark grey; structureless; uniform looking; strongly calcareous; carbonaceous intervals; gradational.
865 - 895	Sandstones: medium grey; initial 10' very fine grained with thin shales; rest fine grained; clean; cross laminated; silt intraclasts 882 - 883 and 893 - 893.5; calcareous; BCA 75°; abrupt below.
895 - 904	Mudstones: black; coaly; non calcareous; abrupt below.
904 - 908	Sandstone: fine to coarse grained; granular and gritty locally; laminated; calcareous; abrupt (erosional?).
908 - 927	Mudstone: medium grey; silty; structureless; non calcareous; gradational.
927 - 939	Siltstones: medium grey; argillaceous; chaotic look; paleosoil?; non calcareous; gradational.

939 - 945	Mudstones: medium grey; silty; upper non calcareous; lower half calcareous; gradational.
945 - 948	Mudstones: black; carbonaceous; some hard dirty coal; gradational.
948 - 955	Mudstones: non calcareous; structureless; gradational.
955 - 972	Siltstones/Mudstone: dark grey; silty upper half; laminated; coal at 1.0' above base; non calcareous; gradational.
972 - 976	Mudstone: black; carbonaceous; gradational.
976 - 985	Siltstone/Mudstone: well laminated; many burrows; strongly calcareous; gradational.
985 - 989	Mudstones: black; carbonaceous; non calcareous; gradational.
989 - 998	Mudstone: silty; medium grey; coaly stringers; calcareous; gradational.
998 - 1004	Sandstones/Mudstone: medium grey; silty laminated; strongly calcareous; gradational.
1004 - 1007.5	Mudstones: silty; non calcareous; gradational.
1007.5 - 1014.5	Siltstone: initial 2.5' light grey; rest dark grey; argillaceous and carbonaceous; no lamination; upper 2.5' calcareous; rest non calcareous; gradational.
1014.5 - 1026	Sandstone: medium grey; very fine grained; cross laminated; ripple lamination; burrows; lower 2.4' medium grained; graded intervals; coal stringers; calcareous; scoured below.
1026 - 1032	Mudstone: black; coaly carbonaceous; pyrite clasts; lower half calcareous; gradational.
1032 - 1039	Mudstone/Siltstones: very fine grained, argillaceous sands at 1037 to 1038.5; laminated sparsely; strongly calcareous; BCA 60^{o}; gradational.
1039 - 1042	Mudstone: medium grey; carbonaceous; lower silty and laminated; strongly calcareous; abrupt.

1042 - 1043	COAL
1043 - 1051.5	Siltstone/Mudstone: muds greater; interbedded; laminated locally; fracture at 1046.5; calcite veining at 1046.5; BCA 70°; gradational.
1051.5 - 1057	Mudstone: black; upper carbonaceous, lower 1.5' silty; calcareous patches; gradational.
1057 - 1059.3	Siltstone: medium grey; no laminations; strongly calcareous; gradational below.
1059.3 - 1065.5	Mudstones: dark grey to black; top coaly; some coal lost? (approximately 3.0'); silty; poorly laminated; non calcareous; gradational.
1065.5 - 1081	Mudstones: dark grey to black; initially silty; carbonaceous locally; gradational.
1081 - 1087	Siltstone/Sandstone: medium grey; silty, richly argillaceous; 1.5' very fine grained sands; well laminated; strongly calcareous. BCA 80°.
1087 - 1100	Mudstone: dark grey; silty (homogenously); non calcareous; gradational.
1100 - 1105.5	Siltstone: medium grey to dark grey; argillaceous content 10% intimately throughout; non calcareous; very gradational.
1105.5 -1111.5	Mudstone: dark grey to black; carbonaceous, non calcareous; structureless; gradational.
1111.5 - 1116	Mudstone: black, initial 0.5' sandy; gradational.
1116 - 1125	Siltstone/Mudstones: medium grey; alternating; laminated; silts have erosional contacts with muds; erosional below; 0,8' sandstone in centre.
1125 - 1127	Mudstone: black; silty; calcareous; BCA 75°.

T.D.

PINE PASS | June 27, 1975

Hole No. 75-4 | Footage: 98.0' - 110.0' | LAB NO. 3292

SIZE AND RAW ANALYSES

Size Fraction	Wt %	Ash %	Cum Wt %	Cum Ash %	F.S.I.
1/4" x 28M	79.5	6.7	79.5	6.7	1 1/2
28M x OM	20.5	5.7	100.0	6.5	1

Head Raw	R.M.	Ash %	Vol.	F.C.	F.S.I.
	2.1	7.3	18.6	72.0	1 1/2

PINE PASS

June 27, 1975

Hole No. 75-4 Footage: 98.0' - 110.0'

LAB NO. 3292

SINK-FLOAT ANALYSES 1/4" x 28M

S.G. Fraction	Wt %	Ash %	Cum Wt %	Cum Ash %	F.S.I.
-1.45	91.3	3.6	91.3	3.6	1 1/2
1.45-1.60	3.3	24.7	94.6	4.3	1
+1.60	5.4	63.5	100.0	7.5	1/2

PINE PASS

June 27, 1975

Hole No. 75-4 Footage: 98.0' - 110.0'

LAB NO. 3292

FROTH FLOTATION ANALYSES 28M x 0

F.F. Fraction	Wt %	Ash %	Cum Wt %	Cum Ash %	F.S.I.
Stage I	57.8	3.3	57.8	3.3	1 1/2
Stage II	9.5	5.7	67.3	3.6	1 1/2
Tails	32.7	9.9	100.0	5.7	1

F.F. Parameters

Pulp Density	-	10%
Reagent Dosage	-	0.48 lbs/Ton Kerosene:MIBC (4:1)
Conditioning Time	-	1 minute
Stage I	-	1st minute froth
Stage II	-	2nd minute froth

FINE PASS 75-4 @ 98.0'-110.0' .25 X 28M

--DIRECT--					--CUM FLOATS--			--CUM SINKS--		+-0.1 DISTR	
			WT>	CUM WT>			SINK WT				
S.G.	WT>	ASH>	ASH TT	ASHTT	WT>	ASH>	ASH>	WT>	ASH>	S.G.	WT>
1	2	3	4	5	6	7	8	9	10	11	12
1.45	91.30	3.60	3.29	3.29	91.30	3.60	4.24	8.70	48.78	1.45	0.00
1.60	3.30	24.70	.82	4.10	94.60	4.34	3.43	5.40	63.50	1.55	0.00
9.99	5.40	63.50	3.43	7.53	100.00	7.53	0.00	.00	0.00	1.65	0.00

BIRTLEY ENGINEERING

PINE PASS

June 27, 1975

Hole 75-4 Footage: 879.5' - 897.0'

LAB NO. 3293

SIZE AND RAW ANALYSES

Size Fraction	Wt %	Ash %	Cum Wt %	Cum Ash %	F.S.I.
1/4" x 28M	81.3	15.3	81.3	15.3	1 1/2
28M x 0M	18.7	6.8	100.0	13.7	5

	R.M.	Ash %	Vol.	F.C.	F.S.I.
Head Raw	1.1	14.4*	16.5	68.0	1 1/2

*Air Dry Basis

Birtley Engineering

Subsidiary of Great West Steel Industries

PINE PASS | June 27, 1975

Hole 75-4 | Footage: 879.5' - 897.0' | LAB NO. 3293

SINK-FLOAT ANALYSES 1/4" x 28M

S.G. Fraction	Wt %	Ash %	Cum Wt %	Cum Ash %	F.S.I.
-1.45	81.4	2.9	81.4	2.9	1 1/2
1.45-1.60	1.4	24.9	82.8	3.3	1
+1.60	17.2	71.7	100.0	15.0	1/2

Birtley Engineering
Subsidiary of Great West Steel Industries

PINE PASS June 27, 1975

Hole 75-4 Footage: 879.5' - 897.0' LAB NO. 3293

FROTH FLOTATION ANALYSES 28M x 0

F.F. Fraction	Wt %	Ash %	Cum Wt %	Cum Ash %	F.S.I.
Stage I	88.4	3.0	88.4	3.0	5 1/2
Stage II	4.6	8.5	93.0	3.3	4 1/2
Tails	7.0	48.0	100.0	6.4	1 1/2

F.F. Parameters

Pulp Density	-	10%
Reagent Dosage	-	0.48 lbs/Ton Kerosene:MIBC (4:1)
Conditioning Time	-	1 minute
Stage I	-	1st minute froth
Stage II	-	2nd minute froth

PINE PASS 75-5 @ 879.5′-897.0′ .25" X 28M

--DIRECT--					--CUM FLOATS--			--CUM SINKS--		+-0.1 DISTR	
			WT>	CUM WT>			SINK WT				
S.G.	WT>	ASH>	ASH TT	ASHTT	WT>	ASH>	ASH>	WT>	ASH>	S.G.	WT>
1	2	3	4	5	6	7	8	9	10	11	12
1.45	81.40	2.90	2.36	2.36	81.40	2.90	12.68	18.60	68.18	1.45	0.00
1.60	1.40	24.90	.35	2.71	82.80	3.27	12.33	17.20	71.70	1.55	0.00
9.99	17.20	71.70	12.33	15.04	100.00	15.04	0.00	.00	0.00	1.65	0.00

BIRTLEY ENGINEERING

PINE PASS

Hole 75-4 Footage: 900.0' - 907.0'

June 27, 1975

LAB NO. 3294

SIZE AND RAW ANALYSES

Size Fraction	Wt %	Ash %	Cum Wt %	Cum Ash %	F.S.I.
1/4" x 28M	79.9	2.3	79.9	2.3	8 1/2
28M x 0M	20.1	3.1	100.0	2.5	9

	R.M.	Ash %	Vol.	F.C.	F.S.I.
Head Raw	0.9	2.4*	19.8	76.9	8 1/2

*Air Dry Basis

PINE PASS

June 27, 1975

Hole 75-4 Footage: 900.0' - 907.0'

LAB NO. 3294

SINK-FLOAT ANALYSES 1/4" x 28M

S.G. Fraction	Wt %	Ash %	Cum Wt %	Cum Ash %	F.S.I.
-1.45	99.5	2.0	99.5	2.0	8 1/2
+1.45	0.5	37.3	100.0	2.2	1 1/2

Birtley Engineering

Subsidiary of Great West Steel Industries

PINE PASS

June 27, 1975

Hole 75-4 Footage: 900.0' - 907.0'

LAB NO. 3294

FROTH FLOTATION ANALYSES 28M x 0

F.F. Fraction	Wt %	Ash %	Cum Wt %	Cum Ash %	F.S.I.
Stage I	88.0	2.1	88.0	2.1	9
Stage II	7.0	3.8	95.0	2.2	9
Tails	5.0	14.8	100.0	2.9	8 1/2

F.F. Parameters

Pulp Density	-	10%
Reagent Dosage	-	0.48 lbs/Ton Kerosene:MIBC (4:1)
Conditioning Time	-	1 minute
Stage I	-	1st minute froth
Stage II	-	2nd minute froth

PINE PASS DEVELOPMENT CORP. July 29, 1975

HOLE NO: DDH - 75-6 FOOTAGE: 465'-481' LAB. NO. 3368

SIZE AND RAW ANALYSES

Size Fraction	Wt. %	Ash %	F.S.I.	Cum Wt. %	Cum Ash %
1/4" x 28M	93.9	5.6	1	93.9	5.6
28M x 100M	4.7	4.8	2	98.6	5.6
100M x 0	1.4	7.1	1 1/2	100.0	5.6

	R.M.	ASH %	V.M. %	F.C.%	F.S.I.
1/4" x 0 (Raw)	1.7	5.6	19.6	73.1	1 1/2

PINE PASS DEVELOPMENT CORP. July 29, 1975

HOLE NO: DDH 75-6 FOOTAGE: 465' - 481' LAB NO. 3368

SINK-FLOAT ANALYSES 1/4" x 28M

S.G. Fraction	Wt. %	Ash %	F.S.I.	Cum Wt. %	Cum Ash %
- 1.30	61.2	1.7	1 1/2	61.2	1.7
1.30 - 1.35	23.6	4.2	1 1/2	84.8	2.4
1.35 - 1.40	6.5	9.0	1 1/2	91.3	2.9
1.40 - 1.45	3.2	14.1	1 1/2	94.5	3.2
1.45 - 1.50	1.4	78.1	1	95.9	3.5
1.50 - 1.60	1.3	22.0	1/2	97.2	3.7
+ 1.60	2.8	71.1	N.A.	100.0	5.6

Birtley Engineering

Subsidiary of Great West Steel Industries

PINE PASS 75-6 @465'-481' .25 X 28M

--DIRECT--					--CUM FLOATS--			--CUM SINKS--		+-0.1 DISTR	
S.G.	WT>	ASH>	WT> ASH TT	CUM WT> ASHTT	WT>	ASH>	SINK WT ASH>	WT>	ASH>	S.G.	WT>
1	2	3	4	5	6	7	8	9	10	11	12
1.30	61.20	1.70	1.04	1.04	61.20	1.70	5.40	38.80	13.91	1.30	0.00
1.35	23.60	4.20	.99	2.03	84.80	2.40	4.41	15.20	28.99	1.40	34.70
1.40	6.50	9.00	.59	2.62	91.30	2.87	3.82	8.70	43.92	1.50	5.90
1.45	3.20	14.10	.45	3.07	94.50	3.25	3.37	5.50	61.28	1.60	0.00
1.50	1.40	78.10	1.09	4.16	95.90	4.34	2.28	4.10	55.53	1.70	0.00
1.60	1.30	22.00	.29	4.45	97.20	4.58	1.99	2.80	71.10	1.80	0.00
9.99	2.80	71.10	1.99	6.44	100.00	6.44	0.00	.00	0.00	1.90	0.00

BIRTLEY ENGINEERING

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ROKE OIL ENTERPRISES LTD. CALGARY, ALBERTA

Company: PAN OCEAN OIL LIMITED — Field: FALLING CREEK — Location: PINE PASS — Province: BRITISH COLUMBIA — Witnessed By: HANKEL

EQUIPMENT DATA

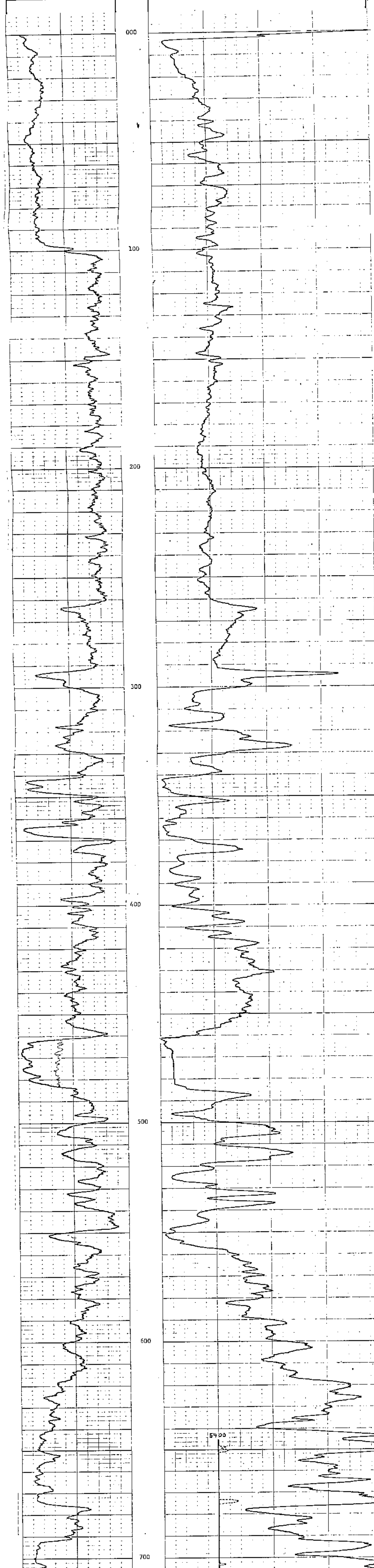
GAMMA RAY		NEUTRON	
RUN NO.	ONE	RUN NO.	ONE
TOOL MODEL NO.		LOG TYPE	NEUTRON/NEUTRON
DIAMETER	$1\frac{11}{16}$	TOOL MODEL NO.	
DETECTOR MODEL NO.		DIAMETER	$1\frac{11}{16}$
TYPE	SCINTILLATION	DETECTOR MODEL NO.	
LENGTH	18 INCH	TYPE	PROPORTIONAL
DISTANCE TO N. SOURCE	6 FT.	LENGTH	4 INCH
		SOURCE MODEL NO.	MRC-N-SS-W
GENERAL		SERIAL NO.	
HOIST TRUCK NO.		SPACING	
INSTRUMENT TRUCK NO.	S.-5	TYPE	AmBe
TOOL SERIAL NO.	340	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	934	12	5	100	0L	14 API	3	500	0L	270 API

REMARKS LOGGED THROUGH NQ DRILL ROD
55 DEGREE ANGLE HOLE

GAMMA RAY	DEPTHS	NEUTRON
GAMMA RAY INCREASES		NEUTRON INCREASES
API 14		API 270
0 — 140		0 — 2700 — 5400



PK-FP 75(2)A

ROKE OIL ENTERPRISES LTD. CALGARY, ALBERTA

Company: PAN OCEAN OIL LIMITED — Well: 75-4 — Field: FALLING CREEK — Location: PINE PASS — Province: BRITISH COLUMBIA — Witnessed By: DYSON

EQUIPMENT DATA

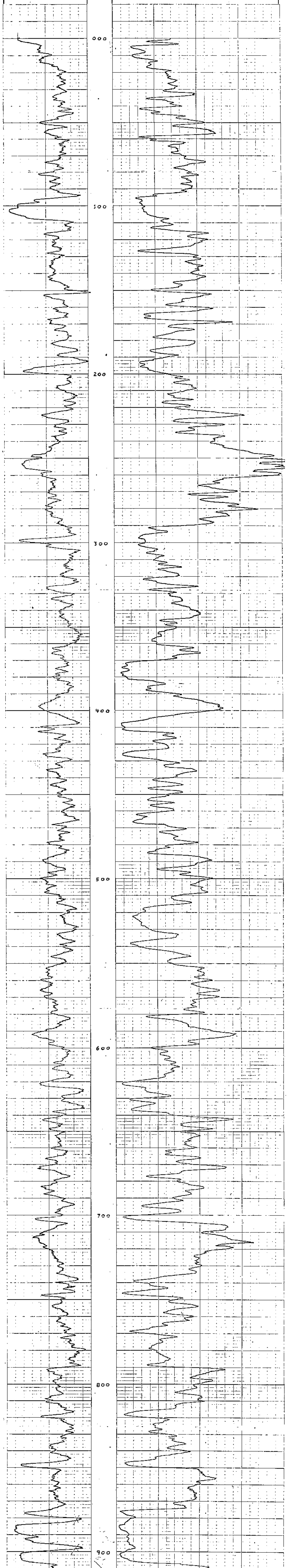
GAMMA RAY		NEUTRON	
RUN NO.	ONE	RUN NO.	ONE
TOOL MODEL NO.		LOG TYPE	NEUTRON/NEUTRON
DIAMETER	$1\frac{11}{16}$	TOOL MODEL NO.	
DETECTOR MODEL NO.		DIAMETER	$1\frac{11}{16}$
TYPE	SCINTILLATION	DETECTOR MODEL NO.	
LENGTH	18 INCH	TYPE	PROPORTIONAL
DISTANCE TO N. SOURCE	6 FT	LENGTH	4 INCH
		SOURCE MODEL NO.	MRC-N-SS-W
GENERAL		SERIAL NO.	71
HOIST TRUCK NO.		SPACING	17 INCH
INSTRUMENT TRUCK NO.	SU-5	TYPE	AmBe
TOOL SERIAL NO.	340	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	000	1070	12	5	100	0	14 API	3	500	0	260 API

REMARKS 55 DEGREE ANGLE HOLE
LOGGED THROUGH NQ ROD

GAMMA RAY	DEPTHS	NEUTRON
GAMMA RAY INCREASES		NEUTRON INCREASES
14		260
0 — 70 — 140		0 — 2600 — 5200



ROKE OIL ENTERPRISES LTD. CALGARY, ALBERTA

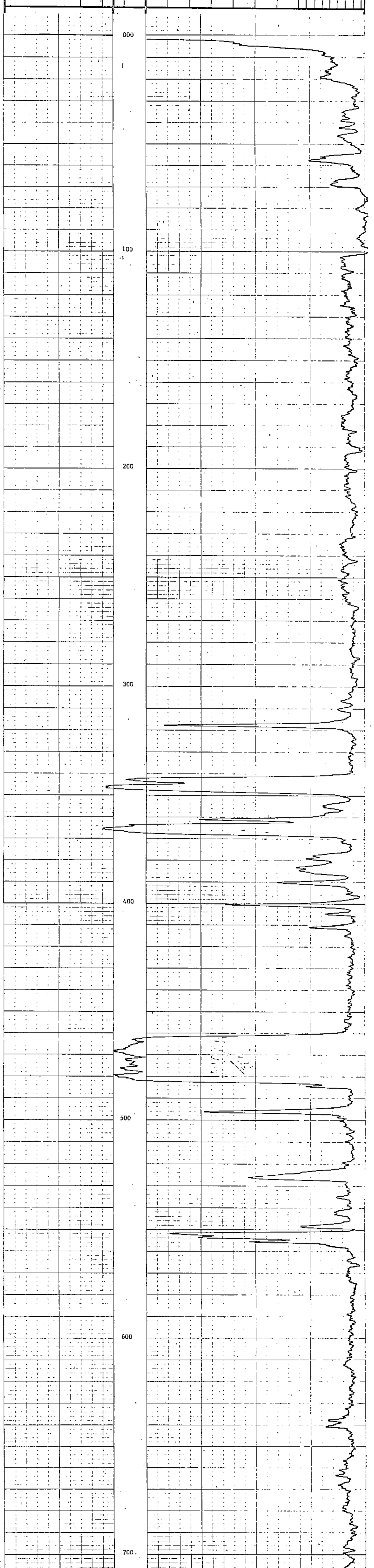
Company: PAN OCEAN OIL LIMITED — Well: 75-6 — Field: FALLING CREEK — Location: PINE PASS — Province: BRITISH COLUMBIA — Witnessed By: HANKEL

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	933	10					3	500	2.21R	26.0

REMARKS LOGGED THROUGH NQ DRILL ROD
55 DEGREE ANGLE HOLE

DENSITY TOOL SERIAL NO 457

	DEPTHS	CALIPER (DIAMETER – INCHES)
GAMMA RAY API		
		BULK DENSITY (GRAMS/CC)



PK-FP 75(2)A

PR-PINE PASS 75(3)A. 75-10

ROKE OIL ENTERPRISES LTD. CALGARY, ALBERTA

SIDEWALL DENSILOG

FILE NO.

COMPANY	PAN OCEAN OIL LIMITED
WELL	75-10
LOCATION	JOHNSEN CREEK
FIELD	PINE PASS
PROVINCE	BRITISH COLUMBIA

LSD
SEC
TWP
RGE
W ___ M

Other Services: GRN

Permanent Datum GROUND LEVEL Elev.
Log Measured from RIG FLOOR 20 in. Above Perm. Datum
Well Depths Measured from RIG FLOOR

K.B.
CSG
G.L.

Run. No.	ONE
Date	5 JULY 1975
First Reading	552
Last Reading	00
Footage Logged	552
Depth Reached	555
Depth Driller	558
Casing Roke	26
Casing Driller	27
Fluid Type	WATER
Liquid Level	00
Min. Diam.	2.375 (NQ)
Operating Time	2 HOURS
Truck No.	SU-5
Recorded By	RAINEY
Witnessed By	HANKEL

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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	552	10					3	500	2.21	26.0

REMARKS LOGGED THROUGH NQ DRILL ROD
61 DEGREE ANGLE HOLE
DEPTH SCALE ONE FOOT TOO SHALLOW

DENSITY TOOL SERIAL NO 457

GAMMA RAY
API

DEPTHS

CALIPER
(DIAMETER – INCHES)

BULK DENSITY
(GRAMS/CC)

PR-PP 75(3)A

PR- PINE PASS 75(3)A.

ROKE

GAMMA RAY NEUTRON LOG

OIL ENTERPRISES LTD. CALGARY, ALBERTA

FILE NO.
LSD
SEC
TWP
RGE
W ____ M

COMPANY ______
WELL DDH-74-1
LOCATION ______
FIELD HASLER CREEK
PROVINCE BRITISH COLUMBIA

Other Services: DENS

Permanent Datum GROUND LEVEL Elev. ______
Log Measured from RIG FLOOR 1.5 Ft. Above Perm. Datum
Well Depths Measured from RIG FLOOR

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

Run. No.	ONE
Date	11 OCTOBER 1974
First Reading	744
Last Reading	000
Footage Logged	744
Depth Reached	745
Depth Driller	745
Casing Roke	
Casing Driller	
Fluid Type	WATER
Liquid Level	0
Min. Diam.	NQ
Rm @ °F	
Operating Time	2 HOURS
Truck No.	35

584

Recorded By PETERSON Witnessed By GERMSHIELD

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.	
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.	50
HOIST TRUCK NO.	35	SPACING	17 INCH
INSTRUMENT TRUCK NO.		TYPE	AmBe
TOOL SERIAL NO.	177	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	000	744	12	3	500	OL	20	3	1000	OL	150

REMARKS

GAMMA RAY	DEPTHS	NEUTRON
GAMMA RAY INCREASES →		NEUTRON INCREASES →

PR-PP 75(3)A

PR. PINE PASS 75(3)A 74-1

ROKE SIDEWALL DENSILOG

OIL ENTERPRISES LTD. CALGARY, ALBERTA

FILE NO.	
LSD	
SEC	
TWP	
RGE	
W ___ M	
COMPANY	
WELL	DDH-74-1
LOCATION	
FIELD	HASLER CREEK
PROVINCE	BRITISH COLUMBIA
Other Services:	GRN
Permanent Datum	GROUND LEVEL
Elev.	
Log Measured from	RIG FLOOR 1.5 Ft. Above Perm. Datum
Well Depths Measured from	RIG FLOOR
K.B.	
CSG	
G.L.	

Run. No.	ONE
Date	11 OCTOBER 1974
First Reading	725
Last Reading	000
Footage Logged	725
Depth Reached	728
Depth Driller	745
Casing Roke	
Casing Driller	
Fluid Type	
Liquid Level	
Min. Diam.	NQ
Operating Time	3 HOURS
Truck No.	35
Recorded By	PETERSON
Witnessed By	GERMSHIED

584

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	724	10					3	1000	3R	16.72

REMARKS

LOGGED THROUGH DRILL ROD - SCALE NOT ACCURATE
DENSITY TOOL SERIAL NO A-128

PR-PP 75(3)A

Pe. Pine Pass 75(3)A. 75-2

ROKE
SIDEWALL DENSILOG

OIL ENTERPRISES LTD. CALGARY, ALBERTA

FILE NO.	
LSD	
SEC	
TWP	
RGE	
W ___ M	
COMPANY	PAN OCEAN OIL LIMITED
WELL	75 - 2
LOCATION	FALLING CREEK - PINE PASS
FIELD	PINE PASS
PROVINCE	BRITISH COLUMBIA
Other Services:	GRN
Permanent Datum	GROUND LEVEL
Elev.	
Log Measured from	RIG FLOOR, 6 Ft. Above Perm. Datum
Well Depths Measured from	RIG FLOOR
K.B.	
CSG	
G.L.	

Run. No.	ONE
Date	4 JUNE 1975
First Reading	952
Last Reading	00
Footage Logged	952
Depth Reached	955
Depth Driller	968
Casing Roke	24
Casing Driller	24
Fluid Type	WATER
Liquid Level	00
Min. Diam.	2.375 (NQ)
Operating Time	2-1/2 HOURS
Truck No.	SU 5
Recorded By	RAINEY
Witnessed By	GERMSCHEID

584

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	952	10					3	500	2.42R	20.37

REMARKS LOGGED THROUGH NQ ROD - SCALE APPROXIMATE

70 DEGREE ANGLE HOLE

DENSITY TOOL SERIAL NO 553

	DEPTHS	CALIPER (DIAMETER – INCHES)
GAMMA RAY API		
		BULK DENSITY (GRAMS/CC)

PR-PP 75(3)A

11,240

Pr. Pine Pass 75-(3)A. 75-2

ROKE

OIL ENTERPRISES LTD. CALGARY, ALBERTA

GAMMA RAY NEUTRON LOG

FILE NO.
LSD
SEC
TWP
RGE
W_____M

COMPANY PAN OCEAN OIL LIMITED
WELL 75 - 2
LOCATION FALLING CREEK - PINE PASS
FIELD PINE PASS
PROVINCE BRITISH COLUMBIA

Other Services: DENS

Permanent Datum GROUND LEVEL Elev. ____ K.B. ____
Log Measured from RIG FLOOR .6 Ft. Above Perm. Datum CSG ____
Well Depths Measured from RIG FLOOR G.L. ____

Run. No.	ONE
Date	4 JUNE 1975
First Reading	954
Last Reading	00
Footage Logged	954
Depth Reached	955
Depth Driller	968
Casing Roke	24
Casing Driller	24
Fluid Type	WATER
Liquid Level	00
Min. Diam.	2.375 (NQ)
Rm @ °F	
Operating Time	2-1/2 HOURS
Truck No.	SU 5
Recorded By	RAINEY
Witnessed By	GERMSCHEID

584

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.	
DETECTOR MODEL NO.		DIAMETER	$1\frac{11}{16}$
TYPE	GEIGER	DETECTOR MODEL NO.	
LENGTH	18 INCH	TYPE	PROPORTIONAL
DISTANCE TO N. SOURCE	6 FEET	LENGTH	4 INCH
		SOURCE MODEL NO.	MRC-N-SS-W
GENERAL		SERIAL NO.	71
HOIST TRUCK NO.		SPACING	
INSTRUMENT TRUCK NO.	SU 5	TYPE	AmBe
TOOL SERIAL NO.	340	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	954	12	5	100	5L	10 API	3	100	8L	130 API

REMARKS LOGGED THROUGH NQ ROD
70 DEGREE ANGLE HOLE

GAMMA RAY	DEPTHS	NEUTRON
GAMMA RAY INCREASES →		NEUTRON INCREASES →
API 10; 50 100 150		API 130; 1040 2340 3640

PR-PP 75(3)A

Pr. Pine Pass 75(3)A.

ROKE OIL ENTERPRISES LTD. CALGARY, ALBERTA

GAMMA RAY NEUTRON LOG

FILE NO.	
COMPANY	PAN OCEAN OIL LIMITED
WELL	75 - 3
LOCATION	HASLER CREEK
FIELD	PINE PASS
PROVINCE	BRITISH COLUMBIA
LSD	
SEC	
TWP	
RGE	
W	M
Other Services:	DENS
Permanent Datum	GROUND LEVEL
Elev.	
Log Measured from	RIG FLOOR
Ft. Above Perm. Datum	1
Well Depths Measured from	RIG FLOOR
K.B.	
CSG	
G.L.	

Run. No.	ONE
Date	8 JUNE 1975
First Reading	870
Last Reading	00
Footage Logged	870
Depth Reached	871
Depth Driller	897
Casing Roke	00
Casing Driller	00
Fluid Type	WATER
Liquid Level	15
Min. Diam.	2.375 (NQ)
Rm @ °F	
Operating Time	2-1/2 HOURS
Truck No.	SU 5
Recorded By	RAINEY
Witnessed By	GERMSCHEID

584

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.	
DETECTOR MODEL NO.		DIAMETER	$1\frac{11}{16}$
TYPE	GEIGER	DETECTOR MODEL NO.	
LENGTH	18 INCH	TYPE	PROPORTIONAL
DISTANCE TO N. SOURCE	6 FT.	LENGTH	6 INCH
		SOURCE MODEL NO.	MRC-N-SS-W
GENERAL		SERIAL NO.	71
HOIST TRUCK NO.		SPACING	
INSTRUMENT TRUCK NO.	SU 5	TYPE	AmBe
TOOL SERIAL NO.	340	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	15	12	5	100	1L	13 API	3	1000	0L	500 API
	15	870	12	5	100	1L	13 API	3	500	0L	250 API

REMARKS LOGGED THROUGH NQ ROD
SCALE CHANGE @ 15 FEET

PR-PP 75(3)A

PR- PINE PASS 75(3)A. 75-3.

ROKE — SIDEWALL DENSILOG

OIL ENTERPRISES LTD. CALGARY, ALBERTA

FILE NO.
LSD
SEC
TWP
RGE
W______M

COMPANY PAN OCEAN OIL LIMITED

WELL 75 - 3

LOCATION HASLER CREEK

FIELD PINE PASS.

PROVINCE BRITISH COLUMBIA

Other Services: GRN

Permanent Datum GROUND LEVEL Elev. ______ K.B. ______
Log Measured from RIG FLOOR 1 Ft. Above Perm. Datum CSG ______
Well Depths Measured from RIG FLOOR G.L. ______

Run. No.	ONE		
Date	8 JUNE 1975		
First Reading	865		
Last Reading	00		
Footage Logged	865		
Depth Reached	868		
Depth Driller	897		
Casing Roke	00		
Casing Driller	00		
Fluid Type	WATER		
Liquid Level	15		
Min. Diam.	2.375 (NQ)		
Operating Time	2-1/2 HOURS		
Truck No.	SU 5		

Recorded By RAINEY | Witnessed By GERMSCHEID

584

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	865	10					3	500	2.42R	20.37

REMARKS LOGGED THROUGH NQ ROD - SCALE APPROXIMATE

DENSITY TOOL SERIAL NO 553

CALIPER (DIAMETER — INCHES)

GAMMA RAY API

DEPTHS

BULK DENSITY (GRAMS/CC)

PR-PP75(3)A

Pr. Pine Pass 75(3)A.

ROKE OIL ENTERPRISES LTD. CALGARY, ALBERTA

GAMMA RAY NEUTRON LOG

FILE NO.

LSD
SEC
TWP
RGE
W ___ M

COMPANY PAN OCEAN OIL LIMITED

WELL 75-4

LOCATION FALLING CREEK

FIELD PINE PASS

PROVINCE BRITISH COLUMBIA

Other Services:

Permanent Datum GROUND LEVEL Elev.
Log Measured from RIG FLOOR 3.3 Ft. Above Perm. Datum
Well Depths Measured from RIG FLOOR

K.B.
CSG
G.L.

Run. No.	ONE
Date	14 JUNE 1975
First Reading	1070
Last Reading	000
Footage Logged	1070
Depth Reached	1071
Depth Driller	1087
Casing Roke	15
Casing Driller	15
Fluid Type	WATER
Liquid Level	000
Min. Diam.	2.375 (NQ)
Rm @ °F	
Operating Time	3 HOURS
Truck No.	SU-5
Recorded By	RAINEY
Witnessed By	DYSON

584

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.	
DETECTOR MODEL NO.		DIAMETER	$1\frac{11}{16}$
TYPE	SCINTILLATION	DETECTOR MODEL NO.	
LENGTH	18 INCH	TYPE	PROPORTIONAL
DISTANCE TO N. SOURCE	6 FT	LENGTH	4 INCH
		SOURCE MODEL NO.	MRC-N-SS-W
GENERAL		SERIAL NO.	71
HOIST TRUCK NO.		SPACING	17 INCH
INSTRUMENT TRUCK NO.	SU-5	TYPE	AmBe
TOOL SERIAL NO.	340	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	000	1070	12	5	100	0	14 API	3	500	0	260API

REMARKS 55 DEGREE ANGLE HOLE
LOGGED THROUGH NQ ROD

GAMMA RAY	DEPTHS	NEUTRON
GAMMA RAY INCREASES →		NEUTRON INCREASES →
14		260
0 70 140		0 2600 5200

PR-PP 75(3)A

PR-PINE PASS 79(3)B 75-4

ROKE

SIDEWALL DENSILOG

OIL ENTERPRISES LTD. CALGARY, ALBERTA

FILE NO.
LSD
SEC
TWP
RGE
W ___ M

COMPANY PAN OCEAN OIL LIMITED

WELL 75-4

LOCATION FALLING CREEK

FIELD PINE PASS

PROVINCE BRITISH COLUMBIA

Other Services: GRN

Permanent Datum GROUND LEVEL Elev. ___
Log Measured from RIG FLOOR 3.3 Ft. Above Perm. Datum
Well Depths Measured from RIG FLOOR

K.B. ___
CSG ___
G.L. ___

Run. No.	ONE		
Date	16 JUNE 1975		
First Reading	1080		
Last Reading	000		
Footage Logged	1080		
Depth Reached	1083		
Depth Driller	1087		
Casing Roke	15		
Casing Driller	15		
Fluid Type	WATER		
Liquid Level	00		
Min. Diam.	2-63/64		
Operating Time	2-1/2 HOURS		
Truck No.	SU-5	584	

Recorded By RAINEY Witnessed By DYSON

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	1080	10					3	1000	2.21R	59.1

REMARKS 55 DEGREE ANGLE HOLE

DENSITY TOOL SERIAL NO 457

DEPTHS

CALIPER
(DIAMETER - INCHES)

GAMMA RAY
API

BULK DENSITY
(GRAMS/CC)

Pe. Pine Pass 75-(3)A. 75-5

ROKE OIL ENTERPRISES LTD. CALGARY, ALBERTA

GAMMA RAY NEUTRON LOG

FILE NO.	
LSD	
SEC	
TWP	
RGE	
W___M	
COMPANY	PAN OCEAN OIL LIMITED
WELL	75-5
LOCATION	HASLER CREEK
FIELD	PINE PASS
PROVINCE	BRITISH COLUMBIA
Other Services:	DENS
Permanent Datum	GROUND LEVEL Elev.
Log Measured from	RIG FLOOR 2 Ft. Above Perm. Datum
Well Depths Measured from	RIG FLOOR
K.B.	
CSG	
G.L.	

Run. No.	ONE
Date	20 JUNE 1975
First Reading	1134
Last Reading	00
Footage Logged	1134
Depth Reached	1135
Depth Driller	1148
Casing Roke	4
Casing Driller	4
Fluid Type	WATER
Liquid Level	49
Min. Diam.	2.375 (NQ)
Rm @ °F	
Operating Time	3 HOURS
Truck No.	SU-5
Recorded By	RAINEY
Witnessed By	HANKEL

584

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.	
DETECTOR MODEL NO.		DIAMETER	$1\frac{11}{16}$
TYPE	SCINTILLATION	DETECTOR MODEL NO.	
LENGTH	18 INCH	TYPE	PROPORTIONAL
DISTANCE TO N. SOURCE	6 FT.	LENGTH	4 INCH
		SOURCE MODEL NO.	MRC-N-SS-W
GENERAL		SERIAL NO.	71
HOIST TRUCK NO.		SPACING	17 INCH
INSTRUMENT TRUCK NO.	SU-5	TYPE	AmBe
TOOL SERIAL NO.	340	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	49	12	5	100	2L	14 API	3	1000	0L	520 API
	49	1134	12	5	100	2L	14 API	3	500	0L	260 API

REMARKS LOGGED THROUGH NQ DRILL ROD
55 DEGREE ANGLE HOLE

GAMMA RAY	DEPTHS	NEUTRON
GAMMA RAY INCREASES →		NEUTRON INCREASES →
API 14		API 520
28 98 168		0 5200 10,400

PR-PP 75(3)A

PR-Pine Pass 75(3)A 75-5

ROKE

SIDEWALL DENSILOG

OIL ENTERPRISES LTD. CALGARY, ALBERTA

FILE NO.	
LSD	
SEC	
TWP	
RGE	
W_ M	
COMPANY	PAN OCEAN OIL LIMITED
WELL	75-5
LOCATION	HASLER CREEK
FIELD	PINE PASS
PROVINCE	BRITISH COLUMBIA
Other Services:	GRN

Permanent Datum GROUND LEVEL Elev. ___ K.B. ___
Log Measured from RIG FLOOR 2 Ft. Above Perm. Datum CSG ___
Well Depths Measured from RIG FLOOR G.L. ___

Run. No.	ONE
Date	21 JUNE 1975
First Reading	1125
Last Reading	00
Footage Logged	1125
Depth Reached	1128
Depth Driller	1148
Casing Roke	4
Casing Driller	4
Fluid Type	WATER
Liquid Level	49
Min. Diam.	2.375 (NQ)
Operating Time	3 HOURS
Truck No.	SU-5
Recorded By	RAINEY
Witnessed By	HANKEL

584

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	1125	10					3	500	2.21R	26.0

REMARKS LOGGED THROUGH NQ DRILL ROD
55 DEGREE ANGLE HOLE

DENSITY TOOL SERIAL NO 457

GAMMA RAY API	DEPTHS	CALIPER (DIAMETER – INCHES)
		BULK DENSITY (GRAMS/CC)

PR-PP75(3)A

Pe Pine Pass 75(3)A. 75-6

ROKE SIDEWALL DENSILOG

OIL ENTERPRISES LTD. CALGARY, ALBERTA

FILE NO. 6

LSD
SEC
TWP
RGE
W___M

COMPANY PAN OCEAN OIL LIMITED
WELL 75-6
LOCATION FALLING CREEK
FIELD PINE PASS
PROVINCE BRITISH COLUMBIA

Other Services: GRN

Permanent Datum GROUND LEVEL Elev.
Log Measured from RIG FLOOR 2 Ft. Above Perm. Datum
Well Depths Measured from RIG FLOOR

K.B.
CSG
G.L.

Run. No.	ONE
Date	25 JUNE 1975
First Reading	933
Last Reading	00
Footage Logged	933
Depth Reached	936
Depth Driller	938
Casing Roke	102
Casing Driller	102
Fluid Type	WATER
Liquid Level	00
Min. Diam.	2.375 (NQ)
Operating Time	2 HOURS
Truck No.	SU-5
Recorded By	RAINEY
Witnessed By	HANKEL

584

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	933	10					3	500	2.21R	26.0

REMARKS LOGGED THROUGH NO DRILL ROD
55 DEGREE ANGLE HOLE

DENSITY TOOL SERIAL NO 457

DEPTHS

CALIPER (DIAMETER – INCHES)

GAMMA RAY API

BULK DENSITY (GRAMS/CC)

PR-PP 75(3)A

PR - PINE PASS 75(3)A.

ROKE

GAMMA RAY NEUTRON LOG

OIL ENTERPRISES LTD. CALGARY, ALBERTA

FILE NO.	6
LSD	
SEC	
TWP	
RGE	
W ___ M	
COMPANY	PAN OCEAN OIL LIMITED
WELL	75-6
LOCATION	FALLING CREEK
FIELD	PINE PASS
PROVINCE	BRITISH COLUMBIA
Other Services:	DENS
Permanent Datum	GROUND LEVEL
Elev.	
Log Measured from	RIG FLOOR 2 Ft. Above Perm. Datum
Well Depths Measured from	RIG FLOOR
K.B.	
CSG	
G.L.	

Run. No.	ONE
Date	25 JUNE 1975
First Reading	934
Last Reading	00
Footage Logged	934
Depth Reached	935
Depth Driller	938
Casing Roke	102
Casing Driller	102
Fluid Type	WATER
Liquid Level	00
Min. Diam.	2.375 (NQ)
Rm @ °F	
Operating Time	2 HOURS
Truck No.	SU-5
Recorded By	RAINEY
Witnessed By	HANKEL

584

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.	
DETECTOR MODEL NO.		DIAMETER	$1\frac{11}{16}$
TYPE	SCINTILLATION	DETECTOR MODEL NO.	
LENGTH	18 INCH	TYPE	PROPORTIONAL
DISTANCE TO N. SOURCE	6 FT.	LENGTH	4 INCH
		SOURCE MODEL NO.	MRC-N-SS-W
GENERAL		SERIAL NO.	
HOIST TRUCK NO.		SPACING	
INSTRUMENT TRUCK NO.	SU-5	TYPE	AmBe
TOOL SERIAL NO.	340	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	934	12	5	100	0L	14 API	3	500	0L	270 API
			?								

