

37. PALYNOLOGY OF SITES 358, 356, 355 DSDP, LEG 39, SOUTHWESTERN ATLANTIC OCEAN

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SUMMARY

The palynology of 45 samples from DSDP Sites 355, 356, and 358 is briefly discussed. Owing to the scarcity of the palynomorphs recovered, the tentative ages given are based on individual occurrences rather than assemblages. The material studied from Site 358 ranges in age from late Eocene to late Oligocene; the material from Site 356 is undifferentiated upper Cretaceous (possible Senonian). No diagnostic elements were obtained from Site 355. The majority of species recorded are illustrated, systematic descriptions are not presented in this paper.

INTRODUCTION

Leg 39 drilling along the eastern margin of Brazil provided the opportunity to investigate the palynology of a wide variety of sediments. The present report summarizes the palynological analyses from borehole material cored at Sites 355, 356 and 358 (Figure 1). Site 358 is in the northeastern part of the Argentine Basin at 37°39.31'S, 35°57.82'W. The main sedimentary types penetrated, through intermittent coring, are radiolarian, siliceous, and ferruginous mudstones and marly chinks. Site 355 is in the Brazil Basin at 15°42.59'S, 30°36.03'W. The sedimentary sequence comprises a thick accumulation of zeolitic clays, underlain by a thin deposit of calcareous sediment which, in turn, overlies a fractured and weathered basaltic basement. Site 356 is on the São Paulo Plateau at 28°17.22'S, 41°05.28'W. The deposits penetrated range from marly chalk and mudstone to conglomeric clays. Further details are included in the Site Report chapters of this volume.

SAMPLE PREPARATION

The rock samples were prepared by means of standard palynological techniques using hydrofluoric acid followed, if necessary, by slight oxidation with concentrated nitric acid. Slides are kept in the palynological collection of EPR-E, Bordeaux. The coordinates given are those taken on a Zeiss photomicroscope I, No. 52348.

COMPOSITION AND AGE OF ASSEMBLAGES

The stratigraphic distribution of the palynomorphs obtained from all three sites is plotted in Figure 2. Fifty-five samples were prepared for palynological investigation. Samples were taken from those intervals for which age assignment by means of other fossil groups, such as foraminifers, coccoliths, and radiolarians, proved difficult. The occurrence of palynomorphs was very limited: the majority of samples are barren or contain only scarce specimens. In fact, most of the species recorded were encountered sporadically in the preparations. Preservation of microfossils varies

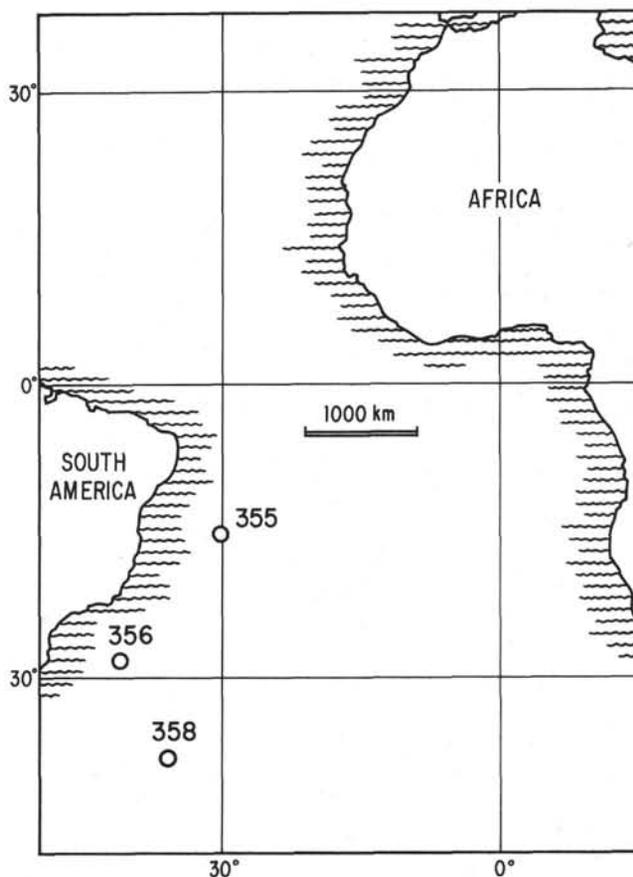


Figure 1. Locations of Sites 355, 356, and 358, DSDP Leg 39.

from good to extremely poor; the spores are generally better preserved. For these reasons, numerical analyses and detailed correlations with other areas were not attempted. Instead, tentative ages are given, and these are mostly based on individual occurrences. From the meager evidence available it was not possible to draw any conclusions concerning paleogeography, although

Cores 9 and 8 collectively contain *Deflandrea phosphoritica*, *Hystrichokolpoma cinctum*, *Operculodinium centrocarpum*, *Systematophora placacantha*, *Thalassiphora succincta*, and a badly preserved specimen of *Chropteridium* sp. An Oligocene age is assigned to this interval.

