Palynological Analysis of Longtom-1 and Sidetrack Gippsland Basin.

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Introduction

Thirty-five samples have been analysed from Longtom-1 comprising twenty-eight sidewall cores and five cuttings samples from the original hole and an additional two cuttings samples from the Sidetrack hole. Lithological units and palynological zones recognised are given in the following summary. The interpretative data with zone identification and Confidence Ratings are recorded in Tables 1A-B and basic data on residue yields, preservation and diversity are recorded on Tables 2A-B. All species which have been identified with binomial names are tabulated on separate palynomorph range charts for the Strzelecki and Golden Beach Groups and a combined chart for the Latrobe and Seaspray Groups. Relinquishment lists for palynological slides and residues from samples analysed in Longtom-1 are provided at the end of the report.

An average of 11 grams of the sidewall cores and 10 grams of the cuttings were processed for palynological analysis (Tables 2A-B). Residue yields were low to very low from the Seaspray Group but mainly high from the older Latrobe, Golden Beach and Strzelecki Groups. Palynomorph concentration were mostly moderate to high with mainly fair to good preservation from the Seaspray and Latrobe Groups but declined to mainly low to moderate concentrations in the deeper Golden Beach and Strzelecki Groups in line with a decline in overall preservation to poor to fair. Spore-pollen diversity averaged 24+ species/sample over all samples but was highest in the Latrobe Group at 37+ species/sample. Microplankton diversity was on average 10+ species/sample in the Seaspray Group, 3+ species/sample in the Latrobe and Golden Beach Groups but less than one species/sample in the Strzelecki Groups.

Palynological Summary of Longtom-1

AGE	UNIT/FACIES	SPORE-POLLEN ZONES (MICROPLANKTON ZONES)	DEPTHS (metres)
MIDDLE MIOCENE TO EARLY MIOCENE	SEASPRAY GROUP Gippsland Limestone 80-1184m Lakes Entrance Fm. 1184-1245m	*T. bellus* (*Operculodinium* Superzone) Middle *P. tuberculatus* (*Operculodinium* Superzone)	1048-1177 (1048-1177) 1242-1244 (1242-1244)
MIDDLE EOCENE	LATROBE GROUP Gurnard Formation 1245-1256m	Lower *N. asperus* (*A. australicum*)	1253 (1253)
EARLY EOCENE EARLY EOCENE LATE PALEOCENE PALEOCENE MAASTRICHTIAN	LATROBE GROUP Undifferentiated coastal plain facies of shales, coals and sands 1256-1533m	*P. asperopolus* Lower *M. diversus* (*A. hyperacanthum*) Upper *L. balmei* (*A. homomorphum*) Lower *L. balmei* Upper *T. longus*	1268 1308 (1308) 1358 (1358) 1428 1483-1510
CAMPANIAN	Unnamed Volcanics 1533-1568m	NOT ANALYSED	
TURONIAN	GOLDEN BEACH GROUP Lacustrine shales and fluviatile sands, siltstones and shales 1568-1935m	*P. mawsonii* and *H. trinalis* Subzone † (*Rimosicysta* Superzone)	1567-1934* (1567-1862)
APTIAN - BARREMIAN	STRZELECKI GROUP Fluviatile sands and shales 1935-2236m	*P. notensis* ‡	1986-2172

T.D. 2242m

NOTES:

* Two cuttings samples analysed from Longtom-1 Sidetrack between 2316-2445m are both from *H. trinalis* Subzone† of *P. mawsonii* Zone.

† *Hoegisporis trinalis* Subzone is a new zone used for the first time in the Gippsland Basin.

‡ The *Pilosisporites notensis* Zone is a new zone recently proposed by Morgan et al. (1995) as a partial replacement for the *Cyclosporites hughesii* Zone.

Geological Comments

1. Longtom-1 located on the Northern Strzelecki Terrace penetrates an abridged sections of the four major groups recognised in the Gippsland Basin. The boundaries between the Seaspray, Latrobe and Golden Beach Groups are major unconformities, while the boundary between the Golden Beach Group and underlying Strzelecki Group intersected in the original Longtom-1 hole is interpreted as a faulted contact.

2. The Longtom-1 Sidetrack diverted to the downthrown side of the fault intersected more section of the Golden Beach Group and terminated whilst still within this unit according to the palynological analysis of cuttings.

3. Only the basal 208 metres of Seaspray Group below the 13.375 inch casing point at 1037m was analysed. The section is subdivided into the Lakes Entrance Formation overlain by the Gippsland Limestone by a good log break at 1184m which is well expressed on the gamma, sonic and density/porosity logs. The largely Middle Miocene *T. bellus* Zone was identified in four samples distributed through the Gippsland Limestone while only two samples were analysed from the basal five metres of the Lakes Entrance Formation. These gave a Middle *P. tuberculatus* Zone or younger age suggesting that most if not all of the Oligocene is missing at the base of the Seaspray Group. In this the palynology is consistent with the foraminiferal ages in the adjacent wells Sunfish-2 and Sperm Whale-1 where the Early Miocene zonule G is the oldest foraminiferal zone identified.

4. The one sample analysed from the 11 metres thick Gurnard Formation between 1245-1256m at the top of the Latrobe Group provides a good Middle Eocene date near the base of the unit. The thinness of the unit suggests that it may represent only the Middle Eocene and if so the unconformity at the top of the Latrobe would include Late Eocene as well as Oligocene and have a duration of up to 11 million years according to current correlations to the time scale of Haq *et al.* (1987, 1988).

5. The sedimentary package from the base of the Gurnard Formation at 1256m to the top of a massive sandstone at 1270.5m is unusual and unexpected in this part of the basin. The unit from its base consists of a shale interbedded and overlain by two coal seams (at 1263-1265m and 1267-1267.8m), in turn overlain by a fining up sand (1256-1263m). The Early Eocene *P. asperopolus* Zone age from the shale immediately below the coals makes these coals the most easterly coals in the basin assigned to either the *P. asperopolus* or

N. asperus Zones, and the only coals of this age found east of the Marlin Channel. These sediments which are clearly deposited in a coastal plain environment are also facies equivalent of the youngest part of the Flounder Formation in the Tuna field 10 kms to the southeast of Longtom-1.

6. The massive sand between 1270.5-1294.5m is also most likely a facies equivalent of the Flounder Formation and the major sequence boundary corresponding to the cutting of the Tuna-Flounder Channel probably lies within or at the base of this sand. The sand is most likely to be *P. asperopolus* or Upper *M. diversus* Zone in age, with the older Middle *M. diversus* and most of the Lower *M. diversus* Zones removed by erosion.

7. The discovery of the *A. hyperacanthum* microplankton Zone at 1308m in Longtom-1 together with an equivalent occurrence in Sweetlips-1 at 1559m (Partridge 1990a) represents the two most northern records of this marine incursion into the Gippsland Basin. The zone was recorded in Longtom-1 interbedded with and immediately above a coal but is not distinguished by any particularly signature on the electric logs. This is consistent with most other wells in the basin. The *A. hyperacanthum* Zone marine incursion appears to have been a very short duration event which did not allow time for deposition of a lithologically distinctive marker bed.

