W1019

WCR VOL 2

SNOOK-1

(W1019)

ESSO EXPLORATION AND PRODUCTION
AUSTRALIA INC.

WELL COMPLETION REPORT

SNOOK-1

VOLUME 2

INTERPRETED DATA

VIC/P27

ESSO AUSTRALIA RESOURCES LIMITED

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1. SUMMARY OF WELL RESULTS

Formation/Horizon	Pre-drill Depth (mSS)	Post Drill Depth (mSS)
Gippsland Limestone (seafloor)	28	28
Top of Latrobe Group	1107	1106
Top of "Coarse Clastics"	1122	1126
Mid *N. asperus* Seismic Marker	1236	1249
Lower *N. asperus* Seismic Marker	1358	1380
TD	1529	1529

2. INTRODUCTION

Snook-1 was drilled to test an anticlinal closure along the same anticlinal trend as the Mulloway and Whiptail discoveries. Snook-1 is located 4.7km northeast of Flying Fish-1 and 7km west of Mulloway-1, (Figure 1). Multiple reserves were expected within an *N. asperus* to *M. diversus* section of coastal plain coals, shales and sandstones. The major risk assessed was the access to mature source.

Snook-1 was drilled to a total depth of 1529mSS and failed to encounter any hydrocarbons. Structure, reservoir and seal were all present. The most likely reason for the failure of the well is the lack of a migration pathway to mature source.

Snook-1 represents the Year 3 commitment well for the VIC/P27 permit.

3. STRATIGRAPHY

Snook-1 intersected an Upper *N. asperus* to *P. asperopolis* aged section as predicted. The top of Latrobe Group was intersected at -1106.5mSS less than 1m from prediction. Twenty metres of glauconitic mudstones and siltstones of the Gurnard Formation overlie the top of "Coarse Clastics" at 1126.5 which was 4.5m low to prediction.

The upper part of the Latrobe Group is dominated by sandstones and coals of Middle to Lower *N. asperus* age. The sandstones are up to 30m thick and are representative of a middle to upper coastal plain environment. Below -1250mSS the proportion of coals increases dramatically, sandstones of up to 5m occur together with common siltstones and shales. The section is dated as Lower N. asperus and is interpreted as a lower coastal plain environment. The Lower N. asperus seismic marker is identified at -1380mSS, 22m low to prediction.

A thin section of P. asperopolis age is identified between -1408mSS and -1429mSS. There is less coal in the section and sands are better developed ranging up to 8m thick. A similar lower coastal plain environment is interpreted.

The basal section of the well shows a reversion to a fluvial dominated regime. Thick sands and minor shales and coals make up the interval. Sidewall cores in this interval are barren of palynomorphs so no age can be assigned with confidence. It is interpreted that the well reached T.D. in sediments of uppermost M. diversus age.

4. STRUCTURE

Re-mapping post-drill has shown the pre-drill interpretation to be correct. There is 15m of independent closure at the top of Latrobe at Snook. At the level of the Lower N. asperus seismic marker there is 12m of fault independent closure or 25m of fault dependent closure.

5. GEOPHYSICAL ANALYSIS

Seismic control of the Snook structure is provided primarily by a 250m x 1km grid of 2D lines from the G88A survey. The data are of very good quality down to the level of the N. asperus coals but deteriorates below this due to signal attenuation by the coals.

The primary target in Snook-1 was the Lower N. asperus reservoir which contains oil in Whiptail-1A and Mulloway-1. The Lower N. asperus seismic marker corresponds to the top of a coal which seals this reservoir.

The top of "Coarse Clastics" was intersected 4.5m deep to prediction. On seismic, the event is defined as the zero crossing from a white trough to a black peak and is easily carried over the structure. Depth conversion was achieved using an average velocity map derived from seismic VNMO's and conversion factors calculated at the well locations. The post drill map to the top of "Coarse Clastics" (Enclosure 2) does not differ significantly from the pre-drill interpretation.

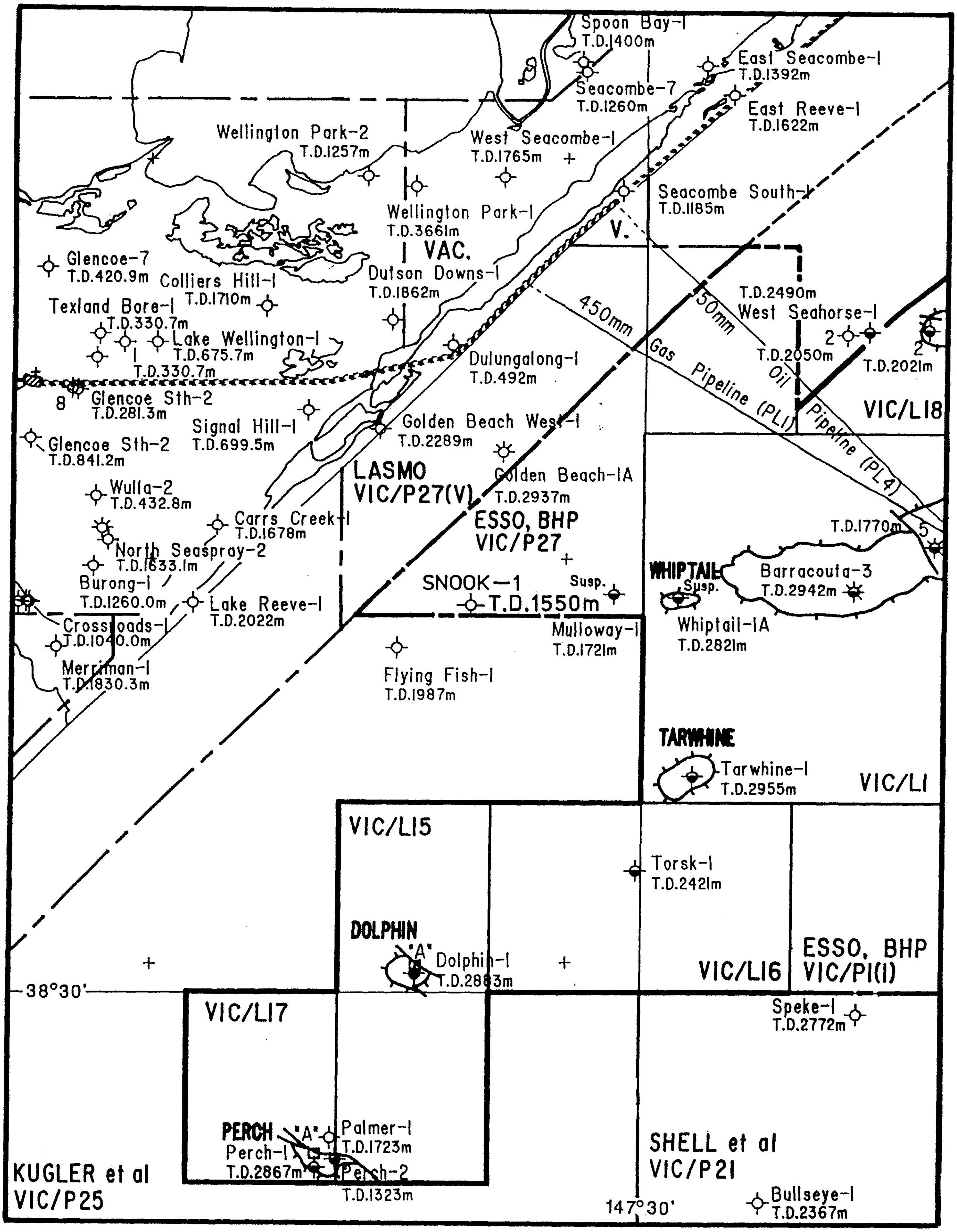
The Lower N. asperus seismic marker was intersected 22m deep to prediction in Snook-1. This depth error occurred because the time pick for this horizon at the well location was 20msec too high. In Mulloway-1 and Whiptail-1A this marker corresponds to a black peak on seismic. Post drill, it is evident that the N. asperus section contains more coals and the consequent interference effects result in the top of the coal marker, correlated from the other wells, being expressed on seismic as a white trough. Depth conversion to the Lower N. asperus seismic marker was carried out using a constant interval velocity from the top "Coarse Clastics". The post-drill map to the Lower N. asperus (Enclosure 3) was generated using a corrected time map and the interval velocity from the well. Although the horizon is deeper, the shape and size of the structure do not alter significantly.

