PALYNOLOGICAL ANALYSIS

SWORDFISH-1, GIPPSLAND BASIN

by

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INTRODUCTION

Swordfish-1 is the first well drilled in the central part of the Gippsland Basin for 7 years. The adjacent wells, Cod-1 the third offshore well in the basin and Salmon-1 the twenty-first offshore well, were drilled in 1965 and 1969 respectively, both being drilled in the first drilling cycle.

The intervening years have seen an increasing sophistication of the palynological zonation and a more careful selection of the sidewall core programme to achieve the best results from this zonation. Consequent on the better sampling, a more detailed zonation is possible in Swordfish-1 compared to Cod-1 and Salmon-1. Moreover, the results from Swordfish-1 have indicated the need for revision of the concepts of some of the zones as well as the need for revision of the zonation in adjacent wells.

The thirty-one sidewall cores and seven cuttings samples examined from the Latrobe Group intersected in Swordfish-1 are given on Table 1. The zonation of the sequence is summarised below and on the accompanying Data Sheet. A revised Data Sheet for Salmon-1 is also attached.

SUMMARY

Unit	Spore-Pollen Zones	Dinoflagellate Zones
	Unconformity	
Gurnard Formation Unit A	Upper N. asperus 6560'-6564'	P. coreoides 6564'
	Middle N. asperus 6571'-6587'	D. extensa Zone equivalent 6571'-6587'
	Lower N. asperus 6619'-6658'	D. heterophylcta 6619'-6631' W. echinosuturata 6658'
Gurnard Formation Unit B	Lower N. asperus 6671'-6709'	A. diktyoplokus 6671'-6698'
	Unconformity	
Latrobe Coarse Clastics	P. asperopolus 6730'-7227'	
	Upper M. diversus 7279'-7468'	
	Lower M. diversus 7591'-7978'	W. hyperacantha 7961'-7978'
	Unconformity	
	Upper L. balmei 8054'	

T.D. 8100 feet.

GEOLOGICAL COMMENTS

1. The Gurnard Formation in Swordfish-1 is the most continuous sequence through the Middle and Late Eocene for the study of dinoflagellates from the Bass Strait region. This section is probably present in other wells in the Gippsland Basin but has never been sampled closely enough or the samples have not yielded diverse dinoflagellate suites. The well Nannygai-1 falls into this latter category; the Gurnard Formation was well sampled but did not yield good dinoflagellate assemblages.

2. The sampling in the Gurnard Formation in Swordfish-1 has established in a single sequence the first appearances and extinctions of a number of important dinoflagellate species and has forced the revision of the concept of the *Deflandrea heterophylcta* zone.

3. A twofold subdivision of the Gurnard Formation was recognised from the lithologies of the sidewall cores. Unit A (6560'-6658') in the sidewall cores is characterised by fine angular quartz grains and glauconite in a siltstone matrix. The unit B (6671'-6709') in contrast, lacks glauconite and contains coarse well rounded quartz grains and abundant pyrite.

4. This lithological change is reflected in the dinoflagellate assemblages. The sample from 6658 feet at the base of unit A, although of very low yield, contains a single specimen of *Wetzeliella echinosuturata* Wilson. This is the first record of this extremely important species from the Gippsland Basin.

   The absence of *W. echinosuturata* had been interpreted by Partridge (1976) as evidence of section missing at time of cutting of the Marlin Channel. It was also taken as being equal in age to the lowest part of the Lower *N. asperus* Zone (Partridge, 1976 figure-2). The presence of *W. echinosuturata* at the base of the unit A necessitates a revision of the age of the base of the Lower *N. asperus* Zone and the timing of the formation of the Marlin Channel.

   The unit B of the Gurnard Formation is still clearly Lower *N. asperus* Zone in age, based on -

   (a) the abundance of *Nothofagidites* spp. relative to *Haloragacidites harrisii*; and
   (b) the first appearance of index species for the Lower *N. asperus* Zone such as *Proteacidites recavus* and *Proteacidites rugulatus* at the base of unit B.

The boundary between the P. asperopolus Zone and Lower N. asperus Zone is still one of the most distinctive changes in the spore-pollen succession in the Gippsland Basin and the author still correlates the obvious time break between these zones with time of cutting of the Marlin Channel. However, this does create a problem since the availability of fine grained sediments to the Tasman Sea as revealed by the D.S.D.P. Site 283 apparently corresponds to the first appearance of W. echinosuturata.

Although it is likely because of the very sporatic occurrence of W. echinosuturata that its true range does extend down to the base of unit B, the possibility that it doesn't is just as likely. If the latter is true, this suggests that unit B hints at the presence of an unrecognised (of a recognised) sequence within the basin.

Unit B, although containing a distinctive dinoflagellate suite in Swordfish-1, cannot as yet be recognised in other wells. To find its areal distribution would necessitate careful re-examination of samples from the Gurnard Formation in other wells and this is beyond the scope of this report.

5. The Wetzeliella hyperacantha Dinoflagellate ingression or zone discussed in Partridge (1976, p.76) is represented in two sidewall cores at 7961 and 7978 feet. Both samples contain diverse dinoflagellate assemblages including the nominated species as well as the mangrove pollen Spinizonocolpites prominatus.

