

Horizons investigated from both zones contain a predominance of land derived forms, with occasional microplankton occurring throughout the section.

The microfloral suites obtained from the three well sequences are documented and discussed below and the age of the sediments is discussed. Microfloras obtained from approximately age-equivalent sediments are shown to exhibit considerable variation in both quantitative and qualitative representation of spores, pollen grains and microplankton. Some of the variations observed in the microfloras are briefly discussed and the potential usefulness of certain plant microfossils in the interpretation of palaeoenvironments is indicated.

NOTE ON METHODS OF EXTRACTION

Extraction procedures used in the examination of the sediments include initial treatment in hydrofluoric acid followed by mineral separation with zinc bromide. Residues were then subjected to brief exposure to ultrasonic vibration (1 minute) before mounting in glycerine jelly.

The zinc bromide treatment was found to be unsatisfactory for samples from Kingfish A-1 well, 8000 - 8500 feet since small pyrite crystals were embedded in and/or closely attached to the walls of the contained plant microfossils. Consequently, the plant microfossils were extracted by treatment with hydrofluoric acid followed by immersion in 50% hydrochloric acid before exposure to ultrasonic vibration.

INTERPRETATIVE

MICROFLORAL CONTENT AND AGE OF SEDIMENTS

Kingfish(A-1)well

7402, feet, 7422 feet, and 7433 feet (core samples)

Samples from these levels failed to yield spores, pollen grains, or microplankton.

7595-98 feet and 7593-601 feet (core samples)

The microfloras which are composed of spores and pollen grains are documented by Dettmann (1967a) who referred them to the Eocene Duplopollis orthoteichus Assemblage.

7884 feet, 7934 feet, and 8113 feet (sidewall cores)

Dettmann (1967b) lists spore and pollen types obtained from the sediments. The horizon at 7934 feet yielded Dacrydiumites balnei and on this basis the microflora was considered to be referable to the Paleocene Triorites edwardsii Assemblage or to the late Cretaceous-early Tertiary Transition Assemblage. Evidence documented below from cuttings between 8000 feet and 8300 feet supports the former assignment.

8000 - 8300 feet (cuttings)

Small residues of fairly preserved plant microfossils were extracted from cutting samples between 8000 and 8300 feet. Chitinous foraminiferal tests in whorls of up to eight chambers were observed in the majority of samples between 8000 feet and 8150 feet. Microplankton are also abundant between 8000 feet and 8200 feet and numerically outnumber spores and pollen grains (60-70% microplankton, 30-40% spores and pollen). Pollen forms identified include rare angiospermous types referable to Nothofagidites emarcidus (Cookson), Proteacidites crassus Cookson, and P. subscabratus Couper, and more numerous gymnospermous grains which are represented by Phyllocladidites mawsonii Cookson, Podocarpidites ellipticus Cookson, Microcachryidites antarcticus Cookson, Dacrydiumites ellipticus

INTERPRETATIVE

Harris, and D. balmei Cookson (at 8200 feet only). The microplankton present include diverse hystrichosphaerid forms together with Cyclonephelium retiintertextum Cookson, Cordosphaeridium spp., and Deflandrea dilwynensis Cookson & Eisenack. The occurrence of Dacrydiomites ellipticus, D. balmei, and Deflandrea dilwynensis supports assignment of the microfossils to the Triorites edwardsii Assemblage, despite the fact that Triorites edwardsii was not observed in any of the samples.

Spores and pollen grains are more common in samples between 8200 feet and 8300 feet, but are numerically insubordinate to microplankton. Amongst the pollen, Phyllocladidites reticulosaccatus^{Harris}, Stephanoporopollenites^{occur} obscurus Harris, and Dacrydiomites ellipticus occur. Microplankton are represented by hystrichosphaerid types. The pollen species listed above indicate that horizons at 8300 feet are within the Triorites edwardsii Zone; forms diagnostic of older palynological zones were not observed.