6. DISCUSSION

Post-drill, Snook-1 has shown that structure seal and reservoir are all present. The most likely reason for the failure of the well is a lack of a valid migration pathway to mature source intervals identified away to the southeast in the central graben.

FIGURES

SNOOK-1
Locality Map
Scale 1:250 000



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APPENDIX I

APPENDIX-1

PALYNOLOGICAL ANALYSIS OF SNOOK-1 GIPPSLAND BASIN.

by

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ESSO AUSTRALIA LTD.

Esso Australia Ltd.
Palaeontology Report 1990/12

July, 1990

INTERPRETED DATA

INTRODUCTION

Twenty sidewall core samples were processed from Snook-1 and examined for spores, pollen and microplankton. Eight samples gave high yields, eight samples gave low to very low yields and the remainder moderate yields of oxidized organic residue. There were no obvious correlations between sample lithology and residue yield, or between residue yield and resultant palynomorph concentration and diversity, which could have been used to high-grade the samples (see Table-2). The only general observation that can be made is that the paler coloured lithologies tended to give the lower yields, and lowest palynomorph concentrations and diversity. All samples were thermally immature, a reflection of the shallow depth of the samples, and as a consequence preservation overall was good and sometimes exceptional. Because of the good preservation recorded diversity was generally high and the average diversity of spores and pollen in the productive samples was 30.8 species per sample. Microplankton diversity was low to very low, ranging from 1 to 8 species. Highest diversity of microplankton occurs near the top of the Latrobe Group and in the overlying Lakes Entrance Formation.

Lithological units and palynological zones from base of Lakes Entrance Formation to T.D. are given in the following summary. Interpretative data with indentification of zones and confidence ratings are recorded in Table-1 and basic data on residue yields, preservation and diversity are recorded in Table-2. All species which can be identified with binomial names are tabulated on the accompanying range chart.

PALYNOLOGICAL SUMMARY OF SNOOK-1

AGE	UNIT/FACIES	SPORE-POLLEN ZONES (Dinoflagellate Zones)	DEPTH RANGE (mKB)
Oligocene	Lakes Entrance Formation	Upper *N. asperus*	1120.0
	1125.0m		
Late Eocene	Latrobe Group (Gurnard Fm.)	Upper *N. asperus*	1137.0
	1155.0m		
Late Eocene	Latrobe Group (Undiff. coarse clastic facies)	Middle *N. asperus* (*G. extensa*)	1155.5-1206.5 (1155.5-1177.0)
Middle Eocene		Lower *N. asperus*	1263.5-1406.5
Early Eocene		*P. asperopolus*	1427.0-1444.5
	T.D. 1550.0m (Driller) T.D. 1553.5m (Schlumberger)		

GEOLOGICAL COMMENTS

1. The *P. asperopolus* Zone occurring between 1427-1444.5m is the oldest identifiable palynological zone in Snook-1. The 109 metres of section penetrated below this zone contained sidewall cores whose lithologies were unfavourable for palynology. Three samples were processed but only the sidewall core at 1470.5m gave a meager assemblage, which although suspected to be partially contaminated, indicated an age no older than the upper part of the Upper *M. diversus* Zone, based on the presence of *Santalumidites cainozoicus*.

2. The shallowest sidewall core sample in the *P. asperopolus* Zone at 1427m is unusual in being characterized by commom freshwater dinoflagellate cysts, the colonial algae *Botryococcus* and finely disseminated amorphous kerogen. A shallow freshwater lacustrine environment of deposition is envisaged. The gamma-ray and neutron/porosity logs indicate a maximum thickness of less than 1.5 metres, for the claystone unit sampled, suggesting that the lake had a maximum duration of about 50,000 years based on the average depositional rate for the Latrobe Group in Snook-1.

3. A notable feature of the assemblages from Snook-1 is the rarity of the distinctive species *Proteacidites pachypolus* and *P. asperopolus*. The former was recorded in only four samples and never in any numbers. *Proteacidites asperopolus* was only recorded in two samples. In the higher sample at 1353.0m the species is present in some numbers and this is regarded as an abundance acme even though the assemblage has not been counted. Abundances of *P. pachypolus* and *P. asperopolus* are obviously reflecting some environmental control on the parent plant because the peak abundance of the fossil form-species are not evenly distributed within the coastal plain environments in the Gippsland Basin. It is suggested that the abundances of these species are greatest in "lower coastal plain" close to the palaeoshorelines, whereas Snook-1 is on the "upper coastal plain" during the Early and Middle Eocene at a greater distance from the palaeoshoreline.

4. The base of the first abundance or Acme of *P. pachypolus* was use to initially define the base of the *P. asperopolus* Zone by Stover & Evans (1974). Later it realized that the first appearance of *P. asperopolus* was within the *P. pachypolus* Acme, and that all abundances of

P. asperopolus were not time equivalent to the *P. pachypolus* Acme. This resulted in the redefinition of the base of the *P. asperopolus* Zone as the FAD (First Appearance Datum) for the eponymous species, or other species whose FADs were coincident or nearly so (such as *Conbaculites apiculatus*, *Sapotaceoidaepollenites rotundus* etc.). Most abundances of *P. asperopolus* were indeed found to lie within the Lower *N. asperus* Zone, the most clear example of this being in Barracouta-4 (Partridge, 1977). This abundance or acme of the species *Proteacidites asperopolus* when associated with the rare but distinctive pollen species *Plicodiporties crescentus* ms Partridge 1971, is here recognised as a potential correlative time line within the Lower *N. asperus* Zone. Although it will need further testing this is an important observation as the Lower *N. asperus* Zone, which represents virtually the entire Middle Eocene, has proved difficult to subdivide using spores and pollen, even though the zone displays high diversity. This association is recognised in the following wells along the northern margin of the Central Deep in the Gippsland Basin:

WELL NAME	ACME OF *P. asperopolus*	OCCURRENCES OF *P. crescentus*
Barracouta-4	1168.6-1192.4m	1157.3m
Mulloway-1	1285.3-1369.5	1285.3m
Snapper-5	(Not obvious)	1332m
Snook-1	1353m	1353m
Whiptail-1A	1257.5-1344m	1278m

5. The top of the Gurnard Formation in Snook-1 is picked at the slight increase on the gamma-ray log at 1125m, and the base at 1155m where there is a corresponding reduction on the gamma-ray log. The base is also characterised by a reduction in the separation between the neutron porosity and bulk density logs. The only sidewall core recovered from this unit was a glauconitic claystone which gave a marine assemblage assignable to the Upper *N. asperus* Zone.

BIOSTRATIGRAPHY

Zone and age-determinations have been made using criteria proposed by Stover & Partridge (1973, 1982) and unpublished observations made on Gippsland Basin wells drilled by Esso Australia Ltd.

Author citations for most spore-pollen species can be sourced from Stover & Partridge (1973, 1982), or other references cited herein. Species names followed by "ms" are unpublished manuscript names. Author citations for dinoflagellates can be found in Lentin & Williams (1985, 1989).

Proteacidites asperopolus **Zone: 1427.0-1444.5 metres** **Early Eocene.**

The two samples assigned to this zone gave high residue yields and high palynomorph diversity in which the key zone indicator species were rare. From the deeper sample at 1444.5m only a single specimen each of the species *Proteacidites asperopolus* and *Clavastephanocolporites meleosus* ms were recorded. The frequent occurrence of *Santalumidites cainozoicus* in the sample encouraged searching of additional slides until the zone species were found. Although the FAD (First Appearance Datum) for *Santalumidites cainozoicus* is within the underlying Upper *M. diversus* Zone it is generally not frequent or common in that zone. The assemblage from 1444.5m is also characterized by common fungal spores, hypae and fruiting bodies.

