

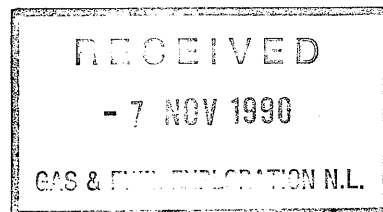


APPENDIX 12.

PALNOLOGY.

PINE LODGE-1

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PALYNOLOGY OF GAS AND FUEL PINELODGE-1,

OTWAY BASIN, AUSTRALIA

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for GAS AND FUEL

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FIGURE 2. MATURITY PROFILE, GAS AND FUEL PINELODGE-1

APPENDIX I PALYNOMORPH DISTRIBUTION DATA

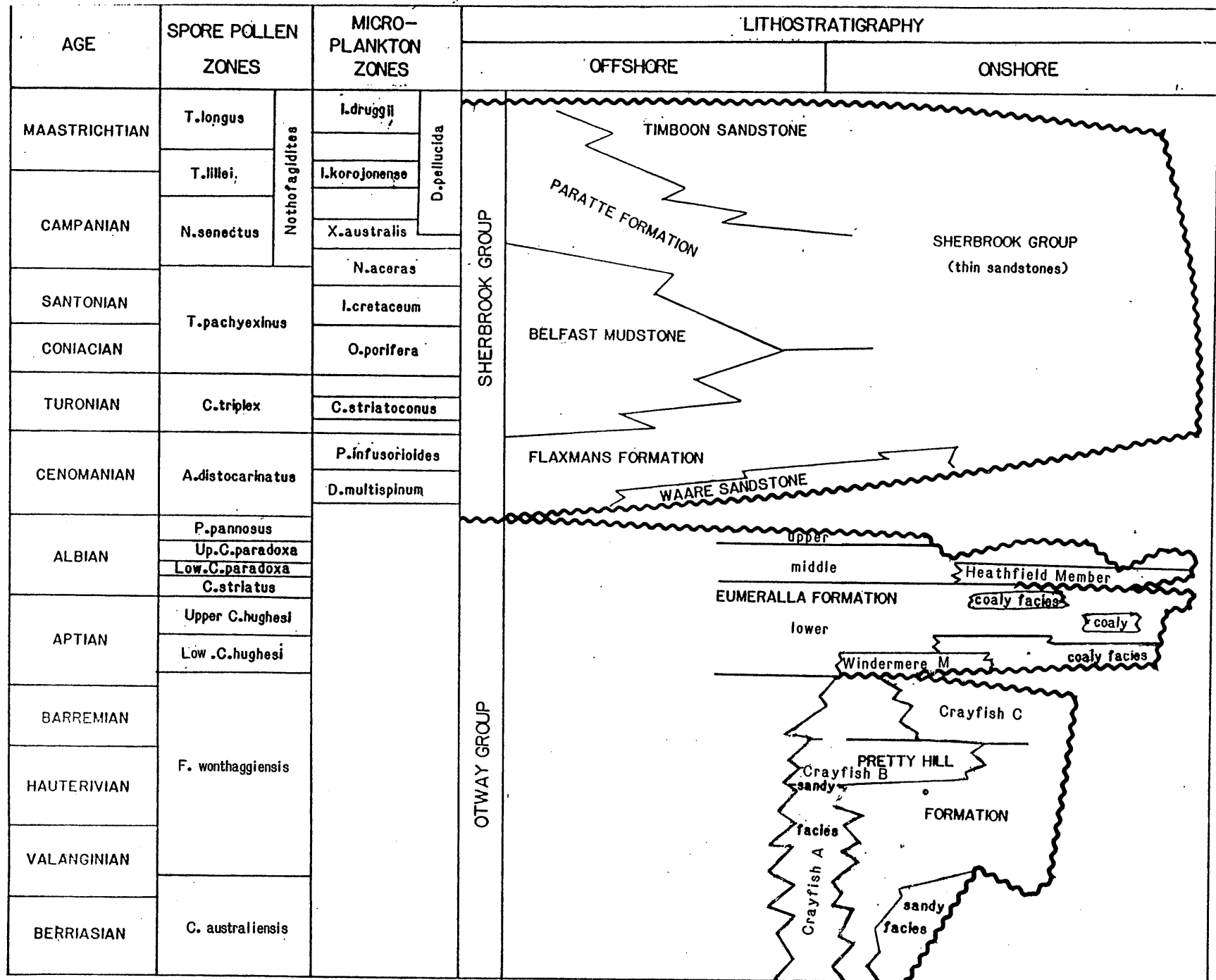


FIGURE 1. CRETACEOUS REGIONAL FRAMEWORK, OTWAY BASIN

I SUMMARY

1030m (swc) : upper M. diversus Zone : Early Eocene :
nearshore: marine : immature : usually associated with
the Dilwyn Formation.

1079m (swc) : upper T. longus Zone (and M. druggii
Dinoflagellate Zone) : late Maastrichtian : nearshore
marine : immature : usually associated with top Curdies
or Paaratte.

1123.5m (swc) : mixed T. lillei Zone with presumably mud
contaminating L. balmei Zone : Campanian with caved
Paleocene : marginal marine : immature : usually
associated with the Timboon/Paaratte interval.

1300m (swc) - 1789m (swc) : T. pachyexinus Zone (1300m is
N. aceras Dinoflagellate Zone, 1624m is I. cretaceum
Dinoflagellate Zone) : Santonian - Coniacian :
nearshore marine : immature : usually associated with
the Belfast Mudstone and correlatives.

1885m (cutts) (1886.5m swc) - 2030m (swc) : C. triplex Zone
: Turonian : nearshore to marginal marine : early
marginally mature : usually associated with the lower
Belfast Mudstone and Flaxmans Formation.

2033m (cutts) (2041m swc) - 2087m (swc) : A. distocarinatus
Zone : Cenomanian : marginal to nearshore marine :
marginally mature : usually associated with the
Flaxmans Formation and Waare Sandstone.

2109m (swc) - 2135 (swc) : P. pannosus Zone : late Albian :
