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PETRO-CANADA EXPLORATION INC.

THUNDERCLOUD COAL PROJECT

TECHNICAL REPORT

JANUARY, 1980

104-J-1

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00242

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SUMMARY

Petro-Canada Exploration Inc.'s Thundercloud Coal Project is located in northwestern British Columbia at Longitude 130°45' W and Latitude 58°15' N approximately 1150 km north-northwest of Vancouver, B.C.

Coal licences forming the property are located to cover the Cretaceous coal bearing sediments of the Skeena Group strata.

Petro-Canada conducted exploration in the form of detailed mapping, hand trenches and drilling on the coal licenses starting in May 1979, following reconnaissance by prospector T. Mould in the summer of 1978.

The area is structurally complex. Block faults and thrusts each show a strike slip component and there also appears to be some related drag folding. Further, a few minor intrusives have been observed along probable fault zones and there is a regional sub-greenschist facies of metamorphism. The rank of the sub-bituminous coal appears to have been increased by the metamorphism and there is evidence that this coal may have some agglomerating properties.

Exploration to date has identified three distinct coal seams, which in the drilled sections have undergone multiple fault repetition and, in at least one case, fault thickening of the coal seam itself. It appears likely that this thrust fault repetition, if present over a large enough area of the property, may represent a potentially economic coal resource. If further drilling proves up coal of economic quantity and quality the geologic structures as presently understood are amenable to surface mining and perhaps to underground mining methods.

In addition, the property is suitably located to take advantage of infrastructure development generated to the west at Telegraph Creek on the Stikine River or to the east at the town of Dease Lake which is presently located on a major north-south highway and is the planned terminus of the partially completed BCR extension.

A local market potential should also be evaluated.

INTRODUCTION

2.1 Location and Means of Access

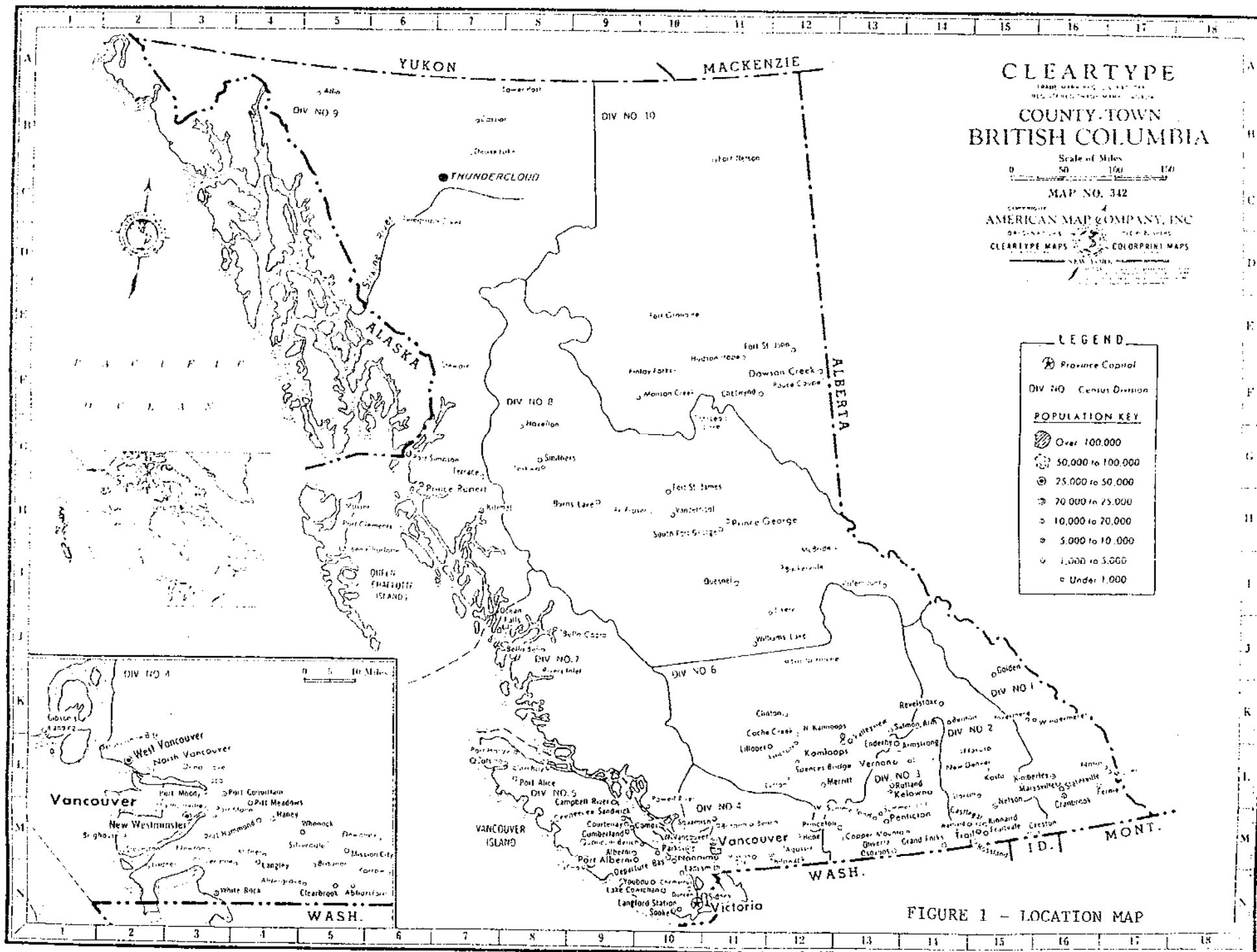
The Thundercloud Coal Project is located in northwestern British Columbia at Longitude $130^{\circ}45'W$ and Latitude $58^{\circ}15' N$ on the Stikine Plateau. The property is approximately 1150 km by air north-northwest of Vancouver, B.C. (Figure 1).

The only satisfactory means of access to the property is by helicopter from Dease Lake on the Stewart-Cassiar highway. For the purposes of airlifting supplies, the closest road access is the Dease Lake - Telegraph Creek highway which passes within 10 km. of the property at the locality known as Cariboo Meadows. An airstrip and a float plane base are available at Dease Lake.

2.2 Land Tenure

Crown Coal Licence Nos. 4545 to 4558 inclusive covering 3569.8 hectares were granted to Pacific Petroleum Ltd. on January 15, 1979. On the basis of field work conducted last summer additional ground was applied for and Licence Nos. 5310, 5311 and 5312 covering 816.6 hectares were granted on September 10, 1979.

On November 26, 1979 a transfer conveying all interest in these licences from Pacific Petroleum Ltd. to Petro-Canada Exploration Inc. was submitted to the Ministry of Energy, Mines and Petroleum Resources and we are now awaiting approval of the transfer.



2.3 Topography

The Thundercloud property is situated on a gently sloping plateau approximately 5 km west of the deeply incised Tuya River valley. The Tuya River is a major southward flowing tributary of the Stikine River. The coal licenses center on the Little Tuya River and its tributary, Mansfield Creek.

The average elevation of the property is about 800 m a.m.s.l., with valleys about 150 m lower. In general, the plateaus are drift covered with outcrop visible only in the steep valleys. The area is moderately to well forested with some open muskeg areas on the plateau tops. Figure 2 shows an aerial view of the property looking west along Mansfield Creek.

2.4 Exploration History

The occurrence of coal along the Tuya River was first reported as early as 1887 by G. M. Dawson of the Geological Survey of Canada. Since that time others, Gabrielse (1962) and Eisbacher (1973) have noted coal within the area as thin lignite seams.

Although the Cassiar District has had a great deal of mineral exploration carried out over the past several years, little coal exploration has been done until recently. Hence, the stratigraphy of the area is not well known and there is a confusion of stratigraphic names.

In this report, the stratigraphic nomenclature proposed or redefined by Tipper and Richards (1976) will be used.



FIGURE 2 - AERIAL VIEW OF THE PROPERTY LOOKING WEST ALONG MANSFIELD CREEK

In the summer of 1978, prospector T. Mould did a brief reconnaissance of the area, which led to Petro-Canada's acquisition of the initial 14 Crown coal licenses.

In May and June, 1979, the author and temporary staff of Petro-Canada carried out a field program of mapping, hand trenching and drilling on the property.

1979 EXPLORATION PROGRAM

3.1 Objectives

The objectives of the 1979 Exploration program carried out by Petro-Canada were to:

- 1) determine whether there is sufficient coal in place to merit further exploration.
- 2) delineate the stratigraphy and structure of the property.
- 3) test the quality of the coal.

3.2 Field Program

The 1979 field program was begun on May 7, 1979. Accommodation and services were provided in the town of Dease Lake. Table II on the following page lists the temporary and permanent personnel employed on the project. A total of 13 technical and support staff contributed to the field work and office compilation. A list of all contractors who provided services is shown in Table III.

Helicopter support, using a Hughes 500D, was provided by Terr-Air Rotary of Ross River, Y.T. for personnel and drill moves in May and June.



FIGURE 3 - SURVEYING DRILLSITE TDD 79-02 USING THE MARINAV CORP. SATELLITE SURVEY INSTRUMENT

THUNDERCLOUD COAL PROJECT

SUMMARY OF COAL LICENCES

TABLE NO. I

<u>Licence</u>	<u>N.T.S.</u>				<u>Annual</u>	
<u>No.</u>	<u>Ref. No.</u>	<u>Block</u>	<u>Units</u>	<u>Hectares</u>	<u>Rental</u>	<u>Anniversary</u>
4545	104-J-2	K	43, 44, 53, 54	272.86	\$ 1,365	January 15
4546	104-J-2	K	45, 46, 55, 56	272.86	1,365	January 15
4547	104-J-2	K	63, 64, 73, 74	272.74	1,365	January 15
4548	104-J-2	K	65, 66, 75, 76	272.74	1,365	January 15
4549	104-J-2	K	67, 68, 77, 78	272.74	1,365	January 15
4550	104-J-2	K	83, 84, 93, 94*	124 +	620	January 15
4551	104-J-2	K	85, 86, 95, 96*	256.84	1,285	January 15
4552	104-J-7	C	5, 6, 15, 16*	243 +	1,215	January 15
4553	104-J-7	C	23, 24, 33, 34*	226 +	1,130	January 15
4554	104-J-7	C	25, 26, 35, 36*	267 +	1,335	January 15
4555	104-J-7	C	27, 28, 37, 38	272.34	1,365	January 15
4556	104-J-7	C	43, 44, 53, 54	272.22	1,365	January 15
4557	104-J-7	C	45, 46, 55, 56	272.22	1,365	January 15
4558	104-J-7	C	47, 48, 57, 58	<u>272.22</u>	<u>1,365</u>	January 15
TOTAL - Licences issued January 15, 1979				3,569.78	\$ 17,870	

*excludes any portion over adjoining coal lot

5310	104-J-7	C	7, 8, 17, 18	272.48	\$ 1,365	September 10
5311	104-J-7	C	65, 66, 75, 76	272.08	1,365	September 10
5312	104-J-7	C	67, 68, 77, 78	<u>272.08</u>	<u>1,365</u>	September 10
TOTAL - Licences issued September 10, 1979				<u>816.64</u>	<u>\$ 4,095</u>	

TOTAL

4,386.42 ha.
x 2,471
 10,838.84 acres

TABLE II

LIST OF PERSONNEL EMPLOYED

Office Staff

J. Y. Wright	Chief Geologist
A. E. Bienia	Geologist
J. L. Reid	Geologist
D. C. Kinton	Senior Landman
C. M. E. Kassam	Clerk
E. E. Topacio	Draftsman
M. A. Yancie	Secretary

Field Staff

Permanent

J. L. Reid	Geologist
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Temporary

W. M. Proudlock	Geologist
D. V. Thomas	Geologist
M. Carr	Assistant
P. George	Assistant
K. Samson	Assistant
B. Tupper	Assistant

TABLE III

LIST OF CONTRACTORS AND SERVICES

Aircraft Charter

Terr-Air Rotary Ltd.	Ross River, Y.T.
B. C. Yukon Airways	Dease Lake, B.C.
Air North	Whitehorse, Y.T.

Coal Quality Studies

Loring Laboratories	Calgary
Roke Oil Enterprises	Calgary

Consultants

G. R. Jordan Consulting Services Ltd.	Calgary
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Drilling

J. T. Thomas Diamond Drilling	Smithers, B.C.
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Mapping Services

R. M. Hardy and Associates	Calgary
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Rentals

Bow Mac Truck Rentals	Watson Lake, Y.T.
Canadian Marconi	Calgary
Spillsbury Tindal Communications	Vancouver, B.C.

Trucking

CDC Trucking Ltd.	Ft. Nelson, B.C.
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Miscellaneous Services

Kinnear Drafting	Calgary
Cathahan Drafting	Calgary

Also, B.C. Yukon Airways provided a Hughes 500D in the fall for the reclamation and survey work done. The Hughes 500D proved to be very good for all aspects of the work and terrain encountered.

Communications were provided by using two SBX-11A single side band transmitting radios rented from Spillsbury Tindal Communications of Vancouver, B.C. Also a Canadian Marconi VHF system with handsets, was used during the mapping, with limited success.

3.3 Surveying and Photogrammetry

R. M. Hardy and Associates provided a semi-controlled 1:10,000 scale metric map of the property using N.T.S. photos. They also provided a 1:20,000 scale photo mosaic of the immediate region.

The diamond drill locations were surveyed using a Marinav Corporation satellite surveying instrument. This compact computerized system which is illustrated in Figure 3 gave precise UTM coordinates and elevations. The system is particularly useful in regions such as this, where there are virtually no known surveyed points from which a conventional survey can be carried out. The author kindly acknowledges the work of Mr. Bob Tupper who carried out the survey.

3.4 Geological Mapping

The 1979 exploration program included both reconnaissance and detailed geological mapping. No outcrops were observed on the plateau tops during the reconnaissance mapping. Hence, the detailed mapping centered along the Little Tuya River and Mansfield Creek valleys at a scale of 1:10,000. A number of two-man mapping teams used a chain and compass mapping method. The mapping was carried out by Petro-Canada's staff and the subsequent interpretation was done by the author with some assistance from G. R. Jordan Consulting Services Ltd.



FIGURE 4 - DRILL MOVE USING THE HUGHES 500D HELICOPTER

The author acknowledges the very able field assistance provided by D. Thomas and W. Proudlock, geologists, as well as by the summer assistants: M. Carr, P. George and K. Samson. The results of the mapping are described in a later section of this report.

3.5 Diamond Drilling

J. T. Thomas Diamond Drilling of Smithers, B.C., provided an airborne Longyear 38 drill for the program. NQ wireline core was extracted using a standard Longyear core barrel. A Hughes 500D was used for drill moves as shown in Figure 4. The program started on May 23, 1979 and a total of four holes were drilled. Total footage drilled was 878 m.

3.6 Trenching

All major coal outcrops on the property were hand trenched and sampled in 1979. The results and correlation of this are described later in this report.

3.7 Coal Quality Studies

The holes were geophysically logged and analyses were carried out on all significant coal intersections in the core. Also analyses were done on the trench samples collected. The objectives of these procedures were to determine the coal characteristics and quality for each seam encountered.

Appendix 'A' contains the seam profiles of all seams encountered greater than 1.0 m thick. The coal quality data is plotted opposite to the interval sampled. Also, Figure 5 shows the correlation of hand trenches 1, 3 and 4 to Seam 2 identified in drill hole TDD 79-03.

Appendix 'B' consists of all the downhole geophysical logs.



FIGURE 6 - RECLAIMED DRILLSITE TDD 79-03 LOCATED NORTH OF MANSFIELD CREEK.
(Site is in the lower right hand corner of photo)

3.8 Reclamation

The reclamation work on the property was carried out under the supervision of the author to the specifications of Ranger Dunlop, B.C. Forest Service, Lower Post, B.C.

The work was done for Petro-Canada by McCrory Holdings (Yukon) Ltd. Six planned drill sites were cleared and of these sites, four were located in natural clearings or areas of light cover. Thus, minimal disturbance was caused during the 1979 program. Figure 6 shows reclaimed drillsite TDD 79-03, just north of Mansfield Creek.

3.9 Cost Breakdown

The breakdown of expenditures made in 1979 on the Thundercloud Property is shown in Table IV.

TABLE IV
 THUNDERCLOUD PROJECT
EXPENDITURES 1979 - COST BREAKDOWN

	<u>SUB FEATURE</u>	<u>AMOUNT SPENT</u>
Surveying and Photogrammetry	290	\$ 4,875
Permits	297	138
Camp and Outside Subsistence	306	315
Reclamation	322	2,817
Drilling - Direct Drilling Costs	329	51,706
- Rig Costs	333	9,736
- Consumables	336	10,586
Geophysical Logging	339	8,650
Outside Labour	376	3,216
Assaying and Testing	425	2,008
Consulting Fees	440	443
Non-controllable Materials	459	1,337
Other Services	460	635
Aircraft Charter	490	48,073
Company Labour	502	15,911
Auto, Travel and Subsistence	515	9,153
Freight and Hauling	537	1,200
Equipment Rentals	572	1,391
Communications	582	3,230
Administration	656	<u>10,080</u>
TOTAL		<u>\$ 185,500</u>

GEOLOGY

4.1 Regional Geology

The Thundercloud Coal Project is located in Cretaceous rocks of the intermontane Tagish Belt of northwestern B.C. The region is bounded to the north by the Atlin Horst, to the west by the Coast Plutonic complex and to the east by the Omineca Crystalline Belt. Tertiary to Recent volcanics of Level Mountain and Mt. Edziza bound the property area to the west, north and south. Flows on Mt. Edziza have been dated to be as recent as 2,000 years B.P., with three younger flows known to overlie it. (Souther, J. G., 1971).

This region has undergone much study and exploration for precious and base metals in the last several years, but little work in coal exploration has been done.

In general, the Mesozoic rocks of this region are thought not to be severely disturbed. Block faulting with intrusive rocks in the fault zones is common, but there is little regional evidence for large scale transcurrent fault displacement and only minor thrust faulting has been noted. All the rocks do however, show a sub-greenschist facies of metamorphism.

The regional record begins in Late Triassic time with the deposition of dominantly basalt and andesitic island arc volcanics of the Takla Group. In early to middle Jurassic time, calc-alkaline island arc basalts and rhyolitic volcanics and sediments of the Hazelton Group were deposited. In middle to late Jurassic time, as a result of the erosion of the older Takla and Hazelton Group rocks, the Bowser Lake Group was deposited. This period defines the end of island arc volcanism in the area.

FIGURE 7

STRATIGRAPHIC COLUMN

PERIOD	GROUP	FM	LITHOLOGY AND STRUCTURE
Tertiary (Eocene) to Upper Cretaceous	SUSTUT	Brother's Peak Fm	A thick assemblage of conspicuously bedded continental strata of relatively simple structure. Conglomerates, sandstone, shale and bands of tuff
		Tango Fm	
Earliest Upper Cretaceous to Early Cretaceous	SKEENA		Interbedded marine and non-marine sedimentary and volcanic strata. Sediments are of greywacke, sandstone, shale and conglomerate with <u>common minor or major coal seams</u> . Volcanics are grey, green or vari-colored basaltic to rhyolitic breccias, tuffs and flows. The proportion of sediments to volcanics can vary widely.
Upper to Middle Jurassic	BOWSER LAKE		Thick assemblage of marine and non-marine sediments composed dominantly of shale, siltstone, sandstone and conglomerate, with one interbedded assemblage of green to grey feldspathic andesitic breccia, tuff and flows.
Middle to Early	HAZELTON		Thick and widespread assemblage of basaltic to rhyolitic volcanic rocks, sedimentary rocks, their tuffaceous equivalents, and minor limestone
Late Triassic	TAKLA		Basaltic and andesitic volcanic rocks, with preponderance of augite porphyry, pelitic sediments, and minor carbonate rocks.

(Reference: Tipper H. W. and Richards T.A., 1976)

A major break in deposition occurred between latest Jurassic to early Cretaceous times, marked by a period of uplift and erosion before the deposition of the successor basins of the Skeena and Sustut Groups (Tipper, H. W., and Richards, T.A., 1976).

4.2 Stratigraphy

4.2.1 General Statement

The coal measures which occur on the Thundercloud property are found in continental clastic sediments very likely belonging to the Skeena Group. Figure 7 shows a general stratigraphic column for the area.

It is probable that these sediments were deposited during early to late Cretaceous times when a shallow sea is thought to have existed to the north and east, between the stable eastern craton and the actively developing uplift areas to the south and west, particularly the Stikine Arch.

At this time, the Whitehorse trough, which may have extended continuously during Jurassic time to the Fernie Basin of southeastern B.C., was beginning to break up into a number of local basins. This is thought to be due to the uplift of the Omineca Crystalline Belt.

Clastic sediments from the erosion of the western and southern highlands were transported northeasterly by streams and deposited over the older Hazelton and Bowser Lake Group rocks, possibly forming a deltaic environment at the margins of the uplift.

Accumulations of plant debris formed at this time, between phases of continental sedimentation. There is a marked similarity between the Thundercloud area and the Laberge area, just south of Carmacks, Y.T. where coal forming plant accumulations have been noted (Gabrielse, H., 1957) (Bostock and Lees, 1938).

The local stratigraphy is difficult to unravel because of multiple fault repetition of the section.

Figures 8 to 10 incl. illustrate how the drilled stratigraphic sections of TDD 79-01, 79-02 and 79-03, respectively, can be shown to consist of a much smaller portion of a 'normal' section. In these Figures, the repeated, overturned and/or fault thickened sections are correlated to the 'normal' portion of the drilled section. Thus, the column on the right of each figure shows a "normalized" stratigraphic section.

Figure 11 shows a correlation between composite "normalized" sections for each of the above drill holes.

4.2.2 Seam Stratigraphy

There are at least three distinct coal seams present within the composite normalized section. The lowest seam in the normalized sections has been labelled '1'. The true thickness of this seam is 2.4 m. Seam 2 consists of lower 4.5 m interval and an upper 0.5 m interval. The main coal outcrop found on the property beside the Little Tuya River, for which the trench log is shown in Figure 5 is thought to be Seam 2 (lower). Figure 12 is a photograph of this outcrop.

Seam 3 (up section) consists of a lower 0.7 m coal band and an upper 0.5 m band with a 0.3 m sandstone split between the two.

In TDD 79-03 a concordant igneous unit was intersected above Seam 3 and there is strong evidence that this unit was emplaced into, or flowed over another coal seam which may be as much as 6 m thick. (Figure 11)

Thin section evidence shows that this unit could be a flow. Depending upon the erosional topography at the time of this event, it is possible that a fourth seam may exist on the property. Further drilling could establish its presence.

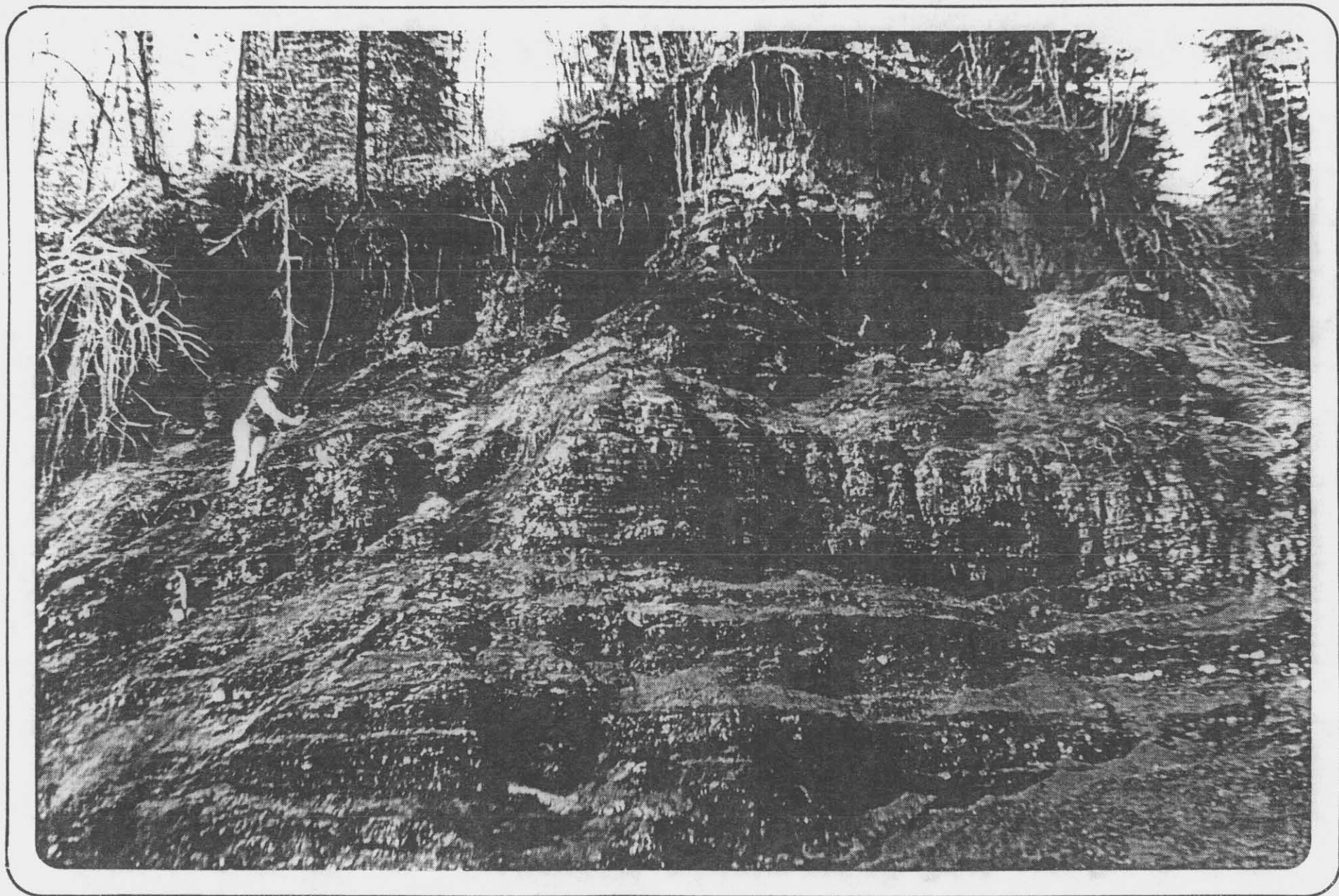


FIGURE 12 - OUTCROP OF COAL SEAM 2 (LOWER) ON THE SOUTH SIDE OF THE LITTLE TUYA RIVER.
THIS IS THE LOCATION FOR TRENCH #1 SCHEMATICALLY ILLUSTRATED IN FIGURE 5.

4.3 Structural Geology

The structure of the property appears typical of that of the Tagish Belt. An interpretative geology map of the property is shown in Figure 13 and a series of sections across the property is shown in Figures 14a to 14e inclusive. (On these sections 'V' and 'V'_c indicates volcanics and volcano-clastics, respectively).

Block faulting appears to control the valleys of the Tuya, Little Tuya Rivers and probably Mansfield Creek. Figure 15 shows a structure and formline contour map of Seam 2 (lower) illustrating a basin-like folded structure which in turn has been thrust-faulted along its eastern margin. It is likely that the block faults, thrust faults and the folded structures illustrated in Figure 15 may represent different patterns of failure of rocks with a high mechanical contrast within a single and consistent stress regime. There is also evidence which indicates a strike slip component along many of the faults. Figure 16 shows one of the minor block faults mapped on the property.

It should be noted that the volcanics shown in Figure 13 and Figure 14 appear to have been tectonically placed in their present position. It is possible that this may be relatively small scale block faulting within a normal Skeena Group section and these volcanics may not be related to the Triassic, Level Mountain, volcanics to the northwest. The volcanics mapped along the western margin of property consist of grey, green to vari-colored basaltic to rhyolitic breccias, tuffs and flows more typical of the Skeena Group volcanics than the Level Mountain flow basalts.



FIGURE 16 - ONE OF THE SMALL SCALE BLOCK FAULTS MAPPED ON THE PROPERTY.
THE BLOCK ON THE RIGHT HAS BEEN DISPLACED ABOUT 20 m IN A
RELATIVE DOWNWARD MOTION. THE LOCATION IS ON MANSFIELD CREEK

RESOURCE POTENTIAL

5.1 Potential Geological Coal Resource

It is the opinion of the author that significant geological resource potential for coal exists on the licenses from Mansfield Creek northwards to the Little Tuya River and possibly farther north, as shown on the formline and structure contour map. (Figure 15)

It should be noted that all interpretations of the geological coal resource illustrated in Figures 13 to 15 incl. were done on a conservative basis. However, it seems unlikely and too fortuitous that all of the diamond holes drilled in this area encountered the only areas with multiple thrust fault repetition of the coal bearing section. No resource calculations have been made at this time because it is felt that there is insufficient information in view of the complexity of the structure.

