



WCR
VOL 1

WCR VOLUME 1
TEXT & ENCLOSURES

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GAS AND FUEL EXPLORATION N.L.

PEP 119

OTWAY BASIN

VICTORIA

McEACHERN No. 1
WELL COMPLETION REPORT

VOLUME I

V.AKBARI

JULY, 1990

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SUMMARY

McEachern No. 1 was drilled as a wildcat exploration well in PEP 119 Otway Basin Victoria.

Participants in the well were Gas & Fuel Exploration N.L. (Operator), SAGASCO Resources Ltd, Minora Resources N.L., Base Resources Ltd, and Beach Petroleum N.L.

McEachern No. 1, was located 22 km west of the township of Casterton and approximately 45 km northeast of Mt. Gambier and about 6 km north of petroleum well Heathfield No. 1.

The Pretty Hill Formation was the primary objective of the well and was considered to be both a potential oil and gas play.

Drilling commenced on 19th December, 1989 and reached a total depth of 2384 m (KB) on 8th January, 1990.

At total depth the following logs were run:

Dual Laterolog/Microspherically Focused Log
Four Arm Dipmeter/Gamma Ray
Long Spaced Sonic Log
Spectral Lithodensity/Compensated Neutron Log
Velocity Survey
Side Wall Cores.

One open hole drill stem test was carried out over the interval 1445.7 - 1456 m in the Pretty Hill Formation and produced 41 barrels of salty gassy water and 9 barrels of slightly muddy gassy water.

No conventional coring operations were performed.

No significant shows were observed while drilling down to 1426.5m. The maximum background gas was 3.6 unit (equivalent to 720 ppm) recorded at 1365m.

At the depth of 1452m, a drilling break (from 6m/hr to 30-24m/hr) was encountered and continued to 1456m. The circulated samples consisted of sandstone with good visual porosity and up to 20% pin point, dull, occasionally bright bluish yellow fluorescence becoming dull, medium brown with depth and giving slow to moderately fast, dull, pale, yellowish blue cut fluorescence.

A trace of liquid hydrocarbon was also reported in the bottom hole cutting sample.

Based on the above evidence, a drill stem test was recommended and then approved.

No other significant shows were reported while drilling to the total depth. After logging all horizons were interpreted to be water saturated.

McEachern No. 1 well was plugged and abandoned as a dry hole and the rig was released at 0900 hours on 11th January, 1990.

PEP 119 OTWAY BASIN

McEACHERN NO. 1 GAS & FUEL

EXPLORATION N.L.

Status: P & A, Dry Hole
 Location: Lat. 37° 33' 51.29"S
 Long 141° 11' 25.50"E
 Hole Size: 12 1/4" to 354m, 8 1/2"
 to 2384m
 Seismic: CDP405 line WMC82-N
 Casing Shoe: 9 5/8 at 354m
 Elevation: 76.0 GL. 81.13 KB. A.S.L
 Plugs: 2060-2010m, 1410-1360m, Spudded: 19.12.89, Rig Released
 360-310m and surface 11.1.1990.

Rock Unit	Depth	Subsea	Thickness
Heytesbury Group	surface	81	160
Otway Group			
Eumeralla Formation	160	-79	950
Basal Eumeralla Sand	1095	-1014	15
Pretty Hill Formation			
Shale Unit	1110	-1029	315
Shale-Sand Unit	1425	-1344	693
Basal Sand	2126	-2045	225
Casteron Formation	2343	-2262	41
Total Depth (Driller)	2384	-2303	
Total Depth (Logger)	2380	-2299	

Logs: LSS/GR/TAC, SLDT/CNT/GR, FED/GR, SWC, Velocity Survey, Mud Log

Test: One conventional Open Hole DST over the interval 1445.7 - 1456m

Core: 48 SWC; nil Conventional

CONCLUSION

- McEachern was drilled in a fault block on the northern flank of the Penola Trough.
- The basal Eumeralla Sand was found to be present but is shaly and has poor reservoir quality.

- The unconformity at the top of Pretty Hill Formation as seen in Seismic Sections was confirmed by palynology. However lithologically it was not recognised.
- The Pretty Hill Formation can be divided into 3 major units:-
 - An Upper Shale - siltstone dominated unit
 - A Middle Sand - shale unit characterized by GARNET and a sharp break in maturity profile
 - A Lower Sand unit with excellent reservoir properties
- The Pretty Hill Formation was entered 71m higher than forecast. However the Pretty Hill Sand - Shale unit and the Casterton Formation were encountered respectively 41m and 202m low to prognosis.
- The Pretty Hill Formation was found to be structurally higher than at Tullich -1 as was mapped.
- The well appears to have been a valid test of the upper most sand of the middle unit of the Pretty Hill Formation.
- Excellent reservoir sands were encountered in the Pretty Hill Formation but were penetrated down dip from the structural culmination.
- A distinct break in the maturity profile of the organic matter and distinct lithology change is seen in the boundary of upper and middle unit of Pretty Hill Formation (see figure 9). This may be as a result of differences in province and/or depositional environment between the two units.
- The organic matter within the Otway Group was found to have the bulk composition of Type III kerogen capable of generating gas and light hydrocarbon.
- The organic content and its level of maturity in Casterton Formation was found to be considerably higher than both Pretty Hill and Eumeralla Formations.

RECOMMENDATION

The following are recommended based on the above conclusions.

- To consider the basal Pretty Hill reservoir sand as the primary exploration objective where it is at realistically drillable depth.
- The middle unit of the Pretty Hill Formation should be considered the main exploration target in areas where the basal unit is too deep to be prospective.
- Attempts should be made to evaluate the Casterton Formation for source potential.
- In any exploration drilling, 200-300m of Casterton Formation be penetrated, side wall core samples and where possible a final conventional core be cut at total depth for source rock evaluation study.

Prepared by: V. Akbari

1. INTRODUCTION

McEachern No. 1 was drilled primarily to penetrate the entire Pretty Hill Formation interval and to verify the nature of the fluid content within its sand reservoirs. The secondary objectives were Heathfield Sandstone and the basal sand of the Eumeralla Formation.

In the Otway Basin, sandstones within the Pretty Hill Formation, and particularly its basal sand unit, exhibit excellent reservoir characteristics and many have shown encouraging hydrocarbon shows. Significant recoveries of gassy water and gas in PEP-119 and in the Katnook area situated on the same trend in the adjacent permit, were further encouraging criteria justifying the drilling of McEachern No. 1.

The McEachern prospect was defined as the result of 1988 Heathfield and 1989 Heathfield Detail Seismic Surveys. It is a tilted normal fault block situated on the northern terrace of the northwest-southeast trending Penola Trough. The structure narrows toward the east and dips gently northward. The vertical and lateral seals were expected against the dominantly shale/mudstones in the Eumeralla Formation and the upper Pretty Hill Formation.

The result of the recent geochemical studies carried out in PEP-119 suggest the Casterton Formation to be a mature source rock capable for generating hydrocarbon for overlaying Pretty Hill Formation.

Prior to the drilling of McEachern No. 1. There was thought that sufficient source rock, reservoir, and seal were present for the generation and accumulation of hydrocarbons in the structure.

2. WELL HISTORY

2.1 Location (See Figure 1 and 2)

Co-ordinates:	Latitude: 37° 33' 51.20"S Longitude: 141° 11' 25.50"E
Geophysical Control:	Shot point: 52m south of VP 224 Seismic Line: WMC82-N
Real Property Description	Country of Follett Parish of Nangeela Shire of Glenelg
Property Owner:	Crown

2.2 General Data

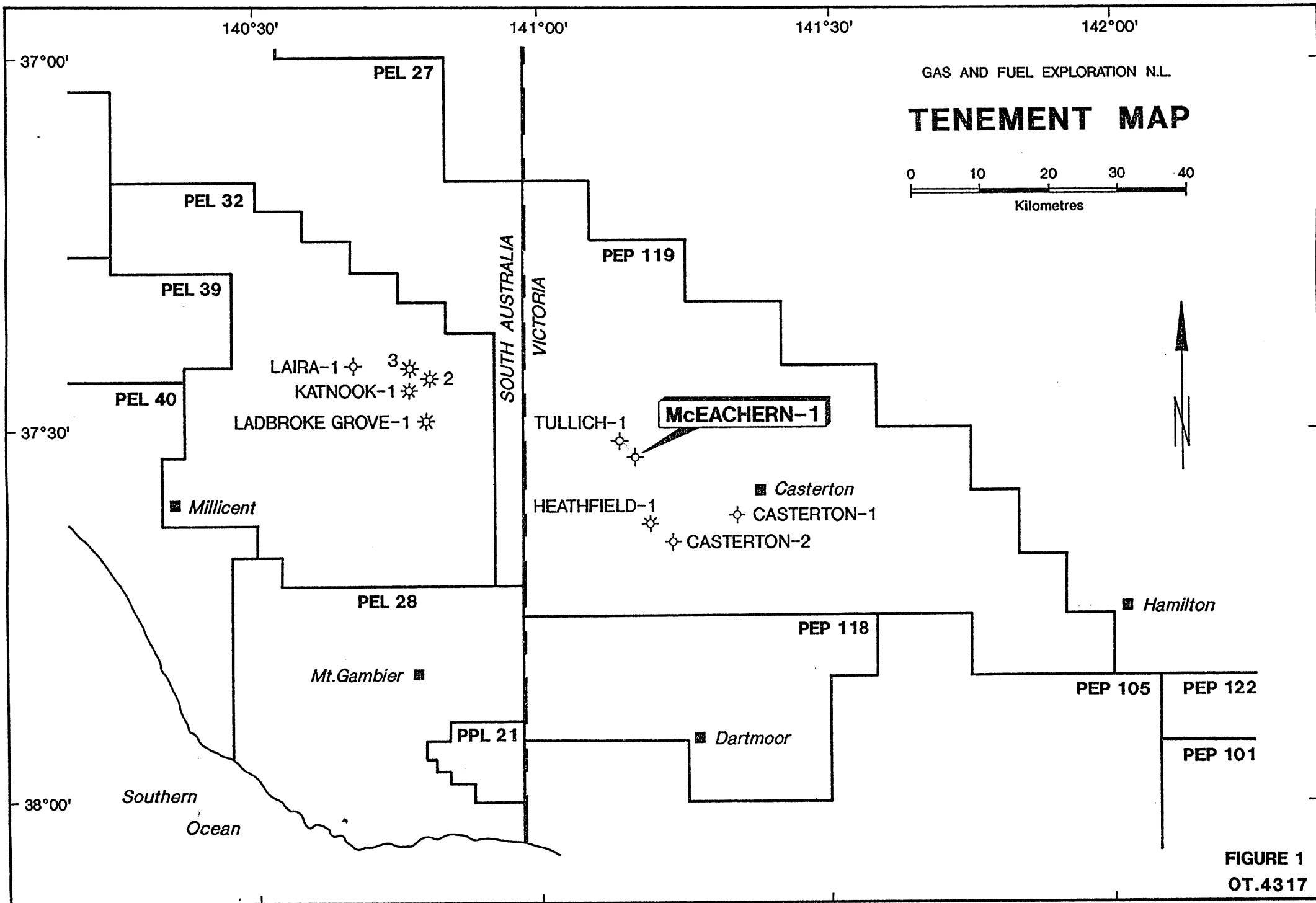
Well Name:	McEachern No. 1
Operator:	Gas & Fuel Exploration N.L. Level 11, 151 Flinders Street <u>MELBOURNE VIC 3000</u>

