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PLACER DEVELOPMENT LIMITED

A REPORT ON THE EXPLORATION OF LIARD COAL BASIN, WATSON LAKE, M.D., YUKON TERRITORY

REPORT ON THE EXPLORATION OF
THE EXPLORATION LICENCES
66, 67, 68, 69, 113 and 114

N.T.S. 105-A-2-SEQ & SWQ

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DATE: June 20, 1980

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SUMMARY

Placer Development Limited's exploration of the Liard coal Basin has indicated the wide spread presence of lignite in a broad northwest trending basin. Limited outcrop exposure of the unconsolidated sediments largely obviates the use of surface prospecting techniques. The geology is best known from diamond drill core data.

Coal was encountered in all ten of the holes drilled by Placer Development Limited. Coal quality is low (ash, 17.51%: calorific value, 5,972 BTU) but within the range of coal quality now utilized in other power development schemes. Seams range up to about six metres in thickness and seam intersections in excess of two metres in thickness are common. Strip ratios in the areas drilled to date are relatively high in comparison to the low unit value of the coal.

The area underlain by coal is large and poorly tested. This in combination with low topographic and structural relief provides an attractive environment for additional reconnaissance exploration drilling designed to locate coal deposits with low strip ratios. An exploration program with a cost of $586,000 is recommended.

INTRODUCTION

This report describes the exploration work carried out to date on Placer Development Limited's Liard Coal Venture.

PURPOSE OF PROJECT

A number of potential hydro electric power generation sites have been identified in the southern Yukon Territory and northern British Columbia. Power generated at some of these sites could be the basis of a new transmission grid supplying consumers now using diesel generated electrical energy or being supplied with electricity on an interruptible basis. However, due to the high initial capital cost of the reservoir and dam, hydroelectric power is expensive unless the power requirement is 300 MW or larger. According to B.C. Hydro's "Liard Hydroelectric Studies Information Bulletin #2" (Sept., 1979) power from these power sites could not be available until the 1990's.

The existing or reasonably assured power demand within 250 miles of Watson Lake, Y.T. is approximately 38 MW. The power demand in the region could be between 75 and 100 MW within five years if all planned mine development in the area takes place. Estimates of existing and projected power demands are summarized below.

Consumer	Current Requirement (MW)	Future Requirement (MW)
Watson Lake	5	5
Cantung	5	5
Cypress Anvil	15	20
Carmacks	2	2
Teslin	1	2
Cassiar	10	15
Howards Pass	-	10-25
Mactung	-	5
Logtung	-	10
Len Ed	-	5
Total	38	94

There is in addition a possibility that a pipeline along the Alaska Highway could require as much as 60 MW of locally generated power.

The purpose of the Liard Coal Basin exploration venture is to identify and develop coal reserves which could meet the projected shortfall in electrical generation capacity, replace existing diesel fixed generators and provide a lower cost alternative to the hydrolectric schemes proposed for the Liard River. To meet these goals a reserve of 50 - 100 million tons of 6,000 to 7,000 B.T.U. coal will need to be identified and evaluated.

Location

The Liard Coal Property is located in the Yukon Territory, immediately north of the border with British Columbia and in the vicinity of Watson Lake, Y.T. The coal license areas are within N.T.S. map sheets 105 - A-2, 3 and 6.

Property

The property consists of eight coal exploration licences issued by the Department of Indian Affairs and Northern Development. The licenses are summarized as follows:

Licence No.	Area (Acres)	Expiry Date
66	47,830	July 11, 1980
67	46,464	July 11, 1980
68	27,353	July 11, 1980
69	15,133	July 11, 1980
70	46,994	July 11, 1980
71	47,468	July 11, 1980
113	25,500	Oct. 23, 1982
114	30,880	Oct. 23, 1980
Total Acreage	287,622	

The contiguous block of coal licenses consisting of licenses 66, 67, 68, 69, 70 and 71 are bounded by $60^{o}00'$ north latitude to the south and $60^{o}22.5'$ to the north, $129^{o}30'$ west longitude to the west and $129^{o}00'$ to the east. Licenses 113 and 114 are bounded by $60^{o}00'$ north latitude to the south and

$60^{o}7.5'$ to the north; and $128^{o}30'$ west longitude to the east and $129^{o}00'$ to the west. The locations and boundaries are illustrated in figures I and II.

Access

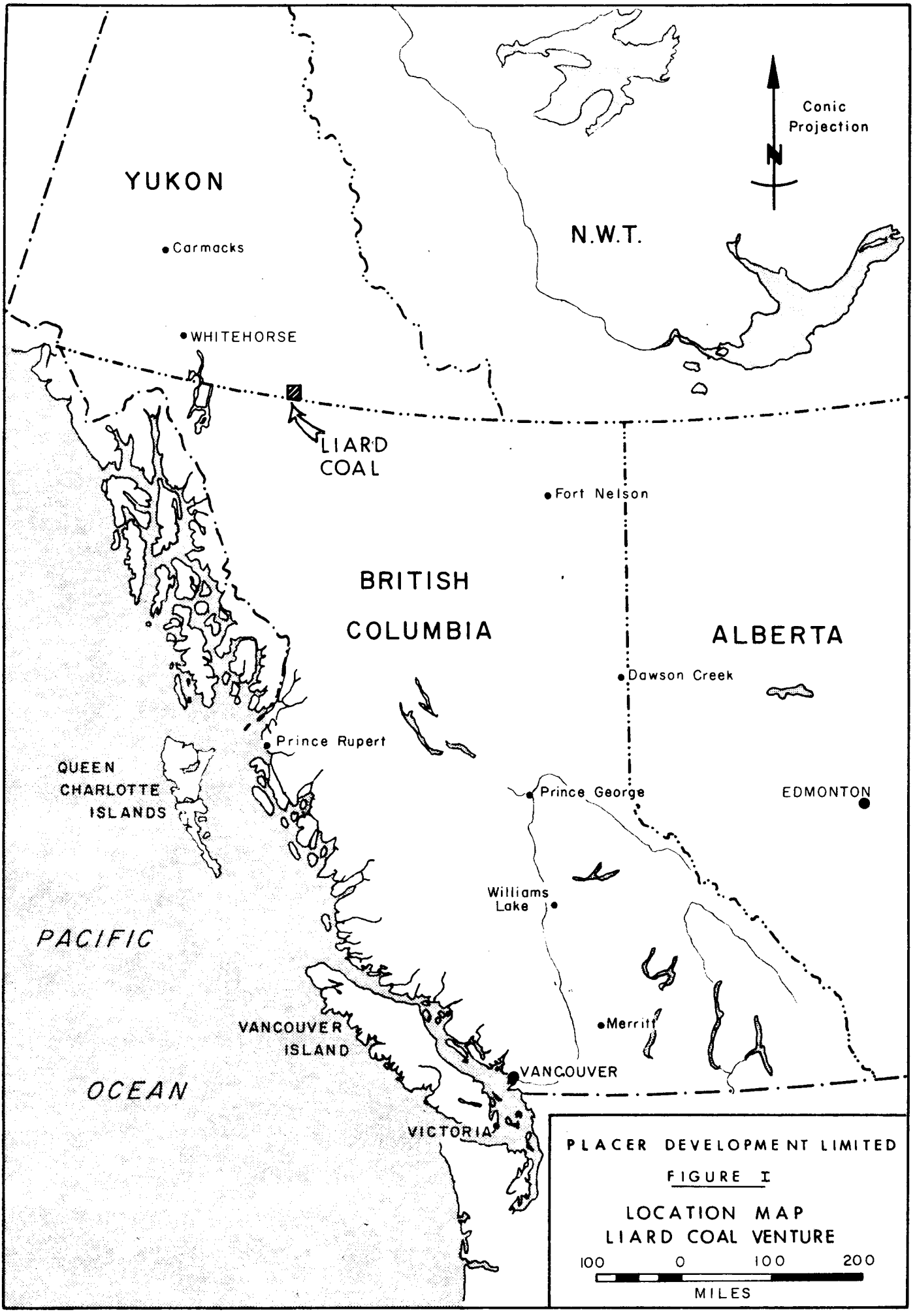
All of the coal exploration licenses, with the exception of License 71, are accessible by existing roads as illustrated in Figure III. The area of the licenses is traversed by the Alaska and Campbell Highways. Logging roads constructed by Yukon Forest Products provide additional access in areas adjacent to the public highways and the Liard River. An abandoned logging road which begins at the Alaska Highway enters the area from the west. Placer Development Limited has constructed approximately 11 Km of drill site access roads during its tenure. A portion of this area is also accessible by motor boat along the Liard, Frances and Rancheria Rivers.

Coal Exploration License 71 is not readily accessible except by heliocopter at this date.

The area of the coal licenses is one of general low topographic relief except immediately adjacent to the rivers. Access roads are easily constructed except in the immediate vicinity of surficial drainages where boggy conditions are common.

EXPLORATION HISTORY

Placer's initial exploration venture in the Liard Coal Basin was a reconnaissance traverse by B. Ainsworth and D.M. Jenkins during August of 1976. They searched the banks of the Liard River for coal exposures which have been reported in the literature since at least the early 20th Century. Exposures of weathered coal were found at several localities and coal float was found in some of the streams debouching into the Liard River. An incomplete exposure of a coal seam approaching 20 feet in thickness was found south of Watson Lake. This discovery led to the acquisition of two coal licences.


Conic
Projection
N
YUKON
N.W.T.
Carmacks
WHITEHORSE
LIARD
COAL
Fort Nelson
BRITISH
COLUMBIA
ALBERTA
Dawson Creek
Prince Rupert
QUEEN
CHARLOTTE
ISLANDS
Prince George
EDMONTON
Williams
Lake
PACIFIC
OCEAN
VANCOUVER
ISLAND
Merritt
VANCOUVER
VICTORIA
PLACER DEVELOPMENT LIMITED
FIGURE I
LOCATION MAP
LIARD COAL VENTURE
100 0 100 200
MILES

PLACER DEVELOPMENT LIMITED

LIARD COAL EXPLORATION LICENCES

WATSON LAKE, YUKON TERRITORY

FIGURE 2

Copies may be obtained from the Map Distribution Office, Department of Mines and Technical Surveys Ottawa.

Scale 1:250,000

1 Inch to 4 Miles Approximately

Miles 5 0 5 10 15 20 Miles

Kilometres 5 0 5 10 15 20 25 30 Kilometres

Lic. No. 71 | Lic. No. 70 | Lic. No. 67 | Lic. No. 66 | Lic. No. 69 | Lic. No. 68 | Lic. No. 61 | Lic. No. 62

NTS 105-A-6 | NTS 105-A-7 | NTS 105-A-3 | NTS 105-A-2

YUKON TERRITORY

PROVINCE OF BRITISH COLUMBIA

129° 00'

FILE NO. 77-00-V-162-2B-0012

LEGEND

⑨ THE CAMPBELL HIGHWAY

LOGGING ROADS

OUTLINE OF THE LOCATION MAP
1:50 000 SCALE

REFERENCE

ROADS:-*ROUTES*:
- hard surface - *pavée*
- loose surface - *de gravier*
- cart track - *de terre*
- trail - *sentier*
- Deletions - *Suppressions* x x x x x

Road, Hard Surface, Heavy Duty — 3 or more Lanes / 2 Lanes — Partially completed / Route No.
" Hard Surface, Heavy Duty — 2 Lanes
" Hard Surface, Medium Duty — 3 or more Lanes — Not less than 14 ft. wide
" Loose Surface, Graded and Drained — 3 or more Lanes
Roads — Poor condition
Railway, Double Track
" Single Track — Station / Stop
Boundary, International
" Provincial
" County or Land District
" Reservation, Military, etc.
Electric Power Line — on Steel Towers / on Wood Poles

REFERENCE

Triangulation Station
Contours, Elevation — 1500 / 1000
" Depression — 2000 / 1500
Form Lines
Stream, Intermittent
Dam
Falls
Rapids
Airfield, Military, El. in feet 765
" Civil
" Auxiliary
Building
Church
School
Spot Elevation, in feet .821
Wooded Areas
Swamp or Marsh
Cliff
W.L. 631
Navigation Light
Mud or Sand
Seaplane Base
Seaplane Anchorage
Fire Lookout Tower
Bench Mark BM 752
Telephone, Trunk Route

I. Borovic and P. Pacor prospected the area of the coal licences and a larger area along the Liard, Rancheria and Frances rivers during May and June of 1977. Coal outcrop discoveries duringthis program provided the impetus for acquisition of six additional coal licences in that year. Mapping, prospecting and sampling of the area was accomplished in September of 1977.

A program of bulldozer trenching and widely spaced diamond drilling commenced in November of 1977 and ran intermittently through April of 1978. A total of four trenches were cut. Their locations are shown on the Geology Map (Figure III). The locations of the three diamond drill holes completed during this period are shown on the same map. Significant coal intersections were encountered in all of the 1977 and 1978 diamond drill holes. This encouragement led to a seven hole diamond drilling program during 1979. This program was carried out in an area west of the Liard River and immediately north and south of the Alcan Highway (Figure III).

Early recognition of the problems inherent in the exploration of a very poorly exposed coal basin led to a search for a relatively low cost alternative to grid diamond drilling. A trial of volatile hydrocarbon soil geochemistry was suggested by P.M.D. Bradshaw and subsequently carried out by Barringer Magenta Limited during 1979.

Geology

The oldest geological notes on the Upper Liard coal were written by G.M. Dawson. Following are excerpts from D.B. Dowling's "Coal Fields of B.C., G.S.C. Memoir 69 of 1915:"

> "The Upper Liard was traversed by Dr. G.M. Dawson, who notes Tertiary rocks on the Dease River and again on the Upper Liard and Frances Rivers and on his map joins them all into one rather large area. His description of the rocks in the Liard is here incorporated:

"'Six miles from the canyon Tertiary clays of whitish and grey colours, and associated with impure lignite, are first met with, and these continue to appear here and there along the river as far as the Frances. The thickest bed of lignite observed was about three feet, four miles below the Frances. The lignite is generally impure and often very distinctly laminated. It resembles in character the lignites of the Miocene of British Columbia, and the associated clays and soft shales are similar in character to those of that formation. Numerous boulders of basalt are found along this part of the river, and the basalt was observed to form a mural cliff, at a height of about 300 feet above the river, at a place just below the mouth of the Rancheria river. This rock evidently overlies the lignite-bearing beds. The shaley clays and lignites show evidence of considerable disturbance, and dip in some places at rather high angles. This may be due to the action of old land-slides along the banks of the river; but appears to be rather too constant to be satisfactorily accounted for in this way."'

W.S. Hopkins Jr. of the Geological Survey of Canada carried out a palynological study of sediments from the Liard Coal Basin. He tentatively identified the flora as being upper Paleocene or lowest Eocene in age.

I. Borovic (1978) reported to Placer Development an interpretation of an airborne magnetic survey which formed part of his initial evaluation of the coal potential of the region. The sedimentary or structural basin which he outlined in that report is shown in Figure III of this report. His description is as follows:

"Lower Tertiary sediments occur in an elongated trough, approximately outlined on the 1:50,000 scale map, 105-A-3, 3 and 6. The outline of the trough is

based on the 1"=4 miles G.S.C. geology map 105A and correlation supported by the airborne magnetic survey (1961), shown on the sheet 105-A-2, 3 and 6. The trough (basin) is elongated in NW-SE direction more or less along the Liard River and probably cut by two or more cross faults of obscure nature. The airborne magnetic survey shows existence of tertiary volcanic rocks, which was verified by field examination of the area. The thickest (?) portion of the trough appears to be located around Dodo Lakes and Upper Liard."

The Paleocene age lignite containing sediments have been penetrated to a maximum depth of 153 metres in a single drill hole. The total stratigraphic range, which has been penetrated by bore holes, is thought to be approximately 180 metres. This is based on rather tenuous stratigraphic correlations. The northern most holes cannot be placed in the existing correlation matrix. This is due to gross changes in lithology and a lack of marker horizons. The base of the Paleocene stratigraphic section has not been identified, therefore, the thickness of the Paleocene sediments is unknown as is the total thickness of basin fill in the Liard Coal Basin. Due to the paucity of outcrop, a data base bearing on sediment thickness or distribution does not exist in most areas away from the Liard River or the drill pattern.

The sediments penetrated by the bore holes are classical fining upward sequences of unconsolidated clastic sediments deposited in fluvial environments. These sequences commonly range between 5 and 15 metres thick. Texturally the sediments range from boulder gravels to silty clays with organic clay and coal. Normally the coarsest sediments are granule sized grains. Textural immaturity is characteristic of the finer sands. Sorting tends to increase as grain size increases in the sand size fraction. Mineralogically the coarser sediments are immature and rock fragments are abundant. These rock fragments range in composition from acid and intermediate intrusive plutonic rocks to chemically equivalent effusive rocks.

Lignitic coal was found in every drill hole. Due to poor recovery, thickness and quality of coal are not easily evaluated from the drill core (see Appendix A for drill logs). Some of the coal seams are only known from the geophysical logs which comprise Appendix B of this report. Coal analysis are given in Appendix C and are also shown on the drill sections (Figures IV to XIII).

Arithmetic means of analytical data (Appendix C) for 30 selected samples from diamond drill holes provide an indication of coal quality. These samples were selected because they contain less than 25% ash on a dry basis. These means are as follows:

	Mean Value	Range
H_2O (As Received)	38.55%	24.43 - 44.46%
Ash (Dry Basis)	17.51%	8.62 - 25%
Sulphur (Dry Basis)	0.28%	0.18 - 0.44
BTU's (As Received)	5.972	5258 - 7261
BTU's (Dry Basis)	9,549	8319 - 10,706

Ultimate analyses of the coal have not been carried out. Chemical analyses of the ash have not been made.

Physically the coal consists of dark brown to black colored very finely divided organic matrix with varying amounts of wood chips, charcoal and grass or leaf fragments comprising the remainder of the carbonaceous materials. Inorganic contaminents consist largely of silt or clay size material dispersed through the coal and are not readily identified in quantities approaching 10%. The coal contacts are generally gradational, through increases in the quantity of clay to organic clay.

The coal seams range in thickness up to approximately 15 metres including all splits and dirty coal. The best drill hole (LC-2) has an aggregate thickness of coal in seams exceeding one metre in thickness, of approximately 16.4 metres. This is contained within a 48 metre stratigraphic thickness. The top of this interval lies 56 metres below the surface.

FILE NO. 78-05-V-162-1B-0009

Depth in Metres from collar L.C.-1.	Moisture %	Ash %	Volatile Matter %	Fixed Carbon %	Sulphur %	Calorific Value BTU/lb.
— 7.7 m	26.68 as recvd.	39.05	30.63	3.64	0.43	3,656
	dry basis	53.26	41.77	4.97	0.58	4,987
— 0.3 m	24.65	43.65	27.89	3.81	0.30	2,371
		57.93	37.01	5.06	0.40	3,147
0.7 m	22.51	54.07	13.83	9.59	0.24	1,639
		69.78	17.85	12.37	0.31	2,115
— 0.3 m	19.52	55.89	14.22	10.37	0.21	1,631
		69.45	17.67	12.88	0.26	2,027
0.4 m	22.72	54.95	13.27	9.06	0.23	1,561
		71.11	17.17	11.72	0.30	2,020

Figure IV

Placer Development Limited

LIARD COAL - V-162

D.D.H. L.C.-1 graphic log showing coal intersections and proximate analyses

May 15, 1978 — Scale 1:500 — I. B - A.K.

FILE NO. 78-05-V162-2B-0010

Depth in Metres from collar	L.C.-2.	Moisture %		Ash %	Volatile Matter %	Fixed Carbon %	Sulphur %	Calorific Value BTU/lb.
0.2 m		36.61	as recv'd.	19.00	24.42	19.97	0.16	5,114
			dry basis	29.98	38.53	31.49	0.26	8,067
1.7 m		40.50		12.36	27.19	19.95	0.14	5,482
				20.78	45.70	33.52	0.24	9,214
0.3 m		44.46		4.79	28.53	22.22	0.14	5,946
				8.62	51.36	40.02	0.25	10,706
0.2 m		44.21		8.64	26.30	20.85	0.16	5,493
				15.48	47.14	37.38	0.28	9,846
0.3m		41.78		5.42	30.09	22.71	0.17	6,158
				9.31	51.68	39.01	0.29	10,567
1.8 m		42.76		7.69	28.31	21.24	0.13	5,757
				13.44	49.47	37.09	0.22	10,058
1.5 m		42.23		5.33	29.26	23.18	0.13	6,139
				9.22	50.65	40.13	0.23	10,627
1.2 m		41.14		9.47	28.10	21.29	0.14	5,741
				16.09	47.73	36.18	0.24	9,754
0.6m		39.22		11.49	27.99	21.30	0.14	5,676
				18.91	46.05	35.04	0.23	9,338
0.3m		41.25		23.95	20.05	14.75	0.10	3,855
				40.76	34.13	25.11	0.17	6,562
4.0m		35.59		11.36	29.80	23.25	0.15	6,217
				17.63	46.27	36.10	0.23	9,652
0.8 m		27.42		20.45	29.23	22.90	0.22	5,896
				28.18	40.28	31.54	0.31	8,123
2.2 m		36.58		5.68	31.94	25.80	0.15	6,734
				8.95	50.37	40.68	0.24	10,619
1.3 m		37.38		14.18	28.05	20.39	0.16	5,704
				22.65	44.80	32.55	0.26	8,994
1.8 m		33.76		17.57	28.26	20.41	0.20	5,640
				26.53	42.66	30.81	0.31	8,514
0.4m		35,06		14.70	28.34	21.90	0.21	5,832
				22.64	43.64	33.72	0.33	8,980
0.2 m		23.61		37.11	23.62	15.66	0.24	4,364
				48.58	30.92	20.50	0.32	5,713
1.7m		23.65		21.74	33.23	21.38	0.18	6,301
				28.47	43.53	28.00	0.23	8,253

Figure V

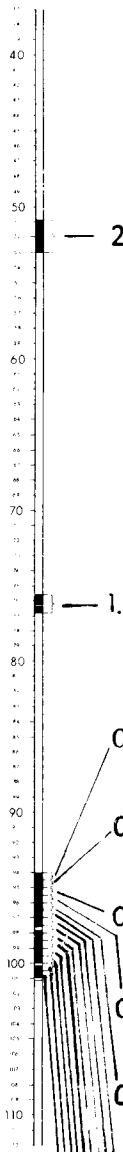
Placer Development Limited

LIARD COAL-V-162

D.D.H. L.C.-2 graphic log showing coal intersections and proximate analyses

May 15, 1978 — Scale 1:500 — I.B. — A.K.

FILE NO. 78-05-V-162-1B-0011



Depth in Metres from collar	L.C-3.	Moisture %	Ash %	Volatile Matter %	Fixed Carbon %	Sulphur %	Calorific Value BTU/lb.
— 2.1m		35.13 as recv'd.	15.41	29.40	20.06	0.21	5,747
		dry basis	23.75	45.33	30.92	0.33	8,859
— 1.2m		35.97	18.36	25.87	19.80	0.26	6,319
			28.68	40.41	30.91	0.40	8,200
	0.5m	27.58	47.73	18.90	5.79	0.09	2,641
			65.91	26.10	7.99	0.13	3,647
	0.5m	30.41	36.67	21.61	11.31	0.14	3,735
			52.69	31.05	16.26	0.20	5,367
	0.5m	26.15	51.37	17.04	5.44	0.07	2,348
			69.55	23.07	7.38	0.10	3,180
	0.5m	27.95	41.86	22.25	7.94	0.13	3,286
			58.10	30.88	11.02	0.18	4,561
	0.5m	31.06	31.97	24.21	12.76	0.14	4,087
			46.37	35.11	18.52	0.21	6,016
	0.5m	37.40	19.95	25.30	17.35	0.17	4,884
			31.87	40.41	27.72	0.28	7,802
	0.5m	32.80	33.13	22.49	11.58	0.11	3,766
			49.30	33.47	17.23	0.17	5,604
	0.5m	36.70	20.49	25.42	17.39	0.20	4,859
			32.36	40.16	27.48	0.31	7,676
	0.5m	41,11	9.78	29.80	19.31	0.18	6,020
			16.61	50.60	32.79	0.30	10,222
	0.5m	39.68	10.27	30.41	19.64	0.19	6,124
			17.03	50.41	32.56	0.32	10,153
	0.5m	35.06	30.77	19.81	14.36	0.15	3,845
			47.38	30.50	22.12	0.23	5,921
	0.5m	39.87	14.92	26.46	18.75	0.16	5,258
			24.81	44.00	31.19	0.27	8,744
	0.5m	38.17	15.47	30.18	16.18	0.20	5,376
			25.03	48.81	26.16	0.32	8,695
	0.4m	40.53	11.66	27.32	20.49	0.23	5,716
			19.61	45.94	34.45	0.39	9,611

Figure VI

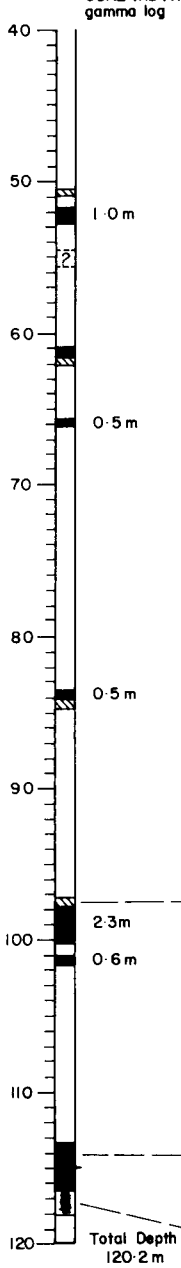
Placer Development Limited

LIARD COAL-V-162

D.D.H. L.C.-3 graphic log showing coal intersections and proximate analyses.

May 15, 1978 — Scale 1:500 — I.B. - A.K.

79-1



COAL WIDTH gamma log	ANALYZED WIDTH	MOISTURE %	ASH %	VOLATILE MATTER %	FIXED CARBON %	SULPHUR %	CALORIFIC VALUE BTU/lb	SAMPLE NUMBER
1·0 m	0·15 m	4·2 (air dried)	30·13	43·97	21·16	0·29	7,153	58901
		(dry basis)	31·69	46·06	22·25	0·31	7,523	
0·5 m								
0·5 m	0·36 m	4·41	29·63	45·05	20·91	0·44	7,366	58902
			31·00	47·13	21·87	0·46	7,706	
		3·69	70·85	20·15	5·31	0·25	2,069	58903
			73·56	20·92	5·52	0·26	2,148	
2·3m	0·4m	4·72	45·68	35·33	14·27	0·26	5,628	58904
	1·4m		47·94	37·08	14·98	0·27	5,907	
0·6m	0·15m	6·87	22·96	44·37	25·80	0·32	8,140	58905
			24·65	47·64	27·71	0·34	8,740	
		6·87	22·96	44·37	25·80	0·32	8,140	58906
	1·5 m		24·65	47·64	27·71	0·34	8,740	
	1·5 m	6·11	42·46	32·11	19·32	0·24	5,556	58907
			45·22	34·20	20·58	0·26	5,918	

Total Depth 120·2 m

Poor Recovery – No Gamma Log

COAL < 50% ASH

ORGANIC CLAY > 50% ASH

FIGURE VII

PLACER DEVELOPMENT LIMITED

LIARD COAL V-162

GRAPHIC LOG SHOWING COAL INTERSECTIONS AND PROXIMATE ANALYSES

DDH 79-1

MAY, 1980. SCALE 1: 500 D.M.J. (J. L.)

79-2

COAL WIDTH gamma log	ANALYZED WIDTH	MOISTURE %	ASH %	VOLATILE MATTER %	FIXED CARBON %	SULPHUR %	CALORIFIC VALUE BTU/lb	SAMPLE NUMBER
0·9m								
		(air dried)	33·53	40·56	19·26	0·38	6,559	58908
	0·8m	(dry basis) 6·65	35·92	43·45	20·63	0·41	7,026	
2·9m	0·95m	5·80	33·12	40·65	20·43	0·14	7,255	58909
			35·16	43·15	21·69	0·15	7,702	
1·2m	1·2m	6·97	25·83	49·58	17·62	0·23	7,756	58911
	0·8m	6·22	27·77	53·29	18·94	0·25	8,337	
	0·5m	4·35	45·80	33·31	14·67	0·13	4,894	58912
			48·84	35·52	15·64	0·14	5,219	
			59·76	24·92	10·97	0·12	3,510	58913
			62·48	26·05	11·47	0·13	3,670	
0·7m	0·20m	8·30	11·43	51·79	28·48	0·40	8,962	58914
			12·46	56·48	31·06	0·44	9,773	
0·6m								
1·1m	0·8m	6·93	32·04	42·54	18·49	0·50	6873	58915
			34·43	45·71	19·86	0·54	7385	
2m Very Dirty	1·1m	4·54	58·31	27·95	9·20	0·28	3760	58916
	1·9m	7·58	61·08	29·28	9·64	0·29	3939	
3·1m	1·0m	6·38	18·59	48·78	20·05	0·26	8651	58917
			20·11	52·78	27·11	0·28	9361	
			28·97	44·51	20·14	0·27	7565	58918
			30·94	47·54	21·52	0·29	8081	

Total Depth 129·5m

COAL < 50% ASH

ORGANIC CLAY > 50% ASH

FIGURE VIII

PLACER DEVELOPMENT LIMITED

LIARD COAL V-162

GRAPHIC LOG SHOWING COAL INTERSECTIONS AND PROXIMATE ANALYSES

DDH 79-2

MAY, 1980 SCALE 1:500 D.M.J. (J.L.)

79-3

COAL WIDTH gamma log	ANALYZED WIDTH	MOISTURE %	ASH %	VOLATILE MATTER %	FIXED CARBON %	SULPHUR %	CALORIFIC VALUE BTU/lb	SAMPLE NUMBER
3·4 m								
0·8 m								
1·4 m	1·4 m	6·08 (air dried)	54·56	30·20	9·16	0·21	4,150	58943
		(dry basis)	58·09	32·16	9·75	0·22	4,419	
<0·8 m Dirty								
<0·8 m Dirty								
1·6 m	<<1·6m	9·86	10·28	50·23	29·63	0·34	8,922	58944
			11·41	55·72	32·87	0·38	9,898	
1·1 m	1·2 m							
0·03m								
1·1 m								

15 20 30 40 50 60 70 80 90 100 110 120 130 140 150

Total Depth 153 m

COAL < 50 % ASH

ORGANIC CLAY > 50 % ASH

FIGURE IX

PLACER DEVELOPMENT LIMITED

LIARD COAL V-162

GRAPHIC LOG SHOWING COAL INTERSECTIONS AND PROXIMATE ANALYSES

DDH 79-3

MAY, 1980. SCALE 1:500 DMJ. (J.L.)

79-4

COAL WIDTH gamma log	ANALYZED WIDTH	MOISTURE %	ASH %	VOLATILE MATTER %	FIXED CARBON %	SULPHUR %	CALORIFIC VALUE BTU/lb	SAMPLE NUMBER
		(as recv'd)	67·78					58925
		(dry basis)	88·70					
<0·5m			32·51	24·73	11·91	0·15	3,861	58926
0·9m	0·9m	23·58	47·01	35·77	17·22	0·21	5,584	
1·7m	1·5m	30·85						
0·6m			12·77	35·99	19·18	0·20	6,173	58927
1·6m	1·4m	32·06	18·80	52·97	28·23	0·30	9,086	
1·9m	1·4m	24·43						
	0·4m	30·07	17·69	37·68	20·20	0·20	6,287	58928
			23·41	49·86	26·73	0·26	8,319	
			44·85	17·67	7·41	0·07	2,559	58929
			64·13	25·27	10·60	0·10	3,660	
0·4m			Dirty					
			Dirty					
			Dirty					
			26·95	30·77	18·47	0·28	5,376	58930
0·7m	0·7m		35·38	40·38	24·24	0·37	7,056	
	1·0m		18·94	33·31	15·67	0·19	5,419	58931
			27·89	49·04	23·07	0·28	7,979	
	1·2m	23·81	17·76	32·93	17·19	0·22	5,573	58932
2·5m	0·9m	32·08	26·16	48·52	25·32	0·32	8,210	
	0·85m	32·12	7·30	39·42	25·63	0·18	7,261	58933
	1·6m	27·65	10·09	54·49	35·42	0·25	10,036	
4·6m	1·5m	30·87	13·76	34·23	21·14	0·15	6,197	58934
	0·53m	22·36	19·90	49·51	30·59	0·21	8,964	
			24·14	33·98	19·52	0·28	5,929	58935
2·0m	1·5m		31·09	43·76	25·15	0·36	7,636	
1·7m	<10% Recovery	8·68						
		(air dried)	9·25	52·12	29·95	0·17	9,339	58920
		(dry basis)	10·13	57·07	32·80	0·19	10,227	
			Dirty					

Total Depth 143·8

FIGURE X

PLACER DEVELOPMENT LIMITED

LIARD COAL V-162

GRAPHIC LOG SHOWING COAL INTERSECTIONS AND PROXIMATE ANALYSES DDH 79-4

MAY, 1980. SCALE 1:500 D.M.J. (J.L.)

COAL <50% ASH

ORGANIC CLAY >50% ASH

79-5

COAL WIDTH gamma log	ANALYZED WIDTH	MOISTURE %	ASH %	VOLATILE MATTER %	FIXED CARBON %	SULPHUR %	CALORIFIC VALUE BTU/lb	SAMPLE NUMBER
0·6m								
0·3m								
1·8 m	1·5 m	35·08 (as recvd)	18·98	30·24	15·70	0·16	5,334	58936
		(dry basis)	29·24	46·58	24·18	0·25	8,217	
1·4m	1·2m	37·47	14·84	31·06	16·63	0·11	5,531	58937
			23·73	49·67	26·60	0·18	8,845	
2·3 m (1·0m + 0·7m)	1·0m	29·14	19·29	32·08	19·49	0·16	5,736	58938
	0·7m		27·23	45·27	27·50	0·22	8,095	
1·5 m	1·0 m	25·33	26·94	26·51	21·22	0·14	5,331	58939
			36·08	35·50	28·42	0·19	7,139	
		29·02	18·86	33·81	18·31	0·16	6,153	58940
			26·57	47·63	25·80	0·22	8,669	
1·5m								
1·6m	1·2 m	27·30	12·02	36·44	24·24	0·30	6,785	58941
			16·53	50·12	33·35	0·41	9,333	
0·7m	2·3m	18·76	29·40	33·06	18·78	0·33	5,821	58942
			36·19	40·70	23·11	0·41	7,165	
2·3m								

30 40 50 60 70 80 90 100 110 120 130

Total Depth 139·2

COAL < 50 % ASH

ORGANIC CLAY > 50 % ASH

FIGURE XI

PLACER DEVELOPMENT LIMITED

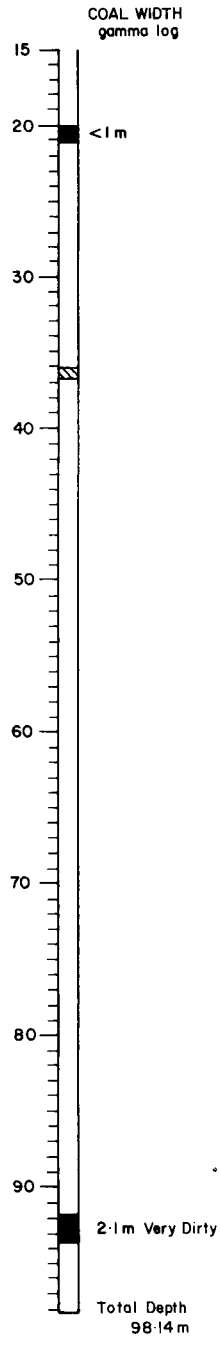
LIARD COAL V-162

GRAPHIC LOG SHOWING COAL INTERSECTIONS AND PROXIMATE ANALYSES

DDH 79-5

MAY, 1980. SCALE 1:500 D.M.J. (J.L.)

