ANGLO AUSTRALIAN OIL COMPANY N.L.

WELL COMPLETION REPORT

KILLARA NO. 1
(W1048)

PEP 101

OTWAY BASIN
VICTORIA

VOLUME 1 (TEXT) W1048

Prepared by:
I.D. Buckingham

July, 1992

VOLUME 1 : TEXT

LIST OF CONTENTS

CONTENTS		PAGE

FIGURES

TABLES

APPENDICES

I. Details of Drilling Plant

II. Summary of Wellsite Operations

III. Drilling Fluids Recap

IV. Bit Record

V. Cuttings Sample Description

VI. Sidewall Core Description

VII. Formation Testing

VIII. Velocity Survey

IX. Palynology

X. Source Rock & Maturation

XI. Water Analyses

XII. Log Analyses

ENCLOSURES

			Scale
1.	Composite Well Log		1:500
2.	Mud Log		1:500
3.	Halliburton Wireline Logs		
	DLL - MSFL - GR		1:200
		&	1:500
	BCS - CAL - GR		1:200
		&	1:500
	DLL - BCS - MSFL - GR (Composite)		1:200
		&	1:500
	Four Electrode Dipmeter (resistivity curves)		1:200
		&	1:500
	Four Electrode Dipmeter (tadpole plot)		1:200
		&	1:500

SUMMARY

Killara No. 1 was drilled as a wildcat exploration well in PEP 101, Otway Basin, Victoria.

Participants in the well were Anglo Australian Oil Company N.L. (Operator) Cultus Petroleum (Australia) N.L., Bridge Oil Limited and Winton Oil N.L.

Killara No. 1 is located 13 km northwest of the township of Koroit, 32 km northwest of Warrnambool, 54 km northeast of Portland, 200 km west of Geelong and 260 km west southwest of Melbourne.

The Lower Cretaceous aged Pretty Hill Formation was the primary objective of the well and was considered to be a potential oil play.

The well spudded at 11:30 pm on 6th June, 1991 and reached a total depth of 2409 m (KB) at 6:30 am on 25th June, 1991.

At total depth the following logs were run:

Dual Laterolog/Micro-spherically focused Laterolog/Gamma Ray
Compensated Sonic Log
Dipmeter
Velocity Survey
Sidewall Cores

Significant gas recordings were observed during drilling. The first background gas (C1) readings were observed at a depth of 600 m. and correspond with the top of the Eumeralla Formation. C1 values increased slowly with depth and at approximately 1285 m. C2 was recorded. Low levels of C3 were observed from 1350 m. onwards. No marked increase in

background gas values was observed at the boundary between the Eumeralla Formation and the Pretty Hill Formation. Significant gas readings were observed over the interval 1625 -1765 m. and at 1700 m. the first indications of C4 were recorded. This interval includes the Killara Coals (informal name). Below this sequence background gas readings continued to decrease with only C1 values remaining constant until total depth was called at 2410 metres (2409 m. driller).

No fluorescence was observed during penetration of the Pebble Point Formation. Traces of dull gold (mineral?) fluorescence was noted from 1500 m. to 1518 m. At 2013 m. bright blue fluorescence was noted in a few grains. An instantaneous slow streaming cut and a milky blue residual ring was observed. A Drill Stem Test was undertaken at this level.

Two drill stem tests were carried out. The first test was conducted over the interval 2010.1 - 2026.0 m. and was designed to test a basal sand in the shaly upper Pretty Hill Formation. The test tool was reverse circulated and an estimated 2 barrels of rathole mud and 68 barrels of formation water were recovered.

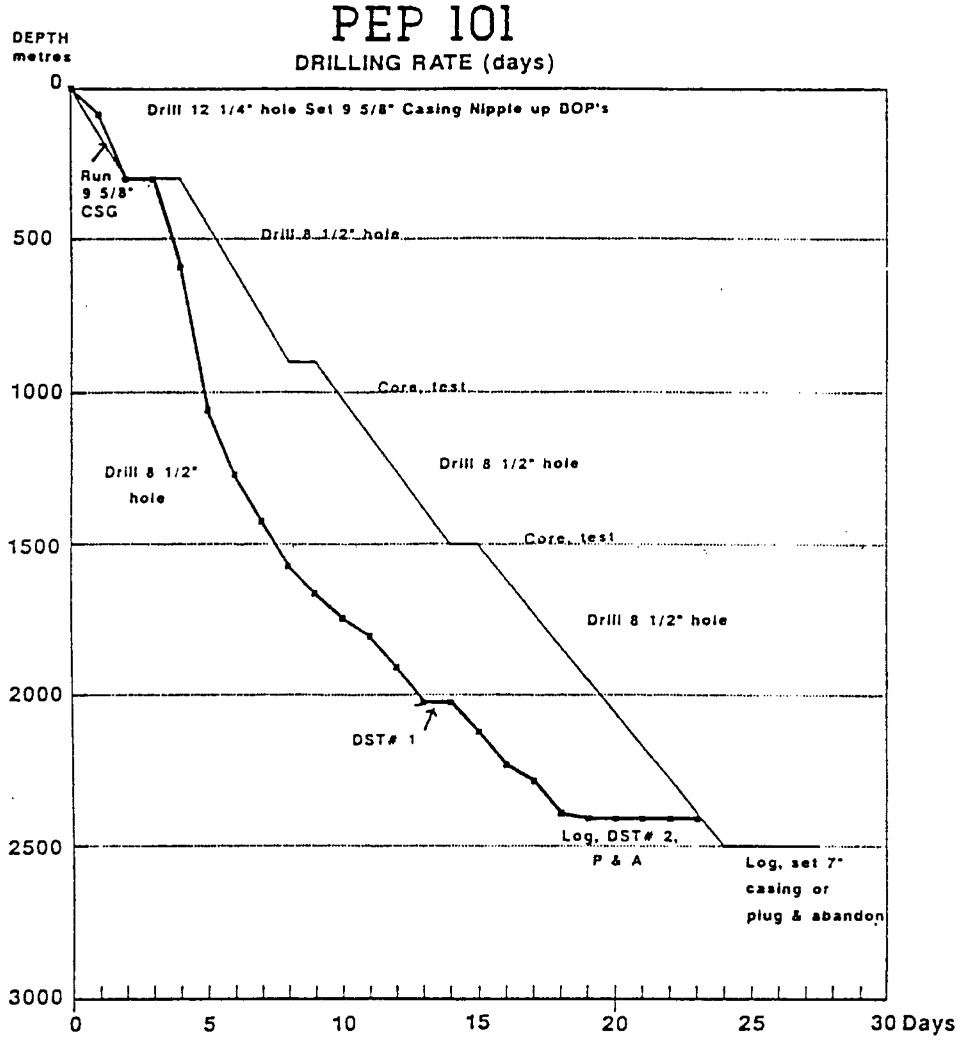
The second test was conducted over the interval 446.92 - 492.91 m., testing sands of the Pebble Point Formation. The test recovered 374 m. of rathole mud, muddy formation water and sand. The test string was completely plugged with sand up to 45 m. above the test tools.

No conventional coring operations were performed.

Killara No. 1 was plugged and abandoned as a dry hole and the rig was released at 1600 hours on 29th June, 1991.

KILLARA No.1

PEP 101



PENETRATION RATE CURVE
ACTUAL V'S PREDICTED

Location

GEOGRAPHIC	Latitude	:	38 11'24.22"S
	Longitude	:	142 13'19.12"E
A.M.G	Easting	:	607,011.56
	Northing	:	5,772,376.70
ELEVATION	Ground level	:	70.72 m ASL
	Kelly Bushing	:	76.00 m ASL

Total Depth 2409.0 m

Type New Field Wildcat

Date

WELL SPUDDED	6 June 1991
T.D. REACH	25 June 1991
RIG RELEASE	29 June 1991
STATUS	Plugged & Abandoned

Figure 1

CONCLUSIONS

- Killara No.1 was drilled on a highly faulted anticlinal structure formed as a result of fault block rotation associated with major basin faulting.

- The primary reservoir objective of this well, the sands of the lower Pretty Hill Formation, was interpreted to be present and exhibited fair-good reservoir characteristics.

- The presence of a thick coal sequence (Killara Coals) in the upper part of the Pretty Hill Formation has, to the author's knowledge, not been previously observed in the Otway Basin. The age of this unit corresponds to that of the upper Laira Formation, found in the South Australian portion of the Penola Trough. This same coally unit was not present in the Greenslopes -1 well drilled approximately 8 km to the north of Killara -1.

- The maturity profile indicates that both the Eumeralla and upper Pretty Hill Formation are immature to marginally mature for the generation of liquids and immature for the generation of gas. The lower section of the upper Pretty Hill Formation and the lower Pretty Hill Formation are marginal to early mature for the generation of liquids and immature for the generation of gas.

- The primary target reservoirs of the Pretty Hill Formation and the secondary target Heathfield reservoir were found to be water flushed. The remarkable similarity in water salinities between those recovered from the Tertiary Pebble Point Formation, approximately 450 m and that recovered from the basal section of the upper Pretty Hill at 2013 m suggests the possibility of communication most likely via the major fault network.

- Furthermore, while validity of structural closure from seismic evidence in the upper Pretty Hill Formation has been re-confirmed it would now appear that the well was not a valid test of the reservoirs of the lower Pretty Hill Formation in a closed position for a re-interpretation indicates that these reflectors are steeply dipping and that at this level the structure opens in a westerly direction.

- Although plugged and abandoned as a dry hole, Killara No. 1 has achieved a number of geological objectives well beyond expectation.

  Firstly, the presence of the Killara Coals in the upper Pretty Hill Formation indicates that potential source rocks may occur in the deeper sections where its maturity as a source for hydrocarbons is increased.

  Secondly, the Killara Coals represent a readily mappable seismic unit and as such will simplify mapping in this section of the Otway Basin. This unit is seismically represented by a series of high amplitude continuous reflectors that have generally been considered to represent the basal sandy section of the Pretty Hill Formation.

  Thirdly, the presence of hydrocarbons throughout the thermally immature sections of the well indicate that the source of these hydrocarbons must be must be in the deeper sections of the basin. The only known sequence that has the ability to generate hydrocarbons and is deeper is the Casterton Beds.

RECOMMENDATIONS

The following recommendations are based on the above observations and conclusions giving full consideration to the limits placed on data available within PEP 101:

- A major basin study project involving a re-interpretation of all existing gravity, seismic and geological data should be initiated. The project should place particular emphasis on structural analysis, source rock and reservoir potential, play type and aspects relevant to hydrocarbon generation, migration and entrapment.

- Seismic mapping should be directed towards delineating the extent of the Killara Coals and the underlying Casterton Formation and resolving the structural complexities of the area.

- An attempt should be made to reduce seismic maps to 1:100,000 scale so that a regional picture of the structural style of the area and the distribution of the various lithologies can be gained.

- A gravity survey could be implemented to outline the structural framework of the north-western section of the permit.

- The best prospect, delineated from the above programme of works should be drilled to Basement.

- Further age dating of the section containing the Killara Coals should be carried out. The discrepancies between Morgan's and Dettmann's two analyses through this section should be evaluated. Conventional wisdom dictates that any major coal sequences found within this part of the section should be assigned to the lower Eumeralla Formation.

1. INTRODUCTION

Killara No. 1 was drilled to test the hydrocarbon potential of the Pretty Hill Formation in an anticlinal structure that developed as a result of rotation of a major fault block during growth faulting. As part of this evaluative process the stratigraphy and structure of the prospect was to be verified.

Within the Otway Basin, in both Victoria and South Australia, the Pretty Hill Formation (particularly the lower sand unit) exhibits excellent reservoir characteristics, and many of the wells that have penetrated this sequence have exhibited encouraging hydrocarbon shows. In the Katnook and Ladbroke Grove Gas Fields in the South Australian portion of the Otway Basin the Pretty Hill Formation is the primary reservoir.

