

PACIFIC OIL & GAS PTY LIMITED

HACKING No 1

EP 12 GEORGINA BASIN, N.T.

WELL COMPLETION REPORT

ONSHORE

AUTHOR: G. Weste

DATE: May, 1989

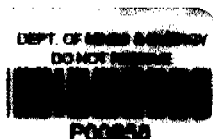
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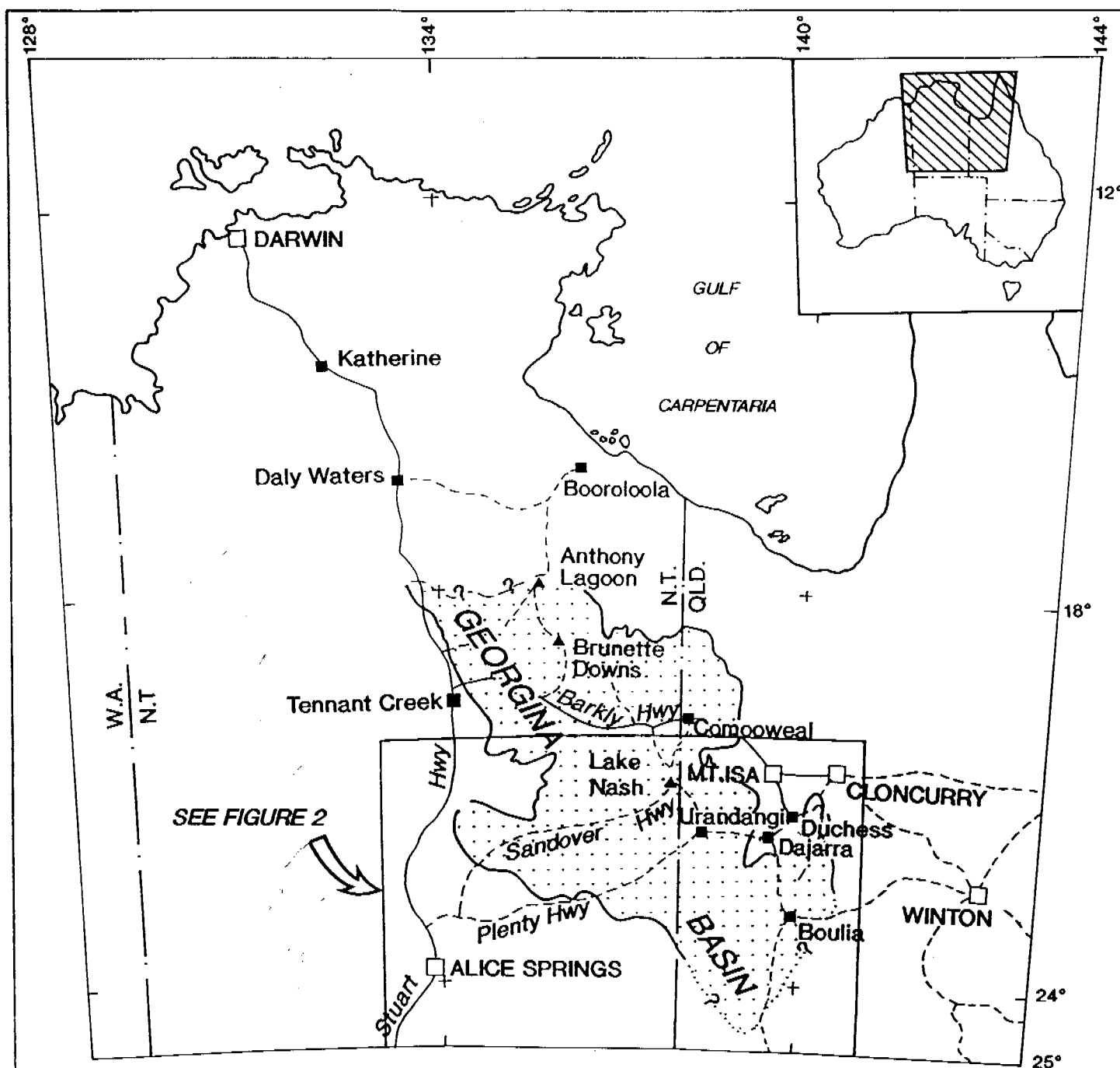


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Geological boundaries

- Known
- - - Approximate boundary of Mesozoic cover
- - - Inferred
- Inferred and concealed

- ■ Towns
- ▲ Homestead

- Major road(sealed)
- - - Major and minor roads (unsealed)

0 200 400 km

GEORGINA BASIN
Location and access roads

Figure 1
Pacific Oil & Gas Plan No. PetNTcw 589

1. SUMMARY

Hacking No 1 was the last of three stratigraphic petroleum wells drilled in the Georgina Basin in 1988 by Pacific Oil and Gas Pty Limited. The well was sited close to the southern margin of the basin in EP 12 in the Northern Territory. The wells drilled prior to Hacking No 1 were Phillip No 1,2 in EP10 (N.T.) and Bradley No 1 in ATP380P (QLD).

