



EXPLORATION DIVISION

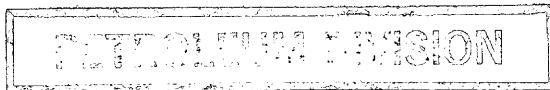
SDA 954

22 AUG 1990

GEOPHYSICAL INTERPRETATION REPORT
VIC/P28
OS88A REGIONAL SURVEY



SHELL AUSTRALIA E. & P. OIL AND GAS



SDA 954

22 AUG 1990

**GEOPHYSICAL INTERPRETATION REPORT
VIC/P28
OS88A REGIONAL SURVEY**

By

SOUTHERN TEAM

MAY 1990

**THE SHELL COMPANY OF AUSTRALIA LIMITED
1 Spring Street, Melbourne, 3001**

CONTENTS

1. INTRODUCTION

2. GEOPHYSICAL INTERPRETATION
 - 2.1 Seismic Data
 - 2.2 Gravity and Magnetism Data
 - 2.3 Seismic Correlation
 - 2.4 Results

3. SUMMARY

LIST OF FIGURES

<u>No.</u>	<u>Title</u>
1.	VIC/P28 Seismic Coverage.
2.	Bathymetry Map.
3.	Seismic Comparison.
4.	Tectonic Elements within Regional Structural Setting.
5.	Stratigraphic Table
6.	Regional Seismic Dip Line OS88A-13.
7.	Regional Seismic Dip Line OS88A-23.
8.	Modelled Gravity Profile 1

ENCLOSURES

1.	Shotpoint Location Map
2.	Residual Magnetic Field Map with Interpretation.
3.	Bouguer Gravity Field Map.
4.	Near Top Jan Juc Formation Time Structure Map
5.	Top Anglesea Siltstone Time Structure Map.
6.	Base Demons Bluff Formation Time Structure Map.
7.	Top Eastern View Formation Time Structure Map.
8.	Top Otway Group/Eumeralla Formation Time Structure Map.
9.	Intra Otway Group Brown/Jade Events Time Structure Map.
10.	Composite Top Basement and Top Otway Gp. Time Structure Map with Onshore Geology.

1. INTRODUCTION

On 22nd December, 1987, Shell was awarded the offshore exploration permit VIC/P28 in the Torquay Sub-basin (Fig. 1). The permit is located at the mouth of Port Phillip Bay and covers an area of 7900km². Water depth in most of the permit area is between 60 and 80 metres (Fig. 2).

At the time of the award, only 485 km of modern seismic data had been acquired within the permit (1972 Hematite Petroleum survey and several 1982/1984 regional BMR lines). Two wells had been drilled in the permit; Nerita-1 drilled by Shell in 1967, and Snail-1 by Hematite in 1973.

In July 1988, Shell acquired a 1552km regional seismic survey over the permit (Encl. 1). The survey was acquired using the G.S.I. vessel M/V Magnificent Creek with gravity and magnetic data being recorded simultaneously. The objectives of the seismic survey and its subsequent interpretation were to outline the tectonic framework of the Torquay Sub-basin, eliminating unprospective regions, and highgrading attractive areas. This report describes the interpretation approach and summarises the results of the geophysical interpretation.

2. GEOPHYSICAL INTERPRETATION

Seismic, gravity, and magnetic data have been used to produce an interpretation of the basin geometry, structural elements, fault patterns, within the Torquay Sub-basin.

2.1 Seismic Data

The modern seismic data coverage in VIC/P28 is shown in Figure 1. The grid consists of 3 vintages of useful seismic. In 1972 Hematite Petroleum acquired 225 km of 24-fold data. This was added to in 1982 and 1984 by the BMR who acquired 260 km of regional data within the permit. The quality of this data was significantly improved by Shell in-house reprocessing using phase deconvolution and K/F filtering. Prior to 1972 a small single fold seismic survey was acquired by Shell in 1966, and a three-fold survey by Hematite in 1969. This data is considered unusable.

In 1988 Shell acquired 1552 km of seismic data using the GSI vessel M/V. Magnificent Creek. This acquisition used a 37.5 litre sleeve airgun source array and a 300 channel, 3750 m digital fibre optic cable. Processing was performed by GSI and includes K/F filtering and DMO. This new data is of a superior quality to that previously acquired (Fig. 3) and has successfully imaged much deeper section.

