

THE PALEOCENE POLLEN FLORA OF COLOMBIA

BY

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INTRODUCTION

The first Paleocene pollen species of Colombia were described in van der Hammen (1954). One species was redescribed in van der Hammen (1956b).

The associations of species and the climatic changes of the Paleocene were described and discussed in van der Hammen (1957a) and the palynological correlation of sediments of this age in van der Hammen (1957b).

The new species found in the Paleocene are described here, but those which are known already from the Maestrichtian and the Eo-Oligocene are also mentioned.

Therefore this article constitutes something like a catalogue of the most important Paleocene species of Colombia.

Nearly all the holotypes were found in the same samples on which the general diagram was based (van der Hammen, 1957a).

The terminology which has been used in the following descriptions corresponds almost completely with the definitions of Iversen & Troels-Smith (1950).

The generic names, proposed in van der Hammen (1956a), have been used here only inasmuch as they are valid according to the rules of the Code of Botanical Nomenclature.

All the samples were prepared by Schulze treatment.

The holotypes are kept in the collection of the Palynological Section of the Servicio Geologico Nacional de Colombia, in Bogotá.

POLYPLICATES

Ephedripites Bolchowitina 1953

Ephedripites vanegensis nov. sp.

Description: Polylicate. With a smooth zone at each pole; diameter of this zone $\pm 10 \mu$. Size of the grain: $\pm 34 \mu$ long and $\pm 19-23 \mu$ wide; pollen index relatively variable; exine thicker in the polar areas; number of plicae $\pm 30-50$. Sometimes the exine is open at one of the "plicae", thus simulating a colpus. The diameter of the polar area of the holotype is about 9μ , and the proportion of this diameter to the width of the grain is about 0.4.

Holotype: Slide F-I-73, Col. S.G.N. (HB-284). Photo 3. Size $34 \times 23 \mu$. Coal, region of Lebrija, Paleocene, Zone C.

Natural relationship: This type of pollen is being encountered in certain species of *Ephedra*, but as well in *Spathiphyllum* (Araceae). The pollen grains of *Spathiphyllum* have a larger smooth area than *Ephedra*, and for this reason *Ephedripites vanegensis* shows more resemblance to this genus of the Araceae. *Spathiphyllum* is

very common nowadays in the wet regions with abundant *Mauritia* palms and it is a very interesting fact that the pollen grains of *Ephedripites vanegensis* appear at practically the same time as the pollen grains of *Mauritia*.

MONOCOLPATES

Longapertites van Hoeken Klinkenberg 1964

Longapertites proxapertitoides nov. sp.

Description: Monocolpate, foveolate to reticulate, size of pollen grain 40–60 μ . The diameter of the lumina is 0.5–6 μ . Colpus long, in general longer than the visible length of the grain, sometimes nearly circular, in some cases the colpus is a little bit shorter than the length of the grain. The size of the individual lumina is very variable. It is possible to distinguish at least two varieties, although it seems that there exist intermediate types between both: one with foveolate sculpture and the other with reticulate sculpture.

Holotype: Slide F-III-22, Col. S. G. N. (Cat. Ha-457). Photo 1. Size 29 μ . Carbonaceous shale, region of Tibú (Catatumbo), Paleocene, Zone A.

Longapertites proxapertitoides var. *proxapertitoides*

Foveolate sculpture.

Type: Slide F-III-22, Col. S.G.N. (Catat. Ha-457). Photo 1 (see above) (same as holotype of *L. proxapertitoides*).

Longapertites proxapertitoides var. *reticulatus* nov. var.

Reticulate sculpture.

Type: Slide F-III-22, Col. S.G.N. (Catat. Ha-457). Photo 2. Size 45.5 μ . Carbonaceous shale, region of Tibú (Catatumbo), Paleocene, Zone A.

Retimonocolpites Pierce 1961

Retimonocolpites regio nov. sp.

Description: Monocolpate. Sculpture very fine, micro-reticulate to micro-foveolate. Colpus in the middle apparently with a not very well defined margo. Pollen grain oval, long (index pollinis 2). Colpus long, of the same size as, or somewhat shorter than the length of the grain. Size of the grain: long 47–53 μ , wide 20–25 μ .

Holotype: Slide F-I-73, Col. S.G.N. (HB-284). Photo 4. Size 48 \times 24 μ . Coal, region of Lebrija, Paleocene, Zone C.

Natural relationship: *Retimonocolpites regio* must belong to a plant of the family of the Palmae.

Retimonocolpites microreticulatus nov. sp.

Description: Monocolpate, finely reticulate. Maximum diameter of the lumina 1 μ , but the majority is smaller. Size of the grain \pm 17–18 μ . The holotype is 17.5 μ long and 14.5 μ wide.

Holotype: Slide F-V-43, Col. S.G.N. (RL-8). Photo 7; see above. Coal, region of Lebrija (Valle Medio of the Magdalena), Paleocene, base of zone C.