8. The interval from 1294.5m to top of volcanics at 1533m is a relatively homogenous sequence of interbedded sands, shales and coals typical of the coastal plains facies in the Gippsland Basin. The Early Eocene and two Paleocene sample all contain marine dinoflagellates indicating consistent marine influence while the two Maastrichtian samples are both non-marine. The thickest sand in this interval at 1434-1463m conveniently separates the marine and non-marine samples and based on available age dating probably is approximately at the level of the Mid-Paleocene seismic marker. The Cretaceous/Tertiary boundary is poorly constrained by the available samples in Longtom-1 but if the latter interpretation is correct it should lie below this sand. The most likely position is within the thin shale bed between 1462-1474m.

9. The volcanics between 1533-1568m lie on the unconformity surface between the Golden Beach and Latrobe Groups. The duration of the unconformity from the palynological dating, extends from probable early Turonian to latest Maastrichtian, a period in excess of 20 million years. As the extrusion of volcanics would only represent a fraction of this time regional correlation across the basin suggests they are most likely Campanian in age. As such

they are closer in age to the Latrobe Group sediments and are best included in that group.

10. The 375+ metres thick Golden Beach Group deposited between 1568-1935m is interpreted to represent alternating episodes of lacustrine and fluviatile deposition. The lacustrine environments can be subdivided into "deep" and "shallow" lakes based on combined log and palynological analysis. The "deep" lakes are characterised by the more diverse microplankton assemblages with microplankton relative to spore-pollen abundances typically between 5% to 30%. The "shallow" lakes are characterised by monotypic or nearly monotypic microplankton assemblages with variable microplankton abundances from <1% to 20%.

    Three episodes of "deep" lakes are interpreted to occur in Longtom-1 from combined log and palynological analysis. The most distinctive is at the top of the sequence between 1564-1617m. It is characterised by a constant or slightly coarsening-up gamma ray log; a broad separation on the density/neutron porosity logs and a sonic log which shows a sharp break to slower sediments at the base and then gradually increases in velocity up section. In the two sidewall cores analysed from this lacustrine shale episode the basal sample at 1615m has a microplankton diversity of eight species and abundance of 26% relative to the spore-pollen. The sample at 1567m near the top of the shale has a recorded microplankton diversity of just three species and abundance of only 5%. A distal offshore environment of deposition is also favoured by the spore-pollen assemblages which show a distinct "Neves effect" with high abundances of gymnosperm pollen. This effect is most extreme in the bottom sample where gymnosperm pollen comprise 85% of the pollen count and gymnosperm pollen of the *Araucariacites/Dilwynites* complex an exceptionally high 75%. The "Neves effect" is a tendency for bisaccate pollen, and other buoyant spores and pollen with "comparatively greater transportability" to have greater relative abundance the further offshore you go in any depositional basin (Traverse 1988, p.413). This feature has previously been recognised and commented on in Admiral-1 (Partridge 1990b). The other two "deep" lake episodes are interpreted on log character and limited palynological sampling to lie between 1759-1788m and 1861-1885m. Most notable for both episodes is the slow sonic log.

    The "shallow" lakes are characterised by thinner shale beds and hence are undoubtedly more ephemeral. Only the sidewall cores at 1721m and 1922m clearly belong to this category, and of these the deeper sample provides a more distinctive log signature. A "shallow" lake is interpreted for the interval 1917-1923m which is characterised by a broad separation on the density/neutron porosity logs but without any particular characteristic signature on either the gamma or sonic logs. The palynological assemblage at 1922m within this shale contain a microplankton abundance of 21% comprised of a single fresh water algal species. The spore-pollen assemblage is dominated by spores 61% with *Cyathidites minor* at 30% and *Gleichenlidites circinidites* at 20% the dominate species. Unlike the "deep" lakes there was no "Neves effect" and gymnosperm pollen of the *Araucariacites/Dilwynites* complex comprised only 6% of the total pollen count.

11. Another "shallow" lake environment may be represented by the shale between 1885-1889m as it does not have a broad separation of the density/porosity logs nor a slow sonic. This shale is moreover of particular interest as it immediately overlies the gas column in Longtom-1 between 1889-1935mKB yet underlies, with quite a sharp break on the logs, the oldest identified "deep" lake episode between 1861-1889m.

The following environmental interpretation can be applied to the deposition of these two shales. The older shale between 1885-1889m starts out as a shallow lake which following a sudden deepening of the basin, perhaps as the result of a tectonic event, is replaced by a deep lake depositing finer more distal lake facies between 1861-1889m. As the lake fills up it returns to mixed "shallow" lake and fluviatile facies over the interval 1788-1861m which is in turn replaced by the next "deep" lake episode.

In terms of sequence stratigraphy analysis the shale between 1885-1889m would be equivalent to the last part of a Transgressive Systems Tract, the sharp log break at 1885m would be a Downlap Surface and the overlying shale between 1861-1885m part of a Highstand System Tract with a probable condensed section at its base.

12. Considering the stratigraphic nomenclature applied to the Golden Beach Group the "deep" lake facies would be equivalent to the Kipper Shale while the mixed "shallow" lake and fluviatile facies would be equivalent to the Judith Formation. The palaeogeographic location of Longtom-1 along the probable northern margin of the purported "Kipper lake" makes it much more likely to have a higher percentage of the shallow facies typical of the Judith Formation. Because the base of the oldest "deep" lake facies approximates the top of the gas column in Longtom-1 it is speculated that the base of this facies is an effective regional seal within the Golden Beach Group. For this to be true the fluviatile sands and siltstones interbedded with the three "deep" lake episodes in Longtom-1 would need to pinch out to the south and the three "deep" lake episodes merge to form a thick unbroken

"deep" lake facies. Based on the above speculation the preferred choice for the boundary between the Judith and Kipper Formations is at the base of the oldest "deep" shale facies at 1885m.

13. Palynological correlation of the Golden Beach Group in Longtom-1 to specific intervals of the thick sections of this group penetrated in other wells is currently not possible with any confidence because the key species used to define the new *Hoegisporis trinalis* Subzone of the *P. mawsonii* Zone have not been reported (or not consistently recorded) in palynological studies prior to 1990. Presently the in *H. trinalis* Subzone can only be recognised in Admiral-1 between 1912-2103.5m (Partridge 1990b), and in the adjacent Sweetlips-1 and Emperor-1 wells based on the recent review by Partridge (1993). Unfortunately, confident correlation is not possible to either of the thick sections of the Golden Beach Group penetrated in Kipper-1 and Judith-1 because of the lack of key species in the recorded assemblages. Both these wells require additional microscope examination of existing material.

14. The Strzelecki Group in Longtom-1 is assigned to the *Pilosisporites notensis* Zone recently established by Morgan *et al.* (1995) as a replacement for the *C. hughesii* Zone. This change is desirable because the *C. hughesii* Zone is being applied to sections in the Bass Strait basins using different criteria which have created confusion and/or ambiguity.

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 *et al.* (1987). The Tertiary microplankton zones identified are based on a scheme developed but only published in outline by Partridge (1975, 1976), while the *Rimosicysta* Superzone identified in the Golden Beach Group is a name applied to the unusual algal cyst assemblages described by Marshall (1989).

Author citations for most spore-pollen species identified and discussed can be sourced from Stover & Partridge (1973, 1982), Helby *et al.* (1987) or references quoted in those papers. Dinoflagellates can be found in the index of Lentin & Williams (1993) and acritarchs and other organic walled algae can be found in the index of Fensome *et al.* (1990). Species names followed by "ms" are unpublished manuscript names.