The improved quality of this new data, combined with the gravity and magnetic data has allowed the delineation of three main tectonic elements within the permit; a basin deep (herein called the 'Torquay Basin Deep'), a basement terrace (now called the 'Snail Terrace'), and areas of shallow basement (Fig. 4). However the changing orientation of the major fault pattern, especially between the basin deep and terrace means that the line orientation is often oblique to the dip and strike, hence data quality is not always optimal. The high reflectivity of coals within the Eastern View Formation also produces strong multiples within the seismically bland Otway Group.

2.2 Gravity and Magnetics Data

In conjunction with the 1988 seismic survey, EDCON acquired marine gravity and sea-magnetometer data over the same grid as the seismic survey. This raw data was forwarded to the Compagnie General de Geophysique (CGG) main processing centre in Massy, France, where it was processed and interpreted.

The sea-magnetometer data was corrected and levelled, removing the regional magnetic field and correcting mistie problems. The filtered residual field values were gridded and contoured, (Encl. 2).

The gravity data was processed, correcting for drift, latitude, water depth, and free air to produce corrected Bouguer anomaly values. An examination of misties at the profile intersections showed a number of the lines were systematically lower than the other profiles. These lower profiles were acquired after mechanical work on the gravimeter, and the problem could only be resolved by application of a levelling program.

The gravity data is believed to be valid within the central part of the survey area but in the western part the Bouguer values may be too low. Fortunately this western area is a region of shallow basement and is

considered unprospective. Once levelled, the Bouguer gravity data was gridded and contoured, (Encl. 3). A first vertical derivative Bouguer anomaly map was also produced.

2.3 Seismic Correlation

The interpretation of stratigraphic levels (Fig. 5) was based on ties to Snail-1 and Nerita-1 using zero phase synthetic seismograms. Eight horizons were interpreted; Near Top Jan Juc Formation, Top Anglesea Siltstone, Base Demons Bluff Formation, Top Eastern View Formation, Top Otway Group (Top Eumeralla Fm.), two intra-Otway Group events, and Top Basement (where possible). Time structure maps at each of these levels are shown in Enclosures 4-10. Examples of interpreted seismic lines illustrating the seismic reflection characters used for correlation are shown in Figs. 6 and 7.

The near Top Jan Juc Formation, is picked as a strong white peak at the top of a reflective package. The Top Anglesea Siltstone is picked at the base of this reflective interval. The Base Demons Bluff Formation is a low amplitude event within a set of low amplitude reflections. This appears to be a conformable boundary. The top Eastern View Formation is an angular unconformity at the top of high amplitude reflections associated with coals. There appear to be angular relationships within the Eastern View Formation, however the scope of this exercise did not permit the extensive correlation of these events.

The Top Otway Group is the deepest event which can be tied from the two wells. This was picked at the base of the high amplitude package of reflectors. Subtle angularity is evident at this level. An intra-Otway Group event (Brown) was interpreted in the Torquay Basin Deep. This was picked at the base of a seismically bland zone which generally varies between 200 and 800 msec thick. This event shows minor angularity. Another intra-Otway Group event (Jade) was interpreted on the Snail Terrace. This was also picked at the base of a bland zone, however angularity is far more pronounced in the Snail Terrace area (Figs. 6, 7). It is not known whether these two intra-Otway events are the same stratigraphic level due to the inability to correlate across the Snail Terrace bounding fault system. The bland nature of the overlying package may be consistent with the lithologically monotonous nature of the Eumeralla Formation, thus the brighter reflections below the intra-Otway event may be the Pretty Hill Formation equivalent, as known in the western Otway Basin.

Shallow basement is characterised by a highly irregular, high amplitude reflection. In the terrace area, basement is mapped as the strong amplitude event beneath which there is little or no coherent data. The "smoothed" nature of the basement reflection compared with the overlying sequence may be due to signal smearing related to the high degree of faulting.

The biggest problem encountered during this interpretation was fault correlation between the dip lines. The large line spacing (minimum 5 km between dip lines) meant that it was necessary to jump correlate faults between dip lines, based on reflection character on either side of the fault. Fault ties to the strike lines were often at considerable depth (greater than 3 seconds) where data quality is quite poor making some fault correlations speculative.

2.4 Results

The magnetic field within VIC/P28 shows two distinct magnetic zones (Encl. 2). In the central and northern parts of the permit the magnetic pattern is almost featureless with the exception of some isolated anomalies related to shallow volcanics and deeper intrusives. In the western, southern, and eastern parts there is a profusion of high amplitude events related to shallow magnetic basement. The lack of signature from the Snail Terrace area indicates the strong event picked on seismic is probably non-magnetic basement and not of volcanic/intrusive origin. The magnetic data also supports the interpretation of shallow basement to the southwest and southeast of the Terrace area. Numerous features interpreted from seismic to be shallow volcanics have a magnetic response. Several deeper high amplitude seismic events correspond with low frequency magnetic anomalies indicating their probable intrusive origin.

