Palynological analysis of the interval 1010 to 1832 metres in Eric the Red–1, Otway Basin.

by

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Summary

In this report relinquished palynological slides from 33 samples (26 sidewall cores and 7 cuttings) are analysed or reviewed from Eric the Red–1, over a ~820 metre interval from 1010 to 1831.5 metres. The section analysed extends from the upper part of the Eumeralla Formation into the lower Sherbrook Group, and a summary of the identified palynological zones, their ages, and the suggested correlation of the section to the revised stratigraphy of the Sherbrook Group is provide below:

Table–1: Palynological summary for Eric the Red–1

AGE	EQUIVALENT LITHOLOGICAL UNIT	SPORE–POLLEN ZONES & Subzones	MICROPLANKTON ZONES & Subzones
SANTONIAN to CONIACIAN	BELFAST MUDSTONE equivalent ?968–1098m	*T. apoxyexinus* Zone 1010–1025†m *P. mawsonii* Zone 1097m	*C. tripartita* Subzone 1010–1025†m *C. striatoconum* Zone 1097m
TURONIAN	FLAXMAN FORMATION equivalent ?1098–1295m	*P. mawsonii* Zone 1151–1275m *G. ancorus* Subzone 1177–1275m	*P. infusorioides* Zone 1177–1250.5m *K. polypes* Subzone 1180†m
TURONIAN	WAARRE FORMATION ?1295m–1644m Subdivided into Unit C ?1295m–1413m Unit B ?1413m–1543m Unit A ?1543–1644m	*P. mawsonii* Zone 1306†m–1630m *L. musa* Subzone 1316–1336m *H. trinalis* Subzone 1437–1630m	*P. infusorioides* Zone 1316–1520m *I. evexus* Subzone 1316m–1328.5m *C. edwardsii* Subzone 1437m–1520m
LATE ALBIAN	EUMERALLA FORMATION ?1644–1875m T.D.	*C. paradoxa* Zone 1678m–1754.5m	Not zoned.

† Depth from cuttings sample

The study identifies a higher pick for the top of the *C. paradoxa* SP Zone within the Eumeralla Formation, provides a partial subdivision of the *P. mawsonii* SP and *P. infusorioides* MP Zones into new subzones through the Waarre and Flaxman Formations, and identifies the *C. striatoconum* MP Zone, *C. tripartita* MP Subzone and *T. apoxyexinus* SP Zone from mixed shale and sandstone facies equivalent to units A and B of the Belfast Mudstone (Fig.1).

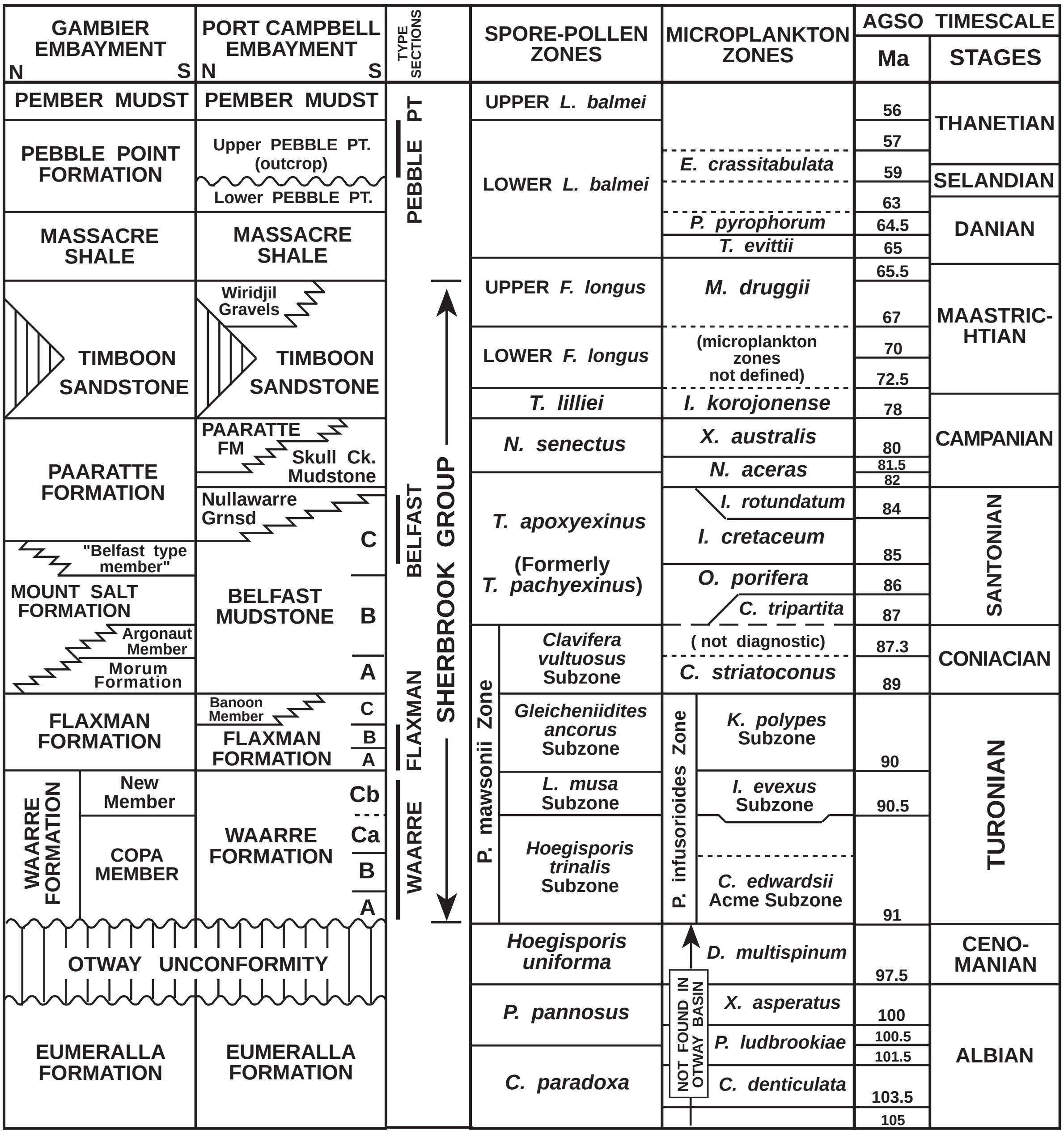

Figure 1. Revised Sherbrook Group stratigraphy, palynological biostratigraphy and proposed correlation to international stages and AGSO chronometric timescale (Young & Laurie, 1996).

The boundary between the Sherbrook and Otway Group is difficult to pick owing to barren, contaminated or indeterminate samples, but is considered to lie between sidewall cores at 1630m (containing a non-marine *H. trinalis* SP Subzone assemblage) and 1678m (containing a skewed *C. paradoxa* Zone assemblage).

Detailed interpretative data on all samples, including zone identifications and Confidence Ratings and environmental interpretation are recorded in Table 2, whilst basic data on sidewall core lithologies, number of palynological slides, visual residue yields, preservation and species diversity are presented on Table 3

Counts of selected samples are recorded on Table 4 and distribution of selected palynomorphs are presented on Table 5.