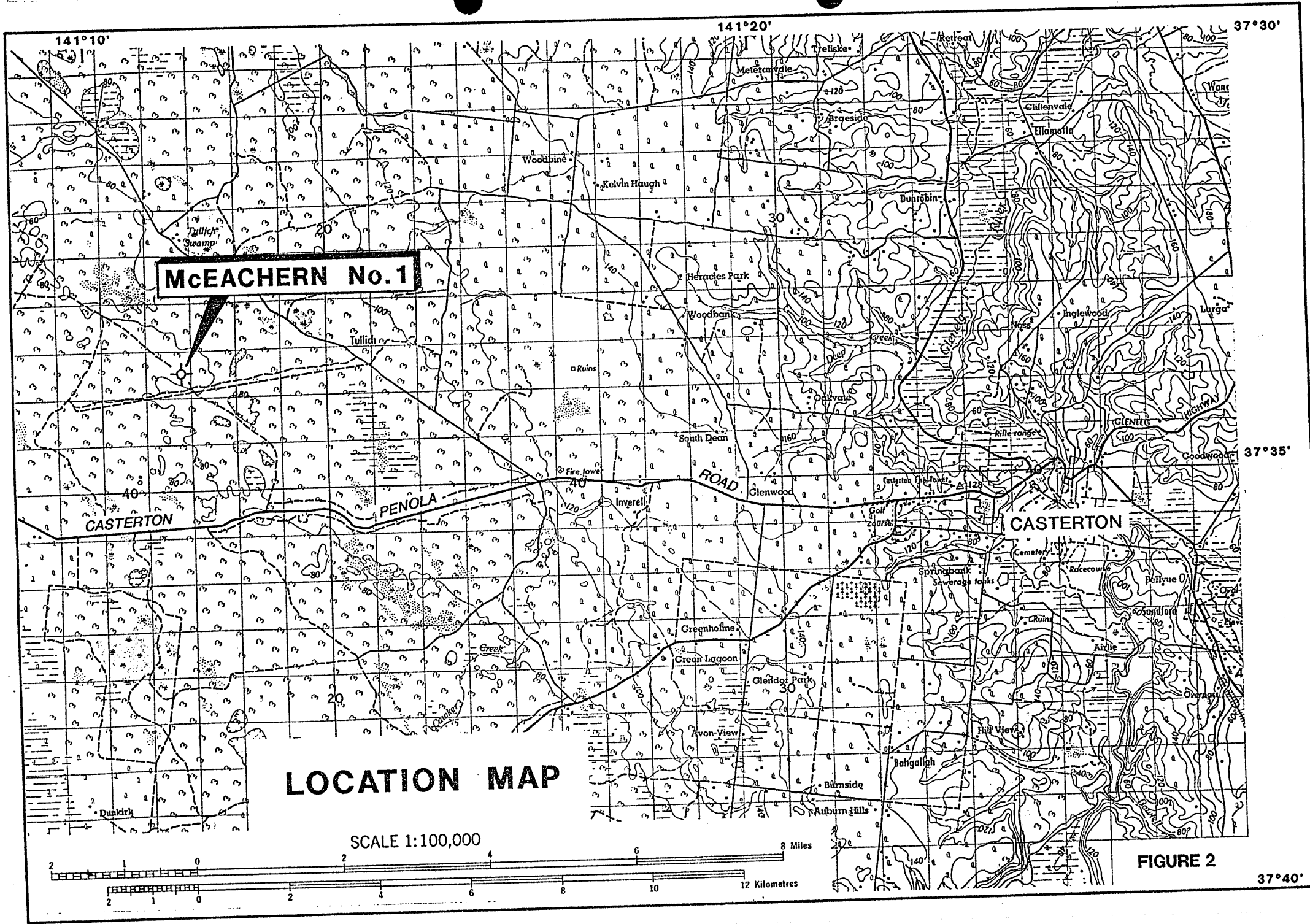
Participants:	Beach Petroleum N.L. Level 7, 345-355 George Street <u>SYDNEY NSW 2000</u>
---------------	--

Minora Resources N.L. 8th Floor - Durack Centre 263 Adelaide Terrace <u>PERTH WA 6001</u>
--

Base Resources Ltd (Giant) Level 17 141 Walker Street <u>NORTH SYDNEY NSW 2060</u>

SAGASCO Resources Ltd 3rd Floor, Emmett House 60 Hindmarsh Square <u>ADELAIDE SA 5000</u>
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2.2 General Data (cont.)

Elevation: Ground Level 76.30m ASL
Kelly Bushing 81.13m ASL
(unless otherwise stated, all depths refer to K.B.)

Total Depth: Driller 2384m
Wireline Logger 2380m

Drilling Commencement: 19th December 1989 @ 1000 hours
Total Depth Reached: 7th January 1990 @ 0230 hours
Rig Released: 11th January 1990 @ 0900 hours
Drilling Time to T.D: 19 days
Status: Plugged and abandoned, dry hole.

2.3 Drilling Data: (See also Appendices 1 & 2)

2.3.1 Drilling Contractor

Gearhart Drilling Services Australia

2.3.2 Drilling Rig

G.D.S.A Rig 2

2.3.3 Casing and Cementing Details

A 16" Conductor pipe was set at 9.0 m prior to rig up.

Surface Casing

Size: 9 5/8"
Weight and Grade: 36 lb/ft. STC 8rd J55
Centralisers: 351m, 342m, 333m, 324m, 315m and
4 more centralisers over next four couplings.
Float Collar: 342m
Shoe: 354m
Cement: 280 sacks Class "A" with 2.5% prehydrated gel and 160 sacks Class A neat
Method: Single plug displacement. (Top plug only)
Equipment: Halliburton services

2.3.3 Casing and Cementing Details (cont.)

Cement Plugs

Plug No. 1

Interval: 2060 - 2010m
Cement: 60 sacks class "A" neat
Method: Balanced
Tested: No

Plug No. 2

Interval: 1410 - 1360m
Cement: 60 sacks class "A" neat
Method: Balanced
Tested: No

Plug No. 3

Interval: 360 - 310m
Cement: 60 sacks class "A" neat
Method: Balanced
Tested: 10,000 lbs. weight

Plug No. 4

Interval: surface
Cement: 20 sacks class "A" neat

2.3.4 Drilling Fluid

The hole was spudded using high viscosity mud in order to prevent conductor wash-out. Drilling continued uneventfully to the 9 5/8" casing point using fresh water. Fresh water/gel/polymer mud was used to drill 8 1/2-in hole down to the total depth. Beside minor tight hole conditions experienced while making bit trip at 934m, no other problems were encountered. Wireline logging was completed at total depth without incident. The caliper log showed moderate wash-out from the 9 5/8-in casing shoe down to 780m below which depth the hole was found to be very close to the gauge.

(See Appendix 3 for details).

2.3.5 Water supply

Drilling water was obtained and transported from water supply bores which were some four kilometers from the well location.

2.4 Formation Sampling and testing

2.4.1 Cuttings

Cutting samples were collected at 10m intervals from surface to 357m (9 5/8-in Casing point) and at 5m intervals from 357m to the T.D. Each sample was washed, air dried, and divided into five splits, four of which were stored in labelled polythene bags and the fifth one was stored in a plastic sample tray.

The washed and dried samples in trays were distributed to the following.

- SAGASCO Resources
- Beach Petroleum
- Base Resources
- Minora Resources
- D.I.T.R. (Director of Petroleum Group)

In addition, from surface to T.D. unwashed samples were collected at 10m intervals. These samples were stored in labelled cloth bags. The washed and dried polythene bags and the unwashed, air dried and cloth bag samples were retained by the operator.

(See Appendix 4 for description).

2.4.2 Cores

- (i) No conventional coring operations were carried out.
- (ii) Forty-eight sidewall cores were attempted of which thirty-four were recovered. The samples were divided into five sets five of which were sent to the following consultants.
 - One set to Keiraville Konsultants for T.O.C and vitrinite reflectance.

