PALYNOLOGICAL ANALYSIS OF WHALESHARK-1
GIPPSLAND BASIN

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INTRODUCTION

Seventeen sidewall cores in Whaleshark-1 were examined, cleaned and split by author and then forwarded to Laola Pty Ltd in Perth for processing to extract organic microfossils (palynomorphs). All samples were examined by author for their contained spores, pollen and microplankton to derive the data and interpretations in this report.

Between 6 to 17 grams (average 12.3g) of each sidewall core was processed for palynological analysis. Residue yields were extremely low in the Latrobe Group coarse clastic section, mostly moderate in the overlying greensand section and Flounder Formation, and very low in the Seaspray Group. Palynomorph concentration on the slides overall was moderate to high and preservation generally fair to good and occasionally exceptional. As a consequence of good preservation overall spore-pollen diversity was high averaging 27+ species per sample. Microplankton were rare and of limited diversity (0-3 species) in the Latrobe coarse clastic section but common to very abundant through the greensand section, Flounder Formation and Seaspray Group. Microplankton diversity in these latter three units averaged 9+ species.

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

PALYNOLOGICAL SUMMARY OF WHALESHARK-1

AGE	UNIT/FACIES		SPORE-POLLEN ZONES (DINOFLAGELLATE ZONES)	DEPTHS (mKB)
MIOCENE	SEASPRAY GROUP		*P. tuberculatus*	2617-2721
EARLY EOCENE	LATROBE GROUP	Flounder Formation Equivalent	*P. asperopolus* (*K. edwardsii*) Upper *M. diversus* (*D. waipawaense*)	2725-2726 (2726) 2746-2756 (2746)
EARLY EOCENE / PALEOCENE	LATROBE GROUP	Unnamed Greensand Unit	Lower *M. diversus* Upper *L. balmei* Lower *L. balmei* (*E. crassitabulata*) (*A. circumtabulata*)	2760-2765 2783 2786-2807 (2786-2799) (2807)
MAASTRICHTIAN	LATROBE GROUP	Undifferentiated coastal plain sands.	Upper *T. longus* (*M. druggii*)	2822-2850 (2822)

GEOLOGICAL COMMENTS

1. Palynological analysis has been performed on the basal 105 metres of the Seaspray Group (3 samples) and immediately underlying 128 metres of the Latrobe Group (14 samples). This represents one sample every 52.5 metres in the Seaspray Group and one sample every 9.8 metres in the Latrobe Group.

2. The base of the Seaspray Group is Whaleshark-1 is most likely no older than Early Miocene and unconformably overlies, at 2722m, a marine Early Eocene to Paleocene condensed section which is 87+ metres thick. This in turn overlies, in apparent conformity, a Maastrichtian marine sandy section which is probably considerably thicker than the 50+ metres penetrated in Whaleshark-1.

3. The condensed section at the top of the Latrobe Group between 2722m to the top of the first sand at 2808.5m can be subdivided on the basis of the sidewall core lithologies into two units.

The upper unit between 2722-2758m can be characterised as a black siltstone with a trace to common amounts of glauconite and/or pyrite. This unit is correlated to the Flounder Formation based partly on the lithology but also because the identification of the *K. edwardsii* and *D. waipawaense* dinoflagellate Zones near the top and base of the interval. It is quite likely that the intervening *K. thompsonae* and *W. ornatum* dinoflagellate Zones occur in the unsampled interval between 2726-2746m. All four zones are characteristic of Flounder Formation.

The lower unit between 2758-2808.5m can be characterised as a grey green, fine grained, glauconitic sandstone. This unit, which contains the Lower *M. diversus*, Upper *L. balmei* and Lower *L. balmei* Zones and equivalent microplankton assemblages (not all of which are given formal zone names) can be correlated with the Paleocene condensed section sampled in Hapuku-1 between 2812.4-2865.1m (Partridge, 1975a).

4. The section below 2808.5m is correlated to the undifferentiated or coarse clastic part of the Latrobe Group because it lacks obvious glauconite and is much coarser grained. The sidewall cores at 2839m and 2842m in particular contain significant coarse grained quartz. With the possible exception of the unsampled interval between 2808.5-2822m the section is assigned to the Upper *T. longus* Zone and is thus Maastrichtian in age. The environment of deposition is marine based on the presence of dinoflagellates and absence of coals.

5. To emphasis the difference in the environment of deposition of the Early Eocene to Paleocene condensed section and the underlying Maastrichtian undifferentiated Latrobe section approximate rates of deposition have been calculated.

