GEOLOGICAL SURVEY OF CANADA

DEPARTMENT OF ENERGY, MINES AND RESOURCES

PAPER 73-12

SOME SPORES AND POLLEN FROM THE CHRISTOPHER FORMATION (ALBIAN) OF ELLEF AND AMUND RINGNES ISLAND, AND NORTHWESTERN MELVILLE ISLAND, CANADIAN ARCTIC ARCHIPELAGO

(Report, 1 textfigure, and 6 plates)

W.S. Hopkins

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ABSTRACT

Results are presented of a brief palynological examination of samples of the Christopher Formation (Albian) from four localities within the Sverdrup Basin.

Approximately seventy spore and pollen entities (marine phytoplankton are not treated) are illustrated and their environmental implications are discussed briefly. Generally, the microflora is comparatively large and similar to that of more southerly regions; a warm temperature climate is suggested by the assemblage. The upper part of the formation contains the first occurrence of tricolpate (definite angiosperm) pollen.

RÉSUMÉ

On donne ici les résultats d'un bref examen palynologique des échantillons de la formation de Christopher (Albienne) provenant de quatre emplacements à l'intérieur du bassin Sverdrup.

Quelque soixante-dix spécimens de spores et de pollen (le phytoplancton marin n'est pas traité) sont illustrés et leur influence sur le milieu environnant est exposée brièvement. En général, la microflore est comparativement plus grande et analogue à celle des régions situées plus au sud; dans son ensemble elle fait supposer un climat chaud tempéré. La partie supérieure de la formation renferme la première venue de pollen tricolpate (angiosperme bien déterminé).

SOME SPORES AND POLLEN FROM THE CHRISTOPHER FORMATION (ALBIAN) OF ELLEF AND AMUND RINGNES ISLAND, AND NORTHWESTERN MELVILLE ISLAND, CANADIAN ARCTIC ARCHIPELAGO

INTRODUCTION

The data and conclusions, on Albian microfloras from the western and central parts of the Sverdrup Basin, given in this paper are part of a more comprehensive study dealing with Albian to Paleogene pollen and spores of the whole basin. Panarctic Oils supplied the samples and stratigraphic information from Melville Island; the samples from Ellef and Amund Ringnes Islands were collected by the writer during the summers of 1971 and 1972.

ACKNOWLEDGMENTS

The writer is indebted to H. R. Balkwill of the Geological Survey of Canada for the field support which made possible this work in the Arctic Islands. W. W. Nassichuk and D. W. Myhr, of the Geological Survey, critically reviewed the manuscript and their comments and suggestions are gratefully acknowledged.

REGIONAL SETTING

A large regional depression, indicated in textfigure 1, was named the Sverdrup Basin by Fortier (1957). This basin, encompassing a large part of the Queen Elizabeth Islands, contains a sequence of essentially conformable upper Paleozoic, Mesozoic and Tertiary sediments. Following Fortier's original work, a large amount of geological investigation has been carried out in the region, and has resulted in the establishment of a general structural and stratigraphic framework. Several detailed structural and stratigraphic studies are currently being conducted by staff of the Geological Survey of Canada and it seems probable that changes in interpretation will result. Consequently, some of the comments to follow on the Christopher Formation may require revision.

For a generalized description of the geology of the Sverdrup Basin, particularly the Mesozoic stratigraphy, reference is made to Fortier, *et al.* (1963), Nassichuk (1972), Plauchut (1971) and Thorsteinsson and Tozer (1970). Tozer and Thorsteinsson (1964) discuss Melville Island while the area of the Ringnes Islands is dealt with specifically by Heywood (1955), Stott (1969), and others. Balkwill (1972) has prepared a revised geologic map and stratigraphic section of Amund Ringnes Island, based on his recent work in the Ringnes Islands. These papers contain essentially complete bibliographies of previous work done in the Sverdrup Basin.

CHRISTOPHER FORMATION

The name Christopher Formation was given by Heywood (1955) to a sequence of predominantly marine shale on Ellef Ringnes Island that lies between two largely nonmarine units, the Isachsen Formation below and the Hassel Formation

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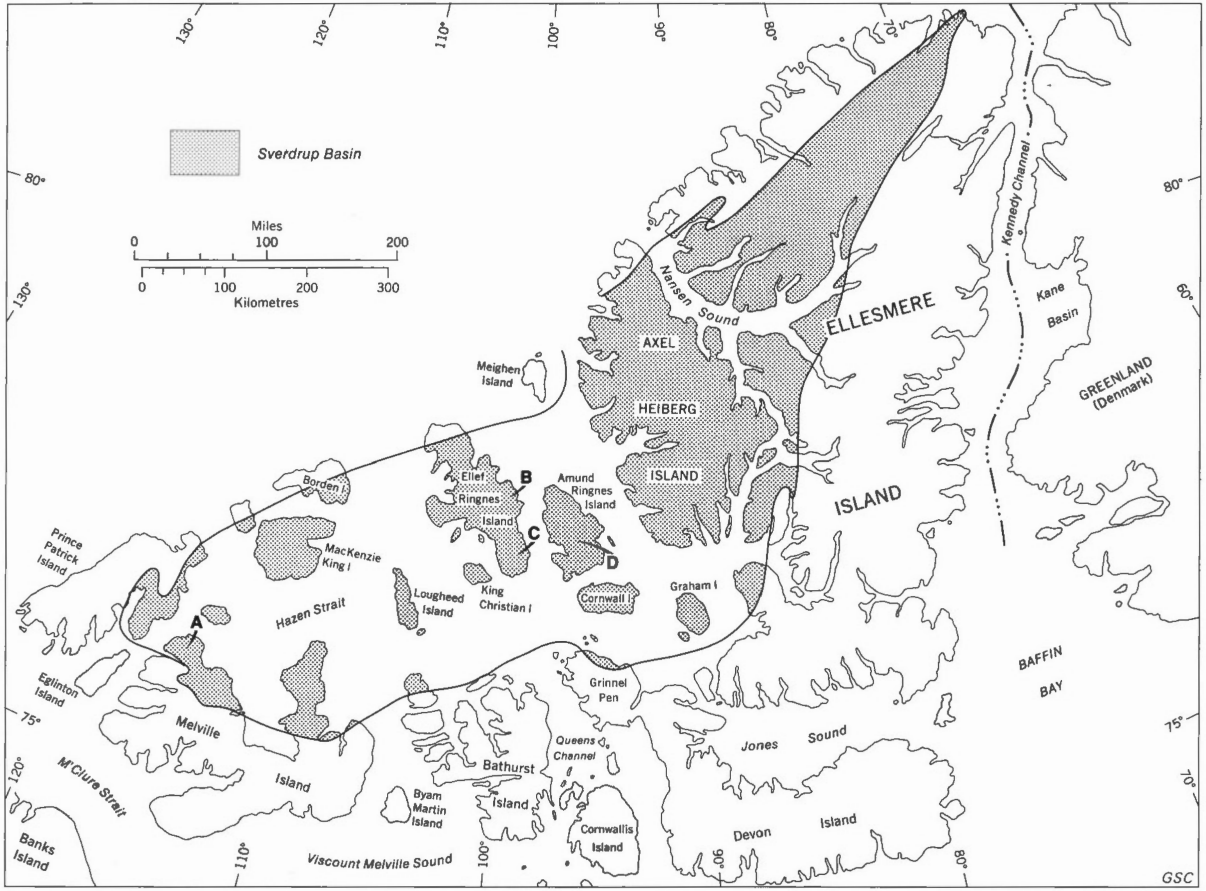

Textfigure 1. Map showing the Sverdrup Basin, Canadian Arctic Archipelago (after Thorsteinsson and Tozer, 1970, p. 550). Location of the 4 sections discussed in the text are indicated by the letters A, B, C, D

above. The Christopher is widespread throughout the Sverdrup Basin and occurs, in places, outside of the Basin proper. This unit apparently represents a marine transgression from the northwest to the southeast and, although dominantly shale, it does contain sandstone tongues and lenses near the basin margins. Thickness is variable, ranging from 130 feet on southern Prince Patrick Island to 4,600 feet on the east side of Glacier Fiord on southern Axel Heiberg Island (Tozer, 1963). On the Sabine Peninsula of Melville Island, the formation is known to attain a thickness of 400 feet (Tozer and Thorsteinsson, 1964). On Ellef Ringnes Island, Heywood (1955) measured 1,540 feet of Christopher strata, apparently near Isachsen Dome near the west-central part of the island. Near to Helicopter Dome on the east coast, Stott (1969) measured more than 2,500 feet. Balkwill (pers. com.) measured 3,000 feet of Christopher on northern Amund Ringnes Island.

In spite of the marine origin of the Christopher Formation, diagnostic fossils appear to be comparatively rare, and those that do occur are found only in the upper part of the formation. Ammonites, which have been collected at only a few localities including one near the top of the formation, indicate an Albian age. Recent fossil collections, made by H. R. Balkwill from the middle of the Christopher Formation on Amund Ringnes Island (base of KC-2; *see* Balkwill, 1972) and identified by J. A. Jeletzky (GSC Internal Report Number KM-6-1973-JAJ), suggest an early Middle Albian age. Ammonites collected from the Sabine Peninsula of northeastern Melville Island have been dated as late Early or early Middle Albian.