2.4.2 Cores (cont.)

- One set to Dr R. Morgan for palynology.
- Three sets to Amdel Coring Services for petrography, X-ray diffraction and rock evaluation.

The depth recovery and analysis carried out on sidewall cores are as follows:

(See Appendix 5 for sidewall core description).

NO.	INTERVAL (m)	RECOVERY (m)	TOC	XRO	R.E	PET	VR	PAL
1	2378	none						
2	2366.6	none						
3	2354.6	none						
4	2344.6	none						
5	2330.6	2.7				*		
6	2259.6	1.0				*		
7	2226.6	1.7					*	
8	2202.6	1.0				*		
9	2148.6	2.0				*		
10	2116.6	none						
11	2076.1	none						
12	2041.6	none						
13	2023.6	0.7		*			*	
14	1992.6	none						
15	1946.1	0.5				*		*
16	1924.6	none						
17	1895.6	none						
18	1857.6	3.0		*	*	*	*	*
19	1824.6	none						
20	1801.6	1.5						
21	1796.6	1.0				*		
22	1766.6	1.0				*		
23	1741.1	0.5		*			*	
24	1674.6	2.5		*				
25	1649.1	1.5				*		*
26	1607.6	2.0		*				

T.O.C. : Total organic Carbon

X.R.D : X-Ray diffraction

R.E : Rock Evaluation

PET : Petrography

PAL : Palynology

VR : Vitrinite reflectance

2.4.2 Cores (cont.)

<u>NO.</u>	<u>INTERVAL (m)</u>	<u>RECOVERY (m)</u>	<u>TOC</u>	<u>XRO</u>	<u>R.E</u>	<u>PET</u>	<u>VR</u>	<u>POL</u>
27	1593.6	1.5				*		
28	1573.6	30	*					
29	1545.6	2.0		*		*		
30	1523.6	2.5			*			*
31	1504.6	3.0	*	*	*		*	*
32	1461.6	3.0	*		*		*	*
33	1435.1	none						
34	1414.1	3.0	*		*		*	*
35	1384.1	none						
36	1364.6	2.5	*	*	*		*	*
37	1293.6	none						
38	1289.5	3.0	*	*	*		*	*
39	1174.5	3.5	*		*		*	*
40	1146.6	3.5		*				
41	1113.6	2.0	*	*			*	
42	1048.6	1.5	*		*		*	*
43	905.6	1.5		*	*			*
44	793.1	2.0	*	*			*	
45	699.6	2.5	*	*	*		*	*
46	594.6	2.0		*				
47	504.6	3.2	*	*	*		*	
48	402.6	3.2	*	*			*	

2.4.3 Tests

One conventional open hole drill stem test was earned out as follows:-

DST No. one
Interval Tested: 1445.7 - 1456m
Formation: Pretty Hill
Packers Depth: top: 1443.2 bottom 1445.7m
Water cushion: none
Prewflow: 6 minutes, weak - moderate blow
Initial Shut-in: 30 minutes
Second Flow: 61 minutes, moderate blow gradually decreasing to weak blow

Pressures:

	Top Recorder at 1438.4 m	Bottom Recorder <u>1455.2 m</u>
1st period		
Initial Hydrostatic	2314.07 PSIA	2348.41 PSIA
Initial Flow	443.59 "	517.64 "
Final Flow	598.83 "	635.71 "
Initial Shut-In	598.83 "	635.71 "
Final Shut-In	2063.48 "	2079.34 "
2nd period		
Initial Flow	739.49 "	748.83 "
Final Flow	1645.01 "	1661.09 "
Initial Shut-In	1645.01 "	1661.09 "
Final Shut-In	2072.80 "	2083.81 "
Final hydrostatic	2307.75 "	2320.85 "

Recovery

41 bbls. (897m) salty gassy water
9 bbls. (200m) muddy, gassy water

Intermittent gas flares were reported during the 27 minutes period of reverse circulation.

2.4.3 Tests (cont.)

Chemical Analysis

Five samples were collected during the reverse circulation period. The following are the field chemical analysis.

Sample	Cl ⁻ (ppm)	Ca ⁺⁺ (ppm)	K ⁺ (ppm)	Rw (ohm)
muddy gassy water	16500	380	25000	0.22 @ 87°F
salty gassy water	15000	480	n.m	0.24 @ 84°F
salty gassy water	14000	440	n.m	0.25 @ 83°F
salty gassy water	14000	440	n.m	0.25 @ 82°F
salty gassy water	14000	510	n.m	0.25 @ 81°F

Note:

The rig water had Rw = 10.0 ohm at 78°F.

Minor dull bluish white fluorescence was observed in the first sample.

n.m = Not measured.

Assessment:

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

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

The test produced formation water and the gas flared during the reverse circulation is thought to be in situ solution gas.

2.5 Logging and Surveys (See Enclosure 1)

2.5.1 Mud Logging

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

2.5.2 Wireline Logging

Wireline Logging was performed by Gearhart Pty. Ltd. using a standard truck mounted unit. One logging suite consisting of the following logs was carried out at total depth.

<u>Suite 1</u>	<u>Interval (m)</u>
Dual Laterolog/Microspherically Focused Resistivity and Gamma Ray Log (DLL/MSFL/GR)	2379 - 354
Spectral Lithodensity/Compensated Neutron log with Gamma Ray (SLDT/CNT/GR)	2378.8-1375
Four Electrode Dip Meter/Gamma Ray (FED/GR)	2375-1050
Bore hole Compensated Long spacing Sonic/Gamma Ray BCT(LSS)GR/TAC	2380-18.3
Well Evaluation Log (WEL)	2175-2050 1610-1410

2.5.3 Deviation Surveys

Hole deviation surveys were conducted regularly with the following results.

<u>Depth (m)</u>	<u>Deviation (Deg)</u>
32	3/4
73	1 3/4
131	0
280	1/2
347	3/4
545	1/2
742	1
922	1
1124	2
1323	1
1531	1 3/4
1683	2
1890	2
2130	3

2.5.4 Velocity Survey

A velocity survey was carried out by Velocity Data Pty. Ltd. the result of which is included as Appendix - 5.

3. RESULTS OF DRILLING

3.1 Stratigraphy

The following stratigraphic intervals have been delineated using penetration rate, cutting analysis, wireline log interpretation, palynology, and clay analysis (See Figures 3 & 4, Appendixes 7, 8).

<u>GROUP</u>	<u>FORMATION</u>	<u>DEPTH</u> (MKB)	<u>DEPTH</u> MSS	<u>THICKNESS</u> (M)
Heytesbury	Port Campbell limestone	surface	81	30
	Undifferentiated	30	51	130
Otway Group	Eumeralla	160*	-79	950
	Basal Eumeralla Sand	1095	-1014	15
Pretty Hill	Shale Unit	1110*	-1029	315
	Shale-Sand Unit	1425	-1344	693
	Basal Sand	2126	-2045	225
Casteron Formation		2343	-2262	41
Total Depth (Driller)		2384	-2303	
Total Depth (Logger)		2380	-2299	

*Palynology

3.2 Lithological Description

3.2.1. Heytesbury Group (surface - 160m)

Port Campbell Limestone surface to 30m

CALCARENITE, off white, light yellow, loose, friable in part, medium to very coarse, dominantly coarse to very coarse, sub-rounded to rounded, abundant fossil fragments, bryozoa, forams, crinoids, and shell fragments.

McEACHERN No.1

PROGNOSED AND ACTUAL STRATIGRAPHY

DEPTHS IN METRES K.B.