Three gravity profiles across the central part of the permit have been modelled. The Bouguer gravity field and modelled profile 1 are shown in Enclosure 3 and Figure 8. This modelling demonstrates the presence of shallow basement and two fault bound regions of thicker sedimentary section (the half-graben style Snail Terrace and the Torquay Basin Deep). When a density contrast of 0.4 g/cc was used in the modelling, depth to basement was calculated to be in the order of 1000 m in the regions of shallow basement and 4000 m in the basin deep. This model used the assumptions that basement is crystalline, with density = 2.67 g/cc, and the density of the sediments = 2.37 g/cc. Profile 1 was remodelled with a density contrast of 0.3 g/cc. This produced a depth to basement in the basin deep greater than 5000 m. Basement has not been penetrated by the drill bit in the Torquay Sub-basin, however the onshore geology of the Mornington Peninsula (Encl. 10) suggests basement may consist of low grade metasediments - phyllites, schists, etc. - thus the assumption of crystalline basement may be incorrect. A lower density contrast would result in basement being at least 5000-6000 m deep in the central area of VIC/P28.

The Bouguer gravity field supports the interpretation from seismic of the main structural elements; the Torquay Basin Deep, Snail Terrace and areas of shallow basement. Despite the low frequency contouring normally associated with gravity mapping, the structural grain interpreted from seismic was also evident. The presence of the NW-SE striking structural grain can be seen on the Snail Terrace, as can the E-W and SW-NE grain in the Torquay Basin Deep. The "gravity nose" seen in the northern area (Encl. 3) is mapped seismically as a structural high.

The structure maps shown (Enclosures 4 to 10) are based on seismic data. However, the seismic interpretation was made easier by the availability of the other geophysical data, especially in the confirmation of basement on the Snail Terrace and recognition of shallow volcanics and intrusives in the area.

3. SUMMARY

The mapping of seismic within the Torquay Sub-basin has shown the region to be structurally complex, and has revealed several provinces each with individual structural styles. Despite uncertainties posed by interpretation on such a regional scale, the main structural trends have been identified. These include areas of shallow basement in the south and east of the permit, the heavily faulted Snail Terrace and the Torquay Basin Deep (Encls. 4-10).

143°30' 144°00' 144°30' 145°00'

HINDHAUGH CREEK-1

ANGLESEA-1

NERITA-1

OLANGOLAH-1

SNAIL-1

KONKON-1

38°30'

39°00'

BASS BASIN

801741 010

- SHELL 1988 SURVEY
- HEMATITE 1972 SURVEY
- BMR 1982 & 1984 SURVEYS

0 20KM

OS88A-13 (FIG.5)

OS88A-23 (FIG.6)