Tozer and Thorsteinsson (1964, p. 161) indicated that a small collection of ammonites from Mackenzie King Island is "suggestive of an Aptian age". This remains tentative and more data are required. A general problem in correlation, apparently basin wide, is the almost complete absence of diagnostic megafossils from the lower half of the formation. Unfortunately, the Christopher Formation cannot be adequately age bracketed because of the paucity of fossils in the formations above and below. The underlying Isachsen is entirely of Early Cretaceous age, ranging from late Valanginian, including probably Hauterivian and Barremian; possibly also Aptian (Tozer and Thorsteinsson, 1964). Plauchut (1971, p. 673) indicates that the top of the Isachsen is "most probably lower Albian." The age of the overlying Hassel Formation, although largely barren of diagnostic marine invertebrate remains, appears to be latest Albian and/or Cenomanian on the basis of pollen and spore analysis (Hopkins and Balkwill, 1973). In conclusion, the bulk of the fossil data from various localities throughout the Sverdrup Basin suggests that the Christopher is essentially Albian in age, although some Aptian may be present.

LOCATION AND SIGNIFICANCE OF SAMPLES

Locations of sample-collecting localities are indicated on figure 1. Twelve samples, collected by Panarctic Oils Ltd. from the bottom of shot holes were examined from Melville Island (Loc. A, Fig. 1, at approximately 76°20'N; 115°34'W). Preservation of these samples ranged from poor to fair. On Ellef Ringnes Island, a total of 15 samples were examined, eight from the north end (Loc. B, Fig. 1, at approximately 78°40'N; 100°10'W) near Cape Cairo and seven from the south end, just east of Hoodoo Dome (Loc. C, Fig. 1, at approximately 78°24'N; 99°30'W). Finally, eight samples from Amund Ringnes Island (Loc. D, Fig. 1, at approximately 78°24'N; 95°30'W) were included in the study. On the latter islands, preservation of palynomorphs ranged from fair to good.

This comparatively limited number of samples is not sufficient to produce any sort of biostratigraphic zonation. However, there is no evidence to suggest that significant variation of palynomorph distribution occurred during Christopher deposition. There is only one significant exception; the first evidence of angiosperms, in the form of simple small tricolpate grains, are present in the very uppermost Christopher. They were not encountered in the middle or lower Christopher.

Maceration followed essentially standard techniques with solution of the rock in hydrochloric and hydrofluoric acids, oxidation of the organic residue in either Schultzes solution or bleach. This was followed by potassium hydroxide, then mounting in glycerine jelly as a permanent mount.

MICROFLORA

GENERAL REMARKS CONCERNING THE MICROFLORA

In general, the palynomorphs recovered from the Christopher are comparatively well preserved and moderately numerous. Dinoflagellates and other phytoplankton are present in most samples, occasionally making up to 8 per cent of the total. These, however, are beyond the scope of this report. Representative coniferales are treated in a general way, being classified into six more or less easily identified genera, i.e. *Araucariacites*, *Classopollis*, *Eucommiidites*, *Laricoidites*, *Podocarpidites* and *Tsugaepollenites*. Another less distinctive group is referred to the Taxodiaceae-Cupressaceae. The remaining saccate forms, because of their almost endless variation in morphology, size and preservation, are simply assigned to "miscellaneous bisaccate conifers". Most probably would be considered members of the Pineaceae.

Below are listed the palynomorphs which have been identified and to which formal names have been applied. In so far as possible, they are classified into the natural botanical system.

Class Hepaticae
- *Triporoletes radiatus* (Dettmann) Playford
- *Triporoletes reticulatus* (Pocock) Playford

Family Sphagnaceae
- *Sphagnum antiquasporites* Wilson and Webster
- *Sphagnum buchenauensis* (Krutzsch) Elsik
- *Sphagnum regium* Drozhastchich
- *Cingulatisporites distaverrucosus* Brenner
- *Cingutriletes clavus* (Balme) Dettmann

Family Selaginellaceae
- *Acanthotriletes* cf. *A. varispinosus* Pocock
- *Neoraistrickia* cf. *N. robusta* Brenner
- cf. *Neoraistrickia* sp.

Family Lycopodiaceae
- *Lycospora* sp.
- *Lycopodiumsporites austroclavatidites* (Cookson) Potonié
- *Lycopodiumsporites reticulumsporites* (Rouse) Dettmann
- *Lycopodiumsporites* cf. *L. marginatus* Singh
- *Lycopodiumsporites facetus* Dettmann
- *Lycopodiacidites caperatus* Singh
- *Lycopodiacidites canaliculatus* Singh
- *Sestrosporites pseudoalveolatus* (Couper) Dettmann

Family Cheiropleuriaceae
- *Dictyophyllidites* sp.

Family Cyatheaceae or Dicksoniaceae
- *Cyathidites australis* Couper
- *Cyathidites minor* Couper
- *Kuylisporites lunaris* Cookson and Dettmann

Family Gleicheniaceae
Gleicheniidites senonicus Ross
Ornamentifera baculata Singh

Family Osmundaceae
Osmundacidites wellmanii Couper
Baculatisporites comaumensis (Cookson) Potonié
Todisporites major Couper
cf. *Biretisporites* sp.

Family ?Matoniaceae
Matonisporites phlebopteroides Couper

Family Polypodiaceae-Dennstaedtiaceae
Laevigatosporites ovatus Wilson and Webster

Family Schizaeaceae
Appendicisporites tricornitatus Weyland and Greifeld
Cicatricosisporites ludbrooki Dettmann
Cicatricosisporites australiensis (Cookson) Potonié
Cicatricosisporites dorogensis Potonié and Gelletich
Cicatricosisporites hallei Delcourt and Sprumont
Cicatricosisporites cf. *C. pseudotripartitus* (Bolkhovitina) Dettmann
Cicatricosisporites sp. A
Lygodiumsporites sp.

Spores - Incertae Sedis
Clavifera triplex (Bolkhovitina) Bolkhovitina
Concavissimisporites parkini (Pocock) Singh
Concavissimisporites variverrucatus (Couper) Singh
Concavissimisporites verrucosus Delcourt and Sprumont
Contignisporites cooksonii (Balme) Dettmann
Contignisporites fornicatus Dettmann
Converrucosisporites cf. *C. saskatchewanensis* Pocock
Deltoidospora psilostoma Rouse
Deltoidospora juncta (Kara-Murza) Singh
Granulatisporites cf. *G. dailyi* Cookson and Dettmann
Leptolepidites major Couper
Pilosisporites verus Delcourt and Sprumont
Pilosisporites trichopapillosus (Thiergart) Delcourt and Sprumont
Pilosisporites sp.
Tigrisporites scurrandus Norris
Trilobosporites apiverrucatus Couper
Trilobosporites canadensis Pocock
Trilobosporites purverulentus (Verbitskaya) Dettmann
Trilobosporites sp.
Verrucosisporites rotundus Singh
Schizosporis parvus Cookson and Dettmann
Undulatisporites undulapolus Brenner

Order Cycadales or Bennettitales
Cycadopitys sp. A
Cycadopitys sp. B

Family Caytoniaceae
Vitreisporites pallidus (Reissinger) Nilsson

Family Araucariaceae
Araucariacites australis Cookson

Family Pineaceae
Laricoidites magnus (Potonié) Potonié, Thomson and Thiergart
Tsugaepollenites mesozoicus Couper

Family Taxodiaceae
Taxodium cf. *T. hiatipites* Wodehouse
Inaperturopollenites sp.

Family Podocarpaceae
Podocarpidites sp.

Family Cheirolepidaceae
Classopollis torosus (Reissinger) Couper

Coniferophyta - Incertae Sedis
Eucommiidites minor Groot and Penny

Angiospermae - Incertae sedis
Tricolpites sp. A
Tricolpites sp. B

COMPOSITION OF THE MICROFLORA

Excluding the phytoplankton, and excluding the large variation in the bisaccate conifer pollen, a total of 70 separate entities have been named. According to the writer's interpretation of botanical affinities, this breaks down to 9 species of bryophytes, 7 lycopods, 19 ferns, 22 spores - *incertae sedis* (probably mostly ferns), 2 probable cycads, 1 seed fern and assorted collection of gymnosperms and at least two species of angiosperms.

With one notable and important exception, no particular variation in distribution of pollen types was noted from top to bottom of the formation. Evidently the climate and other physical environmental parameters held comparatively constant throughout deposition of the Christopher Formation. The exception was the occurrence of several early and morphologically simple tricolpate grains representing early angiosperms. These were found only in the very uppermost portion of the formation.

Generally the flora of the surrounding country during Christopher deposition was a conifer-fern complex. These two broad groups are by far the most common of the spore and pollen types. Virtually all of the conifer genera, as well as large numbers of miscellaneous bisaccates, are well represented in nearly every sample. Of those identified at a generic level, *Tsugaepollenites* seems to be the most abundant. Conversely, *Araucariacites*, *Classopollis* and *Eucommiidites* appear to be the least common. All of this suggests a complicated and varied coniferous forest.

Among the ferns, spores of the Gleicheniaceae are overwhelmingly dominant, as they seem to be throughout the Cretaceous rocks of the Arctic Islands. Next in abundance are members of the family Schizaeaceae of which at least six species of *Cicatricosisporites* are present. Other fern families identified are considered representatives of the Cyathaceae, the Matoniaceae, and the Osmundaceae. Abundant genera of other probable filicales also are present. Finally, though limited in number, there are representatives of the Spagnaceae, Lycopodiaceae and Selaginellaceae.

Monocolpate pollen grains are conspicuous by their rarity, with only a few specimens being found. The large size of these specimens suggests they may belong to the Cycadales or Bennettitales. Several smaller monocolpate grains doubtfully belong to the Ginkgoales. A few simple tricolpate pollen grains were encountered near the top of the formation, representing early and unknown angiosperms.

