Upper Cretaceous palynoflora from Quiriquina Island, Chile

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Introduction

The materials investigated were provided by Prof. S. MAEDA, Department of Geology, Faculty of Science, Chiba University, who collected from the Upper Cretaceous Quiriquina Formation being distributed in Quiriquina Island and Tumbes Peninsula, central Chile.

The author has found many spores, pollen grains, and other microfossils in the material from the Quiriquina Formation of Quiriquina Island and only a few palynomorphs from Tumbes Peninsula. Forty-two species of plant microfossils, consisting of microspores and pollen grains, are recorded from the Quiriquina Formation (Upper Senonian or Maastrichtian) of Quiriquina Island. One genus and six species are instituted as new taxa.

Acknowledgements

The author expresses his gratitude to Prof. Dr. S. MAEDA, Department of Geology, Faculty of Science, Chiba University, for supplying the samples upon which this study is based. Thanks are also due to Dr. T. KIMURA, Department of Earth Sciences, Tokyo Gakugei University, for providing some literatures on paleobotany and palynology of South America.

Materials and palynological notes

The samples from the Quiriquina Formation of Quiriquina Island and Tumbes Peninsula were examined. The material from Quiriquina Island is a dark gray mudstone and the Tumbes Peninsula material is a greenish mudstone containing many molluscan fossils.

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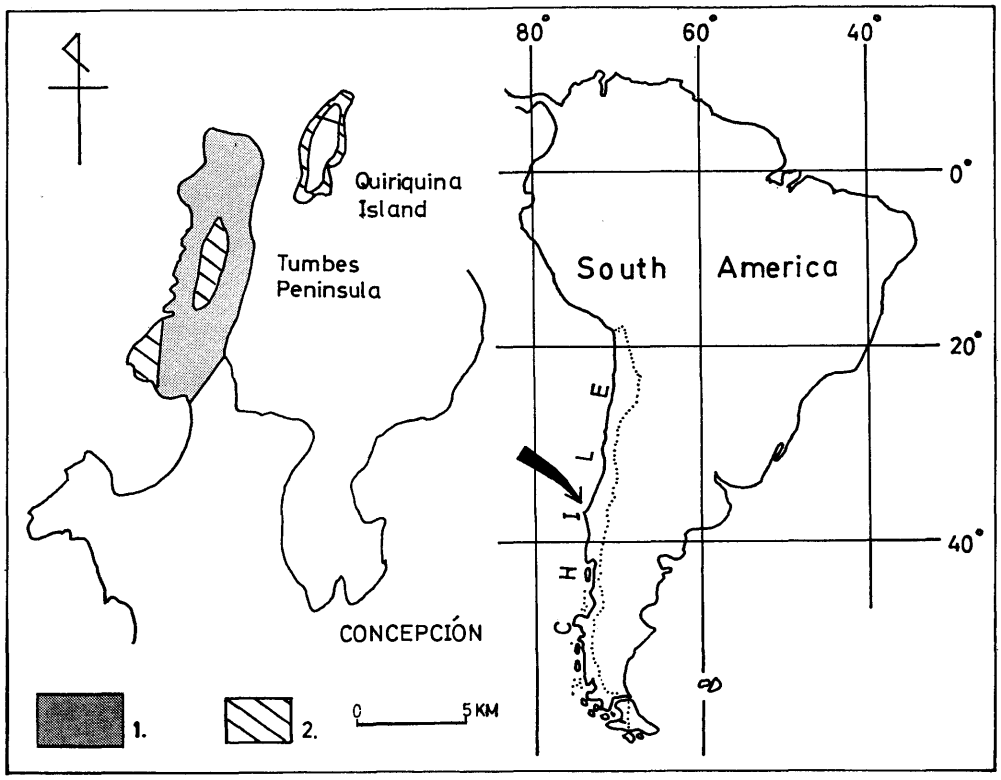
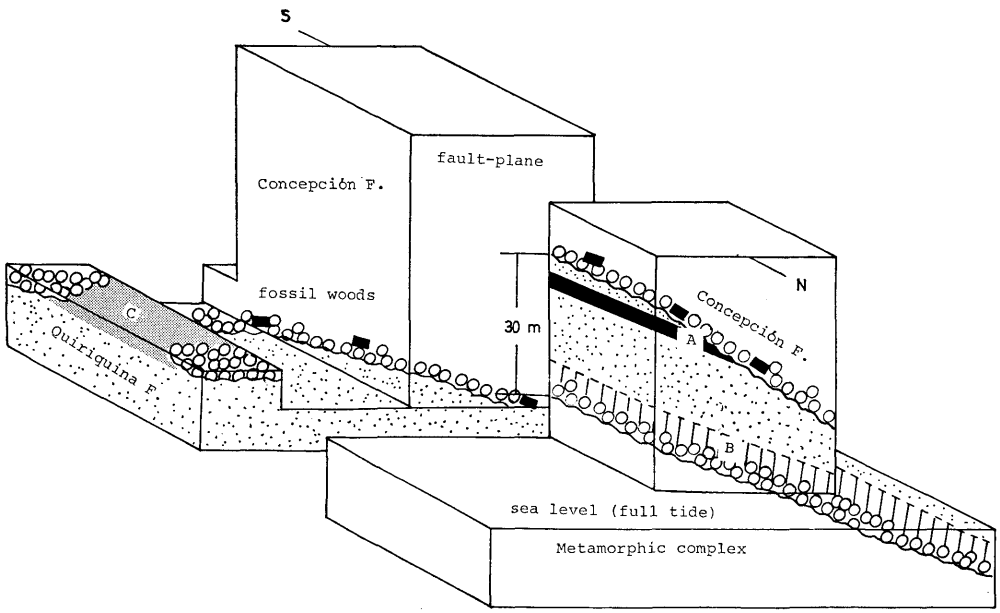


Text-fig. 1. Locality map showing situation of the Island of Quiriquina.
1 : Metamorphic complex
2 : Quiriquina Formation



Text-fig. 2. A generalized block diagram showing geological structure of the Island of Quiriquina.
A, C : Fossil plants localities
B : Fossiliferous glauconite sandstone
(after S. Maeda et al., 1972)

All palynomorphs reported in this paper are from Quiriquina Island and as follows.

Trilete spores :

Deltoidospora quiriquinaensis n. sp.

Deltoidospora sp. A

Deltoidospora sp. B

Cyathidites cf. *minor* COUPER

Cyathidites australis COUPER

Leiotriletes sp.

Trilites cf. *parvallatus* KRUTZSCH

Quiriquinaspora chilensis n. gen. & n. sp.

Duplosporis sp.

Monolete spores :

Laevigatosporites dehiscens TAKAHASHI

Polypodiidites inangahuensis COUPER

Punctatosporites sp.

Pollen grains :

Tsugaepollenites mesozoicus COUPER

Pinuspollenites concepcionensis n. sp.

Pinuspollenites sp.

Piceaepollenites sp.

Podocarpidites exiguus HARRIS

Podocarpidites multesimus (BOLKHOVITINA) POCOCK

Podocarpidites sp.

Phyllocladidites mawsoni COOKSON

Parvisaccites cf. *radiatus* COUPER

Trisaccites microsaccatus (COUPER) COUPER

Inaperturopollenites laevigatus TAKAHASHI

Monocolpopollenites sp.

Clavatipollenites hughesii COUPER emend. KEMP

Liliacidites variegatus COUPER

Tricolpopollenites fallax (R. POTONIÉ)) THOMSON & PFLUG

Tricolpites microreticulatus (TAKAHASHI) n. comb.

Tricolpites sp.

Tricolporopollenites minor TAKAHASHI

Tricolporopollenites microporifer TAKAHASHI

Tricolporopollenites punctulosus n. sp.

Tricolporopollenites sp.

Retitricolporites sp.

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

Triatriopollenites maedae n. sp.

Triporopollenites shimensis TAKAHASHI

Triporopollenites festatus TAKAHASHI

Proteacidites minor n. sp.

Proteacidites sp.

Beaupreaidites sp.

Nothofagi dites sp.

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.

The Quiriquina microflora studied in this paper contains some species which do not appear in Tertiary, but in Mesozoic or Cretaceous: *Tsugaepollenites mesozoicus* COUPER, *Podocarpidites multesimus*(BOLKHOVITINA)POCOCK, *Parvisaccites* cf. *radiatus* COUPER, *Trisaccites microsaccatus* (COUPER) COUPER, *Clavatipollenites hughesii* COUPER emend. KEMP etc. Species appearing in both Upper Cretaceous and Paleogene are *Cyathidites* cf. *minor* COUPER, *Cyathidites australis* COUPER, *Laevigatosporites dehiscens* TAKAHASHI, *Phyllocladidites mawsoni* COOKSON, *Inaperturopollenites laevigatus* TAKAHASHI, *Liliacidites variegatus* COUPER, *Tricolpites microreticulatus* (TAKAHASHI) n. comb., *Tricolporopollenites minor* TAKAHASHI, *Triporopollenites festatus* TAKAHASHI, and *Triporopollenites shimensis* TAKAHASHI. Tertiary species are as follows: *Polypodiidites inangahuensis* COUPER, *Podocarpidites exguus* HARRIS, *Tricolpopollenites fallax* (R. POTONIE) THOMSON & PFLUG, and *Tricolporopollenites microporifer* TAKAHASHI.