CONCLUSIONS

Exploration on the Thundercloud property to date indicates a good potential for the presence of significant tonnages of sub-bituminous thermal coal with possible agglomerating properties.

Further drilling will be required to fully evaluate the potential of the area, but the initial results from the 1979 field program are very encouraging.

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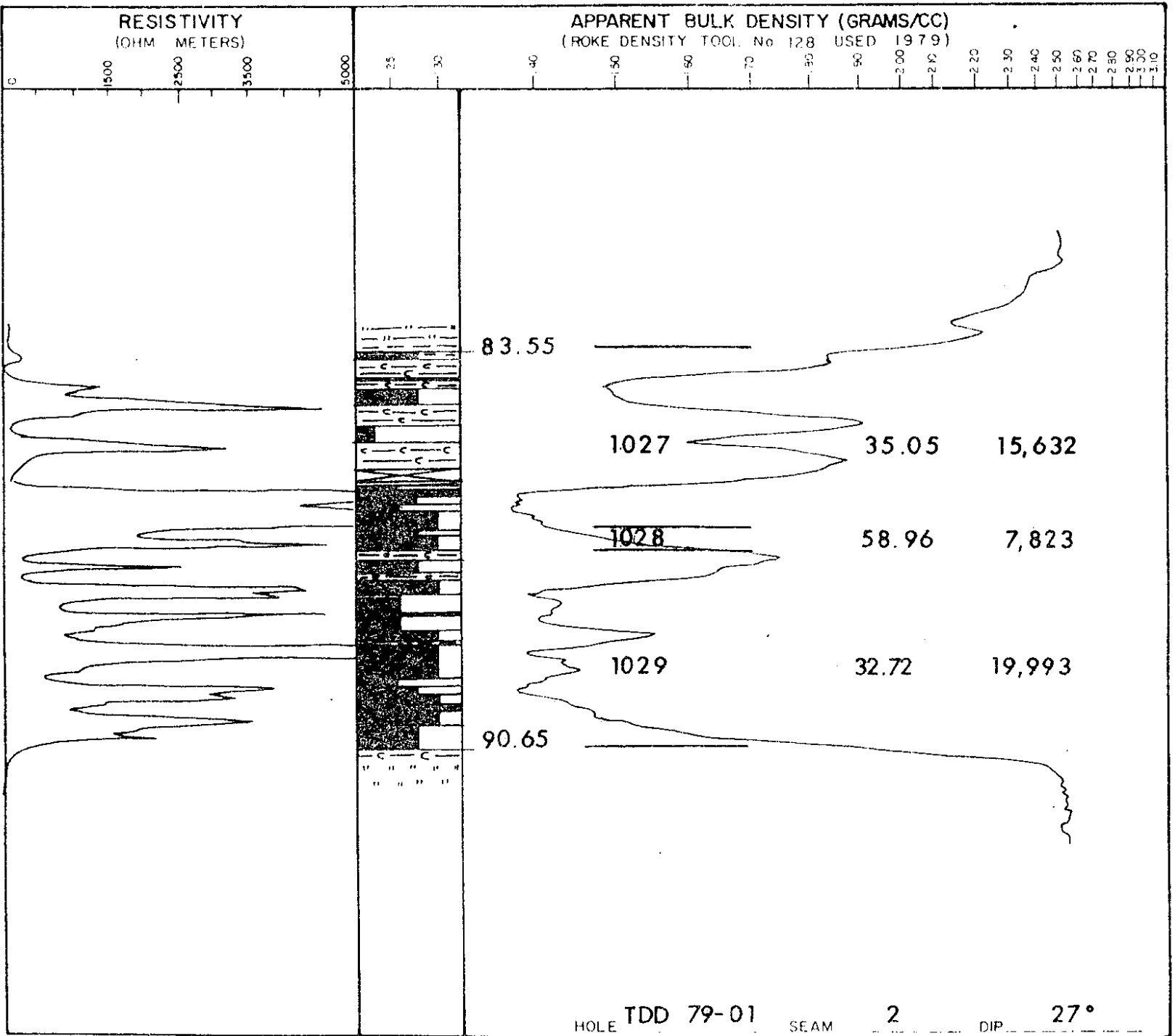
APPENDIX A

SEAM PROFILES

NOTE: On each of the following seam profiles the analysis for each sampled interval is shown in the following manner:

SAMPLE NO.	Percent Dry Ash	CALORIFIC VALUE KJ/Kg
------------	-----------------	--------------------------

PETRO - CANADA EXPLORATION INC.
 THUNDERCLOUD PROJECT

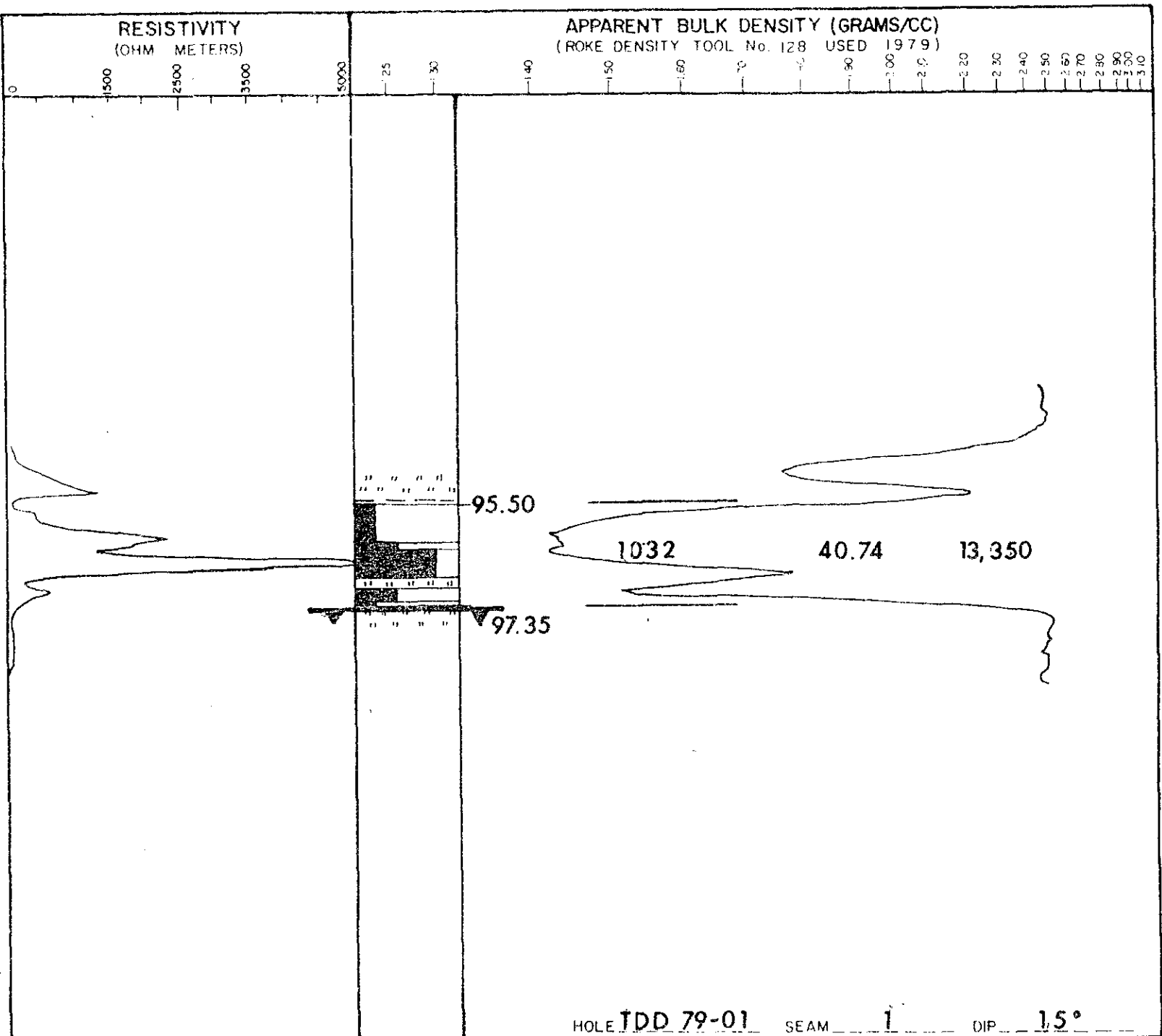


SEAM PROFILE

HOLE	SEAM
TDD 79-01	2

HOLE TDD 79-01 SEAM 2 DIP 27°

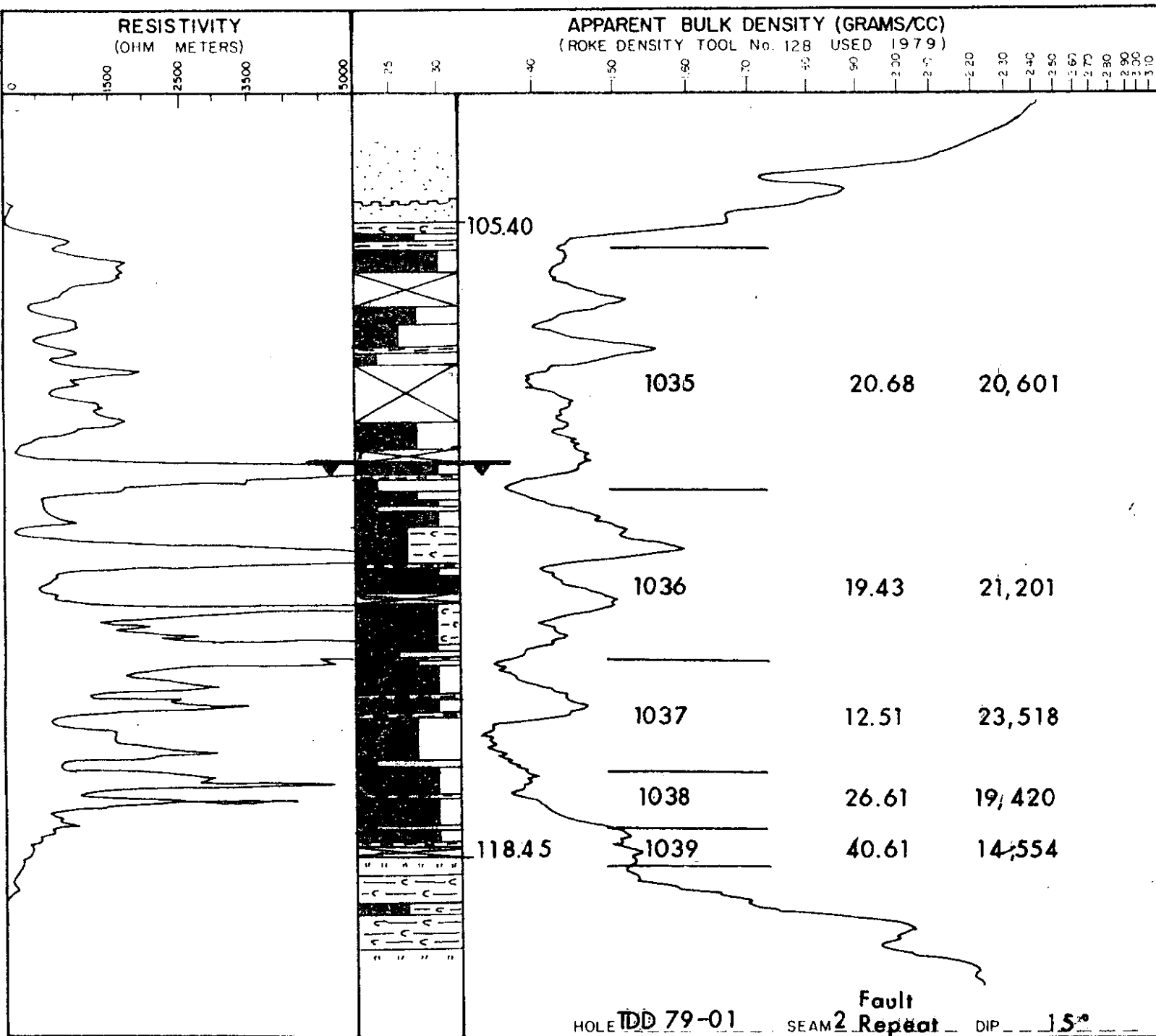
PETRO - CANADA EXPLORATION INC.
 THUNDERCLOUD PROJECT



HOLE	SEAM
TDD 79-01	1

HOLE TDD 79-01 SEAM 1 DIP 1.5°

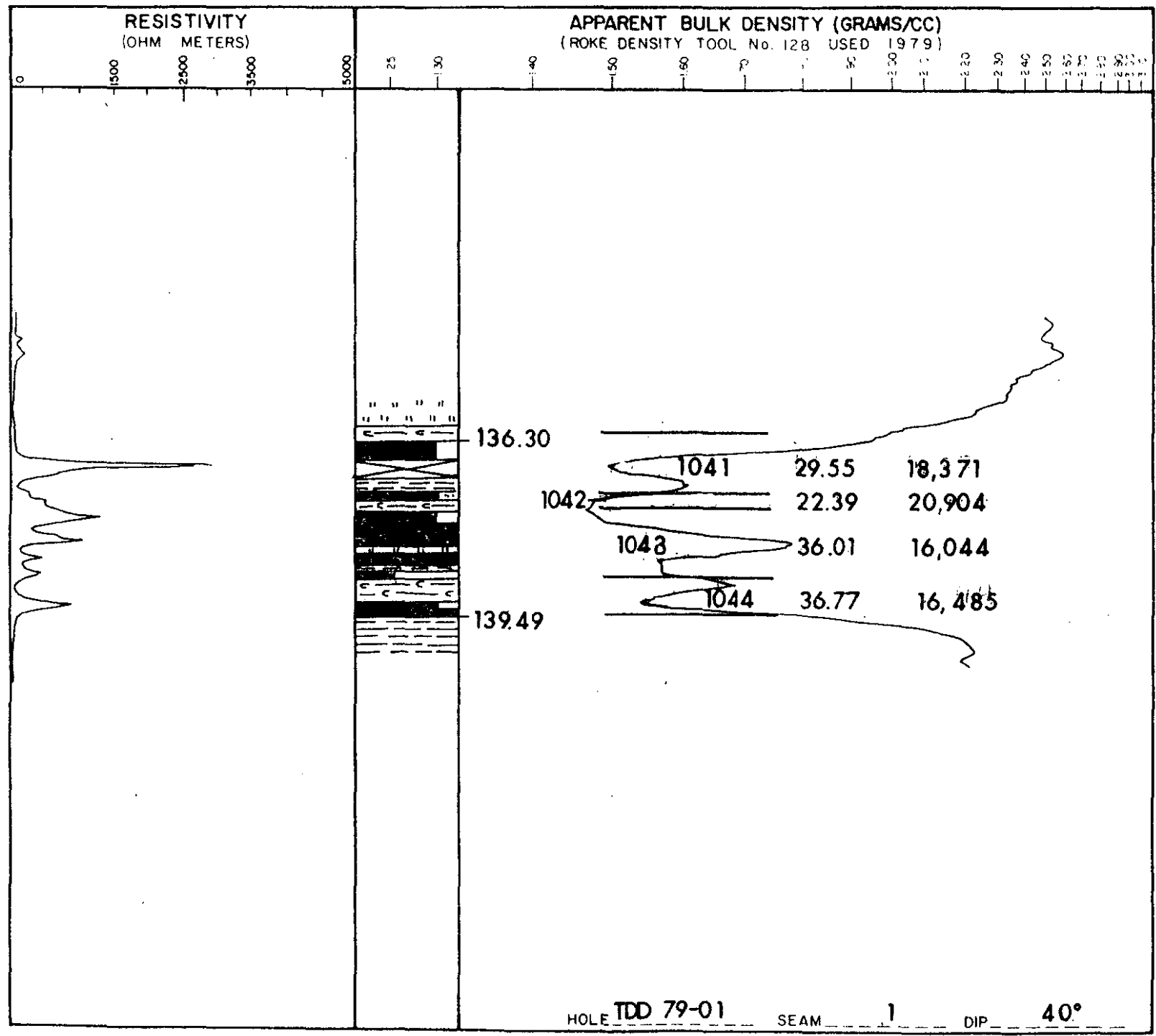
PETRO - CANADA EXPLORATION INC.
THUNDERCLOUD PROJECT



SEAM PROFILE

HOLE	SEAM
TDD 79-01	2

PETRO - CANADA EXPLORATION INC.
 THUNDERCLOUD PROJECT

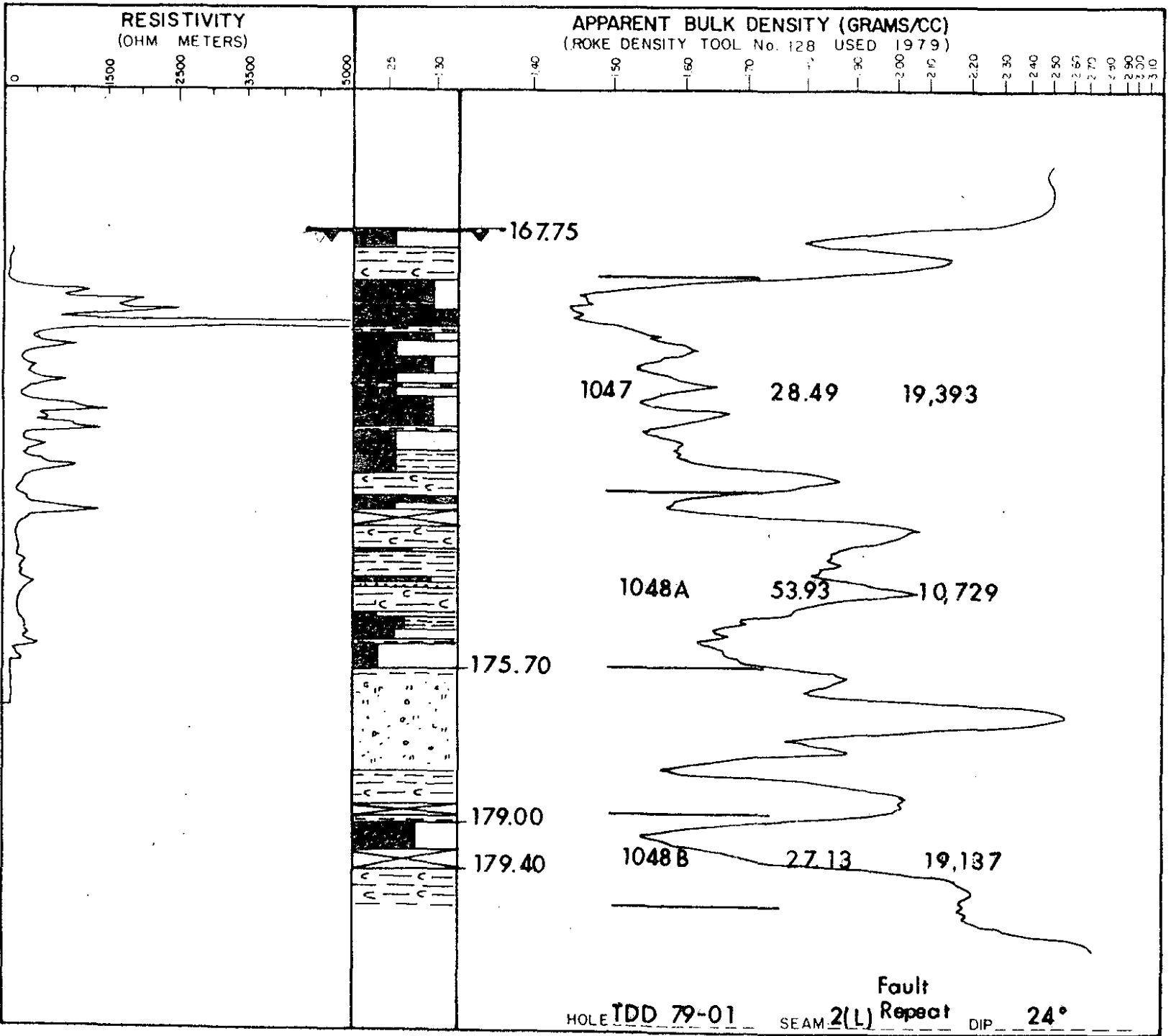


SEAM PROFILE

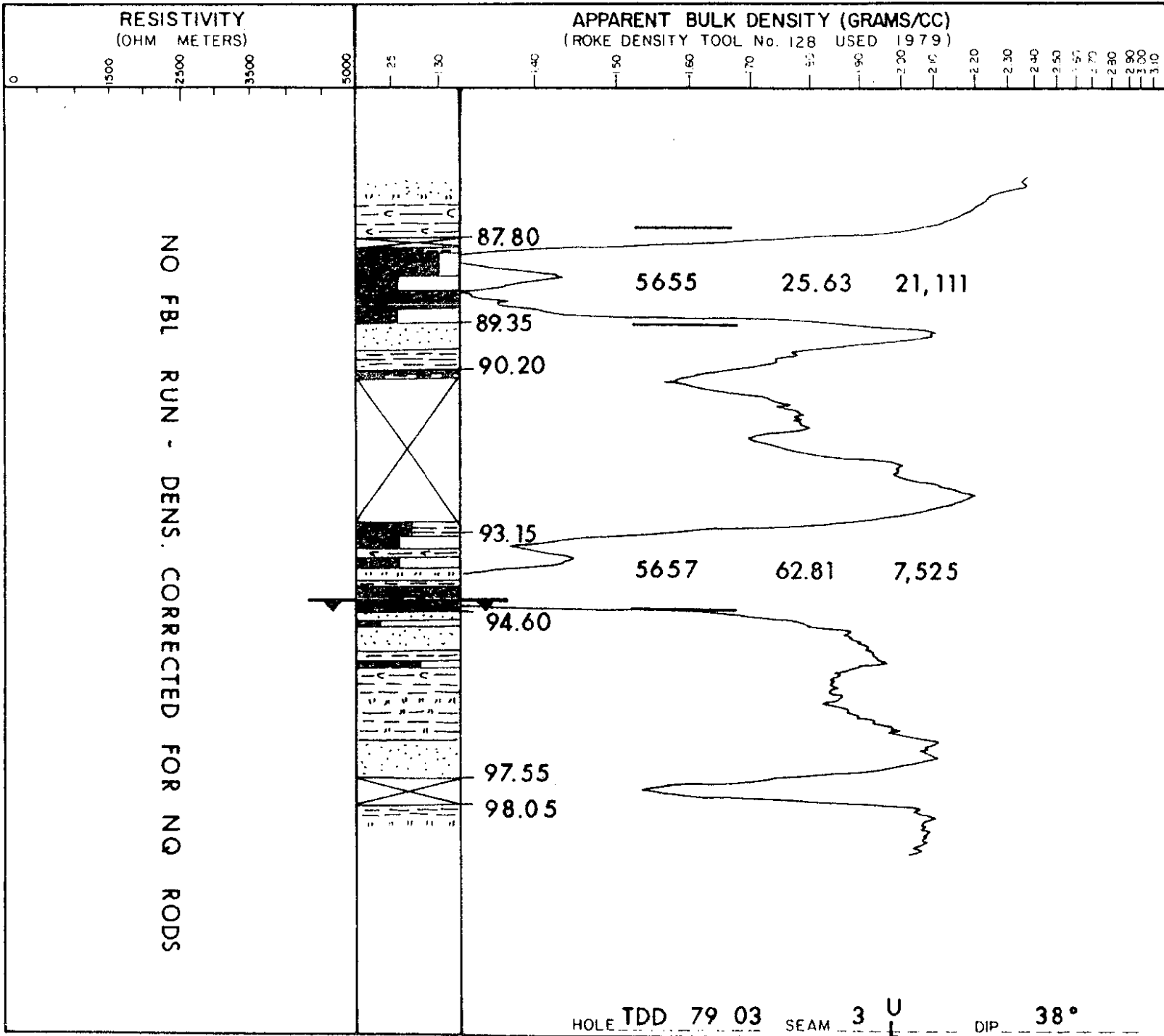
HOLE	SEAM
TDD 79-01	1

HOLE TDD 79-01 SEAM 1 DIP 40°

PETRO - CANADA EXPLORATION INC.
THUNDERCLOUD PROJECT



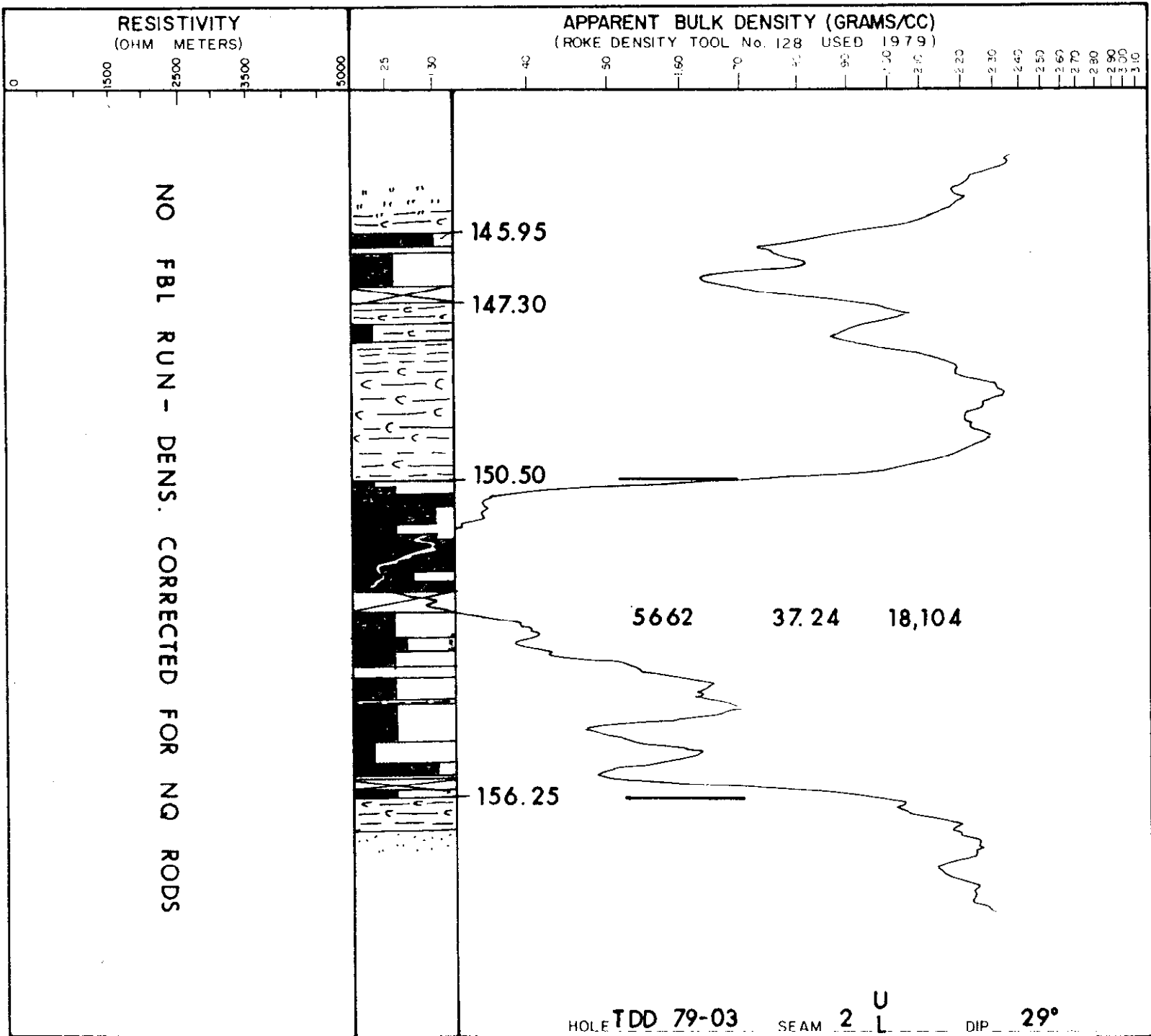
PETRO - CANADA EXPLORATION INC.
THUNDERCLOUD PROJECT