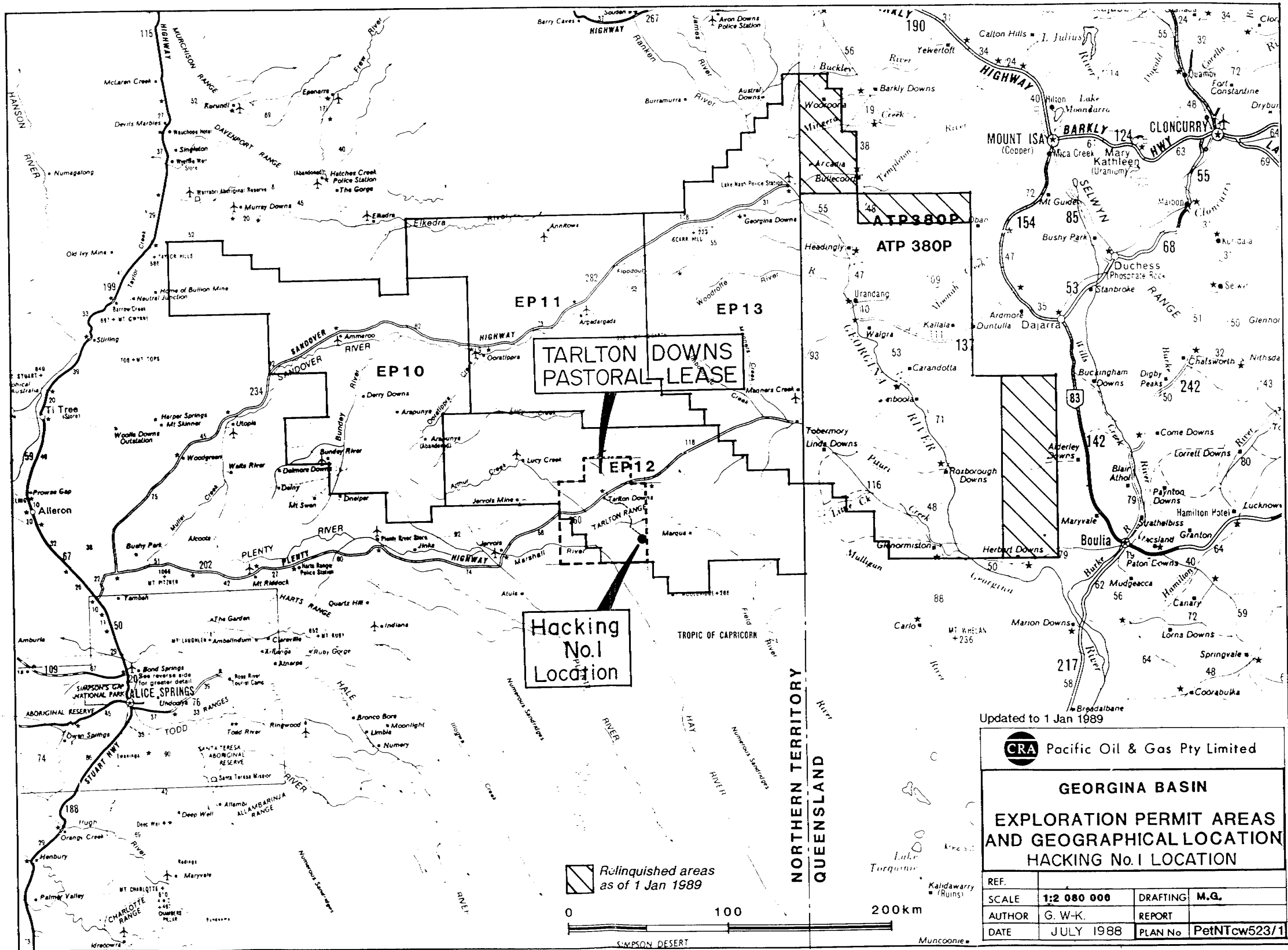
The Hacking No 1 location was chosen to assess the source rock and reservoir potential of the Cambrian sequence in an extension of the Beantree Anticline. the prognosed stratigraphic sequence was largely based on a postulated basement high indicated by modelling of gravity and magnetic data. Crystalline basement was calculated to be at approximately 800mBGL and the Early and Middle Cambrian carbonates were expected to be higher energy shoals of limited thickness, characteristic of deposition on the flanks of a paleo high. Shoals generally have a high reservoir potential and a primary objective of the well was to test their development and the degree of preservation of their primary porosity. Reservoir development in the lower Arrinthrunga Formation was also a primary objective. A secondary objective was to evaluate source rock development in the Cambrian sequence.

The Hacking No 1 81/2" precollar was air hammer/foam drilled to 80mBGL by Gorey and Cole Rig 3 on the 11th August, 1988. Rockdril Rig 20 re-entered the precollar with considerable difficulty on the 16th August, 1988, deepened the 81/2" hole to 87.5mRT and 7" casing was set in weathered upper Arrinthrunga Formation. 6" rotary drilling was carried out to 251.0mRT and 5" casing set. 4.35" diamond core drilling then commenced and upper Arrinthrunga Formation thinly bedded recrystallized dolomitic limestone and rare calcareous mudstone, with very poor secondary porosity and traces of bitumen, were cored to 269.0m.

The Eurowie Sandstone Member, a strongly silica and dolomite cemented quartz sandstone with interbeds of intraclast dolomite, was intersected between 269.0 and 298.5m. Minor intergranular porosity contained traces of possible bituminous residues.

Lower Arrinthrunga Formation pervasively recrystallised, often dolomitised and stylonodular intraclast calcarenites/dolarenites and dololutites were then intersected to 752.0m. The basal 31m contains interbeds of calcite cemented feldspathic quartz sandstone with up to 14.5% point count visible porosity. Porosity in the carbonates was very minor secondary vugs. Minor to fair oil shows occurred as bleeding heavy oil.

A 458m thick section of Arthur Creek Formation (equivalent to the "unnamed" shoal carbonates prognosed to exist in the vicinity of



Updated to 1 Jan 1989

CRA Pacific Oil & Gas Pty Limited

GEORGINA BASIN
EXPLORATION PERMIT AREAS
AND GEOGRAPHICAL LOCATION
HACKING No. 1 LOCATION

REF.			
SCALE	1:2 080 000	DRAFTING	M.G.
AUTHOR	G. W-K.	REPORT	
DATE	JULY 1988	PLAN No.	PetNTcw523/1

the anticipated basement high) was intersected at 752.8m. Intraclast calcarenite, partly phosphatic and bioclastic, is interbedded with stylonodular calcilutite which becomes more abundant and darker with depth. Pervasive recrystallization has removed all primary porosity and secondary porosity is limited to minor scattered very small and quite large vugs. A higher gas background, scattered minor gas shows up to 27 units and a hydrocarbon odour from freshly broken dark grey calcilutite indicate a source rock in the gas generating phase.

Red Heart Dolomite, also unprognosed, was intersected between 1209.9m and 1221.9m. Intraclast grainstones and micrites have been strongly dolomitised and fractured. Porosity occurs as vugs and fractures. Minor oil shows were associated with small vugs.

Weathered granite basement was intersected at 1222.9m. Minor fluorescence occurred on fine fractures. The depth to basement was 434m greater than prognosed.

The well was terminated at 1234.3mDF on the 14th September, 1988. DST No 1 was then carried out over the interval 1205.8m to TD to assess shows and porosity in the Red Heart Dolomite. 4.4bbl water and 21bbl drilling mud were recovered. Wireline logs were run and the well was plugged and abandoned as a dry well. The rig was released on the 18th September, 1988.

2. GENERAL DATA

2.1 Permit

EP 12, Northern Territory

2.2 Permit Holder & Operator

Pacific Oil and Gas Pty Limited
826 Whitehorse Road, Box Hill, Victoria 3128

2.3 Well Type

Deep stratigraphic test

2.4 Objectives

Lower Arrinthrunga Formation
Unnamed Middle Cambrian carbonates

2.5 Location & Elevation

Latitude 22 50 16.0 S
Longitude 137 01 02.8 E

AMG coord 707 028m E
(Zone 53) 7 473 014m N
Elevation 279m AHD
Drill floor +2.5m AGL

The location was measured by McKimmie Jamieson & Partners Pty Limited, surveyors, using satellite fixing.

2.6 Dates & Durations

Precollar spudded	11.08.88
Precollar completed	11.08.88
Precollar re-entered	0600 hrs on 16.08.88
TD reached	1015 hrs on 14.09.88
Plugged & abandoned	1200 hrs on 18.09.88
Re-entry to TD	30.2 days
Re-entry to P & A	34.2 days
Down time	23.5 hrs

2.7 Total Depth & Status

Total depth (driller) 1234.3mRT
Total depth (logger) 1234.0mRT
Status - plugged and abandoned as a dry well

2.8 Water Supply

Drilling water was obtained from a station cattle bore "Camel Bore" (RN 14028) located approximately 800m east of the well site. A water bore drilled at the well site failed to find sufficient water for drilling or consumption and was abandoned at 105m because of caving.

