ESSO EXPLORATION AND PRODUCTION AUSTRALIA INC.

WELL COMPLETION REPORT

VOLUME 2
INTERPRETED DATA

BLACKBACK-3

GIPPSLAND BASIN
VICTORIA

ESSO AUSTRALIA LIMITED

By John Phillips
April 1994

CONTENTS

FIGURES

APPENDICES

ENCLOSURES

1. Summary of Well Results

Blackback 3 spudded on 11 March 1994. The Top of Latrobe Group was penetrated 11 m high to prognosis (-2804 mSS) and consisted of Eocene aged (N.asperus) sediment. Two 18 m cores were cut and recovered in the Latrobe Group. (Core 1: 2837 m - 2855 m KB; Core 2: 2855 m - 2873 m KB). A total depth of 3125 m KB was reached in Cretaceous aged sediments on 31 March 1994. An electric logging suite consisting of resistivity, neutron density, sonic, dipmeter and magnetic resonance logs, was run together with pressure survey, zero offset VSP and sidewall core runs. Log analysis, pressure data and core analysis indicated that the Eocene section encountered at the Top of Latrobe Group and above the Field OWC was tight and would be non-productive. Consequently, no net pay is interpreted in Blackback 3. The well was plugged and abandoned as a dry hole, and the rig was released 14 April 1994.

STRATIGRAPHIC SUMMARY

Formation/Horizon	Predicted Depth (mTVDSS)	Actual Depth (mTVDSS)
Gippsland Limestone (sea-floor)	-321	-318
Lakes Entrance Formation	-2555	-2515
Top of Latrobe Group Unconformity	-2815	-2804
Base of Eocene Channel	Not Prognosed	-2853
Base Paleocene/Top Cretaceous	Not Prognosed	-2889
TOTAL DEPTH	-3100	-3100

2. Introduction

Blackback 3 was drilled as an appraisal well designed to define the reservoir configuration, fluid content and integrity of structural interpretation in the south western part of the Blackback Field. The Blackback 3 well is located in some 318 m of water, 2.2 km west south west of the Blackback 2 well, 2.7 km west southwest of the Hapuku 1 well and within the VIC/P24 exploration permit of the Gippsland Basin (Figure 1).

Blackback 3 represents the fifth penetration of the Latrobe Group within the Blackback/Terakihi structural feature. The Hapuku 1 well (1975) encountered a thin N. asperus marine sequence at the Top of Latrobe Group unconformity overlying an M. diversus to L. balmei Paleocene aged sequence within which oil saturated reservoir was identified. Blackback 1 was drilled in 1989 and encountered oil productive section within an N. asperus (Eocene) channel fill section at the Top of Latrobe Group. This sequence rests unconformably on Cretaceous aged (Upper T. longus) sediment. Terakihi 1 (1989) drilled the northern lobe of the structure and penetrated good quality oil saturated Cretaceous reservoir (Upper T. longus) at the Top of Latrobe Group. The Blackback 2 well (1992) tested the crest of the Blackback/Terakihi structure at a location 500 m to the west of the original Hapuku 1 discovery well. An M. diversus to L. balmei (Paleocene) stratigraphic sequence was penetrated at the Top of Latrobe Group and exhibited two hydraulically discrete gas sands above, and independent of, an oil column which exhibited the field OWC (-2834 mSS). This Paleocene section rested unconformably upon an Upper T. longus Cretaceous section (see Figure 2).

Given the stratigraphic variations between existing well control a number of possible outcomes were considered predrill for Blackback 3. The well was specifically designed to address this stratigraphic uncertainty and the structural integrity in the southwest of Blackback field.

3. Structure

In seismic time, the Blackback/Terakihi structure at the Top of Latrobe Group unconformity consists of two small closures separated by an eastwest trough. This trough is coincident with a prominent present day sea-floor channel. The two time closures are located near the Terakihi 1 and Blackback 2 well locations. The main portion of the field exists in time as a northeast plunging nose. In depth (Enclosure 4), the structure is considered a four way dip closure with vertical relief of 78 m over an area encompassing the Terakihi 1 to Blackback 3 locations (some 23 km^2). The Blackback Top of Latrobe feature is primarily a remnant of extensive erosion at the Top of Latrobe Group.

Underpinning the Top of Latrobe Group feature is a significantly different intra Latrobe Group structural configuration consisting of a northwest-southeast trending graben, which has undergone inversion during the Miocene - Oligocene compressional events. The pre-inversion structural configuration served to focuss post Paleocene channel processes and hence the distribution of the distal marine Eocene section. The Blackback 3 well intersected the Top of Latrobe Group at -2804 mSS some 11 m high to prognosis. This result, whilst slightly raising the southwestern flank of the field, has generally confirmed the predrill structural interpretation of this area. Analysis of dip information from the FMI logging tool has established consistency of structural dip magnitude and orientation with the Blackback 2 well within the Late Cretaceous section (Appendix 3).

4. Stratigraphy

As described in the introduction, the Blackback Field exhibits several distinct reservoir types at the Top of Latrobe Group: the high quality Cretaceous aged marine shoreface sand at Terakihi 1, the highly productive Paleocene aged marine sands of Blackback 2 and Hapuku 1 and the poor quality Eocene channel fill facies of Blackback 1 and 3 (Enclosure 3).

Following the Blackback 2 well where discrete base sealed Paleocene aged gas reservoirs were encountered, various stratigraphic models were proposed in the southwestern part of the field, each dealing with the extent and fluid content of these gas sands in different ways. The significance of the Blackback 3 well location is better appreciated when considering the predrill potential for oil legs to the gas sands should the Paleocene sequence have been more areally extensive. Consequently, Blackback 3 was located to address the possibility of downdip oil legs to the Blackback 2 gas sands whilst still being optimally located for drainage, should a different (Eocene or Cretaceous) stratigraphic scenario be encountered. Based on detailed seismic evidence, it was considered predrill that the most likely result at the Blackback 3 location would be Cretaceous aged (Upper T. longus) reservoir section at the Top of Latrobe Group (similar to Terakihi 1).

Blackback 3 encountered a poor reservoir quality Eocene (N. asperus) aged channel fill facies at the Top Latrobe Group (Enclosure 2). This result was postulated predrill as a lowside case. The Eocene model was supported by regional geological ties into the nearby Athene 1 well (Enclosure 3). The 49 m thick N. asperus section (2829 m KB - 2878 m KB) at Blackback 3 consists of poorly sorted fine to coarse grained glauconitic sandstone which exhibits an abundant clay matrix (up to 35%). This matrix is composed of kaolinite, illite/smectite, glauconite and chlorite. The sandstone is essentially matrix supported with the abundance of pore filling clays (Appendix 4) reducing permeabilities to fractions of a millidarcy. This is illustrated by core analysis, thin sections, SEM and MDT pressure survey results (Appendices 2, 4, 5 and 6).

The distinction in Blackback-3, between the Eocene channel fill sequence (N. asperus) and the underlying Paleocene section (L. balmei) is not immediately apparent using the standard electric logs and cuttings descriptions. Palynological analysis (Appendix 1) of core 1, 2 and sidewall cores suggests the Paleocene/Eocene boundary to lie in the interval 2850 m KB to 2898.2 m KB. All samples within this interval proved either barren of palynomorphs or to contain an age indeterminate assemblage of palynomorph species. It is noted however, that the sidewall core sample at 2867.5 m KB contained the species Homotryblium tasmaniense which is consistently recorded in overlying samples (Eocene) whilst the sidewall core sample at 2879.5 m KB contained the species Peninsulapollis gillii which is diagnostic of the older L. balmei section. Therefore it is plausible to place the Eocene/Paleocene boundary within the interval 2867.5 m - 2879.5 m KB. The FMI data set was utilised to provide a more refined base Eocene pick. Dip magnitude and azimuth through the upper portion of the Eocene section (cored interval with age control) are relatively low angle with consistent orientation (2.7° at 325° NW) and are interpreted as planar beds (Appendix 3). Dip-azimith changes from the northwest to predominantly northeast at approximately 2873 m KB. Crossbed dip magnitudes show a marked increase (8°-27°) from 2878 m KB.

Additional information from the MRIL log (magnetic resonance) suggests rock quality changes occur over the interval 2875 - 2880 m, inferring that the potential change from the poor quality distal marine glauconitic sandstone of the Eocene channel fill into the better quality Paleocene sands may occur in this interval. Consequently, and in consideration of all the above data, the Eocene/Paleocene boundary is placed at 2878 m KB.

The Paleocene section in Blackback 3 is characterised by medium to coarse grained sandstones exhibiting poor to moderate sorting and common glauconite. Age control is again limited by poor sidewall core recovery and poor palynomorph assemblages. Whilst confidence in assigning the broad L. balmei zonation to two samples (2888.2 m and 2902 m KB) was good to excellent, further subdivision of this section on a spore-pollen basis was not possible. However, the microplankton assemblages associated with these two sidewall core samples do indicate a lower L. balmei affinity (Appendix 1) (together with some fragmented dinoflagellate cysts in a sample from 2913 m KB). In addition to this evidence, the section below 2914 m KB is dominantly better quality sandstone (as evidenced by MRIL and MDT measurements) and also exhibits higher than usual potassium (contained in Alkali Feldspar) levels, probably reflecting more granitic southern margin provenance. Consequently, the Paleocene/Maastrichtian boundary is placed at 2914 m KB. Whilst the first confident palynological evidence of an Upper T. longus (Cretaceous) zone occurs at 2971 m KB mineralogical/reservoir quality evidence indicates the interval 2914 - 2971 is similar to the Cretaceous section confidently identified by palynology.

The well reached a total depth of 3125 m KB in Cretaceous aged clean medium grained well sorted quartzose sandstone of probable T. longus age (last confident T. longus date at 3062m KB).

5. Hydrocarbons

No significant hydrocarbon shows were encountered within the Gippsland Limestone or Lakes Entrance Formation in Blackback 3. Background gas levels within this section varied from 0.1 - 1.0% (5-50 units) with a broad 141 unit peak encountered at approximately 1350 m KB. At the Top of Latrobe Group a gas peak of 9.1% (81% C1; 9% C2; 6% C3; 3% C4; 1% C5+ (see Enclosure 1)) was recorded over a 5 m interval (2830 - 2835 m) and was accompanied by hydrocarbon fluorescence described as 5% moderately bright, pinpoint, pale yellow in colour and giving a very faint solvent cut with no residue. The Top of Latrobe Group was intersected some 31 m above the Blackback Field OOWC (-2834 mSS). Two consecutive cores were cut and recovered (2837 - 2855 m and 2855 - 2872.9 m on WCL) through the Field OOWC (2859 m KB). Palynological analysis of chip samples from the cores identified a middle N. asperus spore pollen assemblage which confirmed an Eocene reservoir age and initially indicated a similar reservoir result to that of the Blackback 1 well.

Description of the cores (Volume 1: Appendix 2) indicated patchy development of fluorescence above the field OOWC. Fluorescence was not observed in core below 2847 m KB, some 12 m above the Field OOWC. Above 2847 m KB (within core 1), fluorescence is described (Volume 1: Appendix 1 and 2) as a trace up to 50% dull patchy to moderately bright yellow fluorescence. Solvent cut varied from weak fast streaming to an instant cut.

Analysis of pressure survey data failed to identify any hydrocarbon/water contact. In general very low permeabilities were observed from pressure data between 2830 m - 2859 m MD KB (Appendix 5) with no wireline hydrocarbon samples able to be recovered from this interval due to reservoir quality. These results were in contrast to the Eocene section of Blackback 1 and suggested the quality of the Blackback 3 reservoir section is significantly worse than that of the Blackback 1 well.

On the basis of the pressure survey results (indicating tight reservoir), preliminary core analysis of plugs (suggesting core permeabilities of only 0.1 to 7.0 millidarcies - significantly poorer than Blackback 1 permeability) and preliminary log analysis (which indicates high water saturation) no production testing of the zone was conducted.

Quantitative log analysis (Appendix 2) was conducted to determine water saturation and porosity over the reservoir section above the Field OOWC. The high clay/glauconite content of this section necessitated detailed petrographic analysis including thin section, SEM and Mineralogical analysis (Appendix 4). These analyses were then used to construct a mineralogical model of the Blackback 3 reservoir section which was used in the log analysis process to gauge porosities and saturations. The Eocene section at Blackback 3 is essentially homogeneous with only minor variations in matrix clay content.

Accordingly, an average effective porosity of 11.3% is calculated from log analysis over the interval 2832 m KB - 2859 m KB, whilst average total water saturation from the interval is calculated to be 85%. Average clay volume for the interval 2832 - 2859 m MDKB is 37%. On the basis of a net pay cutoff of 65% Sw, no net oil pay can be mapped in Blackback 3. Permeabilities of less than 10 x Sw millidarcies as seen in the core plug analysis, also precludes mapping net pay in the well.

6. Geophysical Discussion

Blackback-3 intersected the Top of Latrobe Group 11 m high to prognosis. This represents an error of 0.39%.

The G89AB 3D seismic survey covers the Blackback field and was used to produce the updated Top of Latrobe Group depth structure map (Enclosure 4). The seismic data quality of this survey is poor - fair, with rapid sea floor topography variations producing raypath distortions. Coherent noise trains are also pervasive throughout the dataset and are caused by multiple effects from the progradational carbonate facies within the Gippsland Limestone.

The production of a synthetic seismogram and a seismic calibration log at Blackback-3 (Enclosures 5 and 6) has led to a refined tie to the Top of the Latrobe Group at the well location. As a result of this refinement, the southwest portion of the field has been remapped.

Distribution of reservoir units below the Top of Latrobe Group unconformity is difficult to image seismically and the pre-drill prognosis for the Blackback-3 location recognised a number of possible scenarios. The presence of Eocene channel fill facies beneath the unconformity, as intersected in Blackback-3, was one of the recognised possible outcomes.

Seismic velocities derived from the G89AB Blackback 3D seismic survey are considered unreliable for depth conversion. Prior to drilling Blackback-3, a gross interval velocity map (from seafloor to Top of Latrobe Group) was constructed using velocities from wells within a 20 km radius of the Blackback field. This interval velocity map was multiplied by the seismic isochron from seafloor to the Top of Latrobe Group. The resulting isopach was then added to the waterbottom depth structure map to produce a final pre-drill Top of Latrobe Group depth structure map.

In an attempt to increase confidence in the post-drill depth conversion process, seismic velocities from the recently acquired G92AM South Marlin Channel 3D survey were utilised. This survey overlaps the southwest portion of the G89AB Blackback 3D survey and covers the Blackback-3 location. Seismic velocities derived from this survey are considered to be reliable for depth conversion purposes.

The interval velocity from seafloor to the Top of Latrobe Group was computed from continuous horizon keyed velocity analyses using the Dix formula. After editing and smoothing, the correction to average velocities was carried out in two steps. A conversion factor of 94% was applied to the interval velocity map which in turn was multiplied by the seismic isochron from seafloor to the Top of Latrobe Group. The resulting isopach was then added to the waterbottom map to produce a depth structure map. Residual shifts at well locations remaining after this step were removed by creating a grid of the residual corrections and subtracting the grid from the depth map.

The final Top of Latrobe Group depth structure map (Enclosure 4) has been produced by merging the pre-drill depth structure map with the post-drill depth structure map derived using the G92AM South Marlin Channel 3D seismic velocities.

7. Conclusion

The Blackback 3 results further confirms the complexity of stratigraphy within the Blackback Field. The well encountered the Top of Latrobe Group some 11 m high to prognosis, but intersected poor quality Eocene aged reservoir. The quality of the Blackback 3 reservoir section above the Field OOWC is significantly worse than the Eocene section encountered by the Blackback 1 well. No net oil pay is calculated in Blackback 3. The physical differences between the Eocene rock types (reservoir vs essentially non reservoir) are important to establish and if quantifiable may give a means by which productive Eocene reservoir can be delineated within the channelised portion of the field. The Blackback 3 well has confirmed the presence of Eocene aged section in the southwest of the field with the base of Eocene channel interpreted to subcrop between the Blackback 2 and Blackback 3 wells.

FIGURES

figure 1, 2 follow

PE905149

This is an enclosure indicator page.
The enclosure PE905149 is enclosed within the container PE900959 at this location in this document.

The enclosure PE905149 has the following characteristics:

ITEM_BARCODE =	PE905149
CONTAINER_BARCODE =	PE900959
NAME =	Blackback-3 Locality Map
BASIN =	GIPPSLAND
PERMIT =	VIC/P24
TYPE =	GENERAL
SUBTYPE =	PROSPECT_MAP
DESCRIPTION =	Blackback-3 Locality Map. Figure 1 of WCR volume 2.
REMARKS =	This item contains colour.
DATE_CREATED =	02/09/1994
DATE_RECEIVED =	20/10/1994
W_NO =	W1097
WELL_NAME =	Blackback-3
CONTRACTOR =	
CLIENT_OP_CO =	Esso Australia Limited

(Inserted by DNRE - Vic Govt Mines Dept)

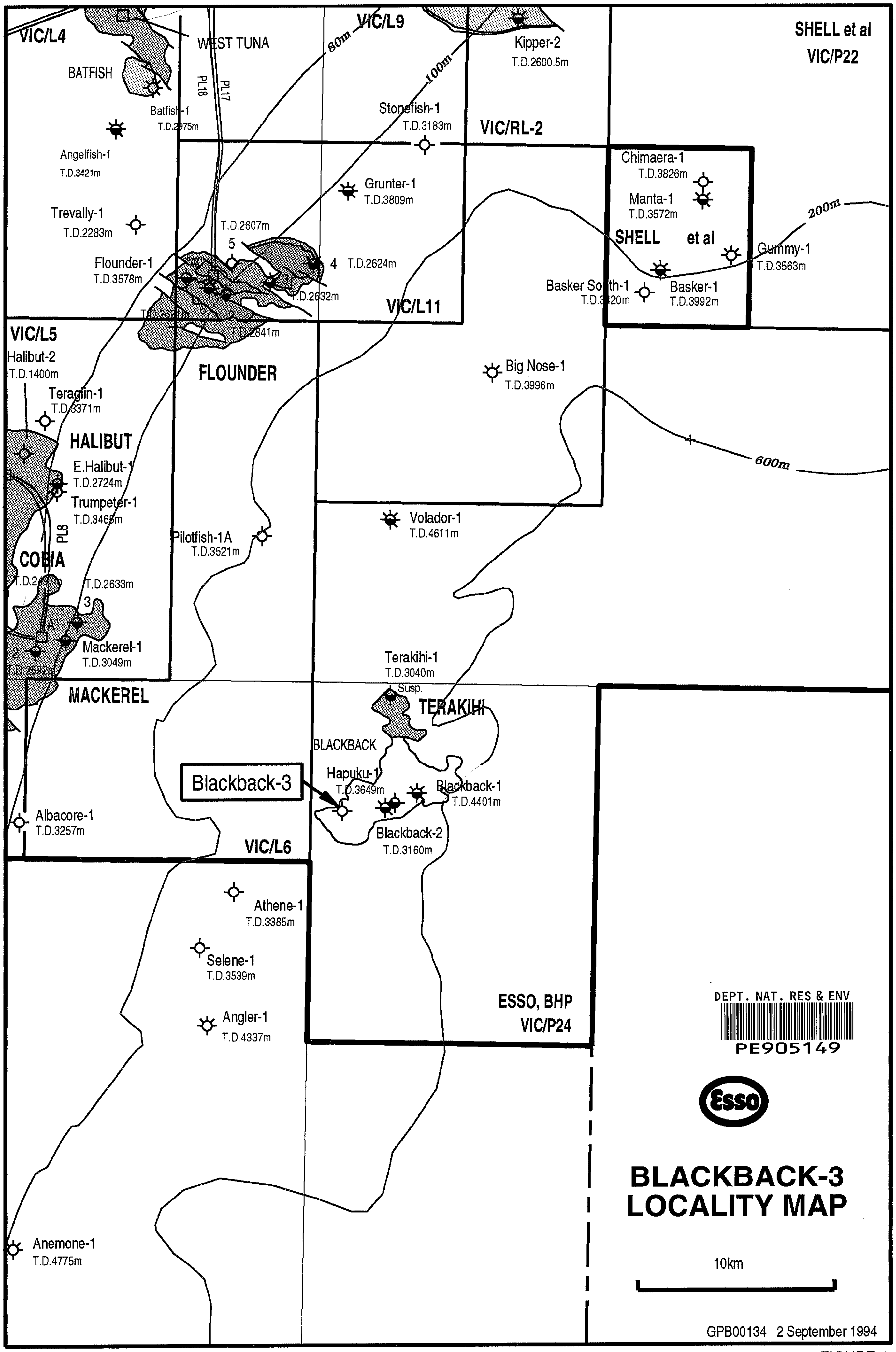

VIC/L4
BATFISH
WEST TUNA
PL18
PL17
VIC/L9
80m
100m
Kipper-2
T.D.2600.5m
SHELL et al
VIC/P22
Batfish-1
T.D.2975m
Stonefish-1
T.D.3183m
VIC/RL-2
Angelfish-1
T.D.3421m
Chimaera-1
T.D.3826m
Grunter-1
T.D.3809m
Manta-1
T.D.3572m
200m
Trevally-1
T.D.2283m
T.D.2607m
5
SHELL et al
Gummy-1
T.D.3563m
Flounder-1
T.D.3578m
4
T.D.2624m
T.D.2632m
Basker South-1
Basker-1
T.D.3992m
VIC/L11
T.D.2841m
VIC/L5
Halibut-2
T.D.1400m
FLOUNDER
Big Nose-1
T.D.3996m
Teraglin-1
T.D.3371m
HALIBUT
600m
E.Halibut-1
T.D.2724m
Trumpeter-1
T.D.3465m
Volador-1
T.D.4611m
PL8
Pilotfish-1A
T.D.3521m
COBIA
T.D.2633m
3
Mackerel-1
T.D.3049m
2
Terakihi-1
T.D.3040m
Susp.
MACKEREL
TERAKIHI
BLACKBACK
Blackback-3
Hapuku-1
T.D.3649m
Blackback-1
T.D.4401m
Albacore-1
T.D.3257m
Blackback-2
T.D.3160m
VIC/L6
Athene-1
T.D.3385m
Selene-1
T.D.3539m
DEPT. NAT. RES & ENV
PE905149
Angler-1
T.D.4337m
ESSO, BHP
VIC/P24
Esso
BLACKBACK-3
LOCALITY MAP
Anemone-1
T.D.4775m
10km
GPB00134 2 September 1994

FIGURE 1

PE905150

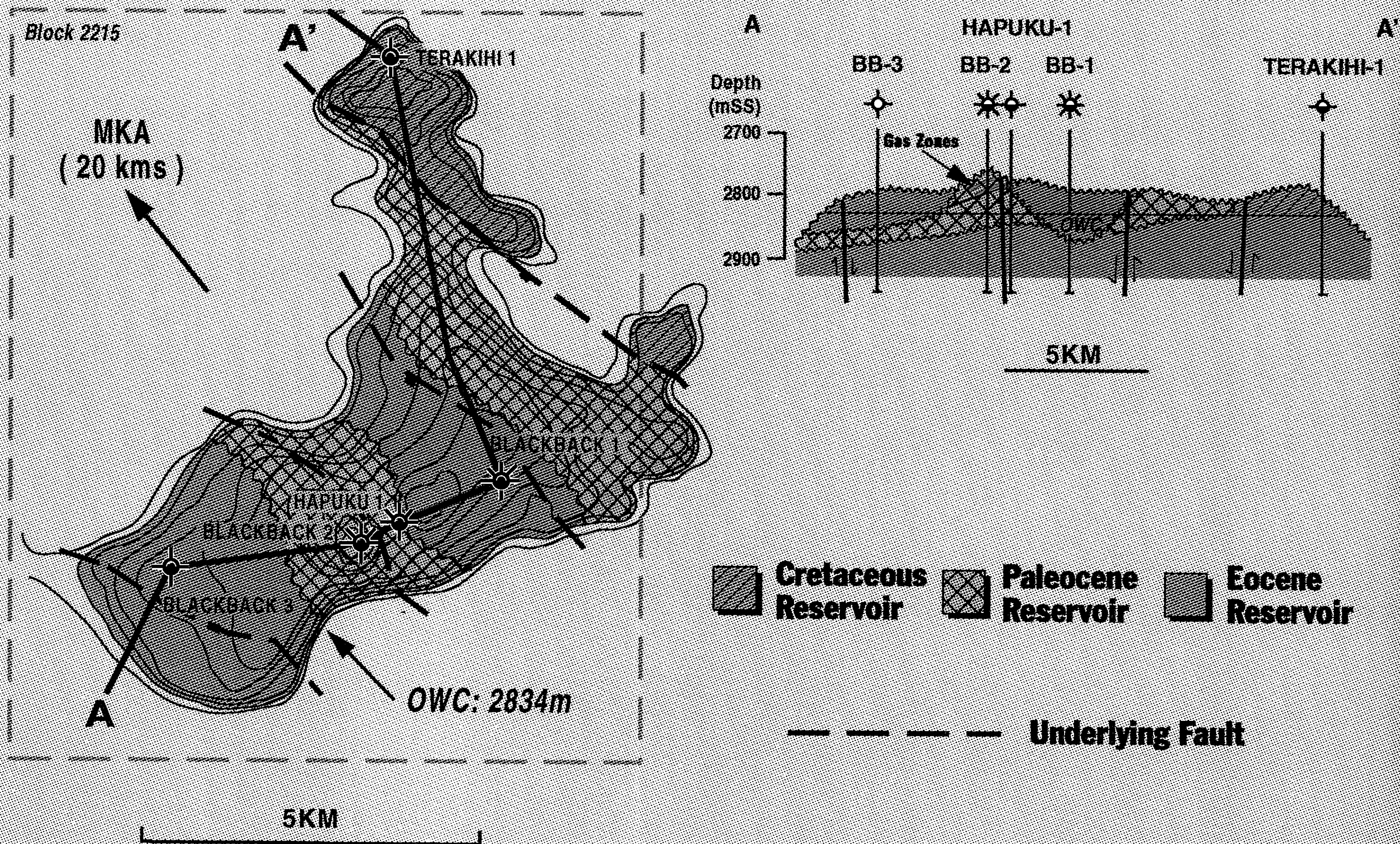
This is an enclosure indicator page.
The enclosure PE905150 is enclosed within the container PE900959 at this location in this document.

The enclosure PE905150 has the following characteristics:

ITEM_BARCODE =	PE905150
CONTAINER_BARCODE =	PE900959
NAME =	Blackback Field showing 3 Reservoirs
BASIN =	GIPPSLAND
PERMIT =	VIC/P24
TYPE =	WELL
SUBTYPE =	GEOL_MAP
DESCRIPTION =	Blackback field showing the Cretaceous, Paleocene and Eocene Reservoirs. Figure 2 of WCR volume 2.
REMARKS =	This item contains colour.
DATE_CREATED =	
DATE_RECEIVED =	20/10/1994
W_NO =	W1097
WELL_NAME =	Blackback-3
CONTRACTOR =	
CLIENT_OP_CO =	Esso Australia Limited

(Inserted by DNRE - Vic Govt Mines Dept)

BLACKBACK FIELD



GPV01203

Figure 2.

APPENDIX
1A

APPENDIX 1A

APPENDIX 1 A)

Palynological Analysis

Palynological Analysis of Blackback-3 Gippsland Basin

by

Alan D. Partridge
Biostrata Pty Ltd
A.C.N. 053 800 945

Biostrata Report 1994/6
24 May 1994

INTERPRETATIVE DATA

Introduction

Thirty-one samples comprising 23 sidewall cores and 8 conventional core samples were analysed in Blackback-3. The author cleaned, split the selected sidewall cores and forwarded them to Laola Pty Ltd in Perth for processing to prepare the palynological slides. The eight core samples were sent directly to Laola Pty Ltd for initial urgent age dating.

An average of 22.3 grams of the conventional core samples and 13.2 grams of the sidewall cores were processed for palynological analysis (Table 2). Residue yields were mostly low to very low from both the conventional cores and sidewall cores. Palynomorph concentration on the slides was quite variable ranging from low to barren in the coarser grained sandstone samples to very high from some of the argillaceous sandstones and siltstones. The highest yielding sidewall cores, most of which had high palynomorph concentrations, were from the Late Cretaceous Upper *T. longus* Zone below 2971m. Preservation of palynomorphs varied from poor to very good. It is noticeable from the sandier lithologies that many of the larger dinoflagellate cysts are fragmented. This could have been caused either by initial post-depositional bioturbation of the sediments or later during the palynological preparations. Recorded spore-pollen diversity ranges up to 55 species/sample. Average diversity, excluding barren and very low yielding samples is 33+ species. Microplankton diversity in the same samples averages 12+ species and ranges from 3+ to 29+ species/sample. All productive samples contained microplankton.

Lithological units and palynological zones from the base of the Seaspray Group to Total Depth are given in the following summary. The interpretative data with zone identification and Confidence Ratings are recorded in Table-1 and basic data on residue yields, preservation and diversity are recorded on Tables-2 and 3. All species which have been identified with binomial names are tabulated on the palynomorph range charts. Relinquishment list for palynological slides and residues from samples analysed in Blackback-3 are provided at the end of the report.

Palynological Summary for Blackback-3

AGE	UNIT/FACIES	SPORE-POLLEN ZONES (DINOFLAGELLATE ZONES)	DEPTHS (mKB)
MIOCENE TO OLIGOCENE	SEASPRAY GROUP	*P. tuberculatus* (*F. leos*) Upper *N. asperus* (*F. leos*)	2772.4-2818 (2809-2818) 2823-2829 A (2823-2829 A)
LATE EOCENE	LATROBE GROUP "Blackback Channel Sands"	Upper *N. asperus* Middle *N. asperus* (*C. incompositum*)	2829 B 2835-2850 (2835-2850)
PALEOCENE	LATROBE GROUP "Hapuku Marine Sands"	*L. balmei* (*A. circumtabulata*)	2898.2-2902 (2898.2)
MAASTRICHTIAN	LATROBE GROUP "Terakihi Marine Sands"	Upper *T. longus* (*M. druggii*)	2971-3062 (2971-3004)
			T.D. 3125m

Geological Comments

1. The palynological analysis in Blackback-3 indicates that three marine sand units separated by unconformities can be recognised in the 296 metres of Latrobe Group penetrated, whilst in the basal 60 metres analysed from the overlying Seaspray Group, two deep marine claystone units can be distinguished which may also be separated by an unconformity.

2. The lithological pick for the Top of Latrobe Group is taken at 2829m where it was fortuitously sampled by SWC-40. This sidewall core consisted of a dark brown-grey calcareous claystone in sharp contact with a dark brown-grey, fine to medium grained, glauconitic sandstone. These two lithologies were processed separately to yield significantly different palynological assemblages. The claystone, which comprised less than 20% of the sidewall

core gave a very low yield in which microplankton comprised 87% of the palynomorphs recorded. The limited diversity of the spore-pollen and microplankton recorded from the sample is a direct consequence of the very low yield. The glauconitic sandstone, in contrast gave a high residue yield which was dominated by spores, pollen and fungal remains with microplankton a low 7% of the total count. This marked increase in microplankton abundance in the claystone lithology and subsequent decline in overlying samples from the Seaspray Group (Table-1) has the characteristics of a flooding surface. As both parts of SWC-40 gave the same age (within currently available resolution or understanding) it is uncertain whether the boundary may also represent a sequence boundary or simply reflect a downlap surface within a single depositional cycle.

3. The identification in Blackback-3 of the Upper *N. asperus* Zone, and the new *Fromea leos* Microplankton Zone, from a calcareous claystone facies typical of the basal Seaspray Group has potential significance to the identification of the seismic pick for the Top of Latrobe across the Blackback/Terakihi field. The Upper *N. asperus* Zone is recorded from the same facies in Hapuku-1 between 2804-2810.5m (9200-9221 ft) and in Blackback-1 Sidetrack-1 at 2884m MDRKB, but is apparently absent at the base of the Seaspray Group in both Blackback-2 and Terakihi-1. These latter wells are therefore interpreted as located higher on the original erosional palaeotopography over the Blackback/Terakihi field (but not necessarily higher on the current structure) because they do not contain any of the Middle to Late Eocene "Blackback Channel Sands" which fill the *N. asperus* Channel. Aside from the Blackback/Terakihi field the occurrence of an Upper *N. asperus* Zone section at the base of the Seaspray Group has a extremely restricted distribution in the offshore Gippsland Basin. Confident identification has only been made in a few nearshore wells extending in an arc from Tommyruff-1, through Perch-2, Blenny-1, Snook-1, Seahorse-2, Seahorse-1 to Harlequin-1A. Other wells along this arc are too poorly sampled or not analysed in sufficient detail. Very poor data suggests it may also be found in the wells lying between Athene-1 and Anemone-1. But again most wells to the south of the Blackback/Terakihi field are insufficiently sampled across the Top of Latrobe.

4. The Upper *N. asperus* Zone section may be part of what is informally referred to as the "Early Oligocene wedge", for that the basal part of the Seaspray Group between the seismic pick of the "Top of Latrobe" and a deeper lithological pick for the "Top of Latrobe". In most cases samples from the "Early Oligocene wedge" are assigned to the *P. tuberculatus* Zone

because they contain the distinctive spore *Cyatheacidites annulatus*. Given that the seismic pick for the "Top of Latrobe" in Blackback-3 may be taken as high as 2798m (J. Phillips pers comm. 9th May 1994) it would be consistent with present understanding to correlate all the interval 2798-2829m in Blackback-3 with the "Early Oligocene wedge".

5. The **new** *Fromea leos* Microplankton Zone is erected in Blackback-3 because of the potential of this microplankton assemblages to biostratigraphically characterise the "Early Oligocene wedge". The eponymous species is as yet undescribed. The specific name is an acronym for the Lakes Entrance Oil Shaft where the form was first recorded from the Lakes Entrance Greensand in 1969 during the study of onshore spore-pollen assemblages by Partridge (1971). In the subsequent 26 years the species has only rarely been recorded in the offshore Gippsland Basin even though the basal Seaspray Group has been routinely sampled and analysed by palynology. It is now suspected that *Fromea leos* ms characterises a part of the Early Oligocene which is not represented by sedimentary section over most of the offshore basin. By establishing a new zone it is hoped to better map the distribution of this unit.

6. The *Fromea leos* Microplankton Zone is considered to be younger than the *Phthanoperidinium comatum* Microplankton Zone and to straddle the boundary between the Upper *N. asperus* and *P. tuberculatus* Spore-Pollen Zones. Although of early Oligocene age precise correlation to the cycle charts of Haq *et al.* (1987, 1988) is uncertain.

7. The "*N. asperus* Channel-fill" originally recognised in Blackback-1 (Partridge & Hannah, 1990) and referred to as Eocene channel infill unit by Gross (1993) is here informally named the "Blackback Channel Sands". The base of the channel is confidently placed below the core sample at 2861m which contains a limited assemblage of fragmented dinoflagellate cysts, including the diagnostic form *Areosphaeridium capricornum*. With considerable less confidence the channel base can be considered to lie between the sidewall cores at 2867.5m and 2879.5m. Because these samples were virtually barren the few species that were recorded could very easily be contaminants introduced from the drilling mud or during the palynological processing. Notwithstanding this caveat the shallower sample at 2867.5m contains *Homotryblium tasmaniense* which is recorded consistently in the overlying samples whilst the deeper sample at 2879.5m contains *Peninsulapollis gillii* which is diagnostic of the underlying *L. balmei* Zone samples. The "Blackback Channel Sands" are therefore between 32 metres to a possible

maximum of 50 metres thick in Blackback-3 where they are all Late Eocene in age. In contrast it is 80+ metres thick (TVD) in Blackback-1 where it also contains the older Middle Eocene Lower *N. asperus* Zone (Partridge & Hannah, 1990).

8. The underlying "Hapuku Marine Sands" informally named in Blackback-2 by Partridge (1993b) gave poor results. Only two samples contained useful assemblages. Although they could only be assigned to the broad *L. balmei* Zone on the spore-pollen the associated microplankton indicate the assemblages would be equivalent to the Lower *L. balmei* Zone. Based on a few fragmented dinoflagellate cysts it is likely the samples at 2887m and 2913m also belong to the *L. balmei* Zone but the data is too limited to justify any zone assignment. Thus, the base of the Paleocene and position of the 63 Ma Sequence Boundary mapped by Gross (1993) can be fixed no more precisely in Blackback-3 on palynology than lying between samples at 2913m and 2971m.

9. The *Alisocysta circumtabulata* Microplankton Zone identified at 2898.2m is considered to be older than the more widely distributed *Eisenackia crassitabulata* Zone. It can be correlated into the better sampled Hapuku-1 sequence where it occurs over the interval 2840-2848.7m (9317-9346 ft) in cores 2 and 3. The *A. circumtabulata* Zone is also recorded in Whaleshark-1 at 2807m (Partridge, 1993a) and in Roundhead-1 at 2657.5-2678m (Partridge, 1989). In other earlier palynological reports on wells in the Gippsland Basin it is likely that some occurrences of the *A. circumtabulata* Zone have been incorrectly assigned to the *E. crassitabulata* Zone.

10. The Early Eocene unit identified as equivalent to The Flounder Formation in Blackback-2 (Partridge, 1993b) is not present in Blackback-3 where it has probably been removed by the erosive event which cut the *N. asperus* Channel.

11. The five samples between 2971-3062m are characterised by high diversity assemblages with a characteristic abundance of *Gambierina rudata* (average 14% of spore-pollen count) and frequent to abundant microplankton. The unit is informally referred to as the "Terakihi Marine Sands" after the similar but thicker (200+ metres) section intersected in Terakihi-1 (Partridge, 1990). The unit is considered to be nearshore marine because the samples consistently contain microplankton and the overall section lacks any coals.

12. All units analysed in Blackback-3 are marine and there is a progressive increase in marine character based on organic microplankton species abundance and diversity. In the "Terakihi Marine Sands" average microplankton abundance is <10%, whilst in the "Blackback Channel Sands" the average is <30%, increasing to >55% in the overlying basal Seaspray Group (Table-1). The count data from the "Hapuku Marine Sands" is too skewed to be meaningful, but eight samples counted in Hapuku-1 from this unit average 51% microplankton (Partridge, 1975a).

13. The "Blackback Channel Sands" and some of the samples from the Seaspray Group contain frequent to common reworking of Paleocene and Early Eocene spores, pollen and microplankton. The reworked palynomorphs may represent as much as 4% of the total count and 10% of the microplankton count. The commonest reworked species are *Homotryblium tasmaniense*, *Glaphrocysta retiintexta* and *Lygistepollenites balmei*. Similar reworking was recorded from Blackback-1 and Partridge & Hannah (1990) argued that the most likely source areas for the reworked sediments was to the south and south-west. The intersection in Blackback-2 of microplankton rich sediments of Early Eocene age, equivalent to the Flounder Formation, suggests that local reworking from the palaeotopographic highs on the Blackback/Terakihi field may also have been a sediment source for the "Blackback Channel Sands". The coarser grain size of this unit compared to the Turrum Formation makes it unlikely that these sands have been transported down the Marlin Channel.

    One particularly significant reworked species was the identification of the index dinoflagellate *Wilsonidinium ornatum* from the basal Seaspray Group at 2826.2m. This is the key index species of the stratigraphically next younger zone above the *D. waipawaense* Zone discovered at the top of the "Hapuku Marine Sands" in Blackback-2. It is tempting to suggest that it was derived locally and thus is indicative of the occurrence of younger zones in the latter unit.

    Rare reworked Permian and Early Cretaceous spores and pollen were also recorded, mainly from the Seaspray Group but they are not regarded as diagnostic of a particular provenance.

Biostratigraphy

Zone and age determinations are based on the spore-pollen zonation scheme proposed by Stover & Partridge (1973), partially modified by Stover & Partridge (1982) and Helby, Morgan & Partridge (1987), and a dinoflagellate zonation scheme which has only been published in outline by Partridge (1975b, 1976). Other modifications and embellishments to both zonation schemes can be found in the many palynological reports on the Gippsland Basin wells drilled by Esso Australia Ltd. Unfortunately this work is not collated or summarised in a single report.

Author citations for most spore-pollen species can be sourced from Stover & Partridge (1973, 1982), Helby, Morgan & Partridge (1987) or other references cited herein. Author citations for dinoflagellates can be found in the indexes of Lentin & Williams (1985, 1989), in the paper by Wilson (1988), or other references cited herein. Species names followed by "ms" are unpublished manuscript names.

Proteacidites tuberculatus Spore-Pollen Zone: 2772.4-2818.0 metres
Oligocene.

The four samples assigned to the zone contain the key index species *Cyatheacidites annulatus* and the deepest sample also contains *Proteacidites tuberculatus*. *Chenopodopollis* spp. recorded in the shallowest sample is the only other zone diagnostic species in moderate diversity assemblages dominated by long ranging spores and pollen. *Nothofagidites emaridus/heterus* dominate all the counts with *Araucariacites australis* and *Phyllocladidites mawsonii* the next most frequent types. The rare species *Droseridites tholus* ms (Partridge, 1973) was recorded at 2809m and 2818m.

Upper _Nothofagidites asperus_ Spore-Pollen Zone: 2823.0-2829.0 metres
Early Oligocene.

This zone was recorded over a 6 metre interval and samples are assigned to the zone on the presence of *Proteacidites stipplatus*, *P. rectomarginis* and *Aglaoreidia qualumis* and absence of spore *Cyatheacidites annulatus*. The spore-pollen assemblages are dominated by *Nothofagidites* spp. (average 61%) with *Phyllocladidites mawsonii* having a maximum abundance of only 7% at 2826.2m, which is similar to the abundance range of 2.2% to 8% from this zone in Blenny-1 (Partridge, 1992).

The low diversity spore-pollen assemblage from the low yield recovered from the very small 2.2 grams of calcareous claystone split from SWC-40 at 2829m is non-diagnostic. Although a single oxidised or "ghosted" specimen questionably referred to *Cyatheacidites annulatus* was found in the one kerogen slide recovered this was eventually dismissed as either drilling mud or laboratory contamination as this index species could not be found after an extensive search of the two overlying high diversity samples. The glauconitic sandstone fraction from the same sidewall core in contrast yielded a high diversity assemblage. Although *Proteacidites recavus* was recorded (which perhaps could be interpreted as a transition morphotype to *P. stipplatus*?) no other more typical Middle *N. asperus* Zone species were identified even after an extensive search of all available slides, and therefore the Upper *N. asperus* Zone assignment is preferred. Amongst the moderate diversity microplankton assemblage from the glauconitic sandstone sample only *Areosphaeridium capricornum* would support the older Middle *N. asperus* Zone assignment.

Unusual or rare species in the assemblages include *Malvacipollis grandis* ms and *Ricciaesporites boxatus* ms at 2826.2m and *Cyperaceae* pollen at 2829m (sample B). The latter species is a typical rare form in Upper *N. asperus* Zone in the Torquay Embayment.

Fromea leos Microplankton Zone: **2809.0-2826.2 metres**
Early Oligocene.

This is a new zone defined as the interval above the acme of *Phthanoperidinium comatum* to the Last Appearance Datum (LAD) of *Fromea leos* ms. The assemblages are characterised by abundant *Spiniferites* spp. (14%-39%), *Fromea* spp. (<1%-33%) or *Operculodinium centrocarpum* (5%-35%), with the frequent to common occurrences of *Hystrichokolpoma rigaudae* (13% at 2826.2m), *Phthanoperidinium* sp. cf. *P. eocenicum* (11% at 2823m) and *Thalassiphora pelagica* (6% at 2809m). The assemblages are distinguished from the more usual *Operculodinium* spp. Microplankton Association generally found in the basal Seaspray Group in lacking the consistent and often common occurrence of the species *Protoellipsodinium simplex* ms and *Pyxidinopsis pontus* ms. Additional taxonomic descriptive work needs to be done to fully document the microplankton assemblages in this zone.

The sample A at 2829m is not assigned to this zone as it lacks any of the *Fromea* species. This may be partly a preparation problem as the small *Fromea* species are hard to find in the kerogen slides of the overlying samples. This is because they are mostly filtered out of the filtered kerogen fractions and too dilute or obscured in the unfiltered kerogen fractions. The sample also contains morphotypes of *Protoellipsodinium simplex* ms more typical of the Miocene suggesting there may have been some mud contamination of the sample.

Middle *Nothofagidites asperus* Spore-Pollen Zone: 2835.0-2850.0 metres
Late Eocene.

The five spore-pollen assemblages within this interval are assigned to the upper part of the Middle *N. asperus* Zone based on the presence of *Proteacidites rectomarginis* and/or *Anacolosidites sectus* in most samples. Other species considered to range no older than this zone are rare but include *Tricolpites thomasii* and *Verrucosisporites cristatus* at 2837m, and *Aglaoreidia qualumis* at 2835m and 2841m. Most of the other species in these high diversity assemblages (which average >30 species/sample and have a combined diversity of 72+ species) can be considered long ranging. There is, however, a curious assortment of rare or unusual species mixed with rare species which have been interpreted as reworked. Included in the unusual category are *Bysmapollis emaciatus, Cupanieidites reticulatus* and *Proteacidites confragosus* at 2841m, and *Cyperaceae* pollen and *Tetrapollis campbellbrownii* Macphail & Truswell *in* Macphail *et al.* 1993 at 2850m, whilst *Proteacidites grandis* at 2835m and *Myrtaceidites tenuis* at 2850m are two of the most obvious reworked forms. *Proteacidites pachypolus* which occurs in four of the five samples may also be reworked as it is rarely found in upper part of the Middle *N. asperus* Zone in the coastal plain facies developed in the northwestern part of the basin. Notably absent from such rich assemblages was *Triorites magnificus* although this species was recorded from core-1 in the nearby Blackback-1 Sidetrack-1. All the samples are dominated by abundant *Nothofagidites emarcidus/heterus* (47%-53% of spore-pollen count) with *Haloragacidites harrisii* the next most common type (3%-11%).

The five core and single sidewall core sample between 2853-2870m contained too few spores and pollen to be assigned to any zone, but the associated microplankton in some of the samples suggests they are probably no older than this zone.

***Corrudinium incompositum* Microplankton Zone:** **2835.0-2850.0 metres**
Late Eocene.

Three of the five samples in the interval contained the index species *Corrudinium incompositum*. Other diagnostic species are *Tritonites spinosus* at 2835m and 2841m (see Marshall & Partridge, 1988), *Deflandrea leptodermata* at 2847m and *Diphyes ariensis* ms at 2850m. The dominant forms in the assemblages are *Fromea* spp., *Spiniferites* spp. and the *Areosphaeridium capricornum* complex. This latter species displays considerable morphological variability and with more rigorous taxonomic treatment has the potential for subdivision into a number of morphotypes which may have stratigraphic significance. The occurrence of this species complex as a dominant element in the low yielding samples from core-2 suggests that the base of the Late Eocene may extend as deep as 2861m.

The samples from 2835m to 2867.5m all contain *Homotryblium tasmaniense* as a constant accessory and often frequent species. It has a maximum abundance of 6% of the microplankton in sample at 2837m and is considered to reflect the presence of considerable reworking from older Early Eocene zones, either from immediately adjacent Flounder Formation as identified in Blackback-2 (Partridge, 1992) or from areas to south and west of the Blackback/Terakihi field (see Partridge & Hannah, 1990). Other species considered reworked include *Tritonites pandus*, *Diphyes colligerum*, *Hystrichokolpoma truncatum*, *Apectodinium homomorphum* and *Glaphrocysta retiintexta*.

***Lygistepollenites balmei* Spore-Pollen Zone:** **2898.2-2902.0 metres**
Paleocene.

Both samples clearly belong to the broader *L. balmei* Zone but lack definitive species to justify confident assignment of either sample to the Upper or Lower subzones, even though the associated microplankton would strongly support a Lower *L. balmei* Zone assignment. Key species recorded include the eponymous species *Lygistepollenites balmei*, *Gambierina rudata*, *G. edwardsii*, (including the *G. megaedwardsii* ms variety), *Australopollis obscurus* and common *Peninsulapollis gillii*. Total diversity is 36+ species and undoubtedly would be much higher had the recovery been better. As is typical of channel fill units in the basin some species reworked from the underlying Upper *T. longus* Zone were recorded.

The zone may extend as shallow as 2879.5m based on the occurrence of *Peninsulapollis gillii* and as deep as 2913m based on the associated microplankton.

Alisocysta circumtabulata Microplankton Zone: **2898.2 metres**
Early Paleocene.

The *Alisocysta circumtabulata* Zone is recognised in the Gippsland Basin as the interval between the Last Appearance Datum (LAD) of *Palaeoperidinium pyrophorum* to the LAD of *A. circumtabulata*. The younger *Eisenackia crassitabulata* Zone can in turn be considered as the interval between the LAD of *A. circumtabulata* to the LAD of *E. crassitabulata*. In practice each of the above three species characterise discreet incursions (which may be condensed sections of individual Paleocene cycles) separated by packages of rock which are microplankton barren or lack diagnostic species. The *E. crassitabulata* Zone is the most widespread or at least most widely recognised incursion, although it is quite likely that some assignments to this zone need to be revised and reassigned to the *A. circumtabulata* Zone. In Blackback-3 this zone is dominated by *A. circumtabulata* and *A. margarita (senso lato)* which represent more than >50% of the assemblage whilst *Eisenackia crassitabulata* is quite rare. Other potentially diagnostic species in the zone are *Cladopyxidium facetus* ms and *Deflandrea speciosus*. All other recorded species have known longer ranges or are too rare in the basin to be of practical use.

Glaphrocysta retiintexta Microplankton Association: **2902.0 metres.**

Although only a very small residue yield was obtained this was a highly unusual sample as it was overwhelmingly dominated by *Glaphrocysta retiintexta* which comprised 94% of the total assemblage and 98% of the total microplankton. Unfortunately the abundance of this species does not appear to have much significance for subdividing the Early Paleocene. In Whaleshark-1 for instance *G. retiintexta* comprised 92% of the lower sample assigned to the *E. crassitabulata* Zone.

Upper _Tricolpites longus_ Zone: 2971.0-3062.0 metres **Maastrichtian.**

The five deepest recovered sidewall cores are all confidently assigned to the Upper. *T. longus* Zone based on the consistent abundance of *Gambierina rudata* (10%-17%) associated with *Stereisporites* (*Tripunctisporis*) spp. in four of the five samples. All samples contain high diversity assemblages with numerous other zone indicators, the most notable of which are *Forcipites* (al. *Tricolpites*) *longus*, *Proteacidites clinei* ms, *P. reticuloconcavus* ms, *P. otwayensis* ms and *Tricolporites lilliei*. The spore-pollen assemblages are dominated by *Proteacidites* spp. (22%-31%) with secondary abundances of *Phyllocladidites mawsonii* (7%-10%), *Podosporites microsaccatus* (6%-12%) and *Peninsulapollis gillii* (5%-10%).

Nothofagidites spp. varies from <1% to 7%. Total diversity in the zone is 75+ species.

A most interesting and unusual occurrence was the record of three specimens of the primitive angiosperm *Lactoripollenites africanus* Zavada & Benson 1987 at 3000.4m.

***Manumiella druggii* Zone 2971.0-3004.0 metres Maastrichtian.**

Manumiella druggii and the closely related species *M. conorata*, which are conspicuous in the samples, are considered diagnostic of this zone. *Manumiella seelandica* is also recorded but most specimens are probably not *senso strictus*. Accessory species are few but include *Alterbidinium acutulum, Palaeostomocystis golzowense* and *Horologinella incurvata*. An undescribed *Micrhystridium* sp. dominates the high microplankton count in the shallowest sample where it comprises 56% of the microplankton count.

The two deepest sidewall cores lack specimens of *Manumiella* spp. but can be characterised by containing *Palaeostomacystis reticulata* and *Paralecaniella stoveri* ms of Marshall (1984). It is uncertain whether these samples should be considered as lying below the FAD for *M. druggii* and related species so no attempt is made to distinguish them as a separate zone.

References

GROSS, M.D., 1993. Determination of reservoir distribution over the Blackback/Terakihi oil field, Gippsland Basin, Australia. *APEA J. 33*, 1-14.

HAQ, B.U., HARDENBOL, J. & VAIL, P., 1987. Chronology of fluctuating sea levels since Triassic. *Science 235*, 1156-1167.

HAQ, B.U., HARDENBOL, J. & VAIL, P., 1988. Mesozoic and Cenozoic chronostratigraphy and cycles of sea-level change. *SEPM Special Publication No. 42*, 71-108.

HELBY, R., MORGAN, R. & PARTRIDGE, A.D., 1987. A palynological zonation of the Australian Mesozoic. *Mem. Ass. Australas. Palaeontols 4*, 1-94.

LENTIN, J.K. & WILLIAMS, G.L., 1985. Fossil Dinoflagellates: Index to genera and species, 1985 Edition. *Canadian Tech. Rep. Hydrog. Ocean Sci. 60*, 1-451.

LENTIN, J.K. & WILLIAMS, G.L., 1989. Fossil Dinoflagellates: Index to genera and species, 1989 Edition. *AASP Contribution Series No. 20*, 1-473.

MACPHAIL, M.K., KELLET, J.R., REXILIUS, J.P. & O'RORKE, M.E., 1993. The "Geera Clay equivalent": a regressive marine unit in the Renmark Group that sheds a new light on the age of the Mologa weathering surface in the Murray Basin. *AGSO Jour. Aust. Geol. & Geophys. 14*, 47-63.

MARSHALL, N.G., 1984. Late Cretaceous dinoflagellates from the Perth Basin, Western Australia. PhD thesis, University of Western Australia (unpubl.).

MARSHALL, N.G. & PARTRIDGE, A.D., 1988. The Eocene acritarch *Tritonites* gen. nov. and the age of the Marlin Channel, Gippsland Basin, southeastern Australia. *Mem. Ass. Australas. Palaeontols 5*, 239-257.

PARTRIDGE, A.D., 1971. Stratigraphic palynology of onshore Tertiary sediments of the Gippsland Basin, Victoria. Univ. N.S.W. MSc. thesis (unpubl.).

PARTRIDGE, A.D., 1973. Revision of the spore-pollen zonation in the Bass Basin. *Esso Aust. Ltd. Palaeo. Rept. 1973/4*.

PARTRIDGE, A.D., 1975a. Palynological analysis of Hapuku-1, Gippsland Basin. *Esso Aust. Ltd. Palaeo. Rept. 1975/13*, 1-9.

PARTRIDGE, A.D., 1975b. Palynological zonal scheme for the Tertiary of the Bass Strait Basin (Introducing Paleogene Dinoflagellate Zones and Late Neogene Spore-Pollen Zones). *Geol. Soc. Aust. Symposium on the Geology of Bass Strait and Environs, Melbourne*, November, 1975. *Esso Aust. Ltd. Palaeo. Rept. 1975/17* (unpubl.).

PARTRIDGE, A.D., 1976. The geological expression of eustacy in the early Tertiary of the Gippsland Basin. *APEA J. 16* (1), 73-79.

PARTRIDGE, A.D., 1989. Palynological analysis of Roundhead-1, Gippsland Basin. *Esso Aust. Ltd Palaeo. Rept. 1989/17*, 1-26.

PARTRIDGE, A.D., 1990. Palynological analysis of Terakihi-1, Gippsland Basin. *Esso Aust. Ltd. Palaeo. Rept. 1990/13*, 1-11.

PARTRIDGE, A.D., 1992. Palynological analysis of Blenny-1, Gippsland Basin. *Biostrata Report 1992/3*, 1-29.

PARTRIDGE, A.D., 1993a. Palynological analysis of Whaleshark-1, Gippsland Basin. *Biostrata Report 1993/1*, 1-22.

PARTRIDGE, A.D., 1993b. Palynological analysis of sidewall cores from Blackback-3, Gippsland Basin. *Biostrata Report 1993/4*, 1-17.

PARTRIDGE, A.D. & HANNAH, M.J., 1990. Palynological analysis of Blackback-1 and its sidetracks 1 and 2 in permit VIC/P24, Gippsland Basin. *Esso Aust. Ltd. Palaeo. Rept. 1990/4*, 1-22.

STOVER, L.E. & PARTRIDGE, A.D., 1973. Tertiary and late Cretaceous spores and pollen from the Gippsland Basin, southeastern Australia. *Proc. R. Soc. Vict. 85*, 237-286.

STOVER, L.E. & PARTRIDGE, A.D., 1982. Eocene spore-pollen from the Werillup Formation, Western Australia. *Palynology 6*, 69-95.

WILSON, G.J., 1988. Palaeocene and Eocene dinoflagellate cysts from Waipawa, Hawkes Bay, New Zealand. *N.Z. Geol. Surv. Palaeo. Bull. 57*, 1-96.

ZAVADA, M.S. & BENSON, J.M., 1987. First fossil evidence for the primitive angiosperm family Lactoridaceae. *Amer. J. Bot. 74* (10), 1590-1594.

Table-1: Interpretative Palynological Data for Blackback-3.

Sample Type	Depth (m)	Spore-Pollen Zone	CR	Microplankton Zone (or Association)	CR	Comments or Key Species
SWC-46	2772.4	*P. tuberculatus*	B2	(*Operculodinium* spp.)		Microplankton 89%. Frequent specimens of *Cyatheacidites annulatus*.
SWC-45	2798.0	*P. tuberculatus*	B2	(*Operculodinium* spp.)		Microplankton 68%. Shallowest reworked *Homotryblium tasmaniense*.
SWC-44	2809.0	*P. tuberculatus*	B2	*F. leos*	B2	Microplankton 66%. LAD *Fromea leos* ms.
SWC-43	2818.0	*P. tuberculatus*	B2	*F. leos*	B4	Microplankton 38%. *Proteacidites tuberculatus* present.
SWC-42	2823.0	Upper *N. asperus*	B2	*F. leos*	B3	Microplankton 24%. *Proteacidites rectomarginis* and *P. stipplatus* present.
SWC-41	2826.2	Upper *N. asperus*	B1	*F. leos*	B2	Microplankton 40%. *Malvacepollis grandis* ms present.
SWC-40	2829.0 A	Upper *N. asperus*	B4	*(Operculodinium spp.)*		Microplankton 87%. Assemblage limited by low yield.
SWC-40	2829.0 B	Upper *N. asperus*	B1			Microplankton 7%. *Proteacidites recavus* present.
SWC-38	2835.0	Middle *N. asperus*	B1	*C. incompositum*	B2	Microplankton 21%. *Aglaoreidia qualumis* & *Proteacidites rectomarginis* present.
Core-1	2837.0	Middle *N. asperus*	B1	*(A. capricornum)*		Microplankton 33%. *Anacolosidites sectus* & *Tricolpites thomasii* present.
Core-1	2841.0	Middle *N. asperus*	B1	*C. incompositum*	B1	Microplankton 37%. *Proteacidites confragosus* present.
Core-1	2847.0	Middle *N. asperus*	B2	(*A. capricornum*)		
SWC-35	2850.0	Middle *N. asperus*	B4	*C. incompositum*	B2	Microplankton 45%.
Core-1	2853.0	Indeterminate		(*A. capricornum*)		Limited dinoflagellate assemblage.
Core-2	2857.0	Indeterminate		(*A. capricornum*)		Limited fragmented dinoflagellate assemblage.
Core-2	2861.0	Indeterminate		(*A. capricornum*)		Most dinoflagellates fragmented.
Core-2	2866.0	Indeterminate				Barren of palynomorphs.

Table-1: Interpretative Palynological Data for Blackback-3 cont...

Sample Type	Depth (m)	Spore-Pollen Zone	CR	Microplankton Zone (or Association)	CR	Comments or Key Species
SWC-32	2867.5	Indeterminate				*Homotryblium tasmaniense* fragment present.
Core-2	2870.0	Indeterminate				Barren of palynomorphs.
SWC-31	2875.0	Indeterminate				Barren of palynomorphs.
SWC-30	2879.5	Indeterminate				*Peninsulapollis gillii* present.
SWC-28	2887.0	Indeterminate				Single specimen of *Alisocysta margarita* present.
SWC-26	2898.2	*L. balmei*	B1	*A. circumtabulata*	B2	Microplankton 16% dominated by *Alisocysta* spp.
SWC-24	2902.0	*L. balmei*	B2	(*G. retiintexta*)		Microplankton 96%. *Graphrocysta retiintexta* 94%.
SWC-22	2913.0	Indeterminate		(*G. retiintexta*)		Rare fragmented specimens *G. retiintexta*.
SWC-19	2936.2	Indeterminate				Barren of palynomorphs.
SWC-18	2946.0	Indeterminate				Rare spore-pollen recorded not diagnostic.
SWC-14	2971.0	Upper *T. longus*	B1	*M. druggii*	B3	Microplankton 28%. *Gambierina* spp. 16%.
SWC-11	3000.4	Upper *T. longus*	B1	*M. druggii*	B3	Microplankton <1.5%. *Gambierina* spp. 17%.
SWC-10	3004.0	Upper *T. longus*	B1	*M. druggii*	B3	Microplankton 4%. *Gambierina* spp. 12%.
SWC- 8	3022.0	Upper *T. longus*	B1			Microplankton 6%. *Gambierina* spp. 15%.
SWC- 4	3062.0	Upper *T. longus*	B2			Microplankton 8%. *Gambierina* spp. 11%.

