LEIDSE GEOLOGISCHE MEDEDELINGEN, Vol. 38, pp. 173—180, published separately 1.10.1966

POLLEN FLORA AND AGE OF THE TAKUTU FORMATION (GUYANA)

BY

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ABSTRACT

A palynological study was made of cores from two bore-holes in the Takutu Formation, North Rupununi Savannas, Guyana. A rather rich Lower Cretaceous flora was described from some samples, and the *Classopollis*-association of other samples suggests a Jurassic age. A few new species were described.

INTRODUCTION

The Takutu Formation (Barron & Dujardin, 1955, unpubl. rep.) crops out in several river beds in the North Rupununi Savannas of Guyana.
The outcrops in the Takutu River were first mapped in 1875 by Barrington Brown. Other outcrops are in the Rupununi and Rewa Rivers. All the outcrops consist of shales, mudstones or sandstones. The shales are predominant in the eastern part (Takutu River) and the sandstones in the western part (Rewa River) of the area (Bleackley, 1962; Wicherts, 1965, unpubl. rep.). Near St. Ignatius mission an outcrop of dark grey carbonaceous shale occurs, which yielded Ostracods and remains of *Pagiophyllum*. A possible age of Permian to Triassic was given by the British Museum, the range of *Pagiophyllum* being Upper Permian to Lower Cretaceous (McConnell, 1960).
The Takutu Formation lies in a basin between the Pakaraima Mountains in the North, and the Kanuku Mountains in the South (fig. 1). Recent geophysical studies have revealed a maximum thickness of more than 11,000 feet of sediments in the centre of the basin, while a thickness of some 6,000 feet may be calculated from the outcrops for the section in the Rewa River (Wicherts, 1965).
Dip measurements of the outcrops in the Rewa River, show a general dip to the North in the southern part and to the South in the northern part of the basin. The axis of this „syncline" lies in the middle of the basin, approximately above the deepest part of the basin on that place (more than 6,000 feet deep, according to Wicherts). In the centre of the „syncline" in the Rewa River, the sandstones are predominant, but mudstones occur in the southern part of the basin. Dip measurements in the Takutu and Ireng Rivers show the same tendency as described above for the eastern part of the basin, although there may be a „secondary" fold in the central part of the basin, that complicates the picture. Mudstones and shales predominate in outcrops in this western part of the basin.

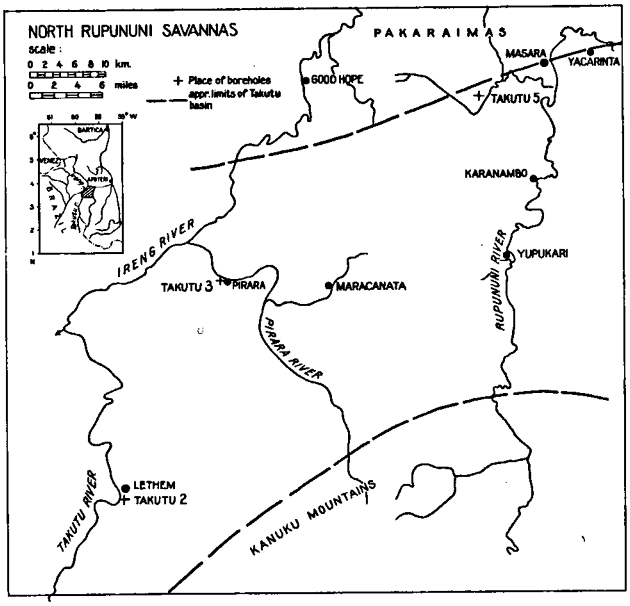

Fig. 1. Map of the North Rupununi savannas with the localities of the boreholes; the approximate limits of the Takutu basin are according to Wicherts (1965).

During 1964 and 1965, four test-holes, each deeper than 300', were drilled. One of the principal purposes was the collection of material for pollen analysis. The logs of the three more important of these drill-holes (Takutu 2, 3 and 5) are given in fig. 2. The data were taken from the original drilling logs in Wicherts (1965). They are simplified and schematized to serve our purpose and to give clearly the most important facts as to lithology, and colour. The location of these bore-holes, and their position in relation to the boundaries of the basin, are indicated in fig. 1. For further details on the drill-holes and the lithology we may refer to the above mentioned report of Wicherts.

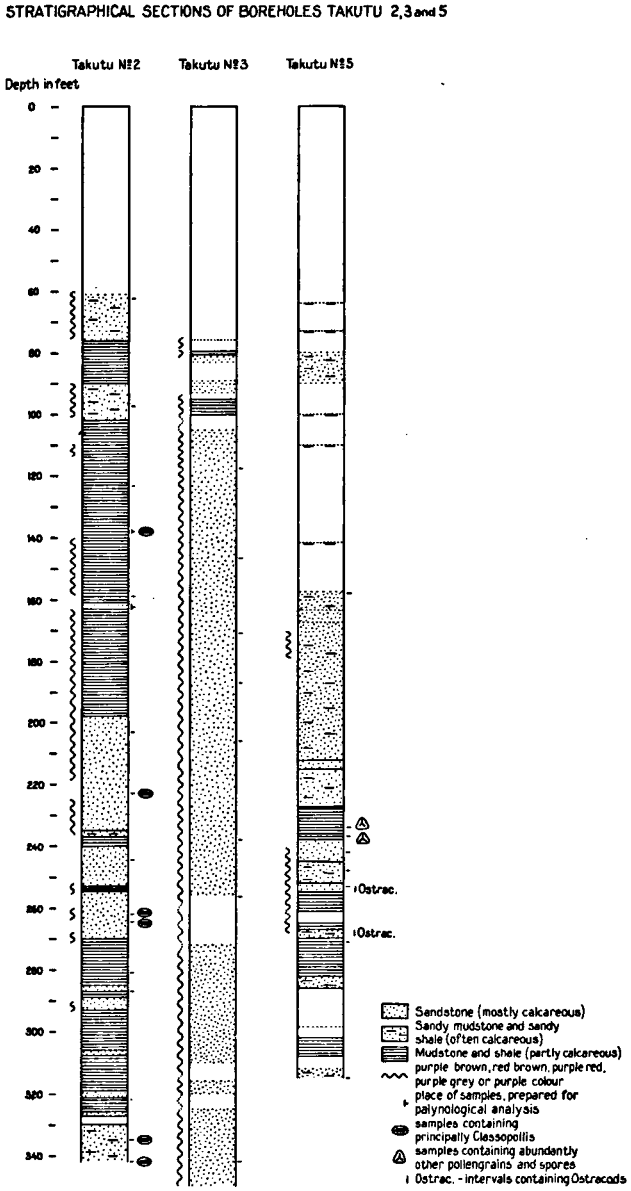

Fig. 2. Stratigraphical sections of boreholes Takutu 2, 3 and 5, somewhat simplified. Indicated are the position of the samples for pollen analysis.