Kingfish²(B-1)well

Samples examined include sediments of core 4 (7480, 7489 feet) and core 5 (7511, 7517 feet), which yielded abundant carbonaceous material consisting chiefly of wood fragments and rare spores and pollen grains. Microplankton were not observed.

7480 feet

Spores: Gleicheniidites circinidites (Cookson)
Trilites tuberculiformis Cookson
Pollen: Proteacidites annularis Cookson
P. crassus Cookson
P. dilwynensis Harris
P. subscabratus Coupér
Podocarpidites ellipticus Cookson
Phyllocladidites mawsonii Cookson

INTERPRETATIVE

7498 feet

Pollen: Araucariacites australis Cookson
Proteacidites annularis Cookson
P. subscabratus Couper
Tricolpites sp.

7511 feet

Spores: Cyathidites australis Couper
Gleicheniidites circinidites (Cookson)
Pollen: Proteacidites annularis Cookson
P. incurvatus Cookson
P. subscabratus Couper
Phyllocladidites mawsonii Cookson
Tricolporites microreticulatus Harris
Triorites harrisii Couper

7517 feet

Spores: Baculatisporites comaumensis (Cookson)
Cyathidites australis Couper
Gleicheniidites circinidites (Cookson)
Pollen: Dacrydiumites florinii Cookson & Pike
Proteacidites crassus Cookson
P. dilwynensis Harris
P. subscabratus Couper

The sparse microfloras are referred to the Eocene Duplopollis orthoteichus Assemblage on the basis of Proteacidites dilwynensis.

³
Kingfish C-1 well

7655 feet (sidewall core)

Reasonably well preserved plant microfossils obtained from the sample include abundant cuticular material, low concentrations of spores and pollen grains, and rare microplankton. Species identified include:

Spores: Cyathidites australis Couper
C. splendens Harris
Gleicheniidites circinidites (Cookson)
Stereisporites antiquasporites (Wilson & Webster)
Pollen: Araucariacites australis Cookson
Nothofaridites emarcidus (Cookson)
Podocarpidites elliotii Cookson
Proteacidites annularis Cookson
P. crassus Cookson
P. dilwynensis Harris

INTERPRETATIVE

P. subscabratus Couper
Microplankton: Deflandrea dartmooria Cookson & Eisenack

7934 feet (sidewall core)

A residue containing abundant cuticular material and fairly preserved spores and pollen grains was extracted from the sample. Species identified include:

Spores: Baculatisporites comaumensis (Cookson)
Cyathidites splendens Harris
Gleicheniidites circinidites (Cookson)
Latobosporites crassus Harris

Pollen: Araucariacites australis Cookson
Banksiaeidites sp.
Dacrydiumites ellipticus Harris (1 specimen only)
D. florinii Cookson & Pike
Myrtaceidites eugenioides Cookson & Pike
Nothofagidites emarcidus (Cookson)
Phyllocladidites mawsonii Cookson
Podocarpidites ellipticus Cookson
Proteacidites annularis Cookson
P. crassus Cookson
P. incurvatus Cookson
P. subscabratus Couper
Triorites harrisii Couper

8005 feet (sidewall core)

Reasonably well preserved spores and pollen grains were extracted from the sample and include the following species:

Spores: Cyathidites minor Couper
C. splendens Harris
Gleicheniidites circinidites (Cookson)
Laevigatosporites ovatus Wilson & Webster
Trilites tuberculiformis Cookson

Pollen: Araucariacites australis Cookson
Cycadopites sp.
Dacrydiumites ellipticus Harris
Microcachryidites antarcticus Cookson
Nothofagidites emarcidus (Cookson)
N. cf. brachyspinulosus (Cookson)
Phyllocladidites mawsonii Cookson
P. reticulosaccatus Harris
Polyporina fragilis Harris
Proteacidites crassus Cookson
P. incurvatus Cookson
P. subscabratus Couper
Podocarpidites ellipticus Harris

