

Pacific Oil & Gas Pty Limited

BROUGHTON-1

EP 5

McARTHUR BASIN, NORTHERN TERRITORY

WELL COMPLETION REPORT

AUTHOR: J. Torkington
I. McM. Ledlie

DATE: October 1988

SUBMITTED BY: *Ledlie*

ACCEPTED BY: *C. D. T...*

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: CIS, Canberra
: Pacific Oil & Gas Pty Limited, Box Hill

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CRAE REPORT NO. 303621

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Pet NTcw 4040	Locality Diagram	1:1,000,000
Pet NTcw 4037	Time-Depth Curve Broughton-1	
Pet NTcw 912	Magnetic Susceptibility	1:500
Pet NTcw 148	Stratigraphy	
Pet NTcw 4031	Composite Well Log	1:1000

**THE FOLLOWING
ENCLOSURES
WERE NOT SUBMITTED
WITH THIS REPORT,**

- ❖ 2. Gamma, Caliper, S.P. and Dual Resistivity.
- ❖ 3. Gamma, Caliper, Density and Neutron Porosity.
- ❖ 5. Magnetic Susceptibility Log.
- ❖ 6. Composite Well Log.
- ❖ 7. Velocity Survey Report.

THERE WERE
NO PLANS
SUBMITTED
WITH THIS REPORT.



Pacific Oil & Gas Pty Limited

(INC. IN VICTORIA)

20 February 1990

MEMORANDUM

TO: C. Gumley
I. Clementson

FROM: Kevin Lanigan

RE: McARTHUR BASIN WELL LOCATIONS

The following list of well locations is an update of John Torkington's February 1989 memo, revised to include Pacific's first three wells.

WELL	LATITUDE (S)	LONGITUDE (E)	A G M		HEIGHT (AMSL)
			EAST	NORTH	
Alexander-1	15°10'13.6"	134°51'17.5"	484408.00	8322810.0	62.0
Scarborough-1	15°10'59"	134°47'54"	478332.0	8321396	56.0
Supply-1	15°12'41.6"	134°45'59.0"	474910.39	8318254.48	78.0
Lady Penrhyn-1	15°04'45.4"	133°59'33.4"	391731.48	8332652.66	102.90
Broughton-1	14°21'41.0"	133°37'29.5"	351721.05	8411858.15	107.54
Borrowdale-2	15°07'23.5"	133°48'56.5"	372741.99	8327698.31	124.34
Friendship-1	14°52'33"	133°54'36.0"	382750	8355100	59.04
Prince of Wales-1	14°45'38.8"	133°56'40.7"	386409.22	8367861.72	60.41
Lawrence-1	14°58'28.79"	133°55'36.25"	384596.3	8344191.4	60.5
Golden Grove-1	14°50'35.80"	134°21'49.50"	431547.45	8358905.1	80.4
Altree-1	15°55'28.70"	133°47'07.98"	370006.7	8239016.6	212.8
Altree-2	15°55'30.31"	133°47'07.36"	369988.55	8238966.9	212.8

n.b. Alexander-1, Scarborough-1 and Supply-1 locations were interpreted from juxtaposition to shotpoints on the AMCOO 1983 St. Vidgeon Seismic Survey. Lady Penrhyn-1, Broughton-1, Borrowdale-2, Friendship-1 and Prince of Wales-1, were traversed during the Roper Valley seismic survey. Lawrence-1, Golden Grove-1, and Altree-1 & -2, were surveyed using GPS satellite fixing.

All heights are for ground level.

Kevin Lanigan
KEVIN LANIGAN

12 JUN 1990

**BPB SLIMLINE SERVICES**

29 MOONBI STREET BRENDALE QUEENSLAND AUSTRALIA
P.O. BOX 465 STRATHPINE QUEENSLAND 4500
Telephone: (61) 07 881 1969 Facsimile: (61) 07 881 0005 Telex: (71) 42555 (BPB AA)

PD:MC

7th June, 1990.

Pacific Oil & Gas Pty. Limited,
Private Box 509,
BOX HILL Vic 3128.

ATTENTION: Mr. Kevin Lanigan


Dear Kevin,

Recently you requested official confirmation of BHT readings for two of your wells in the N.T.

Following is the information you requested.

Golden Grove 1 BHT 43 deg C at 440 m
Broughton 1 BHT 68 deg C at 1000 m

Yours sincerely,
BPB INSTRUMENTS (AUSTRALIA) PTY. LIMITED


Pat Daley
Operations Manager - Slimline Services

12 JUN 1990



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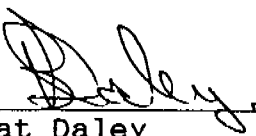
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BPB INSTRUMENTS (AUSTRALIA) PTY. LIMITED



Pat Daley
Operations Manager - Slimline Services

Type Log	Run No	Interval (ft)	Date	No	Interval (ft)	Recovery	No	Interval (ft)	Recovery
Self Potential, Dual Focussed Resistivity	1/2	908m - Surface Casing (86m)	10/09/88						
Gamma Ray, Caliper Density, Neutron Porosity	3/4								
Gamma Ray, Caliper Sonic	3/5								
Self Pot. Dual foc Resistivity	6/7	1000m -	16/09/88						
G/Ray, Cal. Dens. Neutron Por.	8/9	900m							
Gamma Ray, Cal. Son. Chemical Analysis (water, oil, gas)	8/10								

Summary & Conclusions:

Broughton-1 was drilled in the Northern Territory Licence EP5, approximately 90km north east of Mataranka. The hole was drilled to test the hydrocarbon potential of the Lower Roper Group and Base Roper Group unconformity which represented the primary reservoir objective. Sands in the Bessie Creek sandstone (not intersected), the Hodgson Sandstone Member and the Limmen Sandstone were considered secondary targets.