SHELL-AUSTRALIA
E & P. OIL AND GAS

Author: EXO

VIC/P28 SEISMIC COVERAGE

Report No.: SDA 954

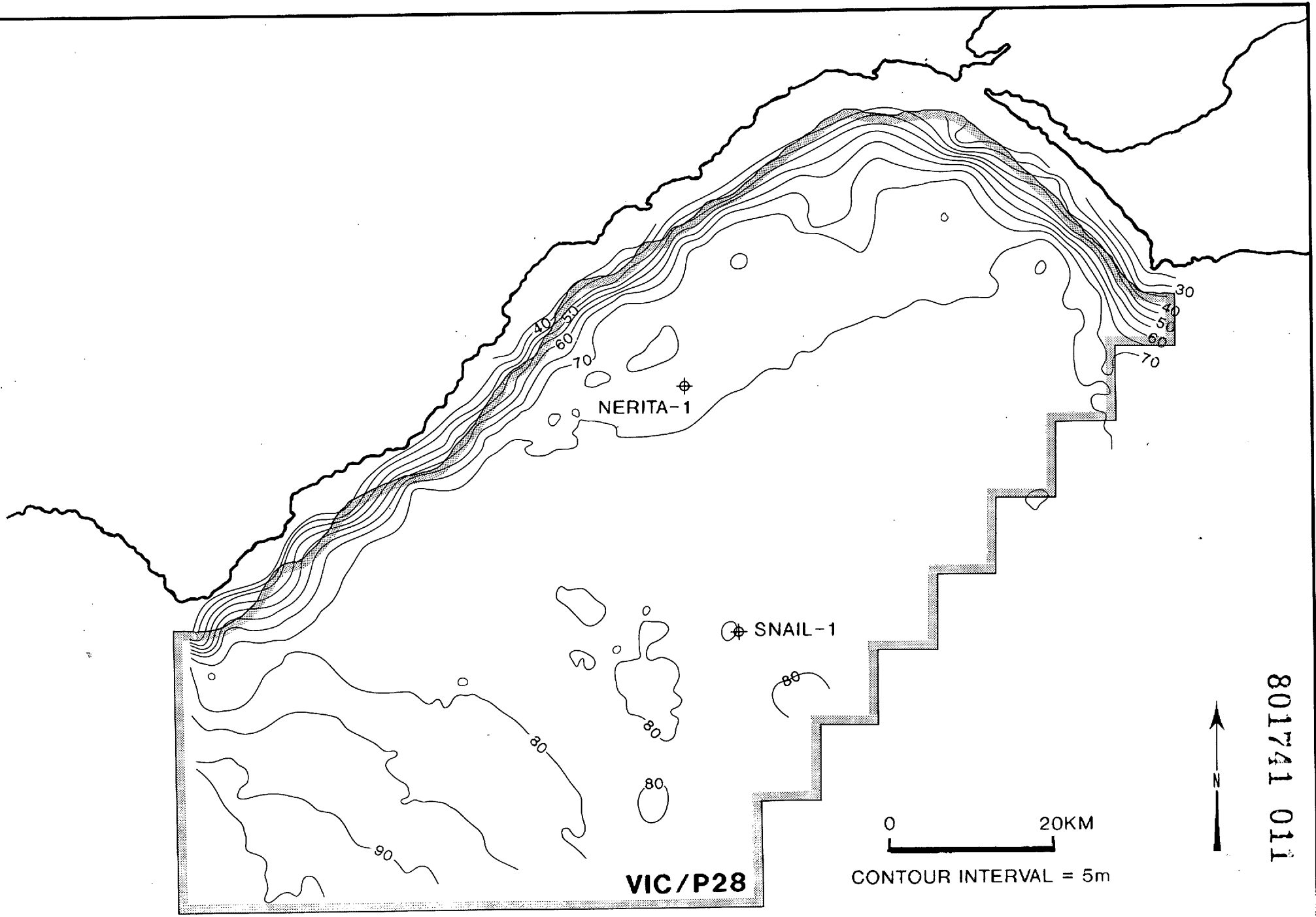
Date: OCTOBER 1989

Drawing No.: 25677

VIC/P28 TORQUAY SUB-BASIN

Figure
1

VIC/P28 TORQUAY SUB BASIN
BATHYMETRY MAP



801741 011

This is Page Number **801741_012X**

This is an enclosure indicator page.

The page that follows this page is an uncatalogued
fold-out with page number:

801741_012Y

and is enclosed within the document PE801741 at
this page.

