WCR VOL 2

ORANGE ROUGHY-1

(W 1121)

Esso Australia Ltd.

WELL COMPLETION REPORT

ORANGE ROUGHY-1

VOLUME 2

INTERPRETATIVE DATA

GIPPSLAND BASIN, VICTORIA

ESSO AUSTRALIA LTD

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WELL COMPLETION REPORT

VOLUME 2: INTERPRETATIVE DATA

CONTENTS

TABLES

FIGURES

APPENDICES

ENCLOSURES

1.	Orange Roughy Synthetic	
2.	Recon Seismic Line - Nannygai-1 to Orange Roughy-1 to Kingfish-8 at 50cm/sec	
3.	Top of Latrobe Time Map	1:50,000
4.	Top of Latrobe Average Velocity Map	1:50,000
5.	Top of Latrobe Depth Map	1:50,000
6.	Top of Latrobe to Jade SB Interval Velocity Map	1:50,000
7.	Jade SB Depth Map	1:50,000
8.	Juniper SB Depth Map	1:50,000
9.	Orange SB Depth Map	1:50,000
10.	Nannygai-1 to Orange Roughy-1 to Kingfish-9 Structural Cross Section H:V = 100:1	1:100,000
11.	Nannygai-1 to Orange Roughy-1 to Kingfish-8 Structural Cross Section with Wells and Stratigraphy	1:100,000
12.	Orange Roughy - Well log (2200 - 2600m) with Horizon Picks	1:400
13.	Average Amplitude Attribute Map, Cobalt to Orange SB Interval	1:50,000

ATTACHMENTS

1. Well Completion Log

1. *SUMMARY OF WELL RESULTS*

Orange Roughy 1 spudded on 16 June 1995. The Top of Latrobe Group was penetrated 13 metres high to prognosis (2247m TVDSS) and consisted of Early Oligocene to Eocene aged (N.asperus) sediment. One core was cut and recovered in the Latrobe Group. (Core 1: 2313.5m - 2331.9m KB Driller's Depths). A total depth of 2603m MD was reached in L.Balmei aged sediments on 26 June 1995. An electric logging suite consisted of resistivity, neutron-density, sonic, dipmeter logs together with a velocity survey and sidewall core run. Log analysis and core analysis indicate that the Eocene section encountered below the Top Latrobe Group did not contain any producible hydrocarbons. Consequently, no net pay is interpreted in Orange Roughy-1. The well was plugged and abandoned as a dry hole and the rig released on 30 June 1995.

Table 1: Prognosed vs Actual Tops

Formation/Horizon	Predicted Depth (m TVDSS)	Actual Depth (m TVDSS)
Gippsland Limestone	74	75
Base High Velocity Channel	1375	1371
Mid Miocene Marker	1795	1775
Top Latrobe Group	2260	2247
50.0 MY Sequence Boundary (Orange SB)	2308	2294
51.5 MY Sequence Boundary (Jade SB)	2324	2330
54.2 MY Sequence Boundary (Raw Sienna SB)	2486	2483
Total Depth	2580	2578

2. *INTRODUCTION*

Orange Roughy-1 was drilled as an exploration well designed to assess the hydrocarbon potential of a small NE-SW trending four way dip closure combined with a stratigraphic component on the western flank of the West Kingfish field. The Orange Roughy-1 well is located in some 75 metres of water within the VIC/L7 licence area, 2.0 kms northwest of the Kingfish-8 well and 5.5 kms west of the West Kingfish production facility.

Detailed stratigraphic correlation between the West Kingfish area, Gurnard-1 and Nannygai-1 wells suggested major lithological changes within the Early Eocene aged sequences to the west of the Kingfish-8 well and hence possibly provide a mechanism for migration of the top porosity surface from the 50.5 MY sequence boundary (Juniper SB) at Kingfish-8 to the 50.0 MY sequence boundary (Orange SB) over the Orange Roughy-1 location.

The concept was thought to provide a structural spill for the West Kingfish accumulation, with the model suggesting that both the structural and stratigraphic closure mapped at Orange Roughy to share an original oil-water contact with the West Kingfish reservoirs (2328m TVDSS) and hence prove a western extension of the West Kingfish field.

The stratigraphic component of the Orange Roughy prospect was established by the transgressive nature of successive sequences between the 51.5 and 48.5 MY sequence boundaries. Seismic evidence (decrease to the west of acoustic impedance in the interval 51.5 - 50.0 MY) suggested the possible transition from offshore shale to a lower shoreface facies in the 50.5 - 50.0 MY sequence across the Orange Roughy prospect. The 50.5-50.0 MY unit is marked by an offshore shale at the Kingfish-8 and upper shoreface to proximal lower shoreface facies in the Nannygai-1 well. The overlying 50.0 - 48.5 MY sequence was interpreted to and subsequently retained its distal character across the Orange Roughy prospect.

In the most likely case, the reservoir section above the interpreted OOWC (2328m TVDSS) at Orange Roughy was interpreted to comprise of distal lower shoreface and minor marine shale within the 50.0-50.5 MY sequence and good quality upper shoreface sand in the 50.5-51.5 MY sequence (correlating to P-1.1N / M-1.2 reservoir unit in Kingfish-8). The prospect was assessed to contain some 13 MBO EUR (Most Likely case) and have a 31% chance of economic success.

3. ***STRUCTURE***

In seismic time the Orange Roughy Prospect at the Top of Latrobe Group displayed only 3 msec of vertical closure. The time structure over the northern and western parts of the West Kingfish field is significantly distorted by the presence of high velocity material within the Miocene aged (post Latrobe Group) channel complex and thus the northern edge of the Orange Roughy prospect was not correctly depicted in seismic time at any pre-Miocene level. At the top of porosity (Orange Sequence Boundary), 3 msec time closure is observed at the Orange Roughy location with the prospect opening to the NE as it becomes influenced by the Miocene channel. The time high for Orange Roughy at the deeper Sienna (54.2 MY) level was located slightly to the southeast of the overlying Orange (50.0 MY) and Top Latrobe Group time highs.

At depth, the Top Latrobe Group (TOL) structure at Orange Roughy was interpreted to have some 10 metres of unfaulted independent NNE-SSW oriented four way dip closure. The independent closure was interpreted to be separated from the West Kingfish TOL structure by a shallow E-W trending saddle with structural spill to the SW towards the Nannygai-1 well.

At the deeper top porosity surface (Orange sequence boundary - 50 MY SB), the Orange Roughy feature displayed independent four way dip closure, but with less independence from the West Kingfish field, with only 4 metres of vertical relief above the saddle point.

Given the result of the Orange Roughy-1 well it is interpreted that there is limited closure to the Orange Roughy prospect. The absence of any significant shows and the small interval of poor shows (2 metres in top of core) indicates the absence of any significant independent structural closure. The possibility that the 50.5-50.0 MY unit in the Nannygai-1 well (comprising of upper shoreface to proximal lower shoreface facies) extends eastward to the Orange Roughy area thereby providing a thief zone for any potential hydrocarbons which would migrate to the Orange Roughy structure.

4. ***STRATIGRAPHY***

Stratigraphic control for the Orange Roughy well was provided by the Nannygai-1, Gurnard-1, Kingfish-8 and KF-8 sidetrack wells. In all wells, the Top of Latrobe Group intersections were marine shales (non-net rock) of lower to middle N.Asperus ages (informally termed the Gurnard Formation in this area). The thickness of the non-net section within the 'Gurnard Formation' generally thins towards the west (shorewards) with the development of lower shoreface sandstone development in both the Nannygai-1 and Gurnard-1 wells within the interval below the 48.5 MY SB (Cobalt SB). Conversely, the more basinward Kingfish-8 location exhibits marine shale from the Top of Latrobe Group down to the 50.5 MY SB (Juniper sequence boundary). The exception to this is the localised development of the P-1.1 South reservoir within the Gurnard Formation in several of the West Kingfish field wells on the 50.0 MY SB (Orange SB).

As forecast on the basis of seismic evidence (decrease to the west of acoustic impedance within the interval 51.5 - 50.0 MY sequence), the 50.5 - 50.0 MY unit (Juniper to Orange SB) in Orange Roughy-1 is marked by a thin basal offshore shale grading to an overlying distal lower shoreface package. The same stratigraphic unit in the eastern Kingfish-8 well is marked by an offshore shale. The thin sand developed on the 51.5 MY SB (Jade SB) in both Kingfish-8 & Orange Roughy-1 is interpreted to be a shoreface facies within a transgressive systems tract. The stratigraphic sequence between the 52.5-51.5 MY SB (Lavender to Jade SB) at the Orange Roughy location is marked by a transgressive systems tract, the vertical succession suggesting a retrogradational stacking pattern of parasequences and subsequent truncation by the 51.5 MY Sequence Boundary (Jade SB). In the eastern Kingfish-8 well, the 52.5-51.5 MY sequence comprises two parasequences grading from offshore shale to upper shoreface facies whilst the parasequences comprise of lower shoreface to predominantly upper shoreface sands at the landward Orange Roughy-1 well. Below the 52.5 MY SB (Lavender SB), deposition occurred largely in the coastal plain.

5. *HYDROCARBONS*

No significant hydrocarbon shows were encountered within the Gippsland Limestone, Lakes Entrance Formation or Latrobe Group in the Orange Roughy-1 well. Background gas levels within the post Latrobe section varied from 0.1 - 1.0% (5-50 units). Gas levels within the Latrobe Group were maintained at 0.1 - 1.0% (5-50 units) with an increase in the heavier gas components from that recorded in the post Latrobe section. Core #1 (2313.5m - 2331.9m, Driller's depths) was cut across the top porosity section in Orange Roughy-1, however, only 5 metres of 20-50% moderately bright pale yellow to gold fluorescence, exhibiting a moderate fast streaming cut with thin-patchy residue ring was recorded across the top of the reservoir section. With the exception of the above oil show, no other fluorescence shows were recorded in the Orange Roughy-1 well. Quantitative log analysis was conducted to determine water saturation and porosity over the sandstone intervals within the Orange Roughy-1 well. No net oil pay is mapped in the Orange Roughy well.

6. *GEOPHYSICAL DISCUSSION*

a) Introduction

Table 2: Pre-drill vs Post-drill Key Seismic Horizon Assessment

Horizon	Predicted Depth	Actual Depth	Difference	%
TOL	-2260	-2247	13m high	0.58%
ORANGE SB (50 my)	-2308	-2294	14m high	0.61%
JADE SB (51.5 my)	-2324	-2330	6m low	0.23%
SIENNA SB (54.2 my)	-2486	-2483	3m low	0.12%

Several key horizons were encountered high to the pre-drill prediction (See Table 2). Because of severe channelling in the shallower section of the Top of Latrobe depth map in this area has always been a difficult surface with a fair degree of uncertainty. The current Top of Latrobe depth map results from a variety of inputs from J. Mitchell and J. Stober, C. Cohen, M. Cousins and M. Moore. The Orange Roughy-1 well was 13m high to prediction and represents an 0.58% error, in depth prediction.

b) Seismic Tie

Well logs were edited and the checkshots verified to produce a synthetic seismic trace using both the sonic and density logs. The resulting synthetic trace made an excellent character tie to the seismic data for both the Latrobe Group and post Latrobe Group stratigraphy. (Enclosure 1).

The horizon ties to the seismic were fair. Seismically, the Orange SB had been picked at the base of the black peak but the synthetic showed that the middle of the black peak was the correct tie. Similarly the Jade and Juniper SB's could be picked a few milliseconds lower. Pre-drill picks on other horizons were unaltered by the Orange Roughy-1 well tie. Based on these updated ties, the time interpretation for the Orange SB was adjusted (Figure 1).

Enclosure 2 is a reconstructed seismic line passing through the 3 important wells, Nannygai-1, Orange Roughy-1 and Kingfish-8 displayed at 50cm/sec with the post-drill time interpretation and the 3 well synthetics as overlays.

c) Depth Conversion

The post-drill Top of Latrobe Group time map is displayed on Enclosure 3. This surface was divided into the pre-drill depth grid to produce an Average Velocity Map to the Top of Latrobe Group (Enclosure 4). The velocity contours on this map were then adjusted to fit the new data from the Orange Roughy well. An updated depth map for the Top of Latrobe Group was then produced (Enclosure 5). This updated depth map slightly enhances the closure at the Orange Roughy-1 location and raises the spill point from -2270m to -2260m towards the Nannygai-1 nose.

The Jade SB was the next horizon to be depth converted since it is sufficiently deep, below the Top of Latrobe Group on the western side of the Kingfish Field to prevent grossly erroneous interval velocities. Checkshots exist in some 15 wells across the Kingfish Field and these were used to construct an interval velocity map for the Top of Latrobe Group to Jade SB isopach. The interval velocity map for the Top of Latrobe to Jade SB is displayed on Enclosure 6. Note the strong velocity gradient from Kingfish-8 to Orange Roughy-1 (3333 m/s to 3730 m/s). Figures 3 and 4 display the drift corrected sonics for each of these well confirming these velocities. The faster than expected interval velocity in the Orange Roughy-1 well results in the pre-drill isopach of 64m expanding to 83m and thus lowering the Jade SB surface, and the associated spill points.

The interval velocity derived from well data was then multiplied by the seismic isochron and the resulting isopach corrected to fit the well isopachs. This isopach was then added to the revised Top of Latrobe Group to create the new Jade SB Depth Map (Enclosure 7).

In comparison to the pre-drill Jade SB Depth Map this post-drill map has a slightly deeper spill towards Nannygai-1, (-2385m as opposed to -2375m), and the spill point is pulled back closer to the Orange Roughy-1 well (steepening the western flank with possibly a very minor closure existing at this level at Orange Roughy-1).

d) <u>Depth Interpretation of Orange and Juniper SB's</u>

Since these two intervening horizons are too close to use the depth layering technique it was decided to pro-rata the Top of Latrobe Group to Jade SB isopach according to the ratio of these two time horizons to the associated interval isochron. This method produced two new depth surfaces namely Juniper SB Depth Map and Orange SB Depth Map. Both surfaces were adjusted to conform to the well depths.

The Juniper SB Depth Map produced a surface fairly similar to the Jade SB surface but marginally less steep on the western flank, resulting from the isopach thickening westwards. This surface represents the top of porosity in the West Kingfish field area. The westward extent of the thinning, overlying marine shale will dictate the spill point for the field. The Kingfish-8ST1 well recognised an OOWC at -2328m which is very close to the spill point between the West Kingfish Field proper and a possible small closure south of the Orange Roughy-1 location. Refer to Enclosure 8 for the Juniper SB Depth Map.

The shallower Orange SB Depth Map is shown as Enclosure 9. This surface reveals a good closure of some 20m over an area of approximately 2 square kilometres. At Orange Roughy-1 as predicted, porosity exists below this surface, and the well appears to be optimally located. However no hydrocarbons were encountered.

A spill point at -2335m is quite close to the West Kingfish OOWC of -2328m. Note porosity at this surface does not extend eastwards to Kingfish-8 or Kingfish-8STI wells. Note also the almost negligible drainage envelope from the north into this closure, hence any hydrocarbons present in the closure would have to spill from the West Kingfish field proper.

e) <u>Analysis of Results</u>

To assist in explaining the results a cross section was constructed from Nannygai-1 across the mapped spill points and through Orange Roughy-1 and Kingfish-8 and Kingfish-8ST1 wells (Enclosure 10).

As resulting from the rapid increase in interval velocity from the Top of Latrobe Group to the Jade SB, note how the isopach has thickened and deepened the surface giving a much steeper western flank. The two horizons of prime importance are the Orange SB and the Juniper SB. The Juniper SB is largely controlled by the Jade surface and as previously mentioned actually lowers the western spill point towards Nannygai-1. Interestingly the saddle between Orange Roughy-1 and West Kingfish field is very close to the field OOWC at - 2338m and is believed to be the spill point for the Kingfish Field.

To attempt to explain this dry well result, it is necessary to look at sand distribution in conjunction with the currently mapped structural surfaces. The geological cross section from Nannygai-1 to Kingfish-8 (through Orange Roughy-1) has been updated for the revised structural mapping and stratigraphy (Enclosure 11). The top of porosity in Orange Roughy-1 is the Orange SB at -2294m, yet there is still significant closure westwards (down to -2335m).

If one looks carefully at the Orange Roughy-1 log there is a 7 metre silty zone just above the Orange SB (Enclosure 12). Log analysis indicates that there is no porosity in this silty zone. The equivalent zone, namely Cobalt to Orange SB in the updip Nannygai-1 well has a 59% N/G with the sands being interpreted as lower shoreface. This zone is quite thin (32m at Nannygai-1 and 15m at Orange Roughy-1), and hence is less than 20 milliseconds on the seismic data. A careful visual analysis of this thin seismic zone indicates that there is a shingling of seismic amplitudes in the vicinity of the Nannygai-1 well (Figure 5).

An average amplitude display of the seismic pulse in the Cobalt to Orange SB intervals is displayed on Enclosure 13. Note how there appears to be a strong Northeast to Southwest lineations of these amplitudes across the map along strike of the depositional direction. This is interpreted to be indicative of sandier facies prograding in the dip direction. These lineations continue from Nannygai-1 down past the Orange Roughy-1 location, but appear to cease before the western edge of the Kingfish field near Kingfish-8. If correct, it could be expected that immediately below the Cobalt surface there exists a sandy facies extending down towards the Orange Roughy-1 location with sandy/silty toes of the progrades onlapping the Orange Roughy-1 feature, and allowing any hydrocarbons to leak out and migrate up towards Nannygai-1. The saddle of this surface, west of Orange Roughy-1, would come very close to the crest of the Orange Roughy-1 closure at -2294m, and hence act as a thief zone to the feature (Enclosure 10).

7. *CONCLUSION*

The Orange Roughy-1 result further confirms the complexity and risks associated the depth conversion and structural interpretation in the area of the high velocity channel. Whilst the Top Latrobe Group and Top porosity (Orange SB) were intersected some 13-14 metres high to prognosis and the stratigraphic interpretation for the 50.0-50.5 MY sequence (distal lower shoreface) was realised at the Orange Roughy-1 location, only 5 metres of poor fluorescence was observed below top porosity in the well. The most likely explanation for failure of the Orange Roughy-1 well is the presence of potential thief sandstones stringers within the 48.5-50.0 MY interval which extend eastward from Nannygai to the Orange Roughy area, thereby providing a means of hydrocarbon migration via a westerly upward development of porosity.

8. *BIBLIOGRAPHY*

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Schlumberger Report, Kingfish-8, Seismic Calibration and Geogram Processing Report, March 1992 (WF2 921138)

Nannygai-1 Well Completion Report August 1972 (WF3 AC 841330)

Gurnard-1 Well Completion Report November 1970 (WF3 820668)

Schlumberger Report, Orange Roughy-1 Geophysical Airgun Report (no library ref. no.)

