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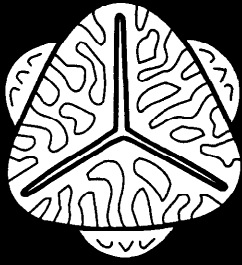


Report 640/06
SANTOS File 1997/46

Palynostratigraphic Review of PEP 119, Otway Basin, Victoria

for
SANTOS Ltd

P.L. Price
5th July, 1998



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PETROLEUM DIVISION

PEP119 (Victoria) Otway Group Review

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PEP 119 (Victoria) Otway Group Review

Summary of Conclusions

- Unit APK321 represents a ubiquitous readily recognised Palynostratigraphic unit confined to the lower Eumeralla Formation extending down to within the upper part of the Windermere - Katnook Sandstone ("basal Eumeralla unit").
- Units APK31 and APK22 are widely distributed in PEP119 and are confined to the "basal Eumeralla unit" including the Windermere - Katnook Sandstone - uppermost Laira Formation of the Katnook #2 Reference Section.
- The Crayfish Sub Group on the Merino High is represented by the upper Laira Formation and lower Pretty Hill - Casterton Formation with the lower Laira and upper Pretty Hill being lost to an intra-Crayfish unconformity.
- The base Eumeralla unconformity of the Robe and Penola Troughs (eg Heathfield #1) seems less significant in relation to Merino High (eg Mocamboro #11) where most of the loss of Crayfish section seems to occur at the intra-Crayfish unconformity.
- The "Sawpit Sandstone" extends into PEP119 onto the Marino High but is probably not represented in Mocamboro #11 or Digby #1 perhaps being lost to the intra-Crayfish unconformity.
- The Sawpit #1 'basal shale' subunit B of the Penola Trough is the facies equivalent of the "McEachern Sandstone" on the Marino High.
- The Casterton Formation could be redefined to include the Sawpit #1 'basal shale' subunit A and as such spans from within APK121 into APK11.
- There is no evidence of a substantial regional unconformity between the Casterton Formation *sl* and Pretty Hill Formation in the Penola Trough or Marino High; this part of the section seems conformable in most areas.
- The Casterton Formation *sensu lato* deposition seems not to have been confined by the Penola Trough Crayfish structures and extends beyond the Penola Trough axial region of major Crayfish Sub Group deposition extending over the Marino High.
- The formation tops and palynostratigraphic limits for the wells considered in this study are summarised on Page 23.

PEP 119 (Victoria) Otway Group Review

Introduction

In the course of relating the Gordon palynostratigraphic results to the adjacent well biostratigraphic successions, it became apparent that there were some correlation problems; these are outlined in the Gordon Palynology Report (Price, 1997). In an attempt to resolve the correlation of eastern end of the Penola Trough and the Merino High within PEP119 Victoria, forty-five sidewall core and conventional core samples from Casterton #1, McEachern #1, Mocamboro #11 and Tullich #1 representing the lower part (Early Cretaceous to latest Jurassic) of the Otway Basin section were submitted for palynological examination. In addition, the equivalent sections from Gordon #1 and Digby #1 the were reviewed and selected samples re examined; the available taxa distribution data from Heathfield #1, Bus Swamp #1, Sawpit #1 and Katnook #2 together with equivalent reference sections from the Eromanga Basin (including Ingella #1, Kercummurra #1, Bolderwood #1, Dullingari - Murta Wells, Cowan #1, Tartulla #1, Mulapula #1, Wyandra #1 and Murta data compiled by Benson, 1993) were considered in the context of the taxa distribution for this part of the Penola Trough and Merino High. The study was directed primarily towards establishing the biostratigraphic succession, age relationships and inferred lithostratigraphic correlation of the sampled sections.

The samples were examined in detail from unoxidized +20 μ m fraction, +20 μ m -80 μ m oxidised 1.65sg floats fraction and +80 μ m oxidised 1.65sg floats fraction to determine their palynomorph assemblage characteristics; species lists were compiled from these examinations. The deposition environment, palynofacies - organic facies characteristics and level of thermal alteration of the sampled section were established only in general terms; while limited statistical assemblage data were established, detail transmitted light - fluorescent examination of the unoxidized total organic fraction required for such studies was not undertaken.

The biostratigraphic, broad qualitative palynofacies and environmental data for study area are tabulated on the appended Palynostratigraphical Data Tables; the text provides an overview of the results supplementing the sample by sample descriptions set out in the Data Tables. The palynostratigraphic determinations given on the Data Tables follow the convention of offering an assignment defining the most probable biostratigraphic limits for the sampled horizon. This confident, but often rather broad, assignment is supplemented by a more specific ("best guess") determination but with varying degrees of uncertainty depending upon the preservation and diversity of the individual palynoflora recovered. The inferred lithostratigraphic and Age assignments are based upon this latter, more speculative, palynostratigraphic estimate.

The distribution of all taxa identified is presented in the appended charts as alphabetical check lists and oldest occurrence lists for the Early Cretaceous to Late Jurassic palynofloras. Graphical presentations of palynomorph species diversity within various morphological and presumed phylogenetic groups are appended also.

Otway Basin Palynostratigraphic Nomenclature

Introduction

The biostratigraphic nomenclature adopted for this study is based upon that of Price *et al*, 1985 and Filatoff & Price, 1988 developed initially for the Surat and Eromanga Basin sections but adapted for the Otway Basin by Price, 1993, 1995, 1996, 1997 and this study. The units and their relationship to the nomenclatures of Morgan, 1985 and 1992, Dettmann, 1986 and Dettmann and Playford, 1969 and Morgan *et al*, 1995 are summarised on Page 13 and the relationship of the palynostratigraphic units to the Otway Basin and Eromanga lithostratigraphy is presented on Page 14 and 17; their relationship to the Katnook #2 and Sawpit #1 Reference Sections are given on Pages 15 and 16.

The lithostratigraphical conventions of Morton *et al* 1995 for the Otway Basin have been adopted with some modifications. However, the evidence for a major time break or significant regional unconformity between the Casterton Formation and the lower Crayfish Sub Group (hence the exclusion of the Casterton Formation from the Otway Group) is questioned and there is a need for revision and formal definition of the various lithofacies of the Pretty Hill Formation. The differentiation of the Windermere Sandstone from the Katnook Sandstone (and their placement in the Eumeralla and Crayfish Sub Group respectively) needs review on the basis of the palynostratigraphic data and interpretation from the present review in conjunction with the distribution data for *Ruffordiaspora spp.*, *Foraminisporis asymmetricus* and *Pilosisporites notensis* given by Morgan, 1989 for Katnook #2.

The units of Dettmann, 1963 and 1986, Dettmann and Playford, 1969; Burger, 1973, 1988 and 1989; Morgan, 1985, 1988, 1989 and 1992; Helby *et al* 1987 have been used widely in Otway Basin studies. These nomenclatures however, have been applied in different ways in the various well sections giving some confusion as to what is represented by a particular unit in any given study. The confusion is heightened where similarly named units have been applied in Great Australian (Artesian) Basin (GAB) region and in West Australia. Further, there is no absolute consensus as to the

precise order of appearance of certain of the Early Cretaceous index taxa in the Otway Basin (and in reference to the other Early Cretaceous Australian provinces) as their introduction is blurred by the extent of the base Eumeralla unconformity, facies constraints, differing concepts as to the morphological limits of the index taxa and, possibly, floral migration if the interpretation of Dettmann, 1986 is accepted.

Morgan *et al*, 1995 reviewed and revised the Otway Basin palynostratigraphy as part of the comprehensive stratigraphic review of the western Otway Basin by MESA (Morton and Drexel Eds., 1995). The revised nomenclature of Morgan *et al*, 1995 gives some stability to the Otway Basin palynostratigraphy overcoming the ambiguity of the "*C. hughesii* Zone" with the introduction of the "*P. notensis* Zone". This related to a different concept of the *C. hughesii* Subzone as established by Dettmann and Playford, 1969 (top *C. stylosus* to base *C. striatus* together with some assemblage constraints particularly in respect of the base of the Subzone) and the "*C. hughesii* Zone (or Subzone)" in its various guises as used by Morgan 1980, 1985, 1992, Price *et al* 1985, Helby *et al* 1987 and Burger, 1988 (see Page 13).

The retention by Morgan *et al*, 1995 of the "*F. wonthaggiensis* Zone" for the interval between the entry of *D. speciosus* and *P. notensis* seems unfortunate in respect of its differing use in other parts of Australia and the GAB region in particular. The present study, when interpreted in conjunction with Sawpit #1 data, suggests that the range of *D. speciosus* is more like its range in the GAB where it extends down closer to the oldest occurrence of *C. hughesii* than to *F. wonthaggiensis* (see Page17); thus, the use of *D. speciosus* to define the base of the "*F. wonthaggiensis* Zone" significantly extends its stratigraphic span in terms of both Burger's 1973 original concept (base *F. asymmetricus* and *P. notensis* and base *C. ludbrookiae* and *F. wonthaggiensis*) and that of Helby *et al* 1987 (base *F. asymmetricus* to base *F. wonthaggiensis*). In stratigraphic terms, the "*F. wonthaggiensis* Zone" *sensu lato* (\equiv APK122 + APK21) part of the Crayfish Sub Group is the equivalent of the Cadna Owie + Murta + much of the Namur rather than just the Cadna Owie if an equivalence of the *F. wonthaggiensis* Zone *sensu stricto* (\equiv APK2) of the Eromanga Basin is accepted. [Note that the present

interpretation of the lithostratigraphic range of some of the index taxa in the Eromanga Basin differs from that given by Alley and White, 1996]. In terms of the Eromanga Basin concept of the *F. wonthaggiensis* Zone ss, the "upper *F. wonthaggiensis* zone" of Morgan, 1993 and Morgan *et al* 1995 is closer to its stratigraphic span.

The distinctive diverse palynofloras of APK321 including both *Pilosisporites parvispinosus* and *P. notensis* characterise the lower limits of the Eumeralla Formation and represents the deepest most consistent and easily recognised palynostratigraphic datum in the region. However, interspersed with these typical APK321 palynofloras are fern dominated associations that are very restricted in species diversity; some of which are indistinguishable from Crayfish Sub Group APK12 associations (eg SWC58 1105m in Gordon #1). Their resolution is possible only in closely sampled sections.

Below the range of *P. parvispinosus*, *Pilosisporites spp* become scarce and the palynofloras include some fern dominated (mostly *Cyathidites* and *Osmundacidites*) associations with very rare, intermittent occurrences of *P. notensis* and / or *F. asymmetricus* but with consistent (in terms of two or three 'species' being represented) to notable *Ruffordiaspora spp*. These associations are difficult to assign individually, particularly in the absence of the index taxa *F. asymmetricus* and *P. notensis*. However, in the context of the associations from the same levels in adjacent wells (with closely spaced sample points) in the eastern Penola Trough and Merino High of PEP119 (Victoria), they form a consistent palynostratigraphic interval referable to either APK22 or APK31.

In terms of the Katnook 2 reference section (Page 15), unit APK31 and APK22 associations extend down through the Windermere and Katnook Sandstone into the uppermost Laira Shale (to about 2111.5m) implying that there is no significant unconformity between the Eumeralla Formation and the Crayfish Sub Group in the Katnook region. Katnook #2 is the Type Section of the Katnook Sandstone and Laira Formation (Moreton *et al* 1995 page 63 & fig 5.14) and is considered to represent the

most complete upper Crayfish Sub Group section. However, in much the Robe Trough and the Penola Trough, units APK31 and APK22 are widespread BUT this section is bounded at its base by a major hiatus (the base Eumeralla unconformity) resting on section as old as APK122 Pretty Hill sediments at the Trough margins. Thus conceptually, in terms of the sedimentation cycles in the Robe and Penola Troughs at least, the APK22 - APK31 section should be regarded as part of the Eumeralla depositional cycle despite including the uppermost part of the Laira Formation Type Section in Katnook #2. [Note that the depositional history of the Merino High seems to be a little different with the possibility of an intra-Crayfish hiatus being a significant feature; Page 23].

A further complication to the resolution of the Eumeralla - Crayfish boundary is the relation of APK22 of the present nomenclature to the *P. notensis* Zone of Morgan *et al* 1995 with respect of the scarce and sporadic distribution of *P. notensis* below the base of *P. parvispinosus*. By definition unit APK22 is included in *P. notensis* Zone but in application it is often (but not always) excluded with APK22 palynofloras (typically with isolated *P. notensis* occurrences) being placed in the underlying "*F. wonthaggiensis* zone" (eg Katnook #2; cf Page 15 with fig 5.14 of Morton *et al* 1995). For much of the Penola Trough and Robe Trough this seems not to be an issue as APK321 extends to the unconformity; nevertheless, there are sections in the western Otway Basin where these APK22 - APK31 units are suspected and are often associated with a sand unit. If it is accepted that they are confined to the Eumeralla depositional cycle, perhaps these represent the basal channel sands deposited on the Crayfish erosional surface offering better hope of a predictable exploration target rather than a chance occurrence of an intra Crayfish sand being close to the unconformity surface. The lithostratigraphic relationships of the APK31 and APK22 sections are particularly significant in the present interpretation of the Merino High succession.

The separation of the oldest occurrence datum of *F. asymmetricus* and *P. notensis* in the GAB is relatively slight being essentially coincident in the absence of

very close sampling. [cf Alley and White, 1996 Fig 6.1 and Alexander and Sansome 1996 fig 5.17 where there may be some confusion as to the difference between "PK22" of Price *et al* 1985 and "APK22" of the present nomenclature]. The stratigraphic separation of these taxa in the Otway Basin is probably equally small but this is difficult to assess with few closely sampled wells and as *F. asymmetricus* is very patchy in its distribution in the Otway section. Also, its records may be blurred by a similarly ornamented form ("*Verrucosasporites*" "*pseudoasymmetricus*"); for example, in this study, the records of *F. asymmetricus* at 1475.5m in Tullich #1, 1006m in Mocamboro #11 and 1825.8m in Heathfield #1 may need some scrutiny. Thus, the distinction between section assigned to either APK31 or APK22 in this study should be accorded a degree of scepticism but their separation from APK32 (above) or APK21 (below) is much more easily sustained and reliable. It is worth noting that, in the Eromanga Basin, *F. asymmetricus* and *F. wonthaggiensis* seem more consistent and reliable markers than *P. parvispinosus* and *P. notensis*; this seems to be the converse of the Otway Basin palynostratigraphic succession.

Following the application of base *Triporoletes reticulatus* datum by Morgan 1993, Morgan *et al* 1995 to subdivide the "*F. wonthaggiensis* zone" *sensu lato*, this datum was adopted as the indicator for the base of APK212 by Price, 1993, 1997. However, this is inconsistent with the Eromanga Basin distribution of *T. reticulatus* as it is known to extend down below the range of *F. wonthaggiensis* to just above the base of *D. speciosus*. [cf Alley and White, 1996 Fig 6.1]. It is assumed that in the Otway Basin the *T. reticulatus* datum is above the *F. wonthaggiensis* datum (as opposed to the "*F. wonthaggiensis* zone" *sl*); however, in many sections *F. wonthaggiensis* and *T. reticulatus* the two taxa appearing to have a similar oldest occurrence points (eg, the Katnook #2 data of Morgan, 1989 and Heathfield #1, Morgan, 1989). [Note that Moreton *et al* 1995 Fig 5.14 indicate that the "upper *F. wonthaggiensis* zone" extends down only to about 2150m in Katnook #2 but the taxa distribution data of Morgan, 1989 indicates *T. reticulatus* is present to at least 2595.5m]. In this context it is worth considering that *T. reticulatus* is reasonably consistent in the Eromanga Basin down to within APK21 and very rare and sporadic below the base *F. wonthaggiensis* datum.

Perhaps the relative distribution of these taxa will prove to be similar in the Otway Basin with the present estimation of their Otway distribution being obscured (in addition to their scarcity at the base of their range) by the assumption that the "*F. wonthaggiensis* Zone" is the equivalent unit in both the GAB and Otway Basin.

The APK22 and APK31 palynofloras of the Otway Basin (and the GAB equivalents) typically include a diversity (but often are only a minor component of the palynoflora) liverwort forms including *Triporoletes reticulatus* (eg *Aequitriradites* spp, *Cooksonites* spp, *C. variabilis*, "*Verrucosasporites*" spp and *Januasporites* spp) and the fern form *Crybelosporites berberioides*. These forms decline down section in APK212 and are generally absent in the APK211 and APK1 associations. A similar down section decline is noted in the Eromanga and Surat Basins, but some of these forms may become established again (albeit sporadically) in units APK11, APJ6 and APJ5.

Thus, APK212 perhaps is best considered as an assemblage zone (with the presence of *T. reticulatus* as being but one of its characteristics) with a vaguely defined base and may well prove to encompass most (if not all) of unit APK2. Nevertheless, it allows the discrimination of the upper Laira Formation of Katnook region from the lower Crayfish above the "Sawpit Sandstone" in Sawpit (Page 15 and 16) and may facilitate the resolution of the upper Cadna-Owie from the lower Cadna-Owie and Murta in the Eromanga Basin; its recognition is crucial to the resolution of the Merino High Crayfish section.

The present study revealed a close similarity of the Eastern Penola Trough APK3 - APK1 section to the equivalent in the Eromanga Basin particularly with respect of the order of entry of the various index taxa and perhaps, coincidentally, the gross sedimentation succession. Interestingly, Alley and White, 1996 record an identical palynofloral succession to the Otway Basin with respect of the index taxa in the Eromanga Basin; however, as noted above, the present review records some differences especially with respect to *T. reticulatus* and *F. wonthaggiensis*.

The order of pollen and spore taxa entry given for the Western Australian section by Helby *et al* 1987 and Backhouse, 1988 remains enigmatic in relation to the Eromanga and Otway palynofloral succession. Almost all of the index taxa lying between the entry of *Ruffordiaspora* (= *Cicatricosisporites*) *australiensis* and *Foraminisporis asymmetricus* in eastern Australia appear at about the one level (that of the *R. australiensis* oldest occurrence datum; see Helby *et al* 1987 Fig 13 and Backhouse 1988 Fig 34) in the West. This gives the impression of an older (earlier) entry (with respect of the *F. asymmetricus* and *Ruffordiaspora* oldest occurrence data) for many of these index taxa (eg *P. notensis*) in West Australian sections. In the Otway and Great Australian Basin regions, *Ruffordiaspora spp* are consistent to notable (with two or three forms represented) to about the *P. notensis* datum but are very sporadic in their distribution below this (*cf* Helby *et al* 1987 fig 13, where *Ruffordiaspora* (= *Cicatricosisporites*) is given as being "consistent" to the base of its range). It is possible that this erratic extension of the *Ruffordiaspora spp* range below the *P. notensis* datum has not been recognised in the West Australia regions (it certainly is NOT consistent below the *P. notensis* datum in East Australia contrary to that indicated by Helby *et al* 1987 fig 13).

