PACIFIC OIL & GAS PTY LIMITED

MACINTYRE NO. 1

EP 10, NORTHERN TERRITORY

WELL COMPLETION REPORT

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DATE: June, 1990

SUBMITTED BY:

ACCEPTED BY:

COPIES TO: N.T. Mines Department
CIS Canberra
Pacific Oil & Gas Pty Limited, Alice Springs
Pacific Oil & Gas Pty Limited, Melbourne

CRAE Report No. 303848

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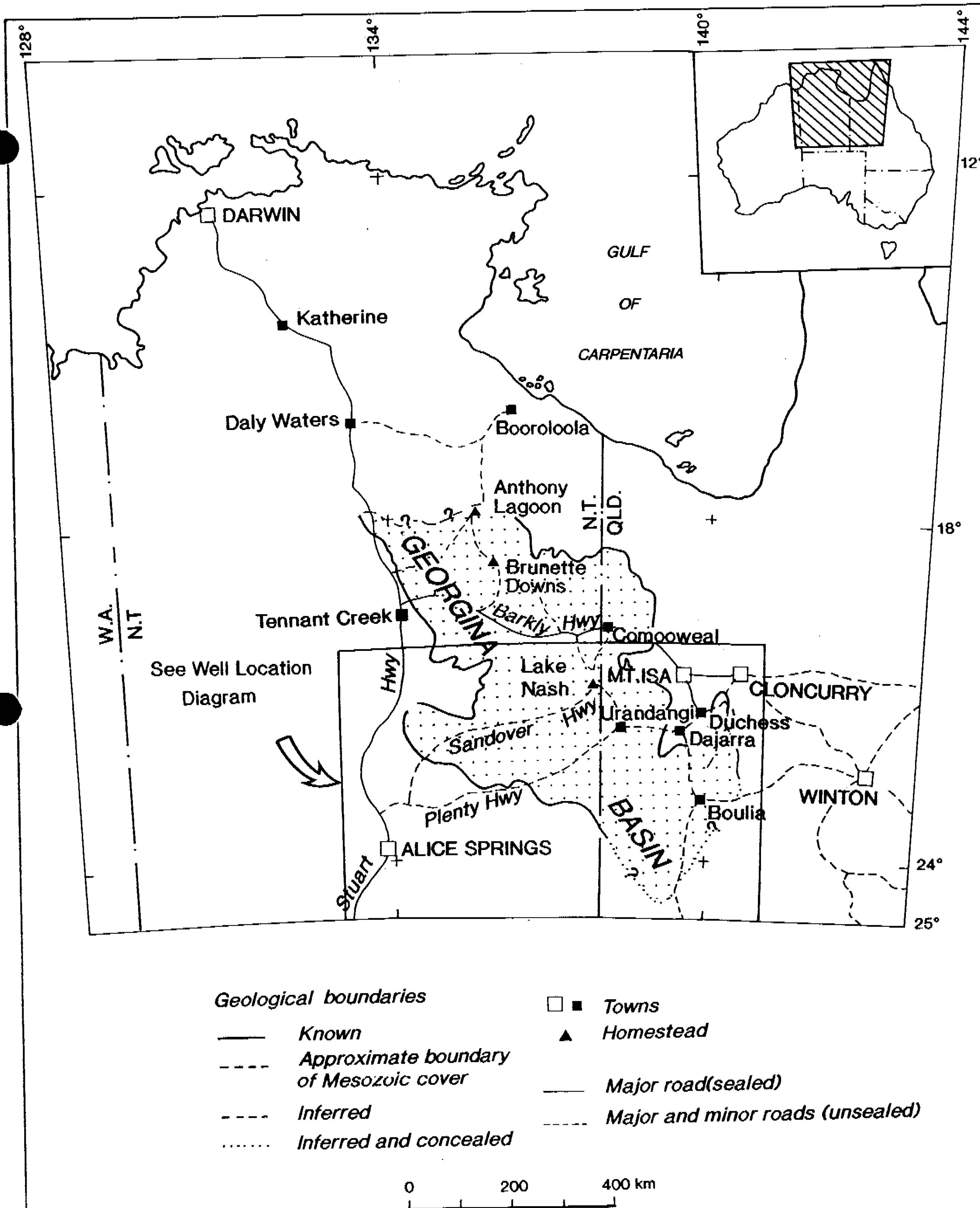
1. SUMMARY AND INTRODUCTION

MacIntyre No. 1 was the first of two exploration wells drilled by Pacific Oil and Gas Pty. Limited during the company's 1989 Georgina Basin Drilling Programme. The purpose of the well was to test a closed structure defined by the 1988 Bundey River seismic survey and 1989 Bundey infill seismic. The structure has 20ms (approximately 50m) of closure and an areal extent of 15.5km² at the "gold horizon" (near top Arthur Creek level). The well was designed to determine the thickness, quality and fluid content of reservoir rock facies. It would also provide good lithologic and geophysical control in the area between P.O.G. Phillip No.2, P.O.G. Baldwin No.1 and BMR 13 Sandover. Potential reservoirs within Early Cambrian Red Heart Dolomite (Errarra Formation) and Andagera Formation formed the primary objectives of the well. MacIntyre No.1 would also help to determine the thickness, quality and maturation level of source rocks and the presence of any reservoir facies horizons (shoals) within the Arthur Creek Formation.

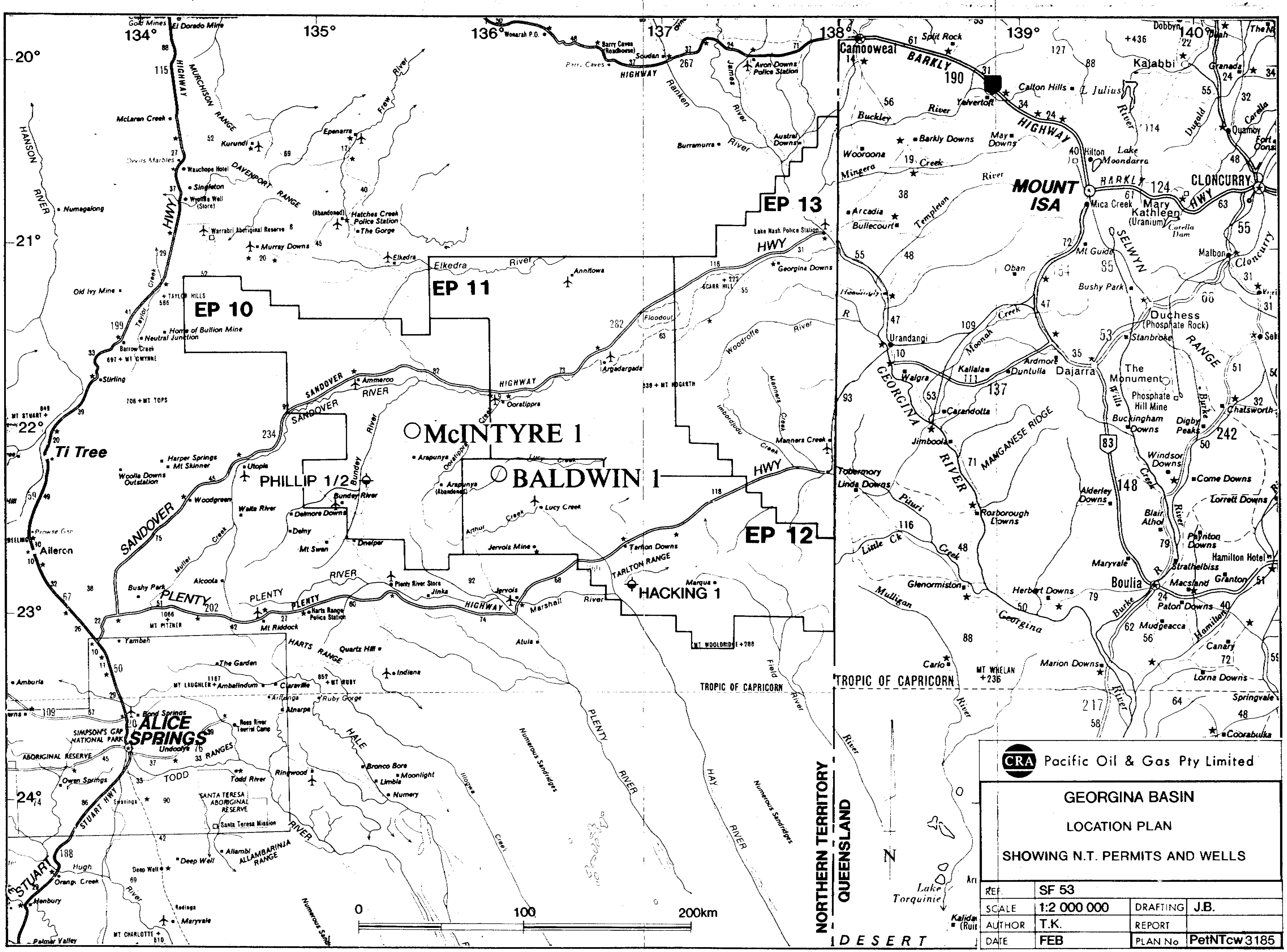
The well is located approximately 248km NE of Alice Springs, Northern Territory, and approximately 23km east of the Derry Downs homestead, in EP10NT (Plans PETNTcw589 and 3185). A precollar for the hole was drilled by Gorey and Cole Drillers' Rig No. 5 on the 8th of November, 1989. Rockdril Rig 20 re-entered the precollar at 1500 hrs on 7th December, 1989. Drilling stopped at 0302 hrs on December 30th, 1989, at a total depth of 959.95m (Driller), after penetrating 108.5m of Late Proterozoic (Adelaidean) Mopunga Group sediments. The well was hammer drilled with air to a depth of 373.6m using two hammer bits and then rotary drilled to 5" casing shoe depth (549m) with one tri-cone bit. The remainder of the hole was continuously cored to total depth using two core bits (Appendix X). A total of 411m of core was cut and recovered (100% recovery). Wireline logging runs were performed at intermediate casing depth and total depth. A checkshot survey and vertical seismic profile were also obtained from the well at total depth.

MacIntyre No. 1 achieved its proposed objectives without any serious technical problems. The well was spudded in thin Tertiary red-brown sandy soil and intersected a sedimentary sequence comprising the Late Cambrian - Early Ordovician Tomahawk Beds, Mid to Late Cambrian Arrinthrunga Formation and Middle Cambrian Chabalowe and Arthur Creek Formations, before reaching Adelaidean Mopunga Group sediments at 852.6m. The Mopunga Group has been tentatively subdivided in the well into the Elkera Formation (Top 852.6m), Grant Bluff Formation (Top 896m) and ?Elyuah Formation (Top 948.5m). The well stopped drilling 40m short of it's anticipated total depth (1000m) due to the lack of any hydrocarbon indications in the Adelaidean section and because of slow ROP. The tops of all formations penetrated (apart from the Eurowie Sandstone Member, 24m H) were between 20 - 34m low to prognosis. Porosity development throughout the Cambrian section was very patchy with the best porosities and permeabilities occurring in a shoaly interval in the upper part of the Arthur Creek Formation. This zone, between 630 and 645m, had fair to excellent visible fenestral vug porosity in part and a maximum measured permeability of 1141 md (Appendix II). This zone was not evaluated by drill stem



GEORGINA BASIN
Location and access roads

Pacific Oil & Gas Plan No. PetNTcw 589


CRA Pacific Oil & Gas Pty Limited
GEORGINA BASIN
LOCATION PLAN
SHOWING N.T. PERMITS AND WELLS
REF. SF 53
SCALE 1:2 000 000
DRAFTING J.B.
AUTHOR T.K.
REPORT
DATE FEB
PLAN No PetNTcw3185
EP 10
EP 11
EP 12
EP 13
McINTYRE 1
BALDWIN 1
PHILLIP 1/2
HACKING 1
ALICE SPRINGS
MOUNT ISA
CLONCURRY
Ti Tree
Aileron
Camooweal
Boulia
Urandangi
Dajarra
Duchess
NORTHERN TERRITORY
QUEENSLAND
TROPIC OF CAPRICORN
SANDOVER HIGHWAY
PLENTY HIGHWAY
BARKLY HIGHWAY
STUART HWY
GEORGINA RIVER
PLENTY RIVER
HAY RIVER
DESERT
0
100
200km
N
134°
135°
136°
137°
138°
139°
140°
20°
21°
22°
23°
24°

testing, however it probably would have flowed under test.

