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AGE AND CORRELATION OF PALYNOFLORAS FROM THE TYPE CADNA-OWIE FORMATION, SOUTHWESTERN EROMANGA BASIN

GEOLOGICAL SURVEY

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CONTENTS

FIGURES

TABLES

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BIOSTRAT. NO. 5/87
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ABSTRACT

Palynofloral assemblages from the Cadna-owie Formation at the type section and in the adjacent area are correlated with the *Cyclosporites hughesii* Zone of Aptian age. Palynofloras from the type section indicate that this interval of the formation was deposited under freshwater to slightly paralic conditions. The youngest part of the formation encountered in boreholes to the north was deposited under marine transgressive conditions correlative with the first major widespread marine event to affect the Eromanga Basin during the early Aptian. Deposition of the formation in the southwestern Eromanga Basin was contemporaneous with that of the Wyandra Sandstone Member in deeper parts of the basin and the Coffin Hill Member of the Gilbert River Formation in the Carpentaria Basin.

INTRODUCTION

The Cadna-owie Formation was proposed by Wopfner *et al.* (1970), to define the transitional unit between Algebuckina Sandstone and Bulldog Shale in the southwestern portion of the Eromanga Basin (Figs. 1 and 2). The term has been used widely since in the South Australian and Queensland portions of the basin and it has a number of correlatives in other parts of the basin.

The age of the formation at the type section is only poorly known although elsewhere its age range has been defined from a variety of palaeontological evidence. On the basis of a restricted palynoflora recovered from one sample from the type section the formation there was tentatively assigned to the lower part of the *Speciosus* Assemblage of Dettmann (1963), implying an age of Neocomian to early Aptian (Harris, 1965).

During July 1985 an examination was made of the type sections of the Late Jurassic and Early Cretaceous sediments in the southwestern part of the Eromanga Basin. This included detailed study of the type section of the Cadna-owie Formation 5.5km southwest of Mt. Dutton, and of the Mt. Anna reference section. Sediments at the latter site consist of silicified and ferruginized sandstones and are unsuitable for palynological processing. Although the Cadna-owie Formation at the type section is weathered and thus appears to have a low potential for palynology, a series of samples were taken from thin beds of carbonaceous clay from high in unit 8 of Wopfner *et al.*, (1970) from which Harris (1965) obtained his palynoflora. These samples and a re-examination of Harris's sample form the basis of the present study which aims to provide much greater detail on the palynology of the sediments at the type section and thus more accurate information on its age and environment of deposition. To enhance the palynological knowledge of the formation in this area the details of palynofloras from the formation in SADME Toodla 1 well (Fig. 1) are included.

CADNA-OWIE FORMATION

In the southern and western portions of the Eromanga Basin the Cadna-owie Formation is a partly carbonaceous, coarsening-upwards siltstone and fine- to medium-grained sandstone up to 100m thick. Approximately 20m of sediment are exposed at the type section (Fig. 3), although a continuous section is not available at the site. The basal massive sandstone unit containing pebbles and boulders unconformably overlies an undulating surface eroded on the Algebuckina Sandstone. Overlying the basal sandstone is approximately a metre of calcareous sandstone above which are several metres of unexposed section. The organic-rich fine sand to silt unit (unit 8 of Wopfner *et al.*, 1970) contains leaf impressions and oxidized twigs. This organic matter occurs in small channel fills or thin layers along bedding planes and these were sampled for palynological processing. The overlying 10m or so of the formation is comprised largely of laminated to crossbedded fine sandstones containing a few interbeds of ferruginous and crossbedded, calcareous sandstone and minor pebble and grit layers. Although plant matter is present in the central part of this unit the sediments are too weathered to warrant sampling.

The formation has been intersected in a number of boreholes in the general area of the type section. Two such holes to the north of the type section are Santos Oodnadatta-1, which has been studied palynologically by Dettmann (1963), Dettmann and Playford (1969) and Morgan (1980b), and micropalaeontologically by Ludbrook (1966) and Scheibnerova (1980), and South Australia Department of Mines and Energy (SADME) Toodla-1 for which a palynological examination has been made by Alley (1985) (Fig. 1). Palaeontological information from the Cadna-owie Formation in Oodnadatta-1, however, is limited because recovery of sediment was poor and available samples are sludges.

Approximately 20m of Cadna-owie Formation were intersected during the drilling of Toodla-1 well where it is composed mainly of interbedded siltstones, fine-grained sandstones and minor intercalations of claystones (Griffiths, 1980). Only the uppermost 4m of the formation here are believed to have been deposited in a marginal marine environment, the rest being non-marine.

Harris (1965) reported on a restricted palynoflora from the lower plant-bearing beds at the type section and tentatively ascribed the assemblage to the lower part of the *Speciosus* Assemblage (Dettmann, 1963), later referred to as the *Cyclosporites hughesii* Subzone of the *Dictyotosporites speciosus* Zone (Dettmann and Playford, 1969). The above assemblage of Harris, however, contains only three species which have significant bearing on palynological zonation, namely *Cyclosporites hughesii*, *Dictyotosporites speciosus*, and *Foraminisporis wonthaggiensis*. These species occur together throughout the *Foraminisporis wonthaggiensis* to *Cyclosporites hughesii* zones, indicating that the assemblage can only be dated within an interval ranging from Late Neocomian to Aptian (Fig. 4).

The Cadna-owie Formation is regarded as a shallow water, non-marine to marginal marine unit deposited during a marine transgression which commenced possibly as early as the Neocomian (Wopfner *et al.*, 1970), although palaeontological evidence for this is lacking at the type section.

Correlatives of the Cadna-owie Formation elsewhere in the basin are shown in Figure 4. Despite the different names applied to the formation it is remarkably uniform over a large part of the Eromanga Basin. Sandstone members occur in the upper part of the formation in the southwestern portion of the basin (Mount Anna Sandstone Member of Wopfner *et al.*, 1970) and in Queensland (Wyandra Sandstone Member of Senior *et al.*, 1975). Drillhole information indicates that unconformities may occur at the base and top of the formation, or that the contacts with bounding units may be conformable (Wopfner *et al.*, 1970; Senior *et al.*, 1978; Burger and Senior, 1979; Moore and Pitt, 1984, 1985; Dettmann and Williams, 1985; Price *et al.*, 1985; Forbes, 1986). Deposition of the Cadna-owie Formation is believed to have commenced in the Neocomian (Valanginian) and continued until the early Aptian (Morgan, 1980a, 1984; Dettmann and Williams, 1985; Price *et al.*, 1985; Burger, 1986).

METHODS

Ten samples were taken from the only prospective unit at the type section for processing (Fig. 3). Two of the samples were abandoned before processing because they were too weathered. The location of the sample studied by Harris (S 980) in the sequence is unknown other than it came from the same unit sampled in this study. Eight samples were obtained from the Cadna-owie Formation in Toodla-1 and processed in 1979 but the palynofloras were not studied until now. Not all the Cadna-owie Formation in Toodla-1 was available for sampling because of approximately 3m of core loss. Details of all the above samples are shown in Table 1.

TABLE 1: SAMPLE DETAILS

SADME preparation no.	Lithology	Depth (m)
TYPE SECTION (see Fig. 3)		
S 980 (Harris, 1965)	unknown	outcrop
S 6137	organic-rich sandstone	outcrop
S 6138	organic-rich sandstone	outcrop
S 6153	organic-rich sandstone	outcrop
S 6152	organic-rich sandstone	outcrop
S 6151	organic-rich sandstone	outcrop
S 6150	organic-rich sandstone	outcrop
S 6149	organic-rich sandstone	outcrop
S 6148	organic-rich sandstone	outcrop
TOODLA-1		
S 4927	claystone	264.65
S 4928	claystone	265.56
S 4930	carbonaceous shale	265.75
S 4931	shale	266.45
S 4923	carbonaceous siltstone	272.10
S 4916	claystone	277.80
S 4924	siltstone	279.95
S 4925	siltstone	283.80

The samples were processed using different techniques because the work was undertaken over a period of some 20 years. However, they generally followed the standard technique including crushing, then HF and HCl treatment, heavy liquid separation (zinc bromide), Schulze Solution, K_2CO_3 solution and mounting the palynomorphs in glycerine jelly. All but three samples (S 6137, S 6138, S 6153) from the type section proved to be barren of palynomorphs, although they contained abundant vitrinite.

Microscope analyses were undertaken with a Zeiss Photomicroscope III. A count of at least 300 palynomorphs was attempted for each sample to determine the relative frequency between the pollen/spores and microplankton (Appendix 1).

Following the initial count of 300, counting of the pollen/spores and microplankton continued separately until approximately 200 of the latter had been identified. Relative frequencies of pollen/spore species were then calculated as a percentage of the total pollen/spores counted (usually 4-500) and the microplankton species calculated from the total acritarch and dinoflagellate assemblage. Preservation was poor in samples S 4928 and S 4925 from Toodla-1 and thus no counts were undertaken. Extensive scanning of all microscope slides followed the counting to record the less common to rare palynomorphs. A full list of taxonomic references for palynomorphs encountered is given in Appendix 2. All unprocessed sample material, palynomorph residues and microscope slides are held at the Department of Mines and Energy, South Australia. In view of the excellent preservation of the palynomorphs from some samples in both the type section and Toodla-1 an extensive photographic catalogue has been constructed (Figures 5 to 121).