POLLEN ASSOCIATIONS, AGE AND ENVIRONMENT

Bore-hole Takutu 3 is in the central part of the basin, and penetrated principally reddish sandstones. The 9 core-samples prepared for pollen analysis were all sterile, as could be expected.

Bore-hole Takutu 2 lies more in the southern part of the basin, not far from the exposures in the Takutu River near St. Ignatius Mission where fossils were found. The section contains principally mudstones and shales, alternating with some sandstones. 16 core-samples were prepared for pollen analysis, and 6 of them contained pollen grains (see fig. 2). All these 6 samples contained a similar pollen association, dominated completely by *Classopollis*. The pollen grains are rather carbonized and not very well preserved. A few spores were found, but they were indeterminable.

The core-sample from 137'-138' contained enormous quantities of *Classopollis*, some 20,000 pollen grains per slide.

The sample from 223' contained also abundant pollen grains of *Classopollis*, both single and in tetrads, although not as abundant as in the former sample.

The sample from 262' contained only little, badly preserved pollen of *Classopollis*.

The sample from 264½' contained abundant *Classopollis* again (tetrads and singles), but the grains were considerably carbonized.

The sample at 335' contained, partly broken, carbonized pollen grains of *Classopollis*. Some grains possibly of the *Circulina* type were found, and a few indeterminable trilete spores.

The sample from 342' contained abundantly carbonized grains of *Classopollis* and a few indeterminable trilete spores.

It seems that a high *Classopollis* percentage indicates coast-near conditions, and the plants producing this pollen probably grew in the coastal area (Pocock & Jansonius, 1961).

According to studies of recent pollen sedimentation on the shelf and in coastal areas (Muller, 1959; Gutjahr, 1960), very high frequencies of pollen in general, may also indicate coastal or near-coast conditions. Both facts, abundance of *Classopollis* and high pollen frequencies, are therefore indications of a coastal or near-coast shallow water environment.

As to the age, *Classopollis* occurs frequently and often very abundantly in Jurassic strata. The beginning of the Cretaceous shows mostly a clearly marked decline of frequency, but higher up in the Cretaceous (Aptian) they become sometimes more abundant again.

However, the very high frequencies of *Classopollis* over a greater interval, are highly suggestive of a (pre-Purbeckian) Jurassic age (see also Burger, 1966).

Bore-hole Takutu 5 is situated near the northern limit (probably formed by a fault; Wicherts, 1965) of the basin, and shows again a somewhat different lithology. The section consists mainly of sandy mudstones and shales, with some intercalations of grey shales and mudstones in the lower part. This lower part contained Ostracods on two levels (see fig. 2).

8 samples were prepared for pollen analysis, two of which contained abundant and excellently preserved pollen grains. The association was relatively rich in species, permitting a more accurate age determination. The following list gives the specific content of the samples at 234' and 237', containing 16 species of spores and 13 of pollen grains. Four new species were described from this material, and one new variety. The systematic treatment of this whole pollen flora is found in the systematical part of this publication. Those species that occur in both samples are indicated with one asterisk (*), those species that occur only in the sample 234' are indicated with two asterisks (**), and the other species were only found in the sample at 237'.

List of Species found in the samples from 234′ and 237′ of bore-hole Takutu 5.

Cyathidites australis Couper *)
Cyathidites minor Couper *)
Deltoidospora nana Burger
Matonisporites cf. *dorogensis* (Kedves) Burger
Matonisporites equiexinus Couper
Matonisporites guianensis nov. spec.
Klukisporites elongatus (Delcourt & Sprumont) nov. comb. *) (= *Ischyosporites* (*Klukisporites*) *pseudoreticulatus* (Couper) Döring)
Psilatriletes circumundulatus Brenner
Undulatisporites undulapolis Brenner
Undulatisporites takutuensis nov. spec.
Densoisporites microrugulatus Brenner
Converrucosisporites proxigranulatus Brenner
Rotverrusporites rupununiensis nov. spec.
Pilosisporites trichopapillosus (Thiergart) Delc. & Sprum. *crassiexinatus*
Peromonolites fragilis Burger
Laevigatosporites gracilis Wilson & Webster
Vitreisporites pallidus (Reissinger) Nilsson
cf. *Abietineaepollenites* sp.
cf. *Cerebropollenites mesozoicus* (Couper) Nilsson **)
Inaperturopollenites giganteus Góczán *)
Araucariacites australis Cookson
Araucariacites guianensis nov. spec. *)
Exesipollenites tumulus Balme *)
Classopollis cf. *torosus* (Reissinger) Couper **) sensu lato
Cycadopites cf. *fragilis* Singh *) (cf. *Monosulcites minimus* Couper?)
Eucommiidites troedssonii Erdtman *)
Eucommiidites cf. *minor* Groot & Penny *)
Ephedripites sp.
Tricolporopollenites distinctus Groot & Penny

As to the frequency of the different groups of pollen grains and spores, the following approximate percentages were found for the sample from 237′.

