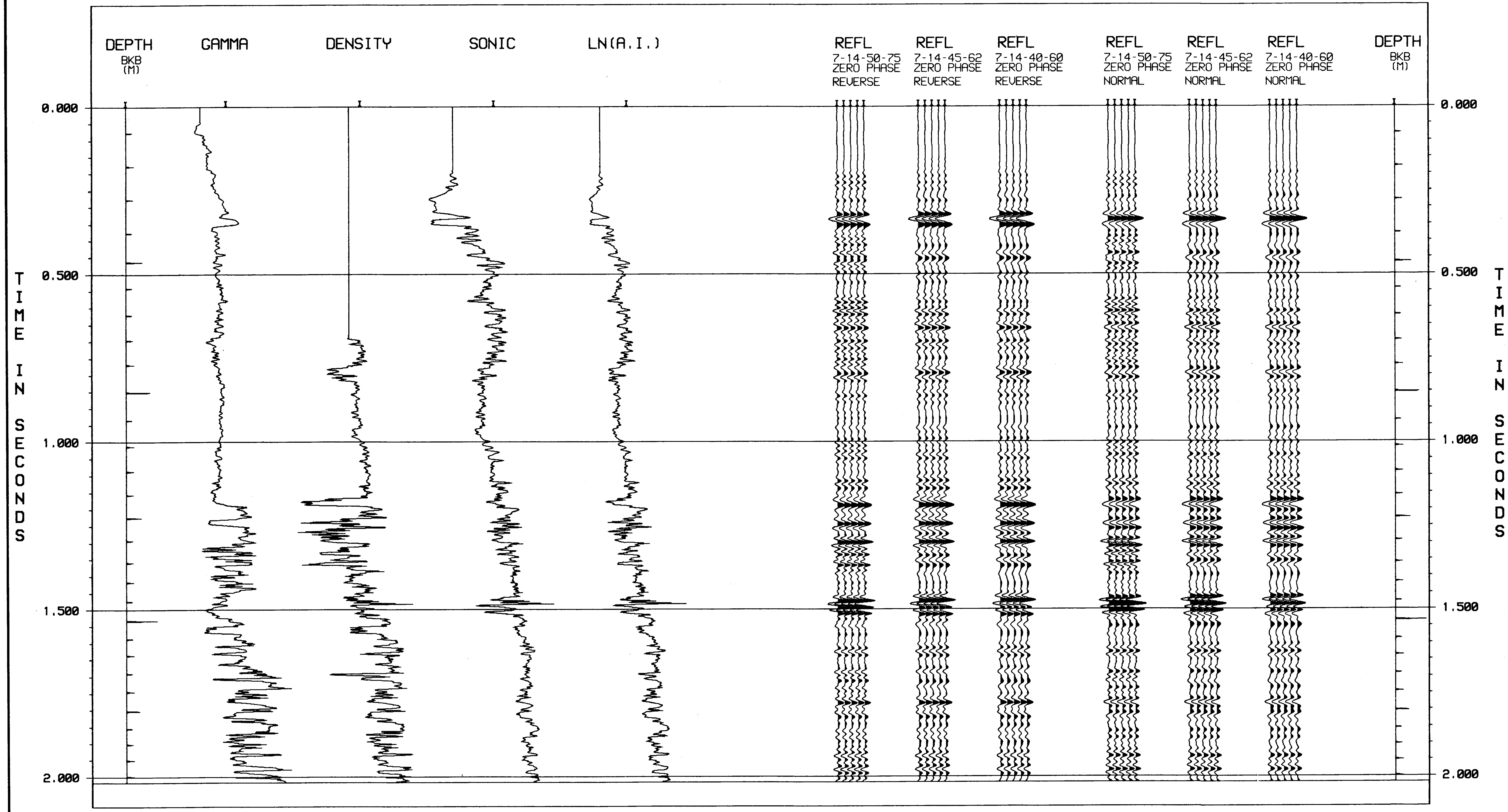

SHELL AUSTRALIA

WELL: JUDITH-1

VERT. SCALE: 10CM/SECOND, NON-LINEAR DEPTH SCALE, 100 UNITS PER DIVISION

DATUM : SEA LEVEL

POLARITY : NORMAL : COMPRESSIONAL ARRIVAL GIVES WHITE LOOP.

REVERSE : COMPRESSIONAL ARRIVAL GIVES BLACK LOOP.

GENERATED : 18 JUNE 1990

DEPTH(M) BELOW KB	TIME(MSEC) BELOW SRD
21	0
1100	934
1250	1050
1451	1192
1700	1358
1888	1466
2100	1586
2250	1662
2394	1740
2495	1800
2655	1880
2865	1980

SHELL-AUSTRALIA E.& P. OIL AND GAS

GIPPSLAND BASIN

SYNTHETIC SEISMOGRAM
JUDITH-1

Author: EXO	Date: JULY 1990
Report No.: SDA 938	Drawing No.: 26267

Encl 2

APPENDIX 1
PALYNOLOGY

APPENDIX 1

Palynology

PALYNOLOGICAL ANALYSIS, JUDITH-1

GIPPSLAND BASIN

by

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Palaeontological report prepared 7 February 1990 for
The Shell Company of Australia Ltd.

Consultant Palynologist, 20 Abbey St., Gladesville, NSW 2111

INTRODUCTION

Forty eight sidewall core samples and five cuttings samples, representing the interval 1449.0 to 2923.0m in Judith-1, were processed and examined for spore-pollen and dinoflagellates.

Yields and preservation were adequate to high but down-hole caving and low levels of mud-contamination has reduced the confidence of many age-determinations.

Lithological units and palynological determinations are summarized below. Interpretative and basic data are given in Tables 1 and 2 respectively. Check lists of all species recorded are attached. Electric log data were unavailable.

SUMMARY

AGE	UNIT	ZONE	DEPTH RANGE (m)	ENVIRONMENT
Late Oligocene - Miocene	LAKES ENTRANCE FORMATION	P. tuberculatus	1449.0	open marine
- - - - -	- - - - -	- Top of Latrobe	- - - - -	- - - - -
Early Oligocene	GURNARD facies?	Upper N. asperus	1451.0	open marine
Late Eocene	GURNARD facies	Middle N. asperus	1454.0	open marine
Middle Eocene	LATROBE GROUP coarse clastics	Lower N. asperus	1471.0	marginal marine
Early Eocene	"	P. asperopolus	1488.0-1503.5	marginal marine
- - - - -	- - - - -	- unconformity?	- - - - -	- - - - -
Early Eocene	"	Middle M. diversus	1509.5	channel fill
"	"	Lower M. diversus	1546.0	marginal marine
Paleocene	"	Upper L. balmei	1571.5-1622.0	marginal marine
"	"	Lower L. balmei	1667.5-1701.5	coastal plain
Maastrichtian	"	Upper T. longus	1764.0-1835.5	coastal plain
"	"	Lower T. longus	1858.0-1875.5	coastal plain
- - - - -	- - - - -	- unconformity	- - - - -	- - - - -
Lower Santonian - Turonian	GOLDEN BEACH FORMATION	P. mawsonii	1993.0-2721.0	rift-valley lake

GEOLOGICAL COMMENTS

1. Judith-1 contains an almost continuous sequence of palynological zones from the Cenomanian-Lower Turonian A. distocarinatus to the Oligo-Miocene P. tuberculatus Zone. Not recorded are the Upper M. diversus, T. lilliei, N. senectus and T. apoxyexinus Zones.

2. The SWC descriptions and palynological determinations indicate that Top of Latrobe occurs between 1449.0 and 1451.0m.

   Based on the abundance of glauconite, the SWC at 1454.0m was shot in the Gurnard facies and, despite the confident Middle N. asperus Zone date, the sample is likely to be part of a condensed sequence incorporating older sediments [see Biostratigraphy Section].

   The glauconitic siltstone sampled at 1451.0m may be part of the same facies or part of the informally named "Oligocene Wedge" - a glauconitic marl and claystone facies which separates Latrobe Group coarse clastics and limestones/marls of the Lakes Entrance Formation in a number of wells around the margin of the basin. The latter is considered the less likely due to the absence of carbonate but is possible due to the Early Oligocene date [see Biostratigraphy Section].

3. Sidewall core descriptions indicate a facies change, from glauconitic to argillaceous siltstones between 1503.5-1509.5m.

   If this lithologic change corresponds to the boundary between P. asperopolus and M. diversus Zone sediments, then I note that thicknesses of the latter [minimum 43m, possibly 68m] run counter to the general thinning trend of M. diversus Zone sediments as these onlap the northern margin of the Gippsland Basin.

4. The SWC at 1509.5m contains a Lower M. diversus Zone palynoflora that appears to have been reworked during Middle M. diversus Zone time. This scenario is typical of Early Eocene channel sediments. Erosion rather than non-deposition appears to be responsible for the absence or very thin nature of M. diversus Zone sediments in wells surrounding the Kipper Trend.

5. Paleocene sediments [minimum 155m] and Maastrichtian sediments [minimum 93m] in Judith-1 are thin relative to sections penetrated in wells closer to the central deep. Again, this may reflect thinning of the unit up onto the flanks of the basin, or erosion.

6. It is possible that the Lower T. longus Zone interval in Judith-1 will appear to correlate with T. lilliei Zone sediments in adjacent wells. This is due to the extreme rarity of the T. longus Zone index species in the early Maastrichtian and therefore some imprecision in the position of the T. longus/T. lilliei Zone boundary in individual wells.

7. On present indications, sediments of Campanian, T. lilliei and N. senectus Zone age are absent. This can only be confirmed by additional palynological analyses of sediments between 1858.0-1993.0m.