The well has proven that the Chabalowe Formation extends in the subsurface between Phillip No.2 and BMR 13 Sandover, and that the early Cambrian sequences (Errarra Formation, Andegera Formation) have pinched out in a westerly direction between Baldwin No.1 and MacIntyre No.1, somewhere to the east of the MacIntyre location.

Rare bitumen (dead oil) staining was observed in cuttings samples from the Upper Arrinthrunga Formation and several trace oil shows were encountered in the basal parts of the Arrinthrunga Formation and Chabalowe Formation. Poor to fair oil shows were observed scattered through the aerobic facies of the Arthur Creek Formation, however fluorescence, oil bleeds and staining were often associated with low permeability lithologies, were generally discontinuous and nowhere more than a few centimetres in thickness. Minor oil staining and fluorescence were also noted in the basal shoal facies of the Arthur Creek Formation and these shows were evaluated by drill stem testing. DST Nos. 1 and 2 were run over the interval 801.13m - 821.05m. Both tests recovered mud and water. Initial Formation Pressure was evaluated at about 1058.5 psig and flow capacity at 13.35md-ft (Appendix III).

The Arthur Creek Formation source rocks (anaerobic facies) were found to have maturities ranging from mature to overmature for the generation of oil.

MacIntyre No.1 was plugged and abandoned in compliance with Northern Territory Government regulations from the 31st December, 1989 to the 1st January, 1990. Four abandonment plugs were set at the following depths: 836 - 786.5m, 579 - 483m, 280 - 48m, 48 - 2.5m (surface). Rockdril Rig 20 was released at 2230 hrs on 1st January 1990.

2. WELL HISTORY

2.1 General Data

Well Name:	MacIntyre No. 1
CRAE Number:	RD/DD 89 GB 11
Well Type:	Wildcat
Interest Holders:	Pacific Oil & Gas Pty Ltd - 100%
Permit:	EP 10 (Ammaroo), Northern Territory
Operator:	Pacific Oil & Gas Pty Ltd., 826 Whitehorse Road, Box Hill, Victoria, 3128
Map References:	Huckitta (SF53-11) 1:250,000 sheet Arapunga (6053) 1:100,000 sheet
Seismic Line:	89-104, Shot Point 930
Surveyed Location: (AGD 66)	Latitude: 22° 02' 19.84" S Longitude: 135° 32' 06.22" E
AMG Co-ordinates: (AMG66, Zone 53)	555 215m East 7 562 768m North
Surveyed Elevation: (AHD)	Ground Level: 379.0m Drill Floor: 381.5m
Total Depth:	Driller: 959.95m Logger: 960.80m
Primary Objectives:	Red Heart Dolomite Andagera Formation
Secondary Objectives:	Arthur Creek Formation (Possible shoals) Arthur Creek Formation (Source Rock).
Status:	Plugged and Abandoned
Well Cost:	A$461,177

2.2 Drilling Data

Precollar Drilling Date:	8th November 1989
Date drilling commenced: (Main hole)	8th December 1989
Date drilling completed:	30th December 1989

Date Well Abandoned:	31st December 1989 - 1st January 1990
Date Rig Released:	1st January 1990 at 2230 hrs
Drilling time to T.D.:	23 days
Total Rig days: (incl. precollar)	24 days
Contractors:	Precollar: Gorey and Cole Drillers 1 Brown Street Alice Springs N.T. 0870
	Main Hole: Rockdril Contractors P/L 1 Jijaws Street Sumner Park Qld 4074
Drilling Rigs:	Precollar: Gorey and Cole Rig No. 5 Main Hole: Rockdril Rig 20
Rig Details:	Precollar: Modified Ingersoll-Rand TH60 Main Hole: Longyear 600 "Coremaster"
	Complete specifications for Rockdril Rig 20 can be found in Appendix XII, "Rig Specifications".

2.3 Drilling Summary

2.3.1 Precollar Hole

Drilling of the precollar hole section commenced at 1238 hrs on the 8th November 1989, using Gorey and Cole Drillers' Rig No. 5. An 8" pilot hole was hammer drilled to 24.12m (GL) after which the hammer was pulled out and layed down. A 12¼" hammer bit was picked up and the hole reamed to a depth of 6m where a 1m length of 14" steel conductor was temporarily installed at surface. The remainder of the pilot hole was then widened down to total depth before pulling out of hole to run the 10" conductor pipe. Three joints of 10" steel conductor were run and landed at 18.3m(GL) and Gorey and Cole Rig No.5 was released to the Baldwin location at 0830 hours on the 9th November 1989. Rig No.5 returned to the MacIntyre location on the 11th November and cemented the 10" conductor in place using 20sxs of class "A" neat cement mixed with borewater (total slurry volume was 4.6bbls).

Site preparation commenced on the 7th November and was completed by the 17th November, 1989. Access to the drilling location was improved by the grading and watering of 19.2km of pastoral tracks from the Arapunya - Derry Downs boundary gate to seismic line 89-104. An area of approx. 60 x 100m was cleared for the drilling rig and camp. A turkeys nest dam (18 x 18 x 3m) was constructed adjacent to the previously drilled water bore (RD89GB10). Final preparations included the excavation of a cellar for the rig, as well as a sump and flare pit.

2.3.2 Main Hole

A complete drilling record for the main hole section of MacIntyre No. 1 is given in Appendix X, including an "Actual Time-Depth Curve", "Drilling Parameters Plot" and "Mud Parameters Plot" (Appendix X, Plans PETNTcw3149, 3151 and 3150 respectively). The following summary is based on information extracted from daily IADC Drilling Reports and Wellsite geologist's Morning Reports.

2.3.2.1 8½" Hole section

Rockdril Rig No. 20 arrived at the MacIntyre well location on 2nd December 1989, however heavy rains and a crane breakdown delayed rigging up operations for several days and the drilling rig was not fully operational until the 7th of December. Trucks were unloaded commencing on the 4th and the rig was positioned over the previously drilled precollared hole on the 5th of December.

Bit No. 1, a flat-face hammer was made up on a drill collar and R.I.H. at 1500 hours on December 7th, wet cement was tagged at 18m. An attempt was made to activate the hammer, however the wet cement sludge prevented it from operating. The hammer was pulled out of hole and the mud tanks were installed and rigged up to allow water injection. The hammer bit was then run back to bottom, however it failed to activate once again. It was pulled out of hole, stripped down and repaired and then rerun. The cement plug was hammered out and the hole drilled ahead using air to 68.2m where the string became stuck on connection. Water was injected into the hole and the hole was reamed before drilling ahead to 99.5m where returns were lost. Circulation was re-established after stiff foam was pumped around. Drilling then continued to 7" casing depth of 127.5m

After circulating and conditioning the hole, a wiper trip was made and the hammer bit was pulled out and layed down.

Ten joints of 7", 29ppf, N-80, 8-round casing were run and landed at 125.25m. A 45bbl spacer of fresh water was pumped with no returns to surface. The casing was then cemented with a 12 bbl slurry of 15.6ppg neat class "A" cement (25% excess). The plug was bumped with 1000psi - no cement returns were seen at surface. After waiting on cement for 7.75 hours, the BOP's were nippled up and successfully tested. The 10"/7" casing/casing annulus was cemented from surface while WOC.

2.3.2.2 6" Hole Section

R.I.H. with bit no. 2 and tagged cement at 124m. Drilled out the top and bottom plugs and pulled out of hole. The roller bit was layed down and a 6.1" hammer bit picked up, function tested and RIH. Hammer drilled cement, shoe and new formation to 133.6m. Water was circulated into the hole and a leak-off test performed (8.3 ppg mud, 200 psi applied surface pressure, leak-off at 17.7ppg equivalent mud weight). The hammer was not functioning after the leak-off test and was pulled out of hole and inspected before being rerun. The bit was run back to bottom but failed to activate due to blockages and was pulled out of hole and cleared. After running back in hole, drilling continued to 373.6m (with surveys) where the hammer became blocked again. Bit No. 3 was P.O.O.H. with tight hole from 187m to the 7" casing shoe. The hammer was serviced and the BOP's function tested before the bit was R.I.H. An attempt was made to circulate air, however there were problems unloading the hole due to a large amount of water in the annulus and the hammer bit became blocked. A 16 stand short trip was made to try to clear the hammer but this was unsuccessful and the bit had to be pulled out of hole to be cleared. The bit was R.I.H. again and an attempt made to establish circulation on bottom (no go - hammer blocked again). The hammer bit was pulled out of hole and layed down. A 6" roller bit and new B.H.A was made up and R.I.H. The hole was cleared 6 stands off bottom and then circulated and conditioned each stand while running in to bottom. Rotary drilling with surveys then continued to 438.6m where the hole was circulated and conditioned before pulling out to change the bit nozzles and B.H.A. Bit No.4 was rerun and drilling continued to 447.6m where heavy rains caused a power blackout and the hole was circulated while the bit rotated off bottom. Channeling and washouts due to high water run-off undermined the mud pits causing them to slump down towards the sump at about a 20° angle. Forty-five minutes were lost repairing the flowline and mud system. After the storm abated, new hole was drilled with surveys to intermediate casing shoe depth (549m). The hole was circulated and conditioned and then displaced to gel mud. A wiper trip was made to surface (strapped out - depth OK), the bit run back in hole and the hole circulated and conditioned for 2 hours. Bit No.4 was then POOH and all 3½" drillpipe and 4.75" drill collars were laid down. 28 hours were lost waiting on the Century logging truck to arrive on site (access was hampered by bad road conditions due to the heavy rain on the 13th) The BOP's were function tested while waiting for Century - all OK. Picked up CHD101 drillstring and R.I.H. to circulate before logging. P.O.O.H. and rigged up Century and ran logging suite No. 1 consisting of:

Neutron - Rd - GR	550.0 - Surface
Density - GR - Cal	550.0 - 125.0m
Sonic	550.0 - 125.0m
SP - Rs - GR	550.0 - 125.0m
Magnetic Susc	184.0 - 550.0m
Dipmeter	547.5 - 125.0m

The Magnetic Susceptibility log was recorded while running in and no repeat section was made. Cycle skipping was apparent during the sonic tool run and one pad on the dipmeter tool did not function, however there were no hole problems during logging. Century was rigged down and fifty-five joints of 5", 13ppf, FL4S casing were then run with the shoe at 548.74m. The casing string was cemented in place with a 15 bbl slurry of 15.6ppg neat class "A" cement (cement slurry volume calculated on 10% excess over hole volume from the caliper log). The cement was displaced with 35bbls of water and the plug bumped with 1500psi. Waited on cement for 8 hours. Set the 5" casing slips and seals and tested the BOP stack (all OK).