The well was spudded at 0730 hours on August, 18, 1988. A 7 7/8 inch hole was rotary drilled to 10.2m where a 7 inch conductor was set. The hole was then cored with CHD101 to 83.5m and subsequently opened up to 5 5/8 inch with a rotary bit. 5 inch casing was set at 83.5m. Cement was drilled along with a further 6.4m of new formation prior to the running of a formation integrity test. The hole was then drilled with CHD101 to 908.9m where logs were run while waiting on additional drill rods. The hole was then completed to a total depth of 1000m which was reached at 0830 hours on September, 16, 1988. Logs were again run, along with a velocity survey, prior to the well being abandoned.

The well spudded in the Corcoran Formation and intersected the Nathan Group at 563m. The McArthur Group was not penetrated. Minor oil shows were recorded in the Hodgson and Limmen Sandstone. No tests were conducted.

The rig was released at 1130 hours September, 18, 1988.

WELLSITE J. Torkington
GEOLOGIST I. Ledlie

CARD PREPARED
BY: J. Torkington

APPROVED
BY: *I. Ledlie*

DATE:
12/10/88

SECTION 1 - ENGINEERING DATA

1.1 Engineering Summary

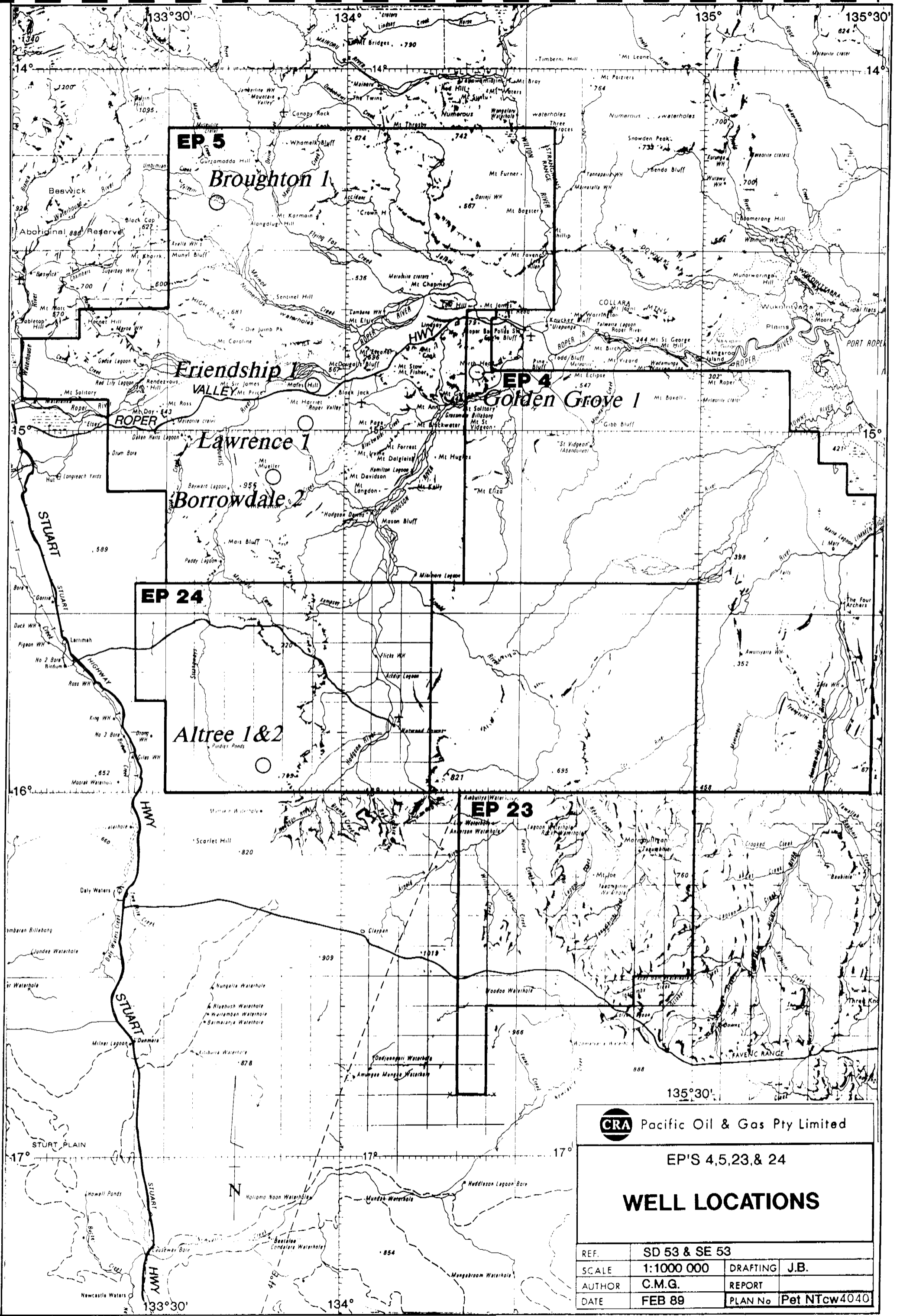
Broughton-1 is located in Northern Territory Exploration Permit 5 (EP 5) approximately 90km to the northeast of Mataranka (Figure 1). The hole was drilled to test the hydrocarbon prospectivity of the lower Roper Group and the uppermost McArthur Group of the Proterozoic McArthur Basin. The hole was drilled by Pacific Oil & Gas Pty Limited as the sole permit holder and operator, using Rockdril Contractors Pty Limited's Rig 18, a modified Mindrill 55 (Longyear 550).