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SUBTYPE =	PROSPECT_MAP
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DATE_RECEIVED =	
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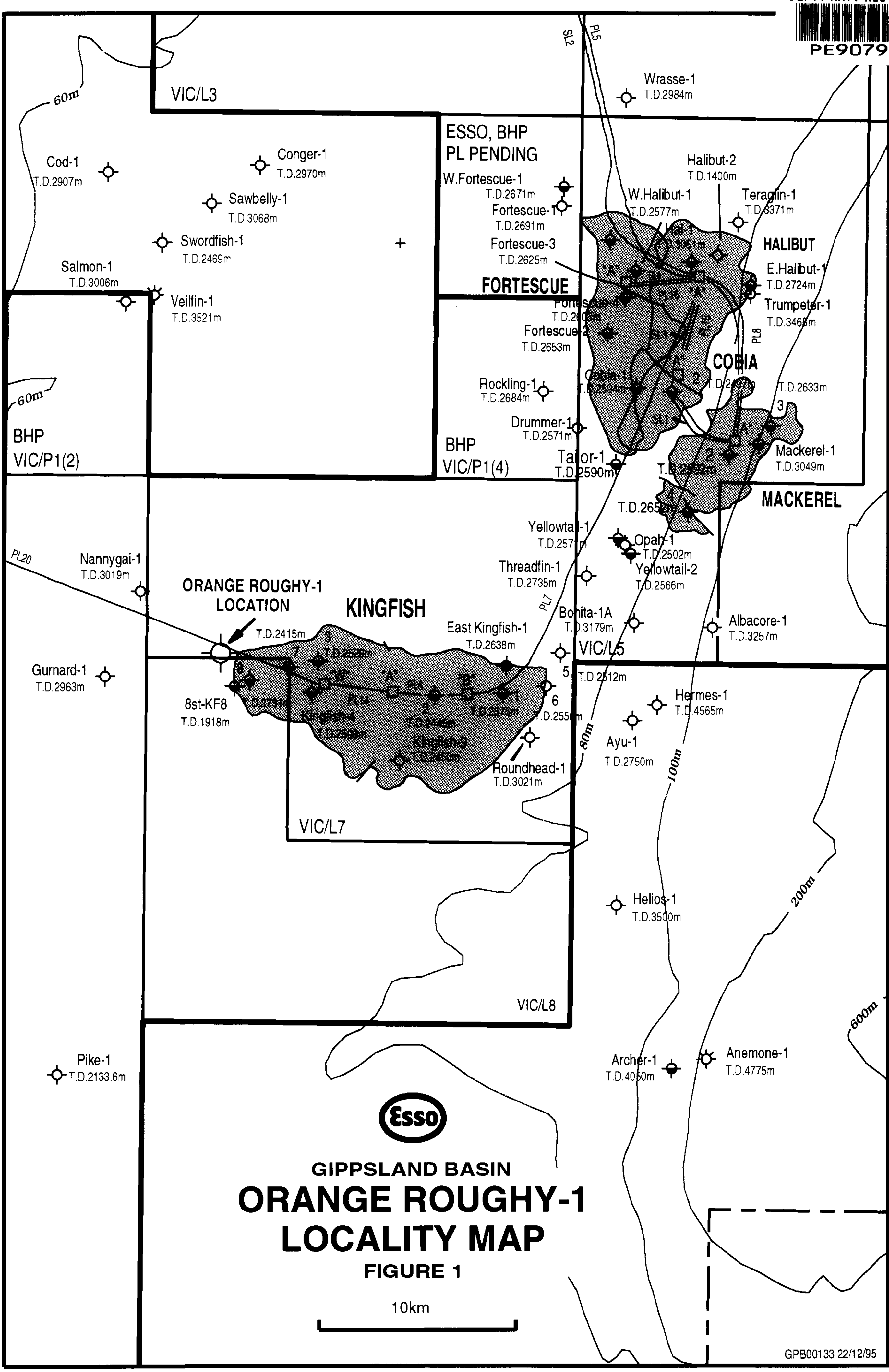
CONTRACTOR =	ESSO
CLIENT_OP_CO =	ESSO

(Inserted by DNRE - Vic Govt Mines Dept)



GIPPSLAND BASIN
ORANGE ROUGHY-1 LOCALITY MAP
FIGURE 1

PE907947

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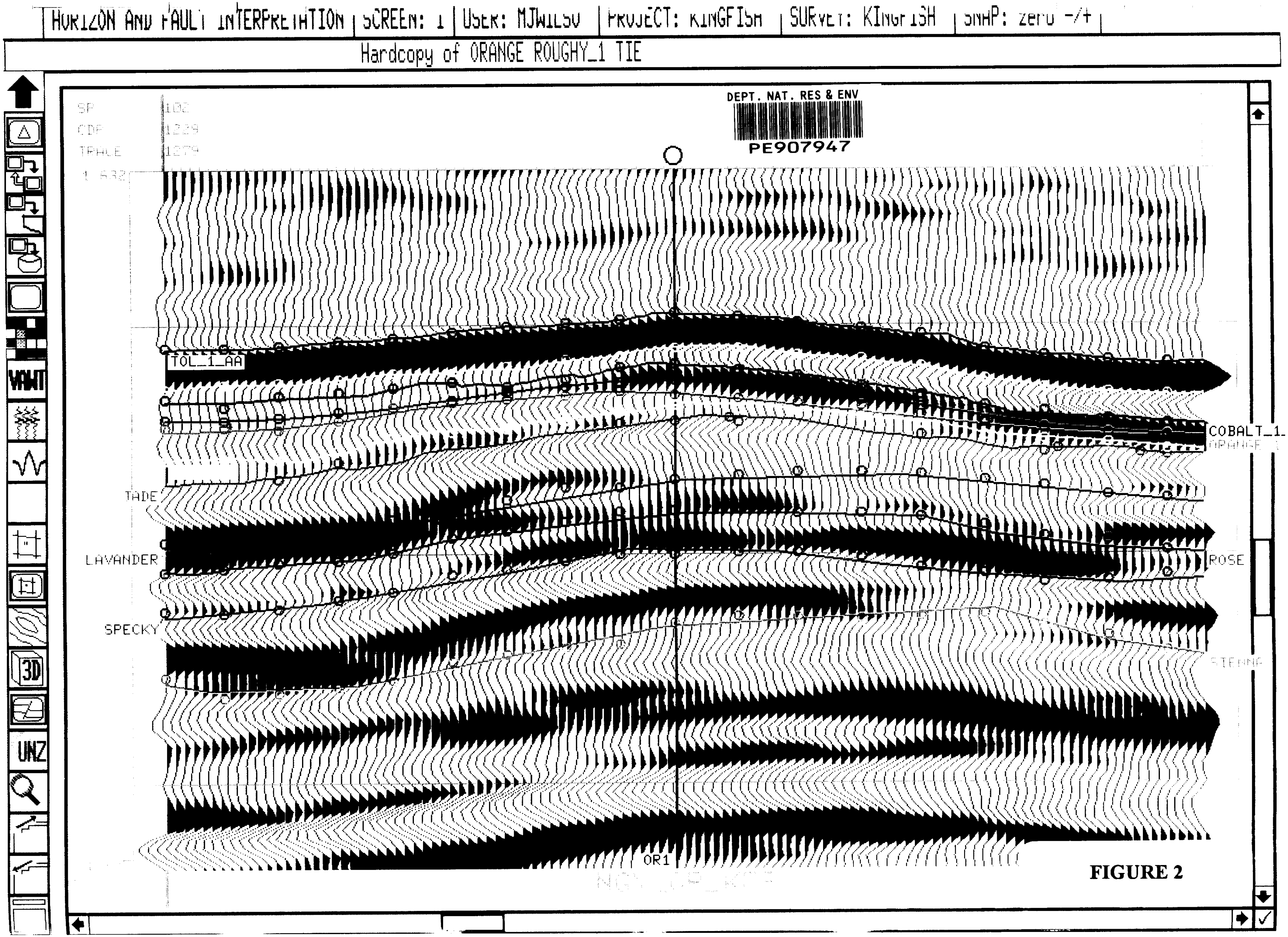

HORIZON AND FAULT INTERPRETATION | SCREEN: 1 | USER: MJWILSO | PROJECT: KINGFISH | SURVEY: KINGFISH | SNAP: zero -/+
Hardcopy of ORANGE ROUGHY_1 TIE
DEPT. NAT. RES & ENV
PE907947
SP
CDP
TRACE
TOL_1_AA
COBALT_1
TADE
LAVANDER
ROSE
SPECKY
OR1

FIGURE 2

PE907948

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DATE_RECEIVED =
W_NO = W1121
WELL_NAME = Orange Roughy -1
CONTRACTOR = ESSO
CLIENT_OP_CO = ESSO

(Inserted by DNRE - Vic Govt Mines Dept)

KINGFISH-8
Drift Corrected Sonic

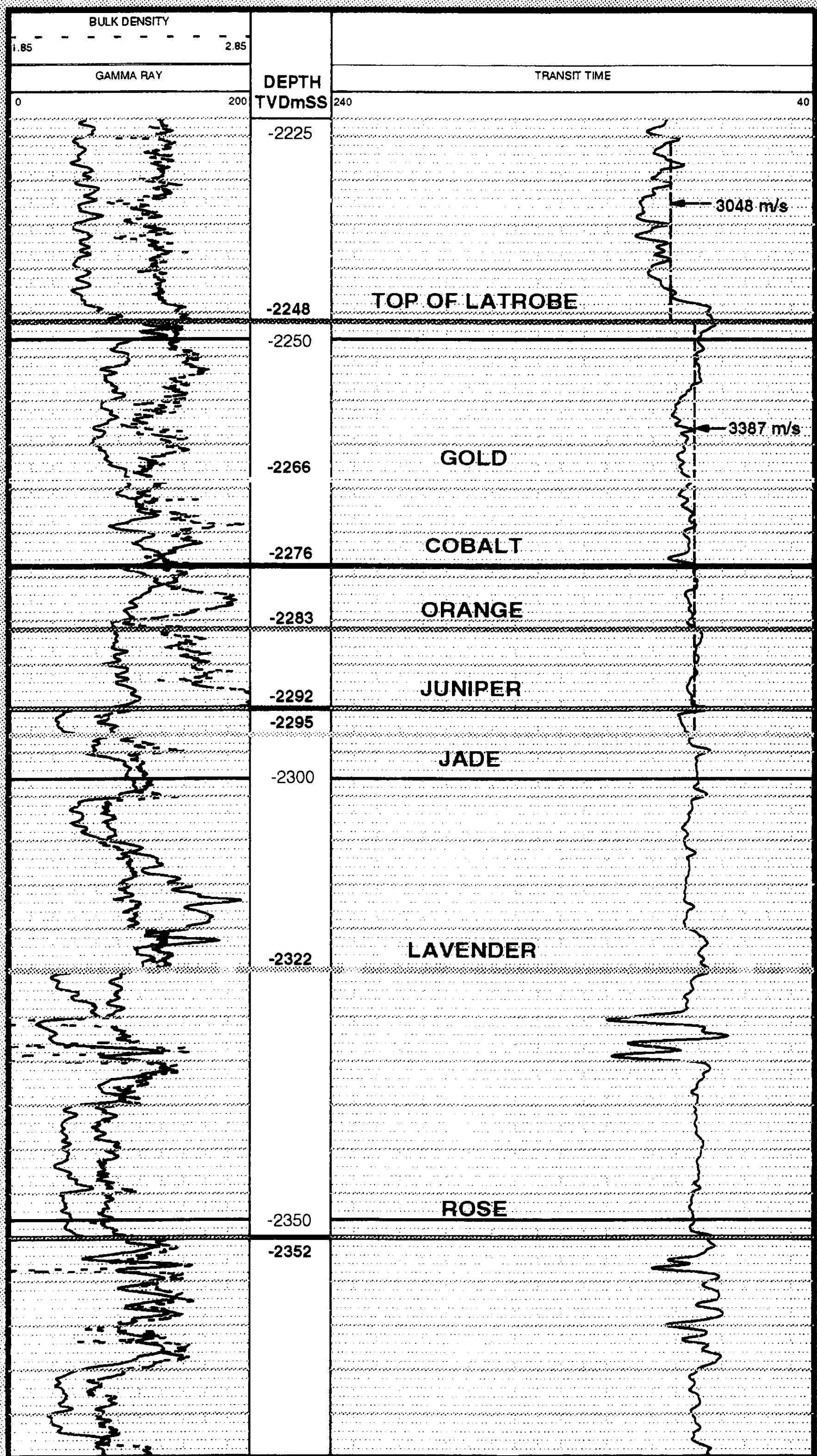

FIGURE 3

GPL00137 2/11/95

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WELL_NAME =	Orange Roughy -1
CONTRACTOR =	ESSO
CLIENT_OP_CO =	ESSO

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ORANGE ROUGHY-1
Sonic

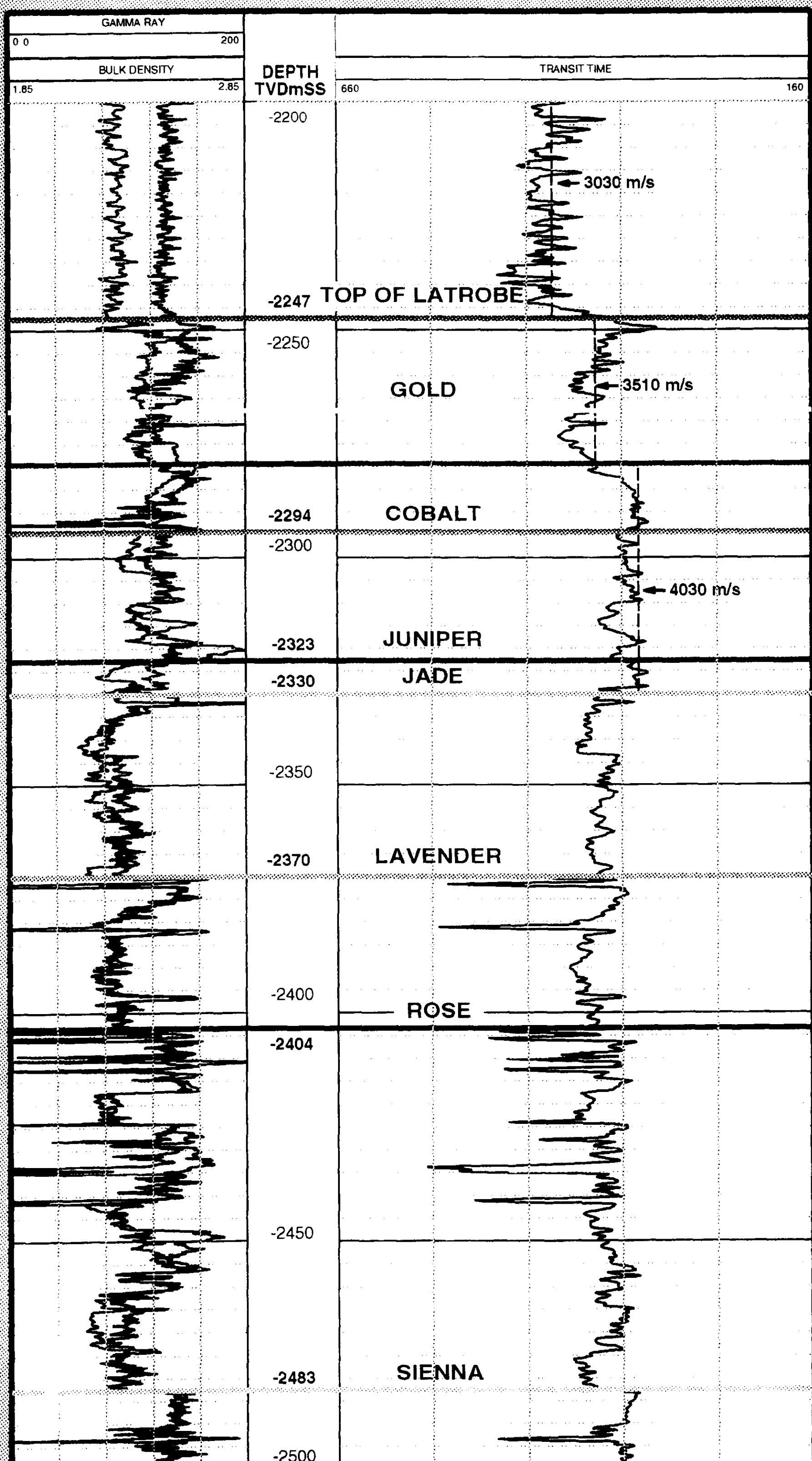

FIGURE 4

GPL00138 2/11/95

PE907950

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PERMIT = VIC/L7
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SUBTYPE = SECTION
DESCRIPTION = Horizon and Fault Interpretation, Seismic Section with Interpretation, (Figure-5 from WCR vol.2) for Orange Roughy-1
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DATE_RECEIVED =
W_NO = W1121
WELL_NAME = Orange Roughy -1
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CLIENT_OP_CO = ESSO

(Inserted by DNRE - Vic Govt Mines Dept)

DEPT. NAT. RES & ENV
PE907950

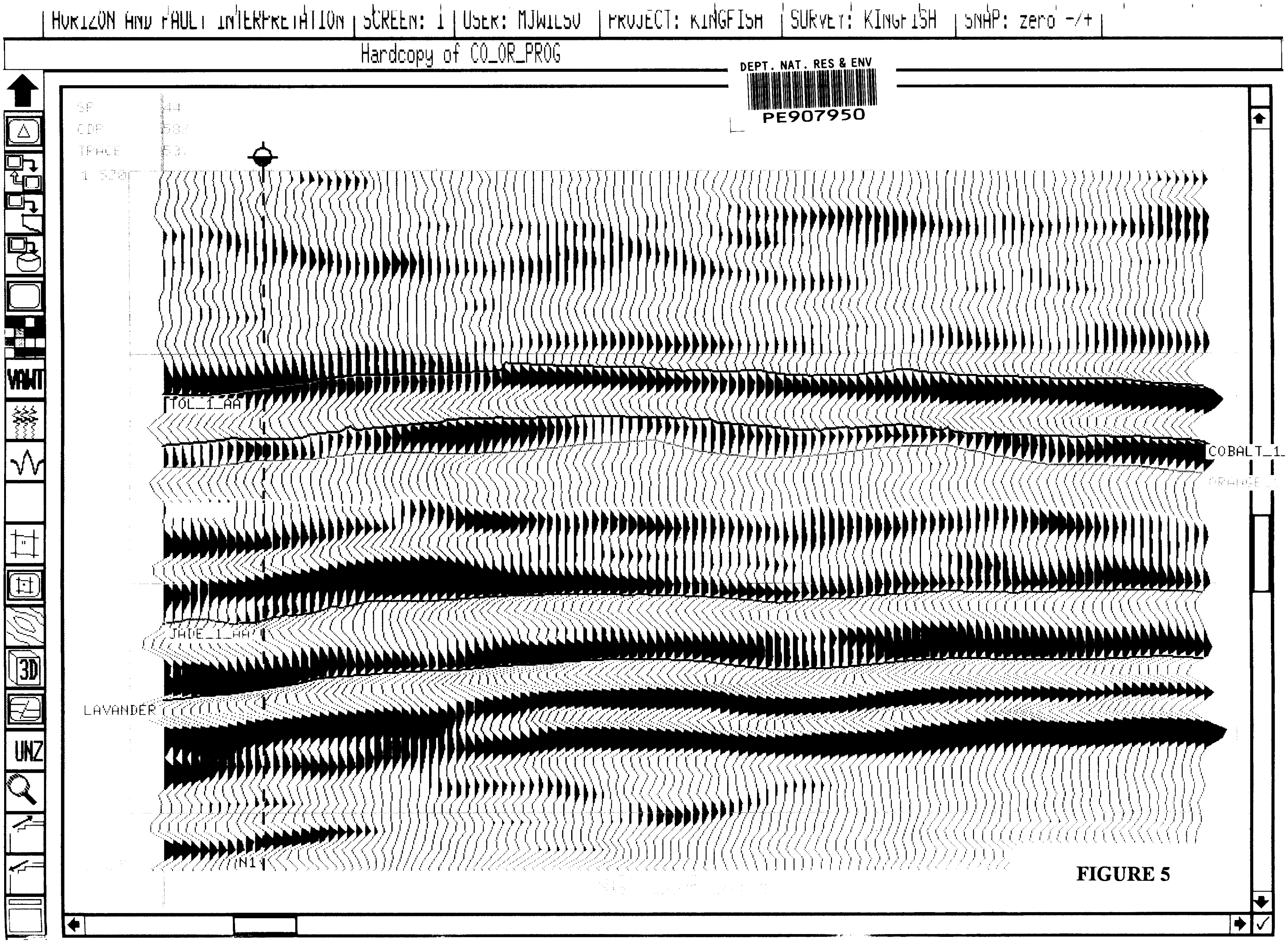

FIGURE 5

APPENDIX 1

APPENDIX 1

ORANGE ROUGHY-1

Palynological Analysis

Palynological Analysis
of
Orange Roughy-1,
Gippsland Basin.

by

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Biostrata Report 1995/16

24 August 1995

CONTENTS

INTERPRETATIVE DATA

BASIC DATA

INTERPRETATIVE DATA

Introduction

Twenty-six sidewall cores between 2267m to 2591m were analysed in Orange Roughy-1. The author cleaned, split the selected sidewall cores and forwarded them to Laola Pty Ltd in Perth for processing to prepare the palynological slides. Lithological units and palynological zones recognised in the Latrobe Group and overlying Seaspray Group are given in the following summary. The interpretative data with zone identification and Confidence Ratings are recorded in Table 1 and basic data on residue yields, preservation and diversity are recorded on Tables 2 and 3. All species which have been identified with binomial names are tabulated on the palynomorph range chart. Relinquishment list for palynological slides and residues from samples analysed in Orange Roughy-1 are provided at the end of the report.