That the Quiriquina microflora consists mainly of *Cyathidites*, *Tsugaepollenites*, *Phyllocladidites*, *Parvisaccites*, *Trisaccites*, *Clavatipollenites*, *Liliacidites*, *Proteacidites*, *Beaupreaidites*, *Duplospris*, and tricolpate-tricolporate-triporate-polyporate pollen garins, indicates that its geological age is not Paleogene, but Upper Cretaceous. An existence of the genera *Proteacidites* and *Beaupreaidites* appearing in Campanian and Maastrichtian in the *Aquilapollenites* province of the circum-Pacific regions and Siberia

indicates probably Upper Cretaceous (Upper Senonian or Maastrichtian) in age.

Descriptive palynology

Anteturma **Sporites** H. POTONIÉ 1893.

Turma Triletes REINSH 1881 emend. R. POTONIÉ & KREMP 1954.

Subturma Azonotriletes LUBER 1935.

Infraturma Laevigati BENNIE & KIDSTONE 1886 emend. R. POTONIÉ 1956.

Genus *Deltoidospora* MINER 1935 emend. R. POTONIÉ 1956.

Type species: *Deltoidospora hallii* MINER 1935.

Deltoidospora quiriquinaensis n. sp.

Pl. 1, figs. 1, 2a-b, 3a-b.

Description: Spores trilete; outline triangular in polar view, with slightly concave sides and rounded angles. Trilete mark undulate or sometimes straight, sometimes gaping, and reaching to the equator. Exine 0.8-1.2 μ thick, levigate. Grain size 26-32 μ.

Holotype: Pl. 1, fig. 1; grain size 31.7 μ, exine 0.8 μ thick; slide GN 2412.

Occurrence: Few; Quiriquina Formation in Quiriquina Island.

Remarks: The present specimens are closely similar to *Deltoidospora nodaensis* MIKI (1972) drom the Tamagawa Formation (Lower Senonian) of the Kuji Group, but are distinguishable from the latter by the undulated trilete mark. Furthermore, the specimens are superficially similar to *Deltoidospora delica* SAH and *Cyathidites congoensis* SAH from the Neogene strata, Kundava (Africa), but these african species possess larger size and straight trilete mark.

Botanical affinity: ? Gleicheniaceae.

Deltoidospora sp. A

Pl. 1, fig. 5.

Description: Spore trilete; amb triangular in polar view, with slightly concave or convex sides rounded angles. Y-mark straight and reaching to the equator. Exine 1.2 μ thick, levigate. Grain size 41.3 μ.

Occurrence: Very rare; Quiriquina Formation in Quiriquina Island.

Remarks: Only one specimen was found. This specimen resembles figures 15 and 20 of plate 1 and figure 43 of plate 2 illustrated by G. E. ROUSE (1957) from the Comox and Oldman Formations of western Canada, but the author can not determine its specific name.

Botanical affinity : Unknown.

Deltoidospora sp. B

Pl. 1, fig. 6.

Description : Spore trilete, outline roundly subtriangular in polar view, with convex sides and broadly rounded angles. Y-mark straight, reaching almost to the equator. Exine 1.3 μ thick, levigate. Grain size 41 μ.

Occurrence : Very rare ; Quiriquina Formation in Quiriquina Island.

Remarks : The specimen is closely similar to *Deltoidospora* sp. (G. E. ROUSE, 1962, plate 3, fig. 4) from the Burrard Formation of western British Columbia.

Botanical affinity : Unknown.

Genus *Cyathidites* COUPER 1953.

Type species : *Cyathidites australis* COUPER 1953.

Cyathidites cf. *minor* COUPER

Pl. 1, figs. 4a-b.

1953. *Cyathidites minor* COUPER, New Zealand Geol. Surv., Paleont. Bull., 22, p. 28, pl. 2, fig. 13.

Dimensions : Equatorial diameter 50 μ ; exine 1 μ thick, levigate.

Occurrence : Very rare ; Quiriquina Formation in Quiriquina Island.

Remarks : This specimen is a little larger than *Cyathidites minor* recorded already from many localities of the world.

Botanical affinity : Cyatheaceae.

Cyathidites australis COUPER

Pl. 1, figs. 7a-b.

1953. *Cyathidites australis* COUPER, New Zealand Geol. Surv., Paleont. Bull. 22, p. 27, pl. 2, figs. 11-12.

Dimensions : Equatorial diameter 59.2 μ ; exine 1 μ thick, levigate.

Occurrence : Very rare ; Quiriquina Formation in Quiriquina Island.

Botanical affinity : Cyatheaceae.

Genus *Leiotriletes* NAUMOVA 1937 emend. POTONIÉ & Kremp 1954.

Type species : *Leiotriletes sphaerotriangulus* (LOOSE 1932) POTONIÉ & KREMP 1954.

Leiotriletes sp.

Pl. 1, fig. 9.

Description: Spore trilete, amb subtriangular, sides in part slightly convex, angles broadly rounded. Y-mark extends nearly to equator and gaps. Exine weakly infrapunctate.

Dimensions: Equatorial diameter 26.8 μ; exine 0.9 μ thick.

Occurrence: Very rare; Quiriquina Formation in Quiriquina Island.

Remarks: This form is similar to *Leiotriletes parvus* GUENNEL (SMITH & BUTTERWORTH, 1967, p. 122, pl 1, figs. 3-4) in form and size, but the former possesses weak ornamentation.

Infraturma Apiculati BENNIE & KIDSTON 1886 emend. R. POTONIÉ 1956.

Subinfraturma Verrucati DYBOVA & JACHOWICZ 1957.

Genus *Trilites* COOKSON 1947 ex COUPER 1953.

Type species: *Trilites tuberculiformis* COOKSON 1947.

Trilites cf. *parvallatus* KRUTZSCH

Pl. 1, fig. 8.

1959. *Trilites parvallatus* KRUTZSCH, Geologie, Jrg. 8, 21/22, p. 152, pl. 27, fig. 298.

Dimensions: Equatorial diameter 46 μ; wart 2.7 μ high.

Occurrence: Very rare; Quiriquina Formation in Quiriquina Island.

Remarks: *Trilites parvallatus* is a rounded triangular form with convex sides, but the present specimen is a form with slightly concave sides. The author describes it as *Trilites* cf. *parvallatus* KRUTZSCH.

Botanical affinity: ? *Lygodium.*

Infraturma Murornati POTONIÉ & Kremp 1954.

Genus *Quiriquinaspora* n. gen.

Description: Trilete spore. Outline triangular in polar view, with slightly concave sides and rounded angles. Trilete mark narrow, straight or slightly undulate. Numerous pores on each surface. Pores circular with slightly raised margin; large pores 4-5 μ in diameter, small pores 1.5-2 μ in diameter.

Type species: *Quiriquinaspora chilensis* n. gen. & n. sp.

Quiriquinaspora chilensis n. sp.

Pl. 1, figs. 11-13.

Description : Spores trilete ; outline triangular in polar view, with slightly concave sides and rounded angles. Trilete mark slender, narrow, straight or sometimes slightly undulate, and reaching to the equator. Exine thin, levigate. Pores circular with margin slightly raised outside, ten-fifteen in number on both proximal and distal surfaces, 1.5-5 μ in diameter. Grain size 25.7-28.7 μ.

Holotype : Pl. 1, fig. 11 ; grain size 25.7 μ, fifteen pores (six pores on proximal surface), 1.5-4 μ in diameter ; slide GN 2420.

Occurrence : Few ; Quiriquina Formation in Quiriquina Island.

Remarks : A new form-genus *Quiriquinaspora* is a monotypic genus. The present author has found no description referable to the present specimens. Spore of *Cnemidaria speciosa* from Bolivia is superficially similar to the present specimens.

Botanical affinity : ? Cyatheaceae.

Turma Monoletes IBRAHIM 1933.

Subturma Azonomonoletes LUBER 1935.

Infraturma Laevigatomonoleti DYBOVA & JACHOWICZ 1957.

Genus *Laevigatosporites* IBRAHIM 1933.

Type species: *Laevigatosporites vulgaris* IBRAHIM 1933.