REMARKS LOGGED THROUGH NQ DRILL ROD
55 DEGREE ANGLE HOLE

GAMMA RAY	DEPTHS	NEUTRON
GAMMA RAY INCREASES → API 14; 0 – 140		NEUTRON INCREASES → API 270; 0 – 2700 – 5400

PR-PP 75(3)A

Pr. Pine Pass 75(3)A

ROKE OIL ENTERPRISES LTD. CALGARY, ALBERTA

GAMMA RAY NEUTRON LOG

FILE NO.

LSD
SEC
TWP
RGE
W M

COMPANY PAN OCEAN OIL LIMITED

WELL 75-7

LOCATION HASLER CREEK

FIELD PINE PASS

PROVINCE BRITISH COLUMBIA

Other Services: DENS

Permanent Datum GROUND LEVEL Elev.

Log Measured from RIG FLOOR 2 Ft. Above Perm. Datum

Well Depths Measured from RIG FLOOR

K.B.
CSG
G.L.

Run. No.	ONE
Date	30 JUNE 1975
First Reading	1124
Last Reading	00
Footage Logged	1124
Depth Reached	1125
Depth Driller	1127
Casing Roke	74
Casing Driller	74
Fluid Type	WATER
Liquid Level	00
Min. Diam.	2.375 (NQ)
Rm @ °F	
Operating Time	2-1/2 HOURS
Truck No.	SU-5
Recorded By	RAINEY
Witnessed By	HANKEL

584

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.	
DETECTOR MODEL NO.		DIAMETER	$1\frac{11}{16}$
TYPE	SCINTILLATION	DETECTOR MODEL NO.	
LENGTH	18 INCH	TYPE	PROPORTIONAL
DISTANCE TO N. SOURCE	6 FT.	LENGTH	4 INCH
		SOURCE MODEL NO.	MRC-N-SS-W
GENERAL		SERIAL NO.	71
HOIST TRUCK NO.		SPACING	17 INCH
INSTRUMENT TRUCK NO.	SU-5	TYPE	AmBe
TOOL SERIAL NO.	340	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	1124	12	5	100	0L	14 API	3	500	0L	260 API

REMARKS LOGGED THROUGH NQ DRILL ROD WATER FLOWING FROM THE HOLE AT 10 GALLONS PER MINUTE
55 DEGREE ANGLE HOLE

GAMMA RAY	DEPTHS	NEUTRON
GAMMA RAY INCREASES →		NEUTRON INCREASES →
API 14		API 260
0 — 140		0 — 2600 — 5200

PR-PP 75(3)A

Pe. Pine Pass 75(3)A. 75-7

ROKE

OIL ENTERPRISES LTD. CALGARY, ALBERTA

SIDEWALL DENSILOG

FILE NO.	
LSD	
SEC	
TWP	
RGE	
W___M	
COMPANY	PAN OCEAN OIL LIMITED
WELL	75-7
LOCATION	HASLER CREEK
FIELD	PINE PASS
PROVINCE	BRITISH COLUMBIA
Other Services:	GRN
Permanent Datum	GROUND LEVEL
Elev.	
Log Measured from	RIG FLOOR, 2 Ft. Above Perm. Datum
Well Depths Measured from	RIG FLOOR
K.B.	
CSG	
G.L.	

Run. No.	ONE
Date	30 JUNE 1975
First Reading	1122
Last Reading	00
Footage Logged	1122
Depth Reached	1125
Depth Driller	1127
Casing Roke	74
Casing Driller	74
Fluid Type	WATER
Liquid Level	00
Min. Diam.	2.375 (NQ)
Operating Time	2-1/2 HOURS
Truck No.	SU-5
Recorded By	RAINEY
Witnessed By	HANKEL

584

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	1122	10					3	500	2.21	26.0

REMARKS LOGGED THROUGH NQ DRILL ROD
55 DEGREE ANGLE HOLE
WATER FLOWING FROM THE HOLE AT 10 GALLONS PER MINUTE
DENSITY TOOL SERIAL NO 457

PR-PP 75(3)A

PR- PINE PASS 75(3)A

ROKE

GAMMA RAY NEUTRON LOG

OIL ENTERPRISES LTD. CALGARY, ALBERTA

FILE NO.	COMPANY PAN OCEAN OIL LIMITED
LSD	WELL 75-8
SEC	LOCATION HASLER CREEK
TWP	FIELD PINE PASS
RGE	PROVINCE BRITISH COLUMBIA
W ____ M	Other Services: DENS

Permanent Datum GROUND LEVEL Elev. ____ K.B. ____
Log Measured from RIG FLOOR 2 Ft. Above Perm. Datum CSG ____
Well Depths Measured from RIG FLOOR G.L. ____

Run. No.	ONE		
Date	8 JULY 1975		
First Reading	1170		
Last Reading	00		
Footage Logged	1170		
Depth Reached	1171		
Depth Driller	1188		
Casing Roke	96		
Casing Driller	97		
Fluid Type	WATER		
Liquid Level	00		
Min. Diam.	2.375 (NQ)		
Rm @ °F			
Operating Time	3 HOURS		
Truck No.	SU-5		584

Recorded By RAINEY Witnessed By HANKEL

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.	
DETECTOR MODEL NO.		DIAMETER	$1\frac{11}{16}$
TYPE	SCINTILLATION	DETECTOR MODEL NO.	
LENGTH	18 INCH	TYPE	PROPORTIONAL
DISTANCE TO N. SOURCE	6 FT.	LENGTH	4 INCH
		SOURCE MODEL NO.	MRC-N-SS-W
GENERAL		SERIAL NO.	71
HOIST TRUCK NO.		SPACING	17 INCH
INSTRUMENT TRUCK NO.	SU-5	TYPE	AmBe
TOOL SERIAL NO.	340	STRENGTH	3 CURIES

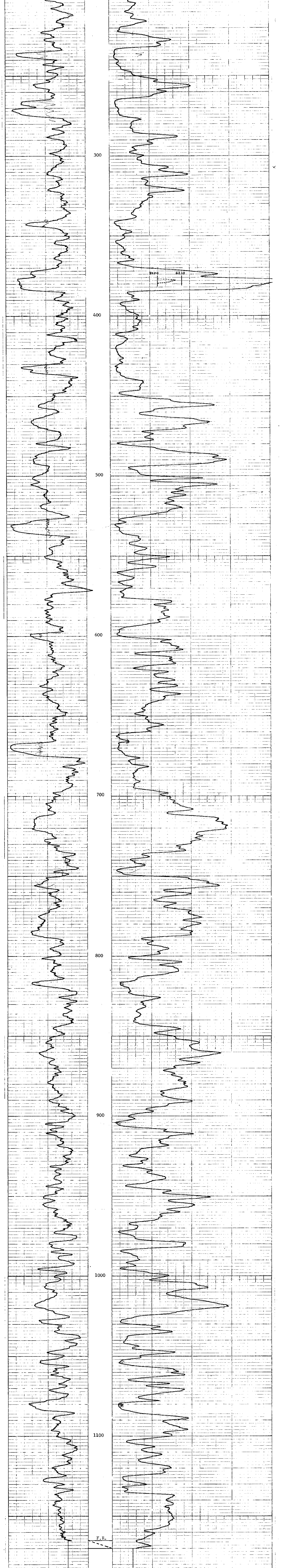
LOGGING DATA

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	1170	12	5	100	0L	14 API	3	500	0L	270 API

REMARKS LOGGED THROUGH NQ DRILL ROD
60 DEGREE ANGLE HOLE

15-8

GAMMA RAY	DEPTHS	NEUTRON
GAMMA RAY INCREASES →		NEUTRON INCREASES →
API 14		API 270
0 — 140		0 — 2700 — 5400



PR-PP 75(3)A

PR-PINE PASS 75-(3)A. 75-8

ROKE

OIL ENTERPRISES LTD. CALGARY, ALBERTA

SIDEWALL DENSILOG

FILE NO.	
LSD	
SEC	
TWP	
RGE	
W M	
COMPANY	PAN OCEAN OIL LIMITED
WELL	75-8
LOCATION	HASLER CREEK
FIELD	PINE PASS
PROVINCE	BRITISH COLUMBIA
Other Services:	GRN
Permanent Datum	GROUND LEVEL Elev.
Log Measured from	RIG FLOOR 2 Ft. Above Perm. Datum
Well Depths Measured from	RIG FLOOR
K.B.	
CSG	
G.L.	

Run. No.	ONE		
Date	8 JULY, 1975		
First Reading	1170		
Last Reading	000		
Footage Logged	1170		
Depth Reached	1173		
Depth Driller	1188		
Casing Roke	96		
Casing Driller	97		
Fluid Type	WATER		
Liquid Level	000		
Min. Diam.	2.375 (NQ)		
Operating Time	3 HOURS		
Truck No.	SU-5		
Recorded By	RAINEY	Witnessed By	HANKEL

584

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	1170	10					3	500	2.21	26.0

REMARKS LOGGED THROUGH NQ ROD
60 DEGREE ANGLE HOLE

DENSITY TOOL SER # 457

DEPTHS

CALIPER
(DIAMETER – INCHES)

GAMMA RAY
API

BULK DENSITY
(GRAMS/CC)

PR-PP 75(3) A

PR-Pine Pass 75(3)A

ROKE

GAMMA RAY NEUTRON LOG

OIL ENTERPRISES LTD. CALGARY, ALBERTA

FILE NO.	
LSD	
SEC	
TWP	
RGE	
W M	
COMPANY	PAN OCEAN OIL LIMITED
WELL	75-9
LOCATION	HASLER CREEK
FIELD	PINE PASS
PROVINCE	BRITISH COLUMBIA
Other Services:	DENS
Permanent Datum	GROUND LEVEL Elev.
Log Measured from	RIG FLOOR 3 Ft. Above Perm. Datum
Well Depths Measured from	RIG FLOOR
K.B.	
CSG	
G.L.	

Run. No.	ONE
Date	10 JULY 1975
First Reading	495
Last Reading	00
Footage Logged	495
Depth Reached	496
Depth Driller	498
Casing Roke	101
Casing Driller	101
Fluid Type	WATER
Liquid Level	00
Min. Diam.	2.375 (NQ)
Rm @ °F	
Operating Time	2 HOURS
Truck No.	SU-5
Recorded By	RAINEY
Witnessed By	DYSON

584

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.	
DETECTOR MODEL NO.		DIAMETER	$1\frac{11}{16}$
TYPE	SCINTILLATION	DETECTOR MODEL NO.	
LENGTH	18 INCH	TYPE	PROPORTIONAL
DISTANCE TO N. SOURCE	6 FT.	LENGTH	4 INCH
		SOURCE MODEL NO.	MRC-N-SS-W
GENERAL		SERIAL NO.	71
HOIST TRUCK NO.		SPACING	17 INCH
INSTRUMENT TRUCK NO.	SU-5	TYPE	AmBe
TOOL SERIAL NO.	340	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	495	12	5	100	0L	14 API	5	500	0L	250 API

REMARKS LOGGED THROUGH NQ DRILL ROD

60 DEGREE ANGLE HOLE

GAMMA RAY	DEPTHS	NEUTRON
GAMMA RAY INCREASES →		NEUTRON INCREASES →
API 14		API 250
0 ... 140		0 ... 2500 ... 5000

PR-PP 75(3)A

Pr. Pine Pass 75(3)A. 75-9

ROKE

SIDEWALL DENSILOG

OIL ENTERPRISES LTD. CALGARY, ALBERTA

FILE NO.	COMPANY PAN OCEAN OIL LIMITED
LSD	WELL 75-9
SEC	LOCATION HASLER CREEK
TWP	FIELD PINE PASS
RGE	PROVINCE BRITISH COLUMBIA
W. ___ M	

Other Services: GRN

Permanent Datum GROUND LEVEL Elev. ____ K.B. ____
Log Measured from RIG FLOOR 3 Ft. Above Perm. Datum CSG ____
Well Depths Measured from RIG FLOOR G.L. ____

Run. No.	ONE
Date	10 JULY 1975
First Reading	493
Last Reading	00
Footage Logged	493
Depth Reached	496
Depth Driller	498
Casing Roke	101
Casing Driller	101
Fluid Type	WATER
Liquid Level	00
Min. Diam.	2.375 (NQ)
Operating Time	2 HOURS
Truck No.	SU-5
Recorded By	RAINEY
Witnessed By	DYSON

584

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	493	10					3	500	2.21R	26.0

REMARKS LOGGED THROUGH NQ DRILL ROD
60 DEGREE ANGLE HOLE

DENSITY TOOL SERIAL NO 457

DEPTHS

CALIPER
(DIAMETER – INCHES)

GAMMA RAY
API

BULK DENSITY
(GRAMS/CC)

PR-PP 75(3)A

PR PINE PASS 75(3)B 75-10

ROKE

GAMMA RAY NEUTRON LOG

OIL ENTERPRISES LTD. CALGARY, ALBERTA

FILE NO.	COMPANY PAN OCEAN OIL LIMITED
LSD	WELL 75-10
SEC	LOCATION JOHNSEN CREEK
TWP	FIELD PINE PASS
RGE	PROVINCE BRITISH COLUMBIA
W ___ M	Other Services: DENS

Permanent Datum GROUND LEVEL Elev. ___ K.B. ___
Log Measured from RIG FLOOR 20 IN. Above Perm. Datum CSG ___
Well Depths Measured from RIG FLOOR G.L. ___

Run. No.	ONE		
Date	5 JULY 1975		
First Reading	555		
Last Reading	00		
Footage Logged	555		
Depth Reached	556		
Depth Driller	558		
Casing Roke	26		
Casing Driller	27		
Fluid Type	WATER		
Liquid Level	00		
Min. Diam.			
Rm @ °F			
Operating Time	2 HOURS		
Truck No.	SU-5		

584

Recorded By RAINEY Witnessed By HANKEL

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.	
DETECTOR MODEL NO.		DIAMETER	$1\frac{11}{16}$
TYPE	SCINTILLATION	DETECTOR MODEL NO.	
LENGTH	18 INCH	TYPE	PROPORTIONAL
DISTANCE TO N. SOURCE	6 FT.	LENGTH	4 INCH
		SOURCE MODEL NO.	MRC-N-SS-W
GENERAL		SERIAL NO.	71
HOIST TRUCK NO.		SPACING	17 INCH
INSTRUMENT TRUCK NO.	SU-5	TYPE	AmBe
TOOL SERIAL NO.	340	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	555	12	5	100	0L	14 API	3	500	0L	260 API

REMARKS LOGGED THROUGH NQ DRILL ROD
61 DEGREE ANGLE HOLE

GAMMA RAY	DEPTHS	NEUTRON
GAMMA RAY INCREASES → API 14 0 140		NEUTRON INCREASES → API 260 0 2600 5200

PR - PINE PASS 75(3)A.

ROKE OIL ENTERPRISES LTD. CALGARY, ALBERTA

SIDEWALL DENSILOG

FILE NO.	
LSD	
SEC	
TWP	
RGE	
W ___ M	
COMPANY	PINE PASS DEVELOPMENT LTD.
WELL	H 5
LOCATION	WILLOW CREEK
FIELD	PINE PASS AREA
PROVINCE	BRITISH COLUMBIA
Other Services	GRN

Permanent Datum GROUND LEVEL Elev ___ K.B. ___
Log Measured from RIG FLOOR 1.5 Ft. Above Perm. Datum CSG ___
Well Depths Measured from RIG FLOOR G.L ___

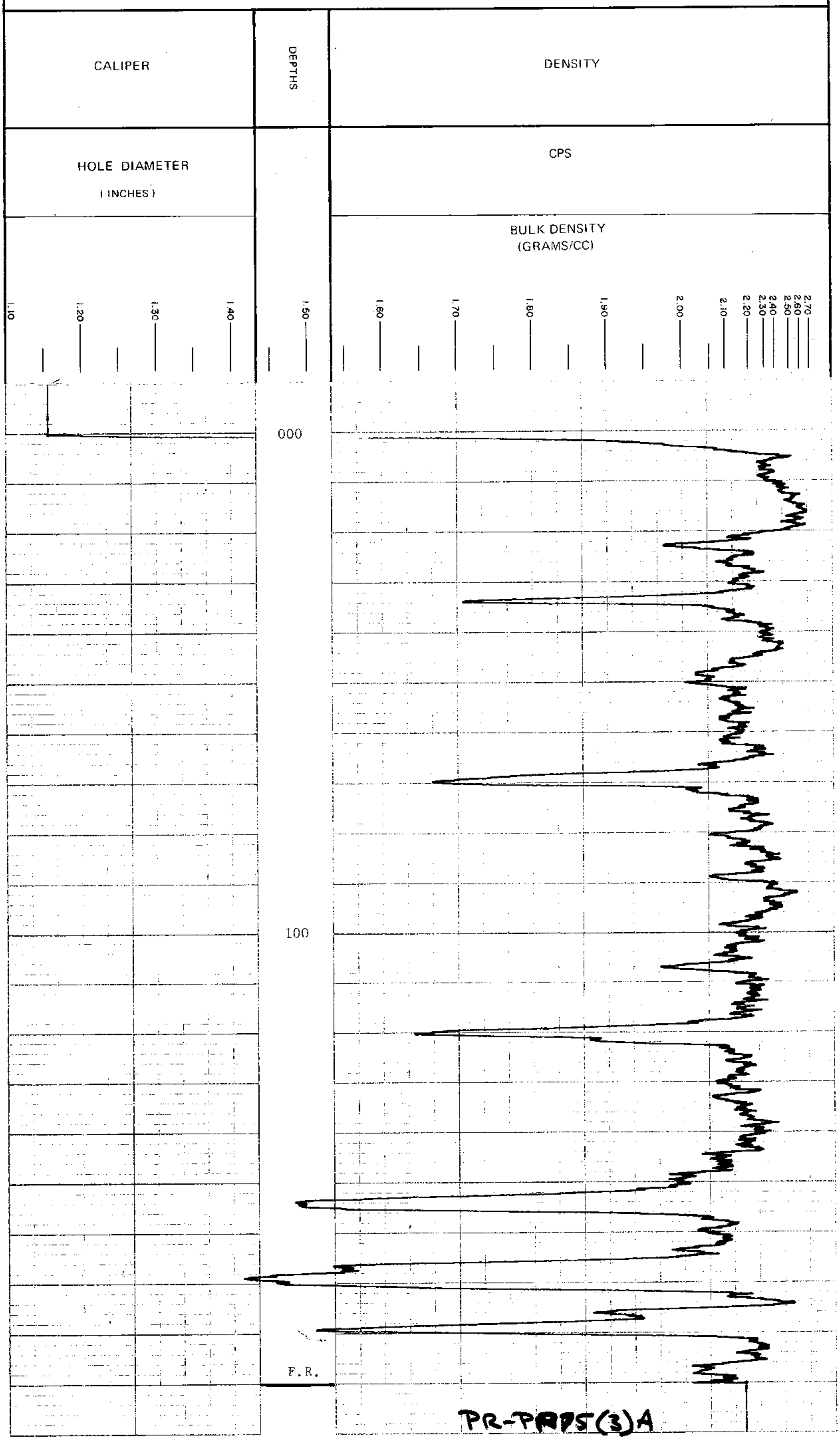
Run. No.	ONE		
Date	14 FEBRUARY 73		
First Reading	190		
Last Reading	0		
Footage Logged	190		
Depth Reached	193		
Depth Driller			
Casing Roke			
Casing Driller			
Fluid Type	WATER		
Liquid Level			
Min. Diam.	3 INCH		
Rm @ °F			
Operating Time	2 HOURS		
Truck No.	20		
Recorded By [redacted]		Witnessed By	YOON

584

LOGGING DATA

RUN NO.	DEPTHS FROM	DEPTHS TO	SPEED FT/MIN	T.C. SEC.	SENS SETTINGS	ZERO DIV. L OR R	CPS/DIV.	
1	195	0	9	3	60	2 R		

REMARKS LOGGED THROUGH DRILL ROD. (NO CALIBRATION)



PR-PP75(3)A

PR-Pine Pass 75(3)A

H-5

ROKE

GAMMA RAY NEUTRON LOG

OIL ENTERPRISES LTD. CALGARY, ALBERTA

FILE NO.	
COMPANY	PINE PASS DEVELOPMENT LTD
WELL	H 5
LOCATION	WILLOW CREEK
FIELD	PINE PASS AREA
PROVINCE	BRITISH COLUMBIA
LSD	
SEC	
TWP	
RGE	
W _ M	

Permanent Datum GROUND LEVEL Elev. ____ K.B. ____
Log Measured from RIG FLOOR 1.5 Ft. Above Perm. Datum D.F. ____
Well Depths Measured from RIG FLOOR G.L. ____

Run No	ONE
Date	14 FEBRUARY 73
First Reading	200
Last Reading	0
Footage Logged	200
Depth Reached	201
Depth Driller	
Casing Roke	
Casing Driller	
Fluid Type	WATER
Liquid Level	0 FEET
Min Diam	3 INCH
Operating Time	2 HOURS
Truck No.	20
Recorded By	PETERSON
Witnessed By	YOON

584

EQUIPMENT DATA

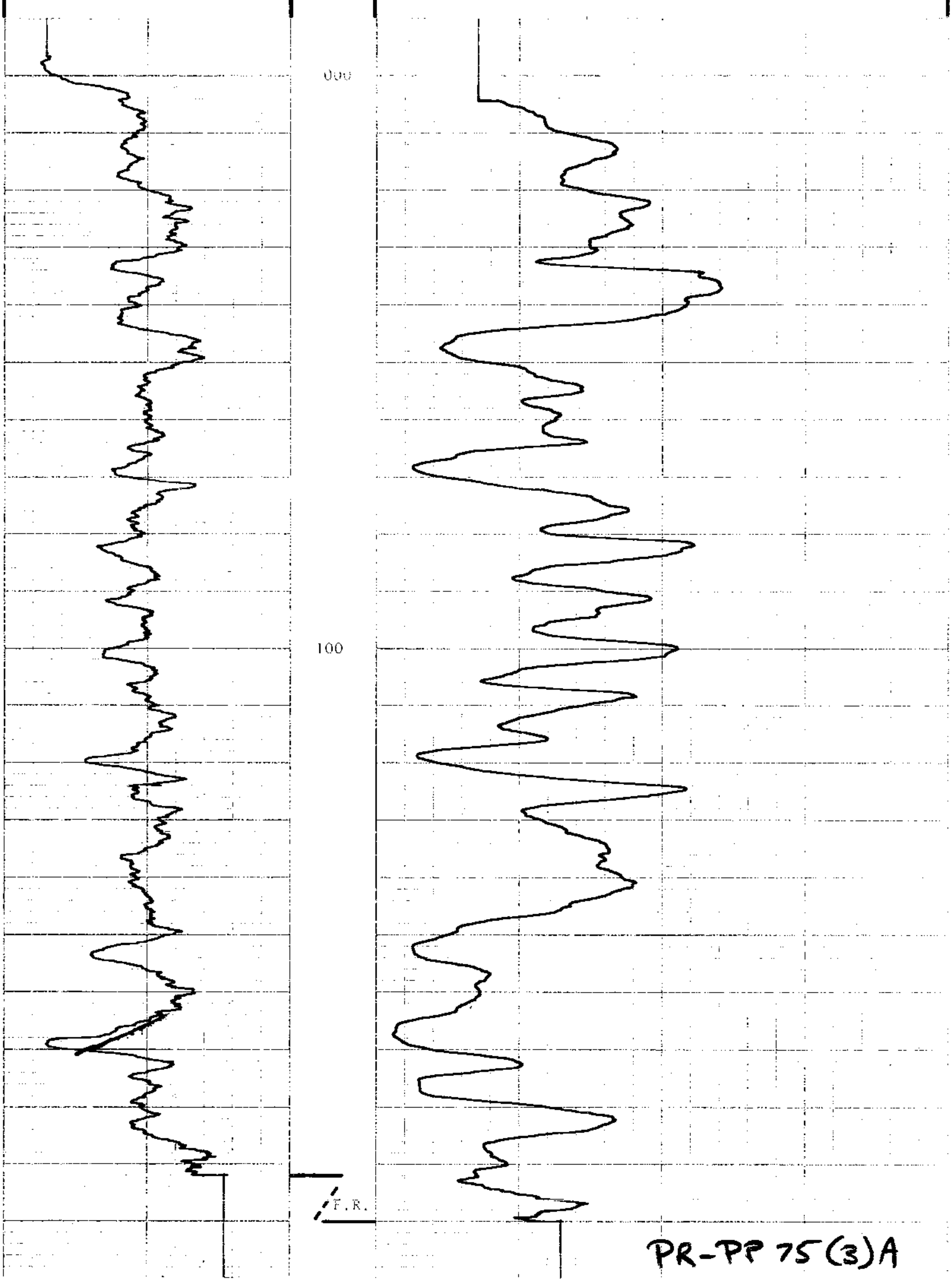
GAMMA RAY		NEUTRON	
RUN NO	ONE	RUN NO	ONE
TOOL MODEL NO		LOG TYPE	NEUTRON/NEUTRON
DIAMETER	$1\frac{11}{16}$	TOOL MODEL NO	
DETECTOR MODEL NO		DIAMETER	$1\frac{11}{16}$
TYPE	GEIGER	DETECTOR MODEL NO	
LENGTH	18 INCH	TYPE	PROPORTIONAL
DISTANCE TO N. SOURCE	8.55 FT	LENGTH	6 INCH
GENERAL		SOURCE MODEL NO	MRC-N-SS-W
		SERIAL NO	598
HOIST TRUCK NO		SPACING	19 INCH
INSTRUMENT TRUCK NO	20	TYPE	AmBe
TOOL SERIAL NO	CGN27U4A74	STRENGTH	6.94×10^6 N/S

LOGGING DATA

GENERAL				GAMMA RAY				NEUTRON			
RUN NO	DEPTHS FROM	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	0	200	12	4	17	0L	10	4	0.23	1L	30 CPS

REMARKS LOGGED THROUGH DRILL ROD

GAMMA RAY	DEPTHS	NEUTRON
GAMMA RAY INCREASES →		NEUTRON INCREASES →
API, ⟷ 10		CPS, ⟷ 30
0 — 100		30 — 330 — 630



PR-PP 75(3)A

PR- PINE PASS 75(3)A.

ROKE

SIDEWALL DENSILOG

OIL ENTERPRISES LTD. CALGARY, ALBERTA

FILE NO.	COMPANY PINE PASS DEVELOPMENT LTD.
LSD	WELL H 4
SEC	LOCATION WILLOW CREEK
TWP	FIELD PINE PASS AREA
RGE	PROVINCE BRITISH COLUMBIA
W M	Other Services: GRN

Permanent Datum GROUND LEVEL Elev.
Log Measured from RIG FLOOR 1 5 Ft. Above Perm. Datum
Well Depths Measured from RIG FLOOR
K.B.
CSG
G.L.

Run. No.	ONE
Date	12 FEBRUARY 73
First Reading	298
Last Reading	0
Footage Logged	298
Depth Reached	301
Depth Driller	
Casing Roke	
Casing Driller	
Fluid Type	WATER
Liquid Level	202 FT
Min. Diam.	3 INCH
Rm @ °F	
Operating Time	3 HOURS
Truck No.	20

584

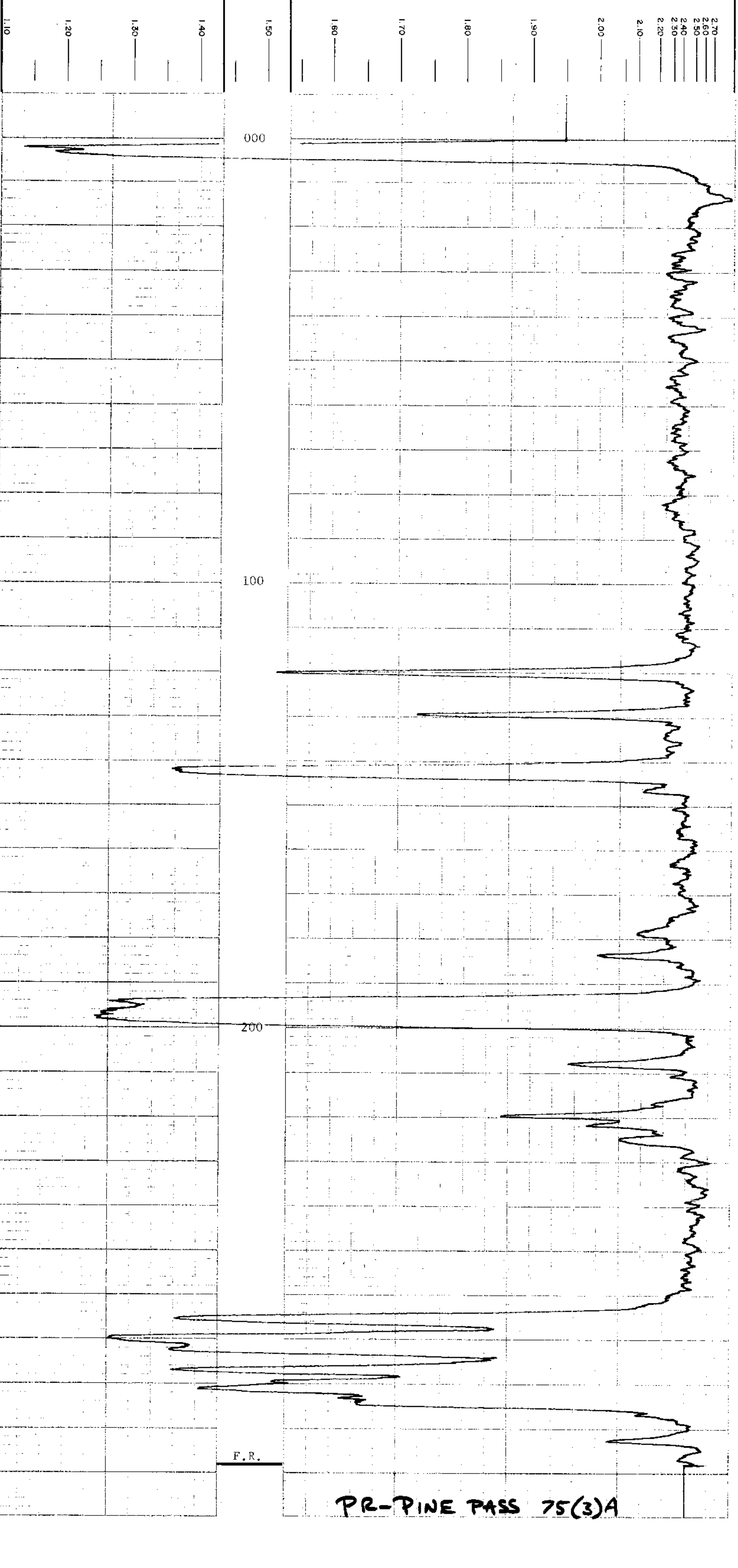
Recorded By PETERSON Witnessed By YOON

LOGGING DATA

RUN NO.	DEPTHS FROM	DEPTHS TO	SPEED FT/MIN	T.C. SEC.	SENS SETTINGS	ZERO DIV. L OR R	CPS/DIV.
1	0	298	9	3	0-60	2 R	

REMARKS

CALIPER	DEPTHS	DENSITY
HOLE DIAMETER (INCHES)		CPS
		BULK DENSITY (GRAMS/CC)



PR-PINE PASS 75(3)A

PR- PINE PASS 75(3)A. H-4.

ROKE

GAMMA RAY NEUTRON LOG

OIL ENTERPRISES LTD. CALGARY, ALBERTA

FILE NO.	
COMPANY	PINE PASS DEVELOPMENT LTD
LSD / SEC / TWP / RGE / W M	
WELL	H 4
LOCATION	WILLOW CREEK
FIELD	PINE PASS AREA
PROVINCE	BRITISH COLUMBIA

Permanent Datum GROUND LEVEL Elev. ____ K.B. ____
Log Measured from RIG FLOOR 1.5 Ft. Above Perm. Datum D.F. ____
Well Depths Measured from RIG FLOOR G.L. ____

Run No.	ONE
Date	12 FEBRUARY 73
First Reading	301
Last Reading	0
Footage Logged	301
Depth Reached	302
Depth Driller	
Casing Roke	
Casing Driller	
Fluid Type	WATER
Liquid Level	201 FEET
Min. Diam.	3 INCH
Operating Time	2 HOURS
Truck No.	20
Recorded By	PETERSON
Witnessed By	YOON

584

EQUIPMENT DATA

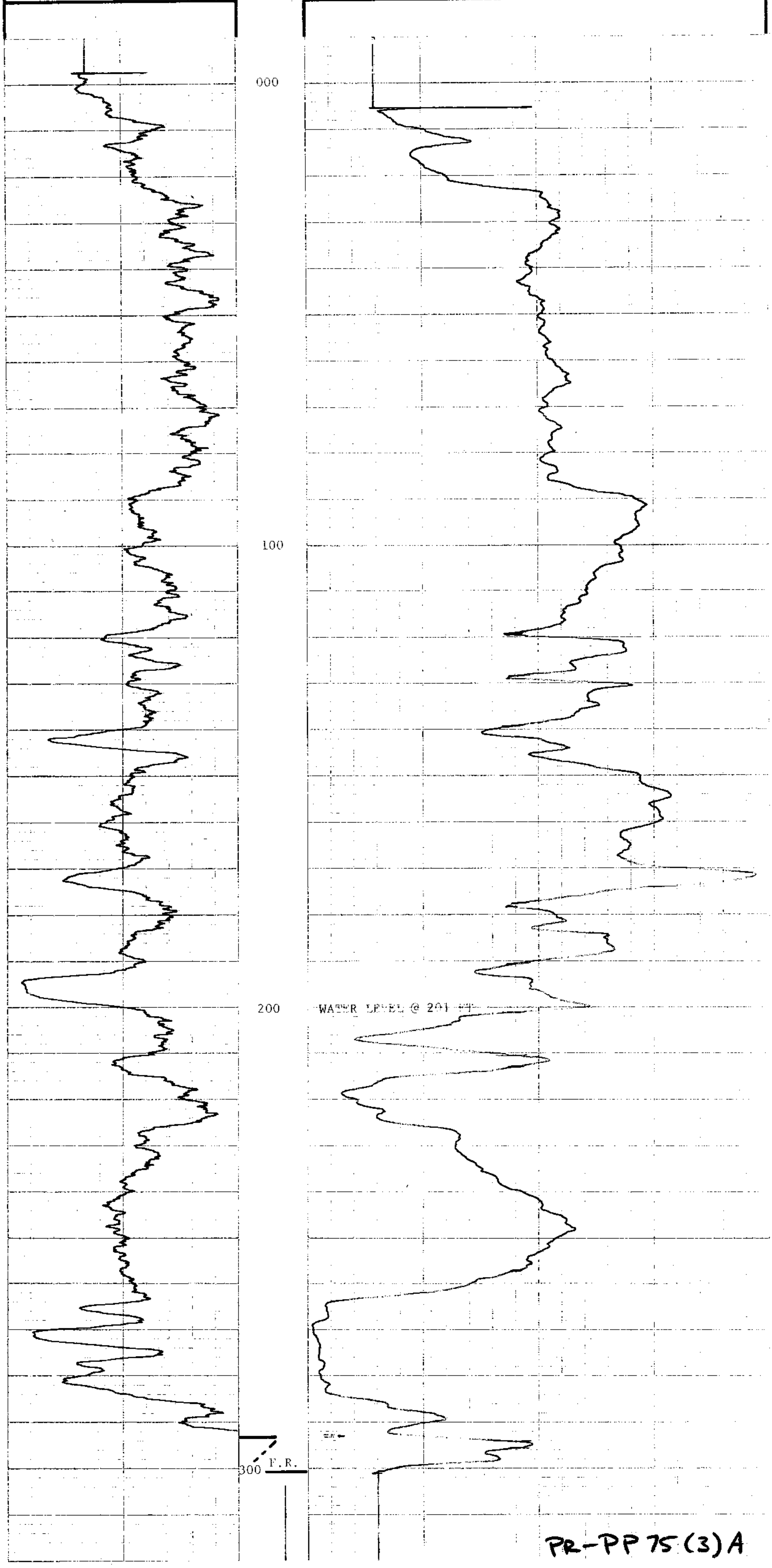
GAMMA RAY		NEUTRON	
RUN NO	ONE	RUN NO	ONE
TOOL MODEL NO		LOG TYPE	NEUTRON/NEUTRON
DIAMETER	$1\frac{11}{16}$	TOOL MODEL NO	
DETECTOR MODEL NO		DIAMETER	$1\frac{11}{16}$
TYPE	GEIGER	DETECTOR MODEL NO	
LENGTH	18 INCH	TYPE	PROPORTIONAL
DISTANCE TO N. SOURCE	8.55 FT	LENGTH	6 INCH
GENERAL		SOURCE MODEL NO	MRC-N-SS-W
HOIST TRUCK NO		SERIAL NO	598
INSTRUMENT TRUCK NO	20	SPACING	19 INCH
TOOL SERIAL NO	CGN27U4A74	TYPE	AmBe
		STRENGTH	6.94 $\times 10^6$ N/S

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	0	301	12	4	17	0 L	10	4	0.23	21	30 CPS

REMARKS

GAMMA RAY	DEPTHS	NEUTRON
GAMMA RAY INCREASES → API ⇥10⇤ 0 — 100		NEUTRON INCREASES → CPS ⇥30⇤ 60 — 360 — 660



PR-PP 75 (3) A

PR- PINE PASS 75(3)A.

ROKE

SIDEWALL DENSILOG

OIL ENTERPRISES LTD. CALGARY, ALBERTA

FILE NO.	
LSD / SEC / TWP / RGE / W.___M	
COMPANY	PINE PASS DEVELOPMENT LTD.
WELL	H 3
LOCATION	WILLOW CREEK
FIELD	PINE PASS AREA
PROVINCE	BRITISH COLUMBIA
Other Services	GRN
Permanent Datum	GROUND LEVEL Elev.
Log Measured from	RIG FLOOR 1.5 Ft. Above Perm. Datum
Well Depths Measured from	RIG FLOOR
K.B. / CSG / G.L.	

Run No.	ONE
Date	10 FEBRUARY 73
First Reading	698
Last Reading	0
Footage Logged	698
Depth Reached	701
Depth Driller	701
Casing Roke	
Casing Driller	
Fluid Type	WATER
Liquid Level	0 FEET
Min. Diam.	3 INCH
Rm @ °F	
Operating Time	3 HOURS
Truck No.	20
Recorded By	PETERSON
Witnessed By	YOON

584

LOGGING DATA

RUN NO	DEPTHS FROM	DEPTHS TO	SPEED FT/MIN	T.C. SEC	SENS SETTINGS	ZERO DIV. L OR R	CPS/DIV.
1	0	698	9	3	0.60	2R	

REMARKS

CALIPER	DEPTHS	DENSITY
HOLE DIAMETER (INCHES)		CPS / BULK DENSITY (GRAMS/CC)

PR-PP 75(3)A

Pr. Pine Pass 75(3)A. 4-3

ROKE

GAMMA RAY NEUTRON LOG

OIL ENTERPRISES LTD. CALGARY, ALBERTA

FILE NO.	
LSD	
SEC	
TWP	
RGE	
W M	
COMPANY	PINE PASS DEVELOPMENT LTD.
WELL	H 3
LOCATION	WILLOW CREEK
FIELD	PINE PASS AREA
PROVINCE	BRITISH COLUMBIA

Permanent Datum GROUND LEVEL Elev. ____ K.B. ____
Log Measured from RIG FLOOR 1.5 Ft. Above Perm. Datum D.F. ____
Well Depths Measured from RIG FLOOR G.L. ____

Run No.	ONE		
Date	10 FEBRUARY 73		
First Reading	699		
Last Reading	0		
Footage Logged	699		
Depth Reached	701		
Depth Driller	701		
Casing Roke			
Casing Driller			
Fluid Type	WATER		
Liquid Level	0 FT		
Min. Diam.	3 INCH		
Operating Time	3 HOURS		
Truck No.	20		
Recorded By	PETERSON	Witnessed By	YOON

584

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	
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	598
HOIST TRUCK NO	20	SPACING	19 INCH
INSTRUMENT TRUCK NO		TYPE	AmBe
TOOL SERIAL NO	CGN27U4A74	STRENGTH	6.94×10^6 N/S

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	0	699	12	4	17	0L	10	4	0.23	2L	30 CPS

REMARKS

GAMMA RAY	DEPTHS	NEUTRON
GAMMA RAY INCREASES →		NEUTRON INCREASES →
API 10		CPS 30
0 — 100		60 — 360 — 660

PR-PP 75(3)A

Pe. Pine Pass 75(3)A. H-2

ROKE

OIL ENTERPRISES LTD. CALGARY, ALBERTA

GAMMA RAY NEUTRON LOG

FILE NO.	
LSD	
SEC	
TWP	
RGE	
W _ M	
COMPANY	PINE PASS DEVELOPMENT LTD
WELL	H 2
LOCATION	WILLOW CREEK
FIELD	PINE PASS AREA
PROVINCE	BRITISH COLUMBIA

Permanent Datum GROUND LEVEL Elev. ___ K.B. ___
Log Measured from RIG FLOOR 1.5 Ft. Above Perm. Datum D.F. ___
Well Depths Measured from RIG FLOOR G.L. ___

Run No.	ONE		
Date	8 FEBRUARY 73		
First Reading	600		
Last Reading	0		
Footage Logged	600		
Depth Reached	602		
Depth Driller	602		
Casing Roke	30		
Casing Driller	30		
Fluid Type	WATER		
Liquid Level	63 FEET		
Min. Diam.	3 INCH		
Operating Time	3 HOURS		
Truck No.	20		
Recorded By	PETERSON	Witnessed By	YOON

584

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	
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	598
HOIST TRUCK NO		SPACING	19 INCH
INSTRUMENT TRUCK NO	20	TYPE	AmBe
TOOL SERIAL NO	CGN27U4A74	STRENGTH	6.94×10^6 N/S

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	0	600	12	4	17	0 L.	10	4	0.23	2 L	30 CPS

REMARKS

GAMMA RAY	DEPTHS	NEUTRON
GAMMA RAY INCREASES → API 10		NEUTRON INCREASES → CPS 30
0 — 100		60 — 360 — 660

PR-PP 75(3)A

PR. PINE PASS 75(3)A. H-2

ROKE

SIDEWALL DENSILOG

OIL ENTERPRISES LTD. CALGARY, ALBERTA

FILE NO.	
COMPANY	PINE PASS DEVELOPMENT LTD.
LSD / SEC / TWP / RGE / W ___ M	
WELL	H 2
LOCATION	WILLOW CREEK
FIELD	PINE PASS AREA
PROVINCE	BRITISH COLUMBIA
Other Services	GRN
Permanent Datum	GROUND LEVEL
Elev.	
Log Measured from	RIG FLOOR 1.5 Ft. Above Perm. Datum
Well Depths Measured from	RIG FLOOR
K.B.	
C.S.G.	
G.L.	