Mauritiidites van Hoeken Klinkenberg 1964

Mauritiidites franciscoi (v.d.H. 1956b) van Hoeken Klinkenberg 1964

(*Monocolpites franciscoi* v.d.H. 1956b, p. 112, fig. 2)

There can be distinguished different varieties, which in certain small details differ from the holotype.

Mauritiidites franciscoi var. *franciscoi*

Corresponds with the description and the holotype of *M. franciscoi*.

Mauritiidites franciscoi var. *pachyexinatus* nov. var.

Exine thicker ($\pm 2 \mu$), echini thick ($\pm 2-2.5 \mu$ at the base).

Holotype: Slide F-I-78, Col. S.G.N. (sample HB-285). Photo 5. Size 49μ . Coal, Vanegas (Valle Medio of the Magdalena); Paleocene, uppermost part of Zone C (near the limit with the Eocene).

Mauritiidites franciscoi var. *minutus* nov. var.

Pollen grains smaller (holotype 39μ), echini relatively small, partly curved.

Holotype: Slide V-I-92, Col. S.G.N. (sample HB-268). Photo 6. Size 39μ . Coal, Vanegas (Valle Medio of the Magdalena), Paleocene, Zone C.

Natural relationship: This species with its varieties belongs to the Mauritiaceae (Palmae), and the majority probably to the genus *Mauritia*.

Echimonocolpites nov. gen.

Monocolpate pollen grains (with one normal colpus) with spines (echini); not visible are the "roots" of these spines at the inner side of the exine (difference with *Mauritiidites*).

Genotype: *Echimonocolpites ruedae* (v.d.H.) nov. comb.

Echimonocolpites (al. *Monocolpites*) *ruedae* (v.d.H. 1954) nov. comb.

A more complete description is the following:

The holotype (Slide C-1-23, Col. S.G.N., Suesca, Maestrichtian, Zone C) measures 27μ , is transparent (exine almost colorless), slightly flattened at one side, and shows well-defined echini of $\pm 1-3 \mu$ long. The colpus is not very well defined. In some specimens of the Paleocene (Slide F-V-47, Col. S.G.N.), the spines are densely placed and they seem to radiate in a very regular manner from a point located in the centre of the grain; for the rest they are identical with the holotype of *E. ruedae*. Although there is perhaps justification in establishing a variety, for the time being we shall refrain from creating it.

Psilamonocolpites nov. gen.

Description: \pm Psilate pollen grains and with one colpus which is approximately as long as the grain (varies between slightly less and slightly more). The colpus is longer than in *Arecipites* Woodhouse and does not maintain the widening till the end of the colpus as in *Palmaepollenites* R. Pot.

Genotype: *Psilamoncolpites* (al. *Monocolpites*) *medius* (v.d.H. 1956b) nov. comb.

An extensive description of *Psilamoncolpites medius* can be found in van der Hammen (1956b, p. 112 and fig. 1). According to Potonié (1958) the genus *Monocolpites* (Erdtman, 1947) v.d.H. 1954, 1956 is not valid, but if it would be valid, it seems difficult to include this species and other similar species in it.

Therefore we established this new genus. To this genus also belong the species described as *M. huertasi* and *M. grandis* v.d.H. 1954; it is not certain whether *M. minutus* belongs to *Psilamoncolpites* or to *Arecipites*. The difference between the four species, which can all be encountered in the Paleocene, is principally found in the size:

minutus: 20–24 μ

huertasi: 25–27.5 μ

medius: 30–37.5 μ

grandis: 39–45(–60) μ

Natural relationship: Palmae.

Gemmamoncolpites nov. gen.

Monocolpate and clearly gemmate pollen grains. In this respect they differ from *Sabalpollenites*.

Genotype: *Gemmamoncolpites* (al. *Monocolpites*) *gemmatus* (v.d.H. 1964) nov. comb.

Gemmamoncolpites gemmatus (v.d.H. 1954) nov. comb. (v.d.H. 1954, p. 88 and Pl. 2).

The holotype (Slide C-I-23, Col. S.G.N., Suesca, Maestrichtian, Zone B), measures 22.5 μ and a slightly different variation (*M. gemmatus* "B") equally measures 22.5 μ . Monocolpate, micro-gemmate; the gemmae sometimes are locally forming something like an incomplete reticulum, or they are irregularly grouping together. This species is also very common in the Paleocene.

PROXAPERTURATES

Proxapertites

Proxapertites operculatus (v.d.H.)

(*Proxapertites operculatus* (v.d.H. 1954) v.d.H. 1956b, p. 113, Pl. I, fig. 3)

(*Monocolpites operculatus* v.d.H. 1954, p. 89, Pl. 5)

Certain differences can be observed between the specimens of this species, partly of size (35 to 65 μ) and partly of sculpture (between foveolate and reticulate). Nevertheless, it seems difficult to ascertain if these signify real varieties, or simply individual variations.

