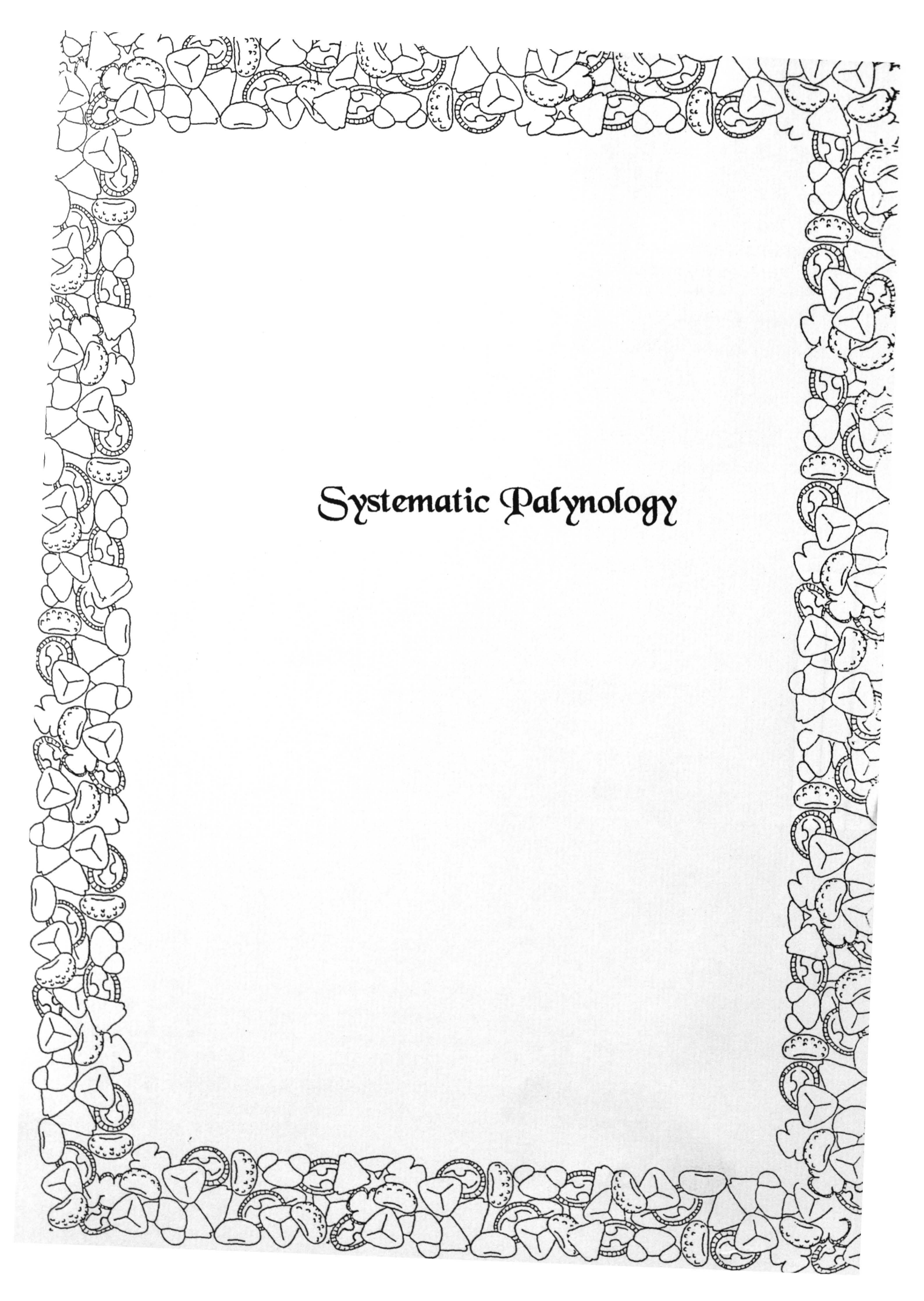


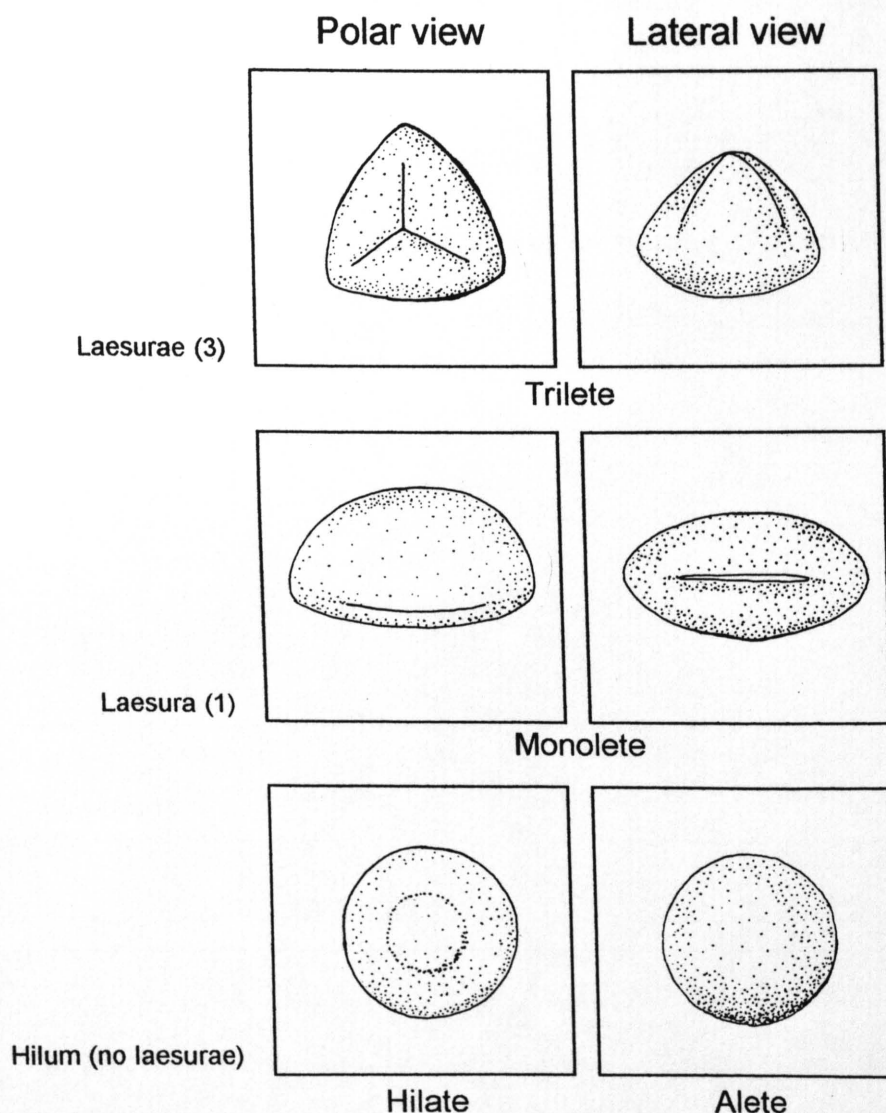


Systematic Palynology

Spores

Graphic glossary of technical terms

Figure 3.3



Spore

Definition:

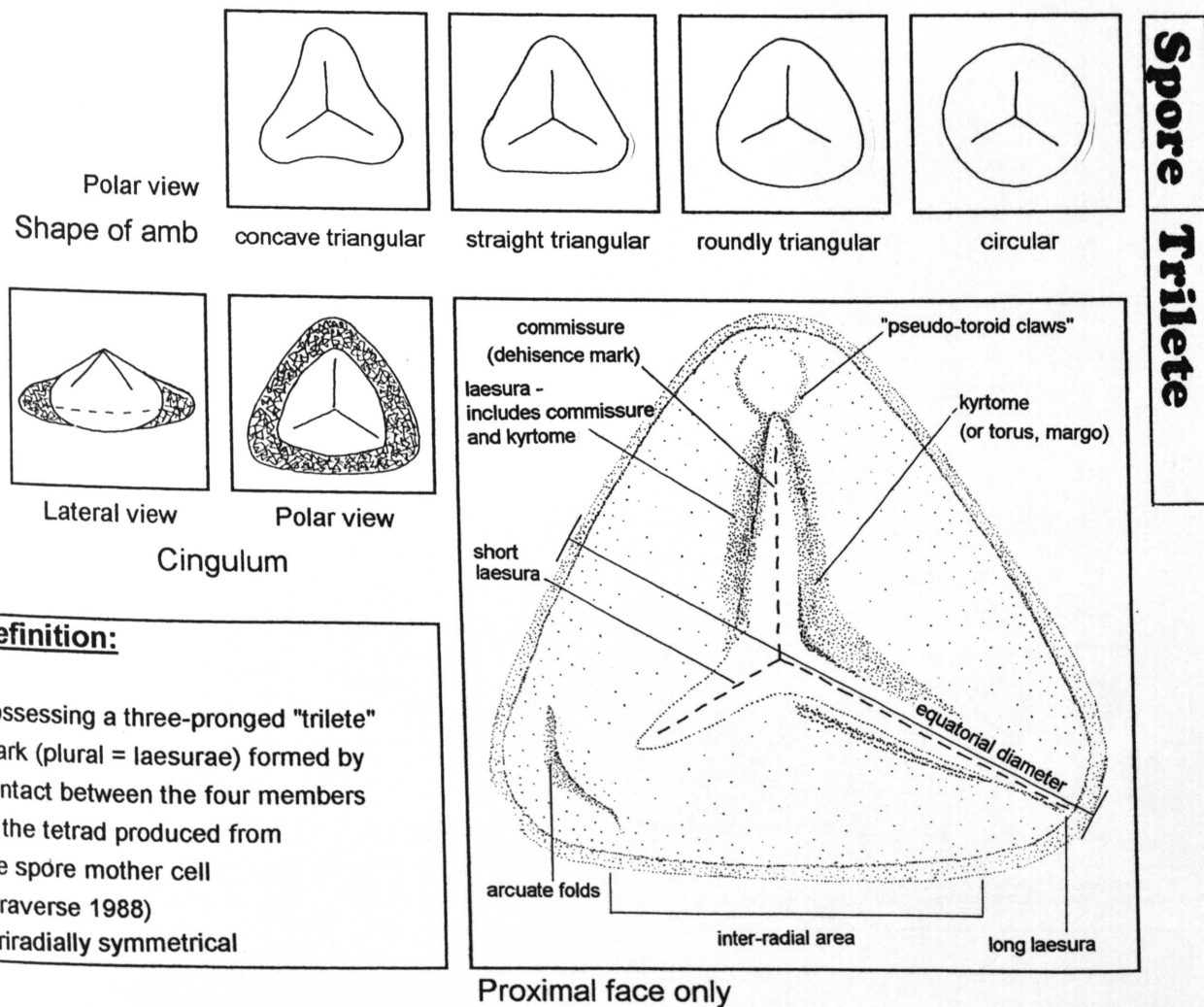
Morphologically, spores are recognised according to the character of the aperture. Spores possess laesurae, either trilete or monolete (Dettmann 1963) or a hilum. Inaperturate forms are known as alete. The true definition of a spore relies on its function rather than its morphology, as it is a propagative body which may give rise to either the sporophyte or the gametophyte generation of a primitive plant. Spores were first recognised as a separate division in palynology by Potonié in 1893.

No alete or hilate spores were found in the samples examined

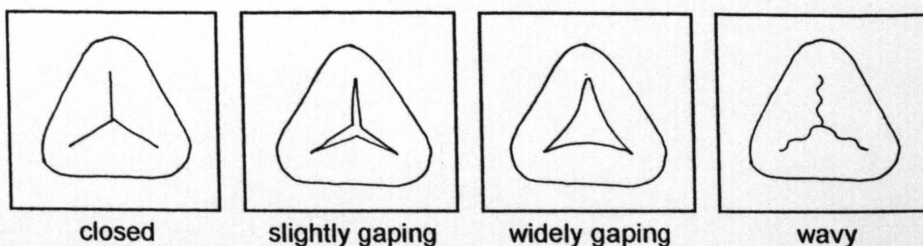
Trilete spores

Graphic glossary of technical terms

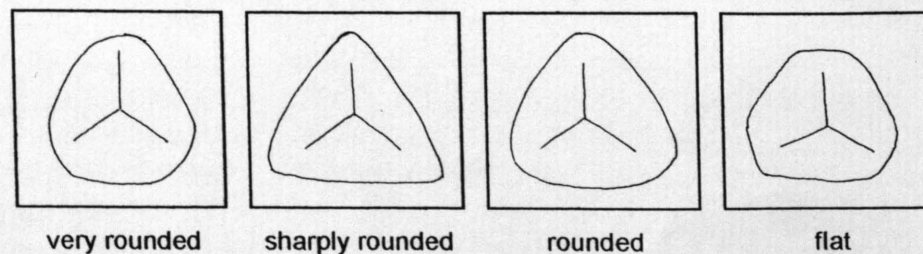
Figure 3.4



Commissure

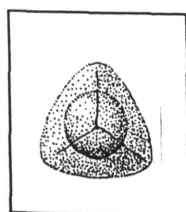


Apices

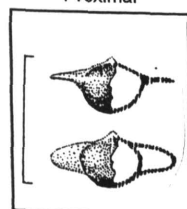


Interulobites sp Paden Phillips & Felix 1971

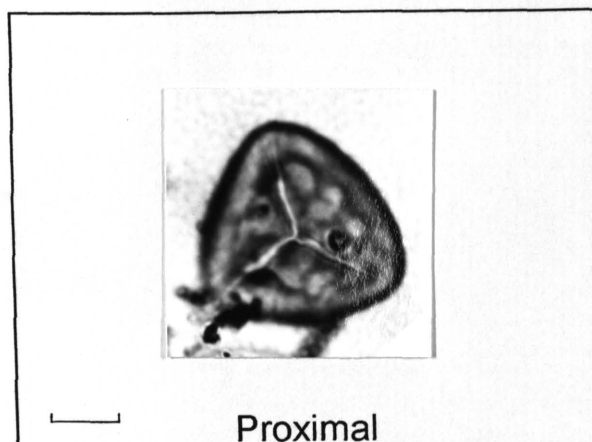
Type species *Interulobites intraverrucatus* (Brenner) Paden Phillips 1971



Proximal



Lateral



Proximal

Scale bar = 10 μ

Figure 3.5

Specimens studied (7)

Spec no	Eq diam (μ)	Cingulum (μ)
Bold type = illustrated specimen		
12--11	30	2
61-40	16	2
97-23	35	2
99-30	39	3
227-3	24	2
231-6A	26	2
231-19A	24	2
Averages	28	2

Illustrated specimen

LM. Focus on proximal face to show laesurae

Description

Amb shape	Circular to sub-triangular Av 28 μ diameter
Laesurae	Trilete. Commissure closed May have lightly marked rim Reaches 2/3 to cingulum
Cingulum	Narrow (2 μ) Even width
Exospore	Approx 2 μ thick
Sculpturing	Large flat verrucae are seen on distal face. Project into central cavity of spore.

Spore
Trilete
Cingulate

Literature

Author	Description	Illustration	Geog loc	Age
Ioannides & Colin 1974 p 896		Pl 4 no 3 & 4	Offshore S Am	? Senonian
Jansonius & Hills 1976		p 1334	n/a	n/a
Scott 1976		p 584 Pl 6 no 7-12	South Africa	Lower Cretaceous
McLachlan & Pieterse 1978		No desc	Offshore S Africa	Upper Cretaceous

Remarks

The west coast specimens complied with the generic diagnosis given in Jansonius & Hills (1976). They resembled several published illustrations, especially those of *I. sinuosus* described by Scott (1976). They are differentiated from other cingulate trilete spores by their smaller size (>30 μ diam), almost circular outline and robust, flat verrucae.

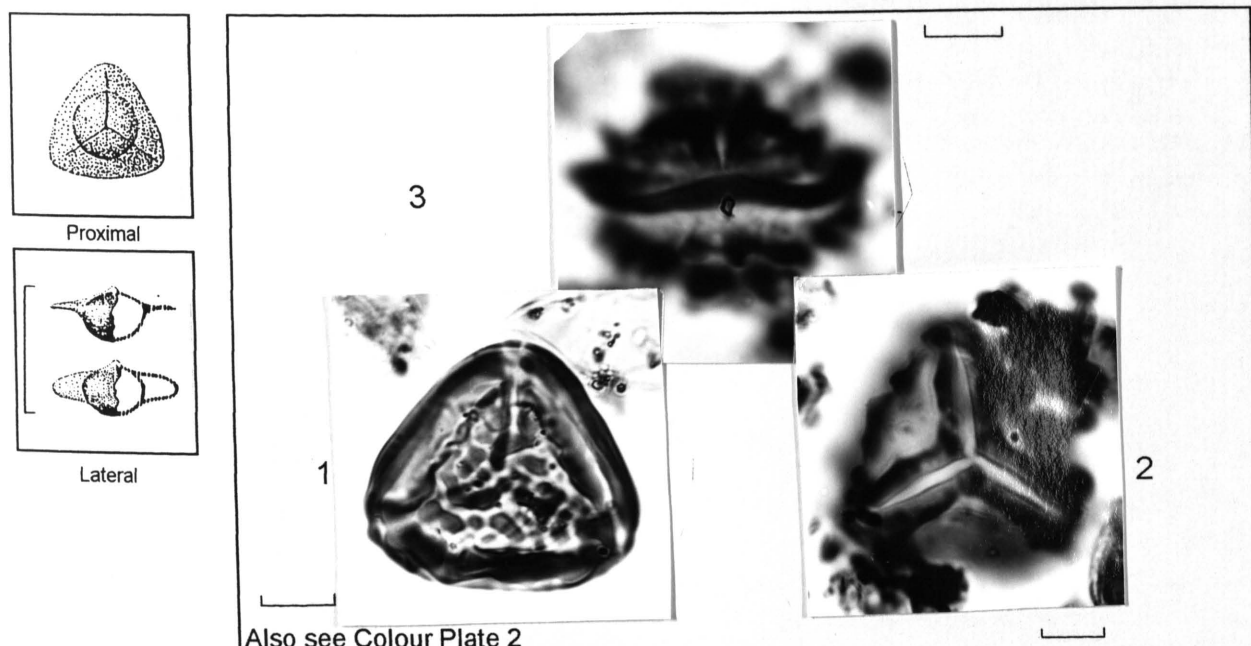
Botanical affinities Not known

Distribution Rare. 1.5% of 12-1 Main Peat Horizon, Koingnaas

Age bracket Lower to Upper Cretaceous

Polypodiaceoisporites retirugatus Muller 1968

Type species *P. speciosus* Potonie (1951) 1956



Also see Colour Plate 2

Scale bars = 10 μ

Figure 3.6

Spore
Trilete
Cingulate

Illustrated specimens

Spec no	Eq diam (μ)	Cingulum (μ)
63-13	35	5
158-41	39	2
159-17	40	29*

* polar length

Averages of specimens

Equatorial diam (μ) 22 specs	36
Cingulum width (μ) 21 specs	4
Polar length (μ) 1 specimen	29

Ranges of specimens

Equatorial diam (μ) 22 specs	25-45
Cingulum width (μ) 21 specs	2--7
Polar length (μ) 1 spec	29

Description

Amb shape	Rounded triangular, convex sides, av. 36 μ in diameter Anisopolar in equatorial view
Laesurae	Trilete; closed, with rays reaching half-way or more to the equator. Bordered by narrow margo.
Cingulum	Psilate, broad (4 μ). Even width throughout.
Exospore	Approx 2 μ thick
Sculpturing	Differentially sculptured; robust rugulae & verrucae on distal face, 3 μ wide. Finer verrucae on proximal face.

Illustrated specimens

- (63-13) LM. Focus on proximal face of spore showing fine sculpturing, closed commissure and narrow margo.
- (158-41) LM. Polar aspect. This specimen has generally more robust sculpture than that in 1.
- (159-17) LM. Equatorial view. One ray of the trilete mark can be seen at the top.

Literature

Author	Description	Illustration	Geog loc	Age
Muller 1968	p 7	Pl 1 fig 8	Malaysia	Senonian and younger
Hekel 1972	p 5	Pl 2 fig 2, 3	Australia	early Tertiary
Kemp 1974	p 818	Pl 2 fig 21, 22	Ninetyeast Ridge	?early Miocene
Partridge 1978	no desc	Pl 1 fig 9a, 9b	offshore Angola	late Tertiary

Remarks

Some similarity exists with the genus *Muricingulisporis*, as both are cingulate with robust sculpturing. In *Muricingulisporis*, the elements are fused into muri whereas in the west coast specimens the sculpturing is verrucate/rugulate, thus they were not placed in this genus. However, they show fused elements which completely surround the laesurae, as seen in *Muricingulisporis*.

They are differentiated from other cingulate trilete spores by the presence of a marked margo

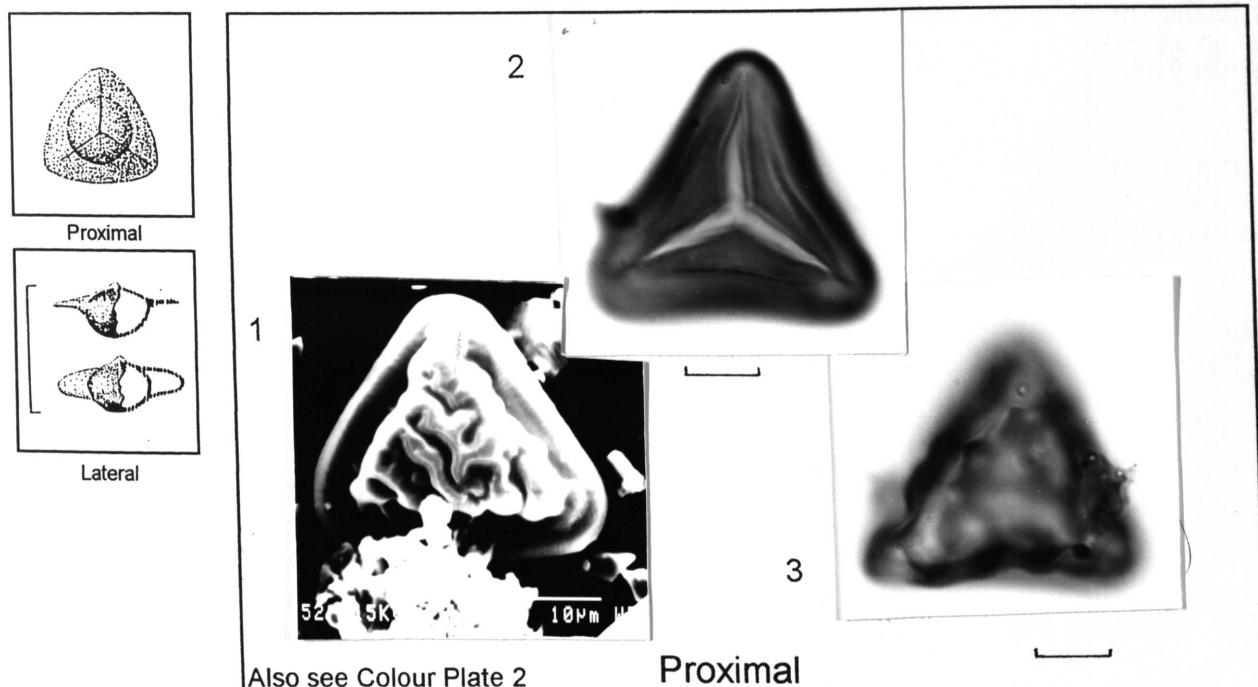
Botanical affinities Muller (1968) reports that this spore type was probably produced by a fern species belonging or related to the genus *Pteris*.

Distribution Little known. Found in the Main Peat Horizon at Koningnaas (4% of 12-2) and at Langklip and Somnaas/Noup.

Age bracket Mid Cretaceous to late Tertiary

Polypodiaceoisporites sp cf *P. tumulatus* Partridge 1973

Type species *P. speciosus* Potonie (1951) 1956



Also see Colour Plate 2

Proximal

Scale bars =10 μ

Figure 3.7

Spore
Trilete
Cingulate

Specimens studied (9)

Spec no	Eq diam (μ)	Cingulum (μ)
Bold type = illustrated specimen		
96-42	35	2
97-18	43	3
100-37	34	3
102-8	30	3
105-22	37	4
106-23	44	3
107-29	30	3
192-20A	23	3
247-31	32	4
Averages	34	3

Description

Amb shape	Triangular, straight sides Av. 34 μ in diameter
Laesurae	Trilete; commissure may gape slightly. Rays reach to border of cingulum.
Cingulum	Psilate, broad (3 μ). Appears wider in interrarial areas.
Exospore	Approx 2 μ thick
Sculpturing	Differentially sculptured; robust rugulae on distal face 3 μ wide. Proximal face almost psilate.

Illustrated specimens

1. (247-31) SEM showing distal face of spore, robust rugulae and psilate cingulum.
2. (100-37) LM. Focus on proximal face showing gaping commissure and almost psilate surface.
3. As in 2 above, focus on distal face to show rugulae.

Literature

Author	Description	Illustration	Geog loc	Age
Kemp & Harris 1977 p 11		Pl 1 fig 6, 7	Ninetyeast Ridge	Eo-Miocene

Remarks

Polypodiaceoisorites tumulatus differs from *P. retirugatus* in having a cingulum which may vary in width, being wider in the interradian areas (Kemp & Harris 1977). The west coast specimens of each species differ in their overall shape (*P. tumulatus* has a straight amb and *P. retirugatus* a roundly triangular amb), their laesurae (*P. tumulatus* does not have a margo and the commissure may gape a little), and their sculpturing (*P. retirugatus* has verrucate/ rugulate sculpturing on both faces whereas *P. tumulatus* has robust rugulae on the distal face while the proximal face is almost psilate).

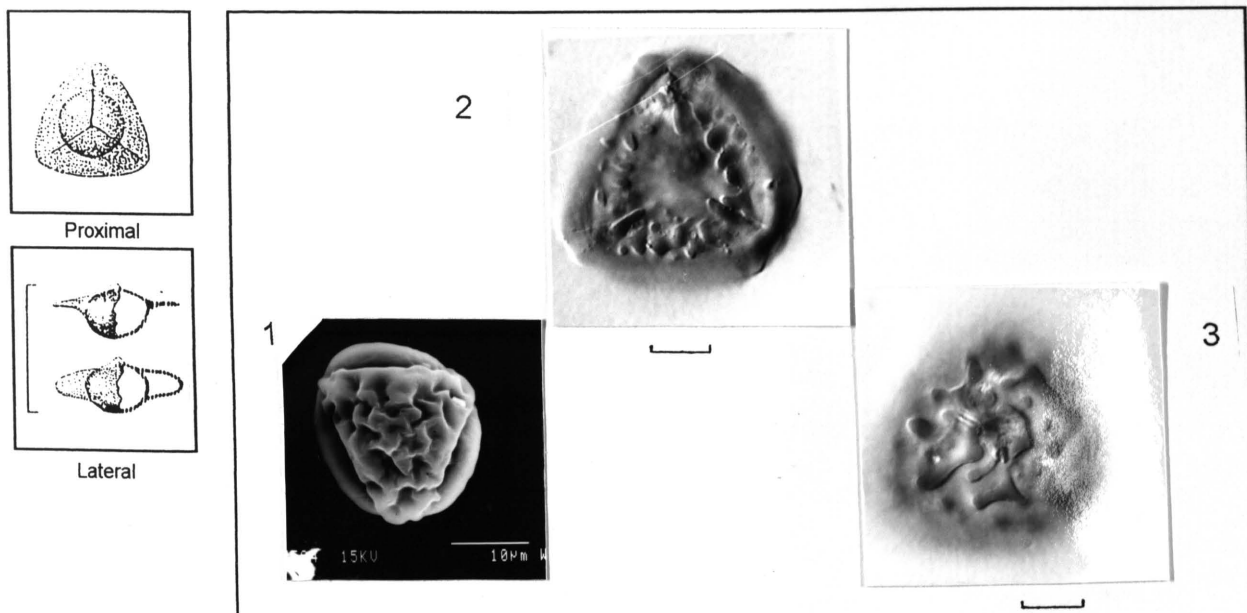
Botanical affinities Muller (1968) likened the dispersed species *P. retirugatus* to the spores of *Pteris*; the basic similarity of morphology shown by *P. sp cf tumulatus* suggests a similar relationship (Kemp & Harris 1977).

Distribution Little known. Found in the Main Peat Horizon at Koingnaas (4% of 12-1). Single specimen found in stringer above Main Peat. Also known from upper levels at Langklip.

Age bracket Eo-Miocene

Polypodiaceoisporites sp A

Type species *P. speciosus* Potonie (1951) 1956



Scale bars = 10 μ

Proximal

Figure 3.8

Spore
Trilete
Cingulate

Specimens studied (9)

Spec no	Eq diam (μ)	Cingulum (μ)
Bold type = illustrated specimen		
36-36	33	4
153-9	30	3
153-15	38	4
174-4	39	5
174-27A	38	5
245-18	25	4
263-10	25	3
264-18A	22	3
271-36	31	5
Averages	31	4

Description

Amb shape	Roundly triangular, convex sides. Av. 31 μ in diameter
Laesurae	Trilete; commissure gapes Rays reach to border of cingulum.
Cingulum	Psilate, broad (4 μ). Wider in interradian areas.
Exospore	Approx 2 μ thick
Sculpturing	Differentially sculptured; robust rugulae/verrucae on distal face 3 μ wide and verrucae 5 μ high Proximal face bears smaller, isolated verrucae, 1x1 μ

Illustrated specimens

1. (245-18) SEM showing distal face of spore, robust rugulae and psilate cingulum.
2. (271-36) NOR-LM. Focus on proximal face showing gaping commissure.
4. As in 2 above, different focus level to show proximal verrucae and psilate cingulum.

Literature

Author	Description	Illustration	Geog loc	Age
Jansonius & Hills 1976 p 2098		p 2098	Germany	Eocene

Remarks

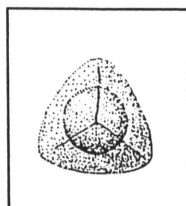
This group of specimens possibly constitutes a new species, as they cannot be assigned to *P. retirugatus* or *P. sp cf tumulatus*. The commissure of these specimens gapes while in *P. retirugatus* it does not. *P. sp cf tumulatus* has an almost psilate proximal face, whereas these specimens have verrucae.

Botanical affinities Possibly *Pteris*, as suggested for *P. retirugatus* by Muller (1968)

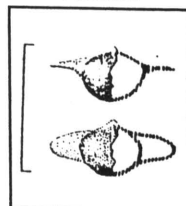
Distribution Very rare. Isolated specimens found in the Main Peat Horizon and above at Koingnaas. Also known from Langklip and Somnaas/Noup.

Age bracket Eocene

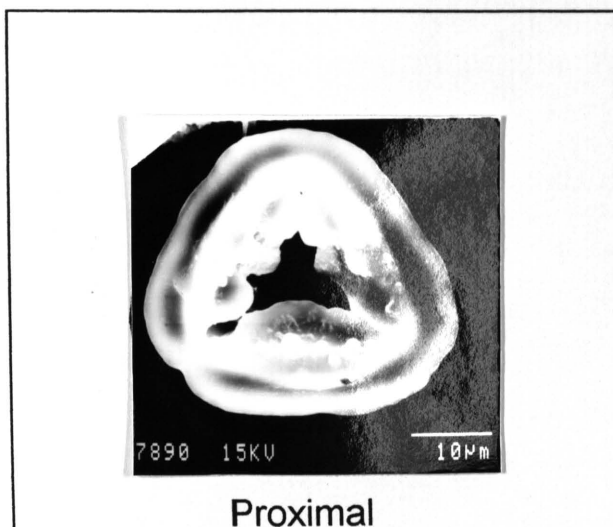
Type species *P. speciosus* Potonie (1951) 1956



Proximal



Lateral



Proximal

Scale bars = 10 μ

Figure 3.9

Spore
Trilete
Cingulate

Specimens studied (12)

Spec no	Eq diam (μ)
Bold type = illustrated specimen	
12--32	22
46-31	45
59-26	50
81-29	37
128-36	25
140-32	30
193-23	25
187-28	24
194-18	22
231-28A	19
251-11	40
267-18A	18
Averages	30

Description

Amb shape	Triangular Av. 30μ in diameter
Laesurae	Trilete; commissure may gape Rays reach to border of cingulum.
Cingulum	Psilate, broad (illustrated specimen 5μ). Appears wider in interrarial areas.
Exospore	Approx 2μ thick
Sculpturing	Verrucae; flat or high, 1-3μ diam Rugulae; 2-4μ wide Psilate interrarial areas seen

Illustrated specimen

SEM showing distal face of spore with damaged laesurae. Spore also shows flat, robust verrucae (5μ at base) and psilate cingulum.

Literature

Author	Description & illustration
Jansonius & Hills 1976	p 2098

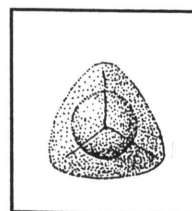
Remarks

Specimens which could not confidently be assigned to a particular species of *Polypodiaceoisporites* were placed in this 'portmanteau' grouping.

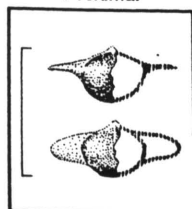
Botanical affinities Possibly *Pteris* (Muller 1968)

Distribution Little known. Found in all levels at Koinaas. Rarer in Langklip but not known from Somnaas/Noup.

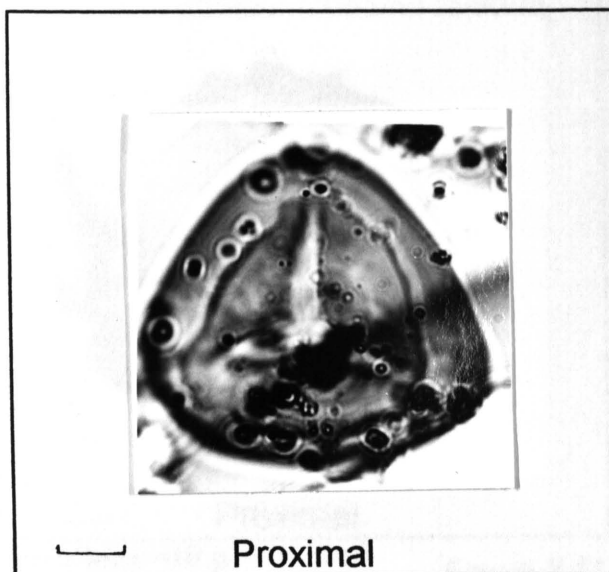
Age bracket Mid Cretaceous - Tertiary

Type species *Cingultriletes congruens* Pierce 1961

Proximal



Lateral



Proximal

Scale bars = 10 μ

Figure 3.10

Spore
Trilete
Cingulate**Specimens studied (3)**

Spec no	Eq diam (μ)	Cingulum (μ)
Bold type = illustrated specimen		
84-27	44	2
86-3	47	7
135-26	30	5
Averages	40	5

Illustrated specimen

LM. Focus on proximal face to show laesura and cingulum

Description

Amb shape	Roundly triangular, straight to convex sides. Av. 40 μ diam
Laesurae	Trilete; rim not marked. Commissure may gape slightly. Long rays reach to cingulum.
Cingulum	Psilate, broad (5 μ).
Exospore	Approx 2 μ thick
Sculpturing	Main body of spore and cingulum are psilate.

Literature

Author	Description	Illustration	Geog loc	Age
Dettmann 1963	p 69	Pl 14 Fig 5-8	Australia	Mesozoic & Tertiary
Jansonius & Hills 1976		p 481	n/a	n/a
Jansonius & Hills 1976		p 2706	n/a	n/a

Remarks

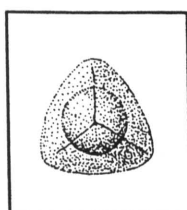
Stereisporites subgen. *Cingultriletes* is distinguished from other cingulate trilete spores by its' psilate sculpturing. Both the cingulum and the main body of the spore show no marked elements of sculpture. A discussion on the validity of the genus is given in Jansonius & Hills (1976). Dettmann (1963) also comments on the comparison of this type and others.

Botanical affinities Not stated, but possibly with *Sphagnum* (Dettmann 1963).

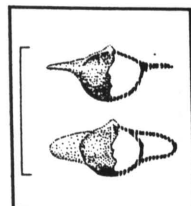
Distribution Very rare. Found below the Main Peat Horizon at Koingnaas. Single specimen from within the Main Peat Horizon. Unknown from Langklip or Somnaas/Noup.

Age bracket Mesozoic to Tertiary

Type species *Verrucingulatisporites verrucatus* Kedves 1961

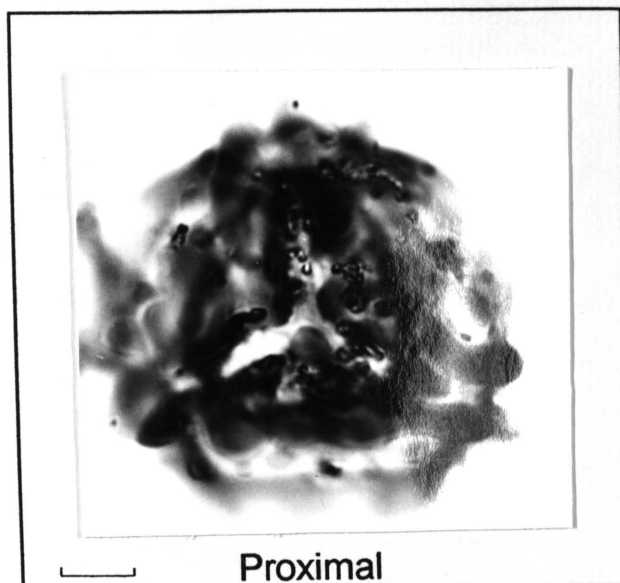


Proximal



Lateral

Also see Colour Plate 2



Proximal

Scale bars = 10 μ

Figure 3.11

Spore

Trilete

Cingulate

Specimens studied (12)

Spec no	Eq diam (μ)	Cingulum (μ)
Bold type = illustrated specimen		
58-42	30	2
76-38	50	3
101-36	54	2
102-32	70	5
163-29	37	2
187-36	40	36*
232-26	30	3
253-1	33	2
257-15	28	3
260-38	33	2
264-37A	25	3
266-8A	30	3
Averages	38	3

* polar length

Illustrated specimen

LM. Focus on proximal face to show laesura and sculpturing.

Description

Amb shape	Very roundly triangular. Anisopolar in equatorial view.
Laesurae	Trilete. Commissure may gape Reaches 2/3 to cingulum Obscured on some specimens by heavy sculpturing. May be rimmed by fused verrucae.
Cingulum	Narrow (3 μ) and sculptured. Large verrucae from faces of spore may extend beyond it.
Exospore	Approx 2 μ thick
Sculpturing	Very robust, consisting of verrucae and rugulae. Verrucae 2-4 μ at base, 3-5 μ high and may be pointed. Rugulae 2-4 μ wide, may extend more than 10m. On some specimens, form a peak at the apices.

Literature

Author	Description	Illustration	Geog loc	Age
Jansonius & Hills 1976		p 3178	n/a	n/a

Remarks

The Koinaas specimens were placed within *Verrucingulatisporites* as they agree with the generic diagnosis given in Jansonius & Hills (1976). No similar forms were found in the other literature consulted, thus they could not be identified to species level. Possibly, two species are included here, as two specimens were much larger and showed a more regular sculpturing pattern.