The Killara prospect was seismically identified as a growth faulted rotated fault block induced anticline. The potential of the prospect was further supported by the interpreted presence of a thick sequence of Casterton Formation (major source potential) juxtaposed the structure and at a depth that where maturation should be well developed.

The well developed infrastructure and proximity of markets were other reasons justifying the drilling of Killara No. 1.

2. WELL HISTORY

2.1 Location (See Figures 2 & 3)

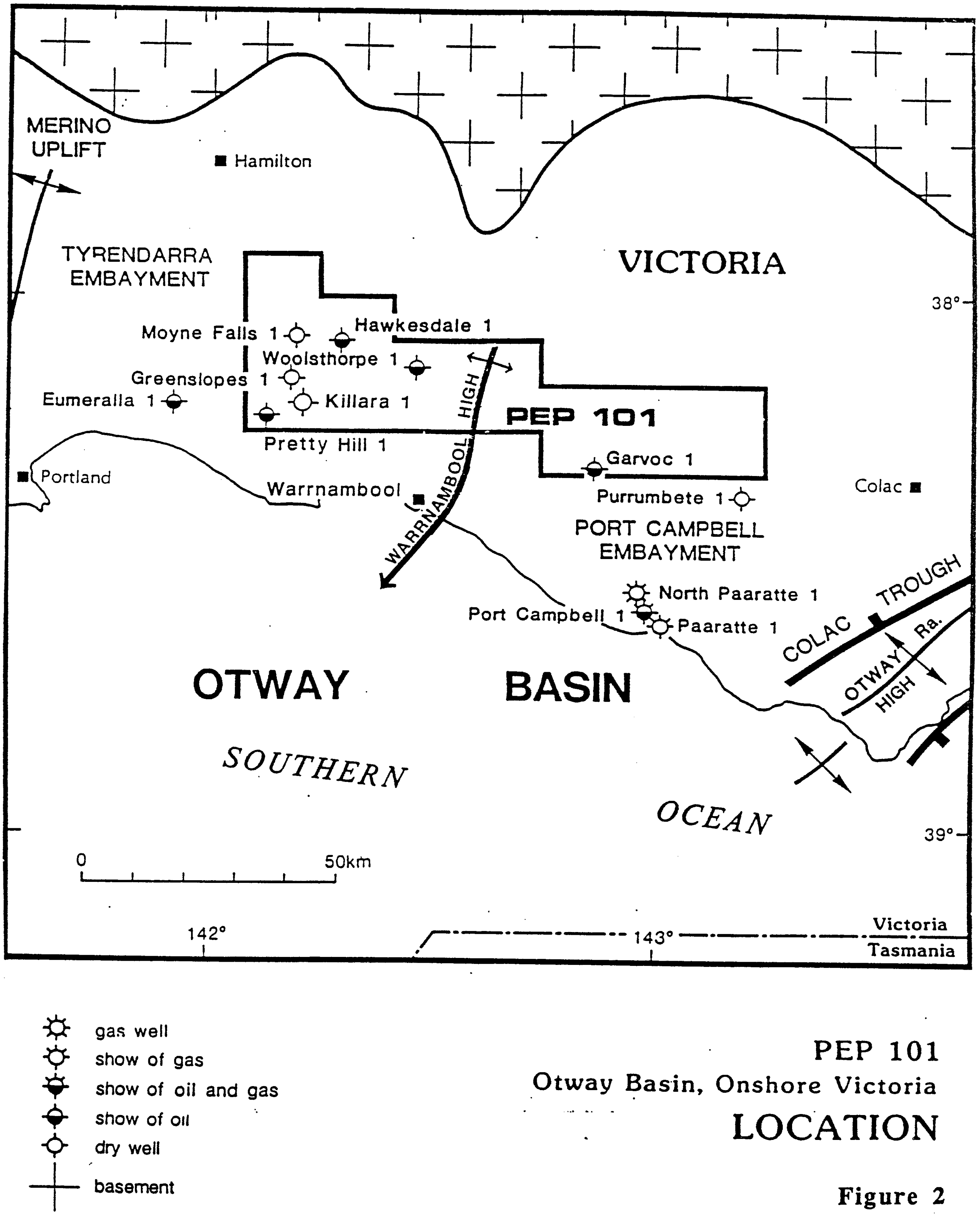
Co-ordinates:	Latitude: 38° 11' 24.22"S Longitude: 142° 13' 19.12"E
Geophysical Control:	Seismic Line: OPX 89 - 63 The well was located approximately 210m. west of Shot Point: 480
Description:	Country of: Villiers Parish of: Willatook C. A.: 35 Shire of: Warrnambool
Property Owners:	Grace A. Roache & Mary E. O'Brien, "Glenwood", Hawkesdale, Vic., 3287.
Access to Location:	Gained through property owned by Fred Moutray, "Gnerrang" RMB 5250, Yambuck, Vic., 3285.

2.2 General Data

Well Name:	Killara No. 1
Operator:	Anglo Australian Oil Company N.L. Level 4 766 Elizabeth Street Melbourne 3000

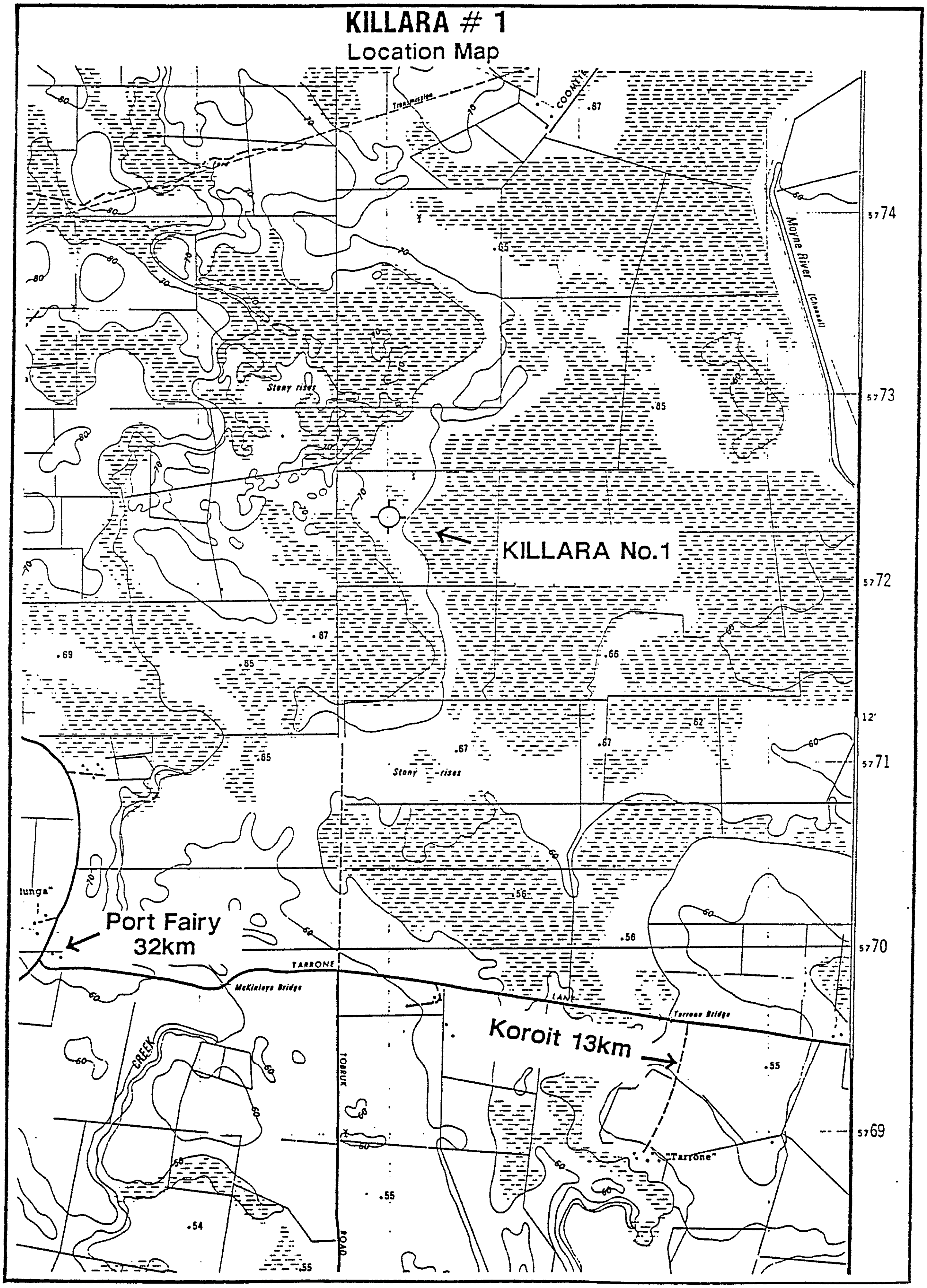
Participants:	Cultus Petroleum Level 1 25 Merriwa Street Gordon NSW 2072
	Bridge Oil Limited 255 Elizabeth Street Sydney NSW 2000
	Winton Oil N.L. Kiewa Street Albury NSW 2640
Elevation:	Ground Level: 70.72 m ASL Kelly Bushing: 76.0 m ASL Unless otherwise stated, all depths refer to K.B.)
Total Depth:	Driller: 2409.0 m. Wireline Logger: 2410.0 m.
Drilling Commencement:	6th June 1991 @ 2330 hrs
Total Depth Reached:	25th June 1991 @ 0630 hrs
Rig Released:	29th June 1991 @ 1600 hrs
Drilling Time to T.D.:	18.5 days
Status:	Plugged and abandoned, dry hole.

TENEMENT MAP



PEP 101
Otway Basin, Onshore Victoria
LOCATION

Figure 2



DRAWN F.TRAVIATI

Figure 3

2.3 Drilling Data (see appendices 1, 2 &3)

2.3.1 Drilling Contractor

Gearhart Drilling Services Pty. Ltd.
5 Westcombe Street
Darra QLD 4076

2.3.2 Drilling Rig

Gearhart Rig No. 2

2.3.3 Casing and Cementing Details

16" conductor was set at 11.0 m prior to rig up.

Surface Casing

Size:	9 5/8"
Weight and Grade:	36lb/ft, K55
Float Collar:	
Shoe:	304.8 m
Cement:	Lead slurry -180 sacks Class "A" with 4% Bentonite by weight of water Tail slurry - 152 sacks Class "A" neat
Method:	Displacement
Equipment:	Halliburton Services

Cement Plugs

Plug No. 1

Interval:	1790 - 1730 m
Cement:	70 sacks Class "A" with 0.4% HR4
Method:	Balanced
Tested:	No

Plug No. 2

Interval:	638 - 578 m
Cement:	74 sacks Class "A" neat
Method:	Balanced
Tested:	No

Plug No. 3

Interval:	550 - 490 m
Cement:	71 sacks Class "A" neat
Method:	Balanced
Tested:	Bumped for DST#2. Polished plug to 492.91 m.

Plug No. 4

Interval:	490 - 430 m
Cement:	77 sacks Class "A" neat
Method:	Balanced
Tested:	No

Plug No. 5

Interval:	334 - 274 m
Cement:	84 sacks Class "A" neat
Method:	Balanced
Tested:	No

Plug No. 6

Interval:	302 - 272 m
Cement:	53 sacks Class "A" neat
Method:	Balanced
Tested:	No

Plug No. 7

Interval:	38 - 8 m
Cement:	53 sacks Class "A" neat
Method:	Top up.
Tested:	No

2.3.4 Drilling Fluid

An $8^{1/2}$" hole pilot hole was spudded using fresh water AQUAGEL mud. The $12^{1/4}$" hole was drilled to the casing point at 307 m. The 9 5/8" casing was set at 304.8 m without significant problems.