2.3.2.3 CHD101 Hole Section

A 4¾" re-run roller bit was run in to drill out the top and bottom cement plugs, cement shoe-track and casing shoe (TOC was tagged at 543m). After drilling out the casing shoe and sump to 549m, rotary drilling ceased and the roller bit was P.O.O.H. to allow coring operations to commence. The core barrel was made up, tubes set and bit no.6 was R.I.H. The hole was circulated and conditioned and displaced to Drilfloc - CMC - freshwater mud. After repairing a feed hydraulic hose, the hole was then cored to 551.55m where a leak-off test was performed (8.4ppg mud, 900psi applied surface pressure, no leak-off at 18.0ppg equivalent mud weight). Coring continued to 553m where the rig cooling system had to be repaired due to the rig overheating (lost 1 hour). Cored ahead to a depth of 580.95m where it was necessary to ream over core no.7 which was left in the hole when pulling the core tube. The whole core was successfully recovered. Continued coring to 640.45m where a bit change was made.

R.I.H. with new bit no. 7 and cored ahead to a depth of 662.75m, where the core tube became stuck. Three hours were lost tripping out the stuck tube and changing the landing ring. The bit was rerun and coring continued to 686.35m where the tube became stuck once again and the wireline parted. A further 4½ hours were spent tripping the bit and repairing the wireline. The wireline parted again at 750.85m while trying to free a stuck core tube. Three and a half hours were spent tripping the bit and repairing the core retrieval overshot. Bit No.7 was run back to bottom and after circulating and conditioning the hole, coring continued to 821.05m where it was decided to conduct a drill stem test over the basal shoal of the Arthur Creek Formation due to the presence of trace to poor oil shows and some thin zones of fair to good vuggy porosity. The hole was circulated and conditioned for 3.75hrs and a wiper trip made to the 5" casing shoe. The bit was run back to bottom and after circulating for a further 3½hrs the bit was POOH (strapped out). The test tools were made up and run in on drill collars to bottom. DST No.1 was then run over the interval 801.13 - 821.05m. The test was a conventional bottom hole test and a total of 278m of mud and water was recovered from the drill string when the test tool was POOH.

A wiper trip was made and the hole conditioned for 3½ hrs. A second DST was then run over the same interval as DST No.1 in an attempt to recover a more representative sample of formation fluid. The well was swabbed, however operations were hampered by the slow pulling speeds the rig winch would allow. A bailing assembly was made up and bailing continued until consistent Rw values were obtained from the recovered fluids. The test tools were pulled out of hole and layed down (recovered 337m of mud and water). Bit No.7 was rerun and cored ahead to 896.5m where a trip was made to recover the core tube after the wireline parted. Coring continued to 904.3m at which time the Caterpillar 3306 main rig engine broke down. Inspection showed that it was not repairable and a back up motor was hooked up to allow circulation and rotation to continue while waiting on a replacement engine to arrive from Alice Springs. Twenty-seven and a half hours were lost waiting for and installing the new engine. Cored ahead with surveys to total depth of 959.95m. The hole was conditioned before POOH to run wireline logs. Rigged up Century and ran suite No. 2 comprising:-

Density - GR - Cal	960.0 - 541.9m
Neutron - Rd - GR	960.0 - 543.2m
Sonic	960.0 - 511.0m
SP - Rs - GR	960.0 - 538.4m
Magnetic Susc.	Tool failed
Dipmeter	960.5 - 551.4m
VSP	956.0 - 266.4m

Problems were experienced with the sonic tool cycle skipping between 830 and 780m. The Magnetic Susceptibility tool run was cancelled as it would not stabilise while running in hole and the logging engineer was unable to calibrate it. The dipmeter tool failed on the first run and had to be repaired before a complete run could be made. The shallow resistivity tool appeared to be shorted out due to the low resistivity mud in the borehole and is essentially useless. Cyclic interference is also apparent on the SP curve.

After logging was completed and Century and Velocity Data rigged down, open-ended drill pipe was R.I.H. to 836m and the abandonment programme commenced (an Abandonment Schematic and complete details of abandonment plugs are given in Appendix XI). Plug No. 1 was set from 836 - 786.5m, the pipe was pulled slowly to 579m (43 singles laid down) and plug No. 2 was then set from 579 - 519m. P.O.O.H. to surface and picked up the 5" casing cutter. Three attempts were made to cut the 5" casing (250m, 239m and 227m), however in each case the casing would not move with up to 45,000lbs of pull exerted with the casing grapple. RIH and tagged Plug No.2 at 483m and weight tested to 6000lbs. POOH and layed down 30 stands of pipe. Made up the casing cutter and R.I.H. Attempted to cut the 5" casing at 180m without success and the cutter was P.O.O.H. R.I.H. with open-ended pipe and set plug no. 3 (280 - 150m) and pulled out of hole laying down pipe and collars. Fourteen stands were left in the derrick to tag the plug. Waited on cement for 5 hours and nippled down the BOP stack. R.I.H. and tagged plug no.3 at 48m - weight tested to 2000lbs. P.O.O.H. laying down drill pipe. Rigged down and removed BOP and wellhead from cellar. Set surface plug by top fill method (48m - surface). Rockdril Rig 20 was released at 2230 hours on 1 January 1990.

2.3.3 Lost Time

A total of 143.65 hours (5.99 days) of time was lost during the drilling of MacIntyre No. 1. This represents 23.6% of the total time spent on drilling the well.

The following table lists the amount of lost time in various categories:

O P E R A T I O N	TIME (HOURS)
Hole problems - Air drilling	31.75
Lost circulation	0.25
Cutting casing	11.25
Reaming	3.75
Standby - Wait on weather, etc.	1.25
DST delays	16.25
Rig Repairs	28.25
Core recovery problems	16.75
Wait on Century/Logging problems	27.75/6.40
TOTAL	143.65

Three main factors contributed the bulk of the time lost during the drilling of MacIntyre No.1. These were: (a) difficulties with air drilling because of hammer blockages and too much water in the annulus for the compressor to unload; (b) delays while waiting for Wireline Logging and DST personnel to arrive on site. This was mainly a logistics problem due to the remoteness of the drilling location, although bad weather also contributed to access problems in part; and (c) Rig repairs, in particular the breakdown of the rig prime mover. Problems with core recovery equipment, logging tools and the casing cutter (during the P&A programme) contributed a lesser, but still significant, amount to the total time lost.

2.3.4 Water Supply

Water for drilling and camp purposes was obtained from a water bore (RD89GB10) drilled on the western edge of the drilling location prior to the arrival of Rig 20 . The bore was located about 8m north of shot-point 920 on line 89-104 and the approximate co-ordinates are 555 096m East, 7 562 776m North. Water was struck at 64m with a flow rate of approximately 2.25 l/s (1780 gph) and standing water level was 55m. The Rw of the bore water was 2.024 ohm-m at 25°C (Classic Comlabs Ltd Report 9AD3147, Appendix IVa). The bore was abandoned by welding a steel plate to the casing at surface after all site operations were completed.

2.3.5 Deviation Surveys

Deviation surveys were run using an Eastman downhole camera. Surveys were taken approximately every 100m during drilling and coring operations. The well was essentially vertical as the maximum recorded deviation was less than 1°. Hole deviation is summarized graphically in Plan PETNTcw 3151, Appendix X; on the P.O.G. Composite Log (Enclosure I); and the EXLOG Mudlog (Enclosure II) and is tabulated below:-

DEPTH (m)	DEVIATION	DEPTH (m)	DEVIATION
125	½°	616	0°
222	¼°	721	3/4°
319	¼°	800	¼°
425	3/4°	898	3/4°
523	3/4°	954	¼°

2.3.6 Completion Summary

MacIntyre No. 1 was plugged and abandoned as a dry hole between the 31st December 1989 and 1st January 1990.

Four abandonment plugs were set and several attempts were made to cut and retrieve the 5" casing string. Complete details can be found in Appendix XI along with an Abandonment Schematic. Plug depths were as follows:

Plug No.1:	836 - 786.5m
Plug No.2:	579 - 483m
Plug No.3:	280 - 48m
Plug No.4:	48 - Surface

2.3.7 Fishing Operations

No fishing operations were carried out.

2.4 FORMATION EVALUATION

2.4.1 Geological Supervision & Mudlogging

Geological supervision at the wellsite was provided by A.G.Kress of Pacific Oil and Gas. Additional wellsite supervision in the absence of Pacific Oil personnel was provided by Colin Higgins of COLIN HIGGINS & ASSOCIATES (Perth) and Greg Clota of GEOWELLCO (Adelaide).

Mudlogging services were provided by EXPLORATION LOGGING OF AUSTRALIA (EXLOG). Instruments monitored pit level, rate of penetration (ROP) and both chromatograph and total mud gas. A Hydrogen Sulphide (H_2S) gas detector was in operation at all times during the drilling operation. No gas readings were obtained between 26.5m and 126.5m as the hole was air-drilled and no gas sniffer was installed in the blooie line. A gas sniffer was installed approximately 6m from the wellhead after 7" casing had been run and this was in operation intermittently during the 6" air-drilled hole section. Zero gas was recorded between the 7" shoe and 165m and between 300m and 373.6m (where drilling with water commenced). Samples were caught, washed and described at 3m intervals from surface to 7" casing shoe (125.25m) and again at 3m intervals from below the 7" shoe to 549m (5" casing shoe depth). All cuttings samples were examined under ultraviolet (UV) light for the presence of hydrocarbons. Cuttings descriptions can be found in Appendix I(a).

ROP, mud gas and lithology are summarised graphically on the 1:500 scale mudlog (EXLOG Formation Evaluation Log, Enclosure II). Splits of the cuttings have been retained for:

(a) Pacific Oil and Gas Pty Limited
(b) Northern Territory Department of Mines

2.4.2 Calcimetry

The proportion of calcite and dolomite in each cuttings sample was determined using an auto-calcimeter. Calcimetry was also performed on 5m intervals of ground core. Calcimetry results are summarised graphically on the 1:500 scale mudlog (Enclosure II) and at 1:5000 scale on plan PETNTcw3152.

2.4.3 Testing and Coring

Drill Stem Testing:
Two DST's were run during the drilling of MacIntyre No.1 using conventional bottom hole testing equipment run on CHD101 drillrods. Both tests were conducted over a porous dolostone interval in the basal shoal of the Arthur Creek Formation. A brief summary of each test is given below and complete details can be found in Appendix III.

DST No.1 - 801.13 to 821.05m

Reason for test:	To determine the fluid content and reservoir properties of a porous dolomite exhibiting trace oil staining and hydrocarbon fluorescence.		
Date Run:	24th December 1989.		
Recorder Depths:	Top: 799.2m	Bottom:	806.65m
Pressures:	IHP: 1164.1psi		1175.9psi
	IFP: 132.4/164.0		149.4/177.5
	ISIP: 954.6		967.3
	FFP: 201.7/414.0		216.2/426.6
	FSIP: 880.0		892.6
	FHP: 1160.8		1165.2
Times:	Initial Flow:	10 minutes.	
	Initial Shut-in:	30 minutes.	
	Final Flow:	120 minutes.	
	Final Shut-in:	240 minutes.	
Temperature:	131.36°F (55.2°C)		
Recovery:	149m mud, 60m water cut mud, 69m water. Total 278m (2.7 bbl). Rw of recovery 1.1 ohm-m at 90°F.		

DST No.2 - 801.13 to 821.05m

Reason for test:	To obtain a more representative fluid sample from the formation following the recovery of water from DST No.1.		
Date Run:	25th December 1989.		
Recorder Depths:	Top: 799.2m	Bottom:	806.65m
Pressures:	IHP: 1149.0psi		1163.1psi
	IFP: 82.3/156.7		111.0/171.0

	ISIP: 936.2	949.4
	FFP: 184.0/547.4	201.7/560.4
	FSIP: 652.8	666.3
	FHP: 1144.6	1160.5
Times:	Initial Flow:	11 minutes.
	Initial Shut-in:	30 minutes.
	Final Flow:	458 minutes.
	Final Shut-in:	31 minutes.
Temperature:	131.17°F (55.1°C)	
Recovery:	Fluid tagged with swabbing assembly at 261m. Recovery from string when pulled was 338m of water and mud (4.0 bbl). Rw of recovery 1.17 ohm-m at 77°F.	