COMPOSITION OF THE PALYNOFLORAS

Type section:

The occurrence and frequency of palynomorphs are listed in Appendix 1. Pollen are dominated by coniferous taxa including *Microcachryidites antarcticus* (14-32%), *Podocarpidites ellipticus* (16-27%), *Alisporites grandis* (1-11%), *A. similis* (3-7%) and four other species *Araucariacites australis*, *Classopollis chateaunovii*, *Cycadopites nitidus* and *Trisaccites microsaccatus* which vary in frequency up to 4%. Spores of the cryptogams are well represented, particularly *Cyathidites minor/australis* (12-18%), *Osmundacidites wellmanii* (2-7%) and *Baculatisporites comaumensis* (3-5%) along with lesser amounts of *Stereisporites antiquasporites* and the lycophytic spore *Retitriletes austroclavatidites* both of which compose up to 5% of the assemblage.

After extensive scanning of all microscope slides only two species of microplankton, *Canningia* sp.A and *Cribroperidinium muderongense* were observed (Appendix 1). No microplankton were recorded in two of the samples indicating that they are extremely rare in the unit that was sampled. Two species of algae, *Schizosporis reticulatus* and *S. spriggii* are present in three of the samples.

Four species of pollen and spores that have been recycled from Permian sediments occur sporadically in two samples. These species include *Dulhuntispora parvithola, Pseudoreticulatus pseudoreticulatus, Striatoabieites multistriatus* and *Weylandites lucifer* (see Remaniė, Appendix 1).

Toodla-1:

Pollen of coniferous taxa are again important elements of the spore/pollen assemblage: *Microcachryidites antarcticus* (14-24%), *Podocarpidites ellipticus* (2-18%), *Classopollis chateaunovii* (up to 14%), *Trisaccites microsaccatus* (to 7%), *Alisporites grandis/similis* (to 9%) and *Araucariacites australis* (to 2%). Some samples show higher frequencies of the cryptogams than at the type section: *Cyathidites minor/australis* (13-14%), *Baculatisporites comaumensis* (2-19%), *Osmundacidites wellmanii* (1-6%), *Gleicheniidites circinidites* (a few samples contain 5-7%), *Stereisporites antiquasporites* (to 6%) and *Retitriletes austroclavatidites* (1-5%).

Unlike the type section a significant marine influence is recognized in the upper few metres of Toodla-1 (264.65m to 266.45m or samples S 4927, 4928, 4930 and 4931). Although one of the samples (S 4928) was not counted because of poor preservation, the other samples showed that the microplankton formed between 5 and 20% of the palynomorph assemblages. The dominant components of the microplankton assemblages are the dinoflagellates *Aptea attadalica* (3-27%), *Oligosphaeridium pulcherrimum* (5-9%), *Chlamydophorella nyei* (2-5%), *Cleistosphaeridium* spp., comprising four species, *C. aciculare* (4-8%), *C. ancoriferum* (2%), *C. polypes* (1-5%), *C. polytrichum* (2-7%), and one unknown species (2%), *Muderongia mcwhaei* (4%), *Cyclonephelium distinctum* (1-5%), *Cyclonephelium (Tenua) pilosa* (10-15%), *Palaeoperidinium cretaceum*, and abundant acritarchs of the genus *Micrhystridium* (11-33%).

A few recycled Permian pollen were recorded including *Alisporites* cf. *A. nuthallensis* and *Potoniéisporites balmei.*

CORRELATION AND AGE

A number of palynostratigraphic zonations have been constructed for Jurassic and Cretaceous sedimentary sequences in Australia. The correlations made in this study are with those established for the Eromanga Basin and adjacent basins, in particular the zonation of Helby *et al.* (1987) (Fig. 4).

Spore/pollen assemblages from the type section and Toodla-1 are correlated with the *Cyclosporites hughesii* Zone (Fig. 4). This correlation is supported by the association of *Dictyotosporites speciosus* with *C. hughesii, Cooksonites variabilis, Murospora florida, Biretisporites spectabilis, Kraeuselisporites linearis, Contignisporites cooksoniae, Foraminisporis asymmetricus,* and *Pilosisporites notensis* in the absence of *Crybelosporites striatus.* The base of the *C. hughesii* Zone is generally regarded as being marked by the first appearance of *Foraminisporis asymmetricus* (Burger, 1973a, 1973b, 1974; Morgan, 1984; Price *et al.*, 1985; Helby *et al.*, 1987). The first occurrence of *F. asymmetricus* also defines the base of palynostratigraphic unit PK3 of Price *et al.* (1985), and the base of palynostratigraphic subzone PK3.2 by the incoming of *Pilosisporites parvispinosus* Dettmann 1963. The lack of *P. parvispinosus* in all of the samples indicates that the spore/pollen assemblages are correlative with PK3.1 and the early part of the *C. hughesii* Zone.

The abundance of microplankton in the upper assemblages in Toodla-1, offers a further means of dating. Dinoflagellates first occur in significant numbers at 266m; below this level they are extremely rare. On specimen of the acritarch *Micrhystridium* sp. was recovered at 277.8m and a broken, poorly preserved specimen of *Odontochitina operculata* was found at 279.95m. The significance of these two specimens is difficult to assess, particularly in the light of the large volume of pollen and spores (many thousands) that were observed before the microplankton were found. In this paper, however, significant marine influence is regarded as occurring first at approximately 266m.

The microplankton assemblages are correlated with the *Odontochitina operculata* dinoflagellate Subzone a (Fig. 4), on the basis of the following evidence. The assemblages are marked by the presence of *Odontochitina operculata* (occurring first at 279.95m depth) and the common occurrence of *Aptea attadalica*, the youngest occurrence of which is used to define the base of the succeeding Subzone b (Morgan, 1980b). *Muderongia mcwhaei* is also common in the assemblages, thus supporting the above conclusion. The presence of *Canningia* sp. A, *Chlamydophorella solida*, *Cleistosphaeridium ancoriferum*, *Lithodinia helbyi* and *Protoellispsodinium denispinum* which normally occur near the boundary between subzones a and b, indicates that the assemblages belong near the upper part of Subzone a.

As shown above, the four samples from the type section produced only two specimens of dinoflagellates. The first occurrence of *Cribroperidinium muderongense* predates the base of the *O. operculata* Zone (Morgan, 1980b), thus this dinoflagellate is of no value in correlating with Toodla-1. On the other hand the specimen of *Canningia* sp. A in the assemblages from the type section suggests they may be tentatively correlated with those in Toodla-1.

Although the ages of palynological zonal boundaries are slightly revised from time to time, current information places the *Cyclosporites hughesii* Zone, palynostratigraphic unit PK3.1 and *Odontochitina operculata* Subzone a in the early Aptian (Fig. 4). Thus the larger part of the Cadna-owie Formation at the type section and in Toodla-1 are of early Aptian age. Whether the older unsampled sediments at the type section (units 1-7 of Wopfner *et al.*, 1970) are also early Aptian or extend back in age to the Neocomian can not be demonstrated by the above palynological evidence. The Cadna-owie Formation in Toodla-1, however, can be no older than the *Cyclosporites hughesii* Zone, implying that all of the unit there is Aptian. It is probable that all of the formation at the type section is also of Aptian age.

An understanding of the palaeontology and age of the Cadna-owie Formation in Santos Oodnadatta No. 1 Well is hampered by the fact that only meagre sludge samples were recovered from the unit. After a review of available published and unpublished information and the sludge samples, I regard the formation depths as given by Freytag (1966) and Wopfner *et al.* (1970) as correct: the upper boundary as 307m (1007 feet) and the lower limits as 337m (1107 feet) (Fig. 3).

The interval in Oodnadatta-1 outlined above has been studied by a number of workers. Ludbrook (1959, 1966) and Scheibnerova (1980, 1986) examined the foraminiferal biostratigraphy of part of the unit in the well and ascribed an Aptian age to the faunas. Two samples of sludge from 320-323m (1052-1061 feet) and 331-333m (1087-1092 feet) produced palynofloras correlative with the *Cyclosporites hughesii* Zone (Dettmann, 1963; Dettmann and Playford, 1969). However, these designations should be regarded with some caution since the samples have been affected by downhole contamination from the overlying fossiliferous horizons. Palynological examination was made of a sample of sludge from 323-325m (1051-1066 feet) by Morgan (1980b) but he was unable to assign a zonation because of significant downhole contamination. This sample and another from the underlying Algebuckina Sandstone contained a number of younger zonal and associate palynomorph species and as much as 8% microplankton derived from overlying strata. Thus there is uncertainty about the age of the Cadna-owie Formation in Oodnadatta-1 although in general the assemblages recovered by Dettmann (1963) and Morgan (1980b) are similar to those from the type section and Toodla-1. In view of the problems outlined above no reliable correlation can be made on palynological grounds between the two southern sites and Oodnadatta-1. However, if the Aptian age determined by the foraminiferal studies (Ludbrook, 1959, 1966; Schreibnerova, 1980, 1986) is correct then the age of the Cadna-owie Formation at all three localities is the same. The palynological zonation (*Cyclosporites hughesii*) ascribed by Dettmann (1963) is consistent with the Aptian age.

