WCR VOL 2

SNAPPER-4 (W827)

ESSO EXPLORATION AND PRODUCTION
AUSTRALIA INC.

W827

OIL and GAS DIVISION

WELL COMPLETION REPORT
SNAPPER-4
VOLUME 2
INTERPRETATIVE DATA

12 OCT 1984

GIPPSLAND BASIN
VICTORIA

ESSO AUSTRALIA LIMITED

Compiled by: M. FITTALL

JUNE, 1984

SNAPPER-4

WELL COMPLETION REPORT

VOLUME 2

(Interpretative Data)

CONTENTS

1. Geological and Geophysical Analysis

FIGURES

1. Stratigraphic Table

APPENDICES

1. Micropalaeontological Analysis
2. Palynological Analysis
3. Qantitative Log Analysis
4. Wireline Test Report
5. Geochemical Report
6. Synthetic Seismic Trace

ENCLOSURES

1.	Geological Cross Section	2195/OP/7
2.	Top of Latrobe Group Structure	2195/OP/8
3.	*P. asperopolus* Structure	2195/OP/10
4.	Upper *M. diversus* Structure	2195/OP/9
5.	Top of L-1 Coal Structure	2195/OP/11
6.	Well Completion Log	

0907L

GEOLOGICAL AND GEOPHYSICAL ANALYSIS

Prognosis (KB=21m A.S.L.)

Formation/Horizon	Pre-drill Depth (mSS)	Post-drill Depth (mSS)
Gippsland Limestone	55	57
Lakes Entrance Formation	942	1025.5
Top of Latrobe Group (Top of N-1.0 unit)	1242	1238.5
Top of "coarse clastics" (Top of N-1.1 unit)	1264	1267.2
P. asperopolus seismic marker (Top of N-1.4 unit)	1378	1373.5
Upper *M. diversus* seismic marker	1526	1524.0
Top of L-1 coal (below Upper *L. balmei* seismic marker)	1767	1781.0
T. longus horizon	2615	2346.0?
Total Depth	2800	2800

Introduction

Snapper-4 was drilled to explore for deeper pool oil accumulations below the top of Latrobe Group oil and gas field. The secondary objective of the well was to confirm the interpretation of the western flank of the Snapper field.

Previous Drilling History

The Snapper Field was discovered in June, 1968 by Snapper-1 (T.D. -3746m) and confirmed by the drilling of Snapper-2 (T.D. -3042m) and Snapper-3 (T.D. -3202m) in 1969. All three wells encountered the major N-1 gas and oil reservoir at the top of the Latrobe Group. Snapper-1 intersected a 200.5m gross hydrocarbon column, consisting of 192 metres gross gas (138.5 metres net) and an 8.5 metre gross oil column. Snapper-1 and 2 also encountered some thin gas bearing and oil bearing sands dispersed throughout the Paleocene and Upper Cretaceous section.

Development drilling commenced in March, 1981 and 21 development wells have been drilled from the 27 slot Snapper A platform. The vertical Snapper A-21 well was drilled to a depth of -3247m as an exploration well to evaluate the sands below the N-1 reservoir. It encountered several oil and gas bearing sands within Paleocene and Upper Cretaceous sediments. In particular, it resulted in the discovery of the L-1 oil accumulation in the Upper L. balmei zone. Other significant intra-Latrobe Group oil discoveries were made during the drilling of the exploration portion of the A-6 and A-8 development wells. (See Enclosure 1.)

GEOLOGICAL SUMMARY

Structure

The Snapper Field is a faulted southwest-northeast trending anticline (Enclosure 2). The east-west trending high angle reverse fault (the "Snapper Fault") which occurs along the northern side of the field, changes character and throw along its length. It is thought to have formed by reactivation of original normal basin-forming faults in response to basinwide compression following deposition of the Latrobe Group sediments.

Northwesterly trending normal faults are the dominant fault type cutting across the Snapper closure. These are interpreted to have been formed in response to the opening of the Tasman Sea during the Late Cretaceous.

Snapper-4 was located on the mapped crest of a fault bounded anticlinal block forming part of the Snapper structure (Enclosure 2). The well was drilled updip of Snapper-3 at the level of the Upper L. balmei seismic marker, and is interpreted to have been a valid structural test. Most of the intra-Latrobe Group horizons were drilled close to prediction (see Prognosis). However, the L-1 coal (below the Upper L. balmei seismic marker) was drilled 14.0m low to prediction, and so closure is less at this level than had been predicted.

The T. longus horizon, which was predicted at -2615m, is interpreted to have been intersected at -2346m. The position of this horizon was originally based on palynological data from Snapper-3. A substantial gap exists in the Snapper-3 age zonations between the base of Lower L. balmei and top of T. longus intervals. Age dating of Snapper-4 has greatly narrowed this gap, and consequently the T. longus horizon has been placed 269m above the original prediction.

Stratigraphy

The Snapper-4 well penetrated the limestones and calcareous sediments of the Gippsland Limestone and Lakes Entrance Formation as predicted.

The Top of Latrobe Group (top of N-1.0 unit) was intersected at -1238.5m, 3.5m high to prediction. The N-1 reservoir of the Snapper Field is divided into 10 mappable units: N-1.0 to N-1.9. This subdivision is based on the correlation of field-wide coals and/or shale sequences within a dominantly sandstone section, and is readily recognised in Snapper-4. The uppermost N-1.0 unit in Snapper-4 consists of glauconitic siltstones and fine grained sandstones of Lower to Mid N. asperus age. The underlying "coarse clastics" units of Mid M. diversus to Lower N. asperus age, consist of good quality sands underlain by shale or coal.

A reasonable correlation can be made between Snapper-3 and Snapper-4 below the thick coal underlying the N-1.9 unit, down to the L-1 coal. (The Upper L. balmei seismic marker is mapped approximately 35m above the L-1 coal.) The Latrobe Group in this interval is of uppermost Upper L. balmei to Mid M. diversus age and consists of interbedded sands, silts, shales and coals. The sequence in Snapper-4 is significantly shalier than Snapper-3, and consequently has a lower net to gross. Some growth on the fault bounding the Snapper-3,4 block is evident at this level. Approximately 15m of thickening of this interval is seen in Snapper-4 by comparison to Snapper-1 across the fault.

No reasonable correlation can be made between Snapper-3 and Snapper-4 below the L-1 coal. The Latrobe Group in Snapper-4, below the L-1 coal to T.D., consists of interbedded sands, silts, shales and coals of an interpreted fluvial environment of deposition. The sequence seen in Snapper-4 is considerably shalier than in Snapper-3. This section ranges in age from uppermost Upper L. balmei to T. longus.

However, several thick sands are penetrated in Snapper-4 within the Lower L. balmei section from -2090m to -2250m. These sands are interbedded with shale, and no coals are present in this interval. This sequence is interpreted to have been deposited in a nearshore marine environment.

Some stratigraphic thickening has occurred throughout the Upper L. balmei to T. longus interval due to movement on the fault bounding the SW Snapper block. Approximately 65m of thickening in the interval between the L-1 coal and the T. longus horizon is seen in Snapper-4 by comparison to Snapper-1 across the fault.

Hydrocarbons

Snapper-4 intersected the Snapper oil and gas field in the N-1 units close to prediction. Gas shows were encountered within the Latrobe Group below -1640m and the presence of gas was confirmed by RFT sampling. No significant oil zones are interpreted to have been penetrated below the N-1 reservoir units in Snapper-4.

Snapper-4 intersected a 148.0m gross (76.8m net) gas column and 4.0m gross (4.0m net) oil column in the N-1.0 to N-1.4 units. Log analysis interprets the GOC at 1407.5 mKB (-1386.5m), which is 4.5m low to prediction, and the OWC at 1411.5 mKB, which is 0.5m low to prediction. RFT pressure data indicates an OWC at 1412.0 mKB. An RFT sample taken at 1410.1 mKB (-1389.1m) recovered 47^{o} API oil with a GOR of 516 SCF/STB. Geochemical analysis of the oil suggests it has undergone some biodegradation and water washing. Average porosities of the hydrocarbon sands range from 13% in shaly sands to 27% in clean sands. Average water saturations in the gas sands range from 7% in clean sands, to 45% in shaly sands. The average water saturation of the oil sand is 16%.

Log analysis interprets three thin (less than 1m net porous thickness) hydrocarbon bearing sands between 1666 mKB (-1645m) and 1687 mKB (-1666m). The hydrocarbons are interpreted to be gas. Average water saturations range from 60% to 95% and average porosities range from 13% to 24%.

Log analysis interprets numerous hydrocarbon bearing sands between 1827 mKB (-1806m) and 2118 mKB (-2097m). 9.25m of net gas, plus 21.0m of hydrocarbon bearing sands are interpreted. These sands are commonly shaly and are of 2-3m net porous thickness. Average water saturations range from 41% to 82% and average porosities range from 13% to 24%. RFT pressure data indicates these sands form at least two separate hydrocarbon systems. Possible GWC's are interpreted at 1906 mKB (-1887m) and 1950 mKB (-1929m). An RFT sample taken at 1942.6 mKB (-1921.6m) recovered small amounts of gas.

Log analysis interprets numerous hydrocarbon bearing sands between 2266 mKB (-2241m) and 2791 mKB (-2770m). 7.0m of net gas, plus 37.25m of hydrocarbon bearing sands are interpreted. These sands are commonly shaly, with net porous thicknesses of 1-2m, occasionally up to 5m. Average water saturations range from 40% to 80%, and average porosities range from 7% to 22% but are commonly 15%. RFT samples taken at 2529.5 mKB (-2508.5m) and 2668.5 mKB (-2647.5m) recovered some gas, and a trace of condensate from the 2529.5 mKB sample. RFT pressure data suggests a possible GWC below 2530 mKB (-2509m), but this could not be determined due to discontinuities in the water gradients plotted at these depths.

Geophysical Summary

Seismic markers at the top of Latrobe Group, top of N-1.4 unit and top of N-1.9 unit came in 3.5 metres high, 4.5 metres high and 2 metres high respectively. The well confirmed the N-1 reservoir structural interpretation on the western flank of the Snapper Field and provided additional information about reservoir characteristics in this flank.

The exploration target zones below the N-1 reservoir were 14 metres low to prediction at the L-1 coal marker (Enclosure 5). The error has been attributed to difficulties in mapping the L. balmei seismic marker on which the interpetation to the L-1 coal unit was based. The L. balmei seismic marker cannot be correlated to a distinctive lithological unit on the well logs but appears to correlate to a positive reflection coefficient generated by a sand/shale section at the top of the Upper L. balmei zone. The low frequency and variable nature of the reflector makes it a difficult marker to map accurately.

0883L

FIGURES

SNAPPER-4

STRATIGRAPHIC TABLE

SEA FLOOR

Epoch	Series	Formation Horizon	Palynological Zonation Spore-Pollen (Assemblage Zone)	Planktonic Foraminiferal Zonation	Drill Depth (metres)	Subsea Depth (metres)	Thickness (metres)
PLEIST. / PLIO. / MIOCENE	LATE / MID.	GIPPSLAND LIMESTONE	T. bellus	A1/A2, A3, A4, B1, B2, C, D1/D2	78.0	57.0	968.5
MIOCENE	MID. / EARLY	LAKES ENTRANCE FORMATION	T. bellus / P. tuberculatus	E/F, G	1046.5	1025.5	213.0
MIOCENE / OLIGOCENE / EOCENE	EARLY / LATE / EARLY / LATE	(hatched interval)	P. tuberculatus, Upper N. asperus	H1, H2, I, J1, J2, K	1259.5	1238.5	
EOCENE	LATE / MIDDLE	GURNARD FORMATION	Mid. N. asperus		1259.5	1238.5	28.7
EOCENE / PALEOCENE / LATE CRET.	MIDDLE / EARLY / LATE / EARLY	LATROBE GROUP	Lower N. asperus, P. asperopolus, Upper M. diversus, Mid. M. diversus, Lower M. diversus, Upper L. balmei, Lower L. balmei, T. longus, T. lilliei		1288.0	1267.0	1533.0 +
LATE CRET.			T. longus		2821.0	2800.0	

STRATIGRAPHIC.TABLE.WCR.1-84

Dwg. 2195/OP/6

APPENDIX 1

FORAMINIFERAL ANALYSIS, SNAPPER-4

GIPPSLAND BASIN

by

J.P. Rexilius.

Esso Australia Ltd. November 16, 1983.

Palaeontological Report 1983/35.

0655L

INTERPRETATIVE DATA

INTRODUCTION
SUMMARY TABLE
GEOLOGICAL COMMENTS
DISCUSSION OF ZONES
REFERENCES
FORAMINIFERAL DATA SHEET
TABLE 1 : INTERPRETATIVE DATA, SNAPPER-4

INTRODUCTION

Twenty one sidewall core samples were examined for their foraminiferal content from 1988.0m to 1273.0m in Snapper-4. Diverse to moderately diverse planktonic foraminiferal assemblages were recovered from all samples of the marine carbonate section. Four sidewall core samples examined from the Gurnard Formation (sidewall cores at 1260.0, 1266.5, 1270.0 and 1273.0m) were all barren of foraminifera.

Tables 1 and 2 provide a summary (Basic and Interpretative) of the palaeontological analysis in Snapper-4. A summary of the biostratigraphic breakdown of the stratigraphic units in Snapper-4 is given below.

SUMMARY

AGE	UNIT	ZONE	DEPTH (m)
Mid Miocene	Gippsland Limestone	D-2/D-1	988.0-1048.0
	log break at 1046.5m		
Mid Miocene	Lakes	D-2/D-1	1068.0-1129.0
Mid Miocene	Entrance	E-2	1149.8-1168.5
Early Miocene	Formation	F	1189.0-1240.0
Early Miocene		G	1250.0-1258.5
	log break at 1259.5m		
-	Gurnard Formation	Indeterminate	1260.0-1273.0
	log break at 1288.0m		
-	Latrobe Group (coarse clastics)	(not studied)	

T.D. 2821m

GEOLOGICAL COMMENTS

Log character indicates that the base and top of the Gurnard Formation is at 1259.5 and 1288.0m respectively. The Gurnard Formation in Snapper-4 cannot be age dated using foraminifera. The formation is barren of foraminifera. Palynological evidence indicates that the formation ranges in age from Middle Eocene to early Late Eocene (Macphail, 1983).

In Snapper-4 the Gurnard Formation is disconformably overlain by the Lakes Entrance Formation. The hiatus between the two formations spans approximately 16 my. The disconformity at 1259.5m represents a well defined seismic horizon in Snapper-4 and probably equates with the 21.4 type-1 unconformity of Haq *et al.* (1983).

The boundary between the Lakes Entrance Formation and the Gippsland Limestone is selected at 1046.5m on the basis of a subtle log change. A sidewall core shot on the boundary (SWC 40 at 1048.0m) consists of partly recrystallised fine grained calcarenite with sponge spicules. This is the lowest sample of Gippsland Limestone in the well. This level marks the proximal edge of the prograding Gippsland Limestone at the Snapper-4 location.

DISCUSSION OF ZONES

The Tertiary biostratigraphy in Snapper-4 is based on the Gippsland Basin planktonic foraminiferal zonal scheme of Taylor (in prep).

Indeterminate Interval : 1260.0 - 1273.0m.

The upper part of the Gurnard Formation (1260.0-1273.0m) is barren of foraminifera. Palynological evidence (Macphail, 1983) indicates that the entire Gurnard Formation (1259.5-1288.0m) spans the interval Middle Eocene - earliest Late Eocene (Lower and Middle *N. asperus* Zones).

Zone G : 1250.0 - 1240.0m.

The uphole appearance of *Globigerinoides trilobus* at 1258.5m defines the base of Zone G.

Zone F : 1189.0 - 1240.0m.

The uphole entry of *Globigerinoides sicanus* at 1240.0m defines the base of Zone F.

Zone E-2 : 1149.8 - 1168.5m.

The base of Zone E-2 is marked by the uphole appearance of *Praeorbulina glomerosa* at 1168.5m.

Zones D-2/D-1 : 988.0 - 1129.0m.

The base of Zone D-2 is defined by the first appearance uphole of Orbulina universa at 1129.0m. Zones D-2 and D-1 have been grouped because the lower boundary defining species of Zone D-1, Globorotalia peripheroacuta, has not been recorded. Taylor (in prep.) also differentiates the two zones on the basis of a diversity decline of Globigerinoides spp. at the top of Zone D-2. This biostratigraphic event however can be obscured by, and possibly confused with, the transition from the pelagic Lakes Entrance Formation to the prograding shelfal Gippsland Limestone (note: the Gippsland Limestone contains more impoverished and more poorly preserved planktonic foraminiferal assemblages than the Lakes Entrance Formation).

REFERENCES

HAQ, B.U., HARDENBOL, J., WRIGHT, R., & BLECHSCHMIDT, J., 1983. Cenozoic Cycle Chart. Exxon Production Research Company (Preliminary).

MACPHAIL, M.K. 1983. Palynological analysis, Snapper-4, Gippsland Basin. Esso Australia Ltd., Palaeontology Report 1983/44.

TAYLOR, D.J. (in prep.) Observed Gippsland biostratigraphic sequences of planktonic foraminiferal assemblages.

MICROPALEONTOLOGICAL DATA SHEET

BASIN: GIPPSLAND ELEVATION: KB: 21.0m GL: -57.0m

WELL NAME: SNAPPER-4 TOTAL DEPTH: 2821mKB

AGE		FORAM. ZONULES	HIGHEST DATA Preferred Depth	Rtg	Alternate Depth	Rtg	Two Way Time	LOWEST DATA Preferred Depth	Rtg	Alternate Depth	Rtg	Two Way Time
PLEISTOCENE		A_1										
		A_2										
PLIOCENE		A_3										
		A_4										
		B_1										
MIOCENE	LATE	B_2										
		C										
	MIDDLE	D_1	988.0	0								
		D_2						1129.0	0			
		E_1										
		E_2	1149.8	0				1168.5	0			
	EARLY	F	1189.0	0				1240.0	0			
		G	1250.0	0				1258.5	0			
		H_1										
OLIGOCENE	LATE	H_2										
		I_1										
		I_2										
	EARLY	J_1										
		J_2										
EOCENE		K										
		Pre-K										

COMMENTS: The absence of Zone E-1 may be the result of a gap in sampling or may be the result of hiatus.

CONFIDENCE RATING:

- O: SWC or Core - Complete assemblage (very high confidence).
- 1: SWC or Core - Almost complete assemblage (high confidence).
- 2: SWC or Core - Close to zonule change but able to interpret (low confidence).
- 3: Cuttings - Complete assemblage (low confidence).
- 4: Cuttings - Incomplete assemblage, next to uninterpretable or SWC with depth suspicion (very low confidence).

NOTE: If an entry is given a 3 or 4 confidence rating, an alternative depth with a better confidence rating should be entered, if possible. If a sample cannot be assigned to one particular zone, then no entry should be made, unless a range of zones is given where the highest possible limit will appear in one zone and the lowest possible limit in another.

DATA RECORDED BY: M.J. Hannah DATE: 26/7/83

DATA REVISED BY: J.P. Rexilius DATE: 15/8/93

TABLE 1

SUMMARY OF PALAEONTOLOGICAL ANALYSIS, SNAPPER-4, GIPPSLAND BASIN.

INTERPRETATIVE DATA

NATURE OF SAMPLE	DEPTH (M)	MICROFOSSIL YIELD	PRESERVATION	DIVERSITY	ZONE	AGE	COMMENTS
SWC 30	1273.0	Barren	-	-	-	-	
SWC 31	1270.0	Barren	-	-	-	-	
SWC 32	1266.5	Barren	-	-	-	-	
SWC 34	1260.0	Barren	-	-	-	-	
SWC 35	1259.5	High	Good	Moderate/High	G	Early Miocene	
SWC 36	1254.9	High	Good	Moderate/High	G	Early Miocene	
SWC 37	1250.0	High	Good	Moderate	G	Early Miocene	
SWC 38	1240.0	Moderate	Moderate	Moderate/High	G	Early Miocene	
SWC 39	1228.5	Moderate	Moderate/Poor	Moderate/High	F	Early Miocene	
SWC 40	1213.9	Moderate	Moderate/Poor	Moderate	F	Early Miocene	
SWC 41	1189.0	Moderate	Moderate	Moderate/High	F	Early Miocene	
SWC 42	1168.5	High	Moderate	Moderate/High	E-2	Mid Miocene	Rare bryozoan fragments
SWC 43	1149.8	High	Good	Moderate/High	E-2	Mid Miocene	
SWC 44	1129.0	High	Good	High	D-2/D-1	Mid Miocene	
SWC 45	1108.0	Moderate	Good	Moderate/High	D-2/D-1	Mid Miocene	

TABLE 1

SUMMARY OF PALAEONTOLOGICAL ANALYSIS, SNAPPER-4, GIPPSLAND BASIN.

INTERPRETATIVE DATA

NATURE OF SAMPLE	DEPTH (M)	MICROFOSSIL YIELD	PRESERVATION	DIVERSITY	ZONE	AGE	COMMENTS
SWC 46	1088.0	Moderate/High	Good	Moderate/High	D-2/D-1	Mid Miocene	Rare bivalves and bryozoan fragments
SWC 47	1068.0	High	Good	Moderate/High	D-2/D-1	Mid Miocene	
SWC 48	1048.0	Moderate	Moderate/Poor	Moderate	D-2/D-1	Mid Miocene	Sponge spicules
SWC 49	1028.0	Low	Poor	Moderate/Low	D-2/D-1	Mid Miocene	Echinoid spines, sponge spicules, bryozoan fragments, shell fragments
SWC 50	1008.0	Moderate/Low	Moderate/Poor	Moderate	D-2/D-1	Mid Miocene	Sponge spicules
SWC 51	988.0	Moderate	Moderate	Moderate	D-2/D-1	Mid Miocene	Sponge spicules

BASIC DATA

TABLE 2 : FORAMINIFERAL DATA, SNAPPER-4

RANGE CHART : TERTIARY PLANKTONIC FORAMINIFERA

TABLE 1

SUMMARY OF PALAEONTOLOGICAL ANALYSIS, SNAPPER-4, GIPPSLAND BASIN.

BASIC DATA

NATURE OF SAMPLE ZONE	DEPTH (M) AGE	MICROFOSSIL YIELD	PRESERVATION	DIVERSITY
SWC 30	1273.0	Barren	-	-
SWC 31	1270.0	Barren	-	-
SWC 32	1266.5	Barren	-	-
SWC 34	1260.0	Barren	-	-
SWC 35	1259.5	High	Good	Moderate/High
SWC 36	1254.9	High	Good	Moderate/High
SWC 37	1250.0	High	Good	Moderate
SWC 38	1240.0	Moderate	Moderate	Moderate/High
SWC 39	1228.5	Moderate	Moderate/Poor	Moderate/High
SWC 40	1213.9	Moderate	Moderate/Poor	Moderate
SWC 41	1189.0	Moderate	Moderate	Moderate/High
SWC 42	1168.5	High	Moderate	Moderate/High
SWC 43	1149.8	High	Good	Moderate/High
SWC 44	1129.0	High	Good	High
SWC 45	1108.0	Moderate	Good	Moderate/High
SWC 46	1088.0	Moderate/High	Good	Moderate/High
SWC 47	1068.0	High	Good	Moderate/High
SWC 48	1048.0	Moderate	Moderate/Poor	Moderate
SWC 49	1028.0	Low	Poor	Moderate/Low
SWC 50	1008.0	Moderate/Low	Moderate/Poor	Moderate
SWC 51	988.0	Moderate	Moderate	Moderate

FOSSIL TYPE : PLANKTONIC FORAMINIFERA

Well Name SNAPPER - 4 Basin GIPPSLAND Sheet No. 1 of 1

SAMPLE TYPE OR NO. *	30	31	32	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51
FOSSIL NAMES / DEPTHS	1273·0	1270·0	1266·5	1260·0	1285·5	1254·9	1250·0	1240·0	1228·5	1213·9	1189·0	1168·5	1149·8	1129·0	1108·0	1088·0	1068·0	1048·0	1028·0	1008·0	988·0
Globigerina woodi					▓	▓	▓	▓	▓	---	▓	—	—	▓	—	▓	—	—	---	---	---
Globigerina woodi connecta					▓	▓	—	—	---	---	---										
Globigerinoides trilobus					—	▓	▓	▓	—	—	—	—	▓	▓	—	—	—	---		---	
Globigerina praebulloides					—	▓	▓	—	—												
Globoquadrina dehiscens s.l.					—																
Globoquadrina dehiscens s.s.					—							---		—							
Globorotalia continuosa					—	—	---														
Globoquadrina advena					---																
Globorotalia bella						▓			---												
Globorotalia obesa						—		—													
Globorotalia zealandica						---															
Globigerina ciperoensis						---															
Globorotalia miozea miozea							---	---	—	▓	▓	---	—	▓	—	—	▓	▓	---	---	▓
Globorotalia praescitula							—	—	---	---		—	—	—	—		—	---	---	---	—
Globorotalia praemenardii								—	—		—	—		—	---	—	—	---		---	
Globigerinoides sicanus								---		---	—	—	▓		—		---				
Globoquadrina altispira									---												
Globigerina bulloides									—		▓	—	—	▓	—	—	—	—	---	—	—
Globigerinoides ruber											---										
Praeorbulina glomerosa												—	—	---							
Globorotalia miozea miozea - G. miozea conoidea transition												---	---	—	---						
Globorotalia sp. 1													---								
Orbulina suturalis														—							
Orbulina universa														—		—	▓	---	---	—	▓
Globorotalia peripheronda																---					
Globorotalia miozea conoidea																▓	—				
Globorotalia sp. aff. *G.miotumida conomiozea*																---					
Globorotalia sp. 2																			---		
Orbulina bilobata																				---	---

* C=CORE S=SIDEWALL CORE
T=CUTTINGS J=JUNK BASKET

--- Rare
—— Few
▓ Common

PALAEO.CHART-2
DWG.1107/OP/287

APPENDIX 2

PALYNOLOGICAL ANALYSIS
SNAPPER-4, GIPPSLAND BASIN

by

M.K. Macphail

Esso Australia Ltd
Palaeontology Report 1984/8
0878L

June 1984

INTERPRETATIVE DATA

INTRODUCTION
SUMMARY TABLE
GEOLOGICAL COMMENTS
DISCUSSION OF AGE ZONES
TABLE-1 INTERPRETATIVE DATA
TABLE-2 ANOMALOUS AND UNUSUAL OCCURRENCES OF SPORE POLLEN
PALYNOLOGY DATA SHEET

INTRODUCTION

One hundred and twelve (112) sidewall core samples were processed and examined for spore-pollen and dinoflagellates. Recovery, preservation and diversity were mostly good and, given the good sampling density, it is likely that the well will improve correlations within the Snapper field. Palynological zones and lithological facies division from the base of the Lakes Entrance Formation to the total depth of the well are given below. The occurrences of spore-pollen and dinoflagellate species are tabulated in the accompanying range chart. Anomalous and unusual occurrences of spore-pollen and dinoflagellates are listed in Table 2.

SUMMARY

AGE	UNIT/FACIES	ZONE	DEPTH(m)
Early Miocene	Lakes Entrance Formation	P. tuberculatus	1258.5
Log break at 1259.5m			
Late Eocene	Gurnard	Middle N. asperus	1260.0-1265.0
Mid./Late Eocene	Formation	Lower N. asperus	1266.5-1287.0
Log break at 1288.0m			
Mid./Early Eocene		Lower N. asperus	1306.0-1346.5
Mid./Early Eocene		P. asperopolus	1350.5-1414.9
Early Eocene		Upper M. diversus	1441.9-1530.4
Early Eocene	Latrobe Group	Middle M. diversus	1574.5-1746.5
Early Eocene	Coarse Clastics	Lower M. diversus	1765.5-1780.3
Paleocene		Upper L. balmei	1800.6-2078.9
Paleocene		Lower L. balmei	2084.0-2352.2
Maastrichtian		Upper T. longus	2368.0-2740.0
Late Cretaceous		Lower T. longus	2768.2-2804.0

T.D. 2821m

GEOLOGICAL COMMENTS

1. The Snapper-4 well contains a continuous sequence of sediments from the Late Cretaceous Lower T. longus Zone to the Middle/Late Eocene Middle N. asperus Zone. An approximately 172m thick section of Middle M. diversus Zone sediments is recognized. It is highly unlikely that comparable thicknesses of Middle M. diversus Zone sediments do not occur in other Snapper wells (cf. data sheets Partridge, 1975).

2. The palynological data support the foraminiferal evidence (Rexilius, 1984) for a hiatus in deposition from the Late Eocene to the Early Miocene at the Snapper-4 wellsite. The surface represented by the log-break at 1288.0m is likely to represent either or both the 21.4 and 30 million year unconformities.

3. Spore-pollen and dinoflagellates recovered from the Gurnard Formation, picked on lithological and log characteristics as occurring from 1259.5 to 1288.0m (Rexilius ibid) demonstrate this unit is Middle N. asperus to Lower N. asperus Zone in age. Abundance of dinoflagellates over this section varies from virtually absent, e.g. at 1279.0m and 1265.0, to common e.g. at 1266.5m. This probably reflects facies-related variation in preservation. Relative yield and types of spore-pollen encountered across this section however suggest the Lower N. asperus interval of the Gurnard Formation was deposited in a shallow marine environment, relatively close to the palaeoshore line. The sample at 1266.5m represents the time equivalent of the Lower N. asperus Zone Wetzeliella echinosuturata Zone recognized by Partridge (1976). The highest coal, representing a fully terrestrial environment, is at 1313m.

4. A number of marine transgressions or marginal marine environments are recorded within the Latrobe Group coarse clastics below 1313m. These are (in order of increasing age): 1414.9m (P. asperopolus Zone), 1441.9m (Upper M. diversus Zone), 1628.9m, 1638.5m, and 1675.5m (Middle M. diversus Zone), 1765.5m (Lower M. diversus Zone), and 2029.0m and 2063.0-2078.9m (Upper L. balmei Zone). None can be correlated with the dinoflagellate zones established by Partridge (1976). The sample at 1780.3m may be the time equivalent of marine Rivernook Beds in the onshore Princetown Section, Otway Basin (cf. Cookson & Eisenack 1967).

5 The M. diversus and T. longus Seismic Markers fall within sediments of these ages in the Snapper-4 well. However the Upper L. balmei Seismic Marker lies within sediments of Middle M. diversus Zone age.

6. Sediment deposited in T. longus and L. balmei Zone times are markedly thicker in Snapper-3 and Snapper-4 than in Snapper-A21 or Snapper-1 (average 405m, 485m vs 515m, 535m). This supports the conclusion (A. Young, pers. comm.) that a growth fault exists between Snapper-1 and Snapper-4. Since thicknesses of M. diversus and P. asperopolus/Lower N. asperus Zone sediments are approximately the same in all four wells, growth of this fault was largely pre-Eocene.

7. The well bottomed in T. longus Zone sediments as predicted by seismic stratigraphy and biostratigraphic data from the Snapper-3 well.

BIOSTRATIGRAPHY

The zone boundaries have been established using the criteria of Stover & Evans (1973), Stover & Partridge (1973), Partridge (1975) and subsequent proprietry revisions including Macphail (1983).

Lower Tricolpites longus Zone, 2768.2 to 2804.0m

Two samples are recognized as belonging to this zone, based on the prevelance of Gambierina over Nothofagidites. Dilwynites granulatus, which first appears within the T. longus Zone occurs at 2804.0m and Tricolporites longus at 2768.2m.

Upper Tricolpites longus Zone 2390.1 to 2740.0m

Samples within this section contain the general T. longus Zone indicators such as, frequent to abundant Gambierina, Tricolpites longus, Proteacidites amolosexinus, P. otwayensis, P. cleinii and P. wahooensis in addition to Late Cretaceous species such as Tricolporites lilliei and Triporopollenites sectilis. The base of the zone is defined by the first appearances of Tetracolporites verrucosus and Proteacidites gemmatus at 2740.0m. Stereisporites punctatus first occurs at 2710.0m. The upper boundary is provisionally picked at 2368.0m, the highest sample to contain frequent Gambierina. Occurrences of Stereisporites punctatus, Tetracolporites verrucosus, Proteacidites gemmatus, P. otwayensis, and Triporopollenites sectilis in a Gambierina rudata-dominated palynoflora at 2390.1m confirm this sample as Upper T. longus Zone in age.

Lower Lygistepollenites balmei Zone, 2084.0 to 2352.2m

Palynofloras within this interval are dominated by small-diameter Proteacidites species and gymnosperm pollen (including rare to frequent Lygistepollenites balmei). The lower boundary is picked at 2352.2m, the first sample to lack species ranging no higher than the Late Cretaceous. Tetracolporites verrucosus in this sample shows it likely to be no younger than Lower L. balmei Zone in age. The upper boundary is placed at 2084.0m, the highest sample containing Proteacidites gemmatus. The first occurrences of taxa which first appear in the Lower L. balmei Zone are: Integricorpus antipodus at 2309.4m, and Polycolpites langstonii at 2265.3m. The first occurrence of Haloragacidites harrisii is in the Upper L. balmei Zone, at 2029.0m.