Thus, the *Ruffordiaspora australiensis* and *Ruffordiaspora spp* data given by Backhouse, 1988 and Helby *et al* 1987 may be equivalent to the deepest consistent to notable occurrence of *Ruffordiaspora spp* (as opposed to their evolution point); this seems to form a correlatable horizon in the Eromanga and Otway Basins at about (or just below) the base of APK22. Perhaps it is worth noting in this regard that the West Australian Early Cretaceous section is marine where the land plant elements could be expected to be less reliable and the need for their close study is lessened by the high resolution provided by marine dinoflagellates. Compounding the problem of east-west correlation (and also for the Eromanga - Otway correlation), is the irregularity of the distribution of *Foraminisporis asymmetricus* at the base of its range particularly in the Otway Basin where its oldest occurrence datum is essentially unusable for correlation; (for example, compare Dettmann, 1986 Fig 3 with the present interpretation on Page 13).

As noted above, the base *D. speciosus* datum (base APK122) lies well down into the Crayfish Sub Group into the Sawpit #1 "basal shale" unit (the top of subunit B "McEachern Sandstone" equivalent; Page 17) and the base *C. hughesii* datum (base APK121) lies a little lower at the base of the Sawpit #1 "basal shale" unit subunit A (Page 17). However, while Moreton *et al* 1995 (Moreton *et al* 1995, fig 5.10) and Price, 1993, 1996, 1997 regarded the lowest sub unit of the Sawpit #1 "basal shale" (2450m - 2461.5m) as being part of the Pretty Hill Formation (and Crayfish Sub Group), a recent compilation by the Minerals and Petroleum Victoria (MPV) considered it as being the uppermost part of the Casterton Formation; this concept was accepted by Price, 1997 on the basis of the distribution of *C. hughesii*, *C. "quasihughesii"*, *Ruffordiaspora ssp* and *D. speciosus* in relation to Casterton and "basal shale". It is this interpretation of the distribution of the Casterton Formation that is adopted here although unit APK121 has been identified only in Bus Swamp #1 in terms of the Casterton Formation *sl* of the Merino High; (there are some records of *C. hughesii* in cuttings samples from the Casterton interval; eg McEachern #1 at 2354m).

The presence (albeit as isolated specimens) of *Ruffordiaspora ssp* almost to the base of the Gordon #1 (the best preserved Casterton palynofloras recovered to date) and *Cyclosporites "quasihughesii"* within the Casterton Formation suggests that the Casterton Formation lies wholly within APK121 and APK1. Additionally, the presence of APK121 in the uppermost Casterton Formation (depending on how the Sawpit, Robertson and Bus Swamp sections are interpreted) and *C. "quasihughesii"* lower in APK11 Casterton in the context of their proximity of the base of APK122 suggests that there is not a substantial depositional break between the Casterton Formation and the Pretty Hill Formation; there seems therefore, little justification for excluding the Casterton Formation from the Otway Group.

OTWAY BASIN NOMENCLATURE

Dettman & Playford, 1969	Dettman 1986	Morgan, 1985 (Otway Basin Review)	Morgan, 1992 (Zema 1)	Morgan et al; 1995 (MESA Otway Volume)	APG Consultants			
								└─ <i>Phyllocladites mawsonii</i>
<i>A. distocarinatus</i>	<i>A. distocarinatus</i>	<i>A. distocarinatus</i>	<i>A. distocarinatus</i>	<i>A. distocarinatus</i>	APK7			
<i>P. pannosus</i>	<i>P. pannosus</i>	<i>P. pannosus</i>	<i>P. pannosus</i>	<i>P. pannosus</i>	APK6			└─ <i>C. paradoxa</i> └─ <i>Crybelosporites</i> sp. cl. <i>C. brenner</i> (sp. 1255)
<i>C. paradoxa</i>	<i>C. paradoxa</i>	<i>C. paradoxa</i>	<i>C. paradoxa</i>	<i>C. paradoxa</i>	APK5	APK52		└─ <i>Phimopollenites pannosus</i>
						APK51		└─ <i>Pilosisporites grandis</i>
<i>C. striatus</i>	<i>C. striatus</i>	<i>C. striatus</i>	<i>C. striatus</i>	<i>C. striatus</i>	APK4			└─ <i>Coplospora paradoxa</i>
								└─ <i>Crybelosporites striatus</i>
								└─ <i>Cooksonites variabilis</i>
								└─ <i>Pilosisporites parvispinosus</i>
<i>C. hughesii</i>	<i>C. hughesii</i>	<i>C. hughesii</i>	<i>C. hughesii</i>	<i>C. hughesii</i>	APK3	APK32	APK322 APK321	└─ <i>M. evansii</i>
								└─ <i>F. wonthaggiensis lunaris</i>
								└─ <i>Foraminisporis asymmetricus</i>
								└─ <i>Pilosisporites notensis</i>
<i>C. hughesii</i>	<i>C. hughesii</i>	<i>C. hughesii</i>	<i>C. hughesii</i>	<i>C. hughesii</i>	APK2	APK21	APK212	└─ <i>M. evansii</i> consistent to frequent
								└─ <i>Triporoletes reticulatus</i>
								└─ <i>Foraminisporis wonthaggiensis</i>
<i>C. stylosus</i>	<i>C. stylosus</i>	<i>C. stylosus</i>	<i>C. australiensis</i>	<i>C. australiensis</i>	APK1	APK12	APK122	└─ <i>Diclytosporites speciosus</i>
								└─ <i>Cyclosporites hughesii</i>
						APK11		└─ <i>Ruffordiaspora</i> spp. <i>R. australiensis</i>
			<i>R. watherooensis</i>	<i>R. watherooensis</i>	APJ6	APJ62	APJ622	└─ <i>Foraminisporis dailyi</i>
							APJ621	└─ <i>Ceratosporites equalis</i>
						APJ61		└─ <i>Retitriteles watherooensis</i>
					APJ5			└─ <i>Murospora florida</i>

Palynostratigraphic Nomenclature

PEP 119 Vic Otway Gp Rev

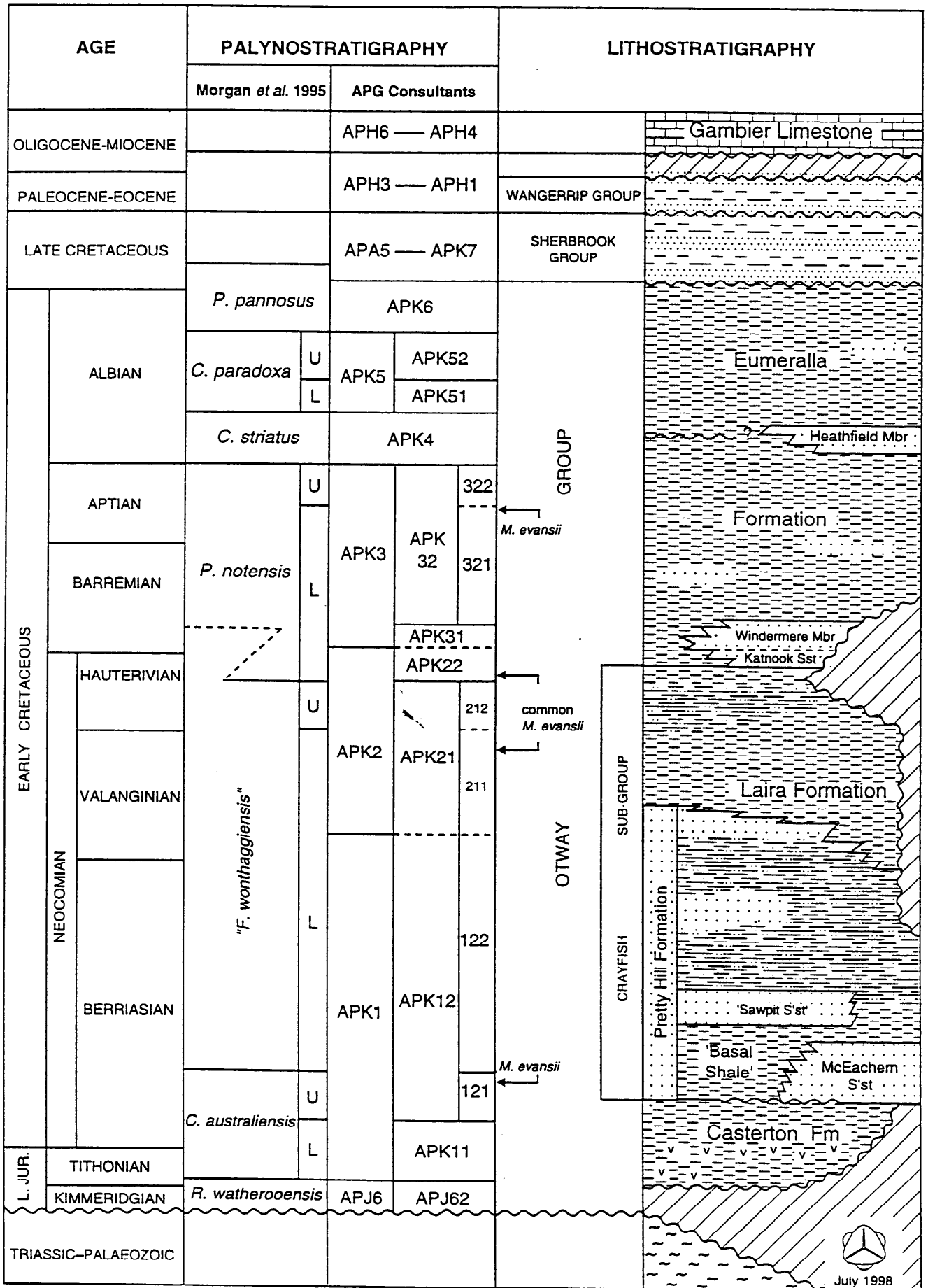
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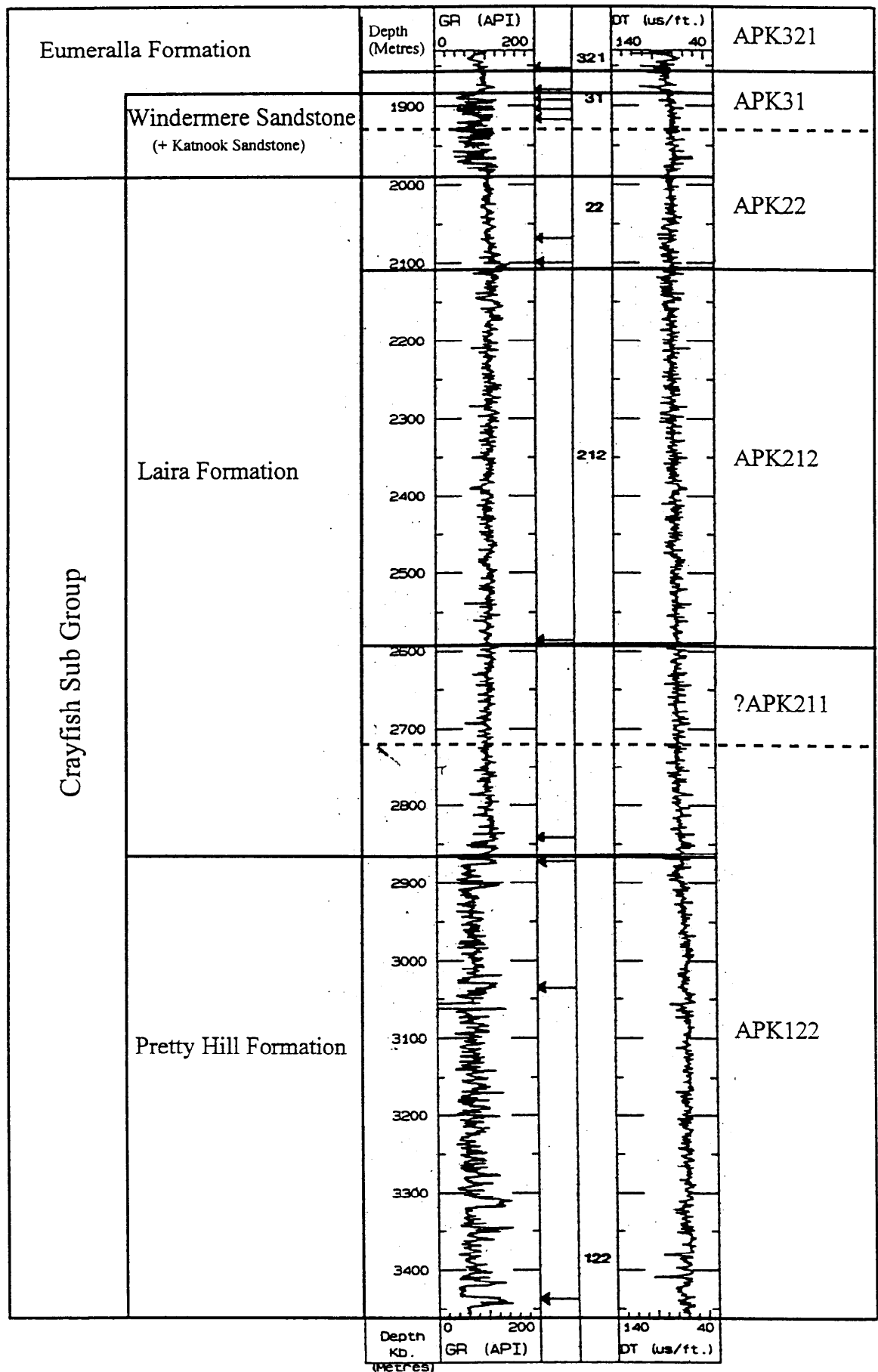
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Otway Basin Stratigraphic Nomenclature

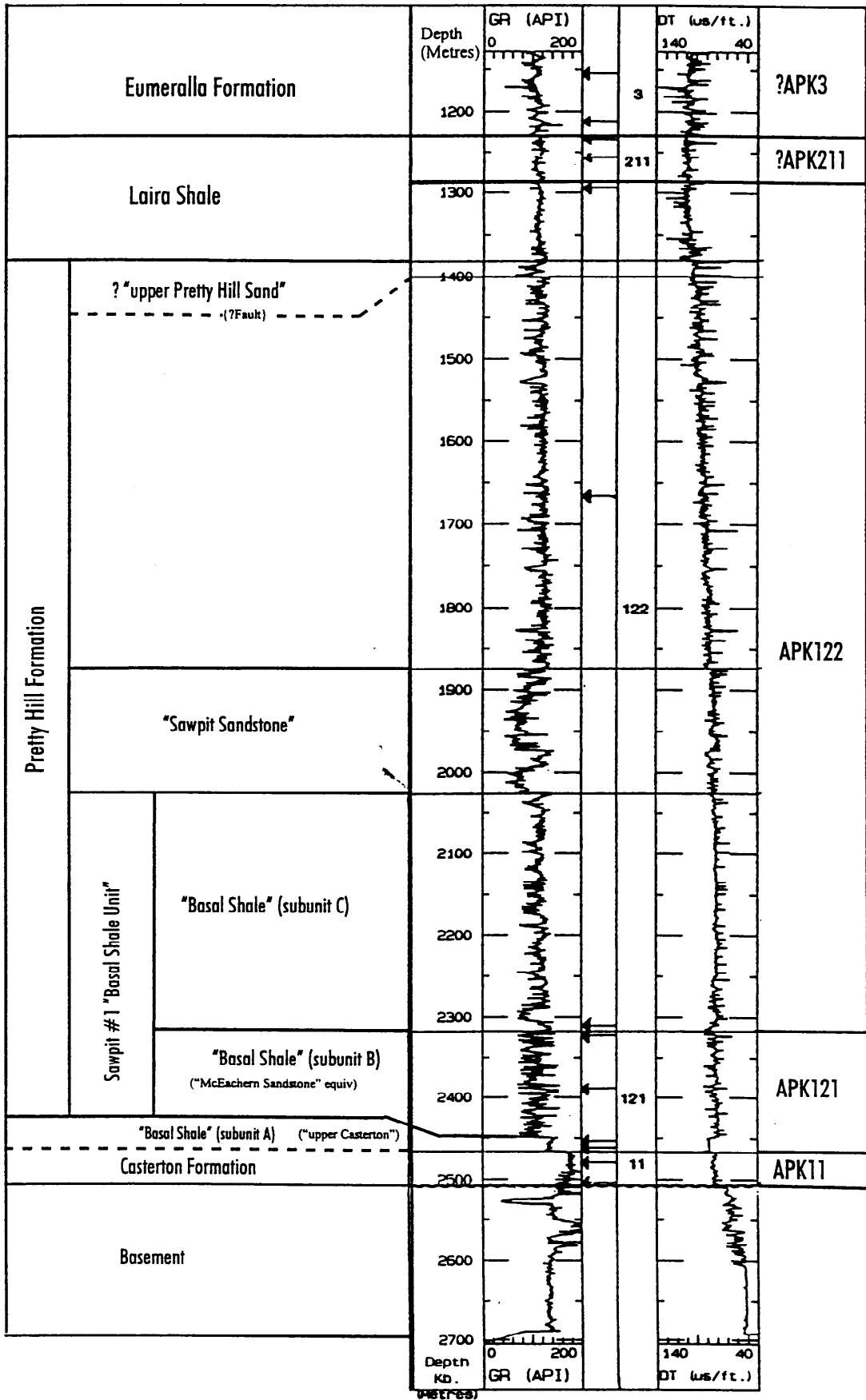


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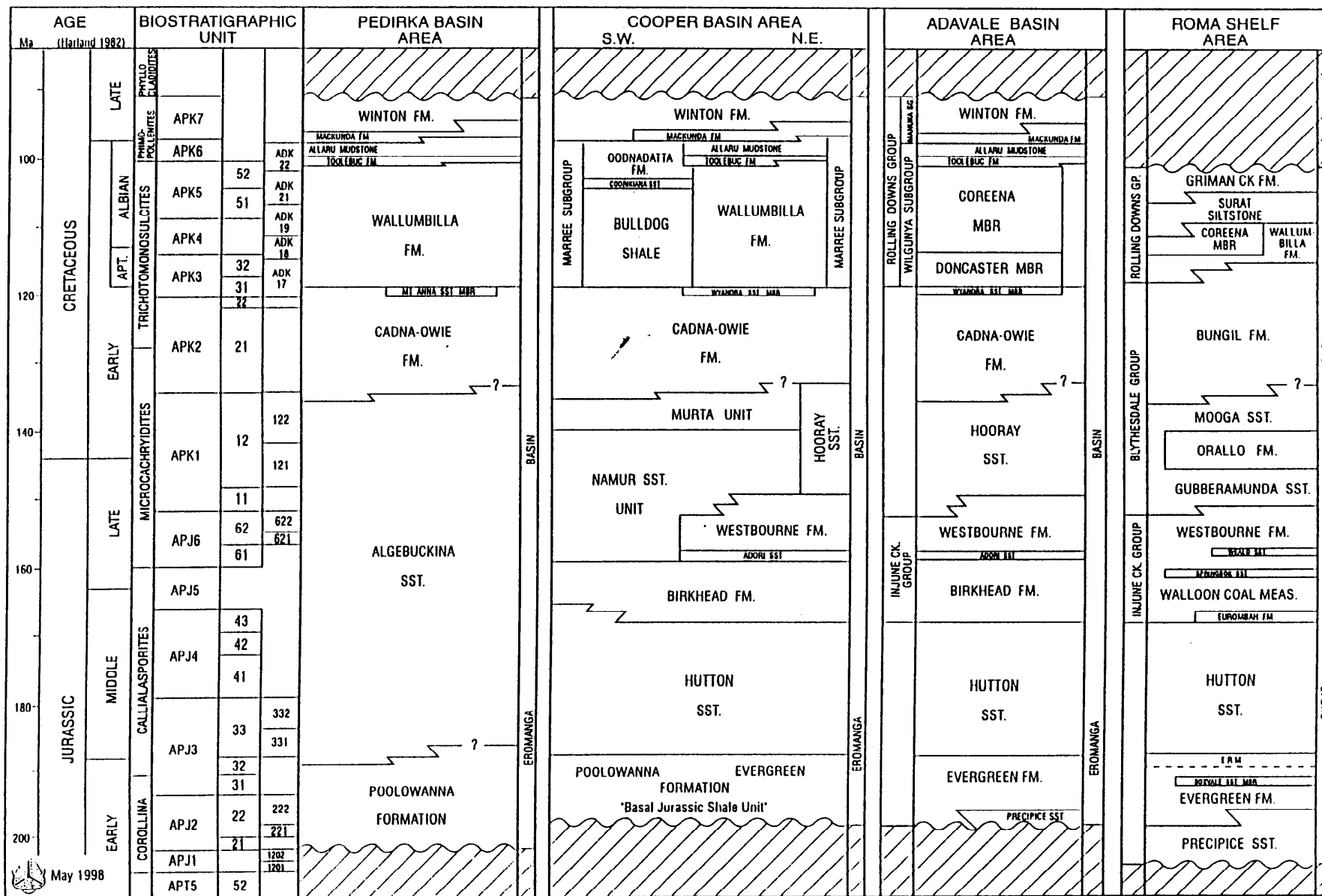
Katnook #2 Reference Section