Confidence Ratings

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

Alpha codes: Linked to sample type

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

Numeric codes: Linked to fossil assemblage

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

BASIC DATA

Table 2: Basic Sample Data

Table 3: Basic Palynomorph Data

Relinquishment Lists Of Palynological Slides & Residues

Spore-Pollen Range Chart

Microplankton Range Chart

Table 2: Basic Sample Data - Blackback-3.

Sample Type	Depth (metres)	Lithology	Sample Wt (g)	Residue Yield
SWC-46	2772.4	Med grey calc. claystone. Mud penetrated.	11.9	Moderate
SWC-45	2798.0	Lt gry micritic limestone. Hard & well cleaned.	13.4	Low
SWC-44	2809.0	Med. grey hard calc. claystone.	9.9	Low
SWC-43	2818.0	Brn-grey calcareous silty claystone.	13.4	Low
SWC-42	2823.0	Brn-gry calcareous claystone.	12.4	Moderate
SWC-41	2826.2	Brn-gry calcareous siltstone.	11.7	Moderate
SWC-40	2829.0	Sample A. Dk brn grey calcareous claystone.	2.2	Very low
SWC-40	2829.0	Sample B. Dk brn grey f.-med grn. glauconitic (<20%) sandstone.	12.9	Moderate
SWC-38	2835.0	Dk brn gry, f. grn. qtz sandstone - glauconite not obvious <5%. Sample firm and well cleaned.	14.6	High
Core-1	2837.0		25.3	Moderate
Core-1	2841.0		26.1	Moderate
Core-1	2847.0		20.6	Moderate
SWC-35	2850.0	Dk brn-gry, minor grn-gry fine grn. qtz glauconitic (<20%). sandstone with med. gry clay matrix. Sample not cleaned.	10.2	Low
Core-1	2853.0		21.2	Very low
Core-2	2857.0		23.2	Very low
Core-2	2861.0		20.2	Very low
Core-2	2866.0		20.5	Very low
SWC-32	2867.5	Med gry-grn med-fine qtz sandstone with v. f. glauc. in matrix. Sample firm - moderately clean.	16.2	Very low
Core-2	2870.0		21.3	Very low
SWC-31	2875.0	Med dk grn-gry f-med. qtz sandstone with <15% glauc. Sample firm and well cleaned.	15.0	Very low
SWC-30	2879.5	Med dk grn-gry crs grn glauc (<30%) & pyritic qtz sandstone, white clay matrix. Sample firm - fairly well cleaned.	18.9	Very low
SWC-28	2887.0	Off white & grn mottled crs qtz sandstone with accessory glauconite <20% & pyrite. Sample friable - not cleaned.	18.0	Very low
SWC-26	2898.2	Dk grn med-crs grn glauconitic (30%) & pyritic sandstone. Sample firm & well cleaned.	18.1	Low
SWC-24	2902.0	Gry-grn med-crs quartz sandstone with 10% glauconite. Sample friable, not cleaned.	13.6	Very low
SWC-22	2913.0	Lt grn-gry f.-crs grn sst with abund. argillaceous matrix. Sample broken & friable not cleaned.	12.5	Very low
SWC-19	2936.2	Lt gry-off white fine-crs sst with white clay matrix and tr. glauconite <2%. Poorly cleaned.	8.5	Very low
SWC-18	2946.0	Lt grn-gry fine grn qtz sst with kaolonitic and glauconitic matrix. Well cleaned.	10.5	Very low
SWC-14	2971.0	Dk gry f-med grn argillaceous sst with glauconite <20%. Sample firm, and well cleaned.	12.1	High
SWC-11	3000.4	Dk gry med-crs argillaceous sandst. Possibly pyritic. Minimal cleaning.	13.1	High
SWC-10	3004.0	Dk. gry poorly sorted argillaceous sst with qtz grn up to 3mm and shaly rock frags. Not cleaned.	13.0	High
SWC- 8	3022.0	Med gry f-med grn sandstone with micaceous matrix. Not cleaned.	11.9	High
SWC- 4	3062.0	Gry wh. crs qtz sandstone with minor matrix, with glauconite & pyrite. Processed because deepest sample but not cleaned.	9.6	Very low

Table-3: Basic Palynomorph Data for Blackback-3.

Sample Type	Depth (m)	Palynomorph Concentration	Palynomorph Preservation	Number S-P Species*	Microplankton Abundance	Number MP Species*
SWC-46	2772.4	High	Poor-fair	18+	Very Abundant	12+
SWC-45	2798.0	High	Fair-good	20+	Very Abundant	6+
SWC-44	2809.0	High	Poor-fair	26+	Very Abundant	12+
SWC-43	2818.0	High	Poor-fair	29+	Abundant	11+
SWC-42	2823.0	High	Poor	24+	Common	9+
SWC-41	2826.2	High	Poor-fair	44+	Abundant	16+
SWC-40	2829.0 A	High	Poor-fair	17+	Very Abundant	9+
SWC-40	2829.0 B	High	Fair-good	39+	Frequent	13+
SWC-38	2835.0	High	Poor-fair	38+	Common	24+
Core-1	2837.0	High	Poor-good	42+	Abundant	25+
Core-1	2841.0	High	Poor-good	41+	Abundant	29+
Core-1	2847.0	High	Poor-fair	20+	Abundant	11+
SWC-35	2850.0	High	Poor-good	23+	Abundant	15+
Core-1	2853.0	Low	Poor	NR	Abundant	8+
Core-2	2857.0	Low	Poor	NR	Abundant	5+
Core-2	2861.0	Low	Poor	NR	Abundant	3+
Core-2	2866.0	Barren				
SWC-32	2867.5	Very low	Poor	4+	Rare	1+
Core-2	2870.0	Very low	Very Poor	NR	Very Rare	2?
SWC-31	2875.0	Barren				
SWC-30	2879.5	Very low	Fair	3+	Very Rare	2?
SWC-28	2887.0	Very low	Poor-good	3+	Very Rare	1+
SWC-26	2898.2	High	Good	34+	Common	13+
SWC-24	2902.0	Very High	Excellent	11+	Very Abundant	5+
SWC-22	2913.0	Very low	Poor	1+	Rare	1+
SWC-19	2936.2	Barren				
SWC-18	2946.0	Very low	Good	3+	NR	
SWC-14	2971.0	High	Fair-good	49+	Common	10+
SWC-11	3000.4	High	Fair-good	55+	Rare	8+
SWC-10	3004.0	High	Fair-good	54+	Frequent	8+
SWC- 8	3022.0	Low	Poor-good	37+	Frequent	6+
SWC- 4	3062.0	High	Fair-good	29+	Frequent	5+

NR = Not recorded

Diversity:

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

RELINQUISHMENT LIST - PALYNOLOGY SLIDES

WELL NAME & NO: BLACKBACK-3
PREPARED BY: A.D. PARTRIDGE
DATE: 3 May 1994

Sheet 1 of 2

SAMPLE TYPE	DEPTH (M)	CATALOGUE NUMBER	DESCRIPTION
SWC-46	2772.4	P196588	Kerogen slide sieved/unsieved fractions
SWC-46	2772.4	P196589	Oxidised slide 2
SWC-46	2772.4	P196590	Oxidised slide 3 (1/2 cover slip)
SWC-45	2798.0	P196591	Kerogen slide sieved/unsieved fractions
SWC-45	2798.0	P196592	Oxidised slide 2 (1/2 cover slip)
SWC-44	2809.0	P196593	Kerogen slide sieved/unsieved fractions
SWC-44	2809.0	P196594	Oxidised slide 2
SWC-43	2718.0	P196595	Kerogen slide sieved/unsieved fractions
SWC-43	2718.0	P196596	Oxidised slide 2
SWC-43	2718.0	P196597	Oxidised slide 3
SWC-42	2823.0	P196598	Kerogen slide sieved/unsieved fractions
SWC-42	2823.0	P196599	Oxidised slide 2
SWC-42	2823.0	P196600	Oxidised slide 3
SWC-42	2823.0	P196601	Oxidised slide 4 (1/2 cover slip)
SWC-41	2826.2	P196602	Kerogen slide sieved/unsieved fractions
SWC-41	2826.2	P196603	Oxidised slide 2
SWC-41	2826.2	P196604	Oxidised slide 3
SWC-41	2826.2	P196605	Oxidised slide 4 (18mm cover slip)
SWC-40A	2829.0	P196606	Kerogen slide sieved/unsieved fractions
SWC-40B	2829.0	P196607	Kerogen slide sieved/unsieved fractions
SWC-40B	2829.0	P196608	Oxidised slide 2
SWC-40B	2829.0	P196609	Oxidised slide 3
SWC-40B	2829.0	P196610	Oxidised slide 4 (1/2 cover slip)
SWC-38	2835.0	P196611	Kerogen slide sieved/unsieved fractions
SWC-38	2835.0	P196612	Oxidised slide 2
SWC-38	2835.0	P196613	Oxidised slide 3
SWC-38	2835.0	P196614	Oxidised slide 4
CORE-1	2837.0	P196615	Kerogen slide sieved fraction (1/2 cover slip)
CORE-1	2837.0	P196616	Oxidised slide 2
CORE-1	2837.0	P196617	Oxidised slide 3
CORE-1	2841.0	P196618	Kerogen slide sieved fraction (1/2 cover slip)
CORE-1	2841.0	P196619	Oxidised slide 2
CORE-1	2841.0	P196620	Oxidised slide 3 (1/2 cover slip)
CORE-1	2847.0	P196621	Kerogen slide sieved fraction (1/2 cover slip)
CORE-1	2847.0	P196622	Oxidised slide 2
CORE-1	2847.0	P196623	Oxidised slide 3

RELINQUISHMENT LIST - PALYNOLOGY SLIDES

WELL NAME & NO: BLACKBACK-3
PREPARED BY: A.D. PARTRIDGE
DATE: 3 May 1994

Sheet 2 of 2

SAMPLE TYPE	DEPTH (M)	CATALOGUE NUMBER	DESCRIPTION
SWC-35	2850.0	P196624	Kerogen slide sieved/unsieved fractions
SWC-35	2850.0	P196625	Oxidised slide 2 (1/2 cover slip)
CORE-1	2853.0	P196626	Kerogen slide sieved (18mm cover slip)
CORE-2	2857.0	P196627	Kerogen slide sieved (1/2 cover slip)
CORE-2	2861.0	P196628	Kerogen slide sieved (18mm cover slip)
CORE-2	2866.0	P196629	Kerogen slide sieved fraction (1/2 cover slip)
SWC-32	2867.5	P196630	Kerogen slide sieved/unsieved fractions
CORE-2	2870.0	P196631	Kerogen slide sieved fraction (15mm cover slip)
SWC-31	2875.0	P196632	Kerogen slide sieved fraction (15mm cover slip)
SWC-30	2879.5	P196633	Kerogen slide sieved fraction (15mm cover slip)
SWC-28	2887.0	P196634	Kerogen slide sieved fraction (15mm cover slip)
SWC-26	2898.2	P196635	Kerogen slide sieved/unsieved fractions
SWC-26	2898.2	P196636	Oxidised slide 2
SWC-24	2902.0	P196637	Kerogen slide sieved fraction (18mm cover slip)
SWC-22	2913.0	P196638	Kerogen slide sieved fraction (15mm cover slip)
SWC-19	2936.2	P196639	Kerogen slide sieved fraction (15mm cover slip)
SWC-18	2946.0	P196640	Kerogen slide sieved fraction (15mm cover slip)
SWC-14	2971.0	P196641	Kerogen slide sieved/unsieved fractions
SWC-14	2971.0	P196642	Oxidised slide 2
SWC-14	2971.0	P196643	Oxidised slide 3
SWC-14	2971.0	P196644	Oxidised slide 4
SWC-11	3000.4	P196645	Kerogen slide sieved/unsieved fractions
SWC-11	3000.4	P196646	Oxidised slide 2
SWC-11	3000.4	P196647	Oxidised slide 3
SWC-11	3000.4	P196648	Oxidised slide 4
SWC-10	3004.0	P196649	Kerogen slide sieved/unsieved fractions
SWC-10	3004.0	P196650	Oxidised slide 2
SWC-10	3004.0	P196651	Oxidised slide 3
SWC-10	3004.0	P196652	Oxidised slide 4
SWC- 8	3022.0	P196653	Kerogen slide sieved/unsieved fractions
SWC- 8	3022.0	P196654	Oxidised slide 2
SWC- 8	3022.0	P196655	Oxidised slide 3
SWC- 8	3022.0	P196656	Oxidised slide 4
SWC- 4	3062.0	P196657	Kerogen slide sieved/unsieved fractions

RELINQUISHMENT LIST - PALYNOLOGY RESIDUES

WELL NAME & NO: BLACKBACK-3
PREPARED BY: A.D. PARTRIDGE
DATE: 17 MAY 1994

SAMPLE TYPE	DEPTH (M)	DESCRIPTION
SWC-14	2971.0	Oxidised residue.
SWC-11	3000.4	Oxidised residue.
SWC-10	3004.0	Oxidised residue.
SWC- 8	3022.0	Oxidised residue.

PE900777

This is an enclosure indicator page.
The enclosure PE900777 is enclosed within the container PE900959 at this location in this document.

The enclosure PE900777 has the following characteristics:

ITEM_BARCODE =	PE900777
CONTAINER_BARCODE =	PE900959
NAME =	Microplankton Range Chart
BASIN =	GIPPSLAND
PERMIT =	VIC/P24
TYPE =	WELL
SUBTYPE =	DIAGRAM
DESCRIPTION =	Blackback 3 Microplankton Range Chart. Enclosure from appendix 1A of WCR volume 2.
REMARKS =	
DATE_CREATED =	
DATE_RECEIVED =	20/10/94
W_NO =	W1097
WELL_NAME =	Blackback-3
CONTRACTOR =	
CLIENT_OP_CO =	Esso Australia Limited

(Inserted by DNRE - Vic Govt Mines Dept)

PE900778

This is an enclosure indicator page.
The enclosure PE900778 is enclosed within the container PE900959 at this location in this document.

The enclosure PE900778 has the following characteristics:

ITEM_BARCODE = PE900778
CONTAINER_BARCODE = PE900959
NAME = Spore-Pollen Range Chart
BASIN = GIPPSLAND
PERMIT = VIC/P24
TYPE = WELL
SUBTYPE = DIAGRAM
DESCRIPTION = Blackback 3 Spore-Pollen Range Chart. Enclosure from appendix 1A of WCR volume 2.
REMARKS =
DATE_CREATED =
DATE_RECEIVED = 20/10/94
W_NO = W1097
WELL_NAME = Blackback-3
CONTRACTOR =
CLIENT_OP_CO = Esso Australia Limited

(Inserted by DNRE - Vic Govt Mines Dept)

APPENDIX
1B

APPENDIX 1B

APPENDIX 1 B)

FORAMINIFERAL ANALYSIS OF THE POST LATROBE GROUP

ESSO BLACKBACK #3, GIPPSLAND BASIN

Foraminiferal-Biostratigraphic Report on 15 Sidewall Cores

Qianyu Li & Brian McGowran

Department of Geology & Geophysics, The University of Adelaide, Adelaide SA 5005

15 September 1994

Summary

An analysis of planktonic foraminifera in 15 sidewall-core samples from Blackback 3 indicates that the sampling interval (2826.2m-1125m) spans the later Eocene to late Pliocene. Although badly preserved, taxa from the lowermost 4 samples (2826.2m-2809m) are found to indicate the later Eocene and early Oligocene. The Miocene sequence is represented by 9 samples between 2798m-1822m, whereas the early and late Pliocene each by one single sample in the uppermost sampling section (1252m and 1125m respectively). A detailed zonation is listed in Table 1 (p. 6).

Among benthic foraminifera, deep-water agglutinated forms characterize the lower 7 samples, but this fauna is replaced by hyaline-walled species at around 2600m, ie. the later part of the early Miocene. A tendency of shallowing-upward is evidenced by the presence of some shelf elements like *Discorbis*, *Elphidium* and *Discorbinella* in the uppermost two samples (Pliocene). A similar feeling was caught up at 2200m, close to the middle and late Miocene boundary, in which a less-diverse fauna is featured by small-sized taxa including *Discorbis*. This shallowing, however, is by no means an equivalent of that in the Pliocene because the Pliocene samples contain a diverse fauna with many benthic as well as planktonic species. Coupled with the shallowing tendency was perhaps an increasing oxygen level in the bottom water that counts for the change from an agglutinants-dominated to a hyaline species-dominated benthic fauna in the later part of the early Miocene onward.

The overal biostratigraphy and depositional environment discussed in this report are similar to the findings by Taylor (1975) from Hapuku 1. Differences, if any, are probably resulted from an up-dated zonation adapted in this presentation using standard N zones, rather than local schemes.

Material and Methods

We received 15 SWC samples in early August 1994. The descriptive statement attached to the material shows that at least 10 samples are clean and devoid of any contamination. Samples between 2200m-2772.4m were broken and more or less penetrated with mud, and thus might contain displaced materials.

Samples were soaked, and washed using a standard 63µm sieve. Residue were dried and separated into two fractions: 63-150µm and >150µm. The 63-150µm fraction may contain specimens described as "small", and the >150µm may have medium (150-250µm) to large (>250µm) specimens.

About 400 foraminiferal specimens were picked from each sample, but this number could not be met in the first sample (2826.2m) where specimens are extremely rare. Important species or species groups were identified and listed in the Appendices (1--plankton and 2--benthic). Neither quantitative counting nor any statistic analysis has been done.

The condition of preservation ranges from poor to moderately good. About half of the samples from the lower part of the section contain many poorly-preserved specimens, for which identifications are tentative or open.

Results

2826.2m (SWC-41)
No plankton was found. Benthics were represented only by a few agglutinated forms, particularly *Cyclammina* cf. *cancellata.*

2823m (SWC-42)
This sample conains a rich, though badly preserved, planktonic fauna. Taxa which could be positively identified include *Subbotina* spp. (*S. eocaena*) and (one specimen of) *Morozovella* sp.

In contrast, benthics are relatively rare, with the following forms: *Cyclammina*, *Cibicides* cf. *wuellerstorfi*, *Cibicidoides* spp. and *Uvigerina* sp.

2818m (SWC-43)
Though similarly poorly preserved, the planktonics from 2818m are richer than in the previous sample. Among others, *Subbotina labiacrassata*, *S. angiporoides* (including subspecies *minima*) and *Globoquadrina venezuelana* were identified. This association suggests an early Oligocene age.

Benthics were also diverse, having many agglutinated and hyline forms (Appendix 2). Deep-water forms such as *Haplophragmium*, *Cyclammina*, *Discammina*, *Stilostomella* and *Pullenia*, indicate a middle slope environment with water depths about 500-800m.

2809m <u>(SWC-44)</u>
Foraminifera in this sample is similar to those found in 2818m in both composition and preservation. The most important characteristic is that many more large-sized specimens occur and several taxa are found for the first time. The newly introduced forms include (planktonic) *Globorotaloides* spp. and *Paragloborotalia nana* and (benthic) *Anomalinoides* sp., *Gyroidinoides* spp. and *Vulvulina pennatula.*

2798m <u>(SWC-45)</u>
The overall faunal character is similar to that found in 2809m. The planktonics are dominated by *Catapsydrax* and *Globorotaloides* groups and the benthics by agglutinated forms including *Cyclammina*, *Discammina*, *Vulvulina*, *Ammodiscus* and *Haplophragmium.* The only difference is that this sample contains such globoquadrine planktonics as *Globoquadrina* sp. and *Gq. tripartita.* A late Oligocene to earliest Miocene age is thus indicated.

2772.4m <u>(SWC-46)</u>
Unlike the prededing two samples, large-sized plankton in this sample are rare, though specimens are still similarly rich. Long-ranging species found include *Catapsydrax dissimilis*, *C. unicavus* and *Globorotaloides* spp. (particularly *G. suteri* and *G.* cf. *testarugosa*). Accompaning these are several good specimens of *Globoquadrina dehiscens*, a stratigraphic marker species first appearing close to the Oligocene/Miocene boundary. This sample thus can be positively dated as early Miocene, zone N4 equivalent.

A sharply decline in the agglutinated benthics was noticed in this sample. On the other hand, several new hyaline forms were found: *Sphaeroidina bulloides*, *Siphonina australis* and *Osangularia* sp.

2770m <u>(SWC-47)</u>
With rare and mainly small-sized specimens, this sample must mark a change in the depositional environment, if not in climate. The occurrence of some fresh, angular quartz grains may be a similar signal.

Though *Catapsydrax dissimilis* was still distinct among the plankton, the influx of the *Globoturborotalita* group (*Gt. woodi* and *Gt. connecta*) is the main feature for this sample. In southern mid latitudes including southern Australia, the *woodi* datum has been widely used as the marker of zone N5 (or later) in the early Miocene.

Several specimens of *Discorbinella* were found in the less diverse benthic fauna, indicating a shelf (to upper slope) deposition.

2600m (SWC-48)

Unlike the previous sample, this sample contains rather diverse fauna with abundant specimens. The *woodi* group dominated the plankton, but several species were newly introduced: *Globorotalia zealandica, Gr. praescitula* and *Globigerinoides trilobus*. This is a later early Miocene (N6-N7), warmer-water association.

Important benthic taxa include *Globocassidulina subglobosa, Astrononion, Discorbinella, Cyclammina* and *Ammodiscus*.

2550m (SWC-50)

Foraminifera in this sample are both rich and large. Among the plankton, the predominance of the *woodi* group is now diluted by the occurrence of *Praeorbulina glomerosa* (sensu lato) and several *Globorotalia* (particularly *Gr. archeomenardii, Gr. praemenardii* and *Gr. miozea*). The first *P. glomerosa* datum is commonly used to mark the early and middle Miocene boundary, and because of this, this sample can be placed in the later N8 zone, or early part of the middle Miocene.

Also perceived is a slight increase of agglutinated, deep-water benthics like *Ammodiscus, Karreriella* and *Trochammina*.

2501m (SWC-52)

This sample bears a planktonic fauna apparently developed from the previous sample. Specimens representing the *woodi-trilobus* lineage are common, and so are those of *Gr. archeomenardii-praemenardii, Gr. miozea* and *Gr. scitula*. The major feature, however, is the incoming of *Orbulina* (mainly *O. suturalis*), a post-N8 marker. Together with these are a small proportion of *Globigerina bulloides* and tenuitellids. It is tentatively dated as representing zones N9-N10, middle Miocene.

There are rare benthic species and specimens, and agglutinated forms are virtually absent.

2400m (SWC-53)

Many large-sized specimens are found in this sample. In the presence of *Orbulina*, the *Gr. miozea-miotumida* complex is the major feature. Other species include *Gr. scitula* and *Gr. praemenardii*, as well as the *woodi-trilobus* lineage. This planktonic association suggest a middle middle Miocene age, or zones N10-N11 equivalents.

Among the benthics, specimens of *Cibicidoides pseudoungerianus, Chilostomella, Nodosaria* and those of the uniloculars are distinct.

2200m <u>(SWC-54)</u>

The plankton in this sample is represented only by a few *Orbulina* and globigeriniforms which cannot be identified due to their small size and bad preservation.

In contrast, small benthics are common and dominated by cassidulinid forms (*Cassidulina margaritae* and *Globocassidulina* spp.). Coupled with these, the presence of *Discorbis* sp. and *Cibicides* spp. may indicate a cooler and shallower depositional environment.

1822m <u>(SWC-56)</u>

This sample contains a diverse fauna with numerous small specimens. The occurrence of *Neogloboquadrina pachyderma* indicates a late Miocene age. This is supported by *Globorotalia conomiozea*, a species first appearing in the middle part of zone N17. Other common species include *Globigerina bulloides, G. quinqueloba, Globorotaloides unicavus, Globorotalia miotumida* and *Orbulina suturalis.*

Benthics are mainly species of *Cibicides, Cassidulina, Globocassidulina, Astrononion, Lagena, Fissurina* and *Uvigerina*, indicating an upper slope to outer shelf environment.

1252m <u>(SWC-59)</u>

A sharp change in the plankton in this sample is evidenced not only by the rich and large-sized specimens but the occurrence of several new forms such as *Globorotalia puncticulata, Gr. crassaformis, Gr. margaritae* and *Sphaeroidinellopsis* sp. Other common species include *Globigerina bulloides, G. falconensis, Gr. scitula, Gr. menardii* s.l. and the *Neogloboquadrina acostaensis-pachyderma* complex. The first appearance of *Gr. puncticulata* is from the earliest Pliocene, while *Gr. margaritae* has a known range only within the early Pliocene. Thus an early Pliocene age, or zones N19-N20 equivalents, is suggested for this sample.

Some benthics are also large, but the change is mainly marked by the introduction of some shallower-water taxa including *Elphidium* and *Quinqueloculina*. Several other forms are also quite distinct: *Cibicidoides pseudoungerianus, Amphicoryna bradyi, Rectouvigerina* sp. and *Nonionella* sp. This is a mid to outer shelf association.

1125m <u>(SWC-60)</u>

This is the uppermost and youngest sample examined in this report. It contains a rich and better preserved fauna. The plankton features the Pliocene *Gr. puncticulata-Gr. crassaformis* association, but the stratigraphically most useful form is *Gr. inflata*, a species with a known first appearance in the late Pliocene. Lacking any younger forms, this sample thus reasonably represents the late Pliocene, or zone N21 equivalent.

Among the benthics, *Uvigerina bassensis* occurred abundantly. Several forms living close to mid-shelf conditions were also present: *Virgulina rotundata, Elphidium* spp., *Discorbinella scopos* and *Cassidulina laevigata.*

Table 1. Planktonic foraminiferal biostratigraphy for Blackback 3.

depth (m)	*sample*	*zone*	*age*	*events*	*correlation to Taylor*
1125	SWC-60	N21	**late Pliocene**	first *Gr. inflata.*	A-3
1252	SWC-59	N19-N20	**early Pliocene**	first *Gr. puncticulata* & *Gr. margaritae*	A-4
1822	SWC-56	N17	**late Miocene**	first *Gr. conomiozea.*	B-1
2200	SWC-54	?N15-N16		rare and non-diagnostic	B-2 to C
2400	SWC-53	N10-N11	**middle Miocene**	*Gr. miozea-miotumida* complex.	D-1
2501	SWC-52	N9-N10		first *Orbulina.*	D-2 to E-1
2550	SWC-50	N8		first *P. glomerosa.*	E-1
2600	SWC-48	N6-?N7	**early Miocene**	*Gr. praescitula* & *Gr. zealandica.*	G
2700	SWC-47	N5		first *Gt. woodi,* distinct *C. dissimilis.*	G to H-1
2772.4	SWC-46	N4		good *Gq. dehiscens.*	H-1
2798	SWC-45	?N4		good *C. dissimilis* & *Gq. tripartita.*	H-2 to I-1
2809	SWC-44		**early Oligocene**	*C. dissimilis* & *S. angiporoides.*	?J-2
2818	SWC-43			*S. angiporoides* & *S. labiacrassata.*	
2823	SWC-42		**?late Eocene or earlier**	*Subbotina eocaena* group.	?K
2826.2	SWC-41			no plankton.	

Discussion

1. Planktonic foraminiferal biostratigraphy

As summarized in Table 1, the planktonic results show that the samples examined cover the deposition from the later Eocene to late Pliocene. Standard N zones (for the Neogene) were correlated based on specific first/last appearance datums and faunal associations. However, we could not positively identify any hiatuses because of the long spacing between most samples.

As they contain only badly preserved specimens, the lower four samples could not be dated into any zones, but overall ages were suggested: late Eocene or earlier for the bottom two samples, and an early Oligocene age for the two samples immediately above. Only from 2798m upward, when preservation was better, did identification of taxa become confident, hence a better resolution in biostratigraphy.

The sample from 2798m show transitional faunal features between those from the unzoned pre-Miocene intervals and from the well-defined Miocene-Pliocene samples. It is tentatively placed in the earliest part of the Miocene because of the occurrence of *Gq. tripartita.* Although it ranges from late Eocene to early Miocene, *Gq. tripartita* became common only from the earliest Miocene *Gq. dehiscens* zone upward (Jenkins, 1985).

Three samples (2772.4m, 2700m, 2600m) are well defined as belonging to the early Miocene. The 2600m sample contains typical *Gr. zealandica* and *Gr. praescitula*, but whether it is a N6 or N7 deposition is not ascertained. McGowran & Li (1995) found these two species mainly within zone N6 in the Lakes Entrance Oil Shaft. The sample may be of zone N6 had these species behaved similarly here, but a further evaluation seems to be inappropriate.

We draw the early/middle Miocene boundary at the first *Praeorbulina glomerosa*, in contrast to Taylor (1975) and Kennett & Srinivasan (1983) who used the first *Orbulina* datum. We do so by following the standard chronobiostratigraphy (McGowran & Li, 1993; Berggren et al., 1995).

At least three samples (2550m, 2501m, 2400m) are of the middle Miocene, respectively representing zones N8 (N8b), N9-N10 and N10-N11. We lack marker species to date more precisely for the latter two samples, but we can verify that the fauna is a pre-N12 association.

The sample from 2200m contain a rare and non-diagnostic fauna, and could not be dated. This feature, however, suggests a cool and shallow environmental condition. Globally such a condition occurred in the latest middle Miocene to earliest late Miocene, so a N15-N16 age equivalent for this sample was suggested.

Only one sample, 1822m, has been positively dated as from the late Miocene. An age in the proximity of upper zone N17 is indicated by the presence of *Gr. conomiozea* in this sample.

The uppermost two samples are of early Pliocene (1252m) and late Pliocene (1125m) respectively, based on contemporary species like *Gr. puncticulata, Gr. margaritae* and *Gr. inflata*. *Gr. puncticulata* and *Gr. crassaformis* appeared successively in the early Pliocene (Taylor, 1975; Kennett & Srinivasan, 1983). The co-existence of these two species in sample 1252m thus suggests that it can be allocated to the *Gr. crassaformis* zone of Kennett & Srinivasan (1983), other than the slightly earlier *Gr. puncticulata* zone.

2. Environmental interpretations

Planktonics and benthics are both important in our following discussion of depositional palaeoenvironments, but the benthics will be emphasized because they reflect more about bottom water conditions including water depth and nutrient level, as well as any climate-imposed effects.

The Eocene and Oligocene deposits at Blackback 3 are thin, with a maximum thickness of about 15m (2826.2m-2809m). The deposits might have been either strongly condensed or truncated with hiatuses. The bad preservation of foram specimens in these sediments hampers better resolution. However, we predict an unconformity in the 11m interval between early Oligocene SWC 44 and early Miocene SWC 45.

(1) Palaeogene agglutinated benthic fauna.

The agglutinates-dominated benthic fauna occurred from Eocene, through Oligocene, to the later part of the early Miocene, where it started to be replaced by hyaline-walled species. Many of these agglutinate taxa are now living near middle bathyal (~ 1000m) or a deeper water depth. A deep-water environment might exist if the agglutinates were indeed deep-water dwellers.

However, species of *Cyclammina, Ammodiscus, Haplophragmium, Discammina* and *Vulvulina* could indicate one of several environments. (i) Comparison with modern distribution might indicate bathyal (to slope) deposition, except that there has been an oceanward shift since the Palaeogene. (ii) Changes in temperature or in oxygen supply could be the cause, but these work in opposite directions. Sluggish circulation is on response to warming. Taylor (1975) demonstrates the same uneasiness about the same assemblages in Hapuku 1, in his suggestion that a lagoonal environment is succeeded by rise and slope environments. The material is not sufficient to resolve this question of benthic agglutinated benthics in the virtual absence of planktonics.

(2) Neogene hyaline benthic fauna.

Hyaline species occurred also in the Eocene-Oligocene, but did not become consistent until sample 2772m (N4), and did not become predominant until sample 2600m (N6-?N7). They subsequently replaced the agglutinates from 2501m (N9-N10) onward. These timings are significant, because three of the Miocene warmings were in the same time periods. The first N4 warming not only caused the radiation of the planktonic *Globoquadrina* lineage but also attracted some subtropical larger benthics (particularly *Amphistegina*) into southern Australia, which was about 15° south of the present latitude. It was the height of the third-order sequence TB1.4 (Haq et al., 1987). The N6 (to N7) warming, representing a high sealevel of sequence TB2.1, caused stratification in the water column attracting *Globorotalia* species (Li & McGowran, 1994). It was the first of several climatic fluctuations in the Miocene, and the most crucial time in the evolution of benthic fauna in the Gippsland and southern Australia (Li & McGowran, 1995). By the time of N9, similar agglutinated forms were no longer surviving at this locality, presumably indicating that a well oxidised bottom water had developed.

The warmest period in the Miocene, however, was between N8-N9 (2550m-2501m), which we termed the Miocene climatic optimum (McGowran & Li, 1993, 1994). The direct faunal evidence is, among others, the evolution of *Pareorbulina-Orbulina* lineage and a large-scale invasion into southern Australian waters of many (sub)tropical larger benthic foraminifera (eg McGowran, 1979; McGowran & Li, 1994; Li et al., 1995). However, little impact has been observed in small benthics at either Lakes Entrance Oil Shaft (Li & McGowran, 1995) or Blackback 3 (Appendix 2).

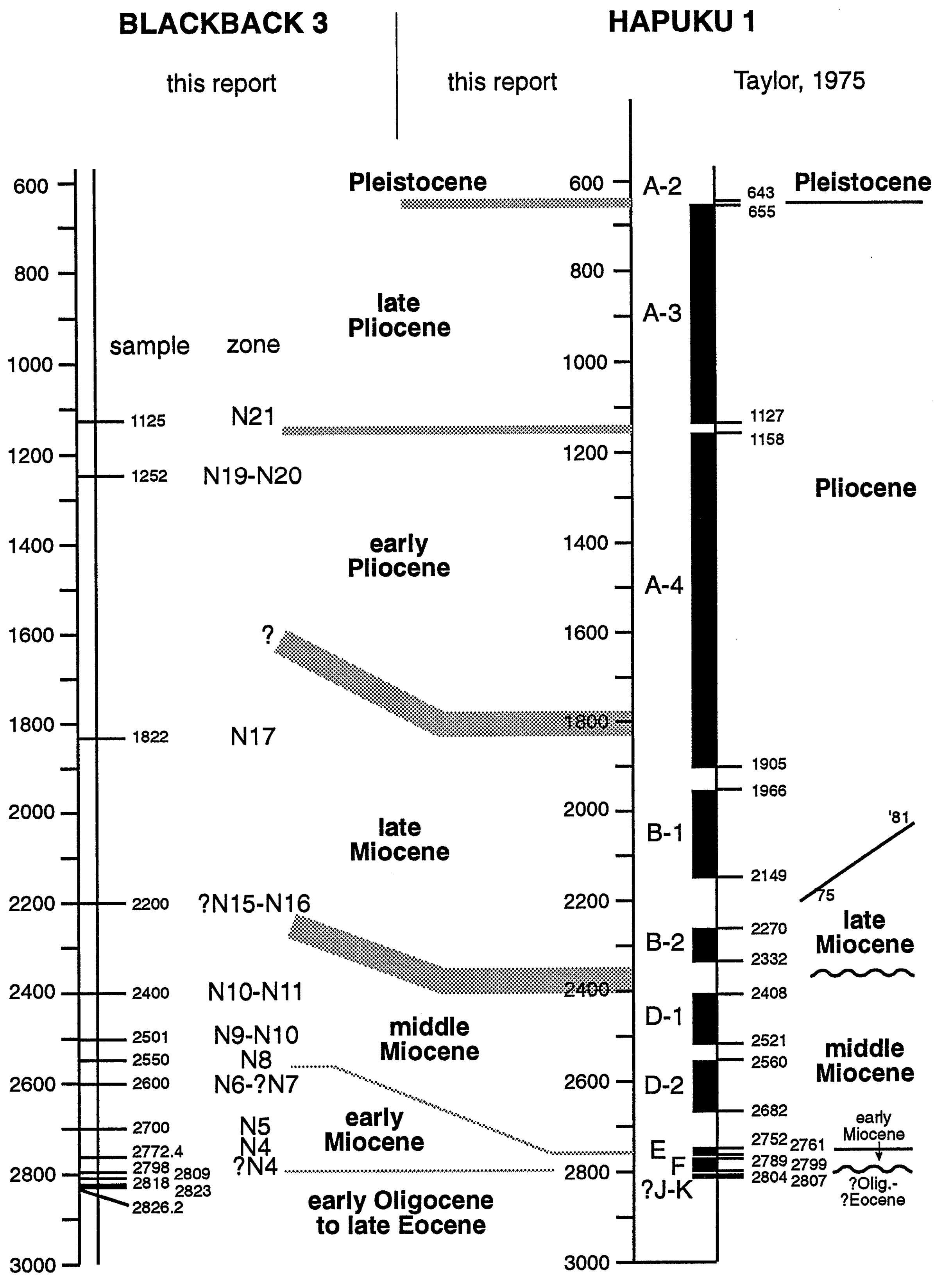


Fig. 1. Planktonic foraminiferal biostratigraphy: Blackback 3 and Hapuku 1.

A general shallowing trend is held for the whole section because of the introduction of some shelf taxa occurring in the uppermost (Pliocene) samples. The large-sized planktonic and benthic specimens found in these samples suggest that it was still rather warm, presumably relating to the early Pliocene (TB3.4) and late Pliocene (TB3.6) warmings respectively.

On the other hand, the late Miocene samples (2200m, 1822m) contain mostly small specimens, indicating a cool condition. In sample 2200m, planktonics are rare, with no diagnostic species, whereas benthics are dominated by small sized cassidulinids. Species from sample 1822m are similarly small, but the majority could be identified. They are the only two samples indicating a cold water condition in a rather shallow (probably shelf) setting.

3. Correlation with Hapuku 1

The overall biostratigraphy and inferred palaeoenvironments are similar to those depicted by Taylor (1975) for Hapuku 1. For a better correlation, we modified Taylor's zonation on the basis of the datums he identified, and this modification is presented in Appendix 3.

Biostratigraphic correlation of Blackback 3 and Hapuku 1 is shown in Fig. 1. It is apparent that differences do exist between these two cores, particularly the thickness of the early Miocene and the boundary between the late Miocene and early Pliocene.

The early Miocene in Blackback 3 is about 200m thick (2600-2809m), compared to only 20m (2761-2799m) in Hapuku 1. However, the level on which Miocene sedimentation commenced is similar between the two cores, ie. about 2800m.

Taylor (1975) used his B-1/B-2 boundary for the late Miocene/early Pliocene boundary, but he later (1981) changed to be within his zone B-1. A scrutiny of his results shows that *Globorotalia puncticulata* (1905m) appeared earlier than *Gr. sphericomiozea* (1783m) at Hapuku 1. This contradicts other observations, and the opposite seems to be true (Kennett & Srinivasan, 1983; Jenkins, 1985). We use the first appearance of *Gr. sphericomiozea* (1783m) for that boundary, by following Kennett & Srinivasan (1983) and Berggren et al. (1995).

Conclusions

1. The sampling interval of Blackback 3 (2826.2m-1125m) covers sequences of the later Eocene, early Oligocene, Miocene and Pliocene. Planktonic foraminiferal datums and faunal associations permit correlation of the Miocene and Pliocene strata to the standard N zones.

2. A sluggish circulation may have existed during the most of the early Miocene and earlier periods. Under this circulation, an oxygen-poor bottom condition developed to support the

agglutinated taxa which dominated the benthic fauna. A deeper water setting, probably slope to bathyal, is suggested for the most of the early Miocene.

3. Changes in the benthic fauna occurred mainly at three levels: 2772.4m, 2600m and 2501m. The first two are marked by the occurrence of many hyaline-walled species, and the last (2501m) by the total disapperance of the agglutinated species. A well-oxidised bottom condition may have developed since the later early Miocene.

4. The biostratigraphy of Blackback 3 is very similar to that found in Hapuku 1, except that the early Miocene in Blackback 3 is about 10 times thicker than in Hapuku 1. At both localities, however, early Miocene sedimentation was initiated at a similar well depth, at about 2800m.

References

BERGGREN, W.A., KENT, D.V., SWISHER, C.C. & AUBRY, M.-P., 1995. A revised Cenozoic geochronology and chronostratigraphy. SEPM Spceial Volume (in press).

HAQ, B.U., HARDENBOL, J. & VAIL, P.R., 1987. The chronology of fluctuating sea-level since the Jurassic. Science, 235: 1156-1167.

JENKINS, D.G., 1985. Southern mid-latitude Paleocene to Holocene planktic foraminifera. In: Bolli, H.M., Saunders, J.B. & Perch-Nielsen, K., Eds., Plankton Stratigraphy. Cambridge University Press, 87-154.

KENNETT, J.P. & SRINIVASAN, M.S. 1983. Neogene Planktonic Foraminifera A Phylogenetic Atlas. Stroudsburg, Pennsylvania: Hutchinson Ross Publishing Company, 265p.

LI, Q. & McGOWRAN, B., 1994. Miocene upwelling events: foraminiferal evidence from southern Australia. Australian Journal of Earth Sciences, 41(6) (in press).

LI, Q. & McGOWRAN, B., 1995. Benthic foraminiferal response to the Miocene oscillation on a mid-latitude margin: Lakes Entrance, southern Australia. Micropaleontology, (in press).

LI, Q., MOSS, G., McGOWRAN, B. & QUILTY, P.G., 1995. Endemic foraminifera from southern Australia: Evidence of a transforming Southern Ocean? (being summitted to AGSO Australian Journal of Geology & Geophysics).

McGOWRAN, B., 1979. The Australian Tertiary: foraminiferal overview. Marine Micropalentology, 4: 235-264.

McGOWRAN, B. & LI, Q., 1993. Miocene planktonic foraminifera from Lakes Entrance in Gippsland: Midlatitude neritic signal from a transforming ocean. Memoir of the Association of Australasian Palaeontologists, 15: 395-405.

McGOWRAN, B. & LI, Q., 1994. The Miocene oscillation in southern Australia. Spec. Vol. Australian Vertebrate Evolution, Palaeontology and Systematics, Records of the South Australian Museum. (in press)

TAYLOR, D., 1975. Foraminiferal sequence, Hapuku #1. ESSO Palaeontology Report 1974/14.

TAYLOR, D., 1981. Summary Planktonic foraminiferal biostratigraphy-- Gippsland Basin (a chart) (as an enclosure to Athene-1 well completion report).

Appendex 1. Distribution of planktonic foraminifera in Blackback 3 (x=rare; C=common).

	2826	2823	2818	2809	2798	2772	2700	2600	2550	2501	2400	2200	1822	1252	1125
Subbotina eocaena		x	x	x											
S. angiporoides		x	x	x	?										
S. labiacrassata		?	x												
S. spp.		x	x	x	x										
Catapsydrax dissimilis			x	C	C	C	C	x	x						
C. unicavus				C	C	C	C	x	x				x		
Globorotaloides spp.		x	x	x	x	x	x	x							
Globoquadrina sp.					x										
Gq. venezuelata		x	x	x	x										
Gq. tripartita					x										
Gq. dehiscens						C	x								
Gq. globosa													x		
"Globigerina" ouachitaensis		x	x	?											
Globoturborotalita woodi							x	C	C	C	x				
Gt. cf. apertura															x
Globigerinoides trilobus s.l.								x	x	x	x			x	
Praeorbulina glomerosa									C						
Orbulina spp.										C	x	x	x		x
Globorotalia zealandica								x							
Gr. praescitula								x							
Gr. scitula										x	x			x	
Gr. prae-(archeo-)menardii									C	x	x				
Gr. menardii s.l.														x	x
Gr. miotumida											x	x	x		
Gr. miozea									C	x	x	x			
Gr. conomiozea												x	?		
Gr. sphericomiozea													cf.	cf.	
Gr. puncticulata														C	C
Gr. margaritae														x	
Gr. crassula															x
Gr. crassaformis														C	C
Gr. inflata															x
Paragloborotalia nana s.l.			x	x											
P. mayeri s.l.															
P. continuosa							x	x	x						
Neogloboquadrina acostaensis														x	
N. pachyderma													x	x	x
N. dutertrei															x
Sphaeroidinellopsis sp.														x	
Globigerina bulloides										x			x	x	
G. falconensis														x	x
G. ciperoensis					x		?								
Tenuitella spp.										x	x				
Globigerinita spp.										x	x		x		x
Morozovella? (?reworked)		x													
unidentified		C	C	x	x							x			

Appendix 2. Distribution of benthic foraminifera in Blackback 3 (x=rare; C=common).

	2826	2823	2818	2809	2798	2772	2700	2600	2550	2501	2400	2200	1822	1252	1125
Ammodiscus parri				x	x	x		x	x						
Cyclammina cf. cancellata	x	x	x	x	x		x	x							
Haplophragmium sp.			x	x	x										
H. subglobosum					x				x						
Discammina cf. compressa				x	x										
Ammobaculites spp.			x	C	x		x								
Trochammina spp.				x	x		x	x	C						
Karreriella bradyi					x				x						
Eggerina sp.						x									
Glomospira				x											
Valvulina pennatula				x											
Clavulina spp.		x	x		x										
Textularia spp.														x	x
Cibicides sp.			x	C		x						x	x	x	x
C. cf. wuellerstorfi		x													
Cibicidoides sp.		x		x		?									
C. pseudoungerianus										x	x			C	x
Anomalinoides sp.						x						x			
Gyroidinoides spp.				C			x	x	x						
Osangularia sp.						x									
Oridosalis tener									x						
Siphonina cf. australis						x									
Sphaeroidina bulloides						x		x	x	x					
Planulina spp.								x							
Discorbinella scopos +							x	x							x
Discorbis spp.												x			
Pullenia quinqueloba			x	x										x	
P. bulloides			x	x											
Nonion spp.															x
Astrononion								x					x	x	
Nonionella														x	x
Elphidium spp.														x	x
Cassidulina laevigata s.l.										x			C	x	x
C. margaritae							x					x			
Globocassidulina spp.			x						x	x	x	C	C		x
Uvigerina spp.		x				x							x		
Uvigerina bassensis														x	C
Rectouvigerina														x	
Trifarina bradyi			x												
Bulimina cf. inflata															x
Globobulimina pacifica															C
Chilostomella pacifica											C				
Virgulina rotundata															C
Bolivina spp.						x	x			x				x	x
Lagena-Oolina										x	x		x	x	x
Fissurina			x							x	x		x	x	
Amphicoryna			x											x	x
Nodosaria spp.									x	x	x				
Stilostomella			x		x										
Sigmomorphina			x												
Sigmoilina														x	
Quinqueloculina sp.														x	

Appendix 3. Foraminiferal biostratigraphy of Hapuku #1.

depth (ft)	depth (m)	Taylor, 1975		this report	
1995	608.08				
2110	643.13	A-2	Pleistocene	N22	Pleistocene
2150	655.32				
2203	671.47				
2297	700.12				
2400	731.52				
2505	763.52				
2600	792.48				
2700	822.96				
2800	853.44				late Pliocene
2900	883.92	A-3		N21	
2996	913.18				
3096	943.66				
3196	974.14				
3268	996.09				
3300	1005.84				
3400	1036.32				
3500	1066.8				
3590	1094.23		Pliocene		
3700	1127.76				
3800	1158.24				
3900	1188.72				
4005	1220.72				
4090	1246.63			N20	
4200	1280.16				
4280	1304.54				
4350	1325.88				early Pliocene
4500	1371.6				
4700	1432.56	A-4			
4900	1493.52			N19	
5100	1554.48				
5300	1615.44				
5530	1685.54			N18	
5650	1722.12				
5850	1783.08				
6050	1844.04				
6250	1905				
6450	1965.96			N17	
6650	2026.92	B-1			late Miocene
6850	2087.88			I	
7050	2148.84				
7450	2270.76	B-2	late Miocene	N16	
7650	2331.72				
7900	2407.92			N15	
7970	2429.26	D-1		N14	
8100	2468.88				
8270	2520.7		middle Miocene	N12	middle Miocene
8400	2560.32			N11	
8600	2621.28	D-2			
8800	2682.24			N9	
9030	2752.34	E			
9060	2761.49			N8	
9150	2788.92		early Miocene	N7	
9172	2795.63	F			early Miocene
9182	2798.67			and	
9200	2804.16		?early Oligocene or ?late Eocene		
9209	2806.9	?J-2 or K		earlier	and
9218	2809.65				
9221	2810.56				earlier
9227	2812.39				
9236	2815.13				

APPENDIX 2

APPENDIX 2

APPENDIX 2

QUANTITATIVE FORMATION EVALUATION

Esso Australia Limited

Blackback 3
Petrophysics Formation Evaluation
A New Approach using LASER

Interval: 2832 metres - 3074 metres MDKB

Petrophysicist: W. Scott Dodge Snr

September 1994

Exploration Department
Formation Evaluation

Blackback 3

Petrophysics Formation Evaluation
A New Approach using LASER

TABLE OF CONTENTS

Blackback 3

Petrophysics Formation Evaluation
A New Approach using LASER

Summary

The Blackback 3 well was drilled to determine the extent of the southwest portion of the Blackback/Terakihi field. Reservoir age, quality and hydrocarbon potential were unknown in this portion of the field. The petrophysical well logs (Enclosure 1) and whole core have been evaluated to resolve these outstanding questions at Blackback 3.

An Eocene age N.asperus reservoir containing unproducible oil was penetrated just below the Top of Latrobe unconformity. Based upon a 10 md permeability cutoff, all of the oil bearing reservoir interval is non productive. The oil column from 2832 metres to the Blackback FOWC at 2859 metres (-2834m TVDSS) computed oil saturations ranging from 10 percent to 30 percent pore volume. Additional low oil saturated rock down to 2877 metres is identified and may be part of a relict oil zone as seen in other wells in the Blackback field. Fluorescence in core was observed as deep as 2849 metres, while oil saturation measured from fluids extraction of the core detected oil as deep as 2854.8 metres. However, the low oil saturations may be within the measurement error of the core fluid saturation calculations.

Reservoir permeability and capillary pressure are the controlling factors which permit oil emplacement in the Eocene reservoir above -2834 metres TVDSS.

No other hydrocarbon bearing reservoirs were identified deeper in the well in the Paleocene (2878 metres) and Late Cretaceous (2914 metres) reservoirs to the total depth of Blackback 3 (3125 metres).

The Formation Evaluation Summary of porosity, saturation and mineralogy as determined by LASER can be found in Appendix A and Enclosure 2.

Formation Evaluation of Blackback 3

The Blackback 3 well was drilled with a 12.25 inch bit from the surface casing at 1100 metres to a depth of 2837 metres. Two 18 metre cores were cut with 100 percent recovery within the oil column of the Eocene reservoir. Core depth is from 2835 metres to 2871 metres, however the core had to be shifted downward 2 metres to correct driller's depth to loggers depth. The shift was determined from the depth at which the hole size changed from 12.25 inches to 9.875 inches (core barrel diameter) at 2837 metres.

Twenty five wellsite core plugs were cut for rapid porosity and permeability determination (Core Laboratories, August 1994). The results of the rush analyses indicated the oil bearing reservoir was of poor quality with permeability in the range of 0.3 md to 5 md. Further analyses from the MDT formation tester confirmed that the reservoir was of low permeability and that no oil samples could be recovered due to the tight formation. The final overburden Klinkenberg corrected air permeability from 195 core plugs over the entire core interval yielded permeability in the range of 0.02 md to 3 md. The average core porosity is 18 percent, wherein lies the anomaly of reservoir quality in the Blackback Eocene age reservoir.

The anomaly of little variation in porosity as permeability ranges from 0.02 md to 100 md as seen in Blackback 1 ST1 has been resolved in an earlier report (Dodge, August 1994). Micro porosity in the glauconitic marine sandstones and clay matrix of the Eocene reservoirs can account for over half of the total pore volume. This large micro porosity component results in high irreducible water saturation ranging from 60 percent at Blackback 1 to 85 percent in Blackback 3 (Enclosure 2). The production test of Blackback 1 ST1 produced 1500 STBD of oil with no formation water. The reservoir permeability and capillary pressure are the controlling factors which permit oil emplacement in the Eocene reservoir above the Blackback field oil water contact.

NUMAR's Magnetic Resonance Imaging Log (MRIL) was run over the interval from 2830 metres to 2950 metres. Several evaluations (Mardon, 1994, Dodge, 1994) of this tool have shown that the MRIL provides a good estimate of permeability as compared to core permeability. Reservoir absolute permeability as determined from core, MRIL and Multiple Linear Regression (MLR) has been used to identify reservoir quality sandstone above a 10 md cutoff. Reservoir permeability is above 1000 md below a depth of 2914 metres which is the top of the Late Cretaceous reservoir. Between 2878 metres to 2914 metres in the Paleocene age reservoir, permeability is poorer than that in the Late Cretaceous averaging 50 md. Eocene, Paleocene and Late Cretaceous mineralogy has been evaluated by MINERALOG (Core Laboratories, 1994) and detailed petrography incorporating thin section point count, XRD, XRF, SEM and a mineral quantification programme which uses this data (MINQUANT) (Klimentidis, 1994). Detailed comparisons of mineralogy between Blackback 3 and other Eocene reservoirs has shown that the poor permeability characteristics at Blackback 3 are caused by increased matrix clay content (Dodge, August 1994). The mineralogic properties from thin section point count analysis in the Eocene reservoir are shown in Table 1:

Table 1

BLACKBACK 3 SELECTED MINERALS
MEAN POINT COUNT ABUNDANCE
BULK VOLUME (%)

QUARTZ (QZMO+QZPO)	GLAUCONITE (OGGL)	FELDSPAR (FSUN+FSKF)	SIDERITE (CBSD+ICSD)	CLAY (OGGL+OTHER)	PORES (PVIG+PVSC)
38	23	8	5	40	3

The total clay component (40 percent) is the overriding mechanism which reduces the reservoir permeability. A 40 percent clay content results in as much as 12 percent micro porosity in the sandstone. Hence the remaining effective pore volume is only 8 percent. This ratio of micro porosity to total porosity results in 60 percent of the pore volume containing water which is immobile.

A LASER formation model based on the above mineral components has been used to determine porosity and mineralogy at Blackback 3 (Dodge, Oct 1994). The LASER model consisting of the following minerals: Quartz, K Feldspar, Siderite, and a Composite Clay of 60% Glauconite and 40% Illite-Smectite is described in Appendix C.

Data Acquisition and Processing

The Petrophysics Logging Summary in Appendix B contains the Suite 1 logging data for Blackback 3. Run 1 Dipole Sonic was recorded in Monopole, Dipole, First Motion Detection and Stoneley mode. Run 2 was acquired in HIRES mode at a logging speed of 900 fph. The petrophysical measurements were processed as shown in the flowchart below. The following wellbore petrophysical logging measurements were used in LASER to compute porosity, and mineralogy. Water saturation was computed using a LOGIC programme incorporating the Waxman Smits water saturation model.

FIELD ACQUISITION PETROPHYSICAL MEASUREMENTS

Logging Tool	Mneumonic	Petrophysical Measurement
Azimuthal Resistivity Imager	ARI	LLD
		LLS
Micro Spherically Focussed	SRTE	MSFL
Compensated Neutron	CNTG	HNPO
Dipole Sonic Imager	DSI	DTCO
Litho Density	LDTD	HNRH
		PEF
Spectral Gamma Ray	NGTD	THOR
		POTA
		URAN

↓

ENVIRONMENTAL CORRECTIONS
HIRES SIGNAL PROCESSING

↓

Input	Processing	Output
LLD	Borehole Size Correction	LLDC
LLS	Borehole Size Correction	LLSC
MSFL	Borehole Size Correction	MSFC
HNPO	Formation Temperature Corr	HNPORC
THOR	Borehole KCL/BARITE Corr	THOR
POTA	Borehole KCL/BARITE Corr	POTA
URAN	Borehole KCL/BARITE Corr	URAN
RHLS	Esso HIRES ALPHA	HNRHOB
RHS1	Esso HIRES ALPHA	HRHOB
RHS2	Esso HIRES ALPHA	ALPHA
RHLI	Esso HIRES ALPHA	HDRHO

↓

LASER
WAXMAN SMITS
PETROPHYSICAL PROCESSING

↓

Curve Mneumonic	Curve Description
PERM.MER	Permeability
PHIE	Effective Porosity
PHIT	Total Porosity
PHIP.MOD	Modelled Producible Porosity
SWT	Total Water Saturation
SWI.MOD	Modelled Irreducible Water Saturation
RHOGA	Grain Density
VDCLAY	Dry Clay Volume
VOIL	Oil Volume
CHLORITE	Fe-Chlorite
CLAY-2	60% Glauconite, 40% Illite-Smectite
KFELDS	Potassium Feldspar
QRTZ	Quartz
SIDERITE	Siderite (Fe-Carbonate)

The wellbore condition was affected by significant washouts over the interval from 2859 metres to 2873 metres. This washout, seen on Enclosure 1 has had an adverse affect on the bulk density, neutron porosity, acoustic transit time and micro spherically focussed resistivity. The nuclear and acoustic measurements were edited to remove the effect of high porosity thus resulting in the straight line segments over this interval. Porosity and water saturation over the washout interval are semi-quantitative at best and should only be used qualitatively.

Following the environmental corrections and HIRES signal processing, the bulk density measurement was used as the depth reference to shift all other petrophysical measurements.

References

Core Laboratories, "Results of a MINERALOG Analysis of Selected Samples from Well Blackback #3 Australia", File: PRP-94013, August 1994.

Core Laboratories, "A Core Analysis Report For Well Blackback #3 Australia", Files: WCA-94006/PRP-94013, August 1994.

Dodge, W.S., "Blackback 3 FMI Analysis", Esso Australia Limited, May 1994.

Dodge, W.S., Phillips, J.M., "Operational Aspect and Results of NUMAR's Magnetic Resonance Image Log at Blackback", Exxon Production Research Company Formation Evaluation Newsletter, July 1994.

Dodge, W.S., "Nuclear Magnetic Resonance Evaluation of Blackback 2 Reservoir Core", Exxon Production Research Company Formation Evaluation Newsletter, July 1994.

Dodge, W.S., "Blackback Eocene Age Channel Fill Formation Evaluation", Esso Australia Limited, August 1994.

Dodge, W.S., "Blackback/Terakihi Field Study Petrophysics Formation Evaluation: A New Approach Using LASER", Esso Australia Limited, October 1994.

Klimentidis, R.J., "Blackback 3 Thin Section, XRD, XRF, MINQUANT Petrography", Exxon Production Research Company, EPR.94.

Mardon, D.J., "NUMAR MRIL Log Evaluation of the Blackback #3 well", NUMAR Inc, May 1994.

