DEPT. NAT. RES & ENV
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W970. IONA-1. W.C.R. VOL 1 OF 2.

BEACH PETROLEUM N.L.

(Incorporated in South Australia)

PEP 108
OTWAY BASIN

IONA NO. 1

WELL COMPLETION REPORT
TEXT

BY
A. BUFFIN
OCTOBER
1988

BEACH PETROLEUM N.L.

IONA NO. 1

PEP 108 - OTWAY BASIN

WELL COMPLETION REPORT

BY:

ANDREW BUFFIN
OCTOBER, 1988.

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WELL SUMMARY SHEET

PEP 108 OTWAY BASIN IONA # 1 - BEACH PETROLEUM

STATUS: Completed and Suspended as a Gas Well.

LOCATION : Lat 38° 34' 30.46"S
Long 143° 01' 57.33"E
Seismic - SP 235; OB 81A C-62

HOLE SIZE: 12¼" to 247m
8½" to 1490m

ELEVATION : 126.5 G.L. 131.4m KB.
SPUDDED : 22.30 hrs 6 March 1988
RIG RELEASED: 17.00 hrs 23 March 1988

CASING SHOE: 9⅝" to 243.5m
5½" to 1480.6m

RIG : GDSA Rig 2,Superior 700E

ROCK UNIT	KB	SS	THICKNESS	ROCK UNIT	KB	SS	THICKNESS
PORT CAMPBELL LMST	surface	+ 126.5	39	BELFAST	1237	-1105.6	38.5
GELLIBRAND MARL	39	+ 92.4	163	WAARRE Unit D	1275.5	-1144.1	23.5
NARRAWATURK MARL	202	- 70.6	78	Unit C	1299	-1167.6	29
MEPUNKA SST.	280	- 148.6	55	Unit B	1328	-1196.6	38
DILWYN FORM	335	- 203.6	206	Unit A	1366	-1234.6	15.5
PEMBER MEMBER	541	- 409.6	69	EUMERALLA	1381.5	-1250.1	108.5+
PEBBLE POINT FRM.	610	- 478.6	50	TD (DRILLER)	1490	-1358.6	
PAARATTE FORM	660	- 528.6	345	TD (LOGGER)	1487	-1355.6	
SKULL CREEK	1005	- 873.6	132.5				
NULLAWARRE	1137.5	-1006.1	99.5				

LOGS: DLL-MSFL-SP-GR; BCS-GR; SLD-CNS-GR; CIS; FED; CBL-GR; MUDLOG.

TESTS: DST # 1 1292.6m - 1305.5m Flowed at 8.1MMCFD
SFT @ 1406.6, 1390, 1370.5, 1342.5, 1337.5, 1336, 1324, 1321.5, 1316, 1306, 1211.5, 1188 - Sample rec: 1324m.

CORES: 1305.5 - 1314.5m 100% rec.
48 SWC (41 recovered 1 misfire 6 empty)

SUMMARY

Iona No. 1 was the second of a three well, drilling programme in the Otway Basin. Located in PEP 108, the well represented the final farmin commitment for Bridge Oil Limited to earn a 50% equity in the permit.

Participants in the well were, Beach Petrolum N.L., (Operator) and Bridge Oil Limited.

The well was located 10 km. north of Port Campbell and 50 km. southeast of Warrnambool.

The prospect was a seismically defined fault block culmination immediately on the upthrown side of the Sherbrook Trough. Roll over was present at both near top Upper Cretaceous and near base Upper Cretaceous horizons.

The principle target horizon was the near base Upper Cretaceous Waarre Sandstone, secondary targets included the Lower Tertiary Pebble Point Formation, the Upper Cretaceous Timboon Sandstone Member and the Nullawarre Greensand Member.

Drilling commenced on the 6th March, 1988 and reached a total depth of 1490m (KB) on the 17th March, 1988.

A conventional open hole drill stem test was run over the interval 1293m - 1305m, which flowed at 8.1 MMCFD and several SFT intervals were tested. A conventional core was cut over the interval 1305.5m - 1314.5m, with 100% recovery and 48 SWC's were shot.

At total depth, the following wire line logs were run:

DLL-MSFL-GR

BCS-GR

SLD-CNS-GR

CIS

FED

CBL-VDL-GR-CCL

Iona No. 1 was completed and suspended as a potential gas well. The rig was released on the 23rd March, 1988.

CONCLUSIONS

The following conclusions can be drawn from the drilling of Iona # 1.

1. GENERAL STRATIGRAPHY

- Narrawaturk Marl.

The Narrawaturk Marl displays a predominantly argillaceous nature and is distinctly less calcareous at Iona # 1 than in other wells drilled in the Port Campbell Embayment.

- Pebble Point Formation.

The gamma-ray log displays a high gamma ray at the base of the Pebble Point, a coarsening upward sequence to a well developed medial sandstone and an upper Pebble Point characterised by a fining upward sequence toward the basal Pember Mudstone Member. This is typical of a "type 2" response (Buffin, 1987, Port Campbell Embayment Study #1).

- Nullawarre Greensand Member.

The Nullawarre Greensand is present at Iona #1 confirming its extension east of the Port Campbell Anticline. It becomes finer with depth and exhibits a downward increase in glauconitic content. Selected Formation Tests (SFT's) established that it is a tight sandstone having poor reservoir character.

- Belfast Mudstone/Waarre Unit D (Flaxmans)

The combined thickness of these predominantly argillaceous units results in an adequate seal for the underlying hydrocarbons contained within the underlying Waarre Unit C sandstone.

Unit D may represent a transgressive sequence or flooding surface at the top of a tidal channel inlet delta as the channel sands Unit C are overlain by organic shales and sands of the transgression. This is due to either a sea level rise, or a deltaic "lobe switch". Unit D marks the end of an active delta progradation, the coastal wave energy was probably low as there does not appear to be an erosional surface.

- Waarre Unit C

The Waarre Unit C was extensively cored and tested, (Fig. 1). Unit C is present, as predicted, displaying a well developed reservoir sandstone and exhibiting excellent porosity and permeability.

The basal 9m interval of the unit coarsens upward and is overlain by 20m of clean coarse grained sandstone with one major distinctive shale band. Similar characterisitic log responses have been noted throughout the embayment within the Unit C sandstone body eg. North Paaratte #1.

The basal sandstone unit represents a mouth bar deposit coarsening upward to a channel facies of the upper sandstone unit. The shale band may represent an interdistributary bay deposit or tidal flat deposit resulting from lateral channel migration.

The shale is not recognised as having extensive lateral coverage and does not appear to act as a permeability barrier. Pressure data within the gas sands suggests hydrocarbon communication throughout the Unit C sandstone body.

- Waarre Units A and B

Unit B is characterised by a predominant siltstone/shale sequence, one major medial sandstone body is identified. The sandstone is fine grained, moderately hard and has poor visual porosity due to the well developed calcareous cement.

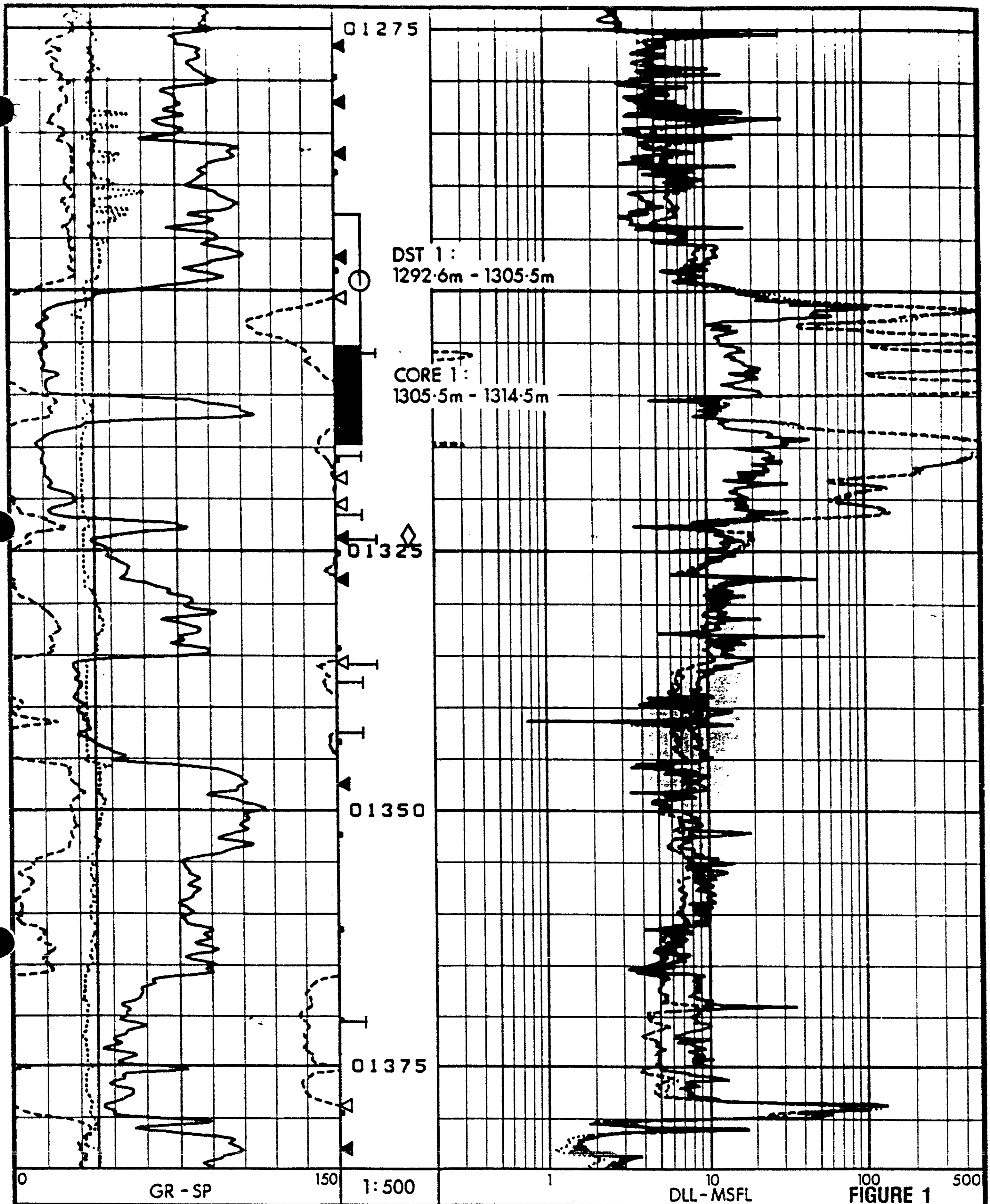

FIGURE 1

Beach Petroleum NL

SFT interval
SWC recovered
SWC no recovery
Fluorescence show

DST & CORE DEPTHS = DRILLERS DEPTHS

PEP 108
IONA-1
CORE AND TEST INTERVALS OVER THE WAARRE FORMATION

AUTHOR: A. BUFFIN   DATE : SEPT. 1988   DRAWN : L.N.

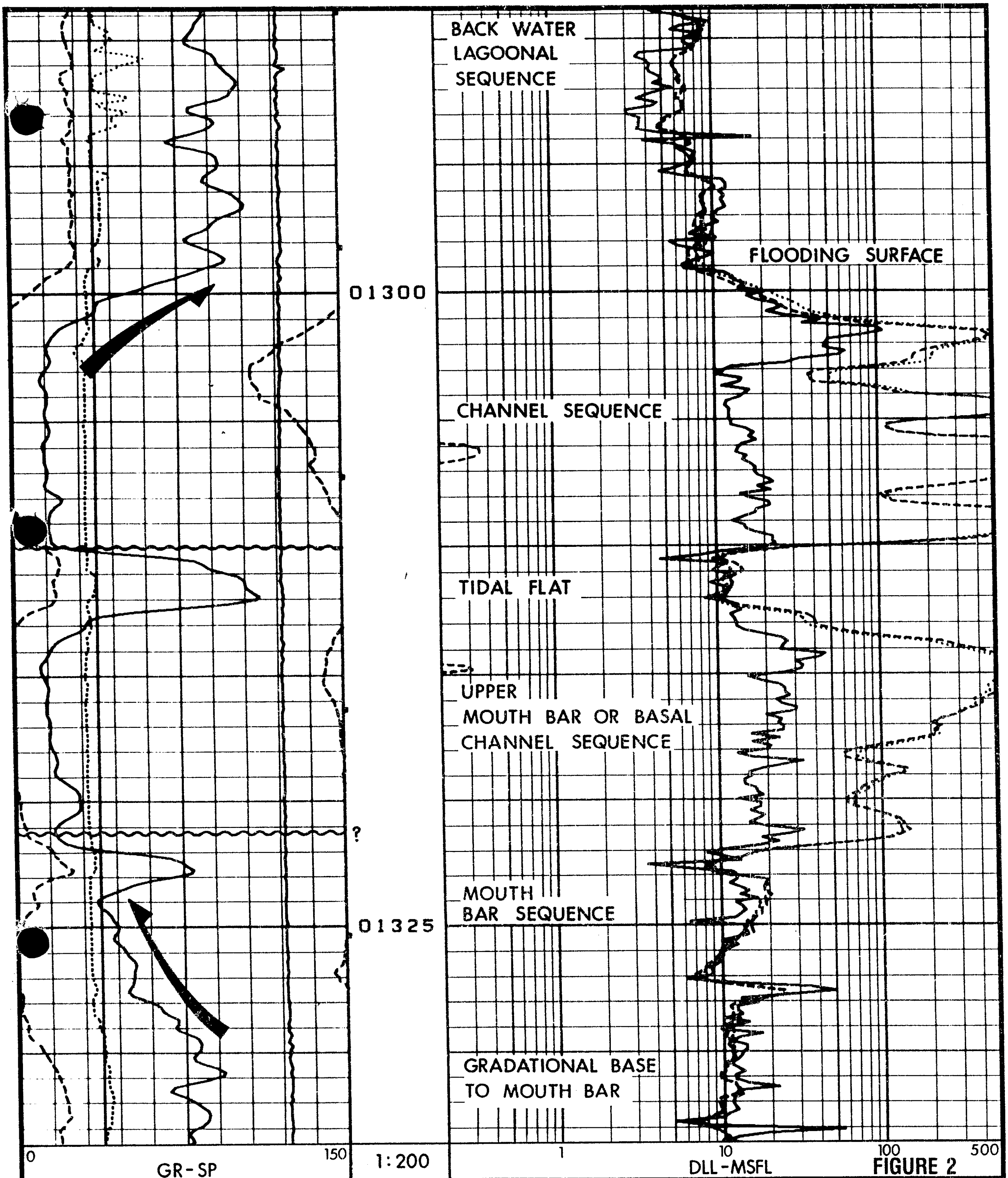

FIGURE 2

Beach Petroleum NL

PEP 108

IONA-1

POSSIBLE SEDIMENTARY SUBENVIRONMENTS SEEN WITHIN THE UPPER WAARRE

AUTHOR: A. BUFFIN DATE: SEPT. 1988 DRAWN: L.N.

Drwg No. OT 4027

Unit A consists of a fining upward sequence with a high resistivity peak that may represent a thin limestone bed, overlying the Eumeralla uncomformity.

SFTs performed within the sandstones of Unit A and B infer a water wet sandstone.

- Eumeralla Formation

The upper (1381.5-1411m) Eumeralla Formation may represent a sequence of reworked sediments being a lithic sandstone rather than more typical claystone. High gas readings (greater than those recorded in the Waarre Unit C) were recorded at 1374m and at 1405m possibly representing a lower gas leg.

Selection Formation Testing over the sequence failed to establish a gas zone and suggested the sequence was tight. It is felt a complete understanding of the lithology was not established, the gas readings may result from a number of thin interbedded sandstone beds not easily identified by the conventional logging tools in the well.

2. MINERALOGY

X-ray diffraction analysis of sediments from Iona # 1 was used to identify clay minerals characterisitic of the various stratigraphic units.

3. PALYNOLOGY

Palynological studies confirmed a number of hiatuses at:

a) Top Dilwyn - Basal Nirranda (Mid and Late Eocene missing).

b) Top Waarre Unit D - Basal Belfast (O. porifera zone missing).

c) Top Eumeralla - Base Waarre Unit A (Cenomanian missing)

A. distocarinatus is not observed at Iona # 1, implying a younger Waarre Formation.

Age dating the upper most Paaratte "Timboon Member" and basal Pebble Point is contentious. Based on the distinctive log character the Cretaceous - Tertiary boundary is placed at 660m, however palynological studies infer a higher Cretaceous boundary within the charactieristic basal Tertiary shales normally attributed to the Pebble Point Formation.

4. SOURCE

The Eumeralla sediments penetrated by the bit were marginally mature for oil and immature for gas. A geochemical evaluation of oil shows observed in sidewall cores from this formation suggest a higher plant source, deposited in oxic conditions. The samples of oil were not biodegraded, nor had they undergone any water washing.

Gas entrapped within the Waarre Unit C sandstone is assumed to be sourced from deeply buried Eumeralla sediments.

5. MIGRATION

Migration probably occured along the Sherbrook Fault Zone. It is assumed deeply buried Eumeralla sediments are mature for gas generation and entrapment has occured within the first strutural culmination on the upthrown side of a major conduit.

6. ENTRAPMENT

Possible entrapment of oil within the Iona structure is observed within the uppermost and lowermost sections of the Waarre Unit C sandstone body.

An MSFL "anomaly" over the uppermost 2m of the Unit C sandstone is coincident with a zone of fluoresence. These two features could imply initial oil entrapment with later flushing by gas so that only a residual oil is now observed.

A minor oil leg may be present beneath the gas cap, however, substanial oil entrapment is not possible in the now almost fully gas saturated structure. This fact is confirmed by log analysis within the basal zone of the Unit C sandstone.

7. REGIONAL SIMILARITIES

A number of regional similarities were noted between log, core and lithological data obtained from the Port Campbell Gas Fields and data from the newly discovered Iona gas field. These similarities confirm the depositional environments and facies observed throughout the Port Campbell Gas Fields extend east toward the Iona region.

8. SEISMIC

Post drill seismic data indicate that the pre-dill top Dilwyn is in fact top Mepunga Sandstone.

The Waarre Formation initially mapped as an upper peak is represented by a lower peak in a charteristic peak-trough-peak sequence.

The Pebble Point Formation is generally difficult to identify accurately when attempting to pick and successfully map the correct seismic horizon throughout the Port Campbell Embayment. This was the case at Iona #1 where the pre-drill seismic pick did not coincide with the post drill geological formation top.

RECOMMENDATIONS

With a sucessful gas discovery at Iona # 1 the following recommendations should be considered for continued future success and development throughout the region.

1. Define and delineate with additional seismic surveys similar "Iona-type" structures:

   a) To the east of the Port Campbell Gasfields along the upthrown side of the Sherbrook Fault Zone.

   b) To the west of the Port Campbell Gasfields along the upthrown side of the Boggy Creek Fault Zone.

   These structures should be matured for drilling.

2. Develop the depostional model of the Upper Waarre in an attempt to predict confidently the location of good reservoir Waarre Unit C sandstone bodies. This should include an attempt to core the entire Waarre Unit C in a future well.

3. Determine the presence of "reworked Eumeralla" sediments. Coring the uppermost Eumeralla may determine if the Upper Eumeralla sediments are a series of thin fine grained interbedded sands with potential oil and gas entrapment.

4. Attempt to establish a regional Rw. Testing has been unable to recover Waarre Formation water, to date Rw values for log analysis have only been estimates.

5. If gas has filled the initial structures immediately on the upthrown side of the major fault zones, oil may be present updip to the north. Structural features immediately updip from the gas accumulations should be defined and drilled for both their oil and gas potential.

1. INTRODUCTION

Iona No. 1 was drilled in the Port Campbell Embayment of the Otway Basin.

The Otway Basin is an east-west trending trough extending from Cape Jaffa in South Australia to the King Island - Mornington Peninsular Ridge. The basin contains up to 8000 metres of late Jurassic to recent sediments and has an areal extent of 105000 square kilometres.

The well was designed to test the hydrocarbon prospectivity of the near base Upper Cretaceous, Waarre Formation.