Core 7 yielded no stratigraphically significant elements, including such elements as *Operculodinium centrocarpum*, *Tectatodinium* sp., and a single record of a form provisionally attributed to *Lejeunia*; the last species is possibly derived from upper Cretaceous sediments. A reasonable assemblage was obtained from Section 358-6-3. It includes *Cyclonephelium* cf. *reticulosum*, *Deflandrea phosphoritica*, *Operculodinium centrocarpum*, and *Thalassiphora succincta*. On the basis of the presence of *T. succincta*, presently known from Oligocene sediments, and *C. cf. reticulosum* (type described from the middle-upper Oligocene), a tentative Oligocene age may be assigned to this assemblage.

Core 5 contains *Deflandrea phosphoritica*, *Tuberulodinium vancamptoeae*, and *Schematophora speciosa*. The presence of both *D. phosphoritica*, a species to date not recorded from Miocene sediments, and *T. vancamptoeae*, a form unknown from deposits older than upper Oligocene, may indicate a late Oligocene age. The presence of *S. speciosa* in Section 5-1 is unusual. This species is generally considered to be absent from rocks younger than Eocene, although it has been questionably recorded from the middle Miocene of Australia.

SITE 355

Site 355 proved to be least fossiliferous of the three sites studied. Nearly all samples are devoid of any type of acid-insoluble microfossils, and only sparse organic matter was obtained in the preparations. Most palynomorphs obtained were referred to as *Pterospermopsis* spp., and no attempt was made to differentiate them to species level. *Tasmanites* spp., *Tythodiscus* sp., *Leiosphaeridia* spp., scattered specimens of *?Rugaepollis* sp., and some possible derived Cretaceous forms constitute the rest of the assemblages. Dinoflagellates are absent, with the exception of Section 355-17-1 which yielded two questionable records of *Deflandrea phosphoritica* (a species confined to the Eocene and Oligocene). This assemblage is too limited for any definite stratigraphic conclusion to be drawn, but a marine depositional environment is indicated, at least for the interval represented by Core 355-15.

SITE 356

The assemblages obtained from this site are very restricted, both numerically and in diversity. Hence, only broad generalizations can be made concerning their stratigraphic significance.

The microflora is a mixture of terrestrially derived micro-fossils and marine microplankton, accompanied by abundant wood matter. Although reworking from older rocks appears to have considerably contributed to the composition of the assemblages (as at Site 355), the above characteristics suggest that the sediments were not deposited far from land. Core 356-41 is virtually

devoid of any type of palynomorph with the exception of scarce specimens apparently derived from older sediments, and certain spheres of unknown affinity (?algal). Only the topmost sample of Core 356-40 (Section 1) can be considered rich in palynomorphs. Interesting is the occurrence of *Reticulitrites heteroluminensis*, a species recently described from the Cenomanian of Gabon (Boltenhagen 1975b), and *Ephedripites* sp., a highly distinctive upper Cretaceous/lower Tertiary form with spiral ridges frequently illustrated in the Russian literature. Another important occurrence is of a "triporosulcate" species tentatively referred to *Accuratipollis* Chlonova, 1961. This palynomorph seems to be structurally related to the Tertiary genus *Anaculosidites* (Cookson and Pike) Potonie, 1960. The type of *Accuratipollis* was originally reported from the upper Cretaceous of Western Siberia, but forms exhibiting similar morphological characters have also been described from equatorial Africa (e.g., from Gabon, by Belsky and Boltenhagen, 1963).

The above data cannot provide an age more precise than Late Cretaceous. Core 39 contains the richest assemblages at this site. Besides other species, it contains *Dinogymnium* (*D. acuminatum*), a genus unknown below the upper Coniacian, *Deflandrea granulostriatum*, reported from the Maestrichtian of the Senegal Basin and upper Senonian of Eastern Brazil (Herngreen, 1975b), *Punctioratipollis krutzschii*, recently described from the Turonian of Gabon (Boltenhagen, 1975a), *Foveotricolpites prolatus* from the upper Senonian of Eastern Brazil (Herngreen, 1975a), and *Silicisphaera buspina*, a new form recorded from Turonian and Senonian deposits. As a whole, this assemblage may justify a Senonian age, probably not older than upper Coniacian.

The assemblage obtained from the top of Core 38 is sparse. *Dinopterygium cladoides*, *D. acuminatum*, and *Xenascus ceratioides* are the most significant elements. A Senonian age, probably younger than upper Coniacian, may be assigned to this interval.