Run No.	ONE
Date	8 FEBRUARY 73
First Reading	599
Last Reading	0
Footage Logged	599
Depth Reached	602
Depth Driller	602
Casing Roke	30
Casing Driller	30
Fluid Type	WATER
Liquid Level	0 FT
Min. Diam.	3 INCH
Rm @ °F	
Operating Time	3 HOURS
Truck No.	20
Recorded By	PETERSON
Witnessed By	YOON

584

LOGGING DATA

RUN NO.	DEPTHS FROM	DEPTHS TO	SPEED FT/MIN	T.C. SEC	SENS SETTINGS	ZERO DIV. L OR R	CPS/DIV.
1	0	599	8	3	0.60	2R	

REMARKS

PR-PP75(3)A

PR- PINE PASS 75(3)A · H-1

ROKE

GAMMA RAY NEUTRON LOG

OIL ENTERPRISES LTD. CALGARY, ALBERTA

FILE NO.	
LSD	
SEC	
TWP	
RGE	
W M	
COMPANY	PINE PASS DEVELOPMENT LTD.
WELL	H 1
LOCATION	WILLOW CREEK
FIELD	PINE PASS AREA
PROVINCE	BRITISH COLUMBIA

Permanent Datum GROUND LEVEL Elev. ____ K.B. ____
Log Measured from RIG FLOOR, 2.0 Ft. Above Perm. Datum D.F. ____
Well Depths Measured from RIG FLOOR G.L. ____

Run No.	ONE		
Date	1 FEBRUARY 73		
First Reading	1541		
Last Reading	0		
Footage Logged	1541		
Depth Reached	1542		
Depth Driller			
Casing Roke			
Casing Driller			
Fluid Type	WATER		
Liquid Level	0 FT		
Min. Diam.			
Operating Time	4 HOURS		
Truck No.	20		

Recorded By PETERSON | Witnessed By YOON

584

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	
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
GENERAL		SOURCE MODEL NO	MRC-N-SS-W
HOIST TRUCK NO	20	SERIAL NO	598
INSTRUMENT TRUCK NO		SPACING	19 INCH
TOOL SERIAL NO	CGN27U4A74	TYPE	AmBe
		STRENGTH	6.94×10^6 N/S

LOGGING DATA

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	NEUTRON T C SEC	NEUTRON SENS SETTINGS	NEUTRON ZERO DIV L OR R	NEUTRON API N UNITS PER LOG DIV
1	0	1541	12	4	17	0L	10	4	23	2L	30 CPS

REMARKS

PR-PP 75(3)A

Pr. Pine Pass 75(3)A. H-1

ROKE

OIL ENTERPRISES LTD. CALGARY, ALBERTA

SIDEWALL DENSILOG

FILE NO.	
LSD	
SEC	
TWP	
RGE	
W M	
COMPANY	PINE PASS DEVELOPMENT LTD.
WELL	H 1
LOCATION	WILLOW CREEK
FIELD	PINE PASS AREA
PROVINCE	BRITISH COLUMBIA
Other Services	GRN
Permanent Datum	GROUND LEVEL
Elev.	
Log Measured from	RIG FLOOR
Ft. Above Perm. Datum	
Well Depths Measured from	RIG FLOOR
K.B.	
CSG	
G.L.	

Run. No.	ONE
Date	1 FEBRUARY 73
First Reading	1537
Last Reading	0
Footage Logged	1537
Depth Reached	1540
Depth Driller	
Casing Roke	
Casing Driller	
Fluid Type	WATER
Liquid Level	0 FT
Min. Diam.	3 INCH
Rm @ °F	
Operating Time	4 HOURS
Truck No.	20
Recorded By	PETERSON
Witnessed By	YOON

584

LOGGING DATA

RUN NO.	DEPTHS FROM	DEPTHS TO	SPEED FT/MIN	T.C. SEC.	SENS SETTINGS	ZERO DIV. L OR R	CPS/DIV.
1	0	1537	9	3	60	2R	

REMARKS

CALIPER	DEPTHS	DENSITY
HOLE DIAMETER (INCHES)		CPS
		BULK DENSITY (GRAMS/CC)

PR-PP75(3)A

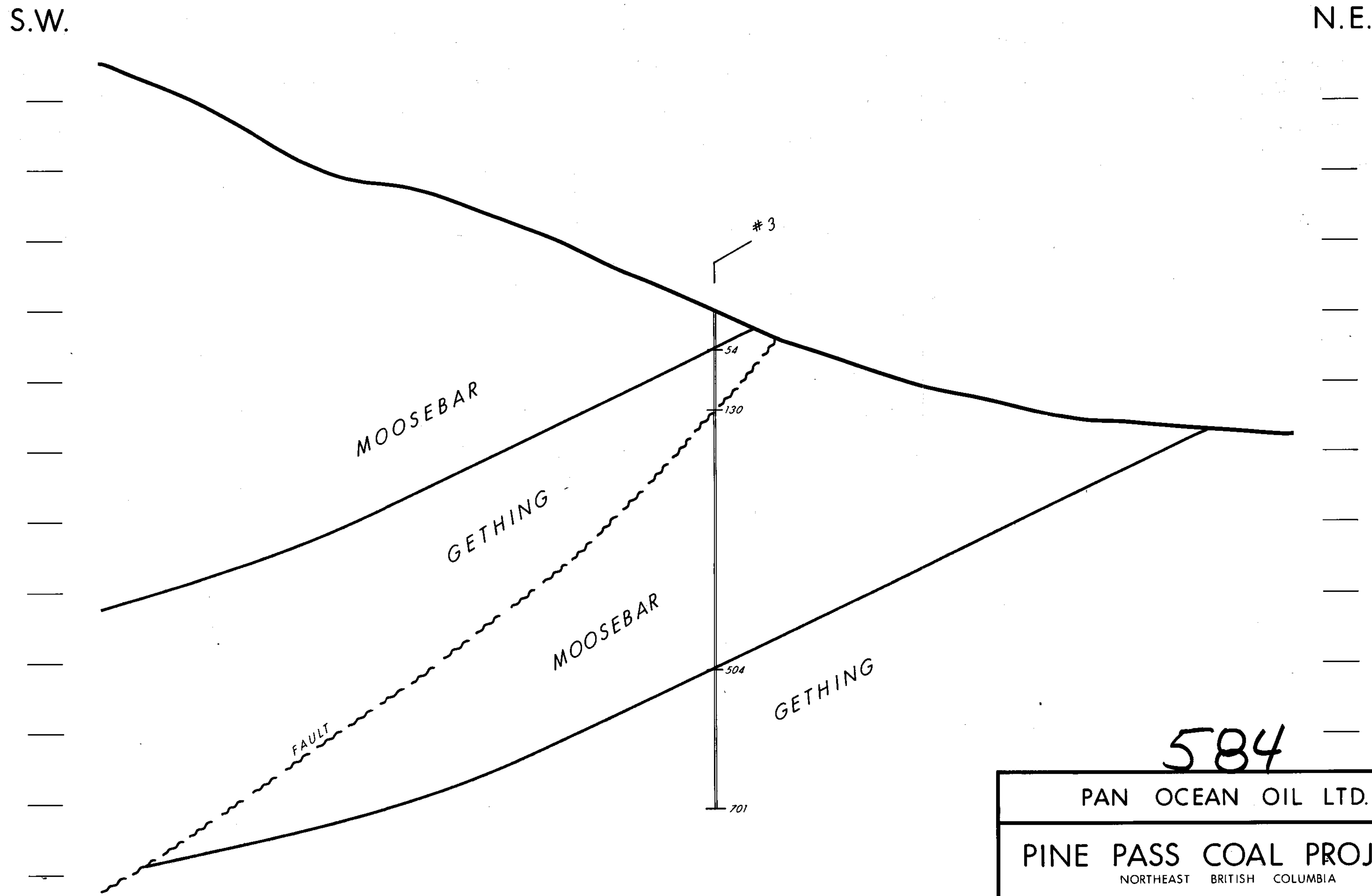


Figure 73/10

NOTE : Drill hole location and topography are approximate only.

584

PAN OCEAN OIL LTD.

PINE PASS COAL PROJECT

NORTHEAST BRITISH COLUMBIA

SCHEMATIC
STRUCTURAL CROSS SECTION
UPPER WILLOW CREEK

JUNE 1973

SCALE : Horizontal – 1 inch = 100 feet
Vertical – 1 inch = 100 feet

PAUL DYSON CONSULTANTS

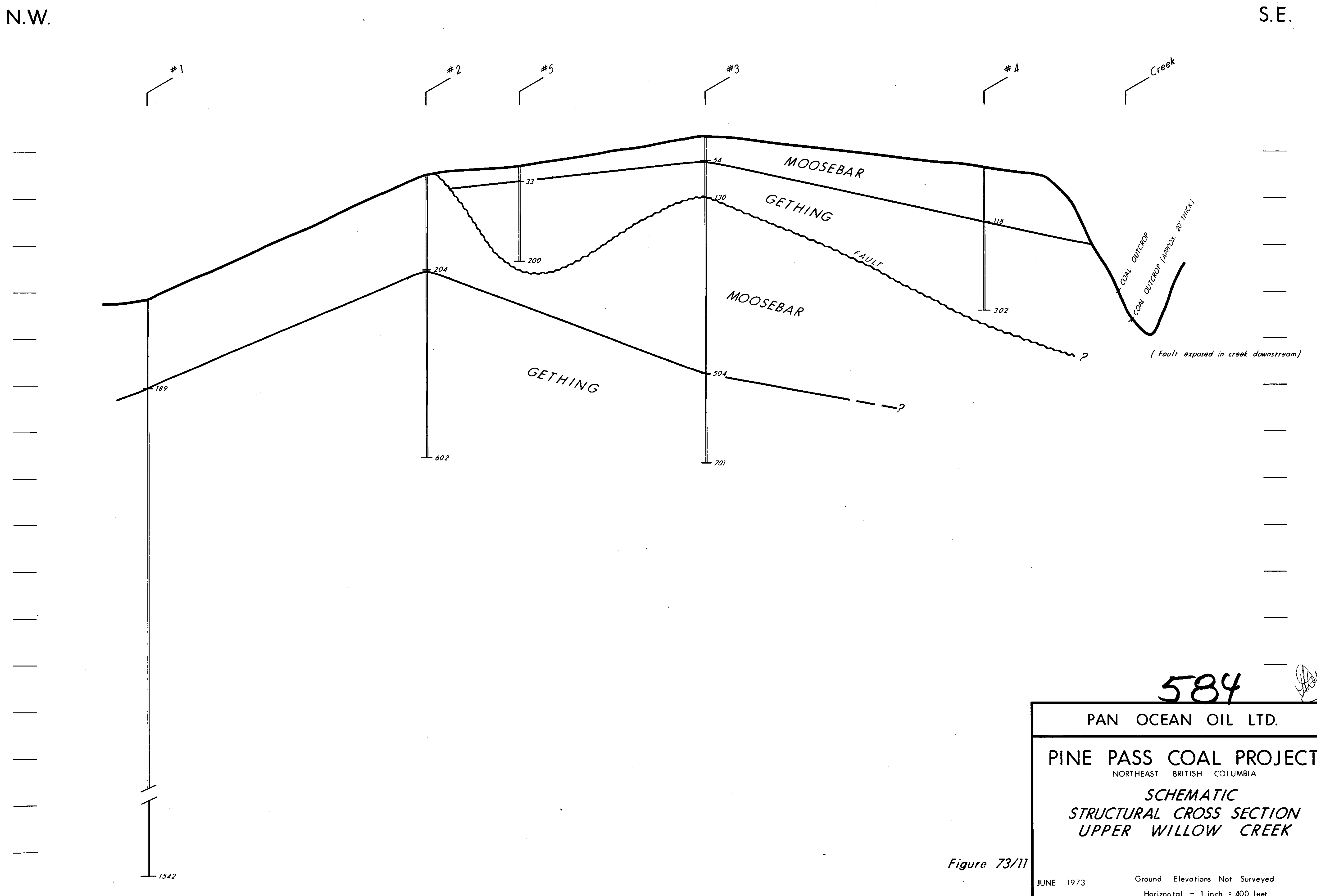


Figure 73/11

584

PAN OCEAN OIL LTD.

PINE PASS COAL PROJECT
NORTHEAST BRITISH COLUMBIA

SCHEMATIC
STRUCTURAL CROSS SECTION
UPPER WILLOW CREEK

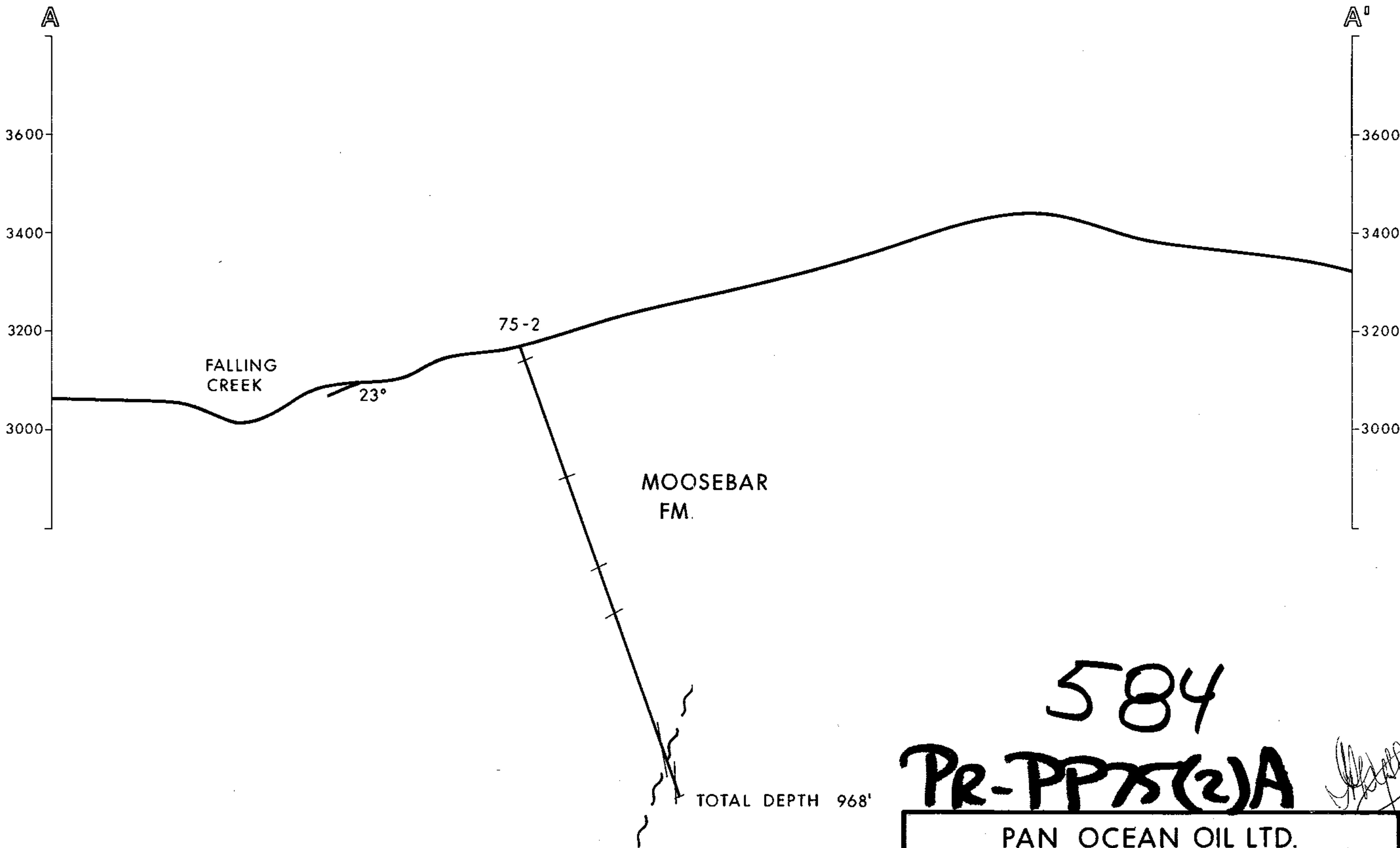
JUNE 1973

Ground Elevations Not Surveyed

SCALE : Horizontal – 1 inch = 400 feet
Vertical – 1 inch = 100 feet

PAUL DYSON CONSULTANTS

NOTE : Drill hole locations and topography are approximate only.



584

PR-PP75(2)A

PAN OCEAN OIL LTD.

PINE PASS COAL PROSPECT
NORTH EASTERN BRITISH COLUMBIA

STRUCTURAL CROSS SECTION
A - A'

1" = 200'

0 100 200 400 600

DATE: OCT./75

PAUL DYSON CONSULTANTS

Figure 75/6

584

Figure 75/7

PAN OCEAN OIL LTD.

PINE PASS COAL PROSPECT
NORTH EASTERN BRITISH COLUMBIA

STRUCTURAL CROSS SECTION
B - B'

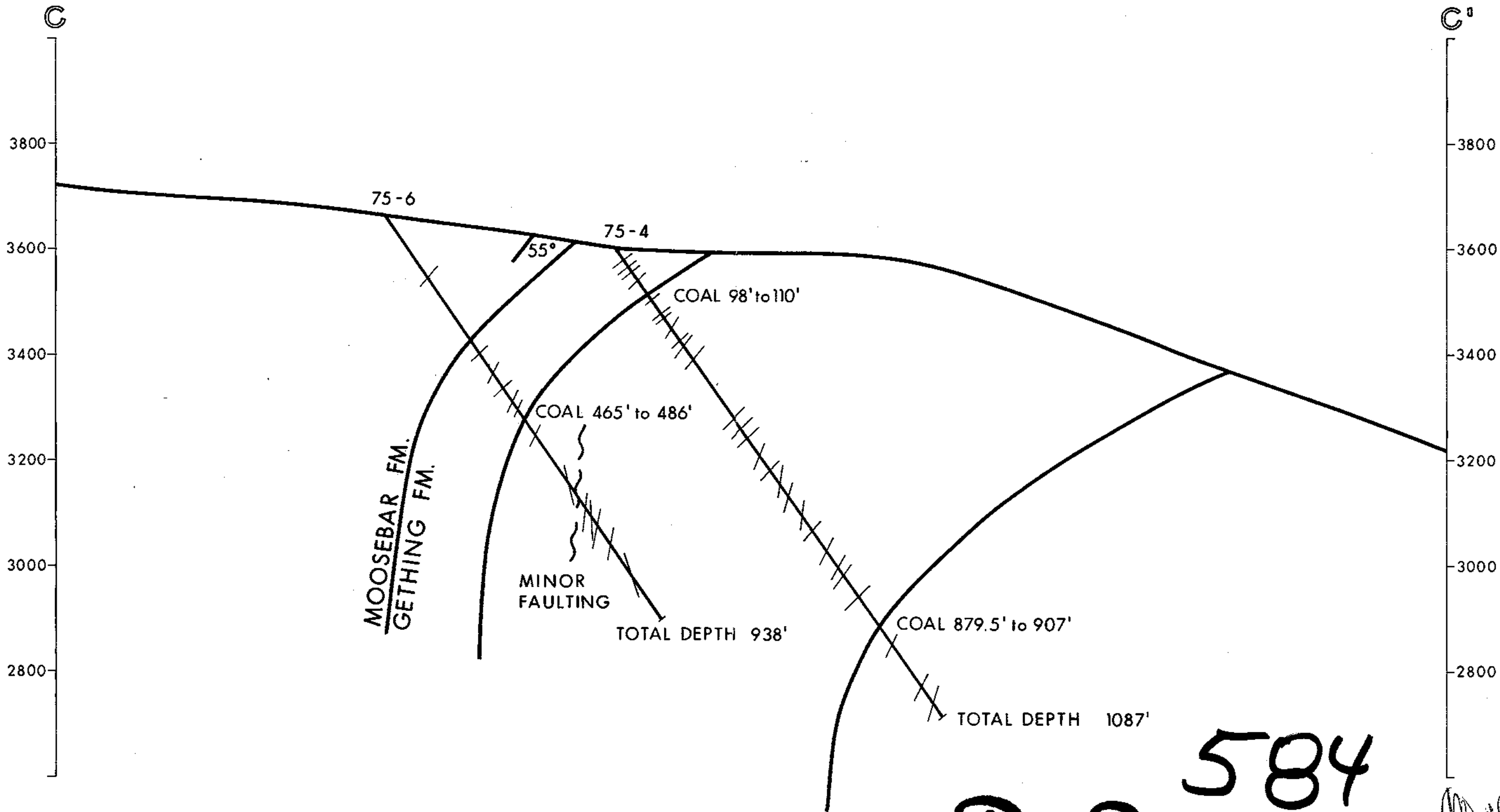
1" = 200'

0 100 200 400 600

DATE: OCT./75

PAUL DYSON CONSULTANTS


B'
B''
4400
4200
4000
3800
3600
3400
3200
3000
PROBABLE MAJOR FAULT
PRE - GETHING
75 - 7
GETHING
FORMATION
COAL 783' TO 787'
TOTAL DEPTH 1127'
CONGLOMERATE
(PROBABLY CADOMIN)
42°
PRE-GETHING
FORMATION
584
PR-PP 75(2)A
PAN OCEAN OIL LTD.
PINE PASS COAL PROSPECT
NORTH EASTERN BRITISH COLUMBIA
STRUCTURAL CROSS SECTION
B'-B''
1" = 200'
0 100 200 400 600
DATE: OCT./75
PAUL DYSON CONSULTANTS
Figure 75/8



584
PR-PP 75(2)A

PAN OCEAN OIL LTD.

PINE PASS COAL PROSPECT
NORTH EASTERN BRITISH COLUMBIA

STRUCTURAL CROSS SECTION
C - C'

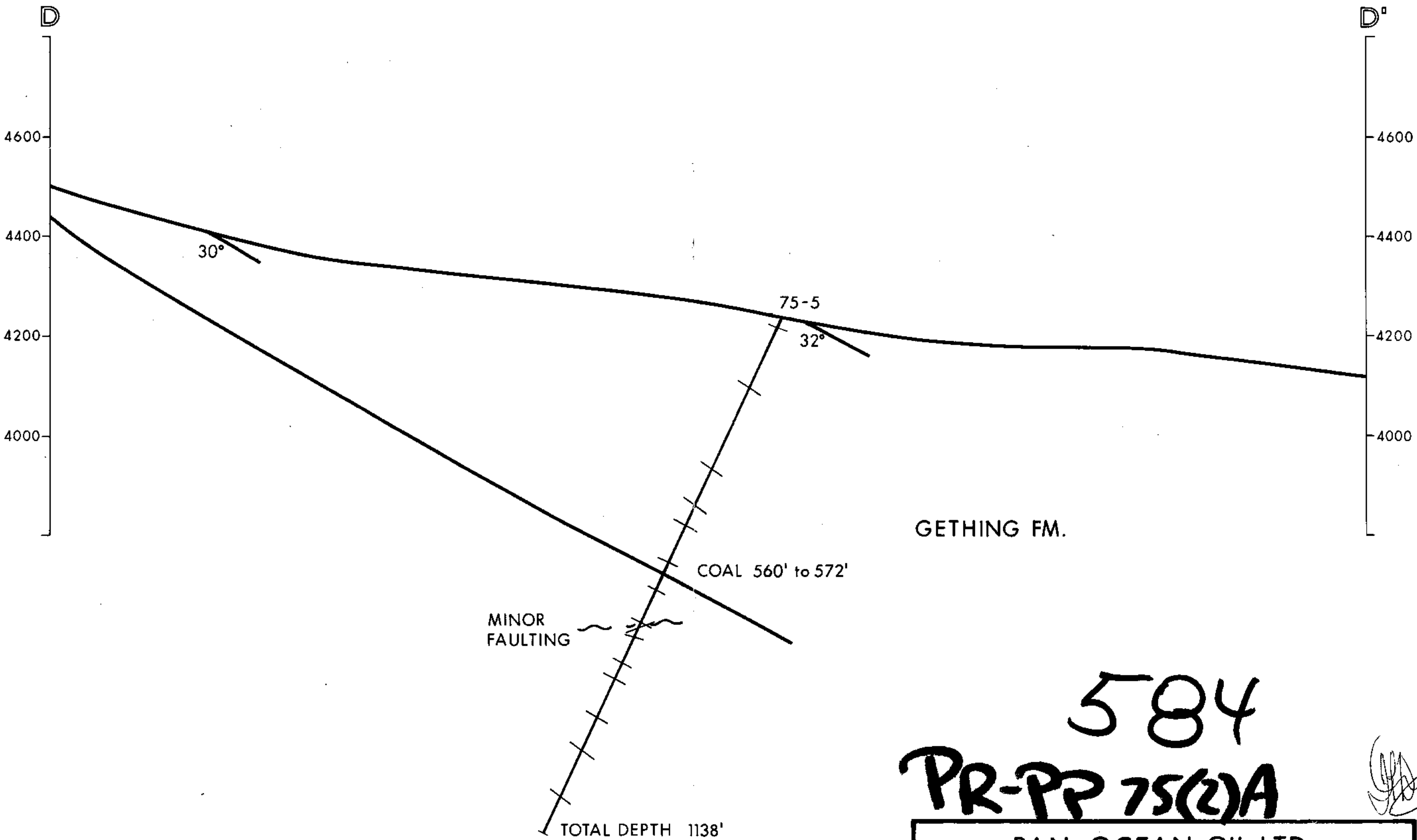
1" = 200'

0 100 200 400 600

DATE: OCT./75

PAUL DYSON CONSULTANTS

Figure 75/9



584

PR-PP 75(2)A

Figure 75/10

PAN OCEAN OIL LTD.

PINE PASS COAL PROSPECT
NORTH EASTERN BRITISH COLUMBIA

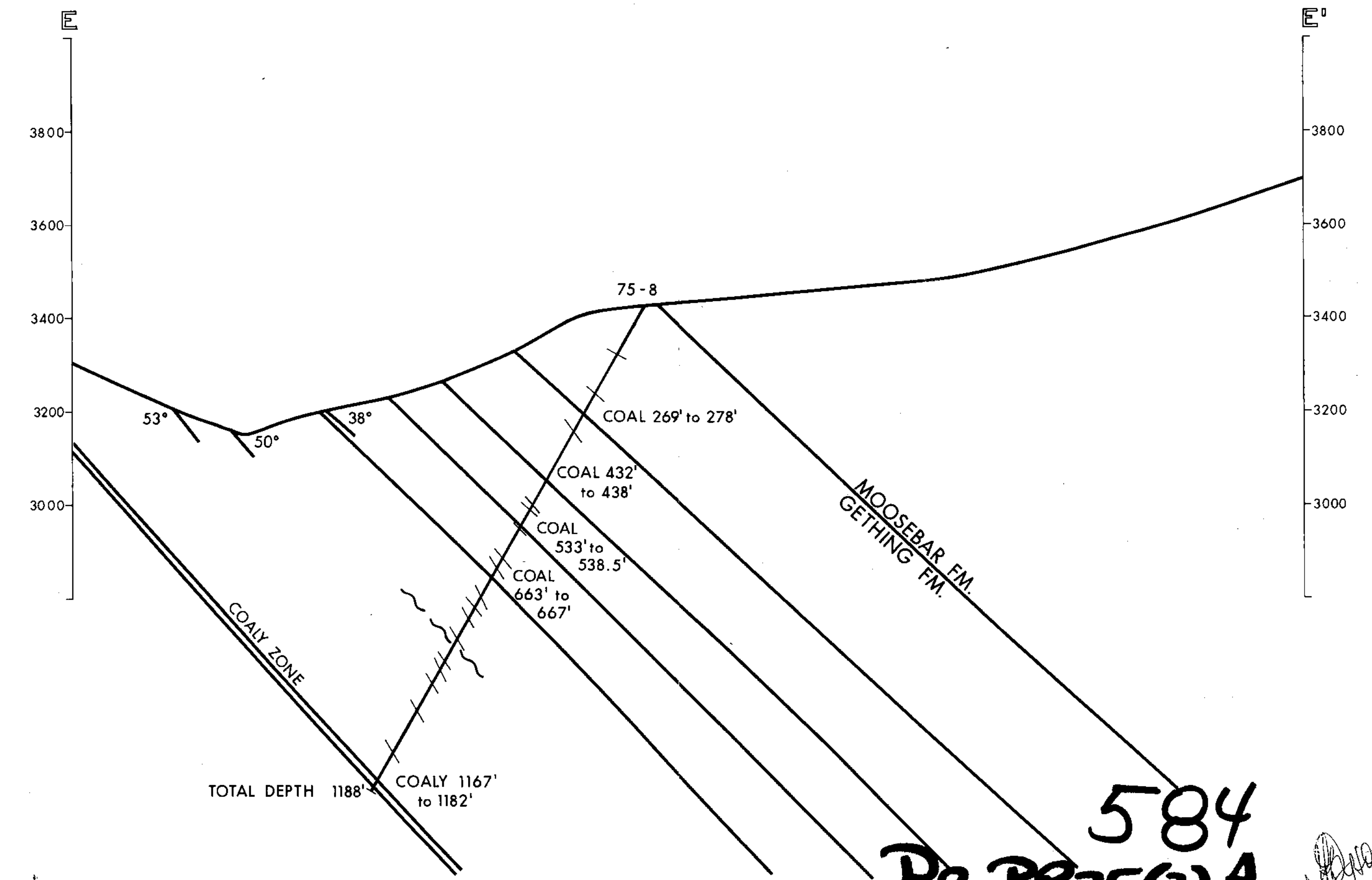
STRUCTURAL CROSS SECTION
D - D'

1" = 200'

0 100 200 400 600

DATE: OCT./75

PAUL DYSON CONSULTANTS



584
PR-PP75(2)A

PAN OCEAN OIL LTD.

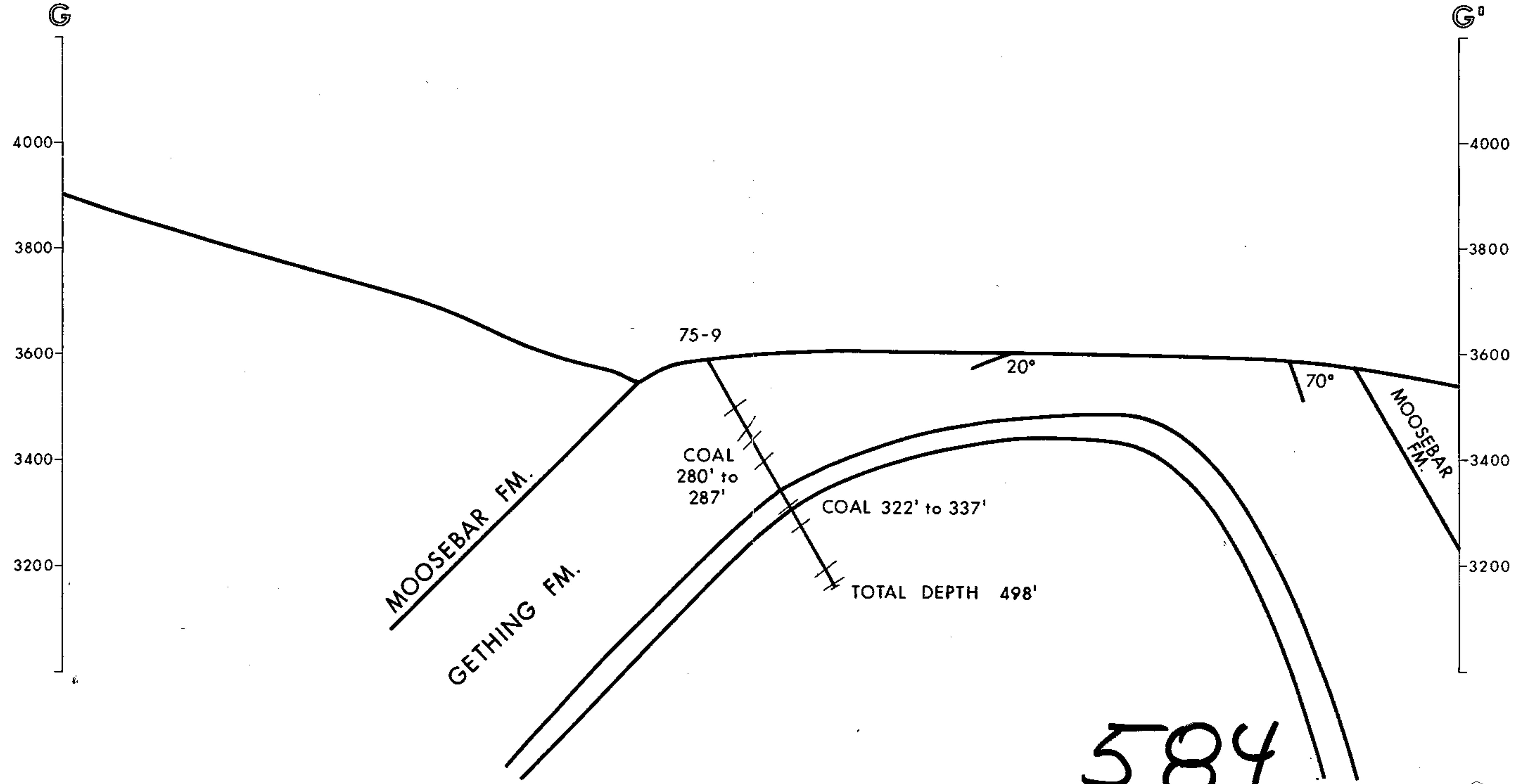
PINE PASS COAL PROSPECT
NORTH EASTERN BRITISH COLUMBIA

STRUCTURAL CROSS SECTION
E - E'

1" = 200'
0 100 200 400 600
DATE: OCT./75

PAUL DYSON CONSULTANTS

Figure 75/11



584

PR-PP75(2)A

Figure 75/12

PAN OCEAN OIL LTD.

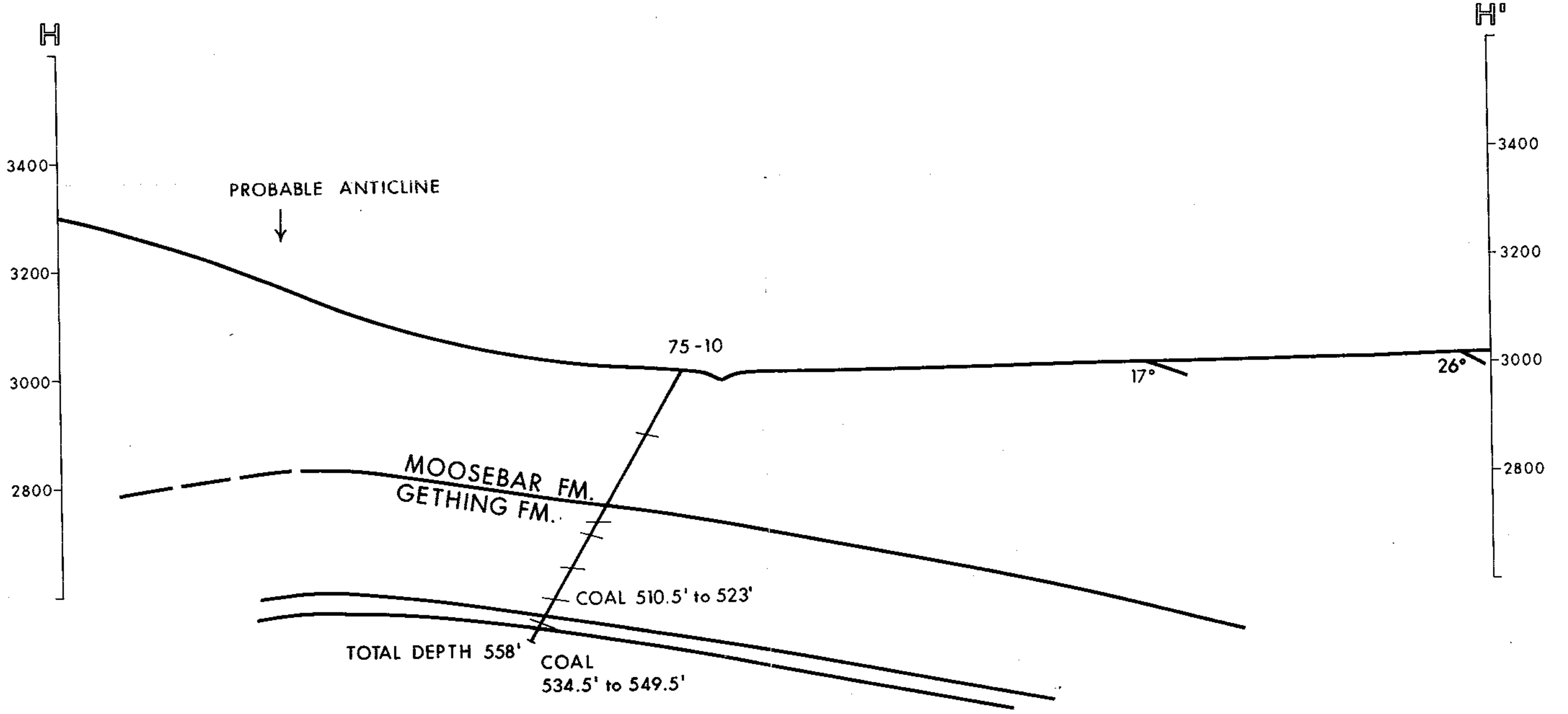
PINE PASS COAL PROSPECT
NORTH EASTERN BRITISH COLUMBIA

STRUCTURAL CROSS SECTION
G - G'

1" = 200'

0 100 200 400 600 DATE: OCT./75

PAUL DYSON CONSULTANTS



584

PR-PP 75(2)A

Figure 75/13

PAN OCEAN OIL LTD.

PINE PASS COAL PROSPECT
NORTH EASTERN BRITISH COLUMBIA

STRUCTURAL CROSS SECTION
H – H'

1" = 200'

0 100 200 400 600

DATE: OCT./75

PAUL DYSON CONSULTANTS

PAN OCEAN OIL LTD.

PINE PASS COAL PROJECT

N. E. BRITISH COLUMBIA

N.T.S. 93 - P - 5, 93 - O - 8, 93 - O - 9

COAL LICENCES 2905 - 2962, 3560 - 3591

VOLUME II

PREPARED BY :

PAUL DYSON CONSULTANTS
CALGARY, ALBERTA

OCT. 1975

PR-PINE PASS 75(4)A

PINE PASS COAL PROJECT

NORTHEAST BRITISH COLUMBIA

(1974 - 1975)

VOLUME II

COAL QUALITY

Prepared for: Pan Ocean Oil Ltd.
Calgary, Alberta

by: Paul Dyson Consultants
Calgary, Alberta

October 1975

GWS

BIRTLEY ENGINEERING (CANADA) LTD.

Subsidiary of Great West Steel Industries Ltd.

5112-3rd ST. S.E., CALGARY, ALBERTA T2H 1J6 PHONE 403-253-3719

REPORT NO. B-0076

CONFIDENTIAL

OPEN FILE

REPORT ON THE QUALITY OF COAL FROM THE PINE PASS AREA, BRITISH COLUMBIA

TO

PINE PASS DEVELOPMENT CORPORATION

October, 1975

Submitted By:

Dr. D. F. Symonds, P. Eng.
General Manager

&

C. Gange-Harris
Coal Petrography Department

S Y N O P S I S

THE SAMPLES TESTED TO DATE INDICATE THAT THE PINE PASS PROPERTY CONTAINS LOW AND, LOW MEDIUM VOLATILE BITUMINOUS COAL. IT SEEMS PROBABLE THAT A CLEAN COAL CAN BE PRODUCED AT A YIELD IN EXCESS OF 90%, AN ASH CONTENT OF LESS THAN 5%, AND SULPHUR CONTENT OF APPROXIMATELY 0.8%.

THE F.S.I. VALUES ARE LOW, BUT IT IS FELT THAT THE COAL COULD BE AN EXCELLENT COMPOSITE OF A BLEND IN CONVENTIONAL COKE MAKING.

BULK SAMPLES SHOULD BE EXTRACTED AND REPRESENTATIVE CLEAN COAL SAMPLES SENT TO POTENTIAL MARKETS FOR CONFIRMATION OF ITS WORTH IN A BLEND.

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7.5
.14

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GWS

BIRTLEY ENGINEERING (CANADA) LTD.

Subsidiary of Great West Steel Industries Ltd.

5112-3rd ST. S.E., CALGARY, ALBERTA T2H 1J6 PHONE 403-253-3719

QUALITY OF COAL FROM PINE PASS AREA

INTRODUCTION

The purpose of the testing programme was:-

a) To examine the washability and coking characteristics of the Diamond Drill Hole Samples.

b) Correlation of various coal layers in the Diamond Drill Holes in the Pine Pass Area.

c) To find by Petrographic examination, the composition of three (3) Diamond Drill Holes in the Pine Pass Area.

The programme could be divided into four sections, mainly:-

a) Geology and correlation of samples.

b) Sink-Float analysis.

c) Washability characteristics.

d) Maceral Composition and Rank Determination.

SECTION 1

1.1 GEOLOGY

The Pine Pass area is located in the North East of British Columbia, approximately 16 miles west of Chetwynd and 18 miles north of the Sukunka Area. The coal deposits are all of Lower Cretaceous age and occur in the Gething Formation. The Gething Formation is a northwestern extension of the Luscar Formation of the lower foothills belt of Alberta. The Gething and Cadomin Formations belong to the Bullhead group. There are three known significant coal outcrops in the Pine Pass Area and these range in thickness from seven (7) feet up to fifteen (15) feet. In the perios 1946 - 1950, there were a number of holes drilled and the signigicant coal occurances varied in range from nine (9) feet thick up to twenty-seven (27) feet thick. Drilling programs were also carried out in 1973 and the results for these have been included in a previous report.

For further geological information, consult the paper by Mr. P. Dyson, "Geology of the Gething Coal Deposits, Peach and Pine River Areas North Eastern British Columbia." 1973, presented at the 75th Annual General Meeting of CIM, Vancouver, B. C. In addition, a detailed geological report is to be submitted by Paul Dyson Consultants Ltd.

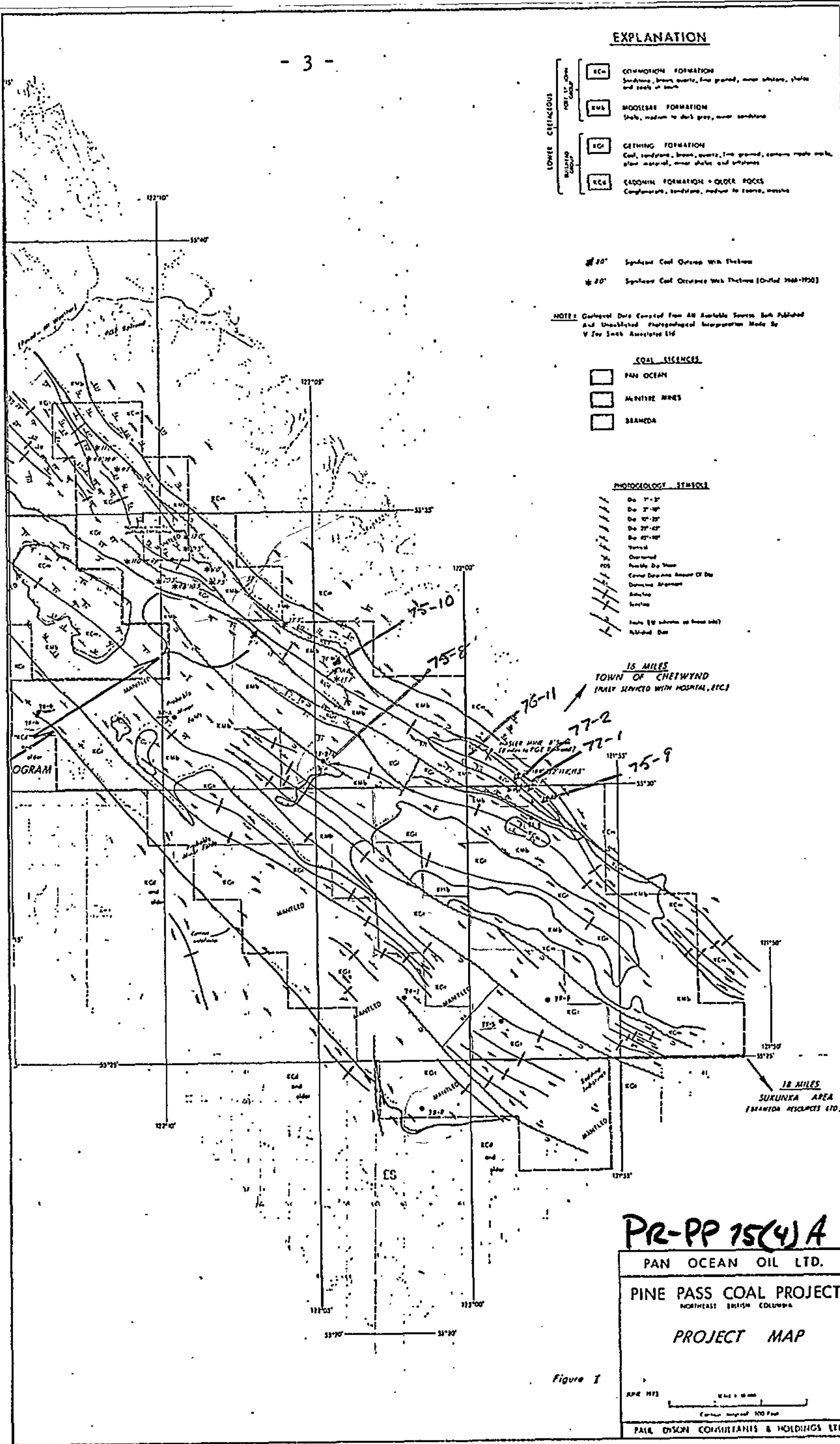

EXPLANATION
LOWER CRETACEOUS
COMMOTION FORMATION
MOOSEBAR FORMATION
GETHING FORMATION
CADOMIN FORMATION + OLDER ROCKS
COAL LICENCES
PAN OCEAN
McINTYRE MINES
BRAMEDA
16 MILES
TOWN OF CHETWYND
(FULLY SERVICED WITH HOSPITAL, ETC.)
75-10
75-8
76-11
77-2
77-1
75-9
MANTLED
18 MILES
SUKUNKA AREA
(BRAMEDA RESOURCES LTD)
PR-PP 15(4) A
PAN OCEAN OIL LTD.
PINE PASS COAL PROJECT
NORTHEAST BRITISH COLUMBIA
PROJECT MAP
PAUL DYSON CONSULTANTS & HOLDINGS LTD.