DISCUSSION

Palynological dating of the Cadna-owie Formation from deeper parts of the Eromanga Basin in northeastern South Australia shows that the major portion of the unit is within the *Foraminisporis wonthaggiensis* Zone (Fig. 4; Dettmann & Williams, 1985). The base of the Zone in this area may approximate the base of the formation or may be within the Murta Member of the underlying Mooga Sandstone, whereas the top of the Zone is below the Wyandra Sandstone. The palynological information suggests that a local hiatus may occur just below the Wyandra Sandstone (Dettmann & Williams, 1985). The remainder of the Cadna-owie Formation (Wyandra Sandstone) here appears to be in the *Cyclosporites hughesii* Zone; little or no marine influence can be detected until the passage into the Bulldog Shale (Wallumbilla Formation) when microplankton of the *Odontochitina operculata* Zone become frequent.

Work in the same area and adjacent Queensland indicates that the top of the formation may be early Aptian in age, and also that marine influence occurs in the middle *F. wonthaggiensis* Zone and again in the upper part of the formation (Senior *et al.*, 1975; Senior *et al.*, 1978; Moore & Pitt, 1985; Ambrose *et al.*, 1986; Moore *et al.*, 1986). In New South Wales the upper Cadna-owie Formation is included in the marine microplankton unit *O. operculata* Subzone a and is early Aptian in age, although the greater part of the formation is assigned to the *F. wonthaggiensis* Zone during which paralic to nonmarine conditions prevailed (Morgan, 1980a, 1984).

Further north in the Eromanga Basin and in the Carpentaria Basin the upper part of the Gilbert River Formation is the time equivalent of the Cadna-owie Formation (Exon & Senior, 1976). Here, however, marine conditions commence at least in the early part of the *Cicatricosisporites australiensis* Zone and continue through the *F. wonthaggiensis* and early *Cyclosporites hughesii* zones (Burger, 1973, 1980, 1982, 1986).

The above correlations indicate that deposition of the Cadna-owie Formation at the type section and in the adjacent area was contemporaneous with that of the Wyandra Sandstone Member and Coffin Hill Member, which were deposited under marine transgressive conditions in the Barremian and early Aptian. The Aptian age determined from the Cadna-owie Formation in the study area, however, implies that only the youngest part of the unit is present and was deposited just prior to and during the major marine transgression in the Barremian and earliest Aptian (Frakes *et al.*, 1987). The Aptian age also implies that only the youngest part of the transgression is recorded in the southwestern part of the Eromanga Basin and that here the Cadna-owie Formation is in part the time equivalent of the basal Bulldog Shale found in deeper parts of the Basin to the northeast (Dettmann & Williams, 1985).

Wopfner *et al.* (1970) regarded the Cadna-owie Formation generally as a shallow-water, marginal-marine deposit, and the carbonaceous shales and siltstones from which the palynofloras were recovered at the type section as marginal swamp deposits formed in estuaries or barred lagoons. The very rare occurrence of dinoflagellates supports the latter conclusion and indicates freshwater to very slightly paralic conditions. A similar interpretation applies to the lower part of the formation in Toodla-1 and it is probable that deposition of this part of the unit was contemporaneous with the sediments investigated at the type section. Above 266m in Toodla-1 microplankton diversity is moderate to high (22 to 30 species). Parallel similar diversities were recognised by Morgan (1980a, 1984) in the early Aptian and regarded as evidence of marine transgressive conditions. This transgression is correlative with the first major widespread marine event in the Eromanga Basin during which the uppermost Cadna-owie Formation and lower Bulldog Shale were deposited.

TAXONOMIC NOTES

Descriptive notes are given here of a few poorly known spores in Australia, one unknown spore, an unknown megaspore and a taxon of unknown affinity.

Densoisporites perinatus Couper 1958
(Figures 68,69)

Couper (1958) first described this species from the Middle Jurassic of Yorkshire and it occurs vary rarely in the Cadna-owie Formation from both the type section and Toodla-1. The inner spore body is rounded to subtriangular in shape with an exine 1-2 microns thick and psilate on its outer surface. Overall diameter of the central body is 45-54 microns and the perisporium may extend up to 6 microns further from the body. The perisporium is characteristically very thin, psilate to slightly scabrate and arranged in an irregularly folded pattern around the central spore; the perisporium is attached at the proximal surface; the raised lips of the trilete mark often extend onto the perisporium surface.

In discussing the genus *Densoisporites*, Dettmann (1963) referred *D. perinatus* to *D. velatus* Weyland & Kreiger emend. Krasnova 1961. However, the specimens regarded as *D. perinatus* in this study are significantly different both in the spore body and in the structure of the perisporium and are thus maintained as a separate species.

Dictyotosporites complex Cookson & Dettmann 1958
(Figures 33, 34, 35)

A variety of this species exhibiting much finer ornamentation than usual and first recorded by Filatoff (1975) occurs in very low frequencies in the Cadna-owie Formation, although my investigations around the southern margins of the Eromanga Basin show that it is more common in Late Jurassic sediments. The muri are up to 15 microns high and often lower in height on one side of the spore than the other, giving an asymmetrical appearance to its overall shape. The muri form thin branches near their terminii, enclosing irregular, polygonal and rounded lumina up to 2 microns in diameter although most commonly less than 1 micron in diameter. The ornamentation is fragile and easily broken and is partly absent on some specimens.

Spore *gen. et sp.* indet.
(Figures 76, 77, 78)

Subsphaerical trilete spore with convexly pointed to pyramidal proximal surface. Trilete mark gaping and extending almost to amb. Gula approximately 10 microns high extending from dehiscence mark; thin and easily folded. Sporoderm stratified; nexine 2 microns thick and smooth; sexine 3-4 microns thick. Sexine covered with numerous bacula, 5 microns high and 2 microns thick with blunt to rounded apices. Ornament reduced near proximal pole; greatest development at equator and on distal surface. Remainder of sexine largely scabrate. Overall spore diameter 70 microns, including ornament and gula. Only one specimen observed and affinity unknown.

Megaspore *gen. et spec.* indet.
(Figure 79)

Subtriangular megaspore with short open trilete mark extending half way to amb. Sporoderm stratified; nexine 5 microns thick; sexine 50 microns thick, forming an irregular flange or cingulum. Sexine arranged largely into radially oriented ridges 20 microns wide and 5-8 microns high and occasionally connected or anastomosing to form large irregular reticulate ornamentation on distal surface. Where ridges extend onto the cingulum they form prominent projections 35 microns high and 30-35 microns wide at the base. Remainder of the distal surface is finely pitted, although this may be a preservational feature. Proximal surface irregular and radial ridges not as well developed with largely radial orientation. Towards the proximal pole the exine becomes rugulate to corrugate; remainder of the sporoderm on the proximal surface is psilate. Overall diameter of the megaspore is 680 microns.

Incertae sedis.
(Figure 80)

Subsphaerical to subtriangular form with stratified exine; nexine 1-1.5 microns thick; sexine developed into cingulum up to 4 microns wide, which, on some specimens, appears tricrassate although no trilete or any dehiscence mark is observed on any of the specimens. Outer surface of the form is covered with small gemmae (occasionally echinae) 1 micron high and wide. Overall diameter 40-56 microns. This distinctive palynomorph occurs throughout the Cadna-owie Formation in Toodla-1, increasing in frequency with depth and achieving its greatest frequency in the Algebuckina Sandstone, although usually comprising less than 1% of the total assemblage.

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PHOTOGRAPHIC CATALOGUE OF POLLEN, SPORES AND MICROPLANKTON

The reference details for each figure are given in the final sentence of each caption and include in order: SADME palynological catalogue number, stage coordinates for a Zeiss Photomicroscope 3, original microscope magnification (N = Nomarski interference contrast), palynological negative and photograph number.

5. *Cyathidites australis*; optical section showing simple exine and rupture along trilete scar. S 4924/4, 19.0/97.9, x 500, 277/25.

6. *Cyathidites minor*; simple psilate, trilete spore. S 6138/2, 2.3/94.6, x 500, 304/33.

7. *Dictyophyllidites crenatus*; relatively thick exine and sinuous laesurae with irregular thickened lips. S 6138/2, 21.0/94.9, x 500, 304/26.

8. *Biretisporites spectabilis*; thick exine displaying very faint surface ornamentation. S 4924/4, 19.0/97.9, x 500, 277/10.

9. *Baculatisporites comaumensis*; equatorial view, showing well developed baculate ornamentation. These appear to be a continuous gradation in form between this species and the more granulate *Osmundacidites wellmanii*. S 6153/1, 16.1/93.3, x 500, 302/33.

10. *Leptolepidites major*; equatorial view of dome-shaped verrucae. S 6153/1, 8.0/102.8, x 500, 300/9.

11. *Leptolepidites verrucatus*; equatorial and proximal view of large verrucae. S 6153/1, 18.0/94.5, x 500, 300/13.

12. *Neoraistrickia truncatus*; equatorial view of distinctive bacula with flattened and slightly flared terminii. S 6153/1, 8.2/104.0, x 790, 298/12.

13 and 14. *Neoraistrickia densata*; Fig. 13 showing flattened bacula more densely spaced than on *N. truncatus*, Fig. 14 showing reduced sculpture on proximal surface coalescing to form irregular rugulae. S 980/1, 22.2/89.0, x 790N, 305/13,14.

15. *Pilosisporites notensis*; proximal and equatorial view showing conate ornamentation on the radial regions with sparser development over the poles. S 4927/4, 18.4/109.6, x 200, 308/6.