DISCUSSION OF ZONES

Species identified from the samples examined are given on the attached distribution sheets. The basis for choosing the zone intervals is discussed in the following :

Upper N. asperus Zone 6560(2) to 6564(0) feet -

The sample at 6564 feet contains a characteristic Upper N. asperus assemblage including the presence of Proteacidites rectomarginis and the common occurrence of the key species Proteacidites stipplatus. The sample also lacks forms such as Proteacidites adenanthoides, P. leightonii, P. crassus and numerous other species which become extinct within or at the top of the Middle N. asperus Zone. The general spotty distribution of many of the Lower and Middle N. asperus Zone indicator species on the distribution charts is a reflection of the general low yield of fossils from individual samples in the Gurnard Formation. Considering the composite assemblage from all samples in these underlying zones the diversity is quite high. The Upper N. asperus age is supported by the presence of the dinoflagellate Phthanoperidinium coreoides but lack of dinoflagellates such as Corrudinium incompositum and Eisenackia ornata characteristic of the underlying zone.

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Lower M. diversus Zone 7591(1) to 7978(0) feet -

The base of this zone is readily identified from the diverse assemblages obtained from the two samples in the Wetzeliella hyperacantha dinoflagellate ingression. A number of spore-pollen species from these samples are diagnostic of this zone including Intratriporopollenites notabilis, Crassiretitriletes vanraadshoovenii, Spinizonocolpites prominatus and Proteacidites pachypolus. The presence of Lygistepollenites balmei in these same samples is interpreted as reworking. The samples overlying this basal transgression are of somewhat lower diversity but can still be assigned to the Lower M. diversus Zone on presence of Tetracolporites multistrixus and T. textus and lack of indicator species for the overlying zones.

Upper Lygistepollenites balmei Zone 8054(1) feet -

This single samples is assigned to the L. balmei Zone on the common presence of the nominated species and occurrence of Polycolpites langstonii. The presence of Proteacidites grandis indicates the sample is from the Upper subdivision of the L. balmei Zone.

REFERENCES

Cookson, I.C., and Eisenack, A., 1965,
Microplankton from the Browns Creek Clays,
SW Victoria: Proc. Roy. Soc. Victoria, vol.79, no. 1, p. 119-131.

Partridge, A.D., 1976,
The geological expression of eustacy in the Early Tertiary of the
Gippsland Basin : APEA, Jour. vol. 16, pt. 1, p. 73-79.

The sample at 6560 feet can only be tentatively referred to the Upper N. asperus Zone. It contains species such as Proteacidites grandis Intratriporopollenites notabilis, Proteacidites pachypolus and Lygistepollenites balmei which are not known elsewhere to range into Upper N. asperus Zone. Consequently, these species are interpreted as reworked. Similar assemblages with reworking are known from the top of Gurnard Formation in Gurnard-1 at 7200 feet and Bream-2 at 6080 feet.

Middle N. asperus Zone 6571(1) to 6587(0) feet -

The base of this zone is picked at 6587 feet on the presence of the important pollen species Triorites magnificus. The dinoflagellates from the samples support this age and are very similar to the assemblages from the Browns Creek Clays in the Otway Basin (Cookson and Eisenack, 1965). The samples however, only contain rare rather dubious specimens of the dinoflagellate Deflandrea extensa. Nevertheless, they are age equivalent to the dinoflagellate zone bearing this name (Partridge, 1976). The characteristic dinoflagellate species in this zone in Swordfish-1 occur together with D. extensa in the Middle N. asperus Zone in Groper-1. From the geographic distribution of D. extensa in the Gippsland Basin it appears that D. extensa could be restricted to very shallow water, near shore environments, and to lakes and lagoons developed behind the shoreline.

Lower N. asperus Zone 6619(0) to 6709(1) feet -

The base of this zone can be readily picked on the rise in abundance of Nothofagidites pollen and the synchronous decrease of Haloragacidites harrisii (Casuarina) pollen (see Table 2). The base can also be defined by the first occurrence of Proteacidites recavus and P. rugulatus. The top is chosen on the negative evidence of absence of forms characteristic of the overlying zone.

Within the Lower N. asperus Zone in Swordfish-1, three dinoflagellate assemblages or zones can be recognised. The youngest zone is based on the occurrence of Deflandrea heterophylcta at 6619 and 6631 feet. The Wetzeliella echinosuturata zone is based on the occurrence of this species at 6658 feet. The Areosphaeridium diktyoplokus zone is for those samples between 6671 and 6709 feet containing A. diktyoplokus or Deflandrea oebisfeldensis but lacking W. echinosuturata or D. heterophylcta.

Previously, the D. heterophylcta zone has been used cover all assemblages from the Gurnard Formation in other wells having the species D. heterophylcta, D. oebisfeldensis and A. diktyoploku either in combination or separately. The Swordfish-1 results suggest that the first appearance of D. heterophylcta is significantly later than the first appearances of the other two species. This had not been recognised before because of the relatively

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poor sample density versus rate of sedimentation within the Gurnard Formation in any one well. Consequently, these dinoflagellate assemblages have previously been lumped.