Upper Lygistepollenites balmei Zone, 1800.6 to 2078.9m

The first occurrence of Verrucosisporites kopukuensis at 2078.9m defines the base of this zone. Apectodinium homomorpha, a dinoflagellate which first appears at or slightly below the Lower/Upper L. balmei Zone boundary is abundant in this sample, as is Lygistepollenites balmei. Tetracolporites verrucosus and Jaxtacolpus pieratus extend their range into the Upper L. balmei section in this well, occurring at 2029.0m, 1986.0m, and 1902.0m and 2029.0m and 1918.1m respectively. With the exception of Verrucosisporites kopukuensis, taxa which first appear in the Upper L. balmei Zone are not recorded until close to the upper boundary, e.g. Proteacidites annularis at 1918.1m, P. incurvatus at 1902.0m and Cyathidites gigantis at 1822.0m. Conversely, a number of typically Eocene species occur in this section: Beaupreadites elegansiformis at 2011.5m, Periporopollenites vesicus at 1945.7m, Cupanieidites orthoteichus and Triporopollenites ambiguus at 1867.0m, and Malvacipollis diversus at 1822.0. The upper boundary is defined by the last appearance of Lygistepollenites balmei at 1800.6m (3 specimens in an otherwise virtually barren siltstone). Australopollis obscurus, Cyathidites gigantis and (common) Lygistepollenites balmei confirm an Upper L. balmei Zone age for the sample at 1822.0m.

Lower Malvacipollis diversus Zone, 1765.5 to 1780.3m

Two samples are assigned to this zone. The lowermost, at 1780.3m, contains abundant Malvacipollis diversus and rare occurrences of species which first occur in this zone: Intratriporopollenites notabilis, Spinizonocolpites prominatus, Crassiretitriletes vanraadshoovenii and Polypodiaceoisporites varus. The sample at 1765.5m contains Cyathidites gigantis, a species not known to range above the Lower M. diversus Zone. This extends the range of Banksiaeidites elongatus down into this zone.

Middle Malvacipollis diversus Zone, 1574.5 to 1746.5m

The first occurrence of Proteacidites tuberculiformis at 1746.5m defines the base of this zone. Other species which first appear in the Middle M. diversus Zone occur higher within the zone: Anacolosidites acutullus at 1719.7m, Proteacidites leightonii at 1675.5m, Tricolporites paenestriatus at 1648.5m Anacolosidites rotundus at 1647.3m (common in a coal palynoflora), Beaupreadites verrucosus at 1638.5m and Proteacidites alveotatus and P. ornatus at 1574.5m. The upper boundary is picked at 1574.5m, the highest sample to lack indicator species of the Upper M. diversus Zone.

The section assigned to the Middle M. diversus Zone contains a number of significant anomalous occurrences (see Table 2). The more important of these include: the typically Lower M. diversus Zone dinoflagellate indicator species Deflandrea dartmooria at 1675.5m and 1628.9m; Lygistepollenites balmei (5 specimens) and Cyathidites gigantis (2 specimens) in a non-marine siltstone at 1634.0m; Tricolpites incisus and Proteacidites recavus, species which first appear in the P. asperopolus Zone, at 1628.9m; and an assemblage virtually comprised of thick-walled spore species only, Crassiretitriletes vanraadshoovenii, Polypodiaceoisporites varus, Verrucosisporites kopukuensis, Cyathidites splendens and Stereisporites punctatus at 1609.0m. This spore assemblage is rarely recorded outside the Lower M. diversus Zone (where it usually includes Cyathidites gigantis).

Upper Malvacipollis diversus Zone, 1441.9 to 1530.4m

This section comprises samples containing frequent to common Malvacipollis diversus with Proteacidites pachypolus and, at 1441.9m, Myrtaceidites tenuis. Spinizonocolpites prominatus occurs at 1495.5m.

Proteacidites asperopolus Zone, 1350.5 to 1414.9m

The concurrence of Myrtaceidites tenuis and Proteacidites asperopolus at 1414.9m define the lower boundary of this zone. This sample contains Spinizonocolpites prominatus, a species which is last recorded in this zone, and Tricolpites leuros and Tricolporites retequetrus, species which have not been previously recorded below the N. asperus Zone. Intratriporopollenites notabilis occurs at 1411.9m - in a coal palynoflora dominated by Proteacidites, Haloragacidites and Periporopollenites demarcatus. The upper boundary, at 1350.5m, is defined by the highest sample containing Proteacidites asperopolus in a Proteacidites-dominated palynoflora.

Lower Nothofagidites asperus Zone 1266.5 to 1346.5m

The lower boundary of this zone is picked at 1265.5m, the first sample to be dominated by Nothofagidites. The occurrence of Anacolosidites rotundus indicates the sample is no younger than Lower N. asperus Zone in age. Proteacidites asperopolus, which ranges no higher than this zone, occurs in a Nothofagidites-dominated assemblage at 1330.0m. Species which first appear in the Lower N. asperus Zone occur at 1313.4m (Nothofagidites falcatus, Tricolporites delicatus), 1306.0m (Proteacidites rugulatus), 1287.0m (Rugulatisporites trophus and the dinoflagellate Areosphaeridium diktyoplokus), and 1275.4m (Tricolpites simatus). Verrucatosporites attinatus, which first appears in the upper part of the Lower N. asperus Zone, occurs at 1270.0m. The upper boundary, picked at 1266.5m, is defined by the last appearance of Proteacidites asperopolus. This sample contains the very rare dinoflagellate species Wetzeliella echinosuturata.

Middle Nothofagidites asperus Zone, 1260.0 to 1265.0m

Two samples are assigned to this zone. The lowermost contains the very rare species Tricolpites arcilineatus as well as Proteacidites rugulatus, a species which ranges no higher than the Middle N. asperus Zone. The higher sample contains the dinoflagellate indicator species Vozzhenikovia extensa together with Milfordia homeopunctata, a species rarely recorded below this zone.

Proteacidites tuberculatus Zone, 1258.5

Occurrences of Cyatheacidites annulatus (8 specimens), Foveotriletes crater and the dinoflagellate Pyxidinopsis pontus confirm a P. tuberculatus Zone age for this sample.

REFERENCES

COOKSON, T.C. & EISENACK, 1967. Microplankton from the Paleocene Rivernook Bed, Victoria. Proc. Roy. Soc. Vict., 80:247-258.

MACPHAIL, M.K. 1983. A revision of the Maastrichtian T. longus Zone based on palynological data from the Hapuku-1 and Pilotfish-1 wells, Gippsland Basin, 1983/19.

PARTRIDGE, A.D., 1976. The geological expression of eustacy in the Early Tertiary of the Gippsland Basin. Apea (1976):73-79.

REXILIUS, J.P., 1983. Micropalaeontological analysis of Snapper-4, Gippsland Basin, Victoria. Esso Australia Ltd., Palaeontological Report 1983/35.

STOVER, L.E. & EVANS, P.R., 1973. Upper Cretaceous spore-pollen zonation, offshore Gippsland Basin, Australia. Spec. Publ. Geol. Soc. Aust., 4, 55-72.

STOVER, L.E. & PARTRIDGE, A.D., 1973. Tertiary and Late Cretaceous spores and pollen from the Gippsland Basin, Southeastern Austalia. Proc. Roy. Soc. Vict., 85, 237-86

PALYNOLOGY DATA SHEET

BASIN: GIPPSLAND   ELEVATION: KB: + 21m   GL: - 57m

WELL NAME: SNAPPER-4   TOTAL DEPTH:

AGE	PALYNOLOGICAL ZONES	HIGHEST DATA Preferred Depth	Rtg	Alternate Depth	Rtg	Two Way Time	LOWEST DATA Preferred Depth	Rtg	Alternate Depth	Rtg	Two Way Time
NEOGENE	*T. pleistocenicus*										
	M. lipsis										
	C. bifurcatus										
	T. bellus										
PALEOGENE	*P. tuberculatus*	1258.5	0				1258.5	0			
	Upper *N. asperus*										
	Mid *N. asperus*	1260.0	1				1265.0	1			
	Lower *N. asperus*	1266.6	1				1346.5	2	1330.0	1	
	P. asperopolus	1350.5	2				1414.9	0			
	Upper *M. diversus*	1441.9	1				1530.4	1			
	Mid *M. diversus*	1574.5	1				1746.5	1			
	Lower *M. diversus*	1765.5	0				1780.3	0			
	Upper *L. balmei*	1800.6	2	1822.0	1		2078.9	1			
	Lower *L. balmei*	2084.0	2	2169.2	1		2352.2	2	2328.4	1	
LATE CRETACEOUS	*T. longus*	2368.0	2	2390.1	0		2804.0	2	2768.2	1	
	T. lilliei										
	N. senectus										
	U. *T. pachyexinus*										
	L. *T. pachyexinus*										
	C. triplex										
	A. distocarinatus										
EARLY CRET.	*C. paradoxus*										
	C. striatus										
	F. asymmetricus										
	F. wonthaggiensis										
	C. australiensis										
	PRE-CRETACEOUS										

COMMENTS: Subdivision of the T. longus Zone is as follows (confidence ratings in parenthesis)

Upper T. longus 2368.0 (2) - 2740.0 (1)

Upper T. longus 2768.2 (1) - 2804.0 (2)

Please note the Upper T. longus Zone approximates to the T. longus Zone as recognised in pre-1982 wells.

CONFIDENCE RATING:
- O: SWC or Core, Excellent Confidence, assemblage with zone species of spores, pollen and microplankton.
- 1: SWC or Core, Good Confidence, assemblage with zone species of spores and pollen or microplankton.
- 2: SWC or Core, Poor Confidence, assemblage with non-diagnostic spores, pollen and/or microplankton.
- 3: Cuttings, Fair Confidence, assemblage with zone species of either spores and pollen or microplankton, or both.
- 4: Cuttings, No Confidence, assemblage with non-diagnostic spores, pollen and/or microplankton.

NOTE: If an entry is given a 3 or 4 confidence rating, an alternative depth with a better confidence rating should be entered, if possible. If a sample cannot be assigned to one particular zone, then no entry should be made, unless a range of zones is given where the highest possible limit will appear in one zone and the lowest possible limit in another.

DATA RECORDED BY: M.K. Macphail   DATE: 1 June 1984

DATA REVISED BY: DATE:

TABLE I : SUMMARY OF PALYNOLOGICAL ANALYSIS - SNAPPER-4

INTERPRETATIVE DATA

SAMPLE NO.	DEPTH (m)	YIELD	DIVERSITY SPORE POLLEN	LITHOLOGY	ZONE	AGE	CONFIDENCE RATING	COMMENTS
SWC 35	1258.5	Good	Fair	Lmst.	P. tuberculatus	Early Miocene	0	Frequent C. annulatus; F. crater
SWC 34	1260.0	Fair	Low	Slst.	Middle N. asperus	Late Eocene	1	V. extensa
SWC 33	1265.0	Good	Good	Ss., carb. glau.	Middle N. asperus	Late Eocene	1	T. arcilineatus, P. rugulatus
SWC 32	1266.5	Good	Good	Ss., glau.	Lower N. asperus	Middle Eocene	2	P. asperopolus (? contam.), N. falcatus, T. simatus
SWC 31	1270.0	Low	Low	Slst.	Lower N. asperus	Middle Eocene	2	V. attinatus, P. pachypolus
SWC 30	1273.0	Good	Low	Ss.	Lower N. asperus	Middle Eocene	2	N. falcatus, P. pachypolus
SWC 29	1274.0	V. good	V. good	SS., carb.	Lower N. asperus	Middle Eocene	0	P. asperopolus, T. simatus, N. falcatus D. heterophylcta
SWC 28	1275.4	Good	Fair	Slst.	Lower N. asperus	Middle Eocene	0	T. simatus, P. asperopolus
SWC 27	1279.0	V. low	Good	Slst.	Lower N. asperus	Middle Eocene	1	P. asperopolus, abund. Nothofagidites
SWC 26	1281.5	Good	Good	Slst.	Lower N. asperus	Middle Eocene	1	N. falcatus, A. diktyoplokus
SWC 25	1287.0	Good	V. good	Slst.	Lower N. asperus	Middle Eocene	0	A. rotundus, P. asperopolus, R. trophus, T. delicatus, A. diktyoplokus
SWC 23	1306.0	Good	Fair	Slst.	Lower N. asperus	Middle Eocene	1	P. asperopolus, P. rugulatus, abund. Nothofagidites
SWC 22	1307.4	Negligible	-	Coal	Indeterminate	-		H. harrisii
SWC 21	1313.4	Good	Fair	Slst.	Lower N. asperus	Middle Eocene	0	T. delicatus, P. asperopolus
SWC 20	1330.0	Good	Fair	Slst.	Lower N. asperus	Middle Eocene	1	P. asperopolus, abund. Nothofagidites
SWC 18	1346.5	Good	Fair	Cly.	Lower N. asperus	Middle Eocene	1	A. rotundus, abund. Nothofagidites
SWC 17	1350.5	Good	Low	Slst.	P. asperopolus	Mid./Early Eocene	1	P. asperopolus, abund. Proteacidites
SWC 16	1362.0	V. good	Fair	Coal	Indeterminate	-	-	Nothofagidites abundant
SWC 15	1372.0	Low	Low	Slst.	Indeterminate	-	-	contaminated

TABLE I : SUMMARY OF PALYNOLOGICAL ANALYSIS - SNAPPER-4

INTERPRETATIVE DATA

SAMPLE NO.	DEPTH (m)	YIELD	DIVERSITY SPORE POLLEN	LITHOLOGY	ZONE	AGE	CONFIDENCE RATING	COMMENTS
SWC 14	1387.5	Fair	Low	Coal	Indeterminate	-	-	Abund. H. harrisii & Nothofagidites
SWC 10	1411.9	Good	Fair	Coal	P. asperopolus	Mid./E. Eocene	1	M. tenuis, I. notabilis
SWC 9	1414.9	V. good	V. good	Slst.	P. asperopolus	Mid./Early Eocene	0	M. tenuis, P. asperopolus, S. prominatus, frequent M. diversus & P. pachypolus
SWC 8	1441.9	Fair	Good	Slst.	Upper M. diversus	Early Eocene	1	M. diversus, P. pachypolus
SWC 3	1495.5	V. low	Low	Ss.	Upper M. diversus	Early Eocene	1	P. pachypolus, S. prominatus
SWC 153	1514.0	Good	Good	Ss.	Upper M. diversus	Early Eocene	1	P. pachypolus, abund. M. diversus
SWC 152	1530.4	Low	Good	Slst.	Upper M. diversus	Early Eocene	1	as above
SWC 150	1574.5	Good	Good	Slst.	Middle M. diversus	Early Eocene	1	B. elegansiformis, P. tuberculiformis P. ornatus, P. alveolatus
SWC 149	1609.0	V. low	Fair	Slst.	Middle M. diversus	Early Eocene	2	C. vanraadshooveni, P. varus
SWC 175	1611.5	Fair	Low	Coal	Middle M. diversus	Early Eocene	2	T. paenestriatus; common M. subtilis, H. harrisii and Nothofagidites
SWC 147	1614.5	V. low	Fair	Slst.	Middle M. diversus	Early Eocene	1	P. tuberculiformis
SWC 146	1621.0	Good	Fair	Coal	Middle M. diversus	Early Eocene	1	A. acutullus
SWC 174	1628.9	Good	Good	Slst.	Middle M. diversus	Early Eocene	2	B. verrucosus, D. dartmooria
SWC 144	1634.0	Low	Fair	Slst.	No older than Lower M. diversus		-	C. orthoteichus, I. notabilis
SWC 143	1638.5	V. good	Good	Slst. carb.	Middle M. diversus	Early Eocene	1	P. tuberculiformis, B. verrucosus, P. leightonii
SWC 173	1647.3	Good	Good	Coal	Middle M. diversus	Early Eocene	1	P. tuberculiformis
SWC 141	1648.5	Good	Good	Slst.	Middle M. diversus	Early Eocene	2	T. paenestriatus
SWC 172	1675.5	V. good	Good	Sh.	M. diversus	Early Eocene	-	D. dartmooria, frequent M. diversus
SWC 137	1688.7	Low	Fair	Slst.	No older than Lower M. diversus		-	I. notabilis

TABLE 1 : SUMMARY OF PALYNOLOGICAL ANALYSIS SNAPPER-4

INTERPRETATIVE DATA

SAMPLE NO.	DEPTH (m)	YIELD	DIVERSITY SPORE POLLEN	LITHOLOGY	ZONE	AGE	CONFIDENCE RATING	COMMENTS
SWC 171	1702.0	Good	Good	Slst.	M. diversus	Early Eocene	-	P. kopiensis
SWC 135	1719.7m	Fair	Low	Clyst.	Middle M. diversus	Early Eocene	1	A. acutullus
SWC 134	1728.0	Low	Fair	Slst.	Middle M. diversus	Early Eocene	2	T. heleosus, P. lapis
SWC 170	1746.5	Good	Good	Sh.	Middle M. diversus	Early Eocene	1	P. tuberculiformis
SWC 132	1765.5	Good	Fair	Slst.	Lower M. diversus	Early Eocene	0	M. diversus, C. gigantis, D. dartmooria . P. incurvatus
SWC 131	1780.3	Good	Fair	Ss.	Lower M. diversus	Early Eocene	0	I. notabilis, S. prominatus (abund.), M. diversus, C. vanradshooveni, P. varus
SWC 130	1800.6	Negligible	V. low	Slst.	Upper L. balmei	Paleocene	2	L. balmei
SWC 129	1822.0	Good	Fair	Slst.	Upper L. balmei	Paleocene	0	L. balmei common, C. gigantis V. kopukuensis
SWC 128	1849.0	Good	Good	Slst.	Upper L. balmei	Paleocene	1	L. balmei, V. kopukuensis and Gleicheniidites frequent-common
SWC 127	1856.0	Good	Low	Slst.	Upper L. balmei	Paleocene	1	L. balmei abund., V. kopukuensis
SWC 126	1867.0	Fair	Low	Clyst.	Upper L. balmei	Paleocene	1	L. balmei freq., V. kopukuensis
SWC 125	1877.0	V. Low	V. Low	Slst.	L. balmei	Paleocene	1	L. balmei
SWC 169	1889.4	Negligible	V. low	Ss.	L. balmei	Paleocene	-	L. balmei
SWC 124	1889.5	Negligible	V. low	Ss.	L. balmei	Paleocene	-	L. balmei
SWC 123	1894.3	Negligible	Low	Ss.	Indeterminate	-	-	
SWC 167	1902.0	Good	Fair	Sh.	Upper L. balmei	Paleocene	0	L. balmei common, P. incurvatus
SWC 168	1902.0	Good	Good	Sh.	L. balmei	Paleocene	1	L. balmei frequent, H. harrisii

TABLE I : SUMMARY OF PALYNOLOGICAL ANALYSIS SNAPPER-4

INTERPRETATIVE DATA

SAMPLE NO.	DEPTH (m)	YIELD	DIVERSITY SPORE POLLEN	LITHOLOGY	ZONE	AGE	CONFIDENCE RATING	COMMENTS
SWC 121	1905.0	Barren	-	Ss	-	-	-	
SWC 120	1910.0	Negligible	-	Ss	-	-	-	L. balmei
SWC 119	1918.1	Good	Good	Sh.	Upper L. balmei	Paleocene	2	L. balmei abund., V. kopukuensis, J. pieratus, I. antipodus
SWC 166	1925.0	V. low	Fair	Ss.	L. balmei	Paleocene	-	L. balmei, H. harrisii, A. obscurus
SWC 165	1933.0	Low	Fair	Ss.	Upper L. balmei	Paleocene	2	N. endurus and Gleicheniidites frequent
SWC 115	1935.5	Negligible	V. low	Ss.	Indeterminate	-	-	
SWC 164	1942.3	Negligible	V. low	Ss.	Indeterminate	-	-	
SWC 163	1945.7	Low	V. Low	Ss.	L. balmei	Paleocene	-	L. balmei
SWC 112	1953.0	V. good	Good	Slst.	Upper L. balmei	Paleocene	1	L. balmei abund., V. kopukuensis, freq. Gleicheniidites
SWC 111	1970.4	Low	Fair	Slst.	Upper L. balmei	Paleocene	2	L. balmei, P. annularis
SWC 108	1986.0	Good	Good	Slst.	Upper L. balmei	Paleocene	2	L. balmei abund., P. langstonii, V. kopukuensis, T. verrucosus,
SWC 107	2011.5	Low	Fair	Slst., coaly,	Upper L. balmei	Paleocene	2	Gleicheniidites frequent
SWC 106	2029.0	V. good	Fair	Slst.	L. balmei	Paleocene	-	L. balmei abund., H. harrisii, J. pieratus, G. retiintexta, A. homomorpha
SWC 105	2046.9	V. good	Low	Slst.	L. balmei	Paleocene	-	Abundant A. obscurus
SWC 161	2063.0	V. low	V. low	Sh.	L. balmei	Paleocene	-	frequent L. balmei
SWC 102	2078.9	V. good	Fair	Sh.	Upper L. balmei	Paleocene	1	L. balmei abund., V. kopukuensis, A. homomorpha

TABLE I : SUMMARY OF PALYNOLOGICAL ANALYSIS SNAPPER-4

INTERPRETATIVE DATA

SAMPLE NO.	DEPTH (m)	YIELD	DIVERSITY SPORE POLLEN	LITHOLOGY	ZONE	AGE	CONFIDENCE RATING	COMMENTS
SWC 101	2084.0	Low	V. Low	Ss., carb.	Lower L. balmei	Paleocene	2	L. balmei frequent, P. gemmatus
SWC 100	2104.0	Fair	Fair	Sh.	Lower L. balmei	Paleocene	2	H. elliotii and L. balmei frequent
SWC 97	2169.2	Good	Low	Slst.	Lower L. balmei	Paleocene	1	L. balmei and T. verrucosus frequent; P. angulatus abundant
SWC 96	2188.0	V. low	Low	Slst.	Indeterminate	-	-	H. elliotii; P. angulatus common
SWC 95	2211.1	Low	Low	Ss.	Eocene spore pollen only		-	
SWC 94	2226.3	Low	V. Low	Ss.	L. balmei	Paleocene	-	L. balmei, common P. angulatus
SWC 93	2246.0	Good	Low	Sh.	Lower L. balmei	Paleocene	1	L. balmei, frequent T. verrucosus I. antipodus, P. langstonii
SWC 91	2288.1	V. low	V. low	Slst.	Indeterminate	-	-	L. balmei
SWC 90	2309.4	Low	Low	Sh.	Lower L. balmei	Paleocene	0	T. verrucosus, I. antipodus
SWC 89	2328.4	Good	Fair	Sh.	Lower L. balmei	Paleocene	1	L. balmei, T. verrucosus and S. punctatus frequent
SWC 88	2352.2	Low	Fair	Sh.	Lower L. balmei	Paleocene	1	L. balmei, T. verrucosus
SWC 87	2368.0	Low	Low	Slst.	Upper T. longus	Maastrichtian	2	Gambierina > L. balmei
SWC 86	2390.0	Low	Fair	Sh.	Upper T. longus	Maastrichtian	0	T. verrucosus, S. punctatus P. gemmatus, P. otwayensis, T. sectilis
SWC 85	2407.4	Fair	Fair	Sh.	Upper T. longus	Maastrichtian	0	G. rudata frequent, S. punctatus, P. gemmatus, P. wahooensis
SWC 84	2425.0	V. Low	V. Low	Slst.	No younger than Upper T. longus			P. otwayensis

TABLE I : SUMMARY OF PALYNOLOGICAL ANALYSIS SNAPPER-4

INTERPRETATIVE DATA

SAMPLE NO.	DEPTH (m)	YIELD	DIVERSITY SPORE POLLEN	LITHOLOGY	ZONE	AGE	CONFIDENCE RATING	COMMENTS
SWC 83	2448.1	Good	Good	Slst.	Upper T. longus	Maastrichtian	0	G. rudata common, S. punctatus, T. longus, P. otwayensis, T. verrucosus
SWC 82	2465.0	V. low	V. low	Slst.	Upper T. longus	Maastrichtian	0	T. longus, S. punctatus
SWC 160	2477.0	V. low	V. low	Ss.	T. longus	Late Cretaceous	-	T. longus
SWC 80	2504.9	Good	Fair	Sh., coaly	Indeterminate	-	-	L. balmei palynoflora (caved)
SWC 79	2516.0	Low	Good	Sh.	Upper T. longus	Maastrichtian	0	T. longus, T. verrucosus, S. punctatus, P. gemmatus, P. otwayensis, G. wahooensis, T. lilliei
SWC 78	2524.4	Low	Low	Ss.	Eocene palynoflora only			
SWC 77	2532.9	V. low	Low	Ss.	Upper T. longus	Maastrichtian	1	S. punctatus, P. wahooensis
SWC 76	2550.0	V. low	Fair	Slst.	Upper T. longus	Maastrichtian	0	T. longus, S. punctatus, T. verrucosus, P. gemmatus, freq. G. rudata
SWC 75	2572.0	Barren	-	Ss.	Indeterminate		-	Eocene contaminants only
SWC 103	2640.0	V. low	Low	Slst.	Upper T. longus	Maastrichtian	1	S. punctatus, P. otwayensis
SWC 70	2650.5	Low	Low	Sh.	Upper T. longus	Maastrichtian	0	P. otwayensis, frequent G. Rudata and T. verrucosus
SWC 68	2670.0	Low	V. Low	Sh.	T. longus	Late Cretaceous	-	G. rudata relatively frequent
SWC 66	2683.5	Barren	-	Sh./Ss.	Indeterminate	-	-	
SWC 65	2688.0	Negligible	V. Low	Ss.	Indeterminate	-	-	G. rudata
SWC 63	2693.0	Low	V. Low	Sh.	Upper T. longus	Maastrichtian	1	G. rudata freq., T. verrucosus P. gemmatus

TABLE I : SUMMARY OF PALYNOLOGICAL ANALYSIS SNAPPER-4

INTERPRETATIVE DATA

SAMPLE NO.	DEPTH (m)	YIELD	DIVERSITY SPORE POLLEN	LITHOLOGY	ZONE	AGE	CONFIDENCE RATING	COMMENTS
SWC 61	2710.0	Fair	Fair	Slst.	Upper T. longus	Maastrichtian	0	G. rudata common, S. punctatus, T. lilliei
SWC 60	2713.3	V. good	Low	Coal	T. longus	Late Cretaceous	-	R. mallatus, P. cleinei, G. rudata in P. mawsonii-dominated palynoflora
SWC 59	2725.5	Low	Fair	Sh.	Upper T. longus	Maastrichtian	1	G. rudata common. P. gemmatus, P. otwayensis, T. verrucosus
SWC 58	2740.0	Low	Fair	Sh.	Upper T. longus	Maastrichtian	1	T. longus, T. verrucosus, P. gemmatus, frequent G. rudata
SWC 57	2743.6	Negligible	-	Ss.	No older than T. lilliei	Late Cretaceous		G. rudata
SWC 56	2750.7	Barren	-	Ss.	-	-	-	
SWC 55	2760.0	Negligible	-	Ss.	Indeterminate	-	-	G. rudata
SWC 54	2768.2	V. low	V. low	Ss.	Lower T. longus	Late Cretaceous	1	G. rudata, G. edwardsii, T. longus
SWC 53	2784.0	Fair	Low	Sh., carb.	T. longus	Late Cretaceous	-	G. rudata frequent, T. sectilis
SWC 52	2804.0	Low	Fair	Sh.	Lower T. longus	Late Cretaceous	2	T. lilliei, nos. G. rudata = N. endurus, D. granulatus, T. sectilis

TABLE 2

ANOMALOUS AND UNUSUAL OCCURRENCES OF SPORE-POLLEN TAXA IN SNAPPER-4

SAMPLE NO.	DEPTH(m)	ZONE	TAXON	COMMENTS
SWC 35	1258.5	P. tuberculatus (0)	Myrtaceidites eucalyptoides	
SWC 35	1258.5	P. tuberculatus (0)	Foveotriletes crater	Rare sp.
SWC 34	1260.0	Middle N. asperus (1)	Milfordia homeopunctata	Rare sp.
SWC 33	1265.0	Middle N. asperus (1)	Beaupreadites trigonalis	Uncommon sp.
SWC 33	1265.0	Middle N. asperus (1)	Tricolpites arcilineatus	Very rare ms. sp. (A. Partridge)
SWC 32	1266.5	Lower N. asperus (2)	Rhamnaceae	Modern taxon
SWC 32	1266.5	Lower N. asperus (2)	Wetzeliella glabra	Rare dinoflagellate
SWC 32	1266.5	Lower N. asperus (2)	Verrucatosporites attinatus	Rare sp.
SWC 30	1273.0	Lower N. asperus (2)	Parvisaccites catastus	
SWC 29	1274.0	Lower N. asperus (0)	cf. Amperea	Modern Euphorbiaceae
SWC 29	1274.0	Lower N. asperus (0)	Cunoniaceae	Di-and tricolpate spp.
SWC 29	1274.0	Lower N. asperus (0)	Dodonaea	Modern taxon
SWC 29	1274.0	Lower N. asperus (0)	Phyllocladidites palaeogenicus	Rare sp.
SWC 29	1274.0	Lower N. asperus (0)	Lygistepollenites balmei	(Rare reworked) Paleocene sp.
SWC 28	1275.4	Lower N. asperus (0)	Camarozonosporites australiensis	V. rare in Eocene
SWC 27	1279.0	Lower N. asperus (1)	Proteacidites reticulatus	Rare below Middle N. asperus Zone.
SWC 25	1287.0	Lower N. asperus (0)	Anacolosidites rotundus	Rare sp.
SWC 25	1287.0	Lower N. asperus (0)	Rugulatisporites trophus	Rare sp.
SWC 25	1287.0	Lower N. asperus (0)	Clavatipollenites glarius	Very rare sp.
SWC 25	1287.0	Lower N. asperus (0)	Phyllocladidides palaeogenicus	Rare sp.
SWC 18	1346.5	Lower N. asperus (1)	Anacolosidites rotundus	As for SWC 25
SWC 16	1362.0	(P. asperopolus)	Proteacidites callosus	In Nothofagidites, H. harrisii-dominated coal palynoflora
SWC 15	1372.0	(P. asperopolus)	Tetracolpites psilatus	Ms. sp. (Macphail)
SWC 14	1387.5	(P. asperopolus)	Beaupreadites verrucosus	In H. harrisii-dominated coal palynoflora

TABLE 2

ANOMALOUS AND UNUSUAL OCCURRENCES OF SPORE-POLLEN TAXA IN SNAPPER-4

SAMPLE NO.	DEPTH(m)	ZONE	TAXON	COMMENTS
SWC 14	1387.5	(P. asperopolus)	Proteacidites echinatus	V. rare ms. sp. (Macphail). As above.
SWC 14	1387.5	(P. asperopolus)	Tricolpites reticulatus	Ms. sp (Stover)
SWC 10	1411.9	P. asperopolus (1)	Intratriporopollenites notabilis	In H. harrisii, P. demarcatus-dominated coal palynoflora
SWC 9	1414.9	P. asperopolus (0)	Spinizonecolpites prominatus	Top of range of rare sp. (marine siltstone).
SWC 9	1414.9	P. asperopolus (0)	Tricolpites reticulatus Cookson	Rare sp.
SWC 9	1414.9	P. asperopolus (0)	Tricolpites retequetrus	Not prev. recorded below Middle N. asperus Zone
SWC 3	1495.5	Upper M. diversus (1)	Spinizonocolpites prominatus	Rare sp. (non marine sandstone)
SWC 153	1514.0	Upper M. diversus (1)	Gemmatricolporites cf. gestus	
SWC 153	1514.0	Upper M. diversus (1)	Proteacidites echinatus	As for SWC 14
SWC 153	1514.0	Upper M. diversus (1)	Proteacidites callosus	Uncommon sp.
SWC 149	1609.0	(Middle M. diversus)	Palynoflora of thick walled spore spp. including C. vanraadshooveni, P. varus & V. kopukuensis	
SWC 152	1530.4	Upper M. diversus (1)	Proteacidites xestoformis	Uncommon sp.
SWC 149	1609.0	(Middle M. diversus)	Aequitriradites verrucosus	Cretaceous sp.
SWC 146	1621.0	(Middle M. diversus)	Proteacidites lapis	In Gleicheniidites coal palynoflora
SWC 174	1628.9	Middle M. diversus (2)	Proteacidites recavus	Very rare below upper P. asperopolus Zone; in marginal marine siltstone
SWC 174	1628.9	Middle M. diversus (2)	Tricolpites incisus	Not prev. recorded below P. asperopolus Zone
SWC 174	1628.9	Middle M. diversus (2)	Deflandrea mooria	Lower M. diversus Zone dinoflagellate
SWC 144	1634.0	(Middle M. diversus)	Cyathidites gigantis	Reworked ? Sample contains 5 spores of L. balmei
SWC 143	1638.5	Middle M. diversus (1)	Tricolpites circumlumenus	Ms. sp. (Macphail)
SWC 143	1638.5	Middle M. diversus (1)	Myrtaceoipollenites australis	Uncommon sp.
SWC 173	1647.3	Middle M. diversus (1)	Proteacidites tuberculiformis	Common in coal palynoflora
SWC 173	1647.3	Middle M. diversus (1)	Anacolosidites rotundus	Common in coal palynoflora