Laevigatosporites dehiscens TAKAHASHI

Pl. 2, figs. 2-3.

1961. *Laevigatosporites dehiscens* TAKAHASHI, Mem. Fac. Sci., Kyushu Univ., Ser. D, 11, 3, p. 290, pl. 16, figs. 4-8.

Dimensions : 27-34 μ in length, 20-21 μ in width ; exine 0.8-0.9 μ thick (less than 1 μ in thickness).

Occurrence : Few ; Quiriquina Formation in Quiriquina Island.

Remarks : The present specimens are identifiable with *Laevigatosporites dehiscens* TAKAHASHI from Japan.

Botanical affinity : Polypodiaceae.

Genus *Polypodiidites* ROSS 1949 emend. POTONIÉ 1966.

Type species : *Polypodiidites senonicus* ROSS 1949.

Polypodiidites inangahuensis COUPER

Pl. 2, fig. 1.

1953. *Polypodiidites inangahuensis* COUPER, New Zealand Geol. Surv., Paleont. Bull., 22, p. 29, pl. 2, fig. 16.

Dimensions: Equatorial diameter: length 60 μ, breadth 38 μ; verrucae 4 μ high.

Occurrence: Rare; Quiriquina Formation in Quiriquina Island.

Remarks: This specimen is very closely similar to *Polypodiidites inangahuensis* COUPER from the Lower Miocene strata of New Zealand.

Botanical affinity: Polypodiaceae.

Genus *Punctatosporites* IBRAHIM 1933.

Type species: *Punctatosporites minutus* IBRAHIM 1933.

Punctatosporites sp.

Pl. 2, fig. 4.

Description: Spore kidney shaped, anisopolar, bilateral monolete. Monolete mark occurring along the concave crest, distinct, length approximately 2/3 equatorial axis. Exine weakly punctate, 1 μ thick. Size: equatorial axis 44.5 μ long, polar axis 37.2 μ long.

Occurrence: Rare; Quiriquina Formation in Quiriquina Island.

Remarks: The present specimen resembles *Laevigatosporites albertensis* ROUSE showing the punctate ornamentation from the Oldman and Brazeau Formations of western Canada. The former is distinguishable from the latter in the strong monolete mark and larger size

Anteturma **Pollenites** R. POTONIÉ 1931.

Turma Saccites ERDTMAN 1947.

Suburma Monosaccites CHITALEY 1951 emend. POTONIÉ & KREMP 1954.

Infraturma Saccizonati BHARADWAJ 1957.

Genus *Tsugaepollenites* R. POTONIÉ & VENITZ 1934 emend. R. POTONIÉ 1958.

Type species: *Tsugaepollenites igniculus* (R. POTONIÉ 1931)

R. POTONIÉ &VENITZ 1934.

Tsugaepollenites mesozoicus COUPER

Pl. 2, fig. 7.

1958. *Tsugaepollenites mesozoicus* COUPER, Palaeontographica, B, 103, 4-6, p. 155, pl. 30, figs. 8-10.

1966. *Cerebropollenites mesozoicus*, D. BURGER, p. 261, pl. 28, figs. 1-2.

Dimensions: Diameter in the equator 49 μ; vesicles 5.5 μ high.

Occurrence: Rare; Quiriquina Formation in Quiriquina Island.

Remarks: The present specimen is partially broken, but it belongs undoubtedly to *Tsugaepollenites mesozoicus*.

Botanical affinity: *Tsugaepollenites mesozoicus* is comparable in its morphology with the pollen grains of *Tsuga*.

Subturma Disaccites COOKSON 1947.

Genus *Pinuspollenites* RAATZ 1937.

Type species: *Pinuspollenites labdacus* (R. POTONIÉ 1931) RAATZ 1937.

Pinuspollenites concepcionensis n. sp.

Pl. 2, figs. 13-17.

Description: Bisaccate; central body spherical to subspherical; measuring 19.4-28 X 17-21 μ. Exine of proximal cap about 1 μ thick, tectate; distal exine psilate to punctate, between sacci about 10 μ wide. Air sacs slightly smaller than central body or equal, attached distally, forming two half globes, 8.5-16.6 μ wide, provided with an indistinct intrareticulum. Overall breadth of grain 35-39. μ.

Holotype: Pl. 2, fig. 15; overall breadth of grain 38 μ, central body 19.5 X 21 μ, breadth of sacci 16.6 μ; slide GN 2421.

Occurrence: Common; Quiriquina Formation in Quiriquina Island.

Remarks: The species is similar to *Podocarpidites exiguus* HARRIS (1965, p. 85-86, pl. 26, fig. 11, not holotype) from the basal Tertiary formation, Victoria, Australia, but is much smaller.

Botanical affinity: Pinaceae - - - *Pinus*.

Pinuspollenites sp.

Pl. 2, fig. 18.

Description: Bisaccate; central body oval, measuring 32.7 X 29.8 μ. Exine of proximal cap thin; distal exine punctate, between sacci more than 10 μ wide. Air sacs smaller than central body, attached distally, forming two half globes, 24 μ wide, provided with an intrareticulum. Overall breadth of grain 51 μ.

Occurrence: Rare; Quiriquina Formation in Quiriquina Island.

Remarks: Only one specimen was found. This is similar to *Pinuspollenites minimus*

(COUPER) KEMP.

Botanical affinity : Pinaceae - - - *Pinus.*

Genus *Piceaepollenites* R. POTONIÉ 1931.

Type species : *Piceaepollenites alatus* R. POTONIÉ 1931.

Piceaepollenites sp.

Pl. 2, fig. 19.

Description : Bisaccate ; central body oval, length of central body (corpus) 51 μ. Exine of proximal cap thin (1$\mu\pm$) ; distal exine psilate (?). Air sacs smaller than central body, attached distally, forming two half globes, provided with an intrareticulum.

Occurrence : Rare ; Quiriquina Formation in Quiriquina Island.

Remarks : Only one specimen was found. The author could not decide its specific name.

Botanical affinilty : Pinaceae - - - *Picea.*

Genus *Podocarpidites* COOKSON 1947 emend. R. POTONIÉ 1958.

Type species : *Podocarpidites ellipticus* COOKSON 1947.

Podocarpidites exiguus HARRIS

Pl. 2, fig. 12.

1965. *Podocarpidites exiguus* HARRIS, Palaeontographica, B, 115, 4-6, p. 85-86, pl. 26, fig. 12 (holotype), except fig. 11.

Dimensions : Breadth of central body 27.3 μ, length of central body 22 μ, total breadth 41μ, breadth of saccus 20 μ.

Occurrence : Rare ; Quiriquina Formation in Quiriquina Island.

Remarks : The present specimen is identified with the holotype (pl. 26, fig. 12) of *Podocarpidites exiguus* described and illustrated by W. K. HARRIS (1965).

Botanical affinity : Podocarpaceae.

Podocarpidites multesimus (BOLKHOVITINA) POCOCK

Pl. 2, fig. 8.

1956. *Podocarpus multesima* BOLKHOVITINA, Trans. Geol. Inst. Acad. Sci., USSR, 2, p. 127, pl. 24, fig. 235.

1957. *Podocarpidites biformis* ROUSE, Can J. Bot., 35, p. 397, pl. 2, tig. 13.

1962. *Podocarpidites multesimus* (BOLKHOVITINA) POCOCK, Palaeontographica, B, 111, 1-3, p. 67, pl. 10, figs. 161-162; pl. 11, fig. 163.

Dimensions: Breadth of central body 30 μ; length of central body 28.6 μ; breadth of saccus 23.7 μ; total breadth of grain presumedly 60 $\mu\pm$.

Occurrence: Rare; Quiriquina Formation in Quiriquina Island.

Remarks: The specimen is poor in preservation, but is obviously assignable to *Podocarpidites multesimus* (BOLKHOVITINA) POCOCK.

Botanical affinity: Podocarpaceae - - - *Podocarpus*.

Podocarpidites sp.

Pl. 2, fig. 11.

Description: Bisaccate; central body oval to subspherical, measuring 19.5 X 27.7 μ. Exine of proximal cap thin, distal exine psilate. Leptoma about 5 μ wide. Distal saccus bases parallel. Air sacs attached distally, forming two half globes, provided with an intrareticulum. Total breadth of grain 40.5 μ.

Occurrence: Rare; Quiriquina Formation in Quiriquina Island.

Botanical affinity: Podocarpaceae - - - ? *Podocarpus*.

Genus *Phyllocladidites* COOKSON 1947 ex COUPER 1953.

Type species: *Phyllocladidites mawsoni* COOKSON 1947.

Phyllocladidites mawsoni COOKSON

Pl. 2, fig. 9.