See photo 8.

Natural relationship: cf. *Astrocaryum acaule*.

Proxapertites tertiaria nov. sp.

Description: Pollen grains very large, $\pm 130 \mu$ (but variable), with a very large ($\pm 90 \mu$, variable) and \pm irregular (like in *Proxapertites operculatus*) "aperture".

Tectum perforate, and large "columellae". The grain has some resemblance with "*Monocolpites*" *humbertoides* v.d.H. 1954, which possibly also belongs to the genus *Proxapertites*.

Holotype: Slide F-V-56, Col. S.G.N. Photo 16. Size 128 μ . Coal, region of Lebrija, Paleocene.

Natural relationship: This species must belong to the Anonaceae.

DIPORATES

Retidiporites Varma & Rawat 1963

Retidiporites magdalenensis nov. sp.

Description: Diporate, micro-reticulate. Pores without annulus, sometimes slightly elongate, simulating short colpi. Diameter of the pores up to $\pm 10 \mu$. The lumina of the reticulum are smaller than 1μ . Muri relatively wide. Thickness of the exine 1–1.5 μ . The size varies between ± 30 and 40μ long and ± 20 and 30μ wide. Frequently one side is more convex than the other. This species is related to *R. bengalensis* Varma & Rawat.

Holotype: Slide F-V-41, Col. S.G.N. (RL-11). Photo 9. (other specimen F-V-43, Col. S.G.N. (RL-8)) (Photo 10). Coal, region of Lebrija (Valle Medio of the Magdalena), Paleocene, Zone C.

SYNCOLPORATES

Syncolporites v.d.H. 1954

Syncolporites lisamae v.d.H.

(*Syncolporites lisamae* v.d.H. 1954, p. 91, Pl. 10)

A more complete description is given here than in 1954.

Description: Syncolporate, scabrate to micro-verrucate. The exine is slightly thicker and darker near the pores, thus forming something like an annulus. Size ± 18 – 21μ . The exine in the intercolpia is thin. The height of the sculpture elements is $\pm 0.5 \mu$. The zone of the annulus is psilate.

This species was described from the Maestrichtian, but is also common in Zone A of the Paleocene, equally upwards.

STEPHANOCOLPATES

Scabrastephanocolpites nov. gen.

Stephanocolpate pollen grains, exine scabrate. They differ from *Stephanocolpites* and *Polycolpites* by the different sculpture.

Genotype: *Scabrastephanocolpites scabratus* nov. sp.

Scabrastephanocolpites scabratus nov. sp.

Description: Stephanocolpate, scabrata, tectate. The columellae are clearly visible in optical section; the thickness of the exine is 1–2 μ , 5 colpi. The size is $\pm 37 \mu$.

Holotype: Slide F-III-22, Col. S.G.N. (Cat.-457). Photo 11. Size 37 μ . Coal, Catatumbo, Paleocene.

Scabrastephanocolpites lisamae nov. sp.

Description: Stephanocolpate, finely granulate, apparently scabrata (-microverrucate). Colpi relatively short, with something like costae. The colpi and the "costae" show a very irregular aspect, so that it is very difficult to count the colpi (6?). Rounded form. Size $\pm 30 \mu$.

Holotype: Slide F-I-78, Col. S.G.N. (HB-285). Photo 14. Size 30 \times 30 μ .

Paratype: Slide F-I-73, Col. S.G.N., coord. 102.8^s \times 50.8). Coal, region of Lebrija (Valle Medio of the Rio Magdalena), Paleocene, upper part of zone C.

Scabrastephanocolpites vanegensis nov. sp.

Description: Stephanocolpate, scabrata; 4 colpi, which are open rather much (polar view). The polar area measures about 9 μ . Slight indication of a margo. The size is about 37 μ . The exine apparently is thin.

Holotype: Slide F-I-78, Col. S.G.N. (HB-285). Photo 15. Size 37 \times 37 μ . Coal, region of Lebrija, Paleocene, upper part of Zone C.

Verrustephanocolpites nov. gen.

Stephanocolpate pollen grains, exine verrucate. They differ from *Stephanocolpites* and *Polycolpites* by the different sculpture.

Genotype: *Verrustephanocolpites verrucatus* nov. sp.

Verrustephanocolpites verrucatus nov. sp.

Description: Stephanocolpate, verrucate. The diameter of the verrucae is variable, in general ± 1 –1.5 μ . 5 short colpi. The polar area is large. Size $\pm 40 \mu$.

Holotype: Slide F-III-22, Col. S.G.N. (Catat.-457). Photo 13. Size 40.5 μ . Coal, Catatumbo, Paleocene.

Gemmastephanocolpites nov. gen.

Stephanocolpate pollen grains, exine gemmate. They differ from *Stephanocolpites* and *Polycolpites* by the different sculpture.

Genotype: *Gemmastephanocolpites gemmatus* nov. sp.