Sawpit #1 Reference Section



JURASSIC-CRETACEOUS STRATIGRAPHY - SOUTHERN GREAT ARTESIAN BASIN



Application of Palynostratigraphic nomenclature

The units of Price *et al*, 1985 and Price, 1993, 1995, 1996, 1997 (with some revision) have been used in this study in an attempt to increase the biostratigraphic resolution and to lessen any possible ambiguity with the earlier nomenclatures arising from differences of interpretation as to the order of entry of certain index taxa in the Otway Basin. The equivalent units of Morgan *et al*, 1995 however, are given also on Page 14 to assist in relating the results of this study to the stratigraphic interpretation given in the 1995 MESA compilation; reference should be made to Page 13 also if there is a need to relate an earlier nomenclature to this study.

The "best guess" assignments given on the Palynological Data Sheets take into account the assignments from the equivalent section in the adjacent well sections. However, all cuttings data have been excluded from this interpretation as there is a high probability of the taxa distribution data being blurred by contamination from higher in the section.

Weight has been given to the distribution of the lowest consistent to notable occurrence with a degree of morphological variation of *Ruffordiaspora spp* particularly in the context of the distinctive fern dominated associations near the base of the Eumeralla. In this regard, the Katnook #2 sequence should be re-examined, particularly in respect of the isolated occurrence of *F. asymmetricus* and *P. notensis* in the Windermere Sandstone, Katnook Sandstone and upper Laira Shale; this well is assumed to be the most complete mid Otway Group section possibly representing the entire Eumeralla - Laira boundary transition and with close palynological sampling. Particularly intriguing in the context of this study, is the deepest notable and diverse occurrence of *Ruffordiaspora spp* at SWC 2111.5m immediately below the deepest occurrence of *P. notensis* at SWC 2103m; both these horizons are in the type Laira Formation below the Windermere - Katnook Sandstone but immediately above a log break (albeit subtle) at about 2115m (see Page 15).

In contrast to Morgan *et al*, 1995, no reliance has been placed upon the highest occurrence of *Microfosta evansii* in term of the position of the top of the Laira Formation (and base-Eumeralla unconformity) in the present correlation. This algal form frequently occurs (sometimes as a notable component; eg Casterton #1 at 1096m, Digby #1 at 1096.8m and Mocamboro #11 at 832.6m) with typical APK321 palynofloras in the Otway Basin particularly in this region (PEP 119, Victoria) of the Penola Trough and Merino High.

In an attempt to better define the index taxa distribution in terms of environmental and facies constraints, the broad statistical data were used to define several "Palynofacies" associations which are recorded on the appended Palynostratigraphic Data Tables.

- "*Ruffordiaspora* - *Cyathidites* Palynofacies" Ferns dominant; mostly *Cyathidites*; *Ruffordiaspora* notable; *Pilosisorites* scarce or absent.
- "*Pilosisorites* - *Cyathidites* Palynofacies" Ferns dominant; mostly *Cyathidites*; *Pilosisorites* notable and diverse; *Ruffordiaspora* notable.
- "*Pilosisorites* - *Osmundacidites* Palynofacies" Ferns dominant; *Osmundacidites* \geq *Cyathidites*; *Pilosisorites* notable and diverse.
- "*Ruffordiaspora* - *Osmundacidites* Palynofacies" Ferns dominant; *Osmundacidites* \geq *Cyathidites*; *Ruffordiaspora* notable; *Pilosisorites* scarce or absent; Lycopods conspicuous.
- "*Osmundacidites* - *Retitriletes* Palynofacies" Ferns dominant; *Pilosisorites* absent; *Ruffordiaspora* scarce or absent; *Osmundacidites* = *Cyathidites*; Lycopods conspicuous or notable and relatively diverse.
- "*Osmundacidites* Palynofacies" Ferns dominant; *Pilosisorites* absent; *Ruffordiaspora* scarce or absent; *Osmundacidites* » *Cyathidites*; Lycopods scarce.
- "*Cyathidites* Palynofacies" Ferns dominant; *Pilosisorites* absent; *Ruffordiaspora* scarce or absent; *Cyathidites* > *Osmundacidites*; Lycopods scarce.
- "Lycopod Palynofacies" Lycopod > Ferns \geq Gymnosperms.
- "Conifer Palynofacies" Gymnosperm \geq cryptogams.
- "Casterton Palynofacies" Palynodebris diffuse; Palynoflora restricted; mostly conifer remnants
- "Casterton aquatic Palynofacies" Palynodebris diffuse; Palynoflora restricted; mostly conifer and leiosphere remnants

Correlation PEP119 (Victoria) Well Sections

The wide spread APK321 associations were represented in all the wells considered in this study although not all were examined in this review. The base *Foraminisporis wonthaggiensis "lunaris"* datum lying within the APK321 unit however, could not be resolved due to the uneven distribution of samples available for reexamination. Unlike most other regions of the Penola Trough where unit APK321 overlies APK212 or older section, there is a sequence with APK31 and APK22 palynofloras representative of the Windermere - Katnook - uppermost Laira section of Katnook #2 (Page 15). This "basal Eumeralla" section is represented in Heathfield #1, McEachern #1, Bus Swamp #1, Gordon #1, Mocamboro #11 and Digby #1 (Well Correlation Enclosure).

Of the wells considered in this review, Heathfield #1 appears to include the most "normal" Penola Trough upper Crayfish Sub Group sequence. The "basal Eumeralla Formation" overlies a moderately thick APK212 upper Laira Shale (?1750m - 1945m) and the well's TD is perhaps just within the APK122 upper Pretty Hill Formation; the section is similar to the Katnook #2 (Page 15) but some 400m of upper Laira Formation is lost at the base Eumeralla unconformity. As with other well sections in the western Otway Basin, there is little evidence of APK211 section where *F. wonthaggiensis* ranges significantly below the base *T. reticulatus* datum. The sections to the north of Heathfield on the flank of the Penola Trough (Tullich #1 and McEachern #1) seems to show a loss of the Laira Shale towards McEachern where a relatively thin APK122 lower Crayfish Sub Group section (Pretty Hill Formation) overlies the Casterton Formation.

To the east of the Penola Trough, in the Marino High well sections (Bus Swamp #1, Gordon #1, Casterton #1, Mocamboro #11 and Digby #1), there seems to be some APK21 (possibly APK212) preserved below the APK31 - APK22 "basal Eumeralla" and above the APK122 - APK1 lower Pretty Hill - Casterton Formation section. Whether the APK212 sequence in these well sections is a thin wedge of upper Laira preserved on the eroded lower Pretty Hill surface or it represents an earlier

onset of the Eumeralla depositional cycle can not be determined from the data considered in this study; that is, is the APK21 section conformable with the overlying APK22 - APK31 "basal Eumeralla" (equivalent to the Katnook #2 Windermere - Katnook - uppermost Laira interval) or is it bounded top and bottom by depositional (or erosional) breaks representing a "wedge" of upper Laira sediments preserved under the ubiquitous blanket of Eumeralla?

With either interpretation, an intra-Crayfish unconformity is implied and accounts for the loss of most of the upper Pretty Hill and lower Laira Formation in these thin (relative to the axial Penola Trough sequence) Crayfish Sub Group sections of the Marino High. The strongest evidence for upper Laira APK21 sediments being preserved (and the presence of an intra-Crayfish unconformity) is in Digby #1, Mocamboro #11 and perhaps Gordon #1; their presence in Casterton #1 (section not sampled) and Bus Swamp #1 (section not examined in this study) is inferred by log correlation from the southeastern wells (Well Correlation Enclosure) and very tentative palynostratigraphic data from Bus Swamp #1.

The relation of the APK21 upper Laira of the Merino High wells to the adjacent Penola Trough wells immediately to the west (McEachern #1, Tullich #1 and Heathfield #1) is unclear and open to a number of possibilities. For example, the APK122 shale section of McEachern #1 and Tullich #1 immediately underlying the Eumeralla (interpreted as Laira Formation on Well Correlation Enclosure) may represent an APK122 shale facies of the Pretty Hill similar to that above the Sawpit Sandstone in Sawpit #1 (Page 16). Alternatively, the inference of APK21 upper Laira in Bus Swamp #1 and Casterton #1 may not be justified (although this would only shift the correlation problem further southeast). Or, it is possible (but less likely) that the APK212 associations of Digby #1, Mocamboro #11 and Gordon #1 are impoverished APK22 palynofloras implying that the "basal Eumeralla" (and base-Eumeralla unconformity) extends lower than is suggested by the interpretation adopted here.

In the absence of a more detailed sampling of the upper Crayfish shales in the region, the present palynostratigraphic data should be considered in conjunction with the details of the tectonic setting (*is there structural separation at the time of Crayfish deposition of Tullich and McEachern from Bus Swamp, Casterton and Gordon?*) and the seismic sections (*how much more Crayfish is below the Heathfield well section?; can the intra-Crayfish unconformity in Digby, Mocamboro and Gordon be resolved and extended to the northwest?*).

The mid Pretty Hill Formation APK122 sand in Sawpit (the "Sawpit Sandstone", 1860m - 2025m; Page 16) seems to extend into the Victorian Penola Trough and Merino High region being represented in McEachern (1754m - 1797m), Bus Swamp (1427m - 1552m), Gordon #1 (1550m - 1736m) and Casterton #1 (1476m - 1715m) perhaps offering a migration path from the deeper parts of the Penola Trough. In wells such as Gordon #1 and Casterton #1, the resolution of the "Sawpit Sandstone" within the arenaceous lower Pretty Hill section is weak as the intervening shales are not very thick nor distinctive. The "Sawpit Sandstone" does not seem to extend (or has been truncated by the intra-Crayfish unconformity) as far south east as Mocamboro #11 or Digby #1.

The basal Pretty Hill Formation of the Marino High is more arenaceous than that at Sawpit with the "basal shale" subunit B of Sawpit #1 (Page 16) being the correlative of the "McEachern Sandstone". Their equivalence is suggested both by a distinctive "streaky" log signature and the base *D. speciosus* datum (base APK122) lying towards the top of both units. The "McEachern Sandstone" extends though McEachern #1, Gordon #1, Casterton #1, Mocamboro #11 and Digby #1 although few diagnostic palynofloras have been recovered from the interval.

The palynostratigraphic - log correlation of the lower Pretty Hill - Casterton Formation interval from the Sawpit #1 reference section (Page 16) to the Merino High wells (Well Correlation Enclosure) strongly suggests that the Crayfish Sub Group of the Merino High is truncated and not a thin equivalent of the entire Crayfish Sub Group.

Well Correlation PEP119 Victoria

Stratigraphic Datum		Penola Trough					Merino High				
Lithostratigraphy	Palynostrat.*	Katnook #2	Sawpit #1	Heathfield #1	Tullich #1	McEachern #1	Bus Swamp #1	Gordon #1	Casterton #1	Mocambo #11	Digby #1
Top Eumeralla Fm											
	Base APK5		(805)			(504)	(300)			(103)	
	Base APK4			(1263.1)	(908.9)	(699.6)			(617.8)	(360)	(735.6)
	Top APK321	(1857)		(1531.9)	(1063.1)	(905.6)	(756)	(1035)	(740.7)	(550)	(1096.8)
	Base APK321	(1861.6)	(1217)	(1647.7)	(1061.3)	(905.6)	(862)	(1118)	(1097.6)	(816.8)	(1096.8)
Top Windermere S'St		1882		1718	1148.8	1095	7836	71124	71160	910	1304
	Base APK31	(1928)		(1735)		(1048.6)				(869)	(1318.1)
	Base APK22	(2111.5)		(1735)		(1113.6)	(886)	(1275)		(965)	(1364.4)
Top Crayfish Sub Group		2151	1227.5	1750	1178	1138	892	1212	1218	968	1398
Top Laura Formation		2151	1227.5	1750	1178	1138	892	1212	1218	968	1398
	Base APK212	(2595)		(1945)			(913)	(1275)		(1061)	(1536.4)
	Base APK211	(2724.5)	(1259)	(1945)			(957)				
Top Pretty Hill Fm		2847	1380	2060	21475.5	1425	1250	1328	1352	1091	1598
Top "Sawpit S'St"			1875			1754	1427	1550	1476		
Top Sawpit "base shale"			2025			1797	1552	1736	1715		
Top "McEachern S'St"						2126		1900	2072	1165	1675
	Base APK122	(3035)	(2320.5)	(2280)	(1664.2)	(1946.1)	(1786)	(1761)	(2062.7)	(1319.1)	(1591)
Top Casterton Fm s/			2450			2343	1789.5	2118	2225		1960
	Base APK121	(3440)	(2461)				(1790)	(1882)			
	Base APK11		(2505)					(2325)	(2253.1)		(2002)
	Base APJ6							(2337.5)	(2360.2)		(2048.2)
Top Basement			2507					2364	2450	1374	2050
	Base data	3440	2505	2280	1664.2	1946.1	1790	2337.5	2360.2	1319.1	2048.2

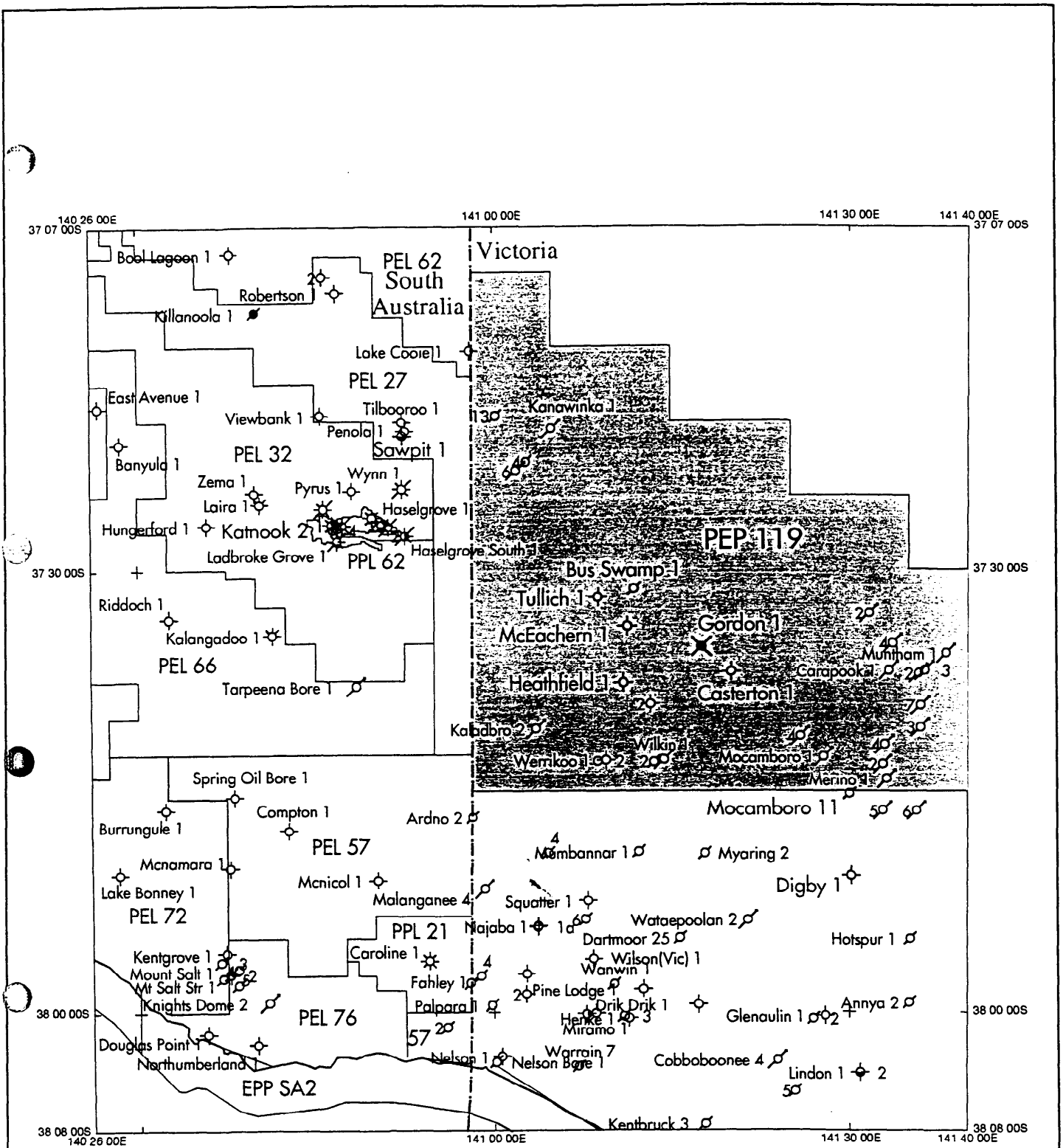
PEP119 Well Formation Top Summary



PEP 119 Vic Orway Gp Rev

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APG Cons 640/06 Rev 11/18 10:17:03

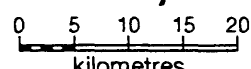
*Note: the bracketed depth given for a palynostratigraphic unit is the deepest sample point for the particular unit and not the inferred base of the unit.