1947. *Disaccites* (*Phyllocladidites*) *mawsoni* COOKSON, B. A. N. Z. Antarctic Res. Exped. 1929-1931, Rpts. Ser. A, 2, pt. 8, p. 133, pl. 14, figs. 22-28.

1953. *Dacrydiumites mawsonii* COOKSON, Aust. J. Bot., 1, 1, p. 66, pl. 1, figs. 9-26.

1953. *Dacrydiumites mawsonii* COOKSON, Aust. J. Bot., 1, 3, p. 465, pl. 1, fig. 10.

1953. *Phyllocladidites mawsonii*, COUPER, N. Z. Geol. Surv., Paleont. Bull., 22, p. 38, pl. 9, fig. 135.

Dimensions: Body breadth 25-29 μ, body length 29.6-30 μ, sacci breadth 7-11.5 μ.

Occurrence: Rare; Quiriquina Formation in Quiriquina Island.

Remarks: The present specimen is clearly referable to *Phyllocladidites mawsoni*.

Botanical affinity: *Dacrydium*.

Genus *Parvisaccites* COUPER 1958.

Type species : *Parvisaccites radiatus* COUPER 1958.

Parvisaccites cf. *radiatus* COUPER

Pl. 3, figs. 1a-b, 2 (?).

1958. *Parvisaccites radiatus* COUPER, Palaeontographica, B, 103, 4-6, p. 154, pl. 29, figs 5-8 ; pl. 30, figs. 1-2.

Dimensions : Overall breadth of grain 50-57 μ ; breadth of central body 33.3-42 μ ; length of central body 35-36 μ ; breadth of saccus 9-14 μ.

Occurrence : Rare ; Quiriquina Formation in Quiriquina Island.

Remarks : The specimen of the plate 3, figures 1a-b is clearly comparable with *Parvisaccites radiatus* COUPER in many morphological features. The figure 2 is uncertain, whether it belongs to *P. radiatus* or not.

Botanical affinity : Podocarpaceae.

Subturma Polysaccites COOKSON 1947.

Genus *Trisaccites* COOKSON & PIKE 1954.

Type species : *Trisaccites microsaccatus* (COUPER 1953) COUPER 1960.

Trisaccites microsaccatus (COUPER) COUPER

Pl. 2, fig. 10.

1953. *Dacrydium microsaccatum* COUPER, N. Z. Geol. Surv., Paleont. Bull., 22, p. 35, pl. 4, fig. 38.

1954. *Trisaccites micropterus* COOKSON & PIKE, Aust. J. Bot., 2, 1, p. 64, pl. 2, fig. 21-29.

1957. *Podosporites micropterus*, BALME, Aust. Comm. Soc. Ind. Res. Org., Coal Res. Sect, p. 34, pl. 9.

1960. *Trisaccites microsaccatus*, COUPER, N. Z. Geol. Surv., Paleont. Bull., 32, p. 46, pl. 4, figs. 12-13.

Dimensions : Diameter of grain 21.8 μ, length of bladder 12-26 μ, breadth of bladder 3.5-5.5 μ.

Occurrence : Rare : Quiriquina Formation in Quiriquina Island.

Remarks : R. A. COUPER (1953) named *Dacrydium microsaccatum* for three-winged fossil pollen grain from the Upper Cretaceous (Sub-piripauan) strata of New Zealand. The sporotype *Trisaccites* was proposed by COOKSON and PIKE (1954) for the sporomorph with three narrow, broadly attached bladders. The genus *Trisaccites* is appropriate for the present specimen.

Botanical affinity : ? *Dacrydium.*

Turma Aletes IBRAHIM 1933.

Subturma Azonaletes LUBER 1935 emend. POTONIÉ & KREMP 1954.

Infraturma Psilonapiti ERDTMAN 1947.

Genus *Inaperturopollenites* PFLUG & THOMSON 1953 emend. R. POTONIÉ 1958.

Type species: *Inaperturopollenites dubius* (R. POTONIÉ & VENITZ) THOMSON & PFLUG 1953.

Inaperturopollenites laevigatus TAKAHASHI

Pl. 2, figs. 5-6.

1957. *Inaperturopollenites laevigatus* TAKAHASHI, Mem. Fac. Sci., Kyushu Univ., Ser. D, 5, 4, p. 216-217, pl. 38, fig. 18; pl. 39, fig. 16.

Dimensions: 19.6-35 μ in diameter; exine 0.6-0.9 μ thick.

Occurrence: Rare; Quiriquina Formation in Quiriquina Island.

Remarks: The present specimens with levigate exine are referable to *Inaperturopollenites laevigatus* TAKAHASHI.

Botanical affinity: Taxodiaceae.

Turma Plicates NAUMOVA 1939 emend. R. POTONIÉ 1960.

Subturma Monocolpates IVERSEN & TROELS-SMITH 1950.

Genus *Monocolpopollenites* THOMSON & PFLUG 1953.

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

Monocolpopollenites sp.

Pl. 3, fig. 3.

Description: Outline subelliptical or pentagonal, length 32.7 μ, breadth 22.7 μ. One prominent furrow in the full length of the grain. Exine about 0.5 μ thick, very finely punctate.

Occurrence: Rare; Quiriquina Formation in Quiriquina Island.

Remarks: Only one grain was found. This specimen resembles *Monocolpopollenites* sp. reported by S. MANUM (1962, p. 47, pl. 12, fig. 12).

Botanical affinity: Palmae.

Genus *Clavatipollenites* COUPER 1958.

Type species: *Clavatipollenites hughesii* COUPER 1958 emend. KEMP 1968.

Clavatipollenites hughesii COUPER emend. KEMP

Pl. 3, figs. 22-25.

1958. *Clavatipollenites hughesii* COUPER, Palaeontographica, B, 103, 4-6, p. 159, pl. 31, figs. 19-22.

1968. *Clavatipollenites hughesii*, KEMP, Palaeontology, 11, 3, p. 426-429, pl. 80, figs. 6-19.

Dimensions: Length of grain 20.3-24.7 μ, breadth of grain 17.2-20.8 μ, depth of grain ?; endexine thin, ektexine (baculate projection) 1-2 μ long.

Occurrence: Few; Quiriquina Formation in Quiriquina Island.

Remarks: The genus *Clavatipollenites* appears in Lower Cretaceous of Europe and Canada and in Upper Cretaceous (Turonian-Cenomanian) of U. S. A. The Quiriquina grains of *Clavatipollenites* seem to indicate an appearance in the youngest age of Cretaceous.

Botanical affinity: Unknown.

Genus *Liliacidites* COUPER 1953.

Type species: *Liliacidites kaitangataensis* COUPFR 1953.

Liliacidites variegatus COUPFR

Pl. 3, fig. 26.

1953. *Liliacidites variegatus* COUPER, New Zealand Geol. Surv., Paleont. Bull., 22, p. 56, pl. 7, figs. 98-99.

Dimensions: Length of grain 28.5 μ, breadth of grain 22.5 μ; exine reticulate, muri baculate, 0.8 μ high, lumen of reticulum 1 μ $\pm$ in diameter.

Occurrence: Very rare; Quiriquina Formation in Quiriquina Island.

Remarks: The present specimen is referable to *Liliacidites variegatus* COUPER (1953).

Botanical affinity: Liliaceae.

Subturma Triptyches NAUMOVA 1939 emend. R. POTONIÉ 1960

Genus *Tricolpopollenites* THOMSON & PFLUG 1953.

Type species: *Tricolpopollenites parmularius* (R. POTONIÉ 1934) THOMSON & PFLUG 1953.

Tricolpopollenites fallax (R. POTONIÉ) THOMSON & PFLUG

Pl. 4, figs. 1-4.

1934. *Pollenites fallax* R. POTONIÉ, Arb. Inst. Palaeont. Petrogr. Brennst., 4, p. 70, tab. 3, fig. 10.

1953. *Tricolpopollenites liblarensis* (THOMSON) THOMSON & PFLUG *fallax* (R. POTONIÉ) THOMSON & PFLUG, Palaeontographica, B, 94, p. 96-97, pl. 11, figs. 133-151.

1962. *Tricolpopollenites fallax* (R. POTONIÉ) THOMSON & PFLUG, J. J. GROOT & C. R.

GROOT, Palaeontographica, B, 111, 4-6, p. 168-169, pl. 30, fig. 34.

Dimensions: Length 11.6-14.4 μ; breadth 6-10.2 μ; exine levigate, 0.5-0.7 μ thick.

Occurrence: Few; Quiriquina Formation in Quiriquina Island.

Remarks: The present specimens are referable to *Tricolpopollenites fallax* (R. POTONIÉ) THOMSON & PFLUG. The Japanese species with the levigate exine, *Tricolpopollenites weylandii* TAKAHASHI, is larger than *T. fallax*.