TABLE 2

ANOMALOUS AND UNUSUAL OCCURRENCES OF SPORE-POLLEN TAXA IN SNAPPER-4

SAMPLE NO.	DEPTH(m)	ZONE	TAXON	COMMENTS
SWC 173	1647.3	Middle _M. diversus_ (1)	_Podosporites microsaccatus_	Common in coal palynoflora
SWC 141	1648.5	Middle _M. diversus_ (2)	Umbelliferae	Modern taxon
SWC 172	1675.5	(Middle _M. diversus_)	_Proteacidites rugulatus_	35 um, as for SWC 174 (_P. recavus_)
SWC 172	1675.5	(Middle _M. diversus_)	_Clavifera_ cf. _vultuosus_	V. rare ms. sp. (A. Partridge)
SWC 172	1675.5	(Middle _M. diversus_)	_Foveogleicheniidites_	Ms. genus
SWC 172	1675.5	(Middle _M. diversus_)	_Deflandrea dartmooria_	As for SWC 174
SWC 171	1702.0	(Middle _M. diversus_)	_Foveotriletes balteus_	
SWC 132	1765.5	Lower _M. diversus_ (2)	_Banksieaidites elongatus_	Not prev. recorded below Middle _M. diversus_ Zone
SWC 132	1765.5	Lower _M. diversus_ (2)	_Tricolporites adelaidensis_	Rare below Middle _M. diversus_ Zone
SWC 132	1765.5	Lower _M. diversus_ (2)	_Tricolporites moultonii_	As above
SWC 132	1765.5	Lower _M. diversus_ (2)	_Proteacidites rugulatus_	V. rare below _P. asperopolus_ Zone
SWC 129	1822.0	Upper _L. balmei_ (0)	_Tricolporites scabratus_	
SWC 129	1822.0	Upper _L. balmei_ (0)	_Foveotriletes balteus_	
SWC 128	1849.0	Upper _L. balmei_ (1)	_Matonisporites ornamentalis_	Frequent
SWC 126	1867.0	Upper _L. balmei_ (1)	_Tricolpites circumlumenus_	Rare ms. sp. (Macphail)
SWC 167	1902.0	(Upper _L. balmei_)	_Tetracolporites verrucosus_	Rare above Lower _L. balmei_ Zone
SWC 119	1918.1	Upper _L. balmei_ (1)	_Jaxtacolpus pieratus_	V. rare above Lower _L. balmei_ Zone
SWC 166	1925.0	(Upper _L. balmei_)	_Tricolpites vergilius_	Late Cretaceous ms. sp. (Partridge)
SWC 165	1933.0	Upper _L. balmei_ (2)	_Triporopollenites ambiguus_	Not prev. (?) recorded below _M. diversus_ Zone
SWC 163	1945.7	(Upper _L. balmei_)	_Periporopollenites vesicus_	Eocene sp.
SWC 112	1953.0	Upper _L. balmei_ (1)	Pantocolpate sp.	
SWC 108	1986.0	Upper _L. balmei_ (2)	_Tetracolporites verrucosus_	As for SWC 167
SWC 108	1986.0	Upper _L. balmei_ (2)	_Proteacidites_ cf. _reflexus_	

TABLE 2

ANOMALOUS AND UNUSUAL OCCURRENCES OF SPORE-POLLEN TAXA IN SNAPPER-4

SAMPLE NO.	DEPTH(m)	ZONE	TAXON	COMMENTS
SWC 107	2011.5	Upper L. balmei (2)	Gleichenidites sp. nov.	Apiculate
SWC 107	2011.5	Upper L. balmei (2)	Beaupreadites elegansiformis	V. rare below Middle M. diversus Zone
SWC 106	2029.0	(Upper L. balmei)	Jaxtacolpus pieratus	As for SWC 119 (marine siltstone)
SWC 106	2019.0	(Upper L. balmei)	Parvisaccites catastus	
SWC 103	2078.9	Upper L. balmei (1)	Tricolporites gigantis	Rare ms. sp. (Macphail)
SWC 96	2188.0	(Lower L. balmei)	Dacrycarpites australiensis	V. rare in Paleocene
SWC 93	2246.0	Lower L. balmei (1)	Elphredripites notensis	Rare sp.
SWC 92	2265.3	Lower L. balmei (0)	Polycolpites langstonii	Rare in this zone
SWC 89	2328.4	Lower L. balmei (1)	Schizaea digitatoides	Rare sp.
SWC 89	2328.4	Lower L. balmei (1)	Aquitriradites spinulosus	Typically Late Cretaceous
SWC 89	2328.4	Lower L. balmei (1)	Foveosporites canalis	Typically Late Cretaceous
SWC 88	2352.2	Lower L. balmei (1)	Schizaea digitatoides	As for SWC 89
SWC 86	2390.1	Upper T. longus (1)	Peromonolites cf. baculatus	
SWC 80	2504.9	(Upper T. longus)	Cupanieidites orthoteichus	Not prev. recorded below M. diversus Zone, not apparently caved.
SWC 79	2516.0	Upper T. longus (0)	Dacrycarpites australiensis	Rare in Maastrichtian
SWC 79	2516.0	Upper T. longus (0)	Periporopollenites demarcatus	
SWC 79	2516.0	Upper T. longus (0)	Gephyrapollenites wahooensis	Rare sp.
SWC 76	2550.0	Upper T. longus (0)	Phyllocladidites palaeogenicus	Rare sp.
SWC 103	2640.0	Upper T. longus (1)	Proteacidites cf. protograndis	Ms. sp. (Macphail)

APPENDIX 3

SNAPPER-4

QUANTITATIVE LOG ANALYSIS

Interval: 1260 - 2800m KB

Analyst : D.J. Henderson

Date : December, 1983

QUANTITATIVE LOG ANALYSIS SNAPPER-4

INTERVAL EVALUATED

1260m - 2800m KB.

LOGS AVAILABLE

DLL-MSFL-GR	1509m - 779m;	2820m - 1500m
LDT-GR	1513m - 779m	
BHC-CNL-GR	1513m - 779m;	2821m - 1500m
LDT-CNL-GR	2821m - 1500m	

ANALYSIS METHOD

1. The EALOG program ENV 1.1 was used to correct LLD, MSFL, GR and CNL logs for borehole environmental effects. The CNL logs were converted to sandstone porosity units by adding 0.04 to environmentally corrected log readings.

2. Porosity, water saturation and shale fraction were determined using a Dual Water Model as described by Coates et al. (1982).

   (a) The gamma ray log was used to estimate shale fraction for the interval 1260m - 1500m using the relationships:

   $$VSH = .33(2^{(2\ VCLGR)} - 1)$$

   $$\text{where } VCLGR = \frac{GR - GRclean}{GRshale - GRclean}$$

   (b) For the interval 1500m - 2800m the shale fraction was estimated using the relationship:

   $$SwB = \frac{mx - mclean}{mshale - mclean}$$

   where mx, mclean and mshale are the slopes of the log-matrix line, water-matrix line and wet clay line respectively.

   (c) Bulk density and neutron porosity values in the N-1 reservoir hydrocarbon zone were corrected for hydrocarbon effects.

   (i) Expected grain density was calculated using the relationships:

   $$ERHOMAA = \rho ma + VSH (\rho mashale - ma)$$

   $$\text{where } \rho ma\ shale = \frac{\rho b\ shale - \emptyset N\ shale}{1 - \emptyset N\ shale}$$

   (ii) Apparent grain density was calculated using the relationship:

   $$RHOMAA = \frac{\rho b - \emptyset N}{1 - \emptyset N}$$

   (iii) Where RHOMA < ERHOMA, the density and neutron log values were corrected for hydrocarbon effect by moving log points along the vectors:

   $$\Delta b / \Delta \emptyset N = 1.125 \quad \text{for gas}$$
   $$\Delta b / \Delta \emptyset N = 1.960 \quad \text{for oil}$$

   until RHOMAA = ERHOMA

(d) Total porosity was determined using the relationship:

$$\varnothing t = \frac{\varnothing D \times \varnothing dcN - \varnothing N \times \varnothing dcD}{\varnothing dcN - \varnothing dcD}$$

where ØdcN and ØdcD are apparent neutron and density porosity values for a dry clay point. Density and neutron values are corrected for hydrocarbon effect.

(e) Where $\Delta\rho b$ from the LDT log indicated bad hole conditions, total porosity was estimated from the sonic log using the Hunt-Raymer relationship adjusted to match total porosity in good hole conditions:

$$\varnothing t_S = .63\ \varnothing_S\ (H\text{-}R) + .055$$

(f) Apparent bound (clay) and free water resistivities were determined using the relationships:

$$Rwa = \varnothing t^m \times Rt$$
$$RwF = RwA \text{ in clean water sand}$$
$$RwB = RwA \text{ in shale zones}$$

(g) Theoretical deep resistivity (Ro) assuming 100% water saturation was calculated using the relationship:

$$Ro = \frac{RwF \times RwB}{\varnothing t^m\ [RwB + SwB\ (RwF - RwB)]}$$

Saline water was assumed to occupy free pore space in the N-1 reservoir hydrocarbon zone. This is supported by drainage capillary pressure data.

(h) Total water saturation was calculated from relationship:

$$Swt = \left(\frac{RO}{RT}\right)^{1/n}$$

(i) The Dual Water Model assumes that hydrocarbons exist only in free pore space. Effective water saturation (Swe) was determined using the relationship:

$$Swe = 1 - \frac{\varnothing t}{\varnothing e}\ (1 - SwT)$$

Zones with high shale content where Øt/Øe becomes large were modelled to ensure that Swe = 1 where shale content exceeds 0.65.

(j) Effective porosity was calculated using the relationship:

$$\varnothing e = \varnothing t\ [1 - VSH^{(2-3.08\ VSH)}]$$

This relationship is an adaptation of the SARABAND porosity model discussed by Clavier et al. (1977). The relationship recognises that shale occurs as structural grains, disseminations and laminations. Effective porosity is assumed to be 0 where the shale fraction exceeds 0.65.

(k) For the N-1 reservoir, hydrocarbon pore volume was determined using the relationship:

$$PHISH = (1 - SwT)\ \varnothing t$$

(l) Cumulative hydrocarbon pore volume.

$$HPORT = \sum \left[\frac{PHISH}{NPER}\right]$$

where NPER is the analysis sample density.

Variable Analysis Parameters

Rm	=	0.135,	1510m-1260m; .081, 2920m-1510m
Rmf	=	0.086,	1510m-1260m; .066, 2820m-1510m
Rmc	=	0.241,	1510m-1260m; .110, 2820m-1510m
a	=	1.000	
m	=	2.000	
n	=	2.000	
ρ ma	=	2.650 g/cc	
ρ shale	=	2.420,	1510m-1260m; increasing to 2.680 at 2800m
ØN shale	=	0.430,	1510m-1260m; decreasing to 0.325 at 2800m
ØdcD	=	0.195,	1510m-1260m; depth function 1510m-2800m
ØdcN	=	0.212,	1510m-1260m; depth function 1510m-2800m
RwF	=	0.140,	1260m-1414.5m; .76, 1414.5m-1510m; variable to 2800m
RwB	=	0.980,	1260m-1510m; variable to 2800m
GRclean	=	15	
GRshale	=	115	

Summary Data

N-1 Reservoir:

Net gas sand	76.75m MD	=	76.75m TVD
Net oil sand	4.00m MD	=	4.00m TVD
Possible net oil sand	1.25m MD	=	1.25m TVD

Intra Latrobe Section:

Net gas sand	16.25m MD	=	16.25m TVD
Possible net hydrocarbon	58.25m MD	=	58.25m TVD

Net gas sand occurs in 3 zones. Possible net hydrocarbon sand occurs in 44 zones, 30 which are less than 1 metre thick. In the intra Latrobe section much of the apparent net hydrocarbon bearing sand occurs in shaley sections, some of which overly apparent water productive clean sands.

D.J. HENDERSON

SUMMARY OF RESULTS

Interval Evaluated: 1260 - 2800m

Depth Interval (m)	Net* Thickness (m)	Porosity	Water Saturation	Remarks
1264.5-1268.5	4.0	.120-.230(.175)	.17-.32 (.22)	Gas, shaly
1271.0-1273.0	2.0	.105-.145(.130)	.22-.45(.32)	Gas, shaly
1273.25-1274.25	1.0	.110-.200(.170)	.18-.28(.22)	Gas, shaly
1278.25-1280.0	1.75	.115-.180(.160)	.25-.41(.32)	Gas, shaly
1285.5-1288.5	3.0	.150-.190(.170)	.38-.55(45)	Gas, shaly
1288.5-1305.25	16.75	.165-.340(.275)	.03-.35(.08)	Gas, clean, possible mud invasion
1308.5-1310.5	2.0	.170-.300(.220)	.14-.28(.23)	Gas, shaly
1312.0-1312.75	0.75	.145-.225(.180)	.16	Gas, shaly
1314.5-1318.25	3.75	.195-.300(.244)	.11-.26(.21)	Gas, shaly to top
1319.75-1328.25	8.5	.190-.330(.245)	.05-.17(09)	Gas, most clean
1332.5-1343.25	10.75	.110-.300(.260)	.04-.33(.07)	Gas, clean
1353.5-1361.5	8.0	.235-.315(.265)	.06-.44(.09)	Gas, clean
1364.25-1365.5	1.25	.190-.260(.235)	.13-.29(.21)	Gas, clean
1368.0-1370.0	2.0	.150-.290(.210)	.11-.42(.29)	Gas, carbonaceous at base
1374.0-1374.75	0.75	.250-.270(.260)	.10-.12(.11)	Gas,carbonaceous, shaly
1377.0-1378.0	1.0	.175-.295(.245)	.10-.45(.25)	Gas, clean
1379.5-1381.25	1.75	.170-.305(.265)	.06-.34(.12)	Gas, clean
1384.25-1384.75	0.5	.115	.21	Gas, dolomitic
1391.5-1394.25	2.75	.150-.320(.270)	.07-.13(.09)	Gas, clean
1403.0-1407.5	4.5	.185-.305(.270)	.12-.15(.14)	Gas, clean
1407.5-1411.5	4.0	.185-.305(.270)	.12-.30(.16)	Oil, clean
1413.0-1414.25	1.25	.160-.255(.220)	.25-.46(.33)	Possible oil, thin shaly
1417.75-1441.0	0	.155-.345(.270)	1.0	Water, clean, some dolomitic
1443.5-1445.0	0	.110-.260(.205)	1.0	Water, shaly carbonaceous
1447.75-1450.25	0	.185-.340(.300)	1.0	Water, shaly, carbonaceous
1451.75-1452.5	0	.115-.150(.130)	1.0	Water, shaly
1454.25-1459.25	0	.115-.285(.205)	1.0	Water, clean, dolomitic at base
1462.75-1471.75	0	.105-.335(.244)	1.0	Water, clean, dolomitic at base
1471.75-1477.5	0	.105-.235(.180)	1.0	Water, clean, dolomitic
1477.5-1485.0	0	.135-.290(.220)	1.0	Water, some dolomitic
1486.0-1495.0	0	.110-.320(.235)	1.0	Water, clean
1497.25-1500.0	0	.105-.235(.175)	1.0	Water, shaly

SUMMARY OF RESULTS

Interval Evaluated: 1260 - 2800m

Depth Interval (m)	Net* Thickness (m)	Porosity	Water Saturation	Remarks
1502.25-1505.5	0	.145-.215(.180)	1.0	Water, clean
1505.5-1512.5	0	.195-.325(.260)	1.0	Water, clean
1513.0-1520.0	0	.145-.30(.225)	1.0	Water, clean, dolomitic at base
1522.75-1527.25	0	.150-.280(.240)	1.0	Water, clean
1531.0-1545.0	0	.205-.30(.265)	1.0	Water, clean
1560.5-1573.25	0	.130-.305(.240)	1.0	Water, shaly at top, some dolomitic
1574.25-1607.5	0	.205-.30(.27)	1.0	Water, clean
1623.0-1625.5	0	.210-.265(.244)	1.0	Water, clean
1631.25-1632.0	0	.180-.225(.205)	1.0	Water, shaly
1633.5-1634.25	0	.145-.170(.155)	1.0	Water, shaly
1641.5-1644.5	0	.170-.285(.240)	1.0	Water, most clean
1649.75-1650.25	0	.170	1.0	Water, shaly
1651.25-1652.5	0	.145-.260(.20)	1.0	Water, carbonaceous
1654.0-1656.0	0	.250-.285(.260)	1.0	Water, clean
1657.75-1658.5	0	.235-.265(.250)	1.0	Water, shaly
1660.5-1662.0	0	.145-.250(.230)	1.0	Water, clean
1666.25-1670.5	0	.120-.305(.235)	.65-1.0	Possible hydrocarbons in shaly section
1674.0-1674.75	0	.190-.225(.210)	1.0	Shaly, carbonaceous
1678.25-1684.25	0	.130-.270(.195)	.75-.95	Shaly in part
1686.75-1687.25	0.5	.125	.60	Hydrocarbons, shaly
1688.5-1692.0	0	.120-.265(.220)	1.0	Clean
1696.25-1696.75	0	.115	1.0	Shaly
1702.0-1702.5	0	.155	1.0	
1720.5-1722.5	0	.160-.245(.220)	1.0	Water, most clean
1723.25-1724.0	0	.120-.235(.195)	1.0	Water, carbonaceous
1724.75-1726.0	0	.125-.170(.150)	1.0	Water, shaly
1729.0-1730.25	0	.165-.200(.190)	1.0	Water, shaly
1750.75-1759.25	0	.120-.320(.255)	1.0	Water, shaly at top
1759.25-1761.0	0	.120-.160(.140)	1.0	Water, shaly
1762.75-1763.25	0	.180	1.0	Water, shaly, carbonaceous
1764.0-1764.5	0	.140	1.0	Water, very shaly, carbonaceous
1775.25-1778.75	0	.155-.220(.195)	1.0	Water
1779.5-1780.0	0	.160	1.0	Water, very shaly
1780.5-1787.75	0	.110-.285(.240)	1.0	Water, shaly at base
1807.5-1808.5	0	.120-.160(.140)	1.0	Water, shaly
1827.25-1829.0	0	.120-.215(.170)	.65-.88(.74)	Possible hydrocarbons, shaly
1830.0-1837.0	0	.160-.260(.235)	.46-.86(.71)	Possible hydrocarbons, most clean
1837.5-1843.5	0	.110-.259(.215)	.54-1.0(.76)	Possible hydrocarbons, shaly at base
1852.0-1852.75	0	.145-.155(.150)	.70	Possible hydrocarbons, shaly

SNAPPER-4

SUMMARY OF RESULTS

Interval Evaluated: 1260 - 2800m

Depth Interval (m)	Net* Thickness (m)	Porosity	Water Saturation	Remarks
1862.75-1863.75	0	.165-.260(.215)	.90	Shaly
1868.75-1869.75	0	.12	.71	Possible hydrocarbons
1877.0-1882.75	0	.120-.245(.195)	.59-1.0(.82)	Possible hydrocarbons at top, some shaly
1884.5-1885.25	0.5	.140-.190(.170)	.65	Possible hydrocarbons
1888.75-1890.0	1.25	.140-.240(.205)	.42-.63(.52)	Gas, clean
1890.75-1892.75	1.5	.110-.160(.130)	.49-.76(.60)	Gas, shaly
1892.75-1895.50	2.25	.170-.255(.220)	.37-.61(.44)	Gas, shaly at top
1904.5-1906.5	2.0	.120-.210(.155)	.44-1.0(.55)	Hydrocarbons, shaly at base
1909.0-1913.25	4.25	.110-.255(.215)	.35-.56(.41)	Gas, most clean
1916.25-1917.0	0	.120-.175(.160)	.70-1.0(.79)	Water Productive, shaly
1918.75-1920.0	0	.100	1.0	Shaly
1923.0-1927.0	3.0	.135-.215(.180)	.52-1.0(.60)	Hydrocarbons, most shaly
1931.75-1933.75	1.0	.150-.220(.195)	.47-.96(.65)	Hydrocarbons
1934.25-1937.0	0	.130-.190(.170)	.63-.86(.76)	Water productive, shaly
1942.0-1943.25	1.25	.185-.245(.215)	.52-1.0(.59)	Hydrocarbons, carbonaceous
1945.0-1947.25	0	.135-.235(.190)	.48-.80(.67)	Water productive, most clean
1949.0-1949.75	0.75	.155-.270(.220)	.60	Hydrocarbons
1953.75-1954.75	0	.06	.70	Water productive, very shaly
1963.25-1966.0	2.75	.135-.205(.170)	.37-.56(.42)	Hydrocarbons, most shaly
1971.0-1971.5	0	.10	.56	Hydrocarbons, very shaly
1973.0-1974.25	1.25	.185-.265(.230)	.50	Hydrocarbons, clean, carbonaceous
1975.5-1976.25	0	.10	.50	Hydrocarbons, very shaly
1977.0-1979.25	2.25	.155-.270(.200)	.42-.57(.49)	Hydrocarbons, shaly
1983.75-1985.0	0	.20-.225(.215)	.80	Water productive
1986.75-1988.75	0	.135-.175(.155)	.57-.90(.72)	Possible hydrocarbons, shaly
1988.75-1991.0	0	.180-.245(.225)	.77	Possible hydrocarbons, shaly at top
1992.0-1995.0	0	.165-.215(.180)	.65-.95	Hydrocarbons at top, most shaly
1998.5-2000.0	0.75	.175-.235(.210)	.63	Hydrocarbons, thin
2001.5-2002.75	0.5	.150-.210(.180)	.63	Hydrocarbons, shaly, thin
2006.25-2007.0	0	.145-.190(.175)	1.0	Water, shaly
2016.5-2019.5	0	.165-.260(.210)	.80	Water productive, some shaly

SNAPPER-4

SUMMARY OF RESULTS

Interval Evaluated: 1260 - 2800m

Depth Interval (m)	Net* Thickness (m)	Porosity	Water Saturation	Remarks
2023.0-2025.0	0	.13	.81	Water productive, very shaly
2031.0-2033.0	0	.08	.64-.82(.68)	Water productive, tight
2034.75-2035.25	0	.09	.90	Thin
2039.0-2040.5	0	.095-.165(.145)	.73-.81(.77)	Water productive
2047.75-2049.0	0	.08-.125(.105)	.70-.80(.75)	Water productive, shaly
2063.5-2066.25	0	.05-.175(.115)	.60-.78(.67)	Water productive, shaly
2067.0-2069.75	0	.170-.255(.230)	.58-1.0	Possible hydrocarbons at top
2071.25-2072.75	0	.125-.225(.180)	.78-.90(.82)	Water productive, most shaly
2075.5-2077.75	0	.080-.105(.085)	.87-.99(.93)	Water, very shaly
2083.25-2084.75	1.5	.155-.190(.175)	.49-.65(.55)	Hydrocarbons
2088.5-2091.5	3.0	.130-.180(.145)	.43-.80(.50)	Hydrocarbons, shaly
2094.25-2095	0.5	.140	.51-.82(.62)	Hydrocarbons, thin, shaly
2109.5-2118.0	0	.125-.255(.210)	.66-1.0(.79)	Possible hydrocarbons, most clean
2125.25-2136.0	0	.165-.265(.240)	1.0	most clean
2151.0-2159.5	0	.155-.255(.225)	1.0	Clean
2160.0-2162.0	0	.135-.155(.145)	1.0	Shaly
2171.0-2172.25	0	.065-.110(.085)	.86	Water productive, very shaly
2174.25-2177.25	0	.195-.285(.240)	1.0	Clean
2190.25-2197.25	0	.120-.245(.185)	1.0	Shaly to top
2200.0-2201.25	0	.125-.195(.160)	.69-.87(.76)	Water productive, clean
2202.25-2205.75	0	.120-.245(.200)	1.0	Clean
2209.5-2210.25	0	.120-.270(.210)	1.0	Clean
2211.5-2218.5	0	.165-.255(.220)	1.0	Most clean
2218.5-2222.5	0	.160-.220(.180)	1.0	Clean
2227.75-2229.5	0	.135-.160(.150)	.90	Shaly, water productive
2248.75-2249.25	0	.140	.85	Shaly, water productive
2251.75-2252.25	0	.140	.85	Shaly, water productive
2260.25-2260.75	0	.15	1.0	Clean
2266.5-2271.0	0	.175-.210(.195)	.55-1.0(.80)	Hydrocarbons at top, shaly at top
2312.5-2313.5	0	.140-.145(.145)	.85	Water productive, shaly
2316.25-2317.25	0.5	.130-.170(.150)	.52-.75(.63)	Hydrocarbons, shaly
2353.5-2355.5	0	.080-.110(.095)	.48-.80(.61)	Hydrocarbons, shaly, tight
2355.5-2358.75	0	.130-.225(.185)	.73-.90(.79)	Possible hydrocarbons, clean
2361.75-2362.5	0	.135	.61	Hydrocarbons, very shaly
2364.0-2365.25	0	.190-.210(.200)	.51-.86(.66)	Possible hydrocarbons, clean
2370.0-2373.0	0	.135-.200(.165)	.73-.91(.81)	Water productive, shaly at base

SUMMARY OF RESULTS

Interval Evaluated: 126C - 2800m

Depth Interval (m)	Net* Thickness (m)	Porosity	Water Saturation	Remarks
2376.5-2379.5	0	.175-.235(.215)	.40-.94(.75)	Possible hydrocarbons at top, clean
2380.25-2382.5	0	.145-.200(.175)	.61-1.0(.80)	Water productive, clean
2397.75-2399.0	0	.045-.110(.075)	.44-.70(.54)	Hydrocarbons, very shaly
2401.25-2402.25	0	.080-.110(.100)	.49-.58(.53)	Hydrocarbons, very shaly
2405.0-2406.25	.75	.125-.180(.155)	.41-.87(.64)	Hydrocarbons, most shaly
2417.5-2418.0	0	.085	.48-.77(.58)	Hydrocarbons, shaly
2421.75-2422.25	0	.085	.59	Hydrocarbons, shaly
2426.75-2428.5	0	.070-.110(.090)	.47-.55(.51)	Hydrocarbons, shaly
2434.5-2435.25	0.5	.125	.49-1.0(.71)	Hydrocarbons, shaly
2441.0-2442.0	0.5	.155-.215	.49-1.0(.77)	Hydrocarbons, clean
2442.5-2443.5	1.0	.140-.190(.160)	.58-.80(.65)	Hydrocarbons
2444.75-2445.25	0.5	.135	.59	Hydrocarbons, shaly
2449.25-2450.0	0.75	.160	.50	Hydrocarbons, some shaly
2457.0-2458.25	0	.060-.110(.075)	.50-.73(.62)	Hydrocarbons, shaly
2471.75-2472.5	0	.080	.50-.88(.65)	Hydrocarbons, very shaly
2475.5-2477.75	0	.125-.195(.170)	.69-.98(.83)	Water productive, shaly at top
2479.75-2480.5	0	.055-.160(.110)	.52-.70(.60)	Hydrocarbons, shaly at top
2481.5-2484.25	0.5	.140-.180(.165)	.55-.92(.75)	Possible hydrocarbons, most clean
2489.5-2495.5	1.5	.130-.220(.185)	.38-.88(.62)	Hydrocarbons at top, shaly at top
2498.25-2499.0	0.75	.120-.125(.125)	.46-.67(.53)	Hydrocarbons, shaly
2509.25-2509.75	0.5	.130	.51	Hydrocarbons, thin, shaly
2511.25-2512.5	0	.050-.090(.070)	.55-.79(.66)	Hydrocarbons, very shaly
2523.25-2530.25	7.0	.120-.205(.155)	.34-.62(.47)	Gas, clean
2533.5-2534.25	0.5	.060-.145(.085)	.58-.75(.63)	Hydrocarbons, most shaly
2546.5-2547.25	0	.075-.090(.080)	.50-.63(.55)	Hydrocarbons, shaly
2558.75-2560.75	0	.050-.10(.075)	.48-.68(.61)	Hydrocarbons, most shaly
2560.75-2562.25	0	.125-.150(.135)	.56-.82(.70)	Possible hydrocarbons
2564.25-2566.25	0.75	.160-.185(.170)	.41-.83(.65)	Hydrocarbons, shaly at top
2566.25-2568.25	0	.145-.165(.155)	.85-.90(.87)	Water, clean
2569.25-2570.75	0	.060-.170(.120)	.94	Water
2574.25-2575.25	0.5	.155-.185(.170)	.49-.98(.73)	Hydrocarbons at top
2589.25-2590.0	0.5	.130-.170(.150)	.55	Hydrocarbons, clean
2592.5-2593.0	0.5	.135-.165(.150)	.58	Hydrocarbons, thin, shaly

SUMMARY OF RESULTS

Interval Evaluated: 1260 - 2800m

Depth Interval (m)	Net* Thickness (m)	Porosity	Water Saturation	Remarks
2605.5-2606.0	0.5	.140	.58	Hydrocarbons, thin, shaly
2608.0-2609.25	0	.120	.44-.89(.60)	Hydrocarbons, shaly
2612.75-2613.25	0	.08	.64	Hydrocarbons, shaly, thin
2623.5-2624.25	0.5	.135-.160(.145)	.40-.60(.48)	Hydrocarbons, shaly
2628.25-2633.25	5.0	.150-.190(.165)	.39-.70(.62)	Hydrocarbons, clean
2635.0-2635.5	0.5	.125	.51	Hydrocarbons, shaly
2640.0-2640.5	0	.08	.60	Hydrocarbons, shaly
2652.5-2655.0	0	.05-.145(.115)	.47-.83(.66)	Hydrocarbons at top, shaly at top
2658.75-2663.25	0,5	.060-.21(.14)	.64-.87	Possible hydrocarbons, most clean
2666.0-2668.75	2.25	.11.5-.185(.145)	.63	Hydrocarbons, shaly at top
2676.0-2678.25	1.0	.125-.145(.135)	.39-.76(.65)	Possible hydrocarbons, shaly at top
2683.75-2688.25	4.5	.125-.180(.150)	.36-.61(.44)	Hydrocarbons, clean
2690.75-2691.5	0.75	.150	.39	Hydrocarbons, clean
2698.75-2702.5	1.75	.130-.155(.140)	.37-.73(.55)	Hydrocarbons
2742.25-2752.25	5.5	.120-.165(.145)	.40-.80(.64)	Possible hydrocarbons, most clean
2767.25-2770.25	3.0	.125-.170(.140)	.36-.58(.45)	Hydrocarbons, clean
2777.5-2778.25	0.5	.135	.61	Hydrocarbons, clean
2789.5-2791	?	.065-.245(.200)	.34-.60(.40)	Hydrocarbons; porosity suspect due to bad hole.

PE601251

This is an enclosure indicator page.
The enclosure PE601251 is enclosed within the container PE902529 at this location in this document.

The enclosure PE601251 has the following characteristics:

ITEM_BARCODE =	PE601251
CONTAINER_BARCODE =	PE902529
NAME =	Log Analysis
BASIN =	GIPPSLAND
PERMIT =	
TYPE =	WELL
SUBTYPE =	WELL_LOG
DESCRIPTION =	Log Analysis
REMARKS =	
DATE_CREATED =	29/09/83
DATE_RECEIVED =	12/10/84
W_NO =	W827
WELL_NAME =	Snapper-4
CONTRACTOR =	ESSO
CLIENT_OP_CO =	ESSO

(Inserted by DNRE - Vic Govt Mines Dept)

PE601253

This is an enclosure indicator page.
The enclosure PE601253 is enclosed within the container PE902529 at this location in this document.

The enclosure PE601253 has the following characteristics:

```
     ITEM_BARCODE = PE601253
CONTAINER_BARCODE = PE902529
             NAME = Log Analysis
            BASIN = GIPPSLAND
           PERMIT =
             TYPE = WELL
          SUBTYPE = WELL_LOG
      DESCRIPTION = Log Analysis
          REMARKS =
     DATE_CREATED = 13/10/83
    DATE_RECEIVED = 12/10/84
             W_NO = W827
        WELL_NAME = Snapper-4
       CONTRACTOR = ESSO
     CLIENT_OP_CO = ESSO
```

(Inserted by DNRE - Vic Govt Mines Dept)

PE601254

This is an enclosure indicator page.
The enclosure PE601254 is enclosed within the container PE902529 at this location in this document.

The enclosure PE601254 has the following characteristics:

ITEM_BARCODE = PE601254
CONTAINER_BARCODE = PE902529
NAME = Log Analysis
BASIN = GIPPSLAND
PERMIT =
TYPE = WELL
SUBTYPE = WELL_LOG
DESCRIPTION = Log Analysis
REMARKS =
DATE_CREATED = 29/09/83
DATE_RECEIVED = 12/10/84
W_NO = W827
WELL_NAME = Snapper-4
CONTRACTOR = ESSO
CLIENT_OP_CO = ESSO

(Inserted by DNRE - Vic Govt Mines Dept)

PE601255

This is an enclosure indicator page.
The enclosure PE601255 is enclosed within the container PE902529 at this location in this document.

