DEPT. NAT. RES & ENV
PE902149

PETROLEUM DIVISION
09 NOV 1989

MINORA
RESOURCES NL

PEP 111
OTWAY BASIN
VICTORIA

WINDERMERE-2

WELL COMPLETION REPORT
VOLUME I

(W992)

PETROLEUM DIVISION

09 NOV 1989

WINDERMERE-2
WELL COMPLETION REPORT
PEP 111 - OTWAY BASIN
VICTORIA - AUSTRALIA

MINORA RESOURCES NL
NOVEMBER 1989

CONTENTS

****

FIGURES

1. Location Map
2. Windermere-2 Well Schematic
3. Windermere-2 Time Utilisation Chart
4. Windermere-2 Time/Depth Curve
5. Otway Basin Biostratigraphy
6. Time Structure Map of Near Base Heathfield Member
7. Time Structure Map of Near Top Windermere Member
8. Time Structure Map of Near Top Crayfish Formation

ENCLOSURES

1. Composite Log (1:500)
2. Mudlog (1:500)
3. Wellsite Lithology Log (1:500)
4. Seismic Line MO88-52

VOLUME II

APPENDICES

A. Daily Drilling Reports
B. Drilling Fluid Summary
C. Lithological Descriptions
D. Conventional Core Descriptions
E. Sidewall Core Descriptions
F. Core Analysis
G. Petrological Report
H. Wireline Log Interpretation
I. Casing and Cementing Reports and Bit Record
J. Drill Stem Test Reports
K. Source Rock Analysis and Petroleum Geochemistry
L. Palynology
M. Well Location Survey Plan
N. Well Velocity Survey
O. Survey Data

MINORA RESOURCES NL

WELL : WINDERMERE-2

LATITUDE: 38°14'10.56" S

LONGTITUDE: 142°01'17.9" E

SHOT POINT: 367

SEISMIC LINE: MO88-52

ELEVATION GL: 46.14m KB: 51.65m

SPUDDED: 2230 hrs 9 March 1989

COMPLETED: 1700 hrs 19 April 1989

PERMIT : PEP 111

STRUCTURE TYPE : Fault bounded anticline

STATUS: Plugged and abandoned

RIG: ATCO-APM Rig No. A-2

TOTAL DEPTH DRILLER: 3595.4m

LOGGER: 3595.3m

COMPLETION DETAILS:
Plugged and abandoned

CASING SIZE	SHOE DEPTH(m)
20"	10m
$13\frac{3}{8}$"	314m
$9\frac{5}{8}$"	1867m

FORMATIONS PENETRATED (measurements in metres)

AGE	FORMATION	DEPTH	SUBSEA	THICKNESS
Recent/Undifferentiated	Surficial	0.0	+ 51.6	5.5
Miocene	Port Campbell Limestone	5.5	+ 46.1	90.0
Miocene	Gellibrand Marl	95.5	- 43.9	261.5
Oligocene	Clifton Formation	357.0	- 305.4	68.0
Eocene	Dilwyn Formation	425.0	- 373.4	242.2
Paleocene	Pember Mudstone	667.2	- 615.6	48.3
Paleocene	Pebble Point Formation	715.5	- 663.9	34.5
Santonian- Maastrichtian	Paraatte Formation	750.0	- 698.4	200.0
Santonian- Maastrichtian	Belfast Mudstone	950.0	- 898.4	59.3
Albian	Upper Eumeralla Subunit	1009.3	- 957.7	160.7
Albian	Middle Eumeralla Subunit	1170.0	-1118.4	501.0
Albian	Heathfield Member	1671.0	-1619.4	135.6
Albian-Aptian	Lower Eumeralla Subunit	1806.6	-1755.0	1380.4
Aptian	Windermere Member	3187.0	-3135.4	105.0
Barremian	Crayfish Formation	3292.0	-3240.4	303.4+

WELL SUMMARY : Windermere-2 was drilled on a fault bounded anticlinal structure 1km southeast of the Windermere-1 Heathfield Member oil discovery well to appraise this discovery in an updip location and explore deeper objectives. The well failed to intersect any economic accumulation of hydrocarbons and was plugged and abandoned. The most likely reason for the well being dry at Heathfield level was the non development of Lower Eumeralla subunit coals present below the producing zone at Windermere-1. At deeper levels the well was drilled outside closure and all potential reservoir sections were of poor quality. Although dry the well intersected sediments with excellent source potential in the Lower Eumeralla Subunit.

Estimated well cost $1.67 million.

MINORA RESOURCES NL

WELL : WINDERMERE-2

LOGS

LOG TYPE	RUN No	INTERVAL (m)	BHT/TIME
DLL-MSFL-GR	1	304.7-1855.4	262°F/ 5.0 hrs
BCS-MEL-GR	1	15.1-1856.0	268°F/ 10.78 hrs
DLL-MSFL-GR	2	1865.5-3594.8	266°F/ 9.07 hrs
BCS-MEL-GR	2	1865.5-3558	275°F/ 16.25 hrs
SLD-CNS-GR	2	1865.5-3594.7	260°F/ 7.03 hrs
FAD	2	2500-3200	

FORMATION TESTS

Test No	INTERVAL (m)	FORMATION	Flow (min)	Shut in (min)	BOTTOM GAUGE IP/FP	Shut in Press	RESULTS
1	1775.2 - 1802.3 (D)	Heathfield Member	180	360	135 / 2362	2030.1	Rec 299m mud and muddy formation water Rw 0.3 @ 70°F
2	3182.0 - 3198.0	Windermere Member	Misrun		-Packer seat failed		
3	3174 - 3230.7	Windermere Member	71	142	1772 / 3223	2155	Rec 122lm slightly gas cut water cushion with a trace of oil.

FULL HOLE CORES

No	INTERVAL (m)	FORMATION	CUT(m)	REC%
1	1743.8-1749.3(D)	Heathfield Member	5.5	78
2	1777.0-1793.9(D)	Heathfield Member	16.9	99

PERFORATIONS

INTERVAL (m)	FORMATION	SHOTS/ FT
N/A		

MINORA RESOURCES NL

WELL : WINDERMERE-2

LOG INTERPRETATION

INTERVAL (m)	FORMATION	Ø %	Sw%	INTERVAL (m)	FORMATION	Ø %	Sw%
1671-1701	Heathfield	16.1	97.4				
1720-1748	Member	12.0	81.7				
1760-1806		10.8	80.1				
2529-2547	Lower	7.7	87.4				
	Eumeralla						
3187-3194	Windermere	10.9	78.5				
	Member						
3316-3325	Crayfish	6.5	55.8				
3529-3552		4.9	72.0				

NET PAY INTERVALS (m) : NIL

CORE ANALYSIS (LOGGERS DEPTH)

INTERVAL (m)	Ø	K.	So.	Sw.	INTERVAL (m)	Ø	K.	So.	Sw.
1743.83-1746.24	13.9	0.113	-	-					
1777.02-1793.34	14.0	0.519	0.055	67.7					

1. INTRODUCTION

Windermere-2, an exploration well located approximately 1km southeast of the Windermere-1 Heathfield Member oil discovery (Figure 1) was spudded on 9 March 1989 at 2230 hours. The well reached a total depth of 3595m on April 13, 1989 and was plugged and abandoned on April 19, 1989.

Windermere-2 was the only well to be drilled as part of the 1989 exploration programme in PEP 111 and is located in the northern portion of the permit on the downthrown side of the Pretty Hill Terrace.

The well failed to intersect any economic accumulation of hydrocarbons.

2. WELL HISTORY

2.1 General Data

Well Name:	Windermere#2
Name of Operator:	Minora Resources NL 263 Adelaide Terrace PERTH WA 6000
Participants:	Minora Resources NL 25.5% Cultus Petroleum NL 29.5% Pan Pacific Pet.(Vic) NL 15.0% National Venture Corp. 10.0% Petro Energy Eastern Pty Ltd 10.0% Command Petroleum NL 10.0%
Petroleum Title:	PEP 111 Otway Basin - Victoria
Location:	Latitude 38°14'10.56"S Longitude 142°01'17.9" E North 5,767,461.67 metres East 589,409.72 metres Seismic Line MO88-52 VP367 1km SE of Windermere #1 16km NW of Port Fairy - Victoria
Elevations:	Ground Level 46.14 metres Kelly Bushing 51.65 metres
Water Supply:	Shallow bore on site
Total Depth:	Driller 3595.4 metres Logger 3595.3 metres
Well Spudded:	09/03/1989 (2230 hours)
Total Depth Reached:	13/04/1989 (2400 hours)
Rig Released:	19/04/1989 (1700 hours)
Well Status:	Plugged and Abandoned

2.2 Drilling Summary

Windermere No.2 was drilled approximately 16 kms North-west of Port Fairy, Victoria using the ATCO APM A2 rig (Midcontinent U-36-A, rated to 3600m) which had been mobilised from Penola, South Australia.

A 20" conductor had been set and cemented, prior to the arrival of the rig, using an auger and ready-mix cement. The well was spudded at 22.30 hours March 9, 1989. 17½" OH was control drilled to 341m without any difficulties using viscous sweeps down to the Gellibrand Marl and then 8% KC1 brine through this dispersive marl. 13⅜" casing was set high and cemented (with full returns) at 314m due to 4 joints not drifting.

The leak-off test at the 13⅜" shoe yielded a mud weight equivalent of 19.0 ppg. Drilling proceeded in 12¼" OH (using a 3% KC1/polymer mud) to 1743.8m where Core No. 1 was cut (1743.8 - 1749.3m, 78% recovery) stopping in a shale bed. 8½" OH was drilled to 1777m. Core No. 2 was then cut from 1777.0 - 1793.9m (99% recovery). With the possibility of cutting further cores drilling continued in 8½" OH to 1802.3m where OH DST 1 (1775.2 - 1802.3m) was run to fully evaluate the Heathfield Member. (Recovered 299m of mud and muddy water.) Drilling continued in 8½" OH to 1869m (9⅝" casing point). Electric logs were run and a leak off test conducted to determine whether it would be possible, from a well control point of view, to continue drilling to TD without setting 9⅝" casing, since there was no requirement to protect the potential reservoir in the Heathfield Member. Thefracture gradient proved to be too low. After opening the 8½" OH (1744 - 1869m) to 12¼", the 9⅝" shoe gave a mud weight equivalent of 12.7ppg. Drilling of the 8½" OH commenced with the same KC1/polymer mud as the previous section, however, due to the relatively slow progress the system was changed to freshwater at 2079m, which resulted in a significant increase in ROP. At 2853m, prior to entering an objective, a polymer mud was circulated and maintained until TD. Few hole problems were experienced while circulating with water although the caliper log revealed a uniformly eroded hole which can be expected due to the higher annular velocities required for hole cleaning. An PDC bit was run at 2216m. Although the bit drilled at approximately the same rate as a rock bit, it was uneconomical to continue its use and so it was pulled after 9 hours on bottom.