The shallower sample at 1427.0m is dominated by finely disseminated amorphous material and is characterized by presence of the colonial algae *Botryococcus* and fresh-water dinoflagellate cysts referable to the genera *Saeptodinium* and *Morkallacysta*. Indicator species for the zone are slightly more frequent than in the underlying sample and include specimens of *Sapotaceoidaepollenites rotundus* and several specimens of both *Conbaculites apiculatus* ms and *Nothofagidites goniatus*. *Proteacidites asperopolus* was not found. This sample also is the LAD (Last Appearance Datum) for *Myrtaceidites tenuis* which ranges no higher than the *P. asperopolus* Zone.

Lower *Nothofagidites asperus* Zone: 1263.5-1406.5 metres Middle Eocene.

The base of the zone is picked at 1406.5m on the increase in abundance of *Nothofagidites* spp. above the LAD of *M. tenuis*. However, in the absence of key indicator species known to first occur in the Lower *N. asperus* Zone only a low confidence rating can be assigned to this sample. Higher confidence ratings are assigned to the overlying samples which contain the FADs for *Nothofagidites asperus*, *Tricolpites thomasii*, and *Matonisporites ornamentalis* (this is a disjunct younger datum as this species is also found in the *L. balmei* Zone) all from 1389.0m; *Tricolporites leuros* and *Proteacidites recavus* from 1353.0m; *Tricolpites simatus* and *Plicodiporites crescentus* ms Partridge 1971, from 1353.0m; and finally *Nothofagidites falcatus* and *Proteacidites reflexus* from 1263.5m.

The incoming of new species, rather than "local" species extinctions, are regarded as more reliable for separating the Middle from the Lower subdivision of the *N. asperus* Zone. A few LADs are of importance and in Snook-1 these are *Anacolosidites luteoides* and *Proteacidites asperopolus* at 1353.0m, and *Proteacidites reflexus* at 1263.5m.

Microplankton are rare in the Lower *N. asperus* Zone, but include non-marine dinoflagellate cysts at 1389.0m and 1406.5m, and the monospecific assemblage of the more typical "marine" dinoflagellate *Deflandrea antarctica* at 1283.0m.

Middle *Nothofagidites asperus* Zone: 1155.5-1206.5 metres Late Eocene.
and
***Gippslandica extensa* Zone: 1155.5-1177.0 metres Late Eocene.**

The top and bottom of the Middle *N. asperus* Zone is picked respectively on the LAD and FAD of *Triorites magnificus* which unfortunately was only recorded from these two delimiting samples. The only other diagnostic pollen recorded are *Aglaoreidia qualumis* at 1177.0m and *Dryadopollis* (al. *Tricolporites*) *retequetrus* at 1155.5m.

The *G. extensa* Dinoflagellate Zone, which was informally proposed (as the *Deflandrea extensa* Zone)in Partridge (1976) is recognised in two samples based on the occurrence of the eponymous species. Associated dinoflagellates are not particularly diagnostic. The assemblages are undoubtedly much more diverse, but recording this diversity is not possible because of the low yields from the samples.

Upper *Nothofagidites asperus* Zone: 1120.0-1137.0 metres Oligocene-Late Eocene.

The two shallowest samples are assigned to the Upper *N. asperus* Zone with poor confidence ratings. Although high diversity assemblages were recorded it is felt that they are still only partial assemblages because of the low residue yields recovered. An Upper rather than Middle *N. asperus* Zone assignment for the deepest sample at 1137.0m is favoured by the FADs for *Foveotriletes crater* and *Proteacidites stipplatus*. Favouring an older age for this sample are the LADs for *Proteacidites crassus* and *Triporopollenites ambiguus* which are not considered to occur above the Middle subzone. The associated microplankton in the sample are dominated by abundant *Spiniferites* spp. and common *Operculodinium centrocarpum* without any index species typically found in the Middle *N. asperus* Zone, and this has significantly influenced the decision to assign the sample to the Upper subzone. The shallower sample at 1120.0m from the basal Lakes Entrance Formation is assigned to the Upper *N. asperus* Zone principally on the negative evidence of the absence of the distinctive spore *Cyatheacidites annulatus*. The presence of rare *Protoellipsodinium simplex* ms in a microplankton assemblage dominated by *Operculoidinium centrocarpum* does however suggest the sample could be younger.

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TABLE-1: INTERPRETATIVE PALYNOLOGICAL DATA SNOOK-1, GIPPSLAND BASIN

SAMPLE TYPE	DEPTH (metres)	SPORE-POLLEN ZONE	DINOFLAGELLATE ZONE (OR ASSOCIATION)	CONFIDENCE RATING	COMMENT
SWC 30	1120.0	Upper *N. asperus*	*(O. centrocarpum)*	2	Could be younger.
SWC 29	1137.0	Upper *N. asperus*	*(O. centrocarpum)*	2	FAD *Foveotriletes crater.*
SWC 26	1155.5	Middle *N. asperus*	*G. extensa*	0	LAD *Triorites magnificus.*
SWC 25	1164.5	*N. asperus*		1	No middle subzone species recorded.
SWC 24	1177.0	Middle *N. asperus*	*G. extensa*	0	*Aglaoreidia qualumis* present.
SWC 23	1201.0	*N. asperus*		1	No middle subzone species recorded.
SWC 22	1206.5	Middle *N. asperus*		1	FAD *Triorites magnificus.*
SWC 21	1237.0	*N. asperus*		1	
SWC 20	1263.5	Lower *N. asperus*		1	*Proteacidites reflexus* present.
SWC 19	1283.0	*N. asperus*	*(D. antarctica)*	1	*Tricolpites simatus* present.
SWC 16	1353.0	Lower *N. asperus*		1	LAD *Proteacidites asperopolus*
SWC 15	1358.5	Lower *N. asperus*		1	
SWC 11	1389.0	Lower *N. asperus*		1	*Tricolpites thomasii* present.
SWC 9	1406.5	Lower *N. asperus*		2	*Nothofagidites >> H. harrisii.*
SWC 8	1420.0	Indeterminate			
SWC 7	1427.0	*P. asperopolus*	*(Saeptodinium)*	1	LAD *Myrtaceidites tenuis.*
SWC 6	1444.5	*P. asperopolus*		1	FAD *Proteacidites asperopolus.*
SWC 5	1453.0	Indeterminate			Barren of fossils.
SWC 4	1470.5	Indeterminate			No older than Upper *M. diversus* Zone.
SWC 2	1527.0	Indeterminate			Barren of fossils.

LAD = Last Appearance Datum
FAD = First Appearance Datum

PALYNOLOGY DATA SHEET

BASIN: GIPPSLAND **ELEVATION:** KB: +21 m GL: -28 m

WELL NAME: SNOOK-1 **TOTAL DEPTH:** 1553.5 m

AGE	PALYNOLOGICAL ZONES	HIGHEST DATA				LOWEST DATA			
		Preferred Depth	Rtg	Alternate Depth	Rtg	Alternate Depth	Rtg	Preferred Depth	Rtg
NEOGENE	*T. pleistocenicus*								
	M. lipsis								
	C. bifurcatus								
	T. bellus								
	P. tuberculatus								
PALEOGENE	Upper *N. asperus*	1120	2					1137	2
	Middle *N. asperus*	1155.5	0					1206.5	1
	Lower *N. asperus*	1263.5	1			1389	1	1406.5	2
	P. asperopolus	1427	1					1444.5	1
	Upper *M. diversus*								
	Middle *M. diversus*								
	Lower *M. diversus*								
	Upper *L. balmei*								
	Lower *L. balmei*								
LATE CRETACEOUS	Upper *T. longus*								
	Lower *T. longus*								
	T. lilliei								
	N. senectus								
	T. apoxyexinus								
	P. mawsonii								
	A. distocarinatus								
EARLY CRET.	*P. pannosus*								
	C. paradoxa								
	C. striatus								
	C. hughesii								
	F. wonthaggiensis								
	C. australiensis								

COMMENTS: Depths in metres.
Gippslandica extensa Dinoflagellate Zone: 1155.5-1177 m

CONFIDENCE RATING:

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

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

DATA RECORDED BY: A.D. Partridge **DATE:** July 1990

DATA REVISED BY: **DATE:**

BASIC DATA

TABLE-2: BASIC DATA

RANGE CHART

TABLE-2: BASIC PALYNOLOGICAL DATA SNOOK-1, GIPPSLAND BASIN

SAMPLE TYPE	DEPTH (metres)	LAB. NO.	LITHOLOGY	RESIDUE YIELD	PALYNOMORPH CONCENTRATION	PRESERVATION	NO. OF S-P SPECIES*	MICROPLANKTON ABUNDANCE	NO. SPECIES*
SWC 30	1120.0	78306 Z	Calcareous Claystone	Low	High	Good	29+	Moderate	7+
SWC 29	1137.0	78306 Y	Glauconitic Claystone	Moderate	High	Fair	41+	High	6+
SWC 26	1155.5	78306 X	Dark grey friable sandstone	Low	Moderate	Good	29+	Low	4+
SWC 25	1164.5	78306 W	Light grey sandstone	Low	Low	Good	12+	Very Low	1
SWC 24	1177.0	78306 V	Medium grey sandstone	Moderate	Low	Good	28+	Low	8+
SWC 23	1201.0	78306 U	Homogeneous siltstone	High	High	Good	35+		
SWC 22	1206.5	78306 T	Laminated siltstone	High	Moderate	Fair-good	32+		
SWC 21	1237.0	78306 S	Homogeneous siltstone	High	Moderate	Fair	34+		
SWC 20	1263.5	78306 R	Interlaminated sst./siltstone	High	High	Good	44+		
SWC 19	1283.0	78306 Q	Fine sandstone	Moderate	Low	Poor-good	16+	Very Low	1
SWC 16	1353.0	78306 O	Sst. with thin carb. laminae	High	High	Good	51+	(Very Low)	(1)
SWC 15	1358.5	78306 N	White sst. with carb. laminae	High	Low	Good	32+		
SWC 11	1389.0	78306 J	Light brown sandstone	Low	High	Good	43+	Very Low	1
SWC 9	1406.5	78306 H	Sst. (possible mud penetration)	Moderate	Moderate	Good	23+	Very Low	1
SWC 8	1420.0	78306 G	Pale siltstone	Very Low	Very Low	Fair-good	6+		
SWC 7	1427.0	78306 F	Dark carbonaceous? claystone	High	Moderate	Fair-good	49+	Moderate	1
SWC 6	1444.5	78306 E	Homogeneous carb. claystone	High	Moderate	Good	38+		
SWC 5	1453.0	78306 D	Very light grey claystone	Very Low	Barren				
SWC 4	1470.5	78306 C	Light brown sandstone	Very Low	Very Low	Good	12+	(Very Low)	(1)
SWC 2	1527.0	78306 B	Light brown sandstone	Very Low	Barren				

Microplankton in (brackets) = contamination

* Diversity:
- Very Low = 1- 5 species
- Low = 6-10 species
- Moderate = 11-25 species
- High = 26-74 species
- Very High = 75+ species

(ADP276)

PE900485

This is an enclosure indicator page.
The enclosure PE900485 is enclosed within the container PE902110 at this location in this document.

The enclosure PE900485 has the following characteristics:

ITEM_BARCODE = PE900485
CONTAINER_BARCODE = PE902110
NAME = Palynological Range Chart
BASIN = GIPPSLAND
PERMIT = VIC/P27
TYPE = WELL
SUBTYPE = DIAGRAM
DESCRIPTION = Palynological Range Chart for Snook-1
REMARKS =
DATE_CREATED =
DATE_RECEIVED =
W_NO = W1019
WELL_NAME = SNOOK-1
CONTRACTOR =
CLIENT_OP_CO = ESSO AUSTRALIA LIMITED

(Inserted by DNRE - Vic Govt Mines Dept)

APPENDIX 2

APPENDIX 2

SNOOK 1

QUANTITATIVE LOG ANALYSIS

Interval: 1137 - 1533 mMDKB
Analysts: A. P. Clare.
T. M. Frankham.
Date : May, 1990.

SNOOK 1: QUANTITATIVE LOG ANALYSIS

Wireline log data from the **Snook 1** exploration well has been quantitatively analysed over the interval 1137 - 1533 mMDKB for effective porosity and effective water saturation. No hydrocarbon shows were encountered during the drilling of the well and this analysis comfirms the preliminary interpretation that well was dry.

Results are presented in the form of the accompanying depth plots and listing, and are summarised and discussed below.

DATA QUALITY:

Logs Used:

- GR (gamma ray)
- LLD (deep laterolog)
- RHOB (bulk density)
- NPHI (neutron porosity)
- DT (sonic transit time)

Log quality appears to be satisfactory. Minor depth matching was undertaken prior to carrying out the analysis. The MSFL, Density and Neutron logs suffer in some intervals owing to hole washout.

ANALYSIS METHODOLOGY

Porosities and water saturations were calculated for the total "Coarse Clastic" section using an iterative technique which converges into a preselected grain density window by appropriately incrementing or decrementing shale volume. Initial shale volume is derived from the Gamma Ray response. The model incorporates porosity calculation from density-neutron crossplot algorithms, water saturation from the dual water relationship, hydrocarbon corrections to the porosity logs where applicable, and convergence upon the preselected grain density window (calculated from hydrocarbon and shale corrected density and neutron logs) by shale volume adjustment. Algorithms used are shown in appendix 1 .

Since some of the hole was washed out, resulting in invalid density and neutron log values, sonic porosity (Raiga-Clemenceau et al. algorithm) and shale volume from gamma ray curves were also calculated . The sonic porosity was normalised to the above derived density-neutron crossplot total porosity where the hole is in-gauge (normalisation multiplier: 0.91). This normalised sonic porosity and the shale volume from gamma ray were then substituted for the density-neutron derived total porosity and shale volume through the washed out zones.

Unfortunately, some of the hole in the interval 1311-1324 mMDKB is so badly washed out that even the sonic log data is invalid. In these sections, no analysis was attempted.

WATER SALINITY

The total "Coarse Clastics" aquifer intersected by the Snook 1 well has been flushed with fresh water. Rwa calculations suggest that the aquifer salinity is in the order of 400 - 600 ppm NaCl.eq.

ANALYSIS PARAMETERS.

VSH and POROSITY from DENSITY-NEUTRON, with VSH from GR & porosity from SONIC substituted in zoned intervals.

```
Tortuosity; 'a'................................ : 1.00
Cementation factor; 'm'........................ : 2.00
Saturation exponent; 'n'....................... : 2.00
Fluid density.................................. : 1.00
Gamma Ray value in clean formation (grmin)...... : 35
Gamma Ray value in shale (grmax)................ :140
Apparent shale resistivity..................... :30.00
Apparent bulk density of shale.................. : 2.450
Apparent neutron porosity of shale.............. : 0.390
(Apparent shale porosity....................... : 0.28)
Input hydrocarbon density...................... : 1.00
Lower limit of grain density .................. : 2.645
Upper limit of grain density................... : 2.675
Formation Water entered in terms of SALINITY.
Database curve selected for Salinity input.
Measured Rmf................................... : 0.253
Temperature at which Rmf measured.............. : 20.6 deg.C
Sxo derived from Sw (Sxo = Sw**z).
Z (where Sxo=SW**Z)............................ : 0.30
Logged TD...................................... : 1553
Logged bottom hole temperature................. :  49 deg.C
Est. sea bed temperature....................... :  10 deg.C
Water depth.................................... :  28
KB height...................................... :  21
Irreducible water saturation................... : 0.025
Vsh upper limit for effective porosity.......... : 0.65
Minimum effective porosity for hydrocarbons..... : 0.03
```

APPENDIX 1

ALGORITHMS AND LOGIC USED IN THE QUANTITATIVE ANALYSIS.