   The explanation favoured here is that Judith-1 has intersected the Lowry (1987) "intra-Campanian" unconformity. Given that igneous material was recovered at 1879m [Run 1 sidewall sample description sheet], volcanics may mark the position of an erosion surface.

8. Due to limited sampling and the difficulty of dating mud contaminated SWCs shot in the critical interval [1875.5-1993.0m: see Biostratigraphy Section], it is uncertain whether sediments of Santonian, T. apoxyexinus Zone age are present or not in Judith-1.

   Species which range no lower than the T. apoxyexinus Zone occur at 1984.0m and 1993.0m but the specimens appear to be caved. The former sample lacks "Kipper Shale" dinocysts and therefore represents a facies that is different from the underlying P. mawsonii Zone.

9. SWC and cuttings samples between 2017.0 and 2721.0m are confidently dated as Turonian-Lower Santonian, P. mawsonii Zone.

   The thickness of P. mawsonii Zone unit in Judith-1 [minimum 704m] is comparable to that penetrated in Kipper-1. The relatively shallow depth of the top of the zone is consistent with the location of the well on the upside of a major fault.

10. This unit is characterized by a unusual assemblage of freshwater dinocysts and other algae, previously

recorded only from Kipper-1, Sunfish-1 and grab samples from the Bass Canyon (Marshall, 1990).

These algae, informally known as the "Kipper Shale" dinocysts are abundant only in the upper part of the zone, above 2113.0m and may prove useful in correlating facies across the fault separating Judith-1 and the Kipper wells. Conversely an undescribed but distinctive dinocyst is confined to the lower part of the P. mawsonii Zone, suggesting that this section was not penetrated by Kipper-1.

11. Although it is uncertain if any of the above dinocysts are diagnostic of a particular facies or Zone in the Gippsland Basin, these algae **are** likely to indicate a particular intra-rift valley lacustrine environment.

12. Judith-1 is one of ca. five wells in the offshore Gippsland Basin which appear to have penetrated into Cenomanian-Lower Turonian, Appendicisporites distocarinatus Zone.

As with the other wells [Golden Beach-1, Moray-1, Sole-1, Tuna-1] the A. distocarinatus dates are of low confidence due to poor preservation and low diversity of palynomorphs. A similar scenario prevails in the Otway Basin.

It is recommended that future wells likely to intersect Turonian-Cenomanian sediments be sampled in detail at the appropriate depths in order to improve the palynological recognition of non-marine A. distocarinatus Zone units and environments along the southern margin.

13. The well terminated within the early Late Cretaceous Golden Beach Formation. As is usually the case, recycled Early Cretaceous and Permo-Triassic spore-pollen are frequent in SWCs shot in this formation.

PALAEOENVIRONMENTS

1. Based on the first reliable occurrence of marine dinoflagellates, the Judith-1 wellsite was located in a coastal plain but away from any direct marine influence from Maastrichtian times until the Late Paleocene.

   The earliest definite marine influence recorded in Judith-1 is the Apectodinium homomorpha transgression at 1571.5m. Thereafter, in common with much of the Gippsland Basin, the site was affected by the progressive encroachment of the Tasman Sea. Significant developments include:

   (a) the establishment of a Nypa palm (mangrove) swamp close to but probably not at the wellsite during the earliest Eocene Apectodinium hyperacantha transgression [see Partridge, 1976].

   (b) the persistence of marginal marine/deltaic conditions through the Early Eocene.

   (c) the establishment of open marine conditions at the wellsite during the P. asperopolus Zone, based on (i) the deposition of glauconitic sandstones and siltstones between 1471.0-1503.5m and (ii) the marked increase in abundance and diversity of marine dinoflagellates at and above 1488.0m.

2. During the Turonian-Santonian the wellsite is likely to have been located within a rift valley, almost certainly within the circumference of a large freshwater lake. This lake appears to have fluctuated in area and possibly in depth during the P. mawsonii Zone.

   The evidence for this, as in Kipper-1 and Sunfish-1 consists of freshwater algae whose relative abundance appears to vary inversely with swamp gymnosperms, ferns and other cryptogams.

   Assuming this relationship reflects the distance of the wellsite from the paleoshoreline, then it is possible to speculate on environmental trends due to the unusually thick and well-sampled P. mawsonii Zone sediments in Judith-1:

(a) 2496-2721.0m.

This interval is characterized by very low numbers of a distinctive but undescribed Rimosicysta [R. robusta ms] which almost certainly was tolerant of nearshore/swamp conditions since the cyst occurs in coal floats at 2496-99m, 2571-74m and 2583-86m.

(b) 2143.0-2474.0m

This interval is characterized by sporadic occurrences of dinocysts, mainly Rimosicysta kipperii. Whilst the palaeoenvironmental significance of this is uncertain, the increase upsection in the relative abundance of shrub conifers and treeferns [Microcachrydites antarcticus, Podosporites microsaccatus, Cyatheacidites tectifera] suggests progradation of the shoreline.

(c) 1993.0-2113.0m

This interval is characterized by a marked increase in the abundance of peridinacean cysts and diversity of Rimosicysta spp. This trend is considered to reflect a major expansion/deepening of the lake.

BIOSTRATIGRAPHY

Zone and age-determinations have been made using criteria proposed by Stover & Partridge (1973), Helby *et al.* (1987) and unpublished observations made on Gippsland Basin wells drilled by Esso Australia Ltd. The informal subdivision of the *T. longus* Zone proposed by Macphail (1983b: see Helby *et al.*, *ibid* p.58) is followed here. Zone names have not been altered to conform with nomenclatural changes to nominate species such as *Tricolpites longus* [now *Forcipites longus*: see Dettman & Jarzen, 1988].

Dinocyst species encountered in the *P. mawsonii* Zone interval conform well with genera and species described by Marshall (1990).

Because of mud-contamination and the possibility of recycled spore-pollen within lacustrine sediments, it is not certain that the **last** appearance of *Appendicisporites distocarinatus* or **first** appearances of *Phyllocladidites mawsonii* are reliable indicators of age in this well.

Appendicisporites distocarinatus Zone 2895.0-2908.0m
Cenomanian-Lower Turonian

SWC samples at 2895.0m and 2908.0m are provisionally dated as *A. distocarinatus* Zone based on the presence of the nominate species **and** absence of *definite* specimens of *Phyllocladidites mawsonii*. The sample at 2908.0m contains an *Ornamentifera* sp. whose closest known analogue is a species, *O.* sp cf *Ornamentifera sentosa*, recovered by Norwick & Burger (1975) from Cenomanian sediments on Bathurst Is., Northern Territory. Otherwise species typical of non-marine Cenomanian sediments elsewhere in Australia were absent. Accordingly a *P. mawsonii* age remains a possibility for this interval given the rarity of the nominate species in the Turonian.

SWCs below 2908.0m were not recovered or [2923.0m] extensively mud-contaminated. Palynomorphs recovered include the acritarch *Micrhystridium*, derived from the Kipper Shale?

Phyllocladidites mawsonii Zone 1993.0-2721.0m Lower Santonian
-Turonian

This interval is represented by twenty two SWC and five cuttings samples, most of which yielded poorly-preserved palynofloras dominated by gymnosperm pollen, *Gleicheniidites* and other long-ranging spores.

The nominate and index species of the zone, Phyllocladidites mawsonii, is present throughout the interval although on staining characteristics at least some specimens are caved.

Similarly, described/undescribed species of "Kipper Shale" dinocysts are ubiquitous but only become frequent-dominant in palynofloras near the top of the zone [1993.0-2017.0, 2113.0m].

The base of the P. mawsonii Zone is picked at 2721.0m, a mud-contaminated sample containing the distinctive spore Appendicisporites distocarinatus as well as Phyllocladidites mawsonii.

The first appearance of dinocysts, a species informally described as Rimosicysta robusta, is at 2705.0m. This species extends up section to 2202.0m. The first occurrence of a **described** "Kipper Shale" dinocyst species, R. kipperii, is at 2474.0m. Other records of biostratigraphic significance are:

1. Ornamentifera spp. cf O. sentosa and O. minima Norvick & Burger 1975 at 2653.0m, 2248.0m and 2282.0m [see above].

2. Interulobites intraverrucatus in the SWC sample at 2344.0 and cuttings at 2571-74.0m. These records are important evidence that the samples and hence the associated dinocysts are no younger than P. mawsonii Zone (cf Marshall, 1990). Appendicisporites distocarinatus occurs in the cuttings palynoflora.

3. Frequent to common Cyatheacidites tectifera at 2248.0m. Again this is good evidence that the sample is no younger than Lower Santonian since the species is abundant only in the P. mawsonii Zone in Southern Australia. Several spores have rugulate sculpture on the distal surface and may prove to be the first records in Australia of the related South American fossil spore C. archangelskyi.

Balmeisporites holodictyus and Rouseisporites reticulatus occur in association at 2282.0 and2325.0m.

The upper boundary is provisionally picked at 1993.0m, based on frequent Rimosicysta kipperii. This palynoflora includes a caved? specimen of Tricolpites confessus, a species which first appears in the T. apoxyexinus Zone.

The indeterminate SWC at 1984.0m is extensively contaminated by palynomorphs derived from drilling mud, including T.

confessus.

Lower _Tricolpites longus_ Zone 1858.0-1875.5m Maastrichtian

This zone is weakly defined by the first appearance of _Tetracolporites verrucosus_ in a mixed _Nothofagidites-Gambierina_ palynoflora at 1875.5m. _Tricolporites lilliei_ and _Triporopollenites sectilis_ demonstrate that the sample is no older than 'upper' _T. lilliei_ Zone.

The second of the two samples assigned to this zone contains _Forcipites longus_ and therefore is no older than Lower _T. longus_ Zone. The age determination is supported by the relative abundance of _Nothofagidites_ [frequent] and _Gambierina_ [common]. _Stereisporites punctatus_ is absent.