During the 8½" OH two rock bits were pulled prematurely due to wash out in the bits themselves, one in the nozzle port, the other in the weld of the bit. A wash out also occurred in the slip area of the drill pipe.

After high gas readings from a sand at 3188 - 3195m an OH Straddle Test, DST 2 (3182.0m - 3198.0m) was attempted, however a packer failed. A conventional OH DST 2A (3174.0 - 3230.7m) was successful, whichrevealed evidence of hydrocarbons in an extremely tight formation. (Recovered the water cushion only, with a trace of mud and oil).

Drilling continued in 8½" OH beyond the original TD of 3170m to 3595m since gas readings were still encouraging. the new TD was reached at 24.00 hours April 13, 1989, 34 days after spudding. Logs were subsequently run with only the DLL-MSFL-GR-CAL and BCS-MEL-GR logging from 3595m and 3565m respectively, due to caving of the hole over the section where the OH DST's had been run. Several attempts were made to ream out the ledges, but without success. Subsequent logging runs were run from approximately 3200m after reaming.

After evaluation of logs, the well was plugged and abandoned as shown in Figure 2, the casing head removed, and a sign erected in accordance with the Department of Industry, Technology & Resources, Victoria. The rig was released at 17.00 hours April 19, 1989, 41 days after spudding.

Estimated total cost of the well was A$1.67 million.

A time utilisation chart is shown in Figure 3.

A time/depth chart is shown in Figure 4.

Copies of the Daily Drilling Reports are included as Appendix A.

2.3 Drilling Fluid Summary

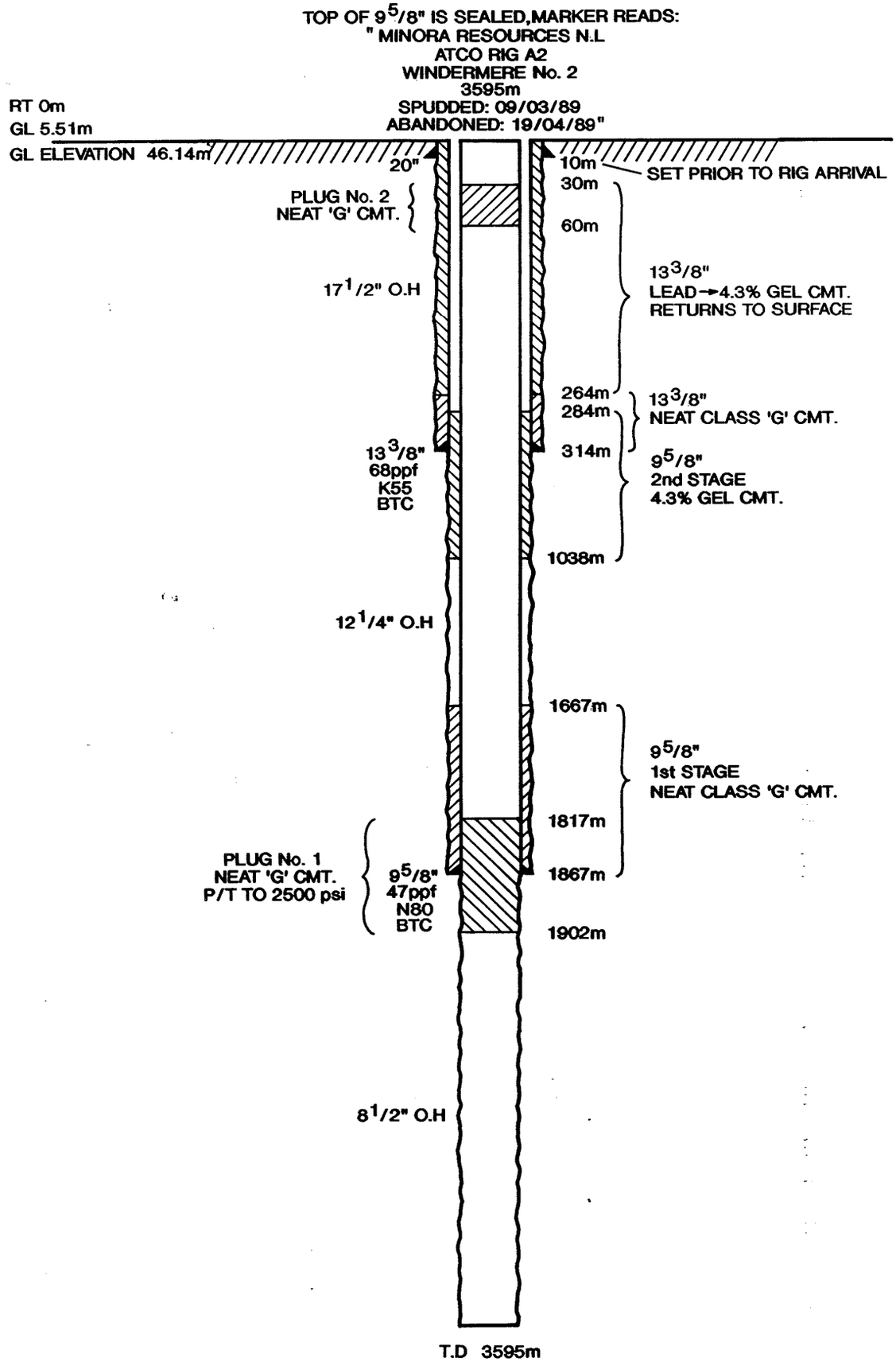
The Drilling Fluid Summary is presented in Appendix B.

2.4 Formation Sampling

Drill cuttings samples were collected at 10 metre intervals from surface to 1720 metres and then at 5 metre intervals to total depth. One split of samples was forwarded to the Victorian Government Core Laboratory while the remaining splits were sent to Core Laboratories in Perth for storage.

Descriptions of the cuttings are included as Appendix C.

WINDERMERE–2
WELL SCHEMATIC
(AS ABANDONED)