Materials and Methods

The study is based on relinquished palynological slides borrowed from the Department of Natural Resources and Environment. The interval studied (1010–1831.5m) is equivalent to the lower part of the Belfast Mudstone to the upper part of the Eumeralla Formation. Additional relinquished palynological slides were also available for another 18 sidewall cores between 373 and 970m covering a section from the Late Santonian to Late Eocene in age, but these were not reviewed as part of this study. The Basic Data range chart prepared by Dr Roger Morgan in March 1993, and included in the Well Completion Report was available during the study, but not the final interpretative written report.

Based on the number of palynological slides in the relinquishment collection, yields were mainly moderate between 1010m and 1520m, then declined to moderate to low below 1530m. Concentration of palynomorphs on the slides is variable with approximately half the samples containing moderate to high concentrations, while the other half contained low to very low concentrations (Table 3). Surprisingly, considering the shallow depth of the samples, preservation of the palynomorph was rather poor, due mainly to poor preparation of the samples, mostly a result of over-oxidation of the assemblages. Spore-pollen diversity was mainly moderate to high, while microplankton diversity was mostly low and only occasionally moderate. The seven cuttings samples in the collection all appear to be rush preparations and are mostly of poor quality. Only the two most critical cuttings at 1025m and 1180m were counted, but the results were disappointing and should be interpreted with caution.

The assemblage abundances given on Table 4 were counted under a x40 objective (usually on slides sieved at 10µm), and although providing a good approximation of the abundance of the major species groups they cannot be considered accurate to better than about ±1%. On tables and in text the abundance of spore-pollen species is always expressed as a percentage of the spore-pollen count. In contrast, the microplankton abundances are generally expressed as percentage of combined spore-pollen and microplankton count (eg. Table 2), but abundance of individual genera/species are given as percentages of just the microplankton count on Table 4. Because of the low numbers of microplankton counted in the samples (between 1 and 49 specimens) the relative abundance of individual species is not particularly reliable. Larger counts of the generally rare microplankton was not practical under the designated scope of this study.

Palaeoenvironments

ENVIRONMENT	TYPICAL LITHOLOGIES	CHARACTERISTICS OF PALYNOLOGICAL ASSEMBLAGES
NON-MARINE — including marsh, overbank, fluviatile and alluvial environments	**Coals** and **carbonaceous mudstones**	**Microplankton** absent to extremely rare, all non-marine species. **Spore-pollen** assemblages skewed with high abundances of certain species. Diagnostic species include gymnosperm pollen: *Phyllocladidites mawsonii, P. eunuchus, Trichotomosulcites subgranulatus* and spores: *Gleicheniidites* spp., *Cyathidites* spp. *Cicatricosisporites* spp., and *Ruffordiaspora* spp.
LACUSTRINE — mostly moderately long-standing fresh-water lakes on coastal plain. Ephemeral lakes mostly lack microplankton.	**Mudstones** to **siltstones** — massive or laminated	**Microplankton** diversity low (1 to 3 species), abundance usually low, but if high normally dominated by single species. Characteristic species: *Amosopollis cruciformis, Sigmopollis carbonis* and *Micrhystridium* sp. A. **Spore-pollen** assemblages less skewed but in large palaeolakes can show Neves effect characterised by abundance of *Dilwynites* spp.
PARALIC — marine incursions extending landward of palaeoshoreline. Includes coastal lagoons, estuaries and interdistributary bays. But only lagoons have unique microplankton and algae.	**Mudstones** to **sandstones** — laminated, mottled (burrowed), carbonaceous, pyritic.	**Microplankton** diversity low to moderate (3 to ~8 species), abundance low to moderate (1% to ~10%). Characterised by marine, brackish and cosmopolitan forms. Typical species include: *Amosopollis cruciformis, Heterosphaeridium* spp., *Cribroperidinium edwardsii* and algae *Botryococcus braunii.* **Spore-pollen** assemblages typically homogenous.
NEARSHORE MARINE — or proximal marine immediately offshore from palaeoshoreline.	**Mudstones** to **sandstones** — laminated, pyritic, burrowed, slightly calcareous, rare glauconite, but still carbonaceous.	**Microplankton** diversity low to moderate (>3 to <12 species), abundance moderate (>5% to <30%). Contains most marine species often associated with an abundance of forms washed out of the paralic environments. **Spore-pollen** assemblages typically homogenous.
OFFSHORE MARINE — or distal marine equivalent to middle and outer neritic environments.	**Mudstones** to **sandstones** — glauconitic, pyritic, calcareous, sparsely carbonaceous.	**Microplankton** diversity increases to >10 species and abundance >10%, with abundances of species often variable between samples. **Spore-pollen** assemblages generally show distinct Neves effect with abundance of *Dilwynites* pollen.
OCEANIC MARINE — outer shelf to slope environments.	**Mudstones** — often glauconitic, calcareous, pyritic.	**Microplankton** diversity >15 or 20 species and abundance >30%, with abundances of species often variable between samples. **Spore-pollen** often poorly preserved, with consequent increased prominence of more robust spores. Neves effect still present in better preserved assemblages.

Figure 2. Empirical model for palaeoenvironments in Sherbrook Group.

The palaeoenvironments assigned to the samples on Table 2 is based on consideration of 1) abundance, diversity and type of microplankton in the palynological assemblage, 2) the way the spore-pollen composition is skewed by changes in abundance of different species, and 3) the lithology of the samples. The various environmental categories distinguished and their corresponding lithological and palynological characteristics are summarised on Figure 2.

Relative to age equivalent section in wells examined from the onshore Port Campbell Embayment the lower Sherbrook Group is less marine, even though most samples contain some microplankton. All coal and many carbonaceous claystone samples contain skewed palynomorph assemblages, which are dominated by particular spore or pollen species, and often lack key index species required for the identification of the finer zone subdivisions.

Biostratigraphy

The zone and age determinations are based on the Australia wide Mesozoic spore-pollen and microplankton zonation schemes described by Helby *et al.* (1987), with finer resolution provided by the subzones outlined in Figure 1. The latter are based on extensive unpublished work in the onshore Port Campbell Embayment (eg. Partridge, 1994, 1997; 1999). Identification of zones is determined from the presence/absence of key species recorded in Table 5, supported by the changes in assemblage composition recorded by the abundance data in Table 4. Preparation of a comprehensive range chart showing distribution of all species recorded was not commissioned as part of this review study, and is likely to be deferred until completion of re-examination of the shallower samples in well.

Author citations for most spore-pollen species can be sourced from Helby *et al.* (1987), Dettmann (1963), Stover & Partridge (1973) or other references cited herein, whilst author citations for dinoflagellates can be found in the index of Williams *et al.* (1998). Species names followed by “ms” are unpublished manuscript names.

Tricolporites apoxyexinus spore–pollen Zone
and
Chatangiella tripartita microplankton Subzone
Interval: 1010 to 1025? metres.
Age: Santonian.

Although the eponymous species *Tricolporites apoxyexinus* was not recorded, *Ornamentifera sentosa* present at 1010m, and *Latrobosporites amplus* in the cuttings at 1025m are diagnostic secondary index species. The age assignment is supported by the eponymous species of the *C. tripartita* MP Subzone in both samples. Moderate abundance and diversity of marine microplankton, and absence of coals suggests a nearshore marine environment for the interval, which is correlated with unit B of the Belfast Mudstone recognised in the Port Campbell Embayment (Fig.1).