SEAM PROFILE

HOLE	SEAM
TDD 79-03	3 U

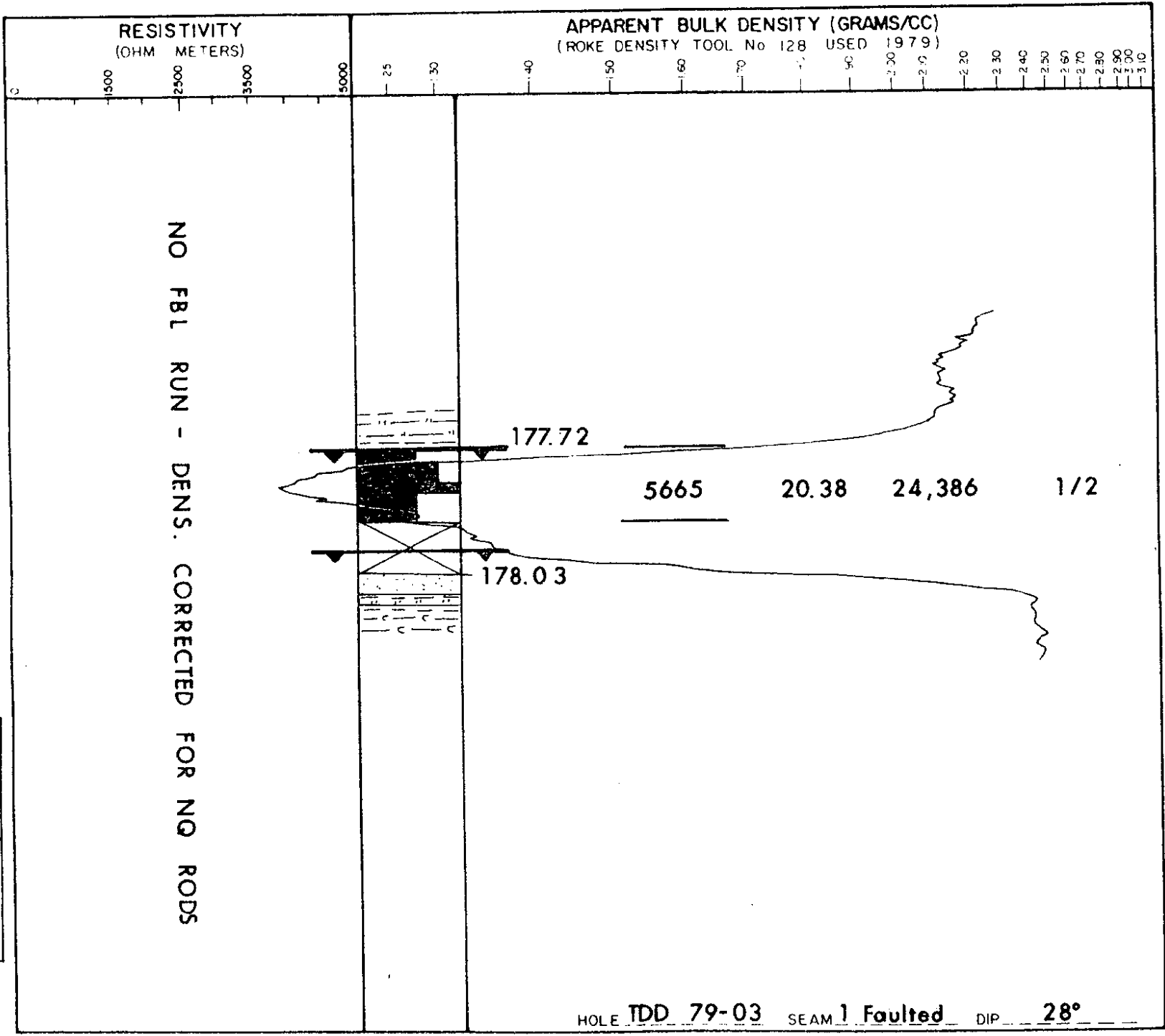
PETRO - CANADA EXPLORATION INC.
THUNDERCLOUD PROJECT



SEAM PROFILE

HOLE	SEAM
TDD 79-03	2 U

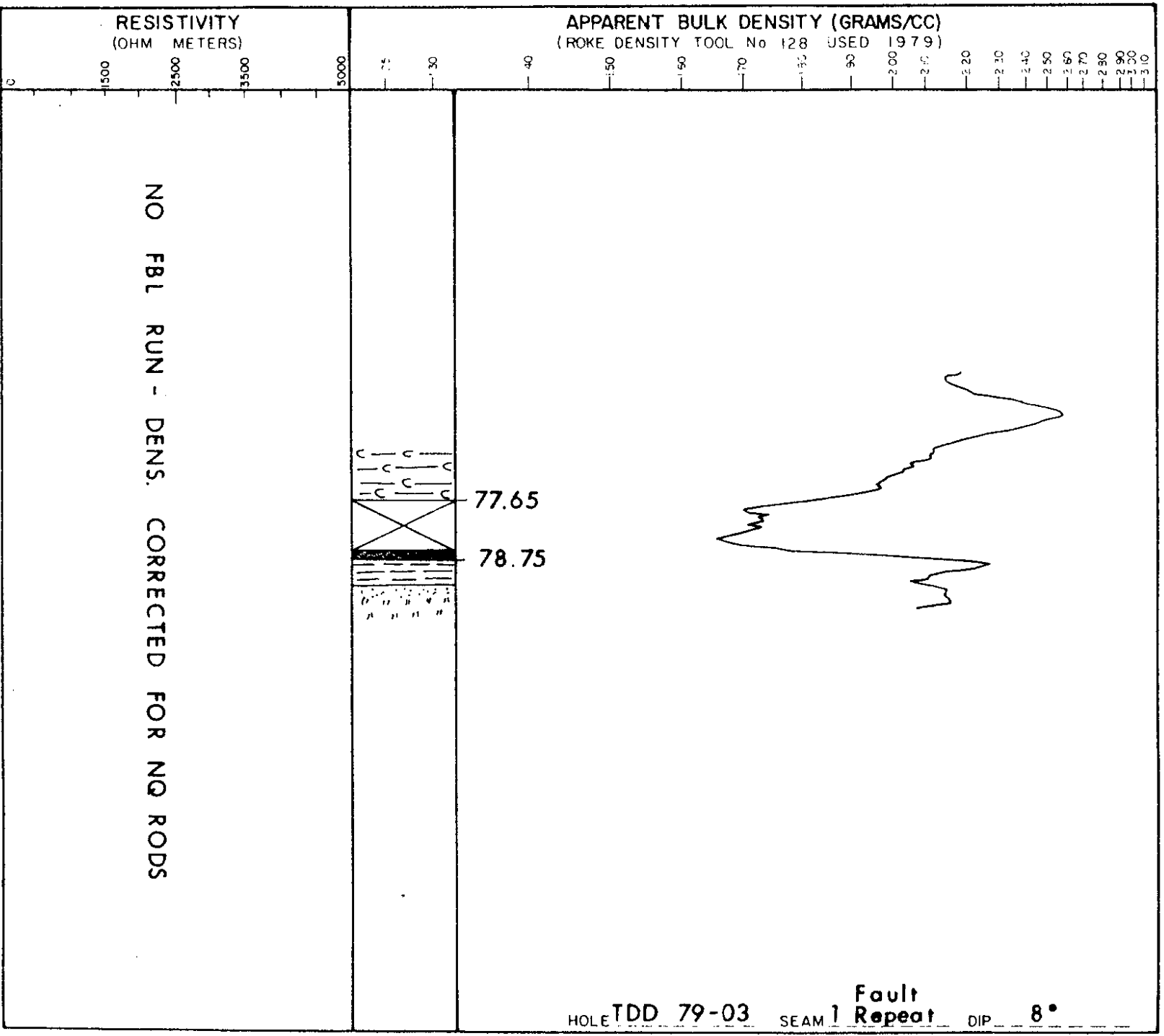
PETRO - CANADA EXPLORATION INC.
THUNDERCLOUD PROJECT



SEAM PROFILE

HOLE	SEAM
TDD 79-03	1

PETRO - CANADA EXPLORATION INC.
THUNDERCLOUD PROJECT



SEAM PROFILE

HOLE	SEAM
TDD 79-03	1

APPENDIX B

GEOPHYSICAL LOGS

NOTE: No Downhole Geophysical Logs were run
on TDD 79-04 due to extremely poor
ground conditions.

72 - Thunderhead 79 (5) 242

720 - 79-01

ROKE

FOCUSED BEAM LOG

OIL ENTERPRISES LTD. CALGARY, ALBERTA

FILE NO. COMPANY **AMALIC PETROLEUMS LTD (GULF OIL)**
 WELL **720-79-01**
 LOCATION **THUNDERHEAD** PROJECT
 FIELD **ZIVA RIVER**

LOG NO. **11**
 DATE **JUNE 79**
 TIME **12:30 AM**

LOGGING SERVICE **COLLIERIA**
 LOGGING ENGINEER **GRV / DEN/CA**
 LOGGING TECHNICIAN **CS**

LOGGING COMPANY **COLLIERIA**
 LOGGING ENGINEER **GRV / DEN/CA**
 LOGGING TECHNICIAN **CS**

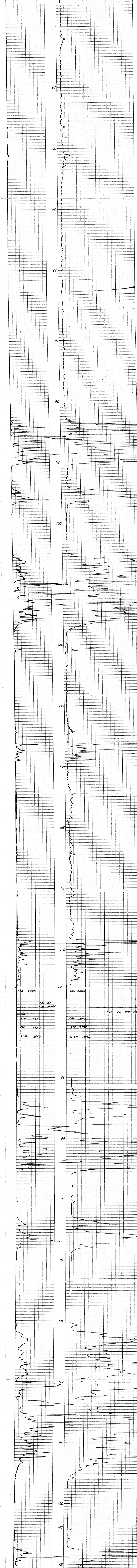
LOGGING COMPANY **COLLIERIA**
 LOGGING ENGINEER **GRV / DEN/CA**
 LOGGING TECHNICIAN **CS**

LOGGING COMPANY **COLLIERIA**
 LOGGING ENGINEER **GRV / DEN/CA**
 LOGGING TECHNICIAN **CS**

LOGGING COMPANY **COLLIERIA**
 LOGGING ENGINEER **GRV / DEN/CA**
 LOGGING TECHNICIAN **CS**

LOGGING COMPANY **COLLIERIA**
 LOGGING ENGINEER **GRV / DEN/CA**
 LOGGING TECHNICIAN **CS**

Remarks: **7 ELECTRODE SONDE**
20 CM BEAM
1 M ARRAY
FBL # B
CURRENT HI
MUD FISH 520.8



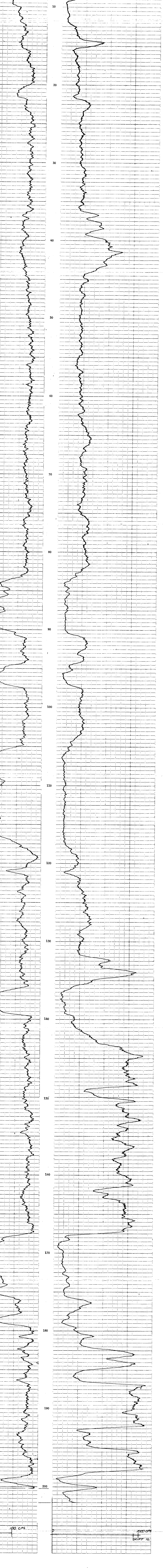
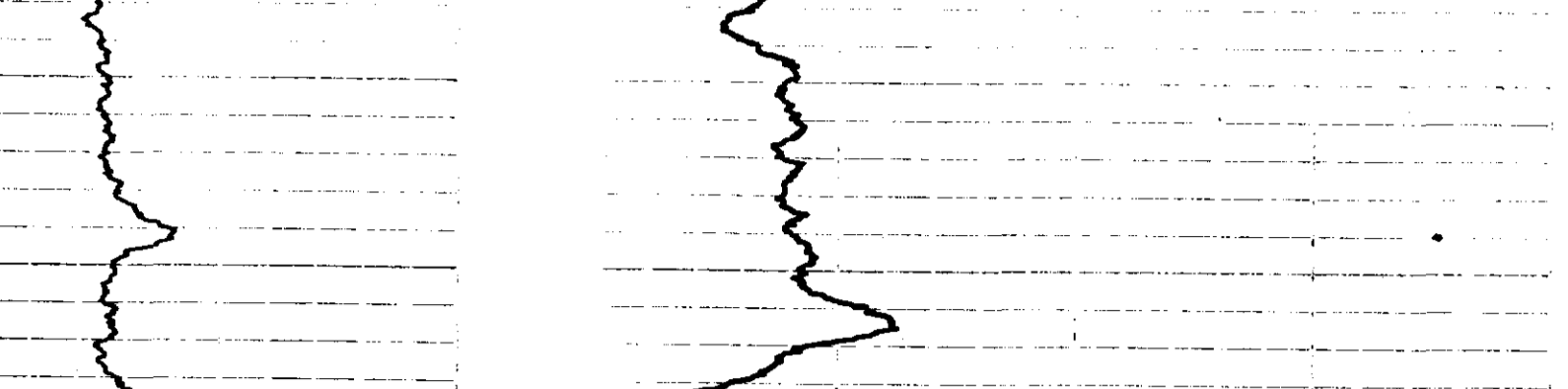
LOG ZERO CAL ON 500 RANGE CAL ZERO REC ZERO STOP ZERO

FILE NO.	COMPANY	ELECTRIC PERFORMING LTD. (SINKING DEPT)	CALGARY, ALBERTA
L.S.D.	WELL	TDD 79 - 01	
S.C.	LOCATION	THUNDERBOLT PROJECT	
T.M.	N	M	
FIELD	TIVA RIVER		
242			
(2)			
Permanent Downhole Log Measured from Well Depth Measured from	PROVINCIAL BERTH COMPANY	Other Services:	
GROUND LEVEL	GRAND LEVEL	BERTH-CAL. FBI	
ASBESTOS FROM SHOWN	ASBESTOS FROM SHOWN	K.C.	
		C.S.	
		G.L.	
		MERCURY	
Run No.	Date	29 MAY 1979	
First Reading	Last Reading	202.4	
Footage Logged	Depth Berth	202.4	
Depth Berth	Depth Berth	224.6	
Coring Rate		12	
Coring Depth		12.2	
Liquid Level		WATER	
Min. Depth		7.57 CM	
Run #		1	
Operating Time		1.5 HOURS	
Tool No.		FU # 3	
Recorded By	Witnessed By	RETD	

EQUIPMENT DATA			
GAMMA RAY		NEUTRON	
RUN NO.	ONE	RUN NO.	ONE
TOOL MODEL NO.	R GRN 169	LOG TYPE	NEUTRON/NEUTRON
DIAMETER	4.28 CM	TOOL MODEL NO.	R GRN 169
DETECTOR MODEL NO.		DIAMETER	4.28 CM
TYPE	SCINTILLATION	DETECTOR MODEL NO.	
LENGTH	10 CM	TYPE	PROPORTIONAL
DISTANCE TO N. SOURCE	2.07 M	LENGTH	15.24 CM
		SOURCE MODEL NO.	MRC-N-SS-W
		SERIAL NO.	187
		SPACING	43.13 CM
		TYPE	AmBe
		STRENGTH	3 CURIES
GENERAL			
HOIST TRUCK NO.			
INSTRUMENT TRUCK NO.	FU # 3		
TOOL SERIAL NO.	169 - 002		

LOGGING DATA											
GENERAL				GAMMA RAY				NEUTRON			
RUN NO.	DEPTH		SPEED	T.C.	SENS.	ZERO	API G. R. UNITS	T. C.	SENS.	ZERO	API N. UNITS
	FROM	TO									
1	0	202	4	3	100	0	18	3	1000	1 L	70

REMARKS



100 CPS (Gamma Ray scale)

1000 CPS (Neutron scale)

SWIFT 7L

TY - THUNDERBOLT 78 (3) (1)
78-79-01

ROKE

SIDEWALL DENSLOG
CALIPER

OIL ENTERPRISES LTD. CALGARY, ALBERTA

FILE NO. COMPANY **PACIFIC PETROLEUMS LTD (OILWMS DEPT)**

WELL **T90 78-01** PROJECT **(L3)**

LOCATION **THUNDERBOLT**

FIELD **TYNA RIVER**

PROVINCE **BRITISH COLUMBIA**

Other Service: **GEN. EIL**

Present Date: **TOP OF CASE**

Log Measured from: **GROUND LEVEL**

Well Depth Measured from: **GROUND LEVEL**

Run No. **012**

Date **29 MAY '79**

First Reading **0**

Last Reading **202.4**

Fracture Logged **202.4**

Depth Reached **202.4**

Depth Driller **1/2**

Casing Driller **1/2**

Fluid Type **WATER**

Liquid Level **0**

Min. Depth **1.67 CM**

Operating Time **2.3 H.R.**

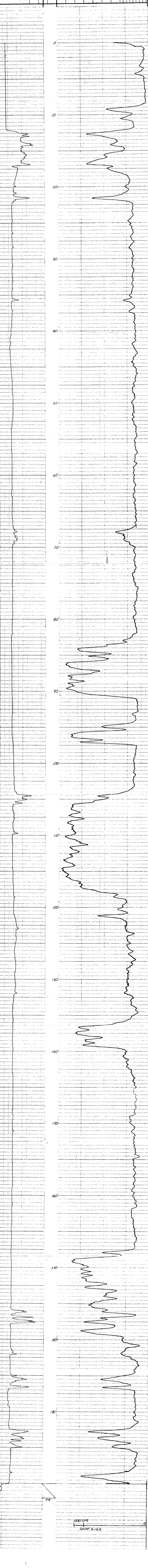
Tool No. **ED 73**

Recorded By **PLUMMER**

Witnessed By **RDJ**

GENERAL			GAMMA RAY			SIDEWALL DENSLOG		
RUN NO.	DEPTHS	SPEED	T.C.	ZERO	API G.R. UNITS	T.C.	SENS	ZERO
	FROM	TO	SEC.	DIV. L OR R	PER LOG DIV.	SEC.	SETTINGS	DIV. L OR R
1	0	202	4			3	1000	2.15
								62.5

REMARKS **DEN TOOL # 128**
CAL TOOL # 758



TY - THUNDERBOLT 78 (3)A 7902

ROKE

OIL ENTERPRISES LTD. CALGARY, ALBERTA

GAMMA RAY NEUTRON LOG

242

(L4)

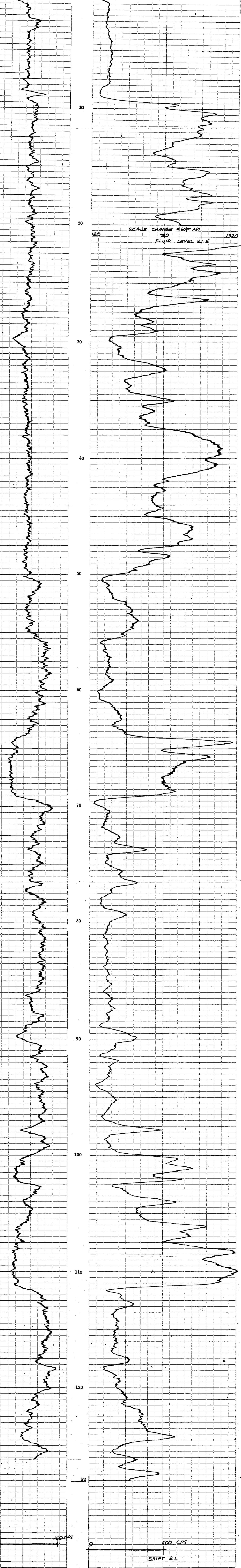
FILE NO.	COMPANY	PACIFIC PETROLEUMS LTD. (OILING DEPT.)
LSD SEC	WELL	TMD 79 - 02
TWP	RGE	
M	LOCATION	THUNDERBOLT PROJECT
	FIELD	TUYA RIVER
	PROVINCE	BRITISH COLUMBIA
Permanent Datum	TOP OF CASING	Elw. _____
Log Measured from	TOP OF CASING	Above Perm. Datum
Well Depth Measured from	TOP OF CASING	
		K.B. _____
		CSG _____
		G.L. _____
		APERTURE _____
Run No.	ONE	
Date	30 MAY 1979	
First Reading	128 M	
Last Reading	0	
Footage Logged	128	
Depth Reached	128.2	
Depth Differ	130.1	
Casing Hole	9.14	
Fluid Type	WATER/MUD	
Liquid Level	21.5	
Min. Diam.	7.57 CM	
Rm @		
Operating Time	1.2 HOUR	
Truck No.	FU # 3	
Recorded By	JUBANZ	Witnessed By
		RETD

EQUIPMENT DATA			
GAMMA RAY		NEUTRON	
RUN NO.	ONE	RUN NO.	ONE
TOOL MODEL NO.	R GRN 169	LOG TYPE	NEUTRON/NEUTRON
DIAMETER	4.28 CM	TOOL MODEL NO.	
DETECTOR MODEL NO.		DIAMETER	4.28 CM
TYPE	SCINTILLATION	DETECTOR MODEL NO.	
LENGTH	10 CM	TYPE	PROPORTIONAL
DISTANCE TO N. SOURCE	2.07 M	LENGTH	15.24 CM
		SOURCE MODEL NO.	MRC-N-SS-W
		SERIAL NO.	187
		SPACING	43.1 CM
HOIST TRUCK NO.		TYPE	AmBe
INSTRUMENT TRUCK NO.	FU # 3	STRENGTH	3 CURTES
TOOL SERIAL NO.	169 - 002		

LOGGING DATA										
GENERAL			GAMMA RAY				NEUTRON			
RUN NO.	DEPTHS	SPEED	T.C.	SENS	ZERO	API G. R. UNITS	T. C.	SENS	ZERO	API N. UNITS
	FROM	TO	SEC.	SETTINGS	DIV. L OR R	PER LOG DIV.	SEC.	SETTINGS	DIV. L OR R	PER LOG DIV.
1	0	20	4	3	100	0	3	1000	2 L	120
	20	128	4	3	100	0	3	500	2 L	60

REMARKS LOGGED THROUGH DRILL RODS

GAMMA RAY	DEPTH	NEUTRON
GAMMA RAY INCREASES →		NEUTRON INCREASES →
API 10		API 140
0		2640



SHIFT 2L

728-79-02
 71-THUNDERBOLT 79 (3)A

ROKE

SIDEWALL DENSILOG

OIL ENTERPRISES LTD. CALGARY, ALBERTA

FILE NO. COMPANY PACIFIC PETROLEUMS LTD. (MINING DEPT)
 WELL IDD 79 - 02
 LOCATION THUNDERBOLT PROJECT
 FIELD TIVA RIVER
 PROVINCE BRITISH COLUMBIA
 PERMIT DUTY TOP OF CASING 1500
 LOG MEASURED FROM TOP OF CASING ABOVE FROM DATUM
 WHAT DEPTHS MEASURED FROM TOP OF CASING
 OTHER SERVICE: GSR

242
 (LS)

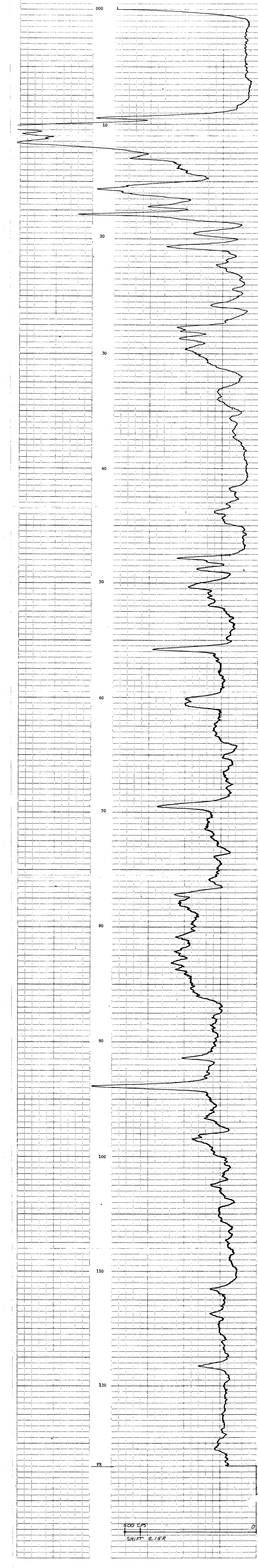
Run No. ONE
 Date 30 MAY 1979
 First Reading 127 M
 Last Reading 0
 Footage Logged 127
 Depth Received 127.9
 Depth Driller 130.1
 Casing Roke 9.14
 Fluid Type WATER/MD
 Liquid Level 21.5
 Min. Diam. 7.57 CM

Operating Time 1.2 HOURS
 Truck No. FU # 3

Recorded By: TUBANZ Witnessed By: REID

GENERAL			GAMMA RAY			SIDEWALL DENSILOG				
RUN NO.	DEPTHS		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
	FROM	TO								
1	0	127					3	500	2.15 R	27.5

REMARKS: DENS TOOL # 128
 NOTE: POSITION OF RODS IN THE DRILL HOLE MUST BE TAKEN INTO CONSIDERATION WHEN USING THE DENSITY SCALE



74-THUNDERBOLT-242208-72(3) 7208 (1)

ROKE

SIDEWALL DENSLOG

OIL ENTERPRISES LTD. CALGARY ALBERTA

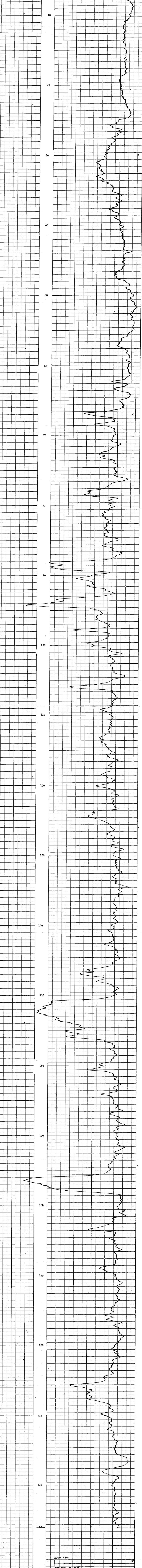
242

FILE NO.	COMPANY	PACIFIC PETROLEUM LTD. (CRINING DEPT)
WELL	TUD - 79 - 03	
LOCATION	THUNDERBOLT PROJECT	
FIELD	RYAN RIVER	
PROVINCE	BRITISH COLUMBIA	
Other Services:	GEN	
Permanent Datum	TOP OF CASING	K. B.
Log Measured from	TOP OF CASING	Flow
Well Depth Measured from	TOP OF CASING	Flow from Datum
	TOP OF CASING	G.L.
		METRIC
Run No.	ONE	
Date	5 JUNE 1979	
Full Reading	226 M	
First Reading	0	
Fourth Reading	227	
Depth Reached	227.6	
Depth Rate	227.6	
Casing Rate	62.8	
Fluid Type	WATER	
Liquid Level	0	
Nil. Depth	1.57 CM	
Circulation Time	1 HOUR	
Truck No.	RT #3	
Recorded By	ERINAZ	
Witnessed By	REID	

GENERAL			GAMMA RAY			SIDEWALL DENSLOG					
RUN NO.	FROM	TO	SPEED M/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	0	226	4					3	500	2.15 R	27.5

REMARKS: DENS TOOL # 128
 NOTE: POSITION OF RODS IN THE DRILL HOLE MUST BE TAKEN INTO CONSIDERATION WHEN USING THE DENSITY SCALE

CALIPER DIAMETER - CM	DEPTHS	GAMMA RAY API	BULK DENSITY (GRAMS/CC)
-----------------------	--------	---------------	-------------------------



79-710000000 79 (5) 79-08

ROKE

GAMMA RAY NEUTRON LOG

OIL ENTERPRISES LTD. CALGARY, ALBERTA

FILE NO. COMPANY PACIFIC PERFORMERS LTD. (ACTING DEPT)