Psilate trilete spores	53 %
Converrucosisporites	3 %
Peromonolites	3 %
Cycadopites	10 %
Inaperturopollenites	3 %
Bisaccate pollen grains	4 %
Ephedripites	4 %
Exesipollenites	3 %
Eucommiidites	17 %

The association as a whole is directly comparable with the „Wealden" floras from Europe and with the Lower Cretaceous floras from North America. If we take this association, rich in spores and poor in *Classopollis*, into consideration, and also the lithology and the presence of Ostracods, the facies could best be defined as a „Wealden facies".
Many of the species found, are characteristic of both the Jurassic and Lower Cretaceous. However, the scarcity or absence of *Classopollis* and the high frequency of *Matonisporites* suggest a Cretaceous rather than a Jurassic age. The presence of species like *Densoisporites microrugulatus* and *Peromonolites fragilis* strongly points to a Lower Cretaceous age, and the same can be said for *Pilosisporites trichopapillosus*, that is only reported from the Lower Cretaceous and the uppermost „Malm". The presence of *Tricolporopollenites distinctus* also points to Lower Cretaceous, while the complete absence of other younger species points to a pre-Aptian age. We may therefore date the two samples as pre-Aptian Lower Cretaceous.

CONCLUSIONS

The pollen flora of the samples 234′ and 237′ of bore-hole Takutu 5 are of (pre-Aptian) Lower Cretaceous age. The pollen flora of the interval between 137′ and 342′ contains a *Classopollis* flora with high pollen frequencies, strongly suggesting a (Pre-Purbeckian) Jurassic age.
As the facies and stratigraphical succession of the uppermost part of the Takutu 2 section show many similarities with the lower part of the section of bore-hole Takutu 5, an eventual correlation of these parts seems to be at least one possibility. Similarities are the presence and succession of sandy mudstones alternating with grey shales and mudstones; the presence of $CaCO_3$ crystals in the sandy rocks at 225′ in Tak. 5 and 70′ in Tak. 2; very fine-grained sandstone or mudstone is mentioned in the original log from approximately 245′ in Tak. 5 and from approximately 95′ in Tak. 2; the presence of Ostracods and dark grey shales in the lower part of Tak. 5 and in the exposures near to bore-hole Tak. 2.
The age given to the pollen associations of both bore-holes would also be in general agreement with this possible correlation.
The age of the reddish sandstones of bore-hole Takutu 3 is unknown, but its position in the centre of the basin with its synclinal structure suggests the possibility of a younger age than the sediments of the other two, more lateral, bore-holes.
It is hoped that when deeper bore-holes are drilled, it will be possible to solve these problems of correlation by means of further palynological studies.

SYSTEMATICAL PART

Superdivision TRILETES (Reinsch 1881) Pot. & Kremp 1954

Genus CYATHIDITES Couper 1953

Cyathidites australis Couper 1953
Plate III Fig. 12
Example: Slide Tak. 5, 237'd; coordinates 34.0 × 102.2, micr. P040; grainsize 65μ.
Occurrence: Bore-hole Takutu 5, depth 237'.

Cyathidites minor Couper 1953
Plate II Fig. 7
Example: Slide Tak. 5, 237' d; coordinates 40.8 × 100.7, micr. P040; grainsize 28μ.
Occurrence: Bore-hole Takutu 5, depth 237'.

Genus DELTOIDOSPORA (Miner 1935) Potonié 1956

Deltoidospora nana Burger 1966
Plate II Fig. 10
Example: Slide Tak. 5, 237' d; coordinates 33.0 × 104.7, micr. P040; grainsize 27μ.
Occurrence: Bore-hole Takutu 5, depth 237'.

Genus MATONISPORITES Couper 1958

Matonisporites cf. *dorogensis* (Kedves 1960) Burger 1966
Plate I Fig. 4
Example: Slide Tak. 5, 237' a; coordinates 26.8 × 100.5, micr. P040; grainsize 55μ.
Occurrence: Bore-hole Takutu 5, depth 237'.

Matonisporites equiexinus Couper 1958
Plate I Fig. 5
Example: Slide Tak. 5, 237' c; grainsize 41μ.
Occurrence: Bore-hole Takutu 5, depth 237'.

Matonisporites guianensis nov. spec.
Plate III Fig. 16
Holotype: Slide Tak. 5, 237'e; coordinates 30.4 × 116,—, micr. P058; grainsize 50μ.
Occurrence: Bore-hole Takutu 5, depth 237'.
Description: Trilete spores, with a relatively thick wall, and principally psilate sculpture. Thickness of spore wall about 3.5—4μ. Laesurae bordered on each side by a darker zone of about 3.5μ wide. Laesurae about 33μ long, reaching in projection the inner side of the spore wall in optical section. The inner surface of the exine in the interradial areas (visible in optical section) is irregular, and irregularities of probably the same type are present in the area of the distal pole. Size of the grain about 50μ.

Genus KLUKISPORITES Couper 1958

Klukisporites elongatus (Delc. & Sprum. 1955) nov. comb.
Plate II Fig. 6
Example: Slide Tak. 5, 237'c; coordinates 33.4 × 100.7, micr. P040; grainsize 47μ.
Occurrence: Bore-hole Takutu 5, depth 237'.
Remarks: This species was described as *Lycopodiumsporites elongatus* Delc. & Sprum. 1955, but it seems advisable now to place it in the genus *Klukisporites*, as *Lycopodiumsporites* is characterized by thinner, more or less membranous muri. This possibility was already suggested by Delcourt, Dettman & Hughes (1963).
Synonym: *Ischyosporites* (al. *Klukisporites*) *pseudoreticulatus* (Couper 1958) Döring 1965.

Genus PSILATRILETES (van der Hammen 1954) ex Potonié 1956

Psilatriletes circumundulatus Brenner 1963
Plate II Fig. 9
Example: Slide Tak. 5, 237'e; coordinates 39.9 × 117.3, micr. P058; grainsize 41μ.
Occurrence: Bore-hole Takutu 5, depth 237'.

Genus UNDULATISPORITES Pflug in Thomson & Pflug 1953

Undulatisporites undulapolis Brenner 1963
Plate III Fig. 14
Example: Slide Tak. 5, 237'e; coordinates 31.65 × 116.6, micr. P058; grainsize 55μ.
Occurrence: Bore-hole Takutu 5, depth 237'.

