2045

Geological Study

PEP 118 - Otway Basin

TEXT

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PEP 118

GEOLOGICAL STUDY

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1. INTRODUCTION

This report comprises two major sections.

A. Geological Field Trip:
Stokes River and Merino High. (Friday 2nd June, 1989)

B. Geological Review.

Each section is treated separately and both reach independent conclusions. The report, however combines the results of both sections and highlights those areas where our geological perception and understanding is limited or lacking.

Under the constraints of this report, no attempt is made to develop the geological concepts beyond their basic ideas, however the proposed recommendations, if acted upon and carried out to completion, will aid in developing a complete and comprehensive geological picture of the permit and indicate new directions for further hydrocarbon exploration.

2. RECOMMENDATIONS

The following recommendations are suggested as a guide for future exploration in PEP 118:

1. Exploration should be restricted to the north-eastern corner of PEP 118 and centred around the township of Digby.

2. The semi-regional Crawford River Seismic Survey has identified a western extension of the Ardonachie Trough. A detailed seismic survey should be planned to infill the original Crawford River Seismic Survey so that the complicated structural nature of this area is better understood, particularly the relationship between the Ardonachie Trough in PEP 105, the Penola Trough in PEP 119 and the existance of an inferred transfer fault.

   Good seismic quality must be maintained, as in the Crawford River Seismic Survey, and interpretable data must not be lost (ref: Stokes River Seismic Survey and regional seismic line B-B[1]). Regional deep seismic sections should be acquired to understand properly the extensional tectonic evolution and structural patterns of the region.

   If possible, balanced geoseismic sections should be attempted in order to derive a model which can make both geometrical sense and obey stratigraphic constraits, (Gibbs, 1983).

3. While stratigraphy in the north-eastern corner of PEP 118 is not readily identifiable, it is assumed the half-graben rift valley, determined from recent seismic interpretation, contains a sequence of Eumeralla, Pretty Hill and Casterton sediments, overlying Basement.

N.B. Recently the DITR approached the operator and suggested the possibility of the Government drilling a stratigraphic well. In order to gain maximum value from a stratigraphic bore, the operator suggested a location (See regional seismic line B-B[1]). At this location basement will be drilled at a depth of 1400m and will enable the entire stratigraphy of the Western Ardonachie Trough to be tested.

Such a well will increase our understanding of:

(a) The seal and source potential of the Upper Pretty Hill Formation Shales.

(b) The reservoir potential of the Lower Pretty Hill Formation Sandstone Units.

(c) The source potential of the Casterton Formation.

Geological supervision of the well would be required with cuttings and cores fully described and stored for future analysis. The well should be fully logged and a velocity survey undertaken to tie well data to seismic data.

4. A comprehensive source rock study of the Eumeralla and Belfast sediments should be undertaken. An initial study should include, where possible:

- Palynological studies to confirm the Eumeralla and/or Belfast age of sediments selected for the source rock study.
- Determination of Dispersed Organic Matter, (DOM)
- Determination of Total Organic Carbon, (TOC)
- Vitrinite Reflectance
- Kerogen Type
- Rock-Eval Pyrolysis

5. An attempt should be made to construct geohistory diagrams of selected wells within PEP 118 and 105.

6. A source rock data bank of Upper Pretty Hill Formation shale and Casterton Formation sediments should be organised and collated to aid our understanding of the source rock potential of these units.

7. Due to the shallow nature of the Eumeralla sediments, future seismic shot hole cuttings from surveys over the north-eastern corner of PEP 118 should be caught and retained for future analysis.

8. Shallow Department of Industry, Technology and Resources, and private well bores identified across the study area should be investigated further to determine whether samples are available for further analytical studies.

9. Due to the poor preservation of surface samples and the lack of surface outcrop exposure, additional samples could be obtained by shallow coring or augering across the Merino High region.

10. Western Mining Corporation (WMC), as operator of the mining lease that covered the north-eastern corner of PEP 118 and the Merino High, should be approached in an effort to obtain cuttings and core data from the investigatory coal bores they drilled over the study area in the early 1980's. Log data and any supplementary geological data produced by WMC should be acquired in addition to the cuttings/core samples.

SECTION A

GEOLOGICAL FIELD TRIP - STOKES RIVER

AND MERINO HIGH

Friday 2nd June, 1989

A.3. AIMS

The field trip had three goals.

1. Locate and determine the surface expression of a "major" fault, identified in the recent regional Crawford River Seismic Survey, Line CR 88-3/3A, (fig.3).

2. Obtain surface samples of Eumeralla Formation (as indicated on the 1:62360 Dartmoor and 1:25000 Hamilton Geological Sheets), for the purpose of:-

    a) Age Dating

    b) Source rock potential

3. Determine what percentage of surface outcrop exposure is present over the Stokes River and Merino High areas.

A.4. HISTORICAL REVIEW

The Merino High represents a major structural unit within the western onshore Otway Basin. Lower Cretaceous sediments are shown to outcrop over the 1100km^2 Merino-Casterton-Coleraine area, which occupies a broadly triangular tableland bounded by the Kanawinka Fault to the southwest, the Hotspur and Grassdale Monoclines to the south and southeast, and the Coleraine Fault to the north, (fig.4), (J.G. Douglas et al. 1988).

Exploration within the study area is very limited. The region is covered by numerous shallow bores, (Enclosure 1) whilst only Wataepoolan-2, Hotspur-1 and Myaring-2 represent deep stratigraphic bores of significance within the area and Casterton-1 represents the only exploration well, (Enclosure 2).

Seismic coverage across the study area is limited to the Crawford River Seismic Survey, and regional 1972 Shell lines, (Enclosure 2).

A 5. DISCUSSION

The field trip comprised a one day excursion to the Stokes River and Merino High regions in PEP's 118 and 119 centred around the townships of Digby and Merino, (Enclosure 3).

All three aims of the field trip were fulfilled by the excursion and a series of photographs, (Enclosure 4 and figs. 5-20) highlight the major features of importance observed throughout the region.

The photographs included in this report serve to demonstrate:

a) The surface expression of the "major" fault, identified in CR88-3/3A.
b) The surface outcrop exposures observed on the field trip.
c) The percentage of surface outcrop exposure seen throughout the region.

A.5.1 CR88-3/3A Fault

Whilst a major fault is identified on seismic line CR88-3/3A, (fig.3) that clearly affects the basement sediments, there does not appear to be any apparent surface expression of this fault. This fact is highlighted in Figures 5 and 6.

A.5.2 Surface Outcrop Exposures

Outcrop data was observed at several exposures, (Enclosure 4). Dip and strike readings were measured where bedding planes could identified and outcrop samples taken for source rock analysis rock analysis (Appendix 3), petrological studies (Appendix 4) age dating (Appendix 5)

Figures 5 and 6 were taken to display any surface expression of the fault identified on CR88-3/3A (Fig 3).

Both photographs show no surface expression despite the evidence of a major basement movement.

Figures 7 and 8 display a bedding plane of ferruginous sandstone observed near the Mackenzie Creek Road. The published geological map, (fig. 4) identifies this exposure as Pebble Point Formation, and indeed, the ferruginous nature of the sandstone is characteristic of Pebble Point Formation sediments.

Palynological age dating however identified a lean Albian Assemblage, (see Appendix 5) implying sediments of Eumeralla Formation age. The identification of Eumeralla Formation rather than Pebble Point Formation sediments at this location casts a doubt over the reliability of the published surface gological map.

Source rock analysis of the outcrop implies a lean source rock low in dispersed organic matter (DOM) though marginally mature for hydrocarbon generation.

Figure 9 displays a roadside cutting of thinly bedded, light grey, massive mudstone. No sedimentary structures were identified in the sediments. Subsequent petrological studies defined the outcrop as a silty limestone with silt grade quartz and feldspar in a contiguous mosaic of fine grained carbonate, (Appendix 4).

Whilst the published geological map infers the presence of Eumeralla Formation sediments at this location, palynological age dating was unable to confirm an age although abundant inertinite may suggest deep weathering of a pre-Quaternary rock, (Appendix 5).

A silty limestone has not previously been identified within Cretaceous sediments of the Otway Basin though it has been identified in mid to late Tertiary sediments, particularly within the Nirranda and/or Heytesbury Groups. If it is Tertiary, its recognition again conflicts with the previously mapped surface geology.

Figures 10 and 11 demonstrate the poor outcrop exposure generally observed throughout the study area. The upper bed is described as a massive, hard, fine grained, moderatly sorted, well cemented sandstone overlying a soft, friable sandstone bed. Palynological studies show it to be totally barren, (only modern pollen and spores were recorded and presumed to be modern soil contaminants) although the published surface geology map infers sediments of Eumeralla Formation age.

Figure 12, and subsequent Figures, 13-16 show an example of a good outcrop exposure. The exposure displays numerous interbedded conglomeratic bands and fine grained sandstone beds overlain by a coarse grained sandstone, (fig.15). Some fining up sequences were noted, (fig.16) but otherwise no further sedimentary structures were observed.

The upper unit, (fig.15) represents a good porous sandstone with visually estimated porosity values up to 30% and displaying good inferred permeability. Palynological studies recorded only modern spores and pollen, and, whilst the geological surface map indicates Eumeralla Formation sediments present at the outcrop location, it was not possible to confirm this. If the sediments observed at this location are, as indicated, Eumeralla Formation, then surface geology suggests the existance of a potentially good Eumeralla Formation reservoir.

In summary, rare surface outcrops were identified throughout the study area. These outcrops displayed various lithologies, as resolved by petrological and XRD analysis. Palynological techniques however were unable to determine accurately the age of most outcrops.

A.5.3 Percentage Surface Outcrop Exposure

At various locations across the study area, photographs were taken to indicate the very limited presence of outcrop exposure throughout the study area, (figs. 17-20). The author would suggest only 1% of the region exhibits any surface outcrop exposure.

A.5.4 Stokes River Shot Hole #17

Cuttings from a seismic shot hole (Enclosure 1) were despatched for palynological analysis and age dating. Four samples from:

a) 24-30m

b) 30-36m

c) 36-42m

d) 42-48m

were studied and confirmed the sediments to be of Eumeralla Formation age. Levels b) and d) recorded particularly rich and diverse assemblages indicating assignment to upper C. paradoxa palynozone, associated with the upper Eumeralla Formation, (Appendix 2). The common and diverse nature of the pollen and spores indicates a non-marine environment. At level b) rare algal acritarchs suggest a minor lacustrine influence, whilst at level d) an absence of algal acritarchs suggests a fluvial, rather than lacustrine influence.

Source rock analysis of the seismic shot hole cuttings demonstrate typical Eumeralla Formation sediments with rare DOM and low TOC values. V_R readings imply marginal hydrocarbon maturity, (Appendix 3).

The shot hole sediments therefore display a lean, marginally mature, potentially gas prone Eumeralla Formation at depths greater than 25m.

A.5.5 Additional Well Data Coverage

Prompted by the success of the shot hole results, a well listing for the region was obtained from the Geological Survey of Victoria and all wells drilled throughout the study area to depths greater than 25m were plotted. (Enclosure 1). The wells fell into three categories:

1. Bores drilled by Western Mining Corporation (WMC) as a regional coal study.
2. Bores drilled by the Department of Industry, Technology and Resources (DITR) as a coal study and ground water study.
3. Private bores, drilled as water bores.

Those wells drilled by WMC were cored and logged. Core data was offered to the DITR on the basis that they retrieved the ditch cuttings from each well site. This offer was ignored, consequently the government has no record of core and/or cutting data from the WMC bores. Additionally bores drilled by the DITR included many "old" (pre-1960's) wells with no log or core data.

Of the numerous wells drilled across the study area, only recent DITR bores and some private bores have core and/or cuttings data, (Enclosure 5). Whilst a lack of data from so many wells is disappointing, Eumeralla Formation sediments, identified by palynological age dating where necessary, can be isolated from those wells with cored and/or cuttings data for further analysis. A comprehensive source rock investigation of these sediments, for example, will aid our understanding of the source rock potential of the Eumeralla Formation within PEP 118.

The following wells are listed by the Geological Survey of Victoria as having core and/or cutting data:

PRIVATE BORES

PARISH	WELL NO.	CUTTINGS/CORE
BAHGALLAH (2040)	10004	Cuttings
	10005	"
	10006	"
MYARING (3246)	10003	"
	10007	"
WEECURRA (3784)	10007	"

DITR BORES

PARISH		WELL NO.	CUTTINGS/CORE
MOCAMBORO	(3132)	00002	Core
		00003	Cuttings/Core
		00004	Cuttings/Core
		00005	Cuttings
		00008	Cuttings
		00009	Cuttings
		00010	Cuttings
DIGBY	(2522)	00001	Cuttings
		00002	Cuttings
MERINO	(3092)	00008	Core
MUNTHAM	(3221)	00005	Cuttings

A.6 CONCLUSIONS

In light of the field trip and subsequent analystical work, the following conclusions can be drawn regarding the geology of the Stokes River/Merino High area.

1. Surface outcrop exposure was very limited, possibly representing only 1% of the study area.

2. A major fault, mapped on seismic line CR88-3/3A was not evident at surface.

3. Published surface geological mapping was unreliable.

4. Eumeralla Formation sediments were defined at outcrop and at shallow subsurface depths.

5. Source Rock studies of the near surface and surface Eumeralla Formation sediments confirm them to be lean, with low TOC, and marginally mature with VR_O values between 0.43 - 0.65.

6. In general, surface samples were not good for palynological analysis and often contained only modern pollen contaminants.

7. Whilst numerous shallow well bores were located throughout the study area, only 18% had cores or cuttings available for further analysis.

SECTION B

GEOLOGICAL REVIEW - PEP 118

B.3. AIMS

The geology of PEP 118 is reviewed and displayed in a data package which attempts to standardize well data, (Appendix 1). Formation tops identified in each well are reviewed and the various data contained in the wells are collated and presented in a uniform format.

Potential reservoirs and seals, identified across the permit, are reviewed and discussed.

The present structural understanding of the region is presented in light of the recently acquired seismic data.

Source rocks, potential migration pathways and timing are reviewed, uniting structural ideas with geochemical data.

Whilst the hydrocarbon potential of the permit is reviewed briefly, no attempt is made in this report to present detailed conceptual hydrocarbon plays. However, by following the combined recommendations of section A and B, a better geological understanding of the region could be achieved guiding future exploration toward the prospective hydrocarbon areas.

This report is designed as a foundation for future exploration in PEP 118.

B.4. GEOLOGICAL SETTING

PEP 118 is situated in the central onshore Otway Basin and dominated by the Mumbannar Platform trending north-west into South Australia as the Kalangadoo High and south-east into PEP 105 as the Homerton Plaform. Within the permit the Stokes River Anticline represents the major dominant feature trending in a south-west north-east direction, (fig.21).

To the south of the permit two major normal faults are identified, the Tartwaup Fault and the Wanwin Fault. The Portland Trough lies to the south on the down-thrown side of these fault systems.

North and east of the permit lie the Penola and Ardonachie Troughs. These troughs appear to have somewhat more antiquity than the Portland Trough and may represent a failed rift system. North-east of the permit, trending in a similar fashion to the Stokes River Anticline, lies the Merino High, a table land area of outcroping Lower Cretaceous sediments, (see section A - this report).