WELL T80 79 - 03

LOCATION THUNDERBOLT PROJECT

FIELD TIVA RIVER

PROVINCE BRITISH COLUMBIA

LOG TYPE TOP OF CASING

DATE 5 JUNE 1979

LOG MEASURED FROM 202 OF CASING

LOG MEASURED FROM 202 OF CASING

LOG MEASURED FROM 202 OF CASING

LOG MEASURED FROM 202 OF CASING

LOG MEASURED FROM 202 OF CASING

LOG MEASURED FROM 202 OF CASING

LOG MEASURED FROM 202 OF CASING

LOG MEASURED FROM 202 OF CASING

LOG MEASURED FROM 202 OF CASING

LOG MEASURED FROM 202 OF CASING

LOG MEASURED FROM 202 OF CASING

LOG MEASURED FROM 202 OF CASING

242

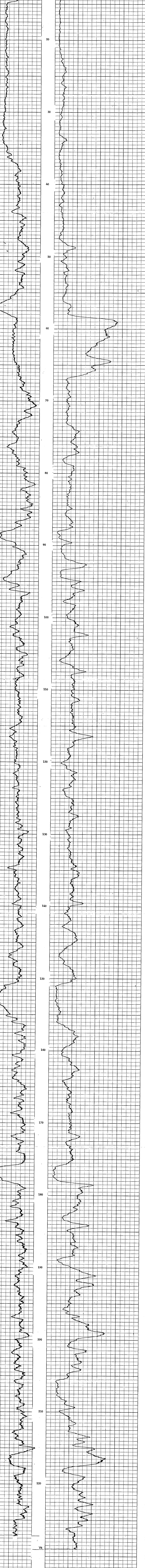
EQUIPMENT DATA

GAMMA RAY		NEUTRON	
RUN NO.	ONE	RUN NO.	ONE
TOOL MODEL NO.	R GRN 169	LOG TYPE	NEUTRON/NEUTRON
DIAMETER	4.28 CM	TOOL MODEL NO.	R GRN 169
DETECTOR MODEL NO.		DIAMETER	4.28 CM
TYPE	SCINTILLATION	DETECTOR MODEL NO.	
LENGTH	10 CM	TYPE	PROPORTIONAL
DISTANCE TO N. SOURCE	2.07 M	LENGTH	15.24 CM
GENERAL		SOURCE MODEL NO.	
MOIST TRUCK NO.		SERIAL NO.	157
INSTRUMENT TRUCK NO.	FU # 3	SPACING	43.1 CM
TOOL SERIAL NO.	169 - 002	TYPE	AmBe
		STRENGTH	3 CURIES

LOGGING DATA

GENERAL		GAMMA RAY		NEUTRON	
RUN NO.	1	SPEED	4	T.C.	3
DEPTHS	0 TO 229	M. MIN		SENS	500
				ZERO	1 L
				API N. UNITS	60
				PER LOG DIV	

REMARKS LOGGED THROUGH DRILL RODS



APPENDIX C

GEOLOGICAL LOGS

THUNDERCLOUD COAL PROJECT
DIAMOND DRILL HOLE SUMMARY

DRILL HOLE NO: TDD 79-01

LOCATION:

(a) Coal Licence: 4557
(b) U.T.M.: 6,461,878 N 393,518 E
(c) Elevation: 756.68 m

AZIMUTH AND INCLINATION:

(a) Collar Vertical

CORE SIZE: NQ

FORMATIONS DRILLED:

metres
to
to
to
to
to
to

COAL SEAMS INTERSECTED:

TOTAL DEPTH:	Drillers'	221.59 m	Geophysical	202.4
CASING:	Drillers'	12.19 m	Geophysical	12.0

DATE DRILLED: May 23 - 26, 1979

DRILLED BY: J. T. Thomas Diamond Drilling

LOGGED BY: M. Carr, J. Reid, D. Thomas

GEOPHYSICAL LOGS: DEN, CAL; FBL: GRN

ABANDONMENT PROCEDURE: Casing left in hole

<u>Interval</u> (metres)	<u>Length</u> (metres)	
0.00 - 12.19	12.19	OVERBURDEN
12.19 - 13.75	1.56	Claystone: grey, silty, unconsolidated, occasional coal stringers.
13.75 - 14.32	0.57	Core loss.
14.32 - 14.59	0.27	Mudstone: silty.
14.59 - 15.51	0.92	Sandstone: coarse grained with minor pebble zones, pebbles to 5 cm. diameter poorly sorted and poorly cemented.
15.51 - 22.02	6.51	Mudstone: grey, carbonaceous, poorly cemented, silty phases from 17.37 to 22.02 m, occasional concretions. (Core loss 19.53 - 20.42) BCA - 53 ^o
22.02 - 22.26	0.24	Sandstone: very coarse grained, poorly consolidated, occasional thin coal lenses, concretions.
22.26 - 22.27	0.01	Mudstone: coaly, sheared with numerous polished surfaces.
22.27 - 22.28	0.01	Sandstone: as at 22.02.
22.28 - 22.31	0.03	Mudstone: as at 22.26.
22.31 - 22.58	0.27	Sandstone: as at 22.02.
22.58 - 22.78	0.20	Mudstone: as at 22.26.
22.78 - 22.92	0.14	Sandstone: as at 22.02.
22.92 - 23.47	0.55	Core loss.
23.47 - 25.06	1.59	Mudstone: silty interbedded with coarse grained sandstone, both poorly cemented, most layers 1.0 - 4.0 cm. thick.
25.06 - 25.35	0.29	Core loss.

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25.35 - 26.51	1.16	Mudstone: dark grey, fissile, conchoidal fractures, with occasional concretions up to 2.0 cm.
26.51 - 30.92	4.41	Mudstone: as at 25.35 but with concretions up to 5.0 cm.
30.92 - 36.18	5.26	Sandstone: medium grained poorly sorted, interbedded with mudstone, sandstone has gradational contacts to muddy phases, occasional concretionary lenses up to 5.0 cm. thick. BCA = 70°
36.18 - 36.31	0.13	Fault gouge, with numerous slickensides BCA = 49°, poorly cemented angular rock fragments, matrix of uncemented clays.
36.31 - 36.98	0.67	Core loss.
36.98 - 37.07	0.09	Mudstone: with sandy phases and concretions as at 25.35.
37.07 - 37.12	0.05	Sandstone: medium grained with interbedded coaly mudstone, mudstone and siltstone, occasional concretions.
37.12 - 37.38	0.26	Mudstone: black, carbonaceous, massive.
37.38 - 37.40	0.02	Sandstone: as at 37.07.
37.40 - 37.44	0.04	Mudstone: as at 37.12.
37.44 - 38.26	0.82	Sandstone: as at 37.07. BCA = 70°
38.26 - 38.71	0.45	Core loss.
38.71 - 39.39	0.68	Sandstone: as at 37.07.
39.39 - 39.75	0.36	Mudstone: grey with carbonaceous phases.
39.75 - 44.47	4.72	Sandstone: as at 37.07, coarsening toward base, massive bedding at 42.31 except for occasional mudstone layers 2.0 - 3.0 cm. thick.
44.47 - 44.50	0.03	Core loss.
44.50 - 44.64	0.14	Sandstone: medium grained with coal stringers up to 0.5 cm. thick.
44.64 - 44.81	0.17	Mudstone: dark grey with coaly stringers.

TDD 79-01

44.81 - 44.91	0.10	Sandstone: as at 44.50 with coaly stringers.
44.91 - 48.47	3.56	Mudstone: dark grey, with occasional sandy phases, containing coal stringers.
48.47 - 57.02	8.55	Mudstone: occasional silty phases up to 2.0 cm. thick.
57.02 - 60.37	3.35	Mudstone: silty, gradational to sandstone with silty phases toward base, minor shears at base. BCA = 36°
60.37 - 65.42	5.05	Mudstone: grey, sandy and silty phases throughout with gradational contacts. BCA = 76°
65.42 - 67.98	2.56	Sandstone: medium grained with silty and mudstone phases.
67.98 - 68.19	0.21	Fault gouge, as at 36.18, slickensides. BCA = 27°
68.19 - 69.36	1.17	Sandstone: as at 65.42.
69.36 - 69.65	0.29	Fault gouge. BCA = 27°.
69.65 - 69.68	0.03	Core loss.
69.68 - 73.87	0.19	Sandstone: as at 65.42. BCA = 63°.
73.87 - 76.22	2.35	Mudstone: dark grey, sandy and silty phases, minor shears at 74.21.
76.22 - 82.62	6.40	Sandstone: medium grained with silty and muddy phases, occasional fine to very fine grained zones.
82.62 - 83.89	1.27	Mudstone: occasional silty phases.
83.89 - 83.94	0.05	Coal: dull bright, finely laminated.
83.94 - 84.05	0.11	Coal: bright interbedded with minor carbonaceous mudstone, layers up to 0.05 cm. thick.
84.05 - 84.30	0.25	Mudstone: brown to black, carbonaceous with bright coal stringers and amber nodules.
84.30 - 84.36	0.06	Coal: bright banded, spherical to elliptical nodules of amber disseminated throughout, to 0.07 cm., coal is brittle, vitreous, has conchoidal fracture.

TDD 79-01

84.36 - 34.43	0.07	Core loss.
84.43 - 84.48	0.05	Coal: dull bright.
84.48 - 84.58	0.10	Mudstone: grey carbonaceous with bright coal stringers.
84.58 - 84.70	0.12	Coal: bright banded, very hard.
84.70 - 84.79	0.09	Coal: bright.
84.79 - 84.85	0.06	Coal: dull bright.
84.85 - 84.93	0.08	Mudstone: grey, carbonaceous with bright coal stringers.
84.93 - 84.99	0.06	Coal: dull bright.
84.99 - 85.02	0.03	Mudstone: grey carbonaceous.
85.02 - 85.04	0.02	Coal: bright conchoidal fractures.
85.04 - 85.25	0.21	Mudstone: grey carbonaceous, with amber nodules.
85.25 - 85.34	0.09	Coal: dull bright, soft, possible shear zone.
85.34 - 85.35	0.01	Coal: calcite filled fractures, polished surfaces.
85.35 - 85.43	0.08	Coal: dull bright, amber nodules.
85.43 - 85.53	0.10	Coal: bright banded.
85.53 - 86.00	0.47	Mudstone: dark grey carbonaceous, convolute bedding with contorted coal.
86.00 - 86.02	0.02	Coal: dull, sheared.
86.02 - 86.24	0.22	Core loss.
86.24 - 86.30	0.06	Mudstone: grey carbonaceous.
86.30 - 86.31	0.01	Coal: bright.
86.31 - 86.34	0.03	Coal: dull banded.
86.34 - 86.36	0.02	Coal: dull bright, amber nodules.
86.36 - 86.46	0.10	Coal: bright, hard.
86.46 - 86.52	0.06	Coal: dull bright.

TDD 79-01

86.52 - 86.53	0.01	Coal: dull banded.
86.53 - 86.61	0.08	Coal: dull bright.
86.61 - 86.65	0.04	Coal: dull banded.
86.65 - 86.67	0.02	Coal: dull bright.
86.67 - 86.73	0.06	Coal: dull banded.
86.73 - 86.85	0.12	Coal: bright banded.
86.85 - 86.94	0.09	Coal: bright.
86.94 - 87.02	0.08	Coal: bright banded, amber nodules.
87.02 - 87.07	0.05	Coal: bright.
87.07 - 87.10	0.03	Coal: bright banded.
87.10 - 87.15	0.05	Coal: dull banded, amber nodules.
87.15 - 87.42	0.27	Coal: bright banded.
87.42 - 87.43	0.01	Mudstone: with bright coal stringers.
87.43 - 87.48	0.05	Core loss.
87.48 - 87.66	0.18	Mudstone: grey carbonaceous.
87.66 - 87.68	0.02	Coal: bright.
87.68 - 87.77	0.09	Coal: bright banded.
87.77 - 87.85	0.08	Coal: bright.
87.85 - 87.88	0.03	Coal: dull banded.
87.88 - 88.00	0.12	Mudstone: black carbonaceous.
88.00 - 88.17	0.17	Coal: bright.
88.17 - 88.24	0.07	Coal: dull bright.
88.24 - 88.31	0.07	Coal: bright.
88.31 - 88.34	0.03	Coal: dull banded.
88.34 - 88.38	0.04	Coal: bright.

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88.38 - 88.47	0.09	Coal: dull banded.
88.47 - 88.57	0.10	Coal: dull with bright stringers.
88.57 - 88.61	0.04	Coal: bright.
88.61 - 88.79	0.18	Coal: bright banded.
88.79 - 88.88	0.09	Coal: dull sheared.
88.88 - 89.06	0.18	Coal: bright banded with amber.
89.06 - 89.11	0.05	Coal: bright banded.
89.11 - 89.12	0.01	Mudstone: coaly, sheared.
89.12 - 89.13	0.01	Coal: bright.
89.13 - 89.17	0.04	Mudstone: black carbonaceous.
89.17 - 89.27	0.10	Coal: bright banded.
89.27 - 89.33	0.06	Coal: bright.
89.33 - 89.78	0.45	Coal: bright banded.
89.78 - 89.83	0.05	Coal: dull banded sheared.
89.83 - 89.95	0.12	Coal: bright banded, amber.
89.95 - 89.98	0.03	Coal: dull banded, soft.
89.98 - 90.11	0.13	Coal: bright banded.
90.11 - 90.17	0.06	Coal: bright.
90.17 - 90.18	0.01	Coal: dull, banded.
90.18 - 90.25	0.07	Coal: bright.
90.25 - 90.53	0.28	Coal: bright banded.
90.53 - 90.88	0.35	Coal: dull bright, blocky, hard, (soft and sheared 90.63 - 90.73).
90.88 - 90.90	0.02	Mudstone: brown.
90.90 - 90.95	0.05	Coal: dull, highly sheared, calcite filled fractures, polished surfaces.

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Interval	Thickness	Description	Sample	Interval	Width	Ash	Calorific Value (KJ/Kg)
90.95 - 91.24	0.29	Mudstone: coaly sheared, polished surfaces.					
91.24 - 93.16	1.92	Siltstone: with sandy and mudstone phases, convolute bedding, BCA poorly defined @ 75° at 0.9 m. from root joints at FCA - 27°.					
			1026	83.83 - 84.36	0.53	57.60	
			1027	84.36 - 85.95	2.59	35.05	15,632
			1028	85.95 - 86.30	0.35	58.96	7,823
			1029	86.30 - 90.95	4.65	32.72	19,993
			1030	90.95 - 93.16	2.21	75.23	
93.16 - 93.57	0.41	Siltstone: as at 91.24 m., with occasional coal stringers.					
93.57 - 95.67	0.10	Mudstone: coaly, with stringers of bright coal, contorted bedding, amber.					
95.67 - 95.86	0.19	Concretion: with fine calcite veinlets and amber.					
95.86 - 95.91	0.05	Coal: bright sheared.					
95.91 - 96.62	0.71	Coal: dull with numerous bright coal stringers throughout, concretion at top 0.10 width, amber at base, minor fold with fold axis 90° to core axis, similar style.					
96.62 - 96.70	0.08	Coal: dull banded.					
96.70 - 97.17	0.47	Coal: bright banded amber.					
97.17 - 97.21	0.04	Mudstone: black carbonaceous.					
97.21 - 97.34	0.13	Siltstone: grey, bright coal stringers throughout, convolute bedding, polished surfaces.					
97.34 - 97.40	0.06	Coal: dull banded.					
97.40 - 97.52	0.12	Coal: bright.					
97.52 - 97.59	0.07	Coal: dull bright.					
97.59 - 97.70	0.11	Coal: dull, with polished surfaces.					
97.70 - 98.61	0.91	Siltstone: grey with sandy and muddy phases, convolute bedding, polished surfaces throughout, possible fault zone?					

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Sample	Interval	Width	Ash	Calorific Value (KJ/Kg)
1031	95.36 - 95.86	0.50	85.90	
1032	95.86 - 97.70	1.84	40.74	13,350
1033	97.70 - 98.20	0.50	83.86	
98.61 - 102.16	3.55	Siltstone: convolute bedding, occasional concretions.		
102.16 - 104.17	2.01	Sandstone: medium grained, convolute bedding with silty phases, fractured throughout with slickensides.		
104.17 - 105.77	1.60	Sandstone: unconsolidated, medium grained as at 102.16 but core is plastic, thinly sheared, slickensides throughout fault gouge 105.04 - 105.17 m.		
105.77 - 105.94	0.17	Mudstone: carbonaceous, occasional coal stringers, heavily sheared.		
105.94 - 106.02	0.08	Coal: dull bright, heavily sheared.		
106.02 - 106.17	0.15	Mudstone: grey, heavily sheared, core is plastic coaly at base.		
106.17 - 106.56	0.39	Coal: bright banded, sheared, slickensides throughout.		
106.56 - 107.10	0.54	Core loss.		
107.10 - 107.35	0.25	Coal: dull bright, heavily sheared to pulverized.		
107.35 - 107.76	0.41	Coal: dull banded, heavily sheared.		
107.76 - 107.89	0.13	Mudstone: grey, massive.		
107.89 - 108.07	0.18	Coal: dull massive, pulverized at base.		
108.07 - 109.14	1.07	Core loss		
109.14 - 109.28	0.14	Coal: dull bright pulverized.		
109.28 - 109.38	0.10	Coal: bright banded, slickensides, sheared.		
109.38 - 109.58	0.20	Coal: dull bright, pulverized.		
109.58 - 109.91	0.33	Core loss.		
109.91 - 110.08	0.17	Coal: dull bright sheared.		

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110.08 - 110.20	0.12	Mudstone: coaly, occasional bright coal stringers.
110.20 - 110.28	0.08	Coal: highly pulverized.
110.28 - 110.37	0.09	Coal: dull banded sheared, pulverized.
110.37 - 110.39	0.02	Coal: dull, heavily sheared, pulverized.
110.39 - 110.52	0.13	Coal: dull bright, sheared.
110.52 - 110.54	0.02	Coal: bright, hard vitreous.
110.54 - 110.56	0.02	Mudstone: coaly.
110.56 - 110.65	0.09	Coal: bright banded.
110.65 - 110.77	0.12	Coal: dull, bright.
110.77 - 110.86	0.09	Coal: bright, banded.
110.86 - 111.00	0.14	Coal: bright.
111.00 - 111.65	0.65	Coal and Mudstone, thinly interbedded: coal is bright to bright banded generally hard to very hard with abundant amber nodules; mudstone is carbonaceous with bright coal stringers. Interbed widths vary from 0.05 to 0.14 m.
111.65 - 111.68	0.03	Coal: bright.
111.68 - 111.76	0.08	Mudstone: coaly.
111.76 - 111.82	0.06	Coal: bright banded.
111.82 - 111.86	0.04	Coal: dull banded.
111.86 - 112.07	0.11	Coal: bright banded, sheared, calcite veinlets at base.
112.07 - 112.36	0.29	Coal: bright, hard, amber with minor mudstone splits of 0.05 m. average.
112.36 - 113.12	0.76	Coal: bright banded to bright, hard, with numerous thin coaly mudstone splits varying from 0.01 to 0.05 m. width.
113.12 - 113.14	0.02	Sandstone: grey brown, medium grained, numerous dull stringers, and small lenses.

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113.14 - 113.26	0.12	Coal: bright banded to bright.
113.26 - 113.33	0.07	Coal: dull banded, highly sheared with slickensides, core solid.
113.33 - 113.37	0.04	Mudstone: coaly, bright coal stringers.
113.37 - 113.48	0.11	Coal: bright banded to dull banded.
113.48 - 113.50	0.02	Mudstone: coaly, very thin, dull bright coal stringers abundant.
113.50 - 114.07	0.57	Coal: bright banded occasional amber nodules, minor shear zone at 113.53. Minor mudstone splits - .01 m. widths at 113.77 and 114.02.
114.07 - 114.12	0.05	Mudstone: coaly, bright coal lenses and stringers.
114.12 - 114.36	0.24	Coal: bright banded, amber nodules.
114.36 - 114.42	0.08	Mudstone: brown abundant dull coal stringers.
114.42 - 114.93	0.51	Coal: bright banded, core loss at 114.65 - 114.91 m.
114.93 - 115.12	0.19	Coal: dull banded, highly sheared and pulverized.
115.12 - 115.19	0.07	Coal: bright banded broken.
115.19 - 115.29	0.10	Coal: dull bright, as at 114.93 m.
115.29 - 115.78	0.49	Coal: bright banded.
115.78 - 115.80	0.02	Coal: bright.
115.80 - 115.86	0.06	Mudstone: coaly, bright coal stringers.
115.86 - 116.33	0.47	Coal: bright to bright banded, clean, hard core solid.
116.33 - 116.38	0.05	Mudstone: coaly, bright coal stringers.
116.38 - 116.45	0.07	Coal: dull banded.
116.45 - 116.63	0.18	Coal: bright to bright banded.
116.63 - 116.67	0.04	Mudstone: coaly, bright coal stringers.
116.67 - 116.70	0.03	Coal: bright.

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116.70 - 116.76	0.06	Mudstone: coaly, bright coal stringers, abundant amber nodules.
116.76 - 116.78	0.02	Mudstone, with silty phase: coaly.
116.78 - 116.82	0.04	Coal: bright.
116.82 - 116.96	0.14	Core loss.
116.96 - 116.97	0.01	Mudstone: coal, bright coal stringers.
116.97 - 116.99	0.02	Coal: bright banded.
116.99 - 117.28	0.30	Siltstone: light brown.
117.28 - 117.75	0.47	Mudstone: very carbonaceous with bright coal stringers and lenses to 1.50 cm. thick, coal lenses comprise 30 - 35% of unit, numerous polished surfaces parallel to lenses BCA - 70°.
117.75 - 117.89	0.14	Mudstone: as at 117.28, but coal content to 60% of unit, and lacks coal lenses, core is not sheared.
117.89 - 117.96	0.07	Core loss.
117.96 - 118.62	0.66	Mudstone: carbonaceous with bright coal stringers decreasing down hole, coal content decreases from 15 - 20% near top of unit to 5 - 10% at base.
118.62 - 118.64	0.02	Siltstone: light grey.
118.64 - 118.66	0.02	Mudstone: as at 117.96m., coal content 15 - 20%.
		Calorific
		Value
		(Kj/Kg)
		Sample
		Interval
		Width
		Ash
		Value
		(Kj/Kg)
		1034
		1035
		1036
		1037
		1038
		1039
118.66 - 119.21	0.55	Mudstone: carbonaceous with occasional bright coal stringers 5 - 10%, core is sheared and pulverized at 118.97 - 119.00 m., bedding contorted slickensides.
119.21 - 119.22	0.01	Coal: dull lenses interbedded with brown carbonaceous mudstone.

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119.22 - 120.99	1.77	Mudstone: grey brown, with dull bright coal fragments and rootlets increasing in abundance toward base, convolute bedding, slickensides at base.
120.99 - 121.01	0.02	Core loss.
121.01 - 121.19	0.18	Mudstone: as at 119.22 with occasional dull bright coal stringers up to 1 mm. thick slickensides.
121.19 - 121.41	0.22	Siltstone: light grey, contorted irregular stringers of brown mudstone, dull coal at base and foot of unit, convolute bedding.
121.41 - 121.61	0.20	Mudstone: carbonaceous, with occasional bright coal stringers, 5 - 10%; increasing toward base to 55 - 60%.
121.61 - 123.32	1.71	Mudstone: as at 121.41 m. coal content varies from 5 - 20% with more silty phases at base.
123.32 - 123.44	0.12	Core loss.
123.44 - 128.32	4.88	BCA - 71°.
128.32 - 131.52	3.20	Mudstone: silty, light grey brown, with fine grained sandstone and siltstone phases, calcite veining, occasional concretions throughout, moderately consolidated, core loss 129.67 - 199.69.
131.52 - 131.63	0.11	Sandstone: silty, fine grained, light grey, poorly sorted and consolidated.
131.63 - 131.88	0.25	Mudstone: as at 128.32 m.
131.88 - 131.95	0.07	Sandstone: as at 131.52 m. BCA - 78°.
131.95 - 132.89	0.94	Core loss.
132.89 - 133.34	0.45	Sandstone: as at 131.52 m. with silty and muddy phases throughout.
133.34 - 134.05	0.71	Mudstone: silty, light grey brown, silty and sandy phases throughout, moderately consolidated grading to poorly cemented at base.
134.05 - 134.11	0.06	Sandstone: as at 131.52 m.

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134.11 - 135.40	1.29	Sandstone: medium grained with silty phases and coal stringers gradational to a coarse grained to granular sandstone with angular grains, occasional calcite filled vugs, convolute bedding, BCA - 50°.
135.40 - 136.08	0.68	Sandstone: silty, uncemented with occasional cemented phases 1.0 - 2.5 cm. thick.
136.08 - 137.08	1.00	Siltstone: brown, cemented and uncemented phases, conchoidal fracture.
137.08 - 137.35	0.27	Mudstone: grey to black, coaly, pulverized to sheared, with polished surfaces.
137.35 - 137.55	0.20	Coal: bright to bright and banded.
137.55 - 137.59	0.04	Sandstone: with carbonaceous fragments.
137.59 - 137.74	0.15	Coal: bright to bright and banded.
137.74 - 137.84	0.10	Mudstone: carbonaceous with bright coal stringers throughout.
137.84 - 137.87	0.03	Coal: bright.
137.87 - 137.94	0.07	Sandstone: carbonaceous fragments and bright coal stringers.
137.94 - 138.06	0.12	Coal: bright with sandy bands.
138.06 - 138.28	0.22	Mudstone: dark grey, carbonaceous, with numerous bright coal stringers 1.0 - 2.0 mm.
138.28 - 138.50	0.22	Coal: bright to bright and banded, sheared at base.
138.50 - 138.92	0.42	Coal: bright, interbedded with 1.0 - 2.0 mm. laminations, mudstone.
138.92 - 139.02	0.10	Siltstone: brown, well cemented, coaly stringers, polished surfaces.
139.02 - 139.22	0.20	Coal: bright, interbedded with carbonaceous mudstone laminations 1.0 - 2.0 mm.
139.22 - 139.29	0.07	Mudstone: dark grey, massive.
139.29 - 139.41	0.12	Coal: dull banded.

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Interval	Width	Description	Samples	Interval	Width	Ash	Calorific Value (Kj/Kg)
139.41 - 139.84	0.43	Mudstone: grey, carbonaceous, with laminations of bright coal, BCA - 65°.					
139.84 - 139.96	0.12	Coal: bright to bright banded, 2.0 cm. zone with numerous thin mudstone laminations.					
139.96 - 139.97	0.01	Mudstone: as at 139.41 m.					
139.97 - 140.09	0.12	Coal: bright, sheared in upper 6.0 cm.					
140.09 - 140.22	0.13	Mudstone: as at 139.41 m.					
			1040	136.44 - 136.94	0.50	85.59	
			1041	136.94 - 138.06	1.12	29.55	18,371
			1042	138.06 - 138.29	0.23	22.39	20,904
			1043	138.29 - 139.41	1.12	36.01	16,044
			1044	139.41 - 140.22	0.81	36.77	16,485
140.22 - 142.04	1.82	Mudstone: brown with fine coal stringers, silty, and coaly phases, occasional concretions throughout to 2.0 cm., thick convolute bedding.					
142.04 - 143.57	0.53	Sandstone: fine grained with silty and muddy phases, cross bedded, bedding contorted in places.					
143.57 - 148.33	4.76	Sandstone: medium to coarse grained, graded bedding, occasional silty and muddy laminations BCA - 76°.					
148.33 - 148.44	0.11	Core loss.					
148.44 - 149.32	0.88	Sandstone: as at 143.57 becomes more granular.					
149.32 - 150.79	1.47	Sandstone: as at 142.04, BCA - 62°.					
150.79 - 168.06	17.27	Sandstone: as at 143.57, some uncemented zones up to 1.7 cm. thick BCA - 49.50°, core loss at 157.57 - 157.58.					
168.06 - 168.09	0.03	Sandstone: fine grained, grey, BCA - 66°.					
168.09 - 168.47	0.36	Coal: dull banded.					
168.47 - 169.06	0.59	Mudstone: grey, with stringers of bright coal and coalified plant fragments.					
169.06 - 169.55	0.49	Coal: bright to bright banded coal interbedded.					

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169.55 - 169.58	0.03	Mudstone: coaly with bright coal laminations.
169.58 - 169.89	0.31	Coal: bright to bright banded, interbedded.
169.89 - 169.96	0.07	Mudstone: as at 169.55 m.
169.96 - 170.11	0.15	Coal: bright to bright banded.
170.11 - 170.26	0.15	Coal: dull banded.
170.26 - 170.28	0.02	Siltstone: brown with coal stringers.
170.28 - 170.41	0.13	Coal: dull banded.
170.41 - 170.51	0.10	Coal: bright to bright banded.
170.51 - 170.56	0.05	Coal: dull banded.
170.56 - 170.77	0.21	Coal: bright banded to bright.
170.77 - 170.85	0.08	Coal: dull banded.
170.85 - 170.86	0.01	Coal: bright banded.
170.86 - 170.95	0.09	Coal: dull banded.
170.95 - 171.01	0.06	Mudstone: grey, BCA - 67°.
171.01 - 171.03	0.02	Core loss.
171.03 - 171.17	0.14	Coal: dull banded.
171.17 - 171.34	0.17	Coal: bright banded, minor shears and slickensides.
171.34 - 171.39	0.05	Coal: dull banded.
171.39 - 171.53	0.14	Coal: bright banded to bright.
171.53 - 171.55	0.02	Coal: dull banded.
171.55 - 171.71	0.16	Coal: bright banded, well defined cleavage at 25° to core axis.
171.71 - 171.78	0.07	Mudstone: carbonaceous with occasional bright bands.
171.78 - 171.80	0.02	Coal: bright.
171.80 - 172.13	0.07	Coal: dull banded.