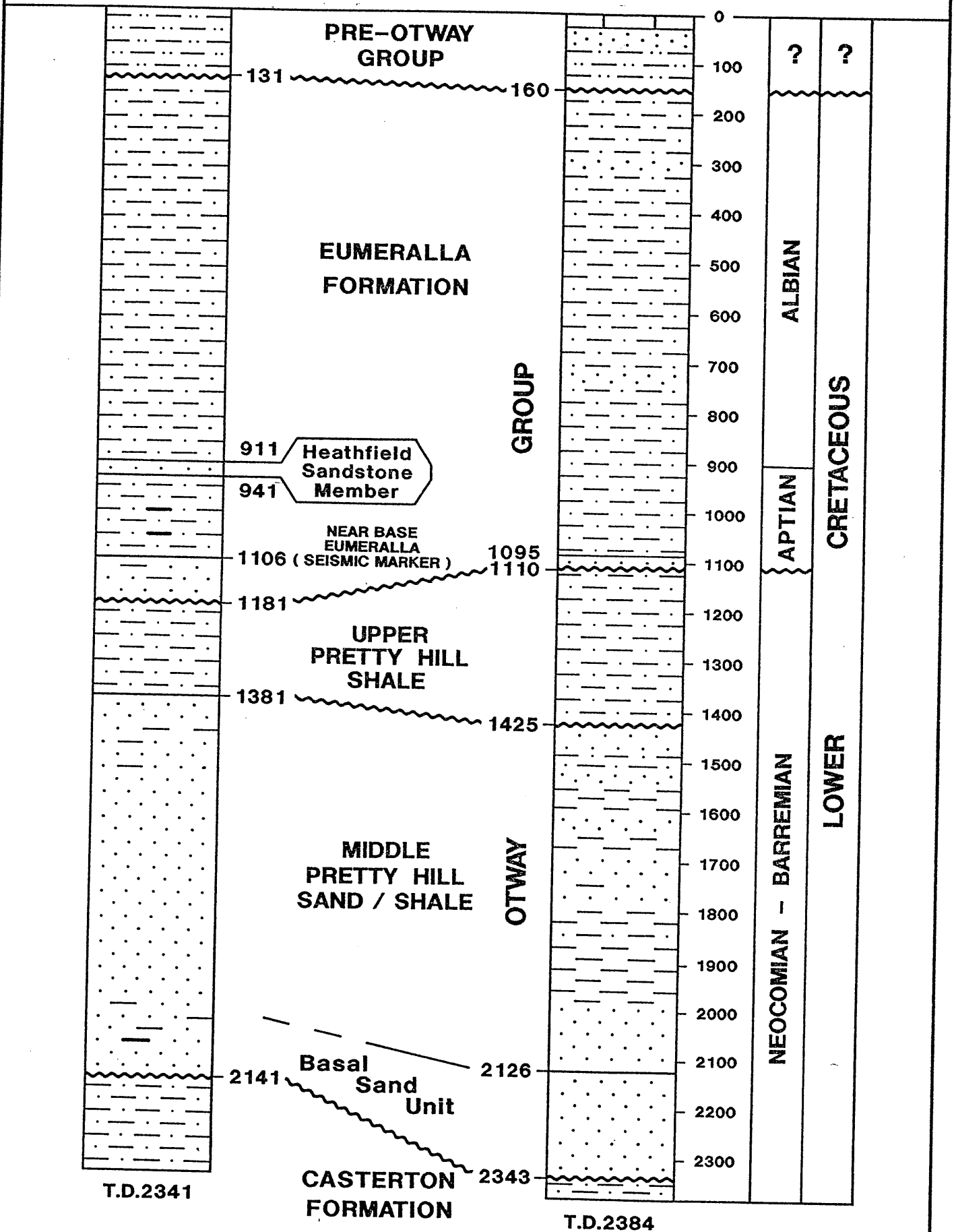


FIGURE 3
OT.4277

PEP 119 STRATIGRAPHIC COLUMN PENOLA TROUGH OTWAY BASIN

PERIOD	EPOCH	AGE	ZONATION	FORMATION	PETROLEUM OCCURENCES	
TERTIARY	LATE	MIOCENE		GAMBIER LIMESTONE		
		OLIGOCENE				
	EARLY	EOCENE	N. asperus P. aspero M. diversus	WANGERRIP GROUP		
		PALEOCENE	L. balmei			
CRETACEOUS	LATE	MAASTR. TO CENOMANIAN		CONDENSED SHERBROOK GROUP	☼ GELTWOOD BEACH 1	
	EARLY	ALBIAN	P. pannosus			
			C. paradoxa	EUMERALLA FORMATION	☼ HEATHFIELD 1 ☼ KATNOOK 2 ☼ LAKE ELIZA 1 ☼ GELTWOOD BEACH 1	
		APTIAN	C. striatus	HEATHFIELD SANDSTONE MEMBER	☼ KATNOOK 1 ☼ TULLICH 1	
			C. hughesi			
			BARREMIAN	F. wonthaggiensis	PRETTY HILL FORMATION	☼ KALANGADOO 1 ☼ KATNOOK 2,3 ☼ LADBROKE GROVE 1 ☼ ROBERTSON 1 ☼ CRAYFISH 1
		HAUTERIVIAN				
		VALANGINIAN				
		BERRIASIAN	C. australiensis	CASTERTON FORMATION		
	JURASSIC	LATE	TITHONIAN	R. watherooensis	V V V V V	☼ KALANGADOO 1 (CO ₂)
PALAEOZOIC BASEMENT				+ +		

**OT.4219
FIGURE 4**

Heytesbury Group (undifferentiated) 30m - 160m

SANDSTONE, quartzose, translucent to very light grey, light brown, medium to very coarse grained dominantly coarse to very coarse grained, subrounded to rounded, dominantly subrounded. Moderately sorted quartz, in part unconsolidated, no apparent matrix, rare multi-color lithics, very good visual porosity interbedded with CLAYSTONE, dark greenish - grey in part dark brownish grey, firm - soft, in part dispersive, moderately silty rarely micaceous, moderately glauconitic in part with traces of very dark green, medium to coarse grained glauconite pellets.

3.2.2 Otway Group (160m - 2384m)

Eumeralla Formation

160m to 1110m

CLAYSTONE medium green grey, medium blue grey firm, in part sticky, occasionally dispersive in part, very silty, becoming siltstone in part, in part micaceous, trace carbonaceous material interbedded with SANDSTONE medium green grey, light grey brown in part, speckled, friable to firm, in part hard, fine to medium grained. Subangular to subrounded, moderately sorted quartz grains and lithic fragments including "volcanolithics" and chlorite?, trace to common medium brownish grey and greenish grey argillaceous matrix, dispersive in part, silty in part, trace calcareous cement, trace carbonaceous material, poor visual porosity and SILTSTONE light - medium green grey, light - medium bluish green, in part soft to firm, in part blocky, rarely dispersive in part, very argillaceous, rarely micaceous, slightly to moderately carbonaceous, slightly calcareous and minor COAL black to very dark brown, soft to firm, dull luster, blocky in part, subfissile in part, rarely argillaceous and pyritic in part.

The Basal Eumeralla Sand Member was encountered at 1095m (Log). The member was not recognised in the samples. Log characteristics however suggest the member to be an upward fining shaly sand.

Pretty Hill Formation	1110m to 2343m
Upper Shale Unit	1110m to 1425m

CLAYSTONE light to medium grey, light to medium green grey, firm to hard, dominantly firm, very rarely soft and dispersive, blocky in part, subfissile to fissile, dominantly fissile, rarely carbonaceous, occasionally very carbonaceous grading into argillaceous coal, trace mica, dominantly to rarely silty occasionally very silty grading into and/or interlaminated with SILTSTONE, light to medium green grey occasionally medium - dark brown, rarely off white to very light grey, speckled in part, soft to firm, occasionally hard, dispersive in part, blocky in part, subfissile in part, extremely argillaceous, rarely micaceous, rare to occasionally carbonaceous, interbedded with minor SANDSTONE, light to medium green grey, light grey to brownish grey, rarely off white to very light grey, speckled in part, fine to medium grained, subangular to subrounded, moderately sorted quartz grain and multi-colored lithics including volcanolithics, firm to hard, common to abundant argillaceous matrix, light to medium grey green kaolinitic clay matrix, in part dispersive, common calcareous cement, common carbonaceous flecks, rare mica, rare pyrite, very rare, partially altered feldspars, poor to moderate visual porosity and minor COAL black to very dark brown, soft to firm, dull luster, blocky in part, subfissile in part rarely argillaceous and pyritic in part.

Middle Pretty Hill Sand/Shale Unit	1425m - 2126m
------------------------------------	---------------

SANDSTONE, off white to very light grey, clear in part, rarely light yellowish grey, loosely consolidated to friable, rarely loose, rarely firm in part, fine to coarse grained, dominantly medium occasionally very coarse grained, subangular - subrounded, dominantly subangular, poorly sorted quartz, clear to translucent, occasionally frosty, trace to common medium grey and medium green grey lithics, trace to common white Kaolinitic clay matrix, dispersive in part, rare clear to translucent pink and medium red Garnet, moderate to good visual porosity interbedded with CLAYSTONE, medium to dark grey, medium - dark brownish grey firm, occasionally hard, rarely soft and dispersive in part, rarely micaceous moderately carbonaceous occasionally grading into carbonaceous claystone (shaly coal) occasionally silty and SILTSTONE, medium grey, medium brownish grey, medium green grey, speckled in part, firm to occasionally hard, argillaceous, trace to finely micaceous, trace carbonaceous detritus and minor COAL black to dark brown and dark brownish grey, firm, blocky in part, subfissile to fissile in part, slaty cleavage in part, dully, earthy, very argillaceous in part, occasionally with subconcoidal fractures.

Basal Pretty Hill Sand

2126m - 2343m

SANDSTONE, clear, off white, rarely very light grey to very light brownish grey, loose, very rarely friable, fine to very coarse grained, dominantly coarse to very coarse, occasionally granule, angular to subangular, rarely subrounded poorly to occasionally fairly sorted quartz clear, translucent, occasionally frosty no apparent matrix (Kaolinitic clay matrix easily washed away) rare to very rare multi-colored metamorphic lithics (phyllite, chert?, quartzite, serpentine?, garnets, reworked medium green shale fragments) rare mica flecks, very rare pyrite, rare quartz overgrowth, some quartz grains have dark grey to

black inclusions, excellent visual porosity interbedded with minor CLAYSTONE light green, light green grey, medium - dark grey, medium to dark brown grey, in part firm to hard, occasionally very hard, dominantly blocky, subfissile to fissile commonly carbonaceous in part, trace mica, moderately silty, grading into and/or interlaminating with SILTSTONE light to medium green, medium to dark grey, speckled in part, firm to hard, occasionally very hard, dominantly blocky, trace mica flecks and streaks, trace to moderately carbonaceous in part, moderately argillaceous in part rarely grading into very fine sandstone.

Casterton Formation *24*
2343m - 2384m

41

CLAYSTONE medium to dark brownish grey, speckled, medium grey, dark grey, dark grey in part, firm to hard, in part soft and dispersive, blocky and subfissile in part, commonly micaceous, trace to common carbonaceous, moderately silty in part grading into or interlaminated with SILTSTONE light to medium green, medium to dark grey, speckled in part, firm to hard, occasionally very hard, dominantly blocky, trace mica flecks and streaks, trace to moderately carbonaceous in part, moderately argillaceous in part rarely grading into very fine sandstone with poor to no visual porosity.

3.3 Hydrocarbon Indications

3.3.1 Mud Gas Reading

The mud gas detection equipment was operational from 9 meter (16-in Conductor shoe) to 2384 meter (Total Depth).

Levels of gas in the drilling mud from 9 meter to approximately 440 meters were below the detection capabilities of the system.

From 440 to 1425m, the level of background gas rose to steady trace C₁ (approximately 0.5 unit).