Proteacidites asperopolus Zone 6730(3) to 7227(1) feet -

Swordfish-1 shows the classic high abundances of the species Proteacidites pachypolus which was originally taken as a key characteristic defining the P. asperopolus Zone. In clastic sediments in Swordfish-1, the abundance of P. pachypolus varies between 5 and 11 percent. The interbedded coals in contrast only show 1 to 2 percent P. pachypolus. Similar high abundance of this species are known from the Marlin, Snapper, Tuna and Flounder wells and from Salmon-1. However, away from this limited geographic area, the abundance of P. pachypolus or P. asperopolus is not as great and is not considered as very reliable. The base of the P. asperopolus Zone has therefore also been taken at the first appearances of the indicator species such as P. asperopolus, Santalumidites cainozoicus, Conbaculites apiculatus and Clavastephanocolporites melosus. An examination of the range charts for Swordfish-1 show that these latter species do not extend down to the base of the high abundance of P. pachypolus. Swordfish-1 also shows at least 450 feet of section with high abundance of P. pachypolus.

In terms of the regional boundary between the P. asperopolus and Upper M. diversus Zones defined on the first appearance of indicator species the results from Swordfish-1 suggest that the time range of high abundances of P. pachypolus and/or P. asperopolus extends from the upper part of the Upper M. diversus Zone through the whole of the P. asperopolus Zone. In spite of this interpretation, the base of the P. asperopolus Zone in Swordfish-1 is taken at the base of the P. pachypolus abundance to agree with the boundary in adjacent wells. Re-evaluation of all wells in this part of the Gippsland Basin to conform with the regional base of the P. asperopolus Zone is beyond the scope of this report.

Upper M. diversus Zone 7279(2) to 7468(1) feet -

The base of this zone is taken at the first appearance of the species Proteacidites xestoformis, P. tuberculiformis, Triporopollenites ambiguus and T. helosus while the boundary with the overyling P. asperopolus Zone is placed at the base of the section containing abundant P. pachypolus. Table 2 however, clearly shows that the P. pachypolus abundance is characteristic of clastic sediments and not the coals. The highest two samples in the Upper M. diversus Zone which are coals, may therefore not be entirely reliable and can only be given a confidence rating of 2.

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TABLE 1: Summary of Palynological Analyses, Swordfish-1, Gippsland Basin, Australia.

Sample and	Depth	Zone	Age	Confidence Rating	Preservation	Diversity	Remarks
SWC 34	6560'	Upper *N. asperus*	Early Oligocene	2	Fair to poor	High	Reworking common
SWC 33	6564'	Upper *N. asperus*	Early Oligocene	0	Good	Moderate	
SWC 32	6571'	Middle *N. asperus*	Late Eocene	1	Fair	Moderate	
SWC 31	6587'	Middle *N. asperus*	Late Eocene	0	Very good	High	With *Triorites magnificus*
SWC 30	6604'	Indet.	Middle-Late Eocene	-	Fair	Low	
SWC 29	6619'	Lower *N. asperus*	Middle Eocene	0	Good	High	*D. heterophylcta* Dinoflagellate zone
Cuttings	6620'-30'	Lower *N. asperus*	Middle Eocene	3	Fair	Moderate	
SWC 28	6631'	Lower *N. asperus*	Middle Eocene	0	Good	Moderate	Top occurrence of *A. diktyoplokus*
Cuttings	6630'-40'	Lower *N. asperus*	Middle Eocene	3	Fair	Moderate	
SWC 27	6643'	Lower *N. asperus*	Middle Eocene	1	Fair	Moderate	
SWC 26	6658'	Lower *N. asperus*	Middle Eocene	1	Fair	Low	Occurrence of *Wetzeliella echinosuturata* Wilson
SWC 25	6671'	Lower *N. asperus*	Middle Eocene	1	Poor	Moderate	
SWC 24	6685'	Lower *N. asperus*	Middle Eocene	1	Fair	Moderate	
SWC 23	6695'	Lower *N. asperus*	Middle Eocene	0	Good	High	
SWC 22	6698'	Lower *N. asperus*	Middle Eocene	0	Fair	Moderate	
SWC 21	6709'	Lower *N. asperus*	Middle Eocene	1	Fair	Moderate	
SWC 20	6732'	Indet.	Early Eocene?	-	Good	Low	Very low microfossil yield
Cuttings	6730'-40'	*P. asperopolus*	Early Eocene	3	Fair	Fairly low	Coal fraction of cuttings
Cuttings	6750'-60'	*P. asperopolus*	Early Eocene	3	Fair	Low	
SWC 19	6775'	Indet.	Early Eocene	-	Good	Very low	Virtually barren
SWC 18	6785'	*P. asperopolus*	Early Eocene	1	Fair	Moderate	
SWC 17	6921'	*P. asperopolus*	Early Eocene	1	Fair	Moderate	
SWC 16	7000'	*P. asperopolus*	Early Eocene	1	Fair	Moderate	
Cuttings	7030'-40'	*P. asperopolus*	Early Eocene	3	Fair	Moderate	Coal fraction of cuttings
Cuttings	7160'-70'	*P. asperopolus*	Early Eocene	3	Fair	Moderate	Coal fraction of cuttings
SWC 14	7169'	*P. asperopolus*	Early Eocene	1	Good	High	
SWC 13	7227'	*P. asperopolus*	Early Eocene	1	Good	Moderate	
SWC 12	7279'	Upper *M. diversus*	Early Eocene	2	Fair	Low	Coal lithology
Cuttings	7280'-90'	Upper *M. diversus*	Early Eocene	3	Fair	Moderate	Coal fraction of cuttings
SWC 11	7344'	Upper *M. diversus*	Early Eocene	1	Fair	Moderate	
SWC 10	7440'	Upper *M. diversus*	Early Eocene	1	Good	High	
SWC 9	7468'	Upper *M. diversus*	Early Eocene	1	Good	High	
SWC 8	7591'	Lower *M. diversus*	Early Eocene	1	Fair	High	
SWC 7	7668'	Lower *M. diversus*	Early Eocene	0	Poor	Moderate	Diverse dinoflagellate suite
SWC 5	7886'	Lower *M. diversus*	Early Eocene	1	Fair	Moderate	
SWC 4	7961'	Lower *M. diversus*	Early Eocene	0	Good	High	*Proteacidites pachypolus* fairly common. *Wetzeliella hyperacantha* Zone.
SWC 3	7978'	Lower *M. diversus*	Early Eocene	0	Good	Moderate	*W. hyperacantha* Dinoflagellate Zone.
SWC 2	8054'	Upper *L. balmei*	Late Paleocene	1	Fair	Moderate	