The enclosure PE601255 has the following characteristics:

ITEM_BARCODE = PE601255
CONTAINER_BARCODE = PE902529
NAME = Log Analysis
BASIN = GIPPSLAND
PERMIT =
TYPE = WELL
SUBTYPE = WELL_LOG
DESCRIPTION = Log Analysis
REMARKS =
DATE_CREATED = 29/09/83
DATE_RECEIVED = 12/10/84
W_NO = W827
WELL_NAME = Snapper-4
CONTRACTOR = ESSO
CLIENT_OP_CO = ESSO

(Inserted by DNRE - Vic Govt Mines Dept)

APPENDIX 4

SNAPPER-4 RFT REPORT

S.T. Koh
September, 1983

SNAPPER -4 RFT TESTS

Summary

A series of RFT tests were conducted in the Snapper-4 exploration well over the periods July 9, 1983 (Runs 1-2) and September 13-14, 1983 (Runs 3-6). Runs 1-2 were made after drilling the 12 1/4 inch hole to 1516m MDKB (1495m SS) and runs 3-6 were made after drilling the 8 1/2 inch hole to 2821m MDKB (2800m SS). The main objectives of these tests were to obtain pressures in the N-1 reservoir between the interval 1493-1266.5m MDKB (1472-1245.5m SS) and investigate hydrocarbon shows indicated on mudlogs or by log interpretation below the N-1 reservoir within the Intra-Latrobe between the interval 2668.5-1601m MDKB (2647.5-1580m SS). Results from this RFT program confirmed the presence of a 148.0m gross gas column in the N-1 reservoir from the Top of Latrobe at 1259.5m MDKB (1238.5m SS) to the GOC at 1407.5m MDKB (1386.5m SS) overlying a 4.5m gross vertical oil column with an OWC at 1412m MDKB (1391m SS). Three small gas bearing intervals were established by this program within the Intra-Latrobe at Snapper-4.

Results and Discussions

A total of six RFT runs were conducted over the interval 1266.5-2668.5m MDKB as follows:

Run Number	Pretests	Interval (m MDKB)	Interval (m SS)
1	18	1266.5-1493	1245.5-1472
2	1	1410.1	1389.1
3	25	1601.0-2668.5	1580.0-2647.5
4	2	2529.5-2530.0	2508.5-2509.0
5	1	2668.5	2647.5
6	3	1942.4-1942.6	1921.4-1921.6

Of the 50 pretests attempted, 42 were successful in providing formation pressures, four were interpreted to be supercharged, three were seal failures and one pretest resulted in a tight test. The pressures from the Hewlett-Packard (HP) gauge are considered accurate and were used for all subsequent analysis. Results of this RFT program are given in Tables 1 and 2 and illustrated in Figures 1-3. A total of four RFT sampling runs with seven separate seats were taken and their results are summarised as follows.

Run/Seat Number	Sampling Depth m MDKB	Sampling Depth m SS	Recoveries
2/19	1410.1	1389.1	15.6 litres oil, GOR 516 SCF/STB. 2 3/4 gallon segregated sample lost during transfer.
4/45	2530.0	2509.0	No samples taken due to seal failure during pretest.
4/46	2529.5	2508.5	30.2 Ft^3 gas, 17.3 litres water and trace condensate. Segregated chamber opened at surface recovered: 20.6 Ft^3 gas, 6.5 litres water and trace condensate.

Run/Seat Number	Sampling Depth m MDKB	m SS	Recoveries
5/47	2668.5	2647.5	1.6 Ft^3 gas and 21.0 litres water. Segregated chamber opened at surface recovered: 1.5 Ft^3 gas and 9.0 litres water.
6/48	1942.5	1921.5	No samples. Seal failure occurred 3 minutes after the 6 gallon chamber was opened.
6/49	1942.4	1921.4	6 gallon chamber sample recovery reported with seat 6/50. No segregated sample due to seal failure 1 minute after 2 3/4 gallon chamber was opened.
6/50	1942.6	1921.6	7.1 Ft^3 gas, 20.95 litres mud and filtrate. Segregated chamber opened at surface recovered: 11.2 Ft^3 gas, 7.2 litres mud and filtrate.

Sample run number 2 consisted of a 22.8 litre lower chamber (main) with a 3.7 litre upper chamber (segregated) while run numbers 4 to 6 consisted of a 22.8 litre lower chamber with a 10.4 litre upper chamber. Full details of the sample data are given in Table 2.

The main results which are illustrated in Figures 1-3 are as follows:

1. The presence of a 148.0m gross vertical gas column in the N-1 reservoir from the Top of Latrobe at 1259.5m MDKB (1238.5m SS) to the GOC at 1407.5m MDKB (1386.5m SS) with a measured gas gradient of 0.16 psi/m overlying a 4.5m gross vertical oil column from the GOC to the OWC at 1412m MDKB (1391m SS) with a measured oil gradient of 0.85 psi/m was confirmed. Sample run number 2/19 located within the oil zone at 1410.1m MDKB (1389.1m SS) recovered 15.6 litres of oil with a GOR of 516 SCF/STB.

2. The Snapper-4 pressures in the south western fault block within the N-1 reservoir between 1266.5-1493m MDKB (1245.5-1472m SS) were consistently drawndown by 15-19 psi when compared to the Snapper A-21 RFT pressures in the central fault block (measured 24 months previously in July 1981). The pressure drawdown was mainly due to production from nearby fields.

3. As expected, the N-1 reservoir in Snapper-4 within the south western fault block, is believed to be in good hydraulic communication with the Gippsland Aquifer since measured pressure data was drawndown by 65 psi relative to the original Gippsland Aquifer pressure.

4. Below 1691m MDKB (1670m SS) water gradient discontinuities can be observed at several depths in both Snapper-4 and Snapper A-21 wells. In the interval 1621-1691m MDKB (1600-1670m SS) level the pressures taken in Snapper-4 were generally lower than the A-21 well pressures by about 30 psi whereas below this level the pressures taken in Snapper-4 were lower than Snapper A-21 pressures by varying amounts.

5. As shown in Figure 3, the RFT program conducted in the Intra-Latrobe confirmed indications of hydrocarbon accumulations provided by mudlogs and wireline logs in the following three intervals. In all cases, a common water gradient line above and below the intervals was not present so there is considerable uncertainty in the estimated GWC positions.

a) Two pretest pressures located within the sand interval 1889-1895m MDKB (1868-1874m SS) gave a gas gradient of 0.16 psi/m. Based on an assumed water gradient of 1.42 psi/m through the water seat 3/33 at 1990m MDKB (1969m SS) a GWC at 1906m MDKB (1885m SS) is interpreted.

b) RFT sampling run number 6/50 at 1942.6m MDKB (1921.6m SS) recovered a total of 18.3 Ft^3 gas and 28.15 litres mud and filtrate. The large amount of mud recovered during this run was as a result of seal failures while sampling the 6 gallon and 2 3/4 gallon chambers. Based on an assumed gas gradient of 0.16 psi/m through pressure seat 3/35 at 1942.5m MDKB (1921.5m SS) and a water gradient of 1.42 psi/m through the water seat 3/33 at 1990m MDKB (1969m SS) a GWC at 1950m MDKB (1929m SS) is interpreted.

c) Two pretest seats (3/23 and 4/46) located within the sand interval 2523.4-2531.0m MDKB (2502.5-2510.0m SS) gave a gas gradient of 0.18 psi/m. Two other pretest seats (3/24 and 3/25) located above 2530m MDKB (2510m SS) and within this sand interval were interpreted to be supercharged. Sample run number 4/46 taken at 2529.5m MDKB (2508.5m SS) recovered a total of 50.8 Ft^3 gas and 23.8 litres of water. Because of water gradient discontinunities and lack of good water seats around this level location of the GWC for this gas column cannot be determined.

6. Sample run number 5/47 at 2668.5m MDKB (2647.5m SS) recovered a total of 3.1 Ft^3 gas and 30 litres of filtrate from the two chambers. Because of the large amount of filtrate recovered, indications of hydrocarbon accumulation by wireline logs could not be confirmed.

7. The Schlumberger RFT strain gauge pretest pressures (Runs 1 and 3) were within - 5.3 psi and 6.7 psi of the HP pressures. Full details of the pressure data are given in Table 1.

4799f:4

TABLE 1

RFT PRETEST PRESSURES

SERVICE COMPANY: Schlumberger   RFT RUN NO.: 1 (SUITE 2)

WELL: Snapper 4
DATE: 9 July, 1983
OBSERVERS: BC/PP/KST

SEAT NO.	DEPTH m MDKB	DEPTH m SS	REASON 1 FOR TEST	GAUGE 2	TEMP 3 CORR.	UNITS 4	IHP psi	IHP ppg	FORMATION PRESS. psi	FORMATION PRESS. ppg	FHP psi	FHP ppg	TEST RESULT	TEMP (°F)
1/1	1493	1472	PT	SCH	Y	G	2679	10.5	2092	8.3	2679	10.5	V	164
				HP	Y	A	2694.8	10.5	2104.4	8.3	2694.5	10.5		
1/2	1463.5	1442.5	PT	SCH	Y	G	2624	10.5	2049	8.3	2624	10.5	V	164
				HP	Y	A	2640.8	10.5	2063.6	8.3	2641.4	10.5		
1/3	1438.5	1417.5	PT	SCH	Y	G	2580	10.5	2016	8.3	2581	10.5	V	164
				HP	Y	A	2595.5	10.5	2028.4	8.3	2596.7	10.5		
1/4	1426	1405	PT	SCH	Y	G	2559	10.5	1999	8.3	2559	10.5	V	163
				HP	Y	A	2573.9	10.5	2011.3	8.3	2574.9	10.5		
1/5	1418.5	1397.5	PT	SCH	Y	G	2545	10.5	1989	8.3	2546	10.5	V	162
				HP	Y	A	2560.5	10.5	2001.4	8.3	2562.0	10.5		
1/6	1411.3	1390.3	PT	SCH	Y	G	2532	10.5	1979	8.3	2532	10.5	V	161
				HP	Y	A	2548.4	10.5	1990.6	8.3	2548.7	10.5		
1/7	1410	1389	PT	SCH	Y	G	2530	10.5	1978	8.3	2531	10.5	V	160
				HP	Y	A	2546.2	10.5	1989.5	8.3	2546.7	10.5		

1. Pressure Test = PT
   Sample & Pressure Test = SPT
2. Gauges = SCH = Schlumberger Strain Gauge
   = HP = Hewlett Packard
3. Yes = Y
   No = N
4. PSIA = A
   PSIG = G

KB (Southern Cross) = 21 m

3485f:9

TABLE 1

RFT PRETEST PRESSURES

SERVICE COMPANY: Schlumberger   RFT RUN NO.: 1 (SUITE 2)   WELL: Snapper 4

DATE: 9 July, 1983

OBSERVERS: BC/PP/KST

SEAT NO.	DEPTH m MDKB	DEPTH m SS	REASON 1 FOR TEST	GAUGE 2	TEMP 3 CORR.	UNITS 4	IHP psi	IHP ppg	FORMATION PRESS. psi	FORMATION PRESS. ppg	FHP psi	FHP ppg	TEST RESULT	TEMP (°F)
1/8	1408.5	1387.5	PT	SCH	Y	G	2529	10.5	1977	8.4	2529	10.5	V	159
				HP	Y	A	2543.5	10.5	1988.2	8.4	2544.7	10.5		
1/9	1406.5	1385.5	PT	SCH	Y	G	2525	10.5	1975	8.4	2526	10.5	V	159
				HP	Y	A	2541.1	10.5	1986.5	8.4	2541.4	10.5		
1/10	1404	1383	PT	SCH	Y	G	2521	10.5	1977	8.4	2522	10.5	V	158
				HP	Y	A	2536.8	10.5	1986.1	8.4	2537.2	10.5		
1/11	1357.5	1336.5	PT	SCH	Y	G	2437	10.5	1965	8.6	2437	10.5	V	153
				HP	Y	A	2454.3	10.5	1978.9	8.6	2454.3	10.5		
1/12	1342	1321	PT	SCH	Y	G	2411	10.5	1964	8.7	2411	10.5	V	153
				HP	Y	A	2426.4	10.5	1976.5	8.7	2426.7	10.5		
1/13	1339	1318	PT	SCH	Y	G	2404	10.5	1963	8.7	2404	10.5	V	152
				HP	Y	A	2421.3	10.5	1976.0	8.8	2421.8	10.5		

1. Pressure Test = PT
   Sample & Pressure Test = SPT
2. Gauges = SCH = Schlumberger Strain Gauge
   = HP = Hewlett Packard
3. Yes = Y
   No = N
4. PSIA = A
   PSIG = G

KB (Southern Cross) = 21 m

3485f:10

TABLE 1

RFT PRETEST PRESSURES

SERVICE COMPANY: Schlumberger

RFT RUN NO.: 1 (SUITE 2)

WELL: Snapper 4

DATE: 9 July, 1983

OBSERVERS: BC/PP/KST

SEAT NO.	DEPTH m MDKB	DEPTH m SS	REASON 1 FOR TEST	GAUGE 2	TEMP 3 CORR.	UNITS 4	IHP psi	IHP ppg	FORMATION PRESS. psi	FORMATION PRESS. ppg	FHP psi	FHP ppg	TEST RESULT	TEMP (°F)
1/14	1333	1312	PT	SCH	Y	G	2395	10.5	1962	8.8	2395	10.5	V	152
				HP	Y	A	2411.2	10.5	1974.8	8.8	2411.4	10.5		
1/15	1325	1304	PT	SCH	Y	G	2380	10.5	1962	8.8	2380	10.5	V	152
				HP	Y	A	2396.5	10.5	1973.6	8.8	2397.1	10.5		
1/16	1304	1282	PT	SCH	Y	G	2344	10.5	1960	8.9	2344	10.5	V	150
				HP	Y	A	2359.0	10.5	1971.0	8.9	2359.4	10.5		
1/17	1293	1272	PT	SCH	Y	G	2325	10.5	1958	9.0	2325	10.5	V	150
				HP	Y	A	2339.7	10.5	1969.1	9.0	2339.3	10.5		
1/18	1266.5	1245.5	PT	SCH	Y	G	2276	10.5	1954	9.2	2276	10.5	V	149
				HP	Y	A	2292.6	10.5	1965.5	9.2	2292.2	10.5		
2/19	1410.1	1389.1	SPT	SCH	Y	G	2527	10.5	1979	8.4	2531	10.5	V	159
				HP	Y	A	2543.5	10.5	1990.4	8.3	2543.4	10.5		

1. Pressure Test = PT
   Sample & Pressure Test = SPT
2. Gauges = SCH = Schlumberger Strain Gauge
   = HP = Hewlett Packard
3. Yes = Y
   No = N
4. PSIA = A
   PSIG = G

KB (Southern Cross) = 21 m

3485f:11

TABLE 1

RFT PRETEST PRESSURES

SERVICE COMPANY: Schlumberger   RFT RUN NO.: 3 (SUITE 3)

WELL: Snapper 4
DATE: 13 September, 1983
OBSERVERS: BC/PP/KST

SEAT NO.	DEPTH m MDKB	DEPTH m SS	REASON 1 FOR TEST	GAUGE 2	TEMP 3 CORR.	UNITS 4	IHP psi	IHP ppg	FORMATION PRESS. psi	FORMATION PRESS. ppg	FHP psi	FHP ppg	TEST RESULT	TEMP (°F)
3/20	2668.5	2647.5	PT	SCH	Y	G	4405	9.7	3935	8.7	4405	9.7	V	221
				HP	Y	A	4411.5	9.7	3939.1	8.7	4412.0	9.7		
3/21	2630.5	2609.5	PT	SCH	Y	G	4338	9.7	3867	8.7	4337	9.7	V	223
				HP	Y	A	4348.3	9.7	3877.7	8.7	4349.5	9.7		
3/22	2566	2545	PT	SCH	Y	G	4228	9.7	3810	8.8	4227	9.7	Supercharged tight	223
				HP	Y	A	4243.3	9.7	3828.7	8.8	4245.9	9.7		
3/23	2530	2509	PT	SCH	Y	G	4170	9.7	3740	8.7	4170	9.7	V	221
				HP	Y	A	4183.3	9.7	3753.6	8.7	4185.7	9.7		
3/24	2527	2506	PT	SCH	Y	G	4164	9.7	3775	8.8	4163	9.7	Supercharged tight	219
				HP	Y	A	4184.1	9.7	3795	8.8	4184.8	9.7		
3/25	2524.5	2503.5	PT	SCH	Y	G	4160	9.7	3754	8.8	4160	9.7	Supercharged tight	220
				HP	Y	A	4180.8	9.7	3774	8.8	4180.7	9.7		
3/26	2494	2473	PT	SCH	Y	G	4116	9.7	3626	8.6	4116	9.7	V	221
				HP	Y	A	4129.1	9.7	3640.3	8.6	4131	9.7		

1. Pressure Test = PT
   Sample & Pressure Test = SPT
2. Gauges = SCH = Schlumberger Strain Gauge
   = HP = Hewlett Packard
3. Yes = Y
   No = N
4. PSIA = A
   PSIG = G

Southern Cross KB = 21m

TABLE 1

RFT PRETEST PRESSURES

SERVICE COMPANY: Schlumberger

RFT RUN NO.: 3 SUITE 3

WELL: Snapper 4

DATE: 14 September, 1983

OBSERVERS: PP/RK/KST

SEAT NO.	DEPTH m MDKB	DEPTH m SS	REASON 1 FOR TEST	GAUGE 2	TEMP 3 CORR.	UNITS 4	IHP psi	IHP ppg	FORMATION PRESS. psi	FORMATION PRESS. ppg	FHP psi	FHP ppg	TEST RESULT	TEMP (°F)
3/27	2269	2248	PT	SCH	Y	G	3752	9.7	3234	8.4	3753	9.7	V	213
				HP	Y	A	3769.3	9.7	3247.8	8.4	3771.6	9.7		
3/28	2220	2199	PT	SCH	Y	G	3672	9.7	3155	8.4	3675	9.7	V	211
				HP	Y	A	3692.3	9.7	3169.8	8.4	3694.5	9.7		
3/29	2204.5	2183.5	PT	SCH	Y	G	3654	9.7	3135	8.4	3654	9.7	V	210
				HP	Y	A	3669.7	9.7	3147.9	8.4	3671.9	9.7		
3/30	2113.5	2092.5	PT	SCH	Y	G	3506	9.7	2994	8.4	3510	9.7	V	207
				HP	Y	A	3527.8	9.7	3010.8	8.4	3528.5	9.7		
3/31	2084	2063	PT	SCH	Y	G	3465	9.7	3005	8.5	3473	9.8	Super-charged tight	204
				HP	Y	A	3481.3	9.7	3013.0	8.5	3482.8	9.7		
3/32	2069	2048	SPT	SCH	Y	G	3444	9.8	2942	8.4	3443	9.8	V	203
				HP	Y	A	3460.3	9.8	2954.8	8.4	3460.9	9.8		
3/33	1990	1969	PT	SCH	Y	G	3318	9.8	2841	8.5	3319	9.8	V	119
				HP	Y	A	3333.0	9.8	2854.9	8.5	3334.9	9.8		

1. Pressure Test = PT
   Sample & Pressure Test = SPT

2. Gauges = SCH = Schlumberger Strain Gauge
   = HP = Hewlett Packard

3. Yes = Y
   No = N

4. PSIA = A
   PSIG = G

KB (Southern Cross) = 21 m

SCH gauge drift from zero evident in all seats.. Had to re-zero SCH gauge every seat.

TABLE 1

RFT PRETEST PRESSURES

SERVICE COMPANY: Schlumberger

RFT RUN NO.: 3 (SUITE 3)

WELL: Snapper 4

DATE: 14 September, 1983

OBSERVERS: PP/RK/KST

SEAT NO.	DEPTH m MDKB	DEPTH m SS	REASON 1 FOR TEST	GAUGE 2	TEMP 3 CORR.	UNITS 4	IHP psi	IHP ppg	FORMATION PRESS. psi	FORMATION PRESS. ppg	FHP psi	FHP ppg	TEST RESULT	TEMP (°F)
3/34	1964.2	1943.2	PT	SCH	Y	G	3279	9.8	2819	8.5	3279	9.8	V	197
				HP	Y	A	3293.9	9.8	2832.5	8.5	3295.2	9.8		
3/35	1942.5	1921.5	PT	SCH	Y	G	3242	9.8	2781	8.5	3241	9.8	V	196
				HP	Y	A	3259.9	9.8	2796.7	8.5	3261.5	9.8		
3/36	1925.2	1904.2	PT	SCH	Y	G	3219	9.8	-	-	3221	9.8	T	195
				HP	Y	A	3234.4	9.8	-	-	3235	9.8		
3/37	1912.5	1891.5	PT	SCH	Y	G	3196	9.8	2736	8.5	3196	9.8	V	194
				HP	Y	A	3214.1	9.8	2751.0	8.5	3215.8	9.8		
3/38	1894.5	1873.5	PT	SCH	Y	G	3168	9.8	2724	8.5	3168	9.8	V	193
				HP	Y	A	3184.6	9.8	2738.2	8.5	3187.0	9.8		
3/39	1889.6	1868.6	PT	SCH	Y	G	3161	9.8	2722	8.5	3161	9.8	V	192
				HP	Y	A	3179.1	9.8	2737.4	8.5	3180.0	9.8		
3/40	1880	1859	PT	SCH	Y	G	3146	9.8	2649	8.4	3146	9.8	V	192
				HP	Y	A	3164.2	9.8	2663.5	8.4	3165.7	9.8		

1. Pressure Test = PT
   Sample & Pressure Test = SPT

2. Gauges = SCH = Schlumberger Strain Gauge
   = HP = Hewlett Packard

3. Yes = Y
   No = N

4. PSIA = A
   PSIG = G

Southern Cross KB = 21 m

3485f:14

TABLE 1

RFT PRETEST PRESSURES

SERVICE COMPANY: Schlumberger

RFT RUN NO.: 3/4/5 (SUITE 3)

WELL: Snapper 4

DATE: 14 September, 1983

OBSERVERS: PP/RK/KST

SEAT NO.	DEPTH m MDKB	DEPTH m SS	REASON 1 FOR TEST	GAUGE 2	TEMP 3 CORR.	UNITS 4	IHP psi	IHP ppg	FORMATION PRESS. psi	FORMATION PRESS. ppg	FHP psi	FHP ppg	TEST RESULT	TEMP (°F)
3/41	1691	1670	PT	SCH	Y	G	2837	9.8	2370	8.3	2837	9.8	V	183
				HP	Y	A	2854.8	9.8	2383.7	8.3	2855.1	9.8		
3/42	1682.2	1661.2	PT	SCH	Y	G	2822	9.8	2360	8.3	2821	9.8	V	181
				HP	Y	A	2839.5	9.8	2376.2	8.3	2841.6	9.8		
3/43	1668.2	1647.2	PT	SCH	Y	G	2804	9.8	2341	8.3	2803	9.8	V	179
				HP	Y	A	2818.3	9.8	2353.6	8.3	2819.0	9.8		
3/44	1601	1580	PT	SCH	Y	G	2691	9.8	2241	8.3	2690	9.8	V	173
				HP	Y	A	2707.4	9.8	2256.3	8.3	2708.1	9.8		
4/45	2530	2509	SPT	SCH	Y	G	4162	9.6	-	-	-	-	SF	231
				HP	Y	A	4178.4	9.6	-	-	-	-		
4/46	2529.5	2508.5	SPT	SCH	Y	G	4162	9.6	3740	8.7	4163	9.6	V	231
				HP	Y	A	4178.1	9.6	3753.5	8.7	4178.4	9.6		
5/47	2668.5	2647.5	SPT	SCH	Y	G	4373	9.6	3926	8.7	4373	9.6	V	242
				HP	Y	A	4388.0	9.6	3938.2	8.7	4385.4	9.6		

1. Pressure Test = PT
   Sample & Pressure Test = SPT
2. Gauges = SCH = Schlumberger Strain Gauge
   = HP = Hewlett Packard
3. Yes = Y
   No = N
4. PSIA = A
   PSIG = G

Southern Cross KB = 21m

3485f:15

TABLE 1

RFT PRETEST PRESSURES

SERVICE COMPANY: Schlumberger

RFT RUN NO.: 6 (SUITE 3)

WELL: Snapper 4

DATE: 14 September, 1983

OBSERVERS: BC/PP/KST

SEAT NO.	DEPTH m MDKB	DEPTH m SS	REASON 1 FOR TEST	GAUGE 2	TEMP 3 CORR.	UNITS 4	IHP psi	IHP ppg	FORMATION PRESS. psi	FORMATION PRESS. ppg	FHP psi	FHP ppg	TEST RESULT	TEMP (°F)
6/48	1942.5	1921.5	SPT	SCH	Y	G	3217	9.7	2795	8.5	-	-	Seal Failure During 6 gal. Sampling	
				HP	Y	A	3224.3	9.7	2796.0	8.5	-	-		
6/49	1942.4	1921.4	SPT	SCH	Y	G	3220	9.7	2794	8.5	-	-	Seal Failure During 2 3/4 Gal. Sampling	
				HP	Y	A	3223	9.7	2797.4	8.5	-	-		
6/50	1942.6	1921.6	SPT	SCH	Y	G	3222	9.7	2797	8.5	3223	9.7	V	201
				HP	Y	A	3225	9.7	2797.7	8.5	3225.4	9.7		

1. Pressure Test = PT
   Sample & Pressure Test = SPT

2. Gauges = SCH = Schlumberger Strain Gauge
   = HP = Hewlett Packard

3. Yes = Y
   No = N

4. PSIA = A
   PSIG = G

Southern Cross KB = 21

3485f:16

TABLE 2 (3846f/8)

RFT SAMPLE TEST REPORT

WELL: SNAPPER-4
OBSERVER: BC/PP/KST DATE: July 9, 1983 RUN: 2 (Suite 2)

		CHAMBER 1 (22 lit.)		CHAMBER 2 (3.7 lit.)	
	SEAT NO.	2/19		2/19	
	DEPTH m MDKB	1401.1 m KB		1401.1 m KB	
A.	RECORDING TIMES	(Hours:Minutes:Seconds)		(Hours:Minutes:Seconds)	
	Tool Set	224400		-	
	Pretest Open	224425		-	
	Time Open	224827		230105	
	Chamber Open	224830		230105	
	Chamber Full	225600		230350	
	Fill Time	7 mins. 30 secs.		2 mins. 45 secs.	
	Start Build-up	225600		230350	
	Finish Build-up	225915		230530	
	Build-Up Time	3 mins. 15 secs.		1 min. 40 secs.	
	Seal Chamber	225930		230556	
	Tool Retract	-		230750	
	Total Time	15 mins. 30 secs.		8 mins. 20 secs.	
B.	SAMPLE PRESSURES				
	IHP	2543.5	psia	-	psia
	ISIP	1990.4	psia	1989.7	psia
	Initial Flowing Press.	1945	psia	1979	psia
	Final Flowing Press.	1974	psia	1978	psia
	Sampling Press. Range	1945-1974	psia	1978-1979	psia
	FSIP	1989.6	psia	1989.6	psia
	FHP	-	psia	2543.4	psia
	Form.Press.(Horner)				
C.	TEMPERATURE				
	Depth Tool Reached	1428	m KB	1428	m KB
	Max. Rec. Temp.	72.1	°C	72.1	°C
	Time Circ. Stopped	2015 hrs. July 8, 1973		2015 hrs. July 8, 1983	
	Time Since Circ.	26.25	hrs.	26.5	hrs.
D.	SAMPLE RECOVERY				
	Surface Pressure	1100	psig	-	psig
	Amt Gas	50.6	CF	-	CF
	Amt Oil	15600	cc	-	cc
	Amt Water	Nil		-	cc
	Amt. Others (mud)	1000	cc	-	
E.	SAMPLE PROPERTIES				
	Gas Composition				
	C1	590,460	ppm	-	ppm
	C2	132,480	ppm	-	ppm
	C3	18,170	ppm	-	ppm
	1C4/nC4	7,570	ppm	-	ppm
	C5	5,300	ppm	-	ppm
	C6+	3,030	ppm	-	ppm
	CO2/H2S	0.8%/Trace		-	ppm
	Oil Properties Waxy	47	°API	-	°API @ °C
	Colour	Greyish Red			
	Fluorescence	Bright White Blue			
	GOR SCF/STB	516		-	
	Water Properties/Filtrate				
	Resistivity	-	- °C	-	- °C
	NaCl Equivalent	-	ppm	-	ppm
	Cl-titrated	-	ppm	-	ppm
	NO3	-	ppm	-	ppm
	Est. Water Type	-		-	
	Mud Properties				
	Resistivity	0.203 @ °C 14		0.203 @ °F 14	
	Ca[1] Equivalent	42000	ppm	42000	ppm
	Cl- titrated	16000	ppm	16000	ppm
	Calibration				
	Calibration Press.	-	psig	-	psig
	Calibration Temp.	-	°C	-	°C
	Hewlett Packard No.	974		974	
	Mud Weight	10.5		10.5	
	Calc. Hydrostatic	10.5		10.5	
	RFT Chokesize	0.030		0.020	
	Remarks	Lower - 6 Gal. at surface.		Upper segregated - 1 gal. Lost sample during transfer.	