2.9 Principal Contractors

Precollar drilling	Gorey & Cole Drillers
Rotary & core drilling	Rockdril Contractors Pty Limited
Drillstem testing	Australian DST Pty Limited
Mud Chemicals	Milpark Australia Pty Limited
Wireline logging	BPB Instruments (Aust) Pty Limited
Mudlogging	Gearhart Geodata Pty Limited
Velocity Survey	Velocity Data Services Pty Limited

2.10 Costs

Drilling and other contractors	\$379 233
other (vehicles, rentals, analyses, etc.)	\$ 72 234
total well cost	\$451 457

3. DRILLING

3.1 Drilling Summary

The Hacking No 1 precollar was drilled on the 11th August 1988 using Gorey and Cole Rig 3, a modified Ingersoll - Rand TH60. 12 1/2" hole was air drilled to 15mBGL and 10" PVC conductor run. 8 1/2" hammer air/foam drilling extended the hole to 80mBGL. lost circulation occurred from 45 to 80m.

Rockdril Rig 20, a Longyear 600 Coremaster, entered the precollar at 0600hrs on the 16th August with 8 1/2" HTC F3 bit No 1 on a drill collar. A bridge was tagged at 43.9mDF and the hole was reamed from 43.9 to 82.0m with no returns to surface. New hole was drilled to 87.5m without returns. A Rapidgel pill was pumped and on POOH the pipe stuck at 32m. An initial attempt to backream, pouring deisel and Millfree down the annulus was not succesful. Reaming and backreaming from 36m and pouring water and Newdrill down the annulus was successful. The hole was then succesfully reamed to 87.5m. Circulation was maintained for 15mins, the bit POOH and the bottom hole assembly broken down.

Two joints of BTC and 5 joints of 8 round K55 23ppf 7" casing were run and the casing shoe landed at 85.9m. 8.8bbbls of 15.6ppg class A cement were pumped and displaced. Following WOC for 11.5 hrs the BOP's were nipped up, the bottom hole assembly made up, RIH with cup tester and the BOP stack and valves successfully tested to 1500psi, and the hydril tested to 1000 psi.

Bit No 2, an SEC S84F, was RIH, float, cement and shoe drilled out, and 6" hole drilled in new formation to 89.0m. A formation integrity test leaked off at 180psi applied surface pressure equivalent to a mud weight of 11.8ppg. 6" hole was drilled to 251.0m encountering lost

circulation at 148m, remedied by addition of mica LCM which resulted in 80% returns. The deviation at 250m was 30.

The drill string was POOH, pipe laid down and wireline logs run. Logging took 8 hrs. Following a Rapidgel sweep, 13ppf K55 5" casing was run, landed at 249.63m and cemented with 52 sacks of class A cement. Following WOC for 15hrs the CHD101 string was RIH with cup tester and the BOP's tested. 4 1/4" Bit No 3 was RIH and cement only drilled out before carrying out a leak off test. A core barrel and Bit No 4 (4.33" Longyear 8 step diamond) were RIH and cored out remaining cement, casing shoe and new formation to 252.9m where the bit stopped cutting and another leak off test was carried out. There was no leak off at a surface pressure of 520psi, equivalent to a mud weight of 20.3ppg.

Bit No 5 (4.33" Longyear 8 step) was RIH and CHD101 coring commenced. By 670m the deviation had increased to 70 and at TD was 100. Bit No 6 was run at 509m, Bit No 7 at 755m and Bit No 8 (rerun Bit No 6) at 789m. All were Longyear 8 step. Bit No 9, a Longyear 4 step was RIH at 915m and drilled to TD. A major breakdown of the rotation gearbox at 789m on the 1st September resulted in 22hrs lost time.

1234mTD was reached on the 15th September and a bottom hole DST No 1 was carried out from 1209.75 to 1233.95m. the DST was completed in 15 hours. Wireline logs were run, including a velocity survey. Total logging time was 46.5 hrs.

Abandonment commenced at 1430hrs on the 18th September. Plugs were set at 1234 - 1174m to seal porosity in the Red Heart Dolomite, at 460 - 400m to seal porous basal lower Arrinthrunga sands, at 280 - 213.5m to seal across the 5" casing shoe, and a surface plug was set at 12.5m - surface. Plug No 3 was tagged at 1000lbs. The rig was released at 1200hrs on the 18th September.

3.2 Operation Times

Drilling	49.0 hrs
Coring	437.0
Tripping	49.25
C & C	4.0
Reaming	26.75
Casing	7.5
WOC	28.0
DOC	4.75
BOP	10.5
Surveys	9.25
Rig	15.5
Logging	48.0
DST	15.0
Pulling Tube	8.0
Repairs	24.5

3.3 Lost Time

Rig breakdowns 24.5 hrs

The principal cause of breakdowns was the large number of rig operational hours since major overhaul. The main breakdown was in the rotation gearbox (21.5 hrs)

Reaming precollar 40 hrs

Considerable difficulties were experienced re-entering the precollar which was a very poor hole.

Dumping mud 1.5 hrs

Core recovery problems 14.25 hrs

Core recovery problems were not excessive and were usually caused by a stuck core tube.

Wireline logging problems 9 hrs

The principal delay was caused by problems with recording electronics in the logging truck.

3.4 Drilling Rigs

Precollar: Gorey & Cole Rig 3, Ingersoll-Rand TH-60
main hole: Rockdril Rig 20, Longyear 600 Coremaster
(full details are included in Appendix V)

3.5 Drilling Methods

Precollar: airhammer/foam (surface to 251m)
main hole: rotary/continuous diamond coring (251-1234m)

3.6 Casing Program

hole size (ins)	8 1/2	6	4.35
depth (mDF)	87.5	251.0	1234.0
casing size (ins)	7	5	-
casing type	BTC	FL45	-
casing weight (ppf)	23	13	-
casing grade	K55	K55	-
casing depth (mDF)	85.9	249.6	-

3.7 Drilling Fluids

A bentonite mud system was used from precollar to 251m. The mud system was then displaced to Newdrill - New Vis - CMC polymer with a water spacer. Mud properties specified were:

weight	<9.0 ppg
viscosity	>36 secs
water loss	<12 ml

3.8 Surveys

Hole deviation was measured by Eastman camera. Specified maximum hole deviation was 50. The following deviation surveys were carried out:

147m	2 1/2o	830m	9o
350	misrun	885	9o
470	4o	912	misrun
670	7o	930	9o
700	misrun	1028	10o
710	7o	1080	93/4o
770	7 1/2o	1138	10o
789	8 1/2o	1195	10o

The high deviation was caused by steeply dipping strata

3.9 Completion

Hacking No 1 was plugged and abandoned as a dry hole between 1430 hrs on 17.09.88 and 1200 hrs on 18.09.88. Four abandonment plugs were set at the following depths:

plug 1	1234 - 1174m	
plug 2	460 - 400	
plug 3	213.5 - 280	Tagged
plug 4	12.5 - 2.5	

A schematic plan of abandonment is included in Appendix IV

4. FORMATION EVALUATION

4.1 Mudlogging

Precollar air drilled cuttings were collected every 2m and examined by handlens. Mudlogging services for the rotary and diamond drilling were supplied by Gearhart Geodata Pty Ltd (monitoring instruments mounted in a caravan, plus one mudlogger). Rotary drilled cuttings were caught and washed every 2m, and described following examination under low power binocular microscope and ultra-violet light. Cuttings descriptions are included in Appendix I. Ditch gas values and C1-C5 breakdown were monitored continuously with a Carlo Erba 4200 flame ionisation device. H₂S and ROP were continuously monitored. Duplicate samplex tray samples and duplicate washed and dried cuttings were preserved for future analysis. One set will be forwarded to the Northern Territory Department of Mines and Energy and the other retained by Pacific Oil and Gas.