Upper _Tricolpites longus_ Zone 1764.0-1835.5m Maastrichtian

Palynofloras within this interval are characterized by common-abundant _Gambierina_.

The lower boundary is defined by the first appearance of _Stereisporites punctatus_ at 1835.5m and the upper boundary at 1764.0m by the last appearance of species which range no higher than this zone, e.g. _Forcipites longus_, _Proteacidites reticuloconcavus_, _Tricolporites lilliei_ and _Triporopollenites sectilis_.

Lower _Lygistepollenites balmei_ Zone 1667.5-1701.5m Paleocene

This interval is distinguished from the above zone by the abundance of _Proteacidites_ spp., in particular _P. angulatus_, and rarity of _Gambierina rudata_. The nominate species is frequent to common. _Australopollis obscurus_ is abundant at 1667.5m, picked as the top of the zone.

Upper _Lygistepollenites balmei_ Zone 1571.5-1622.0m Paleocene

The lower boundary is defined by the first appearance at 1622.0m of _Proteacidites incurvatus_ and _Malvacipollis subtilis_ in a palynoflora dominated by _Lygistepollenites balmei_, _Nothofagidites kaitangata_ and _Australopollis obscurus_

The sample is mud-contaminated [_Rimosicysta kipperii_, _Phimopollenites pannosus_] making it uncertain whether specimens of the Paleocene dinoflagellate _Apectodinium homomorphum_ are _in situ_ or caved.

The upper boundary, at 1571.5m, is defined by _Cyathidites_ gigantis, Banksieaeidites elongatus and Polycolpites langstonii in a palynoflora dominated by Lygistepollenites balmei, Gleicheniidites and Australopollis obscurus. Apectodinium homomorphum is frequent.

Based on staining characteristics, the interval 1571.5-1667.5m is the source of much of the caved spore-pollen encountered in Judith-1, in particular Australopollis obscurus and Phyllocladidites mawsonii.

Lower Malvacipollis diversus/A. hyperacantha Zone 1546.5m Early Eocene

The one palynoflora assigned to this zone contains an association of spore-pollen and dinoflagellates which first appears in, and possibly is unique to, the Lower M. diversus Zone: Spinizonocolpites prominatus, Crassiretitriletes vanraadshoovenii, Polypodiaceoisporites varus, Apectodinium hyperacantha and Fibrocysta bipolare. The nominate species Malvacipollis diversus is abundant.

Although all of the above species range above the Lower M. diversus, the sample is highly unlikely to be younger than this zone based on the relative abundance of S. prominatus and frequency of [reworked] Lygistepollenites balmei and other long-ranging Cretaceous-Paleocene species.

Middle Malvacipollis diversus Zone 1509.5m Early Eocene

The palynoflora at 1509.5m is essentially Lower M. diversus Zone [Cyathidites gigantis and frequent Proteacidites grandis and Malvacipollis spp.] but includes a population of the typically Middle M. diversus Zone dinoflagellate Apectodinium parvum and two specimens of Proteacidites ornatus, a species which first appears in the same zone.

Although species diagnostic of the Upper M. diversus-P. asperopolus Zone are absent, e.g. Myrtaceidites tenuis and Proteacidites pachypolus, the sample does appear to contain anomalously early records of Proteacidites crassus and Tricolporites leuros.

This mixture of species is characteristic of channel fill sediments which have undergone reworking, in the present case during the Middle M. diversus Zone and possibly during P. asperopolus Zone time.

The change in lithology from argillaceous to glauconitic between 1509.5 and 1503.5m may correspond to the biostratigraphic boundary between the P. asperopolus and M. diversus Zones.

Proteacidites asperopolus Zone 1488.0-1503.5m Early Eocene

The three SWC samples within this interval contain Myrtaceidites tenuis and Proteacidites pachypolus and therefore definitely are no older than Upper M. diversus Zone.

The lower boundary, at 1503.5m, is defined by the first appearance of Tricolpites incisus and Clavatipollenites glarius, species which very occasionally are found below this zone. Proteacidites ornatus and Intratriporopollenites notabilis demonstrate the sample is no younger than P. asperopolus Zone.

The sample contains a number of Early Eocene marine dinoflagellates, e.g. Cordosphaeridium inodes, Homotryblium tasmaniense and Apectodinium sp cf Apectodinium parvum, as well as reworked Paleocene spp. such as Australopollis obscurus and Lygistepollenites balmei.

The palynoflora recovered from the SWC at 1502.0m is similar except that dinoflagellates present include fragments of a Kisselovia sp., possibly K. coleothrypta. Specimens of the typically Middle N. asperus Zone species Tricolpites thomasii and Lower N. asperus Zone dinoflagellate Areosphaeridium diktyoplokus indicate minor mud-contamination of this SWC.

The upper boundary is confidently placed at 1488.0m, a sample containing the nominate species, Sapotaceoidaepollenites rotundus and frequent Conbaculites apiculatus in addition to species which range no higher than the P. asperopolus Zone, e.g. Myrtaceidites tenuis, Proteacidites ornatus and P. tuberculiformis. Dinoflagellates include Cleistosphaeridium epacrum, Apectodinium sp. cf A. hyperacantha and [caved] Areosphaeridium diktyoplokus.

Lower Nothofagidites asperus Zone 1471.0m Middle Eocene

Palynofloras at and above 1471.0m are dominated by Nothofagidites emarcidus-heterus, a reliable indication of a N. asperus Zone age.

One sample is confidently assigned to the Lower N. asperus Zone, based on Proteacidites asperopolus, Tricolpites simatus, Verrucatosporites attinatus, Rugulatisporites trophus and the dinocyst Tritonites pandus. Areosphaeridium *diktyoplokus* is present, and a *Deflandrea* sp. closely resembling the Early Eocene species *D. dartmooria* frequent, in this sample.

Middle *Nothofagidites asperus* Zone 1454.0m Late Eocene

The sample at 1454.0m contains both pollen and dinoflagellate index species for the Middle *N. asperus* Zone: *Triorites magnificus* and *Gippslandica extensa*. Other dinoflagellates include *Cleistosphaeridium epacrum* and *Schematophora speciosus*.

The occurrence of an Early Eocene species *Proteacidites tuberculiformis* indicates incorporation of older sediments, probably through bioturbation.

Upper *Nothofagidites asperus* Zone 1451.0m Early Oligocene

The SWC at 1451.0m is dated as Upper *N. asperus* Zone with a low degree of confidence due to the **absence** of both Middle *N. asperus* and *P. tuberculatus* Zone indicators, in particular *Cyatheacidites annulatus* and the dinocyst *Protoellipsodinium simplex*. Dinoflagellates are abundant relative to spore-pollen.

Irrespective of the zonal uncertainty, an Early Oligocene age is probable based on the presence of multiple specimens of *Pyxidinopsis pontus* and the abundance of *Nothofagidites* spp., including *N. falcatus*.

Proteacidites tuberculatus Zone 1449.0m Oligo-Miocene

Cyatheacidites annulatus and *Protoellipsodinium simplex* confirm a *P. tuberculatus* Zone age for this, the highest sample available for palynological analysis in Judith-1.

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LEGEND

SPORE-POLLEN

P. tub. = P. tuberculatus Zone
U. N.a. = Upper N. asperus Zone
M. N.a. = Middle N. asperus Zone
L. N.a. = Lower N. asperus Zone
P. asp. = P. asperopolus Zone
U. M.d. = Upper M. diversus Zone
M. M.d. = Middle M. diversus Zone
L. M.d. = Lower M. diversus Zone
U. L.b. = Upper L. balmei Zone
L. L.b. = Lower L. balmei Zone
U. T.l. = Upper T. longus Zone
L. T.l. = Lower T. longus Zone
T. lil. = T. lilliei Zone
N. sen. = N. senectus Zone
T. apx. = T. apoxyexinus Zone
P. maw. = P. mawsonii Zone
A. dst. = A. distocarinatus Zone
P. pan. = P. pannosus Zone
C. pdx. = C. paradoxa Zone
C. str. = C. striatus Zone
C. hug. = C. hughesii Zone
F. wng. = F. wonthaggiensis Zone
C. aus. = C. australiensis Zone

DINOFLAGELLATE

P. com. = P. comatum Zone
C. inc. = C. incompositum
D. ext. = D. extensa Zone
D. het. = D. heterophylcta
T. pan. = T. pandus Zone
A. aro. = A. australicum
T. ast. = T. asteris Zone
K. edw. = K. edwardsii
K. tom. = K. thompsonae
K. orn. = K. ornatum
K. wai. = K. waipawaensis
A. hyp. = A. hyperacantha
A. hom. = A. homomorphum
E. crs. = E. crassitabulata
T. evt. = T. evittii Zone
M. drg. = M. druggii Zone
I. kor. = I. korojonense
X. aus. = X. australis
N. asc. = N. asceras
I. cre. = I. cretaceum
O. por. = O. porifera
C. str. = C. striatoconus
P. inf. = P. infusorioides
D. mlt. = D. multispinum
X. asp. = X. asperatus
P. lud. = P. ludbrookiae
C. den. = C. denticulata
M. tet. = M. tetracantha
D. dav. = D. davidii
O. opr. = O. operculata