Botanical affinity: Dicotyledonae.

Genus *Tricolpites* COOKSON 1947 ex COUPER 1953 emend. BELSKY, BOLTENHAGEN & POTONIÉ 1965

Type species: *Tricolpites reticulatus* COOKSON 1947.

Tricolpites microreticulatus (TAKAHASHI) n. comb.

Pl. 4, figs. 24-26.

1961. *Tricolpopollenites microreticulatus* TAKAHASHI, Mem. Fac. Sci., Kyushu Univ., Ser. D, Geol., 11, 3, p. 318, pl. 23, figs. 37-43.

Dimensions: Length of grain 16.5-22 μ, breadth of grain 17-20 μ; lumen of reticulum less than 1μ in diameter, muri baculate, less than 1 μ high.

Occurrence: Few; Quiriquina Formation in Quiriquina Island.

Remarks: The author (1961) gave the names *Tricolpopollenites reticulatus* and *Tricolpopollenites microreticulatus* to the tricolpate pollen grains with reticulate exine, but the genus *Tricolpites* which has a priority is valid for such pollen grains.

Botanical affinity: *Salix* or *Platanus*.

Tricolpites sp

Pl. 4, fig. 23.

Description: Grain small, tricolpate, isopolar, colpae long, broad, sub-spheroidal. Exine finely reticulate, muri clavate, 1 μ $\pm$ high. Grain size 20 X 14.4 μ.

Occurrence: Rare; Quiriquina Formation in Quiriquina Island.

Remarks: The author could find no illustration comparable with the present specimen. Accordingly, he can not determine its specific name.

Botanical affinity: Unknown.

Subturma Ptychotriporines NAUMOVA 1939.

Infraturma Prolati ERDTMAN 1943.

Genus *Tricolporopollenites* PFLUG & THOMSON 1953.

Type species: *Tricolporopollenites dolium* (R. POTONIÉ 1931) THOMSON & PFLUG 1953.

Tricolporopollenites minor TAKAHASHI

Pl. 4, figs. 5-13.

1961. *Tricolporopollenites minor* TAKAHASHI, Mem. Fac. Sci., Kyushu Univ., Ser. D, Geol., 11, 3, p. 320-321, pl. 24, figs. 18-31.

Dimensions: Length of grain 10-15.4 μ, breadth of grain 8.4-13.8 μ; exine levigate, less than 1 μ thick.

Occurrence: Common; Quiriquina Formation in Quiriquina Island.

Remarks: *Tricolporopollenites minor* which is distinguishable from the european species *Tricolporpollenites megaexactus exactus* (R. POTONIÉ) was described by the author (1961) as a new species from the Paleogene sediments in Japan. The present specimens are a little smaller than the Japanese specimens, but apparently assignable to *T. minor*.

Botanical affinity: Cyrillaceae.

Tricolporopollenites microporifer TAKAHASHI

Pl. 4, figs. 14-17.

1961. *Tricolporopollenites microporifer* TAKAHASHI, Mem. Fac. Sci., Kyushu Univ., Ser. D, Geol., 11, 3, p. 323-324, pl. 25, figs. 1-3.

Dimensions: Length of grain 12.4-21 μ, breadth of garin 10.4-14 μ; exine chagrenate or intrarugulate, 0.7-1 μ thick.

Occurrence: Few; Quiriquina Formation in Quiriquina Island.

Remarks: The present specimens are closely similar to *Tricolporopollenites microporifer* TAFAHASHI in all features, but somewhat smaller than the latter.

Botanical affinity: Unknown.

Tricolporopollenites punctulosus n. sp.

Pl. 4, figs 18-21.

Description: Tricolporate pollen. Grain prolate-spheroidal. Colpi long, distinct, converging into a polar area; pores small and circular. Exine 1 μ thick, punctate. Size range 17-24.3 X 15-23 μ.

Holotype: Pl. 4, fig. 19; 24.3 μ long, 18.4 μ wide; exine 1 μ thick, punctate; slide GN 2411.

Occurrence: Few; Quiriquina Formation in Quiriquina Island.

Remarks: The present specimens are similar to *Tricolporopollenites incertus* TAKAHASHI from the Paleogene sediments in Japan, but is distinguishable from the latter by the different form of caverna and pores.

Botanical affinity: Unknown.

Tricolporopollenites sp.

Pl. 4, fig. 22.

Description: Tricolporate pollen. Equatorial contour rounded triangular; grain flattened and seen in polar view. Colpi long and distinct. Pores distinctly developed. Exine chagrenate, 0.6 μ thick. Grain size 21.5 μ in equatorial diameter.

Occurrence: Rare; Quiriquina Formation in Quiriquina Island.

Botanical affinity: Unknown.

Genus *Retitricolporites* V. D. HAMMEN 1956 ex V. D. HAMMEN & WIJMSTRA 1964.

Type species: *Retitricolporites quianensis* V. D. HAMMEN & WIJMSTRA 1964.

Retitricolporites sp.

Pl. 4, figs. 27a-b.

Description: Tricolporate pollen. Grain circular in polar view. Colpi long and distinct. Pores distinctly developed. Exine reticulate. Lumen of reticulum 1-2.2 μ in diameter. Muri baculate or clavate, 0.9 μ high. Grain size 23.5 μ in equatorial diameter.

Occurrence: Rare; Quiriquina Formation in Quiriquina Island.

Botanical affinity: Caprifoliaceae.

Turma Poroses NAUMOVA 1937 emend. R. POTONIÉ 1960.

Subturma Triporines NAUMOVA 1939 emend. R. POTONIÉ 1960.

Genus *Triatriopollenites* PFLUG 1953.

Type species: *Triatriopollenites rurensis* THOMSON & PFLUG 1953.

Triatriopollenites maedae n. sp.

Pl. 3, figs. 4-5.

Description: Triporate pollen. Equatorial contour triangular-convex. Pores small, equatorial, sometimes one or two pores subequatorial. Exine thin, 0.8-1 μ thick, chagrenate or weakly punctate without annulus and tumescens, but with distinctly developed atrium and labrum in the pore areas. Grain size 21-22 μ in diameter.

Holotype: Pl. 3, fig. 4; grain size 21.4 μ in equatorial diameter, exine 0.8 μ thick, chagrenate; slide GN 2416.

Occurrence: Few; Quiriquina Formation in Quiriquina Island.

Remarks: This new species is similar to *Triatriopollenites aroboratus* PFLUG from the Upper Cretaceous and Lower Tertiary formations in Germany, but is distinguished from the latter by the grain size.

Botanical affinity: Myricaceae.

Genus *Triporopollenites* THOMSON & PFLUG 1953 ememd. R. POTONIÉ 1960.

Type species: *Triporopollenites coryloides* PFLUG 1953.

Triporopollenites shimensis TAKAHASHI

Pl. 3, figs. 6-10.

1961. *Triporopollenites shimensis* TAKAHASHI, Mem. Fac. Sci., Kyushu Univ., Ser. D, Geol., 11, 3, p. 301-302, pl. 20, figs. 5-14.

Dimensions: Grain size 21-24 μ in equatorial diameter; exine chagrenate, 0.8-1.1 μ thick.

Occurrence: Few; Quiriquina Formation in Quiriquina Island.

Remarks: *Triporopollenites shimensis* TAKAHASHI was first described by the author (1961) from the Japanese Tertiary formations. This species is widely distributed in the Paleogene and Miocene sediments of Japan.

Botanical affinity: Ulmaceae or Moraceae.

Triporopollenites festatus TAKAHASHI

Pl. 3, fig. 11.

1961. *Triporopollenites festatus* TAKAHASHI, Mem. Fac. Sci., Kyushu Univ., Ser. D, Geol. 11, 3, p. 301, pl. 19, figs. 29-37.

Dimensions: Grain size 22 μ in equatorial diameter; exine 0.8 μ thick, forming annulus in the pore areas.

Occurrence: Rare; Quiriquina Formation in Quiriquina Island.

Remarks: This specimen is identified with *Triporopollenites festatus* TAKAHASHI from the Paleogene and Upper Cretaceous sediments of Japan.

Botanical affinity: Betulaceae.

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

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

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

Pl. 3, fig. 21

Description: Triporate pollen. Grain triangular with convex sides in polar view. Arci present, polar islands absent. Exine thin, psilate. Grain size 13.6 μ in equatorial diameter.

Occurrence: Very rare; Quiriquina Formation in Quiriquina Island.

Remarks: Only one specimen was found. Many specimens of this species were found in the Concepción Formation, central Chile.

Botanical affinity: Unknown.

Genus *Proteacidites* COOKSON 1950.

Type species: *Proteacidites adenanthoides* Cookson 1950

Proteacidites minor n. sp.

