Introduction

The coal material investigated was provided by Prof. S. Maeda, Department of Geology, Faculty of Science, Chiba University, who collected it from the Eocene Concepción Formation in the Concepción area, central Chile. The author has found many spores and pollen grains in the coal material from the Concepción Formation. Thirty-four species of plant microfossils consisting of microspores and pollen grains, are described in this paper. Eight species are instituted as new species.

Acknowledgements

The author expresses his gratitude to Prof. Dr. S. Maeda, Department of Geology, Faculty of Science, Chiba University, for supplying the sample material upon which this study is based. Thanks are also due to Prof. Dr. T. Kimura, Department of Earth Sciences, Tokyo Gakugei University, for providing some literature on palaeobotany and palynology of South America.

Material and method

The examined coal sample was obtained from the Concepción Formation in the Concepción area, central Chile. The sample is a bituminous coal. The material was processed by me-

* Received Feb. 12, 1977; read Jan. 21, 1977 in Tokyo.
Kiyoshi TAKAHASHI

Palynological assemblage

The plant microfossils recovered from the studied coal material indicate a total of 34 palynomorph types which appear to be important for characterizing the Concepción palynological assemblage. This includes 17 arboreal angiosperms, 2 probable or known non-arboreal angiosperms, 4 gymnosperms, 1 moss and 11 ferns. Approximate percentages of counted specimens for the entire assemblage are moss and ferns 62% (trilete-53.5%, monolete-8.5%), gymnosperms 4% (saccate-0.5%, inaperturate-3.5%), and angiosperms 34% (monocolpate-1.5%, dicolpate and tricolporate-1.5%, triporate-31%).

The fossil genera and species found are as follows.

Trilete spores:
- Deltoidospora sp.
- Leiotriletes minus n. sp.
- Leiotriletes microadiennis KRUTZSCH
- Stereisporites concepcionensis n. sp.
- Concavisporites sp.
- Triplanosporites minor n. sp.
- Triplanosporites sp.
- Punctatisporites sp.
- Gleicheniidites speciosus n. sp.
- Gleicheniidites circinidites (COOKSON) n. comb.

Monolette spores:
- Laevigatosporites ovulatus n. sp.
- Laevigatosporites dehiscens TAKAHASHI

Pollen grains:
- Dacrydiumites cf. florinii COOKSON & PIKE
- Inaperturopollenites pseudodubius TAKAHASHI
- Inaperturopollenites laevigatus TAKAHASHI

Mechanical and chemical methods (maceration by KClO₃ and conc. HNO₃, treatment by 15% KOH and then by acetylation method, centrifuging and washing in pure water after each step). The residues were mounted in glycerine jelly. All slides were sealed with a mixture of solid paraffin and canada balsam.

All specimens illustrated in this paper and the sample from which they were obtained are in the palynological collection of the Department of Geology, Nagasaki University.

Text-fig. 1. Index map showing the sampling locality (x) at Coronel coalfield near Concepción.
Ephedripites sp.
Monocolopollenites cf. kyushuensis
Takahashi
Liliacitides variegatus Couper
Smilacipites setarius (R. Potonié) R. Potonié
Triopropolitenites sp.
Triopropolitenites festatus Takahashi
Momipites sp.
Myrtaceidites parvus Cookson & Pike
formae anesus Cookson & Pike
Myrtaceidites parvus Cookson & Pike
formae nesus Cookson & Pike
Myrtaceidites sp.
Triorites minor Couper
Triorites cf. harrisi Couper
Subtripropolitenites rotundus n. sp.
Subtripropolitenites falsus n. sp.
Subtripropolitenites levius Takahashi
Dicotolpollis sp.
Tricolopollenites sp.
Rhoipites bradleyi Wodehouse
Rhoipites sp.
Foveotricolporites foveolatus n. sp.


Of these species, Leiotorites microadriennis Krutzsch, Gleichenioidites circinoidites (Cookson) n. comb., Smilacipites setarius (R. Potonié) R. Potonié, Sub-

triporopollenites levius Takahashi, Triorites cf. harrisi Couper, Rhoipites bradleyi Wodehouse, Myrtaceidites parvus Cookson & Pike forma anesus Cookson & Pike, and Myrtaceidites parvus Cookson & Pike forma nesus Cookson & Pike appear only in Paleogene or Tertiary. Other species appear in both Lower Tertiary and Upper Cretaceous. Triorites minor Couper is only an Upper Cretaceous species from New Zealand. Foveotricolporites foveolatus n. sp. is similar to Foveotricolporites caldensis Guzmán from the pollen zone I(a) (Lower Eocene) of Tibu area, Colombia.

All above-mentioned species except Triorites minor Couper appear commonly in Paleogene or Eocene. Accordingly, the Concepción Formation indicates a possibility to be an Eocene age.

Stratigraphic and geographic distribution of all above-mentioned species is summarized as follows.