The $8^{1/2}$" hole was drilled to 2409 m over 18.5 days using a KCL - EZ MUD - Polymer mud system. This resulted in a very long section of open hole 2104 m and yet there were only minor tight hole problems that effected drilling time. The caliper log showed a very good gauge hole over most of the section. Typical mud properties close to T.D. were:

Weight	9.3 - 9.4 ppg
Viscosity	38 - 40 seconds
yield point	11 - 15 lb/100 ft^2
Filtrate	5.5 - 6.8 cc
Chlorides	23,000 - 25,000 mg/lt
%KCL	4 to 4.5

For further details see Appendix III, "Drilling Fluids Recap".

2.3.5 Water Supply

Drilling water was obtained from a water bore drilled specially for this purpose. The water bore was located approximately 100 m north of the rig and the water stored in a turkey's nest.

2.4 Formation Sampling and Testing

2.4.1 Cuttings

Cuttings samples were collected at 10 m intervals from surface to casing point and at 3 m intervals from casing shoe to total depth. Samples for immediate analysis were washed and a split stored in a clear plastic sample tray. Larger sample volumes were not washed but allowed to air dry. No splits were made with the total sample to be sent to the Department of Manufacturing and Industry Development for storage. This set of unwashed and dried samples was dispatched to the Department (Director of Energy Division) and the remaining plastic sample tray collection was retained by the operator. (see Appendix V for description)

2.4.2 Cores

(i) No conventional coring operations were carried out.

(ii) Twenty four sidewall cores were attempted of which 16 were recovered. The list of these sidewall cores is summarised in Table - 1.

2.4.3 Tests

Two conventional open hole drill stem test were carried out DST No.1 was an "on-bottom" test carried out immediately after penetrating the potential reservoir unit. DST No.2 was carried out during the abandonment process and tested off plug No.3.

The results of the tests were as follows:-

DST No.	One
Interval Tested	2010.1 - 2026.0 m
Formation	upper Pretty Hill Sandstone
Packers depth	2010.1 m & 2007.72 m

Water cushion	None
Preflow	13.17 minutes, slight blow increasing
Initial Shut-in	34.88 minutes
Second Flow	59.27 minutes, weak blow increasing for first 15 min. of period then decreasing for remainder of period.
Second Shut-in	124.67 minutes

Pressures:

	Top Recorder at 2003.21 m	Bottom Recorder at 2025.0 m
1st Period		
Initial Hydrostatic	3249.70 psi	3305.58 psi
Initial Flow	805.33 psi	923.36 psi
Final Flow	832.80 psi	937.64 psi
Initial Shut-In	832.80 psi	937.64 psi
Final Shut-In	2370.95 psi	2416.93 psi
2nd Period		
Initial Flow	971.08 psi	1167.22 psi
Final Flow	1577.48 psi	1630.80 psi
Initial Shut-In	1577.48 psi	1630.80 psi
Final Shut-In	2393.76 psi	2445.67 psi
Final Hydrostatic	3246.25 psi	3277.72 psi

Temperature:

Measured temperature at a depth of 2022.0 m was 224.0°F.

Comment:

All downhole pressures are in absolute psia. Plugging is evident in the lower test string, with the bottom gauge showing a false initial hydrostatic due to being forced into the fill in the bottom of the hole.

Recovery:

Reverse circulated 2 bbl of rathole mud and 68 bbl of formation water.

Chemical Analysis

Six fluid samples were collected during pulling out the DST tool. The following are laboratory chemical analyses of sample No.5:

Sample No	5 (of 6)	Depth (m)	2010 - 2026
CO_3^{2-} (ppm)	330	HCO_3^- (ppm)	320
Cl^- (ppm)	15 000	SO_4^{2-} (ppm)	28
Ca^{2+} (ppm)	900	Na^+ (ppm)	7300
Mg^{2+} (ppm)	45	K^+ (ppm)	1200
pH	7.3		
Conductivity (microsiemens/cm) @ 25°C			40 000

Assessment

No problems were encountered during the course of drill stem testing.

The test was mechanically successful and the collected data are valid.

The test recovered formation water whose chemical analysis is very similar to that recovered from DST #2. This may indicate that the reservoirs are in communication.(see Appendix VII for details of DST results).

DST No.	Two
Interval Tested	446.92 - 492.91 m
Formation	Pebble Point Formation
Packers depth	446.92 m & 444.54 m
Water cushion	None
Preflow	18.99 minutes, moderate blow decreasing to weak after 6 min., no blow after 12 min.
Initial Shut-in	33.01 minutes
Second Flow	60.03 minutes, no blow
Second Shut-in	119.97 minutes

Pressures:

	Top Recorder at 440.03 m	Bottom Recorder at 491.99 m
1st Period		
Initial Hydrostatic	720.54 psi	802.45 psi
Initial Flow	492.68 psi	658.38 psi
Final Flow	588.27 psi	662.00 psi
Initial Shut-In	588.27 psi	662.00 psi
Final Shut-In	589.54 psi	662.33 psi
2nd Period		
Initial Flow	589.54 psi	662.33 psi
Final Flow	590.01 psi	663.15 psi
Initial Shut-In	590.01 psi	663.15 psi
Final Shut-In	591.59 psi	665.29 psi
Final Hydrostatic	720.38 psi	802.29 psi

Temperature:

Measured temperature at a depth of 487.0 m was 110.0°F.

Comment:

All downhole pressures are in absolute psia. Test string was completely plugged with sand up to 45 m above test tools.

Recovery:

Recovered 374 m of rathole mud, formation water and sand.

Chemical Analysis

A fluid sample was collected during pulling out the DST tool. The following are laboratory chemical analyses:

Sample No	1	Depth (m)	447 - 493
CO_3^{2-} (ppm)	160	HCO_3^- (ppm)	160
Cl^- (ppm)	14 000	SO_4^{2-} (ppm)	8
Ca^{2+} (ppm)	740	Na^+ (ppm)	6600
Mg^{2+} (ppm)	30	K^+ (ppm)	470
pH	7.0		
Conductivity (microsiemens/cm) @ 25°C			38 000

Assessment

No problems were encountered during the course of drill stem testing. The test was mechanically successful and the collected data are valid.

The test recovered formation water whose chemical analysis is very similar to that recovered from DST #1. This may indicate that the reservoirs are in communication. (see Appendix VII for details of DST results)

TABLE -1

LIST OF SIDEWALL CORES

KILLARA No1

No.	Depth (m)	Recovery	Lithology	Remarks
1	2405	yes	Claystone	Palynology
2	2360	nil		Petrology
3	2160	nil		Palynology
4	2080	yes	Siltstone	Petrology
5	2015	yes	Siltstone	Petrology
6	1975	yes	Slst/Claystone	Palynology
7	1908	yes	Mudstone	Palynology
8	1881	yes	Sandstone	Petrology
9	1872	yes	Sandstone	Petrology
10	1780	yes	Claystone	Palynology
11	1753	yes	Siltstone	Palynology
12	1612	yes	Siltstone	Petrology
13	1565	yes	Mudstone	Palynology
14	1535	yes	Mudstone	Palynology
15	1385	yes	Siltstone	Palynology
16	1121	yes	Claystone	Palynology
17	900	nil		Palynology
18	691	yes	Claystone	Petrology
19	631	nil		Palynology
20	582	nil		Palynology
21	458	nil		Petrology
22	453	yes	Sandstone	Petrology
23	430	nil		Palynology
24	350	nil		Palynology

See Appendix VI for detailed lithological description.

2.5 Logging and Surveys (see Enclosure 1)

2.5.1 Mud Logging

A standard skid-mounted Halliburton (Geodata Division) unit was used to record penetration rate, continuous mud gas monitoring, intermittent mud and cuttings gas analysis, pump rate and mud volume data. The mud log is included as Enclosure 2.

2.5.2 Wireline Logging (see Enclosure 3)

Wireline logging was performed by Halliburton Logging Services using a standard truck mounted unit. One logging run consisting of the following logs was carried out at total depth:

Suite 1	Interval (m)
DLL/MSFL/SP/CAL	2409.8 - 304.0
Gamma Ray	2409.8 to Surface

Suite 2	Interval (m)
Compensated Sonic Log (BCS)	2409.8 - 304.0

Suite 3	Interval (m)
Four Electrode Dipmeter (FED)	2409.4.-.1200.0

Suite 4	Interval (m)
Velocity Survey (CIS)	2409.8 - Surface

Suite 5	
Sidewall Coring (SWC)	1 Gun, 24 SWC

2.5.3 Deviation Surveys

Hole deviation surveys were conducted regularly with the following results:

Depth (m)	Deviation (Deg)
33	1/4
76	1/4
150	1/4
226	1/4
307	1/4
459	1/4
610	3/4
769	1/2
912	1 1/4
997	3/4
1053	1
1157	0
1242	1/2
1337	1/4
1422	1 1/2
1469	1
1526	7/8
1564	1/2
1631	1
1659	1 1/2
1706	Miss Run
1716	1 1/2
1743	2
1792	Miss Run
1801	1 1/4
1896	1 1/2
2094	1
2255	Miss Run
2264	Miss Run

2.5.4 Velocity Survey

A velocity Survey was recorded by Velocity Data Pty. Ltd. and processed by Velseis PTY. Ltd. The results are included as Appendix VIII.

3. RESULTS OF DRILLING

3.1 Stratigraphy

The following stratigraphic intervals have been identified using penetration rate, cutting and sidewall core analysis, wireline log interpretation and palynological results (see figure 4).

Group	Formation	Depth (K.B.)	Depth Sub Sea	Thickness (m)
	Newer Volcanics	Surf.	+70.7	36
Heytesbury				
	Port Campbell Lmst	36	+34.7	271
	Gellibrand	307	231	136
Wangerrip				
	Dilwyn			
	Pember Mudstone	443	367	5
	Pebble Point	448	372	33
Sherbrook				
	Paaratte (undiff.)	481	405	98
	Belfast Mudstone	579	503	10
	Flaxmans	589	513	23
Otway				
	Eumeralla	612	536	935
	Heathfield Sand Mbr.	1011	935	36
Crayfish Sub-Group				
	upper Pretty Hill	1544	1468	665
	(equiv. Geltwood Beach)			
	Killara Coals	1637	1561	159
	lower Pretty Hill	2208	2132	201+
Total Depth (Driller)		2409	2333	
Total Depth (Logger)		2410.8	2334.8	