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172.13 - 172.15	0.02	Mudstone: grey, carbonaceous.				
172.15 - 172.52	0.37	Coal: dull banded with occasional muddy laminations.				
172.52 - 172.91	0.39	Mudstone: grey carbonaceous, polished surfaces, core loss at 172.76 - 172.82.				
172.91 - 172.95	0.04	Coal: dull banded.				
172.95 - 173.06	0.11	Coal: bright.				
173.06 - 173.19	0.13	Coal: dull banded.				
173.19 - 173.30	0.11	Mudstone: carbonaceous with occasional bright coal laminations.				
173.30 - 173.34	0.04	Coal: bright banded.				
173.34 - 173.63	0.29	Mudstone: grey, coaly phases with bright coal laminations, sheared in upper 0.1 m. of unit.				
173.63 - 173.67	0.04	Coal: dull banded.				
173.67 - 173.73	0.06	Coal: bright banded.				
173.73 - 173.80	0.07	Mudstone: grey, coalified plant fragments throughout.				
173.80 - 173.85	0.05	Coal: bright banded.				
		Sample	Interval	Width	Ash	Calorific Value (Kj/Kg)
		1047	169.06 - 172.52	3.46	28.49	19,393
		1048	172.52 - 176.15	3.63	53.93	10,729
173.85 - 173.88	0.03	Mudstone: coaly with occasional bright coal laminations.				
173.88 - 173.90	0.02	Greywacke: poorly sorted, clay to pebble sized particles, angular and rounded clasts.				
173.90 - 173.94	0.04	Mudstone: grey, sheared.				
173.94 - 173.99	0.05	Coal: dull banded.				
173.99 - 174.21	0.22	Mudstone: coaly with laminations of bright coal.				
174.21 - 174.30	0.09	Coal: dull banded.				

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174.30 - 174.31	0.01	Coal: bright.
174.31 - 174.39	0.08	Mudstone: as at 173.99 m., sheared.
174.39 - 174.47	0.08	Greywacke: as at 173.88 m., upper contact is conformable, lower contact is unconformable with under lying mudstone. *(1)
174.47 - 174.89	0.42	Mudstone: carbonaceous, sheared, coaly and silty phases.
174.89 - 175.00	0.11	Coal: dull banded.
175.00 - 175.04	0.04	Mudstone: grey, carbonaceous plant fragments and amber lenses.
175.04 - 175.08	0.04	Coal: bright.
175.08 - 175.11	0.03	Mudstone: as at 173.99 m.
175.11 - 175.17	0.06	Coal: bright banded.
175.17 - 175.24	0.07	Mudstone: as at 173.99 m.
175.24 - 175.29	0.05	Coal: dull banded.
175.29 - 175.38	0.09	Coal: bright.
175.38 - 175.40	0.02	Coal: dull banded.
175.40 - 175.50	0.10	Mudstone: as at 173.99 m.
175.50 - 176.01	0.51	Coal: dull banded with occasional bright lenses, core loss at 175.54 - 175.87.
176.01 - 176.16	0.15	Mudstone: as at 173.99 m.
176.16 - 178.08	1.92	Greywacke: poorly sorted, grey sandy matrix with grit and clasts to 1.0 mm. Unit grades from cemented to uncemented.
178.08 - 178.68	1.60	Mudstone: as at 173.99 m. grading to grey carbonaceous mudstone with occasional dull banded to bright coal stringers up to 0.05 m.
178.68 - 178.92	0.24	Core loss.
178.92 - 179.01	0.09	Mudstone: as at 178.08 m.

* (1) This probably represents channel cut and fill.

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179.01 - 179.48	0.47	Coal: interbedded, bright, dull banded to bright banded, interbeds average 0.15 m. width.				
179.48 - 180.33	0.85	Mudstone: grey to dark grey, silty and coaly phases throughout, carbonaceous plant fragments, bright to bright banded coal laminations and lenses up to 0.05 m. width.				
180.33 - 180.93	0.60	Mudstone: grey-brown, carbonaceous, with bright coal laminations, grades at base into fine grained sandstone.				
180.93 - 181.24	0.31	Sandstone: fine grained, uncemented at base.				
181.24 - 183.28	0.04	Siltstone: grey with muddy and sandy phases, mostly poorly cemented, uncemented at base with coaly laminations. Core loss at 181.26 - 181.97 m.				
183.28 - 184.19	0.91	Sandstone: fine grained becoming coarse grained to granular at base, coalified plant fragments in upper 15 cm., cemented and uncemented zones throughout.				
184.19 - 184.24	0.03	Volcaniclastic: green-grey unidentified.				
184.24 - 184.78	0.03	Sandstone: as at 183.28 m.				
184.78 - 185.01	0.23	Conglomerate: grits and sand pebbles, coarse grained at base, graded bedding.				
185.01 - 185.46	0.45	Conglomerate: as at 184.78 with convolute bedding and coal stringers .035 m. from top of unit.				
185.46 - 185.73	0.27	Sandstone: coarse grained, grades into fine conglomerate at base.				
185.73 - 187.05	1.32	Siltstone: green-grey, sandy phases throughout, poorly cemented.				
187.05 - 187.53	0.48	Sandstone: grey-brown to grey-green, silty phases throughout, coalified plant fragments, massive.				
		Sample	Interval	Width	Ash	Calorific Value (Kj/Kg)
		1048B	178.68 - 181.97	3.29	27.13	19,137

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187.53 - 191.11	3.58	Conglomerate: medium grained sand matrix, elliptical rounded pebbles to 0.5 cm., some clay clast of same size, also pebbles of andesite and granitic rock.				
191.11 - 191.12	0.01	Coal: bright stringers.				
191.12 - 193.18	0.06	Conglomerate: as at 187.53 m., poorly defined bedding, BCA - 72°.				
193.18 - 193.93	0.75	Mudstone: grey, poorly to uncemented.				
193.93 - 194.07	0.14	Greywacke: grey, fine grained sand matrix with silty and sandy phases.				
194.07 - 196.19	2.12	Sandstone: medium grained, poorly sorted, muddy and silty phases, poorly cemented core loss at 194.11 - 194.16 m.				
196.19 - 198.82	2.63	Conglomerate: as at 187.53 m.				
198.82 - 199.38	0.56	Siltstone: dark grey, coaly, poorly cemented.				
199.38 - 199.40	0.02	Coal: dull banded.				
199.40 - 199.60	0.20	Coal: bright to bright banded.				
199.60 - 199.70	0.10	Coal: dull banded.				
199.70 - 199.73	0.03	Coal: bright				
199.73 - 199.95	0.22	Coal: dull banded.				
199.95 - 200.05	0.10	Mudstone: dark grey, carbonaceous.				
200.05 - 200.20	0.15	Coal: dull banded, hard.				
		Sample	Interval	Width	Ash	Calorific Value
		1049A	199.38 - 200.20	0.82	39.43	15,305
200.20 - 201.04	0.84	Greywacke: medium grained sandy matrix, angular and rounded clasts of granitic rock (possibly chlorite).				
201.04 - 201.22	0.18	Coal: dull banded.				
201.22 - 201.25	0.03	Coal: bright.				
201.25 - 201.73	0.48	Coal: dull banded.				

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201.73 - 201.84	0.11	Mudstone: dark grey, carbonaceous, BCA - 78 ^o .
201.84 - 201.93	0.09	Coal: dull banded.
201.93 - 202.03	0.10	Coal: bright, massive, calcite filled fracture at base.
202.03 - 202.12	0.09	Mudstone: grey, bright coal stringers.
202.12 - 202.17	0.05	Siltstone: grey, convolute bedding.
202.17 - 202.44	0.27	Mudstone: dark grey, coaly, sheared.
202.44 - 202.99	0.55	Sandstone: grey, fine grained, massive, well cemented, coalified plant fragments.
202.99 - 204.47	1.48	Mudstone: silty, coaly phases, coalified plant fragments, poorly cemented at base BCA - 74 ^o .
204.47 - 205.44	0.97	Sandstone: grey, fine grained, massive, well cemented, coalified plant fragments, graded bedding with fining upward sequence.
205.44 - 206.07	0.63	Breccia: angular clasts of mudstone and assorted granitic rock fragments to 1.0 cm.
206.07 - 206.17	0.10	Sandstone: fine grained massive, well cemented BCA - 78 ^o .
206.17 - 206.20	0.03	Core loss.
206.20 - 207.78	1.58	Sandstone: as at 206.07 m., with silty phases.
207.78 - 208.03	0.25	Mudstone: coaly, sheared, occasional bright coal stringers.
208.03 - 208.41	0.38	Coal: dull banded, sheared, calcite filled fractures at base.
208.41 - 208.44	0.03	Coal: bright.
208.44 - 208.64	0.20	Coal: dull banded.
208.64 - 209.54	0.90	Mudstone: dark grey carbonaceous, occasional bright coal laminations, sheared near base.
209.54 - 209.61	0.07	Mudstone: silty, BCA - 69 ^o .

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209.61 - 210.45	0.84	Mudstone: dark grey, carbonaceous, poorly cemented, occasional bright coal bands and stringers, amber nodules.
210.45 - 211.75	1.30	Siltstone: grey, well cemented.
211.75 - 213.74	2.01	Mudstone: grey, massive, coalified leaf fragments, core loss at 212.32 - 212.45 m. occasional concretion to 2.0 cm. width, BCA - 64°.
213.74 - 221.59	7.85	Mudstone: as at 211.75 m., occasional silty phases, occasional layers are poorly cemented, BCA - 65°.

Sample	Interval	Width	Ash	Calorific Value (Kj/Kg)
1049B	200.05 - 202.03	1.98	53.14	10,425
1050	108.03 - 208.64	0.61	43.61	14,059

221.59

E.O.H.

THUNDERCLOUD COAL PROJECT
DIAMOND DRILL HOLE SUMMARY

DRILL HOLE NO: TDD 79-02

LOCATION:

(a) Coal Licence: 4556
(b) U.T.M.: 6,461,990 N 394,383E
(c) Elevation: 784.89 m

AZIMUTH AND INCLINATION:

(a) Collar Vertical

CORE SIZE: NQ

FORMATIONS DRILLED:

metres
to
to
to
to
to
to

COAL SEAMS INTERSECTED:

TOTAL DEPTH:	Drillers'	132.95 m	Geophysical	128.2
CASING:	Drillers'	9.14 m	Geophysical	9.0

DATE DRILLED: May 27-29, 1979

DRILLED BY: J. T. Thomas Diamond Drilling

LOGGED BY: M. Carr, J. Reid

GEOPHYSICAL LOGS: GRN (through rods)

ABANDONMENT PROCEDURE: Casing pulled

<u>Interval</u> (metres)	<u>Length</u> (metres)	
0.00 - 9.14	9.14	OVERBURDEN
9.14 - 11.11	1.97	Conglomerate: elliptical clasts of basalt up to 0.10 m diameter, matrix of grey silty sand, other unidentified rock types present in small rounded pebbles (<1.0 cm) and grits.
11.11 - 11.28	0.17	Core loss.
11.28 - 12.58	1.30	Conglomerate: as at 9.14 m.
12.58 - 13.37	0.79	Possible Fault Breccia: angular fragments up to 0.25 m, sheared, highly fractured, sandy matrix, poorly sorted, stained brown. Core is in poor condition, most of the matrix has been washed away by the drilling.
13.37 - 14.33		Core loss.
14.33 - 16.23	1.90	Fault Breccia: as at 12.58 m.
16.23 - 16.59	0.36	Basalt: dark grey, flow rock, fractured, iron rich, aphanitic.
16.59 - 16.92	0.33	Core loss.
16.92 - 17.54	0.62	Basalt: as at 16.23 m, iron stained on joint surfaces.
17.54 - 18.30	0.76	Fault Breccia: as at 12.58 m, core loss 17.79 - 18.14.
18.30 - 18.38	0.08	Basalt: as at 16.23 m.
18.38 - 18.84	0.46	Fault Breccia: as at 12.58 m.
18.84 - 18.90	0.06	Core loss.
18.90 - 19.53	0.63	Basalt: as at 16.23 m.
19.53 - 19.91	0.38	Fault Breccia: as at 12.58 m.
19.91 - 20.42	0.51	Core loss.
20.42 - 21.36	0.94	Basalt: as at 16.23 m.

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21.36 - 21.47	0.11	Fault Breccia: as at 12.58 m.
21.47 - 21.82	0.35	Core loss.
21.82 - 22.78	0.96	Basalt: as at 16.23 m.
22.78 - 22.90	0.12	Breccia: as at 12.58 m.
22.90 - 27.52	4.62	Basalt: as at 16.23 m, orthogonal joints at 50° and 18° to core axis, minor breccia, uncemented at 24.06 - 24.12 m. Core loss at 24.95 - 24.99 m.
27.52 - 27.66	0.14	Breccia: as at 12.58 m.
27.66 - 28.82	1.16	Basalt: dark grey to black, aphanitic, massive, occasional calcite filled fractures, minor magnetite in fractures, iron stained.
28.82 - 29.11	0.29	Core loss.
29.11 - 30.09	0.98	Basalt: as at 27.66 m, brecciated at base, calcite filled fractures.
30.09 - 31.90	1.81	Volcaniclastic: sandy siltstone matrix with granule to pebble clasts, uncemented to poorly cemented, brecciated, calcite fracture filling, core mostly broken.
31.90 - 32.11	0.21	Andesite: massive with calcite fracture filling parallel to core axis.
32.11 - 32.31	0.20	Volcaniclastic: as at 30.09 m.
32.31 - 33.27	0.96	Andesite: slightly vesicular, brecciated, numerous small calcite stringers.
33.27 - 33.71	0.44	Volcaniclastic: as at 30.09 m.
33.71 - 35.36	1.65	Basalt: as at 27.66 m, occasional volcaniclastic beds as at 30.09 m.
35.36 - 36.98	1.62	Basalt: as at 27.66 m, amygdaloidal at base of unit, more brecciated toward base.
36.98 - 37.19	0.21	Volcaniclastic as at 30.09 m, but more brecciated.
37.19 - 40.71	3.52	Basalt: as at 27.66 m, massive, fracturing approximately parallel to core axis, highly Fe stained along fractures.

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40.71 - 41.76	1.05	Core loss.
41.76 - 44.28	2.52	Basalt: as at 37.19 m, slickensides, minor magnetite.
44.28 - 44.35	0.07	Core loss.
44.35 - 44.56	0.21	Basalt: as at 27.66 m, slickensides.
44.56 - 45.22	0.66	Fault Breccia: slickensides, many calcite stringers, core highly fractured.
45.22 - 50.68	5.46	Basalt: as at 27.66 m, minor shear zone at 47.00, calcite fracture filling, vugs at 48.46 - 49.16 m, slickensides on fracture at base of unit. BCA - 15°
50.68 - 50.96	0.28	Mudstone: dark grey, carbonaceous, massive, some polished surfaces, core highly shattered.
50.96 - 52.71	1.75	Siltstone: grey-green, sandy, poorly cemented, massive with occasional coal stringers.
52.71 - 52.97	0.26	Basalt: as at 45.22 m.
52.97 - 53.34	0.37	Fault Breccia: core pulverized.
53.34 - 53.90	0.55	Volcanic breccia: andesite clasts, numerous, calcite veins, iron stained.
53.90 - 55.11	1.21	Andesite: brecciated, calcite veins, iron-stained.
55.11 - 55.38	0.27	Mudstone: grey, massive with possible clay clasts.
55.38 - 55.42	0.04	Mudstone: black, carbonaceous.
55.42 - 56.29	0.87	Sandstone: dark grey, very fine grained, massive, becoming more fractured toward base, unidentified green mineral filling fractures (may be serpentine or chlorite) slickensides, iron staining.
56.29 - 57.00	0.71	Siltstone: dark grey to grey, massive, gritty core pulverized.

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57.00 - 57.24	0.24	Sandstone: green grey, medium grained partially cemented, slickensides throughout at 70° to core axis.
57.24 - 57.37	0.10	Mudstone: grey with occasional worm burrows.
57.37 - 57.40	0.03	Coal: dull banded.
57.40 - 57.92	0.58	Mudstone: light grey, massive.
57.92 - 59.97	2.05	Sandstone: light grey, silty, thinly bedded, fine carbonaceous laminations, graded bedding, fining upwards. BCA - 52° - 67°
59.97 - 61.71	1.74	Mudstone: grey, massive, minor carbonaceous lenses at base, core is solid at top becomes pulverized at base.
61.71 - 62.23	0.52	Sandstone: as at 57.92 m, core shattered at base.
62.23 - 62.79	0.56	Core loss.
62.79 - 63.26	0.47	Sandstone: as at 57.92 m.
63.26 - 63.30	0.04	Coal: dull bright.
63.30 - 64.47	1.17	Sandstone: as at 57.92 m, poorly cemented at base.
64.47 - 66.50	2.03	Conglomerate: grey, grades from a granular sandstone to cobble conglomerate, rounded clasts of granitic rocks, chert and siltstone, poorly cemented phases, some iron stained zones.
66.50 - 67.67	1.17	Core loss.
67.67 - 67.84	0.17	Conglomerate: as at 64.47 m.
67.84 - 69.19	1.35	Core loss.
69.19 - 69.31	0.12	Conglomerate: as at 64.47 m.
69.31 - 70.10	0.79	Core loss.
70.10 - 70.21	0.11	Mudstone: black, carbonaceous.
70.21 - 70.26	0.05	Coal: bright.

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70.26 - 70.37	0.11	Mudstone: as at 70.10 m.
70.37 - 72.16	1.79	Siltstone: grey, massive, poorly cemented at top, gradational to mudstone at base.
72.16 - 72.24	0.08	Core loss.
72.24 - 72.64	0.40	Mudstone: dark grey, massive, sheared with slickensides at top of unit, upper and lower contacts are gradational.
72.64 - 73.05	0.41	Siltstone: massive with sandy phases.
73.05 - 74.46	1.41	Sandstone: grey, massive, poorly cemented in upper 0.09 m. BCA - 68°
74.46 - 75.71	1.25	Mudstone: grey, silty, massive, poorly cemented zones. BCA - 67°
75.71 - 77.72	2.01	Sandstone: grey-green, medium to coarse grained, poorly cemented, possibly chloritic.
77.72 - 78.23	0.51	Siltstone: muddy phases, sheared with slickensides.
78.23 - 78.33	0.10	Core loss.
78.33 - 79.22	0.89	Mudstone: grey, silty at base.
79.22 - 79.55	0.33	Siltstone: grey, massive, sandy at base.
79.55 - 80.33	0.78	Sandstone: medium grained, cross-bedded.
80.33 - 80.85	0.52	Siltstone: grey, laminated, sandy phases.
80.85 - 83.66	2.81	Mudstone: grey, laminated, poorly cemented phases to massive. BCA - 72°
83.66 - 84.43	0.77	Core loss.
84.43 - 86.99	2.56	Mudstone: as at 80.85, with numerous silty and sandy phases throughout, core ground and fractured.
86.99 - 87.48	0.49	Core loss.
87.48 - 88.85	1.37	Siltstone: as at 80.33 m. BCA - 77°

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88.85 - 89.65	0.80	Mudstone: as at 80.85 m.
89.65 - 90.07	0.42	Sandstone: coarse grained, massive, poorly cemented.
90.07 - 90.27	0.20	Conglomerate: pebble, sandy matrix, uncemented.
90.27 - 91.07	0.80	Sandstone: grey, massive with silty phases, poorly cemented.
91.07 - 91.48	0.41	Mudstone: dark grey massive with silty phases, bright coal stringers, core pulverized at base.
91.48 - 91.90	0.42	Core loss.
91.90 - 92.07	0.17	Mudstone: as at 91.07 m.
92.07 - 92.43	0.36	Sandstone: coarse grained, poorly cemented, porous.
92.43 - 95.32	2.89	Mudstone: dark grey, as at 91.07, occasional coal stringers, coaly phases, sheared with slickensides. BCA - 57 ^o
95.32 - 95.92	0.60	Sandstone: fine to medium grained, graded bedding, poorly cemented, sheared with slickensides.
95.92 - 96.73	0.21	Siltstone: massive with sandy and muddy phases, sheared with slickensides.
96.73 - 97.40	0.67	Mudstone: dark grey, massive, sheared at base, slickensides.
97.40 - 98.12	0.72	Siltstone: as at 92.92 sandy and muddy phases, BCA - 59 ^o
98.12 - 98.56	0.44	Sandstone: coarse grained, gradational to pebble conglomerate, well cemented, volcanic rock fragments, chert pebbles and coal clasts present throughout.
98.56 - 99.67	0.11	Mudstone: grey, sheared, core heavily fractured at base.

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99.67 - 100.18	0.51	Siltstone: gradational to medium grained sandstone at base.
100.18 - 100.58	0.40	Sandstone: medium grained laminated, BCA - 56°
100.58 - 101.08	0.50	Conglomerate: pebbles of chert, volcanic rock fragments, and occasional coal stringers.
101.08 - 101.38	0.30	Sandstone: medium grained as at 100.18 m.
101.38 - 101.89	0.51	Conglomerate: as at 100.58 m, bright coal lenses, core pulverized in places.
101.89 - 102.72	0.83	Core loss.
102.72 - 103.02	0.30	Siltstone: grey, massive, gradational contact.
103.02 - 103.92	0.90	Sandstone: grey, medium grained, occasional calcite fracture filling, poorly cemented at top of unit.
103.92 - 104.39	0.47	Core loss.
104.39 - 106.39	2.00	Sandstone: as at 103.02 m.
106.39 - 107.68	1.29	Conglomerate: elliptical pebbles of chert and volcanics, rock fragments of granitic rocks and cobbles up to 4.5 cm, sandy matrix massive, well cemented, appears brecciated in places.
107.68 - 107.90	0.22	Sandstone: as at 103.02 m. BCA - 52°
107.90 - 109.36	1.46	Conglomerate: as at 106.39 m.
109.36 - 109.73	0.37	Core loss.
109.73 - 111.36	1.63	Conglomerate: as at 106.39 m.
111.36 - 111.86	0.50	Core loss.
111.86 - 112.71	0.85	Mudstone: dark grey, carbonaceous, laminated, slickensides throughout, heavily sheared with sandy phases. BCA - 56°

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112.71 - 113.05	0.34	Siltstone: dark grey, laminated, sandy phases.
113.05 - 113.57	0.52	Sandstone: grey, medium grained with silty phases. BCA - 42°
113.57 - 114.86	1.29	Siltstone: as at 112.71 m with muddy phases, heavily sheared, slickensides.
114.86 - 114.91	0.05	Core loss.
114.91 - 116.01	1.10	Siltstone: as at 112.71 m. BCA - 16°
116.01 - 116.49	0.48	Mudstone: grey, massive.
116.49 - 116.70	0.21	Sandstone: grey, medium grained, thinly bedded.
116.70 - 117.96	0.26	Core loss.
117.96 - 118.69	0.73	Sandstone: as at 116.49 m. BCA - 40°.
118.69 - 118.98	0.29	Conglomerate: rounded to angular granules, poorly cemented, sheared, possibly chloritic with slickensides, black carbonaceous mudstone matrix, occasional bright coal lenses at base, 1 cm. thick.
118.98 - 120.61	1.63	Siltstone: grey, sandy phases throughout, sheared with slickensides, coal stringers.
120.61 - 130.12	9.51	Sandstone: medium grained, silty laminations massive, slickensides throughout, small scale offsets show reverse faulting, calcite fracturing filling and clay clasts. BCA - 43°
130.12 - 130.15	0.03	Core loss.
130.15 - 131.03	1.12	Sandstone: as at 120.61 m, slickenside steps show normal fault movement.
131.03 - 132.14	1.11	Siltstone: grey, massive with slickensides throughout.
132.14 - 132.55	0.41	Sandstone: as at 120.61 m.
132.35 - 132.95	0.40	Siltstone: as at 131.03 m. BCA - 22°
132.95		E.O.H.

THUNDERCLOUD COAL PROJECT
DIAMOND DRILL HOLE SUMMARY

DRILL HOLE NO: TDD 79-03

LOCATION:

(a) Coal Licence: 4552
(c) U.T.M.: 6,458,532 N, 394,071 E
(e) Elevation: 772.28 m

AZIMUTH AND INCLINATION:

(a) Collar Vertical

CORE SIZE: NQ

FORMATIONS DRILLED:

metres
to
to
to
to
to
to

COAL SEAMS INTERSECTED:

TOTAL DEPTH:	Drillers'	232.56 m	Geophysical	227.0 m
CASING:	Drillers'	62.80 m	Geophysical	--

DATE DRILLED: May 30 - June 5, 1979

DRILLED BY: J. T. Thomas Diamond Drilling

LOGGED BY: J. Reid, M. Carr, P. George

GEOPHYSICAL LOGS: DEN, GRN (both logged through rods)

ABANDONMENT PROCEDURE: Casing pulled

<u>Interval</u> (metres)	<u>Length</u> (metres)	
0.00 - 36.25	36.25	OVERBURDEN: clay, dark grey, uncemented, core plastic, becomes pebbly mud at base with dropstones of sandstone and granitic rocks, pebbles vary in size 0.1 - 3.0 cm.
36.25 - 36.27	0.02	Mudstone: coaly, convolute bedding.
36.27 - 39.39	3.12	Siltstone: dark grey, gritty, massive but highly fractured, coaly stringers throughout, sandy phases near base.
39.39 - 41.72	2.33	Sandstone: silty phases and laminations, very lensoidal, coarsens at base.
41.72 - 41.76	0.04	Core loss.
41.76 - 42.12	0.36	Sandstone: as at 39.39 m.
42.12 - 44.40	2.28	Siltstone: dark grey, carbonaceous, disturbed bedding, muddy and sandy phases, sandy phase at base 44.26 - 44.40 m.
44.40 - 44.81	0.41	Core loss.
44.81 - 46.17	1.36	Sandstone: as at 39.39 m, poorly cemented at base.
46.17 - 47.85	1.68	Core loss.
47.85 - 48.46	0.61	Siltstone: dark grey, sandy phases, coal stringers bedding disturbed.
48.46 - 48.99	0.53	Sandstone: coarse grained to granular, light grey massive with occasional clay clasts.
48.99 - 49.21	0.22	Siltstone: dark grey muddy phases, bedding disturbed.
49.21 - 49.55	0.34	Sandstone: as at 48.46 m.
49.55 - 49.67	0.12	Siltstone: as at 48.99 m.
49.67 - 50.02	0.35	Sandstone: as at 48.46 m.
50.02 - 50.75	0.73	Siltstone: as at 48.99 m, coaly at base, interbedded black carbonaceous sandstone, fine grained, bright coal stringers throughout.

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50.75 - 50.78	0.03	Coal: bright banded, sheared with numerous slickensides.
50.78 - 50.88	0.10	Mudstone: black carbonaceous, coal stringers throughout.
50.88 - 50.90	0.02	Core loss.
50.90 - 52.76	1.86	Siltstone: grey, sandy phases, convolute bedding, massive. BCA - 71 ⁰
52.76 - 53.03	0.27	Mudstone: dark grey, sheared, bright coal stringers.
53.03 - 53.21	0.18	Siltstone: as at 50.90 m, gritty phases.
53.21 - 54.73	0.52	Mudstone: metamorphosed, coaly, dark grey to black, bright graphite lenses throughout. Coal is in part altered to graphite. Diabasic sill in contact with unit at base.* Occasional interbedded lamination of baked coaly mudstone. Unit is highly fractured at top and becomes sheared at base, calcite fracture filling, disseminated pyrite throughout.
54.73 - 56.77	0.04	Mudstone: metamorphosed as at 53.21 m.
56.77 - 57.00	0.23	Core loss.
57.00 - 57.94	0.94	Mudstone: metamorphosed as at 53.21 m.
57.94 - 66.39	8.45	Diabase sill: shallowly emplaced, grey, fine grained at top, massive with calcite fracture filling, slickensides on fractures. BCA - 22 ⁰ - 58 ⁰ , minor serpentine alteration along some fractures, occasional small angular xenoliths of baked mudstone throughout, small elongated vesicles abundant in upper 0.28 m of unit, minor disseminated sulfides throughout, possibly pyrrhotite ± pyrite. Core loss from 60.01 - 60.05 m.