Zone	Sample Depths in feet	Dinoflagellates	Spores	Gymnosperms	Angiosperms (total)	*Phyllocladidites mawsonii*	*Nothofagidites* spp.	*H. harrisii*	*Malvacepollis* spp.	*Proteacidites pachypolus*	*Prot. grandis* (complex)
N. asperus	6564	41	17	44	39	11	18	15	X	-	-
	6587	69	16	20	64	7	27	17	2	-	-
	6695	17	4	29	67	14	30	11	1	X	-
	6698	8	13	40	47	11	16	6	1	4	1
	6709	6	4	28	68	14	22	7	5	X	X
P. asperopolus	6730-40 *	-	-	12	88	-	2	16	2	1	4
	6785	-	2	6	92	-	1	19	17	8	4
	6921	25	10	4	86	-	6	43	2	5	X
	7000	-	7	18	75	1	1	18	7	7	10
	7030-40 *	-	-	-	100	-	3	63	12	1	-
	7160-70 *	-	2	15	83	-	X	33	5	2	X
	7169	3	39	8	53	-	X	4	3	11	11
	7227	-	20	11	69	-	4	12	11	6	-
U.M. diversus	7279 *	-	-	9	91	-	-	2	40	-	-
	7280-90 *	-	1	2	97	-	3	72	6	-	1
	7344	39	19	2	79	1	5	61	2	-	-
	7440	-	27	6	67	-	4	25	5	-	1

* Coal lithologies

Note: Dinoflagellates expressed as percentage of combined spores, pollen and dinoflagellates. Other categories expressed as percentage of total spore-pollen count excluding dinoflagellates and acritachs.

Table-2: Relative abundance of various microfossils from selected samples in Swordfish-1.

BASIN Gippsland DATE May 2, 1977

WELL NAME Swordfish-1 ELEVATION K.B: + 83 feet

AGE	PALYNOLOGIC ZONES	HIGHEST DATA Preferred Depth	Rtg.	Alternate Depth	Rtg.	2 way time	LOWEST DATA Preferred Depth	Rtg	Alternate Depth	Rtg.	2 way time
OLIG-MIO.	P. tuberculatus										
	U. N. asperus	6560	2	6564	0		6564	0			
EOCENE	M. N. asperus	6571	1				6587	0			
	L. N. asperus	6619	0				6709	1			
	P. asperopolus	6730	3	6785	1		7227	1			
	U. M. diversus	7279	2	7344	1		7468	1			
	M. M. diversus										
	L. M. diversus	7591	1				7978	0			
PALEOCENE	U. L. balmei	8054	1				8054	1			
	L. L. balmei										
	T. longus										
LATE CRETACEOUS	T. lilliei										
	N. senectus										
	C. trip./T.pach.										
	C. distocarin.										
	T. pannosus										
EARLY CRETACEOUS											
PRE-CRETACEOUS											

COMMENTS: Wetzeliella hyperacantha Dinoflagellate Zone 7961 ft (1) to 7978 ft (1)

For discussion of dinoflagellate sequence between 6560 to 6709 feet see palnology report.

RATINGS:
0; SWC or CORE, EXCELLENT CONFIDENCE, assemblage with zone species of spores, pollen and microplankton.
1; SWC or CORE, GOOD CONFIDENCE, assemblage with zone species of spores and pollen or microplankton.
2; SWC or CORE, POOR CONFIDENCE, assemblage with non-diagnostic spores, pollen and/or microplankton.
3; CUTTINGS, FAIR CONFIDENCE, assemblage with zone species of either spore and pollen or microplankton, or both.
4; CUTTINGS, NO CONFIDENCE, assemblage with non-diagnostic spores, pollen and/or microplankton.