NOT TO SCALE

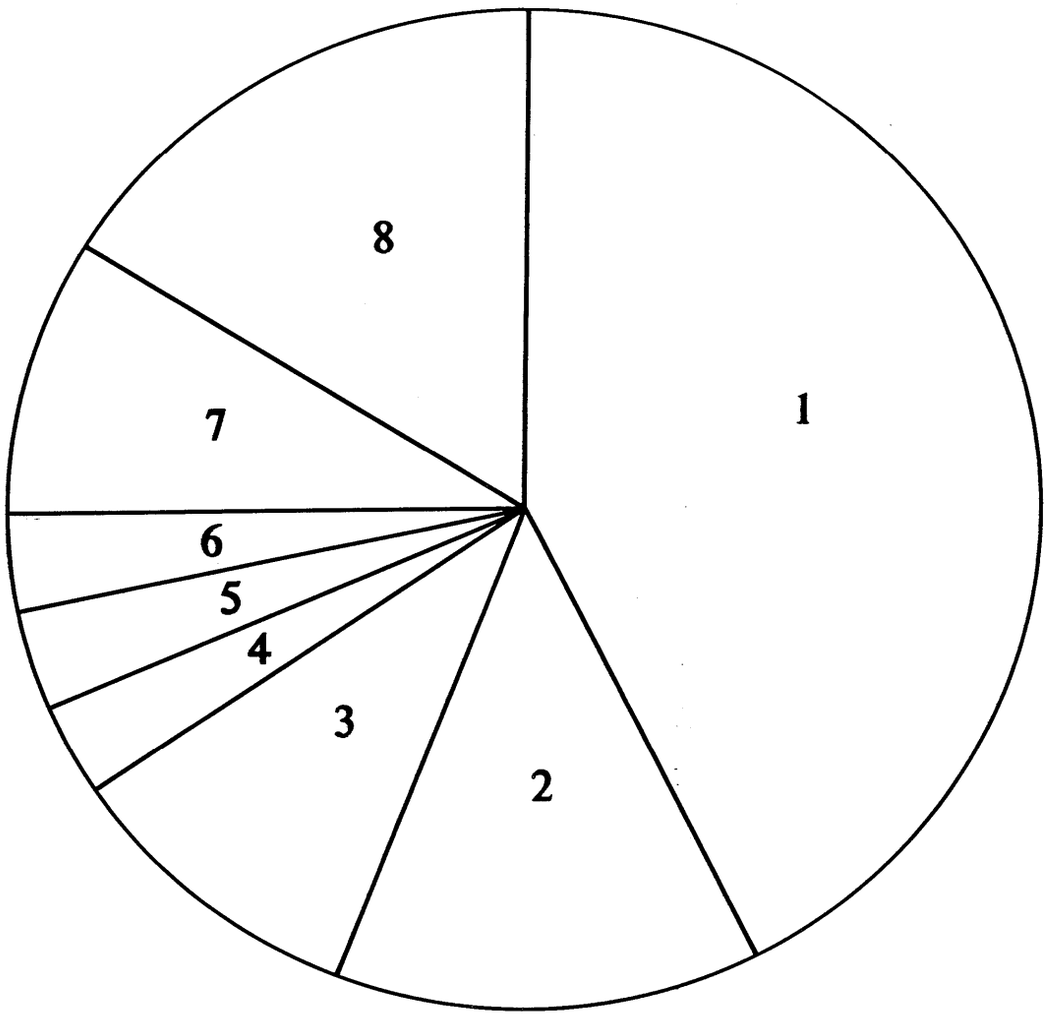
Author: B. McELHINNEY Date: 20/10/89

FIGURE 2

PEP 111
OTWAY BASIN
VICTORIA

WINDERMERE–2

TIME UTILIZATION

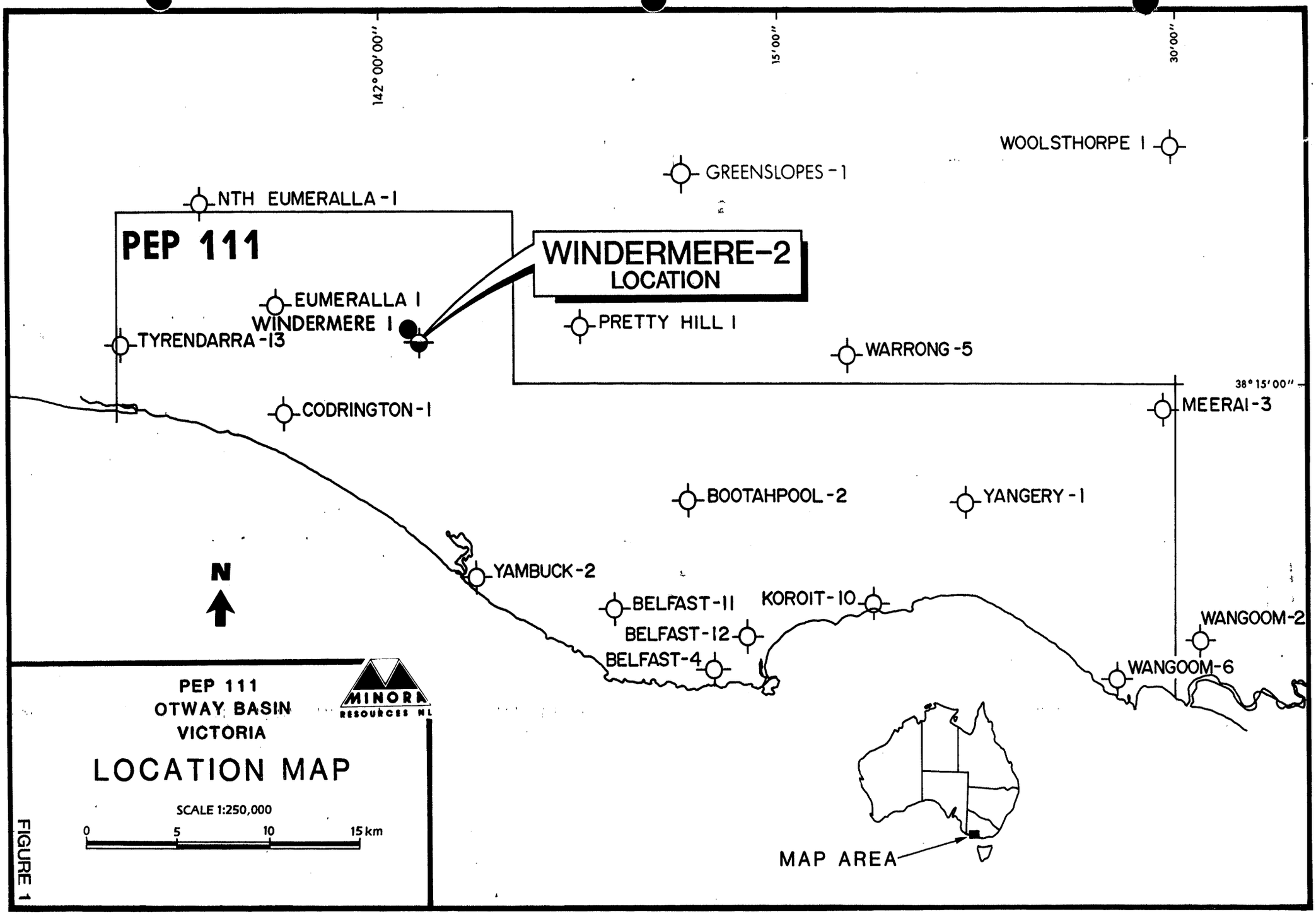


1	DRILLING & SURVEYING (42.7%)	5	DOWNHOLE PROBLEMS/ DELAYS (3.3%)
2	TRIPPING (13.0%)	6	RIG REPAIR (3.2%)
3	HOLE CONDITIONING (9.5%)	7	CASING & CEMENTING (9.1%)
4	RIG UP/RIG DOWN (3.1%)	8	EVALUATION (16.1%)

SPUDDED : 22.30 HRS 9/3/1989
RIG RELEASED : 17.00 HRS 19/4/1989
TOTAL HRS : 979.5

FIGURE 3

MINORA RESOURCES NL


142° 00' 00"
15' 00"
30' 00"
38° 15' 00"
WOOLSTHORPE 1
GREENSLOPES - 1
NTH EUMERALLA - 1
PEP 111
WINDERMERE-2
LOCATION
EUMERALLA 1
WINDERMERE 1
TYRENDARRA - 13
PRETTY HILL 1
WARRONG - 5
CODRINGTON - 1
MEERAI - 3
BOOTAHPOOL - 2
YANGERY - 1
N
YAMBUCK - 2
BELFAST - 11
KOROIT - 10
BELFAST - 12
WANGOOM - 2
BELFAST - 4
WANGOOM - 6
PEP 111
OTWAY BASIN
VICTORIA
MINORA
RESOURCES NL
LOCATION MAP
SCALE 1:250,000
0
5
10
15 km
MAP AREA
FIGURE 1

PE907878

This is an enclosure indicator page.
The enclosure PE907878 is enclosed within the container PE902149 at this location in this document.

The enclosure PE907878 has the following characteristics:

ITEM_BARCODE	= PE907878
CONTAINER_BARCODE	= PE902149
NAME	= Time/Depth & Stratigraphic Column
BASIN	= OTWAY
PERMIT	= PEP 111
TYPE	= WELL
SUBTYPE	= MONTAGE
DESCRIPTION	= Time Depth Chart & Predicted vs. Actual Stratigraphic Section (Figure 4 from Well Completion Report vol.1) for Windermere-2
REMARKS	=
DATE_CREATED	= 31/10/89
DATE_RECEIVED	= 9/11/89
W_NO	= W992
WELL_NAME	= Windermere-2
CONTRACTOR	= Minora Resources NL
CLIENT_OP_CO	= Minora Resources NL

(Inserted by DNRE - Vic Govt Mines Dept)

2.5 Gas Detection and Penetration Rate

Mudlogging Services were provided by Gearhart Geodata Pty Ltd. A continuous reading flame ionizing total gas detector and gas chromatograph were in operation from surface to total depth. Drilling rate, pump stroke and pit volume data were also continuously monitored. A data log recording lithology, gas, drill rate and other data was prepared at a 1:500 scale and is included as enclosure 2

2.6 Conventional Coring

Two conventional cores were cut by Christensen.
No. 1 1743.8-1749.3m driller. Rec. 78%
No. 2 1777.0-1793.9m driller. Rec. 99%
(see Appendix D).

2.7 Sidewall Cores

24 cores were attempted and 23 were recovered. (see Appendix E).

2.8 Wireline Logging

The following logs were run by Gearhart Australia.

Run 1	DLL/MSFL/GR/SP/Cal	304.7-1855.4m.
	BHCS/GR/MEL/Cal	15.1-1856.0m.
Run 2	DLL/MSFL/GR/SP/Cal	1865.5-3594.8m.
	BHCS/GR/MEL/Cal	1865.5-3558.0m.
	SLD/CNS/PE/GR/Cal	1865.5-3594.7m.
	FAD	2500.0-3200.0m.
	(sidewall cores and velocity survey)	

The maximum recorded temperature was 275°F at 3558 metres - 16 hours after circulation ceased. Because of hole problems there were several clean-out trips and lower temperatures were recorded on later logs. No temperature extrapolation has been made and a bottom hole temperature of 280°F has been assumed for the log interpretation (see Appendix H).

2.9 Drill Stem Tests

Three open hole drill stem tests were attempted. (see Appendix J).

DST #1 (Conventional bottom hole)
Interval: 1775.2-1802.3m
Periods: Open 7 & 180 mins. Closed 30 & 360 mins.
Result: Weak air blow, no gas to surface. Recovered 299m of mud and muddy formation water. Sample from sample chamber was 99% water, slightly gas cut. (Rw=0.3 @ 70°F).

DST #2 (Off-bottom conventional straddle).
Interval: 3182.0-3198.0m (TD 3230.7m)
Result: Misrun. Could not seat packers.

DST #2A (3 packer bottom hole)
Interval: 3174.0-3230.7m
Periods: Open 6 & 71 mins. Closed 30 & 142 mins.
Result: Weak air blow for 1-2 seconds then dead. No flow on second opening. Recovered 1221m of slightly gas cut water cushion with a trace of oil (<1%) at the top. Sample chamber contained about 2 litres of oil cut mud as well as gas under pressure. (The oil recovered was very dispersed and was estimated to be less than 10 litres in total). Less water cushion was recovered than was run (1306m) probably being due to it being aerated when initially pumped into the pipe and the air subsequently rising out.

2.10 Velocity Survey

A check shot survey was conducted by Velocity Data Pty Ltd (see Appendix N).

2.11 Deviation Surveys

Deviation surveys conducted at regular intervals are summarised in Appendix O. A maximum deviation of 6° was recorded at 3324m.

3. GEOLOGY

3.1 Regional Geology

The Otway Basin formed as a rifted continental margin basin with the Late Jurassic to Mid-Cretaceous rifting and initial breakup stage dominated by continental sedimentation. The Late Cretaceous - Tertiary sequence deposited during the break up of the Australia-Antarctic continental plates is comprised of four depositional sequences with widespread marine shales or marls intercalated with carbonates or porous sandstones. The stratigraphy of the Otway Basin is shown in Figure 5.

PEP 111 is located in the Tyrendarra Embayment on the Mussel Platform. The latter is a broad shelf area upthrown by the Mussel Fault from the deeper Voluta Trough. Two north-south ridges are superimposed on this platform, the Merino Uplift/Dartmoor ridge north of Portland and the Warrnambool High in the eastern part of the permit. These ridges separate two post-breakup, predominantly Late Cretaceous depocentres, the Gambier Embayment straddling the Victoria/South Australia border and the Tyrendarra Embayment in the eastern part of the basin. These