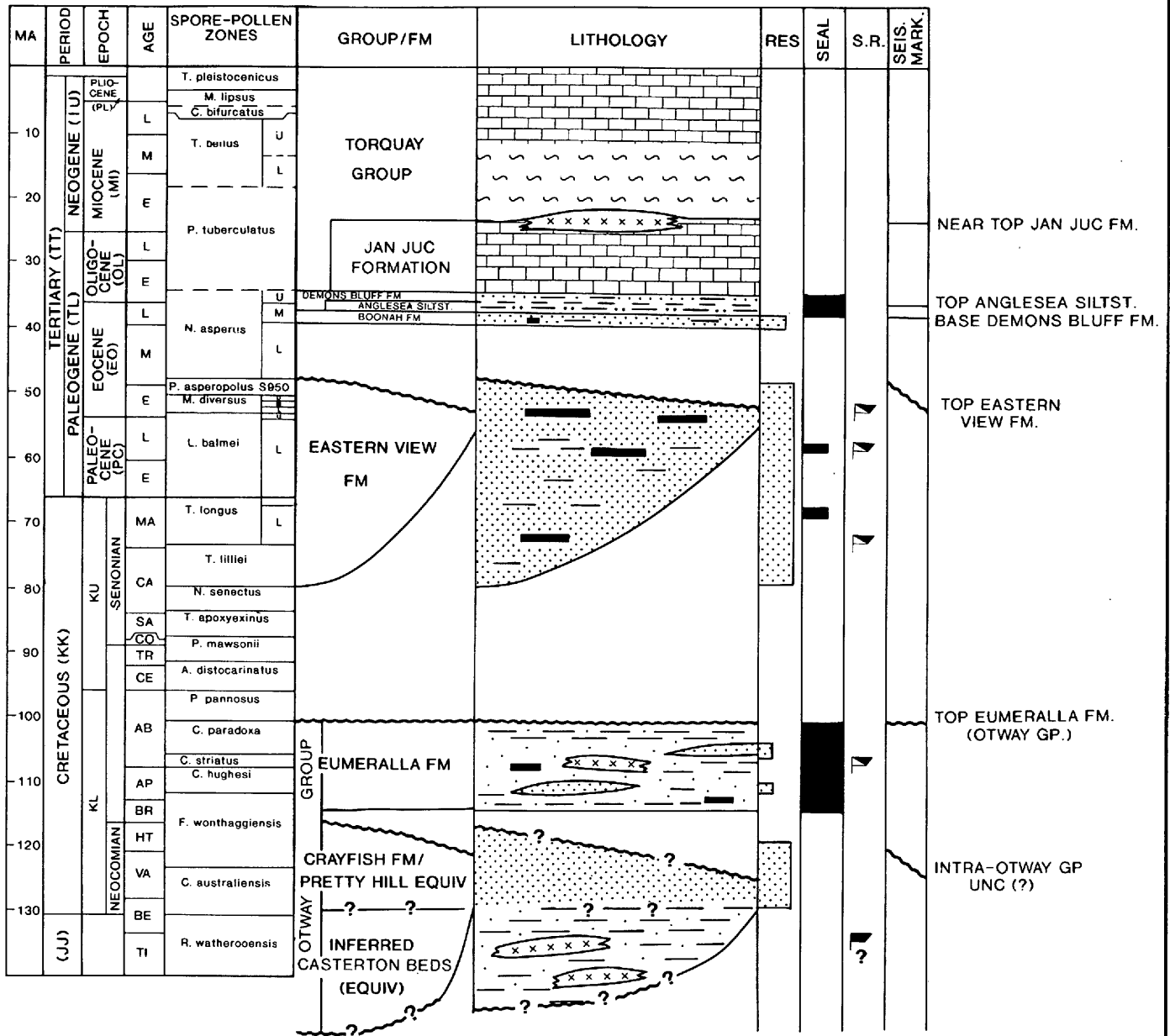
This is Page Number **801741_013X**

This is an enclosure indicator page.

The page that follows this page is an uncatalogued
fold-out with page number:

801741_013Y

and is enclosed within the document PE801741 at
this page.



This is Page Number **801741_015X**

This is an enclosure indicator page.

The page that follows this page is an uncatalogued
fold-out with page number:

801741_015Y

and is enclosed within the document PE801741 at
this page.