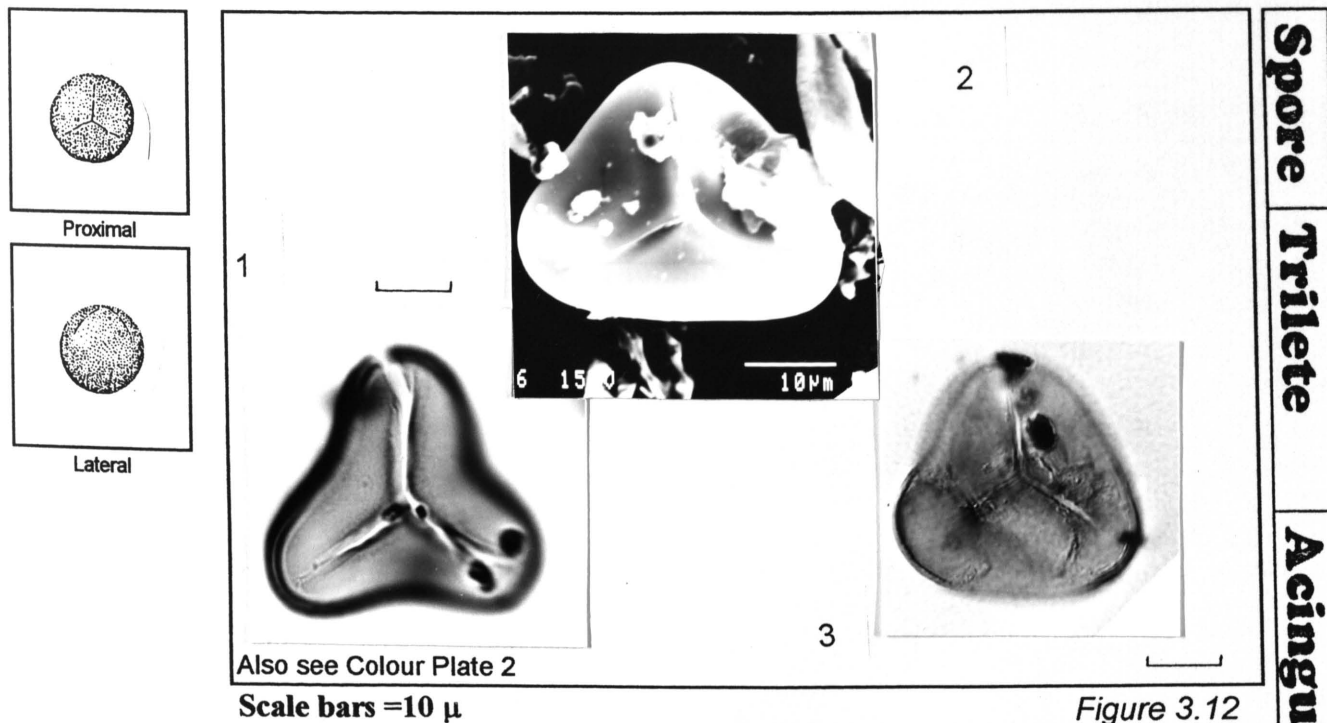
Botanical affinities Not known

Distribution Rare. Found at all levels at Koinaas. Single specimen known from Langklip.

Age bracket Unknown.

Cyathidites australis Couper 1953

Type species *C. australis* Couper 1953



Specimens studied (33)

Spec no	Eq diam (μ)
Bold type = illustrated specimen	
164-19	35
248-9	35
271-12	32

Averages of specimens

Eq diam (μ)	39
-------------	----

Ranges of specimens

Eq diam (μ)	19-72
-------------	-------

Description

Amb shape	Triangular; concave sides Average equ diameter 39μ
Apices	Broadly rounded.
Laesurae	Trilete. Narrow rays clearly defined and reach 2/3 to equator. Commissure may gape
Exospore	Thin (1-2μ) Spores not usually crumpled
Sculpturing	Psilate

Illustrated specimens All proximal view

1. (164-19) LM. Photo shows concave sides and well-marked laesurae.
2. (248-9) SEM. Partly obscured by debris.
3. (271-12) NOR-LM enhancing sculptural details. Laesurae well seen, commissure closed.

Literature

Author	Description	Illustration	Geog loc	Age
Couper 1953	p 27	PI 2 fig 11	New Zealand	Jurassic - Lower Cretaceous
Dettmann 1963	p 22	PI 1 fig 1-3	Australia	Mesozoic
Harris 1965	p 79	PI 24 fig 11	Australia	Tertiary
Harris 1974		fig 9	Ninetyeast Ridge	Palaeocene
Burger 1976	p 116	PI 18 fig 3-5	Australia	
Kemp & Harris 1977	p 8	No illustr	Ninetyeast Ridge	Palaeo-Miocene
Scholtz 1985	p 19	Fig 4 E	South Africa	U Cretaceous - Tertiary
Kar 1985	No desc, PI 1 fig 1 & 2, PI 28 fig 1		India	
El Beialy 1995	p 315	PI 4 fig 1	Egypt	Cretaceous

Remarks

Harris (1974) and Burger (1976) comment that *Cyathidites australis* may intergrade with *C. minor*.
 Kemp & Harris (1977) further comment that the two species are separated on a size basis.
 Further distinguishing points include the nature of the amb sides and the laesurae.

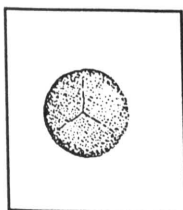
Botanical affinities Couper (1953) suggested that these may be the spores of an ancestral tree fern, similar to *Cladophlebis*. Cyatheaceous and dickoniaceous ferns (Dettmann 1963).

Distribution Well known (5% of 12-14). Found at all levels at Koinaas. Also known from Langklip and Somnaas/Noup.

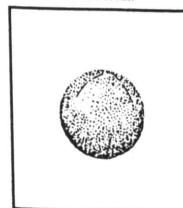
Age bracket Jurassic - Tertiary

Cyathidites minor Couper 1953

Type species *C. australis* Couper 1953

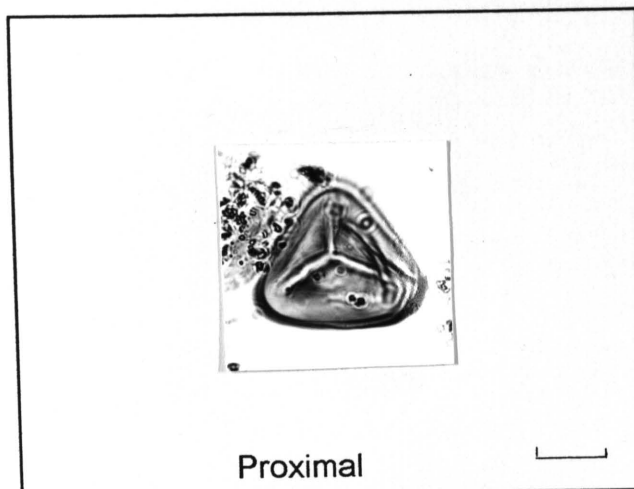


Proximal



Lateral

Also see Colour Plate 1



Proximal

Scale bar = 10 μ

Figure 3.13

Specimens studied (16)

Spec no	Eq diam (μ)
Bold type = illustrated specimen	
4-14	20

Averages of specimens

Eq diam (μ)	25
-------------------	----

Ranges of specimens

Eq diam (m)	20-30
-------------	-------

Illustrated specimen

(4-14) LM. Proximal view showing laesurae

Description

Amb shape	Triangular; concave to straight sides. Equ diam av 25 μ
Apices	Broadly rounded.
Laesurae	Trilete. Narrow rays clearly defined and reach 2/3 to equator. Commissure may gape
Exospore	Thin (1 μ) Spores often crumpled
Sculpturing	Psilate

Spore
Trilete

Acingulate
psilate

Literature

Author	Description	Illustration	Geog loc	Age
Couper 1953		Pl 2 fig 13	New Zealand	Jurassic - Lower Cretaceous
Dettmann 1963	p 22	Pl 1 fig 4&5	Australia	Mesozoic
Harris 1965	p 79	Pl 24 fig 12	Australia	Lower Tertiary
Brenner 1968	p 349	Pl 1 fig 3	Peru	Mid Cretaceous
Hekel 1972		Pl 2 fig 4	Australia	Tertiary
Harris 1974		fig 9	Ninetyeast Ridge	Palaeocene
Hos 1974	p 7	fig 13	Australia	Upper Eocene
Ioannides & Colin 1974	p 896	Pl 4 fig 1	Offshore S Am	Tertiary
Burger 1976	p 116	Pl 18 fig 6 & 7	Australia	
Kemp & Harris 1977	p 8	No illustr	Ninetyeast Ridge	Palaeo-Miocene
McLachlan & Pieterse 1978		Pl 1 fig 1	Offshore S Africa	Cretaceous
Saxena & Misra 1990			India	

Remarks

As mentioned for *C. australis*, Harris (1974) and Burger (1976) comment that *C. australis* may intergrade with *C. minor*. Kemp & Harris (1977) further comment that the two species are separated on a size basis. The west coast specimens were differentiated according to size and the thickness of the exine. Where any doubt existed, they were recorded as *Cyathidites* sp.

Botanical affinities Couper (1953) stated that these spores are known in at least three species of living ferns. Similar to the spores of *Coniopteris* (Couper 1953). Cyatheaceous and dicksoniaceae ferns (Dettmann 1963).

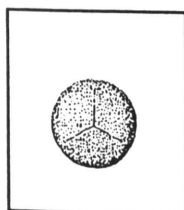
tree fern, similar to *Cladophlebis*. Cyatheaceous and dickoniaceous ferns Dettmann (1963).

Distribution Rare. Found in channel peats and Main Peat Horizon at Koingnaas.

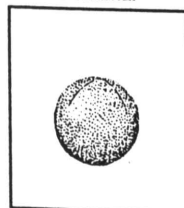
Age bracket The species shows world-wide distribution in Mesozoic sediments (Dettmann 1963).

Cyathidites splendens Harris 1965

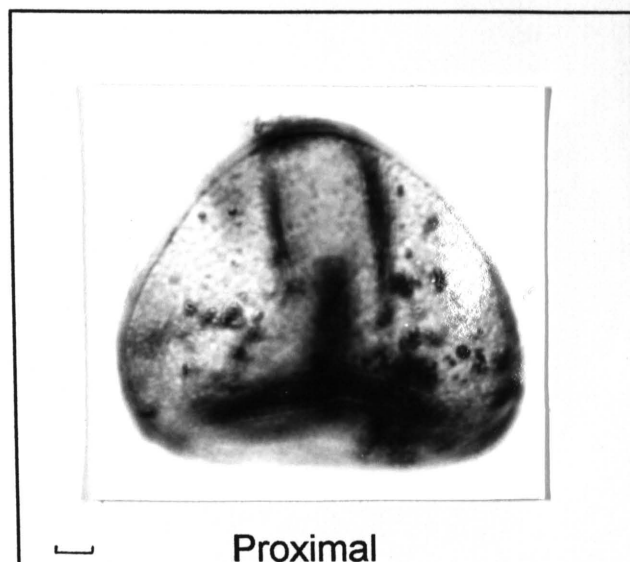
Type species *C. australis* Couper 1953



Proximal



Lateral



Scale bar = 10 μ

Figure 3.14

Specimens studied (5)

Spec no	Eq diam (μ)
Bold type = illustrated specimen	
69-35	90
77-4	105
80-40	105
92-2	120
92-42	120
Average	108

Illustrated specimen

(80-40) LM. Oblique view, showing anisopolar spore

Description

Amb shape	Triangular; concave to straight sides. Anisopolar Av diam 108 μ
Apices	Broadly rounded.
Laesurae	Trilete. Rays reach 2/3 to equator. Commissure may gape
Exospore	Approx 2-5 μ
Sculpturing	Psilate, scabrate

Spore
Trilete
Acingulate
psilate

Literature

Author	Description	Illustration	Geog loc	Age
Harris 1965	p 79	Pl 24 fig 13-15	Australia	Lower Tertiary

Remarks

Where found, large trilete spores were often numerous in the west coast samples. They have been assigned to *C. splendens* and *Lygodiumsporites* sp. Harris (1965) commented that spores of similar morphology to the new species he was proposing occurred in *Lygodium*.

The two types are differentiated thus:

C. splendens is generally a larger spore (over 100 μ) with concave sides and longer laesurae when the two are compared. *Lygodiumsporites* is an almost spherical spore, with short laesurae and a gaping commissure.

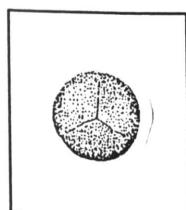
Botanical affinities *Lygodium* (Harris 1965)

Distribution Rare. Found in Main Peat Horizon and below at Koningnaas

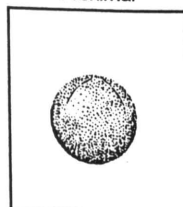
Age bracket Tertiary

Deltoidospora sp Couper 1958

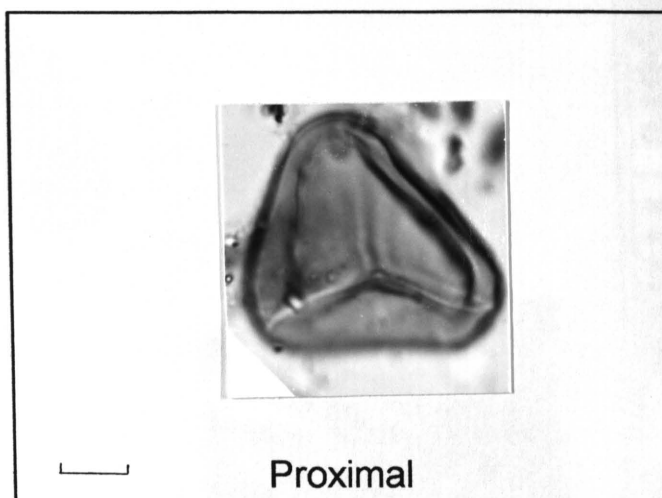
Type species *D. hallii* Miner 1935



Proximal



Lateral



Proximal

Scale bar = 10 μ

Figure 3.15

Specimens studied (23)

Spec no	Eq diam (μ)
99-39	32

Averages of specimens

Eq diam (μ)	44
-------------------	----

Ranges of specimens

Eq diam (m)	13-70
-------------	-------

Illustrated specimen

LM. Spore is folded

Description

Amb shape	Triangular to subcircular Equ diam av 44 μ
Apices	Rounded
Laesurae	Trilete. Rays clearly defined and reach almost to equator. Commissure usually closed. Laesurae may be ridged
Exospore	Thin (1-2 μ)
Sculpturing	Psilate

Spore

Trilete

Acingulate

psilate

Literature

species	Author	Description	Illustration	Geog loc	Age
<i>D. hallii</i>	Miner 1935	p 618	PI 24 fig 7	USA	Jurassic-Cretaceous
<i>Deltoidospora</i>	Jansonius & Hills 1976	p 748			
<i>D. hallii</i>	McLachlan & Pieterse 1978	PI 1 fig 4		Offshore S Africa	Cretaceous
<i>Deltoidospora</i> sp	Jardine & Magloire 1965	PI 1 fig 1-3		W Africa	Cretaceous

Remarks

Deltoidospora was erected as a portmanteau genus for the reception of small trilete spores, deltoid or sub-deltoid in shape, which were otherwise not assignable to another genus. The same approach has been taken when dealing with the west coast specimens. Those included here bear a resemblance to several published illustrations and descriptions. They were not placed into species as little palaeobotanical or biostratigraphical information would be gained.

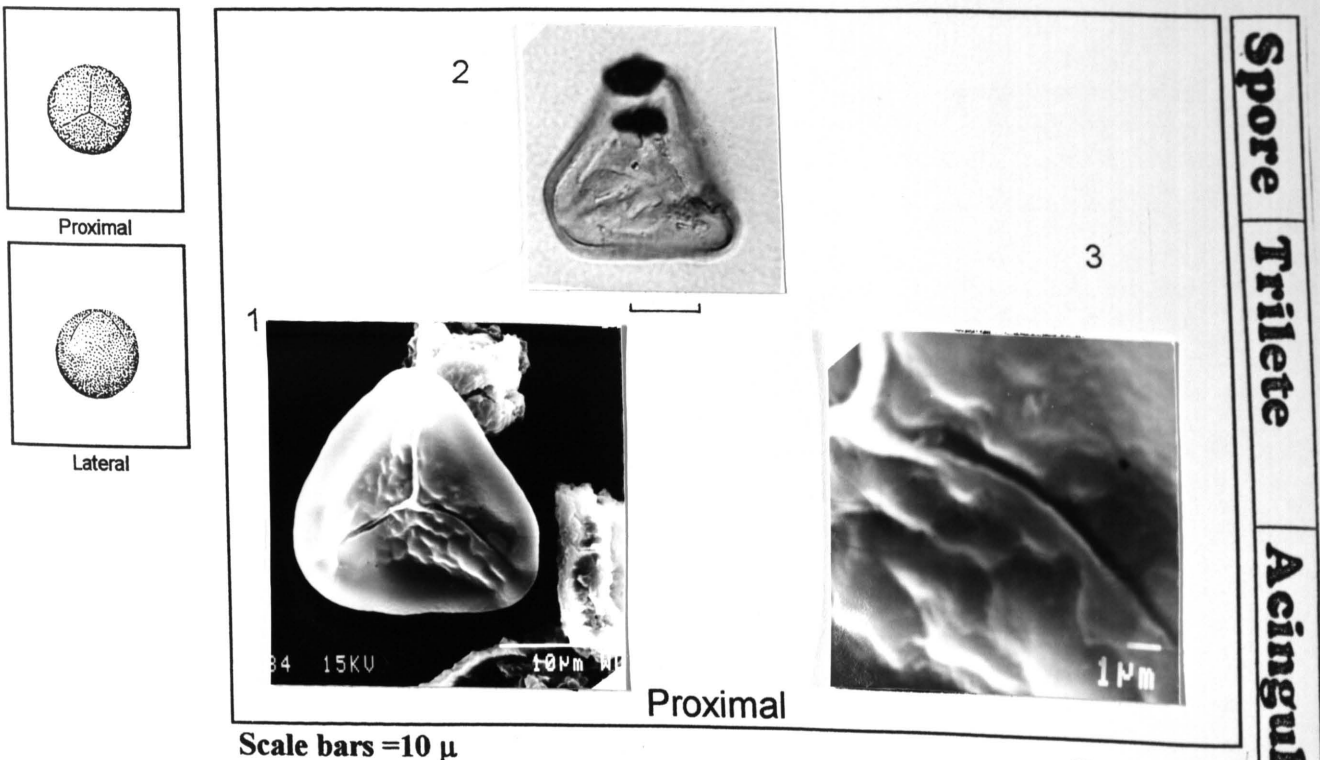
Botanical affinities Small trilete spores of the type commonly found associated with many Mesozoic ferns (Jansonius & Hills 1976). Gleicheniaceae and Adiantaceae (Martin 1973). Also discussed in Dettmann (1963).

Distribution Rare. Known from all levels at Koningnaas and from Langklip

Age bracket Jurassic - Cretaceous

Dictyophyllidites sp Couper 1958

Type species *D. harrissii* Couper 1958



Scale bars = 10 µ

Figure 3.16

Specimens studied (20)

Spec no	Eq diam (µ)
Bold type = illustrated specimens	
11-26	26
251-5	23
274-9	24
Averages of specimens	
Eq diam (µ)	23
Ranges of specimens	
Eq diam (µ)	11-26

Description

Amb shape	Triangular, straight sides Equ diam av 23µ
Apices	Sharply rounded to pointed
Laesurae	Trilete. Long rays clearly defined and reach almost to equator. Commissure raised with interrarial thickening.
Exospore	Thin (1-2µ)
Sculpturing	Psilate

Illustrated specimens All proximal view

- (251-5) SEM showing details of surface of laesurae border
- (274-9) NOR-LM enhancing laesurae border texture
- As 1 above, detail of sculpturing

Literature

species	Author	Description	Illustration	Geog loc	Age
<i>D. harrissii</i>	Couper 1958	p 140	PI 21 fig 6	New Zealand	Jurassic
<i>D. arcuatus</i>	Pocknall & Mildenhall 1984	p18	PI 1 fig 2-5	New Zealand	U Oligo-L Miocene
<i>D. concavus</i>	Harris 1965	p 80	PI 24 fig 18,19	Australia	Lower Tertiary
<i>D. concavus</i>	Martin 1973	p 8	fig 30	Australia	Tertiary
<i>Dictyophyllidites</i>	Jansonius & Hills 1976	p 786	n/a	n/a	n/a
<i>D. harrissii</i>	Hekel 1972		PI 2 fig 8	Australia	Tertiary
<i>Dictyophyllidites</i> sp	McLachlan & Pieterse 1978		PI 1 fig 12	Offshore S Africa	Cretaceous

Remarks

Specimens assigned to *Dictyophyllidites* sp were recognised by the presence of the thickened laesurate borders. They were similar to several published illustrations and descriptions.

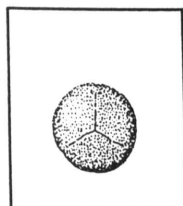
Botanical affinities *Dictyophyllum* (Jurassic fern) Couper (1953). Gleicheniaceae (Pocknall & Mildenhall 1984). Also discussed in Dettmann (1963).

Distribution Very rare. Found at all levels in all sites.

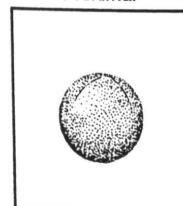
Age bracket The species shows world-wide distribution in Mesozoic sediments (Dettmann 1963).

Gleicheniidites sp Ross 1949

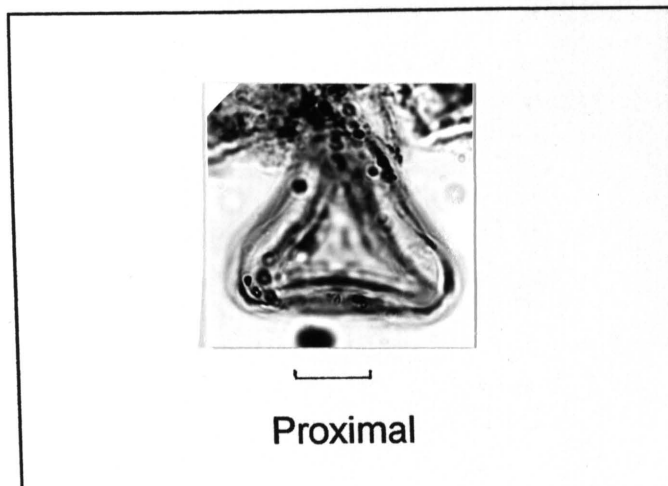
Type species *G. senonicus* Ross 1949



Proximal



Lateral



Proximal

Scale bar = 10 μ

Figure 3.17

Specimens studied (12)

Spec no	Eq diam (μ)
Bold type = illustrated specimen	
62-37	27
63-11	19
126-26	25
126-26	25
127-()	26
129-35	24
136-2	24
138-32	35
201-40A	33
205-35	17
208-20	30
209-3	19
235-5A	20
Average	27

Description

Amb shape	Triangular; usually concave sides. Eq diam av 27 μ
Apices	Rounded
Laesurae	Trilete. Rays clearly defined, reach the equator.
Exospore	Thin(1-2 μ) Main feature of genus is interradian thickening of exine
Sculpturing	Psilate

Range of specimens

Eq diam (μ)	17-35
-------------------	-------

Illustrated specimen

(127-) LM. Specimen partly obscured by debris

Spore **Trilete** **Acingulate** **psilate**

Literature

species	Author	Description	Illustration	Geog loc	Age
<i>G. circinidites</i>	Cookson 1953	p 464	Pl 1 fig 5 & 6	Australia	Lower Tertiary
<i>G. circinidites</i>	Dettmann 1963	p 64	Pl 13 fig 6-10	Australia	U Mesozoic
<i>G. circinidites</i>	Harris 1965	p 82	Pl 25 fig 17	Australia	Palaeogene
	Jansonius & Hills 1976		p 1123		
<i>G. circinidites</i>	Martin 1973	p 6	fig 9	Australia	Pliocene
<i>G. circinidites</i>	Burger 1976	p 125	Pl 22 fig 3-7	Australia	Cretaceous
<i>G. circinidites</i>	McLachlan & Pieterse 1978		Pl 1 fig 41	Offshore S Africa	Cretaceous
<i>G. sp A</i>	Dettmann & Thomson 1987		Fig 4 e	Antarctica	Cretaceous

Remarks

The genus is discussed in Dettmann (1963) and Jansonius & Hills (1976).

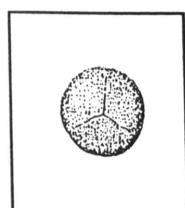
Botanical affinities Gleicheniaceae (Jansonius & Hills 1976)

Distribution Rare. Known from two samples (12-2 Main Peat, 34-10 channel peats, Koingnaas.

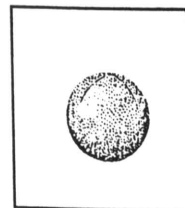
Age bracket Basal Jurassic - Miocene (Jansonius & Hills 1976)

***Lygodiumsporites* sp** Potonie', Thomson & Thiergart 1950 ex Potonie' 1956

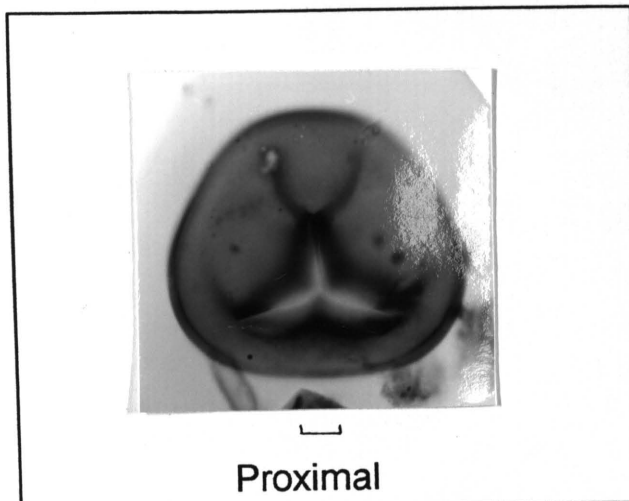
Type species *L. adriennis* (Potonie' & Gelletich) Potonie', Thomson & Thiergart ex Potonie' 1956



Proximal



Lateral



Proximal

Scale bar = 10 μ

Figure 3.18

Specimens studied (14)

Spec no	Eq diam (μ)
Bold type = illustrated specimen	
24-35	76
34-20	90
34-26	90
50-8	66
69-1	78
70-8	95
80-1	120
81-11	105
183-()	56
263-1	55
264-10A	58
266-12A	57
266-20A	57
278-21	76
Average	77

Description

Amb shape	Sub-circular to rounded triangular Av equatorial diam 77 μ Spherical in lateral view
Apices	Very rounded.
Laesurae	Trilete. Short rays reach 1/2 to equator. Commissure often gapes
Exospore	Thin; approx 1-2 μ
Sculpturing	Psilate

Illustrated specimen

LM. Specimen seen in oblique aspect.

Proximal face with laesurae well seen

Ends of laesurae feature 'pseudo-toroid claws'

Range of specimens

Eq diameter (14 specimens) 55-120 μ

Spore
Trilete
Acingulate
psilate

Literature

species	Author	Description	Illustration	Geog loc	Age
<i>L. reticulatiformis</i>	Jardine & Magloire 1965		Pl 1 fig 8	W Africa	Cretaceous
<i>Lygodiumsporites</i>	Jansonius & Hills 1976		p 1561	n/a	n/a
<i>L. padappakkarensis</i>	Rao 1989	No desc	Pl 1 fig 20 & 21	India	
<i>L. lakiensis</i>	Saxena & Misra 1990		Pl 3 fig 1	India	Neogene

Remarks

General similarities exist between *Lygodiumsporites* and *Cyathidites splendens*.

Botanical affinities *Lygodium* (Harris 1953)

Distribution Dominant. Well known from Main Peat Horizon at Koingnaas and high level at Langklip. Fewer specimens known from channel peats. Absent from above MPH and Somnaas/Noup.

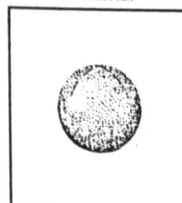
Age bracket Cretaceous - Tertiary

Todisporites sp Couper 1958

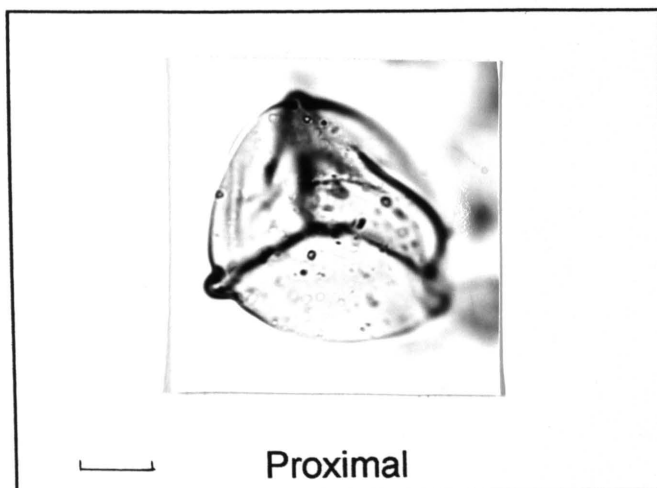
Type species *T. major* Couper 1958



Proximal



Lateral



Proximal

Scale bar = 10 μ

Figure 3.19

Specimens studied (10)

Spec no	Eq diam (μ)
Bold type = illustrated specimen	
48-11	34
49-24	27
49-12	38
62-35	35
63-7	15
89-18	62
108-5	47
234-9A	26
235-33A	30
Average	35

Description

Amb shape	Circular, or rounded triangular Eq diam av 35 μ
Apices	Very rounded
Laesurae	Trilete. Rays narrow and long, easily reach equator of spore
Commissure	Closed. Often raised considerably
Exospore	Thin(1-2 μ) spores often folded
Sculpturing	Psilate

Range of specimens

Eq diam (μ)	15-62
-------------------	-------

Illustrated specimen

(62-35) LM. Sub-rounded amb with commissure considerably raised.

Literature

species	Author	Description	Illustration	Geog loc	Age
<i>T. major</i>	Couper 1958	p 134	Pl 16 fig 6	England	Jurassic
<i>Todisporites</i>	Jansonius & Hills 1976	p 2909			
<i>T. major</i>	Martin 1973	p 6	fig 7 & 8	Australia	Oligocene
<i>T. minor</i>	McLachlan & Pieterse 1978		Pl 1 fig 11	Offshore S Africa	Cretaceous

Remarks

Some of the west coast specimens bear a resemblance to *Deltoidospora* sp in Kemp & Harris (1977). They were not identified as *Matonisporites* as the spores are usually circular not triangular, with a thin exine less than 2 μ , although they do possess the elevated laesura usually seen in *Matonisporites*.

Botanical affinities Genus erected to accommodate spores similar to those of *Todites* (Jansonius & Hills 1976). Characteristic of Osmundaceae (Martin 1973)

Distribution Main Peat Horizon and above at Koingnaas

Age bracket Mesozoic - Tertiary

Spore

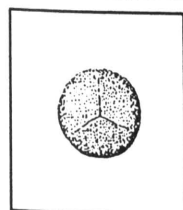
Trilete

Acingulate

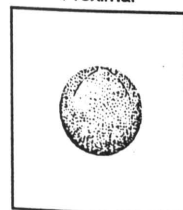
psilate

Undulatisporites sp Pflug in Thomson & Pflug 1953

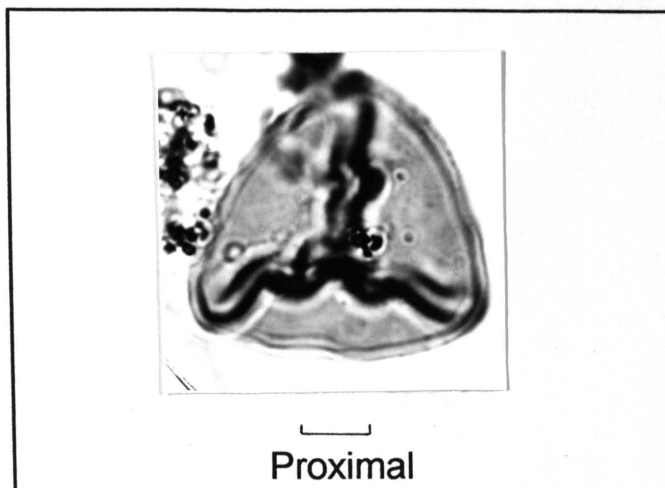
Type species *U. microcutis* Pflug 1953



Proximal



Lateral



Proximal

Scale bars = 10 μ

Figure 3.20

Specimens studied (2)

Spec no	Eq diam (μ)
Bold type = illustrated specimen	
86-1	41
86-41	47
Average	44

Illustrated specimen

(86-1) LM. Commissure has very marked wavy laesurae

Description

Amb shape	Triangular; concave sides Eq diam av 44 μ
Apices	Rounded
Laesurae	Trilete. Rays clearly defined, Commissure wavy
Exospore	Approx 2-4 μ thick
Sculpturing	Psilate

Literature

Genus & sp	Author	Description	Illustration	Geog loc	Age
<i>Undulatisporites</i>	Jansonius & Hills 1976		p 3135	n/a	n/a
<i>Undulatitriteles</i>	Jansonius & Hills 1976		p 3136	n/a	n/a
<i>Undulatisporites</i> sp	McLachlan & Pieterse 1978		Pl 1 fig 14	Offshore S Africa	Cretaceous

Remarks

The west coast specimens resembled *Undulatisporites* Klein 1959, however they do not possess a cingulum, which is a feature of the genus. They resemble illustrations of *Undulatisporites* Pflug less closely, however they match the generic diagnosis.

Botanical affinities Unknown

Distribution Very rare. Two specimens found in sample 12-33 Main Peat, Koinaas.

Age bracket

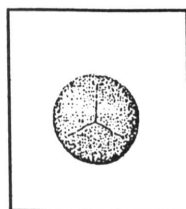
Spore

Trilete

Acingulate

psilate

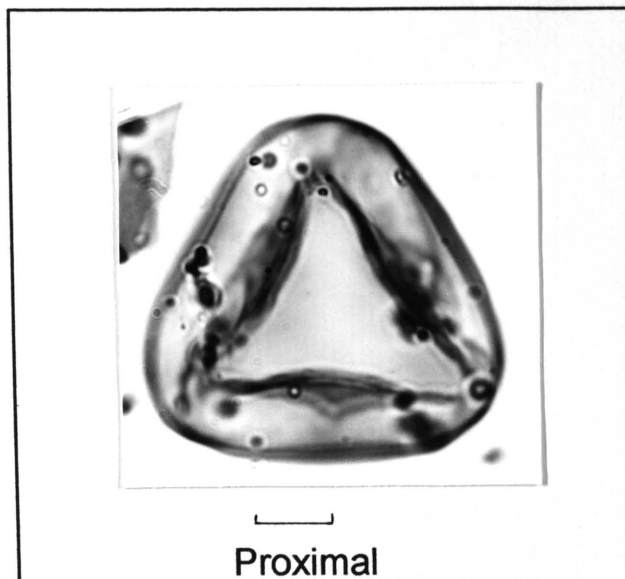
Trilete spore A



Proximal



Lateral



Proximal

Scale bar = 10 μ

Figure 3.21

Specimens studied (25)

Spec no	Eq diam (μ)
Bold type = illustrated specimen	
70-16	44

Averages of specimens

Eq diam (25)	31 μ
--------------	----------

Ranges of specimens

Eq diam (25)	22-53 μ
--------------	-------------

Description

Amb shape	Triangular; concave or straight sides. Av equ diameter 31 μ
Apices	Broadly rounded to pointed.
Laesurae	Trilete. Commissure always gapes, sometimes very widely. Reaches almost to equator.
Exospore	1-3 μ in thickness
Sculpturing	Psilate

Illustrated specimen

(70-16) LM showing straight sides and widely-gaping commissure.

Literature

Genus	Author	Description & illustration	Geog loc	Age
<i>Laroccatriletes</i>	Jansonius & Hills 1976	p 1454	Europe	U Mesozoic

Remarks

The west coast specimens bore little resemblance to any published illustrations or descriptions. The gaping commissure was thought to be a feature of the spores and not caused by damage, as many similar specimens were found. The specimens appeared somewhat similar to the illustration of *Laroccatriletes* Burger 1966 in Jansonius & Hills (1976), however it is a line drawing not a photograph, and it was not stated that the gaping commissure was a feature of the genus, thus a positive identification was not made.

Botanical affinities Unknown

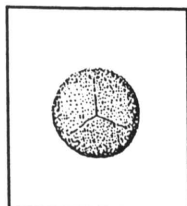
Distribution Rare. Known from all levels and all sites

Age bracket Unknown

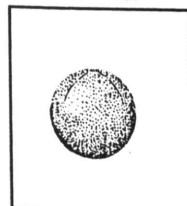
Spore Trilete Acingulate psilate

Osmundacidites wellmanii sp Couper 1953

Type species *O. wellmanii* Couper 1953



Proximal



Lateral

Also see Colour Plate 1

Specimens studied (7)

Spec no	Eq diam (μ)
Bold type = illustrated specimen	
2--40	60
6--8	42
6--24	60
6--42	43
72-13	58
73-27	78
77-1	63
Average	58

Literature

species	Author	Description	Illustration	Geog loc	Age
<i>O. wellmanii</i>	Couper 1953		Pl 1 fig 5	New Zealand	Jurassic - L Cret
<i>O. wellmanii</i>	Couper 1953	p 38	Pl 1 fig 1	New Zealand	Cretaceous
<i>O. wellmanii</i>	Dettmann 1963	p 31	Pl 3 fig 19-21	Australia	U Mesozoic
various	Martin 1973	p 5	Fig 5	Australia	Tertiary
<i>O. wellmanii</i>	Harris 1974		Pl fig 7	Ninetyeast Ridge	Tertiary
<i>Osmundacidites</i>	Jansonius & Hills 1976		p 1833	n/a	n/a
<i>O. wellmanii</i>	Kemp & Harris 1977	p 11	Not illustr	Ninetyeast Ridge	Tertiary
<i>O. wellmanii</i>	McLachlan & Pieterse 1978		Pl 1 fig 17	Offshore S Africa	Cretaceous
<i>O. cephalus</i>	Saxena & Misra 1990			India	

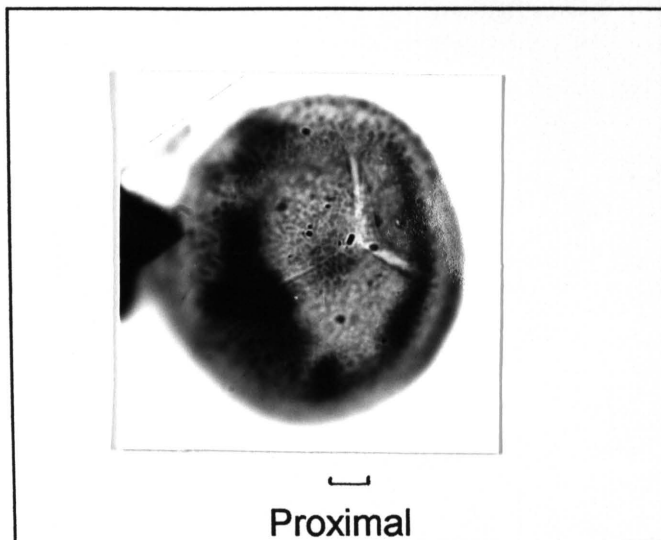
Remarks

Dettmann (1963) notes that Australian specimens are often distorted with arcuate folds. This feature was noted in the west coast specimens and is shown in the illustrated specimen.

Botanical affinities Osmundaceae (Couper 1953). Martin (1973) discussed the various forms which have been attributed to the Osmundaceae.