The prospect was seismically mapped at "near top Dilwyn", "near top Pebble Point" and "near base Upper Cretaceous". Seismic interpretation mapped the Iona prospect as a fault block feature, the structural culmination was formed by rollover into the Sherbrook Fault Zone to the south, and into a fault zone to the north.

Anticipated source rocks, the Belfast Mudstone Member and the Eumeralla Formation, would be mature for hydrocarbons on the downthrown side of the Sherbrook Fault Zone. Vertical migration is proposed along the Sherbrook Fault Zone. Seals are formed vertically by the overlying Belfast Mudstone Member and laterally by the argillaceous Eumeralla Formation.

2. WELL HISTORY

2.1 Location (see Figs. 3 & 4)

Co-ordinates:	Latitude 38° 34' 30.46" S Longitude 143° 01' 57.33" E
Gephysical Control:	Line OB81A-C62 Shotpoint 235 Beach Petroleum N.L. 1981 Curdie Seismic Survey (Reprocessed)
Real Property Description:	Parish of Paaratte Shire of Heytesbury County of Heytesbury
Property Owner:	J. & G. J. Bognar S. Meek

2.2 General Data

Well Name and Number:	Iona No. 1
Tenement:	PEP 108
Operator:	Beach Petroleum N.L. Level 7, 345 George Street, SYDNEY NSW 2000
Participants:	Beach Petroleum N.L. Bridge Oil Limited Westpac Plaza, 60 Margaret Street, SYDNEY NSW 2000

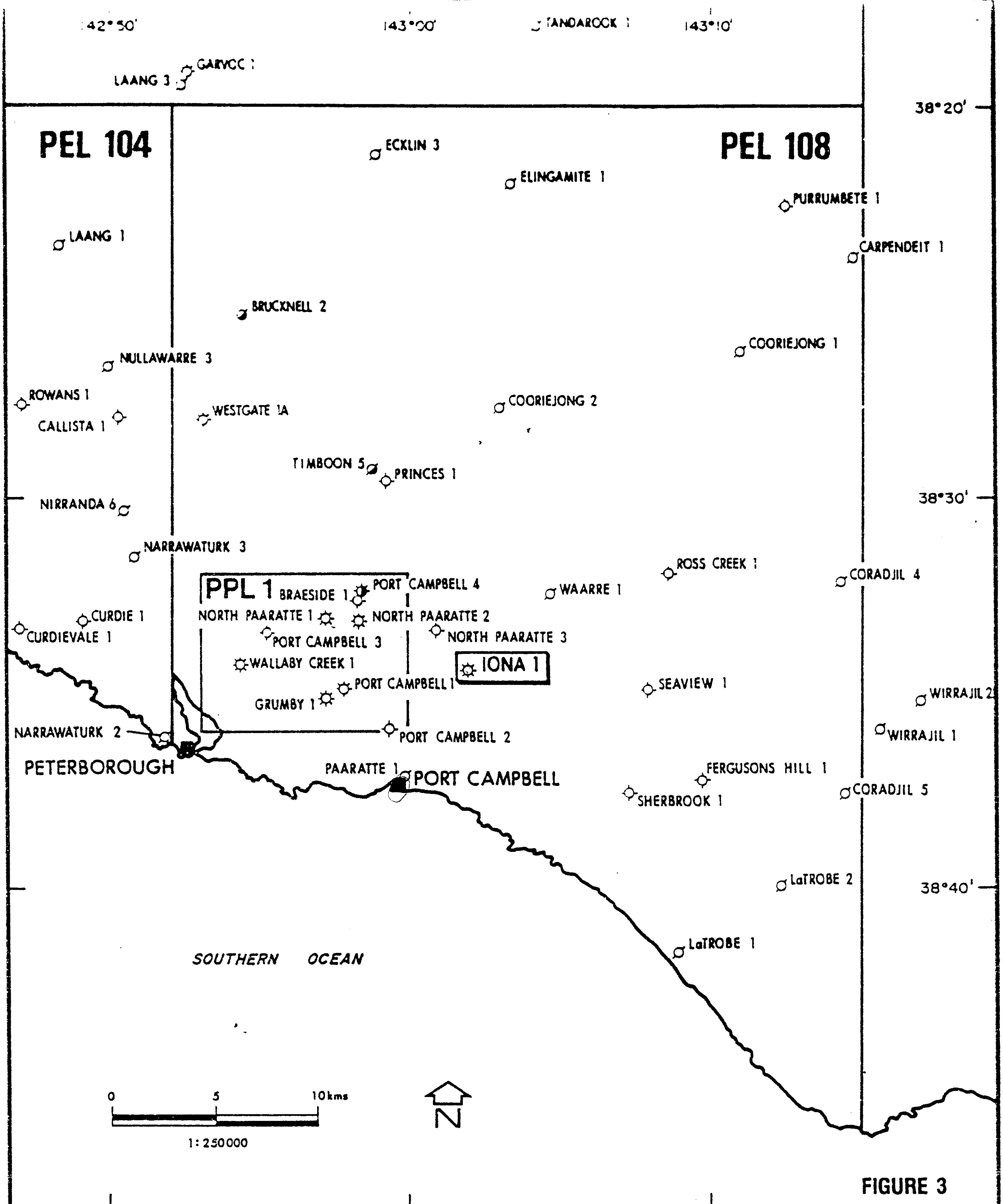

FIGURE 3

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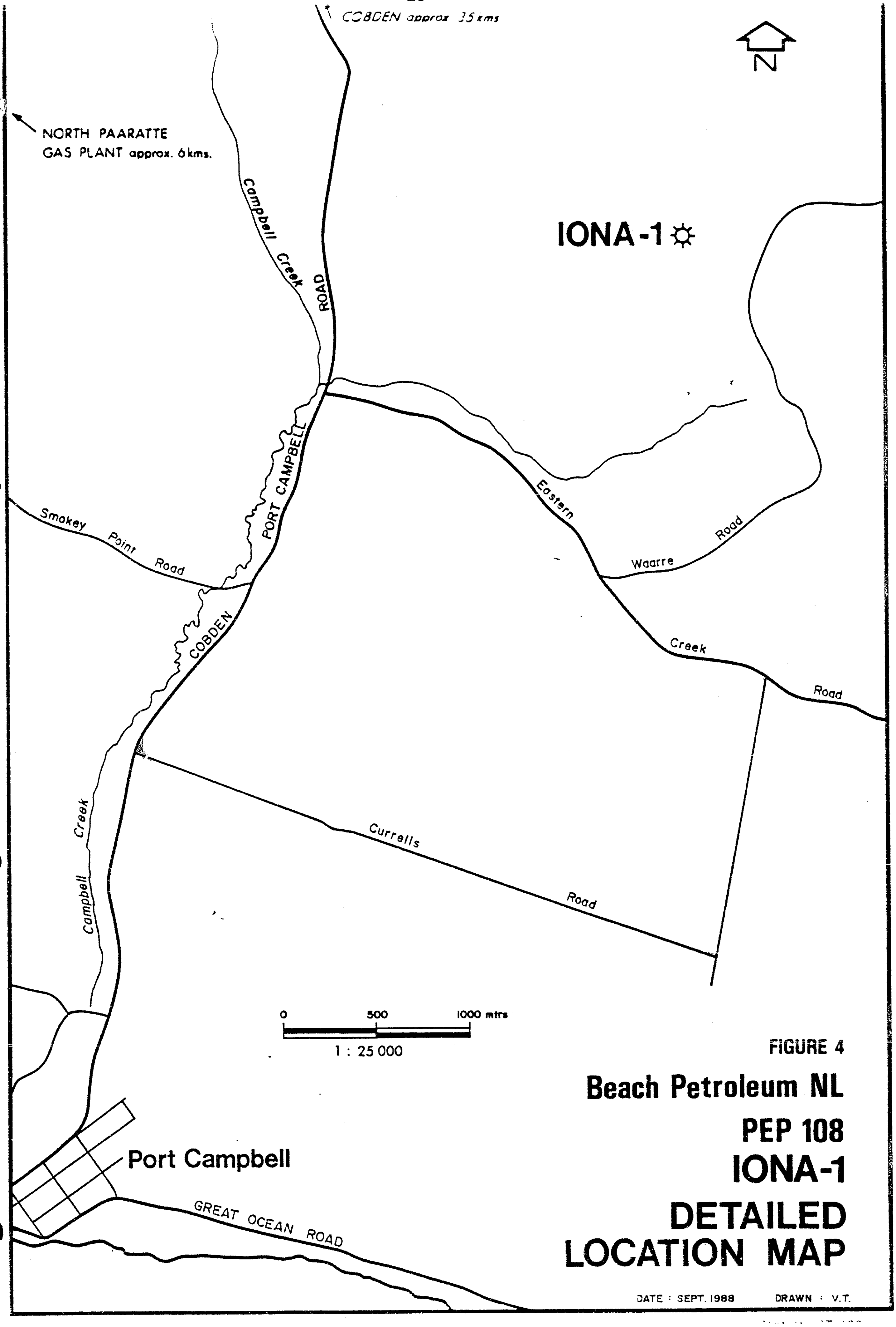
V.D.M.E. Bore
V.D.M.E. Bore with Oil Show
Abandoned with Gas Show
Abandoned with Oil and Gas Show
Gas Well

PEP 108
IONA-1
REGIONAL LOCATION MAP

AUTHOR : A. BUFFIN DATE : SEPT. 1988 DRAWN : L.N.


COBDEN approx 35 kms
N
NORTH PAARATTE
GAS PLANT approx. 6 kms.
IONA-1
Campbell Creek
ROAD
PORT CAMPBELL
COBDEN
Smokey Point Road
Eastern
Waarre Road
Creek
Road
Currells
Road
Creek
Campbell
0
500
1000 mtrs
1 : 25 000
Port Campbell
GREAT OCEAN ROAD
FIGURE 4
Beach Petroleum NL
PEP 108
IONA-1
DETAILED
LOCATION MAP
DATE : SEPT. 1988
DRAWN : V.T.

Elevation:	Ground Level 126.5m AMSL
	Kelly Busing 131.4m AMSL
	(Unless otherwise stated, all depths refer to KB).
Total Depth:	Driller 1490m
	Wire Line Logger 1487m
Drilling Commenced:	6th March, 1988 @ 22.30 hours
Total Depth Reached:	17th March, 1988 @ 08.00 hours
Rig Released:	23rd March, 1988 @ 17.00 hours
Drilling Time to Total Depth:	10.4 days
Status:	Completed and suspended as a gas well.

2.3 Drilling Data (Refer to Appendix 1 and Fig. 5)

2.3.1 Drilling Contractor

Gearhart Drilling Services Pty. Ltd.
5 Westcombe Street,
DARRA QLD 4076

2.3.2 Drilling Rig

G.D.S. Rig 2, Superior 700E

2.3.3 Casing and Cementing Details

Conductor

A 16" conductor pipe was set at 9.5m KB.

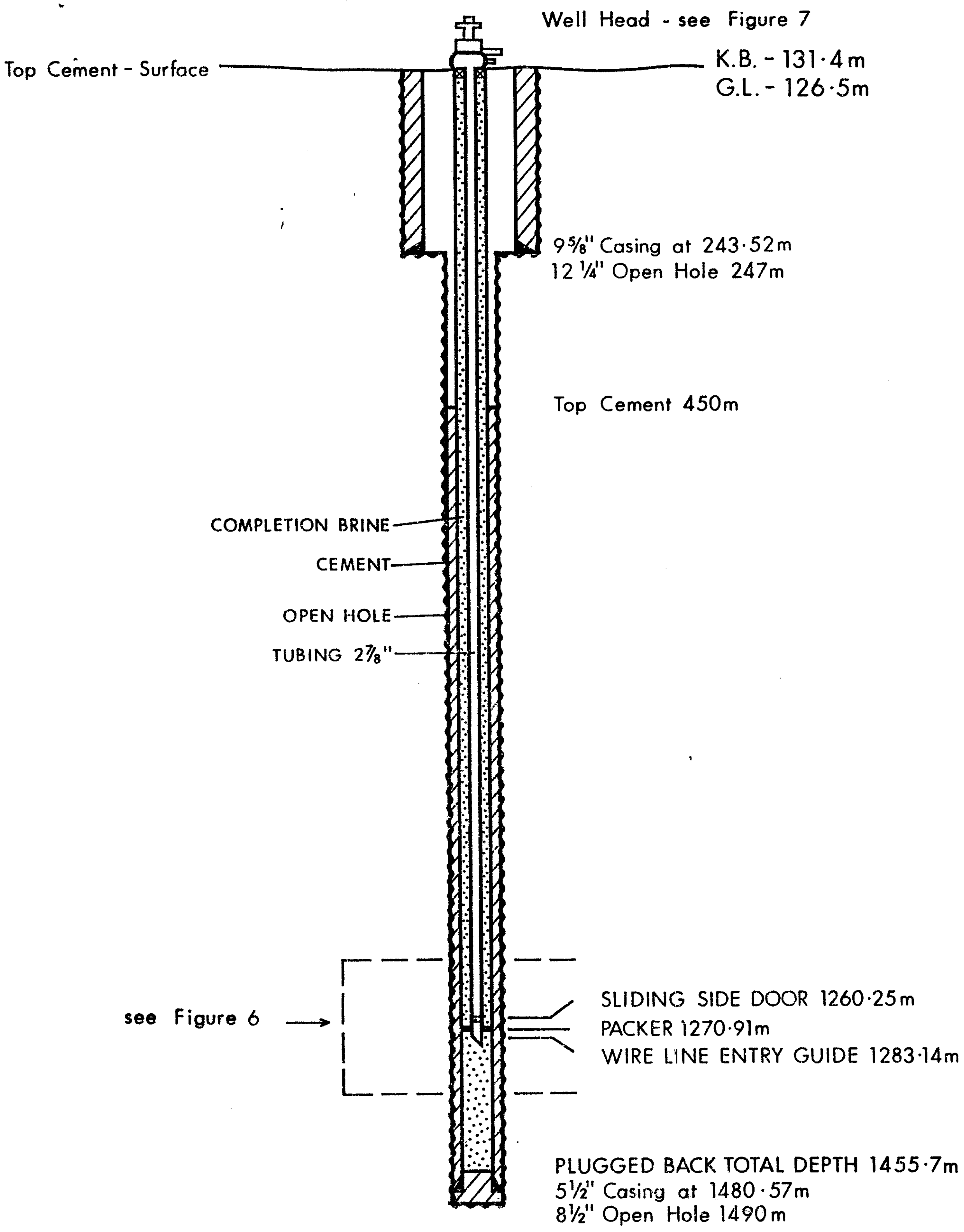


FIGURE 5

Beach Petroleum NL

PEP 108
IONA-1

WELL COMPLETION DIAGRAM

AUTHOR: A.BUFFIN DATE: JULY 1988 DRAWN BY: L.N.

Drwg No. OT 4014 F

Surface Casing

Size:	9-5/8"
Weight and Grade:	40 lb/ft N80
Float Collar:	231.6m
Shoe:	243.52m
Centralizers:	237.0m
	219.0m
	207.0m
Cement:	Preflush:-
	20 bbls fresh water
	Lead:-
	222 sacks of Class "A" cement with 57 bbls of water and 2.5% prehydrated gel. Slurry volume 76.7 bbls at 12.8 ppg.
	Tail:-
	81 sacks of Class "A" cement with 10 bbls of water. Slurry volume 17 bbls, at 15.6 ppg.
Cemented to:	Surface
Method:	Displaced by 57.8 bbls mud

Production Casing

Size:	5½"
Weight and Grade:	15½ lb/ft J55
Float Collar:	1456.19m
Shoe:	1480.57m

Centralizers:	1474m	1336.1m
	1450m	1324m
	1420.5m	1311m
	1408.5m	1300m
	1396.5m	1287.6m
	1384.3m	1275.9m
	1372.4m	1263.7m
	1360.3m	1251.6m
	1348.2m	1239.5m

Cement:

Preflush:-

10 bbls water with MORFLO II and MFI

Lead:-

#1) 125 sacks of Class "A" cement with 37.8 bblsd 3% prehydrated gel mixwater. Slurry volume 49 bbls at 12.3 ppg

#2) 97 sacks of Class "G" cement with 29.5 bbls 3% prehydrated gel mixwater. Slurry volume 38.2 bbls at 12.3 ppg

Tail:-

261 sacks of Class "G" cement with 31 bbls of water and 0.75% HALAD. Slurry volume 53.5 bbls at 15.8 ppg.

Cemented to: 450m KB.

Method: Displaced by 113.7 bbls water

Equipment: Halliburton, HT400 Truck

2.3.4 Completion Details

Iona No. 1 was completed and suspended as a gas well, (Figs. 6 & 7).

Prior to completion the well was displaced with NaCl completion brine:-

- 9.3 ppg
- 11.5 pH
- Inhibitor 303
- ¾ ppb Sodium Sulphate

The completion tail pipe assembly was run in on $2^7/8$" tubing and hung off a tubing hanger installed at surface.

Major components within the completion assembly comprise:-

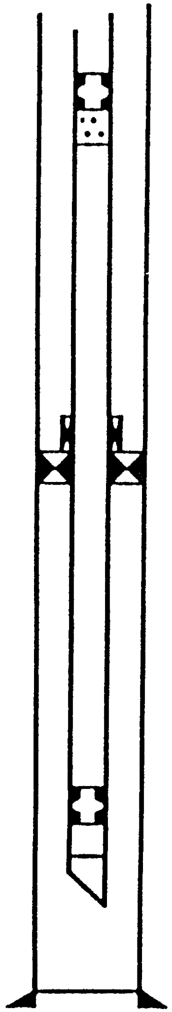
- An SSD (Sliding door) assembly set at 1259.43m-1260.25m.
- A packer for 5½" casing set at 1269.68m-1270.9m
- An XN Nipple with Nogo at 1282.51m-1282.76m
- Wire line entry guide at 1282.87m-1283.14m.

The casing and tubing was pressure tested, the BOP'S were nippled down and a Christmas Tree assembly installed at the surface.

2.3.5 Drilling Fluid (see Appendix 3 for details)

12¼" Hole (0m-247m)

The well was spudded in surface clays with fresh water. Within the upper marls, lime and KCl were added to reduce hydration and produce flocculated mud.