ACKNOWLEDGMENTS

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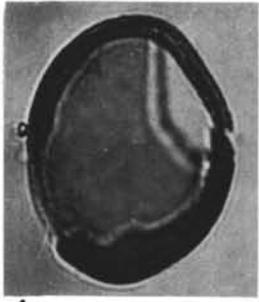
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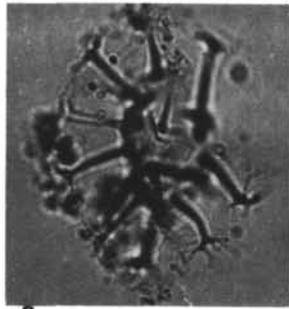
PLATE 1
All figures $\times 750$

- Figure 1 *Tectatodinium* sp.
Specimen showing precingular archaeopyle:
Section 358-7-2; 105668
- Figure 2 *Nematosphaeropsis* sp.
Section 358-10-4; SL.1:1095112.
- Figure 3 *Operculodinium centrocarpum* (Deflandre and Cookson) Wall, 1967.
Precingular archaeopyle upwards; Section 358-6-3;
940139.
- Figure 4 *Phthanoperidinium eocenicum* (Cookson and Eisenack) Lentin and Williams, 1973.
Section 358-10-4; SL.1:1158208.
- Figure 5 *Spiniferites ramosus* (Eisenack) Loeblich and Loeblich, 1966.
Section 358-5-1; 1156231.
- Figure 6 *Leptodinium* sp.
Apical view; Section-358-8-3; 1137225.
- Figure 7 *Hystrichokolpoma rigaudae* Deflandre and Cookson, 1955.
Apical view; Section 358-10-4; SL.2:99598.
- Figure 8 *Hystrichokolpoma cinctum* Klumpp, 1953.
Section 358-9-2; 106698.
- Figure 9 *Schematophora speciosa* Deflandre and Cookson, 1955.
Apical view slightly offset, Section 358-5-1;
107040.
- Figure 10 *Cyclonephelium* cf. *reticulosum* Gerlach, 1961.
Section 358-6-3; 110366.
- Figure 11 *Thalassiphora succincta* Morgenroth, 1966.
Section 358-6-3; 97353.
- Figure 12 *Deflandrea phosphoritica* Eisenack, 1938.
Core 358-10, CC; 1113190.
- Figure 13 *Tuberculodinium vancampoe* (Rossignol) Wall, 1967.
Section 358-5-3; 934214.
- Figure 14 ? *Lejeunia* sp.
Section 358-7-2; 94970.
- Figure 15 *Trichodinium castanea* (Deflandre) Clarke and Verdier, 1967.
Section 356-39-5; SL.1:1163222.