Coring:
The well was continuously cored at CHD101 size from 549m to 959.95m. Total cored 410.95m, total recovered 100%. All core was examined under UV light for hydrocarbon fluorescence. A chip sample was taken from core every 2m and stored in samplex trays. Detailed lithological descriptions are given in Appendix I(b). Results of core analysis, petrology and palaeontology are given in Appendices II, V and VII respectively. All core is stored at the Pacific Oil and Gas office in Alice Springs and will be despatched to the Northern Territory Department of Mines core store in Alice Springs at a later date.

2.4.4 Electric Logging

Electric logging services were provided by Century Geophysical Corporation Pty Ltd using truck 7741. A complete set of petrophysical data was acquired from MacIntyre No. 1, comprising the following services; 9036A (Density-Gamma Ray-Caliper), 9300A (Sonic), 9072A (Neutron Porosity-Deep Resistivity-Gamma Ray), 9400 (Dipmeter), 9600 (Magnetic Susceptibility), 9010C (Self Potential-Shallow Resistivity-Gamma Ray). Logs are included as Enclosure III. The following logging suites were run:-

Type of Log	Interval	BHT/Time
Suite 1: Intermediate Logs		
9072A	550.0 - Surface	-
9036A	550.0 - 125m	-
9300A	550.0 - 125m	49°C/9hrs 43mins
9010C	550.0 - 125m	-
9600A	184.0 - 550m	-
9400A	547.5 - 125m	50°C/15hrs 41mins

Suite 2: Final Logs

9036A	960.0 - 541.9m	-
9072A	960.0 - 543.2m	68°C/7hrs 20mins
9300A	960.0 - 511.0m	-
9010C	960.0 - 538.4m	68°C/12hrs 27mins
9600A	557.3 - -	Tool failed
9400A	960.5 - 551.4m	68°C/18hrs 45mins
Velocity Survey	900.0 - 30m	-
VSP	956.0 - 266.4m	-

2.4.5 Geothermal Gradient

An approximate geothermal gradient of 4.48°C per 100m (44.8°C per km) has been calculated using the maximum observed bottom hole temperatures recorded during the two logging suites and two DST's. A discussion of the method used, a table of temperature data and a "Geothermal Gradient Plot" are given in Appendix IX.

2.4.6 Vertical Seismic Profiling (VSP)

A Check-shot and full VSP survey were run at total depth (960.0m) on 31st December 1989, by Velocity Data Services using the Century Geophysical wireline unit for depth control and positioning of their geophones. The check-shot survey comprised a total of 7 levels with an offset of 23m, using AN-60 explosive as an energy source. Data quality was considered to be poor. Shot points were at 900m (201msec), 852m (194msec), 805m (189msec), 576m (146msec), 418m (115msec), 178m (64msec), and 30m (43msec).

The VSP consisted of 35 shots at 29 levels between 956 and 266.4m.

The velocity survey and VSP results are attached as Enclosure IV.

2.4.7 Synthetic Seismograms

A synthetic seismogram has been generated by VELSEIS Pty Limited, Brisbane, based on the density and sonic data derived from the Century logs. The synthetic seismogram and data listing are included in Enclosure V.

2.4.8 Magnetic Susceptibility

Magnetic Susceptibility readings of all core recovered from MacIntyre No. 1 were taken and averaged at 1m intervals. This data has been incorporated into a

Magnetic Susceptibility Plot which is included as Enclosure VI. A plot of magnetic susceptibility (10m averages) versus depth is given in Plan PETNTcw3152.

2.4.9 Elemental Analysis

A representative portion of each 3m cuttings sample collected from MacIntyre No.1 was obtained by splitting. Bulk samples of ground rock were also obtained over the entire cored section of MacIntyre No. 1 at 5m intervals using a "Goldfields" core grinder. A total of eighty-two grind samples and 163 cuttings samples of around 50g weight were sent to Australian Laboratory Services Pty Ltd in Brisbane for analysis of 19 different elements. Analytical methods used were: Fire Assay for Au, Pt and Pd; ICP for Cu, Pb, Zn, Ag, Fe, As, Ni, Ba, Ca, Mg, K, Co, Ti, P, S and V.

Five additional samples of quarter-core were taken at one metre intervals over the contact between the organic-rich section of the Arthur Creek Formation and the basal shoal (799.65m - 804.65m) and a further three samples over a mineralised section of the basal shoal (813m - 815m). These samples were subjected to the same analyses as the cuttings and core grinds.

Results of these analyses are tabulated in Appendix VIII.

3. GEOLOGY

3.1 Objectives

POG MacIntyre No. 1 was a wildcat exploration well, drilled as part of the work program for EP10, Ammaroo, Northern Territory. The well's location was selected after processing and interpretation of the 1988 Bundey River seismic survey and 1989 Bundey infill seismic. It was positioned on the northern flank of a seismically-defined culmination. The well's final surveyed co-ordinates are:

Latitude: 22° 02' 19.84" South
Longitude: 135° 32' 06.22" East

The purpose of the well was to determine the potential for commercial quantities of hydrocarbons to occur in the structure. It was designed to test for the distribution, thickness, quality and fluid content of any reservoir rock facies which may have been present, in particular the Errarra Formation dolomite and Andagera Formation clastics. These reservoirs formed the primary objectives of MacIntyre No.1, while source rocks and possible reservoir rocks in the Arthur Creek Formation formed the secondary objectives. The well would also provide good lithologic and geophysical control in this portion of the basin, between P.O.G. Phillip No.2 and P.O.G. Baldwin No.1.

3.2 Regional Setting and Structure

The Georgina Basin is a large Palaeozoic intracratonic sedimentary basin trending north-west from latitude 25°S in western Queensland into the east central portion of the Northern Territory to about 18°S (Plan PETNTcw589), (Smith, 1972). The basin is about 1000km long, 500km wide and has an area of approximately 325 000km². It comprises a sequence of sedimentary rocks of Late Proterozoic to Devonian age (Draper et al, 1978), which were deposited on a major segment of an extensive epicontinental shelf which covered most of eastern Australia. Basement under the basin is an irregular surface of granitic ridge and depression topography, subdued by Upper Proterozoic to lower Cambrian sequences. Vendian to Lower Cambrian rocks forming the base of the sequence in the southern portion of the basin are siliciclastics with minor carbonate rocks of marine and terrestrial origin (Draper et al, 1978). The Middle to Upper Cambrian shelf sediments comprise carbonates in the north and east, and mixed carbonate and terrigenous rocks in the west (Radke, 1981). Lower to Middle Ordovician sediments are progressively restricted in extent (southern margin to Toko syncline), become more siliciclastic with decreasing age and are of shallow marine origin. Devonian sandstones of freshwater (alluvial fan, braided stream and lacustrine) and aeolian origin are restricted to the southern part of the basin (Smith, 1967). A regional correlation of stratigraphic units is shown in Plan PETNTcw3023.

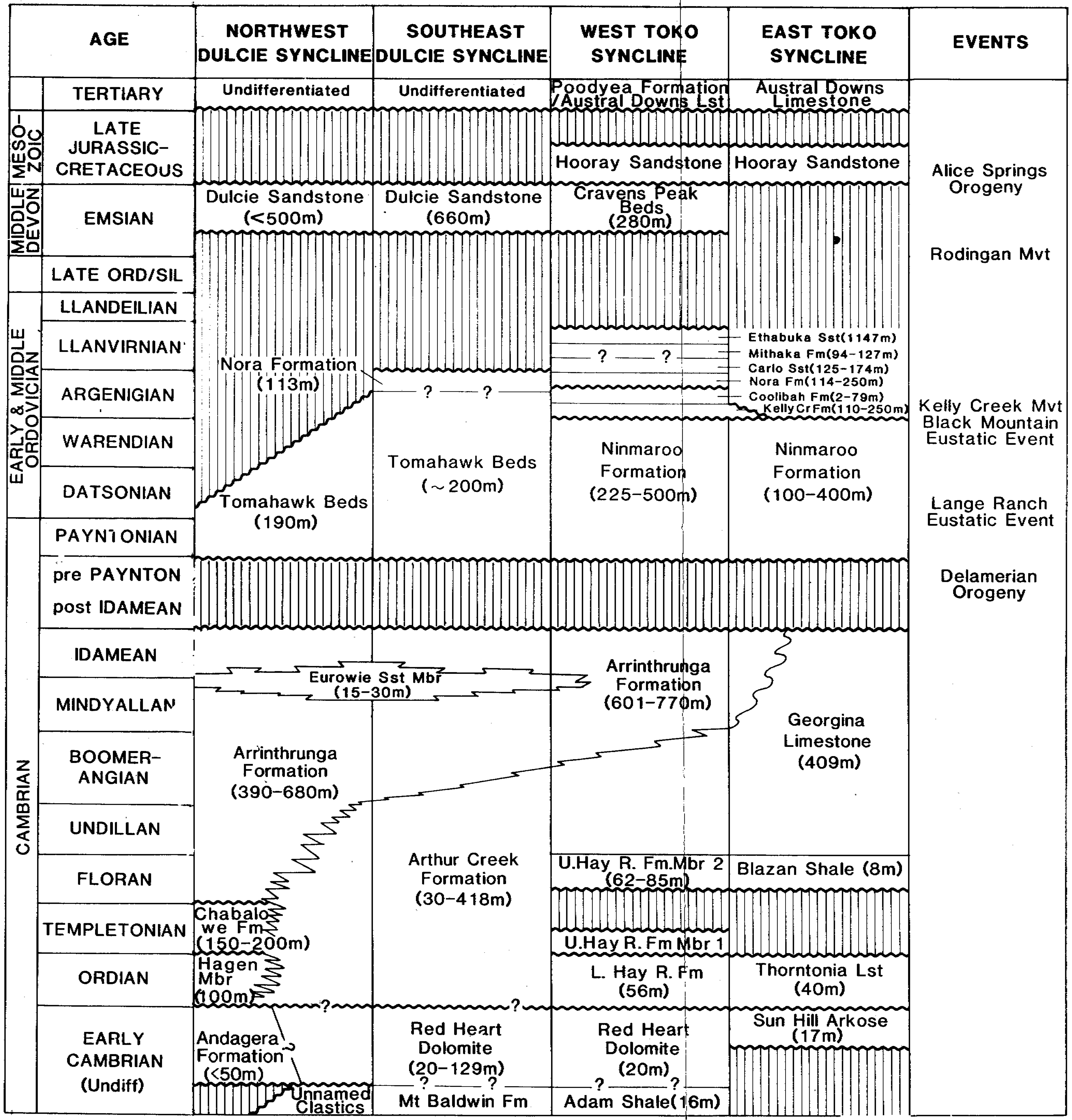


FIG.4

CRA Pacific Oil & Gas Pty Limited

SOUTHERN GEORGINA BASIN

CORRELATION OF STRATIGRAPHIC UNITS

(Modified from Morris, 1988)

REF.			
SCALE		DRAFTING	
AUTHOR	A.G. KRESS	REPORT	303525
DATE	APRIL 1989	PLAN No	PetNTcw3023

The margins of the Georgina Basin are often identified as an unconformity, commonly faulted, separating Lower Proterozoic, Carpentarian, and Adelaidean rocks from Vendian (late Adelaidean) and later sediments (Draper et al, 1978). The Georgina Basin is bounded by the Proterozoic Mt Isa Block to the east; by the Arunta Block to the south; by the Proterozoic Davenport Province, Tennant Creek and Arunta Blocks and the Palaeozoic Wiso Basin to the west; and by the Proterozoic McArthur and South Nicholson Basins to the north (Freeman et al, in press).