B.5. CURRENT STATUS OF EXPLORATION

The exploration permit occupies an area of approximately 1100km^2.

Drilling:- Within PEP 118 only two exploration wells, and nine deep Department of Industry, Technology and Resources (DITR) bores have been drilled, (fig.22) representing a total well density of 1 well per 100km. and whilst wells are fairly evenly scattered across most of the permit, no deep bores have been drilled in the eastern quarter of the region.

Seismic:- Enclosure 6 shows seismic coverage across the permit highlighting the fact that the majority of seismic was shot to locate potential plays along the upthrown and downthrown margins of the Tartwaup Fault. The 1-2km grid, detailed over the Najaba and Squatter prospects, represents seismic coverage over approximately 20% of the permit. A further 5% of the permit is covered by a semi-detailed 2-3km grid over the Stokes River Anticline.

The outstanding 75% of the permit is only sparsely covered by regional Shell seismic lines, (shot in the early 1970's) and the Crawford River Seismic Survey.

Exploration in PEP 118, can therefore be considered immature.

B.6. STRATIGRAPHY

The stratigraphy of PEP 118 is essentially a typical Otway Basin stratigraphy, (fig.1) differing slightly from the Port Campbell Embayment stratigraphy to the east by the absence of the Skull Creek Mudstone and Nullawarre Sandstone Members and an inability to identify formational units within the Nirranda and Heytesbury Groups.
A Tertiary and Upper Cretaceous stratigraphy is identified in the various DITR bores, (Appendix 1 and Table 1), however the two exploration wells serve as key stratigraphic wells within the permit.

Najaba-1A drilled on the down-thrown side of the Tartwaup Fault penetrated the entire Tertiary and Upper Cretaceous section. Notable stratigraphic features observed in Najaba-1A include:

- An intra-Pember sandstone unit exhibiting excellent reservoir characteristics.
- A Pebble Point Formation and Upper Paaratte (Timboon sandstone) Formation displaying a poor reservoir quality due to a high clay content.
- An ill-defined Waarre Formation comprising a poorly developed sandstone with abundant quartz overgrowths.

Squatter-1, drilled on the upthrown side of the Tartwaup Fault displayed a similar Tertiary and Upper Cretaceous section. However, the Sherbrook Group was considerably

condensed. Notable stratigraphic features observed in Squatter-1 include:

- A characteristic Pebble Point Formation identified by a high glauconitic/iron oxide content. Reservoir quality was poor.

- Waarre Formation, represented by a fine-grained tight sandstone with poor porosity and an abundant argillaceous matrix.

The Heathfield Sandstone Member of the Eumeralla Formation and the Pretty Hill Formation have not been identified within the PEP 118 area, however these sediments have been observed in exploration wells drilled to the north, in PEP 119, (ref: Casterton-1, Heathfield-1, McEachern-1).

Any well drilled in the north eastern corner of the permit would undoubtedly penetrate Pretty Hill Formation sediments and the Casterton Formation (again not penetrated within PEP 118 although identified in Casterton-1).

The presence of a Heathfield Sandstone member within the Eumeralla Formation is not predictable and the lateral extent of this sandstone body is not known within PEP 118.

B.7. RESERVOIRS

Potential reservoir units, shown in Figure 23, include

- Dilwyn Formation
- An Intra-Pember Mudstone Sandstone Unit
- Pebble Point Formation/Top Paaratte Formation
- Waarre Formation
- Intra-Eumeralla Formation Sandstones Units (Heathfield Sandstone Member)
- Pretty Hill Formation Sandstone Units

B.7.1 Dilwyn Formation

Whilst the sandstone units of the Dilwyn Formation exhibit excellent reservoir qualities with clean sands displaying good visual porosity and good inferred permeability, the Formation is also recognised as a regional aquifer. The Dilwyn Formation outcrop is seen at various locations across PEP 118 and these serve as excellent intake zones for the Dilwyn Formtion waters. Any hydrocarbons reservoired within the Dilwyn sediments will probably suffer from severe flushing.

B.7.2 Intra-Pember Mudstone Unit

A number of wells have penetrated a sandstone unit displaying good reservoir qualities within the Pember Mudstone, (fig.24).

At Najaba-1A the sandstone was described as:

"SANDSTONE, light grey, friable, very fine to fine grained dominantly fine grained, subangular, moderate sorting, trace green and black lithics, trace silty material, very weak silica cement, 10-20% visual porosity, trace carbonaceous detritus, no fluorescence, no odour."

Whilst the sandstone unit has obvious positive features, it appears to be an isolated lenticular body sealed within the Pember Mudstone, (fig.25). As the Pember Mudstone is immature in this area, direct hydrocarbon sourcing is not possible and hydrocarbon entrapment would require fault migration pathways.

The intra-Pember Mudstone sandstone body is a feature identified only on the downthrown side of the Tartwaup Fault, on the upthrown side no intra-Pember sandstone units have been recognised. The lateral extent of this potential reservoir is therefore very limited in PEP 118.

B.7.3 Pebble Point Formation/Top Paaratte Formation (Enclosures 7 and 8).

Oil shows have been recorded within the Pebble Point Formation.

eg. Lindon-1	:	3 metre oil column
Wilson-1	:	17 metre column of fluorescence

Whilst these shows are encouraging and testify to:-

(a) The presence of liquid hydrocarbons in the Otway basin.

(b) The reservoir potential of the Pebble Point Formation;

the Pebble Point Formation generally exhibits a poor reservoir quality.

On the downthrown side of the Tartwaup Fault a thickening of the Pebble Point Formation is recognised as the Formation appears to roll-over into the fault, (fig.26). At Wilson-1 a 17m column of fluorescence was identified within such a setting and represents a region where the reservoir potential of the Pebble Point Formation may be improved. This feature however is restricted to a very limited area of PEP 118. On the upthrown side of the fault the Pebble Point Formation displays poor reservoir quality. A typical description is:

> "GLAUCONITIC CLAYSTONE WITH INTERBEDDED SANDSTONE: light brown to medium green sandstone, very fine to very coarse dominantly coarse, angular to subangular, poor to moderate sorting, quartz grains with common brown oxide staining, dominant medium brown to medium green argillaceous matrix, trace to abundant iron oxide, poor visual porosity".

The underlying Paaratte Formation often exhibits cleaner sandstones representing potentially better reservoirs. Often however, due to the vertical relief of the subtle Late Cretaceous/Early Tertiary structures, the upper Paaratte sandstone units do not have structural closure.

B.7.4 Waarre Formation (Enclosure 9 and 10)

Sandstones of the Waarre Formation represent the historical primary target of the Otway Basin eg. Port Campbell High Gas Fields, Caroline-1 (CO_2 well), and recently, the successfully completed gas well Iona-1. In each case gas was reservoired within upper Waarre Formation sandstone units.

In PEP 118, a relatively thick Waarre Formation sequence was identified at Najaba-1A on the downthrown side of the Tartwaup Fault but the sandstone exhibited poor reservoir quality suffering from the diagenetic effects of burial and a high authigenic clay content. Although Najaba-1A exhibited a poor Waarre Formation sandstone, very little else is known about the Waarre Formation within the region and the potential it may have on the downthrown side of the Tartwaup Fault cannot be determined from one well alone. Within PEP 118 the downthrown area is very small and contains few potential Waarre Formation plays.

On the upthrown side of the Tartwaup Fault the reservoir potential of the Waarre Formation is less appealing. The Waarre Formation is generally thin and sandstones display very poor reservoir quality. Over the eastern half of the permit the Waarre Formation is absent, whilst to the west and south Waarre Formation sediments thicken toward the Tartwaup Fault, (see Enclosure 9) though may only reach a maximum thickness of 25m.

The relatively thin nature of the Waarre Formation and the poor reservoir quality observed in PEP 118 detracts from the Waarre Formation's general appeal as a primary reservoir and casts doubt on it seriously being considered as a potential target.

Nevertheless, the possibility exists of both a "thicker" Waarre Formation and the presence of sub-divisions similar to those identified in the Port Campbell Embayment. An "intra-Belfast sandstone unit" observed at Squatter-1, (fig.27) is observed in Dartmoor-25, (fig.28) and at Mumbannar-6, (fig.29). At Squatter-1, only cuttings were available for palynological age dating, and confirmed the basal sand unit (cf. Port Campbell-Unit A) as A. distocarinatus palynozone (P. infusorioides, Dinoflagellate Zone) which is a feature normally seen in the Waarre Formation. The upper "intra-Belfast sandstone unit" (cf. Port Campbell-Unit C), however was confirmed as C. triplex palynozone which is normally assigned to the Belfast Mudstone. At Dartmoor-25, the basal shale unit (cf. Port Campbell-Unit B) was dated as A. distocarinatus, again typical of the Waarre Formation. The positive identification of a Belfast Mudstone age for the upper sandstone unit, restricts the Waarre Formation to, at best, a sandstone-shale sequence and certainly not the "Port Campbell type" Waarre Formation reservoir sequence.

The reservoir quality of the "intra-Belfast sandstone unit" is poor, the sandtone typically being described as:

> "SANDSTONE: very light grey to off white, firm to hard, very fine to fine, well sorted, subangular to subrounded, trace siliceous cement, abundant carbonaceous material, poor visual porosity becoming well cemented with depth, trace dark green glauconite".

This does not lend much encouragement to the recognition of a new reservoir unit within the Belfast Mudstone.

B.7.5 Intra-Eumeralla Sandstone Units.

A number of sandstone units have been identified within the Eumeralla Formation, notably the Heathfield Sandstone Member, identified in PEP 119 to the north, (fig.30).

Oil and gas shows have been recorded within from these sand bodies in sub-economic quantities, e.g. Port Campbell-4, Windemere-1. The limited lateral extent of these sandstones, the inability to identify them successfully on seismic sections, and the poor reservoir quality of the sandstones, all imply that these sands are not viable exploration targets.

B.7.6 Pretty Hill Formation

No well in PEP 118 has drilled the Pretty Hill Formation, however Pretty Hill Formation sandstone units observed in wells throughout the Otway Basin represent feasible reservoirs and it is felt that similar potential reservoirs probably exist in the north-eastern corner of the permit.

To the north in PEP 119, particularly within the Penola Trough, sandstone bodies identified throughout the Pretty Hill Formation, (fig.31) are described as:

> "SANDSTONE: Light grey, fine to coarse becoming dominantly coarse with depth, moderately hard to loose, variably kaolinitic, calcareous and argillaceous. Biotite and muscovite are common with minor garnets and lithics".

Good porosities are thought to exist within Pretty Hill Formation sandstone units and average porosities of 11% existing to a depth of 2200m, (Guba, 1989). To the west, in the South Australian Penola Trough, gas was discovered in the Pretty Hill Formation at Katnook-2 and Ladbroke Grove-1. The Pretty Hill sandstone bodies are therefore proven reservoir units.

Within PEP 118, the Crawford River Seismic Survey, shot as a regional grid in the north-eastern corner of the permit, identifies a possible western extension to the Ardonachie Trough. The presence of Pretty Hill Formation sandstone units is interpreted at depths of 1250m+ hence presents viable exploration targets.

B.7.7 Summary

Of the reservoirs reviewed, only the Pretty Hill Formation Sandstone units represent feasible exploration targets displaying good reservoir qualities at acceptable drillable depths.

The Dilwyn Formation, whilst showing good reservoir qualities, is recognised as a regional aquifer and any hydrocarbons trapped within the Dilwyn Formation sandstone units would be subject to flushing.

The intra-Pember Mudstone sandstone is only recognised on the downthrown side of the Tartwaup Fault, and is present only in a small proportion of PEP 118. The isolated, lenticular nature of the sand bodies relies upon faults as migrational pathways, faulting at this level is uncommon.

The Pebble Point Formation is characterized by an abundant clay content degrading the reservoir quality.

The Waarre Formation is thin or absent over the permit and displays poor reservoir quality.

The Intra-Eumeralla Formation sandstone units generally consist of sandstone bodies of limited lateral extent and poor reservoir quality. The Heathfield Sandstone Member, identified to the north in PEP 119 may represent the sole exception. In PEP 118, however, both the seismic identification and the lateral extent ofthe Heathfield Sandstone Member are unknown.

B.8 SEALS

Potential hydrocarbon seals are shown in Figure 32 and for PEP 118, include:

- Nirranda Group Marls
- Pember Mudstone
- Pebble Point Formation
- Belfast Mudstone
- Eumeralla Formation Shale Units
- Upper Pretty Hill Formation Shale Units

B.8.1 Nirranda Marl

Whilst the Dilwyn Formation cannot be considered as a viable target in PEP 118, the overlying marls identified within the Nirranda Group could act as an ideal seal.

B.8.2 Pember Mudstone (Enclosure 11)

The Pember Mudstone represents a well developed thick argillaceous unit over much of PEP 118, (Enclosure 11), and would adequately seal any hydrocarbons reservoired in the underlying Pebble Point Formation.

Across PEP 118, the Pember Mudstone thins to the north-east, (as does the Pebble Point Formation), whilst thickening in two isolated depocentres, one in the west, centred near Ardno-2 and the other to the east centred around Lindon-1. A prominent nose, (also identified in the Pebble Point Formation) is observed, trending in a north-easterly direction from Dartmoor-25 toward the Merino High, (see Enclosures 7 and 11).

Intra-Pember Sandstone units, generally observed within the Pember Mudstone on the downthrown side of the Tartwaup Fault, would be adequately sealed by the encapsulating Pember Mudstone.

B.8.3 Pebble Point Formation

Although the Pebble Point Formation has been recognised and described as a reservoir because of the highly argillaceous nature of the Formation in PEP 118 the Pebble Point could also be regarded as an adequate seal for the underlying Paaratte Formation sandstone units.

B.8.4 Belfast Mudstone (Enclosure 12)

The Belfast Mudstone acts as a seal for the underlying Waarre Formation, however the mudstone appears to thin rapidly to the east. The arenaceous quality of the Belfast Mudstone also increases eastwards again reducing the overall standing of the Belfast Mudstone as a seal in this direction, (fig.33).

As noted within the Pember Mudstone/Pebble Point Formation a distinct north-easterly trending nose is identified this is also observed in both the Belfast Mudstone and the underlying Waarre Formation sediments, (see Enclosures 9, 10 and 12).

B.8.5 Eumeralla Formation Shale Units.

With a predominantly argillaceous nature the Eumeralla

Formation forms a satisfactory seal for any interbedded sandstone units deposited throughout the Eumeralla Formation. The proven ability of the Eumeralla Formation as a seal has been displayed throughout the Otway Basin where sub-commercial oil and gas reservoirs have been reservoired and entrapped within intra-Eumeralla sandstone bodies:

eg. Katnook-1
Windemere-1
Port Campbell-4

B.8.6 Upper Pretty Hill Formation Shale Unit.

This unit has not been identified within PEP 118, however, the presence of a unit sealing the underlying Pretty hill Formation sandstone bodies can be inferred from those areas where the Pretty Hill Formation has been fully drilled and described, (fig.31).

The unit comprises predominantly mudstone and shales inter-bedded with siltstone and minor sandstone beds. Within the Penola Trough it appears to be present as a consistent lithological unit that can be correlated throughout most of the Penola Trough, (Guba, 1989).