16. and 17. *Kuylisporites lunaris*; distal surface with granulate ornamentation and semicircular shallow depressions facing outwards towards amb; proximal surface with granulate surface and thickened laesurae margins. Fig. 16., S 6153/1, 4.7/96.2, x N790, 300/5; Fig. 17, S 6153/4, 19.2/89.9, X N790, 302/5.

18. *Lycopodiacidites asperatus*; composite photograph of equatorial and distal surfaces showing thick, sinuous rugulae, occasionally coalescing to form an imperfect reticulum. S 6153/1, 8.8/97.4, x N790, 299/35,36.

19. *Lycopodiacidites dettmannae*; equatorial and part proximal surface showing rugulae and short bacula (some with expanded tops). S 6153/3, 2.1/108.5, x N1000, 306/35.

20. and 21. *Retitriletes austroclavatidites*; distal and proximal views showing well developed reticulum and high, thin muri. S 6153/1, 16.6/101.3, x 790, 299/15,16.

22. and 23. *Retitriletes circolumenus*; proximal view with smooth surface and rugulae at the contact faces, distal view with almost perfect reticulum of rounded to polygonal lumina. S 6153/3, 13.8/102.7, x N790, 297/1,2.

24. and 25. *Retitriletes facetus*; proximal view of radially arranged, elongate, rectangular lumina and overall granulate outer surface; equatorial view of high membraneous muri and stratified exine. S 6153/1, 5.7/100.6, x N500, x 500, 300/19,21.

26., 27. and 28. *Retitriletes watherooensis*; distal view of almost perfect reticulum of rounded lumina; proximal view of trilete scar; equatorial view showing muri of short, flat-topped clavae. S 980/1, 15.7/100.4, x N500, 305/18,19,20.

29. *Reticulatisporites pudens*; distal surface with low, rounded muri enclosing irregular lumina. S 6153/1 13.3/91.2, x N790, 300/32.

30. *Cyclosporites hughesii*; proximal surface of radially arranged muri, bifurcating towards spore amb. S 4916/4, 9.8/78.6, x N790, 284/28.

31. and 32. *Foveosporites canalis*; proximal surface with coalescing foveolae and long laesurae extending to amb; equatorial view of unstratified exine penetrated by circular foveolae. S 6153/3, 5.2/117.3, x N790, X 790, 306/30,31.

33., 34., and 35. *Dictyotosporites complex*; view of specimen with fine-meshed reticulate sculpture; proximal view showing trilete scar on subcircular spore body, and asymmetrical fine-meshed reticulate sculpture; proximal view of specimen with reduced surface reticulum more characteristic of the species. Fig. 33, S 6153/1, 7.0/118.7, x N500, 301/31; Fig. 34, S 6153/3, 7.0/108.1, x N500, 307/8; Fig. 35, S 6153/4, 12.0/105.9, x 790, 302/19.

36. *Dictyotosporites filosus*; proximal view showing laesurae and short muri enclosing small polygonal lumina. S 6153/1, 18.4/114.0, x N790, 301/33.

37. and 38. *Dictyotosporites speciosus*; proximal view of circular spore body and tall, thick muri with bifurcating terminii; view of reticulum showing larger, thicker lumina, enclosing circular to polygonal lumina. S 6153/4, 14.0/106.1, x N790, 302/13,15.

39. and 40. *Januasporites* cf. *J. spiniferus*; distal surface with sclerinous reticulate ornamentation, muri with serrated crests; proximal and equatorial surfaces with high irregular spinules and echinae. Fig. 39., S 6153/3, 7.0/96.2, x N790, 297/36; Fig. 40, S 6153/1, 22.3/111.7, x N790, 299/8.

41. *Klukisporites scaberis*; distal surface showing large, subcircular to polygonal lumina; granules enclosed in lumina not visible on photograph. S 6138/1, 10.8/90.6, x N500, 304/35.

42. *Cicatricosspisporites australiensis*; oblique view showing partly smooth proximal face and well developed distal ornamentation. S 4924/4, 3.1/81.4, x 500, 277/21.

43. and 44. *Cicatricosisporites ludbrookii*; proximal surface with reduced sculpture; distal surface with sets of parallel muri terminating at the radials. Fig. 43., S 6153/1, 14.8/108.2, x N500, 301/1; Fig. 44., S 6153/4, x N500, 302/16.

45. and 46. *Trilobosporites antiquus*; specimen showing barely visible apical, foveo-reticulate sculpture but well developed thickened lips adjacent to the laesurae. S 6143/3, 8.0/107.4, x 400, x N500, 297/17,18.

47. *Trilobosporites perverulentus*; distal view with strongly developed circular lumina in the radial regions and granulate surface elsewhere. S 4927/4, 17.0/92.5, x 790, 308/16.

48. and 49. *Ischyosporites crateris*; psilate proximal surface with thickened, pitted laesurae margins; equatorial surface with thick muri enclosing rounded lumina. S 6153/1, 16.9/103.0, x N500, x 500, 300/3,4.

50. *Stereisporites antiquasporites*; psilate proximal surface with short simple trilete mark and cingulum; many specimens show thickenings in the radial area. S 6153/1, 15.2/98.6, x N790, 300/33.

51. *Gleicheniidites senonicus*; proximal surface showing thick inter-radial crassitudes extending around radials, with narrow, but elevated laesurae lips. S 6153/3, 7.9/118.5, x N790, 306/34.

52. and 53. *Annulispora folliculosa*; proximal surface showing slight radial thickenings; distal surface with well developed circular, polar crassitude formed of irregular verrucae. S 980/1, 6.2/109.6, x N790, 305/24,25.

54. *Nevesisporites vallatus*; proximal surface with scattered grana and gemmae but concentrated along the contact faces. S 6153/4, 19.1/100.1, x N790, 302/4.

55. *Rogalskaisporites canaliculus*; proximal view, but distal circular, polar crassitude and circumpolar ridge are visible; radially directed striae between the latter and the cingulum are also visible. S 4924/4, 21.0/87.6, x 790, 277/4.

56. *Foraminisporis asymmetricus*; oblique distal view of distinctive verrucate ornamentation. S 6153/1, 15.3/100.0, x N500, 301/35.

57. *Foraminisporis wonthaggiensis*; reduced granulate ornamentation on the proximal surface, but spinulose, baculate and echinate ornamentation visible along the equator. S 6137/1, 9.8/92.4, x N790, 305/6.

58. *Foraminisporis dailyi*; proximal surface showing clusters of verrucae in central areas of each contact face. S 6138/1, 3.7/96.6, x N790, 303/28.

59. *Antulsporites saevus*; distal surface with spinae, bacula and verrucae; striate cingulum also visible. S 6153/4, 3.0/125.2, x N790, 302/29.

60. *Sestrosporites pseudoalveolatus*; proximal view of distinctive foveolate ornamentation. S 6153/3, 2.6/98.2, x N790, 297/20.

61. and 62. *Camarozonosporites clivosus*; distal view of widely spaced verrucae; equatorial and proximal view of thin, sinuous laesurae and weakly developed inter-radial thickenings. S 6138/2, 17.8/103.7, x N790, 304/12,13.

63. and 64. *Contignisporites cooksonae*; distal cicatricose ornamentation with muri coalescing towards equator; proximal view of single muri adjacent and parallel to cingulum. S 6153/4, 10.9/124.5, x N500, x 500, 302/24,25.

65. *Murospora florida*; proximal surface with strongly developed cingulum. S 6153/1, 14.2/122.2, x 500, 300/27.

66. *Crybelosporites berberioides*; composite photograph of part of tetrad showing irregularly folded perisporium. S 6153/3, 10.9/90.7, x N500, 306/20,22.

67. *Crybelosporites stylosus*; proximal surface showing rounded spore body and faint trilete mark, and extensively pitted perisporium. S 6153/1, 15.9/89.5, x 500, 301/22.

68. and 69. *Densoisporites perinatus*; proximal view of subtriangular spore body, long trilete mark and simple thick exine; distal surface showing thin minutely folded perisporium. S 4916/4, 8.8/79.0, x N790, 284/31,32.

70. *Densoisporites velatus*; equatorial and proximal view showing two-layered perisporium with radial thickenings, the outer surface being largely scabrate. S 6153/1, 16.2/91.9, x 500, 301/29.

71. and 72. *Velosporites triquetrus*; equatorial view of minutely pitted to punctate perisporium; proximal view showing main spore body with weakly developed trilete mark, and pitted perisporium. Fig. 71., S 6153/1, 9.3/112.1, x N790, 299/3; Fig. 72., S 4916/4, 14.5/105.0, x N790, 284/7.

73. and 74. *Aequitriradites verrucosus*; proximal view of cingulum and trilete mark; distal pole showing low verrucae clustered around the polar opening. Fig. 73, S 6153/1, 15.4/113.3, x 500, 301/8; Fig. 74, 6153/1, 9.5/111.9, x N500, 301/9.

75. *Triporoletes reticulatus*; distal view of large reticulate ornamentation and cingulum. S 6153/3, 3.3./98.2, x 500, 307/12.

76., 77. and 78. Spore *gen. et sp.* indet., azonate, apiculate trilete spore; oblique distal view of baculate and granulate ornamentation; equatorial view showing overall spore shape and proximal gula; equatorial view of gula and trilete mark. S 6153/3, 6.2/106.9, 2 x N500, 1 x N790, 303/11,12,13.