NOTE: If a sample cannot be assigned to one particular zone, then no entry should be made. Also, if an entry is given a 3 or 4 confidence rating, an alternate depth with a better confidence rating should be entered, if possible.

DATA RECORDED BY: Alan Partridge DATE May 2, 1977

DATA REVISED BY: DATE

FORM No R 315 12/72

BASIN GIPPSLAND DATE May 2, 1977

WELL NAME Salmon-1 ELEVATION + 99 feet

AGE	PALYNOLOGIC ZONES	HIGHEST DATA Preferred Depth	Rtg.	Alternate Depth	Rtg.	2 way time	LOWEST DATA Preferred Depth	Rtg	Alternate Depth	Rtg.	2 way time
OLIG-MIO.	P. tuberculatus										
EOCENE	U. N. asperus										
	M. N. asperus										
	L. N. asperus	6630					6688	2			
	P. asperopolus	6888	1				7172	1			
	U. M. diversus	7220	2	7310	1		7310	1			
	M. M. diversus										
	L. M. diversus	7844	1				7844	1			
PALEOCENE	U. L. balmei	8008	1				8152	1			
	L. L. balmei	8820	2				9865	1			
	T. longus										
LATE CRETACEOUS	T. lilliei										
	N. senectus										
	C. trip./T.pach.										
	C. distocarin.										
	T. pannosus										
EARLY CRETACEOUS											
PRE-CRETACEOUS											

COMMENTS: Deflandrea heterophylcta Dinoflagellate Zone 6630'(1) to 6688'(2)
Eisenackia crassitabulata Dinoflagellate Zone 9250' (2)

RATINGS:
0; SWC or CORE, EXCELLENT CONFIDENCE, assemblage with zone species of spores, pollen and microplankton.
1; SWC or CORE, GOOD CONFIDENCE, assemblage with zone species of spores and pollen or microplankton.
2; SWC or CORE, POOR CONFIDENCE, assemblage with non-diagnostic spores, pollen and/or microplankton.
3; CUTTINGS, FAIR CONFIDENCE, assemblage with zone species of either spore and pollen or microplankton, or both.
4; CUTTINGS, NO CONFIDENCE, assemblage with non-diagnostic spores, pollen and/or microplankton.

NOTE: If a sample cannot be assigned to one particular zone, then no entry should be made. Also, if an entry is given a 3 or 4 confidence rating, an alternate depth with a better confidence rating should be entered, if possible.

DATA RECORDED BY: L.E.S./A.D.P.; A.D.P. DATE June 1971; Dec. 1971; Jan. 1975.

DATA REVISED BY: A.D. Partridge DATE May, 1977.

FORM No R 315 12/72

Well Name SWORDFISH-1 Basin GIPPSLAND Sheet No. 1 of 7

SAMPLE TYPE *	S	S	S	S	S	S	T	S	T	S	S	S	S	S	S	S	S	T	T	S	S	S	S	T	T	S	S	S
PALYNOMORPHS / DEPTHS	6560	6564	6571	6587	6604	6619	6620-30	6631	6630-40	6643	6658	6671	6685	6695	6698	6709	6732	6730-40	6750-60	6775	6785	6921	7000	7030-40	7160-70	7169	7227	7279
A. qualumis																												
A. acutullus																												
A. luteoides																												
A. oculatus																												
A. sectus																												
A. triplaxis																												
A. obscurus																												
B. disconformis			/										/		/								/			/	/	
B. arcuatus																/												
B. elongatus					/																							
B. mutabilis																												
B. otwayensis																												
B. elegansiformis																		/						/				/
B. trigonalis				/																								
B. verrucosus														/														
B. bombaxoides																												
B. emaciatus		/																/										
C. bullatus																												
C. heskermensis																												
C. horrendus																												
C. meleosus																												
C. apiculatus																												
C. leptos																												
C. striatus																												
C. vanraadshoovenii																												
C. orthoteichus/major				/		/										/				/	/				/		/	
C. annulatus	C				C		C		C										C									
C. gigantis																												
C. splendens						/		/			/			/	/	/					/		/			A	/	
D. australiensis		/	/	/												/										/		
D. granulatus		/	/	/	/			/			/	/	/	/	/	/					/	/	/		/		/	
D. tuberculatus		/						/		/			/	/	/	/									/			
D. delicatus																												
D. semilunatus																										/		
E. notensis																												
E. crassiexinus																							/					
F. balteus	/																											
F. crater																												
F. lucunosus									C																			
F. palaequetrus			/																									
G. edwardsii																												
G. rudata																												
G. divaricatus																												
G. gestus																												
G. catathus																										/		
G. cranwellae																												
G. wahooensis																												
G. bassensis														/														
G. nebulosus																												
H. harrisii	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/		/	/	/	/	/	/	/	/
H. astrus																					/				/			
H. elliottii		/	/					/		/																		
I. anguloclavatus																/		/					/		/			
I. antipodus																												
I. notabilis	RW													RW?														
I. gremius		/				/								/														
I. irregularis		/	/						/		/																	
J. peiratus																												
K. waterbolkii			/			/			/																			
L. amplus																												
L. crassus																												
L. ohaiensis																												
L. bainii																												
L. lanceolatus														/														/
L. balmei	RW					RW									RW	RW												
L. florinii	/	/	/	/	/	/	/	/		/	/		/	/	/	/	/	A			/	/	/	/	/	/	/	/
M. diversus														/			/					/	/	/		/	/	/
M. duratus																												
M. grandis																												
M. perimagnus																												

*C= core; S= sidewall core; T= cuttings.