Undulatisporites takutuensis nov. spec.
Plate II Fig. 8
Holotype: Slide Tak. 5, 237e; coordinates 125.8 × 31.6, micr. P058; grainsize 47μ.
Occurrence: Bore-hole Takutu 5, depth 237'.
Description: Trilete spores with a (more or less irregular) rounded triangular amb. Laesurae undulating, almost as long as radius. Exine 2—4μ thick, inner surface somewhat irregular, fossulate. Fossulae irregular in place and in course. Size of holotype 47μ.
Remarks: We placed this species in the genus *Undulatisporites*, because of its resemblance to *Undulatisporites pseudobrasiliensis* Krutzsch 1959.

Genus DENSOISPORITES Weyland & Krieger 1953

Densoisporites microrugulatus Brenner 1963
Plate I Fig. 1
Example: Slide Tak. 5, 237c; coordinates 34.9 × 101.7, micr. P040; grainsize 85μ.
Occurrence: Bore-hole Takutu 5, depth 237'.

Genus CONVERRUCOSISPORITES Potonié & Kremp 1954

Converrucosisporites proxigranulatus Brenner 1963
Plate II Fig. 11
Example: Slide Tak. 5, 237e; coordinates 32.3 × 120.3, micr. P058; grainsize 38μ.
Occurrence: Bore-hole Takutu 5, depth 237'.

Genus ROTVERRUSPORITES Döring 1964

Rotverrusporites rupununiensis nov. spec.
Plate I Fig. 3
Holotype: Slide Tak. 5, 237d; coordinates 36.4 × 115.1, micr. P058; grainsize 85μ.
Occurrence: Bore-hole Takutu 5, depth 237'.
Description: Trilete, verrucate spores. Amb. strongly rounded, almost circular. Thickness of spore wall about 5—6μ. Length of laesurae about 35—42μ, clearly marked and often bifurcating at their ends. Densely verrucate both on the distal and the proximal side; cross-section of verrucae more or less polygonal; diameter of verrucae about 2—7μ. A row of verrucae of the same size is present on each side of the laesurae. Height of verrucae possibly up to 3μ, but not projecting more than about 1μ beyond the visible circumference. Size of spore about 85μ.
Remarks: This species resembles *Rotverrusporites* (al. *Verrucosisporites*) *obscurilaesuratus* (Pocock 1962) Döring 1964, and *R.* fsp. *A* of Döring 1964. However, *R. rupununiensis* has, amongst others, very clearly defined laesurae.

Genus PILOSISPORITES Delcourt & Sprumont 1955

Pilosisporites trichopapillosus (Thiergart 1949) Delcourt & Sprumont 1955
Plate I Fig. 2
Example: Slide Tak. 237f; coordinates 45.4 × 119.15, micr. P058; grainsize 77μ.
Occurrence: Bore-hole Takutu 5, depth 237'.
Description: The length of the sculpture elements is appr. 5μ (var. 2—6μ); the exine is 4—5μ thick, and the laesurae measure 30—36μ each. The aequat.amb. is rounded triangular, with convex sides.
Remarks: The exine is somewhat thicker than indicated in the original description. We may bring our specimen therefore to another form *P.trichopapillosus crassiexinatus*.

Genus APICULATISPORIS Potonié & Kremp 1956

One grain, apparently belonging to this genus, was found. It does not correspond exactly to any described species, but it seems not justified to describe a new species on the base of one, somewhat damaged, specimen.
Plate III Fig. 13
Example: Slide Tak. 5, 237e, coordinates 37.7 × 118.6, micr. P058; grainsize 84μ.
Occurrence: Bore-hole Takutu 5, depth 237'.

Superdivision MONOLETES Ibrahim 1933

Genus PEROMONOLITES Erdtman 1947 ex Couper 1953

Peromonolites fragilis Burger 1966
Plate III Fig. 15 (tetrad)
Example: Slide Tak. 5, 237d (and e). Grainsize 30—40μ (Tetrad appr. 70μ).
Occurrence: Bore-hole Takutu 5, depth 237'.
Remarks: In most cases, we found the grain in tetrads.

Genus LAEVIGATOSPORITES Ibrahim 1933

Laevigatosporites gracilis Wilson & Webster 1946
(not illustrated)
Example: Slide Tak. 5, 237e; coordinates 41.0 × 118.3, micr. P058; grainsize 32.5μ.
Occurrence: Bore-hole Takutu 5, depth 237'.

Superdivision VESICULATAE Iversen & Troels-Smith 1950

Genus VITREISPORITES (Leschik 1955) Jansonius 1962

Vitreisporites pallidus (Reissinger 1938) Nilsson 1958
Plate IV Fig. 26
Example: Slide Tak. 5, 237e; coordinates 33.3 × 113.6, micr. P058; grainsize 26μ.
Occurrence: Bore-hole Takutu 5, depth 237'.

cf. Genus ABIETINEAEPOLLENITES Potonié 1951

(Bisaccate pollen grains, plate IV fig. 23 and 27)
Several grains of bisaccate pollen grains were found, that partly may belong to this genus, and partly to other bisaccate genera. Two grains were illustrated here. The small number of grains does not permit a more exact determination.
Examples: Slide Tak. 5, 237e; coordinates 36.9 × 114.4 and 30.9 × 113.1, micr. P058; grainsize resp. 51μ and 56μ.
Occurrence: Bore-hole Takutu 5, depth 237'.

Genus CEREBROPOLLENITES Nilsson 1958

cf. *Cerebropollenites mesozoicus* (Couper 1958) Nilsson 1958
Plate IV Fig. 20 (group)
Example: Tak. 5, slide 234a; coordinates 35.9 × 117.4, micr. P058; size of group appr. 50μ.
Occurrence: Bore-hole Takutu 5, depth 234'.
Remarks: One group of grains was found, strongly resembling this species. A positive determination is not possible until other specimens will be found.

Superdivision INAPERTURATAE Iversen and Troels-Smith 1950

Genus INAPERTUROPOLLENITES (Pflug 1952 ex Thomson & Pflug 1953) Potonié 1958

Inaperturopollenites giganteus Góczán 1964
(not illustrated)
Example: Slide Tak. 5, 237e; coordinates 32.2 × 122.5, micr. P058; grainsize 52μ.
Occurrence: Bore-hole Takutu 5, depth 234' and 237'.