Access to the location was via the Mainoru Road, the Goondooloo Road, existing pastoral roads and a seismic line (Line 88-401) access track. Drill site preparation involved clearing a drilling pad over an area of approximately 50 x 50m. Potable and drill water was obtained from Barmguerikba Creek, approximately 23km from the drill site.

Well site supervision was provided by John Torkington and Ian Ledlie.

Broughton-1 was spudded at 0730 hrs on August 18, 1988 with the rotary drilling of a 7-7/8 inch hole to 10.2 metres. A 7 inch conductor was then set and cemented at 10.2 metres. A CHD101 mm core barrel (103mm reamer shell) was made up and the cement drilled out. The 103mm hole was then fully cored to 83.5 metres and subsequently reamed out to 5 5/8". A five inch casing string was set and cemented at 83.5 metres. Good cement returns were observed at the surface. The blow out preventer system was installed and pressure tested to 1000psi for 15 minutes. A 4 1/4" roller bit was run in the hole and cement and new formation drilled to 89.9 metres at which point a Formation Integrity Test was conducted. The formation was found to still hold pressure at 800psi. The CHD101 core barrel was again made up and the hole continuously cored from 89.9 metres to 908.9 metres, which was reached at 1800 hrs on September 9, 1988. While waiting for the delivery of additional drill rods, the following wireline logs were run from 908.9m to the surface casing shoe; Spontaneous potential, Dual focussed resistivity, Gamma Ray, Density, Neutron Porosity and Sonic.

Coring in 103mm recommenced at 0100hrs on September 14 and reached a total depth of 1000 metres at 0830 hrs on September 16. The hole from 900 metres to total depth was logged, using the above logs, and the rig placed on standby awaiting Velocity Data. The velocity survey was commenced at 0000 hrs on September 18 and was completed by 1000 hrs. Following detailed evaluation of the wireline logs and the shows encountered while drilling, it was decided to plug and abandon the hole with two cement plugs set over the following intervals, 98-68m and 30m-surface. The rig was released at 1130 hrs on September 18, 1988.



CRA Pacific Oil & Gas Pty Limited

EP'S 4,5,23 & 24

WELL LOCATIONS

REF.	SD 53 & SE 53		
SCALE	1:1000 000	DRAFTING	J.B.
AUTHOR	C.M.G.	REPORT	
DATE	FEB 89	PLAN No	Pet NTcw4040

Figure 1

1.2 General Data

Well Name: Broughton-1

Well Type: Exploration

Operator: Pacific Oil & Gas Pty Limited

Licence Holders: Pacific Oil & Gas Pty Limited 100%

Petroleum Title: EP5, Northern Territory

Location: Latitude: 14° 21' 41" ✓
 Longitude: 133° 37' 29.5" ✓
 Flying Fox 1:100,000 Sheet ✓
 AMG GR: 351721.05E 8411858.15N ✓
 Zone 53

Elevation: Ground level 107.54m AMSL
 Drilling Floor 109.04m AMSL

Total Depth: 1000m (bgl) driller
 1000m (bgl) logger

Commencement Date: 0730 hrs August 18, 1988

Total Depth Reached: 0830 hrs September 16, 1988

Rig Released: 1130 hrs September 18, 1988

Drilled by: Rockdril Contractors Pty Ltd

Drilling Rig: Rig 18, Modified Mindrill 55,
 (Longyear 550)

Hole size: 103 mm

Wireline logs: Spontaneous Potential
 Dual Focussed Resistivity
 Gamma Ray, Caliper
 Density
 Neutron Porosity
 Multichannel Sonic
 Run as two suites: 900m - Surface casing
 : 1000m - 900m

Abandonment: Cement plugs over the following intervals
 98 - 68m, 30m - Surface.

1.3 Drilling Rig

ROCKDRIL RIG 18 - RIG AND EQUIPMENT DESCRIPTION

- DRILLING RIG: Longyear-Model 550
(Modified Mindrill 55)
1. Drawworks: Longyear single drum operating 3/4" line up to 4 parts with lockhead disc breaking system.
 2. Power: One Caterpillar type 3304T diesel engine, mechanically driving rotation and drawworks (5 speeds) and hydraulically driving holdback rams, breakout and spinning tools and chuck.

One Perkins 4.354 diesel engine hydraulically driving two (2) triplex pumps and wireline winch assembly.
 3. Mast: Box section angle type mast

Working height above sub structure-50 ft.

Static hook load capacity (4 lines) 85,000 lbs.

