W572 1 of 9

PALYNOLOGY OF UPPER CRETACEOUS AND LOWER TERTIARY SEDIMENTS IN WOODSIDE COLLIERS HILL No.1 WELL

BY MARY E DETTMANN

A recent palynological examination (Dettmann 1970) of six sidewall cores from Woodside Colliers Hill No.1 well revealed that sediments from between 4416 feet and 5550 feet within the "Golden Beach Beds" are of Upper Cretaceous age. Futthermore it was demonstrated that the section could be subdivided in terms of the Upper Cretaceous spore-pollen zonation scheme of Dettmann and Playford (1969); sediments between 4416 and 4540 feet are attributable to the Senonian Tricolpites pachyexinus Zone and horizons at 5425-5550 feet to the ?Cenomanian - ?Turonian Appendicisporites distocarinatus Zone.

The object of the present study is to delimit more precisely the vertical extents of the Upper Cretaceous spore-pollen zones within the "Golden Beach Beds" in the well, and to assess the age of the overlying Latrobe Valley Coal Measures. The study is based upon an examination of four samples (additional to those examined by Dettmann 1970) from the "Golden Beach Beds" and three horizons of the Latrobe Valley Coal Measures. The samples were processed by the method outlined by Dettmann (1970) and all were found to contain plant microfossils including spores and pollen grains together with wood and cuticular fragments. Several samples also yielded rare microplankton.

Data obtained from a specific analyses of the plant microfossil assemblages and the integration of this data with previously documented results (Dettmann 1970) enables palynological zonation and age determination of the Colliers Hill No.1 well section examined. As will be shown subsequently the Latrobe Valley Coal Measures are in the middle and upper portions (1860 - 2905 feet) of Upper Eocene age, and at the base (4090 feet) of uppermost

Cretaceous or early Paleocene age. The "Golden Beach Beds" are of Upper Cretaceous age, including horizons of the ?Cenomanian - ?Turonian Appendicisporites distocarinatus Zone and the Senonian Tricolpites pachyexinus Zone. The intervening (Turonian) Clavifera triplex Zone has not been recognized in the material examined.

The evidence derived from the palynological examination of the samples is also synthesised in terms of assessing the depositional enviorment and source material of the Latrobe Valley Coal Measures and the "Golden Beach Beds".

PLANT MICROFOSSIL ASSEMBLAGES AND AGE DETERMINATIONS

A. Late Eocene

1860 feet

A well preserved, prolific assemblage of spores and pollen was extracted from the sample. Other microfossils recovered include infrequent wood and cuticular tissue. The following species were identified:

Spores:
- Baculatisporites sp.
- Cyathidites australis Couper
- C. minor Couper

Pollen:
- Araucariacites australis Cookson
- Beaupreaidites elegansiformis Cookson
- B. verrucosus Cookson
- Dacrydiumites florinii Cookson & Pike
- Malvacipollis sp.
- Nothofagidites asperus (Cookson)
- N. cinctus (Cookson)
- N. emarcidus (Cookson)
- N. deminutus (Cookson)
- N. heterus (Cookson)
- N. goniatus (Cookson)
- N. vansteenisi (Cookson)
- Phyllocladidites mawsonii Cookson
- Polyporina sp.
- Polycolpites sp.
- Podocarpidites ellipticus
- Proteacidites annularis Cookson
- P. crassus Cookson
- P. incurvatus Cookson
- P. subscabratus Couper

Triorites harrisii Couper
T. magnificus Cookson
Tricolporites prolata Cookson

Remanié: Cicatricosisporites australiensis (Cookson) - Lower and/or early Upper Cretaceous
2905 feet

Plant microfossils extracted from the sample include well preserved and abundant pollen grains together with less frequent spores and rare microplankton. The following types were observed:

Spores: Cyathidites australis Couper
C. minor Couper
Densoisporites velatus Weyland & Krieger

Pollen: Beaupreaidites verrucosus Cookson
Casuarinidites cainozoicus Cookson & Pike
Dacrydiumites florinii Cookson & Pike
Microcachryidites antarcticus Cookson
Nothofagidites brachyspinulosus (Cookson)
N. cinctus (Cookson)
N. asperus (Cookson)
N. emarcidus (Cookson)
N. incrassatus (Cookson)
Phyllocladidites mawsonii Cookson
Podocarpidites ellipticus Cookson
Proteacidites annularis Cookson
P. crassus Cookson
P. crassipora Harris
P. rectomarginus Cookson
P. incurvatus Cookson
P. subscabratus Couper
P. pachypolus Cookson & Pike
Triorites magnificus Cookson
T. harrisii Couper
Tricolporites scabratus Harris

Microplankton: Deflandrea phosphoritica Eisenack

Remanié: Aequitriradites spinulosus (Cookson & Dettmann) - Lower and/or early Upper Cretaceous

The upper sample contains an abundance and diversity of Nothofagidites, a feature of southern Australian Late Eocene microfloras. Supporting evidence for such an age is provided by the presence of Triorites magnificus and Beaupreaidites verrucosus. The underlying horizon at 2905 feet contains a continued abundance of Nothofagidites, fairly plentiful Phyllocladites mawsonii, Triorites harrisii, and Proteacidites together with Triorites magnificus and Beaupreaidites verrucosus. The microflora is accordingly

considered to be of Late Eocene age. The microplankton species, Deflandrea phosphoritica recorded from 2905 feet is widely distributed in southern Australian Eocene sediments (Deflandre and Cookson 1955, Cookson and Eisenack 1965).