Genus ARAUCARIACITES Cookson 1947

Araucariacites australis Cookson 1947
Plate IV Fig. 21
Example: Slide Tak. 5, 237f; coordinates 33.2 × 115.6, micr. P058; grainsize 84μ.
Occurrence: Bore-hole Takutu 5, depth 237′.
Remarks: The sculpture of our grains seems to be more pronounced (micro-verrucate to scabrate) than the sculpture of the grains described as *A. australis*. They correspond, however, to the specific description, and there seems to be no sufficient difference to establish a new species.

Araucariacites guianensis nov. spec.
Plate IV Fig. 18
Holotype: Slide Tak. 5, 237f; coordinates 43.6 × 125.8, micr. P058; minimum grainsize 75μ (other example: Slide Tak. 5, 234a; coordinates 33.4 × 127.6, micr. P058; grainsize 68μ).
Occurrence: Bore-hole Takutu 5, depth 237′.
Description: grains inaperturate, sculpture type micro-gemmate to micro-clavate. Sculpture-elements very clearly defined. Otherwise similar to *A. australis*.
Remarks: This species and the former resemble the grains described as *Inaperturopollenites atlanticus* Groot, Penny & Groot 1961.
However, the sculpture of the last-mentioned species is described simply as „scabrate".

Superdivision MONOPORATAE Iversen & Troels-Smith 1950

Genus EXESIPOLLENITES (Balme 1957) Brenner 1963

Exesipollenites tumulus Balme 1957
Plate III Fig. 17
Example: Slide Tak. 5, 237d (see also slides Tak. 5, 237e and 234a); grainsize 24μ.
Occurrence: Bore-hole Takutu 5, depth 234′ and 237′. Rather frequent.
Remarks: None of our grains shows the sometimes occurring trilete mark, as mentioned and illustrated by Brenner (1963).

Superdivision AEQUATORANNULATAE Burger 1966

Genus CLASSOPOLLIS (Pflug 1953) Pocock & Jansonius 1961

Classopollis cf. *torosus* (Reissinger 1950) Couper 1958 sensu lato
Plate IV Fig. 24
Example: Slide Tak. 5, 234a; coordinates 41.0 × 119.8, micr. P058; grainsize 37μ.
Occurrence: Bore-hole Takutu 5, depth 234′ (rare). Bore-hole Takutu 2, 137—139′, 223′, 262′, 264½′, 281′, 287′, 335′, 347′ (frequent).
Remarks: As most of the material is rather badly preserved, a comparison with the species described by Burger (1965a and b) is not well possible. The name *C.* cf. *torosus* is therefore used here in a wide sense.

Superdivision MONOCOLPATAE Iversen and Troels-Smith 1950

Genus CYCADOPITES (Wodehouse 1933) ex Wilson & Webster 1946

Cycadopites cf. *fragilis* Singh 1964
Plate IV Fig. 22
Example: Slide Tak. 5, 237e; coordinates 28.2 × 126.1, micr. P058; grainsize 30μ.
Occurrence: Bore-hole Takutu 5, depth 237′ (frequent).
Remarks: Our grains resemble this species and *Entylissa nitidus* Balme 1957; they also resemble grains (incorrectly?) determined as *Monosulcites minimus* Cookson 1947 by several authors.

Superdivision PRAECOLPATES Erdtman 1948

Genus EUCOMMIIDITES (Erdtman 1948) Couper 1958

Eucommiidites troedssonii Erdtman 1948
Plate IV Fig. 19
Example: Slide Tak. 5, 237c; coordinates 31.1 × 104.1, micr. P040; grainsize 37μ.
Occurrence: Bore-hole Takutu 5, depth 234′ and 237′.

Eucommiidites cf. *minor* Groot & Penny 1960
Plate IV Fig. 25
Example: Slide Tak. 5, 237e; coordinates 31.6 × 124.8, micr. P040; grainsize 20μ.
Occurrence: Bore-hole Takutu 5, depth 234′ and 237′ (frequent).
Remarks: the specimens are definitely smaller than those of the preceding species. Although their form may be more or less spherical, this is often not the case (see fig.)

Superdivision POLYPLICATAE Erdtman 1952

Genus EPHEDRIPITES Bolkhovitina 1953

Several grains of the *Ephedripites* type were found, but a specific determination is not given here.
Example: Slide Tak. 5, 237e; coordinates 36.3 × 126.8, micr. P058.
Occurrence: Bore-hole Takutu 5, depth 237′.

Superdivision TRICOLPORATAE Iversen & Troels-Smith 1950

Genus TRICOLPOROPOLLENITES (Pflug 1952) Thomson & Pflug 1953

Tricolporopollenites distinctus Groot & Penny 1960
(not illustrated)
Grains very similar to those described under this name,

were found two times. The first specimen was found in the sample 237' of Takutu 5, but could not be found back later. A second specimen, apparently also belonging to this species, but in rather bad condition, was found in the sample from 234' of Takutu 5. This one is mentioned as example.
Example: Slide Tak. 5, 234a; coordinates 38.8 × 128, micr. P058; grainsize 19μ.
Occurrence: Bore-hole Takutu 5, depth 234' and 237'.

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PLATE I

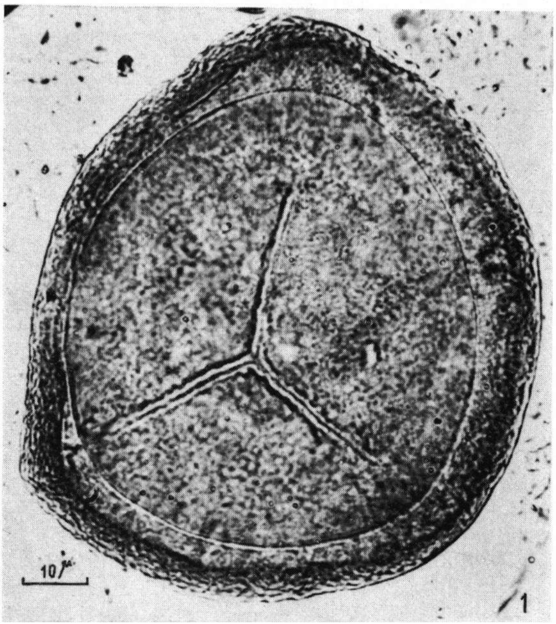
Fig. 1. *Densoisporites microrugulatus*

Fig. 2. *Pilosisporites trichopapillosus*

Fig. 3. *Rotverrusporites rupununiensis* nov. sp.