Palynological Summary of Orange Roughy-1

AGE	UNIT/FACIES (metres)	SPORE-POLLEN ZONES (MICROPLANKTON ZONES)	DEPTHS (metres)
OLIGOCENE	SEASPRAY GROUP 147-2275m	*P. tuberculatus* (*Operculodinium* Superzone)	2267-2270 (2267-2270)
EARLY OLIGOCENE	LATROBE GROUP Gurnard Formation 2275-2311.5m	Upper *N. asperus* (*P. comatum*)	2281 (2281)
LATE EOCENE		Middle *N. asperus* (*C. incompositum*)	2285 (2281)
MIDDLE EOCENE		Lower *N. asperus* (*D. heterophlycta*) (*A. australicum*)	2290-2305 (2297) (2305)
EARLY EOCENE	LATROBE GROUP Unnamed Greensand 2311.5-2319.5m	NOT SAMPLED (suggested age based on log correlation to Kingfish-8)	
EARLY EOCENE	LATROBE GROUP Undifferentiated shoreface facies of shales and sands 2319.5-2395.3m	Upper *M. diversus* (*W. ornatum*)	2320 (2320)
		Middle *M. diversus*	2357.1
EARLY EOCENE TO PALEOCENE	LATROBE GROUP Undifferentiated coastal plain facies of shale, coals and sands 2395.3-2607m	Lower *M. diversus*	2407.1-2462
		Upper *L. balmei* (*A. homomorphum*)	2481-2515 (2510)
		L. balmei	2538-2545.5

T.D. 2607mKB (logger)

Between 3.3 g to 15.8 g (average 9.3 grams) of the sidewall cores were processed for palynological analysis (Table 2). Residue yields were very low to low from the Seaspray Group and Gurnard Formation but contained moderate to high palynomorph concentrations. In contrast in the underlying undifferentiated Latrobe Group, although residue yields were mostly high, palynomorph concentration on the slides were mostly very low to low with only 26% of the samples showing moderate palynomorph concentrations (Table 3). Palynomorph preservation was mainly poor to fair decreasing to very poor below 2500m. The average spore-pollen diversity is 21+ species per sample excluding the four lowest yielding samples. The average microplankton diversity is 14+ species per sample in the basal Seaspray Group and Gurnard Formation but less than one species per sample in the underlying undifferentiated Latrobe Group.

Geological Comments

1. The sequence analysed in Orange Roughy-1 extends from Early Oligocene to Paleocene, from the base of the open marine Seaspray Group to within the coastal plain, coal measures facies of the undifferentiated part of the Latrobe Group. A continuous sequence of spore-pollen zones were recorded over the interval analysed with the exception of the *P. asperopolus* Zone which probably occurs in the unsampled Unnamed Greensand. A continuous sequence of microplankton zones is only found through the Gurnard Formation where a condensed section of four Middle Eocene to basal Oligocene zones were recorded. An additional two microplankton zones were recognised in individual samples from the undifferentiated Latrobe, whilst the microplankton assemblages from the Seaspray Group can only be assigned to the broad *Operculodinium* Superzone.

2. The basal 10 metres of the Seaspray Group is sampled by two sidewall cores both overwhelmingly dominated by dinoflagellates (> 86% of total spore-pollen and microplankton count). Other marine fossils in the samples are the chitinous inner liners of foraminifera and rare scolecodonts (chitinous mouthparts or teeth of marine annelid worms). The assemblages are typical of the *P. tuberculatus* Zone and *Operculodinium* Superzone and are considered to represent a deep water open marine environment. Although there remains an 11 metre sampling gap to the shallowest sample analysed in underlying Gurnard Formation it is suggested there is a hiatus between these units as the newly recognised *F. leos* microplankton Zone (Partridge 1994, 1995) is missing.

3. A 36.5 metres thick section of the Gurnard Formation is interpreted from logs and correlation to Kingfish-8 to lie between 2275-2311.5m. Although only five sample were analysed over this interval they show an apparent continuous Middle Eocene through Late Eocene to basal Oligocene suite of spore-pollen and microplankton zones. Similar sequences have been reported from both Kingfish-7 and 8 (Partridge 1977, 1992). The abundant microplankton in the samples (ranging from 18% to 34%), associated occurrence of microforaminiferal inner; abundant glauconite in some of the samples, and low average deposition rate of ~ 3 metres/million years is interpreted to indicate deposition in a distal open marine as a condensed section extending for a period of between 4 to 12 million years. Duration of zones is according to current correlation to time scale of Haq *et al.* (1987, 1988).

4. The eight metre thick Unnamed Greensand identified over the interval 2311.5-2319.5m is derived from log correlation with Kingfish-8 and to a lesser extent Kingfish-7. Although this interval was not sampled by sidewall cores it is considered likely to contain the *P. asperopolus* spore-pollen Zone and *K. thompsonae* microplankton Zone identified in both Kingfish-7 and 8 (Partridge 1977, 1992). It may also contain part of the Upper *M. diversus* spore-pollen Zone and/or the *K. edwardsii* microplankton Zone.

5. The 75 metre interval from 2319.5-2395.3m is interpreted to represent "shoreface facies" of the Latrobe Group as it is a predominantly sandy section which lacks coals and has few good shale beds (see sidewall core descriptions). Only two good palynomorph assemblages were obtained from this interval. An argillaceous sandstone at 2320m from the top of the unit gave a meagre but extremely diagnostic assemblage which belonged to the Upper *M. diversus/W. ornatum* Zones while a pyritic siltstone at 2357.1m which gave a sharp spike on the density log yielded an apparent non-marine assemblage assigned to the Middle *M. diversus* Zone. Two samples shot between 2344.5-2348m, in what is interpreted as the most shaly section on the logs, unfortunately gave only extremely meagre yields and their recorded assemblages are considered to be of low reliability. Notwithstanding that caveat the presence of multiple specimens of the dinoflagellate *Homotryblium tasmaniense* in the sample at 2345m suggests that this shale is almost certainly no older than the Upper *M. diversus* Zone. On comparing these results to Kingfish-8 it is proposed that the 35 metre thick interval between 2319.5m to ~ 2355m in Orange Roughy-1 is

missing in Kingfish-8 through either erosion or due to a marked thinning and change in facies.

Either interpretation is possible and depends on what is the age and mode of deposition of the base of the overlying Unnamed Greensand. If the *K. thompsonae* and *D. waipawaense* Zones in Kingfish-8 (Partridge 1992, 1993) are reliably identified and not reworked it is likely that the interval 2319.5m to ~ 2355m in Orange Roughy-1 correlates to the interval ~ 2307m to ~ 2318m in Kingfish-8 which comprises the lower part of the Unnamed Greensand and highest sand of the underlying shoreface facies. If however, the basal part of the Unnamed Greensand actually belongs to the *P. asperopolus/K. thompsonae* Zones and its true age is obscured by substantial reworking from the older Upper *M. diversus* and *W. ornatum/D. waipawaense* Zones as was demonstrated in the conventional cores in Kingfish-7 (Partridge 1977), then the interval 2319.5m to ~ 2355m in Orange Roughy-1 at best is only represented by the top coarse clastics sand between ~2315.5m to ~2318.3m in Kingfish-8. This latter interpretation suggests there may be up to 75 metres of erosion (or thinning?) at the top of the undifferentiated Latrobe coarse clastics in Kingfish-7 and 8 relative to the section preserved in Orange Roughy-1.

6. The highest coal in Orange Roughy-1 occurs at 2395.4m and the interval 2395.3-2466.8m is a distinctive coastal plain coal measures package. This unit is 71.5m thick and contains 15 single or paired coal seams between 0.2 to 0.8 metres thick which sum to representing 8% of the total section. The seven samples analysed over this interval all gave very similar assemblages assigned to the Lower *M. diversus* Zone. No in situ microplankton were recorded from any of the samples. Similar results were obtained from Kingfish-8 where the top of the coals correlates with the top of the Lower *M. diversus* Zone and no microplankton were recorded from the zone (Partridge 1992).

7. The *A. hyperacanthum* microplankton Zone found at the base of the Lower *M. diversus* Zone was not recorded in Orange Roughy-1 but logically lies in the inadequately sampled shale unit between 2472.5-2482m. Unfortunately the sidewall core analysed at 2481m was essentially barren and consequently its assignment to the *L. balmei* Zone is of very low confidence. The presence of the *A. hyperacanthum* Zone could however be confirmed by analysis of cuttings as the depth of this shale is sufficiently below the top of the Latrobe Group to reduce the problems of masking caused by cavings from the basal Seaspray Group.

8. From 2485m to T.D. at 2603.5m (driller) the seven samples analysed gave results consistent with the Paleocene *L. balmei* Zone. Unfortunately preservation was very poor in the samples and the Upper and Lower subzones are poorly defined. The section can be clearly differentiated from the overlying Lower *M. diversus* Zone by the scarcity of coals. Only three thin seams at 2518m, 2564m, 2583m(?) are evident on the density log while a fourth seam at 2591m was sampled by the deepest sidewall core.

Biostratigraphy

Zone and age determinations are based on the spore-pollen zonation scheme proposed by Stover & Partridge (1973), partially modified by Stover & Partridge (1982) and a dinoflagellate zonation scheme which has only been published in outline by Partridge (1975, 1976). Other modifications and embellishments to both zonation schemes can be found in the many palynological reports on the Gippsland Basin wells drilled by Esso Australia Ltd. Unfortunately this work is not collated or summarised in a single report.

Author citations for most spore-pollen species can be sourced from Stover & Partridge (1973, 1982), Helby, Morgan & Partridge (1987) and those for dinoflagellates can be found in the index of Lentin & Williams (1993). Species names followed by "ms" are unpublished manuscript names.

***Proteacidites tuberculatus* spore-pollen Zone**
and
***Operculodinium* microplankton Superzone**
Interval: 2267.0-2270.0 metres
Age: Early Oligocene

The two sidewall cores assigned to these zones are overwhelmingly dominated by microplankton (>86%) and not surprisingly the rarer spore-pollen mostly comprise by long ranging species. The exception is the key spore *Cyatheacidites annulatus* whose FAD (First Appearance Datum) is diagnostic of the zone.

The microplankton assemblages are dominated by abundant *Spiniferites* spp. and common to abundant *Operculodinium centrocarpum*. Other frequent to common species are *Hystrichokolpoma rigaudae*, *Lingulodinium machaerophorum*, *Dapsilidinium pseudocolligerum* and *Protoellipsodinium simplex* ms. The prominence of the last two species confirm these to samples are younger than the *Fromea leos* Zone of Partridge (1994, 1995).

Microforaminiferal inner liners were present in both palynomorph assemblages.

Upper *Nothofagidites asperus* spore-pollen Zone
and
***Phthanoperidinium comatum* microplankton Zone.**
Interval: 2281.0 metres
Age: Basal Early Oligocene

The spore-pollen in the assemblage are mostly long ranging species dominated by *Nothofagidites* spp. at 65% of the pollen count. The only restricted species was a single specimen of *Psiladiporites pertritus* ms which has been recorded as lower as this zone in the outcrop sections of the Torquay Subbasin. Otherwise the zone assignment is based on the negative evidence of absence of index species for older or younger zones.

The common associated microplankton which comprise 18% of spore-pollen and microplankton count are dominated by *Spiniferites* spp. and *Phthanoperidinium comatum*. The abundance of the latter (~25% of microplankton count) is diagnostic of the *P. comatum* Zone.

Middle *Nothofagidites asperus* spore-pollen Zone
and
***Corrudinium incompositum* microplankton Zone.**
Interval: 2285.0 metres
Age: Late Eocene

In this high diversity spore-pollen assemblage dominated by *Nothofagidites* spp. (>50%) the occurrence of *Trioroites magnificus* and *Agloreidia qualumis* confirm an age no older, and *Proteacidites pachypolus* and *Santalumidites cainozoicus* an age no younger than the Middle *N. asperus* Zone.

Amongst the most diverse microplankton assemblage recovered from the Gurnard Formation in Orange Roughy-1 the occurrence of the eponymous species *C. incompositum* in association with *Deflandrea leptoderma*, *Corrudinium corrugatum* and the acritarch *Tritonites spinosus* is considered diagnostic of the microplankton zone. The microplankton assemblage is dominated by a small dark sphere with a circular pylome referred to as *Fromea* sp. cf. *F. chytra* and this species represents ~45% of microplankton count.

Lower *Nothofagidites asperus* spore-pollen Zone
Interval: 2290.0-2305.0 metres
Age: Middle Eocene

Although all three samples gave low yields they could readily be assigned to the Lower *N. asperus* Zone on an abundance of *Nothofagidites* spp. (eg. 43% at 2290m and 34% at 2297m). Diagnostic first and last appearances of species however are rare. They are restricted to the oldest occurrence within the zone of

Nothofagidites falcatus, *N. vansteenisii* (both at 22297m) and *Foveotriletes palaequetrus* (at 2290m), and the youngest occurrences of *Proteacidites asperopolus* (at 2297m) and *Conbaculites apiculatus* ms (at 2305m). The spore-pollen zone assignment is however well supported by the following associated microplankton assemblages.

***Deflandrea heterophlycta* microplankton Zone**
Interval: 2297.0 metres
Age: Middle Eocene
The overlap of the ranges of the eponymous species and *Areosphaeridium australicum* ms in this sample confirms the *D. heterophlycta* Zone. Other key species in the sample are the oldest occurrence of the acritarch *Tritonites inaequalis* and the presence of the rare species *Rhombodinium glabrum* and *Diphyes ariensis* ms. The immediately overlying sample at 2290m may also belong to this zone as it also contains *T. inaequalis* as well as rare *Areospheridium arcuatum* but unfortunately lacks either of the key index species. *Fromea* sp. cf. *F. chytra* at ~ 55% dominates the microplankton assemblage at 2290m, but is only common ~ 15% at 2297m in an assemblage which lacks a single dominant species.

***Areosphaeridium australicum* microplankton Zone**
Interval: 2305.0 metres
Age: Middle Eocene
Common to abundant *A. australicum* ms associated with the acritarchs *Tritonites tricornus* and *T. pandus* in a very low yielding sample is diagnostic of the upper part of this zone based on the stratigraphic ranges documented by Marshall & Partridge (1988). The presence of *Achileodinium biformoides* in the sample is one of the few records of this species in the Gippsland Basin.

Upper *Malvacipollis diversus* spore-pollen Zone
and
***Wilsonidium ornatum* microplankton Zone.**
Interval: 2320.0 metres
Age: Early Eocene
This extremely low yield sample from the top of the undifferentiated part of the Latrobe Group gave a very diagnostic palynomorph assemblage. Amongst the spore-pollen were the FADs in the well of *Proteacidites pachypolus* and *Myrtaceidites tenuis* which were both common. Other important species recorded are *Polypodiaceoisporites varus* ms, *Proteacidites nasus* and *P. leightonii*. Overall the assemblage was dominated by *Haloragacidites harrisii* and *Malvacipollis* spp.

Although the associated microplankton were very limited the presence of a few specimens of the eponymous species enabled confident identification of the *Wilsonidium ornatum* Zone.

Homotryblium tasmaniense microplankton Superzone
Interval: 2345.0 metres
Age: Early Eocene
The sample at 2345m unfortunately gave only a low yield with low palynomorph concentration. The limited spore-pollen assemblage belongs to the broad *M. diversus* Zone which is consistent with its stratigraphic position. The palynological slides also contained a single specimen of *Deflandrea* sp. and approximately a dozen fragmented specimens of *Homotryblium tasmaniense*. Interpreting this as an acme of the latter species his sample is considered no older than the Upper *M. diversus* Zone. The zone name is derived from Harris (1965) but raised to a superzone rank in the Gippsland Basin to contain the so called "*Wetzeliella*" Zones which allow subdivision of the total range of *H. tasmaniense*.

Middle _Malvacipollis diversus_ spore-pollen Zone
Interval: 2357.1 metres
Age: Early Eocene
The oldest appearance of *Proteacidites tuberculiformis* at 2357.1m confirms the presence of the Middle *M. diversus* Zone. Except for the introduction of this new species the total assemblage is very similar to those recorded from the underlying Lower *M. diversus* Zone

Lower _Malvacipollis diversus_ spore-pollen Zone
Interval: 2407.5-2462.0 metres (55+ metres).
Age: Early Eocene
The seven sidewall cores over this interval gave mostly high residue yields containing only low to moderate concentrations of spore-pollen and fungal spores and hyphae which mostly were poorly preserved. The assemblages were all of similar character in which the consistent and usually common or abundant occurrence of *Proteacidites grandis* can be considered diagnostic of the zone. Other frequent to abundant species in the samples include *Cyathidites splendens*, *Gleicheniidites circinidites*, *Haloragacidites harrisii* and in the upper part of the interval *Malvacipollis diversus*. *Laevigatosporites ovatus* is noteworthy for its consistent presence through the zone. Index species are rare, usually only being recorded from a single sample. *Tetracolporites multistrixus* ms at 2457m and *Rotoverrusporites stellatus* at 2462m typically have their last appearances within the zone while *Intratriporopollenites notabilis* at 2431.8m and *Proteacidites leightonii*

at 2421.8m and typically have their first appearances within the zone. Somewhat surprisingly no microplankton were recorded in any of the samples. This omission may be due to the overall poor preservation.

***Lygistepollenites balmei* spore-pollen Zone**
Interval: 2481.0-2561.5 metres (80+ metres).
Age: Paleocene
The eight deepest samples in the well are all very poorly preserved from which only low to moderate diversity assemblages were recorded. Residues from five of the samples were re-oxidised and additional slides examined but this did not significantly increase the number of species recorded. Total spore-pollen diversity in the zone is only 42 species (see range chart). Although the interval clearly belong to the broad *L. balmei* Zone on the presence of the eponymous species, or can be no older than the zone based on the FADs for *Haloragacidites harrisii* and *Malvacipollis subtilis* (in sample at 2561.5m), subdivision of into the Upper and Lower *L. balmei* Zones is very difficult. The sample at 2510m is assigned to the Upper subzone based on the co-occurrence of *Malvacipollis diversus*, *Verrucosisporites kopukuensis* and a single specimen of the dinoflagellate *Apectodinium homomorphum* (short spines variety). The latter species is also the basis for identification of the microplankton zone of that name. The five deepest samples however lack species which can justify confident assignment to either subzone, although the questionable presence of *Tetracolporites verrucosus* at 2515m and 2538m hints that the well may have reached total depth in the Lower *L. balmei* Zone.

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Table-1: Interpretative Palynological Data for Orange Roughy-1.

SAMPLE TYPE	DEPTH (M)	Spore-Pollen Zones (Microplankton Zones)	*CR	Comments or Key Species
SWC 30	2267.0	*P. tuberculatus* (*Operculodinium* Sz)	B2	Microplankton > 90% *Cyatheacidites annulatus* present.
SWC 29	2270.0	*P. tuberculatus* (*Operculodinium* Sz)	B2	Microplankton 86% FAD of *Cyatheacidites annulatus*.
SWC 28	2281.0	Upper *N. asperus* (*P. comatum*)	B2 B2	Microplankton 18% Common *Phthanoperidinium comatum*.
SWC 27	2285.0	Middle *N. asperus* (*C. incompositum*)	B1 B1	Microplankton 19% FAD of *Triorites magnificus*.
SWC 26	2290.0	Lower *N. asperus*	B4	Microplankton 31% LAD *Tritonites inaequalis*.
SWC 25	2297.0	Lower *N. asperus* (*D. heterophlycta*)	B1 B2	Microplankton 34% FAD of *Deflandrea heterophlycta*.
SWC 24	2305.0	Lower *N. asperus* (*A. australicum*)	B2 B2	FADs of *A. australicum* ms; *Tritorites tricornus* and *T. pandus*.
SWC 23	2320.0	Upper *M. diversus* (*W. ornatum*)	B1 B3	Abundant *Proteacidites pachypolus* with FAD & LAD of *Wilsonidium ornatum*.
SWC 22	2345.0	(*H. tasmaniense* Sz)	B3	Microplankton present suggest an age no older than Upper *M. diversus* Zone.
SWC 21	2347.5	Indeterminate		Very low yield sample - virtually barren
SWC 19	2357.1	Middle *M. diversus*	B2	FAD of *Proteacidites tuberculiformis*.
SWC 17	2407.5	Lower *M. diversus*	B2	Common *Proteacidites grandis* with frequent *P. incurvatus*.
SWC 16	2421.8	Lower *M. diversus*	B2	Abundant *Malvacipollis diversus* and *P. grandis*.
SWC 15	2431.8	Lower *M. diversus*	B2	Common *P. grandis* with *Intratriporopollenits notabilis* present.
SWC 14	2441.5	Lower *M. diversus*	B2	Low diversity assemblage with rare *Proteacidites grandis*.
SWC 13	2451.5	Lower *M. diversus*	B2	Common *Proteacidites grandis* .
SWC 12	2457.5	Lower *M. diversus*	B2	Abundant *P. grandis* and *Gleicheniidites circinidites*.
SWC 11	2462.0	Lower *M. diversus*	B2	FAD of common *Proteacidites grandis*.
SWC 9	2481.0	*L. balmei*	B5	Nearly barren sample with LAD of *L. balmei*.
SWC 8	2485.0	Upper *L. balmei*	B2	*L. balmei, Polycolpites langstonii* with *Verrucosisporites kopukuensis*.
SWC 7	2510.0	Upper *L. balmei* (*A. homomorphum*)	B2	Zones based on single specimens of *V. kopukuensis* and *Apectodinium homomorphum* (short spined variety).
SWC 6	2515.0	*L. balmei*	B2	FAD of *V. kopukuensis* in very poorly preserved assemblage with possible presence of *Tetracolporites verrucosus*.
SWC 5	2538.0	*L. balmei*	B2	Frequent poorly preserved specimens of *Lygistepollenites balmei*, with questionable *T. verrucosus*.
SWC 4	2545.5	*L. balmei*		*L. balmei* present.