TABLE 2: SUMMARY OF BASIC PALYNOLOGICAL DATA

SWC	DEPTH (m)	YIELD S-P	YIELD DINO	DIVERSITY S-P	DIVERSITY DINO	PRES.	LITH.*
Logging Run 1							
49	1449.0	med.	med.	low	high	good	ST.ls
48	1451.0	low	high	med.	med.	poor	ST.gc
47	1454.0	mod.	med.	high	high	mod.	GC
46	1471.0	high	high	med.	high	good	ST.gc
45	1488.0	med.	med.	high	med.	mod.	ST.gc
44	1502.0	low	low	med.	med.	poor	ST.gc
43	1503.5	med.	high	high	med.	good	SS.gc
42	1509.5	high	med.	med.	low	good	ST.cl
41	1546.5	high	high	med.	med.	mod.	ST.cl
39	1571.5	med.	low	med.	low	poor	ST.cl
38	1600.0	high	–	high	–	mod	ST.cl
36	1622.0	high	caved?	high	low	good	ST.cl
34	1667.5	med.	–	med.	–	mod.	ST.cl
33	1691.0	High	caved	med.	–	good	ST.sa
32	1701.5	high	–	med.	–	good	ST.cl
29	1764.0	med.	–	high	–	good	ST.cl
28	1777.5	high	caved	med.	–	mod.	MS/CO
27	1803.0	low	caved	med.	low	mod.	ST.sa
26	1821.5	low	–	high	–	mod.	ST.cl
25	1835.5	high	caved	high	low	mod.	ST.cl
24	1858.0	high	–	high	–	mod.	ST.cl
22	1875.5	med.	–	high	–	poor	ST.cl
19	1977.0	low	caved	med.	–	mod.	ST.cl
18	1984.0	low	–	med.	–	mod.	MS.st
17	1993.0	med.	med.	med.	med.	poor	ST.sa
16	2017.0	med.	med.	med.	high	poor	ST.cl
15	2023.0	high	low	high	med.	poor	ST.sa
ctg	2025-28	high	low	high	low	good	
12	2092.0	med.	low	med.	low	poor	SS.cl
ctg	2112-14	high	low	high	low	mod.	
11	2113.0	med.	high	med.	high	poor	ST.cl
10	2143.0	high	caved	med.	–	poor	SS.st
08	2176.0	med.	–	high	–	mod.	ST.sa
07	2202.0	low	low	med.	low	good	ST.sa
05	2224.0	med.	low	med.	low	mod.	ST.cl
04	2248.0	high	low	high	low	poor	SS.st
02	2282.0	high	low	high	low	mod.	ST.cl
01	2308.0	high	low	med.	low	mod.	SS.cl

TABLE 2: SUMMARY OF BASIC PALYNOLOGICAL DATA

SWC	DEPTH (m)	YIELD S-P	YIELD DINO	DIVERSITY S-P	DIVERSITY DINO	PRES.	LITH.
Logging Run 2							
30	2325.0	high	low	low	low	poor	ST
28	2344.0	med.	low	med.	low	poor	ST
27	2364.0	low	-	low	-	mod.	ST.sa
22	2435.0	med.	-	low	-	poor	SS.st
21	2474.0	low	low	low	low	poor	ST.sa
ctg	2496-99	high	low	med.	low	mod.	ST.co
ctg	2571-74	low	low	med.	low	poor	ST.co
ctg	2583-86	low	low	med.	low	poor	ST.co
14	2630.5	high	-	med.	-	poor	ST.cl
13	2653.0	low	low	low	low	mod.	SS.st
11	2705.0	high	low	med.	low	mod.	MS.st
10	2721.0	high	caved	med.	-	poor	MS
05	2895.0	low	-	med.	-	poor	ST.cl
04	2908.0	low	caved	med.	-	mod.	ST.cl
03	2923.0	low	caved	med.	-	mod.	SS.cl

* Lithological descriptions [main rock type.qualifer] taken from hand-written sidewall sample description sheet.

PART A: SAMPLES 1451.0-2023.0m

Well Name JUDITH-1 Basin GIPPSLAND Sheet No. 1 of 5

SAMPLE TYPE OR NO. *	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S
FOSSIL NAMES / DEPTHS (metres)	1451.0	1454.0	1471.0	1488.0	1502.0	1503.5	1509.5	1546.5	1571.5	1600.0	1622.0	1667.5	1691.0	1701.5	1764.0	1777.5	1803.0	1821.5	1835.5	1858.0	1875.5	1977.0	1984.0	1993.0	2017.0	2023.0
SPORE-POLLEN																										
Alisporites grandis					R																					
A. similis													•													
Amosopollis cruciformis												•									•				•	•
Anacolosidites acutullus				•	•	•																				
A. rotundus ms			•		•	•																				
A. sectus																										
Araucariacites australis		•		•		•	•	•		•	•				•		•	•	•	•	•			•	•	
Arecipites spp.				•		•				•																
Australopollis obscurus					C				•	•	•	•	•			•		•		•		C	•		C	
Baculatisporites comaumensis								R										•								•
B. disconformis		•		•	•					•	•	•	•													
Balmeisporites holodictyus																									•	
Banksieaeidites arcuatus										•																
B. elongatus							•		•																	
B. lunatus ms																										
Basopollis mutabilis ms								•	•					•												
B. otwayensis ms									•	•	•	•		•	•		•	•			•					
Beaureadites eleganssiformis		•	•			•																				
B. orbiculatus												•			•											
B. verrucatus		•					•																			
Bluffopollis scabratus			•																							
Camarozonosporites australiensis													•			•			•		•		•			
C. dumus ms							•													•	•					
C. heskermensis													•	•				•		•	•					
C. horrendus ms																				•	•					
Ceratosporites equalis																										•
Cicatricosisporites australiensis								R			R			R				•								•
C. ludbrookii												R														
C. pseudotripartitus													R													
C. spp. indet./undescribed	•												R									C		•		
Clavifera triplex			•					•	•	•							•	•	•							
Clavatipollenites glarius			•			•																				
Conbaculatisporites apiculatus ms				•						C																
Concavissimisporites penolaensis																									•	
Coptospora sp. nov.																									•	
Crassiretitriletes vanraadshooveni					•																					
Crybelosporites striatus																			R							
Cunoniaceae-type				•						•																
Cupanieidites or oteichus		•	•	•	•	•																				
C. reticularis				•																						
Cyathidites australis				R				R	R				R					R								
C. gigantis							•		•																	
C. minor	•	•		•		•		•	•		•	•	•					•					•		•	•
C. palaeospora	•		•																							
C. splendens			•	•	•	•	•	•	•	•	•		•	•	•		•	•	•	•		C				•
Cyclosporites hughesii														R												
Dacrycarpites australiensis				•				•					•		•	•										
Deltoidaspora			•	•																						
Densoisporites velatus																				•	•					
Dicotetradites clavatus		•		•		•	•			•		•					•		•	•		C	C			
Dictyophyllidites spp.						•							•													
Dictyotosporites speciosus																					R					
Dilwynites granulatus						•			•										•			C		•	•	•
D. tuberculatus					•	•																				
Dryptopollenites semilunatus			•																							

C=CORE S=SIDEWALL CORE R = REWORKED SP.

Well Name JUDITH-1 Basin GIPPSLAND Sheet No. 2 of 5

SAMPLE TYPE OR NO. *	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S
FOSSIL NAMES / DEPTHS metres	1451.0	1454.0	1471.0	1488.0	1502.0	1503.5	1509.5	1546.5	1571.5	1600.0	1622.0	1667.5	1691.0	1701.5	1764.0	1777.5	1803.0	1821.5	1835.5	1858.0	1875.5	1977.0	1984.0	1993.0	2017.0	2023.0
Elphredripites notensis				•		•		•																		
Ericipites scabratus	•					•				•							•			•	•	C				
Foraminisporis asymmetricus																								R		R
Forcipites longus															•					•	?					
Forcipites spp. indet./undescribed															•				•							
Foveosporites canalis													R												•	
Foveotriletes balteus					•																					
F. parviretus					R			R			R		R	R						R						
Gambierina rudata											•	•	•	•	•	•	•	•	•	•	•	C	C			C
Gleicheniidites spp.	•		•	•	•	•	•	•	•	•	•	•	•	•		•	•	•	•	•		C	•	•	•	•
Grapnelispora cf evansii																				•						
Haloragacidites harrisii	•	•	•	•	•	•	•	•	•	•	•						C					C				
Herkosporites elliotii				•					•	•			•	•		•		•		•					•	•
Ilexpollenites anguloclavatus		•	•				•	•			•		•									C				
Intratriporopollenites notabilis						•																				
Ischyosporites gremius	•	•	•	•	•	•																				C
I. irregularis ms					•	•		•								C										
I. punctatus																			R							
Klukisporites scaberis																			R							
Kraeuselisporites majus														•				•	•		•					•
Laevigatosporites spp.		•		•	•	•		•	•	•	•	•	•	•	•		•	•	•	•	•	C?	•	•		
Latrobosporites amplus									•		•	•	•	•			•	•	•	•		C				
L. crassus				•			•		•		•	•			•	•	•	•	•		•	C				
Leptosporites verrucatus					R									R												
Liliacidites ruppiaeformis ms															•			•	•							
L. spp. indet./undescribed				•											•					•	•					•
cf Lycopodiacites asperatus					R					R			R												•	
Lycopodiumsporites australoclavatidites																							•			
L. circolumenus														R												
L. nodosus																										
L. spp.			•								•	•		•	•	•			•	•				•		•
Lygistepollenites balmei						R		R	•	•	•	•	•	•		•	•	•	•	•	•	C	C		C	
L. florinii	•	•		•	•	•	•	•	•	•	•	•	•	•			•	•	•		•	C			C	
Malvacipollis diversus		•					•	•																		
M. duratus ms			•	•		•	•																			
M. robustus ms		•																								
M. subtilis			•	•	•	•	•				•															
Matonisporites ornamentalis	•	•				•			•	•	•															
Micrantheum spinyspora		•																								
Microcachrydites antarcticus	•		•								•				•	•	•		•	•	•	•	•	•	•	•
Milfordia homeopunctata					•	•																				
Monolites alveolatus			•																							
Myrtaceidites eugenioides				•																						
M. eucalyptoides	•	•			•	•																				
M. parvus-mesonesus		•	•	•	•	•	•																			
M. tenuis				•	•	•		C																		
Neoraistrickia truncata		R																						R		
Nothofagidites asperus	•	•									•															
N. brachyspinulosus		•	•		•				•																	
N. deminutus-vansteenii	•	•	•																							
N. emarcidus-heterus	•	•	•	•	•	•	•															C	C		C	C
N. flemingii		•	•	•	•	•	•		•		•												C			
N. falcatus	•	•																				C				
N. goniatus			•	•																						
N. kaitangata								C	•	•	•	•	•	•			•	•	•	•	•	C		C		
N. senectus s.l.										•	•	•		•				•	•	•	•					

* C=CORE S=SIDEWALL CORE

R = REWORKED SP.