In Whaleshark-1 the Flounder Formation (2722-2758m) is considered to span the time interval 49.5-51.5 Ma and have a depositional rate of 18 metres per million years (m/my) and the Unnamed greensand (2758-2808.5m) a depositional rate of 3.4 m/my. Average depositional rate for composite interval is 5 m/my.

The depositional rate for the underlying Maastrichtian cannot be estimated in Whaleshark-1 but the rate for the combined Upper and

Lower *T. longus* Zones has been calculated in the following wells:

BASKER-1	88 m/my
BASKER SOUTH-1	86 m/my
HAPUKU-1	>96 m/my
SHARK-1	37 to 61 m/my

These rate are 10 to 20 times greater than the average depositional rate in the condensed section in Whaleshark-1. Assuming that equivalent depositional rates apply to Whaleshark-1 during the Maastrichtian the probable thickness of the Upper to Lower *T. longus* Zone interval in this well ranges from 259 to >672 metres.

6. Both the Flounder Formation and Unnamed greensand units are considered to have been deposited in a distal marine environment a considerable distance offshore from the palaeoshoreline. The evidence for a distal environmental setting is based on the presence of a condensed section representing an almost complete set of palynological zones deposited at very low rates of deposition. The recorded zonation is as complete as is possible to obtain with the available sidewall core spacing. Further, an open marine environment is clearly indicated by the consistent presence of abundant and diverse microplankton suites. The spore-pollen assemblages also support a distal offshore environment as most of the assemblages are dominated by pollen types that typically display the "Neves effect". This is the tendency for bisaccate pollen, certain buoyant spores, and other pollen with "comparatively greater transportability" to have greater relative abundance the further offshore you go in any depositional basin (Traverse, 1988, p.413). In Whaleshark-1 the "Neves effect" is displayed by the higher abundance of gymnosperm pollen (especially *Podocarpidites* spp. and *Dilwynites* spp.) relative to samples from sections of the same age in coastal plain environmental settings.

7. The undifferentiated Latrobe section, although clearly marine based on the presence of dinoflagellates, is considered to be deposited in a more proximal nearshore environment. The deposition rate of this section is interpreted to be greater, the microplankton are less abundant and less diverse and there is no obvious abundance preference in the spore-pollen assemblages, although the latter is hard to detect because of the low recoveries from the available samples.

8. There is a major time break, of at least 25 million years, but not necessarily an erosive unconformity at the top of the Latrobe Group at 2722m. The base of Seaspray Group is dated as no older than Early Miocene (approximately 25 Ma) while the top of the underlying Latrobe Group is considered to be no younger than the 49.5 Ma Sequence

Boundary on the cycle charts of Haq *et al.* (1987, 1988). This interpretation is based on the recording of the diagnostic acritarch *Tritonites bilobus* and the *K. edwardsii* dinoflagellate Zone within 4 metres of the top of Latrobe. Extending the arguments for the age of channelling and the major erosive event at the top of Latrobe presented by Marshall & Partridge (1988) it is proposed that cessation of deposition of the condensed section at Whaleshark-1 correlates with the cutting of the Marlin Channel located in the central part of the basin west of Whaleshark-1 at the 49.5 Ma Sequence Boundary. The palaeobathymetry created by the submarine Marlin Channel caused the more distal eastern part of the basin to be starved of sediments from the end of the Early Eocene until probably well into the Miocene. The occurrence of an apparent complete Early Eocene and Paleocene section below the top of Latrobe suggests strongly that there has been only negligible erosion at the top of Latrobe at Whaleshark-1 .

9. A minor time break of approximately 1 million years duration probably occurs in the 4 metre interval between the Upper and Lower *M. diversus* Zones to account for the absence of the Middle *M. diversus* Zone. This probable disconformity is best placed on the electric logs at 2758m and would correlate to the 51.5 Ma Sequence Boundary at which time the cutting of the Tuna-Flounder Channel system was believed to have been initiated.

10. A second minor time break is possible in the 3 metre interval between the Upper and Lower *L. balmei* Zones. In the thicker coastal plains sequences in the western parts of the basin considerable section occurs between the base of the Upper *L. balmei* Zone and youngest occurrence of the dinoflagellate *Eisenackia crassitabulata*. On the current correlations of the zones to the time scale of Haq *et al.* (1987, 1988) this interval is assigned a duration of 2 million years. An alternative interpretation which is equally as a plausible on our current knowledge is that *E. crassitabulata* ranges into younger sediments in marine sections and that it is only represented by a partial range in the thicker but predominantly coastal plain facies in the western part of the basin. If this disconformity is present the best log pick appears to be at 2784m where there is a reduction in the separation between the neutron porosity and bulk density logs.