Shale volume calculated from Density and Neutron log responses as follows:

```
vshdn = ((nphi+0.04) - ((rhogav-rhob)/(rhogav-rhof)))/ \
         ((phinsh+0.04) - ((rhogav-rhobsh)/(rhogav-rhof)))
vshdn = max(0,(min(1,vshdn)))
```

Apparent shale porosity calculated from density-neutron crossplot algorithm using apparent bulk density of shale and apparent neutron porosity (limestone matrix) of shale.

```
h = 2.71 - rhobsh + phinsh*(rhof-2.71)
if (h < 0)then
 rhoma = 2.71 - 0.64*h
else
 rhoma = 2.71 - 0.5*h
endif
phish = (rhoma-rhobsh)/(rhoma-rhof)
```

Bound water resistivity (rwb) calculated via Archie, using apparent shale porosity and apparent shale resistivity.

```
rwb = (rsh*(phish**m))/a
```

Total porosity calculated from density-neutron crossplot algorithms, using bulk density and neutron porosity (limestone matrix, decimal p.u.) log values.

```
h = 2.71 - rhob + nphi*(rhof-2.71)
if (h < 0)then
 rhoma = 2.71 - 0.64*h
else
 rhoma = 2.71 - 0.5*h
endif
phit = (rhoma-rhob)/(rhoma-rhof)
```

Water saturation (total) calculated using dual water relationship:

```
1/rt=(swt**n)*(phit**m)/(a*rw)+swt**(n-1)*(swb*(phit**m)/a)*((1/rwb)-(1/rw))
      This is solved for Sw by Newtons solution
      exsw=0
      sw  =0.9
      aa  =((phit**m)/(a*rw))
      bb  =((phit**m)*swb/a)*((1/rwb)-(1/rw))
      dowhile(exsw.le.5)
       fx1=(aa*(sw**n))+(bb*(sw**(n-1)))-(1/rt)
       fx2=(n*aa*(sw**(n-1)))+((n-1)*bb*(sw**(n-2)))
        if((abs(fx2)).lt.0.0001)then
         fx2=0.0001
        endif
      swp=sw
      sw =swp-(fx1/fx2)
      if((abs(sw-swp)).le.0.01)then
       exitdo
      endif
      exsw=exsw+1
      enddo
      swt=sw
              [ where:swb = bound water saturation           ]
              [           = max(0,(min(1,(vsh*phish/phit)))) ]
```

Effective porosity and water saturation derived from calculated total porosity and water saturation as follows:

```
       phie= max(0.001,(phit-(vsh*phish)))
       swe = max(swirr,( 1 - ((phit/phie)*(1-swt))))
          if (vsh > vshco) {
             swt  = 1
             swe  = 1
             phie = 0
          }
          if (vsh > (vshco-0.2)) {
             phie= phie*((vshco-vsh)/0.2)
             swe = 1-((1-swe)*((vshco-vsh)/0.2))
          }
```

Sonic porosity, if used, is calculated as follows:

```
      phis = 1-((dtma/dt)**(1/x))
           where, in clastics,
           dtma = 182.1
              x = 1.6
           (Raiga-Clemenceau et al.(paper G, 1986 SPWLA trans.))
```

SNOOK_1

ANALYSIS SUMMARY.

Net porosity cut-off..........: 0.120 volume per volume
Net water saturation cut-off..: 0.500 volume per volume

Net Porous Interval based on Porosity cut-off only.
Both Porosity and Sw cut-offs invoked when generating Hydrocarbon-Metres.

	GROSS INTERVAL (metres) (top) -(base)	Gross Metres	NET POROUS INTERVAL Net Metres	Net to Gross	Mean Vsh	(Std.) (Dev.)	Mean Porosity	(Std.) (Dev.)	Mean Sw	(Std.) (Dev.)	HYDROCARBON METRES	
MDKB	1142.2-1154.5	12.3	8.4	68 %	0.235	(0.076)	0.163	(0.023)	1.000	(0.000)	0.000	WATER
MDKB	1154.6-1199.6	45.0	44.4	99 %	0.037	(0.070)	0.298	(0.030)	1.000	(0.000)	0.000	WATER
MDKB	1204.0-1205.0	1.0	0.9	95 %	0.165	(0.047)	0.267	(0.034)	1.000	(0.000)	0.000	WATER
MDKB	1206.6-1235.8	29.2	29.0	99 %	0.027	(0.041)	0.296	(0.027)	1.000	(0.000)	0.000	WATER
MDKB	1236.8-1245.8	8.9	8.8	99 %	0.049	(0.076)	0.258	(0.025)	1.000	(0.000)	0.000	WATER
MDKB	1249.2-1270.1	20.9	20.5	98 %	0.056	(0.058)	0.276	(0.032)	1.000	(0.000)	0.000	WATER
MDKB	1277.8-1282.3	4.4	4.3	98 %	0.117	(0.108)	0.236	(0.033)	1.000	(0.000)	0.000	WATER
MDKB	1283.8-1289.3	5.5	5.1	94 %	0.084	(0.109)	0.260	(0.045)	1.000	(0.000)	0.000	WATER
MDKB	1294.6-1299.8	5.3	5.2	98 %	0.030	(0.016)	0.291	(0.021)	1.000	(0.000)	0.000	WATER
MDKB	1305.3-1336.4	31.2	21.7	70 %	0.038	(0.063)	0.300	(0.029)	1.000	(0.000)	0.000	WATER
	(Some portions of the above sand not analysed. Thus, "net" and "net to gross" are minimum figures)											
MDKB	1344.8-1347.8	3.0	1.9	63 %	0.160	(0.102)	0.225	(0.032)	1.000	(0.000)	0.000	WATER
MDKB	1352.7-1356.1	3.4	3.3	97 %	0.271	(0.102)	0.215	(0.032)	1.000	(0.000)	0.000	WATER
MDKB	1357.1-1360.0	2.9	2.4	81 %	0.277	(0.128)	0.211	(0.045)	1.000	(0.000)	0.000	WATER
MDKB	1362.8-1364.7	1.8	1.2	68 %	0.406	(0.024)	0.170	(0.027)	1.000	(0.000)	0.000	WATER
MDKB	1365.9-1373.4	7.5	7.3	99 %	0.088	(0.085)	0.287	(0.032)	1.000	(0.000)	0.000	WATER
MDKB	1373.8-1374.9	1.1	1.1	96 %	0.304	(0.112)	0.240	(0.046)	1.000	(0.000)	0.000	WATER
MDKB	1375.6-1386.8	11.3	10.8	96 %	0.138	(0.132)	0.248	(0.044)	1.000	(0.000)	0.000	WATER
MDKB	1395.3-1401.2	5.8	5.2	89 %	0.051	(0.091)	0.271	(0.032)	1.000	(0.000)	0.000	WATER
MDKB	1404.8-1406.7	1.8	1.5	84 %	0.194	(0.103)	0.224	(0.039)	1.000	(0.000)	0.000	WATER

ANALYSIS SUMMARY. (continued)

	GROSS INTERVAL (metres) (top) -(base)	Gross Metres	NET POROUS INTERVAL Net Metres	Net to Gross	Mean Vsh	(Std.) (Dev.)	Mean Porosity	(Std.) (Dev.)	Mean Sw	(Std.) (Dev.)	HYDROCARBON METRES	
MDKB	1408.3-1414.9	6.6	6.3	95 %	0.106	(0.098)	0.260	(0.030)	1.000	(0.000)	0.000	WATER
MDKB	1421.4-1424.9	3.5	2.9	84 %	0.340	(0.091)	0.188	(0.034)	1.000	(0.000)	0.000	WATER
MDKB	1427.4-1438.8	11.3	10.7	95 %	0.071	(0.093)	0.271	(0.036)	1.000	(0.000)	0.000	WATER
MDKB	1445.3-1449.1	3.8	3.2	86 %	0.116	(0.151)	0.216	(0.046)	1.000	(0.000)	0.000	WATER
MDKB	1453.5-1462.2	8.7	8.4	98 %	0.090	(0.112)	0.231	(0.030)	1.000	(0.000)	0.000	WATER
MDKB	1464.1-1467.8	3.8	3.7	99 %	0.208	(0.103)	0.244	(0.039)	1.000	(0.000)	0.000	WATER
MDKB	1470.6-1486.6	16.0	16.0	100 %	0.093	(0.102)	0.246	(0.035)	1.000	(0.000)	0.000	WATER
MDKB	1488.4-1490.3	1.9	1.8	92 %	0.145	(0.157)	0.261	(0.038)	1.000	(0.000)	0.000	WATER
MDKB	1492.3-1532.8	40.6	40.5	100 %	0.103	(0.084)	0.241	(0.035)	1.000	(0.000)	0.000	WATER

PE600972

This is an enclosure indicator page.
The enclosure PE600972 is enclosed within the container PE902110 at this location in this document.