Well Name SWORDFISH-1 Basin GIPPSLAND Sheet No. 2 of 7

SAMPLE TYPE *	T	S	S	S	S	S	S	S	S	S
PALYNOMORPHS / DEPTHS	7280-90	7344	7440	7468	7591	7668	7886	7961	7978	8054
A. qualumis										
A. acutullus										
A. luteoides										
A. oculatus										
A. sectus										
A. triplaxis										
A. obscurus										
B. disconformis							/			
B. arcuatus		/		/						
B. elongatus										
B. mutabilis										
B. otwayensis										
B. elegansiformis										
B. trigonalis										
B. verrucosus										
B. bombaxoides										
B. emaciatus										
C. bullatus										
C. heskermensis				/						
C. horrendus										
C. meleosus										
C. apiculatus										
C. leptos										
C. striatus										
C. vanraadshoovenii								/	/	
C. orthoteichus/major				/						
C. annulatus										
C. gigantis								/		
C. splendens		/	/			/		/	/	/
D. australiensis					/					
D. granulatus		/	/	/		/A	/			
D. tuberculatus							/			
D. delicatus										
D. semilunatus			/							
E. notensis										
E. crassiexinus										
F. balteus										
F. crater										
F. lucunosus										
F. palaequetrus										
G. edwardsii										
G. rudata										
G. divaricatus										
G. gestus										
G. catathus										
G. cranwellae										
G. wahooensis										
G. bassensis										
G. nebulosus										
H. harrisii	/	/	/	/			/	/	/	
H. astrus	/									
H. elliottii										
I. anguloclavatus			/	/	/					
I. antipodus										
I. notabilis				/				/		
I. gremius				/						
I. irregularis							/			
J. peiratus										
K. waterbolkii										
L. amplus										
L. crassus		/								
L. ohaiensis										
L. bainii										
L. lanceolatus										
L. balmei								RW	RW	/A
L. florinii	/		/	/	/	/	/			/
M. diversus	/	/	/	/			/	/	/	
M. duratus										
M. grandis										
M. perimagnus										

*C= core; S= sidewall core; T = cuttings.

Well Name SWORDFISH-1 Basin GIPPSLAND Sheet No. 3 of 7

PALYNOMORPHS \ DEPTHS	6560	6564	6571	6587	6604	6619	6620-30	6631	6630-40	6643	6658	6671	6685	6695	6698	6709	6732	6730-40	6750-60	6775	6785	6921	7000	7030-40	7160-70	7169	7227	7279
SAMPLE TYPE *	S	S	S	S	S	S	T	S	T	S	S	S	S	S	S	S	S	T	T	S	S	S	S	T	T	S	S	S
M. subtilis		/		/		/				/	/		/	/	/	/		/	/		/	/	/	/	/	/	/	/A
M. ornamentalis		/			/			/																				
M. hypolaenoides																												
M. homeopunctatus				/																								
M. parvus/mesonesus				/	/	/						/		/	/	/		/			/							
M. tenuis																						/	/	/			/	
M. verrucosus																												
M. australis																												
N. asperus		/																										
N. asperoides																												
N. brachyspinulosus		/	/			/		/		/																		
N. deminutus		/	/	/	/	/		/			/			/	/													
N. emarcidus/heterus	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/		/	/	/	/	/	/	/	
N. endurus																												
N. falcatus		/	/	/	/	/																						
N. flemingii			/		/	/		/			/	/	/	/	/	/			/							/	/	
N. goniatus			/							/			/	/	/	/												
N. senectus																												
N. vansteenisii	/	/	/								/		/			/		/									/	
O. sentosa																												
P. ochesis																												
P. catastus																												
P. demarcatus						/								/		/							/					
P. magnus																												
P. polyoratus					/																							
P. vesicus																												
P. densus						/		/																				
P. velosus		/																										
P. morganii/jubatus																												
P. mawsonii	/	/	/	/	/	/	/	/		/	/	/	/	/	/	/	/						/					
P. reticulosaccatus												/																
P. verrucosus																												
P. crescentis																												
P. esobalteus													/	/				/	/				/	/	/			/
P. langstonii																												
P. reticulatus																												
P. simplex																												
P. varus																												
P. adenanthoides (Prot.)						/								/	/	/						/		/				
P. alveolatus																												
P. amolosexinus																												
P. angulatus																												
P. annularis		/		/		/		/						/	/	/					/	/	/	/	/	/	/	
P. asperopolus						/						/		/	/	/												
P. biornatus																											/	
P. clarus														/														
P. cleinei																												
P. confragosus																												
P. crassis					/									/		/												
P. delicatus																												
P. formosus																												
P. grandis	RW				/	/		/					/	/	/	/		/			/A		/			/A		
P. grevillaensis																		/										
P. incurvatus																												
P. intricatus																												
P. kopiensis	/RW													/	/		/			/								
P. lapis																												
P. latrobensis																												
P. leightonii	RW				/	/									/	/		/A	/		/A					/		
P. obesolabrus																												
P. obscurus						/								/	/		/					/						
P. ornatus														/											/			
P. otwayensis																												
P. pachypolus	RW			/	/	/		/					/	/	/	/	/	/		/	/A	/A	/A	/	/A	/A	/A	
P. palisadus																												
P. parvus															/													
P. plemmelus							/														/							
P. prodigus															/													
P. pseudomoides										/				/		/	/											
P. recavus										/				/		/												