Mesozoic rocks conceal any connection between the Georgina Basin and Daly River Basin to the northwest, while the southeastern margin is concealed beneath the Mesozoic Eromanga Basin (Draper et al, 1978). The basin has been asymetrically deformed by minor to moderate folding and faulting, especially in the east and south, with local intense faulting and thrusting on the margins (Freeman et al, in press), although large areas appear not to have been disturbed tectonically and the sediments are mainly flat-lying and unmetamorphosed (Smith, 1972). Structural deformation took place during an Upper Devonian or early Carboniferous orogeny . Along the southern margin there are numerous parallel faults, downthrown to the east, which trend north-west for up to 80 kilometres, and some anticlines, domes, and monoclines are known. The most prominent folds are the Dulcie and Toko Synclines. Both are asymmetric folds with steep dips on their south-western flanks; in the Toko Syncline these steep dips are clearly related to faults, but there is no evidence of faulting along the south-western flank of the Dulcie Syncline (Smith, 1967).

3.3 Results of Drilling

3.3.1 Stratigraphy and Depositional Environment

TABLE 1 - STRATIGRAPHY, MACINTYRE NO.1

FORMATION NAME	AGE	FORMATION TOP (M)			THICK-NESS (M)
		DF	GL	SS	
Surface Cover	Cainozoic	2.5	Surface	-379.0	2
Tomahawk Beds	Cambro-Ordovician	4.5	2	-377.0	34
U. Arrinthrunga	Mid to Late Cambrian	38.5	36	-333.0	135.5
Eurowie Sst Mbr	Mid to Late Cambrian	174	171.5	-207.5	107
L. Arrinthrunga	Mid to Late Cambrian	281	278.5	-100.5	138
Chabalowe	Mid Cambrian	419	416.5	37.5	157
Arthur Creek	Mid Cambrian	576	573.5	194.5	276
Elkera	Adelaidean	852	849.5	470.5	44
Grant Bluff	Adelaidean	896	893.5	514.5	52.5
?Elyuah	Adelaidean	948.5	946.0	567.0	11.5+

Table 1 lists the tops of all Formations intersected during the drilling of MacIntyre No.1, together with subsea elevations and thicknesses. All depths given are loggers depths. Note that in some cases there is a slight discrepancy between log Formation tops and those selected from the core (see Appendix Ib). Figure PETNTcw3152 presents a graphic summary of the stratigraphy encountered.

A brief stratigraphic summary follows based on wellsite lithologic descriptions and wireline log characteristics. Detailed descriptions of cuttings and cores are given in Appendix I, sections (a) and (b). Electric logs may be found in Enclosure III.

MacIntyre No.1 was terminated after penetrating 108+m of Adelaidean MOPUNGA GROUP sediments. These sediments were laid down as relatively even-thickness sheets during a transgression across the SW Georgina Basin (Freeman, 1986). The claystones and siltstones were deposited in a relatively quiet environment, while the sandstones were probably formed in a shallow, wave-dominated environment (Freeman, 1986). The Elyuah, Grant Bluff and Elkera Formations comprise the Mopunga Group (Walter, 1980) and the 108m interval intersected in MacIntyre No.1 has been tentatively subdivided into these three formations.

The basal 11.5m of the well has been assigned to the ?ELYUAH FORMATION. The top of the formation was selected at 948.5m where lithology changes from sandstone-dominant above to siltstone-dominant below. The transition from the overlying Grant Bluff Formation is completely gradational and a possibility exists that the unit is merely a more shaly interval within the Grant Bluff Formation. The upper part of the formation consists of medium grey to medium dark grey coarse siltstone (which grades to very fine grained sandstone in part) which is thickly laminated to flaser bedded in part and contains some thin to thick interlaminations of pinkish grey sandstone. The siltstone is thickly interbedded (between 0.5-1m thick beds) with medium light grey, very fine to fine sandstone which has common quartz overgrowths and no visible porosity. The sandstone contains common irregular patches of anhydrite. Below 953m the lithology is predominantly siltstone and a colour change takes place through light brownish-grey to mottled greenish-grey and greyish red by 955.5m. Grainsize also appears to decrease with depth to some extent with some claystone being present in the bottom interval. A possible fault occurs at 955.41m where a 6cm thick interval of soft, slickenslided, claystone occurs. The lower interval also contains irregular mottles of pinkish-red or white anhydrite. Freeman (1986) noted that massive aggregates of gypsum have been exposed in the basal Grant Bluff Formation elsewhere, but indicated that these may have possibly been concentrated by surficial processes. The lowermost 4.5m of the formation as intersected in this well consists of thickly laminated to thinly bedded coarse siltstone which is argillaceous and micaceous. The laminations have diffuse contacts and alternate in colour from dark greenish-grey/greenish-black to greyish-red/dusky brown and probably represent redox boundaries. The gradational nature of the contact between the ?Elyuah and Grant Bluff Formations is most evident on the density and sonic logs, where a gradual increase in both density and sonic velocity is noted. No apparent change in Resistivity occurs and the Gamma-ray trace indicates an increase in shaliness below 955m with thinly interbedded units of sandstone and siltstone between 948.5 and 955m.

The GRANT BLUFF FORMATION (Adelaidean) overlies the ?Elyuah Formation conformably and with a gradational contact. The formation consists of white to very light grey, very fine to fine grained sandstones in thin to thick beds. Bed thickness increases with decreasing depth. The sandstone contains common very thin to thin laminations of dark greenish-grey claystone and soft sediment deformation features and small slump structures are scattered throughout. Below around 927m there are common thin to thick interbeds of finely laminated dark grey to greyish-black coarse siltstone which contains some fine carbonaceous matter. Anhydrite becomes common in the lower part of the formation, usually as fracture filling. No significant porosity or permeability was noted over the interval.

The Gamma-ray log shows the interbedded nature of the sandstones well. They are generally fairly "clean" with an average reading of 30 to 45 API units, while the siltstones/claystones have readings of between 60 and 120 API units. The upper contact is gradational in core but is selected at around 896m from wireline logs where a sharp decrease in density is apparent.

The ELKERA FORMATION (Adelaidean) overlies the Grant Bluff Formation conformably. This unit consists predominantly of thin to medium bedded dolomite with common dolomitic siltstones and minor sandstones. Clastics are common in the lower part of the formation (plan PETNTcw3152). Directly above the light grey fine sandstone of the Grant Bluff Formation is an 8m thick interval of very thinly to thinly laminated light greenish-grey silty dolomite to dolomitic siltstone with occasional thin pinkish-red and pale brown coloured intervals. This unit grades upwards into dark reddish-brown dolomitic siltstone with occasional thin to thick interbeds of reddish-brown to greenish-grey fine to medium grained sandstone. A thin pale pinkish-red dolomitic oolithic grainstone bed occurs at 875.08 to 875.30m and marks the transition from "clastic-dominated" lithologies to predominantly carbonate lithologies. The oolithic grainstone is overlain by pale to moderate brown and greyish-red massive dolomite which is stylolitic and contains thin to thick laminations of dark grey siltstone. Between 869.10 and 866.70m, the sequence fines upwards from a rudaceous dolomitic conglomerate (with abundant pebble and granule sized clasts which are grain supported) to laminated dolomite with scattered granule-sized clasts. This sequence is overlain in turn by pale brown to reddish-brown finely laminated dolomitic siltstone to silty dolomite with a thin horizon of massive sandy, glauconitic, white to pinkish-red dolarenite at 866.21 to 865.85m. The uppermost part of the formation consists of a massive, stylolitic sandy dolarenite shoal with minor vuggy porosity which grades up into an algal laminated dolomite and dolomitic mudstone which is locally brecciated/ conglomeratic. This grades in turn to a stromatolitic medium dark grey to dark grey dolomite at the top of the sequence.

Freeman (1986) states that the Elkera Formation is capped by a distinctive stromatolitic dolostone marker horizon which contains the unique, columnar, branching stromatolite Georginia howchini. The horizon in MacIntyre No.1 does not appear to contain branching stromatolites, however it is distincly different from the overlying Arthur Creek Formation lithologies.

On wireline logs the top of the Formation is marked by an increase in the Gamma-ray trace from around 25 API units in the Arthur Creek shoals to around 120-150 API units in the algal-laminated and stromatolitic units at the top of the Elkera Formation. a decrease in resistivity and density curves is apparent as well as a slight increase in neutron porosity and sonic traces.

The Mopunga Group is overlain disconformably by the ARTHUR CREEK FORMATION (Middle Cambrian). In the early Middle Cambrian (Ordian) a transgression of the sea resulted in the deposition of carbonate shoals. Following this transgression, low energy conditions prevailed and carbonaceous shoals of the Arthur Creek Formation accumulated in the deeper, anoxic parts of the marine basin (Freeman, 1986). As the sea shallowed, more oxic conditions evolved and organisms proliferated in a calcareous shale environment in a relatively warm climate.

The "basal shoal" of the Arthur Creek Formation occurs from 802.65m to 852m. At base it consists of a 2m thick interval of pale buff to light greenish-grey algal laminated dolosiltite which overlies the stromatolitic unit of the Elkera Formation with a sharp (erosive) contact. Above this to 828.22m, the formation consists of massive, fossiliferous dolomite, generally dusky to dark yellowish-brown in colour, with common thin laminations of dark brownish-grey carbonaceous dolosiltite to dolomitic siltstone. This interval contains common brachiopods and hyolithids, however no trilobites appear to be present. Fractures are common to abundant and are generally infilled by anhydrite. Traces of galena are present as void filling between 850.05-850.55m. Overlying this interval is a thick, relatively clean dolomitic shoal. The shoal consists of light brown to medium grey very fine crystalline dolomite which is stylolitic and contains occasional very thin, wavy siltstone laminations. The unit has intermittently developed vuggy porosity, minor fractures and pervasive anhydrite which infills void spaces. Galena occurs in a large fracture between 814.80 and 815m. Between 822.20 and 828.22m there are occasional large nodules of ?dolomite after chert. The "basal shoal interval" can be subdivided into three sections based on the Gamma-ray log. These are: (1) a lower "clean" interval of shoal with API readings of 20-30 units; (2) an intermediate "silty" section with readings of around 45 API units; and (3) an upper shoal section with readings of 10-15 API units. Spikes in the Density, Neutron and Sonic logs are most likely due to thin zones of secondary porosity development.

Overlying the basal shoal is a 33m thick section of dark grey to greyish-black, very carbonaceous, calcareous to dolomitic siltstone, which corresponds to the anaerobic facies of the Arthur Creek Formation (Freeman, 1986). This facies was deposited in a marine euxinic environment under anaerobic conditions. The unit is faintly laminated to massive and contains rare thin shoaly intervals (generally less than 10cm thick). Fossils are common to abundant, including brachiopods and trilobites. On wireline logs this interval is marked by a characteristic increase in gamma-ray readings from around 10 API units in the basal shoal to an average of around 210 API units in the basal part of the section to around 150 in the upper part. Some spikes of well over 300 API units are apparent in very organic-rich intervals. Shifts are also noticeable in the Sonic, Neutron and Density traces.

The remainder of the Arthur Creek Formation is subtidal aerobic facies. This interval consists of thinly laminated and thinly bedded very dark grey and brownish-black microcrystalline limestone which commonly exhibits nodular bedding or sedimentary boudinage. The unit is quite fossiliferous and bioturbation is evident throughout, especially below 642m. The interval also contains some dolomitic shoal horizons. One of these, developed between 632 and 643.50m has some potential as a reservoir, especially in the basal 4m, however the remainder of the aerobic facies is generally tight.