Distribution Well known (10% of 12-22) Main Peat Horizon, Koingnaas. Isolated specimens found in other samples from other levels at Koingnaas and Somnaas/Noup

Age bracket Mesozoic - Tertiary



Proximal

Scale bar = 10 μ

Figure 3.22

Description

Amb shape	Circular to subcircular (or spherical)
Apices	Indiscernible; very rounded
Laesurae	Trilete. Rays narrow and long, reaching the equator.
Exospore	Thin (1-2 μ) spores often folded
Sculpturing	Granular (fine grains)

Illustrated specimen

(73-27) LM. Focus on trilete mark

Spore

Trilete

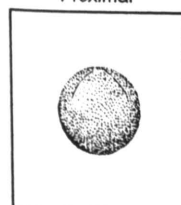
Acingulate
granulate

Foveotrilletes sp Potonie' 1956

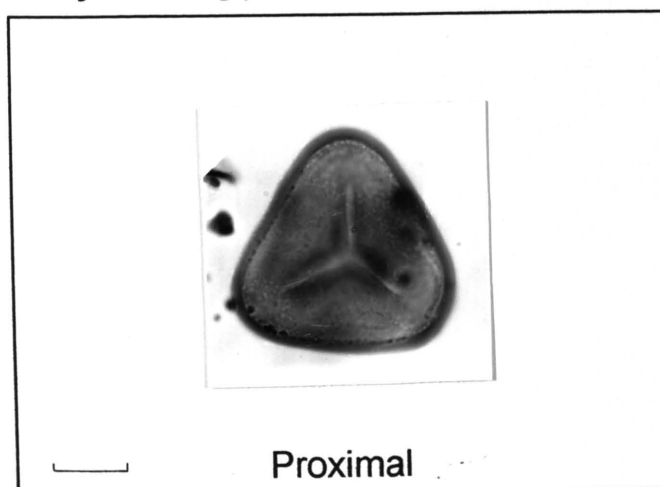
Type species *F. scrobiculatus* (Ross ex Weyl. & Krieg.) Potonie' 1956



Proximal



Lateral



Proximal

Scale bar = 10 μ

Figure 3.23

Specimens studied (2)

Spec no	Eq diam (μ)
Bold type = illustrated specimen	
8-36	24
26-12	19
Average	22

Illustrated specimen

(8-36) LM. This specimen appears very similar to *F. margaritae* in Germeraad *et al* (1966) but not to the same species shown in Scholtz (1985).

Description

Amb shape	Triangular; straight or slightly convex sides Av equ diam 22 μ
Apices	Rounded
Laesurae	Trilete. Rays straight and may reach the equator. Commissure may gape a little
Exospore	1-3 μ
Sculpturing	Foveolate; small (<0.2 μ) pits which form a dense shallow reticulum

Literature

species	Author	Description	Illustration	Geog loc	Age
<i>F. parviretus</i>	Dettmann 1963	p 42	pl 6 fig 8-13	Australia	Cretaceous
<i>F. margaritae</i>	Germeraad, Hopping & Muller 1966	p 286		Africa, S Am	To Eocene
<i>F. crater</i>	Stover & Partridge 1973	p 248	Pl 14 fig 1-3	Australia	Oligo - Miocene
<i>Foveotrilletes</i> sp	Harris 1974		Pl fig 12	Ninetyeast Ridge	Palaeocene
<i>Foveotrilletes</i>	Jansonius & Hills 1976		p 1050	n/a	n/a
<i>F. palaequetrus</i>	Kemp & Harris 1977	p 16	Pl 2 fig 7	Ninetyeast Ridge	Tertiary
<i>F. margaritae</i>	Salard-Chebouldaef 1979		Pl fig 4	Africa	Mid-Cret - Tertiary
<i>F. lacunosus</i>	Pocknall & Mildenhall 1984		p 18 Pl 1 fig 6	New Zealand	U Oligo - Pliocene
<i>F. palaequetrus</i>	Pocknall & Mildenhall 1984		p 18 Pl 1 fig 7	New Zealand	L Oligo - L Miocene
<i>F. margaritae</i>	Scholtz 1985	p 21	Fig 4H	South Africa	L Tertiary

Remarks

Too few specimens were found to permit identification to species level for this group, which may include members of more than one species due to variances in size, shape and sculpturing.

Botanical affinities *Lycopodium* (Kemp & Harris 1977), Ophioglossaceae (Germeraad, Hopping & Muller 1966)

Distribution Very rare. Isolated specimens known from Main Peat Horizon, Koingnaas

Age bracket Mid-Cretaceous - Tertiary

Spore

Trilete

Acingulate

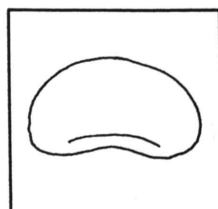
foveolate

Monolete spores

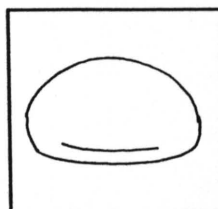
Graphic glossary of technical terms

Figure 3.24

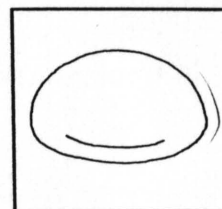
Lateral view
Shape of amb



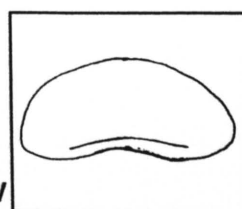
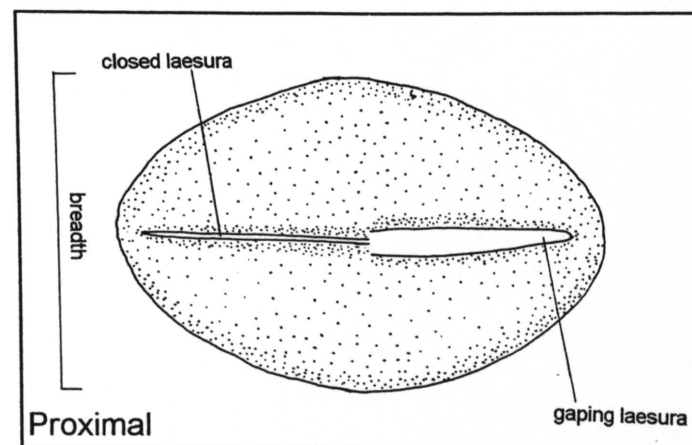
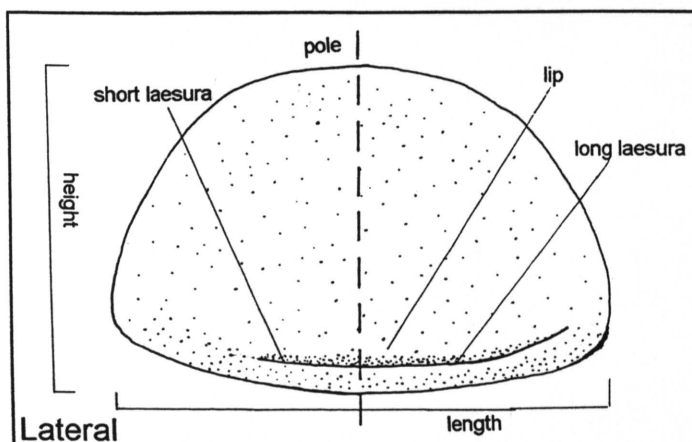
concavo-convex
("Bean-shaped" or "reniform")



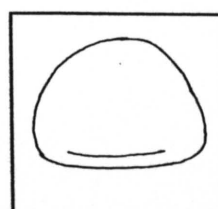
plano-convex



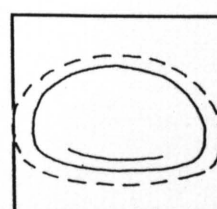
biconvex



elongate



globular



perispore

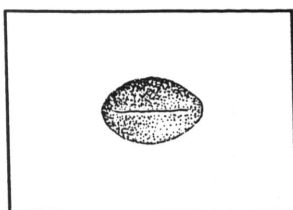
Lateral view

Spore
Monolete

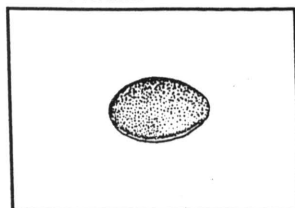
Definition:

Possessing a single aperture (laesura) centred at the pole, formed by the contact between the members of the tetrad produced from the mother cell (Traverse 1988). Bilaterally symmetrical.

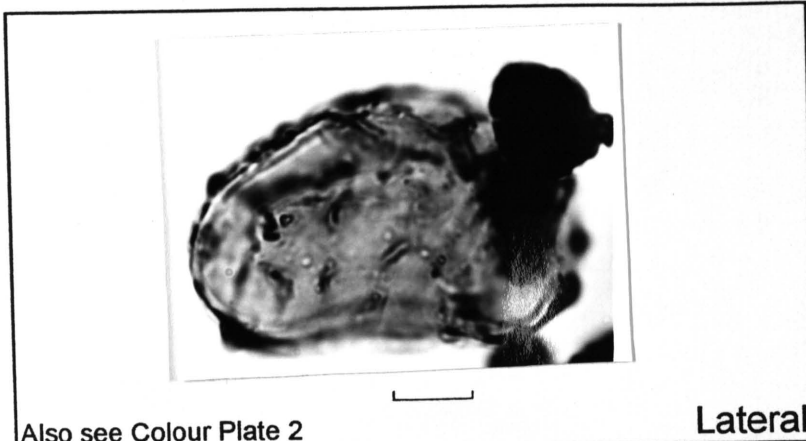
Type species *P. pliocaenicus* (Krutzsch 1967)



Proximal



Lateral



Also see Colour Plate 2

Lateral

Scale bar = 10 μ

Figure 3.25

Spore
Monolete
Perinous

Specimens studied (2)

Spec no	Length (μ)	Height (μ)
Bold type = illustrated specimen		
91-14	56	35
121-32	35	25
Averages	46	30

Illustrated specimen

(91-14) LM. Specimen partly obscured by debris
Shows robust hamulate surface

Description

Amb shape	Concavo-convex
Laesura	Monolete 3/4 length of spore
Exospore	Thick - 2-5 μ including perispore
Perispore	Thin (1 μ) Approx 2 μ from central body
Sculpturing	Perispore - Loose folds with rugulae approx 10 μ in length and 1m wide, spaced 5 μ apart Central body probably smooth

Literature

Author	Description	Illustration	Geog loc	Age
Krutzsch 1957	p 222	p 87 fig 2 - 6	Germany	U Pliocene
Jansonius & Hills 1976		1951	n/a	n/a

Remarks

Distinguished from *Peromonolites* by loose, rugulate perispore

Botanical affinities The recent genera *Paesia*, *Asplenium*, *Athyrium* and *Blechnum* among others produce similar spores

Distribution Very rare. Isolated specimens found in peat stringers above and below the Main Peat Horizon at Koingnaas

Age bracket Upper Pliocene

Type species *P. bowenii* (Couper 1953)

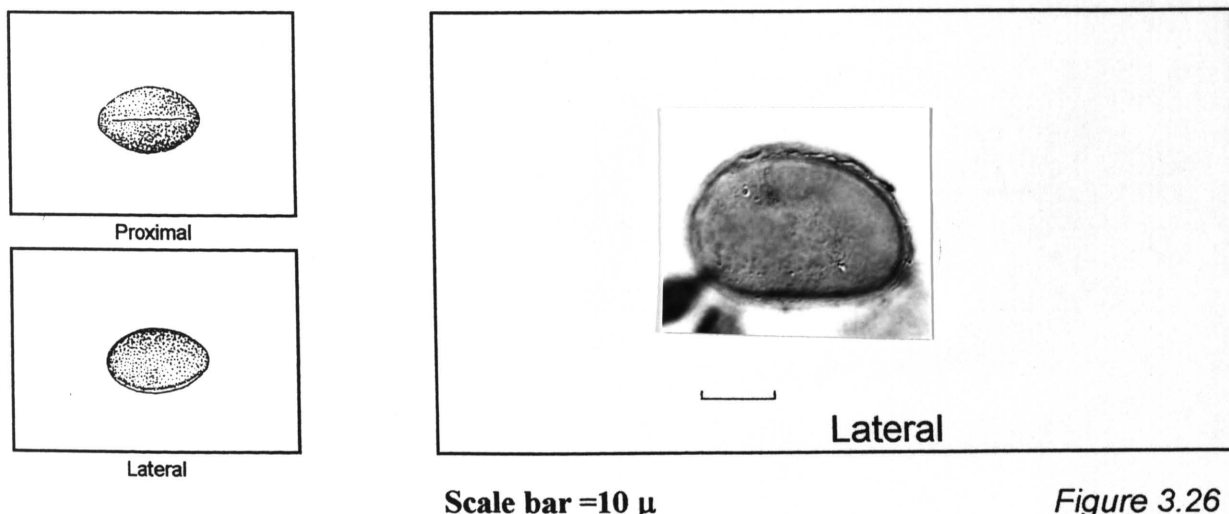


Figure 3.26

Specimens studied (9)

Spec no	Length (μ)	Height (μ)
Bold type = illustrated specimen		
36-31	38	20
36-34	36	22
44-1	37	22
90-33	22	17
255-9	31	22
155-31A	43	23
158-27	28	16
252-41	35	21
255-9	31	22
Averages	38	23

Description

Amb shape	Plano-convex to biconvex
Laesura	Monolete; not well seen as obscured by perispore but probably extends length of spore
Exospore	Thick - 2-5μ including perispore
Perispore	Close to central body Thin (0.5μ)
Sculpturing	Low, granular elements on perispore; may vary (according to original species description) Central body probably smooth.

Illustrated specimen

(255-9) NOR-LM showing perispore and sculpturing

Literature

Author	Description	Illustration	Geog loc	Age
Couper 1953	p 32	PI 3 fig 31	New Zealand	Cretaceous
Couper 1960	p 40	PI 2 fig 1	New Zealand	L. Senonian - Maastrichtian
Jansonius & Hills 1976		1970	n/a	n/a

Remarks

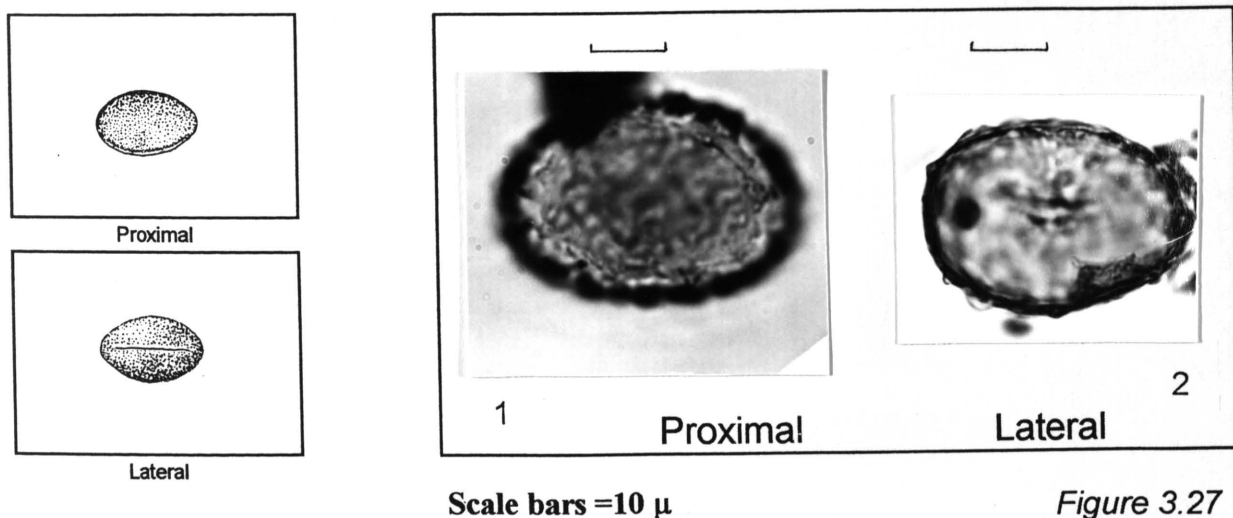
Genus originally nominated by Erdtman in 1947 for fossil monolete spores with a perispore. Representatives of two species belonging to it were found within the west coast sediments, *P. bowenii* and *P. densus*.

Botanical affinities Not stated. ?*Paesia* (Couper 1953)

Distribution Rare. Main Peat Horizon and stringers above it at Koingnaas, and at Langklip.

Age bracket Cretaceous

Type species *P. bowenii* (Couper 1953)



Spore
Monolete
Perinous

Figure 3.27

Specimens studied (9)

Spec no	Length (μ)	Height (μ)	Breadth (μ)
Bold type = illustrated specimen			
24-30	33	B 26	
37-8	47	B 31	
83-12	41	H 25	
83-22	40	H 25	
87-23	41	H 25	
90-27	60	H 30	
90-36	65	H 40	
113-12	34	B 34	
116-10	38	H 18	
Averages	44	B = 30	H = 27

Description

Amb shape	Plano-convex to biconvex Oval in polar view
Laesura	Monolete; not well seen as obscured by perispore but probably 3/4 length of spore
Exospore	Thick - 2-5μ including perispore
Perispore	Close to central body Thick (2μ)
Sculpturing	Perispore - verrucate. Elements 0.5 - 1μ high, spaced 3-5μ apart. Central body not well seen due to heavy perispore.
Illustrated specimens	
1. (83-13) LM. Laesura not seen. Focus on sculpturing	
2. (113-12) LM. Focus on laesura	

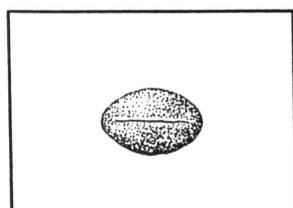
Literature

Author	Description	Illustration	Geog loc	Age
Harris 1965	p 84	Pl 24 fig 3-5	Australia	M Palaeocene
Stover & Evans 1973	none	Pl 2 7a,b	Offshore Australia	M Palaeocene
Harris 1974	none	Pl 1 fig 5	Ninetyeast Ridge	Palaeocene
Kemp & Harris 1977	p 19	none	Ninetyeast Ridge	Palaeo-Miocene
Jansonius & Hills 1976		p 1970	n/a	n/a

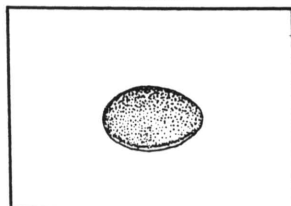
Remarks

Genus originally nominated by Erdtman in 1947 for fossil monolete spores with a perispore. This species is distinguished from *P. bowenii* by the heavier, sculptured perispore.
Botanical affinities Unknown (Kemp & Harris 1977)
Distribution Little known. Found at all levels at Koingnaas
Age bracket Palaeocene-Miocene

Type species *L. vulgaris* (Ibrahim) Ibrahim 1933



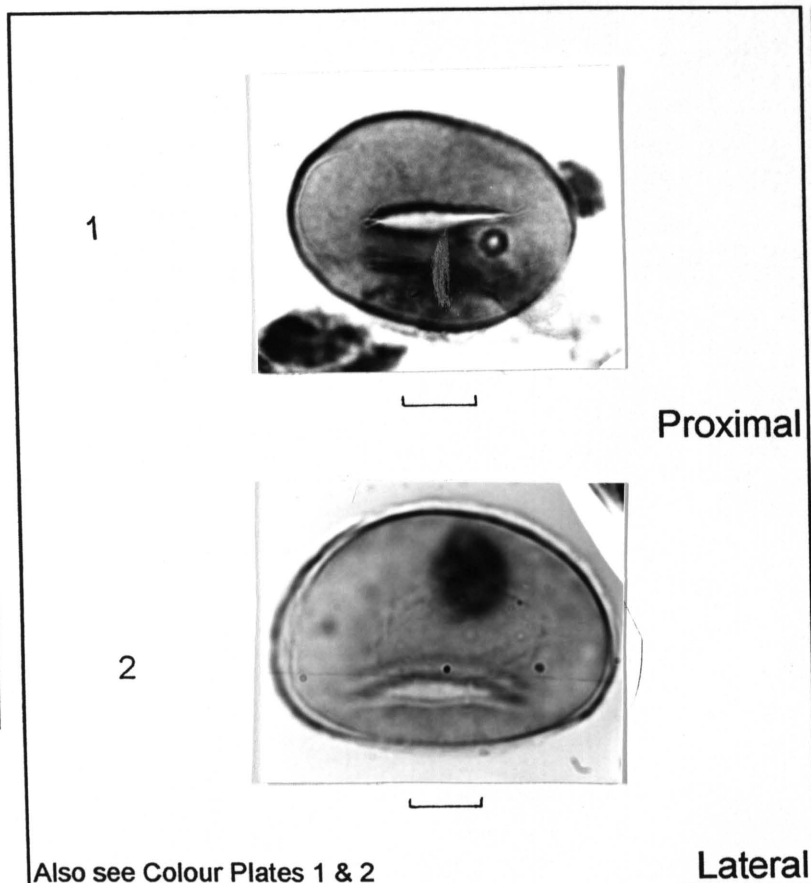
Proximal



Lateral

Illustrated specimens

1. (218-27) LM. Proximal view showing gaping laesura, measuring half length of spore. Exine smooth.
2. (91-18) LM. Lateral/oblique aspect shows slightly gaping laesura



Also see Colour Plates 1 & 2

Scale bars =10 μ

Figure 3.28

Spore
Monolete
Aperinous
psilate

Specimens studied (44)

Spec no	Length (μ)	Height (μ)
Bold type = illustrated specimens		
91-18	47	32
218-27	37	28*

* Breadth

Averages of specimens	
Length (44 specimens)	35
Height (40 specimens)	25
Breadth (4 specimens)	24
Ranges of specimens	
Length (44 specimens)	14-77
Height (40 specimens)	11-49
Breadth (4 specimens)	19-28

Description

Amb shape	Plano-convex to biconvex "bean-shaped"
Laesura	Monolete; not lipped. 2/3 to 5/6 spore length, may gape
Exospore	Usually thin, approx 1 μ . 'acavate' = no perispore Specimens with thicker exine appear to have more sculpturing
Sculpturing	Almost smooth, 'laevigate' or 'psilate'. Under SEM, 'punctate' structure seen. Individual holes less than 0.5 μ in diameter, more than 1 μ apart.

Literature

Published illustrations which resemble the west coast specimens

species	Author	Description	Illustration	Geog loc	Age
<i>L. gracilis</i>	Wilson & Webster 1946	p 273	fig 4	USA	Tertiary
<i>L. ovatus</i>	Wilson & Webster 1946	p 273	fig 5	USA	Tertiary
<i>L. haardtii</i>	Thomson & Pflug 1953	p 59	Taf 3 fig 27-38	Europe	
<i>L. ovatus</i>	Dettmann 1963	p 86	PI 29 fig 9-11	Australia	Devonian - Recent
<i>L. major</i>	Harris 1965	p 83	PI 24 fig 1	Australia	Tertiary
<i>L. major</i>	Harris 1974		PI 1 fig 1	Ninetyeast Ridge	Palaeocene
(Genus)	Jansonius & Hills 1976	p 1436	p 1436	n/a	n/a
<i>L. gracilis</i>	McLachlan & Pieterse 1978		PI 3 Fig 20	Offshore SA	Cret-Tertiary
<i>L. haardtii</i>	McLachlan & Pieterse 1978		PI 3 fig 19	Offshore SA	Cret-Tertiary
<i>L. ovatus</i>	Martin 1973	p 13	Fig 50	Australia	Eo-Pleistocene
<i>L. ovatus</i>	Hos 1974	p 7	Fig 6	Australia	U Eocene
<i>L. ovatus</i>	Burger 1976	p 137	PI 27 fig 3 & 4	Australia	Cretaceous
<i>L. ovatus</i>	Kemp & Harris 1977	p 24	PI 3 fig 4	Ninetyeast Ridge	Palaeo-Oligocene
<i>Monolites</i>	Jansonius & Hills 1976	p 1701	p 1701	n/a	n/a

Remarks

Several genera to accommodate such spores may be found in the literature. However, many of them are junior synonyms of *Laevigatosporites*; such as *Phaseolites*, *Punctatosporites* & *Reticulatosporites* (Schopf, Wilson & Bentall 1944); *Intrapunctatosporis*, *Monolites*, *Phaseolites*, *Polypodiumsoprites*, and *Polypodiaceasporites* (Srivastava 1971). van der Hammen (1956) suggested *Psilamonoletes*, however Potonié (1960) considers this to be a later synonym of *Monolites*, itself a synonym. Dettmann (1963) states that 'similar, if not identical, spores have been recorded frequently from other parts of the world in sediments ranging from Devonian to Recent' which possibly accounts for the plethora of names.

Individual species descriptions often lack detail (*L. gracilis* Wilson & Webster 1946, *L. discordatus* Thomson & Pflug 1953). Harris (1974) indicates that 'gradational forms between *L. major* and *L. ovatus* make separation difficult'.

A range of forms was seen in the west coast samples, from concavo-convex to biconvex; large (length 77 μ) to small (length 14 μ); possessing either a thin (0.5 μ) or a relatively thicker and more sculptured exine.

All smooth-walled monolete spores found in the samples examined were assigned to *Laevigatosporites* sp. The reasons for this are; firstly, the confusion caused by the creation of numerous genera which appear to be synonymous with *Laevigatosporites*; secondly, the brief and conflicting species descriptions which do not encourage identifications to species level; thirdly, the vast geological range of such spores which supplies no useful stratigraphic information; and finally, the fact that they may be affiliated botanically with many different plants does not aid palaeoenvironmental interpretation.

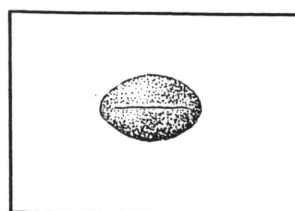
Distribution Significant. Smooth-walled monolete spores were found in all but one of the samples examined, reaching a maximum contribution of 15% (12-14, Main Peat Horizon, Koingnaas) averaging 5%. No trends were seen in their distribution.

Age bracket Devonian - Recent

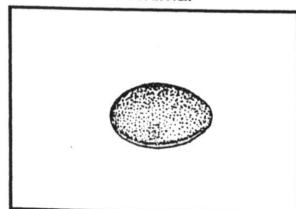
Botanical affinities Genera *Schizaea* and *Fistulosa*. Families Schizaeaceae and Blechnoideae. (Harris 1965). Martin (1973) adds that perispores of other types may be shed to leave completely smooth monolete spores.

Polypodiidites inangahuensis Couper 1953

Type species *P. senonicus* Ross 1949



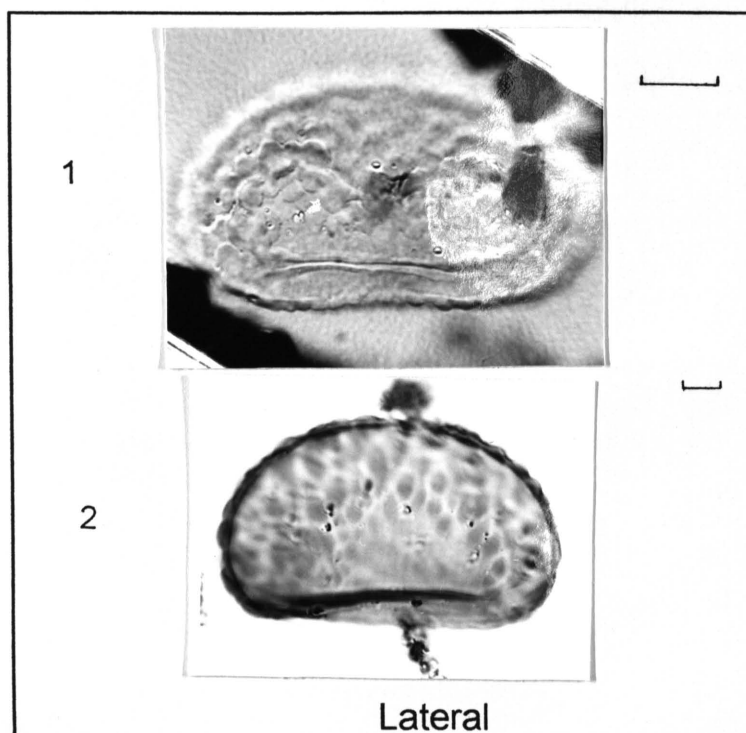
Proximal



Lateral

Illustrated specimens

1. (253-25) NOR-LM. Lateral aspect, showing verrucae decreasing in size towards the laesura.
2. (101-3) LM. This grain has verrucae which are elongated perpendicular to the laesura.



Scale bars = 10 μ

Figure 3.29

Spore **Monolete** **Aperinous** **Verrucate**

Specimens studied (14)

Spec no	Length (μ)	Height (μ)
Bold type = illustrated specimens		
34-22	51	27
35-3	49	32
35-19	57	32
69-38	68	42
77-35	105	50
88-3	105	69
99-10	105	30
100-28	75	50
101-3	87	45
101-32A	68	48*
232-16	43	27
232-33	50	30
253-25	56	33
254-10	48	30
Averages	69	38

* Breadth

Description

Amb shape	Plano-convex to concavo-convex in equatorial view
Laesura	Monolete; 3/4 length of spore Narrow, usually closed. Thin, marked lips.
Exospore	Very thick (3-4 μ) No perispore
Sculpturing	Verrucate. Elements decrease in size toward laesura and are irregular in size and shape. Verrucae 1-2 μ high, giving an undulating profile to the spore, Max 3 μ diameter in plan view. May be elongated perpendicular to laesura. Verrucae spaced 1-3 μ apart forming a negative reticulum.

Literature

Name	Author	Description	Illustration	Geog loc	Age
<i>Polypodioidites inangahuensis</i>					
	Couper 1953		Pl 2 fig 16	New Zealand	L. Mio-Pliocene
<i>Polypodioidites inangahuensis</i>					
	Couper 1960	p 39	Pl 1 fig 7	New Zealand	M. Oligo-Pleistocene
<i>Polypodiisporites inangahuensis</i>		p 83	Pl 24 fig 1		
	Pocknall & Mildenhall 1984 p 21		Pl 4 fig 1, 2	New Zealand	M. Eo-late Miocene

Remarks

Pocknall & Mildenhall (1984) note that "nomenclatural chaos (has been) caused by the use of *Polypodioidites* Ross 1949 (ex Couper 1953), *Polypodiisporonites* Potonié 1931, *Verrucatosporites* Pflug & Thomson in Thomson & Pflug 1953, and *Reticuloidosporites* Pflug in Thomson & Pflug 1953 for verrucate monolete spores". The nomenclature and its validity or otherwise is discussed in Jansonius and Hills (1976) under *Polypodiaceasporites* Baksi 1962 p 2095, *Polypodiaceasporites* (Thiergart 1937, 1938) ex Potonié 1956 p 2096, *Polypodiceasporites* Biswas 1962 p 2097, *Polypodioidites* Ross 1949 p 2101, *Polypodiisporites* Potonié 1931 ? in Potonié & Gelletich 1933 ex Potonié 1956 p 2102, *Polypodiisporites* Khlonova 1961 p 2103, *Polypodiisporonites* Potonié 1931 p 2104, *Polypodipites* Khlonova 1960 p 2105, *Polypodisporites* Ilyina 1968 p 2106, *Polypodites* Botschamnikova 1960 in Pokrovskaya & Stelmak p 2107, *Verrucatosporites* Pflug & Thomson in Thomson & Pflug 1953 p 3176 and *Verru-monoletes* van der Hammen 1956 p 3194.

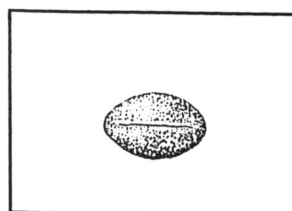
The verrucate monolete spores encountered in this research have been assigned to *Polypodioidites* and *Polypodiisporites* because these were the two genera most often encountered in the literature consulted. Playford & Dettmann (1965) stated that *Polypodioidites* is distinguishable from *Polypodiisporites* in possessing markedly reduced proximal sculptural elements. Only one species belonging to *Polypodioidites* was recognised in the west coast sediments. *Polypodioidites inangahuensis* is distinct from most verrucate monolete spores because it is generally larger with much smaller verrucae irregularly distributed over the spore surface (Pocknall & Mildenhall 1984). This species has been placed into *Polypodioidites* following its author. In the literature it has been variously assigned to *Polypodioidites*, *Polypodiisporites* and *Verrucatosporites*.

Distribution Significant. Maximum of 11% in 12-14 & 12-41. Average of 2% of Koinaas samples from all levels.

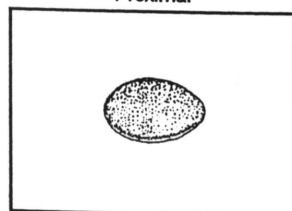
Age bracket Middle Eocene to Pleistocene

Botanical affinities *Microsorium diversifolium* (Couper 1953). Polypodiaceae (Pocknall & Mildenhall 1984)

Type species *P. favus* Potonié 1931



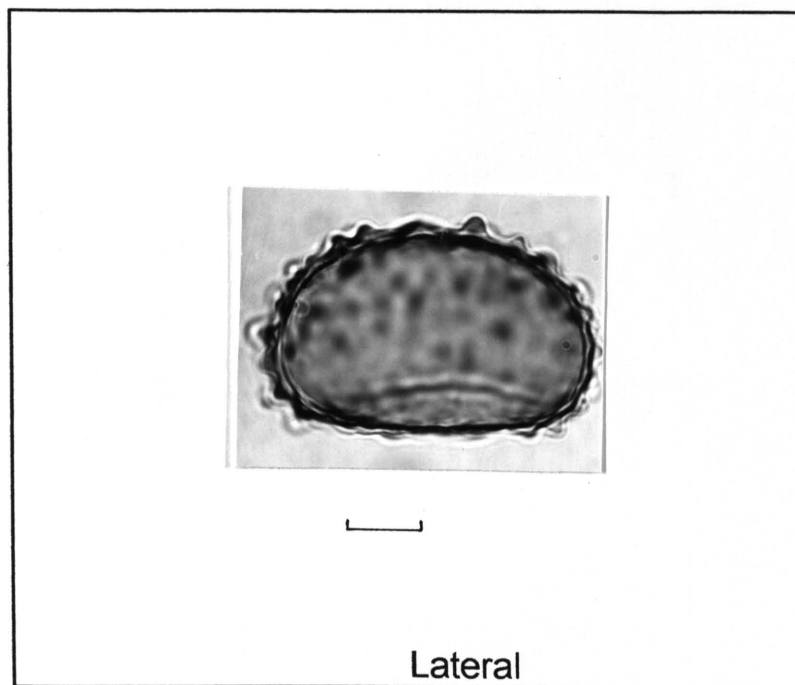
Proximal



Lateral

Illustrated specimen

1. (192-24) LM. Shows sculptural
Lateral aspect, showing sculptural
elements which vary between verruc-
ae and gemmae.



Lateral

Scale bar = 10 μ

Figure 3.30

Spore

Monolete

Perinous

verrucate

Specimens studied (9)

Spec no	Length (μ)	Height (μ)
Bold type = illustrated specimens		
81-17	35	15
156-22	27	27
184-21	30	27
186-3	36	30*
186-36	42	30
187-21	40	25
192-24	45	30
197-29	38	20
232-19	35	23
Averages	41	28
	* Breadth	

Description

Amb shape	Plano-convex in lateral view Roundly oval in proximal view
Laesura	Monolete; 3/4 length of spore Not well marked. May gape.
Exospore	Thick (3-5 μ) including sculpturing. No perispore.
Sculpturing	Sculpturing elements vary between verrucae and gemmae (3-7 μ diam, 5-7 μ apart, c 3 μ high) not arranged in a reticulate pattern.

Literature

Name	Author	Description	Illustration	Geog loc	Age
<i>Polypodiaceasporites tuberculensis</i>					
	Baksi 1962	p 19	Pl 3 fig 40	India	Oligocene
<i>Polypodiidites perverrucatus</i>					
	Couper 1953		Pl 2 fig 17, 18	New Zealand	L. Miocene
<i>Polypodiidites perverrucatus</i>					
	Couper 1960	p 39	Pl 1 fig 8	New Zealand	U. Oligo-M. Miocene
<i>Polypodiidites perverrucatus</i>					
	Pocknall & Mildenhall 1984	p 22	Pl 2 fig 5	New Zealand	L. Oligo-U. Miocene
<i>Verrucatosporites alienus</i>					
	Pflug & Thomson in Thomson & Pflug 1953	p59 Taf 3 fig 46-51		Germany	
<i>Verrucatosporites usmensis</i>					
	Germeraad, Hopping & Muller 1966	p290	Fig 3	USA, Africa, Asia	
<i>Verrucatosporites usmenoides</i>					
	van der Hammen 1956	p 116	Fig 7		

Remarks

This species has been placed within the genus *Polypodiisporites* as the sculpturing elements are evenly spaced. The west coast specimens resembled several published illustrations and descriptions. But for the nomenclatural uncertainties, they would have been identified as *Verrucatosporites usmensis*. According to Jansonius & Hills (1976) *Verrucatosporites* is a synonym of *Polypodiisporites*. The specimens were not identified with *Polypodiaceasporites tuberculensis* as although the sculptural elements appear similar, Baksi states that they are less frequent towards the laesura which would place them within the genus *Polypodiidites*. Jansonius & Hills (1976) state that Baksi's generic name is a junior homonym and illegitimate. The specimens were not identified with *Polypodiidites perverrucatus* because of the slightly different overall shape and the laesura of the west coast specimens is shorter.

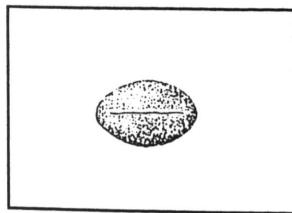
Distribution Well known in upper levels at Langklip. Maximum of 6% in 35-9. Very rare at Koingnaas, single specimens found in several samples

Age bracket Probably found throughout Tertiary.

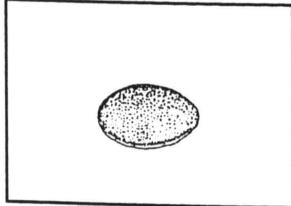
Botanical affinities Polypodiaceae.

Polypodiisporites sp Potonié 1931

Type species *P. favus* Potonié 1931



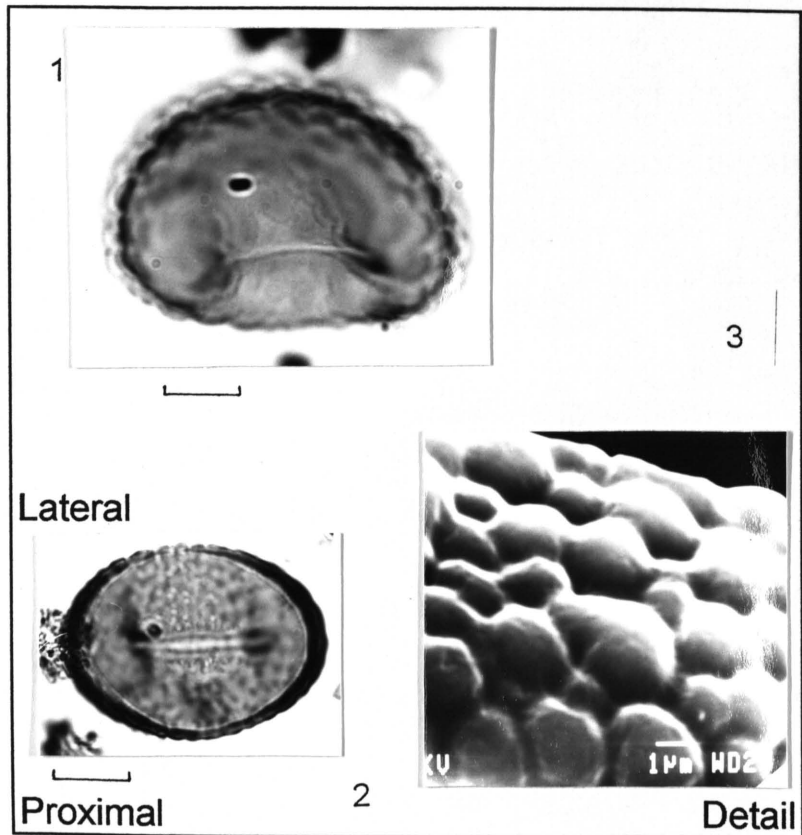
Proximal



Lateral

Illustrated specimen

1. (146-12) LM showing spore with coarse sculpturing. Negative reticulum seen. Laesura obscured by verrucae.
2. (187-34) LM, proximal view of narrow laesura, which gapes little and measures over half the spore length.
3. (268-24) SEM. Lateral view. Detail of sculpturing.