Well Name JUDITH-1 Basin GIPPSLAND Sheet No. 3 of 5

SAMPLE TYPE OR NO. *	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S
FOSSIL NAMES / DEPTHS metres	1451.0	1454.0	1471.0	1488.0	1502.0	1503.5	1509.5	1546.5	1571.5	1600.0	1622.0	1667.5	1691.0	1701.5	1764.0	1777.5	1803.0	1821.5	1835.5	1858.0	1875.5	1977.0	1984.0	1993.0	2017.0	2023.0
Osmundacites wellmanii																					•			•		
Parvisaccites catastus			•	•					•																	
Peninsulapollis askinae																							C			
P. gillii										•		•	•	•	•	•	•	•	•	•	•	C?	C			
Periporopollenites demarcatus			•	•	•	•	•				•				•	•			•	•						
P. polyoratus		•					•				•	•			•	•				•		C				
P. vesicus				•																						
Peromonolites bacculatus ms												•														
P. densus										•	•		•				•	•		•						
Phimopollenites pannosus											C					C										•
Phyllocladidites mawsonii	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	C	C		•	•
P. verrucosus								C			•	•		•		•		•			•					
P. reticulosaccatus									•	•		•	•	•	•	•			•				C		•	
Phyllocladus palaeogenicus	•		•							•																
Podocarpidites spp.	•	•	•	•		•	•	•	•	•	•	•	•		•	•	•	•	•	•	•	•	•		•	•
Podosporites erugatus			•																							
P. microsaccatus				•		•	•	•			•	•			•	•	•		•	•	•	•	•		•	•
Polycingutriletes pocockii																										
Polypodiaceoisporites varus				•	•			•																		
Polypodiidites spp.	•		•															•	•			C				
Polycolpites langstonii									•		•															
Proteacidites adanthoides		•				•	•																			
P. ademonosus ms																•		•		•	•					
P. angulatus												•	•	•	•		•			•		C				
P. annularis				•	•	•	•		•													C				
P. asperopolus			•	•																						
P. callosus																										
P. cleinei ms															•	•	•	•	•		•					
P. cf confragosus															•											
P. crassus		•	•	•	•		•																			
P. differentipollis		•																								
P. dierama															•	•		•	•							
P. grandis	•			•	•	•	•																			
P. incurvatus							•				•															
P. kopiensis						•																				
P. latrobensis			•		•	•																				
P. leightonii			•	•	•	•																				
P. nasus		•		•																						
P. obscurus			•			•	•			•																
P. ornatus				•																						
P. otwayensis ms															•		•	•	•							
P. pachypolus		•	•	•	•	•																				
P. palisadus															•					•	•					
P. pseudomoides			•																							
P. rectus								•		•																
P. reticuloconcavus ms															•			•	•		•	C		C		
P. reticuloscabratus			•		•				•																	
P. retiformis													•		•			•	•							
P. tuberculiformis		R		•		•																				
P. xestoformis ms						•																				
P. spp. indet./undescribed	•		•	•	•	•		•	•	•	•	•	•	•	•	•	•	•	•	•	•		•			
Pseudowinterapollis cranwellae											•															
P. wahooensis																		•								
Quadraplanus brossus																•						C				
Rouseisporites reticulatus													•	•					•		•					
R. simplex																	•							•	•	•

* C=CORE S=SIDEWALL CORE

R = REWORKED SP.

Well Name JUDITH-1 Basin GIPPSLAND Sheet No. 4 of 5

FOSSIL NAMES / DEPTHS (metres)	1451.0	1454.0	1471.0	1488.0	1502.0	1503.5	1509.5	1546.5	1571.5	1600.0	1622.0	1667.5	1691.0	1701.5	1764.0	1777.5	1803.0	1821.5	1835.5	1858.0	1875.5	1977.0	1984.0	1993.0	2017.0	2023.0
SAMPLE TYPE OR NO. *	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S
Rugalatisporites mallatus					•	•		•		•													•			
R. trophus			•																							
Santalumidites cainozoicus			•	•	•	•																				
Sapotaceoidaepollenites rotundus		•	•	•																						
cf Sestrosporites																										•
Spinizonocolpites prominatus								•																		
Stereisporites antiquisporites								•	•	•	•		•	•	•			•		•	•	•			•	•
S. australis f. crassa					•						•			•		•	•					C				
S. punctatus ms				•	•	•		•	•	•	•	•	•	•	•	•	•	·	•				C			
S. regium ms																•		•	•	•	•					
S. spp.		•				•	•	•	•	•	•	•	•	•		•		•	•	•	•		•	•		
Stoveripollis lunaris																•										
taeniate bisaccates [Permo-Triassic]																							R	R	R	R
Tetracolporites multistrixus ms						•	•		•					•												
T. textus ms									•													C				
T. verrucosus											•		•	•		•		•	•		•					
Tetradopollis securus																		•			•					
Tricolpites confessus													•		•	•		•	•		•		C	C?		
T. gigantis ms									•	•																
T. halis				•		•		•																		
T. incisus				•	•	•																				
T. phillipsii							•		•		•			•			•									
T. reticulatus										•																
T. paenestriatus				•		•																				
T. simatus		•	•																							
T. thomasii			•		C																					
T. waiparensis															•	•		•	•	•	•					
T. spp indet./undescribed			•	•		•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Tricolporites adelaidensis						•																				
T. balmei ms										•																
T. lilliei															•			•	•	•	•					
T. moultonii ms						•																				
T. patulus																										
T. scabratus		•				•																				
T. sphaerica						•	•																			
T. spp. indet./undescribed			•	•	•	•	•	•	•	•	•	•	•		•	•	•	•	•	•	•	•	•	•		•
indeterminate trilete spores	•		•		•	•		•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Triletes tuberculiformis		•																								
Triorites magnificus																										
Triporopollenites heleosus				•		•																				
T. sectilis															•	•		•	•	•	•					
Trisaccites																										•
Verrucatosporites attinatus ms			•																							
Verrucosisporites kopukuensis		•	•	•	•			•	•																	
Bysmapollis emaciatus					•																					
Myrtaceidites verrucosus						•																				
Corollinia spp.													R													
Proteacidites amolosexinus															•			•		•	•					
Appendicisporites distocarinatus																	R								•	•
Proteacidites wahooensis																			•							
Cyatheacidites tectifera																									•	

C=CORE S=SIDEWALL CORE

R = REWORKED SP.
C = CONTAMINANT

Well Name JUDITH-1 Basin GIPPSLAND Sheet No. 5 of 5

SAMPLE TYPE OR NO. *	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S
FOSSIL NAMES / DEPTHS (METRES)	1451.0	1454.0	1471.0	1488.0	1502.0	1503.5	1509.5	1546.5	1571.5	1600.0	1622.0	1667.5	1691.0	1701.5	1764.0	1777.5	1803.0	1821.5	1835.5	1858.0	1875.5	1977.0	1984.0	1993.0	2017.0	2023.0
DINOFLAGELLATES & OTHER ALGAE																										
Achomosphaera crassipellis								•																		
Aireiana verrucosa			•																							
Apectodinium homomorphum								•	•		C						C		C			C		C		
A. hyperacanthum						•		•																		
Areosphaeridium arcuatum		•																								
A. capricornum	•																									
A. diktyoplokus			•	C	C																					
Baltisphaeridium nanum																										
Cleistosphaeridium epacrum ms		•	•	•																						
Cordosphaeridium inodes		•	•	•		•	•																			
Deflandrea dartmooria			•																							
D. spp. indet/undescribed				•					•																	
Fibrocysta bipolare								•																		
Homotryblium tasmaniense				•		•																				
Impagidinium spp.	•	•																								
Kenleyia spp.								•																		
Kisselovia sp. cf K. coleothrypta					•																					
Operculodinium centrocarpum	•				•	•											C					C				
Paralecaniella indentata		•		•	•	•		•																		
Pediastrum																									•	
peridinaceaen cysts cf Luxadinium																			C					•	•	•
Pyxidinopsis pontus ms	•																									
Rimosicysta cf cucullata																									•	
R. cf eversa																									•	
R. kipperii											C													•	•	
R. cf kipperii																								•	•	
R. robusta ms																										
R. spp. indet./undescribed																						C		•	•	
Schematophora speciosus		•																								
Spiniferites spp.	•	•			•		•										C					C				
Thalassiphora spp.			•																							
Wuroia corrugata																								•	•	
W. unciformis																								•	•	
INDET. DINOCYSTS	•	•	•	•	•	•		•	•				C											•	•	•
Apectodinium parvum							•																			
Micrhystridium																								•	•	
Veryhackium																										
Gippslandica extensa		•																								
Tritonites pandus			•																							
Hystrichosphaeridium rigaude				•																						
Rimosicysta cf aspera																								•	•	

C=CORE S=SIDEWALL CORE R = REWORKED SP.