TUBING COLLAR 2-7/8" EUE	3.670	2.913	-	0.13	1259.30	1259.43
SSD OTIS TYPE 'XO' (ASSY NO: 121X03) WITH 2.313 'X' PROFILE & 2-7/8" EUE THRDS	3.750	2.313	-	0.82	1259.43	1260.25
TUBING 2-7/8" 6.5 PPF J55 EUE AB MOD, 1 JOINT	2.875	2.441	2.347	9.22	1260.25	1269.47
ANCHOR & SEAL ASSY, BAKER MODEL: K-22, SIZE: 40-DA32 WITH 2-7/8" EUE BOX UP	3.700	2.480	-	0.21	1269.47	1269.68
PACKER BAKER 44SAB32 x 26 FOR 5-½" CASING WITH 3-½" NU 10RD BOX	4.500	2.688	2.625	1.23	1269.68	1270.91
MILLOUT EXTENSION BAKER WITH 3-½" NU 10RD PIN x PIN	3.465	3.031	-	1.69	1270.91	1272.60
CROSSOVER BAKER HEAVY DUTY 3-½" NU 10RD BOX x 2-7/8" EU 8RD PIN	4.252	2.411	2.347	0.12	1272.60	1272.72
TUBING 2-7/8" 6.5 PPF J55 EUE AB MOB, 1 JOINT	2.875	2.441	2.347	9.66	1272.72	1282.38
TUBING COLLAR 2-7/8" EUE	3.670	2.913	-	0.13	1282.38	1282.51
LANDING NIPPLE FOR 2-7/8" 6.5 PPF J55 EUE TUBING OTIS XN WITH NO GO	3.500	2.313	-	0.25	1282.51	1282.76
CATCHER SUB OTIS TYPE RH (ASSY NO. 12 RH2500)	3.670	2.375	-	0.11	1282.76	1282.87
WIRELINE ENTRY GUIDE (EX US JOINT 2-7/8" TUBING)	2.875	2.441	2.347	0.27	1282.87	1283.14
PERFORATIONS - NOT PERFORATED						
5-½" CASING 15.5 PPF J55 STC - PBTD 1455.70m	5.500	4.950	4.825	1475.79	4.78	1480.57
- SHORT MARKER JOINT	5.500	4.950	4.825	10.39	1325.59	1335.98

FIGURE 6

Beach Petroleum NL

PEP 108

IONA-1
COMPLETION STRING

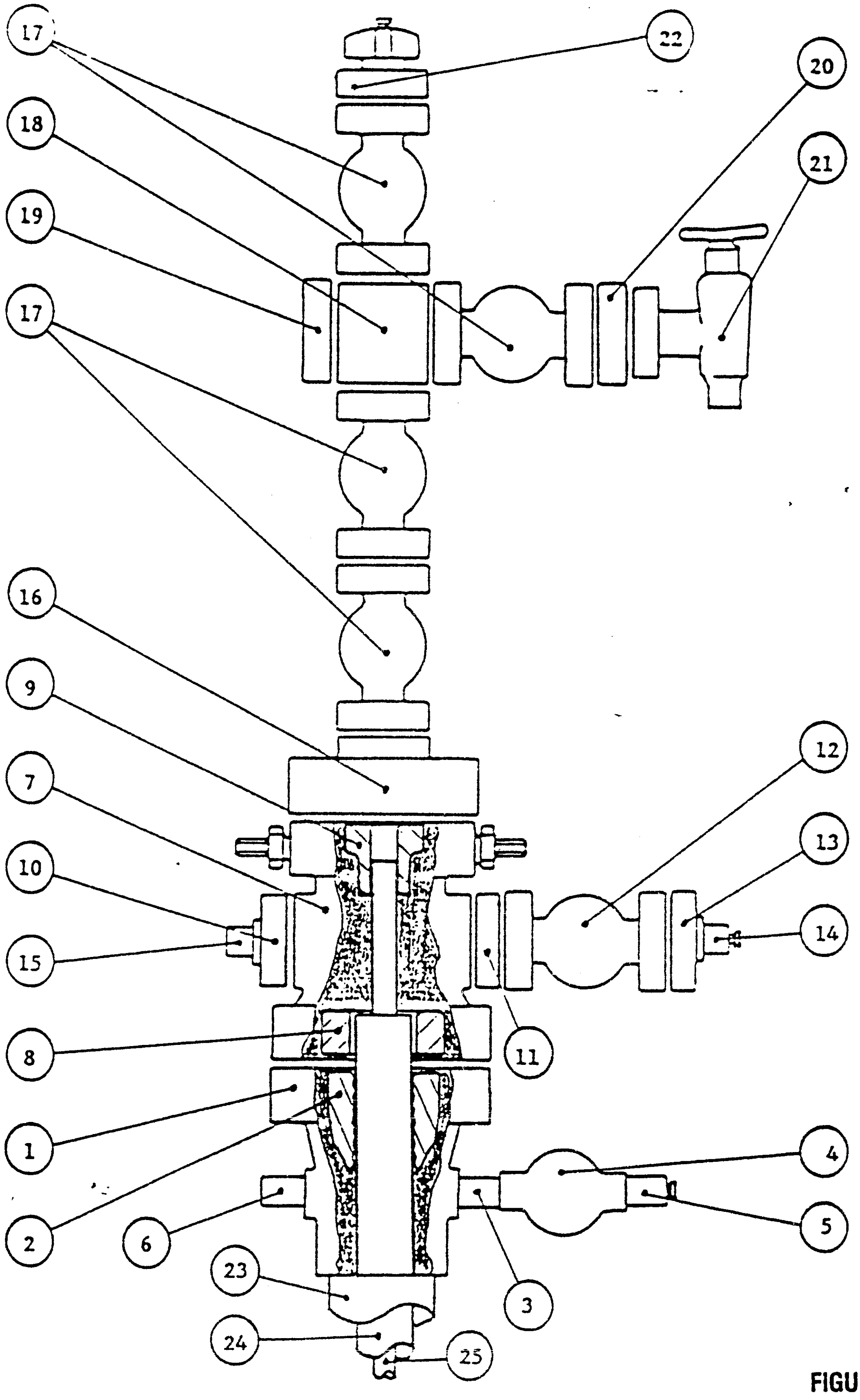


FIGURE 7

Beach Petroleum NL

PEP 108

IONA-1

WELLHEAD SCHEMATIC

AUTHOR: V. SANTOSTEFANO DATE: APRIL 1988

IONA #1 - WELLHEAD PARTS LIST

(EXCLUDES STUDS, NUTS AND GASKETS)

Item No	Make	Description	Qty
A. Casing Head			
1	CIW	Casing Head Type 'WF' 11" - 3000# with two 2" LPSO and 9-5/8" 8RD Female Bottom Prep	1
2	CIW	Casing Hanger Type 'CA' 11" x 5-1/2"	1
3	CIW	Nipple 2" LP x 8" Long	1
4	CIW	Gate Valve Type 'F' 2-1/16" - 3000# with screwed ends 2" LP	1
5	CIW	Bull Plug 2" LP Tapped 1/2" NPT	1
6	CIW	Bull Plug 2" LP Solid	1
B. Tubing Head			
7	CIW	Tubing Head Type 'F' 11" - 3000# x 7-1/16" - 3000# with two 3-1/8" - 3000# SSO's and 'X' Bushing Bottom Prep	1
8	CIW	'X' Bushing Secondary Packoff 11" x 5-1/2"	1
9	CIW	Tubing Hanger Type F-FBB 7" x 2-7/8" EUE Top and Bottom with BPV Thrd. No extended neck. (Threadlocked to tubing).	1
10	CIW	Companion Flange 3-1/8" - 3000# x 3" LP	1
11	CIW	Studded Adaptor Flange 3-1/8" - 3000# x 2-9/16" - 5000#	1
12	CIW	Gate Valve Type 'F' 2-1/2" - 3000# with Flanged ends 2-9/16" - 5000#	1
13	CIW	Companion Flange 2-9/16" - 5000# x 2-1/2" LP	1
14	CIW	Bull Plug 2-1/2" LP Tapped 1/2" NPT	1
15	CIW	Bull Plug 3" LP Solid	1
C. Christmas Tree			
16	CIW	Tubing Head Adaptor Flange 7-1/16" - 3000# x 2-9/16" - 5000#	1
17	CIW	Gate Valve Type 'F' 2-1/2" - 3000# with Flanged Ends 2-9/16" - 5000#	4
18	CIW	Cross 2-9/16" x 2-9/16" - 5000#	1
19	CIW	Blind Flange 2-9/16" - 5000#	1
20	-	Double Studded Adaptor Flange 2-9/16" - 5000# x 2-1/16" - 3000#	*
21	CIW	Choke Type 'H' 2-1/16" - 3000# x 2" LP	*
22	CIW	Christmas Tree Cap 2-9/16" - 5000# x 2-7/8" EUE	1
D. Casing			
23	-	9-5/8" 40 PPF N80 BTC	-
24	-	5-1/2" 15.5 PPF J55 STC	-
25	-	2-7/8" 6.5 PPF J55 EUE A/B Mod.	-

* Not installed as at 21.4.88

Mud properties were typically:

Weight : 8.4 rising to 9.0 ppg.

Viscosity : 28 increasing to 52 seconds.

The mud viscosity was increased toward casing point to aid hole cleaning. Controlled penetration rates avoided overloading the hole.

8½" Hole (247m-1490m)

The lime flocculated mud from the 12¼" hole was retained to drill through the Dilwyn Formation sandstones. The following mud properties were maintained:

Weight : 8.8 ppg.

Viscosity : 34 seconds.

PV/YP : 5/15

Prior to entering the Pebble Point Formation the mud system was deflocculated and converted to a fresh-water gel polymer. Conversion was gradual and enabled the filtrate to stabilize within the 6-8 cm^3 range. Within the Paaratte Formation the viscosity was increased and maintained at 40-45 seconds, whilst water loss was relaxed to 10 cm^3. Water loss was reduced throughout the basal Paaratte (Skull Creek) mudstones by regular polymer additions and a stable mud weight loss maintained. Prior to drilling the Waarre Formation, typical mud properties stabilized at:

Weight : 9.3 ppg.

Viscosity : 40-45 seconds.

PV/YP : 16/15

Gel : 5/18

Water Loss: 6.5-7.0cm.

C^{2-} : 1050 ppm.

Ca^{2+} : 50 ppm.

Within the Upper Waarre gas sands, mud alkalinity was reduced by residual CO_2 contamination.

Prior to cementing the 5½" casing the mud yield point was reduced from 46 to 36 seconds to aid turbulence during displacement.

The hole was finally displaced to 9.3 ppg brine. Minor tight hole problems were experienced during trips particularly throughout the Paaratte Formation.

2.3.6. Water Supply

Drilling water was obtained from a nearby dam and pumped to the rig via a 3" lay-flat hose.

2.4. Formation Sampling and Testing

2.4.1. Cuttings

Lagged samples of cuttings were collected from the shale shakers at the following intervals:-

Surface -	10m	No sample.
10m -	500m	10m intervals.
500m -	1490m	5m intervals.

Four sets of washed and air-dried samples were collected and stored in labelled polythene bags, samples were distributed as follows:-

Two sets for Beach Petroleum N.L.
One set for Bridge Oil Ltd.
One set for D.I.T.R., (Victoria)

A further set of washed and oven dried samples were collected and stored in plastic Samplex trays. These were retained by Beach Petroleum N.L.

One set of unwashed, air-dried samples was taken at 10m intervals from 250m to T.D. These were stored in calico bags and retained for future studies.

2.4.2. Cores

i) One conventional core was cut from 1305.5-1314.68m (100% recovery). For further details reference should be made to Appendices 12 and 13.

ii) Forty-eight sidewall cores were attempted . Forty-one were recovered, one core misfired, three bullets were empty and three were not accepted.

SWC	Depth (m)	SWC	Depth (m)
1	1481	16	1301
2	1453	17	1297
3	1441.5	18	1287
4	1423	19	1202
5	1407	20	1276.5
6	1396.5 NR	21	1254
7	1391.5	22	1240
8	1383	23	1185
9	1379 NR	24	1139
10	1347.5	25	1135.5 NR
11	1336 NR	26	1094
12	1328	27	1075.5
13	1324	28	1054
14	1321 NR	29	1018
15	1318 NR	30	942

SWC	Depth (m)	SWC	Depth (m)
31	858	40	621
32	820	41	611.5 NR
33	772	42	602
34	704	43	586
35	664.5	44	543
36	659.5	45	485.5
37	652.5	46	402.5
38	634.5	47	331
39	623	48	301

NR = No Recovery.

Descriptions and analyses of the cores are enclosed as Appendix 2.

2.4.3. Formation Tests

i) Drill Stem Test #1 (Refer to Appendix 7)

Interval Tested	:	12092.6m - 1305.5m.
Formation Tested	:	Waarre (Unit C).
Packers Set at	:	1290.5m.
		1292.6m.
Valve Open	:	16 minutes
		Strong vigorous air blow followed by gas cut mud and water cushion.
Final shut in	:	30 minutes.
Pressure (PSI)	:	Initial Hydrostatic - 2029
(@ 1285m).		First initial flow - 1598
		First final flow - 1742
		First C.I.P. - 1767

		Second Initial flow - 1559
		Second final flow - 1689
		Second C.I.P. - 1742
		Final Hydrostatic - 2160
BHT	:	53.3°c (128°F)
Recovery	:	Estimated 8.1 MMCFD gas.
Assessment	:	The Waarre (Unit C) sandstone displays excellent reservoir characteristics.

ii) Selected Formation Tests (SFT) (Refer to Appendices 8 and 9)

One SFT run was made over twelve zones of interest.

	Depth (m)	Pressure (psi)	Comments
# 1 -	1406.5	18.2	Tight) Reworked
# 2 -	1390	40.3	Tight) Eumeralla
# 3 -	1370.5	1830.8	Waarre - Unit A
# 4 -	1342.5	1767.8	Waarre - Unit B
# 5 -	1337.5	1760.8	Waarre - Unit B
# 6 -	1324	1745.2	Waarre - Unit C
# 7 -	1321.5	1745.0	Waarre - Unit C
# 8 -	1316	1745.0	Waarre - Unit C
# 9 -	1306	1745.0	Waarre - Unit C
#10 -	1211.6	719.9	Tight) Nullawarre
#11 -	1188	957.9	Tight)
#12 -	1336	1759.2	Waarre - Unit B

Pressure data indicates a gas water contact (GWC) at 1326m, (Fig. 8).

2.5 Logging and Surveys

2.5.1. Mud Logging (See Enclosure 2)

A skid-mounted Gearhart unit was utilized to provide a rate of penetration (ROP), continuous gas monitoring (including CO_2

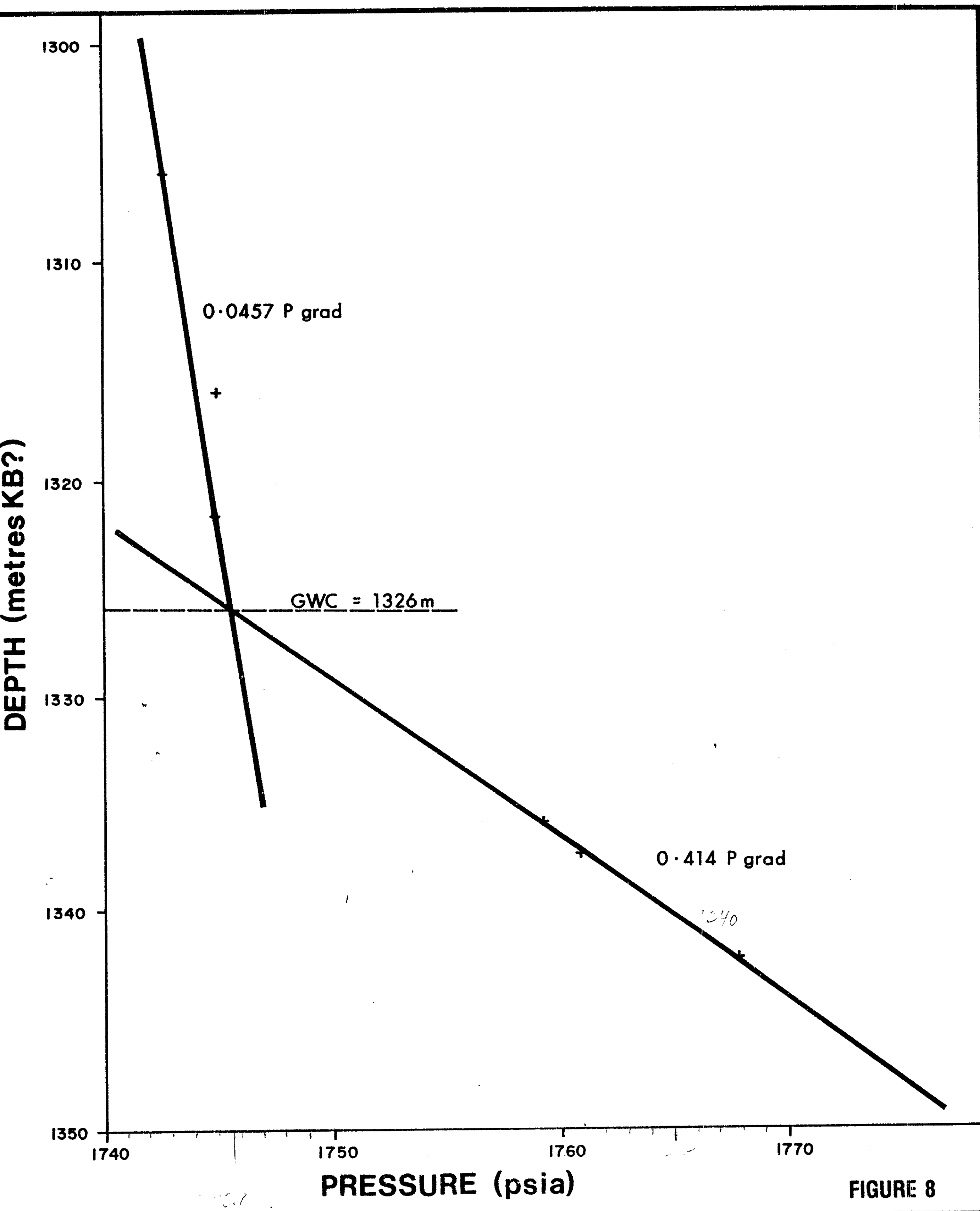


FIGURE 8

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PEP 108

IONA-1

SFT TESTS

DISPLAYING PRESSURE GRADIENTS AND POSSIBLE GAS-WATER CONTACT (GWC)

AUTHOR: A BUFFIN DATE: MAY 1988 DRAWN: L.N.

Drwg No. OT 3993

detection), intermittent mud and cuttings gas analysis, pump rate and mud volume data and independent cuttings descriptions.

2.5.2. Wire line Logging (See Enclosure 1 & 3).

Gearhart Pty. Ltd. recorded the following logs in open hole, and a portion of the Gamma Ray and cement bond log, logged in cased hole:-

Dual Laterolog (DLL-MSFL-SP-GR-CAL)

DLL-MSFL-SP-CAL : 1486.4m - 243.5m (9 5/8" casing shoe)

GR : 1486.4m - 23.1m

Sonic Log (BCS-GR)

BCS-GR : 1483.3m - 243.5m (9 5/8" casing shoe)

Density-Neutron Log (SLD-CNS-GR)

SLD-CNS-GR : 1486m - 918.2m

SLD-CNS-GR : 680m - 598.4m

Dipmeter (FED)

FED : 1484m - 994.7m

Cement Bond Log (CBL-VDL-GR-CCL)

CBL-VDL-CCC : 1455.7m (P.B.T.D.)* - 369.4m

* P.B.T.D. = Plugged-back total depth

In addition to the above logs, the following interpretive data was computer generated at the well site.

Well evaluation log and x-plot.

WEL : 1485m - 1290m

Dipmeter evaluation

NEXUS : 1484m - 994.7m

2.5.3 Deviation Surveys

The results of deviation surveys, using a TOTCO survey instrument were:-

Depth (m)	Deviation (°)	Depth (m)	Deviation (°)
32	¼	652	0
79	¼	855	¼
125	0	974	¼
197	¼	1117	¼
245	¼	1218	½
353	3/4	1484	3/4
498	¼		

2.5.4. Velocity Survey

A velocity survey was performed by Velocity Data at 22 levels, (Appendix 4). A synthetic seismogram was computed by Digimap, (Enclosure 4).

3. RESULTS OF DRILLING

3.1 FORMATION TOPS, (Figs. 9 & 10)

The following formation tops were picked using cuttings descriptions, mud logs and wire line log interpretation, (all depths are in metres).