From 1425m to 2345m (Top Casterton Formation), background mud gas reading was relatively stable ranging from 1-2 unit C₁ and trace C₂, C₃, C₄.

From 2345m to total depth (2384m) the background mud gas decreased to steady 0.5 unit.

The relative increase in mud gas is probably related to increased concentration and maturity level of the organic matter in the drilled sediment. Minor fluctuation of total gas reading is due to the change of penetration rate.

An anomalous gas reading from 0.6 unit to 15 units associated with a drilling break (from 6 m/hr. to 30-24 m/hr) was observed from 1452m to 1454m. Drill stem test No. 1 was subsequently carried out which recovered gas cut salt water.

3.3.2 Sample Fluorescence

Cutting samples were routinely inspected for fluorescence at 10m intervals from 10m to 360m and at 5 meter intervals from 360m to 2380m (T.D.)

The following shows were reported

<u>Depth</u>	<u>%</u>	<u>Lithology</u>	<u>Fluorescence</u>	<u>Cut</u>
1426.5-1435	tr.- 5	Sand	dull, m.bl.yell	Pale yell
1435 -1452	5 -10	"	"	"
1452 -1456	up to 20%	"	"	"
1456 -1460	tr.- 5	"	"	"
1460 -1490	trace	"	"	"
1490 -1495	Few Specks	"	"	"

No fluorescence or oil staining were reported in any of the side wall cores cut.

4. GEOLOGY

4.1 Structure

McEachern prospect was defined as the result of Heathfield Seismic Survey (1988) and Heathfield Detailed Seismic Survey (1989). It was interpreted as a tilted normal fault block situated on the northern terrace of northwest-southeast trending Penola Trough, and defined by the seismic lines WMC82-N, WMC82-R, HF14, and HFD10. Within the block, there is a small horst trending northwest - southeast and this can be seen on the lines HF-14 and HFD-10.

Closure of the prospect was defined for the following three seismic markers.

- Near the base Eumeralla
- Intra-Pretty Hill Formation
- Near the base Pretty Hill Formation

The three maps (Figs. 5, 6, 7) showed the crestal location being against the fault, bounding the structure to the south and the structure relies on cross fault seal against younger units.

McEachern No. 1 was located on the up thrown side of the fault and was drilled to test the intra-Pretty Hill Formation and Heathfield sand in crestal positions (see Fig. 8).

4.2 Discussion

The well results indicated that:-

The Heathfield sand was not developed in the prospect area.

The upper Pretty Hill shale unit is disconformably overlain by Eumeralla Formation.

PE906720

This is an enclosure indicator page.
The enclosure PE906720 is enclosed within the
container PE906727 at this location in this
document.

The enclosure PE906720 has the following characteristics:

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- CONTAINER_BARCODE = PE906727
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- BASIN = OTWAY
- PERMIT = PEP119
- TYPE = WELL
- SUBTYPE = VELOCITY_CHART
- DESCRIPTION = Seismic Section and Time-Depth Curve,
McEachern-1
- REMARKS =
- DATE_CREATED = 9/01/90
- DATE_RECEIVED =
- W_NO = W1017
- WELL_NAME = McEARCHERN-1
- CONTRACTOR =
- CLIENT_OP_CO = GFE RESOURCES LTD

(Inserted by DNRE - Vic Govt Mines Dept)

