LEIDSE GEOLOGISCHE MEDEDELINGEN, deel 33, pp. 63—69, separate published 10-1-'65

SOME NEW SPECIES OF CLASSOPOLLIS FROM THE JURASSIC OF THE NETHERLANDS

by

D. BURGER.

INTRODUCTION.

During an extensive investigation on Upper Jurassic and Lower Cretaceous pollen and spores we were able to make a detailed study of *Classopollis* (Pflug 1953) Pocock & Jansonius 1961. The basic material for our study consisted of a boring section in the East of Holland, that was very kindly placed to the disposal of Dr. Th. van der Hammen, head of the Palynological Laboratory, by the N.V. Nederlandsche Aardolie Maatschappij (N.A.M.) in Oldenzaal.

The grains of *Classopollis* form an interesting object of inquiry because of the complexity of features to be observed on these grains. All that has been published about *Classopollis* before has been insufficient for any comparison with new material, both concerning the descriptions and the illustrations. It was the outstanding publication of Pocock and Jansonius (1961), that contained detailed and complete descriptions of some *Classopollis* species which permitted us to make a comparison with the Dutch *Classopollis* grains.

The Dutch samples from the Upper Jurassic mostly contain a rich pollen flora, in which *Classopollis* is represented with 25 to 100 %, that is to say in numbers up from 2000 to 3000 per slide. The fine state of preservation permitted to study even the most subtle details; the present paper is the result of this study.

In spite of their favourable condition more than half of all grains proved to be too distorted or wrinkled for a closer examination. Only some thousands of grains could be selected without ruptures or deformations, a condition which is absolutely necessary for a detailed study of all features.

Some of the features of *Classopollis*, that we consider to be characteristic for specific determination, are also mentioned in the paper of Pocock and Jansonius. The morphological terminology that is used in our paper is derived from Faegri and Iversen (1964). The following characteristics are regarded to be important:

1. Type of exine sculpture and structure, which may be different on the distal and proximal hemisphere of the grain.
2. Ornamentation or lack of ornamentation of endexinal surface.
3. Structure of distal aperture.
4. Degree of equatorial exine thickening.
5. Number of equatorial endostriae.
6. Thickness of exine.
7. Shape of the grain. This feature is only of value for a specific determination in excellently conserved material.

The grain size proved to be only of relative value. The results of many measurements showed a slow decrease of the grain size in each species, going upwards in the boring section (to be published later). It seems that the ratio between polar and equatorial axis is more constant. However, just like the grain shape this feature is only useful in order to obtain an exact value in the case of a brilliant pollen preservation.

In spite of the excellent condition of the pollen material, the real structure of the distal pore has not been discovered beyond all doubt for some *Classopollis* species. The closest investigation, either in polar or in tangential view could not always lead to a satisfying decision. Both *C. torosus* and *C. alexi* show a speckled membrane spanning the pore aperture. This membrane must be a rudiment of the ektexine with reduced columellae. In tangential view the endexine of *C. torosus* can be seen to wedge out at the edge of a circular area at the pole. *C. multistriatus* also shows an endopore (Plate I fig. 6), the loosened ektexine shows an aperture as well. *C. hammenii* has a pore area in which the columellae are absent: there are neither sculpture elements nor perforations visible, indicating that the ektexine is lacking. The endexine is running undisturbed across the polar area.

Another remarkable feature visible on many grains is the ring-shaped transition zone between the distal hemisphere and the equatorial band, generally representing an exine thinning. Balme (1957) mentioned the presence of an operculum in his description of *Classopollis*, but it is doubtful whether there can be spoken of an operculum, considering the presence of a distal pore with an evident germinal function. For this reason we prefer the term r i m u l a (Pflug 1953).

PHOTOGRAPHS.