TABLE 2

RFT SAMPLE TEST REPORT (3846f/9)

WELL: SNAPPER-4

OBSERVER: PP/RK/KST   DATE: 14 September, 1983   RUN: 4

	CHAMBER 1 (22.8 lit.)		CHAMBER 2 (10.4 lit.)	
SEAT NO.	4/46		4/46	
DEPTH m KB	2529.5		2529.5	
A. RECORDING TIMES	(Hours:Minutes:Seconds)		(Hours:Minutes:Seconds)	
Tool Set	104410		-	
Pretest Open	104435		-	
Time Open	104736		110320	
Chamber Open	104749		110330	
Chamber Full	105649		110645	
Fill Time	9 mins.		3 mins. 15 secs.	
Start Build-up	105649		110645	
Finish Build-up	110300		111220	
Build-Up Time	6 mins. 11 secs.		5 mins. 35 secs.	
Seal Chamber	110159		111130	
Tool Retract	-		111300	
Total Time	17 mins. 49 secs.		11 mins. 01 sec.	
B. SAMPLE PRESSURES				
IHP	4178.1	psia	-	psia
ISIP	3753.5	psia	3754.3	psia
Initial Flowing Press.	1332.4	psia	1698.7	psia
Final Flowing Press.	1783	psia	1589.0	psia
Sampling Press. Range	1332-1783	psia	1698.7-1589.0	psia
FSIP	3754.3	psia	3754.2	psia
FHP	-	psia	4178.4	psia
Form.Press.(Horner)				
C. TEMPERATURE				
Depth Tool Reached	2577	m KB	2577	m KB
Max. Rec. Temp.	230	°F	230	°F
Time Circ. Stopped	1200(hrs)	Sept 13/83	1200 hrs	Sept 13/83
Time since Circ.	23	hrs.	23	hrs.
D. SAMPLE RECOVERY				
Surface Pressure	1500	psig	1380	psig
Amt Gas	30.2	CF	20.6	CF
Amt Oil (waxy)	NIL	cc	NIL	cc
Amt Water + Trace Condens.	17300	cc	6500	cc
E. SAMPLE PROPERTIES				
Gas Composition				
C1	469968	ppm	143283	ppm
C2	57876	ppm	34725	ppm
C3	36495	ppm	31518	ppm
1C4/nC4	11673	ppm	17510	ppm
C5	2230	ppm	6025	ppm
C6+	379	ppm	975	ppm
CO2/H2S	9.2	%/Nil	9.0	%/Nil
Oil Properties	-	°API @ °C	-	°API @ °C
Colour	-		-	
Fluorescence (Condensate)	Bright Blue White		Bright Blue White	
GOR				
Water Properties/Filtrate				
Resistivity	0.26	@ 58 °F	0.248	@ 67 °F
NaCl Equivalent	30 000	ppm	29 000	ppm
Cl-titrated	15 000	ppm	15 000	ppm
NO3	140	ppm	130	ppm
Est. Water Type	Filtrate	pH = 6.6	Filtrate	pH = 6.3
Mud Properties				
Resistivity	0.30	@ 13.3°C	0.30	@ 13.3°C
Na Cl Equivalent	25000	ppm	25000	ppm
Cl - titrated	16000	ppm	16000	ppm
Calibration				
Calibration Press.	-	psig	-	psig
Calibration Temp.	-	°C	-	°C
Hewlett Packard No.	947		947	
Mud Weight	9.5+		9.5+	
Calc. Hydrostatic	9.7		9.7	
RFT Chokesize	1 x 0.03		1 x 0.03	
Remarks	Lower Chamber		Upper Chamber	

TABLE 2
RFT SAMPLE TEST REPORT

WELL: SNAPPER 4
OBSERVER: PP/RK/KST   DATE: 14 September, 1983   RUN: 5

	CHAMBER 1 (22.8 lit.)		CHAMBER 2 (10.4 lit.)	
SEAT NO.	5/47		5/47	
DEPTH m KB	2668.5		2668.5	
A. RECORDING TIMES	(Hours:Minutes:Seconds)		(Hours:Minutes:Seconds)	
Tool Set	145210		-	
Pretest Open	145237		-	
Time Open	145450		152800	
Chamber Open	145500		152825	
Chamber Full	152300		154000	
Fill Time	28 min.		11 mins. 35 secs.	
Start Build-up	152300		154000	
Finish Build-up	152730		154740	
Build-Up Time	4.5 min.		7 mins. 40 secs.	
Seal Chamber	152625		154320	
Tool Retract	-		154800	
Total Time	34 mins. 15 secs.		21 mins. 35 secs.	
B. SAMPLE PRESSURES				
IHP	4388.0	psia	-	psia
ISIP	3938.2	psia	3939.5	psia
Initial Flowing Press.	115	psia	312	psia
Final Flowing Press.	2300	psia	2408	psia
Sampling Press. Range	115-2300	psia	312-2408	psia
FSIP	3939.5	psia	3935.4	psia
FHP	-	psia	4385.4	psia
Form.Press.(Horner)				
C. TEMPERATURE				
Depth Tool Reached	2701	m KB	2701	m KB
Max. Rec. Temp.	245	°F	245	°F
Time Circ. Stopped	1200 hrs	Sept 13/83	1200 hrs	Sept 13/83
Time since Circ.	27	hrs.	27	hrs.
D. SAMPLE RECOVERY				
Surface Pressure	380	psig	380	psig
Amt Gas	1.6	CF	1.5	CF
Amt Oil	NIL	cc	NIL	cc
Amt Water	21000	cc	9000	cc
E. SAMPLE PROPERTIES				
Gas Composition				
C1	114,626	ppm	223,521	ppm
C2	17,362	ppm	30,867	ppm
C3	13,271	ppm	14,929	ppm
1C4/nC4	5,836	ppm	7,782	ppm
C5	1,506	ppm	1,882	ppm
C6+	216	ppm	650	ppm
CO2/H2S	5.4	%/Nil	4.3	%/Nil
Oil Properties	-	°API @ °C	-	°API @ °C
Colour	-		-	
Fluorescence (Water)	Trace (White)		-	
GOR	-		-	
Water Properties/Filtrate				
Resistivity	0.248 @ 61	°F	0.255 @ 58	°F
NaCl Equivalent	30,000	ppm	30,000	ppm
Cl-titrated	16,000	ppm	16,000	ppm
NO3	180	ppm	160	ppm
Est. Water Type	Filtrate pH = 7.0		Filtrate pH = 6.8	
Mud Properties				
Resistivity	0.30	@ 13.3°C	0.30	@ 13.3°C
NaCl Equivalent	25,000	ppm	25,000	ppm
Cl - titrated	16,000	ppm	16,000	ppm
Calibration				
Calibration Press.	-	psig	-	psig
Calibration Temp.	-	°C	-	°C
Hewlett Packard No.	947		947	
Mud Weight	9.5+		9.5+	
Calc. Hydrostatic	9.6		9.6	
RFT Chokesize	1 x 0.030		1 x 0.030	
Remarks	Lower Chamber		Upper Chamber	

RFT SAMPLE TEST REPORT

WELL: SNAPPER-4 (3846f:12)

OBSERVER: PP/RK/KST DATE: 14 September, 1983 RUN: 6

	CHAMBER 1 (22.8 lit.)		CHAMBER 2 (10.4 lit.)	
SEAT NO.	6/48		6/48	
DEPTH	1942.5		1942.5	
A. RECORDING TIMES	(Hours:Minutes:Seconds)		(Hours:Minutes:Seconds)	
Tool Set	193415		-	
Pretest Open	193435		-	
Time Open	193848		-	
Chamber Open	193910		-	
Chamber Full	(Observed seal failure			
Fill Time	after lower chamber			
Start Build-up	opened). -		-	
Finish Build-up	-		-	
Build-Up Time	-		-	
Seal Chamber	-		-	
Tool Retract	-		-	
Total Time	-		-	
B. SAMPLE PRESSURES				
IHP	3224.3	psia	-	psia
ISIP	2796	psia	-	psia
Initial Flowing Press.	2207	psia	-	psia
Final Flowing Press.	-	psia	-	psia
Sampling Press. Range	-		-	
FSIP	-	psia	-	psia
FHP	-	psia	-	psia
Form.Press.(Horner)	-		-	
C. TEMPERATURE				
Depth Tool Reached	2067	m KB	2067	m KB
Max. Rec. Temp.	200	°F	200	°F
Time Circ. Stopped	1200 hrs	Sept 13/83	1200 hrs	Sept 13/83
Time since Circ.	-	hrs.	-	hrs.
D. SAMPLE RECOVERY				
Surface Pressure	-	psig	-	psig
Amt Gas	-	CF	-	CF
Amt Oil (waxy)	-	cc	-	cc
Amt Water	-	cc	-	cc
E. SAMPLE PROPERTIES				
Gas Composition				
C1	-	ppm	-	ppm
C2	-	ppm	-	ppm
C3	-	ppm	-	ppm
1C4/nC4	-	ppm	-	ppm
C5+	-	ppm	-	ppm
CO2/H2S	-	%/Nil	-	%/Trace
Oil Properties	-	°API @ °C	-	°API @ °C
Colour				
Fluorescence (Condensate)				
GOR	-		-	
Water Properties/Filtrate				
Resistivity	-	@ 69 °F	-	@ 64 °F
NaCl Equivalent	-	ppm	-	ppm
Cl-titrated	-	ppm	-	ppm
NO3/Ca2+	-	ppm	-	ppm
Est. Water Type	-		-	
Mud Properties				
Resistivity	-	@ 75°C	-	@ 75°C
Na Cl Equivalent	-	ppm	-	ppm
Cl - titrated	-	ppm	-	ppm
Calibration				
Calibration Press.	-	psig	-	psig
Calibration Temp.	-	°C	-	°C
Hewlett Packard No.	947		947	
Mud Weight	9.5+		9.5+	
Calc. Hydrostatic	9.0		9.6	
RFT Chokesize	1 x 0.030		1 x 0.030	
Remarks	Lower Chamber Seal Failure		Upper Chamber Not Opened	

RFT SAMPLE TEST REPORT

WELL: SNAPPER-4

OBSERVER: PP/RK/KST DATE: 14 September, 1983 RUN: 6

	CHAMBER 1 (22.8 lit.)		CHAMBER 2 (10.4 lit.)	
SEAT NO.	6/49		6/49	
DEPTH m KB	1942.4		1942.4	
A. RECORDING TIMES	(Hours:Minutes:Seconds)		(Hours:Minutes:Seconds)	
Tool Set	194749			
Pretest Open	194759			
Chamber Open	195030			
Chamber Full	200100			
Fill Time	10 mins. 30 secs.			
Start Build-up	200100			
Finish Build-up	201410			
Build-Up Time	13 mins. 10 secs.		-	
Seal Chamber	201220			
Tool Retract	-			
Total Time	24 mins. 31 secs.		-	
B. SAMPLE PRESSURES				
IHP	3223	psia	-	psia
ISIP	2797.4	psia	-	psia
Initial Flowing Press.	635	psia	-	psia
Final Flowing Press.	2316	psia	-	psia
Sampling Press. Range	635-2316			
FSIP	2669	psia	-	psia
FHP	-	psia	-	psia
Form.Press.(Horner)				
C. TEMPERATURE				
Depth Tool Reached	-	m MDKB	-	m MDKB
Max. Rec. Temp.	-	°F	-	°F
Time Circ. Stopped	-	(hrs)	-	hrs
Time since Circ.	-	hrs.	-	hrs.
D. SAMPLE RECOVERY				
Surface Pressure	-	psig	-	psig
Amt Gas	-	CF	-	CF
Amt Oil (waxy)	-	cc	-	cc
Amt Water	-	cc	-	cc
E. SAMPLE PROPERTIES				
Gas Composition				
C1	-	ppm	-	ppm
C2	-	ppm	-	ppm
C3	-	ppm	-	ppm
1C4/nC4	-	ppm	-	ppm
C5+	-	ppm	-	ppm
CO2/H2S	-	%/Nil	-	%/Trace
Oil Properties	-	°API @ °C	-	°API @ °C
Colour				
Fluorescence (Condensate)				
GOR				
Water Properties/Filtrate				
Resistivity	-	@ 69 °F	-	@ 64 °F
NaCl Equivalent	-	ppm	-	ppm
Cl-titrated	-	ppm	-	ppm
NO3/Ca2+	-	ppm	-	ppm
Est. Water Type				
Mud Properties				
Resistivity	-	@ 75°C	-	@ 75°C
Na Cl Equivalent	-	ppm	-	ppm
Cl - titrated	-	ppm	-	ppm
Calibration				
Calibration Press.	-	psig	-	psig
Calibration Temp.	-	°C	-	°C
Hewlett Packard No.				
Mud Weight				
Calc. Hydrostatic				
RFT Chokesize				
Remarks	Re-open lower chamber after after pretest. Seal chamber when FSIP = 2669		Seal Failutre after opening upper chamber Seal chamber immedi.	

TABLE 2

RFT SAMPLE TEST REPORT

(3846f/11)

WELL: SNAPPER 4

OBSERVER: PP/RK/KST DATE: 14 September, 1983 RUN: 6

	CHAMBER 1 (22.8 lit.)		CHAMBER 2 (10.4 lit.)	
SEAT NO.	6/50		6/50	
DEPTH m KB	1942.6		1942.6	
A. RECORDING TIMES	(Hours:Minutes:Seconds)		(Hours:Minutes:Seconds)	
Tool Set	202110		-	
Pretest Open	202140		-	
Time Open	202430		202810	
Chamber Open	202435		202830	
Chamber Full	202730		205845	
Fill Time	-		-	
Start Build-up	-		-	
Finish Build-up	-		-	
Build-Up Time	-		-	
Seal Chamber	202730		205845	
Tool Retract	-		205845	
Total Time	6 mins. 20 secs.		31 mins. 15 secs.	
B. SAMPLE PRESSURES				
IHP	3225	psia	-	psia
ISIP	2797.7	psia	2710	psia
Initial Flowing Press.	2626	psia	284	psia
Final Flowing Press.	-	psia	-	psia
Sampling Press. Range	-	psia	-	psia
FSIP	2710	psia	2409.6	psia
FHP	-	psia	3225.4	psia
Form.Press.(Horner)				
C. TEMPERATURE				
Depth Tool Reached	2067	m KB	2067	m KB
Max. Rec. Temp.	212	°F	212	°F
Time Circ. Stopped	1200 Hrs	Sept 13/83	1200 Hrs	Sept 13/83
Time since Circ.	32	hrs.	32	hrs.
D. SAMPLE RECOVERY				
Surface Pressure	1000	psig	1150	psig
Amt Gas	7.1	CF	11.2	CF
Amt Oil	-	cc	-	cc
Amt Water	-	cc	-	cc
Mud and Filtrate	20,950	cc	7200	cc
E. SAMPLE PROPERTIES				
Gas Composition				
C1	74,510	ppm	320,950	ppm
C2	9,650	ppm	34,730	ppm
C3	6,220	ppm	11,610	ppm
1C4/nC4	2,670	ppm	4,260	ppm
C5	850	ppm	1,410	ppm
C6+	108	ppm	540	ppm
CO2/H2S	2.4	%/Nil	8.5	%/Nil
Oil Properties	-	°API @ °C	-	°API @ °C
Colour	-		-	
Fluorescence	-		-	
GOR	-		-	
Water Properties/Filtrate				
Resistivity	0.267 @ 64	°F	0.267 @ 58	°F
NaCl Equivalent	30,000	ppm	27,500	ppm
Cl-titrated	15,000	ppm	16,000	ppm
NO_3/Ca^{2+}	160	ppm	180	ppm
Est. Water Type	Mud & Filtrate pH = 6.8		Mud & Filtrate pH = 6.4	
Mud Properties				
Resistivity	0.30	@ 13.3°C	0.30	@ 13.3°C
Ca^{2+}/NO_3^-	25,000	ppm	25,000	ppm
Cl - titrated	16,000	ppm	16,000	ppm
Calibration				
Calibration Press.	-	psig	-	psig
Calibration Temp.	-	°C	-	°C
Hewlett Packard No.	947		947	
Mud Weight	9.5+		9.5+	
Calc. Hydrostatic	9.7		9.7	
RFT Chokesize	1 x 0.030		1 x 0.030	
Remarks	Reopen lower chamber after pre-test		Opened upper chamber after sealing lower chamber	

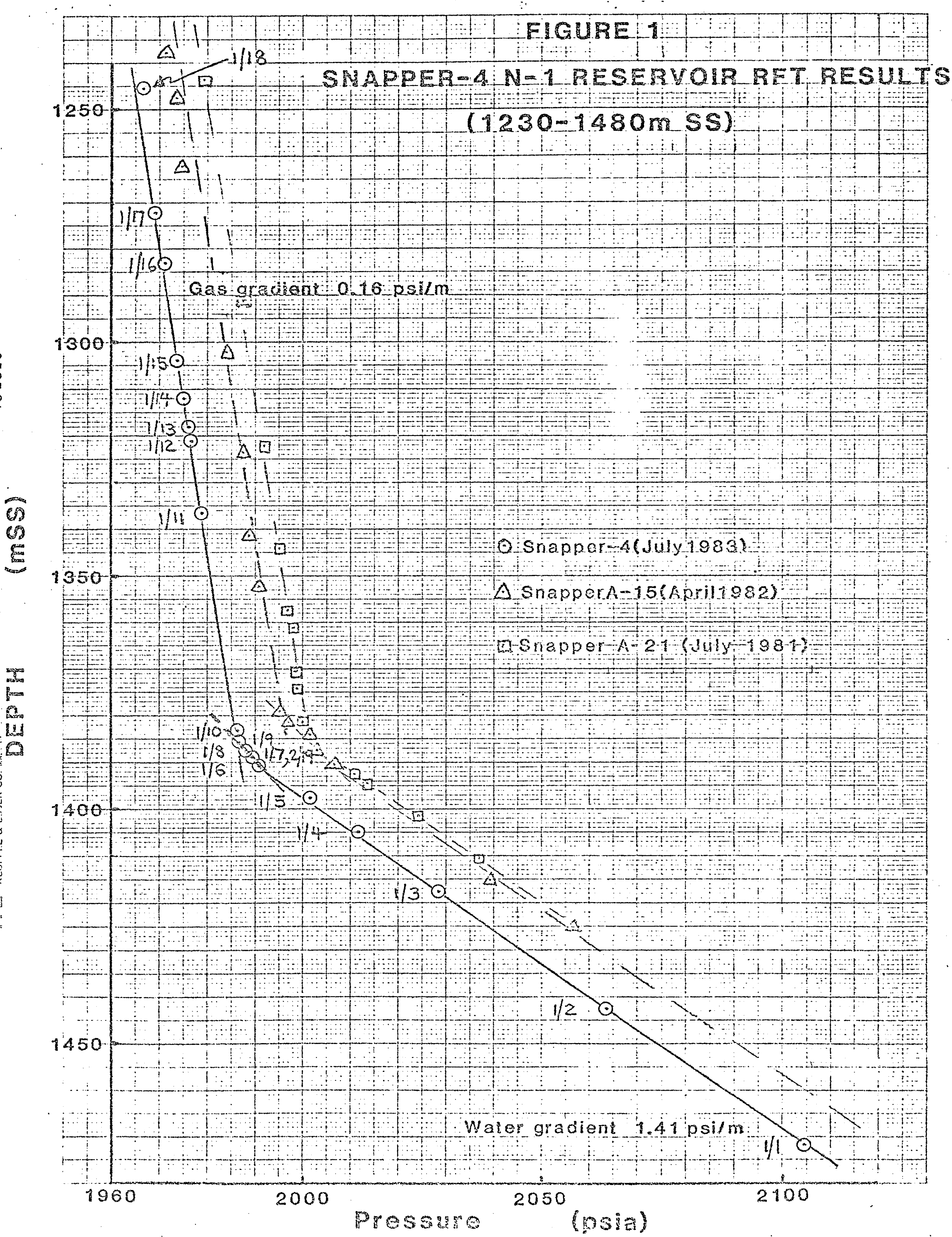
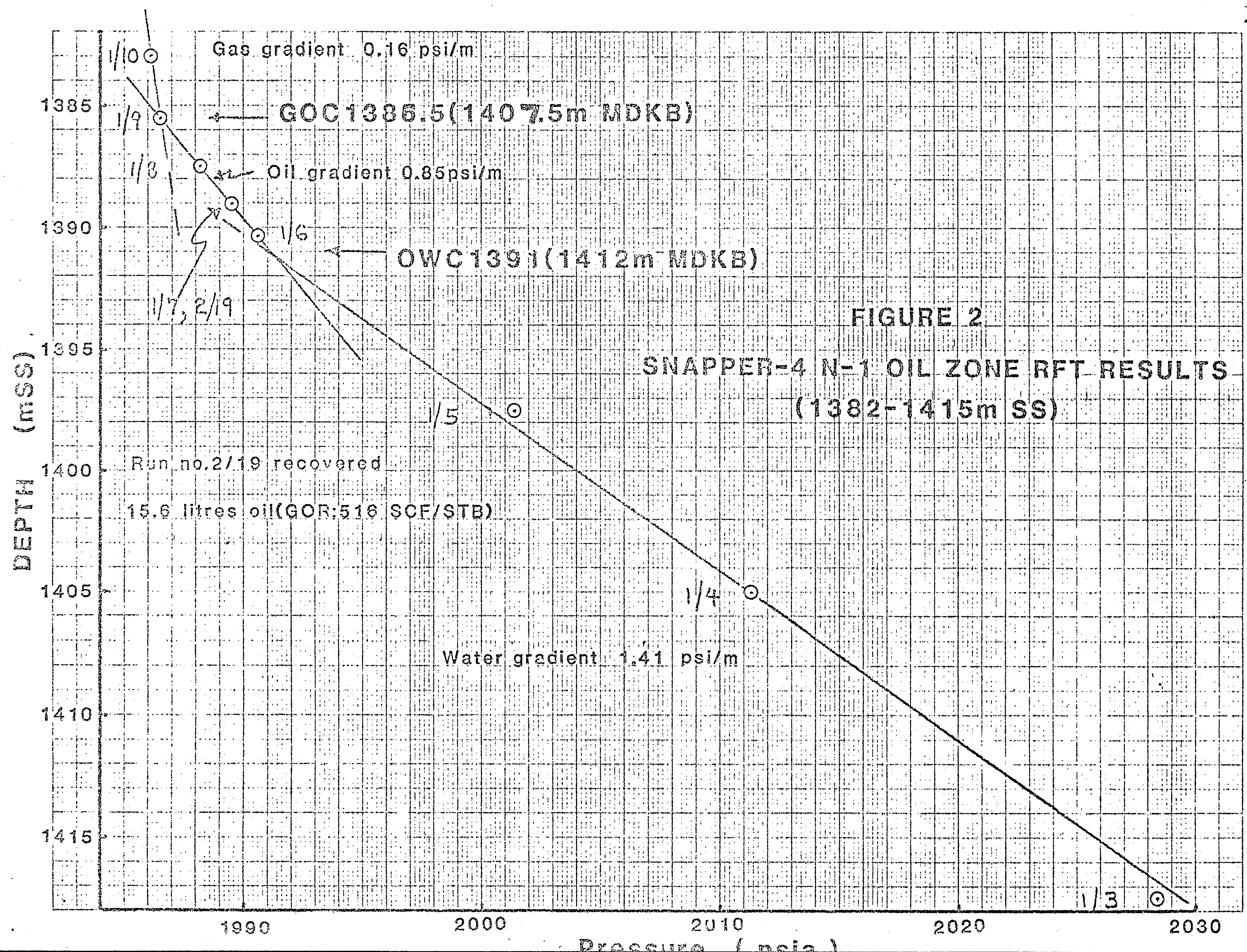


FIGURE 1
SNAPPER-4 N-1 RESERVOIR RFT RESULTS
(1230-1480m SS)
Gas gradient 0.16 psi/m
Water gradient 1.41 psi/m
Snapper-4 (July 1983)
Snapper A-15 (April 1982)
Snapper A-21 (July 1981)
DEPTH (mSS)
Pressure (psia)
1250
1300
1350
1400
1450
1960
2000
2050
2100
1/18
1/17
1/16
1/15
1/14
1/13
1/12
1/11
1/10
1/9
1/8
1/7,2/3
1/6
1/5
1/4
1/3
1/2
1/1
461510



461510
Gas gradient 0.16 psi/m
GOC 1386.5 (1407.5m MDKB)
Oil gradient 0.85psi/m
OWC 1391 (1412m MDKB)
1/10
1/9
1/8
1/7, 2/19
1/6
1/5
1/4
1/3
FIGURE 2
SNAPPER-4 N-1 OIL ZONE RFT RESULTS
(1382-1415m SS)
Run no.2/19 recovered
15.6 litres oil (GOR:516 SCF/STB)
Water gradient 1.41 psi/m
DEPTH (mSS)
1385
1390
1395
1400
1405
1410
1415
1990
2000
2010
2020
2030
Pressure (psia)

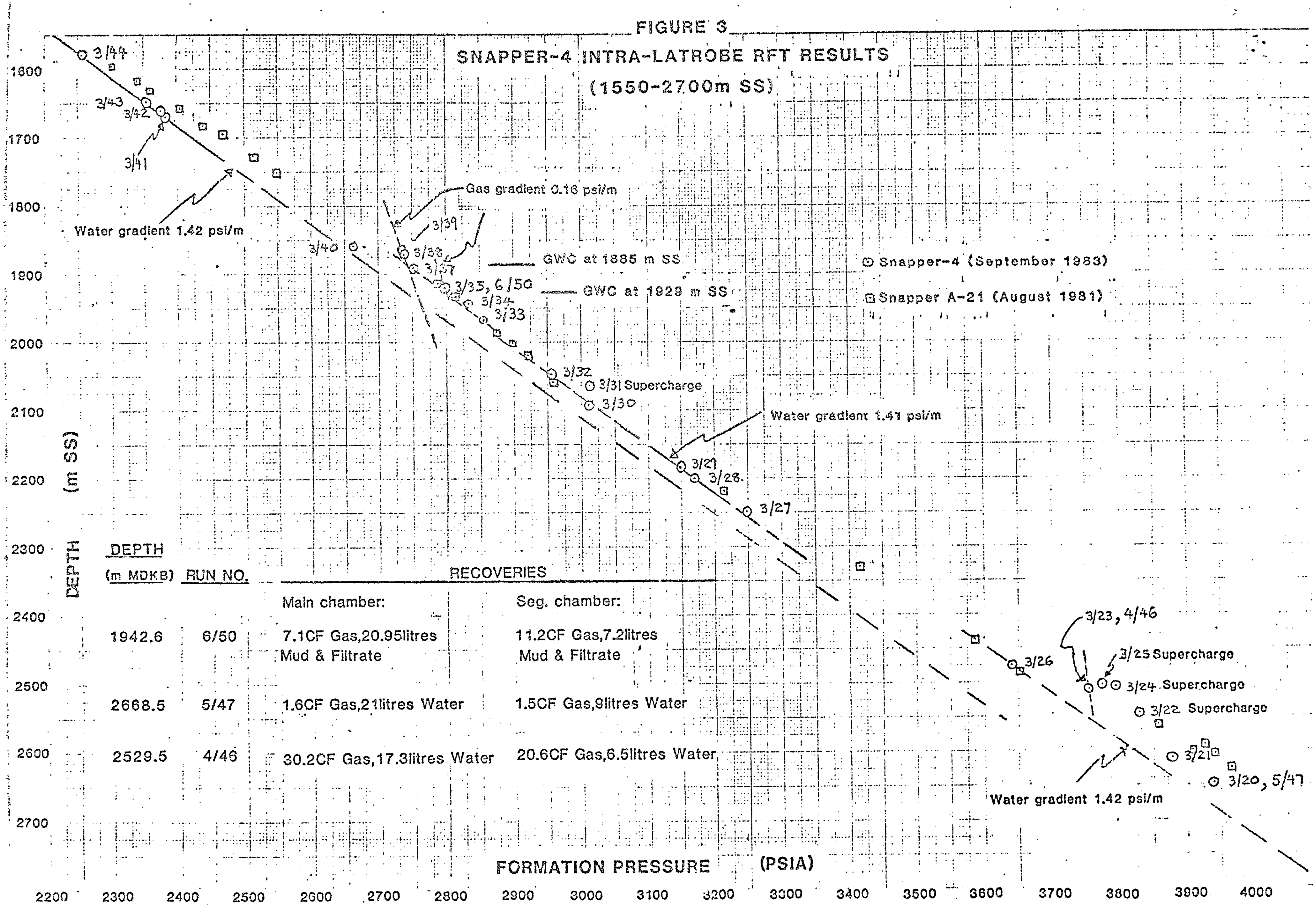


FIGURE 3

SNAPPER-4 INTRA-LATROBE RFT RESULTS (1550-2700m SS)

APPENDIX 5

GEOCHEMICAL REPORT
SNAPPER-4 WELL, GIPPSLAND BASIN
VICTORIA

by

J.K. EMMETT

Sample handling and analysed by:

- D.M. Ford)
- D.M. Hill) Esso Australia Ltd.
- J. Maccoll)
- Exxon Production Research Company
- Geochem Laboratories

Esso Australia Ltd May 1984

Geochemical Report

0851L/1_5

CONTENTS

LIST OF TABLES

1. C_1-4 Headspace Cuttings Gas Data

2. Total Organic Carbon Report

3. Vitrinite Reflectance Report

4. Rock-Eval Pyrolysis Results

5. Kerogen Elemental Analysis Report

6. Kerogen Elemental Atomic Ratios Report

7. C_{15+} Liquid Chromatography Results

8. Snapper-4 Oil, RFT - 2/19 at 1410m(KB) - C_{4-7} Data

9. " " " " " " " - Liquid Chromatography Data

10. Snapper-4 Oil, RFT 2/19 at 1410m(KB), - API gravity, % Sulphur and Carbon Isotope Data

LIST OF FIGURES

1(a) C_{1-4} Cuttings Gas log

(b) % Wet (C_{2-4}) Gas log

2. Vitrinite Reflectance vs. Depth

3. Rock-Eval Maturation and Organic Matter Type

4. Atomic H/C vs. Atomic O/C - Modified Van Krevelen Plot

5. Principal Products of Kerogen Evolution

6. C_{15+} Saturate Chromotogram, Cuttings Extract, 2040-2055m(KB)

7. " " " " " 2340-2355m(KB)

8. " " " " " 2505-2520m(KB)

9. " " " " " 2775-2790m(KB)

10. "Whole Oil" Chromatogram, Snapper-4 Oil, RFT 2/19 at 1410m(KB)

11. C_{15+} Saturate Chromatogram, Snapper-4 Oil, RFT 2/19 at 1410m(KB)

SNAPPER-4

INTRODUCTION

Various geochemical analyses were performed on samples of wet canned cuttings, sidewall cores and conventiopnal cores. Canned cuttings composited over 15-metre intervals were collected from 220m(KB) down to Total Depth (T.D.) at 2821m(KB). Light hydrocarbon (C_{1-4}) headspace gases were determined for alternate 15-metre intervals from 990m(KB) down to T.D. Selected samples were then hand-picked for more detailed analyses, such as Total Organic Carbon (T.O.C.), Rock-Eval pyrolysis, kerogen isolation and elemental analysis and C_{15+} liquid and gas chromatography. Vitrinite reflectance ($\bar{R}_v$ max) measurements were performed by Professor A.C. Cook of Wollongong.

An oil sample, RFT 2/19 at 1410m(KB) was analysed by 'whole oil' and C_{4-7} gas chromatography, C_{15+} liquid and gas chromatography and mass spectrometry, API gravity and % sulphur. Carbon isotope determinations were also performed on the saturate and aromatic fractions.

DISCUSSION OF RESULTS

The detailed headspace - C_{1-4} cuttings gas analysis data are presented in Table 1. This data is more conveniently represented in log form in Figures 1(a) and 1(b). Total cuttings gas values in the Gippsland Limestone and Lakes Entrance Formations are moderately rich only (fig. 1[a]) and are indicative of a marginal potential to source dry gas. Cuttings gas values in the Latrobe Group however, are generally rich to very rich, with a generally higher amount of wet (C_{2+}) gas components present (fig. 1[b]), compared to cuttings gas in the overlying Lakes Entrance and Gippsland Limestone Formations. Hence the Latrobe Group sediments are rated as having very good hydrocarbon source potential for both oil and gas.

Total Organic Carbon values for the Latrobe Group are rich (average T.O.C. = 2.36%, Table 2) which supports the previous very good hydrocarbon source potential rating.

Vitrinite reflectance (R_v max) data are presented in Table 3 and have been plotted against depth in Figure 2. The maturation gradient conforms fairly well to a straight line as shown in Figure 2, and using this profile the top of organic maturity (taken to be R_v max = 0.65%) occurs in the Latrobe Group at approximately 2200m(KB). Detailed vitrinite reflectance and exinite fluoresence data are given in Appendix-1 - Report by A.C. Cook.

The results of Rock-Eval pyrolysis analyses of samples with T.O.C. values of 0.5% or more, are listed in Table 4. In Figure 3, Hydrogen Index has been plotted against T_{max} (^{o}C), and fields delineating the basic kerogen types and their degree of maturation (indicated by equivalent vitrinite reflectance values) are also shown. Figure 3 shows that organic matter in the Latrobe Group sediments varies from modal Type III to intermediate Type II-III (i.e. predominantly woody-coaly-herbaceous kerogen), with a few samples plotting as intermediate Type I-II (i.e. quite oil-prone, exinite-rich kerogen). The Rock-Eval results confirm again a very good gas plus oil source potential for the Latrobe Group sediments.

Elemental analyses of selected kerogen concentrates isolated from conventional and sidewall cores from the Latrobe Group, are listed in Table 5. Approximate Hydrogen : Carbon (H/C), Oxygen : Carbon (O/C) and Nitrogen : Carbon (N/C) atomic ratios are given in Table 6. These results are labelled "approximate" since the oxygen % is calculated by difference, and the naturally occurring organic sulphur % (which may be up to a few percent) was not determined. Figure 4 is a modified Van Krevelen Plot of atomic H/C ratio versus atomic O/C ratio. Comparison of Figure 4 with Figure 5, a similar plot, showing the principal products of kerogen evolution, re-affirms that Type III kerogen predominates, although some samples plot as oil-prone Type II-III and type II kerogen.

The C_{15+} liquid chromatography results from selcted Latrobe Group canned cuttings are listed in Table 7. Total Extract values are very rich, and the amount of hydrocarbon material present, increases down the well with increasing maturity. These C_{15+} liquid chromatography results also testify to a very good hydrocarbon source potential for the Latrobe Group sediments.

The corresponding C_{15+} saturate chromatograms (Figures 6-9) represent hydrocarbon distributions derived from typically terrestrial organic matter, as indicated by an envelope of high molecular weight waxy n-alkanes showing odd over even predominance which decreases with increasing maturity. High pristane (peak 'a'): phytane (peak 'b') ratios (i.e. 6) are also a typical indicator of organic matter derived from a terrestrial (i.e. oxic) environment.

In Tables 8, 9 and 10 respectively, C_{4-7} gasoline-range hydrocarbon; liquid chromatography; and API gravity, % Sulphur and Carbon Isotope data are listed for an oil sample RFT 2/19 at 1410m(KB). A whole oil chromatogram with Sulphur compound trace and a C_{15+} saturate hydrocarbon chromatogram are shown in Figures 10 and 11 respectively. The Snapper-4 oil is a fairly mature, medium API, paraffinic-based crude which appears to have been partially altered in the reservoir as a result of biodegradation and/or water washing. At 1410m(KB), this oil occurs within the zone of fresh-water flushing. Biodegradation is indicated by the relative reduction in the amount of n-alkanes in the $N-C_{10}$ to $N-C_{17}$ range (Figs. 9 and 10), whereas the very small quantities of low molecular weight aromatic hydrocarbons (i.e. benzene and toluene, Table 8) which are readily water soluble, is evidence of some water washing alteration.

CONCLUSIONS

1. The top of organic maturity for significant hydrocarbon generation in Snapper-4 occurs in the Latrobe Group sediments at approximately 2200m(KB).

2. The Latrobe Group sediments are rated as having very good hydrocarbon source potential for both oil and gas.

3. Oil located in the Top Latrobe Group Reservoir section is a fairly mature, medium API, paraffinic-based crude, which appears to have been partially altered as a result of contact with fresh water.

APPENDIX

1. Detailed Vitrinite Reflectance and Exinite Fluorescence Data

   - by A.C. Cook

TABLE 9

LIQUID CHROMATOGRAPHY DATA (Insolubles and Loss free basis)

SNAPPER-4 OIL, RFT 2/19 at 1410m(KB)

%	Saturates	=	79.6
%	Aromatics	=	12.5
%	N.S.O.	=	6.0
%	Non-Eluted N.S.O.	=	1.1
%	Asphaltenes	=	0.8

14/02/84

ESSO AUSTRALIA LTD.