Appendix A

Formation Evaluation Log Summary
STATS Interval Summary
Formation Evaluation Results Listing

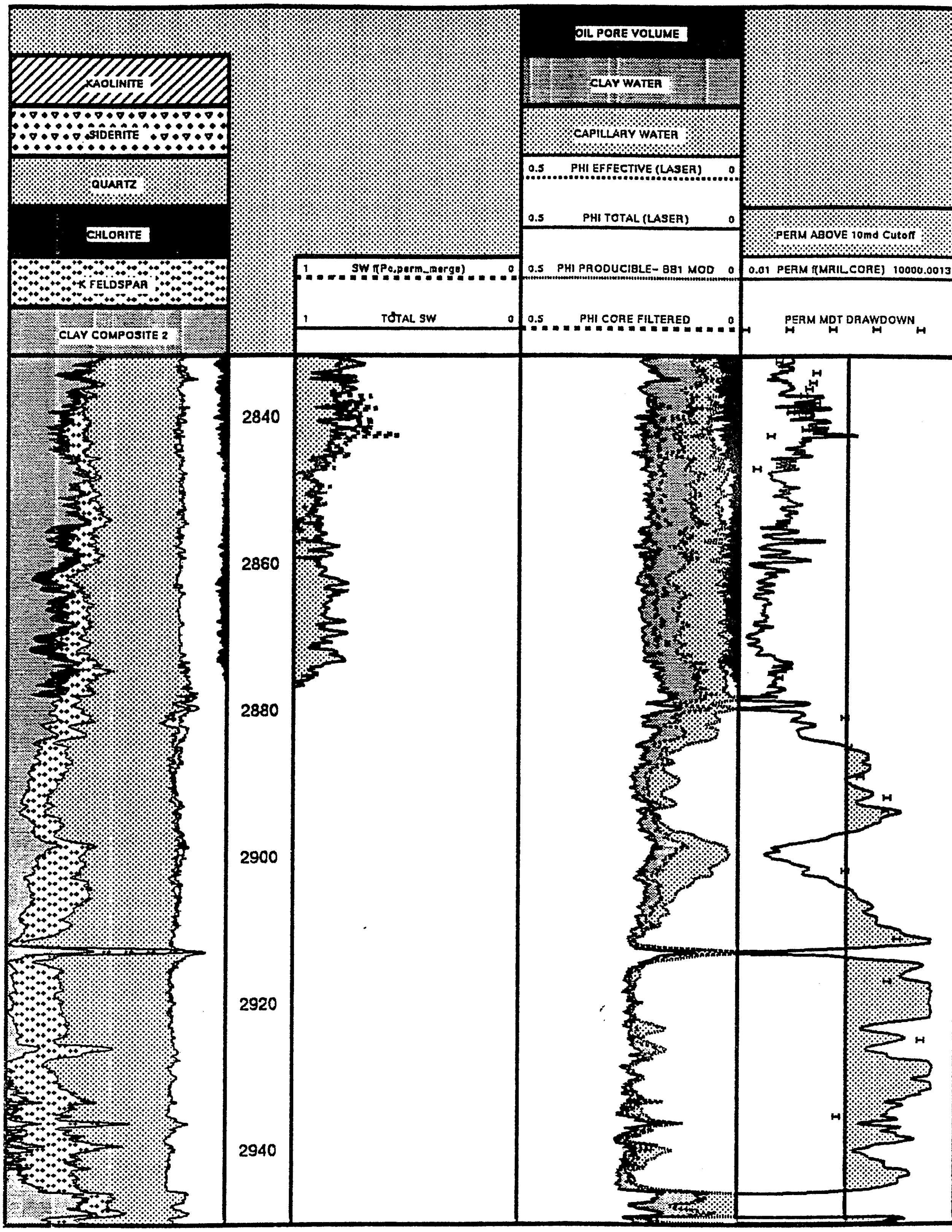


Figure A1 - Blackback 3
Formation Evaluation of Eocene-Paleocene-Cretaceous Reservoirs

Table 1 BLACKBACK_3

ANALYSIS SUMMARY

HYDROCARBON VOLUME BASED ON TOTAL POROSITY AND TOTAL WATER SATURATION

Net permeability cut-off..........: 10.00 md
Net water saturation cut-off......: 0.650 volume per volume

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

	GROSS INTERVAL (metres) (top) -(base)	Gross Metres	NET PERMEABLE INTERVAL Net Metres	Net to Gross	Mean Vwclay	(Std.) (Dev.)	Mean Phie	Mean Phit	(Std.) (Dev.)	Log Mean Permeabilty	Mean Swt	INTEGRATED HYDC PORE VOL	FLUID ID
MDKB	2832.0-2849.0	17.0	0.2	1 %	0.32	(0.010)	0.15	0.22	(0.008)	15.97	0.79	0.000	OIL
MDKB	2849.1-2859.0	9.9	0.0	0 %	-	-	-	-	-	-	-	-	TIGHT
Blackback Field OWC: 2859m TVDSS													
MDKB	2859.2-2878.1	18.9	0.0	0 %	-	-	-	-	-	-	-	-	TIGHT
MDKB	2878.2-2883.8	5.6	0.0	0 %	-	-	-	-	-	-	-	-	TIGHT
MDKB	2883.9-2897.3	13.4	11.2	83 %	0.14	(0.034)	0.19	0.22	(0.012)	38.32	1.00	0.000	WATER
MDKB	2897.7-2912.4	14.7	8.4	57 %	0.11	(0.043)	0.20	0.22	(0.012)	87.57	1.00	0.000	WATER
MDKB	2913.3-2945.6	32.3	32.0	99 %	0.07	(0.052)	0.23	0.24	(0.017)	336.05	1.00	0.000	WATER
MDKB	2973.2-2984.0	10.8	10.7	99 %	0.16	(0.033)	0.16	0.19	(0.009)	566.98	1.00	0.000	WATER
MDKB	2984.1-2997.4	13.3	13.3	100 %	0.11	(0.029)	0.21	0.24	(0.022)	1034.83	1.00	0.000	WATER
MDKB	3005.0-3016.5	11.5	11.5	100 %	0.04	(0.026)	0.21	0.22	(0.009)	1383.81	1.00	0.000	WATER
MDKB	3023.2-3044.0	20.8	20.8	100 %	0.02	(0.027)	0.19	0.20	(0.006)	1387.60	1.00	0.000	WATER
MDKB	3061.2-3063.9	2.7	2.7	100 %	0.04	(0.049)	0.19	0.20	(0.006)	1231.94	1.00	0.000	WATER
MDKB	3064.0-3067.7	3.7	3.7	100 %	0.04	(0.027)	0.24	0.25	(0.009)	1489.38	1.00	0.000	WATER
MDKB	3069.5-3074.0	4.5	4.5	100 %	0.01	(0.022)	0.23	0.23	(0.010)	1589.14	1.00	0.000	WATER

WELL: BLACKBACK_3

* DEPTH * metres	PERM.MER MD	PHIE FRAC	PHIT FRAC	SWT FRAC	VOIL FRAC	VWCLAY fraction
2832.000	0.295	0.072	0.191	0.893	0.021	0.544
2832.250	0.240	0.081	0.203	0.806	0.041	0.557
2832.500	0.299	0.111	0.226	0.744	0.057	0.524
2832.750	0.216	0.108	0.217	0.717	0.062	0.492
2833.000	0.119	0.106	0.212	0.697	0.064	0.466
2833.250	0.266	0.100	0.205	0.742	0.052	0.475
2833.500	0.283	0.085	0.191	0.781	0.042	0.483
2833.750	0.112	0.094	0.204	0.814	0.037	0.478
2834.000	0.129	0.093	0.197	0.865	0.027	0.458
2834.250	0.069	0.080	0.179	0.923	0.014	0.423
2834.500	0.085	0.085	0.182	0.797	0.037	0.417
2834.750	0.108	0.078	0.178	0.740	0.046	0.440
2835.000	0.120	0.036	0.148	0.917	0.013	0.495
2835.250	0.167	0.092	0.204	0.719	0.057	0.498
2835.500	0.257	0.103	0.215	0.780	0.047	0.509
2835.750	0.265	0.103	0.215	0.801	0.042	0.512
2836.000	0.300	0.127	0.228	0.753	0.055	0.464
2836.250	0.228	0.132	0.226	0.737	0.060	0.425
2836.500	0.162	0.127	0.221	0.760	0.053	0.417
2836.750	0.123	0.116	0.215	0.789	0.045	0.432
2837.000	0.249	0.102	0.203	0.841	0.032	0.454
2837.250	1.879	0.105	0.209	0.830	0.035	0.450
2837.500	1.196	0.112	0.205	0.821	0.037	0.419
2837.750	0.778	0.104	0.198	0.841	0.032	0.423
2838.000	0.286	0.117	0.209	0.809	0.039	0.415
2838.250	0.929	0.120	0.210	0.769	0.048	0.402
2838.500	0.091	0.122	0.206	0.771	0.047	0.377
2838.750	2.747	0.087	0.181	0.879	0.023	0.424
2839.000	1.408	0.104	0.194	0.824	0.034	0.401
2839.250	0.404	0.124	0.208	0.793	0.042	0.359
2839.500	1.051	0.121	0.204	0.810	0.038	0.359
2839.750	1.084	0.125	0.207	0.784	0.046	0.361
2840.000	0.701	0.156	0.234	0.714	0.066	0.349
2840.250	0.800	0.120	0.203	0.821	0.037	0.380
2840.500	3.217	0.108	0.197	0.903	0.019	0.388
2840.750	1.155	0.134	0.216	0.852	0.032	0.365
2841.000	0.891	0.133	0.212	0.841	0.034	0.352
2841.250	1.686	0.143	0.217	0.813	0.040	0.326
2841.500	1.485	0.169	0.236	0.752	0.057	0.300
2841.750	1.954	0.133	0.209	0.838	0.034	0.336
2842.000	1.140	0.134	0.207	0.828	0.036	0.328
2842.250	9.962	0.146	0.218	0.783	0.048	0.314
2842.500	9.442	0.118	0.197	0.861	0.028	0.349
2842.750	0.511	0.143	0.215	0.796	0.044	0.330
2843.000	0.924	0.132	0.210	0.838	0.035	0.338
2843.250	0.467	0.140	0.219	0.834	0.036	0.346
2843.500	0.567	0.133	0.217	0.841	0.034	0.362
2843.750	0.546	0.123	0.205	0.864	0.028	0.368
2844.000	0.284	0.128	0.211	0.847	0.032	0.361
2844.250	0.351	0.130	0.210	0.848	0.032	0.355
2844.500	0.544	0.121	0.200	0.917	0.017	0.351
2844.750	0.304	0.168	0.239	0.791	0.049	0.323
2845.000	0.743	0.150	0.227	0.829	0.039	0.344
2845.250	0.782	0.146	0.225	0.826	0.039	0.363
2845.500	0.074	0.103	0.204	0.907	0.019	0.435
2845.750	0.332	0.115	0.209	0.891	0.023	0.427
2846.000	0.145	0.115	0.208	0.900	0.021	0.413
2846.250	0.224	0.117	0.209	0.896	0.022	0.409
2846.500	0.205	0.111	0.203	0.910	0.019	0.419

2846.750	0.280	0.121	0.214	0.877	0.026	0.424
2847.000	0.294	0.118	0.216	0.861	0.030	0.440
2847.250	0.084	0.102	0.206	0.906	0.019	0.464
2847.500	0.063	0.078	0.187	0.989	0.002	0.476
2847.750	0.075	0.101	0.205	0.929	0.014	0.461
2848.000	0.075	0.091	0.201	0.929	0.014	0.491
2848.250	0.083	0.085	0.193	0.960	0.008	0.496
2848.500	0.127	0.102	0.205	0.924	0.016	0.466
2848.750	0.171	0.106	0.202	0.930	0.014	0.438
2849.000	0.169	0.124	0.215	0.883	0.025	0.411
2849.250	0.267	0.112	0.203	0.912	0.018	0.418
2849.500	0.367	0.105	0.201	0.917	0.017	0.425
2849.750	0.137	0.101	0.200	0.915	0.017	0.434
2850.000	0.208	0.098	0.196	0.932	0.013	0.450
2850.250	0.189	0.102	0.204	0.879	0.025	0.458
2850.500	0.089	0.084	0.191	0.927	0.014	0.476
2850.750	0.187	0.104	0.202	0.901	0.020	0.435
2851.000	0.219	0.115	0.206	0.884	0.024	0.395
2851.250	0.259	0.114	0.202	0.898	0.021	0.402
2851.500	0.350	0.116	0.209	0.877	0.026	0.419
2851.750	0.524	0.105	0.198	0.903	0.019	0.414
2852.000	0.298	0.112	0.204	0.881	0.024	0.401
2852.250	0.139	0.100	0.195	0.915	0.017	0.423
2852.500	0.190	0.093	0.187	0.927	0.014	0.428
2852.750	0.377	0.112	0.202	0.909	0.018	0.412
2853.000	0.262	0.103	0.198	0.922	0.016	0.422
2853.250	0.196	0.102	0.198	0.920	0.016	0.420
2853.500	0.263	0.098	0.198	0.917	0.017	0.450
2853.750	0.254	0.099	0.199	0.887	0.023	0.461
2854.000	0.102	0.085	0.192	0.900	0.019	0.486
2854.250	0.194	0.103	0.201	0.861	0.028	0.447
2854.500	0.160	0.086	0.191	0.912	0.017	0.475
2854.750	0.109	0.093	0.199	0.893	0.021	0.450
2855.000	0.049	0.118	0.216	0.889	0.024	0.411
2855.250	0.304	0.123	0.217	0.901	0.021	0.395
2855.500	0.415	0.139	0.228	0.878	0.027	0.373
2855.750	0.134	0.139	0.225	0.861	0.031	0.372
2856.000	0.043	0.104	0.199	0.873	0.027	0.410
2856.250	0.077	0.115	0.207	0.910	0.019	0.406
2856.500	0.243	0.130	0.215	0.888	0.024	0.361
2856.750	1.916	0.135	0.218	0.882	0.026	0.354
2857.000	0.230	0.120	0.207	0.909	0.019	0.376
2857.250	0.059	0.139	0.222	0.851	0.033	0.364
2857.500	0.043	0.158	0.235	0.811	0.043	0.340
2857.750	0.038	0.126	0.212	0.848	0.032	0.372
2858.000	0.142	0.104	0.196	0.912	0.018	0.401
2858.250	0.242	0.097	0.191	0.920	0.016	0.419
2858.500	0.133	0.119	0.214	0.844	0.034	0.426
2858.750	0.042	0.105	0.208	0.842	0.034	0.452
2859.000	0.184	0.125	0.218	0.860	0.031	0.420
2859.250	0.659	0.117	0.210	0.901	0.021	0.410
2859.500	0.474	0.111	0.210	0.910	0.019	0.430
2859.750	0.028	0.116	0.212	0.892	0.023	0.416
2860.000	0.021	0.123	0.214	0.885	0.025	0.394
2860.250	0.033	0.121	0.203	0.911	0.018	0.377
2860.500	0.101	0.133	0.216	0.851	0.032	0.357
2860.750	0.213	0.133	0.214	0.856	0.031	0.347
2861.000	0.081	0.142	0.215	0.872	0.028	0.318
2861.250	0.069	0.155	0.224	0.882	0.026	0.285
2861.500	0.095	0.158	0.222	0.887	0.025	0.270
2861.750	0.058	0.165	0.228	0.852	0.034	0.260
2862.000	0.044	0.166	0.227	0.811	0.043	0.254
2862.250	0.032	0.161	0.225	0.802	0.045	0.270

2862.500	0.068	0.164	0.230	0.773	0.052	0.283
2862.750	0.070	0.144	0.215	0.786	0.047	0.305
2863.000	0.037	0.136	0.209	0.851	0.031	0.334
2863.250	0.036	0.140	0.217	0.866	0.029	0.320
2863.500	0.071	0.143	0.218	0.830	0.037	0.316
2863.750	0.064	0.136	0.217	0.780	0.047	0.351
2864.000	0.026	0.111	0.195	0.835	0.032	0.381
2864.250	0.028	0.121	0.211	0.821	0.037	0.401
2864.500	0.039	0.127	0.214	0.858	0.030	0.382
2864.750	0.060	0.135	0.217	0.832	0.037	0.355
2865.000	0.058	0.137	0.217	0.839	0.035	0.341
2865.250	0.069	0.135	0.215	0.862	0.029	0.341
2865.500	0.046	0.132	0.216	0.865	0.029	0.360
2865.750	0.052	0.130	0.213	0.870	0.028	0.357
2866.000	0.047	0.148	0.224	0.844	0.035	0.327
2866.250	0.048	0.146	0.223	0.862	0.031	0.326
2866.500	0.044	0.137	0.220	0.860	0.031	0.357
2866.750	0.049	0.133	0.218	0.873	0.028	0.370
2867.000	0.062	0.138	0.218	0.878	0.027	0.347
2867.250	0.050	0.140	0.217	0.860	0.030	0.333
2867.500	0.055	0.139	0.216	0.845	0.033	0.335
2867.750	0.032	0.131	0.213	0.771	0.049	0.357
2868.000	0.034	0.118	0.199	0.838	0.033	0.369
2868.250	0.046	0.113	0.199	0.902	0.020	0.394
2868.500	0.058	0.126	0.215	0.869	0.028	0.394
2868.750	0.044	0.132	0.216	0.891	0.024	0.366
2869.000	0.033	0.134	0.216	0.839	0.035	0.363
2869.250	0.028	0.133	0.216	0.775	0.049	0.360
2869.500	0.018	0.132	0.209	0.793	0.043	0.335
2869.750	0.017	0.146	0.217	0.837	0.035	0.294
2870.000	0.029	0.149	0.217	0.877	0.027	0.281
2870.250	0.036	0.143	0.215	0.883	0.025	0.296
2870.500	0.027	0.137	0.213	0.838	0.034	0.316
2870.750	0.018	0.122	0.203	0.896	0.021	0.346
2871.000	0.031	0.129	0.211	0.887	0.024	0.344
2871.250	0.041	0.135	0.212	0.925	0.016	0.316
2871.500	0.042	0.139	0.212	0.910	0.019	0.297
2871.750	0.036	0.142	0.213	0.824	0.037	0.287
2872.000	0.033	0.139	0.212	0.808	0.041	0.299
2872.250	0.069	0.107	0.190	0.851	0.029	0.348
2872.500	0.088	0.123	0.205	0.806	0.040	0.350
2872.750	0.095	0.131	0.213	0.784	0.046	0.346
2873.000	0.134	0.125	0.211	0.776	0.047	0.378
2873.250	0.198	0.100	0.191	0.823	0.035	0.411
2873.500	0.251	0.103	0.193	0.857	0.027	0.406
2873.750	0.082	0.102	0.193	0.871	0.025	0.384
2874.000	0.186	0.088	0.175	0.930	0.013	0.386
2874.250	0.149	0.088	0.181	0.885	0.021	0.410
2874.500	0.204	0.085	0.181	0.920	0.014	0.429
2874.750	0.114	0.089	0.183	0.913	0.016	0.409
2875.000	0.094	0.099	0.186	0.893	0.020	0.373
2875.250	0.105	0.093	0.178	0.950	0.009	0.367
2875.500	0.103	0.099	0.184	0.918	0.015	0.365
2875.750	0.086	0.095	0.178	0.928	0.013	0.352
2876.000	0.098	0.090	0.171	0.983	0.003	0.346
2876.250	0.104	0.089	0.167	0.989	0.002	0.335
2876.500	0.063	0.103	0.179	0.939	0.011	0.312
2876.750	0.136	0.096	0.175	0.994	0.001	0.341
2877.000	0.195	0.093	0.173	1.000	0.000	0.360
2877.250	0.132	0.103	0.179	1.000	0.000	0.333
2877.500	0.054	0.079	0.162	1.000	0.000	0.342
2877.750	0.038	0.069	0.151	1.000	0.000	0.332
2878.000	0.010	0.090	0.161	1.000	0.000	0.314

2878.250	0.010	0.078	0.149	1.000	0.000	0.324
2878.500	0.039	0.091	0.158	1.000	0.000	0.303
2878.750	0.525	0.123	0.183	1.000	0.000	0.277
2879.000	0.876	0.137	0.195	1.000	0.000	0.266
2879.250	0.181	0.100	0.162	1.000	0.000	0.284
2879.500	0.011	0.067	0.131	1.000	0.000	0.292
2879.750	0.037	0.074	0.136	1.000	0.000	0.284
2880.000	0.311	0.115	0.172	1.000	0.000	0.260
2880.250	0.650	0.129	0.184	1.000	0.000	0.253
2880.500	0.587	0.132	0.188	1.000	0.000	0.255
2880.750	0.476	0.153	0.217	1.000	0.000	0.294
2881.000	0.334	0.141	0.206	1.000	0.000	0.297
2881.250	0.299	0.132	0.197	1.000	0.000	0.296
2881.500	0.618	0.152	0.211	1.000	0.000	0.272
2881.750	1.229	0.166	0.216	1.000	0.000	0.229
2882.000	1.293	0.168	0.213	1.000	0.000	0.207
2882.250	0.595	0.131	0.180	1.000	0.000	0.225
2882.500	0.424	0.128	0.182	1.000	0.000	0.246
2882.750	0.447	0.123	0.180	1.000	0.000	0.264
2883.000	0.479	0.116	0.179	1.000	0.000	0.286
2883.250	0.491	0.125	0.191	1.000	0.000	0.303
2883.500	0.607	0.134	0.193	1.000	0.000	0.269
2883.750	0.966	0.147	0.198	1.000	0.000	0.237
2884.000	1.772	0.156	0.198	1.000	0.000	0.191
2884.250	3.847	0.180	0.217	1.000	0.000	0.168
2884.500	6.838	0.189	0.224	1.000	0.000	0.159
2884.750	8.819	0.186	0.228	1.000	0.000	0.192
2885.000	10.481	0.159	0.205	1.000	0.000	0.210
2885.250	16.933	0.171	0.212	1.000	0.000	0.189
2885.500	26.854	0.161	0.201	1.000	0.000	0.182
2885.750	35.269	0.172	0.212	1.000	0.000	0.185
2886.000	40.727	0.181	0.219	1.000	0.000	0.174
2886.250	40.631	0.176	0.212	1.000	0.000	0.166
2886.500	38.751	0.179	0.219	1.000	0.000	0.183
2886.750	29.116	0.156	0.200	1.000	0.000	0.199
2887.000	30.269	0.157	0.197	1.000	0.000	0.183
2887.250	42.098	0.186	0.222	1.000	0.000	0.165
2887.500	45.770	0.183	0.215	1.000	0.000	0.144
2887.750	44.517	0.201	0.233	1.000	0.000	0.147
2888.000	38.508	0.196	0.228	1.000	0.000	0.145
2888.250	31.204	0.197	0.225	1.000	0.000	0.129
2888.500	21.642	0.206	0.236	1.000	0.000	0.134
2888.750	15.270	0.208	0.238	1.000	0.000	0.139
2889.000	10.382	0.201	0.233	1.000	0.000	0.148
2889.250	9.143	0.208	0.238	1.000	0.000	0.138
2889.500	10.352	0.203	0.230	1.000	0.000	0.123
2889.750	12.067	0.205	0.234	1.000	0.000	0.131
2890.000	14.496	0.202	0.230	1.000	0.000	0.129
2890.250	19.858	0.205	0.233	1.000	0.000	0.129
2890.500	27.002	0.204	0.232	1.000	0.000	0.127
2890.750	39.432	0.206	0.231	1.000	0.000	0.116
2891.000	50.321	0.200	0.225	1.000	0.000	0.112
2891.250	54.647	0.196	0.219	1.000	0.000	0.103
2891.500	46.130	0.214	0.237	1.000	0.000	0.104
2891.750	32.874	0.209	0.230	1.000	0.000	0.095
2892.000	23.697	0.201	0.220	1.000	0.000	0.088
2892.250	19.215	0.192	0.212	1.000	0.000	0.092
2892.500	20.685	0.184	0.204	1.000	0.000	0.091
2892.750	30.215	0.171	0.197	1.000	0.000	0.116
2893.000	53.099	0.173	0.198	1.000	0.000	0.115
2893.250	134.553	0.194	0.217	1.000	0.000	0.105
2893.500	271.791	0.209	0.228	1.000	0.000	0.086
2893.750	316.348	0.203	0.219	1.000	0.000	0.076

2894.000	200.208	0.190	0.208	1.000	0.000	0.083
2894.250	120.863	0.184	0.206	1.000	0.000	0.102
2894.500	95.568	0.179	0.206	1.000	0.000	0.124
2894.750	92.925	0.191	0.221	1.000	0.000	0.136
2895.000	85.385	0.193	0.224	1.000	0.000	0.146
2895.250	63.735	0.184	0.219	1.000	0.000	0.160
2895.500	46.823	0.182	0.220	1.000	0.000	0.173
2895.750	34.334	0.180	0.216	1.000	0.000	0.165
2896.000	27.870	0.184	0.220	1.000	0.000	0.166
2896.250	19.519	0.183	0.216	1.000	0.000	0.152
2896.500	10.383	0.169	0.202	1.000	0.000	0.151
2896.750	4.980	0.156	0.193	1.000	0.000	0.167
2897.000	3.552	0.163	0.200	1.000	0.000	0.171
2897.250	2.731	0.166	0.207	1.000	0.000	0.187
2897.500	1.668	0.157	0.201	1.000	0.000	0.201
2897.750	0.816	0.136	0.185	1.000	0.000	0.225
2898.000	0.363	0.123	0.182	1.000	0.000	0.271
2898.250	0.186	0.121	0.188	1.000	0.000	0.308
2898.500	0.096	0.109	0.173	1.000	0.000	0.293
2898.750	0.101	0.130	0.187	1.000	0.000	0.261
2899.000	0.126	0.139	0.190	1.000	0.000	0.232
2899.250	0.061	0.142	0.192	1.000	0.000	0.228
2899.500	0.054	0.143	0.190	1.000	0.000	0.217
2899.750	0.076	0.156	0.197	1.000	0.000	0.187
2900.000	0.090	0.145	0.183	1.000	0.000	0.178
2900.250	0.196	0.165	0.203	1.000	0.000	0.174
2900.500	0.269	0.165	0.206	1.000	0.000	0.187
2900.750	0.354	0.163	0.204	1.000	0.000	0.185
2901.000	0.556	0.169	0.207	1.000	0.000	0.175
2901.250	0.823	0.176	0.210	1.000	0.000	0.157
2901.500	0.893	0.183	0.217	1.000	0.000	0.156
2901.750	0.663	0.166	0.203	1.000	0.000	0.169
2902.000	0.651	0.187	0.221	1.000	0.000	0.156
2902.250	0.659	0.177	0.209	1.000	0.000	0.147
2902.500	1.394	0.203	0.228	1.000	0.000	0.116
2902.750	2.748	0.210	0.233	1.000	0.000	0.104
2903.000	3.331	0.197	0.224	1.000	0.000	0.126
2903.250	3.728	0.181	0.210	1.000	0.000	0.132
2903.500	4.579	0.179	0.208	1.000	0.000	0.133
2903.750	6.423	0.171	0.198	1.000	0.000	0.125
2904.000	10.003	0.180	0.210	1.000	0.000	0.137
2904.250	12.584	0.180	0.211	1.000	0.000	0.139
2904.500	15.241	0.174	0.204	1.000	0.000	0.140
2904.750	15.954	0.174	0.208	1.000	0.000	0.157
2905.000	18.386	0.178	0.210	1.000	0.000	0.145
2905.250	20.258	0.175	0.206	1.000	0.000	0.141
2905.500	21.137	0.177	0.213	1.000	0.000	0.166
2905.750	23.994	0.175	0.210	1.000	0.000	0.158
2906.000	32.668	0.175	0.206	1.000	0.000	0.145
2906.250	42.969	0.181	0.212	1.000	0.000	0.142
2906.500	49.359	0.184	0.214	1.000	0.000	0.140
2906.750	56.317	0.197	0.224	1.000	0.000	0.125
2907.000	45.057	0.194	0.219	1.000	0.000	0.115
2907.250	33.350	0.190	0.214	1.000	0.000	0.110
2907.500	31.369	0.191	0.213	1.000	0.000	0.100
2907.750	41.360	0.197	0.215	1.000	0.000	0.085
2908.000	62.448	0.210	0.229	1.000	0.000	0.085
2908.250	71.992	0.205	0.222	1.000	0.000	0.077
2908.500	73.229	0.207	0.225	1.000	0.000	0.082
2908.750	69.679	0.206	0.225	1.000	0.000	0.090
2909.000	67.445	0.201	0.224	1.000	0.000	0.107
2909.250	86.290	0.191	0.216	1.000	0.000	0.115
2909.500	149.444	0.199	0.225	1.000	0.000	0.120

2909.750	248.784	0.209	0.233	1.000	0.000	0.108
2910.000	305.364	0.215	0.239	1.000	0.000	0.109
2910.250	335.660	0.214	0.237	1.000	0.000	0.104
2910.500	428.460	0.208	0.228	1.000	0.000	0.090
2910.750	697.363	0.223	0.241	1.000	0.000	0.083
2911.000	1336.848	0.231	0.246	1.000	0.000	0.068
2911.250	2132.712	0.237	0.246	1.000	0.000	0.040
2911.500	2087.126	0.235	0.241	1.000	0.000	0.027
2911.750	1143.468	0.237	0.241	1.000	0.000	0.019
2912.000	247.201	0.228	0.238	1.000	0.000	0.049
2912.250	22.118	0.173	0.228	1.000	0.000	0.252
2912.500	1.096	0.093	0.195	1.000	0.000	0.465
2912.750	0.010	0.000	0.108	1.000	0.000	0.501
2913.000	0.010	0.043	0.118	1.000	0.000	0.344
2913.250	1.994	0.135	0.164	1.000	0.000	0.135
2913.500	8.221	0.159	0.181	1.000	0.000	0.098
2913.750	22.200	0.175	0.193	1.000	0.000	0.084
2914.000	98.653	0.194	0.200	1.000	0.000	0.027
2914.250	515.655	0.212	0.214	1.000	0.000	0.011
2914.500	1097.877	0.215	0.221	1.000	0.000	0.025
2914.750	1304.632	0.213	0.221	1.000	0.000	0.033
2915.000	953.410	0.230	0.240	1.000	0.000	0.044
2915.250	644.663	0.230	0.242	1.000	0.000	0.057
2915.500	471.228	0.236	0.249	1.000	0.000	0.058
2915.750	400.465	0.236	0.245	1.000	0.000	0.040
2916.000	330.969	0.242	0.248	1.000	0.000	0.028
2916.250	332.889	0.244	0.253	1.000	0.000	0.040
2916.500	434.753	0.245	0.253	1.000	0.000	0.037
2916.750	711.969	0.242	0.251	1.000	0.000	0.041
2917.000	1405.658	0.237	0.247	1.000	0.000	0.048
2917.250	2106.338	0.230	0.240	1.000	0.000	0.047
2917.500	2109.283	0.227	0.236	1.000	0.000	0.045
2917.750	1909.851	0.236	0.247	1.000	0.000	0.051
2918.000	1826.462	0.238	0.251	1.000	0.000	0.057
2918.250	2302.414	0.248	0.258	1.000	0.000	0.045
2918.500	2189.466	0.238	0.243	1.000	0.000	0.022
2918.750	2155.454	0.243	0.247	1.000	0.000	0.021
2919.000	2139.323	0.234	0.240	1.000	0.000	0.025
2919.250	2125.789	0.232	0.238	1.000	0.000	0.026
2919.500	2095.995	0.236	0.246	1.000	0.000	0.044
2919.750	1961.492	0.216	0.226	1.000	0.000	0.047
2920.000	2019.845	0.232	0.239	1.000	0.000	0.031
2920.250	2116.577	0.232	0.240	1.000	0.000	0.038
2920.500	2158.830	0.241	0.247	1.000	0.000	0.028
2920.750	2173.435	0.239	0.241	1.000	0.000	0.008
2921.000	2247.821	0.250	0.254	1.000	0.000	0.016
2921.250	2190.373	0.241	0.246	1.000	0.000	0.019
2921.500	2112.196	0.234	0.239	1.000	0.000	0.027
2921.750	2100.873	0.231	0.241	1.000	0.000	0.042
2922.000	980.253	0.231	0.241	1.000	0.000	0.049
2922.250	391.687	0.231	0.241	1.000	0.000	0.044
2922.500	126.372	0.239	0.249	1.000	0.000	0.045
2922.750	56.752	0.242	0.253	1.000	0.000	0.053
2923.000	32.666	0.233	0.246	1.000	0.000	0.058
2923.250	25.129	0.224	0.239	1.000	0.000	0.068
2923.500	34.032	0.221	0.236	1.000	0.000	0.067
2923.750	68.689	0.228	0.243	1.000	0.000	0.067
2924.000	163.589	0.224	0.241	1.000	0.000	0.078
2924.250	334.248	0.220	0.239	1.000	0.000	0.089
2924.500	421.771	0.221	0.236	1.000	0.000	0.069
2924.750	367.777	0.231	0.244	1.000	0.000	0.058
2925.000	209.731	0.224	0.240	1.000	0.000	0.073
2925.250	132.528	0.217	0.232	1.000	0.000	0.070

2925.500	72.087	0.205	0.236	1.000	0.000	0.141
2925.750	42.519	0.189	0.232	1.000	0.000	0.194
2926.000	35.977	0.185	0.226	1.000	0.000	0.189
2926.250	37.468	0.179	0.219	1.000	0.000	0.179
2926.500	71.047	0.187	0.215	1.000	0.000	0.128
2926.750	137.139	0.198	0.224	1.000	0.000	0.117
2927.000	141.392	0.213	0.236	1.000	0.000	0.106
2927.250	162.320	0.204	0.221	1.000	0.000	0.075
2927.500	413.568	0.201	0.209	1.000	0.000	0.039
2927.750	1876.443	0.234	0.234	1.000	0.000	0.001
2928.000	2014.367	0.234	0.234	1.000	0.000	0.003
2928.250	2148.691	0.242	0.242	1.000	0.000	0.000
2928.500	2341.092	0.261	0.261	1.000	0.000	0.000
2928.750	2303.146	0.247	0.253	1.000	0.000	0.026
2929.000	2212.777	0.240	0.246	1.000	0.000	0.027
2929.250	2166.792	0.246	0.246	1.000	0.000	0.000
2929.500	2014.423	0.239	0.239	1.000	0.000	0.000
2929.750	1821.871	0.214	0.220	1.000	0.000	0.029
2930.000	722.077	0.220	0.224	1.000	0.000	0.022
2930.250	725.799	0.223	0.232	1.000	0.000	0.043
2930.500	1538.042	0.243	0.243	1.000	0.000	0.000
2930.750	2182.268	0.236	0.244	1.000	0.000	0.038
2931.000	2217.212	0.234	0.244	1.000	0.000	0.047
2931.250	2267.946	0.251	0.251	1.000	0.000	0.001
2931.500	2269.050	0.236	0.248	1.000	0.000	0.054
2931.750	1332.414	0.240	0.250	1.000	0.000	0.049
2932.000	1066.141	0.224	0.248	1.000	0.000	0.108
2932.250	1079.526	0.240	0.252	1.000	0.000	0.056
2932.500	551.728	0.217	0.240	1.000	0.000	0.106
2932.750	457.587	0.222	0.245	1.000	0.000	0.107
2933.000	283.635	0.232	0.249	1.000	0.000	0.078
2933.250	121.113	0.168	0.223	1.000	0.000	0.223
2933.500	258.576	0.226	0.251	1.000	0.000	0.098
2933.750	340.552	0.240	0.257	1.000	0.000	0.070
2934.000	216.772	0.242	0.254	1.000	0.000	0.055
2934.250	165.673	0.248	0.258	1.000	0.000	0.048
2934.500	148.330	0.249	0.258	1.000	0.000	0.041
2934.750	141.871	0.255	0.264	1.000	0.000	0.040
2935.000	112.503	0.256	0.267	1.000	0.000	0.041
2935.250	104.950	0.219	0.245	1.000	0.000	0.097
2935.500	232.241	0.217	0.223	1.000	0.000	0.026
2935.750	219.227	0.214	0.228	1.000	0.000	0.062
2936.000	52.161	0.171	0.204	1.000	0.000	0.154
2936.250	22.434	0.130	0.169	1.000	0.000	0.176
2936.500	64.415	0.179	0.202	1.000	0.000	0.105
2936.750	281.878	0.226	0.228	1.000	0.000	0.007
2937.000	205.061	0.247	0.247	1.000	0.000	0.000
2937.250	98.182	0.209	0.228	1.000	0.000	0.086
2937.500	198.453	0.238	0.246	1.000	0.000	0.033
2937.750	253.967	0.254	0.258	1.000	0.000	0.017
2938.000	273.900	0.244	0.262	1.000	0.000	0.067
2938.250	580.105	0.249	0.266	1.000	0.000	0.067
2938.500	716.032	0.268	0.275	1.000	0.000	0.033
2938.750	368.601	0.246	0.268	1.000	0.000	0.100
2939.000	158.576	0.231	0.261	1.000	0.000	0.129
2939.250	54.663	0.180	0.237	1.000	0.000	0.239
2939.500	47.736	0.238	0.255	1.000	0.000	0.077
2939.750	23.432	0.190	0.227	1.000	0.000	0.170
2940.000	15.815	0.193	0.228	1.000	0.000	0.163
2940.250	23.937	0.225	0.251	1.000	0.000	0.098
2940.500	31.153	0.229	0.249	1.000	0.000	0.088
2940.750	39.705	0.241	0.255	1.000	0.000	0.062
2941.000	45.619	0.217	0.248	1.000	0.000	0.120

2941.250	67.919	0.239	0.260	1.000	0.000	0.079
2941.500	115.380	0.246	0.252	1.000	0.000	0.031
2941.750	107.694	0.222	0.249	1.000	0.000	0.100
2942.000	119.462	0.225	0.247	1.000	0.000	0.100
2942.250	116.123	0.222	0.253	1.000	0.000	0.133
2942.500	183.204	0.242	0.265	1.000	0.000	0.098
2942.750	427.964	0.250	0.268	1.000	0.000	0.081
2943.000	531.808	0.247	0.267	1.000	0.000	0.092
2943.250	598.376	0.242	0.260	1.000	0.000	0.082
2943.500	475.074	0.247	0.268	1.000	0.000	0.096
2943.750	312.892	0.232	0.261	1.000	0.000	0.133
2944.000	289.624	0.241	0.264	1.000	0.000	0.102
2944.250	288.406	0.247	0.268	1.000	0.000	0.093
2944.500	269.711	0.238	0.268	1.000	0.000	0.140
2944.750	170.020	0.233	0.268	1.000	0.000	0.158
2945.000	101.273	0.217	0.260	1.000	0.000	0.198
2945.250	53.676	0.221	0.263	1.000	0.000	0.196
2945.500	14.122	0.194	0.243	1.000	0.000	0.226
2945.750	0.639	0.094	0.173	1.000	0.000	0.360
2946.000	0.010	0.079	0.174	1.000	0.000	0.436
2946.250	0.010	0.093	0.180	1.000	0.000	0.395
2946.500	0.010	0.070	0.179	1.000	0.000	0.498
2946.750	0.010	0.092	0.191	1.000	0.000	0.453
2947.000	0.010	0.084	0.185	1.000	0.000	0.460
2947.250	0.010	0.111	0.210	1.000	0.000	0.456
2947.500	0.010	0.147	0.239	1.000	0.000	0.419
2947.750	0.010	0.139	0.230	1.000	0.000	0.417
2948.000	0.010	0.144	0.224	1.000	0.000	0.364
2948.250	0.010	0.096	0.195	1.000	0.000	0.454
2948.500	0.010	0.063	0.177	1.000	0.000	0.520
2948.750	0.010	0.061	0.168	1.000	0.000	0.488
2949.000	0.010	0.110	0.194	1.000	0.000	0.384
2949.250	361.473	0.201	0.253	1.000	0.000	0.239
2949.500	452.493	0.196	0.244	1.000	0.000	0.218
2949.750	264.273	0.183	0.237	1.000	0.000	0.246
2950.000	0.010	0.159	0.221	1.000	0.000	0.284
2950.250	0.010	0.160	0.225	1.000	0.000	0.297
2950.500	98.251	0.161	0.219	1.000	0.000	0.263
2950.750	0.010	0.122	0.203	1.000	0.000	0.369
2951.000	0.010	0.125	0.201	1.000	0.000	0.347
2951.250	0.010	0.129	0.197	1.000	0.000	0.311
2951.500	0.010	0.135	0.198	1.000	0.000	0.288
2951.750	534.319	0.191	0.234	1.000	0.000	0.197
2952.000	526.554	0.203	0.249	1.000	0.000	0.207
2952.250	198.000	0.189	0.247	1.000	0.000	0.264
2952.500	0.010	0.157	0.230	1.000	0.000	0.331
2952.750	0.010	0.147	0.223	1.000	0.000	0.348
2953.000	310.677	0.194	0.249	1.000	0.000	0.245
2953.250	722.685	0.221	0.263	1.000	0.000	0.181
2953.500	477.388	0.205	0.258	1.000	0.000	0.219
2953.750	460.064	0.202	0.254	1.000	0.000	0.220
2954.000	737.361	0.214	0.252	1.000	0.000	0.173
2954.250	920.273	0.230	0.264	1.000	0.000	0.148
2954.500	595.853	0.210	0.254	1.000	0.000	0.199
2954.750	0.010	0.145	0.229	1.000	0.000	0.342
2955.000	0.010	0.141	0.203	1.000	0.000	0.285
2955.250	0.010	0.091	0.168	1.000	0.000	0.356
2955.500	393.484	0.154	0.198	1.000	0.000	0.199
2955.750	558.335	0.200	0.249	1.000	0.000	0.199
2956.000	782.664	0.216	0.252	1.000	0.000	0.165
2956.250	933.070	0.229	0.260	1.000	0.000	0.144
2956.500	888.816	0.232	0.266	1.000	0.000	0.156
2956.750	645.445	0.219	0.263	1.000	0.000	0.195

2957.000	0.010	0.167	0.238	1.000	0.000	0.315
2957.250	0.010	0.080	0.173	1.000	0.000	0.425
2957.500	0.010	0.127	0.187	1.000	0.000	0.274
2957.750	179.469	0.156	0.209	1.000	0.000	0.243
2958.000	198.029	0.163	0.217	1.000	0.000	0.245
2958.250	306.076	0.164	0.213	1.000	0.000	0.223
2958.500	141.192	0.161	0.217	1.000	0.000	0.255
2958.750	187.575	0.164	0.218	1.000	0.000	0.248
2959.000	109.599	0.147	0.202	1.000	0.000	0.251
2959.250	216.530	0.144	0.194	1.000	0.000	0.227
2959.500	266.250	0.152	0.201	1.000	0.000	0.223
2959.750	113.276	0.146	0.201	1.000	0.000	0.250
2960.000	0.010	0.126	0.189	1.000	0.000	0.287
2960.250	146.847	0.141	0.194	1.000	0.000	0.239
2960.500	193.898	0.140	0.190	1.000	0.000	0.229
2960.750	217.443	0.143	0.193	1.000	0.000	0.226
2961.000	205.895	0.150	0.201	1.000	0.000	0.233
2961.250	8.734	0.141	0.199	1.000	0.000	0.267
2961.500	0.010	0.133	0.192	1.000	0.000	0.269
2961.750	0.010	0.128	0.188	1.000	0.000	0.276
2962.000	61.423	0.130	0.184	1.000	0.000	0.248
2962.250	271.335	0.146	0.193	1.000	0.000	0.217
2962.500	457.729	0.155	0.195	1.000	0.000	0.186
2962.750	919.810	0.194	0.221	1.000	0.000	0.122
2963.000	732.808	0.195	0.230	1.000	0.000	0.160
2963.250	741.563	0.186	0.220	1.000	0.000	0.152
2963.500	653.419	0.181	0.217	1.000	0.000	0.166
2963.750	886.055	0.192	0.220	1.000	0.000	0.127
2964.000	1054.389	0.217	0.241	1.000	0.000	0.111
2964.250	815.052	0.200	0.232	1.000	0.000	0.147
2964.500	241.346	0.150	0.200	1.000	0.000	0.227
2964.750	0.010	0.107	0.185	1.000	0.000	0.354
2965.000	0.010	0.092	0.181	1.000	0.000	0.407
2965.250	0.010	0.137	0.201	1.000	0.000	0.293
2965.500	317.756	0.162	0.210	1.000	0.000	0.220
2965.750	266.693	0.169	0.221	1.000	0.000	0.235
2966.000	693.127	0.194	0.230	1.000	0.000	0.167
2966.250	545.800	0.183	0.226	1.000	0.000	0.189
2966.500	393.866	0.174	0.220	1.000	0.000	0.213
2966.750	63.358	0.148	0.205	1.000	0.000	0.261
2967.000	0.010	0.128	0.195	1.000	0.000	0.306
2967.250	38.723	0.156	0.215	1.000	0.000	0.272
2967.500	0.010	0.145	0.216	1.000	0.000	0.315
2967.750	0.010	0.147	0.213	1.000	0.000	0.300
2968.000	0.010	0.141	0.210	1.000	0.000	0.313
2968.250	210.915	0.173	0.227	1.000	0.000	0.249
2968.500	197.026	0.175	0.231	1.000	0.000	0.254
2968.750	68.545	0.168	0.230	1.000	0.000	0.275
2969.000	230.151	0.174	0.227	1.000	0.000	0.246
2969.250	0.010	0.159	0.224	1.000	0.000	0.294
2969.500	173.403	0.163	0.217	1.000	0.000	0.249
2969.750	0.010	0.126	0.187	1.000	0.000	0.275
2970.000	0.010	0.098	0.175	1.000	0.000	0.354
2970.250	0.010	0.117	0.183	1.000	0.000	0.302
2970.500	0.010	0.103	0.183	1.000	0.000	0.365
2970.750	0.010	0.088	0.174	1.000	0.000	0.392
2971.000	0.010	0.088	0.176	1.000	0.000	0.402
2971.250	0.010	0.080	0.166	1.000	0.000	0.396
2971.500	0.010	0.092	0.174	1.000	0.000	0.373
2971.750	0.010	0.136	0.202	1.000	0.000	0.302
2972.000	177.421	0.161	0.215	1.000	0.000	0.247
2972.250	0.010	0.125	0.194	1.000	0.000	0.316
2972.500	0.010	0.063	0.154	1.000	0.000	0.417

2972.750	0.010	0.051	0.151	1.000	0.000	0.435
2973.000	0.010	0.069	0.135	1.000	0.000	0.299
2973.250	0.010	0.095	0.147	1.000	0.000	0.241
2973.500	583.442	0.156	0.191	1.000	0.000	0.162
2973.750	286.169	0.140	0.186	1.000	0.000	0.210
2974.000	358.377	0.146	0.190	1.000	0.000	0.200
2974.250	441.104	0.150	0.191	1.000	0.000	0.186
2974.500	484.294	0.157	0.197	1.000	0.000	0.182
2974.750	539.547	0.167	0.206	1.000	0.000	0.179
2975.000	408.703	0.162	0.206	1.000	0.000	0.202
2975.250	376.419	0.152	0.196	1.000	0.000	0.201
2975.500	366.623	0.155	0.199	1.000	0.000	0.205
2975.750	473.978	0.154	0.194	1.000	0.000	0.183
2976.000	489.128	0.156	0.196	1.000	0.000	0.181
2976.250	570.919	0.159	0.196	1.000	0.000	0.167
2976.500	569.447	0.165	0.202	1.000	0.000	0.171
2976.750	764.988	0.168	0.197	1.000	0.000	0.134
2977.000	573.792	0.153	0.188	1.000	0.000	0.162
2977.250	519.513	0.151	0.188	1.000	0.000	0.171
2977.500	620.802	0.162	0.197	1.000	0.000	0.159
2977.750	701.845	0.161	0.192	1.000	0.000	0.142
2978.000	595.590	0.166	0.203	1.000	0.000	0.167
2978.250	519.170	0.152	0.190	1.000	0.000	0.172
2978.500	658.903	0.163	0.196	1.000	0.000	0.152
2978.750	794.804	0.170	0.198	1.000	0.000	0.129
2979.000	740.726	0.169	0.200	1.000	0.000	0.140
2979.250	682.138	0.167	0.200	1.000	0.000	0.150
2979.500	639.461	0.164	0.198	1.000	0.000	0.157
2979.750	742.193	0.165	0.195	1.000	0.000	0.136
2980.000	680.340	0.160	0.192	1.000	0.000	0.145
2980.250	977.130	0.174	0.194	1.000	0.000	0.095
2980.500	801.176	0.163	0.190	1.000	0.000	0.123
2980.750	780.512	0.160	0.187	1.000	0.000	0.125
2981.000	410.736	0.131	0.170	1.000	0.000	0.178
2981.250	503.180	0.140	0.176	1.000	0.000	0.166
2981.500	1031.753	0.178	0.198	1.000	0.000	0.088
2981.750	872.060	0.167	0.191	1.000	0.000	0.112
2982.000	909.397	0.164	0.187	1.000	0.000	0.102
2982.250	1042.870	0.175	0.193	1.000	0.000	0.083
2982.500	827.424	0.155	0.179	1.000	0.000	0.112
2982.750	978.255	0.171	0.191	1.000	0.000	0.093
2983.000	717.183	0.156	0.186	1.000	0.000	0.135
2983.250	574.291	0.150	0.185	1.000	0.000	0.160
2983.500	429.480	0.140	0.180	1.000	0.000	0.182
2983.750	306.222	0.131	0.175	1.000	0.000	0.200
2984.000	0.010	0.100	0.153	1.000	0.000	0.240
2984.250	618.111	0.139	0.171	1.000	0.000	0.143
2984.500	1417.151	0.209	0.216	1.000	0.000	0.032
2984.750	1163.679	0.204	0.222	1.000	0.000	0.080
2985.000	870.237	0.179	0.205	1.000	0.000	0.121
2985.250	973.012	0.178	0.199	1.000	0.000	0.099
2985.500	720.975	0.179	0.212	1.000	0.000	0.151
2985.750	675.994	0.210	0.251	1.000	0.000	0.183
2986.000	915.795	0.222	0.253	1.000	0.000	0.143
2986.250	1110.530	0.229	0.253	1.000	0.000	0.109
2986.500	1190.565	0.242	0.267	1.000	0.000	0.102
2986.750	1292.750	0.247	0.266	1.000	0.000	0.085
2987.000	961.537	0.229	0.262	1.000	0.000	0.139
2987.250	1160.572	0.244	0.270	1.000	0.000	0.110
2987.500	1174.106	0.244	0.267	1.000	0.000	0.107
2987.750	976.348	0.233	0.265	1.000	0.000	0.139
2988.000	1045.620	0.236	0.264	1.000	0.000	0.127
2988.250	1125.404	0.240	0.269	1.000	0.000	0.114

2988.500	857.058	0.217	0.250	1.000	0.000	0.151
2988.750	1051.243	0.225	0.251	1.000	0.000	0.118
2989.000	1305.691	0.232	0.248	1.000	0.000	0.072
2989.250	1318.955	0.234	0.249	1.000	0.000	0.070
2989.500	1262.975	0.234	0.252	1.000	0.000	0.082
2989.750	1216.999	0.232	0.255	1.000	0.000	0.089
2990.000	1312.779	0.240	0.257	1.000	0.000	0.076
2990.250	992.599	0.220	0.248	1.000	0.000	0.126
2990.500	1265.477	0.229	0.246	1.000	0.000	0.077
2990.750	949.010	0.210	0.238	1.000	0.000	0.128
2991.000	1071.047	0.220	0.244	1.000	0.000	0.110
2991.250	801.753	0.200	0.234	1.000	0.000	0.150
2991.500	960.148	0.209	0.236	1.000	0.000	0.125
2991.750	1052.439	0.214	0.239	1.000	0.000	0.110
2992.000	1105.917	0.213	0.234	1.000	0.000	0.098
2992.250	912.754	0.196	0.223	1.000	0.000	0.124
2992.500	1036.746	0.201	0.224	1.000	0.000	0.103
2992.750	1123.498	0.211	0.231	1.000	0.000	0.093
2993.000	1283.796	0.231	0.248	1.000	0.000	0.075
2993.250	1302.543	0.234	0.250	1.000	0.000	0.073
2993.500	1064.469	0.218	0.243	1.000	0.000	0.110
2993.750	1154.029	0.225	0.246	1.000	0.000	0.097
2994.000	831.314	0.203	0.235	1.000	0.000	0.146
2994.250	975.057	0.207	0.233	1.000	0.000	0.120
2994.500	969.192	0.201	0.226	1.000	0.000	0.117
2994.750	1241.410	0.213	0.228	1.000	0.000	0.071
2995.000	1065.360	0.201	0.222	1.000	0.000	0.097
2995.250	838.699	0.187	0.217	1.000	0.000	0.133
2995.500	684.611	0.175	0.209	1.000	0.000	0.155
2995.750	992.983	0.197	0.221	1.000	0.000	0.109
2996.000	871.359	0.189	0.217	1.000	0.000	0.128
2996.250	869.617	0.197	0.226	1.000	0.000	0.134
2996.500	995.063	0.210	0.237	1.000	0.000	0.118
2996.750	1199.156	0.220	0.238	1.000	0.000	0.084
2997.000	1220.889	0.218	0.236	1.000	0.000	0.079
2997.250	1154.414	0.205	0.223	1.000	0.000	0.083
2997.500	666.026	0.166	0.200	1.000	0.000	0.153
2997.750	661.186	0.167	0.200	1.000	0.000	0.154
2998.000	832.857	0.173	0.200	1.000	0.000	0.124
2998.250	530.243	0.158	0.196	1.000	0.000	0.174
2998.500	719.095	0.167	0.198	1.000	0.000	0.143
2998.750	328.773	0.146	0.191	1.000	0.000	0.206
2999.000	284.207	0.143	0.190	1.000	0.000	0.213
2999.250	299.128	0.142	0.188	1.000	0.000	0.209
2999.500	182.806	0.140	0.190	1.000	0.000	0.231
2999.750	336.834	0.138	0.182	1.000	0.000	0.199
3000.000	74.540	0.104	0.154	1.000	0.000	0.227
3000.250	61.917	0.105	0.156	1.000	0.000	0.230
3000.500	179.722	0.111	0.157	1.000	0.000	0.210
3000.750	261.209	0.117	0.160	1.000	0.000	0.198
3001.000	516.691	0.143	0.180	1.000	0.000	0.166
3001.250	549.231	0.152	0.188	1.000	0.000	0.166
3001.500	412.109	0.145	0.186	1.000	0.000	0.188
3001.750	761.846	0.166	0.195	1.000	0.000	0.133
3002.000	563.865	0.165	0.203	1.000	0.000	0.172
3002.250	432.425	0.155	0.197	1.000	0.000	0.191
3002.500	640.157	0.160	0.194	1.000	0.000	0.154
3002.750	635.669	0.164	0.199	1.000	0.000	0.157
3003.000	236.465	0.140	0.188	1.000	0.000	0.220
3003.250	676.012	0.152	0.182	1.000	0.000	0.140
3003.500	794.868	0.153	0.179	1.000	0.000	0.117
3003.750	550.856	0.128	0.161	1.000	0.000	0.148
3004.000	255.176	0.105	0.147	1.000	0.000	0.191

3004.250	304.268	0.102	0.142	1.000	0.000	0.179
3004.500	648.553	0.112	0.138	1.000	0.000	0.117
3004.750	888.745	0.148	0.169	1.000	0.000	0.095
3005.000	1170.282	0.182	0.196	1.000	0.000	0.063
3005.250	1500.464	0.217	0.222	1.000	0.000	0.022
3005.500	1408.094	0.209	0.216	1.000	0.000	0.034
3005.750	1295.845	0.206	0.218	1.000	0.000	0.054
3006.000	1430.066	0.214	0.222	1.000	0.000	0.034
3006.250	1491.013	0.218	0.223	1.000	0.000	0.024
3006.500	1407.426	0.206	0.212	1.000	0.000	0.032
3006.750	1301.651	0.190	0.199	1.000	0.000	0.042
3007.000	1534.377	0.208	0.210	1.000	0.000	0.008
3007.250	1215.794	0.193	0.206	1.000	0.000	0.061
3007.500	1579.043	0.216	0.217	1.000	0.000	0.005
3007.750	1562.469	0.215	0.217	1.000	0.000	0.008
3008.000	1357.271	0.207	0.217	1.000	0.000	0.043
3008.250	1250.107	0.196	0.208	1.000	0.000	0.057
3008.500	1479.678	0.211	0.216	1.000	0.000	0.021
3008.750	1321.866	0.205	0.216	1.000	0.000	0.049
3009.000	1393.536	0.211	0.219	1.000	0.000	0.039
3009.250	1229.209	0.198	0.212	1.000	0.000	0.063
3009.500	1380.969	0.198	0.205	1.000	0.000	0.032
3009.750	1156.913	0.182	0.197	1.000	0.000	0.065
3010.000	932.906	0.177	0.201	1.000	0.000	0.107
3010.250	1101.561	0.187	0.205	1.000	0.000	0.080
3010.500	1455.721	0.212	0.218	1.000	0.000	0.027
3010.750	1219.543	0.203	0.218	1.000	0.000	0.068
3011.000	1081.952	0.195	0.215	1.000	0.000	0.090
3011.250	1266.835	0.204	0.217	1.000	0.000	0.059
3011.500	1054.711	0.196	0.217	1.000	0.000	0.096
3011.750	1442.824	0.214	0.221	1.000	0.000	0.031
3012.000	1446.332	0.211	0.217	1.000	0.000	0.028
3012.250	1471.034	0.209	0.214	1.000	0.000	0.022
3012.500	1509.885	0.218	0.222	1.000	0.000	0.020
3012.750	1484.968	0.213	0.218	1.000	0.000	0.022
3013.000	1640.949	0.227	0.227	1.000	0.000	0.000
3013.250	1655.477	0.231	0.231	1.000	0.000	0.000
3013.500	1486.290	0.219	0.226	1.000	0.000	0.026
3013.750	1550.159	0.222	0.225	1.000	0.000	0.015
3014.000	1622.928	0.222	0.222	1.000	0.000	0.000
3014.250	1656.355	0.231	0.231	1.000	0.000	0.000
3014.500	1426.565	0.220	0.229	1.000	0.000	0.039
3014.750	1578.152	0.223	0.225	1.000	0.000	0.010
3015.000	1538.997	0.226	0.230	1.000	0.000	0.020
3015.250	1635.590	0.225	0.225	1.000	0.000	0.000
3015.500	1434.139	0.221	0.230	1.000	0.000	0.038
3015.750	1504.349	0.225	0.231	1.000	0.000	0.026
3016.000	1516.604	0.223	0.228	1.000	0.000	0.023
3016.250	1321.681	0.202	0.213	1.000	0.000	0.047
3016.500	1530.943	0.228	0.233	1.000	0.000	0.023
3016.750	1393.964	0.215	0.224	1.000	0.000	0.041
3017.000	1290.165	0.199	0.211	1.000	0.000	0.051
3017.250	1349.203	0.201	0.210	1.000	0.000	0.040
3017.500	1137.926	0.185	0.200	1.000	0.000	0.071
3017.750	1211.104	0.177	0.189	1.000	0.000	0.051
3018.000	812.779	0.155	0.180	1.000	0.000	0.115
3018.250	970.829	0.172	0.193	1.000	0.000	0.096
3018.500	1248.478	0.193	0.205	1.000	0.000	0.055
3018.750	932.998	0.192	0.217	1.000	0.000	0.117
3019.000	935.762	0.190	0.215	1.000	0.000	0.115
3019.250	1242.744	0.211	0.226	1.000	0.000	0.069
3019.500	753.236	0.195	0.229	1.000	0.000	0.156
3019.750	824.738	0.206	0.239	1.000	0.000	0.150

3020.000	1420.279	0.237	0.249	1.000	0.000	0.052
3020.250	1154.223	0.222	0.243	1.000	0.000	0.095
3020.500	491.159	0.195	0.242	1.000	0.000	0.209
3020.750	488.105	0.178	0.221	1.000	0.000	0.197
3021.000	637.015	0.188	0.228	1.000	0.000	0.175
3021.250	840.521	0.201	0.234	1.000	0.000	0.143
3021.500	883.272	0.195	0.223	1.000	0.000	0.130
3021.750	703.770	0.191	0.226	1.000	0.000	0.163
3022.000	1021.476	0.212	0.238	1.000	0.000	0.115
3022.250	909.169	0.211	0.240	1.000	0.000	0.136
3022.500	621.734	0.196	0.236	1.000	0.000	0.183
3022.750	195.324	0.156	0.209	1.000	0.000	0.240
3023.000	131.040	0.140	0.197	1.000	0.000	0.242
3023.250	738.372	0.151	0.178	1.000	0.000	0.127
3023.500	1281.078	0.178	0.186	1.000	0.000	0.037
3023.750	1389.314	0.194	0.200	1.000	0.000	0.027
3024.000	1486.917	0.192	0.194	1.000	0.000	0.006
3024.250	1531.376	0.196	0.196	1.000	0.000	0.000
3024.500	1563.628	0.205	0.205	1.000	0.000	0.000
3024.750	1574.899	0.208	0.208	1.000	0.000	0.000
3025.000	1569.800	0.207	0.207	1.000	0.000	0.000
3025.250	1589.077	0.212	0.212	1.000	0.000	0.000
3025.500	1559.643	0.204	0.204	1.000	0.000	0.000
3025.750	1549.904	0.201	0.201	1.000	0.000	0.000
3026.000	1560.898	0.204	0.204	1.000	0.000	0.000
3026.250	1528.001	0.195	0.195	1.000	0.000	0.000
3026.500	1511.055	0.191	0.191	1.000	0.000	0.000
3026.750	1507.959	0.192	0.192	1.000	0.000	0.001
3027.000	1528.633	0.196	0.196	1.000	0.000	0.000
3027.250	1533.089	0.197	0.197	1.000	0.000	0.000
3027.500	1531.913	0.196	0.196	1.000	0.000	0.000
3027.750	1532.671	0.197	0.197	1.000	0.000	0.000
3028.000	1565.846	0.206	0.206	1.000	0.000	0.000
3028.250	1547.607	0.201	0.201	1.000	0.000	0.000
3028.500	1556.316	0.203	0.203	1.000	0.000	0.000
3028.750	1531.137	0.196	0.196	1.000	0.000	0.000
3029.000	1537.873	0.198	0.198	1.000	0.000	0.000
3029.250	1394.300	0.185	0.190	1.000	0.000	0.020
3029.500	1546.544	0.201	0.201	1.000	0.000	0.000
3029.750	1537.269	0.198	0.198	1.000	0.000	0.000
3030.000	1521.118	0.193	0.193	1.000	0.000	0.000
3030.250	1521.745	0.194	0.194	1.000	0.000	0.000
3030.500	1385.237	0.174	0.177	1.000	0.000	0.014
3030.750	1479.634	0.182	0.182	1.000	0.000	0.000
3031.000	1516.988	0.192	0.192	1.000	0.000	0.000
3031.250	1463.300	0.187	0.189	1.000	0.000	0.007
3031.500	1319.026	0.175	0.181	1.000	0.000	0.028
3031.750	1527.510	0.195	0.195	1.000	0.000	0.000
3032.000	1387.872	0.189	0.194	1.000	0.000	0.024
3032.250	1549.617	0.201	0.201	1.000	0.000	0.000
3032.500	1165.264	0.171	0.183	1.000	0.000	0.055
3032.750	1416.811	0.189	0.192	1.000	0.000	0.018
3033.000	1343.782	0.189	0.196	1.000	0.000	0.032
3033.250	1528.757	0.196	0.196	1.000	0.000	0.000
3033.500	1535.044	0.201	0.202	1.000	0.000	0.003
3033.750	1408.208	0.190	0.195	1.000	0.000	0.021
3034.000	1562.645	0.205	0.205	1.000	0.000	0.000
3034.250	1426.751	0.192	0.196	1.000	0.000	0.018
3034.500	1219.644	0.179	0.190	1.000	0.000	0.051
3034.750	1329.584	0.185	0.193	1.000	0.000	0.033
3035.000	1205.223	0.179	0.190	1.000	0.000	0.053
3035.250	1495.695	0.198	0.200	1.000	0.000	0.009
3035.500	1199.491	0.189	0.203	1.000	0.000	0.062