Table-1: Interpretative Palynological Data for Orange Roughy-1 cont.

SAMPLE TYPE	DEPTH (M)	Spore-Pollen Zones (Microplankton Zones)	*CR	Comments or Key Species
SWC 3	2561.5	*L. balmei*		Presence of *Haloragacidites harrisii* and *Malvacipollis subtilis* confirms age no older than this zone even though eponymous species not recorded.
SWC 1	2591.0	Indeterminate		Coal lithology on processing gave abundant semi-opaque kerogen but failed to yield any significant palynomorphs.

LAD = Last appearance datum
FAD = First appearance datum

Confidence Ratings

The concept of Confidence Ratings applied to palaeontological zone picks was originally proposed by Dr. L.E. Stover in 1971 to aid the compilation of micropalaeontological and palynological data and to expedite the revision of the then rapidly evolving zonation concepts in the Gippsland Basin. The original scheme which mixed confidence in fossil species assemblage with confidence due to sample type gradually proved to be rather limiting as additional refinements to existing zonations were made. With the development of the STRATDAT computer database as a replacement for the increasingly unwieldy paper based Palaeontological Data Sheet files a new format for the Confidence Ratings was proposed. These are given for individual zone assignments on Table 1, and their meanings are summarised below:

Alpha codes: Linked to sample type

A Core
B Sidewall core
C Coal cuttings
D Ditch cuttings
E Junk basket
F Miscellaneous/unknown
G Outcrop

Numeric codes: Linked to fossil assemblage

1	**Excellent confidence:**	High diversity assemblage recorded with key zone species.
2	**Good confidence:**	Moderately diverse assemblage recorded with key zone species.
3	**Fair confidence:**	Low diversity assemblage recorded with key zone species.
4	**Poor confidence:**	Moderate to high diversity assemblage recorded without key zone species.
5	**Very low confidence:**	Low diversity assemblage recorded without key zone species.

BASIC DATA

Table 2: Basic Sample Data - Orange Roughy-1.

SAMPLE TYPE	DEPTH (Metres)	REC (cm)	LITHOLOGY	SAMPLE WT (g)	RESIDUE YIELD
SWC 30	2267.0	>2.0	Medium grey calcilutite - well cleaned	11.3	Low
SWC 29	2270.0	>1.5	Light-medium grey calcilutite - moderately well cleaned. Some mud contamination.	8.1	Low
SWC 28	2281.0	3.0	Brown green glauconitic siltstone with >30% glauconite - well cleaned.	12.4	Low
SWC 27	2285.0	4.0	Dark grey-green glauconitic sandstone with >60% glauconite - well cleaned.	13.0	Low
SWC 26	2290.0	3.5	Dark brown green glauconitic sandstone with >25% glauconite - well cleaned	15.8	Low
SWC 25	2297.0	4.2	Brown-grey medium-fine grained sandstone - glauconite not obvious - well cleaned.	14.4	Low
SWC 24	2305.0	4.5	Black green-grey matrix supported sandstone with rounded quartz up to 2mm - well cleaned.	14.5	Very low
SWC 23	2320.0	>2.0	Medium grey medium grained sandstone with abundant matrix - moderately well cleaned.	8.1	Very low
SWC 22	2345.0	2.5	Light grey clayey siltstone - well cleaned.	9.7	Low
SWC 21	2347.5	2.0	Medium grey very fine grained sandstone.	6.7	Very low
SWC 19	2357.1	2.0	Brown and grey laminated siltstone with common fine pyrite - poorly cleaned.	9.9	High
SWC 17	2407.5	2.0	Light grey fine grained sandstone - moderately well cleaned.	8.6	Moderate
SWC 16	2421.8	2.8	Brown grey brittle claystone with faint lamination up to 2mm - moderately well cleaned.	10.5	High
SWC 15	2431.8	~2.0	Brown grey brittle shale - moderately well cleaned.	8.9	High
SWC 14	2441.5	~2.5	Brown grey brittle shale - poorly cleaned.	9.3	High
SWC 13	2451.5	2.5	Off white - light grey fine grained sandstone - well cleaned.	9.8	Very low
SWC 12	2457.5	2.5	Dark brown carbonaceous siltstone mixed with fine-medium sandstone - well cleaned.	9.7	High
SWC 11	2462.0	3.0	Mottled dark brown siltstone and light brown sandstone - well cleaned.	8.1	High
SWC 9	2481.0	<1.5	Light-medium grey very fine grained sandstone - moderately well cleaned.	6.7	Very low
SWC 8	2485.0	~5.0	Medium grey siltstone with faint laminations - poorly cleaned.	3.6	High
SWC 7	2510.0	2.0	Medium grey fine grained sandstone - moderately well cleaned.	8.0	High
SWC 6	2515.0	~1.5	Laminate claystone/sandstone. Sample broken up - poorly cleaned.	9.3	High
SWC 5	2538.0	2.0	Grey-brown siltstone faintly laminated - well cleaned.	8.4	High
SWC 4	2545.5	~2.5	Dark brown claystone/siltstone - brittle - moderately well cleaned.	7.8	High
SWC 3	2561.5	~1.5	Dark brown grey siltstone - moderately well cleaned.	6.2	High
SWC 1	2591.0	~4.0	Coal - well cleaned.	3.3	High

Table-3: Basic Palynomorph Data for Orange Roughy-1.

Sample Type	Depth (M)	Palynomorph Concentration	Palynomorph Preservation	Number S-P Species*	Microplankton Abundance	Number MP Species*
SWC 30	2267.0	High	Poor-good	20+	Abundant	12+
SWC 29	2270.0	High	Poor	16+	Abundant	13+
SWC 28	2281.0	Moderate	Poor-fair	20+	Common	11+
SWC 27	2285.0	High	Fair	34+	Common	18+
SWC 26	2290.0	High	Poor-fair	30+	Abundant	16+
SWC 25	2297.0	Moderate	Poor-fair	35+	Abundant	18+
SWC 24	2305.0	Moderate	Poor-fair	19+	Abundant	10+
SWC 23	2320.0	Moderate	Poor-good	24+	Rare	5+
SWC 22	2345.0	Very low	Poor	9+	Rare	2+
SWC 21	2347.5	Very low	Poor	3+	NR	
SWC 19	2357.1	Low	Poor-fair	18+	NR	
SWC 17	2407.5	Low	Poor-fair	28+	NR	
SWC 16	2421.8	Moderate	Poor-fair	17+	NR	
SWC 15	2431.8	High	Very poor-poor	24+	NR	
SWC 14	2441.5	Low	Very poor	15+	NR	
SWC 13	2451.5	Low	Poor-fair	15+	NR	
SWC 12	2457.5	Moderate	Very poor-poor	17+	NR	
SWC 11	2462.0	Moderate	Poor	19+	Very rare	(1)
SWC 9	2481.0	Very low	Poor	2+	Rare	(1+)
SWC 8	2485.0	Very low	Poor	10+	NR	
SWC 7	2510.0	Very low	Very poor	19+	Very rare	1
SWC 6	2515.0	Moderate	Very poor	26+	Very rare	1
SWC 5	2538.0	Low	Very poor	15+	NR	
SWC 4	2545.5	Low	Very poor	15+	NR	
SWC 3	2561.5	Very low	Very poor	15+	NR	
SWC 1	2591.0	Very low	Very poor	1+	NR	

NR = Not recorded
( )* = Caved MP Species

Diversity:

Very low	= 1-5	species
Low	= 6-10	species
Moderate	= 11-25	species
High	= 26-74	species
Very high	= 75+	species

RELINQUISHMENT LIST - PALYNOLOGY SLIDES

WELL NAME & NO: ORANGE ROUGHY-1
PREPARED BY: A.D. PARTRIDGE
DATE: 9 AUGUST 1995

Sheet 1 of 3

SAMPLE TYPE	DEPTH (M)	CATALOGUE NUMBER	DESCRIPTION
SWC 30	2267.0	P196845	Kerogen slide: filtered/unfiltered
SWC 30	2267.0	P196846	Oxidised slide 2: 8μm filter
SWC 29	2270.0	P196847	Kerogen slide: filtered/unfiltered
SWC 28	2281.0	P196848	Kerogen slide: filtered/unfiltered
SWC 28	2281.0	P196849	Oxidised slide 2: 8μm filter
SWC 27	2285.0	P196850	Kerogen slide: filtered/unfiltered
SWC 27	2285.0	P196851	Oxidised slide 2: 8μm filter - 2/3 cover slip
SWC 26	2290.0	P196852	Kerogen slide: filtered/unfiltered
SWC 26	2290.0	P196853	Oxidised slide 2: 8μm filter
SWC 25	2297.0	P196854	Kerogen slide: filtered/unfiltered
SWC 25	2297.0	P196855	Oxidised slide 2: 8μm filter
SWC 24	2305.0	P196856	Kerogen slide: filtered/unfiltered
SWC 23	2320.0	P196857	Kerogen slide: filtered/unfiltered - 2/3 cover slips
SWC 22	2345.0	P196858	Kerogen slide: filtered/unfiltered
SWC 22	2345.0	P196859	Oxidised slide 2: 8μm filter
SWC 22	2345.0	P196860	Oxidised slide 3: 8μm filter - 1/2 cover slip
SWC 21	2347.5	P196861	Kerogen slide: 2/3 cover slip - ? filtered
SWC 19	2357.1	P196862	Kerogen slide: filtered/unfiltered
SWC 19	2357.1	P196863	Oxidised slide 2: 8μm filter
SWC 19	2357.1	P196864	Oxidised slide 3: 8μm filter
SWC 19	2357.1	P196865	Oxidised slide 4: 15μm filter
SWC 19	2357.1	P196866	Oxidised slide 5: 15μm filter
SWC 17	2407.5	P196867	Kerogen slide: filtered/unfiltered
SWC 17	2407.5	P196868	Oxidised slide 2: 8μm filter
SWC 17	2407.5	P196869	Oxidised slide 3: 8μm filter
SWC 17	2407.5	P196870	Oxidised slide 4: 15μm filter - 1/2 cover slip
SWC 16	2421.8	P196871	Kerogen slide: filtered/unfiltered
SWC 16	2421.8	P196872	Oxidised slide 2: 8μm filter
SWC 16	2421.8	P196873	Oxidised slide 3: 8μm filter
SWC 16	2421.8	P196874	Oxidised slide 4: 15μm filter
SWC 16	2421.8	P196875	Oxidised slide 5: 15μm filter

RELINQUISHMENT LIST - PALYNOLOGY SLIDES

WELL NAME & NO: ORANGE ROUGHY-1
PREPARED BY: A.D. PARTRIDGE
DATE: 9 AUGUST 1995

Sheet 2 of 3

SAMPLE TYPE	DEPTH (M)	CATALOGUE NUMBER	DESCRIPTION
SWC 15	2431.8	P196876	Kerogen slide: filtered/unfiltered
SWC 15	2431.8	P196877	Oxidised slide 2: 8μm filter
SWC 15	2431.8	P196878	Oxidised slide 3: 8μm filter
SWC 15	2431.8	P196879	Oxidised slide 4: 15μm filter
SWC 15	2431.8	P196880	Oxidised slide 5: 15μm filter
SWC 14	2441.5	P196881	Kerogen slide: filtered/unfiltered
SWC 14	2441.5	P196882	Oxidised slide 2: 8μm filter
SWC 14	2441.5	P196883	Oxidised slide 3: 8μm filter
SWC 14	2441.5	P196884	Oxidised slide 4: 15μm filter
SWC 14	2441.5	P196885	Oxidised slide 5: 15μm filter
SWC 13	2451.5	P196886	Kerogen slide: filtered/unfiltered - 2/3 cover slips
SWC 12	2457.5	P196887	Kerogen slide: filtered/unfiltered
SWC 12	2457.5	P196888	Oxidised slide 2: 8μm filter
SWC 12	2457.5	P196889	Oxidised slide 3: 8μm filter
SWC 12	2457.5	P196890	Oxidised slide 4: 15μm filter
SWC 12	2457.5	P196891	Oxidised slide 5: 15μm filter
SWC 11	2462.0	P196892	Kerogen slide: filtered/unfiltered
SWC 11	2462.0	P196893	Oxidised slide 2: 8μm filter
SWC 11	2462.0	P196894	Oxidised slide 3: 8μm filter
SWC 11	2462.0	P196895	Oxidised slide 4: 15μm filter
SWC 11	2462.0	P196896	Oxidised slide 5: 15μm filter
SWC 9	2481.0	P196897	Kerogen slide: filtered/unfiltered
SWC 8	2485.0	P196898	Kerogen slide: filtered/unfiltered
SWC 8	2485.0	P196899	Oxidised slide 2: 8μm filter
SWC 8	2485.0	P196900	Oxidised slide 3: 8μm filter
SWC 8	2485.0	P196901	Oxidised slide 4: 15μm filter
SWC 7	2510.0	P196902	Kerogen slide: filtered/unfiltered
SWC 7	2510.0	P196903	Oxidised slide 2: 8μm filter
SWC 7	2510.0	P196904	Oxidised slide 3: 8μm filter
SWC 7	2510.0	P196905	Oxidised slide 4: 15μm filter
SWC 7	2510.0	P196906	Oxidised slide 5: 15μm filter
SWC 7	2510.0	P196907	Oxidised slide 6: 8μm filter
SWC 7	2510.0	P196908	Oxidised slide 7: 8μm filter

RELINQUISHMENT LIST - PALYNOLOGY SLIDES

WELL NAME & NO: ORANGE ROUGHY-1
PREPARED BY: A.D. PARTRIDGE
DATE: 9 AUGUST 1995

Sheet 3 of 3

SAMPLE TYPE	DEPTH (M)	CATALOGUE NUMBER	DESCRIPTION
SWC 6	2515.0	P196909	Kerogen slide: filtered/unfiltered
SWC 6	2515.0	P196910	Oxidised slide 2: 8μm filter
SWC 6	2515.0	P196911	Oxidised slide 3: 8μm filter
SWC 6	2515.0	P196912	Oxidised slide 4: 15μm filter
SWC 6	2515.0	P196913	Oxidised slide 5: 15μm filter
SWC 6	2515.0	P196914	Oxidised slide 6: 8μm filter
SWC 6	2515.0	P196915	Oxidised slide 7: 8μm filter
SWC 5	2538.0	P196916	Kerogen slide: filtered/unfiltered
SWC 5	2538.0	P196917	Oxidised slide 2: 8μm filter
SWC 5	2538.0	P196918	Oxidised slide 3: 8μm filter
SWC 5	2538.0	P196919	Oxidised slide 4: 15μm filter
SWC 5	2538.0	P196920	Oxidised slide 5: 15μm filter
SWC 5	2538.0	P196921	Oxidised slide 6: 8μm filter
SWC 5	2538.0	P196922	Oxidised slide 7: 8μm filter
SWC 4	2545.5	P196923	Kerogen slide: filtered/unfiltered
SWC 4	2545.5	P196924	Oxidised slide 2: 8μm filter
SWC 4	2545.5	P196925	Oxidised slide 3: 8μm filter
SWC 4	2545.5	P196926	Oxidised slide 4: 15μm filter
SWC 4	2545.5	P196927	Oxidised slide 5: 15μm filter
SWC 4	2545.5	P196928	Oxidised slide 6: 8μm filter
SWC 4	2545.5	P196929	Oxidised slide 7: 8μm filter
SWC 3	2561.5	P196930	Kerogen slide: filtered/unfiltered
SWC 3	2561.5	P196931	Oxidised slide 2: 8μm filter
SWC 3	2561.5	P196932	Oxidised slide 3: 8μm filter
SWC 3	2561.5	P196933	Oxidised slide 4: 15μm filter
SWC 3	2561.5	P196934	Oxidised slide 5: 15μm filter
SWC 3	2561.5	P196935	Oxidised slide 6: 8μm filter
SWC 3	2561.5	P196936	Oxidised slide 7: 8μm filter
SWC 1	2591.0	P196937	Kerogen slide: filtered/unfiltered
SWC 1	2591.0	P196938	Oxidised slide 2: 8μm filter
SWC 1	2591.0	P196939	Oxidised slide 3: 8μm filter
SWC 1	2591.0	P196940	Oxidised slide 4: 15μm filter
SWC 1	2591.0	P196941	Oxidised slide 5: 15μm filter

RELINQUISHMENT LIST - PALYNOLOGY RESIDUES

WELL NAME & NO: ORANGE ROUGHY-1
PREPARED BY: A.D. PARTRIDGE
DATE: 14 AUGUST 1995

Sheet 1 of 1

SAMPLE TYPE	DEPTH (M)	DESCRIPTION
SWC 19	2357.1	Kerogen residue
SWC 16	2421.8	Kerogen residue
SWC 16	2421.8	Oxidised residue
SWC 15	2431.8	Kerogen residue
SWC 15	2431.8	Oxidised residue
SWC 14	2441.5	Kerogen residue
SWC 14	2441.5	Oxidised residue
SWC 12	2457.5	Kerogen residue
SWC 12	2457.5	Oxidised residue
SWC 11	2462.0	Kerogen residue
SWC 11	2462.0	Oxidised residue
SWC 7	2510.0	Oxidised residue
SWC 7	2510.0	Oxidised residue
SWC 6	2515.0	Kerogen residue
SWC 6	2515.0	Oxidised residue
SWC 6	2515.0	Oxidised residue
SWC 5	2538.0	Kerogen residue
SWC 5	2538.0	Oxidised residue
SWC 5	2538.0	Oxidised residue
SWC 4	2545.5	Kerogen residue
SWC 4	2545.5	Oxidised residue
SWC 4	2545.5	Oxidised residue
SWC 3	2561.5	Kerogen residue
SWC 3	2561.5	Oxidised residue
SWC 3	2561.5	Oxidised residue
SWC 1	2591.0	Kerogen residue
SWC 1	2591.0	Oxidised residue

PE900895

This is an enclosure indicator page.
The enclosure PE900895 is enclosed within the container PE900894 at this location in this document.

The enclosure PE900895 has the following characteristics:

ITEM_BARCODE = PE900895
CONTAINER_BARCODE = PE900894
NAME = Palynomorph range chart
BASIN = GIPPSLAND
PERMIT =
TYPE = WELL
SUBTYPE = DIAGRAM
DESCRIPTION = Palynomorph range chart
REMARKS =
DATE_CREATED = 1/12/95
DATE_RECEIVED = 2/01/96
W_NO = W1121
WELL_NAME = Orange Roughy -1
CONTRACTOR = ESSO
CLIENT_OP_CO = ESSO

(Inserted by DNRE - Vic Govt Mines Dept)

APPENDIX 2

APPENDIX 2

ORANGE ROUGHY-1

Quantitative Formation Evaluation

Esso Australia Ltd
Exploration Department

ORANGE ROUGHY
Formation Evaluation
Log Analysis Report

Petrophysicist: L.J. Finlayson
September 1995

ORANGE ROUGHY-1 LOG ANALYSIS

Orange Roughy-1 wireline logs have been analysed for effective porosity and water saturation over the interval 2310m to 2570m. Analysis was carried out using LASER derived total porosity and a Dual Water saturation model.

Note that all depths quoted below are MDKB unless specified otherwise.

DATA

Logs Acquired

Suite 1

LDT-AS-GR	134.2m to 748.7m

Suite 2

DLL-MSFL-LDT-CNL-AS-NGT	741.0m to 2602.5m (MSFL and CNL to 2195m)
CSAT	737.1m to 2600.0m
SHDT	2170.0m to 2606.0m
CST	2267.1m to 2591.0, 30/30 recovered

Note: All logs acquired conventionally on wireline.

Log Quality and Processing

- The NGT curves were environmentally corrected for barite and potassium in the mud by Schlumberger using the ALPHA filtering option.
- Schlumberger ALPHA processed hi-res bulk density curve HNRH was used with TNPH in LASER porosity calculations.
- An offset of +3 PU was applied to TNPH instead of rigorously applying environmental corrections.

INTERPRETATION

Logs Used

LLD, LLS, MSFL, HNRH, TNPH, POTA, THOR (Schlumberger).

Analysis Parameters

a	1
m	1.85
n	2
Apparent Shale Porosity (PHISH)	0.15
Shale Resistivity (RSH)	15 ohmm
Formation Water Resistivity (RW)	0.07 ohmm (35,000 ppm NaCleq)
Bottom Hole Temperature	90 DEGC

Total Porosity

Total porosity was derived from LASER using a 4 mineral model based on quartz, feldspar, illite and pyrite.

Mineralog

The Mineralog analytical technique is based on the infrared absorption of a finely ground sample dispersed in a potassium bromide matrix.

In this well the samples were from core chips and the volume percentages of common rock forming minerals are displayed in a table and compared on a depth plot with the LASER outputs. Mineralog accuracy is plus or minus five percent. In general, a good match is seen with the LASER output which validates the mineral model and total porosity calculated.