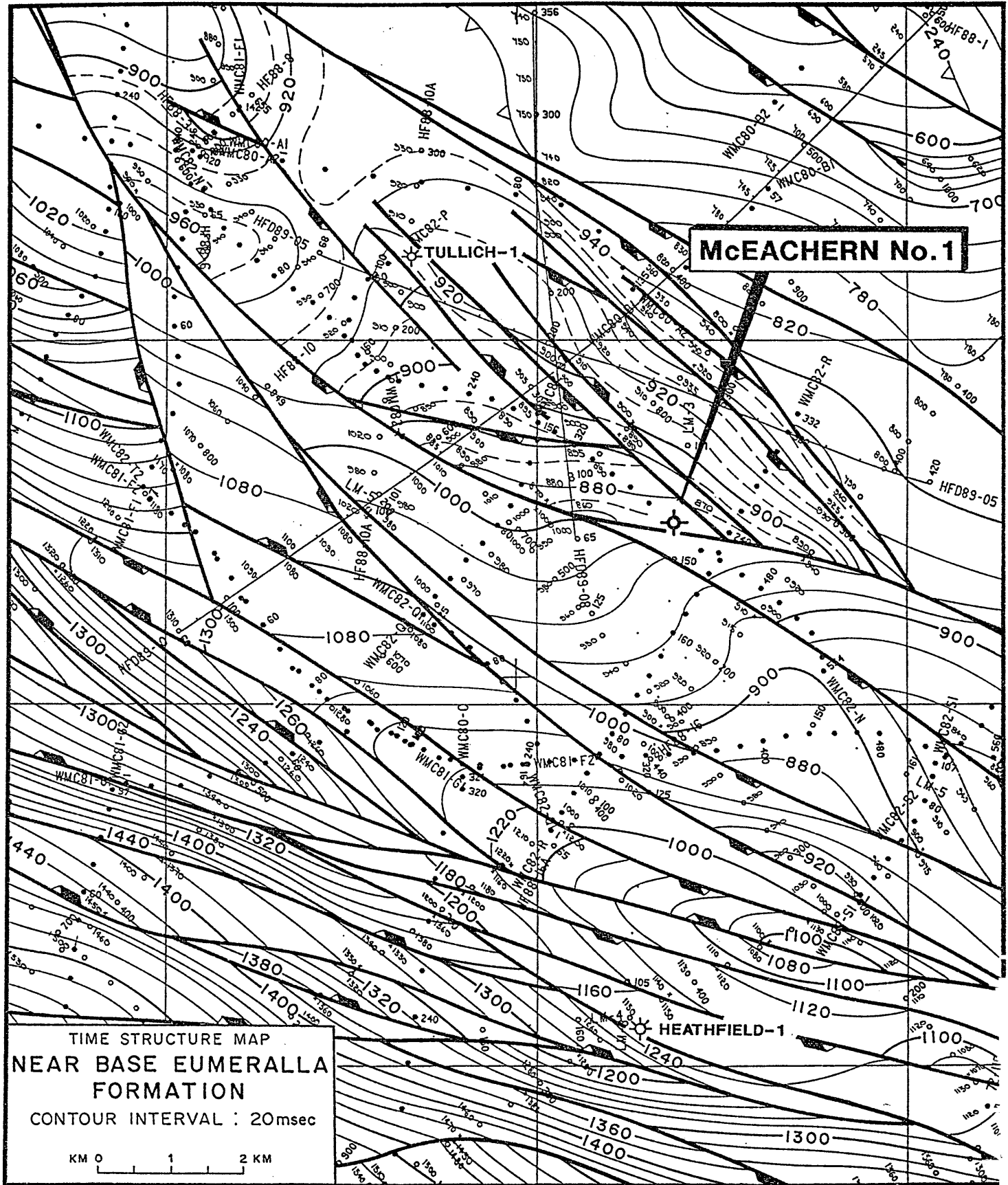


FIGURE 6

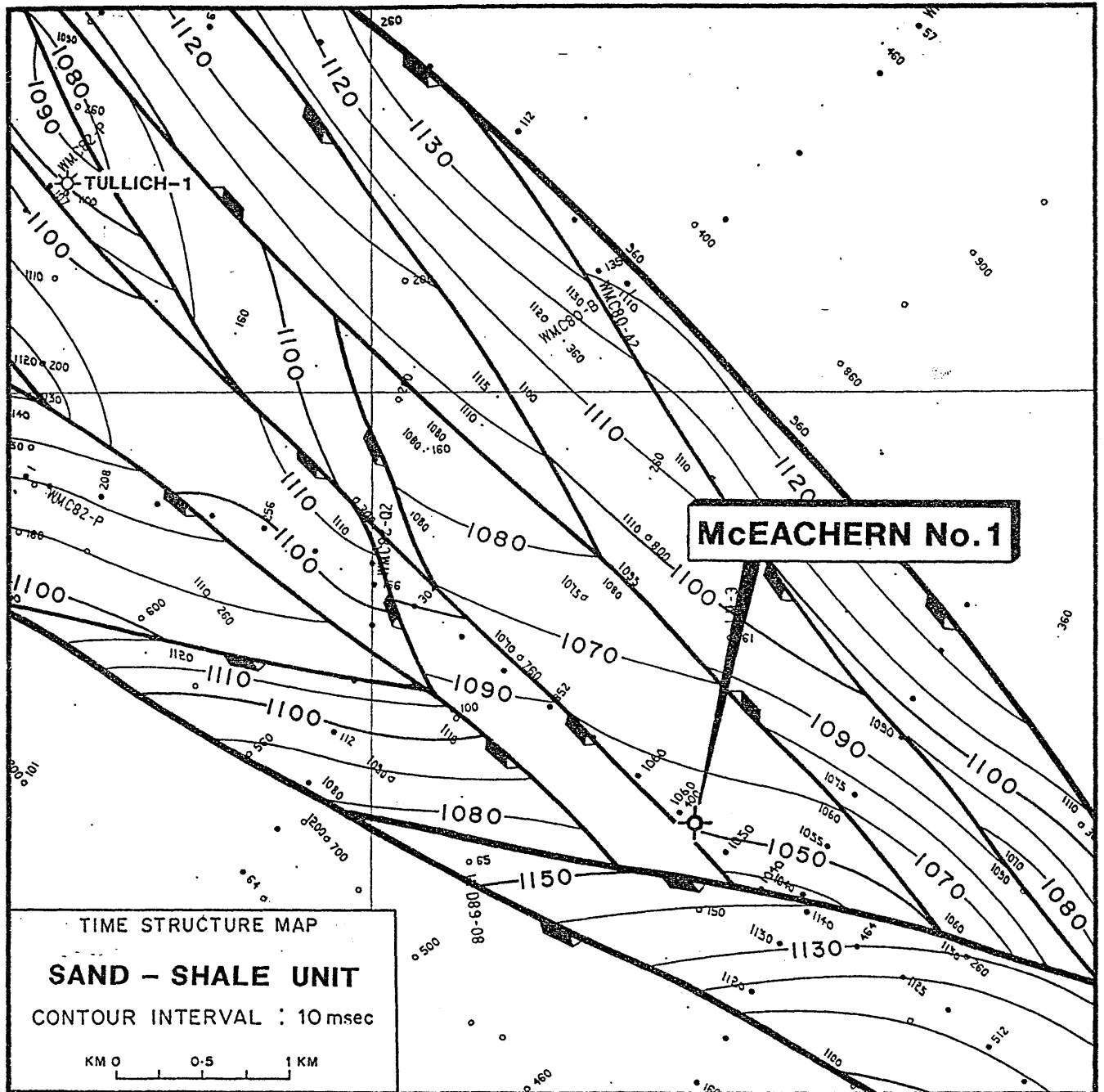


FIGURE 7

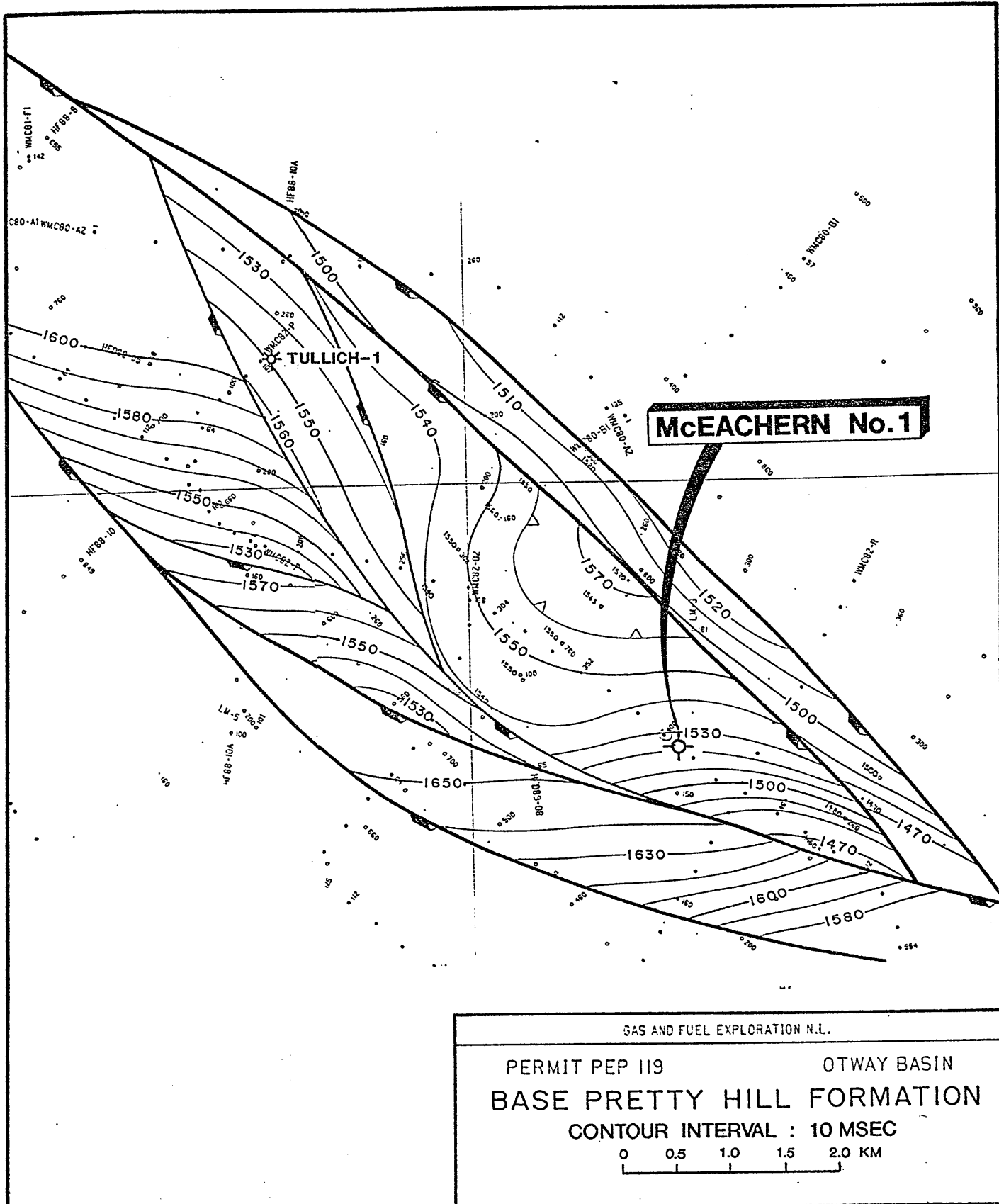


FIGURE 8

The disconformity although pronounced in seismic sections and confirmed by palynological age dating, could not be recognized in cutting samples or dipmeter log.

The throw of the fault bounding the structure to the south is believed to be much less than originally prognosed and that the critical dip into the northern fault is absent.

The well entered the Pretty Hill Formation (Upper Shale unit) at 1110.5m (71m higher than forecast). The basal Eumeralla sand was found to be very poorly developed. The entire Eumeralla Formation is typified by a monotonous shale with uniform log response throughout.

Within the Upper Pretty Hill Shale unit, the gamma ray log exhibit higher values than similar lithologies in the Eumeralla Formation which is possibly an indication of higher maturity level.

No major lithology changes were reported in the boundary of Eumeralla and Pretty Hill Formation. The disconformity seen in seismic section is confirmed by the palynological zone. F. wonthaggiensis encountered at 1174.5m (See Appendix - 11). The thickness of the upper Pretty Hill shale unit was found to be some 115 metres greater than originally proposed.

The Intra Pretty Hill sand/shale sequence (Intra Pretty Hill seismic marker) was intersected at 1425m (44 metres low) below which depth the first massive and garnetiferous sand was encountered. The seal for the sands within this unit as well as the basal Pretty Hill is provided by over 1000 metres of clay and shale of the Eumeralla Formation.

The overall thickness of the Pretty Hill Formation was found to be some 273 metres thicker than prognosed. The Casterton Formation was found 202m lower than forecast.

4.3 Porosity and Water Saturation

Four zones were selected for log analysis using the Crocker Data Processing (CDP) Petrology log package.

Zone #1	1420 - 1470m
Zone #2	1530 - 1610m
Zone #3	1750 - 1810m
Zone #4	2070 - 2170m

Each zone selected for log analysis represented a sandstone unit and effectively covered the entire Pretty Hill Formation sediment file.

Zone #1

Represents the upper argillaceous Pretty Hill Formation and includes an interval of sandstone units. During drilling a high C₁ gas peak was associated with some fluorescence over the sandstone intervals. A DST was performed over the interval 1445.7 - 1456.04m.

Zone #2

Corresponds to a series of interbedded sandstone/shale units within the mid Pretty Hill Formation. The uppermost sandstone unit displayed some patchy dull yellow fluorescence and an associated C₁ gas peak with minor C₂.

Zone #3

A predominantly arenaceous sequence within the mid Pretty Hill Formation. Sandstone cuttings display good inferred porosity, gas levels however show only background levels of 500ppm. No fluorescence was associated with the sandstones.

Zone #4

Represents a basal mid Pretty Hill Formation sequence of the uppermost basal Pretty Hill Formation sandstone unit. Sandstone cuttings all display good inferred porosity. Gas levels remain between background levels 500 - 1000ppm and no fluorescence was associated with the sandstone units.

4.3 Porosity and Water Saturation (cont'd)

Prior to log analysis some log data reprocessing was required.

- Depth matching the data was necessary, particularly on a poorly matched sonic log. Data was matched to the resistivity log.
- Bad data readings were set to missing, particularly sonic log cycle skips.
- Sonic readings were set to missing from surface to 355m (ie. casing readings).
- An SP drift correction was effected.

Log interpretation was performed in two stages.

1. Preinterpretation (1st pass)/Preinterpretation cross-plots.
2. Complex Lithology (2nd pass) utilizing the Indonesian Equation/complex Lithology cross - plots.

A complete data set of log interpretation results and logs are contained in Appendix 13, however the following salient points are evident:

Zone #1

Average SW	-	90%
Average PHIE	-	Sandstone 1425 - 1429m: 14%
		Sandstone 1453 - 1460m: 17.5%

Log interpretation indicates some irreducible gas associated with the sandstone units and a minor amount of moveable gas. The DST confirms the possible presence of moveable gas: - 41 bbls of gassy water were recovered.

4.3 Porosity and Water Saturation (cont'd)

V.clay is high testifying to the argillaceous nature of the zone, within the sandstone units thin zones exist with V.clay values of 30-40%.

Zone #2

Average SW	-	100%
Average PHIE	-	Sandstone 1542 - 1549m: 20%
		Sandstone 1561 - 1570m: 9.5%
		Sandstone 1582 - 1601m: 18%

V.clay is generally high except over the sandstone bodies where values decrease to 20-25%.

Zone #3

Average SW	-	100%
Average PHIE	-	Sandstone 1755 - 1796m: 19.5%
		(in part PHIE greater than 25%).

V.clay is low over the sandstone interval averaging 20%.

Zone #4

Average SW	-	95% (over entire zone)
		85% (2094 - 2133m)
Average PHIE	-	Sandstone 2131 - 2170m: 22%
		(in part PHIE greater than 25%).