Table 1

C1-C4 HYDROCARBON ANALYSES

REPORT A - HEADSPACE GAS

BASIN - GIPPSLAND
WELL - SNAPPER 4

SAMPLE NO.	DEPTH	GAS CONCENTRATION (VOLUME GAS PER MILLION VOLUMES CUTTINGS)								GAS COMPOSITION (PERCENT)								
		METHANE C1	ETHANE C2	PROPANE C3	IBUTANE IC4	NBUTANE C4	WET C2-C4	TOTAL C1-C4	WET/TOTAL PERCENT	TOTAL GAS M	E	P	IB	NB	WET GAS E	P	IB	NB
72730 A	1005.00	2167	100	38	13	7	158	2325	6.80	93.	4.	2.	1.	0.	63.	24.	8.	4.
72730 C	1035.00	2708	133	42	12	6	193	2901	6.65	93.	5.	1.	0.	0.	69.	22.	6.	3.
72730 E	1065.00	999	69	25	5	4	103	1102	9.35	91.	6.	2.	0.	0.	67.	24.	5.	4.
72730 G	1095.00	933	65	31	6	4	106	1039	10.20	90.	6.	3.	1.	0.	61.	29.	6.	4.
72730 I	1125.00	1164	87	47	6	6	146	1310	11.15	89.	7.	4.	0.	0.	60.	32.	4.	4.
72730 K	1155.00	1737	155	102	13	15	285	2022	14.09	86.	8.	5.	1.	1.	54.	36.	5.	5.
72730 M	1185.00	942	115	100	17	25	257	1199	21.43	79.	10.	8.	1.	2.	45.	39.	7.	10.
72730 O	1215.00	507	84	88	24	42	238	745	31.95	68.	11.	12.	3.	6.	35.	37.	10.	18.
72730 Q	1245.00	2058	225	186	52	98	561	2619	21.42	79.	9.	7.	2.	4.	40.	33.	9.	17.
72730 S	1275.00	1209	137	125	39	65	366	1575	23.24	77.	9.	8.	2.	4.	37.	34.	11.	18.
72730 U	1305.00	3136	335	321	117	204	977	4113	23.75	76.	8.	8.	3.	5.	34.	33.	12.	21.
72730 W	1335.00	8257	2549	1539	300	464	4852	13109	37.01	63.	19.	12.	2.	4.	53.	32.	6.	10.
72730 Y	1365.00	6324	3076	1684	283	408	5451	11775	46.29	54.	26.	14.	2.	3.	56.	31.	5.	7.
72731 A	1395.00	48591	9813	3640	522	708	14683	63274	23.21	77.	16.	6.	1.	1.	67.	25.	4.	5.
72731 C	1425.00	26658	6334	2680	438	604	10056	36744	27.37	73.	17.	7.	1.	2.	63.	27.	4.	6.
72731 E	1455.00	11172	2985	1367	241	300	4893	16065	30.46	70.	19.	9.	2.	2.	61.	28.	5.	6.
72731 G	1485.00	6620	2054	1277	274	367	3972	10592	37.50	63.	19.	12.	3.	3.	52.	32.	7.	9.
72731 I	1515.00	3281	1039	625	124	178	1966	5247	37.47	63.	20.	12.	2.	3.	53.	32.	6.	9.
72731 K	1545.00	3816	5593	4195	726	892	11406	20222	56.40	44.	28.	21.	4.	4.	49.	37.	6.	8.
72731 M	1575.00	97178	29202	10556	1032	1119	41909	139087	30.13	70.	21.	8.	1.	1.	70.	25.	2.	3.
72731 O	1605.00	59860	9693	2608	217	246	12764	72624	17.58	82.	13.	4.	0.	0.	76.	20.	2.	2.
72731 Q	1635.00	132942	31048	6897	579	546	39070	172012	22.71	77.	18.	4.	0.	0.	79.	18.	1.	1.
72731 S	1665.00	138839	15689	2653	248	206	18796	157635	11.92	88.	10.	2.	0.	0.	83.	14.	1.	1.
72731 U	1695.00	129365	14559	2506	219	251	17535	146900	11.94	88.	10.	2.	0.	0.	83.	14.	1.	1.
72731 W	1725.00	121830	11139	1500	108	71	12818	134648	9.52	90.	8.	1.	0.	0.	87.	12.	1.	1.
72731 Y	1755.00	218108	24901	4526	434	365	30226	248334	12.17	88.	10.	2.	0.	0.	82.	15.	1.	1.
72732 A	1785.00	54306	12905	3449	331	360	17045	71351	23.89	76.	18.	5.	0.	1.	76.	20.	2.	2.
72732 C	1815.00	95703	9013	1498	141	116	10768	106471	10.11	90.	8.	1.	0.	0.	84.	14.	1.	1.
72732 E	1845.00	50843	5301	1036	96	106	6539	57382	11.40	89.	9.	2.	0.	0.	81.	16.	1.	2.
72732 G	1875.00	48570	4806	909	88	95	5898	54468	10.83	89.	9.	2.	0.	0.	81.	15.	1.	2.
72732 I	1905.00	99468	10194	2041	184	211	12630	112098	11.27	89.	9.	2.	0.	0.	81.	16.	1.	2.
72732 K	1935.00	78840	7386	1399	131	159	9075	87915	10.32	90.	8.	2.	0.	0.	81.	15.	1.	2.
72732 M	1965.00	110259	17961	3583	371	426	22341	132600	16.85	83.	14.	3.	0.	0.	80.	16.	2.	2.
72732 O	2010.00	30406	7781	1859	170	218	10028	40434	24.80	75.	19.	5.	0.	1.	78.	19.	2.	2.
72732 Q	2040.00	26027	6692	1645	168	199	8704	34731	25.06	75.	19.	5.	0.	1.	77.	19.	2.	2.
72732 S	2070.00	146	3	0	0	0	3	149	2.01	98.	2.	0.	0.	0.	100.	0.	0.	0.
72732 U	2100.00	102812	6614	877	70	75	7636	110448	6.91	93.	6.	1.	0.	0.	87.	11.	1.	1.
72732 W	2130.00	7621	2423	625	69	87	3204	10825	29.60	70.	22.	6.	1.	1.	76.	20.	2.	3.
72732 Y	2160.00	8458	5036	2461	281	504	8282	16740	49.47	51.	30.	15.	2.	3.	61.	30.	3.	6.
72733 A	2190.00	21535	4078	1146	113	179	5516	27071	20.38	80.	15.	4.	0.	1.	74.	21.	2.	3.
72733 C	2220.00	11191	1582	389	42	52	2065	13256	15.58	84.	12.	3.	0.	0.	77.	19.	2.	3.
72733 E	2250.00	12358	1713	420	52	61	2246	14604	15.38	85.	12.	3.	0.	0.	76.	19.	2.	3.
72733 G	2280.00	41356	2717	485	67	52	3321	44707	7.43	93.	6.	1.	0.	0.	82.	15.	2.	2.
72733 I	2310.00	205257	30923	6194	778	419	38314	243571	15.73	84.	13.	3.	0.	0.	81.	16.	2.	1.
72733 K	2340.00	82249	6080	1237	165	98	7580	89829	8.44	92.	7.	1.	0.	0.	80.	16.	2.	1.
72733 M	2370.00	134159	8307	1174	108	108	9697	143856	6.74	93.	6.	1.	0.	0.	86.	12.	1.	1.
72733 O	2400.00	56996	4059	961	92	72	5184	62180	8.34	92.	7.	2.	0.	0.	78.	19.	2.	1.

Table [illegible] cont.

14/02/84

ESSO AUSTRALIA LTD.

PAGE

C1-C4 HYDROCARBON ANALYSES

REPORT A - HEADSPACE GAS

BASIN - GIPPSLAND
WELL - SNAPPER 4

GAS CONCENTRATION (VOLUME GAS PER MILLION VOLUMES CUTTINGS) | GAS COMPOSITION (PERCENT)

SAMPLE NO.	DEPTH	METHANE C1	ETHANE C2	PROPANE C3	IBUTANE IC4	NBUTANE C4	WET C2-C4	TOTAL C1-C4	WET/TOTAL PERCENT	TOTAL GAS M	TOTAL GAS E	TOTAL GAS P	TOTAL GAS IB	TOTAL GAS NB	WET GAS E	WET GAS P	WET GAS IB	WET GAS NB
72733 Q	2430.00	31124	2132	550	54	43	2779	33903	8.20	92.	6.	2.	0.	0.	77.	20.	2.	2.
72733 S	2460.00	58068	4505	1028	88	89	5710	63778	8.95	91.	7.	2.	0.	0.	79.	18.	2.	2.
72733 U	2490.00	29164	4676	1543	112	186	6517	35681	18.23	82.	13.	4.	0.	1.	72.	24.	2.	3.
72733 W	2520.00	34402	7087	2398	242	307	10034	44436	22.58	77.	16.	5.	1.	1.	71.	24.	2.	3.
72733 Y	2550.00	2925	3643	2790	320	531	7284	10209	71.35	29.	36.	27.	3.	5.	50.	38.	4.	7.
72734 A	2580.00	34943	4154	1140	107	131	5532	40475	13.67	86.	10.	3.	0.	0.	75.	21.	2.	2.
72734 C	2610.00	31161	3124	996	110	122	4352	35513	12.25	88.	9.	3.	0.	0.	72.	23.	3.	3.
72734 E	2640.00	8932	1589	528	63	89	2269	11251	20.17	80.	14.	5.	1.	1.	70.	23.	3.	4.
72734 G	2670.00	38850	3820	1144	98	120	5182	44032	11.77	88.	9.	3.	0.	0.	74.	22.	2.	2.
72734 I	2700.00	61394	710	2411	253	276	3650	65044	5.61	94.	1.	4.	0.	0.	19.	66.	7.	8.
72734 K	2730.00	70819	7473	2408	218	222	10321	81140	12.72	87.	9.	3.	0.	0.	72.	23.	2.	2.
72734 M	2760.00	62943	9405	3003	275	359	13042	75985	17.16	83.	12.	4.	0.	0.	72.	23.	2.	3.
72734 O	2790.00	4475	1799	982	100	160	3032	7507	40.39	60.	24.	13.	1.	2.	59.	32.	3.	5.
72734 Q	2820.00	39240	5108	1613	167	257	7145	46385	15.40	85.	11.	3.	0.	1.	71.	23.	2.	4.

27/03/84

Table 2

ESSO AUSTRALIA LTD.

PAGE

TOTAL ORGANIC CARBON REPORT

BASIN - GIPPSLAND
WELL - SNAPPER 4

SAMPLE NO.	DEPTH	AGE	FORMATION	AN	TOC%	AN	TOC%	AN	T/C03	DESCRIPTION
72687 U	1068.00	MIOCENE-OLIGOCENE	LAKES ENTRANCE	1	.37					LT MED GRY SLST. V CALC.

===> DEPTH : 1047.50 TO 1259.50 METRES. <=== I ===> AVERAGE TOC : .37 % EXCLUDING VALUES GREATER THAN 10.00 % <===

SAMPLE NO.	DEPTH	AGE	FORMATION	AN	TOC%	AN	TOC%	AN	T/C03	DESCRIPTION
72687 H	1260.00	EOCENE	LATROBE GROUP-GURNARD FM.	1	.64					MED-DK BRN-GY SLST.CARB.
72687 B	1275.40	EOCENE	LATROBE GROUP-GURNARD FM.	1	.33					MED BRN SDYSLST.QTZ.CALC
72687 A	1279.00	EOCENE	LATROBE GROUP-GURNARD FM.	1	.29					MED BRN SDYSLST.QTZ.CALC
72686 Z	1281.50	EOCENE	LATROBE GROUP-GURNARD FM.	1	.66					MED BRN-GY SDY SLST.QTZ.
72686 Y	1287.00	EOCENE	LATROBE GROUP-GURNARD FM.	1	1.59					MED-DK GRN-GRY SDY SLST.

===> DEPTH : 1259.50 TO 1288.00 METRES. <=== I ===> AVERAGE TOC : .70 % EXCLUDING VALUES GREATER THAN 10.00 % <===

SAMPLE NO.	DEPTH	AGE	FORMATION	AN	TOC%	AN	TOC%	AN	T/C03	DESCRIPTION
75686 T	1330.00	EOCENE	LATROBE GROUP	1	4.03					MED-DK GRY SLST.CARB.NC.
72686 O	1372.00	EOCENE	LATROBE GROUP	1	1.45					LT-MED GRY SLST.CARB.NC.
72686 M	1389.00	EOCENE	LATROBE GROUP	1	2.36					MED-DK GRY SLST.CARB.NC.
72686 I	1414.90	EOCENE	LATROBE GROUP	1	2.59					MED-LT OLGRY SLST.N CALC
72686 N	1441.90	EOCENE	LATROBE GROUP	1	3.36					MED-LT OLGRY SLST.N CALC
72728 Y	1638.50	EOCENE	LATROBE GROUP	1	2.95					OL GRY SLTST.
72729 U	1746.50	EOCENE	LATROBE GROUP	1	3.05					DK GRY FISSILE SLTST.
72728 R	1765.50	EOCENE	LATROBE GROUP	1	2.20					OL GRY SLTST.
72728 U	1822.00	PALEOCENE	LATROBE GROUP	1	.24					LT OL GRY SLTST.
72728 F	1918.10	PALEOCENE	LATROBE GROUP	1	3.62					DARK GREY SHALE.
72728 C	1953.00	PALEOCENE	LATROBE GROUP	1	1.49					DK GRY SLTST.MICA.
72728 A	1986.00	PALEOCENE	LATROBE GROUP	1	2.23					DK GRY SLTST.MICA.
72727 X	2046.90	PALEOCENE	LATROBE GROUP	1	.31					MED DK GRY SLTST.
72727 V	2078.90	PALEOCENE	LATROBE GROUP	1	2.48					LT-MED LT GRY SDY SLTST.
72727 R	2146.90	PALEOCENE	LATROBE GROUP	1	.13					LT OL GRY SLTST.
72727 M	2246.00	PALEOCENE	LATROBE GROUP	1	.48					DK GRY SHALE.
72727 I	2328.40	PALEOCENE	LATROBE GROUP	1	.55					MED GRY SILTY SHALE.
72727 F	2390.10	LATE CRETACEOUS	LATROBE GROUP	1	1.46					MED OL GRY SLTST. COALY.
72727 E	2407.40	LATE CRETACEOUS	LATROBE GROUP	1	1.14					MED OL GRY SLTST.
72727 C	2448.10	LATE CRETACEOUS	LATROBE GROUP	1	1.06					MED OL GRY SLTST. COALY.
72726 Y	2516.00	LATE CRETACEOUS	LATROBE GROUP	1	1.13					DK GRY SLTY SHALE.
72726 V	2550.00	LATE CRETACEOUS	LATROBE GROUP	1	1.07					LT OL GRY SNDY SILTSTONE
72729 H	2566.50	LATE CRETACEOUS	LATROBE GROUP	1	1.27					MED GRY CLYST. COALY.
72727 N	2640.00	LATE CRETACEOUS	LATROBE GROUP	1	1.68					MED GRY SLTST. MICA.
72727 G	2645.00	LATE CRETACEOUS	LATROBE GROUP	1	4.30					GRY' BLK FISSILE SLTST.
72726 S	2650.50	LATE CRETACEOUS	LATROBE GROUP	1	1.52					MED DK GY SLST.COAL.MICA
72726 W	2670.00	LATE CRETACEOUS	LATROBE GROUP	1	2.98					DK GRY SHALE.COALY FRAGS
72726 L	2693.00	LATE CRETACEOUS	LATROBE GROUP	1	3.06					DK GRY SLTST.COALY FRAGS
72726 J	2710.00	LATE CRETACEOUS	LATROBE GROUP	1	2.64					DK GRY SLTST.COALY FRAGS
72726 H	2725.50	LATE CRETACEOUS	LATROBE GROUP	1	1.47					MED GY CLYST.COALY FRAGS
72726 G	2740.00	LATE CRETACEOUS	LATROBE GROUP	1	4.41					LT-MED OL GY SLTST.COALY

ESSO AUSTRALIA LTD.

TOTAL ORGANIC CARBON REPORT

BASIN - GIPPSLAND
WELL - SNAPPER 4

SAMPLE NO.	DEPTH	AGE	FORMATION	AN	TOC%	AN	TOC%	AN	T/C03	DESCRIPTION
72726 B	2784.00	LATE CRETACEOUS	LATROBE GROUP	1	7.57					OL GRY SLTST. ABUND COAL
72726 A	2804.00	LATE CRETACEOUS	LATROBE GROUP	1	7.57					OL GRY SLTST. ABUND COAL

===> DEPTH : 1288.00 TO 2804.00 METRES. <=== I ===> AVERAGE TOC : 2.36 % EXCLUDING VALUES GREATER THAN 10.00 % <===

VITRINITE REFLECTANCE REPORT

BASIN - GIPPSLAND
WELL - SNAPPER 4

SAMPLE NO.	DEPTH	AGE	FORMATION	AN	MAX. RO	FLUOR. COLOUR	NO.CNTS.	MACERAL TYPE
72686 G	1446.00	EOCENE	LATROBE GROUP	5	.44	GRN-OR	20	E ABUNDANT,I SPARSE
72729 A	1621.00	EOCENE	LATROBE GROUP	5	.46	GRN-OR	29	COAL
72727 V	2078.90	PALEOCENE	LATROBE GROUP	5	.58	YEL-DULL OR	23	DOM ABUNDANT,I>V>>E
72727 H	2352.20	PALEOCENE	LATROBE GROUP	5	.77	YELL-OR	28	V>I>E,DOM ABUNDANT
72726 Z	2504.90	LATE CRETACEOUS	LATROBE GROUP	5	.84	OR-DULL OR	18	I>V>E,DOM COMMON
72726 I	2716.30	LATE CRETACEOUS	LATROBE GROUP	5	.98	OR-DULL OR	25	V>I=E,DOM COMMON
72726 A	2804.00	LATE CRETACEOUS	LATROBE GROUP	5	.71	YEL-OR	30	V=E>I,DOM ABUNDANT

Table 4

27/03/84

ESSO AUSTRALIA LTD.

ROCK EVAL ANALYSES

BASIN - GIPPSLAND
WELL - SNAPPER 4

REPORT A - SULPHUR & PYROLYZABLE CARBON

SAMPLE NO.	DEPTH	SAMPLE TYPE	AGE	TMAX	S1	S2	S3	PI	S2/S3	PC	COMMENTS
72687 H	1260.0	SWC	EOCENE	426.	.06	.04	.96	.60	.04	.00	
72686 Z	1261.5	SWC	EOCENE	421.	.05	.10	.06	.36	1.66	.01	
75686 T	1330.0	SWC	EOCENE	411.	1.60	12.14	.64	.12	18.96	1.14	
72686 O	1372.0	SWC	EOCENE	412.	.44	2.03	.30	.18	6.76	.20	
72686 M	1369.0	SWC	EOCENE	415.	.74	6.01	.61	.11	9.85	.56	
72686 I	1414.9	SWC	EOCENE	415.	.41	4.47	.48	.08	9.31	.40	
72686 H	1441.9	SWC	EOCENE	417.	.36	5.04	.71	.07	7.09	.45	
72728 Y	1638.5	SWC	EOCENE	428.	.74	3.96	.55	.16	7.20	.39	
72729 U	1746.5	SWC	EOCENE	434.	.59	5.79	.55	.09	10.52	.53	
72728 P	1765.5	SWC	EOCENE	431.	.32	2.07	.40	.13	5.17	.19	
72728 F	1918.1	SWC	PALEOCENE	432.	.75	4.47	.40	.14	11.17	.43	
72728 C	1953.0	SWC	PALEOCENE	434.	.38	2.52	.28	.13	9.00	.24	
72728 A	1986.0	SWC	PALEOCENE	435.	.46	2.86	.27	.14	10.59	.27	
72727 V	2078.9	SWC	PALEOCENE	433.	.73	3.43	.29	.18	11.82	.34	
72727 I	2328.4	SWC	PALEOCENE	428.	.20	.27	.14	.43	1.92	.03	
72727 F	2390.1	SWC	LATE CRETACEOUS	434.	.33	1.26	.17	.21	7.41	.13	
72727 E	2407.4	SWC	LATE CRETACEOUS	432.	.24	.63	.10	.28	6.30	.07	
72727 C	2448.1	SWC	LATE CRETACEOUS	437.	.28	.97	.10	.23	9.70	.10	
72726 Y	2516.0	SWC	LATE CRETACEOUS	435.	.27	.59	.17	.31	3.47	.07	
72726 V	2550.0	SWC	LATE CRETACEOUS	436.	.47	.58	.19	.45	3.05	.08	
72729 H	2586.5	SWC	LATE CRETACEOUS	445.	.60	.55	.22	.53	2.50	.09	
72727 W	2640.0	SWC	LATE CRETACEOUS	438.	.42	.92	.11	.31	8.36	.11	
72727 B	2645.0	SWC	LATE CRETACEOUS	441.	1.63	6.91	.27	.19	25.59	.71	
72726 S	2650.5	SWC	LATE CRETACEOUS	438.	1.02	2.95	.23	.26	12.82	.33	
72726 O	2670.0	SWC	LATE CRETACEOUS	442.	1.24	3.61	.21	.26	17.19	.40	
72726 L	2693.0	SWC	LATE CRETACEOUS	444.	1.36	10.10	.35	.12	28.85	.95	
72726 J	2710.0	SWC	LATE CRETACEOUS	442.	1.46	4.68	.27	.24	17.33	.51	
72726 H	2725.5	SWC	LATE CRETACEOUS	434.	.93	1.53	.22	.38	6.95	.20	
72726 G	2740.0	SWC	LATE CRETACEOUS	439.	1.90	9.25	.24	.17	38.54	.92	
72726 B	2784.0	SWC	LATE CRETACEOUS	440.	4.57	27.78	.31	.14	89.61	2.69	
72726 A	2804.0	SWC	LATE CRETACEOUS	438.	5.67	28.83	.30	.16	96.10	2.87	

PI=PRODUCTIVITY INDEX   PC=PYROLYZABLE CARBON   TC=TOTAL CARBON   HI=HYDROGEN INDEX   OI=OXYGEN INDEX

ROCK EVAL ANALYSES

BASIN - GIPPSLAND
WELL - SNAPPER 4

REPORT B - TOTAL CARBON,H/O INDICES

SAMPLE NO.	DEPTH	SAMPLE TYPE	FORMATION	TC	HI	OI	HI/OI	COMMENTS
72687 H	1260.0	SWC	LATROBE GROUP-GURNARD FM	.64	6.	150.	.04	
72686 Z	1261.5	SWC	LATROBE GROUP-GURNARD FM	.66	15.	9.	1.67	
75686 T	1330.0	SWC	LATROBE GROUP	4.03	301.	15.	20.07	
72686 O	1372.0	SWC	LATROBE GROUP	1.45	140.	20.	7.00	
72686 M	1369.0	SWC	LATROBE GROUP	2.36	254.	25.	10.16	
72686 T	1414.9	SWC	LATROBE GROUP	2.59	172.	18.	9.56	
72686 H	1441.9	SWC	LATROBE GROUP	3.36	150.	21.	7.14	
72728 Y	1638.5	SWC	LATROBE GROUP	2.95	134.	18.	7.44	
72729 U	1746.5	SWC	LATROBE GROUP	3.05	189.	18.	10.50	
72728 P	1765.5	SWC	LATROBE GROUP	2.20	94.	18.	5.22	
72728 F	1918.1	SWC	LATROBE GROUP	3.62	123.	11.	11.18	
72728 C	1953.0	SWC	LATROBE GROUP	1.49	169.	18.	9.39	
72728 A	1986.0	SWC	LATROBE GROUP	2.23	128.	12.	10.67	
72727 V	2078.9	SWC	LATROBE GROUP	2.48	138.	11.	12.55	
72727 T	2328.4	SWC	LATROBE GROUP	.55	49.	25.	1.96	
72727 F	2390.1	SWC	LATROBE GROUP	1.46	86.	11.	7.82	
72727 E	2407.4	SWC	LATROBE GROUP	1.14	55.	8.	6.88	
72727 C	2448.1	SWC	LATROBE GROUP	1.06	91.	9.	10.11	
72726 Y	2516.0	SWC	LATROBE GROUP	1.13	52.	15.	3.47	
72726 V	2550.0	SWC	LATROBE GROUP	1.07	54.	17.	3.18	
72729 H	2586.5	SWC	LATROBE GROUP	1.27	43.	17.	2.53	
72727 W	2640.0	SWC	LATROBE GROUP	1.68	54.	6.	9.00	
72727 B	2645.0	SWC	LATROBE GROUP	4.30	160.	6.	26.67	
72726 S	2650.5	SWC	LATROBE GROUP	1.52	194.	15.	12.93	
72726 O	2670.0	SWC	LATROBE GROUP	2.98	121.	7.	17.29	
72726 L	2693.0	SWC	LATROBE GROUP	3.06	330.	11.	30.00	
72726 J	2710.0	SWC	LATROBE GROUP	2.64	177.	10.	17.70	
72726 H	2725.5	SWC	LATROBE GROUP	1.47	104.	14.	7.43	
72726 G	2740.0	SWC	LATROBE GROUP	4.41	209.	5.	41.80	
72726 B	2784.0	SWC	LATROBE GROUP	7.57	366.	4.	91.50	
72726 A	2804.0	SWC	LATROBE GROUP	7.57	380.	3.	126.67	

T.O.C. = Total organic carbon, wt. %
S1 = Free hydrocarbons, mg HC/g of rock
S2 = Residual hydrocarbon potential (mg HC/g of rock)
S3 = CO2 produced from kerogen pyrolysis (mg CO2/g of rock)
PC* = 0.083 (S_1 + S_2)
Hydrogen Index = mg HC/g organic carbon
Oxygen Index = mg CO2/g organic carbon
PI = S1/S1+S2
Tmax = Temperature Index, degrees C.

PI=PRODUCTIVITY INDEX PC=PYROLYZABLE CARBON TC=TOTAL CARBON HI=HYDROGEN INDEX OI=OXYGEN INDEX

ESSO AUSTRALIA LTD.

KEROGEN ELEMENTAL ANALYSIS REPORT

BASIN - GIPPSLAND
WELL - SNAPPER 4

SAMPLE NO.	DEPTH	SAMPLE TYPE	--- ELEMENTAL % (ASH FREE) --- N%	C%	H%	S%	O%	ASH%	COMMENTS
72686 Z	1281.50	SWC	1.23	66.91	4.37	.00	27.50	13.64	HIGH ASH
72686 Y	1287.00	SWC	.79	66.85	5.05	.00	27.30	12.93	HIGH ASH
72686 U	1313.40	SWC	.41	67.36	5.46	.00	26.77	8.43	
72686 T	1330.00	SWC	.72	69.38	5.46	.00	24.45	7.06	
72686 Q	1350.50	SWC	.48	69.16	5.57	.00	24.78	3.65	
72686 O	1372.00	SWC	.77	66.95	5.28	.00	27.00	8.89	
72686 M	1389.00	SWC	.55	70.41	5.72	.00	23.32	5.55	
72686 I	1414.90	SWC	.75	69.98	5.34	.00	23.93	9.03	
72686 H	1441.90	SWC	.69	66.59	4.75	.00	27.97	8.98	
72729 D	1574.50	SWC	.74	64.45	5.42	.00	29.39	16.27	HIGH ASH
72729 B	1614.50	SWC	.89	71.17	5.50	.00	22.44	3.98	
72729 Y	1626.90	SWC	1.05	69.40	4.53	.00	25.01	3.16	
72728 X	1648.50	SWC	1.16	71.95	5.38	.00	21.52	5.68	
72729 W	1675.50	SWC	1.04	66.22	5.16	.00	27.57	22.28	HIGH ASH
72729 U	1746.50	SWC	.87	62.92	5.07	.00	31.14	18.17	HIGH ASH
72728 Q	1780.30	SWC	1.18	76.42	5.39	.00	17.00	7.83	
72728 K	1677.00	SWC	1.31	78.55	5.95	.00	14.20	8.22	
72728 I	1694.30	SWC	1.00	79.92	5.40	.00	13.67	2.22	
72729 S	1902.00	SWC	.98	79.69	6.00	.00	13.33	5.19	
72728 F	1913.10	SWC	1.00	70.09	4.87	.00	24.04	16.01	HIGH ASH
72728 E	1926.50	SWC	1.08	73.71	5.33	.00	19.87	13.00	HIGH ASH
72729 Q	1933.00	SWC	1.05	77.46	5.27	.00	16.23	5.30	
72728 B	1970.40	SWC	.91	80.73	5.33	.00	13.03	3.21	
72728 A	1986.00	SWC	.80	68.31	5.37	.00	25.51	22.78	HIGH ASH
72727 Z	2011.50	SWC	1.14	80.50	5.71	.00	12.64	5.65	
72727 Y	2029.00	SWC	1.10	74.49	5.26	.00	19.15	11.55	HIGH ASH
72729 N	2063.00	SWC	1.00	80.20	5.61	.00	13.18	8.37	
72727 V	2078.90	SWC	.88	57.57	4.45	.00	37.10	11.08	HIGH ASH
72727 U	2084.00	SWC	1.04	79.26	5.57	.00	14.13	13.05	HIGH ASH
72727 T	2104.00	SWC	1.14	82.16	4.26	.00	12.45	5.83	
72727 Q	2169.20	SWC	.68	82.27	7.16	.00	9.89	10.20	HIGH ASH
72727 J	2309.40	SWC	1.03	83.21	4.81	.00	10.96	6.63	
72727 H	2352.20	SWC	1.17	81.24	5.39	.00	12.20	2.22	
72727 F	2390.10	SWC	1.24	75.90	4.96	.00	17.90	16.05	HIGH ASH
72727 L	2407.40	SWC	1.23	83.63	4.73	.00	10.40	4.93	
72727 D	2425.00	SWC	1.25	84.58	4.16	.00	10.01	.52	
72727 C	2448.10	SWC	.92	55.12	4.63	.00	39.33	25.07	HIGH ASH
72726 Z	2504.90	SWC	1.03	79.10	5.76	.00	14.11	4.81	
72726 V	2550.00	SWC	1.28	83.12	5.28	.00	10.33	4.53	
72726 T	2602.90	SWC	1.36	84.22	4.67	.00	9.75	3.18	
72727 W	2640.00	SWC	.86	58.11	3.78	.00	37.25	21.67	HIGH ASH
72727 G	2645.00	SWC	1.25	76.14	4.86	.00	17.75	16.27	HIGH ASH
72726 W	2670.00	SWC	1.15	82.33	4.95	.00	11.57	1.80	
72726 U	2683.50	SWC	1.20	79.44	4.75	.00	14.60	22.80	HIGH ASH
72726 N	2686.00	SWC	.68	84.59	5.16	.00	9.58	5.20	

27/03/84

ESSO AUSTRALIA LTD.

KEROGEN ELEMENTAL ANALYSIS REPORT

BASIN - GIPPSLAND
WELL - SNAPPER 4

SAMPLE NO.	DEPTH	SAMPLE TYPE	--- ELEMENTAL % (ASH FREE) ---						COMMENTS
			N%	C%	H%	S%	O%	ASH%	
72726 J	2710.00	SWC	1.24	77.45	5.97	.00	15.35	20.77	HIGH ASH
72726 H	2725.50	SWC	1.21	84.10	5.92	.00	8.77	9.10	
72726 G	2740.00	SWC	1.11	83.86	5.72	.00	9.31	5.15	
72726 D	2760.00	SWC	.94	61.53	4.04	.00	33.49	18.03	HIGH ASH
72726 A	2804.00	SWC	.87	58.87	5.06	.00	35.19	9.50	

Table 6

27/03/84

ESSO AUSTRALIA LTD.