-  Well included in Palynological Study
-  Santos Licence

**OTWAY BASIN
EASTERN PENOLA
TROUGH**

**Wells
included in
Palynological
Study**



kilometres
UTM, ANS, CM 141E

Santos
South
Australia
Business
Unit

Author:	C. Grasso
Drawn:	D. Owen
Original Scale:	1:700000
Drawn:	M.S.L.
Date:	13 July 1998
Revised Date:	
File Number:	OTWAY 288

Fig.

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Appendix 1

Palynostratigraphical Data Tables

PEP119 Victoria



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Appendix 1

Palynostratigraphical Data Tables

PEP119 Victoria



Sample Sample Type Depth	Palynostratigraphic Unit Age	Lithostratigraphy	Index Taxa	Remarks
Core 1263.1m	APK4	Eumeralla Formation	Base <i>C. striatus</i> Base <i>P. parvispinosus</i>	
Core 1408.2m	APK32 ?APK321	Eumeralla Formation		Sparse association
Core 1531.9m	APK32 ?APK321	Eumeralla Formmation		
Windermere Sandstone ("basal Eumeralla") 1718m				
Core 1647.7m	APK22 - APK32 ?APK321	Eumeralla Formation		<i>P. notensis</i> notable
Core 1735.2m	APK31 - APK321 ?APK31	Basal Eumeralla Formation	Base <i>P. notensis</i> Top & Base <i>M. evansii</i>	<i>F. asymmetricus</i> recorded
Crayfish Sub Group (upper Laira Shale) 1750m				
Core 1825.8m	APK2 - APK31 ???APK212	Laira Shale	?Base <i>F. asymmetricus</i>	This sample is below a log break (1750m or 1800m) which may represent the Eumeralla - Crayfish boundary; the <i>F. asymmetricus</i> occurrence should be checked and confirm that it is not <i>V. "pseudoasymmetricus"</i>
Core17 1945m	APK2 APK212	Laira Shale	Base <i>T. reticulatus</i> , Base <i>F. wonthaggiensis</i>	A doubtful <i>F. wonthaggiensis</i> recorded at core19a No assemblage list available



Sample Sample number Depth Preparation Num.	Palynostratigraphic Unit Palynofacies <i>Index taxa</i>	Inferred Lithostratigraphic Unit <i>Log Interpreted Unit</i>	Inferred Deposition Environment <i>Lithology</i>	Palynomorph			Remarks
				Preservation	Yield <i>Org. Yield</i>	Diversity	
Core 908.9m	APK4 <i>[C. striatus]</i>	Eumeralla Formation					Not examined in this study; assemblage data from Morgan, 1989
Core 1060.3m	APK32 ?APK321 <i>[P. notensis, P. parvispinosus, F. asymmetricus, F. wonthaggiensis]</i>	Eumeralla Formation					Not examined in this study; assemblage data from Morgan, 1989
Core 8 s6576 3482ft 1061.31m P19368	APK321 tentatively lower APK321 <i>Pilosporites - Cyathidites Palynofacies</i> <i>[P. parvispinosus, P. notensis, P. "neograndis", P. "microbaculata", C. variabilis, F. asymmetricus, F. wonthaggiensis]</i>	Lower Eumeralla Formation <i>Eumeralla Formation</i>	Fluvial - lacustrine <i>Laminite, lt gry Siltst & v.f.g., v lt gry Sandst</i>	Fair	Moderate <i>0.10mL/5mL Extremely low</i>	High	Palynoflora dominated by saccate pollen fragments; mostly <i>Alisporites</i> and <i>M. antarcticus</i> . Fern spores subdominant; mostly <i>Cyathidites</i> ; <i>Pilosporites</i> notable and diverse; <i>Ruffordiaspora australiensis</i> notable. Lycopod spores scarce; mostly <i>Retitriletes</i> . Bryophyte spores scarce but moderately diverse. Algal forms notable; mostly leiospheres (notable in < 20µ fraction); <i>S. reticulata</i> notable in > 80µ fraction.
Sample Gap Windermere Sandstone ("basal Eumeralla") 1148.8 Crayfish Sub Group (lower Laira Formation) 1178m							<i>The APK212 upper Laira Formation of Katnook and Heathfield seem to be lost probably truncated at the Crayfish - Eumeralla unconformity as at Sawpit</i>
Core 10 s6575 3994ft 1217.37m P19367	Mesozoic tentatively APK122 - APK21 very tentatively APK122 <i>Cyathidites - Retitriletes Palynofacies</i>	Crayfish Sub Group <i>Laira Formation</i>	Fluvial <i>Mudstone, lt olv gry</i>	Poor	Extremely low <i>0.06mL/5mL Extremely low</i>	Very low	Unoxidised residue only Sparse palynoflora. Fern spores dominate; mostly <i>Cyathidites</i> . Lycopod spores (mostly <i>Retitriletes</i>) conspicuous.



Sample Sample number Depth Preparation Num.	Palynostratigraphic Unit Palynofacies Index taxa	Inferred Lithostratigraphic Unit Log Interpreted Unit	Inferred Deposition Environment Lithology	Palynomorph			Remarks
				Preservation	Yield Org. Yield	Diversity	
Core 10 s6574 3996ft 1217.98m P19366	APK122 - APK2 tentatively APK122 <i>Osmundacidites - Retitriletes</i> Palynofacies [<i>D. speciosus</i> , <i>C. hughesii</i> , <i>M. florida</i>]	Crayfish Sub Group <i>Laira Formation</i>	Fluvial - lacustrine <i>Mudstone, mid gry</i>	Fair thin	High <i>0.09mL/5mL</i> Extremely low	Moderate	Palynoflora dominated by fern spores; mostly <i>Osmundacidites</i> and <i>Cyathidites</i> . Lycopods conspicuous; <i>Retitriletes</i> , <i>L. verrucatus</i> and <i>D. speciosus</i> notable. Conifer saccate pollen prominent; <i>Alisporites</i> and Podocarp forms notable. Algal forms conspicuous; thin walled leiospheres (in fines fraction) and <i>S. reticulata</i> (in coarse fraction). Leptosporangiate tissue remnants notable in coarse fraction
Core 12 s6573 4495ft 1370.08m P19365	APK122 - APK2 tentatively APK122 Conifer Palynofacies [<i>M. florida</i> , <i>D. speciosus</i> , <i>C. equalis</i>]	Crayfish Sub Group <i>Laira Formation</i>	Fluvial <i>Laminite, gm blk Mudst & lt gry sandy Siltst</i>	Poor thin, corroded	Low <i>0.69mL/5mL</i> Moderate	Very low	Oxidised organic residue mostly corroded cuticle tissue. Palynoflora sparse and restricted in diversity. Inaperturate pollen remnants prominent but difficult to identify. Spores restricted in diversity; mostly <i>Cyathidites</i> .
Core 12 s6572 4505ft 1373.12m P19364	APK122 - APK2 tentatively APK122 Conifer Palynofacies [<i>M. evansii</i> , <i>D. speciosus</i> , <i>M. florida</i> , <i>C. stylosus</i>]	<i>Laira Formation</i> <i>Laira Formation</i>	Fluvial - lacustrine <i>Siltstone, olv gry</i>	Fair	Moderate <i>0.14mL/5mL</i> Very low	Moderate	Palynoflora mostly inaperturate pollen and saccate pollen remnants. Fern spores conspicuous; mostly <i>Cyathidites</i> and <i>Osmundacidites</i> . Lycopod spores notable and moderately diverse; mostly <i>Retitriletes</i> and <i>Kekryphalospora</i> . Algal forms notable; mostly Leiospheres (in fine fraction); <i>S. reticulata</i> notable (in unoxidised fraction); <i>Microfista evansii</i> scarce.
Sample Gap Pretty Hill Formation 1475.5m							<i>The log response signature of the Pretty Hill Formation in Tullich is not strongly differentiated from the Laira Shale log signature.</i>
Core 1475.5m	APK122 - APK31 [<i>C. hughesii</i> , <i>M. evansii</i>]						Not examined in this study; assemblage data from Morgan, 1989 <i>F. asymmetricus</i> recorded but should be confirmed.



Sample Sample Number Depth Preparation Number	Palynostratigraphic Unit Age Index Species	Inferred Lithostratigraphic Unit (Log interpreted Unit)	Inferred Depositional Environment Lithology	Polynomorph			Remarks
				Preservation	Yield (Organic yield)	Diversity	
SWC 504m	APK5 [base <i>C. paradoxa</i>]	Eumeralla Formation					Not examined in this study; assemblage data from Morgan, 1990
SWC 699.6m	APK4 [base <i>C. striatus</i>]	Eumeralla Formation					Not examined in this study; assemblage data from Morgan, 1990
SWC 905.6m	APK3 ?APK321 [base <i>F. asymmetricus</i> , <i>T. reticulatus</i> , <i>F. wonthaggiensis</i> ? <i>P. parvispinosus</i>]	Eumeralla Formation					Not examined in this study; assemblage data from Morgan, 1990
SWC 1048.6m	APK22 - APK31 ?APK31 [base <i>P. notensis</i>]	Eumeralla Formation					Not examined in this study; assemblage data from Morgan, 1990 [Morgan, 1990 records <i>P. parvispinosus</i> and <i>F. asymmetricus</i> to 905m with frequent <i>P. notensis</i> ; <i>P. notensis</i> extends to 1048m]
SWC41 s6591 1113.6m 3653.54ft P19369	APK2 - APK3 possibly APK22 - APK31 <i>Ruffordiaspora</i> - <i>Cyathidites</i> Palynoflora [<i>R. australiensis</i> , <i>M. evansii</i> , <i>D. speciosus</i>]	basal Eumeralla Formation or upper Laira Formation (basal Eumeralla Formation)	Fluvial - lacustrine <i>Siltstone, lt gry, sandy.</i>	Fair	Low 0.1mL/5mL Very low	Low	Unoxidised residue only. Palynoflora dominated by fern spores; mostly <i>Cyathidites</i> ; <i>Osmundacidites</i> conspicuous <i>Ruffordiaspora</i> and <i>B. spectabilis</i> notable. Lycopod and bryophyte spores scarce and restricted in diversity. Conifer pollen conspicuous but mostly unidentifiable. Algal forms conspicuous particularly in <20µ fraction); mostly small leiospheres; <i>M. evansii</i> notable
Crayfish Sub Group(lower Laira Shale) 1138.0m							There is an indication of APK21 associations being preserved in Bus Swamp #1, Gordon #1, Mocambora #11 and Digby #1 which suggests that there is a hiatus within the upper Crayfish Sub Group (Laira Formation) perhaps in addition to the Penola and Robe Trough regional unconformity between the Eumeralla Formation and Crayfish Sub Group. This contrasts with the Penola Trough where the upper Crayfish section is truncated with the progressive loss of the APK212 and APK211 section towards the trough margins as in Katnook to Sawpit to Robinson and possibly Heathfield to Tullich to McEachern.



Sample Number Depth Preparation Number	Palynostratigraphic Unit Age Index Species	Inferred Lithostratigraphic Unit (Log interpreted Unit)	Inferred Depositional Environment Lithology	Palynomorph			Remarks
				Preservation	Yield (Organic yield)	Diversity	
SWC40 s6592 1146.6m 3761.81ft P19370	APJ62 - APK3 tentatively APK12 - APK21 extremely tentatively APK122 <i>Osmundacidites - Retitriletes</i> Palynoflora [<i>C. equalis</i>]	basal <i>Laira</i> Formation or upper Pretty Hill Formation (<i>Laira</i> Formation)	Fluvial <i>Claystone, brwn blk,</i>	Poor <i>thin diffuse</i>	Moderate <i>1mL/5mL High</i>	Low	Palynoflora restricted and dominated by fern spores; mostly <i>Cyathidites</i> and <i>Osmundacidites</i> . Lycopods scarce; mostly <i>K. douglasii</i> . Bryophytes very scarce. Conifer pollen conspicuous but few forms identifiable; ?inaperturate pollen notable. Very few algal forms.
SWC 1174.5m	APK122 - APK21 ?APK122 <i>Top M. evansii</i>	basal <i>Laira</i> Formation or upper Pretty Hill Formation					Not examined in this study; assemblage data from Morgan, 1990
SWC 1289.5m	APK122 - APK21 ?APK122 [<i>D. speciosus</i>]	basal <i>Laira</i> Formation or upper Pretty Hill Formation					Not examined in this study; assemblage data from Morgan, 1990
Sample Gap Pretty Hill Formation 1425m							
SWC 1523.6m	APK122 - APK21 ?APK122 [Base <i>M. evansii</i>]	basal <i>Laira</i> Formation or upper Pretty Hill Formation					Not examined in this study; assemblage data from Morgan, 1990 <i>M. evansii</i> recorded lower in cuttings.
SWC28 s6593 1573.0m 5160.76ft P19371	APK122 - APK3 possibly APK122 <i>Cyathidites - Retitriletes</i> Palynofloras [<i>D. speciosus, C. equalis</i>]	basal <i>Laira</i> Formation or upper Pretty Hill Formation (<i>Pretty Hill</i> Formation)	Fluvial <i>Siltstone, lt gry, few carb lam</i>	Poor <i>thin, diffuse</i>	Low <i>0.25mL/5mL Low</i>	Very low	Palynoflora mostly thin corroded saccate pollen and ?inaperturate pollen; mostly unidentifiable and difficult from the abundance of cuticle remnants. Fern spores conspicuous; mostly <i>Cyathidites</i> . Lycopod spores notable but restricted in diversity; <i>D. speciosus</i> notable. Bryophyte spores extremely scarce. Very few algal forms



Sample Sample Number Depth Preparation Number	Palynostratigraphic Unit Age Index Species	Inferred Lithostratigraphic Unit <i>(Log interpreted Unit)</i>	Inferred Depositional Environment <i>Lithology</i>	Polynomorph			Remarks
				Preservation	Yield <i>(Organic yield)</i>	Diversity	
SWC26 s6602 1607.6m 5274.28ft P19372	APJ3 - APK4 possibly APK122 [<i>L. verrucatus</i> , ? <i>D. speciosus</i>]	basal Laira Formation or upper Pretty Hill Formation <i>(Pretty Hill Formation)</i>	?Fluvial <i>Siltstone, lt gry.</i>	Very poor corroded stained	Extremely low <i>0.5mL/5mL Moderate</i>	Extremely low	Unoxidised residue only Very low organic yield recovered. Palynoflora extremely sparse and restricted in diversity; only the more robust forms identifiable.
SWC24 s6603 1674.6m 5494.09ft P19373	APK122 - APK2 probably APK122 <i>Cyathidites</i> Palynofacies [<i>D. speciosus</i> , R " <i>timaworensis</i> "]	basal Laira Formation or upper Pretty Hill Formation <i>(Pretty Hill Formation)</i>	Fluvial <i>Claystone, lt gry</i>	Very poor thin, corroded stained	Very low <i>0.17mL/5mL Very low</i>	Very low	Unoxidised residue only Low organic yield with corroded cuticle and wood fibres conspicuous in the coarse fraction. Sparse restricted palynoflora dominated by thin fragmented spore remnants; few forms identifiable; <i>Cyathidites</i> and <i>Osmundacidites</i> conspicuous..
Sample Gap Sawpit Sandstone 1754m Sawpit #1 "basal shale unit" 1797m							
SWC20 s6604 1801.6m 5910.76ft P19374	APJ62 - APK2 probably APK1 tentatively APK122 <i>Cyathidites</i> Palynofacies [<i>C. equalis</i> , ? <i>Cicatricosisporites "burgeri"</i>]	basal Laira Formation or upper Pretty Hill Formation <i>(Pretty Hill Formation)</i>	Fluvial <i>Claystone, mid gry</i>	Poor thin stained	Very low <i>0.38mL/5mL Low</i>	Low	Unoxidised residue only. Low organic yields with coarse fraction being mostly polynomorph remnants. Palynoflora restricted in diversity. Fern spores dominant; almost entirely <i>Cyathidites minor</i> . Lycopod spores scarce and very restricted in diversity. Bryophyte spores almost entirely absent. Conifer pollen sub dominant; mostly unidentifiable fragments; <i>Alisporites</i> notable. Very few recognisable algal forms [Morgan, 1990 records <i>D. speciosus</i> to 1946m]



Sample Sample Type Depth (Metres)	Palynostratigraphic Unit Age	Inferred Lithostratigraphy (Log Interp)	Palynostratigraphic Datum Reference	Remarks
SWC 300	APK5	Eumeralla Formation	Base <i>C. paradoxa</i>	<i>C. paradoxa</i> recorded lower (856m) in the section from cuttings.
SWC 756	APK3 APK321	Eumeralla Formation	Top <i>C. variabilis</i>	
Windermere Sandstone ("basal Eumeralla") 835m				
SWC 862	APK3 APK321	Eumeralla Formation	Base <i>P. parvispinosus</i> Base <i>F. wonthaggiensis</i> 862 m (Morgan & Burger data)	<i>F. reticulowonthaggiensis</i> present in cuttings at 856 - 870m
SWC 886	APK22 - APK31 ?APK22	? Eumeralla Formation	Base <i>P. notensis</i> Base <i>C. variabilis</i> (Morgan data)	Morgan records high proportions of <i>Cyathidites</i> and <i>Osmundacidites</i> and may be perhaps suggestive of the APK22 - APK31 <i>Cyathidites</i> associations of Gordon #1.
Crayfish Sub Group (??upper Laira Shale) 892m				
SWC 30 913	APK122 - APK2 ???APK21 ????APK212	??upper Laira Formation	Base <i>C. variabilis</i> (Burger data)	There is an indication of APK21 associations being preserved in Bus Swamp #1, Gordon #1, Mocambo #11 and Digby #1 which suggests that there is a hiatus within the upper Crayfish Sub Group (Laira Formation) perhaps in addition to the Penola and Robe Trough regional unconformity between the Eumeralla Formation and Crayfish Sub Group. This contrasts with the Penola Trough where the upper Crayfish section is truncated with the progressive loss of the APK212 and APK211 section towards the trough margins as in Katnook to Sawpit to Robinson and possibly Heathfield to Tullich to McEachern. The persistence of <i>C. variabilis</i> and <i>A. hispidus</i> is perhaps more typical of APK2 associations than APK122 but it should be noted that these taxa can range down into APJ6. Thus, there is very little justification for including this sample in APK212 rather than APK211 or APK122 particularly if the <i>F. wonthaggiensis</i> occurrence at 957m is questioned. The extremely tentative assignment to APK212 is as much based upon the associations from the equivalent section in Gordon #1 (SWC53 1275m), Mocambo #11 and Digby #1. Also, the possibility that it is an impoverished APK22 - APK31 association (and from the "basal Eumeralla" can not be entirely eliminated.