Core Analysis

Routine core porosity and permeability measurements were performed every 25cm on Core Labs CMS-300 equipment at overburden conditions of 4000 psi. Attached is a plot showing a comparison of core and LASER derived total porosity and grain density. In general, a good match is seen which validates the four mineral model used in LASER.

Shale Volume

The Volume of Wet Clay derived from LASER was used as VSH in effective porosity and water saturation calculations.

Free Formation Water Resistivity

Free formation water resistivity was derived from RWA calculations in clean water sands. The value selected (0.07 ohmm) equates to a salinity of 35,000 ppm NaCleq, and is consistent with produced water in the area.

Water Saturations

Total water saturation was calculated using LASER total porosity in the Dual Water programme DWGP. Effective porosity and effective water saturation were calculated using the LASER VWCL as VSH. Invaded zone saturation, SXO, was calculated from effective porosity and the MSFL using an apparent mud filtrate salinity of 0.03 ohmm.

Water saturation was set to 1 and porosity set to 0 in coals and carbonaceous shales.

RESULTS

1. All sands are interpreted as water bearing.

2. Up to 30% fluorescence was observed in sand in core over the interval 2315m to 2320m (approximately 2319m to 2324m log depth). These are considered residual oil shows and could not be quantified by log analysis which calculates 100% water saturation in this interval.

3. A SWC at 2349m with 20% fluorescence is also considered residual oil. Again the amount of oil is so small it cannot be quantified by the wireline logs which calculate 100% water saturation in this zone.

4. Water saturations slightly less than 100% are calculated in several zones below 2400m but are not interpreted as representing residual oil. In these water sands the dual laterolog LLD curve is reading slightly high due to a "squeeze" effect from resistive shoulder beds.

5. The invaded-zone saturation curve, SXO, also suggests there are no intervals with quantifiable hydrocarbon saturations.

6. A 4m shift down has been added to the core data to match the wireline log data.

Attached are the following presentations of results:

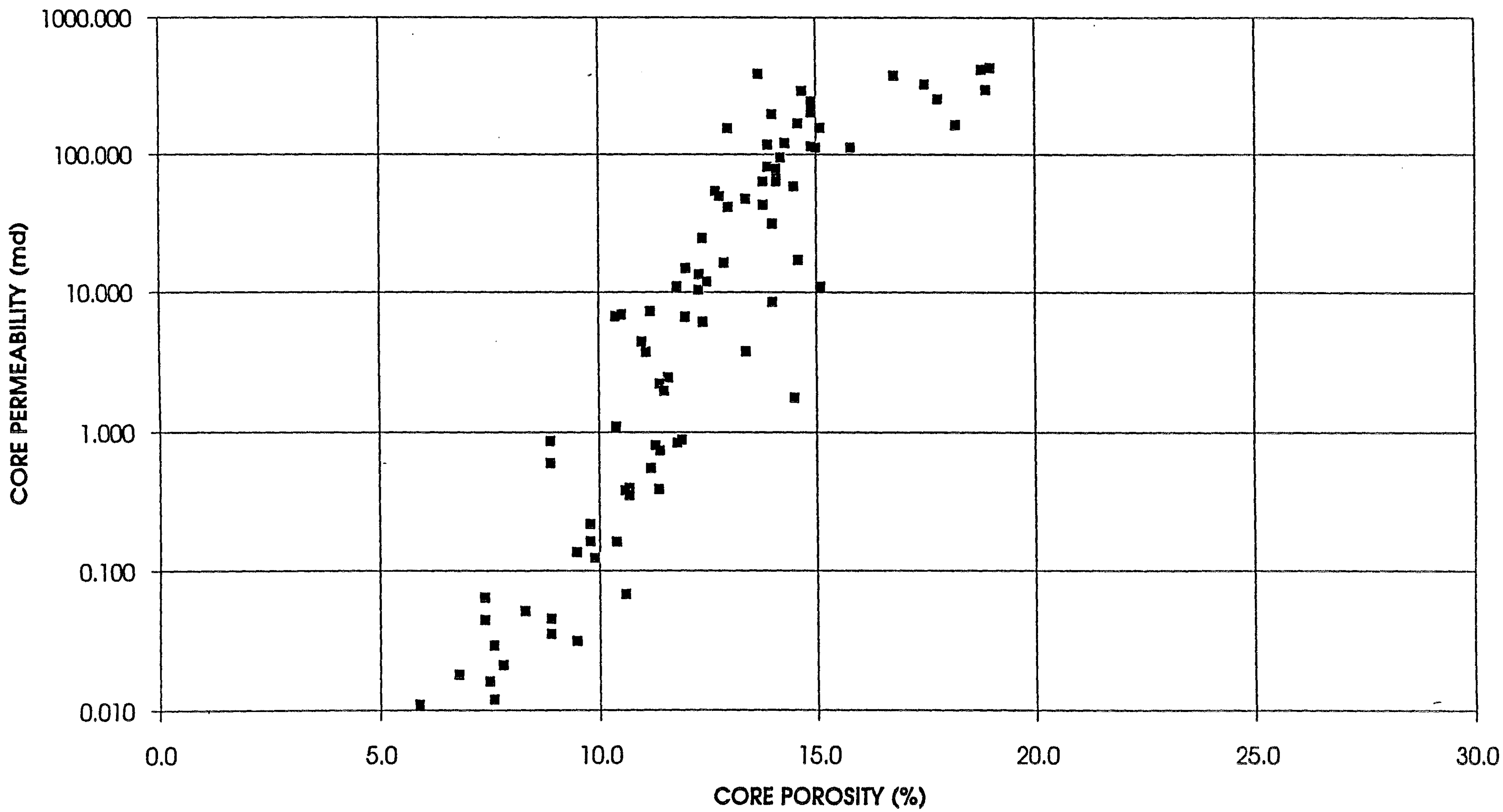
Summary Table
Log Analysis Listing
Core Analysis Plots
Mineralog Tables
Mineralog Plots
Log Analysis Depth Plot

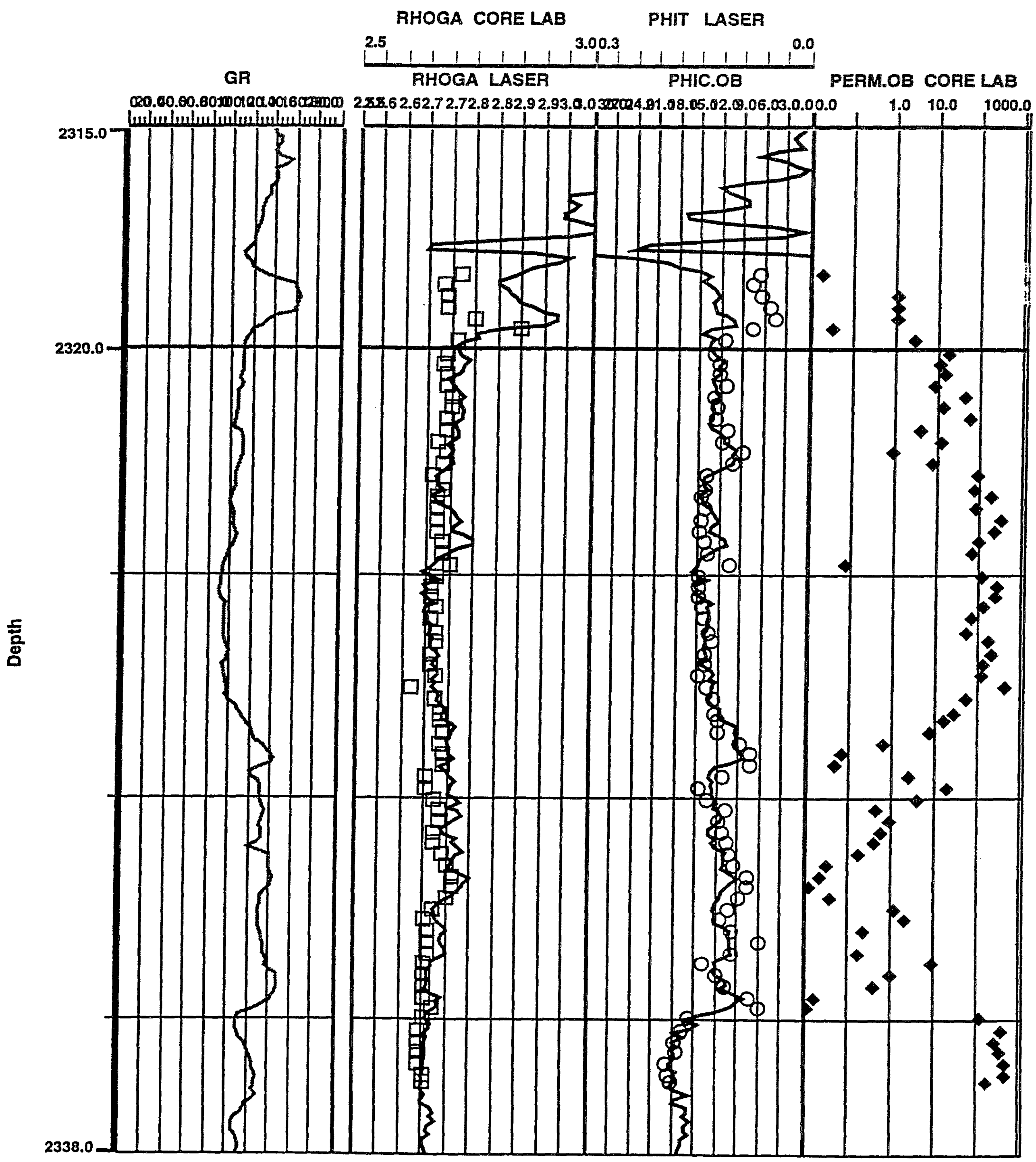
ORANGE ROUGHY 1 LOG ANALYSIS SUMMARY

Net porosity cut-off: 0.120 volume per volume
Depth reference: MDKB

Depth (top)	Depth (base)	Gross (m)	Net (m)	N/G %	Mean Vsh	Mean Porosity	(Std.) (Dev.)	Mean Sw	Comment
2319.2	2344.1	24.9	9	36	0.15	0.14	0.011	1.00	Water
2347.9	2356.9	9	4.8	53	0.12	0.15	0.022	1.00	Water
2357.6	2395	37.4	37.2	100	0.05	0.21	0.031	1.00	Water
2400.4	2405.6	5.2	4	77	0.11	0.19	0.044	0.90	Water
2407.6	2428.6	20.9	19.7	94	0.07	0.22	0.025	0.97	Water
2442.4	2448.8	6.4	6.2	96	0.05	0.23	0.016	0.81	Water
2467.1	2472.6	5.4	5.3	98	0.06	0.21	0.021	0.95	Water
2481.7	2508.3	26.7	24.1	90	0.06	0.2	0.029	0.99	Water
2524.1	2536.7	12.6	12.2	96	0.09	0.19	0.024	0.97	Water
2538.7	2545.1	6.4	5.4	84	0.12	0.19	0.047	1.00	Water
2547.9	2551.3	3.3	2.8	84	0.12	0.2	0.033	0.95	Water
2555.7	2561.7	6.1	5.5	92	0.13	0.19	0.037	0.95	Water
2564.8	2569.8	5.1	4.5	89	0.04	0.19	0.023	0.93	Water

ORANGE ROUGHY 1 CORE POROSITY VS CORE PERMEABILITY




RHOGA CORE LAB
PHIT LASER
2.5
3.0
0.3
0.0
GR
RHOGA LASER
PHIC.OB
PERM.OB CORE LAB
1.0
10.0
1000.0
2315.0
2320.0
2338.0
Depth

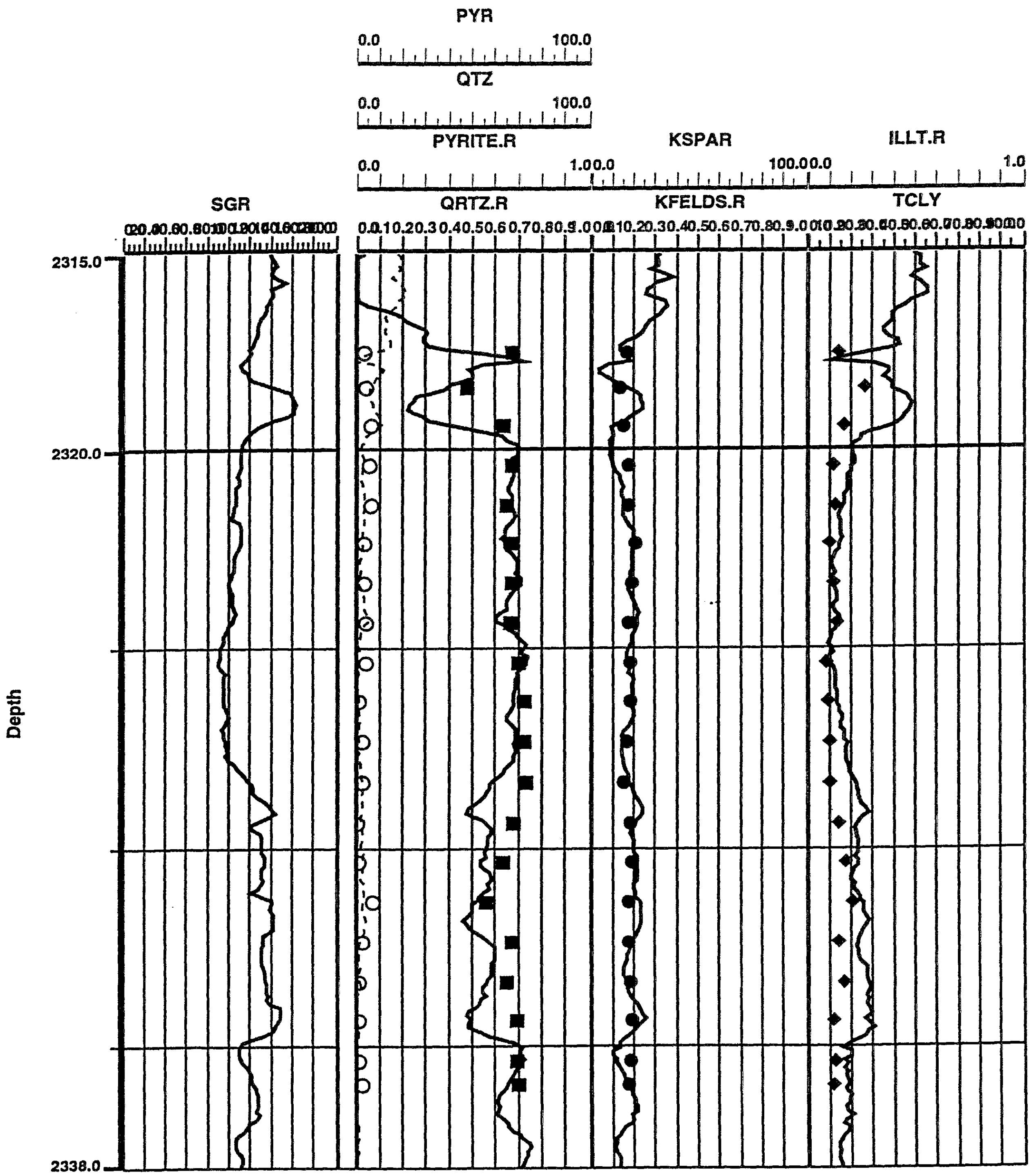
CORE LABORATORIES
MINERALOG ANALYSIS
VOLUME %*

COMPANY: ESSO AUSTRALIA LTD.
WELL NAME: ORANGE ROUGHY #1
WELL LOCATION: AUSTRALIA
SAMPLE TYPE: CORE CHIPS

FILE NO.: PRP-95033
DATE: 4-Sep-95
ANALYSTS: M.KAROLIA
J.LOWRY

DEPTH (M)	GRAIN DENSITY INDEX	QUARTZ	PLAGIOCLASE	K-FELDSPAR	SIDERITE	DOLOMITE	PYRITE	TOTAL CLAY	KAOLINITE	CHLORITE	ILL + SMEC
2313.50	2.72	66	0	17	0	0	3	14	4	0	10
2314.35	2.76	48	0	13	0	0	4	35	12	0	23
2315.35	2.76	64	0	15	0	0	6	15	3	0	12
2316.35	2.75	66	0	18	0	0	5	11	2	0	9
2317.35	2.79	65	0	17	0	0	6	12	1	0	11
2318.35	2.69	67	0	21	0	0	3	9	2	0	7
2319.35	2.71	67	0	19	0	0	3	11	1	0	10
2320.35	2.72	66	0	17	0	0	4	13	1	0	12
2321.35	2.73	71	0	18	0	0	4	7	1	0	6
2322.35	2.64	73	0	18	0	0	1	8	1	0	7
2323.35	2.69	72	0	16	0	0	2	10	1	0	9
2324.25	2.67	73	0	15	0	0	2	10	1	0	9
2325.35	2.63	68	0	18	0	0	0	14	2	0	12
2326.35	2.66	63	0	20	0	0	1	16	3	0	13
2327.35	2.80	58	0	17	0	0	7	18	4	0	14
2328.35	2.67	67	0	17	0	0	2	14	3	0	11
2329.35	2.65	65	0	18	0	0	1	16	3	0	13
2330.35	2.65	69	0	19	0	0	1	11	2	0	9
2331.35	2.66	69	0	18	0	0	1	12	2	0	10
2331.95	2.68	70	0	17	0	0	2	11	1	0	10

*Values calculated using mineral densities supplied by ESSO Australia Ltd.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PYRITE.R
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KSPAR
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ILLT.R
0.0 1.0
SGR
QRTZ.R
KFELDS.R
TCLY
2315.0
2320.0
2338.0
Depth

LASER PARAMETERS: ORANGE ROUGHY-1 4 MINERAL MODEL

CURVE		NAME	GAIN	OFFSET
Density Linear	INPUT	HNRH	1	0
Photoelectric Linear	INPUT	PEF	1	-0.5
Photoelectric Linear	INPUT	HNRH	1	0
CNL Piecewise-Linear	INPUT	TNPH	1	0.03
K weight fraction	INPUT	POTA	1	-0.3
Th weight fraction	INPUT	THOR	1	-1

CONSTRAINT TABLE

INPUT	CONSTRAINT	ERROR
	sum=1	0.005
BULK DENSITY	Density Linear	0.030
VOL.PHOTO XSECTION	Photoelectric Linear	2.000
NEUTRON POROSITY	CNL Piecewise-Linear	0.030
ELEMENTAL YIELD	K weight fraction	0.500
MINERAL VOLUME	Th weight fraction	3.000
CLAY BOUND WATER	0.01	

CONSTRAINT PARAMETER EXCEPTION TABLE

CONSTRAINT	PARAMETER	NAME	VALUE
ALL	rho	PHIE	1.020
ALL	rho	VCLB	1.020
Density Linear	rho	KFEL	2.540
Density Linear	rho	ILLT	2.770
Photoelectric Linear	U	PHIE	0.740
Photoelectric Linear	U	VCLB	0.740
Photoelectric Linear	U	KFEL	7.290
Photoelectric Linear	U	ILLT	8.370
K weight fraction	K	KFEL	10.500
K weight fraction	K	ILLT	4.910
K weight fraction	mode	mat3	3.000
K weight fraction	rho	KFEL	2.540
K weight fraction	rho	ILLT	2.770
Th weight fraction	Th	PHIE	2.500
Th weight fraction	Th	VCLB	2.500
Th weight fraction	Th	QRTZ	2.500
Th weight fraction	Th	KFEL	2.500
Th weight fraction	Th	ILLT	35.000
Th weight fraction	mode	mat3	3.000
Th weight fraction	rho	KFEL	2.540
Th weight fraction	rho	ILLT	2.770
CLAY BOUND WATER	coeff	VCLB	-1.000
CLAY BOUND WATER	coeff	ILLT	0.150
CNL Piecewise-Linear	CNL 0	KFEL	-0.001
CNL Piecewise-Linear	CNL 0	ILLT	0.250
CNL Piecewise-Linear	CNL 5	PHIE	0.003

CNL Piecewise-Linear	CNL 5	VCLB	0.003
CNL Piecewise-Linear	CNL 5	QRTZ	0.018
CNL Piecewise-Linear	CNL 5	KFEL	0.062
CNL Piecewise-Linear	CNL 5	ILLT	0.304
CNL Piecewise-Linear	CNL 10	PHIE	0.008
CNL Piecewise-Linear	CNL 10	VCLB	0.008
CNL Piecewise-Linear	CNL 10	QRTZ	0.059
CNL Piecewise-Linear	CNL 10	KFEL	0.113
CNL Piecewise-Linear	CNL 10	ILLT	0.354
CNL Piecewise-Linear	CNL 20	PHIE	0.016
CNL Piecewise-Linear	CNL 20	VCLB	0.016
CNL Piecewise-Linear	CNL 20	QRTZ	0.153
CNL Piecewise-Linear	CNL 20	KFEL	0.204
CNL Piecewise-Linear	CNL 20	ILLT	0.439
CNL Piecewise-Linear	CNL 40	PHIE	0.022
CNL Piecewise-Linear	CNL 40	VCLB	0.022
CNL Piecewise-Linear	CNL 40	QRTZ	0.354
CNL Piecewise-Linear	CNL 40	KFEL	0.372
CNL Piecewise-Linear	CNL 40	ILLT	0.574
Photoelectric Linear	U	PYRI	
CNL Piecewise-Linear	CNL 0	PYRI	-37.700
CNL Piecewise-Linear	CNL 5	PYRI	0.372
CNL Piecewise-Linear	CNL 10	PYRI	0.494
CNL Piecewise-Linear	CNL 20	PYRI	0.623
CNL Piecewise-Linear	CNL 40	PYRI	0.747
Th weight fraction	Th	PYRI	1.000