MINORA RESOURCES NL

OTWAY BASIN BIOSTRATIGRAPHY

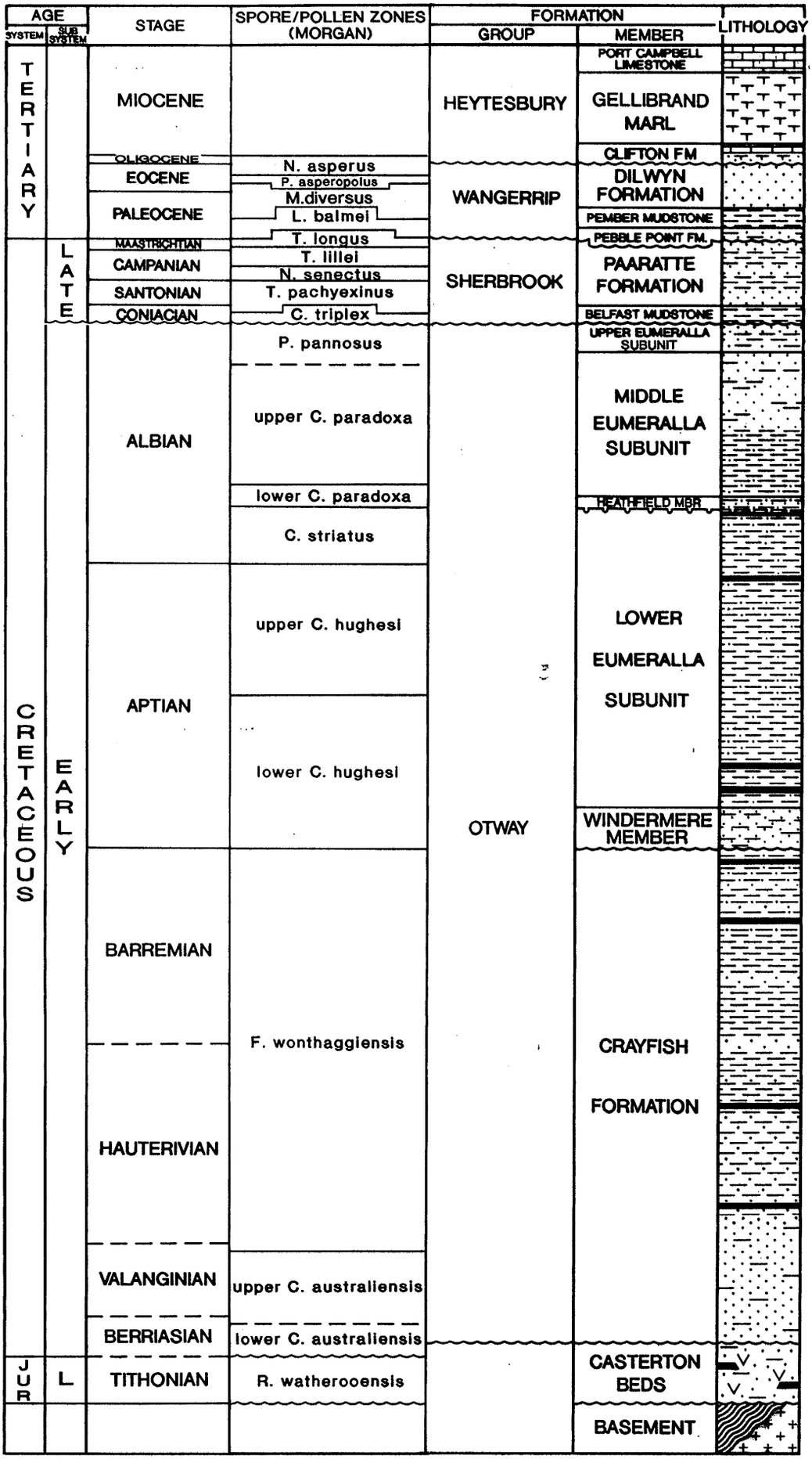


FIGURE 5

Date : OCTOBER 1989

ridges had significantly less effect on Tertiary sedimentation which prograded as a wedge across the basin.

The majority of faults are aligned northwest-southeast sub-parallel to the coast and are represented by major and minor down to the south step faults as well as numerous antithetics. Wrench tectonics are believed to have affected the basin in the Early Cretaceous and again in the Miocene.

3.2 Regional Stratigraphy

Basement in the Otway Basin consists of a complex Palaeozoic Tasman Geosyncline sequence cratonised during the Kanimblan Orogeny. Lithologies comprise high and low grade metamorphics, granites, orthoquartzites, acid-intermediate volcanics with post-Kanimblan Permian glacial sediments also possibly forming economic basement. The structural history of the Palaeozoic sequence is complex, with deposition mainly aligned north-south in fault bounded lows and high areas.

Late Jurassic - Early Cretaceous

A Late Jurassic sequence of carbonaceous siltstones and claystones, sandstones, basaltic volcanics and tuffs, the Casterton Beds represents the oldest known sequence in the basin. The overlying Otway Group was deposited prior to separation of the Australia/Antarctic continental plates under dominantly non-marine conditions in a deep graben formed in an extensional wrench related setting.

The Crayfish Formation comprises several sequences of rift-fill sandstone and shale units, the oldest being massive fanglomerates and braided stream clastics penetrated at Pretty Hill-1 and Greenslopes-1 near the northern boundary of PEP 111. The upper part of the Crayfish Formation is generally more argillaceous and may contain thin sandstones within a predominantly shale section as per Eumeralla-1. The Crayfish Formation is a name given by several operators to the sequence comprising the Pretty Hills and Geltwood Beach Formations. Minora considers that the latter two are now no longer appropriate.

The Eumeralla Formation is the major unit of the Otway Group. Sedimentation commenced in the Aptian with the deposition of a generally arenaceous Windermere Member. Lithology of the sand is dependent on the subcropping unit. Regionally where the subcropping unit is sand the Windermere Member sandstones are formed of less labile material, forming better quality reservoirs. Where the subcropping unit is Crayfish Formation shales the unit becomes more argillaceous. The remainder of the

Eumeralla section consists of fine grained fluviatile and lacustrine deposits of immature feldspathic sediments and volcanogenic claystones. Up to 50% of the arenaceous beds in the unit were derived from volcanic sources. In the PEP 111 area the Eumeralla can be subdivided into three depositional sequences. The Lower Eumeralla Subunit is the most argillaceous and coaly of the three Eumeralla subunits, forming a broad fining upward sequence. Logs show the Middle Eumeralla Subunit (C Paradoxa palynozone, see Figure 5) to comprise numerous argillaceous and arenaceous interbeds. The log character and palynological correlations in the Middle Eumeralla enable the Heathfield Member to be picked at the base of the sequence and also show that the sandstones higher in the Middle Eumeralla are thicker and cleaner than those in the remainder of the Eumeralla Formation. Locally, angularity can be recognised between the middle and Upper Eumeralla. Lithologically, the Upper Eumeralla is similar to the Middle Eumeralla, but the arenaceous units are somewhat thinner bedded and more argillaceous.

Late Cretaceous

Near the end of the Early Cretaceous volcanic activity ceased. A major unconformity (the breakup unconformity) represents a hiatus between the Otway Group and the overlying Sherbrook Group sediments. The Waarre Sandstone, a fluvio-deltaic unit, was the first to be deposited on the unconformity and was restricted to depressions in the Otway Group terrain to the west and to the east of PEP 111. This formation is conformably overlain by the shallow marine to paralic Flaxman Formation and the Nullawaare Greensand. This in turn is overlain by an extensive marine silty claystone, the Belfast Mudstone, partially time equivalent to an offlapping fluvio-deltaic wedge, the Paaratte Formation. The non-marine coarse sandstones, gravels and coals at the top of the Paaratte are referred to as the Timboon Sand.

Tertiary

The Cretaceous-Tertiary boundary is unconformable, with the Sherbrook Group being overlain by the Wangerrip Group. This younger group comprises a basal transgressive conglomeratic sandstone, the Pebble Point Formation overlain by a fine grained pro-delta marine facies unit, the Pember Mudstone. The latter interfingers with, and is overstepped by, a deltaic sandstone, siltstone and shale sequence, the Dilwyn Formation. A regional unconformity separates the Wangerrip Group from the Nirranda and the Heytesbury Groups, each being extensive sequences of marls and limestone with minor sandstones deposited under open marine conditions on a subsiding shelf. The former group is absent at Windermere-2

and is usually comprised of a basal sandstone unit, the Mepunga Formation which passes up into the Narrawaturk Marl. The basal unit of the Heytesbury Group usually consists of a shallow water bioclastic limestone/sandstone unit, the Clifton Formation, which passes upwards into a deeper water facies, the Gellibrand Marl. The Port Campbell Limestone is the overlying formation and consists of an offlapping wedge of coarse bioclastic limestones.

3.3 Previous Exploration

Frome-Broken Hill was granted PEP 5 prior to 1958 and conducted reflection and refraction seismic surveys in the years 1958 to 1964. During this period the wells Pretty Hill-1 and Eumeralla-1 were drilled. Shell farmed into the area in 1965 and conducted seismic surveys from 1966 to 1973. In addition, an aeromagnetic survey was conducted in 1970. North Eumeralla-1 was drilled in 1973 before Shell relinquished the area. Government water bores were drilled from 1959 to 1968.

PEP 5 expired in mid-1975 and the area was taken up by Beach Petroleum in 1976 under PEP 93, Beach did not conduct any exploration within the area, now known as PEP 111. PEP 111 was granted on 4th September 1984 for an initial period of 2 years. The initial term of the Permit was extended by another year, during which Windermere-1 was drilled.

Seismic Surveys carried out in or near PEP 111 are summarised as follows:

DATE	NAME OF SURVEY	COMPANY	CONTRACTOR
1958	Portland and Port Campbell-Timboon	Frome-Broken Hill	United Geophy.
1962	Yambuck-Portland	Frome-Broken Hill	Ray Service
1964	Koroit	Frome-Broken Hill	United Geophy.
1966	Port Fairy-Nelson	Shell	United Geophy.
1969	Hawkesdale	Shell	GSI
1970	Portland-McArthur	Shell	GSI
1971	Nelson-Koroit	Shell	Petty Geophy.
1973	Coastal Strip	Shell	Ray Geophy.
1985	Toolong	Pan Pacific	Geo Systems
1985	Windermere to Port Fairy	Pan Pacific	Seiscom Delta
1988	St. Helens	Minora	Geo Systems

In addition to the 1985 and 1988 seismic acquisition, the permittees have reprocessed the 1971, 1973 and certain older data from the permit area.

Port Campbell Embayment

Port Campbell-1, drilled in 1959 encountered a small flow of petroliferous gas from the Waarre Formation and Port Campbell-4, drilled in 1964, recovered free oil from the Eumeralla Formation. North Paaratte-1, drilled by Beach in 1979, flowed gas at rates of up to 270,000 m^3/d (9.6 mmcf/d) from the Waarre Formation. In 1981, Beach's Grumby-1 flowed gas at 200,000 m^3/d (7.3 mmcf/d) with approximately 50% carbon dioxide and Wallaby Creek-1, also drilled in 1981, tested gas at 280,000 m^3/d (9.8 mmcf/d).

North Paaratte and Wallaby Creek fields contain at least 425 million cubic metres (15 bcf) of gas, and a pipeline transports this gas to Warrnambool.

Tyrendarra Embayment

Few structurally valid wells have been drilled in this area. Modern exploration commenced in the late 1970's with Beach Petroleum acquiring extensive coverage of high resolution seismic. Drilled by Beach in 1983, the Lindon-1 well recovered a small amount of heavy, waxy oil from a drillstem test of the Pebble Point Formation over the interval 891-912m. The Fahley-1 well, drilled farther west by Beach in 1985 is believed to have encountered strong gas shows.

Several exploration wells have been drilled in or near PEP 111, but only Eumeralla-1, drilled by Frome-Broken Hill in 1962-63 and Windermere-1, drilled by Minora Resources NL in 1987 were drilled within the permit area. The remaining boreholes in PEP 111 were drilled by the Victorian Government to evaluate the groundwater of the area, or to supply water for local towns. Most of the latter wells including Windermere-1, penetrated the top of the Eumeralla Formation, whilst Eumeralla-1 appears to have been terminated in the Crayfish Formation. Pretty Hill-1 and North Eumeralla-1 both penetrated the Pretty Hill Sandstone, the latter was terminated in pre-Cretaceous basement.