79. Megaspore *gen. et sp.* indet., zonate, murornate, trilete spore; composite photograph showing reticulate ornamentation becoming ridged and rugulate near the proximal pole. S 6153/4, 20.3/87.3, x 200, 303/16-21.

80. ?Spore *gen. et sp.* indet., view showing ?tricrassate cingulum and overall gemmate ornamentation extending onto cingulum. S 4916/3, 16.6/88.2, x 500, 233/3.

81. *Laevigatosporites belfordii*; equatorial view of large, kidney-shaped, psilate spore. S 4925/3, 18.4/83.3, x 500, 277/22.

82. *Punctatosporites scabratus*; oblique proximal view showing monolete scar and overall scabrate to minutely gemmate ornamentation. S 6153/3, 12.9/108.1, x N790, 297/14.

83. *Cycadopites nitidus*; view of sulcus and smooth exine. S 6153/1, 17.0/126.6, x N790, 299/27.

84. *Alisporites grandis*; distal view of sulcus and large laterally pendant sacci. S 6153/1, 20.0/121.4, x N500, 299/12.

85. *Alisporites lowoodensis*; distal view showing narrow sulcus and sacci that almost fuse to cover the distal surface. S 6153/1, 20.0/97.4, x 790, 299/19.

86. *Alisporites similis*; distal view of sulcus with widely spread sacci that approximate the length of the corpus. S 6153/1, 4.3/104.5, x 500, 299/20.

87. and 88. *Phrixipollenites infrulus*; view of corpus showing granulate cappa; distal view of thickening adjacent to the distal roots, sacci distally pendant and approximately same length as corpus. S 6153, 9.7/119.6, x N500, 303/4,5.

89. and 90. *Phrixipollenites otagoensis*; distal view showing sulcal area and small, finely reticulate sacci; oblique view of small sacci and the thin granulate cappa. Fig. 89, S 6153/3, 18.8/91.4, x N500, 303/1; Fig. 90., 6153/3, 19.0/92.0, x 500, 303/2.

91. and 92. *Podocarpidites ellipticus*; distal surface with wide sulcus and well developed reticulate ornamentation on the sacci. S 6153/2, 11.1/92.7, x N500, x 500, 298/19,21.

93. *Podocarpidites multesimus*; distal view showing strongly reticulate sacci that are much larger than the corpus. S 6153/2, 21.9/97.8, x 500, 298/26.

94. *Vitreisporites pallidus*; distal view of sulcus and elliptical shape of pollen; granulate ornament on sacci. S 6153/2 3.2/118.7, x N790, 298/31.

95. *Microcachryidites antarcticus*; distal view showing distally pendant sacci and rounded corpus. S 6138/2, 18.2/121.6, x 500, 304/36.

96. *Trisaccites microsaccatus*; distal view of rounded subtriangular corpus and strongly distally pendant sacci. S 6153/1, 8.0/113.8, x N790, 300/36.

97. *Trisaccites variabilis*; distal view of the rounded corpus and coarsely sculptured sacci. S 6153/1, 16.0/120.8, x N790, 300/35.

98. *Callialasporites dampierii*; granulate, radially folded saccus. S 6153/3, 11.4/118.4, x N500, 297/26.

99. *Callialasporites microvelatus*; simple, thin scabrate surface and rounded amb with unfolded sacci. S 4925/3, 7.9/116.4, x N790, 277/29.

100. *Callialasporites segmentatus*; strongly convoluted folding of the saccus. S 6153/3, 15.6/90.0, x N500, 297/28.

101. *Callialasporites trilobatus*; trilobate saccus and dark, rounded, subtriangular corpus. S 4925/4, 20.0/83.5, x 500, 231/18.

102. *Callialasporites turbatus*; unfolded sacci but corpus folded into triangular outline. S 6153/3, 17.2/106.2, x N500, 297/29.

103. *Classopollis chateaunovii*; view of pore and strongly ornamented rim. S 6153/1, 21.0/97.6, x N790, 301/14.

104. *Classopollis simplex*; slight ornamentation on the rim, but overall the pollen is smooth to scabrate. S 6138/2, 12.6/105.8, N790, 304/20.

105. *Schizosporis reticulatus*; algae with strongly reticulate structure characteristic of the species. S 6153/1, 10.4/103.7, x N200, 299/5.

106. *Aptea attadalica*; ceratoid dinoflagellate with apical archeopyle and spines concentrated on the horns. S 4931/3, 15.7/92.2, x 500, 308/20.

107. *Batioladinium micropoda*; dinoflagellate with apical archeopyle, operculum still attached and granulate ornamentation. S 4930/4, 8.2/107.2, x 500, 273/6.

108. *Canningia* sp. A; dinoflagellate with apical archeopyle, small antapical horns and granulate ornamentation. S 4927/3, 4.3/96.3, x 500, 308/12,13.

109. *Cleistosphaeridium polypes*; dinoflagellate with apical archeopyle and long, closed processes that bifurcate and flare distally. S 4930/4, 7.1/99.6, x N790, 273/14.

110. *Muderongia mcwhaei*; ceratoid dinoflagellate; apical archeopyle, two cingular horns and antapical horns, one of which is reduced in size. S 4927/4, 12.0/75.8, x 500, 272/5.

111. *Odontochitina operculata*; ceratoid dinoflagellate; apical archeopyle and two antapical horns. S 4927/3, 15.1/82.1, x 200, 308/9,10.

112. *Oligosphaeridium pulcherrimum*; gonyaulacacean dinoflagellate; apical archeopyle and long open, distally expanded processes. S 4927/4, 4.1/108.3, x 500, 272/18.

113. *Tanyosphaeridium salpinx*; probably gonyaulacacean dinoflagellate; apical archeopyle with long tubular processes that open distally. S 4927/4, 10.9/85.4, x N790, 272/6,7.

114. *Cyclonephelium (Tenua) pilosa*; dinoflagellate; apical archeopyle and numerous short, thin, solid processes. S 4930/4, 16.2/79.4, x N790, 272/24.

115. *Apteodinium maculatum*; dinoflagellate with precingular archeopyle and small apical horn. S 4927/4, 3.9/110.4, x 500, 272/16.

116. *Callaiosphaeridium asymmetricum*; gonyaulacacean dinoflagellate with combination archeopyle and tubular, trumpet-shaped processes. S 4930/4, 13.2/98.5, x 500, 272/37.

117. *Dingodinium cerviculum*; dinoflagellate; archeopyle type unknown; thin, transparent membrane encompassing rounded capsule supporting numerous small spines. S 4927/4, 7.9/87.4, x 500, 272/12.

118. *?Micrhystridium* sp., acritarch; species covered with numerous, whispy short spines. S 4930/4, 9.1/95.3, x N790, 273/4.

119. *Micrhystridium* sp., acritarch; species with fewer, longer solid spines. S 4930/4, 9.1/95.3, x N790, 273/4.

120. *Pterospermopsis australiensis*; acritarch with rounded body surrounded by thin flange with regular radially directed folds. S 4930/4, 1.0/90.7, x N790, 273/19.

121. *Veryhachium reductum*; acritarch. S 4927/4, 9.7/104.4, x 500, 272/9.

APPENDIX 1

LIST AND FREQUENCY OF PALYNOMORPHS ENCOUNTERED AT THE TYPE SECTION AND IN TOODLA-1.

SADME NO.	COLUMN NO.
Type Section	
S 980	1
S 6137	2 (deepest)
S 6138	3
S 6153	4
TOODLA-1	
S 4927	5
S 4928	6
S 4930	7
S 4931	8
S 4323	9
S 4916	10
S 4924	11
S 4925	12 (deepest)

Symbols for preservation and yield:
Poor-P, Fair-F, Good-G, Very Good-VG
Excellent-E.

Column number	1	2	3	4	5	6	7	8	9	10	11	12
PRESERVATION:	G	G	G	E	G	VP	G	F	G	VG	G	F
YIELD:	G	G	E	E	G	VP	G	F	G	VG	G	G
PERCENTAGE FREQUENCY IN ASSEMBLAGE: (H = 100%)												
Pollen and spores	H	H	H	H	95	-	83	80	H	H	H	H
Microplankton	O	O	O	O	5	-	17	20	O	O	O	O
POLLEN AND SPORES												
Aequitriradites hispidus	-	-	x	-	-	-	-	-	-	-	-	-
A. spinulosus	X	X	X	X	X	-	-	-	1	X	X	X
A. tilchaensis	-	X	X	X	-	-	-	-	-	-	-	-