During CHD 101 continuous coring (251.35-TD1234m) gas was continuously monitored and core was described and examined by the well-site geologist for porosity and fluorescence immediately following recovery. Chip samples of core were collected every 2m and preserved in samplex trays. A mudlog (scale 1:500, see enclosure II) was constantly updated with cuttings/core descriptions, ROP, and mud gas. All core is currently stored in galvanised iron core trays at the Pacific Oil and Gas office in Alice Springs. Results of core analyses, petrophysical determinations and petrology are included as Appendices VII and IX.

4.2 Wireline Logging

Wireline logging services were supplied by BPB Instruments (Australia) Pty Limited using slim-hole equipment mounted in truck No V331. Logs were run prior to running 5" casing and at TD following DST 1. Logging tools run were Self Potential (SP), Dual Focused Electric (DFE), Density-GammaRay-Caliper (DD3), Dual Spaced Neutron-GammaRay (NN1), Gamma-caliper-Multichannel Sonic (MSI) and Dipmeter (DIP). A bottom-hole maximum recording thermometer was also used.

Suite 1 (57/8" hole)

SP	250-87.5m
DFE	248-87.5m
DD3	249-surface
MSI	249-87.5m

Suite 2 (4.35" hole)

SP	1234-243m
DFE	1232-243m
DD3	1232.5-240m
MSI	1232-243
DIP	1234-249
NN1	1231.5-243

Three quarters of an hour was lost in working the sonic tool through thick mud near the bottom of the hole. A full set of wireline logs is included in enclosure III.

Bottom hole temperatures were measured during both logging suites. A plot of the temperature data is included in Appendix XII and provides a calculated geothermal gradient of 3.08oC per 100m.

4.4 Testing

One drill stem test (DST 1) was carried out by Australian DST Pty. Ltd at TD before wireline logging. DST 1 was carried out over the interval 1205.8-1234m to assess oil shows in fractured Red Heart Dolomite and recovered 4.4 bbl water. Approximately 21 bbl of drilling mud entered the drillstring through a leaking joint during the test.

Initial flow	11 minutes
Initial shut-in	60 minutes
Final flow	120 minutes
Final shut-in	120 minutes

Derived reservoir properties were

Permeability	1.3md
Total skin	-0.9
Reservoir pressure	1624 psia @ 1231.95mRT

It was concluded that the reservoir properties were caused by natural fracturing of the Red Heart Dolomite. An analysis of the well test data by Mitchell Petroleum Services is included in Appendix X.

4.4 Velocity Survey

A velocity survey was conducted at TD by Velocity Data Services using BPB wireline. A total of 21 levels were recorded. Because of a failure in the logging truck recording electronics, shots could not be recorded on tape

and only analogue data were recorded. Although data quality was poor, a reliable synthetic seismogram was generated from the analogue data. Survey data and a synthetic seismogram are included in Enclosure IV.

5. GEOLOGY

5.1 Objectives

Hacking No 1 was sited to assess the source rock and reservoir potential of the Cambrian Georgina Basin sequence near the faulted southern margin. The well was located near a postulated intersection of an eastern extension of the Beantree Anticline and a smaller secondary anticline off the northern flank of an east-northeast trending basement high.

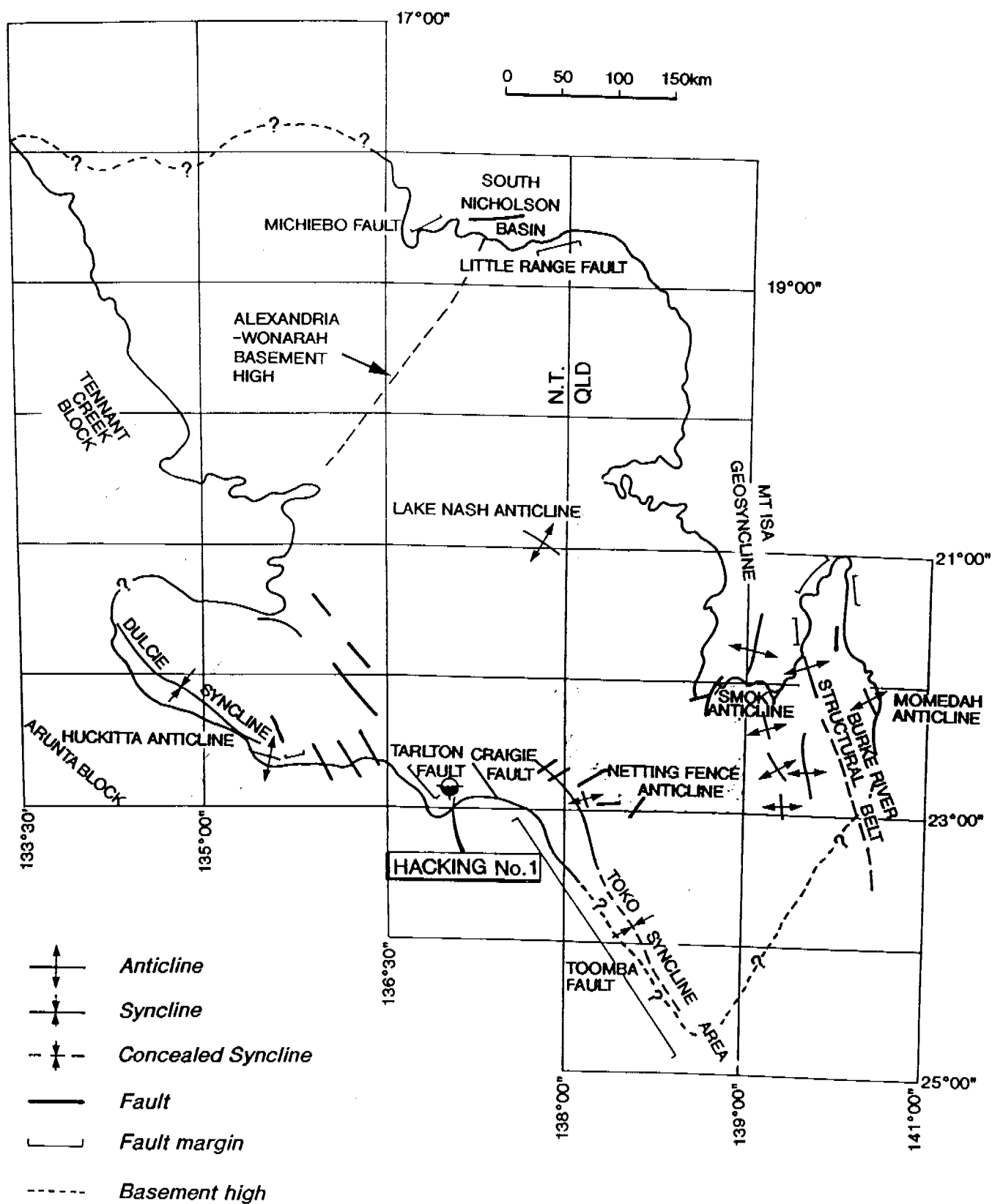
Potential reservoirs were anticipated within the lower Arrinthrunga Formation and in possible Middle Cambrian siliclastics and shoal carbonates (laterally equivalent to the Arthur Creek Formation), deposited in a higher energy environment which could be expected to flank the postulated basement high.