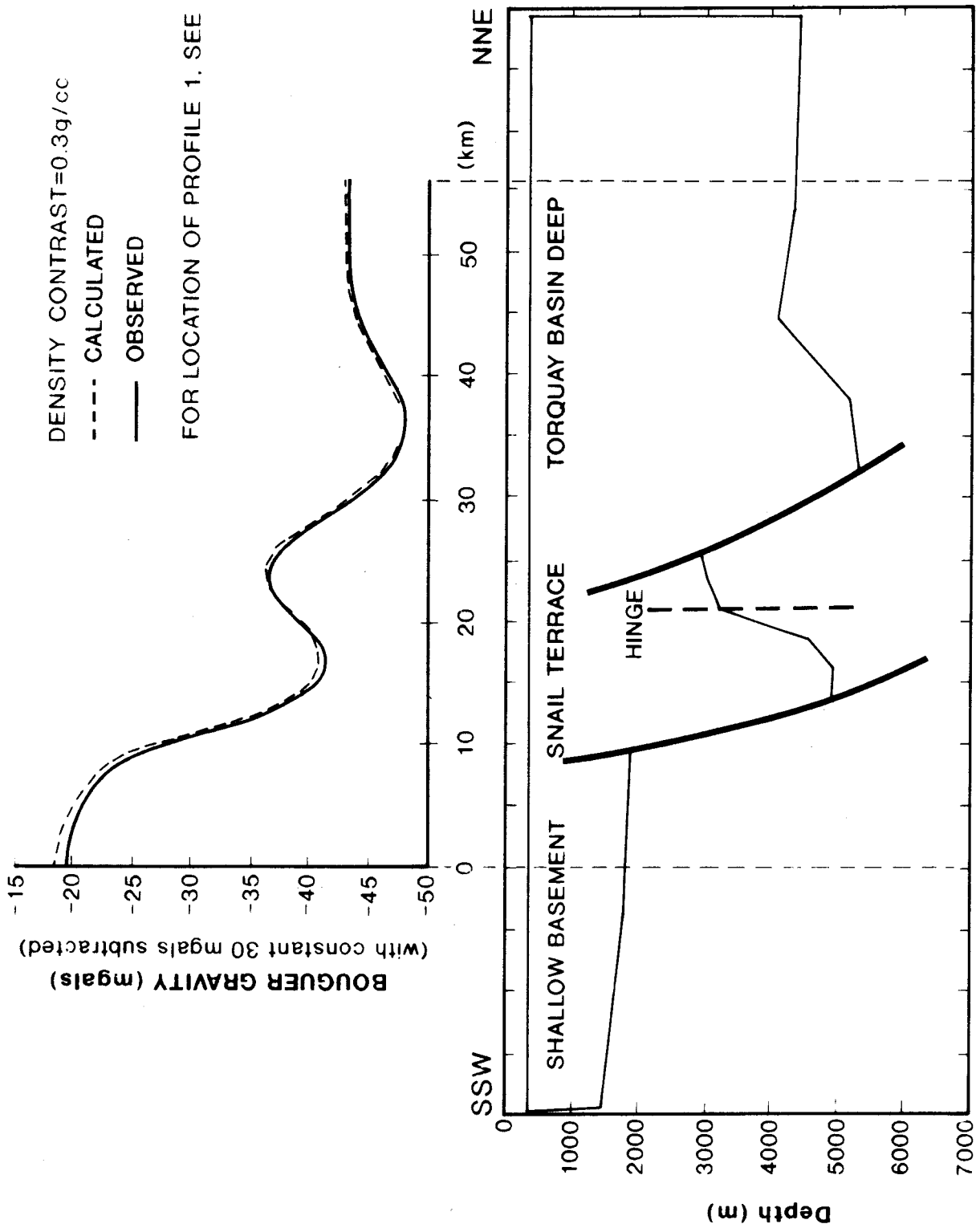
This is Page Number **801741_016X**

This is an enclosure indicator page.

The page that follows this page is an uncatalogued
fold-out with page number:

801741_016Y

and is enclosed within the document PE801741 at
this page.



Profile One



SHELL-AUSTRALIA
OIL AND GAS

TORQUAY SUB-BASIN

MODELLLED GRAVITY PROFILE 1

Figure
8

Author: EXC

Report No.: SDA 954

Date: Oct. 1989

Drawing No.: 25665

PE801742

This is an enclosure indicator page.
The enclosure PE801742 is enclosed within the
container PE801741 at this location in this
document.

The enclosure PE801742 has the following characteristics:

ITEM_BARCODE = PE801742
CONTAINER_BARCODE = PE801741
NAME = VIC/P28 Shot Point Base Map
BASIN = OTWAY
ONSHORE? = N
DATA_TYPE = SEISMIC
DATA_SUB_TYPE = NAV_MAP
DESCRIPTION = Torquay Sub-Basin VIC/P28 Shot-Point
Base Map Enclosure 1Drawing No. 25372
Scale 1:250000
REMARKS =
DATE_WRITTEN = 30-JUN-1990
DATE_PROCESSED =
DATE_RECEIVED = 22-AUG-1990
RECEIVED_FROM = Shell Australia Exploration and
Production Oil and Gas
WELL_NAME =
CONTRACTOR =
AUTHOR =
ORIGINATOR =
TOP_DEPTH =
BOTTOM_DEPTH =
ROW_CREATED_BY = DN07_SW

(Inserted by DNRE - Vic Govt Mines Dept)

PE801743

This is an enclosure indicator page.
The enclosure PE801743 is enclosed within the
container PE801741 at this location in this
document.

The enclosure PE801743 has the following characteristics:

ITEM_BARCODE = PE801743
CONTAINER_BARCODE = PE801741
NAME = VIC/P28 Magnetic Field Map
BASIN = OTWAY
ONSHORE? = N
DATA_TYPE = OTHER_SRVY
DATA_SUB_TYPE = MAG_MAP
DESCRIPTION = Torquay Sub-Basin VIC/P28 Residual
Magnetic Field Map with Interpretation
Enclosure 2 Drawing No. 25886 Scale
1:100 000
REMARKS =
DATE_WRITTEN = 31-JAN-1990
DATE_PROCESSED =
DATE_RECEIVED = 22-AUG-1990
RECEIVED_FROM = Shell Australia Exploration and
Production Oil and Gas
WELL_NAME =
CONTRACTOR =
AUTHOR =
ORIGINATOR =
TOP_DEPTH =
BOTTOM_DEPTH =
ROW_CREATED_BY = DN07_SW

(Inserted by DNRE - Vic Govt Mines Dept)

PE801744

This is an enclosure indicator page.
The enclosure PE801744 is enclosed within the
container PE801741 at this location in this
document.

