PALYNOLOGICAL DETERMINATIONS FOR MARLIN-4

BETWEEN 5930 AND 8546 FEET.

SUMMARY

Zones	Depths	Ages
P. tuberculatus	5930' - 5970'	Early Oligocene
Undetermined	5990'	Middle Eocene?
Lower *N. asperus*	6030' - 6070'	Middle Eocene
P. asperopolus	6100' - 6208'	Middle to Early Eocene
L. balmei	6280' - 8250'	Paleocene
T. longus	8496' - 8546'	Paleocene

INTRODUCTION

Palynological zone determinations for the Latrobe Group and the lower 50 feet of the overlying Lakes Entrance Formation in the Gippsland Basin Marlin-4 well are based on the palynomorph assemblages recovered from 34 sidewall and two conventional cores. Zone names are those proposed by Stover and Evans (1973) and by Stover and Partridge (1973) and the criteria used for the recognition of zones are presented in those publications. Species lists for each zone include those forms considered to be of stratigraphic value for subdividing Gippsland Basin Tertiary sections, consequently, long ranging species are not listed unless they represent a major constituent of a particular sample.

Spore-pollen preservation and abundance is generally good throughout the section. Microplankton--mainly dinoflagellates with some acritarchs--occur commonly to abundantly in the *Proteacidites tuberculatus* through the *P. asperopolus* zones; they are less abundant and their occurrences are sporadic in the *Lygistepollenites balmei* zone. None was found in the *Tricolpites longus* zone.

DISCUSSION

Proteacidites tuberculatus Zone (5930 - 5970 feet)

Assignment to this zone is based on the occurrence of *Cyathaecidites annulatus* Cookson in each of the samples. The assemblages consist mainly of microplankton of which the majority of specimens are either *Operculodinium centrocarpum* (Deflandre and Cookson) Wall or of the *Spiniferites* type. Several undescribed species are also present. Forms identified from the *P. tuberculatus* zone include:

Spore-Pollen

Cyathaecidites annulatus Cookson
Dacrycarpites australiensis Cookson & Pike
Haloragacidites harrisii (Couper) Harris
Ischyosporites irregularis Stover and Evans MS
Lygistepollenites florinii (Cookson & Pike) Stover & Evans
Matonisporites ornamentalis (Cookson) Partridge
Myrtaceidites parvus Cookson & Pike
Nothofagidites asperus (Cookson) Stover & Evans
N. deminutus (Cookson) Stover & Evans
N. emarcidus (Cookson) Harris
N. falcatus (Cookson) Stover & Evans
N. flemingii (Couper) Potonic
N. heterus (Cookson) Stover & Evans
Parviaccites extensus Partridge
Phyllocladidites mawsonii Cookson *ex* Couper

Microplankton

Achomosphaera alcicornu (Eisenack) Davey & Williams
Hystrichokolpoma eisenackii Williams & Downie
Nematosphaeropis balcombiana Deflandre & Cookson
Nematosphaeropsis sp
Operculodinium centrocarpum (Deflandre & Cookson) Wall
Polysphaeridium fibrosum Stover MS
Spiniferites ramosa (Ehrenberg) Loeblich & Loeblich
Spiniferites spp.

Assemblage from 5990 feet.

A positive zone assignment for the asemblage from 5990 feet is precluded because of the rarity of specimens and the lack of zone diagnostic spore-pollen. The overall character of the assemblage differs strikingly from those of the *P. tuberculatus* zone and the sparse spore-pollen species suggest it is most likely Middle Eocene. The few dinoflagellates present are not well preserved and identifications for the most part are uncertain owing to the poor preservation and the lack of complete specimens. Endophragmal fragments, probably of *Deflandrea heterophlycta*, two specimens of *Reticulodinium* and one of *Histiocysta* also suggest a Middle Eocene age. The following additional forms were identified.