ORANGE ROUGHY 1 LOG ANALYSIS LISTING

DEPTH (mRKB)	GR api	RT ohmm	RHOB g/cc	NPHI frac	VSH frac	PHIE frac	SWE frac
2310	124	3.1	2.575	0.265	0.334	0.000	1.000
2311	122	2.9	2.544	0.322	0.336	0.000	1.000
2312	116	2.5	2.556	0.403	0.331	0.000	1.000
2313	119	2.6	2.598	0.409	0.350	0.000	1.000
2314	117	2.5	2.436	0.416	0.260	0.000	1.000
2315	138	3.5	2.479	0.516	0.386	0.000	1.000
2316	141	6.3	2.561	0.594	0.430	0.000	1.000
2317	126	7.5	2.054	0.557	0.210	0.000	1.000
2318	117	6.7	2.586	0.332	0.345	0.000	1.000
2319	160	6.9	2.646	0.265	0.466	0.010	1.000
2320	110	2.0	2.487	0.135	0.204	0.100	1.000
2321	105	1.9	2.518	0.134	0.178	0.097	1.000
2322	111	2.9	2.502	0.113	0.146	0.094	1.000
2323	104	1.8	2.437	0.126	0.110	0.126	1.000
2324	104	1.6	2.474	0.126	0.111	0.119	1.000
2325	91	1.4	2.417	0.126	0.100	0.133	1.000
2326	95	1.5	2.425	0.119	0.125	0.118	1.000
2327	93	1.7	2.420	0.132	0.145	0.123	1.000
2328	107	2.2	2.493	0.124	0.192	0.090	1.000
2329	139	2.6	2.551	0.118	0.274	0.046	1.000
2330	130	2.1	2.506	0.153	0.228	0.091	1.000
2331	127	2.4	2.494	0.146	0.207	0.097	1.000
2332	141	2.8	2.555	0.150	0.262	0.067	1.000
2333	131	3.6	2.531	0.132	0.273	0.060	1.000
2334	147	3.2	2.459	0.142	0.278	0.077	1.000
2335	110	1.4	2.377	0.141	0.151	0.141	1.000
2336	124	1.1	2.345	0.174	0.164	0.160	1.000
2337	117	1.3	2.402	0.166	0.179	0.135	1.000
2338	111	1.3	2.375	0.162	0.146	0.150	1.000
2339	147	1.3	2.372	0.175	0.199	0.138	1.000
2340	148	1.8	2.437	0.182	0.208	0.124	1.000
2341	133	1.8	2.423	0.168	0.157	0.137	1.000
2342	114	2.3	2.512	0.148	0.137	0.116	1.000
2343	100	2.2	2.546	0.124	0.122	0.108	1.000
2344	125	3.8	2.539	0.145	0.278	0.070	1.000
2345	189	4.6	2.542	0.209	0.515	0.000	1.000
2346	181	4.2	2.570	0.202	0.509	0.000	1.000
2347	169	2.3	2.538	0.215	0.374	0.055	1.000
2348	124	3.6	2.443	0.177	0.257	0.112	0.983
2349	95	2.3	2.425	0.123	0.110	0.129	1.000
2350	85	2.7	2.464	0.101	0.069	0.117	1.000
2351	73	2.1	2.441	0.098	0.051	0.128	1.000
2352	102	2.2	2.440	0.105	0.096	0.116	1.000
2353	109	2.5	2.453	0.110	0.122	0.106	1.000
2354	89	1.9	2.370	0.126	0.068	0.156	0.978
2355	93	1.6	2.406	0.119	0.106	0.131	1.000
2356	143	0.9	2.305	0.211	0.233	0.171	1.000

DEPTH (mRKB)	GR api	RT ohmm	RHOB g/cc	NPHI frac	VSH frac	PHIE frac	SWE frac
2357	138	0.4	3.126	0.191	0.567	0.000	1.000
2358	115	1.1	2.388	0.197	0.202	0.151	1.000
2359	112	1.3	2.396	0.186	0.169	0.148	1.000
2360	90	1.0	2.311	0.203	0.073	0.211	1.000
2361	84	0.8	2.286	0.207	0.027	0.234	1.000
2362	77	0.9	2.243	0.201	0.000	0.248	1.000
2363	79	0.8	2.309	0.212	0.019	0.233	1.000
2364	73	0.8	2.263	0.221	0.008	0.254	1.000
2365	65	0.8	2.243	0.205	0.000	0.253	1.000
2366	66	0.8	2.249	0.196	0.000	0.246	1.000
2367	63	0.8	2.251	0.190	0.000	0.242	1.000
2368	63	0.7	2.222	0.223	0.009	0.267	1.000
2369	73	1.0	2.342	0.187	0.040	0.206	1.000
2370	85	0.9	2.257	0.208	0.036	0.237	1.000
2371	76	1.0	2.318	0.174	0.018	0.209	1.000
2372	72	1.2	2.330	0.187	0.014	0.215	1.000
2373	75	0.9	2.285	0.172	0.000	0.220	1.000
2374	83	0.8	2.330	0.164	0.015	0.197	1.000
2375	81	1.0	2.400	0.164	0.042	0.174	1.000
2376	84	1.3	2.435	0.168	0.072	0.158	1.000
2377	71	1.0	2.323	0.179	0.020	0.209	1.000
2378	69	1.1	2.345	0.181	0.011	0.209	1.000
2379	80	1.0	2.345	0.174	0.017	0.200	1.000
2380	89	1.0	2.398	0.172	0.049	0.175	1.000
2381	72	0.9	2.287	0.202	0.018	0.234	1.000
2382	77	0.8	2.298	0.183	0.044	0.212	1.000
2383	105	0.9	2.378	0.171	0.150	0.149	1.000
2384	111	1.1	2.368	0.192	0.179	0.157	1.000
2385	107	1.2	2.352	0.176	0.164	0.156	1.000
2386	97	1.2	2.438	0.175	0.134	0.144	1.000
2387	91	0.9	2.246	0.201	0.035	0.235	1.000
2388	88	0.9	2.326	0.197	0.045	0.208	1.000
2389	99	1.0	2.347	0.208	0.078	0.201	1.000
2390	98	1.0	2.315	0.213	0.064	0.216	1.000
2391	98	1.1	2.282	0.203	0.075	0.214	1.000
2392	107	1.0	2.341	0.198	0.080	0.193	1.000
2393	64	1.1	2.336	0.172	0.016	0.206	1.000
2394	67	0.9	2.315	0.177	0.014	0.214	1.000
2395	95	0.8	2.309	0.172		Coal	
2396	150	7.5	2.572	0.264		Coal	
2397	77	45.6	1.352	0.609		Coal	
2398	150	12.3	2.582	0.226		Coal	
2399	144	9.6	2.559	0.202	0.493	0.001	1.000
2400	153	4.7	2.529	0.187	0.471	0.005	1.000
2401	133	3.9	2.465	0.181	0.357	0.056	1.000
2402	98	2.5	2.375	0.183	0.171	0.157	0.864
2403	93	2.0	2.377	0.176	0.121	0.165	0.938
2404	111	2.1	2.309	0.202	0.103	0.195	0.843
2405	82	1.3	2.228	0.211	0.030	0.251	0.816
2406	79	1.8	2.171	0.314		Coal	

DEPTH (mRKB)	GR api	RT ohmm	RHOB g/cc	NPHI frac	VSH frac	PHIE frac	SWE frac
2407	166	15.4	2.560	0.270		Coal	
2408	101	1.2	2.309	0.203	0.163	0.189	1.000
2409	88	1.2	2.279	0.221	0.097	0.221	0.958
2410	87	1.2	2.252	0.208	0.053	0.233	0.924
2411	97	1.4	2.302	0.218	0.084	0.214	0.911
2412	93	1.4	2.343	0.205	0.085	0.198	0.939
2413	88	1.2	2.282	0.217	0.056	0.231	0.925
2414	102	1.3	2.294	0.216	0.084	0.214	0.931
2415	85	1.1	2.214	0.216	0.035	0.253	0.879
2416	101	1.2	2.293	0.224	0.068	0.222	0.903
2417	76	1.0	2.244	0.217	0.027	0.249	0.915
2418	80	1.1	2.227	0.224	0.054	0.248	0.918
2419	93	1.2	2.322	0.201	0.086	0.199	1.000
2420	83	0.9	2.282	0.206	0.076	0.219	1.000
2421	108	1.5	2.323	0.215	0.170	0.184	0.955
2422	152	1.9	2.581	0.221	0.391	0.030	1.000
2423	81	1.2	2.209	0.218	0.060	0.256	0.868
2424	100	1.6	2.417	0.175	0.106	0.153	1.000
2425	96	1.4	2.307	0.188	0.063	0.201	0.988
2426	95	1.2	2.327	0.198	0.046	0.207	0.994
2427	96	1.3	2.330	0.184	0.053	0.195	1.000
2428	100	1.1	2.353	0.178		Coal	
2429	90	1.5	2.228	0.306		Coal	
2430	154	6.4	2.496	0.221		Coal	
2431	108	26.2	1.536	0.431		Coal	
2432	154	7.3	2.521	0.217	0.428	0.023	0.992
2433	139	7.8	2.516	0.196	0.384	0.041	0.867
2434	155	16.0	2.515	0.244		Coal	
2435	134	16.4	2.506	0.236		Coal	
2436	198	9.1	2.516	0.216		Coal	
2437	142	8.0	2.521	0.230		Coal	
2438	135	6.1	2.504	0.273		Coal	
2439	157	14.4	2.549	0.279	0.485	0.006	1.000
2440	142	12.5	2.585	0.195	0.458	0.007	1.000
2441	152	17.8	2.587	0.235	0.538	0.000	1.000
2442	160	14.8	2.577	0.238	0.496	0.001	1.000
2443	71	1.4	2.278	0.194	0.060	0.224	0.857
2444	72	1.6	2.311	0.188	0.008	0.223	0.839
2445	79	1.8	2.328	0.200	0.026	0.218	0.799
2446	81	1.7	2.295	0.194	0.022	0.224	0.793
2447	77	1.8	2.244	0.245	0.053	0.259	0.684
2448	79	1.6	2.262	0.223	0.071	0.239	0.757
2449	89	17.1	2.070	0.323		Coal	
2450	137	3.8	2.555	0.208		Coal	
2451	144	4.6	2.472	0.193	0.373	0.052	1.000
2452	164	21.4	2.463	0.202		Coal	
2453	152	7.7	2.207	0.428		Coal	
2454	91	2.2	2.327	0.197	0.182	0.179	0.800
2455	160	16.3	2.572	0.219	0.525	0.000	1.000
2456	155	6.3	2.421	0.228	0.435	0.000	1.000

DEPTH (mRKB)	GR api	RT ohmm	RHOB g/cc	NPHI frac	VSH frac	PHIE frac	SWE frac
2457	170	3.2	2.485	0.197	0.486	0.003	1.000
2458	172	15.1	2.480	0.230		Coal	
2459	150	32.4	1.537	0.545		Coal	
2460	137	18.3	1.820	0.496		Coal	
2461	135	3.7	2.360	0.257	0.322	0.141	0.762
2462	154	11.2	2.642	0.218	0.498	0.000	1.000
2463	128	2.6	2.362	0.212	0.239	0.153	0.876
2464	99	1.7	2.296	0.205	0.141	0.201	0.872
2465	144	8.1	2.507	0.217		Coal	
2466	118	2.7	1.638	0.480		Coal	
2467	63	1.8	2.443	0.193		Coal	
2468	73	1.1	2.305	0.211	0.039	0.230	0.979
2469	97	1.3	2.260	0.212	0.049	0.229	0.921
2470	93	1.4	2.323	0.198	0.035	0.210	0.946
2471	93	1.3	2.295	0.213	0.043	0.225	0.900
2472	103	1.5	2.316	0.197	0.129	0.189	0.974
2473	171	2.2	2.445	0.179	0.428	0.057	1.000
2474	180	1.7	2.427	0.207	0.526	0.025	1.000
2475	159	1.8	2.396	0.194	0.441	0.076	1.000
2476	148	1.7	2.385	0.193	0.374	0.112	1.000
2477	156	2.3	2.445	0.192	0.428	0.062	1.000
2478	133	2.5	2.467	0.179	0.335	0.085	1.000
2479	135	2.2	2.437	0.183	0.292	0.108	1.000
2480	150	2.2	2.551	0.202	0.391	0.068	1.000
2481	162	7.2	2.608	0.207	0.482	0.015	1.000
2482	89	1.3	2.311	0.168	0.114	0.188	1.000
2483	105	2.9	2.516	0.152	0.193	0.098	1.000
2484	131	3.1	2.510	0.191	0.247	0.104	1.000
2485	143	6.0	2.534	0.218	0.264	0.105	0.741
2486	106	2.4	2.494	0.180	0.164	0.128	0.997
2487	105	1.6	2.416	0.180	0.097	0.163	1.000
2488	74	1.1	2.331	0.177	0.029	0.207	1.000
2489	77	1.3	2.343	0.166	0.037	0.192	1.000
2490	90	2.4	2.479	0.153	0.086	0.135	1.000
2491	69	1.3	2.358	0.141	0.000	0.186	1.000
2492	68	1.3	2.333	0.143	0.000	0.192	1.000
2493	67	1.3	2.350	0.132	0.000	0.183	1.000
2494	66	1.6	2.338	0.144	0.000	0.192	0.962
2495	77	1.0	2.293	0.185	0.000	0.226	1.000
2496	78	1.3	2.292	0.167	0.000	0.214	0.990
2497	69	1.2	2.314	0.217	0.012	0.238	0.882
2498	76	1.2	2.364	0.175	0.033	0.196	1.000
2499	97	2.2	2.420	0.192	0.089	0.172	0.889
2500	98	1.5	2.341	0.220	0.090	0.208	0.850
2501	90	1.3	2.273	0.232	0.066	0.239	0.856
2502	96	1.4	2.381	0.198	0.101	0.181	0.975
2503	101	1.5	2.382	0.205	0.126	0.178	1.000
2504	113	1.9	2.425	0.195	0.152	0.151	1.000
2505	83	1.2	2.277	0.220	0.074	0.230	0.936
2506	105	1.6	2.310	0.219	0.098	0.207	0.896

DEPTH (mRKB)	GR api	RT ohmm	RHOB g/cc	NPHI frac	VSH frac	PHIE frac	SWE frac
2507	89	1.1	2.336	0.208	0.094	0.204	1.000
2508	118	1.7	2.328	0.161	0.140	0.167	1.000
2509	148	7.0	2.551	0.171	0.388	0.023	1.000
2510	138	9.0	2.601	0.170	0.412	0.012	1.000
2511	135	6.5	2.553	0.181	0.380	0.033	0.981
2512	143	6.1	2.535	0.193	0.392	0.033	1.000
2513	137	5.4	2.539	0.210	0.411	0.030	0.990
2514	143	5.6	2.535	0.234	0.417	0.032	0.992
2515	143	7.5	2.594	0.235	0.442	0.017	0.995
2516	138	4.5	2.253	0.252	0.235	0.141	0.750
2517	152	5.5	2.499	0.238	0.419	0.035	0.853
2518	162	2.6	2.453	0.202		Coal	
2519	148	13.9	2.532	0.349		Coal	
2520	132	3.8	2.534	0.202	0.397	0.036	1.000
2521	141	4.3	2.560	0.173	0.434	0.010	1.000
2522	146	14.6	2.541	0.214	0.471	0.007	1.000
2523	122	3.9	2.482	0.165	0.298	0.085	1.000
2524	116	2.6	2.456	0.165	0.234	0.107	1.000
2525	95	1.4	2.376	0.192	0.125	0.173	1.000
2526	85	1.1	2.248	0.192	0.030	0.232	0.986
2527	89	1.4	2.318	0.174	0.040	0.199	0.979
2528	91	1.6	2.301	0.178	0.026	0.211	0.892
2529	84	1.1	2.331	0.194	0.029	0.215	1.000
2530	102	2.2	2.397	0.191	0.085	0.175	0.864
2531	93	1.9	2.373	0.182	0.073	0.182	0.911
2532	89	1.7	2.367	0.193	0.081	0.189	0.910
2533	89	1.5	2.369	0.198	0.092	0.188	0.971
2534	80	1.1	2.295	0.192	0.061	0.212	1.000
2535	102	1.5	2.339	0.209	0.146	0.183	1.000
2536	111	1.6	2.341	0.199	0.202	0.166	1.000
2537	161	7.7	2.544	0.190	0.524	0.000	1.000
2538	214	7.6	2.535	0.190	0.639	0.000	1.000
2539	120	2.1	2.412	0.173	0.286	0.115	1.000
2540	115	2.3	2.452	0.175	0.219	0.117	1.000
2541	116	1.5	2.365	0.187	0.157	0.156	1.000
2542	120	1.4	2.337	0.192	0.113	0.176	1.000
2543	88	1.1	2.239	0.213	0.029	0.246	0.940
2544	83	1.0	2.200	0.214	0.039	0.260	0.940
2545	145	7.0	2.584	0.260	0.411	0.033	0.894
2546	138	4.6	2.488	0.222	0.388	0.048	0.960
2547	141	5.9	2.477	0.230	0.364	0.069	0.845
2548	127	2.9	2.412	0.204	0.263	0.128	0.892
2549	94	1.4	2.262	0.207	0.083	0.225	0.898
2550	96	1.3	2.356	0.208	0.100	0.197	0.989
2551	123	2.9	2.482	0.208	0.271	0.117	0.940
2552	145	3.3	2.470	0.175	0.402	0.030	1.000
2553	141	2.8	2.454	0.162	0.351	0.058	1.000
2554	127	3.2	2.509	0.177	0.358	0.047	1.000
2555	120	3.2	2.448	0.186	0.263	0.112	0.954
2556	100	2.3	2.397	0.178	0.180	0.144	0.965

DEPTH (mRKB)	GR api	RT ohmm	RHOB g/cc	NPHI frac	VSH frac	PHIE frac	SWE frac
2557	116	2.4	2.450	0.187	0.185	0.133	0.962
2558	115	1.8	2.380	0.202	0.141	0.170	1.000
2559	92	1.3	2.259	0.196	0.058	0.222	0.955
2560	97	1.6	2.383	0.189	0.109	0.172	1.000
2561	94	1.0	2.261	0.224	0.103	0.228	1.000
2562	140	3.9	2.480	0.243	0.359	0.073	0.839
2563	143	5.2	2.497	0.254		Coal	
2564	104	31.1	1.474	0.517		Coal	
2565	85	2.5	2.425	0.179		Coal	
2566	64	2.4	2.430	0.157	0.052	0.167	0.877
2567	65	1.8	2.378	0.151	0.014	0.187	0.919
2568	94	1.4	2.298	0.151	0.018	0.198	1.000
2569	88	1.7	2.389	0.182	0.058	0.182	1.000
2570	81	1.2	2.188	0.189	0.058	0.000	0.000

PE600708

This is an enclosure indicator page.
The enclosure PE600708 is enclosed within the container PE900894 at this location in this document.

The enclosure PE600708 has the following characteristics:

ITEM_BARCODE = PE600708
CONTAINER_BARCODE = PE900894
NAME = Formation Evaluation Log
BASIN = GIPPSLAND
PERMIT =
TYPE = WELL
SUBTYPE = WELL_LOG
DESCRIPTION = Formation Evaluation Log
REMARKS =
DATE_CREATED = 29/09/95
DATE_RECEIVED = 2/01/96
W_NO = W1121
WELL_NAME = Orange Roughy -1
CONTRACTOR = ESSO
CLIENT_OP_CO = ESSO

(Inserted by DNRE - Vic Govt Mines Dept)

APPENDIX 3

APPENDIX 3

ORANGE ROUGHY-1

Core Analysis

CORE ANALYSIS REPORT

of

ORANGE ROUGHY 1

for

ESSO AUSTRALIA LTD

by

ACS LABORATORIES PTY LTD

CONTENTS

CHAPTER 1

INTRODUCTION

1. INTRODUCTION

This report presents the results of, and details of the procedures employed from a Core Analysis study of the seventeen (17) 1½" diameter plugs from Orange Roughy 1.