Leiotorites microadriennis Krutzsch
Eocene: Geiseltal, Germany.

Eocene: Dorog, Bakony, Hungary.

Gleichenioidites circinoidites (Cookson) n. comb.

Early Tertiary: S. Australia, Victoria, Australia.

Laevigatosporites dehiscens Takahashi
Paleogene-Miocene: W. Honshu, N. Kyushu, Japan.

Campanian-Maastrichtian: Hokkaido, Japan.

Upper Cretaceous: Quiriquina Formation, Chile.

Dacrydiumites florinii Cookson & Pike

Maastrichtian-Paleocene: Dorotea Formation, Argentina.

Inaperturopollenites pseudodubius Takahashi
Paleogene-Miocene: W. Honshu, N.
Kyushu, Japan.
Cretaceous-Paleogene: Hokkaido, NE. Honshu, Japan.

Inapertiropolletes laevigatus TAKAHASHI
Paleogene-Miocene: W. Honshu, N. Kyushu, Japan.
Cretaceous-Paleogene: Hokkaido, NE. Honshu, Japan.
Upper Cretaceous: Quiriquina Formation, Chile.

Monocollepapollenites kyushuensis TAKAHASHI
Paleogene-Miocene: W. Honshu, N. Kyushu, Japan.
Upper Cretaceous-Paleogene: Hokkaido, Japan.

Lilacidites variegatus COUPER
Paleocene: Chubut Province, Argentina.
Maastrichtian-Paleocene: Dorotea Formation, Argentina.
Maastrichtian-Miocene: Southland, New Zealand.

Smilacibites setarius (R. POTONIE) R. POTONIE
Eocene: Geiseltal, Germany.

Triporopollenites festatus TAKAHASHI
Paleogene-Miocene: W. Honshu, N. Kyushu, Japan.
Upper Cretaceous-Paleogene: Hokkaido, Japan.
Turonian-Eocene: Sarawak, Malaysia.
Upper Cretaceous: Quiriquina Formation, Chile.

Myrtaceidites parvus COOKSON & PIKE forma aneusus COOKSON & PIKE
Eocene-Pliocene: W. Australia, S. Australia, Victoria, New Guinea.
Upper Cretaceous: Quiriquina Formation, Chile

Myrtaceidites parvus COOKSON & PIKE forma nesus COOKSON & PIKE
Eocene-Pliocene: S. Australia, Victoria, N.S. Wales, Queensland, Australia.

Triorites minor COUPER
Upper Cretaceous: Kaitangata coalfield, New Zealand.
Turonian: Port Campbell No. 2, Victoria, Australia.

Triorites harrissi COUPER
Early Tertiary: Wangerrip Group, Victoria, Australia.
Oligocene: Southland, New Zealand.

Subtritropapollenites levis TAKAHASHI
Paleogene: N. Kyushu, Japan.

Rhoiptes bradleyi WODEHOUSE
Eocene: Green River Formation, U.S.A.

Descriptive palynology

Anteturma Sporites H. POTONIE 1893.
Turuva Triletes REINSH 1881 emend.
R. POTONIE & KREMP 1954.
Subturva Azonotrilletes LUBER 1935.

Infaturma Laevigati BENNIE & KIDSTONE 1886 emend. R. POTONIE 1956.


Type species: Leiotrilletes sphaerotriangularis (LOOSE 1932) POTONIE & KREMP 1954.

Leiotrilletes minus n. sp.

Pl. 9, figs. 19-21

Description: Spores trilete; outline triangular in polar view, with slightly concave sides and somewhat rounded angles. Trilete mark straight and reaching to the equator. Prominent folds 1.5 μ wide, often of unequal length, accompany the trilete mark. Exine thin, chagrenate. Grain size 23.5-27.2 μ.
Holotype: Pl. 9, fig. 20; grain size 27.2 μ, exine thin; slide GN 2527.

Occurrence: Few; Concepción Formation (Eocene) in the Concepción area.

Remarks: The present specimens are superficially similar to Leiotritelites spp. (G. M. Bratzeba, 1969, pl. 8, fig. 3; pl. 20, fig. 4) from the Upper Cretaceous formations, Far East.

Botanical affinity: ? Schizaeaceae.

Leiotritelites microadriennis KRUTZSCH

Pl. 10, fig. 1

1959. Leiotritelites microadriennis KRUTZSCH, Geologie, vol. 8, no. 21-22, p. 61, pl. 1, figs. 3-7.

Dimensions: Grain size 51.7 μ, exine 1.3 μ thick, chagrenate.

Occurrence: Very rare; Concepción Formation (Eocene) in the Concepción area.

Remarks: This specimen is identified with Leiotritelites microadriennis described by W. KRUTZSCH from the lower coal seams (middle Eocene) at Geiseltal.


Genus Stereisporites THOMSON & PFLUG 1953.

Type species: Stereisporites stereoides (POTONIE & VENITZ 1934) THOMSON & PFLUG 1953.