Pl. 3, figs. 13-19.

Description: Triporate pollen. Outline triangular with straight to slightly concave or convex sides in polar view. Pore structure variable, circular or transversely wide in polar view; wide pores shallow, not a notchlike outline in polar view. Pore diameter in polar view 2-4 μ. Exine clearly differentiated into two layers, annulus and vestibulum are not observed, finely punctate to baculate, 0.7-1.5 μ thick. Grainsize 18.5-27 μ in equatorial diameter.

Holotype: Pl. 3, fig. 16; grain size 25 μ in equatorial diamter, exine finely punctate, 0.7 μ thick. Pore diameter 4 μ; slide GN 2413.

Occurrence: Common; Quiriquina Formation in Quiriquina Island.

Remarks: The specimens here recorded are very close in all characteristic features except grain size to *Proteacidites parvus* COOKSON (1950, p. 175, pl. 3, fig. 29) which is much larger than the former and to *P. subscrabratus* COUPER (1960, p. 52, pl. 6, figs. 8-10) except ornamentation of exine. Also, this species is similar to *Proteacidites* sp. which was described by S. ARCHANGELSKY (1973, p. 391-392, pl. 11, figs. 1-2) from the Paleocene sediments of the Chubut Province, Argentina, but is distinguished from the latter by its smaller size and punctate to baculate sculpture.

Botanical affinity: Proteaceae.

Proteacidites sp.

Pl. 3, fig. 12.

Description: Triporate pollen. Outline triangular with concave sides and prominent

apertural areas. Apertures small, probably circular. Exine thin, about 0.6 μ thick, clearly differentiated into two layers. Grain size 14.6 μ in equatorial diameter

Occurrence: Rare; Quiriquina Formation in Quiriquina Island.

Remarks: The present specimen resembles the figure 13 showed by HARRIS as *Proteacidites annularis* COOKSON (W. K. HARRIS, 1965, pl. 28, fig. 13) from the basal Tertiary sediments of southern Australia, but the author reports it as *Proteacidites* sp.

Botanical affinity: ? Proteaceae.

Genus *Beaupreaidites* COOKSON 1950 ex COUPER 1953.

Type species; *Beaupreaidites elegansiformis* COOKSON 1950.

Beaupreaidites sp.

pl. 3, fig. 27.

Description: Triporate pollen. Outline triangular with slightly concave sides and rounded angles; equatorial diamter 27.6 μ; apertures colpoid. Exine 1 μ thick, sculptured by irregularly disposed small warts.

Occurrence: Very rare; Quiriquina Formation in Quiriquina Island.

Remarks: Only one specimen was found. This specimen is superficially similar to *Beaupreaidites verrucosus* COOKSON, but its specific name is not determined.

Botanical affinity: ? *Beauprea.*

Subturma Polyporines NAUMOVA 1937 emend. R. POTONIÉ 1960.

Infraturma Stephanotriti VAN DER HAMMEN 1954 emend. R. POTONIÉ 1960.

Genus *Nothofagidites* ERDTMAN 1947 ex R. POTONIÉ 1960.

Type species; *Nothofagidites flemingii* (COUPER 1953) R. POTONIÉ 1960.

Nothofagidites sp.

Pl. 3, fig. 20.

Description: Polyporate pollen; isopolar, ora functional, 3-4 μ deep and seven in number. Grain peroblate, concave or straight between ora in polar view. Exine 1 μ thick and can be traced completely around ora in polar view. Sculpture finely papillate. Grain size 22 μ in equatorial diamter.

Occurrence: Very rare; Quiriquina Formation in Quiriquina Island.

Remarks: Only one specimen was found. This specimen is very similar to *Nothofagus cranwellae* COUPER (1953, 1960) from Tertiary formations of New Zealand and *N. emarida* (COOKSON) HARRIS from Lower Tertiary deposits of southern Australia.

Botanical affinity : Nothofagus.

Varia (Incertae Sedis)

Genus *Duplosporis* PFLUG 1953 ex R. POTONIÉ 1956.

Type species : *Duplosporis stipator* PFLUG 1953.

Duplosporis sp.

Pl. 1, fig. 10.

Description : Spore with triradiate marks on each polar surface. Equatorial contour triangular with slightly concave or convex. Exine 0.5 μ thick, punctate to baculate, bacula 1 μ high. Grain size 22.4 μ

Occurrence : Very rare ; Quiriquina Formation in QuiriquinaIs land.

Remarks : The present specimen is similar superficially to *Duplosporis borealis* (CHLONOVA) BONDARENKO, but its specific name is not determined.

Botanical affinity : Unknown.

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Explanation of plate 1

(All figures magnified X 1000 unless otherwise mentioned)

Figs. 1, 2a-b, 3a-b. *Deltoidospora quiriquinaensis* n. sp
Fig. 1: holotype, slide GN 2412; figs. 2a-b: slide GN 2412; figs. 3a-b: slide GN 2415.

Figs. 4a-b. *Cyathidites* cf. *minor* COUPER
Slide GN 2414; fig. 4b: X 600.

Fig. 5. *Deltoidospora* sp. A
Slide GN 2414

Fig. 6. *Deltoidospora* sp. B
Slide GN 2416.

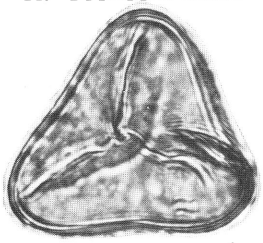
Figs. 7a-b. *Cyathidites australis* COUPER
Slide GN 2412; fig. 7b: X 400

Fig. 8. *Trilites* cf. *parvallatus* KRUTZSCH
Slide GN 2422.

Fig. 9. *Leiotriletes* sp.
Slide GN 2412.

Fig. 10. *Duplosporis* sp.
Slide GN 2413

Figs. 11-13. *Quiriquinaspora chilensis* n. gen. and n. sp.
Fig. 11: holotype, Slide GN 2420; fig. 12: Slide GN 2421; fig. 13: Slide GN 2422.



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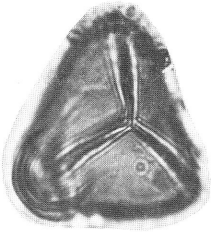

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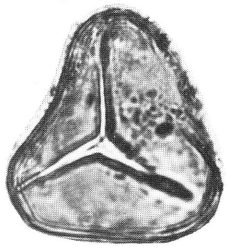

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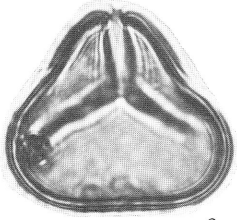

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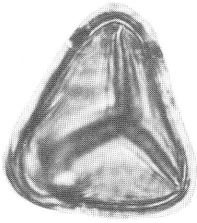

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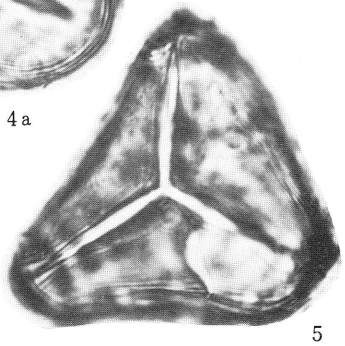

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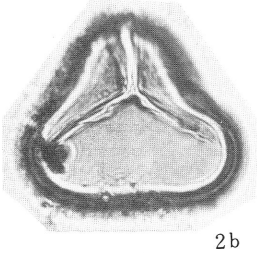

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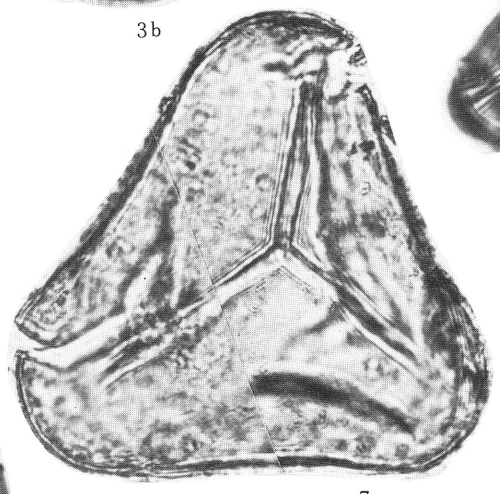

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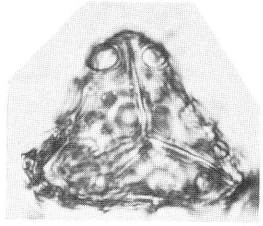

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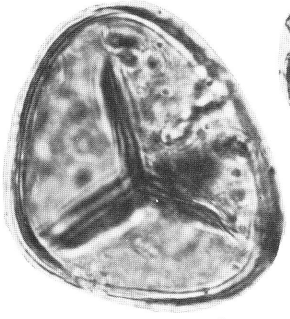