Generalised Stratigraphic Table of the Otway Basin

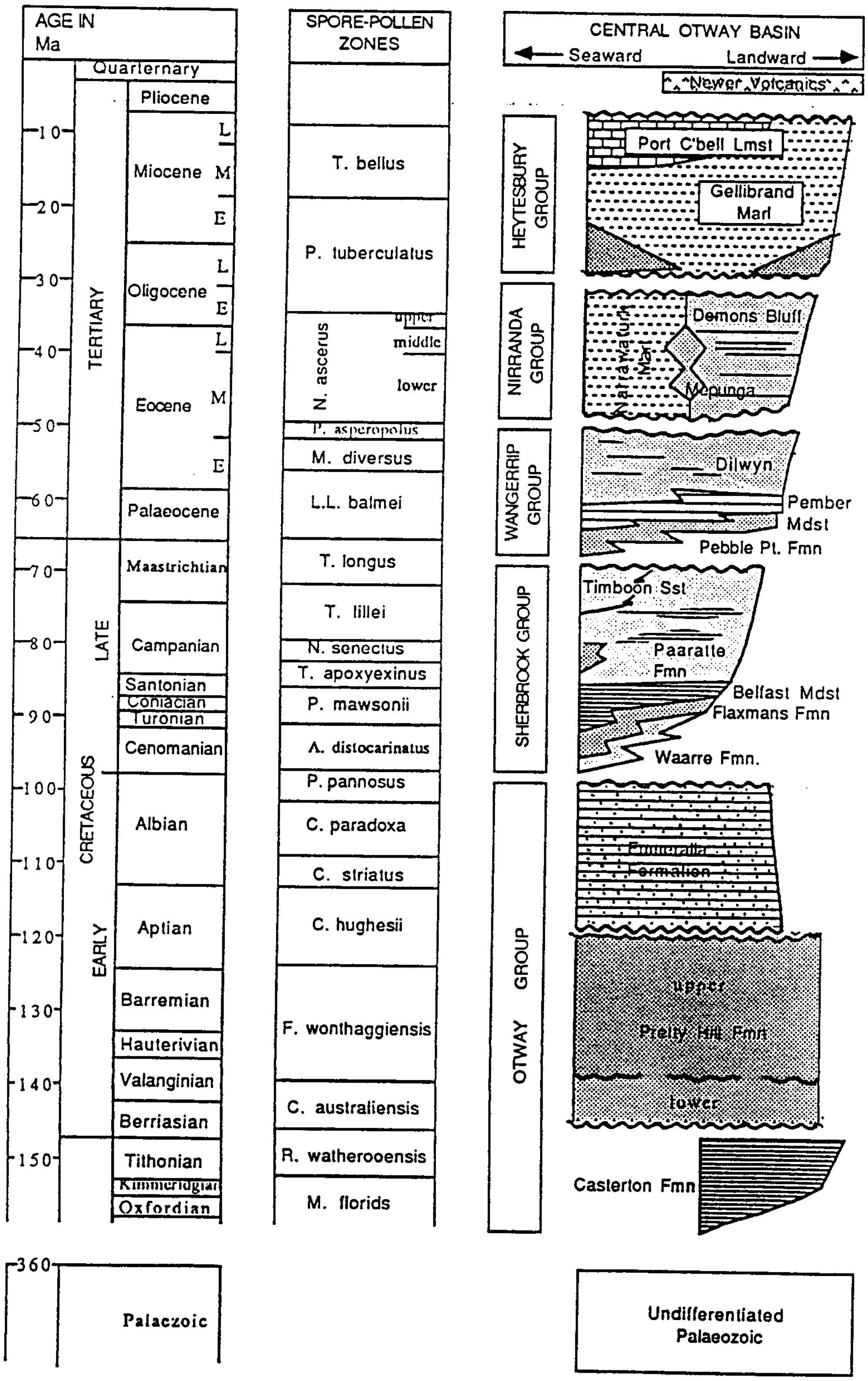


Figure 4.

3.2 Lithological Description

3.2.1 Newer Volcanics (surface - 36 m)

Surface to 20 m

Weathered Basalt, medium to dark grey-green, dark to brown grey-yellow in part, often very hard, scoraceous in part, weathered and crumbly at the top becoming harder with depth, ferruginous in part.

20 - 36 m

Basalt, (possibly Olivine Basalt), dark green grey, dark green, hard to very hard, fresh, amygdaloidal in part, amygdals are occasionally filled with secondary olivine and/or zeolite(?), interlaminated towards the base with light grey, gummy clays and minor fine to medium grained quartzose sands.

3.2.2 Heytesbury Group 36 m - 443 m

Port Campbell Limestone 36 m - 307 m

36 m - 65 m

Marl white to off white, friable, dispersive, abundant fossils some infilled with fine grained sandstone, occasional limestone stringers, interbedded with off white very fine grained sandstone, well sorted, very calcareous cement.

65 m - 210

Calcarenite cream, fine to medium grained, minor inter-granular porosity, trace lithics, fossiliferous.

210 m - 290 m

Limestone light grey, cream, occasionally fossiliferous.

290 m - 300 m

Claystone (Marlstone) white to off white, friable, dispersive, abundant fossils (forams, shells)

300 m - 307 m

Limestone light grey, cream, occasionally fossiliferous.

Gellibrand Marl 307 m - 443 m

307 m - 363 m

Marlstone light grey blue, commonly to abundantly fossiliferous (forams, gastropods, fenestrella) very dispersive, calcareous. 363 m. - 399 m

Limestone off-white to white, light grey-green, often mottled, microcrystalline, hard, blocky, ferruginous in places, often very ferruginous, siderite replacement of bryozoa clasts and glauconite, sucrosic texture, rare oxidised well rounded quartz grains. Limestone becoming multi-hued towards the base.

399 m - 443 m

Marlstone medium to dark grey, grey-green, soft, very fossiliferous (shell fragments - bivalves and bryozoa), very calcareous; interbedded with

Limestone multi-hued, pink, grey, green, off-white, white, cream and light blue, very fossiliferous (bivalves, bryozoa, small ammonites), microcrystalline.

3.2.3 Wangerrip Group 443 m - 481 m

Dilwyn Formation 443 m - 448 m

Pember Mudstone 443 m - 448 m

Siltstone dark blue-black, carbonaceous, argillaceous, common marcasite, common calcite veining (faulting?)

Pebble Point Formation 448 m - 481 m

448 m - 470 m

Sandstone, clear to very light brown, loose, fine to very coarse, dominantly medium to coarse, sub-angular to well rounded, poorly sorted, some grains contain inclusions of mica (biotite?), quartz appears to occur in an argillaceous matrix that is very dispersive, common marcasite, common glauconite, inferred poor porosity.

470 m - 481 m

Siltstone black, very dark green, hard, blocky, carbonaceous inclusions, glauconitic, often sucrosic texture, interbedded with;
Claystone pale green-grey, very calcareous, very soft, fossiliferous, blocky, and minor;
Sandstone clear to frosted, very light brown and pale yellow, loose, coarse to very coarse, subrounded to rounded, some contain inclusions of mica, good inferred porosity.

3.2.4 Sherbrook Group 481 m - 612 m

Undiff. Paaratte Formation 481 m - 579 m

481 m - 531 m

Claystone light grey, grey-green, blocky, very soft, dispersive, abundant fossils (shell fragments, bivalves, bryozoa), chloritic, interbedded with subordinate;
Sandstone loose quartz grains, medium to coarse grained, subangular to subrounded, calcareous clay matrix, poorly sorted, common carbonaceous material, no visible porosity.
Sandstone very fine to coarse grained, the fine grained material occurs as aggregates with traces of glauconite? or chlorite?, no visible porosity.

Siltstone light grey, grey-brown, blocky, sucrosic texture, glauconitic, and
Coal black, bright, brittle.

531 m - 579 m
Claystone light grey, grey-green, blocky, very soft, dispersive, abundant fossils (shell fragments, bivalves, bryozoa), chloritic, interbedded with;
Sandstone clear, tawny grey, loose quartz grains, medium to very coarse grained, subangular to subrounded, poorly sorted, and
Siltstone medium to dark grey, blocky, hard, very pyritic, trace chlorite, non calcareous, with bands of;
Ironstone.

Belfast Mudstone 579 m - 589 m
Claystone light grey, grey-green, blocky, very soft, dispersive, abundant fossils (shell fragments, bivalves, bryozoa), chloritic. This unit does not appear in cuttings to be different to those claystones seen immediately above or immediately below however, it has a distinct gamma ray log character in keeping with that normally observed for this unit.

Flaxmans Formation 589 m - 612 m
Claystone light grey, grey-green, blocky, very soft, dispersive, chloritic. Cuttings descriptions for this unit do not appear to be different to those claystones seen immediately above however, gamma ray log character indicates a slightly coarser grained unit with the sonic log showing a quite different character to that seen above. Sonic transit times are in the range 130-140 millisecs whereas that within the Belfast Formation is >145 millisecs.

3.2.5 Otway Group 612 m - Total Depth (2409 m)

Eumeralla Formation 612 m - 1544 m

612 m - 1011 m

Claystone dark to very dark grey, medium grey, medium to dark brown-grey, medium to dark green-grey, soft to firm, hard in part, blocky in part, dispersive in part. Occasionally subfissile, rarely to slightly calcareous at the top, non calcareous towards the base, small chloritic material disseminated throughout, tuffaceous, rare fine lithics, rare to trace carbonaceous detritus, rare fine mica, rare very hard medium brown grey calcite band, rare ferruginous staining, moderately to commonly silty in part, grading into and interlaminated with;

Siltstone, light to medium green grey, pale green in part, light brown grey in part, speckled, soft to firm, occasionally blocky, rarely carbonaceous and micaceous, tuffaceous, interbedded with very minor;

Sandstone, light grey to beige, light to medium green grey, occasionally light brown grey, firm to hard, very fine to fine, subangular to subrounded, fairly to well sorted quartz and multicoloured lithic fragments, tuffaceous, common off-white kaolinitic argillaceous matrix, trace moderately strong calcite cement, rare partially altered feldspar, very slightly calcareous in part, occasionally micaceous in part, poor to no visual porosity. Palynological analysis of a sample at 984 m confirms that these sediments are in the upper part of the Eumeralla Formation (C. paradoxa), Dettmann, (1991).

Heathfield Sandstone 1011 m - 1047 m

Sandstone clear to frosted, very fine to coarse grained, predominantly medium to coarse, angular to subrounded, very

poorly sorted, multicoloured lithic fragments, trace calcitic cement, low visual porosity, grades in places to;
Siltstone pale to medium grey-brown, occasionally dark grey-brown, soft, friable, blocky argillaceous with traces of carbonaceous material, and;
Claystone pale grey, grey, grey-green, soft, dispersive, massive, occasional loose very coarse quartz grains.

1047 m - 1104 m
Claystone dirty white, pale grey, grey-brown, grey-green, soft, dispersive, pyritic, trace carbonaceous material and minor fossils, occasional loose very coarse quartz grains, grades in places to and interbedded with;
Siltstone dirty to medium grey-brown, firm, blocky, argillaceous, often grades to;
Sandstone clear to frosted, very fine to coarse grained, predominantly medium to coarse, angular to subrounded, very poorly sorted, multicoloured lithic fragments, trace calcitic cement, low visual porosity, with;
Limestone white, dirty to medium grey, grey-brown, hard,brittle, microcrystalline, often forms as hard stringers and;
Coal black, shiny, shaley, fissile, friable to brittle fracture often with a vitreous lustre.

1104 m - 1544 m
Siltstone light grey, grey-brown, grey-green, speckled, trace carbonaceous material, commonly argillaceous, occasionally tuffaceous, trace of fine lignitic material in places, grades in places to, and is interbedded with;
Sandstone light grey, pale green, speckled, very fine to fine grained, lithic, chloritic, trace of carbonaceous material, often tuffaceous, moderate to common calcareous cement. Sandstone

becoming greater percentage of total sample towards base of sequence. From 1500 m - 1518 m traces of dull gold fluorescence was observed within the finer grained sandstone aggregates. No cut was observed but, some residual oil staining was noted in the sample aggregates at 1503 m. Fluorescence may be mineral? with minor;
Claystone grey, light grey-green, pale green,blocky, firm to hard in part, minor fossils, and trace;
Coal black, vitreous lustre, brittle fracture sub-conchoidal in places.

A sidewall core sample taken from 1535 m for palynological analysis yielded assemblages usually associated with the lower part of the Eumeralla Formation (C. hughesii), Morgan, (1991).

3.2.6. Crayfish Sub-Group 1544 m - 2409 m

A revision of the nomenclature of the Early Cretaceous stratigraphy of the Otway Basin is currently being discussed between the B.M.R., Geological Survey of Victoria and the South Australian Department of Mines and Energy. It is the author's understanding that it is proposed that the Crayfish Formation is to be upgraded to Sub-Group status, that the name Geltwood Beach Formation will disappear and that within the Victorian section of the basin that the Geltwood Beach Formation and Pretty Hill Sandstone Formation will become the Pretty Hill Formation. This formation will consist of an upper shaley facies unit generally equivalent to the Geltwood Beach Formation and upper Laira Formation of the Penola Trough and a lower sandy facies unit equivalent to what has for many years been called Pretty Hills Sandstone Formation. In this report the author has adopted this proposed new nomenclature.

upper Pretty Hill Formation 1544 m - 2208 m

This sequence is equivalent to the upper Laira Formation of the Penola Trough and the Geltwood Beach Formation.