CLIMATIC INTERPRETATIONS

In Cretaceous palynology, environmental interpretations are difficult, and can be made only in the broadest terms, and only then by utilizing groups of families. With this is the implicit assumption that the environmental requirements of the families found in the fossil record are similar to those of their modern counterparts. Most evidence suggests that this is true, and indeed without such assumptions, no interpretations, no matter how general, can be made.

The difficulties inherent in assessing past floras on the basis of palynomorphs present is recognized and has been discussed by other authors (Faegri and Iverson, 1964; Potter, 1964; Leopold, 1964; Muller, 1959; and many others). Furthermore, complications are introduced in the case of the Christopher Formation because all palynomorphs have been transported from the site of growth to a marine environment. This fact tends to emphasize an abundance of conifer pollen because they are light and easily transported by wind. However, even with these considerations, some general comments can be made. Hopkins (1971, p. 101) presented a very brief synoptic outline of the climatic requirements of modern families which can be related to microfossils from the Albian Christopher Formation. A somewhat more detailed analysis of the same factors are presented also *in* Hopkins and Balkwill, 1973.

The conclusions arrived at in those papers are the same as those arrived at here. In other words, the microflora would seem to indicate a moist, warm-temperate climate during Christopher deposition. This is in keeping with Smiley's (1969) interpretation of a humid, warm-temperate climate for northern Alaska in Albian time.

CONCLUSIONS

To date, the published work on Cretaceous palynology and paleobotany from the northern Canadian Arctic is very minimal - a tremendous amount of work remains to be done. However, at this early date, and based on examination of these samples, several preliminary conclusions can be drawn.

1) The microflora appears comparatively large, comparable to those of more southerly latitudes.

2) The Albian of the far north contains a flora similar to that of southerly areas, but

3) has a preponderance of forms suggesting a more temperate climate and an essential absence of those which would suggest a hotter and dryer climate.

4) Angiosperms appear to make their earliest appearance in the uppermost Christopher (mid- to Late Albian in age) as represented by small and simple tricolpate grains. This is similar to the situation in more southerly latitudes.

DESCRIPTION OF THE MICROFLORA

DIVISION BRYOPHYTA

Class Hepaticae

Genus *Triporoletes* (Mtchedlishvili) Playford

Triporoletes radiatus (Dettmann) Playford

Plate 1, figure 1

1971, Palaeontology, v. 14, p. 552

Stratigraphic range: Upper Albian in the Peace River of Alberta. Lower Cretaceous in southeastern Australia.

Frequency: Rare.

Triporoletes reticulatus (Pocock) Playford

Plate 1, figure 2

1971, Palaeontology, v. 14, p. 552

Stratigraphic range: Lower Cretaceous in western Canada, Albian in the U.S.A., Lower Cretaceous in southeastern Australia, Siberia and Argentina and other parts of the world.

Frequency: Rare.

Class Musci

Family Sphagnaceae

Genus *Sphagnum* Erhart

Sphagnum antiquasporites Wilson and Webster

Plate 1, figure 3

1946, Am. J. Bot., v. 33, p. 273

Stratigraphic range: Jurassic through Tertiary rocks in many parts of the world.

Frequency: Locally very abundant.

Sphagnum buchenauensis (Krutzsch) Elsik

Plate 1, figure 4

1968, Pollen et Spores, v. 10, p. 302

Stratigraphic range: Similar forms have been found in Cretaceous and Tertiary rocks from various parts of the world.

Frequency: Rare.

Sphagnum regium Drozhastchich

Plate 1, figure 5

1961, Pollen and spores of Western Siberia;
Jurassic-Paleocene, Vnigri, Leningrad, p. 18

Stratigraphic range: Paleocene in the U.S.S.R. and Texas.

Frequency: Rare.

Genus *Cingulatisporites* (Thomson) Potonié

Cingulatisporites distaverrucosus Brenner

Plate 1, figure 6

1963, Maryland Dept. Geology, Mines and Water Resources,
Bull. 27, p. 58

Stratigraphic range: Cretaceous in Maryland.

Frequency: Rare.

Genus *Cingutriletes* (Pierce) Dettmann

Cingutriletes clavus (Balme) Dettmann

Plate, figures 7, 8

1963, Proc. Roy. Soc. Victoria, n.s., v. 77, p. 69

Stratigraphic range: Jurassic, Cretaceous, Tertiary in many parts of the world.

Frequency: Occasional to common.

DIVISION LYCOPODOPHYTA

Family Selaginellaceae

Genus *Acanthotriletes* (Naumova) ex Potonié and Kremp

Acanthotriletes cf. *A. varispinosus* Pocock

Plate 1, figure 9

1962, Palaeontographica, Bd. 111, Abt. B, p. 36

Stratigraphic range: Lower Cretaceous in numerous localities in western Canada.

Frequency: Occasional.

Genus *Neoraistrickia* Potonié

Neoraistrickia cf. *N. robusta* Brenner

Plate 1, figure 10

1963, Maryland Dept. Geology, Mines and Water Resources,
Bull. 27, p. 65

Remarks: Appears similar to Brenner's (1963) species but is somewhat smaller, being 45 to 50μ in maximum dimension. Brenner gives a 59 to 69μ size range.

Stratigraphic range: Cretaceous in Maryland. *Neoraistrickia* spp. are widespread in Jurassic, Cretaceous and Tertiary rocks throughout the world.

Frequency: Rare.

cf. *Neoraistrickia* sp.

Plate 1, figures 11, 12

Remarks: This form appears to be intermediate between *Baculatisporites* and *Neoraistrickia*. It is more spherical than *Neoraistrickia* but the Baculae seem to be somewhat larger than those characteristic of *Baculatisporites*.

Frequency: Only three specimens found.

Family Lycopodiaceae

Genus *Lycospora* Schopf, Wilson and Bentall

Lycospora sp.

Plate 1, figure 13

Frequency: Rare.

Genus *Lycopodiumsporites* Thiergart ex Delcourt and Sprumont

Lycopodiumsporites austroclavatidites (Cookson) Potonié

Plate 2, figure 14

1956, Beih. zum Geol. Jahrb., Bd. 23, p. 46

Stratigraphic range: Jurassic and Cretaceous rocks throughout the world.

Frequency: Abundant.

Lycopodiumsporites facetus Dettmann

Plate 2, figure 15

1963, Proc. Roy. Soc. Victoria, n.s., v. 77, p. 47

Comments: This species is similar to *L. marginatus* Singh, but the latter species appears consistently more triangular in polar outline.

Stratigraphic range: Occurs infrequently, but is widespread in upper Mesozoic sediments of southeastern Australia.

Frequency: Rare.

Lycopodiacidites (Couper) Potonié

Lycopodiacidites caperatus Singh

Plate 2, figure 16

1971, Res. Council Alberta Bull., 28, p. 39

Stratigraphic range: Upper Albian in the Peace River area, Alberta.

Frequency: Occasional.

Lycopodiacidites caniculatus Singh

Plate 2, figure 17

1971, Res. Council Alberta, Bull. 28, p. 38

Stratigraphic range: Middle and Upper Albian in the Peace River area, Alberta. Similar forms have been found in Cretaceous and Tertiary rocks in many parts of the world.

Frequency: Occasional.

Genus *Sestrosporites* Dettmann

Sestrosporites pseudoalveolatus (Couper) Dettmann

1963, Roy. Soc. Victoria, n.s., v. 77, p. 66

Stratigraphic range: Lower Cretaceous and lower Cenomanian from many parts of the world.

Frequency: Rare.

Remarks: Several modern species of *Lycopodium* produce spores essentially identical to *Sestrosporites*.

DIVISION PTEROPHYTA

Family Cheiropleuriaceae

Genus *Dictyophyllidites* (Couper) Dettmann

Dictyophyllidites sp.

Plate 2, figure 18

Frequency: Rare.

Family Cyatheaceae or Dicksoniaceae

Genus *Cyathidites* Couper

Cyathidites australis Couper

Plate 2, figure 19

1953, New Zealand Geol. Surv. Paleont., Bull. 22, p. 27

Stratigraphic range: Widespread in Jurassic and Cretaceous rocks throughout the world.

Frequency: Occasional.

Cyathidites minor Couper

Plate 2, figure 20

1953, New Zealand Geol. Surv. Paleont. Bull. 22, p. 28

Stratigraphic range: Widespread in Jurassic and Cretaceous rocks throughout the world.

Frequency: Occasional.

Genus *Kuylisporites* Potonié

Kuylisporites lunaris Cookson and Dettmann

Plate 2, figure 21

1958, Proc. Roy. Soc. Victoria, v. 70, p. 103

Stratigraphic range: Lower Cretaceous in western Canada, the eastern United States and southeastern Australia.

Frequency: Occasional.

Affinity: The modern genus *Hemitelia*, belonging to the family Cyatheaceae, produces spores that are comparable to those assigned to *Kuylisporites* Potonié (Singh, 1971, p. 102).

Family Gleicheniaceae

Genus *Gleicheniidites* (Ross ex Delcourt and Sprumont) Skarby

Gleicheniidites senonicus Ross

Plate 2, figure 22

1949, Bull. Geol. Inst. Upsala, v. 34, p. 31

Stratigraphic range: Upper Jurassic to Pliocene in Europe; Jurassic, Cretaceous and Tertiary in many parts of the world, both northern and southern hemisphere (Skarby, 1964). Gleicheniaceous spores appear to be restricted to Mesozoic, Paleocene and Eocene rocks in North America.