Racking Capacity-9,600 ft of CHD 76 drill pipe.
 4. Substructure: Allison low loader with box type drill floor and support racking capacity up to 40 tons.
 5. Rig Machinery: Longyear pipe breakout and spinning tool to handle drill pipe and casing up to 3.7".
 6. Rig Pumps: Two (2) Bean 435 triplex pumps hydraulically driven. Capacity 37 gallons/minute Rating 1200 psi.
 7. Mud Systems: Two (2) steel tanks with a capacity of 40 barrels each operating on a settling basis.

One (1) CD62 mono pump for mixing and desilting.

10.

Two (2) only Honda centrifugal pumps for transfer, recirculating and mixing.

8. Kill mud/cement mixing:

One (1) 40 barrel tank utilizing mono pump and hoppers for mixing kill mud and cement as required. Doubles as a mud mixing tank.

9. B.O.P. Equipment:

One (1) Regan Torus annular type blow out preventor with a 7-1/16 bore and having a working pressure of 3,000 psi.

One A.P.I. threaded wellhead and drilling spool to suite 5" A.P.I. casing.

One (1) twin choke manifold with adjustable Cameron chokes and three (3) outlets rated at 3000 psi and two inch (2") 3000 psi valves.

One (1) Hydril K80 accumulator with a storage capacity of eighty (80) gallons at 1500 psi pressure.

One (1) Oilwell D 323 triplex pump with a rating of 3000 psi for use as a kill pump.

One (1) Guiberson type H wireline B.O.P. and oilsaver rated at 3000 psi with a type C releasing attachment.

One (1) lower kelly cock (2.75") with a rating of 3000 psi.

10. Tubular Equipment:

CHD 101 drill pipe (800 metres) and barrels 4-3/4" Collars and Stabilizers.

11. Utility and Auxilary Equipment:

Two (2) Caterpillar power generating units (output 75 k.v.a.'s each).

One (1) fully equipped workshop container carrying tools and spare parts.

Two (2) Toyota Landcruiser utilities.

1.4 Hole Sizes and Depths

7 7/8" hole to 10.2 metres (All depths are drillers')
 CHD101 core to 83.5 metres, reamed out to 5-5/8 inch
 CHD101 core to 1000 metres

N.B. The CHD101 bottom hole assembly includes a 103mm near bit reaming shell.

1.5 Casing and Cementing

7" Conductor:	Grade: AB7
	Depth: 10.2m
5" Surface Casing:	Weight: 13 ppf
	Depth: 83.5m
	Grade: K55
	Thread: FL4S
	No. of Joints: 8
	Shoe depth: 83.5 metres
	Cement Used: 16 sacks Class "A" cement
	Additives: ½ sack calcium chloride
	Remarks: Cemented to surface

1.6 Drilling Mud

A Newdrill polymer mud system was used throughout the well. Details of drilling fluid properties and mud consumed are given in Appendix 1.

1.7 Water Supply

Both drill water and potable water for use in the camp were obtained from Barmguerikba Creek approximately 23km from the drill site.

1.8 Bit and Deviation Record1.8.1 Drilling Bits

A total of 17 bits were used in the drilling of Broughton-1. Details of bit usage are given in Table 1.

TABLE 1

BIT SUMMARYBROUGHTON 1

#	MAKE/TYPE	SERIAL #	DEPTH IN	DEPTH OUT	WOB (KG)	RPM	PUMP PRESSURE (PSI)
1	Smith, J3		0	10.3	1000	130	150
2	Longyear, 3 step	L27914	10.3	83.5	3000	400	300
3	Varell, Tricone	VIN 2253	10.3	83.5	2000	130	150
4	Smith & Grunner, Tric.	P52967	79	89.8	3000	130	150
RR2	Longyear, 3 step	L27914	89.8	109	3000	450	150
5	Longyear, Impreg. S8	L10342	109	165.2	2000	450	450
6	Longyear, 3 step	L29234	165.	332.8	2500	400	400
7	Longyear, Impreg. S8	L10691	332.	460.3	2500	400	350
8	Longyear, Impreg. S8	L10456	460.	549.8	3000	400	300
9	Longyear, Impreg. S8	L10460	549.8	585.6	3000	400	450
10	Longyear, Impreg. S6	L28182	585.6	612.9	2500	400	300
11	Longyear, Impreg. S2	L103492	612.9	621.3	2500	400	600
12	Longyear, Impreg. S2	L10350	621.3	681.6	2500	400	400
RR6	Longyear, 3 step	L29234	681.6	715.3	2500	400	400
13	Longyear, Impreg. S2	L10450	715.3	776.6	2500	400	500
14	Longyear, 3 step	L29235	776.6	859.2	3000	400	500
15	Longyear, Impreg. S6	L28181	859.2	908.9	3000	400	500
16	Longyear, Impreg. S8	L30129	908.9	968.2	2500	450	550
17	Longyear, Impreg. S8	L10692	968.2	1000.0	1500	450	650

N.B. Bit #3, reamed 101 hole to 5 5/8 inch

1.8.2 Deviation

The Broughton-1 well remained within allowable limits of deviation over its entire length. Deviation survey details are given in Table 2. No surveys were conducted between 823m and TD, owing to the absence of a suitable length wireline. The survey at 823m was missrun owing to the survey disk not containing any film.