The cuttings sample at 1025m also contains the microplankton index species *Valensiella griphus* and *Isabelidinium evexus* ms, whose occurrences are anomalous with respect to the *C. striatoconum* Zone age assigned to the sidewall core at 1097m. This anomaly is for the moment interpreted as laboratory cross-contamination with the deeper cuttings sample at 1180m. Confirmation of this interpretation awaits sampling and analysis of new cuttings and additional sidewall cores over interval 1000 to 1200m.

Phyllocladidites mawsonii spore–pollen Zone
Interval: 1097 to 1630 metres.
Age: Turonian–Coniacian.

This zone was identified in nineteen samples over approximately 530 metres, with the eponymous species *Phyllocladidites mawsonii* occurring in 15 out of the 19 samples, and *Clavifera triplex* the original index species recorded from 11 out of the 19 samples. Twelve of the 19 samples can be assigned to the *H. trinalis*, *L. musa* and *G. ancorus* Subzones established in the Port Campbell Embayment (Partridge, 1997, 1999). About half of the samples represent non-marine environments and it is usually those samples that cannot be assigned to the subzones because they lack the critical index species. Independent support for the Turonian to Coniacian age is provided by the associated marine microplankton in the samples which are assigned to the *C. striatoconum* Zone (at 1097m) and new subzones of the *P. infusorioides* Zone (between 1180 and 1520m). Further details of the assemblages from the *P. mawsonii* Zone is provided under the discussion of the subzones.

Conosphaeridium striatoconum **microplankton Zone**
Sample at: 1097 metres.
Age: Coniacian.

The moderate diversity microplankton assemblage from the sidewall core at 1097m is dominated by marine dinoflagellate *Heterosphaeridium* spp. (39% of MP count) and the colonial algae *Amosopollis cruciformis* (54% of MP count), and is assigned to the *C. striatoconum* Zone on the presence of a single specimen of *Isabelidinium balmei*, as this species is not known to range below the zone. Supporting the latter is the presence of *Trithyrodinium* a genus which my records suggest is not typical below this zone in the Otway Basin. Although the associated spore-pollen assemblage is diverse with 34+ species, it strangely lacks the key index species *Gleicheniidites ancorus* ms and *Clavifera vultuosus* ms, even though all four available slides were searched. The sample also contains a distinct Neves effect (Traverse, 1988) with *Dilwynites* pollen abundant at 30%, but lacks the elevated values of *Cupressacites* sp. often associated with the *C. striatoconum* Zone. Therefore, although a confident *P. mawsonii* Zone assignment can be given to the sample it is not possible to assign it to a subzone

Exacerbating the unusual character of the assemblages from 1097m, the immediately underlying sample at 1151m is from a coal that contains a very skewed assemblage dominated by the gymnosperm pollen *Trichotomosulcites subgranulatus* (77%), and also lacks the key index species diagnostic of the subzones. In addition, the overlying cuttings at 1080m contain the dinoflagellate cysts *Valensiella griphus* and *Isabelidinium evexus* ms which are out-of-place with respect to the *C. striatoconum* Zone, and are suspected to have been introduced into the cuttings by cross-contamination from deeper in the well. Confirmation of this latter interpretation and increasing the overall confidence in the current zone picks requires new sampling, as the existing palynological slides have now been fully analysed.

Gleicheniidites ancorus **spore-pollen Subzone**
Interval: 1177 to 1275 metres.
Age: Late Turonian to Coniacian?

Only the coal sample at 1275m contains the eponymous species *Gleicheniidites ancorus* ms, while the two shallower sample at 1250.5m and 1177m can be no younger than this zone based on presence of *Laevigatosporites musa* ms. This interval is age equivalent to my revised concept of the Flaxman Formation in the Port Campbell Embayment (Partridge, 1997, 1999), however in that area the formation is always marine and the character of the equivalent non-marine assemblages has hitherto been unknown. The samples analysed from Eric the Red–1 are largely non-marine to paralic with limited or skewed floras. The

Phyllocladidites mawsonii abundance of 47% at 1275m is especially striking as this species has never been recorded in equivalent abundance from the Waarre Formation.

The assemblages are dominated by the gymnosperm pollen with consistent *Podocarpidites* (average 21%) and variable abundances of *Trichotomosulcites subgranulatus* (<1% to 27%; but 77% at 1151m), *Dilwynites* spp. (<1% to 18%), *Microcachryidites antarcticus* (<1% to 10%) and *Phyllocladidites mawsonii* (<1% to 47%). The spores also show considerable variation of the most prominent forms, with *Gleicheniidites circinidites* having a abundance range of <1% to 19%, *Cyathidites* spp. a range of 1% to 40%, and *Laevigatosporites* spp. a range of <1% to 10%. Angiosperm pollen abundance in general is low but note the 7% abundance of tricolporate pollen at 1219.5m.

In contrast to equivalent age sections of the Flaxman Formation in the Port Campbell Embayment none of the samples in Eric the Red–1 from the *G. ancorus* Subzone displays a Neves Effect (Traverse, 1988).

***Laevigatosporites musa* spore–pollen Subzone**
Interval: 1316–1336 metres.
Age: Mid? Turonian.

The *L. musa* Subzone was originally defined as the interval between the LAD[1] for *Hoegisporis trinalis* ms, and the last consistent appearance of *Laevigatosporites musa* ms, which is usually before the FAD[2] for *Gleicheniidites ancorus* ms. More recent analysis of samples from the top of the Waarre Formation in the Iona and Mylor fields in the onshore Port Campbell Embayment, and now from Eric the Red–1, has extended the range of *Hoegisporis trinalis* ms to nearer the top of the Waarre Formation and potentially through the entire *L. musa* Subzone. As a consequence of these findings the base of the *L. musa* Subzone is identified on alternative criteria, consisting of the FAD of *Tricolporites variverrucatus* ms and an increase in prominence of the eponymous species, although the maximum abundance of *L. musa* remains <2%. Within the *L. musa* Subzone is also found the oldest occurrences of significant abundances (>10% of total SP and MP count) of the colonial algae *Amosopollis cruciformis*, but it needs to be stressed that the presence or absence of this criterium depends on environment of deposition. In Eric the Red–1 only the shallowest sample conforms with a *A. cruciformis* abundance of 13%.

Dr Roger Morgan has used the 10% abundance of *A. cruciformis* as the cutoff to define the base of his Lower *T. apoxyexinus* Zone. Eric the Red–1 is a good

[1] LAD = Last Appearance Datum
[2] FAD = First Appearance Datum

illustration of the danger of using this algal cyst to define a spore-pollen zone boundary, for an inspection of the abundance data (Table 4) will show that if 1316m had not been analysed the next possible position for the base of the "Lower *T. apoxyexinus* Zone" is at 1097m, over 200 metres shallower.