PAGE

KEROGEN ELEMENTAL ANALYSIS REPORT

BASIN - GIPPSLAND
WELL - SNAPPER 4

SAMPLE NO.	DEPTH	SAMPLE TYPE	AGE	FORMATION	ATOMIC RATIOS H/C	ATOMIC RATIOS O/C	ATOMIC RATIOS N/C	COMMENTS
72686 Z	1281.50	SWC	EOCENE	LATROBE GROUP-GURNARD FM	.78	.31	.02	HIGH ASH
72686 Y	1287.00	SWC	EOCENE	LATROBE GROUP-GURNARD FM	.91	.31	.01	HIGH ASH
72686 U	1313.40	SWC	EOCENE	LATROBE GROUP	.97	.30	.01	
72686 T	1330.00	SWC	EOCENE	LATROBE GROUP	.94	.26	.01	
72686 Q	1350.50	SWC	EOCENE	LATROBE GROUP	.97	.27	.01	
72686 O	1372.00	SWC	EOCENE	LATROBE GROUP	.95	.30	.01	
72686 N	1389.00	SWC	EOCENE	LATROBE GROUP	.97	.25	.01	
72686 I	1414.90	SWC	EOCENE	LATROBE GROUP	.92	.26	.01	
72686 H	1441.90	SWC	EOCENE	LATROBE GROUP	.86	.32	.01	
72729 J	1574.50	SWC	EOCENE	LATROBE GROUP	1.01	.34	.01	HIGH ASH
72729 O	1614.50	SWC	EOCENE	LATROBE GROUP	.93	.24	.01	
72729 Y	1628.90	SWC	EOCENE	LATROBE GROUP	.78	.27	.01	
72728 X	1643.50	SWC	EOCENE	LATROBE GROUP	.90	.22	.01	
72729 W	1675.50	SWC	EOCENE	LATROBE GROUP	.93	.31	.01	HIGH ASH
72729 U	1746.50	SWC	EOCENE	LATROBE GROUP	.97	.37	.01	HIGH ASH
72728 G	1780.30	SWC	EOCENE	LATROBE GROUP	.85	.17	.01	
72728 K	1877.00	SWC	PALEOCENE	LATROBE GROUP	.91	.14	.01	
72728 I	1894.30	SWC	PALEOCENE	LATROBE GROUP	.81	.13	.01	
72729 S	1902.00	SWC	PALEOCENE	LATROBE GROUP	.90	.13	.01	
72728 F	1918.10	SWC	PALEOCENE	LATROBE GROUP	.83	.26	.01	HIGH ASH
72728 E	1928.50	SWC	PALEOCENE	LATROBE GROUP	.87	.20	.01	HIGH ASH
72729 Q	1933.00	SWC	PALEOCENE	LATROBE GROUP	.82	.16	.01	
72728 B	1970.40	SWC	PALEOCENE	LATROBE GROUP	.79	.12	.01	
72728 A	1986.00	SWC	PALEOCENE	LATROBE GROUP	.94	.28	.01	HIGH ASH
72727 Z	2011.50	SWC	PALEOCENE	LATROBE GROUP	.85	.12	.01	
72727 Y	2029.00	SWC	PALEOCENE	LATROBE GROUP	.85	.19	.01	HIGH ASH
72729 N	2063.00	SWC	PALEOCENE	LATROBE GROUP	.84	.12	.01	
72727 V	2076.90	SWC	PALEOCENE	LATROBE GROUP	.93	.48	.01	HIGH ASH
72727 U	2084.00	SWC	PALEOCENE	LATROBE GROUP	.84	.13	.01	HIGH ASH
72727 T	2104.00	SWC	PALEOCENE	LATROBE GROUP	.62	.11	.01	
72727 Q	2169.20	SWC	PALEOCENE	LATROBE GROUP	1.04	.09	.01	HIGH ASH
72727 J	2309.40	SWC	PALEOCENE	LATROBE GROUP	.69	.10	.01	
72727 H	2352.20	SWC	PALEOCENE	LATROBE GROUP	.80	.11	.01	
72727 F	2390.10	SWC	LATE CRETACEOUS	LATROBE GROUP	.78	.18	.01	HIGH ASH
72727 E	2407.40	SWC	LATE CRETACEOUS	LATROBE GROUP	.68	.09	.01	
72727 D	2425.00	SWC	LATE CRETACEOUS	LATROBE GROUP	.59	.09	.01	
72727 L	2448.10	SWC	LATE CRETACEOUS	LATROBE GROUP	1.01	.54	.01	HIGH ASH
72726 Z	2504.90	SWC	LATE CRETACEOUS	LATROBE GROUP	.87	.13	.01	
72726 V	2550.00	SWC	LATE CRETACEOUS	LATROBE GROUP	.76	.09	.01	
72726 T	2602.90	SWC	LATE CRETACEOUS	LATROBE GROUP	.67	.09	.01	
72727 W	2640.00	SWC	LATE CRETACEOUS	LATROBE GROUP	.78	.48	.01	HIGH ASH
72727 B	2645.00	SWC	LATE CRETACEOUS	LATROBE GROUP	.77	.17	.01	HIGH ASH
72726 Q	2670.00	SWC	LATE CRETACEOUS	LATROBE GROUP	.72	.11	.01	
72726 O	2683.50	SWC	LATE CRETACEOUS	LATROBE GROUP	.72	.14	.01	HIGH ASH
72726 N	2688.00	SWC	LATE CRETACEOUS	LATROBE GROUP	.73	.08	.01	

27/03/84

ESSO AUSTRALIA LTD.

KEROGEN ELEMENTAL ANALYSIS REPORT

BASIN - GIPPSLAND
WELL - SNAPPER 4

SAMPLE NO.	DEPTH	SAMPLE TYPE	AGE	FORMATION	ATOMIC RATIOS			COMMENTS
					H/C	O/C	N/C	
72726 J	2710.00	SWC	LATE CRETACEOUS	LATROBE GROUP	.93	.15	.01	HIGH ASH
72726 H	2725.50	SWC	LATE CRETACEOUS	LATROBE GROUP	.84	.08	.01	
72726 G	2740.00	SWC	LATE CRETACEOUS	LATROBE GROUP	.82	.08	.01	
72726 D	2760.00	SWC	LATE CRETACEOUS	LATROBE GROUP	.79	.41	.01	HIGH ASH
72726 A	2804.00	SWC	LATE CRETACEOUS	LATROBE GROUP	1.03	.45	.01	

C15+ EXTRACT ANALYSES

BASIN - GIPPSLAND
WELL - SNAPPER 4

REPORT A - EXTRACT DATA (PPM)

SAMPLE NO.	DEPTH	TYPE	AN	AGE	TOTAL EXTRACT	HYDROCARBONS SATS.	HYDROCARBONS AROMS.	HYDROCARBONS TOTAL H/CARBS	NON-HYDROCARBONS ASPH.	NON-HYDROCARBONS ELUTED NSO	NON-HYDROCARBONS NON-ELT NSO	NON-HYDROCARBONS TOTAL NSO	NON-HYDROCARBONS SULPHUR	NON-HYDROCARBONS TOTAL NON/HCS
72732 R	2055.00	CTS	2	PALEOCENE	15412.	2399.	3256.	5655.	7773.	1569.	415.	1984.	0.	9757.
72733 L	2355.00	CTS	2	PALEOCENE	12409.	1019.	1791.	2810.	8440.	970.	970.	1940.	0.	10380.
72733 W	2520.00	CTS	2	LATE CRETACEOUS	2713.	581.	601.	1182.	1175.	339.	17.	356.	0.	1531.
72734 O	2790.00	CTS	2	LATE CRETACEOUS	2176.	687.	541.	1228.	613.	302.	33.	335.	0.	948.

C15+ EXTRACT ANALYSES

BASIN - GIPPSLAND
WELL - SNAPPER 4

REPORT B - EXTRACTS % OF TOTAL

SAMPLE NO.	DEPTH	FORMATION	HYDROCARBONS SAT. %	HYDROCARBONS AROM.%	NON-HYDROCARBONS NSO. %	NON-HYDROCARBONS ASPH.%	NON-HYDROCARBONS SULPH%	SAT/AR	HC/NHC	COMMENTS
72732 R	2055.00	LATROBE GROUP	15.6	21.1	12.9	50.4	.0	.7	.6	EARLY MATURE,TERRESTRIAL
72733 L	2355.00	LATROBE GROUP	8.2	14.4	15.6	68.0	.0	.6	.3	MATURE,TERRESTRIAL
72733 W	2520.00	LATROBE GROUP	21.4	22.2	13.1	43.3	.0	1.0	.8	MATURE,TERRESTRIAL
72734 O	2790.00	LATROBE GROUP	31.6	24.9	15.4	28.2	.0	1.3	1.3	MATURE,TERRESTRIAL

Table 8

C4-C7 OIL

01 NOV 83

77007 AUSTRALIA, SNAPPER 4, RFT 2/19, 1410 M.

	TOTAL PERCENT	NORM PERCENT
METHANE	0.000	
ETHANE	0.041	
PROPANE	0.466	
IBUTANE	0.391	2.41
NBUTANE	0.935	5.76
IPENTANE	0.980	6.04
NPENTANE	1.203	7.41
22-DMB	0.050	0.31
CPENTANE	0.096	0.59
23-DMB	0.165	1.02
2-MP	0.846	5.21
3-MP	0.501	3.08
NHEXANE	1.605	9.88
MCP	0.857	5.27
22-DMP	0.000	0.00
24-DMP	0.098	0.60
223-TMB	0.023	0.14

	TOTAL PERCENT	NORM PERCENT
CHEX	0.106	0.65
33-DMP	0.000	0.00
11-DMCP	0.124	0.77
2-MHEX	0.629	3.87
23-DMP	0.200	1.23
3-MHEX	0.617	3.80
1C3-DMCP	0.282	1.74
1T3-DMCP	0.025	0.15
1T2-DMCP	0.430	2.65
3-EPENT	0.000	0.00
224-TMP	0.000	0.00
NHEPTANE	1.777	10.94
1C2-DMCP	0.057	0.35
MCH	4.028	24.80
ECP	0.184	1.13
BENZENE	0.000	0.00
TOLUENE	0.034	0.21

TOTALS

ALL COMP	16.749
GASOLINE	16.242

SIG COMP RATIOS

C1/C2	2.96
A /D2	5.48
D1/D2	0.05
C1/D2	7.92
PENT/IPENT	1.23
CH/MCP	0.12

PARAFFIN INDEX 1	1.691
PARAFFIN INDEX 2	21.622

INTERPRETER - R.E. METTER
ANALYST - H.M. FRY

CARBON ISOTOPES _ (OIL,CONDENSATES,ROCK EXTRACT)

BASIN - GIPPSLAND
WELL - SNAPPER 4

SAMPLE NO.	DEPTH	SAMPLE TYPE	AGE	FORMATION	----- PDB &C13 SATS.	0/00 ----- &C13 AROM.	COMMENTS
77007	1410.00	OIL	EOCENE	LATROBE GROUP	-26.70	-25.40	

OIL - API GRAVITY,POUR POINT & SULPHUR %

BASIN - GIPPSLAND
WELL - SNAPPER 4

SAMPLE NO.	DEPTH	AGE	FORMATION	API GRAVITY	POUR PT.(OF)	SULPHUR %	COMMENTS
77007	1410.00	EOCENE	LATROBE GROUP	46.70	.00	.19	

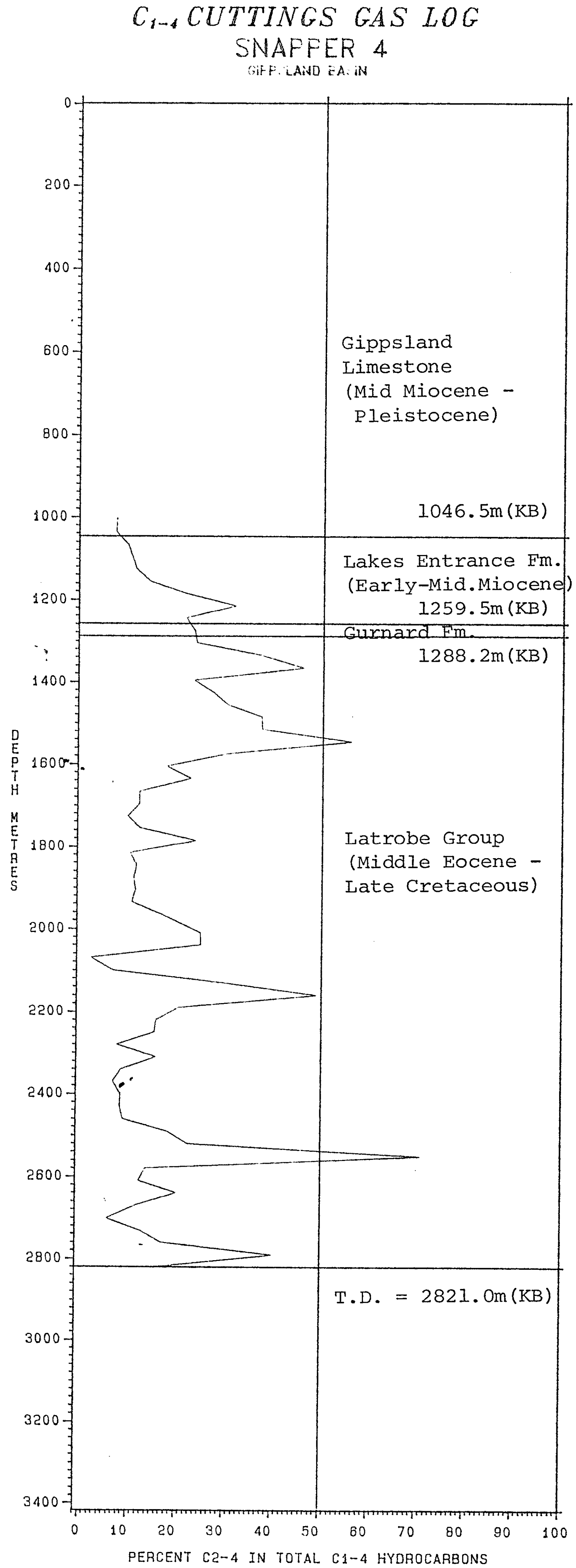
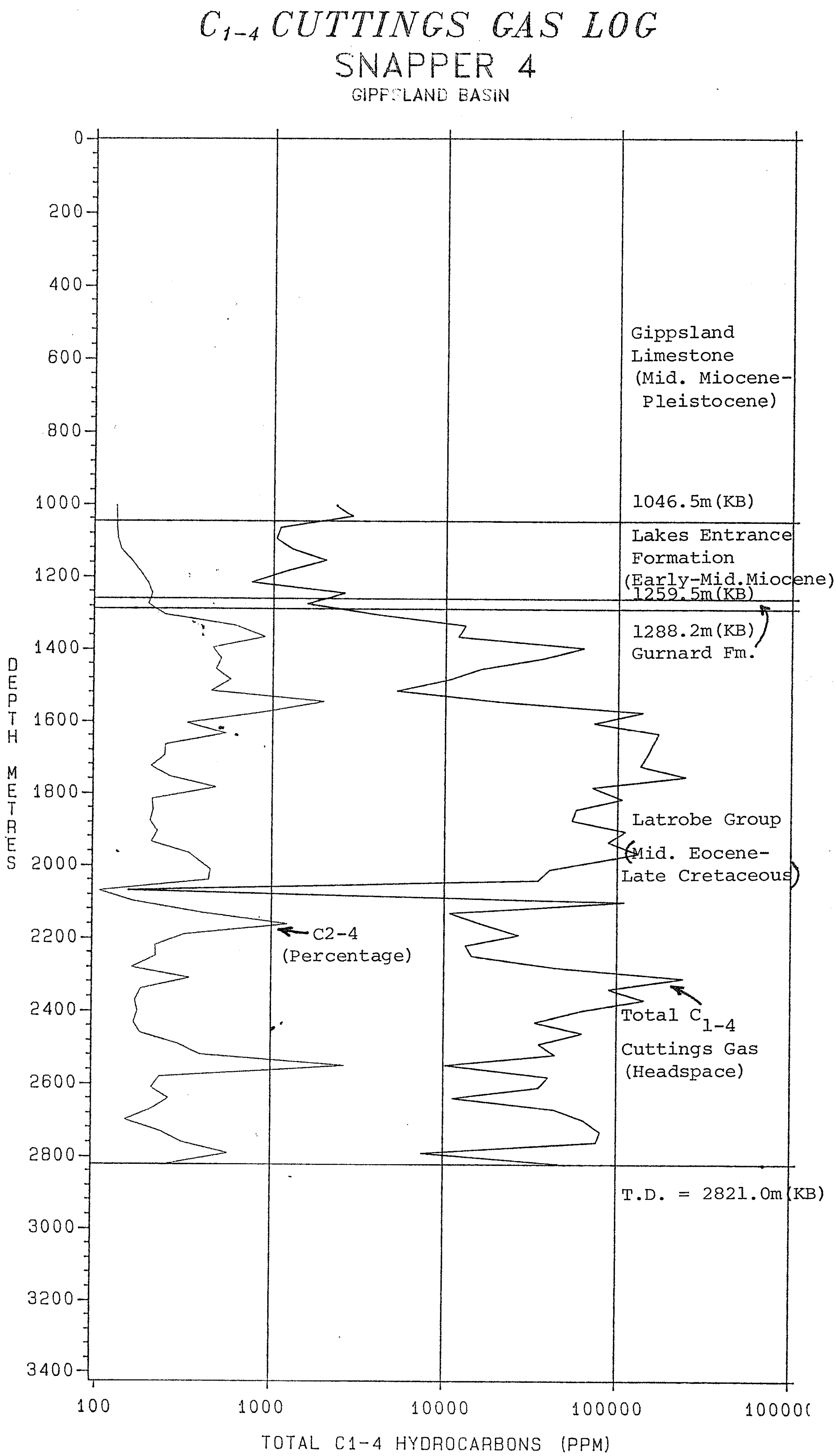
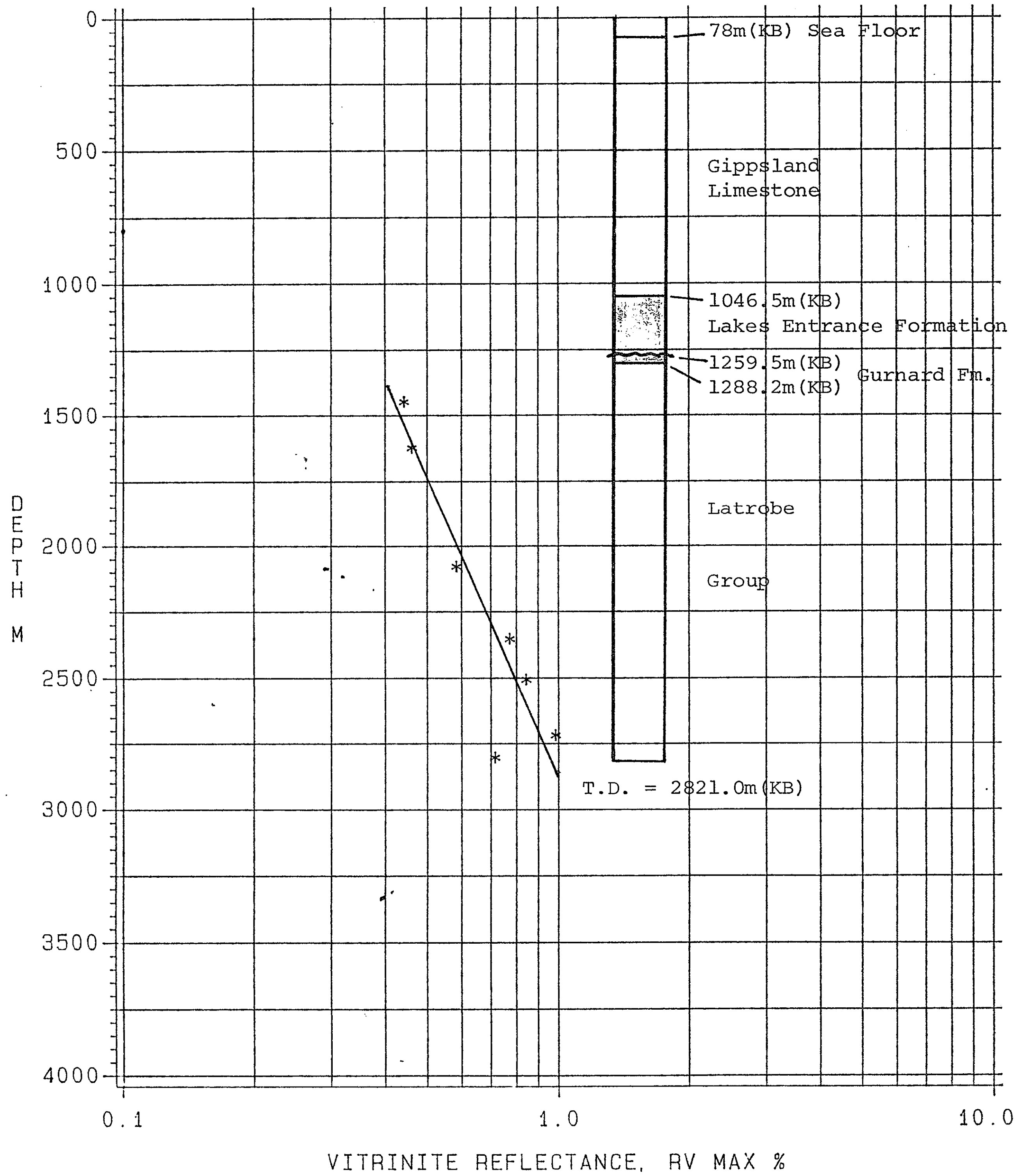

C1-4 CUTTINGS GAS LOG
SNAPPER 4
GIPPSLAND BASIN
DEPTH METRES
0
200
400
600
800
1000
1200
1400
1600
1800
2000
2200
2400
2600
2800
3000
3200
3400
Gippsland Limestone (Mid Miocene - Pleistocene)
1046.5m(KB)
Lakes Entrance Fm. (Early-Mid.Miocene)
1259.5m(KB)
Gurnard Fm.
1288.2m(KB)
Latrobe Group (Middle Eocene - Late Cretaceous)
T.D. = 2821.0m(KB)
0 10 20 30 40 50 60 70 80 90 100
PERCENT C2-4 IN TOTAL C1-4 HYDROCARBONS

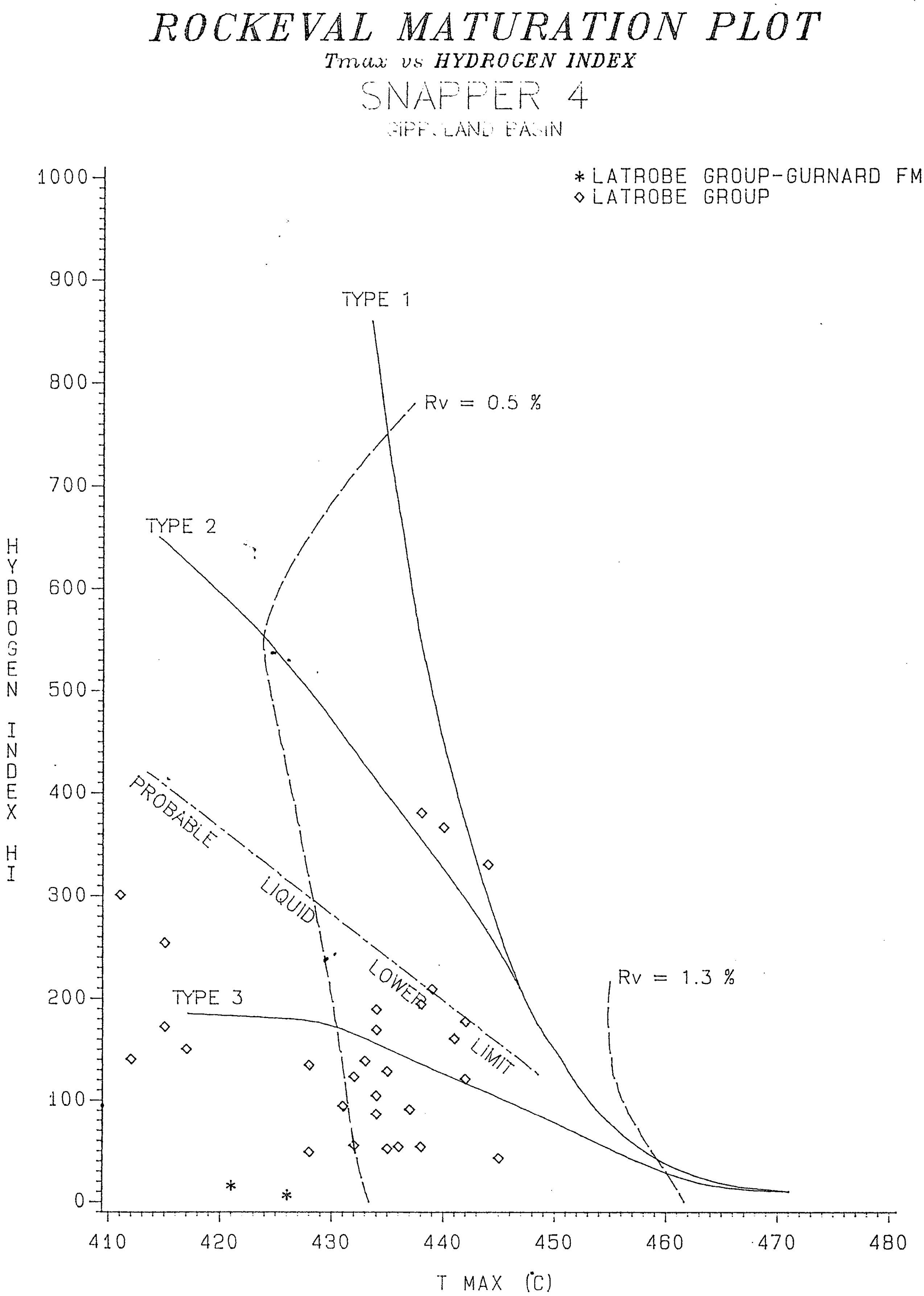
Figure 1(a)

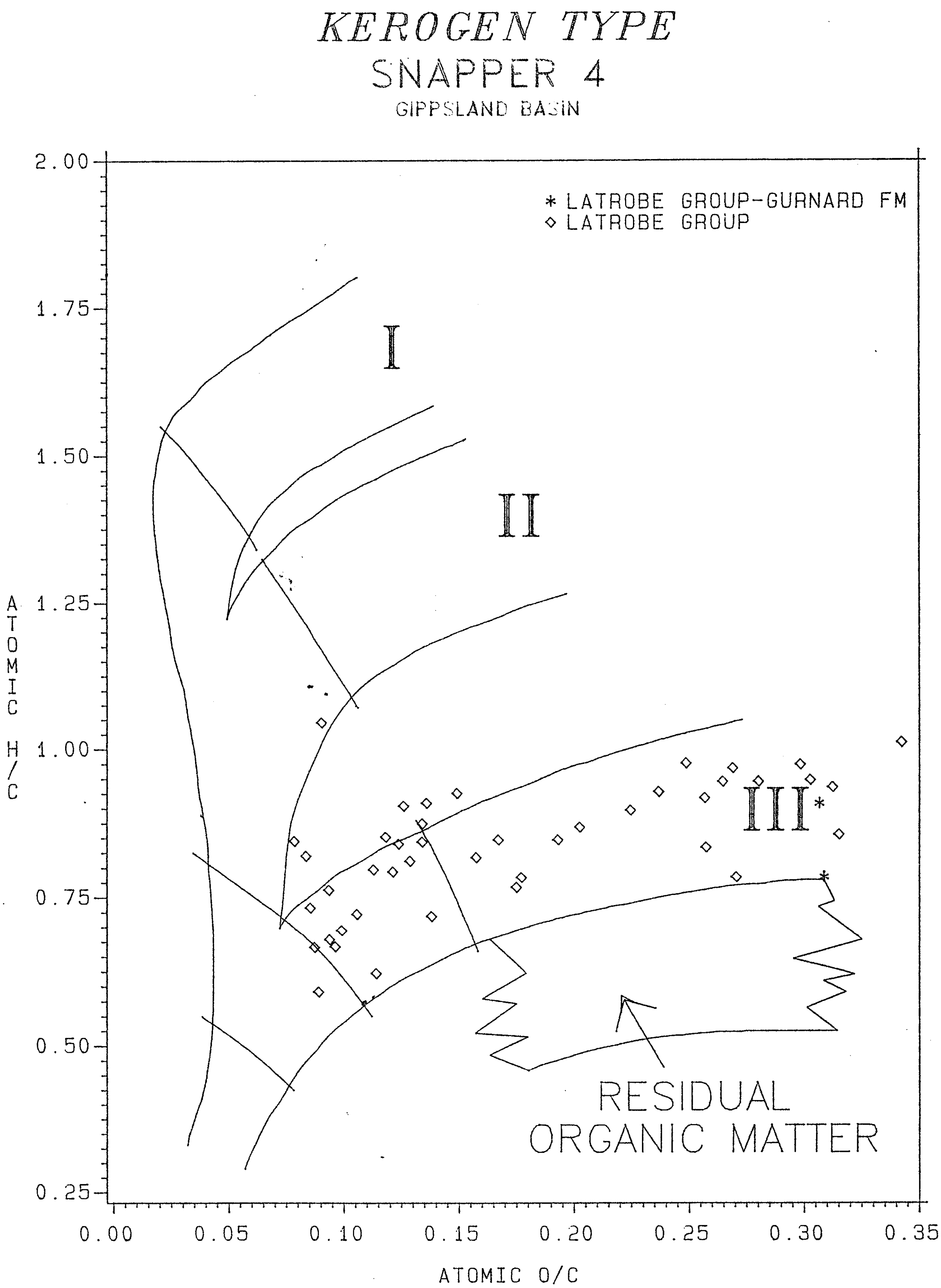


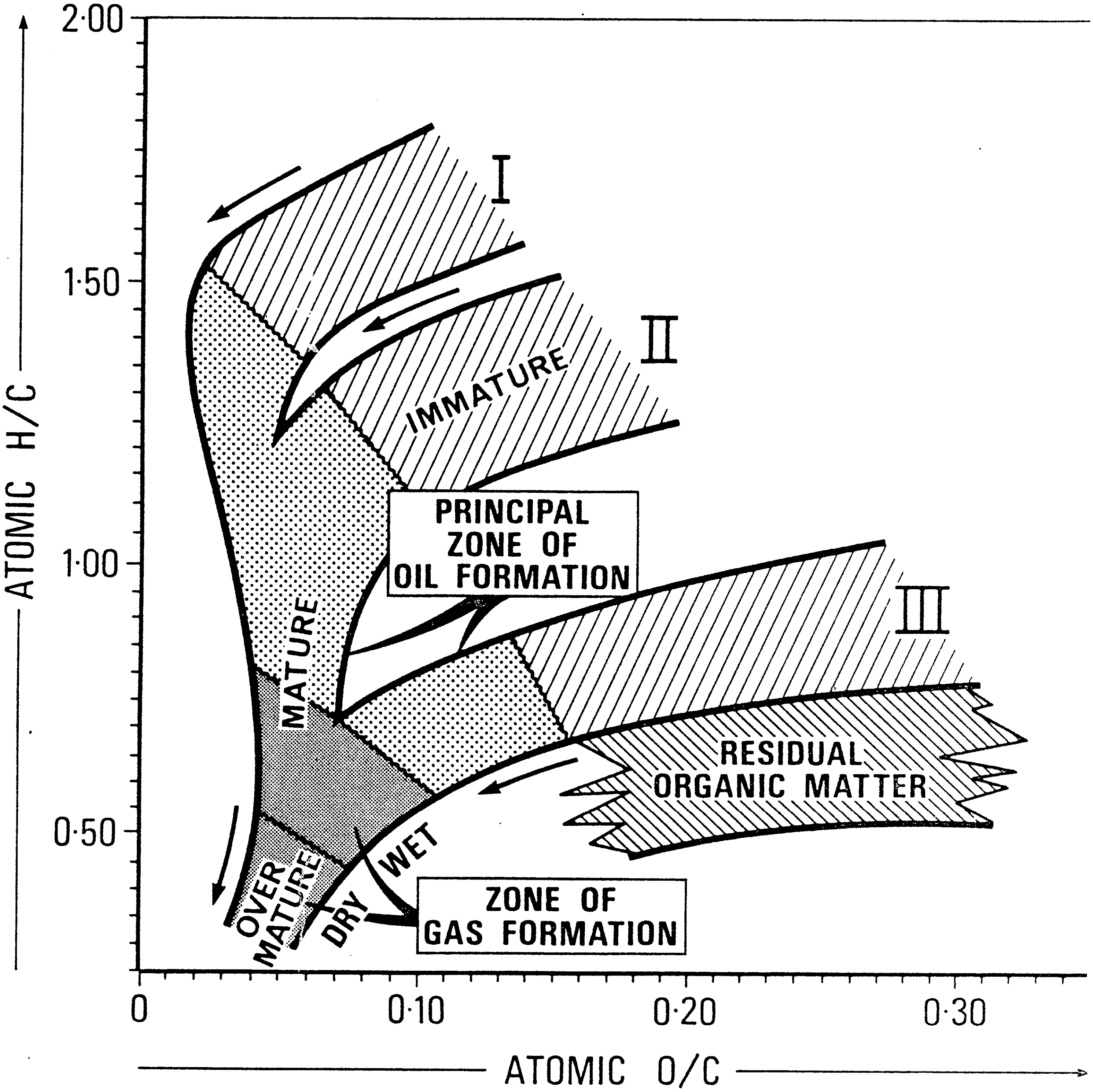
C1-4 CUTTINGS GAS LOG
SNAPPER 4
GIPPSLAND BASIN
DEPTH METRES
0
200
400
600
800
1000
1200
1400
1600
1800
2000
2200
2400
2600
2800
3000
3200
3400
Gippsland Limestone (Mid. Miocene-Pleistocene)
1046.5m(KB)
Lakes Entrance Formation (Early-Mid.Miocene)
1259.5m(KB)
1288.2m(KB)
Gurnard Fm.
Latrobe Group (Mid. Eocene-Late Cretaceous)
C2-4 (Percentage)
Total C1-4 Cuttings Gas (Headspace)
T.D. = 2821.0m(KB)
100
1000
10000
100000
TOTAL C1-4 HYDROCARBONS (PPM)

VITRINITE REFLECTANCE vs. DEPTH
SNAPPER 4
GIPPSLAND BASIN

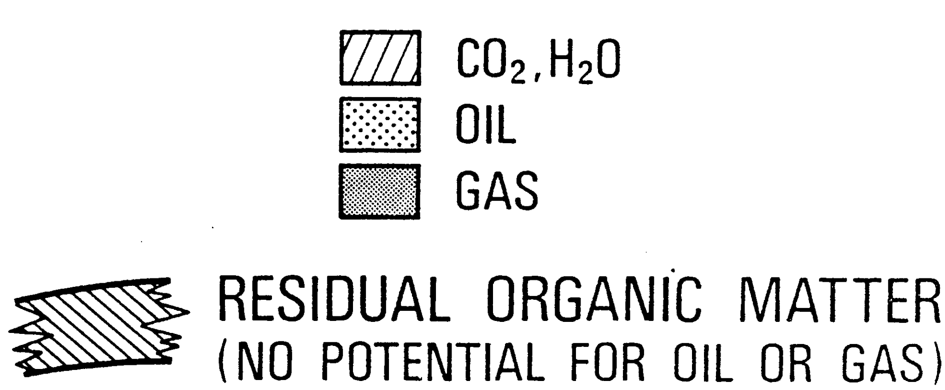



ROCKEVAL MATURATION PLOT
Tmax vs HYDROGEN INDEX
SNAPPER 4
GIPPSLAND BASIN
* LATROBE GROUP-GURNARD FM
◇ LATROBE GROUP
TYPE 1
TYPE 2
TYPE 3
Rv = 0.5 %
Rv = 1.3 %
PROBABLE LIQUID LOWER LIMIT
HYDROGEN INDEX HI
T MAX (°C)
1000
900
800
700
600
500
400
300
200
100
0
410
420
430
440
450
460
470
480