Figure 1

1.2 LOCATION

The area is located between 122° 20' longditude, 55° 40' latitude and 121° 50' longditude, 55° 24' latitude. The location of the boreholes drilled can be found on the map in Figure 1. The depth of each drillhole can be obtained from Table 1.

1.3 TRANSPORTATION FACILITIES

The area is approximately 16 miles southwest of Chetwynd. To the north, approximately 1/2 miles from the Pine Pass Boundry, is the P.G.E. Railway.

1.4 AGGREGATE THICKNESS OF COAL

The footages for the aggregate and seam thickness are taken from lithological charts made of each borehole. When the thickness of the seam was taken into account, small bandings of mudstone and shale were left in the total. The aggregate thickness varies in range from twenty-seven (27) feet up to approximately eighty-three (83) feet. The seam thickness varies in range from eight (8) feet to twenty (20) feet. These figures can be found in Table 1. Note, these are not necessarily true seam thicknessess, but rather intercepted thicknessess in the borehole.

TABLE 1

AGGREGATE AND SEAM THICKNESS OF COAL IN PINE PASS

SAMPLE	FOOTAGE TOTAL	AGGREGATE THICKNESS	THICKEST SEAM
DDH #75-3	0 - 897 feet	44.2 feet	12.2 feet
DDH #75-4	0 - 1087 feet	59.8 feet	17.5 feet
DDH #75-5	0 - 1138 feet	33.5 feet	8.0 feet
DDH #75-6	0 - 938 feet	27.4 feet	20.0 feet
DDH #75-8	0 - 1188 feet	83.3 feet	14.0 feet
DDH #75-9	0 - 498 feet	29.5 feet	15.0 feet
DDH #75-10	0 - 558 feet	33.3 feet	15.0 feet

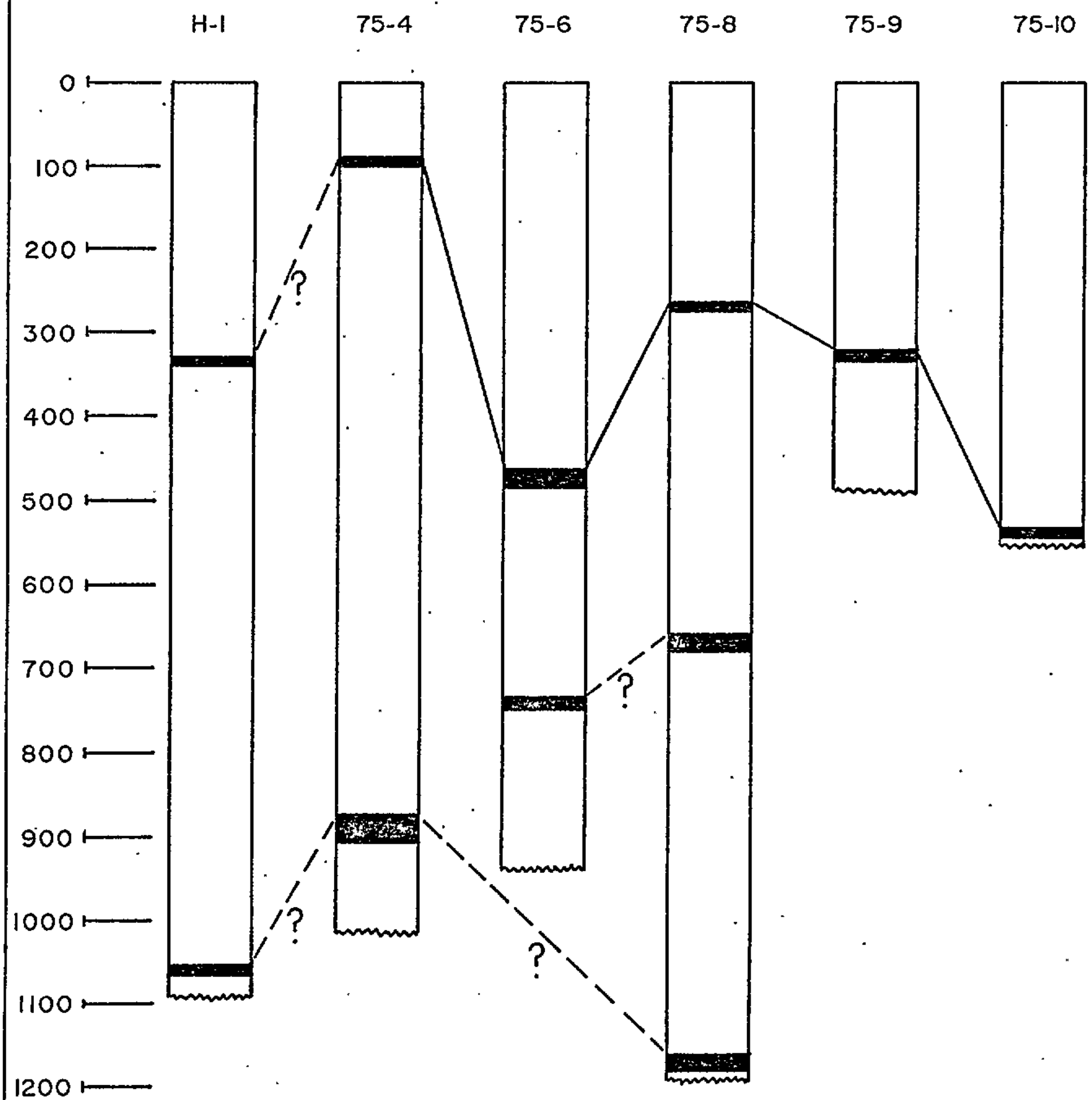


FIGURE 2

PR-PP 75(4)A

BIRTLEY ENGINEERING (CANADA) LTD.

Title CORRELATIONS OF SEAM IN PINE PASS AREA.	Date OCT, 22, 1975 Drawn K. M. LAU

SECTION 2

SINK - FLOAT ANALYSIS

2.1 SAMPLE RECEPTION

All samples were received at the Coal Science & Minerals Testing Plant packed in polyethylene bags. Since the samples were extracted from core at different footages the quantities available for testing were small.

2.2 PRESENTATION OF RESULTS

Results for each hole are presented sequentially. In many of the samples there was sufficient information available to present size fraction calculations which in turn would provide washability curves. The 1/4" x 28 mesh fraction was computed, but only where there was sufficient data available. The original point count on the reflectance of the pellets is also included in addition to the maceral counts. This, hopefully, should facilitate easier understanding of all reflectance and Petrographic data.

2.1.1 TABLES FOR WASHABILITY CURVE CALCULATIONS

The data for production of the washability curves was compiled from the 1/4" x 28 mesh where there was sufficient material enabling this to be done.

For an explanation of the use of these tables, consult the Birtley Engineering publication "Coal Processing in Practice", Parts 1 and 2.

SECTION 3

PETROGRAPHY AND REFLECTANCE DATA

3.1 TYPES OF ANALYSIS

There were two (2) types of analysis carried out, namely petrographic identification of the maceral constituents and Rank Determinations on the vitrinite content of the samples. Maceral analysis is carried out to enable all the constituents to be identified, these constituents are then classified as to Reactives, Semi-Inerts and Inerts. In order to arrive at a representative portion of constituents in a given sample, traverses, under oil immersion, are made across the face of the pellet until a minimum of five hundred (500) points are accounted for.

Rank Determinations are made to obtain the degree of coalification and are taken solely on the vitrinite content of the coal, since the reflective properties of vitrinite are proportional to the volatile matter content of the coal. When measuring reflectance, hereafter referred to as R_o, to obtain the Mean Maximum Reflectance, the stage has to be rotated through 360°. Only in this manner can the Mean Maximum R_o of vitrinite be obtained.

It should be borne in mind that the three (3) borehole samples run were all below 65 mesh and subsequently were not the ideal viewing field for R_o. In place of rotation, many of the readings were spot readings. Some degree of reliability can be expected from spot readings, in that, when the light source from the photo-electric cell hits the polished surface of the vitrinite, the very first reading is closer to the maximum than subsequent spot readings. This has yet to be proven conclusively, but seems to afford some degree of reliability.

3.2 PREPARATION OF SAMPLES

The three (3) samples required no crushing or riffling, due to the size fraction that remained. Each sample was mixed in with thermoplastic at a ratio of one part to two parts coal. They were then subjected to heating and cooling, and the pellets were polished. It is important to note that unless the surface of the pellet being polished is done in gradual and successive grits, then a plucking and tearing action on the coal mars the surface to be studied irreperably and subsequent analysis is extremely difficult to carry out. After the three pellets were polished they were allowed to sit in a dessicator for one (1) day. Tests have shown that at the end of a 24 hour period, Mean Maximum R_o readings can be obtained.

3.3 MACERAL COMPOSITION

Maceral Composition of the three (3) samples is based on the nomenclature found in the International Committee Handbook of Petrology, Table 2. Here again due to the difficulty in interpretation of the small fragments, the interpretations were based solely on experience and the ability of the operator. Interpretation from operator to operator will also vary and this is dependent on many factors. One area, open to a great deal of discussion and varying interpretation is the Pseudo-Vitrinite content versus the Vitrinite content. The Vitrinite and Pseudo-Vitrinite contents can be seen in Table 2. *In Low Rank coals predominence of Pseudo-Vitrinite would be classed as Semi-* Inerts and only one third would be added to the reactives. However, as can be seen in Table 3 , this difference decreases with coal of higher rank. This Pseudo-Vitrinite content or the ability to ascertain Pseudo-Vitrinite lowers the calculated coke stability to very close to the actual stability.

3.4 REFLECTANCE DATA

Reflectance data can be found in Table 4. Each pellet has the minimum fifty (50) points required. Every five points, the microscope and photo-electric cell are checked against a glass standard. The variation should be no more than .02%. However, only the standard readings at the start and end of each twenty-five (25) points is recorded.[1] These are then averaged out to obtain the average R_o%. The results are further compared to Kotter's and volatile matter content is obtained. As can be seen in Figure 5, the

1 Once the equipment is stabilized then 50 readings are taken

TYPICAL ANALYSES OF VITRINOID (V) AND PSEUDO-VITRINITE (PV) IN APPALACHIAN COKING COALS

TABLE 2

V.M. % d.a.f.	Reflectance in Oil ($\bar{R}_o$)											Composition vol. % of Sample		
	Reflectance Types*													
	11	12	13	14	15	16	17	$\bar{R}_oV + \bar{R}_oPV$	$\bar{R}_oV$	$\bar{R}_oPV$	$\bar{R}_oPV - \bar{R}_oV$	V	PV	Weathered V
								High-Volatile						
40	1							0.859						
									0.800		0.126	71.6	28.0	0.4
	2									0.926				
41								0.839						
									0.802		0.076	73.5	26.2	0.3
										0.878				
								Medium-Volatile						
31	56	17						1.137						
	42								1.090		0.083	67.2	32.8	0.0
	66	31								1.173				
27		66	33	1				1.280						
		89	13						1.263					
		49	49	2						1.295	0.032	80.3	19.5	0.2
								Low-Volatile						
21			3	39	46	10	2	1.518						
			5	52	41	2			1.494					
				22	51	22	5			1.553	0.059	79.4	20.1	0.5
19					2	56	42	1.683						
					6	71	23		1.661					
						47	53			1.696	0.035	79.9	20.0	0.1
17						3	54	1.786						
						8	66		1.768					
							48			1.796	0.028	53.0	47.0	0.0

(Taken From L. G. Benedict, R. R. Thompson, J. J. Shigo, R.P. Aikman)

TABLE 4

German, Sydney and Pittsburgh Classification[1]

(From Hacquebard, 1950)

<table>
<tr><th>Percentage of Vitrinite</th><th>GERMANY (E. Stach, 1935)</th><th colspan="2">SYDNEY (P.A. Hacquebard)</th><th colspan="2">PITTSBURGH (R. Thiessen and B.C. Parks, 1948)</th><th>Percentage of Opaque Matter</th></tr>
<tr><td>100-96%</td><td>VITRIT</td><td>VITRAIN</td><td rowspan="2">BRIGHT COAL</td><td rowspan="2" colspan="2">BRIGHT COAL</td><td rowspan="2">LESS THAN 20%</td></tr>
<tr><td>95-51%</td><td>HUMODURIT</td><td>CLARAIN</td></tr>
<tr><td>50-11%</td><td>EUDURIT</td><td>CLARO-DURAIN</td><td rowspan="2">DULL COAL</td><td>SEMI-SPLINT</td><td rowspan="2">DULL COAL</td><td>FROM 20-30%</td></tr>
<tr><td>10- 0%</td><td>OPAKDURIT</td><td>DURAIN</td><td>SPLINT</td><td>MORE THAN 30%</td></tr>
</table>

[1]Fusain has been omitted from this table because no difference of opinion exists regarding this ingredient.

compilation of R_o plus the percentage of macerals can give a reliable guide to the predicted stability.

3.5 REVISED MACERAL DATA

The maceral data for all three (3) samples was revised owing to the R_o and Reactives versus stability indices. On further examination all the Semi-Fusinite in the Semi-Inerts column was included in the Reactives column. This revision tallied more closely with the stability indices then did the previous coke calculations. It must be taken into account that any predicted coke stabilities are reflected only by material below 65 mesh. The revision was carried out because the initial predicted stabilities were far below what could be expected with the respective Rank Determinations of the samples.

3.6 COKE STABILITY CALCULATIONS

The coke stability calculations are described fully by Shipiro etal, 1961. This is based on the surmise that Macerals can be divided into two (2) groups, namely, Reactives and Inerts. Sulphur and ash contents are required for coke stability characteristics.

3.7 VOLATILE MATTER AND STABILITY INDICES

In order to obtain the percentage volatile matter of the vitrinite content of the coal, the average reflectance of each coal was obtained, Table 6, and using the right hand side of Kotter's curve, Figure 3, the volatile matter of the coal is obtained. Conversely using the left hand side of Kotter's curve and the average R_o we are able to ascertain the Carbon content of the vitrinite.

In addition, to obtain an approximate Stability Index, without using Shapiro and Gray's calculation, we use the correlation of R_o against Reactives, Figure 5. In general this tends to provide an excellent guideline as to the approximate Stability Indices to be expected.

TABLE 4

% OF VITRINITES TO PSEUDO-VITRINITES

SAMPLE	% VITRINITES	% PSEUDO-VITRINITES	% BANDED VITRINITES
75-4	48.2	17.9	14.5
75-8	25.3	17.3	20.0
75-9	22.8	11.1	22.3

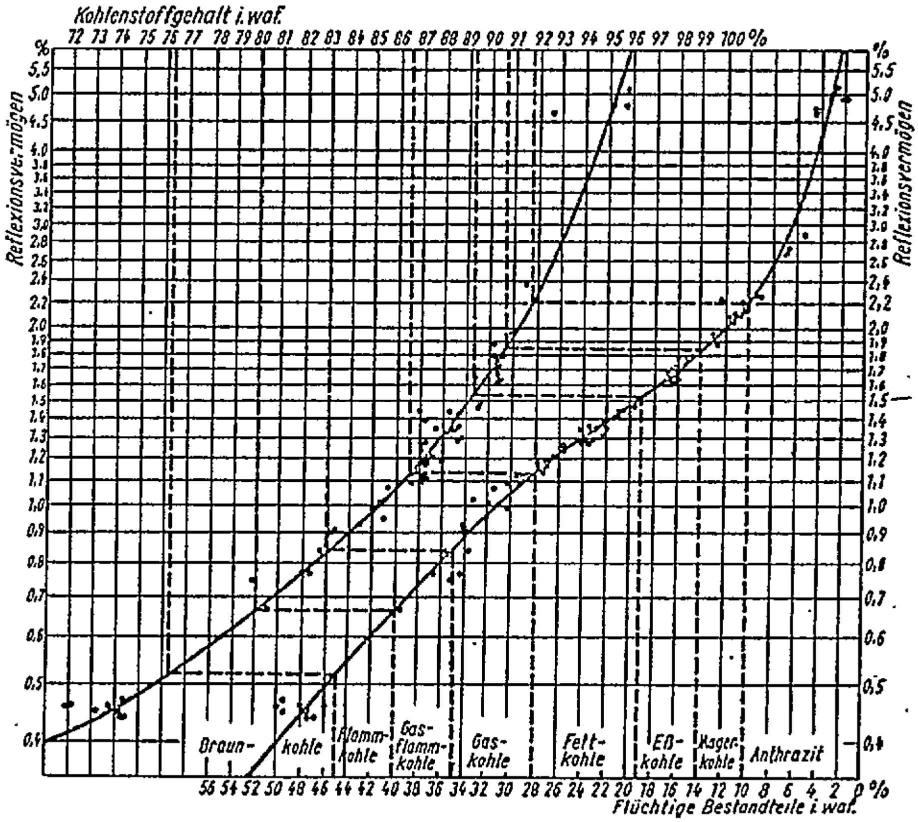
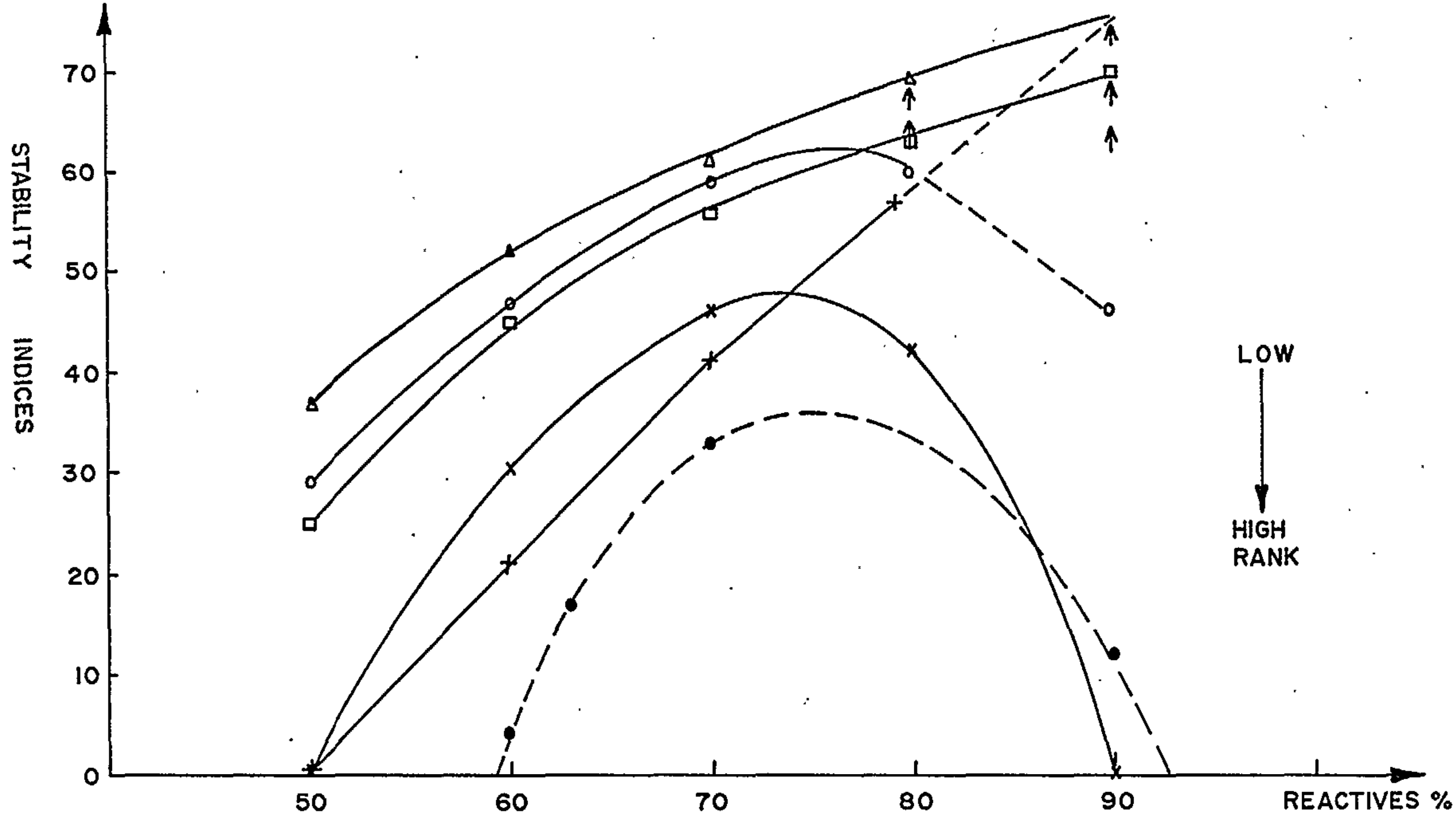


FIGURE 3

PR-PP 75(4)A

BIRTLEY ENGINEERING (CANADA) LTD.

Title.	CORRELATION BETWEEN MAXIMUM REFLECTANCE, AND VOLATILE MATTER, AND CARBON CONTENT.	Drawn. L.Bailey Date. Oct. 17/75



- ● V7 V8 V9
- x V8 V9 V10
- o V10 V11 V12
- △ V12 V13 V14
- □ V14 V15 V16
- + V16 V17 V18

FIGURE 4

BIRTLEY ENGINEERING (CANADA) LTD.

Title.

GRAPH CORRELATING % REACTIVES Ro AGAINST STABILITY INDICIES.

Drawn.
L. Bailey

Date.
Oct. 20/75

PINE PASS DEV.

P.P. 75-3 18.0' - 23.5'

June 27, 1975

LAB NO. 3057

SIZE AND RAW ANALYSES

Size Fraction	Wt %	Ash %	Cum Wt %	Cum Ash %	F.S.I.
1/4" x 28M	85.6	20.3	85.6	20.3	1
28M x 100M	10.8	17.3	96.4	20.0	2
100M x 0	3.6	17.4	100.0	19.9	1-1/2

	R.M.	Ash %	Vol.	F.C.	F.S.I.
Head Raw	0.7	19.8	18.2	61.3	1

PINE PASS DEV. June 27, 1975

P.O. 75-3 18.0' - 23.5' LAB NO. 3057

SINK-FLOAT ANALYSES 1/4" x 28M

S.G. Fraction	Wt %	Ash %	Cum Wt %	Cum Ash %	F.S.I.
-1.30	17.7	2.4	17.7	2.4	5 1/2
1.30-1.35	5.4	4.9	23.1	3.0	2
1.35-1.40	11.3	7.0	34.4	4.3	1 1/2
1.40-1.45	19.8	13.1	54.2	7.5	1
1.45-1.50	3.7	18.8	57.9	8.3	1
1.50-1.60	26.8	24.6	84.7	13.4	1
1.60-1.70	6.8	33.4	91.5	14.9	1
1.70-1.80	1.1	42.0	92.6	15.2	1
1.80-1.90	0.5	48.1	93.1	15.4	1/2
+1.90	6.9	90.3	100.0	20.6	N.A.

PINE PASS DEV.

June 27, 1975

P.O. 75-3   18.0' - 23.5'

LAB NO. 3057

FROTH FLOTATION ANALYSES   28M x 0

F.F. Fraction	Wt %	Ash %	Cum Wt %	Cum Ash %	F.S.I.
Stage I	79.4	12.7	79.4	12.7	2
Stage II	4.9	18.1	84.3	13.0	1 1/2
Tails	15.7	40.3	100.0	17.3	1

F.F. Parameters

Pulp Density	-	10%
Reagent Dosage	-	0.48 lbs/Ton Kerosene:MIBC (4:1)
Conditioning Time	-	1 minute
Stage I	-	1st minute froth
Stage II	-	2nd minute froth

PINE PASS 75-3 @ 18.0'-23.5' .25 X 28M

--DIRECT--					--CUM FLOATS--		--CUM SINKS--			+-0.1 DISTR	
S.G.	WT>	ASH>	WT> ASH TT	CUM WT> ASHTT	WT>	ASH>	SINK WT ASH>	WT>	ASH>	S.G.	WT>
1	2	3	4	5	6	7	8	9	10	11	12
1.30	17.70	2.40	.42	.42	17.70	2.40	20.14	82.30	24.47	1.30	0.00
1.35	5.40	4.90	.26	.69	23.10	2.98	19.88	76.90	25.85	1.40	40.20
1.40	11.30	7.00	.79	1.48	34.40	4.30	19.09	65.60	29.10	1.50	50.30
1.45	19.80	13.10	2.59	4.07	54.20	7.52	16.49	45.80	36.01	1.60	33.60
1.50	3.70	18.80	.70	4.77	57.90	8.24	15.80	42.10	37.52	1.70	7.90
1.60	26.80	24.60	6.59	11.36	84.70	13.42	9.20	15.30	60.16	1.80	1.60
1.70	6.80	33.40	2.27	13.63	91.50	14.90	6.93	8.50	81.57	1.90	0.00
1.80	1.10	42.00	.46	14.10	92.60	15.22	6.47	7.40	87.45	2.00	0.00
1.90	.50	48.10	.24	14.34	93.10	15.40	6.23	6.90	90.30	2.10	0.00
9.99	6.90	90.30	6.23	20.57	100.00	20.57	0.00	.00	0.00	2.20	0.00

BIRTLEY ENGINEERING

PINE PASS DEV.

June 27, 1975

Hole No. P.P. 75-3 Footage: 197' - 202'

LAB NO. 3058

SIZE AND RAW ANALYSES

Size Fraction	Wt %	Ash %	Cum Wt %	Cum Ash %	F.S.I.
1/4" x 28M	85.5	45.3	85.5	45.3	1
28M x 100M	10.6	32.7	96.1	43.9	6
100M x 0	3.9	31.9	100.0	43.4	4 1/2

	Ash %	R.M. %	V.M. %	F.C. %	F.S.I.
1/4" x 0	42.9	1.0	14.3	41.8	1 1/2

PINE PASS DEV. June 27, 1975

Hole No. P.P. 75-3 Footage: 197' - 202' LAB NO. 3058

SINK-FLOAT ANALYSES 1/4" x 28 Mesh

S.G. Fraction	Wt %	Ash %	Cum Wt %	Cum Ash %	F.S.I.
-1.30	14.2	6.3	14.2	6.3	9
1.30-1.35	3.9	6.5	18.1	6.3	4
1.35-1.40	5.0	9.2	23.1	7.0	3 1/2
1.40-1.45	11.0	14.6	34.1	9.4	2
1.45-1.50	1.7	20.6	35.8	10.0	1 1/2
1.50-1.60	6.1	27.8	41.9	12.6	1
1.60-1.70	4.7	37.6	46.6	15.1	1
1.70-1.80	5.7	49.1	52.3	18.8	1
1.80-1.90	5.0	57.8	57.3	22.2	1
+1.90	42.7	76.4	100.0	45.3	N.A.

PINE PASS DEV.

June 27, 1975

Hole No. P.P. 75-3 Footage: 197' - 202'

LAB NO. 3058

SINK-FLOAT ANALYSES 28 Mesh x 100 Mesh

S.G. Fraction	Wt %	Ash %	Cum Wt %	Cum Ash %	F.S.I.
-1.45	52.3	7.9	52.3	7.9	9
1.45-1.60	8.2	23.6	60.5	10.0	2 1/2
+1.60	39.5	68.2	100.0	33.0	1/2

PINE PASS DEV.

June 27, 1975

Hole No. P.P. 75-3   Footage: 197' - 202'

LAB NO. 3058

FROTH FLOTATION ANALYSES   28 Mesh x 0

F.F. Fraction	Wt %	Ash %	Cum Wt %	Cum Ash %	F.S.I.
Stage I	65.2	16.9	65.2	16.9	8
Stage II	5.6	38.3	70.8	18.6	2
Tails	29.2	65.2	100.0	32.2	1

F.F. Parameters

Pulp Density	-	10%
Reagent Dosage	-	0.48 lbs/Ton Kerosene:MIBC (4:1)
Conditioning Time	-	1 minute
Stage I	-	1st minute froth
Stage II	-	2nd minute froth

Birtley Engineering
Subsidiary of Great West Steel Industries

?PINE PASS   75-3 @ 197'-202'   .25 X 28M

--DIRECT--					--CUM FLOATS--			--CUM SINKS--		+-0.1 DISTR	
			WT>	CUM WT>			SINK WT				
S.G.	WT>	ASH>	ASH TT	ASHTT	WT>	ASH>	ASH>	WT>	ASH>	S.G.	WT>
1	2	3	4	5	6	7	8	9	10	11	12
1.30	14.20	6.30	.89	.89	14.20	6.30	44.44	85.80	51.80	1.30	0.00
1.35	3.90	6.50	.25	1.15	18.10	6.34	44.19	81.90	53.96	1.40	21.60
1.40	5.00	9.20	.46	1.61	23.10	6.96	43.73	76.90	56.87	1.50	18.80
1.45	11.00	14.60	1.61	3.21	34.10	9.43	42.12	65.90	63.92	1.60	10.80
1.50	1.70	20.60	.35	3.56	35.80	9.96	41.77	64.20	65.07	1.70	10.40
1.60	6.10	27.80	1.70	5.26	41.90	12.55	40.08	58.10	68.98	1.80	10.70
1.70	4.70	37.60	1.77	7.03	46.60	15.08	38.31	53.40	71.74	1.90	0.00
1.80	5.70	49.10	2.80	9.83	52.30	18.79	35.51	47.70	74.45	2.00	0.00
1.90	5.00	57.80	2.89	12.72	57.30	22.19	32.62	42.70	76.40	2.10	0.00
9.99	42.70	76.40	32.62	45.34	100.00	45.34	0.00	.00	0.00	2.20	0.00

BIRTLEY ENGINEERING

- 27 -

PINE PASS

June 27, 1975

Hole No. P.P. 75-3 Footage: 254.5' - 267.3'

LAB NO. 3069

SIZE AND RAW ANALYSES

Size Fraction	Wt %	Ash %	Cum Wt %	Cum Ash %	F.S.I.
1/4" x 28M	81.8	29.4	81.8	29.4	1/2
28M x 100M	12.5	24.0	94.3	28.7	1 1/2
100M x 0	5.7	28.3	100.0	28.7	1 1/2

	R.M.	Ash %	Vol.	F.C.	F.S.I.
1/4" x 0	0.8	28.5	1.40 14.0	56.7	1/2

PINE PASS

June 27, 1975

Hole No. P.P. 75-3   Footage: 254.5' - 267.3'

LAB NO. 3059

SINK-FLOAT ANALYSES   1/4" x 28 Mesh

S.G. Fraction	Wt %	Ash %	Cum Wt %	Cum Ash %	F.S.I.
-1.30	13.9	2.9	13.9	2.9	2
1.30-1.35	31.3	3.4	45.2	3.2	1 1/2
1.35-1.40	10.4	5.5	55.6	3.7	1 1/2
1.40-1.45	8.9	9.1	64.5	4.4	1 1/2
1.45-1.50	0.8	24.5	65.3	4.7	1 1/2
1.50-1.60	2.2	28.2	67.5	5.4	1 1/2
1.60-1.70	2.3	33.3	69.8	6.3	1 1/2
1.70-1.80	0.9	39.4	70.7	6.8	1
1.80-1.90	0.7	40.6	71.4	7.1	1
+1.90	28.6	85.9	100.0	29.6	N.A.

Birtley Engineering
Subsidiary of Great West Steel Industries

PINE PASS

June 27, 1975

Hole No. P.P. 75-3 Footage: 254.5' - 267.3'

LAB NO. 3059

SINK-FLOAT ANALYSES 28 Mesh x 100 Mesh

S.G. Fraction	Wt %	Ash %	Cum Wt %	Cum Ash %	F.S.I.
-1.45	71.2	4.4	71.2	4.4	1 1/2
1.45-1.60	4.2	19.5	75.4	5.2	1
+1.60	24.6	78.0	100.0	23.1	N.A.

PINE PASS

June 27, 1975

Hole No. P.P. 75-3 Footage: 254.5' - 267.8'

LAB NO. 3059

FROTH FLOTATION ANALYSES 28 Mesh x 0

F.F. Fraction	Wt %	Ash %	Cum Wt %	Cum Ash %	F.S.I.
Stage I	71.7	11.2	71.7	11.2	1 1/2
Stage II	4.0	31.3	75.7	12.3	N.A.
Tails	24.3	70.8	100.0	26.5	N.A.

F.F. Parameters

Pulp Density	-	10%
Reagent Dosage	-	0.48 lbs/Ton Kerosene:MIBC (4:1)
Conditioning Time	-	1 minute
Stage I	-	1st minute froth
Stage II	-	2nd minute froth

PINE PASS 75-3 @ 254.5'-267.3' .25 X 28M

--DIRECT--				--CUM FLOATS--				--CUM SINKS--		+-0.1 DISTR	
S.G.	WT>	ASH>	WT> ASH TT	CUM WT> ASHTT	WT>	ASH>	SINK WT ASH>	WT>	ASH>	S.G.	WT>
1	2	3	4	5	6	7	8	9	10	11	12
1.30	13.90	2.90	.40	.40	13.90	2.90	29.23	86.10	33.95	1.30	0.00
1.35	31.30	3.40	1.06	1.47	45.20	3.25	28.17	54.80	51.41	1.40	51.40
1.40	10.40	5.50	.57	2.04	55.60	3.67	27.60	44.40	62.16	1.50	11.90
1.45	8.90	9.10	.81	2.85	64.50	4.42	26.79	35.50	75.46	1.60	4.50
1.50	.80	24.50	.20	3.05	65.30	4.66	26.59	34.70	76.64	1.70	3.20
1.60	2.20	28.20	.62	3.67	67.50	5.43	25.97	32.50	79.91	1.80	1.60
1.70	2.30	33.30	.77	4.43	69.80	6.35	25.21	30.20	83.46	1.90	0.00
1.80	.90	39.40	.35	4.79	70.70	6.77	24.85	29.30	84.82	2.00	0.00
1.90	.70	40.60	.28	5.07	71.40	7.10	24.57	28.60	85.90	2.10	0.00
9.99	28.60	85.90	24.57	29.64	100.00	29.64	0.00	.00	0.00	2.20	0.00

BIRTLEY ENGINEERING

PINE PASS

June 27, 1975

Hole No. 75-3

Footage: 551.5' - 558.0'

LAB NO. 3291

SIZE AND RAW ANALYSES

Size Fraction	Wt %	Ash %	Cum Wt %	Cum Ash %	F.S.I.
1/4" x 28M	88.2	57.5	88.2	57.5	1/2
28M x 0M	11.8	43.8	100.0	55.9	1

Head Raw	R.M.	Ash %	Vol.	F.C.	F.S.I.
	1.1	57.0*	10.2	31.7	1/2

* Air Dry Basis

PINE PASS

June 27, 1975

Hole No. 75-3   Footage: 551.5' - 558.0'

LAB NO. 3291

SINK-FLOAT ANALYSES   1/4" x 28M

S.G. Fraction	Wt %	Ash %	Cum Wt %	Cum Ash %	F.S.I.
-1.45	6.0	12.2	6.0	12.2	1 1/2
1.45-1.60	16.1	25.9	22.1	22.2	1
+1.60	77.9	68.1	100.0	58.0	N.A.

PINE PASS

June 27, 1975

Hole No. 75-3 Footage: 551.5' - 558.0'

LAB NO. 3291

FROTH FLOTATION ANALYSES 28M x 0

F.F. Fraction	Wt %	Ash %	Cum Wt %	Cum Ash %	F.S.I.
Stage I	31.3	21.1	31.3	21.1	1
Stage II	8.9	32.7	40.2	23.7	1
Tails	59.8	54.0	100.0	41.8	1/2

F.F. Parameters

Pulp Density	-	10%
Reagent Dosage	-	0.48 lbs/Ton Kerosene:MIBC (4:1)
Conditioning Time	-	1 minute
Stage I	-	1st minute froth
Stage II	-	2nd minute froth

PINE PASS 75-3 @ 551.5'-558.0' .25" X 28M

--DIRECT--					--CUM FLOATS--			--CUM SINKS--		+-0.1 DISTR	
S.G.	WT%	ASH%	WT% ASH TT	CUM WT% ASHTT	WT%	ASH%	SINK WT ASH%	WT%	ASH%	S.G.	WT%
1	2	3	4	5	6	7	8	9	10	11	12
1.45	6.00	12.20	.73	.73	6.00	12.20	57.22	94.00	60.87	1.45	0.00
1.60	16.10	25.90	4.17	4.90	22.10	22.18	53.05	77.90	68.10	1.55	0.00
9.99	77.90	68.10	53.05	57.95	100.00	57.95	0.00	0.00	I	1.65	0.00

BIRTLEY ENGINEERING

PINE PASS June 27, 1975

Hole No. 75-4 Footage: 98.0' - 110.0' LAB NO. 3292

SIZE AND RAW ANALYSES

Size Fraction	Wt %	Ash %	Cum Wt %	Cum Ash %	F.S.I.
1/4" x 28M	79.5	6.7	79.5	6.7	1 1/2
28M x 0M	20.5	5.7	100.0	6.5	1

Head Raw	R.M.	Ash %	Vol.	F.C.	F.S.I.
	2.1	7.3	18.6	72.0	1 1/2

PINE PASS June 27, 1975

Hole No. 75-4 Footage: 98.0' - 110.0' LAB NO. 3292

SINK-FLOAT ANALYSES 1/4" x 28M

S.G. Fraction	Wt %	Ash %	Cum Wt %	Cum Ash %	F.S.I.
-1.45	91.3	3.6	91.3	3.6	1 1/2
1.45-1.60	3.3	24.7	94.6	4.3	1
+1.60	5.4	63.5	100.0	7.5	1/2

PINE PASS

June 27, 1975

Hole No. 75-4 Footage: 98.0' - 110.0'

LAB NO. 3292

FROTH FLOTATION ANALYSES 28M x 0

F.F. Fraction	Wt %	Ash %	Cum Wt %	Cum Ash %	F.S.I.
Stage I	57.8	3.3	57.8	3.3	1 1/2
Stage II	9.5	5.7	67.3	3.6	1 1/2
Tails	32.7	9.9	100.0	5.7	1

F.F. Parameters

Pulp Density	-	10%
Reagent Dosage	-	0.48 lbs/Ton Kerosene:MIBC (4:1)
Conditioning Time	-	1 minute
Stage I	-	1st minute froth
Stage II	-	2nd minute froth

FINE PASS 75-4 @ 98.0'-110.0' .25 X 28M

--DIRECT--					--CUM FLOATS--			--CUM SINKS--		+-0.1 DISTR	
S.G.	WT>	ASH>	WT> ASH TT	CUM WT> ASHTT	WT>	ASH>	SINK WT ASH>	WT>	ASH>	S.G.	WT>
1	2	3	4	5	6	7	8	9	10	11	12
1.45	91.30	3.60	3.29	3.29	91.30	3.60	4.24	8.70	48.78	1.45	0.00
1.60	3.30	24.70	.82	4.10	94.60	4.34	3.43	5.40	63.50	1.55	0.00
9.99	5.40	63.50	3.43	7.53	100.00	7.53	0.00	.00	0.00	1.65	0.00

BIRTLEY ENGINEERING

PINE PASS June 27, 1975

Hole 75-4 Footage: 879.5' - 897.0' LAB NO. 3293

SIZE AND RAW ANALYSES

Size Fraction	Wt %	Ash %	Cum Wt %	Cum Ash %	F.S.I.
1/4" x 28M	81.3	15.3	81.3	15.3	1 1/2
28M x OM	18.7	6.8	100.0	13.7	5

	R.M.	Ash %	Vol.	F.C.	F.S.I.
Head Raw	1.1	14.4*	16.5	68.0	1 1/2

*Air Dry Basis

PINE PASS June 27, 1975

Hole 75-4 Footage: 879.5' - 897.0' LAB NO. 3293

SINK-FLOAT ANALYSES 1/4" x 28M

S.G. Fraction	Wt %	Ash %	Cum Wt %	Cum Ash %	F.S.I.
-1.45	81.4	2.9	81.4	2.9	1 1/2
1.45-1.60	1.4	24.9	82.8	3.3	1
+1.60	17.2	71.7	100.0	15.0	1/2

PINE PASS — June 27, 1975

Hole 75-4 — Footage: 879.5' - 897.0' — LAB NO. 3293

FROTH FLOTATION ANALYSES 28M x 0

F.F. Fraction	Wt %	Ash %	Cum Wt %	Cum Ash %	F.S.I.
Stage I	88.4	3.0	88.4	3.0	5 1/2
Stage II	4.6	8.5	93.0	3.3	4 1/2
Tails	7.0	48.0	100.0	6.4	1 1/2

F.F. Parameters

Pulp Density	-	10%
Reagent Dosage	-	0.48 lbs/Ton Kerosene:MIBC (4:1)
Conditioning Time	-	1 minute
Stage I	-	1st minute froth
Stage II	-	2nd minute froth

PINE PASS 75-5 @ 879.5'-897.0' .25" X 28M

--DIRECT--					--CUM FLOATS--			--CUM SINKS--		+-0.1 DISTR	
S.G.	WT>	ASH>	WT> ASH TT	CUM WT> ASHTT	WT>	ASH>	SINK WT ASH>	WT>	ASH>	S.G.	WT>
1	2	3	4	5	6	7	8	9	10	11	12
1.45	81.40	2.90	2.36	2.36	81.40	2.90	12.68	18.60	68.18	1.45	0.00
1.60	1.40	24.90	.35	2.71	82.80	3.27	12.33	17.20	71.70	1.55	0.00
9.99	17.20	71.70	12.33	15.04	100.00	15.04	0.00	.00	0.00	1.65	0.00

BIRTLEY ENGINEERING

PINE PASS

June 27, 1975

Hole 75-4 Footage: 900.0' - 907.0'