79-6



COAL < 50 % ASH

ORGANIC CLAY > 50 % ASH

FIGURE XII

PLACER DEVELOPMENT LIMITED

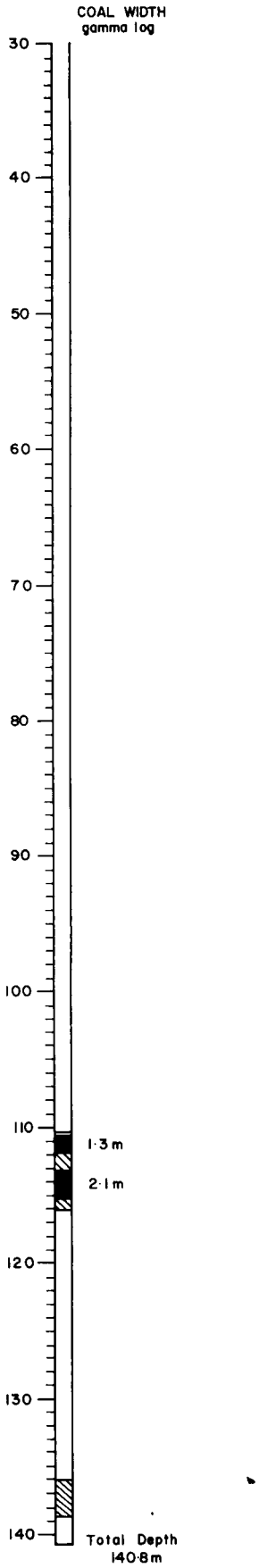
LIARD COAL V-162

GRAPHIC LOG SHOWING
COAL INTERSECTIONS AND
PROXIMATE ANALYSES

DDH 79-6

MAY, 1980. SCALE 1:500 D.M.J. (J.L.)

79-7



COAL <50% ASH

ORGANIC CLAY >50% ASH

FIGURE XIII

PLACER DEVELOPMENT LIMITED

LIARD COAL V-162

GRAPHIC LOG SHOWING
COAL INTERSECTIONS AND
PROXIMATE ANALYSES
DDH 79-7

MAY, 1980 SCALE 1:500 D.M.J. (J.L.)

The coal beds as indicated by the current data base are lenticular in cross section and persistence of a bed or sequence of beds throughout the basin or a major portion of the basin is not to be expected. An east-west cross section from DDH79-2 and DDH79-5 (Figure XIV, in pocket) illustrates the degree of continuity which might be expected. It is possible that continuity along the sedimentary strike may be greater. This direction has not been defined.

A corollary to the lack of continuity of individual coal beds is that individual beds will probably demonstrate strong variations in coal quality.

Borovic who recently (1977) spent a period of several weeks examining outcrops in the Liard Coal Basin made the following comments about the structural geology of the area.

> "Structure and relations to the other formations are not yet well understood. The attitude of the sediments does not follow any visible structural pattern. The beds are sometimes steeply dipping and sometimes horizontal or gently dipping (5^{o}-10^{o})....
>
> A definite angular unconformity was observed at the outcrop RC-77-35 and 36, near the confluence of the Rancheria and Liard Rivers. Coal measures dip 50^{o}SE and are overlain with horizontally lying basal conglomerates followed by deposition of cross-bedded sandstones.
>
> The relative age of the unconformity is possibly post Eocene."

Based on the tentative correlation of coal seams, the structure of the sediments within the drill pattern south of the Alaska highway is flat with a maximum dip of approximately 2-5^{o}NE. Short wavelength folds of low amplitude could occur

between the wide spaced drill holes but there is no unequivocal evidence to suggest this structural complexity in the vicinity of the drill pattern. It is conceivable that broad warps with amplitudes approaching the imprecision of the drill hole collar elevation estimates do exist. Precise surveying of the drill hole collars would resolve this ambiguity.

Estimation of Coal Quality Parameters From Geophysical Logs

ROKE Oil Enterprises Ltd. carried out, at no cost to Placer, an evaluation of the potential for estimating coal quality parameters from geophysical logs. They were supplied by Placer with geological logs of the drill cores and copies of the analyses of coal samples. The results of their study are appended (Appendix D) to this report.

ROKE's study generated estimates of coal quality parameters for 47 intersections of coal or carbonaceous sediments. Unfortunately, ROKE's choices of intersection intervals do not, in most cases, correspond to the intervals sampled during Placer's core logging. In only seven cases are the intervals or combinations of the intervals in the two studies similar enough to validly compare the results. The intervals correspond to sample numbers 58927, 58928, 58929, 58930, 58931, 58933, 58934 and 58940. Those data derived from combinations of assays or estimates from geophysical logs are calculated as averages weighted by the lengths of the intersections.

ROKE's study includes a plot of laboratory derived analytical values for calorific value versus dry ash content. The plot closely approximates a straight line for which a regression coefficient of 0.9886 was calculated. This is taken as indicating the analytical data are of good quality and can be used as a standard against which the estimates of coal quality parameters derived from the geophysical logs can be compared.

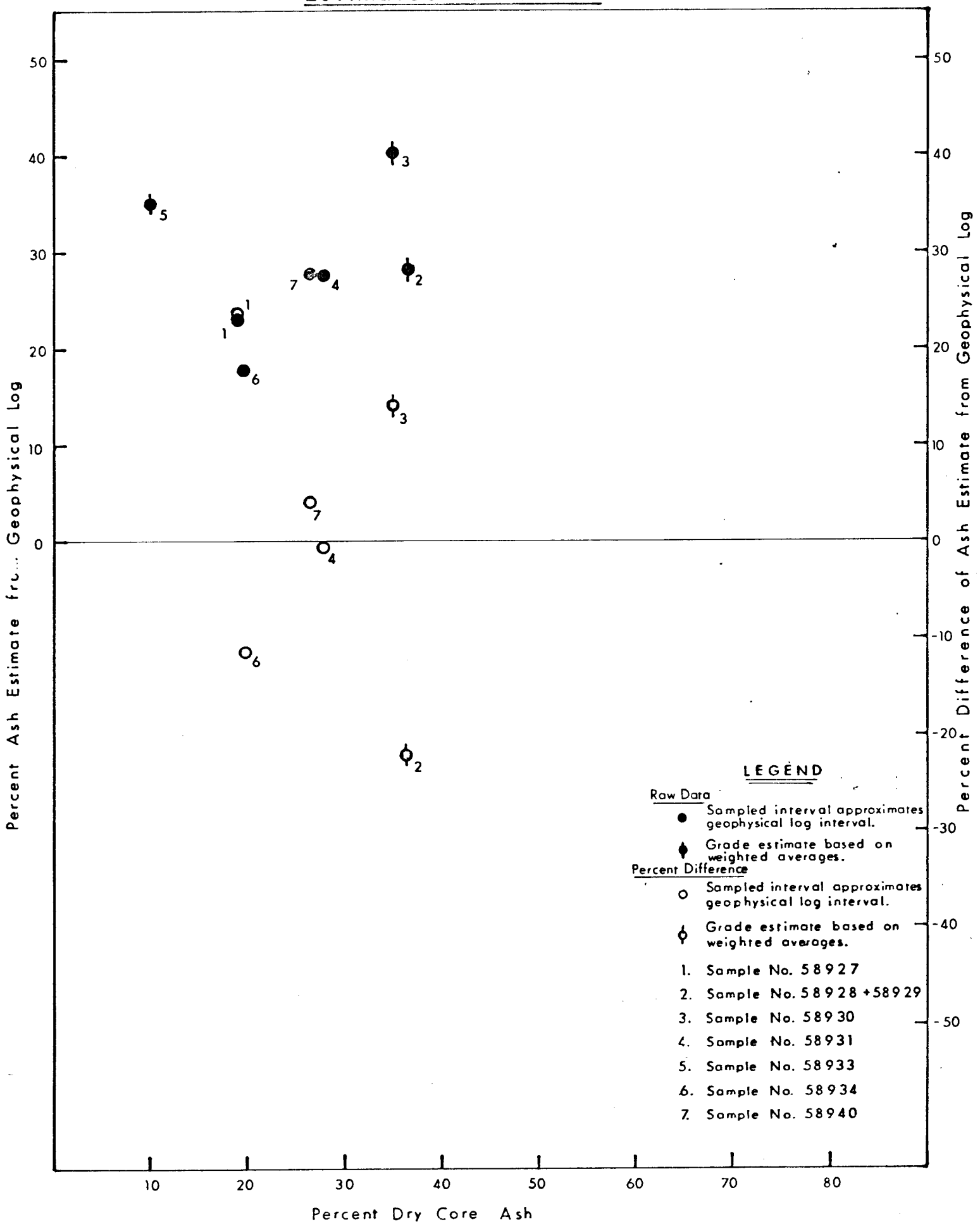
The low ratios of core recovery in most of the coal intersections preclude their use in a comparative analysis with the estimates from geophysical logs. In those cases where high ratios of core recovery were obtained the thicknesses of coal seams as estimated from geophysical logs closely approximate those measured in the core, but only when the coal seams exceed 1 metre in thickness. In the thicker coal seams, seam widths as estimated from the geophysical logs frequently are 0.2 to 0.3 metres less than the true widths. The widths of narrow beds, either of high ash splits in coal seams or narrow coal seams, on the order of 0.3 metre wide or less are overestimated.

The estimated widths are frequently 100% greater than the true widths. The problem is relatively unimportant in the case of isolated narrow coal seams. Such is the case in hole 79-4 where the geophysical log based estimate of the width of the coal seam, at a depth of 101.5 metres, is 0.6 metre as opposed to the true width of 0.30 metre. The problem becomes very important in the case of narrow beds of high ash content within coal seams. Sample number 58933 has an ash content by analysis of 10.09%. The estimated ash content is approximately 250% higher. The difference is due in large part to the over-estimated (0.5 metre) width of an 0.19 metre wide clay bed.

Excluding the case of sample number 58933 the average deviation of estimated ash contents from the measured ash content is 12.66% with a range of up to 23.7% difference. The small size of the sample population precludes vigerous statistical treatment. A graphical plot (Figure XV) of ash content from core analyses against the percentage of deviation of the estimated ash content indicates the best estimates (0.0% deviation) are made at approximately 26.5% ash content. The geophysical logs tend to underestimate the ash contents at lower ash levels and over estimate the ash contents at higher levels.

Figure XV

Comparison of Coal Ash With Estimated Coal Ash



Estimates of calorific value are inversely related to the ash estimates. The most precise estimates are made at the 8150 BTU level (Figure XVI). At lower BTU levels the calorific value is overestimated form the geophysical data. At higher levels the calorific value is underestimated. The estimated calorific value deviates from the measured value by an average of 6.85% (excluding sample 58933).

The distrubution of data points which occurs when estimates of core moisture are plotted (Figure XVII) against the measured moisture indicates the existence of at least two separate populations of data. The reasons for the distribution of the data are not presently known. The percentage of difference between the estimated moisture content and the measured water content of coal was found to be as much as 22.83% but averages 9.9%.

The variability of the data is reduced if those sets of data calculated from weighted averages are ignored. In this case, based on only four samples, it would appear that the estimated ash content is correct within 10% and the estimated calorific value is correct within about 4.2%.

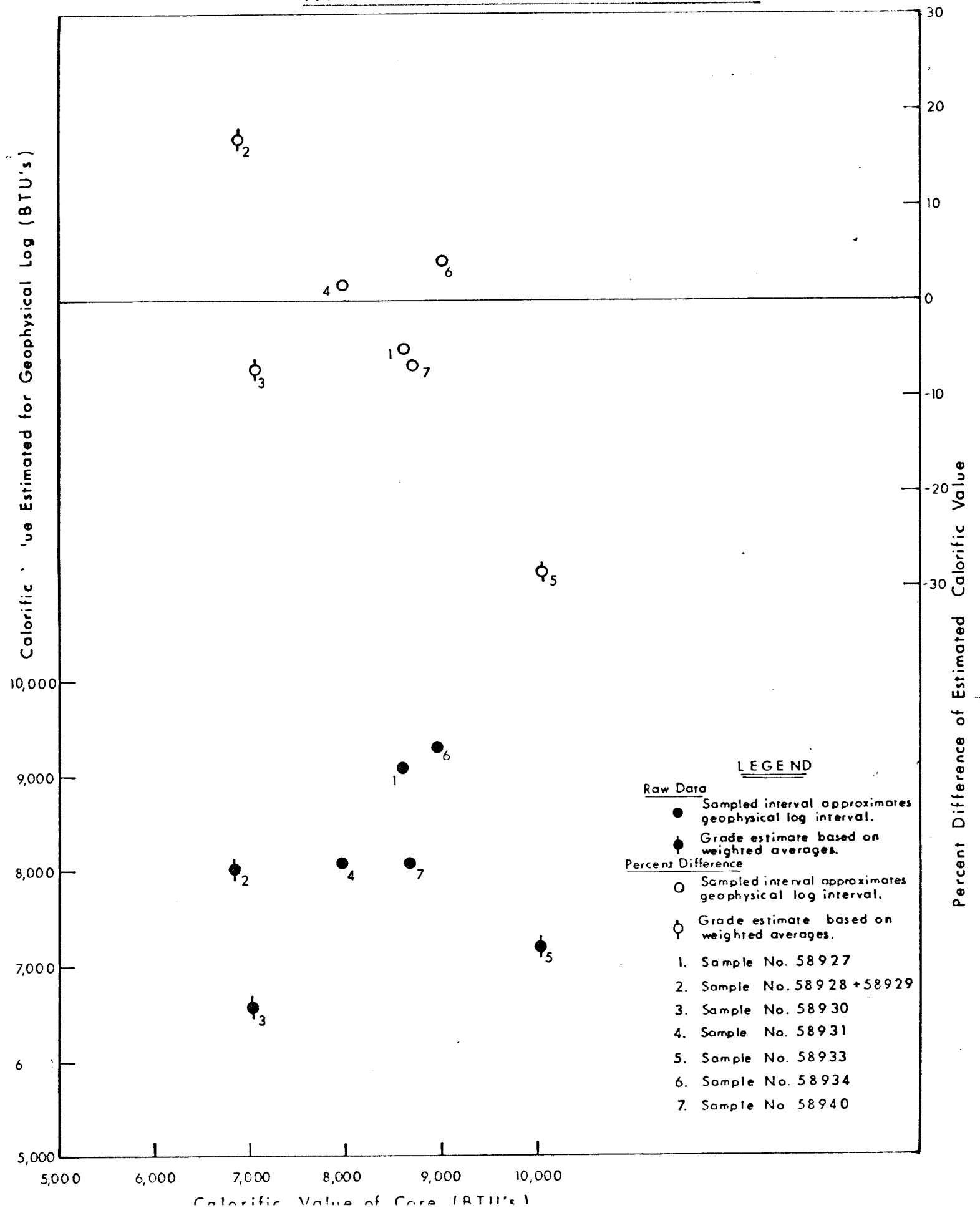
The use of coal quality parameters estimated from the geophysical logs appears to be of value in providing relatively low cost control in a reconnaissance type exploration program. Conversely these estimating techniques are of limited value in the detailed evaluation of potential coal reserves without further refinement.

Soil Geochemistry

Classical surficial exploration techniques of prospecting and geological mapping are of little use in evaluation of the Liard Coal Basin due to the very limited area of outcrop. Geophysical techniques have been useful in that the aeromagnetic data interpretation has allowed gross geograhpical limits to be placed on the basin. Ground geophysical techniques were judged to be

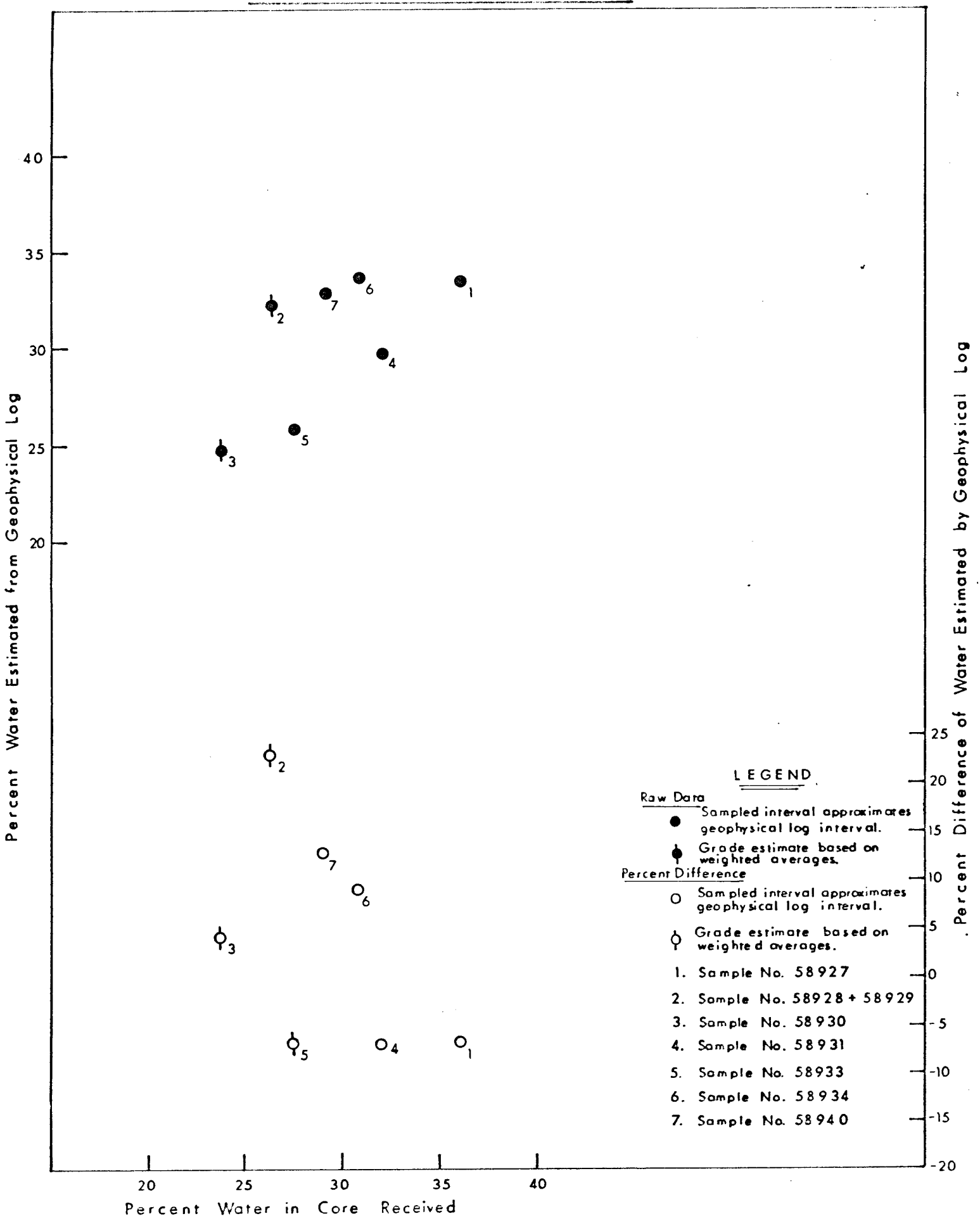
Figure XVI

Comparison of Coal Calorific Value With Estimated Coal Calorific Value



Figure

Comparison of Coal Moisture With Estimated Coal Moisture



inapplicable or too expensive or time consuming for basic exploration of a poorly exposed but potentially very large coal basin. The need for a fast relatively inexpensive exploration method for delineation of the basin led to the decision to try soil geochemistry.

Anomalous gaseous hydrocarbon accumulations in soils are known to occur over oil reservoirs. Maturation of coal should produce volatile hydrocarbons which could produce detectable anomalies in overlying soils. A test of the concept was carried out by personnel from Barringer Magenta Limited. The details of the test as reported by Barringer comprise Appendix E of this report. The study is summarized below.

Surface microlayer and forest litter (L-F-H horizon) samples were collected over several traverses. Three areas were sampled. One area, shown in inset "C" of Barringer's Microlayer Sample Analysis Map, is definitely within the coal basin as proved by the results of the 1979 drilling program. Another area, sampled by a traverse parallel to the Alaska Highway, is east of Watson Lake (inset "B"). That area is believed to be underlain by Paleozoic sediments. The third area sampled (inset "A") was near the Alaska Highway crossing of the Little Rancheria River and Big Creek. Tertiary basalt outcrops along Big Creek. The remainder of the area is masked by glacio-fluvial deposits.

Analyses of samples taken in the "background" area east of Watson Lake gave volatile hydrocarbon contents which ranged from 6.6 ppm to 0.78 ppm. Volatile sulfur contents of the samples ranged from 11.77 ppm down to 4.24 ppm. Statistical treatment of the data indicated a threshold (mean +2 standard deviations) value of 6.75 ppm volatile hydrocarbons and 17.51 ppm volatile sulphur.

Analytical data from samples taken in or proximal to the 1979 drill grid ranged in value from 133.5 ppm to trace volatile hydrocarbon and from 31.0 ppm to trace volatile sulphur. All of the drill holes within the sampled area contained significant coal

seams. Soil sampling within the drill pattern did not give an entirely clear indication of the wide spread coal seams. volatile hydrocarbon contents of the samples were anomalous in only 52% of the cases. Volatile sulphur proved to exceed threshold in only 10% of the samples. All of the drill holes (79-2, 79-3, 79-5) which are located in geochemically anomalous areas, penetrated significant coal seams at depths less than 35 metres. The relationships between other drill intersections and adjacent surficial geochemical values are ambiguous in that near surface penetrations of coal in some drill holes are not indicated by the soil geochemistry. The distribution of geochemical values is such that wide spaced sampling could easily indicate this area to be barren of coal.

The analytical results from the Little Rancheria - Big Creek sampling are difficult to interpret. The sampled area is outside of the basin as interpreted from aeromagnetic data. However, the lack of subsurface data and lack of outcrop permit the argument that the coal basin underlies the area. The volatile hydrocarbon data range from trace to 40.5 ppm. Volatile sulphur ranges in value from 27.46 ppm to 2.28 ppm. anomalous values tend to cluster near the Little Rancheria River but are flanked both to the east and west by analytical values below threshold. The geochemical data resembles those from the area of the 1979 drill pattern. Therefore they can be tentatively interpreted to indicate the presence of hydrocarbon emitting sediments.

In conclusion, soil geochemical sampling shows promise as a technique for identifying areas underlain at shallow depths by coal. Its potential for outlying the coal basin with relatively few widely spaced samples appears to be limited.

EVALUATION

The coal seams sampled in the exploration program have been encountered at depths too deep to be available to surface mining schemes. Using a maximum ash cut off of 25% and a minimum width of one metre, all of the holes except LC-2 have overburden to coal

ratios exceeding 10:1. LC-2 has an Ob: Coal ratio of 5:1 at a minimum depth of 56 metres. This is contained in five separate seams. Therefore the Overburden: Run of Mine Coal ratio can be expected to be about 6.7:1. Unfortunately the ratio for this seam s increased by several fold within 700 metres to the south. The presence of the coal is limited by facies changes within one kilometre to the north. The area within which this seam is potentially mineable is further restricted by the presence of both the Alcan Highway and the channel of Albert Creek. The tonnage of coal potentially available from the area of LC-2 is in the range of 5 to 10×10^6 tonnes. This quantity is not sufficient to satisfy the exploration objective.

Mining of the deposits could potentially be accomplished by relatively low cost earth moving equipment due to their unconsolidated character. However, the unconsolidated nature of the deposits and concomitant low bearing strength substantially increases the quantity of overburden to be moved due to the requesite flat pit wall slopes. The problem is compounded due to the presence of ground water with a high hydrostatic head. The hydrostatic pressure was not measured but in hole LC-3 the artesian low from the hole was great enough that geophysical sondes could not be lowered into the bore hole. The above described conditions indicate that exploration should be, as much as is practical, restricted to areas of low topographic relief as opposed to the steeper hillsides.

The coal quality data generated by the work carried out in the Liard Coal Basin indicates that the coal has a excellent low sulphur content ($\pm$ 0.28% average; 0.44% maximum). The ash content is high with an average of 17.51% for those samples with less than 25% ash. The moisture content averages 38.55% but ranges up to 44.46%. Average gross calorific value for coal with less than 25% ash is 5,972 BTU/lb. The high water content drastically reduces the effective calorific value of the coal (due to latent heat loss) to an average net value of 3,538 BTU/lb.

The high ash content and the inversely related calorific described above indicate the coal is an inefficient fuel for a power station. The presence of thick higher quality coal in the bore holes lends credence to the expectation that significant tonnages of higher quality coal will be encountered elsewhere in the basin.

Costs Incurred

Placer has incurred expenditures totaling $353,584.05 between 1977 and May 1980. Copies of invoices for costs greater than $1,000 comprise Appendix "F". The costs are summarized below:

LIARD COAL
STATEMENT OF EXPENDITURES
1977-1979

	1977	1978	1979	TOTAL
Supervision Salaries			$ 2,603.09	$ 2,603.09
Site Preparation & Maintenance			14,505.71	14,505.71
Equipment Expense			2,623.39	2,623.39
Equipment Maintenance			1,406.42	1,406.42
Roads & Trails		$ 11,413.38	4,995.78	16,409.16
Camp Operations	$ 1,790.11	5,488.91	8,837.92	16,116.94
Telephone & Teletype		203.73	203.95	407.68
Vehicle Expense			3,090.94	3,090.94
Freight			1,560.82	1,560.82
Travel	1,096.98	3,542.08	953.38	5,592.44
Helicopter Expense			4,349.60	4,349.60
Survey Control			64.01	64.01
Surveying-Geological			3,387.77	3,387.77
Surveying-Geophysical			12,160.01	12,160.01
Elemental/Mineralogical Analysis	423.50	3,368.50	1,111.00	4,903.00
Diamond Drilling	16,600.08	118,464.48	93,507.88	228,572.44
Geological Studies			3,975.36	3,975.36
Environmental Studies			1,140.98	1,140.98
Report Preparation			413.40	413.40
Assessment & Rental Payments			(11,592.10)	(11,592.10)
Claims Staking			2,839.00	2,839.00
Legal & Tax Fees			115.14	115.14
Administration	1,906.78	1,873.84		3,780.62
Engineering Services		614.25		614.25
Geology	8,220.90	10,219.04		18,439.94
Geophysics		1,677.44		1,677.44
Property Expense	8,823.10	60.00		8,883.10
Trenching		5,543.50		5,543.50
TOTAL:	$38,861.45	$162,469.15	$152,253.45	$353,584.05

Exploration of the Liard Coal Basin has not identified large tonnages of coal with low strip ratios (10:1). Additional exploration in the area can follow either of two scenarios. One would be to continue work on the hill south of the Alcan Highway where drilling was carried out in 1979. Potential exists in this area for the delineation of coal reserves with low strip ratios. the potential tonnage of recoverable coal, along the coal subcrop, on this hill, is not believed to be large enough to support the requisite power plant. Therefore additional reconnaissance drilling will be necessary to delineate other areas with potential. the second scenario would be to proceed immediately to reconnaissance drilling with the anticipation of encountering elsewhere in the basin sufficient reserves of higher quality coal than are now indicated.

It is recommended that Placer continue reconnaissance drilling in the basin. A program consisting of 53 rotary drill holes distributed mainly in four sections across the basin is proposed for the 1980-1981 field seasons. The proposed drill holes as shown on Figure III are spaced at approximately two kilometre intervals, and the drill sections along which they are to be drilled are spaced at an average of 7.5 to 9.5 kilometres. The holes are to be drilled to a depth of 75 metres. The holes will be logged with a variety of geophysical techniques. Selected coal beds will be sampled with a side wall sampler.

The program will be carried out during the late fall and early spring while the ground is frozen. The drill and ancillary equipment will be mounted on tracked or rubber tired all terrain vehicles in order to reduce road building requirements and facilitate moving between holes.

The project is budgeted for a water based drill fluid system utilizing bentonite clay and a polymer additive because that is the most expensive drill fluid necessary to guarantee success. Costs for this drill fluid are estimated (from previous drilling) to be approximately $1300 per hole. The program proposes an early test of compressed air as a drilling medium. If the test is successful, the savings could be as great as $1200 per hole or $63,600 over the life of the project.

A tentative budget for the exploration program is as follows:

Drilling:	25 hours drill time/hole	$3,575	$189,475
	4 hours stand by/hole	400	21,200
	13 hours moving/hole	1,740	92,220
			$302,895
Mud:	100 bags Quik Gel @ $9/bag	900	47,700
	100 bags Quik Troll @ $4.4/bag	440	23,320
			$71,020
Logging:	logging @ $2.90/ft.		
	Standby @ 0.60/ft.		
	Trip fee @ 0.08/ft.		
	Subsistence for the engineer @ 0.32/ft.	1,000	53,000
			$53,000
Skidder:	Water hauling @ $50/hr.	300	15,900
	Moving @ $50/hr.	100	5,300
			$21,200
Cat:	Road building 55 km @20 hrs/Km @ $65/hour.		71,500
			$71,500
Mobilization			20,000
			$20,000
Compressor Rental @ $6500/month			6,500
			$6,500
Camp Operation			20,000
			$20,000
Salaries			$20,000
			$20,000
			$586,115.00

REFERENCES

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STATEMENT OF QUALIFICATIONS

I, D.M. Jenkins, with business address at 700 Burrard Building, Vancouver, B.C., V6E 3A8, do hereby certify that I have supervised the field work and/or have assessed and interpreted the data resulting from this work on coal exploration licenses 66, 67, 68, 69, 113 and 114.

I also certify that: -

1. I am a graduate of the University of South Florida (B.C. Geology, 1963).
2. I am a graduate of the University of Florda (M.S. Geology, 1966).
3. I was a graduate student at the University of Cincinnati from 1966 to 1970.
4. I have engaged in mineral exploration since 1970.
5. I am a fellow of the Geological Association of Canada.

D.M. Jenkins, M.S., F.G.A.C.
Senior Geologist

APPENDIX A

Drill Hole Logs

PLACER DEVELOPMENT LIMITED

EXPLORATION DEPARTMENT

GRID: _____

HOLE No. L.C.#1

SHEET No. 1 of 9

LOCATION: LIARD RIVER, Y.T. BEARING: _____ LATITUDE: 60° 6½' PROPERTY: LIARD COAL

DATE COLLARED: Nov. 25, 1977 LENGTH: 167.4 m DEPARTURE: 129° ½' CORE SIZE: HQ / WL LOGGED BY: I. BORCVIC

DATE COMPLETED: DEC, 6, 1977 DIP: -90° ELEVATION: 2250' SCALE OF LOG: 1:100 DATE: DEC, 6, 1977.

DEPTH m	m block & %rec.	ROCK TYPE DESCRIPTION	Graph. log	Structure	SAMPLE NO.	COAL ANALYSES: MOISTURE %	% ASH as recvd.	% ASH dry basis	% V. M. as recvd.	% V. M. dry basis	% F. C. as recvd.	% F. C. dry basis	CALORIFIC VALUE as recvd.	CALORIFIC VALUE dry basis	% S	% H	% N	% O	F.S.I.	Reflec	Sp. Gravity	REMARKS
15	15.0	OB GRAVEL																				
	15.6																					
6																						
7	17.1																					
		ORG. MUD																				NOT ANALYSED
8		GRAY CLAY																				
	18.6																					
9																						
20	20.0																					
1																						
	21.9																					
2																						
	22.4																					
3																						
4	24.0																					
5	25.2																					
6																						
7	27.0	GRAVEL																				
	27.6																					
8																						
9																						
30	30.0																					

COAL LOG FORM No. X-1-78, Page 1.

BORHOLE LOG BY: ROKE, CALGARY, ALTA

DATE:

PLACER DEVELOPMENT LIMITED

EXPLORATION DEPARTMENT

GRID: _____

LOGGED BY: _____ HOLE No. CC-1

DATE: Dec 6/78. SHEET No. 2 of 9

DEPTH m	m block & % rec.	ROCK TYPE DESCRIPTION	Graph. log	Structure	SAMPLE NO.	COAL ANALYSES: MOISTURE %	% ASH as recvd	% ASH dry basis	% V. M. as recvd	% V. M. dry basis	% F.C. as recvd	% F.C. dry basis	CALORIFIC VALUE as recvd.	CALORIFIC VALUE dry basis	% S	% H	% N	% O	F.S.I	Reflec.	Sp. Gravity	REMARKS
30	30.0																					
1																						
2																						
3		Coal, dirty, org. mud			30583	26.68	39.05	53.26	30.63	41.77	3.64	4.97	3656	4987	0.43 / 0.58							
4	50																					
5																						
6																						
7	37.2 / 5" / 37.7																					
8	50	seatearth (some root remnants)																				
	31.1	siltstone & org. mud																				
9	40	coal & 20% clay																				
	39.6	siltstone & org. mud																				
40																						
	90																					
1	41.1																					
2	0																					
	42.6																					
3																						
4	30																					
5																						
	45.6																					
6																						
7																						
8		coarse sandstone (poorly consol.) graded bedding →																				

COAL LOG FORM No. X-1-78, Page 2.

BOREHOLE LOG BY: _____

DATE: _____

PLACER DEVELOPMENT LIMITED

EXPLORATION DEPARTMENT

GRID: _____

LOGGED BY: [illegible] HOLE No. [illegible]

DATE: Dec 6/78. SHEET No. 3 of 9

DEPTH m	m block & % rec.	ROCK TYPE DESCRIPTION	Graph. log	Structure	SAMPLE NO.	COAL ANALYSES: MOISTURE %	% ASH as recvd.	% ASH dry basis	% V. M. as recvd.	% V. M. dry basis	% F.C. as recvd	% F.C. dry basis	CALORIFIC VALUE as recvd.	CALORIFIC VALUE dry basis	% S	% H	% N	% O	F.S.I.	Reflec.	Sp. Gravity	REMARKS
48	48.0																					
9	75																					
50	52.0																					
1	100																					
	51.6																					
2																						
3	0																					
4																						
	54.6																					
5	30																					
6	56.1																					
	0																					
7	57.1																					
8																						
9	30																					
	60.0																					
60		↓																				
1		unconsol. sand, sandstone																				
		0.05 m COAL																				
2	15																					
3		↑																				
	63.6																					
4																						
	25																					
5	65.1																					
6	0																					

COAL LOG FORM No. X-1-78, Page 2.

BOREHOLE LOG BY: _____

DATE: _____

GRID: _____

PLACER DEVELOPMENT LIMITED

EXPLORATION DEPARTMENT

LOGGED BY: RD

DATE: Dec, 6, 78.

HOLE No. LC #1

SHEET No. 4 of 9

DEPTH m	m block & % rec.	ROCK TYPE DESCRIPTION	Graph. log	Structure	SAMPLE NO.	COAL ANALYSES: MOISTURE %	% ASH as recvd.	% ASH dry basis	% V. M. as recvd.	% V. M. dry basis	% F.C. as recvd	% F.C. dry basis	CALORIFIC VALUE as recvd.	CALORIFIC VALUE dry basis	% S	% H	% N	% O	F.S.I	Reflec.	Sp. Gravity	REMARKS
66	0	Sandstone																				
	66.6																					
7																						
8	15																					
9	69.6																					
70																						
1																						
2	20																					
3																						
4	74.1																					
5																						
6																						
7	30																					
8																						
9																						
80																						
	80.5																					
1	50																					
2																						
	82.4																					
3																						
4																						

COAL LOG FORM No. X-1-78, Page 2.

BOREHOLE LOG BY: _____

DATE:

GRID: _____

PLACER DEVELOPMENT LIMITED

EXPLORATION DEPARTMENT

LOGGED BY: [illegible] HOLE No. LC #1

DATE: Dec. 6, 1978. SHEET No. 5 of 9

DEPTH m	m block & % rec.	ROCK TYPE DESCRIPTION	Graph. log	Structure	SAMPLE NO.	COAL ANALYSES: MOISTURE %	% ASH as recvd.	% ASH dry basis	% V. M. as recvd.	% V. M. dry basis	% F.C. as recvd	% F.C. dry basis	CALORIFIC VALUE as recvd.	CALORIFIC VALUE dry basis	% S	% H	% N	% O	F.S.I.	Reflec.	Sp. Gravity	REMARKS
84		Sandstone																				
5	50																					
6																						
	86.6																					
7	70																					
8																						
	88.5																					
9	75																					
90																						
	90.6																					
1																						
2	10																					
3																						
4																						
	94.6				94.7																	
	100	COAL			30592	24.65	45.65	57.93	28.89	37.01	9.81	5.06	2,371	3,147	0.80/							
5	95.2				95.0										1.40							
6																						
7																						
8		Sandstone																				
	30																					
9																						
100																						
1	101.0	0.05m COAL																				
2																						

BOREHOLE LOG BY: _____

GRID: _____

PLACER DEVELOPMENT LIMITED

EXPLORATION DEPARTMENT

LOGGED BY: JS

DATE: Dec 6, 1979.