3035.750	1244.910	0.187	0.198	1.000	0.000	0.051
3036.000	1238.188	0.188	0.200	1.000	0.000	0.053
3036.250	1302.905	0.192	0.202	1.000	0.000	0.043
3036.500	1291.567	0.185	0.194	1.000	0.000	0.040
3036.750	1292.511	0.186	0.195	1.000	0.000	0.041
3037.000	1481.835	0.198	0.201	1.000	0.000	0.012
3037.250	1472.137	0.197	0.200	1.000	0.000	0.012
3037.500	1583.432	0.211	0.211	1.000	0.000	0.000
3037.750	1495.460	0.200	0.202	1.000	0.000	0.010
3038.000	1503.636	0.205	0.208	1.000	0.000	0.012
3038.250	1475.854	0.199	0.202	1.000	0.000	0.013
3038.500	1307.739	0.185	0.193	1.000	0.000	0.037
3038.750	1161.217	0.176	0.189	1.000	0.000	0.060
3039.000	1384.725	0.193	0.198	1.000	0.000	0.027
3039.250	1228.201	0.179	0.190	1.000	0.000	0.049
3039.500	1144.779	0.176	0.190	1.000	0.000	0.063
3039.750	1481.424	0.195	0.197	1.000	0.000	0.009
3040.000	1369.401	0.196	0.203	1.000	0.000	0.032
3040.250	1473.012	0.192	0.194	1.000	0.000	0.009
3040.500	1269.874	0.184	0.193	1.000	0.000	0.044
3040.750	1214.104	0.182	0.194	1.000	0.000	0.054
3041.000	1335.131	0.188	0.195	1.000	0.000	0.033
3041.250	1371.091	0.192	0.198	1.000	0.000	0.029
3041.500	1123.732	0.177	0.192	1.000	0.000	0.068
3041.750	1242.885	0.184	0.195	1.000	0.000	0.050
3042.000	1324.665	0.193	0.201	1.000	0.000	0.039
3042.250	1307.483	0.189	0.198	1.000	0.000	0.040
3042.500	1171.022	0.175	0.188	1.000	0.000	0.057
3042.750	1209.991	0.179	0.191	1.000	0.000	0.052
3043.000	1049.904	0.175	0.193	1.000	0.000	0.082
3043.250	1089.444	0.183	0.200	1.000	0.000	0.079
3043.500	1049.695	0.178	0.196	1.000	0.000	0.084
3043.750	1099.010	0.185	0.202	1.000	0.000	0.079
3044.000	1109.674	0.185	0.201	1.000	0.000	0.077
3044.250	892.883	0.165	0.188	1.000	0.000	0.106
3044.500	695.311	0.155	0.186	1.000	0.000	0.139
3044.750	548.513	0.150	0.187	1.000	0.000	0.165
3045.000	745.341	0.155	0.184	1.000	0.000	0.129
3045.250	515.307	0.147	0.184	1.000	0.000	0.169
3045.500	845.291	0.167	0.193	1.000	0.000	0.117
3045.750	543.856	0.149	0.185	1.000	0.000	0.165
3046.000	325.868	0.137	0.180	1.000	0.000	0.200
3046.250	502.157	0.146	0.183	1.000	0.000	0.171
3046.500	732.368	0.155	0.184	1.000	0.000	0.131
3046.750	475.329	0.146	0.185	1.000	0.000	0.177
3047.000	369.250	0.145	0.188	1.000	0.000	0.197
3047.250	435.980	0.148	0.189	1.000	0.000	0.186
3047.500	453.262	0.146	0.186	1.000	0.000	0.181
3047.750	422.552	0.132	0.171	1.000	0.000	0.177
3048.000	0.010	0.117	0.179	1.000	0.000	0.284
3048.250	360.502	0.172	0.219	1.000	0.000	0.218
3048.500	410.686	0.181	0.228	1.000	0.000	0.215
3048.750	0.010	0.164	0.234	1.000	0.000	0.323
3049.000	0.010	0.160	0.227	1.000	0.000	0.306
3049.250	0.010	0.148	0.221	1.000	0.000	0.335
3049.500	0.010	0.131	0.210	1.000	0.000	0.361
3049.750	0.010	0.150	0.212	1.000	0.000	0.284
3050.000	233.705	0.171	0.224	1.000	0.000	0.243
3050.250	436.056	0.194	0.242	1.000	0.000	0.219
3050.500	408.204	0.184	0.232	1.000	0.000	0.218
3050.750	416.641	0.189	0.237	1.000	0.000	0.220
3051.000	505.856	0.188	0.231	1.000	0.000	0.201
3051.250	882.312	0.214	0.246	1.000	0.000	0.144

3051.500	450.841	0.195	0.245	1.000	0.000	0.217
3051.750	653.193	0.203	0.244	1.000	0.000	0.182
3052.000	212.559	0.159	0.212	1.000	0.000	0.239
3052.250	1257.703	0.236	0.256	1.000	0.000	0.084
3052.500	1367.943	0.236	0.249	1.000	0.000	0.062
3052.750	1285.963	0.235	0.252	1.000	0.000	0.078
3053.000	1122.832	0.221	0.242	1.000	0.000	0.100
3053.250	327.645	0.158	0.205	1.000	0.000	0.215
3053.500	548.663	0.157	0.194	1.000	0.000	0.170
3053.750	322.926	0.155	0.201	1.000	0.000	0.213
3054.000	231.401	0.154	0.204	1.000	0.000	0.231
3054.250	0.010	0.105	0.179	1.000	0.000	0.340
3054.500	5.071	0.139	0.199	1.000	0.000	0.266
3054.750	626.374	0.168	0.205	1.000	0.000	0.162
3055.000	1003.759	0.190	0.213	1.000	0.000	0.102
3055.250	909.441	0.177	0.201	1.000	0.000	0.111
3055.500	840.601	0.171	0.198	1.000	0.000	0.121
3055.750	377.149	0.132	0.173	1.000	0.000	0.186
3056.000	0.010	0.101	0.156	1.000	0.000	0.251
3056.250	0.010	0.109	0.166	1.000	0.000	0.262
3056.500	107.057	0.125	0.178	1.000	0.000	0.235
3056.750	492.449	0.162	0.203	1.000	0.000	0.185
3057.000	383.491	0.148	0.192	1.000	0.000	0.197
3057.250	865.680	0.153	0.175	1.000	0.000	0.103
3057.500	1573.980	0.208	0.208	1.000	0.000	0.000
3057.750	1477.618	0.202	0.205	1.000	0.000	0.015
3058.000	1597.998	0.215	0.215	1.000	0.000	0.000
3058.250	1497.833	0.218	0.223	1.000	0.000	0.023
3058.500	1529.870	0.215	0.218	1.000	0.000	0.014
3058.750	1465.504	0.212	0.218	1.000	0.000	0.025
3059.000	980.848	0.163	0.183	1.000	0.000	0.087
3059.250	1302.694	0.167	0.173	1.000	0.000	0.025
3059.500	1098.658	0.165	0.180	1.000	0.000	0.065
3059.750	934.812	0.153	0.173	1.000	0.000	0.089
3060.000	744.377	0.165	0.195	1.000	0.000	0.136
3060.250	915.044	0.183	0.209	1.000	0.000	0.115
3060.500	891.473	0.195	0.222	1.000	0.000	0.128
3060.750	448.760	0.185	0.241	1.000	0.000	0.211
3061.000	975.243	0.204	0.229	1.000	0.000	0.118
3061.250	283.516	0.140	0.195	1.000	0.000	0.211
3061.500	1380.726	0.192	0.198	1.000	0.000	0.027
3061.750	1466.963	0.198	0.202	1.000	0.000	0.015
3062.000	1471.919	0.202	0.206	1.000	0.000	0.016
3062.250	1402.425	0.197	0.203	1.000	0.000	0.027
3062.500	1322.339	0.194	0.203	1.000	0.000	0.040
3062.750	1294.374	0.193	0.203	1.000	0.000	0.045
3063.000	1250.465	0.192	0.203	1.000	0.000	0.053
3063.250	1205.642	0.182	0.197	1.000	0.000	0.055
3063.500	1493.080	0.186	0.186	1.000	0.000	0.000
3063.750	1552.607	0.202	0.202	1.000	0.000	0.000
3064.000	1624.419	0.222	0.222	1.000	0.000	0.000
3064.250	1577.849	0.245	0.252	1.000	0.000	0.026
3064.500	1705.264	0.253	0.254	1.000	0.000	0.006
3064.750	1411.064	0.239	0.254	1.000	0.000	0.055
3065.000	1711.368	0.255	0.256	1.000	0.000	0.006
3065.250	1434.566	0.235	0.248	1.000	0.000	0.048
3065.500	1605.561	0.242	0.247	1.000	0.000	0.018
3065.750	1643.663	0.253	0.258	1.000	0.000	0.018
3066.000	1511.152	0.248	0.260	1.000	0.000	0.042
3066.250	1478.399	0.243	0.255	1.000	0.000	0.045
3066.500	1392.748	0.234	0.249	1.000	0.000	0.055
3066.750	1416.237	0.241	0.257	1.000	0.000	0.056
3067.000	1601.430	0.255	0.262	1.000	0.000	0.028

3067.250	1425.283	0.241	0.254	1.000	0.000	0.054
3067.500	1181.340	0.224	0.248	1.000	0.000	0.091
3067.750	801.998	0.192	0.226	1.000	0.000	0.144
3068.000	669.793	0.145	0.175	1.000	0.000	0.137
3068.250	251.361	0.139	0.186	1.000	0.000	0.216
3068.500	118.995	0.128	0.180	1.000	0.000	0.235
3068.750	0.010	0.138	0.205	1.000	0.000	0.303
3069.000	0.010	0.140	0.212	1.000	0.000	0.327
3069.250	0.010	0.116	0.199	1.000	0.000	0.357
3069.500	767.385	0.191	0.228	1.000	0.000	0.150
3069.750	1584.273	0.234	0.238	1.000	0.000	0.017
3070.000	1373.701	0.218	0.230	1.000	0.000	0.047
3070.250	1682.843	0.243	0.244	1.000	0.000	0.003
3070.500	1686.514	0.239	0.239	1.000	0.000	0.000
3070.750	1681.849	0.238	0.238	1.000	0.000	0.000
3071.000	1681.615	0.238	0.238	1.000	0.000	0.000
3071.250	1670.915	0.235	0.235	1.000	0.000	0.000
3071.500	1642.942	0.227	0.227	1.000	0.000	0.000
3071.750	1628.532	0.229	0.230	1.000	0.000	0.004
3072.000	1640.308	0.227	0.227	1.000	0.000	0.000

Appendix B

Petrophysics Logging Summary
Petrophysics Interpretation Summary
Petrophysics Testing and Coring Summary

ESSO AUSTRALIA LIMITED

PETROPHYSICS LOGGING SUMMARY

WELL :	BLACKBACK 3	
FIELD:	BLACKBACK	
COMPANY:	ESSO AUSTRALIA LIMITED	
LOGGING CO:	SCHLUMBERGER	
LOG DATE:	01-04-94	LAT: 38 31'34.85" S
COUNTRY:	Australia	LONG: 148 31'05.50" E

ELEVATION DATA			
PERMANENT DATUM:	MSL	0.00	metres
	KB:	25.00	metres
	DF:	24.70	metres
	GL:	-318.00	metres

SUITE INFORMATION					
SUITE NO:	1				
DEPTH-DRILLER:	3125.00	metres	CSG-DRILLER:	1100.00	metres
DEPTH-LOGGER:	3099.00	metres	CSG-LOGGER:	1098.00	metres
BTM LOG INT:	3069.50	metres	CSG-SIZE:	13.375	inches
TOP LOG INT:	460.00	metres	BIT SIZE:	9.875	inches

WELLBORE FLUID					
FLUID TYPE:	KCL-PHPA-POLYMER		SAMPLE SOURCE:	FLOWLINE	
DENSITY:	9.50	ppg	FLUID LOSS:	4.80	cc
VISCOSITY:	46.00	seconds	PH:	9.00	

MUD RESISTIVITY				
	TEMP (degC)	RM (ohmm)	RMF (ohmm)	RMC (ohmm)
SURFACE:	26	0.240	0.214	0.449
BOTTOM HOLE:	81	0.111	0.099	0.208
TIME CIRC STOPPED:	12:06	31-03-94		
TIME LOGGER @ BTM:	22:35	31-03-94		

LOGGING SERVICES	
RUN #1:	DSI-GR-MSFL-ARI
RUN #2:	FMI-LDTD-CNTG-NGTD-AMS
RUN #3:	MDT-GR
RUN #3:	MRIL-GR (NUMAR)
RUN #4:	CSI (ZERO-OFFSET VSP)
RUN #5:	CST-GR

REMARKS

LOGGING ENGINEER: NAKANISHI / CLARK
DSI Modes: MONOPOLE / FMD / STONELEY
Cable stretch applied +1M at bottom
GPIT ran with DIP mode
NGS Barite and Potassium corrections made: Potassium = 1.3%, VBAR=0.994
LDL, CNL, and NGS run in HIRES mode (DPPM=HIRES)
CNT eccentered with bowspring, only CNT holesize correction made in realtime
Mud: barite 11.8 ppb, KCL 2.7 %wt, CHLORIDES 15500 ppm
PETROPHYSICIST: S. DODGE
Log and hole quality poor over core #2 (2859.5m to 2872m)

ESSO AUSTRALIA LIMITED

PETROPHYSICS INTERPRETATION SUMMARY

BLACKBACK 3

PETROPHYSICIST: S. DODGE

DATE: 26-07-94

PETROPHYSICS MODEL	
ANALYSIS PROGRAMME:	LASER
POROSITY MODEL:	LEAST SQUARES INVERSION
WATER SATURATION MODEL:	WAXMAN SMITS

WATER SATURATION PARAMETERS				
	SALINITY (eq. NaCl ppm)		*RESISTIVITY (ohmm)*	*TEMPERATURE (degC)*
FORMATION WATER:	30000		0.105	81
CLAY BOUND WATER:	25000		n.a.	81
MUD FILTRATE:	29000		0.110	81
EXCESS CONDUCTIVITY: (mmho)		'BQv'	2.50	
CEMENTATION EXPONENT:		'm'	2.00	
SATURATION EXPONENT:		'n'	2.00	
FORMATION FACTOR CONSTANT:		'a'	1.00	

VARIABLES & CONSTRAINTS		
INPUT CONSTRAINTS	**CONSTRAINT ITEM**	**SOLUTION VARIABLES**
SHALLOW REGION		
HNRHOBC	DENSITY LINEAR	VWXO
HNPORC	CNL PIECEWISE-LINEAR	VCLBW
PEF	PHOTOELECTRIC LINEAR	QRTZ
DTCO.4P	HUNT-RAYMER GARDNER	CLAY_2
THOR	THORIUM WT FRACTION	SIDERITE
POTA	POTASSIUM WT FRACTION	CHLORITE
0	BOUND WATER	KFELDS
1	SUM = 1	
COUNT	*8*	*7*

ESSO AUSTRALIA LIMITED

FORMATION TESTING & CORING SUMMARY

BLACKBACK 3

FORMATION TOPS		
FORMATION NAME	TOP *(metres KB)*	AGE
OLIGOCENE	2798.00	P. tuberculatus
EOCENE	2829.00	M.N. asperus to N. asperus
PALEOCENE	2878.00	L. balmei
LATE CRETACEOUS	2914.00	U.T. longus

CORES					
CORE NO. / SHIFT	TOP *(metres)*	BASE *(metres)*	CUT *(metres)*	RECOVERY *(metres)*	RECOVERY (%)
1 / +2 metres	2835.00	2853.00	18.00	18.00	100
2 / +2 metres	2853.00	2871.00	18.00	18.00	100

FORMATION PRESSURES			
TYPE / NO. *WIRELINE FORMATION TESTER*	*Depth (metres)*	*PRESSURE (psia)*	*DRAWDOWN MOBILITY (md/cp)*
No valid formation fluid sa			
MDT Formation Pressures, see attached.			

wsd 26/07/94

Appendix C
LASER Formation Model

Petrophysical Response of Common Minerals
LASER Mineral Model Parameters
BLACKBACK 3
EOCENE Reservoir

Mineral Classification	Mineral Name	Chemical Elements	Litho Density (gm/cm3)	Photo Electric Factor (barns/electron	Volumetric Cross Section (barns/cm3)	Thermal Neutron Porosity (p.u.)	Compressional Transit Time (usec/m)	Potassium (wt. percent)	Thorium (ppm)
Silicates	Quartz	SiO2	2.650	1.81	4.80	-2.10	190.00	0.00	1.50
Alkali Feldspar	Orthoclase	KAlSi3O8	2.54	2.86	7.26	0.00	175.50	10.50	3.00
Carbonate	Siderite	FeCO3	3.91	14.69	57.44	12.90	143.70	0.00	1.50
Clays	Kaolinite	Al4(Si4O10)(OH)8	2.62	1.70	4.45	32.75	230.00	0.49	1.50
	Illite	K.8(Al1.6Fe.2Mg.2)(Si3.4Al.6)O10(OH)2	2.77	3.03	8.39	15.80		4.91	
	Montmorillonite	Na.33(Al1.67Mg.33)(Si4O10)(OH)2 + 4H2O	2.11	2.11	4.45	50.00		0.38	
	Glauconite	K.7(Fe.7Al1.3)(Si3.3Al.7)O10(OH)2	2.85	5.20	14.81	15.20		5.10	
BB3 Composite Clay	Clay_2	60%Glauconite + 20%Illite + 20%Smectite	2.79	5.08	14.17	14.50	220.00	4.80	16.00
	Fe Chlorite	(Fe5Al)Si3AlO10(OH)8	3.40	12.36	42.02	46.00	220.00	0.00	14.00
Fluids	Formation Water	H2O 30kppm NaCleq	1.02	0.74	0.75		620.00		

Notes:

Reservoir sands primary constituent is quartz with secondary potassium feldspar grains.
Muscovite and Biotite are present in minor amounts and commonly decompose to form authigenic clays (i.e. chlorite).
Chlorite is commonly associated with degraded micas.
Feldspar dissolution develops micro/secondary porosity. Kaolin is formed during dissolution.

Reference: Schlumberger 1990 Element Mineral Rock Catalog

Blackback 3 LASER Formation Model

Structural Grains
- Quartz
- Potassium Feldspar

Structural Clays
- Clay 2

Authigenic Clays
- Clay_2
- Chlorite

Diagenetic Cements
- Siderite

wsd 21/07/94

PE600769

This is an enclosure indicator page.
The enclosure PE600769 is enclosed within the container PE900959 at this location in this document.

The enclosure PE600769 has the following characteristics:

ITEM_BARCODE =	PE600769
CONTAINER_BARCODE =	PE900959
NAME =	Blackback 3 Field processed logs
BASIN =	GIPPSLAND
PERMIT =	
TYPE =	WELL
SUBTYPE =	WELL_LOG
DESCRIPTION =	Blackback 3 Field processed logs
REMARKS =	
DATE_CREATED =	16/09/1994
DATE_RECEIVED =	20/10/1994
W_NO =	W1097
WELL_NAME =	Blackback-3
CONTRACTOR =	ESSO
CLIENT_OP_CO =	ESSO

(Inserted by DNRE - Vic Govt Mines Dept)

PE600822

This is an enclosure indicator page.
The enclosure PE600822 is enclosed within the container PE900959 at this location in this document.

The enclosure PE600822 has the following characteristics:

ITEM_BARCODE =	PE600822
CONTAINER_BARCODE =	PE900959
NAME =	Blackback 3 Formation Evaluation log
BASIN =	GIPPSLAND
PERMIT =	
TYPE =	WELL
SUBTYPE =	WELL_LOG
DESCRIPTION =	Blackback 3 Formation Evaluation log
REMARKS =	
DATE_CREATED =	02/08/1994
DATE_RECEIVED =	20/10/1994
W_NO =	W1097
WELL_NAME =	Blackback-3
CONTRACTOR =	ESSO
CLIENT_OP_CO =	ESSO

(Inserted by DNRE - Vic Govt Mines Dept)

APPENDIX 3

APPENDIX 3

APPENDIX 3

FMI Analysis

M E M O R A N D U M

TO: A.W. Djakic		MELBOURNE:	May 10, 1994
		OUR REF:	WSD:lrw:1245.doc
FROM: Andy Mills		SUBJECT:	Blackback 3 FMI Analysis

This memorandum summarises results from the Blackback 3 FMI structural and stratigraphic analyses. This data was analysed by Scott Dodge and John Phillips the week of April 25, 1994 using Schlumberger's Fracview FMI application software. The data was analysed using a leased Sun Sparc 2 workstation in Esso's Melbourne Central office.

Summary

The major finding are as follows:

- Upper Cretaceous structural orientation: Dip 2.7 deg, Azimuth 282 deg

- Base of Eocene channel "M.N. Asperus" either: 2873 or 2878 metres

- Base of Paleocene "L. Balmei": 2914 metres

Table 1 summarises the structural and stratigraphic features interpreted from the FMI images. All events are documented on separate log image plots wherein a 1:200 scale log shows static images and selected structural and stratigraphic events and 1:10 expanded scale log image plot showing actual planar events indicated on the dynamic processed images. Each feature was classified as one of the following events:

- Structural Bedding
- Planar Bedding
- Crossbed (Hummocks or Trough)
- Reactivation Surfaces (crossbed bounding surfaces)
- Unconformity (erosional features)

Palynological markers were used to constrain the depth range which could contain the base of the Eocene channel and base of Paleocene age sediments. The palynology spore-pollen samples are listed in Table 2.

Structural FMI Image Events

The structural dip within the Latrobe group sediments averages 2.7 degrees dipping towards 282 degrees azimuth. The individual bed forms and resulting dip magnitude and direction are shown in figure 1. The structural beds selected to represent structural orientation were confined to high gamma ray shales which were few in number throughout the Latrobe section. Two beds best representing structural bedding parallel surfaces are from 2950m to 2970m and 3048m to 3054m.

The structural bedding events identified in the Lakes Entrance are shown in figure 2. These events show beds dipping 3.8 degrees at an azimuth of 280 degrees. These beds appear to be conformable to those found in the Eocene channel fill and the Late Cretaceous sequences.

Stratigraphic FMI Image Events

Within the category of stratigraphic events; planar bedding, crossbeds, reactivation surfaces and unconformities have been identified. Each depositional sequence has been summarised in figures 3 through 14 showing the stratigraphic events identified therein.

Eocene Age Channel

The Eocene N. asperus sequence is shown in figure 3 with low angle planar bedding dipping at 2.7 degrees with an average azimuth of 325 degrees. The Eocene sediments are interpreted as offshore marine channel fill rich in glauconite and siderite. Using this geologic model, the dip direction of these channel fill sediments is towards the centre of the channel. The channel axis would be 90 degree to the dip direction reflecting a channel oriented NE/SW or 55/235 degree strike.

The northwest dip direction also indicates that the Blackback 3 well is on the southeasterly flank of the channel. The channel truncates somewhere between this location and the Blackback 2 well. No equivalent Eocene age channel fill is present at Blackback 2, where Paleocene age sedimentation has not been eroded by channeling.

The transition from the Paleocene age L. balmei sediments to the Eocene age N. asperus are shown in Figure 4. Palynology spore-pollen brackets the base of the Eocene marine offshore channel between 2867.5m and 2887m. The primary stratigraphic sedimentation within the Paleocene is NE/SE as shown in figure 6. The dip direction of the Eocene channel fill is NW and this boundary between the two age sequences occurs at 2873 metres. The FMI image in figure 5 shows this boundary where the change from NE to NW sedimentation occurs. This depth also coincides with the approxiate base of core 2 at 2873 metres.

The wellbore is significantly washed out from 2859m to 2873m and only a few stratigraphic events could be identified in the FMI images. The dips within this interval are oriented to the NW consistent with those observed within the main channel fill although at higher dip magnitudes. The affect of wellbore enlargement is seen in figure 5 from 2871.25m to 2872m. The blurring of the images results from poor FMI pad contact with the formation. However a planar event at 2872m can be identified with good confidence. This feature has a northerly dip direction and marks the change towards Eocene sedimentation. The base of channel can be seen in the image as the erosional surface indicated by the dark conductive feature at 2873.1 metres.

At this time the actual base of channel is believed to be at either 2873m or 2878m. Although palynology brackets the base of channel between 2867.5m and 2887m, the base of the Eocene channel could also be interpreted to occur at 2878m. This conclusion is based on FMI dip and ARI/LDT/CNT log response. In figure 6 an abrupt change in NW dipping high angle trough crossbeds from 2878m to 2880m transitions into lower angle crossbedding from 2874m to 2878m. Additionally the ARI/LDT/CNT log response appear to take on a response similar to the main Eocene channel fill beginning at 2878m.

Paleocene Age Sedimentation

A sequence of paleocene age sandstones from 2873m to 2900m shown in figure 6 illustrate high angle trough cross beds associated with high energy environments in addition to lower energy deposition characterised by planar bedding. The low angle planar beds contain an average dip of 3.5 degrees and SE azimuth. The higher angle crossbeds range in dip from 6 to 20 degrees and are oriented primarily ENE as seen in the stereonet and azimuth diagrams.

The base of the paleocene age sedimentation occurs at approximately 2914 metres. The palynology from side wall cores indicates the lowest Paleocene age L. balmei sample at 2913m and Late Cretaceous U.T. longus at 2971m. Approximately at 2914m a change in paleo deposition occurs. Above 2914m low angle planar bedding dips northerly, where below this depth the flow direction is ESE. Further supporting evidence from both the LDT/CNT porosity and MRIL permeability show a marked change towards poorer reservoir quality above 2914m. Figure 7 shows the FMI image of this sequence boundary.

A question about reservoir quality and stratigraphic crossbedding arises within the Paleocene sequence. Trough crossbedding is usually associated with higher energy sandstone deposition as seen from 2891m to 2893m in figure 6. However good crossbedding is also observed from 2878m to 2882m which occurs in a silty dense low porosity sequence similar to lower shore face environments. Why does this good crossbedding occur in poor reservoir quality?

The remainder of the Paleocene age stratigraphy is shown in Figure 7. This sequence is characterised by a very clean high porosity sandstone sequence with low angle bedding parallel dips from 2 to 8 degrees structural dip removed. The saturated GR response at 2913m is shown by the light to white colours in the FMI image. The low angle parallel bedding can be seen on the images above the dense interval above 2913m.

Late Cretaceous Sedimentation

The Late Cretaceous sequence below 2914m shows a large number of bed forms within high porosity sandstones. All three bedforms, crossbeds, planar bedding, and reactivation surfaces are identified in this sequence in figure 8. Most of the crossbeds are flattening upwards trough crossbeds which are usually less than 0.5 metres in thickness and usually bounded by reactivation surfaces, figure 9. These crossbeds approach angles as high as 32 degrees relative dip with structural dip removed.

The low angle planar beds within this sequence dip 2 to 8 degrees with an azimuth of NE to SE. The crossbeds have a dip range of 6 to 34 degrees and are oriented NE to ESE. Both bedding types indicate a NE to SE paleo flow direction within this 30 metre interval. Structural dip has been removed prior to this analyses.

The remainder of the late cretaceous sequence to base of the FMI interpreted data at 3055m continues to support a ENE to ESE paleo current flow direction. Additional individual sand sequences and bed forms are shown in figures 10 through 14.

Recommendation on Future Borehole Image Acquisition at Blackback

Experience with both the FMS tool logged at Blackback-2 and FMI tool at Blackback-3 leads to the following recommendation. In future Blackback drill wells the FMI log be the tool used for the following reasons:

(1) FMI provides 68% wellbore coverage in 9 7/8 inch hole, whereas the FMS provides only 34%. In Blackback-2 the FMS only gave 27% wellbore coverage in the 12 1/4 inch wellbore. This twofold increase provides enough data wherein the interpreter can confidently identify difficult geologic image events such as faults, channel base (i.e. Eocene) and other unconformities. The low resisitivity contrast with the Blackback channel fill deposits yields poor quality image data and events are difficult to identify with the lower wellbore coverage from the FMS tool. Additionally, the FMI has 24 electrode buttons compared to 16 on the FMS per pad which represents a 50% increase yielding improved vertical and lateral resolution.

(2) The FMI data was used extensively by the reservoir engineer to select and locate the exact depths for MDT pre-test pressures and samples. Again the twofold increase in wellbore coverage provides sufficient data to interpret vertical and horizontal wellbore heterogeneity. At Blackback-3 the FMI data was processed by the Melbourne computing centre and returned to the rig in time for the MDT log run, thus allowing the engineer to use the highest quality image data. This was not the case at Blackback-2 where the engineer used the MAXIS image processed data which is of "significant" poorer quality.

Blackback 3 FMI Structural and Stratigraphic Orientation

Table 1

Event	Depth Range (metres)	Dip Magnitude (degrees)	Dip Azimuth (degrees)	Reference(1)	Age
Structural	2820 - 2829	3.8	280	True	Oligocene
Structural	2950 - 3050	2.7	282	True	Late Cretaceous
Planar	2835 - 2862	2.7	325	True	Eocene
Planar	2873 - 2900	3.5	SE	True	Paleocene
Crossbeds	2872 - 2900	6-20	NE	True	Paleocene
Planar	2914 - 2955	2-8	SE	Rel	Late Cretaceous
Crossbeds	2928 - 2955	6-34	NE-ESE	Rel	Late Cretaceous
Crossbeds	2952 - 2955	6-30	NE	Rel	Late Cretaceous
Crossbeds	2985 - 2995	10-42	E	Rel	Late Cretaceous
Crossbeds	3020 - 3055	6-32	SE	Rel	Late Cretaceous

(1) Reference: Rel indicates structural dip of 2.7 deg, azimuth 282 deg removed

Palynology Analyses by Dr. Alan Partridge

Table 2

Age	Sample	Depth	Spore-Pollen Zone
Oligocene	SWC-45	2798.0	P. tuberculatus
	SWC-43	2818.0	P. tuberculatus
	SWC-40	2829.0	P. tuberculatus
Eocene	SWC-40	2829.0	U.N. asperus
	SWC-38	2835.0	M.N. asperus
	Core-1	2837.0	M.N. asperus
	Core-1	2841.0	M.N. asperus
	Core-1	2847.0	M.N. asperus
	SWC-35	2850.0	M.N. asperus
	Core-2	2857.0	N. asperus
	Core-2	2861.0	N. asperus
	SWC-32	2867.5	N. asperus
Paleocene	SWC-28	2887.0	L. balmei
	SWC-26	2898.2	L.L. balmei
	SWC-24	2902.2	L. balmei
	SWC-22	2913.0	L. balmei
Late Cretaceous	SWC-14	2971.0	U.T. longus
	SWC-11	3000.4	U.T. longus
	SWC-10	3004.0	U.T. longus
	SWC-8	3022.0	U.T. longus
	SWC-4	3062.0	U.T. longus

PE903934

This is an enclosure indicator page.
The enclosure PE903934 is enclosed within the container PE900959 at this location in this document.

The enclosure PE903934 has the following characteristics:

ITEM_BARCODE =	PE903934
CONTAINER_BARCODE =	PE900959
NAME =	Blackback 3 2950-3050m U. Cret. structural montage
BASIN =	GIPPSLAND
ON_OFF =	OFFSHORE
PERMIT =	VIC/P24
TYPE =	WELL
SUBTYPE =	MONTAGE
DESCRIPTION =	Blackback 3 Structural Monage. 2950m-3050m Upper Createaceous structural dip 2.7deg, azimuth 282 deg. (Figure 1 from appendix 3, Vol 2 of WCR)
REMARKS =	
DATE_CREATED =	
DATE_RECEIVED =	20/10/94
W_NO =	W1097
WELL_NAME =	Blackback 3
CONTRACTOR =	Esso Australia Ltd
CLIENT_OP_CO =	Esso Australia Ltd

(Inserted by DNRE - Vic Govt Mines Dept)

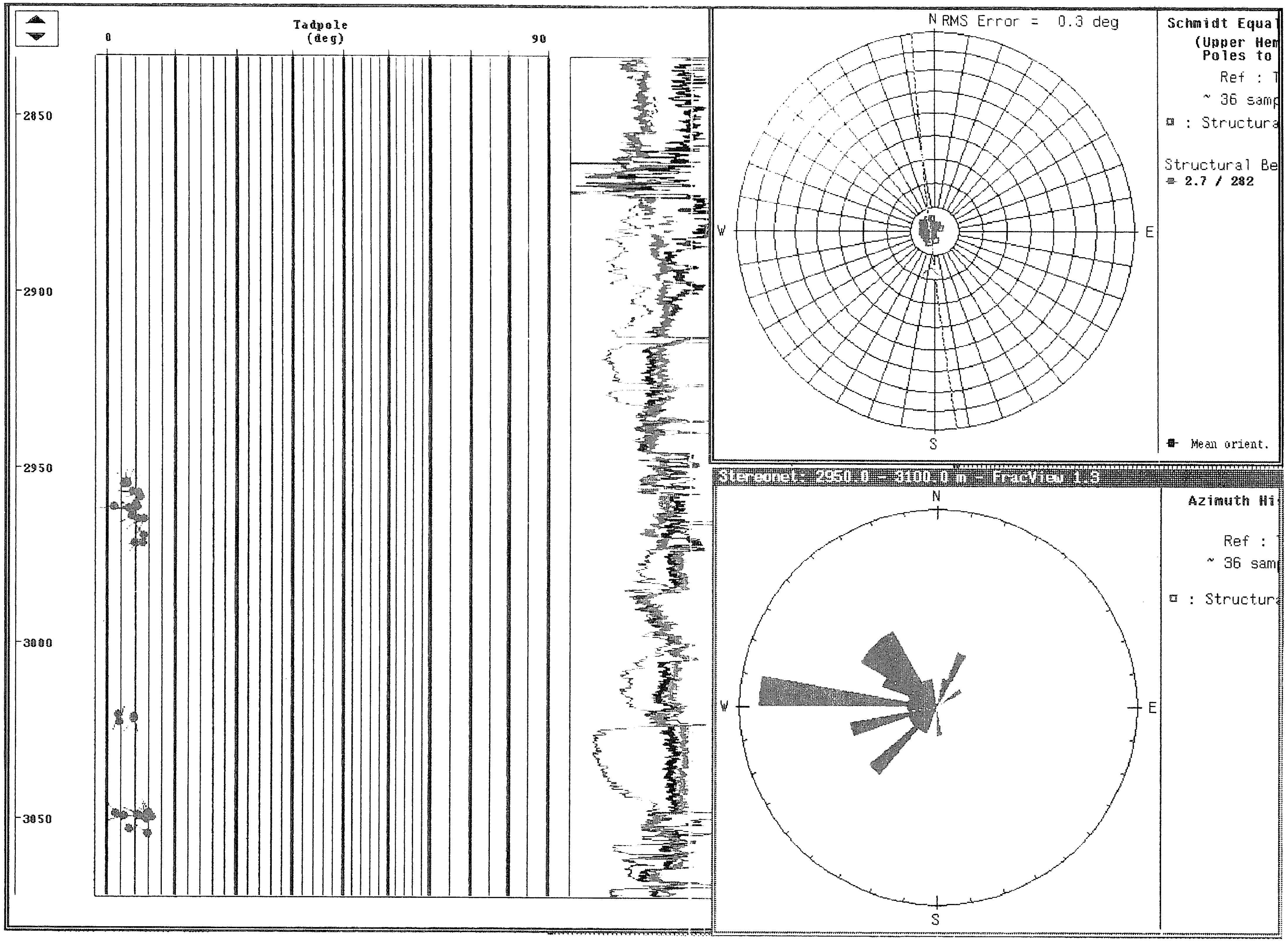


Figure 1 2950m to 3050m Upper Cretaceous Structural Dip 2.7° Azi 282°

PE903935

This is an enclosure indicator page.
The enclosure PE903935 is enclosed within the container PE900959 at this location in this document.

The enclosure PE903935 has the following characteristics:

```
     ITEM_BARCODE = PE903935
CONTAINER_BARCODE = PE900959
             NAME = Blackback 3 2820-2829m Lakes Entr.
                    structual mont.
            BASIN = GIPPSLAND
           ON_OFF = OFFSHORE
           PERMIT = VIC/P24
             TYPE = WELL
          SUBTYPE = MONTAGE
      DESCRIPTION = Blackback 3 Structural Montae.
                    2820m-2829m Lakes Entrance Structural
                    dip 3.8 deg. Azimuth 280 deg. (Figure 2
                    from appendix 3, Vol 2 of WCR)
          REMARKS =
     DATE_CREATED =
    DATE_RECEIVED = 20/10/94
             W_NO = W1097
        WELL_NAME = Blackback 3
       CONTRACTOR = Esso Australia Ltd
     CLIENT_OP_CO = Esso Australia Ltd
```

(Inserted by DNRE - Vic Govt Mines Dept)

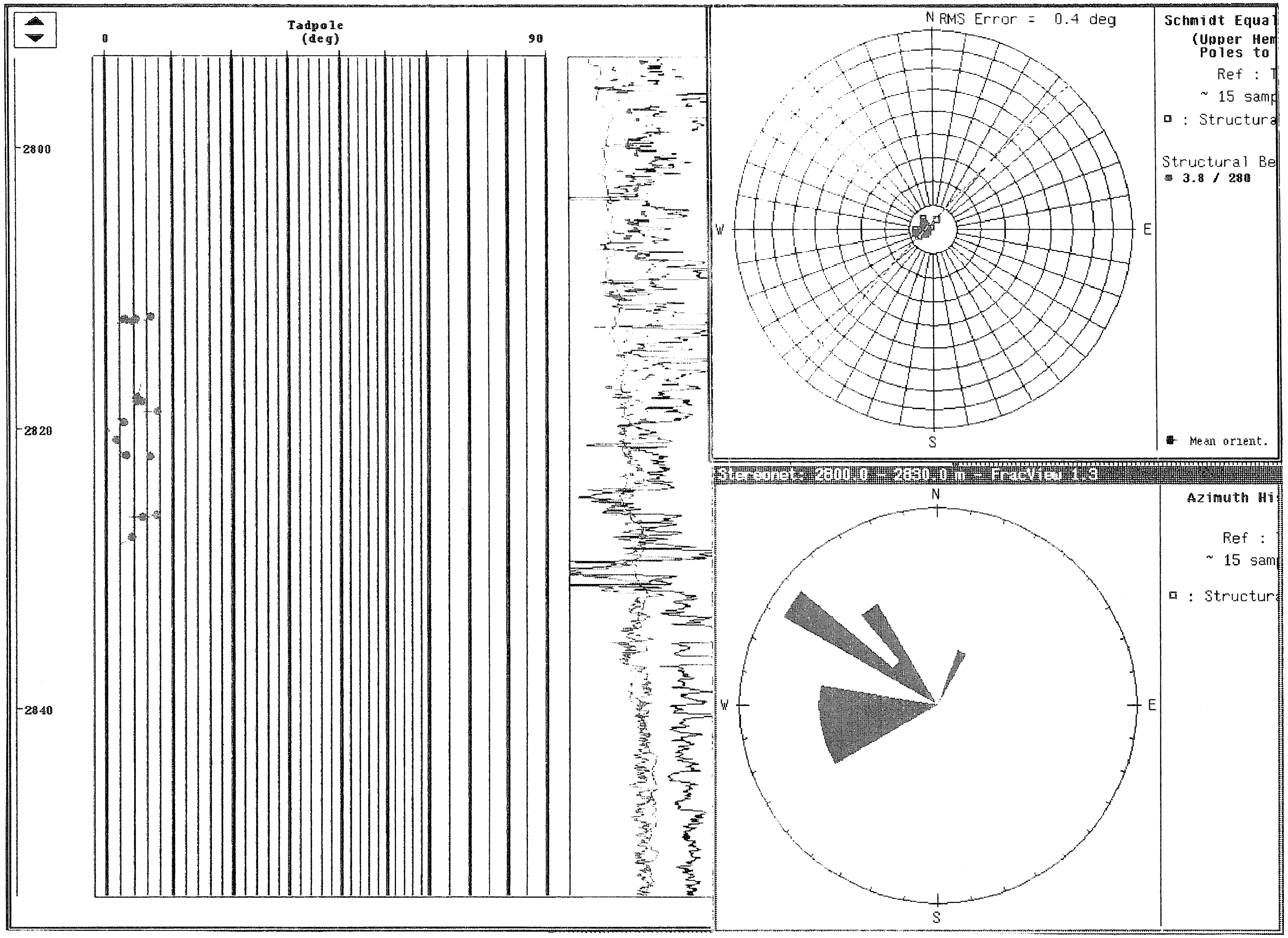


Figure 2 2820m to 2829m Lakes Entrance Structural Dip 3.8° Azi 280°

PE903936

This is an enclosure indicator page.
The enclosure PE903936 is enclosed within the container PE900959 at this location in this document.

The enclosure PE903936 has the following characteristics:

ITEM_BARCODE =	PE903936
CONTAINER_BARCODE =	PE900959
NAME =	Blackback 3 planar parallel bedding in Eocene channel
BASIN =	GIPPSLAND
ON_OFF =	OFFSHORE
PERMIT =	VIC/P24
TYPE =	WELL
SUBTYPE =	MONTAGE
DESCRIPTION =	Blackback 3 Structural Montage. 2835m-2862m Planar parallel bedding in Eocene channel fill: Dip 2.7 drg. Azimuth 325 deg. (Figure 3 from appendix 3, Vol2 of WCR)
REMARKS =	
DATE_CREATED =	
DATE_RECEIVED =	20/10/94
W_NO =	W1097
WELL_NAME =	Blackback 3
CONTRACTOR =	Esso Australia Ltd
CLIENT_OP_CO =	Esso Australia Ltd

(Inserted by DNRE - Vic Govt Mines Dept)

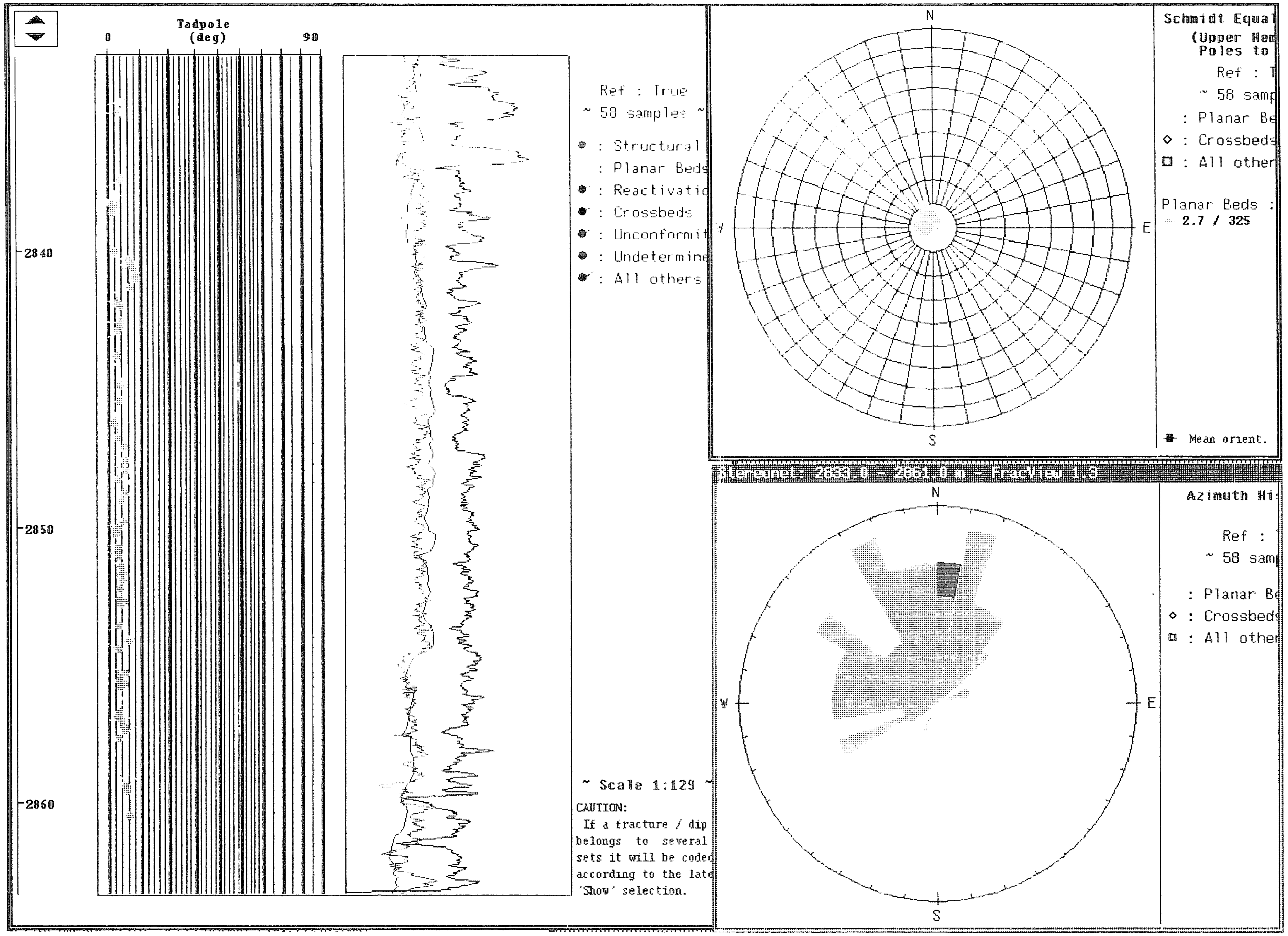


Figure 3 2835m to 2862m Planar paralled bedding in Eocene channel fill: Dip 2.7° Azimuth 325°

PE903937

This is an enclosure indicator page.
The enclosure PE903937 is enclosed within the container PE900959 at this location in this document.

The enclosure PE903937 has the following characteristics:

ITEM_BARCODE =	PE903937
CONTAINER_BARCODE =	PE900959
NAME =	Blackback 3 Top La Trobe stratigraphic bedding
BASIN =	GIPPSLAND
ON_OFF =	OFFSHORE
PERMIT =	VIC/P24
TYPE =	WELL
SUBTYPE =	MONTAGE
DESCRIPTION =	Blackback 3 Structural Montage. To of La Tovbe Eocene (2828m-2872m) and Paleocene(2873m-2928m) stratigraphic bedding. (Figure 4 from appendix 3, Vol 2 of WCR)
REMARKS =	
DATE_CREATED =	
DATE_RECEIVED =	20/10/94
W_NO =	W1097
WELL_NAME =	Blackback 3
CONTRACTOR =	Esso Australia Ltd
CLIENT_OP_CO =	Esso Australia Ltd

(Inserted by DNRE - Vic Govt Mines Dept)

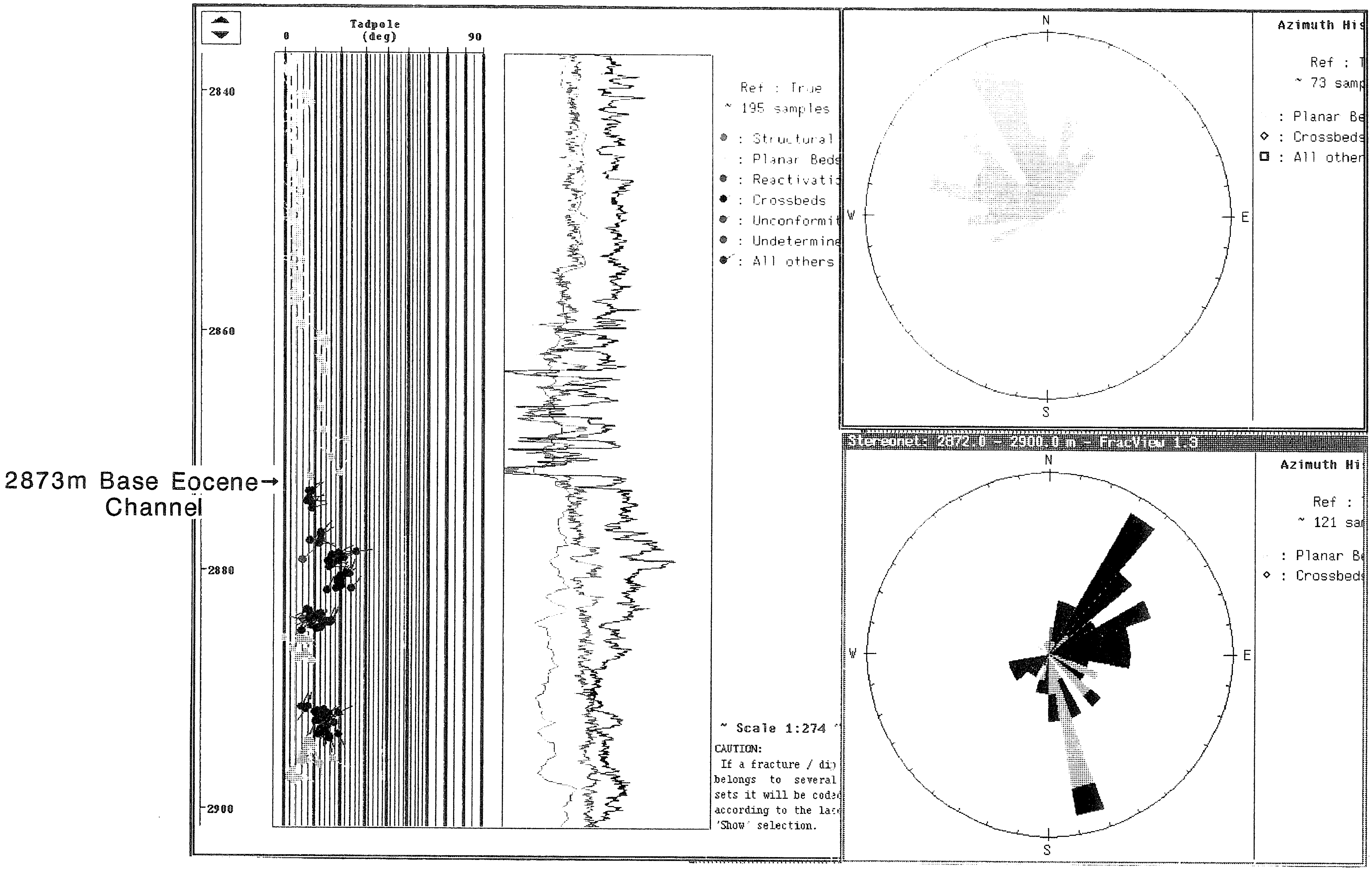


Figure 4 Top of Latrobe Eocene (2829m - 2873m) and Paleocene (2873m - 2928m) stratigraphic bedding.

PE903938

This is an enclosure indicator page.
The enclosure PE903938 is enclosed within the container PE900959 at this location in this document.

The enclosure PE903938 has the following characteristics:

ITEM_BARCODE =	PE903938
CONTAINER_BARCODE =	PE900959
NAME =	Blackback 3 2871m-2873.5m Base Eocene channel
BASIN =	GIPPSLAND
ON_OFF =	OFFSHORE
PERMIT =	VIC/P24
TYPE =	WELL
SUBTYPE =	MONTAGE
DESCRIPTION =	Blackback 3 Structural Montage 2871m-2873.5m Base Eoceneshannel 2873m. (Figure 5 from appendix 3, Vol 2 of WCR)
REMARKS =	
DATE_CREATED =	
DATE_RECEIVED =	20/10/94
W_NO =	W1097
WELL_NAME =	Blackback 3
CONTRACTOR =	Esso Australia Ltd
CLIENT_OP_CO =	Esso Australia Ltd

(Inserted by DNRE - Vic Govt Mines Dept)

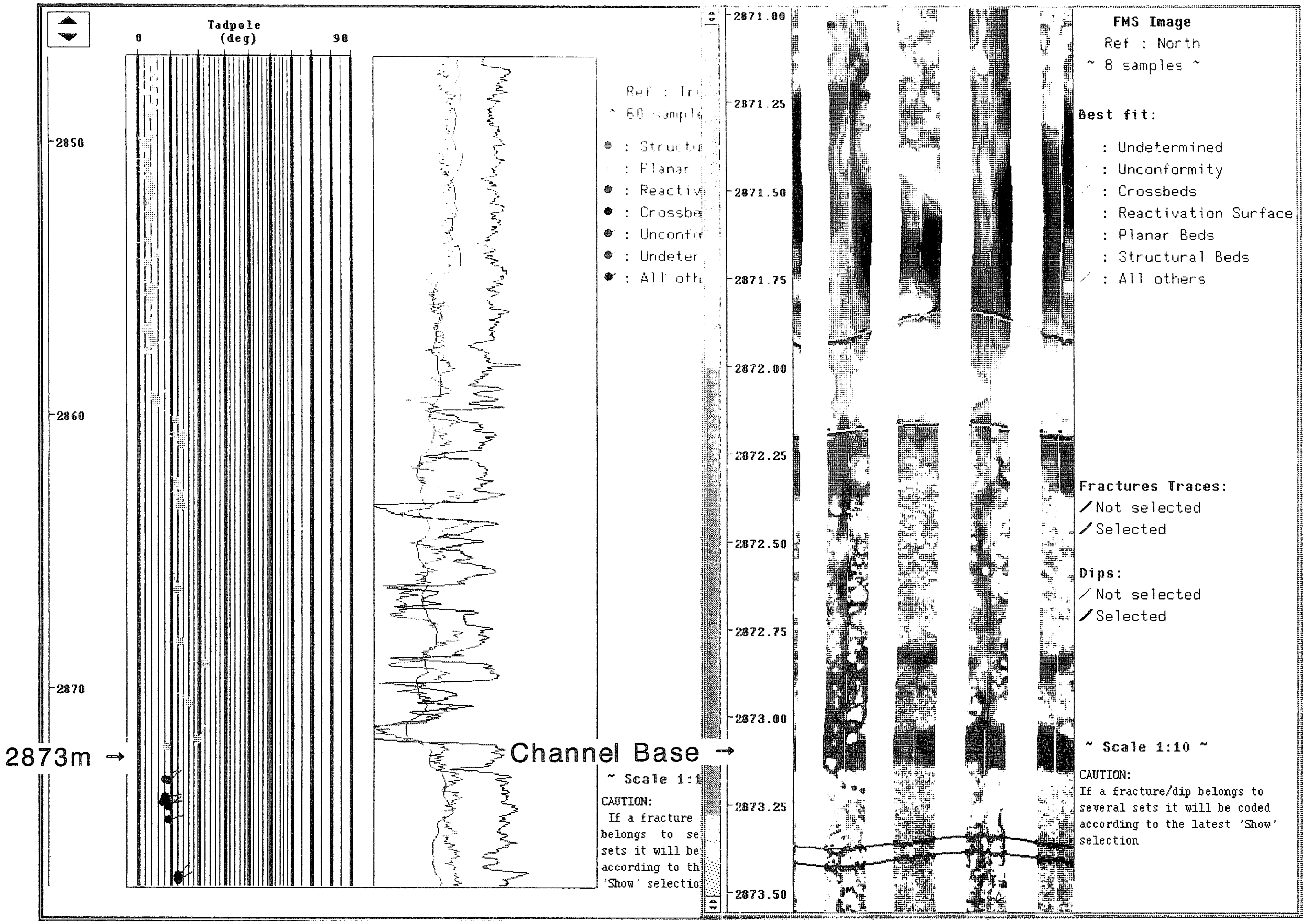


Figure 5   2871m to 2873.5m Base of Eocene channel 2873m

PE903939

This is an enclosure indicator page.
The enclosure PE903939 is enclosed within the container PE900959 at this location in this document.

The enclosure PE903939 has the following characteristics:

ITEM_BARCODE =	PE903939
CONTAINER_BARCODE =	PE900959
NAME =	Blackback 3 trough crossbedding montage
BASIN =	GIPPSLAND
ON_OFF =	OFFSHORE
PERMIT =	VIC/P24
TYPE =	WELL
SUBTYPE =	MONTAGE
DESCRIPTION =	Blackback 3 Structural Montage. 2873m-2900m Paleocene age stratigraphytrough crossbedding and low angle planar bedding. Planar beds: Dip 3.85 deg. Azimuth SE. Crossbeds: Dip 6-20 deg Azimuth NE. (Figure 6om appendix 3, Vol 2 of WCR)
REMARKS =	
DATE_CREATED =	
DATE_RECEIVED =	20/10/94
W_NO =	W1097
WELL_NAME =	Blackback 3
CONTRACTOR =	Esso Australia Ltd
CLIENT_OP_CO =	Esso Australia Ltd

(Inserted by DNRE - Vic Govt Mines Dept)

Base Eocene ?→

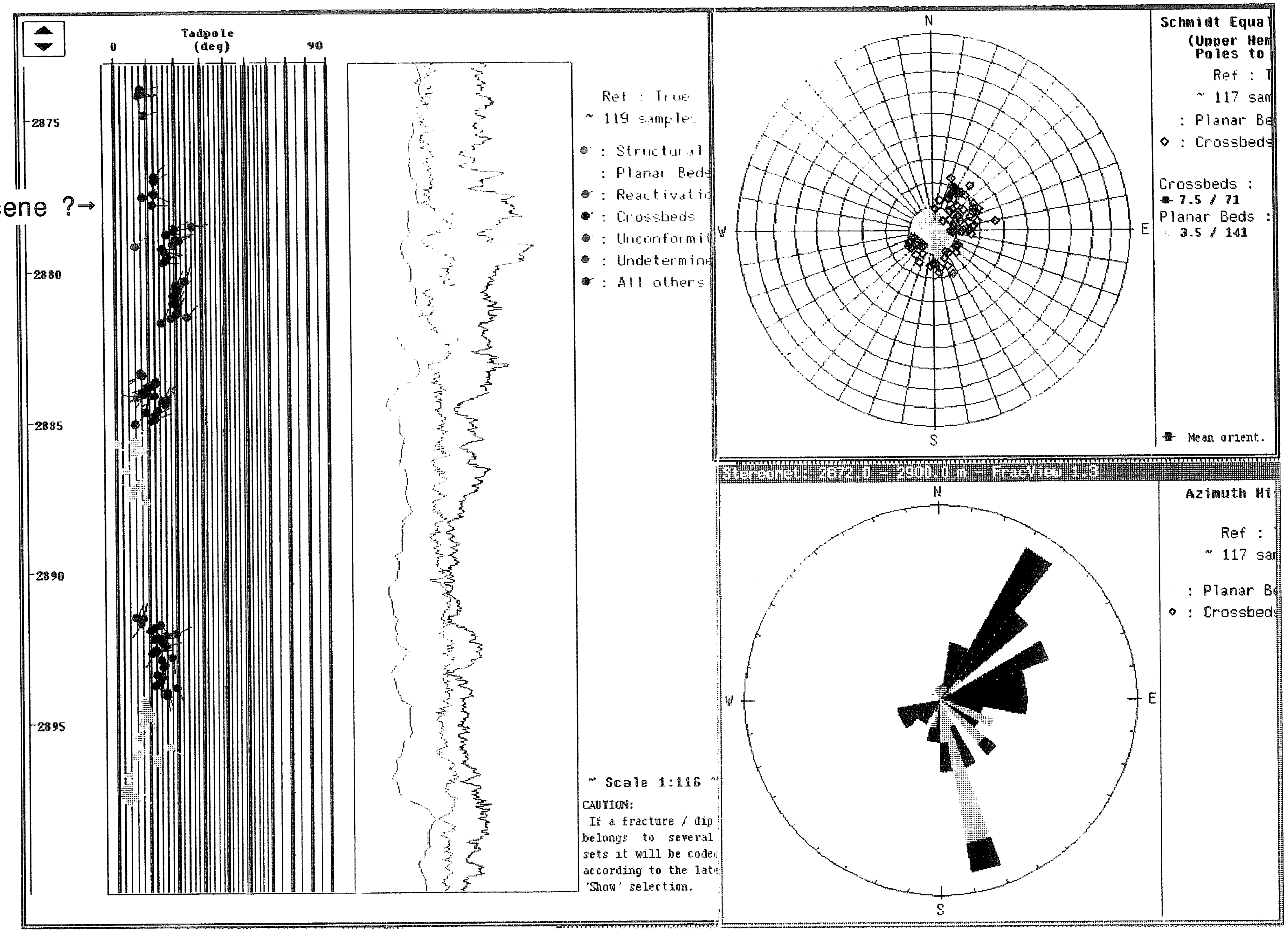


Figure 6 2873m to 2900m Paleocene age stratigraphy trough crossbedding and low angle planar bedding. Planar beds: Dip 3.5° Azi SE Crossbeds: Dip 6°-20° Azi NE

PE903940

This is an enclosure indicator page.
The enclosure PE903940 is enclosed within the container PE900959 at this location in this document.