The enclosure PE801744 has the following characteristics:

ITEM_BARCODE = PE801744
CONTAINER_BARCODE = PE801741
NAME = VIC/P28 Gravity Field Map
BASIN = OTWAY
ONSHORE? = N
DATA_TYPE = OTHER_SRVY
DATA_SUB_TYPE = GRAVITY_MAP
DESCRIPTION = Torquay Sub-Basin Bouguer Gravity Field
Map Enclosure 3 Drawing No. 25887 Scale
1:100 000
REMARKS =
DATE_WRITTEN = 31-JAN-1990
DATE_PROCESSED =
DATE_RECEIVED = 22-AUG-1990
RECEIVED_FROM = Shell Australia Exploration and
Production Oil and Gas
WELL_NAME =
CONTRACTOR =
AUTHOR =
ORIGINATOR =
TOP_DEPTH =
BOTTOM_DEPTH =
ROW_CREATED_BY = DN07_SW

(Inserted by DNRE - Vic Govt Mines Dept)

PE801745

This is an enclosure indicator page.
The enclosure PE801745 is enclosed within the
container PE801741 at this location in this
document.

The enclosure PE801745 has the following characteristics:

ITEM_BARCODE = PE801745
CONTAINER_BARCODE = PE801741
NAME = VIC/P28 Time Structure Map
BASIN = OTWAY
ONSHORE? = N
DATA_TYPE = SEISMIC
DATA_SUB_TYPE = HRZN_CONTR_MAP
DESCRIPTION = Torquay Sub-Basin Near Top Jan Juc
Formation Time Structure Map Enclosure
4 Drawing No. 25685 Scale 1:100 000
REMARKS =
DATE_WRITTEN = 30-SEP-1989
DATE_PROCESSED =
DATE_RECEIVED = 22-AUG-1990
RECEIVED_FROM = Shell Australia Exploration and
Production Oil and Gas
WELL_NAME =
CONTRACTOR =
AUTHOR =
ORIGINATOR =
TOP_DEPTH =
BOTTOM_DEPTH =
ROW_CREATED_BY = DN07_SW

(Inserted by DNRE - Vic Govt Mines Dept)

PE801746

This is an enclosure indicator page.
The enclosure PE801746 is enclosed within the
container PE801741 at this location in this
document.

The enclosure PE801746 has the following characteristics:

ITEM_BARCODE = PE801746
CONTAINER_BARCODE = PE801741
NAME = VIC/P28 Time Structure Map
BASIN = OTWAY
ONSHORE? = N
DATA_TYPE = SEISMIC
DATA_SUB_TYPE = HRZN_CONTR_MAP
DESCRIPTION = Torquay Sub-Basin Top Anglesea
Siltstone Time Structure Map Enclosure
5 Drawing No. 25684 Scale 1:100 000
REMARKS =
DATE_WRITTEN = 30-SEP-1989
DATE_PROCESSED =
DATE_RECEIVED = 22-AUG-1990
RECEIVED_FROM = Shell Australia Exploration and
Production Oil and Gas
WELL_NAME =
CONTRACTOR =
AUTHOR =
ORIGINATOR =
TOP_DEPTH =
BOTTOM_DEPTH =
ROW_CREATED_BY = DN07_SW

(Inserted by DNRE - Vic Govt Mines Dept)

PE801747

This is an enclosure indicator page.
The enclosure PE801747 is enclosed within the
container PE801741 at this location in this
document.

The enclosure PE801747 has the following characteristics:

ITEM_BARCODE = PE801747
CONTAINER_BARCODE = PE801741
NAME = VIC/P28 Time Structure Map
BASIN = OTWAY
ONSHORE? = N
DATA_TYPE = SEISMIC
DATA_SUB_TYPE = HRZN_CONTR_MAP
DESCRIPTION = Torquay Sub-Basin Base Demons Bluff
Formation Time Structure Map Enclosure
6 Drawing No. 25681 Scale 1:100 000
REMARKS =
DATE_WRITTEN = 30-SEP-1989
DATE_PROCESSED =
DATE_RECEIVED = 22-AUG-1990
RECEIVED_FROM = Shell Australia Exploration and
Production Oil and Gas
WELL_NAME =
CONTRACTOR =
AUTHOR =
ORIGINATOR =
TOP_DEPTH =
BOTTOM_DEPTH =
ROW_CREATED_BY = DN07_SW

(Inserted by DNRE - Vic Govt Mines Dept)

PE801748

This is an enclosure indicator page.
The enclosure PE801748 is enclosed within the
container PE801741 at this location in this
document.