Sample Sample Type Depth (Metres)	Palynostratigraphic Unit Age	Inferred Lithostratigraphy (Log Interp)	Palynostratigraphic Datum Reference	Remarks
957m	APK122 - APK2 ???APK211	lower Laira Formation	? Base <i>F. wonthaggiensis</i> (Alley data)	Alley's record of <i>F. wonthaggiensis</i> at 957m is significantly below that of Burger or Morgan (862m). His deeper records of <i>F. wonthaggiensis</i> at 1515.83m and 1790m are given as doubtful ("??") occurrences on the range charts but seem more positive assignments in the supporting text. These deeper occurrence seems a little at odds with the other studies for this well and the palynomorph distribution data for the surrounding wells.
Pretty Hill Formation 1250m				
SWC 1105m	APK122 - APK21 ?APK122	basal Laira Formation or Pretty Hill Formation		
Sawpit Sandstone 1427m				
Core 2 1510m	APK12 - APK2 ?APK122	basal Laira Formation or Pretty Hill Formation	Base & Top <i>M. evansii</i>	Only record of <i>M. evansii</i> in this well section
SWC 1516	APK12 - APK2 ?APK122	basal Laira Formation or Pretty Hill Formation		Questioned <i>F. wonthaggiensis</i> recorded at 1516 and 1790m given on Alley's range chart.



APG Consultants
Palynostratigraphic Data

Casterton #1
File 97/45 (Report 640/07)

Sample Sample number Depth Preparation Num.	Palynostratigraphic Unit Palynofacies (Index Taxa)	Inferred Lithostratigraphic Unit (Log Interpreted Unit)	Inferred Deposition Environment (Lithology)	Palynomorph			Remarks
				Preservation	Yield (Org. Yield)	Diversity	
Core 614.5m	APK4 - APK5 ?APK4 <i>C. hughesii</i> , <i>D. speciosus</i> , <i>P. notensis</i> , <i>C. striatus</i>	Eumeralla Formation					Not examined in this study; assemblage data form Morgan, 1988
Core 617.8m	APK4 - APK5 ?APK4 <i>C. hughesii</i> , <i>D. speciosus</i> , <i>P. notensis</i> , <i>C. striatus</i>	Eumeralla Formation					Not examined in this study; assemblage data form Morgan, 1988
Core 740.7m	APK31 - APK321 ?APK321 <i>C. variabilis</i> , <i>P. notensis</i> , <i>F. asymmetricus</i> <i>M. evansii</i>	Eumeralla Formation					Not examined in this study; assemblage data form Morgan, 1988
Core 1096.1m	APK31 - APK321 ?APK321 <i>C. variabilis</i> , <i>P. notensis</i> , <i>F. asymmetricus</i> <i>M. evansii</i>	Eumeralla Formation					Not examined in this study; assemblage data form Morgan, 1988 <i>M. evansii</i> common
Core 4 s6562 3598ft (1096.67m) P19348	APK321 - APK32 lower APK321 <i>Pilosisporites</i> - <i>Cyathidites</i> Palynofacies (<i>M. evansii</i> , <i>P. notensis</i> , <i>P. "neograndis"</i> , <i>P. ingramii</i> , <i>P. parvispinosus</i> <i>M. florida</i> , <i>C. hughesii</i> , <i>F. wonthaggiensis</i>)	lower Eumeralla Formation (<i>Eumeralla</i> Formation)	Fluvial - lacustrine <i>Sandstone, med grnd &</i> <i>Siltstone, gm gry</i>	Fair	High <i>0.08mL/5mL</i> <i>Extremely low</i>	High	Palynoflora moderately diverse dominated by vascular cryptogams. Fern spores prominent; mostly <i>Cyathidites</i> and <i>Osmundacidites</i> ; <i>Pilosisporites</i> notable. Lycopod spores conspicuous and moderately diverse; mostly <i>Retitriletes</i> . Bryophyte spores notable; mostly <i>Aequitriradites</i> . Saccate pollen and inaperturate pollen conspicuous but mostly unidentifiable remnants; <i>Microcachrydites</i> notable. Algal spores notable; mostly <i>Leiotriletes</i> and <i>M. evansii</i>



Sample Sample number Depth Preparation Num.	Palynostratigraphic Unit Palynofacies [Index Taxa]	Inferred Lithostratigraphic Unit (Log Interpreted Unit)	Inferred Deposition Environment (Lithology)	Palynomorph			Remarks
				Preservation	Yield (Org. Yield)	Diversity	
Core 4 s6563 3601ft 1097.58m P19349	APK321 - APK32 lower APK321 <i>Pilosisporites - Cyathidites</i> Palynofacies <i>[P. notensis, P. ingramii, P. "neograndis", P. parvispinosus, M. evansii, C. hughesii, F. wonthaggiensis</i>	lower Eumeralla Formation (Eumeralla Formation)	Fluvial - lacustrine <i>Siltstone, gm gry Sandstone, med grnd</i>	Fair	High <i>0.17mL/5mL Very low</i>	High	Palynoflora moderately diverse dominated vascular cryptogams. Fern spores prominent; mostly <i>Cyathidites minor</i> and <i>Osmundacidites</i> ; <i>Pilosisporites</i> notable. Lycopod spores notable but moderately diverse; mostly <i>Retitriletes</i> . Bryophyte spores notable; mostly <i>Aequitriradites</i> . Saccate pollen and inaperturate pollen notable but mostly unidentifiable remnants; <i>Microcachrydites</i> notable. Algal spores notable; mostly leiospheres (in fine fraction); <i>M. evansii</i> scarce. [Record of <i>P. notensis</i> at about 1350m ?from cuttings ?Evans 1966]
Sample Gap Windermere Sandstone ("basal Eumeralla") 1160m Crayfish (? upper Laira Formation) 1218m Pretty Hill Formation 1352m							<i>The absence of palynological samples over the Eumeralla - Laira transition precludes the recognition of the APK22 - APK31 "basal Eumeralla" interval and the tentative APK212 upper Laira section thought to present in Gordon, Digby and Mocambo #11. The presence of P. notensis in cuttings at 1350m may support the presence of the APK22 - APK31 section but, on the basis of the present correlation, its occurrence at this level is considered to be contamination.</i>
Core 8 s6564 4508ft 1374.04m P19350	APK12 - APK31 possibly APK122 - APK21 very tentatively APK122 <i>Osmundacidites</i> Palynofacies <i>[C. hughesii, M. evansii</i>	basal Laira Formation or upper Pretty Hill Sandstone (Pretty Hill Formation)	Fluvial - lacustrine <i>Siltstone, gm gry</i>	Fair Stained	Low <i>0.16mL/5mL Very low</i>	Low	Unoxidised residue only. Palynoflora dominated by bisaccate pollen remnants. Spores prominent; mostly fern spores (mostly <i>Osmundacidites</i> ; and <i>Cyathidites minor</i>). Algal spores notable; mostly <i>Microfosta evansii</i> . <i>This association has some of the characteristics of the APK21 associations (a common occurrence of M. evansii and prominence of fern spores) of Gordon, Mocambo and Digby but lacks the bryophyte component.</i>
Core 8 s6565 4509ft 1374.34m P19351	APK122 - APK31 tentatively APK122 <i>Cyathidites</i> Palynofacies <i>[C. hughesii, D. speciosus, M. evansii, C. equalis]</i>	basal Laira Formation or upper Pretty Hill Sandstone (Pretty Hill Formation)	Fluvial - lacustrine <i>Mudstone, dk brwn gry</i>	Fair - poor thin but entire and not corroded; predepositional oxidisation	Very high <i>0.63mL/5mL Moderate</i>	Low	Specialised palynoflora restricted in diversity. Fern spores dominant; mostly <i>Cyathidites minor</i> ; <i>Osmundacidites wellmanii</i> conspicuous; other spore taxa represented as only a minor component. Bisaccate pollen conspicuous; mostly <i>Alisporites</i> ; very few Podocarp forms represented. Cheirolepidiacean pollen notable. Few aquatic spores; mostly leiospheres (in fine fraction); isolated <i>Microfosta evansii</i> <i>A Cyathidites palynoflora is unusual in APK1 but this association lacks the Ruffordiaspora spp or Bryophyte diversity of the APK31 -APK22 Cyathidites dominated palynofloras.</i>



Sample Sample number Depth Preparation Num.	Palynostratigraphic Unit Palynofacies (Index Taxa)	Inferred Lithostratigraphic Unit (Log Interpreted Unit)	Inferred Deposition Environment (Lithology)	Palynomorph			Remarks
				Preservation	Yield (Org. Yield)	Diversity	
Core 8 s6566 4510ft 1374.65m P19352	APK122 - APK31 tentatively APK122 Osmundacidites Palynofacies (D. speciosus, M. evansii)	basal Laira Formation or upper Pretty Hill Sandstone (Pretty Hill Formation)	Fluvial Mudstone, dk brwn gry	Fair Thin	High 0.67mL/5mL Moderate	Low	Specialised palynoflora restricted in diversity. Fern spore dominant; mostly <i>Osmundacidites wellmanii</i> ; <i>Cyathidites</i> conspicuous; <i>Retitriletes</i> scarce but moderately diverse; other spores taxa very scarce. Bisaccate pollen conspicuous; mostly <i>Alisporites</i> ; very few Podocarp forms. Aquatic forms scarce; few Leiospheres in fine fraction.
Core 12 s6567 5611ft 1710.23m P19353	APK1 - APK31 tentatively APK122 Conifer Palynofacies (C. equalis, M. evansii, M. florida)	basal Laira Formation or upper Pretty Hill Sandstone (Pretty Hill Formation)	Fluvial - Lacustrine Siltstone, dk gry	Poor	Low 0.12mL/5mL Very low	Low	Palynoflora dominated by saccate pollen remnants; <i>Alisporites</i> conspicuous. Spores scarce and restricted in diversity; <i>Osmundacidites</i> conspicuous. Algal forms notable; small thick walled leiospheres and <i>Microfosta evansii</i> notable.
Core 12 s6568 5614ft 1711.15m P19354	APK122 - APK21 possibly APK122 Conifer Palynofacies (C. equalis, M. florida, D. speciosus, C. hughesii)	basal Laira Formation or upper Pretty Hill Sandstone (Pretty Hill Formation)	Fluvial Siltstone, dk gry	Fair - poor	Moderate 0.11mL/5mL Very low	Moderate	Palynoflora dominated by bisaccate pollen; mostly <i>Alisporites</i> . Inaperturate pollen (including <i>Callialasporites</i>) conspicuous. Fern spores prominent; mostly <i>Osmundacidites</i> . Lycopod spores scarce but moderately diverse; mostly <i>Retitriletes</i> . Algal forms scarce.
Sample Gap Sawpit Sandstone 1476m Sawpit #1 "basal shale unit"							
Core 1819.1m	APK1 - APK21 ?APK122 <i>D. speciosus</i>	basal Laira Formation or upper Pretty Hill Sandstone ("basal shales unit", Pretty Hill Formation)					Not examined in this study; assemblage data from Morgan, 1988



Sample Sample number Depth Preparation Num.	Palynostratigraphic Unit Palynofacies (Index Taxa)	Inferred Lithostratigraphic Unit (Log Interpreted Unit)	Inferred Deposition Environment (Lithology)	Palynomorph			Remarks
				Preservation	Yield (Org. Yield)	Diversity	
Sample Gap							
Core 14 s6569 6398ft 1950.11m P19355	APK121 - APK21 tentatively APK12 Conifer Palynofacies (<i>C. equalis</i> , <i>M. florida</i> , <i>C. hughesii</i>)	basal Laira Formation or upper Pretty Hill Sandstone ("basal shales unit", Pretty Hill Formation)	Fluvial <i>Siltstone, dk gry</i>	Poor thin corroded	Low - moderate <i>0.15mL/5mL</i> Very low	Low	Palynoflora dominated by bisaccate pollen remnants; mostly <i>Alisporites</i> . Spores sparse and restricted in diversity; mostly <i>Cyathidites</i>
McEachern Sandstone 2072m							
Core 15 s6577 6765ft8in 2062.18m P19356	Indeterminate	Indeterminate <i>McEachern Sandstone Mbr, Pretty Hill Formation</i>	Indeterminate <i>Sandstone, silty gry, carb lam</i>	Poor	Almost nil <i>0.08mL/5mL</i> Extremely low	Almost nil	unoxidised residue only. Organic residue mostly opaque humic palynodebris. Few cuticle and saccate pollen remnants. Isolated spores; isolated spinose acritarch. The few identifiable palynomorphs may represent extremely minor contamination.
Core 15 s6586 6767ft6ins 2062.73m P19357	APK122 - APK2 probably APK122 <i>Osmundacidites - Retitriletes</i> Palynofacies (<i>D. speciosus</i> , <i>C. equalis</i> , <i>M. florida</i>)	basal Laira Formation or Pretty Hill Formation (<i>McEachern Sandstone Mbr,</i> <i>Pretty Hill Formation</i>)	Fluvial <i>Mudstone, dk gry</i>	Poor stained, some fragmented & corroded	Very low <i>0.01mL/5mL</i> Extremely low	Low	Unoxidised residue only. Sparse palynoflora dominated by fern spores; mostly <i>Osmundacidites</i> ; Lycopod spores (mostly <i>Retitriletes</i> notable. Saccate pollen conspicuous; mostly fragmented remnants. Few leiospheres in fine fraction. Morgan, 1988 records <i>C. hughesii</i> at 2063.2m <i>This is one of the few reliable dates from within the McEachern Sandstone in this region; it demonstrates that the APK122 interval extends to about the same distance above the Casterton Formation as in Sawpit #1. This suggests that the McEachern Sandstone is equivalent to the mid subunit of the "Basal Shale" of Sawpit (the thin lower subunit of the "Basal Shale" probably is included in the upper Casterton of this region.</i>



Sample Sample number Depth Preparation Num.	Palynostratigraphic Unit Palynofacies (Index Taxa)	Inferred Lithostratigraphic Unit (Log Interpreted Unit)	Inferred Deposition Environment (Lithology)	Palynomorph			Remarks
				Preservation	Yield (Org. Yield)	Diversity	
Sample Gap Casterton Formation 2225m							
Core 18 s6587 7368ft 2245.77m P19358	APJ6 - APK2 tentatively APK11 Casterton Palynofacies [<i>C. equalis</i>]	Casterton Formation (Casterton Formation)	Fluvial - lacustrine <i>Siltstone, dk gry</i>	Extremely poor diffuse, corroded stained	High 0.36mL/5mL low	Very low	Oxidised organic residue mostly diffuse corroded cuticle, saccate pollen and inaperturate pollen (and or possible leiospheres) fragments; very few identifiable. Spore remnants extremely scarce.
Core 18 s6588 7388ft 2251.86m P19359	APJ62 - APK2 tentatively APK11 Casterton Palynofacies [<i>C. equalis</i>]	Casterton Formation (Casterton Formation)	Fluvial - lacustrine <i>Mudstone, brwn blk, few leaf rem</i>	Extremely poor diffuse, corroded stained	High 0.23mL/5mL Very low	Very low	Oxidised residue dominated by diffuse corroded cuticle and inaperturate pollen fragments; saccate pollen remnants notable. Spores very scarce and restricted; mostly <i>Cyathidites</i> .
Core 18 s6589 7392ft 2253.08m P19360	APJ62 - APK2 possibly APK11 Casterton Palynofacies [? <i>C. quasihughesii</i>]	Casterton Formation (Casterton Formation)	Fluvial - Lacustrine <i>Siltstone, dk grey; few leaf rem.</i>	Extremely poor diffuse, corroded stained	High 0.21mL/5mL Very low	Very low	Oxidised residue dominated by diffuse corroded cuticle and / or inaperturate pollen fragments; very few identifiable. Spores very scarce and restricted; mostly <i>Cyathidites</i> .
Core 18?? s6570 7743ft6ins 2360.22 P19361	Mesozoic	Indeterminate (Casterton Formation)	Indeterminate <i>Siltstone, sandy, dk brwn gry,</i>	--	Almost nil 0.22mL/5mL Very low	Almost nil	Organic residue mostly opaque palynodebris. Few palynomorph remnants; almost none identifiable.