Fig. 4. *Matonisporites* cf. *dorogensis*

Fig. 5. *Matonisporites equiexinus*



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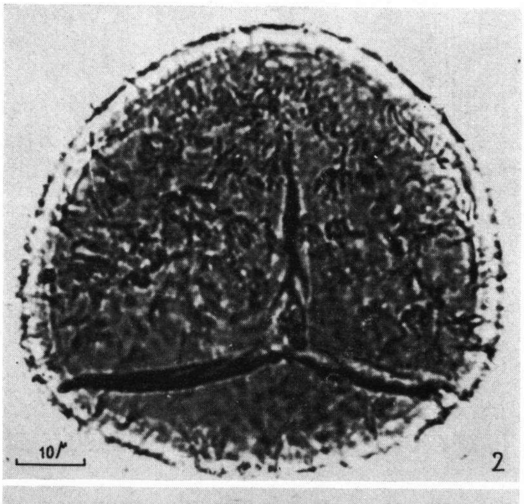

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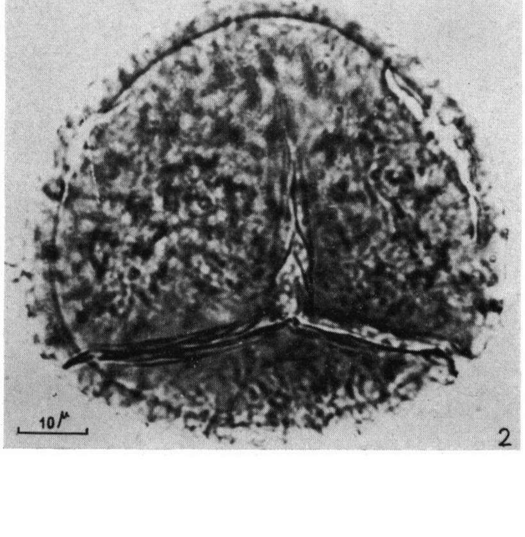

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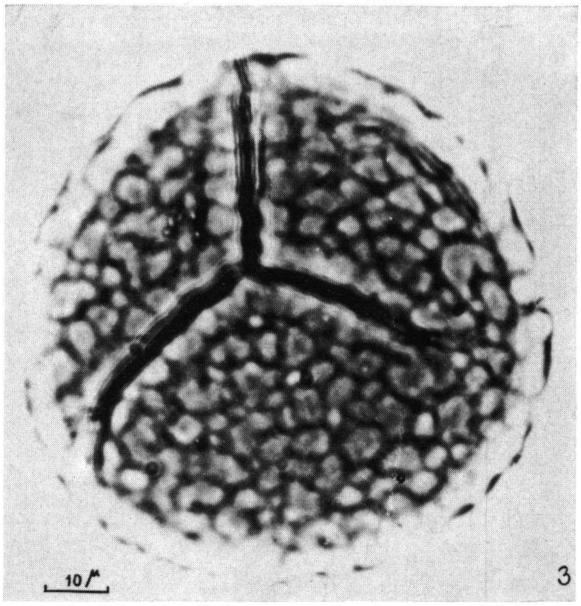

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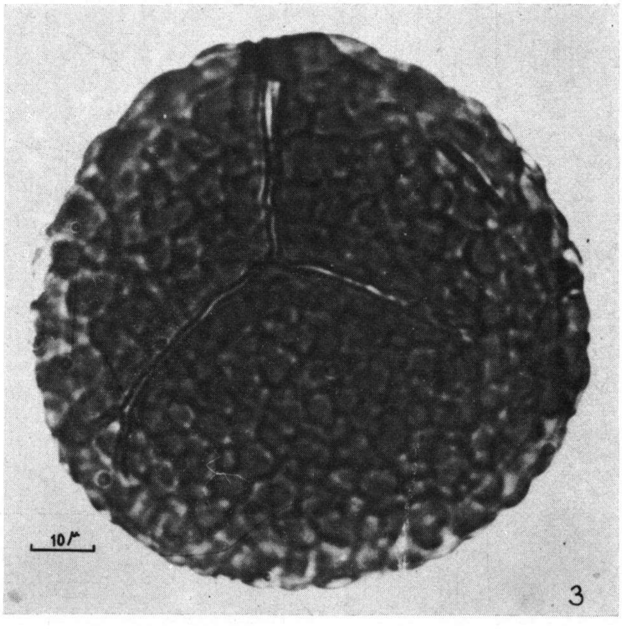

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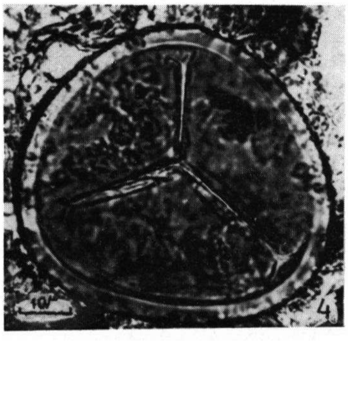
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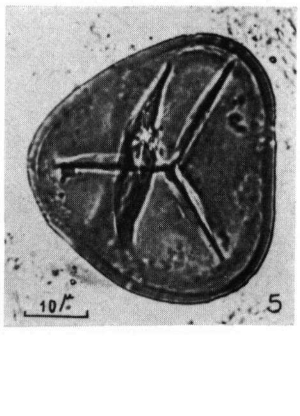

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PLATE II

Fig. 6. *Klukisporites elongatus*

Fig. 7. *Cyathidites minor*

Fig. 8. *Undulatisporites takutuensis* nov. sp.