An important secondary objective of Hacking No 1 was to further assess maturation trends along the southern margin of the basin.

Objectives Lower Arrinthrunga Formation
 Middle Cambrian carbonate shoals

5.2 Geological Summary

The well was spudded in Mesozoic sandstone and claystone 48m thick, overlying upper Arrinthrunga Formation. The uppermost 23m of Arrinthrunga Formation consists of weathering profile rubble and limonite stained clay. Light to medium grey, intensely recrystallised calcarenite and calcilutite predominate below the weathered zone. Continuous coring commenced at 251.35mDF in the lower portion of the upper Arrinthrunga Formation carbonates which are thinly bedded dolomitic limestone and rare calcareous mudstone.



GEORGINA BASIN
Main structural features

(After Draper et al., 1978)

Figure 3

Pacific Oil & Gas Plan No.588

The Eurowie Sandstone Member was intersected at 269.0m, 19m below the prognosed depth. This silica and dolomite cemented fine to medium grained sandstone with intraclastic dolomite interbeds is 29.5m thick (about half that prognosed).

The lower Arrinthrunga Formation was intersected at 298.5m. It is pervasively recrystallised, often dolomitised and stylonodular. Light grey to light brown stylonodular dololutite with 1-2m interbeds of dolorudite, representing higher energy shoaling, form the uppermost 75m. Below this depth dolarenites with occasional stromatolites, intraclast breccias and oil stained oolites increase in abundance downwards to 436m. Between 436 and 448m stylonodular dololutites dominate over dolarenites and minor stromatolites. Vuggy intraclastic calcarenite and dolarenite, subordinate dololutite, rare oolites and large stromatolites, were intersected between 448 and the bottom of the lower Arrinthrunga Formation. The higher energy facies comprises approximately 10-20% of the section and generally occurs in relatively thin (1-2m) coarsening upwards cycles. The basal 31m is characterised by interbeds of coarsening upwards calcite and minor coarse peloidal grainstones and dolomite cemented feldspathic quartz sandstone. The intersected thickness of the lower Arrinthrunga Formation was 453.5m (apparent dip 10o-15o, including hole deviation).

The Arthur Creek Formation was intersected at 752.8m. This formation was not prognosed because it was considered that laterally equivalent higher energy sediments, the "unnamed" shal carbonates, would be found this far south in the basin where gravity and magnetic data indicated shallowing basement. The postulated basement high does not exist in the vicinity of the well and normal Arthur Creek Formation was intersected. Fine to medium grained partly phosphatic bioclastic and intraclastic calcarenite and interbedded dark grey calcilutite and minor quartz sandy limestone become more stylonodular with depth. The basal 142m of the Arthur Creek Formation is dominantly a very dark grey stylonodular calcilutite, rich in organic matter and finely disseminated pyrite. The interval 1188 - 1210m averages 2.4% TOC. Organic content decreases upwards from this interval as stylonodular calcilutites increase in abundance. Dips change from 10o south to 2 - 3o west across a low angle fault intersected at 810m.

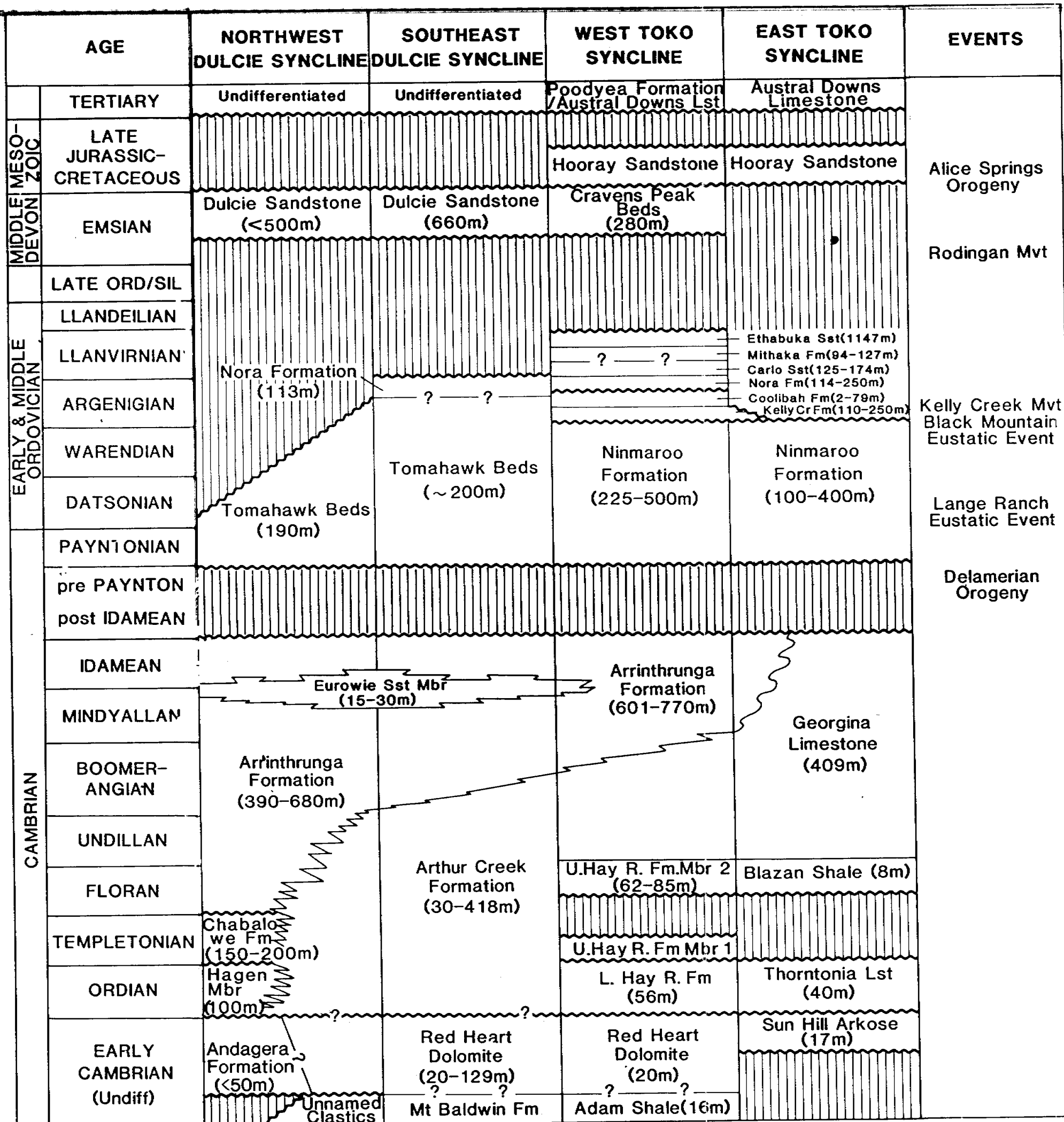



FIG.4

<div>  Pacific Oil & Gas Pty Limited </div>			
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