GROUP	FORMATION (MEMBER)	KB	SS	THICKNESS
Heytesbury	Port Campbell Limestone	Surface	+126.5	39
	Gellibrand Marl Frm.	39	+92.4	163
Nirranda	Narrawaturk Marl Frm.	202	-70.6	78
	Mepunga Sandstone Frm.	280	-148.6	55
	Dilwyn Formation	335	-203.6	206
	Pember Mudstone Mbr.	541	-409.6	69
	Pebble Point Formation	610	-478.6	50
Sherbrook	Paaratte Formation	660	-528.6	345
	Skull Creek Member	1005	-873.6	132.5
	Nullawaare Greensand Mbr.	1137.5	-1006.1	99.5
	Belfast Mudstone	1237	-1105.6	38.5
	Waarre Formation	1275.5	-1144.1	106
Otway	Eumeralla Formation	1381.5	-1250.1	108.5+
	T.D.	1490	-1358.6	

KB = Depth from Kelly Bushing

SS = Depth from sub-sea

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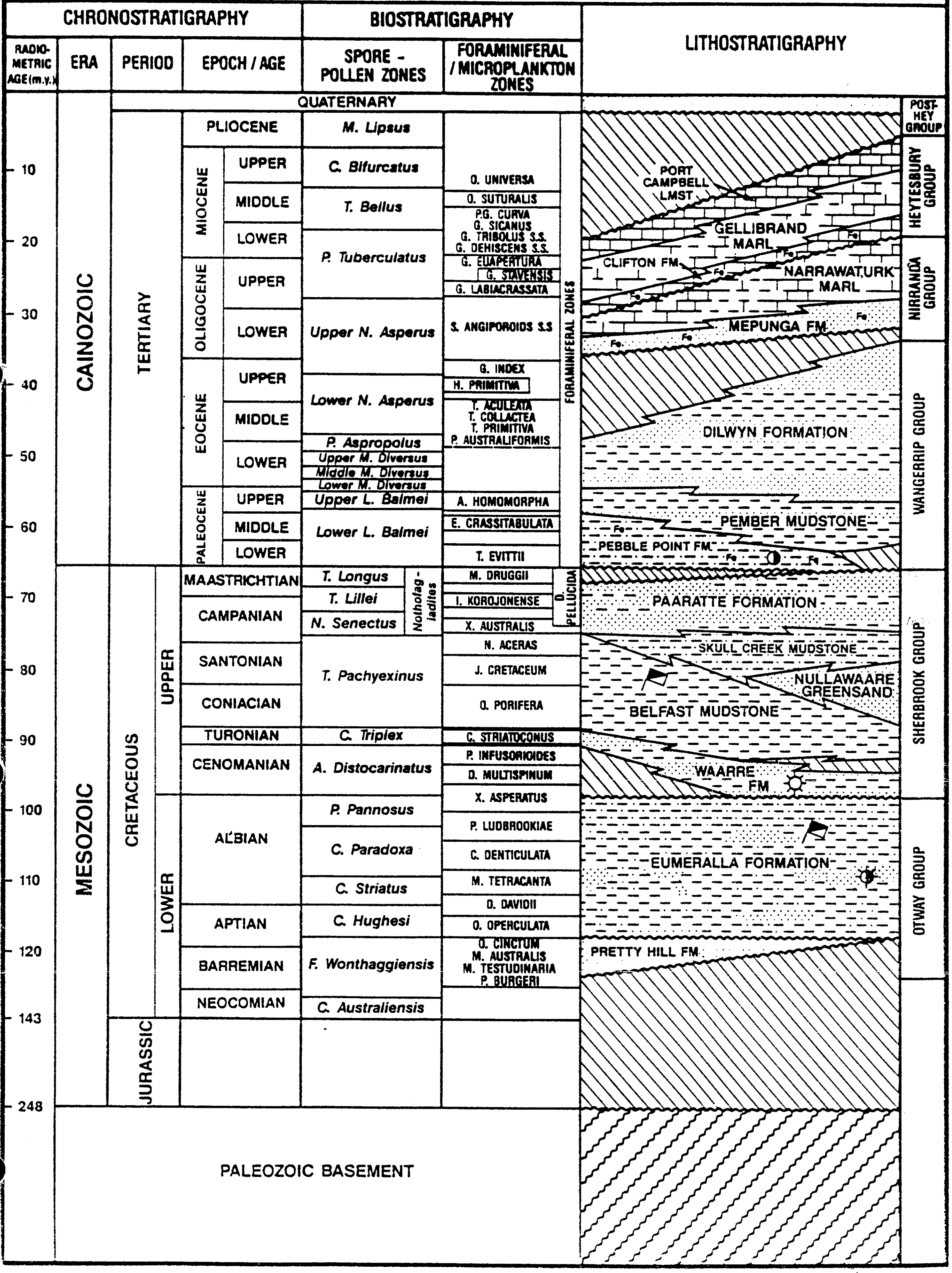
PEP 104/PEP 108 and Environments - Otway Basin
STRATIGRAPHIC TABLE

FIGURE 9



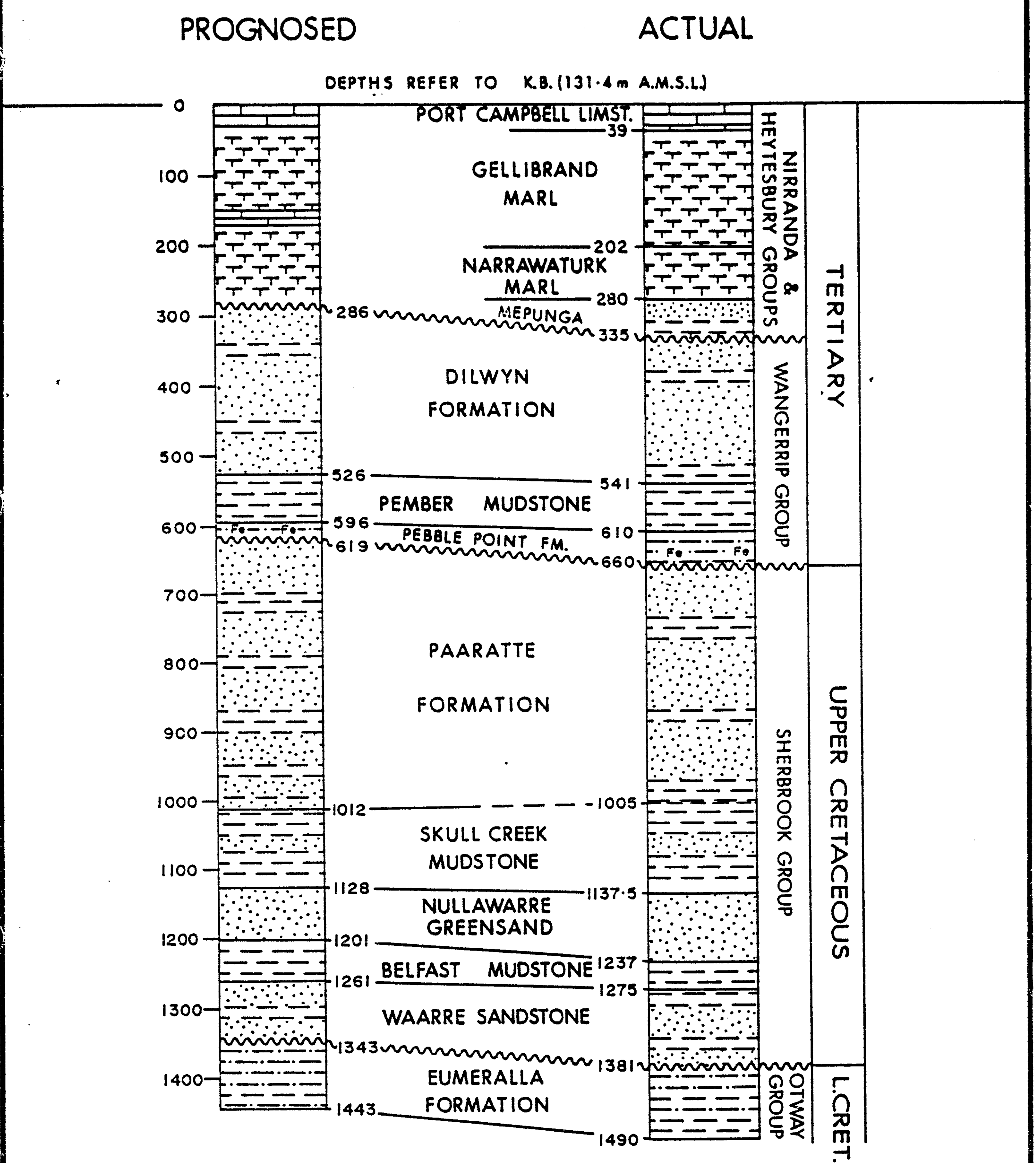


FIGURE 10

Beach Petroleum NL

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PROGNOSED AND ACTUAL STRATIGRAPHY

AUTHOR: A.BUFFIN DATE: MAY 1988 DRAWN BY: L.N.

3.1.1. PORT CAMPBELL LIMESTONE Surface - 39m

LIMESTONE: Off-white, yellow brown, dark yellow orange; soft, sticky; trace fossil fragments; argillaceous and grading to MARL in part with minor CLAYSTONE; dark brown grey; soft; very calcareous.

3.1.2. GELLIBRAND MARL FORMATION 39m - 202m

MARL: Medium dark grey, brown grey, occasionally green grey; soft, dispersive in part, very occasionally firm, sticky; becoming silty in part; common fossil fragments; with very minor LIMESTONE: Off-white, light yellow brown, light yellow grey, brown-orange; soft occasionally firm; trace to common fossil fragments; argillaceous in part; amorphous, occasionally microcrystalline.

3.1.3. NARRAWATURK MARL FORMATION 202m - 280m

CLAYSTONE: Dark to medium grey brown, dark grey, dark brown to medium brown; soft, dispersive, sticky; silty in part; trace carbonaceous detritus.
Occasionally grading to MARL: Medium grey, medium green grey becoming medium to light grey with depth; soft becoming firm with depth; silty in part; glauconitic; common fossil fragment, including, sponge spicules, and gastropods occasional pyrite.
With rare LIMESTONE: Grey, yellow, off-white; firm to moderately hard; common fossil fragments; occasionally oolitic.
With basal unit of GREENALITE ?, Medium to dark green; hard; ovoid to well rounded pellets.

3.1.4. MEPUNGA SANDSTONE FORMATION 280m - 335m

SANDSTONE: Dark grey to dark brown, very dark brown; fine to coarse grained, occasionally very coarse grained, angular to sub-round, occasionally well rounded, poor to good sorting; loose to friable; poor calcareous cement; poor to moderate dark grey to dark brown matrix, quartz with abundant iron staining; abundant fossil fragments decreasing with depth.

Abundant GREENALITE as above, trace pyrite; poor to good visual porosity.

Basal MARL: Dark brown to very dark brown; soft, very dispersive, abundant quartz and green lithics; occasional fossil fragments.

3.1.5. DILWYN FORMATION 335m - 541m

SANDSTONE: Light grey, light brown, becoming off-white with depth; medium to coarse, occasionally very coarse, dominantly medium, sub-angular to sub-round, occasionally round, moderate to occasionally poor sorting; loose to medium hard; calcareous cement in part; trace argillaceous matrix; trace pyrite; trace to common coarse mica; occasional pink, green, black lithics; very rare fossil fragments; moderate to good visual porosity, interbedded with occasional CLAYSTONE: Dark brown, dark grey brown, dark grey, becoming black with depth; micromicaceous, silty in part; carbonaceous in part; soft occasionally becoming firm and fissile, dispersive in part; trace coarse mica flakes; trace to common pyrite; occasionally glauconitic becoming abundant with depth.

Occasionally grading to SILTSONE: Dark brown, dark grey; very argillaceous; occasionally arenaceous; carbonaceous in part; calcareous in part; soft to firm.

3.1.6 PEMBER MUDSTONE MEMBER 541m - 610m

CLAYSTONE: Dark grey, dark grey brown, dark brown; micromicaceous; pyritic; sticky, dispersive, soft occasionally becoming moderate firm, occasionally sub-blocky; silty in part; trace arenaceous; occasionally carbonaceous; rare fossil fragments; trace glauconite becoming abundant with depth.
Interbedded with occasional SANDSTONE: Off-white; loose; coarse grain, angular to round, moderate to poor sorting; trace pyritic; trace glauconitic; poor to nil visual porosity.

3.1.7. PEBBLE POINT FORMATION 610m - 660m

CLAYSTONE: Brown, green, grey green; very soft, very dispersive becoming moderately hard, blocky, sticky; very glauconitic with abundant glauconitic nodules; silty in part, becoming arenaceous; trace to common pyrite.
Interbedded with SANDSTONE: Off-white to medium grey, becoming very dark brown; fine to medium, occasionally coarse grain; loose to friable, sub-round, occasionally angular to subangular, poor to moderate sorting; poor to moderate dispersive brown clay matrix; trace glauconite; moderate pyrite; trace fossil fragments; common black and green lithics; abundant staining; poor to nil visual porosity.

3.1.8. PAARATTE FORMATION 660m - 1070m

SANDSTONE: (660m - 805m) Off-white to pale yellow; loose; medium to coarse grain, moderate sorting, sub-angular to sub-round; trace pyrite; trace glauconite; occasional fossils; abundant multicoloured lithics; good visual porosity, interbedded with very minor CLAYSTONE: Dark grey to very dark grey; soft, very dispersive; becoming occasionally silty.

Trace COAL: Black, fissile, occasionally blocky, brittle; pyritic.

SANDSTONE: (805m - 1020m) Off-white, light to medium grey; fine to coarse grain often becoming very coarse; poor to moderate sorting, angular occasionally sub-angular to sub-round; loose; trace dispersive argillaceous matrix; generally poor cement except at 830m and 1000m where good calcareous cement; trace to common pyrite with occasional pyrite nodules; common red, yellow lithics; good to poor visual porosity.

Common COAL: Silty; Black; hard, conchoidal fracture, blocky; earthy to subvitreous; trace pyrite.

Interbedded with CLAYSTONE: Light to medium to dark grey, dark grey brown, occasionally black; micromicaceous; very carbonaceous in part.

Grading to COAL: Soft to firm, sub-blocky.

SANDSTONE; (1020m - 1070m) Light to medium grey; medium to coarse grain, sub-angular to sub-round, moderate sorting; loose; trace to common lithics; trace pyrite; moderate to good visual porosity.

With SANDSTONE: Medium to dark grey; very fine to fine grain, sub-angular to sub-round, moderate to good sorting; very hard; good calcareous cement; very occasional glauconite; occasional lithics; nil visual porosity.

Interbedded with CLAYSTONE: Very dark grey to dark brown; soft to moderate firm, massive in part, blocky, moderate to very dispersive; slightly arenaceous in part.

3.1.9. SKULL CREEK MUDSTONE MEMBER 1005m - 1137m

CLAYSTONE: Medium to dark grey, medium dark brown, brown; soft to moderately firm, occasionally hard; massive, occasionally fissile; micromicaceous; common glauconite; occasionally silty; occasional carbonaceous material; with occasional COAL: Black; fissile, brittle, moderately hard; pyritic.
Interbedded with minor SANDSTONE: Light to medium grey; medium to coarse occasionally fine grain; subangular to subround, moderately sorted; loose; trace pyrite; moderate visual porosity.

3.1.10. NULLAWAARE GREENSAND MEMBER 1137m - 1237m

SANDSTONE: (1137m - 1215m): Off-white, light grey green, light yellow green to light green with depth; fine to coarse predominantly medium grain; sub-angular to sub-round occasionally round, poor to good sorting; loose to friable; common glauconite; trace pyrite; trace lithics; trace to good argillaceous matrix; good inferred visual porosity.
Interbedded with CLAYSTONE: Dark grey to dark grey geen; soft to medium hard occasionally hard, dispersive, massive, occasionally fissile; slightly silty; common glauconite.

SANDSTONE: (1215m - 1237m): Light grey; fine grain; angular to sub-angular, poorly sorted; moderate to very hard; good amorphous siliceous cement; abundant glauconite; nil visual porosity, interbedded with CLAYSTONE; as above.

3.1.11. BELFAST MUDSTONE MEMBER 1237m - 1275.5m

CLAYSTONE: Medium to dark grey; soft to very occasionally medium hard, dispersive, sticky; micromicaceous, very glauconitic; slightly silty; occasional carbonaceous material; trace pyrite.

3.1.12. WAARRE FORMATION 1275.5m - 1381.5

Unit D

CLAYSTONE (1275.5m - 1299m): Dark to very dark grey; soft, sticky; arenaceous with abundant fine quartz grains; common iron oxide; rare glauconite; carbonate material present with saccharoidal texture.
With minor LITHIC SANDSTONE: Dark grey green; fine grain; sub-rounded, very poorly sorted; loose to friable; abundant white to pale green clay matrix; abundant lithics; abundant glauconite, occasional coarse mica.

Unit C

SANDSTONE (1299m - 1328m): Grey, gold yellow; medium to very coarse grain, predominantly coarse grain; angular to sub-angular occasionally sub-round, moderate sorting; loose; quartz displaying light brown to golden staining; goood visual porosity; 50-70% blue white spotted fluorescence with instant very pale milky white cut and a thin residual ring.
Becoming with depth SANDSTONE: Light grey; medium to very coarse grain with occasional pebble; poor to good sorting; very loose to friable, trace very poor matrix; occasional carbonaceous material; excellent visual porosity; occasional COAL: Black, dark brown; soft to firm; sub-blocky;

silty in part; pyritic in part.

With SHALE: Dark grey to black; hard, fissile; micromicaceous; trace carbonaceous material.

Grading to a basal SANDSTONE: Light grey; very fine to fine grain; subround to round, very well sorted; loose to friable; poor to moderate calcareous matrix; poor visual porosity.

Unit B

SILTSTONE/CLAYSTONE (1328m - 1366m): Dark grey; blocky to occasionally fissile, soft, moderately dispersive; micromicaceous, with very fine thin carbonaceous streaks.

Very occasional COAL: Black; soft to blocky, firm; subvitreous; silty; micromicaceous; common pyrite.

Occasional SANDSTONE: Light grey; very fine; moderately hard, sub-angular to sub-round, good sorting; good calcareous cement; poor to nil visual porosity.

Unit A

SANDSTONE (1366m - 1381.5m): Off-white; very fine to fine occasionally medium grain; angular to sub-round, poor sorting; friable to occasionally hard; good calcareous cement; common lithics; abundant pyrite, poor visual porosity.

3.1.13. EUMERALLA FORMATION 1381.5m - 1490m

(Reworked ?)

LITHIC SANDSTONE (1381.5m - 1411m): Off-white to very light grey to light grey; fine to medium occasionally coarse grain; angular to sub-angular, poor to moderately sorted; friable to occasionally hard; good calcareous cement; abundant lithic fragments; abundant pyrite; trace carbonaceous fragments; poor visual porosity.

and LITHIC SANDSTONE: Dark grey green, dark grey blue; abundant multicoloured lithics; poor cement; poor to occasionally moderate visual porosity.

Interbedded with CLAYSTONE: Blue grey; soft, dispersive; common carbonaceous detritus; abundant quartz, with common COAL.

CLAYSTONE (1411m - 1490m): Light grey to blue grey; soft, dispersive, sticky, becoming moderately hard, blocky; abundant lithics; micromicaceous increasing with depth.

Occasional COAL: Black; brittle, blocky to fissile conchoidal fracture.

Interbedded with minor LITHIC SANDSTONE: Dark grey, off-white and light green; fine to occasional medium grain; sub-angular to sub-round, poor sorting; loose to friable, abundant dispersive kaolinitic matrix; trace pyrite; abundant lithics; poor visual porosity.

4. HYDROCARBONS

4.1 GAS

4.1.1. Mud Gas Readings (Refer to Mud Log - Enclosure 2)

A minor gas peak was recorded from 597m to 625m within the basal Pember Mudstone and the Upper Pebble Point, maximum readings were:

Total gas - 0.3 units (60 ppm)
C1 - 40 ppm.

No gas was recorded throughout the basal Pebble Point Formation and most of the Paaratte Formation.

Gas readings were reported within basal sandstone/siltstone stringers of the Skull Creek Member. An initial gas peak was recorded at:

1093m; Total gas - 0.6 units (120 ppm)
C1 - 110 ppm.

A second peak recorded in the following values at:

1120m; Total gas - 2.6 units (460 ppm)
C1 - 420 ppm
C2 - 12 ppm
C3 - 4 ppm
C4 - 3 ppm

Background gas readings continued within the Skull Creek Member, Nullawarre Greensand Member, Belfast Mudstone and Upper Waarre Unit D. Average readings within the upper Nullawarre Greensand Member (1137m - 1200m) were:

Total gas	-	6 units (1200 ppm)
C1	-	1000 ppm
C2	-	10 ppm

Notable gas peaks were recorded at:

1150m;	Total gas	-	7.2 units (1440 ppm)
	C1	-	1344 ppm
	C2	-	40 ppm
1175m;	Total gas	-	12.5 units (2500 ppm)
	C1	-	2464 ppm
	C2	-	12 ppm

Carbon dioxide was recorded within the Nullawarre Greensand between 1160m - 1220m. A maximum reading of 0.5% was detected between 1165m - 1205m.