Fig. 9. *Psilatriletes circumundulatus*

Fig. 10. *Deltoidospora nana*

Fig. 11. *Converrucosisporites proxigranulatus*

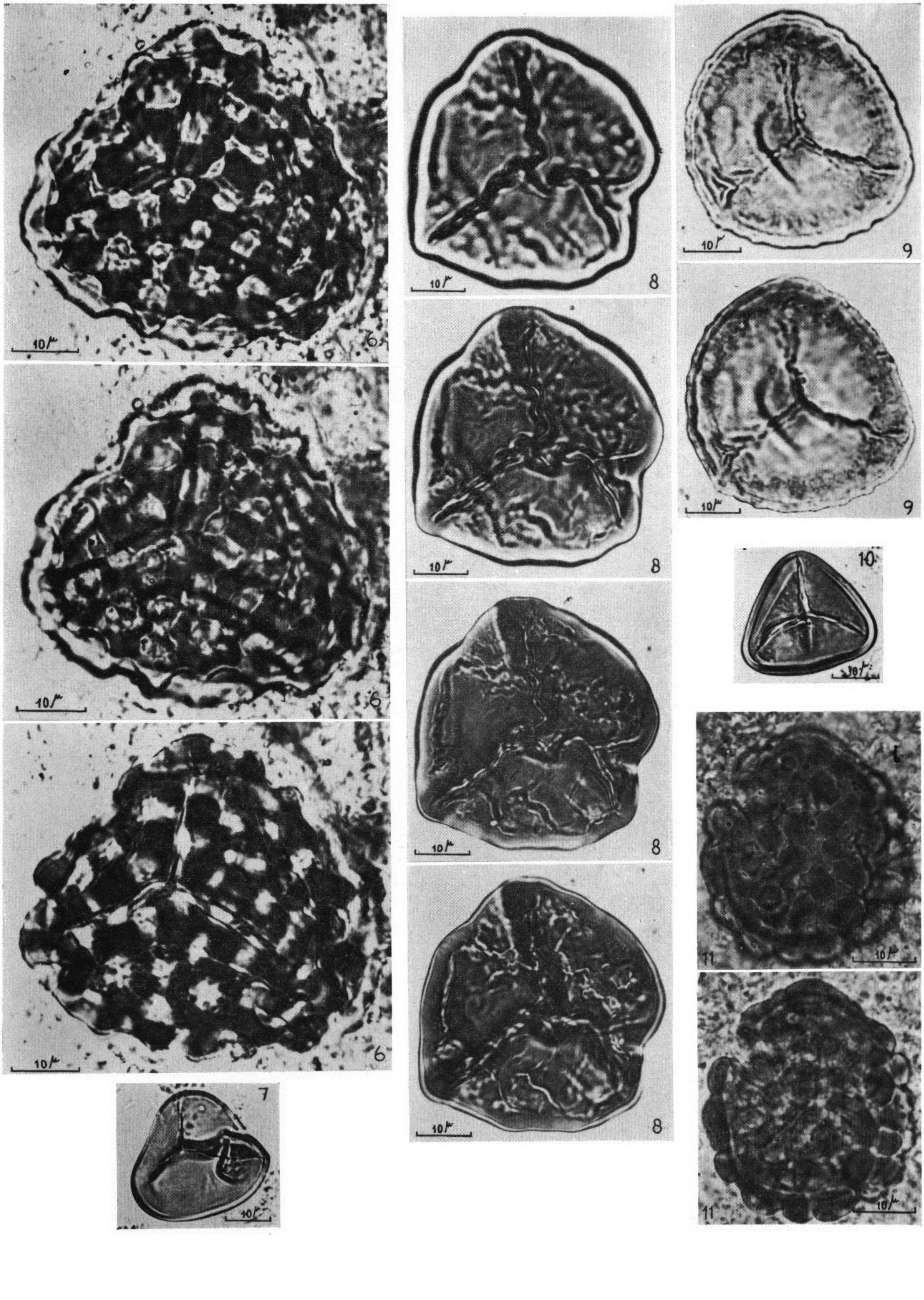
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PLATE III

Fig. 12. *Cyathidites australis*

Fig. 13. *Apiculatisporis* sp.

Fig. 14. *Undulatisporites undulapolis*

Fig. 15. *Peromonolites fragilis* (tetrad)

Fig. 16. *Matonisporites guianensis* nov. sp.

Fig. 17. *Exesipollenites tumulus*

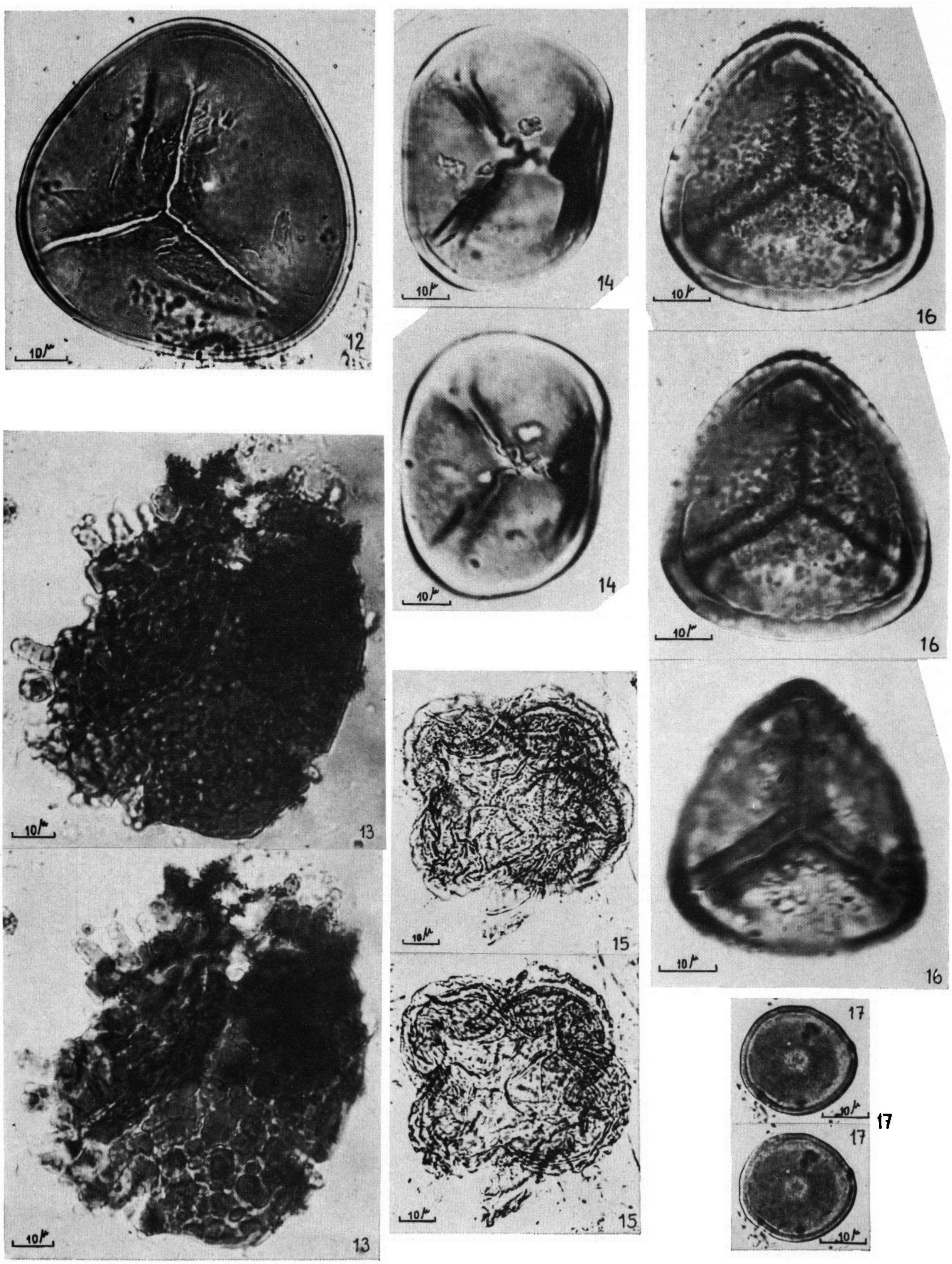
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PLATE IV