Frequency: Abundant.

Genus *Ornamentifera* Bolkhovitina

Ornamentifera baculata Singh

Plate 2, figure 23

1971, Res. Council Alberta, Bull. 28, p. 100

Stratigraphic range: Middle and Upper Albian in the Peace River area, Alberta.

Frequency: Very rare.

Comments: Interradial crassitudes are developed only weakly.

Genus *Osmundacidites* Couper

Osmundacidites wellmanii Couper

Plate 2, figure 24

1955, New Zealand Geol. Surv. Paleont. Bull. 22, p. 20

Stratigraphic range: Widespread in Jurassic and Cretaceous rocks throughout the world. Similar forms are found in many Tertiary deposits.

Frequency: Occasionally abundant.

Genus *Baculatisporites* Thomson and Pflug

Baculatisporites comaumensis (Cookson) Potonié

Plate 2, figure 25

1956, Beih. zum Geol. Jahrb., Bd. 23, p. 33

Stratigraphic range: Late Triassic to Cretaceous rocks throughout the world. Similar forms are found in many Tertiary deposits.

Frequency: Occasional.

Genus *Todisporites* Couper

Todisporites major Couper

Plate 2, figure 26

1958, Palaeontographica, Bd. 103, Abt. B, p. 134

Stratigraphic range: Various Jurassic and Cretaceous rocks in various parts of the world.

Frequency: Comparatively rare.

Family ?Matoniaceae

Genus *Matonisporites* (Couper) Dettmann

Matonisporites phlebopteroides Couper

Plate 3, figure 27

Stratigraphic range: Jurassic and Lower Cretaceous.

Frequency: Specimen only.

Family Polypodiaceae-Dennstaedtiaceae

Genus *Laevigatosporites* (Ibrahim) Schopf, Wilson and Bentall

Laevigatosporites ovatus Wilson and Webster

Plate 3, figure 28

1946, Am. J. Bot., v. 33, p. 273

Stratigraphic range: This and similar forms have been found in Jurassic and Cretaceous rocks, but are particularly abundant in the Tertiary.

Frequency: Occasional.

Family Schizaeaceae

Genus *Appendicisporites* Weyland and Krieger

Appendicisporites tricornatus Weyland and Greifeld

Plate 3, figure 29

1953, Palaeontographica, Bd. 95, Abt. B, p. 43

Stratigraphic range: Cretaceous in various parts of the world.

Frequency: Occasional.

Genus *Cicatricosisporites* Potonié and Gelletich

Cicatricosisporites ludbrooki Dettmann

Plate 3, figures 30, 31

1963, Proc. Roy. Soc. Victoria, n.s., v. 77, p. 54

Stratigraphic range: Similar forms have been found in Cretaceous rocks in several parts of the world.

Frequency: Only two specimens seen.

Cicatricosisporites australiensis (Cookson) Potonié

Plate 3, figure 32

1956, Beih. zum Geol. Jahrb., Bd. 23, p. 48

Stratigraphic range: Lower and Middle Cretaceous from most parts of the world. Purbeckian in England.

Frequency: Comparatively common.

Cicatricosisporites dorogensis Potonié and Gelletich

Plate 3, figure 33

1933, Sitzber Ges. Nat. Freunde (Berlin), v. 33, p. 522

Remarks: The distinction between *C. dorogensis* and *C. hallei* is, for the purpose of this report, based on size. A similar basis for distinction was used by Brenner (1963, p. 47).

Stratigraphic range: This and similar forms are characteristic of Cretaceous rocks from most parts of the world. During the Tertiary, the genus was progressively restricted to more southern latitudes.

Frequency: Occasional.

Cicatricosisporites hallei Delcourt and Sprumont

Plate 3, figure 34

1955, Mem. Soc. Geol. Belgique, n.s., v. 4, p. 17

Remarks: See *C. dorogensis*

Stratigraphic range: Same as *C. dorogensis*

Frequency: Fairly common.

Cicatricosisporites cf. *C. psuedotripartitus* (Bolkhovitina) Dettmann

Plate 3, figures 35, 36

1963, Proc. Roy. Soc. Victoria, n.s., v. 77, p. 54

Remarks: Similarity exists to *C. psuedotripartitus*, however, the muri show marked bifurcation in Christopher specimens. This is not apparent in the type *C. pseudotripartitus*, but in other respects they are identical.

Frequency: Very rare.

Cicatricosisporites sp. A

Plate 3, figure 37

Remarks: This form is similar to *C. perforatus* (Baranov, Nemkova, and Kondratiev) Singh but the pattern of perforations is less orderly than on *C. perforatus*, and may be only a corroded specimen of some other species.

Frequency: 1 specimen only.

Genus *Lygodiumsporites* (Potonié, Thomson, Thiergart) Singh

Lygodiumsporites sp.

Plate 3, figure 38

Remarks: Relationship to the Schizaeaceae is questionable as this particular morphologic form is not particularly unique.

Frequency: Occasional.

SPORES - INCERTAE SEDIS

Genus *Clavifera* Bolkhovitina

Clavifera triplex (Bolkhovitina) Bolkhovitina

Plate 4, figure 39

1966, The importance of palynological analysis for the stratigraphic and paleofloristic investigation, Nauk, Moscow, p. 68

Stratigraphic range: Aptian to Paleocene in the U.S.S.R., Upper Cretaceous in eastern Australia, Neocomian in Germany.

Frequency: Rare.

Affinity: Bolkhovitina suggests a relationship to the Gleicheniaceae.

Genus *Concavissimisporites* (Delcourt and Sprumont) Delcourt, Dettmann, Hughes

Concavissimisporites parkini (Pocock) Singh

Plate 4, figure 40

1964, Res. Council Alberta, Bull. 15, p. 78

Stratigraphic range: Upper Jurassic through Albian in western Canada. Bajocian through Neocomian in England.

Frequency: Rare.

Concavissimisporites variverrucatus (Couper) Singh

Plate 4, figure 41

1964, Res. Council Alberta, Bull. 15, p. 78

Stratigraphic range: Upper Jurassic through Albian in western Canada. Bajocian through Neocomian in England.

Frequency: Rare.

Concavissimisporites verrucosus Delcourt and Sprumont

Plate 4, figure 42

1955, Mem. Soc. Geol. Belgique, n.s., v. 4, p. 25

Stratigraphic range: Upper Jurassic and Neocomian in western Canada. Neocomian to Albian in Maryland.

Frequency: Rare.

Genus *Contignisporites* Dettmann

Contignisporites cooksonii (Balme) Dettmann

Plate 4, figures 43, 44

1963, Proc. Roy. Soc. Victoria, n.s., v. 77, p. 75

Stratigraphic range: Oxfordian to Aptian in western Australia; Berriasian to Aptian in eastern Australia; Barremian to Aptian in the U.S.S.R., Albian in the Peace River area, Alberta; Lower Cretaceous in India.

Frequency: Rare.

Affinity: Some authors have considered this genus as representing the Schizaeaceae. However, to the writer's knowledge, there are no modern Schizaeaceous spores which resemble *Contignisporites*.

Contignisporites fornicatus Dettmann

Plate 4, figures 45, 46

1963, Proc. Roy. Soc. Victoria, n.s., v. 77, p. 76

Stratigraphic range: Neocomian to Albian in southeastern Australia.

Frequency: Rare.

Genus *Converrucosisporites* Potonié and Kremp

Converrucosisporites cf. *C. saskatchewanensis* Pocock

Plate 4, figure 47

1962, Palaeontographica, Bd. 111, Abt. B, p. 47

Stratigraphic range: Neocomian in western Canada.

Remarks: It differs from the type specimen in having somewhat smaller warts, otherwise it appears to be similar.

Frequency: Rare.

Genus *Deltoidospora* (Miner) Potonié

Deltoidospora psilostoma Rouse

Plate 4, figure 48

1959, Micropaleontology, v. 5, p. 311

Stratigraphic range: Upper Jurassic through Cretaceous in many areas.

Frequency: Occasional.

Deltoidospora juncta (Kara-Murza) Singh

Plate 4, figure 49

1964, Res. Council Alberta, Bull. 15, p. 81

Stratigraphic range: Upper Jurassic and Lower Cretaceous in many parts of the world.

Frequency: Rare.

Genus *Granulatisporites* (Ibrahim) Potonié and Kremp

Granulatisporites cf. *G. dailyi* Cookson and Dettmann

Plate 4, figure 50

1958, Proc. Roy. Soc. Victoria, v. 70, p. 99

Remarks: Essentially identical to Cookson's and Dettmann's species but the clustering of granules on the contact faces is not so pronounced.

Stratigraphic range: Lower Cretaceous in eastern Australia.

Frequency: Only two or three specimens found.

Genus *Leptolepidites* Couper

Leptolepidites major Couper

Plate 4, figure 51

1958, Palaeontographica, Bd. 103, Abt. B, p. 141

Stratigraphic range: Middle Jurassic in New Zealand and Britain; Valanginian to ?Cenomanian in western Siberia; Upper Cretaceous in Canada; upper Mesozoic in southeastern Australia.

Frequency: Rare.

Remarks: As indicated by Dettmann (1963, p. 29), the generic diagnosis errs in indicating that both proximal and distal faces are sculptured. These specimens are smooth proximally.

Genus *Pilosisporites* Delcourt and Sprumont

Pilosisporites verus Delcourt and Sprumont

Plate 4, figure 52

1955, Mem. Soc. Geol. Belgique, n.s., v. 4, p. 35

Stratigraphic range: Lower Cretaceous in many parts of the world.