Gemmastephanocolpites gemmatus nov. sp.

Description: Stephanocolpate, gemmate, 5 colpi. The diameter of the gemmae is variable, up to 2 μ . The thickness of the exine is 3–4 μ (including the gemmae). The polar area is relatively large. Size $\pm 33 \mu$.

Holotype: Slide F-III-22, Col. S.G.N. (Cat.-457). Photo 12. Size 33.5 μ . Coal, Catatumbo, Paleocene.

TRIPORATES

There are several species of "Trip.rites" in the Paleocene, which are difficult to distinguish from (or identical with) the species of the Maestrichtian ("Triporites" *annulatus* etc.), with a size between ± 20 and 30μ . Some are more triangular (with flat sides), others show an apparently thinner exine, or seem to be scabrate. New species are not described here, because good material for holotypes is lacking.

TRICOLPATES

Psilatricolpites v.d.H. 1956a; v.d.H. & Wymstra 1964

In this genus a number of tricolpate and psilate species is united, which do not correspond with the genera described until now. It is possible that we shall have to subdivide this group into various genera, but it seems premature to us to do so, because it would increase the existing confusion.

Psilatricolpites palaeocenica nov. sp.

Description: Tricolpate, psilate (locally to slightly scabrate). Size $\pm 50 \mu$. Exine very thick, $2.5-3 \mu$, thicker (to 4μ) near the colpi. Surface slightly irregular, sometimes resembling a scabrate sculpture. With immersion locally small irregular perforations (foveolae) can be distinguished. The colpi, in polar view, open abruptly towards the equator.

Polar area relatively large, $\pm 16 \mu$; index of the polar area ± 0.35 .

Holotype: Slide F-II-98, Col. S.G.N. (Catat.-472). Photo 17. Polar view $50-51 \mu$. Coal, Catatumbo, Paleocene, Zone B.

Retitricolpites v.d.H. 1956a; v.d.H. & Wymstra 1964

(In this genus all the species are united which are tricolpate and clearly reticulate, and which do not belong to other described genera).

Retitricolpites microreticulatus (v.d.H. 1954) v.d.H. & Wymstra 1964

(*Tricolpites microreticulatus* v.d.H. 1954, p. 95, Pl. 2)

Was incorporated in *Retitricolpites* in v.d.H. & Wymstra 1964.

The holotype (Slide V-I-70, Col. S.G.N., Santa Rosita, Maestrichtian, base of Zone C) is tricolpate and micro-reticulate. The reticulum is finer towards the colpi, and has a \pm psilate zone bordering the colpi; but at the ends it is lacking.

Polar area small. Size $\pm 20 \mu$, in polar view.

The specimens from the Paleocene exactly correspond with this description; the size in polar view can be up to 25μ . Has been encountered in the samples RL-7 (near the limit of Zones A and B), RL-13 (in Zone C) and Cat.-472 (in Zone B).

Retitricolpites herrerae (v.d.H. 1954) nov. comb.

(*Tricolpites herrerae* v.d.H. 1954, p. 95 and Pl. 8)

It is now incorporated in *Retitricolpites*.

The holotype (Slide F-I-34, Col. S.G.N., Suesca, Maestrichtian, Zone A) is tricolpate and finely reticulate. The thickness of the exine is clearly visible in optical section ($\pm 1 \mu$). The polar area is small. The size of the grain is $\pm 23 \mu$.

The specimens from the Paleocene are identical with this species described from the Maestrichtian.

Foveotricolpites Pierce 1961

(Tricolpate and foveolate (to perforate) pollen grains)

Foveotricolpites perforatus nov. sp.

Description: Tricolpate, tectum perforate. Exine, except the perforations of the tectum, psilate. Columellae very big. The perforations of the tectum are very large in the polar area (up to 5.5μ diameter), and much smaller towards the equator ($\pm 0.5 \mu$). Colpi relatively short, and polar area relatively large. Thickness of the exine $\pm 3 \mu$, ectexine $\pm 1.5 \mu$. Subspheroidal shape. Size $\pm 45-55 \mu$. Has been found in the Zones A and B of the Paleocene.

Holotype: Slide F-II-97, S.G.N. (Cat.-473). Photo 18. Size $54 \times 49 \mu$. Coal, Catatumbo, Paleocene, Zone B.

Foveotricolpites pomarius nov. sp.

Description: Tricolpate, micro-foveolate (to micro-reticulate), especially in the polar area, but less in the equatorial zone.

Size $\pm 25 \mu$. Subspheroidal shape. Short colpi ($\pm 12 \mu$) with margo. Polar area relatively large. Thickness of the exine $\pm 1 \mu$.

Holotype: Slide F-II-98, Col. S.G.N. (Cat.-472). Photo 19. Size $25.5 \times 24 \mu$. Coal, Catatumbo, Paleocene, Zone B.

Foveotricolpites santanderianus (v.d.H. 1954) nov. comb.