KEROGEN TYPE
SNAPPER 4
GIPPSLAND BASIN
* LATROBE GROUP-GURNARD FM
◇ LATROBE GROUP
I
II
III
RESIDUAL
ORGANIC MATTER
ATOMIC H/C
ATOMIC O/C
2.00
1.75
1.50
1.25
1.00
0.75
0.50
0.25
0.00
0.05
0.10
0.15
0.20
0.25
0.30
0.35



PRINCIPAL PRODUCTS OF KEROGEN EVOLUTION



1380/BS/75

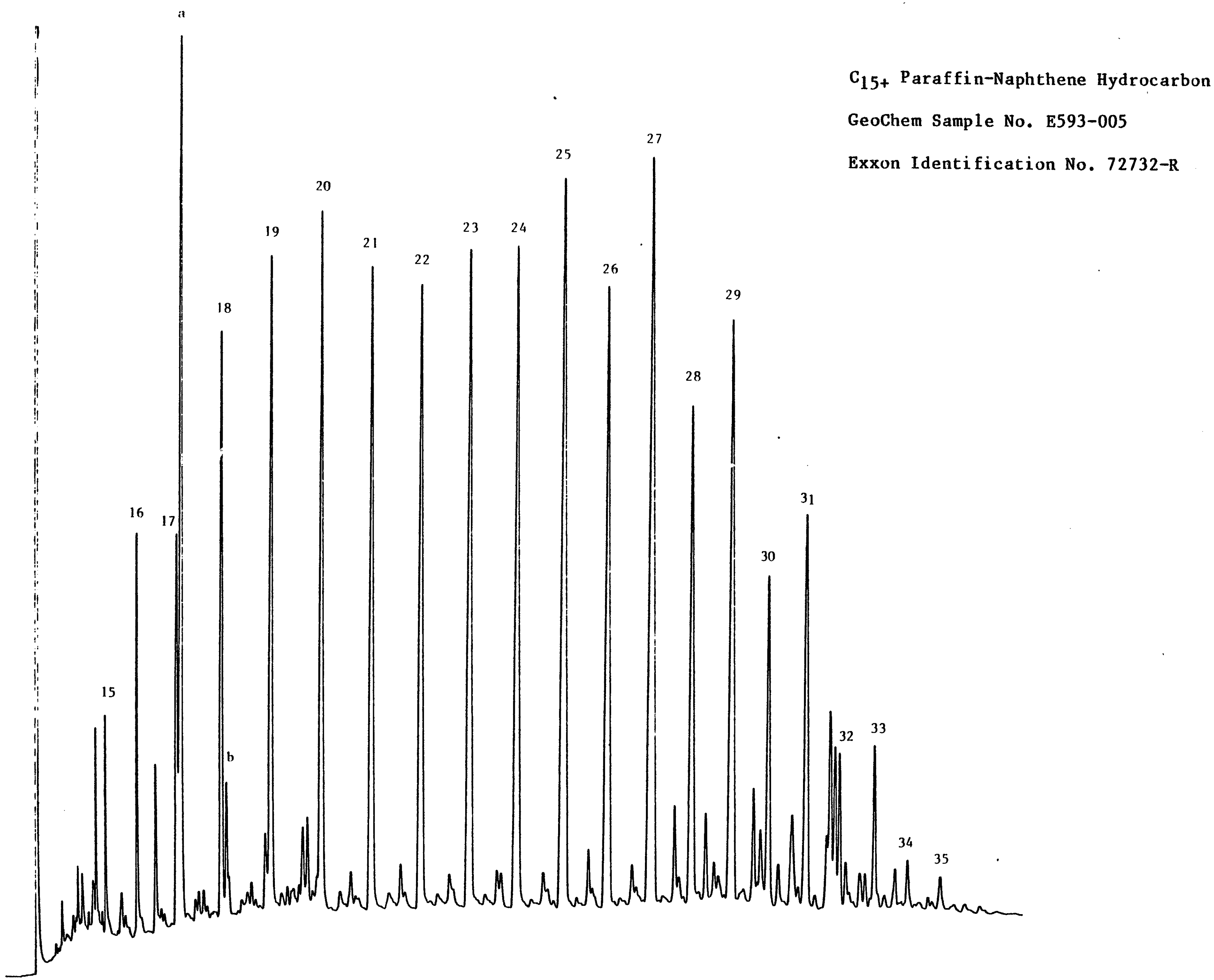


Figure 6 : Snapper-4, cuttings Extract, 2040-2055m(KB), Latrobe Group

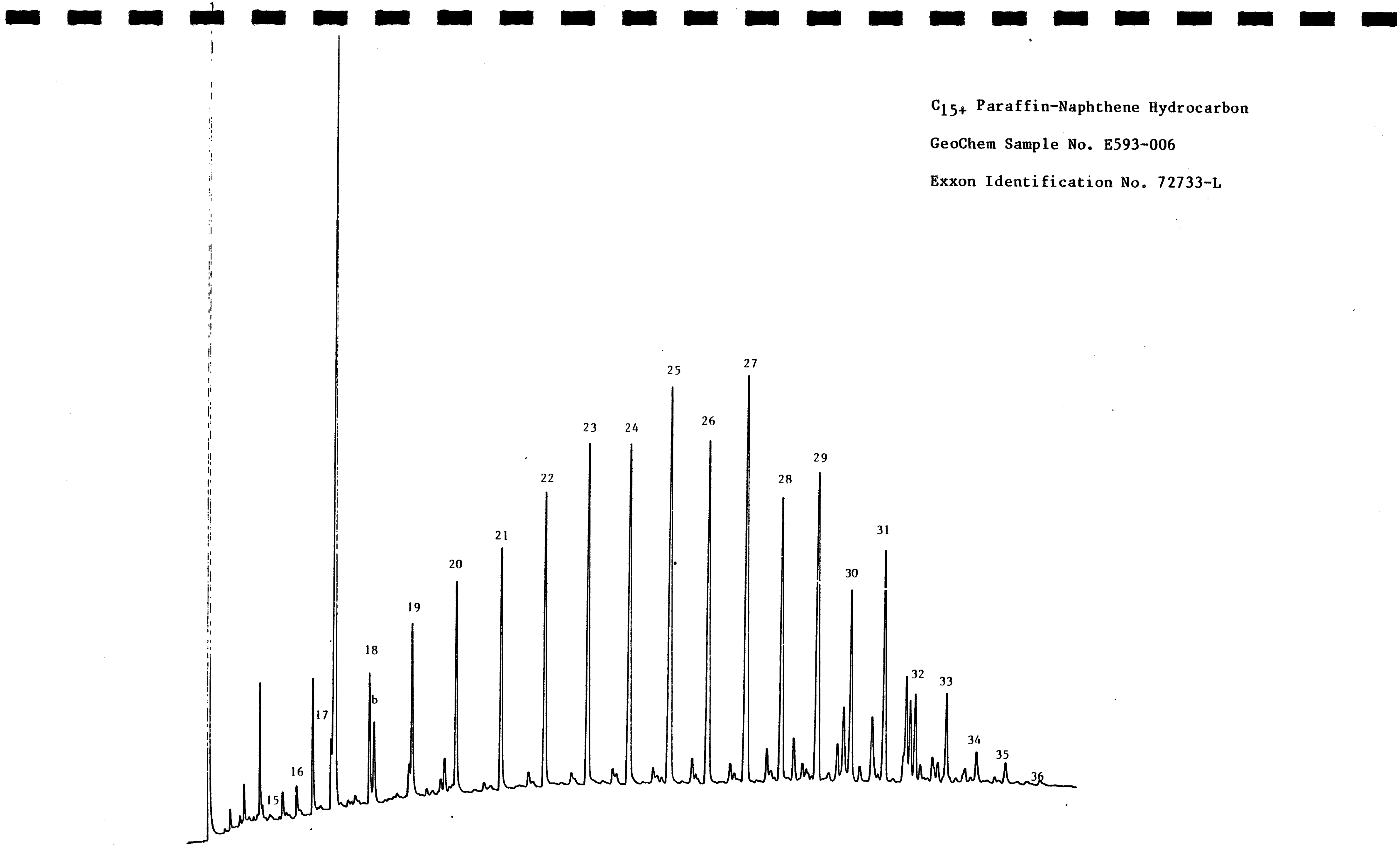


Figure 7 : Snapper-4, Cuttings Extract, 2340-2355m(KB), Latrobe Group

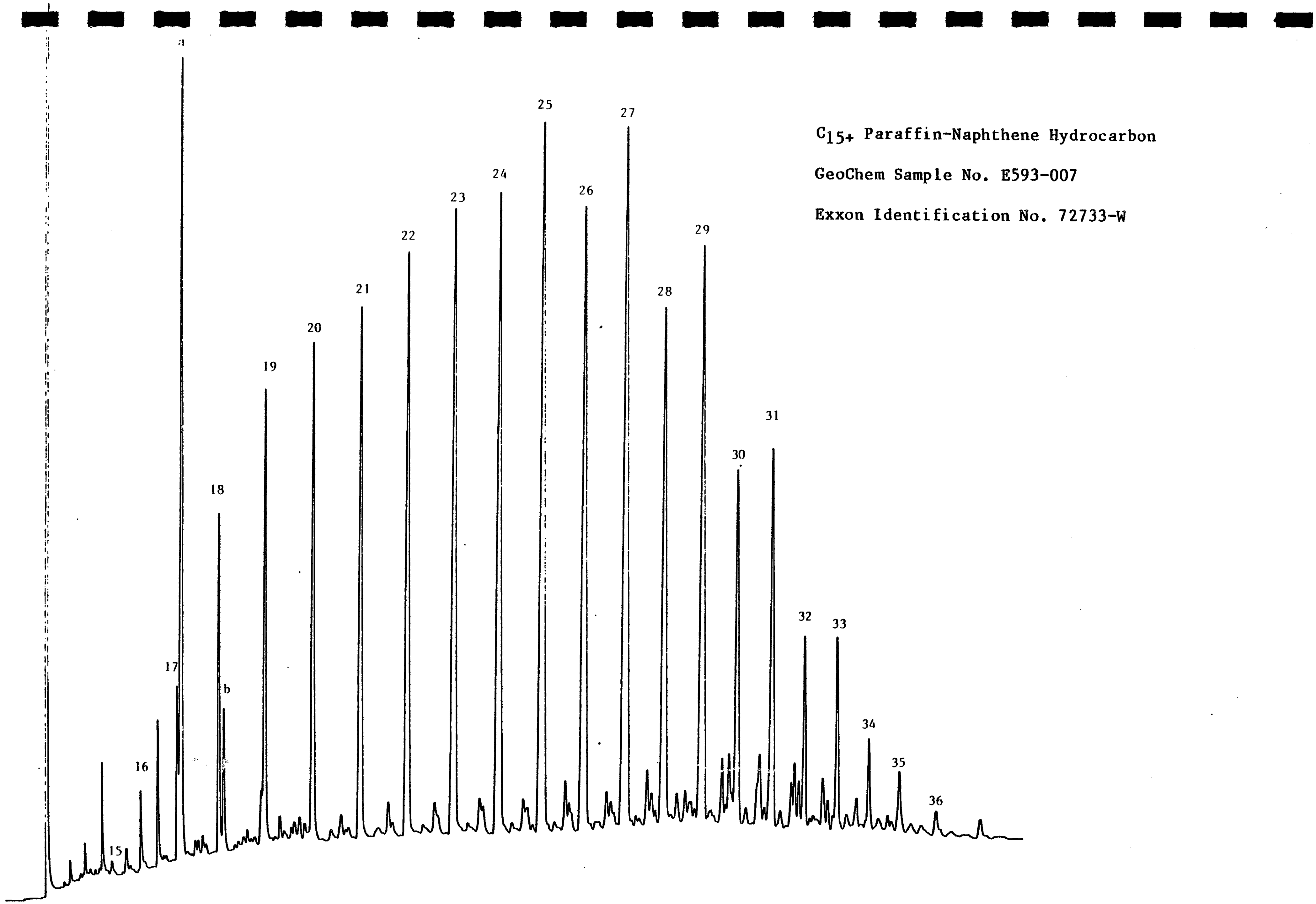


Figure 8 : Snapper-4, Cuttings Extract, 2505-2520m(KB), Latrobe Group

C_{15+} Paraffin-Naphthene Hydrocarbon

GeoChem Sample No. E593-008

Exxon Identification No. 72734-0

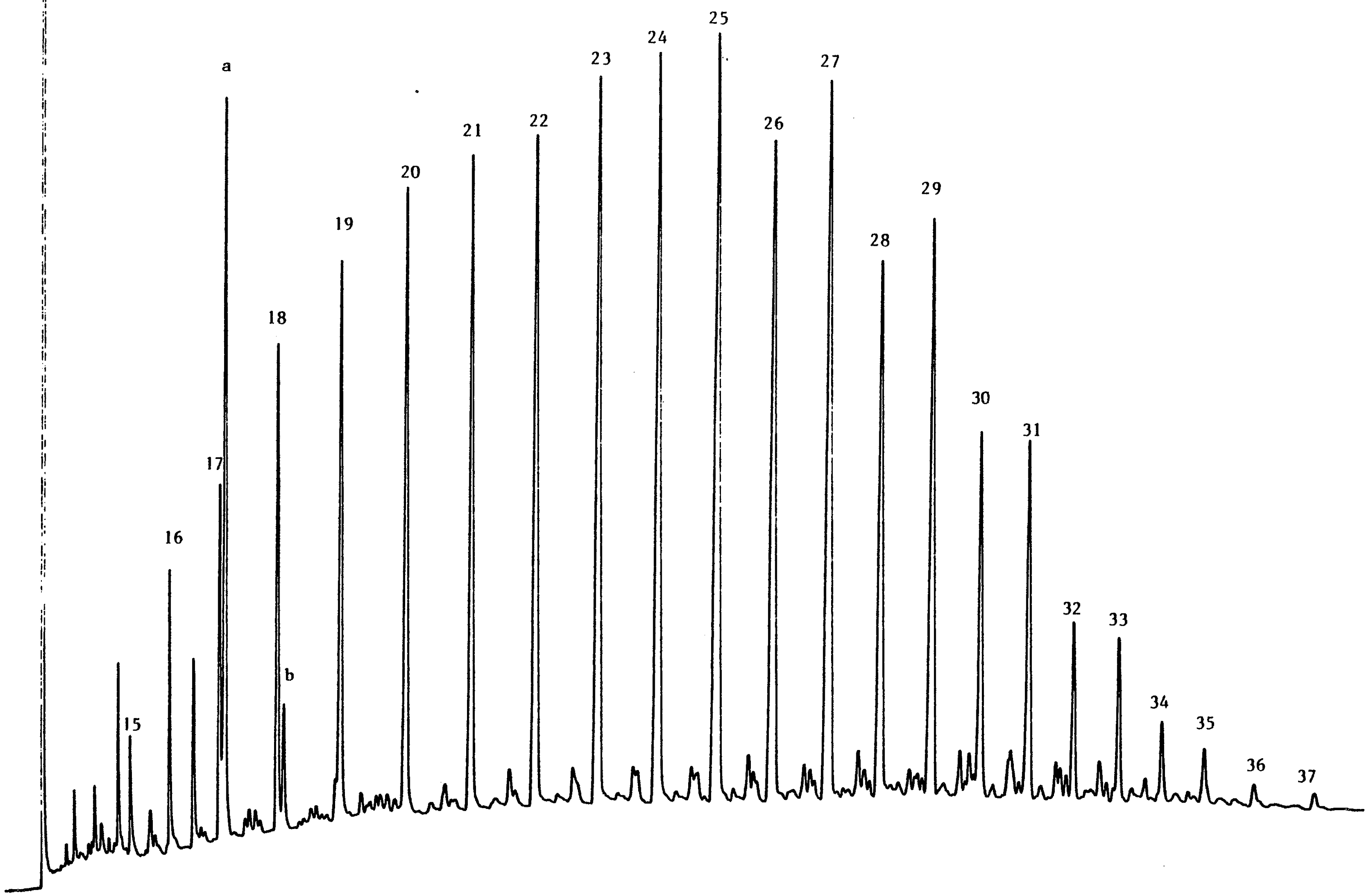


Figure 9 : Snapper-4, Cuttings Extract, 2775-2790m(KB), Latrobe Group

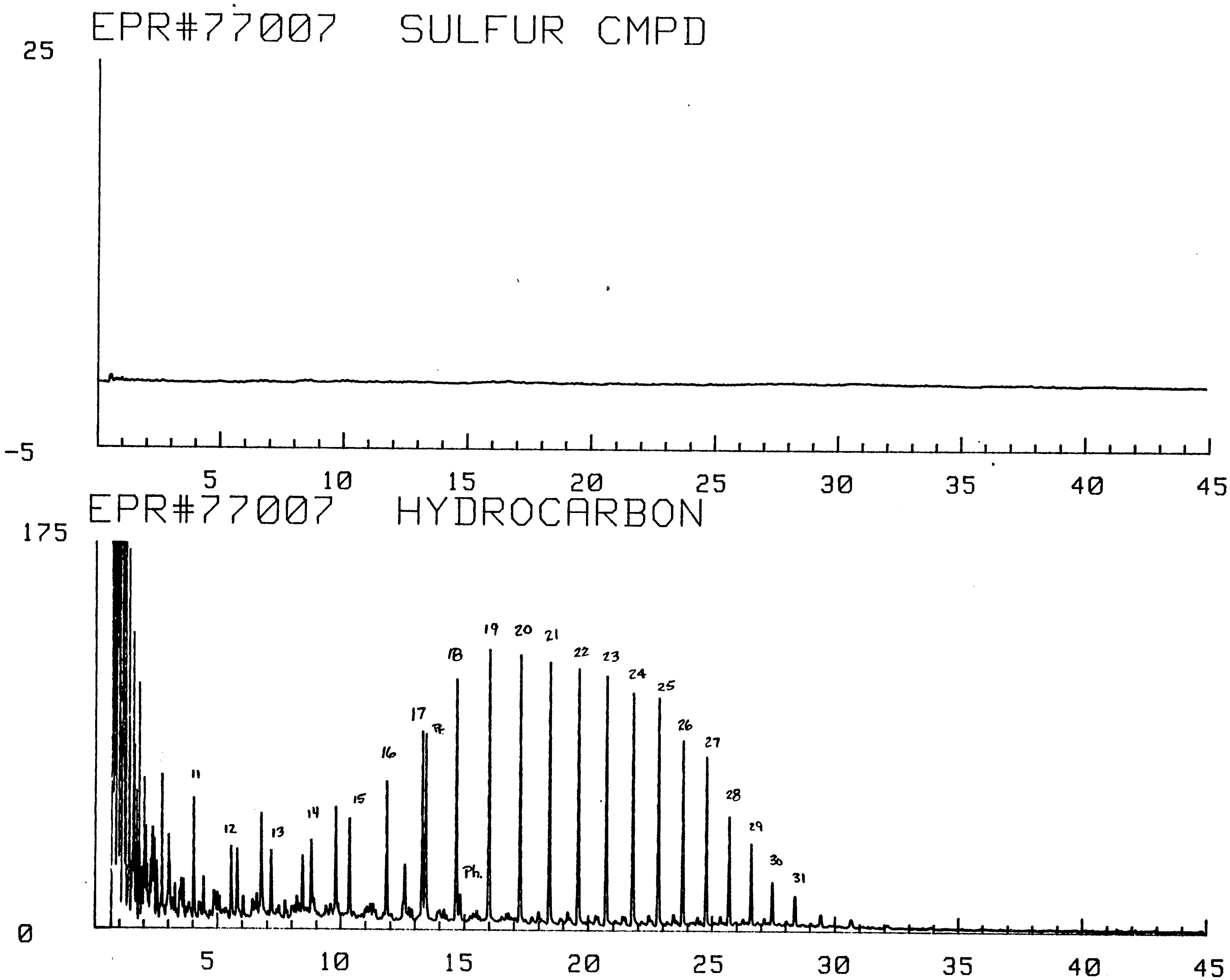


Figure 10 : Snapper-4, RFT 2/19, 1410m(KB), Whole Oil Gas Chromotogram

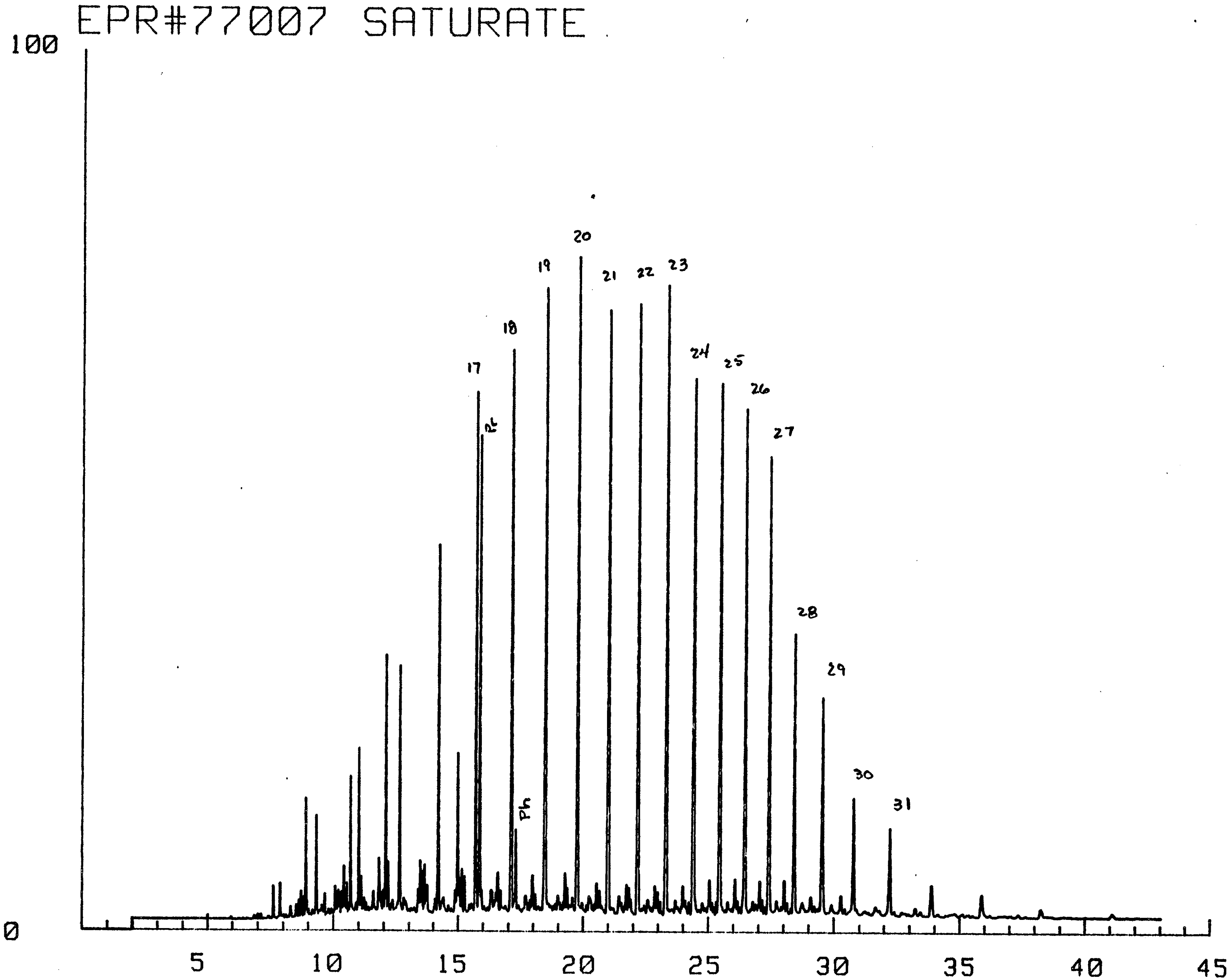


Figure 11 : Snapper-4, RFT 2/19, 1410m

18.11.83

APPENDIX-1

SNAPPER No. 4

KK No.	Esso No.	Depth m	$\bar{R}_o$max %	Range $R_o$max %	N	Exinite fluorescence (Remarks)
18819	72729 -A	1621 swc	0.46	0.37-0.54	29	Abundant liptodetrinite, yellow to orange, common sporinite, green to yellow, sparse suberinite, brown, rare fluorinite, yellow. (No clastic lithologies. Coal is clarite>vitrite>duroclarite. Vitrinite commonly micrinitized, framboidal pyrite common, ?sclerotinite rare. Slight oil cut.
18820	72727 -V	2078.9 SWC	0.58	0.50-0.71	23	Sparse sporinite, yellow, sparse cutinite, dull orange. (Siltstone>>coal. D.o.m. abundant, inertinite abundant, vitrinite common, exinite sparse. Coal is vitrinertite I. Pyrite abundant, framboidal and crystals.)
18821	72727 -H	2352.2 SWC	0.77	0.69-0.85	28	Sparse sporinite, yellow to orange. (Siltstone> coal>sandstone. D.o.m. abundant, V>I>E. Vitrinite abundant, inertinite sparse to common, exinite sparse. Pyrite common and carbonate sparse.)
18822	72726 -Z	2504.9 SWC	0.84	0.74-0.94	18	Rare sporinite, orange to dull orange. (Siltstone. D.o.m. common to abundant, I>V>E. Inertinite common to abundant, vitrinite rare to sparse, exinite rare. Pyrite common, carbonate rare.)
18823	72726 -I	2716.3 SWC	0.98	0.86-1.05	25	Abundant sporinite, orange to dull orange. (Coal> carbonate. D.o.m. common, V>I=E. Vitrinite common, inertinite and exinite absent. Coal is vitrite>duroclarite>inertite. Mineral matter fluorescence dull orange.)
18824	72726 -A	2804 SWC	0.71	0.57-0.80	30	Abundant sporinite, yellow to orange, sparse cutinite, orange, sparse suberinite, brown. (Siltstone>coal. D.o.m. abundant, V=E>I. Vitrinite and exinite abundant, inertinite absent. Coal is vitrite>inertite. Mineral matter fluorescence orange, pyrite abundant in siltstone.)

25.7.83

SNAPPER No. 4

KK No.	Esso No.	Depth m	$\bar{R}_v$ max %	Range R_v max %	N	Exinite fluorescence (Remarks)
18227	72686 -G	1446 SWC	0.44	0.34-0.49	20	Abundant sporinite, yellow to dull orange, abundant resinite/fluorinite, green to orange, common cutinite, orange. (Coal. Clarite= vitrite. Exinite abundant, inertinite sparse. Resinite=or>sporinite>cutinite. Pyrite common.)

APPENDIX 6

SYNTHETIC SEISMIC TRACE

PARAMETERS

WELL: Snapper-4

TD: 2800 metres SS

KB: 21 metres

WATER DEPTH: 55 metres

POLARITY: Peak represents acoustic impedance increase.

PULSE TYPE: Zero phase, second derivative, gaussian function.

PEAK FREQUENCY: 25 Hz to 1390m, 20 Hz to 1540m, 12 Hz to 1750m, 10 Hz to 2829m.

SAMPLE FREQUENCY: 3 metres

CHECK SHOT CORRECTIONS: Yes

COMMENTS: A synthetic seismic trace was generated over the depth interval of 800m KB - 2830m KB.

Sonic and Density logs were edited as follows:

Sonic - Values between 1510m KB and 1570m KB were held constant at 250 us/m.

Density - Values between 1545m KB and 1570m KB were held constant at 2.2 g/cc.

0932L

PE902535

This is an enclosure indicator page.
The enclosure PE902535 is enclosed within the container PE902529 at this location in this document.

The enclosure PE902535 has the following characteristics:

ITEM_BARCODE = PE902535
CONTAINER_BARCODE = PE902529
NAME = Synthetic Seismogram
BASIN = GIPPSLAND
PERMIT =
TYPE = WELL
SUBTYPE = SYNTH_SEISMOGRAM
DESCRIPTION = Synthetic Seismogram
REMARKS =
DATE_CREATED = 12/07/84
DATE_RECEIVED = 12/10/84
W_NO = W827
WELL_NAME = Snapper-4
CONTRACTOR = ESSO
CLIENT_OP_CO = ESSO

ENCLOSURES

PE902530

This is an enclosure indicator page.
The enclosure PE902530 is enclosed within the container PE902529 at this location in this document.

The enclosure PE902530 has the following characteristics:

ITEM_BARCODE = PE902530
CONTAINER_BARCODE = PE902529
NAME = Structural Cross Section
BASIN = GIPPSLAND
PERMIT =
TYPE = WELL
SUBTYPE = CROSS_SECTION
DESCRIPTION = Structural Cross Section Below N-1.9 Unit for Snapper-4
REMARKS =
DATE_CREATED = 1/04/84
DATE_RECEIVED = 12/10/84
W_NO = W827
WELL_NAME = Snapper-4
CONTRACTOR = ESSO
CLIENT_OP_CO = ESSO

(Inserted by DNRE - Vic Govt Mines Dept)

PE902531

This is an enclosure indicator page.
The enclosure PE902531 is enclosed within the container PE902529 at this location in this document.

The enclosure PE902531 has the following characteristics:

ITEM_BARCODE = PE902531
CONTAINER_BARCODE = PE902529
NAME = Structure Map Top of Latrobe Group
BASIN = GIPPSLAND
PERMIT =
TYPE = SEISMIC
SUBTYPE = HRZN_CONTR_MAP
DESCRIPTION = Structure Map Top of Latrobe Group Top of N-1.0 Unit for Snappre-4
REMARKS =
DATE_CREATED = 1/11/83
DATE_RECEIVED = 12/10/84
W_NO = W827
WELL_NAME = Snapper-4
CONTRACTOR = ESSO
CLIENT_OP_CO = ESSO

(Inserted by DNRE - Vic Govt Mines Dept)

PE902532

This is an enclosure indicator page.
The enclosure PE902532 is enclosed within the container PE902529 at this location in this document.

The enclosure PE902532 has the following characteristics:

ITEM_BARCODE =	PE902532
CONTAINER_BARCODE =	PE902529
NAME =	Structure Map P asperopolus Seismic Marker
BASIN =	GIPPSLAND
PERMIT =	
TYPE =	SEISMIC
SUBTYPE =	HRZN_CONTR_MAP
DESCRIPTION =	Structure Map P asperopolus Seismic Marker Top of N-1.4 Unit for Snapper-4
REMARKS =	
DATE_CREATED =	1/01/84
DATE_RECEIVED =	12/10/84
W_NO =	W827
WELL_NAME =	Snapper-4
CONTRACTOR =	ESSO
CLIENT_OP_CO =	ESSO

(Inserted by DNRE - Vic Govt Mines Dept)

PE902533

This is an enclosure indicator page.
The enclosure PE902533 is enclosed within the container PE902529 at this location in this document.

The enclosure PE902533 has the following characteristics:

ITEM_BARCODE = PE902533
CONTAINER_BARCODE = PE902529
NAME = Structure Map Upper Mdiversus Seismic Marker
BASIN = GIPPSLAND
PERMIT =
TYPE = SEISMIC
SUBTYPE = HRZN_CONTR_MAP
DESCRIPTION = Structure Map Upper Mdiversus Seismic Marker Top of N-1.9 Unit for Snapper-4
REMARKS =
DATE_CREATED = 1/01/84
DATE_RECEIVED = 12/10/84
W_NO = W827
WELL_NAME = Snapper-4
CONTRACTOR = ESSO
CLIENT_OP_CO = ESSO

(Inserted by DNRE - Vic Govt Mines Dept)

PE902534

This is an enclosure indicator page.
The enclosure PE902534 is enclosed within the container PE902529 at this location in this document.

The enclosure PE902534 has the following characteristics:

ITEM_BARCODE =	PE902534
CONTAINER_BARCODE =	PE902529
NAME =	Structure Map Top of L-1 Coal Unit
BASIN =	GIPPSLAND
PERMIT =	
TYPE =	SEISMIC
SUBTYPE =	HRZN_CONTR_MAP
DESCRIPTION =	Structure Map Top of L-1 Coal Unit
REMARKS =	
DATE_CREATED =	1/04/84
DATE_RECEIVED =	12/10/84
W_NO =	W827
WELL_NAME =	Snapper-4
CONTRACTOR =	ESSO
CLIENT_OP_CO =	ESSO

(Inserted by DNRE - Vic Govt Mines Dept)

PE601252

This is an enclosure indicator page.
The enclosure PE601252 is enclosed within the container PE902529 at this location in this document.

The enclosure PE601252 has the following characteristics:

ITEM_BARCODE = PE601252
CONTAINER_BARCODE = PE902529
NAME = Well Completion Report
BASIN = GIPPSLAND
PERMIT =
TYPE = WELL
SUBTYPE = WCR_RPT
DESCRIPTION = Well Completion Report
REMARKS =
DATE_CREATED = 2/07/83
DATE_RECEIVED = 12/10/84
W_NO = W827
WELL_NAME = Snapper-4
CONTRACTOR = ESSO
CLIENT_OP_CO = ESSO

(Inserted by DNRE - Vic Govt Mines Dept)