The figures which accompany this paper have been obtained by making a careful selection of the material available, which resulted in some 20 to 25 pollen grains suitable for photographing. The optical equipment consisted of a Leitz Ortholux binocular microscope (laboratory number PO 58), provided with an immersion objective Pl 160 x aperture 1.40 and an ocular lens Periplan 10 x. The microscope light was filtered through 2 green glasses to obtain a monochromatic effect. The photographs were taken on AGFA Isopan IFF 13° Din (16 ASA) with a Leica camera house, the exposure time was 1 second.

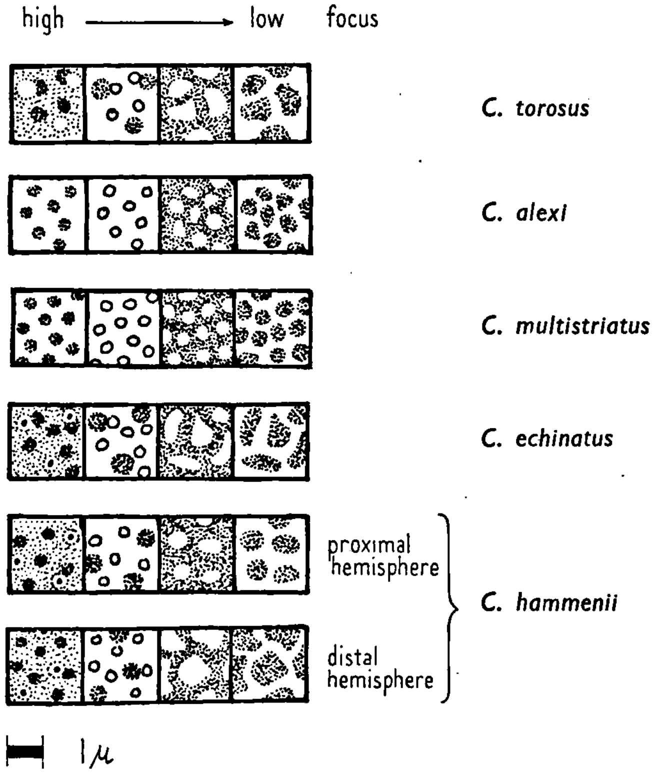
The gradation of the photograph paper depended on the nature of the details to be shown. The entire grain was most favourably reproduced on hard paper, in order to show the equatorial ridges and the exine structure. In this way also the minute exine details of Plate II figs. 9 were pictured with optimal clearness. It was necessary however to use soft paper to make the hair-like echinae of Plate III figs. 14–15 visible: these details make high demands on the quality of the printing procedure.

The magnification generally is 2200 times. As for the figures marked with a micron indication see the Plate explanations.

SYSTEMATICS.

As a result of all observed features of the Dutch *Classopollis* grains we agree with the emended generic description of Pocock and Jansonius (1961), the type species being *Classopollis classoides* (Pflug 1953) Pocock & Jansonius 1961. We also agree with the opinion of Couper (1958) and Pocock & Jansonius that *Circumpollis* and *Canalopollis* Pflug are synonyms for *Classopollis*. However, Couper's description of *C. torosus* is too wide, regarding the great range of variety in exine features, which we consider of specific value.

Therefore we like to make an emendation of *C. torosus*. The original holotype being lost, and no other neotype has been indicated by Couper, we think that it is useful to establish a definite neotype here. Besides *C. torosus* four new species are described.



Text figure 1.

Classopollis torosus (Reissinger 1950) Couper 1958 emended.

Plate I figs. 1 and 2.

Neotype: bore hole Tubbergen 6, depth & slide number 660.5–1, coordinates 34.3–117.5 (PO 58).