The thick nature of the shale unit, in excess of 250m, adds to its excellent sealing capacity. Finally the successful gas discovery within the Lower Pretty Hill sandstones, eg. Katnook-2, Ladbroke Grove-1 confirms the potential of the shales as competent seals for the underlying sands.

B.8.7 Summary

All the units reviewed would represent satisfactory seals (with the possible exception of the Belfast Mudstone). However, the general lack of suitable reservoirs within the Upper Cretaceous and Tertiary sediments negates the need for adequate seals.

Prior experience would suggest that the Lower Pretty Hill Formation sandstones will be adequately sealed by a thick argillaceous Upper Pretty Hill shale unit and regional evidence suggests that the Pretty Hill Formation is present in the north-eastern corner of the permit at drillable depths.

B.9 SOURCE

Potential hydrocarbon source rocks are shown in Figure 34 and for PEP 118 include:

- Belfast Mudstone
- Eumeralla Formation
- Upper Pretty Hill Formation Shale Unit
- Casterton Formation

B.9.1 Belfast Mudstone

The Belfast Mudstone at Najaba-1A displays low quantities of vitrinite and exinite and whilst data available is limited to Squatter-1 and Najaba-1A, (fig. 35) suggests a mature source for oil and marginal maturity for gas, at depths greater than 2500m.

The true potential of the Belfast Mudstone is not known exactly, however earlier workers have suggested the Belfast Mudstone to be gas prone. The presence of residual oil at Wilson-1 and the subsequent analysis of this oil implies a relatively immature source rock with marine affinities exists within the Otway Basin.

Although it is not known from which formation the oil was generated, the possibility of the Belfast Mudstone cannot be discounted.

The Belfast Mudstone generally exhibits a moderate percentage of total organic carbon, (TOC) and relatively high amounts of dispersed organic matter, (DOM).

B.9.2 Eumeralla Formation Shale Units

The sourcing capability of the Eumeralla Formation is well documented and includes oil and gas shows recorded at:

a) Lindon-1

b) Port Campbell-4

c) Windemere-1

d) Iona-1

e) Katnook-1

The oil sources were typed as Eumeralla Formation shales whilst the gas reservoirs consist of sandstone units encapsulated by mature Eumeralla Formation shales.

The data from Najaba-1A and Squatter-1, (fig.36) suggest a lean source, becoming mature for oil at 3000m, with sparse amounts of dispersed organic matter, (DOM) and low total organic carbon, (TOC) readings. These data infer that at best the Eumeralla Formation could be described as having a poor gas prone potential.

The presence of oil shows and commercial gas fields however suggest zones of oil prone and mature gas prone source do exist, possibly within the coals toward the base of the Eumeralla Formation.

B.9.3 Pretty Hill Formation Shale Units

Our understanding of the source potential of the Pretty Hill Formation shale unit is very limited. In PEP 118 there are no data available, however samples acquired from Lindon-1 and Woolsthorpe-1 both show a potential oil and gas mature source rock with a high TOC and DOM composed mainly of gas prone organic matter, (Tabassi, 1988).

B.9.4 Casterton Formation

The source potential of the Casterton Formation, like the Pretty Hill Formation shale unit, is relatively unknown. To date it is felt that the geochemical character of the Casterton Formation has confirmed that:

a) It is a mature source rock.

b) It contains kerogen types capable of generating oil and gas.

B.9.5 Summary

The source potential of the Belfast Mudstone, Eumeralla Formation, Pretty Hill Formation Shale Unit and the Casterton Formation are not fully known within PEP 118, nor the Otway Basin in general. Whilst the source potential of the Eumeralla Formation is accepted, a more precise idea of the source rocks should be established to understand hydrocarbon migration and timing.

B.10 STRUCTURE MIGRATION AND TIMING

B.10.1 Otway Basin - Structural Overview

The Otway Basin was formed by continental rifting and north to north-easterly extension during the Early Cretaceous, (Etheridge 1988).

During the Early Cretaceous, major extensional structures were active as:

a) Rotational normal faults:
   - Trending 290°-310°
   - Dipping 30°-50°

b) Transfer faults:
   - Steeply dipping
   - Orthogonal to normal faults.
   - Present to accommodate variation in position, spacing and dip direction of the rotational normal faults during extension.

The extensional structures are generally buried beneath several kilometres of Late Cretaceous to Tertiary sediments. The character and geometry of these structures can therefore be determined along the basin margins only.

During the Late Cretaceous and Tertiary, thermal subsidence occurred, creating a series of normal faults that displayed similar trends to the Early Cretaceous normal faults but with substantially smaller displacements.

The origin of Tertiary reverse faults and anticlines are unknown, but may be attributed to the reactivation of transfer faults.

B.10.2 Structural Elements - PEP 118 (Enclosure 13)

The Geological setting reviews the major structural features identified in the central onshore Otway Basin and is summarized in Figure 21.

Within PEP 118, three notable structural elements are observed, (see Enclosures 13,14, 15 and Figures 21 and 37).

- Early Cretaceous Normal Faulting.
- Mid-Late Cretaceous and Tertiary Faulting.
- A Transfer Fault.

a) **Early Cretaceous Normal Faulting**

This is identified in the north-eastern corner of the permit and possibly represents a western extension of the Ardonachie Trough. The northern end of regional seismic line A-A' displays a half-graben and bounding rotational normal faults. At the basin margin, a thin Late Cretaceous/Tertiary veneer aids identification of the Early Cretaceous structures.
The Early Cretaceous development of this rift system implies a rift fill sequence of basal Casterton Formation and overlying Pretty Hill Formation.

Initially, sandstone deposition occurred with erosion of the rift valley "hog's back" blocks in a high energy environment. As sediment supply was reduced and the rift valley opened, the development of a rift valley lake system may have occurred. Deposition in this quiescent environment is represented by the overlying siltstone-shale sequence which now acts as a seal for the underlying sandstones and possibly represents a good potential hydrocarbon source rock. This early rift valley system, identified to the east as the Ardonachie Trough and continuing west of the Merino High, as the Penola Trough, may represent an initial aborted rift system. Subsequent successful rifting and separation occurred to the south of PEP 118 where the Tartwaup-Wanwin Fault system forms the northern boundary of the rift system and the Eumeralla Formation forms the rift fill sediment.

Whilst the scenario for potentially good Pretty Hill Formation hydrocarbon plays in the failed Ardonachie-Penola rift system exists, a similar situation is unlikely in the successfully rifted margin, ie. the Portland Trough.

Here a thick Late Cretaceous/Tertiary sediment cover has buried potential reservoir sandstone units to depths where seismic definition is difficult and/or diagenesis has destroyed effective porosity.

b) **Mid-late Cretaceous and Tertiary Faulting**

Intense faulting is observed within the Mid-Late Cretaceous and Tertiary sediments, (see Enclosure 13). The structural grain across PEP 118 is predominantly north-westerly to south-easterly, bearing 300°. Faulting is generally normal down-thrown both basinward and counter basinward, creating a series of minor horst and graben features across the Mumbannar/Homerton platforms (ref:Lindon-1, seismic line B-B', Enclosure 15). Whilst the hydrocarbon potential may be good in an area with such a structural pattern, only poor Late Cretaceous and Early Tertiary reservoirs are identified throughout the permit (Ref B.7, this report).

It appears that the Mid-Late Cretaceous/ Tertiary faulting is generally superficial, and that these faults may "sole-out" in a Eumeralla Formation shale decollment surface.

(c) **Transfer Fault**

The presence of a transfer fault is implied from various features observed in PEP 118, (fig.37) notably:

1. An apparent displacement of the northern basin margins of the Ardonachie and Penola Troughs.
2. The Tartwaup Fault ends between Wilson-1 and Drik Drik-1 whilst the southerly Wanwin Fault becomes the major fault.
3. The identification of a north-easterly trending reverse fault and the Stokes River Anticline may be due to the reactivation of a transfer fault.
4. The displacement of the Merino High Eumeralla Formation surface outcrop and the north-easterly trending Eumeralla Formation outcrop "finger".
5. The identification of a south-westerly plunging nose, observed on all isopach maps, (see Enclosures 7-12) trends in a similar direction to the inferred transfer.
6. Upper Cretaceous faulting displays 90^{o} "dog-leg" features between Dartmoor-25 and Drik Drik-1, (see Enclosure 13).

Whilst no direct evidence supports the presence of a transfer fault within PEP 118, the necessary existence of such an accommodation feature in an extensional tectonic regime should not be disregarded. The various features strongly infer a transfer fault trending in a north-easterly direction orthogonal to the structural grain of the major normal rotational faults.

B.10.3 Migration

Depth to mature source rock sediments within PEP 118 is not well established.

Belfast source rocks probably remain immature over the permit. Hydrocarbons sourced from the Belfast would require horizontal and vertical migration pathways leading from the deep Portland Trough and would probably utilize the Tartwaup-Wanwin Fault system.

Eumeralla Formation source rocks are probably marginally to fully mature over the permit with a mature oil zone from below approximately 3000m. Migration from mature sediments would utilize the faults soling out within the Eumeralla Formation shales. Long range horizontal migration is not necessary however moderate vertical migration would be required.

The source rock potential of the Pretty Hill and Casterton Formations and the maturation of these sediments is not well known (Ref: B.9, this report). Migration from the deeper sections of the Penola and Ardonachie Troughs may be required. Migration is probably not a major problem in the permit as numerous faults are present to aid migration.

B.10.4 Timing

Structural timing can be addressed only on a very general scale, and with no deep seismic data the ability to construct a balanced cross-section and develop an accurate structural picture is not possible.

With a limited understanding of the structural patterns and the tectonic evolution of the area, it is not easy to determine when potential traps were created or when breaching of these structures may have occurred.

In a gross sense, the structural timing of events in the Otway Basin is restricted to:

- Rifting: - Early Cretaceous
- Separation and thermal subsidence: - Tertiary

The timing of hydrocarbon maturation is also poorly understood. When and for how long potential source rocks have been producing hydrocarbons is not known within the central onshore Otway Basin.

B.11 CONCLUSIONS

The following conclusions can be drawn from this geological review of PEP 118.

1. **Stratigraphy**

   a) Tertiary to recent sediments outcrop across the permit.

   b) Sherbrook Group sediments are represented as a "condensed group" on the upthrown side of the Tartwaup Fault across most of PEP 118.

   c) The Eumeralla Formation of the Otway Group outcrops across the north-eastern corner of the permit.

   d) Presence of the Pretty Hill and Casterton Formation can only be surmised within PEP 118.

2. **Exploration Maturity**

   a) Exploration wells drilled in PEP 118 are restricted to Squatter-1 drilled on the upthrown side of the Tartwaup Fault, and Najaba-1A, drilled on the downthrown side of the Tarwaup Fault. Further well data is limited to nine government stratigraphic and/or water bores with rudimentary logs, poor geological control and very little geological supervision. Core data however from the government bores is good.

   b) Seismic coverage is moderate only over the south-western 25% of the permit.

   c) Exploration is immature over the permit as a whole, though moderately mature over the south-western region.

3. **Seismic Quality**

   The acquisition and processing parameters of the various

seismic surveys do not assess adequately each reservoir horizon within the permit, consequently seismic exploration techniques may have failed to address the full hydrocarbon potential of the permit. As an example the Stokes River Seismic Survey demonstrates restricted data acquisition with no interpretable data below the Eumeralla Formation sediments, (see Enclosure 15).

4. **Reservoir Potential**

a) The Dilwyn Formation is likely to be flushed.

b) A reservoir sandstone unit within the Pember Mudstone cannot be considered due to its isolation within a mudstone unit and consequent limited access to migration pathways.

c) Previously identified historic Otway Basin reservoirs, the Pebble Point Formation and Waarre Formation, are poorly developed and, in the case of the Waarre Formation thin or absent across much of the permit.

d) The reservoir potential of Eumeralla Formation sandstone units is unknown with poor seismic identification of sandstone bodies, no close stratigraphic bores, and an inability to "tie" seismic into well data at deeper Eumeralla Formation levels.

e) The Pretty Hill Formation sandstone units regionally have good recognised reservoir potential, however, within PEP 118 they have not been drilled. It is felt Pretty Hill sands, as potential reservoir targets, will be present at drillable depths in the north-eastern corner of the permit.

5. Source Potential

a) The Pember Mudstone is immature within PEP 118. Hydrocarbons sourced from a mature Pember Mudstone would require long range migration to become entrapped within PEP 118 structures.

b) The Belfast Mudstone and Eumeralla Formation shales represent potential source rocks.

c) Shales within the Pretty Hill Formation and Casterton Formation may have source potential, however, our understanding of these sediments is very limited and unknown in PEP 118.

6. Structure

a) The Ardonachie - Penola Trough probably represents an aborted failed rift valley.

b) Structural understanding in PEP 118 includes:

   i) Identification of Early Cretaceous normal faults.

   ii) Abundant Mid to Late Cretaceous normal faults.

   iii) The inferred presence of a north-easterly trending transfer fault.

c) Major structural features identified within PEP 118 include:

   i) The Wanwin-Tartwaup Fault systems.

   ii) The Stokes River Anticline and an associated reverse fault.

   iii) The western end of the Ardonachie Trough.

   iv) The Mumbannar and Homerton Platforms.

7. **Migration**

Numerous faults exist at all levels and could act as vertical migration pathways from the mature source rocks in and around PEP 118.

8. **Timing**

This concept is poorly understood in the Otway Basin and particularly in PEP 118

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Example of surface outcrop

Bedding Plane	-	Dip 10^{o} (bearing 340^{o})
		Strike 250^{o} - 70^{o}
Petrological Description	-	Ferruginous Sandstone
		Porosity - 15%
		Permeability - good
Formation	-	Eumeralla
R_V	-	0.43 - 0.65 (Ave 0.54)
TOC	-	0.36% (DOM sparse)

Example of surface outcrop

Bedding Plane	-	Dip 8^{o} NW (bearing 300^{o})
	-	Strike 210^{o} - 30^{o}
Petrological Description	-	Silty limestone
	-	Porosity - Nil
	-	Silt grade detrital fragments of quartz and feldspar in a contiguous mosaic of fine grained carbonate.
Age	-	Indeterminate.

Example of surface outcrop

Bedding Plane - Dip 17° SW (bearing 210°)

- Strike 120° - 300°

Petrological description - Sandstone

- Fine grained, moderately sorted, well cemented, no visual porosity.

Example of surface outcrop

Bedding Plane	-	Dip 25^{o} NE (Bearing 20^{o})
	-	Strike 290^{o} - 110^{o}
Petrological description	-	Porous sandstone
	-	Porosity - 30%
	-	Permeability - good
Age	-	Indeterminate

Example of limited surface exposure throughout the study area.

PHOTOGRAPHS

1. 50m. South-West MacKenzie Creek Road looking North-West along "inferred" fault zone? (See seismic line CR88-3 SP 240).

2. 200m. South-West MacKenzie Creek Road looking South; Pebble Point Formation bedding plane?

3. See Figure 2.

~~4. Stokes River, near confluence with Teakettle Creek looking North-East.~~

5. MacKenzie Creek; "inferred" fault zone? (See seismic line CR88-3 SP 240), looking North-West toward Stokes River.

~~6. See Figure 5, looking South-East.~~

7. Looking South-East near Bobby Creek; example of limited Otway Group exposure.

8. Roadside exposure 3.2 km North-East MacKenzie Creek Road and 1.0 km West Donibrook Road.

~~9. 12 km North-West Digby looking west; example of limited Otway Group exposure.~~

10. 13 km North-West Digby looking east; see Figure 9.