Stereisporites concepcionensis n. sp.

Pl. 9, figs. 1-7

Description: Spores trilete, outline triangular or subtriangular in polar view, with convex sides and rounded angles. The laesurae of the tetrad scar simple, about 1/2-2/3 spore radius.

Arcuate thickening of the spore wall on the proximal face subtent angles between the laesurae. Exine psilate, less than 1 μ thick; a thickened zone 2-3.5 μ wide surrounds the equator. Equatorial diameter 19.3-25.4 μ.

Holotype: Pl. 9, fig. 5; equatorial diameter 22 μ, laesurae about 1/2 spore radius (5 μ long), a thickened zone 3.5 μ wide; slide GN 2536.

Occurrence: Frequent; Concepción Formation (Eocene) in the Concepción area.

Remarks: The present specimens are very similar to Sphagnum antiquasporites WILSON & WEBSTER (1946, p. 273, fig. 2) from the Paleocene Fort Union Formation of Montana, but the Concepción specimens are different from the Montana species in thickness of the thickened zone.

Botanical affinity: Sphagnum.

Genus Concavisporites PFLUG 1953 emend. DELCOURT & SPRUMONT 1955.

Types pecies: Concavisporites rugulatus PFLUG 1953.

Concavisporites sp.

Pl. 9, fig. 22

Description: Spore trilete. Amb triangular in polar view, with concave sides and rounded angles. Trilete mark straight and reaching to the equator. Exine thin, punctate or chagrenate. Grain size 29 μ.

Occurrence: Rare; Concepción Formation (Eocene) in the Concepción area.

Remarks: Only one specimen was found. This is similar to Concavisporites macellus TAKAHASHI (1964, p. 192-193, pl. 23, figs. 18-19) from the Campanian.
Hakobuchi Group, Hokkaido, Japan, but is different from the latter in length of Y-mark.

*Botanical affinity:* Unknown.

Genus *Triplanosporites* Pflug 1953.

*Type species:* *Triplanosporites sinuosus* Pflug 1953.

*Triplanosporites minor* n. sp.

Pl. 10, figs. 2-3

*Description:* Spores trilete, outline in equatorial view rhombic; polar axis longer than equatorial axis. Trilete mark distinct, reaching almost to the periphery. The proximal and distal poles peaked. Exine thin, psilate. Grain size: polar axis 20–27.3 μ, equatorial axis 18.5–27 μ.

*Holotype:* Pl. 10, fig. 3; polar axis 27.3 μ, equatorial axis 27 μ; exine thin; slide GN 2532.

*Occurrence:* Few; Concepción Formation (Eocene) in the Concepción area.

*Remarks:* The species differs from *Triplanosporites microsinuosus* Pflanzl (F. Mürriger & G. Pflanzl, 1955, p. 87, pl. 5, figs. 12a–b; pl. 6, figs. 21a–b; W. Krutzsch, 1962, p. 42, figs. 1–16) in having extremely thin exine and smaller size.

*Botanical affinity:* Unknown.

*Triplanosporites* sp.

Pl. 10, fig. 4

*Description:* Spore trilete; outline in equatorial view compressed rhombic; polar axis shorter than equatorial axis. Trilete mark distinct, reaching almost to the periphery. Exine chagrenate, thin. Grain size: polar axis 26.3 μ, equatorial axis 30 μ. The distal pole rounded.

*Occurrence:* Rare; Concepción Formation (Eocene) in the Concepción area.

*Remarks:* Only one specimen was found. This specimen differs from *Triplanosporites minor* n. sp. in having compressed rhombic form and rounded distal pole.

*Botanical affinity:* Unknown.


*Type species:* *Punctatisporites punctatus* Ibrahim 1933.

*? Punctatisporites* sp.

Pl. 10, fig. 5

*Description:* Spore trilete; outline circular in polar view. Trilete mark strong, straight and not reaching to the equator. Exine 5 μ thick, fine punctate (?). Grain size 71 μ in diameter.

*Occurrence:* Rare; Concepción Formation (Eocene) in the Concepción area.

*Remarks:* It is not accurately determined whether the present specimen belongs to *Punctatisporites* or not, because of its poor preservation.

*Botanical affinity:* Unknown.

Subturma Zonotriletes Waltz 1935.

Infroturma Cingulati Potonié & Klaus 1954.


*Type species:* *Gleicheniiidites senonicus* Ross 1949.

*Gleicheniiidites speciosus* n. sp.
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Pl. 9, figs. 8-15

Description: Spores trilete; outline triangular in polar view, with usually somewhat convex or concave sides and more or less rounded angles. The proximal wall flattened. Exine 4-6 μ thick at the sides and psilate or chagre- nate (on a few spores a faint rugulate was observed). Trilete mark straight or sometimes somewhat undulating and always reaching to the equator. Grain size 35-42.7 μ in diameter.