11. The important K/T boundary datum in Whaleshark-1 cannot be located more precisely than within the 15 metre interval between the top Cretaceous assemblage at 2822m and the lowest Paleocene assemblage at 2807m. Unfortunately the electric log character over this interval cannot be readily correlated to the better sampled sequences across the K/T boundary in wells to the north of Whaleshark-1.

BIOSTRATIGRAPHY

Zone and age determinations are based on the spore-pollen zonation scheme proposed by Stover & Partridge (1973), partially modified by Stover & Partridge (1982) and Helby, Morgan & Partridge (1987), and a dinoflagellate zonation scheme which has only been published in outline by Partridge (1975b, 1976). Other modifications and embellishments to both zonation schemes can be found in the many palynological reports on the Gippsland Basin wells drilled by Esso Australia Ltd. Unfortunately this work is not collated or summarised in a single report. Note also that the name of the Upper *T. longus* Zone has not been changed to conform with recent nomenclature change to the name of the eponymous species *Forcipites* (al. *Tricolpites*) *longus* (Stover & Evans) Dettmann & Jarzen 1988.

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

Proteacidites tuberculatus Zone: 2617.0-2721.0 metres
and
Tuberculodinium vancampoae Dinoflagellate Zone: 2721.0 metres **Miocene.**

The three sidewall cores analysed from the Seaspray Group all gave meagre yields with limited but overall similar assemblages. The deepest and shallowest samples can be assigned to the *P. tuberculatus* Zone on the occurrence of the key spore *Cyatheacidites annulatus*. The occurrence of the pollen *Guettardidites ivirensis* Khan 1976 (= cf *Reticulataepollis* sp. of Partridge 1971) at 2617m suggest this sample can be assigned to the Middle or Upper subdivisions of the zone (Stover & Partridge 1973, p.243) but otherwise the overall spore-pollen assemblage, whilst of moderate diversity (22+ species in three samples), is rather bland and not very diagnostic and only indicates a broad Oligocene to Early Miocene age.

All three samples are dominated by microplankton (78%-86% of total palynomorph count) and contain additional marine indicators such as microforaminiferal liners (8% at 2721m) and scolecodonts. The occurrence of the distinctive dinoflagellate *Tuberculodinium vancampoae* in the deepest sample at 2721m suggests that the base of the Seaspray Group is no older than Early Miocene based on the compilation of dinoflagellate species ranges in Williams & Bujak (1985).

The oldest occurrence of this species is the basis for recognising the informal *T. vancampoae* Zone within the broader *Operculodinium* spp.

assemblage or "Association" first used informally by Partridge (1976) for Seaspray Group microplankton assemblages. The microplankton assemblages are dominated by *Operculodinium centrocarpum* (56% at 2720m; 39% at 2721m) or *Spiniferites* spp. (48% at 2617m). Other common species are *Protoellipsodinium simplex* ms (11% at 2617m; 5% at 2721m) and *Achomosphaera ramulifera* (15% at 2721m). The composite recorded diversity for the three samples is a moderate 14+ species. This is undoubtedly a marked underestimation of the true microplankton diversity of the assemblages even allowing for the meagre residue yields. Many species are not recorded on the range chart because they could not be identified or are undescribed. Only a few of the latter have been given manuscript names of which the most stratigraphically important are *Protoellipsodinium simplex* ms, *P. mamilatus* ms and *Pyxidinopsis pontus* ms.

***Proteacidites asperopolus* Zone: 2725.0-2726.0 metres**
and
***Kisselovia edwardsii* Dinoflagellate Zone: 2726.0 metres Early Eocene.**

The two closely spaced sidewall cores from immediately below the top of the Latrobe Group contain highly diverse spore-pollen assemblages with a composite recorded diversity of 68 species most of which are good to excellently preserved. The poor preservation recorded in the shallower sample relates mainly to the fragmented nature of many of the dinoflagellates. Although spore-pollen dominate both samples, fungal spores and hyphae are common (16% of total count) at 2726m and abundant (32%) at 2725m while microplankton abundance averages 19%.

The samples are assigned to the *P. asperopolus* Zone on occurrence of *Conbaculites apiculatus* ms and *Sapotaceoidaepollenites rotundus* in both samples and *Clavastephanocolporites meleosus* ms in the shallower sample. The samples are no younger than the *P. asperopolus* Zone based on the consistent occurrence of *Myrtaceidites tenuis*. Both assemblages are very rich and it is considered that the recording of other index species was only limited by the moderate yield extracted.