Emended description: Grain distally monoporate, more or less spherical, provided with a thickened equatorial band. Distal hemisphere flattened and proximal hemisphere slightly cone-shaped. Exine of both hemispheres 1.5 to 2 μ thick, ektexine tectate, perforate and provided with a scabrate sculpture (see text fig. 1). Columellae irregularly circular and between 0.5 and 1 μ in cross-section. Equatorial band 2.5 to 3 μ thick, 7 to 8 μ broad, scabrate, perforate and provided with endotriae, running parallel around the equator and occasionally interrupted, sometimes 5 or 9, but mostly 6 to 8 in number. The endostriae may possibly be regarded as a fusion of rows of columellae. A rimula is clearly visible, formed by a thinning of the exine, caused by reduced columellae. Distal pole showing a small circular area, about 5 μ in diameter in which the endexine is absent. The ektexine with much reduced columellae is spanning the pore aperture. Proximal pole showing a triangular area in which the columellae are much reduced or absent. Endexine everywhere equally thick. When the ektexine loosens, the endexine surface seems to be smooth. Grain size 23 × 27 to 26 × 29 μ.

Distribution: (Western Europe) (Upper) Jurassic and Lower Cretaceous. (Neotype Upper Malm).

Occurrence: frequent, often in tetrads and forming 40 to 70 % of the Dutch *Classopollis* flora.

Remarks: from our specific description follows that *C. torosus* and *C. classoides* (Pflug 1953) Pocock & Jansonius 1961, are not identical. This identity was suggested by Couper (1958) and by Lantz (1958), but Pocock and Jansonius explicitly state that the exine of *C. classoides* is not tectate.

The sculpture of *C. torosus* is difficult to detect and in many cases worn away together with the tectum, in which case the grain seems to be originally intectate.

Classopollis alexi n. spec.

Plate I fig. 3 to 5.

Holotype: bore hole Tubbergen 6, depth & slide number 654–2, coordinates 32.4–109.9 (PO 58).

Description: Grain distally monoporate with a thickened equatorial band and flattened hemispheres. Exine of hemispheres thin, about 1.5 μ, ektexine tectate, perforate (see text fig. 1). Columellae densely packed, circular and not exceeding 0.5 μ in cross-section. Equatorial band 1.5 to 2.5 μ thick and 10 to 11 μ broad, also perforate and showing endostriae which are running parallel around the equator, 8 to 10 in number, 0.5 to 0.6 μ broad, occasionally interrupted or bifurcating. The endostriae may possibly be formed by a fusion of columellae. A rimula is visible as a thinning of the exine, caused by reduced columellae. Distal pole showing a circular area of 9 to 10 μ in diameter (Plate I fig. 5) without sharply limited border where the columellae gradually reduce towards the pole. The pore area is spanned by a perforated membrane that must be the remainder of the ektexine. The endexine may be missing in this area, but this is difficult to discover. Proximal pole showing a circular or triangular area (Plate I fig. 3, Plate III fig. 13), measuring 7 to 11 μ across, apparently the contact area in the tetrad. Here the ektexine is missing except for some rods or granules as remains of the columellae. Endexine has an equal thickness overall. When the ektexine loosens, the endexine can be seen to have a minutely granulated surface on both hemispheres and very faint ridges, running parallel around the equator.
Grain size 33 × 29 to 36 × 33 μ.

Distribution: (Holland) Upper Jurassic and Wealden. (Holotype Upper Malm).

Occurrence: rare, but common in some slides.

Remarks: the grain is seldom found undamaged, so that we could not make a satisfactory photograph in equatorial view. Nevertheless it is easily distinguished by its thin exine and broad equatorial band with heavy endostriae.

Classopollis multistriatus n. spec.
Plate II figs. 10 and 11.

Holotype: bore hole Tubbergen 6, depth & slide number 654–1, coordinates 35.4–109.6 (PO 58).

Description: Grain distally monoporate, spherical, sometimes with slightly flattened poles, provided with a thickened equatorial band. Exine of both hemispheres 1 μ thick, ektexine tectate, perforate (see text fig. 1). Columellae densely packed, circular and less than 0.5 μ in cross-section. Equatorial band 1.5 μ thick, 8 to 9 μ broad, perforate and provided with 10 to 14 endostriae running parallel around the equator, sometimes bifurcating or interrupted. Marginal endostriae often passing into a row of columellae. Rimula distinct, formed by a narrow zone without columellae. Distal pole showing a circular area of 5 μ across in which the ektexine and the endexine are missing (Plate I fig. 6). Endexine is covering the proximal pole. No statements could be made about the ektexine. Endexine equally thick everywhere. When the ektexine loosens, the endexine surface appears to be minutely granular on both hemispheres and shows faint ribs running parallel on the equatorial band.
Grain size 24 to 27 μ.