The enclosure PE600972 has the following characteristics:

ITEM_BARCODE =	PE600972
CONTAINER_BARCODE =	PE902110
NAME =	Quantitative log
BASIN =	GIPPSLAND
PERMIT =	
TYPE =	WELL
SUBTYPE =	WELL_LOG
DESCRIPTION =	Quantitative log
REMARKS =	
DATE_CREATED =	30/05/90
DATE_RECEIVED =	17/07/90
W_NO =	W1019
WELL_NAME =	Snook-1
CONTRACTOR =	SOLAR
CLIENT_OP_CO =	ESSO

(Inserted by DNRE - Vic Govt Mines Dept)

APPENDIX 3

APPENDIX 3

GEOCHEMICAL REPORT

ON

SNOOK 1 WELL

GIPPSLAND BASIN

BY

B.J.BURNS

JUNE 1990

Analyses by
H. Schiller

LIST OF TABLES AND FIGURES

INTRODUCTION

Snook 1 was drilled approx 6km to the west of Mulloway 1 and it penetrated 400m of Latrobe Group sediments. This Latrobe section represents shallow Eocene age sands, siltstones and claystones with interspersed thin coals (<5m thick). These sediments were considered too immature to have acted as a source for either oil or gas. However, nine SWCs from the Eocene section over the interval from 1120m to 1453m were selected from a number of different depositional environments in order to assess the effect of these environments on the oil potential of the rocks.

No oil was recovered from the well but some brown bitumen staining was observed in SWC 30 at 1263.5m and some adjacent cuttings. A sample of this stain was extracted to see if it represented a "residual oil".

RESULTS

The TOC and Rockeval results are presented in Tables 1 and 2 and summarised in Figure 1. All of the samples are from the Eocene *N. asperus* and *P. asperopolous* zones and are mostly medium- to dark-brown carbonaceous siltstones and claystones. The Total Organic Carbon (TOC) content is uniformly "good" to "excellent" with only the two light grey samples at 1420m and 1453m having TOC's less than 0.5% (ie. non-source). The remaining samples had TOC's ranging from 2.77% up to 5.62%

The corresponding Rockeval results (Table 2) are variable with four samples from 1206.5m to 1444.5m having a "good" source richness rating (based on S2 yields in excess of 6mg/g). Gas-plus-oil would be the interpreted hydrocarbon product (at peak maturity) from these four samples with Hydrogen Indices of approx. 230 or greater (Table 2, Fig 2), while the remaining samples would be expected to yield mainly gas. It is worth noting that the sample with the highest HI (328 at 1444.5m) has been described by our palynologist (A.D. Partridge, 1990) as containing abundant fungii remains and could be interpreted as representing an environment of decaying vegetation on the forest floor. Fungii are believed to enhance the oil potential of terrestrial organic matter by selectively degrading and removing the cellulose (gas prone) components and thereby leaving behind the more hydrogen-rich (ie oil-prone) exinite and resinous material.

It is interesting that the two marine units, both the 'open marine' and the 'condensed marine', have quite low Hydrogen Indices even though their TOC contents are 2.77% and 4.76% respectively. This indicates that both environments have been subject to oxidising conditions that have reduced the hydrogen content and effectively destroyed the oil potential of the organic matter.

The low Tmax values for all samples (<426) indicate that the section penetrated in the well is immature.

SIDEWALL CORE EXTRACT

The description of Sidewall Core 30 at 1263.5m in the Snook 1 well included a reference to "...dark brown bitumen..." and it was decided to check if this was in fact a genuine residual oil stain or just a remnant of some indigenous organic matter.

The Sidewall Core had not dried out and so it was hoped that any light gasoline/kerosene components would not have been lost due to evaporation. The sample was scraped clean to remove surface mud and then crushed and extracted with dichloroethane solvent which resulted in a fair amount (1605ppm) of medium to dark brown residue. This residue was quite viscous and 'sticky' which was not typical of other sidewall core extracts from the Gippsland Basin.

Before drying and weighing, a sample of this Total Extract was analysed by gas chromatography and the resulting trace is shown in Figure 1. Despite the richness of the extract it is evident from the GC trace that it does not contain any identifiable hydrocarbons that would normally be associated with the presence of a genuine oil stain. Even a heavily biodegraded oil-stain (the sample is within the biodegradation 'window') would still be expected to produce a large hump of unresolved hydrocarbons in the middle part of the GC trace (to the left of the two tall peaks).

It is concluded that the "...brown stain..." does not represent the presence of any former oil accumulation but is possibly some sort of indigenous resinous material.

REFERENCE

PARTRIDGE, A.D., 1990. Palynological analysis of Snook 1, Gippsland Basin. Esso Australia Ltd. Palaeo. Rept. 1990/12.

(BJB153)

TABLE 1 **TOTAL ORGANIC CARBON**

WELL: SNOOK 1

SAMPLE NO.	DEPTH (m)	TYPE	AGE	ZONE	TOC %	CO3 %	DESCRIPTION
78306 Z	1120.0	CRSW	Eocene	U.N.asperus	2.77	6.43	CLYST M-DK BRN, PLASTIC
78306 Y	1137.0	CRSW	"	U.N.asperus	4.76	1.32	CLYST M BRN, BLOCKY, FIRM
78306 U	1201.0	CRSW	"	N.asperus	4.58	2.92	SLTSTN M BRN, MIC, FIRM
78306 T	1206.5	CRSW	"	M.N.asperus	4.78	1.78	SLTSTN M BRN, COALY FRAG
78306 S	1237.0	CRSW	"	L.N.asperus	3.64	1.05	SLTSTN M BRN, CARB, BLOCKY
78306 G	1420.0	CRSW	"	Indeterminate	0.12	0.51	SLTSTN LT GY, GRADES CLYSTN
78306 F	1427.0	CRSW	"	P.asperopolous	3.27	0.56	CLYSTN M BRN, SL STICKY
78306 E	1444.5	CRSW	"	P.asperopolous	5.62	0.40	CLYSTN M BRN, CARB, SOFT
78306 D	1453.0	CRSW	"	P.asperopolous	0.25	1.61	CLYSTN LT GY, STICKY, SOFT