Proteacidites spp. and *Haloragacidites harrisii* (= *Casuarina* pollen) at 2726m dominate the assemblages. The *Nothofagidites* spp. to *H. harrisii* ratio is 0.6 at 2726m but increases to 2.0 at 2725m but the *Nothofagidites* abundances (12% at 2726m; 20% at 2725m) do not dominate the assemblages as is typical in the overlying Lower *N. asperus* and younger Zones. Other significant abundances are *Malvacipollis* spp. which averages 4.5%, while *Myrtaceidites tenuis* is 2.5% at 2726m. *Proteacidites pachypolus* although recorded in both samples turned out to represent less than 1% of the assemblages while the eponymous species *P. asperopolus* was not recorded.

The microplankton diversity averages 11 species per sample but total diversity is 21+ species. The true diversity is undoubtedly higher but is limited by moderate residue yield, fragmented preservation of many specimens and the fact that many unknown or undescribed forms were not identified with binomial names. Both samples contained *Deflandrea flounderensis* and *Homotryblium tasmaniense* which can be considered typical of the Flounder Formation.

Two specimens of the index dinoflagellate *Kisselovia edwardsii* were recorded at 2726m to identify the zone of this name, while in the shallower sample a single specimen of the acritarch *Tritonites bilobus* Marshall & Partridge 1988 was recorded. This latter form is not considered to range younger than the 49.5 Ma sequence boundary (Haq *et al.* 1987, 1988) and has been recorded with planktonic foraminifera in the Otway Basin correlated to the low latitude Zone P9 (Marshall & Partridge 1988).

Another significant dinoflagellate recorded in the samples is *Arachnodinium antarcticum* whose occurrence in both samples significantly extends its stratigraphic range (Marshall & Partridge 1988, fig.4) into the Early Eocene.

Upper *Malvacipollis diversus* Zone: 2746.0-2756.0 metres
and
Dracodinium waipawaense Dinoflagellate Zone: 2746.0 metres Early Eocene.

Two sidewall cores, which gave moderate yields of high diversity (average 38 species) spore-pollen assemblages of fair preservation are assigned to the Upper *M. diversus* Zone on the occurrence of *M. tenuis* in both samples (5% at 2746m) and *Proteacidites pachypolus* in the shallower sample. Most other spore-pollen species are consistent with but not particularly diagnostic of the zone. There are, however, a few anomalous occurrence as seems to be typical of more distal marine environment. A good specimen of *Aglaoreidia qualumis* recorded at 2746m is particularly noteworthy as this species consistent First Appearance Datum is within the much younger Middle *N. asperus* Zone. As no other conspicuous younger forms were identified contamination is considered unlikely. Species ranging into strata younger than is typical are *Rotverrusporites stellatus* ms and *Tetracolporites multistrixus* ms both recorded at 2756m.

The spore-pollen assemblages are dominated by *Dilwynites* spp. at 2756m (28%) and *H. harrisii* at 2746m (27%) while *Malvacipollis* spp. represents 12% of the assemblage at 2746m but only 4% at 2756m. The *Nothofagidites* spp. to *H. harrisii* ratio is 0.1 at 2746m and 0.3 at 2756m.

Microplankton dominate (80% of total count) the shallower sample but are subordinate (34%) to the spores-pollen (57%) plus fungal spores (9%) in the deeper sample. The reason for this marked difference in abundances is the flood of the dinoflagellate species *Homotryblium tasmaniense* which dominates both the microplankton count (50%) as well as the total count (41%) for the shallower sample at 2746m. This flood or swarm of *H. tasmaniense* is associated with the key index species *Dracodinium waipawaense* which is represent by numerous but mostly poorly preserved specimens even though in total it represents less than 1% of the microplankton count. The association of the *D. waipawaense* Zone with a flood or swarm of *H. tasmaniense* has been noted in other wells in the basin. As such this local acme of *H. tasmaniense* is potentially an important horizon for correlation within the *H. tasmaniense* Zone of Harris (1985). In the Gippsland Basin the *H. tasmaniense* dinoflagellate Zone (which is based on the total range of the species) seems to equate to the interval from the base of the Upper *M. diversus* to top of the *P. asperopolus* spore-pollen Zones and is typical of sediments of the Flounder Formation.

Recorded microplankton diversity is 13+ species in each sample and 20+ species in the zone, but as in the overlying *P. asperopolus* Zone the true diversity is undoubtedly greater. Although the deeper of the two samples cannot be assigned to the currently recognised dinoflagellate zones in the Gippsland Basin its assemblage is consistent with assemblages recorded from the Flounder Formation.