V.clay is again low over the sandstone interval often less than 20%.

4.4 Relevance to occurrences of Hydrocarbon

McEachern No.1 was the fourth petroleum exploration well drilled in PEP-119.

The prospect was tested on the basis of significant sand expected to have been developed in the Pretty Hill Formation. The same sand in the close vicinity of the prospect area (i.e. Heathfield and Casterton area) was reported to have good development, excellent reservoir properties, and have produced gassy water during the course of drill stem testing. The prospect was also situated on the same trend as Katnook area in the Penola Trough where significant gas discoveries were made.

Post drilling results confirmed the existence of good quality reservoir sand particularly in the basal Pretty Hill Formation. The sand beds were also found to be capped by more than 1400 metres of clay and silt of Eumeralla Formation and undifferentiated post Otway Group.

The data from geochemical analysis and vitrinite reflectance evaluation of Eumeralla Formation indicate that the formation although moderately rich in organic content, for most part is immature to marginally mature.

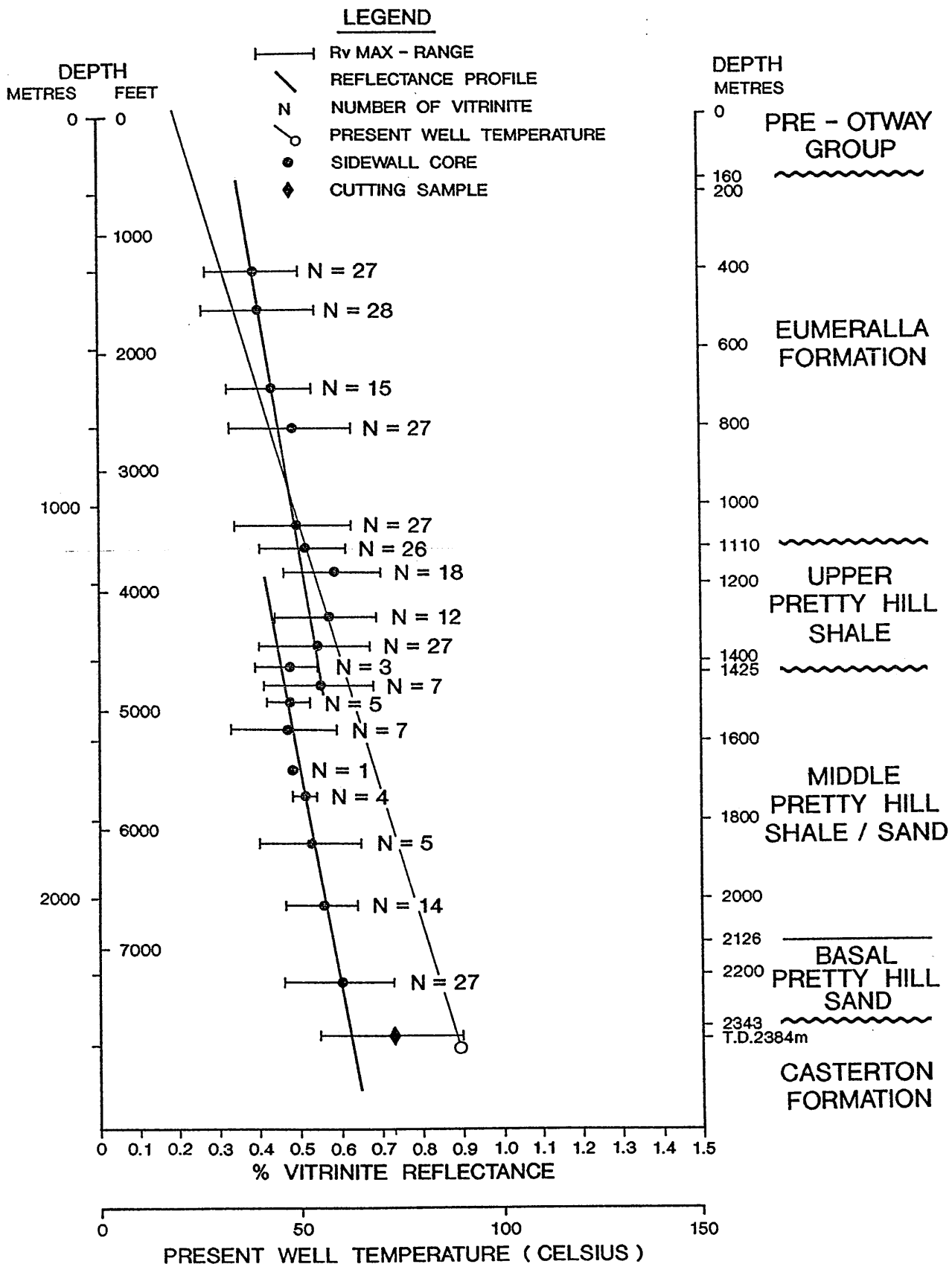
The vitrinite reflectance profile (Fig. 9) reveals the following significant points.

Within the Otway Group, the values of vitrinite reflectance are increasing with depth.

A distinctive shift is apparent in the vitrinite reflectance profile at approximately 1425m which confirms the existence of unconformity separating the Upper Pretty Hill shale unit from underlying Middle Pretty Hill sand/shale sequence.

McEACHERN No.1

VITRINITE REFLECTANCE PROFILE



AUTHOR : V.AKBARI

FIGURE 9
OT.4289

The maximum range of vitrinite reflectance for Eumeralla and Pretty Hill formations are 0.40 - 0.60 and 0.46 and 0.73 respectively indicating the formation to be immature to marginally mature. This is further confirmed by rock evaluation pyrolysis data (Appendix 10) where the values of S1 (extractable organic matter indicating the generated hydrocarbon) is less than 0.2 and the production index (P.I) for most part is less than one.

Palytological data and spores color are also suggesting the formation to be immature down to at least 2100m (See Appendix 11).

Within the drilled part of Casterton Formation, four sidewall cores were shot none of which were recovered. Seven cutting samples (at 5m intervals) were used for source rock assessment and vitrinite reflectance evaluation. (Appendices 9 & 10). The data indicate that:-

The Casterton Formation is considerably richer in organic content than the overlain Pretty Hill and Eumeralla Formation. The average TOC for Casterton Fm is in excess of 1% whilst the average TOC for Pretty Hill and Eumeralla formations are 0.53 and 0.38 respectively.

Range and average values of vitrinite reflectance are also higher than those in Pretty Hill and Eumeralla formation indicating a higher level of thermal maturity.

The T-max and hydrogen index data suggests that the organic matter in Casterton Formation, has a bulk composition of type III Kerogen capable of generating gas and light hydrocarbon.

APPENDIX 2

The McEachern No.1 drill site was prepared by Mt. Gambier Earth Movers Pty. Ltd.

Prior to rig arrival, a 16-in conductor pipe had been installed and cemented.

The G.D.S.A Rig No. 2 was rigged up and McEachern No.1 was spudded on 1000 HRS 19th December, 1989.

Drilling 12 1/4-in hole continued to 357m where the 9 5/8-in casing was run and cemented with float at 342m and shoe at 354m.

The B.O.P.'s, choke manifold, and flareline were installed and the B.O.P.'s were successfully tested to the following pressures.

Blind Rams	1200 PSI
Pipe Rams & Manifold	1500 "
Hydrill	500 "

The float, cement, and shoe were drilled out and after drilling 5 metres of new hole, a formation integrity test was established having 8.7 lb/gal mud in the hole. The formation held 140 PSI.

Drilling 8 1/2-in hole continued uneventfully to 1370m with a bit change at 934m.

At the depth of 1370m, a total of 79.5 hours were lost waiting on repairs to the Silicon Control Rectifier (S.C.R.).

The 8 1/2-in hole was deepened to 1456 meter at which depth drill stem test No.1 was carried out over the interval 1445 to 1456 metres using open hole straddle packers set at 1443.2m, 1445.7m.

Drilling continued with new bit to total depth with bit changes at 1683 and 2138 metres.

The total depth of 2384m was reached at 0630 HRS 8th January, 1990.

The following logs were then run by Gearhart Australia

DLL/MSF/GR

LSS/GR/TAC

FDC/GR

FED/GR

SWC

Velocity Survey

Cement plugs were then set over the interval 2060 - 2010m, 1410 - 1360m, 360-310m.

The last plug was successfully tested to 10,000 lbs. prior to settling surface plug and abandonment of the well.

The rig was released at 0900 HRS, 11th January, 1990.

GAS AND FUEL EXPLORATION N.L.