1544 m - 1637 m

Sandstone clear to translucent, white to very light grey, dark grey, grey-green, light grey-brown, very fine to medium grained, dominantly fine, subrounded, poorly sorted quartz, lithic, trace off-white (kaolinitic) argillaceous matrix, trace moderately strong silica cement, rare very coarse quartz grains, abundant fossil fragments (corals, crustaceans, echinoid, forams and bryozoa), fair to good visual porosity, interbedded with;
Siltstone light grey to grey, grey-green, carbonaceous, calcareous, occasionally dark grey-brown, chloritic, with;
Claystone medium to dark grey, medium to dark brown grey in part, rarely medium to dark green grey in part, rarely blue -grey, firm, hard in part, blocky to sub fissile occasionally dispersive, often interbedded with trace;
Coal generally black, vitreous lustre, brittle fracture sub-conchoidal in places. but also large amounts of very fine lignitic material, occasionally silty in part.

Killara Coals 1637 m - 1764 m

Siltstone light grey to grey, grey-green, carbonaceous, calcareous, occasionally dark grey-brown, chloritic, fossiliferous, interbedded and interlaminated with and often grading to;
Claystone medium to dark grey, medium to dark brown grey in part, rarely medium to dark green grey in part, firm, hard in part, blocky to sub fissile occasionally dispersive, rare carbonaceous detritus, rare fine mica, rare fine lithic fragments, occasionally silty in part, interbedded and interlaminated with;

Sandstone clear to translucent, white to very light grey, dark grey, grey-green, light grey-brown, very fine to medium grained, dominantly fine, subrounded, poorly sorted quartz, lithic, trace off-white (kaolinitic) argillaceous matrix, trace moderately strong silica cement, rare garnet, rare very coarse quartz overgrowth, poor to fair visual porosity, interbedded with and occasionally interlaminated with abundant;
Coal generally black, bright, vitreous lustre, brittle fracture sub-conchoidal in places but, also large amounts of very fine lignitic material, occasionally silty in part. Between 1698 m and 1731 m the coal was dull, earthy, silty and in places graded to a carbonaceous siltstone. Coal accounted for up to a maximum of 60% of some samples.

Dettmann (1991) recorded palynological assemblages containing c. hughesii (upper) for this section, indicating that the ages correspond to the late Barremian - Aptian suggesting that it is lower Eumeralla. Morgan (1992) has already indicated that the sample taken from 1565 m is lower c. hughesii? - upper F. wonthaggiensis zone however definitive zonal assignment of this sample is precluded by relatively poor palynological recovery. Morgan states, "The absence of Pilosisporites notensis and Foraminisporis asymmetricus suggest that an upper F. wonthaggiensis Zone assignment is more appropriate but a C. hughesii Zone assignment cannot be ruled out." Based purely on lithologic evidence the presence of garnet in the sequence suggests that this section should be assigned to the Pretty Hill Formation and the similarity of log character from 1544 m to T.D. also indicates that this sequence should in all likelihood be regarded as one.

1764 m - 1796 m

Siltstone light to medium grey, grey-brown, carbonaceous, chloritic, lithic, interbedded and interlaminated with and often grading to;

Mudstone grey to black, grey-black, minor light grey, carbonaceous, occasionally silty in part, interbedded and interlaminated with;

Sandstone clear to translucent, white to very light grey, dark grey, grey-green, light grey-brown, very fine to fine grained, subangular to subrounded, chloritic, feldspathic, poor to nil visual porosity, interbedded with and occasionally interlaminated with trace;

Coal generally black, bright, vitreous lustre, brittle fracture sub-conchoidal in places.

1796 m - 1933 m

Sandstone clear to translucent, white to very light grey, dark grey, grey-green, light grey-brown, very fine to medium grained, dominantly fine, subrounded, poorly sorted quartz, lithic, trace off-white (kaolinitic) argillaceous matrix, trace moderately strong silica cement, rare garnets, rare very coarse quartz overgrowths, good to very good visual porosity, interbedded with;

Claystone, medium to dark grey, medium to dark brown grey in part, rarely medium to dark green grey in part, firm, hard in part, blocky to sub fissile occasionally dispersive, rare carbonaceous detritus, rare fine mica, rare fine lithic fragments, occasionally silty in part, interbedded and interlaminated with;

Siltstone light to medium grey, grey-brown, carbonaceous, chloritic, lithic, often tuffaceous.

Morgan (1992) analysed a sidewall core sample from 1908 m and assigned the palynological assemblage observed to the upper wonthaggiensis Zone indicating that it was Barremian - Hauterivian in age and therefore represented upper Pretty Hill Formation or the Penola Trough equivalent upper Laira Formation

1933 m - 2208 m

Sandstone clear to translucent, white to very light grey, dark grey, grey-green, very fine to medium grained, rarely very coarse grained, dominantly fine, subrounded, poorly sorted quartz, lithic, trace off-white (kaolinitic) matrix, trace moderately strong silica cement, trace garnets, rare very coarse quartz overgrowths, inferred good to nil visual porosity. (See Section 3.3.2 for description of sample at 2013 m approximately 90% sandstone). Grades in places to and interbedded with subordinate;

Siltstone light to medium grey, dark grey, grey-brown, black-brown, dark green, carbonaceous, chloritic, lithic, occasionally tuffaceous, interbedded and interlaminated with;

Claystone, medium to dark grey, medium to dark brown grey in part, rarely medium to dark green grey in part, firm, hard in part, blocky to sub fissile occasionally dispersive, rare carbonaceous detritus, rare fine mica, rare fine lithic fragments, occasionally silty in part, and

Mudstone dark grey-black, dark grey-brown, greasy in part and

Shale dark grey, sub-fissile, micaceous, platy.

Morgan (1992) analysed a sidewall core sample from 2015 m but found the assemblage population so sparse that a reliable age could not be determined. Dettmann (1991) analysed a cuttings sample from 2049 m and assigned the palynological assemblage observed to the C. hughesii (lower) Zone indicating that it was Valanginian - Barremian in age. "The sample was therefore believed to be at or near the base of the lower c. hughesii Zone (Otway Basin) and equivalent F. wonthaggiensis Zone (Pan Australia)." and therefore is a "correlative of the Geltwood Beach Formation" (upper Pretty Hill Formation. Morgan (1992) concluded that the sidewall core sample at 2080 m contained assemblages associated with the lower wonthaggiensis Zone: Hauterivian - Valanginian age which was equivalent to the lower Laira Formation.

lower Pretty Hill Formation 2208 m - 2409 m (T.D.)
This sequence is equivalent to the sequence known as the Pretty Hills Sandstone Formation. It is also equivalent to the Pretty Hill Sandstone and the sandy units of the lower Laira Formation of the Penola Trough.

2208 m - 2358 m
Sandstone clear to translucent, white to very light grey, light blue-grey, dark grey, grey-green, rare pale pink, very fine to very coarse grained, subangular to subrounded, poorly sorted quartz, lithic, trace garnets, abundant weak off-white (kaolinitic) matrix associated with coarser grains, trace moderately strong silica cement in finer grained aggregates, abundant very coarse quartz grains, inferred poor to fair visual porosity, interbedded with minor;
Siltstone grey, dark grey, grey-green, carbonaceous, grading to and interbedded and interlaminated with;
Mudstone grey, dark grey-green, minor purple, black, greasy in parts and silty.

2358 m - 2409 m (Total Depth)

Sandstone clear to translucent,occasionally frosted,yellow, pink white to very light grey, fine to very coarse grained, appears to be two dominant grain size populations, one medium to very coarse grained and dominantly medium, the other very fine to fine grained and dominantly very fine, angular to rounded, poorly sorted quartz, trace garnets, abundant weak calcareous cement (matrix) associated with coarser grains, trace moderately strong silica cement in finer grained aggregates, abundant very coarse quartz grains, inferred good visual porosity at top of section becoming poorer with depth, interbedded with minor;

Siltstone grey, dark grey, grey-green, carbonaceous, grading to and interbedded and interlaminated with;

Mudstone grey, dark grey-green, minor purple, black, greasy in parts and silty.

Palynological studies on a sidewall core sample at 2405 m by both Morgan (1992) and Dettmann (1991). Both indicated that the sparse and low-moderate diversity assemblages precluded a more definitive zonal assignment but, Dettmann states that the assemblages present indicate that the sample is younger than the R. wantherooensis Zone and is therefore assigned to the C. stylosus Zone and equivalent C. australiensis Zone (Pan-Australia). An age of Tithonian - Valanginian is given. Morgan while agreeing on the sparseness of assemblages within the sample states: "Possible assignment to Cicatricosisporites australiensis - Retitriletes watherooensis of Berriasian age is suggested by the frequent occurrence of Ceratorsporites equalis and the absence of younger indicators." Morgan concludes that an ?australiensis - ?wantherooensis age is probable. Given that in general both analyses suggest that this sample is located either at or near to the base of the Pretty Hill Formation this author accepts that this is the case.

3.3 Hydrocarbon Indications

3.3.1 Mud Gas Reading

The mud gas detection equipment was operational from spud to the total depth (2409 m). No background gas was recorded while drilling the Tertiary and Upper Cretaceous sequences. Initial readings of C1 were recorded commencing at 600 m. Between 600 m and 981 m background gas levels remained low and stable but from 981 to 1044 m (general interval of Heathfield sand member) C1 values increased significantly with individual readings in excess of 1000 ppm being recorded. At 1047 m, immediately below the Heathfield sand member the first traces of C2 were recorded. These values remained low and did not move above trace readings until 1152 m where they increased slightly up to a maximum value of 28 ppm at 1182 m. No C2 was observed from 1194 m to 1293 m although C1 values were all generally significantly higher than those recorded higher in the hole. C2 was again observed from 1293 m and from 1308 m C3 was recorded. C1 values continued to increase as did C2 and C3 with depth. At 1602 m the first recording of C4 was made. This fleeting observation was repeated at 1635 m and from 1704 m to 1839 m fairly constant observations were made. The maximum recorded value of C4 was 120 ppm at a depth of 1734 m in the Killara Coals. C1 values reached 115400 ppm and C2 values reached 2272 ppm at this same depth. C3 values decreased significantly below the coals approximately 1950 m only trace recordings were left. C1 and C2 also decreased rapidly below the coals with C2 values no longer being recorded below 2079

m. C1 values remained in the general range 200 - 600 ppm to total depth.

3.3.2 Sample Fluorescence

Cutting samples were routinely inspected for fluorescence at 10 m. intervals from spud to 307 m (casing point). From casing shoe (304 m) to total depth samples were inspected at 3 m intervals. Other than the standard 3 m interval samples were circulated for analysis at 1841 m, 1869 m, 1896 m and 2358 m.

Traces of dull gold fluorescence within sandstone aggregates was observed between 1500 m and 1518 m. No cut was observed however residual oil stains were reported in a sample at 1500 m.

In a sample at 2013 m bright blue fluorescence was observed in a few grains. An instant slow streaming cut was indicated and a milky blue fluorescent ring left in the evaporation tray. Drill Stem Test No1 was carried out over the interval 2010 m - 2026 m.

No fluorescence was observed in any sidewall cores cut.

3.4. Source Rocks and Maturation (See Appendix X)

Five samples were analysed for TOC, Rock-Eval pyrolysis and vitrinite reflectance. The samples selected for analysis are from depths of 1121 m and 1385 m from the Eumeralla Formation; 1753 m and 1780 m from the Killara Coals and 1975 m from the basal upper Pretty Hill Formation. The results of their analyses are given in Tables 2 & 3 below.

3.4.1 Source Richness, Kerogen Type and Quality (See Table -2)

Source and organic richness are poor in all the samples studied with TOC < 1% and S_1+S_2 < 2 kg of hydrocarbons/tonne.

Hydrogen Index and T_{max} values indicate that these sediments contain organic matter which have a bulk composition of Type IV kerogen (see Figure 5)

TABLE 2

KILLARA No.1

ROCK-EVAL PYROLYSIS

Depth	T_{max}	S_1	S_2	S_3	S_1+S_2	PI	S_2/S_3	PC	TOC	HI	OI
1121	219	0.14	0.11	0.36	0.25	0.58	0.30	0.02	0.69	15	52
1385									0.24		
1753	355	0.08	0.45	0.66	0.53	0.15	0.68	0.04	0.73	61	90
1780	425	0.03	0.14	0.47	0.17	0.19	0.29	0.01	0.67	20	70
1975									0.29		

3.4.2 Maturation (See Table -3)

Measured vitrinite reflectance values are similar over the whole section studied, ranging from 0.46 to 0.50 and suggest that these sediments are marginally mature for the generation of liquid hydrocarbons (see Figure 6).