Scale bars = 10 μ

Figure 3.31

Also see Colour Plate 1

Illustrated specimens

Spec no	Length (μ)	Height (μ)
146-12	42	28
187-34	36	26*
268-24	36	24

* Breadth

Averages of specimens (55 studied)

Length (55 specimens)	45
Height (45 specimens)	29
Breadth (10 specimens)	26

Ranges of specimens

Length (55 specimens)	22-96
Height (45 specimens)	15-56
Breadth (10 specimens)	18-34

Description

Amb shape	Plano-convex to biconvex; reniform to globular in lateral view, oval in proximal view.
Laesura	Monolete, half to almost two-thirds spore length. May gape or be obscured by sculpturing.
Exospore	Usually thick, approx 2-4 μ including sculpturing.
Sculpturing	Verrucate. Individual elements 1-3 μ diam at base, 1-2 μ high, 1-3 μ apart, forming negative reticulum.

Spore
Monolete
Aperinous
Verrucate

Literature

Name	Author	Description	Illustration	Geog loc	Age
<i>Verrucatosporites speciosus</i> Harris 1965		p 83	PI 24 fig 8-10	Australia	Lower Tertiary
<i>Polypodiidites</i> sp Harris 1974		None	PI x fig 2	Ninetyeast Ridge	Palaeocene
<i>Polypodiisporites</i> Jansonius & Hills 1976		p 2102	p 2102	n/a	n/a
<i>Polypodiisporites</i> sp cf <i>P. rugifavus</i> Kemp & Harris 1977		p 23	PI 3 fig 5	Ninetyeast Ridge U.	Eo-Miocene
<i>Polypodiisporites</i> sp Kemp & Harris 1977		p 23	PI 3 fig 7-9	Ninetyeast Ridge	Palaeocene
<i>Polypodiisporites irregularis</i> Pocknall & Mildenhall 1984 p 22			PI 3 fig 1-5	New Zealand	Miocene
<i>Polypodiisporites minimus</i> Pocknall & Mildenhall 1984 p 22			PI 4 fig 3, 4	New Zealand	Palaeo-U Miocene
<i>Polypodiisporites radiatus</i> Pocknall & Mildenhall 1984 p 23			PI 54 fig 1-3	New Zealand	U. Oligo-L. Miocene
<i>Polypodiisporites minutiverrucus</i> Saxena & Misra 1990		p 266	PI 1 fig 5	India	

Remarks

The west coast specimens resemble several published illustrations and descriptions. A range of forms was found, varying in size and shape, bearing coarser or finer sculpturing. As little would be gained by further splitting the group, in terms of biostratigraphic or botanical information they were placed in a 'portmanteau' species, which included all verrucate monolete spores which could not be more accurately placed. Specimens which could not be identified as *Polypodiidites inangahuensis* as they were too small and did not possess noticeably finer sculpture on the proximal face were accepted, as were those with verrucae too low and closely spaced for inclusion in *Polypodiisporites* sp A.

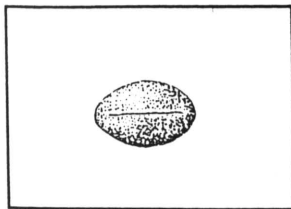
Distribution Common. Found at all levels in all sites.

Age bracket Tertiary

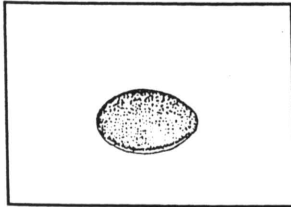
Botanical affinities Polypodiaceae (Pocknall & Mildenhall 1984).

Cicatricosisporites sp Pflug 1953

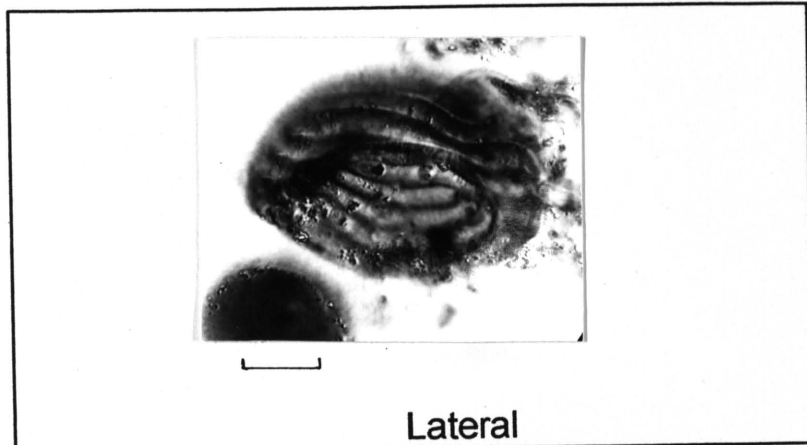
Type species *C. eocenicus* (Selling 1944) n. comb. Jansonius & Hills 1976



Proximal



Lateral



Lateral

Scale bar = 10 μ

Figure 3.32

Spore

Monolete

Aperinous

cicatricose

Specimens studied (3)

Spec no	Length (μ)	Height (μ)
Bold type = illustrated specimen		
86-29	52	28
261-20	42	29
267-33A	54	30
Averages	49	29

Illustrated specimen

(261-20) NOR-LM showing robust ribs

Description

Amb shape	Plano-convex to biconvex
Laesura	Monolete; not well marked probably 3/4 length of spore
Exospore	3 μ thick
Sculpturing	Very robust 'canaliculate' or 'cicatricose' - comprising parallel ridges 3.5 μ wide separated by narrow grooves. Occasional dichotomous branching. Arranged parallel to long axis of spore.

Literature

Author	Description	Illustration	Geog loc	Age
Selling 1944	p 66	PI 4 fig 44		
Thomson & Pflug 1953	p 61	PI 4 fig 13	Europe	Tertiary
Jansonius & Hills 1976		p 468-469, 2530		
McLachlan & Pieterse 1978	No desc	PI 2 fig10	Offshore SA	Cenomanian-Maastrichtian
Scholtz 1985	p 28	Fig 6D	South Africa	?Palaeocene

Remarks

See discussion on *Cicatricosisporites* and *Schizaeoisporites* in Jansonius & Hills 1976.

The sculpturing of the Koingnaas specimens is more robust than that of any spore illustrated in the literature. Too few specimens were found for specific identification.

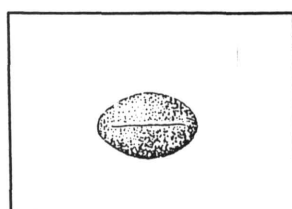
Botanical affinities Genus *Schizaea* (Thomson & Pflug 1953)

Distribution Very rare. Only three specimens were found, in separate samples from the Main Peat Horizon and stringers above it at Koingnaas

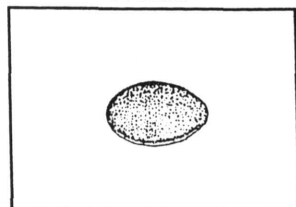
Age bracket U Cretaceous - Tertiary

Echinosporis sp Krutzsch 1967

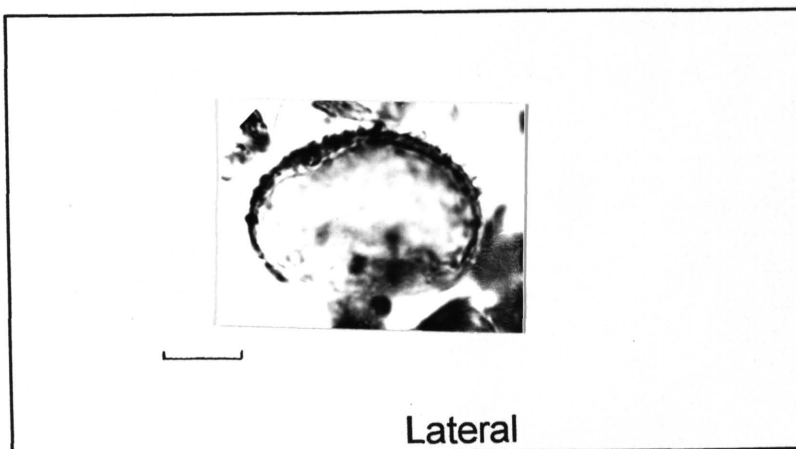
Type species *E. echinatus* (Krutzsch 1967)



Proximal



Lateral



Lateral

Scale bar = 10 μ

Figure 3.33

Specimens studied (3)

Spec no	Eq diam (μ)	Height (μ)
Bold type = illustrated specimen		
90-12	27	20
112-3	29	20
253-12	35	21,5*

* Breadth

Illustrated specimen

(112-3) LM. Focus at edge of spore to show spines

Description

Amb shape	Biconvex
Laesura	Monolete; partly obscured by debris. More than half length of spore
Exospore	1 μ thick
Sculpturing	Echinate; individual elements 2 μ high, with pointed tips. 1 μ diameter at base. Spaced 3 μ apart.

Spore
Monolete
Aperinous
echinate

Literature

Author	Description	Illustration	Geog loc	Age
Krutzsch 1967	p 172	PI 63 fig 10,13	Germany	Miocene
Jansonius & Hills 1976		895	n/a	n/a

Remarks

Differs from other monolete spore genera in possessing echinate sculpture

No match for this spore was found in the literature on southern hemisphere palynology

Botanical affinities Not stated

Distribution Very rare. Three specimens were found from Koinaas.

Age bracket Miocene

Pollen

Graphic glossary of technical terms

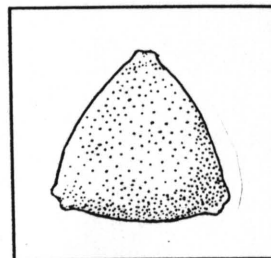
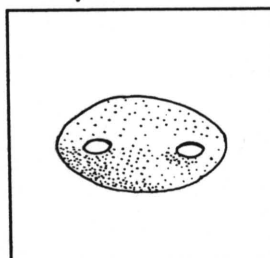
Figure 3.34

Pollen

Equatorial view

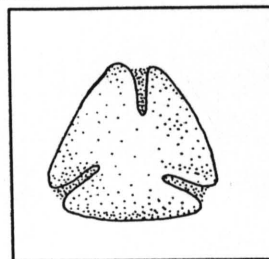
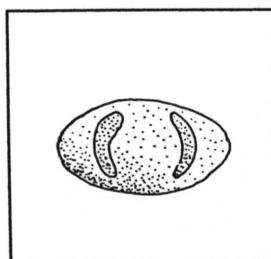
Polar view

Pore = aperture with length to breadth ratio less than 2



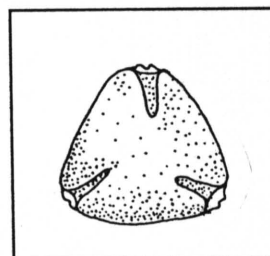
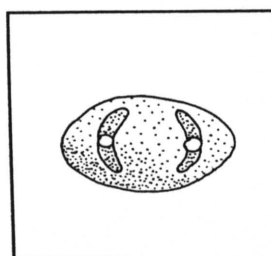
Porate

Colpus = elongated aperture with length/breadth ratio more than 2



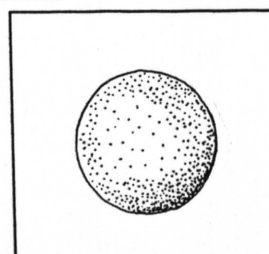
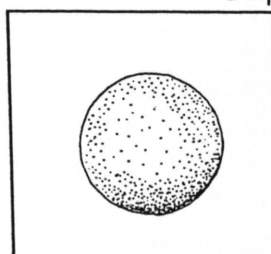
Colpate

Colporus = outer colpus containing inner pore



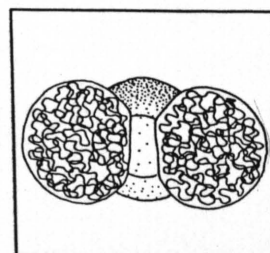
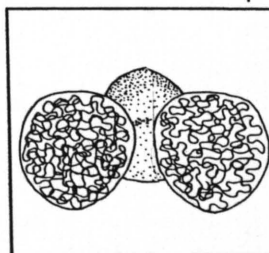
Colporate

Having no apertures at all



Inaperturate

Saccus = expanded sac formed by a separation within the exine filled with alveolate infrastructure



Saccate

Definition:

Morphologically, pollen grains are recognised according to the nature of the aperture or the possession of sacci (air bladders). Pollen grains possess pores or colpi, or complex apertures containing both, or none at all (inaperturate). The true definition of a pollen grain relies on its function rather than its morphology. which may give rise to either the sporophyte or the gametophyte generation. It comprises the microgametophyte of seed plants (gymnosperms and angiosperms). It was first recognised as such by Linnaeus (1751).

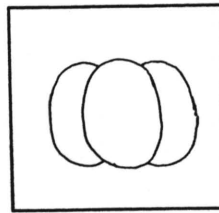
Saccate pollen

Graphic glossary of technical terms

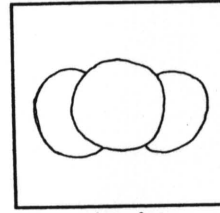
Figure 3.35

Pollen
Saccate

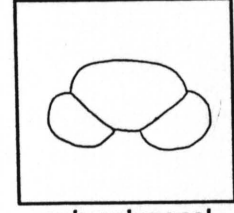
Shape of corpus



oval

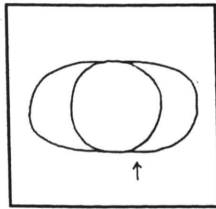


circular

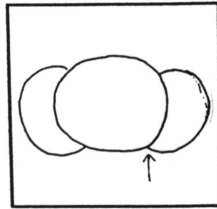


sub-polygonal
Lateral view

Polar view



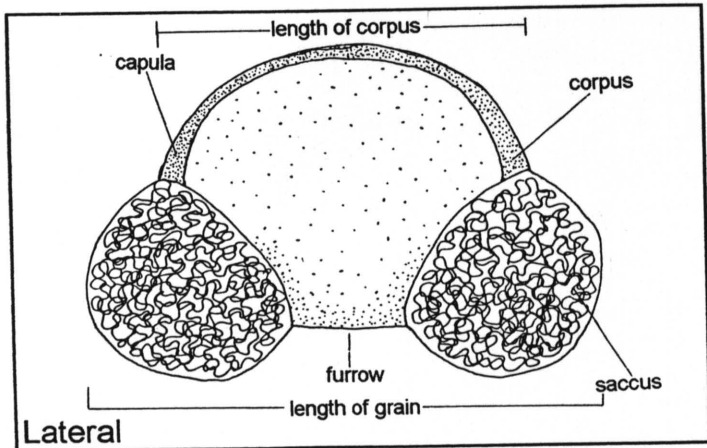
Haploxytonoid



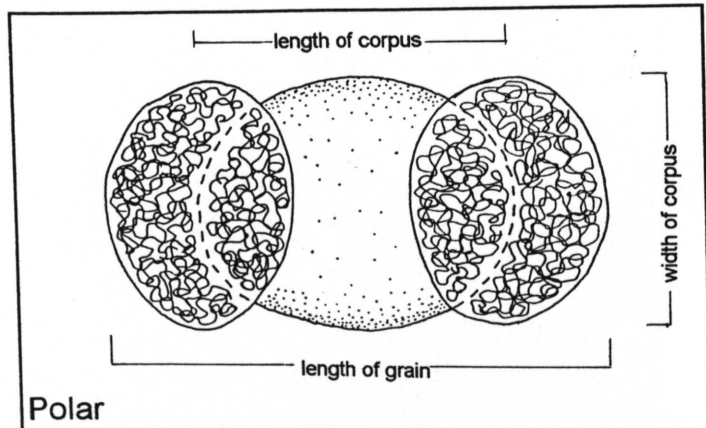
Diploxytonoid

Definition:

Possessing at least one saccus (or bladder) for the purposes of flotation in air or water (Traverse 1988). Saccus is an expanded sac formed by a local separation within the exine of a pollen grain at least partly filled with an alveolate infrastructure (Punt *et al.* 1994)

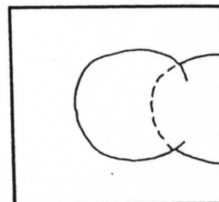


Lateral

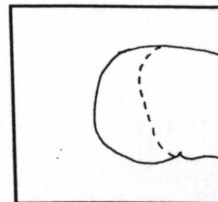


Polar

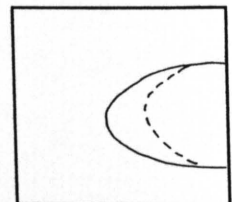
lateral view
Shape of sacci



lobate

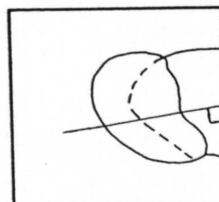


semi-circular

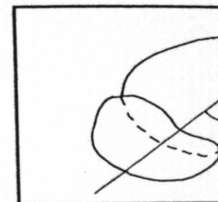


half-moon'

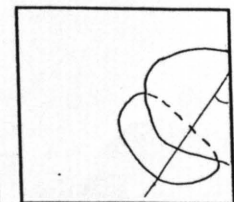
lateral view
Attachment angle



perpendicular



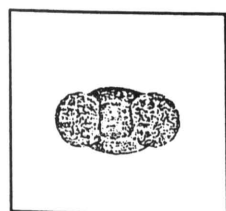
pendant



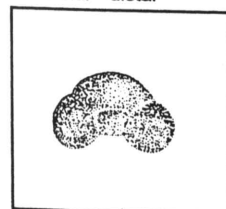
small angle

Alisporites sp Daugherty 1941

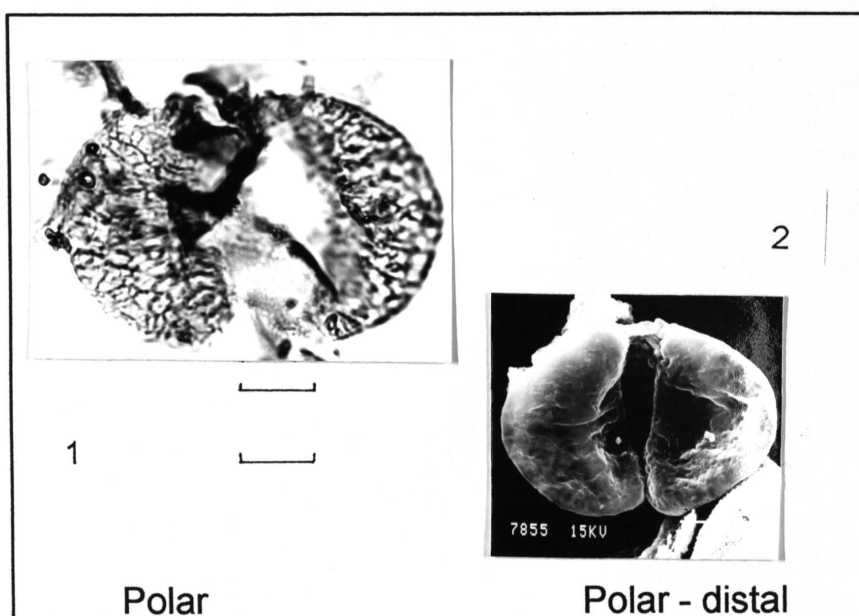
Type species *A. opii* Daugherty 1941



Polar - distal



Lateral



Scale bars = 10 μ

Figure 3.36

Pollen Saccate Bisaccate

Specimens studied (10)

Spec no	Length of grain (μ)	
Bold type = illustrated specimen		Corpus width (μ)
26-16	44	32
26-40	51	34
27-41	13*	21
69-10	50	50
106-32	39	39
130-()	27	28
173-26A	52	37
235-10A	23*	27
250-4	36	25
268-13	31	29
Averages	41	32

Description

Sacci	Two; diametrically opposed Semi-circular 'half moon' shape Small mesh near corpus but larger toward perimeter (equator)
Attachment angle	Perpendicular to long axis of corpus
Corpus	Clearly differentiated from the sacci. Well developed margins Oval in shape Av width of corpus 32 μ Av length of grain 41 μ
Sculpturing	Sacci - reticulate

Illustrated specimens

1. (173-26A) LM. Focus on reticulation of sacci

2. (250-4) SEM. Shows overall shape of sacci and narrow germinal furrow. Proximal polar view.

Literature

species	Author	Description	Illustration	Geog loc	Age
<i>A. grandis</i>	Dettmann 1963	p 102	Pl 25 fig 1-4	Australia	U Jurassic - L Cret
<i>A. similis</i>	Dettmann 1963	p 102	Pl 25 fig 5-7	Australia	U Jurassic - L Cret
<i>A. similis</i>	Muller 1968		Pl 2 fig 1	Malaysia	Cretaceous
<i>A. bilateralis</i>	McLachlan & Pieterse 1978		Pl 4 fig 6	Offshore S Africa	Cretaceous
<i>A. similis</i>	McLachlan & Pieterse 1978		Pl 4 fig 7	Offshore S Africa	Cretaceous

Remarks

The generic formulation of Jain (1968) in Jansonius & Hills (1976) was adopted for the positive identification of grains assigned to *Alisporites* sp.

Alisporites was distinguished from Podocarpaceous pollen by the following features:

1. Relatively thick exine.
2. Oval shaped amb (including sacchi) ie. 'haploxytonoid' feature
3. Central body oval in shape, parallel to sacchi attachment
4. Narrow germinal furrow between sacchi

Botanical affinities Coniferae (Jansonius 1971). Daugherty proposed the genus for all bisaccate pollen types that are not related to the Abietineae or Podocarpaceae.

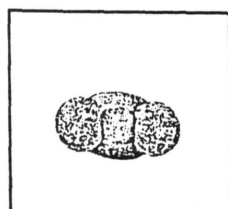
Distribution Very rare. Known from Main Peat Horizon, Koningnaas

Isolated specimen found at Langklip

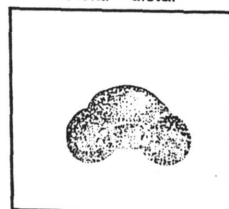
Age bracket U Jurassic - Cretaceous

Podocarpidites marwickii Couper 1953

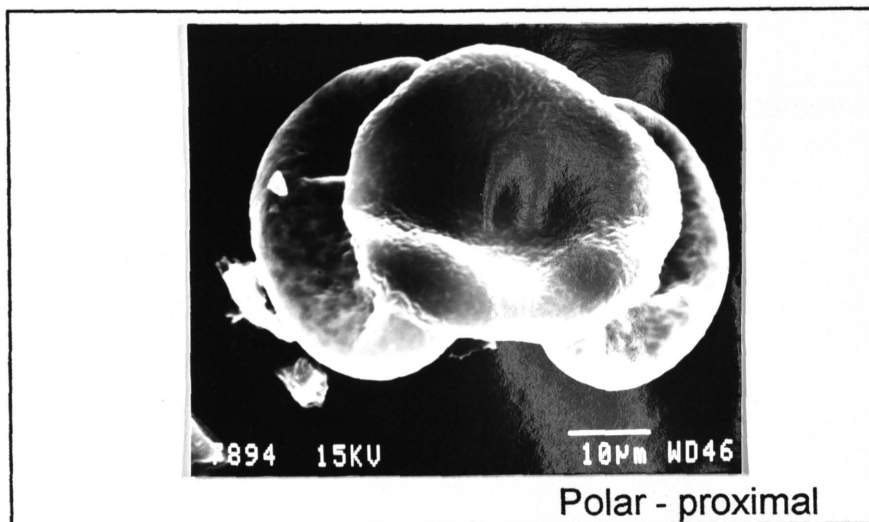
Type species *P. ellipticus* Cookson ex Couper 1953



Polar - distal



Lateral



Polar - proximal

Scale bar = 10 µ

Figure 3.37

Pollen Saccate

Bisaccate

Specimens studied (35)

Averages of specimens	
Length of grain (µ) (34 specs)	45
Corpus width (µ) (35 specs)	28

Ranges of specimens	
Length of grain (µ) (34 specs)	32-72
Corpus width (µ) (35 specs)	19-47

Illustrated specimen

(251-15) SEM. Shows circular corpus and diploxylonoid nature of sacci.

Description

Sacci	Two; diametrically opposed Extend beyond poles of grain Semi-circular in shape
Attachment angle	Perpendicular to long axis of grain
Corpus	Circular to oval in polar view Diploxylonoid - corpus separate from sacci. Av width of corpus 45µ Av length of grain 28µ
Sculpturing	Relatively coarsely reticulate sacci Corpus - faintly sculptured

Literature

Author	Description	Illustration	Geog loc	Age
Couper 1953		Pl 4 fig 39	New Zealand	L Cret-L Oligocene
Couper 1960	p 45	Pl 4 fig 10&11	New Zealand	M Cret-U Eocene
McLachlan & Pieterse 1978		Pl 4 fig 2	Offshore S Africa	Cretaceous

Remarks

The generic diagnosis by Couper states that grains attributed to this genus are similar to those found in the Podocarpaceae. *Podocarpidites marwickii* is similar to *P. major*; the difference being that *P. major* is larger and has more finely reticulate sacci. The west coast specimens may comprise intermediate forms between the two species. Only well-preserved grains have been assigned to this species. Damaged grains which could not be positively placed within this species were counted as *Podocarpidites* sp.

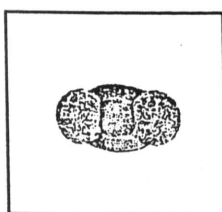
Botanical affinities *Podocarpus* (Couper 1953)

Distribution Well-known. Found at all levels and in all sites.

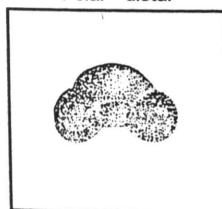
Age bracket Lower Cretaceous to Upper Eocene

Podocarpidites sp A

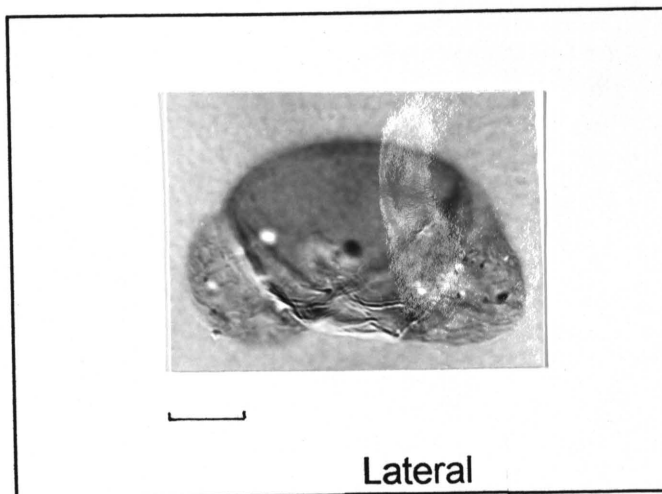
Type species *P. ellipticus* Cookson ex Couper 1953



Polar - distal



Lateral



Lateral

Scale bar = 10 μ

Figure 3.38

Pollen Saccate Bisaccate

Specimens studied (7)

Spec no	Length of grain (μ)	
	Corpus width (μ)	
Bold type = illustrated specimen		
10--31	25	15
20--4	28	21
67-27	70	40
152-9	35	23
219-19	44	22
252-7	40	24
253-39	32	19
Averages	39	23

Description

Sacci	Two; semi-circular in shape Length greater than depth. Extend beyond poles of grain
Attachment angle	Pendant - approx 45° angle to long axis of grain
Corpus	Roundly polygonal in polar view Diploxylonoid - corpus separate from sacci. Av width of corpus 23 μ Av length of grain 39 μ
Sculpturing	Relatively coarsely reticulate sacci. Faintly sculptured corpus

Illustrated specimens

1. (219-19) NOR-LM. Oblique view of grain. Cap of corpus shows slight thickening of exine.

Literature

species	Author	Description	Illustration	Geog loc	Age
<i>P. decorus</i>	Pocock 1962	p 66	fig 159, 160	Canada	Cretaceous
<i>P. ellipticus</i>	Pocock 1962	p 65	fig 153-6	Canada	Cretaceous
<i>P. ellipticus</i>	Dettmann 1963	p 103	Pl 15 fig 8-12	Australia	Upper Mesozoic
<i>P. ellipticus</i>	Hos 1974	p 7	fig 15	Australia	Eocene
<i>P. ellipticus</i>	Burger 1976		Pl 28 fig 13a&b	Australia	Cretaceous
<i>P. kamiesbergensis</i>	Scholtz 1985	p 39	fig 10 A - D	South Africa	L Cret - Palaeocene

Remarks

The west coast specimens did not match any published illustrations or descriptions of particular species. *P. ellipticus* also has large pendant sacchi, however these specimens appeared to differ significantly. They were not positively identified with *P. kamiesbergensis* because the preservation of the few specimens was not good and the taxonomic details could not be ratified.

Scholtz (1985) reports that *P. kamiesbergensis* occurred commonly at Arnot.

Damaged grains which could not be positively placed within this type were counted as

Podocarpidites sp.

Botanical affinities *Podocarpus* (Couper 1953)

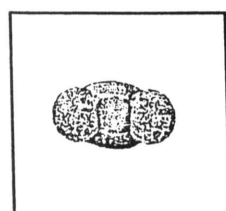
Distribution Rare. Known from Main Peat Horizon and above at Koingnaas.

Isolated specimens found at other sites.

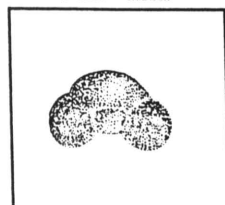
Age bracket Lower Cretaceous to Upper Eocene

Podocarpidites sp B

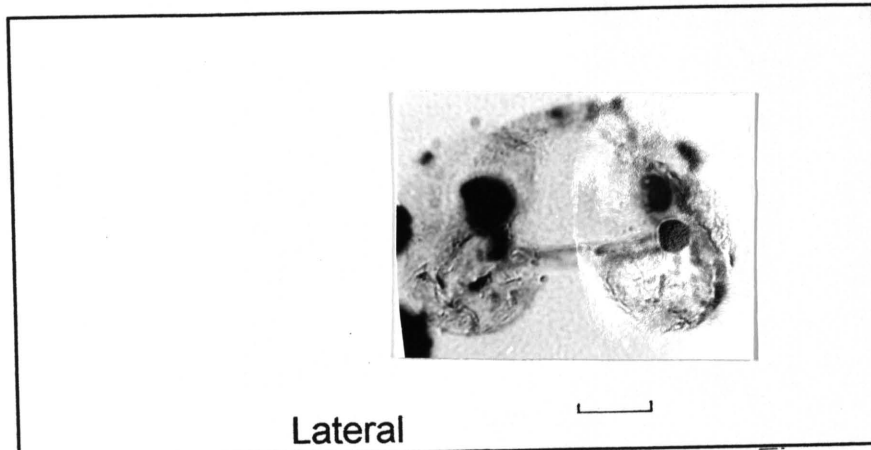
Type species *P. ellipticus* Cookson ex Couper 1953



Polar - distal



Lateral



Lateral

Scale bar = 10 μ

Figure 3.39

Pollen Saccate

Bisaccate

Specimens studied (27)

Spec no	Length of grain (μ)	Corpus width (μ)
Illustrated specimen		
275-6	40	30

Averages of specimens

Length of grain (μ) (22 specs)	35
Corpus width (μ) (25 specs)	25

Ranges of specimens

Length of grain (μ) (22 specs)	20-64
Corpus width (μ) (27 specs)	12-55

Description

Sacci	Two; relatively small sacci Semi-circular to 'half-moon' in shape
Attachment angle	Pendant - almost parallel to long axis of grain
Corpus	Semi-circular to oval in lateral view. Circular to oval in polar view. Diploxytonoid - corpus discernible from sacci. Av width of corpus 25 μ Av length of grain 35 μ
Sculpturing	Relatively coarsely reticulate sacci, coarser at perimeter Corpus - faintly sculptured

Illustrated specimens

1. (275-6) NOR-LM. Corpus is almost semi-circular in shape with small sacci.

Literature

species	Author	Description	Illustration	Geog loc	Age
<i>P. decorus</i>	Pocock 1962 p 66		Pl 4 fig 39	New Zealand	L Cret-L Oligocene
<i>Podocarpus</i> sp	Coetzee & Rogers 1982 p 80		Pl 1 fig 1	South Africa	Miocene
<i>P'carpidites</i> sp	Kemp & Harris 1977 p 28		Pl 4 fig 14	Ninetyeast Ridge	Palaeo-Oligocene
<i>P. multesimus</i>	McLachlan & Pieterse 1978		Pl 4 fig 1	Offshore South Africa	L Cretaceous
<i>P. rugulatus</i>	Pocknall & Mildenhall 1984 p 23	Pl 5 fig 4-7		New Zealand	U Oligo-L Miocene

Remarks

The sacci of the west coast specimens are not so small as those seen in the literature described as *Phyllocladidites*. It does not resemble *P. decorus* closely enough for a positive identification. Damaged grains which could not be positively placed within this species were counted as *Podocarpidites* sp.

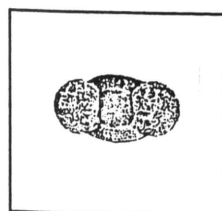
Botanical affinities *Podocarpus* (Couper 1953)

Distribution Well-known. Found at all levels and in all sites.

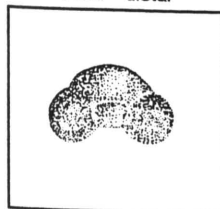
Age bracket Lower Cretaceous to L Miocene

Podocarpidites sp C

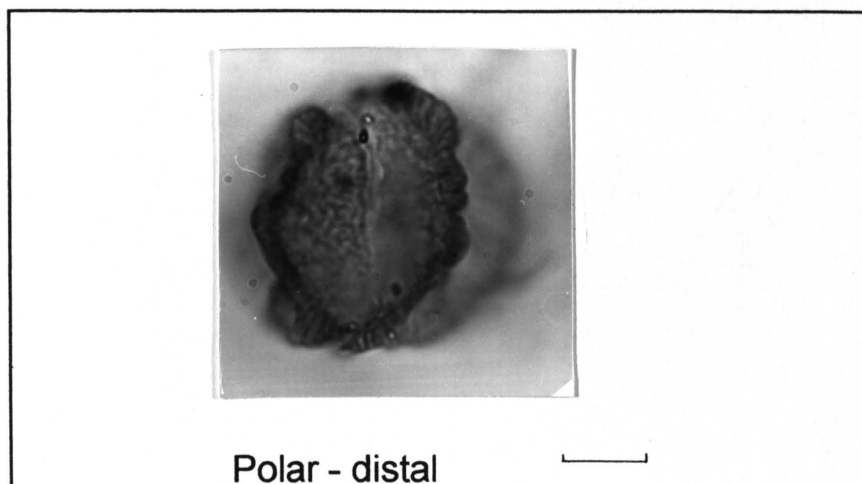
Type species *P. ellipticus* Cookson ex Couper 1953



Polar - distal



Lateral



Polar - distal

Also see Colour Plate 2

Scale bar = 10 μ

Figure 3.40

Specimens studied (3)

Spec no	Length of grain (μ)	
	Corpus width (μ)	
106-1	38	33
106-19	60	44
186-7	52	32
Averages	50	36

Illustrated specimen

(106-1) LM. Ventral furrow narrow. Crassitides well developed.

Description

Sacci	Two; diametrically opposed 'Half-moon' shape Length greater than depth. Extend beyond poles of grain
Attachment angle	Perpendicular to long axis of grain
Corpus	Circular in polar view Diploxytonoid. Crassitides present at bases of sacci Av width of corpus 36 μ Av length of grain 50 μ
Sculpturing	Relatively coarsely reticulate sacci. Faintly sculptured corpus

Literature

species	Author	Description	Illustration	Geog loc	Age
<i>P. marwickii</i>	McLachlan & Pieterse 1978		Pl 4 fig 2	Offshore South Africa	Cretaceous
<i>P. riembreekensis</i>	Scholtz 1985	p 41	Fig 10 E-J	South Africa	L Cret - Palaeocene

Remarks

The west coast specimens were not identified with *P. riembreekensis* Scholtz 1985 because other noted taxonomic features were not seen. The distinguishing feature of this type is the presence of crassitides. Small crassitides were seen on various illustrations of *P. ellipticus*, as well as *P. marwickii*.

Damaged grains which could not be positively placed within this type were counted as *Podocarpidites* sp.

Botanical affinities *Podocarpus* (Couper 1953)

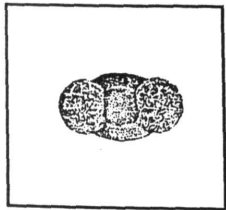
Distribution Very rare. Isolated specimens found in individual samples from above the Main Peat Horizon at Koinaas and from Langklip.