LAB NO. 3294

SIZE AND RAW ANALYSES

Size Fraction	Wt %	Ash %	Cum Wt %	Cum Ash %	F.S.I.
1/4" x 28M	79.9	2.3	79.9	2.3	8 1/2
28M x 0M	20.1	3.1	100.0	2.5	9

	R.M.	Ash %	Vol.	F.C.	F.S.I.
Head Raw	0.9	2.4*	19.8	76.9	8 1/2

*Air Dry Basis

PINE PASS June 27, 1975

Hole 75-4 Footage: 900.0' - 907.0' LAB NO. 3294

SINK-FLOAT ANALYSES 1/4" x 28M

S.G. Fraction	Wt %	Ash %	Cum Wt %	Cum Ash %	F.S.I.
-1.45	99.5	2.0	99.5	2.0	8 1/2
+1.45	0.5	37.3	100.0	2.2	1 1/2

PINE PASS

June 27, 1975

Hole 75-4

Footage: 900.0' - 907.0'

LAB NO. 3294

FROTH FLOTATION ANALYSES 28M x 0

F.F. Fraction	Wt %	Ash %	Cum Wt %	Cum Ash %	F.S.I.
Stage I	88.0	2.1	88.0	2.1	9
Stage II	7.0	3.8	95.0	2.2	9
Tails	5.0	14.8	100.0	2.9	8 1/2

F.F. Parameters

Pulp Density	-	10%
Reagent Dosage	-	0.48 lbs/Ton Kerosene:MIBC (4:1)
Conditioning Time	-	1 minute
Stage I	-	1st minute froth
Stage II	-	2nd minute froth

PINE PASS DEVELOPMENT CORP. July 29, 1975

HOLE NO: DDH - 75-6 FOOTAGE: 465'-481' LAB. NO. 3368

SIZE AND RAW ANALYSES

Size Fraction	Wt. %	Ash %	F.S.I.	Cum Wt. %	Cum Ash %
1/4" x 28M	93.9	5.6	1	93.9	5.6
28M x 100M	4.7	4.8	2	98.6	5.6
100M x 0	1.4	7.1	1 1/2	100.0	5.6

	R.M.	ASH %	V.M. %	F.C.%	F.S.I.
1/4" x 0 (Raw)	1.7	5.6	19.6	73.1	1 1/2

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PINE PASS DEVELOPMENT CORP. July 29, 1975

HOLE NO: DDH 75-6 FOOTAGE: 465' - 481' LAB NO. 3368

SINK-FLOAT ANALYSES 1/4" x 28M

S.G. Fraction	Wt. %	Ash %	F.S.I.	Cum Wt. %	Cum Ash %
- 1.30	61.2	1.7	1 1/2	61.2	1.7
1.30 - 1.35	23.6	4.2	1 1/2	84.8	2.4
1.35 - 1.40	6.5	9.0	1 1/2	91.3	2.9
1.40 - 1.45	3.2	14.1	1 1/2	94.5	3.2
1.45 - 1.50	1.4	78.1	1	95.9	3.5
1.50 - 1.60	1.3	22.0	1/2	97.2	3.7
+ 1.60	2.8	71.1	N.A.	100.0	5.6

Birtley Engineering
Subsidiary of Great West Steel Industries

PINE PASS 75-6 @465'-481' .25 X 28M

--DIRECT--					--CUM FLOATS--			--CUM SINKS--		+-0.1 DISTR	
S.G.	WT>	ASH>	WT> ASH TT	CUM WT> ASHTT	WT>	ASH>	SINK WT ASH>	WT>	ASH>	S.G.	WT>
1	2	3	4	5	6	7	8	9	10	11	12
1.30	61.20	1.70	1.04	1.04	61.20	1.70	5.40	38.80	13.91	1.30	0.00
1.35	23.60	4.20	.99	2.03	84.80	2.40	4.41	15.20	28.99	1.40	34.70
1.40	6.50	9.00	.59	2.62	91.30	2.87	3.82	8.70	43.92	1.50	5.90
1.45	3.20	14.10	.45	3.07	94.50	3.25	3.37	5.50	61.28	1.60	0.00
1.50	1.40	78.10	1.09	4.16	95.90	4.34	2.28	4.10	55.53	1.70	0.00
1.60	1.30	22.00	.29	4.45	97.20	4.58	1.99	2.80	71.10	1.80	0.00
9.99	2.80	71.10	1.99	6.44	100.00	6.44	0.00	.00	0.00	1.90	0.00

BIRTLEY ENGINEERING

PINE PASS DEVELOPMENT CORP. July 29. 1975

HOLE: DDH 75-8 FOOTAGE: 269' - 278'

SIZE AND RAW ANALYSES

Size Fraction	Wt. %	Ash %	F.S.I.	Cum Wt. %	Cum Ash %
1/4" x 28M	90.5	10.1	1	90.5	10.1
28M x 100M	7.1	11.7	2 1/2	97.6	10.2
100M x 0	2.4	8.8	2	100.0	10.2

	R.M.%	ASH %	V.M.%	F.C.%	F.S.I %
1/4" x 0	1.0	10.2	19.8	69.0	1 1/2

PINE PASS DEVELOPMENT CORP. July 29, 1975

HOLE NO. DDH 75-8 FOOTAGE: 269' - 278' LAB NO. 3369

SINK-FLOAT ANALYSES 1/4" x 28M

S.G. Fraction	Wt. %	Ash %	F.S.I. %	Cum Wt. %	Cum Ash %
- 1.30	39.7	2.1	2 1/2	39.7	2.1
1.30 - 1.35	33.1	5.5	1 1/2	72.8	3.6
1.35 - 1.40	9.7	8.7	1 1/2	82.5	4.2
1.40 - 1.45	3.6	15.4	1 1/2	86.1	4.7
1.45 - 1.50	2.5	20.7	1 1/2	88.6	5.2
1.50 - 1.60	3.9	24.5	1 1/2	92.5	6.0
+ 1.60	7.5	49.6	1/2	100.0	9.2

PINE PASS DEVELOPMENT CORP. July 29, 1975

HOLE NO: DDH 75-8 FOOTAGE: 269' - 278' LAB NO. 3369

FROTH FLOTATION ANALYSES 28M x 0

F.F. Fraction	Wt. %	Ash %	F.S.I.	Cum Wt.%	Cum Ash %
Stage 1	74.0	5.4	2 1/2	74.0	5.4
Stage 11	13.0	6.9	2 1/2	87.0	5.6
Tails	13.0	34.0	1/2	100.0	9.3

F.F. Parameters

Pulp Density	-	6%
Reagent Dosage	-	0.48 lb/ton Kerosene: MIBC (4:1)
Conditioning Time	-	1 Minute
Stage 1	-	1st Minute Froth
Stage 11	-	2nd Minute Froth

PINE PASS 75-8 @ 269′-278′ .25 X 28M

	--DIRECT--				--CUM FLOATS--			--CUM SINKS--		+-0.1 DISTR	
S.G.	WT>	ASH>	WT> ASH TT	CUM WT> ASHTT	WT>	ASH>	SINK WT ASH>	WT>	ASH>	S.G.	WT>
1	2	3	4	5	6	7	8	9	10	11	12
1.30	39.70	2.10	.83	.83	39.70	2.10	8.41	60.30	13.95	1.30	0.00
1.35	33.10	5.50	1.82	2.65	72.80	3.65	6.59	27.20	24.23	1.40	48.90
1.40	9.70	8.70	.84	3.50	82.50	4.24	5.75	17.50	32.84	1.50	10.00
1.45	3.60	15.40	.55	4.05	86.10	4.71	5.19	13.90	37.36	1.60	0.00
1.50	2.50	20.70	.52	4.57	88.60	5.16	4.68	11.40	41.01	1.70	0.00
1.60	3.90	24.50	.96	5.53	92.50	5.97	3.72	7.50	49.60	1.80	0.00
9.99	7.50	49.60	3.72	9.25	100.00	9.25	0.00	.00	0.00	1.90	0.00

BIRTLEY ENGINEERING

PINE PASS DEVELOPMENT CORP. July 29, 1975

HOLE No: DDH 75-8 FOOTAGE: 432' - 438' LAB. NO. 3370

SIZE AND RAW ANALYSES

Size Fraction	Wt. %	Ash %	F.S.I.	Cum Wt. %	Cum Ash %
1/4" x 28M	89.0	20.5	1 1/2	89.0	20.5
28M x 100M	8.3	19.5	1 1/2	97.3	20.4
100M x 0	2.7	13.0	1 1/2	100.0	20.2

	R.M.%	Ash %	V.M.%	F.C.%	F.S.I
1/4" x 0	1.1	21.1	26.3	51.5	1 1/2

PINE PASS DEVELOPMENT CORP. July 29, 1975

HOLE NO. DDH 75-8 FOOTAGE: 432' - 438' LAB. NO. 3370

SINK-FLOAT ANALYSES: 1/4" x 28M

S.G. Fraction	Wt. %	Ash %	F.S.I.%	Cum Wt. %	Cum Ash %
- 1.30	16.3	2.0	3 1/2	16.3	2.0
1.30 - 1.35	16.1	5.1	1 1/2	32.4	3.5
1.35 - 1.40	15.3	9.4	1 1/2	47.7	5.4
1.40 - 1.45	14.1	14.1	1 1/2	61.8	7.4
1.45 - 1.50	5.6	17.4	1 1/2	67.4	8.2
1.50 - 1.60	4.7	22.5	1 1/2	72.1	9.2
1.60 - 1.70	3.6	29.2	N.A.	75.7	10.1
1.70 - 1.80	2.3	33.9	N.A.	78.0	10.8
1.80 - 1.90	1.5	39.9	N.A.	79.5	11.4
+ 1.90	20.5	51.1	N.A.	100.0	19.5

Birtley Engineering

Subsidiary of Great West Steel Industries

PINE PASS DEVELOPMENT CORP. July 29, 1975

HOLE NO. DDH 75-8 FOOTAGE: 432' - 438'

FROTH FLOTATION TEST 28M x 0

F.F. Fraction	Wt. %	Ash %	F.S.I. %	Cum Wt. %	Cum Ash %
Stage 1	72.0	6.5	2	72.0	6.5
Stage 11	10.0	9.1	1 1/2	82.0	6.8
Tails	18.0	43.1	N.A.	100.0	13.3

F.F. Parameters

Pulp Density	-	6%
Reagent Dosage	-	0.48 lb/ton Kerosene: MIBC (4:1)
Conditioning Time	-	1 Minute
Stage 1	-	1st Minute Froth
Stage 11	-	2nd Minute Froth

PINE PAS S 75-8 @ 432'-438' .25" X 28M

--DIRECT--					--CUM FLOATS--			--CUM SINKS--		+-0.1 DISTR	
S.G.	WT>	ASH>	WT> ASH TT	CUM WT> ASHTT	WT>	ASH>	SINK WT ASH>	WT>	ASH>	S.G.	WT>
1	2	3	4	5	6	7	8	9	10	11	12
1.30	16.30	2.00	.33	.33	16.30	2.00	19.18	83.70	22.92	1.30	0.00
1.35	16.10	5.10	.82	1.15	32.40	3.54	18.36	67.60	27.16	1.40	51.10
1.40	15.30	9.40	1.44	2.59	47.70	5.42	16.92	52.30	32.36	1.50	24.40
1.45	14.10	14.10	1.99	4.57	61.80	7.40	14.94	38.20	39.10	1.60	8.30
1.50	5.60	17.40	.97	5.55	67.40	8.23	13.96	32.60	42.83	1.70	5.90
1.60	4.70	22.50	1.06	6.61	72.10	9.16	12.90	27.90	46.25	1.80	3.80
1.70	3.60	29.20	1.05	7.66	75.70	10.11	11.85	24.30	48.78	1.90	0.00
1.80	2.30	33.90	.78	8.44	78.00	10.82	11.07	22.00	50.34	2.00	0.00
1.90	1.50	39.90	.60	9.03	79.50	11.36	10.48	20.50	51.10	2.10	0.00
9.99	20.50	51.10	10.48	19.51	100.00	19.51	0.00	.00	0.00	2.20	0.00

BIRTLEY ENGINEERING

PINE PASS DEVELOPMENT CORP. July 29, 1975

HOLE NO. DDH 75-8 FOOTAGE: 533' - 538' LAB NO. 3371

SIZE AND RAW ANALYSES

Size Fraction	Wt. %	Ash %	F.S.I. %	Cum Wt. %	Cum Ash %
1/4" x 28M	90.0	8.0	1	90.0	8.0
28M x 100M	7.4	6.6	2 1/2	97.4	7.9
100M x 0	2.6	9.2	2	100.0	7.9

	R.M. %	Ash %	V.M. %	F.C. %	F.S.I. %
1/4" x 0 (Raw)	1.0	8.8	17.1	73.1	1 1/2

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Birtley Engineering
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PINE PASS DEVELOPMENT CORP. July 29, 1975

HOLE NO. 75-8 FOOTAGE: 533' - 538' LAB. NO. 3371

SINK-FLOAT ANALYSES: 1/4" x 28M

S.G. Fraction	Wt. %	Ash %	F.S.I. %	Cum Wt. %	Cum Ash %
- 1.30	63.5	1.7	2	63.5	1.7
1.30 - 1.35	19.1	4.2	1 1/2	82.6	2.3
1.35 - 1.40	2.9	11.0	1 1/2	85.5	2.6
1.40 - 1.45	1.7	18.5	1 1/2	87.2	2.9
1.45 - 1.50	1.9	23,7	1 1/2	89.1	3.3
1.50 - 1.60	1.9	31.1	1 1/2	91.0	3.9
1.60 - 1.70	3.9	39.0	1 1/2	94.9	5.4
1.70 - 1.80	1.3	47.8	1	96.2	5.9
1.80 - 1.90	0.8	52.5	1/2	97.0	6.3
+ 1.90	3.0	64.3	1/2	100.0	8.0

PINE PASS 75-8 @533'-538'

--DIRECT--					--CUM FLOATS--			--CUM SINKS--		+-0.1 DISTR	
S.G.	WT>	ASH>	WT> ASH TT	CUM WT> ASHTT	WT>	ASH>	SINK WT ASH>	WT>	ASH>	S.G.	WT>
1	2	3	4	5	6	7	8	9	10	11	12
1.30	63.50	1.70	1.08	1.08	63.50	1.70	7.11	36.50	19.48	1.30	0.00
1.35	19.10	4.20	.80	1.88	82.60	2.28	6.31	17.40	36.25	1.40	25.60
1.40	2.90	11.00	.32	2.20	85.50	2.57	5.99	14.50	41.29	1.50	5.50
1.45	1.70	18.50	.31	2.52	87.20	2.88	5.67	12.80	44.32	1.60	5.80
1.50	1.90	31.10	.59	3.11	89.10	3.49	5.08	10.90	46.63	1.70	5.20
1.60	1.90	31.10	.59	3.70	91.00	4.06	4.49	9.00	49.90	1.80	2.10
1.70	3.90	39.00	1.52	5.22	94.90	5.50	2.97	5.10	58.24	1.90	0.00
1.80	1.30	47.80	.62	5.84	96.20	6.07	2.35	3.80	61.82	2.00	0.00
1.90	.80	52.50	.42	6.26	97.00	6.45	1.93	3.00	64.30	2.10	0.00
9.99	3.00	64.30	1.93	8.19	100.00	8.19	0.00	.00	0.00	2.20	0.00

BIRTLEY ENGINEERING

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Subsidiary of Great West Steel Industries

PINE PASS DEVELOPMENT CORP. July 29, 1975

HOLE NO. DDH 75-8 FOOTAGE: 663' - 677' LAB. NO. 3372

SIZE AND RAW ANALYSES

Size Fraction	Wt. %	Ash %	F.S.I. %	Cum Wt. %	Cum Ash %
1/4" x 28M	90.9	9.0	1 1/2	90.9	9.0
28M x 100M	7.0	6.9	1 1/2	97.9	8.8
100M x 0	2.1	7.7	1 1/2	100.0	8.8

	R.M. %	Ash %	V.M. %	F.C. %	F.S.I. %
1/4" x 0 (Raw)	1.0	9.2	15.6	74.2	1 1/2

Birtley Engineering
Subsidiary of Great West Steel Industries

PINE PASS DEVELOPMENT CORP.

July 29, 1975

HOLE NO. DDH 75-8 FOOTAGE: 663' - 677'

LAB. NO. 3372

SINK-FLOAT ANALYSES 1/4" x 28M

S.G. Fraction	Wt. %	Ash %	F.S.I. %	Cum Wt. %	Cum Ash %
- 1.30	72.2	1.8	1 1/2	72.2	1.8
1.30 0 1.35	13.7	3.8	1 1/2	85.9	2.1
1.35 - 1.40	1.4	9.9	1 1/2	87.3	2.2
1.40 - 1.45	0.7	18.9	1 1/2	88.0	2.4
1.45 - 1.50	0.4	25.5	1 1/2	88.4	2.5
1.50 - 1.60	1.0	33.4	1	89.4	2.8
1.60 - 1.70	1.6	40.5	1	91.0	3.5
1.70 - 1.80	1.3	52.0	1	92.3	4.2
1.80 - 1.90	1.6	59.4	1/2	93.9	5.1
+ 1.90	6.1	69.6	N.A.	100.0	9.0

PINE PASS DEVELOPMENT CORP. July 29, 1975

HOLE NO: DDH 75-8 FOOTAGE: 663' - 677' LAB. NO. 3372

FROTH FLOTATION TEST 28M x 0

Size Fraction	Wt. %	Ash %	F.S.I. %	Cum Wt. %	Cum Ash %
Stage I	78.0	2.6	1 1/2	78.0	2.6
Stage II	11.4	6.0	1 1/2	89.4	3.0
Tails	10.6	28.2	1 1/2	100.0	5.7

F.F. Parameters

Pulp Density	-	6%
Reagent Dosage	-	0.48 lb/ton Kerosene: MIBC (4:1)
Conditioning Time	-	1 Minute
Stage I	-	1st Minute Froth
Stage II	-	2nd Minute Froth

Birtley Engineering

Subsidiary of Great West Steel Industries

PINE PASS 75-8 @ 663'-677' .25" X 28M

--DIRECT--					--CUM FLOATS--			--CUM SINKS--		+-0.1 DISTR	
			WT>	CUM WT>			SINK WT				
S.G.	WT>	ASH>	ASH TT	ASHTT	WT>	ASH>	ASH>	WT>	ASH>	S.G.	WT>
1	2	3	4	5	6	7	8	9	10	11	12
1.30	72.20	1.80	1.30	1.30	72.20	1.80	7.75	27.80	27.87	1.30	0.00
1.35	13.70	3.80	.52	1.82	85.90	2.12	7.23	14.10	51.25	1.40	16.20
1.40	1.40	9.90	.14	1.96	87.30	2.24	7.09	12.70	55.81	1.50	2.10
1.45	.70	18.90	.13	2.09	88.00	2.38	6.96	12.00	57.97	1.60	2.60
1.50	.40	25.50	.10	2.19	88.40	2.48	6.85	11.60	59.09	1.70	2.90
1.60	1.00	33.40	.33	2.53	89.40	2.83	6.52	10.60	61.51	1.80	2.90
1.70	1.60	40.50	.65	3.18	91.00	3.49	5.87	9.00	65.24	1.90	0.00
1.80	1.30	52.00	.68	3.85	92.30	4.17	5.20	7.70	67.48	2.00	0.00
1.90	1.60	59.40	.95	4.80	93.90	5.11	4.25	6.10	69.60	2.10	0.00
9.99	6.10	69.60	4.25	9.05	100.00	9.05	0.00	.00	0.00	2.20	0.00

BIRTLEY ENGINEERING

Birtley Engineering

Subsidiary of Great West Steel Industries

PINE PASS DEVELOPMENT CORP. July 29, 1975

HOLE NO. DDH 75-9 FOOTAGE: 322' - 337' LAB. NO. 3373

SIZE AND RAW ANALYSES

Size Fraction	Wt. %	Ash %	F.S.I. %	Cum Wt. %	Cum Ash %
1/4" x 28M	92.4	2.3	1/2	92.4	2.3
28M x 100M	5.5	3.3	N.A.	97.9	2.4
100M x 0	2.1	4.6	1/2	100.0	2.4

	R.M. %	Ash %	V.M. %	F.C. %	F.S.I.
1/4" x 0 (Raw)	1.9	2.4	15.1	80.6	1/2

PINE PASS DEVELOPMENT CORP. July 29, 1975

HOLE NO. DDH -75-9 FOOTAGE: 322' - 337' LAB. NO. 3373

SINK FLOAT ANALYSES 1/4" x 28M

S.G. Fraction	Wt. %	Ash %	F.S.I. %	Cum Wt. %	Cum Ash %
- 1.30	40.9	0.7	1/2	40.9	0.7
1.30 - 1.35	50.6	2.1	1/2	91.5	1.5
1.35 - 1.40	6.8	7.6	1/2	98.3	1.9
1.40 - 1.45	0.9	14.2	N.A.	99.2	2.0
1.45 - 1.50	0.3	20.9	N.A.	99.5	2.1
+ 1.60	0.5	45.4	N.A.	100.0	2.3

PINE PASS DEVELOPMENT CORP. July 29, 1975

HOLE NO. DDH 75-9 FOOTAGE: 322' - 337' LAB. NO. 3373

SINK-FLOAT ANALYSES 28M x 100M

Size Fraction	Wt. %	Ash %	F.S.I. %	Cum Wt. %	Cum Ash %
- 1.35	86.1	1.1	N.A.	86.1	1.1
1.35 - 1.45	8.7	6.7	N.A.	94.8	1.6
1.45 - 1.60	1.7	21.0	N.A.	96.5	2.0
1.60 - 1.80	1.1	27.4	N.A.	97.6	2.2
+ 1.80	2.4	66.5	N.A.	100.0	3.8

Birtley Engineering
Subsidiary of Great West Steel Industries

PINE PASS DEVELOPMENT CORP. July 29, 1975

HOLE NO. DDH 75-9 FOOTAGE: 322' - 337' LAB. NO. 3373

FROTH FLOTATION TEST 28M x 0

Size Fraction	Wt. %	Ash %	F.S.I. %	Cum Wt. %	Cum Ash %
Stage I	86.0	2.2	1/2	86.0	2.2
Stage II	9.4	3.7	1/2	95.4	2.3
Tails	4.6	23.6	N.A.	100.0	3.3

F.F. Parameters

Pulp Density	-	6%
Reagent Dosage	-	0.48 lb/ton Kerosene: MIBC (4:1)
Conditioning Time	-	1 Minute
Stage I	-	1st Minute Froth
Stage II	-	2nd Minute Froth

PINE PASS 75-9 @ 322'-337' .25" X 28M

--DIRECT--				--CUM FLOATS--				--CUM SINKS--		+-0.1 DISTR	
			WT> CUM	WT>			SINK WT				
S.G.	WT>	ASH>	ASH TT	ASHTT	WT>	ASH>	ASH>	WT>	ASH>	S.G.	WT>
1	2	3	4	5	6	7	8	9	10	11	12
1.30	40.90	.70	.29	.29	40.90	.70	2.00	59.10	3.38	1.30	0.00
1.35	50.60	2.10	1.06	1.35	91.50	1.47	.93	8.50	10.99	1.40	58.60
1.40	6.80	7.60	.52	1.87	98.30	1.90	.42	1.70	24.56	1.50	0.00
1.45	.90	14.20	.13	1.99	99.20	2.01	.29	.80	36.21	1.60	0.00
1.50	.30	20.90	.06	2.06	99.50	2.07	.23	.50	45.40	1.70	0.00
9.99	.50	45.40	.23	2.28	100.00	2.28	0.00	.00	0.00	1.80	0.00

BIRTLEY ENGINEERING

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PINE PASS 75-9 @ 322'-337' 28M X 100M

	--DIRECT--			--CUM FLOATS--				--CUM SINKS--		+-0.1 DISTR	
S.G.	WT>	ASH>	WT> ASH TT	CUM WT> ASHTT	WT>	ASH>	SINK WT ASH>	WT>	ASH>	S.G.	WT>
1	2	3	4	5	6	7	8	9	10	11	12
1.35	86.10	1.10	.95	.95	86.10	1.10	2.84	13.90	20.41	1.35	0.00
1.45	8.70	6.70	.58	1.53	94.80	1.61	2.25	5.20	43.35	1.45	0.00
1.60	1.70	21.00	.36	1.89	96.50	1.96	1.90	3.50	54.21	1.55	0.00
1.80	1.10	27.40	.30	2.19	97.60	2.24	1.60	2.40	66.50	1.65	0.00
9.99	2.40	66.50	1.60	3.78	100.00	3.78	0.00	.00	0.00	1.75	0.00

BIRTLEY ENGINEERING

PINE PASS DEVELOPMENT CORP. July 29, 1975

HOLE No. DDH 75-10 FOOTAGE: 510.5' - 523' LAB. NO. 3374

SIZE AND RAW ANALYSES

Size Fraction	Wt. %	Ash %	F.S.I. %	Cum Wt. %	Cum Ash %
1/4" x 28M	89.9	34.3	2	89.9	34.3
28M x 100M	7.6	25.1	5	97.5	33.6
100M x 0	2.5	25.9	4 1/2	100.0	33.4

	R.M. %	Ash %	V.M. %	F.C. %	F.S.I.%
1/4" x 0 (Raw)	1.9	33.6	14.3	50.2	2

PINE PASS DEVELOPMENT CORP. July 29, 1975

HOLE NO. DDH 75-10 FOOTAGE: 510.5' - 523' LAB. NO. 3374

SINK-FLOAT ANALYSES 1/4 " x 28M

S.G. Fraction	Wt. %	Ash %	F.S.I. %	Cum Wt. %	Cum Ash %
- 1.30	18.1	3.3	8	18.1	3.3
1.30 - 1.35	15.1	7.3	4	33.2	5.1
1.35 - 1.40	6.2	18.2	4	39.4	6.4
1.40 - 1.45	4.2	19.7	3 1/2	43.6	7.7
1.45 - 1.50	5.0	27.9	3 1/2	48.6	9.8
1.50 - 1.60	7.3	36.7	1 1/2	55.9	13.3
1.60 - 1.70	11.3	44.8	1	67.2	18.6
1.70 - 1.80	8.4	53.5	1	75.6	22.5
1.80 - 1.90	7.3	59.5	1/2	82.9	25.7
+ 1.90	17.1	75.8	N.A.	100.0	34.3

PINE PASS DEVELOPMENT CORP. July 29, 1975

HOLE NO. DDH 75-10 FOOTAGE: 510.5' - 523' LAB. NO. 3374

SINK-FLOAT ANALYSES 28M x 100M

S.G. Fraction	Wt. %	Ash %	F.S.I. %	Cum Wt. %	Cum Ash %
- 1.35	50.0	5.3	8 1/2	50.0	5.3
1.35 - 1.45	16.1	13.2	4 1/2	66.1	7.2
1.45 - 1.60	8.5	32.3	2	74.6	10.0
1.60 - 1.80	10.5	48.1	1 1/2	85.1	14.8
+ 1.80	14.9	70.8	1/2	100.0	23.1

Birtley Engineering
Subsidiary of Great West Steel Industries

PINE PASS DEVELOPMENT CORP. July 29, 1975

HOLE NO. DDH 75-10 FOOTAGE: 510.5' - 523' LAB. NO. 3374

FROTH FLOTATION TEST 28M x 0

Size Fraction	Wt. %	Ash %	F.S.I. %	Cum Wt. %	Cum Ash %
Stage I	62.3	11.7	7 1/2	62.3	11.7
Stage II	9.5	22.2	4	71.8	13.1
Tails	28.2	49.9	1	100.0	23.5

F.F. Parameters

Pulp Density	-	6%
Reagent Dosage	-	0.48 lb/ton Kerosene: MIBC (4:1)
Conditioning Time	-	1 Minute
Stage I	-	1st Minute Froth
Stage II	-	2nd Minute Froth

Birtley Engineering
Subsidiary of Great West Steel Industries

PINE PASS 75-10 @ 510.5'-523' .25" X 28M

--DIRECT--					--CUM FLOATS--			--CUM SINKS--		+-0.1 DISTR	
S.G.	WT>	ASH>	WT> ASH TT	CUM WT> ASHTT	WT>	ASH>	SINK WT ASH>	WT>	ASH>	S.G.	WT>
1	2	3	4	5	6	7	8	9	10	11	12
1.30	18.10	3.30	.60	.60	18.10	3.30	33.99	81.90	41.51	1.30	0.00
1.35	15.10	7.30	1.10	1.70	33.20	5.12	32.89	66.80	49.24	1.40	30.50
1.40	6.20	18.20	1.13	2.83	39.40	7.18	31.76	60.60	52.41	1.50	16.50
1.45	4.20	19.70	.83	3.66	43.60	8.38	30.94	56.40	54.85	1.60	18.60
1.50	5.00	27.90	1.40	5.05	48.60	10.39	29.54	51.40	57.47	1.70	19.70
1.60	7.30	36.70	2.68	7.73	55.90	13.83	26.86	44.10	60.91	1.80	15.70
1.70	11.30	44.80	5.06	12.79	67.20	19.04	21.80	32.80	66.46	1.90	0.00
1.80	8.40	53.50	4.49	17.29	75.60	22.86	17.31	24.40	70.92	2.00	0.00
1.90	7.30	59.50	4.34	21.63	82.90	26.09	12.96	17.10	75.80	2.10	0.00
9.99	17.10	75.80	12.96	34.59	100.00	34.59	0.00	.00	0.00	2.20	0.00

BIRTLEY ENGINEERING

Birtley Engineering
Subsidiary of Great West Steel Industries

PINE PASS 75 10 @ 510.5'-523' 28M X 100M

--DIRECT--					--CUM FLOATS--			--CUM SINKS--		+-0.1 DISTR	
S.G.	WT>	ASH>	WT> ASH TT	CUM WT> ASHTT	WT>	ASH>	SINK.WT ASH>	WT>	ASH>	S.G.	WT>
1	2	3	4	5	6	7	8	9	10	11	12
1.35	50.00	5.30	2.65	2.65	50.00	5.30	20.47	50.00	40.94	1.35	0.00
1.45	16.10	13.20	2.13	4.78	66.10	7.22	18.35	33.90	54.12	1.45	0.00
1.60	8.50	32.30	2.75	7.52	74.60	10.08	15.60	25.40	61.42	1.55	0.00
1.80	10.50	48.10	5.05	12.57	85.10	14.77	10.55	14.90	70.80	1.65	0.00
9.99	14.90	70.80	10.55	23.12	100.00	23.12	0.00	.00	0.00	1.75	0.00

BIRTLEY ENGINEERING

PINE PASS DEVELOPMENT COPR. July 29, 1975

HOLE NO. DDH 75-10 FOOTAGE: 534.5' - 549.5' LAB. NO. 3375

SIZE AND RAW ANALYSES

Size Fraction	Wt. %	Ash %	F.S.I. %	Cum Wt. %	Cum Ash %
1/4" x 28M	89.5	5.9	1 1/2	89.5	5.9
28M x 100M	7.9	5.3	2 1/2	97.4	5.9
100M x 0	2.6	6.9	2	100.0	5.9

	R.M. %	Ash %	V.M. %	F.C. %	F.S.I. %
1/4" x 0 (Raw)	1.4	5.7	18.4	74.5	2

PINE PASS DEVELOPMENT CORP. July 29, 1975

HOLE NO. DDH 75-10 FOOTAGE: 534.5' - 549.5' LAB. NO. 3375

SINK-FLOAT ANALYSES 1/4" x 28M

S.G. Fraction	Wt. %	Ash %	F.S.I. %	Cum Wt. %	Cum Ash %
- 1.30	68.4	2.6	2	68.4	2.6
1.30 - 1.35	17.2	6.3	1 1/2	85.6	3.3
1.35 - 1.40	6.0	11.2	1 1/2	91.6	3.9
1.40 - 1.45	3.1	16.2	1 1/2	94.7	4.3
1.45 - 1.50	1.6	22.7	1 1/2	96.3	4.6
1.50 - 1.60	1.7	29.3	1 1/2	98.0	5.0
1.60 - 1.70	0.9	36.2	1 1/2	98.9	5.3
1.70 - 1.80	0.3	44.7	1	99.2	5.4
1.80 - 1.90	0.2	48.1	1/2	99.4	5.5
+ 1.90	0.6	73.8	N.A.	100.0	5.9

Birtley Engineering

Subsidiary of Great West Steel Industries

PINE PASS DEVELOPMENT CORP. July 29, 1975

HOLE NO. DDH 75-10 FOOTAGE: 534.5' - 549.5' LAB. NO. 3375

SINK-FLOAT ANALYSES 28M x 100M

S.G. Fraction	Wt. %	Ash %	F.S.I. %	Cum Wt. %	Cum Ash %
- 1.35	62.5	2.0	2 1/2	62.5	2.0
1.35 - 1.45	9.8	11.2	2	72.3	3.2
1.45 - 1.60	14.1	13.4	2	86.4	4.9
1.60 - 1.80	9.3	19.1	2	95.7	6.3
+ 1.80	4.3	25.7	1 1/2	100.0	7.1

Birtley Engineering

Subsidiary of Great West Steel Industries

PINE PASS DEVELOPMENT CORP. July 29, 1975

HOLE NO. DDH 75-10 FOOTAGE: 534.5' - 549.5' LAB. NO. 3375

FROTH FLOTATION TESTS 28M x 0

Size Fraction	Wt. %	Ash %	F.S.I. %	Cum Wt. %	Cum Ash %
Stage I	77.0	3.7	3	77.0	3.7
Stage II	14.6	5.5	2	91.6	4.0
Tails	8.4	16.0	1 1/2	100.0	5.0

F.F. Parameters

Pulp Density	-	6 %
Reagent Dosage	-	0.48 lb/ton Kerosene: MLBC (4:1)
Conditioning Time	-	1 Minute
Stage I	-	1st Minute Froth
Stage II	-	2nd Minute Froth

Birtley Engineering
Subsidiary of Great West Steel Industries

PINE PASS DEVELOPMENT CORP. July 29, 1975

HOLE NO. DDH 75-10 FOOTAGE: 534.5' - 549.5' LAB. NO. 3375

FROTH FLOTATION TESTS 100M x 0

Size Fraction	Wt. %	Ash %	F.S.I. %	Cum Wt. %	Cum Ash %
Stage I	86.5	4.4	3	86.5	4.4
Stage II	9.1	7.8	2	95.6	4.7
Tails	4.4	35.8	1/2	100.0	6.1

F.F. Parameters

Pulp Density	-	6 %
Reagent Dosage	-	0.48 lb/ton Kerosene: MIBC (4:1)
Conditioning Time	-	1 Minute
Stage I	-	1st Minute Froth
Stage II	-	2nd Minute Froth

Birtley Engineering
Subsidiary of Great West Steel Industries

PINE PASS   75-10 @ 534.5'-549.5'   .25" X 28M

--DIRECT--					--CUM FLOATS--			--CUM SINKS--		+-0.1 DISTR	
S.G.	WT>	ASH>	WT> ASH TT	CUM WT> ASHTT	WT>	ASH>	SINK WT ASH>	WT>	ASH>	S.G.	WT>
1	2	3	4	5	6	7	8	9	10	11	12
1.30	68.40	2.60	1.78	1.78	68.40	2.60	4.12	31.60	13.03	1.30	0.00
1.35	17.20	6.30	1.08	2.86	85.60	3.34	3.03	14.40	21.07	1.40	27.90
1.40	6.00	11.20	.67	3.53	91.60	3.86	2.36	8.40	28.12	1.50	6.40
1.45	3.10	16.20	.50	4.04	94.70	4.26	1.86	5.30	35.10	1.60	2.60
1.50	1.60	22.70	.36	4.40	96.30	4.57	1.50	3.70	40.46	1.70	1.20
1.60	1.70	29.30	.50	4.90	98.00	5.00	1.00	2.00	49.94	1.80	.50
1.70	.90	36.20	.33	5.22	98.90	5.28	.67	1.10	61.19	1.90	0.00
1.80	.30	44.70	.13	5.36	99.20	5.40	.54	.80	67.37	2.00	0.00
1.90	.20	48.10	.10	5.45	99.40	5.49	.44	.60	73.80	2.10	0.00
9.99	.60	73.80	.44	5.90	100.00	5.90	0.00	.00	0.00	2.20	0.00

BIRTLEY ENGINEERING

PINE PASS 75-10 @ 534.5'-549.5' 28M X 100M

--DIRECT--					--CUM FLOATS--		--CUM SINKS--			+-0.1 DISTR	
			WT> ASH TT	CUM WT> ASHTT			SINK WT ASH>				
S.G.	WT>	ASH>			WT>	ASH>		WT>	ASH>	S.G.	WT>
1	2	3	4	5	6	7	8	9	10	11	12
1.35	62.50	2.00	1.25	1.25	62.50	2.00	5.87	37.50	15.65	1.35	0.00
1.45	9.80	11.20	1.10	2.35	72.30	3.25	4.77	27.70	17.22	1.45	0.00
1.60	14.10	13.40	1.89	4.24	86.40	4.90	2.88	13.60	21.19	1.55	0.00
1.80	9.30	19.10	1.78	6.01	95.70	6.28	1.11	4.30	25.70	1.65	0.00
9.99	4.30	25.70	1.11	7.12	100.00	7.12	0.00	.00	0.00	1.75	0.00

BIRTLEY ENGINEERING

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Birtley Engineering
Subsidiary of Great West Steel Industries

SAMPLE:- Pine Pass DDH 75-8 @ 663-667'

PELLET NO.:- #2

DATE:- 3/10/75

REFLECTANCE

	1	2	3	4
1	1.39	1.56		
2	1.53	1.52		
3	1.52	1.55		
4	1.60	1.51		
5	1.55	1.64		
6	1.42	1.55		
7	1.59	1.47		
8	1.54	1.44		
9	1.53	1.61		
10	1.53	1.49		
11	1.56	1.45		
12	1.54	1.42		
13	1.59	1.45		
14	1.47	1.42		
15	1.43	1.58		
16	1.46	1.50		
17	1.45	1.49		
18	1.45	1.39		
19	1.64	1.51		
20	1.55	1.49		
21	1.54	1.37		
22	1.59	1.54		
23	1.51	1.58		
24	1.62	1.43		
25	1.61	1.58		

Average Ro = 1.52

Standard Readings

1@	1.02 1.02	.00
2@	1.02 1.02	.00
3@	1.02 1.03	.01
4@	1.02 1.02	.00

COMMENTS:

Due to small size - no rotation of stage

Run By:- ____________________

SAMPLE:- DDH #75 @ 322'-337'

PELLET NO.:- #3 DATE:- 3/10/75

REFLECTANCE

	1	2	3	4
1	1.60	1.59		
2	1.70	1.53		
3	1.53	1.72		
4	1.68	1.79		
5	1.76	1.70		
6	1.75	1.77		
7	1.64	1.66		
8	1.69	1.66		
9	1.76	1.70		
10	1.67	1.63		
11	1.72	1.68		
12	1.65	1.77		
13	1.75	1.64		
14	1.77	1.73		
15	1.74	1.66		
16	1.67	1.65		
17	1.63	1.60		
18	1.74	1.62		
19	1.69	1.66		
20	1.78	1.74		
21	1.74	1.73		
22	1.57	1.74		
23	1.76	1.61		
24	1.83	1.62		
25	1.63	1.66		

Average Ro = 1.69

Standard Readings

1@	1.02 1.02	.00
2@	1.02 1.02	.00
3@	1.02 1.02	.00
4@	1.02 1.02	00

COMMENTS:

No rotation.

Run By:- ____________

Birtley Engineering

Subsidiary of Great West Steel Industries

SAMPLE:- DDH #75-4 @ 900'-907'

PELLET NO.:- #4 DATE:- 3/10/75

REFLECTANCE

	1	2	3	4
1	1.30	1.28		
2	1.37	1.35		
3	1.45	1.49		
4	1.47	1.42		
5	1.39	1.34		
6	1.36	1.38		
7	1.33	1.38		
8	1.31	1.27		
9	1.30	1.41		
10	1.41	1.43		
11	1.30	1.33		
12	1.40	1.40		
13	1.31	1.53		
14	1.32	1.38		
15	1.42	1.42		
16	1.34	1.41		
17	1.29	1.43		
18	1.36	1.36		
19	1.24	1.46		
20	1.42	1.33		
21	1.30	1.38		
22	1.35	1.47		
23	1.38	1.26		
24	1.27	1.30		
25	1.20	1.32		

Average Ro = 1.36

Standard Readings

1@	1.02
	1.02
	.00
2@	1.02
	1.03
	.01
3@	1.02
	1.01
	.01
4@	1.02
	1.02
	.00

COMMENTS:

No rotation.

Run By:-

Birtley Engineering
Subsidiary of Great West Steel Industries

Coal Rank Determination by Vitrinite Reflectance

Samples submitted by: Date: 3/10/75

Area: PINE PASS

Type and number of samples, location and age: 3 Samples

3372-BH DDH-75-8 @ 663' - 677'
3373 DDH-75-9 @ 322' - 337'
3294 DDH-75-4 @ 900' - 907'

Results of Reflectance Measurements

Sample No. or Depth in Well	%Ro	%VM of Vitrinite (from Kotter's curve)	Comparable ASTM Rank
#2 @ 663' - 667'	1.52	19	Low V. B.
#3 @ 322' - 337'	1.69	16	Low V. B.
#4 @ 900' - 907'	1.36	23	Med. Vol B.

Remarks

In many cases no rotation to obtain Mean Maximum Reflectance was possible. All three pellets exhibited signs of weathering and some oxidation.

Examined by: Colin Jury-Harris Date: 2/10/75

Birtley Engineering
Subsidiary of Great West Steel Industries

MACERAL COMPOSITION

Pellet #	Sample & Location	Vitrinites	Semi-Inerts	Inerts	Mineral Matter	Calculated Stability
2	Pine Pass @ 663'-677' DDH 75-8 #3372	62.6%	12.4%	21.6%	3.4%	31
3	Pine Pass @ 322'-337' DDH 75-9 #3373	56.24%	17.08%	26.68%	--	0
4	Pine Pass @ 900'-907' DDH 75-5 #3294	80.7%	6.00%	13%	--	52

REVISED MACERAL, Ro, STABILITY & F.S.I. OF PINE PASS SAMPLES

Pellet No.	Vitrinites	Semi-Inerts	Inerts	Mineral Matter	Ro	V.M. From Ro	F.S.I.	ASTM Rank	Calculated Stability
2	68.16%	7.69%	21.22%	3.4%	1.52	19	1 1/2	LVB	54
3	68.01%	6.14%	26.30%	--	1.69	16	1/2	LVB	45
4	82.1%	4.72%	13.2%	--	1.36	23	8 1/2	MVB	65

MACERAL, Ro, STABILITY & F. S. I. OF PINE PASS SAMPLES

Pellet No.	Vitrinites	Semi-Inerts	Inerts	Minenal Matter	Ro	V.M. From Ro	F.S.I.	ASTM Rank	Calculated Stability
2	62.6%	12.4%	21.6%	3.4%	1.52	19	1 1/2	LVB	31
3	56.24%	17.08%	26.28%	--	1.69	16	1/2	LVB	0
4	80.7%	6.04%	13.1%	--	1.36	23	8 1/2	MVB	52

SUMMARY OF 1/4"x0, V.M., F.S.I. COMPARED TO Ro, V.M.