Frequency: Occasional.

Pilosisporites trichopapillosus (Thiergart) Delcourt and Sprumont

Plate 5, figure 53

1955, Mem. Soc. Belge. Geol. de Paleont., n.s., v. 4, p. 34

Stratigraphic range: Purbeckian to Albian in many parts of the world.

Frequency: Occasional.

Genus *Tigrisporites* Klaus

Tigrisporites scurrandus Norris

Plate 5, figure 54

1967, Palaeontographica, Bd. 120, Abt. B, p. 91

Stratigraphic range: Albian and Cenomanian in Alberta.

Frequency: Rare.

Affinity: Probably in the family Lycopodiaceae. This form looks much like the spores of modern *Lycopodium* species.

Genus *Trilobosporites* Pant ex Potonié

Trilobosporites apiverrucatus Couper

Plate 5, figure 55

1958, Palaeontographica, Bd. 103, Abt. B, p. 142

Stratigraphic range: Uppermost Jurassic to Albian in many parts of the world.

Frequency: Rare.

Trilobosporites canadensis Pocock

Plate 5, figure 56

1962, Palaeontographica, Bd. 111, Abt. B, p. 44

Stratigraphic range: Probably Barremian to Albian.

Frequency: Occasional.

Trilobosporites cf. *T. purverulentus* (Verbitskaya) Dettmann

Plate 5, figure 57

1965, Proc. Roy. Soc. Victoria, n.s., v. 77, p. 60

Stratigraphic range: Albian to Cenomanian in the U.S.S.R. Aptian and Albian in southeastern Australia.

Frequency: Rare.

Remarks: The several specimens encountered are badly corroded and identification is somewhat tenuous.

Trilobosporites sp.

Plate 5, figures 58, 59

Description: A unique, distally warty trilete spore with a concentration of warts in the equatorial-apical region. This would appear to be a new species, or possibly an aberrant form.

Genus *Verrucosisporites* (Ibrahim) Potonié and Kremp

Verrucosisporites rotundus Singh

Plate 5, figure 60

1964, Res. Council Alberta, Bull. 15, p. 96

Stratigraphic range: Aptian and Albian in various parts of the world.

Frequency: Rare.

Genus *Schizosporis* Cookson and Dettmann

Schizosporis parvus Cookson and Dettmann

Plate 5, figure 61

1959, Micropaleontology, v. 5, p. 216

Stratigraphic range: Barremian to Cenomanian in North America and Australia.

Frequency: Rare.

Genus *Undulatisporites* Pflug in Thomson and Pflug

Undulatisporites undulapolus Brenner

Plate 5, figure 62

1963, Maryland Dept. Geol. Mines, Water Resources, Bull. 27, p. 72

Stratigraphic range: Barremian to Albian in various parts of North America.

Frequency: Rare.

DIVISION CYCADOPHYTA

Order Cycadales or Bennettitales

Genus *Cycadopitys* Wodehouse ex Wilson and Webster

Cycadopitys sp. A

Plate 5, figure 63

Description: Elongated, spindle shaped, sulcus gaping at ends, granulate exine, 80 to 95μ long.

Frequency: Rare.

Cycadopitys sp. B

Plate 5, figure 64

Description: Circular pollen grain, broad sulcus bordered by narrow margo, granular, 45 to 55μ.

Frequency: Rare.

DIVISION PTERIDOSPERMOPHYTA

Family Caytoniaceae

Genus *Vitreisporites* (Leschik) Jansonius

Vitreisporites pallidus (Reissinger) Nilsson

Plate 5, figure 65

1958, Lunds, Univ. Arsskr., v. 53, p. 78

Stratigraphic range: Common throughout the entire Mesozoic in both the northern and southern hemispheres.

Frequency: Occasional.

DIVISION CONIFEROPHYTA

Order Coniferales

Family Araucariaceae

Genus *Araucariacites* Cookson ex Couper

Araucariacites australis Cookson

Plate 5, figure 66

1947, British, Australia, New Zealand Antarctic Res. Exped. (1929-1931), Rep. A2, p. 130

Stratigraphic range: Jurassic, Cretaceous and Tertiary in most parts of the world.

Frequency: Occasional.

Family Pineaceae

Genus *Laricoidites* Potonié, Thomson, and Thiergart ex Potonié

Laricoidites magnus (Potonié) Potonié, Thomson and Thiergart

Plate 6, figure 67

1950, Palaeontographica, Bd. 94, Abt. B, p. 64

Stratigraphic range: Similar forms have been reported in Cretaceous and Tertiary rocks from many parts of the world.

Frequency: Rare.

Genus *Tsugaepollenites* (Potonié and Venitz) Potonié

Tsugaepollenites mesozoicus Couper

Plate 6, figure 68

1958, Palaeontographica, Bd. 103, Abt. B, p. 155

Stratigraphic range: A common constituent of the Jurassic and Cretaceous in many parts of the world. Similar forms have been found also in many Tertiary rocks.

Frequency: Occasional.

Family Taxodiaceae

Genus *Taxodium* Richard

Taxodium cf. *T. hiatipites* Wodehouse

Plate 6, figure 69

1933, Torrey Bot. Club Bull., v. 60, p. 493

Remarks: Although this form may not technically represent the modern genus *Taxodium*, it does fit the generic and specific description as indicated by Wodehouse. It also appears to be indistinguishable from reference pollen from modern *Taxodium*. There is little doubt that this pollen grain was derived from some member of the Taxodiaceae.

Stratigraphic range: Similar forms have been found in Cretaceous and Tertiary rocks from most parts of the world.

Frequency: Rare to occasional.

Genus *Inaperturopollenites* (Pflug ex Thomson and Pflug) Potonié

Inaperturopollenites sp.

Plate 7, figure 70

Description: Inaperturate, scabrate, 20 to 40μ in diameter. Exine frequently creased with folds, often split.

Frequency: Rare to common.

Affinity: These palynomorphs are morphologically similar to pollen of the modern gymnosperm families Cupressaceae and Taxodiaceae.

Family Podocarpaceae

Genus *Podocarpidites* Cookson ex Couper

cf. *Podocarpidites* sp.

Plate 7, figure 71

Remarks: As discussed in Hopkins and Balkwill (1973), there is considerable doubt about the stratigraphic range and geographic distribution of the Podocarpaceae during Mesozoic and Tertiary times, at least in North America. However, this particular form fits the description of the above-described genus.

Frequency: Rare.

Stratigraphic range: Widespread throughout the Mesozoic throughout the world. Most abundant in the Jurassic.

Remarks: The Cheirolepidaceae is an extinct family with several megafossil conifer genera all of which produce pollen of the *Classopollis*-type.

Frequency: Occasional.

CONIFERALES - INCERTAE SEDIS

Genus *Eucommiidites* (Erdtman) Couper

Eucommiidites minor Groot and Penny

Plate 7, figure 74

1960, Micropaleontology, v. 6, p. 234

Stratigraphic range: Upper Jurassic to Albian in many parts of the world.

Frequency: Rare.

DIVISION ANTHOPHYTA

Class Dicotyledonae

Genus *Tricolpites* Cookson ex Couper

Tricolpites sp. A

Plate 7, figures 75, 76

Description: Tricolpate, microreticulate, 15 to 20μ in polar diameter.

Frequency: Rare, occurring only in the upper portion of the Christopher Formation.

Tricolpites sp. B

Plate 7, figure 77

Description: Tricolpate, scabrate, 17 to 24μ in polar diameter.

Frequency: Rare, occurring only in the upper portion of the Christopher Formation.

Family Cheirolepidaceae

Genus *Classopollis* (Pflug) Couper

Classopollis torosus (Reissinger) Couper

Plate 7, figures 72, 73

1958, Palaeontographica, Bd. 103, Abt. B, p. 156

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Plates 1 to 6

PLATE 1

Palynomorphs from the Christopher Formation, Sverdrup Basin, all figures x800 unless otherwise indicated

Figure 1. *Triporoletes radiatus* (Dettmann) Playford (GSC 33941) GSC loc. C-26759.

Figure 2. *Triporoletes reticulatus* (Pocock) Playford (GSC 33942) GSC loc. C-26766; x500.

Figure 3. *Sphagnum antiquasporites* Wilson and Webster (GSC 33943) GSC loc. C-26760; x500.

Figure 4. *Sphagnum buchenauensis* (Krutzsch) Elsik (GSC 33944) GSC loc. C-26761.

Figure 5. *Sphagnum regium* Drozhastchich (GSC 33945) GSC loc. C-26760.

Figure 6. *Cingulatisporites distaverrucosus* Brenner (GSC 33946) GSC loc. C-26766.

Figures 7, 8. *Cingutriletes clavus* (Balme) Dettmann (GSC 33947) GSC loc. C-26763.

Figure 9. *Acanthotriletes* cf. *A. varispinosus* Pocock (GSC 33948) GSC loc. C-26758.

Figure 10. *Neoraistrickia* cf. *N. robusta* Brenner (GSC 33949) GSC loc. C-26759.

Figures 11, 12. cf. *Neoraistrickia* sp. (GSC 33950) GSC loc. C-26767.

Figure 13. *Lycospora* sp. (GSC 33951) GSC loc. C-26759.