The enclosure PE903940 has the following characteristics:

ITEM_BARCODE =	PE903940
CONTAINER_BARCODE =	PE900959
NAME =	Blackback 3 dense, high gamma ray sediment
BASIN =	GIPPSLAND
ON_OFF =	OFFSHORE
PERMIT =	VIC/P24
TYPE =	WELL
SUBTYPE =	MONTAGE
DESCRIPTION =	Blackback 3 Structural Montage. 2912.75m-2914m Dense, High Gamma Ray Sediments. (Figure 7 fom appendix 3, Vol 2 of WCR.
REMARKS =	
DATE_CREATED =	
DATE_RECEIVED =	20/10/94
W_NO =	W1097
WELL_NAME =	Blackback 3
CONTRACTOR =	Esso Australia Ltd
CLIENT_OP_CO =	Esso Australia Ltd

(Inserted by DNRE - Vic Govt Mines Dept)

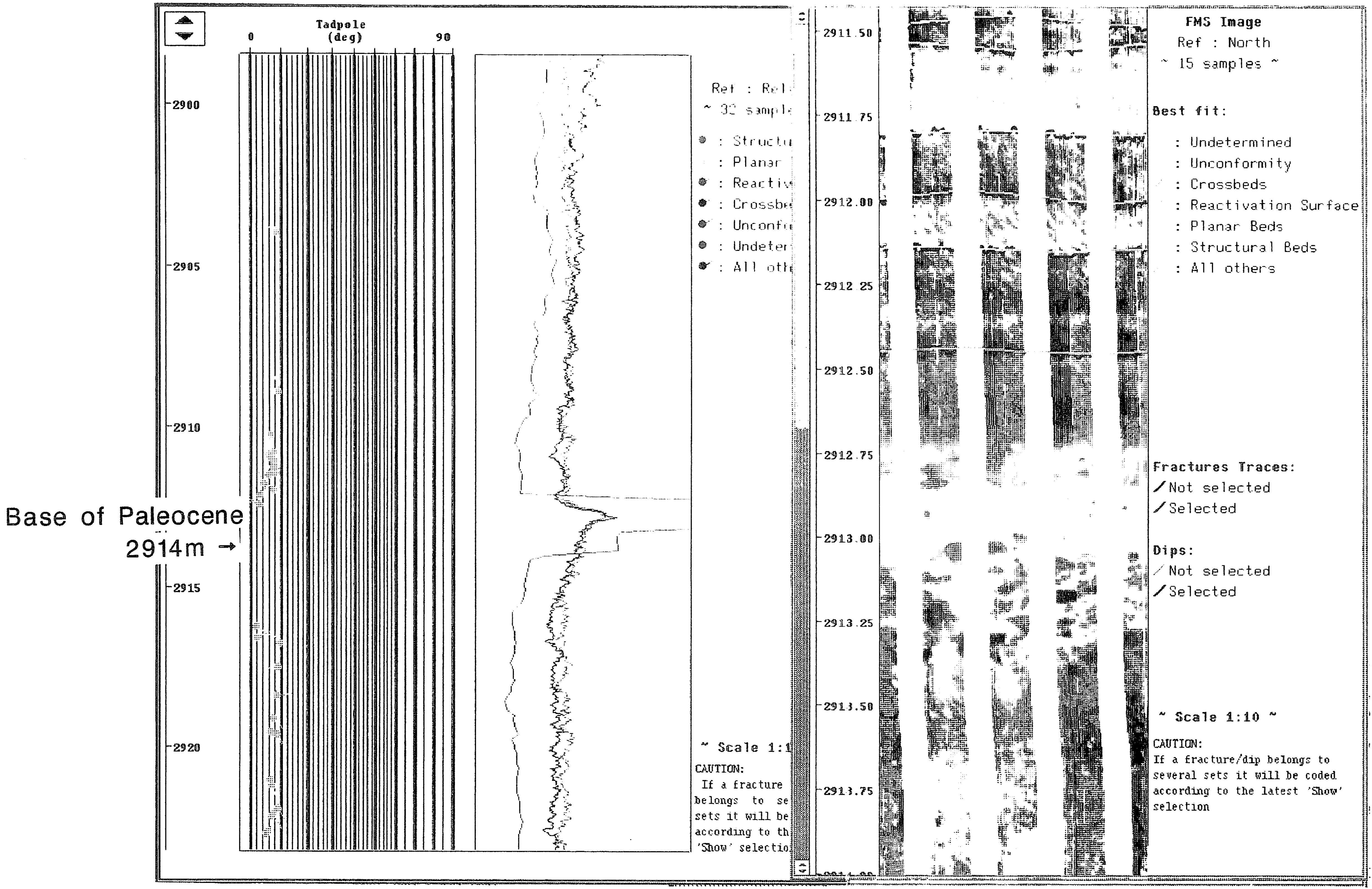


Figure 7   2912.75m to 2914m   Dense, High Gamma Ray sediments

PE903941

This is an enclosure indicator page.
The enclosure PE903941 is enclosed within the container PE900959 at this location in this document.

The enclosure PE903941 has the following characteristics:

ITEM_BARCODE =	PE903941
CONTAINER_BARCODE =	PE900959
NAME =	Blackback 3 L. Cret. structural dip removed
BASIN =	GIPPSLAND
ON_OFF =	OFFSHORE
PERMIT =	VIC/P24
TYPE =	WELL
SUBTYPE =	MONTAGE
DESCRIPTION =	Blackback 3 Structural Montage. 2914m-2955m Late Cretaceous afe stratigraphky structural Dip removed. Planar beds: dip 2-8 deg. azimuth NE-SE Cross beds: Dip 6-34 deg, Azimuth NE-ESE. (Figure 8 appendix 3, Vol 2 of WCR).
REMARKS =	
DATE_CREATED =	
DATE_RECEIVED =	20/10/94
W_NO =	W1097
WELL_NAME =	Blackback 3
CONTRACTOR =	Esso Australia Ltd
CLIENT_OP_CO =	Esso Australia Ltd

(Inserted by DNRE - Vic Govt Mines Dept)

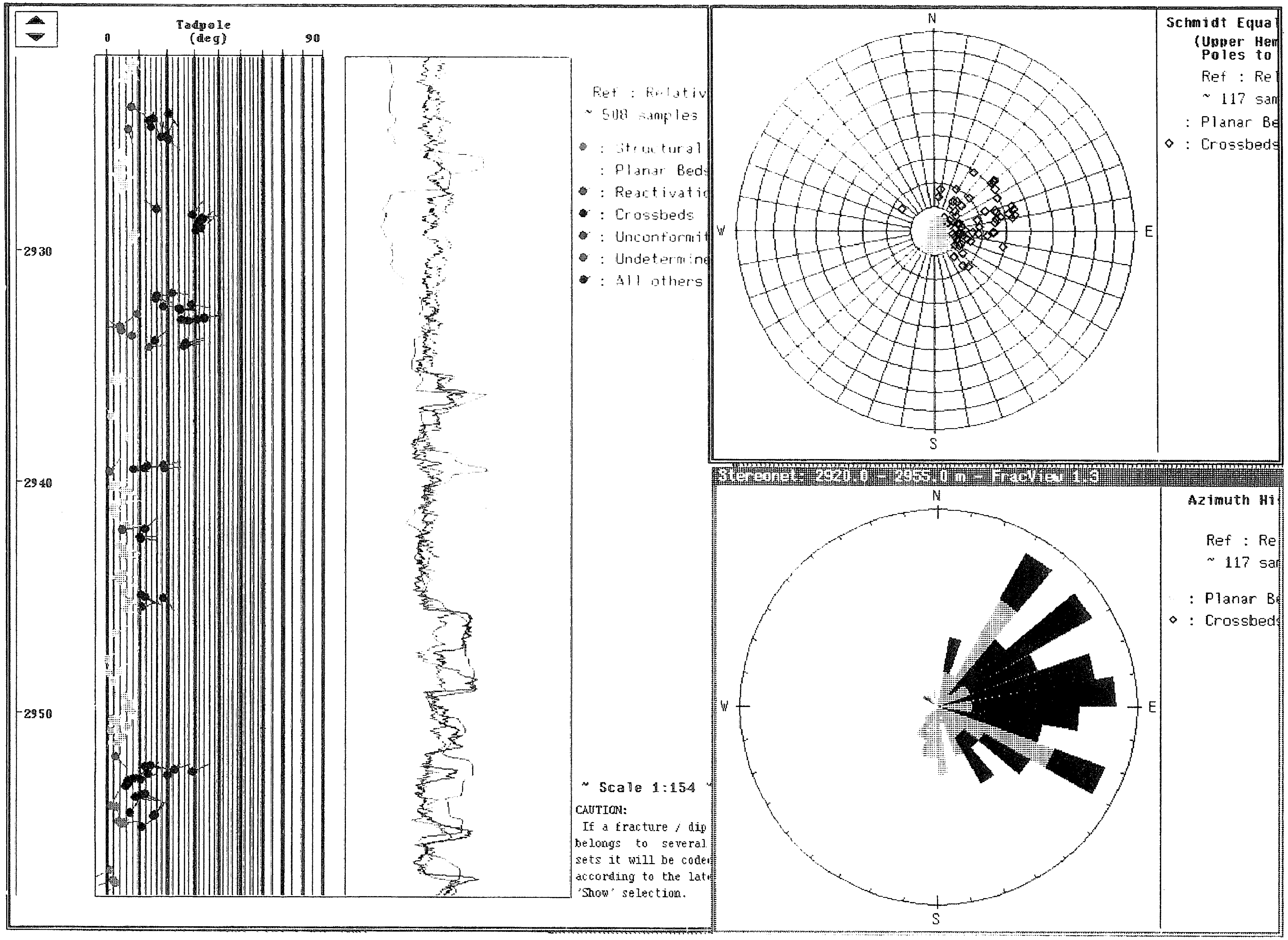


Figure 8 2914m to 2955m Late Cretaceous age stratigraphy Structural Dip removed.

Planar beds: Dip 2°- 8° Azi NE - SE Cross beds: Dip 6°- 34° Azi NE - ESE

PE903942

This is an enclosure indicator page.
The enclosure PE903942 is enclosed within the container PE900959 at this location in this document.

The enclosure PE903942 has the following characteristics:

ITEM_BARCODE =	PE903942
CONTAINER_BARCODE =	PE900959
NAME =	Blackback 3 high angle trough xbeds struct. montage
BASIN =	GIPPSLAND
ON_OFF =	OFFSHORE
PERMIT =	VIC/P24
TYPE =	WELL
SUBTYPE =	MONTAGE
DESCRIPTION =	Blackback 3 Structural Montage. 2931.5m-2934m High angle (30 deg) trough crossbeds. (Figure 9 appendix 3, Vol 2 of WCR).
REMARKS =	
DATE_CREATED =	
DATE_RECEIVED =	20/10/94
W_NO =	W1097
WELL_NAME =	Blackback 3
CONTRACTOR =	Esso Australia Ltd
CLIENT_OP_CO =	Esso Australia Ltd

(Inserted by DNRE - Vic Govt Mines Dept)

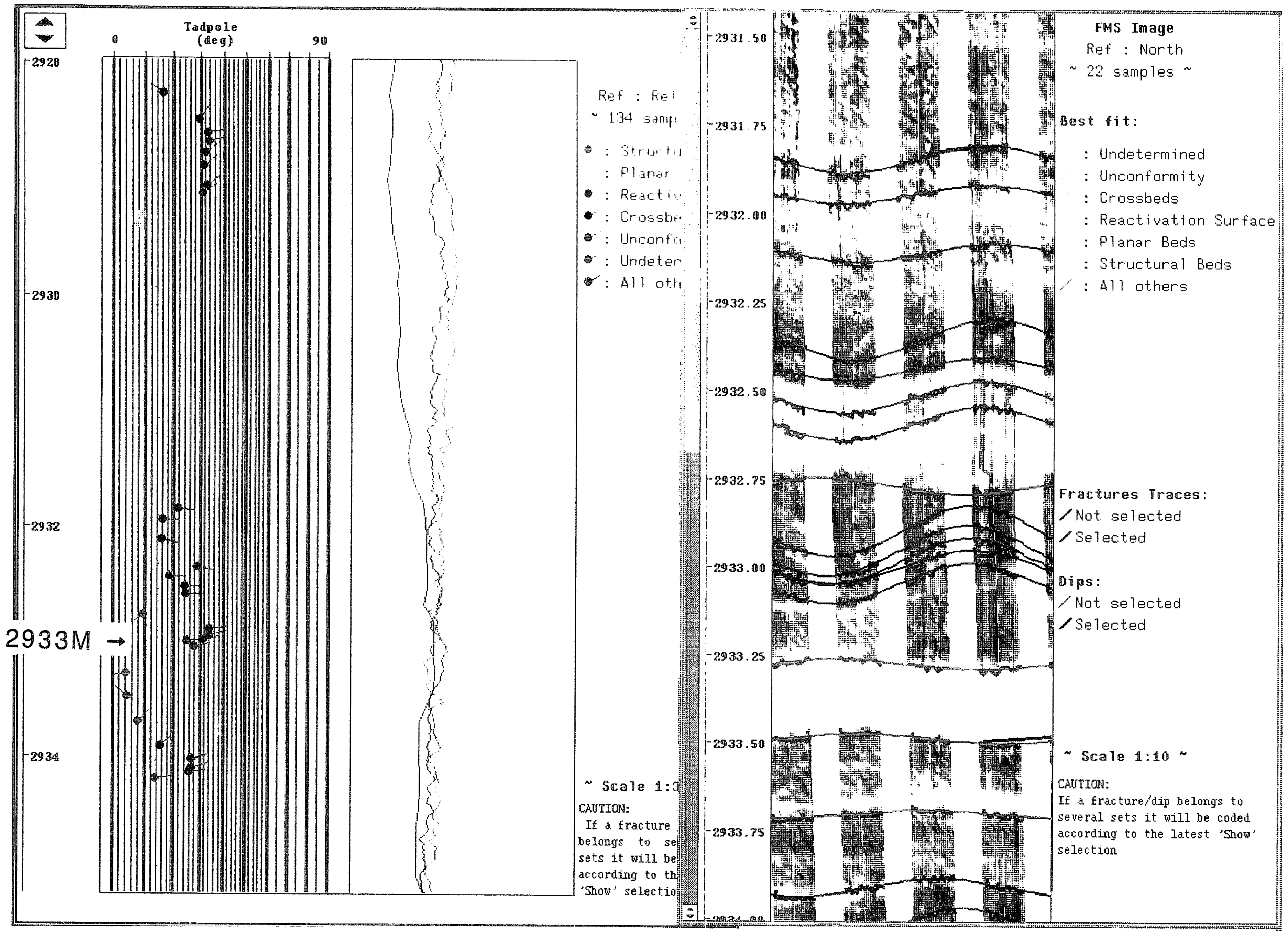


Figure 9 2931.5m to 2934m High angle (30°) trough crossbeds

PE903943

This is an enclosure indicator page.
The enclosure PE903943 is enclosed within the container PE900959 at this location in this document.

The enclosure PE903943 has the following characteristics:

ITEM_BARCODE =	PE903943
CONTAINER_BARCODE =	PE900959
NAME =	Blackback 3 Structural dip removed 2952-2955m
BASIN =	GIPPSLAND
ON_OFF =	OFFSHORE
PERMIT =	VIC/P24
TYPE =	WELL
SUBTYPE =	MONTAGE
DESCRIPTION =	Blackback 3 Structural Montage. 2952m to 2955m Strucutral Dup Removed Crossbeds: Dip 6-30 deg. Azimuth NE. (Figure 10 appensix 3, Vol 2 of WCR)
REMARKS =	
DATE_CREATED =	
DATE_RECEIVED =	20/10/94
W_NO =	W1097
WELL_NAME =	Blackback 3
CONTRACTOR =	Esso Australia Ltd
CLIENT_OP_CO =	Esso Australia Ltd

(Inserted by DNRE - Vic Govt Mines Dept)

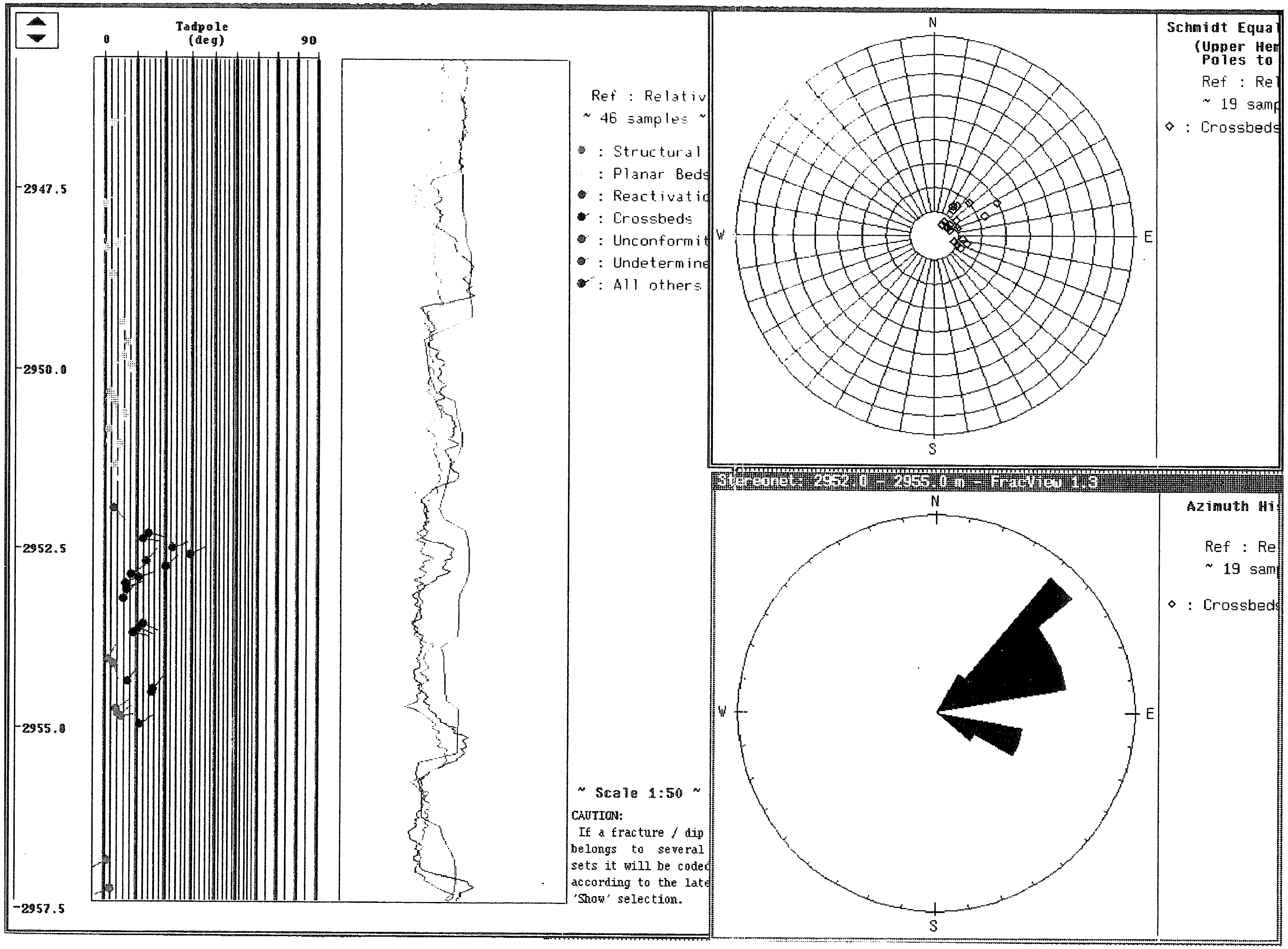


Figure 10   2952 to 2955m   Structural Dip Removed   Crossbeds: Dip 6°– 30°   Azi NE

PE903944

This is an enclosure indicator page.
The enclosure PE903944 is enclosed within the container PE900959 at this location in this document.

The enclosure PE903944 has the following characteristics:

ITEM_BARCODE =	PE903944
CONTAINER_BARCODE =	PE900959
NAME =	Blackback 3 Structural dip removed 2985-2995m
BASIN =	GIPPSLAND
ON_OFF =	OFFSHORE
PERMIT =	VIC/P24
TYPE =	WELL
SUBTYPE =	MONTAGE
DESCRIPTION =	Blackback 3 Structural Montage. 2985m-2995m Structural dip removed crossbeds: dip 10-42 deg Azimuth E. (Figure 11 appendix 3, Vol 2 of WCR)
REMARKS =	
DATE_CREATED =	
DATE_RECEIVED =	20/10/94
W_NO =	W1097
WELL_NAME =	Blackback 3
CONTRACTOR =	Esso Australia Ltd
CLIENT_OP_CO =	Esso Australia Ltd

(Inserted by DNRE - Vic Govt Mines Dept)

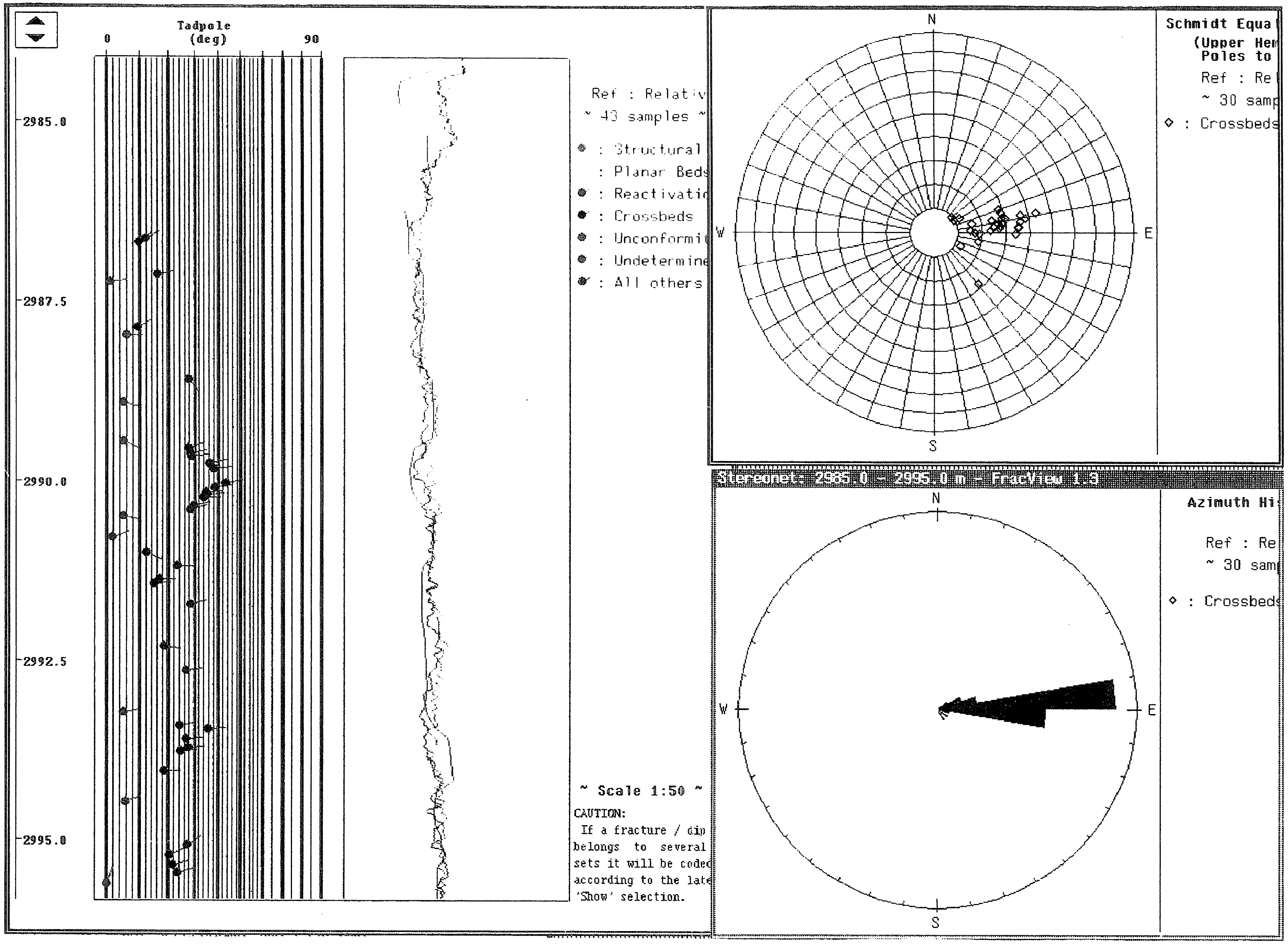


Figure 11 2985m to 2995m Structural Dip Removed Crossbeds: Dip 10°- 42° Azi East

PE903945

This is an enclosure indicator page.
The enclosure PE903945 is enclosed within the container PE900959 at this location in this document.

The enclosure PE903945 has the following characteristics:

ITEM_BARCODE = PE903945
CONTAINER_BARCODE = PE900959
NAME = Blackback 3 High angle xbedding surfaces
BASIN = GIPPSLAND
ON_OFF = OFFSHORE
PERMIT = VIC/P24
TYPE = WELL
SUBTYPE = MONTAGE
DESCRIPTION = Blackback 3 Structural Montage. 2987m-2996m High angle crossbedding with bounding reactiviation surfaced at 2990m. (Figure 12 appendix 3, Vol 2 of WCR).
REMARKS =
DATE_CREATED =
DATE_RECEIVED = 20/10/94
W_NO = W1097
WELL_NAME = Blackback 3
CONTRACTOR = Esso Australia Ltd
CLIENT_OP_CO = Esso Australia Ltd

(Inserted by DNRE - Vic Govt Mines Dept)

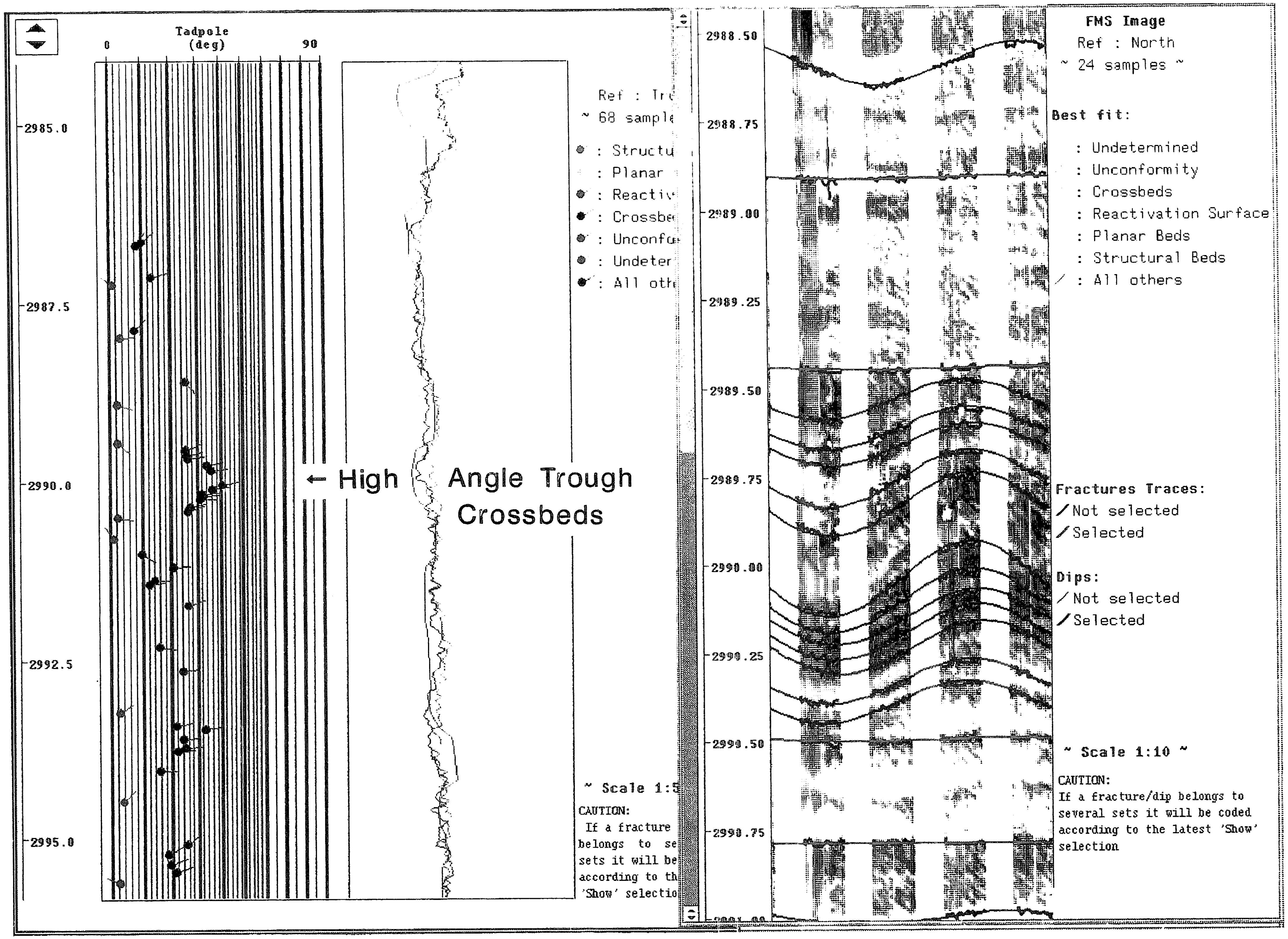


Figure 12 2987m to 2996m High angle crossbedding with bounding reactivation surfaces at 2990m.

PE903946

This is an enclosure indicator page.
The enclosure PE903946 is enclosed within the container PE900959 at this location in this document.

The enclosure PE903946 has the following characteristics:

ITEM_BARCODE =	PE903946
CONTAINER_BARCODE =	PE900959
NAME =	Blackback 3 structural dip removed xbeds montage
BASIN =	GIPPSLAND
ON_OFF =	OFFSHORE
PERMIT =	VIC/P24
TYPE =	WELL
SUBTYPE =	MONTAGE
DESCRIPTION =	Blackback 3 Structural Montage. 3020m to 3055m Structural Dip removed crossbeds: Dip 6-32 deg Azimuth SE. (Figure 13 appendix 3 Vol 2 of WCR).
REMARKS =	
DATE_CREATED =	
DATE_RECEIVED =	20/10/94
W_NO =	W1097
WELL_NAME =	Blackback 3
CONTRACTOR =	Esso Australia Ltd
CLIENT_OP_CO =	Esso Australia Ltd

(Inserted by DNRE - Vic Govt Mines Dept)

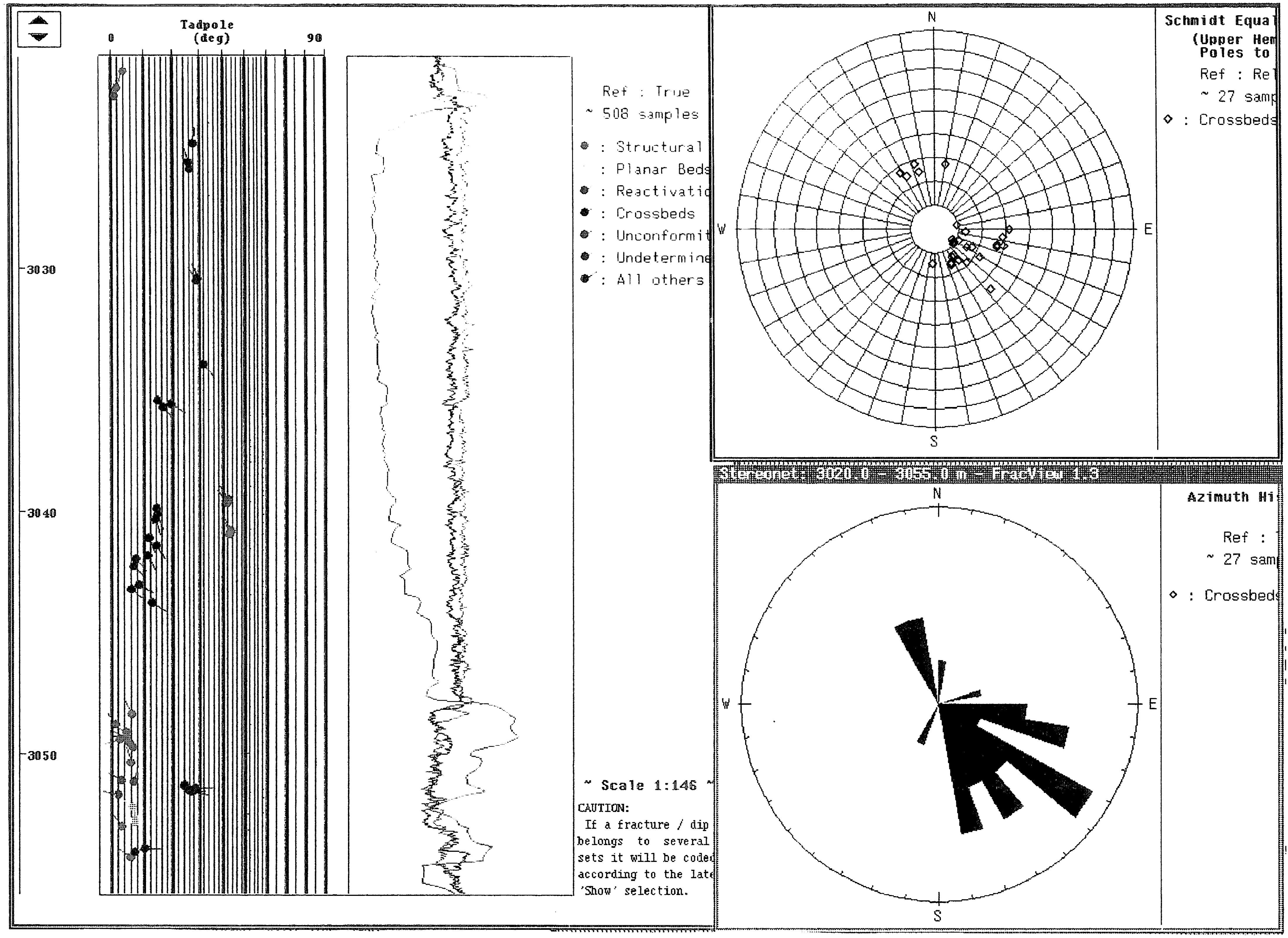


Figure 13 3020m to 3055m Structural Dip Removed Crossbeds: Dip 6°– 32° Azi SE

PE903947

This is an enclosure indicator page.
The enclosure PE903947 is enclosed within the container PE900959 at this location in this document.

The enclosure PE903947 has the following characteristics:

ITEM_BARCODE =	PE903947
CONTAINER_BARCODE =	PE900959
NAME =	Blackback 3 L. Cret. dipping trough xbeds montage
BASIN =	GIPPSLAND
ON_OFF =	OFFSHORE
PERMIT =	VIC/P24
TYPE =	WELL
SUBTYPE =	MONTAGE
DESCRIPTION =	Blackback 3 Structural Montage. Late Cretaceous 25 deg. dipping reough crossbeds bounded by reactivation surfaces. (Figure 14 appendix 3, Vol 2 of WCR)
REMARKS =	
DATE_CREATED =	
DATE_RECEIVED =	20/10/94
W_NO =	W1097
WELL_NAME =	Blackback 3
CONTRACTOR =	Esso Australia Ltd
CLIENT_OP_CO =	Esso Australia Ltd

(Inserted by DNRE - Vic Govt Mines Dept)

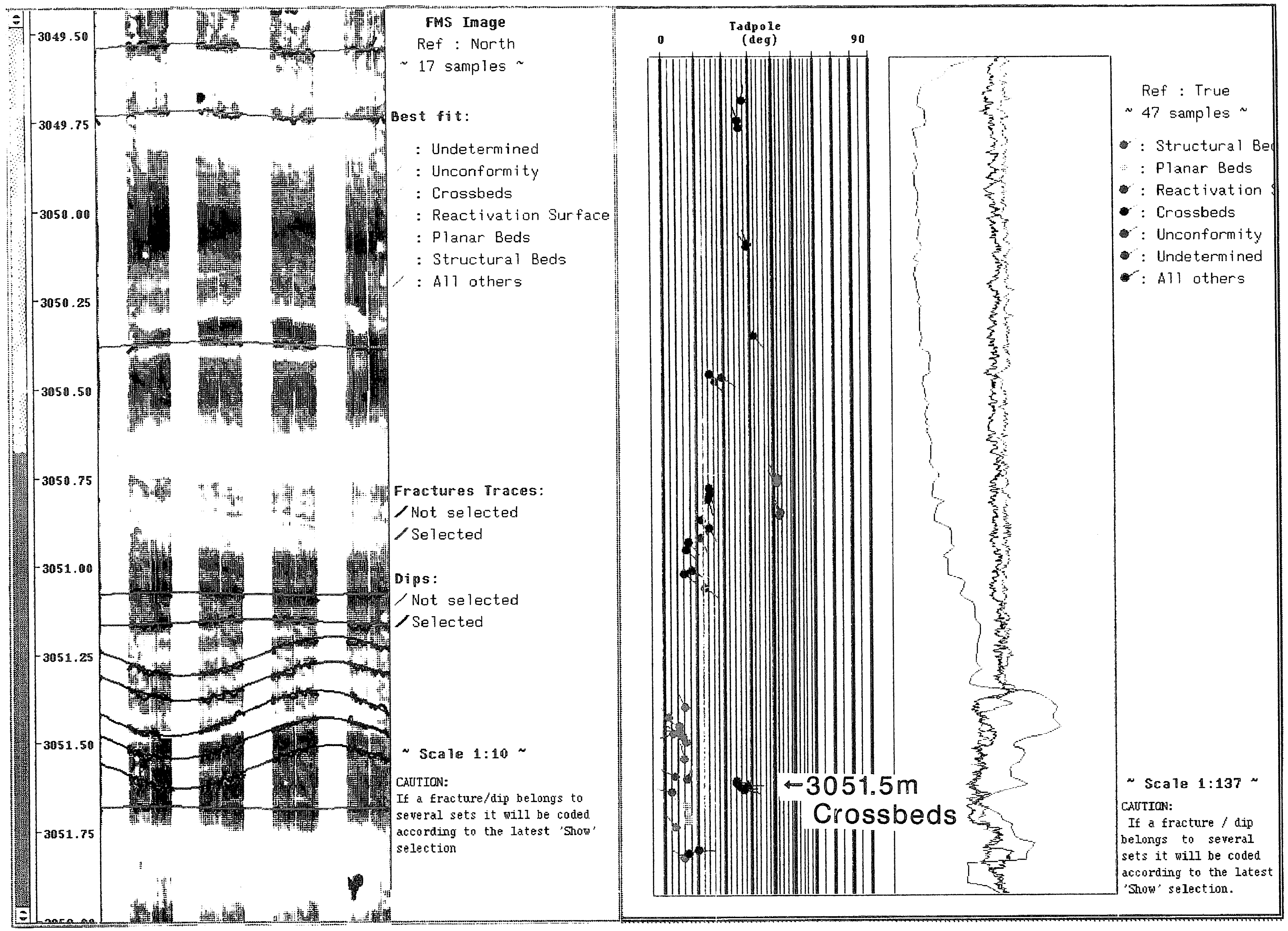


Figure 14 Late Cretaceous 25° dipping trough crossbeds bounded by reactivation surfaces.

APPENDIX 4

APPENDIX 4

Thin Section Petrography, Scanning Electron Microscopy and X-Ray Diffraction Analysis

NB: This Appendix contains only selected materials from each of the above analyses. The detailed reports will be forwarded upon receipt.

A4 - figures 2, 3A, 4A, 5, 6, 7A, 8, 9, 10 and 11 follow

PE905151

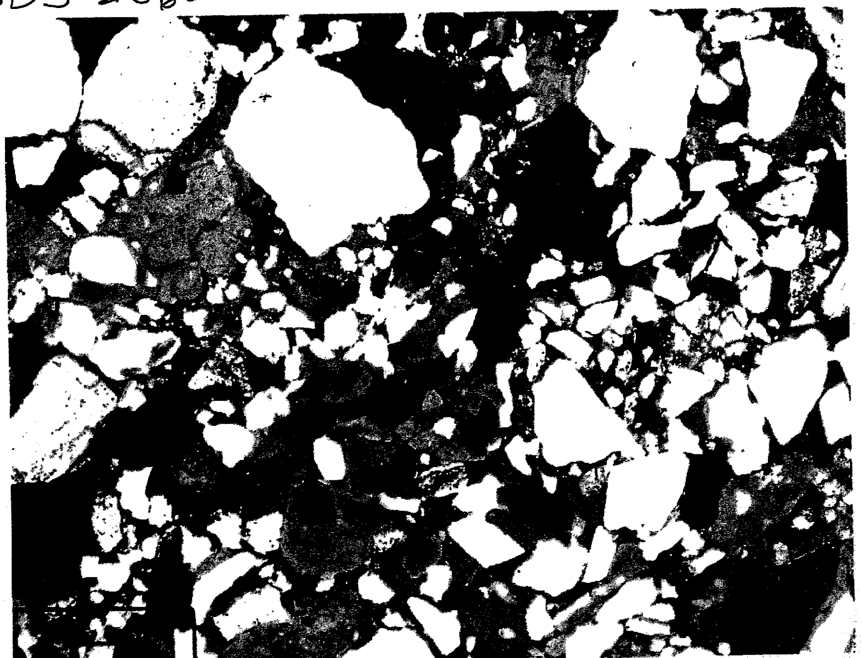
This is an enclosure indicator page.
The enclosure PE905151 is enclosed within the container PE900959 at this location in this document.

The enclosure PE905151 has the following characteristics:

ITEM_BARCODE =	PE905151
CONTAINER_BARCODE =	PE900959
NAME =	Photomicrographs, SEM and SEM graph
BASIN =	GIPPSLAND
PERMIT =	VIC/P24
TYPE =	WELL
SUBTYPE =	PHOTOMICROGRAPH
DESCRIPTION =	Blackback-3 Photomicrographs, SEM and SEM element abundance graph of Diagenetic Chlorite pore lining before quartz cementation. Some chlorite found trapped in quartz overgrowths. Figure 2 of appendix 4 from WCR volume 2.
REMARKS =	This item contains colour.
DATE_CREATED =	30/04/1994
DATE_RECEIVED =	20/10/1994
W_NO =	W1097
WELL_NAME =	Blackback-3
CONTRACTOR =	
CLIENT_OP_CO =	Esso Australia Limited

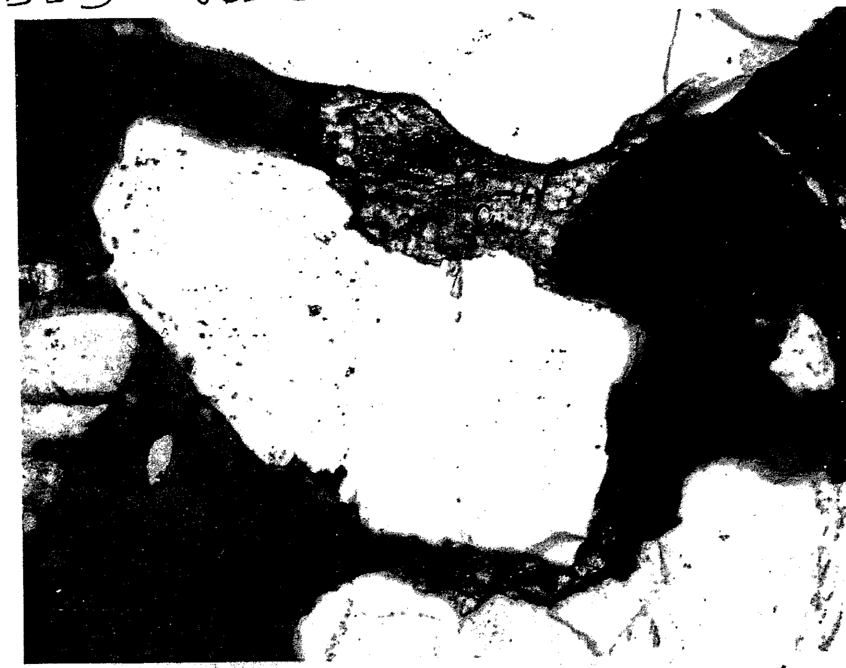
(Inserted by DNRE - Vic Govt Mines Dept)

BB3 2862.5

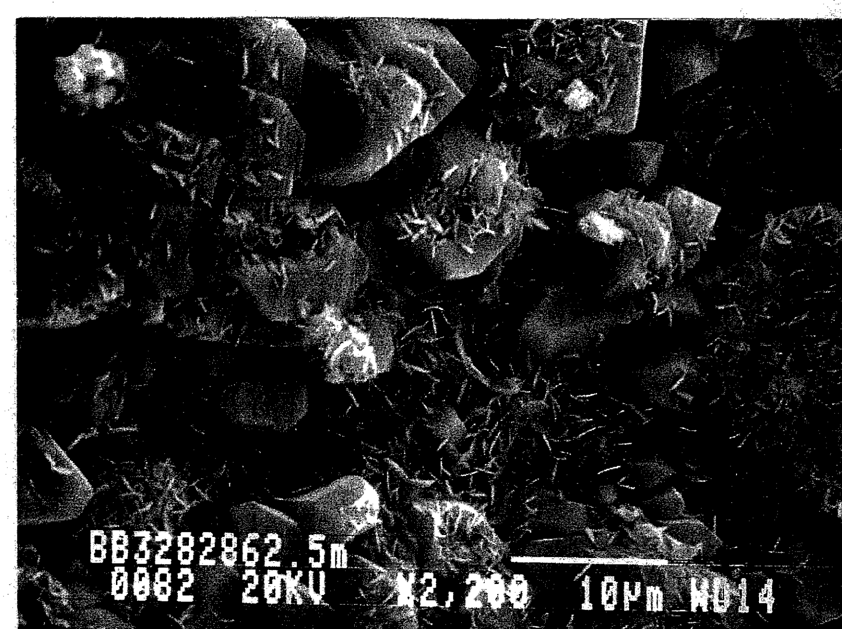


2.5X

BB3 2862.5



10X



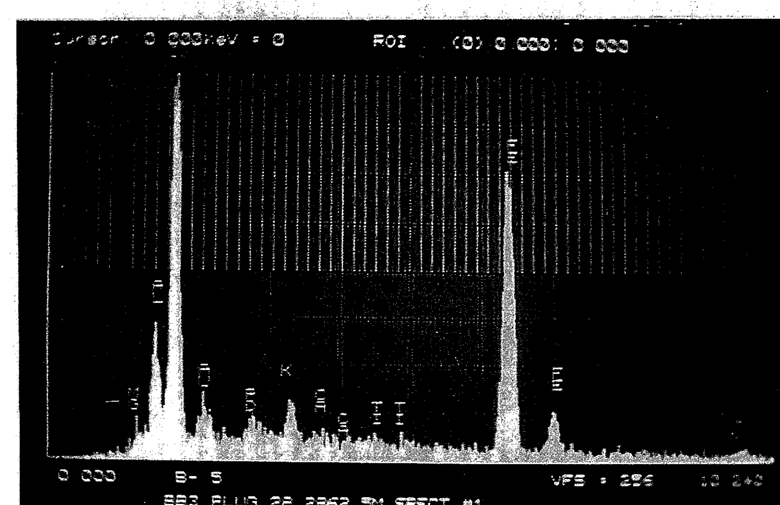


Figure 2 ***Blackback 3*** ***2862.5m (plug 28)***
Diagenetic Chlorite pore lining before quartz cementation. Some chlorite found trapped in quartz overgrowths.

PE905152

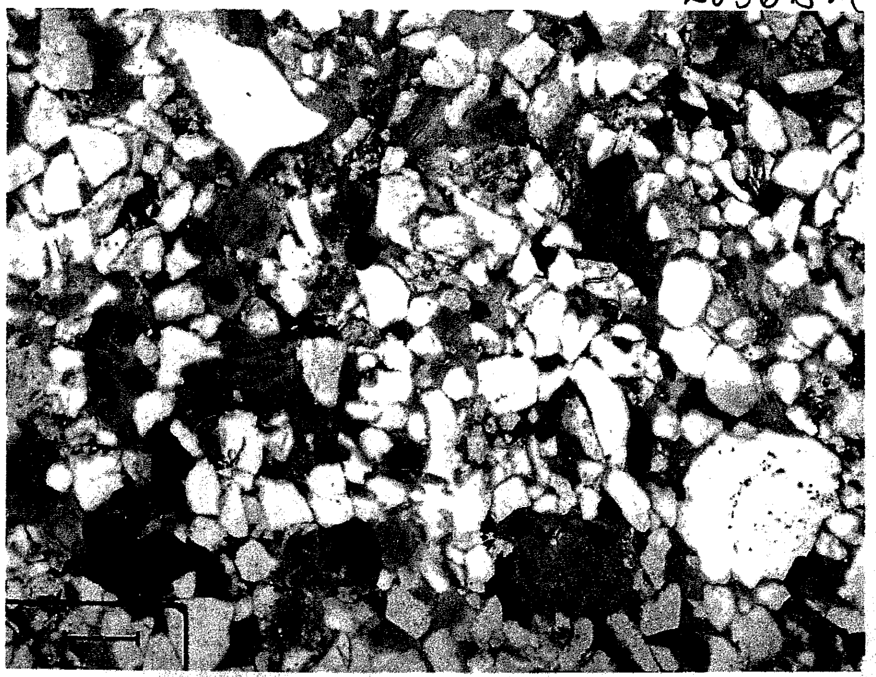
This is an enclosure indicator page.
The enclosure PE905152 is enclosed within the container PE900959 at this location in this document.

The enclosure PE905152 has the following characteristics:

ITEM_BARCODE =	PE905152
CONTAINER_BARCODE =	PE900959
NAME =	Photomicrographs, SEM and SEM graph
BASIN =	GIPPSLAND
PERMIT =	VIC/P24
TYPE =	WELL
SUBTYPE =	PHOTOMICROGRAPH
DESCRIPTION =	Blackback-3 Photomicrographs, SEM and SEM element abundance graph of Diagenetic Fe rich Chlorite [Fe5 Al Si3 Al O10 (OH8)] filling intergranular pore space. Figure 3A of appendix 4 from WCR volume 2.
REMARKS =	This item contains colour.
DATE_CREATED =	30/04/1994
DATE_RECEIVED =	20/10/1994
W_NO =	W1097
WELL_NAME =	Blackback-3
CONTRACTOR =	
CLIENT_OP_CO =	Esso Australia Limited

(Inserted by DNRE - Vic Govt Mines Dept)

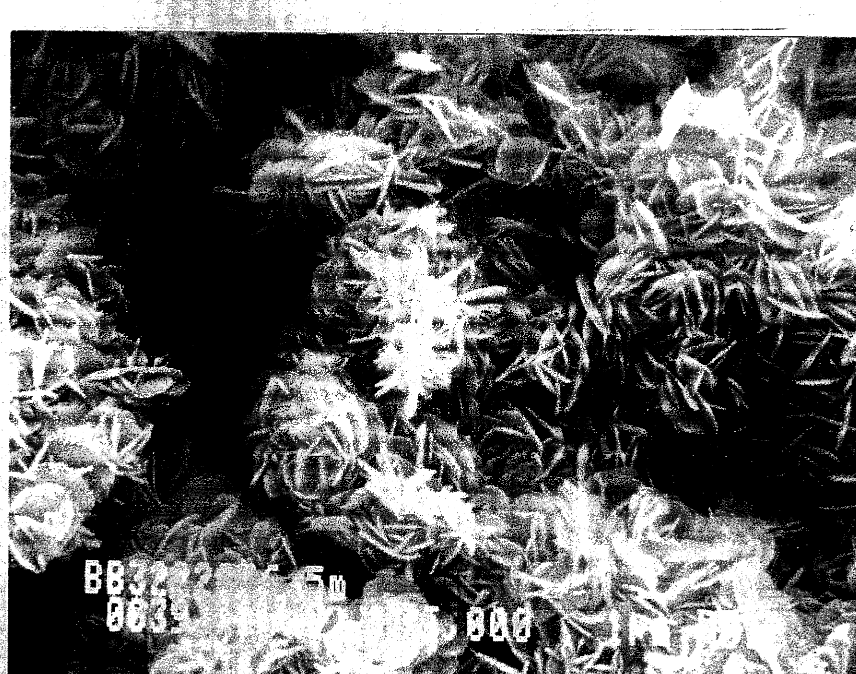
22 2856.5m



2.5X

22 2856.5m

C=carb. 10X



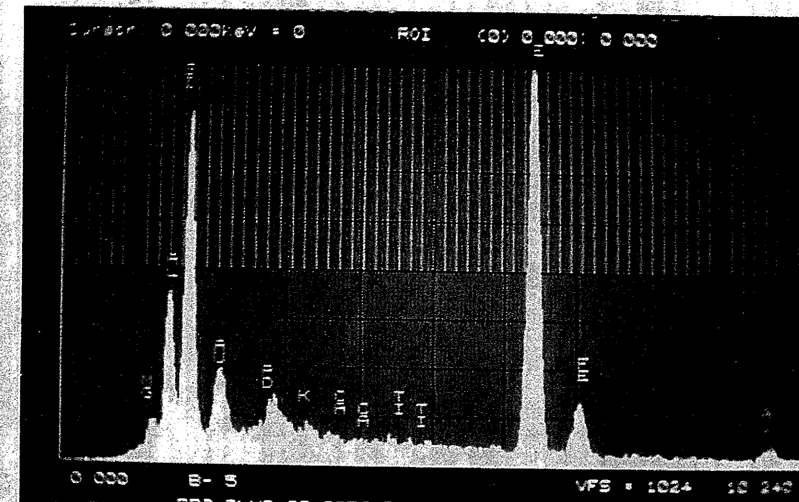


Figure 3A ***Blackback 3*** ***2856.5m (plug 22)***
Diagenetic Fe rich Chlorite [Fe5 Al 5i3 Al 010 (OH8)] filling inter-granular pore space.

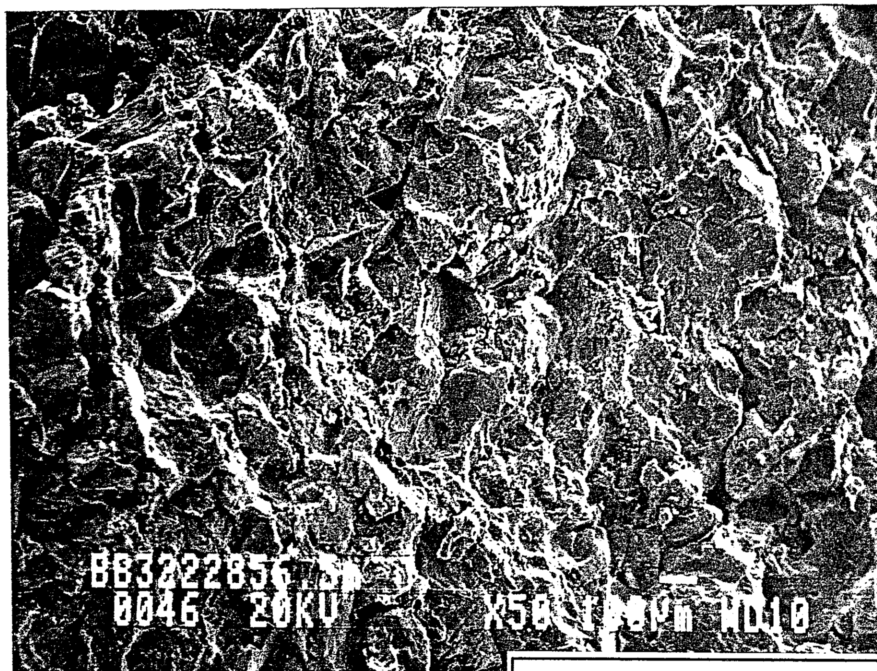
PE905153

This is an enclosure indicator page.
The enclosure PE905153 is enclosed within the container PE900959 at this location in this document.

The enclosure PE905153 has the following characteristics:

ITEM_BARCODE =	PE905153
CONTAINER_BARCODE =	PE900959
NAME =	Blackback-3 SEM photo's
BASIN =	GIPPSLAND
PERMIT =	VIC/P24
TYPE =	WELL
SUBTYPE =	PHOTOMICROGRAPH
DESCRIPTION =	Blackback 3 SEM photo's x50, x100, x600: diagenetic clays have large impact on porosity reduction. Figure 3B of appendix 4 from WCR volume 2.
REMARKS =	This item contains colour.
DATE_CREATED =	30/04/1994
DATE_RECEIVED =	20/10/1994
W_NO =	W1097
WELL_NAME =	Blackback-3
CONTRACTOR =	
CLIENT_OP_CO =	Esso Australia Limited

(Inserted by DNRE - Vic Govt Mines Dept)



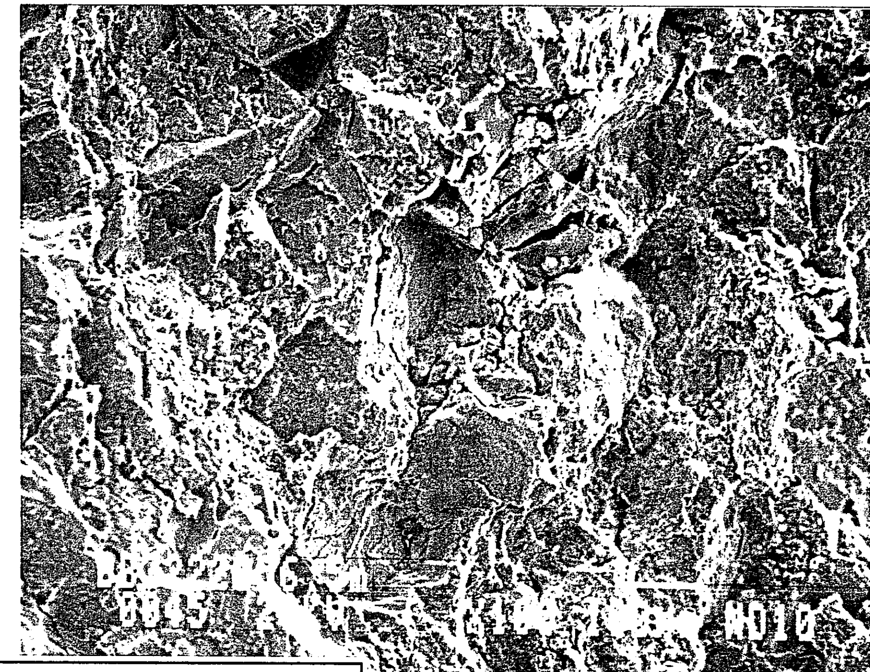


Figure 3B *Blackback 3* *2856.5m (plug 22)*
SEM x 50, x 100, x 600: diagenetic clays have large impact on porosity reduction.

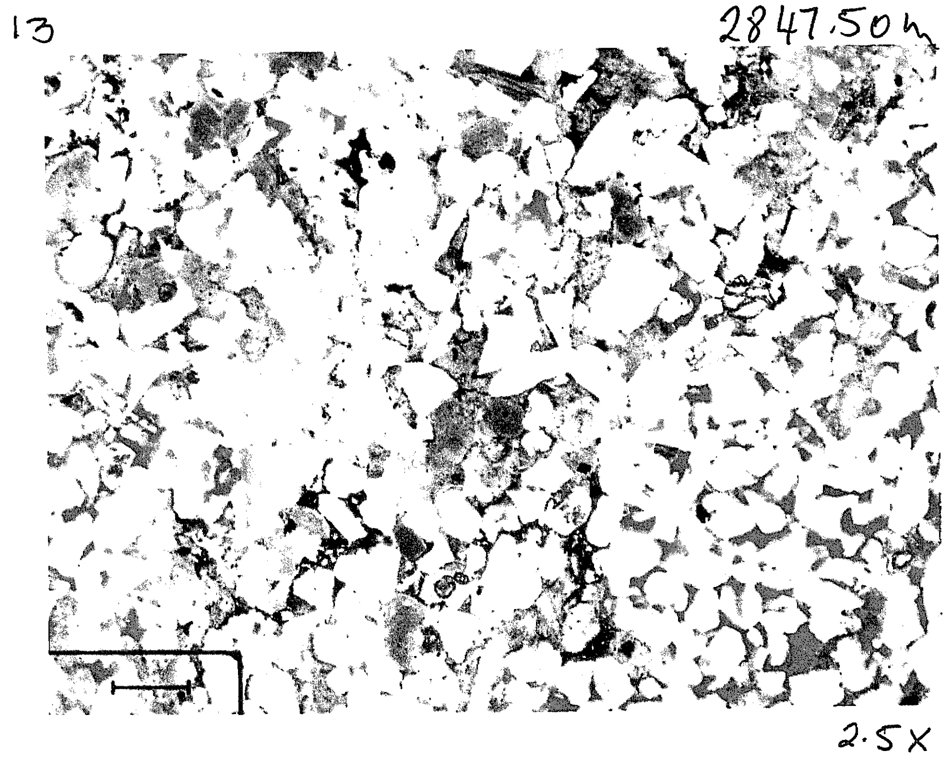
PE905154

This is an enclosure indicator page.
The enclosure PE905154 is enclosed within the container PE900959 at this location in this document.