Lower *Malvacipollis diversus* Zone: 2760.0-2765.0 metres Early Eocene.

Of the two sidewall cores assigned to the Lower *M. diversus* Zone the shallowest at 2760m is confidently assigned on the presence of the index species *Intratriporopollenites notabilis, Spinizonocolpites prominatus* and *Tricolporites paenestriatus* which do not range below this zone, associated with frequent *Malvacipollis diversus* and *Proteacidites grandis* (2%). The deeper sample at 2765m lacks all of the above species except *P. grandis* which is rarer (<1%) and it is assigned to the zone principally on the absence of older indicator species. Although *Lygistepollenites balmei* was recorded it is not associated with other indicator species for the *L. balmei* Zone and therefore is regarded as reworked.

The spore-pollen assemblages are dominated by gymnosperm pollen (44%-47%) and *Dilwynites* spp. is the most abundant type overall (38% at 2760m; 22% at 2765m), and *Proteacidites* spp. the next most abundant category (16% average). Other prominent species are *Haloragacidites harrisii* (8% at 2760m; but only 2% at 2765m); *Nothofagidites* spp. (6% in both samples) and *Proteacidites grandis* (3.2% at 2760m; 0.8% at 2765m) and *Malvacipollis* spp. was recorded as 2% at 2760m.

Although microplankton are common in both samples (13%-20% of total count) there are no significant species in common. The shallower sample can be characterised by the presence of *Wetzeliella symmetrica* and *Diphyes colligerum* and the deeper sample by *Deflandrea dartmooria* and *D. truncata*. The latter sample at 2765m is informally referred to the *D. dartmooria* Association which has been recognised in other wells.

Upper *Lygistepollenites balmei* Zone: 2783.0 metres Late Paleocene.

The top of the Paleocene *L. balmei* Zone is recorded in Whaleshark-1 at 2783m based on the youngest occurrences of frequent *Lygistepollenites balmei* (3%), common *Australopollis obscurus* (5%) and rare *Gambierina rudata* (1.4%). This sidewall core sample is also considered no older than the Upper *L. balmei* Zone based on the presence of *Proteacidites annularis*. The remainder of the spore-pollen species in this moderate diversity assemblage are not particularly diagnostic but are mostly consistent with the zone determination. The presence of a good specimen of *Tricolpites waiparaensis* is anomalous as this species is rare to very rare and inconsistent above the *T. longus* Zones.

The spore-pollen assemblage is dominated by *Dilwynites* spp. (23%) which with other gymnosperm pollen make up 53% of the spore-pollen count. *Proteacidites* spp. at 13% is the commonest angiosperm category and the spores (17%) are dominated by *Gleicheniidites circinidites* (8%).

The microplankton represent 13% of the total count and fungal spores and hyphae at <3% are significantly less abundant than in the overlying Early Eocene zones. The microplankton diversity is a low 5 species and is dominated by *Spinidinium* spp. and *Spiniferites ramosus* s.l. and there were no species recorded which are zone diagnostic.

Lower *Lygistepollenites balmei* Zone: 2786.0-2807.0 metres
and
***Eisenackia crassitabulata* Dinoflagellate Zone: 2786.0-2799.0 metres**
Early Paleocene.

The three sidewall cores of fine grained glauconitic sandstone assigned to this zone gave low to moderate yields of poor to well preserved palynomorphs which were in moderate concentration on the slides. Spore-pollen diversity averaged 26+ species and although the microplankton diversity only averaged 8 species they are abundant in the two shallowest samples.

The samples at 2799m and 2807m are assigned to the Lower *L. balmei* Zone on the presence of *Proteacidites angulatus*. The shallowest sample at 2786m lack this or any other index species of the Lower subdivision of the *L. balmei* Zone, but is assigned to the zone on the basis of the associated dinoflagellates. The absence of index spore-pollen is the combined result of low yield, sandy lithology and marine environment.

Frequent to common age diagnostic spore-pollen in the samples are *Lygistepollenites balmei* (6%-10%); *Australopollis obscurus* (<1%-4%) and *Gambierina rudata* (<1%-5%). Overall the spore-pollen assemblages are dominated by gymnosperm pollen (53%-78%) with *Dilwynites* spp. (7%-26%), *Phyllocladidites mawsonii* (13%-23%) and *Podocarpidites* spp. (14%-15%) being most abundant.