PLATE 1

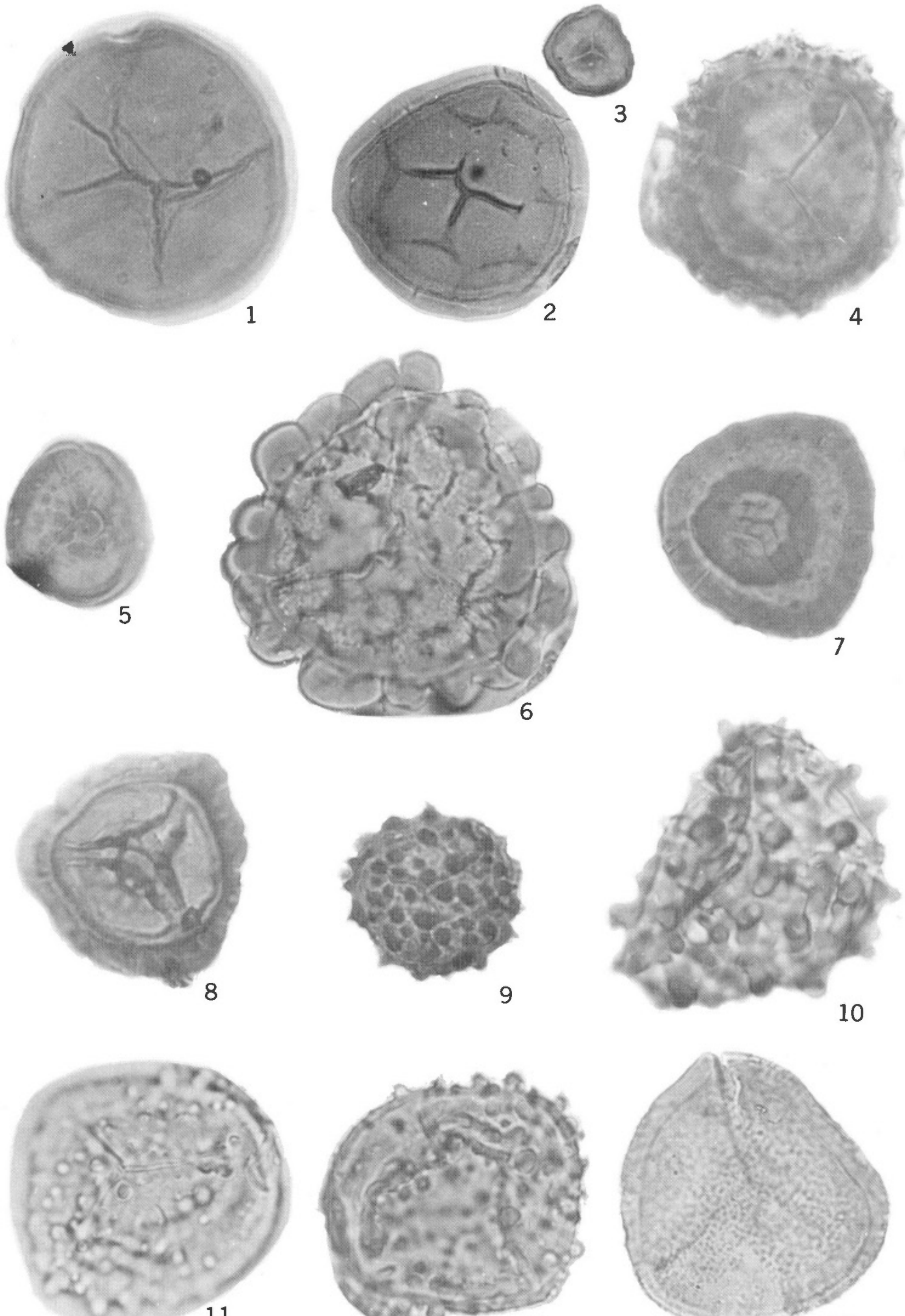


PLATE 2

Palynomorphs from the Christopher Formation, Sverdrup Basin,
all figures x800 unless otherwise indicated

Figure 14. *Lycopodiumsporites austroclavatidites* (Cookson) Potonié (GSC 33952) GSC loc. C-26765.

Figure 15. *Lycopodiumsporites facetus* Dettmann (GSC 33953) GSC loc. C-26763.

Figure 16. *Lycopodiacidites caperatus* Singh (GSC 33954) GSC loc. C-26758.

Figure 17. *Lycopodiacidites caniculatus* Singh (GSC 33955) GSC loc. C-26762; x500.

Figure 18. *Dictyophyllidites* sp. (GSC 33956) GSC loc. C-26759.

Figure 19. *Cyathidites australis* Couper (GSC 33957) GSC loc. C-26760; x500.

Figure 20. *Cyathidites minor* Couper (GSC 33958) GSC loc. C-26761.

Figure 21. *Kuylisporites lunaris* Cookson and Dettmann (GSC 33959) GSC loc. C-26763.

Figure 22. *Gleicheniidites senonicus* Ross (GSC 33960) GSC loc. C-26761.

Figure 23. *Ornamentifera baculata* Singh (GSC 33961) GSC loc. C-26762.

Figure 24. *Osmundacidites wellmanii* Couper (GSC 33962) GSC loc. C-26763; x500.

Figure 25. *Baculatisporites comaumensis* (Cookson) Potonié (GSC 33963) GSC loc. C-26760.

Figure 26. *Todisporites major* Couper (GSC 33964) GSC loc. C-26762.

PLATE 2

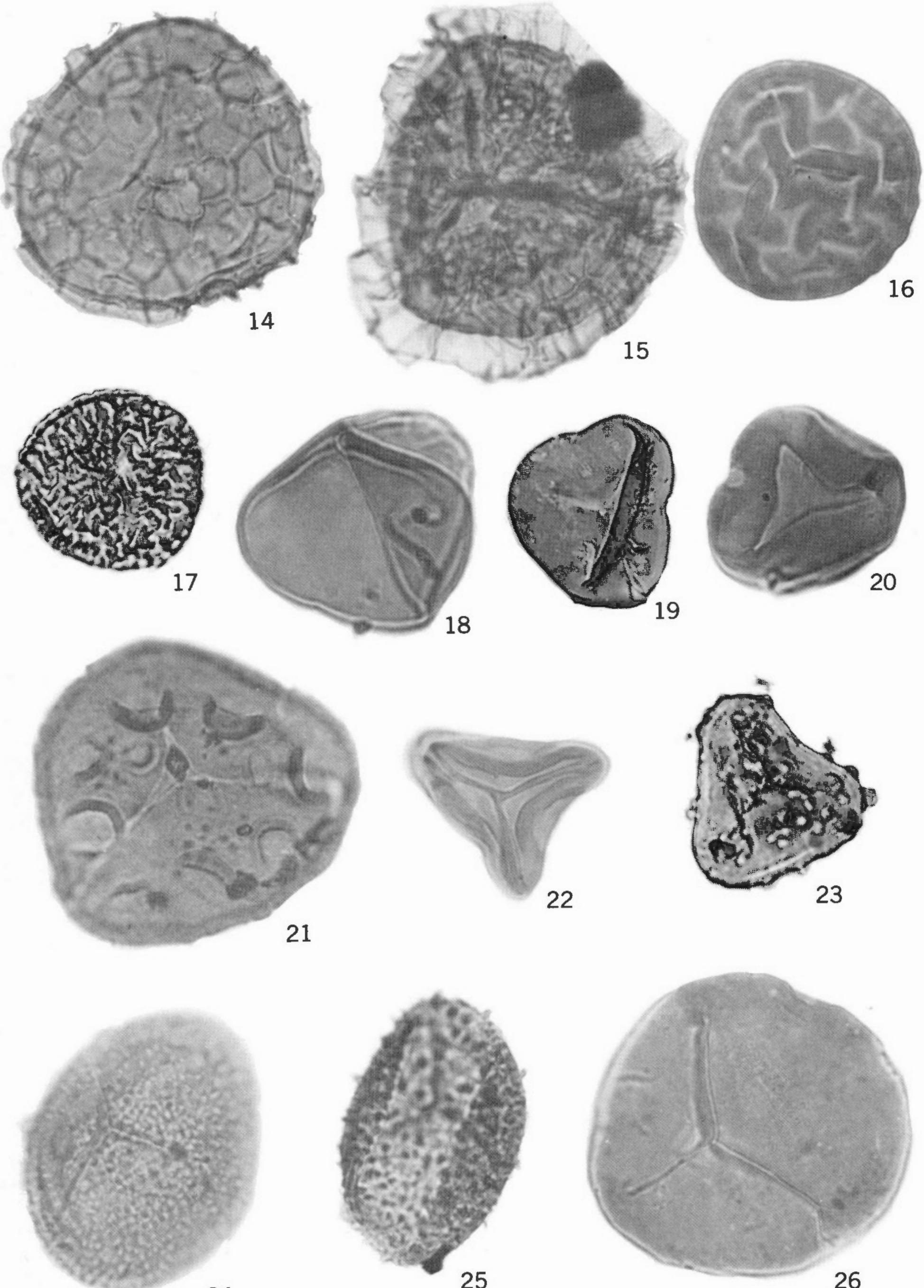


PLATE 3

Palynomorphs from the Christopher Formation, Sverdrup Basin, all figures x800 unless otherwise indicated

Figure 27. *Matonisporites phlebopteroides* Couper (GSC 33965) GSC loc. C-26766; x500.

Figure 28. *Laevigatosporites ovatus* Wilson and Webster (GSC 33966) GSC loc. C-26761.

Figure 29. *Appendicisporites tricornatus* Weyland and Greifeld (GSC 33967) GSC loc. C-26760.