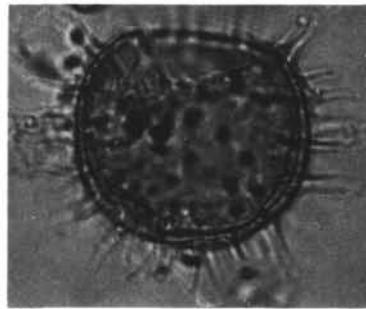
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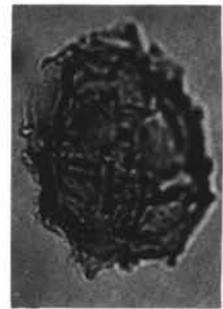
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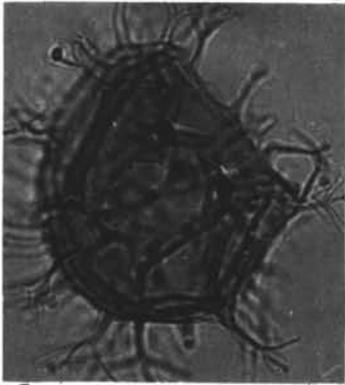
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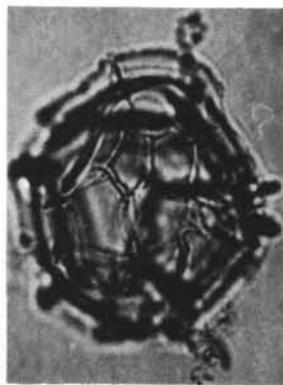
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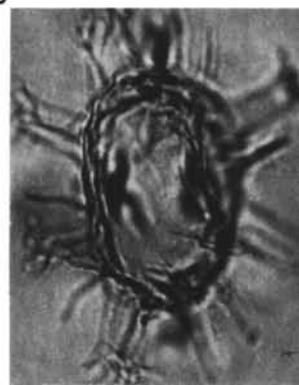
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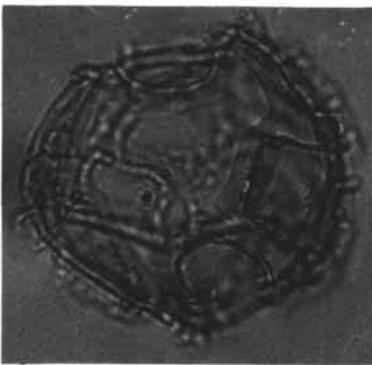
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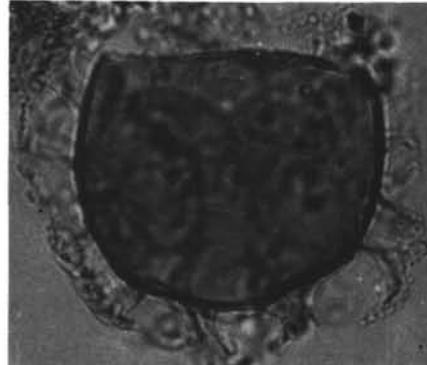
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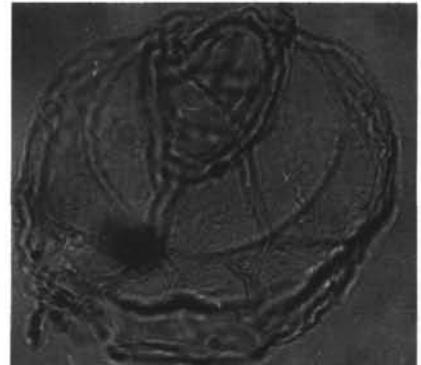
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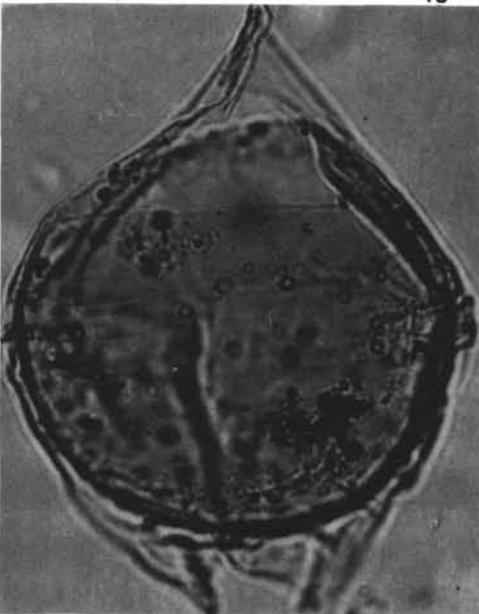
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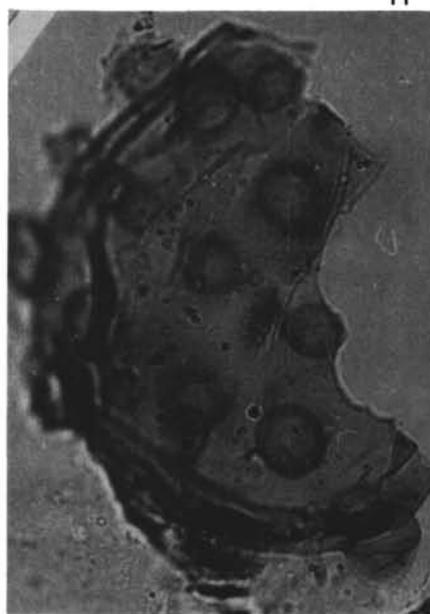
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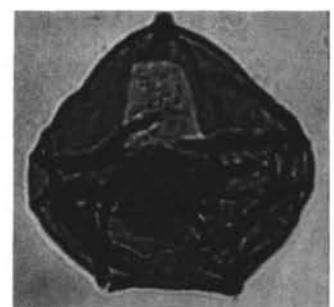
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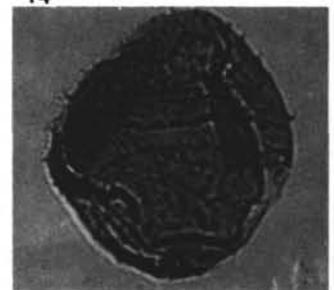
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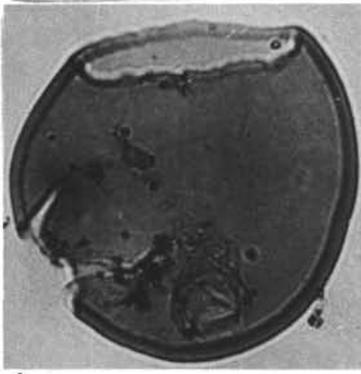
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PLATE 2

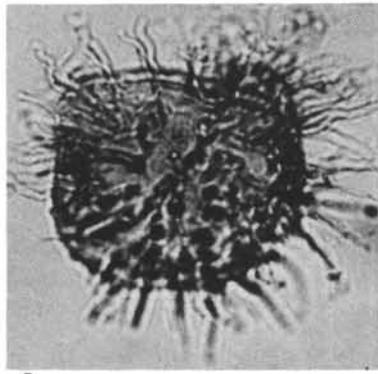
All figures $\times 750$ unless otherwise stated.

- Figure 1 *Fromea* sp.
Section 356-38-1; 1090217.
- Figure 2 *Exochosphaeridium bifidum* (Clarke and Verdier)
Clarke, Davey, Sarjeant, and Verdier, 1968.
Precingular archaeopyle upwards; Section 356-38-1; 932156.
- Figures 3, 4 *Heslertonia* sp.
4. Detail showing striate septa, $\times 1000$, Section 356-38-1; 95580.
- Figures 5, 6 *Silicisphaera buspina* Davey and Verdier (in press).
Speciment showing precingular archeopyle.
6. Phase contrast photograph showing structure of processes, $\times 1000$; Section 356-39-3; 1096120.
- Figure 7 *Conosphaeridium striatoconus* Deflandre and Cookson, 1969.
Section 356-39-5; SL.1:1135170.
- Figures 8, 9 *Dinogymnium acuminatum* Evitt, Clarke, and Verdier, 1967.
8. Section 356-39-4; SL.1:1128202.
9. Section 356-39-4; SL.2:111250.
- Figures 10, 11 *Pterodinium* sp.
10. Dorsal view; Section 356-38-2; SL.1:1057145.
11. Ventral view.
- Figure 12 *Deflandrea granulostriatum* (Jain and Milleped) Herngreen, 1975b.
Section 356-39-3; 94479.
- Figure 13 *Oviodium* sp.
Section 356-40-1; SL.1:1106150.
- Figure 14 *Odontochitina operculata* (O. Wetzel) Deflandre and Cookson, 1955.
Section 356-40-1; SL.1:1023147.