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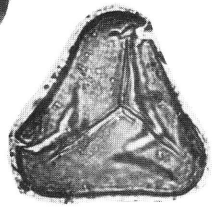

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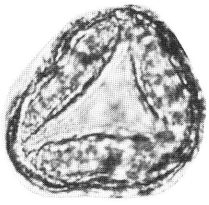

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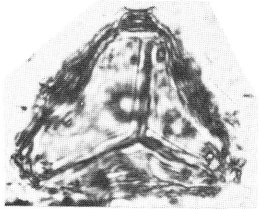

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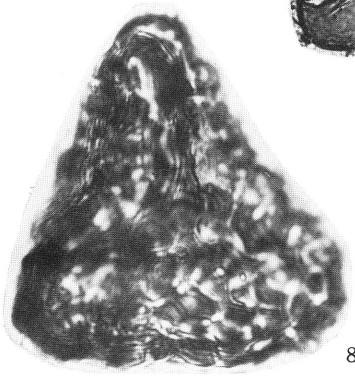

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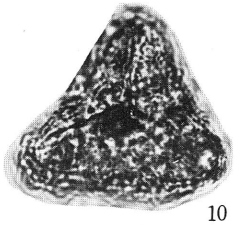

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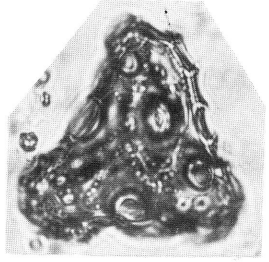


13

Explanation of plate 2

(All figures magnified X 1000)

Fig. 1. *Polypodiidites inangahuensis* COUPER

Slide GN 2422.

Figs. 2-3. *Laevigatosporites dehiscens* TAKAHASHI

Fig. 2: slide GN 2412; fig. 3: slide GN 2411.

Fig. 4. *Punctatosporites* sp.

Slide GN 2411.

Figs. 5-6. *Inaperturopollenites laevigatus* TAKAHASHI

Fig. 5: slide GN 2412; fig 6: slide GN 2420.

Fig. 7. *Tsugaepollenites mesozoicus* COUPER

Slide GN 2417.

Fig. 8. *Podocarpidites multesimus* (BOLKHOVITINA) POCOCK

Slide GN 2412.

Fig. 9 *Phyllocladidites mawsoni* COOKSON

Slide GN 2417.

Fig. 10. *Trisaccites microsaccatus* (COUPER) COUPER

Slide GN 2418.

Fig. 11. *Podocarpidites* sp.

Slide GN 2415.

Fig. 12. *Podocarpidites exiguus* HARRIS

Slide GN 2416.

Figs. 13-17. *Pinuspollenites concepcionensis* n. sp.

Fig. 13: slide GN 2411; fig. 14: slide GN 2417;

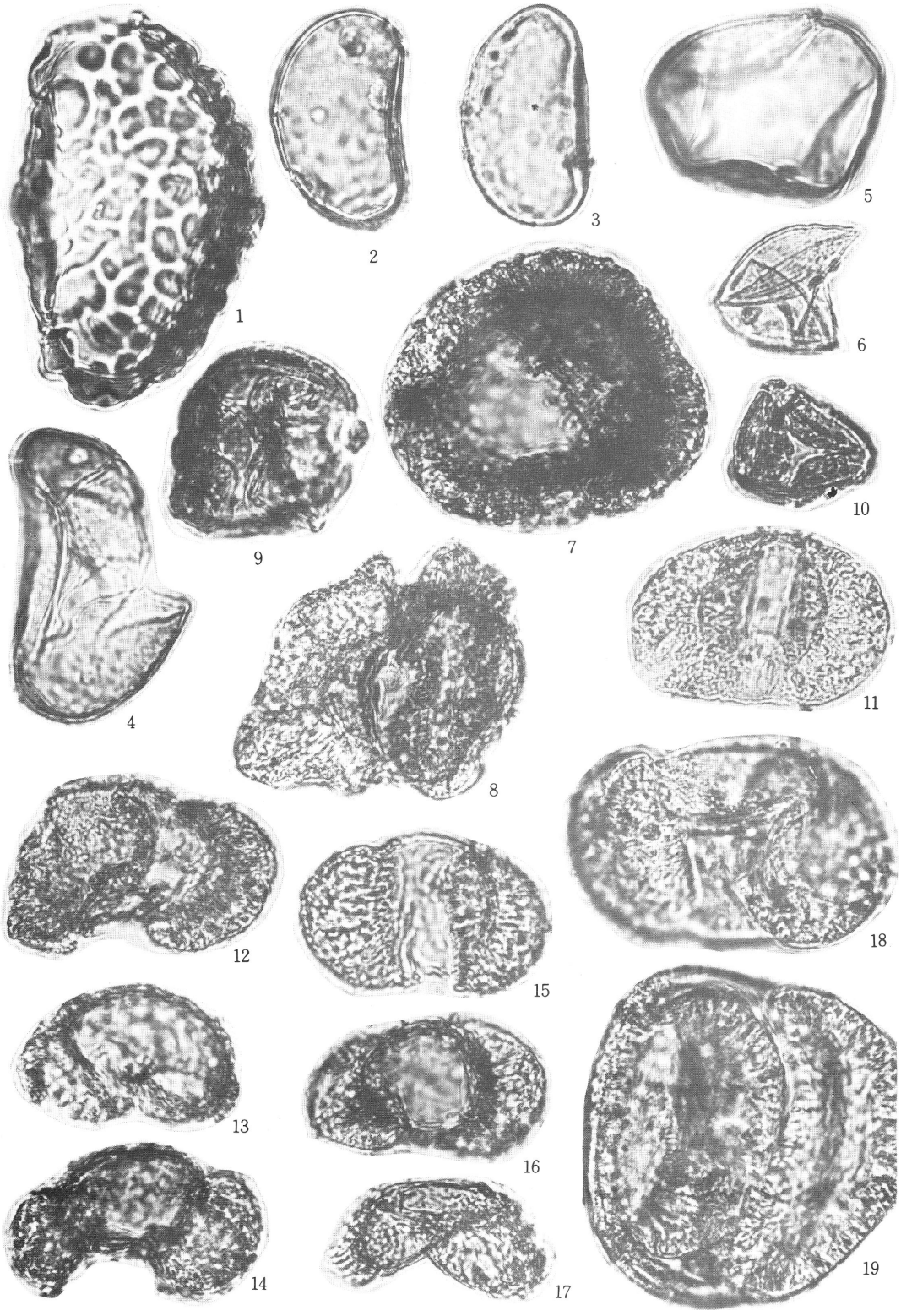
fig. 15: holotype, slide GN 2421; fig. 16: slide GN 2416; f

slide GN 2414.

Fig. 18 *Pinuspollenites* sp.

Slide GN 2411.

Fig. 19. *Piceaepollenites* sp.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Explanation of plate 3

(All figures magnified X 1000)

Figs. 1a-b, 2. *Parvisaccites* cf. *radiatus* COUPER

Figs. 1a-b: slide GN 2413; fig. 2: (?), slide GN 2414.

Fig. 3. *Monocolpopollenites* sp.

Slide GN 2414.

Figs. 4-5. *Triatriopollenites maedae* n. sp.

Fig. 4: holotype, slide GN 2416; fig. 5: slide GN 2414.

Figs. 6-10. *Triporopollenites shimensis* TAKAHASHI

Fig. 6: slide GN 2412; fig. 7: slide GN 2421; figs. 8, 10: slide GN 2411; fig. 9: slide GN 2419.

Fig. 11. *Triporopollenites festatus* TAKAHASHI

Slide GN 2419.

Fig. 12. *Proteacidites* sp.

Slide GN 2428.

Figs. 13-19. *Proteacidites minor* n. sp.

Fig. 13: slide GN 2412; fig. 14: slide GN 2417; fig. 15: slide GN 2411; fig. 16: holotype, slide GN 2413; fig. 17: slide GN 2414; figs. 18-19: slide GN 2419.

Fig. 20. *Nothofagidites* sp.

Slide GN 2415.

Fig. 21 *Myrtaceidites parvus* COOKSON & PIKE forma *anesus* COOKSON & PIKE

Slide GN 2415.

Figs. 22-25 *Clavatipollenites hughesii* COUPER emend. KEMP

Figs. 22, 25: slide GN 2412; fig. 23: slide GN 2419; fig. 24: slide GN 2418.