Figures 30, 31. *Cicatricosisporites ludbrooki* Dettmann (GSC 33968) GSC loc. C-26765; x500.

Figure 32. *Cicatricosisporites australiensis* (Cookson) Potonié (GSC 33969) GSC loc. C-26760.

Figure 33. *Cicatricosisporites dorogensis* Potonié and Gelletich (GSC 33970) GSC loc. C-26763; x500.

Figure 34. *Cicatricosisporites hallei* Delcourt and Sprumont (GSC 33971) GSC loc. C-26767.

Figures 35, 36. *Cicatricosisporites* cf. *C. pseudotripartitus* (Bolkhovitina) Dettmann (GSC 33972) GSC loc. C-26768; x500.

Figure 37. *Cicatricosisporites* sp. A (GSC 33973) GSC loc. C-26760; x500.

Figure 38. *Lygodiumsporites* sp. (GSC 33974) GSC loc. C-26761.

PLATE 3

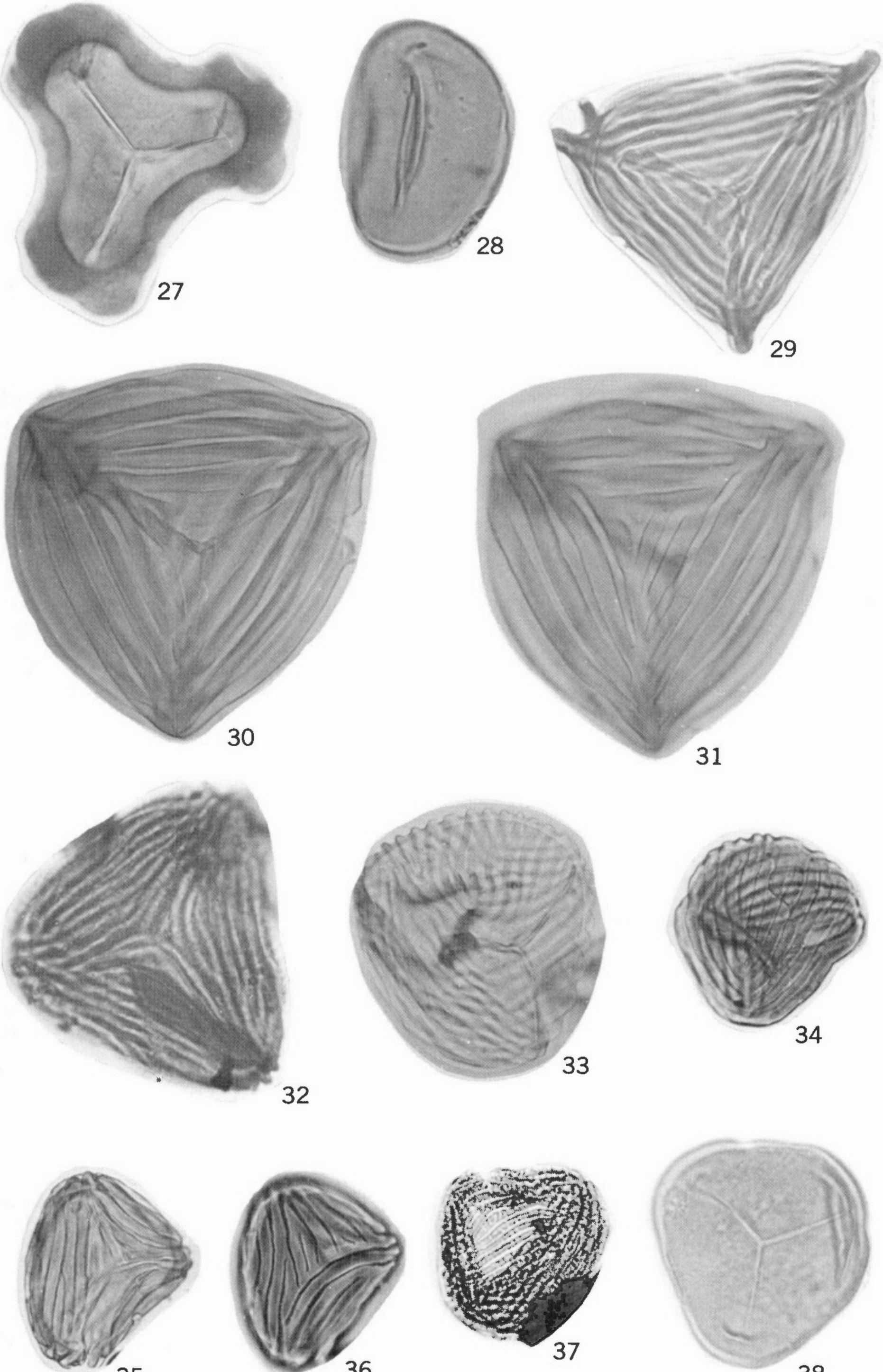


PLATE 4

Palynomorphs from the Christopher Formation, Sverdrup Basin, all figures x800 unless otherwise indicated

Figure 39. *Clavifera triplex* (Bolkhovitina) Bolkhovitina (GSC 33975) GSC loc. C-26759; x500.

Figure 40. *Concavissimisporites parkini* (Pocock) Singh (GSC 33976) GSC loc. C-26757; x500.

Figure 41. *Concavissimisporites variverrucatus* (Couper) Singh (GSC 33977) GSC loc. C-26766; x500.

Figure 42. *Concavissimisporites verrucosus* Delcourt and Sprumont (GSC 33978) GSC loc. C-26757; x500.

Figures 43, 44. *Contignisporites cooksonii* (Balme) Dettmann (GSC 33979) GSC loc. C-26757; x500.

Figures 45, 46. *Contignisporites fornicatus* Dettmann (GSC 33980) GSC loc. C-26766.

Figure 47. *Converrucosisporites* cf. *C. saskatchewanensis* Pocock (GSC 33981) GSC loc. C-26761; x500.

Figure 48. *Deltoidospora psilostoma* Rouse (GSC 33982) GSC loc. C-26760.

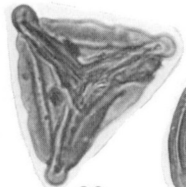
Figure 49. *Deltoidospora juncta* (Kara-Murza) Singh (GSC 33983) GSC loc. C-26759.

Figure 50. *Granulatisporites* cf. *G. dailyi* Cookson and Dettmann (GSC 33984) GSC loc. C-26760; x500.

Figure 51. *Leptolepidites major* Couper (GSC 33985) GSC loc. C-26758; x500.

Figure 52. *Pilosisporites verus* Delcourt and Sprumont (GSC 33986) GSC loc. C-26767.

PLATE 4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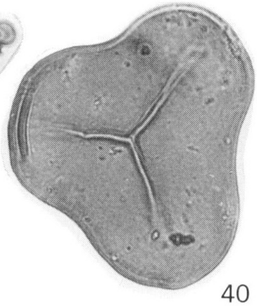
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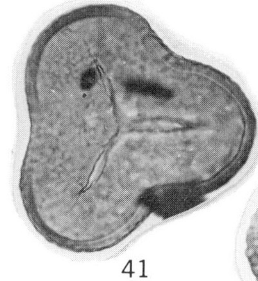
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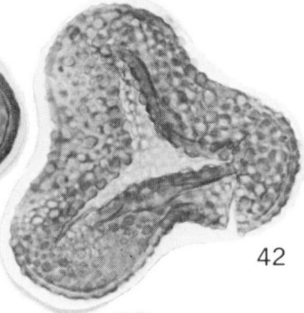
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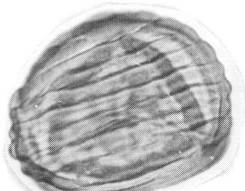
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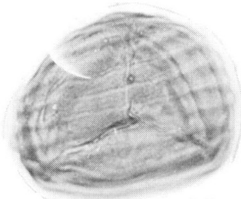
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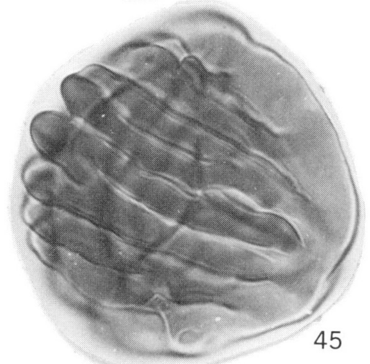
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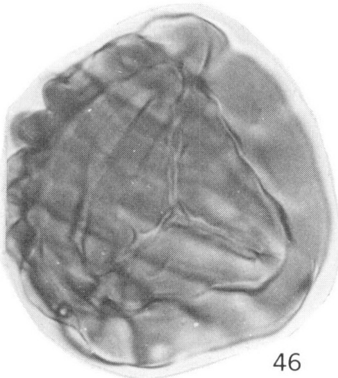
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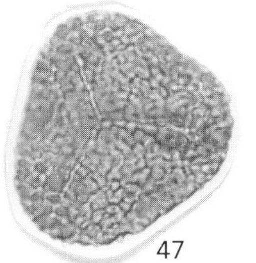
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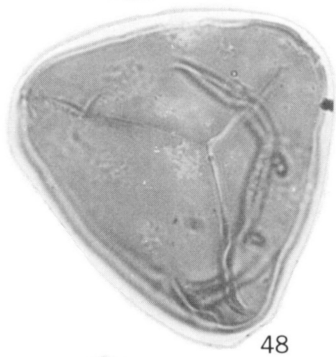
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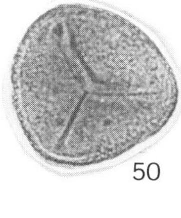
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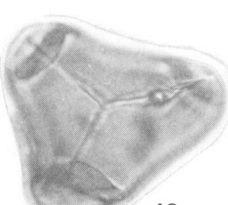
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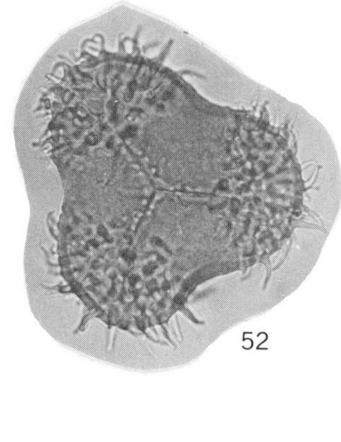
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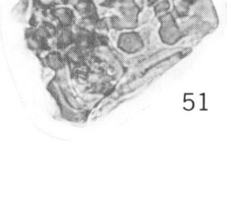
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PLATE 5