***Triporopollenites bellus* spore-pollen Zone.**
Interval: 1048.0 to 1177.0 metres (129+ metres)
Age: Latest Early Miocene to Middle Miocene.
The four shallowest sidewall cores analysed in Longtom-1 gave low residue yields with generally high palynomorph concentration overwhelmingly dominated by dinoflagellates (>85%). Although the recorded spore-pollen assemblages are limited by the low yields, the rare occurrence of *Tubulifloridites antipodica* at 1140m and the rare to frequent occurrence of *Rugulatisporites cowrensis* (formerly *Rugulatisporites micraulaxus* Partridge *in* Stover & Partridge 1973) in the other three samples provides a confident identification of the *T. bellus* Zone. Unfortunately other index species including the eponymous species were not recorded. Further, because of relatively low spore-pollen concentrations on the palynological slides, counts of the spore-pollen assemblages did not provide meaningful supporting data.

Other noteworthy species in the top sample include the species *Acaciapollenites myriosporites, Monoporites media, Myrtaceidites eucalyptoides* and *Chenopodipollis chenopodiaceoides*. All these species are known to have their oldest occurrences as rare species in the underlying *P. tuberculatus* Zone.

The microplankton which dominate these four samples can as yet only be assigned to the broad *Operculodinium* Superzone flora. The assemblages are dominated by dinoflagellates belonging to the *Spiniferites* species complex (>55% of microplankton) with the presence of *Tuberculodinium vancampoae* a potential index species for subdividing this superzone and supporting a younger Miocene age.

Middle *Proteacidites tuberculatus* spore-pollen Zone.
Interval: 1242.0 to 1244.0 metres (>3m but <68m)
Age: Late Oligocene to Early Miocene.
The two closely spaced sidewall cores from the base of the Seaspray Group, gave very low yields and as a consequence only limited assemblages were recorded. The occurrence of *Cyathidites subtilis* in the deepest sample is diagnostic of the Middle subzone of the *P. tuberculatus* Zone. Other key species recorded are *Cyatheacidites annulatus* and *Proteacidites truncatus* at 1242m and *Cyathidites porospora* and *Proteacidites rectomarginis* at 1244m.

The associated microplankton assemblages are dominated by the *Spiniferites* species complex. The rest of the recorded species are all relatively long ranging. Lacking from assemblages are key species considered diagnostic of Early Oligocene.

Lower *Nothofagidites asperus* spore-pollen Zone
and
***Areosphaeridium australicum* microplankton Zone**
Interval: 1253.0 metres (<11 metres from logs)
Age: Middle Eocene.
The single sample analysed from the Gurnard Formation gave a high diversity spore-pollen assemblage dominated by *Nothofagidites* spp. (>37%) associated with a low abundance and low diversity dinoflagellate assemblage dominated by the zone index *Areosphaeridium australicum* ms. Total microplankton were <7% of the composite spore-pollen and microplankton count. The spore-pollen zone assignment is based solely on the abundance of *Nothofagidites* pollen relative to *Haloragacidites harrisii* (= modern *Casuarina* pollen) at <12%, as all the other recorded species can be considered long ranging extending into older zones.

Amongst the other microplankton recorded the acritarch *Tritonites tricornus* is the most important as it is restricted to *A. australicum* Zone (Marshall & Partridge, 1988).

***Proteacidites asperopolus* spore-pollen Zone.**
Interval: 1268.0 (~14 metres)
Age: Early Eocene.
The highest sidewall core analysed from the "coarse clastic" portion of the Latrobe Group is located immediately below the two shallowest coal seams in Longtom-1 at 1263-1265m and 1267-1267.8m, and therefore it not surprisingly contained a non-marine assemblage.

The highly diverse assemblage of 52+ species is considered no older than the *P. asperopolus* Zone based on the FADs in the sample of *Conbaculites apiculatus* ms and *Sapotaceoidaepollenites rotundus*, and no younger than this zone on the LAD in the sample of *Intratriporopollenites notabilis*, and a questionably identified specimen of *Myrtaceidites tenuis*. Unexpectedly the eponymous species was not recorded although *Proteacidites pachypolus* is prominent in the assemblage but rare (<1%) in pollen count.

The assemblage upon counting was found to be dominated by *Proteacidites* spp. at 26% and tricolp(or)ate pollen at 19% and contained surprisingly abundant *Nothofagidites* spp. also at 19%, but a very low *Haloragacidites harrisii* abundance of 5%. The ratio of the last two species is anomalous for the *P. asperopolus* Zone but very typical of the overlying Lower *N. asperus* Zone, which suggests this sample may comes from very high in the former zone. The absence of key species such as *Nothofagidites falcatus* and *Tricolpites simatus* precludes assignment to the Lower *N. asperus* Zone.

Lower *Malvacipollis diversus* spore-pollen Zone
and
***Apectodinium hyperacanthum* microplankton Zone**
Interval: 1308.0 metres
Age: Early Eocene.
Although relatively poorly preserved this sample contains most of the key species characteristic of the *A. hyperacanthum* Zone incursion at the base of the Lower *M. diversus* Zone (Partridge, 1976).

The spore-pollen assemblage is dominated by *Malvacipollis* spp. (mostly *M. diversus*) at 26% of spore-pollen count with the next most abundant species in order are *Gleicheniidites circinidites* (22%); *Tricolp(or)ites* spp. (~11%); with *Laevigatosporites* spp. and *Spinizonocolpites prominatus* each ~5%.

Additional diagnostic species are *Lygistepollenites balmei* still present and 1.3% in count, and the spores *Crassiretitriletes vanraadshoovenii* and *Polypodiaceoisporites varus* ms.

Microplankton are surprisingly abundant at 33% of the combined spore-pollen and microplankton, especially as Longtom-1 is palaeogeographically located at or near the maximum landward penetration of this marine incursion. The *A. hyperacanthum* Zone is not found in any wells north of Longtom-1 but is recorded from Sweetlips-1 approximately 25 kms to the west (Partridge 1990a).

The most abundant microplankton identified in the assemblage are *A. hyperacanthum* at 33% of microplankton count, followed by *Fibrocysta bipolare* at 8% and *Kenleyia* spp. at 5%. Considerable taxonomic work needs to be undertaken to fully document this assemblage as >40% of the assemblage was categorised as undifferentiated dinoflagellates which could not be identified to species level.

Upper *Lygistepollenites balmei* spore-pollen Zone
and
***Apectodinium homomorphum* microplankton Zone**
Interval: 1358.0 metres
Age: Paleocene.
Although over 40 spore-pollen species were recorded from this zone, key index species are rare being restricted to *Malvacipollis subtilis* and questionable *Proteacidites annularis*. Both species are taken to indicate an age no older than the Upper *L. balmei* Zone. The diversity and abundance of the assemblages reinforces this younger age by absence of older index species such as *Proteacidites angulatus* and *Tetracolporites verrucosus*. An age no younger than the Upper

L. balmei Zone is clearly indicated by frequent occurrence of *Lygistepollenites balmei* and rare *Polycolpites langstonii*.

The *A. homomorphum* Zone is identified solely on the rare occurrence of the eponymous species.