*C= core; S= sidewall core; T = cuttings.

Well Name SWORDFISH-1 Basin GIPPSLAND Sheet No. 4 of 7

SAMPLE TYPE *	T	S	S	S	S	S	S	S	S	S
PALYNOMORPHS \ DEPTHS	7280-90	7344	7440	7468	7591	7668	7886	7961	7978	8054
M. subtilis	/		/	/			/			
M. ornamentalis										
M. hypolaenoides										
M. homeopunctatus								/		
M. parvus/mesonesus	/		/			/				
M. tenuis										
M. verrucosus										
M. australis										
N. asperus										
N. asperoides										
N. brachyspinulosus			/				/			
N. deminutus			/							
N. emarcidus/heterus	/	/	/					/		
N. endurus										
N. falcatus										
N. flemingii			/	/				/		
N. goniatus										
N. senectus										
N. vansteenisii		/								
O. sentosa										
P. ochesis										
P. catastus										
P. demarcatus			/	/						
P. magnus										
P. polyoratus										
P. vesicus										
P. densus										/
P. velosus										
P. morganii/jubatus										
P. mawsonii		/			/	/				
P. reticulosaccatus										
P. verrucosus										
P. crescentis										
P. esobalteus	/		/							
P. langstonii										/
P. reticulatus										
P. simplex										
P. varus				/				/		
P. adenanthoides (Prot.)	/		/	/						
P. alveolatus										
P. amolosexinus										
P. angulatus										
P. annularis	/		/	/						
P. asperopolus										
P. biornatus				/				/		
P. clarus										
P. cleinei										
P. confragosus										
P. crassis										
P. delicatus										
P. formosus										
P. grandis	/		/	/	A	/	/			/
P. grevillaensis										
P. incurvatus										
P. intricatus										
P. kopiensis										
P. lapis			/							
P. latrobensis			/							
P. leightonii		/						/		
P. obesolabrus										
P. obscurus			/							
P. ornatus										
P. otwayensis										
P. pachypolus	/							/		
P. palisadus										
P. parvus										
P. plemmelus										
P. prodigus							/			
P. pseudomoides										
P. recavus										

*C= core; S= sidewall core; T = cuttings.

Well Name SWORDFISH-1 Basin GIPPSLAND Sheet No. 5 of 7

PALYNOMORPHS \ DEPTHS	6560	6564	6571	6587	6604	6619	6620-30	6631	6630-40	6643	6658	6671	6685	6695	6698	6709	6732	6730-40	6750-60	6775	6785	6921	7000	7030-40	7160-70	7169	7227	7279
SAMPLE TYPE *	S	S	S	S	S	S	T	S	T	S	S	S	S	S	S	S	S	T	T	S	S	S	S	T	T	S	S	S
P. rectomarginis		/							C				aff															
P. reflexus																												
P. reticulatus																												
P. reticuloconcavus																												
P. reticuloscabratus													/	/		/												
P. rugulatus														/														
P. scitus																												
P. stipplatus		/																										
P. tenuiexinus	/											/											/					
P. truncatus																												
P. tuberculatus																												
P. tuberculiformis																/							/					
P. tuberculotumulatus																												
P. xestoformis (Prot.)																					/					/		
Q. brossus																												
R. boxatus																/												
R. stellatus																												
R. mallatus				/		/															/							
R. trophus														/														
S. cainozoicus												/	/	/		/	/	/										
S. rotundus		/						/						/													/	
S. digitatoides																												
S. marlinensis																												
S. rarus				/																								
S. meridianus										/	/		/	/	/	/	/	/ A			/			/	/			
S. prominatus																												
S. uvatus																												
S. punctatus				/		/				/			/			/												
S. regium																												
T. multistrixus (CP4)																												
T. textus																												
T. verrucosus																												
T. securus																												
T. confessus (C3)																												
T. gillii																												
T. incisus																												
T. longus																												
T. phillipsii																/												
T. renmarkensis																												
T. sabulosus																												
T. simatus																												
T. thomasii																												
T. waiparaensis																												
T. adelaidensis (CP3)						/								/	/	/	/		/				/	/				
T. angurium																												
T. delicatus																												
T. geraniodes																												
T. leuros																		/										
T. lilliei																												
T. marginatus																												
T. moultonii																												
T. paenestriatus		/				/												/			/		/	/		/		/
T. retequetrus																												
T. scabratus														/														
T. sphaerica																	/											
T. magnificus (P3)				/																								
T. spinosus																						/						
T. ambiguus			/																									
T. chnosus																												
T. helosus						/												/ A										
T. scabratus												/		/														
T. sectilis																												
V. attinatus																												
V. cristatus			/																									
V. kopukuensis	/	/			/	/		/		/	/					/												

*C=core; S=sidewall core; T=cuttings.