Holotype: Pl. 9, fig. 8, grain size 39 μ, exine 5 μ thick at the sides; slide GN 2535.

Occurrence: Frequent; Concepción Formation (Eocene) in the Concepción area.

Remarks: The present specimens are similar to Gleichenioides marginatus Takahashi (1964, p. 191-192, pl. 23, figs. 4-17; pl. 40, fl. 1) from the Campanian and Maastrichtian Hakobuchi Group, Hokkaido, Japan, but the former differs from the latter in size and in details of form.

Botanical affinity: Gleicheniaceae—Gleichenia.

Gleichenioides circinidites
(Cookson) n. comb.


Dimensions: Grain size 32.8-40 μ in diameter, exine psilate, at the corners 2.5-μ thick and increasing to 3-4 μ at the sides.

Occurrence: Common; Concepción Formation (Eocene) in the Concepción area.

Remarks: The present specimens are referable to Gleichenia circinidites Cook- son (1953) from the Early Tertiary coal at 619.6 feet of core at Comaum, South Australia, Australia.

Botanical affinity: Gleicheniaceae—Gleichenia.

Turma Monoletes Ibrahim 1933.

Subturma Azonomonoletes
Luber 1935.

Infraturma Laevigatomonoleti
Dybova & Jachowicz 1957.

Genus Laevigatosporites Ibrahim 1933.

Type species: Laevigatosporites vulgaris Ibrahim 1933.

Laevigatosporites ovulatus n. sp.

Pl. 10, figs. 6-10

Description: Spores monolete; outline in lateral view broadly bean-shaped, 26-39×21-30 μ (ratio of width to length 0.7-0.9). Exine smooth, thin (less than 1 μ). Monolete mark straight or somewhat convexly curved and not bordered by ridges. Sometimes folding along the dehiscence furrow.

Holotype: Pl. 10, fig. 7; grain size 39×28.2 μ in lateral view, exine thin; ratio of width to length 0.72; slide GN 2536.

Occurrence: Common; Concepción Formation (Eocene) in the Concepción area.

Remarks: The present specimens are closely similar to Laevigatosporites ovatus Wilson & Webster (1946, p. 273, fig. 5) from the Paleocene Fort Union Formation of Montana and Laevigatosporites major (Cookson) Krutzsch (al. Monol- ites major Cookson, p. 135, pl. 15, fig. 56) from the Tertiary lignites and carbonaceous sandstone in Kerguelen
Island, but differ from the *ovatus* form in having a thin wall and from the *major* form in having a small size and thin wall.  

*Botanical affinity:* Polypodiaceae.

**Laevigatosporites dehiscens**  
**Takahashi**  
Pl. 10, gg. 11  


**Dimensions:** Grain size in lateral view 31×19 μ, exine thin.  

**Occurrence:** Few; Concepción Formation (Eocene) in the Concepción area.  

**Remarks:** This specimen is identified with *Laevigatosporites dehiscens* Takahashi from the Paleogene and Miocene formations of Japan.  

*Botanical affinity:* Polypodiaceae.

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**Anteturma Pollenites** R. Potonié 1931.  

**Turma Saccites** Erdtman 1947.  

**Subturma Disaccites** Cookson 1947.  

**Genus Dacrydiumites** Cookson 1953 ex Harris 1965.  

**Type species:** *Dacrydiumites florinii* Cookson & Pike 1953.  

*Dacrydiumites cf. florinii*  
Cookson & Pike  
Pl. 10, figs. 18-20  


**Dimensions:** Total length of the grain 35.6-43 μ, total height of the grain 30.7-37.4 μ, width of the air sacs 24.2-26.3 μ, height of the air sacs 14.5-23.3 μ.

**Occurrence:** Rare; Concepción Formation (Eocene) in the Concepción area.  

**Remarks:** The present specimens are poor in preservation, but they are barely referable to *Dacrydiumites florinii* Cookson & Pike, ranging from Paleocene to Pliocene in Australia.  

*Botanical affinity:* Dacrydium.

**Turma Aletes** Ibrahim 1933.  

**Subturma Azonaletes** Luber 1935 emend. Potonié & Kremp 1954.  

**Infraturma Psilonapitii** Erdtman 1947.  


**Type species:** *Inaperturopollenites dubius* (Potonié & Venitz 1934) Thomson & Pflug 1953.

**Inaperturopollenites pseudodubius**  
**Takahashi**  


**Occurrence:** Few; Concepción Formation (Eocene) in the Concepción area.  

**Remarks:** This species appears in Paleogene and Miocene of Japan. This is similar to *Inaperturopollenites dubius* (Potonié & Venitz) Thomson & Pflug, but differs from the latter in having a very thin wall.  

*Botanical affinity:* Taxodiaceae.

**Inaperturopollenites laeavigatus**  
**Takahashi**
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Pl. 10, figs. 15-17

1957. *Inaperturopollenites laevigatus* TAKAHASHI, Mem. Fac. Sci., Kyushu Univ., Ser. D, Geol., vol. 5, no. 4, p. 216-217, pl. 38, fig. 18; pl. 39, fig. 16.