TABLE 2 **ROCKEVAL REPORT**

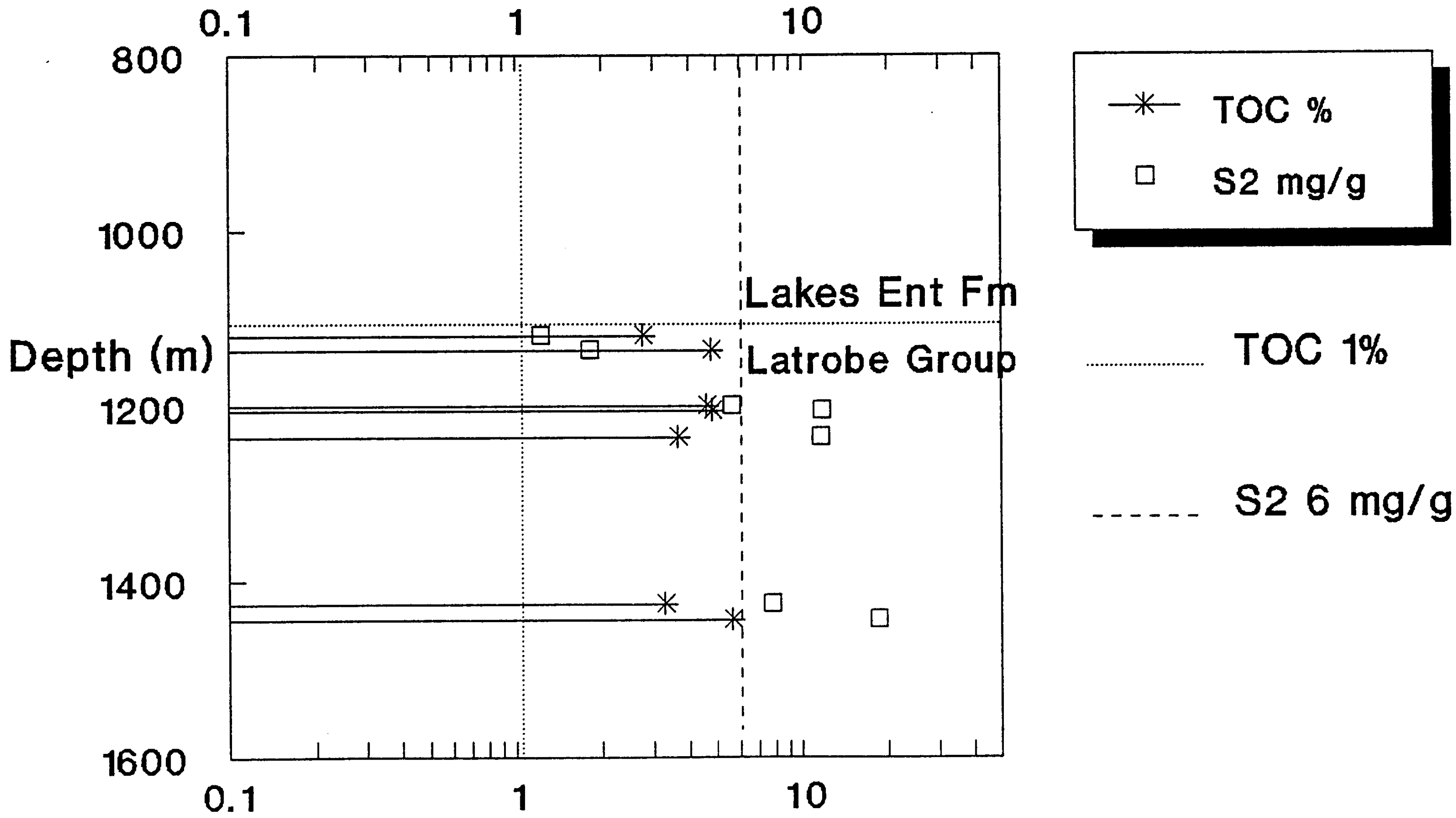
WELL: SNOOK 1

SAMPLE NO.	DEPTH (m)	TOC %	Tmax	S1 mg/g	S2 mg/g	S3 mg/g	HI	OI	HI/OI	ENVIRONMENT
78306 Z	1120.0	2.77	410	0.10	1.20	0.64	43	23	2	Open marine
78306 Y	1137.0	4.76	403	0.20	1.80	0.58	38	12	3	Condensed Marine
78306 U	1201.0	4.58	404	0.35	5.57	1.32	122	29	4	Upper Coastal Plain
78306 T	1206.5	4.78	408	0.84	11.61	0.99	243	21	12	Upper Coastal Plain
78306 S	1237.0	3.64	410	1.20	11.53	0.89	317	24	13	Upper Coastal Plain
78306 F	1427.0	3.27	426	0.39	7.72	0.09	236	3	87	Shallow lacustrine
78306 E	1444.5	5.62	418	1.01	18.41	0.31	328	6	60	Upper C.P. (fungii)

Figure 1

SNOOK 1

Total Organic Carbon & Rockeval



ROCKEVAL MATURATION PLOT Figure 2

SNOOK 1

Gippsland Basin

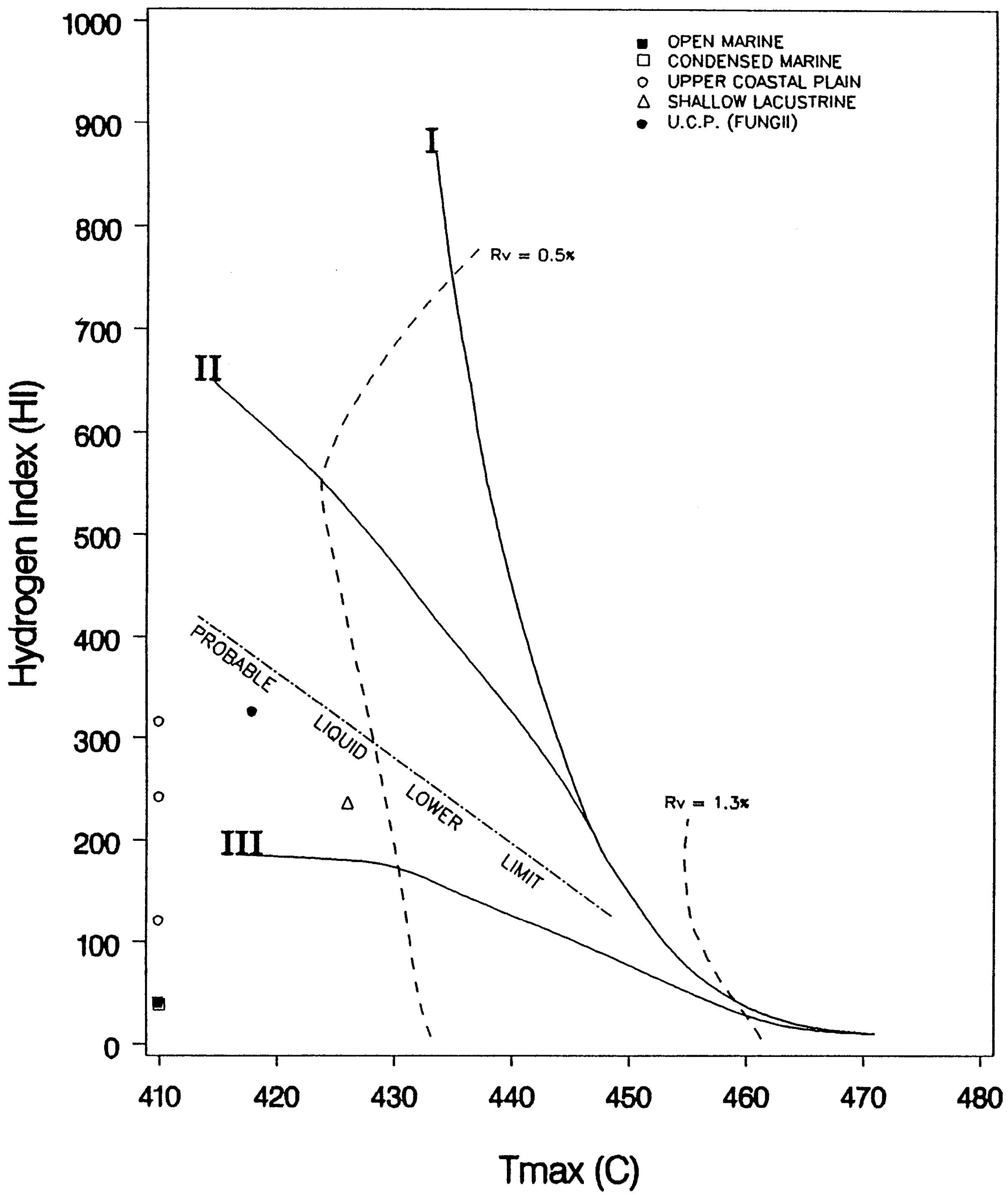


Figure 3.