INTERPRETATIVE

Stephanoporopollenites obscurus Harris
Tiliaepollenites notabilis Harris
Triorites harrisii Couper
Remanié: Trilobosporites trioreticulosus - Lower Cretaceous

8237 feet (sidewall core)

The fairly preserved microflora includes abundant spores and pollen grains and rare microplankton. Constituent species include:

Spores: Cyathidites australis Couper
C. minor Couper
Lacvigatosporites ovatus Wilson & Webster
Gleicheniidites circinidites (Cookson)
Stereisporites antiquasporites (Wilson & Webster)

Pollen: Araucariacites australis Cookson
Dacrydiumites balmei Cookson
D. ellipticus Harris
Monosulcites prominatus McIntyre
Nothofagidites emarcidus (Cookson)
N. cf. brachyspinulosus (Cookson)
Phyllocladidites mawsonii Cookson
P. reticulosaccatus Harris
Proteacidites subscabratus Couper
Stephanoporopollenites obscurus Harris
Triorites harrisii Couper

Microplankton: Epicephalonyxsis indentata Deflandre & Cookson

8260 feet (sidewall core)

Abundant poorly preserved and strongly compressed plant microfossils were extracted from the sample. The assemblage which is chiefly composed of spores and pollen grains also includes rare microplankton.

Spores: Cyathidites splendens Harris
Gleicheniidites circinidites (Cookson)
Stereisporites antiquasporites (Wilson & Webster)

Pollen: Dacrydiumites balmei Cookson
D. ellipticus Harris
D. florinii Cookson & Pike
Microcachryidites antarcticus Cookson
Nothofagidites emarcidus (Cookson)
Proteacidites subscabratus Couper
Phyllocladidites mawsonii Cookson
Stephanoporopollenites obscurus Harris
Tricolpites gillii Cookson
Triorites edwardsii Cookson & Pike f. tenuis Stover & Jones

Microplankton: Deflandrea sp.
Gingiodinium tabulatum Cookson & Eisenack

Microfloras obtained from samples between 7655 feet and 3005 feet

INTERPRETATIVE

are assigned to the Duplopollis orthoteichus Assemblage on the basis of Proteacidites dilwynensis, P. incurvatus, and Tiliaepollenites notabilis. Thus, it appears that Dacrydiumites ellipticus (found at 7934 feet and 8005 feet) and Phyllocladites reticulosaccatus (present at 8005 feet) extend into basal horizons of the Duplopollis orthoteichus Zone.

Triorites edwardsii was observed at 8260 feet where it is associated with Dacrydiumites balmei and Gingiodinium tabulatum; the sediment is accordingly assigned to the Triorites edwardsii Zone. This zone is probably represented at 8237 feet on the basis of Dacrydiumites balmei.

CONCLUSIONS

Sediments examined from Kingfish (¹A-1, ²B-1, and ³C-1) wells yielded microfloras diagnostic of the Duplopollis orthoteichus Zone (Eocene) and the Paleocene Triorites edwardsii Zone. The distribution of these zones in the wells is as follows:

- 1) The D. orthoteichus Zone occurs in all three well sections. In Kingfish A-1 well it is represented at 7595 - 7601 feet; in Kingfish B-1 well it was recognized between 7480 feet and 7517 feet; and in Kingfish C-1 well horizons between 7655 feet and 8005 feet are assigned to the zone. Samples studied from these sections yielded microfloras composed chiefly of land derived plant microfossils; microplankton were observed only in Kingfish C-1 well and occur in minor proportions.
- 2) The Triorites edwardsii Zone is represented in Kingfish A-1, and B-1 wells. In Kingfish A-1 well it was identified in horizons between 7934 feet and 8300 feet; the microfloras extracted from sediments between 8000 feet and 8300 feet include infrequent spores and pollen grains which are outnumbered by microplankton. Chitinous foraminiferal tests were also observed in samples between 8000 feet and 8150 feet. Kingfish C-1 well includes horizons of the T. edwardsii Zone at 8237 feet and 8260 feet; the micro-

INTERPRETATIVE

floras from these horizons contain a dominance of spores and pollen grains with rare microplankton.