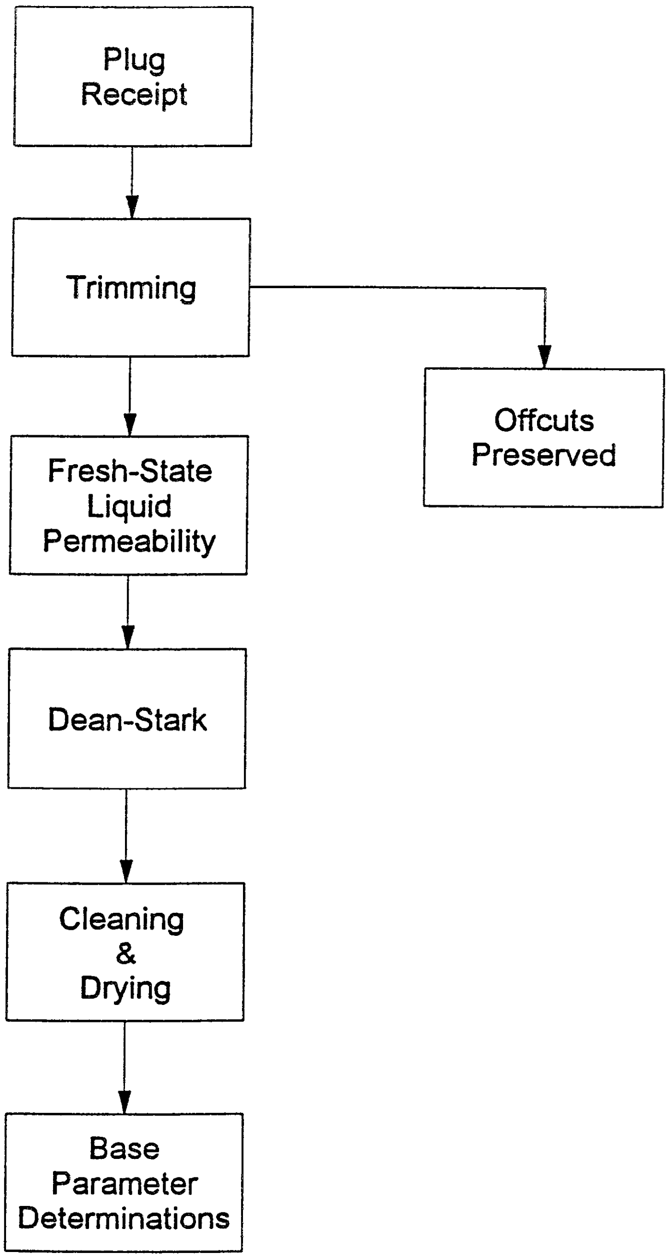
Following discussions between ACS and Esso personnel, a test program was developed and later confirmed by facsimile.

Chapter 2 of this report presents a brief overview of the entire study. Chapter 3 encompasses details of the procedures employed. Chapter 4 presents the results obtained from the study in tabular, and where appropriate, graphical format.

CHAPTER 2

TEST SCHEDULE CHART

TEST SCHEDULE CHART



CHAPTER 3

TEST AND CALCULATION PROCEDURES

3. TEST AND CALCULATION PROCEDURES

3.1 Sample Receipt

On 26th June 1995 the 17 core plugs were received at ACS Laboratories in Brisbane. On 27 June 1995 instruction was received regarding the samples.

3.2 Sample Trimming

The 17 plugs were trimmed to a right cylinder of standard length. Samples were appropriately labeled for later identification and wrapped to prevent loss of pore fluids. The offcuts were also wrapped and refrigerated to preserve their integrity for possible petrological work.

3.2 Fresh-State Liquid Permeability

To determine liquid permeability at overburden pressures the samples were placed in rubber sleeves. This assembly was loaded into a hydrostatic cell and overburden pressure of 4000 psi was applied. Brine was then pumped through the sample whilst monitoring the upstream pressure. The permeability was determined using Darcy's Law through knowledge of the upstream pressure, fluid flow rates, viscosity of the fluid, and the sample's dimensions.

3.4 Residual Fluid Saturations - (Dean- Stark)

By re-fluxing the sample using a solvent such as toluene, the water was collected in a modified tube using the Dean-Stark principal. The oil saturation values were calculated using mass balance and volumetric data.

3.5 Sample Cleaning and Drying

Any residual pore fluids were removed using a Soxhlet extraction apparatus with a 3:1 chloroform/methanol azeotropic mixture. Re-fluxing continued until tests for oil (fluorescence under UV light) and salt (silver nitrate precipitation) showed negative. The cleaned samples were dried in a humidity oven at 50°C and 50% relative humidity to a constant weight. Cooling to room temperature occurred in an airtight container.

3.6 Base Parameter Determinations

On completion of cleaning and drying all samples were weighed and dimensions recorded before analysis.

- **Sample Weighing**

  Dry samples were weighed on an electronic balance to the nearest milligram.

- **Sample Dimensions**

  The length and diameter of each sample was measured with digital callipers, to the nearest micron.

- **Permeability to Air - Ambient**

  Once cleaned and dried, as described above, air permeability was determined on the plug samples. The samples were firstly placed in a Hassler cell with a confining pressure of 250 psi. The confining pressured was used to prevent bypassing of air around the samples when the measurement was made. To determine permeability a known air pressure was applied to the upstream face of each sample creating a flow of air through the core plug. Permeabilities for the samples were calculated using Darcy's Law through knowledge of the upstream pressure, flow rate, viscosity of air and the samples' dimensions.

- **Helium Injection Porosity - Ambient**

  The porosity of the clean and dry core plugs was determined as follows. The plugs were first placed in a sealed matrix cup. Helium held at 100 psi reference pressure was then introduced to the cup. From the resultant pressure change the unknown grain volume was calculated using Boyle's Law.

  The bulk volume was determined by mercury immersion. The difference between the grain volume and the bulk volume is the pore volume and from this the 'effective' porosity was calculated as the volume percentage of pores with respect to the bulk volume.

- **Porosity and Permeability - Overburden Pressure**

To determine the porosity and air permeability of the core plugs at overburden pressure, the samples were placed in a thick walled rubber sleeve. This assembly was loaded into a hydrostatic cell and the pore volume determined at 'ambient' pressure. An overburden pressure of 4000 psi was then applied to the samples and the pore volume reduction caused by this increase in pressure determined. These data are used to derive porosity at the applied overburden pressure. Air permeability at overburden pressure was then measured in the hydrostatic cell, as described previously.

CHAPTER 4

TEST RESULTS

BRINE PERMEABILITY
(FRESH STATE)

Company Esso Australia Ltd

Well Orange Roughy 1

Overburden 4000 psi

Sample Number	Depth meters	Permeability to Brine milliDarcy's	Oil Saturation Sor (percent)
1	2313.60	0.01	0.0
2	2315.45	0.24	0.0
3	2316.45	0.93	0.9
4	2317.45	0.23	0.0
5	2318.45	3.2	0.0
6	2319.45	12	6.1
7	2320.45	216	0.0
8	2321.53	40	0.0
9	2322.45	10	0.0
10	2323.45	6.2	0.0
11	2324.45	< 0.01	0.0
12	2325.45	0.10	0.8
13	2326.45	0.01	0.0
14	2327.45	< 0.01	0.0
15	2328.45	0.04	0.0
16	2329.45	0.09	0.0
17	2330.45	27	0.0

POROSITY AND AIR PERMEABILITY

Company Esso Australia Ltd

Well Orange Roughy 1

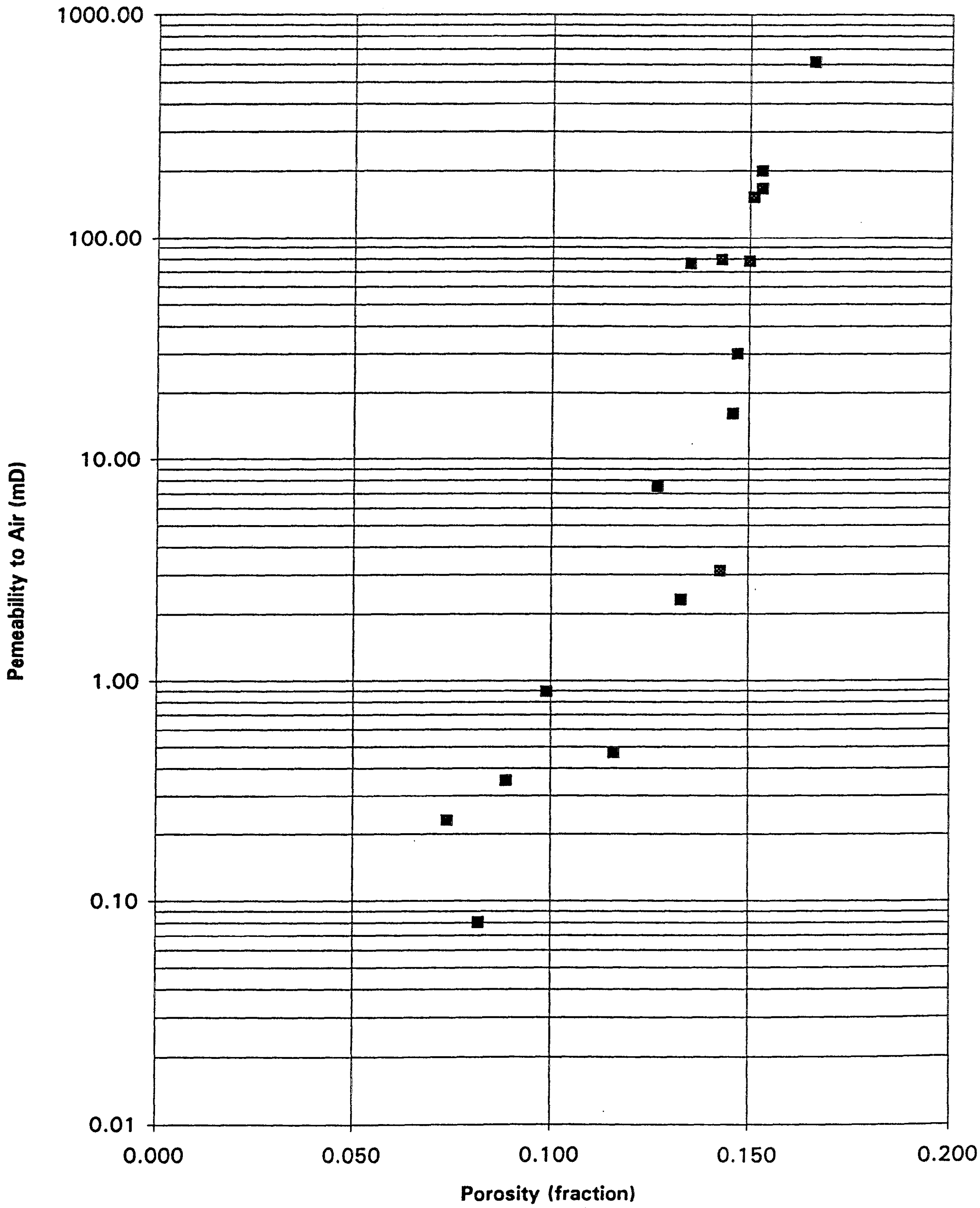
Ambient

Sample Number	Depth meters	Permeability to Air milliDarcy's	Porosity percent	Grain Density (gms/cm^3)
1	2313.60	0.23	8.1	2.70
2	2315.45	16	14.7	2.71
3	1316.45	30	14.8	2.71
4	1317.45	7.5	12.8	2.69
5	2318.45	78	15.1	2.68
6	2319.45	166	15.5	2.68
7	2320.45	611	16.2	2.66
8	2321.53	199	15.2	2.66
9	2322.45	152	15.1	2.67
10	2323.45	76	12.2	2.64
11	2324.45	0.35	9.3	2.69
12	2325.45	3.1	15.1	2.68
13	2326.45	0.47	14.5	2.76
14	2327.45	0.08	9.7	2.73
15	2328.45	0.89	10.6	2.67
16	2329.45	2.3	13.6	2.65
17	2330.45	79	14.5	2.66

Porosity vs Permeability to Air

Company: Esso Australia Ltd
Well: Orange Roughy 1

Ambient



POROSITY AND AIR PERMEABILITY

Company Esso Australia Ltd

Well Orange Roughy 1

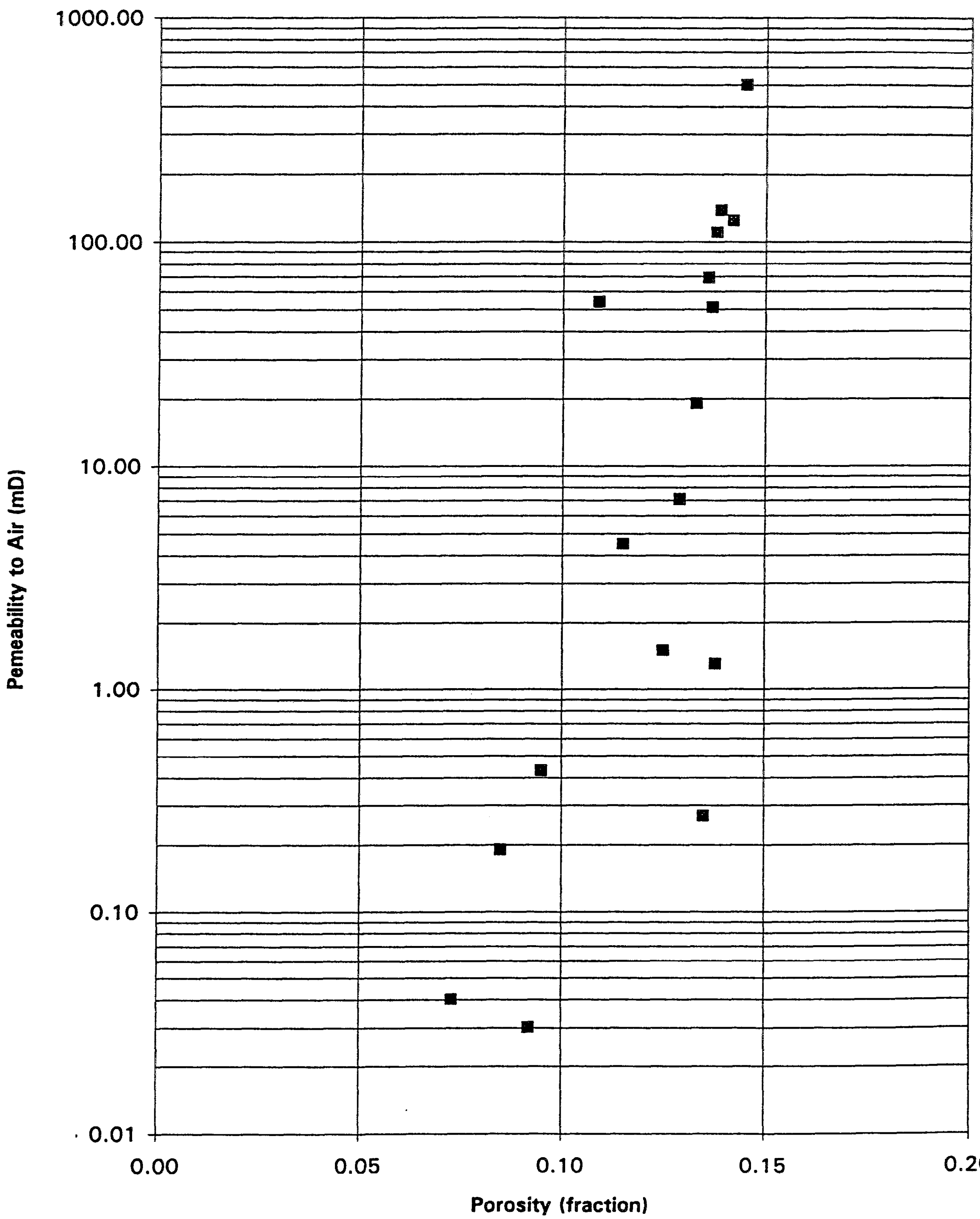
Overburden 4000 psi

Sample Number	Depth meters	Permeability to Air milliDarcy's	Porosity percent	Grain Density (gms/cm^3)
1	2313.60	0.04	7.3	2.70
2	2315.45	7.1	12.9	2.71
3	1316.45	19	13.3	2.71
4	1317.45	4.5	11.5	2.69
5	2318.45	51	13.7	2.68
6	2319.45	124	14.2	2.68
7	2320.45	500	14.5	2.66
8	2321.53	138	13.9	2.66
9	2322.45	110	13.8	2.67
10	2323.45	54	10.9	2.64
11	2324.45	0.19	8.5	2.69
12	2325.45	1.3	13.8	2.68
13	2326.45	0.27	13.5	2.76
14	2327.45	0.03	9.2	2.73
15	2328.45	0.43	9.5	2.67
16	2329.45	1.5	12.5	2.65
17	2330.45	69	13.6	2.66

Porosity vs Permeability to Air

Company: Esso Australia Ltd
Well: Orange Roughy 1

Overburden: 4000 psi



APPENDIX

FLUIDS

BRINE:

Composition	38000 ppm NaCl equivalent
Density	1.008 g/cm^3
Viscosity	1.081 cp

ENCLOSURES

ENCLOSURE 1

ORANGE ROUGHY-1

Orange Roughy Synthetic

PE600709

PE600709

This is an enclosure indicator page.
The enclosure PE600709 is enclosed within the container PE900894 at this location in this document.

The enclosure PE600709 has the following characteristics:

ITEM_BARCODE = PE600709
CONTAINER_BARCODE = PE900894
NAME = Orange Roughy Synthetic Seismogram
BASIN = GIPPSLAND
PERMIT =
TYPE = WELL
SUBTYPE = VELOCITY_CHART
DESCRIPTION = Orange Roughy Synthetic
REMARKS =
DATE_CREATED = 1/09/95
DATE_RECEIVED = 2/01/96
W_NO = W1121
WELL_NAME = Orange Roughy -1
CONTRACTOR = ESSO
CLIENT_OP_CO = ESSO

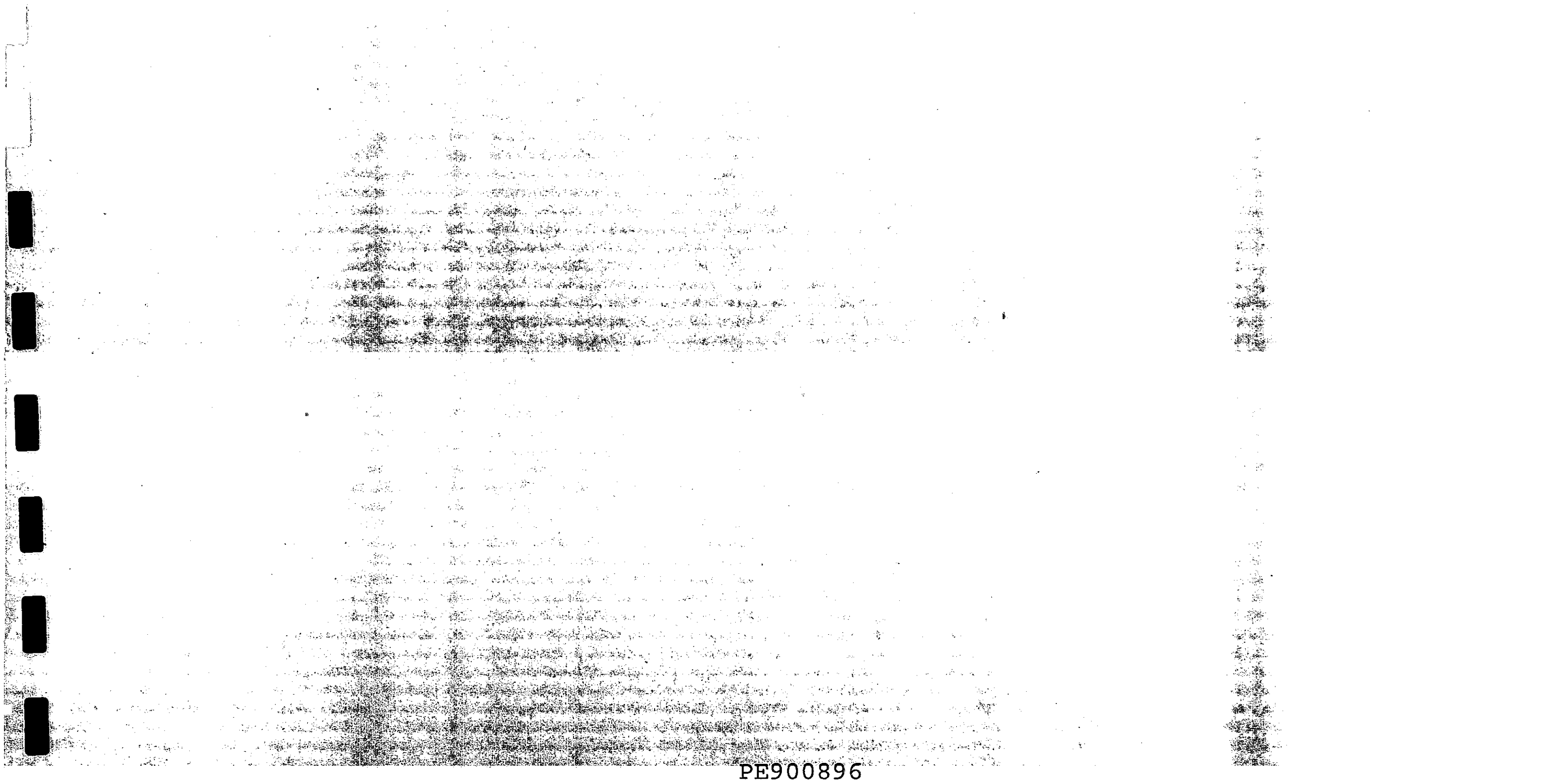
(Inserted by DNRE - Vic Govt Mines Dept)

ENCLOSURE 2

ORANGE ROUGHY-1

Recon Seismic Line - Nannygai-1 to Orange Roughy-1 to Kingfish-8 at 50cm/sec

PE900896



PE900896

This is an enclosure indicator page.
The enclosure PE900896 is enclosed within the container PE900894 at this location in this document.