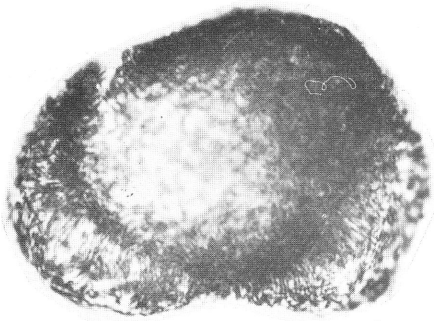
Fig. 26. *Liliacidites variegatus* COUPER

Slide GN 2413.

Fig. 27. *Beaupreaidites* sp.

Slide GN 2420.

plate 3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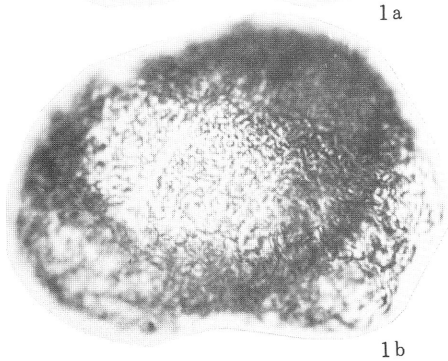
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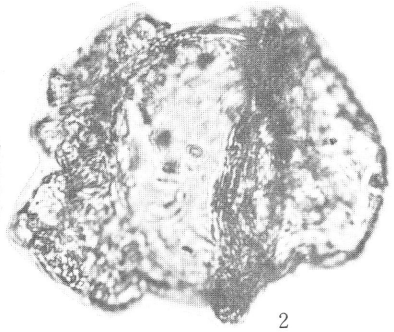
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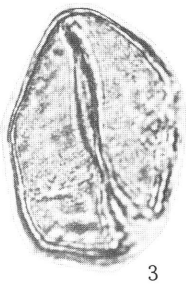
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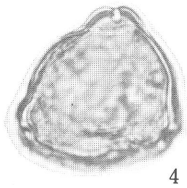
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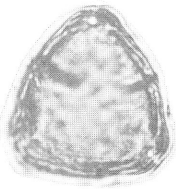
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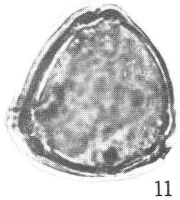
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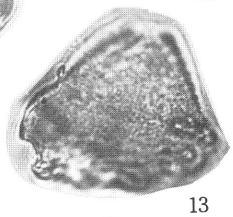
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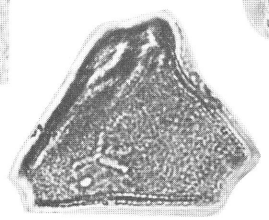
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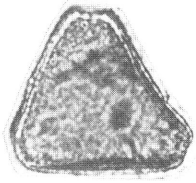
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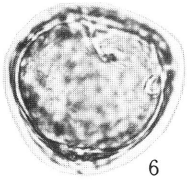
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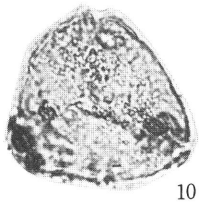
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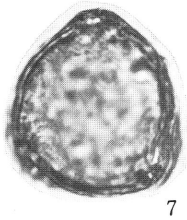
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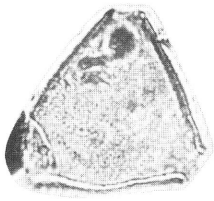
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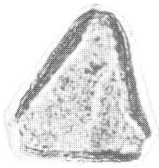
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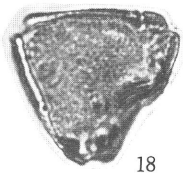
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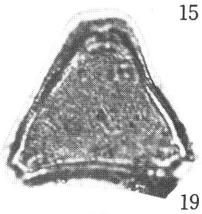
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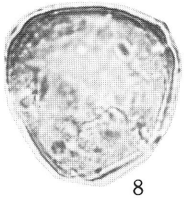
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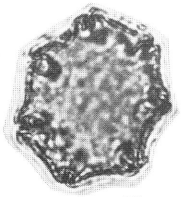
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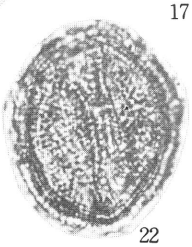
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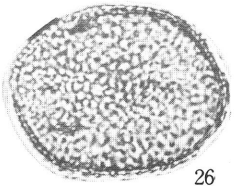
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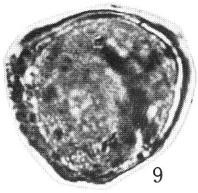
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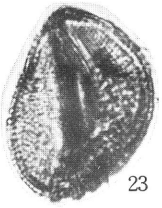
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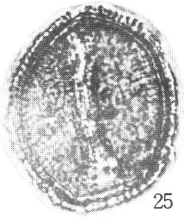
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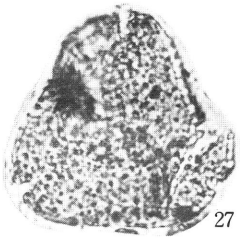
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Explanation of plate 4

(All figures magnified X 1000)

Figs. 1-4. *Tricolpopollenites faliax* (R. POTONIÉ) THOMSON & PFLUG Figs 1, 4 slide GN 2411; figs. 2, 3: slide GN 2414.

Figs, 5-13 *Tricolporopollenites minor* TAKAHASHI
Figs. 5, 6, 9, 10: slide GN 2414; figs. 7, 12, 13: slide GN 2411; figs, 8, 11: slide GN 2412.

Figs. 14-17 *Tricolporopollenites microporifer* TAKAHASHI
Slide GN 2411.

Figs. 18-21. *Tricolporopollenites punctulosus* n. sp.
Fig. 18: holotype, slide GN 2411; fig. 19: slide GN 2419; figs. 20. 21: slide GN 2414.

Fig. 22. *Tricolporopollenites* sp.
Slide GN 2411.

Fig. 23 *Tricolpites* sp.
Slide GN 2411

Figs. 24-26. *Tricolpites microreticulatus* (TAKAHASHI) n. comb.
Fig. 27: slide GN 2412; fig. 28: slide GN 2418; fig. 29: slide GN 2417.

Figs. 27a-b. *Retitricolporites* sp.
Slide GN 2412.

Figs 28-30. Fungi spores.


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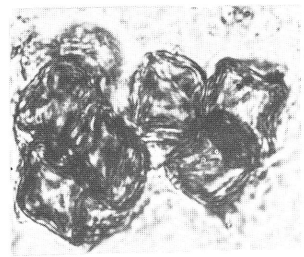
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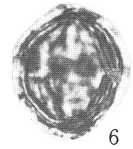
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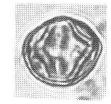
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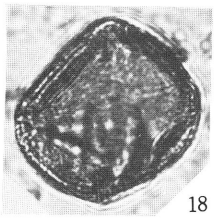
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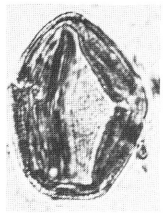
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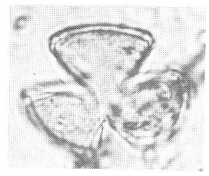
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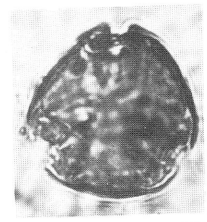
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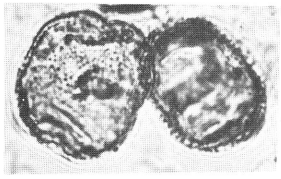
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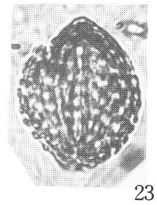
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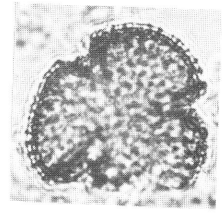
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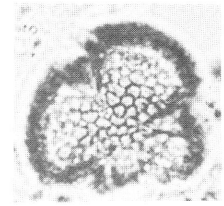
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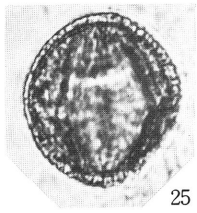
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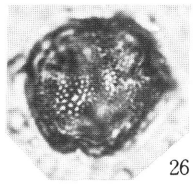
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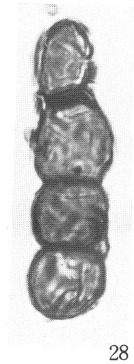
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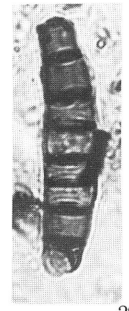
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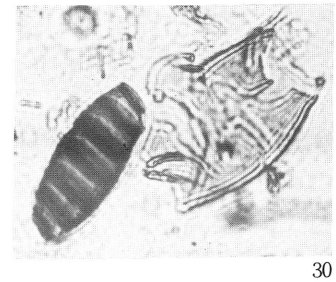
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