The CHABALOWE FORMATION (Middle Cambrian) interdigitates laterally with the Arthur Creek Formation. The contact is totally gradational in core from an algal laminated fossiliferous dolomite in the top of the Arthur Creek Formation to a bioturbated but non-fossiliferous algal laminated to stromatolitic, sandy dolomite in the base of the Chabalowe Formation. The Chabalowe Formation also contains thin laminations of reddish-brown to greenish-grey siltstone, and scattered chert and intraformational conglomerate. A massive anhydrite bed occurs at 576.43 to 576.51m. Freeman (1986) has postulated that deposition of the Chabalowe Formation occurred under near-shore tidal to supratidal conditions, initially a shoal, grading upwards to a sabkha environment, followed by increased terrigenous input and decreased salinity in a near-shore lagoonal setting. The formation is divided into sabkha deposits of the Hagen Member overlain by tidal deposits of the upper Chabalowe Formation (Freeman, 1986). No formal subdivision has been made in MacIntyre No.1, however the Hagen Member may correspond to the interval 507 to 571m where an increase

TABLE 3: HYDROCARBON SHOWS - ARRINTHRUNGA FORMATION

DEPTH (m)	LITHOLOGY	POROSITY	FLUORESCENCE	CUT	RESIDUAL RING/OIL STAIN
87-90	f-m xln oolithic calc grainstone	Nil intpart+ ?trace microvugs	Nil	Nil	trace to rare bitumen stain
120 - 123	micxln-vf xlndol oolithic grainstone	Nil Intxln	Nil	Nil	rare bitumen in (?) stylolite
126 - 129	vfxln calc oolithic grainstone	Nil Intxln	Nil	Nil	rare bitumen stain
135 - 144	micxln to vf xln oolithic calc. grainstone	Nil to v pr. intxln v pr. vug (rare)	Nil	Nil	v. rare bitumen stain
150 - 153	a/a	a/a	Nil	Nil	v. rare bitumen stain
195 - 198	vf xln dolarenite	nil to v pr intxln ?v pr fracture	Nil	Nil	rare bitumen stain
276 - 279	micxln Lst	nil intxln	Nil	Nil	trace bitumen stain
282 - 285	dolomitic oolithic grainstone	v pr. oomoldic vugs (nil intxln)	trace v.dull yellow pin-point	v.weak crush cut	pale yel-brn oil stn? Rare bitumen

Porosity development in the Arrinthrunga Formation is very patchy. Sandstones scattered through the Formation (both clastic and carbonate-siliciclastic) are generally well cemented with nil to very poor visible porosity and are probably tight for the most part. The "best" recorded visible porosities observed in sandstone chips are only very poor to poor (ie less than 10%) and occur in samples from 99-102m, 111-114m, 117-120m and 264-267m.

occurs in the amount of anhydrite present and chert also appears. The upper unit is thinly to thickly bedded yellowish-grey to white microcrystalline dolomite and light grey, very fine grained sandstone and reddish-brown to pale greenish-grey siltstone. Anhydrite is ubiquitous in trace amounts. The top of the formation is apparent in wireline logs with an increase in resistivity and changes in Sonic, Density and Neutron logs.

The ARRINTHRUNGA FORMATION (middle to late Cambrian) overlies the Chabalowe Formation conformably and with a gradational contact. In this well the change is noticeable on calcimetry curves (Plan PETNTcw3152) from dolomite and clastics in the Chabalowe Formation to mixed limestone, dolomite and clastics in the Arrinthrunga Formation. The Arrinthrunga Formation is a complex carbonate and mixed carbonate-siliciclastic sequence which was deposited in an extensive and intermittently emergent, very shallow water sea (Kennard, 1981). The formation has been subdivided into 8 lithofacies by Kennard (1981) and Freeman (1986) has subdivided it into three units: Lower Carbonate, Middle Siliciclastic - carbonate and Upper Carbonate.

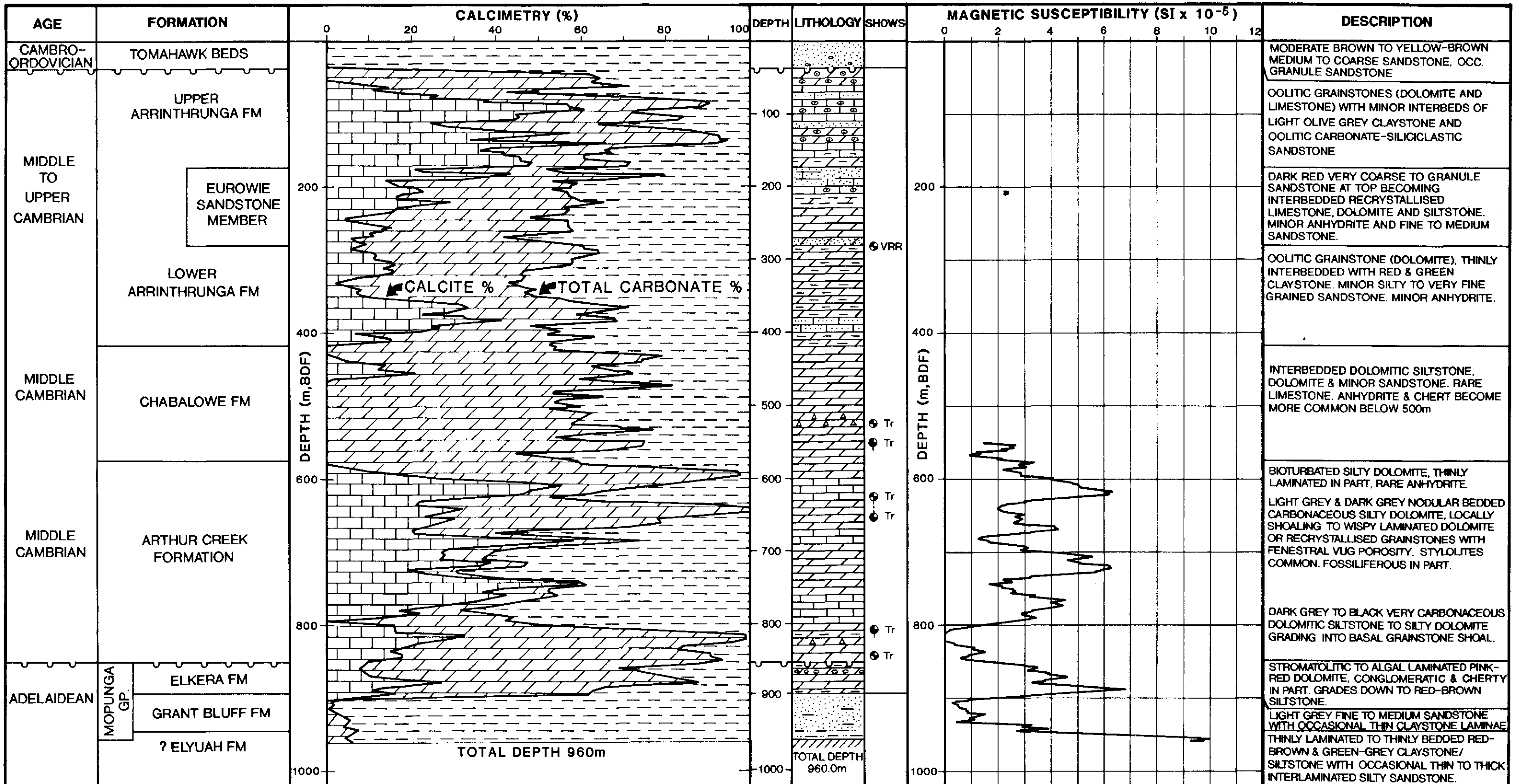
The lower unit occurs between 281 and 419m and consists of thickly interbedded greyish-brown to dusky brown argillaceous siltstone and pale brown to yellowish-brown microcrystalline to very fine crystalline limestone or dolomite. Minor amounts of light grey, very fine grained sandstone also occur. Oolithic grainstone textures are sometimes visible, although the carbonates have been recrystallised in part. Several zones of algal-laminated dolarenite are also present. Traces of glauconite occur in the top of the interval. The middle Carbonate-siliciclastic unit is here referred to as the "EUROWIE SANDSTONE MEMBER". It consists of thinly to thickly interbedded dusky brown and greenish-grey claystone and very light grey, very fine grained dolarenite. Minor amounts of fine crystalline limestone and argillaceous siltstone are also present. The top of the interval is marked by a thick bed of very dark red, very coarse to granule sandstone. The upper carbonate unit is predominantly limestone with thin to thick interbeds of greyish-brown to dusky brown, arenaceous siltstone. The limestones generally exhibit oolithic grainstone textures and mixed carbonate-siliciclastic sandstones are common.

The Arrinthrunga Formation is overlain disconformably by the TOMAHAWK BEDS (Late Cambrian-Early Ordovician) which were deposited as a transgressive unit in a littoral to sublittoral environment. The formation consists of yellowish-brown to dusky red, very fine to fine grained sandstone with minor dusky yellow brown siltstone and dark yellowish-orange claystone immediately overlying the Arrinthrunga Formation. The Tomahawk beds rest with a sharp, unconformable contact on the Arrinthrunga Formation. The contact is evident on the Gamma-ray log as a sharp increase in API units as you pass upwards from clean limestone to weathered sandstone. Between 17.5 and 30m the unit consists of a fining upwards sandstone, from medium to coarse grained at base up to fine to medium grained quartz at top. Minor unconsolidated sand and traces of siltstone are also present in this interval. The upper section of Tomahawk beds in this well consists of moderate brown, coarse to very coarse sand with occasional granule sized quartz grains and common iron staining. The uppermost 2m consists of moderate to dark reddish-brown sandy soil. The Tomahawk Beds at this locality were probably originally very glauconitic, however weathering has resulted in the breakdown of glauconite with commmon iron-staining, clay and occasional ferruginous cement resulting. No fossils were observed in cuttings samples, apart from questionable fragments between 5.5 and 8.5m. Minor amounts of ?chert after dolomite were also present between 8.5 and 11.5m.

3.3.2 Stratigraphic Prognosis

FORMATION NAME	PROGNOSED TOP (m)	ACTUAL TOP (Logs) (m,BDF)	DIFF. TO PROGNOSED TOP (m)	PROG. THICKNESS (m)	ACTUAL THICK. (m)	THICK DIFF. (m)
SURFACE COVER	Surface	"Surface"	0	20	2	-18
TOMAHAWK BEDS	N.P.	?4.5	N.P.	N.P.	34	+34
U. ARRINTHRUNGA	20	38.5	-18.5	178	135.5	-42.5
EUROWIE SST MBR	198	174	-24	50	107	+57
L. ARRINTHRUNGA	248	281	-33	312	138	-174
CHABALOWE	N.P.	419	N.P.	N.P.	157	+157
ARTHUR CREEK	560	576	-16	180	276	+96
RED HEART DOL.	740	Absent	-	50	Absent	-50
ANDAGERA	790	Absent	-	30	Absent	-30
MOPUNGA GROUP	820	852	-32	180+	108+	-
(T.D.)	(1000)	(960.0)	(+ 40.0)			

TABLE 2 - Comparison of Prognosed and Actual Formation Tops and Thicknesses for MacIntyre No. 1.



KEY TO SHOWS

- SHOW OF OIL (VISIBLE IN CORES)
- HYDROCARBON CUT
- FLUORESCENCE
- SHOW OF OIL, HYDROCARBON CUT & FLUORESCENCE

KEY TO CALCIMETRY

- LIMESTONE
- DOLOMITE
- ACID INSOLUBLES

CRA

Pacific Oil & Gas Pty Limited

MacINTYRE No.1
WELL SUMMARY LITHOLOGY, CALCIMETRY AND MAGNETIC SUSCEPTIBILITY

Author	Date March 90	Plan No

Pet NTcw 3152

Formation tops were selected at shot point 930 on line 89-104 after tieing the 1989 infill seismic to the 1988 Bundey River seismic grid and with Pacific's Phillip No.2 well supplying velocity control. A comparison between the prognosed stratigraphy and that actually encountered at the MacIntyre location is given in Table 2.