TABLE 2

DEVIATION SURVEY RECORDS

BROUGHTON-1

DEPTH (m)	DEVIATION (°)
40	0
83.5	0
180	0
286.4	1
379	1
483	0
585.6	0
697	0
823	Miss Run
1000	1.75

1.9 Fishing Operations

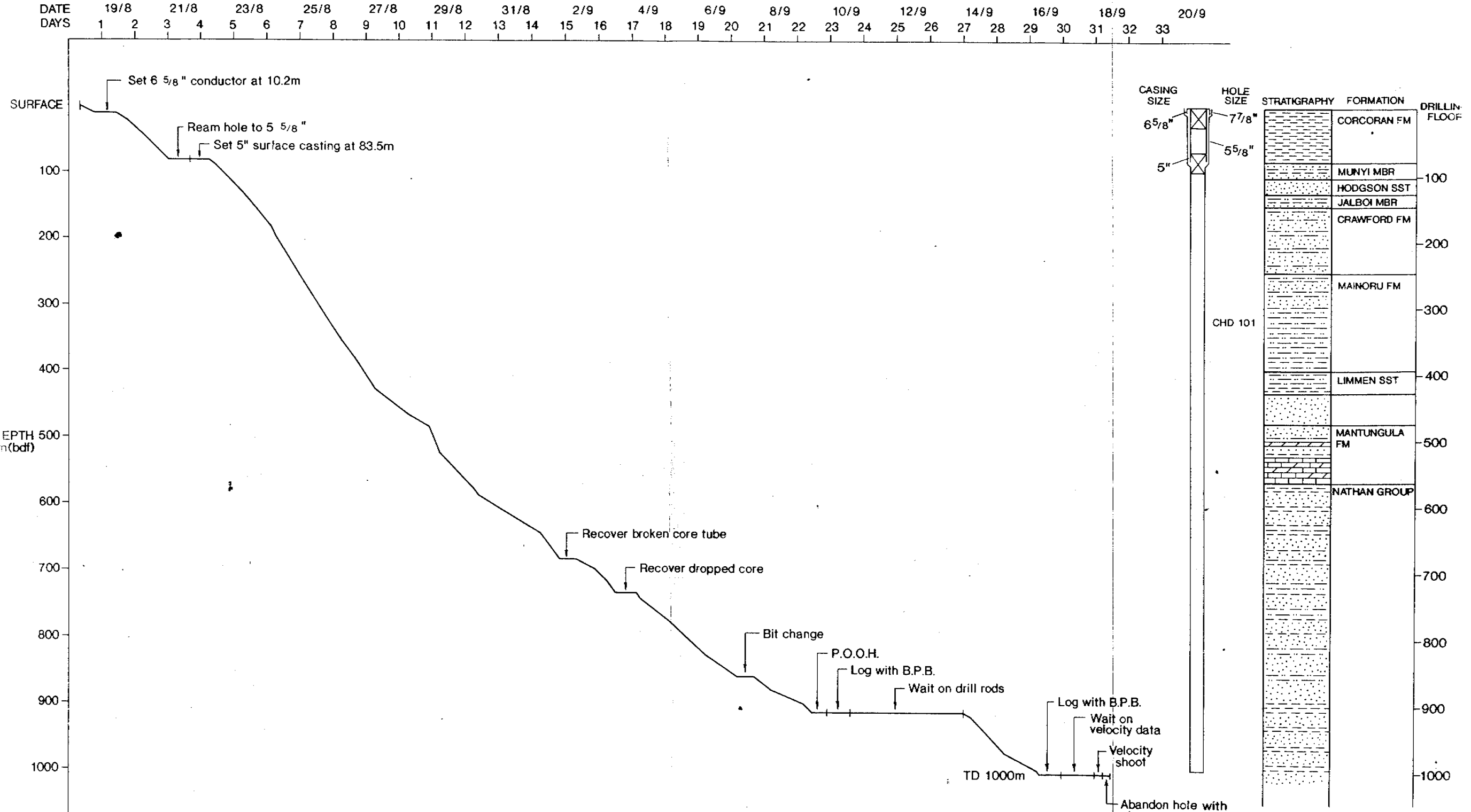
No fishing operations were undertaken.

1.10 Formation Testing

No formation tests were conducted.

1.11 Time Distribution

Time spent on the various phases of the drilling operation are given in Appendix 3, and a time-depth curve for Broughton-1 is illustrated in Figure 2.



Pacific Oil & Gas Pty Limited
BROUGHTON 1 - TIME DEPTH CURVE

Figure 2
11/10/88
J. Torkington

1.12 Well Costs

A detailed cost breakdown for Broughton-1 is given in Table 3.

TABLE 3

WELL COST ANALYSISBROUGHTON-1

ITEM	COST
Drilling General	141407.58
Diamond Drilling	48302.96
Grader/Bulldozing	11921.33
Drilling Materials	5787.55
Drill Stem Testing	0.00
Geophysical Logging	53699.79
Wages & Office Costs	30313.68
Supplies & Communications Gnrl	18799.10
Vehicle Operation General	1877.18
Travel & Accommodation General	2746.42
Hire of Camp Accom. Facilities	1907.41
Depreciation	0.00
Insurances	0.00
Contractors/Consultants Gen.	12223.30
Aircraft Hire	0.00
Geological Consultants	0.00
Laboratory Analysis General	4664.87
Mineralogical Determinations	3275.77
TOTAL	336926.95

SECTION 2 - GEOLOGICAL DATA

2.1 Geological Summary

Broughton-1 was spudded in the Corcoran Formation of the Proterozoic lower Roper Group of the McArthur Basin. The hole was fully cored from 10.2 metres to a total depth of 1000 metres, using a CHD101 coring assembly. Cutting samples were collected at 2 metre intervals from the surface to 10 metres.