CHECK LIST OF SPORE-POLLEN & DINOCYSTS

PART B: SAMPLES 2025-2923.0m

Well Name JUDITH-1 Basin GIPPSLAND Sheet No. 1 of 3

SAMPLE TYPE OR NO. *	T	S	T	S	S	S	S	S	S	S	S	S	S	S	S	S	T	T	T	S	S	S	S	S	S	S
FOSSIL NAMES / DEPTHS metres	2025-28	2092.0	2112-14	2113.0	2143.0	2176.0	2202.0	2224.0	2248.0	2282.0	2308.0	2325.0	2344.0	2364.0	2435.0	2474.0	2496-99	2571-74	2583-86	2630.5	2653.0	2705.0	2721.0	2895.0	2908.0	2923.0
IN SITU & REWORKED [R] SPORE-POLLEN																										
Aequitriradites spinulosus R										•									•							
Alisporites grandis						•																	•	•		
A. similis	•																									
Amosopollis cruciformis		•		•	•			•	•	•	•		•	•	•		•	•	•		•	•	•	•	•	
Appendicisporites distocarinatus			•					•	•	•		•						•					•	•	•	
Appendicisporites spp.						•	•				•	•														
Araucariacites australis	•	•	•		•			•	•	•							•	•	•	•		•	•			
Arecipites spp.																										
Asteropollis asteroides	•		•																							
Australopollis obscurus	•	•	•																							
Baculatisporites comaumensis									•	•			•		•			•								
B. disconformis									•																	
Balmeisporites holodictyus									•	•		•					•									
B. tridictyus																	•									
Biretisporites spp. R												•											•	•		
Camarozonosporites australiensis	•	•						•																		
Ceratosporites equalis				•					•	•							•	•								
Cicatricosisporites australiensis					•	•	•	•	•	•	•	•		•	•		•		•				•	•	•	
C. cuneiformis																	•	•								
C. ludbrookii	•					•		•		•	•						•			•						
C. cf Hughesii										•																
C. spp. indet./undescribed					•		•				•	•			•						•		•		•	
Concavissimisporites penolaensis R?									•															•		
Contignisporites cooksoniae R					•																					
Coptospora sp. nov.					•					•																
Corollinia spp. R			•	•												•										
Crybelosporites striatus R					•																					
Cyathidites australis				•	•	•	•	•	•	•		•			•	•	•		•	•					•	
C. minor	•				•	•	•	•	•								•	•	•	•	•	•		•	•	
Cyclosporites hughesii R					•									•												
Cyatheacidites tectifera					•		•	•	•	•			•										•		•	
Dictyophyllidites crenatus R?																										
D. pectinaeformis R?										•												•				
Dictyotosporites speciosus R						•	•												•		•					
Didecitriletes R					•																					
Dilwynites granulatus	•	•								•							•	•		•		•				
D. tuberculatus					•				•											•						
Elphredripites cf notensis	•																•									
Erdtmanipollis sp.					•				•																	
Foraminisporis asymmetricus R	•			•	•					•							•									
F. wonthaggiensis R									•																	
Foveosporites canalis	•		•					•					•				•			•		•				
Foveotriletes parviretus R?	•					•				•				•								•				
Herkosporites elliotii	•								•											•			•			
Interulobites intraverrucatus													•					•								
Ischyosporites punctatus R?							•			•																
Laevigatosporites spp.	•		•		•	•	•	•	•	•		•	•		•		•	•				•		•	•	
Leptolepidites verrucatus				•	•	•		•	•	•		•	•								•			•		
cf Lycopodiacites asperatus				•	•	•		•	•	•		•	•	•	•	•			•	•		•			•	
Lycopodiumsporites australoclavatidites						•		•	•	•							•									
L. circolumenus								•																		
L. nodosus						•																				
L. spp.				•									•					•	•	•	•	•	•	•	•	
Microcachrydites antarcticus	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Neoraistrickia truncata	•								•	•								•	•						•	

Well Name JUDITH-1 Basin GIPPSLAND Sheet No. 2 of 3

SAMPLE TYPE OR NO. *	T	S	T	S	S	S	S	S	S	S	S	S	S	S	S	S	T	T	T	S	S	S	S	S	S	S
FOSSIL NAMES / DEPTHS (metres)	2025-28	2092.0	2112-14	2113.0	2143.0	2176.0	2202.0	2224.0	2248.0	2282.0	2308.0	2325.0	2344.0	2364.0	2435.0	2474.0	2496-99	2571-74	2583-86	2630.5	2653.0	2705.0	2721.0	2895.0	2908.0	2923.0
Ornamentifera minima																					•					
O. sp. cf O. sentosa Norwick & Burger									•	•											•				•	
Osmundacites wellmanii	•								•																	
Phimopollenites pannosus										•								•								
P. spp.		•		•															•	•						
Phyllocladidites mawsonii	•		•	•	•	•		•	•				•		•	•	•	•	•	•	•	•	•			
P. reticulosaccatus													•				•									
Plicatipollenites spp. R					•				•						•											
Podocarpidites spp.	•	•	•	•	•	•	•	•	•	•		•	•	•	•	•	•	•	•	•	•	•	•	•	•	
Podosporites microsaccatus	•	•		•	•	•	•	•		•		•	•		•			•	•					•		
Polycingutriletes				•		•		•									•									
Proteacidites spp. undescribed	•	•	•					•																		
Pseudowinterapollis cranwellae	•																									
Reticulatisporites pudens																		•								
Rouseisporites reticulatus	•								•	•			•				•	•						•		
R. simplex	•								•	•		•					•	•					•			
Rugulatisporites mallatus [K-var.]	•								•								•				•	•				
cf R. mallatus													•											•		
Schizea digitatoides						•		•		•					•											
Schizocolpus sp.																										
cf Sestrosporites				•		•			•	•			•	•			•	•			•			•		•
Stereisporites antiquisporites		•		•	•	•	•	•		•					•	•	•	•		•	•	•	•		•	•
S. spp.			•	•		•				•					•	•			•	•						
Striatopollis sp.																						•				
taeniate bisaccates				•	•		•		•					•												
Tricolpites spp. indet./undescribed	•				•	•		•	•	•		•	•		•	•		•		•	•	•	•		•	
Tricolporites spp. indet./undescribed	•						•		•	•							•	•		•			•		•	
indeterminate trilete spores	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
Triletes tuberculiformis		•											•									•				
Triporopollenites spp. indet./undescribed										•									•							
Tsugaepollenites spp.				•																						
Verrucosisporites spp.	•		•																•							
Densoisporites velatus							•																			
Gleicheniidites spp	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•			•	•	•	•	•	
Kraeuselisporites majus						•		•		•	•	•				•	•	•		•		•	•			
DINOCYSTS																										
Rimosicysta aspera			•																							
R. cucullata												•														
R. cf cucullata				•																						
R. kipperii		•		•					•	•			•			•										
R. cf kipperii			•	•						•		•	•			•					•					
R. robusta ms							•					•					•	•	•			•				
R. spp. indet./undescribed	•	•		•					•							•						•				
Micrhystridium																										•
peridinacean cysts cf Luxadinium				•						•		•	•													
Spheripollenites psilatus				•																						
amorphous algal cysts	•	•	•	•	•			•		•			•			•				•	•					

Well Name JUDITH-1 Basin GIPPSLAND Sheet No. 3 of 3

SAMPLE TYPE OR NO. *	T		T						S	S	S	S	S	S	S	S	T	T	T	S	S	S	S	S	S	S
FOSSIL NAMES / DEPTHS (METRES)	2025-28	2092.0	2112-14	2113.0	2143.0	2176.0	2202.0	2224.0	2248.0	2282.0	2308.0	2325.0	2344.0	2364.0	2435.0	2474.0	2496-99	2571-74	2583-86	2630.5	2653.0	2705.0	2721.0	2895.0	2908.0	2923.0
MUD CONTAMINANTS/CAVED SPECIES																										
Australopollis obscurus	•		•	•	•	•	•		•	•				•			•			•		•				•
Banksieaeidites lunatus	•																									
Bysmapollis emaciatus			•																							
Cupanieidites orthoteichus	•		•																							
Cyatheacidites annulatus	•		•								•															
Cyathidites gigantis			•																							
C. splendens	•		•			•		•									•									
Dicotetradites clavatus		•	•								•															
Ericipites scabratus							•																			
Foveotriletes lacunosus											•															
Gambierina rudata	•		•			•	•	•		•																
Gleicheniidites spp.	•										•															
Haloragacidites harrisii			•			•								•												
Laevigatosporites spp.	•						•							•												
Latrobosporites amplus									•																•	
Lygistepollenites balmei	•		•	•		•	•																			
L. florinii	•		•																							
Malvacipollis subtilis			•												•											
Nothofagidites emarcidus-heterus			•				•		•		•	•	•										•			
N. falcatus											•															
N. kaitangata	•					•																				
N. cf waipawaensis	•						•																			
Peninsulapollis askinae						•			•									•								
P. gillii	•		•			•		•																		
Peromonolites densus	•		•																							
Phyllocladidites mawsonii	•		•			•	•	•			•							•	•					•		
Proteacidites angulatus			•				•																			
P. amolosexinus																										
P. spp.	•		•	•		•	•	•		•		•												•		•
Stereisporites punctatus ms						•		•		•													•			
S. regium						•		•																		
Tetracolporites multistrixus ms	•																									
T. verrucosus			•																							
Tricolpites phillipsii			•														•									
T. spp.	•		•				•	•			•															
Tricolporites spp.	•		•								•															
Triporopollenites heleosus			•																							
T. sectilis			•				•	•																		
												•														
Apectodinium homomorphum																										
Operculodinium centrocarpum											•	•														
Protoellipsodinium simplex ms											•															
Spiniferites spp.											•												•			