Lower *Lygistepollenites balmei* spore-pollen Zone
Interval: 1428.0 metres
Age: Early Paleocene.
The youngest occurrence of *Tetracolporites verrucosus* in absence of older index species provides a confident assignment of this sample to the Lower *L. balmei* Zone. Other index species for the broader *L. balmei* Zone include the eponymous species, *Gambierina rudata, Latrobosporites amplus, L. ohiaensis* and the frequent occurrence of *Peninsulapollis gillii* in a moderate diversity assemblage of 25 species

The limited microplankton assemblage of four species in the sample unfortunately is not zone diagnostic.

Upper *Tricolpites longus* spore-pollen Zone
Interval: 1483.0-1510.0 metres (27+ metres)
Age: Maastrichtian
The deepest two sidewall cores from the Latrobe Group gave non-marine assemblages dominated by the extinct angiosperm pollen *Gambierina rudata* (>28%) whose abundance indicates an age no older than the Upper *T. longus* Zone. The presence of the FAD of *Stereisporites (Tripunctisporis)* spp. at 1483m confirms this pick. The absence of this latter species from the deeper sample is not considered particularly anomalous but is reflected in the confidence rating assigned to the zone.

Eleven species or 21% of total species list for both samples are considered diagnostic for picking the top of the zone as they are not considered to range above the top of the Cretaceous. In the following the first column were not recorded above 1510m while the second column were not recorded above 1483m.

Battenipollis sectilis
Camarozonosporites horrenudus ms
Densoisporites velatus
Nothofagidites senectus
Proteacidites clinei ms
Pseudowinterapollis wahooensis
Tetradopollis securus ms
Tricolpites confessus

Proteacidites otwayensis ms
Proteacidites pallidus
Proteacidites reticuloconcavus ms

***Phyllocladidites mawsonii* spore-pollen Zone**
and
***Hoegisporis trinalis* Subzone**
Interval: Longtom-1 - 1567.0-1934.0 metres (367+ metres)
Sidetrack - 2316.0-2445.0 metres MDKB (129+ mMD)
Age: Early Turonian

The ten sidewall cores and four cuttings samples are confidently assigned to the *P. mawsonii* Zone of Helby *et al.* (1987) even though the eponymous species *Phyllocladidites mawsonii* was only recorded from sidewall cores at 1778m and 1922m and the closely related *P. eunuchus* ms only recorded from the deepest sidewall core at 1934m and deepest cutting in the Sidetrack hole. Instead, the zone is mainly recognised from the confident identification of the new *Hoegisporis trinalis* Subzone, based on the consistent, to at times abundant, presence of the new species *Hoegisporis trinalis* ms, *Dilwynites pusillus* ms, *Laevigatosporites musa* ms and *Rugulatisporites admirabilis* ms. The importance of these species has been established firstly, in the detailed study of the Golden Beach Group intersected in Admiral-1 (Partridge 1990b) and secondly, from more recent work in the Port Campbell Embayment of the Otway Basin where these zones are associated with marine microplankton assemblages. *Hoegisporis trinalis* ms is particularly important as it can now be demonstrated to be restricted to the lower part of the *P. mawsonii* Zone and is considered to be diagnostic of the Early Turonian.

An age no younger than the *P. mawsonii* Zone is also indicated by the species *Appendicisporites distocarinatus, Interulobites intraverrucatus, Foraminisporis asymmetricus* and *Cyatheacidites tectifera* (only at 1615m) which range no higher than this zone according to ranges in Helby *et al.* (1987, fig.33).

There are also a number of other species which, although rare and usually inconsistent, combine to make the assemblages distinctive. These species are:

Balmeisporites glenelgensis
Cicatricosisporites pseudotripartitus
Crybelosporites brennerii
Densoisporites muratus ms
Dilwynites echinatus ms
Senectotetradites varireticulatus
Striatopollis paraneus
Tricolpites variverrucatus ms

Counts of the assemblages reveal two characteristic end members. Most samples are dominated by gymnosperm pollen assigned to the *Araucariacites/Dilwynites* complex with the new species *Dilwynites pusillus* ms by far the most abundant individual species. A maximum abundance of 55% was recorded for this species at 1615m, which is also the sample with the maximum abundance and diversity of non-marine microplankton. The abundance of these pollen types is interpreted to be a manifestation of the "Neves effect", and this end member type relates to distal (and probable deep water) lacustrine environments. The other end member is characterised by abundances of individual spore species. Typical are abundances of *Cyathidites minor* (30%) and *Gleicheniidites circinidites* (20%) at 1922m; and *Laevigatosporites ovatus* (37%) at 1933.8m. These latter assemblages are reflecting more local and fluctuating environments which is considered to be more typical of fluviatile environments.

***Rimosicysta* microplankton Superzone**
Interval: Longtom-1 - 1567.0-1862.0 metres (295+ metres)
Sidetrack - 2445.0 metres MDKB
Age: Early Turonian

The presence of abundant or diverse *Rimosicysta* spp. or *Wuroia* spp. in the Golden Beach Group is taken as being diagnostic of the *Rimosicysta* Superzone which is used as a general term to broadly cover the unusual algal cyst flora described by Marshall (1989). It is anticipated that interval zones will be established within this superzone once the ranges of individual species is better understood. Only five out of ten sidewall cores analysed in Longtom-1 contain *Rimosicysta* with only the species *R. kipperii* and the new species *R. robustus* ms identified, whilst of the three described *Wuroia* species only *W. tubiformis* was identified in deepest cuttings in the Sidetrack hole. Notably absent are the distinctly shaped *Rimosicysta cucullata* diagnostic of the *Rimosicysta* Superzone in the nearby Sunfish-1 between 2480.7-2485m, and representatives of the genus *Limbicysta* diagnostic of the *Rimosicysta* Superzone from the dredge sample in the Bass Canyon (Marshall 1989). Instead the assemblages are most similar to those recorded from Admiral-1 and Kipper-1 (Partridge 1990b, Marshall 1989). These differences highlight the lack of understanding of both species ranges within the superzone and the correlation of the different sections of the Golden Beach Formation found in the different wells.

The *Rimosicysta* Superzone is only considered to be fully developed in Longtom-1 in the sidewall cores between 1567-1862m corresponding to the presence of "deep lakes" facies discussed under the Geological Comments. The assemblages over this interval have microplankton abundances ranging from < 1% to 30% (average ~8%) and a composite diversity of 10+ species. Each sample shows a different species dominance with *Micrhystridium* sp. A, dominant at 1567m; *Luxadinium* sp. B, (50%) and *Amosopollis cruciformis* (32%) dominant at 1615m; *Sigmopollis* spp. at 1778m and *Rimosicysta* spp. (>80%) at 1862m.

Although *Rimosicysta* and other microplankton are recorded from the cutting it is possible that many of them are caved and therefore these samples may not be truly representative of the distribution of the algal cysts. This is relevant to the four sidewall cores over the interval 1922-1934m where only the deepest contained very rare *Rimosicysta* which may perhaps be contamination. This interval is not considered to be part of "deep lake" facies of the *Rimosicysta* Superzone.