Oil generation from thermally labile exinites (resinite, bituminite and suberinite) commences at VR = 0.45%. Rock-Eval Tmax values are mostly unreliable due to small and ill-defined S_2 peaks.

A high production Index (PI > 2.0) suggests the presence of migrated hydrocarbons in the sample from 1121 m.

TABLE 3
KILLARA No.1
SUMMARY OF VITRINITE REFLECTANCE MEASUREMENTS

Depth (m)	Mean Maximum Reflectance	Standard Deviation	Range	Number of Determinations
1121*	0.52	0.04	0.47 - 0.56	2
1385	0.46	0.05	0.37 - 0.55	22
1753	0.47	0.07	0.38 - 0.58	8
1780	0.50	0.02	0.47 - 0.53	6
1975	0.48	-	-	2

* Influenced by reworked vitrinite.

In his analyses of the thermal maturity of the sediments analysed Morgan (1992) generated data in the form of Thermal Alteration Index, of Staplin (using spore colour). This data is plotted on Figure 5. Morgan's analyses suggest that the samples he evaluated have the following levels of thermal maturity (Table -4).

TABLE 4
KILLARA No.1
SUMMARY OF THERMAL MATURITY USING T.A.I. VALUES

Depth (m)	Colour	TAI	Gas/Condensate	Oil
1535	yellow/ light brown	2.4	immature	immature/ marginal mature
1565	yellow/ light brown	2.45	immature	immature/ marginal mature
1908	light brown	2.55	immature	marginal mature
2015				
2080	light brown	2.65	immature	marginal mature
2405	mid-light brown	2.85	immature	marginal/early mature

HYDROGEN INDEX vs T_{max}

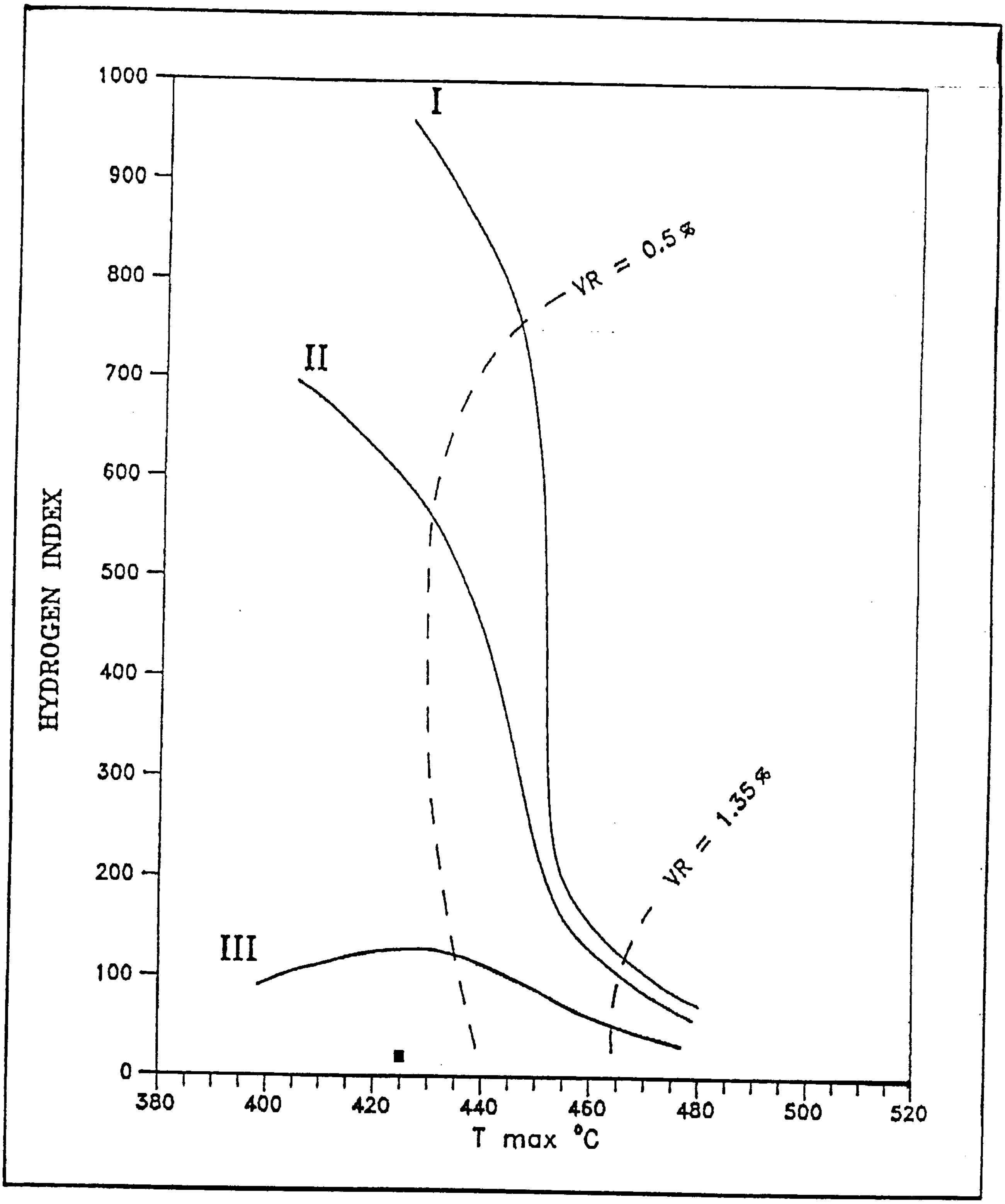


Figure 5

MATURATION PROFILE

VITRINITE REFLECTANCE VERSUS DEPTH

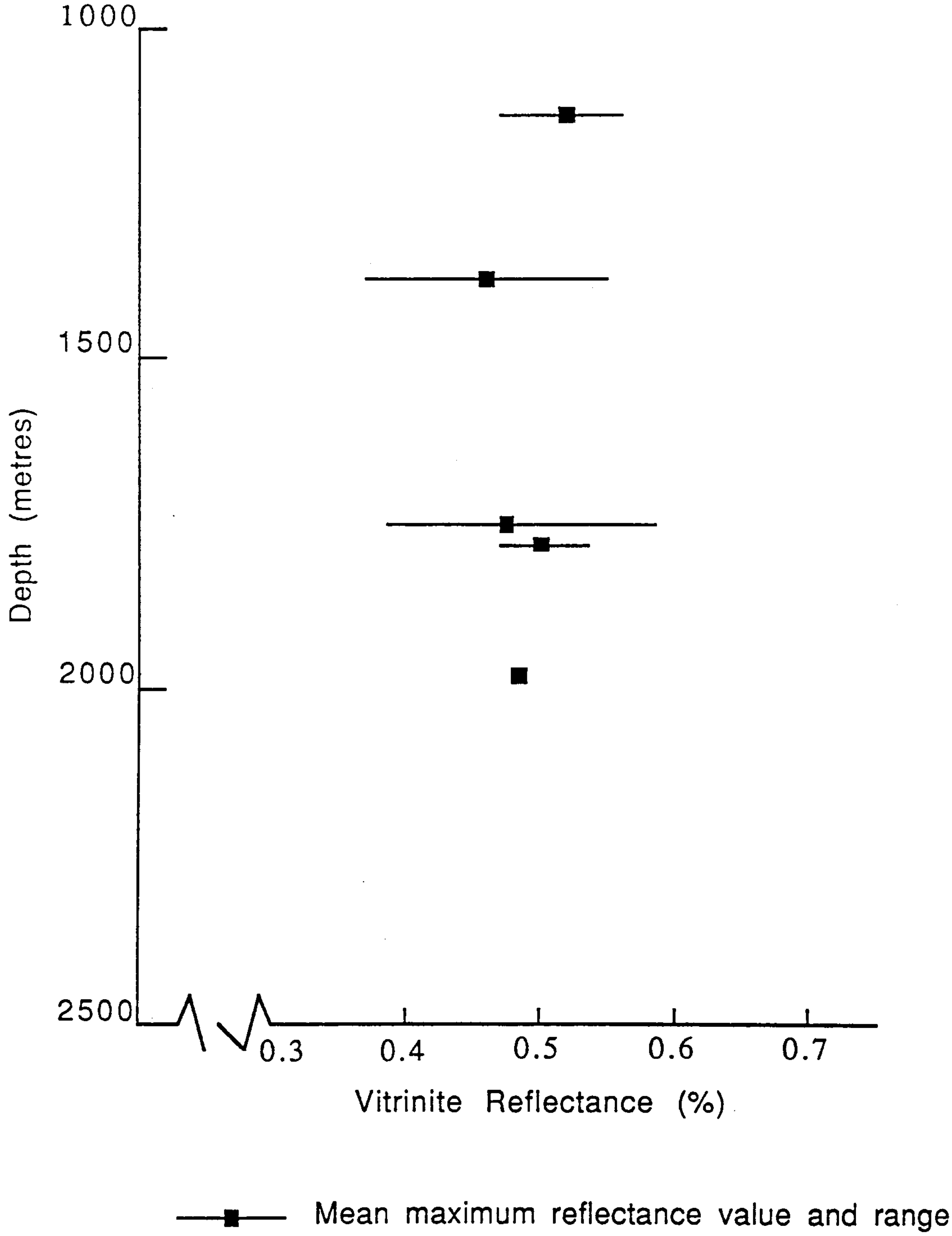


Figure 6

4. GEOLOGY

4.1 Structure

The Killara lead was first identified from seismic lines recorded as part of the 1989 Shamrock Seismic Survey. Upgrading of the lead to prospect status occurred with the acquisition and interpretation of the 1990 Moyne River Seismic Survey.

The Killara Prospect was interpreted as an anticlinal structure juxtaposed a major basin developing, down to basin normal fault. Strong east closure was observed but west and northwest closure was subtle. Intense faulting at the Crayfish level (pre-drill) was interpreted with the structure centred at Shot Point 510 on line OPX89A-63. Data quality below the Crayfish level is generally poor (see Figure 7).

The well location was originally picked at Shot Point 490 on line OPX89A-63 at the intersection with OPX90A-60. Topographic difficulties with this location resulted in the well being moved in a southwesterly direction some 400 metres from this location (see Figure 8). Based on the available post drill interpretation of the prospect it would appear that the Killara No.1 well was not located in a crestal position but was within structural closure at the top Pretty Hill Formation level (see Figure 9).

Post drill analysis also indicates that the sands of the lower Pretty Hill Formation dip to the east, north and south but that they are open in a westerly direction therefore indicating that no valid structural closure is present at this level.