The only wells in the proximity of PEP 111 with recorded oil shows are Eumeralla-1 and Windermere-1. Eumeralla-1 had fluorescence from several zones between 1448 and 2956m (4750 and 9700 feet). The well tested a rotated fault block and was on the downthrown side of the major antithetic fault until it entered the Middle Eumeralla in the upthrown block. North Eumeralla-1 tested a similar structure and penetrated two major fault zones, one of which placed the Pretty Hill Sandstone structural crest upthrown from the well. Whilst Pretty Hill-1 drilled good Pretty Hill Sandstone reservoirs in a prominent upthrown block, the well does not appear to have been crestal at all hydrocarbon objective levels.

Windermere-1 made an oil discovery in the Heathfield Member of the Eumeralla Formation. Open hole DST's 1 and 2 recovered 0.5 and 31.9 barrels of oil respectively. Only traces of oil were recovered with formation water during subsequent swabbing operations. The swabbing results and associated steady inflow of formation water suggest that the well may now be effectively depleted with the current completion. The most likely interpretation is that the well penetrated 5 metres of oil pay from 1805 - 1810 metres, probably in an oil transition zone.

Wells and boreholes drilled within, or close to, the permit are listed in the following table.

YEAR	WELL NAME	COMPANY	T.D. (Subsea)	OLDEST FM PENETRATED
1959	Belfast-4	Government	-1674m	Eumeralla
1967	Belfast-11	Government	-1464m	Eumeralla
1968	Bootahpool-2	Government	-1343m	Eumeralla
1968	Codrington-1	Government	-1262m	Eumeralla
1962	Eumeralla-1	Frome-Broken Hill	-3091m	Crayfish
1985	Greenslopes-1	Phoenix	-2520m	Basement
1966	Koroit-10	Government	-1496m	Eumeralla
1966	Meerai-3	Government	- 690m	Eumeralla
1968	Nautilus-1	Esso	-1982m	Belfast Mudstone
1973	Nth Eumeralla-1	Shell	-2677m	Casterton Beds
1967	Pecten-1A	Shell	-2816m	Eumeralla
1962	Pretty Hill-1	Frome-Broken Hill	-2416m	Casterton Beds
1982	Triton-1	Esso	-3516m	Waarre
1968	Tyrendarra-13	Government	-1362m	Eumeralla
1967	Voluta-1	Shell	-3940m	Flaxman
1960	Wangoom-2	Government	-1036m	Eumeralla
1961	Wangoom-6	Government	-1186m	Eumeralla
1967	Warrong-5	Government	-1021m	Eumeralla
1987	Windermere-1	Minora	-1798m	Eumeralla
1968	Woolsthorpe-1	Interstate Oil Ltd	-1846m	Casterton
1967	Yambuck-2	Government	-1530m	Eumeralla
1960	Yangery-1	Government	-1239m	Eumeralla

3.4 Rationale for Drilling

3.4.1 Geophysical Mapping & Structure

The Windermere-2 prospect was based on mapping of the 1988 St. Helens Seismic Survey. Well control was provided by Windermere-1, Eumeralla-1, Pretty Hill-1 and North Eumeralla-1. The following seven horizons were mapped prior to drilling.

1. Near top Clifton Formation
2. Top Pebble Point Formation
3. Base Belfast Mudstone
4. Near top Heathfield Member
5. Near base Heathfield Member
6. Near top Windermere Member
7. Near top Crayfish Formation

The Windermere-2 location lies outside closure at both near top Clifton Formation and top Pebble Point Formation levels (Enclosure 4). At near base Heathfield level (Figure 6) the structure is dominated by a major northwest-southeast striking down to the south normal fault, antithetics of which divide the horizon into numerous discrete fault blocks. At the deeper levels (Windermere Member and Crayfish Formation) the maximum structural closure is against this normal fault (Figures 7&8), however a crestal horst block to the south within this closure formed by two antithetics was the target for the Windermere-2 well.

3.4.2 Objectives

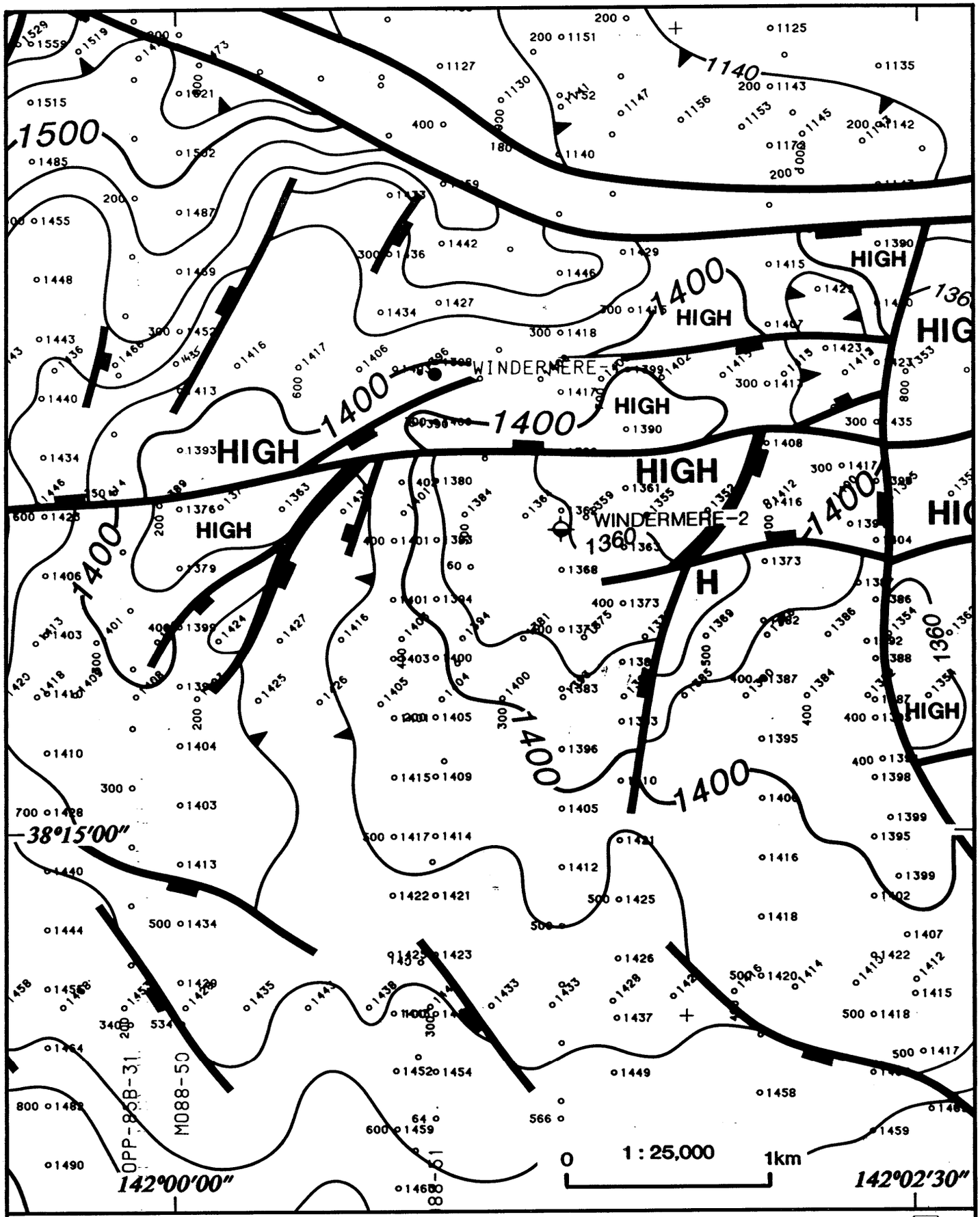
The Windermere-2 exploration well was primarily drilled to appraise the highest location at Heathfield Member level as close as possible to known oil (Windermere-1) and to explore deeper sandstones at Windermere Member and Crayfish Formation levels. Secondary objectives included the Dilwyn and Pebble Point Formation and sands of Middle and Lower Eumeralla subunits.

3.5 Windermere #2 - Stratigraphy

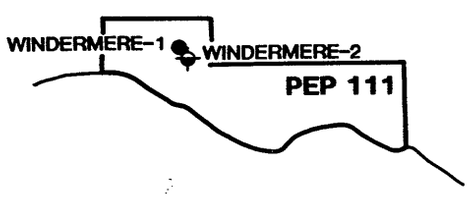
3.5.1 Tertiary

5.5-95.5m **Port Campbell Limestone** (Miocene)

At Windermere #2 the Port Campbell Limestone is 90 metres thick and is dominantly limestone with some sandstone near the surface. The limestone is white to yellowish-white at the surface grading to light grey with depth, soft to moderately hard and fossiliferous with occasional green pellets of glauconite. The sandstone is clear to light brown, fine tocoarse, mostly medium at the top and becoming fine with depth, moderate to well sorted, sub-angular to sub-rounded, occasionally very angular, calcareous cement, iron stained in part, very friable-predominantly loose, good porosity.