Age bracket Lower Cretaceous to Oligocene

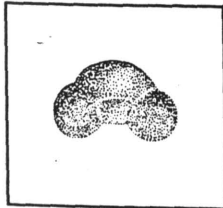
Pollen Saccate
Bisaccate

***Microcachridites antarcticus* Cookson ex Couper 1953**

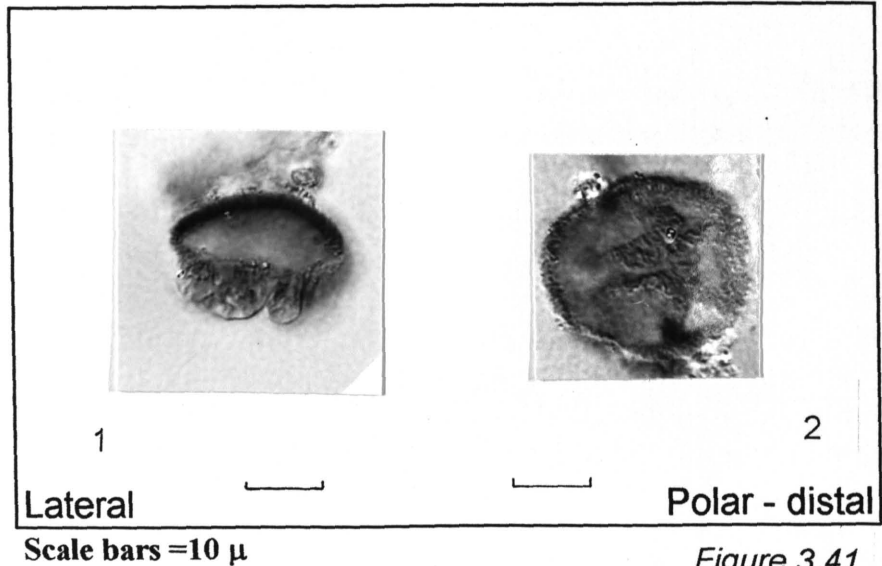
Type species *M. antarcticus* Cookson ex Couper 1953



Polar - distal



Lateral



Scale bars = 10 μ

Figure 3.41

Pollen Saccate
Polysaccate

Specimens studied (7)

Spec no	Length of grain (μ)	
Bold type = illustrated specimen		Corpus width (μ)
88-17	27*	25
259-12	20*	16*
259-28	20	15
260-8	23	26
261-10	25	16
261-42	21	16
262-19	27	17
Averages	23	19

Description

Sacci	Three; small sacci, lobate shape Extend little beyond body of grain
Attachment angle	Pendant
Corpus	Circular in polar view Diploxytonoid. Furrow wide Av width of corpus 19 μ Av length of grain 23 μ
Sculpturing	Relatively coarsely reticulate sacci. Faintly sculptured corpus

Illustrated specimens

1. (261-42) NOR-LM. Lateral view of grain. Cap of corpus shows thickened exine. Height of sacci shown
2. (260-8) NOR-LM showing three sacci within border of corpus

Literature

Author	Description	Illustration	Geog loc	Age
Cookson 1947	p 132	Pl 14 fig 9	Kerguelen	L Tertiary
Couper 1953		Pl 9 fig 134	New Zealand	L Cret- L Oligocene
Couper 1960	p 43	Pl 3 fig 9	New Zealand	U Jurassic - U Eocene
Dettmann 1963	p 103	Pl 26 fig 1-5	Australia	U Mesozoic-Eocene
Harris 1965	p 87	Pl 26 6 & 7	Australia	L Tertiary
Martin 1973	p 16	Fig 63	Australia	L Tertiary
Hos 1974	p 7	Fig 14	Australia	Eocene
Harris 1974		fig 7	Ninetyeast Ridge	Palaeocene
Burger 1976	p 140	Pl 28 fig 9	Australia	Cretaceous
Khan 1976	p 787	Fig 6	New Guinea	Tertiary
Kemp & Harris 1977	p 29	Not illustr	Ninetyeast Ridge	Palaeocene-Eocene
Martin 1978	p 187	fig H	Australia	Tertiary
McLachlan & Pieterse 1978		Pl 4 no 4	Offshore South Africa	U Cretaceous
Coetzee 1980	p 200	Fig 2 b	South Africa	Tertiary
Coetzee & Rogers 1982	p 80	Pl 1 no2	South Africa	Miocene
Coetzee 1983	p 349	Fig 2 no 2	South Africa	Tertiary

Remarks

The genus *Microcachrydites* was proposed for the accommodation of grains similar to those found in the modern genus *Microcachrys*, having several sacchi. According to Jansonius & Hills (1976) most specimens from the type locality possess two sacchi, however in the literature consulted, most grains had three.

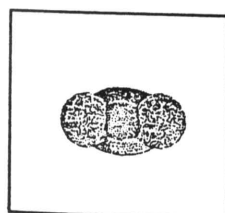
Botanical affinities *Microcachrys* (Cookson 1947). Podocarpaceae (Kemp & Harris 1977)

Distribution Rare. Known from above the Main Peat Horizon at Koningnaas.

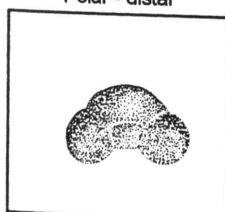
Age bracket Upper Jurassic - Tertiary

Trisaccate pollen A

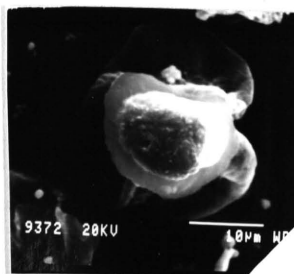
Type species



Polar - distal



Lateral



Polar - proximal

Scale bar = 10 μ

Figure 3.42

Pollen Saccate Polysaccate

Specimens studied (2)

Specimens studied (27)		
Spec no	Length of grain (μ)	
Bold type = illustrated specimen		Corpus width (μ)
268-31	25	25
274-42	48	32
Averages	37	29

Illustrated specimens

(268-31) SEM. Polar view, showing the three sacculi which extend beyond border of grain

Description

Sacci	Three; large sacculi. Semi-circular Extend well beyond body of grain
Attachment angle	Lateral
Corpus	Circular in polar view Diploxytonoid Av width of corpus 29 μ Av length of grain 37 μ
Sculpturing	Relatively coarsely reticulate sacci. Faintly sculptured corpus.

Literature

species	Author	Description	Illustration	Geog loc	Age
<i>P. dacrydiodes</i>	Couper 1953		PI 4 fig 34	Oligocene - Recent	
<i>P. dacrydiodes</i>	Couper 1960	p 45	PI 4 Fig 6 & 7	Tertiary	
<i>Callialasporites</i>	Jansonius & Hills 1976		p 354	n/a	n/a

Remarks

The west coast specimens were not identified with *Podocarpus dacrydiodes* as too few specimens were found to establish the critical features adequately. They were also not identified with *Callialasporites* because the sacculi were separate bladders not one divided into lobes.

Botanical affinities Not known

Distribution Very rare. One specimen known from Somnaas/Noup. Another specimen found during SEM microscopy on sample from above Main Peat Horizon, Koingnaas (not included in statistics)

Age bracket Not known

Porate pollen

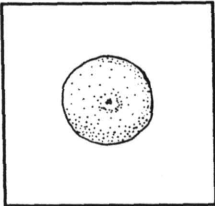
Graphic glossary of technical terms

Figure 3.43

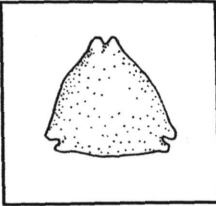
Pollen
Porate

Categories

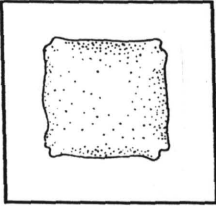
Polar view



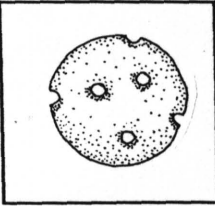
monoporate
Single pore



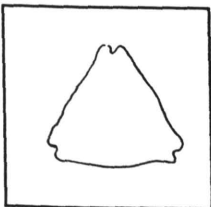
triporate
Three pores



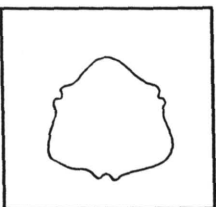
stephanoporate
More than three
Equatorially placed



periporate
More than three
Random placement



Angulaperturate



Planaperturate

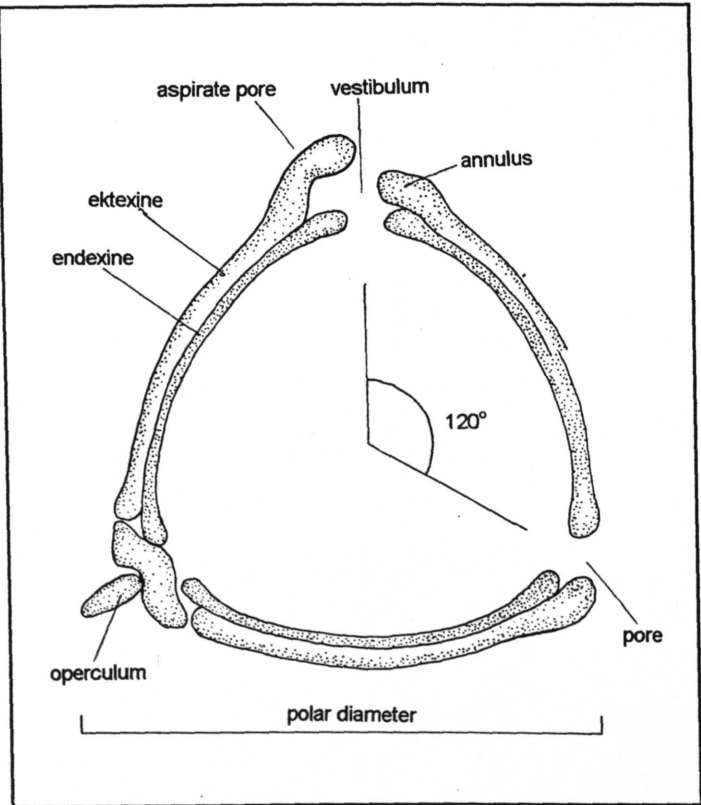
Position of pores



Truncated apices

Definition:

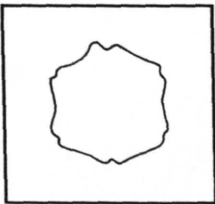
Possessing isodiametric apertures
(greater axis less than twice smaller)
Includes forms with complex pores
(Traverse 1988)



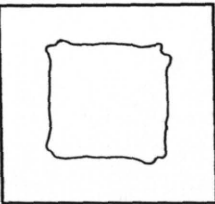
General morphology Polar view

Shape of amb

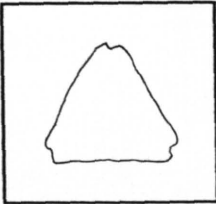
Polar view



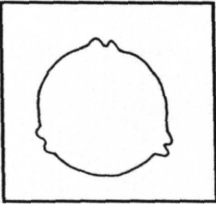
polygonal



square



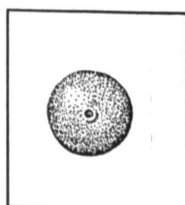
triangular



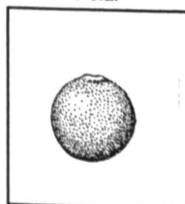
circular

Aglaoreidia sp Erdtman 1960

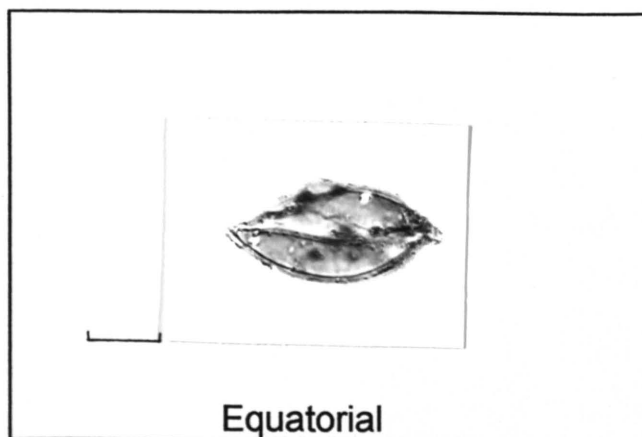
Type species *A. cyclops* Erdtman 1960



Polar



Equatorial



Equatorial

Scale bar = 10 μ

Figure 3.44

Pollen Porate

Monoporate

Specimens studied (1)

Spec no	Eq diam (μ)	
Polar diam (μ)		
Bold type = illustrated specimen		
40-35	29	16

Illustrated specimen

(40-35) NOR-LM. Annulate pore appears at top of grain

Description

Amb shape	Spheroidal, appears to be folded
Pore	Single; large. Diameter of base 5 μ , height 2.5 μ with distinct annulus
Exine	1.5 - 2 μ thick.
Sculpturing	Reticulate. Columellae are very fine. Muri and lumina not well seen.

Literature

Author	Description	Illustration	Geog loc	Age
Stover & Evans 1973		Pl fig 11	Australia	U Cret-Eocene
Jansonius & Hills 1976		p 47	n/a	n/a
Coetzee & Rogers 1982		Pl 1 no 16, 17	South Africa	Miocene
Coetzee 1983	p 345	Fig 2 no 7	South Africa	Miocene

Remarks

Only one monoporate pollen grain was found within the sediments studied. It bears a remarkable resemblance to the grain illustrated in Coetzee & Rogers (1982) and Coetzee (1983) which was identified as *Aglaoreidia qualumis* / *Sparganiaceapollenites barungensis*. The Saldanha grain has an equatorial feature which seems to be a fold. The west coast specimen also bears such a fold, however this feature is not mentioned in any description consulted, thus it is not known whether it is significant or not. The west coast specimen has been identified as *Aglaoreidia* rather than *Sparganiaceapollenites* as the pore in the latter genus is not annulate. Other details of the pore structure could not be observed.

Botanical affinities Monocotylendous (Jansonius & Hills 1976)

Distribution Very rare. A single specimen was found, in 12-37 from the channel peats at Koingnaas

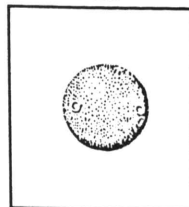
Age bracket U Cretaceous - Miocene

Casuarinidites sp Cookson & Pike 1954

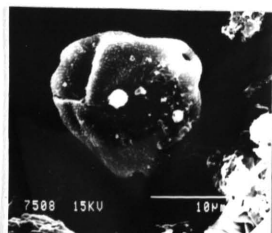
Type species *C. cainozoicus* Cookson & Pike 1954



Polar



Equatorial



1



2

Polar

Scale bar = 10 μ

Description

Figure 3.45

Specimens studied (4)

Spec no	Eq diam (μ)
Bold type = illustrated specimen	
7--3	30
100-21	28
244-7	23
250-5	17
Average	25

Illustrated specimens

- (244-7) SEM showing nature and position of pores
Grain slightly damaged
- Detail of above, focussing on pore and surface of grain

Amb shape	Triangular with convex sides in polar view. Equ diam av 25μ
Pores	Three; placed equatorially Angulaperturate, asperate
Exine	Tectate 1 - 2.5μ thick
Sculpturing	Psilate to scabrate/granulate Under SEM, granulae seen to occur in rows

Literature

species	Author	Description	Illustration	Geog loc	Age
<i>C. cainozoicus</i>	Cookson & Pike 1954 p 200		Pl 1 fig 1-3	Australia	Eocene-Quaternary
<i>C. cainozoicus</i>	Harris 1965	p 90	Pl 27 fig 35	Australia	Palaeo-Eocene
<i>C. cainozoicus</i>	Martin 1973	p 32	Fig 145,146	Australia	Palaeo-Quaternary
<i>C. harrisii</i>	Martin 1973	p 33	Fig 147,148	Australia	Palaeo-Quaternary
<i>Betulaceipites</i>	Jansonius & Hills 1976		p 260	n/a	n/a
<i>Casuarinidites</i>	Jansonius & Hills 1976		p 412	n/a	n/a
<i>Trivestibulop's</i>	Jansonius & Hills 1976		p 3081	n/a	n/a
<i>C. cainozoicus</i>	Martin 1978	p 188	fig Q & P	Australia	Tertiary
<i>C. equisetifolia</i>	Coetzee 1983	p 349	fig 2 no 6	South Africa	Tertiary
<i>C. pulcher</i>	Christopher et al 1990		Pl 1 fig 3, 4	USA	Palaeocene

Remarks

The west coast specimens also bear a resemblance to *Betulaceoipollenites* and *Trivestibulopollenites*. The positive identification with *Casuarinidites* was made because these specimens are identical to grains found previously in South Africa by Coetzee (1983).

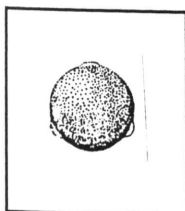
Botanical affinities *Casuarina* (Jansonius & Hills 1976) of the Casuarinales (Hamamelidae).

Distribution Very rare. Found in and below but not above Main Peat Horizon, Koingnaas.

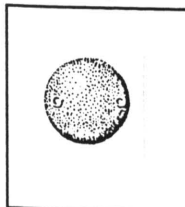
Age bracket Palaeocene - Quaternary

Cricotriporites sp Leidelmeyer 1966

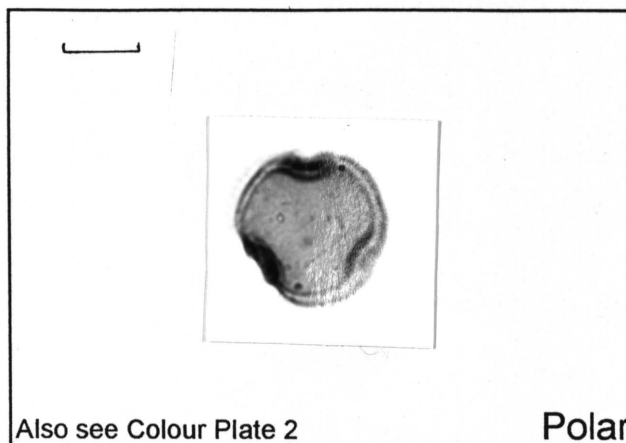
Type species *C. guianensis* Leidelmeyer 1966



Polar



Equatorial



Also see Colour Plate 2

Polar

Scale bar = 10 μ

Figure 3.46

Specimens studied (14)

Spec no	Eq diam (μ)
22-24	24
72-40	35
88-12	31
88-37	27
91-2	23
91-20	23
146-9	22
150-28	21
159-1	23
164-30	21
193-42	25
215-2A	20
229-()	23
277-16	26
Average	25

Bold type = illustrated specimen

Description

Amb shape	Circular in polar view. Equ diam av 25 μ
Pores	Three; placed equatorially Circular in shape Possess annulae or costae pori, sometimes operculate. Angulaperturate Dimensions 6 μ at base, 2 μ high
Exine	Tectate 1 - 2 μ thick
Sculpturing	Psilate to scabrate/granulate

Illustrated specimen

(91-20) LM showing annulate pores

Literature

species	Author	Description	Illustration	Geog loc	Age
<i>C. fragilis</i>	van Hoeken-Klinkenberg 1966		Pl 2 fig 1	Nigeria	M Eocene
<i>C. guianensis</i>	Leidelmeyer 1966	p 54	Pl 4 fig 4	Guyana	Palaeo-L Eocene
<i>C. operculatus</i>	van Hoeken-Klinkenberg 1966		Pl 2 fig 16	Nigeria	M Eocene
<i>Cricotriporites</i>	Jansonius & Hills 1976		p 655	n/a	n/a

Remarks

The west coast specimens also bear a resemblance to *Annutriporites* (Gonzales Gusman 1967) as they have a slightly coarser surface texture than allowed for in *Cricotriporites*. The positive identification was made as the grains satisfy the generic diagnosis of *Cricotriporites* in every other respect. No further literature was available for *Annutriporites*. They are distinguished from *Triorites* in having a circular outline and round annulate pores, occasionally with operculi.

The grains possessing operculi resembled *Cliffortia* (possibly a modern genus) illustrated in Coetzee & Rogers (1982).

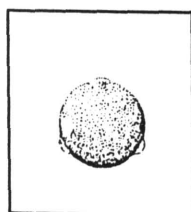
Botanical affinities Not stated

Distribution Very rare. Found at all levels in all sites.

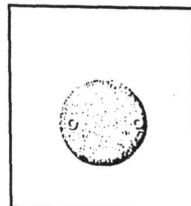
Age bracket Palaeocene - M Eocene

***Echitriporites* sp van der Hammen ex van Hoeken-Klinkenberg 1964**

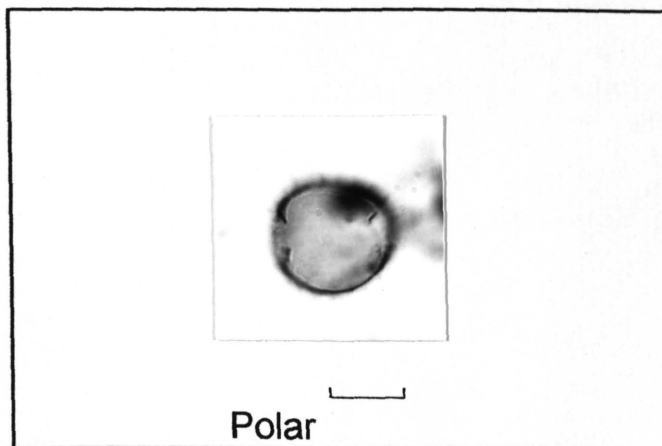
Type species *E. trianguliformis* van Hoeken-Klinkenberg 1964



Polar



Equatorial



Polar

Scale bar = 10 μ

Figure 3.47

Specimens studied (1)

Spec no	Eq diam (μ)
Bold type = illustrated specimen	
145-30	17

Illustrated specimen

(145-30) LM. Focus on edge of grain to show spines

Description

Amb shape	Circular in polar view
Pore	Three large sunken pores, with annulus. Placed equatorially
Exine	Tectate. 1- 1.5 μ thick
Sculpturing	Echinate. Spines 2-3 μ high Less than 1 μ at base

Literature

Author	Description	Illustration	Geog loc	Age
van Hoeken-Klinkenberg 1966 p 218		PI 3 fig 7	Nigeria	Maastrichtian
Jansonius & Hills 1976		p 903	n/a	n/a

Remarks

Only one grain of this type was found in the west coast sediments. It has been placed within the genus *Echitriporites* as it conforms to the generic diagnosis. In the literature consulted, echinate triporate grains have been referred to *Echiperiporites*, which was instituted for the reception of periporate grains (ie four or more pores). The west coast specimen does not closely resemble the grains found by Kemp & Harris (1977) or Coetzee (1978, 80) and thus will not be identified with them.

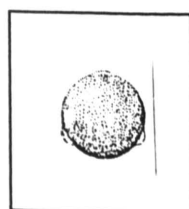
Botanical affinities Not known

Distribution Very rare. A single specimen was found, in 35-1 from the lowest level at Langklip

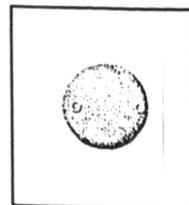
Age bracket Maastrichtian

Intratriporopollenites sp Pflug & Thomson in Thomson & Pflug 1953

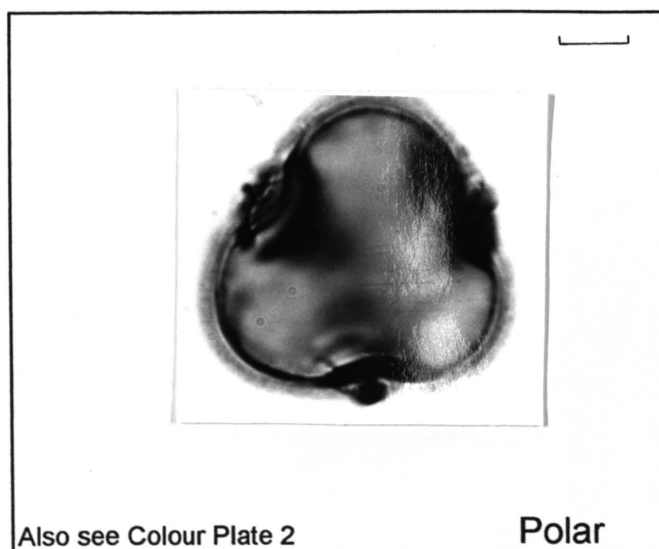
Type species *T. instructus* (Potonie) Thomson & Pflug 1953



Polar



Equatorial



Also see Colour Plate 2

Polar

Scale bar = 10 μ

Figure 3.48

Pollen Perate
Triporate

Specimens studied (2)

Spec no	Eq diam (μ)
Bold type = illustrated specimen	
72-19	34
87-34	39
Average	37

Illustrated specimen

(87-34) LM. Focus on wall of grain and pores

Description

Amb shape	Triangular in polar view Average diameter 37 μ
Pore	Three complex pores with distinct annulus. One specimen with operculum. Placed equatorially Planaperturate
Exine	3-5 μ thick. Columellae fine and highest at angles of grain at angles of grain
Sculpturing	Reticulate. Lumina < 0.5 μ

Literature

Genus/species	Author	Description	Illustration	Geog Loc	Age
<i>Tiliaepollenites notabilis</i>	Harris 1965	p 91	Pl 28 fig 2,3	Australia	Eocene
<i>T. notabilis</i>	Stover & Evans		Pl fig 4	Australia	Eocene
<i>I. notabilis</i>	Pocknall 1982	p 268	Fig 14	New Zealand	
<i>Intratriporopollenites</i>	Jansonius & Hills 1976	p 2903		n/a	n/a
<i>Intratriporopollenites</i>	Jansonius & Hills 1976	p 1340		n/a	n/a

Remarks

The generic name *Tiliaepollenites* is often used in the literature for grains of this type. However, it is invalid.

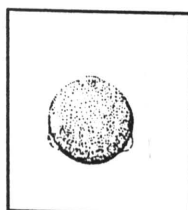
Botanical affinities Tiliaceae (Jansonius & Hills 1976) of the Malvales (Dilleniidae)

Distribution Very rare. Known from the channel peats and Main Peat Horizon at Koingnaas

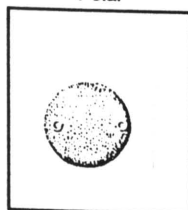
Age bracket Palaeogene (Pocknall 1982)

Momipites sp Wodehouse 1933

Type species *M. coryloides* Wodehouse 1933



Polar



Equatorial

Specimens studied (8)

Spec no	Eq diam (μ)
Bold type = illustrated specimens	
1--9	26
38-9	16
58-32	22
79-39A	20
82-1	33
161-35A	22
248-6	22
268-17	15
Average	22

Literature

species	Author	Description	Illustration	Geog loc	Age
<i>M. africanus</i>	van Hoeken-Klinkenberg 1966			Nigeria	M Eocene
<i>M. coryloides</i>	Wilson & Webster 1946 p 275		fig 15	USA	Tertiary
<i>Momipites</i>	Jansonius & Hills 1976		p 1683	n/a	n/a
<i>Momipites</i>	Jansonius & Hills 1976		p 3576	n/a	n/a

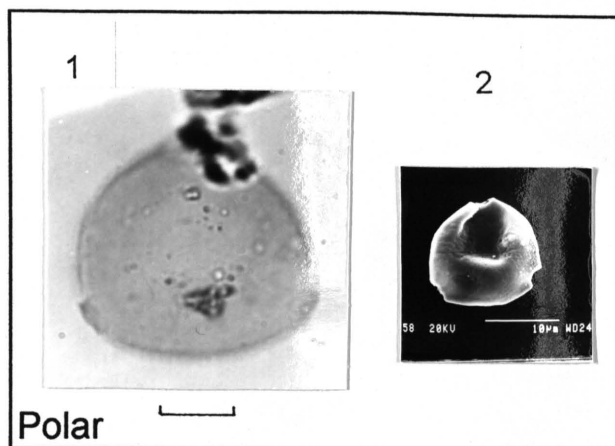
Remarks

The west coast specimens also bear a resemblance to *Engelhardtioipollenites* (Potonié 1951 ex Potonié 1960) and *Engelhardtoidites* (Potonié, Thomson & Thiergart 1950 ex Potonié 1960). They were identified as *Momipites* because the grains satisfy the generic diagnosis. No further literature was available for the other genera.

Botanical affinities *Engelhardtia* and *Alfoaroa* (Jansonius & Hills 1976). Moraceae of the Urticales and Betulaceae of the Fagales (Hamamelidae) (van Hoeken-Klinkenberg 1966)

Distribution Rare. Found in the Channel Peats at Koingnaas. Isolated specimens known from Langklip.

Age bracket Palaeocene - M Eocene



Polar

Scale bars = 10 μ

Figure 3.49

Description

Amb shape	Circular - rounded triangular in polar view. Equ diam av 22 μ
Pores	Three; placed equatorially Simple, small. Angulaperturate Non-protruding
Exine	Tectate 1 - 2 μ thick
Sculpturing	Psilate to scabrate/granulate

Illustrated specimens

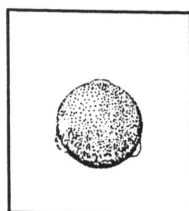
- (82-1) LM. Grain partly obscured by debris
- (268-17) SEM. Grain with relatively large pores

Pollen Porate

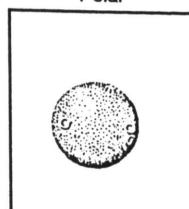
Triplicate

Propylipollis sp Martin & Harris 1975

Type species *P. retiuloscabratus* Harris 1965



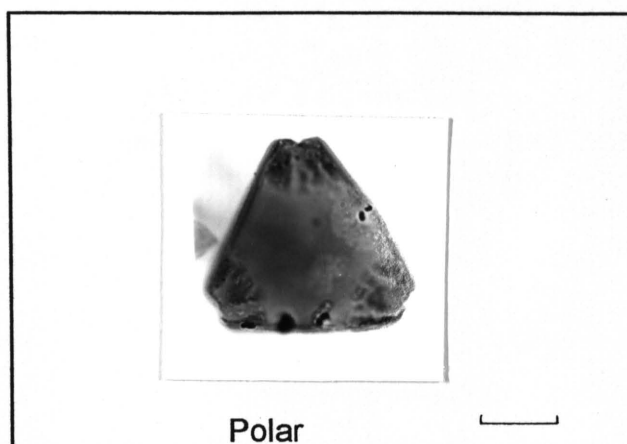
Polar



Equatorial

Specimens studied (9)

Spec no	Eq diam (μ)
Bold type = illustrated specimens	
3--9	23
8--34	24
88-42	43
91-13	40
139-13	23
157-()	26
168-3	17
173-18A	17
232-30	23
Average	26



Polar

Scale bar = 10 μ

Figure 3.50

Description

Amb shape	Triangular in polar view. Equ diam av 26μ
Pores	Three; placed equatorially Angulaperturate. Post-atrium internally striate
Exine	Tectate 1.5 - 2.5μ thick Fine columellae
Sculpturing	Psilate to scabrate/granulate

Illustrated specimen

(8-34) LM showing striations next to pore

Pollen Porate

Triplicate

Literature

species	Author	Description	Illustration	Geog loc	Age
<i>P. annularis</i>	Martin & Harris 1974	p 110	Fig 2C & D		
<i>Propylipollis</i>	Jansonius & Hills 1976		p 2150	n/a	n/a
<i>P. annularis</i>	Stover & Partridge 1982		Pl 2 fig 15	Australia	Eocene
<i>P. annularis</i>	Dettmann & Thomson 1987		fig 6	Antarctica	Cretaceous
<i>P. concretus</i>	Martin & Harris 1974	p 110	Fig 2 H		
<i>P. meyeri</i>	Scholtz 1985	p 61	Fig 14 F-J	South Africa	U Cret-Palaeocene
<i>Propylipollis</i> sp	Scholtz 1985	p 62	Fig 15 A & B	South Africa	U Cret-Palaeocene
<i>Propylipollis</i> sp	Stover & Partridge 1982		Pl 6 no 9	Australia	Eocene

Remarks

The west coast specimens also bear a resemblance to *Engelhardtioipollenites* (Potonié 1951 ex Potonié 1960) and *Engelhardtoidites* (Potonié, Thomson & Thiergart 1950 ex Potonié 1960). The positive identification was made as the grains satisfy the generic diagnosis of *Propylipollis* and no further literature was available for the other genera.

Botanical affinities *Engelhardtia* and *Alfoaroa* (Jansonius & Hills 1976).

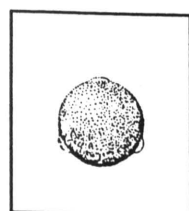
Proteaceae subfamilies Grevilleoideae and Persoonioideae (Scholtz 1985).

Distribution Well known. Found at all levels in all sites.

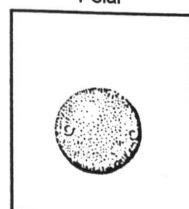
Age bracket U Cretaceous - Eocene

Proteacidites sp Cookson ex Couper 1953

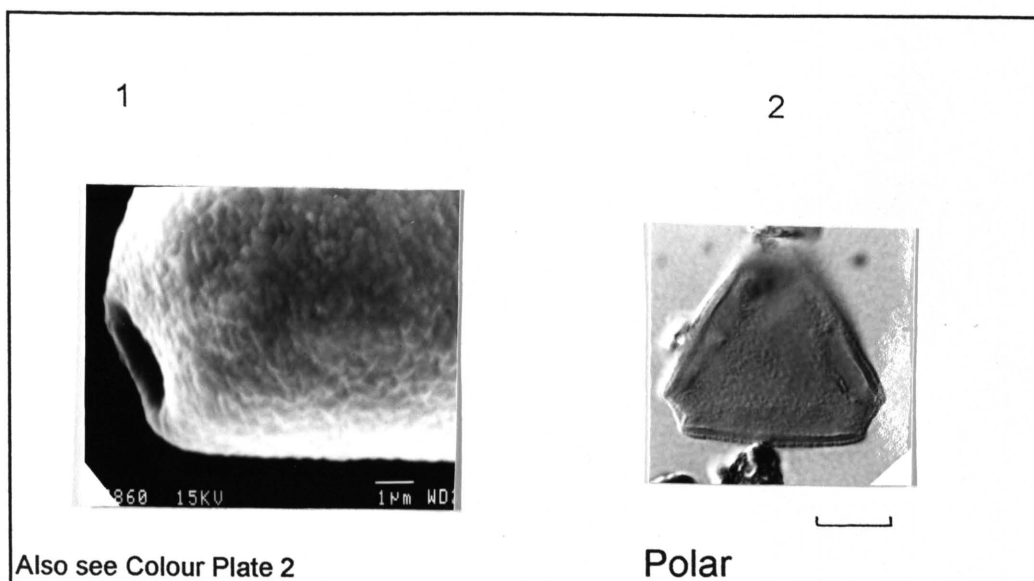
Type species *P. adenanthoides* Cookson 1950



Polar



Equatorial



Also see Colour Plate 2

Scale bars = 10 μ

Figure 3.51

Pollen
Porate
Triporate

Specimens studied (73)

Spec no	Eq diam (μ)
Illustrated specimens	
250-8	15
274-25	27

Average (73 specimens)	
Eq diam (μ)	21

Range (73 specimens)	
Eq diam (m)	10--47

Illustrated specimens

1. (250-8) SEM. Detail of pore - simple structure
2. (274-25) NOR-LM. This grain has relatively coarse surface structure

Description

Amb shape	Triangular to sub-triangular in polar view. Sides may be slightly concave or convex Equ diam av 21μ
Pores	Three; placed equatorially Simple, small, angulaperturate. Circular to oval in shape
Exine	Tectate. 1 - 3μ thick Thickest in interporal areas Does not thin markedly close to pores
Sculpturing	Psilate to scabrate/granulate Details often too fine to be observed with light microscope. SEM photos show that some grains possess perforated tectum.

Literature

species	Author	Description	Illustration	Geog loc	Age
<i>Proteacidites</i>	Jansonius & Hills 1976		p 2152	n/a	n/a
<i>P. adenanth's</i>	Cookson 1953	p 467	Pl 1 fig 20	Australia	U Oligo-L Miocene
<i>P. adenanth's</i>	Couper 1953		Pl 9 fig 137	New Zealand	U Cret - L Oligocene
<i>P. callosus</i>	Martin 1973	p 29	Fig 124	Australia	Tertiary
<i>P. cooksonii</i>	Salard-Chebouldaeff 1979		fig 22	Africa	Oligocene
<i>P. dehaani</i>	Germeraad et al 1966 p 312		Pl 9 3 & 4	Cent. America	
<i>P. dehaani</i>	Salard-Chebouldaeff 1979		fig 3	Africa	Maastrichtian
<i>P. heliciiformis</i>	Khan 1976	p 761	Fig 18	New Guinea	Pliocene
<i>P. ivanhoensis</i>	Martin 1973	p 29	Fig 125-127	Australia	Tertiary
<i>P. isopogiformis</i>	Couper 1960	p 51	Pl 6 fig 1 & 2	New Zealand	M Oligo
<i>P. isopogiformis</i>	Pocknall & Mildenhall 1984 p 43		Pl 23 fig 2	New Zealand	Oligocene-Miocene
<i>P. knightiformis</i>	Khan 1976	p 762	Fig 19 A & B	New Guinea	Pleistocene
<i>P. minimus</i>	Couper 1960	p 49	Pl 5 fig 15 & 16	New Zealand	U Oligo-L Pleistoc.
<i>P. rynthius</i>	Stover & Partridge 1982 p 82		Pl 4 fig 5 - 7	Australia	
<i>P. subscabratus</i>	Couper 1960	p 52	Pl 6 fig 8-10	New Zealand	M-U Oligocene
<i>P. subscabratus</i>	Harris 1965	p 92	Pl 29 fig 8 - 10	Australia	L Tertiary
<i>Triorites africaensis</i>	Jardine & Magloire 1965		Pl 8 fig 14-16	Cote d'Ivoire	Cretaceous
<i>Triorites africaensis</i>	Brenner 1968 p 378		Fig 4		
<i>P. subscabratus</i>	Martin 1973	p 31	Fig 137	New Zealand	Palaeo-Oligocene
<i>P. subscabratus</i>	Hos 1974	p 7	fig 22	Australia	U Eocene
<i>P. subscabratus</i>	Kemp 1975	p 607	Pl 7 fig 3 & 4	Antarctica	Eo-Oligocene
<i>P. subscabratus</i>	Dettmann & Thomson 1987 p 33		Fig 5 r	Antarctica	Cretaceous
<i>P. tenax</i>	Martin 1973		fig 1	Australia	
<i>P. tenuixinus</i>	Pocknall & Mildenhall 1984 p 45		Pl 25 fig 5	New Zealand	U Oligo-L Miocene
Proteaceae	Coetzee & Rogers 1982			South Africa	Miocene
<i>Proteacidites</i> sp	Hos 1974	p 11	fig 38	Australia	U Eocene
<i>Proteacidites</i> sp	Jardine & Magloire 1965		Pl 8 no 1	Africa	Cretaceous
<i>Proteacidites</i> sp	Kemp & Harris 1977 p 49		Pl 8 fig 20	Ninetyeast Ridge	Palaeo-Eo
<i>Proteacidites</i> sp A	Scholtz 1985	p 61	Fig 13 O - P	South Africa	U Cret-Palaeocene
<i>Triorites africaensis</i>	Schrank 1994 p 782		Pl 8 fig 14-16	Sudan	Cretaceous

Remarks

Grains of the type produced by extant Proteaceae are known from all (bar one) of the samples from the west coast. When compared to the literature, the diversity of forms encountered is not vast. Kemp (1975) comments that in New Zealand, and especially in Australia, large reticulate and granulate types characterise the assemblages. The west coast sediments appear to follow those from Antarctica in having small proteaceous grains with smooth or faintly scabrate sculpturing.

Grains were placed within the genus *Proteacidites* if they were triangular in polar view and had simple, angulaperturate pores. The grains were not placed into particular species because a range of morphological variation was encountered. Several authors (Harris 1965, Germeraad *et al.* 1966, Stover & Evans 1973, Stover & Partridge 1982, Pocknall & Mildenhall 1984, and others) have commented on similar occurrences with their material.

The literature list above reflects the number of published illustrations and descriptions that bear a good resemblance to the specimens found.

Botanical affinities Martin & Harris (1974) discuss the affinities of the the genus *Proteacidites*.

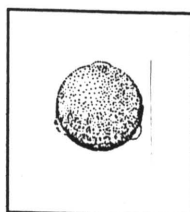
The genus is linked with the Proteaceae, however they state that it should not be concluded that all the species of *Proteacidites* are true Proteaceae as the morphology of some types cannot be matched in any existing family.

Distribution Significant. Found at all levels in all sites.

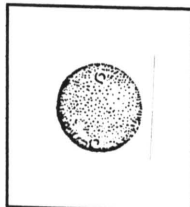
Age bracket Cretaceous - Pleistocene

Triorites sp Erdtman ex Cookson 1950

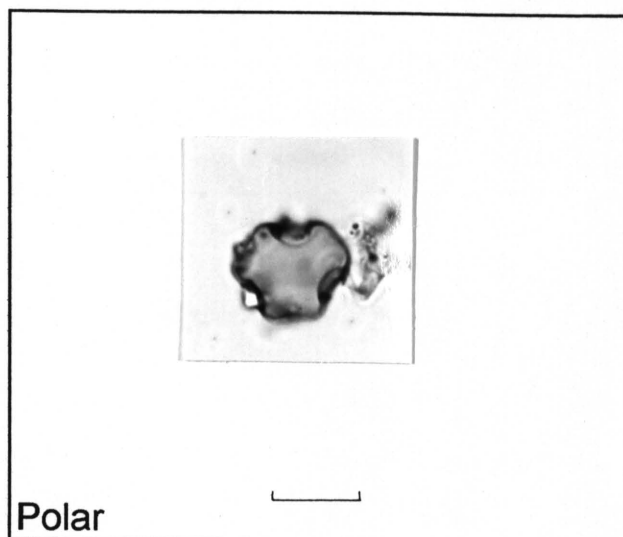
Type species *T. magnificus* Cookson 1950



Polar



Equatorial



Polar

Scale bar = 10 μ

Figure 3.52

Specimens studied (20)

Average (20 specimens)	
Eq diam (μ)	18

Illustrated specimen

(56-22) LM. Grain has sunken, annulate pores and truncated apices.