(*Tricolpites santanderianus* v.d.H. 1954, p. 94, Pl. 8)

The holotype has been found in slide F-I-73, Col. S.G.N. (HB-284); coal, region of Lebrija, Paleocene, Zone C. Is tricolpate and psilate to foveolate, but it appears that the majority of what seem to be "foveolae", in reality are a sort of alveolae between the columellae. Columellae very distinct and large. Thickness of the exine up to $3-4 \mu$. Size $\pm 53 \mu$.

TRICOLPORATES

Retitricolporites v.d.H. 1956a (see also v.d.H. & Wymstra 1964)

We include in this genus a number of tricolporate and clearly reticulate pollen species, that do not belong to other existing genera. This genus might eventually be split up. Specially the two species mentioned here, might be separated as an independent genus, *Bombacites*, the genotype of which is *Retitricolporites annae*.

Description: Tricolporate, reticulate, equatorial limb rounded to triangular, form: "Tilia-type", reticulum often differentiated, colpi short.

Retitricolporites (Bombacites) annae (v.d.H. 1954) nov. comb.

(*Tricolporites annae* v.d.H. 1954, p. 96, Pl. 9)

The holotype of this species is found in slide F-I-73. Col. S.G.N. (HB-284). Coal, region of Lebrija, Paleocene, Zone C. Tricolpate (in general the pores are almost invisible), reticulate. Shape \pm rounded. Colpi short with margo. The polar area and the surrounding zone of the colpi with a heavy reticulum, and a fine reticulum in the central zones of the intercolpia. Size \pm 47–53 μ .

Natural relationship: Bombacaceae.

Retitricolporites (Bombacites) annaeoides nov. sp.

Description: Tricolporate (in general the pores are nearly invisible), reticulate. Shape \pm rounded. Colpi short with margo. Polar area and surrounding zone of the colpi with a heavy reticulum, and fine reticulum in the central zones of the intercolpia. Is much resembling *Tricolporites annae*, but the exine and the reticulum around the pores are thicker; the muri are granulate to micro-foveolate; margo of the colpi is \pm pronounced and protruding. Size \pm 40–43 μ .

Holotype: Slide V-I-87, Col. S.G.N. (HB-283). Size 41.5 μ . Coal, region of Lebrija, Paleocene, Zone C.

Natural relationship: Bombacaceae.

HETEROCOLPATES

Heterocolpites v.d.H. 1956a

Genotype: A recent species. In case this would not be valid, we would hold *H. palaeocenica* as type.

Heterocolpites palaeocenica nov. sp.

Description: Heterocolpate, psilate, tectate. The thickness of the exine in the polar area is about 0.5 μ , and slightly more towards the equator. The pores are not very clearly marked. The size of the holotype is 24.5 (long) \times 23 (wide) μ . Subsphe-roidal shape. Poles slightly flattened. 6 colpi, three of which have pores.

Holotype: Slide F-II-98, Col. S.G.N. (Catat.-472). Photo 20. Coal, region of the Catatumbo, Paleocene, Zone B.

Natural relationship: This grain probably belongs to the family of the Melastomataceae.

TETRADITES

Magnotetradites nov. gen.

Large tetrades with relatively thick exine; not reticulate and without visible apertures; by these characteristics they can be distinguished from *Inaperturotetradites* van Hoeken Klinkenberg, *Ericipites*, etc.

Genotype: *Magnotetradites magnus* (v.d.H. 1954) nov. comb.

Magnotetradites magnus (v.d.H. 1954) nov. comb.

(*Tetradites magnus* v.d.H. 1954, p. 99, Pl. 10)

The holotype can be found in slide F-I-73, Col. S.G.N. (HB-284); coal, region of Lebrija, Paleocene, Zone C. Tetrades. Size $72 \times 67 \mu$. Exine is very thick, 4–5 μ . Sculpture irregular, \pm fossulate(-foveolate); exine slightly undulating. No apertures can be distinguished.

TRILETES

Psilatriteles v.d.H. 1956b

There are several species of *Psilatriteles*, one of which is *Psilatriteles guaduensis* v.d.H. 1954, 1956. Also encountered are the species described as *Triletes psilatus*, *T. magnus* and *T. giganteus* in v.d.H. 1954, and the taxonomic position of which still has to be revised.

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PLATES

The original version of this publication was written 6 years ago as an internal report of the Servicio Geológico Nacional, Bogotá. We apologize for the quality of some of the photographs, but since the type specimens are in Colombia it has not been possible to retake them.