The assemblage from 1860 feet is composed entirely of land derived forms; that from 2905 feet contains a predominance of spores and pollen having similar derivation with rare examples of the possible marine or brackish water indicator Deflandrea phosphoritica. Both samples yielded a small percentage (<1%) of specimens recycled from Lower and/or Early Upper Cretaceous horizons.

B. Uppermost Cretaceous - Early Paleocene

4090 feet

The residue obtained from the sample consists chiefly of wood and cuticular material. Spores and pollen grains are infrequent and microplankton occur rarely. The following forms have been observed:

Spores:	Cyathidites australis Couper
	Camarozonosporites ohaiensis (Couper)
	Gleicheniidites circinidites (Cookson)
	Laevigatosporites ovatus Wilson & Webster
Pollen:	Araucariacites australis Cookson
	Dacrydiumites florinii Cookson & Pike
	Nothofagidites emarcidus (Cookson)
	Phyllocladidites mawsonii Cookson
	Podocarpidites ellipticus Cookson
	Proteacidites amolosexinus Dettmann & Playford N.SP → TLONG
	P. crassus Cookson
	P. reticuloscabratus Harris
	P. subscabratus Couper
	Triorites edwardsii Cookson & Pike
	Triorites harrisii Couper
	Tricolpites gillii Cookson
Microplankton:	Baltisphaeridium sp.
Remaniè:	Cicatricosisporites ludbrooki Dettmann - Lower Cretaceous

Triorites edwardsii and Camarozonosporites ohaiensis are

members of Dettmann and Playford's (1969) Nothofagidites Microflora of uppermost Cretaceous (Senonian and later) age and extend into Harris'S (1965) Triorites edwardsii Zone (Paleocene). The presence of Triorites harrisii supports a Paleocene rather than an uppermost Cretaceous age; however, Proteacidites amolosexinus is hitherto unknown from Tertiary strata, with a documented range of Senonian - uppermost Cretaceous (Dettmann and Playford 1969).

Plant microfossils of the assemblage are mostly land-derived; the occasional examples of Baltisphaeridium are probably of aquatic origin. Recycled spores occur rarely and are from Lower Cretaceous horizons.

C. Senonian

4159 feet

The sample provided very few spores and pollen grains. Examples of the following types have been observed:

Spores: Cyathidites australis Couper
Rouseisporites reticulatus Pocock

Pollen: Araucariacites australis Cookson
Microcachryidites antarcticus Cookson
Phyllocladidites mawsonii Cookson
Podocarpidites ellipticus Cookson
Proteacidites subscabratus Couper

4416-4307 feet

See Dettmann (1970) for microfloral details.

4959 feet

Reasonably well preserved spores and pollen grains occur abundantly in the sample together with less frequent wood and cuticular tissue. Species identified include:

Spores: Cyathidites australis Couper
C. minor Couper
Clavifera triplex (Bolkhovitina)
Cicatricosisporites cuneiformis Pocock
Camarozonosporites amplus (Stanley)

Foraminisporis dailyi (Cookson & Dettmann)
Gleicheniidites circinidites (Cookson)
Kraeuselisporites jubatus Dettmann & Playford
Laevigatosporites ovatus Wilson & Webster)
L. major (Cookson).
Lycopodiumsporites austroclavatidites (Cookson)
Osmundacidites wellmanii Couper
Stereisporites antiquasporites (Wilson & Webster)

Pollen:
Araucariacites australis Cookson
Cycadopites nitidus (Balme)
Classopollis cf. classoides Pflug
Microcachryidites antarcticus Cookson
Phyllocladidites mawsonii Cookson
Podocarpidites ellipticus Cookson
Podosporites microsaccatus (Couper)
Proteacidites subscabratus Couper
Tricolpites sp.
Triorites minor Couper

Remanié:
Cicatricosisporites australiensis (Cookson) -(Lower and/or early
Crybelosporites striatus (Cookson & Dettmann)(Upper Cretaceous

5040 feet

See Dettmann (1970) for microfloral details.