Throughout the Belfast Mudstone gas readings gradually increased:

Total gas	-	0.75 units (150 ppm) to 2.25 units (450 ppm)
C1	-	125 ppm to 400 ppm
C2	-	0 ppm to 15 ppm
C3	-	0 ppm to 5 ppm

Values continued to increase throughout the Upper Waarre, Unit D, gas peaks being associated with arenaceous streaks. High gas readings were associated with a drilling break at top Waarre, Unit C;

1302m;	Total gas	-	54 units (10800 ppm)
	C1	-	10080 ppm
	C2	-	230 ppm
	C3	-	105 ppm

iC4	-	10 ppm
nC4	-	8 ppm

A drill stem test was run over the interval 1293m - 1305.5m, gas flowed at an estimated 7.44 MMCFPD. Samples of the gas stream were collected at the choke manifold and analysed by the Gas and Fuel Corporation (ref: 4.2.1. and Appendix 10).

Gas readings remained high throughout Unit C and a maximum carbon dioxide value of 7.5% was recorded. Within the basal Waarre, units A and B gas readings declined to average values of;

Total gas	-	4 units (800 ppm)
C1	-	700 ppm
C2	-	10 ppm
C3	-	Trace

High gas readings within the upper Eumeralla Formation appear to have been associated with thin sandstone streaks. Two notable gas peaks over the zone 1388m - 1408m were recorded at:

1397m;	Total gas	-	40 units (8000 ppm)
	C1	-	6000 ppm
	C2	-	440 ppm
	C3	-	340 ppm
	C4	-	120 ppm

1405m;	Total gas	-	40 units (8000 ppm)
	C1	-	6000 ppm
	C2	-	530 ppm
	C3	-	310 ppm
	C4	-	140 ppm

Note that the C3 and C4 gas values are higher within the Eumeralla Formation sediments than values recorded within the Waarre, Unit C gas reservoir.

Below 1408m to total depth gas reading declined, although occasional sharp gas peaks were associated with thin coal bands within the Eumeralla Formation.

4.1.2. Gas Chromatography

Gas samples were obtained from the choke manifold during Drill Stem Test #1 over the zone 1293m - 1305m and at 1324m during the select formation tests. Analysis of the samples was performed by Gas and Fuel (DST # 1, Appendix 10) and Flopetrol (SFT #6 @ 1324m, Appendix 11). The average results from these tests were:

	Gas and Fuel DST # 1	Flopetrol SFT # 6 - 1324m
C1	84.25	84.21
C2	3.13	3.3
C3	1.23	1.38
iC4	0.28	0.31
nC4	0.35	0.38
iC5	0.12	0.15
nC5	0.10	0.12
C6	0.19	0.19
C7	0.26	0.40
CO2	5.76	6.02

Air (Contamination)	4.24	-
N2	-	3.54
He	0.09	-
	100.00	100.00

The molecular break down of the gas is displayed in figure 11 and figure 12.

The wellstream gas analysis at Iona #1 displays many similarities to the gas analysed at Wallaby Creek. One difference between Iona #1 and Wallaby Creek #1 is the carbon dioxide content which is slightly greater at Iona #1.

4.2 FLUORESCENCE

Fluorescence was noted in drill cuttings between 1302m - 1304m. A drilling break at 1302m was associated with a sandstone, described as light grey to golden yellow with light brown to golden staining noted on the grains, medium to very coarse predominantly coarse grain, angular to sub-angular, moderate to poor sorting, poor cement, loose to friable, good inferred porosity. The sandstone exhibited 50-70% blue - white spotted fluorescence with an instant very pale milky white cut and a thin residual ring.

The fluorescence may have represented mineral fluorescence rather than hydrocarbon fluorescence and may have been associated with the light brown to golden staining observed on the quartz grains. The sandstone was not typical of the sandstone unit described in core #1. No fluorescence was noted in the drilling mud and no odour was associated with the fluorescence.

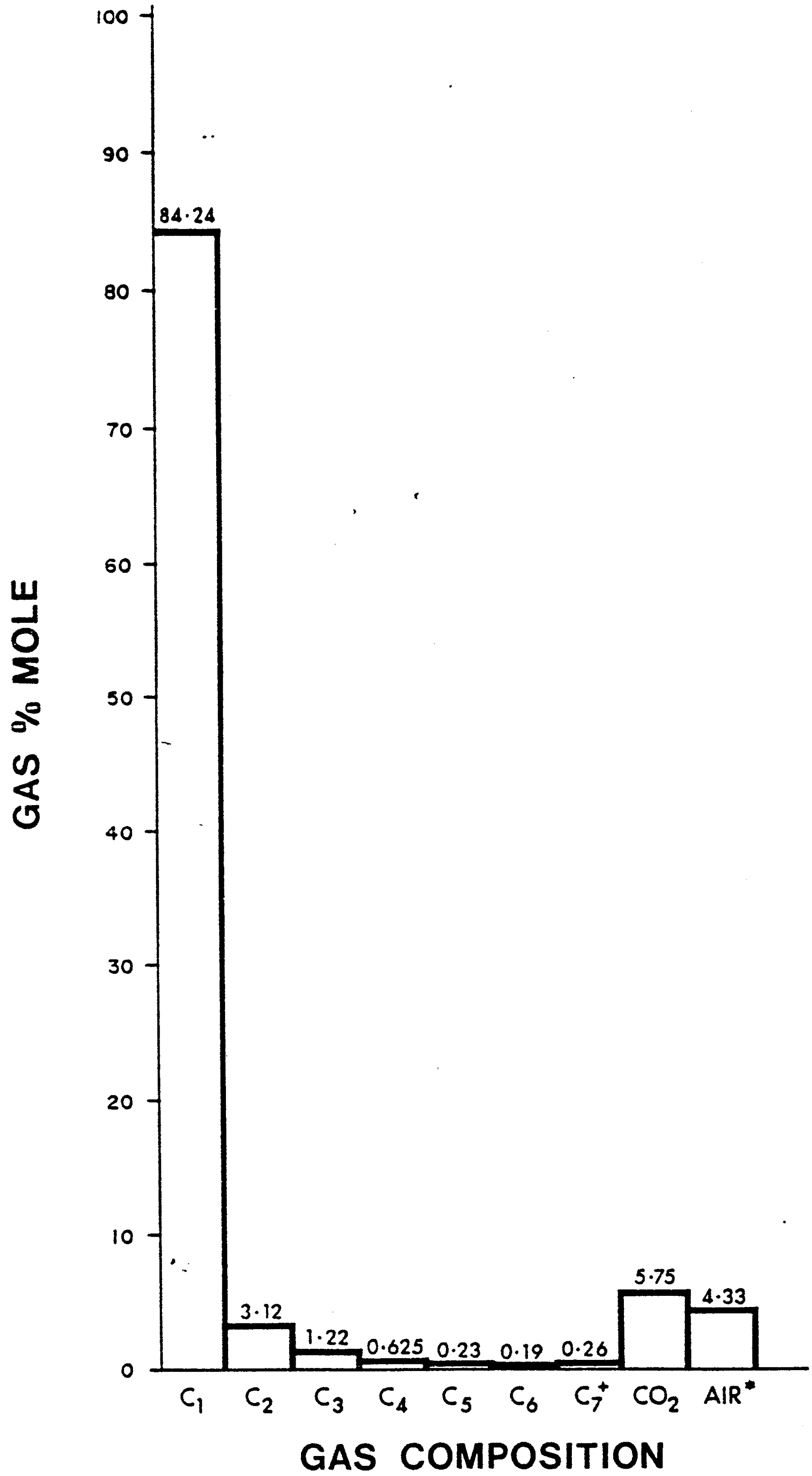

FIGURE 11

*AIR = (N_2 + O_2 + Ar)

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PEP 108

IONA-1

MOLECULAR COMPOSITION OF GAS FROM IONA-1 DST % MOLE

AUTHOR: A. BUFFIN   DATE: MAY 1988   DRAWN BY: L.N.

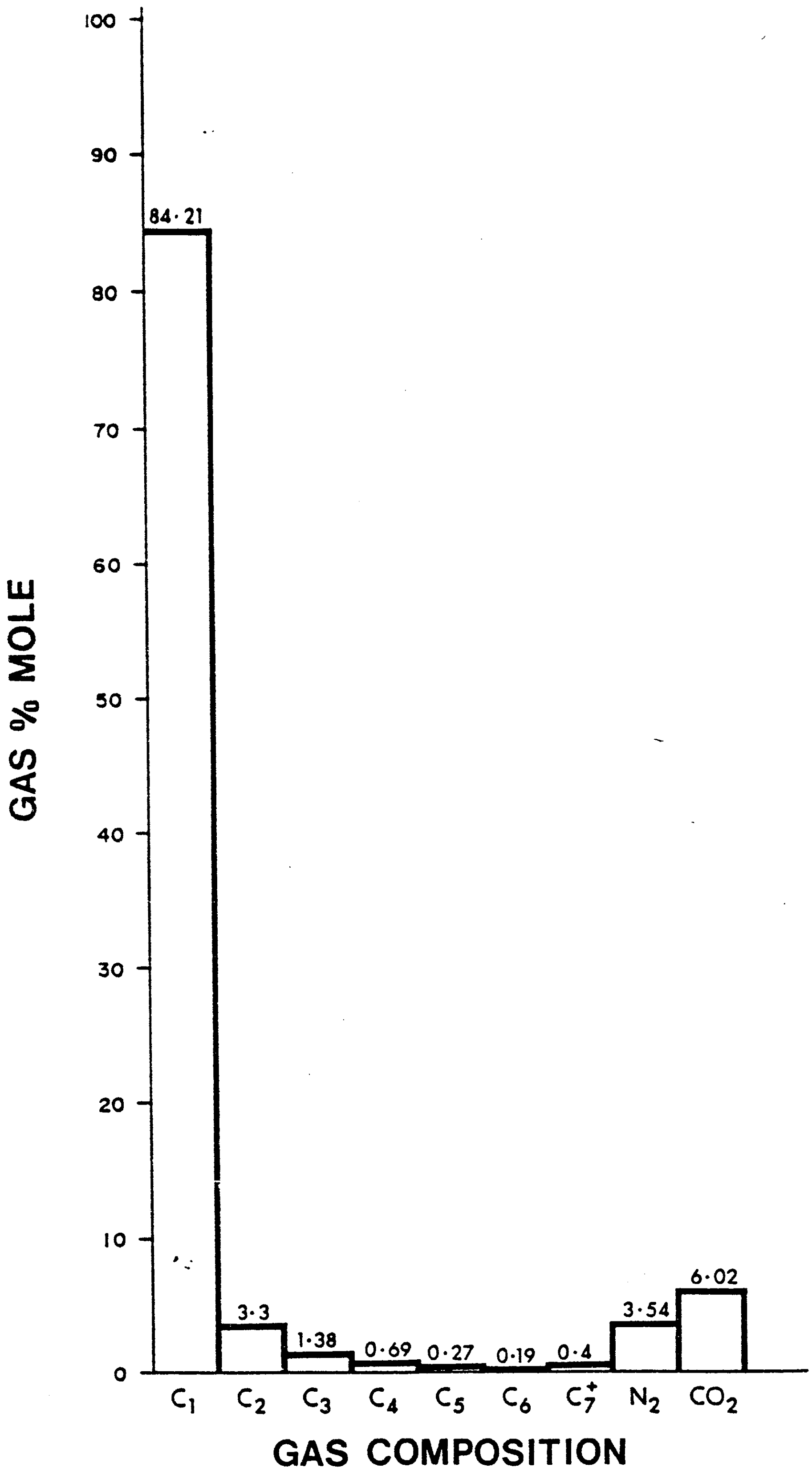

FIGURE 12

Beach Petroleum NL

PEP 108

IONA-1

MOLECULAR COMPOSITION OF GAS FROM IONA-1 SFT % MOLE

AUTHOR: A. BUFFIN DATE: MAY 1988 DRAWN BY: L.N.

No further fluorescence was observed during drilling operations.

Fluorescence was determined within core # 1 at:

Depth	Plug No.
1310.6m -	17
1310.9m -	18
1311.1m -	19
1313.1m -	-

Fluorescence was described as blue to white, patchy with an instant green to yellow cut and a white residual ring.

Fluorescence was also observed in three side wall cores. (See Appendix 2).

SWC # 2 at 1453m:

- 100% Bright yellow fluorescence.
- Weak pale yellow cut.
- Very thin pale yellow residual ring.

SWC # 7 at 1391.5m:

- Dull pale yellow fluorescence, with an occasional bright spot.
- Dull yellow instant cut.
- Very thin residual ring.

SWC # 13 at 1324m:

- Strong yellow fluorescence.
- Weak pale white instant cut.

Two of the above sidewall cores # 2 and # 13 were further investigated. (see 4.3 and Appendix 18).

4.3 OIL SHOWS

Residual oil from SWC # 2 at 1453m within the Eumeralla Formation and SWC # 13 at 1324m within the basal sandstone of Unit C was successfully extracted and analysed by extraction liquid chromatography and gas chromatography techniques.

Genetic affinity indicated that the hydrocarbon was generated from a terrestrial higher plant source deposited in oxic conditions. The hydrocarbon was marginally mature.

An oil column is not present within the Iona #1 structure, there are indications however, that suggest early oil entrapment.

Water washing of the oil is difficult to determine though it is felt this did not occur and there does not appear to be any indications that suggest biodegradation of the oil has occured.

Early oil entrapment may account for the strong fluorescence observed in the uppermost sands of the Unit C sandstone. The sandstone grains were coated with a distinctive brown to golden stain representing residual oil displaced by the later gas emplacement. The high anomalous MSFL peak recorded over the upper 3m of the gas column (see DLL-MSFL log Enclosure 3) may suggest a minor oil column was in place within an earlier structure at Iona.

5. ANALYTICAL DATA

5.1 Structure

The Iona prospect was initially defined by the Beach 1981 Curdie Seismic Survey, and later refined by the 1986 Sherbrook Seismic Survey.

Iona #1 was drilled on shot point 235, on seismic line OB81A-C62, this is not the optimum location, but local topography necessitated drilling Iona #1 slightly off structure. The well was designed to test the hydrocarbon potential and prospectivity of the Waarre Formation, recognised as the reservoir at the Port Campbell Anticline gas fields. 8 - 10km west of Iona #1. The Nullawarre Greensand Member, Timboon Sandstone Member of the Upper Cretaceous Paaratte Formation and the Tertiary Pebble Point Formation represent secondary reservoir targets.

Seismic mapping produced time structure maps at "Top Dilwyn", "Near Top Upper Cretaceous" (Fig. 13) and "Near Base Upper Cretaceous", (Fig. 14). These maps suggested only 0.44 km^2 closure at Waarre Formation level and 1.81 km^2 at Pebble Point Formation level.

The Iona structure was defined as a small feature, displaying dip closure to the west though fault controlled at the northern and southern flanks. The structure is located immediately on the upthrown side of the Sherbrook Fault Zone (Fig. 15).

Results of the check shot survey and the synthetic seismogram indicate that the pre-drill top Dilwyn pick represented the Top Mepunga Sandstone.