Sample Sample Number Depth Preparation Number	Palynostratigraphic Unit Palynofacies Index Species	Inferred Lithostratigraphic Unit (Log interpreted Unit)	Inferred Depositional Environment Lithology	Palynomorph			Remarks
				Preservation	Yield (Organic yield)	Diversity	
SWC 60 s6298 1035.0m P19271	APK321 Pilosisporites - Cyathidites Palynofacies [<i>P. notensis</i> , <i>P. parvispinosus</i> , <i>C. variabilis</i> , <i>F. asymmetricus</i> <i>F. wonthaggiensis lunaris</i> , <i>C. hughesii</i>]	Eumeralla Formation (Eumeralla Formation)	Fluvial Sandstone, f. grained; & Claystone, slightly carbonaceous.	Fair	High [Extremely low]	Moderate	Land plant spores and pollen dominant. Bisaccate and trisaccate pollen remnants prominent; inaperturate pollen notable. Fern spores prominent; mostly <i>Cyathidites</i> ; <i>Pilosisporites</i> notable and diverse. Lycopod spores conspicuous; mostly <i>Retitriletes</i> . Bryophyte spores notable and moderately diverse; mostly <i>Cooksonites</i> and <i>Foraminisporis</i> . Algal forms scarce.
SWC 59 s6297 1063.0m P19270	APK32 possibly APK321 Pilosisporites - Cyathidites Palynofacies [<i>P. notensis</i> , <i>P. parvispinosus</i> , <i>D. speciosus</i>]	Eumeralla Formation (Eumeralla Formation)	Fluvial lacustrine Siltstone, mid grey, carbonaceous flecks	Fair [Thin, over oxidised]	Moderate [Extremely low]	Low	Land plant spores and pollen dominant. Bisaccate pollen remnants prominent; inaperturate pollen notable. Fern spores prominent but restricted in diversity; mostly <i>Cyathidites</i> . Lycopod spores conspicuous; mostly <i>Retitriletes</i> . Leiospheres and <i>S. reticulatus</i> notable
SWC 58 s6296 1105.0m P19269	APK122 - APK3 tentatively APK3 Conifer Palynofacies [<i>C. hughesii</i> , <i>D. speciosus</i>]	Eumeralla Formation (Eumeralla Formation)	Fluvial - swamp Siltstone, brownish black; carbonaceous laminations.	Poor [thin, corroded, fragmented]	High [High]	Low	Palynoflora dominated by saccate pollen, ?inaperturate pollen and cuticle remnants (mostly unidentifiable); cheirolepidiacean pollen prominent. Spores prominent but restricted in diversity; <i>Cyathidites minor</i> , <i>Retitriletes</i> and <i>Neoraistrickia</i> conspicuous. Almost no bryophyte spores present. [The prominence of Cheirolepidiacean pollen, the scarcity of Ruffordiaspora and the absence of Pilosisporites and Foraminisporis are unusual in the Eumeralla; the association is indistinguishable from the APK122 assemblages of the mid Crayfish Sub Group]
SWC 57 s6295 1118.0m P19268	APK321 Pilosisporites - Cyathidites Palynofacies [<i>P. notensis</i> , <i>P. ingramii</i> , <i>P. parvispinosus</i> , <i>C. variabilis</i> , <i>C. hughesii</i> , <i>Crybelosporites 'burgeri'</i> <i>M. evansii</i>]	lower Eumeralla Formation (Eumeralla Formation)	Paralic lagoonal Siltstone, mid dark olive grey, carbonaceous flecks	Fair	Moderate [Extremely low]	High	Palynoflora dominated by land plant spores; diverse fern association; <i>Cyathidites</i> dominant (mostly <i>C. minor</i> but with <i>C. punctatus</i> conspicuous); <i>Osmundacidites</i> and <i>Ruffordiaspora</i> prominent; <i>Pilosisporites</i> notable. Bryophyte spores notable and relatively diverse; <i>Aequitriadites</i> and <i>Cooksonites</i> - <i>Verrucosiporites</i> conspicuous; <i>Foraminisporis</i> group and sphagnaceous forms scarce. Lycopod spores sparse but moderately diverse. Conifer pollen prominent; <i>M. antarcticus</i> conspicuous. Algal forms notable; mostly <i>Sigmopollis</i> and leiospheres; isolated <i>M. evansii</i> and spinose acritarch.



Sample Sample Number Depth Preparation Number	Palynostratigraphic Unit Palynofacies Index Species	Inferred Lithostratigraphic Unit (Log interpreted Unit)	Inferred Depositional Environment Lithology	Palynomorph			Remarks
				Preservation	Yield (Organic yield)	Diversity	
Windermere Sandstone ("basal Eumeralla Formation") 1124m							
SWC 55 1184.0m s6294 P19239	APK122 - APK31 possibly APK22 - APK31 tentatively APK22 <i>Ruffordiaspora - Cyathidites</i> Palynofacies [<i>D. speciosus, Crybelosporites berberioides, M. evansii</i>]	basal Eumeralla Formation or uppermost Laira Formation (<i>Eumeralla</i> Formation)	Fluvial Claystone, mid grey, silty	Fair - poor	Moderate [<i>Very low</i>]	Low	Restricted (?specialised) fern spore dominated palynoflora; mostly <i>Cyathidites minor</i> , <i>Osmundacidites</i> prominent; <i>Ruffordiaspora</i> notable. Bryophyte spores notable; mostly <i>Aequitiradites</i> . Fragmented saccate pollen, inaperturate pollen and corroded cuticle sheets conspicuous. Few leiospheres and <i>S. reticulatus</i>
SWC 54 1211.0m s6293 P19240	APK122 - APK31 possibly APK22 - APK31 tentatively APK22 <i>Ruffordiaspora - Cyathidites</i> Palynofacies [<i>D. speciosus, C. hughesii</i>]	basal Eumeralla Formation or uppermost Laira Formation (<i>Eumeralla</i> Formation)	Fluvial - lacustrine Siltstone, dark grey - black, argillaceous in part.	Fair to fresh	Moderate [<i>High</i>]	Low	Restricted (?specialised) fern spore dominated palynoflora; mostly <i>Cyathidites minor</i> , <i>Osmundacidites</i> conspicuous; <i>Ruffordiaspora</i> notable. Saccate and inaperturate pollen scarce. Few aquatic forms; <i>S. reticulatus</i> and leiospheres notable
Sample Gap Crayfish Sub Group (upper Laira Formation) 1212m							There is an indication of APK21 associations being preserved in Bus Swamp #1, Gordon #1, Mocambo #11 and Digby #1 which suggests that there is a hiatus within the upper Crayfish Sub Group (Laira Formation) perhaps in addition to the regional unconformity between the Eumeralla Formation and Crayfish Sub Group. This contrasts with the Penola Trough upper Crayfish section where the upper Crayfish section is truncated with the progressive loss of the APK212 and APK211 section towards the Trough margins as in Katook tp Sawpit to Robinson and possibly Heathfield to Tullich to McEachern.



Sample Number Depth Preparation Number	Palynostratigraphic Unit Polynofacies Index Species	Inferred Lithostratigraphic Unit (Log interpreted Unit)	Inferred Depositional Environment Lithology	Polynomorph			Remarks
				Preservation	Yield (Organic yield)	Diversity	
SWC 53 1275.0 s6292 P19241	APK122 - APK31 tentatively APK122 - APK21 very tentatively APK212 <i>Osmundacidites</i> Polynofacies [<i>D. speciosus</i> , <i>C. hughesii</i> , <i>M. florida</i> , ? <i>T. reticulatus</i> , <i>C. stylosus</i> , <i>M. evansii</i>]	upper Laira Formation (<i>Eumeralla</i> Formation)	Paralic coastal plain Claystone, mid lt grey; v. fine sandstone in part	Fair	Moderate [<i>Very low</i>]	Moderate	Palynoflora dominated by land plant spores. Fragmented saccate pollen prominent; mostly bisaccate but trisaccate pollen notable. Cheirolepidiacean pollen notable. Fern spores subdominant but somewhat restricted in diversity; <i>Osmundacidites</i> prominent; <i>Cyathidites</i> conspicuous; <i>Ruffordiaspora</i> present but scarce. Bryophytes scarce but moderately diverse (they become very scarce and restricted below this level). Small leiospheres conspicuous in the -20µm fraction; <i>M. evansii</i> conspicuous; few <i>S. reticulatus</i> and <i>Michhystridium</i> present. <i>This association could be representative of any part of the lower Eumeralla or Crayfish Sub Group; the notable occurrence of M. evansii and the persistence of some of the Bryophyte forms may favour APK21 perhaps supported by the somewhat equivocal specimen of T. reticulatus (the APK212 index taxon). The association is reminiscent of the APK21 of Mocambo 11 and Digby.</i>
Sample Gap Pretty Hill Formation 1328m							?Intra - Crayfish hiatus
SWC 52 1369.0m s6291 P19242	APK122 - APK22 very tentatively APK122 <i>Osmundacidites</i> Polynofacies [<i>D. speciosus</i> , <i>C. hughesii</i> , <i>F. daitii</i> <i>M. evansii</i>]	basal Laira Formation or upper Pretty Hill Formation (<i>Pretty Hill</i> Formation)	Paralic coastal plain Mudstone, mid grey, arenaceous	Fair	Moderate [<i>Extremely low</i>]	Moderate	Palynoflora dominated by spores; mostly <i>Osmundacidites</i> ; <i>Cyathidites</i> prominent; <i>C. equalis</i> and <i>L. verrucatus</i> notable; Saccate pollen remnants subdominant. Few leiospheres; few <i>M. evansii</i> ; isolated <i>S. reticulatus</i> and <i>Michhystridium</i> present.
SWC 51 1413.0m s6290 P19243	APK12 - APK2 very tentatively APK122 Lycopod Polynofacies [<i>R. australiensis</i> , <i>C. equalis</i> , <i>C. hughesii</i>]	basal Laira Formation or upper Pretty Hill Formation (<i>Pretty Hill</i> Formation)	Fluvial Mudstone, dark grey, arenaceous in part.	Very poor strongly conoiled	Very low [<i>Extremely low</i>]	Low	Sparse palynoflora of mostly spore remnants with only the more robust forms identifiable: <i>Cyathidites</i> , <i>Ceratospirites equalis</i> , <i>Leptolepidites major</i> and <i>Retitriteles</i> conspicuous. Fragmented saccate pollen remnants conspicuous.



Sample Sample Number Depth Preparation Number	Palynostratigraphic Unit Palynofacies Index Species	Inferred Lithostratigraphic Unit (Log interpreted Unit)	Inferred Depositional Environment Lithology	Palynomorph			Remarks
				Preservation	Yield (Organic yield)	Diversity	
SWC 50 1428.0m s6289 P19244	APJ2 - APK2 Cyathidites Palynofacies [<i>L. verrucatus</i>]	basal Laira Formation or upper Pretty Hill Formation (Pretty Hill Formation)	Fluvial - lacustrine Claystone, dark grey	Very poor thin, corroded	Very low [Extremely low]	Very low	Sparse palynoflora of mostly unidentifiable saccate pollen, cuticle and spore remnants. <i>Cyathidites</i> , <i>Leptolepidites verrucatus</i> and <i>Retitriletes</i> conspicuous. Small leiospheres notable
SWC 49 1482.5m s6288 P19245	APK122 - APK2 very tentatively APK122 Lycopod Palynofacies [<i>D. speciosus</i> , <i>C. equalis</i> , <i>L. belfordii</i> <i>Concavissimisporites "sparsus"</i>]	basal Laira Formation or upper Pretty Hill Formation (Pretty Hill Formation)	Fluvial Claystone, mid dark grey, arenaceous in part	Poor corroded	Moderate [Extremely low]	Moderate	Restricted palynoflora of mostly spores; <i>Cyathidites</i> and <i>Retitriletes</i> conspicuous; <i>L. belfordii</i> , <i>B. spectabilis</i> , <i>Klukisporites</i> , <i>Leptolepidites</i> and <i>Neoraistrickia</i> notable. Saccate pollen prominent; mostly unidentifiable remnants. Very few aquatic forms.
SWC 48 1510.0m s6287 P19246	APK122 - APK2 very tentatively APK122 Lycopod Palynofacies [<i>D. speciosus</i> , <i>C. hughesii</i> , <i>M. evansii</i>]	basal Laira Formation or upper Pretty Hill Formation (Pretty Hill Formation)	Fluvial - lacustrine Mudstone, mid brown grey, grading to v. fine sandstone in part	Poor	Moderate [Very low]	Moderate	Palynoflora dominated by land plant spores; mostly <i>Retitriletes</i> and <i>Osmundacidites</i> ; <i>Cyathidites</i> , <i>Leptolepidites</i> conspicuous. Bisaccate pollen prominent. Leiospheres and <i>M. evansii</i> notable
SWC 47 1536.0m s6223 P19247	APK122 - APK2 tentatively APK122 <i>Osmundacidites</i> Palynofacies [<i>D. speciosus</i> , <i>C. hughesii</i> , <i>C. equalis</i> . <i>Converrucosisporites</i> . cf <i>C. exquisitus</i> 631]	basal Laira Formation or upper Pretty Hill Formation (Pretty Hill Formation)	Fluvial Claystone, dark grey	Fair	Moderate [Low]	Low	Palynoflora dominated by land plant spore and pollen remnants. Fern spores subdominant but restricted in diversity; mostly <i>Osmundacidites</i> spp with <i>Cyathidites minor</i> , <i>C. equalis</i> and <i>L. verrucatus</i> notable. Lycopod spores notable but relatively diverse; mostly <i>Retitriletes</i> spp. Bryophytes very scarce. Almost no aquatic forms noted. Cuticle sheets prominent in oxidised residue. [Absence of <i>F. wonthaggiensis</i> not reliable in view of low Bryophyte association]
SWC 46 1549.0m s6222 P19248	Not examined		Siltstone, mid dark grey				Very low organic recovery



Sample Sample Number Depth Preparation Number	Palynostratigraphic Unit Palynofacies Index Species	Inferred Lithostratigraphic Unit (Log interpreted Unit)	Inferred Depositional Environment Lithology	Palynomorph			Remarks
				Preservation	Yield (Organic yield)	Diversity	
Sawpit Sandstone 1550m							
SWC 44 1593.25m s6221 P19249	APK1 - APK2 tentatively APK1 Conifer Palynofacies [<i>C. hughesii</i> , <i>C. stylosus</i>]	lower Laira Formation or Pretty Hill Formation (Sawpit Sandstone Mbr, Pretty Hill Formation)	Fluvial Laminite, dark grey siltstone & v. fine off white sandstone,	Poor corroded fragmented	Moderate [Low]	Low	Palynoflora dominated by inaperturate pollen and saccate pollen. Fern spores conspicuous; mostly <i>Cyathidites</i> and <i>Osmundacidites</i> . Lycopod spores notable; mostly <i>Retitriletes</i> and <i>Kekryphalospora</i> . Bryophytes scarce. Almost no aquatic forms noted.
SWC 43 1614.0m s6220 P19250	APJ6 - APK2 tentatively APK12 ? <i>Osmundacidites</i> - <i>Retitriletes</i> Palynofacies [<i>C. equalis</i> , <i>M. evansii</i> , <i>C. "hemisphericus"</i>]	lower Laira Formation or Pretty Hill Formation (Sawpit Sandstone Mbr, Pretty Hill Formation)	Fluvial Siltstone, lt - mid grey brown; v. fine sandstone in part	Poor thin corroded	Low - Moderate [Very low]	Moderate	Palynoflora mostly unidentifiable saccate pollen, inaperturate pollen and cuticle remnants. Spores restricted in diversity; <i>Osmundacidites</i> prominent; <i>Cyathidites</i> and <i>Retitriletes</i> conspicuous. Few leiospheres; isolated <i>M. evansii</i> .
Between 1614m & 1761m	Sample Gap Sawpit #1 "basal shale unit" 1736m						Sandy section; additional samples from this section unlikely to yield definitive palynomorph associations.
SWC 40 1761.0m s6219 P19251	APK122 - APK2 possibly APK122 <i>Osmundacidites</i> - <i>Retitriletes</i> Palynofacies [<i>D. filusos cloisonne</i> , <i>D. speciosus</i> , <i>C. hughesii</i> , <i>R. ludbrookine</i> , <i>M. evansii</i>]	lower Laira Formation or Pretty Hill Formation ("basal shale unit", Pretty Hill Formation)	Paralic coastal plain Siltstone, mid - mid dark grey	Poor thin corroded	Low [Very low]	Low	Palynoflora mostly unidentifiable spore, saccate pollen and cuticle remnants. Spores prominent but restricted in diversity; <i>Osmundacidites</i> and <i>Retitriletes</i> conspicuous. Algal forms scarce; isolated <i>M. evansii</i> and <i>Michystridium</i> .



Sample Sample Number Depth Preparation Number	Palynostratigraphic Unit Palynofacies Index Species	Inferred Lithostratigraphic Unit (Log interpreted Unit)	Inferred Depositional Environment Lithology	Palynomorph			Remarks
				Preservation	Yield (Organic yield)	Diversity	
SWC 39 1768.0m s6218 P19252	APJ2 - APK3 very tentatively APK1 Lycopod Palynofacies [<i>L. verrucatus</i> ,]	lower Laira Formation or Pretty Hill Formation ("basal shale unit", Pretty Hill Formation)	Lacustrine Claystone, mid grey	Very poor	Very low [Extremely low]	Very low	Sparse restricted palynoflora of mostly unidentifiable fragmented saccate pollen and cuticle remnants. Spore fragments subdominant; <i>Cyathidites</i> and <i>Retitriletes</i> conspicuous. Algal forms notable; mostly leiospheres.
SWC 38 1810.0m s6217 P19253	Not examined	(Pretty Hill Sandstone)	Mudstone, mid greenish grey, sandstone in part; calcite veins				Very low organic recovery
SWC 36 1882.0m s6216 P19254	APK1 - APK2 possibly APK12 <i>Osmundacidites</i> Palynofacies [<i>C. equalis</i> , <i>C. hughesii</i>]	lower Laira Formation or Pretty Hill Formation ("basal shale unit", Pretty Hill Formation)	Paralic lagoonal Siltstone, mid - dark grey.	Very poor	Low [Extremely low]	Low	Palynoflora mostly unidentifiable saccate pollen and cuticle remnants; inaperturate pollen notable. Spores fragments subdominant but restricted in diversity; <i>Osmundacidites</i> conspicuous. Leiospheres notable, few <i>Michrystidium</i> .
Sample Gap McEachern Sandstone 1900m Casterton Formation 2118m							Sandy section; additional samples from this section unlikely to yield definitive palynomorph associations.
SWC27 2126.0m s6211 P19255	APK1 very tentatively APK11 Casterton Palynofacies [<i>C. 'quasi-hughesii'</i> , ? <i>R. 'backhousei'</i>]	Casterton Formation (Casterton Formation)	Fluvial Siltstone, dark grey	Very poor diffuse, corroded & fragmented	Moderate [Very low]	Very low	Palynoflora of mostly corroded and fragmented inaperturate pollen remnants (often difficult to distinguish from the abundant very fragmented and corroded cuticle remnants); very few forms could be identified; few recognisable saccate pollen. Spores scarce and very restricted in diversity. Few aquatic algal spores; almost entirely leiospheres.