Description

Amb shape	Triangular to subcircular in polar view. Apices may be truncated Equ diam av 18 μ
Pores	Three; placed equatorially Vary from small to large Angulaperturate, circular to oval Possess atria, annulae or costae pori. Dimensions 6 μ at base, 2 μ high
Exine	Tectate 1 - 3 μ thick May vary across grain
Sculpturing	Psilate to scabrate/granulate

Literature

species	Author	Description	Illustration	Geog loc	Age
<i>Triorites</i>	Jansonius & Hills 1976		p 3038	n/a	n/a
<i>T. magnificus</i>	Couper 1953		PI 7 fig 110	New Zealand	U Cret - Eocene

Remarks

Specimens were assigned to this 'portmanteau' type if they were triporate with other than simple pores and could not be more accurately placed. The forms included here bore some resemblance to many published illustrations. However, they could not be confidently identified, partly due to conflicting taxonomic designations, as mentioned in Scholtz (1985) and partly due to the fact that well preserved grains of each form were not found in sufficient number to describe further.

Botanical affinities Not known. Various species of *Triorites* have been allied to families such as Proteaceae and Casuarinaceae.

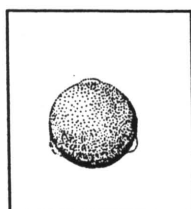
Distribution Little known. Found at all levels, all sites.

Age bracket Upper Cretaceous - Eocene, possibly later

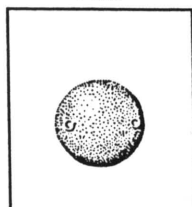
Pollen Porate

Triporate

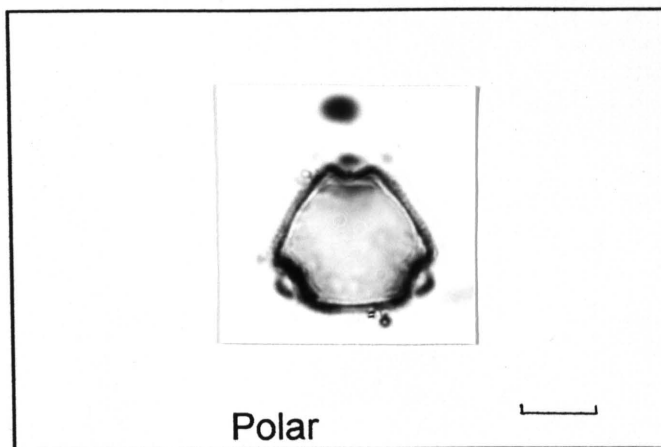
Triporate Pollen A



Polar



Equatorial



Polar

Scale bar = 10 μ

Figure 3.53

Specimens studied (1)

Spec no	Eq diam (μ)
Bold type = illustrated specimen	
136-8	19

Illustrated specimen

(136-8) LM. Focus on wall of grain and pores

Description

Amb shape	Triangular in polar view
Pore	Three complex pores with distinct annulus and operculum. Angulaperturate, placed equatorially
Exine	2-4 μ thick Thicker close to pores
Sculpturing	Reticulate. Robust columellae Reticulum higher in interporal areas Lumina c. 0.5 μ in polar area

Pollen Porate

Triporate

Literature

The west coast specimen could not be identified

Remarks

Only one grain of this type was found in the west coast sediments. It could not be placed with confidence within any known triporate genus in the literature consulted, as the features observed did not match any published illustration or description.

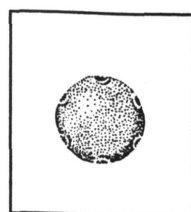
Botanical affinities Not known

Distribution Very rare. A single specimen was found, in 34-10 from the channel peats at Koingnaas

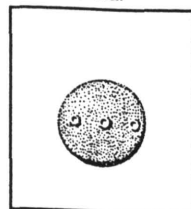
Age bracket Not known

? *Tetraporina* sp Naumova ex Bolkovitina 1953

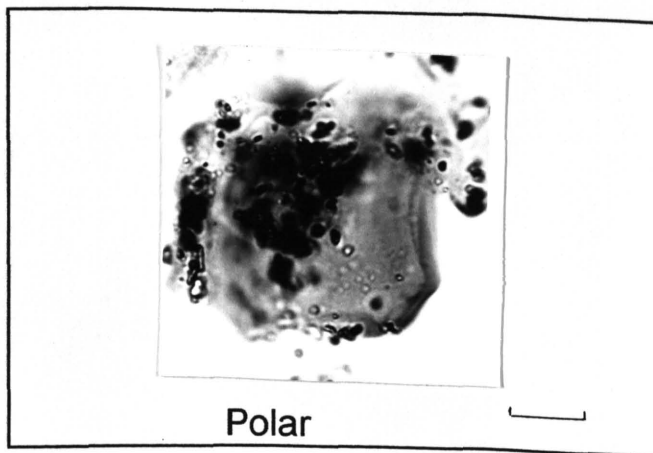
Type species *T. pellucida* Naumova ex Bolkhovitina 1953



Polar



Equatorial



Polar

Scale bar = 10 μ

Figure 3.54

Specimens studied (2)

Spec no	Eq diam (μ)
Bold type = illustrated specimen	
59-38	30
111-38	20

Illustrated specimen

(59-38) LM showing pore structure.
Grain largely obscured by debris

Description

Amb shape	Square in polar view
	Sides concave
Pores	Four aspidate pores placed equatorially, angulaperturate
Exine	1 - 2 μ thick.
Sculpturing	Reticulate. Columellae are very fine.

Literature

Author	Description	Illustration	Geog loc	Age
Jansonius & Hills 1976		p 3416	USSR	Cretaceous

Remarks

Only two specimens were found. Both grains were not well preserved and obscured by debris. They were placed provisionally within the genus *Tetraporina* as no similar grains were described in the literature consulted. The genus accommodates 'angiospermous pollen with four pores, without folds'.

Botanical affinities Probably angiospermous.

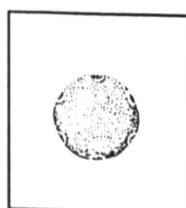
Distribution Very rare. Isolated specimens were found in the Main Peat Horizon and the channel peats at Koinaas

Age bracket Cretaceous

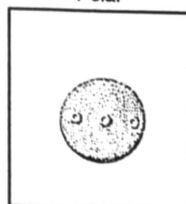
Pollen Porate

Stephanoporate

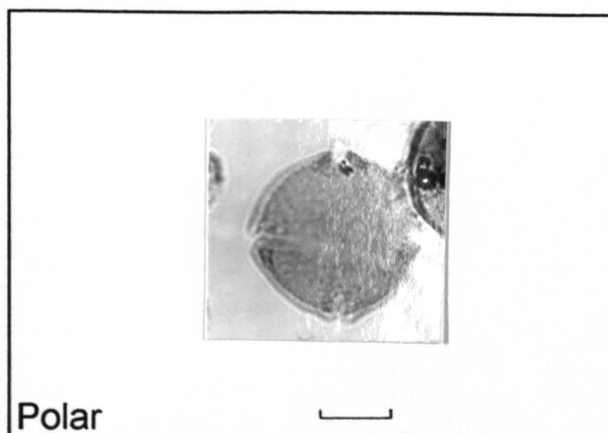
Stephanoporate Pollen A



Polar



Equatorial



Polar

Scale bar = 10 μ

Figure 3.55

Description

Amb shape	Circular in polar view. Equ diam av 22 μ
Pores	Four; one specimen with five Placed equatorially Diameter 2-3 μ Circular to oval in shape Non-aspitate, possess annulae or costae pori
Exine	Tectate 1 - 2 μ thick Fine columellae
Sculpturing	Psilate to granulate

Illustrated specimen

(171-7) LM. Focus on wall of grain and pores

Specimens studied (10)

Spec no	Eq diam (μ)
Bold type = illustrated specimen	
19-16	24
167-4	17
170-7	28
171-7	19
171-15	18
172-26	20
172-29	19
187-8	22
215-31A	27
275-36	24
Average	22

Pollen Porate

Stephanoporate

Literature

The west coast specimens could not be identified

Remarks

No suitable match for this form could be found in the literature consulted.

According to Jansonius & Hills (1976), *Stephanoporites* is a later synonym of *Alnus*, a modern form. *Alnipollenites* has protruding germinals with vestibulae, and the pores are connected by arci, thus the west coast forms cannot be identified with this genus. *Stephanoporopollenites* is concave not convex between the pores. *Polyporites* has pores which are other than equatorially placed. A reasonable similarity exists with the illustration of *Pterocaryapollenites* in Jansonius & Hills (1976), however the west coast specimens have too few pores and they are not aspitate. The west coast specimens do match the generic diagnosis for *Nothofagites*, however four pores are not the norm. Virtually every species has 5-7 pores, and is straight not concave between the pores/colpi.

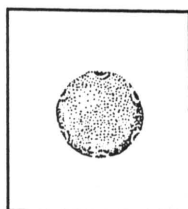
This form can be distinguished from *Byttneripollis* as the pores are smaller, always equatorial and the exine is thicker.

Botanical affinities Unknown

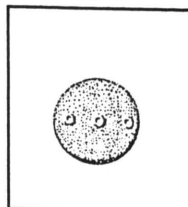
Distribution Rare. Found in 35-4, in the higher part of the sequence at Langklip. Isolated specimens found at top of sequence, and also in Main Peat Horizon, Koinaas.

Age bracket

Stephanoporate Pollen B



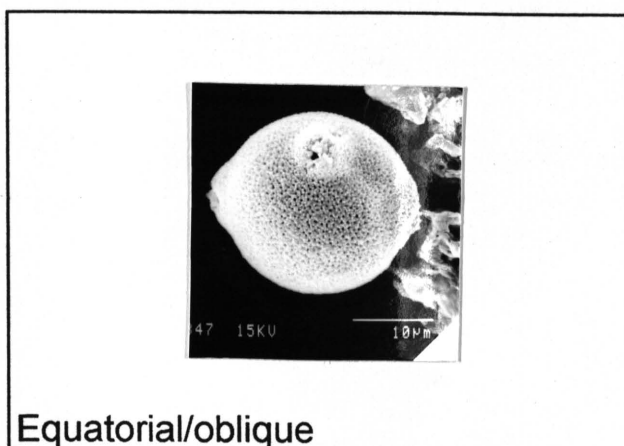
Polar



Equatorial

Specimens studied (4)

Spec no	Eq diam (μ)
Bold type = illustrated specimen	
79-6A	43
81-31	40
82-37	38
249-33	25
Average	37



Equatorial/oblique

Scale bar = 10 μ

Figure 3.56

Description

Amb shape	Spheroidal. Circular in polar view. Equ diam av 37 μ
Pores	Four or more; probably placed equatorially. Circular in shape Each with annulus and atrium Diameter 5 μ . Height 4 μ
Exine	Tectate, perforated. 2-4 μ thick
Sculpturing	Foveolae <0.5 μ diameter At nodes, small granulae found 1 μ high, finer close to pores

Illustrated specimen

(249-33) SEM. Whole grain showing spherical amb, structure of pores and surface

Literature

The west coast specimens could not be identified

Remarks

No suitable match for this form could be found in the literature consulted. The various porate genera considered were mentioned in the remarks for Stephanoporate Pollen A.

This form can be distinguished from *Byttneripollis* as the pores are larger, and the exine is thicker.

Botanical affinities Unknown

Distribution Well known. Found in all levels in all sites

Age bracket Unknown

Pollen Porate

Stephanoporate

Stephanoporate Pollen C

Pollen Porate Stephanoporate



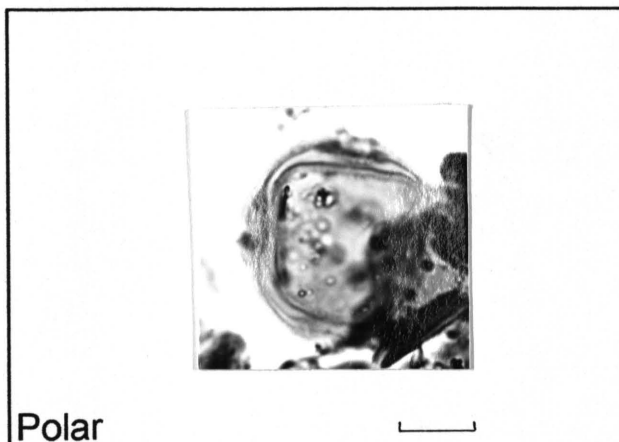
Polar



Equatorial

Specimens studied (5)

Spec no	Eq diam (μ)
Bold type = illustrated specimen	
73-33	27
86-7	32
91-4	30
99-36	25
123-1	22
Average	27



Polar

Scale bar = 10 μ

Figure 3.57

Description

Amb shape	Square in polar view. Equ diam av 27 μ
Pores	Four; placed equatorially planaperturate Large, probably circular in shape Each with annulus and atrium Diameter >5 μ . Height >5 μ
Exine	Tectate, several layers seen. Nexine thickest. Total thickness up to 5 μ , esp sides of amb
Sculpturing	Psilate or finely granulate

Illustrated specimen

(73-33) LM. Partly obscured by debris. Focus on wall of grain and pores

Literature

The west coast specimens could not be identified

Remarks

No suitable match for this form could be found in the literature consulted. The various porate genera considered were mentioned in the remarks for Stephanoporate Pollen A.

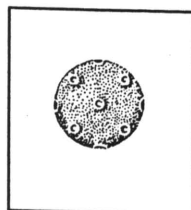
Botanical affinities Unknown

Distribution Very rare. Isolated specimens found in all levels in all sites

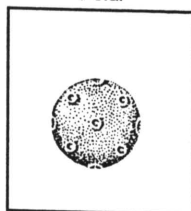
Age bracket Unknown

Byttneripollis sp Couper 1953

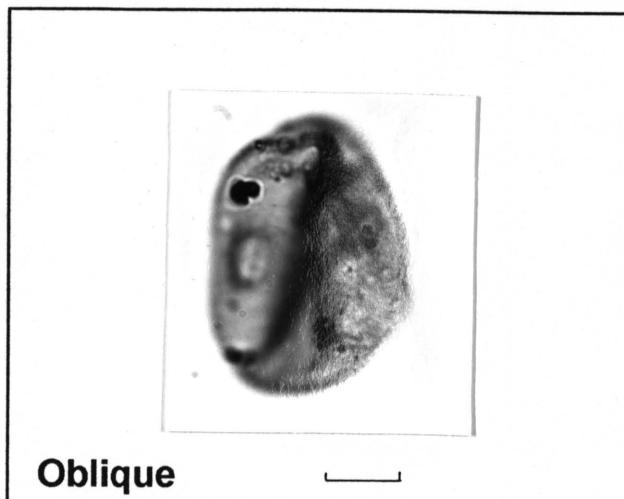
Type species *B. coronarius* Konzalova' 1976



Polar



Equatorial



Oblique

Scale bar = 10 μ

Figure 3.58

Specimens studied (39)

Spec no	Eq diam (μ)
Bold type = illustrated specimen	
70-22	37

Average of specimens (39)	
Eq diam (μ)	26

Range of specimens (39)	
Eq diam (μ)	15-40

Description

Amb shape	Circular (spherical) Often crumpled Av diam 26 μ
Pores	Four, occasionally five Large; 3-5 μ diameter Annulate
Exine	Thin (1 μ)
Sculpturing	Finely reticulate

Pollen Porate

Periporate

Illustrated specimen

(70-22) LM showing folded grain. All four pores seen, marked by annuli

Literature

Author	Description & illustration	Geog loc	Age
Jansonius & Hills 1976	p 3452	Europe	L Miocene

Remarks

The west coast specimens resembled the illustration in Jansonius & Hills (1976) for the genus *Byttneripollis*. No other literature for this genus was found.

This form differed from Stephanoporate Pollen A in that it is probably spheroidal whereas the other is probably oblate in polar view. The pores are assumed to equatorial as they are evenly spaced although many of the grains are found crumpled. In Stephanoporate Pollen A, they are always found on the equator.

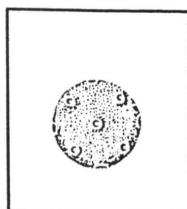
Botanical affinities ? Modern pollen *Byttneria* (Jansonius & Hills 1976) Byttneriaceae of the Malvales (Dilleniidae).

Distribution Well known from all levels at Koinaas and Langklip

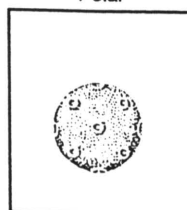
Age bracket L Miocene

Cretacaeiporites sp Herngreen 1974

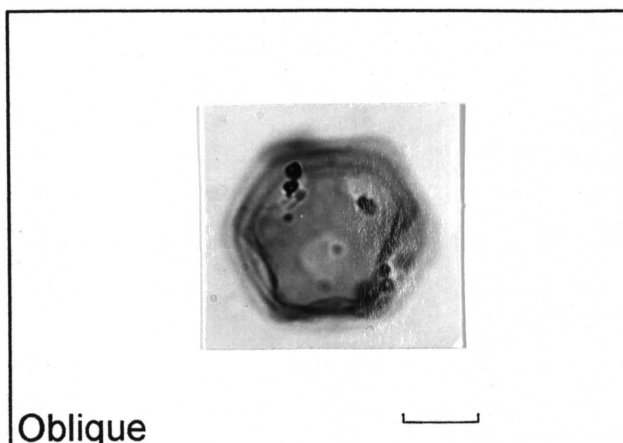
Type species *C. polygonalis* (Jardine & Magloire) nov. comb.



Polar



Equatorial



Oblique

Scale bar = 10 μ

Figure 3.59

Specimens studied (12)

Spec no	Eq diam (μ)
Bold type = illustrated specimen	
29-28	14
64-27	30
64-30	28
64-33	27
80-18	25
257-5	15
257-19	15
277-18	14
277-33	15
277-41	17
278-17	13
278-24	15
278-37	15
Average	19

Description

Amb shape	Polygonal in outline Diameter av 19 μ
Pores	Periporate; regular in size 5 - 7.5 μ diameter Each pore with membrane Sunk below outline of grain
Exine	2 - 5m thick Columellae tall in interporal areas
Sculpturing	Relatively smooth

Range of specimens (12)

Eq diam (μ)	13-30
-------------------	-------

Illustrated specimen

(80-18) LM. Pores and columellae shown

Pollen Porate

Periporate

Literature

species	Author	Description	Illustration	Geog loc	Age
<i>Cretacaeip'tes</i>	Jansonius & Hills 1976		p 652	n/a	n/a
<i>C. polygonalis</i>	Morgan 1978	p 923	Pl 8 fig 3	Angola	Cretaceous
<i>C. mulleri</i>	McLachlan & Pieterse 1978		Pl 5 fig 24	Offshore South Africa	U Cretaceous
<i>C. polygonalis</i>	Schrank 1994	p 782	Fig 8 n	Sudan	Cretaceous

Remarks

The west coast specimens bore a resemblance to several published illustrations of different species. Most of the illustrations did not have accompanying descriptions, and the featured specimens were contorted.

The grains also resemble a form described in Kemp & Harris (1977) as *Polycopites* sp.

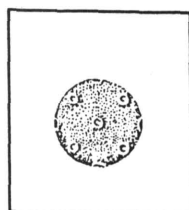
Botanical affinities Not stated

Distribution Well known in isolated samples from Koinaas

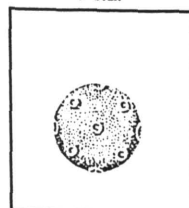
Age bracket Cretaceous

Thymelipollis sp Krutzsch 1966

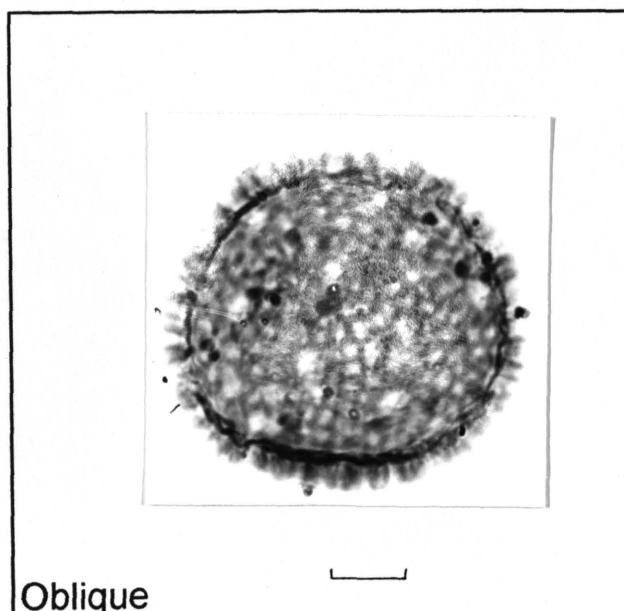
Type species *T. retisculpturis* Krutzsch 1966



Polar



Equatorial



Oblique

Scale bars = 10 μ

Figure 3.60

Description

Amb shape	Circular in outline (spherical) Large; diam av 39 μ
Pores	Periporate; 20-25 open pores regular in size and distribution approx 3 μ diameter
Exine	Thick - 5 μ . Multilayered Complex structure/sculpture
Sculpturing	Reticulate, consisting of tall muri (5 μ) with 'beaded' tops Lumina almost same size as pores, decreasing in size with proximity to pores

Specimens studied (6)

Spec no	Eq diam (μ)
Bold type = illustrated specimen	
11-12	45
37-1	35
69-42	40
152-6	37
174-8	40
124-30	38
Average	39

Illustrated specimen

(11-12) LM. Pores and exine structure and sculpture seen

Literature

species	Author	Description	Illustration	Geog loc	Age
<i>Thymelipollis</i>	Jansonius & Hills 1976		p 2900	Europe	Miocene
<i>T. retisculpturis</i>	Salard-Cheboudaeff 1979 p 782		fig 8	Africa	L Miocene

Remarks

Several genera of periporate pollen resemble this form. *Buxapollis* does not have the robust and diagnostic wall structure. *Pseudospinaepollis* is smaller with a less complex wall. *Chenopodipollis* has too many pores. *Punctioratipollis* has a simple wall with different sculpture.

Botanical affinities Thymelaeaceae (Jansonius & Hills 1976) of the Myrtales (Rosidae)

Distribution Very rare. Isolated specimens found in samples from the Main Peat Horizon Koingnaas and from Langklip.

Age bracket Miocene

Pollen
Porate
Periporate

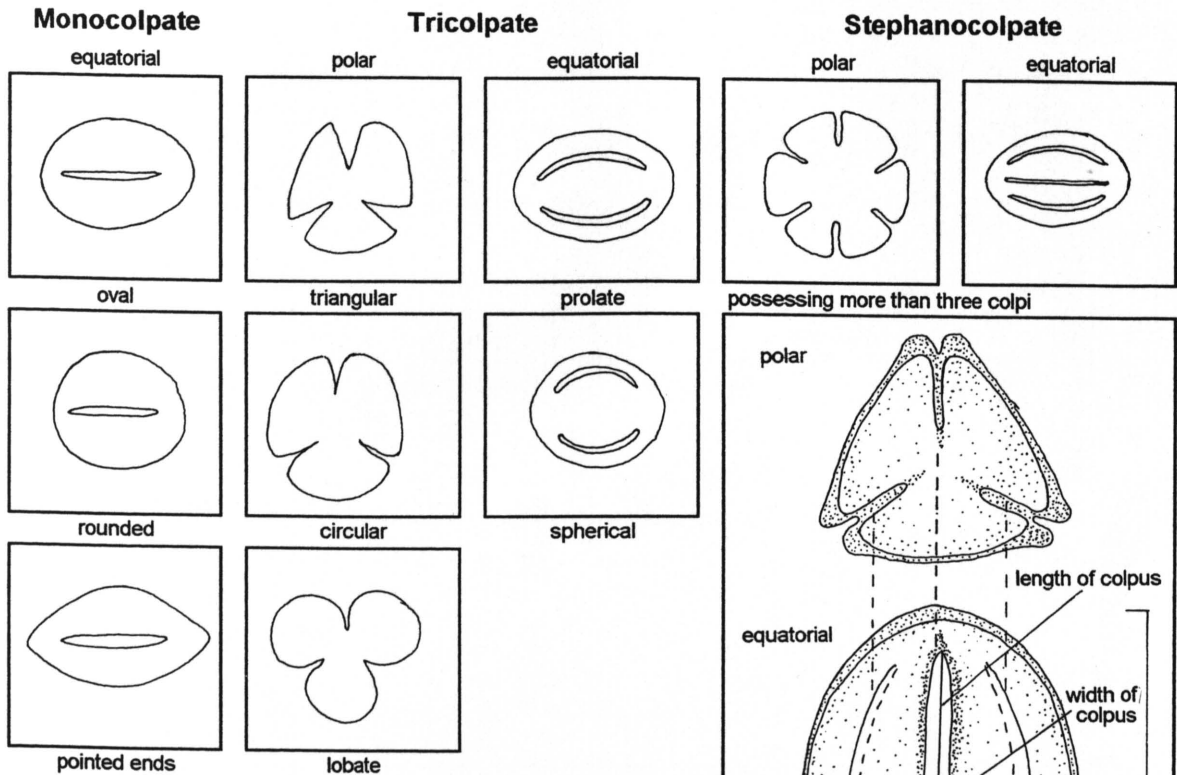
Colpate pollen

Graphic glossary of technical terms

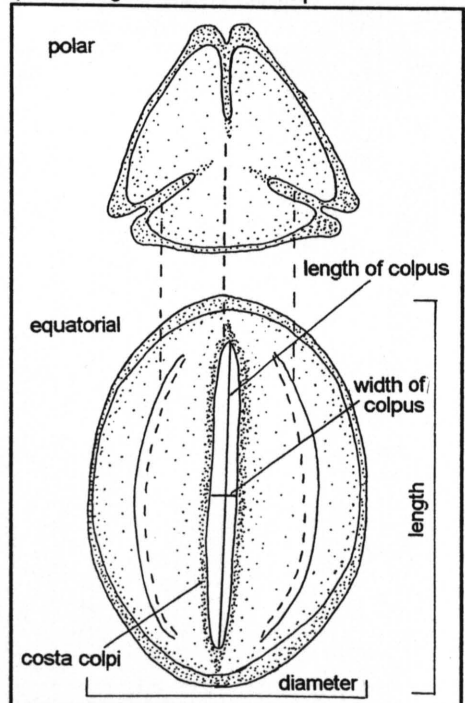
Figure 3.61

Pollen Colpate

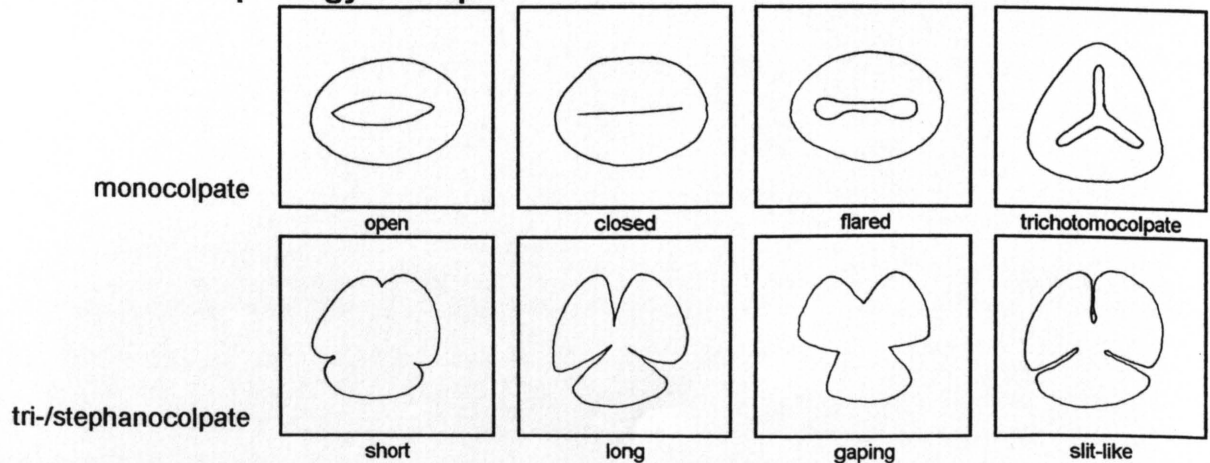
Shape of amb



Definition: Possessing elongated apertures (length more than twice width) devoid of pores (Kremp 1965). Punt *et al.* (1994) add that 'colpi' may be restricted to equatorial, meridional apertures while distal or proximal apertures may be termed 'sulci'

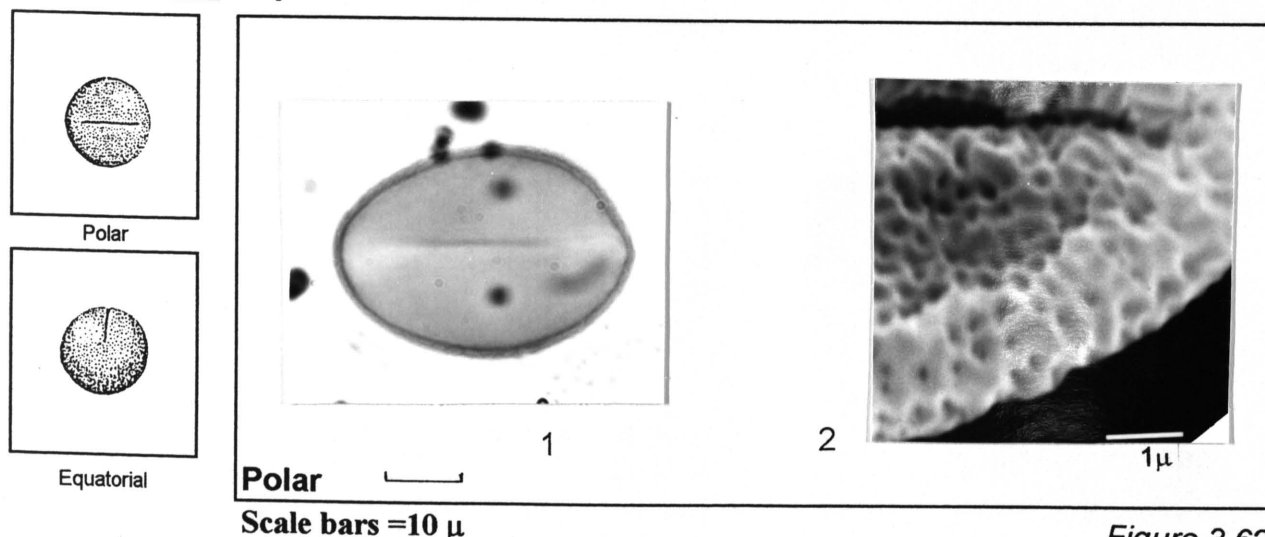


Morphology of colpi



Arecipites sp Wodehouse 1933 emend. Nichols, Ames & Traverse 1973

Type species *A. punctatus* 1933



Scale bars = 10 μ

Figure 3.62

Specimens studied (11)

Average (11 specimens)	
Length (μ)	24
Width (μ)	15

Range (11 specimens)	
Length (μ)	18-37
Width (μ)	11-27

Illustrated specimens

1. (145-23) LM. Grain with closed colpus
2. (245-14) SEM. Details of surface.

Description

Amb shape	Oval in polar view, ends rounded Length of grain av. 24μ Width of grain av. 15μ
Colpus	Single; long, extends almost length of grain. Ends taper, (not open or gaping)
Exine	Perforated tectum 1 - 2μ thick
Sculpturing	Finely pitted Foveolae < 0.5μ

Literature

species	Author	Description	Illustration	Geog loc	Age
<i>A. m' reticulus</i>	Anderson 1960		PI 1 fig 17 & 18	New Mexico	U Cretaceous
<i>A. reticulatus</i>	Anderson 1960	PI 1 fig 19; PI 7 fig 6; PI 8 fig 3; PI 10 fig 7		New Mexico	U Cretaceous
<i>Arecipites</i>	Nichols et al 1973 p 248		PI 1 fig 9 - 12	n/a	n/a
<i>Arecipites</i>	Jansonius & Hills 1976 p 166			n/a	n/a
<i>A. insularis</i>	Kemp & Harris 1977 p 54		PI 4 fig 5 & 6	Ninetyeast Ridge	Palaeocene
<i>A. waitakiensis</i>	Kemp & Harris 1977 p 54			Ninetyeast Ridge	Palaeocene
<i>A. sp</i>	Harris 1978		PI fig 10 & 11	Ninetyeast Ridge	Palaeocene
<i>A. plectimuratus</i>	Scholtz 1985			South Africa	
<i>Arecipites</i> sp	Christopher et al		PI 3 fig 1 & 2		

Remarks

Nichols *et al.* (1973) examine this genus in their paper and compare it to several other monocolpate genera. They state that the features of primary importance for grains belonging to this genus are the form of the colpus (tapering not open or gaping) and the exine structure (tectum supported by collumellae, not reticulate). This genus is differentiated from *Liliacidites* on the latter point.

More than one species may be included in this group as the features vary.

Botanical affinities Palmae, especially modern genus *Phoenix* (Nichols et al 1973) (Arecales: Arecidae)

Distribution Little known; all levels at Koinaas and Langklip

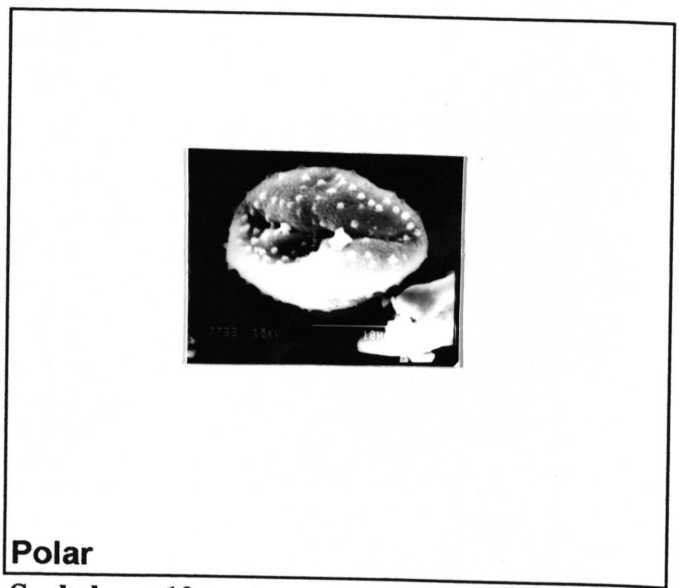
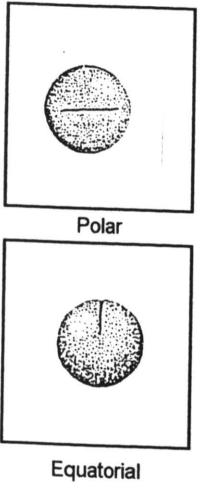
Age bracket Palaeocene

Pollen Colpate

Monocolpate

***Echimonocolpites* sp van der Hammen & García de Mutis 1965**

Type species *E. ruedae* (van der Hammen) van der Hammen & García de Mutis 1965



Polar
Scale bar =10 μ

Figure 3.63

Pollen Colpate Monocolpate

Specimens studied (3)

Spec no	Long axis (μ)
Bold type = illustrated specimen	
107-11	44
247-12	22
248-2	27
Average	25

Illustrated specimen
(247-12) SEM. Echinate surface shown.

Description

Amb shape	Oval in polar view Long axis of grain av. 25 μ
Colpus	Closed. Extends length of grain Ends slightly flared
Exine	Thin; 1 μ
Sculpturing	Echinate; spines very small <1 μ at base, <1 μ high

Literature

species	Author	Description	Illustration	Geog loc	Age
<i>Echimonoc'tes</i>	Jansonius & Hills 1976		p 886	(S America)	Maastrichtian
<i>E. minutus</i>	Salard-Chebodaeff 1979		fig 5 a & b	Africa	L Miocene
<i>E. rarispinosus</i>	Salard-Chebodaeff 1979		fig 2	Africa	L Miocene

Remarks

Botanical affinities Not stated - could be Palmae
Distribution Very rare. Isolated specimens found above and within Main Peat Horizon at Koinznaas and at Langklip.
Age bracket Palaeocene - M Eocene

Liliacidites sp Couper 1953

Type species *L. kaitangataensis* Couper 1953

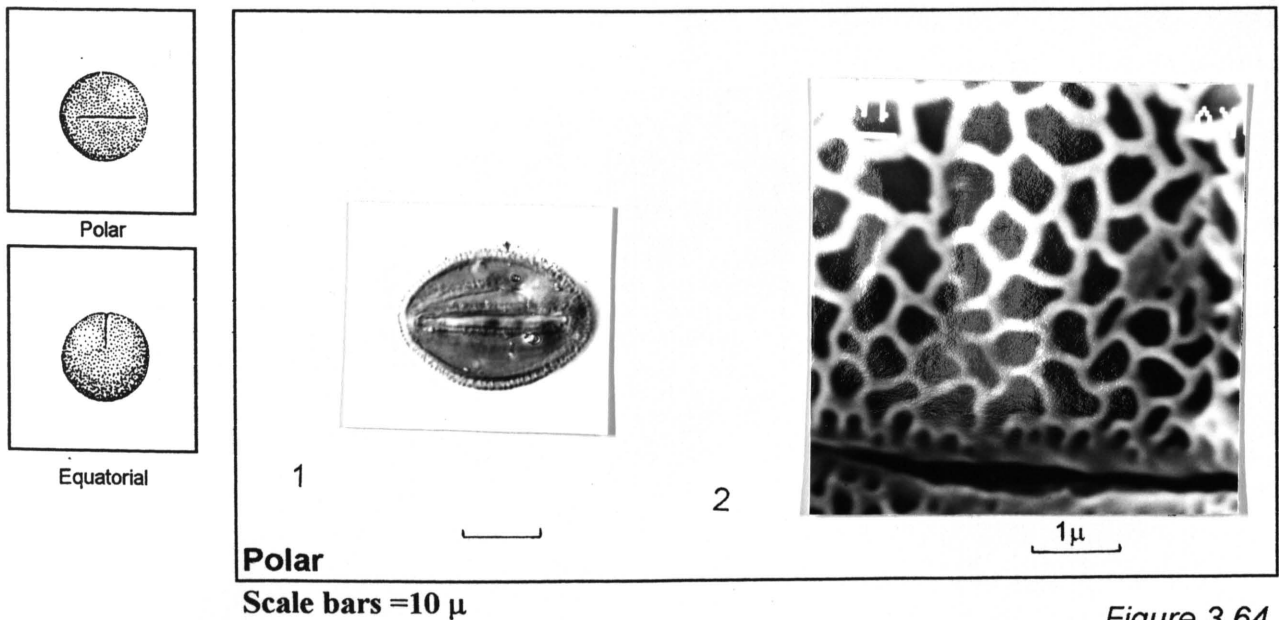


Figure 3.64

Specimens studied (45)

Average (45 specimens)	
Length (μ)	37

Range (45 specimens)	
Length (μ)	15-63

Illustrated specimens

1. (262-13) NOR-LM
Columellae slightly taller in centre
2. (268-18) SEM Details of surface and reticulum

Description

Amb shape	Oval in polar view, ends rounded Length of grain av. 37μ
Colpus	Single; long & broad, may extend almost length of grain Ends taper (not open or gaping) Edges smooth
Exine	1 - 3μ thick Columellae well seen in sexine
Sculpturing	Reticulate; lumina often larger in centre of grain Lumina diameter < muri thickness

Literature

species	Author	Description	Illustration	Geog loc	Age
<i>L. kaitangatae's</i>	Couper 1953		Pl 7 fig 97	New Zealand	U Cretaceous - Miocene
<i>L. intermedius</i>	Couper 1953		Pl 7 fig 100	New Zealand	U Cretaceous - Miocene
<i>L. intermedius</i>	Dettmann 1973		Pl 1 fig 6 - 8	Australia	Cretaceous
<i>L. kaitangatae's</i>	Dettmann 1973		Pl 1 fig 1 5	Australia	Cretaceous
<i>L. aviemorensis</i>	Hos 1974	p 11	Fig 48		
<i>Liliacidites</i>	Jansonius & Hills 1976		p 1489	n/a	n/a
<i>Liliacidites</i>	Jansonius & Hills 1976		p 4462	n/a	n/a
<i>L. intermedius</i>	McLachlan & Pieterse 1978			Offshore South Africa	
<i>Liliacidites</i> sp	Scholtz 1985			South Africa	

Remarks

Couper (1953) established *Liliacidites* 'for the reception of fossil pollens of liliaceous affinities that cannot be more accurately placed' and is used here as a 'portmanteau' category for all monocolpate pollen which have a tapering colpus and a fine reticulum with differential mesh size. Other reticulate grains were referred to *Retimonocolpites*, if the mesh was even.