11. 2 km North-West Paschendale; example of possible Eumeralla sediments.

~~12. Wannon River Valley, looking east from Figure 11 location.~~

13. 2.5 km North-West Paschendale; example of possible Eumeralla sediments (A hard fine grained sandstone bed overlying a soft friable sandstone).

~~14. Moredun Hill; 4.0 km East Sandford looking South, example of possible Eumeralla Formation exposure.~~

15. 5.5 km East Sandford looking West toward Casterton; example of limited Otway Group exposure.

~~16. Wannon Farm exposure; 12 km East Sandford, 10 km West Coleraine from road looking North-East.~~

17. Wannon Farm exposure from 20m.

18. Congolmeratic band within Wannon Farm exposure.

19. Intra-conglomeratic fine grained sandstone within Wannon Farm exposure.

20. Upper coarse grained sandstone within Wannon Farm exposure.

21. Conglomeratic band within Wannon Farm exposure displaying evidence of a fining upward sequence.

22. Conglomeratic band overlying coarse grained sandstone within the Wannon Farm exposure.

~~23. View from Wannon Farm exposure looking south~~ to ~~confluence of Konong and Wannon Rivers~~.

~~24. Konong River crossing looking south.~~

Exposure 25. 5 km South-West Coleraine looking West along Wannon River toward Paschendale.

Exposure 26. 5 km South-West Coleraine looking south (Figures 25 and 26 represent a panoramic view and highlights the lack of Otway Group exposure).

ENCLOSURES

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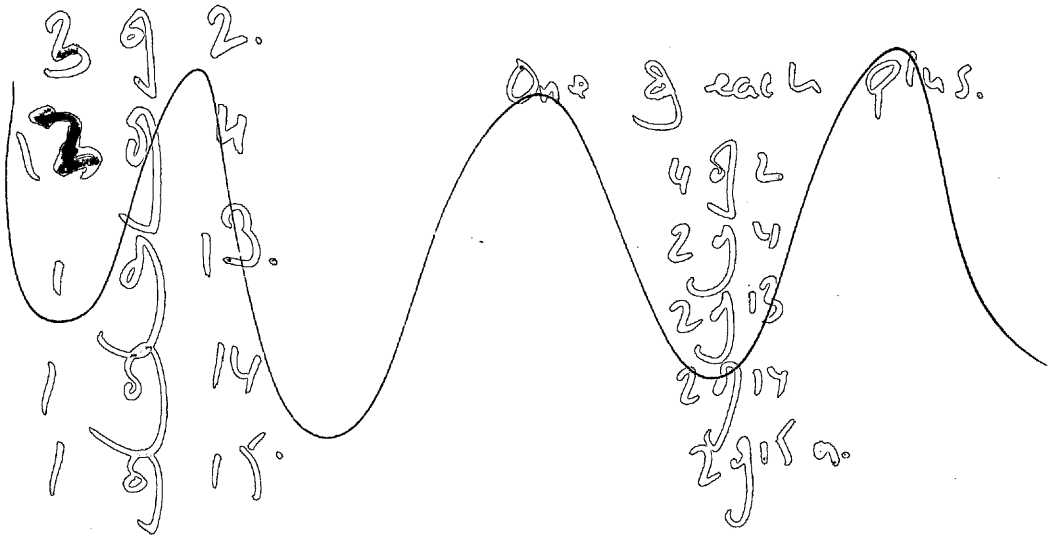

20 - 5km SW Coleraine Looking South and West Along Wannon River Valley

21 - Structural Elements, Central Onshore Otway

22 - PEP 118 - Wells

23 - Potential Reservoir Units

24 - Example of Intra-Pember Mudstone Sandstone Body : Najaba-1A

25 - Isopach Displaying Lenticular Nature of Intra-Pember Sandstone Body

26 - Pebble Point "Infill"

27 - Example of Intra Belfast Sandstone Unit - Squatter-1

28 - As Figure 27 : - Dartmoor-25

29 - As Figure 27 : - Mumbannar-6

30 - Example of Heathfield Sandstone Member : - Heathfield-1

31 - Example of Pretty Hill Formation : - PEP 119

32 - Potential Seal Units

33 - Example of Arenaceous Belfast Mudstone : - Drik Drik-1

34 - Potential Source Rock Units

35 - Vitrinite Reflectance - Belfast Mudstone

36 - Vitrinite Reflectance - Eumeralla Formation

37 - Merino Transfer Fault

Download Heathfield or digitize Heathfield Sandstone

FIGURES

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PEP 118 STRATIGRAPHIC COLUMN

OTWAY BASIN

S N

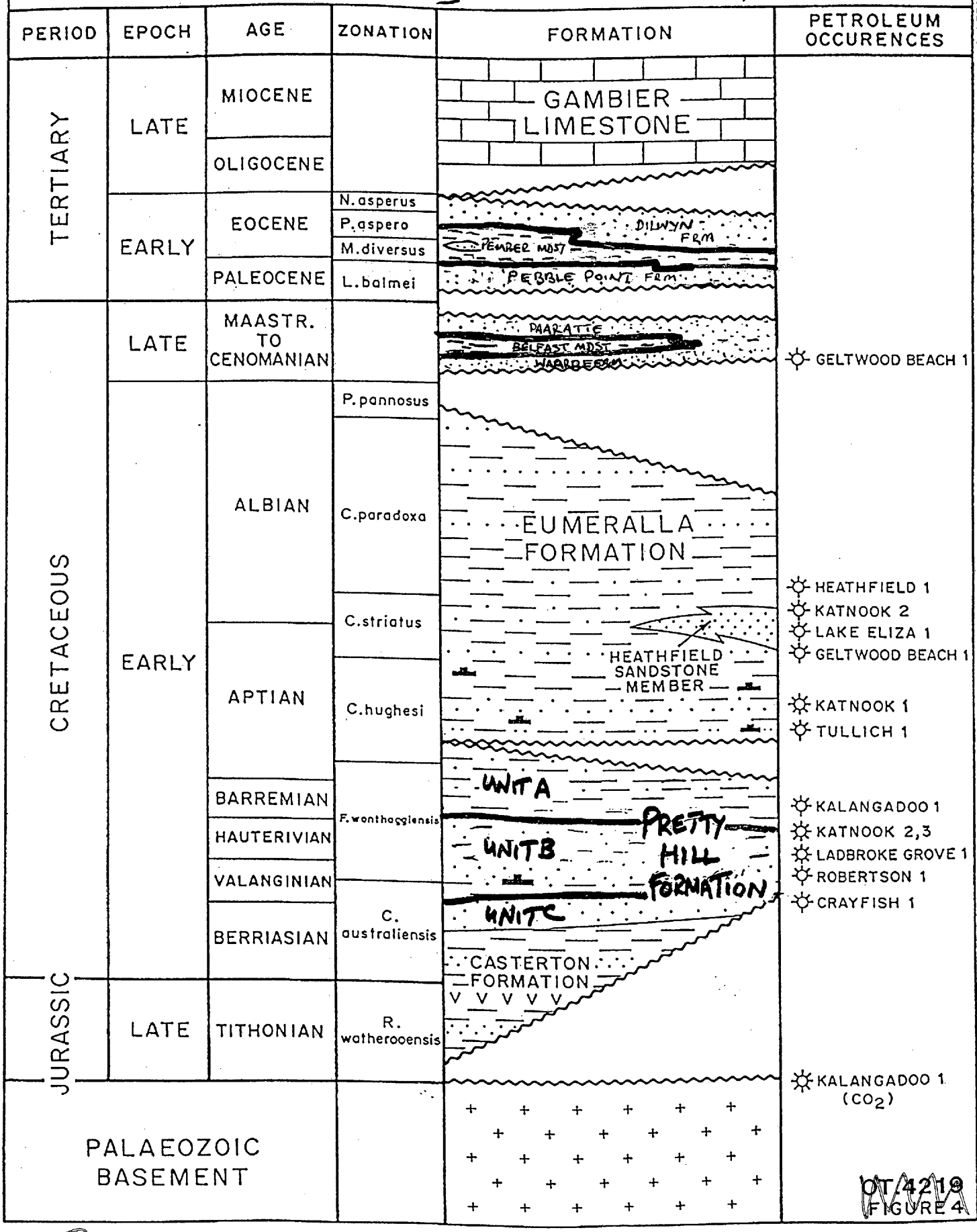

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FIGURE 4

Fig 2.

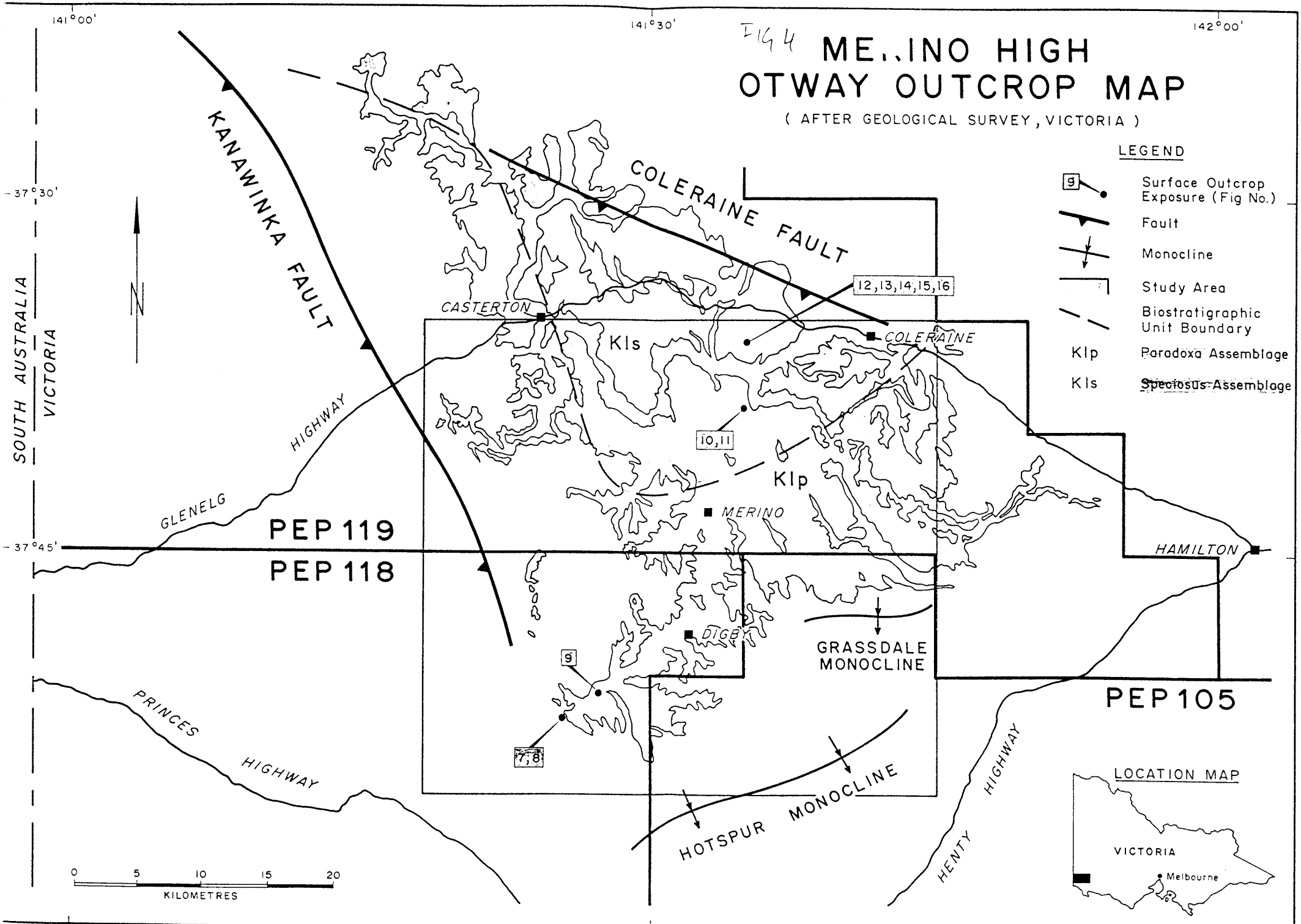
FIG 4
MERINO HIGH
OTWAY OUTCROP MAP
(AFTER GEOLOGICAL SURVEY, VICTORIA)
141°00'
141°30'
142°00'
-37°30'
-37°45'
SOUTH AUSTRALIA
VICTORIA
KANAWINKA FAULT
COLERAINE FAULT
CASTERTON
COLERAINE
HAMILTON
MERINO
DIGBY
GLENELG HIGHWAY
PRINCES HIGHWAY
HENTY HIGHWAY
PEP 119
PEP 118
PEP 105
Kls
Klp
12,13,14,15,16
10,11
9
7,8
GRASSDALE MONOCLINE
HOTSPUR MONOCLINE
LEGEND
Surface Outcrop Exposure (Fig No.)
Fault
Monocline
Study Area
Biostratigraphic Unit Boundary
Klp Paradoxa Assemblage
Kls Speciosus Assemblage
LOCATION MAP
VICTORIA
Melbourne
0 5 10 15 20
KILOMETRES

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CENTRAL ONSHORE OTWAY BASIN

REGIONAL STRUCTURAL GEOLOGY

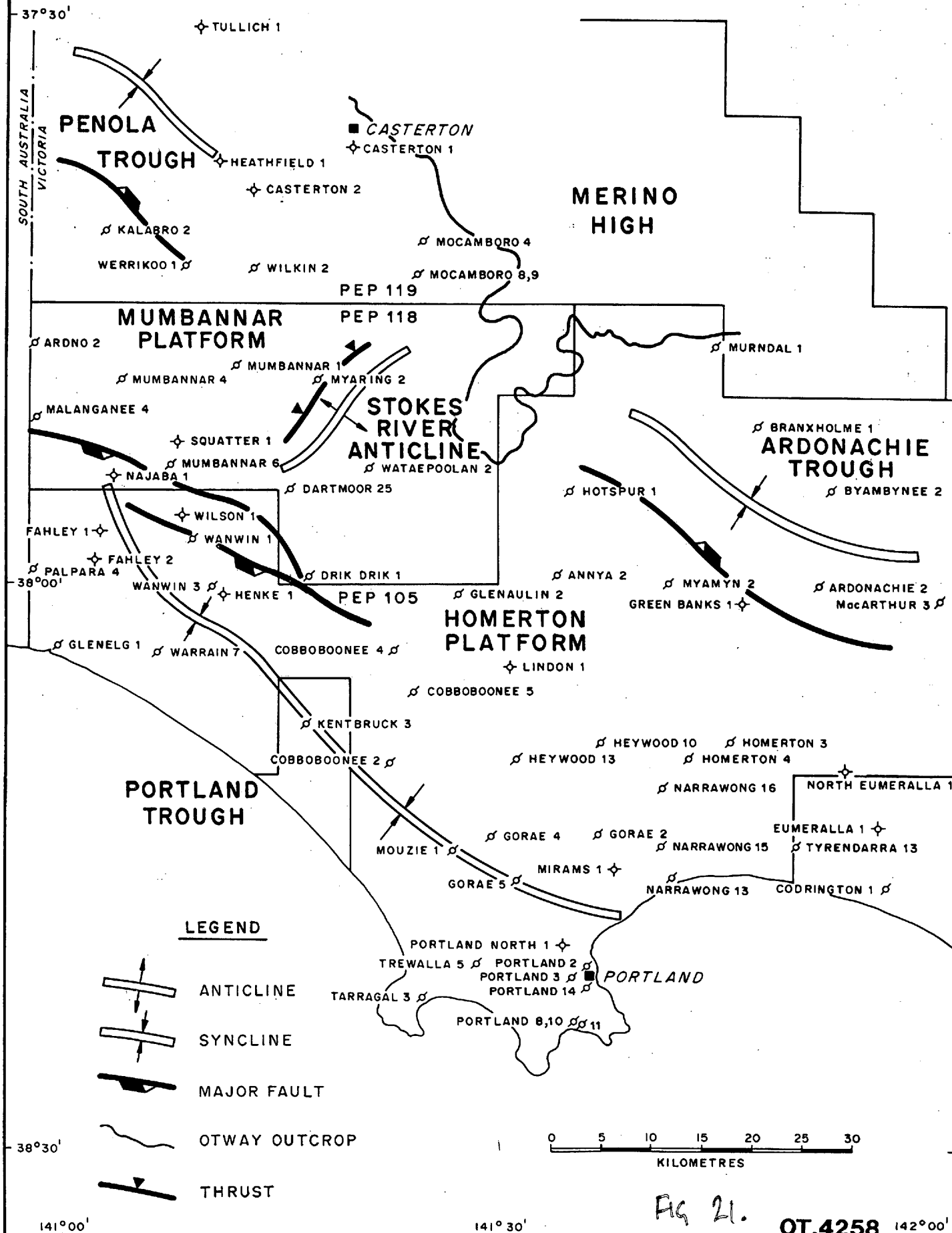

Fig 21.