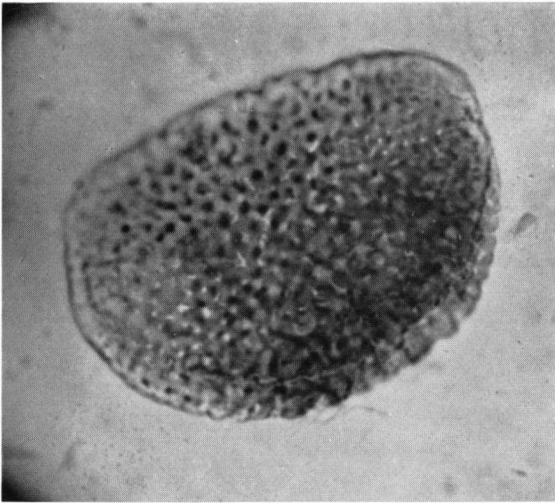


Fig. 1. *Longapertites proxapertitoides*
var. *proxapertitoides*

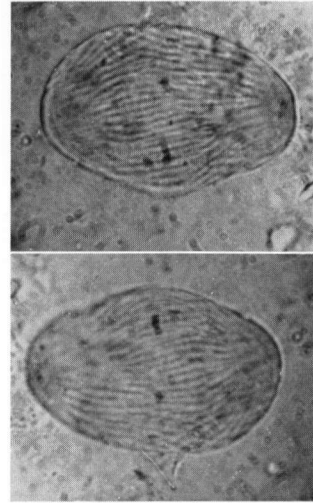


Fig. 3. *Ephedripites vanegensis*

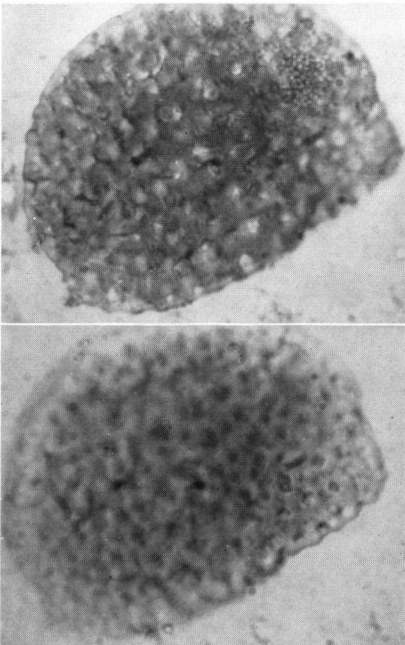


Fig. 2. *Longapertites proxapertitoides*
var. *reticulatus*



Fig. 4. *Retimonocolpites regio*

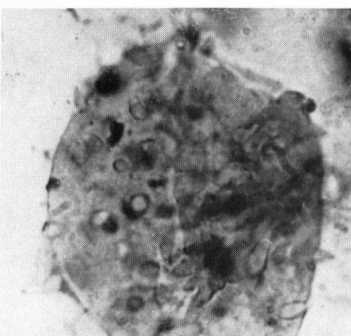


Fig. 5. *Mauritiidites franciscoi*
var. *pachyexinatus*

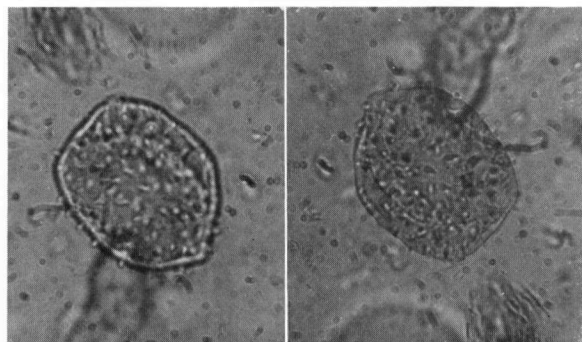


Fig. 6. *Mauritiidites franciscoi*
var. *minutus*

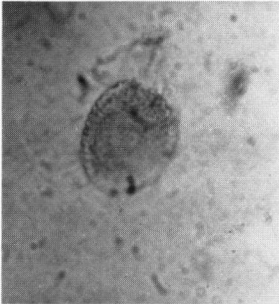
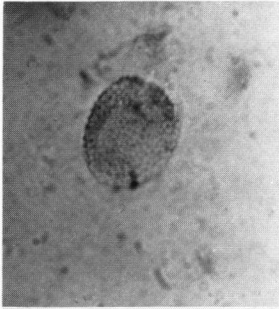


Fig. 7. *Retimonocolpites microreticulatus*

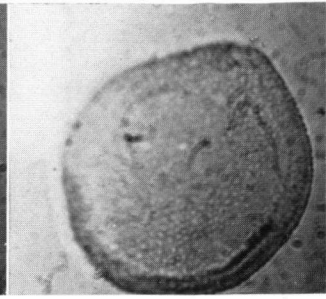
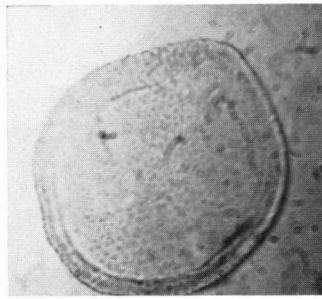