Foveolate tectate specimens were referred to *Arecipites*.

More than one species may be included in this group as the features vary.

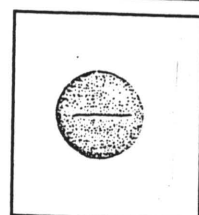
Botanical affinities Liliaceae, Araceae and Amaryllidaceae (Pocknall 1982)

Distribution Little known; all levels at Koingnaas and Langklip

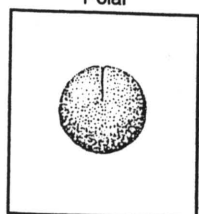
Age bracket Palaeocene

***Monocolpopollenites* sp Pflug & Thomson in Thomson & Pflug 1953**
 emend. Nichols, Ames & Traverse 1973

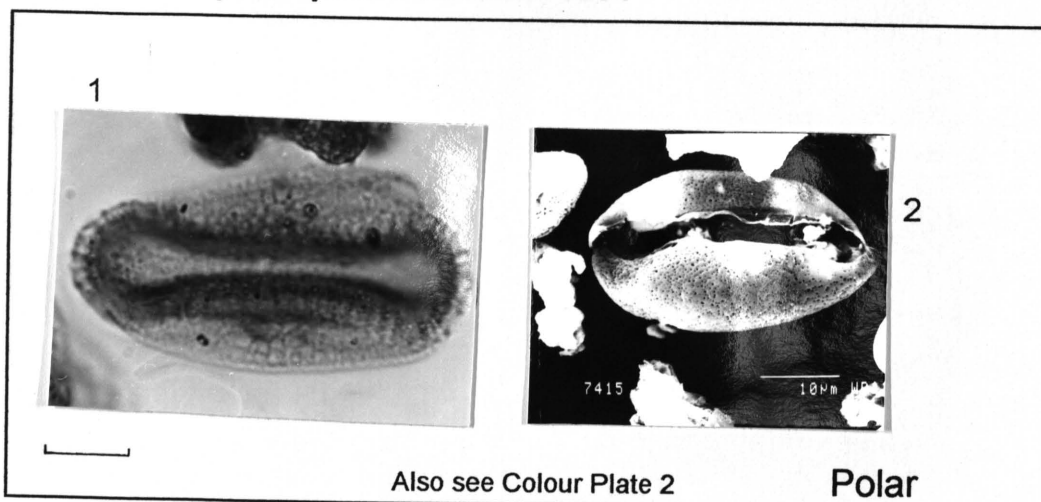
Type species *M. (Pollenites) tranquillus* Potonie' 1934



Polar



Equatorial



Also see Colour Plate 2

Polar

Scale bars = 10 µ

Figure 3.65

Specimens studied (42)

Average (42 specimens)	
Length (µ)	31
Width (µ)	17
Range (42 specimens)	
Length (µ)	12--54
Width (µ)	9--29

Illustrated specimens

1. (97-41) LM. Grain showing colpus with flared ends. Robust columellae can be seen.
2. (247-7) SEM. Grain with finely perforated tectum.

Description

Amb shape	Oval in polar view, ends rounded Length of grain av. 31µ Width of grain av. 17µ
Colpus	Single; long, may extend entire length of grain. Ends flared May be closed in centre
Exine	Tectate; columellae 1 - 3µ high
Sculpturing	Psilate to reticulate Lumina 1µ diam

Pollen Colpate Monocolpate

Literature

species	Author	Description	Illustration	Geog loc	Age
<i>Monocolpopites</i> sp	Jardine & Magloire 1965		Pl 8 fig 31-35		
<i>M. tranquillus</i>	Thomson & Pflug 1953			Europe	
<i>Monocolpites</i> sp*	Thomson & Pflug 1953			Europe	
<i>M. tranquilloides</i>	Nichols et al 1973 p 51		Pl 2 fig 2 - 5	USA	Palaeocene
<i>M. reticulatus</i>	Nichols et al 1973 p 53		Pl 2 fig 6 - 9	USA	Palaeocene
<i>Monocolpopites</i>	Jansonius & Hills 1976		p 1681	n/a	n/a
<i>Monocolpopites</i> sp	Scholtz 1985			South Africa	
<i>M. reticulatus</i>	Christopher et al 1990		Pl 3 fig 7		
<i>Monocolpopites</i> sp* Thomson & Pflug erected many species attributed to this genus, which do not conform with emended diagnosis					

Remarks

As Nichols *et al* (1973) point out, there is much confusion in the literature over the type species of this genus. Their suggestions and comments have been adopted.

Grains were placed within this group if they possessed a long, flaring colpus and reticulate sculpture. More than one species may be included. They were differentiated from other monocolpate grains by these features, as in *Cycadopites* the colpus is long and open, and larger overall; in *Clavatipollenites* the colpus does not flare and the reticulum is coarser.

Botanical affinities Various Monocotyledonae (incl Palmae) and Cycadophyta (Nichols *et al*, 1973)

Distribution Well-known from Langklip & Somnaas/Noup. Isolated specimens from Koinaas.

Age bracket Palaeocene

Retimonocolpites sp Pierce 1961

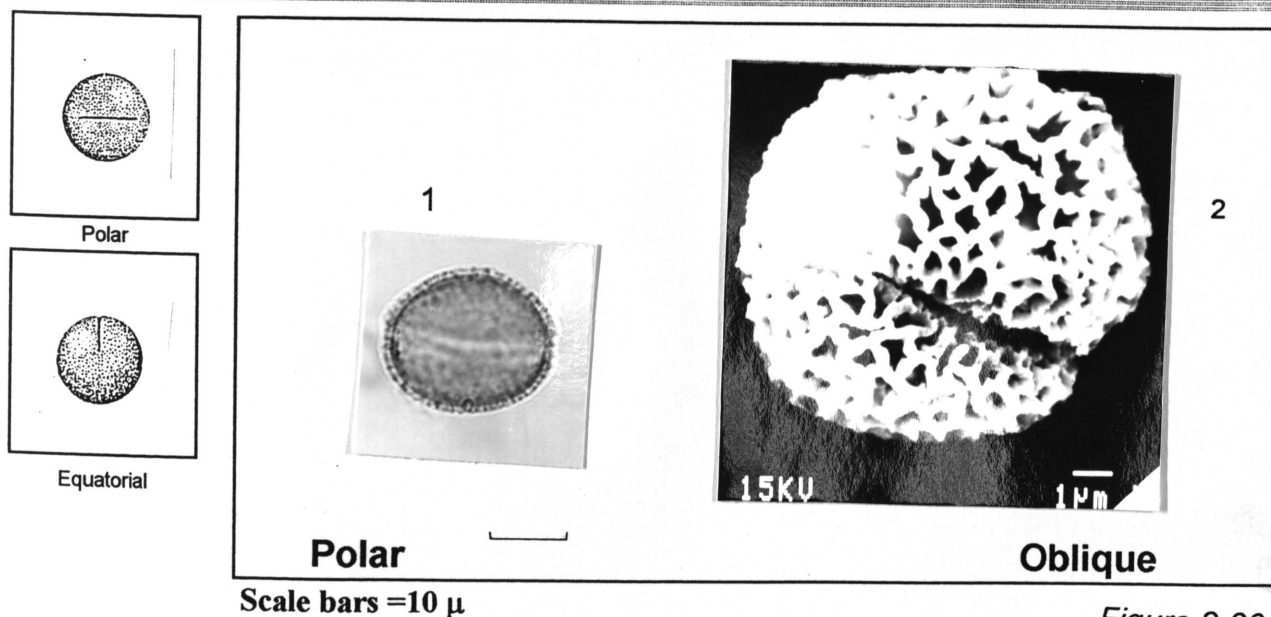


Figure 3.66

Specimens studied (12)

Spec no	Length (μ)	Width (μ)
177-7	40	34
182-18	35	23
183-29	30	20
191-42	12	10
193-36	22	13
194-8	20	15
194-11	20	17
195-19A	21	14
199-5	13	8
247-24	17	14
242-22	17	13
242-26		16
Average	22	16

Description

Amb shape	Oval to almost circular in polar view, ends rounded Length of grain av. 22μ Width of grain av. 16μ
Colpus	Single; long, broad. Extends for length of grain, ends not flared
Exine	Thick (3-5μ) Sexine thicker than nexine Slightly thicker around equator Nexine unstructured
Sculpturing	Coarsely reticulate Lumina c. 1μ Extrasexinous granules at nodes

Illustrated specimens

1. (194-11) LM. Focus on wall of grain
2. (242-22) SEM. Coarse reticulum seen well.

Literature

species	Author	Description	Illustration	Geog loc	Age
<i>R. nigeriensis</i>	van Hoeken-Klinkenberg 1966		Fig 14	Nigeria	M Eocene
<i>R. irregularis</i>	Salard-Chebodaeff 1979		Fig 13	Cameroon	Oligocene
<i>R. pluribaculatus</i>	Salard-Chebodaeff 1979		Fig 8	Nigeria	Maastrichtian

Remarks

The colpus margins of this kind of grain are used to differentiate between various monocolpate genera (Kemp & Harris 1977). The colpus margins of the west coast specimens could not be examined often, thus the grains were not placed within *Clavatipollenites*.

The grains identified as *Retimonocolpites* were differentiated from other monocolpate grains by their exine structure, coarse reticulum and straight colpi.

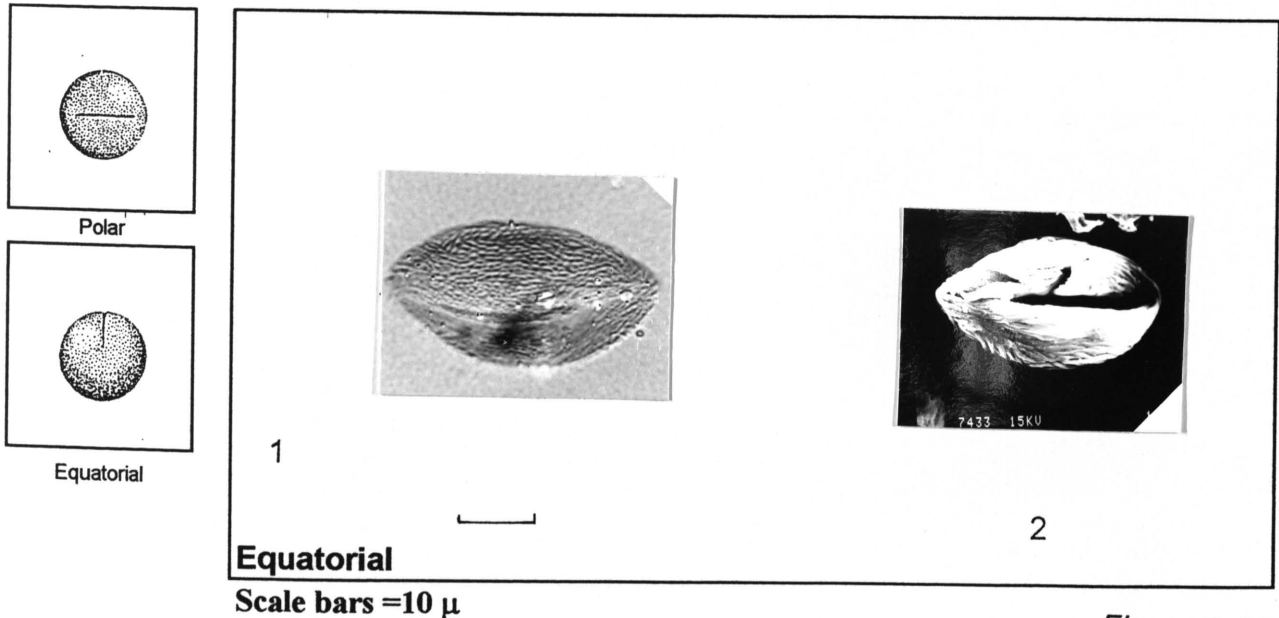
Botanical affinities Not known

Distribution Little known. Found at Koingnaas and Langklip but not Somnaas/Noup.

Age bracket Maastrichtian - M Eocene

Striamonocolpites sp Mather & Mather 1969

Type species *S. longicolpatus* Mather & Mather 1969



Specimens studied (18)

Average (18 specimens)	
Long axis (μ)	32
Range (18 specimens)	
Long axis (μ)	19-45

Illustrated specimens

- (260-22) NOR-LM. Striate surface of grain seen well.
- (242-24) SEM. Grain damaged but striate sculpturing well shown. Colpus virtually closed

Description

Amb shape	Oval in polar view, ends usually pointed Long axis of grain av. 24 μ
Colpus	Closed or slightly gaping Extends length of grain Ends slightly flared
Exine	1 - 3 μ thick
Sculpturing	Striate; vary from 0.5 μ thick and relatively long, to fine and short

Literature

species	Author	Description	Illustration	Geog loc	Age
<i>Striamonocolpites</i>	Jansonius & Hills 1976		p 2730	India	Pliocene

Remarks

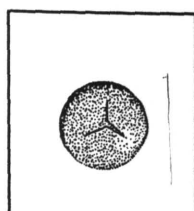
A variety of monocolpate grains are 'lumped' together in this category as no good match was found in the literature consulted and the grains comply with the generic diagnosis as given in Jansonius & Hills (1976).

Botanical affinities ? Palmae (Jansonius & Hills 1976)

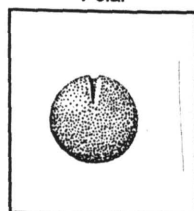
Distribution Rare. Found at Langklip and all levels at Koingnaas.

Age bracket Pliocene

Trichotomocolpate pollen



Polar



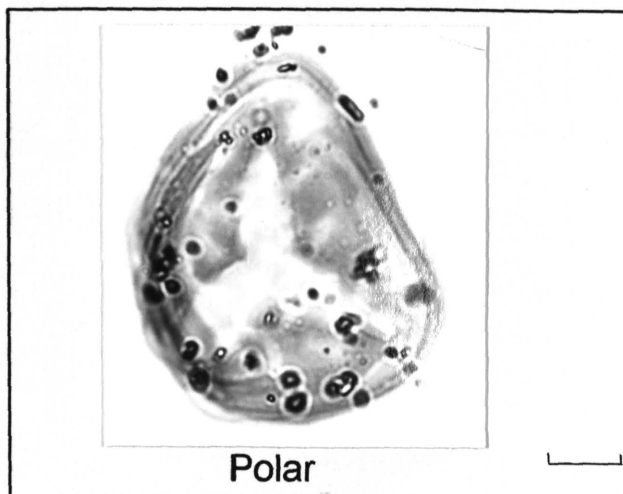
Equatorial

Specimens studied (3)

Spec no	Diameter (μ)
Bold type = illustrated specimen	
71-34	48
239-28	14
274-4	30
Average	31

Illustrated specimen

(71-34) LM. Badly preserved specimen



Polar

Scale bar = 10 μ

Figure 3.68

Description

Amb shape	Rounded triangular to circular in polar view Diameter of grain av. 31 μ
Colpus	Three-slit opening, reaching half-way to corners
Exine	1 - 3 μ thick. Differentiated into layers.
Sculpturing	Variable

Literature

The west coast specimens were not identified

Remarks

These grains were distinguished from trilete spores by the presence of a layered exine.

The trichotomocolpate condition is a variant of the monocolpate aperture (Traverse 1988). Many monosulcate pollen producers (Liliaceae, Palmae) contain abnormal trichotomosulcate pollen (Jansonius & Hills 1976). For this reason, and because the few specimens were poorly preserved, the classification of them will not be attempted further.

More than one species may be included in this group as the features vary.

Botanical affinities *Phormium* and many Palmae (Jansonius & Hills 1976)

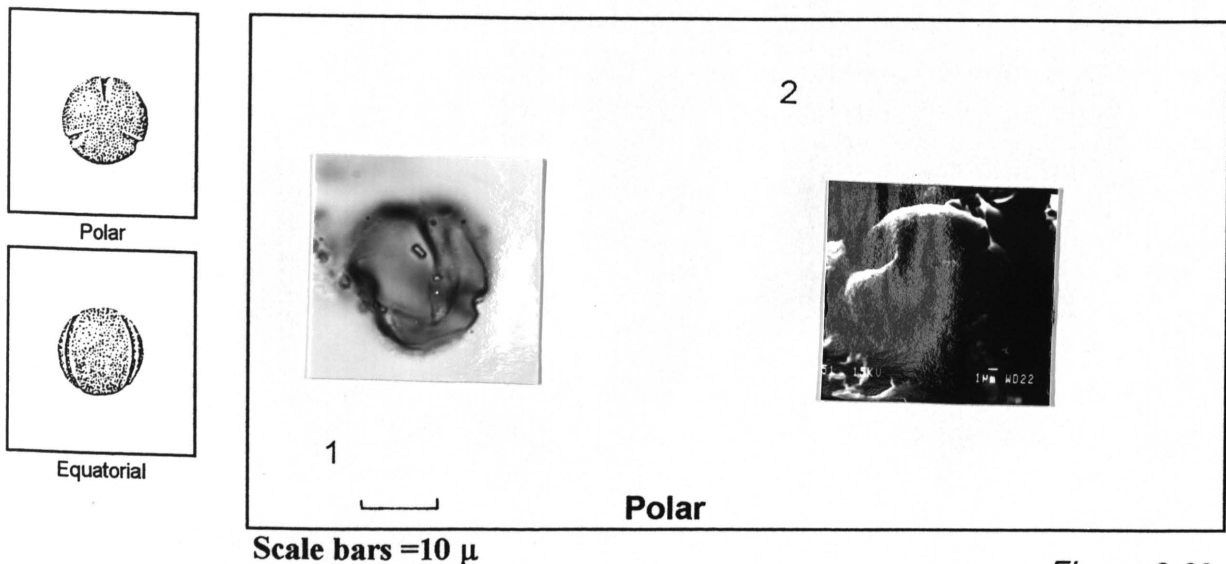
Distribution Very rare. Three specimens found, from the Main Peat Horizon, Koingnaas and from Somnaas/Noup.

Age bracket Unknown

Cupuliferoidaepollenites sp

Potonie', Thomson & Thiergart 1950 ex Potonie 1960

Type species *C. liblarensis* (Thomson in Potonie', Thomson & Thiergart 1950) Potonie' 1960



Pollen Colpate Tricolpate

Specimens studied (8)

Spec no	Equ diam (μ)
Bold type = illustrated specimen	
6--14	18
9--8	10
29-42A	18
40-24	31
50-11	27
57-4	22
65-37	24
247-30	18
Average	21

Description

Amb shape	Circular in polar view. Almost spheroidal Small grain, 21μ diam
Colpi	Three; relatively short, reach halfway to poles May gape, simple margin
Exine	2 - 3μ. Structure not seen well
Sculpturing	Psilate or faintly scabrate

Illustrated specimens

1. (29-42A) LM. Oblique view of badly preserved grain.
2. (247-30) SEM showing scabrate surface and gaping colpi

Literature

Genus/species	Author	Illustration	Geog loc	Age
<i>C. parvulus</i>	Dettmann 1973	Pl 2 fig 11-15	Australia	M-U Cretaceous
<i>Cupuliferoidaep'tes</i>	Jansonius & Hills 1976	p 684	n/a	n/a

Remarks

Specimens were placed within this species if the grain appeared to be psilate and subspheroidal. Dettmann (1973) discusses the validity of several genera erected to accommodate psilate tricolpate pollen.

The west coast specimens matched the published illustrations mentioned above.

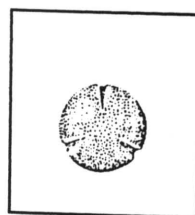
Botanical affinities Not stated

Distribution Little known, from all sites

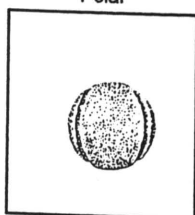
Age bracket Cretaceous

***Echitricolpites* sp** Da Silva Pares Regali, Uesugui & da Silva Santos 1974

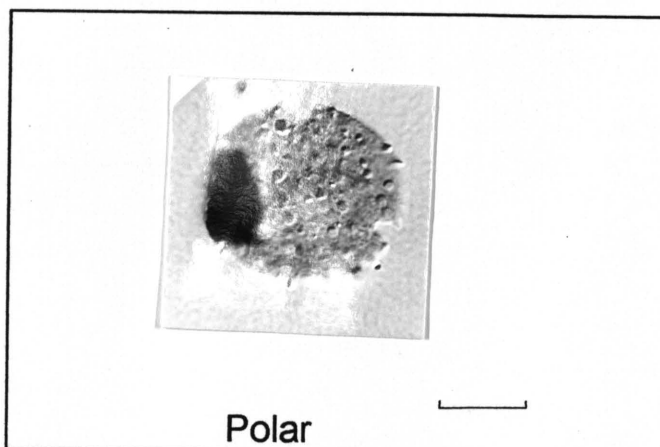
Type species *E. communis* Da Silva Pares Regali, Uesugui & da Silva Santos 1974



Polar



Equatorial



Polar

Scale bar = 10 μ

Figure 3.70

Specimens studied (1)

Spec no	Eq diam (μ)
Bold type = illustrated specimen	
273-5A	21

Illustrated specimen

(273-5A) NOR-LM. Partly obscured by debris

Description

Amb shape	Circular in polar view
Colpi	Three; very short, placed equatorially Long axis appears to be little more than width of colpus at equator
Exine	1 - 2 μ thick. Wall layers not seen well
Sculpturing	Echinate. Spines 2.5 μ high 2 μ diameter at base

Literature

Author	Description & illustration	Geog loc	Age
Jansonius & Hills 1976	p 900	Brazil	Palaeocene
Kemp & Harris 1977	p 34 Pl 5 fig 5-8	Ninetyeast Ridge	Palaeocene
Coetzee 1978	p 18	South Africa	Tertiary

Remarks

Only one specimen of this type was found in the west coast sediments. It matches the generic diagnosis for *Echitricolpites* given in Jansonius & Hills (1976). The accompanying line drawing closely resembles the specimen found. It resembled *Tricolpites* sp 2 (fig 6) in Kemp & Harris 1977.

Botanical affinities Not known

Distribution Very rare. A single specimen was found, in 40-2 from Somnaas/Noup

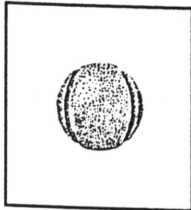
Age bracket Palaeocene

Gemmatricolpites sp Pierce 1961

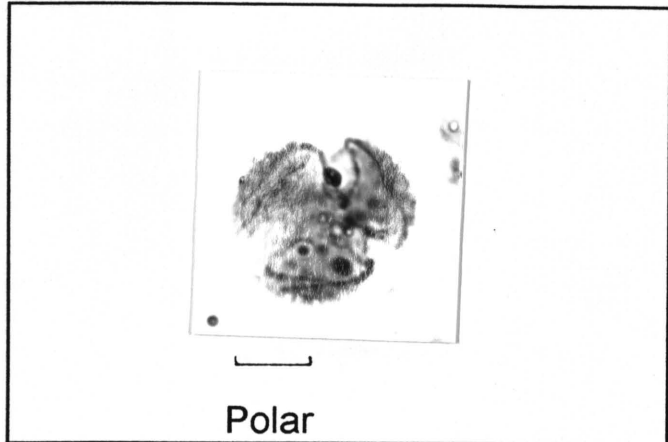
Type species *G. gemmatus* Pierce 1961



Polar



Equatorial



Polar

Scale bar = 10 μ

Figure 3.71

Pollen Colpate

Tricolpate

Specimens studied (5)

Spec no	Eq diam (μ)
Bold type = illustrated specimen	
33-33	28
70-20	26
80-21	40
80-8	33
247-16	14
Averages	28

Description

Amb shape	Approx circular in polar view
Colpi	Three; widely gaping Long; reach far into polar area Placed equatorially
Exine	Thin; 1 - 1.5 μ
Sculpturing	Gemmate; 1 μ height 1 μ diameter at base

Illustrated specimen

(70-20) LM. Focus on wall of grain to show gemmae

Literature

species	Author	Description	Illustration	Geog loc	Age
<i>G. pergemmatus</i>	Muller 1968	p 18	Pl 4 fig 12	Malaysia	Palaeo-Eocene
<i>Gemmatricolpites</i>	Jansonius & Hills 1976		p 1095	n/a	n/a

Remarks

The west coast specimens conformed to the generic diagnosis. However, they did not match published illustrations such as *G. scabratus* in McLachlan & Pieterse (1978) which has much shorter colpi, or *G. vigdisae* in Leidelmeyer (1966) which has costate colpi.

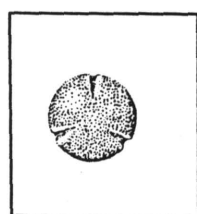
Botanical affinities *Ilex* (Aquifoliaceae) (Muller 1968)

Distribution Rare. Found in all levels at Koingnaas.

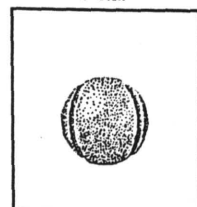
Age bracket Palaeo-Eocene

Retibrevitricolpites sp van Hoeken-Klinkenberg 1966

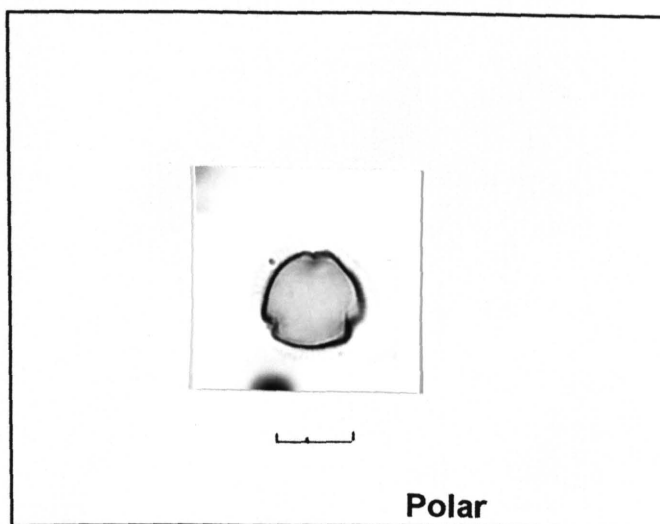
Type species *R. triangulus* van Hoeken-Klinkenberg 1966



Polar



Equatorial



Scale bar = 10 μ

Polar

Figure 3.72

Pollen Colpate

Tricolpate

Specimens studied (8)

Spec no	Equ diam (μ)
Bold type = illustrated specimen	
2-10	34
64-20	30
112-8	13
113-4	13
115-14	16
115-21	14
123-35	13
136-34	27
Average	20

Description

Amb shape	Triangular to circular in polar view
Colpi	Three; very short, gape slightly Angulaperturate Margins not well seen Polar area large as colpi short
Exine	Columellate; 2 - 4 μ thick Sexine thinner at colpi
Sculpturing	Reticulate, lumina 0.5 μ

Illustrated specimen

(113-4) LM. Focus on grain wall to show exine structure

Literature

species	Author	Description	Illustration	Geog Loc	Age
<i>R. distinctus</i>	van Hoeken-Klinkenberg 1966	PI 2 fig 3		Nigeria	M Eocene
<i>R. triangulus</i>	van Hoeken-Klinkenberg 1966	PI 2 fig 2		Nigeria	M Eocene
<i>Retibrevit'pites</i>	Jansonius & Hills 1976	p 2358		n/a	n/a
<i>R. triangulus</i>	Salard-Cheboudaeff 1979	PI fig 1			L Eocene

Remarks

The west coast specimens were placed within the genus *Retibrevitricolpites* rather than *Brevitricolpites* because of their reticulate nature.

Several species may be included due to some variation in overall shape, size and sculpturing.

Botanical affinities Not known

Distribution Rare. Found in the Main Peat Horizon and Channel Peats, Koingnaas

Age bracket Eocene

Striatopollis sp Krutzsch 1959

Type species *S. sarstedtensis* Krutzsch 1959

Pollen Colpate Tricolpate

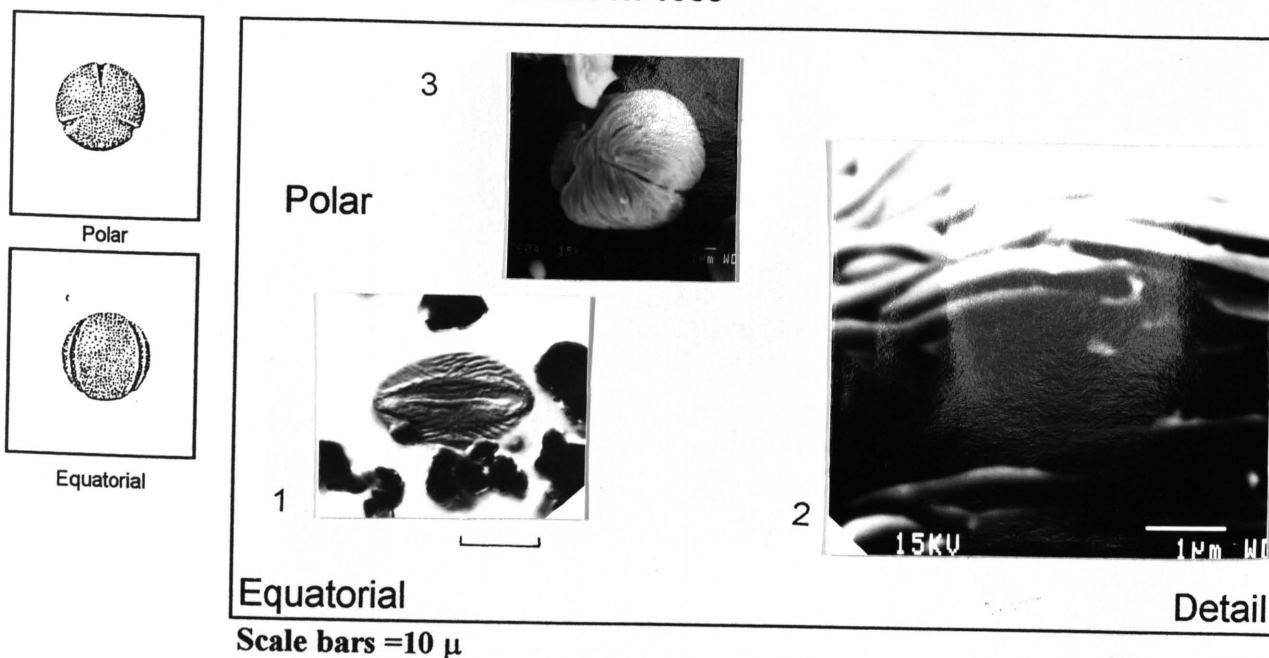


Figure 3.73

Specimens studied (13)

Average (11 specimens)	
Length (μ)	26

Range (11 specimens)	
Length (μ)	12--33

Illustrated specimens

1. (272-27) NOR-LM. Prolate grain with long colpi
2. (244-5) SEM. Detail of grain surface showing sculpturing
3. (245-28) SEM. Oblique polar view.

Description

Amb shape	Oval in equatorial view Poles may be pointed Length of grain av. 26 μ
Colpi	Three; extend almost to poles Distinct; may be closed. Straight or nearly so.
Exine	Nexine relatively thin (<1 μ) Sexine - rows of columellae
Sculpturing	Striate; ribs separated by grooves. Trend basically parallel to colpi, but may begin and stop against each other. Striae 0.5 μ wide, grooves less

Literature

species	Author	Description	Illustration	Geog loc	Age
<i>S. paraneus</i>	Burger 1976	p 152	Pl 34 fig 4-9	Australia	Cretaceous
<i>Striatopollis</i>	Jansonius & Hills 1976		p 2775	Europe	L Palaeocene
<i>Striatopollis</i> sp	McLachlan & Pieterse 1978		Pl fig	Offshore South Africa	
<i>S. bellus</i>	Salard-Chebodaef 1979		Fig 13	Africa	U Eocene

Remarks

Striatopollis is the only genus found in the literature consulted to accept solely tricolpate pollen with striate sculpture. *Aesculidites* may have pores within the colpi (ie tricolporate as well as tricolpate) and the striae are circumstriate. *Ailanthipites* and *Dactylopollis* also include tricolporate forms. *Striatricolpites* has not been designated according to the rules of the ICBN.

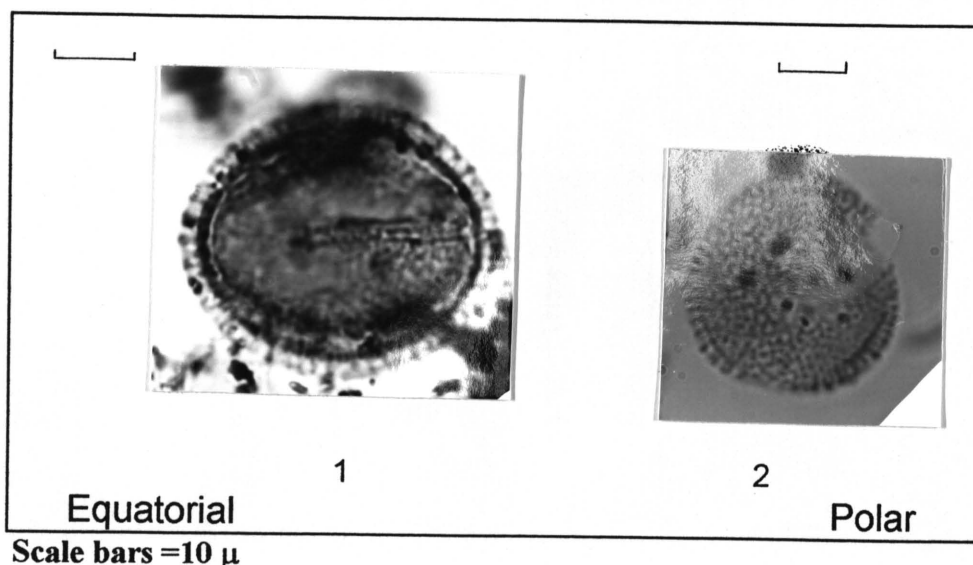
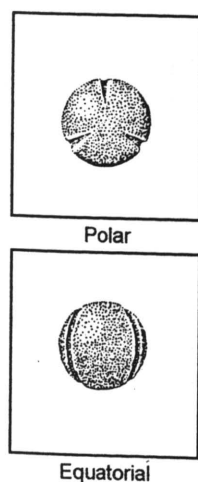
Botanical affinities Not stated

Distribution Little known from all levels, all sites.

Age bracket Palaeogene

Tricolpites alveolatus Couper 1953

Type species *T. reticulatus* Cookson 1947



Scale bars = 10 μ

Figure 3.74

Pollen Colpate Tricolpate

Specimens studied (12)

Average (μ)
Eq diam (7 specs) 32
Polar length (6 specs) 27

Range (μ)
Eq diam (7 specs) 30-40
Polar length (6 specs) 17-36

Description

Amb shape	Circular to almost trilobate in polar view. Spheroidal or oblate in lateral view Relatively large grain, c. 27 μ diam
Colpi	Three; fossaperturate Meridionally aligned, usually closed Long; reach far into polar area
Exine	Thick; 2 - 3 μ Sexine with tall columellae or baculae. Nexine slightly thinner
Sculpturing	Reticulate mesh diameter approx 1 μ

Illustrated specimens

- (103-19) LM showing wall of grain, long colpi and surface reticulum
- (107-36) LM showing circular amb, closed colpi and columellae in sexine.

Literature

Genus/species	Author	Description	Illustration	Geog loc	Age
<i>T. alveolatus</i>	Couper 1953		Pl 8 fig 114,115	New Zealand	L Eocene-Miocene
<i>Tricolpites</i>	Jansonius & Hills 1976		p 2970	n/a	n/a

Remarks

Tricolpites alveolatus is very similar in general morphology to *T. sp* cf. *T. micromunus*, the distinction being that the former is smaller (15 μ) and has a finer reticulum. *T. alveolatus* measures on average 32 μ .

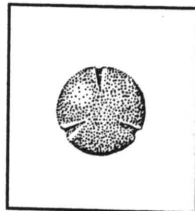
Botanical affinities Not known.

Distribution Rare. Known from all sites

Age bracket L Eocene- Miocene

Tricolpites asperamarginis Mc Intyre 1968

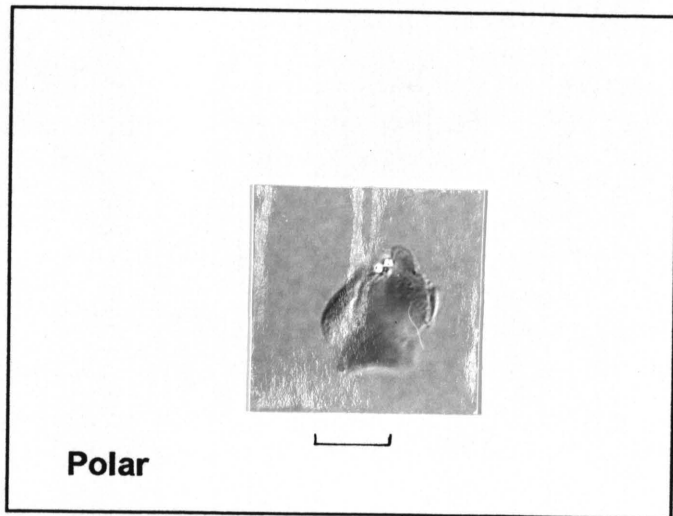
Type species *T. reticulatus* Cookson 1947



Polar



Equatorial



Polar

Scale bar = 10 μ

Figure 3.75

Pollen
Colpate
Tricolpate

Specimens studied (9)

Spec no	Polar diam (μ)
Bold type = illustrated specimen	
25-27	14
25--2	15
48-30	15
111-24	14
235-34A	13
235-40A	17
239-35	14
244-19	15
259-()	12
Average	14

Description

Amb shape	Triangular, almost polygonal, in polar view. Small grain, average 14 μ diam
Colpi	Three; meridionally aligned Gape widely, ragged margin Reach halfway to pole
Exine	1 - 3.5 μ Structure not seen well
Sculpturing	Reticulate; appears possibly striate or granulate on SEM

Illustrated specimen

(239-35) NOR-LM. Badly preserved grain

Literature

Genus/species	Author	Description	Illustration	Geog loc
<i>Tricolpites</i>	Jansonius & Hills 1976	p 2970		n/a
<i>T. asperamarginis</i>	Kemp & Harris 1977	p 32	Pl 5 fig 3 & 4	Ninetyeast Ridge

Remarks

Specimens were placed within this species if they were triangular in polar view, possessed widely gaping colpi and were small (c. 15 μ). This species differs from *T. gillii* as in the latter the colpi do not gape and the sides of the amb are concave. *T. asperamarginis* may appear hexagonal in polar view if the colpi are very broad.