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McEACHERN # 1

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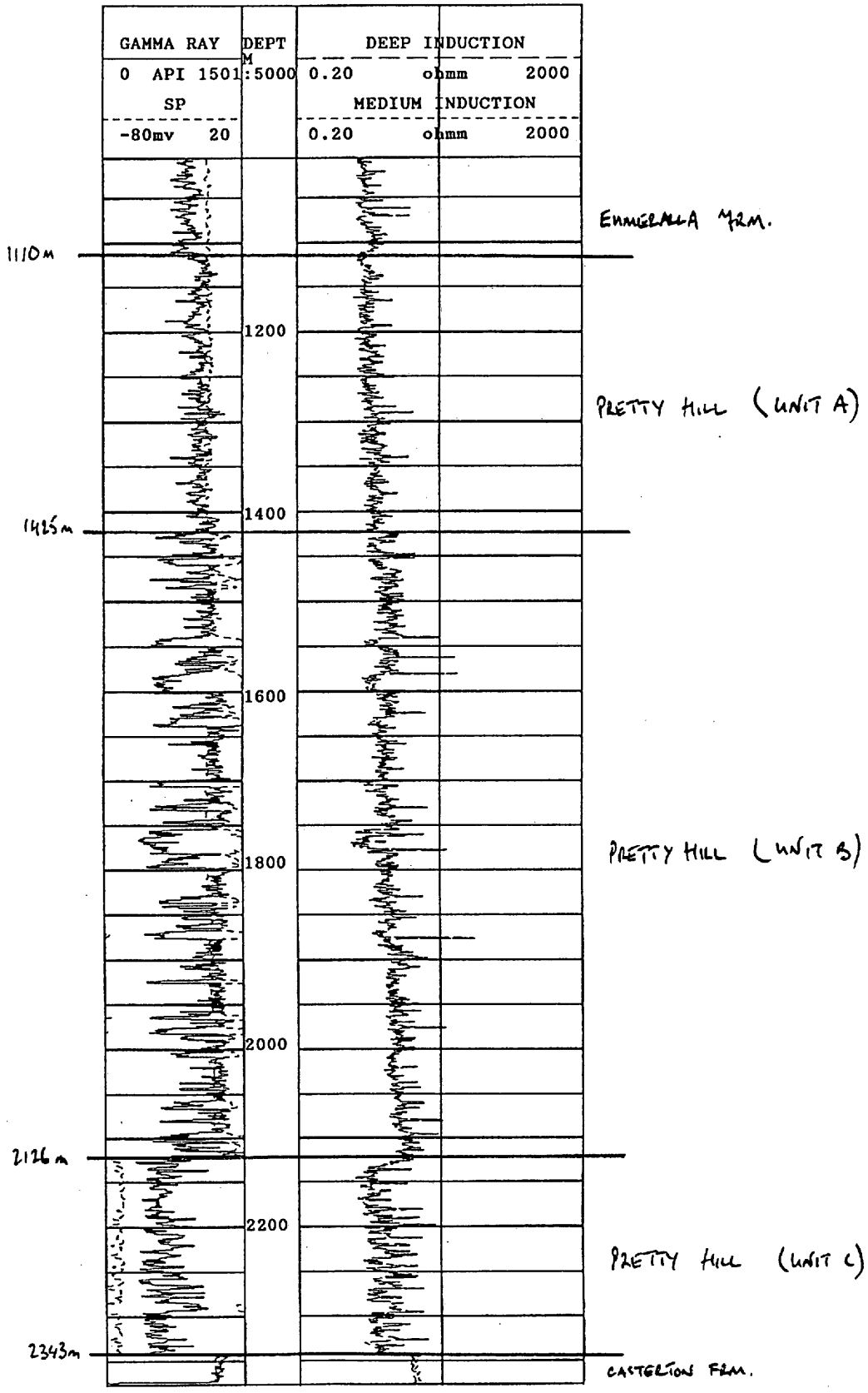

Fig. 31 EXAMPLE OF PRETTY HILL FORMATION - PEP 119

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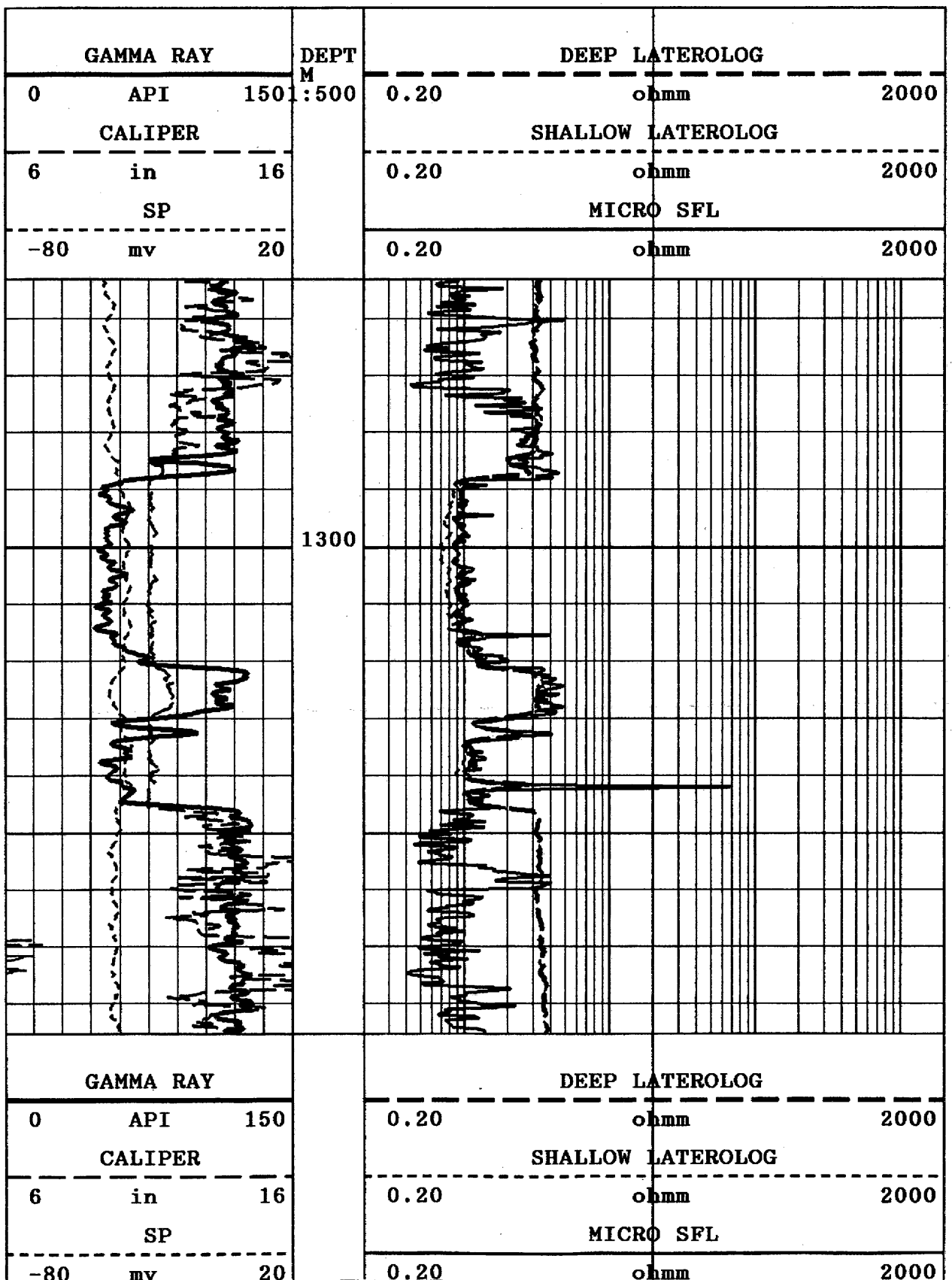

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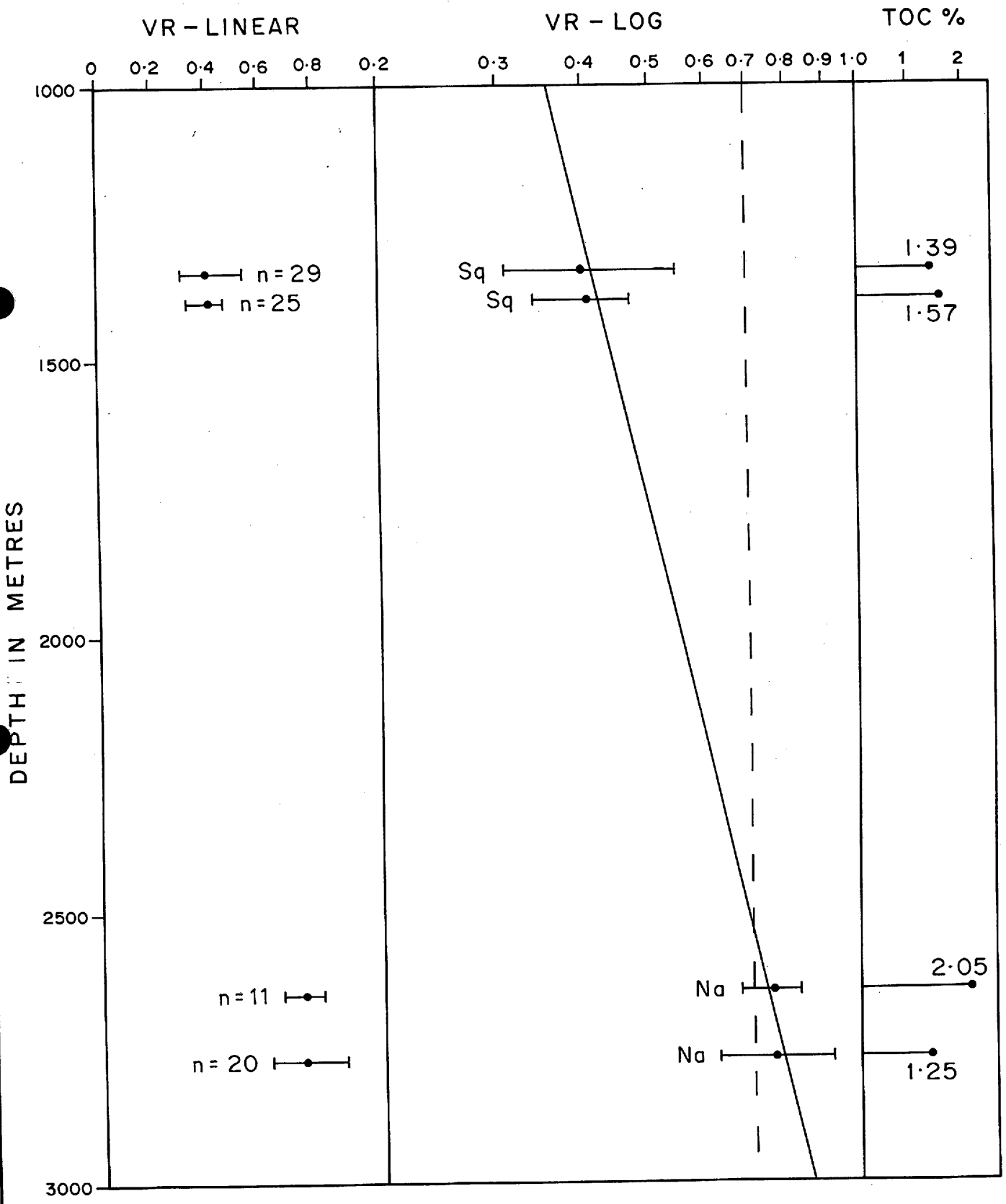
VITRINITE REFLECTANCE OF BELFAST SEDIMENTS



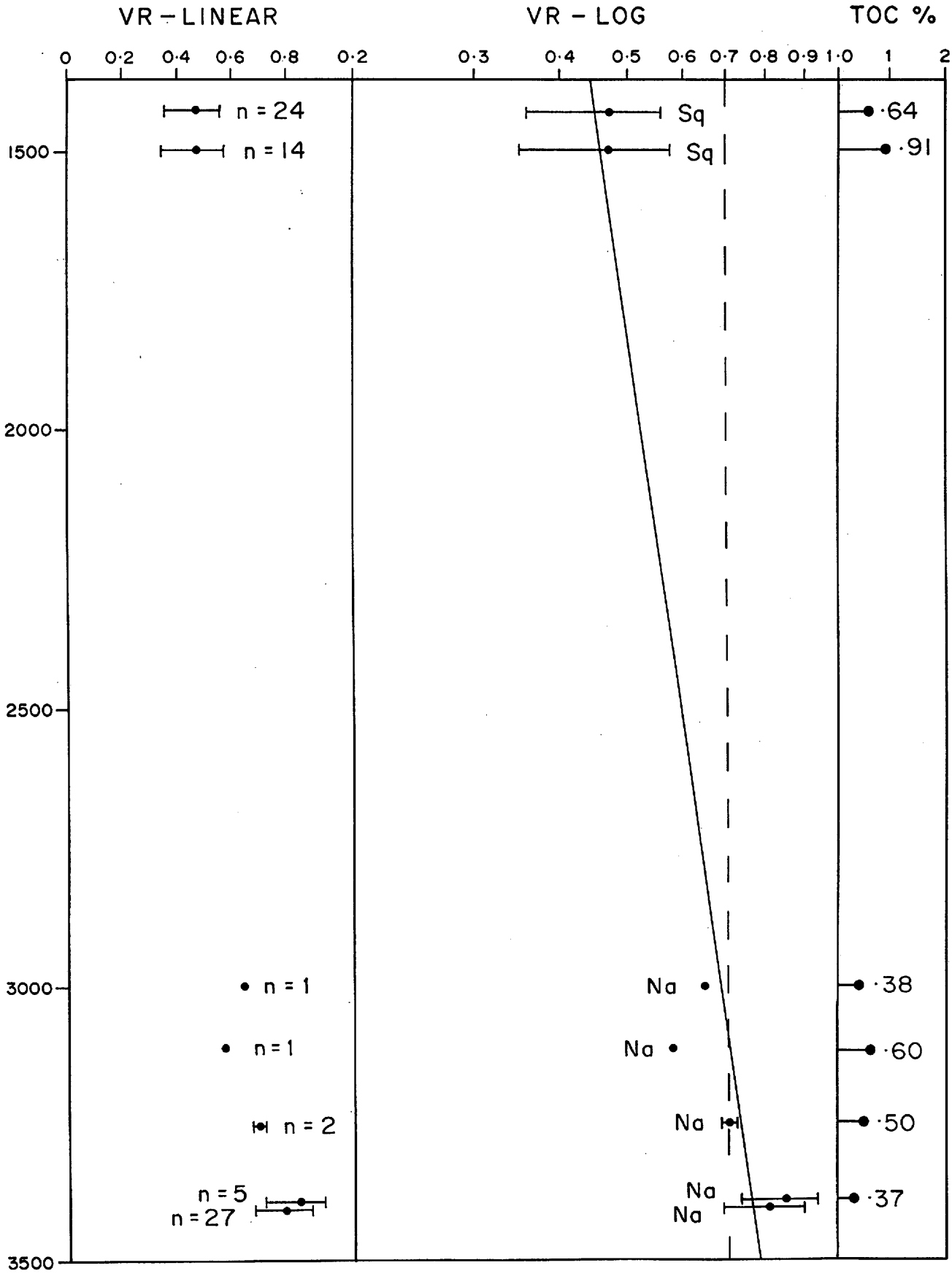
Sq = Squatter - 1

Na = Najaba - 1A

Fig 35.