LOCATION MAP



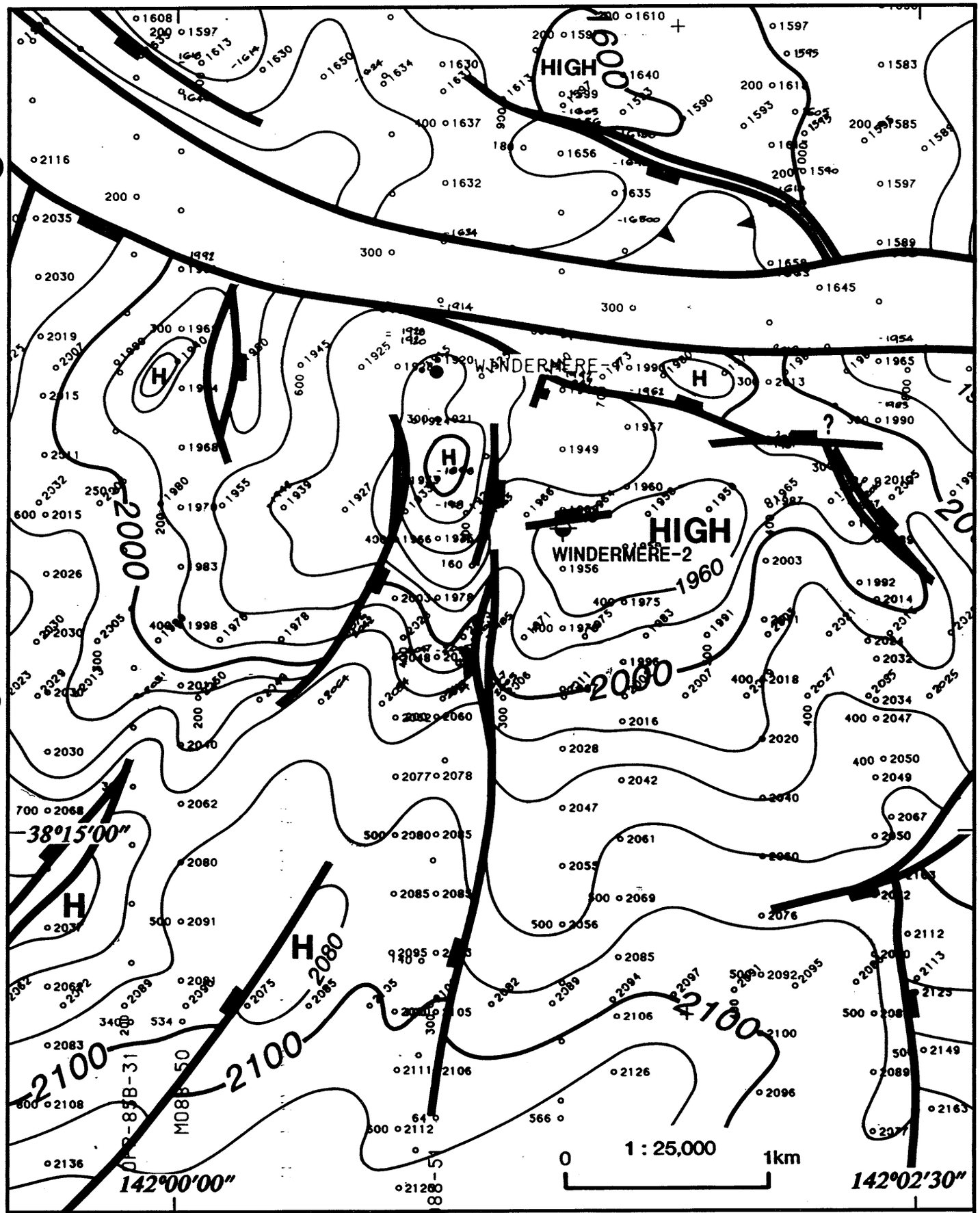
MINORA RESOURCES NL

PEP 111
OTWAY BASIN
VICTORIA

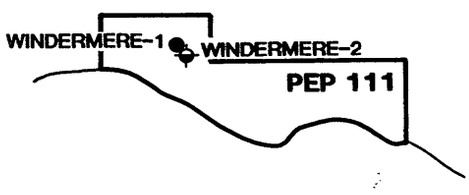
NEAR BASE HEATHFIELD MBR.

TIME STRUCTURE MAP
(PRE DRILL)

FIGURE 6



LOCATION MAP



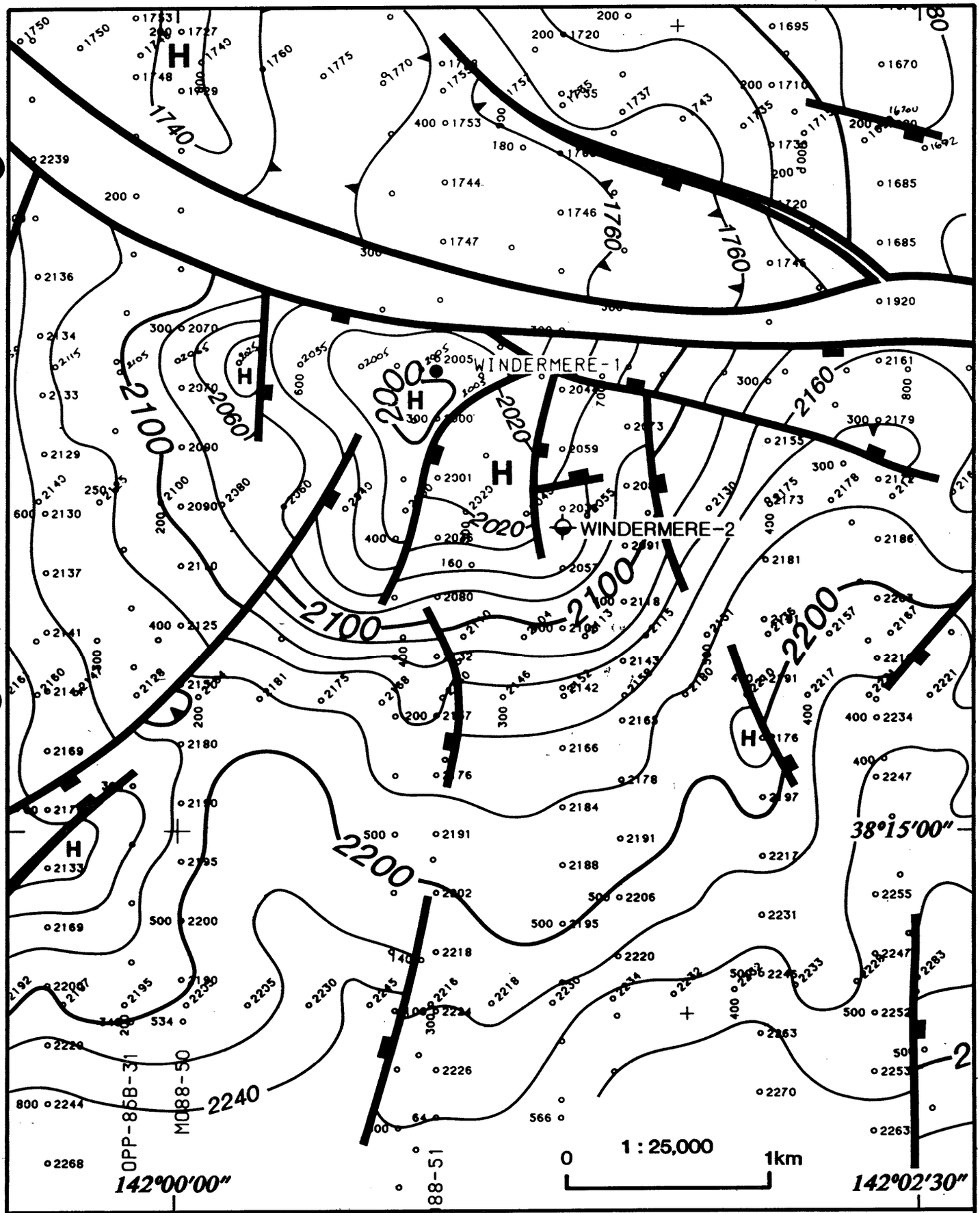
PEP 111
OTWAY BASIN
VICTORIA

MINORA RESOURCES NL

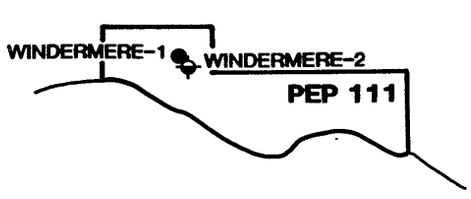
NEAR TOP WINDERMERE MBR.

TIME STRUCTURE MAP
(PRE DRILL)

FIGURE 7



LOCATION MAP



MINORA RESOURCES NL

PEP 111
OTWAY BASIN
VICTORIA

NEAR TOP CRAYFISH FM.

TIME STRUCTURE MAP
(PRE DRILL)

FIGURE 8

95.5-357.0m Gellibrand Marl (Miocene)

This formation is comprised predominantly of marl, with minor limestone and sandstone. The marl is light to medium grey, greenish-grey, mauve grey, soft to firm, with abundant cream to light brown fossil fragments. The limestone is white to yellowish-white, light grey, moderately hard, crystalline, fossiliferous. The sandstone is dark brown, white to light grey, very fine to coarse, mostly fine to medium, poor to moderate sorted, sub-angular to sub-rounded, occasional well rounded, clay matrix, lithic, trace glauconite, loose, poor porosity.

357.0-425.0m Clifton Formation (Oligocene)

The Clifton Formation at Windermere #2 is a sequence of interbedded sandstones and marls/claystones. The sandstone is clear, light to medium brown, fine to medium - becoming coarse to very coarse with depth, moderate sorted, sub-angular to rounded, calcareous cement, silty clay matrix, lithic, trace pyrite and glauconite, friable - loose, good porosity. The claystone/marl is cream, yellowish-grey, greenish-grey, silty, soft to firm, glauconitic, fossiliferous, with some hard limestone bands. The doleritic volcanics encountered near the base of the Clifton Formation in Windermere #1 were not present in Windermere #2.

425.0-667.2m Dilwyn Formation (Eocene)

The Dilwyn Formation is the uppermost unit of the Wangerrip Group and consists of a series of massive sandstones with subordinate silty claystones in the upper half of the formation. The sandstones are clear, medium to coarse, moderate sorted, sub-angular to sub-rounded, loose quartz grains, trace pyrite, good porosity. The claystones are dark brown, greyish-brown, soft, silty, dispersive.

667.2-715.5m Pember Mudstone (Paleocene)

This is a shallow water marine unit comprised of siltstone, claystone and marl with minor sandstone. The siltstone is brownish-black, argillaceous and carbonaceous, pyritic in part, soft to firm. The claystone is brownish-black, silty, carbonaceous, also blue-grey, soft grading to marl. The marl is greenish-grey to pale blue-grey, soft, fossiliferous. The sandstone is clear, light to medium brown, fine to coarse, moderate sorted, sub-angular to rounded, loose quartz grains, trace brown clay matrix, minor pyrite and rare mica, fair to good porosity.

715.5-750.0m Pebble Point Formation (Paleocene)

The Pebble Point Formation is a transgressive conglomeratic sandstone and is the basal unit of the Wangerrip Group. The sandstone is clear to dark yellowish-orange, some moderate brown to dusky brown, fine to very coarse with some conglomerate, predominantly medium to very coarse, poor to moderate sorted, sub-angular to rounded, trace brown clay matrix, loose iron stained quartz grains, minor olive-brown lithic grains, rare pyrite, good porosity.

3.5.2 Cretaceous

750.0-950.0m Paraatte Formation (Santonian-Maastrichtian)

The Paraatte Formation, which is the uppermost unit of the Sherbrook Group, is a sequence of sandstones with minor siltstones in the upper half grading to claystones with subordinate sandstones in the lower half. 750.0-831.0m Sandstone, clear, some light to medium brown, fine to very coarse, poor to moderate sorted, sub-angular to rounded, trace clay matrix, trace lithic grains and glauconite, trace pyrite (up to 5% near base), loose to friable, fair to good porosity. Minor siltstone, medium to dark grey, olive-grey, firm, blocky, argillaceous, carbonaceous and pyritic in part. 831.0-950.0m Claystone, medium light grey to

olive-grey, soft, silty and sandy, dispersive, slightly calcareous, occasionally fossiliferous, minor carbonaceous specks and laminae, trace pyrite.