Red Heart Dolomite, also not prognosed, was intersected between 1209.9m and basement (1221.9m). The lithology is fine to coarse grained intraclastic peloidal dolograine and dolomicrite, pervasively and very intensely dolomitised, vuggy, recrystallised, and strongly fractured. Minor oil bleeds and minor porosity (both fracture and intergranular) were observed. A palaeosol or basement wash, between 1220.8 and 1221.9m, overlies basement.

Crystalline basement was intersected between 1221.9m and TD (1234m). Grey-green biotite adamellite is slightly altered and slightly weathered.

The presence of un-prognosed Arthur Creek Formation and Red Heart Dolomite increased the depth to basement from the prognosed depth of 800m to 1222m and TD from 850m to 1234m.

Wellsite lithological descriptions by interval are included as Appendix I. Thin section descriptions and photomicrographs of samples of lower Arrinthrunga Formation, Arthur Creek Formation, Red Heart Dolomite and basement, by K.R. Martin, are included as Appendix IX.

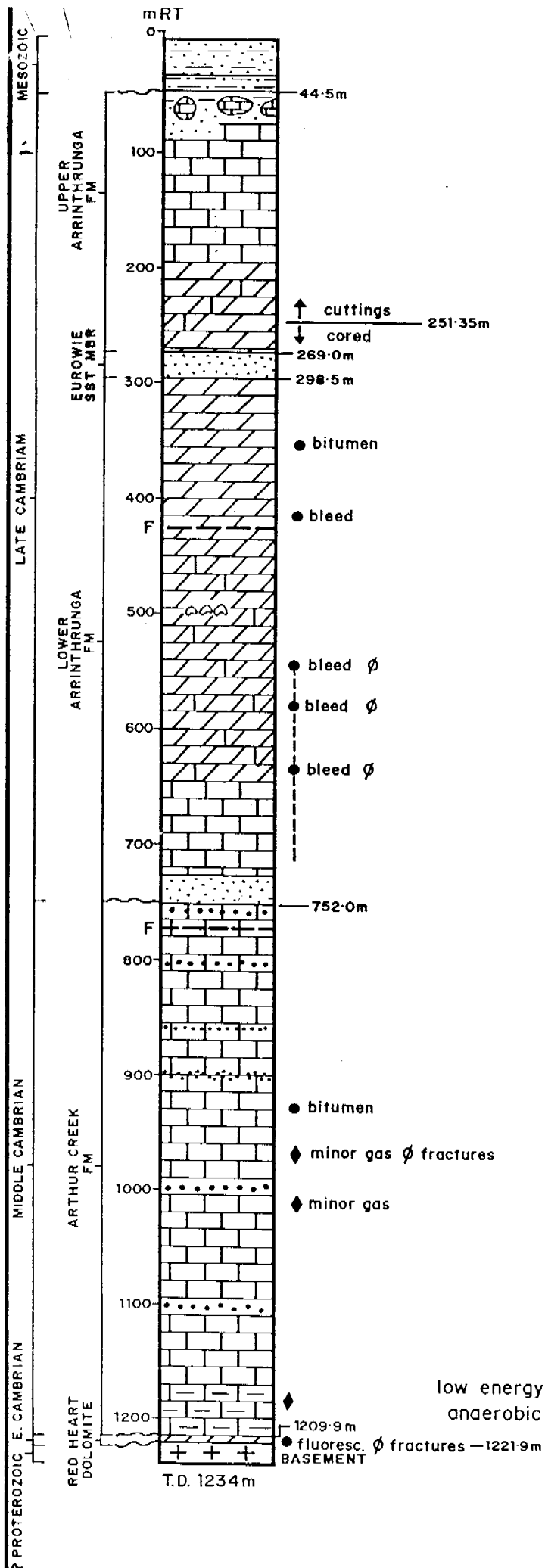
5.3 Stratigraphy

formation	age	top(mDF)	thickness(m)
-	Recent	2.5	1 m
-	Mesozoic	3.5	44.5
Arrinthrunga(upper)	U.Cambrian	48.0	221.0
Eurowie Sst Member	U.Cambrian	269.0	29.5
Arrinthrunga(lower)	U.Cambrian	298.5	454.3
Arthur Creek Formation	M.Cambrian	752.8	457.1
Red Heart Dolomite	E.Cambrian	1209.9	12.0
basement granite	Proterozoic	1221.9	-

note: thicknesses are uncorrected for dip and significant hole deviation (see BPB dipmeter log - Enclosure III and section 3.8).

5.4 Porosity and Permeability

All but 30m of the pre Mesozoic sediments penetrated were carbonates of very low porosity. All of the carbonates are extensively recrystallised and very often dolomitised and no primary porosity has survived. All have complex diagenetic histories involving cementation, neomorphic



Pacific Oil & Gas Pty Limited			
HACKING No. 1			
ACTUAL SECTION			
REF.			
SCALE		DRAFTING	M. Bayly
AUTHOR	G. Weste	REPORT	303526
DATE	May '89	PLAN No.	PetNTcw3041

recrystallisation and replacement, dolomitisation and dissolution. These diagenetic changes have largely destroyed original rock fabrics complicating identification of original grain packing and porosity (e.g. whether the rocks were originally grain or matrix supported).

Although neomorphic aggradation is evident in thin-section in the recrystallisation of micritic allochems to microspar, and some fossils and ooids to spar, the texture of most of the peloidal grainstones suggests that they were largely grain supported and were probably deposited as moderate to well sorted, porous grainstones. Most of the sparry calcite appears to be cement, and neomorphic spar formed from micritic matrix is probably not widespread.

Dolomitisation is also widespread, particularly in the Red Heart Dolomite and the Arrinthrunga Formation. It occurs as apparently late diagenetic coarse grained crystals partly filling large vuggy pores and veins and replacing calcite.

Most of the carbonates contain small amounts of secondary porosity, usually less than 3%, generally associated with dissolution of dolomite or as inter-crystalline porosity resulting from dolomitisation. Dissolution of sparry calcite has also resulted in very minor porosity. The porosity is generally confined to isolated pores and vugs which, although often quite large, lack interconnection resulting in very low permeabilities.

Calcareous and dolomitic sandstone at the base of the Arrinthrunga Formation has 14.5% visible porosity (measured by thin-section point counting). The porosity is all secondary resulting from dissolution of carbonate cement. This rock should have a very good permeability.