An unusual or unexpected occurrence amongst the microplankton was a fragment recorded from the sidewall core at 1615m which was tentatively identified as the marine dinoflagellate species *Cribroperidinium edwardsii*. The fragmented specimen was identified by characteristic paratabulation and an ornament of verrucae within the paraplate boundaries. The discovery was unexpected because this is the first time a purported marine dinoflagellate has been recorded from the Golden Beach Group. The possibility of contamination is considered unlikely because of its similar preservation style to other palynomorphs in the assemblage, whilst reworking is discounted.

Although all slides were examined only one specimen was observed. The occurrence, if it can be confirmed by future work, of *Cribroperidinium edwardsii* is important as this species forms a distinct acme in middle part of Waarre Formation in the Port Campbell Embayment, Otway Basin and may therefore provide a correlation between the basins.

***Pilosisporites notensis* spore-pollen Zone**
Interval: 1986.0-2213.0 metres (227+ metres)
Age: Barremian to Aptian
The *Pilosisporites notensis* Interval Zone has recently been proposed by Morgan *et al*. (1995) to replace the *C. hughesii* Zone of Helby *et al*. (1987, p.37) to avoid ambiguity and confusion with the concept of the *C. hughesii* Zone, as originally defined by Dettmann & Playford (1969), which continues to have currency in the Otway Basin.

Morgan *et al*. (1995, appendix 6.1) define the zone as the interval from the oldest occurrence of *Pilosisporites notensis* to the oldest occurrence of *Crybelosporites striatus* and claim in their comments that the zone **".....is identical in concept to the *C. hughesii* Zone as modified by Helby *et al*. (1987)"**. This statement is wrong as in their original definition Helby *et al*. (*loc. cit*) define the base by the oldest occurrence of *Foraminisporis asymmetricus* which Morgan *et al*. (1995, fig.6.1) show as having its oldest occurrence in the middle of their new *P. notensis* Zone, and approximately at the base of the Aptian in accordance with Helby *et al.* (*loc. cit*).

In Longtom-1 both index species are rare with *P. notensis* recorded from sidewall core at 2078m and *F. asymmetricus* in the picked fraction of cuttings at 2125-50m and both occurring together in the deepest cuttings at 2172m. The occurrence of the diagnostic index species in only 3 of the 8 samples analysed is a typical but frustrating feature of palynological analysis of the Strzelecki Group. The rarity of both index species is considered to reflect the high deposition rates of accumulation of the unit which tends to dilute the diversity of the palynomorphs recorded resulting in bland assemblage of mainly long ranging species.

Considering that only ~300 metres of Strzelecki Group was penetrated, and in light of its probable high depositional rates, it is most likely that only the *P. notensis* Zone is represented in Longtom-1. The absence of *Crybelosporites striatus* in all samples including the cuttings precludes a younger age while the presence of *P. notensis* and *F. asymmetricus* although inconsistent in the samples is taken to infer an age no older than the *P. notensis* Zone for the whole section.

The assemblages from the Strzelecki Group in Longtom-1 are typically dominated by *Podocarpidites* spp. and spores of *Baculatisporites/Osmundacidites* spp. Next most common are spores of *Cyathidites* spp. and *Stereisporites antiquisporites* with occasional frequent occurrences of the spore *Cicatricosisporites australiensis*. The assemblages are distinctly composition different from the assemblages of the overlying Golden Beach Group by lacking common to abundant occurrences of *Dilwynites* spp., *Gleicheniidites circinidites* and *Laevigatosporites* spp.

Microplankton are restricted to the four species *Sigmopollis carbonis, S. hispidus, Schizosporis reticulatus* and *Lecaniella dictyota* (1 specimen). This is a similar suite to that recorded by Dettmann (1986) from the Koonwarra Fossil Bed from the onshore Gippsland Basin and interpreted as fresh water (lacustrine) in origin.

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Table-1A: Interpretative Palynological Data for Longtom-1.

Sample	Depth (m)	Spore-pollen Zone and Subzones	*CR	Microplankton Zones	*CR	Comments and Key Species Present
SWC 60	1048.0	*T. bellus*	B1	*Operculodinium* Sz	B1	Microplankton 86% with *Tuberculodinium vancampoae*. S-P include *Acaciapollenites myriosporites*, *Rugulatisporites cowrensis*.
SWC 59	1107.0	*T. bellus*	B2	*Operculodinium* Sz	B1	Frequent *R. cowrensis*.
SWC 58	1140.0	*T. bellus*	B1	*Operculodinium* Sz	B1	Microplankton 89% with FADs of *T. vancampoae*. FAD of pollen *Tubulifloridites antipodica*,
SWC 57	1177.0	*T. bellus*	B1	*Operculodinium* Sz	B1	FAD of spore *Rugulatisporites cowrensis*.
SWC 56	1242.0	*P. tuberculatus*	B2	*Operculodinium* Sz	B1	FAD of spore *Cyatheacidites annulatus*.
SWC 55	1244.0	Middle *P. tuberculatus*	B2	*Operculodinium* Sz	B1	Microplankton 63% dominated by *Spiniferites* spp. at 59% of MP. FAD of spore *Cyathidites subtilis*.
SWC 53	1253.0	Lower *N. asperus*	B1	*A. australicum*	B2	Microplankton < 7% with FADs of *Tritonites tricornus* and *Areosphaeridium australicum* ms. S-P dominated by *Nothofagidites* spp. 37%.
SWC 51	1268.0	Lower *N. asperus*	B1			S-P dominated by *Nothofagidites* spp. 20%. LAD for *Intratriporopollenites notabilis*. FADs for *Conbaculites apiculatus* ms, *Sapotaceoidaepollenites rotundus*.
SWC 49	1308.0	Lower *M. diversus*	B1	*A. hyperacanthum*	B2	Microplankton 33% with FAD of *Apectodinium hyperacanthum*. S-P dominated by *Malvacipollis* spp. 26% with FAD of *Spinozonocolpites prominatus*.
SWC 48	1358.0	Upper *L. balmei*	B4	*A. homomorphum*	B3	FAD *Malvacipollis subtilis*.
SWC 45	1428.0	Lower *L. balmei*	B1			LAD *Tetracolporites verrucosus*.
SWC 42	1483	Upper *T. longus*	B1			*Gambierina rudata* 33% with *Stereisporites (Tripunctisporis)* sp.
SWC 41	1510	Upper *T. longus*	B4			*Gambierina rudata* 24% without *Stereisporites (Tripunctisporis)* sp.
SWC 37	1567	*P. mawsonii* *H. trinalis* Subz	B1	*Rimosicysta* Sz	B3	Microplankton ~5%. LADs of *Rimosicysta* spp. and pollen *Hoegisporis trinalis* ms.
SWC 36	1615.0	*P. mawsonii* *H. trinalis* Subz	B1	*Rimosicysta* Sz	B3	Microplankton ~26% dominated by *Luxadinium* sp. B, Marshall 1989. S-P dominated by *Dilwynites pusilus* ms at 55%.
SWC 34	1721.0	*P. mawsonii*	B3			Microplankton <1%. *Laevigatosporites musa* ms present assemblage.
SWC 32	1778.0	*P. mawsonii* *H. trinalis* Subz	B1			Microplankton ~4%, mostly *Sigmopollis carbonis*. *Dilwynites* spp. ~50%.
SWC 30	1860.0	*P. mawsonii*	B2			*Densoisporites muratus* ms present Microplankton << 1%.

Table-1A: Interpretative Palynological Data for Longtom-1 cont...