Spore Pollen

Beaupreaidites verrucosus Cookson
Ericipites crassiexinus Harris
Haloragacidites harrisii (Couper) Harris
Lygistepollenities florinii (Cookson & Pike) Stover & Evans
Nothofagidites deminutus (Cookson) Stover & Evans
N. emarcidus (Cookson) Harris
N. falcatus (Cookson) Stover & Evans
Peromonolites vellosus Partridge
Proteacidites adenanthoides Cookson
P. parvus Cookson
Santalumidites cainozoicus (?) Cookson & Pike

Microplankton

Cymatiosphaera sp.
Operculodinium centrocarpum (Deflandre & Cookson) Wall.

Lower *Nothofagidites asperus* Zone (6030 - 6070 feet)

Spore-pollen from this zone are in general not well preserved nor does the assemblage contain a large number of species. The sample from 6030 feet yielded mainly spore-pollen whereas the other two samples assigned to this zone contained common to abundant dinoflagellates. Among the latter, specimens of *Cordosphaeridium dictyoplokus* (Klumpp) Eisenack dominate, and several undescribed forms are present. Palynomorphs identifed within the Lower *N. asperus* zone include:

Spore-pollen

Baculatisporites disconformis Stover
Banksieaeidites arcuatus Stover
Beaupreaidites trigonalis Harris MS
B. verrucosus Cookson
Cupanieidites orthoteichus Cookson & Pike
Cyathidites splendens Harris
Dilwynites granulatus Harris
Ephedra notensis Cookson
Ericipites crassiexinus Harris
Gemmatricolporites gestus Partridge
Haloragacidites harrissi Couper
Ilexpollenites anguloclavatus McIntyre
Liliacidites bainii Stover
Lygistepollenites florinii (Cookson & Pike) Stover & Evans
Malvacipollis diversus Harris
Milfordia homeopunctata (McIntyre) Partridge
M. tenuis Harris
Nothofagidites asperus (Cookson) Stover & Evans
N. brachyspinulosus (Cookson) Harris

N. deminutus (Cookson) Stover & Evans
N. flemingii (Couper) Potonie
N. goniatus (Cookson) Stover & Evans
N. heterus (Cookson) Stover & Evans
Periporopollenities demarcatus Stover
Phyllocladidites mawsonii Cookson
Polycolpites esobalteus (McIntyre) Stover
Proteacidites adenanthoides Cookson
P. alveolatus Stover
P. annularis Cookson
P. asperopolus Stover & Evans
P. crassus Cookson
P. incurvatus Cookson
P. kopiensis Harris
P. leightonii Stover
P. obscurus Cookson
P. pachypolus Cookson & Pike
P. pseudomoides Stover
P. reticuloscabratus Harris
Santalumidites cainozoicus Cookson & Pike
Simplicepollenites meridianus Harris
Tricolpites phillipsii Stover
Verrucosisporites kopukuensis (Couper) Stover

Microplankton
Cordosphaeridium dictyoplokus (Klumpp) Eisenack
C. inodes Eisenack
Cymatiosphaera sp.
Deflandrea sp. cf. *D. heterophlycta* Deflandre & Cookson
Epicephalopyxis indentata Deflandre & Cookson
Hystrichokolpoma cinctum Klumpp
H. rigaudae Deflandre & Cookson
Horologinella incurvata Cookson & Eisenack
Leptodinium maculatum Cookson & Eisenack
Operculodinium centrocarpum (Deflandre & Cookson) Wall
Spiniferites ramosus (Ehrenberg) Loeblich & Loeblich
Spinidinium spp.
Veryhachium sp.
Wetzeliella homomorpha Deflandre & Cookson
Wetzeliella spp.

Specimens of *Nothofagidites* are considerably more abundant than those of *Haloragacidites harrisii* in the Lower *N. asperus* zone. In addition, except for small, non-descript, long ranging forms, specimens and species of *Proteacidites* are sparse to rare in this interval.