Nineteen samples were submitted to Core Laboratories for routine core analysis. The results are included as Appendix VII. Measured Helium porosities ranged from 1.0% to 20.6% and horizontal permeabilities from <0.1md to 155md).

The most porous and permeable samples were:

depth (mDF)	formation	lithology	He porosity (%)	horizontal permeability (md)
630.64	1. Arrinthrunga	friable lst	20.6	39.0
657.10	"	calcarenite	9.8	20.0
1211.45	Red Heart Dol	dolograinstone	3.7	155

The basal Arrinthrunga Formation was not submitted for analysis.

Although the sediments are generally of very low porosity and negligible permeability the various studies show that reservoir potential exists over small intervals in the lower Arrinthrunga Formation and in the Red Heart Dolomite. The Eurowie Sandstone Member also has reservoir potential.

5.5 Source rocks

Core samples were submitted to Amdel Laboratories for analysis of their source rock potential. The results are included in Appendix VIII. TOC values of up to 4.14% were measured in very dark grey calcilutites from the lower portion of the Arthur Creek Formation. Rock Eval pyrolysis data and a modified Van Krevelen plot indicate that the organic matter is mature to overmature and gas prone. Tmax values appear to be suppressed by the presence of migrated hydrocarbons.

5.6 Hydrocarbons

Although no hydrocarbons flowed from the well and a drill stem test failed to recover hydrocarbons, a number of minor oil and gas shows encountered.

Eurowie Sandstone Member

Possible minor bitumenous residues were observed in intergranular porosity in sandstone where silica cement has been removed by secondary solution. The bitumen did not show any natural fluorescence or crush cut.

Lower Arrinthrunga Formation

Heavy oil bled from fine secondary porosity in intraclastic dolarenites and minor calcarenites. The oil bleeds were very minor to fair and were scattered through the unit, becoming more abundant towards the base. The oil fluoresced yellow to yellowish brown, gave a strong yellow white streaming cut and brown residual ring. Samples were sent to Amdel Laboratories for analysis. Bitumenous residues occurred throughout the unit.

Arthur Creek Formation

Background gas values were highest in the Arthur Creek Formation and the darker intervals liberated a faint bitumenous odour. Minor gas shows (up to 27 units against a background of 1.5 units), contained a significant C3 and C4 component. Very minor bitumen staining and dull yellow fluorescence were also observed. The lithology of the formation and the nature of the shows are characteristics of a source rock. Samples were submitted for source rock analysis.

Red Heart Dolomite

Minor oil shows were observed in fine secondary porosity. Minor heavy oil bled from cores and fluoresced bright yellow. The hydrocarbons were apparently residual, but may have been derived from the overlying Arthur Creek Formation.

Basement

Hairline fractures in the basement granite fluoresced yellow indicating minor downwards movement of hydrocarbons from overlying formations.

5.7 Show Descriptions

interval (mRT)	description	gas/bkgrnd (ppm)
269-298.5	?bitumenous residue in 1-2m sandstone intervals with remnant porosity.	C1 0/50
365-368	Heavy trace black bitumenous residue adhering to pore spaces over .5m recrystallised dololomite with trace intercrystalline porosity and dolarenite with fair porosity.	C1 19/7 C2 1/0

414.8-415.2	Heavy oil bleeding from pore spaces, yellow-yellowish brown fluorescence, strong yellow white streaming cut, heavy brown residual ring, in pinhole solution porosity. Also bitumen residue at 376.0-376.1m, 399.0m.	C1 110/10 C2 40/0 C3 7/0 C4 22/0
475.3-493	Occasional 1-10cm zones of black bituminous residues. Yellow cut after prolonged solution in trichlorethane. Trace-good porosity.	
502	Bitumen bearing stromatolite	C1 115/24 C2 42/0 C3 8/0
505.5-506	Trace bleeding oil in pinhole porosity in intraclastic dolerudite.	C1 115/24 C2 33/0 C3 6/0 C4 15/0
557.0-557.3	Trace bleeding oil from trace pinhole porosity.	
558.9-559.2	Yellow brown oil bleed from fair inter-granular porosity.	C1 20 C2 tr
576.8-576.9	Very minor oil bleed from pinhole porosity.	C1 99/20 C2 15/3 C3 34/tr C4 17/0
583.4-583.6	Oil bleed as for 558.9-559.2m	C1 89/20 C2 16/1 C3 34/0 C4 2/0
596.55- 596.75	Poor oil show in thin layer with pinhole porosity	C1 64/11 C2 12/tr C3 45/tr C4 17/tr
630.6-630.8	Very minor dull yellow brown oil bleed from sandy friable porous sandstone.	nil
642.3-642.5	Oil bleed and fluorescence from intergranular and solution porosity.	

644.5	Solution channel in generally non porous calcirudite.	C1 45/7 C2 16/0 C3 3/0
651.6	As above	C1 61/7 C2 14/0 C3 3/0 C4 9/0
667.8-668	Trace bleeding oil from rare fine solution porosity	C1 7/tr
707.5-707.6	Trace bleeding oil from pinhole porosity and bitumen residue.	C1 28 C2 6 C3 tr
686.4,694.6 695,695.6	Trace oil bleeds as above, fluoresce mustard yellow with bright blue halo.	C1 6-11
931.0-932.5	No visible show or fluorescence.	C1 290/20 C2 68/7 C3 19/0 C4 13/0
937.3-937.5	Minor bitumen stain.	C1 9/2 C2 2/1
993	Slight gas bubble from microfractures in 10cm coarse peloidal grainstone. No fluorescence.	C1 1051/450 C2 225/70 C3 76/20 C4 18/2
1013	No visible show. Thin bedded calcilutite with no visible porosity.	C1 3984/238 C2 1125/48 C3 262/14 C4i119/6 C4n38/tr C5 9/0
1104.03	Dull yellow fluorescence in peloidal grainstone.	
1209.8- 1218	Minor spotty bright yellow fluorescence, instant milky white cut and strong residual ring.	C1 541/6 C2 36/tr C3 29/0 C4i17/0 C4n9/0 C5 15/0

1218-	Trace bright yellow fluorescence, fast	C1 200/130
1220.8	cut from trace heavy oil bleeding from	C2 21/6
	pinhole porosity and fine fractures.	C3 14/1
		C4 5/tr
1221.9-	Trace yellow fluorescence as above, in	C1 31/4
1224	hairline fractures in weathered basement.	C2 3/0
		C3 tr/0