The Broughton-1 well encountered a typical lower Roper Group section, approximately 115 metres high to prognosis. Below the Roper Group the well encountered clastic sediments of the Nathan Group which persisted to total depth. Carbonate sediments of the McArthur Group, which represented the primary target in the well, were not penetrated.

The well spudded in claystones of the Corcoran Formation and intersected the Munyi Member of the Abner Sandstone at 82 metres. The Hodgson Sandstone Member was intersected at 105m and exhibited poor to fair shows over the interval 107.8 - 110.25 metres. The oil shows comprised patchy 20% bright yellow fluorescence with an instant blue white crush cut. Similar shows were also noted from several subvertical fractures between 110.5 and 112.7 metres. The sandstone lacked visible porosity. Similar shows were also noted from 128.0 - 128.3 metres at the base of the Hodgson Sandstone.

The Jalboi Member of the Abner Sandstone was intersected at 129 metres, followed by interbedded siltstones and sandstones and minor mudstones of the Crawford Formation at 148 metres. The Mainoru Formation, comprising siltstones, sandstone and mudstone, was intersected at 249 metres and persisted until 397 metres, where the well intersected massive reddish brown claystones of the Wooden Duck Member of the Mainoru Formation.

Sands of the Limmen sandstone were intersected at 439 metres and were found to contain good oil shows between 450.18 and 452.73 metres. Shows consisted of bands of 80% yellow fluorescence with a slow yellow white cut but no ring residue. A minor increase in total gas readings was observed along with occasional live oil on the surface of the core. Microscopic examination of the core revealed little visible porosity and hence no further tests were conducted.

Calcareous and dolomitic sandstones and claystones of the Mantungula Formation were intersected at 478 metres and persisted until 563 metres where claystones, siltstones and sandstones of the Nathan Group were encountered. Broughton-1 remained within the Nathan Group clastics to the well's total depth of 1000m. Table 4 lists actual versus prognosed formation tops for Broughton-1.

TABLE 4

ACTUAL VERSUS PROGNOSED FORMATION TOPSBROUGHTON-1

AGE	FORMATION	FORMATION		
		ACTUAL DEPTH (M)	PROGNOSED DEPTH (M)	DIFF. (M)
Proterozoic	Velkerri Formation		Surface	
	Bessie Creek Sst		15	
	Corcoran Formation	Surface	40	
	Abner Sst			
	- Munyi Mbr	82	205	123 high
	- Hodgson Sst	105	227	122 high
	- Jalboi Mbr	129	249	120 high
	Crawford Formation	148	266	118 high
	Mainoru Formation	249	359	110 high
	Limmen Sandstone	439	544	105 high
	Matungula Formation	478	589	111 high
	Nathan Group	563	Not Present	
McArthur Group	Not Inter.	661		

Wireline log evaluation failed to indicate porous and permeable zones associated with the oil shows previously noted, or any additional anomolous zones that could warrant further testing.

2.2 Well Objectives & Performance

The Broughton-1 well was drilled to test the hydrocarbon potential of the lower Roper Group and the upper McArthur Group of the west central McArthur Basin at the structural culmination of a large faulted dome. In addition, the well was to provide valuable subsurface data on the stratigraphy of the lower Roper and upper McArthur Group.

The well's failure to intersect the upper McArthur Group and more particularly the top McArthur Group unconformity which was seen as the primary objective, was disappointing. Nevertheless the stratigraphic information gained from Broughton-1 was of great value.

In particular the intersection of the Nathan Group, which was thought to have a far more restricted distribution, has led to a revised seismic interpretation and greater understanding of the basin's depositional framework. In addition the hydrocarbon shows observed in the Hodgson and Limmen Sandstones, which were previously thought to be unprospective, indicate that these formations should not be overlooked as potential hydrocarbon-bearing reservoirs.

2.3 Stratigraphy

The stratigraphic nomenclature used in the following discussion is that used by Pacific Oil & Gas. For a detailed lithological description, reference is made to the Core Log in Appendix 4.

PROTEROZOIC

ROPER GROUP

Corcoran Formation

Surface to 82 metres (thickness: 82 metres)

Silty mudstone grading to interbedded siltstones and siltstones grading to very fine sandstones at base of unit. Mudstones are greyish olive green but occasionally grade to dark grey to greyish black. Sandstones are light greenish grey, very fine grained and exhibit poorly developed fining upward cycles. Interbeds along with occasional cross bedding and basal scours are evident at base of coarser interbeds. No visible porosity in the coarser units.

Abner Sandstone - Munyi Member

82-105 metres (thickness: 23 metres)

Grades from a siltstone with interbeds of sandstone at top of unit to a sandstone with siltstone and minor claystone interbeds at base. Siltstones are similar to those of the Corcoran Formation while the sandstones range from a medium grained bluish grey to a very fine grained pinkish grey. Interbeds are occasionally slumped and minor sulphide mineralisation is present, associated with the finer grained units.

Abner Sandstone - Hodgson Sandstone Member

105-129 metres (thickness: 24 metres)

Massive sandstone, very light grey to light grey, fine grained becoming coarse towards the base. Occasional interbedded and slumped siltstone similar to that of above units. Sands are strongly cemented with quartz overgrowths.