HOLE No. ∠C#1

SHEET No. 6 of 9

DEPTH m	m block & % rec.	ROCK TYPE DESCRIPTION	Graph. log	Structure	SAMPLE NO.	COAL ANALYSES: MOISTURE %	% ASH as recvd	% ASH dry basis	% V. M. as recvd	% V. M. dry basis	% F.C. as recvd	% F.C. dry basis	CALORIFIC VALUE as recvd.	CALORIFIC VALUE dry basis	% S	% H	% N	% O	F.S.I.	Reflec.	Sp. Gravity	REMARKS
102	90	sandstone																				
3	103.0	COARSE – SANDSTONE fine breccia (																				
4																						
5																						
6	25																					
7																						
8																						
9	109.2																					
110		↑																				
1	30																					
2																						
		0.05–0.10 m coal																				
3	112.7 50 112.3 50 112.1	CLAY & silt x bedding																				
4																						
5		CLAY & silt																				
6																						
7	40	sandstone ↓																				
8																						
9	119.0																					
120																						

COAL LOG FORM No. X-1-78, Page 2.

BOREHOLE LOG BY: _____

DATE: _____

GRID: _____

PLACER DEVELOPMENT LIMITED

EXPLORATION DEPARTMENT

LOGGED BY: _____ HOLE No. 20-1

DATE: Dec, 6, 1978 SHEET No. 1 of 9

DEPTH m	m block & % rec.	ROCK TYPE DESCRIPTION	Graph. log	Structure	SAMPLE NO.	COAL ANALYSES: MOISTURE %	% ASH as recvd.	% ASH dry basis	% V. M. as recvd.	% V. M. dry basis	% F.C. as recvd	% F.C. dry basis	CALORIFIC VALUE as recvd.	CALORIFIC VALUE dry basis	% S	% H	% N	% O	F.S.I.	Reflec.	Sp. Gravity	REMARKS
120																						
1	50	Sandstone																				
2	121.9	↓																				
3		↓																				
4		↓																				
5	30	↓																				
6		↓																				
7	127.2	↑																				
8	(10)	CLAY & COAL (ORG. MUD.?)																				
	128.2	Sandstone																				
9		↓																				
130		↓																				
1		↓																				
2	30	↓																				
3		Sandstone																				
4		↑																				
5	135.0	↑																				
6		black org. mud																				
		COAL																				
7	65	COAL + 10% CLAY		0'																		
		ORG MUD horiz. bedding		2'																		
8		COAL + 10% CLAY																				

COAL LOG FORM No. X-1-78, Page 2.

BOREHOLE LOG BY: _____

DATE:

PLACER DEVELOPMENT LIMITED

EXPLORATION DEPARTMENT

GRID: _____

LOGGED BY: _____ HOLE No. _____

DATE: Dec. 6, 1978. SHEET No. 8 of 9

DEPTH m	m block & % rec.	ROCK TYPE DESCRIPTION	Graph. log	Structure	SAMPLE NO.	COAL ANALYSES: MOISTURE %	% ASH as recvd	% ASH dry basis	% V. M. as recvd	% V. M. dry basis	% F.C. as recvd	% F.C. dry basis	CALORIFIC VALUE as recvd.	CALORIFIC VALUE dry basis	% S	% H	% N	% O	F.S.I.	Reflec.	Sp. Gravity	REMARKS
138	138.5	COAL + 1% CLAY																				
		ORG. MUD - SEATEARTH																				
9	90	CLAY																				
140	140.0	CLAY & SILT																				
	100	SILT & CLAY																				
1	141.5	SANDSTONE																				
2	60																					
3	143.0																					
4																						
5	10																					
6																						
7	147.0																					
	100																					
	147.6																					
8		COAL		0°																		
	90	CLAY, ORG. MUD		0°																		
9		COAL + 1% CLAY		0°																		
	149.4	ORG. MUD & CLAY																				
	100	"DRIFTWOOD"																				
150	150.1	COAL																				
		ORG. MUD																				
		CLAY - SILT																				
1	100	SILTSTONE																				
	151.6																					
2																						
	75																					
3																						
	153.4	CLAY & SILT																				
		COAL																				
4		CLAY																				
		SILT																				
5																						
	155.2																					
6																						

COAL LOG FORM No. X-1-78, Page 2.

BOREHOLE LOG BY: _____

DATE: _____

PLACER DEVELOPMENT LIMITED

EXPLORATION DEPARTMENT

GRID: _____

LOGGED BY: JS

DATE: Dec. 6/78.

HOLE No. LC#1

SHEET No. 2 of 9

DEPTH m	m block & % rec.	ROCK TYPE DESCRIPTION	Graph. log	Structure	SAMPLE NO.	COAL ANALYSES: MOISTURE %	% ASH as recvd.	% ASH dry basis	% V. M. as recvd.	% V. M. dry basis	% F.C. as recvd	% F.C. dry basis	CALORIFIC VALUE as recvd.	CALORIFIC VALUE dry basis	% S	% H	% N	% O	F.S.I.	Reflec.	Sp. Gravity	REMARKS
156		Sandstone																				
7	25																					
8																						
9	159.2																					
160		GRADED BEDDING																				
1	85	Sandstone	88																			
2	162.0	DRIFT COAL		0°																		
		sandstone																				
3	100																					
4	163.6																					
5																						
6	20																					
7	167.4	COARSE SANDSTONE																				
8		EOH. LC#1																				

COAL LOG FORM No. X-1-78, Page 2.

BOREHOLE LOG BY: _____

DATE:

PLACER DEVELOPMENT LIMITED

EXPLORATION DEPARTMENT

GRID: _____ HOLE No. 26-78

SHEET No. 1 of 6

LOCATION: ALASKA HWY. BEARING: _____ LATITUDE: 60° 03' PROPERTY: LIARD COAL BASIN

DATE COLLARED: MARCH, 14, 1978 LENGTH: 136.2 m DEPARTURE: 128 52' CORE SIZE: HQ / WL LOGGED BY: I. SORSOLI

DATE COMPLETED: MARCH, 29, 1978 DIP: -90° ELEVATION: 2070' SCALE OF LOG: 1:100 DATE: APRIL 4, 1978

CASING 13.2 m

DEPTH m	m block & % rec.	ROCK TYPE DESCRIPTION	Graph. log	Structure	SAMPLE NO.	COAL ANALYSES: MOISTURE %	% ASH as recvd.	% ASH dry basis	% V.M. as recvd.	% V.M. dry basis	% F.C. as recvd.	% F.C. dry basis	CALORIFIC VALUE as recvd.	CALORIFIC VALUE dry basis	% S	% H	% N	% O	F.S.I.	Reflec.	Sp. Gravity	REMARKS
41																						
42	42.6																					
43		gray silt (minor organic matter) (mixed with some clay)																				
	30%																					
44	44.2																					
45																						
46	20%																					
47																						
48	48.2	gray silt contact with fragments of pebbles (½-1 cm) → bedding		25°																		
		sand																				
49		↓ 1 to 10% of pebbles																				
50		(poorly consolidated)																				
51																						
	16																					
52																						
53																						
54					54.6																	
54.8		← 60 cm coal — organic clay & silt 0.20 m ←			58857 54.8	36.61	19.00	29.98	24.42	38.53	19.97	31.49	5114	8067	16/36							
55	100	↓ silty material, heavier, gradually ← organic silt & clay																				
56	56.4				56.9																	
	50	COAL 1.7 m			58852	10.50	12.36	20.78	27.19	45.70	19.95	33.52	5482	9214	.14/.24							
57	57.7																					

COAL LOG FORM No. X-1-78, Page 1.

BOREHOLE LOG BY: ROCC, CALGARY, ALTA

DATE:

GRID: _____

PLACER DEVELOPMENT LIMITED
EXPLORATION DEPARTMENT

LOGGED BY: [illegible]
DATE: April 5, 1978

HOLE No. [illegible]
SHEET No. 2 of 6

DEPTH m	m block & % rec.	ROCK TYPE DESCRIPTION	Graph. log	Structure	SAMPLE NO.	COAL ANALYSES: MOISTURE %	% ASH as recvd.	% ASH dry basis	% V. M. as recvd.	% V. M. dry basis	% F.C. as recvd	% F.C. dry basis	CALORIFIC VALUE as recvd.	CALORIFIC VALUE dry basis	% S	% H	% N	% O	F.S.I.	Reflec.	Sp. Gravity	REMARKS
57	50	COAL 1.7m			58852																	
57.9		clay (rootearth?) silt			57.9																	
58	100	coal, silty clay 0.3m			58.6 58853	44.16	4.79	8.62	28.53	51.36	22.22	40.02	5946	10706	.04/.25							
59	59.4	clay, organic, silty (where from?) 5cm coal			58.9																	
60	100	carb. mud & COAL 0.2m			60.0 58854	44.21	8.64	15.48	26.30	47.14	20.85	37.38	5493	9846	.16/.28							
		clay coal 0.35m			60.3 58855	41.78	5.42	9.31	30.09	51.68	22.71	39.01	6158	10567	.17/.29							
61	60.9	carb. mud & coal																				
62	95	COAL 1.8m			58856	42.76	7.69	13.44	28.31	49.47	21.24	37.09	5757	10058	.13/.22							
62.5		CLAY																				
63	100																					
64	100	COAL 1.5m			58857	42.23	5.33	9.22	29.26	50.65	23.18	40.13	6139	10627	.13/.23							
64.6		CLAY SPLIT			64.3																	
65					65.0																	
66	100	COAL 1.2m			58858	41.14	9.47	16.09	28.10	47.73	21.69	36.18	5741	9754	.14/.24							
66.1					66.2																	
67	60	CLAY																				
67.6		COAL 0.6m			58859	39.22	11.49	18.91	27.99	46.05	21.30	35.04	5676	9938	.14/.23							
68		"Sandy" COAL 0.3m			58860	41.25	23.95	40.76	20.05	34.13	14.75	25.11	3855	6562	.10/.17							
69	60																					
69.7																						
70	50	COAL 1.0m			58861	35.95	11.36	17.63	29.80	46.27	23.25	36.10	6217	9652	.15/.23							
71																						
71.9																						
72		clayish, silty, organic mud			71.9																	
73	75	organic mud			73.0																	
73.8		COAL (quality?) 0.8m			58862	27.42	20.45	28.18	29.23	40.28	22.90	31.54	5896	8123	.28/.31							
74		organic silty mud			73.8																	
75		sand																				

COAL LOG FORM No. X-1-78, Page 2.

BOREHOLE LOG BY: _____
DATE:

GRID: _____

PLACER DEVELOPMENT LIMITED

EXPLORATION DEPARTMENT

LOGGED BY: _____ HOLE No. _____

DATE: _____ SHEET No. 3 of 6

DEPTH m	m block & % rec.	ROCK TYPE DESCRIPTION	Graph. log	Structure	SAMPLE NO.	COAL ANALYSES: MOISTURE %	% ASH as recvd.	% ASH dry basis	% V. M. as recvd.	% V. M. dry basis	% F.C. as recvd	% F.C. dry basis	CALORIFIC VALUE as recvd.	CALORIFIC VALUE dry basis	% S	% H	% N	% O	F.S.I.	Reflec.	Sp. Gravity	REMARKS
75																						
76	50	Sand (minor organic matter)																				
76.8																						
77																						
78																						
79																						
80																						
81																						
82		wash out, caving possible sand																				
83	0%																					
84																						
85																						
86																						
87																						
88																						
89																						
90																						
90.5		↑ Sand																				
91		↓ Coal			91.0																	
92	40%				58863	36.58	5.68	8.95	31.94	50.37	25.80	40.68	6734	10619	.15/.24							
92.9	20%	> Quartz pond (where from?) 2.2 m																				
93																						

COAL LOG FORM No. X-1-78, Page 2.

BOREHOLE LOG BY: _____

DATE:

GRID: _____

PLACER DEVELOPMENT LIMITED

EXPLORATION DEPARTMENT

LOGGED BY: _____ HOLE No. 20-83

DATE: April 5, 1978 SHEET No. 4 of 6

DEPTH m	m block & % rec.	ROCK TYPE DESCRIPTION	Graph. log	Structure	SAMPLE NO.	COAL ANALYSES: MOISTURE %	% ASH as recvd.	% ASH dry basis	% V. M. as recvd.	% V. M. dry basis	% F.C. as recvd	% F.C. dry basis	CALORIFIC VALUE as recvd.	CALORIFIC VALUE dry basis	% S	% H	% N	% O	F.S.I.	Reflec.	Sp. Gravity	REMARKS
93	95.2	COAL (Q. 1911.5)			93.2																	
94	75	GRAY (SLIGHTLY ORGANIC) CLAY																				
95	94.4	← 10 cm org. mud																				
		GRAY SILT																				
96	100	GRAY CLAY whitish clay																				
	96.6																					
97	99																					
98	98.1	gray, org. clay with drift wood																				
99	95				99.4																	
	99.7				99.8																	
100	50	COAL 10 cm black org. mud 1.3			58864	37.38	14.18	22.65	22.05	44.80	20.39	32.55	5704	8994	.16/.26							
	100.3																					
	99																					
1	101.1	scaly earthy clay			101.1																	
	75	whitish clay																				
2	102.4				103.17																	
		COAL 1.8			58865	33.76	17.57	26.53	28.26	42.66	20.41	30.81	5640	8514	.29/.31							
3	80																					
	103.6																					
4		gray, clayish silt			103.6																	
	95	whitish clay																				
5	105.0	Sand gray																				
	6																					
6	106.7																					
		gray silt clay																				
7		gray silty clay clayish silt																				
	99																					
8	108.2	silty clay with coaly, woody particles		0°																		
		gray silt (some organic mat)																				
9	99																					
	109.7																					
110	95																					
111																						

COAL LOG FORM No. X-1-78, Page 2.

BOREHOLE LOG BY: _____

DATE:

GRID: _____

PLACER DEVELOPMENT LIMITED

EXPLORATION DEPARTMENT

LOGGED BY: _____ HOLE No. 2[illegible]

DATE: April 6, 1975. SHEET No. 5 of 5

DEPTH m	m block & % rec	ROCK TYPE DESCRIPTION	Graph. log	Structure	SAMPLE NO.	COAL ANALYSES: MOISTURE %	% ASH as recvd.	% ASH dry basis	% V. M. as recvd.	% V. M. dry basis	% F.C. as recvd	% F.C. dry basis	CALORIFIC VALUE as recvd.	CALORIFIC VALUE dry basis	% S	% H	% N	% O	F.S.I.	Reflec.	Sp. Gravity	REMARKS
111	111.3	org. mud (clay, (silt), sand particles.) clay silt & sand																				
112	25																					
	112.8																					
113																						
	113.4																					
114	0%																					
	114.9	→ diff coal in the sand																				
115		sand																				
	30	clay (org. mud)																				
116	116.4	— whitish clay																				
117	100																					
	118.0	organic mud / greenish clays gradually changing into org. mud and silty			117.8																	
118		↓ COAL ← ORGANIC MUD GRAY CLAY whitish clay			58866	35.06	14.70	22.64	28.34	43.64	21.90	33.72	5832	8980	.21/.33							
	95				118.2																	
119	119.9	← ↓ gray silt																				
120	100																					
	121.0	↑																				
121		sand with lenticles of "drift coal" bedding →																				
122	100			10°																		
	122.5	coal (rotten clay ?) 0.20 <			58867	33.61	32.11	48.38	23.62	30.92	15.66	20.10	4364	5713	.24/.32							
123		silt-earth (org. mud ?)			122.7																	
	90	org. clay ↓																				
124	124.1																					
125	30																					
	125.5																					
126	10																					
	126.5	↓																				
127																						
	99																					
128	128.0	org. mud gradually changing into coal																				128.0 S
	↓																					
129	5	COAL recovery ?			58868	23.65	21.74	28.47	33.23	43.53	21.38	28.00	6301	8253	.18/.23							

COAL LOG FORM No. X-1-78, Page 2.

BOREHOLE LOG BY: _____

DATE: _____

GRID: _____

PLACER DEVELOPMENT LIMITED
EXPLORATION DEPARTMENT

LOGGED BY: _____ HOLE No. _____
DATE: Apr 26/78 SHEET No. 6 of 6

DEPTH m	m block & % rec.	ROCK TYPE DESCRIPTION	Graph. log	Structure	SAMPLE NO.	COAL ANALYSES: MOISTURE %	% ASH as recvd	% ASH dry basis	% V. M. as recvd	% V. M. dry basis	% F.C. as recvd	% F.C. dry basis	CALORIFIC VALUE as recvd.	CALORIFIC VALUE dry basis	% S	% H	% N	% O	F.S.I.	Reflec.	Sp. Gravity	REMARKS
129	5 129.5	COAL 1.7m			58868																	
130	30	seat earth? org. mud silt & clay																				
131	131.0	Sand																				
132	0% 132.5																					
133	0%																					
134	134.1	← sand diff coal																				
135	25	Sand																				
136	136.2	136.2 m E.O.H. LC #2																				

COAL LOG FORM No. X-1-78, Page 2.

BOREHOLE LOG BY: _____
DATE: _____

PLACER DEVELOPMENT LIMITED

EXPLORATION DEPARTMENT

SHEET No. 1 of 5

GRID: _____

LOCATION: ALASKA HWY. BEARING: _____ LATITUDE: 60° 2¼' PROPERTY: CLARD COAL BASIN

DATE COLLARED: MARCH 30, 78. LENGTH: 109.7 DEPARTURE: 128° 58' CORE SIZE: NQ/WL LOGGED BY: I.R-ORONIC

DATE COMPLETED: APR 16, 78 DIP: -90° ELEVATION: 2100' SCALE OF LOG: 1:100 DATE: April 8/1978

DEPTH m	m block & %rec.	ROCK TYPE DESCRIPTION	Graph. log	Structure	SAMPLE NO.	COAL ANALYSES: MOISTURE %	% ASH as recvd.	% ASH dry basis	% V.M. as recvd.	% V.M. dry basis	% F.C. as recvd.	% F.C. dry basis	CALORIFIC VALUE as recvd.	CALORIFIC VALUE dry basis	% S	% H	% N	% O	F.S.I.	Reflec.	Sp. Gravity	REMARKS
37	37.2	light grey, whitish clay																				
38	50	5cm org. mud followed by white clay																				
	38.7	w/clay with dispersed																				
39	50	white clay																				
	39.6																					
40	90	10 cm coal org. mixed 5 clay org mud white clay																				
	40.3																					
41	20																					
42	42.1																					
43																						
44																						
45																						
46	0%	6 runs - no core																				
47																						
48																						
49																						
50																						
51	50.9																					
52	15	COAL 2.0m			58876	35.13	15.41	23.75	29.40	45.33	20.06	30.92	5747	8859	.21/.33							→ 58.2
53	52.5																					

COAL LOG FORM No. X-1-78, Page 1.

BORHOLE LOG BY: _____

DATE

PLACER DEVELOPMENT LIMITED

EXPLORATION DEPARTMENT

GRID: _____

LOGGED BY: [illegible]

DATE: April 8, 1978

HOLE No. LC#3

SHEET No. 2 of 5

DEPTH m	m block & % rec.	ROCK TYPE DESCRIPTION	Graph. log	Structure	SAMPLE NO.	COAL ANALYSES: MOISTURE %	% ASH as recvd	% ASH dry basis	% V. M. as recvd	% V. M. dry basis	% F.C. as recvd	% F.C. dry basis	CALORIFIC VALUE as recvd.	CALORIFIC VALUE dry basis	% S	% H	% N	% O	F.S.I	Reflec.	Sp. Gravity	REMARKS
53	90	weathered clay																				
54	53.9	↓																				
	17	whitish gray clay																				
55	55.5	↓																				
56		silty clay																				
	20																					
57																						
	57.6	↑																				
58		↓ sand (grey, m-f gr, mica!)																				
	20																					
59	59.7																					
60																						
61																						
62																						
63																						
64	0%	7 runs - no core																				
65	0																					
66																						
67																						
68																						
69																						
70																						
71	70.7	→ disposal chips sand																				

COAL LOG FORM No. X-1-78, Page 2.

BOREHOLE LOG BY: _____

DATE:

GRID: _____

PLACER DEVELOPMENT LIMITED

EXPLORATION DEPARTMENT

LOGGED BY: _____ HOLE No. [illegible]

DATE: _____ SHEET No. 2 of 5

DEPTH m	m block & % rec.	ROCK TYPE DESCRIPTION	Graph. log	Structure	SAMPLE NO.	COAL ANALYSES: MOISTURE %	% ASH as recvd.	% ASH dry basis	% V. M. as recvd.	% V. M. dry basis	% F.C. as recvd	% F.C. dry basis	CALORIFIC VALUE as recvd.	CALORIFIC VALUE dry basis	% S	% H	% N	% O	S.I. f.	Reflec.	Sp. Gravity	REMARKS
71	60	grey (mica ?) sand																				
72	71.9																					
73	0	sand ? no core																				
	73.2																					
74	30	sand																				
	74.1	> approx 20 cm of coaly mat.																				
		brg. mud																				
75	90	silt. clay																				
		org. mud																				
		coal ?			756																	
	75.9																					
76	50	COAL 20 cm refl →			SB877	35.97	18.36	28.68	25.87	40.41	19.80	30.91	6319	8200	1.26/1.40 ←							25.8
	76.8	?																				
77					76.8																	
		dark grey sand (micac.)																				
		ripple-bedded with coaly		15°																		
78	75	laminae																				
	78.9																					
79																						
80																						
81																						
82																						
83																						
84	0	no core																				
	0	7 runs																				
85																						
86																						
87																						
88																						
89																						

COAL LOG FORM No. X-1-78, Page 2.

BOREHOLE LOG BY: _____

DATE: _____

PLACER DEVELOPMENT LIMITED
EXPLORATION DEPARTMENT

GRID: _____ LOGGED BY: _____ HOLE No. 2282
DATE: _____ SHEET No. 4 of 5

DEPTH m	m block & % rec.	ROCK TYPE DESCRIPTION	Graph. log	Structure	SAMPLE NO.	COAL ANALYSES: MOISTURE %	% ASH as recvd.	% ASH dry basis	% V. M. as recvd.	% V. M. dry basis	% F.C. as recvd	% F.C. dry basis	CALORIFIC VALUE as recvd.	CALORIFIC VALUE dry basis	% S	% H	% N	% O	F.S.I.	Reflec.	Sp. Gravity	REMARKS
89																						
90	0	no core																				
1																						57.2
																						75.8
																						92.7
2	92.10	→ crushy mud in grey org. mud/clay																				100.75
	10																					
3																						
	93.6	gradual transition into coal																				
4					11.0																	
	94.5	↓			58878	27.58	47.73	65.91	18.90	26.10	5.79	7.99	2641	3647	.09/.13							
5					58879	30.41	26.67	52.69	21.61	31.05	11.31	16.26	3735	5367	.14/.20							
	95				58880	26.15	51.37	69.55	17.04	23.07	5.44	7.38	2348	3180	.07/.10							
6	96.10				58881	27.95	41.86	58.10	22.25	30.88	7.94	11.02	32.86	4561	.13/.18							
					58882	31.06	31.97	46.37	24.21	35.11	12.76	18.52	4087	6016	.14/.21							
	99	COAL			58883	37.40	19.95	31.87	25.30	40.41	17.35	27.72	4884	7802	.17/.28							↓
7					58884	32.80	33.13	49.30	22.49	33.47	11.58	17.23	3766	5604	.11/.17							
	97.6	split t			58285	36.70	20.49	32.36	25.42	40.16	17.39	27.48	4859	7676	.20/.31							97.7
8		org mud split (20 cm)		0°	58886	41.11	9.78	16.61	29.80	50.60	19.31	32.79	6020	10222	.18/.30							
	99				58887	39.68	10.27	17.03	30.41	50.41	19.64	32.56	6124	10153	.19/.32							
9	99.2	← 30 cm split			58888	35.06	30.77	47.38	19.81	30.50	14.36	22.12	3845	5921	.15/.23							
				5°	58889	29.87	14.92	24.81	26.46	44.00	18.25	31.19	5258	8744	.16/.27							
100	95				58890	38.17	15.47	25.03	30.18	48.81	16.16	26.16	5376	8695	.20/.32							100.25
	100.9	↑ 30 cm split — 100.9–101.0 contact			58891	40.53	11.66	19.61	27.32	45.94	20.49	34.45	5716	9611	.23/.39							
1		Cut earth			101.9																	
	99	Whitish clay																				
2	102.5	— — grey clay like																				
3	80																					
	104.3																					
4																						
5																						
6	0%	No core, Caved																				
7																						

COAL LOG FORM No. X-1-78, Page 2.

BOREHOLE LOG BY: _____
DATE:

PLACER DEVELOPMENT LIMITED

EXPLORATION DEPARTMENT

GRID: _____ LOGGED BY: _____ HOLE No. 7643

DATE: _____ SHEET No. 4 of 5

DEPTH m	m block & % rec.	ROCK TYPE DESCRIPTION	Graph. log	Structure	SAMPLE NO.	COAL ANALYSES: MOISTURE %	% ASH as recvd.	% ASH dry basis	% V. M. as recvd.	% V. M. dry basis	% F.C. as recvd	% F.C. dry basis	CALORIFIC VALUE as recvd.	CALORIFIC VALUE dry basis	% S	% H	% N	% O	F.S.I.	Reflec.	Sp. Gravity	REMARKS
107		3 runs no core																				
8	108.2	silt w. min. org. matter & clay band interbedded w. coal/carb. particles.																				
9	109.1	Grey organic mud (some silt)																				
110		COAL C #3																				

COAL LOG FORM No. X-1-78, Page 2.

BOREHOLE LOG BY: _____

DATE:

PLACER DEVELOPMENT LIMITED
EXPLORATION DEPARTMENT

GRID: _____ HOLE No. 79-1
SHEET No. 1 of 4

LOCATION: NTS 105 A 2 W, 033 538 BEARING: _____ LATITUDE: 60°01'23" PROPERTY: Liard Coal Basin
DATE COLLARED: 19 April 79 LENGTH: 120.2 m DEPARTURE: 128°56'25" CORE SIZE: HQ LOGGED BY: D.M. Jennings
DATE COMPLETED: 25 April 79 DIP: 90° ELEVATION: ±2300' (701 m) SCALE OF LOG: 1:200 DATE: 26 April 1979

DEPTH m	m block & %rec.	ROCK TYPE DESCRIPTION	Graph. log	Structure	SAMPLE NO.	COAL ANALYSES: MOISTURE %	% ASH as recvd.	% ASH dry basis	% V.M. as recvd.	% V.M. dry basis	% F.C. as recvd.	% F.C. dry basis	CALORIFIC VALUE as recvd.	CALORIFIC VALUE dry basis	% S	% H	% N	% O	F.S.I.	Reflec.	Sp. Gravity	REMARKS
4		Cased																				
8																						
12																						
16	30% 18	Sand: Unconsol., Coarse-Vy. Coarse grnd., Well sorted Sub. rounded, min. immature Lt. grnish grey color																				
20	26%	Sand: Unconsol, Fine to med. grnd., Sorted, Sub. Ang., Min. immature, 5-10% Muscovite Lt. Brn. color																				
24	09%																					
28	14%	Sand: as @ 18-21m with claystone beds, Sand has Laminae of finely divided Carbonaceous material @ 30.8																				
30																						

GRID: _____

PLACER DEVELOPMENT LIMITED
EXPLORATION DEPARTMENT

LOGGED BY: Jenkins HOLE No. 79-1
DATE: 26 April 1979 SHEET No. 2 of 4

DEPTH m	m block & % rec.	ROCK TYPE DESCRIPTION	Graph. log	Structure	SAMPLE NO.	COAL ANALYSES: MOISTURE %	% ASH as recvd.	% ASH dry basis	% V. M. as recvd.	% V. M. dry basis	% F.C. as recvd	% F.C. dry basis	CALORIFIC VALUE as recvd.	CALORIFIC VALUE dry basis	% S	% H	% N	% O	F.S.I	Reflec.	Sp. Gravity	REMARKS
30																						
	0%																					
34																						
	6%	Claystone: Lt. grey, massive – crudely laminated, 5% plant debris + charcoal																				
	4%	12cm core of Tree Trunk @ 37.2m, 6cm @ 41m, 10cm @ 42m																				
38	0%	Siltstone below 40.2m																				
	30%	Laminae @ 35° to core axis																				
42	35%	As above with fine gravel beds																				
	20%	As above less gravel beds																				
	0%																					
46		Sand: Unconsol., fine grnd., poorly sort. carbonaceous																				
	2%	Wood: 4cm core																				
50	0%				58901																	
	10%	Coal: DK. BRN. finely divided organic matter w/5% wood, 1% pyrite																				
	10%	Claystone: Buff w/plant debris thin fine gravel beds																				
54																						
	30%																					
	6%	Coal: DK. brn., finely divided organic matter w/minor woody matter																				
58	0%																					
	1%	Sand: Unconsol., med.–coarse grnd., well sorted, min. immature																				
	19%	Similar to 12.2–18m																				
62	0%																					
	10%	Claystone: Buff colored, upto 5% plant debris																				

COAL 100 FORM No. X-1-78, Page 2.

BOREHOLE LOG BY: _____

GRID: _____

PLACER DEVELOPMENT LIMITED
EXPLORATION DEPARTMENT

LOGGED BY: Jenkins HOLE No. 79-1
DATE: 26 April 79 SHEET No. 2 of 4

DEPTH m ft-6	m block & % rec	ROCK TYPE DESCRIPTION	Graph. log	Structure	SAMPLE NO.	COAL ANALYSES: MOISTURE %	% ASH as recvd	% ASH dry basis	% V. M. as recvd	% V. M. dry basis	% F.C. as recvd	% F.C. dry basis	CALORIFIC VALUE as recvd.	CALORIFIC VALUE dry basis	% S	% H	% N	% O	F.S.I.	Rollec.	Sp. Gravity	REMARKS
	13%	4cm Coal @ bottom																				
	60%	Sand: Unconsol. med. grnd at bottom grading to silt @ top.																				
70	42%	fining upward sequence as above																				
	0%																					
	0%																					
74	9%	Sand: Unconsol., med grnd.																				
	0%																					
78																						
	0%																					
	0%																					
82																						
	19%	Coal: Dk. brn., soft, finely divided organic matter, few ident. grass blade			58902																	
	66%	Sand: Unconsol., coarse to vy coarse and well sorted @ bottom, finer grnd + poorly sorted towards top, grades to micaceous silt @ top.																				
90																						
	0																					
	0																					
94																						
	<1%	interlaminated coal and silt.																				
	0	98.1 Coal: Dirty, finely divided			58903																	
98	1%	99 organic w/ clay bands																				
	57%	Coal: Dirty, weakly bedded,			58904																	
	60%	101 finely divided organics w/ 3% charcoal, clay bands																				
102		101.7 Clay to 101.7 m																				

COAL LOG FORM No. X-1-78, Page 2.

BOREHOLE LOG BY: _____

PLACER DEVELOPMENT LIMITED

EXPLORATION DEPARTMENT

GRID: _____

LOGGED BY: J. Jenkins HOLE No. 79-1

DATE: 26 April 1979 SHEET No. 4 of 4

DEPTH m	m blank & % rec	ROCK TYPE DESCRIPTION	Graph. log	Structure	SAMPLE NO.	COAL ANALYSES: MOISTURE %	% ASH as recvd	% ASH dry basis	% V. M. as recvd	% V. M. dry basis	% F.C. as recvd	% F.C. dry basis	CALORIFIC VALUE as recvd	CALORIFIC VALUE dry basis	% S	% H	% N	% O	F. S. I.	Reflec.	Sp. Gravity	REMARKS
	8%	101.7 - 103.6 Coal: DK Brn, soft, massive, min. woody material argil. @ bottom			58905																	
	95%	Interbedded Silt and Clay - Lt. grn. to white. weak bedding 90° to core axis																				
106	65%																					
	56%	Silt: med gray, sandy, thin bedded - laminated, organic partings																				
110	0%																					
	0%	Conglomerate: py + silica cemented																				
		113.4 Coal: 20% woody fragments																				
114	64%	114.9 8cm clay band			58906																	
	86%	116.4 20cm of clay bands			58907																	
	49%	Coal: Vy. dirty ± 50% clay.																				
118		117.9																				
	0%																					
		TD 120.2																				
122		Rod broke - hole abandoned																				
126																						
130																						
134																						
138																						

COAL LOG FORM No. X-1-78, Page 2.

BOREHOLE LOG BY: _____

DATE: _____

PLACER DEVELOPMENT LIMITED

EXPLORATION DEPARTMENT

GRID: _____

HOLE No. 79-2

SHEET No. 1 of 4

LOCATION: NTS 105-A-2 W/ (076556) BEARING: _____ LATITUDE: 60°02'23" PROPERTY: Liard Coal Basin

DATE COLLARED: 26 April '79 LENGTH: 129.5 m DEPARTURE: 128°57'16" CORE SIZE: HQ LOGGED BY: D.M. Jenkins

DATE COMPLETED: 3 May '79 DIP: 90° ELEVATION: 2300' (701 m) SCALE OF LOG: 1:200 DATE: 31 April 1979

DEPTH m	m block & %rec.	ROCK TYPE DESCRIPTION	Graph. log	Structure	SAMPLE NO.	COAL ANALYSES: MOISTURE %	% ASH as recvd.	% ASH dry basis	% V.M. as recvd.	% V.M. dry basis	% F.C. as recvd.	% F.C. dry basis	CALORIFIC VALUE as recvd.	CALORIFIC VALUE dry basis	% S	% H	% N	% O	F.S.I.	Reflec	Sp. Gravity	REMARKS
0																						
4																						
8																						
12																						
16																						
20		Cased to 28.6m																				
24																						
28	557	Coal: DK brn-Black, vy. fine grnd. structureless matrix with upto 20% wood fragments, several clay bands			58908																	
	559				58909																	
	561																					
32	563																					

COAL LOG FORM No. X-1-78, Page 1.

BORHOLE LOG BY: _____

DATE: _____

PLACER DEVELOPMENT LIMITED
EXPLORATION DEPARTMENT

GRID: _____

LOGGED BY: Jenkins HOLE No. 79-2
DATE: 31 April 1979 SHEET No. 2 of 4

DEPTH m	m block & % rec.	ROCK TYPE DESCRIPTION	Graph. log	Structure	SAMPLE NO.	COAL ANALYSES: MOISTURE %	% ASH as recvd.	% ASH dry basis	% V. M. as recvd	% V. M. dry basis	% F.C. as recvd	% F.C. dry basis	CALORIFIC VALUE as recvd.	CALORIFIC VALUE dry basis	% S	% H	% N	% O	F.S.I.	Reflec.	Sp. Gravity	REMARKS
	95%	Coal: DK brn - BLK, vy fine grnd matrix w/10% wood fragments 32.6			58910																	
	100%	grading into clay by inter- beds below 34.6m 33.8 34.6 35.1			58911																	
36	95%	Clay-Silt: Lt. grey; micaceous, poorly bedded, grading from silt @ bottom, to clay @ top. Org. & organic rich beds			58912																	
	100%				58913																	
	25%	Clay-Sand: Interbedded clay, silt and unconsolidated sand, Thin coal beds (max. thickness 4cm)																				
40	22%																					
	55%	Silt: Lt. grey, micaceous with abundant organic matter																				
	8%																					
44		bedding @ 90° to core axis																				
	<1%																					
		Wood fragment cored @ 46m																				
	75%	Gravel-Sand: medium gravel-coarse sand; Lt grey; unconsolidated mineralogically immature (coarser clasts are largely rock fragments) moderately sorted																				
48	80%																					
	90%																					
52	40%																					
56	0%																					
	45%	Silt: Lt grey; sandy @ bottom argil. @ top; micaceous; organic fragments common																				
60	0%																					
64	20%	20cm of coal: DK. brn. finely divided organic matter w/several % wood chips 64.6 66.1			58914																	
	97%																					

BOREHOLE LOG BY: _____
DATE: _____

GRID: _____

PLACER DEVELOPMENT LIMITED

EXPLORATION DEPARTMENT

LOGGED BY: D.R. JARVIS HOLE No. 79-2

DATE: 2 May 1979 SHEET No. 3 of 4

DEPTH m	m block & % rec	ROCK TYPE DESCRIPTION	Graph. log	Structure	SAMPLE NO.	COAL ANALYSES: MOISTURE %	% ASH as recvd.	% ASH dry basis	% V. M. as recvd.	% V. M. dry basis	% F.C. as recvd	% F.C. dry basis	CALORIFIC VALUE as recvd.	CALORIFIC VALUE dry basis	% S	% H	% N	% O	F. S.I.	Reflec.	Sp. Gravity	REMARKS
68	100%	Clay and Argil. silt; Lt grey; micaceous 5-10% organic fragments bedding Not obvious																				
	40%																					
72	0%																					
	40%	Sand: fine grained, silty (poorly sorted) w/thin (3 6cm) bed of argil. silt																				
76	60%	abundant organic partings in sand @ 90° to core axis																				
	5%																					
	0%	Sand: As above but w/coarse grnd intervals																				
80																						
	36%	Sand: fine grnd.; poorly sorted w/abundant coal partings; grading upward through silt to clay to coal parting																				
	51%																					
	30%																					
84																						
	0%																					
88																						
		Gravel clasts. to 5cm recovered SOURCE UNKNOWN																				
	10%																					
92		~~Silt and Silty clay; Med grey~~ micaceous																				
	92%	Sand: Unconsol.; fine grnd.; poorly sorted; cohesive due to matrix; grades upward to silt																				
	76%	Sand: Unconsol.; coarse grnd. well sorted																				
96	+80%																					
	0%																					
	41%	Sand; Med grey; fine grnd, poorly sorted (silty) very thinly bedded																				
100																						
	0%																					
104																						

COAL LOG FORM No. X-1-78, Page 2.