The enclosure PE900896 has the following characteristics:

ITEM_BARCODE = PE900896
CONTAINER_BARCODE = PE900894
NAME = Recon Seismic Line - Nannygai1 - Orange Roughy 1 to Kingfish 8 at 50cm sec
BASIN = GIPPSLAND
PERMIT =
TYPE = SEISMIC
SUBTYPE = SECTION
DESCRIPTION = Recon Seismic Line - Nannygai1 - Orange Roughy 1 to Kingsidh 8 at 50cm sec
REMARKS =
DATE_CREATED = 21/12/95
DATE_RECEIVED = 2/01/96
W_NO = W1121
WELL_NAME = Orange Roughy -1
CONTRACTOR = ESSO
CLIENT_OP_CO = ESSO

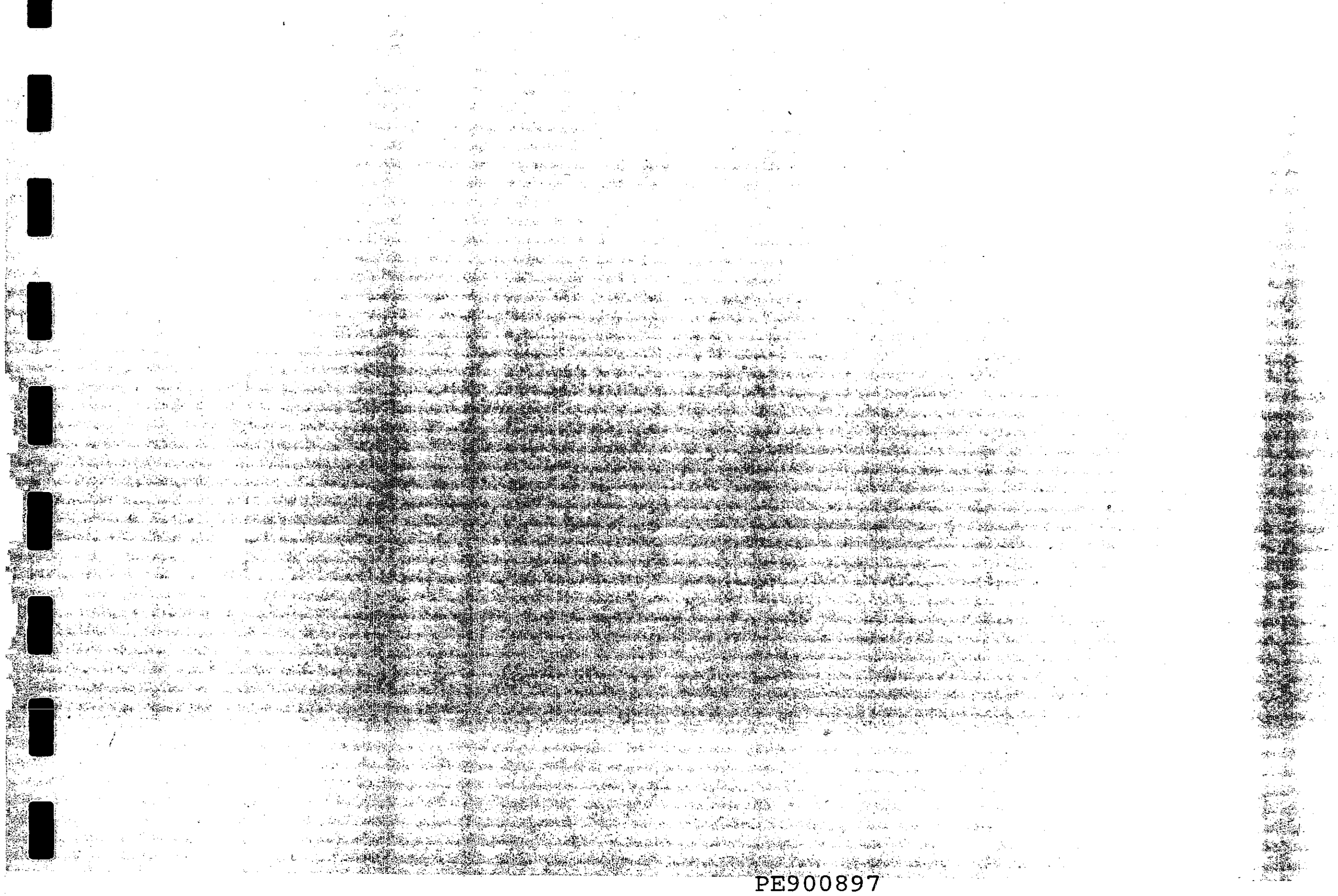
(Inserted by DNRE - Vic Govt Mines Dept)

ENCLOSURE 3

ORANGE ROUGHY-1

Top of Latrobe Time Map

PE900897



PE900897

This is an enclosure indicator page.
The enclosure PE900897 is enclosed within the container PE900894 at this location in this document.

The enclosure PE900897 has the following characteristics:

ITEM_BARCODE =	PE900897
CONTAINER_BARCODE =	PE900894
NAME =	Top of Latrobe timemap
BASIN =	GIPPSLAND
PERMIT =	
TYPE =	SEISMIC
SUBTYPE =	HRZN_CONTR_MAP
DESCRIPTION =	Top of Latrobe timemap
REMARKS =	
DATE_CREATED =	20/12/95
DATE_RECEIVED =	2/01/96
W_NO =	W1121
WELL_NAME =	Orange Roughy -1
CONTRACTOR =	ESSO
CLIENT_OP_CO =	ESSO

(Inserted by DNRE - Vic Govt Mines Dept)

ENCLOSURE 4

ORANGE ROUGHY-1

Top of Latrobe Group Average Velocity Map

PE900898

PE900898

This is an enclosure indicator page.
The enclosure PE900898 is enclosed within the container PE900894 at this location in this document.

The enclosure PE900898 has the following characteristics:

ITEM_BARCODE = PE900898
CONTAINER_BARCODE = PE900894
NAME = Top of Latrobe Average Velocity Map
BASIN = GIPPSLAND
PERMIT =
TYPE = SEISMIC
SUBTYPE = HRZN_CONTR_MAP
DESCRIPTION = Top of Latrobe Average Velocity Map
REMARKS =
DATE_CREATED = 1/09/95
DATE_RECEIVED = 2/01/96
W_NO = W1121
WELL_NAME = Orange Roughy -1
CONTRACTOR = ESSO
CLIENT_OP_CO = ESSO

(Inserted by DNRE - Vic Govt Mines Dept)

ENCLOSURE 5

ORANGE ROUGHY-1

Top of Latrobe Group Depth Map

PE900899

PE900899

This is an enclosure indicator page.
The enclosure PE900899 is enclosed within the container PE900894 at this location in this document.

The enclosure PE900899 has the following characteristics:

ITEM_BARCODE = PE900899
CONTAINER_BARCODE = PE900894
NAME = Top of Latrobe Depth Map
BASIN = GIPPSLAND
PERMIT =
TYPE = SEISMIC
SUBTYPE = HRZN_CONTR_MAP
DESCRIPTION = Top of Latrobe Depth Map
REMARKS =
DATE_CREATED = 1/09/95
DATE_RECEIVED = 2/01/96
W_NO = W1121
WELL_NAME = Orange Roughy -1
CONTRACTOR = ESSO
CLIENT_OP_CO = ESSO

(Inserted by DNRE - Vic Govt Mines Dept)

ENCLOSURE 6

ORANGE ROUGHY-1

Top of Latrobe to Jade SB Interval Velocity Map

PE900900

PE900900

This is an enclosure indicator page.
The enclosure PE900900 is enclosed within the container PE900894 at this location in this document.

The enclosure PE900900 has the following characteristics:

ITEM_BARCODE =	PE900900
CONTAINER_BARCODE =	PE900894
NAME =	Interval Velocity map
BASIN =	GIPPSLAND
PERMIT =	
TYPE =	SEISMIC
SUBTYPE =	HRZN_CONTR_MAP
DESCRIPTION =	Interval Velocity map, Tol to Jade, (enclosure from WCR) for Orange Roughy-1
REMARKS =	
DATE_CREATED =	1/09/95
DATE_RECEIVED =	2/01/96
W_NO =	W1121
WELL_NAME =	Orange Roughy -1
CONTRACTOR =	ESSO
CLIENT_OP_CO =	ESSO

(Inserted by DNRE - Vic Govt Mines Dept)

ENCLOSURE 7

ORANGE ROUGHY-1

Jade SB Depth Map

PE900901

PE900901

This is an enclosure indicator page.
The enclosure PE900901 is enclosed within the container PE900894 at this location in this document.

The enclosure PE900901 has the following characteristics:

ITEM_BARCODE = PE900901
CONTAINER_BARCODE = PE900894
NAME = Depth Map
BASIN = GIPPSLAND
PERMIT =
TYPE = SEISMIC
SUBTYPE = HRZN_CONTR_MAP
DESCRIPTION = Depth Map, Jade SB, (enclosure from WCR) for Orange Roughy-1
REMARKS =
DATE_CREATED = 1/09/95
DATE_RECEIVED = 2/01/96
W_NO = W1121
WELL_NAME = Orange Roughy -1
CONTRACTOR = ESSO
CLIENT_OP_CO = ESSO

(Inserted by DNRE - Vic Govt Mines Dept)

ENCLOSURE 8

ORANGE ROUGHY-1

Juniper SB Depth Map

PE900902

PE900902

This is an enclosure indicator page.
The enclosure PE900902 is enclosed within the container PE900894 at this location in this document.

The enclosure PE900902 has the following characteristics:

ITEM_BARCODE = PE900902
CONTAINER_BARCODE = PE900894
NAME = Depth Map
BASIN = GIPPSLAND
PERMIT =
TYPE = SEISMIC
SUBTYPE = HRZN_CONTR_MAP
DESCRIPTION = Depth Map, Juniper SB, (enclosure from WCR) for Orange Roughy-1
REMARKS =
DATE_CREATED = 1/09/95
DATE_RECEIVED = 2/01/96
W_NO = W1121
WELL_NAME = Orange Roughy -1
CONTRACTOR = ESSO
CLIENT_OP_CO = ESSO

(Inserted by DNRE - Vic Govt Mines Dept)

ENCLOSURE 9

ORANGE ROUGHY-1

Orange SB Depth Map

PE900903

PE900903

This is an enclosure indicator page.
The enclosure PE900903 is enclosed within the container PE900894 at this location in this document.

The enclosure PE900903 has the following characteristics:

ITEM_BARCODE =	PE900903
CONTAINER_BARCODE =	PE900894
NAME =	Depth Map
BASIN =	GIPPSLAND
PERMIT =	
TYPE =	SEISMIC
SUBTYPE =	HRZN_CONTR_MAP
DESCRIPTION =	Depth Map, Orange SB, (enclosure from WCR) for Orange Roughy-1
REMARKS =	
DATE_CREATED =	1/09/95
DATE_RECEIVED =	2/01/96
W_NO =	W1121
WELL_NAME =	Orange Roughy -1
CONTRACTOR =	ESSO
CLIENT_OP_CO =	ESSO

(Inserted by DNRE - Vic Govt Mines Dept)

ENCLOSURE 10

ORANGE ROUGHY-1

Nannygai-1 to Orange Roughy-1 to Kingfish-9
Structural Cross-Section. H:V = 100:1

PE 900904

PE900904

This is an enclosure indicator page.
The enclosure PE900904 is enclosed within the container PE900894 at this location in this document.

The enclosure PE900904 has the following characteristics:

ITEM_BARCODE = PE900904
CONTAINER_BARCODE = PE900894
NAME = Structural Cross Section Kingfish field
BASIN = GIPPSLAND
PERMIT =
TYPE = WELL
SUBTYPE = CROSS_SECTION
DESCRIPTION = Structural Cross Section Kingfish field h:v = 100:1
REMARKS =
DATE_CREATED = 1/09/95
DATE_RECEIVED = 2/01/96
W_NO = W1121
WELL_NAME = Orange Roughy -1
CONTRACTOR = ESSO
CLIENT_OP_CO = ESSO

(Inserted by DNRE - Vic Govt Mines Dept)

ENCLOSURE 11

ORANGE ROUGHY-1

Nannygai-1 to Orange Roughy-1 to Kingfish-8 Structural Cross-Section with Wells & Stratigraphy

PE900905

PE900905

This is an enclosure indicator page.
The enclosure PE900905 is enclosed within the container PE900894 at this location in this document.

The enclosure PE900905 has the following characteristics:

ITEM_BARCODE =	PE900905
CONTAINER_BARCODE =	PE900894
NAME =	Structural/Stratigraphic Cross Section with Wells & Stratigraphy
BASIN =	GIPPSLAND
PERMIT =	
TYPE =	WELL
SUBTYPE =	CROSS_SECTION
DESCRIPTION =	Structural/Stratigraphic Cross Section
REMARKS =	
DATE_CREATED =	1/09/95
DATE_RECEIVED =	2/01/96
W_NO =	W1121
WELL_NAME =	Orange Roughy -1
CONTRACTOR =	ESSO
CLIENT_OP_CO =	ESSO

(Inserted by DNRE - Vic Govt Mines Dept)

ENCLOSURE 12

ORANGE ROUGHY-1

Orange Roughy-1 Well Log (2200 - 2600m) with Horizon Picks

PE600710

PE600710

This is an enclosure indicator page.
The enclosure PE600710 is enclosed within the container PE900894 at this location in this document.

The enclosure PE600710 has the following characteristics:

ITEM_BARCODE = PE600710
CONTAINER_BARCODE = PE900894
NAME = Well log with Horizon picks
BASIN = GIPPSLAND
PERMIT =
TYPE = WELL
SUBTYPE = WELL_LOG
DESCRIPTION = Well log with Horizon picks
REMARKS =
DATE_CREATED = 1/09/95
DATE_RECEIVED = 2/01/96
W_NO = W1121
WELL_NAME = Orange Roughy -1
CONTRACTOR = ESSO
CLIENT_OP_CO = ESSO

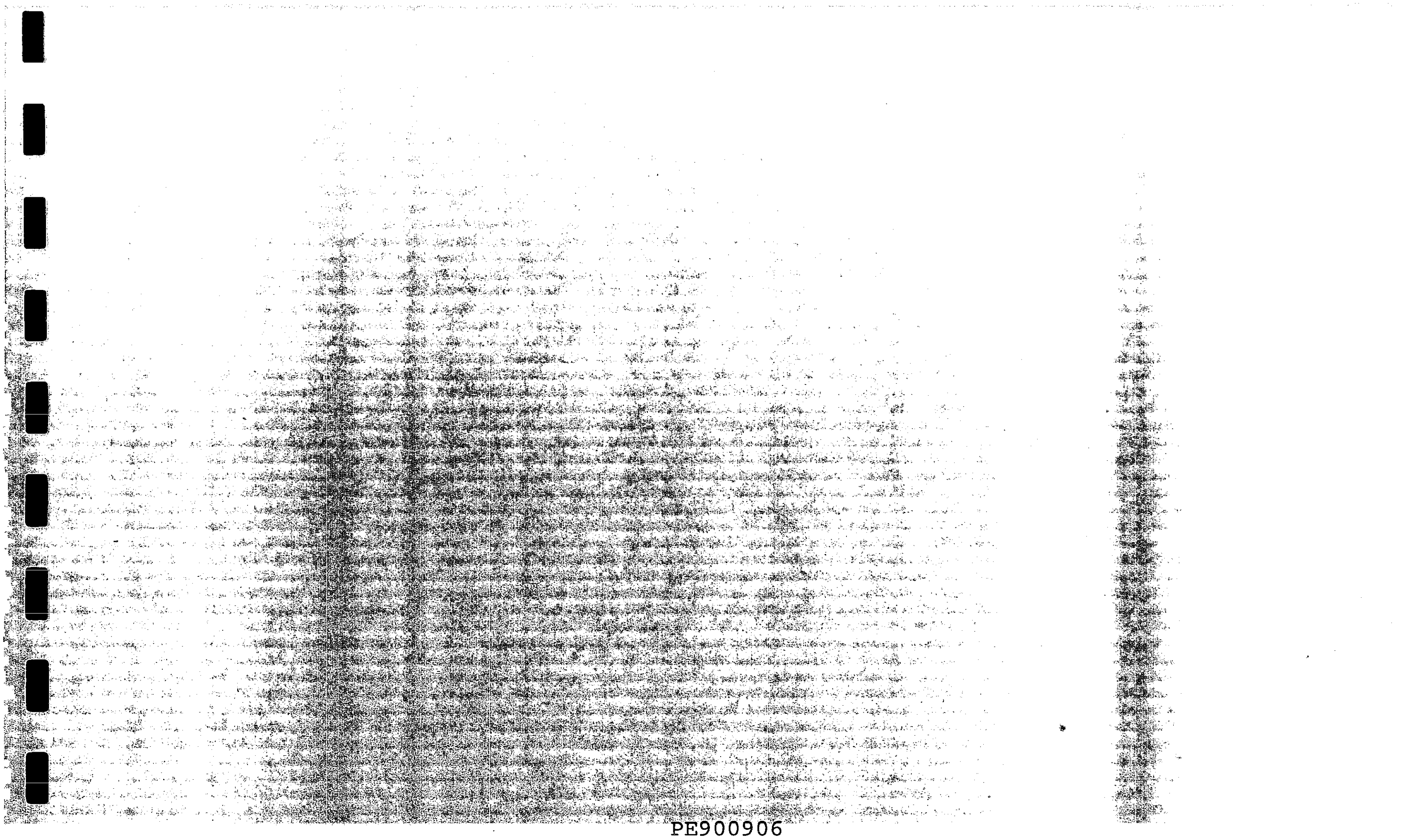
(Inserted by DNRE - Vic Govt Mines Dept)

ENCLOSURE 13

ORANGE ROUGHY-1

Average Amplitude Attribute Map, Cobalt to Orange SB Interval

PE900906



PE900906

This is an enclosure indicator page.
The enclosure PE900906 is enclosed within the container PE900894 at this location in this document.

The enclosure PE900906 has the following characteristics:

ITEM_BARCODE = PE900906
CONTAINER_BARCODE = PE900894
NAME = Average amplitude attribute map - cobalt to orange
BASIN = GIPPSLAND
PERMIT =
TYPE = WELL
SUBTYPE = MAP
DESCRIPTION = Average amplitude attribute map - cobalt to orange
REMARKS =
DATE_CREATED = 27/10/95
DATE_RECEIVED = 2/01/96
W_NO = W1121
WELL_NAME = Orange Roughy -1
CONTRACTOR = ESSO
CLIENT_OP_CO = ESSO

(Inserted by DNRE - Vic Govt Mines Dept)

ATTACHMENTS

ATTACHMENT 1

ORANGE ROUGHY-1

Well Completion Log

PE600711

PE600711

This is an enclosure indicator page.
The enclosure PE600711 is enclosed within the container PE900894 at this location in this document.

The enclosure PE600711 has the following characteristics:

ITEM_BARCODE = PE600711
CONTAINER_BARCODE = PE900894
NAME = Well completion log
BASIN = GIPPSLAND
PERMIT =
TYPE = WELL
SUBTYPE = COMPLETION_LOG
DESCRIPTION = Well completion log
REMARKS =
DATE_CREATED = 27/10/95
DATE_RECEIVED = 2/01/96
W_NO = W1121
WELL_NAME = Orange Roughy -1
CONTRACTOR = ESSO
CLIENT_OP_CO = ESSO

(Inserted by DNRE - Vic Govt Mines Dept)