McEACHERN No.1

CO-ORDINATES LAT : 37°33'51.2"

LONG : 141°11'25.5"

ELEVATION : GLE:76.30 KBE:81.13

SEISMIC : SP.52 LINE.WMC82-N

OBJECTIVE : PRIMARY:INTRA PRETTY HILL SAND

SECONDARY:HEATHFIELD SAND

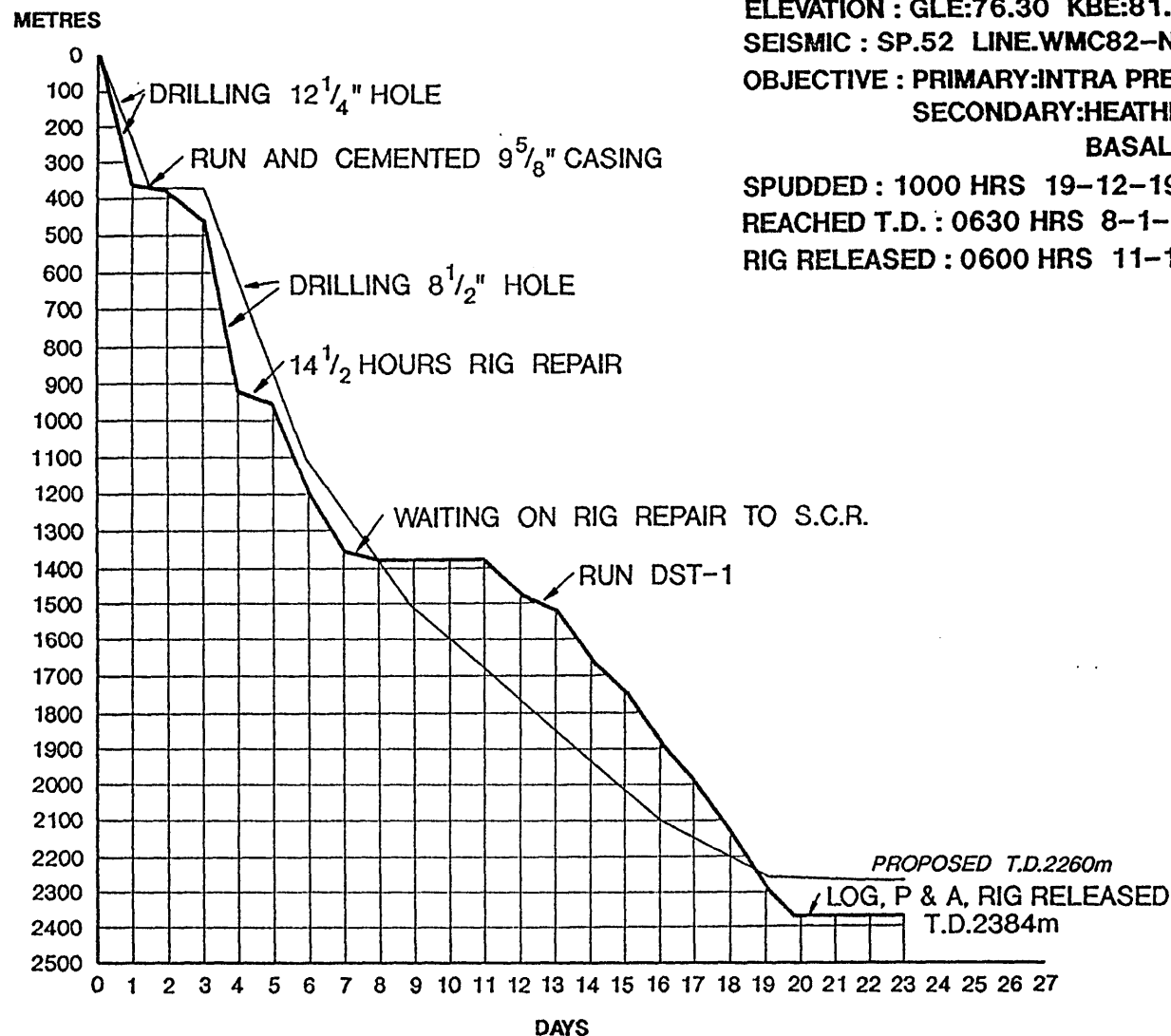
BASAL PRETTY HILL

SPUDDED : 1000 HRS 19-12-1989

REACHED T.D. : 0630 HRS 8-1-1990

RIG RELEASED : 0600 HRS 11-1-1990

CASING	FORMATION	TEST	REMARKS
6" Conductor	165		
9 5/8" 354	EUMERALLA FORMATION		
PLUGS 1/ 2080-2010 2/ 1410-1380 3/ 3610-310 4/ SURFACE	1174.5 UPPER SHALE UNIT 1425 MIDDLE SHALE - SAND UNIT 2118 BASAL SAND 2343 CASTERTON T.D.2384	1	DST-1 INTERVAL : 1445.7 - 1456 RECOVERY : - muddy gassy water - salty gassy water
	PRETTY HILL FORMATION		



PROPOSED T.D.2260m

LOG, P & A, RIG RELEASED

T.D.2384m

PE604716

This is an enclosure indicator page.
The enclosure PE604716 is enclosed within the
container PE906727 at this location in this
document.

The enclosure PE604716 has the following characteristics:

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- CONTAINER_BARCODE = PE906727
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 - BASIN = OTWAY
 - PERMIT = PEP119
 - TYPE = WELL
 - SUBTYPE = COMPOSITE_LOG
- DESCRIPTION = Composite Well Log, (enclosure from WCR
vol.1) for McEachern-1
- REMARKS =
- DATE_CREATED = 11/01/90
- DATE_RECEIVED = 30/07/90
 - W_NO = W1017
 - WELL_NAME = McEARCHERN-1
- CONTRACTOR =
- CLIENT_OP_CO = GAS AND FUEL EXPLORATION NL.

(Inserted by DNRE - Vic Govt Mines Dept)

PE604717

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- CONTAINER_BARCODE = PE906727
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 - BASIN = OTWAY
 - PERMIT = PEP119
 - TYPE = WELL
 - SUBTYPE = MUD_LOG
- DESCRIPTION = Mud Log, (enclosure from WCR vol.1) for
McEarchern-1
- REMARKS =
- DATE_CREATED = 8/01/90
- DATE_RECEIVED = 30/07/90
 - W_NO = W1017
 - WELL_NAME = McEARCHERN-1
 - CONTRACTOR = GEARHART PTY LTD
 - CLIENT_OP_CO = GAS AND FUEL EXPLORATION NL.

(Inserted by DNRE - Vic Govt Mines Dept)

PE604718

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container PE906727 at this location in this
document.

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PERMIT = PEP119
TYPE = WELL
SUBTYPE = WELL_LOG
DESCRIPTION = BCT-GR-TAC Log, 1:200, (enclosure from
WCR vol.1) McEachern-1
REMARKS =
DATE_CREATED = 8/01/90
DATE_RECEIVED = 30/07/90
W_NO = W1017
WELL_NAME = MCEARCHERN-1
CONTRACTOR = HALLIBURTON SERVICES
CLIENT_OP_CO = GFE RESOURCES LTD

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PE604719

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container PE906727 at this location in this
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PERMIT = PEP119
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SUBTYPE = WELL_LOG
DESCRIPTION = BCT-GR-TAC Log, 1:500,(enclosure from
WCR vol.1) McEachern-1
REMARKS =
DATE_CREATED = 8/01/90
DATE_RECEIVED = 30/07/90
W_NO = W1017
WELL_NAME = McEARCHERN-1
CONTRACTOR = HALLIBURTON SERVICES
CLIENT_OP_CO = GFE RESOURCES LTD

(Inserted by DNRE - Vic Govt Mines Dept)

PE604720

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WCR vol.1) McEachern-1
REMARKS =
DATE_CREATED = 8/01/90
DATE_RECEIVED = 30/07/90
W_NO = W1017
WELL_NAME = MCEARCHERN-1
CONTRACTOR = GEARHART PTY LTD
CLIENT_OP_CO = GFE RESOURCES LTD

(Inserted by DNRE - Vic Govt Mines Dept)

PE604721

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container PE906727 at this location in this
document.

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REMARKS =
DATE_CREATED = 8/01/90
DATE_RECEIVED = 30/07/90
 W_NO = W1017
 WELL_NAME = McEARCHERN-1
CONTRACTOR = GEARHART PTY LTD
CLIENT_OP_CO = GFE RESOURCES LTD

(Inserted by DNRE - Vic Govt Mines Dept)

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- CONTAINER_BARCODE = PE906727
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 - TYPE = WELL
 - SUBTYPE = WELL_LOG
- DESCRIPTION = SLDT-CNT-GR Log, 1:200, (enclosure from
WCR vol.1) McEachern-1
- REMARKS =
- DATE_CREATED = 9/01/90
- DATE_RECEIVED = 30/07/90
- W_NO = W1017
- WELL_NAME = McEARCHERN-1
- CONTRACTOR = GEARHART PTY LTD
- CLIENT_OP_CO = GFE RESOURCES LTD

(Inserted by DNRE - Vic Govt Mines Dept)

PE604723

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SUBTYPE = WELL_LOG
DESCRIPTION = SLDT-CNT-GR Log, 1:500, (enclosure from
WCR vol.1) McEachern-1
REMARKS =
DATE_CREATED = 9/01/90
DATE_RECEIVED = 30/07/90
W_NO = W1017
WELL_NAME = McEARCHERN-1
CONTRACTOR = GEARHART PTY LTD
CLIENT_OP_CO = GFE RESOURCES LTD

(Inserted by DNRE - Vic Govt Mines Dept)

PE604724

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container PE906727 at this location in this
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- CONTAINER_BARCODE = PE906727
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- BASIN = OTWAY
- PERMIT = PEP119
- TYPE = WELL
- SUBTYPE = WELL_LOG
- DESCRIPTION = Well Evaluation Log, (enclosure from
WCR vol.1) McEachern-1
- REMARKS =
- DATE_CREATED = 9/01/90
- DATE_RECEIVED = 30/07/90
- W_NO = W1017
- WELL_NAME = MCEARCHERN-1
- CONTRACTOR = GEARHART PTY LTD
- CLIENT_OP_CO = GFE RESOURCES LTD

(Inserted by DNRE - Vic Govt Mines Dept)

PE906728

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container PE906727 at this location in this
document.

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BASIN = OTWAY
PERMIT = PEP119
TYPE = WELL
SUBTYPE = WELL_LOG
DESCRIPTION = Well Log Correlation (enclosure from
WCR vol.1) for McEachern-1
REMARKS =
DATE_CREATED = 30/06/90
DATE_RECEIVED = 19/09/90
W_NO = W1017
WELL_NAME = McEARCHERN-1
CONTRACTOR =
CLIENT_OP_CO = GFE RESOURCES LTD

(Inserted by DNRE - Vic Govt Mines Dept)