The enclosure PE905154 has the following characteristics:

ITEM_BARCODE = PE905154
CONTAINER_BARCODE = PE900959
NAME = Photomicrographs showing porosity
BASIN = GIPPSLAND
PERMIT = VIC/P24
TYPE = WELL
SUBTYPE = PHOTOMICROGRAPH
DESCRIPTION = Blackback 3 Photomicrographs showing good intergranular porosity preservation in quartz rich sample. Large porosity reduction where glauconite is present. Figure 4A of appendix 4 from WCR volume 2.
REMARKS = This item contains colour.
DATE_CREATED = 30/04/1994
DATE_RECEIVED = 20/10/1994
W_NO = W1097
WELL_NAME = Blackback-3
CONTRACTOR =
CLIENT_OP_CO = Esso Australia Limited

(Inserted by DNRE - Vic Govt Mines Dept)



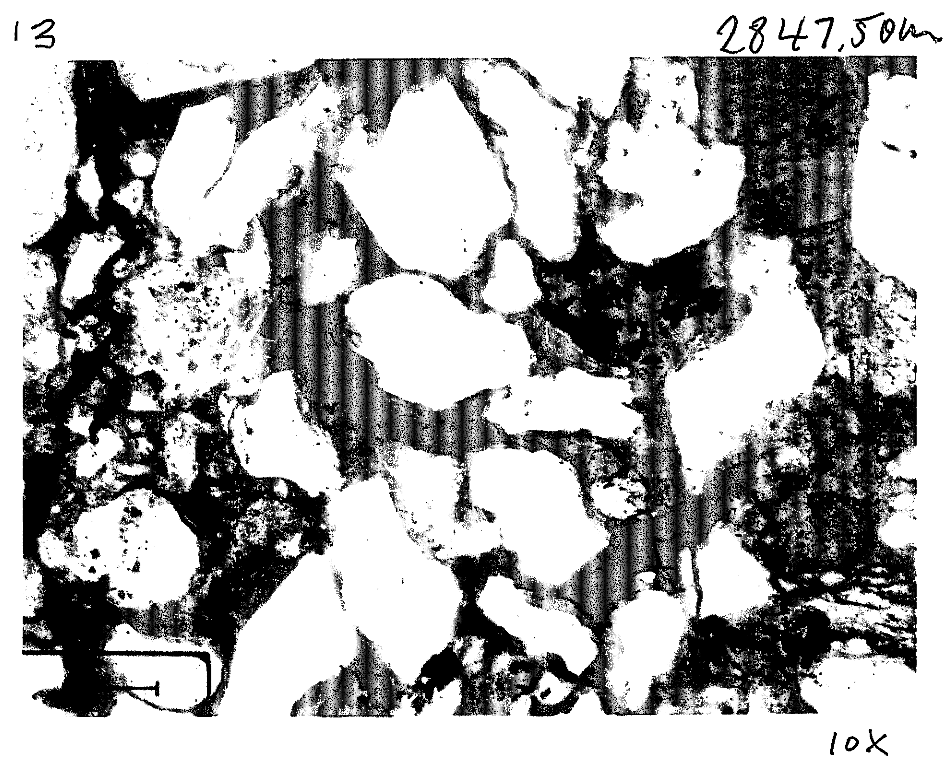


Figure 4A	*Blackback 3*	*2847.5m (plug 13)*

Good intergranular porosity preservation in quartz rich sample. Large porosity reduction where glauconite is present.

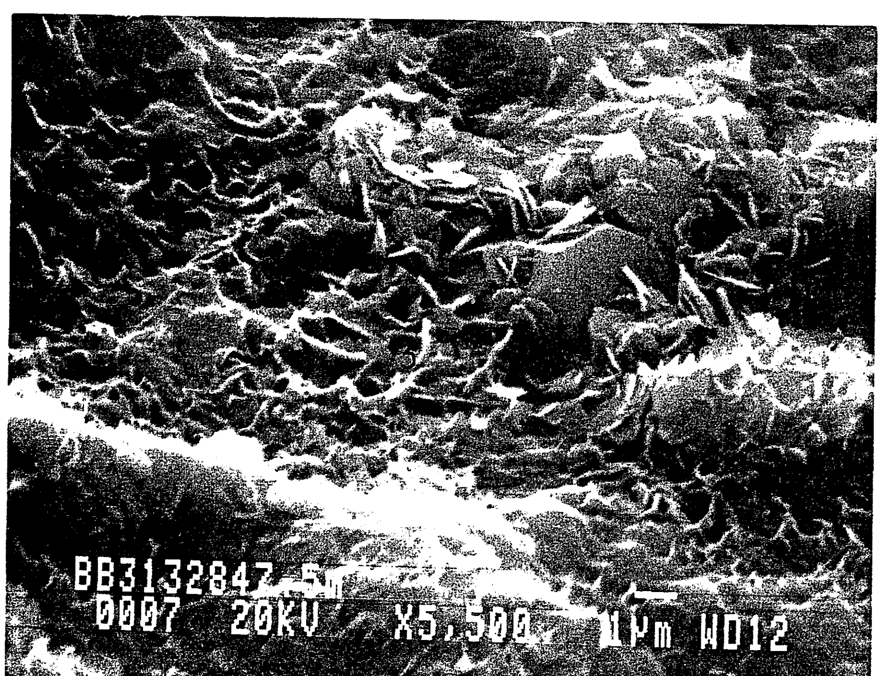
PE905155

This is an enclosure indicator page.
The enclosure PE905155 is enclosed within the container PE900959 at this location in this document.

The enclosure PE905155 has the following characteristics:

ITEM_BARCODE =	PE905155
CONTAINER_BARCODE =	PE900959
NAME =	SEM Photos and SEM abundance graph
BASIN =	GIPPSLAND
PERMIT =	VIC/P24
TYPE =	WELL
SUBTYPE =	PHOTOMICROGRAPH
DESCRIPTION =	SEM photos and SEM element abundance graph of Illitic diagenetic clay coating pore walls. At reservoir conditions this clay is probably more fluffy, extending across proes creating a permeability barrier. Figure4B of appendix 4 from WCR volume 2.
REMARKS =	This item contains colour.
DATE_CREATED =	30/04/1994
DATE_RECEIVED =	20/10/1994
W_NO =	W1097
WELL_NAME =	Blackback-3
CONTRACTOR =	
CLIENT_OP_CO =	Esso Australia Limited

(Inserted by DNRE - Vic Govt Mines Dept)



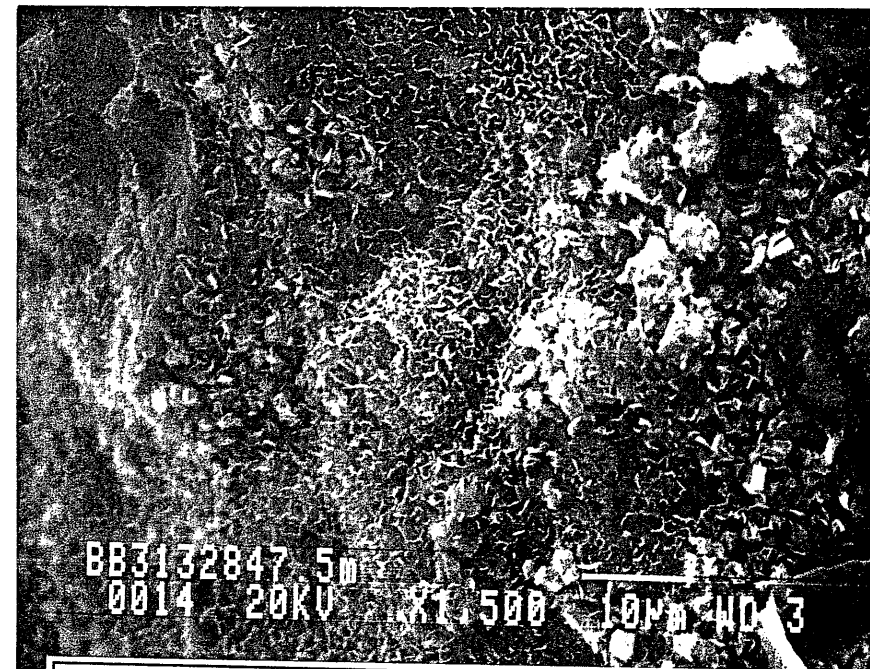
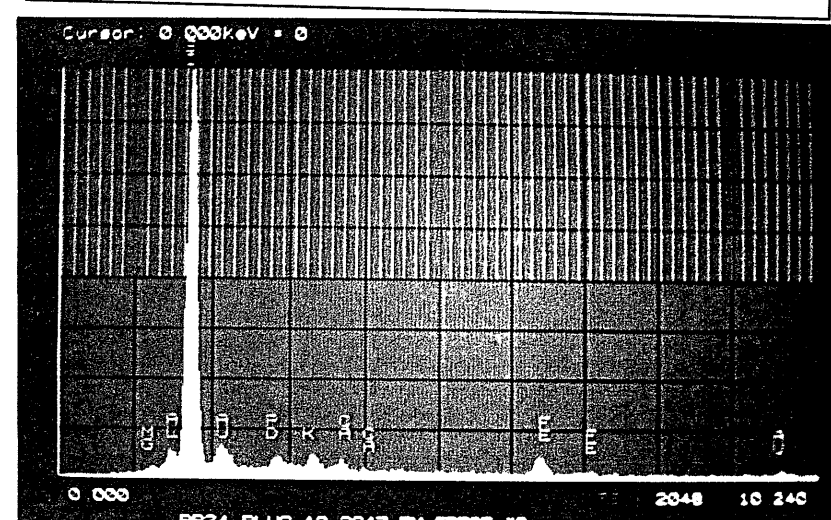


Figure 4B ***Blackback 3*** ***2847.5m (plug 13)***

Illitic diagenetic clay coating pore walls. At reservoir conditions this clay is probably more fluffy, extending across pores creating a permeability barrier.



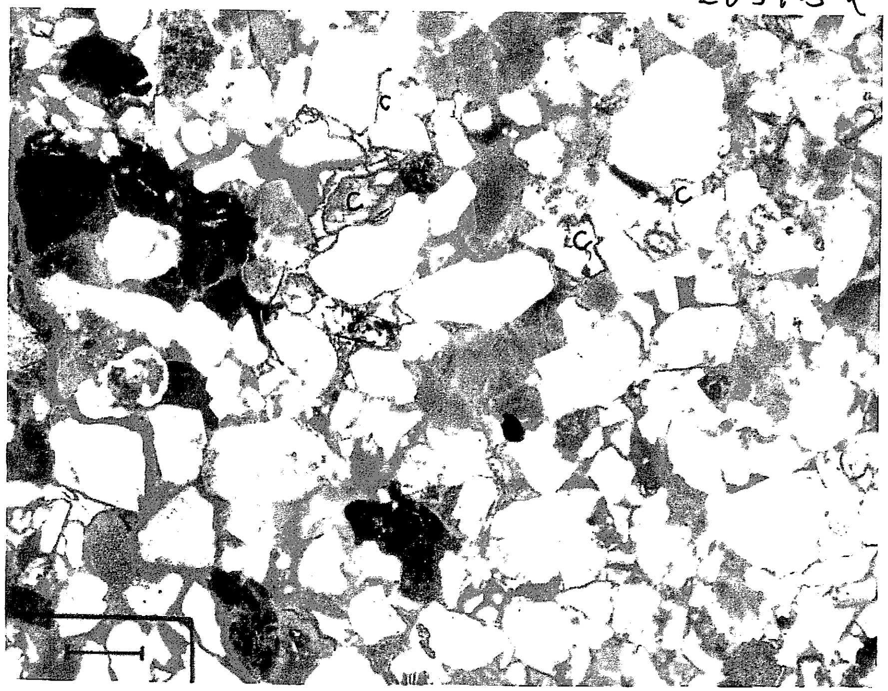
PE905156

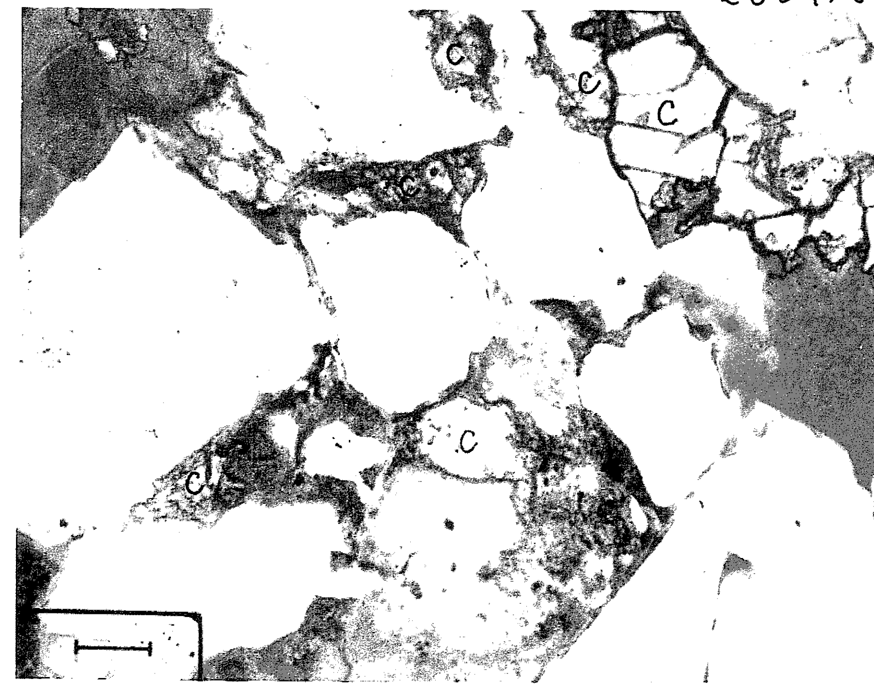
This is an enclosure indicator page.
The enclosure PE905156 is enclosed within the container PE900959 at this location in this document.

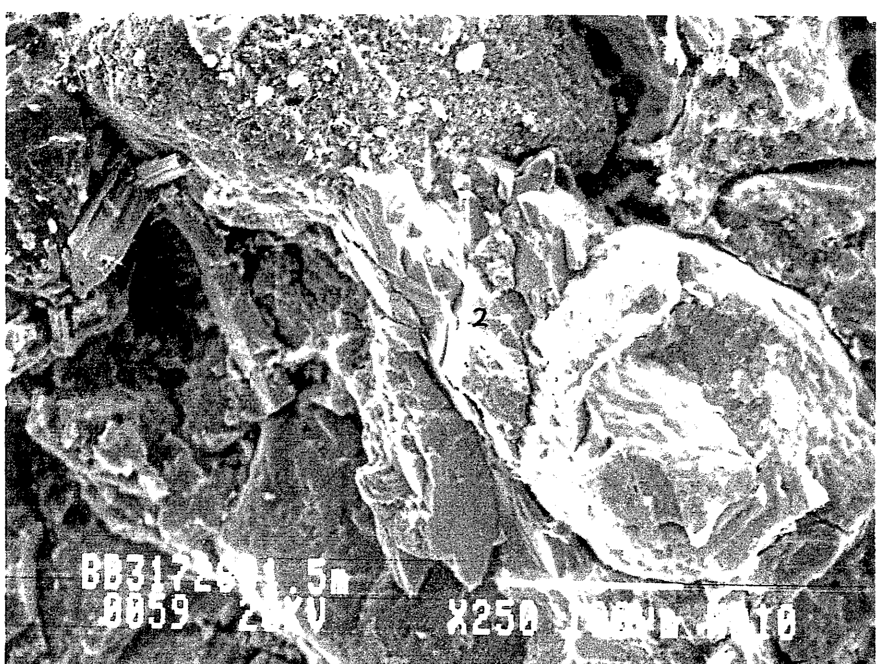
The enclosure PE905156 has the following characteristics:

ITEM_BARCODE =	PE905156
CONTAINER_BARCODE =	PE900959
NAME =	Photomicrographs, SEM and SEM graph
BASIN =	GIPPSLAND
PERMIT =	VIC/P24
TYPE =	WELL
SUBTYPE =	PHOTOMICROGRAPH
DESCRIPTION =	Blackback-3 Photomicrographs, SEM and SEM element abundance graph of Diagenetic Siderite pore filling cement [FeCO3]. Figure 5 of appendix 4 from WCR volume 2.
REMARKS =	This item contains colour.
DATE_CREATED =	30/04/1994
DATE_RECEIVED =	20/10/1994
W_NO =	W1097
WELL_NAME =	Blackback-3
CONTRACTOR =	
CLIENT_OP_CO =	Esso Australia Limited

(Inserted by DNRE - Vic Govt Mines Dept)







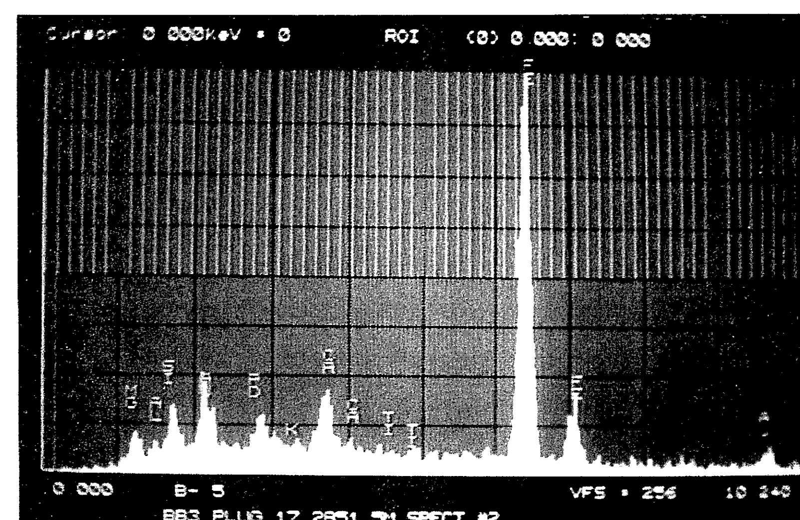


Figure 5 ***Blackback 3*** ***2851.5m (plug 17)***
Diagenetic Siderite pore filling cement [$FeCO_3$].

PE905157

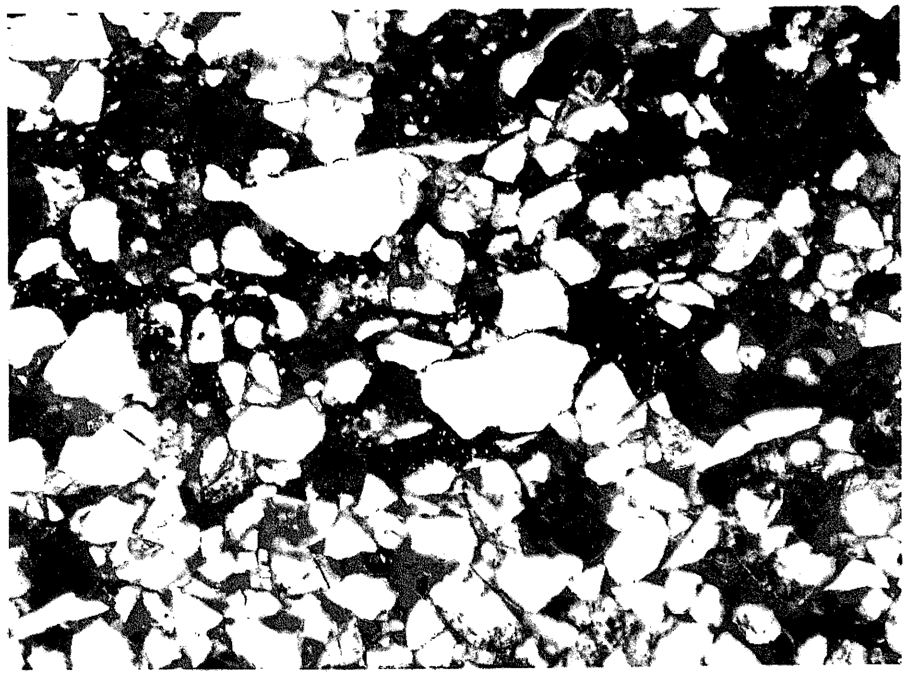
This is an enclosure indicator page.
The enclosure PE905157 is enclosed within the container PE900959 at this location in this document.

The enclosure PE905157 has the following characteristics:

ITEM_BARCODE =	PE905157
CONTAINER_BARCODE =	PE900959
NAME =	Photomicrographs showing porosity
BASIN =	GIPPSLAND
PERMIT =	VIC/P24
TYPE =	WELL
SUBTYPE =	PHOTOMICROGRAPH
DESCRIPTION =	Blackback-3 Photomicrographs showing good interconnected porosity where quartz rich. Glauconite 25% Matrix Clay 6%. Figure 6 of appendix 4 from WCR volume 2.
REMARKS =	This item contains colour.
DATE_CREATED =	30/04/1994
DATE_RECEIVED =	20/10/1994
W_NO =	W1097
WELL_NAME =	Blackback-3
CONTRACTOR =	
CLIENT_OP_CO =	Esso Australia Limited

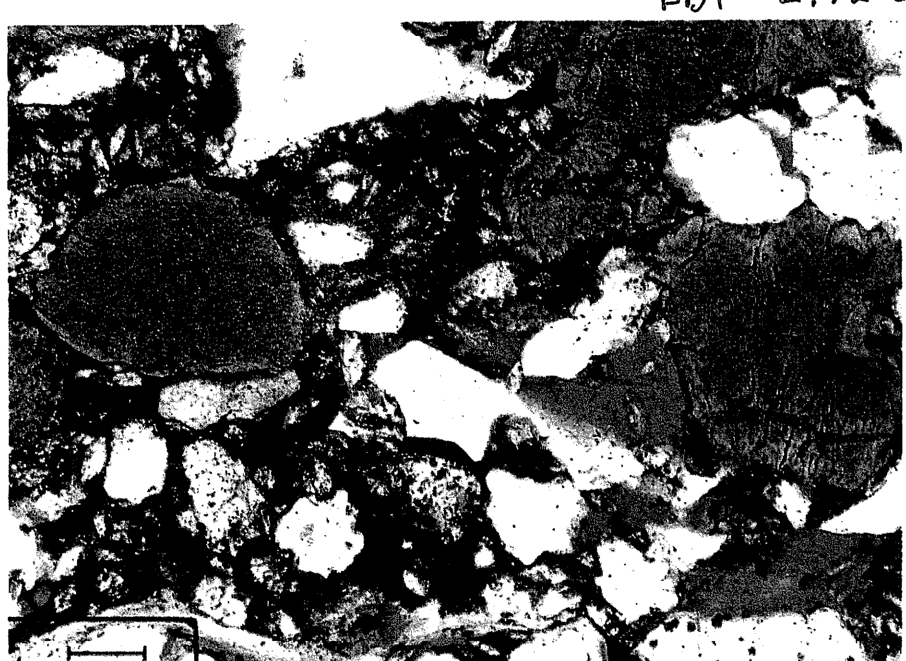
(Inserted by DNRE - Vic Govt Mines Dept)

BB1 2912.2m



2.5X 76903

BB1 2912.2m



76903 10X

Figure 6 **Blackback 1 ST** **2912.2m**
Good interconnected porosity where quartz rich. Glauconite 25% Matrix Clay 6%.

PE905158

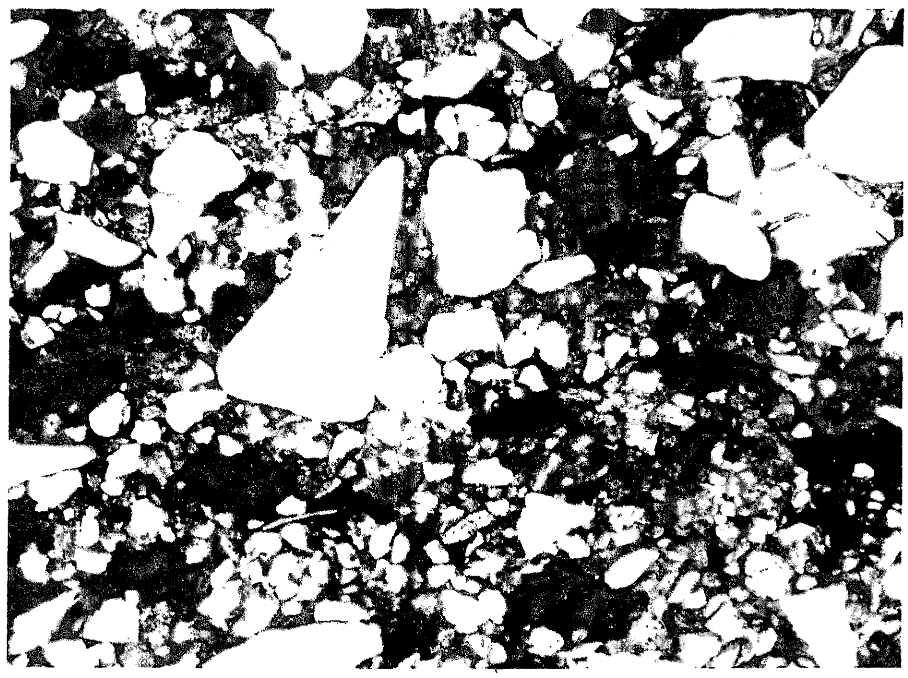
This is an enclosure indicator page.
The enclosure PE905158 is enclosed within the container PE900959 at this location in this document.

The enclosure PE905158 has the following characteristics:

ITEM_BARCODE =	PE905158
CONTAINER_BARCODE =	PE900959
NAME =	Photomicrographs showing porosity
BASIN =	GIPPSLAND
PERMIT =	VIC/P24
TYPE =	WELL
SUBTYPE =	PHOTOMICROGRAPH
DESCRIPTION =	Blackback-3 Glauconitic rich porous sandstone containing 38% Quartz, 10% K-Feldspar, 6% Siderite, 5% Matrix Clay and 24% Glauconite. Figure 7A of appendix 4 from WCR volume 2.
REMARKS =	This item contains colour.
DATE_CREATED =	30/04/1994
DATE_RECEIVED =	20/10/1994
W_NO =	W1097
WELL_NAME =	Blackback-3
CONTRACTOR =	
CLIENT_OP_CO =	Esso Australia Limited

(Inserted by DNRE - Vic Govt Mines Dept)

BB1 2917.00 m



2.5X 76904

BB1 2917.00

76904 10X

Figure 7A **Blackback 1 ST** ***2917m***
Glauconitic rich porous sandstone containing 38% Quartz, 10% K-Feldspar, 6% Siderite, 5% Matrix Clay and 24% Glauconite.

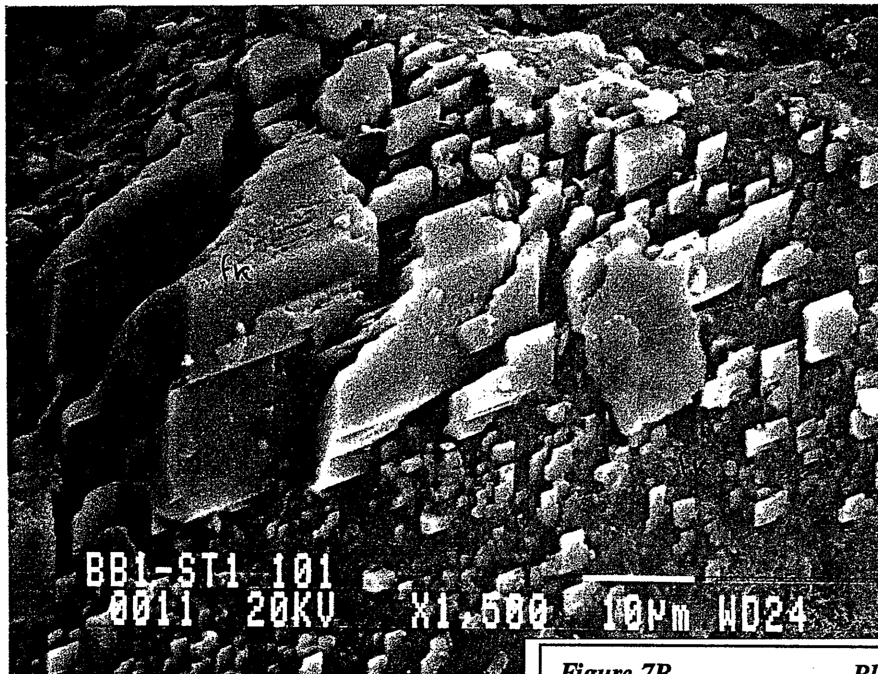
PE905159

This is an enclosure indicator page.
The enclosure PE905159 is enclosed within the container PE900959 at this location in this document.

The enclosure PE905159 has the following characteristics:

ITEM_BARCODE =	PE905159
CONTAINER_BARCODE =	PE900959
NAME =	Blackback-3 SEM photo's
BASIN =	GIPPSLAND
PERMIT =	VIC/P24
TYPE =	WELL
SUBTYPE =	PHOTOMICROGRAPH
DESCRIPTION =	Blackback-3 SEM photo's of K-Feldspar overgrowths on K-Feldspar detrital grain. Cryptocrystalline micro porous chert grain. Figure 7B of appendix 4 from WCR volume 2.
REMARKS =	This item contains colour.
DATE_CREATED =	30/04/1994
DATE_RECEIVED =	20/10/1994
W_NO =	W1097
WELL_NAME =	Blackback-3
CONTRACTOR =	
CLIENT_OP_CO =	Esso Australia Limited

(Inserted by DNRE - Vic Govt Mines Dept)



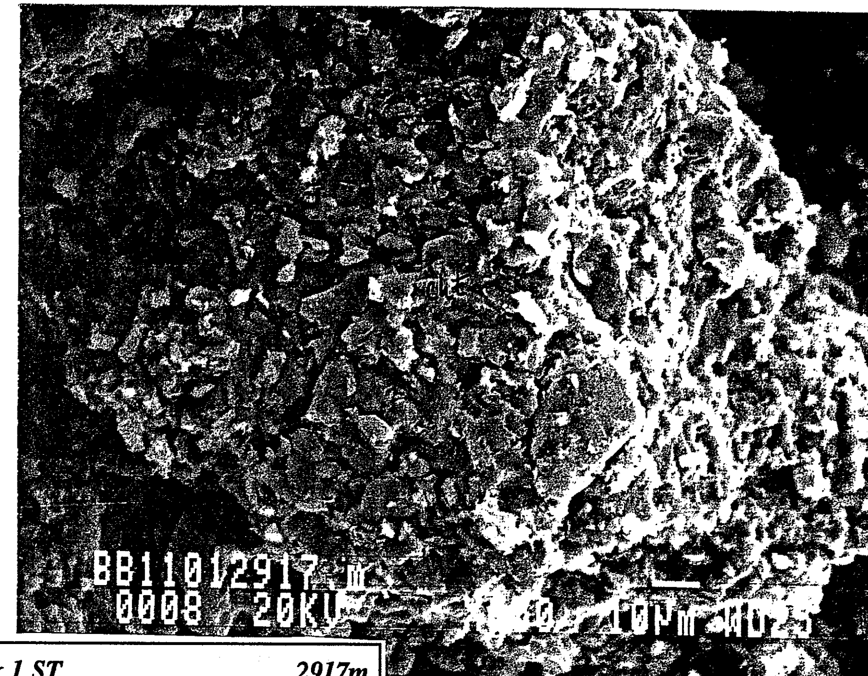
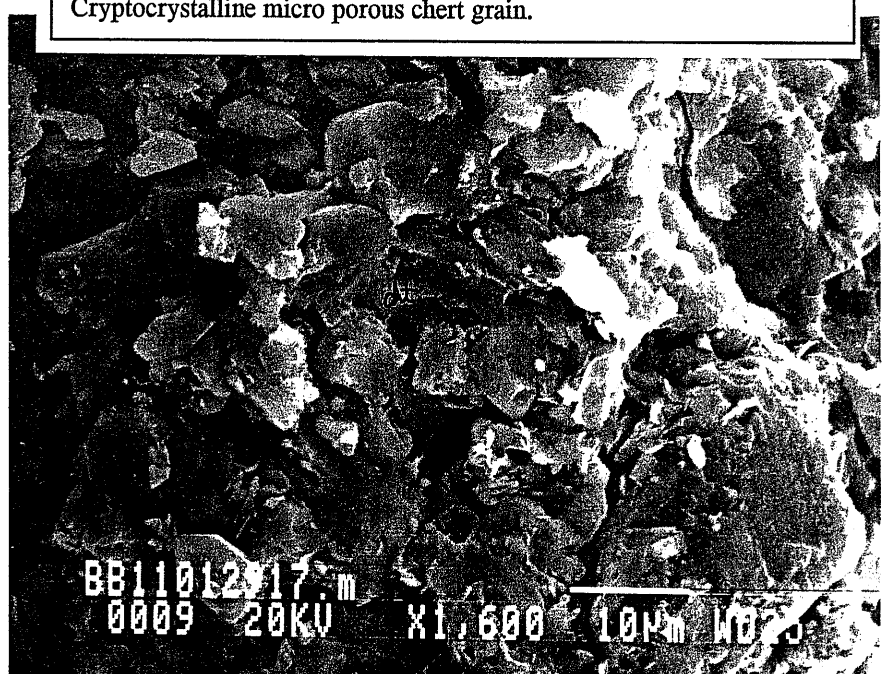


Figure 7B *Blackback 1 ST* *2917m*
K-Feldspar overgrowths on K-Feldspar detrital grain.
Cryptocrystalline micro porous chert grain.



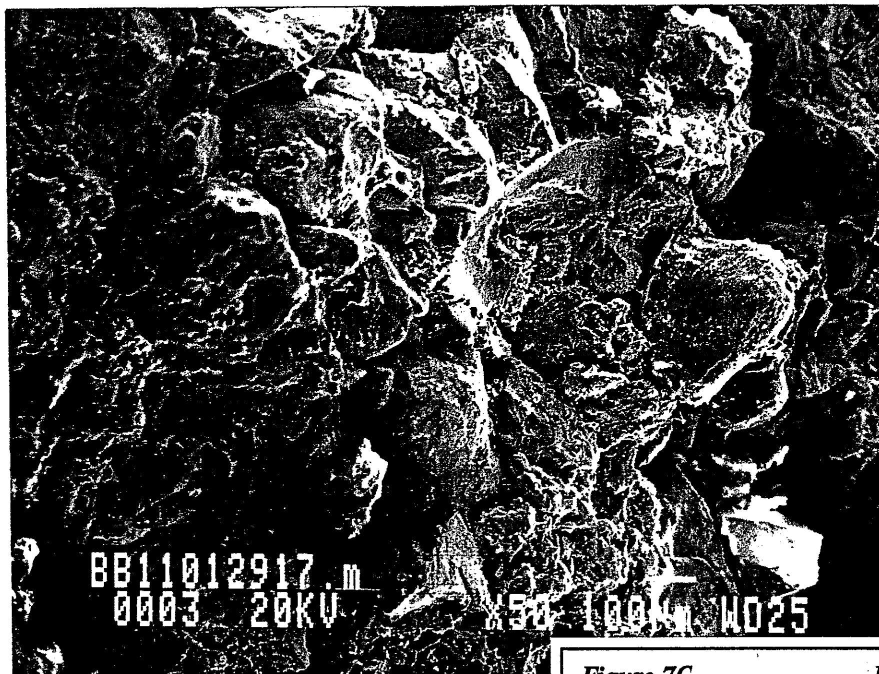
PE905160

This is an enclosure indicator page.
The enclosure PE905160 is enclosed within the container PE900959 at this location in this document.

The enclosure PE905160 has the following characteristics:

ITEM_BARCODE =	PE905160
CONTAINER_BARCODE =	PE900959
NAME =	Blackback-3 SEM photo's
BASIN =	GIPPSLAND
PERMIT =	VIC/P24
TYPE =	WELL
SUBTYPE =	PHOTOMICROGRAPH
DESCRIPTION =	Blackback-3 SEM photo's of Diagenetic Siderite cement filling pore network. Poorly crystaline diagenetic Kaolinite present. Figure 7C of appendix 4 from WCR volume 2.
REMARKS =	This item contains colour.
DATE_CREATED =	30/04/1994
DATE_RECEIVED =	20/10/1994
W_NO =	W1097
WELL_NAME =	Blackback-3
CONTRACTOR =	
CLIENT_OP_CO =	Esso Australia Limited

(Inserted by DNRE - Vic Govt Mines Dept)



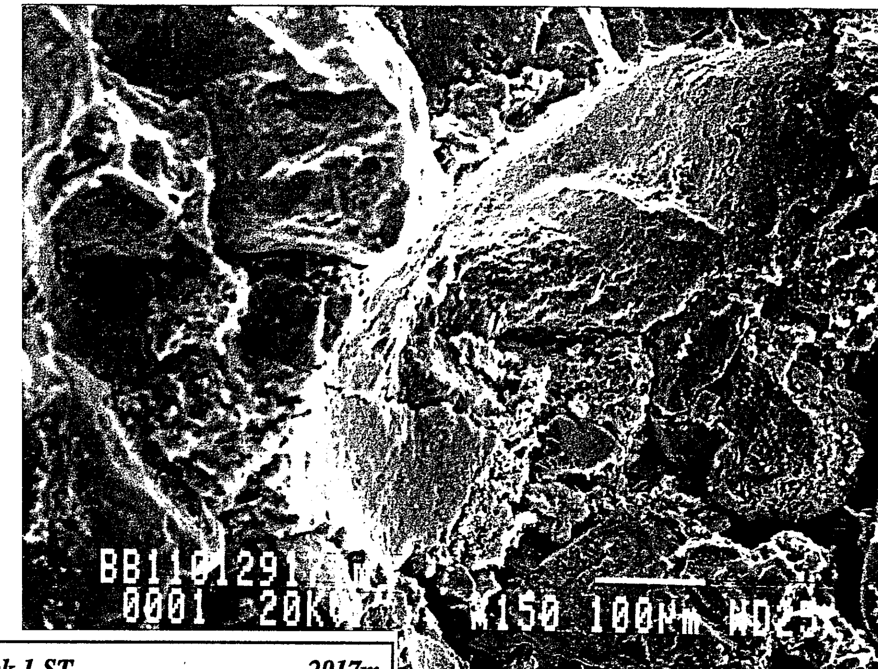
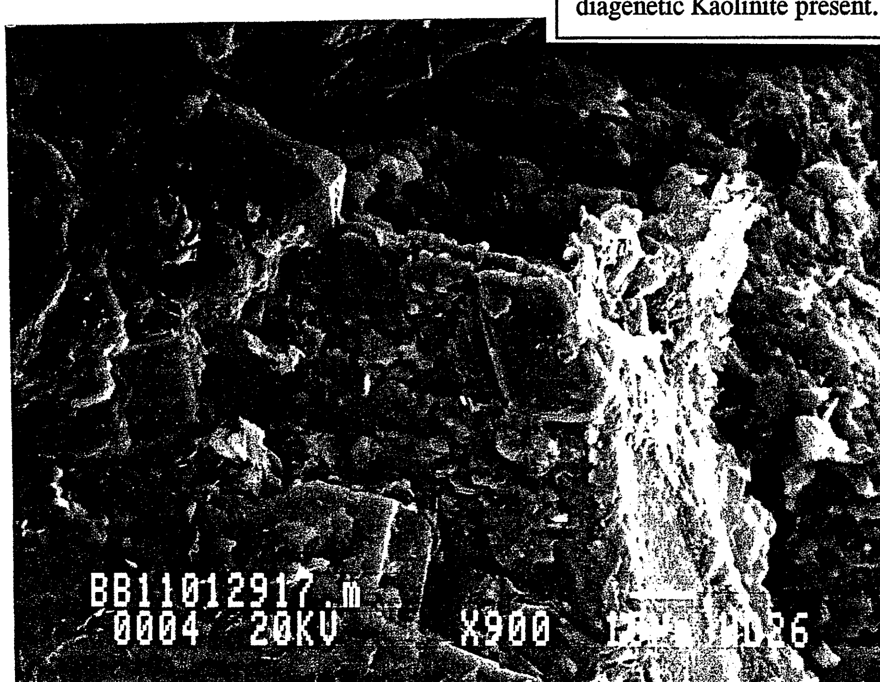
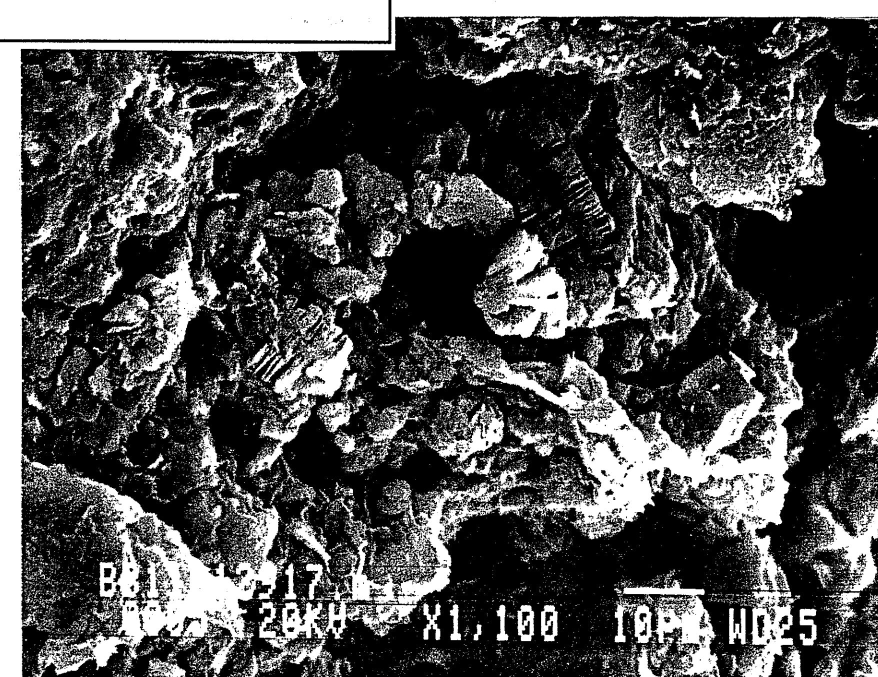


Figure 7C **Blackback 1 ST** *2917m*
Diagenetic Siderite cement filling pore network. Poorly crystalline diagenetic Kaolinite present.





PE905161

This is an enclosure indicator page.
The enclosure PE905161 is enclosed within the container PE900959 at this location in this document.

The enclosure PE905161 has the following characteristics:

ITEM_BARCODE = PE905161
CONTAINER_BARCODE = PE900959
NAME = Photomicrographs & SEM photo's
BASIN = GIPPSLAND
PERMIT = VIC/P24
TYPE = WELL
SUBTYPE = PHOTOMICROGRAPH
DESCRIPTION = Blackback-3 Photomicrographs and SEM photo's of Massive Siderite cement occluding porosity. Figure 7C of appendix 4 from WCR volume 2.
REMARKS = This item contains colour.
DATE_CREATED = 30/04/1994
DATE_RECEIVED = 20/10/1994
W_NO = W1097
WELL_NAME = Blackback-3
CONTRACTOR =
CLIENT_OP_CO = Esso Australia Limited

(Inserted by DNRE - Vic Govt Mines Dept)

BB1 2921.77m

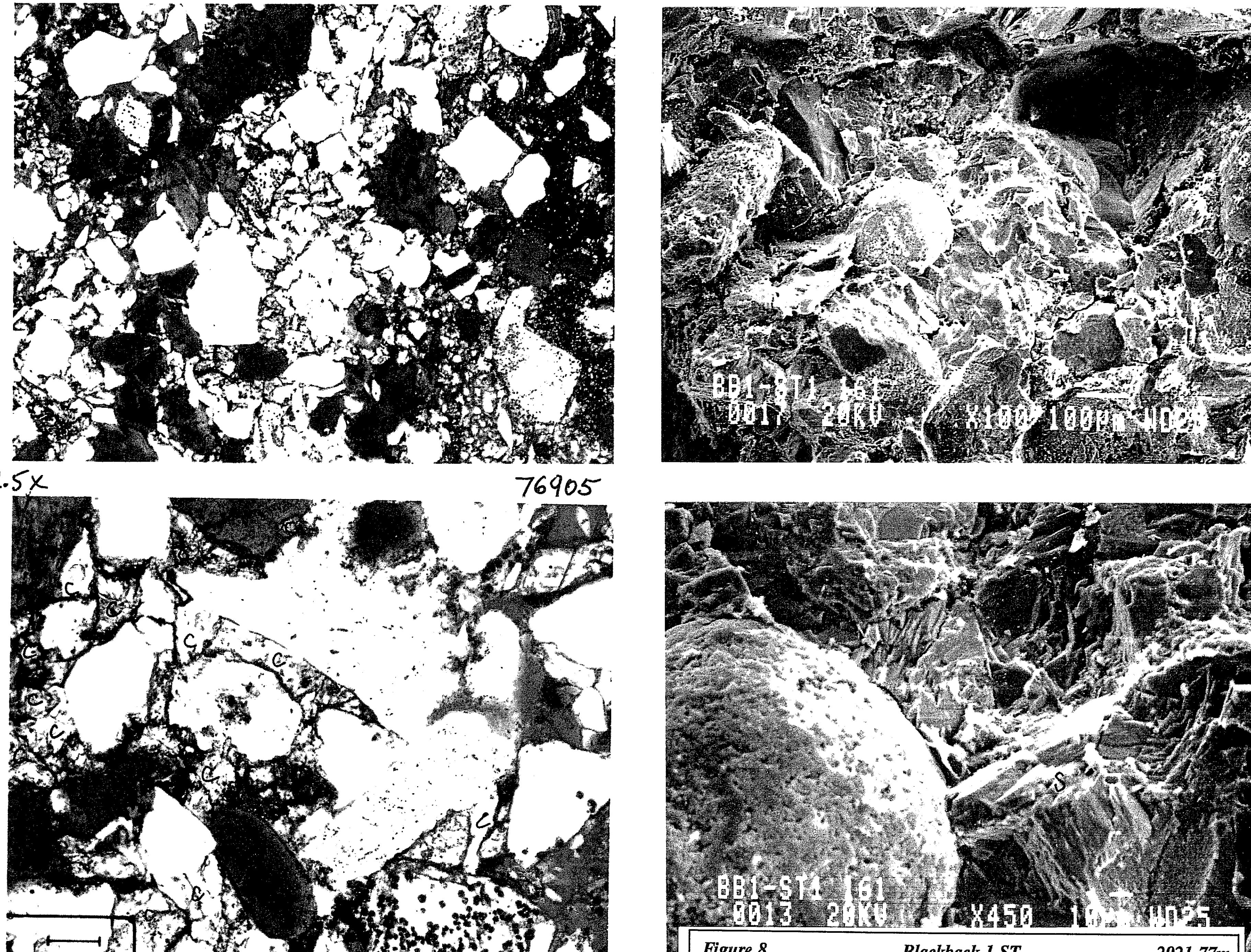


Figure 8 *Blackback 1 ST* *2921.77m*
Massive Siderite cement occluding porosity.

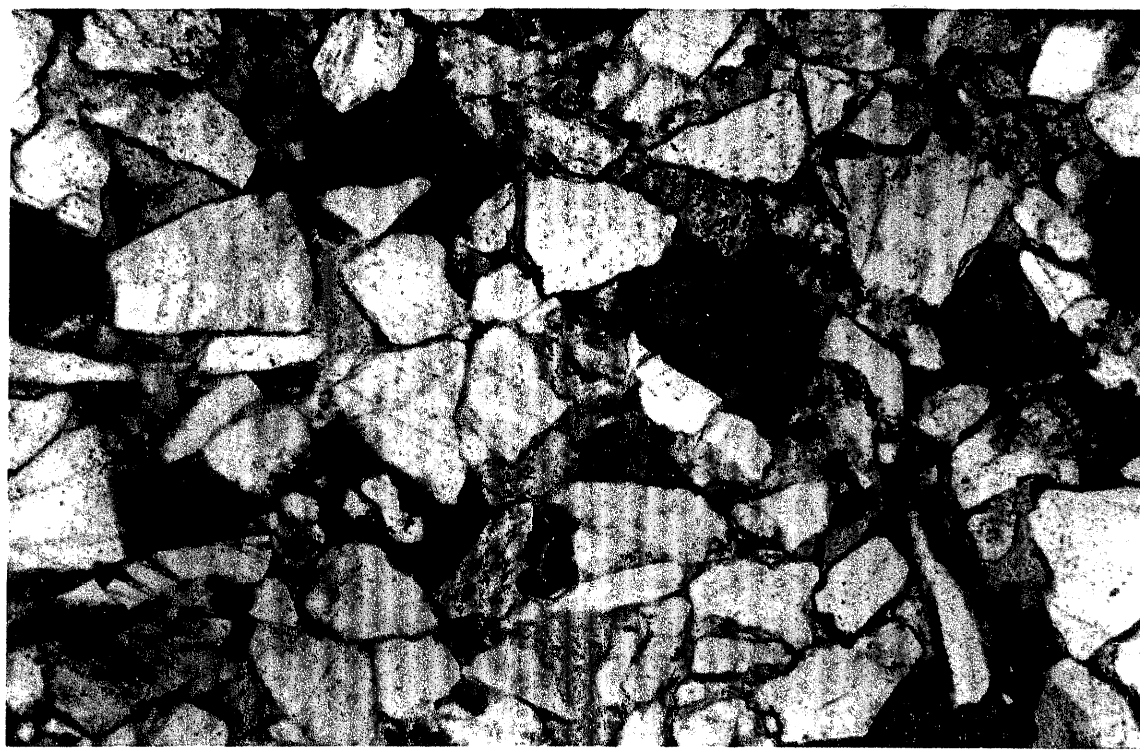
PE905162

This is an enclosure indicator page.
The enclosure PE905162 is enclosed within the container PE900959 at this location in this document.

The enclosure PE905162 has the following characteristics:

ITEM_BARCODE =	PE905162
CONTAINER_BARCODE =	PE900959
NAME =	Blackback-3 Photomicrograph
BASIN =	GIPPSLAND
PERMIT =	VIC/P24
TYPE =	WELL
SUBTYPE =	PHOTOMICROGRAPH
DESCRIPTION =	Blackback-3 Photomicrograph showing relatively limonite-poor and siderite-poor lithology with corresponding large amounts of pores. From appendix 4 of WCR volume 2.
REMARKS =	This item contains colour.
DATE_CREATED =	30/04/1994
DATE_RECEIVED =	20/10/1994
W_NO =	W1097
WELL_NAME =	Blackback-3
CONTRACTOR =	
CLIENT_OP_CO =	Esso Australia Limited

(Inserted by DNRE - Vic Govt Mines Dept)



Core Plug 13 (2904.23 m)

This shows a relatively limonite-poor and siderite-poor lithology with correspondingly large amounts of pores. Near the centre of the field of view are some fresh flakes of biotite, (B).

Figure 9	*Blackback 1 (Original Hole)*
Quartz	53%
Feldspar	1%
Glauconite	15%
Matrix Clay	19%

PE905163

This is an enclosure indicator page.
The enclosure PE905163 is enclosed within the container PE900959 at this location in this document.

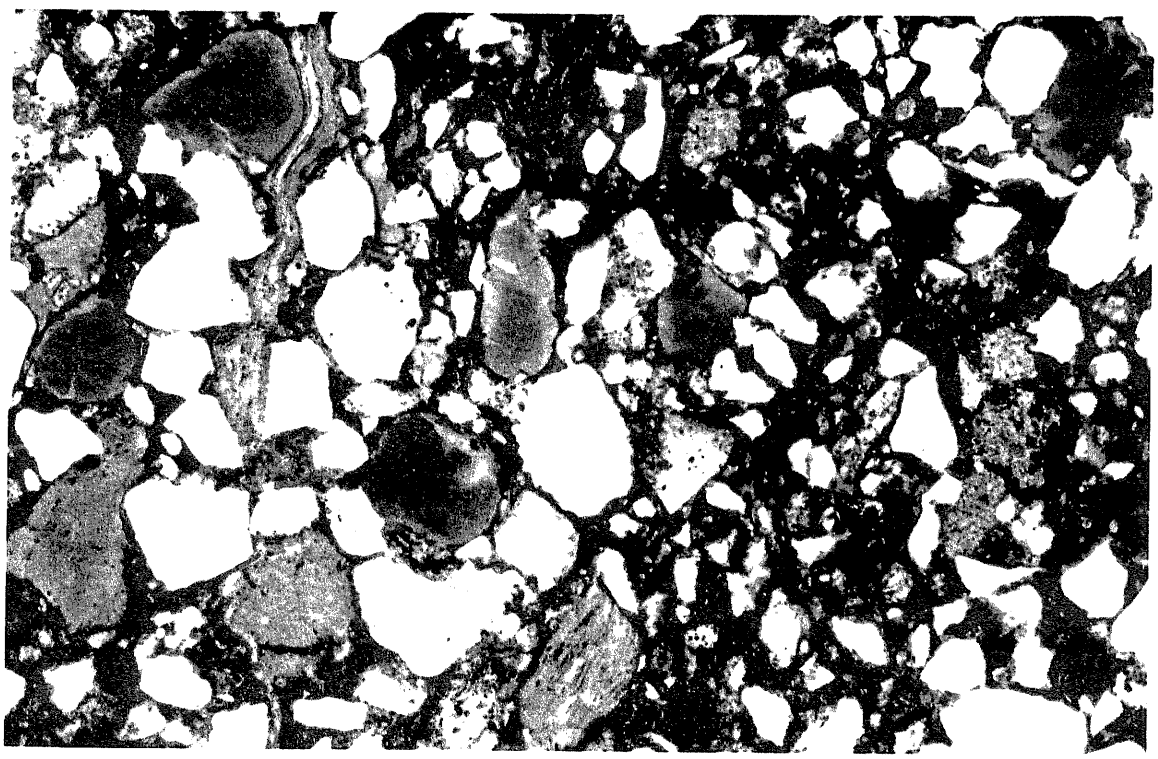
The enclosure PE905163 has the following characteristics:

ITEM_BARCODE =	PE905163
CONTAINER_BARCODE =	PE900959
NAME =	Blackback-3 Photomicrograph
BASIN =	GIPPSLAND
PERMIT =	VIC/P24
TYPE =	WELL
SUBTYPE =	PHOTOMICROGRAPH
DESCRIPTION =	Blackback-3 Photomicrograph thought to consist of semi-amorphous limonitic material (brown) which is relatively abundant. Glauconite (green) is also present. From appendix 4 of WCR volume 2.
REMARKS =	This item contains colour.
DATE_CREATED =	30/04/1994
DATE_RECEIVED =	20/10/1994
W_NO =	W1097
WELL_NAME =	Blackback-3
CONTRACTOR =	
CLIENT_OP_CO =	Esso Australia Limited

(Inserted by DNRE - Vic Govt Mines Dept)

amdel

DEPT. NAT. RES & ENV
PE905163



Core Plug 37 (2906.82 m)

This field shows an area of the rock in which brown matrix material is particularly abundant (especially on the right-hand side of the field). The brown material is thought to consist of probably semi-amorphous limonitic material which may be staining an original clay matrix (probably kaolinite). On the left-hand side of the field of view, green glauconite (G) is more abundant and the rock has a "cleaner" aspect.

Figure 10	*Blackback 1 (Original Hole)*
Quartz	28%
Feldspar	2%
Glauconite	14%
Matrix Clay	16%
Siderite	38%
Point count field of view different from above.	

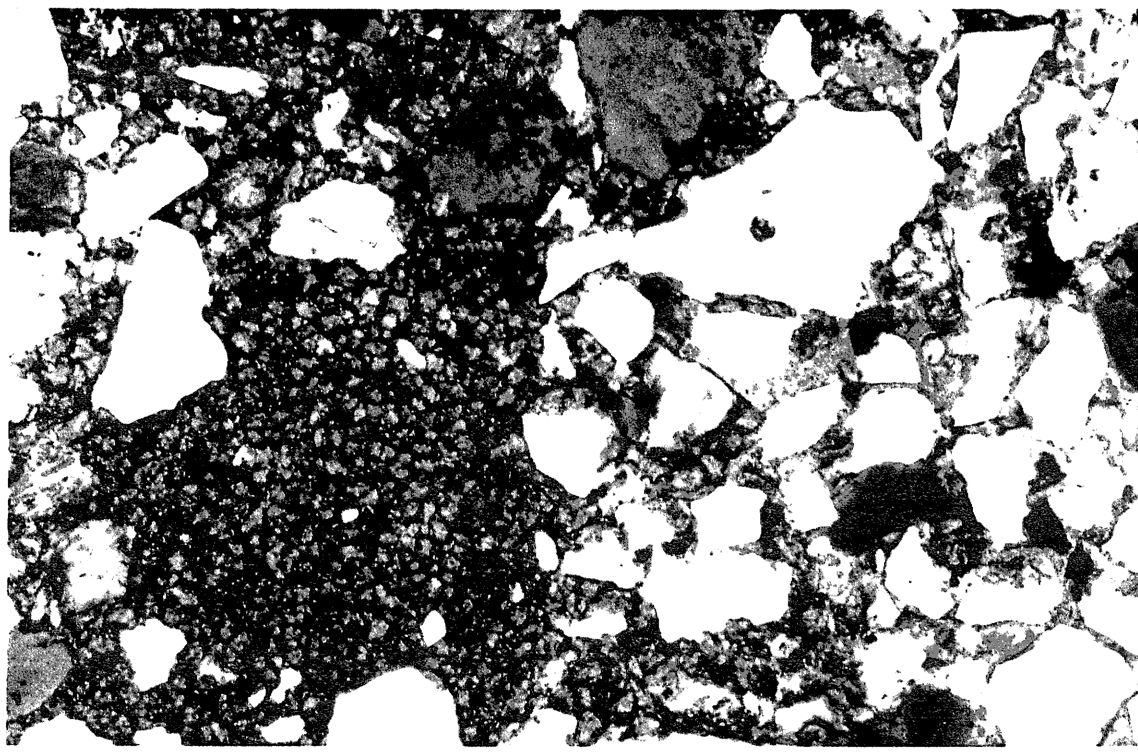
PE905164

This is an enclosure indicator page.
The enclosure PE905164 is enclosed within the container PE900959 at this location in this document.

The enclosure PE905164 has the following characteristics:

ITEM_BARCODE =	PE905164
CONTAINER_BARCODE =	PE900959
NAME =	Blackback-3 Photomicrograph
BASIN =	GIPPSLAND
PERMIT =	VIC/P24
TYPE =	WELL
SUBTYPE =	PHOTOMICROGRAPH
DESCRIPTION =	Blackback-3 Photomicrograph in which siderite shows a rather patchy development. It appears that the siderite aggregates have replaced pre-existing minerals. From appendix 4 of WCR volume 2.
REMARKS =	This item contains colour.
DATE_CREATED =	30/04/1994
DATE_RECEIVED =	20/10/1994
W_NO =	W1097
WELL_NAME =	Blackback-3
CONTRACTOR =	
CLIENT_OP_CO =	Esso Australia Limited

(Inserted by DNRE - Vic Govt Mines Dept)



Core Plug 60 (2908.65 m)

This is a rock in which siderite shows a rather patchy development. The field of view shows, on the left-hand side, a relatively large patch of siderite (larger than adjacent quartz grains) and on the right-hand side a more siderite-poor area in which more blue porosity can be seen. It appears likely from the size and almost monomineralic nature of the siderite aggregates that these have replaced pre-existing minerals.

Figure 11	*Blackback 1 (Original Hole)*
Quartz	35%
Feldspar	2%
Glauconite	12%
Mica	1%
Matrix Clay	4%
Siderite	33%

APPENDIX 5

APPENDIX 5

APPENDIX 5

MDT ANALYSIS

Blackback-3

Wellsite Core Plugs - Porosity and Permeability

and

MDT Drawdown Calculated Effective Permeabilities

April 1994

Mike Scott
Reservoir Technology
Production Department
Esso Australia Ltd.

Contents

1.0 Introduction and Summary

This memo documents the porosity and permeability (P&P) measurements that were obtained from the Blackback-3 (BB-3) well.

Upon encountering Eocene aged reservoir, two important pieces of data were investigated before a well test decision was made. Core plugs (1-1/2" diameter x 2" long) were cut from the 5-1/2" core at the wellsite and sent for routine porosity and permeability analysis at Western Atlas (WA) Core Laboratories in Perth. And, the Schlumberger Modular Dynamics Tool (MDT) was run to measure formation pressures and give an indication of formation productivity.

Table 1 details the core plug porosity and permeability measurements and Table 2 the MDT drawdown calculated permeabilities. Figure 1 demonstrates the porosity versus permeability cross plot and Figure 2 the formation permeability versus depth. For reference, the BKA Field OWC is at a depth of 2859 m MDRKB.

As can be seen from Figures 1 and 2, the majority of permeabilities in the upper "reservoir" zone are less than 1 md which indicates that a tight formation with low production potential.

Reservoir Technology recommended not to production test the well because of the low permeabilities measured in the "reservoir" section. The well was subsequently plugged and abandoned.

2.0 Core Plug Porosity and Permeability Measurements

A total of 18 plugs from Core #1 and 7 plugs from Core #2 were sent to WA Core Laboratories in Perth for P&P analysis.

Because the data was required quickly, the plugs were dried overnight for 12 hours in an oven at 105 degrees centigrade and the P&P was measured on the uncleaned plugs at ambient conditions.

Porosity and grain density was measured by Boyles law helium expansion and the uncleaned permeability was measured by the steady-state permeameter. The data is detailed in Table 1.

Following the initial data transmittal, the plugs were then cleaned via Soxhlet with hot refluxing solvents (toluene for hydrocarbons and methanol for salts) and the plugs dried in an oven at 105 degrees centigrade.

It was noted by WA Corelab that, during the cleaning process, several plugs took longer to clean up than the others and demonstrated a greater oil staining. The plugs demonstrating this extended oil staining were:

Core #1: plugs 1, 3, 9 & 14 and Core #2: plugs 1 & 7.