The microplankton assemblages are each of individual character. The shallowest sample at 2786m is dominated by *Eisenackia crassitabulata* (22% of microplankton count), *Senegalinium dilwynense* (28%) and *Deflandrea speciosus* (9%). The middle sample at 2799m is overwhelmingly dominated by a variety of morphotypes of *Glaphrocysta retiintexta* which comprises 93% of the microplankton count and 81% of the total count. Other important species in the sample are *Eisenackia* sp. cf. *E. crassitabulata*, *Isabelidinium bakeri*, *I. cingulata* Wilson 1988 and *Deflandrea speciosus*. These two samples are assigned to the *E. crassitabulata* dinoflagellate Zone even though the middle sample at 2799m lacks perfect specimens of the zone species.

The microplankton assemblage in the deeper sample at 2807m is not dominated by any species but can be characterised by the presence of *Alisocysta circumtabulata* and *Alisocysta margarita*. The sample also contains frequent poorly preserved specimens of a peridinacean dinoflagellate compared to *Trithyrodinium evittii*. Unfortunately these specimens cannot be confidently assigned to this species nor the sample to the *T. evittii* Zone. Instead the sample is correlated to the informal *A. circumtabulata* Association which was found to lie stratigraphically above the *T. evittii* Zone and below the *E. crassitabulata* Zone in Roundhead-1 (Partridge, 1989).

Upper *Tricolpites longus* Zone: 2822.0-2850.0 metres
and
Manumiella druggii Dinoflagellate Zone: 2822.0 metres Maastrichtian.

Of the four sidewall cores analysed over this interval only two gave datable assemblages. Both were assigned to the Upper *T. longus* Zone on the common occurrence of *Gambierina rudata* (18.2% at 2822m and 10.2% at 2850m). Species whose last appearances indicate an age no younger than this zone are *Proteacidites clinei* ms, *P. reticuloconcavus* ms, *Tricolpites confessus* and *Triporopollenites sectilis* whose LADs occur at 2822m, while *Proteacidites palisadus* has its LAD at 2850m.

Principally because of the meagre yields diagnostic microplankton are very rare. A single specimen of *Manumiella conorata* was recorded at 2822m and is the basis for assigning this sample to the *M. druggii* Zone. Other fragmented specimens of *Manumiella* were recorded from this sample and at 2850m but these cannot be confidently assigned to any species. Several specimens of an undescribed moderate sized dinoflagellate assigned to *Batiacasphaera* sp. were also recorded at 2850m. Notwithstanding the low diversity, low abundance and sporadic occurrence of microplankton it is considered that all of the Upper *T. longus* Zone sampled was deposited in a marine environment.

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TABLE-1: INTERPRETATIVE PALYNOLOGICAL DATA FOR WHALESHARK-1, GIPPSLAND BASIN.

SAMPLE TYPE	DEPTH (m)	SPORE-POLLEN ZONES	*CR OLD	*CR NEW	MICROPLANKTON ZONES (OR ASSOCIATION)	*CR OLD	*CR NEW	COMMENTS
SWC 19	2617	*P. tuberculatus*	2	B4	(*Operculodinium* spp.)	0	B3	Microplankton 86%.
SWC 17	2720	Indeterminate			(*Operculodinium* spp.)	2	B5	Microplankton 83%.
SWC 16	2721	*P. tuberculatus*	0	B2	*T. vancampoae*	0	B3	Microplankton 78% FAD *Cyatheacidites annulatus*.
SWC 15	2725	*P. asperopolus*	0	B1	(*Tritonites bilobus*)	0	B2	Microplankton 22% LAD *Myrtaceidites tenuis*.
SWC 14	2726	*P. asperopolus*	0	B1	*K. edwardsii*	0	B2	Microplankton 16% FAD *Conbaculites apiculatus* ms.
SWC 13	2746	Upper *M. diversus*	0	B1	*D. waipawaense*	0	B2	Microplankton 81% *Homotryblium tasmaniense* 50%.
SWC 12	2756	Upper *M. diversus*	1	B1				Microplankton 34% FAD *Myrtaceidites tenuis*.
SWC 11	2760	Lower *M. diversus*	1	B1				Microplankton 20%.
SWC 10	2765	Lower *M. diversus*	2	B4	(*D. dartmooria*)	1	B1	Microplankton 13%.
SWC 9	2783	Upper *L. balmei*	1	B1				Microplankton 13% FAD *Proteacidites annularis*.
SWC 8	2786	Lower *L. balmei*	2	B4	*E. crassitabulata*	1	B3	Microplankton 34%.
SWC 7	2799	Lower *L. balmei*	0	B2	*E. crassitabulata*	1	B3	Microplankton 87% LAD *Proteacidites angulatus*.
SWC 6	2807	Lower *L. balmei*	0	B1	(*A. circumtabulata*)	1	B3	Microplankton 7%.
SWC 5	2822	Upper *T. longus*	0	B1	*M. druggii*	1	B3	Microplankton 2%; *Gambierina* spp. 18%.
SWC 4	2834	*T. longus/T. lilliei*						Very low yield.
SWC 2	2842	Indeterminate						Virtually barren.
SWC 1	2850	Upper *T. longus*	2	B4				*Gambierina* spp. 10%.