* Coal altered partly to graphite (53.21 - 54.73 m). This is likely due to thermal metamorphism by the intrusion of a shallowly emplaced diabasic sill.

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66.39 - 66.94	0.55	Graphite: core highly pulverized, numerous slickensides.*
66.94 - 74.37	7.43	Mudstone: black, carbonaceous, baked with numerous coaly lenses, heavily fractured, slickensides, degree of baking decreases downhole. Core loss at 68.53 - 68.89 m and 72.05 - 72.09 m. BCA - 72°
74.37 - 76.83	2.46	Siltstone: grey, massive, muddy and sandy phases, calcite fracture filling at base sheared.
76.83 - 77.52	0.69	Sandstone: medium to coarse grained, silty and muddy phases, carbonaceous fragments disturbed bedding.
77.52 - 78.37	0.85	Mudstone: dark grey, massive, carbonaceous bright coal stringers, heavily sheared.
78.37 - 78.53	0.16	Coal: bright to bright banded, heavily sheared.
78.53 - 78.97	0.44	Mudstone: dark grey, fissile, core pulverized.
78.97 - 80.01	0.03	Sandstone: fine grained, silty phases, fractured at base.
80.01 - 87.48	0.47	Siltstone: as at 74.37, occasional coal stringers. BCA - 50° - 55°
87.48 - 88.25	0.77	Mudstone: dark grey, sandy phases, occasional coal stringers grading to coal interbedded with carbonaceous mudstone, sheared.
88.25 - 88.31	0.06	Coal: interbedded and carbonaceous mudstone, sheared.
88.31 - 88.73	0.42	Coal: bright banded to bright, heavily sheared to massive with amber nodules, slickensides.
88.73 - 88.93	0.20	Coal: dull banded, massive, sheared.
88.93 - 88.95	0.02	Coal: bright massive.
88.95 - 88.96	0.01	Coal: dull banded.
88.96 - 89.27	0.31	Coal: bright to bright banded, amber nodules.

* Coal appears to have been naturally coked.

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89.27 - 89.53	0.26	Coal: dull banded, pulverized, sheared.
89.53 - 89.99	0.16	Sandstone: fine grained, muddy at top, occasional coal seam. BCA - 54 ^o
89.99 - 90.13		Mudstone: black carbonaceous, coal lenses, heavily sheared.
90.13 - 90.20	0.07	Coal: pulverized.
90.20 - 90.27	0.07	Mudstone: as at 89.99 m.
90.27 - 90.53	0.26	Core loss.
90.53 - 90.61	0.08	Coal: dull banded, slickensides.
90.61 - 90.70	0.09	Mudstone: black carbonaceous.
90.70 - 90.72	0.02	Coal: dull banded, sheared.
90.72 - 90.77	0.05	Mudstone: as at 90.61 m.
90.77 - 90.95	0.18	Coal: dull banded, sheared.
90.95 - 91.15	0.20	Mudstone: black carbonaceous, bright coal stringers.
91.15 - 91.31	0.16	Coal: dull banded.
91.31 - 91.58	0.27	Siltstone: massive, dark grey.
91.58 - 91.78	0.20	Mudstone: black, carbonaceous, heavily sheared, bright coal stringers throughout.
91.78 - 91.82	0.40	Coal: bright hard.
91.82 - 91.99	0.17	Sandstone: fine grained, disturbed bedding, calcite fracture filling.
91.99 - 92.05	0.07	Coal: dull pulverized.
92.05 - 92.46	0.41	Sandstone: as at 89.53 m.
92.46 - 92.51	0.05	Core loss.
92.51 - 93.57	0.06	Sandstone: grey, medium grained, laminated.
93.57 - 93.65	0.08	Mudstone: coaly, black carbonaceous, sheared.
93.65 - 93.78	0.13	Coal: dull bright sheared.

TDD 79-03

Sample Number	Interval	Width	Dry Ash	Calorific Value (KJ/kg)
93.78 - 95.10	1.32	Mudstone: grey, sandy and coaly phases, poorly cemented at base. Core loss 94.37 - 94.64 m.		
95.10 - 95.96	0.86	Sandstone: grey, medium grained, convolute bedding, sheared, slickensides with calcite fracture filling at base.		
5654	87.95 - 88.25	0.30	85.84	--
5655	88.25 - 89.53	1.28	25.63	21,111
5656	89.53 - 89.99	0.46	89.05	--
5657	89.99 - 92.46	2.47	62.81	7,525
95.96 - 96.88	0.92	Mudstone: dark grey, massive, interbedded medium grained siltstone, occasional concretion, poorly cemented at base.		
96.88 - 97.84	0.96	Siltstone: dark grey, massive, calcite fracture filling.		
97.84 - 97.87	0.03	Mudstone: black carbonaceous, poorly cemented.		
97.87 - 98.15	0.28	Core loss.		
98.15 - 98.52	0.37	Mudstone: as at 97.84.		
98.52 - 100.19	1.67	Sandstone: grey, fine grained, with silty phases, occasional calcite fracture filling.		
100.19 - 100.83	0.64	Mudstone: dark grey poorly cemented.		
100.83 - 102.01	1.18	Sandstone: dark grey, silty, muddy phases.		
102.01 - 102.64	0.63	Mudstone: dark grey, silty, laminated.		
102.64 - 103.25	0.61	Sandstone: grey, coarse grained with muddy phases at base.		
103.25 - 104.10	0.85	Mudstone: dark grey, poorly cemented, sheared, highly fractured.		
104.10 - 105.22	1.12	Sandstone: dark grey, medium grained, silty and muddy phases at base.		
105.22 - 106.03	0.81	Siltstone: dark grey, occasional coal stringers. BCA - 45°		

106.03 - 106.74	0.71	Mudstone: dark grey to black, carbonaceous, heavily sheared.
106.74 - 107.45	0.71	Siltstone: as at 105.22 m.
107.45 - 107.91	0.46	Sandstone: grey, medium grained. BCA - 50°
107.91 - 111.75	3.84	Siltstone: as at 105.22, graded bedding.
111.75 - 112.23	0.48	Sandstone: dark grey, medium grained.
112.23 - 115.52	3.29	Mudstone: dark grey, convolute bedding, silty phases throughout.
115.52 - 115.86	0.34	Sandstone: as at 111.75, poorly cemented at top.
115.86 - 116.50	0.64	Siltstone: dark grey, poorly cemented, massive.
116.50 - 117.31	0.81	Sandstone: medium to coarse grained, silty phases, occasional calcite filled fractures.
117.31 - 119.76	2.45	Mudstone: grey-brown, poorly cemented, sandy phases, coal stringers. BCA - 51°
119.76 - 120.06	0.30	Coal: heavily sheared and pulverized.
120.06 - 120.33	0.27	Mudstone: as at 117.31 m.
120.33 - 121.01	0.68	Core loss.
121.01 - 121.72	0.71	Mudstone: as at 117.31 m.
121.72 - 122.13	0.41	Sandstone: coarse grained gritty.
122.13 - 123.66	1.53	Siltstone: dark grey, muddy phases throughout, poorly cemented.
123.66 - 124.29	0.63	Mudstone: dark grey, occasional concretion 0.17 m width, heavily fractured core, only at base.
124.29 - 125.88	1.59	Siltstone: dark grey, convolute bedding, muddy phases.

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125.88 - 126.10	0.22	Sandstone: medium to coarse grained, dark grey.
126.10 - 127.13	1.03	Siltstone: dark grey, sandy phases, heavily fractured.
127.13 - 127.27	0.14	Sandstone: dark grey, fine grained, poorly cemented.
127.27 - 127.66	0.39	Siltstone: as at 126.10 m.
127.66 - 128.35	0.69	Sandstone: as at 127.13 m.
128.35 - 128.68	0.33	Siltstone: as at 126.10, poorly cemented, pulverized.
128.68 - 130.15	1.47	Sandstone: dark grey, silty phases throughout.
130.15 - 130.23	0.08	Siltstone: as at 126.10.
130.23 - 130.61	0.38	Mudstone: dark grey, massive, silty phases.
130.61 - 130.93	0.32	Sandstone: as at 128.68 m.
130.93 - 133.42	2.49	Siltstone: dark grey, massive with coalified plant fragments.
133.42 - 133.44	0.02	Mudstone: black carbonaceous, massive.
133.44 - 133.45	0.01	Coal: bright.
133.45 - 133.93	0.48	Mudstone: dark grey, massive.
133.93 - 136.47	2.54	Siltstone: dark grey to grey-brown, massive, calcite fracture filling, isolated vugs, sandy phases at base. Core loss at 136.20 - 136.25 m.
136.47 - 136.76	0.29	Mudstone: dark grey, massive. BCA - 65°
136.76 - 139.06	2.30	Siltstone: as at 133.93 with muddy phases.
139.06 - 139.29	0.23	Mudstone: dark grey, occasional bright coal stringers, fractured at top.
139.29 - 139.92	0.63	Siltstone: as at 133.93 with bright coal stringers.
139.92 - 140.28	0.36	Sandstone: coarse grained, coal stringers unidentified green mineral.

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140.28 - 143.55	3.27	Mudstone: dark grey, silty phases, poorly cemented, occasional coal stringers. BCA - 67 ^o
143.55 - 144.85	1.30	Siltstone: as at 133.93 m, convolute bedding.
144.85 - 144.87	0.02	Sandstone: coarse grained granular.
144.87 - 145.16	0.29	Mudstone: grey massive, calcite fracture filling, slickensides. BCA 23 ^o - 82 ^o
145.16 - 145.38	0.22	Sandstone: grey, medium grained, well sorted, massive with coaly plant fragments, moderately well cemented, bright coal stringer, core solid.
145.38 - 145.39	0.01	Core loss.
146.39 - 146.65	0.26	Mudstone: as at 144.87, coaly plant fragments. BCA - 38 ^o , sheared at base, numerous polished surfaces, minor calcite fracture filling, shearing and coaly stringers approximately parallel bedding.
146.65 - 146.80	0.15	Siltstone: grey brown, well cemented, muddy phases, bright coal stringers.
146.80 - 146.88	0.08	Mudstone: black, carbonaceous, bright banded coaly lenses, core pulverized.
146.88 - 147.12	0.24	Coal: bright banded, core highly pulverized.
147.12 - 147.21	0.09	Mudstone: black, carbonaceous, poorly to moderately cemented, coaly lenses, sheared with bright coal stringers.
147.21 - 147.77	0.56	Coal: dirty, interbedded coal laminations.
147.77 - 147.96	0.19	Mudstone: black carbonaceous, bright coaly lenses, amber nodules, sheared minor calcite fracture filling.
147.96 - 148.15	0.19	Mudstone: light grey, moderately well cemented, massive.
148.15 - 148.44	0.29	Mudstone: black, carbonaceous, bright coaly lenses, core pulverized.

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148.44 - 148.89	0.45	Mudstone: brown, poorly to well cemented, highly sheared, numerous bright coal stringers, minor calcite fracture filling.
148.89 - 151.09	2.20	Mudstone: grey brown, well cemented, bedding well defined. BCA - 61°, bright banded coal stringers, minor calcite fracture filling, FCA 43°, slickensides and shearing at base of unit.
151.09 - 151.22	0.13	Coal: dirty, dull banded, massive, hard, core broken.
151.22 - 151.28	0.08	Coal: dull banded, soft, amber lenses, slickensides at numerous attitudes.
151.28 - 151.49	0.21	Coal: bright, moderately soft, sheared, calcite filled along polished surfaces core highly broken.
151.49 - 151.54	0.05	Coal: dull banded, minor calcite, fracture filling, slickensides. BCA - 70°
151.54 - 151.60	0.06	Coal: bright, hard, slickensides, calcite fracture filling, amber nodules.
151.60 - 151.64	0.04	Coal: dull banded, moderately soft, polished surfaces, amber nodules.
151.64 - 151.81	0.17	Coal: bright banded with bright layers to 0.11 m and dull bright layers to 0.01 m thickness of layers decreases toward base of unit.
151.81 - 151.99	0.18	Coal: dull banded, hard, amber, calcite filled fractures, sheared.
151.99 - 152.11	0.12	Coal: bright banded, slickensides.
152.11 - 152.17	0.06	Coal: bright, fractured at base.
152.17 - 152.19	0.02	Mudstone: dark brown, lensoidal bedding, slickensides.
152.19 - 152.39	0.20	Coal: bright, fractured at base.
152.39 - 152.43	0.04	Coal: dull banded.
152.43 - 152.61	0.18	Coal: bright banded, slickensides, amber nodules.

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152.61 - 152.81	0.20	Coal: dull to dull bright, pulverized.
152.81 - 152.96	0.15	Coal: bright, highly broken.
152.96 - 153.31	0.35	Core loss.
153.31 - 153.79	0.48	Coal: dull banded, lenticular ash bands interbedded with dull coal to 1.0 cm.
153.79 - 154.05	0.26	Coal: dull banded to dull bright, occasional stringer bright coal to 0.02 m, polished surfaces.
154.05 - 154.06	0.01	Coal: bright.
154.06 - 154.33	0.27	Coal: dull banded to dull bright, polished surfaces throughout.
154.33 - 154.53	0.20	Core loss.
154.53 - 154.55	0.02	Coal: bright.
154.55 - 155.07	0.52	Coal: dull banded with occasional bright layers 0.0 - 0.04 m width, polished surfaces throughout, minor calcite fracture filling.
155.07 - 155.12	0.05	Mudstone: dark grey, interbedded with laminations of coal.
155.12 - 155.85	0.73	Coal: dull banded, with zones heavily sheared to highly pulverized.
155.85 - 155.88	0.03	Coal: ash band in coal.
155.88 - 156.47	0.59	Coal: dull to bright banded, core pulverized at base.
156.47 - 156.51	0.04	Mudstone: carbonaceous, interbedded with bright coal stringers.
156.51 - 156.67	0.16	Coal: dull banded.
156.67 - 157.31	0.64	Mudstone: dark grey carbonaceous, with bright coal stringers. Core loss 156.70 - 156.97 m.
157.31 - 157.91	0.60	Sandstone: medium grained laminated, silty phases. BCA - 60 ⁰

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Sample Number	Interval	Width	Dry Ash	Calorific Value (kJ/kg)
5661	150.40 - 151.09	0.69	90.49	--
5662	151.09 - 156.47	5.38	37.24	18,104
5663	156.47 - 157.31	0.84	74.14	--
157.91 - 157.93	0.02	Coal: bright.		
157.93 - 158.03	0.10	Mudstone: carbonaceous, bright coal stringers.		
158.03 - 158.28	0.25	Sandstone: medium to coarse grained, massive.		
158.28 - 159.88	1.60	Siltstone: with muddy phases and bright coal laminations and stringers at base. BCA - 64°		
159.88 - 160.02	0.14	Core loss.		
160.02 - 160.98	0.96	Mudstone: dark grey, carbonaceous, bright coal stringers throughout.		
160.98 - 161.07	0.09	Coal: dull bright, heavily sheared.		
161.07 - 162.34	1.27	Siltstone: sandy and muddy phases, bright coal stringers throughout.		
162.34 - 164.33	1.99	Sandstone: fine grained, muddy laminations occasional bright coal stringers. BCA - 55°		
164.33 - 165.83	1.50	Mudstone: dark grey, carbonaceous, heavily sheared at top, bright coal stringers throughout, silty phases.		
165.83 - 172.13	6.30	Siltstone: laminated, bright coal stringers throughout, occasional sandy phases. BCA - 69°		
172.13 - 172.35	0.22	Sandstone: fine grained laminated, coal stringers, coalified plant fragments.		
172.35 - 172.36	0.01	Core loss.		
172.36 - 172.89	0.53	Sandstone: as at 172.13 m.		
172.89 - 174.58	1.69	Siltstone: bright coal stringers at top of unit grading to dark grey, sandy and muddy phases. BCA - 62°		

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174.58 - 176.40	1.82	Mudstone: grey, massive, silty phases, bright coal stringers toward base, core fractured throughout.
186.40 - 176.64	0.24	Coal: dull bright, heavily sheared.
176.64 - 176.77	0.13	Coal: bright banded.
176.77 - 176.81	0.04	Coal: dull banded.
176.81 - 176.97	0.16	Coal: bright banded to bright.
176.97 - 177.02	0.05	Coal: dull banded, amber.
177.02 - 177.14	0.12	Coal: bright to bright banded.
177.14 - 177.19	0.05	Coal: dull banded.
177.19 - 178.28	0.09	Coal: bright to bright banded, amber.

				Calorific
Sample	Interval	Width	Dry	Value
Number			Ash	(kJ/kg)
5665	176.40 - 178.86	2.46	20.38	24,386
178.28 - 178.30	0.02	Coal: bright, ash band with width 0.02 m interbedded.		
178.30 - 178.83	0.53	Coal: dull bright, heavily sheared.		
178.83 - 178.86	0.03	Coal: dull bright, heavily sheared.		
178.86 - 179.24	0.38	Sandstone: buff colored, coarse grained poorly cemented, grains poorly sorted, ranging from 0.05 mm to 2.0 cm, ellipsoidal, minor coal stringers, slickensides.		
179.24 - 179.30	0.06	Mudstone: dark grey, poorly cemented.		
179.30 - 183.39	0.09	Siltstone: grey, poorly cemented sandy and muddy phases toward base. BCA - 61 ^o		
183.39 - 184.04	0.65	Mudstone: dark grey to black, carbonaceous, poorly cemented, heavily fractured.		

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184.04 - 184.16	0.12	Coal: stoney.
184.16 - 184.22	0.06	Coal: bright.
184.22 - 184.26	0.06	Coal: dull bright.
184.26 - 184.30	0.04	Mudstone: black carbonaceous, heavily sheared.
184.30 - 184.56	0.26	Siltstone: dark grey, coalified plant fragments sandy at base.
184.56 - 185.10	0.54	Sandstone: fine to coarse grained, normal graded bedding. BCA - 58 ^o
185.10 - 186.19	1.09	Mudstone: dark grey, poorly cemented, silty phases at base.
186.19 - 187.87	1.68	Siltstone: grey massive, coalified plant fragments throughout.
187.87 - 188.00	0.13	Sandstone: light grey, medium grained. BCA - 66 ^o
188.00 - 188.40	0.40	Mudstone: grey, poorly cemented, fissile.
188.40 - 188.71	0.31	Sandstone: fine grained with silty phases.
188.71 - 188.73	0.02	Coal: bright.
188.73 - 188.77	0.04	Sandstone: as at 188.40 m.
188.77 - 189.17	0.40	Siltstone: as at 186.19 m, sandy phases.
189.17 - 190.69	1.52	Mudstone: dark grey to black, numerous fine coal interbeds, polished surfaces throughout.
190.69 - 190.78	0.09	Siltstone: massive, sandy at base.
190.78 - 191.54	0.76	Sandstone: medium to coarse grained, graded bedding. BCA - 67 ^o
191.54 - 192.20	0.66	Siltstone: as at 186.19 m, sandy phases.
192.20 - 192.86	0.66	Sandstone: as at 190.78 m, conglomeratic phases.
192.86 - 194.53	1.67	Siltstone: as at 186.19 m, core loss at 193.32 - 193.70 m.

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194.53 - 196.32	1.79	Mudstone: grey to black, carbonaceous with bright coal stringers and coalified plant fragments, silty phases.
196.32 - 196.57	0.25	Sandstone: fine grained, massive.
196.57 - 196.85	0.28	Mudstone: as at 194.53 m.
196.85 - 197.48	0.63	Sandstone: grey, fine grained, gritty phases.
197.48 - 197.79	0.31	Mudstone: grey, massive, coalified plant fragments.
197.79 - 198.45	0.66	Siltstone: grey, sandy, massive, conglomeratic phase at top of unit.
198.45 - 198.88	0.43	Sandstone: coarse grained, poorly sorted, conglomeratic phase at base. Clasts are ellipsoidal with strong imbrication. BCA - 57 ^o
198.45 - 199.21	0.76	Siltstone: as at 197.79 m.
199.21 - 200.20	0.99	Conglomerate: poorly sorted, sandy phases throughout, clasts vary in size .02 - 2.00 cm. coalified plant fragments.
200.20 - 200.78	0.58	Sandstone: fine grained, poorly cemented, heavily fractured with silty phases.
200.78 - 201.76	0.98	Mudstone: dark grey, poorly cemented, silty and sandy phases.
201.76 - 203.73	1.97	Sandstone: fine grained, coalified plant fragments and occasional sandy laminations.
203.73 - 204.30	0.57	Siltstone: dark grey, massive.
204.30 - 204.80	0.50	Sandstone: coarse grained with silty phases, and conglomerate lens, 27 cm. from top of unit.
204.80 - 206.38	1.58	Mudstone: interbedded with fine grained sandstone, convolute bedded, occasional bright coal laminations, carbonaceous, core heavily sheared and fractured.
206.38 - 206.45	0.07	Coal: dull banded, polished surfaces throughout, occasional thin mudstone interbeds.
206.38 - 208.54	2.16	Mudstone: dark grey, carbonaceous, numerous bright coal laminations, amber nodules, core is heavily fractured and sheared toward base.

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208.54 - 209.13	0.59	Siltstone: light grey, highly fractured.
209.13 - 209.44	0.31	Mudstone: as at 206.38 m.
209.44 - 209.86	0.42	Sandstone: fine to medium grained. BCA - 70°
209.86 - 210.79	0.93	Mudstone: as at 206.38 m, highly fractured.
210.79 - 211.09	0.30	Sandstone: conglomeratic to fine grained toward base, highly fractured.
211.09 - 211.34	0.25	Mudstone: dark grey, highly fractured, carbonaceous at base.
211.34 - 211.86	0.52	Sandstone: as at 209.44 m, highly fractured.
211.86 - 212.52	0.66	Mudstone: as at 211.09 m.
212.52 - 216.05	3.53	Sandstone: fine grained grading to coarse grained at base, massive, poorly sorted, muddy to granular phases. Core heavily fractured at base.
216.05 - 217.80	1.75	Basalt: amphibole phenocrysts, stretched calcite filled amygdules, chilled lower contact, serpentine fracture filling along joints.
217.80 - 217.97	0.17	Sandstone: medium grained, muddy laminations serpentine fracture filling. BCA - 66°
217.97 - 219.25	1.28	Mudstone: coaly, polished surfaces throughout, core highly fractured. Core loss at 218.40 - 218.54 m.
219.52 - 220.39	0.87	Sandstone: light grey, fine grained massive becoming coarse grained and heavily fractured at base. BCA - 60°
220.39 - 223.03	2.64	Siltstone: grey, laminated, occasional sandy phases.
223.03 - 223.49	0.46	Sandstone: light grey, medium grained, gritty at base.
223.49 - 223.59	0.10	Mudstone: black, very carbonaceous.

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223.59 - 224.35	0.76	Siltstone: massive, coalified fragments throughout, fractured at base.
224.35 - 224.93	0.58	Sandstone: fine grained gradational to gritty coarse grained sandstone at base.
224.93 - 225.22	0.29	Shear zone, minor, serpentinized, fault gouge of siltstone having siltstone matrix. BCA - 72 ⁰
225.22 - 225.58	0.36	Conglomerate: angular and rounded clasts varying from 0.2 - 2.5 cm.
225.58 - 227.15	1.57	Sandstone: light grey, silty and gritty phases, occasional pyrite.
227.15 - 229.37	2.22	Siltstone: light to dark grey, sandy phases, coalified plant fragments, core highly fractured and sheared.
229.37 - 230.73	1.36	Sandstone: medium to coarse grained, fractured at base, occasional coalified plant fragments.
230.73 - 232.56	1.83	Siltstone: as at 227.15 m, core is highly fractured.
232.56		E.O.H.

THUNDERCLOUD COAL PROJECT
DIAMOND DRILL HOLE SUMMARY

DRILL HOLE NO: TDD 79-04

LOCATION:

(a) Coal Licence: 4549
(b) U.T.M.: 6,455,995 N 393,215 E
(c) Elevation: 789.26 m

AZIMUTH AND INCLINATION:

(a) Collar Vertical

CORE SIZE: NQ

FORMATIONS DRILLED:

metres
to
to
to
to
to
to

COAL SEAMS INTERSECTED: None

TOTAL DEPTH: Drillers' 166.17 m Geophysical --

CASING: Drillers' 50.59 m Geophysical --

DATE DRILLED: June 6-8, 1979

DRILLED BY: J. T. Thomas Diamond Drilling

LOGGED BY: J. Reid

GEOPHYSICAL LOGS: None -- hole caving

ABANDONMENT PROCEDURE: Casing pulled

<u>Interval</u> (metres)	<u>Length</u> (metres)	
0.00 - 118.44	118.44	OVERBURDEN: dominantly unconsolidated semi-consolidated pebble to boulder gravels with interbedded muds, silts and sands. Abundance of volcanic clasts generally increases toward base of unit.
118.44 - 118.94	0.50	Volcaniclastic Conglomerate: subrounded to angular clasts up to 0.09 m of andesite and basalt, poorly cemented, core ground for basal 0.30 m.
118.94 - 119.52	0.58	Core loss.
119.52 - 120.16	0.64	Volcaniclastic Greywacke: granule to pebble sized clasts of dominantly volcanic rock (basalts to andesites). Contains iron-rich unidentified grains, poorly sorted.
120.16 - 120.78	0.62	Volcaniclastic Sandstone: light brown, sub-angular to rounded grit comprising to 25% of unit, grit is grain supported by fine sand, occasional angular carbonaceous mudstone clasts.
120.78 - 120.89	0.11	Volcaniclastic Sandstone: green, fine to medium grained, grains composed of green volcanic and unidentified blue earthy material.
120.89 - 121.25	0.36	Volcaniclastic Sandstone: fine grained gradational to black (possibly carbonaceous) lenses, which in turn grade into large angular to sub-angular clasts of volcanics. Abundant carbonaceous clasts.* BCA = 90°
121.25 - 121.55	0.30	Mudstone: black, possibly carbonaceous, silty phases, amber nodules.
121.55 - 121.82	0.27	Volcaniclastic greywacke: poorly sorted, gradational to a granular conglomerate, clasts, angular to subrounded.

*

Core to here may represent a sequence of volcanic mud flows.

121.82 - 121.99	0.17	Volcaniclastic greywacke: dark green, occasional angular fragments of carbonaceous mudstone, bedding poorly defined. BCA = 64°
121.99 - 122.34	0.35	Volcaniclastic: thinly bedded, muddy and silty phases, green to green-grey, gradational to underlying unit.
122.34 - 122.46	0.12	Sandstone: coarse grained, interbeds of greywacke, very well cemented, bedding indistinct. BCA = 53°
122.46 - 122.60	0.14	Volcaniclastic: muddy and silty phases, occasional carbonaceous fragments, poorly sorted.
122.60 - 122.93	0.33	Volcaniclastic: sandstone with conglomeratic phases, poorly sorted, angular to sub-angular fragments, larger clasts to 0.03m at base graded bedding.
Comments *		Core to here and may represent a sequence of volcanic mud flows.
122.93 - 123.14	0.21	Greywacke: fine grained, occasional stringers of carbonaceous mudstone, poorly sorted, minor cross bedding, BCA = 65°
123.14 - 123.57	0.43	Siltstone: numerous thin interbeds of sandy and muddy phases, occasional sub-angular to rounded rock fragments throughout, BCA = 60°. Altered zone 123.53 - 123.57m with chlorite, minor serpentine, and a blue black micaceous mineral.
123.57 - 126.75	0.18	Meta Conglomerate: coarse grained sandy matrix, pebble to cobble clasts, rounded to sub-angular, averaging <0.07m, clasts are of sedimentary, granitic and volcanic origin. At 124.22m mafic volcanic boulder (0.33m wide) shows low grade metamorphism and recrystallization to chlorite and euhedral feldspar grains, unit is poorly sorted.
126.75 - 127.44	0.69	Meta Siltstone: with muddy phases altered to chlorite, gradational contact to underlying unit.
127.44 - 128.37	0.93	Mudstone: pebbly, some alteration of clay fraction to chlorite, clasts are of volcanic, granitic and sedimentary rock.
128.37 - 128.86	0.49	Sandstone: medium grained, indistinct bedding with interbedded greywacke and silty phases BCA = 40°
128.86 - 129.33	0.47	Sandstone: as at 128.37, massive, minor calcite fracture filling, well sorted and well cemented.