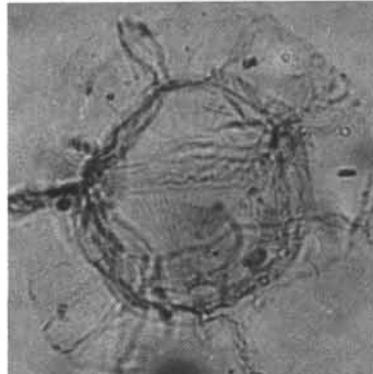
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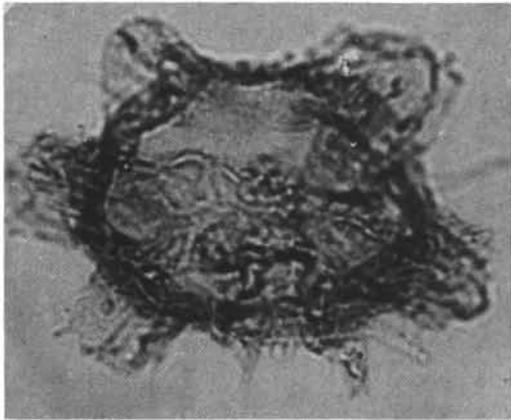
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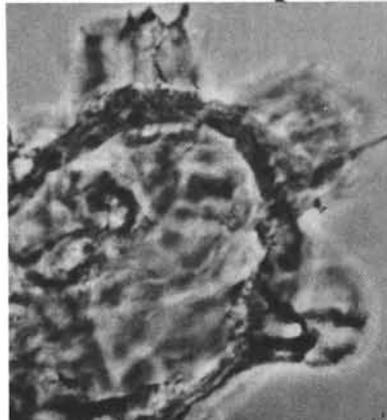
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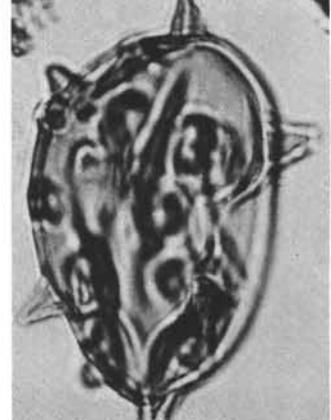
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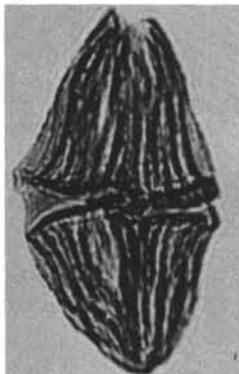
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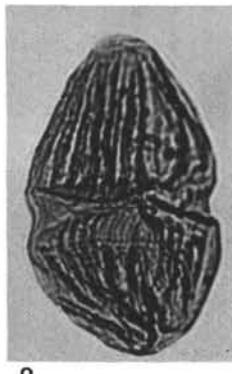
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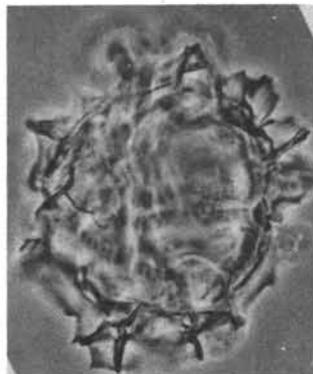
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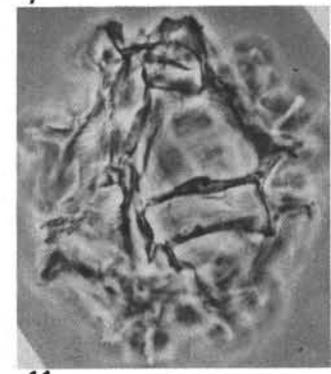
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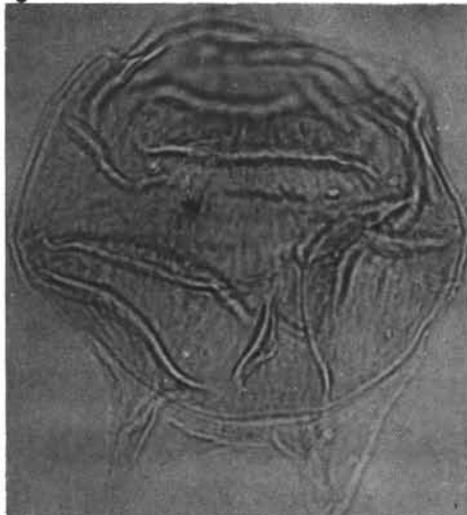
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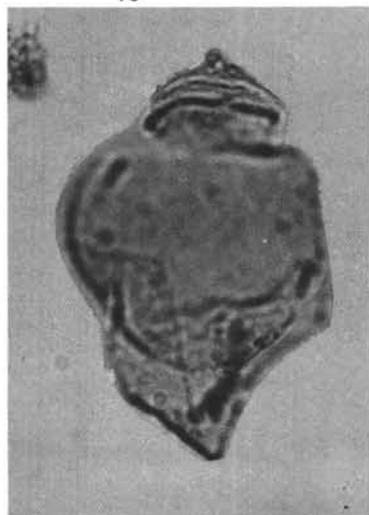
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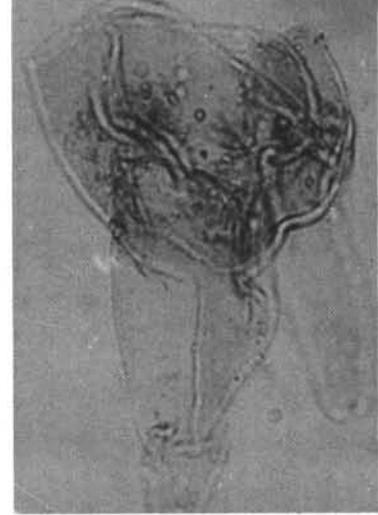
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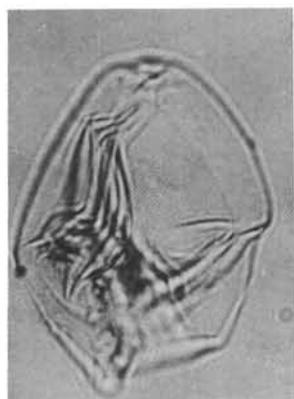
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PLATE 3