The nominate species of the Triorites edwardsii Zone, T. edwardsii, which, in its first occurrences down section, has been used in previous work as a means of delineating the top of the zone, was identified in only one sample from the Kingfish sections. The apparent lack of this species in the majority of/samples assigned to the T. edwardsii Zone suggests that the dispersal of the species may have been limited by factors prevailing during the deposition of the sediments. Amongst the spore and pollen species having stratigraphical significance in relation to the T. edwardsii Zone in the Kingfish sections are the saccate gymnospermous types, Dacrydiunites balmei and D. ellipticus. These species may prove to have wider application in the recognition of the T. edwardsii Zone despite the fact that neither is restricted to the zone.

Saccate pollen may also prove to have significance in environmental interpretations. Traverse and Ginsburg (1966) and Muller (1959) emphasize that the lateral distribution of buoyant saccate pollen is influenced by changes in turbulence, water density, and current patterns.

The environmental significance of microplankton recovered from the Kingfish sections has yet to be assessed fully since most forms identified await detailed taxonomic study. The majority of types observed are of the hystrichosphaerid-type and are referable to the Acritarcha, the affinities of which are uncertain. Nevertheless the group is generally believed to be typical of/shallow marine and brackish-water environments. The dominance of microplankton and their association with foraminiferal remains in the Triorites edwardsii Zone of Kingfish A-1 well is of some interest. Similar observations have been made on certain horizons of

INTERPRETATIVE

the same zone in Halibut A-1 well (report in preparation). In contrast only rare microplankton occur in horizons studied of the T. edwardsii zone in Kingfish C-1 well. A similar rare occurrence was noted from samples investigated of the same zone in Marlin A-1 and B-1 wells (Dettmann 1966a,b,c). Microplankton appear to be absent in the T. edwardsii Zone of Barracouta A-1 and Dolphin A-1 wells (Stover and Jones 1966, Dettmann 1968). Further discussion concerning the distribution of microplankton in sections examined from the Gippsland Basin is planned for a later report.

REFERENCES

- Dettmann, M.E. 1966a. Palynological report on sidewall cores from between 6650 feet and 7254 feet in Esso Gippsland Shelf No.4 well. Unpubl. report submitted to Esso Standard Oil (Australia) Ltd. 23/2/66.
- Dettmann, M.E. 1966b. Palynological report on core 12, Esso Gippsland Shelf No.4 well. Ibid. 21/2/66.
- Dettmann, M.E. 1966c. Palynological report on Esso Gippsland Shelf No.5 well between 749- feet and 9455 feet. Ibid. 12/10/66.
- Dettmann, M.E. 1967a. Palynological report on Esso Kingfish A-1 well, 7595 feet - 7601 feet. Ibid. 3/10/67.
- Dettmann, M.E. 1967b. Palynological report on Esso Kingfish A-1 well, 7834 feet - 8113 feet. Ibid. 6/9/67.
- Dettmann, M.E. 1968. Palynological report on Esso Dolphin A-1 well, 4028 - 9300 feet. Ibid. 24/4/68.
- Muller, J. 1959. Palynology of Recent Orinoco delta and shelf sediments; Reports of the Orinoco Shelf Expedition; Volume 5. Micropaleontology 5, 1-32.
- Stover, L.E. and Jones, D.H. 1966. Palynological dating of cores 14 to 21, Esso Gippsland Shelf No.1, Australia. Esso Production Research Co. Rept. EPR66-ES31.
- Traverse, A. and Ginsburg, R.H. 1966. Palynology of the surface sediments of Great Bahama Bank, as related to water movement and sedimentation. Marine Geol. 4, 417-59.

30th August, 1968.

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

INTERPRETATIVE