Well Name SWORDFISH-1 Basin GIPPSLAND Sheet No. 6 of 7

SAMPLE TYPE *	T	S	S	S	S	S	S			S
PALYNOMORPHS / DEPTHS	7280-90	7344	7440	7468	7591	7668	7880	[illegible]	[illegible]	8054
P. rectomarginis										
P. reflexus										
P. reticulatus										
P. reticuloconcavus										
P. reticuloscabratus			/							
P. rugulatus										
P. scitus										
P. stipplatus										
P. tenuiexinus			/	/		/				
P. truncatus										
P. tuberculatus										
P. tuberculiformis		/	/							
P. tuberculotumulatus										
P. xestoformis (Prot.)				/						
Q. brossus										
R. boxatus										
R. stellatus										
R. mallatus			/	/						
R. trophus										
S. cainozoicus										
S. rotundus										
S. digitatoides										
S. marlinensis										
S. rarus										
S. meridianus	/	/	/	/	/					
S. prominatus								/	/	
S. uvatus										
S. punctatus			/							/
S. regium										
T. multistrixus (CP4)			/		A	/				/
T. textus					/					/
T. verrucosus										
T. securus										
T. confessus (C3)										
T. gillii										
T. incisus										
T. longus										
T. phillipsii										
T. renmarkensis										
T. sabulosus										
T. simatus										
T. thomasii										
T. waiparaensis										
T. adelaidensis (CP3)	/			/						
T. angurium										
T. delicatus										
T. geraniodes										
T. leuros										
T. lilliei										
T. marginatus										
T. moultonii				/						
T. paenestriatus	/		/			/		/		
T. retequetrus										
T. scabratus			/		CF					
T. sphaerica			/							
T. magnificus (P3)										
T. spinosus										
T. ambiguus	/			/						
T. chnosus										
T. helosus			/							
T. scabratus										
T. sectilis										
V. attinatus										
V. cristatus										
V. kopukuensis										
P. bowenii							/			

*C= core; S= sidewall core; T= cuttings.

Well Name SWORDFISH-1 Basin GIPPSLAND Sheet No. 7 of 7

PALYNOMORPHS \ DEPTHS	6560	6564	6571	6587	6604	6619	6631	6643	6658	6671	6685	6695	6698	6709	6785	6921	7000	7169	7227	7344	7468	7591	7668	7886	7961	7978
SAMPLE TYPE *	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
Lept. victorianum	/																									
Ling. solarum	/																									
Syst. placacantha	/	/																								
Cleist. epacrum	/					/																				
Reticulodinium spp.	/					/																				
Defl. phosphoritica	/					/																				
Dino. simplex	/				/					/																
I/ kolp. rigaudae	/													/												
Oper. centrocarpum	/	/ A	/	/	/	/	/			/		/		/		/		/							/	
Spin. ramosa	/	/	/	/	/	/				/					/											/
Phth. coreoides		/		/																						
Nema. balcombiana			/																							
Lept. dispertitum			/																							
Corr. incompositum			/	/																						
Ling. machaerophorum			/							/																
Tect. marlum			/	/		/		/																		
Defl. extensa			cf	cf																						
Eise. ornata				/																						
Dyph. ariensis				/																						
Duos. nudum				/																						
Emme. urnaformis				/																						
Cass. imperfecta				/																						
Bati. compta				/		/																				
Phth. eocenicum				/		/																				
Corr. corrugatum				/	/	/																				
Palm. reticulifera				/		/																				
Balt. nanum				/		/																				
Cord. capricornum				/		/					cf															
Prae. indentata				/				/															/			
Wetz. lineidentata					cf																					
Cycl. vieta					/																					
Neot. dentalia						/																				
Hete. paxilla						/	/																			
Defl. heterophylcta						/	/																			
Spinidinium spp.						/	/		/		/	/		/												
Areo. arcuatum							/																			
Area. diktyoplokus							/	/	/	/		/	/													
Phth. delicatum								/																		
Thal. pelagica								/				/														
Defl. oebisfeldensis								/	/	/	/	/	/	/												
Hemicystodinium spp.								/								/										
Hist. variata									/																	
Wetz. echinosuturata									/																	
Wetz. hyperacantha											/						/	/		/ A	/		/		/	/
Kolp. trabeculoides												/														
Defl. obliquipes												/														
Holo. tricornus													/													
Seno. compacta														/												
Kenleyia spp.															/								/		/	/
Cord. inodes																							/			
Diph. colligerum																							/			
Wetz. homomorpha																							/			
Adna. retiintextum																							/			/
Kenl. lophophora																									/	
Kenl. pachycerata																									/	
Spin. crassipellis																									/	
Balt. septatum																									/	
Eocl. peniculatum																										/

*C= core; S= sidewall core; T= cuttings.