The assemblages from the *L. musa* Subzone are dominated by the gymnosperm pollen (average 64%), mostly undifferentiated bisaccate pollen referred to *Podocarpidites* (average 23%), plus alete pollen *Dilwynites* spp. (average 13%), *Araucariacites australis* (average 7%), and *Hoegisporis trinalis* ms (about 0.5%), and the trisaccate pollen of *Trichotomosulcites subgranulatus* (average 6%). The non-marine coaly sample at 1334m gave a particularly skewed assemblage containing abundant *Phyllocladidites eunuchus* ms (34%). Amongst the spores only *Gleicheniidites circinidites* and *Cyathidites* spp. show significant abundance, while the angiosperm pollen average a low 2.3%. Environment of deposition of the interval ranges from non-marine and paralic to nearshore marine with the peak of the marine transgression occurring in the sample at 1328.5m, which contains the highest diversity of marine microplankton and peak in abundance of the *Dilwynites* pollen suggesting a Neves effect.

***Hoegisporis trinalis* spore–pollen Subzone**
Interval: 1437 to 1630 metres.
Age: Early? Turonian.

The *H. trinalis* Subzone is here identified as the interval from the LAD of Cenomanian species *Hoegisporis uniforma* to the FAD of *Tricolporites variverrucatus* ms. The subzone is recorded in five samples, all of which contain the eponymous species but lack *H. uniforma* and other Cenomanian species. Samples at 1364.5m, 1452m and perhaps 1575m are assigned to the broader *P. mawsonii* Zone because they lack *H. trinalis*. The other main characteristic of this subzone are the more prominent occurrences of the spores *Appendicisporites distocarinatus* and *Verrucosisporites admirabilis* ms. The assemblages continue to be dominated by gymnosperm pollen with *Podocarpidites* (average 26%), and *Microcachryidites antarcticus* (average 10%) most prominent, while *Cyathidites* spp. (average 25%) are the most consistently abundant spores. Angiosperms are low averaging less than 1%.

The non-marine interval below the oldest reliable occurrence of marine microplankton at 1520m is the most problematical. The description of the sandstone lithologies recovered by the sidewall cores are suggestive of the Eumeralla Formation, but this is not the case for the dark grey claystone recovered at 1630m and the argillaceous sandstone interlaminated with coal recovered at 1575m. The deeper of these two samples contains index species

H. trinalis ms, *A. distocarinatus* and *Coptospora pileolus* ms in an assemblage dominated by long ranging *Podocarpidites* spp., *Microcachryidites antarcticus*, and *Cyathidites* spp. The shallower, coaly and hence more environmentally restricted assemblage lacks key index species, but compositionally is almost identical. Both samples emphatically lack any index species of the underlying *C. paradoxa* Zone or of the Cenomanian *Hoegisporis uniforma* Zone (= former Cenomanian concept of the *A. distocarinatus* Zone). My opinion is that these recorded assemblages from the 100 metre interval between 1543 and 1644m, point to the interval belonging to the Waarre Formation, rather than either the Eumeralla Formation or an intervening aged unit not previously recorded from the Otway Basin.

Environment of deposition of the *H. trinalis* Subzone ranges from non-marine and paralic to nearshore marine with the peak of the marine transgression occurring in the sample at 1437m, which contains both the highest diversity of marine microplankton and a peak *Dilwynites* pollen abundance of 20% suggestive of a Neves effect.

***Coptospora paradoxa* spore-pollen Zone**
Interval: 1678–1754.5 metres
Age: Late Albian.

The highest confident identification of the *C. paradoxa* Zone is in the sidewall core at 1678m, which recovered a greenish grey claystone. This samples contains a very skewed spore-pollen assemblage dominated by an undescribed spores of the *Cicatricosisporites/Ruffordiaspora* complex with an abundance of >70%. It also contains significant abundances of the spores *Cyathidites asper* (8%) and *Triporoletes reticulatus* (8%), and a lesser but significant frequency of *Crybelosporites striatus* (1.5%). The eponymous species *Coptospora paradoxa* is present as is the manuscript species *Crybelosporites megastriatus*. The latter has also been recorded from this zone in the adjacent Loch Ard–1 well. Upon confirmation of a confident top to the *C. paradoxa* Zone only a cursory examination was undertaken on the deeper samples in the well. This nevertheless, was sufficient to demonstrated that the prior records of the key index species *Appendicisporites distocarinatus* and *Cribroperidinium edwardsii* in the sidewall core at 1719m should be interpreted as derived from downhole caving.

***Palaeohystrichophora infusorioides* microplankton Zone.**
Interval: 1180 to 1520 metres.
Age: Turonian.

The microplankton recorded through most of the *P. mawsonii* SP Zone are consistent with the *P. infusorioides* Zone. Individually, none of the samples contain a sufficiently diverse microplankton assemblage to provide confident assignment to the zone, but the composite assemblage from all samples through the interval is entirely consistent with this zone identified in other wells throughout the Otway Basin. The identification of the *K. polypes, I. evexus* and *C. edwardsii* Acme Subzones is based solely on a few key species.

Kiokansium polypes **microplankton Subzone.**
Cuttings at: 1180 metres.
Age: Late? Turonian.
The identification of the *K. polypes* Subzone in the cuttings at 1180m based on the presence of *Valensiella griphus* and *Isabelidinium evexus* ms. Other species recorded in this sample and adjacent sidewall cores are all longer ranging extending beyond the limits of the subzone.

Isabelidinium evexus **microplankton Subzone.**
Interval: 1316m to 1328.5 metres.
Age: Early? Turonian.
Both sidewall core samples are assigned to the subzone on the presence of the eponymous species *Isabelidinium evexus* ms. The presence of the colonial algae *Amosopollis cruciformis* in significant abundance (13%) in the shallower sample is consistent with this assignment, but otherwise the remainder of the recorded microplankton are long ranging and not restricted to the subzone.

Cribroperidinium edwardsii **microplankton Acme Subzone.**
Interval: 1437 to 1520 metres.
Age: Early? Turonian.
The *C. edwardsii* Acme Subzone was established for marine dinoflagellate assemblages found in the lower part of the Waarre Formation, which are of relatively low diversity and low abundance, yet contain a dominance of the eponymous species (Partridge, 1994). In Eric the Red–1, because the microplankton are too rare to make a confident assessment of the relative abundance of the individual species, the subzone is based on the total observed range of *Cribroperidinium edwardsii*.

Conclusions and Recommendations

This new palynological study of Eric the Red–1 has confirmed the presence of the Albian *C. paradoxa* Zone in the Eumeralla Formation, and established that the palynological sequence in the lower Sherbrook Group can be assigned to the new spore-pollen and microplankton subzones developed in the Port Campbell Embayment. However, relative to sections in the Port Campbell Embayment the lower Sherbrook Group sequence in Eric the Red–1 is clearly less marine, and many key index species of both the spore-pollen and microplankton subzones are difficult to find, and therefore sparsely recorded in the more non-marine assemblages.

Based on the identification of the palynological subzones, combined with the electric logs and sidewall core lithologies, a provisional subdivision of the Sherbrook Group, according to latest understanding of the traditional formations, is proposed in Table 1.