*CR = Confidence Ratings OLD & NEW
FAD = First Appearance Datum
LAD = Last Appearance Datum

CONFIDENCE RATINGS

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

OLD CONFIDENCE RATINGS

0 SWC or CORE, Excellent Confidence, assemblage with zone species of spore, 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.

NEW CONFIDENCE RATINGS

Alpha codes: Linked to sample type

A Core

B Sidewall core

C Coal cuttings

D Ditch cuttings

E Junk basket

F Miscellaneous/unknown

G Outcrop

Numeric codes: Linked to fossil assemblage

1 **Excellent confidence:** High diversity assemblage recorded with key zone species.

2 **Good confidence:** Moderately diverse assemblage recorded with key zone species.

3 **Fair confidence:** Low diversity assemblage recorded with key zone species.

4 **Poor confidence:** Moderate to high diversity assemblage recorded without key zone species.

5 **Very low confidence:** Low diversity assemblage recorded without key zone species.

BASIC DATA

TABLE 2: BASIC SAMPLE DATA

TABLE 3: BASIC PALYNOMORPH DATA

RELINQUISHMENT LISTS

SPORE-POLLEN RANGE CHART
(ATTACHMENT)

MICROPLANKTON RANGE CHART
(ATTACHMENT)

TABLE 2: BASIC SAMPLE DATA WHALESHARK-1, GIPPSLAND BASIN.

SAMPLE TYPE	DEPTH (M)	LITHOLOGY	SAMPLE WT (g)	RESIDUE YIELD
SWC 19	2617.0	Med-dk grey calcisiltite	8.4	Low
SWC 17	2720.0	Med.grey laminated calcisiltite	5.8	Very low
SWC 16	2721.0	Med.grey calcisiltite tr.glauc.	9.8	Very low
SWC 15	2725.0	Black siltstone, pyritic	13.0	Moderate
SWC 14	2726.0	Dk gry-blk siltstone, pyritic	13.9	Moderate
SWC 13	2746.0	Black glauconitic siltstone	12.7	Moderate
SWC 12	2756.0	Blk-grn glauconitic siltstone	13.1	Moderate
SWC 11	2760.0	Dk grn-brn glauconitic siltstone	14.4	High
SWC 10	2765.0	Dk gry brn glauconitic sandstone	13.1	Moderate
SWC 9	2783.0	Grn-grey glauconitic sandstone	16.5	Moderate
SWC 8	2786.0	Gry-grn glauconitic sandstone	13.4	Low
SWC 7	2799.0	Gry-grn glauconitic sandstone	15.9	High
SWC 6	2807.0	Grn-gry glauconitic sandstone, burrowed.	13.8	Moderate
SWC 5	2822.0	Dk grey clayey sandstone	11.8	Moderate
SWC 4	2834.0	Med grey clayey sandstone	14.7	Very low
SWC 2	2842.0	Lt grey med-crs qtz sandstone	11.4	Very low
SWC 1	2850.0	Lt grey vf-f clayey sandstone	8.2	Very low

TABLE 3: BASIC PALYNOMORPH DATA WHALESHARK-1, GIPPSLAND BASIN

SAMPLE TYPE	DEPTH (M)	PALYNOMORPH CONCENTRATION	FOSSIL PRESERVATION and No. Spore-Pollen Species*		MICROPLANKTON Abundance & No. of Species*	
SWC 19	2617.0	High	Fair-poor	14	Very Abundant	8
SWC 17	2720.0	Low	Poor	6	Very Abundant	5
SWC 16	2721.0	Moderate	Poor	13	Very Abundant	9
SWC 15	2725.0	High	Poor-good	52	Abundant	12
SWC 14	2726.0	High	Excellent	48	Common	10
SWC 13	2746.0	Moderate	Fair	34	Very Abundant	13
SWC 12	2756.0	Moderate	Fair	42	Common	13
SWC 11	2760.0	Moderate	Fair-good	42	Abundant	11
SWC 10	2765.0	Moderate	Fair-good	48	Common	10
SWC 9	2783.0	High	Fair-good	36	Common	5
SWC 8	2786.0	Moderate	Fair-good	22	Very Abundant	8
SWC 7	2799.0	High	Poor-good	21	Very Abundant	7
SWC 6	2807.0	Moderate	Fair	35	Frequent	8
SWC 5	2822.0	Moderate	Fair-v. good	27	Rare	3
SWC 4	2834.0	Moderate	Good	9		
SWC 2	2842.0	Very low	Fair	4		
SWC 1	2850.0	Low	Fair-good	18	Rare	2

*Diversity: Very Low = 1- 5 species.
Low = 6-10 species.
Moderate = 11-25 species.
High = 26-74 species.
Very High = 75+ species.