non-marine : marginally mature : usually associated
with the topmost Eumeralla Formation.

II INTRODUCTION

Seventeen sidewall cores one conventional core and five cuttings of favourable lithology were processed, to provide information on age, environment and maturity for the completion report.

Palynomorph occurrence data are shown as Appendix I and form the basis for the assignment of the samples to seven spore-pollen units of late Albian to early Eocene age. The Cretaceous spore-pollen zonation is essentially that of Dettmann and Playford (1969), but has been significantly modified and improved by various authors since, and most recently discussed in Helby et al (1987), as shown on figure 1 and modified by Morgan (1985) for application in the Otway Basin. The Tertiary zonation is that of Stover and Partridge (1973) and Stover and Evans (1973) as modified by Partridge (1976).

Maturity data was generated in the form of Spore Colour Index, and is plotted on figure 2 Maturity profile of Gas & Fuel Pinelodge-1. The oil and gas windows in figure 2 follow the general consensus of geochemical literature. The oil window corresponds to spore colours of light-mid brown (Staplin Spore Colour Index of 2.7) to dark brown (3.6). These correspond to vitrinite reflectance values of 0.6% to 1.3%.

III PALYNOSTRATIGRAPHY

A 1030m (swc) : upper M. diversus Zone

Assignment to the upper Malvacipollis diversus Zone is indicated by oldest Proteacidites pachypolus and Spinizonocolpites prominatus, and youngest Malvacipollis diversus and Proteacidites grandis without younger indicators. Proteacidites spp and Cyathidites dominate the assemblage and confirm a pre asperus assignment. Nothofagidites spp were not seen.