* C=CORE S=SIDEWALL CORE T=CUTTINGS J=JUNK BASKET

R = REWORKED SP.
C = CONTAMINANT

PALYNOLOGY DATA SHEET

BASIN: GIPPSLAND | ELEVATION: KB: ______ GL: ______

WELL NAME: JUDITH-1 | TOTAL DEPTH: ______

AGE	PALYNOLOGICAL ZONES	HIGHEST DATA Preferred Depth	Rtg	Alternate Depth	Rtg	Two Way Time	LOWEST DATA Preferred Depth	Rtg	Alternate Depth	Rtg	Two Way Time
NEOGENE	*T. pleistocenicus*										
	M. lipsis										
	C. bifurcatus										
	T. bellus										
PALEOGENE	*P. tuberculatus*	1449.0	0				1449.0	0			
	Upper *N. asperus*	1451.0	2				1451.0	2			
	Mid *N. asperus*	1454.0	0				1454.0	0			
	Lower *N. asperus*	1471.0	1				1471.0	1			
	P. asperopolus	1488.0	0				1503.5	2	1488.0	0	
	Upper *M. diversus*										
	Mid *M. diversus*	1509.5	2				1509.5	2			
	Lower *M. diversus*	1546.0	1				1546.0	1			
	Upper *L. balmei*	1571.5	0				1622.0	1			
	Lower *L. balmei*	1667.5	2	1691.0	1		1701.5	1			
LATE CRETACEOUS	Upper T. longus	1764.0	0				1835.5	1			
	Lower T. longus	1858.0	1				1875.5	2	1858.0	1	
	T. lilliei										
	N. senectus										
	T. apoxyexinus										
	P. mawsonii	1993.0	2	2017.0	1		2721.0	1			
	A. distocarinatus	2895.0	2				2908.0	2			
EARLY CRET.	*C. paradoxus*										
	C. striatus										
	F. asymmetricus										
	F. wonthaggiensis										
	C. australiensis										
PRE-CRETACEOUS											

COMMENTS:
1471,0m T. pandus Zone
1546.0m A. hyperacantha Zone
1571,5m A. homomorpha Zone
Maximum abundance of "Kipper Shale" dinocysts 1993.0-2113.0m

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

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

DATA RECORDED BY: M.K. Macphail DATE: 3 February 1990

DATA REVISED BY: ______ DATE: ______

Appendix 2

Micropalaeontology

APPENDIX 2
MICROPALAEONTOLOGY

MICROPALAEONTOLOGICAL ANALYSIS

JUDITH-1, GIPPSLAND BASIN

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January, 1990.

<u>CONTENTS</u>

I. SUMMARY

Judith-1 was drilled in offshore petroleum permit Vic P/11, Gippsland Basin to a depth of 2958mKB. Sidewall cores from 838m to 1563.5m have been examined for foraminifera and calcareous nannoplankton. A summary of the biostratigraphic breakdown of the respective microfossil groups and environmental sub-division is given below:-

Planktonic Foraminiferal Subdivision

839m-890m	:	Indeterminate	
922m-1097m	:	Zone D1	Middle Miocene
1172m-1244m	:	Zones D1/D2	Middle Miocene
1320m	:	Zone E1	basal Middle Miocene
1391m-1436m	:	Zone G	upper Early Miocene
1449m-1451m	:	Zone H1	lower Early Miocene
1454m-1503.5m	:	Indeterminate	

Calcareous Nannoplankton Subdivision

839m-1172m	:	Zone NN6	mid Middle Miocene
1244m-1320m	:	Zone NN5	lower Middle Miocene
1391m-1436m	:	Zone NN3	upper Early Miocene
1449m	:	Zones NN2/NN1	lower Early Miocene
1451m	:	Zone NP25	latest Late Oligocene
1454m-1503.5m	:	Indeterminate	

Environment of Deposition

839m	:	middle neritic
Samples 890m-1172m incl.	:	middle-outer neritic
Samples 1244m-1449m incl.	:	outer neritic
1451m	:	middle-outer neritic
Samples 1454m-1503.5m incl.	:	undifferentiated marine

II. INTRODUCTION

A total of 18 sidewall cores have been scrutinized for foraminifera and calcareous nannoplankton from the interval 839m to 1503.5m in Judith-1. Fossil assemblages identified in the well section, interpreted zonation and depositional environment subdivision have been plotted on the distribution chart (Enclosure No. 1).

III. BIOSTRATIGRAPHIC ANALYSIS

The planktonic foraminiferal letter zonal scheme of Taylor (in prep.) and the NN/NP calcareous nannoplankton zonal scheme of Martini (1971) are used for biostratigraphic subdivision.

(A) Benthonic Foraminiferal Subdivision

1. 839m-890m : Indeterminate

   The impoverished planktonic foraminiferal faunas in the interval lack age-diagnostic taxa.

2. 922m-1097m : Zone D1 (Middle Miocene)

   The sidewall core samples in the interval are assigned to Zone D1 on the basis of the association of Globorotalia miozea miozea and Globorotalia miozea conoidea, and the lack of diverse Globigerinoides, together with Praeorbulina and Orbulina suturalis.

3. 1172m-1244m : Zones D1/D2 (Middle Miocene)

   The sidewall core samples at 1172m and 1244m contain moderate to high yielding planktonic foraminiferal faunas. The occurrence of Orbulina universa in both samples, together with Orbulina suturalis at 1172m and Globorotalia praemenardii at 1244m, indicates that the interval is possibly Zone D2 in age. The lack of Globorotalia miozea conoidea is also consistent with a Zone D2 assignment. However the lack of Praeorbulina and Globigerinoides sicanus, which normally are well represented in Zone D2, puts doubt on a definitive Zone D2 assignment. For that reason the interval is assigned to Zones D1 and D2 undifferentiated.

4. 1320m : Zone E1 (basal Middle Miocene)

   The sample at 1320m contains a rich planktonic foraminiferal assemblage including Praeorbulina glomerosa and Orbulina suturalis without Orbulina universa. These taxa indicate a Zone E1 assignment.

5. 1391m-1436m : Zone G (upper Early Miocene)

   The interval is assigned to Zone G on the basis of the occurrence of Globigerinoides trilobus and the lack of Globigerinoides sicanus. The occurrence of Globorotalia miozea miozea is consistent with an age no older than Zone G.

6. 1449m-1451m : Zone H1 (lower Early Miocene)

   The occurrence of Globigerina woodi connecta without Globigerinoides trilobus indicates that the sidewall core samples at 1449m and 1451m are Zone H1 in age.

7. 1454m-1503.5m : Indeterminate

   The samples in the interval are barren of planktonic foraminifera.

(B) Calcareous Nannoplankton Subdivision

1. 839m-1172m : Zone NN6 (mid Middle Miocene)

   The interval is assigned to Zone NN6 on the basis of the occurrence of Cyclicargolithus floridanus without Sphenolithus heteromorphous.

2. 1244m-1320m : Zone NN5 (lower Middle Miocene)

   The occurrence of Sphenolithus heteromorphous without Helicosphaera ampliaperta is consistent with a Zone NN5 assignment.

3. 1391m-1436m : Zone NN3 (upper Early Miocene)

   The sidewall core samples at 1391m and 1436m include Sphenolithus belemnos and on this basis are assigned to Zone NN3.

4. 1449m : Zones NN2 & NN1 (lower Early Miocene)

   The sample at 1449m is assigned to Zones NN2 and NN1 on the basis of the lack of Sphenolithus belemnos (base Zone NN3 index species) and Zygrhablithus bijugatus (top Zone NP25 index species).

5. 1451m : Zone NP25 (latest Late Oligocene)

   The association of Zygrhablithus bijugatus and Dictyococcites aff. bisectus, and the lack of pre-Zone NP25 taxa, indicates that the sample at 1451m is assignable to Zone NP25.

6. 1454m-1503.5m : Indeterminate

   The samples in the interval are barren of calcareous nannoplankton.

IV. ENVIRONMENT OF DEPOSITION

1. 839m : Middle neritic

The sample at 839m contains a moderately diverse foraminiferal fauna with benthonics predominant. The diverse benthonic fauna includes Globocassidulina subglobosa (frequent), Sphaeroidina bulloides (few), Brizalina (frequent) and Cassidulina laevigata. Deposition in a middle neritic environment is envisaged.

2. Samples 890m-1172m inclusive : Middle-outer neritic

The calcilutites in the interval are interpreted to have been deposited in a middle to outer neritic environment. The rich foraminiferal assemblages in the interval comprise the following diverse benthonic fauna: Brizalina (frequent-abundant), Globocassidulina subglobosa (rare-few), Euuvigerina miozea (rare-few), Trifarina bradyi (frequent-abundant from 890m to 1033m), Cassidulina laevigata (rare-abundant), Siphouvigerina proboscidea (rare-common) and Sphaeroidina bulloides (rare-common).

3. Samples 1244m-1449m inclusive : Outer neritic

The samples in the interval contain high yielding foraminiferal faunas with planktonics representing a dominant element (planktonic percentage ranging from 70 to 95). The benthonic assemblages in the interval include the following bathymetrically significant taxa: Brizalina (rare-frequent), Cassidulina laevigata (rare-few), Globocassidulina subglobosa (few), Siphouvigerina proboscidea (rare-few), Trifarina bradyi (few-frequent) and Sphaeroidina bulloides (few-frequent). Deposition in an outer neritic environment is envisaged.

4. 1451m : Middle-outer neritic

The glauconitic marl at 1451 is interpreted to have been deposited in a middle to outer neritic environment on the basis of containing a benthonic foraminiferal assemblage including Trifarina bradyi (frequent), Brizalina (few), Globocassidulina subglobosa (rare), Sphaeroidina bulloides (few) and Gyroidina subzelandica.