*Dimensions:* 21-36.7 μ in diameter, exine thin, laevigate.

*Occurrence:* Few; Concepción Formation (Eocene) in the Concepción area.

*Remarks:* The present pollen grains fold very often. They are referable to *Inaperturopollenites laevigatus* TAKAHASHI from the Paleogene strata of western Japan.

*Botanical affinity:* Taxodiaceae.


Type species: *Smilacipites echinatus* WODEHOUSE 1933.

*Smilacipites setarius* (POTONIE)

**POTONIE**

Pl. 12, fig. 27


*Dimensions:* Grain size 31.5 μ; length of spine 1.8-2.4 μ.

*Occurrence:* Very rare; Concepción Formation (Eocene) in the Concepción area.

*Remarks:* Only one specimen was found. This pollen grain belongs to the form-genus *Smilacipites*.

*Botanical affinity:* ?Smilax.

Turma Plicates NAUMOVA 1939 emend. POTONIE 1960.

Subturma Polypticates ERDTMAN 1952.

Genus *Ephedripites* BOLCHOVITINA 1953.

Type species: *Ephedripites medio lobatus* BOLCHOVITINA 1953.

*Ephedripites* sp.

Pl. 10, fig. 14

*Description:* Pollen grain ellipsoidal, without a furrow, 24 μ long and 15.8 μ broad. Exine firm, smooth with about 15 longitudinal ridges. Width of ridge 1.1 μ.

*Occurrence:* Very rare; Concepción Formation (Eocene) in the Concepción area.

*Remarks:* Only one specimen was found. This pollen grain belongs to the form-genus *Ephedripites*.

*Botanical affinity:* ?Ephedraceae.

Subturma Monocolpates IVERSEN & TROELS-SMITH 1950.

Genus *Monocolpopollenites* PFLUG & THOMSON 1953.

Type species: *Monocolpopollenites tranquillus* (R. POTONIE 1934) THOMSON & PFLUG 1953.

*Monocolpopollenites* cf. *kyushuensis*

**TAKAHASHI**

Pl. 10, figs. 12-13

Dimensions: Pollen grain 32-33.5 x 17.7-22.5 μ; exine less than 1 μ, chagrenate.

Occurrence: Rare; Concepción Formation (Eocene) in the Concepción area.

Remarks: The present specimens resemble Monocolpopolitanites kyushuensis TAKAHASHI from the Upper Cretaceous and Tertiary strata of Japan.

Botanical affinity: Palmae.

Genus Liliacidites COUPER 1953.

Type species: Liliacidites kaitangataensis COUPER 1953.

Liliacidites variegatus COUPER

Pl. 12, fig. 28


Dimensions: Length of the grain 31.5 μ, breadth of the grain 18.4 μ; exine reticulate, muri baculate, 0.6 μ high, lumen of reticulum 1 μ± in diameter.

Occurrence: Very rare; Concepción Formation (Eocene) in the Concepción area.

Remarks: The present specimen is referable to Liliacidites variegatus COUPER from the Oligocene (Landonian) strata, Mataura Valley, Southland, New Zealand.

Botanical affinity: Liliaceae.

Subturma Dicollpates ERDTMAN 1947.


Type species: Dicollpopolis kockeli PFLANZL 1956.

Dicollpopolis sp.

Pl. 12, fig. 26

Description: Pollen grain dicollpate; outline in polar view circular. Colpus not reaching to the pole. Exine thin, smooth. Grain size 42 μ.

Occurrence: Very rare; Concepción Formation (Eocene) in the Concepción area.

Remarks: Only one specimen was found. This specimen belongs to the form-genus Dicollpopolis established by G. PFLANZL (1956).

Botanical affinity: Unknown.

Subturma Ptychotriporines

NAUMOVA 1939.

Infra turma Prolati ERDTMAN 1943.

Genus Rhoipites WODEHOUSE 1933.

Type species: Rhoipites bradleyi WODEHOUSE 1933.

Rhoipites bradleyi WODEHOUSE

Pl. 12, figs. 30-31, 33a-b


Dimensions: Length of the grains 20-25.8 μ, breadth of the grains 28.8-32 μ; exine finely reticulate.

Occurrence: Few; Concepción Formation (Eocene) in the Concepción area.

Remarks: The present specimens are identifiable with Rhoipites bradleyi WODEHOUSE from the Eocene Green River Formation, U.S.A.

Botanical affinity: Unknown.

Rhoipites sp.

Pl. 12, fig. 29

Description: Pollen grain tricolporate;
outline in lateral view elliptical. Colpi narrow, with large ora, almost reaching to the pole. Exine very finely reticulate. Muri finely baculate. Grain size 15×25.6 μ.