SAMPLE	FOOTAGE	R.M.	ASH	V.M.	F.C.	F.S.I.	Ro	V.M./ KOTTERS	Ro/ REACTIVES	CALCS. C.S.
75-3 1/4" x 0	18.0 - 23.5	0.7	19.8	18.2	61.3	1				
	197 - 202	1.0	42.9	14.3	41.8	1 1/2				
	254 - 267.3	.8	28.5	1.40	56.7	1/2				
	551.5 - 558	1.1	57.0	10.2	31.7	1/2				
75-4 1/4" x 0	98.0 - 110.0	2.1	7.3	18.6	72.0	1 1/2				
	879.5 - 897	1.1	14.4	16.5	68.0	1 1/2				
	900 - 907	.9	2.4	19.8	76.9	8 1/2	1.36	22	65	65
75-6 1/4" x 0	465 - 481	1.7	5.6	19.6	73.1	1 1/2				
75-8 1/4" x 0	269 - 278	1.0	10.2	19.8	69.0	1 1/2				
	432 - 438	1.1	21.1	26.3	51.5	1 1/2				
	533 - 538	1.0	8.8	17.1	73.1	1 1/2				
	663 - 677	1.0	9.2	15.6	74.2	1 1/2	1.52	18	53	54
75-9 1/4" x 0	322 - 337	1.9	2.4	15.1	80.6	1/2	1.69	16	45	45
75-10 1/4" x 0	510.5 - 523	1.9	33.6	14.3	50.2	2				
	534.5 - 549.5	1.4	5.7	18.4	74.5	2				

SUMMARY

5.1 RANK

The coals fell into the low and medium volatile bituminous groups with a majority in the former.

5.2 RAW COAL

As can be seen from Table 5, many of the coals had a low ash content (less than 5%) with volatile matter of between 14% and 20%. F.S.I. values were surprisingly low (2 or below) with the exception of the sample from the 900' - 907' section from Hole #75-4 (8 F.S.I.).

The raw coal results for the major correlatable seam as shown in Table 6 were very consistent: all showed low ash and F.S.I. values. These seams present an average thickness of 15 feet.

Overall the coal found in 1975 appears to be higher in rank than that found in the 1973. This higher rank will account, to a certain extent, for the depression in F.S.I. readings.

5.3 CLEAN COAL

The results for the main seam, see Table 7, indicate that a very low ash clean coal (5% or less) can be produced from this property at very high yield levels (over 90%). Although the F.S.I. values are low (less than 1 1/2) we suspect that, due to the high rank and low ash content, this coal could be very attractive in terms of a blending coal in conventional coke making or possibly a constituent in form coke manufacture.

5.4 WASHABILITY CHARACTERISTICS

As would be expected with low ash coals, the washability characteristics of the coals are very good.

5.5 PETROGRAPHY

Only three samples were run and all three had good percentrages of Reactives to Inerts. The average reflectance was also high. This information coupled with the sink-float analysis means that the coals tested would exhibit low ash and high R_o in the medium volatile bituminous range.

CORRELATION BETWEEN 1973 AND 1975 DRILLING RESULTS

1973 Programme	Yield %	Moist. %	Ash %	V.M.	F.C.	Sulphur	F.S.I.
H-1 A @ 331-338' Total C.C.	78.5	.9	4.3	21.2	73.4	.74	4 1/2
H-1 B @ 338-341 " "	33.6	.6	9.6	23.4	66.4	.48	8
H-2 C @ 397-399 " "	95.2	1.1	2.5	20.8	75.6	.58	6
H-2 D @ 588-593 " "	21.2	.7	10.5	21.4	67.4	.81	5
H-3 A @ 582-586 " "	89.4	.7	3.1	21.9	74.3	.82	6 1/2
H-4 A @ 192-198 " "	93.0	.8	2.2	21.6	75.4	.61	5
H-4 B @ 262-276 " "	34.3	.8	11.4	20.9	66.9	.43	5
1975 Programme							
75-3 18.0-23' Raw Coal	--	.7	19.8	18.2	61.3	--	1
197-202 " "	--	1.0	42.9	14.3	41.8	--	1 1/2
254-267 " "	--	.8	28.5	14.0	56.7	--	1/2
551-558 " "	--	1.1	57.0	10.2	31.7	--	1/2
75-4 98-110 " "	--	2.1	7.3	18.6	72.0	--	1 1/2
879-897 " "	--	1.1	14.4	16.5	68.0	--	1 1/2
900-907 " "	--	.9	2.4	19.8	76.9	--	8 1/2
75-6 465-481 " "	--	1.7	5.6	19.6	73.1	--	1 1/2
75-8 269-278 " "	--	1.0	10.2	19.8	69.0	--	1 1/2
432-438 " "	--	1.1	21.1	26.3	51.5	--	1 1/2
533-538 " "	--	1.0	8.8	17.1	73.1	--	1 1/2
663-677 " "	--	1.0	9.2	15.6	74.2	--	1 1/2
75-9 322-337 " "	--	1.9	2.4	15.1	80.6	--	1/2
510-523 " "	--	1.9	33.6	14.3	50.2	--	2
75-10 534-549 " "	--	1.4	5.7	18.4	74.5	--	2

TABLE 5

TABLE 6

CORRELATION & EXPECTED YIELD OF COAL
IN 1975 DDH's 4, 6, 8, 9, & 10

RAW COAL DDH NO.	DEPTH	R.M.%	ASH%	V.M.%	F.C.	F.S.I.
75-4	95' - 110'	2.1	7.3	18.6	72.0	1 1/2
75-6	465' - 481'	1.7	5.6	19.6	73.1	1 1/2
75-8	269' - 278'	1.0	10.2	19.8	69.0	1 1/2
75-9	322' - 337'	1.9	2.4	15.1	80.6	1/2
75-10	534' - 549'	1.4	5.7	18.4	74.5	2

CLEAN COAL DDH NO.	DEPTH	FLTS @ S.G.	YIELD %	ASH %	F.S.I.
75-4	95' - 110'	1.60	94.6	4.3	1
75-6	465' - 481'	1.60	97.2	3.7	1/2
75-8	269' - 278'	1.60	92.5	6.0	1 1/2
75-9	322' - 337'	1.60	99.5	2.1	1/2
75-10	534' - 549'	1.60	98.0	5.0	1 1/2

SECTION 6

CONCLUSIONS

As a result of the 1973 and 1975 programmes, the following conclusions can be made:-

1) Low ash, as low and generally lower than other Canadian coals.
2) Mostly low volatile coals and also some medium volatile.
3) High yield of the correlated seams at a low (less than 4%) ash content, in excess of 90% yield.
4) Generally low F.S.I.s were recorded.
5) Petrography and R_o indicates stabilities indices of over 40. An extremely good blending coal.

SECTION 7

RECOMMENDATIONS

It is recommended that the only way to actually test this coal on a large scale would be to obtain bulk samples from the East side of the property and have actual coke oven tests run to obtain large scale blending and coking information.

In addition, it would be advantageous to have representative samples taken from the bulk samples that could be studied microscopically to establish the petrography and Reflectance of the various footages sampled. This microscopic study would certainly provide a much clearer seam correlation and composition of the coal being tested.

SECTION 8

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APPENDIX 2

COAL ANALYSES AND COMMENTS

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PINE PASS DEVELOPMENT CO. LTD.

HASLER PROPERTY

ASSESSMENT OF COAL QUALITY

1. INTRODUCTION

The data for the following assessment was collected by Coal Sciences and Minerals Testing and listed in Report No. 025-73, 30th March, 1973. The seams were correlated by Paul Dyson Consultants Ltd. as shown below in Table 1.

Table 1 Seam Correlation

Seam No.	Composite Sample No.
B	3-A 4-A
C	1-A, 1-B 3-B, 3-C, 3-D, 3-E 5-A
D	2-A, 2-B, 2-C 4-B, 4-C
?	1-C
?	2-D

2. COAL QUALITY

2.1 Seam B

This seam represented the most promising overall prospect in terms of coal quality. Excellent yield values of approximately 90% can be expected at 2-3% ash and 22.0% volatile (dmmf basis). Good swelling properties were also encountered in the composite analyses.

However, the upper part of seam B in hole number 4 did give poor FSI readings. The macroscopic petrographic analysis indicated that this depressed value was due to petrography rather than any oxidation. The sulphur content values for this seam were above average.

Summary: Excellent yield-ash characteristics
Low/Medium Volatile Content
Good FSI
Above average sulphur for W. Canada but
still less than 1.0%.

2.2 Seam C

It is noticeable with seam C that not only is there a high proportion of inert material occuring as bands within the seam but that much of this material remains locked within the coal itself,even after washing and subsequent sink-float analysis. The result is that the overall yield-ash characteristics of this seam are poor. The sample from hole 5, however, is the exception giving a yield of 90% at a clean coal ash content of 4%.

N.B. The clean coal composite results appear worse than they actually are because in holes 3 & 5 the raw fines were added into the clean coal sample rather than the more desireable froth flotation concentrates.

The swelling characteristics of seam C were generally good, although the low values encountered in samples 1-A and 3-C may give some cause for concern.

Summary: Yield-ash characteristics: poor
Low/Medium Volatile Content
Average FSI
Average Sulphur

2.3 Seam D

It appeared that the distinct banding of coal and shale that occured for seam D, in hole 2, graded into a more uniform inferior coal in hole 4. Regrettably the good characteristics of the individual bands in hole 2 are destroyed when the whole section is considered as one seam. The FSI values are generally good.

Summary: Yield-ash characteristics: poor
Low/Medium Volatile Content
Average FSI
Average Sulphur

2.4 Unnamed Seams

2.4.1 Composite Sample C from Hole 1

This sample exhibited excellent yield-ash characteristics but had very poor swelling properties which was due to the elevated rank of the coal (16.7% VM (dmmf)).

Summary: Excellent Yield-ash characteristics
Low Volatile Content (Coal is bordering on Semi-Anthracite)
Poor FSI

2.4.2 Composite Sample D from Hole 2

Summary: Poor Yield-ash characteristics
Medium Volatile Content
Average FSI

3. CONCLUSIONS

The overall characteristics of the coal samples are good. The clean coal ash contents are very low; the volatile content lies in the desireable low to low/medium range and the FSI values are generally acceptable. Unfortunately the coal seams are broken up by shale bands which would have to be mined with the coal sections. As a result the yield-ash characteristics are poor.

The results have shown that the coal quality is generally good; the problem, however, is locating uninterrupted seams of economic thickness (greater than 8 feet).

PINE PASS
HOLE NO. 1
20 FEB. 1973

COAL SCIENCE AND MINERALS TESTING
calgary alberta

Box	Depth	Thickness	Description	Sample	YIELD %	ASH %	R.M.%	V.M. %	F.C. %	F.S.I.	SEAM (Fig 8)
BOX 16 & 17			Shale roof								
	331/0 – 333/0	2'0"	Light coal, good Homogeneous, silky texture clarain - vitrain	1		5.4	1.0	20.1	73.5	3	
	333/0 – 334/6	1'6"	Good coal, higher vitrain content than above	2		11.7	0.9	20.6	66.8	6½	
	334/6 – 338/3	1'8"	Some core loss; recovery is 40%, good coal with inert banding. Fragmented.	3		17.2	1.1	19.8	61.9	4½	C
	338/3 – 340/0	1'9"	Siltstone, slicken sided Minor coal banding.	4		63.7	1.0	14.3	21.0	N.A.	
	340/0 – 341/6	1'6"	Coal, high vitrain content shiny - good recovery, Some poor bands	5		21.5	1.0	21.8	55.7	8	
			Shale floor								
BOX 52			Carbonaceous mudstone roof, minor coal bands.								
	1041/0 – 1044/0	1'6"	About 50% recovery, fragmented coal with shale bands.	6		27.7	1.3	10.9	50.1	N.A.	
	1044/0 – 1046/2	1'4"	Core loss, fragmented coal, Silky texture. Clarainous About 60% recovery.	7		9.7	1.3	15.0	74.0	N.A.	
	1046/2 – 1049/0	2'10"	Good core and very light high vitrain content, sparkling sugary appearance.	8		2.0	1.4	17.1	79.5	1½	
			Hard mudstone floor.								

PINE PASS
HOLE NO. 2
20 FEB. 1973

COAL SCIENCE AND MINERAL TESTING
calgary alberta

Box	Depth	Description	No.	YIELD %	ASH %	R.M.%	V.M.%	F.C.%	F.S.I.	SEAM (Fig 8)
BOX 19		Mudstone roof								
	378/0 2'-0" 380/0	Good coal, highly vitrainous Clarain with some durain	1		12.4	0.9	19.5	67.2	3	
	380/0 2'-9" 385/0	70% recovery, shale with minor fragmented coal bands	2		69.2	0.9	11.9	18.0	N.A.	D
	385/0 2'-4" 392/0	About 30% recovery, good coal, lustrous, fragmented, high vitrain content, seat and earth band at 390' approximately.	3		15.2	0.5	23.7	60.6	8½	
	392/0 5'-0" 397/0	Mudstone and shales, some carbonaceous scattered.	4		82.1	–	–	–	–	
	397/0 2'-0" 399/0	Good recovery band coal. clarain, silky texture.	5		3.0	1.0	21.7	74.3	6½	
		Floor - siltstone, strong.								
BOX 89		Shale roof								
	588/2 1'-9" 590/2	Bedded coal with inert banding; high vitrain content in coal fraction; About 90% recovery.	15		28.3	0.6	27.0	44.1	3.	
	590/2 1'-9" 593/0	About 60% recovery, fragmented shale with minor coal sections.	16		77.4	–	–	–	–	
		Floor - shale with minor coal bands, degradational.								

PINE PASS
HOLE NO. 3
20 FEB. 1973

COAL SCIENCE AND MINERAL TESTING
calgary alberta

Box	Depth	Description	Sample	YIELD %	ASH %	R.M.%	V.M. %	F.C%	F.S.I.	SEAM (Fig 8)
Box 29	582/0	Roof - shale								
	3'-2"	85 % recovery, Good coal. High vitrain content. Sparkling appearance. Some fusain. Uniform.	1		6·3	1·3	22·4	70·0	7	B
	586/0	Floor - mudstone, minor coal bands.								
Box 31/32		Roof - fine mudstone								
	623/7 10"	Inferior coal with shale banding.	2		49·6	1·3	14·9	34·2	2½	
	624/5 1'-2	Hard durainous coal; some vitrain bands (minor).	3		24·3	1·1	18·5	56·1	2	
	625/7 11"	Carbonaceous shale	4		82·2	—	—	—	—	
	626/6 10"	Durainous coal; some vitrain bands.	5		16·6	1·1	20·5	61·8	5	
	627/4 7"	Carbonaceous mudstone.	6		78·5	—	—	—	—	
	627/11 2'-4"	Hard coal; durainous coal with occasional vitrain bands; also some minor shale bands.	7		17·2	1·2	19·1	62·5	5	
	630/3 3"	Siltstone band.	8		84·7	—	—	—	—	
	630/6 7"	Inferior coal, mainly durain	9		15·7	1·1	18·5	62·5	1½	C
	631/1 11"	Shale	10		76·9	—	—	—	—	
	632/0 4'-0"	Good coal, friable high vitrain content, speckled appearance	11		6·1	1·2	24·5	68·2	8½	
	636/0 3'-4"	Carbonaceous mudstone, minor coal banding.	12		72·7	—	—	—	—	
	639/4 1'-9"	Dull coal. Some vitrain bands.	13		3·9	1·4	20·7	74·0	3½	
	641/1 4"	Sandstone band	14		80·6	—	—	—	—	
	641/5 2'-4"	Banded coal with mudstone	15		53·3	—	—	—	—	
	643/9 1'-0"	Hard coal; good coal; generally high vitrain content.	16		12·3	1·3	18·4	68·2	3	
	644/9	Floor - shale								

PINE PASS
HOLE NO. 4
20 FEB. 1973

COAL SCIENCE AND MINERALS ESTING
calgary alberta

Box	Depth	Description	YIELD %	ASH %	R.M. %	V.M. %	F.C. %	F.S.I.	SEAM (Fig 8)
Box 9	192/6 3'-3" 195/9	Good coal, high durain content, very hard, some clarain; vitrain concentrated on upper part. 1		1·7	1·4	21·7	75·2	2½	
Box 9	195/9 1'-6" 197/3	Similar to above; slightly higher vitrain content, still very hard. 2		2·6	1·5	22·0	73·9	4	B
Box 9	197/3 9" 198/0	Good coal. Very high vitrain content; sparkling appearance Fractures more easily than above. 3		3·9	1·4	24·1	70·6	8	
Box 9		Floor – mudstone							
Box 12		Roof – mudstone							
Box 12	262/10 3'-8" 266/2	About 80% recovery. Durainous coal. Some core loss, fragmented. 5		14·9	1·1	17·9	66·1	1½	
Box 12	266/2 9" 266/11	Siltstone; minor coal bands 6		83·0	—	—	—	—	
Box 12	266/11 1'-8" 269/2	About 60% recovery. Durainous, some vitrain banding, some clarain. 7		30·9	1·1	18·8	49·2	7½	
Box 12	269/2 1'-11" 276/0	Inferior coal, dull shale. About 30% recovery. 8		71·1	—	—	—	—	D
Box 12	276/0 1'-2" 277/2	Generally shale with some coal bands. 9		67·6	—	—	—	—	
Box 12	277/2 1'-11" 280/0	Clarainous coal. Some vitrain band. Also minor inert shale band. Core loss about 60% recovery. 10		30·5	1·2	18·0	50·3	5½	
Box 12	280/0 1'-3" 284/0	About 30% recovery. Good clarainous coal. Inferior shale banding. Probable loss of core. 11		46·1	1·3	13·8	38·8	1	
Box 12		Floor – mudstone							

PINE PASS
HOLE NO. 5
20 FEB. 1973

COAL SCIENCE AND MINERALS TESTING
calgary alberta

Depth		YIELD %	ASH %	R.M. %	V.M. %	F.C. %	F.S.I.	SEAM (Fig 8)
	Roof shale							
166/0 1'-10" 168/6	High dip in roof, very good coal, very light, high vitrain content, Sugary appearance. Very soft. About 60% recovery.		7.4	0.9	23.5	68.2	8½	D
	Floor shale							

PINE PASS
HOLE NO. 1
20 FEB. 1973

COAL SCIENCE AND MINERALS TESTING
calgary alberta

Seam (Fig 8)

C

Box	Depth	Interval	Description	Sample	Composite	YIELD %	ASH %	R.M.%	V.M. %	F.C. %	F.S.I.	
BOX 16 & 17			Shale roof									
	331/0	2'0"	Light coal, good Homogeneous, silky texture clarain - vitrain	1	COMP 1-A	78.5	4.3	0.9	21.2	73.4	4½	FLTS @ 1.45SG + FF
	333/0	1'6"	Good coal, higher vitrain content than above	2								
	334/6	1'8"	Some core loss; recovery is 40%, good coal with inert banding. Fragmented.	3								
	338/3	1'9"	Siltstone, slicken sided Minor coal banding.	4	COMP 1-B	33.6	9.6	0.6	23.4	66.4	8	FLTS @ 1.45SG + FF
	340/0	1'6"	Coal, high vitrain content Shiny - good recovery, Some poor bands	5								
	341/6		Shale floor									
BOX 52			Carbonaceous mudstone roof, minor coal bands.									
	1041/0	1'6"	About 50% recovery, fragmented coal with shale bands.	6	COMP 1-C	80.6	3.0	1.1	16.4	79.5	1	FLTS @ 1.45SG + RAW-28MESH. NOTE LOW VM (HILTS LAW)
	1044/0	1'4"	Core loss, fragmented coal, Silky texture. Clarainous About 60% recovery.	7								
	1046/2	2'10"	Good core and very light high vitrain content, sparkling sugary appearance.	8								
	1049/0		Hard mudstone floor.									

PINE PASS
HOLE NO. 2
20 FEB. 1973

COAL SCIENCE AND MINERALS TESTING
calgary alberta

Seam (Fig 8)

				YIELD %	ASH %	R.M.%	V.M.%	F.C.%	F.S.I.	
D	Box 19		Mudstone roof							
		378/0 2'-0" 380/0	Good coal, highly vitrainous - Clarain with some durain 1	COMP 2-A 78.5	6.6	1.0	21.7	70.7	3½	FLTS @ 1·45+ RAW −28 MESH
		380/0 2'-9" 385/0	70% recovery, shale with minor fragmented coal bands 2							
		385/0 2'-4" 392/0	About 30% recovery, good coal, lustrous, fragmented. high vitrain content, seat and earth band at 390' approximately. 3	COMP 2-B 87.7	4.4	1.0	24.7	69.9	8½	FLTS @ 1·45+ RAW −28 MESH.
		392/0 5'-0" 397/0	Mudstone and shales, some carbonaceous scattered. 4							
		397/0 2'-0" 399/0.	Good recovery band coal. clarain, silky texture. 5	COMP 2-C 95.2	2.5	1.1	20.8	75.6	6	FLTS @ 1·45+ FF CONC.
			Floor - siltstone, strong.							
	Box 29		Shale roof							
		588/2 1'-9" 590/2	Bedded coal with inert banding; high vitrain content in coal fraction; About 90% recovery. 15	COMP 2-D 21.2	10.5	0.7	21.4	67.4	5	FLTS @ 1·45+ FF CONC.
		590/2 1'-9" 593/0	About 60% recovery, fragmented shale with minor coal sections. 16							
			Floor - shale with minor coal bands, degradational.							

PINE PASS
HOLE NO. 3
20 FEB. 1973.

COAL SCIENCE AND MINERALS TESTING
calgary alberta

Seam (Fig 8)

Seam	Box	Depth	Description		YIELD %	ASH %	R.M.%	V.M. %	F.C %	F.S.I.	
B	Box 29		Roof - shale		COMP 3-A						
		582/0 3'-8" 586/0	85 % recovery, Good coal. High vitrain content. Sparkling appearance Some fusain. Uniform.	1	89.4	3.1	0.7	21.9	74.3	6½	FLTS@ 1·45SG+FF CONC
			Floor - mudstone, minor coal bands.								
C	Box 31 & 32		Roof - fine mudstone								
		623/7 10" 624/5	Inferior coal with shale banding.	2	COMP 3-B						
		624/5 1'-2 625/7	Hard durainous coal; some vitrain bands (minor).	3	36.7	17.7	0.9	20.4	61.0	6	FLTS @ 1·45SG+RAW-28 MESH
		625/7 11". 626/6	Carbonaceous shale	4							
		626/6 10" 627/4	Durainous coal; some vitrain bands.	5							
		627/4 7" 627/11	Carbonaceous mudstone.	6							
		627/11 2'-4" 630/3	Hard coal; durainous coal with occasional vitrain bands; also some minor shale bands.	7	COMP 3-C						
		630/3 3" 630/6	Siltstone band.	8	76.2	9.7	0.8	20.3	69.2	3½	FLTS @ 1·45SG+RAW-28MESH
		630/6 7" 631/1	Inferior coal, mainly durain	9							
		631/1 11" 632/0	Shale	10	COMP 3-D.						
		632/0 4'-0" 636/0	Good coal, friable high vitrain content, speckled appearance	11	93.5	4.5	0.7	25.7	69.1	8½	FLTS @1·45 SG +RAW-28 MESH
		636/0 3'-4" 639/4	Carbonaceous mudstone, minor coal banding.	12							
		639/4 1'-9" 641/1	Dull coal. Some vitrain bands.	13	COMP 3-E						
		641/1 4" 641/5	Sandstone band	14	57.3	7.6	1.0	21.0	70.4	5	FLTS @ 1·45SG+RAW-28 MESH
		641/5 2'-4" 643/9	Banded coal with mudstone	15							
		643/9 1'-0" 644/9	Hard coal; good coal; generally high vitrain content.	16							
			Floor - shale								

PINE PASS
HOLE NO. 4
20 FEB. 1973

COAL SCIENCE AND MINERALS TESTING
calgary alberta

Seam (Fig 8)

Seam	Box	Depth / Thickness	No.	Description	Composite	YIELD %	ASH %	R.M. %	V.M. %	F.C. %	F.S.I.	
B	Box 9	192/6 – 3'-3" – 195/9	1	Good coal, high durain content, very hard, some clarain; vitrain concentrated on upper part.	COMP 4A	93.0	2.2	0.8	21.6	75.4	5	FLTS @1.45 SG + FF CONC.
		195/9 – 1'-6" – 197/3	2	Similar to above; slightly higher vitrain content, still very hard.								
		197/3 – 9" – 198/0	3	Good coal. Very high vitrain content; sparkling appearance. Fractures more easily than above.								
				Floor - mudstone								
D	Box 12			Roof - mudstone								
		262/10 – 2'-8" – 266/2	5	About 80% recovery, Durainous coal. Some core loss, fragmented.	COMP 4-B	34.3	11.4	0.8	20.9	66.9	5	FLTS @ 1.45 SG + FF CONC.
		266/2 – 9" – 266/11	6	Siltstone; minor coal bands								
		266/11 – 1'-8" – 269/2	7	About 60% recovery. Durainous, some vitrain banding, some clarain.								
		269/2 – 1'-11" – 276/0	8	Inferior coal, dull shale. About 30% recovery.								
		276/0 – 1'-2" – 277/2	9	Generally shale with some coal bands.	COMP 4-C	37.4	13.5	0.9	20.0	65.6	6½	FLTS @ 1.45 SG + FF CONC.
		277/2 – 1'-11" – 280/0	10	Clarainous coal. Some vitrain band. Also minor inert shale band. Core loss about 60% recovery.								
		280/0 – 1'-3" – 284/0	11	About 30% recovery. Good clarainous coal. Inferior shale banding. Probable loss of core.								
				Floor - mudstone								

PINE PASS
HOLE NO. 5
20 FEB. 1973

COAL SCIENCE AND MINERALS TESTING
calgory alberta

Seam (Fig 8)

Seam	Depth	Section	YIELD %	ASH %	R.M. %	V.M. %	F.C. %	F.S.I.	
		Roof shale							
D	166/0 1'-10" 168/6	High dip in roof, very good coal, very light, high vitrain content, Sugary appearance. Very soft. About 60% recovery.	COMP.G.A. 92.3	4.1	1.0	24.4	70.5	8½	FLTS @1.45 SG + RAW-28MES.
		Floor shale							

PINE PASS DEVELOPMENT

February 26, 1973

HOLE No. 1

RAW ANALYSES

INTERCEPT #	ASH	R.M.	V.M.	F.C.	F.S.I.
1	5.4	1.0	20.1	73.5	3
2	11.7	0.9	20.6	66.8	6½
3	17.2	1.1	19.8	61.9	4½
4	63.7	1.0	14.3	21.0	N.A.
5	21.5	1.0	21.8	55.7	8
6	27.7	1.3	10.9	50.1	N.A.
7	9.7	1.3	15.0	74.0	N.A.
8	2.0	1.4	17.1	79.5	1½

C

?

PINE PASS DEVELOPMENT

February 26, 1973

HOLE No. 2

RAW ANALYSES

INTERCEPT #	ASH	R.M.	V.M.	F.C.	F.S.I.	
1	12.4	0.9	19.5	67.2	3	
2	69.2	0.9	11.9	18.0	N.A.	
3	15.2	0.5	23.7	60.6	8½	
4	82.1	--	--	--	--	D
5	3.0	1.0	21.7	74.3	6½	
15	28.3	0.6	27.0	44.1	3	?
16	77.4	--	--	--	--	

PINE PASS DEVELOPMENT

February 26, 1973

HOLE No. 3

RAW ANALYSES

INTERCEPT #	ASH	R.M.	V.M.	F.C.	F.S.I	
1	6.3	1.3	22.4	70.0	7	B
2	49.6	1.3	14.9	34.2	2½	
3	24.3	1.1	18.5	56.1	2	
4	82.2	--	--	--	--	
5	16.6	1.1	20.5	61.8	5	
6	78.5	--	--	--	--	
7	17.2	1.2	19.1	62.5	5	
8	84.7	--	--	--	--	
9	15.7	1.1	18.5	62.5	1½	C
10	76.9	--	--	--	--	
11	6.1	1.2	24.5	68.2	8½	
12	72.7	--	--	--	--	
13	3.9	1.4	20.7	74.0	3½	
14	80.6	--	--	--	--	
15	53.3	--	--	--	--	
16	12.3	1.3	18.4	68.2	3	

PINE PASS DEVELOPMENT

February 26, 1973

HOLE NO. 4

RAW ANALYSES

INTERCEPT #	ASH	R.M.	V.M.	F.C.	F.S.I.	
1	1.7	1.4	21.7	75.2	2½	
2	2.6	1.5	22.0	73.9	4	B
3	3.9	1.4	24.1	70.6	8	
4	--	--	--	--	--	
5	14.9	1.1	17.9	66.1	1½	
6	83.0	--	--	--	--	
7	30.9	1.1	18.8	49.2	7½	D
8	71.1	--	--	--	--	
9	67.6	--	--	--	--	
10	30.5	1.2	18.0	50.3	5½	
11	46.1	1.3	13.8	38.8	1	

PINE PASS DEVELOPMENT

February 26, 1973

HOLE NO. 5

RAW ANALYSES

INTERCEPT #	ASH	R.M.	V.M.	F.C.	F.S.I.	
1	7.4	0.9	23.5	68.2	8½	1

COAL SCIENCE AND MINERALS TESTING	
CUSTOMER PINE PASS DEVELOPMENT	1-A Composite 331/0-338/3
DATE March 15th, 1973	

RAW COAL	WT %	MOIST.%	ASH %	V.M.	F.C.	SULPHUR	F.S.I	C.V.
3/4" x 28M	78.7		13.8				3	
28 MESH x 0	21.3		6.7				6	
TOTAL	100.0	0.7	12.8	19.9	66.6	0.54	4½	

PLUS 28 MESH ANALYSIS (SINK-FLOAT 1.45 S.G.)

S.G.FRACTION	WT.%	MOIST.%	ASH %	V.M.	F.C.	SULPHUR	F.S.I.	C.V.
Floats	80.2	1.0	4.4	21.0	73.6	0.81	4	
Sinks	19.8		51.6				½	
TOTAL	100.0		(13.7)					

MINUS 28 MESH ANALYSIS (FROTH FLOTATION)

ELEMENTARY ANALYSIS

STAGE	WT.%	ASH %	F.S.I.
I	52.7	3.9	7½
II	19.8	4.7	7
Tails	27.5	13.8	4

CUMULATIVE ANALYSIS

WT. %	MOIST.%	ASH %	V.M.	F.C.	SULPHUR	F.S.I.	C.V.
52.7		3.9					
72.5	0.5	4.1	22.0	73.4	0.36	7	
100.0		6.8					

TOTAL CLEAN COAL (FLOAT PRODUCT PLUS FLOTATION CONCENTRATE)

	YIELD %	MOIST. %	ASH %	V.M.	F.C.	SULPHUR	F.S.I	C.V.
	78.5	0.9	4.3	21.2	73.4	0.74	4½	

SIGNED: D.T. Symonds

COAL SCIENCE AND MINERALS TESTING	
CUSTOMER PINE PASS DEVELOPMENT	1-B Composite 338/3 - 341/6
DATE March 15th, 1973	

RAW COAL	WT %	MOIST.%	ASH %	V.M.	F.C.	SULPHUR	F.S.I.	C.V.
3/4" x 28M	87.5		49.6				2	
28 MESH x 0	12.5		28.5				7½	
TOTAL	100.0	0.7	43.0	17.5	38.8	0.40	1½	

PLUS 28 MESH ANALYSIS (SINK-FLOAT 1.45 S.G.)

S.G.FRACTION	WT.%	MOIST.%	ASH %	V.M.	F.C.	SULPHUR	F.S.I.	C.V.
Floats	28.3	0.6	8.3	23.6	67.5	0.48	8	
Sinks	71.7		65.2				N.A.	
TOTAL	100.0		(49.1)					

MINUS 28 MESH ANALYSIS (FROTH FLOTATION)

ELEMENTARY ANALYSIS

STAGE	WT.%	ASH %	F.S.I.
I	70.4	13.4	8
II	8.4	25.1	
Tails	21.2	75.3	N.A.

CUMULATIVE ANALYSIS

WT. %	MOIST.%	ASH %	V.M.	F.C.	SULPHUR	F.S.I.	C.V.
70.4	0.6	13.4	22.9	63.1	0.48	8	
78.8		14.7					
100.0		(27.5)					

TOTAL CLEAN COAL (FLOAT PRODUCT PLUS FLOTATION CONCENTRATE)

	YIELD %	MOIST. %	ASH %	V.M.	F.C.	SULPHUR	F.S.I.	C.V.
	33.6	0.6	9.6	23.4	66.4	0.48	8	

SIGNED: D.F. Symonds

COAL SCIENCE AND MINERALS TESTING

CUSTOMER PINE PASS DEVELOPMENT — 1-C Composite 1041/0 - 1049/0

DATE March 15th, 1973

RAW COAL	WT %	MOIST.%	ASH %	V.M.	F.C.	SULPHUR	F.S.I.	C.V.
3/4" x 28M	87.8		15.3				½	
28 MESH x 0	12.2	1.0	11.0	15.8	72.2	0.54	½	
TOTAL	100.0	0.9	15.0	15.4	68.7	0.52	½	

PLUS 28 MESH ANALYSIS (SINK-FLOAT 1.45 S.G.)

S.G.FRACTION	WT.%	MOIST.%	ASH %	V.M.	F.C.	SULPHUR	F.S.I.	C.V.
Floats	77.9	1.1	1.6	16.5	80.8	0.60	1	
Sinks	22.1		74.4				N.A.	
TOTAL	100.0		(17.7)					

* Insufficient Sample

MINUS 28 MESH ANALYSIS (FROTH FLOTATION)

ELEMENTARY ANALYSIS

STAGE	WT.%	ASH %	F.S.I.
*			

CUMULATIVE ANALYSIS

WT. %	MOIST.%	ASH %	V.M.	F.C.	SULPHUR	F.S.I.	C.V.

TOTAL CLEAN COAL (FLOAT PRODUCT PLUS FLOTATION CONCENTRATE)

	YIELD %	MOIST. %	ASH %	V.M.	F.C.	SULPHUR	F.S.I.	C.V.

SIGNED: DF Symonds

COAL SCIENCE AND MINERALS TESTING	
CUSTOMER PINE PASS DEVELOPMENT	2-A Composite 378/0 - 380/0
DATE March 15th, 1973	

RAW COAL	WT %	MOIST.%	ASH %	V.M.	F.C.	SULPHUR	F.S.I.	C.V.
3/4" x 28M	85.1		14.5				2½	
28 MESH x 0	14.9	0.7	9.7	20.4	69.2	0.64	6	
TOTAL	(100.0)		(13.8)					

PLUS 28 MESH ANALYSIS (SINK-FLOAT 1.45 S.G.)								
S.G.FRACTION	WT.%	MOIST.%	ASH %	V.M.	F.C.	SULPHUR	F.S.I.	C.V.
Floats	74.7	1.0	5.9	22.0	71.1	0.68	3	
Sinks	25.3		44.4				1	
TOTAL	100.0		(15.6)					

* Insufficient Sample

MINUS 28 MESH ANALYSIS (FROTH FLOTATION)

ELEMENTARY ANALYSIS			
STAGE	WT.%	ASH %	F.S.I.
*			

CUMULATIVE ANALYSIS							
WT. %	MOIST.%	ASH %	V.M.	F.C.	SULPHUR	F.S.I.	C.V.

TOTAL CLEAN COAL (FLOAT PRODUCT PLUS FLOTATION CONCENTRATE)								
	YIELD %	MOIST. %	ASH %	V.M.	F.C.	SULPHUR	F.S.I.	C.V.

SIGNED: D F Symonds

COAL SCIENCE AND MINERALS TESTING	
CUSTOMER PINE PASS DEVELOPMENT	2-B Composite 385/0 - 392/0
DATE March 15th, 1973	

RAW COAL	WT %	MOIST.%	ASH %	V.M.	F.C.	SULPHUR	F.S.I.	C.V.
3/4" x 28M	80.4		*					
28 MESH x 0	19.6	1.0	5.7	24.7	68.6	0.46	8½	
TOTAL	100.0							

PLUS 28 MESH ANALYSIS (SINK-FLOAT 1.45 S.G.)								
S.G.FRACTION	WT.%	MOIST.%	ASH %	V.M.	F.C.	SULPHUR	F.S.I.	C.V.
Floats	84.1	1.0	4.0	24.7	70.3	0.44	8½	
Sinks	15.9		75.5				½	
TOTAL	100.0		(15.4)					

* Insufficient Sample

MINUS 28 MESH ANALYSIS (FROTH FLOTATION)

ELEMENTARY ANALYSIS			
STAGE	WT.%	ASH %	F.S.I.
*			

CUMULATIVE ANALYSIS							
WT. %	MOIST.%	ASH %	V.M.	F.C.	SULPHUR	F.S.I.	C.V.

TOTAL CLEAN COAL (FLOAT PRODUCT PLUS FLOTATION CONCENTRATE)								
	YIELD %	MOIST. %	ASH %	V.M.	F.C.	SULPHUR	F.S.I.	C.V.

SIGNED: D.F. Symonds

COAL SCIENCE AND MINERALS TESTING		
CUSTOMER	PINE PASS DEVELOPMENT	2-C Composite 397/0 - 399/0
DATE	March 15th, 1973	

RAW COAL	WT %	MOIST.%	ASH %	V.M.	F.C.	SULPHUR	F.S.I.	C.V.
3/4" x 28M	81.1		3.3				4	
28 MESH x 0	18.9		3.3				6½	
TOTAL	100.0	*	(3.3)	*	*	*	*	

PLUS 28 MESH ANALYSIS (SINK-FLOAT 1.45 S.G.)

S.G.FRACTION	WT.%	MOIST.%	ASH %	V.M.	F.C.	SULPHUR	F.S.I.	C.V.
Floats	98.4	1.2	2.6	20.5	75.7	0.58	5½	
Sinks	1.6		43.6				½	
TOTAL	100.0		(3.3)					

*Insufficient Sample

MINUS 28 MESH ANALYSIS (FROTH FLOTATION)

ELEMENTARY ANALYSIS

STAGE	WT.%	ASH %	F.S.I.
I	81.6	2.1	7
II	16.1	3.2	6½
Tails	2.3	25.8	1

CUMULATIVE ANALYSIS

WT. %	MOIST.%	ASH %	V.M.	F.C.	SULPHUR	F.S.I.	C.V.
81.6	0.5	2.1	22.6	74.8	0.58	7	
97.7		2.3					
100.0		2.8					

TOTAL CLEAN COAL (FLOAT PRODUCT PLUS FLOTATION CONCENTRATE)

	YIELD %	MOIST. %	ASH %	V.M.	F.C.	SULPHUR	F.S.I.	C.V.
	95.2	1.1	2.5	20.8	75.6	0.58	6	

SIGNED: D.F Symonds

COAL SCIENCE AND MINERALS TESTING	
CUSTOMER PINE PASS DEVELOPMENT	2-D Composite 588/2 - 593/0
DATE March 15th, 1973	

RAW COAL	WT %	MOIST.%	ASH %	V.M.	F.C.	SULPHUR	F.S.I.	C.V.
3/4" x 28M	86.4		61.4				1	
28 MESH x 0	13.6		31.6				6½	
TOTAL	100.0	1.0	58.3	15.1	25.6	0.37	½	

PLUS 28 MESH ANALYSIS (SINK-FLOAT 1.45 S.G.)								
S.G.FRACTION	WT.%	MOIST.%	ASH %	V.M.	F.C.	SULPHUR	F.S.I.	C.V.
Floats	14.2	0.8	6.5	20.3	72.4	0.81	4½	
Sinks	85.8		70.5				N.A.	
TOTAL	100.0		(61.4)					

MINUS 28 MESH ANALYSIS (FROTH FLOTATION)

ELEMENTARY ANALYSIS			
STAGE	WT.%	ASH %	F.S.I.
I	65.7	16.1	7
II	10.6	28.5	5½
Tails	23.7	71.7	N.A.

CUMULATIVE ANALYSIS							
WT. %	MOIST.%	ASH %	V.M.	F.C.	SULPHUR	F.S.I.	C.V.
65.7	0.5	16.1	23.0	60.4	0.81	7	
76.3		17.8					
100.0		30.6					

TOTAL CLEAN COAL (FLOAT PRODUCT PLUS FLOTATION CONCENTRATE)								
	YIELD %	MOIST. %	ASH %	V.M.	F.C.	SULPHUR	F.S.I.	C.V.
	21.2	0.7	10.5	21.4	67.4	0.81	5	

SIGNED: D.F. Szymanski

COAL SCIENCE AND MINERALS TESTING		
CUSTOMER	PINE PASS DEVELOPMENT	3-A Composite 582/0 - 586/0
DATE	March 15th, 1973	

RAW COAL	WT %	MOIST.%	ASH %	V.M.	F.C.	SULPHUR	F.S.I.	C.V.
3/4" x 28M	84.3		4.2				6½	
28 MESH x 0	15.7		4.8				7	
TOTAL	100.0	*	(4.3)	*	*	*	*	

* Insufficient Sample

PLUS 28 MESH ANALYSIS (SINK-FLOAT 1.45 S.G.)								
S.G.FRACTION	WT.%	MOIST.%	ASH %	V.M.	F.C.	SULPHUR	F.S.I.	C.V.
Floats	93.0	0.7	3.1	21.8	74.4	0.83	6½	
Sinks	7.0		43.2				N.A.	
TOTAL	100.0		(5.9)					

MINUS 28 MESH ANALYSIS (FROTH FLOTATION)

ELEMENTARY ANALYSIS			
STAGE	WT.%	ASH %	F.S.I.
I	54.4	3.3	7½
II	38.8	4.1	7
Tails	6.8	21.3	3

CUMULATIVE ANALYSIS							
WT. %	MOIST.%	ASH %	V.M.	F.C.	SULPHUR	F.S.I.	C.V.
54.4	0.6	3.3	23.0	73.1	0.81	7½	
93.2		3.6					
100.0		4.8					

TOTAL CLEAN COAL (FLOAT PRODUCT PLUS FLOTATION CONCENTRATE)								
	YIELD%	MOIST. %	ASH %	V.M.	F.C.	SULPHUR	F.S.I.	C.V.
	89.4	0.7	3.1	21.9	74.3	0.82	6½	

SIGNED: D.F. [illegible]

COAL SCIENCE AND MINERALS TESTING	
CUSTOMER PINE PASS DEVELOPMENT	3-B Composite 623/7 - 625/7
DATE March 15th, 1973	

RAW COAL	WT %	MOIST.%	ASH %	V.M.	F.C.	SULPHUR	F.S.I.	C.V.
3/4" x 28M	89.5		36.9				1	
28 MESH x 0	10.5	1.3	32.2	17.4	49.1	0.73	4	
TOTAL	100.0	0.8	36.5	15.9	46.8	0.62	1	

PLUS 28 MESH ANALYSIS (SINK-FLOAT 1.45 S.G.)								
S.G.FRACTION	WT.%	MOIST.%	ASH %	V.M.	F.C.	SULPHUR	F.S.I.	C.V.
Floats	29.3	0.7	11.9	21.6	65.8	0.87	6½	
Sinks	70.7		51.7				1	
TOTAL	100.0		(40.0)					

MINUS 28 MESH ANALYSIS (FROTH FLOTATION)

ELEMENTARY ANALYSIS			
STAGE	WT.%	ASH %	F.S.I.

CUMULATIVE ANALYSIS							
WT. %	MOIST.%	ASH %	V.M.	F.C.	SULPHUR	F.S.I.	C.V.

TOTAL CLEAN COAL (FLOAT PRODUCT PLUS FLOTATION CONCENTRATE)								
	YIELD %	MOIST. %	ASH %	V.M.	F.C.	SULPHUR	F.S.I.	C.V.