5. Samples 1454m-1503.5m inclusive : Undifferentiated marine

The interval is barren of foraminifera with the exception of the sample at 1454m which contains rare Haplophragmoides. The occurrence of pelletal glauconite throughout the interval indicates that the siliciclastics were deposited in a marine environment.

V. REFERENCES

MARTINI, E., 1971. Standard Tertiary and Quaternary calcareous nannoplankton zonation. In: FARINACCI, A., (Ed). Proc. Second Planktonic Conf., Roma. : 739-785.

TAYLOR, D.J., (in prep.). Observed Gippsland biostratigraphic sequences of planktonic foraminiferal assemblages.

APPENDIX NO. 1: SUMMARY OF MICROPALAEONTOLOGICAL DATA, JUDITH-1

SAMPLE (mKB)	FORAM YIELD	FORAM PRESERV.	FORAM DIVERSITY	NANNO YIELD	NANNO PRESERV.	NANNO DIVERSITY
SWC60, 839	mod/low	v. poor	mod/high	high	poor	mod/low
SWC59, 890	mod/high	mod/poor	mod/high	high	poor	low
SWC58, 922	high	mod/good	high	high	moderate	mod/low
SWC57, 964	high	mod/good	mod/high	high	mod/good	mod/high
SWC56, 1033	high	mod/good	mod/high	high	mod/good	mod/high
SWC55, 1097	high	moderate	mod/high	high	mod/poor	mod/low
SWC54, 1172	high	moderate	mod/high	high	mod/poor	high
SWC53, 1244	high	good	moderate	high	mod/good	mod/high
SWC52, 1320	high	moderate	mod/high	high	mod/poor	mod/high
SWC51, 1391	mod/low	v. poor	low	low	v. poor	low
SWC50, 1436	high	mod/good	mod/high	high	moderate	moderate
SWC49, 1449	high	mod/good	moderate	high	moderate	mod/high
SWC48, 1451	high	moderate	mod/high	high	mod/poor	moderate
SWC47, 1454	v. low	poor	v. low	barren	-	-
SWC46, 1471	barren	-	-	barren	-	-
SWC45, 1488	barren	-	-	barren	-	-
SWC44, 1502	barren	-	-	barren	-	-
SWC43, 1503.5	barren	-	-	barren	-	-

APPENDIX 3

Petrophysics

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PETROPHYSICS

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PETROPHYISCAL ANALYSIS

1.0 WIRELINE LOGS (all depths are logging depth below derrick floor)

The following wireline logs were run:

Date	Hole Size	Run	Interval	Type
18/10/89	17 1/2"	1	807-213m	DLL/BCSL/GR/CAL
	20" csg.	1	213-80m	GR
26/10/89	12 1/4"	1	2167-798m	DLL/SLS/LDL/CNL/GR/MSFL/CAL/AMS (MSFL & CNL TO 1400M)
27/10/89	12 1/4"	2	2315-2100m	DLL/SLS/LDL/CNL/GR/MSFL/CAL/AMS
2/11/89	12 1/4"	3	2309-1900m	SHDT/GR
		4	2308-839m	CST/GR
14-15/11/89	8 1/2"	1	2956-2303m	DLL/BCSL/LDL/CNL/GR/MSFL/CAL/AMS
15/11/89	8 1/2"	2	2960-2303m	SHDT/GR
16/11/89	8 1/2"	3	2911-2332m	RFT/HP/GR
		4	2958-500m	WST
		5	2956-2325m	CST/GR

2.0 EVALUATION

2.1 General

Petrophysical evaluation indicates the objective Latrobe and Golden Beach Formations to be entirely water-bearing. Marginal hydrocarbon saturations (up to 45%) corresponding to above-background mud gas readings were calculated in the low porosity Lower Golden Beach section (2392m BRT - TD). "Quick-look" permeabilities calculated from RFT pressure data acquired in these argillaceous sandstones ranged from 0.5 to 1.5 mD.

2.2 Factors affecting log evaluation in the 8 1/2 inch hole section (Lower Golden Beach)

2.2.1 Deep Invasion

High mud weight (10.3 ppg) and low porosity/permeability sandstones resulted in relatively deep mud invasion (20-40 inches) between 2300m and T.D. Borehole-corrected resistivity curves were used to calculate an invasion-corrected true formation resistivity (RT).

2.2.2 Porosity Determination

A neutron/sonic combination was used instead of the density/ neutron curves for determination of porosity in zones below 2303m BRT where hole rugosity and resultant FDC correction were deemed excessive.

2.2.3 Determination of A, m, n and Qv

No core-derived values for the cementation exponent (m), saturation exponent (n), Archie constant (A) and cation exchange capacity (Qv) were available for calculation of hydrocarbon saturations in the Golden Beach Formation. Default values used in the calculations were:

m = 2.00
n = 2.00
A = 1.00

In the absence of Qv data, the shaly-sand Indonesia equation was used for calculation of hydrocarbon saturations.

2.2.4 Rw Determination

Resistivity of the formation water over the Lower Golden Beach section (2391m BDF - T.D.) was derived using the Rwa technique ($Rwa = \frac{RT * Por^m}{A}$) over low resistivity sands where no above-background mud gas was recorded. An Rw of 0.09 ohmm corresponding to an NaCl equivalent salinity of 25000 ppm was derived. A relatively featureless SP curve (recorded by Schlumberger and transmitted via computer link) supports this estimate (MF salinity 25000 ppm).

2.3 Evaluation Procedure

2.3.1 Menu Structure

The following steps were used in the petrophysical evaluation of Judith-1:

2.3.1.1 Preliminary Lithology Calculation:

- Correct GR for borehole effects (chart POR-7m)
- Calculate fraction of shale (V_{SH}) from GR
- Apply cutoffs for sst/Sh definition
  sst : $V_{SH} \leq 50\%$
  sh " $V_{SH} \geq 51\%$
- Correct FDC for borehole effects (Chart POR-15a)
- Apply cutoff for coal definition:
  Coal: FDC $\leq$ 2.0 g/cc

2.3.1.2 Preliminary RWA Calculation over Apparently Water-bearing Sandstones

- Correct LLD, LLS and MSFL for borehole effects (Charts R_{cor}-2 and R_{xo}-2)
- Calculate diameter of invasion and true resistivity (R_T) from corrected MSFL, LLS and LLD.
- Correct FDC for borehole effects (Chart Por-15a)
- Calculate porosity from density or neutron/sonic combination
- Calculate R_{WA} from porosity and true resistivity.

2.3.1.3 Latrobe and Upper Golden Beach/Kipper Shale (1504-2304m BDF)

- Correct GR for borehole effects (Chart Por-7m)
- Calculate V_{SH} FROM GR
- Correct LLD, LLS and MSFL for borehole effects (Charts R_{cor}-2 and R_{xo}-2)
- Calculate diameter of invasion and true resistivity from corrected MSFL, LLS and LLD
- Correct FDC for borehole effects (Chart Por-15a)
- Calculate porosity from density log
- Calculate hydrocarbon saturation using the Indonesia equation for shaly sands.

2.3.1.4 Kipper Shale/Lower Golden Beach (2304-2938m BDF); Good Hole Section

- Preliminary corrections/calculations as above
- Iterative calculation of porosity, detailed lithology and apparent matrix density corrected for gas effects using the neutron/density combination
- Calculate hydrocarbon saturation using the Indonesia equation for shaly sands.

2.3.1.5 Kipper Shale/Lower Golden Beach (2304-2938m BDF); Poor Hole Section

- Preliminary corrections/calculations
- Iteractive calculation of porosity, detailed lithology and apparent matrix travel time corrected for gas effects from the neutron/ sonic combination.
- Calculate hydrocarbon saturation using the Indonesia equation for shaly sands.

2.3.2 Petrophysical Parameters (see Table 1 below)

	1504-1700 (Latrobe)	1700-1886 (Latrobe)	1971-2155 (UGB/KSH)	2155-2304 (KIPPER SH)	2304-2938 mBRT (KSH/LGB)
Hole size (inches)	12 1/4	12 1/4	12 1/4	12 1/4	8 1/2
GR_{MA} (API)	12	12	14	14	25
GR_{SH}	84	84	76	82	110
R_M (OHMM)	0.21	0.21	0.17	0.156	0.115
R_{MC}	0.41	0.41	0.32	0.30	0.22
R_W	0.08	0.07	0.067	0.075	0.09
R_{SH}	4.7	4.7	5.0	7.5	9.0
A	1.0	1.0	1.0	1.0	1.0
M	2.098	2.098	2.00	2.00	2.00
N	1.84	1.84	2.00	2.00	2.00
RHO_{MA} (g/cc)	2.66	2.66	2.66	2.66	calculated curve
RHO_{MUD}	1.23	1.23	1.23	1.23	1.23
RHO_{MF}	1.0	1.0	1.0	1.0	1.0
RHO_{HC}					0.15
SAL_{MF} (ppm)					25,000

2.4 Evaluation Summary

No net hydrocarbon zones above the porosity and hydrocarbon saturation cutoffs (10% and 50% respectively) were identified from logs. Gas saturations up to 45% occur in the low porosity/low permeability Lower Golden Beach section between 2391 and 2938m BDF (enclosure 1).

Results of the analysis are summarised below:

	1504–1886 (Latrobe)	1971–2074 (Upper Golden Beach)	2074–2391 (Kipper Shale)	2391–2938 mBRT (Lower Golden Beach)
Gross Thickness (m)	382	103	317	547
Net Sst. (m)	166	64	58	281
Average Porosity (net sst)	24%	18%	12%	9%
Net sst/gross	43%	62%	18%	51%
Net Porous Sst. (≥10%)	164	55	42	102
Average porosity (net porous sst.)	24%	20%	15%	11%
Net porous sst/gross	43%	54%	13%	19%
SH Average	16%	17%	17%	25%