Unfortunately, there are still difficulties with picking the precise location of these formation boundaries because overall the well is poorly sampled for palynology. When the poor quality cuttings samples, low recovery or barren sidewall cores, and non-descript non-marine assemblages are excluded the effective sample spacing is >50 metres. However, substantial improvement could be achieved with additional palynological analysis of the following samples:

Sample Type	**Depth**	**Lithology**
SWC 90	1029m	Arenaceous claystone
Cuttings	1030-40m	Shale on gamma ray
SWC 89	1040.5m	Interlaminated siltstone/claystone
SWC 87	1071m	Claystone
SWC 76	1186m	Interlaminated siltstone/sandstone
Cuttings	1185-95m	Shale on gamma ray
SWC 73	1271m	Claystone
Cuttings	1280-90m	Shale on gamma ray
SWC 71	1292.5m	Silty claystone
SWC 68	1306m	Interlaminated claystone/siltstone
Cuttings	1415-25m	Shale on gamma ray
SWC 51	1543.5m	Pebbly claystone

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Confidence Ratings

The Confidence Ratings assigned to the zone identifications on Table 2 are quality codes used in the STRATDAT relational database 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.

Species Diversity

The use of relative diversity terms equate to the following number of species. Both spore-pollen and microplankton diversity excludes reworked or caved species in the samples.

Low	=	1–10	species
Moderate	=	11–25	species
High	=	26–74	species
Very high	=	75+	species

Table 2: Interpretative Palynological Data for Eric the Red–1

Sample Type	Depth (m)	Spore-Pollen Zone or Subzone	CR	Microplankton Zone or Subzone	CR	Marine MP%	Ac%	Total MP%	Environment from palynology	Comments & Key Species Present
SWC 1	1010	*T.apoxyexinus*	B4	*C. tripartitus*	B3	5%	3%	8%	Marine/nearshore	FADs of *Ornamentifera sentosa* and *Chatangiella tripartitus.*
Cuttings	1025	Mixed assemblage of *T. apoxyexinus* and *G. ancorus*		Mixed assemblage of *C. tripartitus* and *K. polypes*		8%	11%	19%	Marine/nearshore	Poor quality rushed preparation suspected of being cross-contaminated with cuttings at 1180m.
Cuttings	1080	Indeterminate		Indeterminate		X	X		Marine/nearshore	Poor quality rushed preparation.
SWC 86	1097	*P. mawsonii*	B1	*C. striatoconum*	B5	18%	12%	30%	Marine/offshore	FAD of *Isabelidinium balmei.*
SWC 80	1151	*P. mawsonii*	B4			X	X		Non-marine/marsh	Restricted coal flora dominated by *Trichotomosulcites subgranulatus* 77%.
SWC 77	1177	*G. ancorus*	B4			X	3%	3%	Paralic to nearshore marine	LAD of *Laevigatosporites musa* ms.
Cuttings	1180	*P. mawsonii*	D4	*K. polypes*	D3	3%	2%	5%	Paralic to nearshore marine	Poor quality rushed preparation with LAD of *Valensiella griphus.*
SWC 75	1219.5	*P. mawsonii*	B2			NR	<1%	<1%	Non-marine	Limited flora with LAD of *Appendicisporites distocarinatus.*
SWC 74	1250.5	*G. ancorus*	B4			NR	6%	6%	Non-marine/lacustrine to lagoonal	Limited flora with moderate abundance of *Amosopollis cruciformis.*
SWC 72	1275	*G. ancorus*	B2			NR	NR		Non-marine/marsh	Restricted coal flora dominated by *Phyllocladidites mawsonii* 47% with FAD of *Glecheniidites ancorus* ms.
Cuttings	1306	*P. mawsonii*	D2			X	X		Indeterminate	Poor quality rushed preparation mostly comprising undissolved mineral matter.
SWC 67	1316	*L. musa*	B1	*I. evexus*	B2	2%	13%	15%	Marine/nearshore to Paralic	LADs of *Hoegisporis trinalis* ms and *Tricolporites variverrucatus* ms.
SWC 65	1328.5	*L. musa*	B2	*I. evexus*	B2	3%	X	3%	Marine/offshore to Paralic	Maximum diversity of marine microplankton.
SWC 63	1334	*L. musa*	B3			NR	NR		Non-marine/marsh	Restricted coal flora dominated by *Phyllocladidites eunuchus* ms 34%.
SWC 62	1336	*L. musa*	B4			<1%	<1%	<1%	Non-marine to Paralic	FAD of *Tricolporites variverrucatus* ms.
SWC 60	1364.5	*P. mawsonii*	B1			NR	<1%	<1%	Non-marine	Subzone assignment uncertain.
SWC 56	1437	*H. trinalis*	B1	*C. edwardsii*	B2	X	<1%	<1%	Marine/nearshore	Microplankton diverse but uncommon with LAD of *C. edwardsii.*
Cuttings	1452	*P. mawsonii*	D3						Marine/nearshore	Quick scan only.

Table 2: Interpretative Palynological Data for Eric the Red–1

Sample Type	Depth (m)	Spore-Pollen Zone or Subzone	CR	Microplankton Zone or Subzone	CR	Marine MP%	Ac%	Total MP%	Environment from palynology	Comments & Key Species Present
SWC 55	1455	*H. trinalis*	B1			2%	2%	4%	Marine/nearshore	FAD of *Phyllocladidites mawsonii.*
Cuttings	1515	*H. trinalis*	D3	*C. edwardsii*	D3				Marine/nearshore	Quick scan only.
SWC 52	1520	*H. trinalis*	B1	*C. edwardsii*	B3	3%	3%	6%	Marine/nearshore	FADs of *C. edwardsii* and *Clavifera triplex.*
SWC 49	1575	Indeterminate				NR	NR	1%	Non-marine	Low yield sample with bland assemblage that cannot be assigned to zone.
SWC 46	1602	Indeterminate				NR	NR			Essentially BARREN — palynological slides with sparse opaque kerogen and negligibile palynomorphs.
SWC 45	1630	*H. trinalis*	B4			NR	NR		Non-marine	FADs of *Hoegisporis trinialis* ms and *Appendicisporites distocarinatus.*
SWC 42	1667	Indeterminate				NR	NR			Low yielding sample essentially BARREN of palynomorphs.
SWC 40	1678	*C. paradoxa*	B1			NR	NR		Non-marine	LAD of *Coptospora paradoxa* in assemblage dominated by *Cicatricosisporites/Ruffordiaspora* 71%.
SWC 38	1703	Indeterminate								Quick scan only.
SWC 37	1719	Mixed assemblage of *C. paradoxa* and *P. mawsonii*				X			Indeterminated	FAD of *Appendicisporites distocarinatus* recorded by Roger Morgan here considered caved.
SWC 35	1749.5	Indeterminate								Quick scan only.
SWC 34	1754.5	*C. paradoxa*	B4			NR	NR	X	Non-marine	Common *Corallina torosa* 8%.
SWC 32	1790	Indeterminate								Barren on quick scan.
SWC 31	1831.5	Indeterminate								Quick scan — slides sparse with lots of undissolved mineral matter.

CR = Confidence Rating
NR = Not recorded

MP% = Microplanton
Ac% = *Amosopollis cruciformis* %
X = Present in sample but not in count.