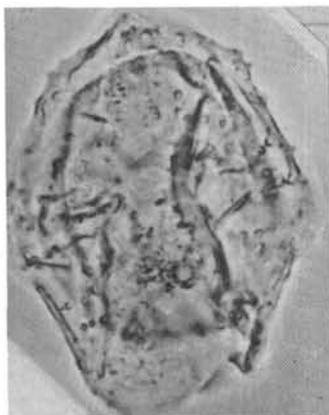
All figures $\times 750$ unless otherwise stated

- Figure 1 *Deflandrea* cf. *acuminata* Cookson and Eisenack 1958.
Apical horn appears folded over periphragm;
Section 356-40-5; SL.2:121038.
- Figure 2 *Cooksoniella* cf. *scheii* (Manum) Lentin and Williams, 1973.
Section 356-40-1; SL.2:117252.
- Figure 3 *Deflandrea* ?*macrocysta* Cookson and Eisenack, 1960.
Archaeopyle type 3 not clearly seen; Section 356-39-5; SL.2:108332.
- Figures 4, 7, 9, 12 *Pterospermopsis* spp.
4. Section 355-15-1; 94440.
7. Section 355-15-1; 187137.
9. Section 355-15-4; 1198148, $\times 500$.
12. Section 355-15-1; 106852, $\times 500$.
- Figure 5 *Foveotricolpites prolatus* Herngreen 1975a.
Section 356-39-4; SL.2:1023108.
- Figure 6 *Leiosphaeridia* sp. (recorded by Harris, 1974, pl. 3, fig. 16).
Section 355-15-1; 102547.
- Figure 8 *Tasmanites* sp.
Specimen showing a very thick exine, Section 355-15-4; 1198148.
- Figure 10 *Tythodiscus* sp.
Section 355-15-1; 100954.
- Figure 11 *Callialasporites* cf. *C. trilobatus* Sukn Dev. 1961.
Section 355-15-2; SL.1:1180128.
- Figures 13, 14. ?*Rugaepollis* sp. Section 355-15-1; 102460, $\times 1000$.
13. Section 355-15-1; 1138106.
14. Detail to show the exine structure.