The thickness of the Cambrian section intersected by MacIntyre No.1 borehole was essentially as expected, however there were some significant differences in the stratigraphy, especially at the base of the Cambrian section to what was anticipated.

Major differences between the actual and prognosed sections were the complete absence of the Red Heart Dolomite (Errarra Formation) and the Andagera Formation, which were primary objectives (Kress, 1989) and the presence of a relatively thick section of Chabalowe Formation (possibly including the Hagen Member below 500m). The actual thickness of the Cambrian section was essentially as anticipated with the thickness of "extra" units in the stratigraphy effectively being cancelled by the thinning or absence of others. For example the 34m thick section of Tomahawk Beds is compensated by the 42.5m "thinning" of the Upper Arrinthrunga Formation; the presence of the Chabalowe Formation is compensated by a "thinning" of the Lower Arrinthrunga Formation; and the thicker Arthur Creek Formation is compensated by the absence of Red Heart Dolomite and Andagera Formation.

Consequently, anticipated Formation tops were in good agreement with those selected from seismic and varied between 16m and 33m low.

The well has illustrated a pinching-out westwards of the Early Cambrian section between Baldwin No.1 and MacIntyre No.1 and the continuity of the Chabalowe Formation in the sub-surface between Phillip No.2 and BMR 13 Sandover.

3.3.3 Porosity and Hydrocarbon Show Summary

During the drilling of MacIntyre No.1, the presence of hydrocarbons was monitored using dual catalytic total gas detectors and a FID chromatograph. A H_2S gas detector was also in operation while drilling.

All gas detectors were in continuous operation from 373.6m to total depth. No gas detectors were used during the drilling of the precollar hole section (to 26.6m) and down to 7" casing shoe depth. A gas sniffer was in intermittent operation during air drilling between 127.5m and 373.6m.

All ditch cuttings and cores were routinely examined for hydrocarbon fluorescence using ultraviolet light.

Evidence of hydrocarbons was present through most of the Cambrian section. Rare to trace amounts of bitumen were observed in several cuttings samples from the upper Arrinthrunga Formation and Eurowie Sandstone Member and the first traces of "live oil" occurred at 282 to 285m in the lower Arrinthrunga Formation. A few very poor to poor hydrocarbon shows were present in the basal Chabalowe Formation and in the upper and basal Arthur Creek Formation. High gas readings (between 40 to 80 units, C1 to C5) were associated with organic-rich source rocks of the lower Arthur Creek Formation, however there were no associated oil shows.

Two drill stem tests performed over the basal Arthur Creek shoal recovered only water.

No significant zones of hydrocarbon occurrence were observed in this well and no net pay is evident on wireline logs. Hydrocarbon shows occurring in each formation are discussed below and are summarised graphically on the Composite Log and Exlog Mudlog (Enclosures I and II respectively)

(a)Tomahawk Beds

No gas detector was in operation over the interval between surface and 7" casing shoe depth. No hydrocarbon fluorescence or bitumen staining was observed in the Tomahawk Beds. Porosity in the sandstones is nil to very poor and they appear tight, while the sands have very poor inferred porosity.

(b)Arrinthrunga Formation

Traces of hydrocarbon gases were first detected at 405m in the very basal portion of the lower Arrinthrunga Formation, with a maximum reading of 1 unit (42ppm methane, 9 ppm ethane) at 408m. No gas was detected between the 7" casing shoe depth of 127.5m (where gas detectors first became operational) and 405m.

Hydrocarbon shows in the Arrinthrunga Formation are summarised in Table 3. The first evidence of hydrocarbons occurred in cuttings samples at 87 to 90m where bitumen staining was evident in limestone chips. The first occurrence of "live oil" was at 282 to 285m where trace oil stain was observed in Anhydrite with associated very dull yellow fluorescence and weak crush cut. The anhydrite in this sample appears to be infilling microvugular porosity and the bitumen or oil forms a rim around the outside of the anhydrite, suggesting the passage of oil through the pores, with later flushing followed by porosity occlusion by anhydrite.

Similarly limestones and dolomites throughout the Formation generally have no visible intercrystalline or interparticle porosity and are impermeable. Some minor porosity development is evident however, usually as oomoldic vugs (in oolithic grainstone lithologies) or fractures. The water bore for the drilling location, RD89GB10, produced brackish water from the upper Arrinthrunga Formation at the rate of 2.25 litres/second (approximately 1223bbls/day) from a zone between 64 and 80m GL (66.5 to 82.5m BDF). Significantly, circulation was lost at 66m BDF in MacIntyre No.1 suggesting that a fracture system with some lateral continuity exists at this depth.

Evidence of fractures is fairly ubiquitous in the Arrinthrunga Formation, usually in the form of medium to coarse crystalline calcite or dolomite which is inferred to be fracture fill. Below around 195m the fractures tend to be infilled by anhydrite. Effective porosity and permeability of the fractures is probably low due to partial or total occlusion by these later cements. Minor amounts of vug porosity were observed in several zones within the Arrinthrunga Formation. The best observed porosity development was seen in a calcareous oolithic grainstone at 117 to 120m. This sample had minor amounts of excellent oomoldic vuggy porosity as most ooids had been totally dissolved leaving only a framework of cement intact. Pores varied in size from 0.2 to 0.8mm in size with very fine to fine crystalline sparry calcite druse lining some vugs. Similarly, oomoldic vug porosity is developed in the zone 120 to 132m, ranging from very poor to poor at top to poor to moderate at base. Vugs are connected and up to 1mm in size and are partly infilled by calcite. Very poor vug porosity was also noted in samples at 114-117m, 141-144m and 336-339m. Very poor to poor oomoldic vug porosity in dolomitic oolitic grainstones was present at 282-288m (partly infilled by anhydrite) and at 384-390m.

(c) Chabalowe Formation

Several trace hydrocarbon shows and one poor to fair hydrocarbon show were noted in shoaly lithologies in the bottom 50m of the Chabalowe Formation. These shows are summarised in Table 4.

Two zones of elevated gas levels were recorded in the Chabalowe Formation. The first, at 438m, peaked at 9 units (50ppm methane, 13.5ppm ethane, 5ppm propane and trace n-butane) over a background level of 0.5 to 1 unit. No hydrocarbon fluorescence or cut was associated with this gas peak.

Gas levels in the remainder of the Chabalowe Formation remained very low (0.5 units) apart from the basal

TABLE 4 - HYDROCARBON SHOWS - CHABALOWE FORMATION

DEPTH (m)	LITHOLOGY	POROSITY	FLUORESCENCE	CUT	RESIDUAL RING/OIL STAIN
528 - 531	Micxln dol	very poor intxln ?very poor fracture	much less than 1% dull to moderately bright yellow, pin-point	very slow, thin straw yellow	5% black asphaltic material (?Gilsonite)
534 - 537	micxln dol	a/a	nil	nil	Trace bitumen inclusions
549.98	micxln to vf xln dol	Nil intxln	trace spotty to pin-point mod yellow	-	-
550.30-550.37	a/a	nil intxln ?very poor fracture	10% spotty to patchy mod bright yellow to bright yellow	instant pale yellow	mod thick bright yellow-white residual flu ring

TABLE 4(CONT) - HYDROCARBON SHOWS- CHABALOWE FORMATION

DEPTH (M)	LITHOLOGY	POROSITY	FLUORESCENCE	CUT	RESIDUAL RING/OIL STAIN
551.00-553.20	micxln to vf xln dol	rare pin-point to mm scale vugs	5-10% patchy bright blue-white increasing to 80-100% (solid) between 551.75-552.10m.	instant blooming to thin fast streaming milky yellow	yel-brn oil bleeding from core. Thick bright yellow resid. flu ring
553.20-554.08	a/a	rare very poor vuggy, nil intxln	trace pin-point to spotty (in lenses)	-	-
554.08-554.75	algal lam dolomite	nil intxln	20-30% spotty to patchy bright blue-white to milky yellow	-	-
554.95-555.60	a/a	a/a	a/a		-
557.20-557.60	wispy lam dol	a/a	20-40% flu, a/a	-	-
558.11	silty, carb dolomite	nil to very poor intxln	trace spotty to patchy dull to mod yellow	-	trace oil bleed
562.07-562.30	silty, carb dolomite	nil intxln + ?v. pr fract	80% patchy to solid bri yel-grn to yel-white	instant	very strong light oil bleed, gas bubbling from core

portion below the 5" casing shoe where the second zone of elevated gas occurs. In this zone the background gas level has increased to 4 to 5 units (C1 to C3) and one (possibly two) gas peaks are evident associated with the hydrocarbon shows in the zone 550.30 - 562.30m. The uppermost of these peaks is at least 16 units (possibly more as the gas trap was bypassed for a short time) at 556m and the lower peak is 20 units at 562m (37.5ppm C1, 21ppm C2, 3.4ppm C3 and traces of nC4 and iC4)

Porosity throughout much of the Chabalowe Formation is very poor to non-existent. Sandstones generally exhibit very poor visible porosity and are tight, while the dolomites have no visible intercrystalline porosity and rarely become vuggy or fractured. Often any porosity which is visible is occluded by anhydrite. Some thin porous zones were noted however, for example the dolomite at 510-513m had rare very poor to poor oomoldic porosity, partly infilled by very fine crystalline euhedral dolomite crystals. Very poor vug or fracture porosity may also be present in the dolomite at 528-531m. Poor inferred fracture porosity possibly occurs over the interval 543-549m. Between 550.05 and 552.20m there are rare occurrences of poorly developed vug porosity. Vugs are weakly fenestral, pin-point to mm-scale and probably largely unconnected due to their small size and scattered distribution.

(d) <u>Arthur Creek Formation</u>

Scattered trace to very poor hydrocarbon shows were present in the intervals 576 to 595m, 653 to 657m, 802 to 818.24m and at 850.05m. A very poor to poor show was noted in a shoaly interval between 628 and 645m. All shows in the Arthur Creek Formation are summarised in Table 5.

Gas levels in the upper part of the Arthur Creek Formation and down to a depth of around 675m remained fairly constant and no significant peaks were recorded. Background gas levels were similar to those in the overlying Chabalowe Formation, ie between 3 to 5 units (C1 to C4). Slightly elevated gas readings were noticeable opposite zones with hydrocarbon shows, however, the highest of these peaks was only 9 units (background 4 units) at 656m.