SEISMIC SECTION

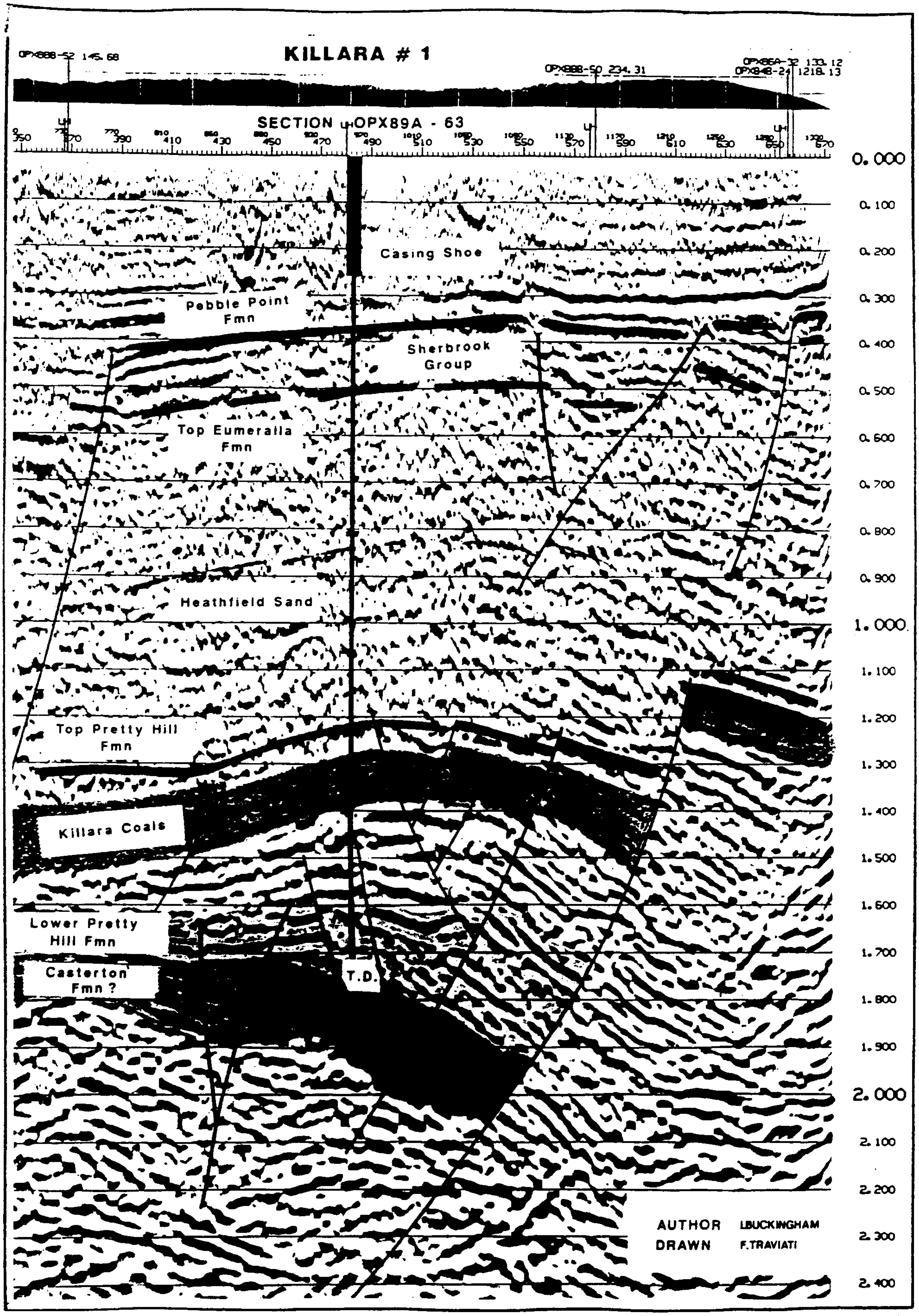


Figure 7

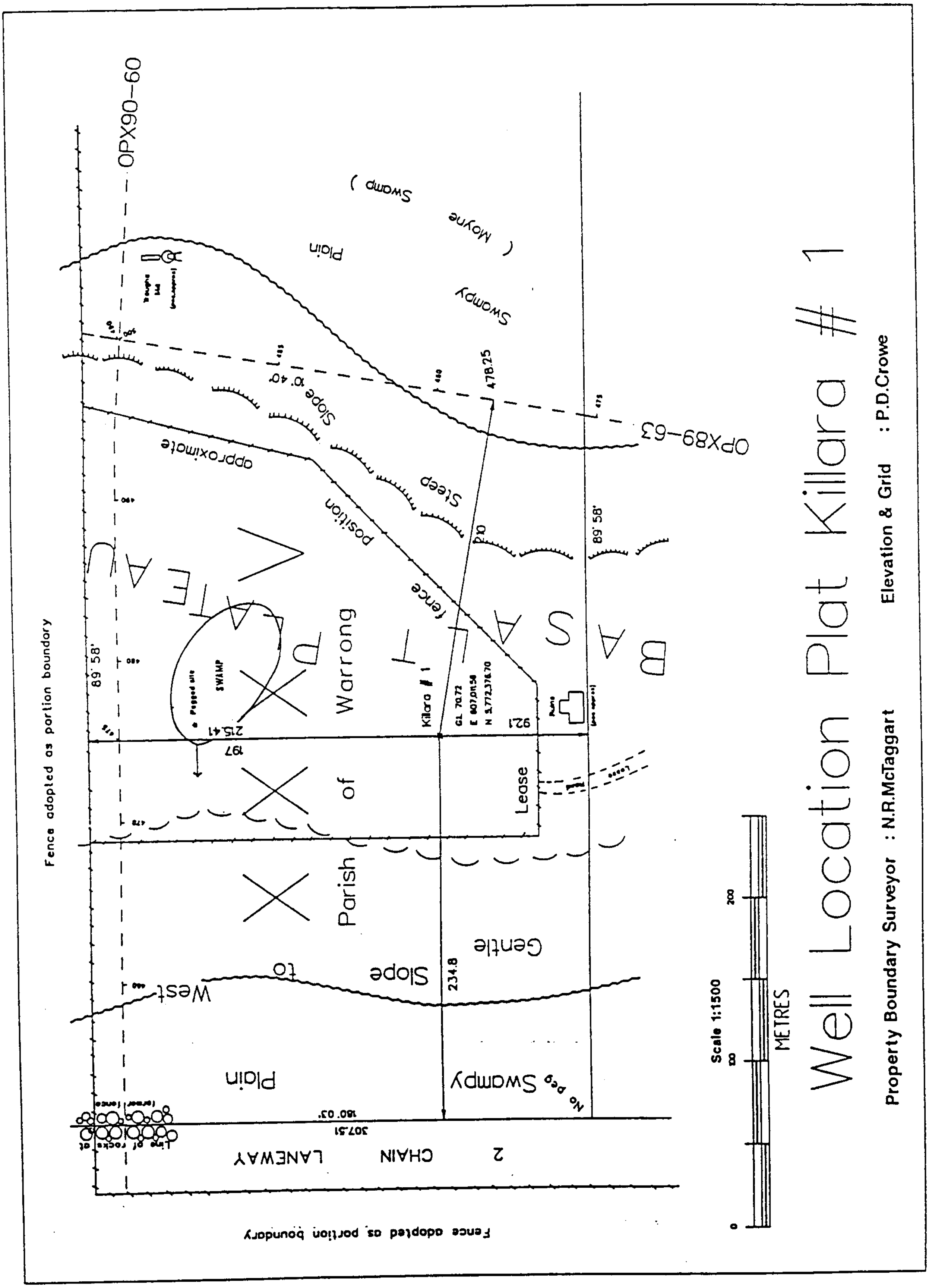
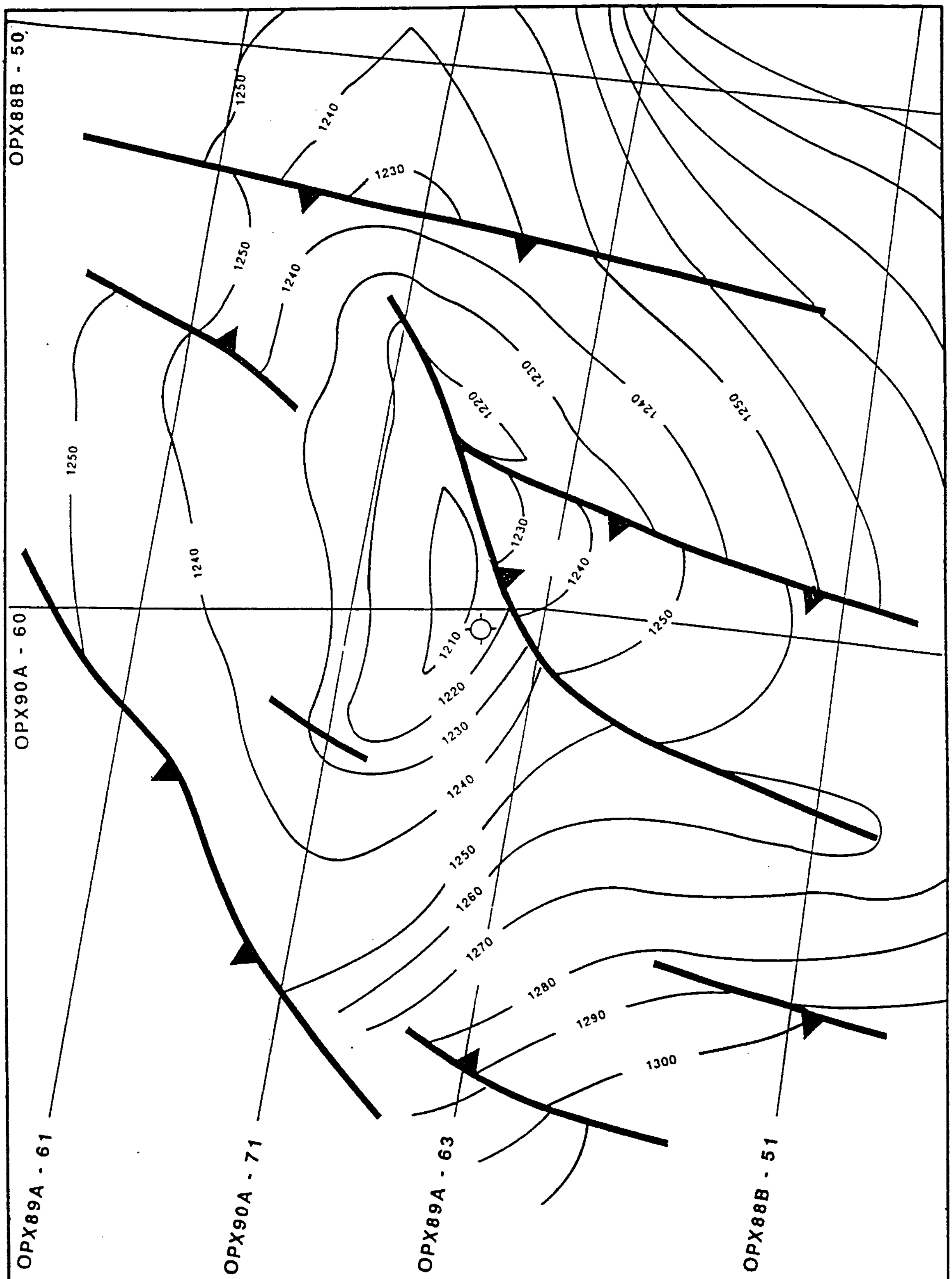

Well Location Plat Killara # 1
Property Boundary Surveyor : N.R.McTaggart
Elevation & Grid : P.D.Crowe
Scale 1:1500
METRES
OPX90-60
OPX89-63
Fence adopted as portion boundary
Fence adopted as portion boundary
Parish of Warrong
Lease
Killara # 1
SWAMP
Swampy Plain
(Moyne Swamp)
Steep Slope 10'40'
approximate position fence
Gentle Slope to West
Plain
No Deg Swampy
2 CHAIN LANEWAY
478.25
234.8
215.41
197
92.1
180.03
307.51
89°58'

Figure 8



KILLARA No 1

PEP 101

Top Pretty Hill Formation

AUTHOR
N.R.McTAGGART
DRAWN
F.TRAVIATI

Figure 9

4.2 Porosity and Water Saturation (See Appendix XII)

The wireline log suite run in Killara No. 1 did not include the density - neutron logs. The decision not to run these logs was justified on the basis of the obvious lack of hydrocarbons. A significant number of potential reservoirs were penetrated during the drilling of this well with a number of cuttings samples circulated when drilling breaks were encountered.

Although a reasonable drilling break was observed at the top of the Pebble Point Formation and subsequent log analysis indicated very significant porosities throughout this section the resultant test (DST No.2) failed to produce any hydrocarbons. The test string was completely plugged with sand up to 45 m above the test tools indicative of the extremely unconsolidated nature of these sands. The large wash-outs, as exhibited on the caliper curve and the unconsolidated nature of the sands have combined to produce dramatically higher log derived porosities than are actually present. Furthermore, the exotic mineral assemblage has effected the resistivity logs and when these elements are combined in the Archie equation lower Sw values are produced.