Palynomorphs from the Christopher Formation, Sverdrup Basin, all figures x800 unless otherwise indicated

Figure 53.	*Pilosisporites trichopapillosus* (Thiergart) Delcourt and Sprumont (GSC 33987) GSC loc. C-26759; x500.
Figure 54.	*Tigrisporites scurrandus* Norris (GSC 33988) GSC loc. C-26768.
Figure 55.	*Trilobosporites apiverrucatus* Couper (GSC 33989) GSC loc. C-26766.
Figure 56.	*Trilobosporites canadensis* Pocock (GSC 33990) GSC loc. C-26765; x500.
Figure 57.	*Trilobosporites* cf. *T. purverulentus* (Verbitskaya) Dettmann (GSC 33991) GSC loc. C-26757.
Figures 58, 59.	*Trilobosporites* sp. (GSC 33992) GSC loc. C-26766; x500.
Figure 60.	*Verrucosisporites rotundus* Singh (GSC 33993) GSC loc. C-26761; x500.
Figure 61.	*Schizosporis parvus* Cookson and Dettmann (GSC 33994) GSC loc. C-26763.
Figure 62.	*Undulatisporites undulapolus* Brenner (GSC 33995) GSC loc. C-26766.
Figure 63.	*Cycadopitys* sp. A (GSC 33996) GSC loc. C-26763; x500.
Figure 64.	*Cycadopitys* sp. B (GSC 33997) GSC loc. C-26758.
Figure 65.	*Vitreisporites pallidus* (Reissinger) Nilsson (GSC 33998) GSC loc. C-26759.
Figure 66.	*Araucariacites australis* Cookson (GSC 33999) GSC loc. C-26767; x500.

PLATE 5

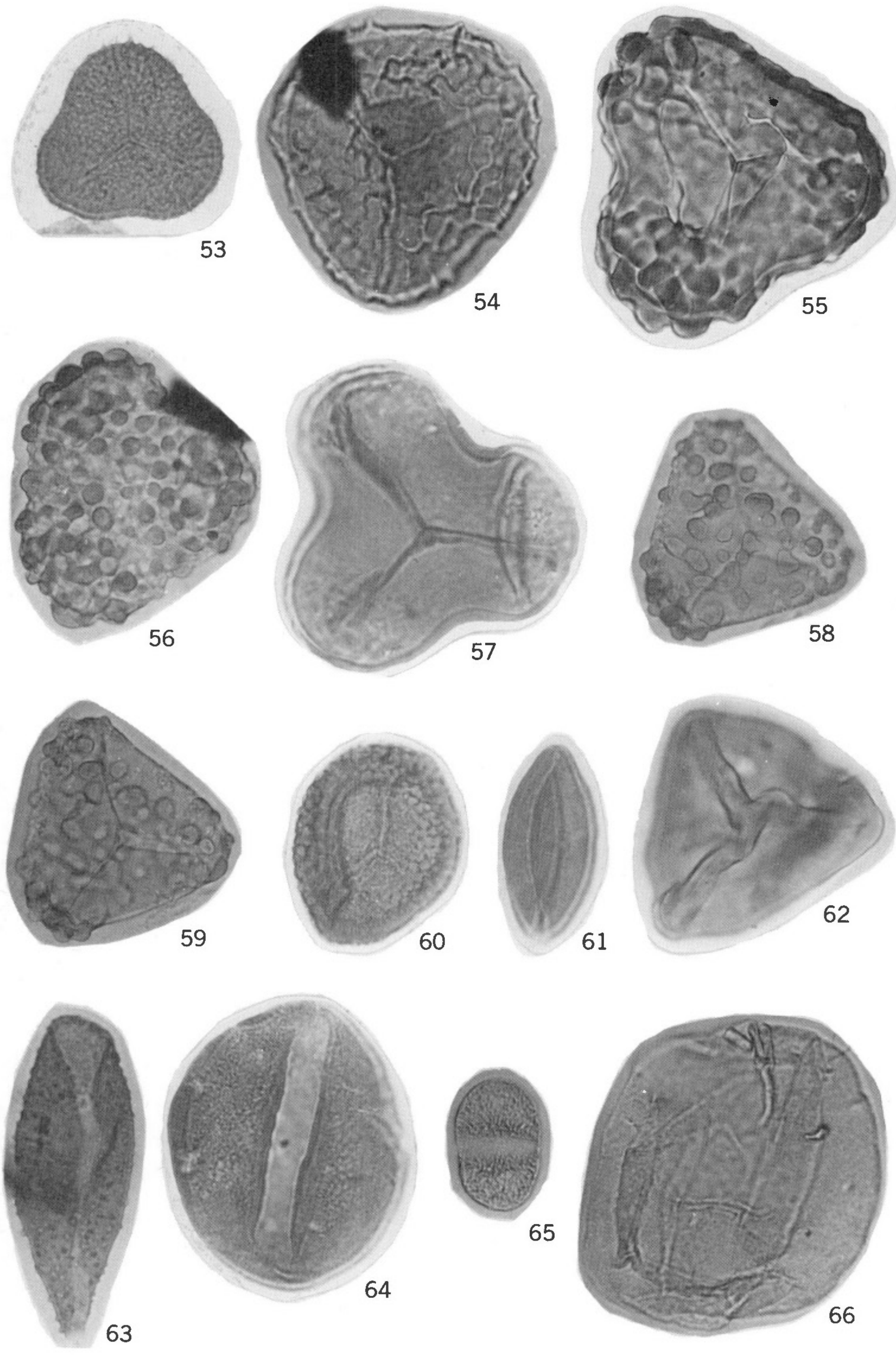


PLATE 6

Palynomorphs from the Christopher Formation, Sverdrup Basin, all figures x800 unless otherwise indicated

Figure 67. *Laricoidites magnus* (Potonié) Potonié, Thomson and Thiergart (GSC 34000) GSC loc. C-26767; x500.

Figure 68. *Tsugaepollenites mesozoicus* Couper (GSC 34001) GSC loc. C-26765.

Figure 69. *Taxodium* cf. *T. hiatipites* Wodehouse (GSC 34002) GSC loc. C-26758.

Figure 70. *Inaperturopollenites* sp. (GSC 34003) GSC loc. C-26759.

Figure 71. cf. *Podocarpidites* sp. (GSC 34004) GSC loc. C-26762; x330.

Figures 72, 73. *Classopollis torosus* (Reissinger) Couper (GSC 34005) GSC loc. C-26768.

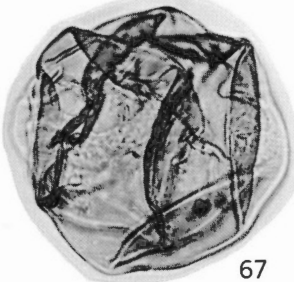
Figure 74. *Eucommiidites minor* Groot and Penny (GSC 34006) GSC loc. C-26765.

Figure 75. *Tricolpites* sp. A (GSC 34007) GSC loc. C-26768; x1000.

Figure 76. *Tricolpites* sp. A (GSC 34008) GSC loc. C-26767; x1000.

Figure 77. *Tricolpites* sp. B (GSC 34009) GSC loc. C-26768; x1000.

PLATE 6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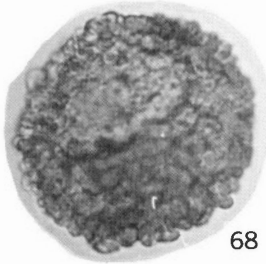
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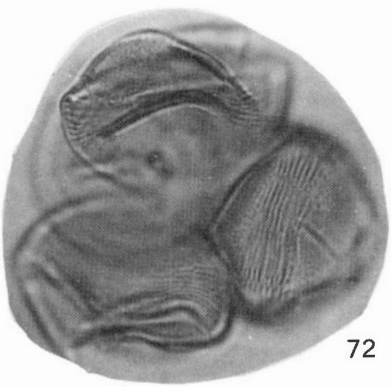
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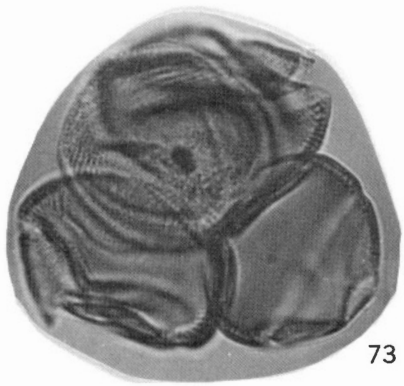
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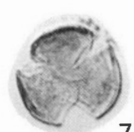
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