SIGNED: D.F. Symonds

CS-3

COAL SCIENCE AND MINERALS TESTING	
CUSTOMER PINE PASS DEVELOPMENT	3-C Composite 627/11 - 631/1
DATE March 15th, 1973	

RAW COAL	WT %	MOIST.%	ASH %	V.M.	F.C.	SULPHUR	F.S.I.	C.V.
3/4" x 28M	88.0		22.6				1½	
28 MESH x 0	12.0	1.0	18.0	19.8	61.2	0.48	4	
TOTAL	100.0	0.8	23.2	18.6	57.4	0.42	1½	

PLUS 28 MESH ANALYSIS (SINK-FLOAT 1.45 S.G.)								
S.G.FRACTION	WT.%	MOIST.%	ASH %	V.M.	F.C.	SULPHUR	F.S.I.	C.V.
Floats	73.0	0.8	8.2	20.4	70.6	0.54	3½	
Sinks	27.0		58.7				N.A.	
TOTAL	100.0		(21.8)					

MINUS 28 MESH ANALYSIS (FROTH FLOTATION)

ELEMENTARY ANALYSIS			
STAGE	WT.%	ASH %	F.S.I.

CUMULATIVE ANALYSIS							
WT. %	MOIST.%	ASH %	V.M.	F.C.	SULPHUR	F.S.I.	C.V.

TOTAL CLEAN COAL (FLOAT PRODUCT PLUS FLOTATION CONCENTRATE)								
	YIELD %	MOIST. %	ASH %	V.M.	F.C.	SULPHUR	F.S.I.	C.V.

SIGNED: D.F. Sigurdson

COAL SCIENCE AND MINERALS TESTING	
CUSTOMER PINE PASS DEVELOPMENT	3-D Composite 632/0 - 636/0
DATE March 15th, 1973	

RAW COAL	WT %	MOIST.%	ASH %	V.M.	F.C.	SULPHUR	F.S.I.	C.V.
3/4" x 28M	84.6		6.2				8½	
28 MESH x 0	15.4	1.0	6.3	25.5	67. 2	0.42	8½	
TOTAL	100.0	*	(6.2)	*	*	*		*

* Insufficient Sample

PLUS 28 MESH ANALYSIS (SINK-FLOAT 1.45 S.G.)

S.G.FRACTION	WT.%	MOIST.%	ASH %	V.M.	F.C.	SULPHUR	F.S.I.	C.V.
Floats	92.3	0.7	4.2	25.7	69.4	0.46	8½	
Sinks	7.7		30.7				1	
TOTAL	100.0		(6.2)					

MINUS 28 MESH ANALYSIS (FROTH FLOTATION)

ELEMENTARY ANALYSIS

STAGE	WT.%	ASH %	F.S.I.

CUMULATIVE ANALYSIS

WT. %	MOIST.%	ASH %	V.M.	F.C.	SULPHUR	F.S.I.	C.V.

TOTAL CLEAN COAL (FLOAT PRODUCT PLUS FLOTATION CONCENTRATE)

	YIELD %	MOIST. %	ASH %	V.M.	F.C.	SULPHUR	F.S.I.	C.V.

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COAL SCIENCE AND MINERALS TESTING	
CUSTOMER PINE PASS DEVELOPMENT	3-E Composite 639/4 - 644/9
DATE March 15th, 1973	

RAW COAL	WT %	MOIST.%	ASH %	V.M.	F.C.	SULPHUR	F.S.I.	C.V.
3/4" x 28M	88.3		33.7				2½	
28 MESH x 0	11.7	1.0	21.6	19.6		0.52	5½	
TOTAL	100.0	0.6	33.5	17.3	48.6	0.42	1½	

NB NOTE DEPRESSED FSI IN COARSE COAL FLOATS

PLUS 28 MESH ANALYSIS (SINK-FLOAT 1.45 S.G.)								
S.G.FRACTION	WT.%	MOIST.%	ASH %	V.M.	F.C.	SULPHUR	F.S.I.	C.V.
Floats	51.6	1.0	4.0	21.4	73.6	0.62	4½	
Sinks	48.4		65.8				½	
TOTAL	100.0		(33.9)					

*Insufficient Sample

MINUS 28 MESH ANALYSIS (FROTH FLOTATION)

ELEMENTARY ANALYSIS			
STAGE	WT.%	ASH %	F.S.I.
*			

CUMULATIVE ANALYSIS							
WT. %	MOIST.%	ASH %	V.M.	F.C.	SULPHUR	F.S.I.	C.V.

TOTAL CLEAN COAL (FLOAT PRODUCT PLUS FLOTATION CONCENTRATE)								
	YIELD%	MOIST. %	ASH %	V.M.	F.C.	SULPHUR	F.S.I.	C.V.

SIGNED: DF Seyward

CS-3

COAL SCIENCE AND MINERALS TESTING	
CUSTOMER PINE PASS DEVELOPMENT	4-A Composite 192/6 - 198/0
DATE March 15th, 1973	

RAW COAL	WT %	MOIST.%	ASH %	V.M.	F.C.	SULPHUR	F.S.I.	C.V.
3/4" x 28M	62.0		2.7				4	
28 MESH x 0	38.0		2.3				5½	
TOTAL	100.0	1.0	(2.5)	22.2	74.3	0.58	3	

PLUS 28 MESH ANALYSIS (SINK-FLOAT 1.45 S.G.)								
S.G.FRACTION	WT.%	MOIST.%	ASH %	V.M.	F.C.	SULPHUR	F.S.I.	C.V.
Floats	99.1	1.0	2.2	21.4	75.4	0.62	4	
Sinks	0.9		40.2				N.A.	
TOTAL	100.0		2.5					

MINUS 28 MESH ANALYSIS (FROTH FLOTATION)

ELEMENTARY ANALYSIS			
STAGE	WT.%	ASH %	F.S.I.
I	83.1	2.1	6
II	14.3	2.9	5
Tails	2.6	14.2	1½

CUMULATIVE ANALYSIS							
WT. %	MOIST.%	ASH %	V.M.	F.C.	SULPHUR	F.S.I.	C.V.
83.1	0.5	2.1	22.1	75.3	0.60	6	
97.4		2.2					
100.0		2.5					

TOTAL CLEAN COAL (FLOAT PRODUCT PLUS FLOTATION CONCENTRATE)								
	YIELD %	MOIST. %	ASH %	V.M.	F.C.	SULPHUR	F.S.I.	C.V.
	93.0	0.8	2.2	21.6	75.4	0.61	5	

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COAL SCIENCE AND MINERALS TESTING	
CUSTOMER PINE PASS DEVELOPMENT	4-B Composite 262/10 - 276/0
DATE March 15th, 1973	

RAW COAL	WT %	MOIST.%	ASH %	V.M.	F.C.	SULPHUR	F.S.I.	C.V.
3/4" x 28M	62.3		54.4				1	
28 MESH x 0	37.7		32.1				5	
TOTAL	100.0	0.9	49.7	14.2	35.2	0.22	1	

PLUS 28 MESH ANALYSIS (SINK-FLOAT 1.45 S.G.)

S.G.FRACTION	WT.%	MOIST.%	ASH %	V.M.	F.C.	SULPHUR	F.S.I.	C.V.
Floats	24.6	1.0	7.0	20.9	71.1	0.50	3½	
Sinks	75.4		66.6				½	
TOTAL	100.0		(51.9)					

MINUS 28 MESH ANALYSIS (FROTH FLOTATION)

ELEMENTARY ANALYSIS

STAGE	WT.%	ASH %	F.S.I.
I	50.4	14.9	6½
II	19.4	20.2	6
Tails	30.2	63.9	1

CUMULATIVE ANALYSIS

WT. %	MOIST.%	ASH %	V.M.	F.C.	SULPHUR	F.S.I.	C.V.
50.4	0.6	14.9	21.0	63.5	0.37	6½	
69.8		16.4					
100.0		30.7					

TOTAL CLEAN COAL (FLOAT PRODUCT PLUS FLOTATION CONCENTRATE)

YIELD %	MOIST. %	ASH %	V.M.	F.C.	SULPHUR	F.S.I.	C.V.
34.3	0.8	11.4	20.9	66.9	0.43	5	

SIGNED: D. F. Sejwart

COAL SCIENCE AND MINERALS TESTING		
CUSTOMER	PINE PASS DEVELOPMENT	4-C Composite 276/0 - 284/0
DATE	March 15th, 1973	

RAW COAL	WT %	MOIST.%	ASH %	V.M.	F.C.	SULPHUR	F.S.I.	C.V.
3/4" x 28M	87.5		47.9				1½	
28 MESH x 0	12.5	1.1	28.2	18.2	52.5	0.50	6	
TOTAL	100.0	1.1	44.3	15.7	38.9	0.53	2	

PLUS 28 MESH ANALYSIS (SINK-FLOAT 1.45 S.G.)								
S.G.FRACTION	WT.%	MOIST.%	ASH %	V.M.	F.C.	SULPHUR	F.S.I.	C.V.
Floats	28.4	0.8	6.1	20.9	72.2	0.64	6½	
Sinks	71.6		63.0				1	
TOTAL	100.0		(46.8)					

MINUS 28 MESH ANALYSIS (FROTH FLOTATION)

ELEMENTARY ANALYSIS			
STAGE	WT.%	ASH %	F.S.I.

CUMULATIVE ANALYSIS							
WT. %	MOIST.%	ASH %	V.M.	F.C.	SULPHUR	F.S.I.	C.V.

TOTAL CLEAN COAL (FLOAT PRODUCT PLUS FLOTATION CONCENTRATE)								
	YIELD %	MOIST. %	ASH %	V.M.	F.C.	SULPHUR	F.S.I.	C.V.

SIGNED: DFSeymash

COAL SCIENCE AND MINERALS TESTING	
CUSTOMER PINE PASS DEVELOPMENT	5-A Composite 166/0 - 168/6
DATE March 15th, 1973	

RAW COAL	WT %	MOIST.%	ASH %	V.M.	F.C.	SULPHUR	F.S.I	C.V.
3/4" x 28M	73.8		8.4				8½	
28 MESH x 0	26.2	0.9	3.1	25.3	70.7	0.50	8½	
TOTAL	100.0	*	*	*	*	*		

* Insufficient Sample

PLUS 28 MESH ANALYSIS (SINK-FLOAT 1.45 S.G.)								
S.G.FRACTION	WT.%	MOIST.%	ASH %	V.M.	F.C.	SULPHUR	F.S.I.	C.V.
Floats	89.6	1.0	4.5	24.0	70.5	0.60	8½	
Sinks	10.4		58.3				2	
TOTAL	100.0		(10.0)					

MINUS 28 MESH ANALYSIS (FROTH FLOTATION)

ELEMENTARY ANALYSIS			
STAGE	WT.%	ASH %	F.S.I.
*			

CUMULATIVE ANALYSIS							
WT. %	MOIST.%	ASH %	V.M.	F.C.	SULPHUR	F.S.I	C.V.

TOTAL CLEAN COAL (FLOAT PRODUCT PLUS FLOTATION CONCENTRATE)								
	YIELD %	MOIST. %	ASH %	V.M.	F.C.	SULPHUR	F.S.I	C.V.

SIGNED: DF Edwards

PINE PASSCON PROJECT

PR-PINE PASS 75(1)A

Oct. '75

PR-PINE PASS-75(1)A

NTS 930/8, 9, 93P/5.

COAL ACT

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

Exploration & Development Work Report Cover Sheet

Property name: ______________ Coal Map No. 930/8, 9, 93P/5.

Location: South of Pine River Land District Peace River

Coal Licence No.(s) 2905-2962, 3560-3591.

Licensee: Pan Ocean Oil Ltd.

Operator: I.P. Dyson Consultants Ltd.

Title of Report: Pine Pass Coal Project

Period covered by Report: Sept 1974 to Oct 1975

Category of work covered in report

Geological Mapping	$ 17,920.00
Surveys: Geophysical	
Geochemical	
Other	
Road Construction	4,728.50
Surface work	
Underground work	
Drilling	167,996.00
Logging	35,052.00
Sampling	
Testing	
Reclamation	8,897.00
Other work	101,080.00
Total value of work reported	$ 335,674.08

Comments:

Value of work approved $335,674.08

Signature: R.C. James Date Nov 24/75
Senior ~~Coal~~ Inspector of mines

Accepted: [signature] Date Nov 26/7
Chief Gold Commissioner
Mineral Resources Branch

(To be prepared in duplicate: Original to be filed with report
Duplicate to be filed on Plan of Operations file)

PINE PASS COAL PROJECT

NORTHEAST BRITISH COLUMBIA

(1974 - 1975)

VOLUME I

GEOLOGY

Prepared for: Pan Ocean Oil Ltd.
Calgary, Alberta

by: Paul Dyson Consultants
Calgary, Alberta

October 1975

ABSTRACT

During the period 1974 - 1975 additional exploration was carried on in the Pine Pass Area.

The main objective of this phase of the exploration was to test the coal bearing sequences of Gething formation at widely scattered locations across the tract of coal licences.

Ten boreholes were completed at widely spaced locations using a helicopter for both servicing and moving the drill rigs. Simultaneously with this program, additional surface mapping was carried out.

Results from the program indicate that the main potential for a economical coal seam lies within the upper portion of the Gething formation. In particular, one seam averaging about twelve feet in thickness was found to give particularly good yields of exceptional low ash, low to medium volatile coal. The coal seams found in the lower portion of the Gething formation were generally dirty and laterally discontinuous. It was concluded that portions of the licence block were not prospective and recommendations are made to relinquish approximately one third of the licences. It is further recommended that additional work be carried out to ascertain in detail the quality of the low ash seam and to assess its mineable extent.

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75/11	Cross-section EE'	1" = 200 feet	see Volume IV
75/12	Cross-section GG'	1" = 200 feet	see Volume IV
75/13	Cross-section HH'	1" = 200 feet	see Volume IV

I. INTRODUCTION

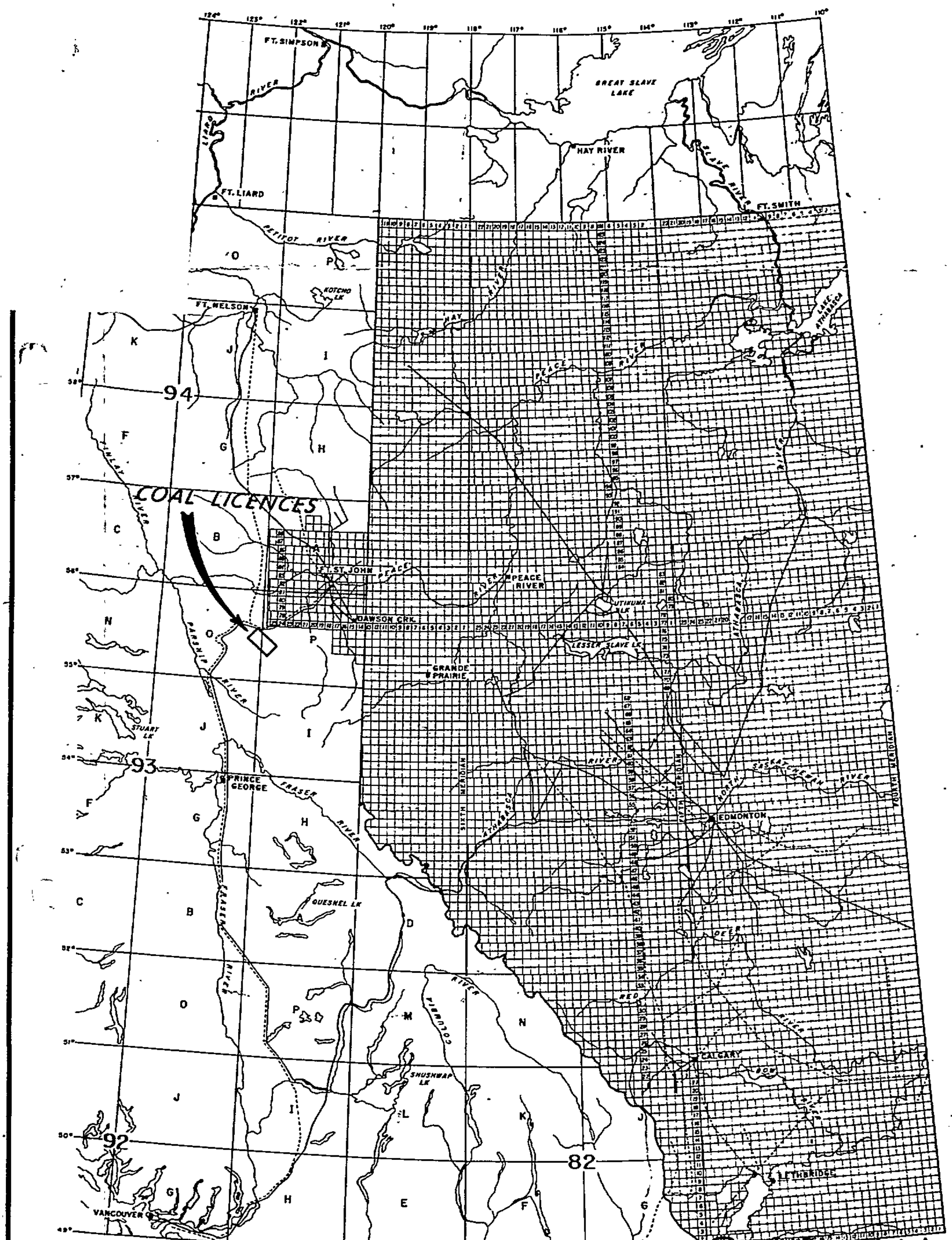
This report describes the exploration work carried out on behalf of Pan Ocean Oil Ltd. in the Pine Pass coal area of northeast British Columbia in 1974 and 1975. Pan Ocean held ninety coal licences under the Coal Act of British Columbia at the time of the exploration. These licences were numbered 2905 to 2962 inclusive and 3560 to 3591 inclusive (see Fig. 75/3).

The exploration was a continuation of that work carried out in 1973 which was fully described in the report "Pine Pass Coal Project, Northeast British Columbia (Phase I)" by Paul Dyson Consultants dated June 1973. This earlier report is attached to this one and should be considered as an introduction to the 1974 - 1975 exploration. All maps, sections and diagrams for this earlier report are prefixed by the number "73" to differentiate them from those prepared for the present report. The analytical data and borehole data has been detached and inserted in the appropriate volume of the present report.

It should be noted that the 1973 report, henceforth referred to as "Dyson - 1973" was filed as a "work commitment report" for the licence block which corresponded with those coal licences now numbered 2905 to 2962. The area covered by coal licences 3560 to 3591 was not an integral part of the acreage block for which that report was compiled. However, it is almost surrounded by the licences for which the 1973 report was written and the text of the 1973 report does, in general, describe the features of this block as well.

I. INTRODUCTION (Cont'd.)

The present report contains only very brief sections on location, access, regional geology, etc. as these are fully described in the 1973 report for those persons unfamiliar with the area.



PK-PP 75(1)A

PAN OCEAN OIL LTD.

PINE PASS COAL PROJECT
NORTHEAST BRITISH COLUMBIA

LOCATION MAP

0 — 90

SCALE : 1 INCH = 90 MILES

PAUL DYSON CONSULTANTS

Figure 75/1

II. GEOLOGY

The regional geology, both stratigraphic and structural, has been discussed in Section II(a) of the previous report (Dyson - 1973). This data is not repeated and those persons unfamiliar with the area should make reference to this report which is attached. Some additional comments on the geology follow.

(a) Stratigraphy

Limited additional stratigraphic data was obtained from the current drill program . No full section of the Gething formation was drilled. However, typical rocks of the Cadomin formation were identified in the field in proximity to some of the drill sites. It is deduced that a true stratigraphic thickness for the Gething formation of between 1500 feet and 2000 feet is realistic.

Detailed correlation of the Gething formation within the licence areas is very difficult. This difficulty is caused by the complex and rapid facies changes that are taking place together with the lack of rock exposure. No thick sections of Gething formation at outcrop can be measured.

This complex pattern of facies changes is illustrated on the Stratigraphic Fence Diagram (Fig. 75/5). This interpretation is the best available at this time but may be subject to revision as additional data becomes available.

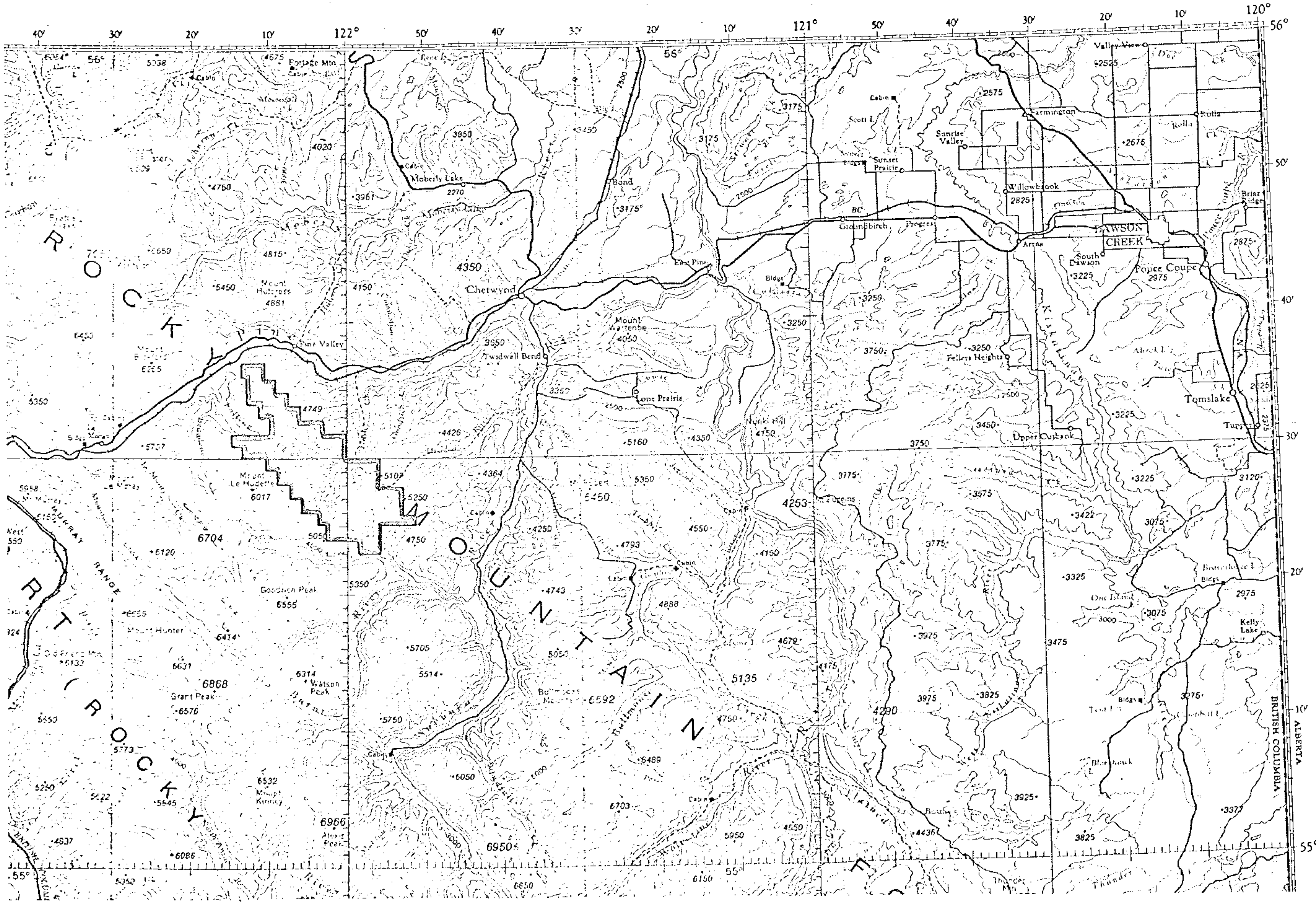


Figure 75/2

PAN OCEAN OIL LTD.

PINE PASS COAL PROJECT
NORTHEAST BRITISH COLUMBIA

COAL LICENCE LOCATIONS

SCALE 1 INCH = 8 MILES

PAUL DYSON CONSULTANTS

II. GEOLOGY (Cont'd.)

The possibility of locating coal seams within the Gates formation in this area has been raised from time to time. Careful examination of Gates formation outcrops both at Falls Mountain immediately to the north and at isolated outliers of Gates formation has failed to reveal any sign of coal. Exploration has consequently been concentrated on the Gething formation.

(b) Structure

As can be seen from the Field Data Map (Fig. 75/4) much of the area has been subjected to intense folding and faulting. In those areas where the folding and/or faulting are most severe as apparent from the limited outcrop, there is not believed to be any mining potential. In general, this area of severe structural complexity lies along the west side of Falling Creek, at the headwaters of Falling Creek and throughout the upper drainage of Hasler Creek

The possibility that much of the rest of the area has similar structure that is masked by poor exposure must be considered. The limited drilling and outcrop information in the Johnsen Creek, lower Hasler Creek area, and Highhat areas does, however, suggest that this area may well be less complex.

III. EXPLORATION PROGRAM

(a) Objectives

The 1974-1975 exploration program was designed to assess the distribution and thickness of coal seams throughout coal licences held by Pan Ocean. The initial 1973 program had limited itself to drilling a very small area where the access was simple. As explained in the previous report "Dyson - 1973", this program had failed to locate a coal seam which appeared to be highly prospective for development. In accordance with the recommendations made in this report it was decided to carry out a widespread drilling program. The drill holes would be located not principally in the hope of immediately locating a mineable block of coal, but primarily to test the stratigraphy of the Gething formation across the whole licence block. The primary concern would be to drill holes perpendicular to the bedding in what would be believed to be unfaulted rock sequences. Hopefully, the results of these drill holes would indicate those areas where the future exploration could be concentrated with the objective of finding a reserve of mineable coal of a suitable grade.

(b) Field Methods

The majority of the outcrops within the area had been mapped during the 1972-1973 field programs. Outcrops are very scarce in the area as can be seen from the Field Data Map (Fig. 75/4) which it is believed shows the majority of the outcrops present on the coal licences.

A series of drill sites were selected based on the existing geological information and the means of access to these sites was considered. In the Fall of 1974, it was decided to drill a limited number of initial drill holes close to existing roads. The first drill site (DH74-1) was selected within 100 yards of an existing road, however, while this hole was being drilled some difficulties were encountered with obtaining the necessary government approvals to continue the program and the program was abandoned after the completion of this hole.

A further nine holes were planned for the summer of 1975 at widely spaced locations. It was decided to carry out the program utilizing a helicopter for both moving and servicing the drills. It was believed that such a program would be competitive in cost in view of the lengths of road required to reach the wider scattered drill sites. Furthermore, reclamation would become an insignificant part of the program rather than a major problem. The equipment used consisted of

(b) Field Methods (Cont'd.)

two Longyear No. 38 diamond drills supported by a Gazelle helicopter. The drills were contracted from Canadian Longyear Ltd. and the helicopter from CanWest Aviation Ltd. This combination of two drills with each drill working two ten hour shifts and a Gazelle helicopter proved to be most satisfactory.

The personnel involved usually consisted of two to three geologists plus two field assistants. These persons were employed in keeping the drilling data including core logging fully up to date and doing additional local field mapping whenever helicopter availability made it possible.

All the drill core was hauled to a central camp located on the Hart Highway approximately twenty five miles west of Chetwynd. The geological and drill personnel were all based at this point.

All the drill holes were logged mechanically with Gamma Ray Neutron and Side Wall Density logs using a helicopter transportable unit from Roke Oil Enterprises Ltd.

(c) Drill Site Location

The reasons behind the location of the drill sites can be summarized as follows:

(i) 74-1 - This drill site, as previously mentioned, was located close to an existing road. Two coal seams approximately eight feet thick with a sandstone unit between them were found on the road. The drill was

(c) Drill Site Location (Cont'd.)

set up to drill through these seams with the purpose of establishing the stratigraphic positions of the seams and at the same time obtaining unweathered samples for analysis.

(ii) 75-2 - This hole was originally part of the 1974 program but access to the location was not completed prior to abandonment of the program. The location was selected to test the thickness of Moosebar formation in this portion of the licence block.

(iii) 75-3 - This hole was located on the top of a ridge which appeared to be composed of essentially flat lying beds of the Gething formation. A normal section for this area would be penetrated.

(iv) 75-4 - This location on the west side of Falling Creek was set up to drill a section of the Gething formation which had been recognized dipping to the west in an apparently structurally continuous block.

(v) 75-5 - This hole located to the west of 75-3 was drilled at an angle into what was assumed to be a structurally undisturbed block of Gething formation.

(vi) 75-6 - This hole immediately to the west of 75-4 was designed to provide overlapping with the 75-4 hole so as to complete the Upper Gething section of this location.

(c) Drill Site Locations (Cont'd.)

(vii) 75-7 - The outcrop of the Cadomin formation which underlies the Gething formation had been located in this area. The location was picked with the purpose of drilling the hole approximately 1000 feet deep to this Cadomin formation. A complete unfaulted section of Lower Gething would thus be available.

(viii) 75-8 - This hole was set up to test the upper portion of the Gething formation in an area to the northwest of Hasler Creek.

(ix) 75-9 - This hole to the immediate south of Hasler Creek was similarly located to test the Upper Gething formation.

(x) 75-10 - This hole on Johnsen Creek was located to spud in the Moosebar formation and to test the Upper Gething formation immediately underlying.

IV. EXPLORATION RESULTS

The drill program consisted of the ten holes mentioned above totalling 9,139 feet, the deepest being 1,183 feet (75-8) and the shallowest being 498 feet (75-9). The geology of each hole is discussed under Section IV(a) and the coals are discussed under IV(b). Detailed data for all the boreholes, i.e. written core description, plotted lithological log, Gamma Ray Neutron and Side Wall Density log, may be found in Volume III. Similarly, details of the coal quality for those coals tested will be found in Volume II.

(a) Geology

The results of each borehole are illustrated on a cross section and discussed separately as follows:

(i) 74-1

This hole failed to locate the two seams which had been apparent in outcrop adjacent to the drill site. Numerous thin coaly stringers were present in the Gething formation at this location, but the core showed abundant fractures and anomalous dips. The section was believed to be faulted and not representative of the Gething formation in this area. The hole was abandoned at a depth of 745 feet.

(a) Geology (Cont'd.)

(ii) 75-2 Cross Section AA' Fig. 75/6

This hole was set up on an outcrop of Moosebar formation. It had been hoped to reach the Gething formation within a few hundred feet, however, the Moosebar appeared to be faulted and the hole was abandoned at a depth of 968 feet while still in Upper Moosebar formation.

(iii) 75-3 Cross Section BB' Fig. 75/7

This hole penetrated a continuous section of Gething formation and was drilled to a depth of 897 feet before being abandoned for mechanical reasons. It had been hoped to reach the Cadomin formation at this location.

(iv) 75-4 Cross Section CC' Fig. 75/9

This hole was drilled to test what was apparently an unfaulted section of Gething formation. The hole commenced in Gething formation and was completed at a depth of 1,087 feet which was close to the mechanical capability of the drill. A continuous section of the Gething formation was penetrated although neither the top nor bottom of the formation was present in the hole. Information from this hole prompted the drilling of 75-6.

(v) 75-5 Cross Section DD' Fig. 75/10

This hole was set up in what was believed to be the lower portion of the Gething formation. It failed to reach

(a) Geology (Cont'd.)

the Cadomin formation which underlies the Gething formation which was drilled to a total depth of 1,138 feet.

(vi) 75-6 Cross Section CC' Fig. 75/9

This hole was set up so as to overlap 74-4. It commenced in the Moosebar formation and was drilled to a depth of 938 feet. The lower 500 feet appears to be common to both 75-4 and 75-6.

(vii) 75-7 Cross Section B' and B" Fig. 75/8

As mentioned in Section III(a), this hole was set up in the hope of reaching the Cadomin formation which had been observed at outcrop. The hole was drilled to 1,127 feet but did not reach the Cadomin formation. It is felt that the Cadomin must be within 100 feet of the base of the hole, but the mechanical capability of the drill did not permit the drilling of a deeper hole.

(viii) 75-8 Cross Section EE' Fig. 75/11

This hole was intended to intersect the Moosebar-Gething contact, however, approximately 100 feet of drift was present at this location and the first bedrock penetrated by the hole was approximately 75 feet below the Moosebar-Gething contact. The upper coal bearing zones of the Gething formation were penetrated the the hole was abandoned at a depth of 1,183 feet

(a) Geology (Cont'd.)

(ix) 75-9 Cross Section GG' Fig. 75/12

This hole was set up as a further test of the Upper Gething formation and appears to reach bedrock at a horizon very close to the Moosebar-Gething contact. The upper part of the Gething was penetrated prior to abandoning the hole at a depth of 498 feet.

(x) 75-10 Cross Section HH' Fig. 75/13

This hole commenced in the Moosebar formation and was drilled so as to penetrate the upper 250 feet of the Upper Gething before being abandoned at a total depth of 558 feet.

In summary, all the holes with the notable exception of 74-1 provided valuable geological information for the evaluation of the coal licences held by Pan Ocean. Even Hole 75-2, which was drilled wholly within the Moosebar formation, gave valuable data regarding the structure in that portion of the acreage. The correlation of the geology and the boreholes is difficult. The stratigraphic fence diagram (75/5)is believed to be the most likely correlation based on an assessment of the detailed lithology of the logs. An excellent correlation exists between Holes 75-4, 75-6, 75-8, 75-9 and 75-10. The correlation to Holes 75-3, 75-5 and 75-7 and indeed between these holes themselves, is less clear. No doubt,alternate correlations might well be developed by other geologists.

(b) Coal

The primary objective of the exploration program was to locate coal seams which would have the potential for being profitably mined. While ever changing technologies do not permit fixed parameters to be used, the objective was in general to locate a good grade coal seam thicker than 5 feet.

The drill program allows some general conclusions to be drawn regarding the distribution of coal within the Gething formation.

Firstly, the upper 300 feet of the Gething formation usually contains at least two coal zones thicker than 5 feet and up to 20 feet thick. With the possible exception of the southern portion of the acreage (75-5), these coal zones are present wherever the upper portion of the Gething formation was drilled (75-4, 75-6, 75-8, 75-9 and 75-10). The coals which are sometimes present in the lower portion of the Gething do not appear to have significant lateral extent due to rapid facies variations within this part of the formation. An example of this is the almost total absence of the coal zone which is present from 875' to 910' in 75-4 the nearest hole which penetrates the same interval (75-8). Other seams where developed in the Lower Gething appear to be either thin or dirty. This observation is in agreement with the information being assembled at the Sukunka coal project.

(b) <u>Coal</u> (Cont'd.)

The best coal seam is undoubtedly in the Upper Gething formation. It seems likely that the low ash coal found in 75-4, 75-6, 75-8, 75-9 and 75-10 is in general correlative. These holes are not closely spaced (except 75-4 and 75-6) and detailed correlation is tentative. Further drilling will be needed in the Hasler Creek-Johnsen Creek area to fully define the correlation. The fence diagram (Fig. 75/5) suggests that Hole 75-5 may have penetrated the seam correlative with this low ash coal seam. If indeed this correlation is correct, the seam has deteriorated significantly to the south.

This section of the report does not discuss the quality of the coal. A discussion of the coal quality together with all the results of analyses made on coal recovered from both the 1975 and 1973 drill programs is included as Volume II.

V. CONCLUSIONS

It is concluded that the only coal seams which are worth exploring are those which lie within the upper 400 feet of the Gething formation. Analytical results (see Volume II) show a coal seam averaging about 8 feet in thickness to have an exceptional low ash content. While the Free Swelling Index is low, the coal does appear to have potential as a blending product.

This coal seam is probably present over a large portion of the north eastern half of the Pan Ocean coal licences. Present drilling is very widely spaced, but sufficient data has been assembled to indicate that in excess of 200 million tons of low ash raw coal is present concentrated in the Johnsen Creek-Hasler Creek area.

The mineability of these reserves is an unknown factor, however, limited outcrop information does suggest that a large portion of the prospective area may well have structural dips below 30°. This being the case, the possibility for the recovery of sufficient coal to support an underground mine undoubtedly exists. In view of the possible recoverable reserves of very low ash coal, additional exploration is certainly warranted in this area.

Drilling and surface mapping has shown much of the remainder of the acreage to have only very minimal potential for development. This conclusion is based on the absence of upper coal bearing zones

V. <u>CONCLUSIONS</u> (Cont'd.)

of the Gething formation and/or the structural complexity of the area (see Fig. 75/4). These areas are not worthy of further exploration.

VI. RECOMMENDATIONS

Recommendations for this project fall into two broad categories - firstly, renewal or surrender of licences, and, secondly, additional exploration.

(a) Licences

Based on the conclusions given above, certain of the licences should be surrendered and the remainder should be maintained for a further term. The Coal Licence Map (Fig. 75/3) shows the total area licenced and indicates those licences which should be surrendered as soon as possible. They are: 2905 to 2909, 2931 to 2940, 2953 to 2962, 3561 to 3564 and 3568 to 3569.

(b) Additional Work

The primary objective of any additional work should be to establish without doubt the quality of the coal present in the low ash seam present in the Hasler Creek-Johnsen Creek area (75-8, 75-9 and 75-10).

It is recommended that bulk samples be obtained from this seam at at least one location and preferably at two locations. Should the budget permit, some additional drilling to test the continuity of this seam between the existing holes should be completed.

(b) Additional Work (Cont'd.)

It is not believed that additional surface data is available, but any that can be obtained as a result of road building, etc. should be recorded.

The only portion of the acreage block not evaluated is the Highhat Creek area. It is possible that additional survey data could be obtained in this area.

I. P. Dyson, P. Geol.

VII. ACKNOWLEDGEMENTS

The completion of the program would have been impossible without the help and co-operation of the technical personnel and contractors.

The drilling program was carried out by Canadian Longyear Ltd. of Vancouver. The foreman, Mr. Elmer Russel, made every effort to maintain an efficient drilling program despite an initial series of mechanical problems with one drill.

The helicopter services were provided by Canwest Aviation Ltd. of Calgary. The helicopter was piloted by Mr. John Pridie who provided efficient and safe service.

Logging of the drill holes was conducted by Roke Oil Enterprises Ltd. of Calgary. Mr. Lance Rainey, the field engineer, carried out his duties most efficiently. Additionally, his general help with the program was greatly appreciated.

The camp was based at Willow Flates on the Hart Highway west of Chetwynd. Mrs. Alice Tricker provided excellent foods for all the crew.

The reclamation program was carried out by Mr. Jim Smith of Chetwynd. He did an excellent job to the satisfaction of the B.C. Forestry officials.

The geological crew consisted of geologists, Mr. Greg Germscheid, Mr. Rory Hankel and Dr. Ali Chowdry. Overall supervision was provided by Mr. Paul Dyson.

SELECTED REFERENCES

No new publications exist for this area. The "Selected References" given in Dyson - 1973 are believed to be essentially complete.

PINE PASS COAL PROJECT

NORTHEAST BRITISH COLUMBIA

(PHASE I)

Prepared for: Pan Ocean Oil Ltd.
Calgary, Alberta.

By: Paul Dyson Consultants.
Calgary, Alberta.

June 1973.

ABSTRACT

The Pine Pass area of northeast British Columbia has good potential for the development of a coal mine producing metallurgical grade coking coal. This conclusion is based on the probable presence of coal seams thicker than 10 feet consisting of low ash coking coal and the proximity of the area to both rail and existing townsite.

Pan Ocean Oil Ltd., recognizing this potential, acquired 67 coal licences in August 1972. An initial exploration program was carried out on these licences in the fall of 1972 and the first months of 1973. The program consisted of field mapping and an initial drilling program of approximately 3000 feet.

These exploration activities confirmed the presence of low ash metallurgical grade coking coal in the medium volatile range. At the same time the existence of some areas of relatively low structural dip was recognized.

However, no thick (10 feet plus) seams of coal of adequate grade were located. The thicker seams all contained numerous shaly partings in the area that was drilled. It is planned to extend the drilling program to other areas licenced by Pan Ocean in 1973 in an attempt to locate thicker seams of good quality coal.

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APPENDICES

1. Borehole Logs (see Volume III)

2. Coal Analyses and Comments (see Volume II)

3. Order-in-Council re Granting of Licences

4. Gamma-Ray Neutron Logs and Density Logs (1"=20') (see Volume III)

I. INTRODUCTION

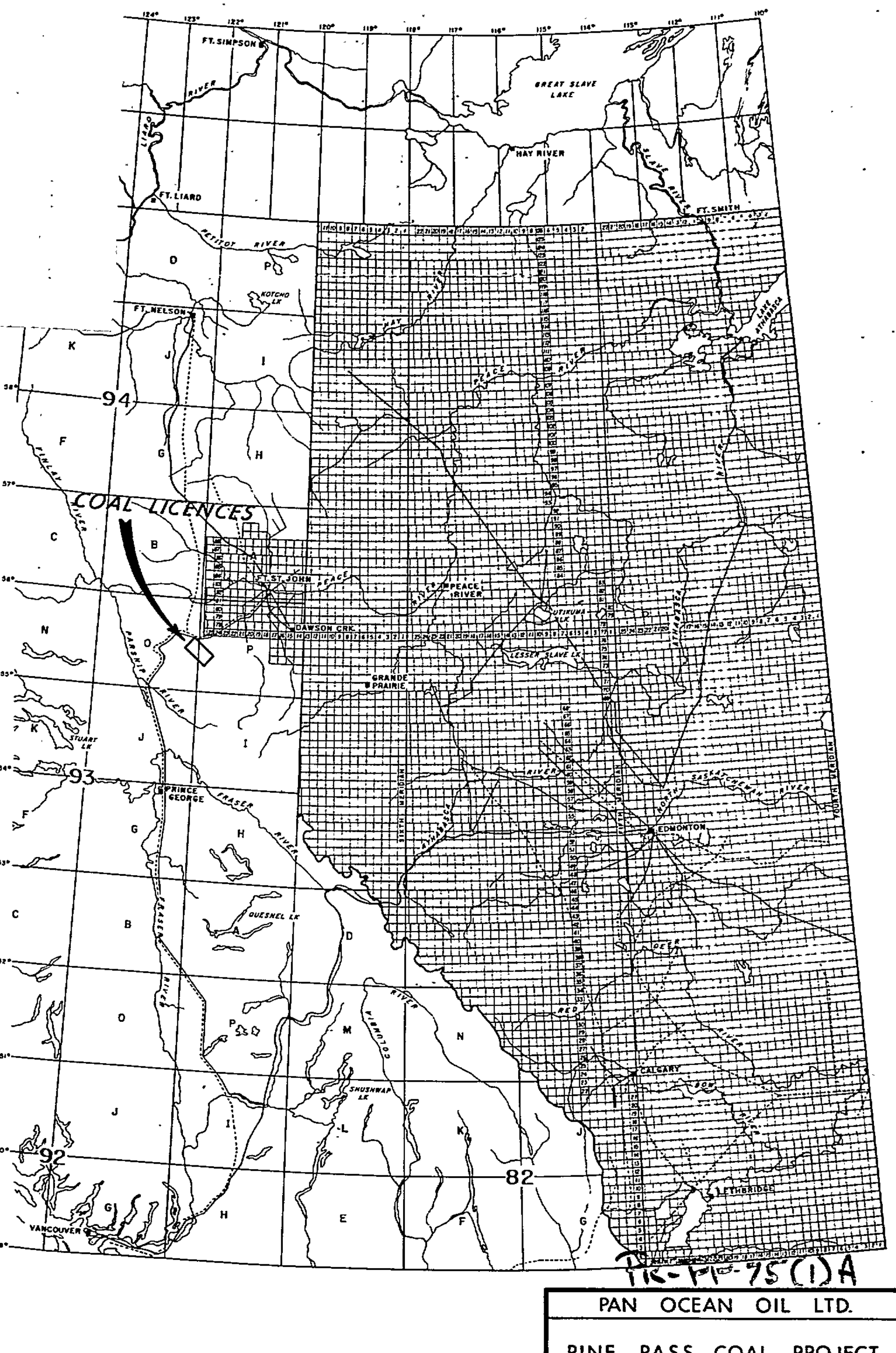
This report describes the initial work carried out by Pan Ocean Oil Ltd. in an attempt to locate an economically viable coal deposit of metallurgical grade coking coal on coal licences acquired in 1972 in northeast British Columbia. The area explored lies immediately south of the Pine Pass in the Foothills belt west of Dawson Creek (Fig. 1).