950.0-1009.3m Belfast Mudstone (Santonian)

The Belfast Mudstone is an extensive marine unit comprised almost totally of claystone with rare sandstone. The claystone is light olive-grey, medium dark grey to brownish-grey, firm, amorphous to blocky, silty and sandy, trace glauconite (up to 5% at base). The sandstone is clear, very fine to fine, moderate sorted, sub-rounded argillaceous matrix, poor porosity.

1009.3-1170.0m Upper Eumeralla Subunit (Albian)

The Eumeralla Formation has been sub-divided into three units in the PEP 111 area and the Upper Eumeralla Subunit is the youngest unit of the Otway Group and is comprised of a series of interbedded continental claystones and lithic sandstones. The Cretaceous Otway Group which includes the Eumeralla and Crayfish Formations was deposited before the final separation of the Australia/Antarctica continental plate. Deposition was under dominantly non-marine conditions in a deep graben which was formed in an extensional wrench related setting. The claystone of the Upper Eumeralla Subunit is white, light to medium-dark grey, pinkish-grey, yellow-grey, soft to firm, sandy in part, trace glauconite, trace pyrite and carbonaceous material. The sandstone are clear, white, pale green to grey-green, fine to medium, moderate sorted, sub-rounded, loose quartz and lithic/quartzite grains, poor to fair porosity.

1170.0-1671.0m Middle Eumeralla Subunit (Albian)

The Middle Eumeralla Subunit is comprised of interbeds of sandstone, siltstone and claystone, and is similar lithologically to the overlying Upper Eumeralla Subunit. The sandstones are white to light grey, light greenish-grey, minor dark

green to grey-black, very fine to medium, occasional coarse, poor to moderate sorted, sub-angular to sub-rounded, clay matrix, mostly hard with moderate to strong calcareous cement and minor thin calcarenite/limestone bands), greenish-grey and grey-black lithic/quartzite grains, pink and white feldspar, trace pyrite and mica, poor porosity. The siltstones are white light to medium grey, grey-brown, greenish-grey, firm to hard, feldspathic, lithic, carbonaceous, argillaceous, calcareous in part, trace pyrite, grades to very fine sandstone. The claystones are light grey, greenish-grey, light olive-grey, light brownish-grey, silty, soft to firm, trace carbonaceous material and pyrite.

1671.0-1806.6m Heathfield Member (Albian)

The Heathfield Member at Windermere #2 is comprised predominantly of lithic sandstones with subordinate shales/claystones. The sandstones are white to light grey, greenish-grey, very fine to medium, occasionally coarse to very coarse, poor to moderate sorted, sub-angular to sub-rounded, occasional quartz overgrowths on some grains, calcareous cement in part, clay matrix, grey-green to black lithic grains, feldspar (weathered in part), micaceous, minor carbonaceous laminae, poor to fair porosity. the shales/claystones are dark grey, brown-black, sub-fissile to massive, hard, trace to common carbonaceous material and plant fragments, minor thin coally bands.

1806.6-3187.0m Lower Eumeralla Subunit (Albian-Aptian)

The Lower Eumeralla Subunit is comprised predominantly of siltstone with lesser amounts of sandstone and shale/claystone. Minor coals are present throughout the Lower Eumeralla particularly below 2898m.
1806.0-2898.0m The siltstones are light to dark grey, yellowish-grey, sub-fissile to blocky, firm to hard, slightly calcareous in part, grades to

very fine sandstone, very argillaceous in part, feldspathic, micaceous dark grey-black lithics and volcanics, lignitic and carbonaceous in part. The sandstone is clear, white, pinkish-grey, yellowish-grey, greenish-grey, silty to very fine occasional medium, poor to moderate sorted, angular to sub-angular, moderate to strong calcareous cement, lithic/volcanic grains, feldspar, trace mica and carbonaceous material, very poor to poor porosity. The shale is brownish-grey, olive-grey, silty, firm, carbonaceous in part, also dark brown to black, lignitic - grading to coal. The claystone is white to yellowish-grey, light brownish-grey, weathered in part, silty in part, soft to firm. (The interval 2528-2547m is predominantly sandstone, clear, white, pale green pale orange-pink, very fine to medium, mostly fine, moderate sorted, sub-angular to sub-rounded, trace calcite grains and calcite cement, pale green, grey, orange pink lithic/quartzite/volcanic grains, white feldspar, minor brown mica, poor to occasional fair porosity.)
2898.0-3187m The siltstones are white, light grey, light brown, light greenish-grey, pale blue-green, light brownish-grey, pinkish-grey, sub-fissile to blocky, firm to hard, sandy in part, lithic, feldspathic, micro-micaceous, trace carbonaceous material. The sandstone is clear, white to medium grey, light to medium brownish-grey, pinkish-grey, yellowish-grey, occasional light greenish-grey, silty to very fine, poor to moderate sorted, angular to sub-angular, hard, moderate calcareous cement, lithic/volcanic grains, feldspar, carbonaceous and micaceous in part, poor to very poor porosity. The shale is brownish-grey, brownish-black, light greenish-grey, light to medium brownish-grey, light olive-grey, silty, firm, carbonaceous in part - grading to coal. The coal is dull brownish-black-shaley, and bright black - brittle with trace pyrite.

3187.0-3292.0 Windermere Member (Aptian)

This is a new name introduced for basal Eumeralla unit directly overlying the Crayfish Formation. The Windermere Member is conformable and somewhat gradational with the overlying Eumeralla sequence although the boundary is placed at a fairly obvious sonic log decrease. A hiatus exists between the Windermere Member and the Crayfish Formation.

This unit is predominantly sandstone with minor siltstone and trace coal. The sandstone is clear and white, minor light greenish-grey, very fine to medium, moderate sorted, angular to sub-angular, trace calcareous cement, moderate to abundant clay matrix, pale greenish-grey lithic grains, white feldspar, minor brown mica, trace pinkish-red garnet, poor to fair porosity. The siltstone is white, light grey, light brown, light greenish-grey, pale blue-green, light brownish-grey, pinkish-grey, sub-fissile to blocky, firm to hard, sandy in part, lithic, feldspathic, micro-micaceous, trace carbonaceous material. The coal is dull brownish-black - shaley, and black - brittle, trace pyrite.

3292.0-3595.0m Crayfish Formation (Barremian)

At Windermere #2 the Crayfish Formation is comprised of a sequence of sandstones and siltstones. The sandstones are clear, white to light grey, greenish-grey, very fine to medium, occasional coarse, mostly fine, poor to moderate sorted, angular to sub-angular, predominantly weak to moderate silica cement, calcareous in part, minor to moderate clay matrix, green and grey-black lithic grains, white an pinkish feldspar, trace mica, rare pink to red garnet, trace to poor porosity. The siltstones are grey, light to medium brownish-grey, pinkish-grey, light greenish-grey, lithic, feldspathic, micro-micaceous, carbonaceous in part, firm to hard, sub-fissile, grading to shale in part.

3.6 Occurrence of Hydrocarbons

0-980m. No gas or fluorescence was detected while drilling this interval which includes the following formations:

Port Campbell Limestone,
Gellibrand Marl,
Clifton Formation,
Dilwyn Formation,
Pember Mudstone,
Pebble Point Formation,
Paraatte Formation,
Belfast Mudstone.

980-1671m. Upper & Middle Eumeralla Subunits. There were no significant gas peaks in this interval and readings ranged from 0 to 15 units. No fluorescene was recorded. Down to 1671m the gas was predominantly C1 (98-100%) with traces of C2 (0-2%) and rare C3 (trace).

1671-1806m. Heathfield Member.
There were no significant gas peaks in this interval and readings ranged from 1 to 9 units. Gas composition was C1 (94-98%) with traces of C2 (3-4%) and rare C3 (tr-2%). Up to 15% very dull orange-yellow fluorescence without cut, (mineral?) was recorded from cuttings at 1765-1777m together with rare specks of dim to bright, blue-white fluorescence which gave an instant crush cut and thin to moderate ring residue. There was no fluorescence in the two cores cut in the Heathfield Member and a drill stem test of the interval 1775-1802m only recovered a small amount of water. The absence of significant hydrocarbon shows from the Heathfield Member at Windermere #2 is in contrast to the oil recovered from drill stem tests of the same unit at Windermere #1.

1806-2630m. Lower Eumeralla Subunit (Upper).
There were no significant gas peaks in this interval other than sharp peaks from thin coals and readings ranged from 1 to 12 units. Gas composition was C1 (88-100%) with minor C2 (0-8%) and C3 (0-4%) and rare C4 (trace). There was minor orange-yellow mineral fluorescence and some coals gave a milky-white crush cut.

2630-3187m. Lower Eumeralla Subunit (Lower).
Gas readings ranged between 1 and 10 units with coal peaks to 50 units - particularly between 2900 and 3100m. Overall there was a significant increase in "heavies" and the gas composition was C1 (60-95%) with C2 (3-15%), C3 (2-15%), C4 (2-8%) and C5 (0-2%). There was minor orange-yellow mineral

fluorescence and some coals gave a milky-white crush cut.

3187-3292m. Windermere Member.
The interval 3187 - 3195m was a poor porosity sandstone with no fluorescence but had gas readings up to 50 units with a composition of C1 (64%), C2 (16%), C3 (13%), C4 (6%) and C5 (1%). A drill stem test of the sand recovered a trace of oil and gas cut water cushion.

The remaining Windermere Member sands had gas readings between 1 and 10 units with peaks to 30 units and a composition of C1 (70-80%), C2 (9-10%), C3 (7-13%), C4 (1-5%) and C5 (tr-2%). There was a trace of dull yellow-white pin-point fluorescence (<1%) with a weak cut and a faint film residue.

3292-3595m. Crayfish Formation.
Gas readings ranged between 2 and 10 units and the gas composition was C1 (70-75%), C2 (8-10%), C3 (12-15%), C4 (2-6%) and C5 (0-2%). There were no significant gas peaks and no fluorescence.

3.7 Reservoir Porosity and Permeability

3.7.1 Port Campbell Limestone

The bio-clastic limestones and sandstones of the Port Campbell Limestone outcrop in the area and from visual examination they have good porosity and permeability. This section was not wireline logged.

3.7.2 Gellibrand Marl

This section was not wireline logged but in cuttings it is comprised predominantly of marl, with minor limestone and sandstone with poor porosity and permeability.

3.7.3 Clifton Formation

The Clifton Formation at Windermere #2 is a sequence of interbedded sandstones and marls/claystones. Cuttings and wireline logs indicate the sandstones to have generally poor porosity with some good porosity at the base.

3.7.4 Dilwyn Formation

The sandstones of the Dilwyn Formation have good to very good visual porosity in cuttings and wireline log data support this.