BOREHOLE LOG BY: _____

DATE: _____

GRID: _____

PLACER DEVELOPMENT LIMITED

EXPLORATION DEPARTMENT

LOGGED BY: Jenkins

DATE: 7 May 74

HOLE No. 79-2

SHEET No. 4 of 4

DEPTH m ft	m blank & % rec.	ROCK TYPE DESCRIPTION	Graph. log	Structure	SAMPLE NO.	COAL ANALYSES: MOISTURE %	% ASH as recvd.	% ASH dry basis	% V. M. as recvd.	% V. M. dry basis	% F.C. as recvd	% F.C. dry basis	CALORIFIC VALUE as recvd.	CALORIFIC VALUE dry basis	% S	% H	% N	% O	F.S.I.	Reflec.	Sp. Gravity	REMARKS
104	0%	Sand																				
108	0%																					
112		Clay-Silt: Abundant organic matter																				
	50%	Coal: DK brn Very finely divided organic matter 112.2 / 112.6			58915																	
	90%	Silt and Clay: Interbedded; Lt. grey-grnish grey to dark grey-brn at base and Top due to high organic content.																				
116	97%																					
	31%																					
	98%	Coal: finely divided organic matter 117.95 / Interbedded zone. Rare light clay content 119.05			58916																	
120	73%	Clay: DK brn-grey; high organic content																				
	64%	Coal: DK brn: finely divided organic matter; upper contact gradational over 10 cm interval w/clay bed 120.6 / 122.5			58917																	
	50%	Coal: As above but w/clay partings; gradational to clay below 122.5			58918																	
124		Clay: light grey; plastic																				
	36%	underlain by																				
	51%	Silt: Med grey; argil. and micaceous																				
128																						
		129.5 Total Depth																				
132																						
136																						
140																						

BOREHOLE LOG BY: _____

PLACER DEVELOPMENT LIMITED

EXPLORATION DEPARTMENT

GRID: _____ HOLE No. 79-3

SHEET No. 1 of 5

LOCATION: NTS 105A2W/(041554) BEARING: — LATITUDE: 60°03'16" PROPERTY: Liard Coal

DATE COLLARED: 4 May 1979 LENGTH: 500' (153 m) DEPARTURE: 128°55'33" CORE SIZE: HQ LOGGED BY: M. Boyd + D. Jenkins

DATE COMPLETED: 9 May 1979 DIP: -90 ELEVATION: 2190' (667 m) SCALE OF LOG: 1:200 DATE: 10 May 1979

DEPTH m	m block & %rec.	ROCK TYPE DESCRIPTION	Graph. log	Structure	SAMPLE NO.	COAL ANALYSES: MOISTURE %	% ASH as recvd.	% ASH dry basis	% V.M. as recvd.	% V.M. dry basis	% F.C. as recvd.	% F.C. dry basis	CALORIFIC VALUE as recvd.	CALORIFIC VALUE dry basis	% S	% H	% N	% O	F.S.I.	Reflec	Sp. Gravity	REMARKS
0																						
4																						
8		Casing																				
12																						
16																						
20		Cave - Ground up coal mixed w/ sand + clay																				
	47%	Sand: Lt. grey; coarse grnd; well sorted; grades upward into fine grnd less well sorted sand @ 23.6m 1% CM grades																				
24	31%																					
	13%	upward to sandy micaceous silt @ top; 2cm coal parting @ top																				
	41%																					
	68%	SANDY, LT. GREY, SLT, WELL SORTED BECOMING MEDIUM GRAINED TO V.F. CLAY WITH SHALE INTERBEDDED WITH THIN BEDS OF PLASTIC, VUGGY COAL, LIMESTONE																				
28																						
	34%	INTERBEDDED DARK, FINE GRAINED TO HEAVILY CARBONACEOUS CLAY GRADING UP INTO MICACEOUS, POORLY BEDDED V COARSE, SANDSTONE																				
	61%	Coal: Black; Hard; finely divided Organic matter			58943																	Sent to Roke
32																						

COAL LOG FORM No. X-1-78, Page 1.

BORHOLE LOG BY: _____

DATE: _____

GRID: _____

PLACER DEVELOPMENT LIMITED
EXPLORATION DEPARTMENT

JENKINS
DATE: 10/11/1979

HOLE No. _____
SHEET No. 2 of 5

-79-

DEPTH m	m block & % rec.	ROCK TYPE DESCRIPTION	Graph. log	Structure	SAMPLE NO.	COAL ANALYSES: MOISTURE %	% ASH as recvd.	% ASH dry basis	% V. M. as recvd.	% V. M. dry basis	% F.C. as recvd	% F.C. dry basis	CALORIFIC VALUE as recvd.	CALORIFIC VALUE dry basis	% S	% H	% N	% O	F.S.I.	Reflec.	Sp. Gravity	REMARKS
32	5%	CLAY, V.F. GRAINED, LITTLE MATERIAL, GREY THROUGHOUT																				
	57%	SANDSTONE: FINE GRAINED, GRADES UNDERLIES INTO V.F. SANDY CLAY & FOSSILIFEROUS VISIBLE. CARBONACEOUS VISIBLE IN QUANTITY AT ± 32.0 – 32.5m																				
	39%	SANDSTONE: DIRTY BROWN, F. GRAINED, GRADING INTO VERY ORGANIC CLAY WITH INTERMITTENT BEDS OF LAMINAL LAYERED COAL. ONE 2cm BAND OF SIDERITE.																				
36	92%	SANDSTONE: GREY, ORGANIC, F. GRAINED, LITTLE LAMINATION, WELL SORTED, NO EXCESS CLAY, ORGANIC FRAGMENTS VISIBLE. GRADES INTO POOR QUALITY COAL. CONTACT TAKEN AT TOP OF INTERBEDDED CLAY																				
	2.0%	CLAY, SLIGHTLY ORGANIC, F. GRAINED																				
	12.5%	QUARTZ RICH SILICIOUS ROCKS, PEBBLES AND VERY COARSE GRAINED SAND HIGHLY MICACEOUS QUARTZ + FELDS																				
40	14%	HIGHLY SILICIOUS ROCKS, PEBBLES AND V. COARSE GRAINED QUARTZ, PLAG FELDSPAR AND SANDSTONE FRAG. BIOTITE & MUSCOVITE. POORLY SORTED.																				
	6%	COARSE GRAINED SAND AND SILICIOUS QUARTZ S.A ABOVE. POORLY SORTED. MICA.																				
44	30%	QUARTZ, ARG. FELDSPARS, C. GRAINED ENDST.																				
	16%																					
48	95%	Silt and Clay: Lt. grey – Brn; Sandy in part high organic content in Clay																				
52	41%	Gravel: coarse pebble to cobble Size; No matrix recovered; clasts consist of quartz, argillite, and acid intrusive rock types.																				
56																						
60																						
	30%	Sand: Med. – DK. grey, fine grnd. poorly sorted micaceous; thin bedded w/coal partings																				
64	50%																					
	87%																					
68	87%																					

COAL LOG FORM No. X-1-78, Page 2.

BOREHOLE LOG BY: _____

DATE: _____

PLACER DEVELOPMENT LIMITED

EXPLORATION DEPARTMENT

GRID: _____ DATE: 10 May, 1979 SHEET No. 3 of 6

DEPTH m	m block & % rec.	ROCK TYPE DESCRIPTION	Graph. log	Structure	SAMPLE NO.	COAL ANALYSES: MOISTURE %	% ASH as recvd.	% ASH dry basis	% V. M. as recvd.	% V. M. dry basis	% F.C. as recvd	% F.C. dry basis	CALORIFIC VALUE as recvd.	CALORIFIC VALUE dry basis	% S	% H	% N	% O	F.S.I.	Reflec.	Sp. Gravity	REMARKS
68	100%																					
	43%																					
	100%	Clay: Lt. grnish grey – Dk. Brn., silty w/ coal @ bottom, moderate organ. @ top																				
72	75%	Sand: Lt. grey – med. Brn; fine grnd poorly sorted w/increasing proportion of silt and clay matrix @ top; Local thin coal partings; Locally thin bedded																				
	100%																					
76	50%																					
	11%	Clay bed; Lt grey silty clay w/silt and fine sand interbeds																				
	52%	Clay is soft and plastic Increasing organic content towards base																				
80	90%																					
	43%	Coal: Dk. Brn.-Black; hard; finely divided organic matrix w/grass moulds 81.0 – 81.75			58944																	Send sample for Logging Correlation
	105%	Clay-silt: Clay-Blue grey; silty. Compact w/Little plasticity w/ 20-30 cm interbeds of silt and sandy silt in top 3m																				
84	61%																					
88																						
92																						
96																						
100																						
	100%	1-2cm Coal partings @ 102.7m																				
104	100%																					

Tricent

COAL LOG FORM No. X-1-78, Page 2.

BOREHOLE LOG BY: _____

DATE: _____

PLACER DEVELOPMENT LIMITED

EXPLORATION DEPARTMENT

GRID: _____

LOGGED BY: [illegible] HOLE No. [illegible]

DATE: 10 May 71 SHEET No. 4 of 5

79-3

DEPTH m	m block & % rec.	ROCK TYPE DESCRIPTION	Graph. log	Structure	SAMPLE NO.	COAL ANALYSES: MOISTURE %	% ASH as recvd.	% ASH dry basis	% V. M. as recvd.	% V. M. dry basis	% F. C. as recvd	% F. C. dry basis	CALORIFIC VALUE as recvd.	CALORIFIC VALUE dry basis	% S	% H	% N	% O	F.S.I.	Reflec.	Sp. Gravity	REMARKS
104	93%	Clay: as above; lower 0.5m gradational to coal by interbeds of coal																				
	73%	Coal: Compact w/clay chips and grass fds.																				
108	96%	Sand: Lt grey; fine grnd.; poorly sorted thin bedded w/ coal partings																				
	46%																					
	93%	Coal 15cm + organic Clay																				
112	63%	Sand: Lt. grey; fine-med. grnd poorly sorted; Rare 1mm thick clay and coal partings (deformed by drilling)																				
	87½																					
	6%																					
116	0%																					
	66%																					
	100%																					
120	59½																					
	35%																					
	67%	Coal partings @ 123-124 m																				
124	33%																					
	0%																					
128																						
	93%																					
132		Clay: Blue grey mot. w grn. + yellow; silty + Sandy; Micaj compact w/ narrow zones of moderate plasticity																				
	0%																					
136		Thin silt bds. w/ abund. muscovite																				
	100%	Coal ball @ 137.5'																				
	0%																					
140	100%																					

COAL. LOG FORM No. X-1-78, Page 2.

BOREHOLE LOG BY: _____

DATE: _____

GRID: _____ EXPLORATION DEPARTMENT DATE: 27 JAN 77 SHEET No. 3 of 5

79-3

DEPTH m	m block & % rec.	ROCK TYPE DESCRIPTION	Graph. log	Structure	SAMPLE NO.	COAL ANALYSES: MOISTURE %	% ASH as recvd.	% ASH dry basis	% V. M. as recvd.	% V. M. dry basis	% F.C. as recvd	% F.C. dry basis	CALORIFIC VALUE as recvd.	CALORIFIC VALUE dry basis	% S	% H	% N	% O	F.S.I.	Reflec.	Sp. Gravity	REMARKS
140																						
	90%	Coal parting @ 142 — 3cm thick																				
	95%																					
144	100%																					
	50%	Coal parting 146.9 — 34cm thick																				
	100%	Coal parting 147.8 — 1cm thick																				
148	100%	Clay as @ 132 m																				
	100%																					
	100%																					Shear @ 40° CA
152	83%																					
		TD 153 m																				
156																						
160																						
164																						
168																						
172																						
176																						

COAL LOG FORM No. X-1-78, Page 2.

BOREHOLE LOG BY: _____

DATE: _____

PLACER DEVELOPMENT LIMITED

EXPLORATION DEPARTMENT

GRID: _____

HOLE No. 77-4 - 79-4

SHEET No. 1 of 5

LOCATION: NTS 105 A 7 W/L (049 SW) BEARING: _____ LATITUDE: 60°01'54" PROPERTY: Liard Coal

DATE COLLARED: _____ LENGTH: 143.8 m DEPARTURE: 128°-4'-45" CORE SIZE: HQ LOGGED BY: DM Jenkins

DATE COMPLETED: _____ DIP: -90 ELEVATION: 2300' (701 m) SCALE OF LOG: 1:200 DATE: 13 May, 1979

DEPTH m	m block & %rec.	ROCK TYPE DESCRIPTION	Graph. log	Structure	SAMPLE NO.	COAL ANALYSES: MOISTURE %	% ASH as recvd.	% ASH dry basis	% V.M. as recvd.	% V.M. dry basis	% F.C. as recvd.	% F.C. dry basis	CALORIFIC VALUE as recvd.	CALORIFIC VALUE dry basis	% S	% H	% N	% O	F.S.I.	Reflec.	Sp. Gravity	REMARKS
0																						
4																						
8																						
12																						
16																						
20																						
24	26.7 m 0% 25%	Sand: Lt. grey; med. grnd. w/ sm cobbles @ top; sorted @ base & poorly sorted near top w/ clay interbeds.																				
28	37% 90%	Clay: Lt. grey – Dk. brn.; silty; non-plastic w/ minor silt interbeds; high lg organic @ 26.51 m to 28.04 m																				
32	0% 0%																					

COAL LOG FORM No. X-1-78, Page 1.

BOREHOLE LOG BY: _____

DATE: _____

GRID: _____

PLACER DEVELOPMENT LIMITED

EXPLORATION DEPARTMENT

LOGGED BY: D.M. Jenkins HOLE No. 79-4

DATE: _____ SHEET No. 2 of 5

DEPTH m	m block & % rec.	ROCK TYPE DESCRIPTION	Graph. log	Structure	SAMPLE NO.	COAL ANALYSES: MOISTURE %	% ASH as recvd	% ASH dry basis	% V. M. as recvd	% V. M. dry basis	% F.C. as recvd	% F.C. dry basis	CALORIFIC VALUE as recvd.	CALORIFIC VALUE dry basis	% S	% H	% N	% O	F.S.I	Reflec.	Sp. Gravity	REMARKS
	31%																					
	20%	Silt: yellowish grn.; ± 50% vy fine sand; vy. micaceous; sorted (minor clay matrix)																				
36	30%																					
	0%																					
40																						
	80%	Clay: Lt. grey; Compact & Non plastic																				
	90%	silty @ base, w/organic																				
44		Laminae in Lower 20cm.																				
	78%	12cm thick coal parting @ 43.3																				
	27%																					
48																						
	0%	Sand Med. grey; fine-coarse grnd.																				
	46%	series of poorly defined fining upward sequences w/rare thin clay beds																				
	40%	8cm Coal parting (core of Log) @ 57.3m																				
52		26cm Coal parting @ 63m																				
	28%																					
	42%																					
56																						
	16%																					
	22%																					
	40%																					
60																						
	35%																					
	45%																					
64	27%																					
	30%																					
	50%	Sand - clay: Thinly bdd. coarse sand and silt and clay w/coal partings																				
68																						

COAL LOG FORM No. X-1-78, Page 2.

BOREHOLE LOG BY: _____

GRID: _____

PLACER DEVELOPMENT LIMITED

EXPLORATION DEPARTMENT

LOGGED BY: _____ HOLE No. _____

DATE: _____ SHEET No. 2 of 5

79-

DEPTH m	m block & % rec.	ROCK TYPE DESCRIPTION	Graph. log	Structure	SAMPLE NO.	COAL ANALYSES: MOISTURE %	% ASH as recvd.	% ASH dry basis	% V. M. as recvd.	% V. M. dry basis	% F.C. as recvd	% F.C. dry basis	CALORIFIC VALUE as recvd.	CALORIFIC VALUE dry basis	% S	% H	% N	% O	F.S.I.	Reflec.	Sp. Gravity	REMARKS
72	51%	Coal: 4/6 cm Brn; wood chips & charcoal																				
	93%	Clay: Lt. grey; silty; compete non-plastic																				
	40%	Sand: Lt. grey; vy. fine grnd. @ base grading upward to silt w/ abundant mica and clay matrix																				
	24%																					
72	78%	Sand: med. grey; coarse grnd; micaceous grades upward to f. sand;																				Minor float coal @ base
	91%	Sand: Lt. grey: vy. fine grnd. grading upward to silt to clay- organic clay to 20 cm coal bed.																				
76	26%																					
	56%	Sand: Lt grey - med. grey; vy coarse grnd to med grnd; well sorted to moderately sorted; mica.																				
	36%																					
80	0%																					
	83%																					
	26%	Sand-silt-clay-coal: Thin interbeds of sediments ranging from vy coarse sand to coal partings																				
84	53%																					
	52%	Clay: Lt. grey - DK Brn; non-plastic; ± 50% organic rich clay; coal beds as marked																				
88	100%	Coal: DK Brn-Black; 75% finely divided organic w/ 25% discernible plant fragments including char; Upper 10 cm contains ± 30% clay as partings; 62 cm org. clay parting from 90.0-90.6 m; 11 cm Clay parting from 92.15-92.27 m; Coal hard w/ exception of 10 cm soft coal near base			58925																	
	71%				68926																	Sent to Roke for study
	95%				58927																	
92	98%				58928																	
	73%				58929																	
	84%	Clay; Lt. grey; silty; non-plastic; w/ silt and organic laminae																				
96		" in Lower half																				
	100																					
	100/5	Sand: Lt. grey; Coarse near base grading to fine grnd. Top; sorted @ base Less well sorted @ Top																				
100	26/5	organic laminae @ Top																				
	87%	Organic Clay: Lt. grey - DK brn.; w/ 30 cm coal bed																				
104	100%	Clay: med. grey: Silty + Silt Laminae @ base and organic @ Top																				

COAL LOG FORM No. X-1-78, Page 2.

BOREHOLE LOG BY: _____

DATE: _____

GRID: _____

PLACER DEVELOPMENT LIMITED

EXPLORATION DEPARTMENT

LOGGED BY: _____ HOLE No. _____

DATE: _____ SHEET No. 11 of 5 -79-14

DEPTH m	m block & % rec.	ROCK TYPE DESCRIPTION	Graph. log	Structure	SAMPLE NO.	COAL ANALYSES: MOISTURE %	% ASH as recvd.	% ASH dry basis	% V. M. as recvd.	% V. M. dry basis	% F.C. as recvd	% F.C. dry basis	CALORIFIC VALUE as recvd.	CALORIFIC VALUE dry basis	% S	% H	% N	% O	F.S.I.	Reflec.	Sp. Gravity	REMARKS
104	84%	Clay + Silt as above																				
	59%	Sand: Thin to med. beds of sand (coarse to fine grnd) and vy. fine gravel																				
108	60%																					
	59%	6 cm coal bed @ 110.33m																				
	16%																					
112	83%																					
	65%	Clay: med. grey - DK. brn.; NON-plastic; silty (more silty @ base) coal beds w/ organic clay margins in upper 1/3																				
	87%																					
116	27%	Sand: Lt. grey; coarse grnd @ base grading upward to laminated silt @ top 119.50																				
	67%																					
120	78%	Coal: ~~Dk. brn. finely divided~~ organic matter w/ ± 30% Lt. brn 121.0 wood fragments; Top 12 cm are 122.0 sandy; Interbeds of clay from 121.3 - 121.4 m			58930																	Roka
	87%				58931																	
	98%																					
124	95%	Clay: w/ Thin interbeds of silt and sand																				
	97%	Coal: DK. brn.; hard; 75% matrix w/ 124.6 75% wood and grass stems - Top 126.5 is a shear @ 15°; 19 cm clay bd. @ 127.10 - 127.29 127.10			58932																	Note Shear
	97%				58933																	Roka
128	97%				58934																	Desiccated
		5 cm coal band @ 128.9m 128.6 129.2			58935																	
	94%	Clay: Lt. grey: In part laminated w/ silt and coal; NON plastic																				
	91%																					
132	93%	Coal: DK. brn.; Hard; 50% finely divided matrix + 50% larger plant fragments; some Narrow 132.8			58920																	
	60%	134.7																				
	10%	Coal and interbed clay																				
136	27%	Silt: Lt. grey; micaceous; micro + laminated; w/ thin beds of clay																				
140																						

COAL LOG FORM No. X-1-78, Page 2.

BOREHOLE LOG BY: _____

DATE: _____

GRID: _____

PLACER DEVELOPMENT LIMITED

EXPLORATION DEPARTMENT

LOGGED BY: N Legg

DATE: _____

HOLE No. 79-4

SHEET No. 5 of 5

79-

DEPTH m	m block & % rec.	ROCK TYPE DESCRIPTION	Graph. log	Structure	SAMPLE NO.	COAL ANALYSES: MOISTURE %	% ASH as recvd.	% ASH dry basis	% V. M. as recvd.	% V. M. dry basis	% F.C. as recvd	% F.C. dry basis	CALORIFIC VALUE as recvd.	CALORIFIC VALUE dry basis	% S	% H	% N	% O	F.S.I.	Reflec.	Sp. Gravity	REMARKS
140		Sand: med. grey; vry. coarse grnd.– granule size; to ± 5% fine gravel well sorted; fine grnd & less well sorted @ Top																				
144		TD 143.8m																				

COAL LOG FORM No. X-1-78, Page 2.

BOREHOLE LOG BY: _____

DATE: _____

PLACER DEVELOPMENT LIMITED

EXPLORATION DEPARTMENT

GRID: _____ HOLE No. _____ SHEET No. 1 of 4 DD77-5

LOCATION: NTS 105A/2W/4 (056555) BEARING: _____ LATITUDE: 60°02'20" PROPERTY: Liard Coal

DATE COLLARED: 14 May 1979 LENGTH: 139.2 m DEPARTURE: 128°53'56" CORE SIZE: HQ LOGGED BY: D Jenkins

DATE COMPLETED: 18 May 1979 DIP: -90° ELEVATION: _____ SCALE OF LOG: 1:200 DATE: 30 May 1979

DEPTH m	m block & %rec.	ROCK TYPE DESCRIPTION	Graph. log	Structure	SAMPLE NO.	COAL ANALYSES: MOISTURE %	% ASH as recvd.	% ASH dry basis	% V.M. as recvd.	% V.M. dry basis	% F.C. as recvd.	% F.C. dry basis	CALORIFIC VALUE as recvd.	CALORIFIC VALUE dry basis	% S	% H	% N	% O	F.S.I.	Reflec	Sp. Gravity	REMARKS
0																						
4																						
8																						
12																						
16		Cased to 18.8m																				
20	10%	Sand: Lt. grey; vy. coarse grnd.; apparently well sorted w/ little fine grnd matrix; mineralogically immature w/ abundant feldspar + 5-10% ferro-mag minerals and f.g. dark rock clasts (very little mica)																				
24	8%																					
	0%																					
28	13%	Finer grnd @ 28.0m w/ clay bds.																				
	6%	Gravel w/ clay: clasts to 2cm relationship of gravel + clay is ambiguous																				
	0%																					
32	15%																					

COAL LOG FORM No. X-1-78, Page 1.

BORHOLE LOG BY: _____

DATE: _____

GRID: _____ PLACER DEVELOPMENT LIMITED — EXPLORATION DEPARTMENT — JENKINS. DATE: _____ SHEET No. 2 of 4 #9-5

DEPTH m	m block & % rec.	ROCK TYPE DESCRIPTION	Graph. log	Structure	SAMPLE NO.	MOISTURE %	% ASH as recvd	% ASH dry basis	% V. M. as recvd	% V. M. dry basis	% F.C. as recvd	% F.C. dry basis	CALORIFIC VALUE as recvd.	CALORIFIC VALUE dry basis	% S	% H	% N	% O	F.S.I.	Reflec.	Sp. Gravity	REMARKS
32	17%	Gravel: 38.7–32.6 m; clasts rnded to subrnded; to 7.5 cm max. diam., av. diam ± 4cm; Clasts consist of basalt, qtz, and meta-sediments; clay mixed w/ pebbles below 35.6m probably																				
36	19%																					
	1%	indicates grinding of underlying fining upward sequence 32.6–31.68 m is fg. sand @ base w/lt. grey micaceous clay @ top																				
	2%																					
40	33%	Clay: Lt–med grey – DK Brn; massive; high organic content w/ 4cm long wood fragments																				
	47%																					
	74%	Coal: Ground up by drilling; contains 41.55–41.8																				
44	100%	Clay: Lt. grey: massive–weakly bdd.; locally silty; high organic content and coal partings 46.9–47.3m 49.6–50.0 51.6–52.4																				
	86%																					
	100%	Thin bd coarse sand @ 50.1m																				
48	80%																					
	62%																					
52	83%																					
	90%	Sand: Lt.–med. grey; fine–med. grnd poorly sorted; w/ abundant organic partings																				
	23%																					
56	93%	Clay: Lt. grey – yellow grey; massive to vy. weakly bdd; silty – vy silty; NON-plastic Organic clay 57.5–57.9 m																				
	97%																					
	93%	Sand: med. grey; coarse grnd; well sorted @ base; finer grnd. & less well sorted above w/ more mica and organic partings, grading to silt–clay clay bed @ 60.2m & 59.9 m																				
60	41%																					
	0%																					
64	0%																					Hole making H2O @ 63m
	18%	30cm Coal: Side wall density Log indicates ± 0.5m clay band below																				
	92%	Coal: DK. Brn: mod. hard; mostly finely divided organic; dirty; grad. lower cont. 67.8			58936																	To Roke
68																						

COAL LOG FORM No. X-1-78, Page 2.

BOREHOLE LOG BY: _____

DATE: _____

GRID: _____ EXPLORATION DEPARTMENT DATE: _____ SHEET No. 1 of 2

79-5

DEPTH m	m block & % rec.	ROCK TYPE DESCRIPTION	Graph. log	Structure	SAMPLE NO.	COAL ANALYSES: MOISTURE %	% ASH as recvd.	% ASH dry basis	% V. M. as recvd.	% V. M. dry basis	% F.C. as recvd	% F.C. dry basis	CALORIFIC VALUE as recvd.	CALORIFIC VALUE dry basis	% S	% H	% N	% O	F.S.I.	Reflec.	Sp. Gravity	REMARKS
72.5	60%	Clay: med. grey - Dk. brn; massive to thin bdd. ± 5mm; non-plastic w/ organic clay + coal partings @ 70.1 - 70.9																				
	76%																					
	91%																					
72		72.9 - 73.7																				
	91%																					
	69%																					
76	93%	Silt: Lt - Med Grey; vy thin bdd ± 3mm vy micaceous; Organic partings																				
	100%	Coal 77.1			58937																	
		Clay: Organic + Sand 78.3 78.8																				
	96%	Coal 79.3			58938																	
80		Sand: Coarse grnd; Organic 80.4																				
	78%	Coal: finely divided Organic 81.3			58939																	
	93%	Clay: Organic 81.86																				
		Coal: finely divided Organic 82.91			58940																	
	93%	Clay + Silt: Interbdd clay and silt																				
84																						
	86%																					
		Sand: med. grey; vy coarse grnd. @ base and finer grnd. above. grading into silt @ 85.7 m																				
	36%																					
88	13%																					
	9%																					
	0%																					
92																						
	37%	Clay: DK. Brn.; Organic w/ coal parting between 92 + 93.5 m; Thin sand bed @ 93.5 m																				
	99%																					
96	94%	Clay + Silt: Organic Clay in bds to 2m thick interbdd w/ vy thin bdd. to laminated silt in bds to 2 m																				
	87%																					
	100%																					
100	80%																					
	100%	Sand: Lt. Grey; vy coarse grnd. @ base w/ 40% granule size grns + 5% fine pebbles grading upward to vy fine sand w/ coal partings																				
104	30%																					

REMARKS: 211 Samples to ROXIE

COAL LOG FORM No. X-1-78, Page 2.

BOREHOLE LOG BY: _____

DATE: _____

-1-

GRID: _____ EXPLORATION DEPARTMENT DATE: _____ SHEET No. 4 of 4

DEPTH m	m block & % rec.	ROCK TYPE DESCRIPTION	Graph. log	Structure	SAMPLE NO.	COAL ANALYSES: MOISTURE %	% ASH as recvd	% ASH dry basis	% V. M. as recvd	% V. M. dry basis	% F.C. as recvd	% F.C. dry basis	CALORIFIC VALUE as recvd.	CALORIFIC VALUE dry basis	% S	% H	% N	% O	F.S.I.	Reflec.	Sp. Gravity	REMARKS
104	10%	as above																				
	40%	107.2																				
108	73%	Coal: ± 25% wood in a matrix of finely divided organic matter 108.8			58941																	
	100%	Silt + Clay: interbdd in bds of clay + silt and bds gradational between silt + clay - bds poorly defined																				
	100%																					
112	87%	Silt: Lt. grey - brn; thin bdd - laminated w/ thin clay interbds; 40% coal partings in top 30 cm																				
	45%	Sand: Lt. grey; vy coarse grnd. grading to fine gravel @ base, @ the top grades to silt over width of 10cm																				
116	53%																					
	82%																					
	100%	Clay: Organic gradational to coal 119.2																				
120	98%	Coal: Dk. Brn.; Hard; < 5% wood fragments; grass crags. abundant; 13cm of clay partings; Contacts gradational 121.5			58942																	
	98%	Clay: Organic																				
	100%	Clay: Med. grey - cream - Dk Brn; Locally silty + gradational to silt; Organic w/ coal partings @ 122.7 - 124.2																				
124	93%	124.3 - 126.4																				
	100%																					
128	97%																					
	57%																					
	100%																					
132	100%	132.3 Coal: vy Dirty w/ high clay content + clay partings 133.8																				
	71%	Silt: white - cream w/ Brn. hues in top 1.8m + lower 20cm; vy fine grnd. w/ abundant clay; bdng not visible; pos. leached zone under coal																				
136	20%																					
140		TD 139.7m.																				

COAL LOG FORM No. X-1-73, Page 2.

BOREHOLE LOG BY: _____

DATE: _____

GRID: _____ EXPLORATION DEPARTMENT SHEET No. 1 of 3 79-6

LOCATION: NTS 105 A2 W/L (018578) BEARING: — LATITUDE: 60°03'33" PROPERTY: Liard Coal Basin

DATE COLLARED: 19 May 1979 LENGTH: 98.1 m DEPARTURE: 128°5-81 CORE SIZE: HQ LOGGED BY: D.M. Jenkins

DATE COMPLETED: 24 May 1979 DIP: -90° ELEVATION: 2220' SCALE OF LOG: 1:100 DATE: 31 May 79

DEPTH m	m block & %rec.	ROCK TYPE DESCRIPTION	Graph. log	Structure	SAMPLE NO.	COAL ANALYSES: MOISTURE %	% ASH as recvd.	% ASH dry basis	% V.M. as recvd.	% V.M. dry basis	% F.C. as recvd.	% F.C. dry basis	CALORIFIC VALUE as recvd.	CALORIFIC VALUE dry basis	% S	% H	% N	% O	F.S.I.	Reflec	Sp. Gravity	REMARKS
0																						
4																						
8																						
12																						
16																						
20		Cased to 21.9 m																				
24	100%	Gravel: Coarse grnd (diam. to > 8cm) Clasts of quartz, basalt, Acid plutonic rxs, and meta seds.																				
28																						
32		Tricones																				

COAL LOG FORM No. X-1-78, Page 1.

BORHOLE LOG BY: _____

DATE: _____

GRID: _____ EXPLORATION DEPARTMENT JENKINS. LOGGED BY: _____ DATE: _____ HOLE No. 79-6 SHEET No. 2 of 2

DEPTH m	m block & % rec.	ROCK TYPE DESCRIPTION	Graph. log	Structure	SAMPLE NO.	COAL ANALYSES: MOISTURE %	% ASH as recvd.	% ASH dry basis	% V. M. as recvd.	% V. M. dry basis	% F.C. as recvd	% F.C. dry basis	CALORIFIC VALUE as recvd.	CALORIFIC VALUE dry basis	% S	% H	% N	% O	F.S.I.	Reflec.	Sp. Gravity	REMARKS
32																						
	Tricored																					
36																						
	<10%																					
	Tricored																					
40																						
44																						
	Recovery																					
48																						
52	Nil																					
56																						
60																						
	±40%	Sand: DK. Grn.; med-fine grnd; Tex immature w/abundant matrix; Cobbles																				
64																						
	Tricored																					
68																						

COAL LOG FORM No. X-1-78, Page 2.

BOREHOLE LOG BY: _____

EXPLORATION DEPARTMENT

DATE: _____ SHEET No. 2 of 3

DEPTH m	m block & % rec.	ROCK TYPE DESCRIPTION	Graph. log	Structure	SAMPLE NO.	COAL ANALYSES: MOISTURE %	% ASH as recvd.	% ASH dry basis	% V. M. as recvd.	% V. M. dry basis	% F.C. as recvd	% F.C. dry basis	CALORIFIC VALUE as recvd.	CALORIFIC VALUE dry basis	% S	% H	% N	% O	F.S.I	Reflec.	Sp. Gravity	REMARKS
68																						
72	Tricone																					
76																						
80																						
84	Nil % recovery	Gravel as from 36.6 – 42.6 m																				
88																						
	<5%	Sand: med. grn. Very disturbed by drilling																				
	<10%	Coal: Sand: Clay: gravel Very disturbed by drilling																				
92	±95%	Clay: lt. grey Coal: very dirty due to abundant clay content + ± 40% clay partings																				
	±100%	Clay: Organic w/abundant wood frags.																				
	100%	Clay: Lt. grey; silty; massive – very poorly bdd.; minor disem. organic matter & rare organic partings																				
96	91%																					
		TD 98.14m																				
100																						
104																						

BOREHOLE LOG BY: _____

DATE:

PEACE RIVER COAL DEVELOPMENT LIMITED

EXPLORATION DEPARTMENT

GRID: _____ SHEET No 1 of 1 DDH 7

LOCATION: NTS 105 A 2 W/2 (043578) BEARING: — LATITUDE: 60°03'33" PROPERTY: Liard Coal Basin

DATE COLLARED: 25 May 1979 LENGTH: 140.8 m DEPARTURE: 128°55'22" CORE SIZE: HQ LOGGED BY: D Jenkins

DATE COMPLETED: 29 May 1979 DIP: -90 ELEVATION: 2070' SCALE OF LOG: 1:200 DATE: 31 May 79

DEPTH m	m block & %rec.	ROCK TYPE DESCRIPTION	Graph. log	Structure	SAMPLE NO.	COAL ANALYSES: MOISTURE %	% ASH as recvd.	% ASH dry basis	% V.M. as recvd.	% V.M. dry basis	% F.C. as recvd.	% F.C. dry basis	CALORIFIC VALUE as recvd.	CALORIFIC VALUE dry basis	% S	% H	% N	% O	F.S.I.	Reflec	Sp. Gravity	REMARKS
0																						
4																						
8																						
12																						
16																						
20		Cased to 21.33																				
24	Nil Recovery																					
28																						
32																						

COAL LOG FORM No. X-1-78, Page 1.