Sample Number Depth Preparation Number	Palynostratigraphic Unit Polynofacies Index Species	Inferred Lithostratigraphic Unit (Log interpreted Unit)	Inferred Depositional Environment Lithology	Palynomorph			Remarks
				Preservation	Yield (Organic yield)	Diversity	
SWC 26 2128.6m s6210 P19256	APJ62 - APK2 very tentatively APK11 Casterton aquatic polynofacies [<i>C. equalis</i>]	Casterton Formation (Casterton Formation)	Lacustrine Siltstone, mid dark grey brown	Pollen: very poor diffuse, corroded & fragmented Acritarchs: fair - fresh.	High [Low]	Very low	Palynoflora of mostly strongly corroded inaperturate pollen fragments (mostly difficult to distinguish from the abundant very fragmented and corroded cuticle remnants); very few forms could be identified. Few recognisable saccate pollen. Aquatic algal spores subdominant to co dominant; almost entirely thin and moderately thick walled leiospheres. Spores very scarce and extremely restricted in diversity.
SWC 25 2160.0m s6209 P19257	APJ62 - APK2 very tentatively APK11 Casterton Polynofacies [<i>C. equalis</i>]	Casterton Formation (Casterton Formation)	Fluvial Siltstone, mid grey brown; v. fine sandstone in part	Extremely poor diffuse, corroded & fragmented	Moderate [Low]	Very low	Palynoflora mostly strongly corroded thin inaperturate pollen, ?saccate pollen and cuticle fragments; few forms could be recognised. Spores extremely scarce and restricted in diversity. Isolated algal spores present.
SWC 20 2205.0m s6208 P19258	APJ62 - APK2 very tentatively APK11 Casterton Polynofacies [<i>C. equalis</i>]	Casterton Formation (Casterton Formation)	Lacustrine Siltstone, light mid brownish grey; off white sandstone laminations	Pollen: extrm. poor diffuse, corroded & fragmented Algae: fair	Moderate [Moderate]	Very low	Palynoflora mostly strongly corroded thin inaperturate pollen remnants together with cuticle fragments; very few forms could be identified; few recognisable saccate pollen. Spores very scarce and restricted in diversity. Algal spores conspicuous; mostly thin walled and small leiospheres.
SWC 19 2215.0m s6191 P19259	APJ6 - APK2 very tentatively APK11 Casterton polynofacies	Casterton Formation (Casterton Formation)	Fluvial Siltstone, mid brown; fine sandstone in part.	Extremely poor diffuse, corroded & fragmented	Moderate [Moderate]	Extremely low	Palynoflora mostly strongly corroded thin inaperturate pollen remnants and cuticle fragments; very few forms could be identified; few recognisable saccate pollen. Spores extremely scarce and restricted in diversity. Few algal spores (mostly leiospheres) present.
SWC 18 2235.0m s6190 P19260	APJ62 - APK2 very tentatively APK11 Casterton Polynofacies [<i>C. equalis</i>]	Casterton Formation (Casterton Formation)	Fluvial Siltstone, dark brown black, claystone in part	Very poor diffuse, corroded & fragmented	High [Moderate]	Low	Palynoflora dominated by corroded inaperturate pollen remnants and cuticle fragments; few recognisable saccate pollen. Spores sparse and restricted in diversity; <i>Osmundacidites</i> and <i>Ceratosporites equalis</i> notable; <i>Contignisporites cooksoniae</i> represented by several specimens. Algal spores very rare; mostly leiospheres.



Sample Sample Number Depth Preparation Number	Palynostratigraphic Unit Palynofacies Index Species	Inferred Lithostratigraphic Unit (Log interpreted Unit)	Inferred Depositional Environment Lithology	Palynomorph			Remarks
				Preservation	Yield (Organic yield)	Diversity	
SWC 17 2270.0m s6189 P19261	APJ62 - APK2 very tentatively APK11 Casterton Palynofacies [<i>C. equalis</i> , <i>C. glebulentus</i>]	Casterton Formation (Casterton Formation)	Fluvial Siltstone, dark brown black, claystone in part	Very poor diffuse, corroded & fragmented	Moderate [Moderate]	Very low	Palynoflora dominated by thin corroded inaperturate pollen remnants and cuticle fragments; few recognisable saccate pollen; pollen and cuticle remnants often difficult to distinguish. Spores very sparse and restricted in diversity; <i>Osmundacidites</i> and <i>Cyathidites</i> notable. Algal spores extremely rare; mostly leiospheres.
SWC 16 2295.5m s6188 P19262	APK1 tentatively APK11 <i>Retitriletes</i> Palynofacies [<i>C. equalis</i> , <i>R. purbeckensis</i>]	Casterton Formation (Casterton Formation)	Fluvial Siltstone, mid dark brown	Very poor corroded fragmented	Low [Low]	Very low	Sparse palynoflora of mostly unidentifiable remnants. Land plant spores dominant; Lycopods (mostly <i>Retitriletes</i> and <i>Kekryphalospora</i>) prominent and moderately diverse. Few recognisable inaperturate or saccate pollen. Few possible algal spores.
SWC 15 2325.0m s6187 P19263	APK1 tentatively APK11 Casterton Palynofacies [<i>R. australiensis</i> , <i>C. equalis</i>]	Casterton Formation (Casterton Formation)	Fluvial Siltstone, mid dark brown, carbonaceous	Very poor diffuse, stained corroded & fragmented	Moderate [Moderate]	Very low	Palynoflora dominated by thin strongly corroded ?inaperturate pollen remnants and cuticle fragments; few recognisable saccate pollen; pollen and cuticle remnants often difficult to distinguish. Spores very sparse and restricted in diversity; <i>Retitriletes</i> and <i>Kekryphalospora</i> notable. Algal spores extremely rare; mostly leiospheres.
SWC 14 2337.5m s6186 P19264	APJ62 - APK1 tentatively APK11 Casterton Palynofacies [<i>C. equalis</i>]	Casterton Formation (Casterton Formation)	Lacustrine Siltstone mid dark brown, carbonaceous	Ext poor diffuse, stained corroded & fragmented	Very high [Very high]	Extremely low	Palynoflora consists almost entirely of thin strongly corroded inaperturate pollen, thin ?leiospheres and cuticle tissue fragments; few forms could be identified. Some humic staining but less than the section 2295 - 2325m. Land plant spores extremely scarce.



Sample Number Depth Preparation Number	Palynostratigraphic Unit Polynofacies Index Species	Inferred Lithostratigraphic Unit (Log interpreted Unit)	Inferred Depositional Environment	Polynomorph			Remarks
				Preservation	Yield (Organic yield)	Diversity	
SWC 48 449.2m P18659	APK4 - APK5 probably APK4 <i>Pilosporites</i> - <i>Cyathidites</i> Polynofacies [<i>C. striatus</i> , <i>C. hughesii</i> , <i>P. parvispinosus</i> , <i>P. notensis</i> <i>D. speciosus</i> , <i>F. asymmetricus</i>]	mid Eumeralla Formation (mid Eumeralla Formation)	Fluvial, coastal plain. lagoonal.	Fair	High	High	A rich palynoflora with a dominance of ferns (<i>Cyathidites</i> , <i>Ruffordiaspora</i> and <i>Osmundacidites</i> prominent); liverworts notable and diverse (<i>Foraminisporis</i> and <i>Aequitriradites</i>); conifers prominent (mostly Podocarps). Algal forms conspicuous and moderately diverse (leiospheres and <i>Sigmopollis</i> notable). [The co occurrence <i>C. hughesii</i> and <i>C. striatus</i> is not regarded as being typical of the Otway Basin but occurs in the Eromanga Basin]
Sample Gap							
SWC 47 735.6m P18660	APK3 - APK4 probably APK4 <i>Ruffordiaspora</i> - <i>Cyathidites</i> Polynofacies [<i>P. notensis</i> , <i>P. 'mikrobaculata'</i> , <i>C. hughesii</i> , <i>C. striatus</i> , <i>C. berberioides</i>]	mid Eumeralla Formation (mid Eumeralla Formation)	Fluvial; coastal plain.	Poor corroded, some thin	Low	Moderate	Palynoflora dominated by ferns (mostly <i>Cyathidites</i> ; <i>Ruffordiaspora</i> notable <i>Pilosporites</i> scarce and restricted diversity); lycopods prominent (<i>Retitriteles</i> conspicuous, <i>Dictyotosporites</i> notable and diverse.); Conifers sparse. Few algae (mostly <i>Sigmopollis</i> and leiospheres). [There is a slight possibility that <i>C. striatus</i> is contamination as its preservation is a little better (fresher) than most of the other palynoflora elements; however, this taxon does take up stain differently to other spore taxa].
Sample Gap							
SWC 43 1096.8m P18661	APK31 - APK321 probably upper APK321 <i>Pilosporites</i> - Conifer Polynofacies [<i>F. asymmetricus</i> , <i>F. wonthaggiensis</i> "lunaris" <i>P. notensis</i> , <i>?P. parvispinosus</i> , <i>C. variabilis</i> , <i>M. Evansii</i>]	lower Eumeralla Formation (lower Eumeralla Formation)	Fluvial; coastal plain.	Poor corroded, some thin	Low	Moderate	Palynoflora dominated by saccate and inaperturate (Conifer) pollen remnants; <i>Corollina</i> notable. Spores prominent; mostly ferns (<i>Cyathidites</i> and <i>Osmundacidites</i>); <i>Pilosporites</i> scarce and restricted in diversity. <i>Ruffordiaspora</i> present. Lycopods and bryophytes subordinate but relatively diverse. Few leiospheres; <i>M. Evansii</i> notable.
Sample Gap							



Sample Sample Number Depth Preparation Number	Palynostratigraphic Unit Palynofacies Index Species	Inferred Lithostratigraphic Unit (Log interpreted Unit)	Inferred Depositional Environment	Palynomorph			Remarks
				Preservation	Yield (Organic yield)	Diversity	
SWC 42 1220.8m P18662	APK22 - APK321 tentatively APK31 <i>Osmundacidites - Retitriletes</i> Palynofacies [<i>C. variabilis</i> , <i>P. notensis</i> , ? <i>P. "rotundus"</i> , <i>T. reticulatus</i> , <i>M. evansii</i>]	basal Eumeralla Formation (<i>Eumeralla Formation</i>)	Fluvial; coastal plain.	Very poor corroded, some thin fragmented	Low	Low	Polynoflora restricted in diversity. Fern dominated (mostly <i>Osmundacidites</i>) polynoflora. <i>Ruffordiaspora</i> and <i>Pilosisporites</i> present but scarce. Lycopods and Bryophytes scarce but moderately diverse. Conifer pollen scarce; mostly inaperturate pollen. Algae notable; mostly <i>Sigmopollis</i> and leiospheres together with an isolated small spinose acritarch and <i>M. evansii</i> . [There are a couple of <i>Pilosisporites</i> specimens; given that they seem scarce in the overlying section in Digby and there is no other evidence of contamination they are considered endemic]
Windermere Sandstone ("basal Eumeralla") 1304m							
SWC 41 1318.1m P18663	APK212 - APK321 probably APK22 - APK31 tentatively APK31 <i>Osmundacidites - Retitriletes</i> Palynofacies [<i>T. reticulatus</i> , <i>F. wonthaggiensis</i> , <i>M. evansii</i>]	basal Eumeralla Formation (<i>basal Eumeralla Formation</i>)	Fluvial; coastal plain.	Poor	Moderate	Low	Fern dominated (mostly <i>Osmundacidites</i>) polynoflora; <i>Ruffordiaspora</i> present but scarce. Lycopods scarce but moderately diverse. Bryophyte spores sparse. Conifer pollen scarce; mostly inaperturate pollen. Few algae; mostly <i>Sigmopollis</i> and leiospheres together with an isolated spinose acritarch and few <i>M. evansii</i> . <i>This associations is similar to that at SWC53 1275m in Gordon #1 assigned to APP21. Its placement in Digby into APK22 reflects its position above a Cyathidites dominated palynoflora. Similar broadly resolved APK21 - APK31 associations from Mocambo #11 have been placed into APK22 because of their position relative to the deepest P. notensis.</i>
SWC 39 1364.4m P18664	APK2 - APK3 tentatively APK22 ? <i>Ruffordiaspora - Cyathidites</i> Palynofacies [<i>C. hughesii</i> , <i>D. speciosus</i> , <i>R. australiensis</i> , <i>R. ludbrookiae</i> <i>F. wonthaggiensis</i>]	basal Eumeralla Formation or uppermost Laira Formation (<i>basal Eumeralla Formation</i>)	Fluvial, overbank.	Fair	High	Low	Polynoflora dominated by a single fern species (<i>Cyathidites minor</i>); <i>Osmundacidites</i> conspicuous; <i>Ruffordiaspora</i> present but scarce; few other fern spores represented. Lycopods notable and diverse. Few Bryophytes, conifers or aquatic forms. [The association is reminiscent of the <i>Ruffordiaspora - Cyathidites</i> Palynofacies of Gordon and Mocambo #11 but the proportion of <i>Ruffordiaspora</i> perhaps is a little low perhaps being overwhelmed by <i>Cyathidites</i>]
Crayfish Sub Group (?upper Laira Formation) 1398m							
<p><i>There is an indication of APK21 associations being preserved in Bus Swamp #1, Gordon #1, Mocambo #11 and Digby #1 which suggests that there is a hiatus within the upper Crayfish Sub Group (Laira Formation) perhaps in addition to the regional unconformity between the Eumeralla Formation and Crayfish Sub Group. This contrasts with the Penola Trough upper Crayfish section where the upper Crayfish section is truncated with the progressive loss of the APK212 and APK211 section towards the Trough margins as in Katnook tp Sawpit to Robinson and possibly Heathfield to Tullich to McEachern.</i></p>							



Sample Sample Number Depth Preparation Number	Palynostratigraphic Unit Palynofacies Index Species	Inferred Lithostratigraphic Unit (Log interpreted Unit)	Inferred Depositional Environment	Polynomorph			Remarks
				Preservation	Yield (Organic yield)	Diversity	
SWC 37 1445.2m P18665	APK122 - APK2 possibly APK21 <i>Osmundacidites - Retitriteles</i> Palynofacies [<i>C. hughesii</i> , <i>D. filusus</i> , <i>C. stylosus</i> , <i>M. evansii</i>]	Laira Formation (Laira Formation)	Fluvial; coastal plain.	Very poor	Low	Low	A sparse fern dominated (mostly <i>Osmundacidites</i> and <i>Cyathidites</i>) palynoflora. Lycopods scarce but moderately diverse. Bryophyte spores sparse. Conifer pollen scarce. Few algae; mostly <i>Sigmopollis</i> and leiospheres together with an isolated spinose acritarch and <i>M. evansii</i> . Some contamination evident.
SWC 36 1457.5m P18666	APK2 probably APK21 <i>Osmundacidites - Retitriteles</i> Palynofacies [<i>F. wonthaggiensis</i> , <i>D. speciosus</i> , <i>D. filusus</i> , <i>M. florida</i> , <i>M. evansii</i>]	Laira Formation (Laira Formation)	Fluvial; coastal plain.	Fair (?carbonised)	High	Moderate	A balanced palynoflora with a dominance and diversity of cryptogams, prominent gymnosperm pollen and a subordinate but relatively diverse fresh to brackish water algal association. Spores dominated by ferns (<i>Cyathidites</i> and <i>Osmundacidites</i>); lycopods <i>Retitriteles</i> , <i>Kekryphalospora</i> and <i>Dictyosporites</i>) prominent and diverse; liverworts notable but relatively diverse. Gymnosperms dominated by Podocarps with Cheirolepidiacean forms notable. Algal association dominated by leiospheres with <i>Microfosta evansii</i> notable.
SWC 30 1506.2m P18667	APK122 - APK2 tentatively APK21 Conifer Palynofacies [<i>D. speciosus</i>]	Laira Formation (Laira Formation)	Fluvial; coastal plain.	Fair - poor	Very low	Low	A sparse but relatively diverse palynoflora. Saccate and inaperturate pollen remnants dominant. Spores prominent and moderately diverse; Ferns (<i>Cyathidites</i>) lycopods (<i>Retitriteles</i>) and liverworts (<i>Aequitriradites</i> , <i>Januasporites</i>) notable. A very sparse leiosphere - algal association.
SWC 29 1536.4m P18668	APK21 probably APK21 very tentatively APK212 <i>Osmundacidites</i> Palynofacies [<i>F. wonthaggiensis</i> , <i>D. speciosus</i> , <i>D. filusus</i> , <i>M. florida</i> , <i>M. evansii</i>]	Laira Formation (Laira Formation)	Fluvial, coastal plain.	Fair	Moderate	Moderate	Diverse spore dominated assemblage. <i>Osmundacidites</i> dominate; <i>Cyathidites</i> and bisaccate pollen prominent; Lycopod spores (<i>Retitriteles</i> , <i>Kekryphalospora</i> and <i>Dictyosporites</i>) prominent and diverse. Bryophytes notable; mostly <i>Aequitriradites</i> . Sparse leiosphere - algal association; <i>M. evansii</i> present.
		??? Intra Crayfish Hiatus????					The Thinness of the APK21 section (in relation to Katook and possibly Heathfield) and its proximity to the APK122 Pretty Hill Formation (particularly the McEachern Sandstone) and Casterton Formation suggests that there is a hiatus within the Crayfish Sub Group accounting for the lower Laira Shale (APK211 and APK122 part) and upper Pretty Hill Formation.



Sample Sample Number Depth Preparation Number	Palynostratigraphic Unit Polynofacies Index Species	Inferred Lithostratigraphic Unit (Log interpreted Unit)	Inferred Depositional Environment	Polynomorph			Remarks
				Preservation	Yield (Organic yield)	Diversity	
SWC 27 1591m P18669	APK121 - APK21 very tentatively APK12 <i>Osmundacidites - Retitriletes</i> Polynofacies [<i>C. equalis</i> , <i>C. hughesii</i>]	basal Laira Formation or upper Pretty Hill Formation (<i>Laira Formation</i>)	Fluvial, overbank.	Fair - poor carbonised	Low	Very low	Spore dominated palynoflora including a prominence of relative few taxa; <i>Cyathidites</i> , <i>Osmundacidites</i> , <i>Neoraistrickia coalita</i> <i>Ceratosporites equalis</i> and <i>Retitriletes nodosus</i> common. Bryophytes very scarce; Bryophyte spores become very scarce from this level and down to TD. Bisaccate pollen prominent but very restricted in diversity; mostly <i>Alisporites lowoodensis</i> . Isolated leiospheres present. Some contamination noted
Sample Gap Pretty Hill Formation 1598m McEachern Sandstone 1701m							
SWC 24 1837.0m P18670	APJ62 - APK3 tentatively APK1 [<i>C. equalis</i>]	Indeterminate	Peat Bog or Dystrophic Swamp.	Fair	Almost nil	Almost nil	An extremely scant palynoflora comprising mud borne contamination.
Casterton Formation 1960m							
SWC 22 1903.2m P18671	APJ62 - APK4 tentatively APK1 "Casterton" lagoonal polynofacies [<i>C. equalis</i> , <i>R. watheroensis</i> , <i>M. antarcticus</i>]	Casterton Formation (<i>Casterton Formation</i>)	Coastal lagoon or lacustrine.	Very poor	Low	Very low	Sparse palynoflora of mostly poorly preserved ?leiosphere and inaperturate pollen remnants. Few recognisable spores; <i>Osmundacidites</i> , <i>Cyathidites</i> and <i>Ceratosporites equalis</i> notable. Common diffuse tissue (?algal or inaperturate pollen remnants).