A. verrucosus	X	-	X	X	-	-	X	-	X	X	X	X
Alisporites grandis	1	11	7	6	2	X	X	3	4	5	3	3
A. lowoodensis	X	X	-	1	-	-	-	-	-	X	-	X
A. similis	4	3	3	7	1	X	X	2	3	3	4	2
Anapiculatisporites dawsonesis	-	-	-	-	-	-	-	-	-	X	-	-
A. pristidentatus	-	-	X	X	X	-	-	-	-	X	X	-
Annulispora folliculosa	X	-	-	X	X	-	X	-	X	-	X	X
Apiculatisporis taroomensis	-	-	-	-	-	-	-	-	-	X	-	-
Araucariacites australis	X	3	X	4	1	X	X	-	X	2	1	1
Baculatisporites comaumensis	5	3	4	5	2	X	4	4	14	9	9	5
Biretisporites potoniaeii	-	X	-	-	-	-	-	-	-	-	-	-
B. spectabilis	X	X	X	X	1	X	X	1	X	X	X	X
Cadargasporites baculatus	-	-	X	-	-	-	-	-	-	-	X	X
C. reticulatus	X	-	-	-	-	-	-	-	-	X	X	-
Callialasporites dampierii	X	-	X	X	X	-	X	-	X	X	X	X
C. microvelatus	-	-	-	-	-	-	-	-	-	-	-	X
C. segmentatus	X	X	X	X	X	-	X	X	X	1	X	X
C. trilobatus	X	X	X	X	X	-	-	-	X	X	X	X
C. turbatus	X	-	X	X	-	-	-	-	-	-	-	-
Camarozonosporites clivosus	X	X	X	X	-	-	-	-	X	X	X	-
C. ramosus	X	X	X	X	X	-	X	-	X	X	X	X
C. rudis	X	-	-	-	X	-	X	-	-	-	-	-
Ceratosporites equalis	2	X	X	X	1	X	1	2	2	1	2	1
C. helidonensis	-	-	-	X	X	-	X	X	X	X	X	-
Cibotiumspora jurienesis	X	X	X	-	X	-	X	X	X	-	X	X
Cicatricosisporites australiensis	X	-	X	X	X	X	X	3	X	X	X	X
C. hughesii	-	-	X	X	-	-	-	-	-	-	-	-
C. ludbrookii	X	X	X	X	-	X	X	1	X	X	X	X
Classopollis chateaunovii	X	4	3	2	4	X	14	5	4	X	X	X
C. simplex	X	X	X	-	X	-	X	X	-	X	-	X
Concavissimisporites penolaensis	-	-	-	-	-	-	X	-	-	-	-	-
Contignisporites cooksoniae	X	X	X	X	X	-	X	X	X	X	X	X
C. glebulentus	-	-	-	-	-	-	-	-	-	X	X	-
C. multimuratus	-	-	-	X	X	-	X	X	-	-	-	X
Converrucosiporites rewanensis	-	-	-	-	-	X	X	-	X	-	X	X
Cooksonites variabilis	-	-	X	-	-	X	-	-	X	-	-	X
Couperisporites tabulatus	X	X	X	X	X	X	-	-	X	X	X	X
Crybelosporites berberioides	-	-	-	X	X	-	-	-	-	-	-	-

C. stylosus	X	-	-	X	-	-	-	-	X	-	X	X
Cyacadopites nitidus	2	2	X	3	2	X	4	1	2	4	4	4
Cyathidites asper	-	-	X	3	-	-	-	-	-	1	-	X
C. australis	3	7	7	10	1	X	1	8	6	4	4	4
C. concavus	X	2	3	X	X	-	X	-	X	X	X	-
C. minor	12	9	18	9	26	X	25	16	12	17	14	13
Cyclosporites hughesii	X	1	X	X	X	-	-	-	X	X	X	X
Densoisporites perinatus	X	-	-	X	-	-	-	-	-	X	-	-
D. velatus	-	X	X	X	X	-	-	-	X	X	-	X
Dictyophyllidites crenatus	3	X	X	X	X	-	-	1	X	X	1	X
D. equiexinus	-	-	X	-	-	-	-	-	-	-	-	-
D. harrisii	X	-	1	X	6	-	1	-	3	X	X	X
Dictyotosporites complex	X	X	X	X	X	-	X	X	X	X	X	X
D. filosus	-	-	X	X	-	-	-	-	-	X	-	X
D. speciosus	X	X	X	X	X	-	X	-	X	X	X	X
Duplexisporites problematicus	-	-	-	-	X	-	-	-	-	-	-	-
Ephedripites sp.	-	-	X	-	-	-	-	-	-	-	-	-
Foraminisporis asymmetricus	X	X	X	X	X	-	X	1	X	X	-	X
F. dailyi	1	X	X	1	X	-	-	-	X	X	X	X
F. wonthaggiensis	2	3	X	X	X	X	X	X	1	X	1	X
Foveosporites canalis	-	X	X	X	X	-	X	-	X	X	X	X
F. moretonensis	-	-	-	-	X	-	-	-	-	X	-	-
Foveotriletes parviretus	X	X	X	X	X	X	X	1	X	X	X	X
Gleicheniidites circinidites	X	X	X	X	7	X	6	5	-	X	X	X
G. senonicus	-	-	X	X	1	X	X	X	-	X	X	X
Ischyosporites crateris	X	X	X	X	X	-	-	-	X	X	X	X
Januasporites cf. *spiniferus*	X	X	-	-	-	-	-	-	-	-	-	-
J. spinulosus	-	X	X	X	-	-	-	-	X	X	X	-
Klukisporites lacunus	-	-	-	-	-	-	-	-	-	-	X	-
K. scaberis	X	X	X	X	X	-	X	-	X	X	X	X
Kraeuselisporites linearis	-	-	X	X	-	-	-	-	-	X	-	-
Kuylisporites lunaris	X	X	X	X	-	-	-	-	X	-	-	X
Laevigatosporites belfordii	X	-	X	X	-	-	-	-	-	-	-	X
L. ovatus	X	X	1	X	1	-	X	1	-	1	X	1
Leptolepidites major	X	1	X	2	2	-	X	1	1	2	1	1
L. verrucatus	X	X	X	X	X	X	X	-	1	1	X	X
Lycopodiacidites asperatus	X	X	X	X	X	X	X	X	X	X	X	X
L. dettmannae	-	X	-	X	X	-	-	-	-	-	-	X
Matonisporites cooksonae	X	X	X	X	X	-	-	X	-	X	-	X
M. crassiangulatus	X	-	X	X	-	-	-	-	-	-	-	X

Microcachryidites antarcticus	18	32	14	32	19	X	14	21	15	15	24	22
Murospora florida	–	X	X	X	X	–	–	–	X	–	X	X
Neoraistrickia densata	X	X	X	X	–	–	–	–	–	X	–	–
N. elongata	–	–	–	X	–	X	X	–	1	–	X	–
N. suratensis	–	–	–	–	–	–	X	–	–	X	–	X
N. trichosa	–	–	X	–	–	–	–	–	–	–	–	–
N. truncatus	X	1	1	2	1	X	X	1	2	3	X	2
Nevesisporites vallatus	X	–	X	X	–	–	–	X	–	X	X	X
Obtusisporis canadensis	X	–	X	X	X	X	–	–	X	X	X	X
Osumundacidites cf. *dubius*	X	–	–	X	X	X	X	–	X	X	X	–
O. wellmanii	7	3	2	5	1	X	2	2	2	6	1	5
Phrixipollenites infrulus	–	–	–	X	–	–	–	–	–	–	–	–
P. otagoensis	–	–	–	X	–	–	–	–	–	–	–	–
Pilosisporites notensis	–	X	–	–	X	–	X	X	–	–	–	–
Podocarpidites ellipticus	22	27	16	24	7	X	2	6	4	11	8	18
P. multesimus	X	–	–	X	–	X	X	2	3	1	4	1
Polycingulatisporites clavus	X	X	–	X	–	–	–	–	X	X	X	–
P. densatus	–	–	–	–	–	–	–	–	–	X	X	X
Punctatosporites scabratus	–	–	X	X	1	–	X	1	X	–	–	X
Reticulatisporites pudens	–	–	–	X	X	–	X	–	–	X	X	X
Retitriletes austroclavatidites	1	5	1	4	2	X	X	1	5	3	3	2
R. circolumenus	X	X	X	X	X	–	X	–	X	X	X	X
R. eminulus	X	X	X	X	X	X	X	–	1	X	1	X
R. facetus	–	X	X	X	X	X	X	–	X	X	–	X
R. huttonensis	X	X	–	–	–	–	–	–	–	X	–	–
R. nodosus	X	X	X	X	X	X	–	–	X	X	X	X
R. reticulumsporites	X	X	X	X	1	–	X	X	2	1	X	X
R. rosewoodensis	2	1	2	X	X	–	X	–	X	1	3	1
R. semimurus	X	–	X	X	–	–	–	–	–	X	–	–
R. (al. *Lycopodiumsporites*) *solidus*	X	–	–	X	–	–	–	–	X	X	X	–
R. watherooensis	X	X	X	X	–	–	X	–	X	X	–	–
R. (al. *Lycopodiumsporites*) sp. A	–	–	–	X	–	–	–	–	–	–	–	–
Rogalskaisporites canaliculus	–	–	–	–	–	–	–	–	–	–	X	–
R. cicatricosus	X	–	–	–	X	–	–	–	–	–	–	–
Rugulatisporites neuquenensis	–	–	–	–	–	–	–	–	–	X	X	X
Sestrosporites pseudoalveolatus	–	–	–	X	X	X	X	X	X	X	–	–

Staplinisporites caminus	-	X	X	X	X	X	-	-	-	-	-	-
Stereisporites antiquasporites	5	X	X	1	3	X	6	X	3	1	3	3
S. pocockii	-	-	X	1	X	-	X	X	X	X	X	X
Todisporites sp.	-	X	-	-	-	-	-	-	-	-	-	-
Trilites tuberculiformis	-	-	X	-	X	-	-	-	-	X	X	X
Trilobosporites antiquus	-	-	-	X	-	-	-	-	X	-	X	-
T. purverulentus	-	-	X	X	X	-	-	X	-	-	-	-
Triporoletes radiatus	X	-	-	X	-	-	X	2	-	X	-	X
T. reticulatus	X	-	X	X	X	X	4	7	1	1	X	X
T. simplex	X	-	-	X	-	-	-	-	-	-	-	-
Trisaccites microsaccatus	2	4	3	2	2	X	7	2	X	X	4	2
T. variabilis	X	-	-	X	-	-	-	-	-	X	X	-
Tuberculatosporites sp.	-	-	X	X	-	-	-	X	-	-	X	-
Velosporites triquetrus	X	-	X	X	X	-	X	X	X	X	-	-
Vitreisporites pallidus	X	-	X	X	X	X	2	X	X	X	X	X