Below 675m to the top of the basal shoal of the Arthur Creek Formation, gas levels increased significantly. This interval corresponds to the organic-rich anaerobic source rock facies of the Arthur Creek Formation. A strong petroliferous odour was noticeable from all core in this zone, however there were no shows of oil observed. Background gas rose quickly from around 8 units at 678m to between 40 to 45 units, with peaks generally exceeding 60 units in more organic-rich intervals. Maximum gas recorded in the well was 80 units

TABLE 5 - HYDROCARBON SHOWS- ARTHUR CREEK FORMATION

DEPTH (M)	LITHOLOGY	POROSITY	FLUORESCENCE	CUT	RESIDUAL RING/OIL STAIN
581.37-581.42	dolomitic algal boundstones	trace v.poor intxln	trace pin-point bright yellow-white to gold	-	-
586.65-587.00	a/a	a/a	trace to 5% patchy, mod blue-white	inst blooming milky cut i/p, wk crush cut i/p	thin mod bright yellow-white residual flu ring
589.83-589.92	a/a	a/a	trace pin-point spotty a/a	a/a	a/a
594.32-594.36	a/a	a/a	a/a	a/a	a/a
628.29-628.41	wispy lam dol lst	nil to v. poor intxln	5% pin-point to spotty mod bright yellow	instant weak	thin dull yellow residual flu ring
631.82-631.90	a/a	a/a	a/a	a/a	a/a
632.74-633.05	vf-f xln dolomite	v. poor intxln	5-10% spotty to patchy mod bright yellow	instant weak	thin to mod thick dull yellow yellow residual flu ring
633.36-633.45	a/a	v. poor intxln v. poor vug	a/a	a/a	a/a

TABLE 5(CONT.) - HYDROCARBON SHOWS- ARTHUR CREEK FORMATION

DEPTH (M)	LITHOLOGY	POROSITY	FLUORESCENCE	CUT	RESIDUAL RING/OIL STAIN
636.30-636.82	a/a	a/a	trace spotty bright yellow	a/a	a/a
637.00-637.10	a/a	v.poor intxln	trace-1% spotty bri yellow	a/a	a/a
637.97-639.55	f xln dolomite	v.poor intxln	20-40% spotty to patchy dull yellow-white	v slow	trace light brn oil stain
639.55-640.36	a/a	a/a	60-80% a/a	a/a	-
644.98	micxln silty dol	v.poor intxln poor vug	1cm thick band of 50% patchy mod yellow	instant slow	-
653.90	a/a	v.poor intxln	patchy pale yellow-white	trace v. slow	trace light brown oil stain
654.50	micxln silty dolomite	nil intxln v.poor vug	patchy bright pale yellow	a/a	a/a
654.90	a/a	a/a	a/a	a/a	a/a
656.60-656.80	a/a	a/a	a/a	a/a	a/a
zone 802.72-809	micxln stylolitic dolomite	minor vugs ?poor fracture	common thin zones of trace -10% pale yellow-white	fast streaming	trace brown oil stain
zone 810.67-811.70	a/a	a/a	a/a	a/a	a/a
815.60-818.24	?oolitic dolomitic grainstone	poor fracture v.poor intxln	a/a	a/a	a/a
850.05-850.10	vf xln dolomite	fair vug and fracture	trace-10% yellow-green	fast streaming	-

(3021ppm C1, 2070ppm C2, 1470ppm C3, 180ppm iC4, 519ppm nC4 and 280ppm C5) with a background of 36 units. From the top of the basal shoal to the top of the Mopunga Group gas levels dropped off markedly. Three gas peaks were recorded in the 28m thick "clean" shoal interval at the top of basal shoal zone - each peak smaller in magnitude than the previous one. The peaks were 35 units (1442ppm C1, 819ppm C2, 593ppm C3, 55ppm iC4, 165ppm nC4 and 70ppm C5) at 806m with a background of 23 units; 29 units (1112ppm C1, 702ppm C2, 493ppm C3, 44ppm iC4, 264ppm nC4 and 44ppm C5) at 810m with a background of 16 units; and 18 units (659ppm C1, 351ppm C2, 255ppm C3, 44ppm iC4, 165ppm nC4 and 55ppm C5) at 818m with a background of 14 units.

One final peak occurs immediately above the contact between the Arthur Creek and Elkera Formations. The peak is 23 units (1250ppm C1, 324ppm C2, 200ppm C3, 22ppm iC4, 82ppm nC4 and 25ppm C5) at 848m with a background of 16 units. This peak may be due, at least in part, to the presence of organic-rich siltstones.

Porosity development in the Arthur Creek Formation, as in the overlying Chabalowe Formation, is patchy. Visual porosity over the interval is generally nil to extremely poor, and often any porosity that is present is partly to totally occluded by either anhydrite or dolomite. The best visual porosity in the Arthur Creek Formation occurs in a recrystallised grainstone shoal between 632 and 642m. Very poor vug porosity occurs in several thin zones between 634.47 and 636.90m with good to excellent fenestral vug porosity occurring between 638 and 639.60m. Although thin shoaly intervals are fairly common elsewhere in the Formation, they generally do not have any significant porosity and are tight. Some porosity is present in the thick basal shoal below the anaerobic facies. Fair fenestral vuggy porosity is evident over several thin zones and some porosity is also present in thin sub vertical fractures below 814m. Anhydrite is fairly common over this interval however, and much of the porosity has been occluded. The final porous interval in the Arthur Creek formation occurs below 843m to around 850m. This zone has poor to moderate vug porosity and possibly some fair fracture porosity. Once again anhydrite occludes much of the porous interval.

(e) <u>Elkera Formation</u>

No hydrocarbon shows were observed in this formation and gas levels were generally low. Background gas levels were 1 to 3 units (C1 to nC4) and there were no peaks recorded. Porosity in this interval is nil to very poor, apart from poor to fair vug porosity in a shoal at 862.44-862.60m

(f) Grant Bluff Formation

No shows of oil were present in the Grant Bluff Formation, however a general increase in gas levels was apparrent and there were several small gas peaks present. Background gas levels rose to 6-8 units (C1 to C3) and the maximum gas recorded was 20 units (145ppm C1, 64ppm C2 and 36ppm C3) at 919m. Sandstones in this formation generally exhibited nil to very poor visible porosity and were tight. Some minor fracture porosity may occur at around 940m.

(g) ?Elyuah Formation

Background gas levels remained at around 6 units in this Formation with a maximum gas reading of 19 units (53ppm C1, 24ppm C2 and 6ppm C3) at 954m. No hydrocarbon shows were present. The siltstones and silty sandstone of this interval had no visible porosity and were considered tight.

3.3.4 Discussion

Interpretation of Pacific's 1988 and 1989 Bundey River Seismic Surveys resulted in the definition of a seismically defined closure in the northeast of the grid. The structure had 20 msec of closure and an areal extent of 15.5km² at the "near-top" Arthur Creek level. Pacific's MacIntyre No.1 well was sited at shot point 930, line 89-104, on the northern flank of the culmination. The well was designed to assess the potential for commercial quantities of petroleum to occur in the structure. MacIntyre No.1 was also well positioned to provide good lithologic and geophysical control in the area between POG Phillip No.2, BMR 13 Sandover and POG Baldwin No.1.

The primary objectives of the well were anticipated reservoirs within the Red Heart Dolomite (Errarra Formation) and Andagera Formation, with secondary targets in potential reservoir shoals and the source rocks of the Arthur Creek Formation.

The well was able to meet it's proposed objectives without any serious technical difficulties. Air hammer drilling of the upper section of the well resulted in greatly improved rates of penetration compared to rotary mud drilling. Minor lost circulation was encountered during the 8½" hole section but this did not pose a significant problem and was quickly overcome.

MacIntyre No.1 intersected approximately 850m of Palaeozoic section comprised of Tomahawk Beds (Cambro-Ordovician), Arrinthrunga Formation (mid to late

Cambrian), Chabalowe Formation (middle Cambrian) and Arthur Creek Formation (middle Cambrian) resting disconformably on Adelaidean Mopunga Group sediments. The Mopunga Group can be tentatively subdivided in this well into the carbonate and carbonate-siliciclastic Elkera Formation underlain by the siliciclastic Grant Bluff Formation and possibly the ?Elyuah Formation. The well stopped 40m short of its anticipated 1000m TD due to slow rate of penetration and a lack of hydrocarbon shows in the Adelaidean rocks. Stratigraphic correlation was enhanced using calcimetry and elemental analysis techniques on cuttings and core. In particular, sulphur and phosphorus proved a useful guide to distinguishing the Chabalowe and Arthur Creek Formations. Elevated sulphur levels are apparent in the Chabalowe Formation while the Arthur Creek Formation contains higher phosphorus readings (Appendix VIII).

Although the thickness of Cambrian section was essentially as anticipated at this locality, there were some major differences between the actual and prognosed stratigraphy. These were:

(a) A 36m section of Tomahawk Beds overlying the Arrinthrunga Formation;

(b) The presence of a relatively thick section of Chabalowe Formation (possibly with Hagen Member present below 500m); and

(c) The complete absence of the Red Heart Dolomite (Errarra Formation) and any basal Cambrian clastics (either Andegera or Mt Baldwin Formation equivalents), which were primary reservoir targets.

The "basal shoal" interval of the Arthur Creek Formation intersected in MacIntyre No.1 is equivalent to the "Errarra Formation" in BMR 13 Sandover, NTGS ELK3 and 7 and Farmout Drillers' Ammaroo 1 and 2. The abundant trilobite fauna within the Arthur Creek Formation has provided an early Templetonian age for the basal grainstone with early to late Floran species occurring in the zone between 701.7m and 737.58m. This age dating combined with absence of early Cambrian archeocyatha precludes the basal shoal from being attributed to the Red Heart Dolomite/Errarra Formation.

The well demonstrated that the early Cambrian Mt Baldwin Formation and Red Heart Dolomite pinch-out in a westerly direction from Pacific's Baldwin No.1 well and that the Chabalowe Formation is present in the subsurface between Phillip No.2 and BMR 13 Sandover. Two thick reservoir-type shoals were intersected in the Arthur Creek Formation. Two drill stem tests in the lower shoal flowed water and gave an initial formation pressure of 1058.5psig. Flow was interpreted to have occurred from a vertical fracture intersecting the wellbore, and drainage area was considered limited. The upper shoal was not tested, however core analysis results yielded permeabilities of up to 1141md. This shoal has the potential to be a significant reservoir, provided the overlying Chabalowe Formation is able to furnish sufficient seal.

Visual inspection of cores and core analysis results indicate that primary intergranular or intercrystalline porosity is absent and that development of secondary porosity is very patchy. Where it does occur, secondary porosity exists as moldic, oomoldic or fenestral vugs or as partly open fractures. It varies between very poor to poor in general, although it may be locally excellent. The best porosity in the drillhole occurs in the Arthur Creek Formation in the shoal between 628 and 645m. The main factor increasing porosity in the Arthur Creek Formation appears to be dolomitisation. Factors decreasing porosity in both the Cambrian and Adelaidean sections are occlusion of pores by anhydrite or dolomite, and quartz overgrowth development and silicification (Appendix V).

Hydrocarbon shows were observed throughout most of the Cambrian section, beginning with bitumen staining in the upper Arrinthrunga Formation at 87 to 90m, with live oil first appearing in the lower Arrinthrunga Formation at 282 to 285m. The most significant shows occurred in the basal Chabalowe Formation and in the upper and lower shoals of the Arthur Creek Formation. There is evidence for the movement of hydrocarbons through the Cambrian sequence at this locality, however the entire sequence here is water-wet.

The source rocks of the Arthur Creek Formation formed a secondary objective of the well. A relatively thick section of anaerobic facies was intersected with TOC's up to 9.74%. Between 770 and 802m samples yielded an average TOC of 3.26% with a Tmax of 467°C. The sediments have maturities ranging from mature to overmature for the generation of oil and migrated/entrapped hydrocarbons appear to be present in some samples.

MacIntyre No.1 was plugged and abandoned as a dry hole in compliance with Northern Territory Government regulations on 1st January 1990.

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Petroleum, drill rotary, drill stratigraphic, drilling mud, drilling methods, drill stem testing, Cambrian, Proterozoic Up, alluvium, carbonate, conglomerate, evaporite, limestone, sandstone, dolomite, geophys borehole, analysis source rock, geothermal, petrology, porosity, permeability, palaeontology, stratigraphy, phosphate, temperature, geochem rock, palynology, reservoir pressure, geochem rock, trap structural, glauconite, pyrite, well data, well logs, water.

Northern Territory, Georgina Basin, EP10NT Ammaroo, Huckitta SF53-11, Arapunga 6053, MacIntyre No. 1, RD/DD89GB11, RD89GB10