The report is divided into several main sections: the introduction, the prospect, the exploration program and the conclusions. Numerous maps, figures and tables accompany the report which is designed to present a comprehensive picture of the project from inception to its present stage.

(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 Sukunka and Pine Rivers in northeastern British Columbia. The area is underlain by Lower Cretaceous sediments which contain the potential coal measures under investigation. Specifically, the Gething formation of Lower Cretaceous age was explored for viable coal seams (see Fig. 2 and 3).

The Cretaceous sequence was folded during the Laramide orogeny being deformed into elongate plunging anticlines



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PAN OCEAN OIL LTD.

PINE PASS COAL PROJECT
NORTHEAST BRITISH COLUMBIA

LOCATION MAP

0 — 90
SCALE : 1 INCH = 90 MILES

PAUL DYSON CONSULTANTS

Figure 73/1

and synclines with associated faulting. This series of en echelon folds and faults has a northwesterly trend. In this area of the Foothills most of the Cretaceous exposures occur in creeks as almost the whole area is covered by vegetation.

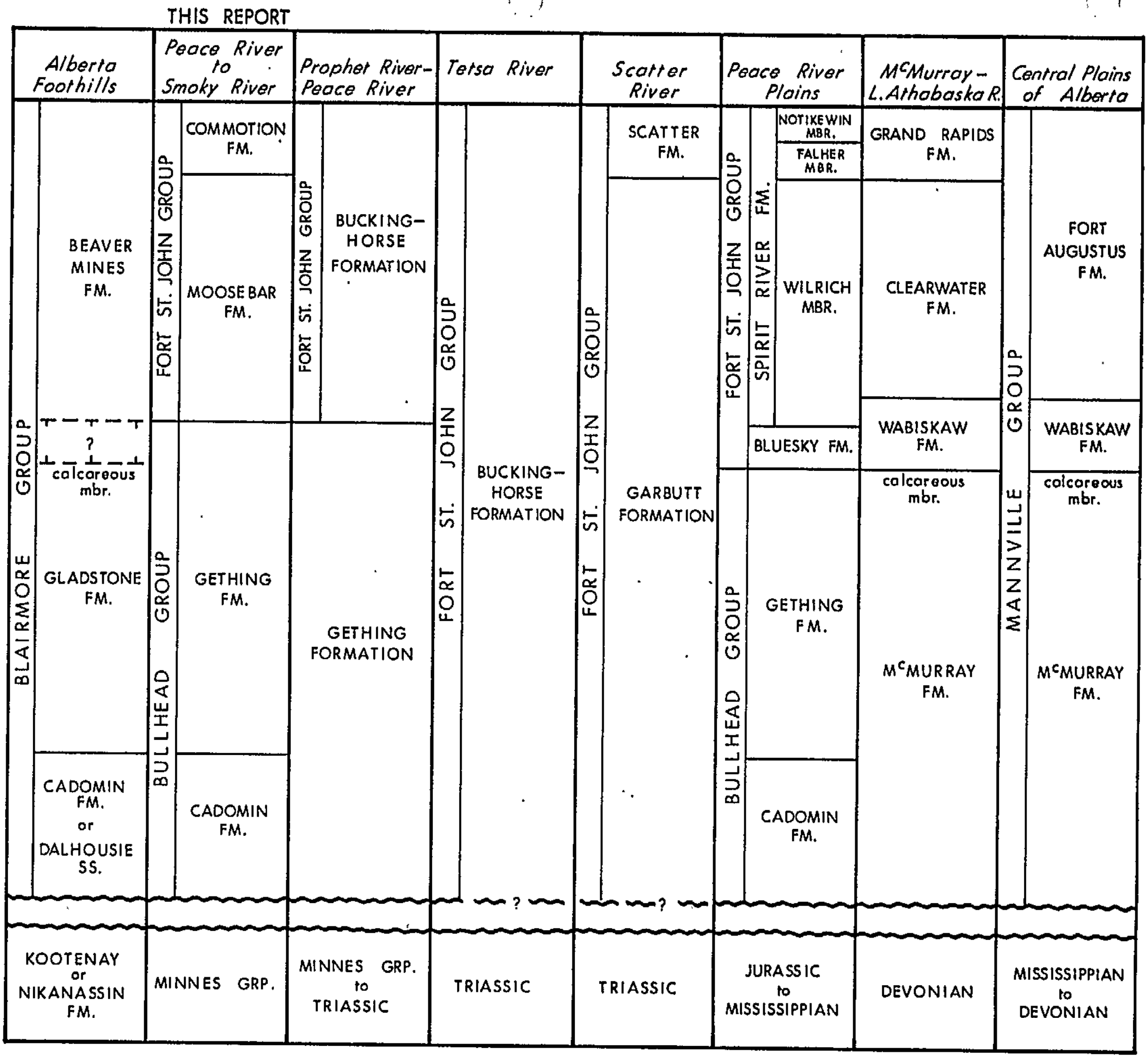
The "Foothills" of this region have considerable relief with elevations within the area under consideration varying from lows of approximately 2000 feet above sea level to slightly over 5000 feet above sea level. As the tree line at this latitude is at approximately 5500 feet above sea level, the hills are totally covered with a dense vegetation.

(b) Access

The Hart Highway provides excellent access along the northern side of the area (see Fig. 4). It is an all weather paved highway.

A road passable to pick-ups in good weather extends up Hasler Creek from its junction with the Pine River to a point adjacent to the old Hasler Mine. Other than this, no access was available to vehicular traffic within the area of interest.

During the exploration program additional access was established and will be discussed in that section of the report.



CORRELATION OF BULLHEAD GROUP IN WESTERN CANADA

Figure 73/

Fig. 3

TABLE OF FORMATIONS

		Formation or Group	Thickness (feet)	Lithology
Lower Cretaceous		Fort St. John Group (includes Moosebar fm.)	3,000 - 5,000	Dark grey, marine shale with fine grained sandstone.
	Bullhead Group 0-2,500	Gething Formation	1,000 - 3,000 (?)	Fine-grained, cherty to quartzose sandstone; rusty weathering shales; carbonaceous mudstone and coal seams; minor conglomerate.
		Cadomin Formation	100 - 500	Massive chert conglomerate and coarse-grained sandstone; carbonaceous shale, minor coal.
	Regional erosional unconformity; bevels rocks of succeedingly older age northward and eastward.			
Jurassic		Minnes Group	0 - 6,000	Massive quartzose sandstone; alternating units of fine-grained sandstone and mudstone; minor carbonaceous sediments.
		Fernie Formation	500 - 1,000	Calcareous and phosphatic shales; rusty weathering shales; glauconitic siltstone; sideritic shales; thinly interbedded sandstone, shale, and siltstone.

(c) Acknowledgments

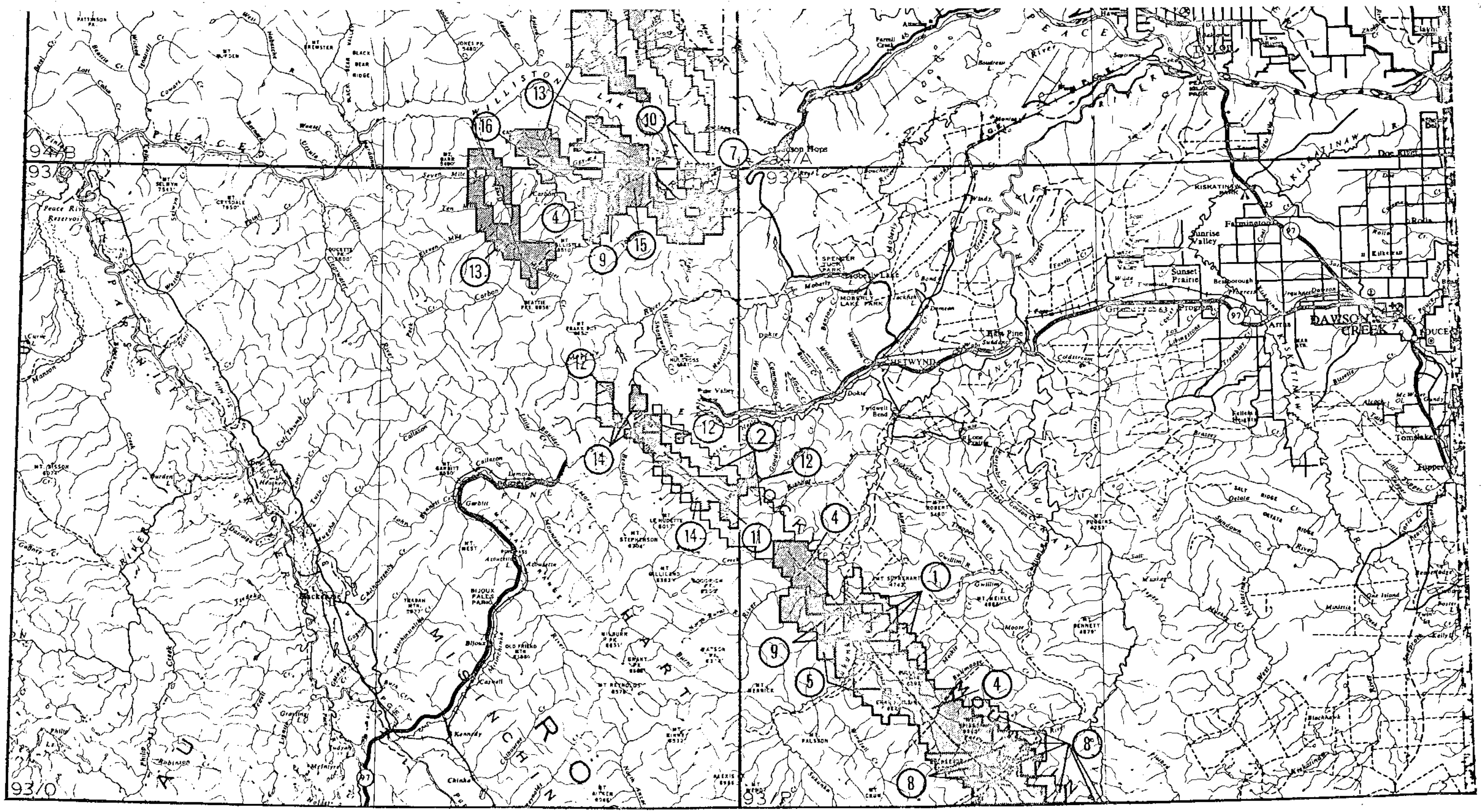
The completion of the exploration program would not have been possible without the co-operation of the numerous technical personnel and contractors and the help of numerous local persons.

The staking program was carried out by Burnett Resource Surveys Ltd. of Burnaby, British Columbia, under the supervision of Mr. Dave Zelmer. This company utilized an Alouette II helicopter provided by Canwest Aviation Ltd. piloted by Mr. John Pridie. The crew stayed in Chetwynd.

The field checking of the area was again based in Chetwynd. A helicopter (Bell 47 Series G3B-1) was contracted from Rotoflite Ltd. Field assistance was provided by Mr. Blake Brady, geologist, Mr. Gary Morrison and Mr. Rick Cox, field assistants. The willing co-operation of all the above is gratefully acknowledged.

The drilling program was carried out by Canadian Longyear Ltd. of Vancouver. The foreman was Mr. Elmer Russel who made every endeavour to keep an efficient operation running despite a strike by the diamond drillers. Bulldozers were hired from Roller Bros. Construction Ltd. of Chetwynd who made every effort with excellent personnel but indifferent equipment.

Supervision of the drilling program was aided by Mr. T. Yoon, geologist, who spent approximately three weeks in the field.



LEGEND

1. Master Exploration Ltd.
2. Pan Ocean Oil Ltd.
4. Brameda Resources Ltd.
5. Brameda Resources Ltd., Teck Corporation Ltd.
7. Cinnabar Peak Mines Ltd.
8. Denison Mines Ltd.
9. Bow River Resources Ltd
11. McIntyre Porcupine Mines Ltd.
12. Pine Pass Coal Ltd.
13. Utah International Ltd.
14. Canada West Petroleums Ltd.
15. Bow River Resources Ltd, Texacal Resources Ltd
16. Ayrshire Coal Co. Inc.

Figure 73/4

PAN OCEAN OIL LTD.

PINE PASS COAL PROJECT
NORTHEAST BRITISH COLUMBIA

COAL LICENCE LOCATIONS

SCALE : 1 INCH = 10 MILES

PAUL DYSON CONSULTANTS

(c) Acknowledgments (Cont'd.)

The co-operation of all the above named parties at all times contributed to the completion of the program as did valuable help received in many ways from local people. The assistance of all the above is gratefully acknowledged.

II. PROSPECT

The exploration program was designed to evaluate coal rights acquired from the British Columbia government in 1972. This section of the report explains the thinking behind the development of the prospect and the acquisition of the coal rights.

Details of the prospect are outlined both from a strictly geological point of view and from an economic point of view. Details of the selection of licences and the methods employed for the staking of these licences are described.

(a) Regional Geology

As stated in the Introduction the area under consideration lies within the Foothills belt of northeastern British Columbia. The geology of the area has been mapped at a scale of 1"=4 miles by Muller (1961) and Stott (1961). These two maps are of a reconnaissance nature only.

Regional stratigraphic studies have been made by the Geological Survey of Canada and published as Stott (1968a) and Stott (1971). In addition to this Stott has from time to time given various unpublished papers at several conferences over the past two or three years.

(a) Regional Geology (Cont'd.)

Several localized stratigraphic and mapping projects have been completed within the area - both by the Geological Survey of Canada and by the British Columbia Department of Mines. These are referred to in the Selected References as Hughes (1964), Hughes (1967), McLearn and Kindle (1950), McKechnie (1955) and Spivak (1944).

(i) Stratigraphy

The rocks exposed in the area of the Pan Ocean coal licences range in age from Jurassic to Lower Cretaceous. While the Fernie group of Jurassic age does not directly underlie the coal licences it is shown on the "Table of Formations" (Fig. 3) as it marks the first major lithologic break below the coal measures of the Gething formation.

The Minnes group is not discussed in this report other than to record its presence underlying the Cadomin formation which marks the base of the Bullhead group.

The Bullhead group contains two formations - the coal bearing Gething formation, and its basal conglomeratic unit - the Cadomin formation.

The Gething formation is overlain by the basal formation of the Fort St. John group - the Moosebar formation. This is an excellent lithologic break from the sandy sequence of the Gething

(i) Stratigraphy (Cont'd.)

formation to the predominantly shale sequence of the Moosebar formation.

Full details of the complex and somewhat controversial stratigraphy of the Minnes and Bullhead groups of this area are contained in the literature - Stott (1963) and Hughes (1964).

(ii) Structure

The mapping of the area by Stott (1961) and Muller (1961) is the only complete structural interpretation of the area. As can be seen from these maps, the structure consists of a series of sub-parallel folds and faults generally trending northwest-southeast. It appears from these maps that folding is the predominant feature, however, this may not be so.

The detailed mapping by McKechnie (1955) and Spivak (1944) has indicated many more faults than are shown on the maps of Stott and Muller. This more likely reflects the scale of mapping rather than a basic difference in interpretation.

(b) Coal Potential

The "coal potential", or to put it more explicitly, the potential of the area for the discovery of a viable coal deposit was dependent on three major criteria:

(b) Coal Potential (Cont'd.)

(i) the probable coal seam distribution and likely coal seam thicknesses,

(ii) the probable coal quality,

(iii) the mining potential.

These three factors were considered separately.

(i) Probable Coal Seams

The area under consideration lay between the Pine Pass and the Sukunka River. In general, it was an area of only reconnaissance mapping although some detail was available along the Pine Pass (McKechnie 1955 and Hughes 1967) and in the Hasler Creek area (Spivak 1944). These detailed mapping projects, previously aimed at acquiring knowledge regarding the coals of the area, are most valuable in this respect.

The data in the Spivak (1944) report describes the coals of the Gething formation as they were known at that time adjacent to the Hasler Mine with some references to coals along Willow Creek. Spivak makes reference to the 8' 8" seam at the Hasler mine and to seams apparently up to at least 15 feet thick in the vicinity. Seams exceeding 7 feet were reported on Johnson Creek and up to 5 feet in the Willow Creek drainage.

McKechnie (1955) wrote a comprehensive report describing a drilling program carried out in Willow, Johnson and Hasler Creek drainages. In total almost 50,000 feet of diamond drilling

(b) Coal Potential (Cont'd.)

was carried out between 1946 and 1951 by the Coal Division of the Department of Lands and Forests of the Province of British Columbia. The results of this program were inconclusive but several coal seam intersections thicker than 10 feet were recognized in the drilling.

In 1969 and 1970, Brameda Resources Ltd. and Pine Pass Coal Co. carried out some exploration along the Pine Pass immediately north of the highway. This exploration consisted of surface mapping, a drilling program and an adit. Once again, the existence of coal seams in the Gething formation with thicknesses greater than 10 feet was indicated.

From this information it was concluded that coal seams at least 10 feet thick and possibly close to 20 feet thick do exist in the Gething formation in the Pine Pass area.

(ii) Probable Coal Quality

Coal quality was poorly defined as the old analyses in the Willow Creek and Hasler areas were not primarily designed to make preliminary assessments of the suitability of the coal for the metallurgical market. Nevertheless, some indication of coal quality was obtained from these old analyses and from regional considerations.

(b) Coal Potential (Cont'd.)

The best data in the immediate area was from the Pine Pass Coal Co. project which included the driving of an adit to obtain bulk samples of coal from a 16 foot seam. Data from the coal recovered from the adit is shown on the "Project Map". As can be seen, the coal is of good coking quality (FSI 7+) and it further appears to be amenable to simple washing to reduce the ash below 6%.

Samples from the old Hasler Mine were similarly encouraging as to low ash content and probable coking quality.

Exploration by Brameda Resources Ltd. to the south in the Sukunka area had similarly found a low ash good quality coking coal.

Other parameters such as volatile matter content and sulphur content were similarly satisfactory. Volatiles content was generally recorded at the low end of the medium volatile range and sulphur content was below 0.65%.

The analyses from the drilling report by McKechnie (1955) generally fall within these same parameters, although once again no quantitative coking information was recorded.

It was concluded that the coal of the Gething formation in the Pine Pass area was probably of medium volatile, low sulphur, low ash coking coal which furthermore would be readily amenable to a relatively simple washing process.

(b) Coal Potential (Cont'd.)

(iii) Mining Potential

The mining potential of an area is affected by three main factors:

(a) a suitable mining method,

(b) sufficient recoverable reserves to support a mine, and

(c) an adequate transportation system.

The possibility of mining large volumes of coal in the area by some form of open pit was believed to be limited. This conclusion was reached as maximum seam thicknesses, in general, were expected to be less than 15 feet. Such thicknesses do not permit the removal of large amounts of overburden especially when the coal at shallower levels is probably oxidized. Although a possibility existed for a unique relationship of topography to coal seam and/or tectonic thicknening of the seam, this was largely discounted. Primary consideration was given to possibilities for underground mining methods.

The most significant factor required was an area of relative structural simplicity containing a seam of a thickness suited to the optimum operation of modern mechanized equipment. In general, increases in dip above 15° to 20° cause a rapid decrease in the efficiency of conventional mechanized equipment. Seams of 6 to 10 feet are probably preferred.

(b) Coal Potential (Cont'd.)

The probability of a seam in the above thickness range was established but little information was available on the detailed structure of the area as the only available mapping for most of the area was of a reconnaissance nature only.

However, as reserves in the order of ten million tons of mineable coal were believed to be a reasonable minimum objective*, an area of two to three square miles underlain by a 5 foot seam at suitable inclinations would be adequate. An area with low dip that would permit mining on this scale was well within the probability of the structure of the area.

One of the main advantages of the area was the proximity of the railway, the paved highway and the town of Chetwynd. Most of the prospective area lies less than ten miles from the railway and essentially all of it within twenty miles of the railway. This is a distinct advantage for any coal property as one of the major problems common to many is the need of many tens of miles of new railway. A new mine in the area would likely be within economic trucking distance of the rail.

Similarly the already existing town of Chetwynd connected to the area by all weather paved highway could be used as a townsite for persons working at any mine in the area. (Fig. 4).

* The establishment of this objective is discussed later.

(b) Coal Potential (Cont'd.)

These two factors make considerable difference to the economics of operating a coal mine in the area. Small mines (500,000 tons per year or even less) could well be feasible in the area.

In conclusion, it can be seen that the Pine Pass area had adequate potential for the development of a coal mine producing metallurgical grade coking coal.

(c) Staking Program

Having concluded that the area immediately south of the Pine Pass extending to and including the headwaters of Hasler Creek had the potential of being underlain by viable coal seams of metallurgical grade, it was decided to acquire all the available coal rights.

In order to select the area to be staked certain basic assumptions were made:

(i) Commercial coal seams (i.e. seams thicker than 5 feet) were limited to the Lower Cretaceous Gething formation.

(ii) Seams were unlikely to exceed 10 feet in thickness.

(iii) Seams less than 10 feet in thickness would not lend themselves to surface mining and the prospects were mainly for underground mine development.

(c) Staking Program (Cont'd.)

(iv) Preferred mining areas were those where the dip of the strata was less than 15°.

(v) Overburden should be less than 2 000 feet.

As portions of the apparently prospective area were not geologically mapped, a photogeological interpretation was completed. This interpretation incorporated all the available data both published and unpublished and indicated that an area of approximately 70 square miles was available for staking.

Application was made to the Government of the Province of British Columbia for permission to stake coal licences in the area. As the area was subject to "Reservation of Coal" permission to stake was granted by Order-In-Council No. 1519 dated April 20, 1972 (see Appendix).

The "Coal Act" of the Province of British Columbia requires that two posts be planted in the ground to mark each coal licence that is requested. Following the decision to stake the above 133 coal licences the physical staking was contracted out to Burnett Resource Surveys Ltd. of Burnaby, B. C.

Two bids were received on the staking and this company was chose both on the basis of the bid and its experience in staking coal licences. (The company had staked over 700 coal licences between 1970 and 1972.)

(c) Staking Program (Cont'd.)

The method used was to plot the chosen licences at a scale of 1:50,000 on the existing government topographic maps for the area. The corners of the licences were then transferred to existing aerial photography by the "radial line plot" method. When in the field these corner locations were photo-identified by the crew chief who was very experienced in this procedure.

Tree cover made it essentially impossible to walk to the photo-identified points from the available limited helicopter landing sites. This being the case, it was decided to use an Alouette II helicopter equipped with man hoist to carry out the staking. In this way, the crew chief and "staker" were able to fly direct to the required point and then lower the staker to the ground at the point without having to land the helicopter. The system became most proficient and the crew chief was able to "leap frog" stakers around. This enabled upwards of 25 coal licences to be staked in a day by a four man party. Despite high winds, the staking which commenced on June 12th, was completed by June 20th. The applications for 67 licences were submitted to the British Columbia Government on June 26, 1972. They were subsequently issued as coal licences No's. 2686 to 2752 inclusive. (Fig. 5)

III. EXPLORATION

The granting of the coal licences to Pan Ocean carried with it an obligation to carry out exploratory work on the licences to fulfill a "work commitment". This initial program is assessed in this section of the report.

(a) Objectives

The initial exploration program for the licences held by Pan Ocean Oil Ltd. had the following technical objectives in mind:

(a) A geological understanding of the distribution of the coal bearing rocks in the area of the licences.

(b) The confirmation of the presence of coal on the licences.

(c) The preliminary delineation of both seam thickness and seam distribution within the coal bearing formation.

(d) The establishment of some initial data regarding coal quality.

(e) An initial assessment of the mining possibilities for the properties.

These objectives were met by the following exploration program. All the available geological data for the area was reassessed to ensure the best possible understanding of the Gething formation.

Following this, a field mapping program was carried out. The objectives of this program were to confirm the reported

(a) Objectives (Cont'd.)

geological structure; to locate coal seams at outcrop if possible; to carry out hand trenching of seams located in order to determine seam thicknesses; and to check access to possible drill sites.

The above field program was followed by a drilling program in one area. The objectives of this drilling program were to test the Gething formation for the presence of possible viable coal seams obtaining, at the same time, unweathered, uncontaminated samples from any such seams for analysis. The drilling would also yield additional structural data.

This report treats the field work stage and the drilling stage of the program as two separate sections.

(b) Field Work

The field work was carried out from Chetwynd. The crew consisted of two geologists and two assistants utilizing a Bell G3B-2 helicopter. The field work was carried out during part of September and October 1972. The work was severely hampered by two early but severe snow storms which split the work into two different spells. The first was from September 16 to September 22 and the second was from October 1 to October 8, 1972. The work was curtailed on both occasions by snow rather than by a sense of completion of the project.

(b) Field Work (Cont'd.)

It quickly became a-parent that there is a general lack of outcrop in the area and that the interpretation of the detailed geology would be time consuming if not impossible from surface mapping. Traversing was essentially limited to the creeks. All the readily traversable tributaries of Hasler, Johnsen and Falling Creek were checked. Some work was also carried out at the headwaters of Willow Creek and on a tributary of the Brazion River. All the data that was recorded has been plotted onto a base map (Fig. 7). As can be seen, the overall interpretation of the geology as shown on the Project Map (Fig. 6) has not been changed. The main reason for this is that further field work will be carried out in 1973 to investigate some of the areas mapped in 1972. In many cases it is not possible at this time to make meaningful changes to the Project Map.

A traverse was made of Hasler Creek beginning east of the Hasler mine westward to approximately the headwaters of Hasler Creek. Except for minor changes in contacts, the mapping near the Hasler mine as shown on Fig. 6 is essentially correct. West of the mine where a broad anticline is indicated within the Gething formation, the beds are actually very highly folded, displayed by tight anticlines and synclines, thus making it unattractive for coal exploration.

(b) Field Work (Cont'd.)

Near the headwaters of Hasler Creek, immediately north of a small lake, a dip slope of resistant beds is overlain by a less resistant unit. This may represent the contact between the Gething and the Moosebar formations. If so, the Gething would occur on the west flank of a syncline, probably with relatively low dips. Large blocks of massive chert conglomerate occur along the creek for a distance of over one half mile. These conglomerate blocks are probably basal Gething or Cadomin formation.

On a side branch of Brazion Creek on the southern block of licences, a five foot coal seam was observed in a predominantly shale/siltstone unit approximately 12 feet above a more resistant, predominantly sandstone unit. All outcrops along Brazion Creek and its tributary appear to be pre-Gething in age.

The Gething formation indicated on the project map (Fig. 6) near the head of a small tributary entering Hasler Creek from the northwest two miles west of the mine proved to be all Moosebar formation except possible Gething formation near the mouth of this tributary.

Traverses of Falling Creek were most unproductive as outcrop in the licence area was very poor. Several strikes and dips were recorded on isolated outcrops believed to belong to the Moosebar formation. At the headwaters of the creek a series of interbedded

(b) Field Work (Cont'd.)

shales, sands and minor coals was assigned to the pre-Gething but this assignment is questionable. More detailed work must be completed to confirm the presence of the coal bearing Gething formation between the pre-Gething rocks and the post-Gething Moosebar formation in this area.

Most emphasis was placed on the area of the divide between Johnsen Creek and Willow Creek for two reasons. An outcrop of coal over 7 feet thick had been reported by Spivak (1944) and thick coal seams were apparently present in the well known well as Texas Gulf Sulphur Sun Falls a-64-B. Furthermore, access to this area for a drilling program would be relatively inexpensive.

The outcrop at the head of Johnsen Creek was hand trenched and found to be approximately 20 feet thick. It did, however, contain almost 3 feet of readily apparent partings. (This presence of these partings was later confirmed by the drilling program).

The structure was confirmed to be essentially a series of west dipping beds with dips generally in the 20° to 30° range. A fault was inferred to exist immediately below the coal outcrop at the headwaters of Johnsen Creek. This fault was later confirmed by the drilling program.

While the field work did not produce the definitive results hoped for, sufficient data was obtained to plan a valid drilling program.

(c) Drilling Program

i) Planning

The objectives of the drilling program were to test the Gething formation for viable coal seams, to obtain unweathered samples of coal for quality control; and to aid in the structural interpretation of the coal licences.

The choice of a location for this initial drilling program was based on several criteria. These were:

(a) An area where the structural dip was below 30°. Such an area might well lend itself to an initial limited mining program should viable coal seams be present.

(b) An area with known coal occurrences.

(c) Good access from existing access road. In this way maximum monies would be expended on drilling rather than on road building.

Bearing these parameters in mind an area on the divide between Willow Creek and Johnsen Creek was chosen. Field work had confirmed the structural dip to be essentially less than 30° and no major faulting or folding had been recognized. From a structural point of view, it was a suitable area. Coal seams had been recognized both at the northwest end of the area and at the southeast end. A well, Texas Gulf Sulphur Sun Falls a-64-B, drilled in 1966, indicated several coal seams in the upper portion of the Gething formation. In fact, the Sonic Log (Fig. 8) indicates two coal seams thicker than 10 feet in the

(c) Drilling Program (Cont'd.)

upper 1200 feet of Gething formation. At the south end of the proposed drilling area a coal seam previously reported by Spivak (1944) as "over 7 feet" had been hand trenched in 1972 and found to be approximately 20 feet thick (see Field Work). While this seam could not be directly correlated to the seams in the TGS well, it did indicate the area to have potential for being underlain by a substantial coal seam.

Access to the area was relatively good by the road built to service the TGS well (Fig. 9). This road was in relatively good repair with the exception of a few washouts at some culverts. New road building would be minimized.

Having decided on the area to be drilled, various alternate drilling methods were available. These ranged from the use of a conventional seismic drill to the use of a diamond drill which retrieves continuous core throughout the interval being drilled. It was decided that the extra costs involved in obtaining a continuous core were well worthwhile when only a limited drilling program was to be undertaken. This method of drilling further ensures that samples of coal recovered are uncontaminated. A frequent problem with other drilling methods - reverse circulation, double-wall drill pipe, etc. - is that the resultant chip samples of coal contain excess ash as a result of chips from non-coal zones being included in the sample. Furthermore, the continuous core enables the top and bottom of the seam and all

(c) Drilling Program (Cont'd.)

partings within the seam to be accurately measured. Bids for this type of drilling were received from three reputable contractors and Canadian Longyear Limited were chosen both on the basis of price and on the basis of experience.

Before proceeding with the upgrading of the road, permission was obtained for a crossing both of the P.G.E. railway and the gas transmission line of Westocast Transmission Ltd. Ploughing of snow for the drill program got underway in mid-January and the drill crew moved in approximately one week later.

ii) Drillhole Summaries

(a) Drillhole No. 1 (H1)

The hole was drilled approximately one half mile up dip and across strike from the TGS test hole (Fig. 9 and 10). Its purpose was to test the seams penetrated by this well and at the same time to provide structural data between the two locations. It was scheduled to be a 1300 foot hole which depth would penetrate the stratigraphic interval equivalent to the 20 foot plus coal intersection found at approximately 2320 feet in the TGS well.

The hole penetrated a portion of the Moosebar formation and entered the Gething formation at *189 feet. A 12 foot coal seam ('C' on Fig. 8) was penetrated from 330 - 342. The only other coal interval thicker than 5 feet found in the

* All depths are measured on the Gamma Ray-Neutron log. There may be minor discrepancies to the depths recorded on the lithologic logs.

Not in written log!!

(c) Drilling Program (Cont'd.)

hole to a total depth of 1542 feet was a 10 foot seam from 1053 feet to 1063 feet. As can be seen from Fig.8 this seam is tentatively correlated to the thick coal interval at 2320 feet in the TGS well. This correlation is uncertain but likely following a detailed analysis of the logs. In the field the correlation was very indefinite and Drillhole No. 1 was deepened to a total depth of 1542 feet in order to be certain that the stratigraphic interval equivalent to the TGS "thick seam" had been penetrated.

(b) Drillhole No. 2 (H2)

Drillhole No. 2 was drilled along strike to the southeast of No. 1 (Fig. 9). It was drilled to a depth of 602 feet but failed to penetrate any good coal seams. The interval equivalent to Seam 'C' in Drillhole No. 1 had essentially shaled out and a lower coaly interval - 'D' - had developed. Interval 'D' contained numerous partings and could not be classed as an economic seam as it was over 50% partings.

(c) Drillhole No. 3 (H3)

This was the next hole along strike towards the outcrop at the head of Johnsen Creek (Fig. 9). This hole encountered structural problems and faulted from the Gething formation back into the Moosebar formation at a depth of 130 feet. Only 76 feet of Gething formation was penetrated above this fault. This interval is shown separately on Fig. 8 . At a depth of 504 feet the Gething formation was re-entered

(c) Drilling Program (Cont'd.)

and the hole was continued to a total depth of 701 feet. (Fig. 11) No apparent viable coal seam was encountered in this hole. Tentative correlations were made for intervals 'A' to 'D' inclusive.

(d) Drillhole No. 4 (H4)

This hole was located near the thick seam outcrop (20 feet plus) that had been recognized in the creek at the head of Johnsen Creek and was specifically drilled to test this seam. It entered the Gething formation at 118 feet and bottomed at 302 feet. Two coal intervals thicker than 5 feet were encountered (Fig. 8). The upper seam (193 feet to 200 feet), labelled 'B', was the best seam encountered in the drilling program. It is discussed later in the section on coal quality. The lower coaly interval, 'D', was approximately 17 feet thick (265 feet to 282 feet) but contained over 6 feet of partings.

(e) Drillhole No. 5 (H5)

This hole was drilled a few hundred feet southeast of Drillhole No. 2 (Fig. 9). It was drilled at no charge by Canadian Longyear as they accepted responsibility for poor core recovery in Drillhole No. 2. It penetrated only 33 feet of Moosebar formation and was drilled to a total depth of 200 feet in the Gething formation (Fig. 11). As can be seen from the diagrams, it penetrates the Gething formation of the upper fault sheet. Very little coal was present in the hole.

(c) Drilling Program (Cont'd.)

iii) Seam Correlation

The correlation of the coal intervals found in the boreholes proved to be very difficult. A tentative correlation has been made on the basis of lithology and the mechanical logs and is illustrated as Fig. 8.

This figure shows four coal zones - labelled A - D inclusive - which are present in at least two of the drillholes. Drillhole No. 1 found some other coal zones but these have not been named on the cross-section. A few comments on each of the zones follow:

Zone A

This is the upper coal zone and nowhere does it exceed 4 feet in thickness. It is best developed at the south end of the drilling area but it cannot be considered as an economic target in the area.

Zone B

Zone B can only be recognized as a coal seam in Drillholes No. 3 and No. 4 although an equivalent marker can possibly be recognized in Drillhole No. 5. The seam thickens rapidly from Drillhole No. 3 to Drillhole No. 4 at which location it is 7 feet thick. This intersection which represents a true stratigraphic thickness of approximately 6 feet represents the best coal seam recognized in the drilling program. While only 7 feet thick, it has no partings. The roof of the seam, while not a perfect sandstone, would probably hold up. It is composed of a hard siltstone.

(c) Drilling Program (Cont'd.)

Zone C and Zone D

These two zones are considered together as the comments on one are equally applicable to the other. They both represent coaly zones which vary from zero to over twenty feet in thickness. Usually, however, over 30% of the total zone is represented by partings of shale and siltstone. While neither zone becomes an attractive prospect within the area of the drill program, these zones may improve in other areas nearby. The intervals represent prospective zones within the Upper Gething formation.

Other Zones

Several thin coaly intervals were encountered in Drillhole No. 1 and are shown on the cross-section (Fig. 8). Of these only one - 1053 feet to 1063 feet - is thicker than 4 feet. Above this 10 foot zone of good clean coal are several coaly partings resulting in 13 feet of coal within a 20 foot interval. The cross-section shows this zone to correlate to the thick coal zone in the TGS well. This correlation is believed correct as a thrust fault can be recognized in the TGS well as shown. Unfortunately the coal quality of this seam is disappointing and it is not a major prospect.

iv) Coal Quality

An extensive program of analysis was carried out on the core samples recovered from this program. Core recovery in some cases was very poor and this is noted on the appropriate seam description

(c) Drilling Program (Cont'd.)

(see Appendix). Some comments on the quality of the coals are also contained in the Appendix. They were made by Dr. D.F. Symonds 7, of Coal Science and Minerals Testing of Calgary.

(d) Conclusions

As a result of the exploration program, certain conclusions can be arrived at with respect to the coal potential of the area. These conclusions concern both the probable presence of viable coal seams of suitable quality and the likelihood of being able to mine these same seams.

The presence of coaly zones thicker than 10 feet has been established by the program. Unfortunately, wherever these zones were encountered - at surface or in drillholes - they were characterized by numerous shaly splits making the seam as a whole non-economic.

The only seam encountered in the drilling program that appears to have economic potential is the 'B' seam (Fig. 8). This seam is thicker than 6 feet where last known and seems to be of excellent quality for a low ash metallurgical grade coking coal.

Vast areas held by Pan Ocean are as yet wholly unknown. No firm conclusions can be drawn as to their potential until test holes have been drilled at selected locations. It is not worthwhile to attempt more detailed mapping of the surface in this

(d) Conclusions (Cont'd.)

poorly exposed area until these test holes have been drilled.

From a structural point of view there does not appear to be large (over 5 square miles) flat/low dip areas. However, the potential certainly exists for mineable areas of 2, 3 or 4 square miles which might well be suited for the development of 250,000 to 500,000 tons per annum mines if a suitable seam is present.

There is a yet insufficient data to form any definite conclusions on the merit of the area and exploration should be continued.

(e) Recommendations

As no coal seams which were immediate prospects for development were found in the drilling program carried out in January and February of 1973, it is recommended that other areas of the licence block be tested.

In particular, the band of Gething formation along Falling Creek should be tested for coal as should the Gething formation at the headwaters of Hasler Creek. Some time should be spent on the ground in both these areas in an attempt to locate the contact between the Gething formation and the Moosebar formation so that drillholes may be located most advantageously. At least one stratigraphic test hole to penetrate the Upper Gething formation should be located in each area.

One additional hole should be drilled southeast of the No. 4 drillhole to test the continuation of the 'B' coal seam which is the best prospect located to date.

(e) Recommendations (Cont'd.)

All the above recommendations can be completed within the budget for the 1973-74 program.

June 15, 1973.

I. P. Dyson, P. Geol.

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APPENDIX 3

ORDER-IN-COUNCIL NO. 1519

PROVINCE OF BRITISH COLUMBIA

PROVINCE OF BRITISH COLUMBIA
MINISTRY OF MINES AND PETROLEUM RESOURCES

VICTORIA

COAL ACT

NOTICE

NOTICE is given that pursuant to subsection (2) of Section 17 of the Coal Act and the authority of Order in Council No. 1519, approved on April 20, 1972, the reservation to the Crown of coal in the following described area:-

> Commencing at the intersection of 55° 15' parallel of north latitude with 121° 45' meridian of west longitude; thence northerly along said 121° 45' meridian of west longitude to 55° 45' parallel of north latitude; thence westerly along said 55° 45' parallel of north latitude to 122° 30' meridian of west longitude; thence southerly along said 122° 30' meridian of west longitude to 55° 30' parallel of north latitude; thence easterly along said 55° 30' parallel of north latitude to 122° 15' meridian of west longitude; thence southerly along said 122° 15' meridian of west longitude to 55° 15' parallel of north latitude; thence easterly along said 55° 15' parallel of north latitude to 121° 45' meridian of west longitude, being the point of commencement, Peace River Land District:

is cancelled for a period of 30 days commencing May 29, 1972, and that Pan Ocean Oil Ltd. has been granted an exclusive right to select and apply for coal licences in the area during the said period.

Frank Richter

Frank Richter
Minister of Mines and Petroleum Resources

Victoria, B. C.
April 24, 1972

1519.

report

THAT Pan Ocean Oil Ltd., duly incorporated under the laws of the Province, has entered into an agreement to develop and operate a coal field in the Peace River Land District and to that end have deposited with the Minister of Finance a performance bond in the sum of $50,000.00;

THAT Pan Ocean Oil Ltd. have satisfied the Minister of Mines and Petroleum Resources that exploration and development of the coal field will proceed forthwith upon approval of this Order;

AND TO RECOMMEND THAT by authority of subsection (2) of Section 17 of the "Coal Act", Chapter 60, Revised Statutes of British Columbia 1960, as amended by Chapter 9, Statutes of British Columbia, 1966, the reservation of coal created by Order in Council No. 281, approved March 4, 1943, in the following described area:

> Commencing at the intersection of 55° 15' parallel of north latitude with 121° 45' meridian of west longitude; thence northerly along said 121° 45' meridian of west longitude to 55° 45' parallel of north latitude; thence westerly along said 55° 45' parallel of north latitude to 122° 30' meridian of west longitude; thence southerly along said 122° 30' meridian of west longitude to 55° 30' parallel of north latitude; thence easterly along said 55° 30' parallel of north latitude to 122° 15' meridian of west longitude; thence southerly along said 122° 15' meridian of west longitude to 55° 15' parallel of north latitude; thence easterly along said 55° 15' parallel of north latitude to 121° 45' meridian of west longitude, being the point of commencement, Peace River Land District;

be cancelled, subject to the observance and performance of the following [illegible]:

(a) Within [illegible] after the [illegible] date of cancellation of the reservation, which date shall be the date stated in the notice required by the said Section 17 to be signed by the Minister of Mines and Petroleum Resources and published in the Gazette, Pan Ocean Oil Ltd. shall [illegible] apply for coal licences under the terms of the 'Coal Act', covering such part of the coal field that the Company considers necessary to the proposed operation.

(2)(c) A total of $150,000.00 must be spent on field exploration and development work to the satisfaction of the Minister in the area licensed during the three-year period following issuance of the licence or licences.

(d)(i) If $75,000.00 or more is spent on such work during the first year following issuance of the licence, or licences, the performance bond will be returned, or

(ii) if, on or before the expiry of three years following issuance of the licence, or licences, a total of $150,000.00 has been spent on such work, the performance bond will be returned.

(e) The licensee shall:-

(i) on demand make available to the Minister for examination by officers of the Department copies of all plans of the licence, or licences, and workings thereon, plans showing the position of all drill holes, logs of drill holes, analyses of coal, technical reports and other documents pertaining to the exploration, development or mining of coal within the licensed area.

(ii) on or before the anniversary date of the licence, or licences

(A) supply to the Minister a report by a professional engineer setting out the work done in the previous year, and giving full information on the results of exploration, development or mining, supported by such plans, drill logs, and other illustrations or supporting documents as may be necessary to portray the work done and the results thereof.

(B) supply a statement of the total expenditure on said work and on the principal subdivisions thereof.

AND TO RECOMMEND THAT upon expiration of the 30-day period during which Pan Ocean Oil Ltd. have the exclusive right to select and apply for coal licences, all rights of Pan Ocean Oil Ltd. shall cease and determine, and this order is deemed to be rescinded and automatically cancelled as to those lands which were not at that time staked under the provisions of the Coal Act, and such lands shall immediately fall within and be included in the said reserve established by Order in Council 281/43:

AND TO FURTHER RECOMMEND THAT all coal existing in any lands lying within the boundaries of the said reservation which have or may hereafter become vacant through the expiry or cancellation of any licence or lease issued under the said "Coal Act", shall immediately on such expiry or cancellation fall within and be included in the said reserve.

DATED THIS 20 DAY OF April A.D. 1972

"Frank Richter"

Minister of Mines and Petroleum Resources

APPROVED THIS 20 DAY OF April A.D. 1972

"W. D. Black"

Presiding Member of the Executive Council