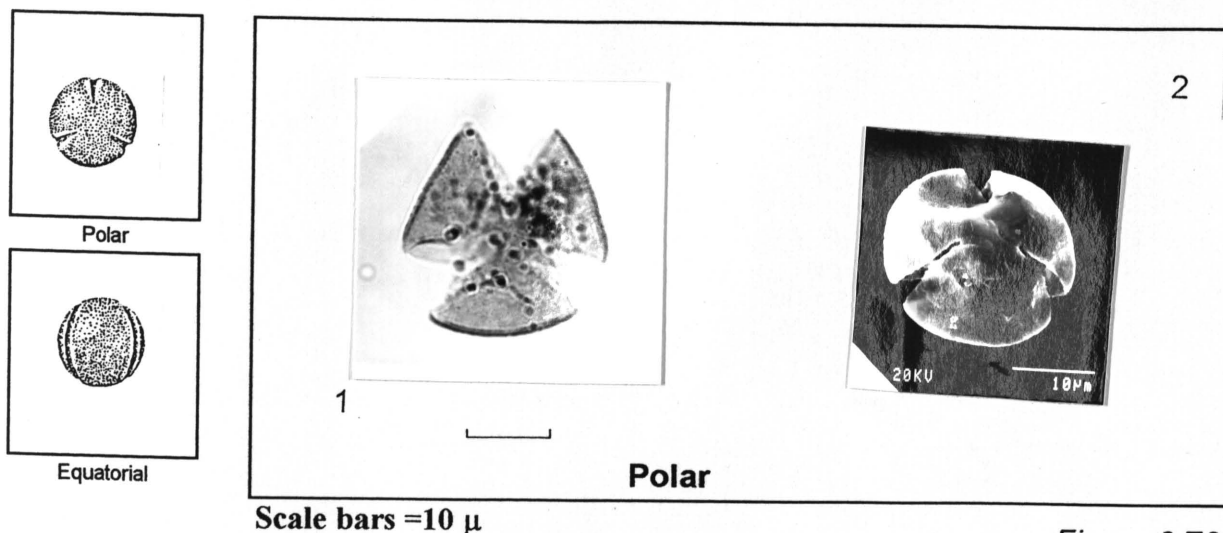
Botanical affinities Not known

Distribution Little known. All levels at Koingnaas

Age bracket Upper Eocene-Oligocene (Kemp & Harris 1977)

Tricolpites confessus Stover 1973

Type species *T. reticulatus* Cookson 1947



Scale bars = 10 μ

Figure 3.76

Specimens studied (23)

Average (μ)
Equatorial diameter (23 specs) 22
Range (μ)
Equatorial diameter (23 specs) 12-29
Illustrated specimens
1. (193-20) LM. Widely gaping colpi,
2. (268-23) SEM. Colpi gape little, surface
appears smooth

Description

Amb shape	Circular in polar view. (not viewed in lateral aspect) Average equatorial diameter 22 μ
Colpi	Three; meridionally aligned Gape widely, simple margin Reach almost to pole
Exine	Thin; 1 - 1.5 μ .
Sculpturing	Reticulate; very fine mesh (<0.5 μ)

Literature

Genus/species	Author	Illustration	Geog loc	Age
<i>Tricolpites</i> sp B	Anderson 1960 p	PI 6 fig 18	New Mexico	L Palaeocene
<i>Tricolpites</i> sp A	Stover & Evans 1973	PI fig 6	Australia	U Cretaceous - Eocene
<i>T. confessus</i>	Stover & Partridge 1973	PI 17 fig 3	Australia	Late Cret - Palaeocene
<i>Tricolpites</i>	Jansonius & Hills 1976	p 2970	n/a	n/a
<i>Tricolpopites</i>	Jansonius & Hills 1976	p 2985	India	L - M Eocene
<i>Tricolpites</i> sp A	Christopher et al 1990	PI 3 fig 12		

Remarks

These specimens were identified as *T. confessus* because of their circular amb in polar view, gaping colpi and relatively smooth surface.

They resembled several published illustrations, as noted above.

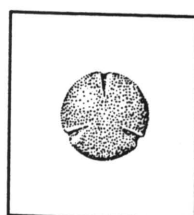
Botanical affinities Not known

Distribution Little known, from Koingnaas and Somnaas/Noup

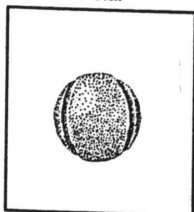
Age bracket U Cretaceous - Palaeocene

Tricolpites cooksonae Dettmann 1973

Type species *T. reticulatus* Cookson 1947



Polar



Equatorial



Polar

Scale bar = 10 μ

Figure 3.77

Pollen Colpate Tricolpate

Specimens studied (23)

Average (μ)
Polar diam (23 specs) 17

Range (μ)
Polar diam (23 specs) 11-28

Illustrated specimen
(246-1) SEM. Grain in polar aspect.

Description

Amb shape	Circular in polar view. (not veiwed in lateral aspect) Small grain, c. 17 μ diam
Colpi	Three; meridionally aligned Gape widely, simple margin Reach half way to pole
Exine	1 - 2 μ thick; sexine slightly thicker than nexine, columellate
Sculpturing	Reticulate; mesh >1 μ diameter Slightly finer adjacent to colpi

Literature

Genus/species	Author	Description	Illustration	Geog loc	Age
<i>T. cooksonae</i>	Dettmann 1973		PI fig 13-19	Australia	M Cretaceous
<i>Tricolpites</i>	Jansonius & Hills 1976		p 2970	n/a	n/a

Remarks

Tricolpites cooksonae is very similar in general morphology to *Retitricolpites virgeus*, as noted by Dettmann (1973). The genus *Retitricolpites* is illegitimate (Jansonius & Hills 1976). Superficial similarities were seen with *T. anguloluminosus* (Anderson 1960) however the muri of that species are more delicate and the colpi are bordered.

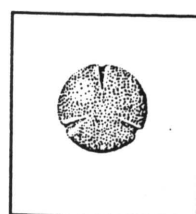
Botanical affinities Not stated

Distribution Very rare. All levels at all sites.

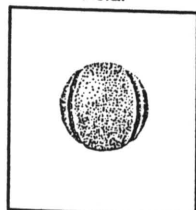
Age bracket Cretaceous onwards

Tricolpites delicatulus Couper 1960

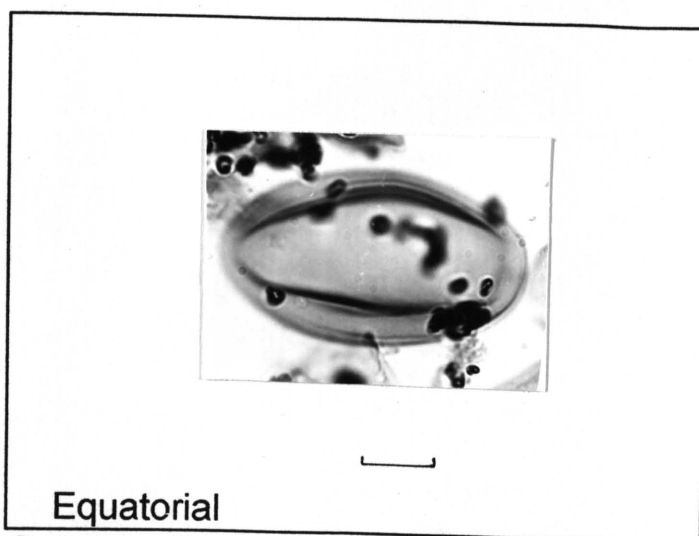
Type species *T. reticulatus* Cookson 1947



Polar



Equatorial



Equatorial
Scale bar = 10 μ

Figure 3.78

Pollen Colpate

Tricolpate

Specimens studied (8)

Spec no	Polar length (μ)
Bold type = illustrated specimen	
28--5	27
28-41	28
31-16	25
108-29	32
108-33	32
110-13A	32
149-32	40
245-20	18
Average	29

Description

Amb shape	Prolate in equatorial view Rounded poles
Colpi	Three; long and narrow Usually closed Reach almost to poles
Exine	Relatively thin; 1 - 2 μ Even thickness throughout grain Fine columellae visible in sexine
Sculpturing	Psilate or finely pitted

Illustrated specimen

(149-32) LM showing long colpi and thin, psilate exine

Literature

Genus/species	Author	Description	Illustration	Geog loc	Age
<i>T. delicatulus</i>	Couper 1960 p 65	PI 10 fig 23, 24	New Zealand	U Oligo - M Miocene	
<i>T. delicatulus</i>	Martin 1973 p 39	Fig 170	New Zealand	U Oligo - M Miocene	
<i>Tricolpites</i>	Jansonius & Hills 1976 p 2970		n/a	n/a	

Remarks

Specimens were placed within this group if they were prolate and appeared to be psilate. They were not identified with *T. psilatus* as this species contains grains which are very small (9 μ) (Martin 1973). They were not placed within *T. pachyexinus* because the colpi do not gape and the grains are prolate.

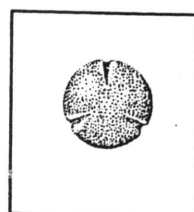
Botanical affinities Not known

Distribution Rare. Known from the channel peats and Main Peat Horizon at Koningnaas and from Langklip.

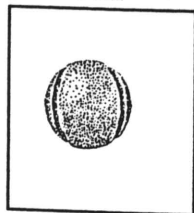
Age bracket U Oligo - M Miocene

Tricolpites giganteus Jardine & Magloire 1965

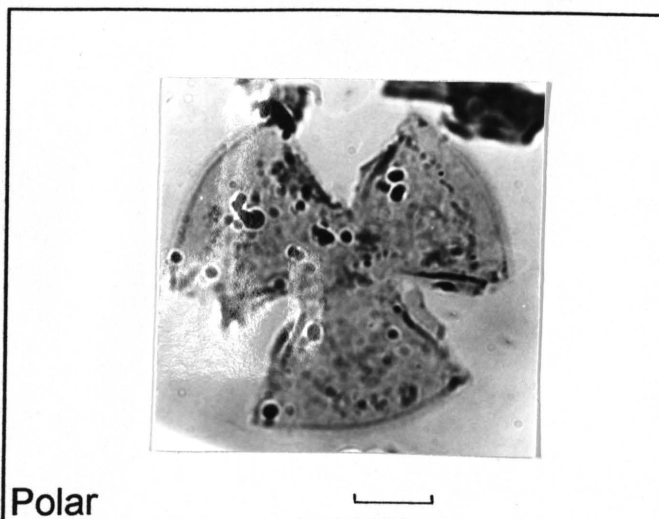
Type species *T. reticulatus* Cookson 1947



Polar



Equatorial



Polar

Scale bar = 10 μ

Figure 3.79

Pollen Colpate Tricolpate

Specimens studied (3)

Spec no	Polar diam (μ)
Bold type = illustrated specimen	
74-9	53
74-1	54
91-25	52
Average	53

Illustrated specimen

(91-25) LM showing long, widely gaping colpi

Description

Amb shape	Circular in polar view. (not veiwed in lateral aspect) Very large grain, 53 μ diam
Colpi	Three; meridionally aligned Gape widely, simple margin Reach almost to pole
Exine	Relatively thin; 3 - 5 μ . Structure not seen well
Sculpturing	Reticulate; fine mesh <0.5 μ diam

Literature

Genus/species	Author	Illustration	Geog loc	Age
<i>T. giganteus</i>	Jardine & Magloire 1965	Pl 11 fig 1-3	Africa	M-U Cretaceous
<i>Tricolpites</i>	Jansonius & Hills 1976	p 2970	n/a	n/a
<i>T. gigantoreticulatus</i>	Morgan 1978	Pl 5 fig 3	Offshore Angola	Cretaceous

Remarks

Specimens were placed within this species if the equatorial diameter measured more than 50 μ and the overall shape was circular in polar view with gaping colpi.

The west coast specimens matched the published illustrations mentioned above. However, a discrepancy exists as the original species was named *T. giganteus* and the specimen featured in Morgan (1978) is named *T. gigantoreticulatus*.

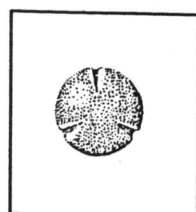
Botanical affinities Not stated

Distribution Very rare. Main Peat Horizon and above at Koinaas.

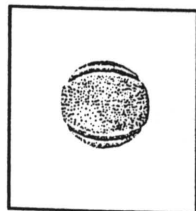
Age bracket Cretaceous

Tricolpites gillii Cookson 1956

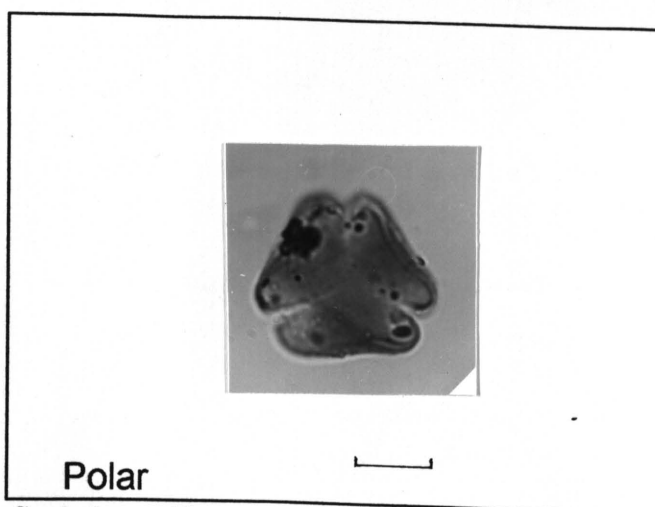
Type species *T. reticulatus* Cookson 1947



Polar



Equatorial



Polar

Scale bar = 10 μ

Figure 3.80

Specimens studied (21)

Average (μ)
Equatorial diameter (20 specs) 19

Range (μ)
Equatorial diameter (20 specs) 12-43

Illustrated specimen
(68-35) LM. Grain in polar view
Shows thickened exine between colpi
Sculpturing not remarkable

Description

Amb shape	Triangular in polar view. Concave to straight sides Average equatorial diameter 22 μ
Colpi	Three; meridionally aligned Usually closed or gape little Reach halfway to pole
Exine	1 - 3 μ - thickest in intercolpial areas Structure not well seen
Sculpturing	Fine but variable. Coarser in intercolpial areas

Literature

Genus/species	Author	Illustration	Geog loc	Age
<i>T. gillii</i>	Harris 1965	PI 27 fig 13		
<i>T. gillii</i>	Stover & Evans 1973	PI fig 6	Australia	U Cretaceous - Eocene
<i>Tricolpites</i>	Jansonius & Hills 1976	p 2970	n/a	n/a
<i>T. gillii</i>	Dettmann & Thomson 1987 Fig 5 k		Australia	

Remarks

Specimens were placed in this group if they were triangular in polar view, with closed colpi or nearly so and a relatively smooth exine. They are differentiated from *Tricolpites* sp A by the nature of the colpi and their overall shape.

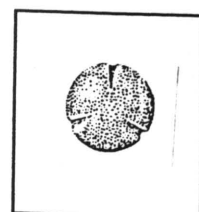
The west coast specimens resembled several published illustrations, none of which had accompanying descriptions.

Botanical affinities Not known

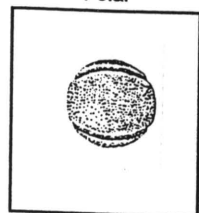
Distribution Well known from Koingnaas and Somnaas/Noup.

Age bracket U Cretaceous - Eocene

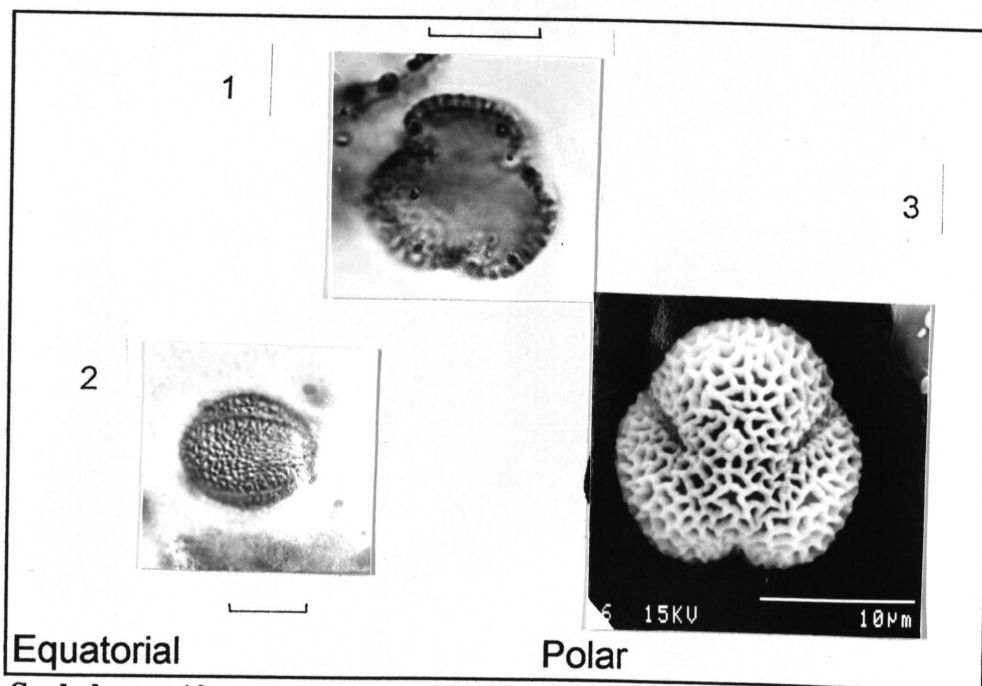
Type species *T. reticulatus* Cookson 1947



Polar



Equatorial



Equatorial

Polar

Scale bars = 10 μ

Figure 3.81

Also see Colour Plate 3

Pollen Colpate

Tricolpate

Specimens studied (76)

Mean (μ)
Eq diam (42 specs) 15
Polar length (34 specs) 15.5

Range (μ)
Eq diam (42 specs) 8-26
Polar length (34 specs) 9-27

Description

Amb shape	Circular to trilobate in polar view Spheroidal or oblate Small grain, approx 25 μ diameter
Colpi	Three; fossaperturate Meridionally aligned, often gaping Long; reach far into polar area
Exine	Stratified; 1 - 1.5 μ total thickness Sexine with columellae Nexine slightly thinner
Sculpturing	Reticulate; mesh diameter 1 μ

Illustrated specimens

1. (100-31) LM showing lobate amb and coarse, evenly meshed reticulum.
2. (261-31) NOR-LM showing long, open colpi. Slightly finer reticulum than that seen in 1.
3. (246-3) SEM . Polar view showing details of reticulum. Luminae often irregular in shape.

Literature

Genus/species	Author	Description	Illustration	Geog loc	Age
<i>T. waiparaensis</i>	Couper 1960	p 66	PI 11 fig 13-15	New Zealand	U Cretaceous
<i>Tricolpites</i>	Kemp 1968	p 430			
<i>T. waiparaensis</i>	Stover & Evans 1973		fig 2	Australia	U Cret-Eocene
<i>Tricolpites</i>	Jansonius & Hills 1976		p 2970	n/a	n/a
<i>T. reticulatus</i>	Kemp & Harris 1977 p 29		PI 5 fig 1 & 2	Ninetyeast Ridge	Palaeocene-Eocene
<i>T. waiparaensis</i>	Harris 1978	p	PI fig 19	Ninetyeast Ridge	Palaeocene
<i>T. reticulatus</i>	Pocknall 1982 p 264		Fig 7	New Zealand	Mid-late Tertiary
<i>T. reticulatus</i>	Scholtz 1985			South Africa	Late Cret-L Tertiary
<i>T. waiparaensis</i>	Dettmann & Thomson 1987 p 33	Fig 5 n			
<i>T. reticulatus</i>	Jarzen & Dettmann 1989 p 100		PI 1 fig 1-8, PI 2 fig 1,2,4 PI 3 fig 7		
<i>T. reticulatus</i>	Venkatachala et al 1989		PI 5 fig 1-11	India, Africa	Palaeo-Eocene
<i>T. microretic'us</i>	Schrank 1994		Fig 8 u	Sudan	Cretaceous
<i>T. micromunus</i>	El Beialy 1995		PI 4 fig 22	Egypt	U Cretaceous
<i>T. microretic'us</i>	El Beialy 1995		PI 4 fig 19	Egypt	U Cretaceous

Remarks

The literature mentioned above includes illustrations which are similar to the west coast specimens. Although very similar, they were judged to be smaller and possess a larger-meshed reticulum than allowed for in *T. reticulatus*.

T. reticulatus is the type species of a genus which is broadly categorized in terms of reticulum architecture and apertural form. The morphology of *Tricolpites reticulatus* and its taxonomic classification was the subject of a detailed paper by Jarzen & Dettmann (1989).

The paper discussed the need for the segregation and reallocation of the multitude of taxa assigned to the genus. The original diagnosis specified little other than the grains should be tricolpate, allowing variability in exine thickness, structure and sculpture. After re-examining the original material, it was emended to include only forms with a stratified exine, the sexinous layer having baculae which form a surface reticulum with a regular mesh size of 1 μ . Forms with supramural sculpture were excluded. Kemp & Harris (1977) comment on species which are very similar or identical to *T. reticulatus*.

The criteria of Dettmann & Jarzen (1989) were followed when dealing with the west coast specimens.

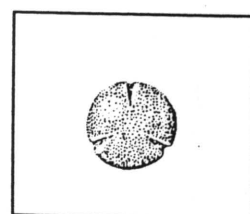
Botanical affinities Not stated.

Distribution Common. Found in all levels at all sites

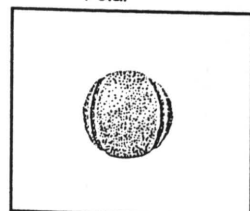
Age bracket ? Upper Cretaceous to Quaternary.

Tricolpopollenites sp Pflug & Thomson in Thomson & Pflug 1953

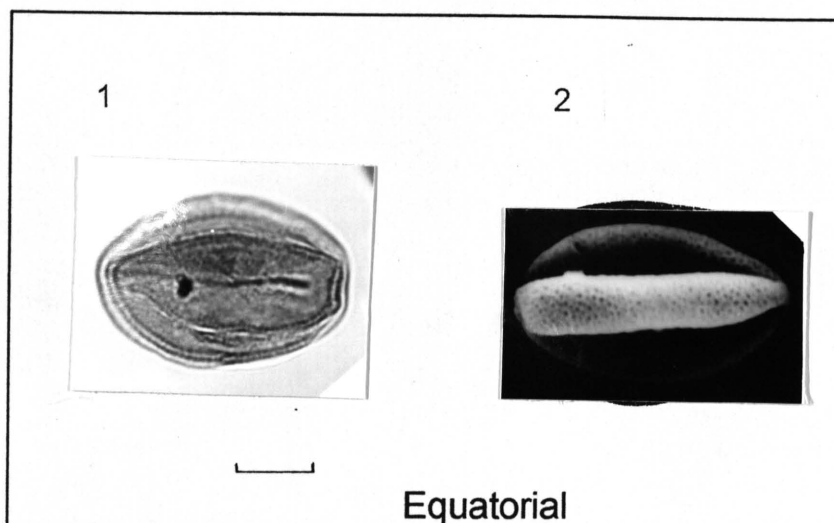
Type species *T. parmularius* (Potonié) Thomson & Pflug 1953



Polar



Equatorial



Scale bars = 10 μ

Figure 3.82

Specimens studied (37)

Average (μ)
Eq diam (37 specs) 16
Polar length (37 specs) 26
Ratio (pol/eq) (37 specs) 2

Range (μ)
Eq diam (37 specs) 7-37
Polar length (37 specs) 14-47
Ratio (pol/eq) (37 specs) 1-3

Description

Amb shape	Prolate in equatorial view Small to large grains Poles relatively pointed
Colpi	Three; usually long and narrow Meridionally aligned, simple margins
Exine	Relatively thin; 1 - 1.5 μ Columellate; very fine structure
Sculpturing	Finely reticulate to psilate

Illustrated specimens

- (195-13A) LM showing prolate amb and long, closed colpi with simple margins.
- (246-3) SEM. Grain probably lobate in polar view. Relatively coarse reticulum

Literature

Genus/species	Author	Description & Illustration	Geog loc	Age
<i>Tricolpites waimumuensis</i>	Couper 1953	p PI fig 122	N Zealand	U Cret-L Oligo
<i>Tricolpites waimumuensis</i>	Couper 1960	p 65 PI 11 fig 13-15	N Zealand	U Cretaceous
<i>Tricolpopollenites</i>	Jansonius & Hills 1976	p 2970	n/a	n/a
<i>Tricolpites pertongicolpus</i>	Pocknall & Mildenhall 1984		N Zealand	U Oligo-L Mioc

Remarks

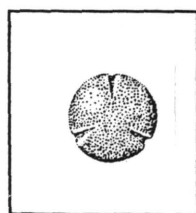
Tricolpopollenites is treated as a 'portmanteau' genus for tricolpate prolate grains which could not be more accurately placed. A great many grains were found with similar morphology ranging from pointed to rounded poles, reticulate to relatively smooth sculpturing, long to relatively short or closed to gaping colpi.

The specimens bear some resemblance to the published illustrations mentioned above. They were placed within *Tricolpopollenites* rather than *Tricolpites* because the original generic diagnosis of the former cites the prolate nature of the grains and does not specify sculpturing details. *Tricolpites* may be restricted in application to include only those grains with a morphology similar to the type species (spherical and lobate) and a surface reticulum of less than 1 μ (Dettmann 1973).

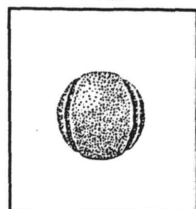
Botanical affinities Not known

Distribution Common. Found in all levels at all sites

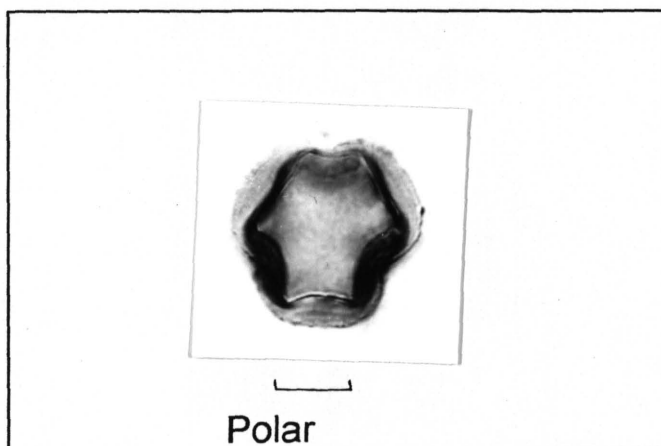
Age bracket ?Possibly U Cretaceous - Mid-Tertiary



Polar



Equatorial



Polar

Scale bar = 10 μ

Figure 3.83

Pollen Colpate

Tricolpate

Specimens studied (2)

Spec no	Equ diam (μ)
Bold type = illustrated specimen.	
8--16	19
275-32	23
Average	21

Illustrated specimen

(275-32) NOR-LM. Focus on wall of grain to show thick exine

Description

Amb shape	Hexagonal in polar view Not seen in lateral aspect 21 μ equatorial diameter
Colpi	Three; short and very broad Fossaperturate Reach less than half way to pole Structure not seen well
Exine	Very thick (>5 μ). 3 layers noted but not well seen. Nexine thicker in colp area, thins at apices Sexine thicker in intercolpal areas Sexine & nexine appear structureless. ? Extrasexinous layer in intercolpal areas only.
Sculpturing	Appears to be psilate No reticulum seen

Literature

The west coast specimens could not be identified.

Remarks

The west coast specimens did not resemble any published illustration or description in the literature consulted.

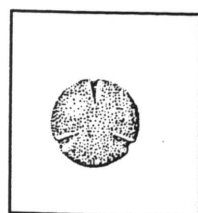
Of particular interest is the very thick, layered but virtually structureless exine.

Botanical affinities Not known

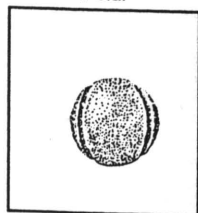
Distribution Very rare. Isolated specimens found from Koinaas and Somnaas/Noup.

Age bracket Unknown

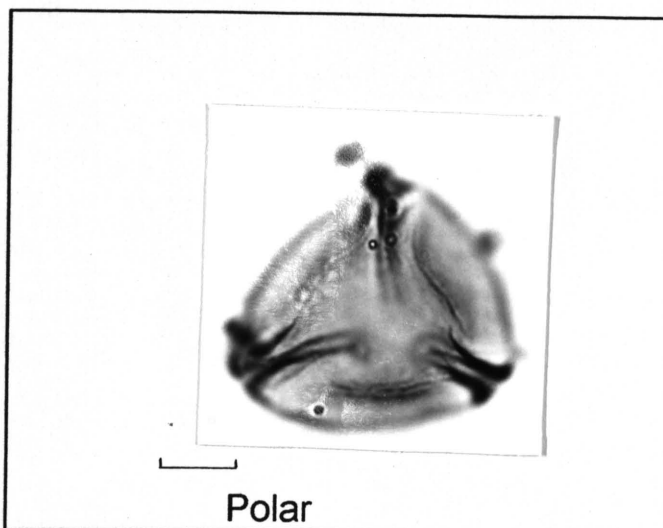
Tricolpate pollen B



Polar



Equatorial



Polar

Scale bar = 10 μ

Figure 3.84

Pollen Colpate Tricolpate

Specimens studied (1)

Spec no	Equ diam (μ)
Bold type = illustrated specimen	
71-17	40

Illustrated specimen

(71-17) LM. Focus on polar area to show length of colpi

Description

Amb shape	Roundly triangular in polar view
Colpi	Three; closed, narrow and very long Angulaperturate, meridionally placed Marked costae colpi Reach almost to pole Structure not seen well
Exine	Thin, 2 μ ; structure not seen well Even thickness over whole grain
Sculpturing	Appears to be psilate No reticulum seen

Literature

The west coast specimens could not be identified.

Remarks

The west coast specimens did not resemble any published illustration or description in the literature consulted.

Of particular interest are the long, thin, well-marked colpi.

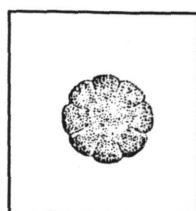
Botanical affinities Not known

Distribution Very rare. Isolated specimen found from Koinaas

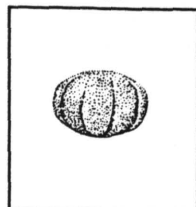
Age bracket Unknown

Ephedripites sp Bolkhovitina ex Potonié 1958

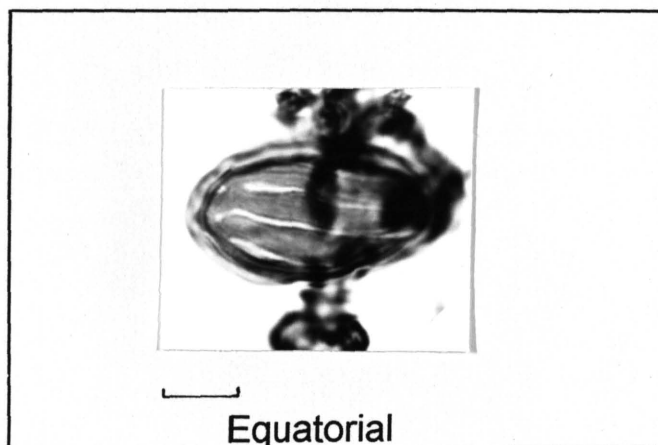
Type species *E. mediolobatus* Bolkhovitina ex Potonié 1958



Polar



Equatorial



Equatorial

Scale bar = 10 μ

Figure 3.85

Specimens studied (1)

Spec no	Eq diam (μ)
Bold type = illustrated specimen	
171-18	30

Illustrated specimen

(171-18) LM showing length and nature of colpi

Description

Amb shape	Prolate with rounded poles
Colpi	More than five. Closed or narrowly gaping Very long; reach to poles
Exine	Thick in intercolpal areas (3 μ) Wall layers not seen well
Sculpturing	Psilate.

Literature

Genus	Author	Description	Illustration	Geog loc	Age
<i>Ephedripites</i>	Jansonius & Hills 1976	p 944		n/a	n/a

Remarks

Only one specimen of this type was found in the west coast sediments. It was thus not assigned to any particular species.

Botanical affinities ? Ephedripaceae

Distribution Very rare. A single specimen was found at Langklip.

Age bracket Unknown

Glencopollis ornatus Pocknall & Mildenhall 1984

Type species *G. ornatus* Pocknall & Mildenhall 1984

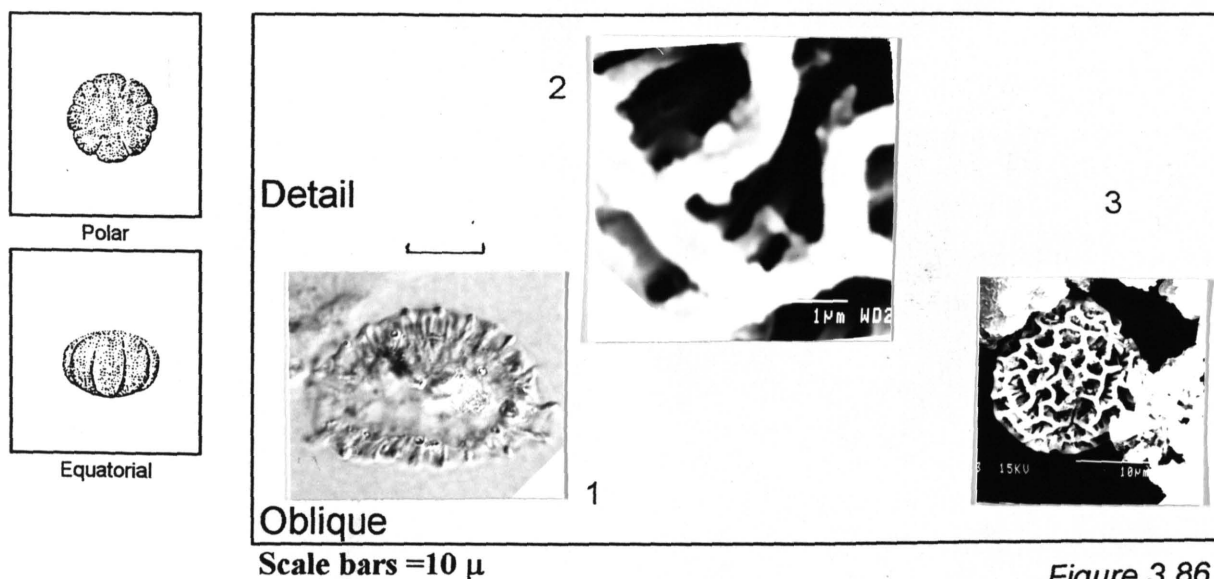


Figure 3.86

Specimens studied (8)

Spec no	Diameter (μ)
Bold type = illustrated specimen	
63-3	38
71-12	47
96-3	47
96-7	25
111-32	27
240-11	30
244-2	22
268-21	20
Average	32

Description

Amb shape	Circular (spherical)
Colpi	Many; not well seen Short and gaping Short; grains have large polar area
Exine	Very thick; >5μ Sexine with very tall columellae which occur in pairs and are united at tips
Sculpturing	Reticulate. Wavy muri with 'beads' Lumina polygonal in outline Irregular shape

Illustrated specimens

- (240-11) NOR-LM. Grain is slightly squashed. Height of columellae seen in wall of grain
- (244-2) SEM. Detail of exine structure and sculpturing
- (244-2) SEM. Whole grain showing convoluted nature of reticulum. Position of colpi difficult to determine.

Literature

Author	Description	Illustration	Geog loc	Age
Pocknall & Mildenhall 1984	p 29	Pl 10 fig 1-5	New Zealand	L Mio - L Pliocene
Barreda 1993	p 172	Pl 1 fig 1 - 6	Argentina	Miocene

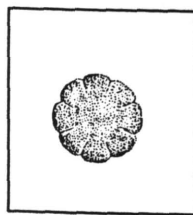
Remarks

The west coast specimens exactly match those found in New Zealand and Argentina.

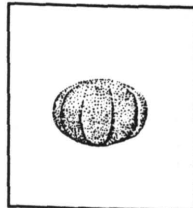
Botanical affinities Family Polygonaceae (Pocknall & Mildenhall 1984) of the Polygonales (Caryophyllidae) or Geraniaceae.

Distribution Known from the Main Peat Horizon at Koingnaas.

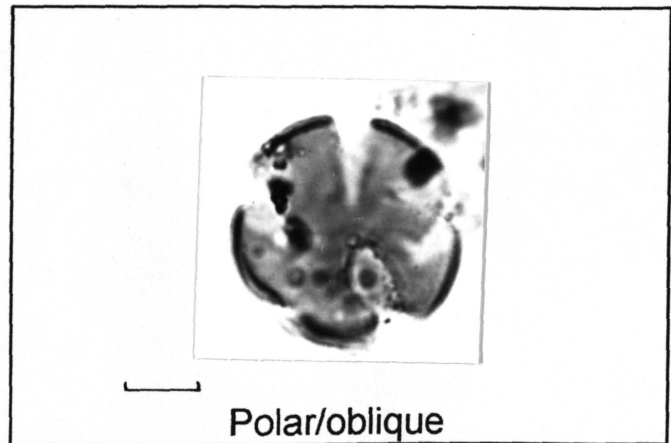
Age bracket L Mio - L Pliocene



Polar



Equatorial



Polar/oblique

Scale bar = 10 μ

Figure 3.87

Specimens studied (1)

Spec no	Eq diam (μ)
Bold type = illustrated specimen	
89-39	29

Illustrated specimen

(89-39) LM. Specimen partly obscured by debris

Description

Amb shape	Oblate; seen in slightly oblique view
Colpi	Five; long and gaping. Ends taper Reach halfway to poles Placed equatorially, simple margins
Exine	2 - 3 μ thick. Wall layers not seen well
Sculpturing	Psilate.

Literature

species	Author	Description	Illustration	Geog loc	Age
<i>P. cooksonii</i>	Sah & Dutta 1966	p 80	Pl 2 fig 15	India	Palaeocene
<i>Polycolpites</i>	Jansonius & Hills 1976	p 900		Brazil	Palaeocene
<i>P. esobalteus</i>	Martin 1978	p 191	Fig 70	Australia	Tertiary

Remarks

Only one specimen of this type was found in the west coast sediments. It closely resembles the illustration in Sah & Dutta (1966) identified as *Polycolpites cooksonii*.

The specimen was not identified as *P. cooksonii* because the genus *Polycolpites* was diagnosed by Couper (1953) as having more than six colpi. Several of the grains cited in Sah & Dutta, as with this specimen, possess only five. If the Indian species is correctly named, the South African specimen should be identified with it, as they are similar in all appearances. The discovery of more specimens will help to confirm the identification.

Botanical affinities ? Rubiaceae (Sah & Dutta 1966)

Distribution Very rare. A single specimen was found, above the Main Peat Horizon at Koningnaas

Age bracket Palaeocene