Occurrence: Very rare; Concepción Formation (Eocene) in the Concepción area.

Remarks: Only one specimen was found. This specimen is similar to Rhoipites bradleyi WODEHOUSE.

Botanical affinity: Unknown.

Genus Foveotricolporites PIERCE 1961.

Type species: Foveotricolporites rhombohedrals PIERCE 1961.

Foveotricolporites foveolatus n. sp.

Pl. 12, figs. 32a–b

Description: Pollen grain tricolporate, subprolate. Colpus with rounded pore relatively narrow. Exine thin, foveolate; lumina less than 1 μ in diameter. Grain size 30×35 μ.

Holotype: Pl. 12, figs. 32a–b; grain size 30×35 μ; slide GN 2527.

Occurrence: Rare; Concepción Formation (Eocene) in the Concepción area.

Remarks: The present specimen is similar to Foveotricolporites voluminosus GUZMAN from the Lower and Middle Eocene of the Tibú area, Colombia, but differs from the latter in having thin wall and smaller lumina.

Botanical affinity: Unknown.

Turma Poroses NAUMOVA 1937

emend. R. POTONIÉ 1960

Subturma Triporines NAUMOVA 1939


Genus Triatriopollenites PFLUG 1953.

Type species: Triatriopollenites rurensis THOMSON & PFLUG 1953.

Triatriopollenites sp.

Pl. 11, figs. 10a–b

Description: Triporate pollen. Equatorial contour triangular-convex. Pores small, equatorial, sometimes one or two pores subequatorial. Exine thin, 0.7 μ thick, chagrenate, without annulus and tumescens, but with distinctly developed atrium in the pore areas. Grain size 30 μ in diameter.

Occurrence: Rare; Concepción Formation (Eocene) in the Concepción area.

Remarks: The present specimen with developed atrium is identified with the form-genus Triatriopollenites.

Botanical affinity: Myricaceae.

Genus Triporopollenites PFLUG & THOMSON 1953 emend.

R. POTONIÉ 1960.

Type species: Triporopollenites coryloides PFLUG 1953.

Triporopollenites festatus TAKAHASHI

Pl. 11, figs. 1–8


1968. Triorites festatus (TAKAHASHI) MOLLER, Micropaleontology, vol. 14, no. 1, p. 15, pl. 3, fig. 10.

Dimensions: Grain size 26–32.8 μ in equatorial diameter; exine 0.6–1.4 μ thick, forming annulus in the pore areas.

Occurrence: Common; Concepción Formation (Eocene) in the Concepción area.

Remarks: The present specimens are
identified with *Triporopollenites festatus* TAKAHASHI from the Paleogene and Upper Cretaceous formations of Japan.  
*Botanical affinity:* Betulaceae.

**Genus Momipites WODEHOUSE 1933.**

**Type species:** *Momipites coryloides* WODEHOUSE 1933.

*Momipites* sp.

Pl. 12, figs. 5-6


*Occurrence:* Rare; Concepción Formation (Eocene) in the Concepción area.

*Remarks:* Only two specimens were found. These specimens belong undoubtedly to the form-genus *Momipites.*  
*Botanical affinity:* Betulaceae.

**Genus Myrtaceidites COOKSON & PIKE 1954 ex R. POTONIE 1960.**

**Type species:** *Myrtaceidites mesonesus* COOKSON & PIKE 1954.

*Myrtaceidites parvus* COOKSON & PIKE forma *anesus* COOKSON & PIKE

Pl. 12, figs. 7-11


*Dimensions:* Grain size 12-13.6 μ in equatorial diameter; exine smooth or chagreneate; polar islands absent.

*Occurrence:* Common; Concepción Formation (Eocene) in the Concepción area.

*Remarks:* The present specimens are identical with the species *Myrtaceidites parvus* COOKSON & PIKE forma *anesus* COOKSON & PIKE described by I.C. COOKSON and K.M. PIKE (1954) from the Eocene to Pliocene sediments in Australia.

*Botanical affinity:* Unknown.

*Known range in Australia:* Eocene to Pliocene.

*Myrtaceidites parvus* COOKSON & PIKE forma *nesus* COOKSON & PIKE

Pl. 12 figs. 12-24

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**Explanation of Plate 9**

*(All figures ×1000)*

Figs. 1-7. *Stereisporites concepcionensis* n. sp.

Figs. 1, 2: slide GN 2531; fig. 3: slide GN 2533; fig. 4: slide GN 2534; fig. 5: holotype, slide GN 2536; fig. 6: slide GN 2541; fig. 7: slide GN 2548.

Figs. 8-15. *Gleicheniidites speciosus* n. sp.

Fig. 8: holotype, slide GN 2535; figs. 9, 10: slide GN 2532; fig. 11: slide GN 2540; fig. 12: slide GN 2548; fig. 13: slide GN 2533; fig. 14: slide GN 2508; fig. 15: slide GN 2536.