OT.4261

VITRINITE REFLECTANCE OF EUMERALLA SEDIMENTS



Sq = Squatter – 1

Na = Najaba – 1A

Fig 36. **OT.4260**

805779 097

CENTRAL ONSHORE OTWAY BASIN

INFERRED LOCATION "MERINO TRANSFER"

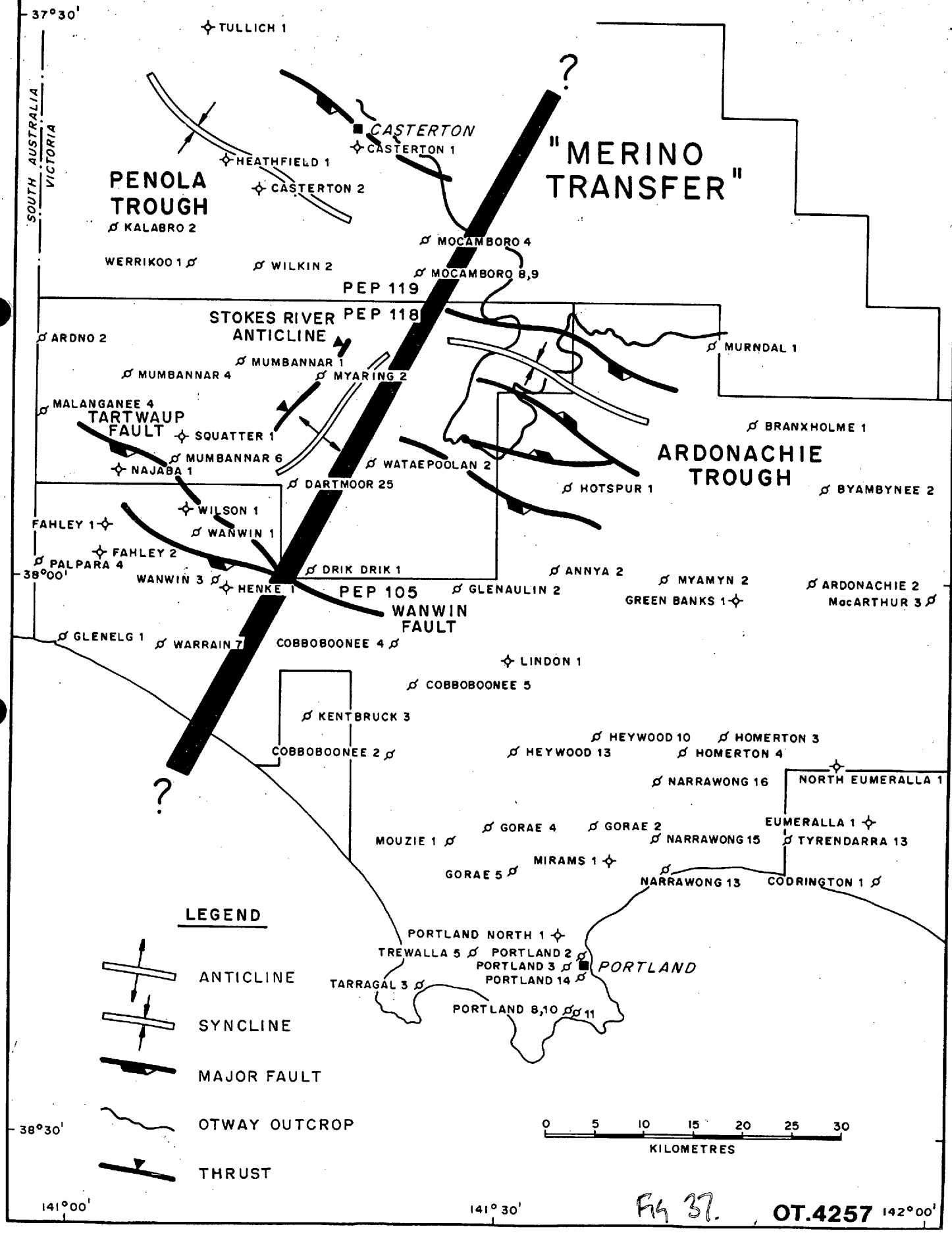


Fig 37.

OT.4257

This is Page Number **805779_098X**

This is an enclosure indicator page.

The page that follows this page is an uncatalogued fold-out (or A4 colour page)with page number:

805779_098Y

and is enclosed within the document PE805779 at this page.

PEP118 AND ENVIRONS
FORMATION TOPS

WELL NAME	WELL TYPE	PERMIT No.	ELEVATION (m) GL	POST NIRRANDA	NIRRANDA GROUP	DILWYN FORMATION	PEMBER MUDSTONE	PEBBLE POINT FORMATION	PAARATTE FORMATION	BELFAST MUDSTONE	WAARRE FORMATION	EUMERALLA FORMATION	TOTAL DEPTH	COMMENTS
ANNYA-2	Govt.Bore	105	150	(353)	Abs	353 (101)	454 (114)	568 (58)	626 (95)	721 (24)	Abs	745 (139+)	884	
ARDNO-2	Govt.Bore	118	66	(163)	Abs	163 (483)	646 (192)	838 (76)	914 (587+)	NR	NR	NR	1501	Possible T.D. in Belfast ?
COBBOBOONEE-4	Govt.Bore	105	123	(489)	489 (66)	555 (478)	1033 (133)	1166 (47)	1213 (703+)	-	-	-	1916	No logs below 1530m.
DARTMOOR-25	Govt.Bore	118	37	(42)	Abs	42 (351)	393 (140)	533 (59)	592 (385)	977 (97)	1074 (13)	1087 (14+)	1101	
DRIK DRIK-1	Govt.Bore	118	40	(73)	73 (18)	91 (374)	465 (136)	601 (21)	622 (294)	916 (111)	1027 (20)	1047 (175+)	1222	
FAHLEY-1	Exploration	105	39	(198)	198 (94)	292 (721)	1013 (274)	1287 (36)	1323 (1055)	-	-	-	3211	No logs below 2143m.
FAHLEY-2	Exploration	105	26	(160)	160 (132)	292 (666)	958 (232)	1190 (30)	1220 (80+)	NR	NR	NR	1300	
GLENAULIN-2	Govt.Bore	105	82	(296)	296 (41)	337 (293)	630 (172)	802 (47)	849 (203)	1052 (18)	1070 (24)	1094 (99+)	1193	
GLENELG-1	Govt.Bore	105	3	(230)	230 (45)	275 (550)	825 (275)	1100 (30)	1130 (1096+)	NR	NR	NR	2226	Also known as NELSON BORE
HENKE-1	Exploration	105	34	(60)	Abs	60 (974)	1034 (282)	1316 (20)	1336 (95+)	NR	NR	NR	1431	
HOTSPUR-1	Govt.Bore	105	89	(155)	Abs	155 (43)	198 (9)	207 (15)	222 (15)	237 (30)	Abs	267 (1010)	1349	Basal Clastics - 1277m. Basement - 1312m.
LINDON-1	Exploration	105	63	(264)	264 (136)	400 (258)	658 (245)	903 (38)	941 (250)	1191 (29)	1220 (8)	1228 (1783)	3011	Drilled 61m. Geltwood Beach Facies
MALANGANEE-4	Govt.Bore	118	57	(181)	181 (57)	238 (428)	666 (189)	855 (40)	895 (595)	1490 (122)	1612 (14)	1626 (93+)	1719	
MUMBANNAR-1	Govt.Bore	118	61	(146)	146 (32)	178 (172)	350 (132)	482 (40)	522 (318)	840 (13)	Abs	853 (279+)	1132	
MUMBANNAR-4	Govt.Bore	118	60	(142)	142 (36)	178 (354)	532 (151)	683 (43)	726 (502+)	NR	NR	NR	1228	
MUMBANNAR-6	Govt.Bore	118	56	(214)	214 (44)	258 (458)	716 (123)	839 (39)	878 (490)	1368 (104)	1472 (21)	1493 (160+)	1653	
MYARING-2	Govt.Bore	118	53	UNDIFFERENTIATED					104 (115) / 335 (176)	219 (16) / 511 (24)	Abs	235 (100) / 535 (191+)	726	Repeat section. Well drilled through reverse fault.
NAJABA-1A	Exploration	118	52	(249)	249 (59)	308 (774)	1082 (317)	1399 (80)	1479 (1165)	2644 (157)	2801 (48)	2849 (563+)	3412	
PALPARA-4	Govt.Bore	105	31	(256)	256 (20)	276 (575)	851 (243)	1094 (12)	1106 (355+)	NR	NR	NR	1461	
SQUATTER-1	Exploration	118	62	(175)	175 (68)	243 (382)	625 (165)	790 (35)	825 (473)	1298 (97)	1395 (19)	1414 (86+)	1500	
WANWIN-1	Govt.Bore	105	53	(155)	155 (21)	176 (863)	1039 (260)	1299 (22)	1321 (464+)	NR	NR	NR	1785	
WANWIN-3	Govt.Bore	105	34	(85)	85 (39)	124 (837)	961 (425)	1386 (28)	1414 (483+)	NR	NR	NR	1852	
WARRAIN-7	Govt.Bore	105	33	(209)	209 (26)	235 (691)	926 (522)	1448 (21)	1469 (317+)	NR	NR	NR	1786	
WATAEPOOLAN-2	Govt.Bore	118	61	(66)	Abs	66 (22)	88 (60)	148 (21)	169 (199)	368 (35)	Abs	403 (561+)	964	
WERRIKOO-2	Govt.Bore	119	63	(34)	34 (36)	70 (335)	405 (87)	492 (63)	555 (252)	809 (45)	Abs	854 (240+)	1094	
WILKIN-2	Govt.Bore	119	66	(28)	Abs	28 (100)	128 (39)	167 (31)	198 (163)	361 (21)	Abs	382 (131+)	513	
WILSON-1	Exploration	105	52	(187)	187 (14)	201 (728)	929 (260)	1189 (90)	1279 (38+)	NR	NR	NR	1317	Shows in Pebble Point

Abs - Absent NR - Not Reached (157) - Thickness (m) 89 - Top (m) GL

PEP118 AND ENVIRONS
FORMATION TOPS

WELL NAME	WELL TYPE	PERMIT No.	ELEVATION (m) GL	POST NIRRANDA	NIRRANDA GROUP	DILWYN FORMATION	PEMBER MUDSTONE	PEBBLE POINT FORMATION	PAARATTE FORMATION	BELFAST MUDSTONE	WAARRE FORMATION	EUMERALLA FORMATION	TOTAL DEPTH	COMMENTS
ANNYA-2	Govt.Bore	105	150	(353)	Abs	353 (101)	454 (114)	568 (58)	626 (95)	721 (24)	Abs	745 (139+)	884	
ARDNO-2	Govt.Bore	118	66	(163)	Abs	163 (483)	646 (192)	838 (76)	914 (587+)	NR	NR	NR	1501	Possible T.D. in Belfast ?
COBBOBOONEE-4	Govt.Bore	105	123	(489)	489 (66)	555 (478)	1033 (133)	1166 (47)	1213 (703+)	-	-	-	1916	No logs below 1530m.
DARTMOOR-25	Govt.Bore	118	37	(42)	Abs	42 (351)	393 (140)	533 (59)	592 (385)	977 (97)	1074 (13)	1087 (14+)	1101	
DRIK DRIK-1	Govt.Bore	118	40	(73)	73 (18)	91 (374)	465 (136)	601 (21)	622 (294)	916 (111)	1027 (20)	1047 (175+)	1222	
FAHLEY-1	Exploration	105	39	(198)	198 (94)	292 (721)	1013 (274)	1287 (36)	1323 (1055)	-	-	-	3211	No logs below 2143m.
FAHLEY-2	Exploration	105	26	(160)	160 (132)	292 (666)	958 (232)	1190 (30)	1220 (80+)	NR	NR	NR	1300	
GLENAULIN-2	Govt.Bore	105	82	(296)	296 (41)	337 (293)	630 (172)	802 (47)	849 (203)	1052 (18)	1070 (24)	1094 (99+)	1193	
GLENELG-1	Govt.Bore	105	3	(230)	230 (45)	275 (550)	825 (275)	1100 (30)	1130 (1096+)	NR	NR	NR	2226	Also known as NELSON BORE
HENKE-1	Exploration	105	34	(60)	Abs	60 (974)	1034 (282)	1316 (20)	1336 (95+)	NR	NR	NR	1431	
HOTSPUR-1	Govt.Bore	105	89	(155)	Abs	155 (43)	198 (9)	207 (15)	222 (15)	237 (30)	Abs	267 (1010)	1349	Basal Clastics - 1277m. Basement - 1312m.
LINDON-1	Exploration	105	63	(264)	264 (136)	400 (258)	658 (245)	903 (38)	941 (250)	1191 (29)	1220 (8)	1228 (1783)	3011	Drilled 61m. Geltwood Beach Facies
MALANGANEE-4	Govt.Bore	118	57	(181)	181 (57)	238 (428)	666 (189)	855 (40)	895 (595)	1490 (122)	1612 (14)	1626 (93+)	1719	
MUMBANNAR-1	Govt.Bore	118	61	(146)	146 (32)	178 (172)	350 (132)	482 (40)	522 (318)	840 (13)	Abs	853 (279+)	1132	
MUMBANNAR-4	Govt.Bore	118	60	(142)	142 (36)	178 (354)	532 (151)	683 (43)	726 (502+)	NR	NR	NR	1228	
MUMBANNAR-6	Govt.Bore	118	56	(214)	214 (44)	258 (458)	716 (123)	839 (39)	878 (490)	1368 (104)	1472 (21)	1493 (160+)	1653	
MYARING-2	Govt.Bore	118	53	UNDIFFERENTIATED					104 (116) / 335 (176)	219 (16) / 511 (24)	Abs	235 (100) / 535 (191+)	726	Repeat section. Well drilled through reverse fault.
NAJABA-1A	Exploration	118	52	(249)	249 (59)	308 (774)	1082 (317)	1399 (80)	1479 (1165)	2644 (157)	2801 (48)	2849 (563+)	3412	
PALPARA-4	Govt.Bore	105	31	(256)	256 (20)	276 (575)	851 (243)	1094 (12)	1106 (355+)	NR	NR	NR	1461	
SQUATTER-1	Exploration	118	62	(175)	175 (68)	243 (382)	625 (165)	790 (35)	825 (473)	1298 (97)	1395 (19)	1414 (86+)	1500	
WANWIN-1	Govt.Bore	105	53	(155)	155 (21)	176 (863)	1039 (260)	1299 (22)	1321 (464+)	NR	NR	NR	1785	
WANWIN-3	Govt.Bore	105	34	(85)	85 (39)	124 (637)	961 (425)	1386 (28)	1414 (483+)	NR	NR	NR	1852	
WARRAIN-7	Govt.Bore	105	33	(209)	209 (26)	235 (691)	926 (522)	1448 (21)	1469 (317+)	NR	NR	NR	1786	
WATAEPOOLAN-2	Govt.Bore	118	61	(66)	Abs	66 (22)	88 (60)	148 (21)	169 (199)	368 (35)	Abs	403 (561+)	964	
WERRIKOO-2	Govt.Bore	119	63	(34)	34 (36)	70 (335)	405 (87)	492 (63)	555 (252)	809 (45)	Abs	854 (240+)	1094	
WILKIN-2	Govt.Bore	119	66	(28)	Abs	28 (100)	128 (39)	167 (31)	198 (163)	361 (21)	Abs	382 (131+)	513	
WILSON-1	Exploration	105	52	(187)	187 (14)	201 (728)	929 (260)	1189 (90)	1279 (38+)	NR	NR	NR	1317	Shows in Pebble Point