Sample	Depth (m)	Spore-pollen Zone and Subzones	*CR	Microplankton Zones	*CR	Comments and Key Species Present
SWC 29	1862	*P. mawsonii* *H. trinalis* Subz	B1	*Rimosicysta* Sz	B3	Microplankton ~11% dominated by *Rimosicysta kipperii*. *Dilwynites* spp. ~52%. FAD of *D. muratus* ms.
SWC 24	1922.0	*P. mawsonii*	B1			Microplankton ~21% almost exclusively *Circulosporites parvus*. FAD *Phyllocladidites mawsonii*.
Cuttings A1	1925-50	*P. mawsonii*	D2	*Rimosicysta* Sz	D3	Unpicked cuttings / mixed lithologies. Common *Dilwynites granulatus* and *D. pusillus* ms with *Senectotetradites varireticulatus*. *Rimosicysta kipperii* present.
Cuttings A2	1925-50	*P. mawsonii* *H. trinalis* Subz	D2	*Rimosicysta* Sz	D3	Picked dark grey claystone with most chips over 5mm diameter. Common *Luxadinium* sp. B and rare *Rimosicysta* spp. Pollen *Hoegisporis trinalis* ms present.
SWC 21	1931	*P. mawsonii*	B1			*Appendicisporites distocarinatus* present.
SWC 20	1933.8	*P. mawsonii* *H. trinalis* Subz	B2			Microplankton ~2%. All *Circulosporites parvus*. S-P dominated by *Laevigatesporites* spp. 45% with *H. trinalis* ms and *Laevigatosporites musa* ms present.
SWC 19	1934	*P. mawsonii* *H. trinalis* Subz	B1			FADs of *H. trinalis* ms, *Rugulatisporites admirabilis* ms, *Senectotetradites varireticulatus* and *Dilwynites pusillus* ms.
SWC 12	1986	*P. notensis*	B4			Assemblage dominated by *Podocarpidites* spp. at 33% and *Baculatisporites/Osmundacidites* at 32%, without zone index species.
SWC 10	2056	Indeterminate				Sample essentially barren. Only kerogen slide available with less than 10 specimens.
SWC 9	2078	*P. notensis*	B2			Frequent *Pilosisporites notensis* in assemblage dominated by *Podocarpidites* spp. at 40%.
Cuttings B1	2125-50	*P. notensis*	D4			Unpicked cuttings / mixed lithologies with spore dominated assemblage typical of Strzelecki Group. *Foraminisporis wonthaggiensis* present.
Cuttings B2	2125-50	*P. notensis*	D2			Picked lithology of medium grey claystone to siltstone with common *Cyathidites australis* and *Cicatricosisporites australiensis* considered typical of Strzelecki. *Foraminisporis asymmetricus* present.
SWC 5	2131.0	*P. notensis*	B4			Frequent *Cicatricosisporites australiensis*.
Cuttings	2172	*P. notensis*	D2			Frequent *Pilosisporites notensis*.
SWC 1	2213.0	*F. wonthaggiensis* or *P. notensis*	B4			Assemblage dominated by *Podocarpidites* spp. 22% and *Baculatisporites/ Osmundacidites* at 20%, with FAD of *Foraminisporis wonthaggiensis*.

Table-1B: Interpretative Palynological Data for Longtom-1 Sidetrack.

Sample	Depth (m)	Spore-pollen Zone and Subzones	*CR	Microplankton Zones	*CR	Comments and Key Species Present
Cuttings	2316	*P. mawsonii* *H. trinalis* Subz	D2			
Cuttings	2445	*P. mawsonii* *H. trinalis* Subz	D1	*Rimosicysta* Sz	D4	Microplankton ~3%. *Hoegisporis trinalis* ms frequent. *Wuroia tubiformis* present. Fragments of insect chitin are common in palynology preparation.

Subz. = Subzone
Sz. = Superzone
LAD = Last Appearance Datum
FAD = First Appearance Datum

Confidence Ratings

The Confidence Ratings assigned to the zone identifications on Table-2A-B are quality codes used in the STRATDAT relational database being developed by the Australian Geological Survey Organisation (AGSO) as a National Database for interpretive biostratigraphic data. Their purpose is to provide a simple relative comparison of the quality of the zone assignments. The alpha and numeric components of the codes have been assigned the following meanings:

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.

Table-2A: Basic Data for Longtom-1, Gippsland Basin.

Sample	Depth (m)	Sample Wt (g)	Yield	Palynomoprh Concentration	Palynomorph Preservation	No. S-P species	No. MP species
SWC 60	1048.0	12.4	Low	High	Good	27+	9+
SWC 59	1107.0	12.4	Low	High	Good	15+	13+
SWC 58	1140.0	15.7	Low	High	Good	19+	10+
SWC 57	1177.0	8.9	Low	Low	Fair-good	26+	14+
SWC 56	1242.0	12.7	Very low	High	Good	15+	14+
SWC 55	1244.0	15.0	Very low	Moderate	Fair	12+	10+
SWC 53	1253.0	13.7	Moderate	Low	Poor-fair	41+	6+
SWC 51	1268.0	9.0	High	Moderate	Fair-good	52+	
SWC 49	1308.0	11.8	High	High	Poor-fair	33+	8+
SWC 48	1358.0	16.3	High	Moderate	Poor	41+	1
SWC 45	1428.0	10.7	High	Low	Poor-fair	25+	5+
SWC 42	1483.0	13.2	High	High	Good	29+	2
SWC 41	1510.0	8.3	High	High	Poor-fair	40+	
SWC 37	1567.0	11.7	High	Moderate	Poor-fair	32+	4+
SWC 36	1615.0	10.9	High	High	Poor-fair	38+	7+
SWC 34	1721.0	12.8	Moderate	Very low	Poor	9+	2+
SWC 32	1778.0	8.6	High	High	Fair	33+	6+
SWC 30	1860.0	6.1	High	Low	Poor	19+	1
SWC 29	1862.0	9.2	Moderate	High	Poor-fair	29+	5+
SWC 24	1922.0	15.6	High	Moderate	Poor	26+	2+
Cuttings A1	1925-50	>10	High	Low	Poor	11+	2+
Cuttings A2	1925-50	7.8	High	Low	Poor-fair	18+	7+
SWC 21	1931.0	11.0	High	Low	Poor	26+	
SWC 20	1933.8	14.5	High	Low	Poor	20+	1
SWC 19	1934.0	13.9	Moderate	Moderate	Poor	26+	1+
SWC 12	1986.0	11.2	High	Moderate	Poor-fair	30+	
SWC 10	2056.0	6.3	Very low	Very low	Poor	3+	1
SWC 9	2078.0	11.3	High	High	Poor	23+	1
Cuttings B1	2125-50	>10	High	Low	Poor	16+	
Cuttings B2	2125-50	2.5	Moderate	Low	Poor-fair	15+	1
SWC 5	2131.0	7.6	High	Moderate	Poor	19+	1
Cuttings	2172	13.9	High	Moderate	Poor	18+	
SWC 1	2213.0	11.9	High	Moderate	Poor	30+	

Table-2B: Basic Data for Longtom-1 Sidetrack, Gippsland Basin.