Figs. 16-18. *Gleicheniidites circinidites* (COOKSON) n. comb.

Fig. 16: slide GN 2507; fig. 17: slide GN 2508; fig. 18: slide GN 2537.

Figs. 19-21. *Leiotrilites minus* n. sp.

Fig. 19: slide GN 2528; fig. 20: holotype; figs. 20, 21: slide GN 2527.

Fig. 22. *Concavisporites* sp.

Slide GN 2535.

*Dimensions:* Grain size 10.7-12.5 μ in equatorial diameter; exine smooth or faintly patterned; polar islands distinct.

*Occurrence:* Abundant; Concepción Formation (Eocene) in the Concepción area.

*Remarks:* The specimens are referable to *Myrtaceidites parvus* COOKSON & PIKE forma *nesus* COOKSON & PIKE described by I.C. COOKSON K.M. PIKE (1954) from the Eocene to Pliocene formations in Australia.

*Botanical affinity:* Unknown.

*Known range in Australia:* Eocene to Pliocene.

**Myrtaceidites** sp.

Pl. 12, fig. 25

*Description:* Grain size 17.5 μ in equatorial diameter. Amb with straight or slightly convex sides. Arci prominent, polar islands absent. Exine thin, chagrenate or faintly punctate.

*Occurrence:* Very rare; Concepción Formation (Eocene) in the Concepción area.

*Remarks:* Only one specimen was found. This specimen coincides with the characteristics of the form-genus *Myrtaceidites*.

*Botanical affinity:* Unknown.


Type species: *Triorites magnificus* COOKSON 1950.

**Triorites minor** COUPER

Pl. 11, fig. 11


*Dimensions:* Grain size 19.7 μ in equatorial diameter. Exine thin, punctate or chagrenate.

*Occurrence:* Very rare; Concepción Formation (Eocene) in the Concepción area.

*Remarks:* Only one specimen was found. This specimen coincides with the characteristics of *Triorites minor* COUPER (1953) from the Upper Cretaceous (Sub-Wangaloan) of the Kaitangata coalfield (New Zealand).

*Botanical affinity:* Unknown.

**Triorites cf. harrisi** COUPER

Pl. 11, figs. 21a-b


*Dimensions:* Grain size 20.8 μ in equatorial diameter. Ora 3.2-4.8 μ in diameter. Exine thin, annulus and labrum around ora, chagrenate.

*Occurrence:* Very rare; Concepción Formation (Eocene) in the Concepción area.

*Remarks:* Only one specimen was found. This specimen is closely similar to *Triorites harrisi* COUPER described by R.A. COUPER (1953) from the Oligocene sediments in the Ford's Old Lignite Mine, Southland (New Zealand).

*Botanical affinity:* Unknown.

Genus *Subtriporopollenites* PFLUG & THOMSON 1953.

*Subtrirhopollenites rotundulus* n. sp.

Pl. 11, figs. 9, 12-13; pl. 12, fig. 4

*Description:* Pollen grain triporate. Grain circular to subtriangular in polar view. Pores circular, 2.4 μ in diameter; one or two pores subequatorial. Exine 0.8-1.5 μ thick, chagrenate, annulus in the areas. Grain size 30.6-36.6 μ in equatorial diameter.

*Holotype:* Pl. 11, fig. 12; grain size 32 μ in equatorial diameter; exine 1 μ thick, chagrenate; slide GN 2530.

*Occurrence:* Few; Concepción Formation (Eocene) in the Concepción area.

*Remarks:* The present specimens are similar to the Japanese species *Subtrirhopollenites kyushuensis* Takahashi (1961, p. 305-306, pl. 20, figs. 35-37; pl. 21, figs. 1-10), but the former differs from the latter in structure of exine in the pore areas (annulus).

*Botanical affinity:* Juglandaceae—? Carya.

*Subtrirhopollenites falsus* n. sp.

Pl. 11, figs. 14-20; pl. 12, figs. 2-3

*Description:* Pollen grain triporate. Grain circular to subtriangular with rounded sides in polar view. Pores small, circular to elliptical; all pores subequatorial, sometimes one pore equatorial. Exine sometimes with weak annulus and labrum, less than 1.5 μ thick, chagrenate or faintly punctate. Grain size 21.5-29 μ in equatorial diameter.

*Holotype:* Pl. 11, fig. 19; grain size 26.5 μ in equatorial diameter; pore 1.7 μ

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**Explanation of Plate 10**

(All figures x1000)

Fig. 1. *Leiostreites microadriennis* Krutzsch
Slide GN 2530.

Figs. 2-3. *Triplanosporites minor* n. sp.
Fig. 2: slide GN 2533; fig. 3: holotype, slide GN 2532.

Fig. 4. *Triplanosporites* sp.
Slide GN 2532.

Eig. 5. *? Punctatisporites* sp.
Slide GN 2526.