MICROPLANKTON

Aptea attadalica	-	-	-	-	3	-	7	27	-	-	-	-
Apteodinium maculatum	-	-	-	-	X	-	-	-	-	-	-	-
Batioladinium micropoda	-	-	-	-	X	-	X	-	-	-	-	-
Callaiosphaeridium asymmetricum	-	-	-	-	-	-	X	-	-	-	-	-
Canningia colliveri	-	-	-	-	X	-	X	-	-	-	-	-
Canningia sp. A	X	-	-	-	-	-	X	-	-	-	-	-
Cassiculosphaeridia reticulata	-	-	-	-	-	-	X	-	-	-	-	-
Chlamydophorella nyei	-	-	-	-	6	-	5	2	-	-	-	-
C. solida	-	-	-	-	1	-	-	1	-	-	-	-
Cleistosphaeridium aciculare	-	-	-	-	-	-	4	8	-	-	-	-
C. ancoriferum	-	-	-	-	2	-	X	X	-	-	-	-
C. polypes	-	-	-	-	1	-	4	5	-	-	-	-
C. polytrichum	-	-	-	-	7	-	2	X	-	-	-	-
Cleistosphaeridium sp.	-	-	-	-	X	-	2	X	-	-	-	-
Coronifera oceanica	-	-	-	-	-	-	2	-	-	-	-	-
Cribroperidinium muderogense	-	-	-	X	-	-	2	3	-	-	-	-
C. perforante	-	-	-	-	2	-	X	2	-	-	-	-
Cyclonephelium (Tenua) aptiense	-	-	-	X	-	X	-	-	-	-	-	-
C. compactum	-	-	-	-	-	X	-	-	-	-	-	-
C. distinctum	-	-	-	-	1	-	2	5	-	-	-	-
C. (Tenua) pilosa	-	-	-	-	10	-	11	15	-	-	-	-

Dingodinium cerviculum	-	-	-	-	1	-	1	X	-	-	-	-
Exochosphaeridium phragmites	-	-	-	-	1	-	1	X	-	-	-	-
Fromea amphora	-	-	-	-	X	-	X	-	-	-	-	-
Hystrichodinium pulchrum	-	-	-	-	-	-	X	-	-	-	-	-
Laciniadinium tenuistriatum	-	-	-	-	-	-	X	-	-	-	-	-
Leptodinium simplex	-	-	-	-	-	-	1	1	-	-	-	-
Lithodinia helbyi	-	-	-	-	1	-	-	-	-	-	-	-
Membranosphaera romaensis	-	-	-	-	-	-	-	1	-	-	-	-
Micrhystridium sp.	-	-	-	-	11	-	33	11	-	X	-	-
Microfasta evansi	-	-	-	-	-	-	1	-	-	-	-	-
Muderongia mcwhaei	-	-	-	-	4	-	4	X	-	-	-	-
M. staurota	-	-	-	-	1	-	-	X	-	-	-	-
Odontochitina operculata	-	-	-	-	3	-	X	-	-	-	X	-
Oligosphaeridium complex	-	-	-	-	-	-	-	X	-	-	-	-
O. pulcherrimum	-	-	-	-	5	-	9	6	-	-	-	-
Palaeoperidinium cretaceum	-	-	-	-	3	-	2	1	-	-	-	-
Protoellipsodinium denispinum	-	-	-	-	-	-	-	X	-	-	-	-
Pterospermopsis aureolata	-	-	-	-	-	-	X	1	-	-	-	-
P. australiensis	-	-	-	-	1	-	3	X	-	-	-	-
P. eurypteris	-	-	-	-	-	-	X	-	-	-	-	-
Spiniferites ramosus ramosus	-	-	-	-	1	-	X	1	-	-	-	-
S. wetzeli	-	-	-	-	3	-	1	X	-	-	-	-
Tanyosphaeridium salpinx	-	-	-	-	X	-	X	X	-	-	-	-
Veryhachium reductum	-	-	-	-	3	-	3	1	-	-	-	-
V. singulare	-	-	-	-	2	-	1	1	-	-	-	-
Wallodinium lunum	-	-	-	-	X	-	X	-	-	-	-	-

<u>ALGAE</u>

Schizosporis reticulatus	-	X	X	X	-	-	-	-	-	-	-	-
S. spriggii	-	-	-	X	-	-	-	-	-	-	-	-

<u>REMANIE</u>

Alisporites cf. *A. nuthallensis*	-	-	-	-	-	-	-	-	-	-	-	X
Cycadopites follicularis	-	-	-	-	-	-	-	-	-	?	-	-
Dulhuntispora parvithola	-	-	-	X	-	-	-	-	-	-	-	-
Potonieisporites balmei	-	-	-	-	-	-	-	-	-	-	X	-
Pseudoreticulatus pseudoreticulatus	-	-	X	-	-	-	-	-	-	-	-	-
Striatoabieites multistriatus	-	-	-	X	-	-	-	-	-	-	-	-
Weylandites lucifer	-	-	-	X	-	-	-	-	-	-	-	-

APPENDIX 2

TAXONOMIC REFERENCES USED IN TEXT

Spores and pollen

Aequitriradites hispidus Dettmann & Playford 1968

Aequitriradites spinulosus (Cookson & Dettmann) Cookson & Dettmann 1961

Aequitriradites tilchaensis (Cookson & Dettmann) Dettmann 1963

Aequitriradites verrucosus (Cookson & Dettmann) Cookson & Dettmann 1961 (Figs. 73,74)

Alisporites grandis (Cookson) Dettmann 1963 (Fig. 84)

Alisporites lowoodensis de Jersey 1963 (Fig. 85)

Alisporites similis (Balme) Dettmann 1963 (Fig. 86)

Anapiculatisporites dawsonensis Reiser & Williams 1969

Anapiculatisporites pristidentatus Reiser & Williams 1969

Annulispora folliculosa (Rogalska) de Jersey 1959 (Figs. 52, 53)

Antulsporites saevus (Balme) Archangelsky & Gamerro (Fig. 59)

Apiculatisporis taroomensis Reiser & Williams 1969

Araucariacites australis Cookson 1947

Baculatisporites comaumensis (Cookson) Potonié 1956 (Fig. 9)

Biretisporites potoniaeii Delcourt & Sprumont 1955

Biretisporites spectabilis Dettmann 1963 (Fig. 8)

Cadargasporites baculatus de Jersey & Paten 1964

Cadargasporites reticulatus de Jersey & Paten 1964

Callialasporites dampierii (Balme) Sukh Dev 1961 (Fig. 98)

Callialasporites microvelatus Schulz 1966 (Fig. 99)

Callialasporites segmentatus (Balme) Srivastava 1963 (Fig. 100)

Callialasporites trilobatus (Balme) Sukh Dev 1961 (Fig. 101)

Callialasporites turbatus (Balme) Schulz 1967 (Fig. 102)

Camarozonosporites clivosus Williams 1974 (McKellar 1974) (Figs. 61,62)

Camarozonosporites ramosus (de Jersey) McKellar 1974 et emend.

Camarozonosporites rudis (Leschik) Klaus 1960

Ceratosporites equalis Cookson & Dettmann 1958

Ceratosporites helidonensis de Jersey 1971

Cibotiumspora jurienesis (Balme) Filatoff 1975

Cicatricosisporites australiensis (Cookson) Potonié 1956 (Fig. 42)

Cicatricosisporites hughesii Dettmann 1963

Cicatricosisporites ludbrookii Dettmann 1963 (Figs. 43,44)
Classopollis chateaunovii Reyre 1970 (Fig. 103)
Classopollis simplex (Danzé-Corsin & Laveine) Reiser & Williams 1969 (Fig. 104)
Concavissimisporites penolaensis Dettmann 1963
Contignisporites cooksoniae (Balme) Dettmann 1963 (Fig. 63)
Contignisporites multimuratus Dettmann 1963
Converrucosisporites rewanensis (de Jersey) Playford & Dettmann 1965
Cooksonites variabilis Pocock 1962
Couperisporites tabulatus Dettmann 1963
Crybelosporites berberioides Burger 1976 (Fig. 66)
Crybelosporites stylosus Dettmann 1963 (Fig. 67)
Cycadopites nitidus (Balme) de Jersey 1964 (Fig. 83)
Cyathidites asper (Bolkhovitina) Dettmann 1963
Cyathidites australis Couper 1953 (Fig. 5)
Cyathidites concavus (Bolkhovitina) Dettmann 1963
Cyathidites minor Couper 1953 (Fig. 6)
Cyclosporites hughesii (Cookson & Dettmann) Cookson & Dettmann 1959 (Fig. 30)
Densoisporites perinatus Couper 1958 (Figs. 68,69)
Densoisporites velatus Weyland & Kreiger emend. Krasnova 1961 (Fig. 70)
Dictyophyllidites crenatus Dettmann 1963 (Fig. 7)
Dictyophyllidites equiexinus (Couper) Dettmann 1963
Dictyophyllidites harrisii Couper 1958
Dictyotosporites complex Cookson & Dettmann 1958 (Figs. 33,34,35)
Dictyotosporites filosus Dettmann 1963 (Fig. 36)
Dictyotosporites speciosus Cookson & Dettmann 1958 (Figs. 37,38)
Duplexisporites problematicus (Couper) Playford & Dettmann 1965
Ephedripites sp.
Foraminisporis asymmetricus (Cookson & Dettmann) Dettmann 1963 (Fig. 56)
Foraminisporis dailyi (Cookson & Dettmann) Dettmann 1963 (Fig. 57)
Foraminisporis wonthaggiensis (Cookson & Dettmann) Dettmann 1963 (Fig. 58)
Foveosporites canalis Balme 1957 (Figs. 31,32)
Foveosporites moretonensis de Jersey 1964
Foveotriletes parviretus (Balme) Dettmann 1963
Gleicheniidites circinidites (Cookson) Dettmann 1963
Gleicheniidites senonicus Ross emend. Skarby 1964 (Fig. 51)