Microplankton comprise about 20% of palynomorphs but are mostly the freshwater Paralecaniella indentata. Some dinoflagellates are present and include frequent Muratodinium fimbriatum, consistent with the spore-pollen zonal assignment .

Nearshore marine environments are indicated by the dominance and diversity of the spore-pollen and rare low diversity dinoflagellates.

These features are normally seen in the Dilwyn Formation. Colourless palynomorphs indicate immaturity for hydrocarbon generation.

B 1079m (swc) : upper T. longus Zone

Assignment to the upper part of the Tricolpites longus Zone is indicated at the base by oldest Stereisporites punctatus, Tetracolporites verrucosus and Tricolpites longus, and at the top by youngest Tricolpites confessus, T. longus and common Gambierina rudata. The assemblage is dominated by Dilwynites and Proteacidites with frequent G. rudata. Minor mud contamination of younger Proteacidites spp and M. diversus was noted.

Dinoflagellates include the age diagnostic Manumiella conorata and M. druggii, as well as the undescribed Canninginipsis "bretonica," all indicating the M. druggii Dinoflagellate Zone of latest Maastrichtian age. A single Nelsoniella aceras specimen is clearly reworked.

Nearshore marine environments are indicated by the low content and diversity of dinoflagellates, and the high content and diversity of spores and pollen.

These features are normally seen at the top of the Curdies Formation, but in nearby Wilson-1 and Henke-1 were seen in dark grey shale. This may represent a terminal Cretaceous transgressive event.

Colourless to light yellow spore colours indicate immaturity for hydrocarbons.

C 1123.5 (swc) : mixed T. lillei with presumed caved L. balmei.

This assemblage is clearly mixed, containing the Tricolporites lillei Zone (T. confessus, T. sabulosus, T. apoxyexinus, T. lillei, T. sectilis without younger indicators) and the Lygistepollenites balmei Zone (Haloragacidites harrisii, L. balmei, Nothofagidites brachyspinulosus). Because of the clean T. longus assemblage at 1079m above, the T. lillei assemblage must be in place, and the L. balmei assemblage caved. Common forms include Cyathidites and Proteacidites with frequent Clavifera triplex and Stereisporites antiquasporites. Rare Permian working was also noted.

Marginal marine environments are indicated by the very rare dinoflagellates (which are not age diagnostic),

and the common and diverse spores and pollen.

These features are normally seen in the Timboon Sandstone/Paaratte Formation interval.

Yellow spore colours indicate immaturity for hydrocarbons.

D 1300m (swc) - 1789m (swc) : T. pachyexinus Zone

Assignment to the Tricolpites pachyexinus Zone is indicated at the top by the absence of younger indicators and at the base by oldest frequent Amosopollis cruciformis (supported by oldest T. confessus and T. apoxyexinus at 1300m and oldest T. gillii at 1624m). Common forms include A. cruciformis, Cyathidites, Falcisporites and Gleicheniidites towards the base, and Osmundacidites and Proteacidites towards the top.

Dinoflagellates are minor (5-10% of palynomorphs), but include age diagnostic forms. At 1300m (swc), Nelsoniella aceras indicates the N. aceras Dinoflagellate Zone. At 1624m (swc), oldest Isabelidinium cretaceum without younger markers, indicates the I. cretaceum Dinoflagellate Zone. At 1789m (swc), zonal markers were absent.

Nearshore marine environments are indicated by the dinoflagellate content (5-10% of palynomorphs) and their low to moderate diversity (4-10 species). Spores and pollen are common and diverse.

These features are normally seen in the Belfast Mudstone and its correlatives.

Yellow spore colours indicated immaturity for hydrocarbon generation.

E 1885m (swc) - (1886.5m swc) - 2030m (swc) : C. triplex Zone

Assignment to the Clavifera triplex Zone is indicated at the top by the absence of younger markers and at the base by oldest Phyllocladidites mawsonii and Clavifera triplex. Cyatheacidites tectifera occurs at 1890m (cutts) only. Common forms include the saccate pollen Microcachyidites and Falcisporites with Cyathidites frequent towards the interval top.