Distribution: (Holland) Upper Jurassic. (Holotype Upper Malm).

Occurrence: rare.

Remarks: the grain is easily recognized by its small size, the thin exine and the broad set of fine endostriae. It is certainly close to *C. torosus*, but it differs from *torosus* by its smaller size, the broader equatorial band (in ratio to the length of the polar axis), the number of endostriae and thinner exine.

Classopollis echinatus n. spec.
Plate III figs. 14 and 15.

Holotype: bore hole Tubbergen 6, depth & slide number 678–2, coordinates 33.1–118.5 (PO 58).

Description: Grain distally monoporate, spherical, usually flattened at the poles, provided with a slightly thickened equatorial band. Exine on both hemispheres 1.5 to 2 μ thick, ektexine tectate, perforate and provided with an echinate sculpture (see text fig. 1). Echinae hair-like, irregularly scattered, extremely hyaline with a height of 1.5 to 2 μ and a basal diameter of less than 1 μ. Columellae irregular to oval in cross-section, twice as long as broad, measuring approximately 1.0 × 0.5 μ. Equatorial band 4 μ broad, about 2 μ thick, covered with echinae (Plate III fig. 17), perforate and provided with 3 to 5 endostriae, which bifurcate sometimes and may possibly be regarded as fusions of equatorial columellae. Usually a rimula is vaguely visible as an exine thinning, caused by reduced columellae. At the distal pole a weakened pore area occurs, visible by its lighter colour; diameter difficult to measure, probably about 5 μ. The pore may be an endopore, regarding the fact that the echinae cover the whole distal hemisphere. Around the proximal pole the exine is thinner and shows no echinae. This may indicate that the ektexine is missing in this area. Endexine overall equally thick. When the ektexine loosens, the endexine surface appears to be smooth.
Grain size 24 to 26 μ.

Distribution: (Holland) Upper Jurassic. (Holotype Upper Malm).

Occurrence: rare.

Remarks: the echinae are readily worn off, thus making the grain very much resemble *C. torosus*. The differences with *torosus* are the form of the columellae (see text figure 1) and the grain shape.

Classopollis hammenii n. spec.

Plate II figs. 7 and 8.

Holotype: bore hole Tubbergen 6, depth & slide number 660.5–2, coordinates 31.5–111.5 (PO 58).

Description: Grain distally monoporate, spherical, provided with an equatorial band. Ektexine on both hemispheres tectate, perforate and provided with a sculpture of small, hyaline, hair-like echinae, reaching up to 1.5 μ. Exine of proximal hemisphere 1.5 to 2 μ thick, columellae circular and measuring about 0.5 μ in cross-section. Exine of distal hemisphere 2.5 μ thick, columellae often polygonal and measuring 1 $\times$ 1 μ in cross-section, set apart about 0.5 μ (see text figure 1). Equatorial band 2 to 2.5 μ thick, 2.5 to 3 μ broad, echinate, perforate and provided with 3 to 4 endostriae, running more or less parallel around the equator and sometimes bifurcating. Marginal endostriae often dissolve in separate columellae (Plate II fig. 9). A rimula is not visible. Ektexine absent at the distal pole in a circular pore area, 7 μ in diameter. Contact area around the proximal pole triangular and measuring about 10 μ. Here the ektexine is also absent. Endexine undisturbed, equally thick everywhere. When the ektexine loosens, the endexine surface appears to be smooth.
Grain size 25 to 27 μ.

Distribution: (Holland) Wealden. (Holotype boundary Jurassic-Wealden).