In particular the intersection of the Nathan Group, which was thought to have a far more restricted distribution, has led to a revised seismic interpretation and greater understanding of the basin's depositional framework. In addition the hydrocarbon shows observed in the Hodgson and Limmen Sandstones, which were previously thought to be unprospective, indicate that these formations should not be overlooked as potential hydrocarbon-bearing reservoirs.

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ROPER GROUP

Corcoran Formation

Surface to 82 metres (thickness: 82 metres)

Silty mudstone grading to interbedded siltstones and siltstones grading to very fine sandstones at base of unit. Mudstones are greyish olive green but occasionally grade to dark grey to greyish black. Sandstones are light greenish grey, very fine grained and exhibit poorly developed fining upward cycles. Interbeds along with occasional cross bedding and basal scours are evident at base of coarser interbeds. No visible porosity in the coarser units.

Abner Sandstone - Munyi Member

82-105 metres (thickness: 23 metres)

Grades from a siltstone with interbeds of sandstone at top of unit to a sandstone with siltstone and minor claystone interbeds at base. Siltstones are similar to those of the Corcoran Formation while the sandstones range from a medium grained bluish grey to a very fine grained pinkish grey. Interbeds are occasionally slumped and minor sulphide mineralisation is present, associated with the finer grained units.

Abner Sandstone - Hodgson Sandstone Member

105-129 metres (thickness: 24 metres)

Massive sandstone, very light grey to light grey, fine grained becoming coarse towards the base. Occasional interbedded and slumped siltstone similar to that of above units. Sands are strongly cemented with quartz overgrowths.

Oil bleeds in core were noted over the gross interval 107.8-110.25 metres, in fractures from 110.5 to 110.85 metres and 112.5 to 112.7 metres and over the interval 128.0 to 128.3 metres. 20% bright yellow to blue white fluorescence with a streaming yellow white cut with weak ring residue was associated with oil bleeds. No porosity. Basal 0.5 metre grades into underlying Jalboi Member.

Abner Sandstone - Jalboi Member

129-148 metres (thickness: 19 metres)

Sandstone with interbeds of claystone and minor siltstone. Sandstones are very light grey to light grey, very fine to fine grained, massive, but boundaries with claystone are slumped and contorted. Claystones are dark grey to black, finely laminated often occurring as collections of thin wisps. Siltstones are similar to above units but occur as small slumped inclusions within sandstone.

Crawford Formation

148-249 metres (thickness: 101 metres)

Interbedded siltstone, sandstone and claystone, range from thinly laminated to interbeds up to 10cm thick. Fining upward cycles and basal scouring of interbeds are commonly evident. Sandstones are very light grey to light greenish grey, very fine grained, becoming more fine grained towards the base. Abundant quartz overgrowths, minor calcite cement, no porosity. Siltstones are medium grey to dark grey grading to very fine sandstone in parts. Mudstones are very dark grey to black and seldom occur in beds thicker than 0.5cm.

Mainoru Formation

249-439 metres (thickness: 190 metres)

Interbedded siltstones and calcareous siltstones with sandstones at the top of the unit and claystones at the base. Interbeds range from several cm's up to 20-30cm with common dewatering structures evident between beds. Siltstones are greyish green to dusky green, grading to white to light greenish grey where calcareous. Sandstones are very light grey to light grey, very fine grained, occasionally calcareous and commonly exhibit a fining upward nature. Claystones are dark reddish brown and become massive over lower several metres of unit.

STRATIGRAPHY – ROPER GROUP


CHAMBERS RIVER FORMATION		COBANBIRINI FORMATION
McMINN FORMATION	KYALLA MEMBER  SHERWIN IRONSTONE MOROAK SANDSTONE MEMBER	
VELKERRI FORMATION		
LANSEN CREEK SHALE		
BESSIE CREEK SANDSTONE		
CORCORAN FORMATION		
ABNER SANDSTONE	HODGSON/MUNYI SANDSTONE MBR.	
	JALBOI MEMBER	
	ARNOLD SANDSTONE MEMBER	
CRAWFORD FORMATION		
MAINORU FORMATION		
LIMMEN SANDSTONE		

Figure 3



Limmen Sandstone439-478 metres (thickness: 39 metres)

Sandstone, light grey to medium light grey, very fine grained to medium grained, occasional thin light olive grey siltstones and claystones, in upper several metres abundant quartz overgrowths. No visible porosity. Good oil shows over the gross interval 450.18 - 452.73 metres and in fractures between 458.45 and 458.65 metres. Numerous oil bleeds on surface of core. Minor increase in the total gas readings, 80% yellow fluorescence with slow yellow white cut but no ring residue from areas where oil bleeds noted.

Mantungula Formation478 - 563 metres (thickness: 85 metres)

Dolomitic mudstones, siltstones, sandstones and limestones. Grades from laminated in finer units to almost massive in sandstones and limestones. Proportions of individual rock types are highly variable but more carbonaceous towards base. Mudstones are dark grey to greyish black, siltstones very light grey and sandstones greyish orange pink to moderate orange pink. The sands are fine grained with occasional minor amounts of glauconite. Limestones are light grey to medium light grey, occasionally medium dark grey, micritic with possible algal mounding structures. Generally no visible porosity except for a number of small vughs, less than 5mm in diameter, evident from 525 - 530 metres. Vughs are lined with very small calcite crystals and do not appear interconnected. A number of small oil bleeds are associated with vughs between 526.15 and 526.35 metres. Yellow white fluorescence, slow yellow crush cut, no ring residue. No increase in gas readings.