Dinoflagellates are rare (1 to 5% of palynomorphs) but lack zone indicators. Heterosphaeridium spp are the most consistent, with the thinwalled Trithyrodinium "marshalli" a rare but distinctive component.

These features are normally seen in the Flaxmans Formation and the correlative lower Belfast Formation.

Yellow to light brown spore colours indicate early marginal maturity for oil, but immaturity for gas/condensate.

F 2033m (cutts) (2041m swc) - 2087m (swc) : A. distocarinatus Zone

Assignment to the Appendicisporites distocarinatus Zone of Cenomanian age is indicated at the top by the absence of younger indicators and confirmed by youngest A. distocarinatus at 2041m (swc), and at the base by the absence of older indicators and oldest A. cruciformis and A. distocarinatus. The base is also

confirmed by the dinoflagellate data. Common forms are the saccate pollen Falcisporites and Microcachryidites.

Dinoflagellates are rare (1 to 5% of palynomorphs) but lack zonal indicators. Heterosphaeridium spp are the most consistent; Trithyrodinium is absent.

Marginal to nearshore marine environments are indicated by the rare low diversity dinoflagellates and the common diverse spores and pollen.

These features are normally seen in the lower FLaxmans Formation and Waare Sandstone.

Light brown spore colours indicate marginal maturity for oil generation.

G 2109m (swc) - 2135m (swc) : P. pannosus Zone

Assignment to the Phimopollenites pannosus Zone is indicated at the top by youngest Coptospora paradoxa and the absence of younger indicators, and at the base by oldest P. pannosus. Common forms include the spores Cyathidites and Osmundacidites with saccate genera much less frequent. Other spores seen more consistently include Balmeisporites holodictyus, Crybelosporites striatus, and Foraminisporis asymmetricus.

Dinoflagellates are absent from the sidewall cores, and present only as minute caving in the cuttings. Non-marine environments are indicated by these features and the common and diverse spores and pollen.

These features are normally seen in the topmost Eumeralla Formation, (the Upper Eumeralla of Kopson and Scholefield, 1990).

Light brown spore colours indicate marginal maturity
for oil and immaturity for gas/condensate.

IV CONCLUSIONS

- A The sampled section includes correlatives of the entire sequence from the topmost Eumeralla to Dilwyn Formation.
- B The distocarinatus Zone is quite thin and lacks a typical Waare Sandstone at the base.
- C The triplex Zone is of average thickness, and the cored sand near 1980m is younger than the typical Waare Sandstone and is more correctly a Flaxmans Sand in time terms.
- D The pachyexinus Zone is thick, as usual, with a thin senectus - longus interval above.
- E Although the Paleocene Pebble Point Formation does not appear to be sampled, its equivalents are presumably present, as evidenced by caving into the lillei Zone. The Paleocene dinoflagellate zones have been seen in nearby Henke-1 and Wilson-1, but are not sampled here.

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PE903708

This is an enclosure indicator page.
The enclosure PE903708 is enclosed within the
container PE903707 at this location in this
document.

The enclosure PE903708 has the following characteristics:

ITEM_BARCODE = PE903708
CONTAINER_BARCODE = PE903707
 NAME = Pine Lodge 1 palynology graphic
 abundance chart
 BASIN = OTWAY
 PERMIT = PEP105
 TYPE = WELL
 SUBTYPE = DIAGRAM
 DESCRIPTION = Pine Lodge 1 palynology range chart of
 graphic abundance
 REMARKS =
 DATE_CREATED = 31/10/90
 DATE_RECEIVED =
 W_NO = W1034
 WELL_NAME = Pine Lodge-1
 CONTRACTOR = Roger Morgan
 CLIENT_OP_CO = Gas and Fuel Exploration N.L

(Inserted by DNRE - Vic Govt Mines Dept)