Because the plugs were cleaned in batch, no oil volume data was reported for the individual plugs. However, oil staining in the plugs was noted down to a depth similar to the common BKA field OWC of 2859 m MDRKB.

After cleaning and drying, P&P was then measured at ambient conditions and at an overburden pressure of 4760 psi. The porosities were measured by helium expansion and the permeabilities were measured by the unsteady-state method on the WA Corelab CMS 300 equipment. This data is also detailed in Table 1.

Figure 1 demonstrates the porosity versus permeability cross-plot from the P&P data.

In general, the BB-3 P&P demonstrated permeabilities 10 times smaller than Blackback-1 within the same porosity class. Blackback-1 was drilled in the Eocene channel east of Blackback-2 and Hapuku-1.

As can be seen from Table 1, P&P at ambient conditions and grain density increases marginally following the cleaning of the plugs. This may indicate that clays or fines in the plug pore throats were removed by the cleaning process. However, the increases in porosity, permeability and grain density are small and therefore this is not considered to be significant.

As can be seen from Table 1 and Figure 1, the majority of the air permeability values are below 1 md indicating a tight formation.

The high grain density (>2.65 gm/cc) of the core plugs demonstrate the high glauconitic and pyritic nature of the plug matrix.

WA Corelab also noted that several plugs had longitudinal fractures which obviously invalidates the permeability measurements. The plugs were:

Core #1: plugs 7 & 13 and Core #2: plugs 4 & 5.

As can be seen from Table 1, when NOBP is applied to the plugs, the fractures close, and the permeability reduces.

3.0 MDT Drawdown Calculated Effective Permeabilities

Table 2 and Figure 2 show the permeabilities calculated from the MDT pretest drawdowns. As can be seen in Figure 2, the MDT drawdown permeabilities are in good agreement with the permeabilities obtained in the P&P analysis.

Due to the small fluid volume withdrawn from the reservoir, typically 10cc to 20cc, the MDT pretest essentially samples mud filtrate. Therefore, to convert the reported mobility to permeability, the mobility has to be multiplied by the mud filtrate viscosity.

Mud filtrate is essentially water. Therefore, using a correlation for water (at a pressure of 4000 psi, a wellbore temperature of approximately 80 degC (176 degF) and a salinity of 35000ppm equivalent NaCl) the mud filtrate viscosity can be reported to be approximately 0.5 cp.

The calculated permeabilities are shown in Table 2.

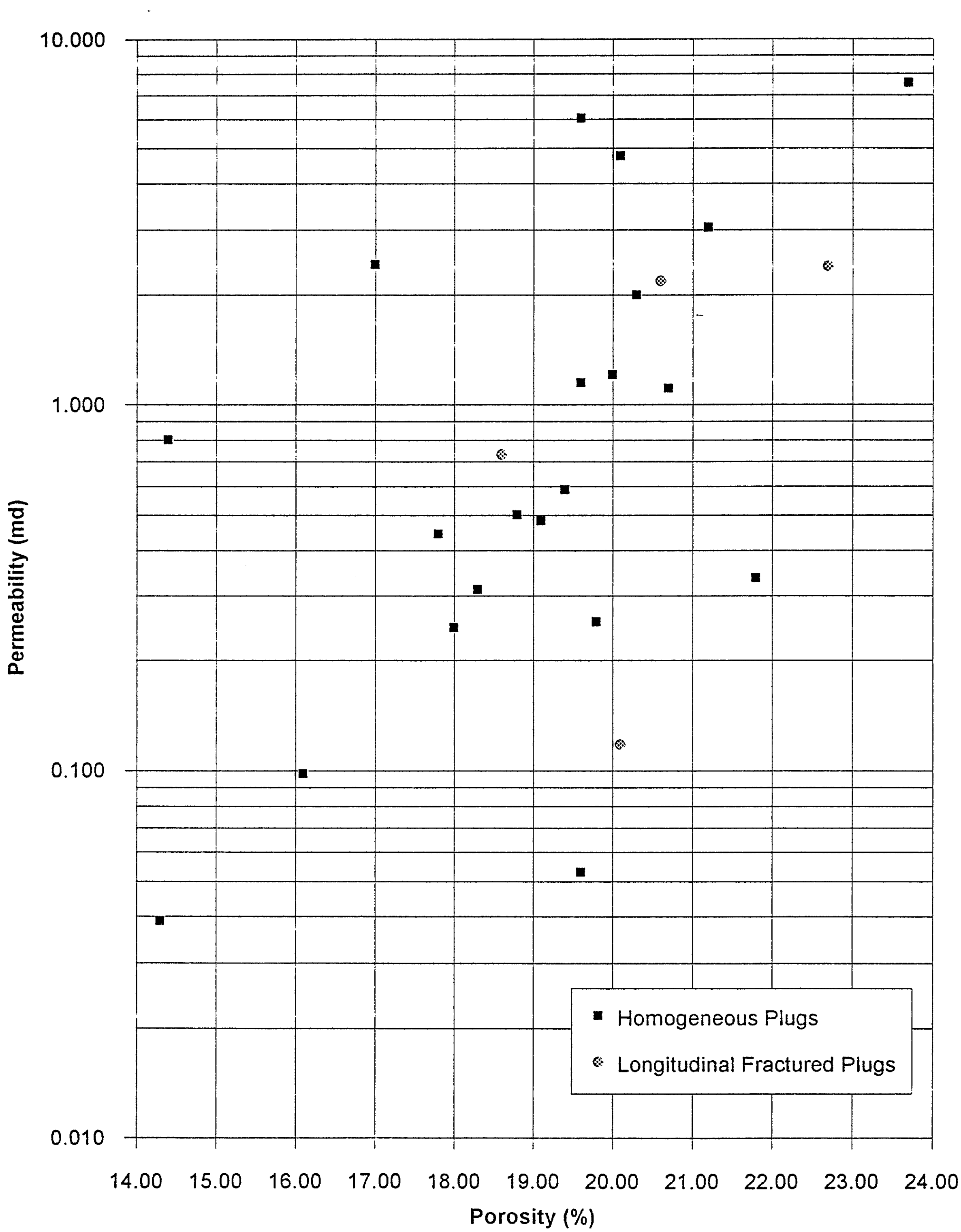
As can be seen from Table 1, Table 2, Figure 1 and Figure 2, the permeabilities in the upper "reservoir" zone are all very low indicating a tight formation.

Below 2875 m MDRKB the MDT permeabilities indicate good quality, high permeable aquifer sands.

Table 1 - Blackback-3 - WA Corelab Porosity and Permeability Results											
Apr-94											
Reference		Depth		Porosity			Permeability			Grain Density	
Core #	Plug #	Core Depth (metres)	Log Depth (m MDRKB)	Rush Analysis Results (%)	Ambient After Cleaning (%)	At 4760 psi NOBP (%)	Rush Analysis Results (md)	Ambient After Cleaning (md)	At 4760 psi NOBP (md)	Rush Analysis Results (gm/cc)	Ambient After Cleaning (gm/cc)
1	1	2835.0	2837.0	14.90	14.90	14.40	0.794	0.978	0.803	2.89	2.89
1	2	2836.0	2838.0	21.70	22.10	21.20	3.480	4.410	3.050	2.76	2.77
1	3	2837.0	2839.0	14.80	15.40	14.30	0.289	0.330	0.039	2.78	2.80
1	4	2838.0	2840.0	17.10	17.10	16.10	0.390	0.409	0.098	2.73	2.73
1	5	2839.0	2841.0	19.30	19.60	18.60	1.450	1.700	0.733	2.72	2.73
1	6	2840.0	2842.0	18.40	18.40	17.00	7.880	8.500	2.420	2.76	2.76
1	7	2841.0	2843.0	20.90	21.40	20.10	67.000	71.000	4.770	2.74	2.75
1	8	2842.0	2844.0	20.80	21.10	20.00	1.890	1.970	1.210	2.71	2.72
1	9	2843.0	2845.0	19.70	20.10	19.10	1.110	1.240	0.484	2.72	2.73
1	10	2844.0	2846.0	18.80	18.80	18.00	0.609	0.609	0.246	2.73	2.73
1	11	2845.0	2847.0	21.40	21.40	20.60	3.520	3.860	2.180	2.72	2.72
1	12	2846.0	2848.0	20.20	20.50	19.40	1.420	1.480	0.588	2.72	2.74
1	13	2847.0	2849.0	20.80	21.10	19.60	49.000	52.000	6.040	2.72	2.72
1	14	2848.0	2850.0	19.20	19.70	18.80	1.080	1.260	0.503	2.74	2.76
1	15	2849.0	2851.0	19.00	19.20	18.30	0.839	1.040	0.312	2.73	2.74
1	16	2850.0	2852.0	20.80	21.30	20.30	3.020	3.840	2.000	2.72	2.74
1	17	2851.0	2853.0	20.20	20.50	19.60	2.080	2.430	1.150	2.74	2.75
1	18	2852.0	2854.0	18.40	18.80	17.80	1.200	1.600	0.446	2.70	2.72
2	1	2853.1	2855.1	23.50	25.20	23.70	18.600	20.100	7.580	2.74	2.78
2	2	2854.0	2856.0	20.40	21.20	20.10	0.769	0.770	0.118	2.78	2.80
2	3	2855.0	2857.0	22.90	23.70	22.70	4.720	5.010	2.390	2.74	2.77
2	4	2856.0	2858.0	20.30	21.00	19.80	5.570	6.540	0.255	2.76	2.78
2	5	2857.0	2859.0	21.40	22.20	20.70	32.000	41.500	1.110	2.78	2.81
2	6	2858.0	2860.0	19.90	20.80	19.60	0.385	0.484	0.053	2.78	2.81
2	7	2859.0	2861.0	22.20	22.90	21.80	1.690	1.750	0.336	2.75	2.76

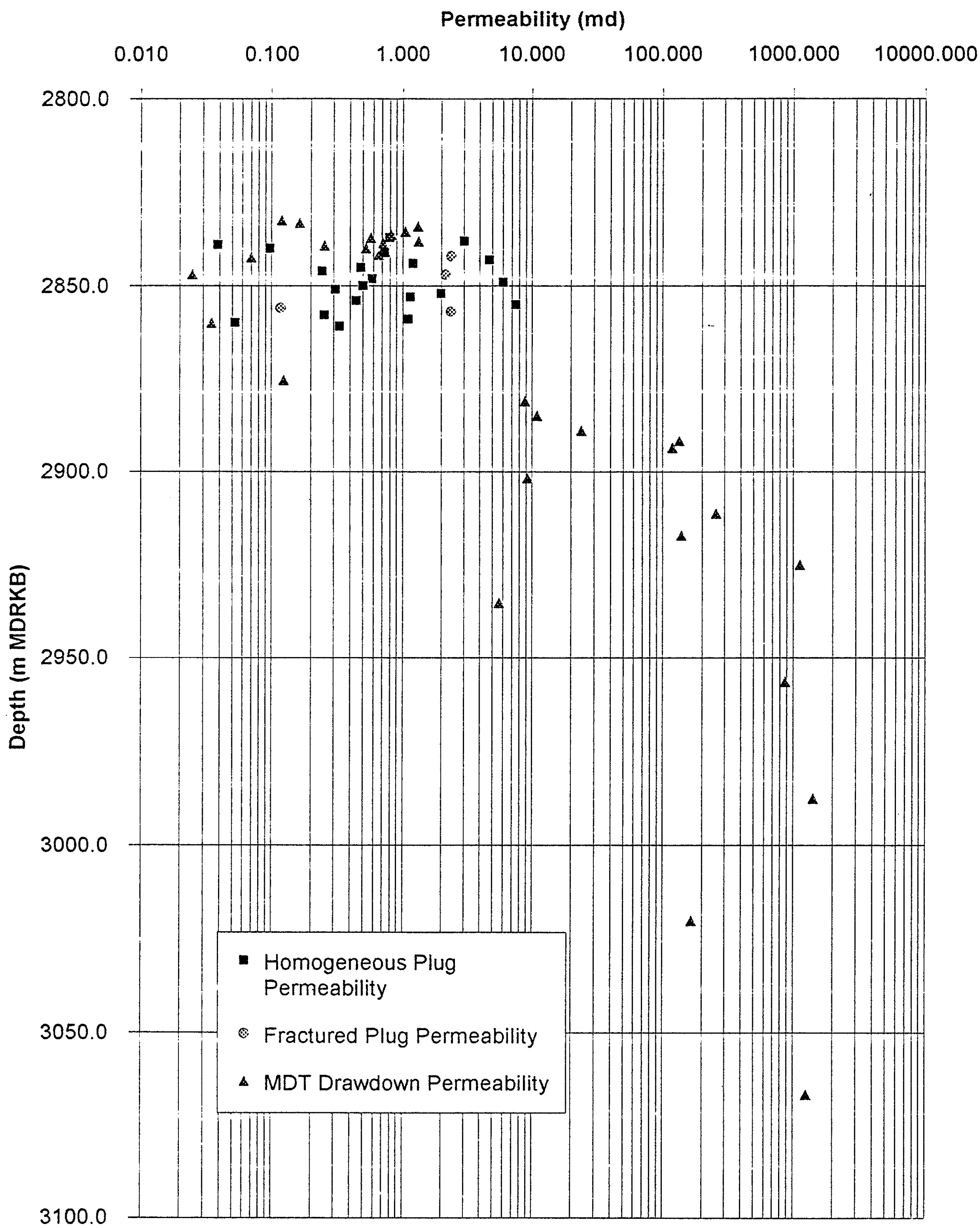
Table 2 - Blackback-3 - MDT Drawdown Calculated Effective Permeabilities				
Apr-94				
Schlumberger Log Reference (Test/File)	EAL MDT Report (Run/Seat)	Log Depth (m MDRKB)	Drawdown Mobility (md/cp)	Drawdown Permeability (md)
1/12	1/1	2832.42	0.24	0.12
2/13	1/2	2833.08	0.33	0.17
3/14	1/3	2834.07	2.64	1.32
4/15	1/4	2835.36	2.10	1.05
5/16	1/5	2836.17	1.64	0.82
6/17	1/6	2837.00	1.15	0.58
8/18	1/7A	2838.07	2.65	1.33
9/19	1/8	2838.50	1.42	0.71
10/20	1/9	2839.17	0.51	0.26
11/21	1/10	2839.88	1.06	0.53
13/23	1/12	2841.57	1.32	0.66
14/24	1/13	2842.31	0.14	0.07
16/26	1/15	2846.84	0.05	0.03
18/28	1/17	2860.03	0.07	0.04
19/29	1/18	2884.88	22.06	11.03
20/30	1/19	2888.88	47.93	23.97
21/31	1/20	2891.68	268.98	134.49
22/32	1/21	2893.57	237.60	118.80
23/33	1/22	2901.68	18.63	9.32
24/34	1/23	2911.04	516.44	258.22
25/35	1/24	2916.91	278.44	139.22
26/36	1/25	2924.83	2268.26	1134.13
27/37	1/26	2935.21	11.20	5.60
28/38	1/27	2956.35	1744.24	872.12
29/39	1/28	2987.32	2855.40	1427.70
30/40	1/29	3020.33	333.05	166.53
31/41	1/30	3066.54	2544.55	1272.28
38/45	1/40	2880.88	17.80	8.90
40/47	1/42	2875.27	0.25	0.13

Figure 1 - BB-3 Porosity versus Permeability @ NOBP



(mts/BB3PHIK.XLS Chart 1)

Figure 2 - BB-3 Permeability versus Depth



BLACKBACK-3

MDT Pressure and Sample Analysis Report

4th & 5th of April 1994

Enrico Bombardieri & Mike Scott
Reservoir Technology
Production Department
Esso Australia Ltd

Contents

1.0 Introduction and Summary

This report details the interpretation of pressure and sample data obtained from the Blackback-3 (BB-3) exploration well.

BB-3 was located 632 278 m east, 5 730 977 m north (latitude 38° 33' 34.85" south, longitude 148° 31' 5.50" east), approximately 18 km south-east of the Mackerel field. Total depth of the well is 3125m MDRKB (KB=25m).

Pressure and sample data were obtained during the 4th and 5th of April 1994 using the Schlumberger Multi Dynamics Tool (MDT) . A total of 36 pressure tests were conducted within the interval 2832.4m to 3066.5 m MDRKB with 22 apparently valid, 4 supercharged, 7 very tight and 3 seat failures. No pressure seats were obtained between 2860m and 2875m MDRKB due to wellbore washout. (1/43 and 1/44 demonstrated seat failures).

Water samples obtained at 2911m MDRKB via the MDT pump-out sub and sample chambers proved to be mud filtrate. This is as expected because of the 1000psi (1.72 psi/m) mud overbalance resulting in mud filtrate flushing the formation. Oil samples were attempted at several locations in the "reservoir" section. The majority failed due to tight/low permeable formation. Samples taken at 2835.5m MDRKB recovered only mud filtrate and exhibited no hydrocarbon sheen.

2.0 Conclusions

Analysis of the pressure and sample data provides the following conclusions:

1. No hydrocarbon/water contacts were able to be identified from the pressure data.
2. No hydrocarbons were recovered from the "reservoir" section of 2832m to 2859m MDRKB.
3. In general, very low permeability (<10 md) exists between 2830m to 2885m MDRKB.
4. A normal 1.437 psi/m aquifer gradient has been interpreted in the deeper high quality Cretaceous sands below 2885m MDRKB.
5. The aquifer drawdown is 82.5psi when compared to the original Gippsland Aquifer pressure. BB-2 was drawn down 79.3psi. This equates to a drawdown of 1.6psi/yr between BB-2 in 1992 and BB-3 in 1994. This is caused by production from the other Bass Strait reservoirs and is considered normal.
6. No valid water samples could be obtained.

3.0 MDT Pressure Tests

Of the 36 pressure tests conducted to confirm fluid gradients and hydrocarbon/water contacts, 22 were apparently valid, 7 very tight, 4 supercharged and 3 lost their seat. Figure 1 details the full pressure data set for BB-3 and Appendix I the individual pressure test results.

Figure 2 details the results obtained in what was believed to be the reservoir region (ie, 2832m to 2859m MDRKB). No oil gradient within this zone could be established and hence, no OWC could be inferred. The reason for the spread of data in Figure 2 is essentially unknown however, two explanations can be hypothesized:

a. The zone is not in good communication with the regional aquifer and therefore pressures within the sands demonstrate varying degrees of drawdown between current and original aquifer pressures.

or

b. The zone has become charged with drilling fluid which has not been able to leak away because of the very low permeability of the formation

Within the "reservoir" zone, results obtained were predominantly very "tight" and demonstrated long build-up times. Figure 3 shows a typical pressure versus time response curve from this low permeability zone.

At depths between 2860m to 2875m MDRKB no data was captured as a result of wellbore washouts. Several attempts were made to obtain data (1/43 & 1/44) however, seat failure prevented this from taking place.

Figure 1 demonstrates the BB-3 aquifer gradient which is 1.437psi/m. The current aquifer pressure is 82.5 psi below the original Gippsland Aquifer gradient at discovery. This is as expected due to production from other reservoirs in the basin and indicates that the lower aquifer sands are in good communication with the regional aquifer.

4.0 MDT SAMPLES

Water

Water samples were initially attempted at 2880.8m MDRKB (1/31) and 2880.3m MDRKB (1/32) but probe plugging prevented samples being obtained. Water samples were then obtained from 2911m MDRKB (1/32 to 1/39).

Two samples (1000cc and 450cc) were obtained from a depth of 2911m after extensive use of the MDT pump-out sub which was used to process several litres of fluid from the formation. Further investigation at the wellsite however revealed the recovered liquid to be mud filtrate. Visual inspection and basic testing revealed that the properties were very similar to the mud composition. This result was not totally unexpected since the mud pressure in the wellbore was 10.25ppg which translates into a pressure over-balance of 1000psi. This overbalance would have flushed the formation water some distance from the wellbore resulting in a low probability of obtaining good formation water samples. As a result, further analysis of the samples was not performed.

Oil

Oil sample pretests were attempted at 2863.3m (1/45), 2854.0m (1/46) and 2849.0m MDRKB (1/47) in order to confirm a hydrocarbon level. However, because of the tightness of the formation, the MDT tool could not withdraw fluid and and therefore no samples were possible.

After an initial pretest (1/48) at 2835.3 m MDRKB an attempt was made to obtain hydrocarbon samples. Initially an attempt was made to fill the 2.75 gallon chamber (1/49). The formation tightness indicated that this would not be possible and therefore an attempt to fill the 450cc chamber (1/50) was made. This also proved unsuccessful and the sampling was aborted. The small amount of liquid captured, 600cc from the 2.75 gallon chamber and 200cc from the 450cc chamber, proved to be mud filtrate which, under visual inspection, did not poses any sign of hydrocarbon sheen.

Table 1 details the full sample history.

Because the sampling was unsuccessful no further PVT analysis or Rheology work was performed.

Appendix I

Full Testing Dataset

Table 1 - Blackback-3 Sample Operation History and Results

Sample Type	Pressure Test Reference	Operation Depth (m MDRKB)	Operation Activity	Volume Pumped (litres)	Operation Time (mins)	General Comments	MDT Resistivity		Volume Recovered (cc)	On-site Fluid Analysis						
							Rw@Start (ohm.m)	Rw@End (ohm.m)		Rw @24deg (ohm.m)	pH	Carbonate CO3 (mg/l)	Bicarbonate HCO3 (mg/l)	Potassium K+ (%)	Chlorides Cl- (ppm)	Colour
Water	1/31	2888.8	Pretest	-	-	Good pretest.										
	1/31	2888.8	Pump out formation	0	22	Probe plugged. Move slightly.										
	1/32	2888.3	Pretest	-	-	Good pretest.										
	1/32	2888.3	Pump out formation	0	13	Probe plugged. Move to new sand.										
	1/33	2911	Pretest	-	-	Good pretest.										
	1/33	2911	Pump out formation	10	18	Good pumpout activity.	0.11	0.07								
	1/34	2911	Open 2.75 gallon chamber	-	19	Probe plugged. Retract and reset.			1000	0.24	6.35	0	550	0.6	16	Grey
	1/35	2911	Pretest	-	-	Good pretest.										
	1/35	2911	Pump out formation	8	12	Good pumpout activity.	0.11	0.07								
	1/36	2911	Open 2.75 gallon chamber	-	5	Probe plugged. Retract and reset.			0							
	1/37	2911	Pretest	-	-	Probe plugged. Retract and reset.										
	1/38	2911	Pretest	-	-	Good pretest.										
	1/38	2911	Pumpout	1	15	Good pumpout activity.	0.11	0.07								
	1/39	2911	Fill 450cc multi-chamber	-	5	Good fill.			450	0.24	6.35	0	550	0.6	16	Grey
Oil	1/43	2868.9	Attempt pretests prior to sampling to demonstrate limits of water oil interface	-	-	Seat failure due to washouts										
	1/44	2868.8		-	-	Seat failure due to washouts										
	1/45	2863.3		-	3	Very tight, no buildup, aborted.										
	1/46	2854		-	3	Very tight, no buildup, aborted.										
	1/47	2849		-	4	Very tight, no buildup, aborted.										
	1/48	2835.3	Pretest	-	3	Good pretest										
	1/49	2835.3	Open 2.75 gallon chamber	-	-	Low productivity, aborted.			600	0.235	7.45	0	845	1.5	15	Grey
	1/50	2835.3	Open 450cc chamber	-	-	Low productivity, aborted.			200	0.235	7.45	0	845	1.5	15	Grey

Figure-1: Blackback-3 MDT Pressure Survey Dataset

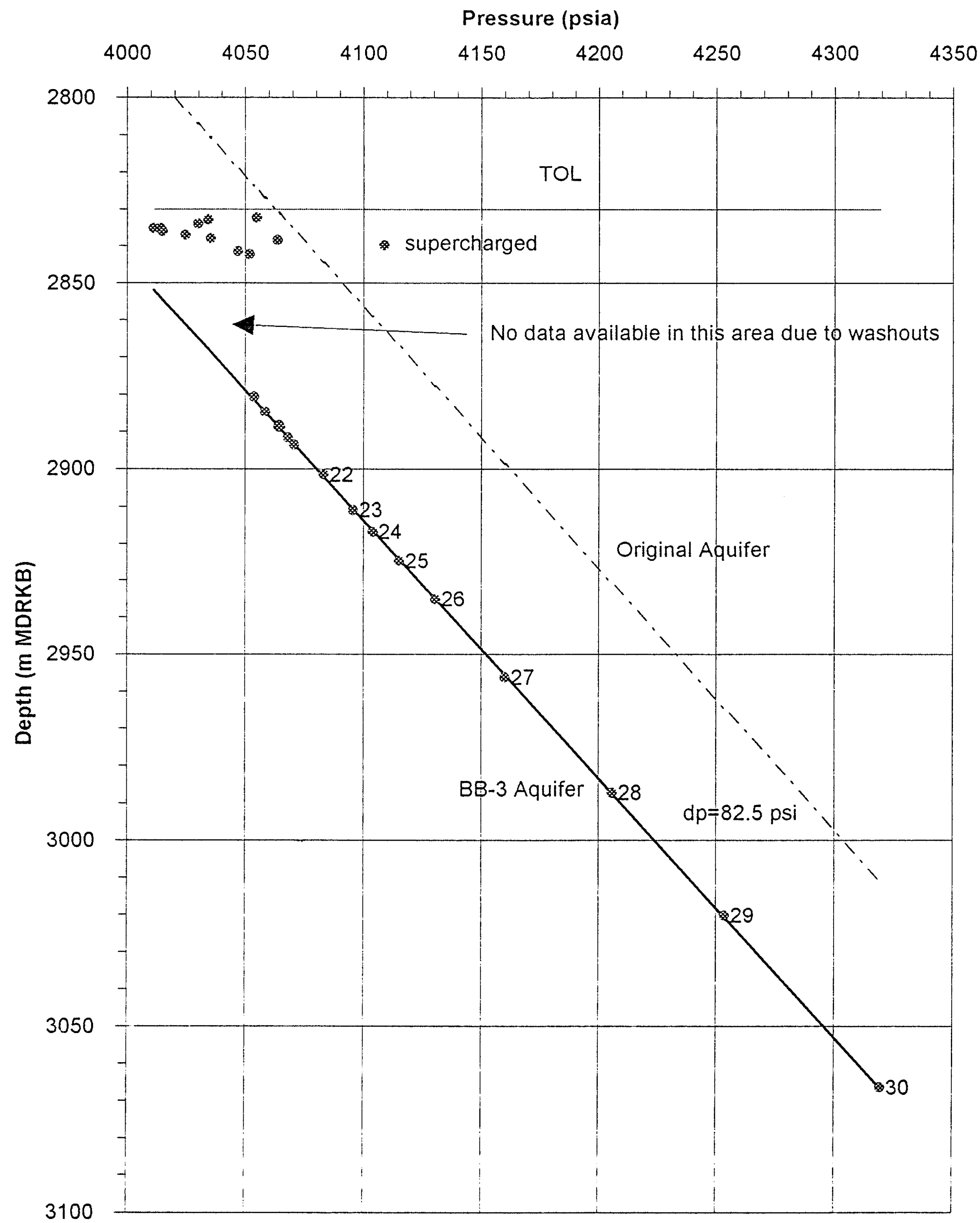


Figure-2: Blackback-3 Reservoir Zone MDT Pressure Survey Dataset

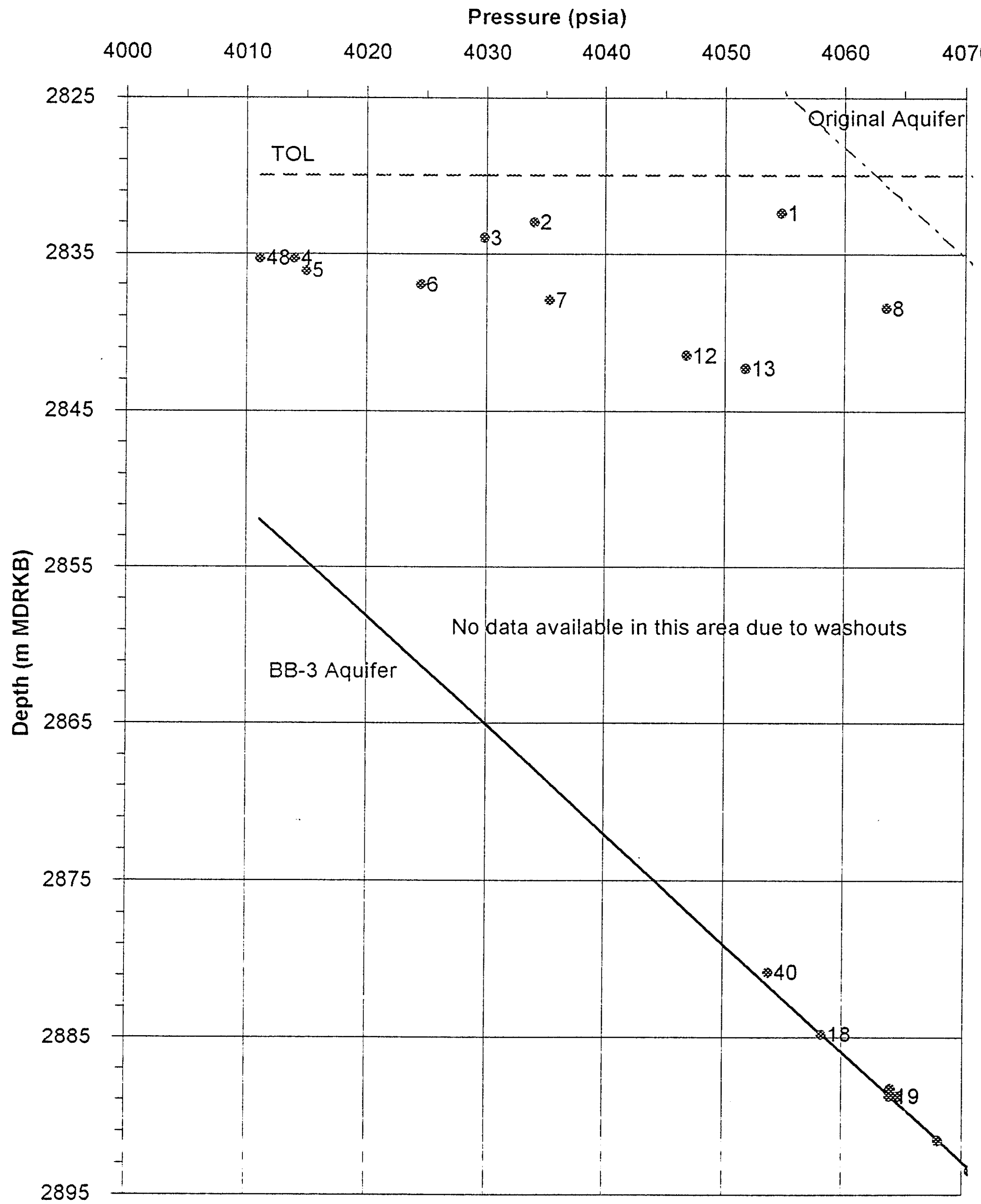
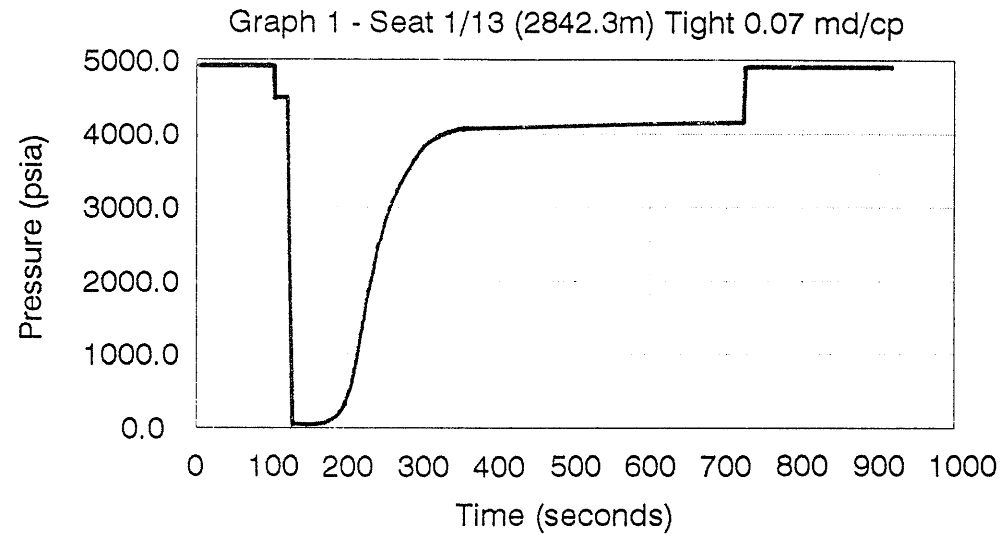
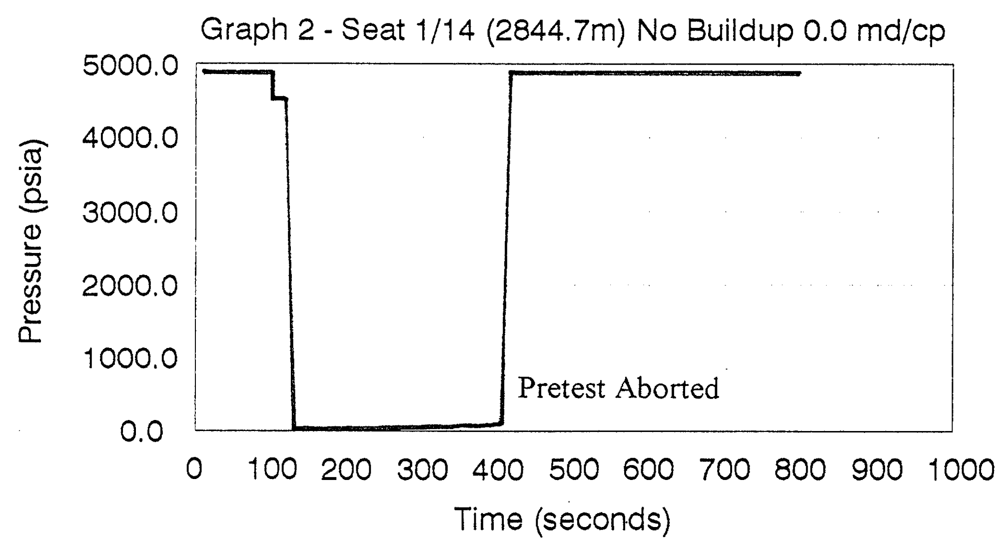
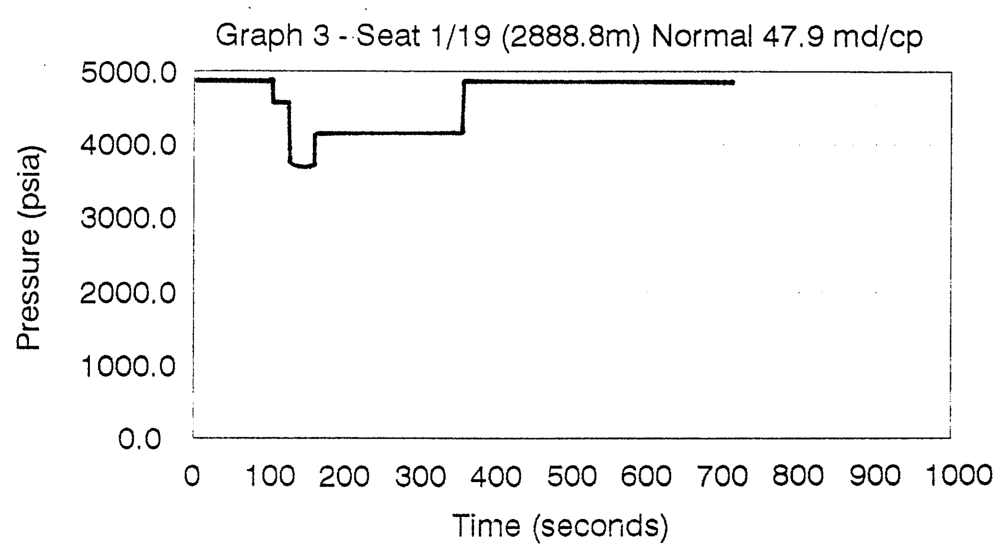


Figure 3 - Typical Pretest Pressure Versus Time Responses







Appendix I

Full Testing Dataset

ESSO AUSTRALIA LTD - MDT PRESSURE DATA

Well	**BLACKBACK-3**	Page	1 of 7
Date	**4-Apr-94 to 5-Apr-94**	Engineer-Geologist	**Mike Scott/Rick Bombardieri/Greg Clota**
Tool Type (MDT, RFT)	**Schlumberger MDT**	KB (metres):	25
Gauge Type	**CQG**	Probe type	**Standard Probe**
Pressure units (psia, psig)	**PSIA**	Temperature units (degF, degC)	**degC**

Run/Seat Number	P=Pretest S=Sample	Depth m MDRKB	Depth m TVDSS	Initial Hydrostatic Pressure	PPg	Time Pretest Start (hh:mm)	Minimum Flowing Pressure	Formation Pressure	PPg	Temp	Time Pretest End (hh:mm)	Final Hydrostatic Pressure	PPg	Total Time Set (mm:ss)	Comments Including Test Quality and Fluid Type.
1/1	✓ P	2832.4	2807.4	4950.5	10.26	19:13	4.6	4054.7	8.40	60.3	19:26	4950.5	10.26	13:00	20cc Withdrawal Tight Formation
1/2	✓ P	2833.0	2808.0	4952.0	10.26	19:35	3.4	4034.0	8.36	62.0	19:43	4952.0	10.26	08:00	10cc Withdrawal Tight Formation 0.3 md/cp
1/3	✓ P	2834.0	2809.0	4953.5	10.26	19:51	1877.2	4029.8	8.34	62.3	19:59	4953.5	10.26	08:00	10cc Withdrawal Normal Pretest 2.6 md/cp
1/4	✓ P	2835.3	2810.3	4956.0	10.26	20:08	1282.9	4014.1	8.31	62.8	20:13	4956.0	10.26	05:00	10cc Withdrawal Normal Pretest 2.1 md/cp
1/5	✓ P	2836.1	2811.1	4957.4	10.26	20:18	872.8	4015.0	8.31	63.1	20:27	4957.4	10.26	09:00	10cc Withdrawal Normal Pretest 1.6 md/cp
1/6	✓ P	2837.0	2812.0	4959.3	10.26	20:34	109.4	4024.5	8.32	63.4	20:43	4959.3	10.26	09:00	10cc Withdrawal Tight Formation 1.1 md/cp
1/7	× P	2838.0	2813.0	4961.0	10.26	20:51	1674.0	-	-	63.9	20:53	4961.0	10.26	02:00	Lost Seat
1/7A	✓ P	2838.0	2813.0	4961.0	10.26	20:54	2194.2	4035.3	8.34	63.8	21:01	4961.0	10.26	07:00	10cc Withdrawal Normal Pretest 2.7 md/cp

ESSO AUSTRALIA LTD - MDT PRESSURE DATA

Well	**BLACKBACK-3**	Page	**2 of 7**
Date	**4-Apr-94 to 5-Apr-94**	Engineer-Geologist	**Mike Scott/Rick Bombardieri/Greg Clota**
Tool Type (MDT, RFT)	**Schlumberger MDT**	KB (metres):	**25**
Gauge Type	**CQG**	Probe type	**Standard Probe**
Pressure units (psia, psig)	**PSIA**	Temperature units (degF, degC)	**degC**

Run/Seat Number	P=Pretest S=Sample	Depth m MDRKB	Depth m TVDSS	Initial Hydrostatic Pressure	PPg	Time Pretest Start (hh:mm)	Minimum Flowing Pressure	Formation Pressure	PPg	Temp	Time Pretest End (hh:mm)	Final Hydrostatic Pressure	PPg	Total Time Set (mm:ss)	Comments Including Test Quality and Fluid Type.
1/8	✓ P	2838.5	2813.5	4962.1	10.26	21:12	425.2	4063.5	8.40	64.0	21:19	4962.1	10.26	07:00	10cc Withdrawal Tight/Normal 1.4 md/cp
1/9	× P	2839.1	2814.1	4963.0	10.26	21:27	35.9	4200+	-	64.3	21:32	4963.0	10.26	05:00	10cc Withdrawal Very Tight Supercharged
1/10	✓ P	2839.8	2814.8	4964.0	10.26	21:39	332.5	4108.7	8.49	64.6	21:54	4964.0	10.26	15:00	10cc Withdrawal Tight Formation 1.1 md/cp
1/11	× P	2840.8	2815.8	4965.8	10.26	22:01	5.8	12.0	0.02	64.4	22:04	4965.8	10.26	03:00	10cc Withdrawal Very Tight Formation No Build-up
1/12	✓ P	2841.5	2816.5	4967.0	10.26	22:11	1360.0	4046.8	8.36	65.0	22:20	4967.0	10.26	09:00	10cc Withdrawal Normal/Slow Buildup 1.3 md/cp
1/13	✓ P	2842.3	2817.3	4968.0	10.26	22:27	6.5	4051.7	8.37	65.3	22:38	4968.0	10.26	11:00	10cc Withdrawal Very Tight/Slow Buildup
1/14	× P	2844.7	2819.7	4971.6	10.26	22:49	5.8	25.0	0.05	65.0	22:57	4971.6	10.26	08:00	10cc Withdrawal Very Tight/ No Buildup
1/15	× P	2846.8	2821.8	4975.5	10.26	23:00	6.0	4390+	-	65.0	23:10	4975.5	10.26	10:00	10cc Withdrawal Tight/Supercharged 0.0 md/cp

ESSO AUSTRALIA LTD - MDT PRESSURE DATA

Well	BLACKBACK-3	Page	3 of 7
Date	4-Apr-94 to 5-Apr-94	Engineer-Geologist	Mike Scott/Rick Bombardieri/Greg Clota
Tool Type (MDT, RFT)	Schlumberger MDT	KB (metres):	25
Gauge Type	CQG	Probe type	Standard Probe
Pressure units (psia, psig)	PSIA	Temperature units (degF, degC)	degC

Run/Seat Number	P=Pretest S=Sample	Depth m MDRKB	Depth m TVDSS	Initial Hydrostatic Pressure	PPg	Time Pretest Start (hh:mm)	Minimum Flowing Pressure	Formation Pressure	PPg	Temp	Time Pretest End (hh:mm)	Final Hydrostatic Pressure	PPg	Total Time Set (mm:ss)	Comments Including Test Quality and Fluid Type.
1/16	× P	2857.6	2832.6	4994.3	10.26	23:20	5.6	9.6	0.02	65.9	23:24	4994.4	10.26	04:00	10cc Withdrawal Tight/ No Buildup 0.0 md/cp
1/17	× P	2860.0	2835.0	4998.3	10.26	23:31	8.4	4530+	-	67.1	23:40	4998.3	10.26	09:00	10cc Withdrawal Tight/Supercharged 0.1 md/cp
1/18	✓ P	2884.8	2859.8	5040.9	10.25	23:51	3956.0	4058.3	8.26	68.0	23:55	5041.1	10.26	04:00	10cc Withdrawal Good/Normal 22.1 md/cp
1/19	✓ P	2888.8	2863.8	5047.9	10.25	0:05	3925.0	4064.0	8.26	68.7	0:07	5048.0	10.25	02:56	20cc Withdrawal Good 47.9 md/cp
1/20	✓ P	2891.6	2866.6	5052.7	10.25	0:14	4058.9	4068.0	8.26	69.2	0:19	5053.0	10.26	05:56	20cc Withdrawal Good test 269.0 md/cp
1/21	✓ P	2893.5	2868.5	5056.1	10.25	0:25	4011.5	4070.7	8.26	69.7	0:29	5056.1	10.25	04:56	20cc Withdrawal Good test 237.6 md/cp
1/22	✓ P	2901.6	2876.6	5069.7	10.25	0:38	3731.0	4083.2	8.26	70.1	0:41	5069.8	10.25	03:00	20cc Withdrawal Good test 18.6 md/cp
1/23	✓ P	2911.0	2886.0	5085.9	10.25	0:50	4083.6	4095.6	8.26	70.6	0:54	5085.8	10.25	04:00	20cc Withdrawal Good test 516.4 md/cp

ESSO AUSTRALIA LTD - MDT PRESSURE DATA

Well	**BLACKBACK-3**	Page	**4 of 7**
Date	**4-Apr-94 to 5-Apr-94**	Engineer-Geologist	**Mike Scott/Rick Bombardieri/Greg Clota**
Tool Type (MDT, RFT)	**Schlumberger MDT**	KB (metres):	**25**
Gauge Type	**CQG**	Probe type	**Standard Probe**
Pressure units (psia, psig)	**PSIA**	Temperature units (degF, degC)	**degC**

Run/Seat Number	P=Pretest S=Sample	Depth m MDRKB	Depth m TVDSS	Initial Hydrostatic Pressure	PPg	Time Pretest Start (hh:mm)	Minimum Flowing Pressure	Formation Pressure	PPg	Temp	Time Pretest End (hh:mm)	Final Hydrostatic Pressure	PPg	Total Time Set (mm:ss)	Comments Including Test Quality and Fluid Type.
1/24	✓ P	2916.9	2891.9	5096.0	10.25	1:00	4079.8	4104.0	8.26	71.1	1:05	5096.0	10.25	05:56	20cc Withdrawal Good test 278.4 md/cp
1/25	✓ P	2924.8	2899.8	5109.4	10.25	1:12	4113.0	4115.2	8.26	71.4	1:15	5109.6	10.25	03:56	20cc Withdrawal Good test 2268.3 md/cp
1/26	✓ P	2935.2	2910.2	5127.4	10.25	1:25	3275.6	4130.6	8.26	71.6	1:28	5127.4	10.25	03:00	20cc Withdrawal Good test 11.2 md/cp
1/27	✓ P	2956.3	2931.3	5163.7	10.25	1:37	4156.7	4160.1	8.26	72.0	1:41	5163.9	10.25	04:00	20cc Withdrawal Good test 1744.2 md/cp
1/28	✓ P	2987.3	2962.3	5217.4	10.25	1:48	4203.7	4205.9	8.26	72.4	1:51	5217.8	10.25	03:00	20cc Withdrawal Good test 2855.4 md/cp
1/29	✓ P	3020.3	2995.3	5274.3	10.25	2:00	4236.2	4253.7	8.27	73.4	2:04	5274.7	10.25	04:00	20cc Withdrawal Good test 3331.0 md/cp
1/30	✓ P	3066.5	3041.5	5354.9	10.25	2:12	4317.7	4319.6	8.27	74.3	2:16	5355.3	10.25	04:00	20cc Withdrawal Good 2544.5 md/cp
1/31	☑ P	2888.8	2865.8	5047.7	10.25	2:36	4588.0	4064.7	8.26	74.6	2:58	5047.7	10.25	22:00	Pretest for water samples Attempt to pump. Probe plugged. Move slightly.

ESSO AUSTRALIA LTD - MDT PRESSURE DATA

Well	BLACKBACK-3	Page	5 of 7
Date	4-Apr-94 to 5-Apr-94	Engineer-Geologist	Mike Scott/Rick Bombardieri/Greg Clota
Tool Type (MDT, RFT)	Schlumberger MDT	KB (metres):	25
Gauge Type	CQG	Probe type	Standard Probe
Pressure units (psia, psig)	PSIA	Temperature units (degF, degC)	degC

Run/Seat Number		P=Pretest S=Sample	Depth m MDRKB	Depth m TVDSS	Initial Hydrostatic Pressure	PPg	Time Pretest Start (hh:mm)	Minimum Flowing Pressure	Formation Pressure	PPg	Temp	Time Pretest End (hh:mm)	Final Hydrostatic Pressure	PPg	Total Time Set (mm:ss)	Comments Including Test Quality and Fluid Type.
1/32	☑	P	2888.3	2863.3	5046.3	10.25	3:01	4058.7	4064.1	8.26	73.7	3:14	5046.8	10.25	13:00	Pretest for water samples Attempt to pump. Probe plugged. Move location.
1/33	☑	P	2911.0	2886.0	5084.7	10.25	3:23	4093.5	4096.0	8.26	73.2	3:41	4096.0	8.26	18:00	Pretest for water samples Pumpout 10litres stopped 3:42
1/34		S	2911.0	2886.0	-	-	3:42	211.0	-	-	74.6	4:01	5085.0	10.25	19:00	Sample 2.75 gallon. Probe plugged. Retract and reset.
1/35	☑	P	2911.0	2886.0	5085.0	10.25	4:04	1909.9	4096.1	8.26	74.2	4:16	-	-	12:00	Pretest for water samples Pump out 8 litres.
1/36		S	2911.0	2886.0	-	-	Open: 4:17	-	-	-	74.6	4:22	5081.6	10.24	05:00	Probe plugged Retract and reset
1/37	☒	P	2911.0	2886.0	5085.0	10.25	4:28	-	-	-	-	-	-	-	-	Probe plugged Retract and reset
1/38	☑	P	2911.0	2886.0	5085.0	10.25	4:30	4093.4	4096.2	8.26	74.6	-	-	-	-	Pretest for water samples Pumpout 1 litre. Pump problems. Chk valve fail.
1/39		S	2911.0	2886.0	-	-	4:45	3240.0	4096.1	8.26	74.5	4:50	5085.0	10.25	05:00	Fill 450cc chamber

ESSO AUSTRALIA LTD - MDT PRESSURE DATA

Well	**BLACKBACK-3**	Page	**6 of 7**
Date	**4-Apr-94 to 5-Apr-94**	Engineer-Geologist	**Mike Scott/Rick Bombardieri/Greg Clota**
Tool Type (MDT, RFT)	**Schlumberger MDT**	KB (metres):	**25**
Gauge Type	**CQG**	Probe type	**Standard Probe**
Pressure units (psia, psig)	**PSIA**	Temperature units (degF, degC)	**degC**

Run/Seat Number		P=Pretest S=Sample	Depth m MDRKB	Depth m TVDSS	Initial Hydrostatic Pressure	PPg	Time Pretest Start (hh:mm)	Minimum Flowing Pressure	Formation Pressure	PPg	Temp	Time Pretest End (hh:mm)	Final Hydrostatic Pressure	PPg	Total Time Set (mm:ss)	Comments Including Test Quality and Fluid Type.
1/40	✓	P	2880.8	2855.8	5032.8	10.25	5:05	3706.3	4053.8	8.26	74.3	5:07	5033.0	10.25	02:00	20cc Withdrawal Good/Normal 17.5md/cp
1/41	×	P	2878.8	2853.8	5029.5	10.25	5:12	6.4	9.1	0.02	73.5	5:16	5029.2	10.25	04:00	20cc Withdrawal Very Tight/Aborted No Buildup
1/42	×	P	2875.2	2850.2	5022.5	10.25	5:23	33.3	4980.0	10.16	74.1	5:26	5022.5	10.25	03:00	10cc Withdrawal Tight Supercharged
1/43	×	P	2868.9	2843.9	5011.8	10.38	-	-	-	-	-	-	-	-	-	Seat Failure Move slightly
1/44	×	P	2868.8	2843.8	5011.0	10.38	-	-	-	-	-	-	-	-	-	Seat Failure Move away
1/45	☒	P	2863.3	2838.3	5001.5	10.36	5:47	5.9	7.0	0.01	72.8	5:50	5001.5	10.25	03:00	10cc Withdrawal Very Tight, Aborted No Buildup
1/46	☒	P	2854.0	2829.0	4985.5	10.33	5:57	6.8	6.8	0.01	72.5	6:00	4986.0	10.25	03:00	10cc Withdrawal Very Tight, Aborted No Buildup
1/47	☒	P	2849.0	2824.0	4976.5	10.31	6:05	7.3	8.0	0.02	72.8	6:09	4976.5	10.25	04:00	10cc Withdrawal Very Tight, Aborted No Buildup

ESSO AUSTRALIA LTD - MDT PRESSURE DATA

Well	BLACKBACK-3	Page	7 of 7
Date	4-Apr-94 to 5-Apr-94	Engineer-Geologist	Mike Scott/Rick Bombardieri/Greg Clota
Tool Type (MDT, RFT)	Schlumberger MDT	KB (metres):	25
Gauge Type	CQG	Probe type	Standard Probe
Pressure units (psia, psig)	PSIA	Temperature units (degF, degC)	degC

Run/Seat Number	P=Pretest S=Sample	Depth m MDRKB	Depth m TVDSS	Initial Hydrostatic Pressure	PPg	Time Pretest Start (hh:mm)	Minimum Flowing Pressure	Formation Pressure	PPg	Temp	Time Pretest End (hh:mm)	Final Hydrostatic Pressure	PPg	Total Time Set (mm:ss)	Comments Including Test Quality and Fluid Type.
1/48 ☑	P	2835.3	2810.3	4953.1	10.26	6:15	2380.3	4011.1	8.30	72.1	6:18	-	-	03:00	Pretest for sample
1/49	S	2835.3	2810.3	-	-	6:19	155.1	158.0	0.33	-	-	-	-	-	Fill 2.75 gallon chamber Abort, no productivity
1/50	S	2835.3	2810.3	-	-	-	281.0	291.0	0.60	-	-	-	-	-	Fill 450 cc chamber Abort, no productivity

Nomenclature:

- ✓ Good pretest for pressure gradient determination
- × Failed pretest for pressure gradient determination
- ☑ Good pretest for sampling
- ☒ Failed pretest for sampling

APPENDIX 6

APPENDIX 6

APPENDIX 6

Core Analysis

A Core Analysis Report For Well Blackback #3 Australia

Prepared for
ESSO Australia Limited.

August 1994

Files : WCA-94006 / PRP-94013

Rock Properties
Core Laboratories
Perth
Australia

WESTERN ATLAS

Core Laboratories

August 30th, 1994

Western Atlas
International
A.R.B.N. 009 474 908
P.O. Box 785
Cloverdale 6105
Western Australia
Tel (09) 353 3944
Fax (09) 353 1369

ESSO AUSTRALIA LIMITED.
360, Elizabeth Street
Melbourne
Victoria 3000

Attention : Mr. Andy Mills

Subject : Routine Core Analysis.
Well : Blackback #3
File : WCA-94006 / PRP-94013

Dear Andy,

Presented herein are the final results of the routine core analysis conducted by Core Laboratories on plug samples from Well Blackback #3. Analyses performed as requested by Esso Australia Ltd. were:

A. Rush and routine core analysis on a set of plug samples received directly from the rig-site on April 1st, 1994. This included porosity and permeability determined at NOB by CMS-300™

B. Routine core (CMS-300) and Dean Stark analyses of two batches of plug samples received on May 12th, 1994 and June 1st, 1994 respectively.

Preliminary data were faxed as they became available.

Core laboratories wishes to thank Esso Australia Limited for the opportunity to have been of service. If you have any questions concerning these results or if we can be of any further assistance to you please do not hesitate to contact us.

Yours sincerely,
CORE LABORATORIES

Rossini Silveira
Rock Properties Laboratory - Perth

INDEX

SECTION 1 : Rush results and porosity and permeability determined at ambient and confining pressure on plug samples received directly from the rig-site.

SECTION 2 : Routine core analysis performed on two batches of samples received later. This included saturation determined Dean Stark analysis, CMS-300™ porosity and permeability at ambient and confining pressure.

SECTION 1

CORE LABORATORIES

Company	:ESSO AUSTRALIA LTD	File No.	: WCA-94006
Well	:BLACKBACK # 3	Date	: 29-08-1994

ANALYTICAL PROCEDURES AND QUALITY ASSURANCE

HANDLING & CLEANING

Solvent	:Toluene/Methanol
Extraction Equipment	:Soxhlet
Extraction time	:Until clean
Drying time	:12 Hours/Until dry
Drying temperature	:95 Deg C.

ANALYSIS

Samples were first dried for 12 hours on receipt from the rig.
Grain volume measured by Boyle's law in a matrix cup using He.
Porosity and permeability measured at ambient.
Samples cleaned and dried, porosity,permeability measured at ambient and at 4760 psi net O.B.

REMARKS

These were procedures used on 25 samples received directly from the rig on the 1st of April 1994

Results of the core analysis performed on plug samples from Core #1.

Sample no.	Depth (m)	Porosity (%)			Permeability (md)			Grain density (gm/cc)	
		Rush analysis result	at ambient after cleaning	at 4760 psi after cleaning	Rush analysis result	at ambient after cleaning	at 4760 psi after cleaning	Rush analysis result	after cleaning
1	2835.00	14.9	14.9	14.4	0.794	0.978	0.803	2.89	2.89
2	2836.00	21.7	22.1	21.2	3.48	4.41	3.05	2.76	2.77
3	2837.00	14.8	15.4	14.3	0.289	0.330	0.039	2.78	2.80
4	2838.00	17.1	17.1	16.1	0.390	0.409	0.098	2.73	2.73
5	2839.00	19.3	19.6	18.6	1.45	1.70	0.733	2.72	2.73
6	2840.00	18.4	18.4	17.0	7.88	8.50	2.42	2.76	2.76
7 *	2841.00	20.9	21.4	20.1	67.0	71.0	4.77	2.74	2.75
8	2842.00	20.8	21.1	20.0	1.89	1.97	1.21	2.71	2.72
9	2843.00	19.7	20.1	19.1	1.11	1.24	0.484	2.72	2.73
10	2844.00	18.8	18.8	18.0	0.609	0.609	0.246	2.73	2.73
11	2845.00	21.4	21.4	20.6	3.52	3.86	2.18	2.72	2.72
12	2846.00	20.2	20.5	19.4	1.42	1.48	0.588	2.72	2.74
13 *	2847.00	20.8	21.1	19.6	49.0	52.0	6.04	2.72	2.72
14	2848.00	19.2	19.7	18.8	1.08	1.26	0.503	2.74	2.76
15	2849.00	19.0	19.2	18.3	0.839	1.04	0.312	2.73	2.74
16	2850.00	20.8	21.3	20.3	3.02	3.84	2.00	2.72	2.74
17	2851.00	20.2	20.5	19.6	2.08	2.43	1.15	2.74	2.75
18	2852.00	18.4	18.8	17.8	1.20	1.60	0.446	2.70	2.72

* Samples #7 and #13 had longitudinal fractures.

Results of the core analysis performed on plug samples from Core #2.

Sample no.	Depth (m)	Porosity (%)			Permeability (md)			Grain density (gm/cc)	
		Rush analysis result	at ambient after cleaning	at 4760 psi after cleaning	Rush analysis result	at ambient after cleaning	at 4760 psi after cleaning	Rush analysis result	after cleaning
1	2853.10	23.5	25.2	23.7	18.6	20.1	7.58	2.74	2.78
2	2854.00	20.4	21.2	20.1	0.769	0.770	0.118	2.78	2.80
3	2855.00	22.9	23.7	22.7	4.72	5.01	2.39	2.74	2.77
4 *	2856.00	20.3	21.0	19.8	5.57	6.54	0.255	2.76	2.78
5 *	2857.00	21.4	22.2	20.7	32.0	41.5	1.11	2.78	2.81
6	2858.00	19.9	20.8	19.6	0.385	0.484	0.053	2.78	2.81
7	2859.00	22.2	22.9	21.8	1.69	1.75	0.336	2.75	2.76

* Samples #4 and #5 had longitudinal fractures.

SECTION 2

CORE LABORATORIES

Company	:ESSO AUSTRALIA LTD	File No.	:PRP-94013
Well	:BLACKBACK # 3	Date	:29-08-1994

ANALYTICAL PROCEDURES AND QUALITY ASSURANCE

HANDLING & CLEANING

Solvent	:Toluene/Methanol
Extraction Equipment	:Soxhlet
Extraction time	:Until clean
Drying time	:Until dry
Drying temperature	:95 Deg C.

ANALYSIS

Water saturation by Dean Stark
Oil saturation by weight difference in Dean Stark
Grain Volume measured by Boyle's Law in a matrix cup using He.
Porosity and Permeability measured in the CMS at ambient and at 4700 psi net O.B.

REMARKS

These were procedures used in the analyses of the 55 plug samples of batch 1 received on the 12th of May 1994, and 144 plug samples of batch 2 received on the 1st of June 1994.

Porosity and permeability determined by CMS-300 and Dean-Stark analysis results.