NATHAN GROUP563 - TD (Thickness: 437 metres plus)

Interbedded claystone and sandstone in varying amounts. Interbeds range from several cm up to several 10's of cm, with bed boundaries varying from planar to slumped. Sandstones are greyish pink to pale red, fine to occasionally medium grained and contain abundant red brown clay matrix and common claystone clasts. Claystones are pale green and moderate reddish brown. The pale green claystones appear to be an alteration product of the red brown claystone.

2.4. Mud Logging

Mud logging services were provided by Gearhart Geodata Pty. Ltd. Rate of penetration, total gas detection, fluorescence and H₂S detection services were provided, as well as lag monitoring and the preparation of a continuous mud log at a scale of 1:100. A copy of the mud log is enclosed with this report as Enclosure 1. In addition, the mud logging personnel assisted Pacific Oil & Gas personnel in the handling, marking and description of core.

2.5 Electrical Logging & Other Services

The following log suites were run by BPB Instruments (Australia) Pty. Ltd.

TABLE 5

ELECTRIC LOGS

BROUGHTON-1

LOG	RUN	INTERVAL (M)	DATE
Spontaneous Potential	1	908m - 82m	10/9/88
Dual Focussed Resistivity	2	"	"
Gamma Ray, Density	3	908-82, GR to Surface	"
Caliper, Neutron Porosity	4	908m - 82m	"
Dual Spaced, Sonic	5	"	"
Spontaneous Potential	6	1000m - 900m	17/9/88
Dual Focussed Resistivity	7	"	"
Gamma Ray, Density	8	"	"
Caliper, Neutron Porosity	9	"	"
Dual Spaced Sonic	10	"	"

Copies of Well Logs are included in this report as Enclosure Nos. 2-4.

A velocity survey was conducted by Velocity Data Pty. Ltd. A total of 24 check shots were recorded from 1000m to surface. A processing report by Velseis Pty. Ltd., is included in this report as Enclosure 7.

2.6 Formation Sampling

2.6.1 Ditch Cuttings

Ditch cuttings were collected at two metre intervals from the surface to the 7 inch casing depth at 10.0 metres. A washed sample was described and a portion submitted to the Department of Mines & Energy.

2.6.2 Conventional Core

The Broughton-1 well was fully cored from 10m to its total depth of 1000m. (Excluding the interval 83.5 - 89.9 metres, which was drilled with a 4½" rotary bit to enable the Formation Integrity Test to be conducted). The core was logged and chip samples taken at 2 metre intervals for microscopic examination. A detailed description of the core is included as Appendix 4. The core from Broughton-1 is stored at CRA Exploration Pty. Ltd., Darwin Office.

2.7 Hydrocarbon Shows

The following hydrocarbon Shows were observed in Broughton-1.

Abner Sandstone - Munyi Member

Residual bitumen staining on vertical fracture at 93.8m. Dull yellow fluorescence. No gas increase, no odour.

Abner Sandstone - Hodgson Sandstone Member

Oil bleeds on core over 107.8 - 107.9m, 108.9m, 109.8 - 110m, 110.15 - 110.25m, 128.0 - 128.3m and in fractures between 110.5 - 110.85m and 112.5 - 112.7m. 20% bright yellow to blue white fluorescence with a streaming yellow crush cut and weak ring residue. No gas increase, no porosity, no odour.

Limmen Sandstone

Oil bleeds on core over following intervals. 450.18 - 450.195m, 450.205 - 450.225m, 450.4 - 450.45m, 450.51 - 450.54m, 450.59 - 450.61m, 450.62 - 450.65m, 451.14 - 451.3m, 451.8 - 452.1m (patchy), 452.1 - 452.5m, 452.5 - 452.67m (patchy), 452.67 - 452.73m, and in fractures 458.45 - 458.65m. 1 unit of total gas (Background 0 units), 80% mottled yellow fluorescence with slow yellow white cut. No ring residue, minor petroliferous odour, no porosity.

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Mantungula Formation

Several small vughs between 526.15 and 526.35m contain live oil yellow fluorescence, slow yellow-white crush cut, no residue. No Gas. Vughs are only several mm across and lined with calcite. No interconnection between vughs.

2.8 Magnetic Susceptibility

Magnetic susceptibility measurements were made at 1 metre intervals along the length of core from Broughton-1. A magnetic susceptibility log is included as Enclosure 5.

2.9 Contributions to Geological Knowledge

The fully cored lower Roper and top Nathan Groups intersected in Broughton-1 will add greatly to understanding the stratigraphy and geological history of the McArthur Basin. The occurrence of Nathan Group as opposed to the prognosed McArthur Group, while disappointing given the well's objectives, has yielded valuable information and assisted in developing an accurate seismic interpretation over this part of the McArthur Basin.

The highly silicified nature of the reservoir units encountered in Broughton-1 gives cause for some concern, however, the presence of shows in both the Hodgson and Limmen Sandstones suggests that these units are perhaps more prospective than previously thought.

Keywords

Drill Stratigraphic; Well Logs; Geophysics Borehole; Hydrocarbon Potential; Proterozoic.

Location

Flying Fox 1:100,000 Sheet 5669; EP5; Broughton 1; McArthur Basin; Northern Territory.

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