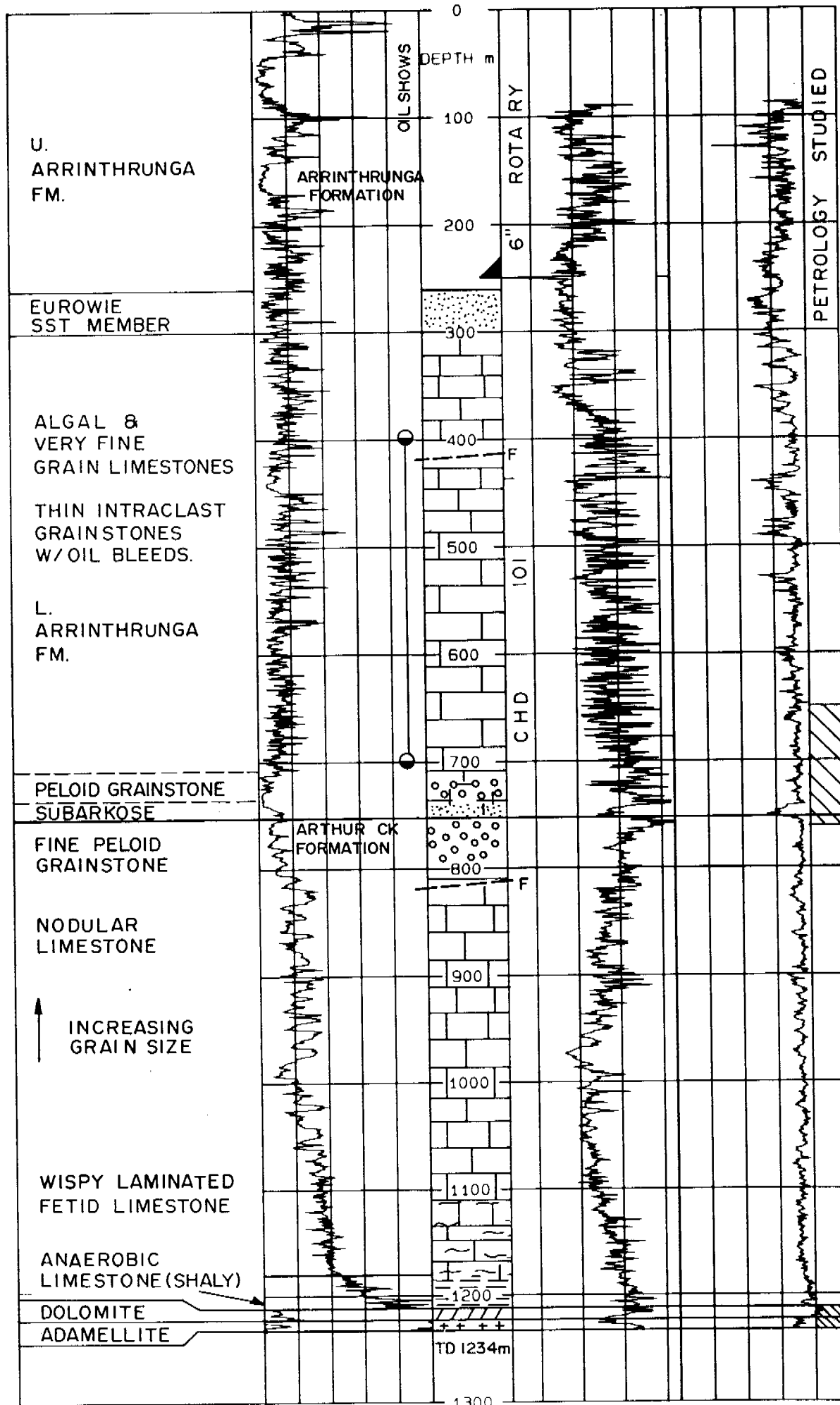
5.8 Palaeontology

Samples of core have been sent to the BMR in Canberra for palaeontological studies which are still in progress at the time of writing. When received the results of the studies will be forwarded for inclusion in this report.

HACKING No. 1 STRATIGRAPHIC COLUMN

FIG. No. 1

0 γ API 300 2 Rd Ω M 20000 1.96 Pb G/CC 2.96



Pacific Oil & Gas Pty Limited			
HACKING No. 1			
STRATIGRAPHIC COLUMN			
REF.	SCALE	DRAFTING	Duo Drafting
AUTHOR	G. W. K.	REPORT	303690
DATE		PLAN NO	PetN Tew 3072



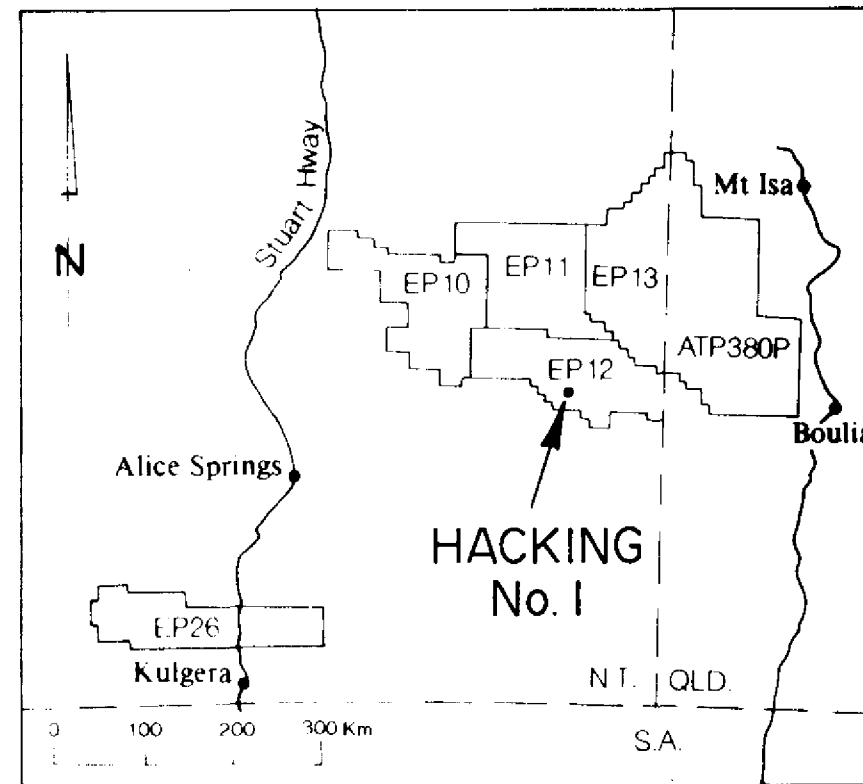
Pacific Oil & Gas Pty. Limited

Stratigraphic Column

Basal Arrinthrunga Formation

HACKING No. 1

FIG. No. 2



GEOLOGICAL SYMBOLS

Conglomerate	Ooids	Slumping
Sandstone	Peloids	Boudinage
Siltstone	Glauconite	Cracking
Claystone	Intraclasts	Dewatering
Limestone	Fossil Fragments	Ripple Marks
Dolomite	Lithic Grains	Cross Bedding
Chert	Feldspar	Oxidation
Anhydrite	Mineralisation	Bioturbation
Volcanics	Stromatolites	Graded Bedding
Metamorphics	Carbonaceous	Visible Porosity
Plutonics	Stylolites	Flaser Bedding
	Scour & Fill	Flat Pebbles
	Nodules	Formation Dip

ENGINEERING SYMBOLS

Deviation Survey
Casing Shoe
Drill Stem Test
Cement Plug
New Bit
Top of Cement
Sample Point



Pacific Oil & Gas Pty Limited

Ref.			
Scale	1:500	Drafting	Duo Drafting
Author	G.J. WAKELIN-KING	Report	303690
Date	13 / 6 / 89	Plan No.	Pet N Tew 3073