The enclosure PE801748 has the following characteristics:

ITEM_BARCODE = PE801748
CONTAINER_BARCODE = PE801741
NAME = VIC/P28 Time Structure Map
BASIN = OTWAY
ONSHORE? = N
DATA_TYPE = SEISMIC
DATA_SUB_TYPE = HRZN_CONTR_MAP
DESCRIPTION = Torquay Sub-Basin Top Eastern View
Formation Time Structure Map Enclosure
7 Drawing No. 25683 Scale 1:100 000
REMARKS =
DATE_WRITTEN = 30-SEP-1989
DATE_PROCESSED =
DATE_RECEIVED = 22-AUG-1990
RECEIVED_FROM = Shell Australia Exploration and
Production Oil and Gas
WELL_NAME =
CONTRACTOR =
AUTHOR =
ORIGINATOR =
TOP_DEPTH =
BOTTOM_DEPTH =
ROW_CREATED_BY = DN07_SW

(Inserted by DNRE - Vic Govt Mines Dept)

PE801749

This is an enclosure indicator page.
The enclosure PE801749 is enclosed within the
container PE801741 at this location in this
document.

The enclosure PE801749 has the following characteristics:

ITEM_BARCODE = PE801749
CONTAINER_BARCODE = PE801741
NAME = VIC/P28 Time Structure Map
BASIN = OTWAY
ONSHORE? = N
DATA_TYPE = SEISMIC
DATA_SUB_TYPE = HRZN_CONTR_MAP
DESCRIPTION = Torquay Sub-Basin Top Otway Group /
Eumeralla Formation Time Structure Map
Enclosure 8 Drawing No. 25859 Scale
1:100 000
REMARKS =
DATE_WRITTEN = 31-DEC-1989
DATE_PROCESSED =
DATE_RECEIVED = 22-AUG-1990
RECEIVED_FROM = Shell Australia Exploration and
Production Oil and Gas
WELL_NAME =
CONTRACTOR =
AUTHOR =
ORIGINATOR =
TOP_DEPTH =
BOTTOM_DEPTH =
ROW_CREATED_BY = DN07_SW

(Inserted by DNRE - Vic Govt Mines Dept)

PE801750

This is an enclosure indicator page.
The enclosure PE801750 is enclosed within the
container PE801741 at this location in this
document.

The enclosure PE801750 has the following characteristics:

ITEM_BARCODE = PE801750
CONTAINER_BARCODE = PE801741
NAME = VIC/P28 Time Structure Map
BASIN = OTWAY
ONSHORE? = N
DATA_TYPE = SEISMIC
DATA_SUB_TYPE = HRZN_CONTR_MAP
DESCRIPTION = Torquay Sub-Basin Intra-Otway Group
Brown / Jade Events Time Structure Map
Enclosure 9 Drawing No. 25682 Scale
1:100 000
REMARKS =
DATE_WRITTEN = 31-OCT-1989
DATE_PROCESSED =
DATE_RECEIVED = 22-AUG-1990
RECEIVED_FROM = Shell Australia Exploration and
Production Oil and Gas
WELL_NAME =
CONTRACTOR =
AUTHOR =
ORIGINATOR =
TOP_DEPTH =
BOTTOM_DEPTH =
ROW_CREATED_BY = DN07_SW

(Inserted by DNRE - Vic Govt Mines Dept)

PE801751

This is an enclosure indicator page.
The enclosure PE801751 is enclosed within the
container PE801741 at this location in this
document.

The enclosure PE801751 has the following characteristics:

ITEM_BARCODE = PE801751
CONTAINER_BARCODE = PE801741
NAME = VIC/P28 Time Structure Map
BASIN = OTWAY
ONSHORE? = N
DATA_TYPE = SEISMIC
DATA_SUB_TYPE = HRZN_CONTR_MAP
DESCRIPTION = Torquay Sub-Basin Composite Top
Basement and Top Otway Group Time
Structure Map with onshore geology
Enclosure 10 Drawing No. 25864 Scale
1:100 000
REMARKS =
DATE_WRITTEN = 31-DEC-1989
DATE_PROCESSED =
DATE_RECEIVED = 22-AUG-1990
RECEIVED_FROM = Shell Australia Exploration and
Production Oil and Gas
WELL_NAME =
CONTRACTOR =
AUTHOR =
ORIGINATOR =
TOP_DEPTH =
BOTTOM_DEPTH =
ROW_CREATED_BY = DN07_SW

(Inserted by DNRE - Vic Govt Mines Dept)