RELINQUISHMENT LIST - PALYNOLOGY SLIDES

WELL NAME & NO: WHALESHARK-1

PREPARED BY: A.D. PARTRIDGE

DATE: 21 DECEMBER 1992

SHEET 1 OF 1

SAMPLE TYPE	DEPTH (M)	CATALOGUE NUMBER	DESCRIPTION
SWC 19	2617	P196297	Kerogen slide sieved/unsieved fractions
SWC 19	2617	P196298	Oxidized slide 2
SWC 17	2720	P196299	Kerogen slide sieved fraction (1/4 cover slip)
SWC 16	2721	P196300	Kerogen slide sieved fraction
SWC 15	2725	P196301	Kerogen slide sieved/unsieved fractions
SWC 15	2725	P196302	Oxidized slide 2
SWC 15	2725	P196303	Oxidized slide 3 (1/2 cover slip)
SWC 14	2726	P196304	Kerogen slide 20 micron sieved
SWC 14	2726	P196305	Oxidized slide 2
SWC 14	2726	P196306	Oxidized slide 3 (1/2 cover slip)
SWC 13	2746	P196307	Kerogen slide sieved/unsieved fractions
SWC 13	2746	P196308	Oxidized slide 2
SWC 13	2746	P196309	Oxidized slide 3
SWC 12	2756	P196310	Kerogen slide sieved/unsieved fractions
SWC 12	2756	P196311	Oxidized slide 2
SWC 12	2756	P196312	Oxidized slide 3
SWC 12	2756	P196313	Oxidized slide 4 (1/2 cover slip)
SWC 11	2760	P196314	Kerogen slide sieved/unsieved fractions
SWC 11	2760	P196315	Oxidized slide 2
SWC 11	2760	P196316	Oxidized slide 3
SWC 11	2760	P196317	Oxidized slide 4
SWC 10	2765	P196318	Kerogen slide sieved/unsieved fractions
SWC 10	2765	P196319	Oxidized slide 2
SWC 10	2765	P196320	Oxidized slide 3 (1/2 cover slip)
SWC 9	2783	P196321	Kerogen slide sieved/unsieved fractions
SWC 9	2783	P196322	Oxidized slide 2
SWC 9	2783	P196323	Oxidized slide 3
SWC 9	2783	P196324	Oxidized slide 4 (1/2 cover slip)
SWC 8	2786	P196325	Kerogen slide sieved/unsieved fractions
SWC 8	2786	P196326	Oxidized slide 2
SWC 8	2786	P196327	Oxidized slide 3 (1/2 cover slip)
SWC 7	2799	P196328	Kerogen slide sieved/unsieved fractions
SWC 7	2799	P196329	Oxidized slide 2
SWC 7	2799	P196330	Oxidized slide 3
SWC 7	2799	P196331	Oxidized slide 4
SWC 6	2807	P196332	Kerogen slide sieved/unsieved fractions
SWC 6	2807	P196333	Oxidized slide 2
SWC 6	2807	P196334	Oxidized slide 3
SWC 5	2822	P196335	Kerogen slide sieved/unsieved fractions
SWC 5	2822	P196336	Oxidized slide 2
SWC 5	2822	P196337	Oxidized slide 3
SWC 5	2822	P196338	Oxidized slide 4
SWC 4	2834	P196339	Kerogen slide (1/4 cover slip)
SWC 2	2842	P196340	Kerogen slide (1/4 cover slip)
SWC 1	2850	P196341	Kerogen sieved/unsieved (1/4 cover slips)

RELINQUISHMENT LIST - PALYNOLOGY RESIDUES

WELL NAME & NO: WHALESHARK-1

PREPARED BY: A.D. PARTRIDGE

DATE: 21 DECEMBER 1992

SAMPLE TYPE	DEPTH (M)	DESCRIPTION
SWC 15	2725	Kerogen residue
SWC 12	2756	Kerogen residue
SWC 7	2799	Oxidized residue
SWC 5	2822	Oxidized residue