Table 3: Basic Sample and Palynomorph Data for Eric the Red–1

Sample Type	Depth (m)	Lithology	Kerogen slides	Oxidised slides	Visual Yield	Palynomorph Concentration	Preservation	No. SP Species	No. MP Species
SWC 1	1010	CLAYSTONE, massive with minor sandstone interbeds.	1	4	High	High	Fair	33	9
Cuttings	1025			4	Moderate	Variable/clumped	Poor-fair	39	11
Cuttings	1080			2	Moderate	Low	Poor	16	9
SWC 86	1097	SANDSTONE argillaceous, inter-laminated with siltstone.	1	3	Moderate	Moderate	Fair	34	11
SWC 80	1151	SANDSTONE medium to coarse grained, interlaminate with COAL.	1	4	Moderate	Moderate	Good	15	1
SWC 77	1177	SANDSTONE fine grained, inter-laminated with carbonaceous Claystone	1	3	Moderate	High	Fair-good	26	5
Cuttings	1180			3	Moderate	Low	Poor	28	7
SWC 75	1219.5	SILTSTONE, massive grading to silty claystone.	1	4	High	Moderate	Poor (over oxid.)	26	1
SWC 74	1250.5	SILTSTONE, laminated and argillaceous.	1	3	Moderate	Low	Poor (over oxid.)	25	1
SWC 72	1275	COAL	1	4	High	Very high	Poor	25	
Cuttings	1306			4	Moderate	Low	Poor (obscured)	23	6
SWC 67	1316	CLAYSTONE interlaminated with minor siltstone.	1	3	High	High	Fair-good	48	10
SWC 65	1328.5	CLAYSTONE, massive, carbonaceous	1	4	High	High	Fair-good	50	22
SWC 63	1334	CLAYSTONE, carbonaceous interlaminated with minor coal.	1	4	High	High	Fair	28	
SWC 62	1336	CLAYSTONE, massive, carbonaceous, micromicaceous, minor siltstone.		3 + B	High	High	Fair-good	45	1
SWC 60	1364.5	CLAYSTONE carbonaceous, inter-laminated with silty sandstone.	1	4	High	Moderate	Fair (over oxid.)	40	1
SWC 56	1437	CLAYSTONE interlaminated with minor sandstone.	1	6	High	High	Fair	30	14

Table 3: Basic Sample and Palynomorph Data for Eric the Red–1

Sample Type	Depth (m)	Lithology	Kerogen slides	Oxidised slides	Visual Yield	Palynomorph Concentration	Preservation	No. SP Species	No. MP Species
Cuttings	1452		1	4	High	High	Fair	27	3
SWC 55	1455	CLAYSTONE massive, common carbonaceous flecks.		3	High	High	Good	32	6
Cuttings	1515		1	4	High	High	Fair	29	2
SWC 52	1520	CLAYSTONE massive, trace to common carbonaceous laminae.		3	High	High	Fair	41	8
SWC 49	1575	SANDSTONE, argillaceous inter-laminated with coal.	1	6	Moderate	Very low	Poor-fair	20	3
SWC 46	1602	CLAYSTONE, massive, only rare carbonaceous flecks.	1	2	Low	Very low	Poor	1	
SWC 45	1630	CLAYSTONE, massive, common carbonaceous flecks and laminae	1	3	Moderate	Low	Poor	41	
SWC 42	1667	SANDSTONE, greenish-grey, speckled, with lithics and argillaceous.	1	1	Low	Very low	Poor	4	
SWC 40	1678	CLAYSTONE, medium grey to greenish grey, rare carbonaceous laminae	1	1	Moderate	Abundant	Fair-good	26	2
SWC 38	1703	CLAYSTONE, massive, medium greenish grey, hard blocky	1	1	Low	Very low	Poor	22	
SWC 37	1719	SANDSTONE, light greenish grey, argillaceous with volcanogenic lithics	1	4	Moderate	Low	Poor	29	3
SWC 35	1749.5	CLAYSTONE, massive medium greenish grey, rare carbonaceous flecks	1	3	Moderate	Low	Poor	27	2
SWC 34	1754.5	SANDSTONE, argillaceous, quartzose & lithic, light greenish grey, speckled.	1	2	Low	Low	Poor	28	3
SWC 32	1790	SANDSTONE as for SWC 34 above.	1	2	Low	Very low	Poor	15	
SWC 31	1831.5	SANDSTONE as for SWC 34 above.	1	3	Low	Very low	Poor	12	1
							Averages:	**27.7**	**5.7**

B = Blank slide included in relinquishment set.

Table 4: Eric the Red–1 **Range and Abundance Chart for selected palynomorphs.**

Sample Type	SWC 1	CTS	SWC 86	SWC 80	SWC 77	CTS	SWC 75	SWC 74	SWC 72	SWC 67
Depth (m)	**1010.0**	**1025.0**	**1097.0**	**1151.0**	**1177.0**	**1180.0**	**1219.5**	**1250.5**	**1275.0**	**1316.0**
SPORES										
Appendicisporites spp.		0.8%					0.5%			0.6%
Baculatisporites spp.	0.7%	0.8%	1.0%		0.7%	2.9%	0.5%			1.2%
Cicatricosisporites spp.	2.0%	1.6%								0.6%
Clavifera spp.		0.8%				1.0%			5.8%	
Crybelosporites spp.										
Cyathidites asper										
Cyathidites (large) >40µm	6.6%	7.2%	1.9%		0.7%	1.0%	1.5%	2.3%		1.2%
Cyathidites (small) <40µm	9.9%	8.8%	6.7%		0.7%	7.8%	9.0%	37.9%	1.9%	8.8%
Dictyophyllidites spp.		4.0%			1.3%	1.0%	1.5%	0.8%	1.5%	2.3%
Gleicheniidites spp.	3.3%	10.4%			1.3%	19.4%	1.0%	0.8%	16.0%	3.5%
Herkosporites/Ceratosporites spp.	0.7%	3.2%		0.7%	1.3%					0.6%
Laevigatosporites ovatus		0.8%			4.0%	1.0%	4.0%		10.2%	1.8%
Laevigatosporites musa ms										0.6%
Monoletes spores undiff.		0.8%		0.7%						
Osmundacidites spp.	3.9%	0.8%	1.9%				4.5%			2.3%
Peromonolites spp.									8.3%	1.2%
Perotrilites spp.										
Retitriletes spp.	2.6%	3.2%	1.9%							
Rugulatisporites spp.							0.5%			2.3%
Stereisporites spp.		0.8%							1.0%	
Triletes undiff.	3.9%	8.8%	1.0%	0.7%	0.7%	1.9%	2.5%	3.0%	0.5%	3.5%
Triporoletes reticulatus		0.8%								
Total Spores:	**34%**	**54%**	**14%**	**2%**	**11%**	**36%**	**26%**	**45%**	**45%**	**30%**
GYMNOSPERMS										
Araucariacites australis	1.3%	4.0%	3.8%	0.7%	8.0%	4.9%	1.0%	5.3%		7.0%
Corollina spp.	3.3%	2.4%	2.9%							1.2%
Cupressacites sp.	1.3%	1.6%	2.9%		0.7%	4.9%				0.6%
Dilwynites pusillus ms	5.3%		20.0%		6.0%	1.9%	3.5%	16.7%		12.9%
Dilwynites spp.	2.6%	2.4%	9.5%	4.0%	10.0%	4.9%	10.5%	1.5%		1.8%
Hoegisporis trinalis ms										1.2%
Microcachryidites antarcticus	11.8%	8.8%	12.4%	6.7%	10.0%	3.9%	9.0%	6.1%		10.5%
Phyllocladidites eunuchus ms					1.3%					0.6%
Phyllocladidites mawsonii	3.9%	2.4%		2.7%		1.9%	0.5%		46.6%	0.6%
Podocarpidites spp.	34.2%	21.6%	26.7%	7.3%	25.3%	28.2%	22.0%	22.0%	7.8%	25.1%
Trichotomosulcites subgranulatus		2.4%	7.6%	76.7%	27.3%	13.6%	19.5%	3.0%	0.5%	5.3%
Total Gymnosperms:	**64%**	**46%**	**86%**	**98%**	**89%**	**64%**	**66%**	**55%**	**55%**	**67%**
ANGIOSPERMS undiff.										
Australopollis obscurus	0.7%				0.7%					1.8%
Liliacidites spp.							1.5%			0.6%
Proteacidites/Triporopollenites spp.	2.0%	0.8%								
Tricolpites/Tricolporites spp.							7.0%	0.8%		0.6%
Total Angiosperms:	**2.6%**	**0.8%**			**0.7%**		**8.5%**	**0.8%**		**2.9%**
Total Spore-Pollen:	**152**	**125**	**105**	**150**	**150**	**103**	**200**	**132**	**206**	**171**
MICROPLANKTON										
Microplankton undiff.	7%	23%	2%			20%				
Amosopollis cruciformis	29%	57%	39%		100%	40%	100%	100%		90%
Chatangiella tripartita	7%	10%				20%				
Cyclonephelium spp.	7%									
Heterosphaeridium spp.	43%	7%	54%							3%
Isabelidinium spp.		3%								
Lecaniella spp.										
Micrhystridium spp.										3%
Nummus spp.			2%							
Palaeohystrichophora infusorioides			2%							
Palambages spp.										3%
Spiniferites spp.	7%									
Valensiella griphus						20%				
Veryhachium spp.										
Total Microplankton Count:	**14**	**30**	**46**		**5**	**5**	**1**	**9**		**29**
Microplankton % of total SP & MP:	**8.4%**	**19.4%**	**30.5%**		**3.2%**	**4.6%**	**0.5%**	**6.4%**		**14.5%**
A. cruciformis as % of total SP & MP:	**2.4%**	**11.0%**	**11.9%**		**3.2%**	**1.9%**	**0.5%**	**6.4%**		**13.0%**
Total SP and MP COUNT:	**166**	**155**	**151**	**150**	**155**	**108**	**201**	**141**	**206**	**200**
Other Palynomorphs Count										
Botryococcus braunii								0.7%		
Fungal fruiting bodies						1.6%		1.3%		0.5%
Fungal spores						1.6%		1.3%		
Fungal hyphae						6.6%		2.7%		1.0%
Reworked Fossils	3.5%	1.3%				1.6%				1.5%
Total Other Palynomorphs:	**6**	**2**				**14**		**9**		**6**
TOTAL COUNT:	**172**	**157**	**151**	**150**	**155**	**122**	**201**	**150**	**206**	**206**