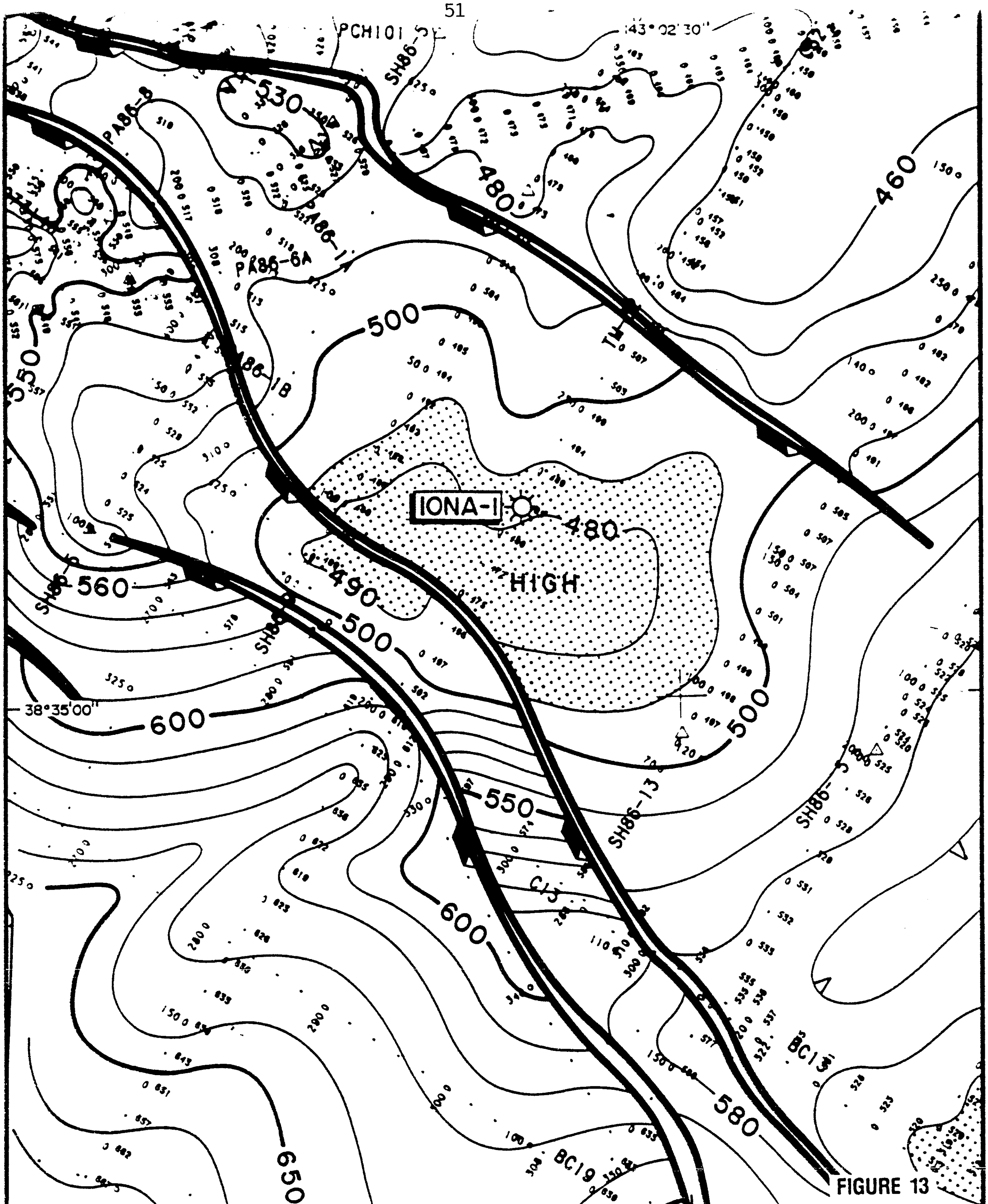

FIGURE 13

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IONA-1

NEAR TOP UPPER CRETACEOUS

0 0·5 1
KILOMETRES

N

AUTHOR : P. JEGANATHAN DATE : DECEMBER 1987 DRAWN : FROM OT 3737 R

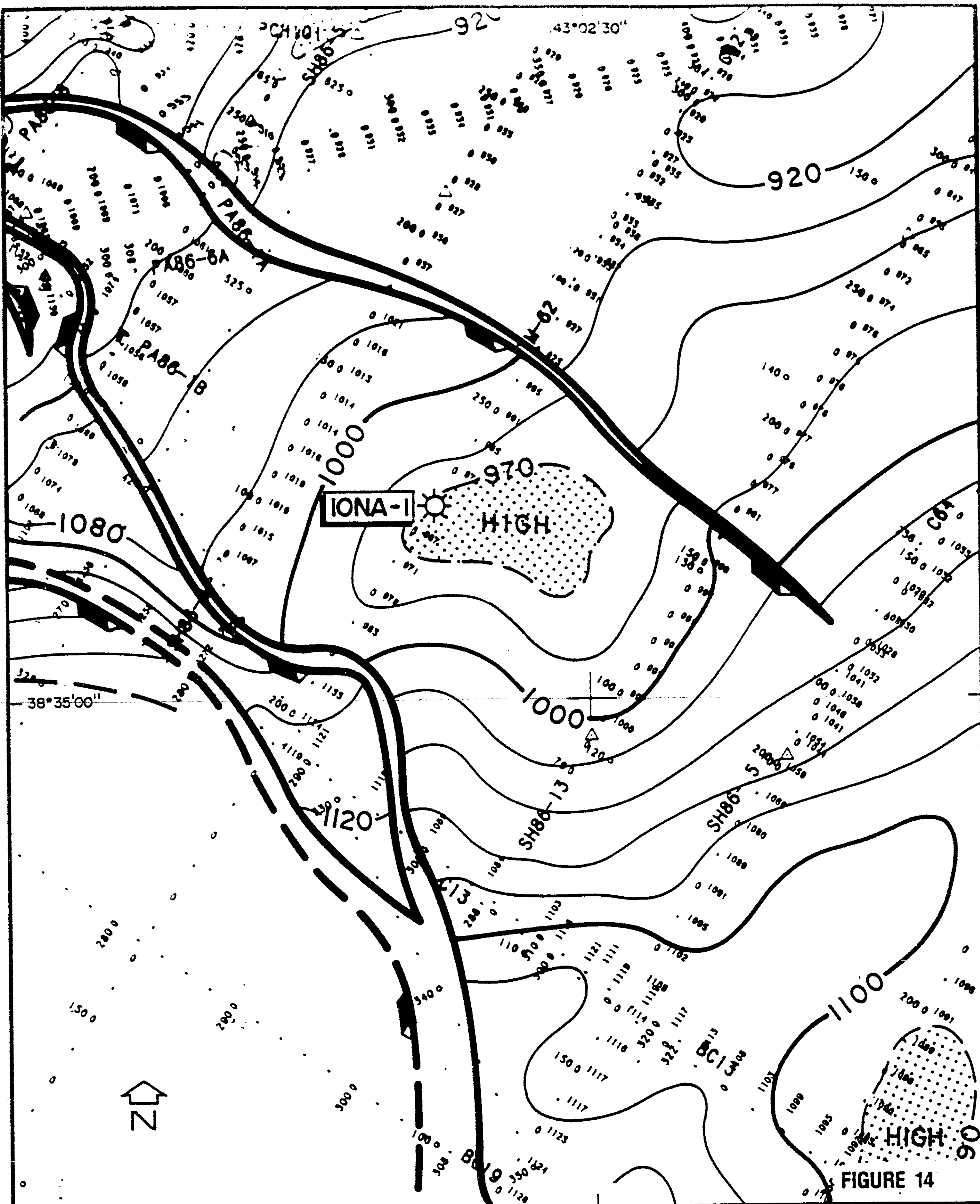

FIGURE 14

0 0.5 1
KILOMETRES

Beach Petroleum NL

PEP 108

IONA-1

NEAR BASE UPPER CRETACEOUS

AUTHOR : P. JEGANATHAN DATE : OCTOBER 1987 DRAWN : FROM OT 3736 R

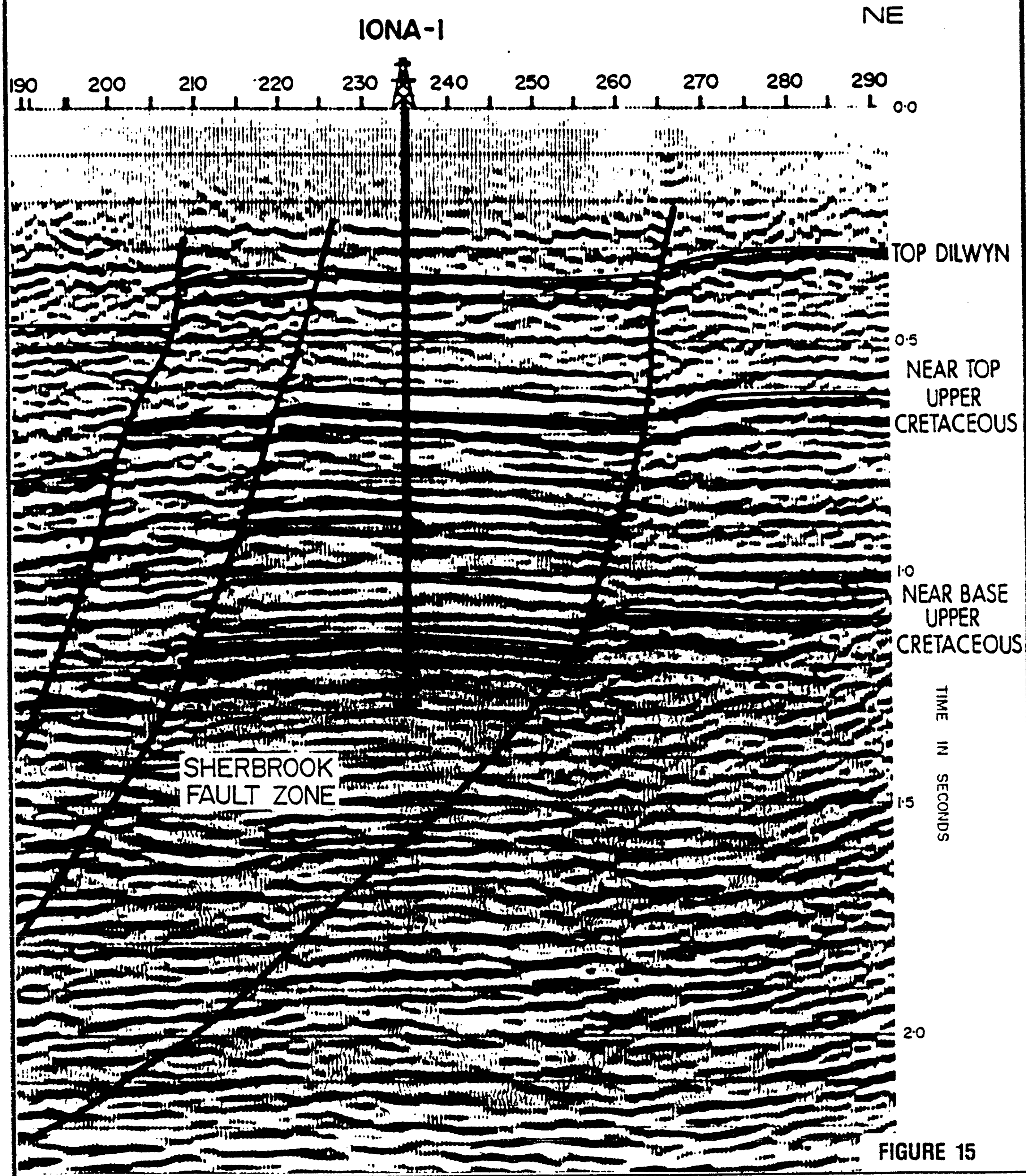

FIGURE 15

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IONA-1

SEISMIC LINE OB81A-C62
Final Stack

AUTHOR : A.BUFFIN DATE : OCTOBER 1988 DRAWN : LG

The Waarre Formation, Unit C, initially thought to be represented by the upper peak, (Fig. 15), was subsequently identified as the lower peak. This horizon ultimately forms a better structure having both larger vertical closure and areal extent.

5.2 Routine and Special Core Analysis, (Fig. 16)

After initial preliminary well site core orientation and description the core was dispatched to AMDEL Ltd., Adelaide for routine and special core analysis, (Appendices 12-16).

- Slabbing: Part of the core was retained in its origional state, whilst a further part of the core was impregnated with resin to maintain original sedimentary features and lithological configurations. This was subsequently described and presented in figure 17 as a detailed core description.

- Sieve Analysis: Performed to determine grain size variation within the core and confirmed the coarse nature of the Waarre, Unit C sandstone.

- Ambient Core Parameters: Porosity, permeability, bulk volume, bulk dry density and apparent grain densities were determined in core plugs cut from the core at approximately 30cm intervals. Porosity and density readings were plotted against the relevant wire line logs to establish a log depth to core depth correlation, (Fig. 18). A depth discrepancy of 2.81m was determined:

  top core, drillers depth - 1305.5m

  top core, loggers depth - 1302.69m

- Porosity at overburden pressure: Eight core plugs were selected and porosities at an overburden pressure of 2000 psi were calculated.

FIGURE 16.

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S.A. Sieve Analysis
m.n. Resistivity Factor and Index
R.G. Residual Gas Analysis
Core Loggers Depth

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IONA-1

SPECIAL CORE ANALYSIS INTERVALS

AUTHOR: A.BUFFIN DATE: MAY 1988

BEACH PETROLEUM NL

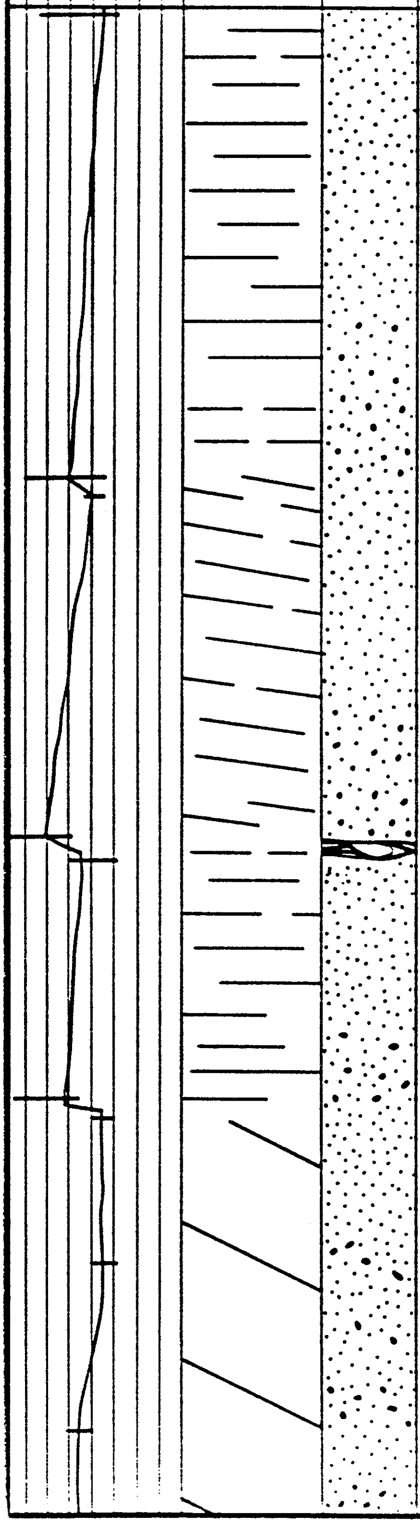
CORE DESCRIPTION

WELL : IONA - I
DATE : 12th May 1988
FORMATION : WAARRE (Unit C)
GEOLOGIST : A. Buffin

CORE No. I   Page I of 3
INTERVAL: 1305·5m to 1309·5m
RECOVERY: 9·18m 100%

FIGURE 17

GRAINSIZE & STRUCTURES (P G VC C M F VF Silt Clay) | LITHOLOGY | DIPS



DEPTH (DRILLERS)	(measured) Ø %	k mD	DESCRIPTION
1305			
			TOP OF CORE 1305·5m
1305·81	23·0	7216	
1306			Massive sandstone
1306·23	24·4	>8000	
1306·43	24·3	>8000	
1306·57	23·4	>8000	
1306·71	25·7	>8000	
1306·75			
1306·80			
1307			
			Massive sandstone with faint low angle bedding
1307·23	27·1	>8000	
1307·54	27·2	>8000	
1307·70			Carbonaceous streaks with interclasts of shale
1307·75			
1307·84	26·4	>8000	
1308			Massive sandstone with faint bedding at the base – defined by pebbles
1308·20	23·3	>8000	
1308·40			
1308·45	28·7	>8000	
1308·80	25·9	>8000	Metre cross-bedding Textural ossilations from 1308·85 - 1309·3
1309			
1309·10	27·5	>8000	
1309·40	26·6	>8000	

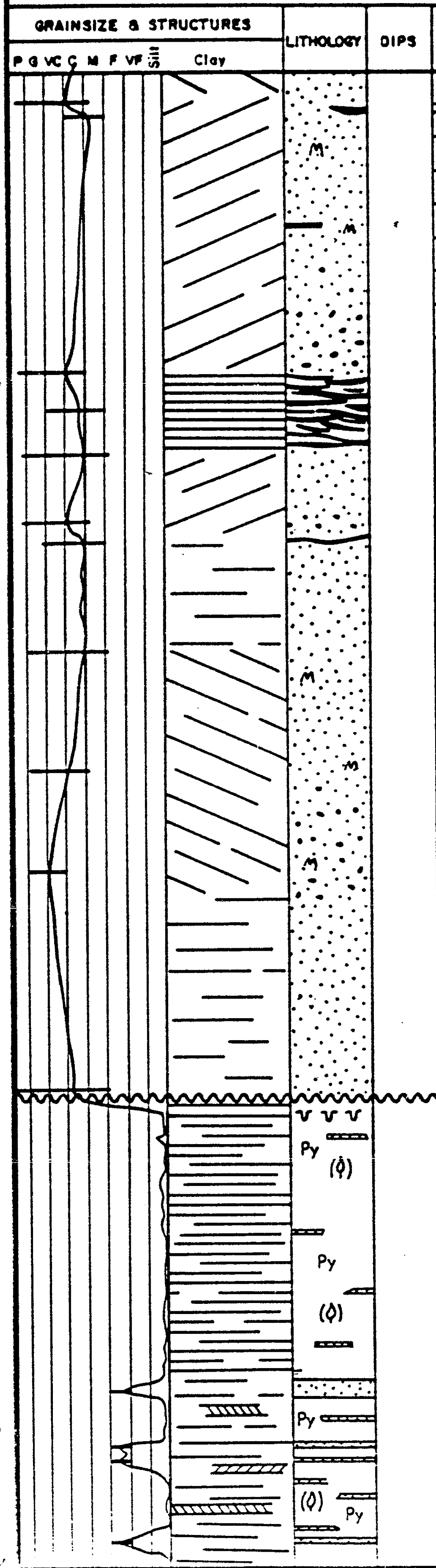
BEACH PETROLEUM NL

CORE DESCRIPTION

WELL : IONA - I
DATE : 12th May 1988
FORMATION : WAARRE (Unit C)
GEOLOGIST : A. Buffin

CORE No. I Page 2 of 3
INTERVAL: 1309·5m to 1314m
RECOVERY: 9·18m 100%

FIGURE 17



DEPTH (DRILLERS)	(measured) ϕ %	k mD	DESCRIPTION
1309·63			Coal
1309·70	26·6	7407	
1310	26·8	>8000	Coal Decimetre cross-bedding
1310·30	25·0	>8000	
1310·40			
			Coal
1310·60	28·6	5149	
1310·63			
			Decimetre cross-bedding
1310·90	23·5	>8000	Coal
1311			
1311·20	24·6	>8000	
1311·24			
1311·50	24·7	>8000	
			Well defined decimetre cross-bedding
1311·60			
1311·80	25·5	>8000	
1311·90			
1312	21·0	6264	
1312·02			
			Massive sandstone with poorly defined horizontal bedding
1312·40	23·0	>8000	
			Rubble - possible interclasts? cobbles with poor sorting
1312·60			
1312·63			Millimetre burrows
1312·70	10·7	6·13	Claystone
1313			Rubble ? with fluorescence :- patchy blue to white. Instant green to yellow cut. Thin white residual ring.
1313·45			Claystone with flaser bedding
1313·50			Rare carboniferous specks in claystone
1313·63			Millimetre cross-bedding, possible sand ripples
1313·68			
1313·93			

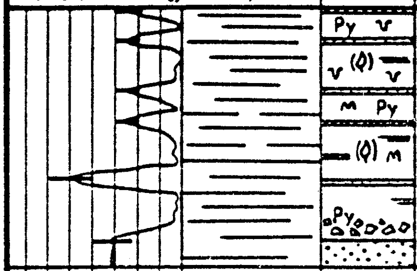
BEACH PETROLEUM NL

CORE DESCRIPTION

WELL : IONA - I
DATE : 12th May 1988
FORMATION : WAARRE (Unit C)
GEOLOGIST : A. Buffin

CORE No. I Page 3 of 3
INTERVAL: 1314 m to 1314·68m
RECOVERY: 9·18m 100%

FIGURE 17

GRAINSIZE & STRUCTURES (P G VC C M F VF Silt Clay)	LITHOLOGY	DIPS	DEPTH (DRILLERS)	(measured) Ø %	k mD	DESCRIPTION
			1314·02			Millimetre vertical to sub-vertical burrows
			1314·09			
			1314·22			
			1314·30			Scattered very coarse grains
						Sand flasers
			1314·46			
			1314·62			Small pebbles at base
						Sandstone with carbonaceous streaks

BOTTOM OF CORE 1314·68m

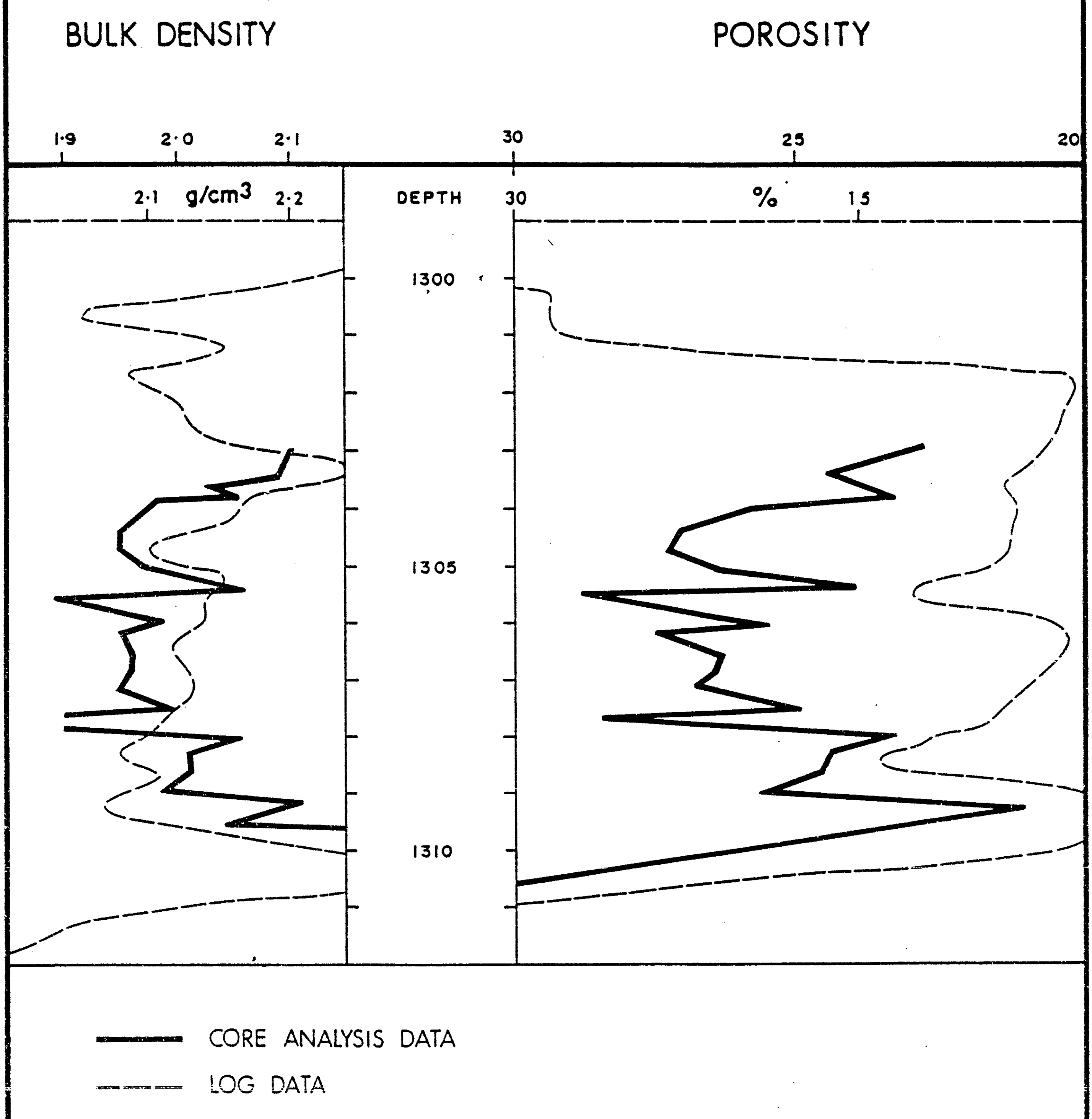


FIGURE 18

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IONA-1

CORE ANALYSIS - AMBIENT BULK DENSITY AND AMBIENT POROSITY VS LOG DATA

AUTHOR: A BUFFIN DATE: MAY 1988 DRAWN BY: L.N.