Proteacidites asperopolus zone (6100 - 6208 feet)
A majority of the spore-pollen species found in the Lower *N. asperus* zone occur also in the *P. asperopolus* zone. The latter, however, has the following additional forms:

Dilwynites tuberculatus Harris
Intratriporopollenites notabilis (Harris) Stover
Malvacipollis perimagnus Stover MS
M. subtilis Stover
Myrtaceoipollenites australis Harris
Nothofagidites vansteenisii (Cookson) Stover & Evans
Proteacidites grandis Cookson
P. latrobensis Harris
P. ornatus Harris
P. tenuiexinus Stover
Schizocolpus marlinensis Stover
Tricolporites adelaidensis Harris MS
T. delicatus Harris MS
Triorites scabratus Couper
Triporopollenites ambiguus Stover

The few spore-pollen species identified in the Lower *N. asperus* zone and not found in the *P. asperopolus* interval in Marlin-4 are:

Banksieaeidites arcuatus Stover
Ephedra notensis Cookson
Gemmatricolporites gestus Partridge
Liliacidites bainii Stover
Milfordia homeopunctata (McIntyre) Partridge
Nothofagidites brachyspinulus (Cookson) Harris

Although the palynomorph assemblages from the *P. asperopolus* zone consist mostly of spore-pollen, microplankton are fairly common, especially in the assemblage from 6100 feet in which incomplete specimens of *Deflandrea flounderensis* Stover are numerous. Specimens of *Wetzeliella homomorpha* Deflandre & Cookson are more frequent in the samples from 6190 and 6208 feet where *W. hyperacantha* Cookson & Eisenack is also present. Undescribed species of *Spinidinium, Phthanoperidinium, Deflandrea* and *Wetzeliella* occur within the *P. asperopolus* interval, together with rare gonyaulacid types.

Specimens of *Nothofagidites* are much less common than in the Lower *N. asperus* zone while those of *Haloragacidites* and *Malvacipollis* increase in relative abundance, as do the proteaceous pollen.

Microplankton

Deflandrea flounderensis Stover
Operculodinium centrocarpum (Deflandre & Cookson) Wall
Spinidinium spp.
Spiniferites ramosa (Ehrenberg) Loeblich & Loeblich
Veryhachium sp.
Wetzeliella homomorpha Deflandre & Cookson
W. hyperacantha Cookson & Eisenack
W. waiparaensis ? Wilson

Lygistepollenites balmei Zone (6280 - 8250 feet)

In Marlin-4 this zone is exceptionally thick extending through an estimated 2000 to 2100 feet of section. The interval contains a rather monotonous spore-pollen assemblage with relatively few angiosperm pollen and numerous consistently occurring spore and gymnosperm pollen species. Dinoflagellates occur sporadically and are found more frequently in the upper 500 feet or so of the zone than in the lower part. In general, the microplankton from the *L. balmei* zone are poorly preserved and individual samples contain few species and it is not unusual to find only one or two species in an assemblage. Their relative abundance also varies greatly from very rare to abundant. Spore-pollen species that occur throughout the *L. balmei* zone include:

Australopollis obscurus (Harris) Krutzsch
Ceratosporites equalis Cookson & Dettmann
Clavifera triplex Bolkovitina
Cyathidites splendens Harris
Dilwynites granulatus Harris
Ericipites scabratus Harris
Gambierina edwardsii (Cookson & Pike) Harris
G. rudata Stover
Gleicheniidites spp. (Abundant at 6300 feet)
Herkosporites elliottii Stover
Latrobosporites amplus (Stanley) Stover
L. crassus Harris
Lygistepollenites balmei (Cookson) Stover & Evans
L. ellipticus (Harris) Stover & Evans
Nothofagidites emarcidus/heterus - undifferentiated
Phyllocladidites mawsonii Cookson
P. reticulosaccatus Harris
Phyllocladus palaeogenicus Cookson & Pike
Periporopollenites polyoratus (Couper) Stover
Peromonolites densus Harris
Proteacidites annularis Cookson
P. minimus Couper

Proteacidites spp. (small forms)
Simplicepollis meridianus Harris
Stereisporites punctatus Stover & Evans MS

In addition to the more or less continuously occurring species listed above, the following forms are present only in the upper part of the zone.