C12+ Total Extract

Snook 1 SWC 20, 1263.5m

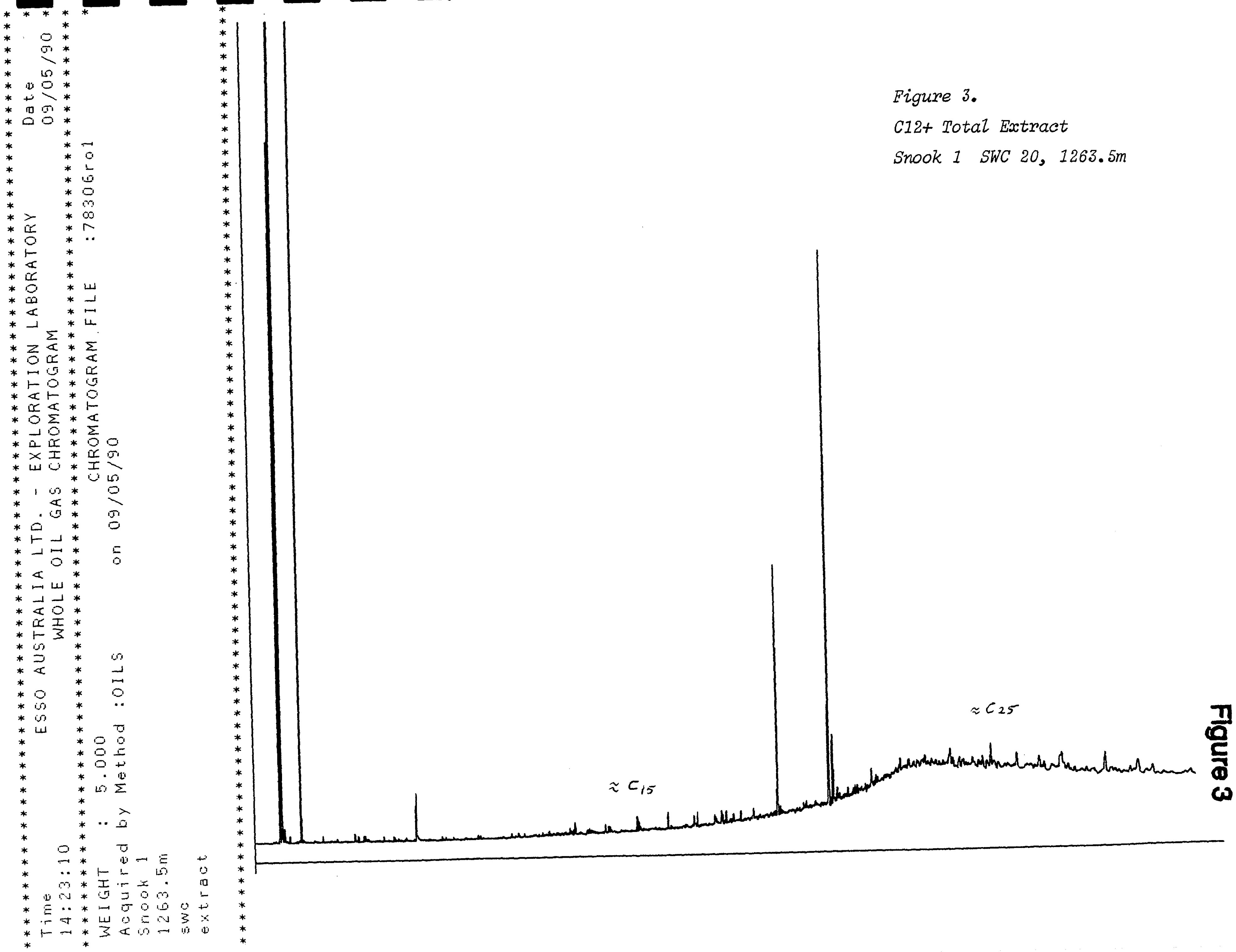


Figure 3

ENCLOSURES

PE902111

This is an enclosure indicator page.
The enclosure PE902111 is enclosed within the container PE902110 at this location in this document.

The enclosure PE902111 has the following characteristics:

ITEM_BARCODE =	PE902111
CONTAINER_BARCODE =	PE902110
NAME =	Structural Cross Section
BASIN =	GIPPSLAND
PERMIT =	
TYPE =	WELL
SUBTYPE =	CROSS_SECTION
DESCRIPTION =	Structural Cross Section
REMARKS =	
DATE_CREATED =	1/06/90
DATE_RECEIVED =	17/07/90
W_NO =	W1019
WELL_NAME =	Snook-1
CONTRACTOR =	ESSO
CLIENT_OP_CO =	ESSO

(Inserted by DNRE - Vic Govt Mines Dept)

PE902112

This is an enclosure indicator page.
The enclosure PE902112 is enclosed within the container PE902110 at this location in this document.

The enclosure PE902112 has the following characteristics:

ITEM_BARCODE = PE902112
CONTAINER_BARCODE = PE902110
NAME = Structure map top coarse clastics
BASIN = GIPPSLAND
PERMIT =
TYPE = SEISMIC
SUBTYPE = HRZN_CONTR_MAP
DESCRIPTION = Structure map top coarse clastics
REMARKS =
DATE_CREATED = 1/06/90
DATE_RECEIVED = 17/07/90
W_NO = W1019
WELL_NAME = Snook-1
CONTRACTOR = ESSO
CLIENT_OP_CO = ESSO

PE902113

This is an enclosure indicator page.
The enclosure PE902113 is enclosed within the container PE902110 at this location in this document.

The enclosure PE902113 has the following characteristics:

ITEM_BARCODE =	PE902113
CONTAINER_BARCODE =	PE902110
NAME =	Structure Map - Lower N asperus
BASIN =	GIPPSLAND
PERMIT =	
TYPE =	SEISMIC
SUBTYPE =	HRZN_CONTR_MAP
DESCRIPTION =	Structure Map - Lower N asperus
REMARKS =	
DATE_CREATED =	1/06/90
DATE_RECEIVED =	17/07/90
W_NO =	W1019
WELL_NAME =	Snook-1
CONTRACTOR =	ESSO
CLIENT_OP_CO =	ESSO

(Inserted by DNRE - Vic Govt Mines Dept)

PE600973

This is an enclosure indicator page.
The enclosure PE600973 is enclosed within the container PE902110 at this location in this document.

The enclosure PE600973 has the following characteristics:

ITEM_BARCODE =	PE600973
CONTAINER_BARCODE =	PE902110
NAME =	Exlog/Formation Evaluation Log
BASIN =	GIPPSLAND
PERMIT =	
TYPE =	WELL
SUBTYPE =	MUD_LOG
DESCRIPTION =	Exlog/Formation Evaluation Log (enclosure from WCR) for Snook-1
REMARKS =	
DATE_CREATED =	25/01/90
DATE_RECEIVED =	17/07/90
W_NO =	W1019
WELL_NAME =	Snook-1
CONTRACTOR =	EXLOG
CLIENT_OP_CO =	ESSO

(Inserted by DNRE - Vic Govt Mines Dept)

PE600974

This is an enclosure indicator page.
The enclosure PE600974 is enclosed within the container PE902110 at this location in this document.

The enclosure PE600974 has the following characteristics:

ITEM_BARCODE =	PE600974
CONTAINER_BARCODE =	PE902110
NAME =	Well Completion Log
BASIN =	GIPPSLAND
PERMIT =	
TYPE =	WELL
SUBTYPE =	COMPLETION_LOG
DESCRIPTION =	Well Completion Log
REMARKS =	
DATE_CREATED =	29/01/90
DATE_RECEIVED =	17/07/90
W_NO =	W1019
WELL_NAME =	Snook-1
CONTRACTOR =	ESSO
CLIENT_OP_CO =	ESSO

(Inserted by DNRE - Vic Govt Mines Dept)

PE902114

This is an enclosure indicator page.
The enclosure PE902114 is enclosed within the container PE902110 at this location in this document.

The enclosure PE902114 has the following characteristics:

ITEM_BARCODE = PE902114
CONTAINER_BARCODE = PE902110
NAME = Synthetic Siesmogram
BASIN = GIPPSLAND
PERMIT =
TYPE = WELL
SUBTYPE = SYNTH_SEISMOGRAM
DESCRIPTION = Synthetic Siesmogram
REMARKS =
DATE_CREATED = 27/02/90
DATE_RECEIVED = 17/07/90
W_NO = W1019
WELL_NAME = Snook-1
CONTRACTOR = ESSO
CLIENT_OP_CO = ESSO

(Inserted by DNRE - Vic Govt Mines Dept)