129.33 - 129.68	0.35	Greywacke: chloritic, probably metamorphosed, minor calcite fracture filling, clasts angular to sub-rounded, dominantly volcanic, occasional sedimentary clasts.
129.68 - 129.96	0.28	Sandstone: fine grained, well sorted, massive.
129.96 - 130.09	0.13	Siltstone: dark grey, massive.
130.09 - 130.18	0.09	Mudstone: likely chloritic, sheared, minor calcite fracture filling, indistinct bedding, BCA - 85°
130.18 - 130.44	0.26	Siltstone: grey, massive, sheared, serpentine fracture filling, possible BCA = 55°
130.44 - 130.77	0.33	Sandstone: green, fine grained, indistinct bedding, calcite fracture filling, massive, BCA - 55°.
130.77 - 132.28	0.51	Greywacke: likely metamorphosed, angular to sub-rounded clasts mainly of volcanics, mafic volcanic clasts are altered to partly recrystallized chlorite and feldspar laths.
132.28 - 132.62	0.34	Siltstone: sandy chloritic, gradational contact to overlying unit, occasional small mafic, granules.
132.62 - 133.91	0.29	Sandstone: greenish, fine to medium grained, contains small lenses of greywacke up to 0.25m.
133.91 - 135.33	1.42	Mudstone: pebbly, dominantly volcanic clasts in massive, poorly to well cemented mudstone, clasts are sub-angular to sub-rounded with size decreasing toward base occasional serpentine fracture filling.
135.33 - 136.17	0.84	Mudstone: pebbly, gradational contact to volcanic clastic conglomerate, contact indistinct, matrix dominantly composed of chlorite, cross cutting sets of polished surfaces, occasional black silty interbands.
136.17 - 136.62	0.45	Greywacke: granules to pebbles of dominantly volcanics in a siltstone size matrix, mafic volcanics altered to chlorite and feldspar, poorly sorted contacts of mafic clasts to matrix is indistinct due to low grade thermal metamorphism. This unit has gradational contact to underlying unit.

136.62 - 137.93	1.31	Volcaniclastic Conglomerate: clasts composed of dominantly altered mafic volcanics, irregular sub-angular to sub-rounded clast, clasts range in size to 5.0 cm., clasts are matrix supported. At 137.76 - 137.85m. are shear zones with cross-cutting polished surfaces, thin serpentine fracture filling.
137.93 - 138.53	0.60	Volcaniclastic Sandstone: coarse grained, clean to lenses of greywacke, bedding indistinct BCA = 47°.
138.53 - 139.62	0.09	Greywacke: with sandy phases, numerous minor fractures. FCA = 32°, polished surfaces, is probably chlorite fracture filling, <0.5 cm., carbonaceous fragments are disseminated through sandstone phases. *(2)
139.62 - 141.13	1.51	Sandstone: lightbrown, fine grained, massive, dull to bright coaly rootlets, at 70 - 80° to core axis.
141.13 - 141.90	0.77	Sandstone: lightbrown, fine grained, massive, dull to bright coal rootlets, at 70 - 80° to core axis. *(3)
141.90 - 142.41	0.51	Conglomerate: rounded clasts in fine grained matrix, matrix/clasts contacts largely distinct. *(4)
142.41 - 142.42	0.01	Coal: dull lenses in sandstone.
142.42 - 143.21	0.79	Sandstone: medium to coarse grained, poorly sorted phases, gradational to conglomerate at base of unit. At 143.11 m., massive silicious, well cemented throughout, occasional pebbles at base show possible zoned alteration.
143.21 - 144.03	0.82	Siltstone: green, massive, minor slickensicles FCA = 45°.

* (2) This sequence of units likely represents a series of volcanic or epiclastic mudflows which have since undergone low grade metamorphism.

* (3) This unit appears to be channel sand cut into underlying sediments.

* (4) This may be due to low grade metamorphic recrystallization.

144.03 - 144.52	0.49	Mudstone: metamorphosed, green, approximately 40% of rock is altered to chlorite, core solid but highly friable.
144.52 - 145.25	0.73	Mudstone: pebbly: numerous sub-rounded mafic clasts, epiclastic, poorly cemented, contacts between clasts and matrix indistinctive to low grade metamorphism.
145.25 - 147.83	2.58	Volcaniclastic: pebbly mudstone, gradational to volcanic conglomerate with minor sandy and silty phases, clasts vary from grit to cobble size, and appear entirely to be mafic volcanics, some vesicular, also iron rich varieties, matrix aphanitic to medium grained recrystallized chlorite.
147.83 - 159.31	1.48	Volcaniclastic: conglomerate: as at 147.83 except, matrix is slightly metamorphosed, matrix appears to gradationally change to greywacke composition, poorly sorted, massive, clasts are dominantly volcanic with occasional sedimentary rock fragments, angular to sub-angular, many of the mafic clasts are finely porphyritic andesites, unit varies from well to moderately cemented. Near base of unit, occasional fractures at numerous altitudes with serpentine fracture filling.
159.31 - 160.06	0.75	Sandstone: grey, fine grained, massive.
160.06 - 160.16	0.10	Breccia: fine grained, angular irregular clasts to 0.4 cm., sandstone matrix as at 159.31 m.
160.16 - 160.62	0.46	Sandstone: grey, fine grained, massive.
160.62 - 160.74	0.12	Siltstone: pebbly, sub-rounded mafic clasts to 4.0 cm. diameter in massive siltstone.
160.74 - 161.04	0.30	Sandstone: as at 160.16 m.
161.04 - 161.65	0.61	Volcaniclastic: greywacke, dominantly mafic volcanic clasts in poorly sorted matrix, slightly metamorphosed.
161.65 - 162.10	0.55	Intermediate Volcanic: massive, fine grained. * (5)
162.10 - 163.07	0.97	Volcaniclastic Conglomerate: as at 147.83 - 159.31 m. serpentine \pm chlorite fracture filling, slightly metamorphosed.

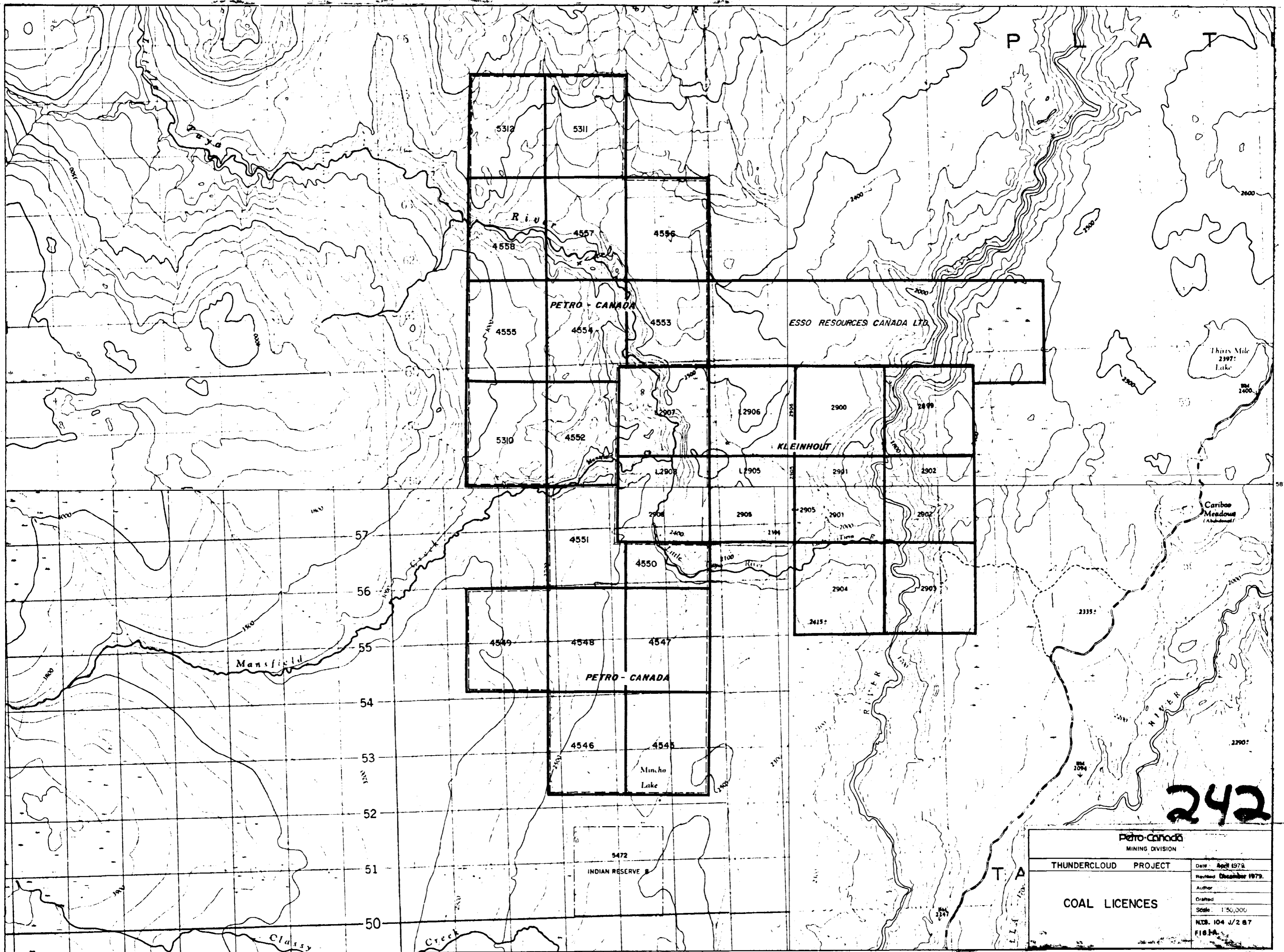
* (5) May possibly be boulder in volcaniclastic above and below this unit or a very thin flow.

163.07 - 166.17

3.10

Volcaniclastic Conglomerate: as at 162.10 m. gradational to very coarse sandstone, volcanic clasts are of more felsic compositions, light grey, partly recrystallized, contacts between clasts and matrix, mostly indistinct, occasionally zoned contacts, occasional fractures, serpentine filled.

- 166.17



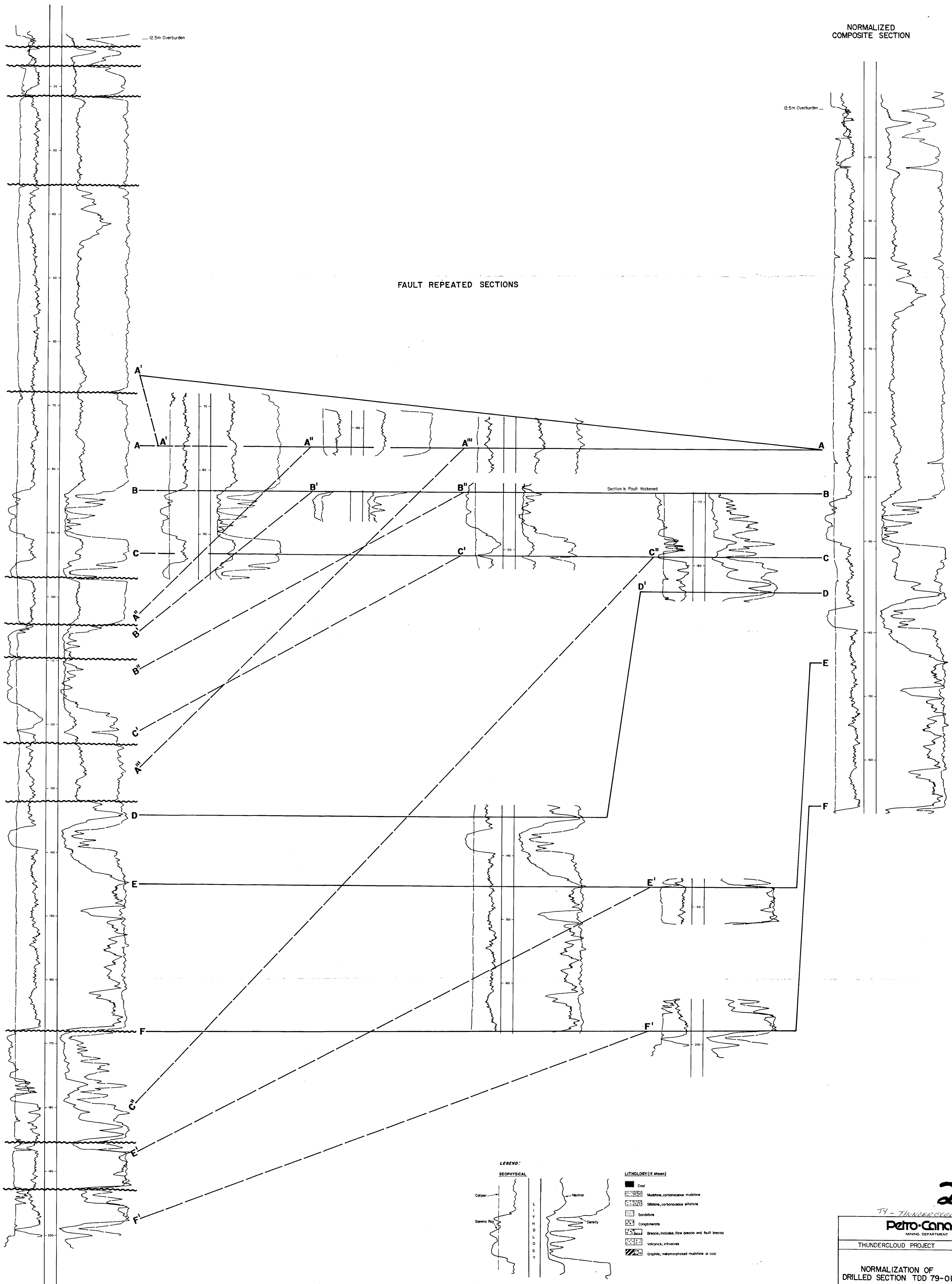
Petro-Canada MINING DIVISION	
THUNDERCLOUD PROJECT	Date: April 1978 Revised: December 1979
COAL LICENCES	Author:
	Drafted:
	Scale: 1:50,000
	NTS. 104 J/2 & 7
FIG. 1A	

TY - Thundercloud 79(2)A (7)

DRILLED SECTION

NORMALIZED COMPOSITE SECTION

FAULT REPEATED SECTIONS



SEAM 2
SEAM 1

LEGEND:

GEOPHYSICAL

Caliper

Gamma Ray

Neutron

Density

LITHOLOGY (if shown)

- Coal
- Mudstone, carbonaceous mudstone
- Siltstone, carbonaceous siltstone
- Sandstone
- Conglomerate
- Breccia, includes flow breccia and fault breccia
- Volcanic, intrusives
- Graphite, metamorphosed mudstone or coal

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T4 - THUNDERCLOUD 79(8)A '01

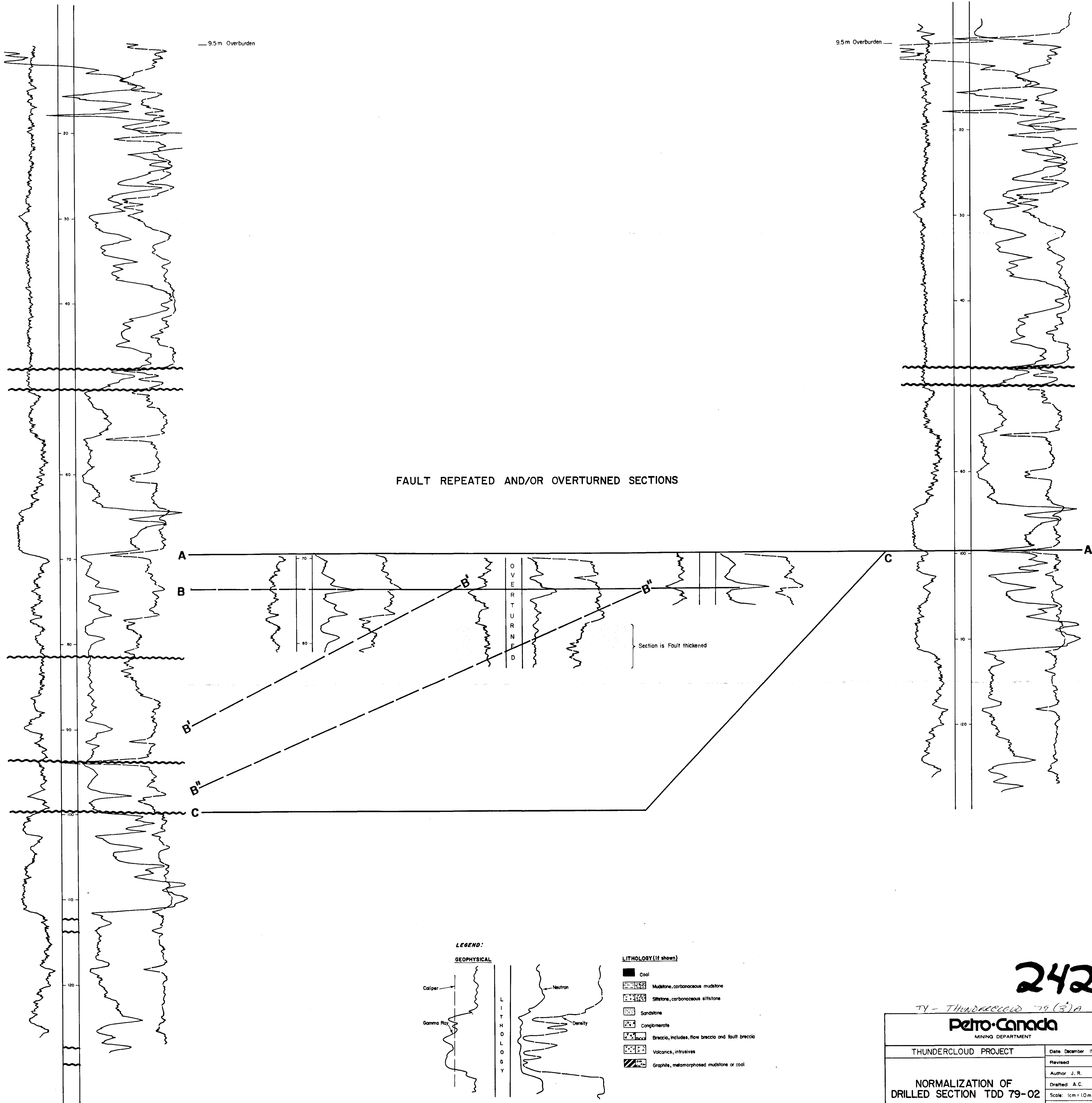
Petro-Canada
MINING DEPARTMENT

THUNDERCLOUD PROJECT	Date: December 1979
	Revised:
	Author: J. R.
	Drafted: A.C.
	Scale: 1cm = 10m
	Figure 8

**NORMALIZATION OF
DRILLED SECTION TDD 79-01**

DRILLED SECTION

NORMALIZED SECTION



242

TY - THUNDERCLOUD 79 (3) A (1)

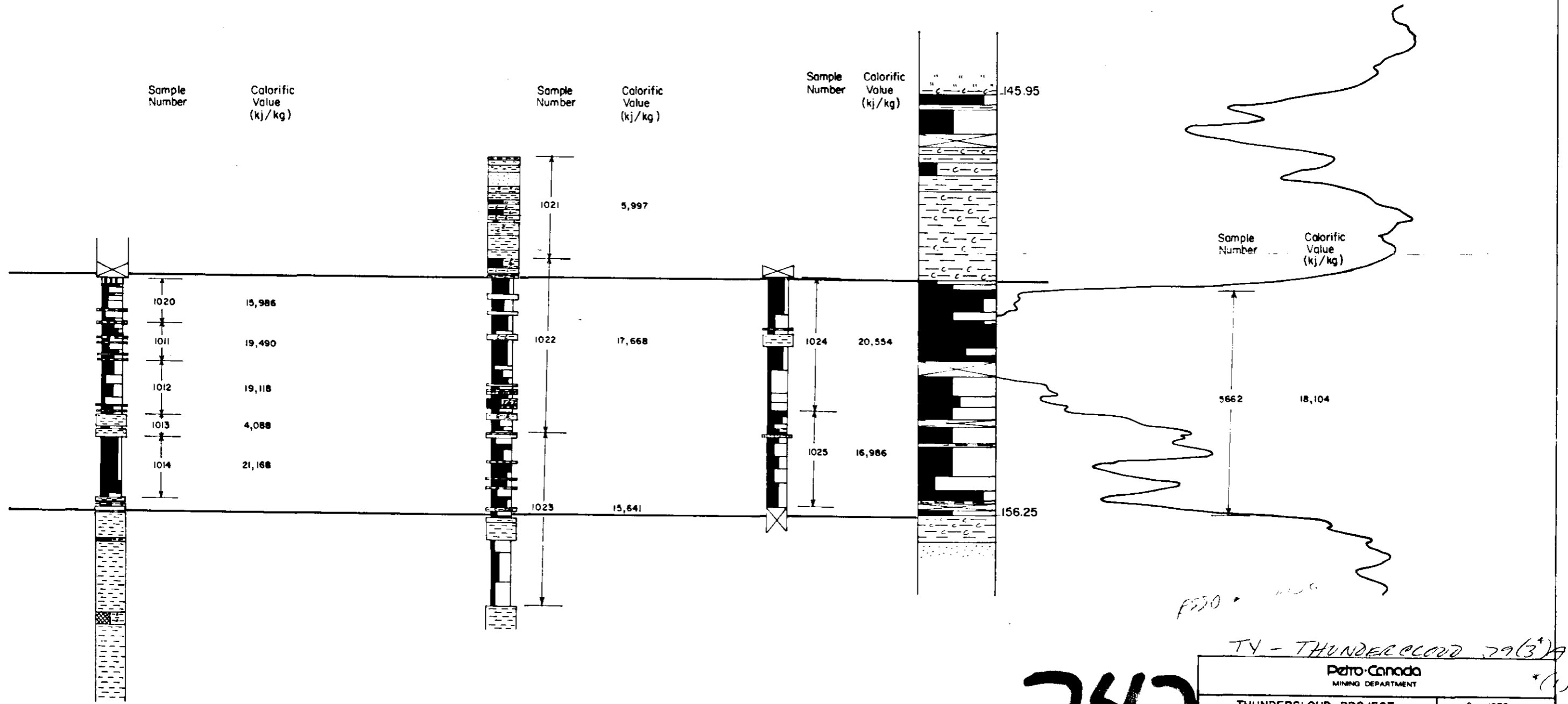
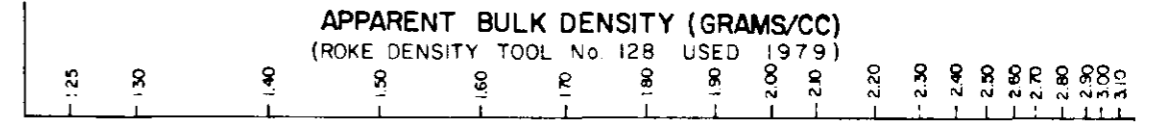
Petrol-Canada MINING DEPARTMENT	
THUNDERCLOUD PROJECT	Date December 1979
NORMALIZATION OF DRILLED SECTION TDD 79-02	Revised
	Author J. R.
	Drafted A. C.
	Scale: 1cm = 10m
	Figure 9

TRENCH 1
Little Tuya River
South Side

TRENCH 3
Mansfield Creek
North Side

TRENCH 4
Mansfield Creek
South Side

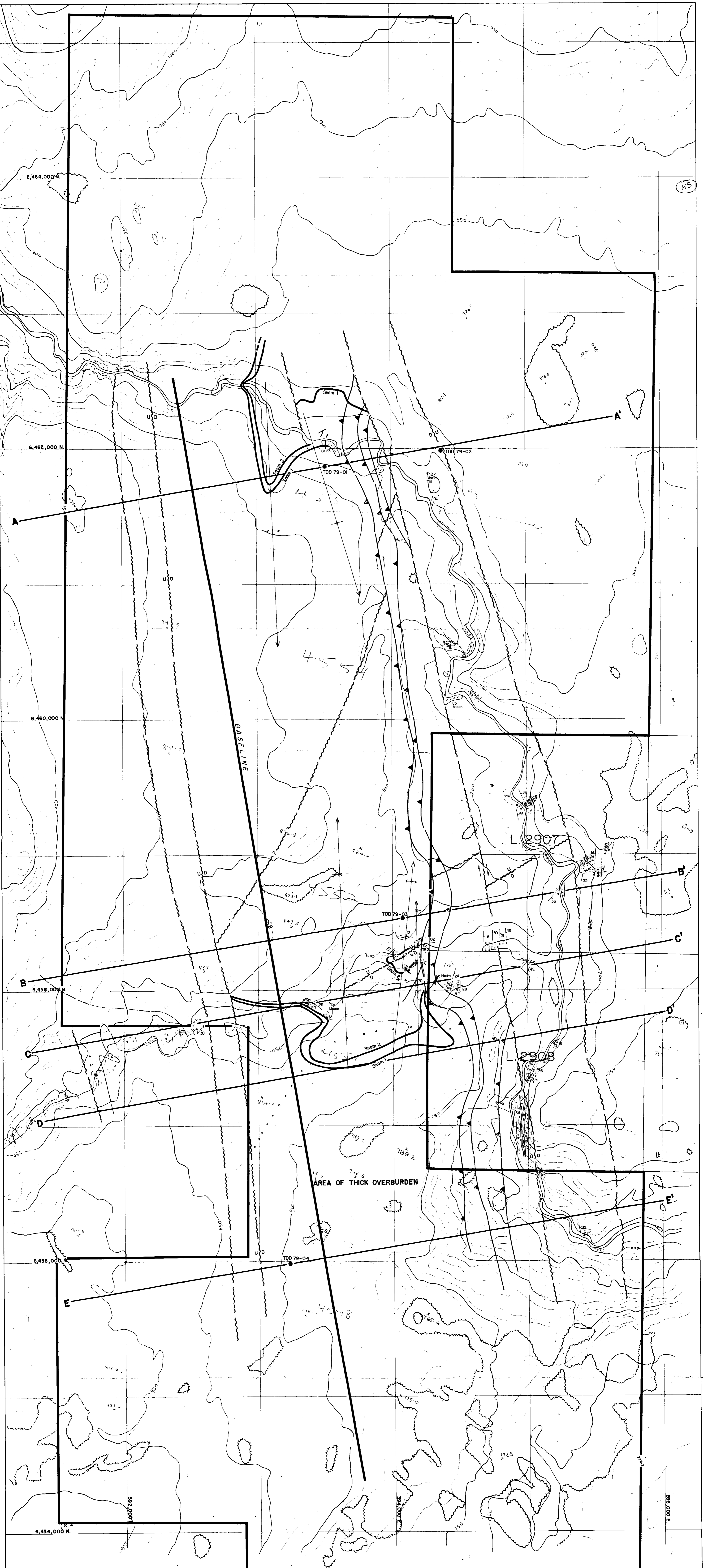
TDD 79-03 Seam 2 Upper & Lower



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*TV - THUNDERCLOUD 79(3)**

Petro-Canada MINING DEPARTMENT	
THUNDERCLOUD PROJECT	Date Dec 1979
Correlation of Hand Trenches # 1, 3, 4 with SEAM 2(u)(l) in TDD 79-03	Revised
	Author J.R.
	Drafted A.C.
	Scale: 1cm = 1.0m
	Figure 5



LEGEND:

LITHOLOGY

- gabro intrusives
- volcanics - unsubsided
- basalts, andesite, rhyolite
- porphyry and minor felsic volcanics
- may be part of both younger B
- older than intrusives B sediments.

SEDIMENTS

- sandstone
- siltstone
- mudstone
- conglomerate - unsubsided - includes both epiclastic and volcanoclastic conglomerates

Note: order of sed type in legend does not indicate stratigraphic sequence.