5153 feet

The microflora extracted from the sample is fairly well preserved and includes good concentrations of the following species of spores and pollen grains:

Spores:
Baculatisporites comaumensis (Cookson)
Cyathidites australis Couper
C. minor Couper
Cicatricosisporites cuneiformis Pocock
C. sp.
Coptospora sp.
Gleicheniidites circinidites (Cookson)
Kraeuselisporites jubatus Dettmann and Playford
Laevigatosporites major (Cookson)
Lycopodiumsporites austroclavatidites (Cookson)
Leptolepidites verrucatus Couper
Stereisporites antiquasporites (Wilson & Webster)

Pollen:
Araucariacites australis Cookson
Cycadopites nitidus (Balme)
Microcachryidites antarcticus Cookson
Podocarpidites ellipticus Cookson
Podosporites microsaccatus (Couper)
Phyllocladidites mawsonii Cookson
Proteacidites subscabratus Couper
Tricolpites pannosus Dettmann & Playford
T. pachyexinus Couper

Remanié:	Aequitriradites spinulosus (Cookson & Dettmann)	(Lower and/or
	Cicatricosisporites ludbrooki Dettmann	(early Upper
		(Cretaceous

5250 feet

A sparse assemblage of spores and pollen grains and abundant wood and cuticular fragments were extracted from the sample. The following species were identified:

Spores:	Cyathidites australis Couper
	C. minor Couper
	Clavifera triplex (Bolkhovitina)
	Cicatricosisporites sp.
	Laevigatosporites ovatus Wilson & Webster
	Lycopodiumsporites austroclavatidites (Cookson)
	Gleicheniidites circinidites (Cookson)
	Stereisporites antiquasporites (Wilson & Webster)
Pollen:	Microcachryidites antarcticus Cookson
	Podocarpidites ellipticus Cookson

The upper sample from 4159 feet yielded insufficient diagnostic forms for precise age determination, but on stratigraphic grounds and other palynological evidence documented herein is of Senonian or uppermost Cretaceous age. As discussed by Dettmann (1970) sediments at 4416 - 4540 feet are of Senonian age and are attributable to the upper portion of the Tricolpites pachyexinus Zone. The next productive sample down section is from 4959 feet and contains a microflora indicative of the lower or middle portions of the Tricolpites pachyexinus Zone. The sample at 5153 feet contains a similar assemblage and is also attributed to the Tricolpites pachyexinus Zone. The sample from 5250 feet provided a sparse assemblage containing Clavifera triplex but lacking other stratigraphically significant species. C. triplex provides evidence that the horizon is within the Clavifera triplex or younger Upper Cretaceous spore-pollen Zones.

The microfloras from all productive samples from between 4159 feet and 5250 feet are composed of land derived forms. Samples

attributed to the Tricolpites pachyexinus Zone contain recycled spores of Lower and/or early Upper Cretaceous age.

D. ?Cenomanian - ?Turonian

5425-5550 feet

See Dettmann (1970) for microfloral details. As discussed by this author the microfloras are composed chiefly of land-derived forms and include recycled examples of Permian, Triassic and Lower Cretaceous age.

CONCLUSIONS

Sediments of the Latrobe Valley Coal Measures in Colliers Hill No.1 well range in age from uppermost Cretaceous or Paleocene to Upper Eocene. The three horizons studied contain a dominance of land derived plant microfossils with rare examples of microplankton suggesting deposition in a continental or brackish to very near shore marine enviorment.

The underlying "Golden Beach Beds" include horizons of the Senonian Tricolpites pachyexinus Zone and the ?Cenomanian - ?Turonian Appendisisporites distocarinatus Zone; the Turonian Clavifera triplex Zone has not been positively identified but may be represented within the interval 5153 - 5425 feet. The microfloral assemblages of the Tricolpites pachyexinus Zone are composed entirely of land-derived forms suggesting accumulation of the sediments in a continental enviorment. Horizons of the Appendicisporites distocarinatus Zone contain a dominance of land-derived forms with minor representation of forms of uncertain derivation.

Recycled spores and pollen grains occur in the majority of samples examined. Types derived from Lower and/or early Upper Cretaceous sediments are rare in the Latrobe Valley Coal Measures and more prevalent in horizons of the Tricolpites pachyexinus Zone of the "Golden Beach Beds".

Underlying strata of the latter rock unit attributed to the Appendicisporites distocarinatus Zone contain reworked Lower Cretaceous, Triassic and Permian forms.

REFERENCES

Cookson, I.C. and Eisenack, A. 1965. Microplankton from the Browns Creek Clays, SW. Victoria. Proc. Roy. Soc. Vict., 79, 119-131.

Deflandre, G. and Cookson, I.C. 1955. Fossil microplankton from Australian late Mesozoic and Tertiary sediments. Aust. J. Marine Freshw. Res., 6, 242-313.

Dettmann, M.E. 1970. Palynological report on Woodside Colliers Hill No.1 well, 4416-5550 feet. Unpubl. report submitted to Woodside Oil N.L. 22/4/1970.

Dettmann, M.E. and Playford, G. 1969. Palynology of the Australian Cretaceous; A review. Chapter 9 in Stratigraphy and Palaeontology; Essays in Honour of Dorothy Hill; K.S.W. Campbell Ed., A.N.U. Press, Canberra.

Harris, W.K. 1965. Basal Tertiary microfloras from the Princetown area, Victoria, Australia. Palaeontographica, 115B, 75-106.

21st July, 1970.

Mary E. Dettmann,
Department of Geology,
University of Queensland,
St. Lucia, Queensland.