PLATE 3



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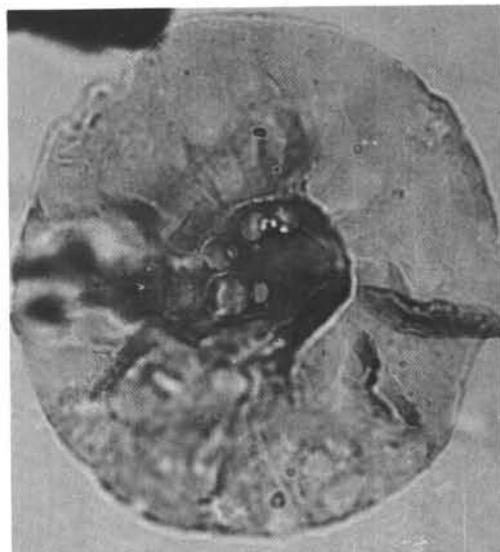
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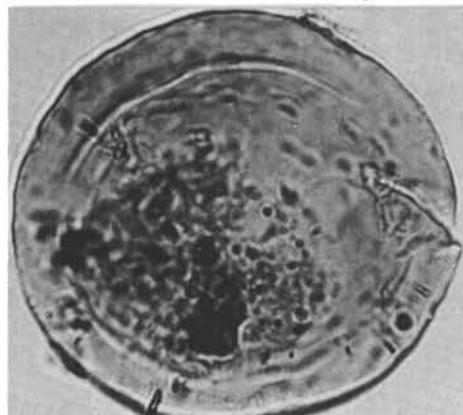
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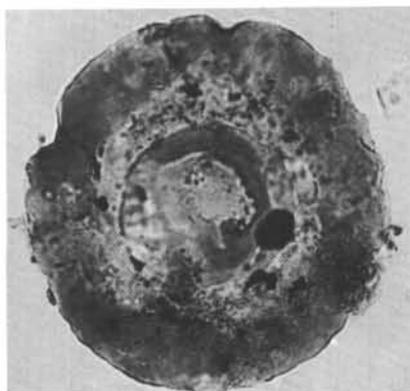
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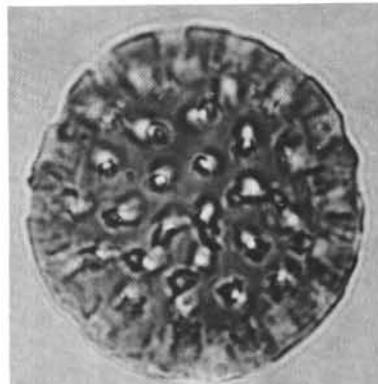
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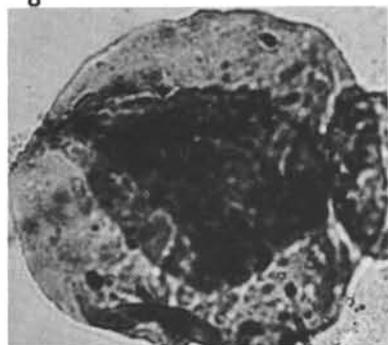
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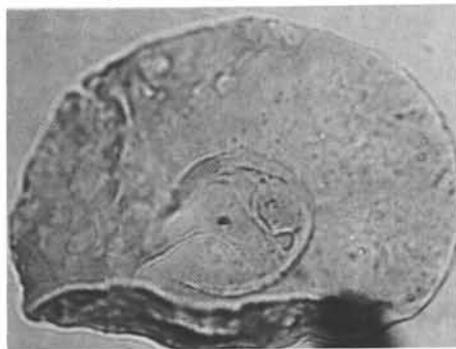
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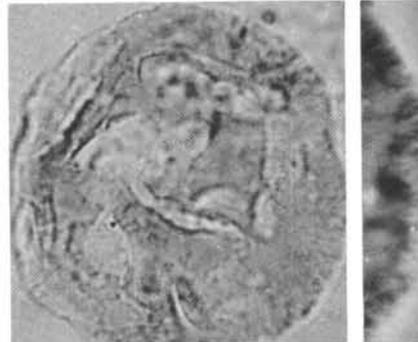
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PLATE 4

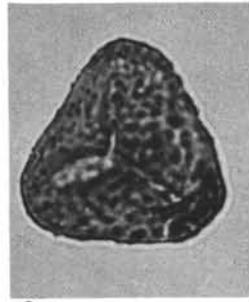
All figures $\times 750$ unless otherwise stated

- Figure 1 *Cyathidites minor* Cooper, 1958.
Section 355-15-2; SL.1:115582.
- Figure 2 *Concavissimisporites* sp.
Section 355-15-2; SL.1:955155.
- Figure 3 *Interulobites* sp. A.
Section 356-40-1; SL.1:932121.
- Figure 4 *Interulobites* sp. B.
Section 356-40-1; SL.2:1015227.
- Figure 5 *Undulatisporites* sp.
Section 356-39-4; SL.1:102690.
- Figure 6 *Pilosisorites* cf. *trichopapillosus* (Thiergart)
Delcourt and Sprumont, 1955.
Section 356-41-1; SL.1:116195.
- Figure 7 Indeterminate sp. 1.
A form structurally similar to modern *Schizeca*
but no germinal scar observed. Section 356-39-4;
SL.2:108163.
- Figure 8 *Ephedripites* sp. A.
Showing spiral costae. Section 356-40-1;
SL.2:119035.
- Figures 9, 11 *Rouseisorites* cf. *reticulatus* Pocock 1962.
9. Section 356-39-4; SL.2:115176.
11. Section 356-39-4; SL.1:1184223.
- Figure 10 *Cerebropollenites mesozoicus* (Cooper) Niltson,
1958.
Section 355-15-2; SL.2:1046173.
- Figure 12 *Reticulitriletes heteroluminensis* Boltenhagen,
1975b.
Section 356-40-1; SL.2:1079223.
- Figure 13 *Cicatricosporites* sp.
Section 356-39-4; SL.1:1100258.
- Figure 14 *Tricolpites* sp.
Section 356-39-2; SL.1:102594.
- Figures 15, 16 *Punctioratipollis krutzschi* Boltenhagen, 1975.
15. Section 356-39-4; SL.2:100740.
16. Section 356-39-4; SL.1:102146.
- Figures 17, 18 *Classopollis* sp.
Specimens showing concentric striations.
17. Section 356-40-1; SL.2:946107.
18. Section 356-40-1; SL.1:947132.
- Figure 19 *Classopollis torosus* (Reissinger) Balme, 1957.
Section 356-39-5; SL.2:120070.
- Figures 20, 21 Cf. *Accuratipollis* sp.
20. Specimen showing round out apical apertures;
Section 356-39-4; SL.1:103732.
21. Specimen showing slit-like apical apertures
(*trichotomosulcate*); Section 356-40-1;
SL.2:946107.