Figs. 6-10. *Laevigatosporites ovulatus* n. sp.
Figs. 6, 7: slide GN 2536; fig. 7: holotype; fig. 8: slide GN 2534; fig. 9: slide GN 2537; fig. 10: slide GN 2535.

Fig. 11. *Laevigatosporites dehiscens* Takahashi
Slide GN 2507.

Fig. 12: slide GN 2533; fig. 13: slide GN 2540.

Fig. 14. *Ephedripites* sp.
Slide GN 2508.

Figs. 15-17. *Inaperturopollenites laevigatus* Takahashi
Figs. 15, 16: slide GN 2532; fig. 17: slide GN 2533.

Figs. 18-20. *Dacrydiumites cf. florinii* Cookson & Pike
Figs. 18, 19: slide GN 2530; fig. 20: slide GN 2539.
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in diameter; exine thin, chagrenate; slide GN 2536.

Occurrence: Abundant; Concepción Formation (Eocene) in the Concepción area.

Remarks: The Japanese species Subtritoporopollenites kyushuensis TAKAHASHI (1961, p. 305-306, pl. 20, figs. 35-37; pl. 21, figs. 1-10) is compared with the present specimens.

Botanical affinity: Juglandaceae—? Carya.

Subtritoporopollenites levius TAKAHASHI

Pl. 12, fig. 1


Dimensions: Grain size 20 µ in equatorial diameter; exine thin, roughly rugulate.

Occurrence: Very rare; Concepción Formation (Eocene) in the Concepción area.

Remarks: Only one specimen was found. The present specimen belongs to the species Subtritoporopollenites levius TAKAHASHI (1961) from the Lower Oligocene formations of the Kasuya and Karatsu coalfields in north Kyushu, Japan. The former is smaller in size than the latter.


References


Kiyoshi TAKAHASHI


NAKOMAN, E. (1966): Contribution à l’étude palynologique des formations tertiaires du Bassin de Thrace. I. Etude qualita-

Explanation of Plate II
(All figures ×1000)

Figs. 1-8. Triporopollenites festatus TAKAHASHI
Fig. 1: slide GN 2532; fig. 2: slide GN 2508; figs. 3, 4: slide GN 2507; fig. 5: slide GN 2528; fig. 6: slide GN 2538; fig. 7: slide GN 2530; fig. 8: slide GN 2536.

Figs. 9, 12, 13. Subtrioropollenites rotundulus n. sp.
Fig. 9: slide GN 2528; fig. 12: holotype, slide GN 2530; fig. 13: slide GN 2508.

Figs. 10a-b. Triatriopollenites sp.
Slide GN 2529.

Fig. 11. Triorites minor COUPER
Slide GN 2536.

Figs. 14-20. Subtrioropollenites falsus n. sp.
Fig. 14: slide GN 2535; fig. 15: slide GN 2532; fig. 16: slide GN 2538; fig. 17: slide GN 2534; fig. 18: slide GN 2537; fig. 19: holotype, slide GN 2536; fig. 20: slide GN 2527.

Figs. 21a-b. Triorites cf. harrisisi COUPER
Slide GN 2538.


Explanation of Plate 12
(All figures ×1000)

Fig. 1. *Subtriporopollenites levius* TAKAHASHI
Slide GN 2536.

Figs. 2-3. *Subtriporopollenites falsus* n. sp.
Fig. 2: slide GN 2539; fig. 3: slide GN 2532.

Fig. 4. *Subtriporopollenites rotundulus* n. sp.
Slide GN 2528.

Figs. 5-6. *Momipites* sp.
Fig. 5: slide GN 2533; fig. 6: slide GN 2536.

Figs. 7-11. *Myrtaceidites parvus* COOKSON & PIKE forma *anesus* COOKSON & PIKE
Fig. 7: slide GN 2538; figs. 8, 11: slide GN 2535; fig. 9: slide GN 2532; fig. 10: slide GN 2533.

Figs. 12-24. *Myrtaceidites parvus* COOKSON & PIKE forma *nesus* COOKSON & PIKE
Fig. 12: slide GN 2534; figs. 13-17, 21: slide GN 2535; figs. 18, 24: slide GN 2539; figs. 19, 20, 23: slide GN 2536; fig. 22: slide GN 2508.

Fig. 25. *Myrtaceidites* sp.
Slide GN 2534.

Fig. 26. *Dicolpopollis* sp.
Slide GN 2536.

Fig. 27. *Smilacipites setarius* (POTONIE) POTONIE
Slide GN 2530.

Fig. 28. *Liliacidites variegatus* COUPER
Slide GN 2532.

Fig. 29. *Rhoipites* sp.
Slide GN 2525.

Figs. 30-31, 33a-b. *Rhoipites bradleyi* WODEHOUSE
Fig. 30: slide GN 2530; fig. 31: slide GN 2529; fig. 33: slide GN 2532.

Figs. 32a-b. *Foveotricolporites foveolatus* n. sp.
Holotype, slide GN 2527.