Porosities determined at surface are plotted against the equivalent porosities obtained under an overburden pressure of 2000 psi, (Fig. 19). Porosity at surface is also plotted against increasing overburden pressures, (Fig. 20) this demonstrates that at an overburden pressure of 4000 psi porosity degradation is not critical and good porosity values within the Upper Waarre Formation are maintained.

Overburden Stress Calculation at 1300m - Top Waarre Unit C.

Hydrostatic pressure at 1326m (measured) = 1746 psia

$\frac{0.414 \times 144}{62.4}$ = equivalent S.G = 0.9554

Hydrostatic pressure at 1300m (calculated) = 1712 psia

From the density log;

Average density over interval 600 - 680m)
) = 2.218
915 - 1300m)

Matrix Stress at 1300m (assuming 2.0 sg) = 3584 psi ✓

$= \frac{1712}{0.9554} \times 2$

Matrix Stress at 1300m (assuming 2.1 sg) = 3763 psi ✓

$= \frac{1712}{0.9554} \times 2.1$

3942.2 psi ✓ K. Mehin

Matrix Stress at 1300m (assuming 2.2 sg) = 37942 psi ????

$= \frac{1712}{0.9554} \times 2.2$

Overburden stress at 1300m;

for 2.0 sg 3584 - 1712 psi = 1872 psi

for 2.1 sg 3763 - 1712 psi = 2051 psi

for 2.2 sg 3942 - 1712 psi = 2230 psi

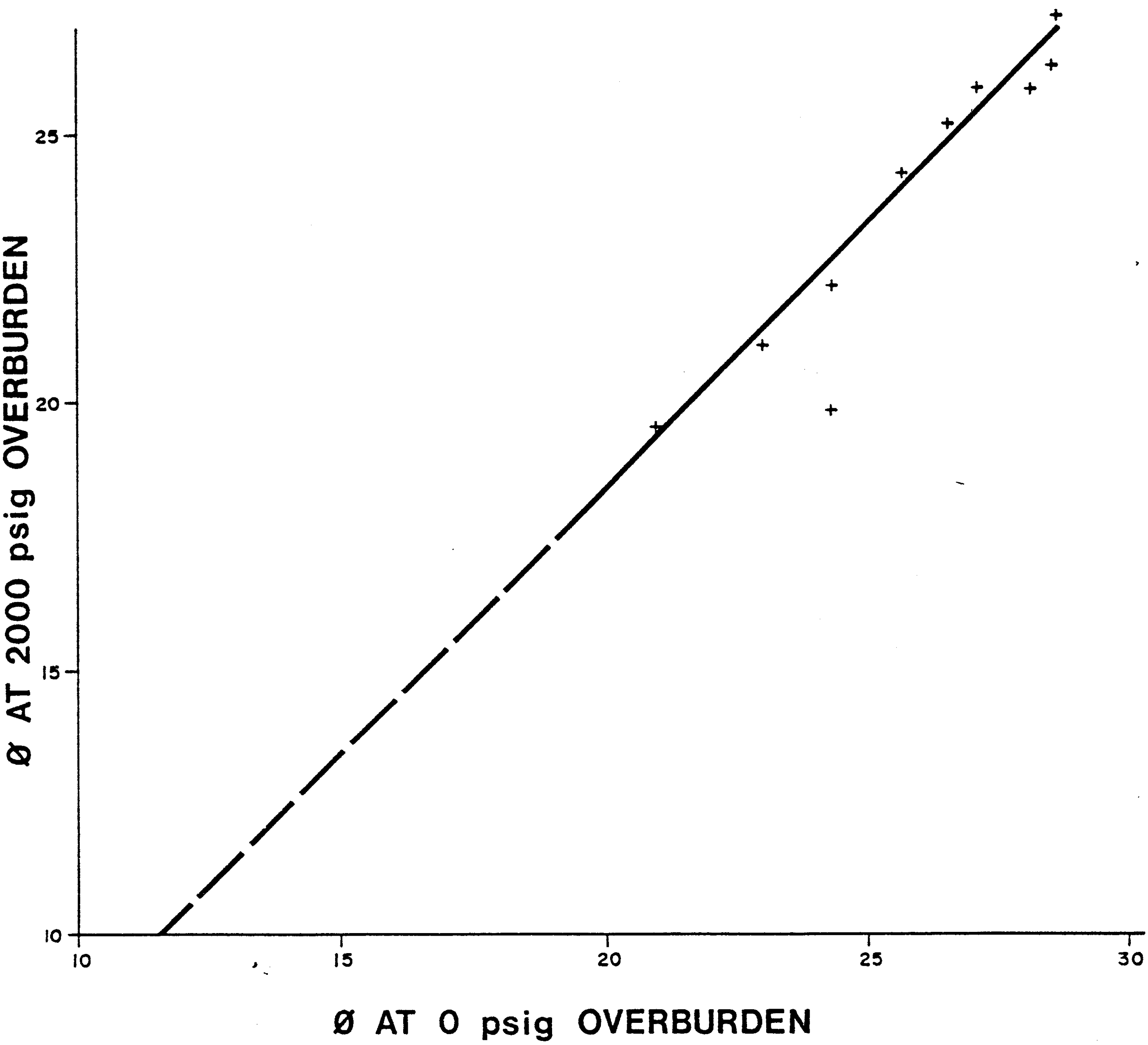

FIGURE 19

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IONA-1

POROSITY AT SURFACE VS OVERBURDEN CONDITIONS

AUTHOR : A. BUFFIN DATE : MAY 1988 DRAWN : L.N.

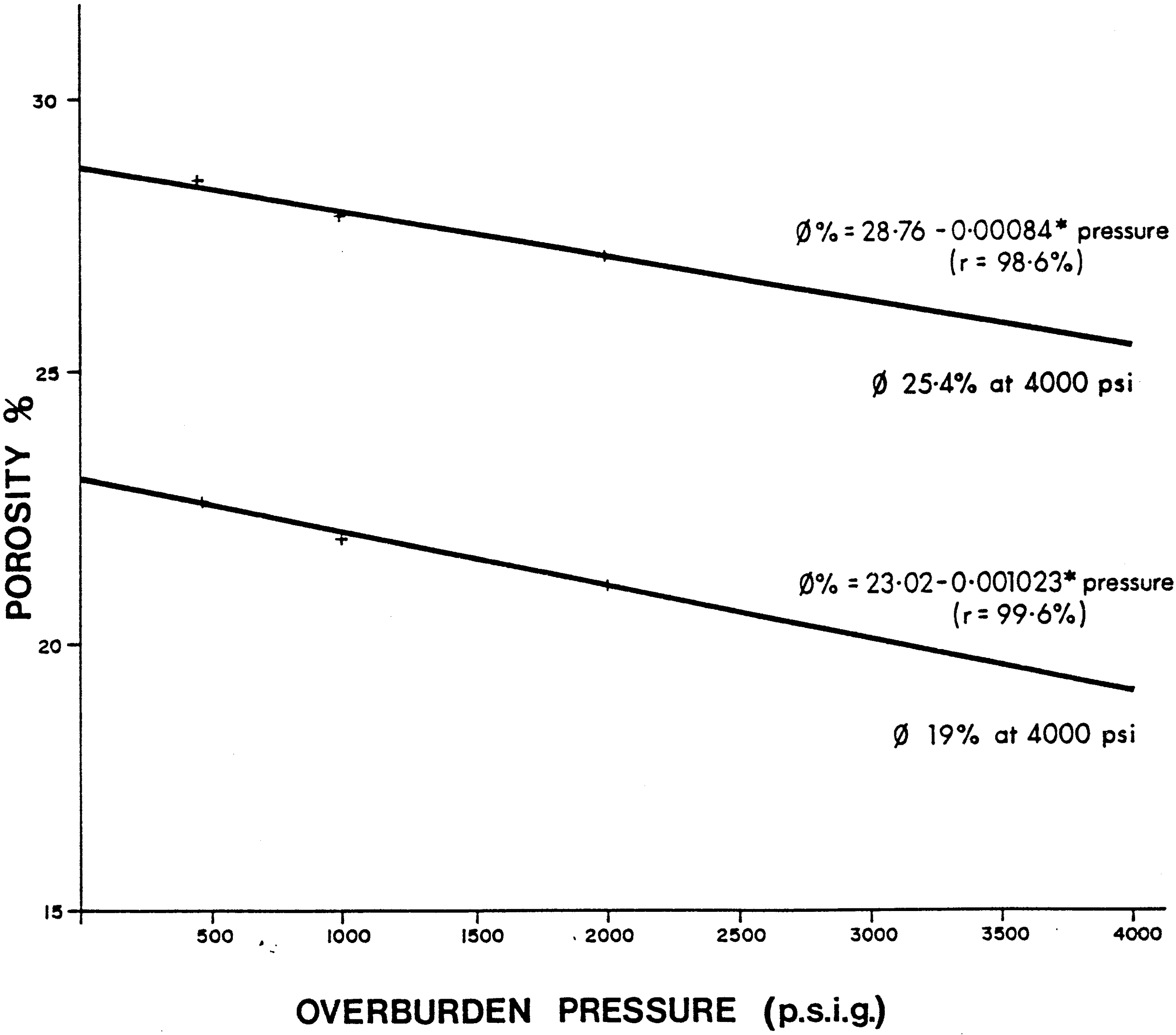

FIGURE 20

Ø% Coefficient equation
r Regression coefficient

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IONA-1

POROSITY VS OVERBURDEN

AUTHOR : A. BUFFIN DATE : MAY 1988 DRAWN BY : L.N.

- "m" and "n" values; Three core plugs, (Fig. 16) were selected to determine the formation resistivity factor and resistivity index.

"m", cementation factor	= 1.74
"n", formation resistivity factor	= 2.08

- Residual Gas Saturation: (Fig. 16), Three core plugs were selected and dispatched to Core Labs., Perth, to determine residual gas saturation and establish a gas recovery factor.

5.3 Log Analysis

A comprehensive petrophysical analysis of the Waarre Formation was undertaken by Bridge Oil Ltd. using the Terra Log 86 software package and is presented in Appendix 19.

The interpretation is specifically orient~~at~~ed to a petrophysical analysis of the gas bearing Waarre Formation Unit C. (Figure 6, Appendix 19). The presence of mov~~e~~able hydrocarbons and good porosities, (upto 25%) are also implied in the Waarre Formation, Unit B sandstone body (1335m - 1345.5m). A lithological description of the unit however describes the sandstone as having a calcareous cement and reduced, poor visual porosity. Further more, pressure tests infer water wet sandstone unit. An erroneous log interpretation is obtained because parameters flagged for the Unit C sandstone are incorrect for the Unit B sandstone and falsely indicate hydrocarbons not water.

SUMMARY - LOG ANALYSIS (REF: APPENDIX 19)

STATIC B.H.T. - 56.7°C (Fig. 21)

RW - A value of 0.2 ohm/m @ 63°C, based on DST recoveries in Port Campbell-4 and Braeside-1, is assumed in all calculations.

VSHALE - The best agreement with XRD studies (<4% clay) is achieved using a soft formation model generally applied to analyse poorly cemented and/or young reservoirs, ie.

	100% SAND	100% SHALE
"TERTIARY" (soft formation) Model	< 10 API	> 100 API

POROSITY - A reasonable correlation between corrected neutron - density porosities and extrapolated, restored state core porosities can be demonstrated.

SW - Four water saturation equations were examined:

a) Archie

b) Total Shale

c) Indonesian

d) Dispersed Shale

Archie SW values are the most conservative of those examined and would seem most appropriate due to the clean nature of the reservoir.

The presence of hydrocarbons in place and moveable hydrocarbons are summarised in figure 6, Appendix 19, which displays a plot of:-

VSHGRTERT'Y = Vshale, gamma ray corrected for young umcompacted rocks.

NDPHI-SC/HC = Neutron-Density crossplot porosity corrected for shale and hydrocarbons.

(1 - SW) x PHI = Hydrocarbons in Place.

MOBILE HC x PHI = Moveable Hydrocarbons.

SUITE	TYPE	t	T°C	$\ln\left(\frac{t+\Delta t}{t}\right)$
1	DLL-MSFL	7·17	48·2	0·130
2	BHC	11·78	51·5	0·081
3	SLD-CNS	16·95	52·7	0·057

Duration of circulation prior to logging (Δt) : 1hr

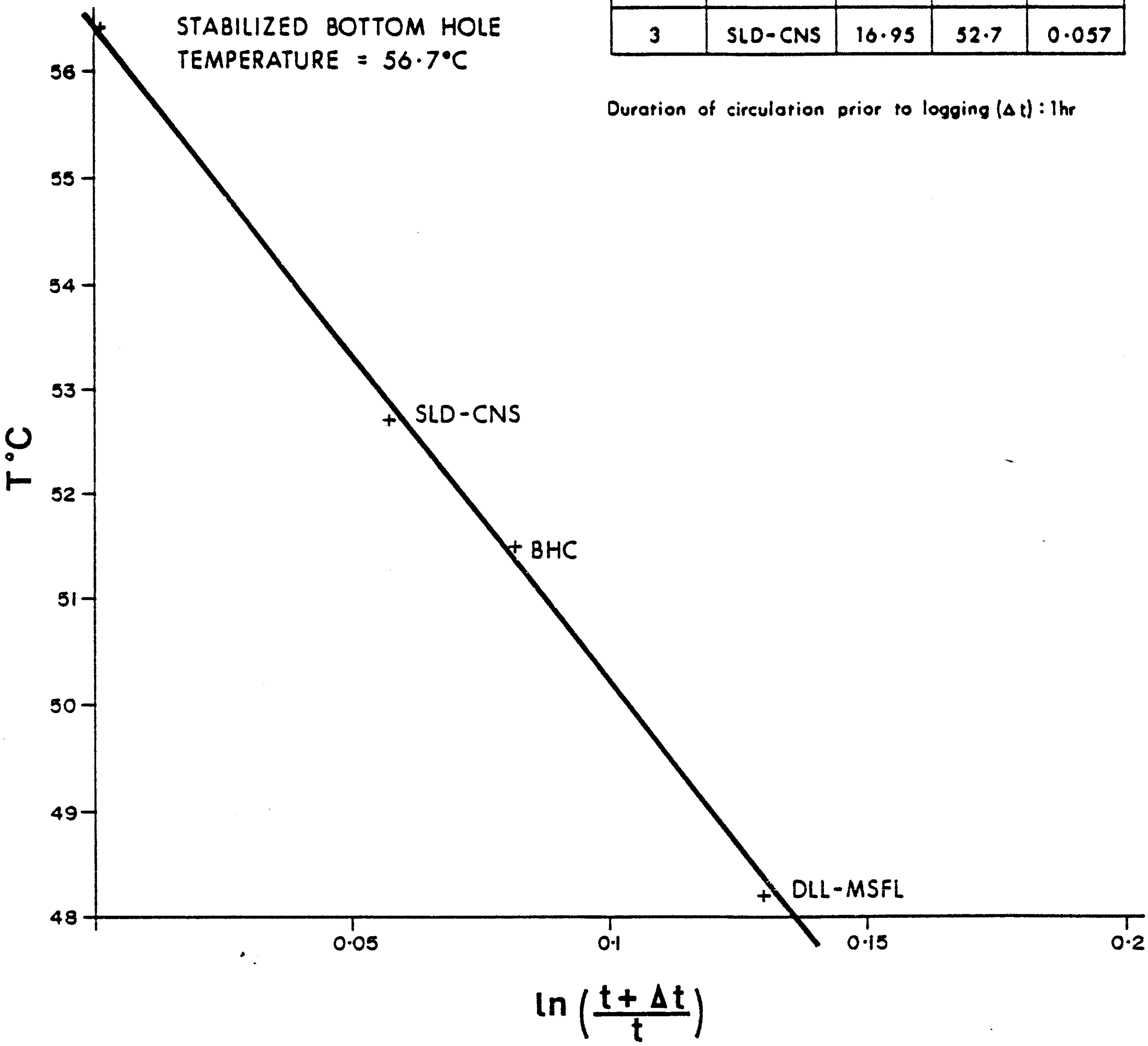

FIGURE 21

Beach Petroleum NL

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IONA-1

STABILIZED BHT ESTIMATE

AUTHOR : A BUFFIN DATE : JULY 1988 DRAWN : L.N.

5.4 X-Ray Diffraction Analysis

X-Ray diffraction (XRD) studies were performed on fourteen samples and determined characteristic clay mineral assemblages associated with the various formations and units present within the Iona # 1 well. The clay mineral assemblages fall into eight groups, (Fig. 22).

(a) Pember/Pebble Point Formation

Mineralogical similarities were noted between the Pember Mudstone and Pebble Point Formation. A characteristically high chlorite/smectite ± illite mixed layer was observed and a relatively minor amount of illite in each of the Tertiary samples.

(b) Paaratte Formation (undifferentiated)

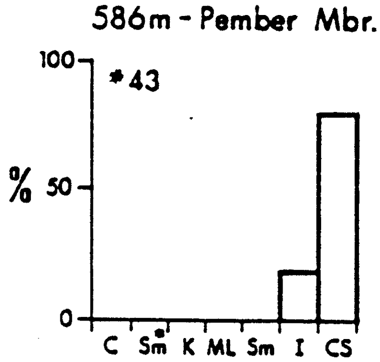
A vastly different mineral assemblage was detected within the upper Paaratte sample, displaying the great difference noted between the upper Cretaceous sediments and the overlying Tertiary sediments. The assemblage is dominated by Kaolinite and illite clays.

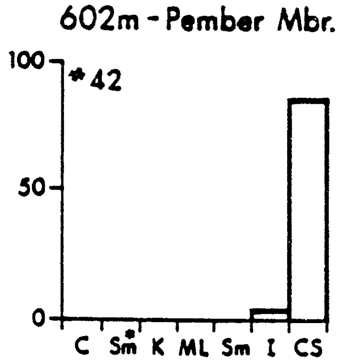
(c) Skull Creek Mudstone Member

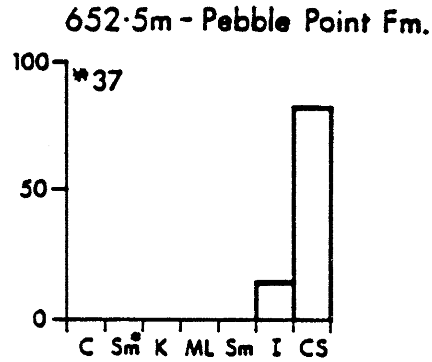
A notable characteristic was the high proportion of mixed-layer (illite/smectite) present within the Skull Creek Member, distinguishing the mudstone from the overlying Paaratte Formation and underlying Belfast Mudstone.

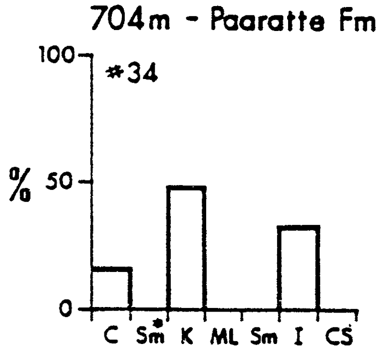
(d) Belfast Mudstone

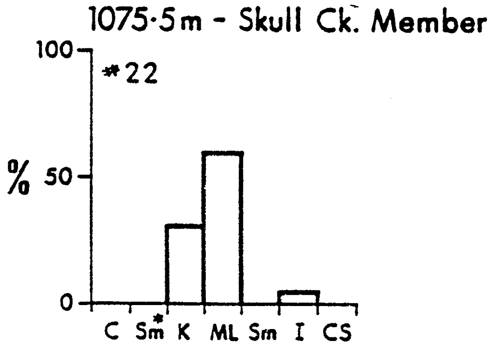
XRD studies show a high percentage of smectite within the Belfast Mudstone. The high proportion of smectite within the Belfast Mudstone probably accounts for the "heaving" nature of the mudstone.