3.7.5 Pember Mudstone

This unit is comprised of siltstone, claystone and marl with minor sandstone and wireline logs and cuttings data indicate the porosity to be poor and the permeability to very low.

3.7.6 Pebble Point Formation

The Pebble Point Formation is a conglomeratic sandstone and wireline logs and cuttings data indicate good porosity and probable fair to good permeability.

3.7.7 Paraatte Formation

The Paraatte Formation is a sequence of sandstones with minor siltstones in the upper half grading to claystones with subordinate sandstones in the lower half. The porosity appears fair to good at the top but decreases with depth as claystone becomes the dominant lithology.

3.7.8 Belfast Mudstone

The Belfast Mudstone is an extensive marine unit comprised almost totally of claystone with rare poor porosity sandstone.

3.7.9 Upper Eumeralla Subunit

The Upper Eumeralla Subunit is comprised of a series of interbedded continental claystones and lithic sandstones. Wireline logs and cuttings indicate the sandstones to have poor to fair porosity and probably low permeability.

3.7.10 Middle Eumeralla Subunit

The Middle Eumeralla Subunit is comprised of interbeds of sandstone, siltstone and claystone, and is similar lithologically to the overlying Upper Eumeralla Subunit with wireline logs and cuttings indicating the sandstones to have poor to fair porosity and low permeability.

3.7.11 Heathfield Member

The Heathfield Member at Windermere #2 is comprised predominantly of lithic sandstones with subordinate shales / claystones. Two cores were cut in this unit and core analysis

results showed the majority of the sand to have fair to good porosities in the 13-16% range but with one exception (2.5md) all permeabilities measured were less than 1 milli-darcy (see Appendix F). Log analysis and drill stem test data (recovered 299 metres of muddy water), tend to confirm the low permeability of the sands.

3.7.12 Lower Eumeralla Subunit

The Lower Eumeralla Subunit is comprised predominantly of siltstone with lesser amounts of sandstone and shale / claystone with minor coals. Visual cuttings examination and log data indicate that in general the sandstones have poor to fair porosity and probably very low permeability. The best reservoir sand in the interval is probably between 2528 and 2547m where Sonic log porosities are 7-10%. The Gamma Ray log indicates the sand to have a clay/shale content of 30-40% and suggest that permeabilities would be very low. Examination of sidewall cores from 2531 and 2534 metres showed them both to have very poor porosity and a high clay content.

3.7.13 Windermere Member

The top of this unit is predominantly sandstone with minor siltstone and trace coal. Sidewall cores at 3190, 3191 and 3194 metres were lithic sandstones with poor visual porosities and a high clay percentages. Calculated Sonic log porosities were 9-16% and from the Gamma Ray log the clay/shale percentages were 10-25%. A drill stem test of the interval 3174 - 3231 metres recovered gas cut water cushion with a trace of oil.

3.7.14 Crayfish Formation

From visual examination the sandstones of the Crayfish Formation had moderate amounts of clay matrix and silica/calcareous cement and very poor to poor porosities. Log evaluation of the intervals 3316-3325m and 3529-3552 metres gave Sonic log porosities of 4-9% and Gamma Ray log clay/shale percentages of 25-50%.

4. CONCLUSIONS AND CONTRIBUTIONS TO GEOLOGICAL KNOWLEDGE

The Windermere-2 exploration well was drilled to appraise the Heathfield Member oil discovery from Windermere-1 in an updip location and explore deeper objectives.

The well penetrated a sequence much as anticipated to Belfast Mudstone level. The Belfast (32m high) appears to have been intersected on the upthrown side of a small normal fault mapped just to the south of the well location (Enclosure 4). Top Heathfield Member was encountered 28m high to prognosis with top porosity appearing to "young" from Windermere-1 to -2. The Heathfield seems to occur as a sand "wedge" thickening to the southeast towards Windermere-2. If however, the zone continues to thicken there may reach a point where Heathfield is overlain by Middle Eumeralla sands reducing the effectiveness of the upper seal. Section below the Heathfield Member was much as anticipated although both the Windermere Member (316m low) and Crayfish Formation (216m low) where significantly low to prognosis. The correlation of the deeper section is difficult due to the large number of faults in the area and lack of good seismic control between the two wells, however a package of seismic events can be reliably mapped over the area. The Windermere Member top was picked at the top of the reflective package which was subsequently found to be the top of the Lower Eumeralla coal package rather than the base. The top Crayfish Formation unconformity was miscorrelated due to the poor seismic data quality at the proposed location because of reflections out of the plane of the section from down to the basin listric faults.

Geochemical analyses conducted in the well and summarised in Appendix K show that the Tertiary and Cretaceous sediments above 2435m are thermally immature with vitrinite reflectances less than 0.5%. Maturation thresholds for the onset of hydrocarbon generation occur within the Lower Eumeralla Subunit, top gas window is interpreted to occur at 2745m with top oil window at 3002m. The Crayfish Formation at a total depth of 3595m is at an optimal oil maturity level (VR=0.97%).

Organic rich sediments with a genetic potential of up to 96kg/tonne occur in the Lower Eumeralla Subunit with the coals at this level containing gas and condensate prone kerogens that are initially mature for hydrocarbon generation. Conversely samples of the Crayfish Formation below the unconformity are organically lean, inertinite rich and dry gas prone.

The oil recovered during DST 2A over the Windermere Member is of terrestrial plant origin similar to the oil produced from the Heathfield Member in Windermere-1. The two oils differ in terms of maturity (VR calc of the Windermere-2 oil being 0.97% versus a VR calc of 0.57% in Windermere-1) and specific aspects of their biomarker geochemistry (see Appendix K). The oils therefore appear to have originated from different Cretaceous source rocks. The most likely

source of the Windermere-2 oil is the adjacent lower Eumeralla coal measures with the Windermere-1 oil being likely sourced from coals directly below the Heathfield Member in that well. Significantly, these coals are not developed in Windermere-2.

It is proposed that the name "Windermere Member" be introduced to refer to the basal sandstone/claystone/siltstone unit of the Lower Eumeralla sequence. Petrological studies on this Windermere Member, summarised in Appendix G show the sands to be of generally poor quality due to reworking of the underlying Crayfish Formation shales and siltstones. The sandstones are characterised by an abundance of ubiquitous brown authigenic clay cement. This may result from an interaction of pore fluids derived from the degradation by oxic and anoxic processes of overlying Lower Eumeralla carbonaceous material.

Windermere-2 encountered no economic accumulations of hydrocarbons at either Heathfield or deeper levels. The lack of anticipated Heathfield oil is probably due to non development of Lower Eumeralla Subunit coals present directly below the oil bearing zone in Windermere-1. The deeper Windermere Member and Crayfish Formation levels are now considered to have been drilled outside closure at this location.

From the analyses conducted in the Windermere-2 well it is evident that high quality source rocks are developed in the Lower Eumeralla Subunit although reservoir quality throughout the Windermere Member and Crayfish Formation is poor. It therefore is necessary to intersect the better developed reservoirs known to exist deeper in the Crayfish Formation at economically drillable depths. To achieve this the exploration emphasis in the permit should be moved on to the Pretty Hill Terrace north of Windermere-2 where these better developed reservoirs have access via a complex fault pattern to both Lower Eumeralla and deeper source sequences.

PE601002

This is an enclosure indicator page.
The enclosure PE601002 is enclosed within the container PE902149 at this location in this document.

The enclosure PE601002 has the following characteristics:

ITEM_BARCODE	= PE601002
CONTAINER_BARCODE	= PE902149
NAME	= Composite Well Log
BASIN	= OTWAY
PERMIT	= PEP 111
TYPE	= WELL
SUBTYPE	= COMPOSITE_LOG
DESCRIPTION	= Composite Well Log (enclosure from WCR vol.1) for Windermere-2
REMARKS	=
DATE_CREATED	= 19/04/89
DATE_RECEIVED	= 9/11/89
W_NO	= W992
WELL_NAME	= Windermere-2
CONTRACTOR	= Minora Resources NL
CLIENT_OP_CO	= Minora Resources NL

(Inserted by DNRE - Vic Govt Mines Dept)

PE601003

This is an enclosure indicator page.
The enclosure PE601003 is enclosed within the container PE902149 at this location in this document.

The enclosure PE601003 has the following characteristics:

ITEM_BARCODE	= PE601003
CONTAINER_BARCODE	= PE902149
NAME	= Mud log
BASIN	= OTWAY
PERMIT	= PEP 111
TYPE	= WELL
SUBTYPE	= MUD_LOG
DESCRIPTION	= Mud Log (enclosure from WCR vol.1) for Windermere-2
REMARKS	=
DATE_CREATED	= 14/04/89
DATE_RECEIVED	= 9/11/89
W_NO	= W992
WELL_NAME	= Windermere-2
CONTRACTOR	= Gearhart Pty Ltd
CLIENT_OP_CO	= Minora Resources NL

(Inserted by DNRE - Vic Govt Mines Dept)

PE601004

This is an enclosure indicator page.
The enclosure PE601004 is enclosed within the container PE902149 at this location in this document.

The enclosure PE601004 has the following characteristics:

ITEM_BARCODE	= PE601004
CONTAINER_BARCODE	= PE902149
NAME	= Wellsite Lithology Log
BASIN	= OTWAY
PERMIT	= PEP 111
TYPE	= WELL
SUBTYPE	= WELL_LOG
DESCRIPTION	= Wellsite Lithology Log (enclosure from WCR vol.1) for Windermere-2
REMARKS	=
DATE_CREATED	= 19/04/89
DATE_RECEIVED	= 9/11/89
W_NO	= W992
WELL_NAME	= Windermere-2
CONTRACTOR	= Minora Resources NL
CLIENT_OP_CO	= Minora Resources NL

(Inserted by DNRE - Vic Govt Mines Dept)

PE902150

This is an enclosure indicator page.
The enclosure PE902150 is enclosed within the container PE902149 at this location in this document.

The enclosure PE902150 has the following characteristics:

ITEM_BARCODE	= PE902150
CONTAINER_BARCODE	= PE902149
NAME	= Siesmic line Migration
BASIN	= OTWAY
PERMIT	= PEP 111
TYPE	= SEISMIC
SUBTYPE	= SECTION
DESCRIPTION	= Seismic Line Migration/Seismic Section, Line MO88-52, St. Helens Survey, (enclosure from WCR vol.1) for Windermere-2
REMARKS	=
DATE_CREATED	= 31/05/98
DATE_RECEIVED	= 9/11/89
W_NO	= W992
WELL_NAME	= Windermere-2
CONTRACTOR	= Minora Resources NL
CLIENT_OP_CO	= Minora Resources NL

(Inserted by DNRE - Vic Govt Mines Dept)