Fig. 18. *Araucariacites guianensis* nov. sp.

Fig. 19. *Eucommiidites troedssonii*

Fig. 20. cf. *Cerebropollenites mesozoicus* (group)

Fig. 21. *Araucariacites australis*

Fig. 22. *Cycadopites* cf. *fragilis*

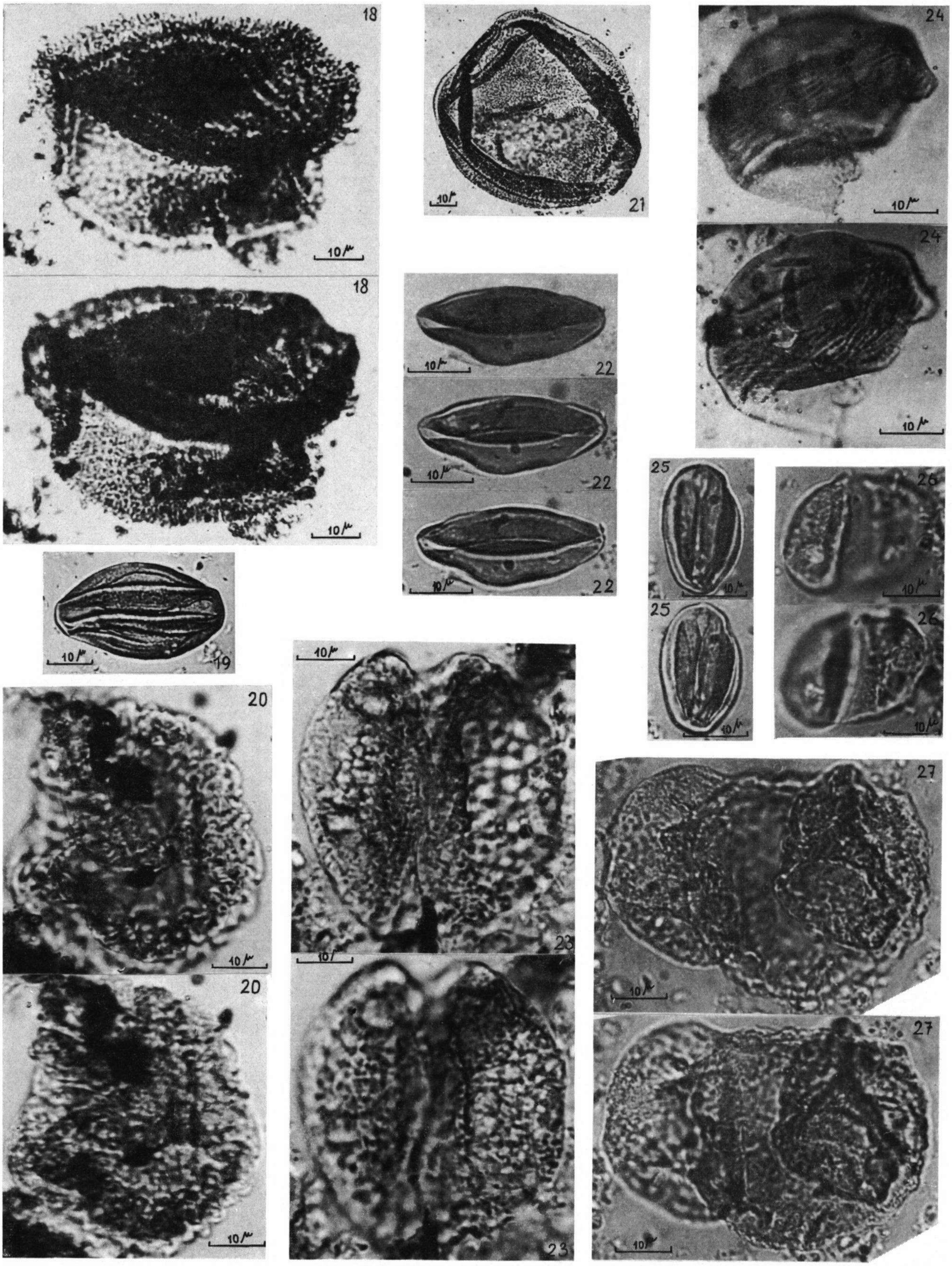
Fig. 23. cf. *Abietineaepollenites*

Fig. 24. *Classopollis* cf. *torosus*

Fig. 25. *Eucommiidites* cf. *minor*

Fig. 26. *Vitreisporites pallidus*

Fig. 27. cf. *Abietineaepollenites*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