Sample	Depth (m)	Sample Wt (g)	Yield	Palynomoprh Concentration	Palynomorph Preservation	No. S-P species	No. MP species
Cuttings	2316	11.8	High	Moderate	Poor-fair	24+	3+
Cuttings	2445	11.4	High	High	Poor-good	29+	5+

RELINQUISHMENT LIST - PALYNOLOGY SLIDES

WELL NAME & NO: LONGTOM-1
PREPARED BY: A.D. PARTRIDGE
DATE: 16 AUGUST 1995 Sheet 1 of 5

SAMPLE	DEPTH (M)	CATALOGUE NUMBER	DESCRIPTION
SWC 60	1048.0	P196942	Kerogen slide: filtered/unfiltered
SWC 60	1048.0	P196943	Oxidised slide 2: 8μm filter
SWC 59	1107.0	P196944	Kerogen slide: filtered/unfiltered
SWC 59	1107.0	P196945	Oxidised slide 2: 8μm filter
SWC 58	1140.0	P196946	Kerogen slide: filtered/unfiltered
SWC 58	1140.0	P196947	Oxidised slide 2: 8μm filter
SWC 57	1177.0	P196948	Kerogen slide: filtered/unfiltered
SWC 57	1177.0	P196949	Oxidised slide 2: 8μm filter
SWC 56	1242.0	P196950	Kerogen slide: filtered/unfiltered
SWC 56	1242.0	P196951	Oxidised slide 2: 8μm filter - 1/2 cover slip
SWC 55	1244.0	P196952	Kerogen slide: filtered/unfiltered
SWC 55	1244.0	P196953	Oxidised slide 2: 8μm filter - 1/2 cover slip
SWC 53	1253.0	P196954	Kerogen slide: filtered/unfiltered
SWC 53	1253.0	P196955	Oxidised slide 2: 8μm filter
SWC 53	1253.0	P196956	Oxidised slide 3: 8μm filter
SWC 53	1253.0	P196957	Oxidised slide 4: 15μm filter
SWC 51	1268.0	P196958	Kerogen slide: filtered/unfiltered
SWC 51	1268.0	P196959	Oxidised slide 2: 8μm filter
SWC 51	1268.0	P196960	Oxidised slide 3: 8μm filter
SWC 51	1268.0	P196961	Oxidised slide 4: 15μm filter
SWC 51	1268.0	P196962	Oxidised slide 5: 15μm filter
SWC 49	1308.0	P196963	Kerogen slide: filtered/unfiltered
SWC 49	1308.0	P196964	Oxidised slide 2: 8μm filter
SWC 49	1308.0	P196965	Oxidised slide 3: 8μm filter
SWC 49	1308.0	P196966	Oxidised slide 4: 15μm filter
SWC 49	1308.0	P196967	Oxidised slide 5: 15μm filter
SWC 48	1358.0	P196968	Kerogen slide: filtered/unfiltered
SWC 48	1358.0	P196969	Oxidised slide 2: 8μm filter
SWC 48	1358.0	P196970	Oxidised slide 3: 8μm filter
SWC 48	1358.0	P196971	Oxidised slide 4: 15μm filter
SWC 48	1358.0	P196972	Oxidised slide 5: 15μm filter
SWC 45	1428.0	P196973	Kerogen slide: filtered/unfiltered
SWC 45	1428.0	P196974	Oxidised slide 2: 8μm filter
SWC 45	1428.0	P196975	Oxidised slide 3: 8μm filter
SWC 45	1428.0	P196976	Oxidised slide 5: 15μm filter
SWC 45	1428.0	P196977	Oxidised slide 4: 15μm filter
SWC 42	1483.0	P196978	Kerogen slide: filtered/unfiltered
SWC 42	1483.0	P196979	Oxidised slide 2: 8μm filter
SWC 42	1483.0	P196980	Oxidised slide 3: 8μm filter

RELINQUISHMENT LIST - PALYNOLOGY SLIDES

WELL NAME & NO: LONGTOM-1
PREPARED BY: A.D. PARTRIDGE
DATE: 16 AUGUST 1995

Sheet 2 of 5

SAMPLE	DEPTH (M)	CATALOGUE NUMBER	DESCRIPTION
SWC 42	1483.0	P196981	Oxidised slide 4: 15μm filter
SWC 42	1483.0	P196982	Oxidised slide 5: 15μm filter - 1/2 cover slip
SWC 41	1510.0	P196983	Kerogen slide: filtered/unfiltered
SWC 41	1510.0	P196984	Oxidised slide 2: 8μm filter
SWC 41	1510.0	P196985	Oxidised slide 3: 8μm filter
SWC 41	1510.0	P196986	Oxidised slide 4: 15μm filter
SWC 41	1510.0	P196987	Oxidised slide 5: 15μm filter
SWC 37	1567.0	P196988	Kerogen slide: filtered/unfiltered
SWC 37	1567.0	P196989	Oxidised slide 2: 8μm filter
SWC 37	1567.0	P196990	Oxidised slide 3: 8μm filter
SWC 37	1567.0	P196991	Oxidised slide 4: 15μm filter
SWC 37	1567.0	P196992	Oxidised slide 5: 15μm filter
SWC 36	1615.0	P196993	Kerogen slide: filtered/unfiltered
SWC 36	1615.0	P196994	Oxidised slide 2: 8μm filter
SWC 36	1615.0	P196995	Oxidised slide 3: 8μm filter
SWC 36	1615.0	P196996	Oxidised slide 4: 15μm filter
SWC 36	1615.0	P196997	Oxidised slide 5: 15μm filter
SWC 34	1721.0	P196998	Kerogen slide: filtered/unfiltered
SWC 34	1721.0	P196999	Oxidised slide 2: 8μm filter
SWC 34	1721.0	P197000	Oxidised slide 3: 8μm filter
SWC 32	1778.0	P197001	Kerogen slide: filtered/unfiltered
SWC 32	1778.0	P197002	Oxidised slide 2: 8μm filter
SWC 32	1778.0	P197003	Oxidised slide 3: 8μm filter
SWC 32	1778.0	P197004	Oxidised slide 4: 15μm filter
SWC 32	1778.0	P197005	Oxidised slide 5: 15μm filter
SWC 30	1860.0	P197006	Kerogen slide: filtered/unfiltered
SWC 30	1860.0	P197007	Oxidised slide 2: 8μm filter
SWC 30	1860.0	P197008	Oxidised slide 3: 8μm filter
SWC 30	1860.0	P197009	Oxidised slide 4: 15μm filter
SWC 30	1860.0	P197010	Oxidised slide 5: 15μm filter
SWC 29	1862.0	P197011	Kerogen slide: filtered/unfiltered
SWC 29	1862.0	P197012	Oxidised slide 2: 8μm filter
SWC 29	1862.0	P197013	Oxidised slide 3: 8μm filter
SWC 29	1862.0	P197014	Oxidised slide 4: 15μm filter
SWC 24	1922.0	P197015	Kerogen slide: filtered/unfiltered
SWC 24	1922.0	P197016	Oxidised slide 2: 8μm filter
SWC 24	1922.0	P197017	Oxidised slide 3: 8μm filter
SWC 24	1922.0	P197018	Oxidised slide 4: 15μm filter