STRUCTURE

- bedding
- attitude of slickensides for shear zone
- foliation
- thrust faults
- normal fault
- strike slip fault showing indicated relative movement
- unsubsided / or unknown fault type
- assumed fault
- uniform, synform, including direction of plunge
- dike 1/ or sill of diabase composition may in part be thin volcanic flows
- projected outcrop of coal seam ①
- ②
- location of diamond drill collar

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TY - THUNDERCLOUD 79 (2)A (U)

Petro-Canada
MINING DEPARTMENT

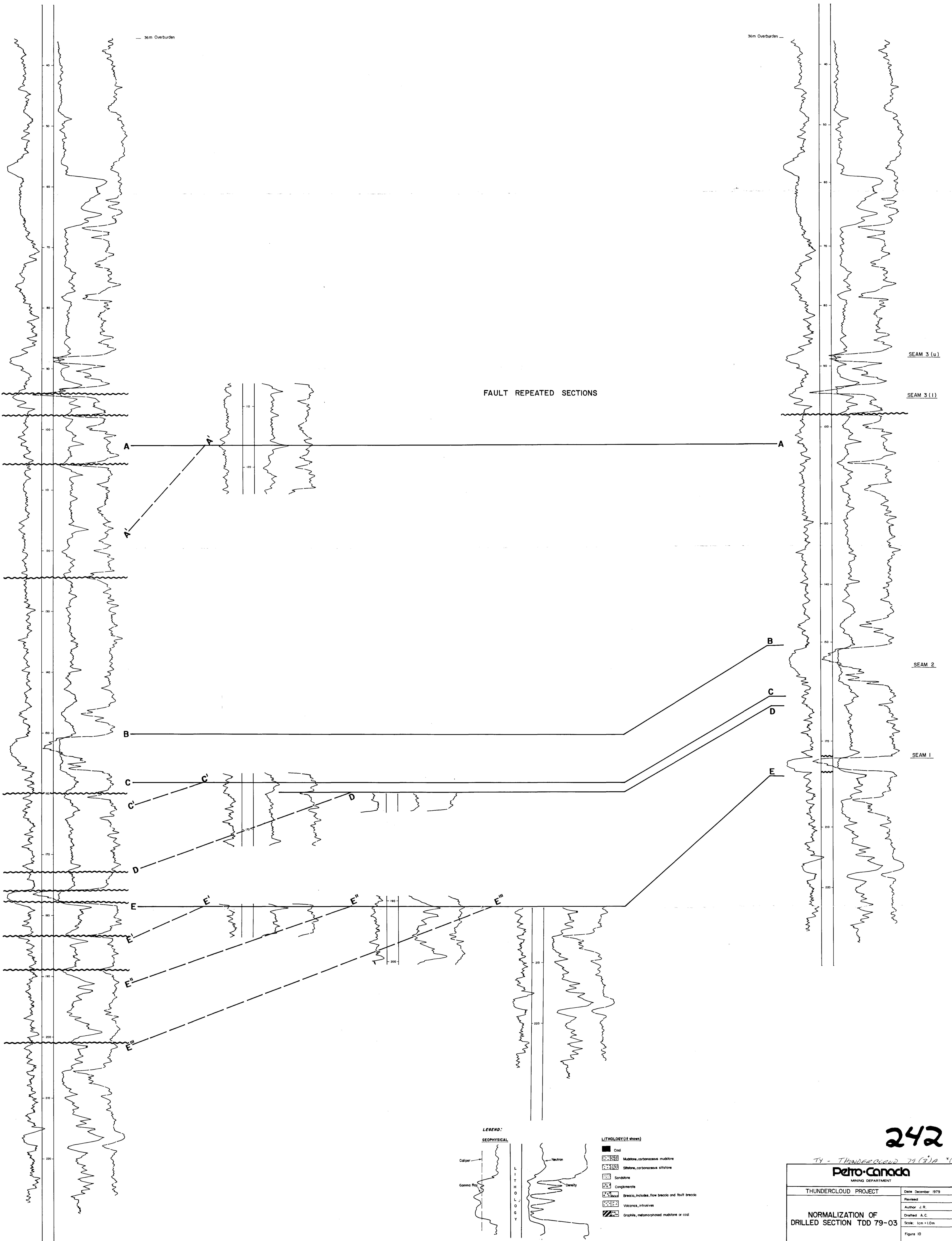
THUNDERCLOUD PROJECT

GEOLOGY

Revised	Date: December 1979
Author: J. Field	
Drafted: JBY	
Scale: 1:10000	
Figure: 13	

DRILLED SECTION

NORMALIZED SECTION



FAULT REPEATED SECTIONS

SEAM 3 (u)

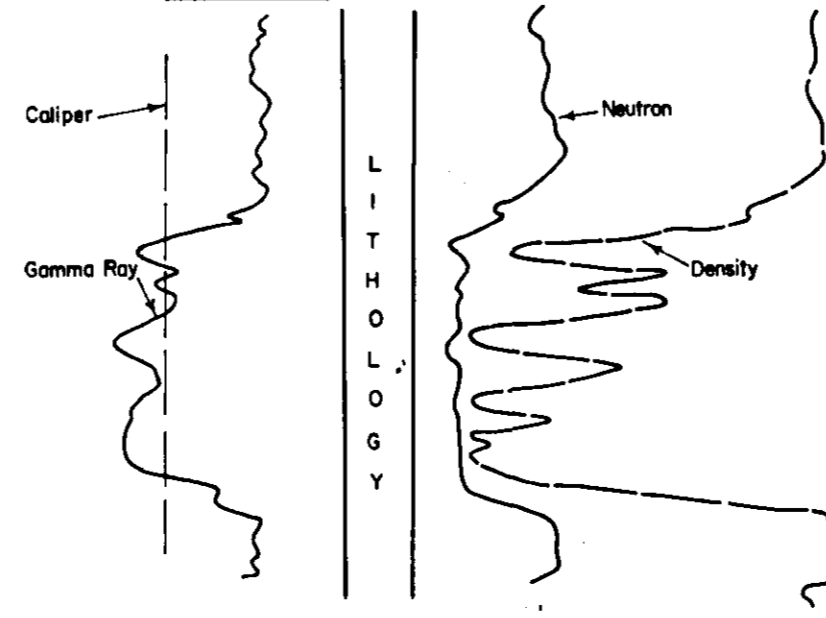
SEAM 3 (l)

SEAM 2

SEAM 1

LEGEND:

GEOPHYSICAL



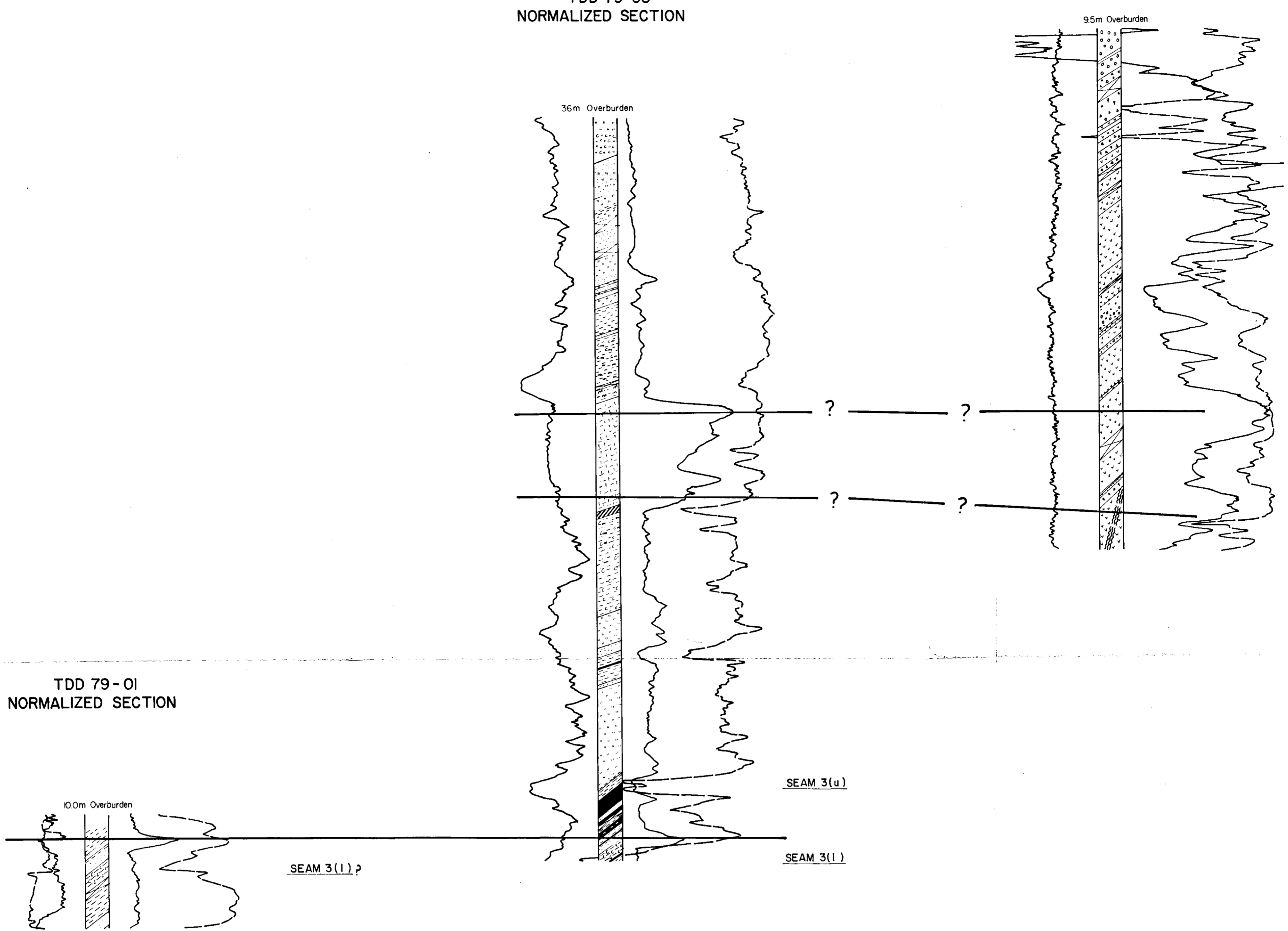
LITHOLOGY (if shown)

- Coal
- Mudstone, carbonaceous mudstone
- Siltstone, carbonaceous siltstone
- Sandstone
- Conglomerate
- Breccia, includes flow breccia and fault breccia
- Volcanics, intrusives
- Graphite, metamorphosed mudstone or coal

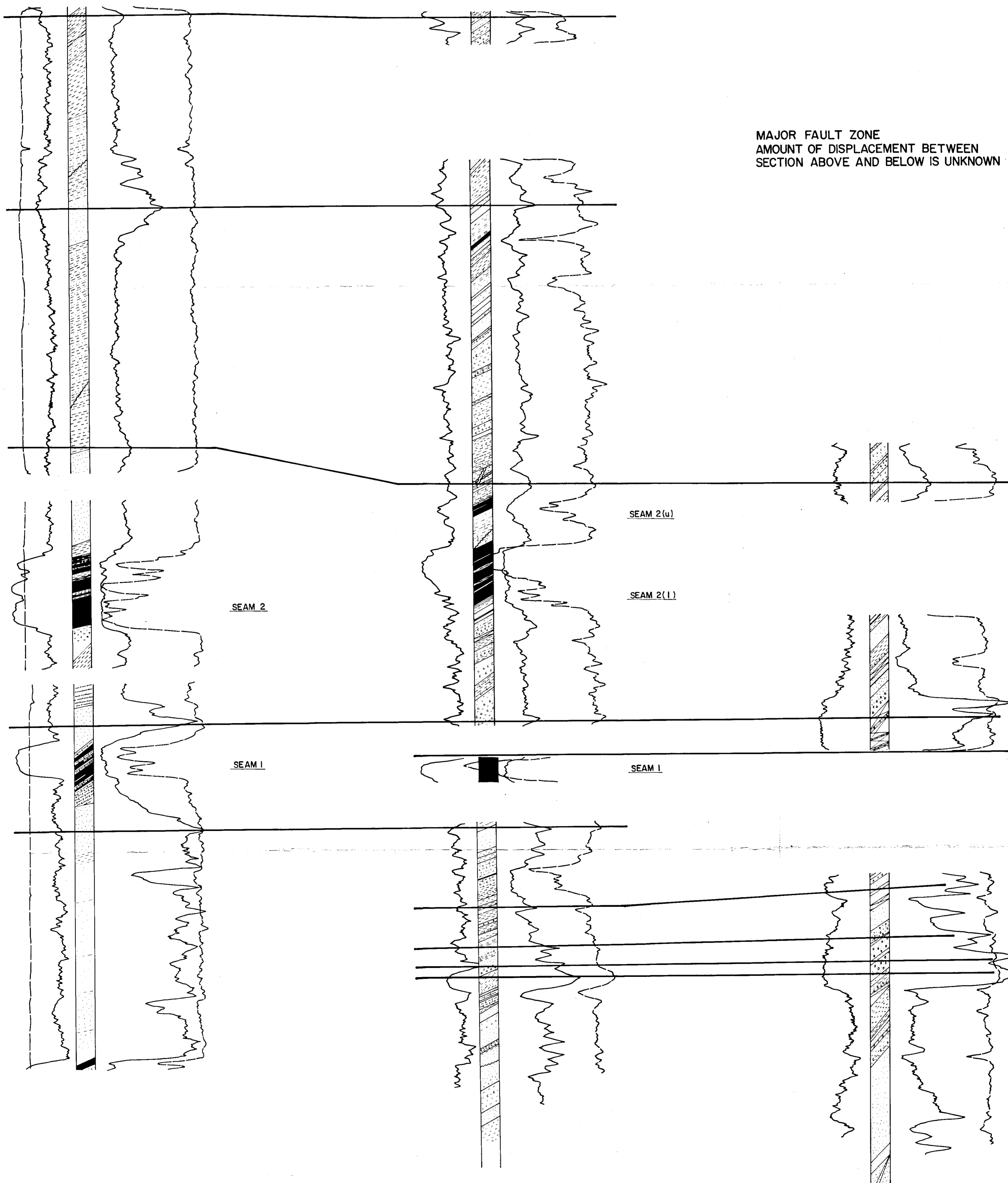
242

TY - THUNDERCLOUD 79 (3)A * (1)

Petro-Canada MINING DEPARTMENT	
THUNDERCLOUD PROJECT	Date: December 1979
NORMALIZATION OF DRILLED SECTION TDD 79-03	
Author: J.R.	Figure ID:
Drafted: A.C.	Scale: 1cm = 1.0m

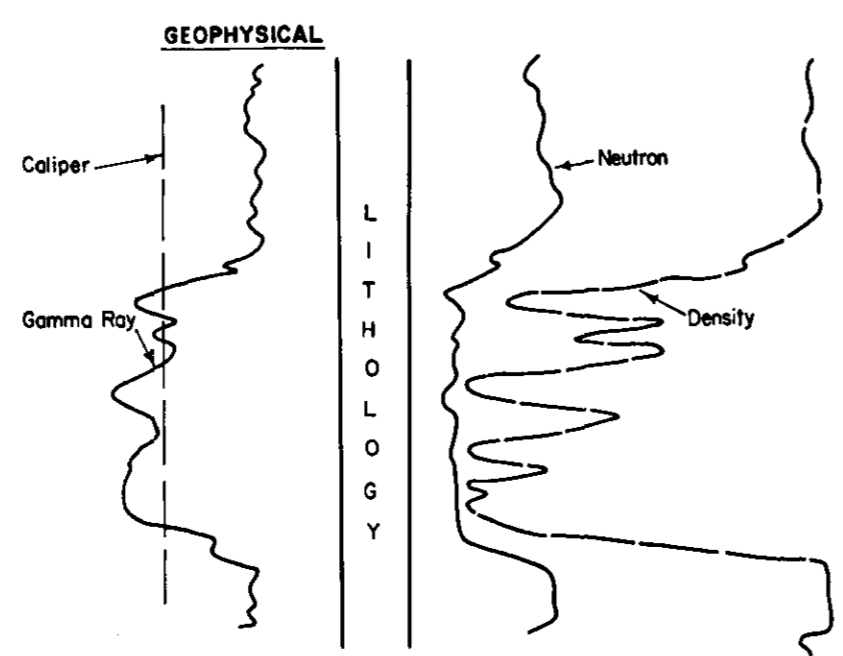


FAULT ZONE - AMOUNT OF DISPLACEMENT UNKNOWN



MAJOR FAULT ZONE
AMOUNT OF DISPLACEMENT BETWEEN
SECTION ABOVE AND BELOW IS UNKNOWN

LEGEND:



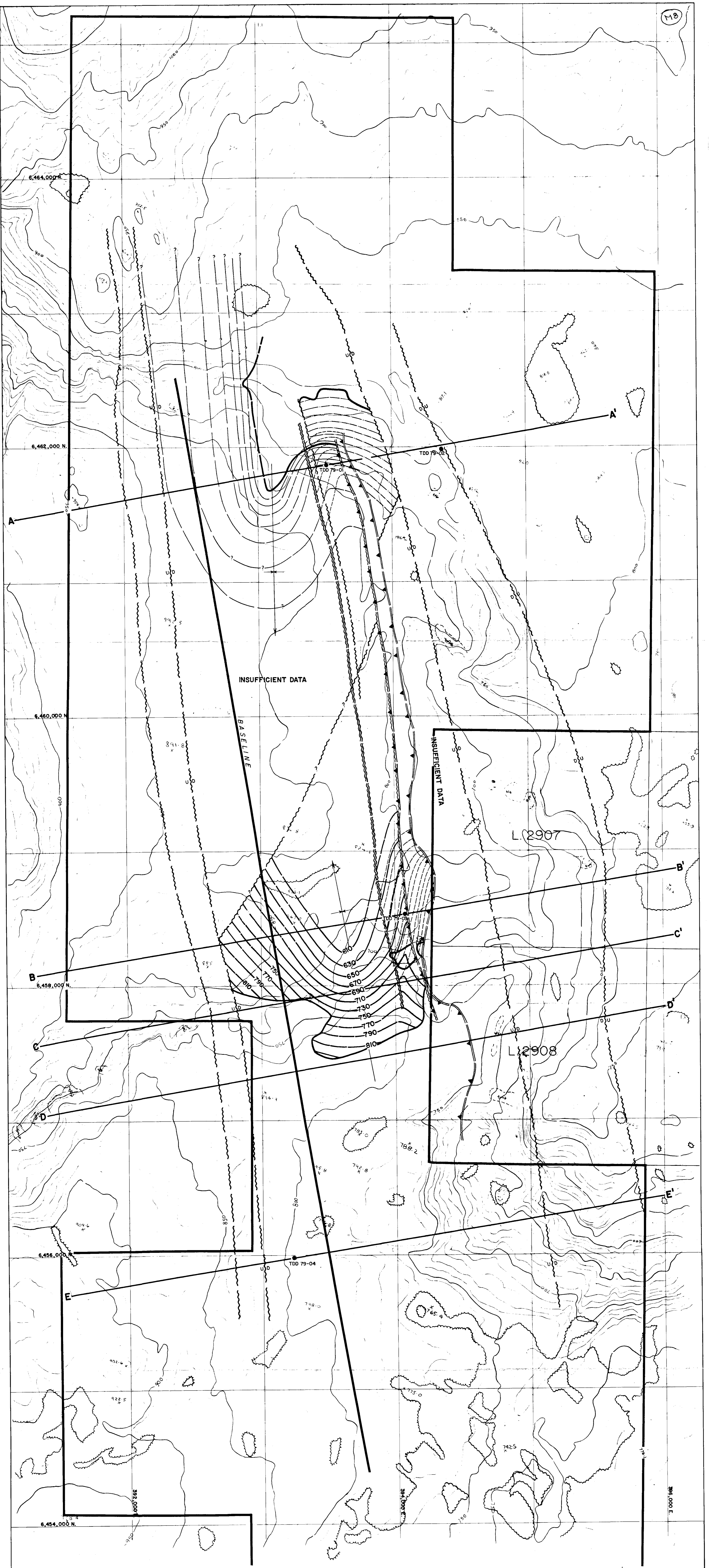
LITHOLOGY (if shown)

- Coal
- Mudstone, carbonaceous mudstone
- Siltstone, carbonaceous siltstone
- Sandstone
- Conglomerate
- Breccia, includes flow breccia and fault breccia
- Volcanics, intrusives
- Graphite, metamorphosed mudstone or coal

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TY - THUNDERCLOUD 79(3)A (1)

Petro-Canada MINING DEPARTMENT	
THUNDERCLOUD PROJECT	Date December 1979
CORRELATION OF NORMALIZED SECTIONS	
TDD 79-01, TDD 79-02, & TDD 79-03	
Author J. Reid	Revised
Drafted edy	
Scale 1cm = 1.0m	
Figure II	



INSUFFICIENT DATA

BASELINE

INSUFFICIENT DATA

L2907

L2908

LEGEND:

- normal fault
- thrust fault, showing base and upper intersection of seam
- thrust fault, as above, superimposed below
- structure contour of base of seam, approx or inferred
- formline contour, inferred



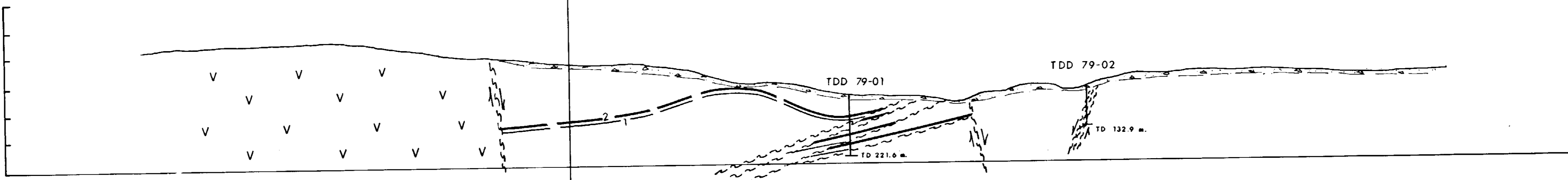
242

TY-THUNDERCLOUD 79 (2)A (1)

Petro-Canada MINING DEPARTMENT	
THUNDERCLOUD PROJECT	Date: December 1979
STRUCTURE AND FORMLINE CONTOUR OF SEAM 2 (lower)	Revised: Author: J. Reid Drawn: etc Scale: 1:10000 Figure 15

119

1100
1000
900
800
700
600
500



BASELINE

242

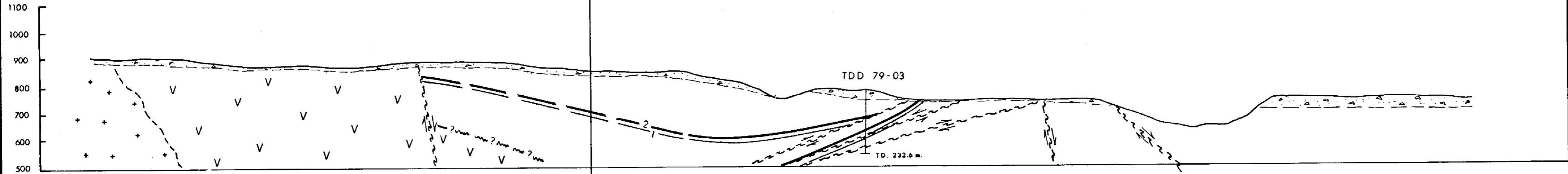
TY - THUNDERCLOUD 79(2)A

*(1)

PETRO-CANADA EXPLORATION		
THUNDERCLOUD AREA		
CROSS SECTION A-A'		
DRAWN BY: J.W.K.	DATE: DEC '79	SCALE: 1:10,000
PREPARED BY: J.R.	DATE:	DRAWING NUMBER
APPROVED BY:	DATE:	Figure 14a

TDD 79-01, TDD-79-02

M 10



242

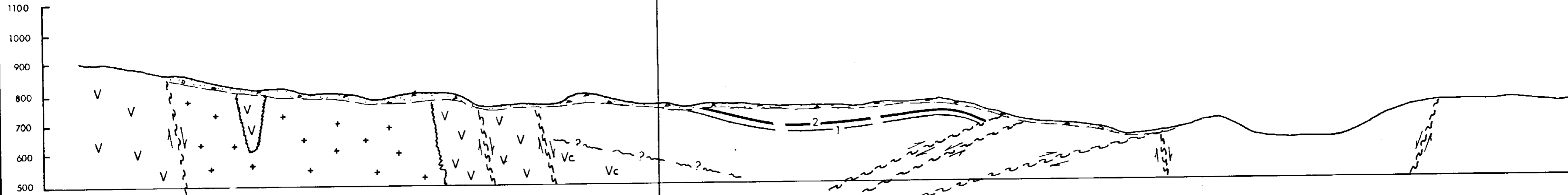
TY - THUNDERCLOUD 79(2)A (1)

PETRO-CANADA EXPLORATION		
THUNDERCLOUD AREA		
CROSS SECTION B-B'		
DRAWN BY: J.W.K.	DATE: DEC '79	SCALE: 1:10,000
PREPARED BY: J.R.	DATE:	DRAWING NUMBER
APPROVED BY:	DATE:	Figure 14b

TDD 79-03

BASELINE

MII



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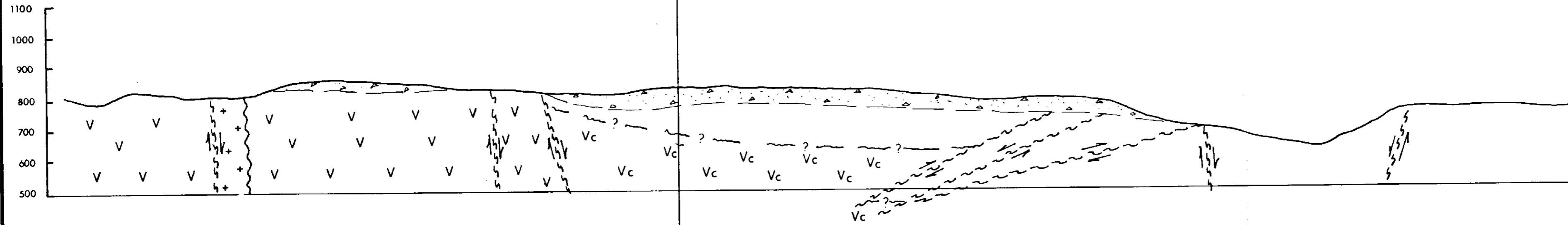
TY - THUNDERCLOUD 79(2)A

*(1)

PETRO-CANADA EXPLORATION		
THUNDERCLOUD AREA		
CROSS SECTION C-C'		
DRAWN BY: J.W.K.	DATE: DEC. '79	SCALE: 1:10,000
PREPARED BY: J.R.	DATE:	DRAWING NUMBER
APPROVED BY:	DATE:	Figure 14c

BASELINE

M12



BASELINE

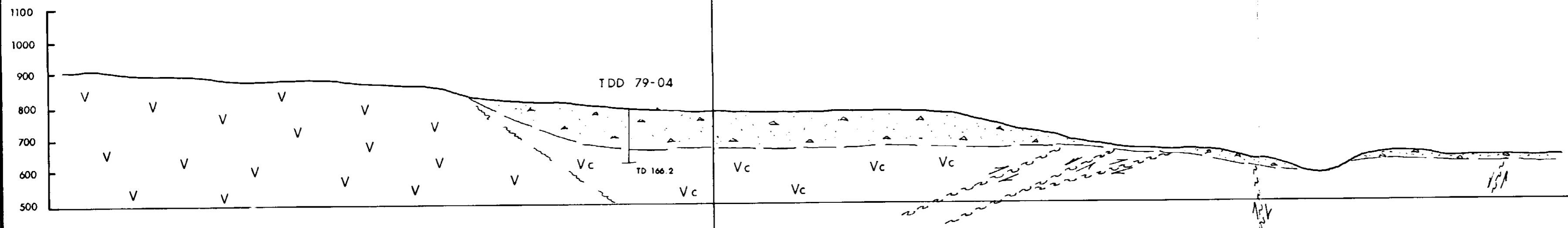
242

TY-THUNDERCLOUD 79(2)A

*(1)

PETRO-CANADA EXPLORATION		
THUNDERCLOUD AREA		
CROSS SECTION D-D'		
DRAWN BY: J.W.K.	DATE: DEC. '79	SCALE: 1:10,000
PREPARED BY: J.R.	DATE:	DRAWING NUMBER
APPROVED BY:	DATE:	Figure 14d

M13



242

TY-THUNDERCLOUD 79(2)*A *(1)

PETRO-CANADA EXPLORATION		
THUNDERCLOUD AREA		
CROSS SECTION E-E'		
DRAWN BY: J.W.K.	DATE: DEC '79	SCALE: 1:10,000
PREPARED BY: J.R.	DATE:	DRAWING NUMBER
APPROVED BY:	DATE:	Figure 14e

TDD-79-04

BASELINE