Occurrence: rare, in a few slides common.

Remarks: the echinae, smaller than those of *C. echinatus*, are easily worn off and many grains can be found without them.

LITERATURE.

Balme, B. E., 1957. Spores and pollen grains from the Mesozoic of Western Australia. Austr. Commonw. Sci. Ind. Res. Org., Coal Res. Sect., pp. 1–50.

Couper, R. A., 1955. Supposedly colpate pollen grains from the Jurassic. Geol. Mag. vol. XCII–6, pp. 471–475.

—— 1958. British Mesozoic microspores and pollen grains. Palaeontogr. 103–B Lf. 4–6, pp. 75–179.

Faegri, K. & Iversen, J., 1964. Textbook of pollen analysis. 2d ed. Munksgaard — Copenhagen (Denmark).

Klaus, W., 1960. Sporen der Karnischen Stufe der Ostalpinen Trias. Jb. Geol. B.A. Sonderbd. 5, pp. 107–183.

Lantz, J., 1958. Étude palynologique de quelques échantillons Mésozoiques du Dorset (Grande-Bretagne). Rev. Inst. Franç. du Petr. vol. 13, pp. 917–943.

Pflug, H. D., 1953. Zur Entstehung und Entwicklung des Angiospermiden Pollens in der Erdgeschichte. Palaeontogr. 95–B Lf. 4–6, pp. 60–171.

Pocock, S. J. & Jansonius, J., 1961. The pollen genus *Classopollis* Pflug, 1953. Micropaleont. vol. 7–4, pp. 439–449.

Reissinger, A., 1950. Die "Pollenanalyse" ausgedehnt auf alle Sedimentgesteine der geologischen Vergangenheit II. Palaeontogr. 90–B, pp. 99–126.

PLATES

Explanation to Plate I (× 2200).

Fig. 1. *Classopollis torosus* emended, equatorial view, distal hemisphere upwards.

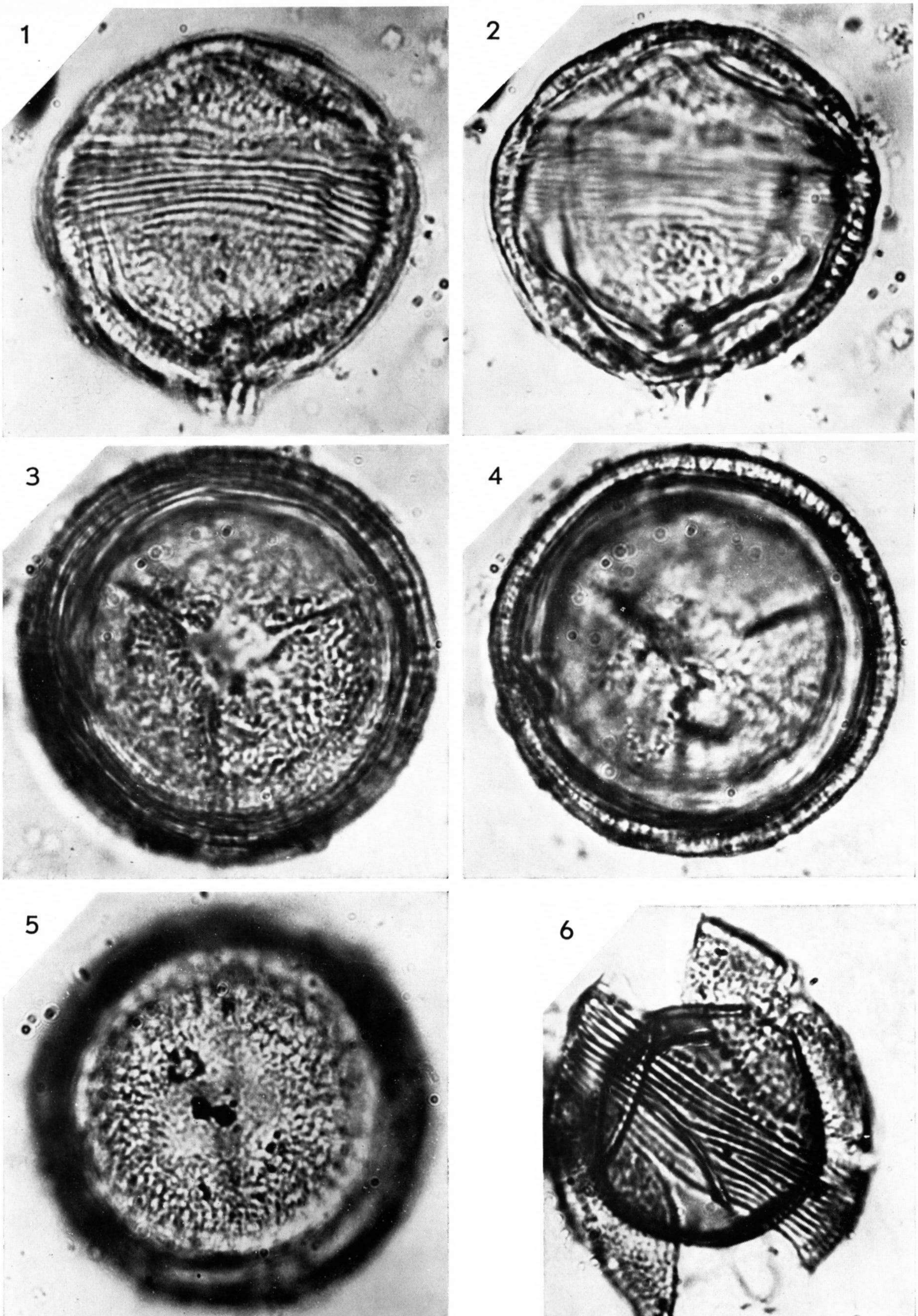
Fig. 2. Idem, showing the equatorial exine thickening and the rimula.