Abs - Absent NR - Not Reached (157) - Thickness (m) 89 - Top (m) GL

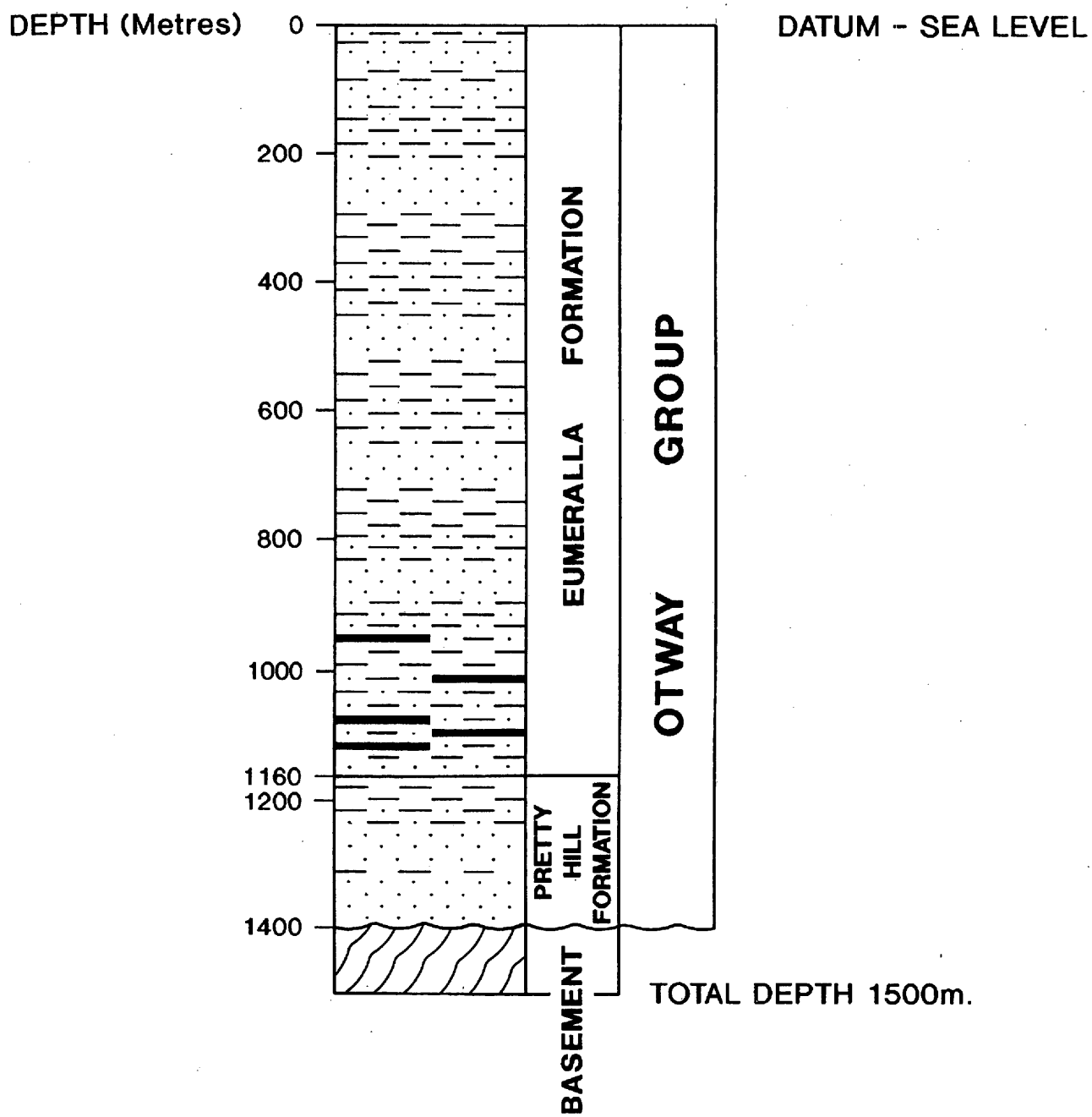
GAS AND FUEL EXPLORATION N.L.

805779 100

STRATIGRAPHIC WELL

SEISMIC LINE CR88-1

SHOTPOINT No.510



OT.4259

FIGURES

PE606632

This is an enclosure indicator page.
The enclosure PE606632 is enclosed within the container PE805779 at this location in this document.

The enclosure PE606632 has the following characteristics:

ITEM_BARCODE	= PE606632
CONTAINER_BARCODE	= PE805779
NAME	= Wataepoolan-2 Well Composite Log
BASIN	= OTWAY
ONSHORE?	= Y
DATA_TYPE	= BOREHOLE
DATA_SUB_TYPE	= COMPOSITE_LOG
DESCRIPTION	= Wataepoolan 2 Well Composite Log with Hand Written interpretation, Gippsland Basin, Scale 1: 2000 (Enclosure in: Geological Study Report of PEP 118) PEP 118, By: A Buffin
REMARKS	=
DATE_WRITTEN	= 31-OCT-1989
DATE_PROCESSED	=
DATE_RECEIVED	=
RECEIVED_FROM	=
WELL_NAME	=
CONTRACTOR	=
AUTHOR	=
ORIGINATOR	=
TOP_DEPTH	=
BOTTOM_DEPTH	=
ROW_CREATED_BY	= EC00_SW

(Inserted by DNRE - Vic Govt Mines Dept)

PE606633

This is an enclosure indicator page.
The enclosure PE606633 is enclosed within the container PE805779 at this location in this document.

The enclosure PE606633 has the following characteristics:

ITEM_BARCODE	PE606633
CONTAINER_BARCODE	PE805779
NAME	Squatter-1 Well Composite Log
BASIN	OTWAY
ONSHORE?	Y
DATA_TYPE	WELL
DATA_SUB_TYPE	COMPOSITE_LOG
DESCRIPTION	Squatter-1 Well Composite Log with Hand Written interpretation, Gippsland Basin, Scale 1: 2000 (Enclosure in: Geological Study Report of PEP 118) PEP 118, By: A Buffin
REMARKS	
DATE_WRITTEN	
DATE_PROCESSED	
DATE_RECEIVED	
RECEIVED_FROM	
WELL_NAME	Squatter-1
CONTRACTOR	
AUTHOR	
ORIGINATOR	
TOP_DEPTH	0
BOTTOM_DEPTH	1500
ROW_CREATED_BY	EC00_SW

(Inserted by DNRE - Vic Govt Mines Dept)

PE606634

This is an enclosure indicator page.
The enclosure PE606634 is enclosed within the container PE805779 at this location in this document.

The enclosure PE606634 has the following characteristics:

ITEM_BARCODE	= PE606634
CONTAINER_BARCODE	= PE805779
NAME	= Najaba-1A Well Composite Log
BASIN	= OTWAY
ONSHORE?	= Y
DATA_TYPE	= WELL
DATA_SUB_TYPE	= COMPOSITE_LOG
DESCRIPTION	= Najaba-1 Well Composite Log with Hand Written interpretation, Gippsland Basin, Scale 1: 2000 (Enclosure in: Geological Study Report of PEP 118) PEP 118, By: A Buffin
REMARKS	=
DATE_WRITTEN	=
DATE_PROCESSED	=
DATE_RECEIVED	=
RECEIVED_FROM	=
WELL_NAME	= Najaba-1
CONTRACTOR	=
AUTHOR	=
ORIGINATOR	=
TOP_DEPTH	= 0
BOTTOM_DEPTH	= 3412
ROW_CREATED_BY	= EC00_SW

(Inserted by DNRE - Vic Govt Mines Dept)

PE606635

This is an enclosure indicator page.
The enclosure PE606635 is enclosed within the container PE805779 at this location in this document.

The enclosure PE606635 has the following characteristics:

ITEM_BARCODE	PE606635
CONTAINER_BARCODE	PE805779
NAME	Myaring-2 Well Composite Log
BASIN	OTWAY
ONSHORE?	Y
DATA_TYPE	BOREHOLE
DATA_SUB_TYPE	COMPOSITE_LOG
DESCRIPTION	Myaring-2 Well Composite Log with Hand Written interpretation, Gippsland Basin, Scale 1: 2000 (Enclosure in: Geological Study Report of PEP 118) PEP 118, By: A Buffin
REMARKS	
DATE_WRITTEN	
DATE_PROCESSED	
DATE_RECEIVED	
RECEIVED_FROM	
WELL_NAME	
CONTRACTOR	
AUTHOR	
ORIGINATOR	
TOP_DEPTH	
BOTTOM_DEPTH	
ROW_CREATED_BY	EC00_SW

(Inserted by DNRE - Vic Govt Mines Dept)

PE606636

This is an enclosure indicator page.
The enclosure PE606636 is enclosed within the container PE805779 at this location in this document.

The enclosure PE606636 has the following characteristics:

ITEM_BARCODE	= PE606636
CONTAINER_BARCODE	= PE805779
NAME	= Mumbannar-6 Well Composite Log
BASIN	= OTWAY
ONSHORE?	= Y
DATA_TYPE	= BOREHOLE
DATA_SUB_TYPE	= COMPOSITE_LOG
DESCRIPTION	= Mumbannar-6 Well Composite Log with Hand Written interpretation, Gippsland Basin, Scale 1: 2000 (Enclosure in: Geological Study Report of PEP 118) PEP 118, By: A Buffin
REMARKS	=
DATE_WRITTEN	=
DATE_PROCESSED	=
DATE_RECEIVED	=
RECEIVED_FROM	=
WELL_NAME	=
CONTRACTOR	=
AUTHOR	=
ORIGINATOR	=
TOP_DEPTH	=
BOTTOM_DEPTH	=
ROW_CREATED_BY	= EC00_SW

(Inserted by DNRE - Vic Govt Mines Dept)

PE606637

This is an enclosure indicator page.
The enclosure PE606637 is enclosed within the container PE805779 at this location in this document.

The enclosure PE606637 has the following characteristics:

ITEM_BARCODE	PE606637
CONTAINER_BARCODE	PE805779
NAME	Mumbannar-4 Well Composite Log
BASIN	OTWAY
ONSHORE?	Y
DATA_TYPE	BOREHOLE
DATA_SUB_TYPE	COMPOSITE_LOG
DESCRIPTION	Mumbannar-4 Well Composite Log with Hand Written interpretation, Gippsland Basin, Scale 1: 2000 (Enclosure in: Geological Study Report of PEP 118) PEP 118, By: A Buffin
REMARKS	
DATE_WRITTEN	
DATE_PROCESSED	
DATE_RECEIVED	
RECEIVED_FROM	
WELL_NAME	
CONTRACTOR	
AUTHOR	
ORIGINATOR	
TOP_DEPTH	
BOTTOM_DEPTH	
ROW_CREATED_BY	EC00_SW

(Inserted by DNRE - Vic Govt Mines Dept)

PE606638

This is an enclosure indicator page.
The enclosure PE606638 is enclosed within the container PE805779 at this location in this document.

The enclosure PE606638 has the following characteristics:

ITEM_BARCODE	= PE606638
CONTAINER_BARCODE	= PE805779
NAME	= Mumbannar-1 Well Composite Log
BASIN	= OTWAY
ONSHORE?	= Y
DATA_TYPE	= WELL
DATA_SUB_TYPE	= COMPOSITE_LOG
DESCRIPTION	= Mumbannar-1 Well Composite Log with Hand Written interpretation, Gippsland Basin, Scale 1: 2000 (Enclosure in: Geological Study Report of PEP 118) PEP 118, By: A Buffin
REMARKS	=
DATE_WRITTEN	=
DATE_PROCESSED	=
DATE_RECEIVED	=
RECEIVED_FROM	=
WELL_NAME	= Mumbannar-1
CONTRACTOR	=
AUTHOR	=
ORIGINATOR	=
TOP_DEPTH	= 0
BOTTOM_DEPTH	= 1132
ROW_CREATED_BY	= EC00_SW

(Inserted by DNRE - Vic Govt Mines Dept)

PE606639

This is an enclosure indicator page.
The enclosure PE606639 is enclosed within the container PE805779 at this location in this document.

The enclosure PE606639 has the following characteristics:

ITEM_BARCODE	PE606639
CONTAINER_BARCODE	PE805779
NAME	Ardno-2 Well Composite Log
BASIN	OTWAY
ONSHORE?	Y
DATA_TYPE	BOREHOLE
DATA_SUB_TYPE	COMPOSITE_LOG
DESCRIPTION	Ardno-2 Well Composite Log with Hand Written interpretation, Gippsland Basin, Scale 1: 2000 (Enclosure in: Geological Study Report of PEP 118) PEP 118, By: A Buffin
REMARKS	
DATE_WRITTEN	
DATE_PROCESSED	
DATE_RECEIVED	
RECEIVED_FROM	
WELL_NAME	
CONTRACTOR	
AUTHOR	
ORIGINATOR	
TOP_DEPTH	
BOTTOM_DEPTH	
ROW_CREATED_BY	EC00_SW

(Inserted by DNRE - Vic Govt Mines Dept)

PE606640

This is an enclosure indicator page.
The enclosure PE606640 is enclosed within the container PE805779 at this location in this document.