Fig. 8. *Proxapertites operculatus*

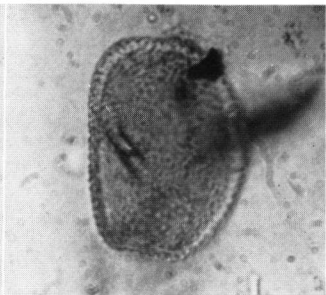


Fig. 9. *Retidiporites magdalenensis*

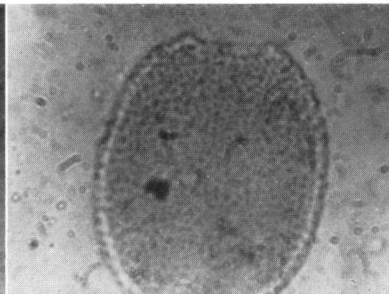
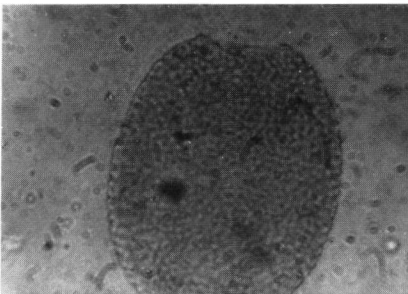


Fig. 10.
Retidiporites magdalenensis

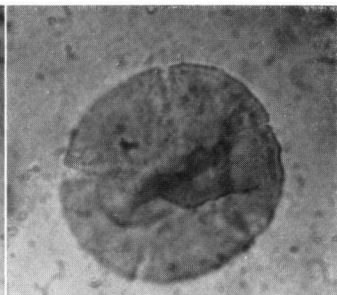
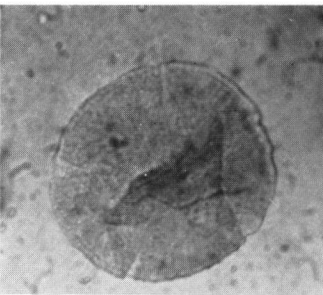


Fig. 11.
Scabrastephanocolpites scabratus

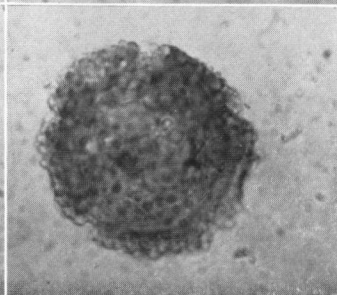
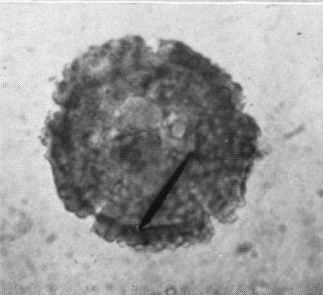


Fig. 12.
Gemmastephanocolpites gemmatus

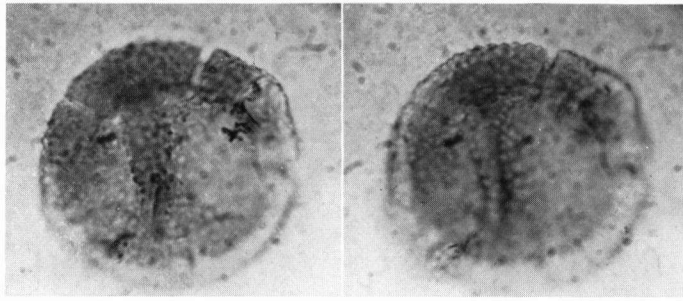


Fig. 13. *Verrustephanocolpites verrucatus*

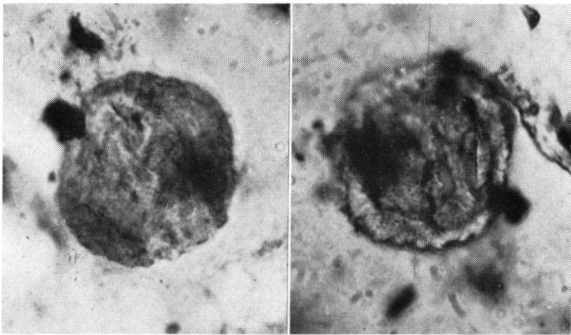


Fig. 14. *Scabrastephanocolpites lisamae*

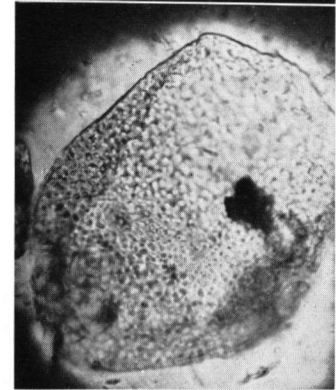
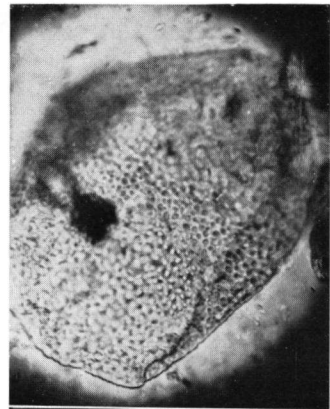