Fig. 3. *Classopollis alexi*, showing proximal pole with trilete mark.

Fig. 4. Idem, showing the thickened equatorial band.

Fig. 5. Idem, with distal pole and the pore area.

Fig. 6. *Classopollis multistriatus*, equatorial view, showing the loosened ektexine and the nature of the distal pore.


1
2
3
4
5
6

Explanation to Plate II. (× 2200, if not stated otherwise).

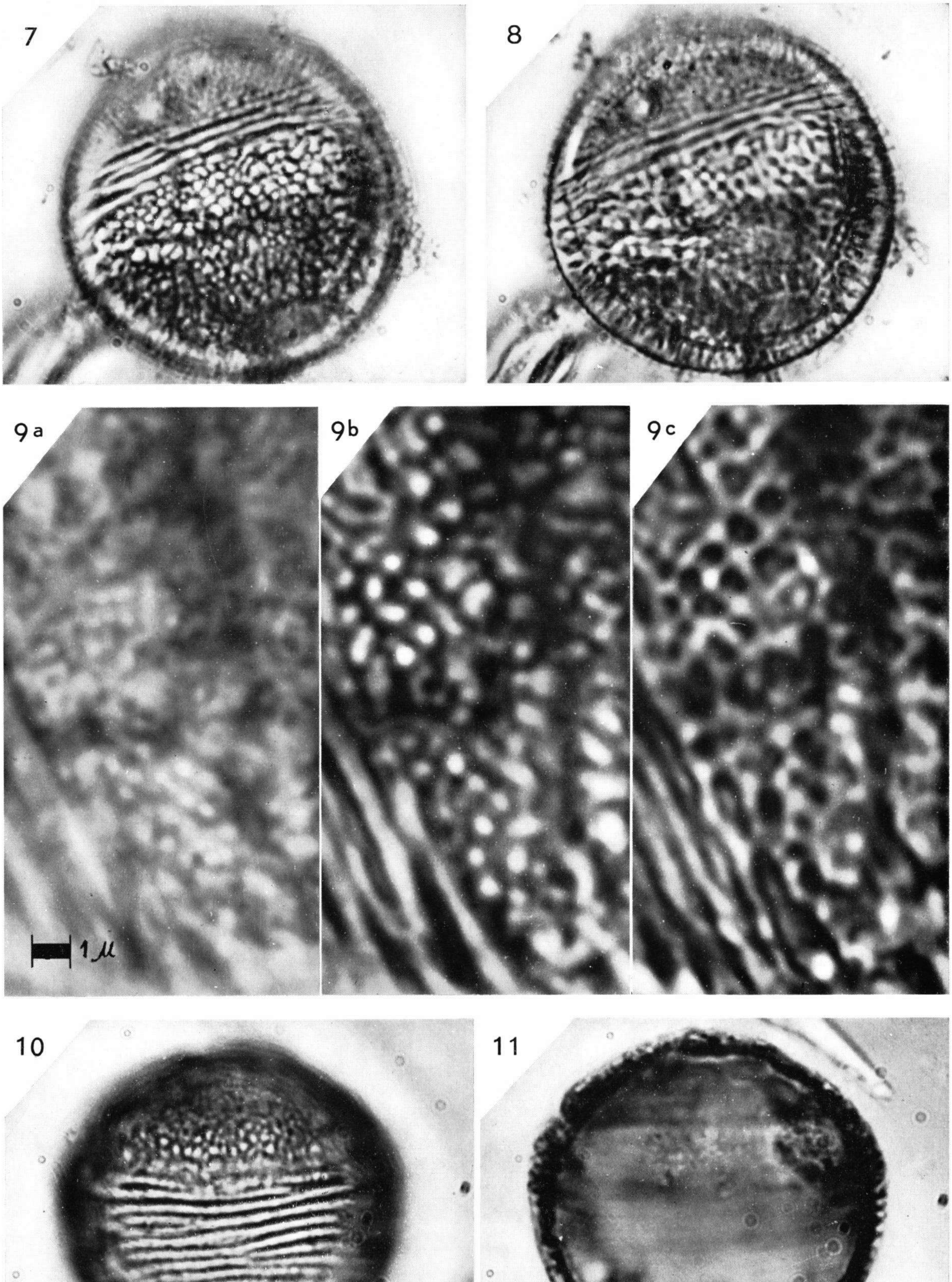
Fig. 7. *Classopollis hammenii*, proximal hemisphere upwards, slightly oblique view, showing vaguely the distal pore.

Fig. 8. Idem, showing the thick distal exine and faintly the echinae at the periphery.

Fig. 9. Detail of exine of the same grain. Magnification about 6400 times.
a. showing the perforate tectum in high focus.
b & c. showing the columellae in medium and low focus plane, respectively as white and black dots.

Fig. 10. *Classopollis multistriatus*, equatorial view, distal hemisphere upwards, showing the broad equatorial band and a part of the rimula.

Fig. 11. Idem, low focus, showing the equatorial exine thickening and the adjacent exine thinning of the rimula.


7
8
9a
9b
9c
1 μ
10
11

Explanation to Plate III. (× 2200, if not stated otherwise).

Fig. 12. *Classopollis hammenii*, polar view, distal hemisphere showing the pore and the typical distal exine structure.