The enclosure PE606640 has the following characteristics:

ITEM_BARCODE	PE606640
CONTAINER_BARCODE	PE805779
NAME	Dartmoor-25 Well Composite Log
BASIN	OTWAY
ONSHORE?	Y
DATA_TYPE	BOREHOLE
DATA_SUB_TYPE	COMPOSITE_LOG
DESCRIPTION	Dartmoor-25 Well Composite Log with Hand Written interpretation, Gippsland Basin, Scale 1: 2000 (Enclosure in: Geological Study Report of PEP 118) PEP 118, By: A Buffin
REMARKS	
DATE_WRITTEN	
DATE_PROCESSED	
DATE_RECEIVED	
RECEIVED_FROM	
WELL_NAME	
CONTRACTOR	
AUTHOR	
ORIGINATOR	
TOP_DEPTH	
BOTTOM_DEPTH	
ROW_CREATED_BY	EC00_SW

(Inserted by DNRE - Vic Govt Mines Dept)

PE606641

This is an enclosure indicator page.
The enclosure PE606641 is enclosed within the container PE805779 at this location in this document.

The enclosure PE606641 has the following characteristics:

ITEM_BARCODE	PE606641
CONTAINER_BARCODE	PE805779
NAME	Drik Drik-1 Well Composite Log
BASIN	OTWAY
ONSHORE?	Y
DATA_TYPE	BOREHOLE
DATA_SUB_TYPE	COMPOSITE_LOG
DESCRIPTION	Drik Drik-1 Well Composite Log with Hand Written interpretation, Gippsland Basin, Scale 1: 2000 (Enclosure in: Geological Study Report of PEP 118) PEP 118, By: A Buffin
REMARKS	
DATE_WRITTEN	
DATE_PROCESSED	
DATE_RECEIVED	
RECEIVED_FROM	
WELL_NAME	
CONTRACTOR	
AUTHOR	
ORIGINATOR	
TOP_DEPTH	
BOTTOM_DEPTH	
ROW_CREATED_BY	EC00_SW

(Inserted by DNRE - Vic Govt Mines Dept)

PE606642

This is an enclosure indicator page.
The enclosure PE606642 is enclosed within the container PE805779 at this location in this document.

The enclosure PE606642 has the following characteristics:

ITEM_BARCODE	PE606642
CONTAINER_BARCODE	PE805779
NAME	Malanganee-4 Well Composite Log
BASIN	OTWAY
ONSHORE?	Y
DATA_TYPE	BOREHOLE
DATA_SUB_TYPE	COMPOSITE_LOG
DESCRIPTION	Malanganee-4 Well Composite Log with Hand Written interpretation, Gippsland Basin, Scale 1: 2000 (Enclosure in: Geological Study Report of PEP 118) PEP 118, By: A Buffin
REMARKS	
DATE_WRITTEN	
DATE_PROCESSED	
DATE_RECEIVED	
RECEIVED_FROM	
WELL_NAME	
CONTRACTOR	
AUTHOR	
ORIGINATOR	
TOP_DEPTH	
BOTTOM_DEPTH	
ROW_CREATED_BY	EC00_SW

(Inserted by DNRE - Vic Govt Mines Dept)

PE606643

This is an enclosure indicator page.
The enclosure PE606643 is enclosed within the container PE805779 at this location in this document.

The enclosure PE606643 has the following characteristics:

ITEM_BARCODE	= PE606643
CONTAINER_BARCODE	= PE805779
NAME	= Ardno-2 Well Composite Log
BASIN	= OTWAY
ONSHORE?	= Y
DATA_TYPE	= BOREHOLE
DATA_SUB_TYPE	= COMPOSITE_LOG
DESCRIPTION	= Ardno-2 Well Composite Log, Gippsland Basin, Scale 1: 2000 (Enclosure in: Geological Study Report of PEP 118) PEP 118, By: A Buffin
REMARKS	=
DATE_WRITTEN	=
DATE_PROCESSED	=
DATE_RECEIVED	=
RECEIVED_FROM	=
WELL_NAME	=
CONTRACTOR	=
AUTHOR	=
ORIGINATOR	=
TOP_DEPTH	=
BOTTOM_DEPTH	=
ROW_CREATED_BY	= EC00_SW

(Inserted by DNRE - Vic Govt Mines Dept)

PE606644

This is an enclosure indicator page.
The enclosure PE606644 is enclosed within the container PE805779 at this location in this document.

The enclosure PE606644 has the following characteristics:

ITEM_BARCODE	PE606644
CONTAINER_BARCODE	PE805779
NAME	Dartmoor-25 Well Composite Log
BASIN	OTWAY
ONSHORE?	Y
DATA_TYPE	BOREHOLE
DATA_SUB_TYPE	COMPOSITE_LOG
DESCRIPTION	Dartmoor-25 Well Composite Log, Gippsland Basin, Scale 1: 2000 (Enclosure in: Geological Study Report of PEP 118) PEP 118, By: A Buffin
REMARKS	
DATE_WRITTEN	
DATE_PROCESSED	
DATE_RECEIVED	
RECEIVED_FROM	
WELL_NAME	
CONTRACTOR	
AUTHOR	
ORIGINATOR	
TOP_DEPTH	
BOTTOM_DEPTH	
ROW_CREATED_BY	EC00_SW

(Inserted by DNRE - Vic Govt Mines Dept)

PE606645

This is an enclosure indicator page.
The enclosure PE606645 is enclosed within the container PE805779 at this location in this document.

The enclosure PE606645 has the following characteristics:

ITEM_BARCODE	= PE606645
CONTAINER_BARCODE	= PE805779
NAME	= Drik Drik-1 Well Composite Log
BASIN	= OTWAY
ONSHORE?	= Y
DATA_TYPE	= BOREHOLE
DATA_SUB_TYPE	= COMPOSITE_LOG
DESCRIPTION	= Drik Drik-1 Well Composite Log, Gippsland Basin, Scale 1: 2000 (Enclosure in: Geological Study Report of PEP 118) PEP 118, By: A Buffin
REMARKS	=
DATE_WRITTEN	=
DATE_PROCESSED	=
DATE_RECEIVED	=
RECEIVED_FROM	=
WELL_NAME	=
CONTRACTOR	=
AUTHOR	=
ORIGINATOR	=
TOP_DEPTH	=
BOTTOM_DEPTH	=
ROW_CREATED_BY	= EC00_SW

(Inserted by DNRE - Vic Govt Mines Dept)

PE606646

This is an enclosure indicator page.
The enclosure PE606646 is enclosed within the container PE805779 at this location in this document.

The enclosure PE606646 has the following characteristics:

ITEM_BARCODE	= PE606646
CONTAINER_BARCODE	= PE805779
NAME	= Malanganee-4 Well Composite Log
BASIN	= OTWAY
ONSHORE?	= Y
DATA_TYPE	= BOREHOLE
DATA_SUB_TYPE	= COMPOSITE_LOG
DESCRIPTION	= Malanganee-4 Well Composite Log, Gippsland Basin, Scale 1: 2000 (Enclosure in: Geological Study Report of PEP 118) PEP 118, By: A Buffin
REMARKS	=
DATE_WRITTEN	=
DATE_PROCESSED	=
DATE_RECEIVED	=
RECEIVED_FROM	=
WELL_NAME	=
CONTRACTOR	=
AUTHOR	=
ORIGINATOR	=
TOP_DEPTH	=
BOTTOM_DEPTH	=
ROW_CREATED_BY	= EC00_SW

(Inserted by DNRE - Vic Govt Mines Dept)

PE606647

This is an enclosure indicator page.
The enclosure PE606647 is enclosed within the container PE805779 at this location in this document.

The enclosure PE606647 has the following characteristics:

ITEM_BARCODE	PE606647
CONTAINER_BARCODE	PE805779
NAME	Mumbannar-1 Well Composite Log
BASIN	OTWAY
ONSHORE?	Y
DATA_TYPE	WELL
DATA_SUB_TYPE	COMPOSITE_LOG
DESCRIPTION	Mumbannar-1 Well Composite Log, Gippsland Basin, Scale 1: 2000 (Enclosure in: Geological Study Report of PEP 118) PEP 118, By: A Buffin
REMARKS	
DATE_WRITTEN	
DATE_PROCESSED	
DATE_RECEIVED	
RECEIVED_FROM	
WELL_NAME	Mumbannar-1
CONTRACTOR	
AUTHOR	
ORIGINATOR	
TOP_DEPTH	0
BOTTOM_DEPTH	1130
ROW_CREATED_BY	EC00_SW

(Inserted by DNRE - Vic Govt Mines Dept)

PE606648

This is an enclosure indicator page.
The enclosure PE606648 is enclosed within the container PE805779 at this location in this document.

The enclosure PE606648 has the following characteristics:

ITEM_BARCODE	= PE606648
CONTAINER_BARCODE	= PE805779
NAME	= Mumbannar-4 Well Composite Log
BASIN	= OTWAY
ONSHORE?	= Y
DATA_TYPE	= BOREHOLE
DATA_SUB_TYPE	= COMPOSITE_LOG
DESCRIPTION	= Mumbannar-4 Well Composite Log, Gippsland Basin, Scale 1: 2000 (Enclosure in: Geological Study Report of PEP 118) PEP 118, By: A Buffin
REMARKS	=
DATE_WRITTEN	=
DATE_PROCESSED	=
DATE_RECEIVED	=
RECEIVED_FROM	=
WELL_NAME	=
CONTRACTOR	=
AUTHOR	=
ORIGINATOR	=
TOP_DEPTH	=
BOTTOM_DEPTH	=
ROW_CREATED_BY	= EC00_SW

(Inserted by DNRE - Vic Govt Mines Dept)

PE606649

This is an enclosure indicator page.
The enclosure PE606649 is enclosed within the container PE805779 at this location in this document.

The enclosure PE606649 has the following characteristics:

ITEM_BARCODE	PE606649
CONTAINER_BARCODE	PE805779
NAME	Mumbannar-6 Well Composite Log
BASIN	OTWAY
ONSHORE?	Y
DATA_TYPE	BOREHOLE
DATA_SUB_TYPE	COMPOSITE_LOG
DESCRIPTION	Mumbannar-6 Well Composite Log, Gippsland Basin, Scale 1: 2000 (Enclosure in: Geological Study Report of PEP 118) PEP 118, By: A Buffin
REMARKS	
DATE_WRITTEN	
DATE_PROCESSED	
DATE_RECEIVED	
RECEIVED_FROM	
WELL_NAME	
CONTRACTOR	
AUTHOR	
ORIGINATOR	
TOP_DEPTH	
BOTTOM_DEPTH	
ROW_CREATED_BY	EC00_SW

(Inserted by DNRE - Vic Govt Mines Dept)

PE606650

This is an enclosure indicator page.
The enclosure PE606650 is enclosed within the container PE805779 at this location in this document.

The enclosure PE606650 has the following characteristics:

ITEM_BARCODE	PE606650
CONTAINER_BARCODE	PE805779
NAME	Myaring-2 Well Composite Log
BASIN	OTWAY
ONSHORE?	Y
DATA_TYPE	BOREHOLE
DATA_SUB_TYPE	COMPOSITE_LOG
DESCRIPTION	Myaring-2 Well Composite Log, Gippsland Basin, Scale 1: 2000 (Enclosure in: Geological Study Report of PEP 118) PEP 118, By: A Buffin
REMARKS	
DATE_WRITTEN	
DATE_PROCESSED	
DATE_RECEIVED	
RECEIVED_FROM	
WELL_NAME	
CONTRACTOR	
AUTHOR	
ORIGINATOR	
TOP_DEPTH	
BOTTOM_DEPTH	
ROW_CREATED_BY	EC00_SW

(Inserted by DNRE - Vic Govt Mines Dept)

PE606651

This is an enclosure indicator page.
The enclosure PE606651 is enclosed within the container PE805779 at this location in this document.

The enclosure PE606651 has the following characteristics:

ITEM_BARCODE	= PE606651
CONTAINER_BARCODE	= PE805779
NAME	= Najaba-1 Well Composite Log
BASIN	= OTWAY
ONSHORE?	= Y
DATA_TYPE	= WELL
DATA_SUB_TYPE	= COMPOSITE_LOG
DESCRIPTION	= Najaba-1 Well Composite Log, Gippsland Basin, Scale 1: 2000 (Enclosure in: Geological Study Report of PEP 118) PEP 118, By: A Buffin
REMARKS	=
DATE_WRITTEN	=
DATE_PROCESSED	=
DATE_RECEIVED	=
RECEIVED_FROM	=
WELL_NAME	= Najaba-1
CONTRACTOR	=
AUTHOR	=
ORIGINATOR	=
TOP_DEPTH	= 0
BOTTOM_DEPTH	= 3425
ROW_CREATED_BY	= EC00_SW

(Inserted by DNRE - Vic Govt Mines Dept)

PE606652

This is an enclosure indicator page.
The enclosure PE606652 is enclosed within the container PE805779 at this location in this document.

The enclosure PE606652 has the following characteristics:

ITEM_BARCODE	PE606652
CONTAINER_BARCODE	PE805779
NAME	Squatter-1 Well Composite Log
BASIN	OTWAY
ONSHORE?	Y
DATA_TYPE	WELL
DATA_SUB_TYPE	COMPOSITE_LOG
DESCRIPTION	Squatter-1 Well Composite Log, Gippsland Basin, Scale 1: 2000 (Enclosure in: Geological Study Report of PEP 118) PEP 118, By: A Buffin
REMARKS	
DATE_WRITTEN	
DATE_PROCESSED	
DATE_RECEIVED	
RECEIVED_FROM	
WELL_NAME	Squatter-1
CONTRACTOR	
AUTHOR	
ORIGINATOR	
TOP_DEPTH	0
BOTTOM_DEPTH	1490
ROW_CREATED_BY	EC00_SW

(Inserted by DNRE - Vic Govt Mines Dept)

PE606653

This is an enclosure indicator page.
The enclosure PE606653 is enclosed within the container PE805779 at this location in this document.

The enclosure PE606653 has the following characteristics:

ITEM_BARCODE	= PE606653
CONTAINER_BARCODE	= PE805779
NAME	= Wataepoolan-2 Well Composite Log
BASIN	= OTWAY
ONSHORE?	= Y
DATA_TYPE	= BOREHOLE
DATA_SUB_TYPE	= COMPOSITE_LOG
DESCRIPTION	= Wataepoolan-2 Well Composite Log, Gippsland Basin, Scale 1: 2000 (Enclosure in: Geological Study Report of PEP 118) PEP 118, By: A Buffin
REMARKS	=
DATE_WRITTEN	=
DATE_PROCESSED	=
DATE_RECEIVED	=
RECEIVED_FROM	=
WELL_NAME	=
CONTRACTOR	=
AUTHOR	=
ORIGINATOR	=
TOP_DEPTH	=
BOTTOM_DEPTH	=
ROW_CREATED_BY	= EC00_SW

(Inserted by DNRE - Vic Govt Mines Dept)