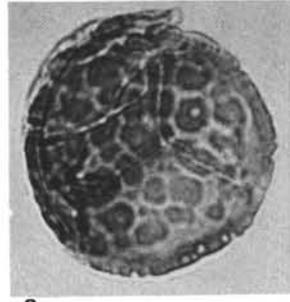
PLATE 4



1



2



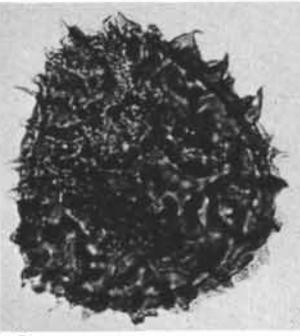
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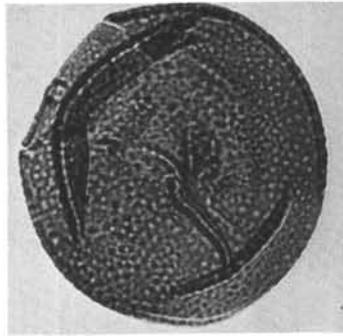
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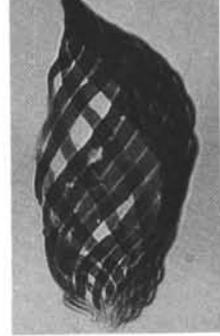
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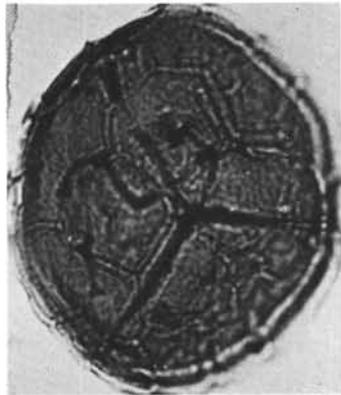
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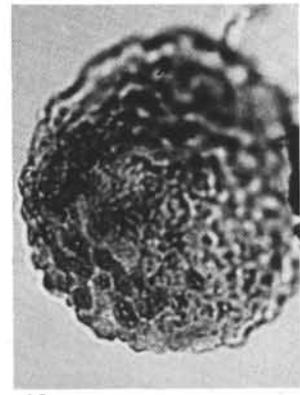
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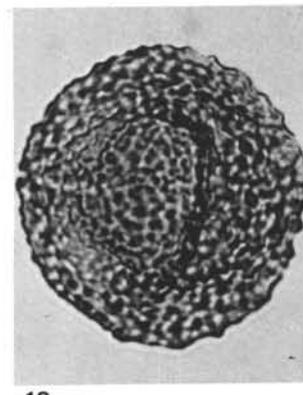
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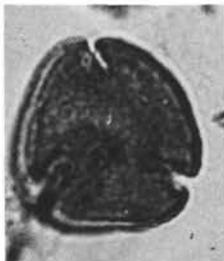
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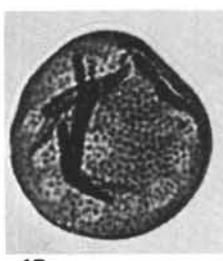
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13



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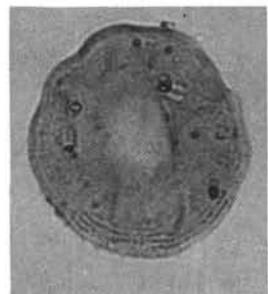
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16



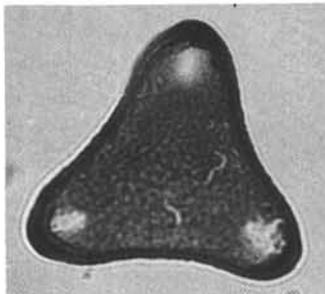
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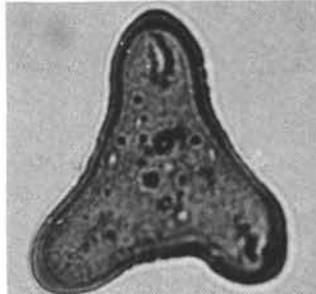
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19



20



21