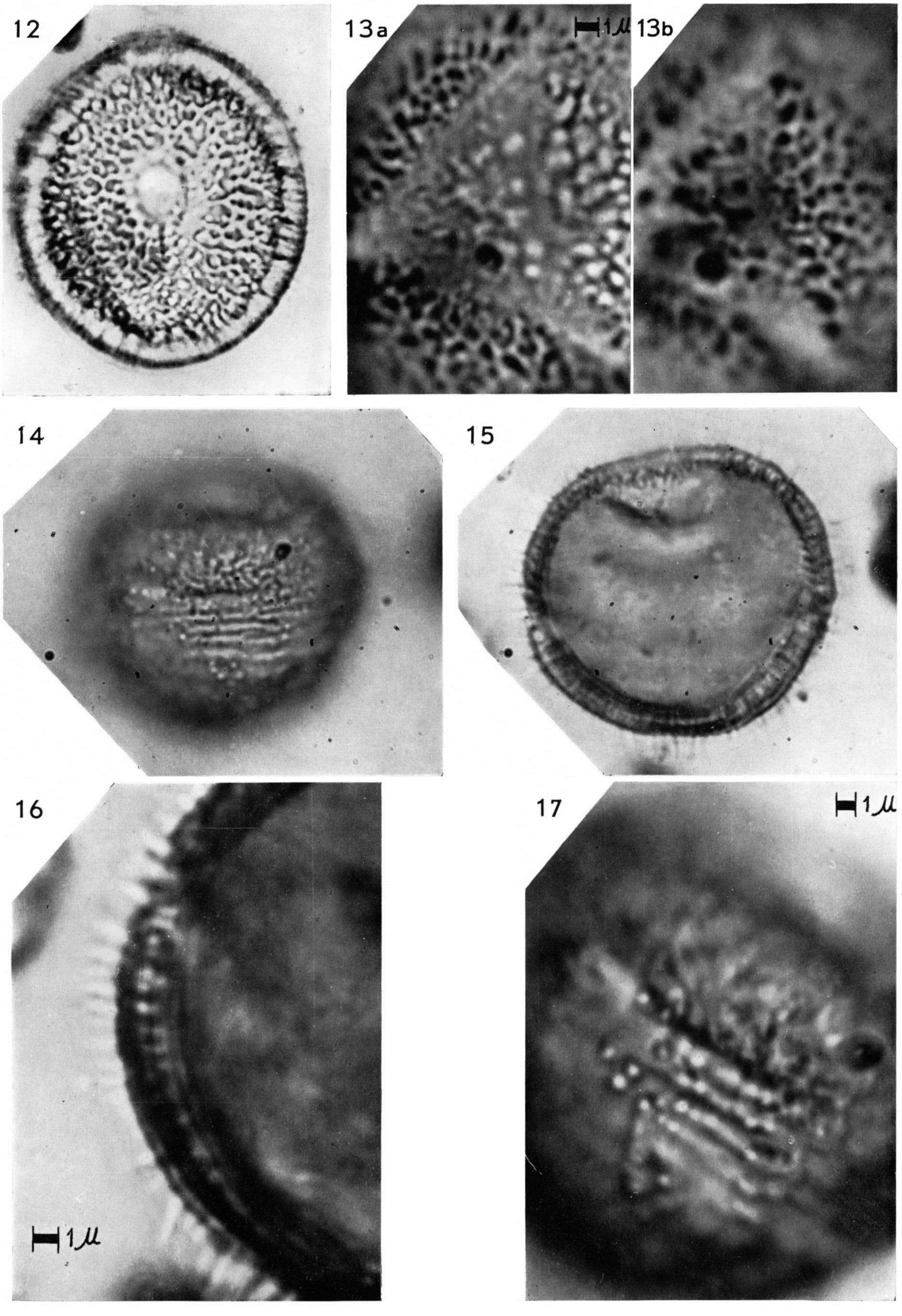
Fig. 13. *Classopollis alexi*, proximal contact area. Magnification 4100 times.
a. high focus, showing remains of the columellae as white dots in the triangular area. Much finer endexinous granulation also visible.
b. low focus view of same area.

Fig. 14. *Classopollis echinatus*, equatorial view, distal hemisphere upwards.

Fig. 15. Idem, showing the echinae.

Fig. 16. Detail of the same grain, tangential view, showing the echinae. Magnification 4400 times.

Fig. 17. Detail of fig. 14, showing the equatorial endostriae and the echinae. Magnification about 3350 times.


12
13a
1μ
13b
14
15
16
1μ
17
1μ