The Heathfield Sand was regarded as a potential reservoir prior to drilling. A good drilling break was observed on penetration and a very poorly sorted sand body grading to siltstone in places was observed. Porosity was inferred to be poorly developed and very minor fluorescence was observed. Log analysis indicated that the porosity was low and water saturations high. No attempt was made to test this unit.

A sample at 1422 m was circulated on the basis of a significant drill break at 1415 m and increasing mud gas readings. These readings peaked at 1425 m. Analysis of cuttings indicated no fluorescence and nil porosity.

Further samples were circulated at 1502 m and 1662 m. The sample at 1502 m consisted mainly of sandstone, very fine to fine grained, lithic with no visible porosity. Minor brown staining believed to be residual oil was noted in the sample from 1503 m. The circulated sample from 1662 m recorded 14 units of total gas but porosity was very poorly developed.

Drill penetration rates through the Killara Coals were consistently high. Gas readings fluctuated greatly with the highest readings corresponding to individual coal beds. Numerous sand bodies were penetrated but no fluorescence was observed and the sands were generally ratty and tight with a very calcareous cement.

Cuttings samples were circulated at 1841 m, 1869 m, 1896 m and 2013 m in the basal section of the upper Pretty Hill Formation. The sample at 1869 m came from the top of a well developed, fining upward sand. Log derived porosities through the sand were calculated to be generally in the mid-twenties with water saturations calculated to be 100%. One lower water saturation value from 1880 m at the base of the sand was due to a significantly higher porosity input value. The cuttings analysis described the sand as containing white kaolinitic cement.

The cuttings sample from 2013 m came from a thick, blocky gradually fining upward sand body. A reverse drilling break was observed on penetrating the sand and rates continued to decrease throughout the unit. At 2013 m a minor reversal of this trend occurred and the recovered sample was found to contain a few grains of bright blue fluorescence with an instantaneous slow streaming cut and milky blue fluorescent ring. Drill Stem Test No.1 recovered 2 bbl of rat hole mud and 68 barrels of formation water indicating that the reservoir is porous and has sufficient permeability to flow.

A cuttings sample was circulated from a sand at 2209 m, immediately below the base of a mudstone. This sand is interpreted to be the top of the lower Pretty Hill Formation. Porosity was inferred to be fair and a weak calcareous cement was present. Log derived sonic porosities in the range 15% to 20% were calculated. When this sample and many others in this formation dried, a fine white powder (kaolinite?) was found to coat most quartz grains. A final cuttings sample (excluding T.D.) was circulated at 2358 m. The sample contained abundant loose quartz grains and a weak calcareous cement. Visual porosity was inferred to be poor to nil and log derived porosities ranged from 5.5% at 2358 m to 20% at 2360 m. Log analyses indicated that all the reservoirs in this formation were water saturated.

Porosity values in this well calculated from the sonic tool must be regarded as suspect in the absence of any other porosity measuring device. Diagenetic cement(s), unconsolidated formations, hole rugosity and secondary porosity, all of which are present in this well, will affect the response of this tool and distort the derived value.

4.3 Contribution to Geology & Relevance to Occurrences of Hydrocarbons

The Killara Prospect is interpreted as an anticlinal structure juxtaposed a major basin developing, down to basin normal fault. Structural closure is seen at top Pretty Hill Formation level. At top lower Pretty Hill Formation level strong east closure has been mapped but west and northwest closure is absent. Intense faulting at the top Pretty Hill Formation level (pre-drill) was interpreted with data quality below this level being generally poor. The similarities in formation water salinities between the Tertiary Pebble Point Formation and the Early Cretaceous Pretty Hill formation may reflect fluid communication throughout the section via the major faulting associated with the development of this structure.

Further support for the testing of this prospect was the interpreted presence of Casterton Formation below the Pretty Hill Formation. It is believed that the Casterton Formation represents a potential source for hydrocarbons in the Otway Basin and the prospect represented an ideal location for testing the hypothesis that hydrocarbons sourced and generated in the underlying Casterton Formation would migrate into sands within the Pretty Hill Formation where they would be sealed by the finer grained sediments of the overlying upper Pretty Hill Formation or Eumeralla Formation.

Although the post drilling analysis confirms the validity of the well within closure on the structure the fact that it does not appear to have been located in a crestal position has not disproved the hypothesis that lead to its drilling. In fact, the presence of significant gas shows while drilling, up to n-C4, particularly through the Killara Coal sequence, which has been subsequently shown to have a poor organic richness and to be immature to marginally mature for the generation of liquid hydrocarbons (see Appendix X) and the presence of oil fluorescence in a sand in the basal upper Pretty Hill, suggests that the source for these hydrocarbons is most likely from a liquid prone source rock deeper in the sequence.

A comparison of the results from Killara No.1 with those obtained from the drilling of Greenslopes No.1 has revealed that this area of the Otway Basin has been tectonically active a number of times during its geological history. These events are summarised below:

A correlation at 2358 m to T.D. in Killara No.1 and 2429 m to T.D. in Greenslopes No.1 suggests that the Total Depth reached in Killara No.1 was possibly some 20 m above the top of the Casterton Formation. This possibility is further supported by the identification of C. australiensis - R. watherooensis in a sample at 2405 m indicating a Berriasian - Tithonian age. A lacustrine environment of deposition is indicated by the presence of fresh water algal cysts.

The overlying lower Pretty Hill Formation is of similar thickness in both wells suggesting that deposition of this unit occurred on a relatively flat topographic surface. A good general sonic log correlation throughout this entire unit is possible however correlation of individual sand bodies is not. Faulting, accompanied by minor block rotation and erosion has resulted in an unconformity (localised?) developing in this general area at the top of the lower Pretty Hill Formation.

Within the upper Pretty Hill Formation a strong sonic correlation point occurs at depths of 1796 m and 1743 m in Killara No.1 and Greenslopes No.1 respectively. In Killara No.1 this depth corresponds to the base of the Killara Coals. In Greenslopes No.1 is does not appear to correspond to any significant identified event but, an unconformity surface has been identified (Greenslopes No.1 WCR) some 150 m deeper in the section. A thick mudstone/siltstone from 2042 m - 2072 m in Killara No.1 is correlated with a similar unit seen in Greenslopes No.1 from 1962 m - 1980 m. The thickness of upper Pretty Hill Formation below the base of this unit is 136 m in Killara No.1 and 325 m in Greenslopes No.1. The 190 m difference in thickness suggests that the area around the Killara No.1 well was raised relative to the Greenslopes area which received a corresponding increase in sedimentation during this period. The mudstone/siltstone unit in both wells suggests a period of quiescence and the similar thicknesses of overlying sediments up to the strong sonic correlation point referred to above indicates that the general area was tectonically stable during the late Valanginian to at least the beginning of the Barremian. In the Killara No.1 well the sediments above this sonic correlation point up to a depth of 1637 m have been named the Killara Coals. They consist of thinly interbedded and interlaminated siltstones, claystones, sandstones with abundant coals. They are represented almost entirely by fining upwards sequences and probably represent deposition in a lower deltaic plain environment associated with a lacustrine delta system. They are 159 metres thick and have not been previously identified in sediments of this age within the basin. In Greenslopes No.1 well the interval above the sonic marker up to a depth of 1657 m may correlate with this sequence. In terms of log character it is very difficult to correlate this 86 m thick interval between the wells however, the lithological descriptions with coals recording up to a maximum of 10% of the sample may suggest that this correlation is acceptable. Lithologically this interval is dominated by sandstones and siltstones with subordinate mudstones and coals. The sands tend to have a more blocky character than the sands in the corresponding section in the Killara well and most likely represent a more proximal depositional environment. They are tight, cemented and quartzose and as such similar to those of the Killara Coals in Killara No.1. The thinner section in Greenslopes No.1 suggests that this area was higher than that at Killara No.1 during deposition of this unit.

The upper Pretty Hill formation from 1544 m to 1637 m (93 m) in Killara No.1 is tentatively correlated with the interval 1581 m - 1657 m (76 m) in Greenslopes No.1. Although both intervals are relatively sandy, the Greenslopes No.1 interval contains more coarser grained clastics. Sand body geometry indicates more blocky units.

Palynological data at 1567 m in Greenslopes No.1 suggests an Early Aptian age (C. hughesii). The palynological data from 1565 m in Killara No.1 gives an age of lower hughesii/upper wonthaggiensis i.e. Aptian?/Barremian whereas the sample at 1535 m returned an age of C. hughesii (Aptian). The top of the Pretty Hill Formation has therefore been placed at 1544m in Killara No.1 and it is suggested that the top of the same unit in Greenslopes No.1 should be placed at 1581 m (K.B.). No pronounced unconformity is interpreted at the top of the Pretty Hill Formation in this area and added difficulty in picking a contact is the fact that the Eumeralla/Pretty Hill Formations appear to have a shale on shale relationship at this point.

In Killara No.1 the Eumeralla Formation is interpreted to represent the interval 612 m - 1544 m (932 m). As described above a sample taken at 1535 m returned an age of C. hughesii. A further sample at 984 m gave an age of C. paradoxa. As these two ages represent the lower and upper age limits of this formation it is assumed that an almost complete sequence is present in this well. Consequently, no major erosion of this formation is apparent. For the equivalent interval in Greenslopes No.1, 580 m - 1581 m (1001 m) no age dating is available above 1367 m and the upper 310 m of this formation is behind casing so no log derived correlation is possible. The Heathfield sand 1011 m - 1047 m (36 m) in Killara No.1 is very tentatively correlated with a sand 986 m - 1024 m (38 m) in Greenslopes No.1.

The similarity in thicknesses throughout this unit would suggest that the area was relatively stable with deposition probably occurring on a large slowly subsiding fault block/terrace. Tectonism towards the end of this period saw the gentle arching of the Killara Greenslopes high commence. Seismically, any unconformity at top Eumeralla level in this area is relatively easy to distinguish on strike lines across this high trend. A comparison of thicknesses for the Late Cretaceous Sherbrook Group indicates that they are nearly identical between the two wells with only a 6 m variation. The Flaxmans Formation varies by only 4 m, the Belfast Mudstone by 14 m and the Paaratte by 24 m. Seismic data suggests a thickening of this Group to the west and east of the Killara structure with onlap onto the high and wedge shaped facies developed. These relatively constant values between the wells suggest a uniformly rising high trend during the time of Sherbrook Group deposition with sediments deposited in a shallow marine environment. The subcrop of this sequence lies just to the north of the Greenslopes No.1 well. Towards the close of this period and into the early Tertiary large scale tectonism occurred in this area. Major faults appear to have re-activated and a series of down-to-basin normal faults and their associated antithetics developed.

The relative thinness of lower Tertiary Wangerrip Group sediments in both wells and the absence of middle Tertiary Nirranda Group sediments in both wells is testimony to the continued emergence of this high trend and the widespread erosion and base levelling that occurred during this period.

The upper Tertiary Heytesbury Group is 407 m thick in Killara No.1 and 259 m thick in Greenslopes No.1. The glauconitic, calcareous, transgressive Clifton Formation was deposited in shallow water basin areas. This unit has not been identified in Killara No.1 but is present in Greenslopes No.1. Conformably overlying the Clifton Formation is the generally thick sequence of marine shelfal deposits of the Gellibrand Marl and Port Campbell Limestone.

The results of Drill Stem Test No.1 provided adequate data on the reservoir characteristics of the Pretty Hill Formation.

While from a commercial perspective the lack of producible hydrocarbons is disappointing the presence of significant shows of hydrocarbons within the structure clearly demonstrates that hydrocarbons are being generated within this area of the basin. Furthermore, given that most of the sequence penetrated in this well is immature to marginally mature for the generation of hydrocarbons it is most likely that the shales of the deeper Casterton Formation represent the best potential source for these hydrocarbons.

Ian D. Buckingham
Consultant.

July, 1992.