BORHOLE LOG BY: _____

DATE: _____

EXPLORATION DEPARTMENT

DATE: JENKINS 79-7 HOLE No. SHEET No. 2 of 4

DEPTH m	m block & % rec.	ROCK TYPE DESCRIPTION	Graph. log	Structure	SAMPLE NO.	COAL ANALYSES: MOISTURE %	% ASH as recvd.	% ASH dry basis	% V. M. as recvd.	% V. M. dry basis	% F.C. as recvd	% F.C. dry basis	CALORIFIC VALUE as recvd.	CALORIFIC VALUE dry basis	% S	% H	% N	% O	F.S.I.	Reflec.	Sp. Gravity	REMARKS
32	0%	? ?																				
	20%	Sand: Med. grey; coarse to very coarse grnd w/Locally abund. fine gravel: Moderately sorted; predominately qtz w/ ± 20% Feldspar + ± 5% ferro-mag. minerals and dark rock clasts, minor muscovite																				
36	13%																					
	15%																					
40	11%																					
	24%																					
	24%																					
44	0%																					
	0%																					
	54%																					
48	0%																					
	8%																					
	0%																					
52	14%																					
	0%																					
56	27%																					
	13%																					
		Gravel: Coarse w/ cobbles to >10cm max. diam. - average 4-5 cm; rounded - sub rounded; clasts composed of acid plutonic rx, basalt, meta-sediments, and qtz.																				
60	Tricorned																					
64																						
1.0																						

COAL LOG FORM No. X-1-78, Page 2.

BOREHOLE LOG BY: _____

GRID: _____

PLACER DEVELOPMENT LIMITED
EXPLORATION DEPARTMENT

JENKINS

DATE: 21 Nov 79 79-7 SHEET No. 2 of 4

DEPTH m	m block & % rec.	ROCK TYPE DESCRIPTION	Graphic Log	Structure	SAMPLE NO.	COAL ANALYSES: MOISTURE %	% ASH as recvd.	% ASH dry basis	% V. M. as recvd.	% V. M. dry basis	% F. C. as recvd	% F. C. dry basis	CALORIFIC VALUE as recvd.	CALORIFIC VALUE dry basis	% S	% H	% N	% O	S.I.	Reflec.	Sp. Gravity	REMARKS
72	±75%	Gravel as above																				
72																						
76		Fluvial																				
80																						
84	7%																					
	±75%																					
88																						
92																						
96																						
100	16%	Sand; Coarse-f. grnd; sorted to poorly sorted; abundant mica, rare wood frags.																				
	9%	Clay parting Thickness unknown																				
104																						

COAL LOG FORM No. X-1-78, Page 2.

BOREHOLE LOG BY: _____

EXPLORATION DEPARTMENT — JENKINS. — DATE: 79-7 — SHEET No. 2 of 2

DEPTH m	m block & % rec.	ROCK TYPE DESCRIPTION	Graph Log	Structure	SAMPLE NO.	COAL ANALYSES: MOISTURE %	% ASH as recvd	% ASH dry basis	% V. M. as recvd	% V. M. dry basis	% F.C. as recvd	% F.C. dry basis	CALORIFIC VALUE as recvd.	CALORIFIC VALUE dry basis	% S	% H	% N	% O	F.S.I.	Reflec.	Sp. Gravity	REMARKS
104	37%	Sand: vy coarse grnd; vy disturbed by drilling (lag deposit at bottom of hole?)																				
	0%																					
108	67%																					
	57%																					
	18%	Clay: Organic Coal: only 8 cm recovered; severly contaminated																				
112	62%	Clay: organic w/ 5-10% wood frags.																				
	100%	COAL																				
	86%	COAL: Clean; fine grnd w/10% wood minor Clay. Clay: Organic w/ 5% wood frags																				
116	100%	Clay: Lt. grey; massive to poorly bdd; w/ 2-5% organic frags																				
	70%	Silt: Lt. grey; argill.; micaceous; abundant organic parting.; vy thin bdd-laminated interbdd in 5-10cm thick units w/ clay bds																				
120	58%																					
	51%																					
	80%	Sand: Lt. grey; med-fine grnd.; mod-poorly sorted; rare thin clay bds. and organic partings																				
124	64%																					
	0%																					
128	15%																					
	30%																					
	58%	Clay: Lt. grey-white w/ med grey mottling; silty; bds not obvious																				
132	186%																					
	1800%																					
	0%																					
	66%	Clay: Organic; thin bdd-laminated w/ coal partings @ 136.2 ± 6 cm 137.7 ± 7 cm 138.2 to 138.4 m																				
136																						
		Clay: Lt. grey mottled w/ med-dk grey w/ cm. patterns; massive; silty																				
140																						Total Depth 140.8 m

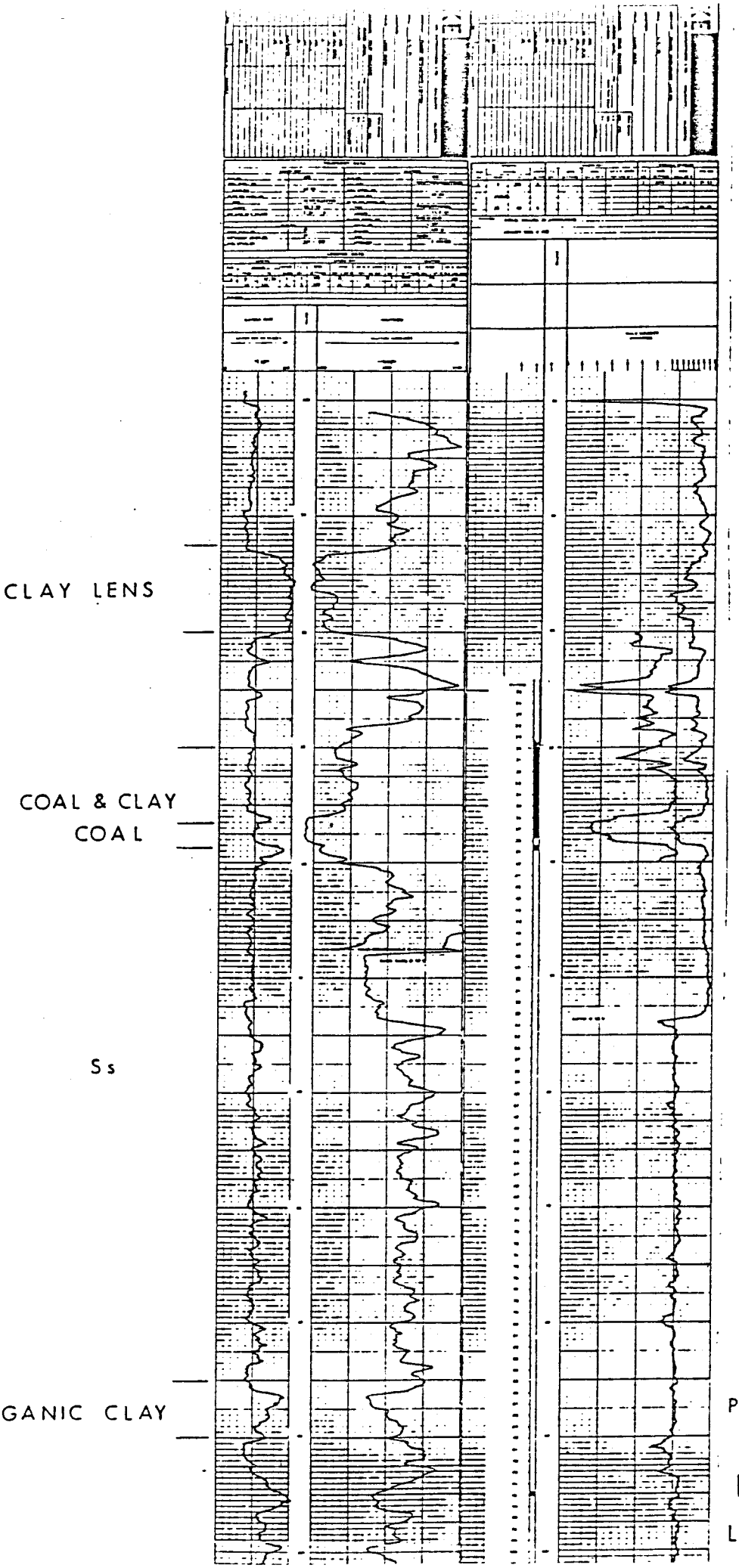
COAL LOG FORM No. X-1-78, Page 2. TD 140.8m

BOREHOLE LOG BY: _____

DATE:

APPENDIX B

Geophysical Logs

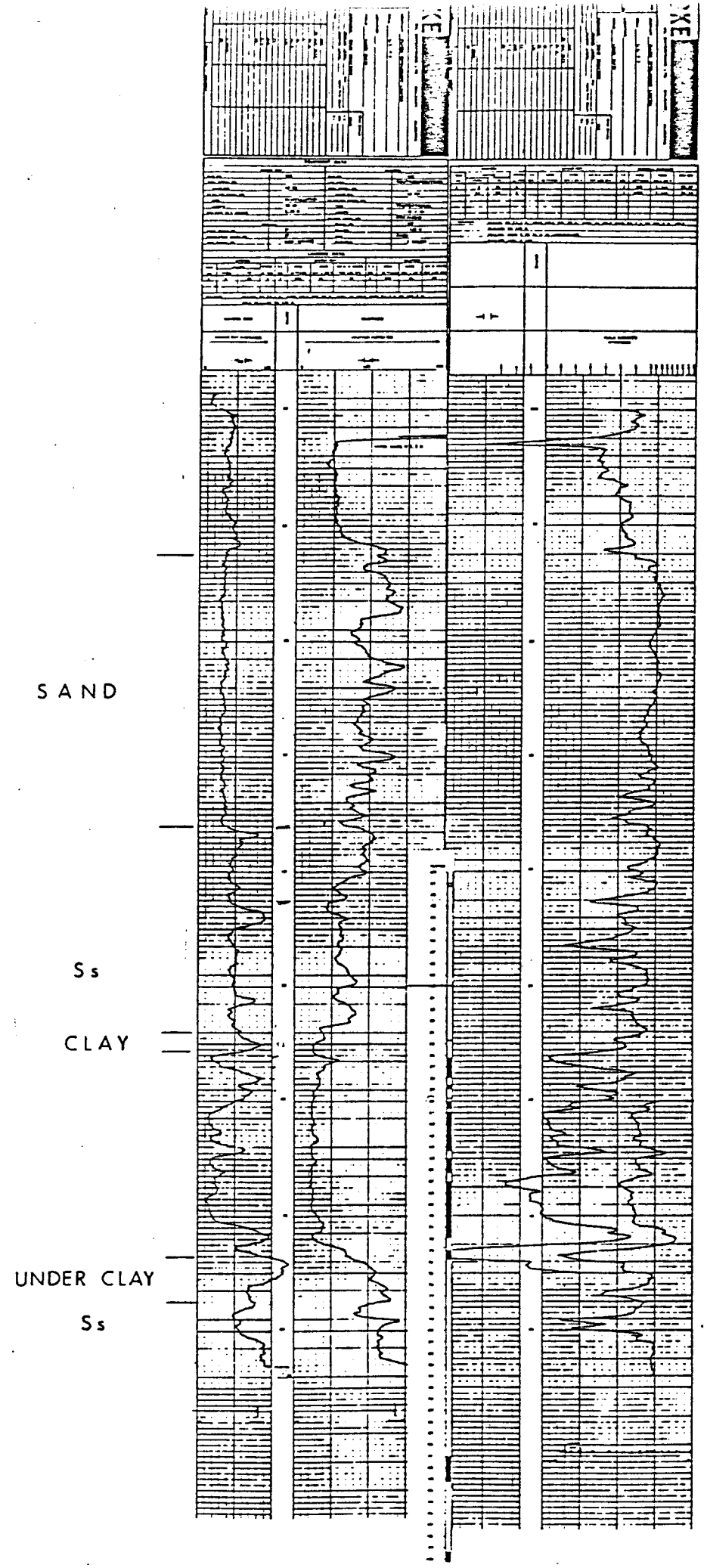


1: 500

Placer Developmenrl

L.C. No. 1

LIARD COAL



1: 500

Placer Development

L. C. No. 2

LIARD COAL

ROKE

OIL ENTERPRISES LTD. CALGARY, ALBERTA

FILE NO.
LSD SEC TWP RGE W ___ M

COMPANY TLAGEE DEVELOPMENT LIMITED
WELL 79-1
LOCATION 7T-16E
FIELD TSAAH BASIN
PROVINCE YUKON TERRITORY
Permanent Datum GROUND LEVEL Elev.
Log Measured from GROUND LEVEL Above Perm. Datum
Belt Depths Measured from METRIC

Other Services
FDL, DIFM-GAL
R.B.
CBL
G.L.

Run No.	ONE
Date	28 APR 1979
First Reading	1001 M
Last Reading	0
Footage Logged	1001
Depth Reached	1000
Depth Driller	1233.8
Casing Rotary	161
Casing Driller	
Fluid Type	LIGNOSOL
Liquid Level	161
Max. Diam.	NOT
Operating Time	1 LOGGER
Truck No.	1330

Recorded By BJH Witnessed By JOHNSON

EQUIPMENT DATA

	GAMMA RAY	NEUTRON	DUAL INDUCTION
Run No.	ONE	ONE	ONE
Serial No.	43 SPC	43 SPC	43 SPC
Location	DOG, POWELL RD.	DOG, POWELL RD.	DOG, POWELL RD.
Detector Model No.	SCINTILLATION	SCINTILLATION SONDE NO.	PROPRIETARY
Length	15 CM	15 CM	15 CM
Diameter	3.8 CM	3.8 CM	3.8 CM
Detector Type	SHORT MODEL NO.	SHORT MODEL NO.	SHORT MODEL NO.
Source Strength	10 MC	10 MC	5 MC
Source Type	RA-BE	RA-BE	RA-BE
Source Serial No.	130	130	130
Detector Serial No.	125 002	125 002	125 002

LOGGING DATA

	GAMMA RAY	NEUTRON	DUAL INDUCTION
Depth Driller	1233.8 M	1233.8 M	1233.8 M
Depth Logger	1235 M	1235 M	1235 M
Bottom Log Interval	1235 M	1235 M	1235 M
Top Log Interval	1000 M	1000 M	1000 M
Casing Driller	161 M	161 M	161 M
Casing Logger	161 M	161 M	161 M
Bit Size	216 MM	216 MM	216 MM
Type Fluid in Hole	LIGNOSOL	LIGNOSOL	LIGNOSOL
Density	1.03	1.03	1.03
Viscosity	38	38	38
pH	9.5	9.5	9.5
Fluid Loss	20 CC	20 CC	20 CC
Source of Sample	FLOWLINE	FLOWLINE	FLOWLINE
Rm @ Meas. Temp.	0.96 @ 25 C	0.96 @ 25 C	0.96 @ 25 C
Rmf @ Meas. Temp.	0.78 @ 25 C	0.78 @ 25 C	0.78 @ 25 C
Rmc @ Meas. Temp.	1.2 @ 25 C	1.2 @ 25 C	1.2 @ 25 C
Source: Rmf / Rmc	MEAS / CALC	MEAS / CALC	MEAS / CALC
Rm @ BHT	0.48 @ 50 C	0.48 @ 50 C	0.48 @ 50 C
Time Since Circ.	3 HRS	3 HRS	3 HRS
Max. Rec. Temp.	50 C	50 C	50 C
Equip. Location	3 OTHER	3 OTHER	3 OTHER
Recorded By	BJH	BJH	BJH
Witnessed By	JOHNSON	JOHNSON	JOHNSON

REMARKS
1000-1233.8 M DRILLER
1000-1235 M LOGGER
1001-1235 M LOG

CALIPER DIAMETER — DEPTH — GAMMA RAY API

BULK DENSITY (APPARENT)

NEUTRON — NEUTRON POROSITY LIMESTONE — DEPTH — GAMMA RAY — GAMMA RAY API

1000 M

SAND
CLAY
SAND
CLAY
SAND
ORGANIC CLAY
COAL
SAND
CLAY
COAL
SAND
COAL
CLAY
SAND
COAL

1200 M

Geophysical Log DDH 79-1

ROKE

OIL ENTERPRISES LTD. CALGARY, ALBERTA

EQUIPMENT DATA

GAMMA RAY		NEUTRON	
RUN NO.	ONE	RUN NO.	ONE
TOOL WITNESS NO.		LOG TAKEN	NEUTRON-NEUTRON
DETECTOR	43 MM	TOOL WITNESS NO.	
DETECTOR MODEL NO.		DETECTOR	43 MM
TYPE	SCINTILLATION	DETECTOR MODEL NO.	
SPACING	36 CM	TYPE	PROPORTIONAL
DISTANCE TO N. SOURCE	2.4 M	SPACING	15 CM
SOURCE		SOURCE MODEL NO.	MAC N 50 M
STRENGTH		STRENGTH	127
JOINT STUCK NO.	130	SPACING	45 CM
INSTRUMENT STUCK NO.	130	TYPE	Am-Be
TOOL DETAIL NO.		STRENGTH	2 CURIES

LOGGING DATA

RUN	GAMMA RAY					NEUTRON				
	DATE		SPEED	T.C.	SENS.	DATE		SPEED	T.C.	SENS.
NO.	FROM	TO	M/MIN.	SEC.	API/CM	FROM	TO	M/MIN.	SEC.	API/CM
1	11.9	11.9	4	1	100					
	31.3	220	4	3	100					

REMARKS LOGGED THROUGH METAL ROOM

GAMMA RAY

GAMMA RAY INCREASES

API 0 — API 130

NEUTRON

NEUTRON INCREASES

API 250 — API 1300 — API 2750

0 10 20 30 40 50 60 70 80 90 100

SAND
COAL
COAL
ORGANIC CLAY
COAL
DIRTY COAL
CLAY
SAND
SAND
CLAY
SAND
CLAY
SAND
COAL
SAND
CLAY
SAND
CLAY
SAND
COAL
SAND
?
COAL
ORGANIC CLAY
DIRTY COAL
COAL

ROKE

OIL ENTERPRISES LTD. CALGARY, ALBERTA

RUN	CASING		SPEED	T.C.	GAMMA RAY			NEUTRON		
NO.	FROM	TO	M/MIN.	SEC.	API/CM	API IN UNITS PER 0.152 M		T.C. SEC.	API/CM	API IN UNITS PER 0.152 M
1	0	363	4							

NEUTRON			
T.C. SEC.	API/CM	API IN UNITS PER 0.152 M	API UNIT
3	300	1.43 M	22.36

REMARKS LOGGED STANDOFF CASING

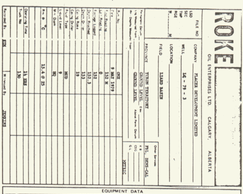
GAMMA RAY API

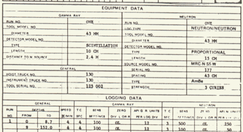
CALIPER (DIAMETER - INCHES)

BULK DENSITY (GRAMS/CC)

0 10 20 30 40 50 60 70 80 90 100

Geophysical Log DDH 79-2





EQUIPMENT DATA

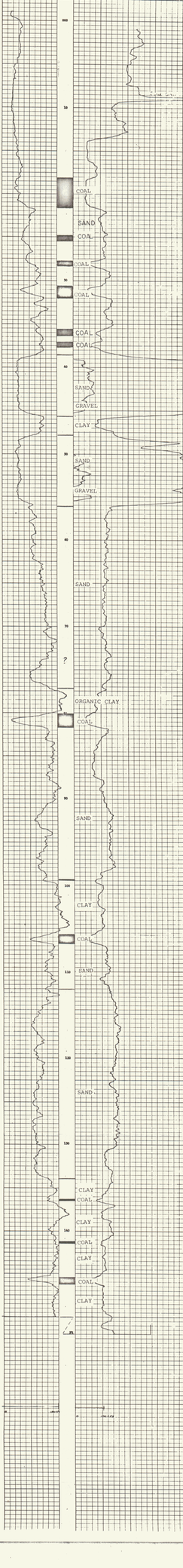
GAMMA RAY		NEUTRON
RUN NO.	ONE	RUN NO.	ONE
TOOL MFR'S. NO.		TOOL MFR'S. NO.	NEUTRON-NEUTRON
DIAMETER	63 MM	DIAMETER	63 MM
DETECTOR MODEL NO.		DETECTOR MODEL NO.	
TYPE	SCINTILLATION	TYPE	PROPORTIONAL
LENGTH	53 CM	LENGTH	15 CM
DISTANCE TO SOURCE	2.4 M	DISTANCE TO SOURCE	1.17 M
SOURCE		SOURCE STRENGTH	MBQ 111 M
		BATCH NO.	117
		SPACING	43 CM
		TYPE	Amite
		STRENGTH	3 CURIES

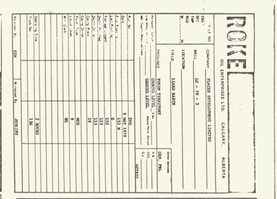
LOGGING DATA

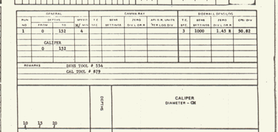
RUN NO.	GAMMA RAY INTERVAL FROM	TO	SPEED (M/MIN)	T.C. SEC.	SCALE	GAMMA RAY API & UNITS PER LOG DIV.	T.C. SEC.	NEUTRON SCALE	NEUTRON API & UNITS PER LOG DIV.
1	0	6.7	6	1	100	25	1.5	500	25
1	152.0	6	6	1	100	25	1.5	500	25

REMARKS: LOGGED THROUGH DRILL ROD.





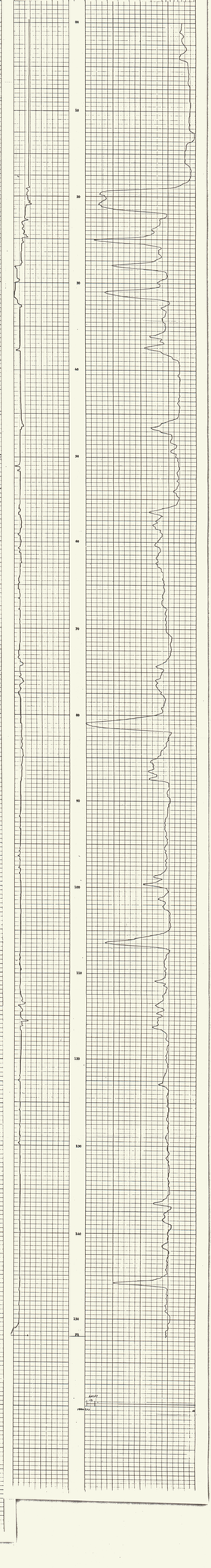




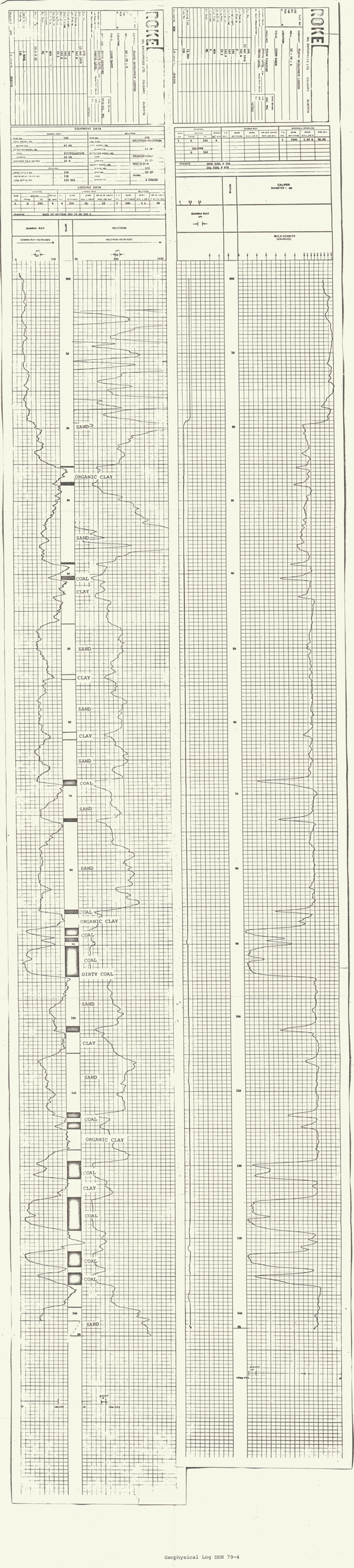
GENERAL				GAMMA RAY				SONIC	
RUN NO.	FROM	TO	SPEED (M/MIN)	T.C. SEC.	SCALE	GAMMA RAY API & UNITS PER LOG DIV.	T.C. SEC.	SCALE (M/S)	SONIC SPEED (M/S)
3	0	151	6				3	1000	1.45 % 90.82
CALIPER									
1	123								

REMARKS: SPUD 1345, 9 FEB
CAL 2005, 9 FEB

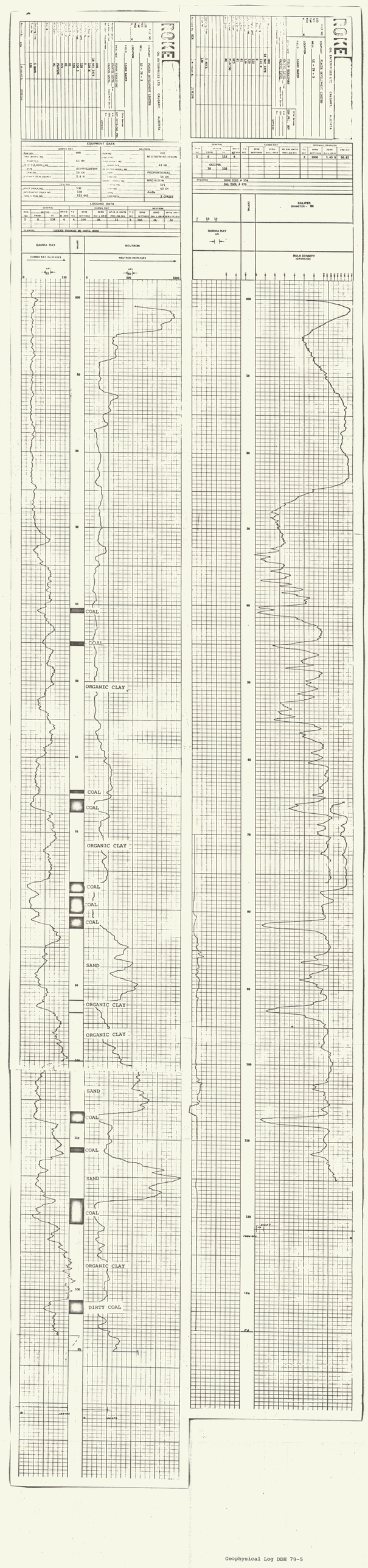




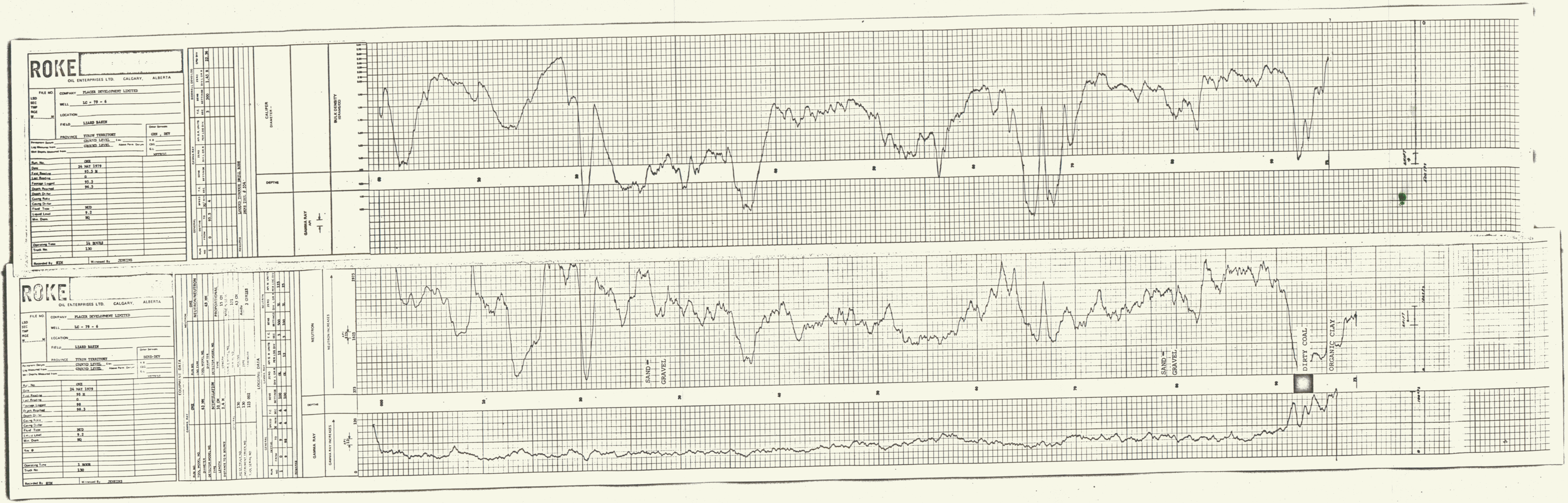
Geophysical Log DDH 79-3



Geophysical Log DDH 79-4



Geophysical Log DDH 79-5


ROKE
OIL ENTERPRIZES LTD. CALGARY, ALBERTA
FILE NO
COMPANY PLACER DEVELOPMENT LIMITED
WELL LC - 79 - 6
LOCATION
FIELD LIARD BASIN
PROVINCE YUKON TERRITORY
Other Services
SONIC-DEV
Permanent Datum: GROUND LEVEL
Log Measured from: GROUND LEVEL
Run No. ONE
Date 24 MAY 1979
First Reading 95.5 M
Last Reading 0
Former Logged 95.5
Depth Reached 96.3
Depth Driller
Casing Type
Casing Driller
Fluid Type MUD
Liquid Level 9.2
Min. Diam. NIL
Operating Time 1 HOUR
Truck No. 130
Recorded By BSK
Witnessed By JENKINS
EQUIPMENT DATA
NEUTRON
Run No. ONE
Log Interval No. 63 M
Depth Scale No. 1:200
Recorder Scale No. 5" PER DIVISION
Type Fluid in Hole MUD
Density 2.4 K
Viscosity 34 CP
Fluid Loss 13.2 M
Source Strength 370
Source Serial No. 110 601
Detector Serial No.
Gain Serial No.
LOGGING DATA
Run No. ONE
Date 24 MAY 1979
Depth Driller 96 M
Depth Logger 96.3
Bottom Log Interval 95.5 M
Top Log Interval 0
Casing Driller 96 M
Casing Logger 96.3
Bit Size 6 3/4"
Type Fluid in Hole MUD
Density 2.4 K
Viscosity 34 CP
Fluid Loss 13.2 M
Source Strength 370
Source Serial No. 110 601
Detector Serial No.
Gain Serial No.
Max. Rec. Temp. 95.5 M
Equip. Location 24 HRS
Recorded By BSK
Witnessed By JENKINS
NEUTRON
GAMMA RAY
CALIPER DIAMETER
BULK DENSITY (CORRECTED)
DEPTH
GAMMA RAY API
NEUTRON INCREASES
GAMMA RAY INCREASES
SAND GRAVEL
SAND GRAVEL
DIRTY COAL
ORGANIC CLAY
Geophysical Log DDH 79-6

ROKE OIL ENTERPRISES LTD. CALGARY, ALBERTA

COMPANY ROKE OIL ENTERPRISES LTD.
WELL 16-36-7-3
FIELD
LOCATION 16-36-7-3
PROVINCE SASKATCHEWAN
COUNTY/PARISH
STATE/COUNTRY
PERMANENT DATUM GROUND LEVEL
LOG MEASURED FROM KELLY BUSHING
DRILLING MEASURED FROM KELLY BUSHING
ELEV. K.B. 2,000
ELEV. D.F.
ELEV. G.L. 1,976
DATE 26-DEC-1979
RUN NO. ONE
DEPTH-DRILLER 1,330
DEPTH-LOGGER 1,330
BTM. LOG INTERVAL 1,328
TOP LOG INTERVAL 0
CASING-DRILLER 8 5/8 @ 30
CASING-LOGGER 30
BIT SIZE 7 7/8
TYPE FLUID IN HOLE GEL CHEM
DENSITY 9.2
VISCOSITY 50
PH 9.5
FLUID LOSS 8.4
SOURCE OF SAMPLE CIRCULATION
RM @ MEAS. TEMP. 1.0 @ 70°F
RMF @ MEAS. TEMP. 0.8 @ 70°F
RMC @ MEAS. TEMP. 1.2 @ 70°F
SOURCE OF RMF & RMC MEASURED
RM @ BHT 0.5 @ 120°F
TIME SINCE CIRC. 12 HRS
MAX. REC. TEMP. 120°F
EQUIP. LOCATION 3 WEYB
RECORDED BY JOHNSON
WITNESSED BY

EQUIPMENT DATA

GAMMA RAY		NEUTRON	
RUN NO.	ONE	RUN NO.	ONE
TOOL MODEL NO.		LOG TYPE	NEUTRON/NEUTRON
DIAMETER	43 MM	TOOL MODEL NO.	
DETECTOR MODEL NO		SOURCE TYPE	43 MM
TYPE	SCINTILLATION	DETECTOR MODEL NO.	
LENGTH	10 CM	TYPE	PROPORTIONAL
SPACING TO SOURCE	2.4 M	LENGTH	15 CM
		SOURCE MODEL NO.	MRC N-15 M
GENERAL		SERIAL NO.	111
HOIST TRUCK NO.	130	SPACING	45 CM
INSTRUMENT TRUCK NO.	130	TYPE	Am-Be
TOOL SERIAL NO.	115 902	STRENGTH	3 CURIES

LOGGING DATA

RUN NO.	GAMMA RAY SECTION FROM	TO	SPEED (M. PER MIN.)	T.C. SEC.	SENS. (API UNITS)	ZERO (API & M. UNITS PER 100 DIV.)	T.C. SEC.	NEUTRON SENS. (API UNITS)	ZERO (API & M. UNITS PER 100 DIV.)
1	0	1,328	6	6	500	OK	3	500	OK

REMARKS LOGGED TOWARDS DRILL HOLE

GAMMA RAY NEUTRON

GAMMA RAY INCREASES — API — 0 — 130

NEUTRON INCREASES — API — 0 — 500 — 1000

SAND
GRAVEL
CLAY
SAND
COAL
ORGANIC CLAY
COAL
SAND
CLAY
ORGANIC CLAY

ROKE OIL ENTERPRISES LTD. CALGARY, ALBERTA

COMPANY ROKE OIL ENTERPRISES LTD.
WELL 16-36-7-3
FIELD
LOCATION 16-36-7-3
PROVINCE SASKATCHEWAN
COUNTY/PARISH
STATE/COUNTRY
PERMANENT DATUM GROUND LEVEL
LOG MEASURED FROM KELLY BUSHING
DRILLING MEASURED FROM KELLY BUSHING
ELEV. K.B. 2,000
ELEV. D.F.
ELEV. G.L. 1,976
DATE 26-DEC-1979
RUN NO. ONE
DEPTH-DRILLER 1,330
DEPTH-LOGGER 1,330
BTM. LOG INTERVAL 1,328
TOP LOG INTERVAL 0
CASING-DRILLER 8 5/8 @ 30
CASING-LOGGER 30
BIT SIZE 7 7/8
TYPE FLUID IN HOLE GEL CHEM
DENSITY 9.2
VISCOSITY 50
PH 9.5
FLUID LOSS 8.4
SOURCE OF SAMPLE CIRCULATION
RM @ MEAS. TEMP. 1.0 @ 70°F
RMF @ MEAS. TEMP. 0.8 @ 70°F
RMC @ MEAS. TEMP. 1.2 @ 70°F
SOURCE OF RMF & RMC MEASURED
RM @ BHT 0.5 @ 120°F
TIME SINCE CIRC. 12 HRS
MAX. REC. TEMP. 120°F
EQUIP. LOCATION 3 WEYB
RECORDED BY JOHNSON
WITNESSED BY

GENERAL RUN NO.	GAMMA RAY SECTION FROM	TO	SPEED (M. PER MIN.)	T.C. SEC.	SENS. (API UNITS PER 100 DIV.)	ZERO (API & M. UNITS PER 100 DIV.)	BOREHOLE COMPENSATED RUN NO.	BOREHOLE COMPENSATED FROM	TO	SPEED (M. PER MIN.)	T.C. SEC.
1	0	132	6				3	1000	1,43	6	30,02

CALIPER
0 132

REMARKS

SONDE TOOL # 334
CAL TOOL # 979

CALIPER DIAMETER - CM

GAMMA RAY API

BULK DENSITY GRAMS/CC

Geophysical Log DDH 79-7

APPENDIX C

Certificates of Analyses

PLACER DEVELOPMENT LIMITED

ATTN: D. M. Jenkins

LORING LABORATORIES LTD.