Sample ID	Depth (metres)	Permeability to air (md)		Klinkenberg perm. (md)		Porosity (%)		Fluid saturations (%pv)		Grain density (gm/cc)
		at ambient	at 4700 psi	at ambient	at 4700 psi	at ambient	at 4700 psi	Oil	Water	
2	2835.10	3.33	2.31	2.69	1.87	21.4	20.6	0.0	84.8	2.71
3	2835.23	3.59	2.49	3.09	2.15	20.0	19.1	0.0	90.2	2.70
5	2835.40	2.51	1.56	1.97	1.19	20.8	20.0	0.0	90.9	2.72
7	2835.50	2.75	1.55	2.31	1.24	19.3	18.5	1.5	87.7	2.82
9	2835.86	1.19	0.766	0.908	0.582	19.0	18.2	0.9	89.9	2.72
11V	2835.95	0.146	0.055	0.079	0.025	18.4	17.7	0.0	91.4	2.73
13	2836.09	0.448	0.207	0.296	0.117	20.1	19.3	0.0	96.2	2.73
14	2836.20	2.98	2.08	2.47	1.73	21.1	20.3	0.0	94.8	2.70
16	2836.35	1.31	0.337	1.10	0.23	18.2	17.3	1.1	96.2	2.72
18	2836.55	0.160	0.051	0.097	0.023	15.6	14.9	0.0	100	2.78
20	2836.80	6.25	4.47	5.33	3.81	21.7	20.8	0.0	90.5	2.72
22V	2836.95	1.05	0.581	0.752	0.465	20.5	19.6	0.0	85.7	2.70
24	2837.12	0.546	0.220	0.390	0.128	18.8	18.1	0.0	97.4	2.77
25	2837.19	0.583	0.169	0.433	0.093	19.3	18.3	0.0	100	2.70
27	2837.36	1.87	1.18	1.53	0.989	19.3	18.5	0.0	95.0	2.73
29	2837.60	2.30	1.35	1.85	1.10	19.5	18.7	0.0	96.2	2.70
31	2837.80	2.33	1.40	1.85	1.11	20.5	19.6	0.0	92.4	2.69
33V	2837.94	0.731	0.336	0.508	0.229	19.8	18.9	0.0	90.8	2.70
35	2838.09	1.20	0.657	0.871	0.528	19.6	18.7	0.0	97.6	2.70
36	2838.20	0.153	0.057	0.095	0.027	14.1	13.6	0.0	98.3	2.95
38	2838.40	4.83	3.58	4.06	3.11	21.2	20.3	0.0	93.2	2.70

Porosity and permeability determined by CMS-300 and Dean-Stark analysis results.

Sample ID	Depth (metres)	Permeability to air (md)		Klinkenberg perm. (md)		Porosity (%)		Fluid saturations (%pv)		Grain density (gm/cc)
		at ambient	at 4700 psi	at ambient	at 4700 psi	at ambient	at 4700 psi	Oil	Water	
40	2838.60	6.997	3.93	5.95	3.32	20.8	19.8	0.0	90.8	2.71
42	2838.77	1.56	0.871	1.10	0.596	19.9	19.0	0.0	90.9	2.73
44V	2838.93	0.595	0.279	0.393	0.169	19.8	18.9	0.0	90.0	2.74
46	2839.02	2.03	1.19	1.60	0.928	18.9	18.0	2.4	92.3	2.70
47	2839.20	2.40	1.37	1.82	1.00	20.3	19.4	0.0	94.7	2.72
49	2839.39	6.43	3.99	5.39	3.39	20.7	19.8	3.4	85.8	2.75
51	2839.60	0.557	0.208	0.365	0.114	17.4	16.6	3.4	89.4	2.78
53	2839.80	4.69	3.31	3.99	2.98	19.8	18.9	1.4	89.8	2.70
55V	2839.95	0.809	0.410	0.568	0.291	20.1	19.2	0.0	88.1	2.73
57	2840.10	0.731	0.436	0.535	0.330	17.3	16.6	7.5	85.7	2.81
58	2840.20	7.04	4.73	5.88	3.97	21.4	20.5	2.2	83.5	2.73
60	2840.40	30.09	24.92	27.47	22.99	22.5	21.6	1.1	82.5	2.69
62	2840.60	0.904	0.626	0.656	0.535	17.7	17.0	0.4	95.0	2.72
64	2840.80	1.01	0.583	0.782	0.474	17.4	16.6	5.5	92.5	2.76
66V	2840.95	1.32	0.618	0.967	0.425	20.8	19.9	2.8	86.3	2.70
68	2841.09	2.04	1.34	1.65	1.14	18.5	17.6	0.0	99.0	2.71
69	2841.23	0.976	0.599	0.687	0.411	18.9	18.3	0.0	96.4	2.73
71	2841.40	0.941	0.536	0.681	0.457	18.1	17.3	0.0	100	2.76
73	2841.60	1.89	0.952	1.38	0.662	19.5	18.7	0.0	93.3	2.73
75	2841.81	1.01	0.607	0.700	0.505	18.9	18.1	0.0	96.3	2.78
77V	2841.95	0.423	0.203	0.263	0.111	19.4	18.7	0.0	94.5	2.77

Porosity and permeability determined by CMS-300 and Dean-Stark analysis results.

Sample ID	Depth (metres)	Permeability to air (md)		Klinkenberg perm. (md)		Porosity (%)		Fluid saturations (%pv)		Grain density (gm/cc)
		at ambient	at 4700 psi	at ambient	at 4700 psi	at ambient	at 4700 psi	Oil	Water	
80	2842.15	0.380	0.191	0.261	0.118	17.5	16.9	0.0	97.6	2.84
82	2842.39	1.69	0.967	1.27	0.702	20.1	19.2	0.0	96.4	2.70
86	2842.74	0.766	0.348	0.524	0.210	18.9	18.1	0.0	0.0	2.73
88V	2842.89	0.817	0.421	0.561	0.267	20.2	19.3	0.0	86.6	2.70
91	2843.20	2.19	1.40	1.82	1.16	19.2	18.3	0.0	98.4	2.71
93	2843.40	0.333	0.112	0.216	0.057	16.6	15.8	0.0	100	2.72
95	2843.57	0.553	0.165	0.409	0.085	18.7	17.9	0.0	100	2.80
97	2843.76	1.25	0.628	0.895	0.422	19.1	18.2	0.6	96.5	2.71
99V	2843.95	0.415	0.157	0.279	0.086	19.0	18.2	1.0	95.9	2.72
101	2844.08	0.396	0.131	0.262	0.063	17.7	16.9	0.0	100	2.73
102	2844.22	0.710	0.306	0.480	0.192	19.1	18.3	0.0	96.0	2.74
104	2844.40	1.04	0.534	0.716	0.394	20.0	19.1	0.0	92.7	2.73
106	2844.60	0.311	0.101	0.198	0.048	17.6	16.8	0.0	99.7	2.71
108	2844.87	1.07	0.605	0.750	0.487	19.4	18.4	0.0	98.3	2.71
110V	2844.96	0.626	0.282	0.422	0.176	20.1	19.1	5.0	91.3	2.72
112	2845.08	0.739	0.291	0.513	0.187	18.6	17.7	0.0	98.7	2.74
113	2845.21	0.533	0.150	0.409	0.081	17.6	16.7	0.0	100	2.78
115	2845.40	0.388	0.121	0.263	0.062	17.0	16.2	0.0	100	2.80
117	2845.60	0.428	0.124	0.279	0.065	17.2	16.3	0.0	98.9	2.79
119	2845.80	0.514	0.154	0.380	0.080	18.4	17.6	0.0	98.1	2.77
121V	2845.96	0.294	0.078	0.200	0.040	18.3	17.3	0.0	99.2	2.75

Porosity and permeability determined by CMS-300 and Dean-Stark analysis results.

Sample ID	Depth (metres)	Permeability to air (md)		Klinkenberg perm. (md)		Porosity (%)		Fluid saturations (%pv)		Grain density (gm/cc)
		at ambient	at 4700 psi	at ambient	at 4700 psi	at ambient	at 4700 psi	Oil	Water	
124	2846.20	0.461	0.140	0.309	0.071	18.4	17.5	0.0	97.7	2.73
126	2846.40	0.604	0.194	0.465	0.112	17.8	16.9	0.0	100	2.72
128	2846.60	0.619	0.234	0.412	0.142	18.8	17.8	0.0	100	2.74
130	2846.80	0.702	0.305	0.470	0.185	18.7	17.8	0.0	98.2	2.73
132V	2846.96	0.304	0.094	0.190	0.042	18.4	17.5	0.0	95.9	2.72
135	2847.19	0.743	0.265	0.476	0.154	18.4	17.5	1.0	89.1	2.74
137	2847.40	1.49	0.76	1.07	0.531	19.4	18.6	0.0	91.5	2.74
139	2847.60	0.869	0.349	0.590	0.216	19.3	18.5	0.0	97.8	2.76
141	2847.80	0.629	0.181	0.493	0.099	18.2	17.4	0.0	92.8	2.75
143V	2847.95	0.411	0.138	0.282	0.075	19.1	18.2	0.0	99.6	2.75
145	2848.10	1.15	0.435	0.805	0.264	18.1	17.2	0.0	91.6	2.76
146	2848.20	0.899	0.336	0.627	0.221	18.6	17.7	0.0	93.6	2.75
148	2848.40	0.620	0.192	0.458	0.106	18.2	17.5	0.0	100	2.76
150	2848.60	0.622	0.141	0.489	0.072	17.1	16.3	0.0	95.8	2.66
152	2848.80	1.03	0.385	0.717	0.240	18.6	17.7	0.0	86.6	2.73
154V	2848.95	0.370	0.110	0.255	0.057	18.5	17.6	0.0	100	2.74
156	2849.10	0.707	0.329	0.473	0.208	18.7	18.0	0.0	85.4	2.75
157	2849.20	0.888	0.377	0.616	0.254	18.4	17.5	0.0	99.4	2.73
159	2849.40	0.996	0.411	0.748	0.286	18.6	17.7	0.0	100	2.74
161	2849.60	1.25	0.551	0.913	0.416	18.5	17.6	0.0	96.9	2.74
163	2849.80	1.69	0.817	1.28	0.590	18.6	17.8	0.0	96.6	2.73

Porosity and permeability determined by CMS-300 and Dean-Stark analysis results.

Sample ID	Depth (metres)	Permeability to air (md)		Klinkenberg perm. (md)		Porosity (%)		Fluid saturations (%pv)		Grain density (gm/cc)
		at ambient	at 4700 psi	at ambient	at 4700 psi	at ambient	at 4700 psi	Oil	Water	
165V	2849.95	0.274	0.069	0.179	0.033	18.2	17.3	0.0	99.3	2.74
167	2850.14	0.667	0.181	0.545	0.105	17.6	16.8	0.0	96.9	2.73
168	2850.20	0.724	0.254	0.499	0.151	18.0	17.2	0.0	97.3	2.73
170	2850.40	0.595	0.209	0.406	0.128	17.6	16.8	0.0	98.3	2.72
172	2850.60	1.254	0.382	0.936	0.256	17.6	16.8	0.0	100	2.74
174	2850.80	1.41	0.633	1.04	0.442	21.0	20.1	0.0	95.8	2.74
176V	2850.95	0.580	0.175	0.450	0.104	19.6	18.7	0.1	96.9	2.75
178	2851.10	0.813	0.274	0.573	0.176	18.8	18.0	0.0	100	2.75
179	2851.20	0.809	0.268	0.560	0.160	18.8	18.0	0.0	96.6	2.73
181	2851.40	1.26	0.438	0.918	0.282	19.8	18.9	0.0	100	2.72
183	2851.65	1.13	0.339	0.829	0.234	18.2	17.4	0.0	99.1	2.73
185	2851.80	1.02	0.413	0.730	0.284	18.9	18.0	0.0	96.5	2.71
187V	2851.95	0.239	0.055	0.157	0.025	16.7	15.9	0.0	100	2.76
189	2852.00	0.547	0.127	0.398	0.065	16.7	16.0	0.0	98.7	2.70
190	2852.20	1.44	0.429	1.16	0.300	17.9	17.1	3.6	94.3	2.71
192	2852.36	0.486	0.105	0.350	0.058	15.5	14.7	0.0	99.8	2.70
194	2852.60	0.915	0.349	0.673	0.239	18.3	17.5	0.3	96.2	2.71
196	2852.84	0.473	0.075	0.359	0.037	18.8	18.0	2.5	94.6	2.79
198	2853.00	0.526	0.070	0.414	0.034	19.4	18.5	1.9	97.0	2.80
203	2853.40	2.10	0.649	1.67	0.472	20.7	19.9	0.0	97.0	2.83
205	2853.50	2.18	0.615	1.73	0.431	21.3	20.4	0.0	92.4	2.80

Porosity and permeability determined by CMS-300 and Dean-Stark analysis results.

Sample ID	Depth (metres)	Permeability to air (md)		Klinkenberg perm. (md)		Porosity (%)		Fluid saturations (%pv)		Grain density (gm/cc)
		at ambient	at 4700 psi	at ambient	at 4700 psi	at ambient	at 4700 psi	Oil	Water	
208	2853.80	0.757	0.136	0.542	0.071	21.5	20.4	0.0	96.7	2.80
210V	2853.95	0.172	0.039	0.107	0.015	20.2	19.3	1.1	97.2	2.72
211	2854.04	0.478	0.074	0.361	0.035	20.0	19.0	0.0	97.4	2.80
213	2854.21	0.740	0.147	0.530	0.083	20.4	19.5	0.0	98.2	2.79
215	2854.41	0.618	0.144	0.422	0.075	20.5	19.6	0.0	99.7	2.76
217	2854.60	3.19	0.663	2.65	0.467	21.4	20.4	0.0	96.8	2.77
219	2854.85	6.20	3.488	5.37	3.048	20.2	19.4	0.2	89.8	2.80
222	2854.99	0.894	0.205	0.653	0.123	19.0	18.1	0.2	89.3	2.77
224	2855.25	0.581	0.109	0.457	0.053	20.8	19.9	0.0	97.9	2.76
230	2855.80	0.540	0.070	0.448	0.032	19.7	18.8	0.0	100	2.76
232V	2855.89	0.182	0.059	0.114	0.029	20.2	19.2	0.0	98.9	2.79
235	2856.23	1.26	0.368	0.996	0.273	17.8	16.9	0.0	98.3	2.79
239	2856.65	0.622	0.115	0.434	0.059	20.5	19.5	0.7	97.5	2.78
241	2856.80	0.373	0.054	0.262	0.023	19.3	18.4	0.0	97.7	2.78
243V	2856.92	0.282	0.052	0.195	0.022	20.3	19.3	0.0	100	2.79
244	2856.99	1.38	0.268	1.04	0.167	21.8	20.9	0.0	100	2.78
246	2857.25	1.71	0.617	1.40	0.545	19.8	19.0	0.0	97.4	2.78
248	2857.35	3.40	1.376	2.98	1.236	20.5	19.6	0.2	94.5	2.81
250	2857.60	0.740	0.106	0.547	0.055	20.4	19.6	0.0	95.4	2.82
252	2857.80	0.332	0.044	0.237	0.018	20.3	19.5	0.0	99.5	2.82
254V	2857.93	0.211	0.031	0.152	0.015	19.4	18.5	0.0	100	2.81

Porosity and permeability determined by CMS-300 and Dean-Stark analysis results.

Sample ID	Depth (metres)	Permeability to air (md)		Klinkenberg perm. (md)		Porosity (%)		Fluid saturations (%pv)		Grain density (gm/cc)
		at ambient	at 4700 psi	at ambient	at 4700 psi	at ambient	at 4700 psi	Oil	Water	
255	2858.00	0.404	0.044	0.306	0.021	19.2	18.4	1.0	93.1	2.83
257	2858.25	0.447	0.062	0.325	0.026	20.2	19.3	1.7	97.0	2.79
259	2858.45	0.859	0.159	0.617	0.086	21.5	20.5	1.9	91.7	2.80
261	2858.60	0.924	0.212	0.666	0.133	21.1	20.1	0.0	92.8	2.80
263	2858.80	0.904	0.379	0.640	0.260	21.6	20.8	0.0	95.3	2.78
265V	2858.97	0.220	0.041	0.155	0.020	20.0	19.1	0.3	99.5	2.77
266	2859.04	0.309	0.101	0.202	0.048	20.9	20.2	0.0	99.0	2.77
268	2859.20	0.640	0.112	0.533	0.050	21.4	20.5	0.0	93.0	2.77
270	2859.40	0.825	0.202	0.614	0.119	21.0	20.1	0.0	98.1	2.77
272	2859.64	0.732	0.120	0.541	0.064	21.9	21.0	0.0	100	2.83
274	2859.80	0.721	0.107	0.540	0.056	22.7	21.8	0.0	100	2.83
276	2860.00	0.603	0.083	0.458	0.044	19.4	18.6	0.0	100	2.85
278V	2860.05	0.377	0.064	0.284	0.034	19.2	18.3	0.0	100	2.84
279	2860.20	0.397	0.067	0.296	0.031	19.1	18.4	0.0	98.3	2.82
281	2860.40	0.503	0.072	0.403	0.033	20.5	19.7	0.0	100	2.81
283	2860.60	0.741	0.178	0.547	0.106	21.8	21.0	0.0	99.1	2.80
285	2860.79	0.613	0.113	0.448	0.059	20.5	19.6	0.0	100	2.79
287V	2860.88	0.206	0.036	0.146	0.017	19.6	18.7	0.0	99.5	2.81
288	2861.00	0.525	0.067	0.435	0.035	19.3	18.6	2.5	96.1	2.87
290	2861.20	0.404	0.060	0.315	0.031	17.7	17.0	0.0	100	2.89
292	2861.40	0.693	0.082	0.536	0.047	17.3	16.5	0.0	100	2.83

Porosity and permeability determined by CMS-300 and Dean-Stark analysis results.

Sample ID	Depth (metres)	Permeability to air (md)		Klinkenberg perm. (md)		Porosity (%)		Fluid saturations (%pv)		Grain density (gm/cc)
		at ambient	at 4700 psi	at ambient	at 4700 psi	at ambient	at 4700 psi	Oil	Water	
294	2861.60	1.04	0.153	0.814	0.097	20.5	19.5	0.0	100	2.81
296	2861.80	0.733	0.089	0.568	0.053	17.5	16.7	0.0	100	2.82
298V	2861.93	0.148	0.021	0.100	0.010	17.2	16.4	0.0	100	2.80
299	2862.00	0.344	0.045	0.257	0.023	15.8	15.1	0.0	100	2.78
301	2862.20	0.433	0.067	0.317	0.031	18.8	18.0	0.0	98.9	2.75
303	2862.40	0.347	0.045	0.261	0.021	17.9	17.1	0.0	100	2.80
305	2862.60	0.739	0.106	0.556	0.058	19.8	19.0	0.0	100	2.79
307	2862.80	0.751	0.106	0.585	0.062	18.5	17.7	0.0	100	2.83
309	2863.00	0.816	0.099	0.635	0.055	18.6	17.8	0.0	100	2.81
311V	2863.09	0.372	0.054	0.284	0.025	19.8	18.9	0.0	100	2.80
312	2863.20	0.917	0.142	0.705	0.083	20.2	19.4	0.0	100	2.83
314	2863.40	0.630	0.079	0.472	0.040	20.4	19.5	0.0	100	2.79
316	2863.60	0.718	0.103	0.531	0.053	20.9	20.0	0.0	99.6	2.78
318	2863.80	0.761	0.097	0.572	0.052	20.3	19.4	1.0	97.3	2.82
320V	2863.93	0.256	0.037	0.194	0.020	19.6	18.6	1.0	100	2.85
321	2864.00	0.650	0.082	0.495	0.046	19.3	18.3	0.5	100	2.87
323	2864.20	0.731	0.087	0.556	0.047	19.9	19.0	0.0	100	2.85
325	2864.40	0.769	0.095	0.584	0.052	19.7	18.7	0.0	100	2.82
327	2864.60	0.572	0.070	0.428	0.037	18.5	17.7	0.0	100	2.81
329	2864.80	0.867	0.095	0.670	0.053	19.6	18.6	0.0	100	2.80
331	2865.00	0.985	0.108	0.777	0.064	20.1	19.1	0.0	100	2.87

Porosity and permeability determined by CMS-300 and Dean-Stark analysis results.

Sample ID	Depth (metres)	Permeability to air (md)		Klinkenberg perm. (md)		Porosity (%)		Fluid saturations (%pv)		Grain density (gm/cc)
		at ambient	at 4700 psi	at ambient	at 4700 psi	at ambient	at 4700 psi	Oil	Water	
333V	2865.08	0.377	0.090	0.291	0.052	18.5	17.8	0.0	100	2.80
334	2865.20	0.337	0.086	0.257	0.050	18.6	18.0	0.5	100	2.80
336	2865.40	0.870	0.082	0.676	0.049	18.1	17.1	0.1	100	2.77
338	2865.60	0.744	0.107	0.554	0.061	18.7	17.7	0.6	100	2.77
340	2865.80	0.370	0.046	0.253	0.020	17.9	17.1	0.0	99.7	2.77
342	2866.00	0.559	0.073	0.440	0.038	17.1	16.2	0.0	100	2.76
344V	2866.05	0.239	0.048	0.168	0.020	18.4	17.7	0.0	100	2.74
345	2866.20	0.288	0.039	0.205	0.017	17.2	16.3	0.0	100	2.72
347	2866.36	1.02	0.171	0.773	0.104	19.0	18.1	0.0	100	2.78
349	2866.60	0.362	0.065	0.258	0.028	18.2	17.4	0.0	100	2.78
351	2866.80	0.798	0.101	0.594	0.052	20.7	19.8	0.0	99.3	2.83
353	2867.00	0.658	0.061	0.549	0.031	19.0	18.1	0.0	100	2.78
355V	2867.07	0.260	0.031	0.185	0.012	19.5	18.5	0.0	100	2.77
356	2867.25	0.684	0.064	0.550	0.030	20.3	19.4	0.0	100	2.79
358	2867.44	0.388	0.045	0.298	0.019	20.2	19.2	0.0	100	2.76
360	2867.54	0.311	0.039	0.227	0.017	18.8	17.9	0.0	100	2.75
362	2867.85	0.405	0.038	0.305	0.017	18.4	17.5	0.0	100	2.79
365	2868.05	0.737	0.070	0.549	0.034	21.3	20.3	1.0	96.3	2.79
367	2868.20	0.853	0.067	0.666	0.037	19.4	18.4	1.3	98.0	2.84
369	2868.40	0.690	0.062	0.523	0.033	18.7	17.8	1.3	97.5	2.83
371	2868.60	0.446	0.040	0.331	0.021	16.4	15.6	0.0	100	2.82

Porosity and permeability determined by CMS-300 and Dean-Stark analysis results.

Sample ID	Depth	Permeability to air (md)		Klinkenberg perm. (md)		Porosity (%)		Fluid saturations (%pv)		Grain density
	(metres)	at ambient	at 4700 psi	at ambient	at 4700 psi	at ambient	at 4700 psi	Oil	Water	(gm/cc)
373	2868.80	0.351	0.031	0.259	0.016	15.2	14.4	0.0	100	2.81
364V	2868.96	0.200	0.026	0.146	0.013	18.4	17.6	0.0	100	2.82
375	2869.00	0.647	0.066	0.488	0.032	20.0	19.1	0.0	100	2.81
377V	2869.09	0.368	0.039	0.275	0.019	19.1	18.1	0.0	100	2.84
378	2869.20	0.778	0.072	0.601	0.039	18.8	17.9	0.0	100	2.84
380	2869.40	1.09	0.085	0.867	0.046	19.8	18.6	0.0	100	2.83
382	2869.60	0.925	0.073	0.722	0.038	19.9	18.8	0.5	99.4	2.67
388V	2870.05	0.427	0.044	0.303	0.020	21.0	19.4	0.0	100	2.80
389	2870.20	0.653	0.059	0.493	0.030	18.3	17.4	0.0	99.8	2.84
391	2870.38	0.528	0.049	0.416	0.022	18.7	17.8	0.0	100	2.86

Additional data determined by CMS-300.

Sample ID	Depth (metres)	Gas slippage factor 'b' (psig) at ambient	Gas slippage factor 'b' (psig) at 4700 psi	Forcheimer Turb. factor at ambient	Forcheimer Turb. factor at 4700 psi	Grain density (gm/cc)
2	2835.1	14.02	14.11	4.485E+10	1.062E+11	2.71
3	2835.2	9.52	9.33	5.538E+10	1.120E+11	2.70
5	2835.4	16.66	18.37	6.830E+10	2.302E+11	2.72
7	2835.5	11.49	15.03	8.593E+10	2.866E+11	2.82
9	2835.9	19.69	19.98	3.187E+11	1.004E+12	2.72
11V	2836.0	62.06	86.61	4.242E+12	1.403E+14	2.73
13	2836.1	34.96	51.80	2.366E+11	8.488E+11	2.73
14	2836.2	12.07	11.91	6.972E+10	1.602E+11	2.70
16	2836.4	11.54	29.68	4.883E+11	3.401E+11	2.72
18	2836.6	48.64	89.06	1.883E+12	1.313E+13	2.78
20	2836.8	9.88	9.79	1.167E+10	2.567E+10	2.72
22V	2837.0	25.02	15.97	2.797E+11	5.581E+12	2.70
24	2837.1	26.63	48.12	6.813E+10	3.363E+11	2.77
25	2837.2	23.18	54.26	5.256E+12	9.075E+11	2.70
27	2837.4	13.51	11.79	2.430E+11	8.151E+11	2.73
29	2837.6	14.82	14.28	8.899E+10	3.587E+11	2.70
31	2837.8	15.97	16.22	1.036E+11	4.059E+11	2.69
33V	2837.9	29.00	30.90	7.323E+11	4.976E+11	2.70
35	2838.1	24.34	15.61	3.941E+11	7.112E+12	2.70
36	2838.2	44.76	80.54	2.840E+12	2.217E+13	2.95
38	2838.4	11.09	8.63	2.065E+10	6.982E+10	2.70

Additional data determined by CMS-300.

Sample ID	Depth (metres)	Gas slippage factor 'b' (psig)		Forcheimer Turb. factor		Grain density (gm/cc)
		at ambient	at 4700 psi	at ambient	at 4700 psi	
40	2838.6	9.97	10.38	7.849E+09	4.481E+10	2.71
42	2838.8	25.80	28.89	1.131E+11	6.628E+11	2.73
44V	2838.9	34.35	43.28	9.199E+11	5.488E+11	2.74
46	2839.0	16.50	17.40	1.557E+11	5.302E+11	2.70
47	2839.2	19.38	22.00	8.387E+10	3.913E+11	2.72
49	2839.4	11.06	10.03	1.633E+10	6.828E+10	2.75
51	2839.6	35.25	54.84	1.037E+12	2.276E+12	2.78
53	2839.8	10.23	6.54	2.774E+10	1.150E+11	2.70
55V	2840.0	27.72	26.80	5.980E+11	2.511E+10	2.73
57	2840.1	23.91	21.10	1.524E+12	5.503E+12	2.81
58	2840.2	11.09	10.74	1.453E+10	4.197E+10	2.73
60	2840.4	4.92	4.34	1.391E+09	2.193E+09	2.69
62	2840.6	24.45	10.92	6.839E+11	7.533E+12	2.72
64	2840.8	18.83	14.59	1.051E+12	7.147E+12	2.76
66V	2840.9	23.09	28.52	2.890E+11	2.009E+12	2.70
68	2841.1	14.23	11.11	3.422E+11	1.442E+12	2.71
69	2841.2	27.02	29.36	5.507E+11	2.206E+12	2.73
71	2841.4	24.58	11.19	7.047E+11	1.347E+13	2.76
73	2841.6	22.34	26.96	1.341E+11	8.498E+11	2.73
75	2841.4	28.64	12.95	4.963E+11	1.063E+13	2.78
77V	2841.9	41.36	55.88	4.636E+10	4.961E+11	2.77

Additional data determined by CMS-300.

Sample ID	Depth (metres)	Gas slippage factor 'b' (psig) at ambient	Gas slippage factor 'b' (psig) at 4700 psi	Forcheimer Turb. factor at ambient	Forcheimer Turb. factor at 4700 psi	Grain density (gm/cc)
80	2842.2	31.15	42.27	4.509E+11	1.890E+12	2.84
82	2842.4	20.73	23.29	1.606E+11	7.712E+11	2.70
86	2842.7	30.27	43.11	7.107E+11	1.428E+11	2.73
88V	2842.9	29.72	37.37	4.954E+11	3.137E+11	2.70
91	2843.2	12.33	12.26	2.447E+11	7.279E+11	2.71
93	2843.4	37.47	65.46	5.259E+11	7.459E+12	2.72
95	2843.6	23.42	62.13	3.786E+12	2.364E+12	2.80
97	2843.8	25.33	30.92	3.013E+11	1.965E+12	2.71
99V	2844.0	33.19	55.63	3.824E+10	2.282E+12	2.72
101	2844.1	35.08	73.26	2.768E+11	2.589E+12	2.73
102	2844.2	31.50	39.47	7.366E+11	3.988E+11	2.74
104	2844.4	28.74	22.87	3.608E+11	7.289E+12	2.73
106	2844.6	39.96	76.28	4.746E+11	8.536E+12	2.71
108	2844.9	26.87	15.56	3.442E+11	8.330E+12	2.71
110V	2845.0	31.96	40.25	9.122E+11	5.427E+11	2.72
112	2845.1	28.94	36.79	9.587E+11	1.452E+11	2.74
113	2845.2	20.12	57.57	6.672E+12	2.688E+12	2.78
115	2845.4	32.43	65.15	4.026E+11	3.232E+12	2.80
117	2845.6	36.50	61.74	8.924E+10	3.874E+12	2.79
119	2845.8	23.51	62.35	6.514E+12	2.328E+12	2.77
121V	2846.0	32.84	65.89	7.279E+11	5.224E+12	2.75

Additional data determined by CMS-300.

Sample ID	Depth (metres)	Gas slippage factor 'b' (psig) at ambient	Gas slippage factor 'b' (psig) at 4700 psi	Forcheimer Turb. factor at ambient	Forcheimer Turb. factor at 4700 psi	Grain density (gm/cc)
124	2846.2	33.20	64.86	2.078E+11	3.470E+12	2.73
126	2846.4	19.77	47.71	5.480E+12	2.019E+12	2.72
128	2846.6	33.40	42.60	9.170E+11	1.422E+12	2.74
130	2846.8	32.56	42.71	6.712E+11	6.296E+10	2.73
132V	2847.0	41.66	85.42	6.308E+11	6.907E+12	2.72
135	2847.2	37.17	47.88	3.040E+11	9.371E+11	2.74
137	2847.6	24.20	27.22	2.607E+11	1.684E+12	2.74
139	2847.8	30.86	40.46	5.576E+11	1.034E+11	2.76
141	2848.0	18.29	54.48	8.261E+12	1.132E+12	2.75
143V	2848.0	31.28	57.08	3.748E+11	1.668E+12	2.75
145	2848.1	27.13	41.51	3.349E+11	3.946E+11	2.76
146	2848.2	28.27	33.71	5.539E+11	2.110E+11	2.75
148	2848.4	23.28	52.69	4.914E+12	2.183E+12	2.76
150	2848.6	17.98	63.56	7.768E+12	4.838E+12	2.66
152	2848.8	27.76	38.84	3.144E+11	4.654E+11	2.73
154V	2849.0	30.97	63.30	4.331E+11	7.604E+12	2.74
156	2849.1	32.50	38.32	6.961E+11	2.446E+11	2.75
157	2849.2	29.17	31.96	2.839E+11	1.516E+11	2.73
159	2849.4	21.05	27.68	5.364E+11	2.201E+11	2.74
161	2849.6	24.01	21.03	1.442E+11	5.004E+12	2.74
163	2849.6	20.66	24.26	1.819E+11	1.351E+12	2.73

Additional data determined by CMS-300.

Sample ID	Depth (metres)	Gas slippage factor 'b' (psig)		Forcheimer Turb. factor		Grain density (gm/cc)
		at ambient	at 4700 psi	at ambient	at 4700 psi	
165V	2850.0	37.15	77.57	3.803E+11	3.448E+11	2.74
167	2850.1	14.91	48.28	6.820E+12	2.556E+12	2.73
168	2850.2	30.07	45.34	5.513E+11	1.320E+12	2.73
170	2850.4	30.95	42.26	1.230E+12	4.805E+11	2.72
172	2850.6	21.43	31.24	2.454E+11	1.284E+11	2.74
174	2850.8	21.76	27.16	1.256E+11	1.131E+12	2.74
176V	2851.0	19.23	45.15	4.427E+12	7.451E+10	2.75
178	2851.1	27.23	36.65	5.218E+11	1.074E+12	2.75
179	2851.2	28.87	44.04	4.327E+11	9.850E+11	2.73
181	2851.4	23.80	34.65	1.676E+11	2.267E+11	2.72
183	2851.7	23.17	28.66	2.614E+11	2.454E+11	2.73
185	2851.8	25.19	29.20	3.568E+11	2.173E+11	2.71
187V	2852.0	37.34	85.02	6.245E+11	8.600E+13	2.76
189	2852.0	24.90	64.06	3.869E+12	5.946E+12	2.70
190	2852.2	15.47	26.68	3.607E+11	3.055E+11	2.71
192	2852.4	26.13	53.68	3.229E+10	2.697E+12	2.70
194	2852.6	23.16	29.50	6.836E+11	5.218E+11	2.71
196	2852.8	21.43	69.47	1.318E+11	1.040E+13	2.79
198	2853.0	17.94	72.18	1.572E+11	1.603E+13	2.80
203	2853.4	15.38	22.75	7.513E+10	1.629E+12	2.83
205	2853.5	15.67	25.86	5.420E+10	1.200E+12	2.80

Additional data determined by CMS-300.

Sample ID	Depth (metres)	Gas slippage factor 'b' (psig) at ambient	Gas slippage factor 'b' (psig) at 4700 psi	Forcheimer Turb. factor at ambient	Forcheimer Turb. factor at 4700 psi	Grain density (gm/cc)
208	2853.8	25.90	59.77	6.086E+11	4.541E+12	2.80
210V	2854.0	44.03	119.57	7.404E+11	1.427E+13	2.72
211	2854.0	21.75	76.46	2.688E+11	1.618E+13	2.80
213	2854.2	25.91	50.09	4.085E+11	3.034E+12	2.79
215	2854.4	30.68	60.96	7.879E+11	5.760E+11	2.76
217	2854.6	11.97	24.87	6.111E+10	1.757E+12	2.77
219	2854.9	8.83	8.19	1.571E+10	7.588E+10	2.80
222	2855.0	23.85	42.90	3.590E+11	1.829E+12	2.77
224	2855.3	18.01	70.76	6.056E+12	6.282E+12	2.76
230	2855.8	13.54	78.39	8.764E+12	7.171E+12	2.76
232V	2855.9	42.66	76.09	1.243E+12	1.201E+13	2.79
235	2856.2	16.35	21.68	3.796E+11	2.807E+11	2.79
239	2856.7	28.84	62.20	5.593E+11	1.970E+12	2.78
241	2856.8	29.06	92.63	4.000E+11	2.647E+13	2.78
243V	2856.9	31.20	95.02	6.317E+11	3.602E+13	2.79
244	2857.0	19.98	37.83	1.923E+11	5.338E+11	2.78
246	2857.3	13.67	8.10	2.231E+11	5.974E+12	2.78
248	2857.4	8.10	6.63	6.813E+10	7.747E+11	2.81
250	2857.6	22.86	60.20	6.411E+11	2.158E+12	2.82
252	2857.8	27.63	100.40	7.067E+11	1.914E+13	2.82
254V	2857.9	27.59	76.03	6.092E+11	3.595E+13	2.81

Additional data determined by CMS-300.

Sample ID	Depth (metres)	Gas slippage factor 'b' (psig)		Forcheimer Turb. factor		Grain density (gm/cc)
		at ambient	at 4700 psi	at ambient	at 4700 psi	
255	2858.0	21.79	73.28	3.456E+11	3.529E+13	2.83
257	2858.3	25.17	93.46	2.621E+11	2.691E+12	2.79
259	2858.5	25.21	54.34	3.945E+11	3.117E+12	2.80
261	2858.6	24.88	38.01	2.848E+11	1.722E+12	2.80
263	2858.6	26.60	29.49	2.432E+11	1.355E+11	2.78
265V	2859.0	29.21	79.19	8.110E+11	3.428E+13	2.77
266	2859.0	36.80	75.30	1.152E+10	5.364E+12	2.77
268	2859.2	13.00	80.39	7.452E+12	6.828E+12	2.77
270	2859.4	22.14	45.08	6.324E+11	1.528E+12	2.77
272	2859.6	23.01	56.58	3.844E+11	6.154E+12	2.83
274	2859.8	21.94	59.91	4.546E+11	4.973E+12	2.83
276	2860.0	20.95	57.52	5.456E+11	6.741E+12	2.85
278V	2860.1	22.30	62.15	1.358E+11	1.584E+13	2.84
279	2860.2	23.14	79.00	2.238E+11	1.976E+13	2.82
281	2860.4	16.55	79.66	5.833E+12	2.348E+11	2.81
283	2860.6	23.19	44.86	5.922E+11	1.857E+12	2.80
285	2860.8	24.26	59.81	8.706E+11	5.428E+12	2.79
287V	2860.9	29.55	81.35	1.363E+12	6.53E+12	2.81
288	2861.00	13.74	63.21	5.363E+12	1.823E+13	2.87
290	2861.20	19.17	61.59	9.206E+10	1.984E+13	2.89
292	2861.40	19.20	48.07	2.724E+11	6.597E+12	2.83

Additional data determined by CMS-300.

Sample ID	Depth (metres)	Gas slippage factor 'b' (psig) at ambient	Gas slippage factor 'b' (psig) at 4700 psi	Forcheimer Turb. factor at ambient	Forcheimer Turb. factor at 4700 psi	Grain density (gm/cc)
294	2861.60	17.43	36.62	1.571E+11	3.046E+12	2.81
296	2861.80	19.04	43.97	3.211E+11	5.790E+12	2.82
298V	2861.93	35.11	81.79	8.730E+11	7.434E+13	2.80
299	2862.00	23.48	63.74	4.166E+11	3.057E+13	2.78
301	2862.20	24.67	79.19	6.846E+10	1.084E+13	2.75
303	2862.40	22.68	79.98	1.711E+11	3.339E+13	2.80
305	2862.60	21.39	54.17	3.998E+11	8.034E+12	2.79
307	2862.80	18.25	46.97	2.482E+11	5.263E+12	2.83
309	2863.00	18.43	52.71	1.925E+11	1.736E+12	2.81
311	2863.09	20.89	78.39	3.341E+11	1.574E+13	2.80
312	2863.20	19.22	45.86	1.586E+11	1.445E+12	2.83
314	2863.40	22.02	63.50	6.953E+11	1.136E+13	2.79
316	2863.60	22.82	62.11	4.649E+11	8.400E+12	2.78
318	2863.80	21.38	55.57	3.808E+11	1.103E+12	2.82
320V	2863.93	22.54	59.19	5.358E+11	2.539E+13	2.85
321	2864.00	20.69	49.81	6.609E+11	7.925E+12	2.87
323	2864.20	20.49	56.25	2.808E+11	1.172E+13	2.85
325	2864.40	20.53	53.31	3.213E+11	7.064E+12	2.82
327	2864.60	22.41	57.20	6.804E+11	1.482E+13	2.81
329	2864.80	18.90	51.35	1.800E+11	6.593E+12	2.80
331	2865.00	17.01	44.51	1.218E+11	2.811E+12	2.87

Additional data determined by CMS-300.

Sample ID	Depth (metres)	Gas slippage factor 'b' (psig)		Forcheimer Turb. factor		Grain density (gm/cc)
		at ambient	at 4700 psi	at ambient	at 4700 psi	
333V	2865.08	20.11	49.96	2.869E+11	2.415E+12	2.80
334	2865.20	21.08	50.60	4.509E+11	1.022E+13	2.80
336	2865.60	18.44	44.18	1.503E+11	2.257E+12	2.77
338	2865.60	22.28	49.68	3.596E+11	2.971E+12	2.77
340	2865.80	31.58	92.55	5.956E+11	3.271E+13	2.77
342	2866.00	17.88	59.57	3.355E+12	7.098E+12	2.76
344V	2866.05	30.00	94.36	9.239E+11	1.897E+13	2.74
345	2866.20	28.38	86.35	7.661E+11	1.870E+13	2.72
347	2866.36	20.77	41.27	1.541E+11	1.198E+12	2.78
349	2866.60	27.52	90.38	6.510E+09	4.765E+12	2.78
351	2866.80	22.17	59.49	4.226E+11	4.324E+12	2.83
353	2867.00	12.96	63.62	3.995E+12	2.113E+13	2.78
355V	2867.07	28.22	109.95	7.182E+11	1.529E+13	2.77
356	2867.20	15.79	74.60	3.583E+12	2.592E+12	2.79
358	2867.40	20.38	90.73	1.223E+11	3.991E+13	2.76
360	2867.60	25.75	91.89	3.889E+11	2.717E+13	2.75
362	2867.80	22.18	82.53	5.280E+10	1.003E+13	2.79
365	2868.05	22.17	67.46	4.147E+10	2.549E+12	2.79
367	2868.20	17.93	51.48	2.480E+11	2.523E+12	2.84
369	2868.40	20.66	56.83	5.371E+11	1.074E+13	2.83
371	2868.60	23.21	62.01	9.971E+10	5.048E+13	2.82

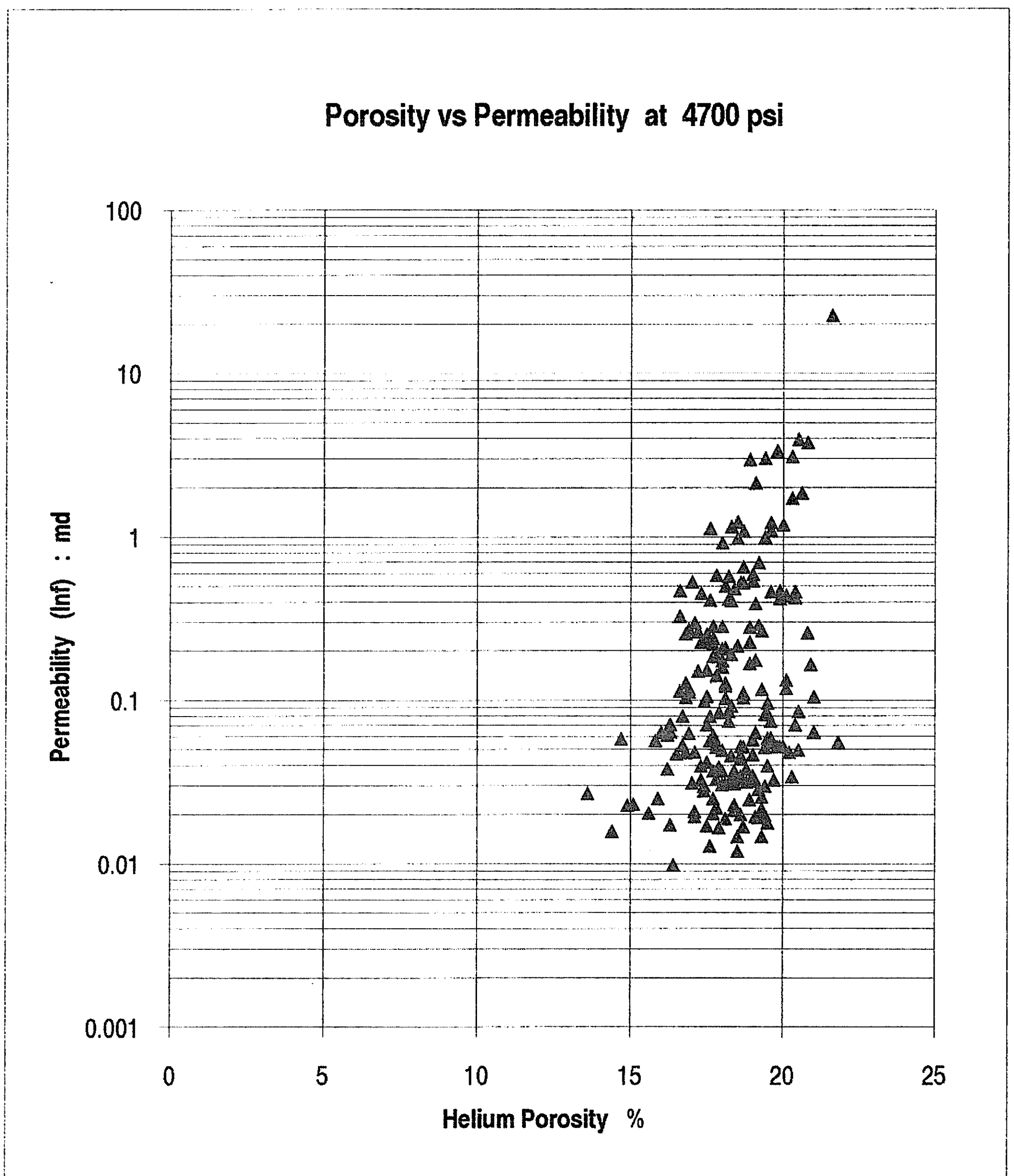
Additional data determined by CMS-300.

Sample ID	Depth (metres)	Gas slippage factor 'b' (psig) at ambient	Gas slippage factor 'b' (psig) at 4700 psi	Forcheimer Turb. factor at ambient	Forcheimer Turb. factor at 4700 psi	Grain density (gm/cc)
373	2868.80	24.08	64.06	1.073E+10	1.170E+13	2.81
364V	2868.00	26.54	73.74	1.373E+12	8.397E+13	2.82
375	2869.00	21.32	66.84	1.117E+12	2.043E+13	2.81
377	2869.09	22.90	70.97	5.130E+10	3.530E+13	2.84
378	2869.20	18.99	53.41	3.082E+11	1.021E+13	2.84
380	2869.39	16.34	52.53	5.568E+10	3.816E+11	2.83
382	2869.60	17.87	57.91	1.920E+11	2.793E+12	2.67
388	2870.05	27.59	81.98	1.829E+11	7.565E+12	2.80
389	2870.20	21.06	62.82	7.452E+11	2.554E+13	2.84
391	2870.38	17.73	77.34	5.215E+12	2.803E+13	2.86

A6 Figures 1, 2, 3 to follow

ESSO AUSTRALIA LIMITED

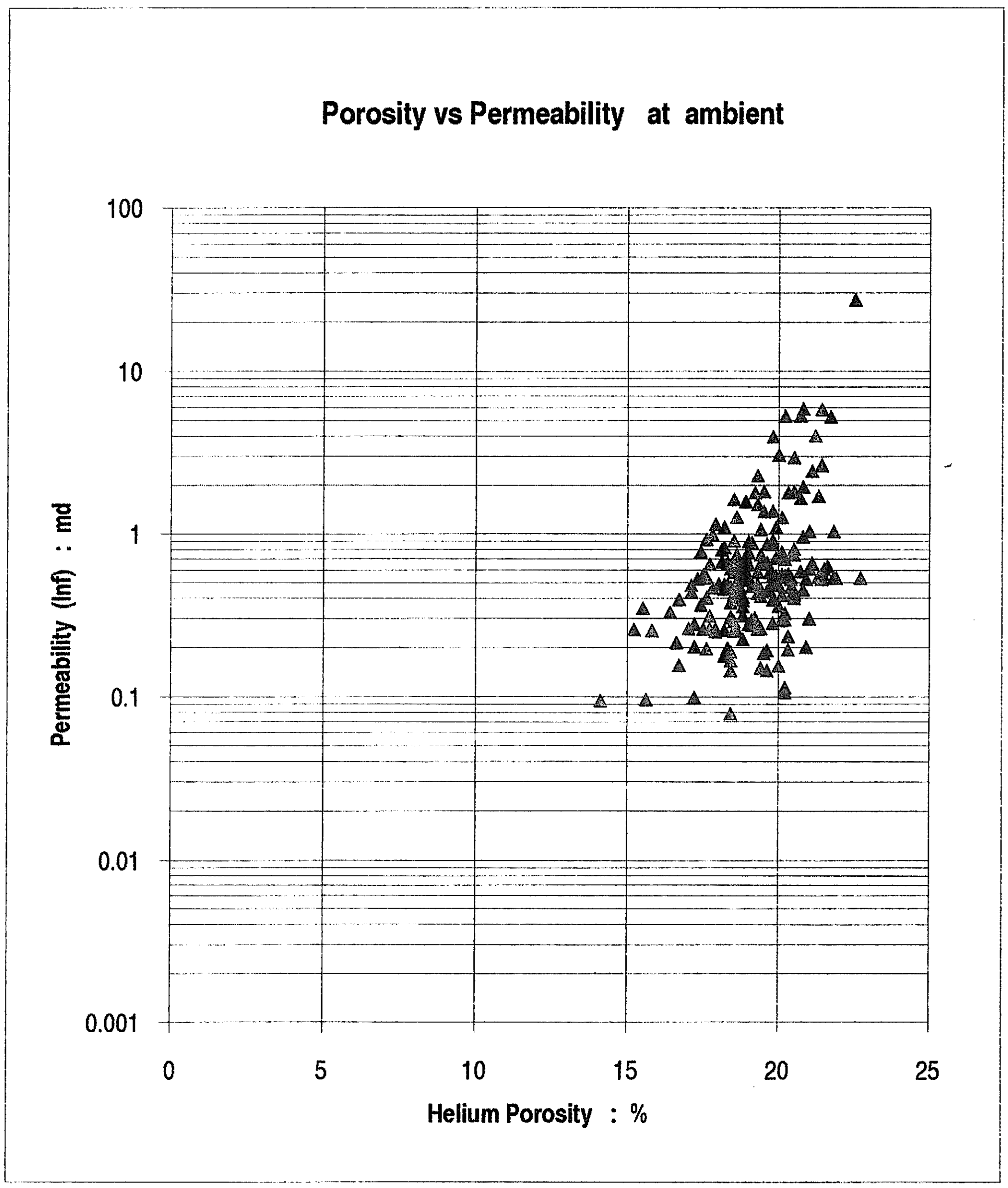
BLACKBACK # 3



A6 Fig 1

ESSO AUSTRALIA LIMITED

BLACKBACK # 3



A6 Fig 2.

PE603293

This is an enclosure indicator page.
The enclosure PE603293 is enclosed within the container PE900959 at this location in this document.

The enclosure PE603293 has the following characteristics:

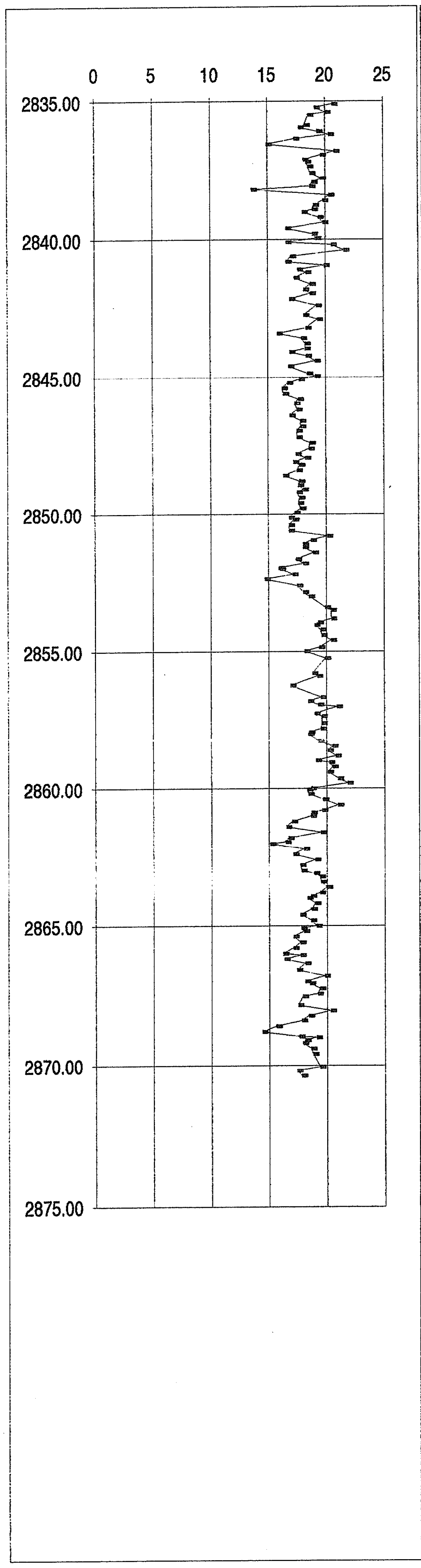
ITEM_BARCODE = PE603293
CONTAINER_BARCODE = PE900959
NAME = Well Log
BASIN = GIPPSLAND
PERMIT = VIC/P24
TYPE = WELL
SUBTYPE = WELL_LOG
DESCRIPTION = Blackback 3 Porosity/ Permeability / Grain Density vs Depth Log. Figure 3 from appendix 6 of WCR volume 2.
REMARKS = This item is in colour.
DATE_CREATED =
DATE_RECEIVED = 20/10/94
W_NO = W1097
WELL_NAME = Blackback-3
CONTRACTOR =
CLIENT_OP_CO = Esso Australia Limited

(Inserted by DNRE - Vic Govt Mines Dept)

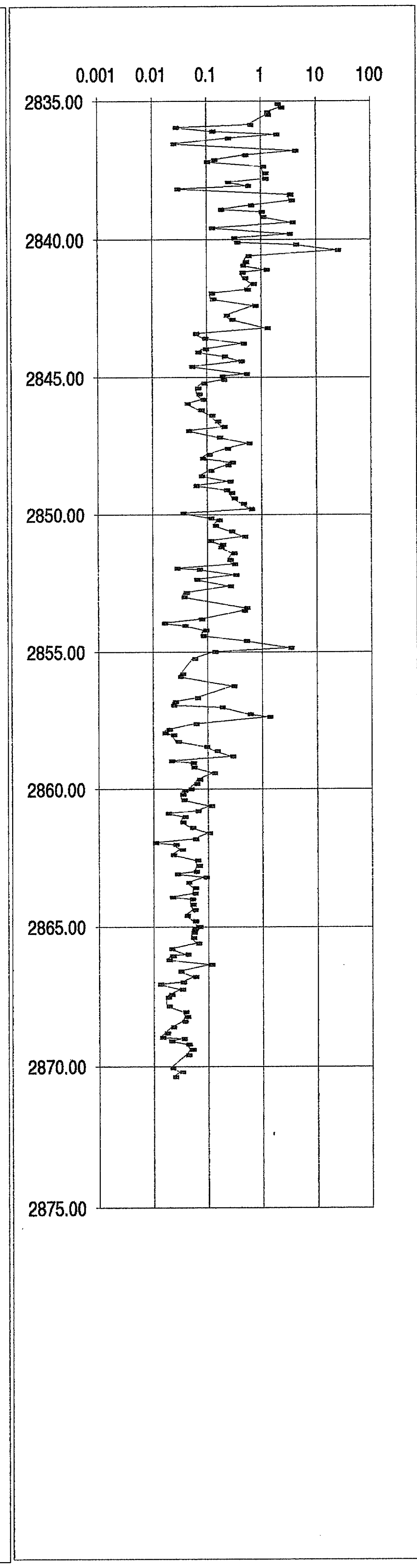
ESSO AUSTRALIA LIMITED

BLACKBACK # 3

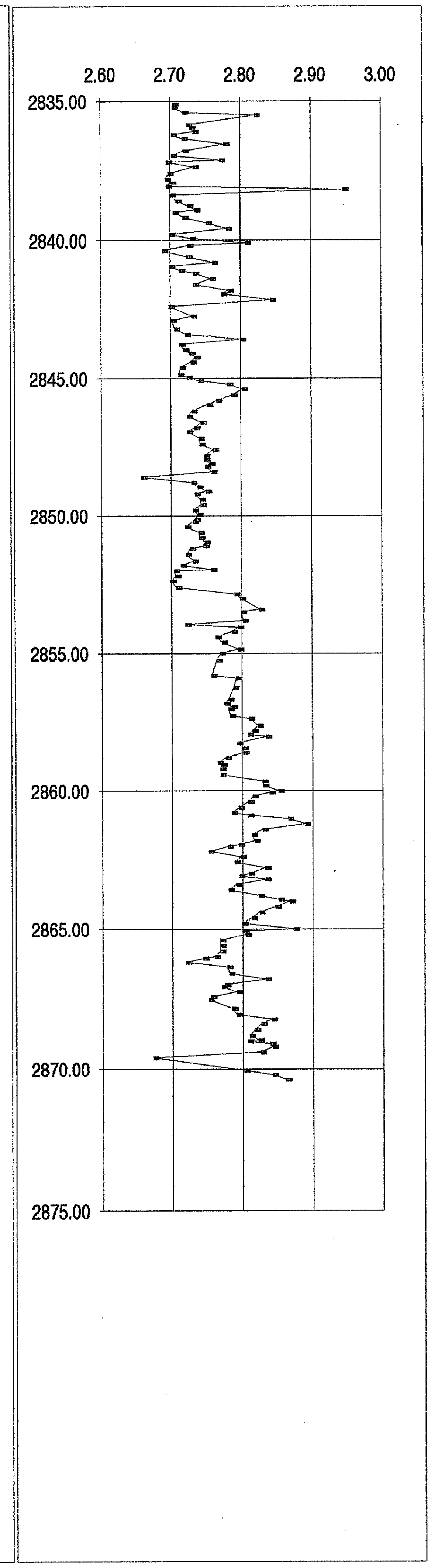
Porosity (%) vs Depth(m)



L. Permeability(md) vs Depth(m)



Grain density (gm/cc) vs depth(m)



SCALE 1:200

A6 . Fig 3

ENCLOSURES

ENCLOSURES

PE600770

This is an enclosure indicator page.
The enclosure PE600770 is enclosed within the container PE900959 at this location in this document.

The enclosure PE600770 has the following characteristics:

ITEM_BARCODE =	PE600770
CONTAINER_BARCODE =	PE900959
NAME =	Formation Evaluation log
BASIN =	GIPPSLAND
PERMIT =	
TYPE =	WELL
SUBTYPE =	WELL_LOG
DESCRIPTION =	Formation Evaluation log
REMARKS =	
DATE_CREATED =	31/03/1994
DATE_RECEIVED =	20/10/1994
W_NO =	W1097
WELL_NAME =	Blackback-3
CONTRACTOR =	Halliburton
CLIENT_OP_CO =	ESSO

(Inserted by DNRE - Vic Govt Mines Dept)

PE600771

This is an enclosure indicator page.
The enclosure PE600771 is enclosed within the container PE900959 at this location in this document.

The enclosure PE600771 has the following characteristics:

ITEM_BARCODE = PE600771
CONTAINER_BARCODE = PE900959
NAME = Well Completion Log
BASIN = GIPPSLAND
PERMIT =
TYPE = WELL
SUBTYPE = COMPOSITE_LOG
DESCRIPTION = Well Completion Log
REMARKS =
DATE_CREATED = 12/07/1994
DATE_RECEIVED = 20/10/1994
W_NO = W1097
WELL_NAME = Blackback-3
CONTRACTOR = ESSO
CLIENT_OP_CO = ESSO

(Inserted by DNRE - Vic Govt Mines Dept)

PE900960

This is an enclosure indicator page.
The enclosure PE900960 is enclosed within the container PE900959 at this location in this document.

The enclosure PE900960 has the following characteristics:

ITEM_BARCODE =	PE900960
CONTAINER_BARCODE =	PE900959
NAME =	Structural Cross section
BASIN =	GIPPSLAND
PERMIT =	
TYPE =	WELL
SUBTYPE =	CROSS_SECTION
DESCRIPTION =	Structural Cross section
REMARKS =	
DATE_CREATED =	30/09/1994
DATE_RECEIVED =	20/10/1994
W_NO =	W1097
WELL_NAME =	Blackback-3
CONTRACTOR =	ESSO
CLIENT_OP_CO =	ESSO

(Inserted by DNRE - Vic Govt Mines Dept)

PE900961

This is an enclosure indicator page.
The enclosure PE900961 is enclosed within the container PE900959 at this location in this document.

The enclosure PE900961 has the following characteristics:

ITEM_BARCODE = PE900961
CONTAINER_BARCODE = PE900959
NAME = Structure map
BASIN = GIPPSLAND
PERMIT =
TYPE = WELL
SUBTYPE = CROSS_SECTION
DESCRIPTION = Structure map - top of Latrobe Unconformity
REMARKS =
DATE_CREATED = 01/09/1994
DATE_RECEIVED = 20/10/1994
W_NO = W1097
WELL_NAME = Blackback-3
CONTRACTOR = ESSO
CLIENT_OP_CO = ESSO

(Inserted by DNRE - Vic Govt Mines Dept)

PE900962

This is an enclosure indicator page.
The enclosure PE900962 is enclosed within the container PE900959 at this location in this document.

The enclosure PE900962 has the following characteristics:

ITEM_BARCODE =	PE900962
CONTAINER_BARCODE =	PE900959
NAME =	Synthetic Seismogram
BASIN =	GIPPSLAND
PERMIT =	
TYPE =	WELL
SUBTYPE =	SYNTH_SEISMOGRAPH
DESCRIPTION =	Synthetic Seismogram
REMARKS =	
DATE_CREATED =	05/09/1994
DATE_RECEIVED =	20/10/1994
W_NO =	W1097
WELL_NAME =	Blackback-3
CONTRACTOR =	Sierra Geophysics Inc.
CLIENT_OP_CO =	ESSO

(Inserted by DNRE - Vic Govt Mines Dept)

PE600772

This is an enclosure indicator page.
The enclosure PE600772 is enclosed within the container PE900959 at this location in this document.

The enclosure PE600772 has the following characteristics:

ITEM_BARCODE =	PE600772
CONTAINER_BARCODE =	PE900959
NAME =	Seismic Calibration Log
BASIN =	GIPPSLAND
PERMIT =	
TYPE =	WELL
SUBTYPE =	VELOCITY_CHART
DESCRIPTION =	Seismic Calibration Log
REMARKS =	
DATE_CREATED =	12/04/1994
DATE_RECEIVED =	20/10/1994
W_NO =	W1097
WELL_NAME =	Blackback-3
CONTRACTOR =	Schlumberger
CLIENT_OP_CO =	ESSO

(Inserted by DNRE - Vic Govt Mines Dept)