Sample Sample Number Depth Preparation Number	Palynostratigraphic Unit Polynofacies Index Species	Inferred Lithostratigraphic Unit (Log interpreted Unit)	Inferred Depositional Environment Lithology	Palynomorph			Remarks
				Preservation	Yield (Organic yield)	Diversity	
Core 9.8 - 12.8m	APK5 Top <i>C. paradoxa</i>	Eumeralla Formation					Not examined in this study; assemblage data form Morgan, 1991
Core 25.9m - 28.8m	APK52 Base <i>P. grandis</i>	Eumeralla Formation					Not examined in this study; assemblage data form Morgan, 1991
Core 96.7m - 103.0m	APK5 ?APK51 Base <i>C. paradoxa</i>	Eumeralla Formation					Not examined in this study; assemblage data form Morgan, 1991 <i>C. paradoxa</i> is recorded from lower in the section but is considered to be contamination.
Core 360m	APK4 Base <i>C. striatus</i>	Eumeralla Formation					Not examined in this study; assemblage data form Morgan, 1991
SWC 550	APK32 ?APK321 Top <i>F. wonthaggiensis "lunaris"</i>	Eumeralla Formation					Not examined in this study; assemblage data form Morgan, 1991
Core 705.1m - 706.3m	APK32 ?APK321 Base <i>F. wonthaggiensis "lunaris"</i>	Eumeralla Formation					Not examined in this study; assemblage data form Morgan, 1991
Core 777.8m - 778.0m	APK32 APK321 <i>P. parvispinosus</i>	Eumeralla Formation					Not examined in this study; assemblage data form Morgan, 1991



Sample Sample Number Depth Preparation Number	Palynostratigraphic Unit Polynofacies Index Species	Inferred Lithostratigraphic Unit (Log interpreted Unit)	Inferred Depositional Environment Lithology	Palynomorph			Remarks
				Preservation	Yield (Organic yield)	Diversity	
FHC16 s6584 779.0m P19375	APK122 - APK3 possibly APK3 <i>Ruffordiaspora</i> - <i>Cyathidites</i> Polynofacies [<i>R. australiensis</i> , <i>D. filosus</i>]	Eumeralla Formation (lower Eumeralla Formation)	Fluvial <i>Siltstone, gm gry</i>	Poor corroded	Very low <i>0.1mL/5mL</i> Extremely low	Very low	Unoxidised residue only Sparse restricted palynoflora dominated by spores remnants. Fern spores prominent; mostly <i>Cyathidites</i> and <i>Ruffordiaspora australiensis</i> . Lycopod spores notable; mostly <i>Retitriletes</i> . Saccate pollen remnants subdominant; few fragments identifiable.
FHC16 s6585 782.3m P19376	APK321 probably lower APK321 <i>Pilosporites</i> - <i>Cyathidites</i> Polynofacies [<i>P. notensis</i> , <i>P. parvispinosus</i> , <i>P. ingramii</i> , <i>P. "neograndis"</i> , <i>C. variabilis</i> , <i>F. wonthaggiensis</i> , <i>C. hughesii</i> , <i>C. stylosus</i>]	lower Eumeralla Formation (Lower Eumeralla Formation)	Fluvial - lacustrine <i>Siltstone, lt olv gry,</i> <i>mottled</i>	Good	High <i>0.1mL/5mL</i> Extremely low	High	Palynoflora dominated by fern spores; mostly <i>Cyathidites</i> ; <i>Osmundacidites</i> notable <i>Pilosporites</i> conspicuous and diverse. Bryophyte spores notable; mostly <i>Aequitriradites</i> , <i>C. variabilis</i> and <i>F. wonthaggiensis</i> . Saccate pollen conspicuous. Cheirolepidiacean pollen notable. Algal forms notable; mostly leiospheres and <i>S. reticulata</i> .
FHC18 s6594 814.5m P19377	APK22 - APK321 possibly lower APK321 <i>Pilosporites</i> - <i>Cyathidites</i> Polynofacies [<i>P. notensis</i> , <i>P. ingramii</i> , <i>P. "neograndis"</i> , <i>C. variabilis</i> , <i>F. wonthaggiensis</i> , <i>C. hughesii</i> , <i>C. stylosus</i> , <i>M. evansii</i>]	lower Eumeralla Formation (Lower Eumeralla Formation)	Fluvial <i>Siltstone, lt gry, pyrite vein</i>	Fair	High <i>0.1mL/5mL</i> Extremely low	High	Palynoflora dominated by fern spores; mostly <i>Cyathidites</i> ; <i>Osmundacidites</i> notable <i>Pilosporites</i> notable and moderately diverse. Bryophyte spores scarce; <i>V. "pseudoasymmetricus"</i> and <i>Januasporites</i> notable. Lycopod spores scarce. Saccate pollen conspicuous; <i>Alisporites</i> notable. Cheirolepidiacean pollen notable. Algal forms scarce.
FHC18 s6595 816.8m P19378	APK321 probably lower APK321 <i>Pilosporites</i> - <i>Osmundacidites</i> - Polynofacies [<i>P. notensis</i> , <i>P. parvispinosus</i> , <i>P. ingramii</i> , <i>P. "neograndis"</i> , <i>C. hughesii</i> , <i>C. stylosus</i>]	lower Eumeralla Formation (Lower Eumeralla Formation)	Fluvial <i>Siltstone, lt gry</i>	Fair	High <i>0.1mL/5mL</i> Extremely low	Moderate	Palynoflora dominated by fern spores; mostly <i>Cyathidites</i> and <i>Osmundacidites</i> . <i>Pilosporites</i> and <i>Ruffordiaspora</i> notable. Saccate pollen scarce; Bryophyte spores scarce and restricted in diversity. Lycopod spores scarce but moderately diverse. Few algal forms



Sample Sample Number Depth Preparation Number	Palynostratigraphic Unit Polynofacies Index Species	Inferred Lithostratigraphic Unit (Log interpreted Unit)	Inferred Depositional Environment Lithology	Polynomorph			Remarks
				Preservation	Yield (Organic yield)	Diversity	
FHC19 s6596 832.6m P19379	APK31 - lower APK321 possibly APK31 <i>Pilosisporites - Osmundacidites</i> Polynofacies [<i>P. notensis</i> , <i>P. ingramii</i> , <i>P. "neograndis"</i> , <i>F. wonthaggiensis</i> , <i>F. asymmetricus</i> , <i>C. hughesii</i> , <i>C. variabilis</i> , <i>C. stylosus</i>]	lower Eumeralla Formation (Lower Eumeralla Formation)	Fluvial - lacustrine <i>Siltstone, lt gry</i>	Fair	High <i>0.2mL/5mL</i> Very low	High	Polynoflora dominated by fern spores; mostly <i>Cyathidites</i> and <i>Osmundacidites</i> . <i>Pilosisporites</i> and <i>Ruffordiaspora</i> notable. Bryophyte spores conspicuous and moderately diverse; <i>Foraminisporis</i> notable. Lycopod spores scarce but moderately diverse. Conifer pollen remnants conspicuous but poorly preserved; large bisaccate pollen notable. Algal spores conspicuous; <i>Microfosta evansii</i> notable
FHC19 s6597 833.3m P19380	APK22 - lower APK321 probably APK31 <i>Pilosisporites - Osmundacidites</i> Polynofacies [<i>P. notensis</i> , <i>P. ingramii</i> , <i>P. "neograndis"</i> , <i>F. wonthaggiensis</i> , <i>C. hughesii</i> ,]	lower Eumeralla Formation (Lower Eumeralla Formation)	Fluvial <i>Siltstone, lt gm gry</i>	Fair	Moderate <i>0.1mL/5mL</i> Extremely low	Moderate	Polynoflora dominated by fern spores; mostly <i>Cyathidites</i> and <i>Osmundacidites</i> . <i>Pilosisporites</i> and <i>Ruffordiaspora</i> notable. Bryophyte spores notable; <i>Foraminisporis wonthaggiensis</i> notable. Lycopod spores scarce. Conifer pollen remnants prominent but poorly preserved; large bisaccate pollen notable. Algal spores scarce; Isolated <i>Microfosta evansii</i> .
FHC20 s6598 852.3m P19381	APK2 - APK321 possibly APK31 <i>Ruffordiaspora - Cyathidites</i> Polynofacies [<i>F. wonthaggiensis</i> , <i>D. speciosus</i> , <i>C. hughesii</i>]	lower Eumeralla Formation (Lower Eumeralla Formation)	Fluvial <i>Siltstone, lt gry, carb lam,</i>	Fair	Moderate <i>0.19mL/5mL</i> Very low	Low - moderate	Polynoflora dominated by fern spores; mostly <i>Cyathidites</i> ; <i>Osmundacidites</i> conspicuous; <i>Ruffordiaspora</i> notable. Bryophyte spores notable; <i>Foraminisporis wonthaggiensis</i> notable. Lycopod spores scarce and restricted in diversity. Conifer pollen remnants conspicuous but poorly preserved; large bisaccate pollen notable. Algal spores scarce; mostly leiospheres note change in organic facies relative to overlying section
FHC21 s6599 869.5m P19382	APK31 - APK321 probably APK31 <i>Ruffordiaspora - Osmundacidites</i> Polynofacies [<i>F. wonthaggiensis</i> , <i>F. asymmetricus</i> , <i>C. hughesii</i> , <i>D. speciosus</i>]	lower Eumeralla Formation (Lower Eumeralla Formation)	Fluvial - lacustrine <i>Siltstone, lt gry</i>	Fair	Moderate <i>0.19mL/5mL</i> Very low	High	Polynoflora dominated by land plant spores; Conifer pollen subdominant. Fern spores prominent; mostly <i>Osmundacidites</i> and <i>Cyathidites</i> ; <i>L. verrucatus</i> conspicuous; <i>Ruffordiaspora</i> notable. (<i>Pilosisporites</i> could be found despite an extensive search of additional material). Lycopod spores conspicuous; mostly <i>Retitriteles</i> ; <i>C. equalis</i> and <i>D. speciosus</i> conspicuous. Bryophyte spores scarce. Algal spores notable; mostly <i>S. reticulatus</i> (in unoxidised and > 80µ fraction) and leiospheres (in < 20µ fraction)
FHC21 s6600 870.6m P19383	Indeterminate	Indeterminate	Indeterminate <i>Siltstone, lt gm gry</i>	—	Almost nil <i>0.04mL/5mL</i> Extremely low	Almost nil	Unoxidised residue only; Extremely low organic recovery consisting mostly of fine (?fusinitic) opaque palynodebris; minor highly corroded cuticle sheets; few spore remnants.



Sample Sample Number Depth Preparation Number	Palynostratigraphic Unit Palynofacies Index Species	Inferred Lithostratigraphic Unit (Log interpreted Unit)	Inferred Depositional Environment Lithology	Palynomorph			Remarks
				Preservation	Yield (Organic yield)	Diversity	
Core 905.9m	APK22 - APK31 ?APK22 <i>P. notensis</i>	basal Eumeralla Formation or uppermost Laira Formation					Not examined in this study; assemblage data from Morgan, 1991
FHC22 s6601 906.55m P19384	APK212 - APK31 tentatively APK22 <i>Ruffordiaspora - Cyathidites</i> Palynofacies [<i>F. wonthaggiensis</i> , <i>D. speciosus</i> , <i>R. ludbrookiae</i> , <i>C. "burgeri"</i> , <i>T. reticulatus</i> , <i>M. evansii</i>]	basal Eumeralla Formation or uppermost Laira Formation (<i>Eumeralla Formation</i>)	Fluvial <i>Siltstone, lt gry</i>	Good - fair	High <i>0.04mL/5mL</i> <i>Extremely low</i>	High	Palynoflora dominated by fern spores; mostly <i>Cyathidites</i> ; <i>Osmundacidites</i> conspicuous; <i>Ruffordiaspora</i> and <i>Cicatricosisporites "burgeri"</i> notable. (Neither <i>Pilosporites</i> nor <i>F. asymmetricus</i> could be found despite an extensive search of additional material). Inaperturate and saccate conifer pollen subdominant. Lycopod spore notable but somewhat restricted in diversity; <i>C. equalis</i> notable. Bryophyte spores notable; <i>T. reticulatus</i> notable. Few algal forms; isolated <i>M. evansii</i> . [This association is reminiscent of the association at 1184m and 1211m in Gordon #1 and 1364m in Digby #1] [Morgan, 1991 records <i>P. notensis</i> in Core 905.9m and SWC 965m]
Windermere Sandstone ("basal Eumeralla") 910m							<i>The section between 832m and 943m is equivalent to the APK22 - APK31 interval in Gordon #1.</i>
FHC23 s6610 942.7m P19385	APK2 - APK31 very tentatively APK22 <i>Osmundacidites - Retitriletes</i> Palynofacies [<i>F. wonthaggiensis</i> , <i>C. hughesii</i> , <i>M. evansii</i> , <i>C. berberoides</i> , <i>C. stylosus</i> , <i>D. speciosus</i>]	basal Eumeralla Formation or uppermost Laira Formation (<i>basal Eumeralla Formation</i>)	Fluvial - lacustrine <i>Siltstone, lt gry</i>	Fair - good	High <i>0.05mL/5mL</i> <i>Extremely low</i>	Moderate	Palynoflora dominated by fern spores; mostly <i>Cyathidites</i> and <i>Osmundacidites</i> ; <i>Ruffordiaspora</i> present but relative rare. (Neither <i>Pilosporites</i> nor <i>F. asymmetricus</i> could be found despite an extensive search of additional material). Conifer bisaccate and trisaccate pollen subdominant. Lycopod spores prominent; <i>C. equalis</i> and <i>Retitriletes</i> conspicuous. Bryophyte spores scarce. Algal spores notable; <i>M. evansii</i> notable (in unoxidised residue) [Morgan, 1991 records <i>P. notensis</i> in Core 905.9m and SWC 965m]
FHC23 s6611 943.0m P19386	APK122 - APK31 very tentatively APK22 <i>Osmundacidites - Retitriletes</i> Palynofacies [<i>C. hughesii</i> , <i>D. speciosus</i> , <i>R. ludbrookiae</i>]	basal Eumeralla Formation or uppermost Laira Formation (<i>basal Eumeralla Formation</i>)	Fluvial - lacustrine; Paralic <i>Siltstone, lt gry</i>	Fair - good	High <i>0.07mL/5mL</i> <i>Extremely low</i>	Moderate	Palynoflora dominated by fern spores; mostly <i>Osmundacidites</i> ; <i>Cyathidites</i> prominent; <i>Ruffordiaspora</i> spp present but scarce. (Neither <i>Pilosporites</i> nor <i>F. asymmetricus</i> could be found despite an extensive search of additional material). Conifer bisaccate and trisaccate pollen subdominant. Lycopod spores prominent; <i>C. equalis</i> and <i>Retitriletes</i> conspicuous. Bryophyte spores scarce. Algal spores notable; <i>M. evansii</i> notable; isolated spinose acritarch. [Morgan, 1991 records <i>P. notensis</i> in Core 905.9m and SWC 965m] <i>The Mocamboro Core 23 associations are similar to that at SWC53 1275m in Gordon #1 assigned to APP21. The placement of the Mocamboro associations into APK22 reflects the presence of P. notensis in SWC 965m. The equivalent association in Digby #1 (SWC 41 1318.1) is also assigned to APK22; the Digby association at 1220.8m is similar florally but has isolated P. notensis and overly a distinctive Cyathidites Palynofacies thought to restricted to APK22 - APK321.</i>



Sample Sample Number Depth Preparation Number	Palynostratigraphic Unit Polynofacies Index Species	Inferred Lithostratigraphic Unit (Log interpreted Unit)	Inferred Depositional Environment Lithology	Polynomorph			Remarks
				Preservation	Yield (Organic yield)	Diversity	
SWC 965m	APK22 - APK31 ?APK22 <i>P. notensis</i>	basal Eumeralla Formation or uppermost Laira Formation					Not examined in this study; assemblage data from Morgan, 1991
Crayfish Sub Group (upper Laira Shale equivalent) 968m							<i>There is an indication of APK21 associations being preserved in Bus Swamp #1, Gordon #1, Mocamboro #11 and Digby #1 which suggests that there is a hiatus within the upper Crayfish Sub Group (Laira Formation) perhaps in addition to the regional unconformity between the Eumeralla Formation and Crayfish Sub Group. This contrasts with the Penola Trough upper Crayfish section where the upper Crayfish section is truncated with the progressive loss of the APK212 and APK211 section towards the Trough margins as in Katmook to Sawpit to Robinson and possibly Heathfield to Tullich to McEachern.</i>
FHC25 s6612 998.8m P19387	APJ4 - APK7 Indeterminate [<i>C. cooksoniae</i> , <i>L. verrucatus</i>]	Indeterminate (upper Laira Shale)	?Fluvial <i>Siltstone, lt gry</i>	Very poor	Extremely low 0.02mL/5mL Extremely low	Extremely low	Low organic recovery of mostly fine opaque palynodebris. Very few palynomorphs; <i>Contignisporites</i> , <i>Cyathidites</i> and leiospheres notable
FHC25 s6613 999.8m P19388	APJ3 - APK7 Indeterminate [<i>L. verrucatus</i>]	Indeterminate (upper Laira Shale)	?Fluvial <i>Siltstone, lt gry; sandy</i>	Extremely poor	Almost nil 0.03mL/5mL Extremely low	Almost nil	Low organic recovery of mostly fine opaque palynodebris. Almost no identifiable palynomorphs.
FHC26 s6614 1016.7m P19389	APK212 - APK22 probably APK212 <i>Osmundacidites - Retitriteles</i> Polynofacies [<i>F. wonthaggiensis</i> , <i>T. reticulatus</i> , <i>M. evansii</i> , <i>D. speciosus</i>]	upper Laira Formation (upper Laira Shale)	Fluvial - lacustrine <i>Siltstone, lt gry; sandy</i>	Poor	Low 0.09mL/5mL Extremely low	Moderate	Palynoflora dominated by fern spores; mostly <i>Osmundacidites</i> ; <i>Cyathidites</i> prominent. Conifer saccate pollen subdominant. Lycopod spores conspicuous; mostly <i>Retitriteles</i> ; <i>D. speciosus</i> notable. Bryophyte spores relatively scarce but moderately diverse. Algal spores notable; <i>M. evansii</i> notable [Morgan, 1991 records <i>F. asymmetricus</i> in SWC 1006m; however, the palynoflora from 1016.7 in the same litho-unit (this study) is typical of the upper Laira APK212 associations and does include " <i>Verrucosporites</i> " " <i>pseudoasymmetricus</i> " and none of the APK3 associates]
FHC26 s6615 1021.0m P19390	Indeterminate	Indeterminate (upper Laira Shale)	Indeterminate <i>Siltstone, v lt gry</i>	Extremely poor	Almost nil 0.13mL/5mL Very low	Almost nil	Low organic recovery of mostly fine opaque palynodebris. Few cuticle remnants. Almost no identifiable palynomorphs [Morgan, 1991 records <i>Triporeletes reticulatus</i> to 1061m]