CERTIFICATE of COAL TESTING

FILE No.: 17457

DATE: August 8, 1979

SAMPLE No	IDENTIFICATION	SAMPLE TYPE	% RECOVERY			REC'D % H_2O	% H_2O	% VOL. MATTER	% ASH	% FIXED CARBON	% S	B.T.U. /LB	F.S.I.
			SINK	FLOAT									
58901	DDH 79-1	Raw Coal			Air Dried	-	4.92	43.97	30.13	21.16	.29	7153	
	50.9 - 52.4m				Dry Basis	-	-	46.06	31.69	22.25	.31	7523	
58902	DDH 79-1	Raw Coal			Air Dried	-	4.41	45.05	29.63	20.91	.44	7366	
	82.9 - 84.7m				Dry Basis	-	-	47.13	31.00	21.87	.46	7706	
58903	DDH 79-1	Raw Coal			Air Dried	-	3.69	20.15	70.85	5.31	.25	2069	
	98.1 - 98.7m				Dry Basis	-	-	20.92	73.56	5.52	.26	2148	
58904	DDH 79-1	Raw Coal			Air Dried	-	4.72	35.33	45.68	14.27	.26	5629	
	98.7 - 101m				Dry Basis	-	-	37.08	47.94	14.98	.27	5907	
58905	DDH 79-1	Raw Coal			Air Dried	-	5.76	49.61	22.31	22.32	.27	8721	
	101.7 - 103.6m				Dry Basis	-	-	52.64	23.67	23.69	.29	9254	
58906	DDH 79-1	Raw Coal			Air Dried	-	6.87	44.37	22.96	25.80	.32	8140	
	113.4 - 114.9m				Dry Basis	-	-	47.64	24.65	27.71	.34	8740	
58907	DDH 79-1	Raw Coal			Air Dried	-	6.11	32.11	42.46	19.32	.24	5556	
	114.9 - 116.4m				Dry Basis	-	-	34.20	45.22	20.58	.26	5918	
5909	DDH 79-2	Raw Coal			Air Dried	-	6.65	40.56	33.53	19.26	.38	6559	
	29 - 29.8m				Dry Basis	-	-	43.45	35.92	20.63	.41	7026	

PLACER DEVELOPMENT LIMITED
ATTN: D. M. Jenkins

LORING LABORATORIES LTD.
CERTIFICATE of COAL TESTING

FILE Nº 17457
DATE August 2, 1979

SAMPLE Nº	IDENTIFICATION	SAMPLE TYPE	% RECOVERY			REC'D % H₂O	INH % H₂O	% VOL. MATTER	% ASH	% FIXED CARBON	% S	B.T.U. /LB.	F.S.I.	
			SINK	FLOAT										
58909	DDH 79-2	Raw Coal			Air Dried	-	5.80	40.65	33.12	20.43	.14	7255		
	29.8 - 30.75m				Dry Basis	-	-	43.15	35.16	21.69	.15	7702		
58910	DDH 79-2	Raw Coal			Air Dried	-	3.61	24.47	64.06	7.86	.10	3325		
	31.7 - 32.6m				Dry Basis	-	-	25.39	66.46	8.15	.10	3450		
58911	DDH 79-2	Raw Coal			Air Dried	-	6.97	49.58	25.83	17.62	.23	7756		
	32.6 - 33.8 m				Dry Basis	-	-	53.29	27.77	18.94	.25	8337		
58912	DDH 79-2	Raw Coal			Air Dried	-	6.22	33.31	45.80	14.67	.13	4894		
	33.8 - 34.6m				Dry Basis	-	-	35.52	48.84	15.64	.14	5219		
58913	DDH 79-2	Raw Coal			Air Dried	-	4.35	24.92	59.76	10.97	.12	3510		
	34.0 - 35.1m				Dry Basis	-	-	26.05	62.48	11.47	.13	3670		
58914	DDH 79-2	Raw Coal			Air Dried	-	8.30	51.79	11.43	28.48	.40	8962		
	64.6 - 66.1m				Dry Basis	-	-	56.48	12.46	31.06	.44	9773		
58915	DDH 79-2	Raw Coal			Air Dried	-	6.93	42.54	32.04	18.49	.50	6873		
	112.2 - 113.0 m				Dry Basis	-	-	45.71	34.43	19.86	.54	7385		
58916	DDH 79-2	Raw Coal			Air Dried	-	4.54	27.95	58.31	9.20	.28	3760		
	117.95 - 119.05m				Dry Basis	-	-	29.28	61.08	9.64	.29	3939		

PLACER DEVELOPMENT LIMITED

ATTN: D. M. Jenkins

LORING LABORATORIES LTD.

CERTIFICATE of COAL TESTING

FILE Nº.: 17457

DATE: August 8, 1979

SAMPLE Nº	IDENTIFICATION	SAMPLE TYPE	% RECOVERY			REC'D % H_2O	INH % H_2O	% VOL. MATTER	% ASH	% FIXED CARBON	% S	B.T.U. /LB	F.S.I.
			SINK	FLOAT									
58917	DDH 79-2	Raw Coal			Air Dried	–	7.58	48.78	18.59	25.05	.26	8651	
	120.6 - 122.5m				Dry Basis	–	–	52.78	20.11	27.11	.28	9361	
58918	DDH 79-2	Raw Coal			Air Dried	–	6.38	44.51	28.97	20.14	.27	7565	
	122.5 - 123.5m				Dry Basis	–	–	47.54	30.94	21.52	.29	8081	
58920	DDH 79-2	Raw Coal			Air Dried	–	8.68	52.12	9.25	29.95	.17	9339	
	132.5 - 134.7m				Dry Basis	–	–	57.07	10.13	32.80	.19	10227	

CANEX PLACER LIMITED,

ATTN: D.Jenkins cc: K. Banks

LORING LABORATORIES LTD.

CERTIFICATE of COAL TESTING

FILE No.: 17269

DATE: July 25, 1979

SAMPLE Nº	IDENTIFICATION	SAMPLE TYPE	% RECOVERY SINK	% RECOVERY FLOAT		REC'D % H.O	% H.O	% VOL. MATTER	% ASH	% FIXED CARBON	% S	B.T.U /LB	F.S.I.
					As Received	18.76	-	33.06	29.40	18.78	.33	5921	
SN 58942	LC-79-5 119.2-121.5	Raw Coal			Air Dried	-	7.09	37.82	33.62	21.47	.38	6657	
					Dry Basis	-	-	40.70	36.19	23.11	.41	7165	
					As Received	23.58	-	7.72	67.78	0.92	.05	N.I.*	
SN 58925	LC-79-4 87.6-88.5	Raw Coal			Air Dried	-	1.48	9.95	87.39	1.18	.07	N.I.	
					Dry Basis	-	-	10.10	88.70	1.20	.07	N.I.	
					As Received	30.85	-	24.73	32.51	11.91	.15	3861	
SN 58926	LC-79-4 88.5-90.00	Raw Coal			Air Dried	-	6.65	33.39	43.88	16.08	.20	5213	
					Dry Basis	-	-	35.77	47.01	17.22	.21	5584	
					As Received	32.06	-	35.99	12.77	19.18	.20	6173	
SN 58927	LC-79-4 90.56-92.0	Raw Coal			Air Dried	-	8.85	48.28	17.14	25.73	.27	8282	
					Dry Basis	-	-	52.97	18.80	28.23	.30	9086	
					As Received	24.43	-	37.68	17.69	20.20	.20	6287	
SN 58928	LC-79-4 92.0-93.4	Raw Coal			Air Dried	-	9.27	45.24	21.24	24.25	.24	7548	
					Dry Basis	-	-	49.86	23.41	26.73	.26	8319	
					As Received	30.07	-	17.67	44.85	7.41	.07	2559	
SN 58929	LC-79-4 93.5- 4.15	Raw Coal			Air Dried	-	4.82	24.05	61.04	10.09	.10	3484	
					Dry Basis	-	-	25.27	64.13	10.60	.10	3660	

* Non-ignition

By: D. Cadwallader

CANEX PLACER LIMITED,

ATTN: D. Jenkins cc: K. Banks

LORING LABORATORIES LTD.

CERTIFICATE of COAL TESTING

FILE No.: 17369

DATE: July 25, 1979

SAMPLE Nº	IDENTIFICATION	SAMPLE TYPE	% RECOVERY SINK	% RECOVERY FLOAT		REC'D % H.O	% H.O	% VOL. MATTER	% ASH	% FIXED CARBON	% S	B T U /LB	F.S.I.
					As Received	23.81	–	30.77	26.95	18.47	.28	5376	
SN 58930	LC-79-4 119.6-121.0	Raw Coal			Air Dried	–	8.01	37.14	32.55	22.30	.34	6491	
					Dry Basis	–	–	40.38	35.38	24.24	.37	7056	
					As Received	32.08	–	33.31	18.94	15.67	.19	5419	
SN 58931	LC-79-4 121.0-122.0	Raw Coal			Air Dried	–	8.74	44.75	25.45	21.06	.26	7282	
					Dry Basis	–	–	49.04	27.89	23.07	.28	7979	
					As Received	32.12	–	32.93	17.76	17.19	.22	5573	
SN 58932	LC-79-4 124.6-125.5	Raw Coal			Air Dried	–	8.81	44.25	23.85	23.09	.29	7487	
					Dry Basis	–	–	48.52	26.16	25.32	.32	8210	
					As Received	27.65	–	39.42	7.30	25.63	.18	7261	
SN 58933	LC-79-4 125.5-127.1	Raw Coal			Air Dried	–	8.87	49.66	9.19	32.28	.23	9146	
					Dry Basis	–	–	54.49	10.09	35.42	.25	10036	
					As Received	30.87	–	34.23	13.76	21.14	.15	6197	
SN 58934	LC-79-4 127.1-128.6	Raw Coal			Air Dried	–	8.62	45.24	18.19	27.95	.19	8191	
					Dry Basis	–	–	49.51	19.90	30.59	.21	8964	
					As Received	22.36	–	33.98	24.14	19.52	.28	5929	
SN 58935	LC-79-4 128.6-129.2	Raw Coal			Air Dried	–	7.46	40.50	28.77	23.27	.33	7066	
					Dry Basis	–	–	43.76	31.09	25.15	.36	7636	

By: D. Crabb

CANEX PLACER LIMITED,

ATTN: D. Jenkins cc: K. Banks

LORING LABORATORIES LTD.

CERTIFICATE of COAL TESTING

FILE No.: 17369

DATE: July 25, 1979

SAMPLE Nº	IDENTIFICATION	SAMPLE TYPE	% RECOVERY SINK	% RECOVERY FLOAT		REC'D % H.O	% H.O	% VOL. MATTER	% ASH	% FIXED CARBON	% S	B.T.U /LB	F.S.I.
					As Received	35.08	-	30.24	18.98	15.70	.16	5334	
SN 589 36	LC-79-5 66.14-67.66	Raw Coal			Air Dried	-	7.60	43.04	27.02	22.34	.23	7593	
					Dry Basis	-	-	46.58	29.24	24.18	.25	8217	
					As Received	37.47	-	31.06	14.84	16.63	.11	5531	
SN 58937	LC-79-5 77.1 - 78.3	Raw Coal			Air Dried	-	9.95	44.73	21.37	23.95	.16	7965	
					Dry Basis	-	-	49.67	23.73	26.60	.18	8845	
					As Received	29.14	-	32.08	19.29	19.49	.16	5736	
SN 58938	LC-79-5 78.8 - 79.8	Raw Coal			Air Dried	-	8.35	41.49	24.96	25.20	.20	7419	
					Dry Basis	-	-	45.27	27.23	27.50	.22	8095	
					As Received	25.33	-	26.51	26.94	21.22	.14	5331	
SN 58939	LC-79-5 80.4 - 81.3	Raw Coal			Air Dried	-	7.36	32.89	33.42	26.33	.18	6614	
					Dry Basis	-	-	35.50	36.08	28.42	.19	7139	
					As Received	29.02	-	33.81	18.86	18.31	.16	6153	
SN 58940	LC-79-5 81.86-82.9	Raw Coal			Air Dried	-	7.65	43.99	24.54	23.82	.20	8006	
					Dry Basis	-	-	47.63	26.57	25.80	.22	8669	
					As Received	27.30	-	36.44	12.02	24.24	.30	6785	
SN 58941	LC-79-5 107.2-108.8	Raw Coal			Air Dried	-	8.95	45.63	15.05	30.37	.37	8498	
					Dry Basis	-	-	50.12	16.53	33.35	.41	9333	

By: D. Enbo

CAMEX PLACER LIMITED,

ATTN: D. Jenkins cc: K. Banks

LORING LABORATORIES LTD.

CERTIFICATE of COAL TESTING

Page # 4

FILE Nº: 17369

DATE: July 25, 1979

SAMPLE Nº	IDENTIFICATION	SAMPLE TYPE	% RECOVERY			REC'D % H₂O	% H₂O	% VOL. MATTER	% ASH	% FIXED CARBON	% S	B.T.U. /LB	F.S.I.
			SINK	FLOAT									
					As Received	7.87	-	29.63	53.52	8.98	.20	4071	
SN 58943	LC-79-3 29.6 - 31.0	Raw Coal			Air Dried	-	6.08	30.20	54.56	9.16	.21	4150	
					Dry Basis	-	-	32.16	58.09	9.75	.22	4419	
					As Received	12.29	-	48.87	10.01	28.83	.33	8462	
SN 58944	LC-79-3 81.0-81.9	Raw Coal			Air Dried	-	9.86	50.23	10.28	29.63	.34	8922	
					Dry Basis	-	-	55.72	11.41	32.87	.38	9898	

By D. Endall

APPENDIX D

Report of Geophysical Log Analysis

ROKE
OIL ENTERPRISES LTD.

516 Moraine Road, N.E., Calgary, Alberta, Canada T2A 2P2
Office (403) 273 - 5553 / Residence (403) 242 - 1045

November 14, 1979

Placer Development Limited
600 Burrard Building
1030 West Georgia
Vancouver, B.C. V6E 3A8

Attention: Mr. David Jenkins

Dear Sirs:

RE: Evaluation Project (Liard Basin)

In recent years we have done considerable development in the area of obtaining coal parameters from geophysical logs. In instances where numerous samples (over 2000) showing a wide range of coal parameters can be obtained, it is possible to make a completely independent analysis from logs.

In instances where limited amounts of log sampling is available (as was the case with the Liard Basin), we attempt to tie in core information with log information to provide additional data.

Required Core Data for Making a Comprehensive Check with Log Derived Data

In order to do this comprehensive check, we require from the core samples the following laboratory measurements:

1) Grain Density
2) Porosity - by helium displacement
3) BTU - dry basis
4) Ash content - dry basis
5) As received moisture content
6) Detection of abundance of stray minerals such as sulphur, calcite, pyrite, marcasite, etc.
7) Ultimate analysis if available.

. . . page two

Discussion of Results

A. A plot of BTU vs Ash Content revealed the following:

1) A wide range of ash content was available which provided reliable regression enabling one to obtain BTU value for water free, ash free coal (11,423 BTU/lb), and determined a parr factor of $(\frac{1}{0.9456}) = 1.0575$

2) The BTU value is helpful in establishing rank of coal. The parr factor indicates the amount of combustable volitiles in the ash.

3) Only one population of points is present indicating only one type of coal present in the seams penetrated.

4) The low scatter of points indicates reliable laboratory measurements.

B. Grain Density and Porosity Determination

The core was sent to Core Laboratories to determine grain density and porosity (non-destructive test).

Small samples were removed from various core sample intervals. They were able to obtain grain densities, however absolutely no porosity determinations could be made because the samples crumbled badly when doing the drying procedure.

The plot of Grain Density vs Ash Content shows a high amount of scatter. When more than one small sample was taken from the "core sample interval", the small samples in question are connected together with a black line. The ash value plotted on the X axis was the value obtained from the entire "Core Sample Interval". The difference in ash between the small sample and the "Core Sample Interval" will cause discrepancies on the X axis value.

For purposes of calculations, it was found using apparent coal density value of 1.44 and an apparent ash density value of 1.93, the ash content and BTU obtained were comparable with that obtained by core.

. . . page three

$$\text{Coal density} = \left(1.44 \times \frac{0.5000}{0.5201}\right) = 1.3843$$

NOTE: Since no ultimate analysis was available on this particular coal, we assumed a Z/A factor of 0.5201, which is reasonable for an average coal.

Using 1.3843 for an intercept on the "0"% Y axis, a best fit line (in our opinion) was constructed. This gave an intercept of slightly less than 2.0 on the Y axis @ 94.56% (parr factor).

$$\text{Ash density} = 1.93 \times \frac{0.50}{0.50} = 1.93 \quad \text{(no correction)}$$

Parameter Used for Log Calculations

1) Water Resistivity - drilling water measurements from each appropriate hole corrected to 40 degrees F.

2) Ash Resistivity (25.0 ohm-m) - average minimum readings obtained from Focused Beam Logs.

3) Apparent Coal Density (1.44) - value required to give results comparable to core data.
NOTE: If Grain Density plot had been more definitive, one could use the value at "0"% Y axis intercept (guesstimated at 1.3843 gives apparent coal density of 1.44).

4) Apparent Ash Density (1.93) - normally the value could be determined from the Y intercept at "94.56"%. The graph indicates a value of near 2.0. However, density log reading values in clays suggest 1.93 to be more accurate.

5) Computed Water Content of Wet Ash (Insitu):

$$\text{Porosity} = \frac{\rho_m - \rho_b}{\rho_m - \rho_{FL}} \times 100$$

$$= \frac{2.65 - 1.93}{2.65 - 1.11} \times 100$$

$$= \underline{46.73\%}$$

. . . page four

6) Apparent Water Density (electron) = $\left(\frac{0.5551}{.5} \times 1.000\right) = 1.11$

$Z/A = \frac{\text{atomic number}}{\text{atomic weight}}$

Density tool normalized Z/A = 0.5000

7) Calorific value of pure coal (11,423 BTU/lb) obtained from core plot.

8) Parr factor correction (0.9456) obtained from core plot.

Observations

1) On hole LC-79-4 (87.6 to 92.0 meters), samples appear to be in wrong order.

2) The coal beds have high insitu water content. The as received moistures suggest the coal on drain basis has relatively high water content. The difference between the as received moisture and the total moisture computed from the logs (don't forget the water in wet ash) should provide information as to the capacity of water that could be drained from the various beds.

3) The types of coal in the various seams appear to be similar.

4) Good hole conditions (minimal caving) in the open hole sections made it possible to obtain good quality logs.

5) Discrepancies between log and core could be due to a variety of factors:
   (a) adjustment and measurements of core sample interval to comparable log sample intervals (missing core or sections not analysed within seam aggravates the situation);
   (b) significant amounts of extraneous minerals;
   (c) variation in ash densities or wet ash water content;
   (d) deviations from mathematical model for burning the wet ash (change in ash volitiles).

Future Work

1) Porosity determination from core for this coal appears to be hopeless at this time.

2) The benefit of Grain Density measurement is also questionable.

. . . page five

3) As received moisture from additional cores would make it possible to obtain a reasonably reliable moveable water computation. Any moisture information from stockpile is extremely beneficial.

4) The use of the 5 Cm Focused Beam Log, and the new version of the density tool will define partings more accurately.

5) Establish formation temperature (temperature log on two of three holes).

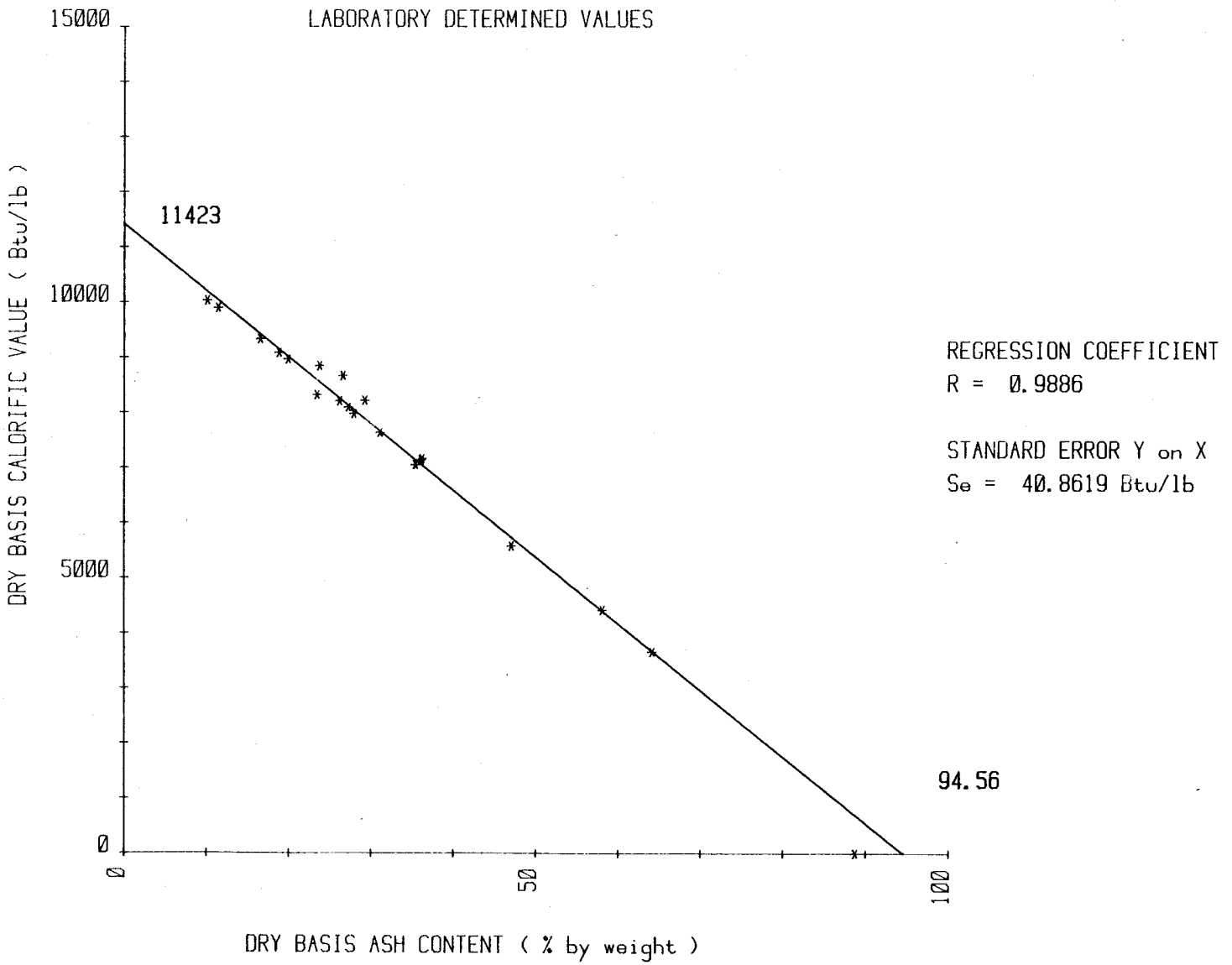
Should you require further information or assistance, please contact us.

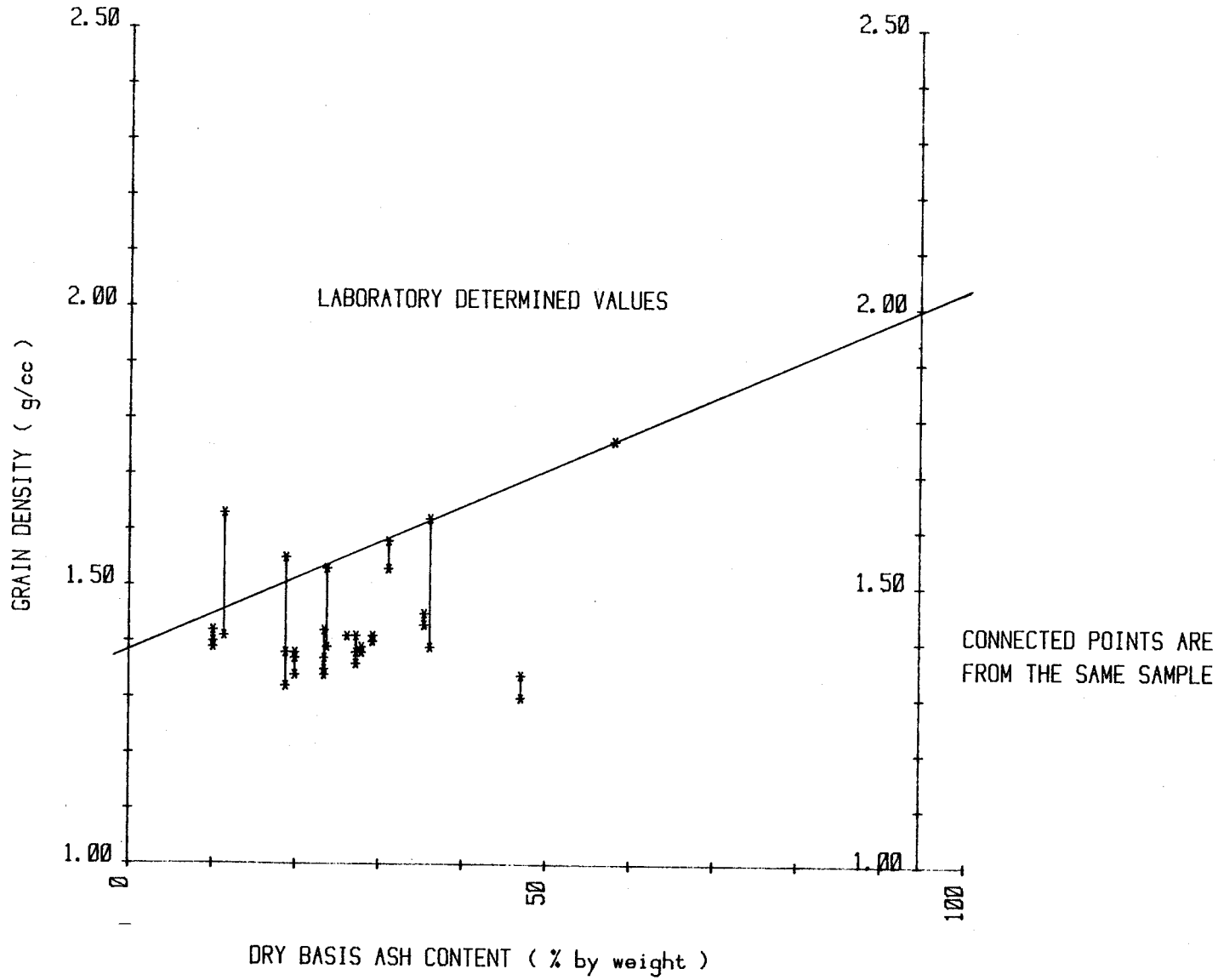
Yours truly,

ROKE OIL ENTERPRISES LTD.

Keith M. Banks
President

KMB/jms


LABORATORY DETERMINED VALUES
15000
10000
5000
0
11423
94.56
DRY BASIS CALORIFIC VALUE (Btu/lb)
0
50
100
DRY BASIS ASH CONTENT (% by weight)
REGRESSION COEFFICIENT
R = 0.9886
STANDARD ERROR Y on X
Se = 40.8619 Btu/lb


2.50
2.00
1.50
1.00
LABORATORY DETERMINED VALUES
GRAIN DENSITY (g/cc)
0
50
100
DRY BASIS ASH CONTENT (% by weight)
CONNECTED POINTS ARE
FROM THE SAME SAMPLE

POKE OIL ENTERPRISES LTD. GEOPHYSICAL COAL ANALYSIS

COMPANY: PLACER DEVELOPMENT LTD FOLE NUMBER: FC 79 - 3 OTD FIELD: LIARD BASIN PROVINCE: YUKON TER
SEAM NUMBER: * INTERVAL: 19.15 TO 19.85 M DEPTH CONTROL FROM: FEL
DATED LOGGED: 9 MAY 1979 LOGGED BY: SIM DIGITIZED BY: EDWARDS CALCULATED BY: EDWARDS
FOCUSED BEAM TOOL # 8 DENSITY TOOL # 554

THESE RESULTS HAVE BEEN OBTAINED USING GEOPHYSICAL LOG DATA
CONSTANTS USED IN THE CALCULATIONS ARE:

WATER RESISTIVITY: 29.65 ohm-m at: 40 degrees F. APPARENT COAL DENSITY: 1.44 g/cc
ASH RESISTIVITY: 25.0 ohm-m APPARENT ASH DENSITY: 1.93 g/cc
COMPUTED WATER CONTENT OF ASH: 46.73 %
Z/A coal = 0.5201 Z/A water = 0.5551 Z/A ash = 0.50
The calorific value of pure coal: 11423 The Parr factor: 0.9456

SAMPLE NUMBER	LOG READINGS					INSITU PERCENTAGES						TRUE DENSITY	FT^3/ LONG TON	LABORATORY EQUIVALENTS	
	DEPTHS		INTERVAL	DENSITY	RESISTIVITY	BY VOLUME			BY WEIGHT						
	FROM	TO				COAL	WATER	ASH	COAL	WATER	ASH			ASH	Btu/lb
1	19.15	19.86	0.71	1.43	46	31.06	42.73	26.21	31.51	31.41	37.08	1.36	26.37	43.71	6143
2	19.86	20.50	0.65	1.49	19	34.11	34.70	31.19	33.19	24.47	42.34	1.42	25.30	45.61	5913
3	20.50	21.10	0.60	1.42	47	31.82	43.27	24.91	32.49	32.02	35.49	1.35	26.55	41.96	6354
4	21.10	21.65	0.55	1.44	53	36.41	38.51	25.08	36.67	28.10	35.23	1.37	26.18	39.00	6712
WEIGHTED AVERAGES INSITU BASIS FOR INTERVALS 1 TO 4															
			2.5			33.21	39.86	26.93	33.32	28.98	37.70	1.38	26.09	42.79	6254

CALORIFIC VALUE 3806 SOLIDS DENSITY 1.76

POKE OIL ENTERPRISES LTD. GEOPHYSICAL COAL ANALYSIS

COMPANY: FLACER DEVELOPMENT LIM HOLE NUMBER: LC 79 - 3 GRID * FIELD: LIARD BASIN PROVINCE: YUKON TER
SEAM NUMBER: * INTERVAL: 24.8 TO 25.5 M DEPTH CONTROL FROM: FEL
DATED LOGGED: 9 MAY 1979 LOGGED BY: SIM DIGITIZED BY: EDWARDS CALCULATED BY: EDWARDS
FOCUSED BEAM TOOL # 8 DENSITY TOOL # 554

THESE RESULTS HAVE BEEN OBTAINED USING GEOPHYSICAL LOG DATA
CONSTANTS USED IN THE CALCULATIONS ARE:

WATER RESISTIVITY: 29.65 ohm-m at: 40 degrees F. APPARENT COAL DENSITY: 1.44 g/cc
ASH RESISTIVITY: 25.0 ohm-m APPARENT ASH DENSITY: 1.93 g/cc
COMPUTED WATER CONTENT OF ASH: 46.73 %
Z/A coal = 0.5201 Z/A water = 0.5551 Z/A ash = 0.50
The calorific value of pure coal: 11423 The Parr factor: 0.9456

SAMPLE NUMBER	LOG READINGS					INSITU PERCENTAGES						TRUE DENSITY	FT^3/ LONG TON	LABORATORY EQUIVALENTS	
	DEPTHS		INTER-VAL	DENSITY	RESIST-IVITY	BY VOLUME			BY WEIGHT						
	FROM	TO				COAL	WATER	ASH	COAL	WATER	ASH			ASH	Btu/lb
1	24.80	25.50	0.70	1.38	70	44.31	39.65	16.05	46.43	30.11	23.46	1.32	27.25	25.49	8344
WEIGHTED AVERAGES INSITU BASIS FOR INTERVALS 1 TO 1															
			0.7			44.31	39.65	16.05	46.43	30.11	23.46	1.32	27.25	25.49	8344

CALORIFIC VALUE 5304 SOLIDS DENSITY 1.58

POKE OIL ENTERPRISES LTD. GEOPHYSICAL COAL ANALYSIS

COMPANY: PLACER DEVELOPEMENT LIM HOLE NUMBER: LC 79 - 3 GRID * FIELD: LIARD BASIN PROVINCE: YUKON TER
SEAM NUMBER: * INTERVAL: 27.8 TO 28.4 M DEPTH CONTROL FROM: FEL
DATED LOGGED: 9 MAY 1979 LOGGED BY: SIM DIGITIZED BY: EDWARDS CALCULATED BY: EDWARDS
FOCUSED BEAM TOOL # 8 DENSITY TOOL # 554

THESE RESULTS HAVE BEEN OBTAINED USING GEOPHYSICAL LOG DATA
CONSTANTS USED IN THE CALCULATIONS ARE:

WATER RESISTIVITY: 29.65 ohm-m at: 40 degrees F. APPARENT COAL DENSITY: 1.44 g/cc
ASH RESISTIVITY: 25.0 ohm-m APPARENT ASH DENSITY: 1.93 g/cc
COMPUTED WATER CONTENT OF ASH: 46.73 %
Z/A coal = 0.5201 Z/A water = 0.5551 Z/A ash = 0.50
The calorific value of pure coal: 11423 The Parr factor: 0.9456

SAMPLE NUMBER	LOG READINGS					INSITU PERCENTAGES						TRUE DENSITY	FT^3/ LONG TON	LABORATORY EQUIVALENTS	
	DEPTHS		INTERVAL	DENSITY	RESISTIVITY	BY VOLUME			BY WEIGHT					ASH	Btu/lb
	FROM	TO				COAL	WATER	ASH	COAL	WATER	ASH				
1	27.80	28.40	0.60	1.54	48	33.88	29.34	36.78	31.82	19.97	48.20	1.47	24.43	49.67	5423

WEIGHTED AVERAGES INSITU BASIS FOR INTERVALS 1 TO 1

0.6			33.88	29.34	36.78	31.82	19.97	48.20	1.47	24.43	49.67	5423

CALORIFIC VALUE 3635 SOLIDS DENSITY 1.84

POKE OIL ENTERPRISES LTD. GEOPHYSICAL COAL ANALYSIS

COMPANY: PLACER DEVELOPMENT LIM HOLE NUMBER: LC 79 - 3 GRID * FIELD: LIARD BASIN PROVINCE: YUKON TER
SEAM NUMBER: * INTERVAL: 30.8 TO 31.7 M DEPTH CONTROL FROM: FEL
DATED LOGGED: 9 MAY 1979 LOGGED BY: SIM DIGITIZED BY: EDWARDS CALCULATED BY: EDWARDS
FOCUSED BEAM TOOL # 8 DENSITY TOOL # 554

THESE RESULTS HAVE BEEN OBTAINED USING GEOPHYSICAL LOG DATA
CONSTANTS USED IN THE CALCULATIONS ARE:

WATER RESISTIVITY: 29.65 ohm-m at: 40 degrees F. APPARENT COAL DENSITY: 1.44 g/cc
ASH RESISTIVITY: 25.0 ohm-m APPARENT ASH DENSITY: 1.93 g/cc
COMPUTED WATER CONTENT OF ASH: 46.73 %
%/A coal = 0.5201 %/A water = 0.5551 %/A ash = 0.50
The calorific value of pure coal: 11423 The Parr factor: 0.9456

SAMPLE NUMBER	LOG READINGS					INSITU PERCENTAGES						TRUE DENSITY	FT^3/ LONG TON	LABORATORY EQUIVALENTS	
	DEPTHS		INTER-VAL	DENSITY	RESIST-IVITY	BY VOLUME			BY WEIGHT					ASH	Btu/lb
	FROM	TO				COAL	WATER	ASH	COAL	WATER	ASH				
1	30.80	31.70	0.90	1.47	63	42.13	32.00	25.88	41.54	22.86	35.59	1.40	25.64	36.40	7025
WEIGHTED AVERAGES INSITU BASIS FOR INTERVALS 1 TO 1															
			0.9			42.13	32.00	25.88	41.54	22.86	35.59	1.40	25.64	36.40	7025