Table 4: Eric the Red–1 Range and Abundance Chart for selected palynomorphs.

Sample Type	SWC 65	SWC 63	SWC 62	SWC 60	SWC 56	SWC 55	SWC 52	SWC 49	SWC 45	SWC 40	SWC 34
Depth (m)	**1328.5**	**1334.0**	**1336.0**	**1364.5**	**1437.0**	**1455.0**	**1520.0**	**1575.0**	**1630.0**	**1678.0**	**1754.5**
SPORES											
Appendicisporites spp.	0.5%		0.6%		0.6%	1.0%	0.7%				
Baculatisporites spp.					1.3%	0.5%	1.3%	2.0%	1.2%		5.1%
Cicatricosisporites spp.				1.9%	0.6%	0.5%	0.7%		0.6%	70.6%	0.7%
Clavifera spp.											
Crybelosporites spp.										1.5%	0.7%
Cyathidites asper										8.3%	
Cyathidites (large) >40µm	2.7%	0.7%	3.7%	1.9%	4.5%	2.9%	2.0%	6.0%	5.5%	2.0%	5.1%
Cyathidites (small) <40µm	5.4%	5.9%	16.6%	9.7%	12.9%	21.4%	18.3%	29.0%	23.8%	1.0%	12.5%
Dictyophyllidites spp.	4.3%	2.6%	4.9%	4.5%	3.9%	5.8%	3.3%	2.0%	2.4%	0.5%	1.5%
Gleicheniidites spp.	3.3%	20.3%	6.1%	3.9%	5.2%	10.7%	5.9%		0.6%		1.5%
Herkosporites/Ceratosporites spp.	0.5%		1.2%		0.6%	1.5%	2.0%	1.0%	0.6%		2.2%
Laevigatosporites ovatus	2.2%	2.0%	1.8%	3.2%	1.9%	2.9%	3.9%				
Laevigatosporites musa ms	0.5%	1.3%	0.6%	0.6%							
Monoletes spores undiff.				0.6%		0.5%					
Osmundacidites spp.	2.2%		1.2%	0.6%			0.7%	4.0%	1.2%		8.1%
Peromonolites spp.			0.6%			1.0%					
Perotrilites spp.				0.6%		0.5%		5.0%	0.6%		0.7%
Retitriletes spp.		0.7%	0.6%		3.2%	0.5%	1.3%		3.7%	0.5%	3.7%
Rugulatisporites spp.	0.5%	1.3%	1.2%	2.6%	0.6%	1.0%	2.0%				
Stereisporites spp.			1.2%	1.3%			1.3%	1.0%	1.2%	0.5%	2.2%
Triletes undiff.	4.9%		2.5%	3.9%	2.6%	2.9%	4.6%	6.0%	5.5%	3.9%	3.7%
Triporoletes reticulatus				0.6%						8.3%	
Total Spores:	**27%**	**35%**	**43%**	**36%**	**38%**	**53%**	**48%**	**56%**	**47%**	**97%**	**48%**
GYMNOSPERMS											
Araucariacites australis	13.0%		9.2%	3.9%	1.9%	1.9%	5.2%	2.0%	2.4%	1.0%	1.5%
Corollina spp.						0.5%	1.3%	4.0%			8.1%
Cupressacites sp.		0.7%		0.6%			0.7%		0.6%		
Dilwynites pusillus ms	7.1%		9.2%	4.5%	14.2%	3.4%	6.5%		0.6%		
Dilwynites spp.	14.1%		5.5%	1.9%	5.8%	5.3%	1.3%		2.4%		5.9%
Hoegisporis trinalis ms	0.5%		0.6%		0.6%		1.3%		1.8%		
Microcachryidites antarcticus	6.5%		4.3%	11.0%	21.9%	7.3%	5.9%	4.0%	11.0%	0.5%	2.2%
Phyllocladidites eunuchus ms		34.0%		3.2%		0.5%	1.3%		0.6%		
Phyllocladidites mawsonii			0.6%	0.6%		1.5%					
Podocarpidites spp.	23.9%	19.6%	22.1%	29.7%	14.8%	24.3%	23.5%	34.0%	32.9%	1.5%	29.4%
Trichotomosulcites subgranulatus	5.4%	9.8%	2.5%	7.1%	2.6%	1.5%	3.9%				4.4%
Total Gymnosperms:	**71%**	**64%**	**54%**	**63%**	**62%**	**46%**	**51%**	**44%**	**52%**	**3%**	**51%**
ANGIOSPERMS undiff.											0.7%
Australopollis obscurus											
Liliacidites spp.	1.6%	1.3%	1.8%				0.7%				
Proteacidites/Triporopollenites spp.			0.6%								
Tricolpites/Tricolporites spp.	0.5%		0.6%	1.3%		0.5%	0.7%		0.6%		
Total Angiosperms:	**2.2%**	**1.3%**	**3.1%**	**1.3%**		**0.5%**	**1.3%**		**0.6%**		**0.7%**
Total Spore-Pollen:	**184**	**153**	**163**	**155**	**155**	**206**	**153**	**100**	**164**	**204**	**136**
MICROPLANKTON											
Microplankton undiff.	50%		50%			13%	11%				
Amosopollis cruciformis			50%	100%	100%	63%	56%				
Chatangiella tripartita											
Cyclonephelium spp.						13%					
Heterosphaeridium spp.	17%										
Isabelidinium spp.	17%										
Lecaniella spp.						13%					
Micrhystridium spp.							11%	100%			
Nummus spp.											
Palaeohystrichophora infusorioides											
Palambages spp.											
Spiniferites spp.	17%										
Valensiella griphus											
Veryhachium spp.							22%				
Total Microplankton Count:	**6**		**2**	**1**	**1**	**8**	**9**	**1**			
Microplankton % of total SP & MP:	**3.2%**		**1.2%**	**0.6%**	**0.6%**	**3.7%**	**5.6%**	**1.0%**			
A. cruciformis as % of total SP & MP:			**0.6%**	**0.6%**	**0.6%**	**2.3%**	**3.1%**				
Total SP and MP COUNT:	**190**	**153**	**165**	**156**	**156**	**214**	**162**	**101**	**164**	**204**	**136**
Other Palynomorphs Count											
Botryococcus braunii											0.7%
Fungal fruiting bodies						0.9%	0.6%		0.6%		
Fungal spores					1.3%	0.9%				1.9%	
Fungal hyphae			1.2%	0.6%			0.6%		0.6%		
Reworked Fossils	1.0%		0.6%					1.9%	0.6%		0.7%
Total Other Palynomorphs:	**2**		**3**	**1**	**2**	**4**	**2**	**2**	**3**	**4**	**2**
TOTAL COUNT:	**192**	**153**	**168**	**157**	**158**	**218**	**164**	**103**	**167**	**208**	**138**