RELINQUISHMENT LIST - PALYNOLOGY SLIDES

WELL NAME & NO: LONGTOM-1
PREPARED BY: A.D. PARTRIDGE
DATE: 16 AUGUST 1995

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SAMPLE	DEPTH (M)	CATALOGUE NUMBER	DESCRIPTION
Cuttings A1	1925-50	P197019	Oxidised slide - rushed
Cuttings A1	1925-50	P197020	Oxidised slide A
Cuttings A1	1925-50	P197021	Oxidised slide B
Cuttings A2	1925-50	P197022	Oxidised slide - rushed
Cuttings A2	1925-50	P197023	Oxidised slide A
Cuttings A2	1925-50	P197024	Oxidised slide B
SWC 21	1931.0	P197025	Kerogen slide: filtered/unfiltered
SWC 21	1931.0	P197026	Oxidised slide 2: 8μm filter
SWC 21	1931.0	P197027	Oxidised slide 3: 8μm filter
SWC 21	1931.0	P197028	Oxidised slide 4: 15μm filter
SWC 21	1931.0	P197029	Oxidised slide 5: 15μm filter
SWC 20	1933.8	P197030	Kerogen slide: filtered/unfiltered
SWC 20	1933.8	P197031	Oxidised slide 2: 8μm filter
SWC 20	1933.8	P197032	Oxidised slide 3: 8μm filter
SWC 20	1933.8	P197033	Oxidised slide 4: 15μm filter
SWC 20	1933.8	P197034	Oxidised slide 5: 15μm filter
SWC 19	1934.0	P197035	Kerogen slide: filtered/unfiltered
SWC 19	1934.0	P197036	Oxidised slide 2: 8μm filter
SWC 19	1934.0	P197037	Oxidised slide 3: 8μm filter
SWC 19	1934.0	P197038	Oxidised slide 4: 15μm filter
SWC 12	1986.0	P197039	Kerogen slide: filtered/unfiltered
SWC 12	1986.0	P197040	Oxidised slide 2: 8μm filter
SWC 12	1986.0	P197041	Oxidised slide 3: 8μm filter
SWC 12	1986.0	P197042	Oxidised slide 5: 15μm filter
SWC 12	1986.0	P197043	Oxidised slide 4: 15μm filter
SWC 10	2056.0	P197044	Kerogen slide: filtered/unfiltered
SWC 9	2078.0	P197045	Kerogen slide: filtered/unfiltered
SWC 9	2078.0	P197046	Oxidised slide 2: 8μm filter
SWC 9	2078.0	P197047	Oxidised slide 3: 8μm filter
SWC 9	2078.0	P197048	Oxidised slide 4: 15μm filter
SWC 9	2078.0	P197049	Oxidised slide 5: 15μm filter
Cuttings B1	2125-50	P197050	Oxidised slide - rushed
Cuttings B1	2125-50	P197051	Oxidised slide - rushed
Cuttings B1	2125-50	P197052	Oxidised slide - A
Cuttings B1	2125-50	P197053	Oxidised slide - B
Cuttings B2	2125-50	P197054	Oxidised slide - X
Cuttings B2	2125-50	P197055	Oxidised slide - A
Cuttings B2	2125-50	P197056	Oxidised slide - B

RELINQUISHMENT LIST - PALYNOLOGY SLIDES

WELL NAME & NO: LONGTOM-1
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SAMPLE	DEPTH (M)	CATALOGUE NUMBER	DESCRIPTION
SWC 5	2131.0	P197057	Kerogen slide: filtered/unfiltered
SWC 5	2131.0	P197058	Oxidised slide 2: 8μm filter
SWC 5	2131.0	P197059	Oxidised slide 3: 8μm filter
SWC 5	2131.0	P197060	Oxidised slide 4: 15μm filter
SWC 5	2131.0	P197061	Oxidised slide 5: 15μm filter
Cuttings	2172.0	P197062	Kerogen slide: filtered/unfiltered
Cuttings	2172.0	P197063	Oxidised slide 2: 8μm filter
Cuttings	2172.0	P197064	Oxidised slide 4: 15μm filter
Cuttings	2172.0	P197065	Oxidised slide 5 15μm filter
Cuttings	2172.0	P197066	Oxidised slide 3: 8μm filter
SWC 1	2213.0	P197067	Kerogen slide: filtered/unfiltered
SWC 1	2213.0	P197068	Oxidised slide 2: 8μm filter
SWC 1	2213.0	P197069	Oxidised slide 3: 8μm filter
SWC 1	2213.0	P197070	Oxidised slide 4: 15μm filter
SWC 1	2213.0	P197071	Oxidised slide 5: 15μm filter

RELINQUISHMENT LIST - PALYNOLOGY SLIDES

WELL NAME & NO: LONGTOM-1 SIDETRACK
PREPARED BY: A.D. PARTRIDGE
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SAMPLE	DEPTH (M)	CATALOGUE NUMBER	DESCRIPTION
Cuttings	2316.0	P197072	Kerogen slide: filtered/unfiltered
Cuttings	2316.0	P197073	Oxidised slide 2: 8μm filter
Cuttings	2316.0	P197074	Oxidised slide 3: 8μm filter
Cuttings	2316.0	P197075	Oxidised slide 4: 15μm filter
Cuttings	2316.0	P197076	Oxidised slide 5: 15μm filter
Cuttings	2445.0	P197077	Kerogen slide: filtered/unfiltered
Cuttings	2445.0	P197078	Oxidised slide 2: 8μm filter
Cuttings	2445.0	P197079	Oxidised slide 3: 8μm filter
Cuttings	2445.0	P197080	Oxidised slide 4: 15μm filter
Cuttings	2445.0	P197081	Oxidised slide 5: 15μm filter

RELINQUISHMENT LIST - PALYNOLOGY RESIDUES

WELL NAME & NO: LONGTOM-1
PREPARED BY: A.D. PARTRIDGE
DATE: 14 AUGUST 1995

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SAMPLE	DEPTH (M)	DESCRIPTION
SWC 53	1253.0	Kerogen residue
SWC 51	1268.0	Kerogen residue
SWC 51	1268.0	Oxidised residue
SWC 49	1308.0	Kerogen residue
SWC 48	1358.0	Kerogen residue
SWC 48	1358.0	Oxidised residue
SWC 45	1428.0	Kerogen residue
SWC 45	1428.0	Oxidised residue
SWC 41	1510.0	Kerogen residue
SWC 41	1510.0	Oxidised residue
SWC 37	1567.0	Kerogen residue
SWC 37	1567.0	Oxidised residue
SWC 36	1615.0	Kerogen residue
SWC 32	1778.0	Kerogen residue
SWC 32	1778.0	Oxidised residue
SWC 30	1860.0	Oxidised residue
SWC 29	1862.0	Kerogen residue
SWC 29	1862.0	Oxidised residue
Cuttings A1	1925-50	Mixed residue
Cuttings A2	1925-50	Mixed residue
SWC 21	1931.0	Kerogen residue
SWC 21	1931.0	Oxidised residue
SWC 20	1933.8	Oxidised residue
SWC 12	1986.0	Oxidised residue
SWC 9	2078.0	Oxidised residue
Cuttings B1	2125-50	Mixed residue
Cuttings B2	2125-50	Mixed residue
SWC 5	2131.0	Oxidised residue
Cuttings	2172.0	Oxidised residue
Cuttings	2316.0	Oxidised residue
Cuttings	2445.0	Kerogen residue
Cuttings	2445.0	Oxidised residue