CALORIFIC VALUE 4745 SOLIDS DENSITY 1.69

POKE OIL ENTERPRISES LTD. GEOPHYSICAL COAL ANALYSIS

COMPANY: PLACER DEVELOPEMENT LIM HOLE NUMBER: IC 79 - 3 GRID * FIELD: LIARD BASIN PROVINCE: YUKON TER
SEAM NUMBER: * INTERVAL: 80.2 TO 81.7 M DEPTH CONTROL FROM: FEL
DATED LOGGED: 9 MAY 1979 LOGGED BY: SIM DIGITIZE BY: EDWARDS CALCULATED BY: EDWARDS
FOCUSED BEAM TOOL # 8 DENSITY TOOL # 554

THESE RESULTS HAVE BEEN OBTAINED USING GEOPHYSICAL LOG DATA
CONSTANTS USED IN THE CALCULATIONS ARE:

WATER RESISTIVITY: 29.65 ohm-m at: 40 degrees F. APPARENT COAL DENSITY: 1.44 g/cc
ASH RESISTIVITY: 25.0 ohm-m APPARENT ASH DENSITY: 1.93 g/cc
COMPUTED WATER CONTENT OF ASH: 46.73 %
Z/A coal = 0.5201 Z/A water = 0.5551 Z/A ash = 0.50
The calorific value of pure coal: 11423 The Parr factor: 0.9456

SAMPLE NUMBER	LOG READINGS					INSITU PERCENTAGES						TRUE DENSITY	FT^3/ LONG TON	LABORATORY EQUIVALENTS	
	DEPTHS		INTER-	DENSITY	RESIST-	BY VOLUME			BY WEIGHT						
	FROM	TO	VAL		IVITY	COAL	WATER	ASH	COAL	WATER	ASH			ASH	Btu/lb
1	80.20	81.70	1.50	1.30	52	34.50	52.85	12.66	38.14	42.34	19.52	1.25	28.75	25.73	8314
WEIGHTED AVERAGES INSITU BASIS FOR INTERVALS 1 TO 1															
			1.5			34.50	52.85	12.66	38.14	42.34	19.52	1.25	28.75	25.73	8314

CALORIFIC VALUE 4357 SOLIDS DENSITY 1.59

ROKE OIL ENTERPRISES LTD. GEOPHYSICAL COAL ANALYSIS

COMPANY: PLACER DEVELOPEMENT LIM HOLE NUMBER: LC 79 - 3 GRID * FIELD: LIARD BASIN PROVINCE: YUKON TER
SEAM NUMBER: * INTERVAL: 105.7 TO 106.8 M DEPTH CONTROL FROM: FEL
DATED LOGGED: 9 MAY 1979 LOGGED BY: SIM DIGITIZED BY: EDWARDS CALCULATED BY: EDWARDS
FOCUSED BEAM TOOL # 8 DENSITY TOOL # 554

THESE RESULTS HAVE BEEN OBTAINED USING GEOPHYSICAL LOG DATA
CONSTANTS USED IN THE CALCULATIONS ARE:

WATER RESISTIVITY: 29.65 ohm-m at: 40 degrees F. APPARENT COAL DENSITY: 1.44 g/cc
ASH RESISTIVITY: 25.0 ohm-m APPARENT ASH DENSITY: 1.93 g/cc
COMPUTED WATER CONTENT OF ASH: 46.73 %
Z/A coal = 0.5201 Z/A water = 0.5551 Z/A ash = 0.50
The calorific value of pure coal: 11423 The Parr factor: 0.9456

SAMPLE NUMBER	LOG READINGS					INSITU PERCENTAGES						TRUE DENSITY	FT^3/ LONG TON	LABORATORY EQUIVALENTS	
	DEPTHS		INTER-	DENSITY	RESIST-	BY VOLUME			BY WEIGHT						
	FROM	TO	VAL		IVITY	COAL	WATER	ASH	COAL	WATER	ASH			ASH	Btu/lb
1	105.70	106.20	0.50	1.73	44	32.81	5.56	61.63	26.72	3.28	70.00	1.69	21.17	62.11	3920
2	106.20	106.80	0.60	1.47	51	35.36	36.06	28.58	34.89	25.78	39.33	1.40	25.65	42.71	6264
WEIGHTED AVERAGES INSITU BASIS FOR INTERVALS 1 TO 2															
			1.1			34.20	22.20	43.60	30.78	14.48	54.74	1.53	23.40	53.43	4968

CALORIFIC VALUE 3516 SOLIDS DENSITY 1.87

FOKE OIL ENTERPRISES LTD. GEOPHYSICAL COAL ANALYSIS

COMPANY: PLACER DEVELOPMENT LIM HOLE NUMBER: LC 79 - 3 GRID * FIELD: LIARD BASIN PROVINCE: YUKON TER
SEAM NUMBER: * INTERVAL: 145.6 TO 146.1 M DEPTH CONTROL FROM: FEL
DATED LOGGED: 9 MAY 1979 LOGGED BY: SIM DIGITIZED BY: EDWARDS CALCULATED BY: EDWARDS
FOCUSED BEAM TOOL # 8 DENSITY TOOL # 554

THESE RESULTS HAVE BEEN OBTAINED USING GEOPHYSICAL LOG DATA
CONSTANTS USED IN THE CALCULATIONS ARE:

WATER RESISTIVITY: 29.65 ohm-m at: 40 degrees F. APPARENT COAL DENSITY: 1.44 g/cc
ASH RESISTIVITY: 25.0 ohm-m APPARENT ASH DENSITY: 1.93 g/cc
COMPUTED MATRIX CORRECTION FACTOR: 0.7[illegible]
[illegible] = 0.5201 [illegible] = [illegible] [illegible] ash = 0.50
The calorific value of pure coal: 11423 The Parr factor: 0.9455

SAMPLE NUMBER	LOG READINGS					INSITU PERCENTAGES						TRUE DENSITY	FT^3/ LONG TON	LABORATORY EQUIVALENTS	
	DEPTHS		INTERVAL	DENSITY	RESISTIVITY	BY VOLUME			BY WEIGHT						
	FROM	TO				COAL	WATER	ASH	COAL	WATER	ASH			ASH	Btu/lb
1	145.60	146.10	0.50	1.55	50	35.48	27.24	37.28	33.09	18.41	48.50	1.48	24.25	48.89	5517

WEIGHTED AVERAGES INSITU BASIS FOR INTERVALS 1 TO 1

0.5	35.48	27.24	37.28	33.09	18.41	48.50	1.48	24.25	48.89	5517

CALORIFIC VALUE 3780 SOLIDS DENSITY 1.83

POKE OIL ENTERPRISES LTD. GEOPHYSICAL COAL ANALYSIS

COMPANY: PLACER DEVELOPMENT LTD FOLD NUMBER: LC 79 - 4 GRID * FIELD: LIARD BASIN PROVINCE: YUKON TER
SEAM NUMBER: * INTERVAL: 67.8 TO 68.4 M DEPTH CONTROL FROM: FEL
DATED LOGGED: 13 MAY 1979 LOGGED BY: SIM DIGITIZED BY: EDWARDS CALCULATED BY: EDWARDS
FOCUSED BEAM TOOL # 8 DENSITY TOOL # 554

THESE RESULTS HAVE BEEN OBTAINED USING GEOPHYSICAL LOG DATA
CONSTANTS USED IN THE CALCULATIONS ARE:

WATER RESISTIVITY: 25.41 ohm-m at: 40 degrees F. APPARENT COAL DENSITY: 1.44 g/cc
ASH RESISTIVITY: 25.0 ohm-m APPARENT ASH DENSITY: 1.93 g/cc
COMPUTED WATER CONTENT OF ASH: 46.73 %
Z/A coal = 0.5201 Z/A water = 0.5551 Z/A ash = 0.50
The calorific value of pure coal: 11423 The Parr factor: 0.9456

SAMPLE	LOG READINGS					INSITU PERCENTAGES						TRUE	FT^3/	LABORATORY	
NUMBER	DEPTHS		INTER-	DENSITY	RESIST-	BY VOLUME			BY WEIGHT			DENSITY	LONG	EQUIVALENTS	
	FROM	TO	VAL		IVITY	COAL	WATER	ASH	COAL	WATER	ASH		TON	ASH	Btu/lb
1	67.80	68.40	0.60	1.36	65	45.16	41.02	13.83	47.95	31.56	20.48	1.30	27.61	22.49	8707

WEIGHTED AVERAGES INSITU BASIS FOR INTERVALS 1 TO 1

	0.6			45.16	41.02	13.83	47.95	31.56	20.48	1.30	27.61	22.49	8707

CALORIFIC VALUE 5478 SOLIDS DENSITY 1.56

POKE OIL ENTERPRISES LTD. GEOPHYSICAL COAL ANALYSIS

COMPANY: PLACER DEVELOPEMENT LIM HOLE NUMBER: LC 79 - 4 GRID * FIELD: LIARD BASIN PROVINCE: YUKON TER
SEAM NUMBER: * INTERVAL: 73.2 TO 73.5 M DEPTH CONTROL FROM: FBL
DATED LOGGED: 13 MAY 1979 LOGGED BY: SIM DIGITIZED BY: EDWARDS CALCULATED BY: EDWARDS
FOCUSED BEAM TOOL # 8 DENSITY TOOL # 554

THESE RESULTS HAVE BEEN OBTAINED USING GEOPHYSICAL LOG DATA
CONSTANTS USED IN THE CALCULATIONS ARE:

WATER RESISTIVITY: 25.41 ohm-m at: 40 degrees F. APPARENT COAL DENSITY: 1.44 g/cc
ASH RESISTIVITY: 25.0 ohm-m APPARENT ASH DENSITY: 1.93 g/cc
COMPUTED WATER CONTENT OF ASH: 46.73 %
Z/A coal = 0.5201 Z/A water = 0.5551 Z/A ash = 0.50
The calorific value of pure coal: 11423 De Parr factor: 0.9456

SAMPLE NUMBER	LOG READINGS					INSITU PERCENTAGES						TRUE DENSITY	FT^3/ LONG TON	LABORATORY EQUIVALENTS	
	DEPTHS		INTERVAL	DENSITY	RESISTIVITY	BY VOLUME			BY WEIGHT						
	FROM	TO				COAL	WATER	ASH	COAL	WATER	ASH			ASH	Btu/lb
1	73.20	73.50	0.30	1.69	40	29.39	13.31	57.30	24.70	8.11	67.19	1.64	21.86	62.90	3824
WEIGHTED AVERAGES INSITU BASIS FOR INTERVALS 1 TO 1															
			0.3			29.39	13.31	57.30	24.70	8.11	67.19	1.64	21.86	62.90	3824

CALORIFIC VALUE 2822 SOLIDS DENSITY 2.02

POKE OIL ENTERPRISES LTD. GEOPHYSICAL COAL ANALYSIS

COMPANY: PLACER DEVELOPEMENT LIM HOLE NUMBER: LC 79 - 4 GPID * FIELD: LIARD BASIN PROVINCE: YUKON TER
SEAM NUMBER: * INTERVAL: 85.5 TO 85.9 M DEPTH CONTROL FROM: FBL
DATED LOGGED: 13 MAY 1979 LOGGED BY: SIN DIGITIZED BY: EDWARDS CALCULATED BY: EDWARDS
FOCUSED BEAM TOOL # 8 DENSITY TOOL # 554

THESE RESULTS HAVE BEEN OBTAINED USING GEOPHYSICAL LOG DATA
CONSTANTS USED IN THE CALCULATIONS ARE:

WATER RESISTIVITY: 25.41 ohm-m at: 40 degrees F. APPARENT COAL DENSITY: 1.44 g/cc
ASH RESISTIVITY: 25.0 ohm-m APPARENT ASH DENSITY: 1.93 g/cc
COMPUTED WATER CONTENT OF ASH: 46.73 %
Z/A coal = 0.5201 Z/A water = 0.5551 Z/A ash = 0.50
The calorific value of pure coal: 11423 The Parr factor: 0.9456

SAMPLE NUMBER	LOG READINGS					INSITU PERCENTAGES						TRUE DENSITY	FT^3/ LONG TON	LABORATORY EQUIVALENTS	
	DEPTHS		INTERVAL	DENSITY	RESISTIVITY	BY VOLUME			BY WEIGHT					ASH	Btu/lb
	FROM	TO				COAL	WATER	ASH	COAL	WATER	ASH				
1	85.50	85.90	0.40	1.64	63	44.57	10.86	44.57	38.88	6.87	54.25	1.58	22.69	47.73	5657
WEIGHTED AVERAGES INSITU BASIS FOR INTERVALS 1 TO 1															
			0.4			44.57	10.86	44.57	38.88	6.87	54.25	1.58	22.69	47.73	5657

CALORIFIC VALUE 4442 SOLIDS DENSITY 1.82

POKE OIL ENTERPRISES LTD. GEOPHYSICAL COAL ANALYSIS

COMPANY: PLACER DEVELOPMENT LIM HOLE NUMBER: LC 79 - 4 GRID * FIELD: LIARD BASIN PROVINCE: YUKON TER
SEAM NUMBER: * INTERVAL: 87.35 TO 94.3 M DEPTH CONTROL FROM: FLL
DATED LOGGED: 13 MAY 1979 LOGGED BY: SIM DIGITIZED BY: EDWARDS CALCULATED BY: EDWARDS
FOCUSED BEAM TOOL # 8 DENSITY TOOL # 554

THESE RESULTS HAVE BEEN OBTAINED USING GEOPHYSICAL LOG DATA
CONSTANTS USED IN THE CALCULATIONS ARE:

WATER RESISTIVITY: 25.41 ohm-m at: 40 degrees F. APPARENT COAL DENSITY: 1.44 g/cc
ASH RESISTIVITY: 25.0 ohm-m APPARENT ASH DENSITY: 1.93 g/cc
COMPUTED WATER CONTENT OF ASH: 46.73 %
Z/A coal = 0.5201 Z/A water = 0.5551 Z/A ash = 0.50
The calorific value of pure coal: 11423 The Parr factor: 0.9456

SAMPLE NUMBER	LOG READINGS					INSITU PERCENTAGES						TRUE DENSITY	FT^3/ LONG TON	LABORATORY EQUIVALENTS	
	DEPTHS		INTERVAL	DENSITY	RESISTIVITY	BY VOLUME			BY WEIGHT						
	FROM	TO				COAL	WATER	ASH	COAL	WATER	ASH			ASH	Btu/lb
1	87.35	89.00	1.15	1.32	61	43.42	45.72	10.87	47.34	36.12	16.53	1.27	28.35	19.22	9101
2	89.00	89.40	0.40	1.73	28	9.51	19.56	70.94	7.75	11.56	80.69	1.69	21.20	83.57	1328
3	89.40	89.80	0.40	1.54	71	47.52	21.15	31.33	44.60	14.38	41.02	1.47	24.40	38.00	6833
4	89.80	90.40	0.60	1.80	26	3.53	12.27	84.19	2.72	6.85	90.43	1.79	20.02	90.82	452
5	90.40	91.90	1.50	1.35	60	42.98	43.25	13.77	45.95	33.51	20.54	1.29	27.80	23.27	8611
6	91.90	92.30	0.40	1.46	37	25.64	42.94	31.42	25.49	30.93	43.58	1.39	25.85	52.52	5079
7	92.30	93.20	0.90	1.34	63	44.31	43.37	12.32	47.69	33.82	18.49	1.28	27.98	20.88	8901
8	93.20	94.30	1.10	1.37	60	42.99	41.38	15.63	45.36	31.64	23.00	1.31	27.43	25.56	8336
WEIGHTED AVERAGES INSITU BASIS FOR INTERVALS 1 TO 8															
			6.5			36.71	37.65	25.65	36.79	27.35	35.86	1.38	26.06	39.33	6672

CALORIFIC VALUE 4203 SOLIDS DENSITY 1.73

POKE OIL ENTERPRISES LTD. GEOPHYSICAL COAL ANALYSIS

COMPANY: PLACER DEVELOPEMENT LIM HOLE NUMBER: LC 79 - 4 GRID * FIELD: LIARD BASIN PROVINCE: YUKON TER
SEAM NUMBER: * INTERVAL: 101.2 TO 101.8 DEPTH CONTROL FROM: FEL
DATED LOGGED: 13 MAY 1979 LOGGED BY: SIM DIGITIZED BY: EDWARDS CALCULATED BY: EDWARDS
FOCUSED BEAM TOOL # 8 DENSITY TOOL # 554

THESE RESULTS HAVE BEEN OBTAINED USING GEOPHYSICAL LOG DATA
CONSTANTS USED IN THE CALCULATIONS ARE:

WATER RESISTIVITY: 25.41 ohm-m at: 40 degrees F. APPARENT COAL DENSITY: 1.44 g/cc
ASH RESISTIVITY: 25.0 ohm-m APPARENT ASH DENSITY: 1.93 g/cc
COMPUTED WATER CONTENT OF ASH: 46.73 %
Z/A coal = 0.5201 Z/A water = 0.5551 Z/A ash = 0.50
The calorific value of pure coal: 11423 The Parr factor: 0.9456

SAMPLE NUMBER	LOG READINGS					INSITU PERCENTAGES						TRUE DENSITY	FT^3/ LONG TON	LABORATORY EQUIVALENTS	
	DEPTHS		INTER-	DENSITY	RESIST-	BY VOLUME			BY WEIGHT						
	FROM	TO	VAL		IVITY	COAL	WATER	ASH	COAL	WATER	ASH			ASH	Btu/lb
1	101.20	101.80	0.60	1.68	49	37.05	10.08	52.87	31.37	6.19	62.45	1.63	22.01	56.03	4654
WEIGHTED AVERAGES INSITU BASIS FOR INTERVALS 1 TO 1															
			0.6			37.05	10.08	52.87	31.37	6.19	62.45	1.63	22.01	56.03	4654

CALORIFIC VALUE 3583 SOLIDS DENSITY 1.92

POKE OIL ENTERPRISES LTD. GEOPHYSICAL COAL ANALYSIS

COMPANY: PLACER DEVELOPMENT LIM HOLE NUMBER: IC 79 - 4 GRID * FIELD: LIARD BASIN PROVINCE: YUKON TER
SEAM NUMBER: * INTERVAL: 102.75 TO 103.45 M DEPTH CONTROL FROM: FDL
DATED LOGGED: 13 MAY 1979 LOGGED BY: SIM DIGITIZED BY: EDWARDS CALCULATED BY: EDWARDS
FOCUSED BEAM TOOL # 8 DENSITY TOOL # 554

THESE RESULTS HAVE BEEN OBTAINED USING GEOPHYSICAL LOG DATA
CONSTANTS USED IN THE CALCULATIONS ARE:

WATER RESISTIVITY: 25.41 ohm-m at: 40 degrees F. APPARENT COAL DENSITY: 1.44 g/cc
ASH RESISTIVITY: 25.0 ohm-m APPARENT ASH DENSITY: 1.93 g/cc
COMPUTED WATER CONTENT OF ASH: 46.73 %
Z/A coal = 0.5201 Z/A water = 0.5551 Z/A ash = 0.50
The calorific value of pure coal: 11423 The Parr factor: 0.9456

SAMPLE NUMBER	LOG READINGS					INSITU PERCENTAGES						TRUE DENSITY	FT^3/ LONG TON	LABORATORY EQUIVALENTS	
	DEPTHS		INTER-VAL	DENSITY	RESIST-IVITY	BY VOLUME			BY WEIGHT					ASH	Btu/lb
	FROM	TO				COAL	WATER	ASH	COAL	WATER	ASH				
1	102.75	103.45	0.70	1.75	49	31.8	7.9	55/ 5	25.5	4.6	62/ 8	1.72	20.90	64.47	3635
WEIGHTED AVERAGES INSITU BASIS FOR INTERVALS 1 TO 1															
			0.7			31.78	7.95	54.94 / 5.33	25.54	4.63	61.60 / 8.23	1.72	20.90	64.47	3635

CALORIFIC VALUE 2918 SOLIDS DENSITY 2.04
THE / INDICATES PRESENCE OF A NON-CONDUCTOR OTHER THAN COAL, SUCH AS SILT, CALCITE or CARBONATE
THE NUMBER ABOVE THE / IS PERCENT CLAY THE THE NUMBER BELOW THE / IS PERCENT SILT, CALCITE or CARBONATE

POKE OIL ENTERPRISES LTD. GEOPHYSICAL COAL ANALYSIS

COMPANY: PLACER DEVELOPMENT LIM HOLE NUMBER: IC 79 - 4 GRID * FIELD: LIARD BASIN PROVINCE: YUKON TER
SEAM NUMBER: * INTERVAL: 119.6 TO 121.8 M DEPTH CONTROL FROM: FDL
DATED LOGGED: 13 MAY 1979 LOGGED BY: SIM DIGITIZED BY: EDWARDS CALCULATED BY: EDWARDS
FOCUSED BEAM TOOL # 8 DENSITY TOOL # 554

THESE RESULTS HAVE BEEN OBTAINED USING GEOPHYSICAL LOG DATA
CONSTANTS USED IN THE CALCULATIONS ARE:

WATER RESISTIVITY: 25.41 ohm-m at: 40 degrees F. APPARENT COAL DENSITY: 1.44 g/cc
ASH RESISTIVITY: 25.0 ohm-m APPARENT ASH DENSITY: 1.93 g/cc
COMPUTED WATER CONTENT OF ASH: 46.73 %
%/A coal = 0.5201 %/A water = 0.5551 %/A ash = 0.50
The calorific value of pure coal: 11423 The Parr factor: 0.9456

SAMPLE NUMBER	LOG READINGS					INSITU PERCENTAGES						TRUE DENSITY	FT^3/ LONG TON	LABORATORY EQUIVALENTS	
	DEPTHS		INTER-	DENSITY	RESIST-	BY VOLUME			BY WEIGHT						
	FROM	TO	VAL		IVITY	COAL	WATER	ASH	COAL	WATER	ASH			ASH	Btu/lb
1	119.60	120.20	0.60	1.37	57	41.52	42.27	16.21	43.81	32.32	23.87	1.31	27.44	26.92	8171
2	120.20	121.00	0.80	1.55	45	33.89	28.19	37.92	31.61	19.06	49.33	1.48	24.25	50.37	5338
3	121.00	121.80	0.80	1.39	60	43.01	39.47	17.52	44.78	29.78	25.44	1.33	27.07	27.74	8072
WEIGHTED AVERAGES INSITU BASIS FOR INTERVALS 1 TO 3															
			2.2			39.29	36.13	24.58	39.38	26.25	34.37	1.38	26.06	36.82	6976

CALORIFIC VALUE 4499 SOLIDS DENSITY 1.69

POKE OIL ENTERPRISES LTD. GEOPHYSICAL COAL ANALYSIS

COMPANY: PLACER DEVELOPMENT LIM HOLE NUMBER: LC 79 - 4 GRID * FIELD: LIARD BASIN PROVINCE: YUKON TER
SEAM NUMBER: * INTERVAL: 124.6 TO 129.0 M DEPTH CONTROL FROM: FDL
DATED LOGGED: 13 MAY 1979 LOGGED BY: SIM DIGITIZED BY: EDWARDS CALCULATED BY: EDWARDS
FOCUSED BEAM TOOL # 8 DENSITY TOOL # 554

THESE RESULTS HAVE BEEN OBTAINED USING GEOPHYSICAL LOG DATA
CONSTANTS USED IN THE CALCULATIONS ARE:

WATER RESISTIVITY: 25.41 ohm-m at: 40 degrees F. APPARENT COAL DENSITY: 1.44 g/cc
ASH RESISTIVITY: 25.0 ohm-m APPARENT ASH DENSITY: 1.93 g/cc
COMPUTED WATER CONTENT OF ASH: 46.73 %
Z/A coal = 0.5201 Z/A water = 0.5551 Z/A ash = 0.50
The calorific value of pure coal: 11423 The Parr factor: 0.9456

SAMPLE NUMBER	LOG READINGS					INSITU PERCENTAGES						TRUE DENSITY	FT^3/ LONG TON	LABORATORY EQUIVALENTS	
	DEPTHS		INTER-VAL	DENSITY	RESIST-IVITY	BY VOLUME			BY WEIGHT					ASH	Btu/lb
	FROM	TO				COAL	WATER	ASH	COAL	WATER	ASH				
1	124.60	126.00	1.40	1.37	62	43.90	40.84	15.26	46.32	31.22	22.46	1.31	27.43	24.74	8435
2	126.00	126.70	0.70	1.37	72	47.74	38.53	13.73	50.35	29.45	20.20	1.31	27.42	21.43	8834
3	126.70	127.20	0.50	1.55	41	30.26	30.37	39.36	28.23	20.54	51.23	1.48	24.26	53.90	4912
4	127.20	128.40	1.20	1.33	69	46.67	42.86	10.47	50.54	33.64	15.82	1.27	28.16	17.60	9297
5	128.40	129.00	0.60	1.49	51	38.17	32.26	29.57	37.14	22.74	40.12	1.42	25.29	41.71	6384
WEIGHTED AVERAGES INSITU BASIS FOR INTERVALS 1 TO 5															
			4.4			42.93	38.56	18.40	44.44	29.00	26.57	1.33	26.91	28.74	7951

CALORIFIC VALUE 5076 SOLIDS DENSITY 1.61

POKE OIL ENTERPRISES LTD. GEOPHYSICAL COAL ANALYSIS

COMPANY: PLACER DEVELOPEMENT LIM HOLE NUMBER: LC 79 - 4 GRID * FIELD: LIARD BASIN PROVINCE: YUKON TER
SEAM NUMBER: * INTERVAL: 132.0 TO 133.9 M DEPTH CONTROL FROM: FDL
DATE LOGGED: 13 MAY 1979 LOGGED BY: SIM DIGITIZED BY: EDWARDS CALCULATED BY: EDWARDS
FOCUSED BEAM TOOL # 8 DENSITY TOOL # 554

THESE RESULTS HAVE BEEN OBTAINED USING GEOPHYSICAL LOG DATA
CONSTANTS USED IN THE CALCULATIONS ARE:

WATER RESISTIVITY: 25.41 ohm-m at: 40 degrees F. APPARENT COAL DENSITY: 1.44 g/cc
ASH RESISTIVITY: 25.0 ohm-m APPARENT ASH DENSITY: 1.93 g/cc
COMPUTED WATER CONTENT OF ASH: 46.73 %
Z/A coal = 0.5201 Z/A water = 0.5551 Z/A ash = 0.50
The calorific value of pure coal: 11423 The Parr factor: 0.9456

SAMPLE NUMBER	LOG READINGS					INSITU PERCENTAGES						TRUE DENSITY	FT^3/ LONG TON	LABORATORY EQUIVALENTS	
	DEPTHS		INTER-VAL	DENSITY	RESIST-IVITY	BY VOLUME			BY WEIGHT					ASH	Btu/lb
	FROM	TO				COAL	WATER	ASH	COAL	WATER	ASH				
1	132.00	133.40	1.40	1.33	68	46.30	43.08	10.62	50.15	33.81	16.04	1.27	28.16	17.91	9259
2	133.40	133.90	0.50	1.45	60	43.05	33.51	23.44	43.04	24.27	32.69	1.38	25.99	33.74	7347
WEIGHTED AVERAGES INSITU BASIS FOR INTERVALS 1 TO 2															
			1.9			45.44	40.56	13.99	48.16	31.15	20.68	1.30	27.56	22.58	8695

CALORIFIC VALUE 5502 SOLIDS DENSITY 1.56

FOKE OIL ENTERPRISES LTD. GEOPHYSICAL COAL ANALYSIS

COMPANY: PLACER DEVELOPEMENT LIM HOLE NUMBER: LC 79 - 4 GRID * FIELD: LIARD BASIN PROVINCE: YUKON TER
SEAM NUMBER: * INTERVAL: 134.9 TO 136.4 M DEPTH CONTROL FROM: FBL
DATED LOGGED: 13 MAY 1979 LOGGED BY: SIM DIGITIZED BY: EDWARDS CALCULATED BY: EDWARDS
FOCUSED BEAM TOOL # 8 DENSITY TOOL # 554

THESE RESULTS HAVE BEEN OBTAINED USING GEOPHYSICAL LOG DATA
CONSTANTS USED IN THE CALCULATIONS ARE:

WATER RESISTIVITY: 25.41 ohm-m at: 40 degrees F. APPARENT COAL DENSITY: 1.44 g/cc
ASH RESISTIVITY: 25.0 ohm-m APPARENT ASH DENSITY: 1.93 g/cc
COMPUTED WATER CONTENT OF ASH: 46.73 %
%/A coal = 0.5201 %/A water = 0.5551 %/A ash = 0.50
The calorific value of pure coal: 11423 The Parr factor: 0.9456

SAMPLE NUMBER	LOG READINGS					INSITU PERCENTAGES						TRUE DENSITY	FT^3/ LONG TON	LABORATORY EQUIVALENTS	
	DEPTHS		INTER-VAL	DENSITY	RESIST-IVITY	BY VOLUME			BY WEIGHT					ASH	Btu/lb
	FROM	TO				COAL	WATER	ASH	COAL	WATER	ASH				
1	134.90	135.60	0.70	1.40	65	45.19	37.20	17.61	46.72	27.87	25.40	1.33	26.88	26.88	8176
2	135.60	136.40	0.80	1.70	45	34.07	9.11	56.82	28.41	5.50	66.09	1.66	21.68	59.53	4231
WEIGHTED AVERAGES INSITU BASIS FOR INTERVALS 1 TO 2															
			1.5			39.26	22.22	38.53	35.98	14.76	49.26	1.51	23.83	47.28	5711

CALORIFIC VALUE 4110 SOLIDS DENSITY 1.80

POKE OIL ENTERPRISES LTD. GEOPHYSICAL COAL ANALYSIS

COMPANY: PLACER DEVELOPEMENT LTD HOLE NUMBER: LC 79 - 5 GRID * FIELD: LIARD BASIN PROVINCE: YUKON TER
SEAM NUMBER: * INTERVAL: 81.0 TO 82.0 ft DEPTH CONTROL FROM: FEL
DATED LOGGED: 18 MAY 1979 LOGGED BY: SIM DIGITIZED BY: EDWARDS CALCULATED BY: EDWARDS
FOCUSED BEAM TOOL # 8 DENSITY TOOL # 554

THESE RESULTS HAVE BEEN OBTAINED USING GEOPHYSICAL LOG DATA
CONSTANTS USED IN THE CALCULATIONS ARE:

WATER RESISTIVITY: 31.96 ohm-m at: 40 degrees F. APPARENT COAL DENSITY: 1.44 g/cc
ASH RESISTIVITY: 25.0 ohm-m APPARENT ASH DENSITY: 1.93 g/cc
COMPUTED WATER CONTENT OF ASH: 46.73 %
Z/A coal = 0.5201 Z/A water = 0.5551 Z/A ash = 0.50
The calorific value of pure coal: 11423 The Parr factor: 0.9456

SAMPLE NUMBER	LOG READINGS					INSITU PERCENTAGES						TRUE DENSITY	FT^3/ LONG TON	LABORATORY EQUIVALENTS	
	DEPTHS		INTERVAL	DENSITY	RESISTIVITY	BY VOLUME			BY WEIGHT					ASH	Btu/lb
	FROM	TO				COAL	WATER	ASH	COAL	WATER	ASH				
1	81.00	82.00	1.00	1.37	65	40.70	42.76	16.54	42.95	32.70	24.35	1.31	27.44	27.69	8077
WEIGHTED AVERAGES INSITU BASIS FOR INTERVALS 1 TO 1															
			1.0			40.70	42.76	16.54	42.95	32.70	24.35	1.31	27.44	27.69	8077

CALORIFIC VALUE 4906 SOLIDS DENSITY 1.60

FOKE OIL ENTERPRISES LTD. GEOPHYSICAL COAL ANALYSIS

COMPANY: PLACER DEVELOPMENT LIM HOLE NUMBER: LC 79 - 5 GRID * FIELD: LIARD BASIN PROVINCE: YUKON TER
SEAM NUMBER: * INTERVAL: 92.3 TO 93.8 M DEPTH CONTROL FROM: FEL
DATED LOGGED: 18 MAY 1979 LOGGED BY: SIM DIGITIZED BY: EDWARDS CALCULATED BY: EDWARDS
FOCUSED BEAM TOOL # 8 DENSITY TOOL # 554

THESE RESULTS HAVE BEEN OBTAINED USING GEOPHYSICAL LOG DATA
CONSTANTS USED IN THE CALCULATIONS ARE:

WATER RESISTIVITY: 31.96 ohm-m at: 40 degrees F. APPARENT COAL DENSITY: 1.44 g/cc
ASH RESISTIVITY: 25.0 ohm-m APPARENT ASH DENSITY: 1.93 g/cc
COMPUTED WATER CONTENT OF ASH: 46.73 %
Z/A coal = 0.5201 Z/A water = 0.5551 Z/A ash = 0.50
The calorific value of pure coal: 11423 The Parr factor: 0.9456

SAMPLE NUMBER	LOG READINGS					INSITU PERCENTAGES						TRUE DENSITY	FT^3/ LONG TON	LABORATORY EQUIVALENTS	
	DEPTHS		INTERVAL	DENSITY	RESISTIVITY	BY VOLUME			BY WEIGHT					ASH	Btu/lb
	FROM	TO				COAL	WATER	ASH	COAL	WATER	ASH				
1	92.30	92.60	0.30	1.51	35	16.78	42.94	40.27	16.13	29.90	53.97	1.44	24.98	67.11	3316
2	92.60	93.20	0.60	1.42	60	38.97	39.04	22.10	39.67	28.87	31.46	1.35	26.54	34.69	7233
3	93.20	93.80	0.60	1.91	34	21.74	1.05	77.21	16.70	0.59	82.72	1.80	19.97	74.09	2473
WEIGHTED AVERAGES INSITU BASIS FOR INTERVALS 1 TO 3															
			1.5			27.60	24.63	47.78	24.62	15.92	59.46	1.55	23.20	60.35	4133

CALORIFIC VALUE 2813 SOLIDS DENSITY 1.97

POKE OIL ENTERPRISES LTD. GEOPHYSICAL COAL ANALYSIS

COMPANY: PLACER DEVELOPEMENT LIM HOLE NUMBER: LC 79 - 5 GRID * FIELD: LIARD BASIN PROVINCE: YUKON TER
SEAM NUMBER: * INTERVAL: 106.3 TO 107.3 M DEPTH CONTROL FROM: FBL
DATED LOGGED: 18 MAY 1979 LOGGED BY: SIM DIGITIZED BY: EDWARDS CALCULATED BY: EDWARDS
FOCUSED BEAM TOOL # 8 DENSITY TOOL # 554

THESE RESULTS HAVE BEEN OBTAINED USING GEOPHYSICAL LOG DATA
CONSTANTS USED IN THE CALCULATIONS ARE:

WATER RESISTIVITY: 31.96 ohm-m at: 40 degrees F. APPARENT COAL DENSITY: 1.44 g/cc
ASH RESISTIVITY: 25.0 ohm-m APPARENT ASH DENSITY: 1.93 g/cc
COMPUTED WATER CONTENT OF ASH: 46.73 %
Z/A coal = 0.5201 Z/A water = 0.5551 Z/A ash = 0.50
The calorific value of pure coal: 11423 The Parr factor: 0.9456

SAMPLE NUMBER	LOG READINGS					INSITU PERCENTAGES						TRUE DENSITY	FT^3/ LONG TON	LABORATORY EQUIVALENTS	
	DEPTHS		INTER-	DENSITY	RESIST-	BY VOLUME			BY WEIGHT						
	FROM	TO	VAL		IVITY	COAL	WATER	ASH	COAL	WATER	ASH			ASH	Btu/lb
1	106.75	107.80	1.05	1.35	60	37.98	46.25	15.76	40.63	35.85	23.52	1.29	27.81	28.11	8028

WEIGHTED AVERAGES INSITU BASIS FOR INTERVALS 1 TO 1

1.1	37.98	46.25	15.76	40.63	35.85	23.52	1.29	27.81	28.11	8028

CALORIFIC VALUE 4641 SOLIDS DENSITY 1.61

POKE OIL ENTERPRISES LTD. GEOPHYSICAL COAL ANALYSIS

COMPANY: PLACER DEVELOPMENT LIM HOLE NUMBER: LC 79 - 7 GRID * FIELD: LIARD BASIN PROVINCE: YUKON TER
SEAM NUMBER: * INTERVAL: 110.75 TO 112.0 M DEPTH CONTROL FROM: FEL
DATED LOGGED: 30 MAY 1979 LOGGED BY: SIM DIGITIZED BY: EDWARDS CALCULATED BY: EDWARDS
FOCUSED BEAM TOOL # 8 DENSITY TOOL # 554

THESE RESULTS HAVE BEEN OBTAINED USING GEOPHYSICAL LOG DATA
CONSTANTS USED IN THE CALCULATIONS ARE:

WATER RESISTIVITY: 32.15 ohm-m at: 40 degrees F. APPARENT COAL DENSITY: 1.44 g/cc
ASH RESISTIVITY: 25.0 ohm-m APPARENT ASH DENSITY: 1.93 g/cc
COMPUTED WATER CONTENT OF ASH: 46.73 %
Z/A coal = 0.5201 Z/A water = 0.5551 Z/A ash = 0.50
The calorific value of pure coal: 11423 The Parr factor: 0.9456

SAMPLE NUMBER	LOG READINGS					INSITU PERCENTAGES						TRUE DENSITY	FT^3/ LONG TON	LABORATORY EQUIVALENTS	
	DEPTHS		INTER-	DENSITY	RESIST-	BY VOLUME			BY WEIGHT						
	FROM	TO	VAL		IVITY	COAL	WATER	ASH	COAL	WATER	ASH			ASH	Btu/lb
1	110.75	111.40	0.65	1.56	40	24.98	32.39	42.63	23.15	21.75	55.10	1.49	24.09	60.04	4171
2	111.40	111.60	0.20	1.67	30	9.62	27.91	62.48	8.22	17.29	74.49	1.61	22.23	82.15	1499
3	111.60	112.00	0.40	1.64	61	42.43	12.14	45.43	37.03	7.68	55.30	1.58	22.69	49.34	5463
WEIGHTED AVERAGES INSITU BASIS FOR INTERVALS 1 TO 3															
			1.3			28.11	25.19	46.70	25.21	16.37	58.42	1.54	23.32	59.45	4242

CALORIFIC VALUE 2879 SOLIDS DENSITY 1.99

POKE OIL ENTERPRISES LTD. GEOPHYSICAL COAL ANALYSIS

COMPANY: PLACER DEVELOPMENT LIM HOLE NUMBER: LC 79 - 7 GRID * FIELD: LIARD BASIN PROVINCE: YUKON TER
SEAM NUMBER: * INTERVAL: 113.7 TO 115.1 M DEPTH CONTROL FROM: FEL
DATE LOGGED: 30 MAY 1979 LOGGED BY: SIM DIGITIZED BY: EDWARDS CALCULATED BY: EDWARDS
FOCUSED BEAM TOOL # 8 DENSITY TOOL # 554

THESE RESULTS HAVE BEEN OBTAINED USING GEOPHYSICAL LOG DATA
CONSTANTS USED IN THE CALCULATIONS ARE:

WATER RESISTIVITY: 32.15 ohm-m at: 40 degrees F. APPARENT COAL DENSITY: 1.44 g/cc
ASH RESISTIVITY: 25.0 ohm-m APPARENT ASH DENSITY: 1.93 g/cc
COMPUTED WATER CONTENT OF ASH: 46.73 %
Z/A coal = 0.5201 Z/A water = 0.5551 Z/A ash = 0.50
The calorific value of pure coal: 11423 The Parr factor: 0.9456

SAMPLE NUMBER	LOG READINGS					INSITU PERCENTAGES						TRUE DENSITY	FT^3/ LONG TON	LABORATORY EQUIVALENTS	
	DEPTHS		INTER-	DENSITY	RESIST-	BY VOLUME			BY WEIGHT						
	FROM	TO	VAL		IVITY	COAL	WATER	ASH	COAL	WATER	ASH			ASH	Btu/lb
1	113.70	114.00	0.30	1.56	41	26.18	31.67	42.15	24.26	21.27	54.48	1.49	24.09	58.75	4326
2	114.00	114.40	0.40	1.61	28	1.71	40.38	57.91	1.53	26.19	72.28	1.54	23.27	91.90	322
3	114.40	115.10	0.70	1.49	43	27.17	38.87	33.96	26.46	27.42	46.12	1.42	25.31	52.97	5024
WEIGHTED AVERAGES INSITU BASIS FOR INTERVALS 1 TO 3															
			1.4			19.68	37.76	42.56	18.50	25.71	55.79	-1.47	24.43	65.04	3566

CALORIFIC VALUE 2113 SOLIDS DENSITY 2.10

APPENDIX E

Geochemical Report

RESULTS OF A SURFACE MICROLAYER AND SOIL SAMPLING SURVEY FOR COAL DEPOSITS IN THE SOUTHEAST YUKON

PREPARED FOR

Placer Development Limited
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PREPARED BY

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M9W 5G2

DECEMBER, 1979

1. INTRODUCTION

1.1 GENERAL STATEMENT

Prospecting, geological mapping, geophysical methods and drilling are most frequently used to explore for coal. Coal measures typically extend for considerable distances and provided that continuity can be established between individual seams, relatively low density drilling patterns and geological mapping are effective for evaluating large deposits. Coal bearing formations can also occur in restricted, irregularly shaped basins such as paleo-river channels. Such deposits may be concealed beneath thick surficial deposits and detailed drilling is often necessary to determine the size of the coal reserve.