Table 5: Stratigraphic distribution of key index palynomorphs in Eric the Red–1.

Sample Type	Depth (metres)	1 Coptospora paradoxa	2 Crybelosporites megastriatus ms	3 Crybelosporites striatus	4 Hoegisporis trinalis ms	5 Appendicisporites distocarinatus	6 Coptospora pileolus ms	7 Phyllocladidites eunuchus ms	8 Cupressacites sp.	9 Dilwynites spp.	10 Interulobites intraverrucatus	11 Verrucosisporites admirabilis ms	12 Clavifera triplex	13 Laevigatosporites musa ms	14 Phyllocladidites mawsonii	15 Cicatricosisporites cuneformis	17 Tricolporites variverrucatus ms	18 Cyatheacidites tectifera	19 Gleicheniidites ancorus ms	20 Proteacidites spp.	21 Clavifera vultuosus ms	22 Ornamentifera sentosa	23 Micrhystridium sp. A	24 Cribroperidinium edwardsii	25 Odontochitina operculata/costatae	26 Heterosphaeridium spp.	27 Amosopollis cruciformis	28 Cyclonephelium compactum	29 Oligosphaeridium spp.	30 Kiokansium polypes	31 Isabelidinium evexus ms	32 Valensiella griphus	33 Palaeohystrichophora infusorioides	34 Isabelidinium balmei	35 Trithyrodinium spp.	36 Chatangiella tripartitus
SWC 1	1010								1%	8%			X		4%					2%		X				3%	2%		X							X
Cuttings	1025	W				Z			2%	2%			1%		2%	X		X	X	1%	X					1%	11%		•		Z	Z			X	X
Cuttings	1080								•	X			X		X	•		•	•	•						X	X		•						X	X
SWC 86	1097								3%	30%		X	•		X	X		•	•	•						17%	12%		•				X	X	X	
SWC 80	1151								•	4%		•	•		3%	•		•	•	•						•	X		•							
SWC 77	1177							1%	1%	16%		X	X	X	•	•		•	•	•						X	3%		•		X					
Cuttings	1180						X	X	5%	7%		•	1%	•	2%	•		•	•	X						X	2%		•		X	X				V
SWC 75	1219.5					X	•	•	•	14%		X	•	•	X	•		•	•							•	X		•		•					
SWC 74	1250.5					X	•	•	•	18%		X	•	•	•	X		•	•							•	6%		•		•					
SWC 72	1275					?	•	•	•	X		•	6%	•	47%	•		•	X							•	•		•		•					
Cuttings	1306					X	•	X	•	X		•	X	X	X	•		•								•	•		•		?					
SWC 67	1316				1%	1%	X	X	X	15%	X	2%	X	X	X	X	X	•					X		X	X	15%		X		X					
SWC 65	1328.5				1%	1%	X	X	•	21%	X	X	X	X	X	X	•	X					•		X	X	X	X	X	X	X					
SWC 63	1334				•	X	•	34%	X	•	•	1%	X	1%	X	•	•						•		•	•	•	•	•							
SWC 62	1336				1%	X	X	X	•	15%	X	X	•	X	X	•	X						•		•	•	X	•	•							
SWC 60	1364.5				•	X	X	3%	X	5%	X	3%	•	X	X	X							•		•	•	X	•	•							
SWC 56	1437				1%	1%	•	X	•	20%	•	1%	X	X	X								•	X	•	X	X	•	X							
Cuttings	1452				•	X	X	X	•	•	•	•	•	•	•								•	X	•	X	•	•								
SWC 55	1455				X	1%	•	X	•	9%	•	1%	X	•	2%								•	•	•	•	2%	X								
Cuttings	1515				X	X	•	X	•	•	•	2%	X	X	X								•	X	•	•	•									
SWC 52	1520				1%	1%	X	1%	X	8%	X	X	X	?									•	X	X	X	3%									
SWC 49	1575				•	•	•	•	•	•													X													
SWC 46	1602				•	•	•	•	•	•													•													
SWC 45	1630			X	2%	X	X	1%	X	3%													•													
SWC 42	1667			•																			•													
SWC 40	1678	X	X	1%																			•													
SWC 38	1703	•	•	•		V																	•													
SWC 37	1719	•	•	X		V		V		V					V								X	V												
SWC 35	1749.5	•	•	X						V													X													
SWC 34	1754.5	•	•	X						V													X													
SWC 32	1790	•	•	•																			•													
SWC 31	1831.5	•	•	•		V																	X													

LEGEND

- 1% = Percentage abundance
- X = Present but <1% of count
- ? = Questionable identification or occurrence
- W = Reworked species occurrence
- V = Caved species occurrence
- Z = Interpreted laboratory cross-contamination
- • = Not recorded in sample within species range

Numbers 1 to 22 are spore-pollen species.

Numbers 23 to 36 are microplankton species