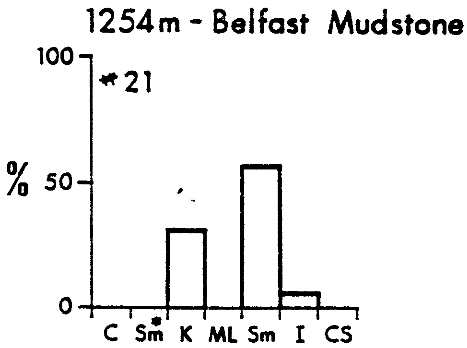












CLAY TYPES

C	Chlorite
Sm*	Smectite, inhibited
K	Kaolinite
ML	Mixed layer (illite/smectite)
Sm	Smectite
I	Illite
CS	Chlorite/Smectite ± Illite mixed layer

FIGURE 22

All depths from K.B.

*10 Sidewall Core Number

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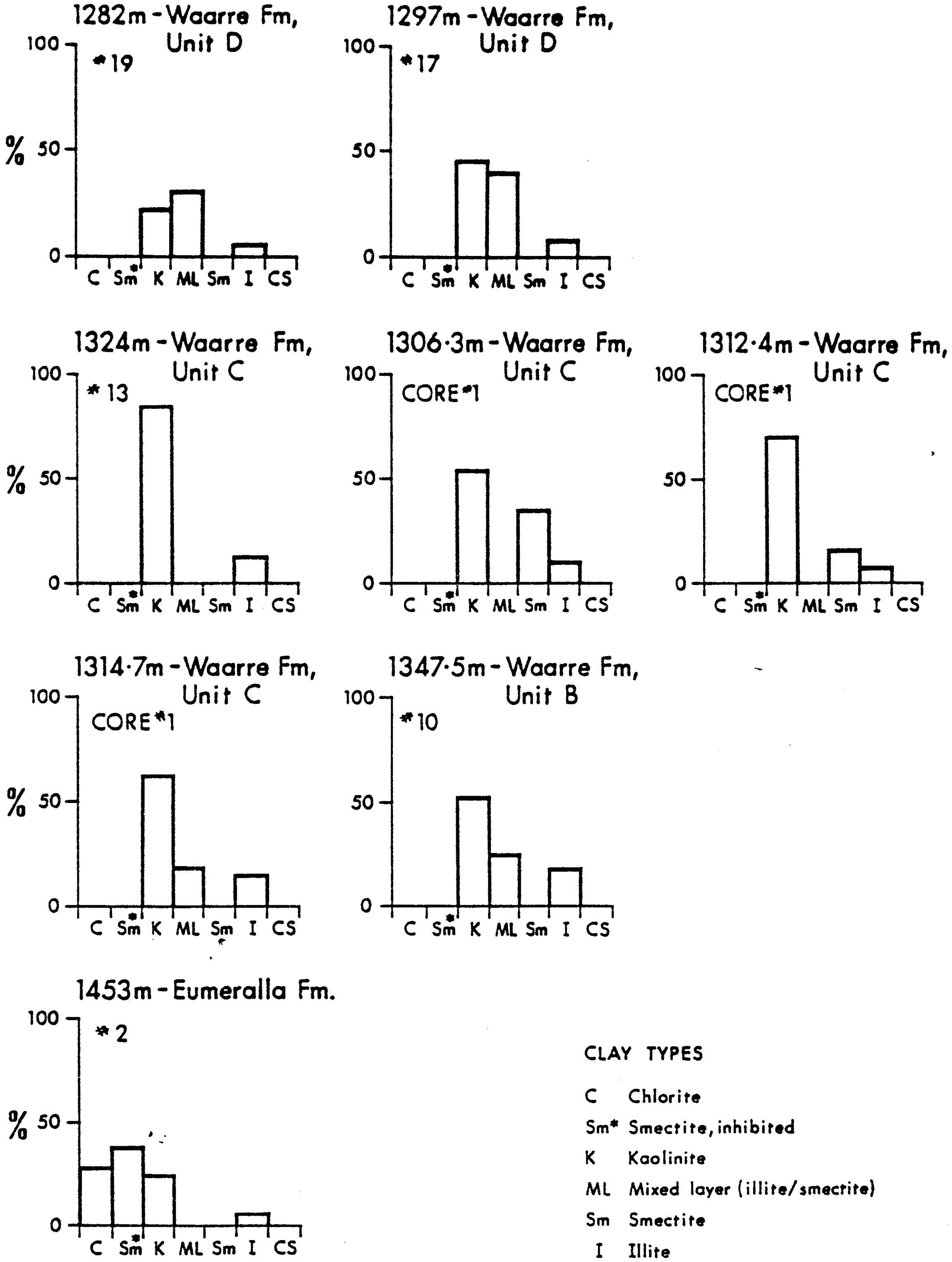
IONA-1

CLAY MINERALOGY

Page 1 of 2

AUTHOR: A.BUFFIN DATE: MAY 1988 DRAWN BY: L.N.



CLAY TYPES

C	Chlorite
Sm*	Smectite, inhibited
K	Kaolinite
ML	Mixed layer (illite/smectite)
Sm	Smectite
I	Illite
CS	Chlorite/Smectite ± Illite mixed layer

FIGURE 22

All depths from K.B.

*10 Sidewall Core Number

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PEP 108
IONA-1
CLAY MINERALOGY

Page 2 of 2

AUTHOR : A BUFFIN DATE : MAY 1988 DRAWN BY : L.N.

(e) Waarre Formation (Unit D)

The mineralogical assemblage determined for the Waarre Formation, Unit D displays a similar character to the Skull Creek Member with kaolinite, a mixed-layer (illite/smectite) clay and minor illite present. The major difference between the two units is the kaolinite/mixed layer ration:

1 : 2 for the Skull Creek Member

1 : 1 for the Waarre, Unit D

(f) Waarre Formation (Unit C - sandstones)

The sandstone of Unit C is characterised by a diagnostically high percentage of kaolinite and minor quantities of illite and smectite.

(g) Waarre Formation (Unit C/Unit B - shales)

The mineral assemblage displayed in the Unit C/Unit B shale bands is similar to that observed in the Waarre Formation, Unit D. As with the Skull Creek/Waarre Formation Unit D, however, the two shales differ in the kaolinite/mixed layer ration:

1 : 1 for the Waare Formation Unit D

2 : 1 for the shale bands of Unit C and Unit B

(h) Eumeralla Formation

The mineralogy of Lower Cretaceous Eumeralla sediments is quite different from the overlying Upper Cretaceous Waarre Formation units, with chlorite and "inhibited" smectite (see Appendix 18) included whilst kaolinite, a particularly abundant mineral within the Waarre Formation, is vastly reduced within the Eumeralla sediments.

The use of XRD studies at Iona # 1 can confirm formations, members or units which display similar depositional character and/or a similar provenance. Mineralogical studies can aid stratigraphic definition of boundaries where log or age dating may prove inconclusive.

5.5 Maturation and Source Rock Analysis

Vitrinite reflectance estimates (Vr) and total organic carbon (TOC) analyses were performed on five sidewall cores. Results of the study are contained in Appendix 6 and summarised in figure 23. The shallow burial depths of Tertiary sediments do not warrant maturation/source rock studies.

The unconformable sufaces shown on (Fig. 23) were determined from palynological age dating and dip meter interpretation.

Upper Cretaceous: Two sidewall cores from the Upper Cretaceous were submitted for analysis, one in the Belfast Mudstone and one in the Waarre Formation Unit D.

The total organic carbon (TOC) content of the Belfast was good and dispersed organic matter (DOM) was abundant. Inertinite was the common maceral type whilst vitrinite and exinite were sparse, reducing the source rock potential of the Belfast Mudstone. Vitrinite reflectance data implies that Belfast Mudstone is immature for hydrocarbons and confirmed by the mid yellow spore colour (Appendix 5).

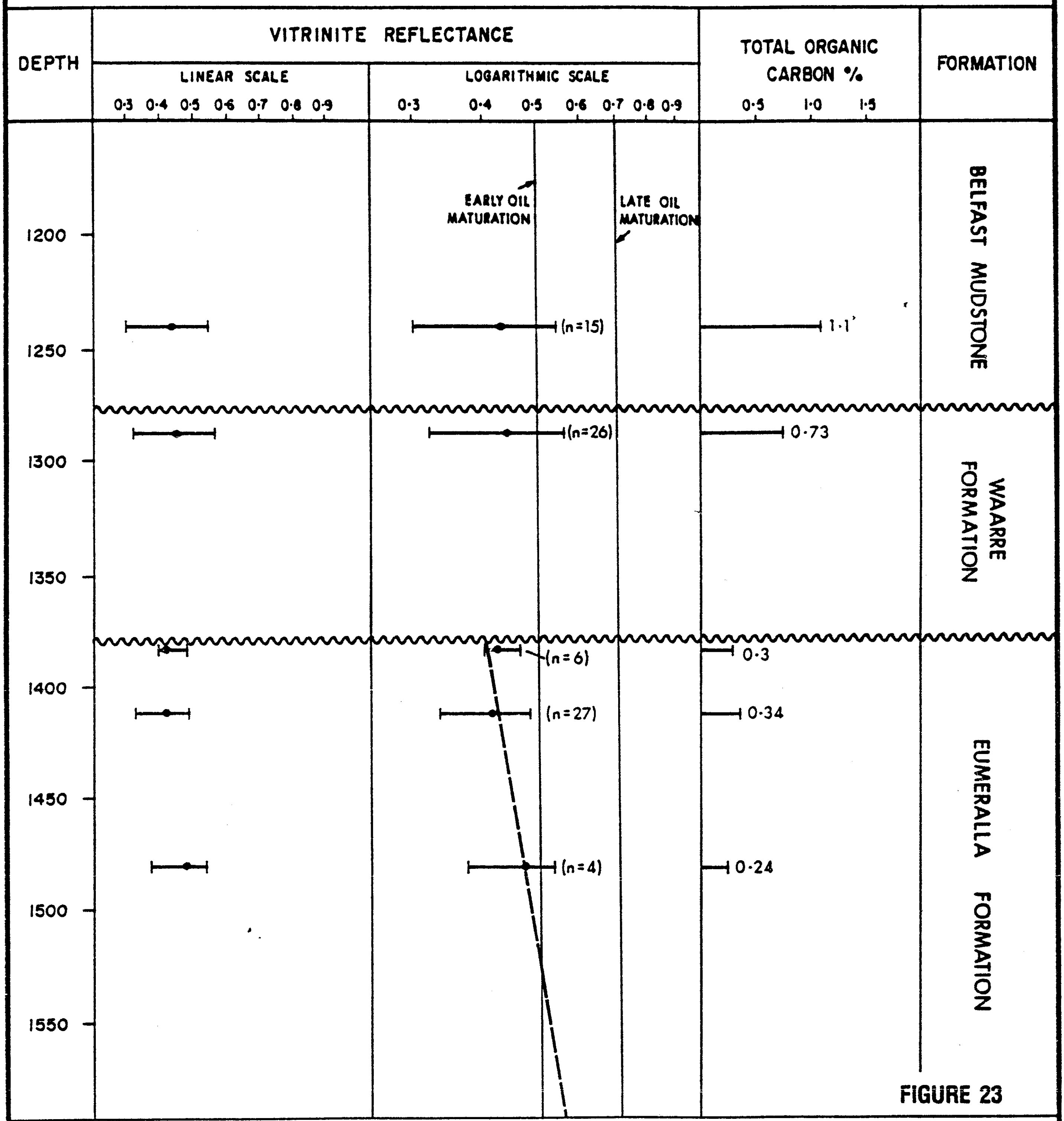

FIGURE 23

NOTE: 1. = Rv max. and range
2. n = number of counts
3. All samples were sidewall cores

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PEP 108

IONA-1

VITRINITE REFLECTANCE AND TOTAL ORGANIC CARBON

AUTHOR: A. BUFFIN DATE: MAY 1988 DRAWN: L.N.

TOC content of the Waarre, Unit D was moderate to good and DOM matter common, inertinite was the common maceral, whilst vitrinite was sparse and exinite rare, reducing the source rock potential of the Waarre, Unit D. The vitrinite reflectance data and spore pollen colour confirms the Waarre, Unit D is immature for hydrocarbons.

Lower Cretaceous: Samples analysed at 1383m and 1481m contained common amounts of inertinite and rare exinite and vitrinite. Whilst a sample at 1423m displayed common vitrinite and sparse to rare inertinite and exinite rare yellow oil droplets were also noted within the sample.

Diverse DOM levels and varying dominant maceral types within the Eumeralla sediments alter significantly throughout the Port Campbell Embayment (Ref: Buffin, 1987, Port Campbell Embayment Study #1).

The Eumeralla sediments at Iona # 1 appear to exhibit a marginal maturity to oil generation, though for gas the sediments remain immature. This is supported by the spore colour index (Figure 2 in Appendix 5).

Extrapolation of the best fit line infers the onset of oil generation at approximately 1550m and gas generation at approximately 2100m. Oil generation therefore may occur within the underlying Eumeralla sediments requiring vertical migration over a short distance. Gas however is sourced from Eumeralla sediments on the down thrown side of the Sherbrook Trough and migrates along the Sherbrook Fault Zone toward the Iona structure.

In summary, the Belfast Mudstone and Waarre Formation at Iona # 1 are immature for oil and gas generation and, though exhibiting good TOC values, they have poor generative potential.

The Eumeralla Formation Formation is marginally mature for oil and immature for gas at Iona # 1, though exhibits the potential to generate oil and gas at depth. This has obviously occurred near the Iona structure, either directly below the Eumeralla sediments penetrated at Iona # 1, or within the sediments in the Sherbrook Trough.

6.0 CONTRIBUTION TO GEOLOGICAL CONCEPTS

Iona #1 represents the first new gas field discovery in the region since the discovery of Port Campbell High gas fields in 1979-1981. The depositional model proposed for the Waarre Formation and the lateral extent of the sandstone body was confirmed by drilling Iona #1. Extending the depositional concepts across the Embayment implies the presence of additional unexplored oil and gas fields throughout the Port Campbell Embayment.

Oil shows observed in Iona #1 indicate oil entrapment has occurred within the region.

The Iona structure combined with proximal deep source rocks, well defined major migration pathways, an adequate seal and good reservoir sandstones represents an excellent configuration for hydrocarbon entrapment.

SUMMARY OF DRILLING OPERATIONS (FIG. 24).

The Iona No. 1 drill site was prepared by R & J Andrew.

Prior to the rig arriving, a 16" conductor pipe was installed to 9.5m (KB).

The G.D.S., Rig #2 was rigged up and Iona #1 was spudded at 2230 hours, 6th March, 1988.

A 12¼" hole was drilled from 9.5m to 247m, 9 5/8" casing was set at 243.5m. The BOP's were installed and function tested to 1500 psi.

An 8½" hole was drilled to 252m, a leak off test established a formation integrity of 16.2 ppg EMW.

The 8½" hole continued from 252m to 1305.5m, with new bits at 976m and 1230m.

DST # 1 was attempted over the interval 1292.6m to 1305.5m, gas flowed at an estimated 8.1 MMCFPD.

Core # 1 was cut from 1305.5m to 1314.68m (100% recovery).

An 8½" hole was drilled from 1314.68m to a total depth of 1490m. Total depth was reached at 0800 hours, 17th March, 1988.

Gearhart Electric logging ran the following logs: DLL-MSFL-GR; BCS-GR; SLD-CNS-GR; FED-GR; WSS; CST; SFT.

5½" Production casing was set at 1480.6m and the well plugged back to 1455.7m.

The well was displaced with NaCl completion brine and Gearhart Electric logging ran the following log; CBL-VDL-GR.

Pick up and ran in completion string, installed and tested Christmas tree.

The rig was released at 1700 hours, 23rd March, 1988.

SPUD : 22·30hrs 6 March 1988
REACHED T.D. : 08·50hrs 17 March 1988
RIG RELEASED : 17·00hrs 24 March 1988

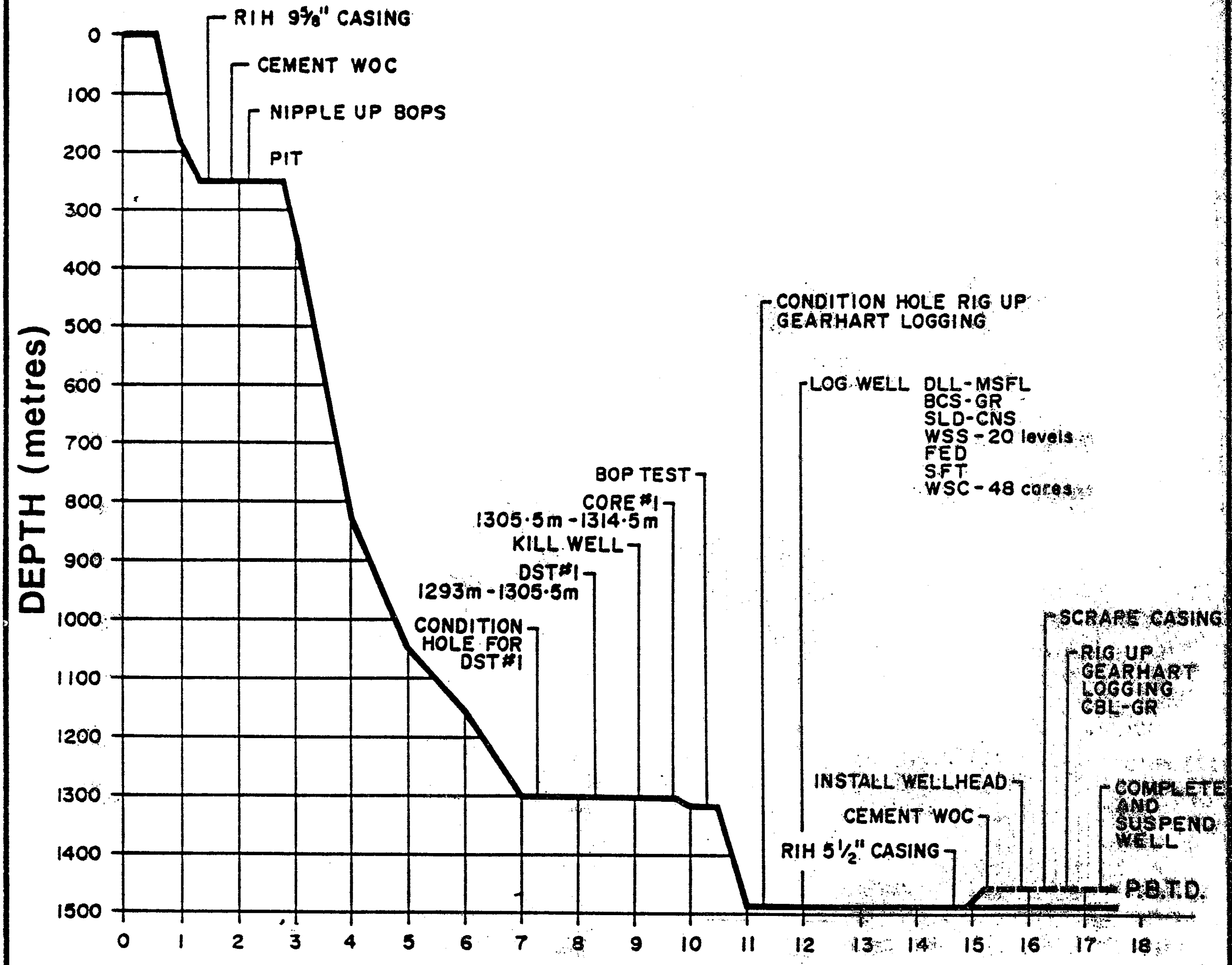

FIGURE 24

Beach Petroleum NL

PEP 108

IONA-1

TIME VS DEPTH

AUTHOR: A BUFFIN DATE: MAY 1988 DRAWN BY: L.N.