There is considerable evidence that concealed oil and gas fields can be detected by hydrocarbon gas leakage at the surface. Preliminary investigations by Barringer Research Limited over known oil reservoirs have shown that anomalous hydrocarbon accumulations are present in surface soils above the oil. Although, as yet, few studies have been conducted over concealed coal deposits, hydrocarbon anomalies could also be expected above coal measures.

During September 1979, Barringer Magenta staff carried out a surface microlayer (SURTRACE) and soil sampling program in the Liard River, Yukon area for Placer Development to test the possible application of hydrocarbon geochemistry in exploration for coal deposits. Previous core drilling by Placer Development outlined several coal bearing areas apparently confined to paleo-river channels. These coal seams are largely concealed beneath thick glacial, fluvial deposits and basalts and only crop out along the bank of the Liard River. Because of the

restricted nature of the depositional basin, detailed drilling patterns would be necessary to outline the lateral extent of the coal. Consequently, a fast, relatively inexpensive exploration method to outline the limits of coal-bearing rocks would be a considerable advantage. Also, several coal seams are generally present within a stratigraphic succession and an indication for the rank of the coal within the sequence could be useful in evaluating the energy resource.

1.2 LOCATION AND ACCESS

The field survey was carried out from a base at Watson Lake, Yukon Territories. This community is situated at the junction of the Alaska and Campbell Highways and is served by a regular air service from Vancouver, Edmonton and Whitehorse. Drill sites on the western side of Liard River are accessible from the Alaska Highway by a series of dry weather gravelled roads. At the time the survey was conducted (September), no problems occurred in reaching all drill sites using a pick-up truck although apparently there was considerable difficulty in traversing the roads earlier in the year. Location of the areas surveyed is shown in Fig. 1.

2. EQUIPMENT AND SAMPLING METHODS

Surface microlayer and forest litter (L-F-H horizon) samples were collected over several detailed and regional traverses previously outlined by Placer Geologists. The location of these samples is indicated on Diagram 1. Forest litter samples were collected at intervals of 200 m. within the detailed area known to have underlying coal seams and along a short traverse 10 km east of Watson Lake and parallel to the Alaska Highway. This traverse was sampled over an area of Paleozoic basement rocks to establish background hydrocarbon and organic sulphur levels in the material. Samples were also collected at 1 km intervals for 45 km along the Alaska Highway between the Liard River and Big Creek bridges. Surface microlayer samples were collected from vegetation and the ground surface continuously between forest-litter sample stations with a backpack SURTRACE sampling unit. This unit consists of a small gasoline engine powered vacuum pump attached to a cyclone. A sampling probe connects to the inlet part of the cyclone and is brushed over the vegetation and ground surface. The particles are separated from the air flow in the cyclone and deposited into a small plastic centrifuge vial. A period of 5 - 10 minutes is generally necessary to collect roughly 0.5 g of particulate matter from the surface microlayer. SURTRACE samples were obtained along the traverse east of Watson Lake and roughly 80% of the lines indicated within the detailed area. A portion of one north-south line within the detailed area and part of the regional traverse west of the Liard River was not sampled with the SURTRACE unit due to rain which commenced on the final day of the field program. Where samples (SURTRACE and forest litter) were taken along the highway, the traverse was made roughtly 100 m away from the road to avoid possible dilution of microlayer material from airborne dust. The sampling commenced on August 30th and was completed in four days.

Samples were air-dried and the SURTRACE material sieved through a 40 mesh screen to remove coarse vegetation fragments such as pine needles. Forest litter were also air-dried, ground and sieved through an 80 mesh screen. Preliminary analysis for volatile hydrocarbon and sulphur contents in 20 samples from "background" control and coal bearing areas established that variations were most evident in the microlayer samples. All microlayer samples were subsequently analysed and results discussed in this report. A selected number of the forest litter samples especially along the regional traverse where no microlayer material was obtained are presently being analysed and results will be described in a supplement to this report.

3. PHYSIOGRAPHY

3.1 TOPOGRAPHY

The region east and west of Watson Lake is an undulating outwash plain dissected by the valley of the Liard River. Relief is 200 m throughout the area. Within the detailed survey area, basalt capped hills generally have plateau crests with moderate to steep side (40°) slopes. Steep sided eskers and other fluvioglacial features are also common. Lakes and small swamps are common especially close to the Liard River.

3.2 DRAINAGE

The principle drainages through the region are the Liard River, Little Rancheria River and Big Creek. Smaller streams drain east from the detailed survey area into the Liard River although many of the prominant valleys between the basalt-capped hills have no active drainage channels. Small swamps have formed locally where free drainage has been impeded.

3.3 SOILS AND VEGETATION

The dominant soil type formed on the outwash material is an orthic dystric brunisol which supports a mature growth of lodgepole pine, aspen and black spruce. Labrador tea and other small shrubs are relatively common particularly on the steeper north facing slopes where there is often a thick cariboo moss cover. Permafrost may be close to the surface beneath this insulating cover although the coarse unsorted nature of the overburden suggests that permafrost is intermittant throughout the area.

3.4 CLIMATE

The climate is cryoboreal with extremely cold winters and short, cool summers. Periods of rain or drizzle are common throughout the summer although the temperature may occasionally reach 20°C.

4. PREVIOUS WORK

Coal occurrences along the Liard River have been known for many years and were described in early Canadian Geological Survey literature. Geological mapping and sampling of coal occurrences were conducted in 1977 and a drilling program carried out in early 1979 by Placer Development.

5. GEOLOGY

Outcrop exposure in the area is extremely poor and only occurs along the Liard Valley. The oldest rocks are probably Lower Paleozoic in age and underlie the region east of Watson Lake. In the absence of more detailed information, the coal is assumed to be Tertiary in age and was deposited during a warm period between major glaciations. The coal is lignitic and is overlain by Tertiary plateau basalts which crop out on the edge of flat topped hill crests. The limits of the basalt cover have been defined from aeromagnetic data. Thick, unsorted gravels and sands forming the Liard River valley were probably deposited during final deglaciation of the area.

6. VOLATILE HYDROCARBON AND SULPHUR GEOCHEMISTRY

Distribution of volatile hydrocarbon and sulphur levels in microlayer samples is shown in Diagram 254-2. Volatile sulphur values in samples from the "background" traverse east of Watson Lake are generally higher than volatile hydrocarbon contents. Sulphur abundances range from 4.7 to 11.8 ppm and hydrocarbon levels from 0.8 to 6.6 ppm. Statistics for this group of samples are given in Table I.

TABLE I

Mean, Standard Deviation and Threshold for Volatile Hydrocarbon and Sulphur from Background Samples

	Mean	Standard Deviation	Threshold (M + 2 SD)
Volatile Hydrocarbons	2.65	2.05	6.75
Volatile Sulphur	6.5	2.13	17.51

Prominant hydrocarbon and sulphur anomalies can be defined within the detailed area based on these thresholds. A large hydrocarbon anomaly (133 ppm) occurs at the south end of line 2 (Anomaly B) associated with increased sulphur content. Anomaly A outlines a distinct enrichment of both hydrocarbon and sulphur on both lines 1, 2 and 3. Although it is difficult to establish the orientation of this anomaly due to the low density of samples, one peak may trend roughly east-west across both lines 1 and 2. Sulphur and hydrocarbon values decrease progressively from this peak. A second anomaly may extend north from line 3 across traverses 5 and 6 where there are lower contrast anomalies E and F. There are also smaller but relatively high contrast hydrocarbons at intervals along

line C (No. D and E). Although only a small number of microlayer samples were collected along the Big Creek - Liard River traverse, there is a significant increase of hydrocarbon and sulphur over a 2 km. interval east of the Little Rancheria River. Samples from detailed and regional traverses appear to have concomintant increases of both volatile sulphur and hydrocarbon content. Sulphur levels demonstrate a rather broader pattern along lines B and C than the hydrocarbon.

In contrast to microlayer samples, the forest litter from both background and detailed survey areas have consistantly high volatile sulphur levels than hydrocarbon content. Both components are higher in the area underlain by coal although the small number of samples presently analysed prevents a direct comparison to be made with surface microlayer analyses.

7. INTERPRETATION

There is obviously a significant enhancement of volatile hydrocarbon and volatile sulphur in surface microlayer material underlain by coal compared to an area apparently underlain by non-coal bearing rocks. No information for the thickness, number and depth of coal seams intersected during the drilling has been provided although from indications in outcrop along the Liard River, the coal bearing rocks apparently strike northwest. The highest abundances occur in samples from moderate to steep hill slopes which could be explained by thin overburden cover above the coal. Anomalies 1, 5 and 6 may reflect a possible coal bearing channelway which either contains less coal to the north or is covered by thicker overburden.

8. CONCLUSIONS AND RECOMMENDATIONS

Significant hydrocarbon and sulphur anomalies appear to be present in areas underlain by coal although these should be compared with results of drilling to establish how closely the known coal sub-outcrop compares with the spatial distribution of hydrocarbon and sulphur values. Microlayer sampling is slower than conventional soil sampling although it provides a continuous profile of hydrocarbon and sulphur variation. A small orientation of possible hydrocarbon and sulphur accumulation in B horizon soils and/or the surface microlayer collected using a small trowel rather than the backpack unit should be carried out. When results of additional forest litter sample analyses are made available, these will be described in a supplement to this report. It is also strongly recommended that further investigations are made into the possible application of chromatography as a method for identifying the rank of the coal.

BARRINGER RESEARCH LIMITED

304 CARLINGVIEW DRIVE
REXDALE, ONTARIO, CANADA
PHONE: 416-677-2491
CABLE: BARESEARCH

Laboratory Report

DATE

MICROLAYER SAMPLES VOLATILE HYDROCARBON AND SULPHUR RESULTS. ALL VALUES IN PPM.

REPORT NUMBER

SAMPLE NUMBER	Vh	Vs		Sample Number	Vh	Vs		Sample Number	Vh	Vs
2	18.78	13.54		62	25.59	7.75		102	5.01	Tr
4	33.48	13.89		64	107.69	31.00		104	9.14	2.58
6	20.42	12.50		66	22.50	15.50		106	Tr	7.75
8	Tr	2.50		68	36.94	15.50		108	5.05	7.75
10	11.02	7.50		70	11.30	5.69		110	4.10	9.69
12	11.27	5.00		72	2.77	14.55		114	1.58	3.88
14	20.21	15.62		74	19.12	27.12		116	7.40	7.75
16	33.07	6.25		76	4.12	13.82		118	1.37	0.65
18	38.14	15.50		78	49.98	16.10		120	3.24	3.88
20	63.51	22.55		80	2.03	6.96		122	6.01	4.80
24	47.47	Tr		82	34.49	13.56		124	12.09	14.12
26	3.56	Tr		84	6.67	12.92		126	2.16	8.46
46	133.50	29.97		86	2.60	1.29		128	0.45	7.06
48	36.87	6.64		88	12.61	2.58		130	3.00	11.77
50	15.58	Tr		90	13.80	9.30		132	3.24	4.24
52	4.90	17.14		92	5.09	4.43		134	5.40	8.82
54	3.05	13.57		94	1.11	19.38		138	6.60	4.71
56	4.69	12.83		96	10.01	Tr		140	0.9	6.85
58	2.94	17.51		98	3.45	1.55		142	5.06	5.57
60	3.15	13.81		100	21.14	9.69		144	2.88	4.11

MICROLAYER SAMPLES VOLATILE HYDROCARBON AND SULPHUR RESULTS. ALL VALUES IN PPM.

Laboratory Report/

Sample Number	Vh	Vs								
146	3.00	6.85								
148	1.57	4.46								
150	2.55	6.09								
152	1.30	7.40								
156	2.88	4.11								
158	3.0	6.85								
160	0.60	2.28								
162	32.40	9.59								
164	16.20	4.11								
166	28.08	9.59								
168	40.50	27.40								
170	15.00	15.98								
172	Tr	6.85								
209	1.80	1.71								
211	3.60	5.14								
213	16.65	1.71								
215	6.60	9.13								
217	1.80	13.70								
219	3.15	8.56								
221	5.40	11.42								
223	11.70	13.70								
225	8.28	9.59								
227	5.40	13.70								
229	1.80	1.71								
231	2.52	2.74								

FOREST LITTER VOLATILE HYDROCARBON AND SULPHUR RESULTS IN PPM.
(DUPLICATE ANALYSES)

Laboratory Report/

Sample Number	Vh	Vs		Sample Number	Vh	Vs				
51A	2.42	15.29		151A	1.13	9.03				
51B	2.35	13.20		151B	1.08	9.90				
53A	1.58	21.59								
53B	1.30	20.35								
55A	1.72	18.99								
55B	1.44	14.92								
57A	3.36	15.91								
57B	3.01	15.17								
59A	2.52	19.36								
59B	2.17	22.57								
61A	2.87	21.71								
61B	2.31	16.77								
73A	1.72	14.58								
73B	1.40	12.73								
75A	1.50	11.86								
75B	1.50	16.10								
77A	2.38	18.82								
77B	2.30	18.28								
79A	2.43	13.71								
79B	2.33	15.45								
143A	0.78	3.92								
143B	0.66	3.92								
145A	0.61	5.11								
145B	0.69	5.33								
147A	1.18	8.81								
147B	1.03	7.62								
149	0.83	7.72								

APPENDIX F

Invoices for Expenditures

General Testing Laboratories Division
Superintendence Company (Canada) Ltd.
1001 East Pender St.
Vancouver, B.C. V6A 1W2
Ph (604) 254-1647

INVOICE V29689
DATE March 13, 1978
JOB NO.
LAB NO. 7802-2804

'0250
LACER DEVELOPMENT LTD.
)0 - 1050 West Georgia Street,
ancouver, B.C.
Att: Mr. R. Borovic

To: Testing 18 submitted Coal Samples, marked: 30553 to 61 and 30583 to 92: for Moisture, Ash, Volatile Matter, Sulphur and Calorific Value = 13 @ 60.50 — 786.50

5 samples with out Calorific Value (high Ash) = @ 44.50 — 222.50

$ 1,009.00

ROKE OIL ENTERPRISES LTD.

516 MORAINE ROAD N.E., CALGARY, ALBERTA T2A 2P2 • TELEPHONE 273-5553

TO: Placer Development Limited,
800 - 1030 West Georgia Street,
Vancouver, B.C.

INVOICE № 1267

DATE March 20, 1978

SERVICES RENDERED Re: Liard Basin Field - Service Order #2669 - Dated March 15, 1978

Total Logging Charges	$ 698.39	
Round-trip mileage from Grande Prairie		
Pavement - 400 mi @ .35/mi	140.00	
Off-pavement - 1100 mi @ .50/mi	550.00	
Meals: 4 days @ 15.00/day	60.00	
Accommodation	25.00	
		$ 1,473.39

V-162

INVOICE

The high ash content and the inversely related calorific described above indicate the coal is an inefficient fuel for a power station. The presence of thick higher quality coal in the bore holes lends credence to the expectation that significant tonnages of higher quality coal will be encountered elsewhere in the basin.

Costs Incurred

Placer has incurred expenditures totaling $353,584.05 between 1977 and May 1980. Copies of invoices for costs greater than $1,000 comprise Appendix "F". The costs are summarized below:

LIARD COAL
STATEMENT OF EXPENDITURES
1977-1979

	1977	1978	1979	TOTAL
Supervision Salaries			$ 2,603.09	$ 2,603.09
Site Preparation & Maintenance			14,505.71	14,505.71
Equipment Expense			2,623.39	2,623.39
Equipment Maintenance			1,406.42	1,406.42
Roads & Trails		$ 11,413.38	4,995.78	16,409.16
Camp Operations	$ 1,790.11	5,488.91	8,837.92	16,116.94
Telephone & Teletype		203.73	203.95	407.68
Vehicle Expense			3,090.94	3,090.94
Freight			1,560.82	1,560.82
Travel	1,096.98	3,542.08	953.38	5,592.44
Helicopter Expense			4,349.60	4,349.60
Survey Control			64.01	64.01
Surveying-Geological			3,387.77	3,387.77
Surveying-Geophysical			12,160.01	12,160.01
Elemental/Mineralogical Analysis	423.50	3,368.50	1,111.00	4,903.00
Diamond Drilling	16,600.08	118,464.48	93,507.88	228,572.44
Geological Studies			3,975.36	3,975.36
Environmental Studies			1,140.98	1,140.98
Report Preparation			413.40	413.40
Assessment & Rental Payments			(11,592.10)	(11,592.10)
Claims Staking			2,839.00	2,839.00
Legal & Tax Fees			115.14	115.14
Administration	1,906.78	1,873.84		3,780.62
Engineering Services		614.25		614.25
Geology	8,220.90	10,219.04		18,439.94
Geophysics		1,677.44		1,677.44
Property Expense	8,823.10	60.00		8,883.10
Trenching		5,543.50		5,543.50
TOTAL:	$38,861.45	$162,469.15	$152,253.45	$353,584.05

Exploration of the Liard Coal Basin has not identified large tonnages of coal with low strip ratios (10:1). Additional exploration in the area can follow either of two scenarios. One would be to continue work on the hill south of the Alcan Highway where drilling was carried out in 1979. Potential exists in this area for the delineation of coal reserves with low strip ratios. the potential tonnage of recoverable coal, along the coal subcrop, on this hill, is not believed to be large enough to support the requisite power plant. Therefore additional reconnaissance drilling will be necessary to delineate other areas with potential. the second scenario would be to proceed immediately to reconnaissance drilling with the anticipation of encountering elsewhere in the basin sufficient reserves of higher quality coal than are now indicated.

It is recommended that Placer continue reconnaissance drilling in the basin. A program consisting of 53 rotary drill holes distributed mainly in four sections across the basin is proposed for the 1980-1981 field seasons. The proposed drill holes as shown on Figure III are spaced at approximately two kilometre intervals, and the drill sections along which they are to be drilled are spaced at an average of 7.5 to 9.5 kilometres. The holes are to be drilled to a depth of 75 metres. The holes will be logged with a variety of geophysical techniques. Selected coal beds will be sampled with a side wall sampler.

The program will be carried out during the late fall and early spring while the ground is frozen. The drill and ancillary equipment will be mounted on tracked or rubber tired all terrain vehicles in order to reduce road building requirements and facilitate moving between holes.

The project is budgeted for a water based drill fluid system utilizing bentonite clay and a polymer additive because that is the most expensive drill fluid necessary to guarantee success. Costs for this drill fluid are estimated (from previous drilling) to e approximately $1300 per hole. The program proposes an early test of compressed air as a drilling medium. If the test is successful, the savings could be as great as $1200 per hole or $63,600 over the life of the project.

A tentative budget for the exploration program is as follows:

Drilling:	25 hours drill time/hole	$3,575	$189,475
	4 hours stand by/hole	400	21,200
	13 hours moving/hole	1,740	92,220
			$302,895
Mud:	100 bags Quik Gel @ $9/bag	900	47,700
	100 bags Quik Troll @ $4.4/bag	440	23,320
			$71,020
Logging:	logging @ $2.90/ft.		
	Standby @ 0.60/ft.		
	Trip fee @ 0.08/ft.		
	Subsistence for the engineer @ 0.32/ft.	1,000	53,000
			$53,000
Skidder:	Water hauling @ $50/hr.	300	15,900
	Moving @ $50/hr.	100	5,300
			$21,200
Cat:	Road building 55 km @20 hrs/Km @ $65/hour.		71,500
			$71,500
Mobilization			20,000
			$20,000
Compressor Rental @ $6500/month			6,500
			$6,500
Camp Operation			20,000
			$20,000
Salaries			$20,000
			$20,000
			$586,115.00

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Dowling, D.B. (1915) — Coal Fields of B.C. G.S.C. Memoir 69, 1915.

Edwards, K. (1979) — Geophysical Coal Analysis of Four 1979 Liard Basin Drillholes; Personal Communication.

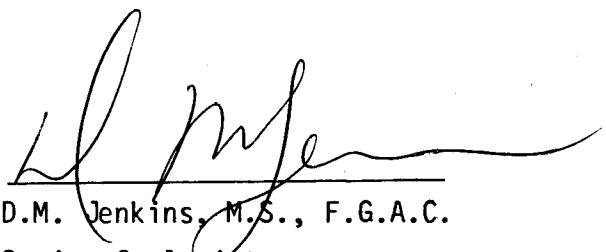
Hopkins, W.S. Jr. (1978) — Polynology Report No. T-11-WSH-1978; Institute of Sedimentary and Petroleum Geology.

STATEMENT OF QUALIFICATIONS

I, D.M. Jenkins, with business address at 700 Burrard Building, Vancouver, B.C., V6E 3A8, do hereby certify that I have supervised the field work and/or have assessed and interpreted the data resulting from this work on coal exploration licenses 66, 67, 68, 69, 113 and 114.

I also certify that: -

1. I am a graduate of the University of South Florida (B.C. Geology, 1963).
2. I am a graduate of the University of Florda (M.S. Geology, 1966).
3. I was a graduate student at the University of Cincinnati from 1966 to 1970.
4. I have engaged in mineral exploration since 1970.
5. I am a fellow of the Geological Association of Canada.



D.M. Jenkins, M.S., F.G.A.C.
Senior Geologist

PROVISIONAL MAP
105 A/6

CANADA

EDITION 1

CARTE PROVISOIRE
105 A/6

1:50,000

Refer to this map as: 105 A E EDITION 1 MCS SERIES A 722

CONVERSION SCALE FOR ELEVATIONS

Feet / Metres

T.N. 0°14' W 4 Mils — 32°21' 575 Mils — Magnetic North

Use diagram only to obtain numerical values.
APPROXIMATE MEAN DECLINATION 1965
FOR CENTRE OF MAP
Annual change decreasing 5.0'

ONE THOUSAND METRE
UNIVERSAL TRANSVERSE MERCATOR GRID
ZONE 9

GRID ZONE DESIGNATION: 9V

100 000 M SQUARE IDENTIFICATION: VT / VS

EXAMPLE OF METHOD USED TO GIVE A REFERENCE TO NEAREST 100 METRES (IN FOLLOWING GRID INTERVAL IS A UNIT) AND MUST BE READ TO RIGHT AND UP

REFERENCE POINT — CHURCH (as shown)

EASTING: Read number on grid line immediately to left of point; Estimate tenths of a square from line to point

NORTHING: Read number on grid line immediately below point; Estimate tenths of a square from line to point

EXAMPLE: MILITARY GRID REFERENCE 375984

Nearest whole grid reference (100,000 metres square) 62 metres

DEPARTMENT OF NATIONAL DEFENCE
ARMY SURVEY ESTABLISHMENT
SECOND EDITION
CANADA, SHEET 105 A/2 WEST HALF
1:50,000
SERIES

Refer to this Map as: 105 A/2 West Half EDITION 2 ASE SERIES A 722

DEPARTMENT OF NATIONAL DEFENCE
ARMY SURVEY ESTABLISHMENT
SECOND EDITION
CANADA, SHEET 105 A/2 EAST HALF
1:50,000

Refer to this Map as: 105 A/2 East Half EDITION 2 ASE SERIES A 722

Surveyed, compiled
Army Survey Establishment
Aerial photography

TO GIVE GRID REFERENCE ON THIS SHEET
(North), EASTING (in SMALLER type) is printed around the top and bottom of the map. These are for locating the full co-ordinates NORTHING (in SMALLER type) is printed at the sides of the MARGIN ON THE FACE OF THE MAP, No. 6 (1)

POINT — BENCH MARK

FOR STANDARD MILITARY GRID REFERENCE

East: Two-figure number of square in which point is situated appears at the top and bottom of the map, and on the two east sides of the map. Thus 81

North: Two-figure number of square in which point is situated appears at the sides of the map, and on the two north sides of the map. Thus 59

Example: MILITARY GRID REFERENCE 817597

To receive 100 Metres

Nearest whole grid reference (100,000 metres square) 62 metres

ONE THOUSAND METRE
UNIVERSAL TRANSVERSE MERCATOR GRID
ZONE 9

REFERENCE

Roads: more than a mile; less than a mile; Hard surface, all weather; Hard surface, all weather (Dual Highway); Loose surface, all weather; Loose surface, fair weather only; Track; Private Road, Trail

Railways: Single; Multiple; Power Transmission Line; Telephone or Telegraph, stock route; Normal gauge, multiple track; Normal gauge, single track; Abandoned, or under construction; Narrow gauge, single track; Bridge, underpass or overpass; Tunnel

Boundary, International; Province; County or District; Township or Parish; City or Town; Reservation, Indian, Military, etc.

Power Transmission Line; Telephone or Telegraph, stock route; Horizontal Control Point; Boundary Marker; Bench Mark; Spot Elevation, (in feet); Mine or Pit

REFERENCE

House, Building; School; Church; with conspicuous Tower or Spire; Post Office; Tower, Radio Mast, Lookout, etc.; Cemetery; Quarry; Sand or Gravel Pit; Cliff; Cutting; Embankment; Saw Mill

Lighthouse; Wharf or Pier; Foreshore Flats; Swamp or Marsh; Lake or Pond, intermittent; Glacier or Snowfield; Stream, intermittent; Irrigation Canals, Ditches; Inundated Land, seasonal; Containers, elevated; depression; approximate; Forest, Heavy, Light

LEGEND

THE CAMPBELL HIGHWAY

LOGGING ROADS

BEDDING (INCLINED, HORIZONTAL)

RC-77-31 SAMPLED COAL SEAM

DRILL HOLE, PROPOSED DRILL HOLE

OUTLINE OF POSSIBLE EXTENSION OF LIARD COAL BASIN REPRESENTING APPROXIMATE CONTACT OF TERTIARY AND OLDER ROCKS AS SHOWN ON GSC MAPS 19-1966 (105A) & 1110A (104P)

OUTLINE OF THE DEEPER PORTIONS OF THE TERTIARY (?) TROUGH CONTAINING COAL (ON THE BASIS OF THE AIRMAG DATA)

V Volcanic Rocks

Scale 1:50,000
1.25 inches to 1 Mile approximately

INDEX TO ADJOINING SHEETS

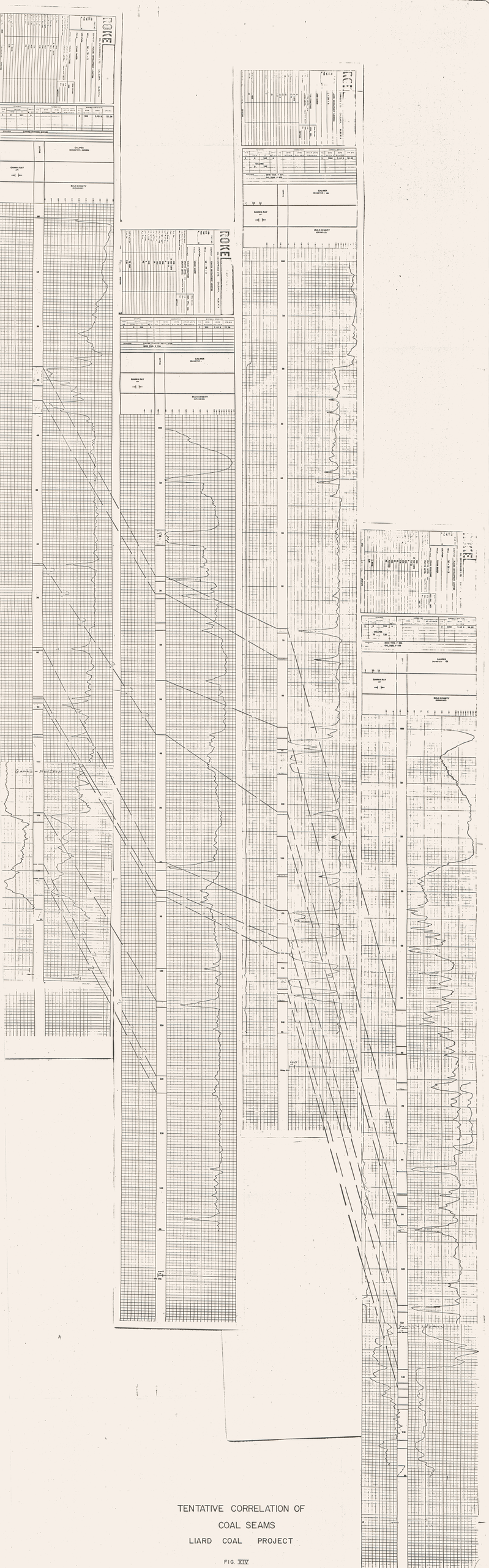
105 A/6 MIDDLE CANYON; 105 A/5 LONGFISH LAKE; 105 A/7 DODD LAKES; 105 A/10 WATSON LAKE; 105 A/11 UPPER HYLAND; 104 P/9 LOWER DEASE RIVER; 104 P/8 LOWER POST

FIGURE III

LIARD COAL GEOLOGY MAP

WATSON LAKE, Y.T.

Revised 16 June, /80



TENTATIVE CORRELATION OF

COAL SEAMS

LIARD COAL PROJECT

FIG. XIV

INSET A
Scale 1:50000

INSET B
Scale 1:50000

INSET C
Scale 1:25000

Area of Inset C

LEGEND

- l Litter sample
- o Microlayer sample
- 100 Sample numbers

LOCATION MAP

0 10 miles

PLACER DEVELOPMENT LTD

LAIRD RIVER AREA, YUKON TERRITORY

MICROLAYER VOLATILE HYDROCARBON AND VOLATILE SULPHUR SURVEY

SAMPLE NUMBERS

August 1979

Dwg. No. 254-1

BARRINGER MAGENTA

INSET A
Scale 1 : 50000

INSET B
Scale 1 : 50000

INSET C
Scale 1 : 25000

Area of Inset C

LOCATION MAP
0 10 miles

LEGEND

PLEISTOCENE AND RECENT
(D) Unconsolidated glacial, fluvioglacial, and alluvial deposits; volcanic ash

TERTIARY
(C) Vesicular olivine basalt

MISSISSIPPIAN
(B) Argillite, slate, tuff(?), chert breccia

CAMBRIAN AND ORDOVICIAN
(A) Dark grey and black, non-calcareous argillite, slate, and phyllite

- l Litter sample
- ○ Microlayer sample
- 1.5 Volatile hydrocarbons in p.p.m.
- 4.6 Volatile sulphur in p.p.m.
- (A) Anomaly
- 1 Traverse number
- 79-6 Diamond Drill Hole

GEOLOGY FROM H. GABRIELSE, 1966, GEOLOGICAL SURVEY OF CANADA, MAY 19, 1966.

BARRINGER MAGENTA

PLACER DEVELOPMENT LTD

LAIRD RIVER AREA, YUKON TERRITORY

MICROLAYER VOLATILE HYDROCARBON AND VOLATILE SULPHUR SURVEY

MICROLAYER SAMPLE ANALYSIS

August 1979

GEOLOGY AND DRILL HOLE LOCATION ADDED BY D.M. JENKINS.

Dwg. No. 254-2

INSET A
Scale 1:50000

INSET B
Scale 1:50000

INSET C
Scale 1:25000

Area of Inset C

LEGEND

- Litter sample
- Microlayer sample
- 1.5 Volatile hydrocarbons in p.p.m.
- 4.6 Volatile sulphur in p.p.m.

LOCATION MAP

0 10 miles

PLACER DEVELOPMENT LTD

LAIRD RIVER AREA, YUKON TERRITORY

MICROLAYER VOLATILE HYDROCARBON AND VOLATILE SULPHUR SURVEY

LITTER SAMPLE ANALYSIS

August 1979

Dwg. No. 254-3

BARRINGER MAGENTA