Fig. 16. *Proxapertites tertiaria*

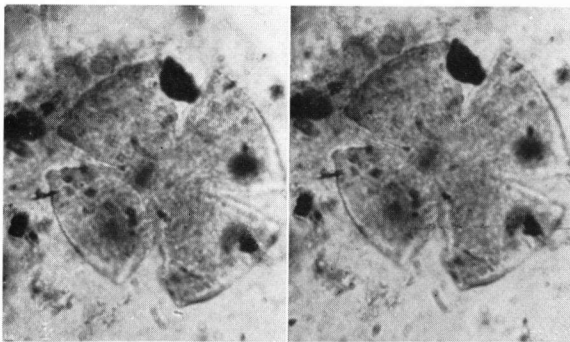


Fig. 15. *Scabrastephanocolpites vanegensis*

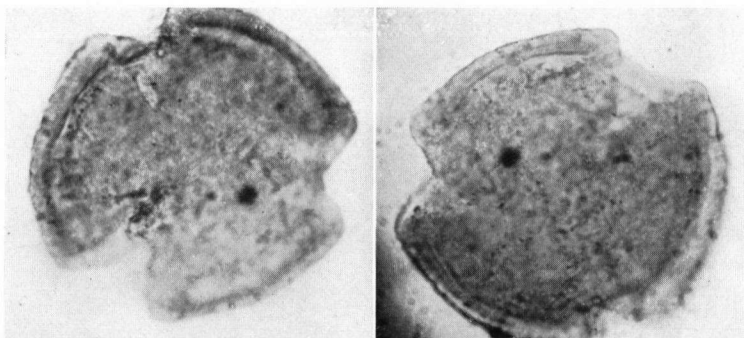


Fig. 17. *Psilatricolpites palaeocenica*

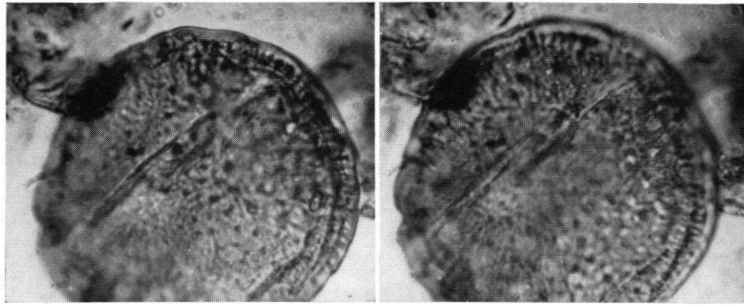


Fig. 18. *Foveotricolpites perforatus*

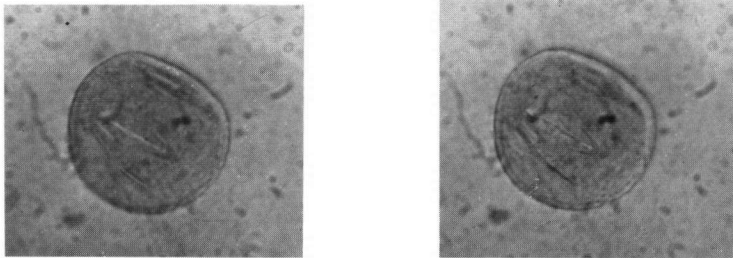


Fig. 19. *Foveotricolpites pomarius*

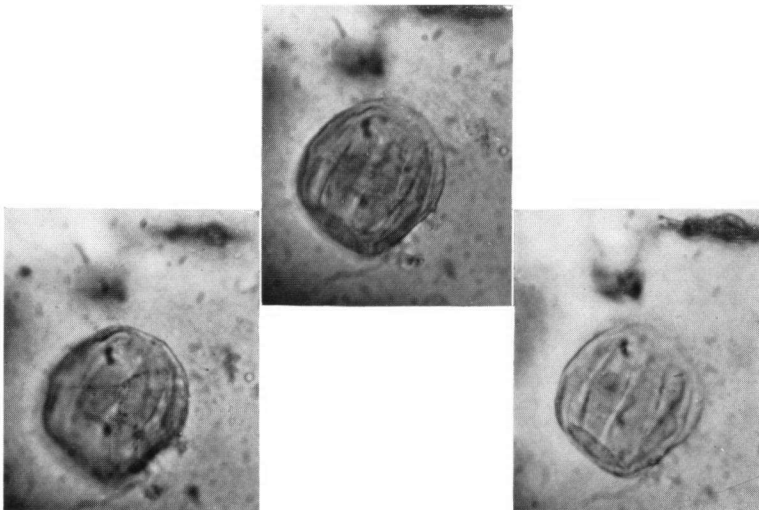


Fig. 20. *Heterocolpites palaeocenica*