Haloragacidites harrisii (Couper) Harris
Lygistepollenites florinii (Cookson & Pike) Stover & Evans
Malvacipollis diversus Harris
Nothofagidites brachyspinulosus (Cookson) Harris
N. flemingii (Couper) Potonie
Parvisaccites catastus Partridge
Polycolpites langstonii Stover
Proteacidites pseudomoides Stover
P. reticuloscabratus Harris

Similarly, there are some species that have their last (youngest) occurrence in the lower two-thirds of the *L. balmei* zone in this well. These are:

Latrobosporites ohaiensis (Couper) Stover
Proteacidites angulatus Stover
Tetracolporites verrucosus Stover
Stereisporites regium (Drozhastichich) Drugg

Dinoflagellates from the *L. balmei* zone consist of *Cyclonephelium retiintextum* Cookson, *Deflandrea dilwynensis* Cookson, *D. medcalfii* Stover, and *Wetzeliella homomorpha* Deflandre and Cookson. In addition to these described species, some new forms of *Deflandrea* and *Spinidinium* are also present.

Tricolpites longus Zone (8496 to 8546 feet)

The lowermost two sidewall core samples from Marlin-4 are assigned to the *T. longus* zone based on the shallowest occurrences of the following spore-pollen species.

Quadraplanus brossus Stover
Proteacidites cleinei Stover & Partridge MS
P. palisadus Couper
P. reticuloconcavus Stover & Partridge MS
Tetradopollis securus Stover & Partridge MS
Tricolpites confessus Stover
T. waiparaensis Couper

Palynomorph assemblages from this zone consist entirely of spore-pollen in which specimens of *Gambierina rudata* are frequent and those of *Nothofagidites* are lacking.

CONCULSIONS

In Marlin-4 an unconformity located between 5970 and 5990 feet separates the post-Latrobe Oligocene section from the Middle Eocene Latrobe sequence represented at the top by the Lower *Nothofagidites asperus* zone. This zone is underlain by the middle to early Eocene *Proteacidites asperopolus* zone. Both zones contain sparse to abundant microplankton as well as spore-pollen.

Another unconformity situated between 6208 and 6280 feet separates the *P. asperopolus* zone from the Paleocene *Lygistepollenites balmei* zone. No assemblage indicative of the early Eocene *Malvacipollis diversus* zone was identified in Marlin-4. The *L. balmei* zone is exceedingly thick in this well, extending through an estimated 2000 to 2100 feet of section and is underlain conformably by the Paleocene *Tricolpites longus* zone. Spore-pollen assemblages dominate the Paleocene interval, although microplankton occur discontinuously in the *L. balmei* zone.

SAMPLES EXAMINED

Sample	Depth	Zone
SWC 42	5930'	*P. tuberculatus*
SWC 41	5950'	*P. tuberculatus*
SWC 40	5970'	*P. tuberculatus*
SWC 39	5990'	Indeterminate
SWC 38	6010'	Indeterminate
SWC 37	6030'	Lower *N. asperus*
SWC 36	6050'	Lower *N. asperus*
SWC 35	6070'	Lower *N. asperus*
SWC 34	6100'	*P. asperopolus*
Core 1	6130'	*P. asperopolus*
SWC 32	6190'	*P. asperopolus*
SWC 31	6208'	*P. asperopolus*
SWC 29	6280'	*L. balmei*
SWC 28	6300'	*L. balmei*
SWC 27	6350'	*L. balmei*
SWC 26	6390'	*L. balmei*
SWC 25	6510'	*L. balmei*
SWC 24	6642'	*L. balmei*
SWC 23	6816'	*L. balmei*
SWC 22	6954'	*L. balmei*
SWC 20	7170'	*L. balmei*
SWC 19	7310'	*L. balmei*
Core 2	7403'	*L. balmei*
SWC 17	7506'	*L. balmei*
SWC 16	7706'	*L. balmei*
SWC 15	7764'	*L. balmei*
SWC 12	7855'	*L. balmei*
SWC 11	7897'	*L. balmei*
SWC 10	7990'	*L. balmei*
SWC 9	8076'	*L. balmei*
SWC 8	8092'	*L. balmei*
SWC 6	8190'	*L. balmei*
SWC 5	8250'	*L. balmei*
SWC 3	8404'	Indeterminate
SWC 2	8496'	*T. longus*
SWC 1	8546'	*T. longus*

REFERENCES

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