Ischyosporites crateris Balme 1957 (Figs. 48,49)
Januasporites cf. *J. spiniferus* Singh 1964 (Figs. 39,40)
Januasporites spinulosus Dettmann 1963
Klukisporites lacunus Filatoff 1975
Klukisporites scaberis (Cookson & Dettmann) Dettmann 1963 (Fig. 41)
Kraeuselisporites linearis (Cookson & Dettmann) Dettmann 1963
Kuylisporites lunaris Cookson & Dettmann 1958 (Figs. 16,17)
Laevigatosporites belfordii Burger 1976 (Fig. 81)
Laevigatosporites ovatus Wilson & Webster 1946
Leptolepidites major Couper 1958 (Fig. 10)
Leptolepidites verrucatus Couper 1953 (Fig. 11)
Lycopodiacidites asperatus Dettmann 1963 (Fig. 18)
Lycopodiacidites dettmannae Burger 1980 (Fig. 19)
Matonisporites cooksonae Dettmann 1963
Matonisporites crassiangulatus (Balme) Dettmann 1963
Microcachryidites antarcticus Cookson 1947 (Fig. 95)
Murospora florida (Balme) Pocock 1961 (Fig. 65)
Neoraistrickia densata Filatoff 1975 (Figs. 13,14)
Neoraistrickia elongata Reiser & Williams 1969
Neoraistrickia suratensis McKellar 1974
Neoraistrickia cf. *N. trichosa* Filatoff 1975
Neoraistrickia truncatus (Cookson) Pontoniè 1956 (Fig. 12)
Nevesisporites vallatus de Jersey & Paten 1964 (Fig. 54)
Obtusisporis canadensis Pocock 1970
Osmundacidites cf. *O. dubius* Burger 1980
Osmundacidites wellmanii Couper 1953
Phrixipollenites infrulus Haskell 1968 (Figs. 87,88)
Phrixipollenites otagoensis (Couper) Haskell 1968 (Figs. 89,90)
Pilosisporites notensis Cookson & Dettmann 1958 (Fig. 15)
Podocarpidites ellipticus Cookson 1947 (Figs. 91,92)
Podocarpidites multesimus (Bolkhovitina) Pocock 1962 (Fig. 93)
Polycingulatisporites clavus (Balme) Burger 1980
Polycingulatisporites densatus (de Jersey) Playford & Dettmann 1965
Punctatosporites scabratus (Couper) Norris 1965 (Fig. 82)
Reticulatisporites pudens Balme 1957 (Fig. 29)
Retitriletes austroclavatidites (Cookson) Döring *et al.* 1963 (Figs. 20,21)
Retitriletes circolumenus (Cookson & Dettmann) Backhouse 1978 (Figs. 22,23)
Retitriletes eminulus (Dettmann) Srivastava 1977

Retitriletes facetus (Dettmann) Srivastava 1972 (Figs. 24,25)
Retitriletes huttonensis McKellar 1974
Retitriletes nodosus (Dettmann) Srivastava 1977
Retitriletes reticulumsporites (Rouse) Döring *et al.* 1963
Retitriletes rosewoodensis (de Jersey) McKellar 1974
Retitriletes semimuris (Danzé-Corsin & Laveine) McKellar 1974
Retitriletes (al. Lycopodiumsporites) solidus Burger 1980
Retitriletes watherooensis Backhouse 1978 (Figs. 26,27,28)
Retitriletes (al. Lycopodiumsporites) sp. A Filatoff 1975
Rogalskaisporites canaliculus Filatoff 1975 (Fig. 55)
Rogalskaisporites cicatricosus (Rogalska) Danzé-Corsin & Laveine 1963
Rugulatisporites neuquenesis Volkheimer 1972
Sestrosporites pseudoalveolatus (Couper) Dettmann 1963 (Fig. 60)
Staplinisporites caminus (Balme) Pocock 1962
Stereisporites antiquasporites (Wilson & Webster) Dettmann 1963 (Fig. 50)
Stereisporites pocockii Burger 1980
Todisporites sp.
Trilites tuberculiformis Cookson 1947
Trilobosporites antiquus Reiser & Williams 1969 (Figs. 45,46)
Trilobosporites perverulentus (Verbitskaya) Dettmann 1963 (Fig. 47)
Triporoletes radiatus (Dettmann) Playford 1971
Triporoletes reticulatus (Pocock) Playford 1971 (Fig. 75)
Triporoletes simplex (Cookson & Dettmann) Playford 1971
Trisaccites microsaccatus (Couper) Couper 1960 (Fig. 96)
Trisaccites variabilis (Dev) Haskell 1968 (Fig. 97)
Tuberculatosporites sp.
Velosporites triquetrus (Lanz) Dettmann 1963 (Figs. 71,72)
Vitreisporites pallidus (Reissinger) Nilsson 1958 (Fig. 94)

Microplankton

Aptea attadalica (Cookson & Eisenack) Davey & Verdier 1974 (Fig. 106)
Apteodinium maculatum Eisenack & Cookson 1960 (Fig. 115)
Batioladinium micropoda (Eisenack & Cookson) Brideaux 1975 (Fig. 107)
Callaiosphaeridium asymmetricum (Deflandre & Courteville) Davey & Williams 1965 (Fig. 116)
Canningia colliveri Cookson & Eisenack 1960
Canningia sp. A Morgan 1980 (Fig. 108)
Cassiculosphaeridia reticulata Davey 1969

Retitriletes facetus (Dettmann) Srivastava 1972 (Figs. 24,25)
Retitriletes huttonensis McKellar 1974
Retitriletes nodosus (Dettmann) Srivastava 1977
Retitriletes reticulumsporites (Rouse) Döring *et al.* 1963
Retitriletes rosewoodensis (de Jersey) McKellar 1974
Retitriletes semimuris (Danzé-Corsin & Laveine) McKellar 1974
Retitriletes (al. Lycopodiumsporites) solidus Burger 1980
Retitriletes watherooensis Backhouse 1978 (Figs. 26,27,28)
Retitriletes (al. Lycopodiumsporites) sp. A Filatoff 1975
Rogalskaisporites canaliculus Filatoff 1975 (Fig. 55)
Rogalskaisporites cicatricosus (Rogalska) Danzé-Corsin & Laveine 1963
Rugulatisporites neuquenesis Volkheimer 1972
Sestrosporites pseudoalveolatus (Couper) Dettmann 1963 (Fig. 60)
Staplinisporites caminus (Balme) Pocock 1962
Stereisporites antiquasporites (Wilson & Webster) Dettmann 1963 (Fig. 50)
Stereisporites pocockii Burger 1980
Todisporites sp.
Trilites tuberculiformis Cookson 1947
Trilobosporites antiquus Reiser & Williams 1969 (Figs. 45,46)
Trilobosporites perverulentus (Verbitskaya) Dettmann 1963 (Fig. 47)
Triporoletes radiatus (Dettmann) Playford 1971
Triporoletes reticulatus (Pocock) Playford 1971 (Fig. 75)
Triporoletes simplex (Cookson & Dettmann) Playford 1971
Trisaccites microsaccatus (Couper) Couper 1960 (Fig. 96)
Trisaccites variabilis (Dev) Haskell 1968 (Fig. 97)
Tuberculatosporites sp.
Velosporites triquetrus (Lanz) Dettmann 1963 (Figs. 71,72)
Vitreisporites pallidus (Reissinger) Nilsson 1958 (Fig. 94)

Microplankton

Aptea attadalica (Cookson & Eisenack) Davey & Verdier 1974 (Fig. 106)
Apteodinium maculatum Eisenack & Cookson 1960 (Fig. 115)
Batioladinium micropoda (Eisenack & Cookson) Brideaux 1975 (Fig. 107)
Callaiosphaeridium asymmetricum (Deflandre & Courteville) Davey & Williams 1965 (Fig. 116)
Canningia colliveri Cookson & Eisenack 1960
Canningia sp. A Morgan 1980 (Fig. 108)
Cassiculosphaeridia reticulata Davey 1969

Chlamydophorella nyei Cookson & Eisenack 1958
Chlamydophorella solida Morgan 1980
Cleistosphaeridium aciculare Davey 1969
Cleistosphaeridium ancoriferum (Cookson & Eisenack) Davey *et al.* 1966 emend. Cookson & Eisenack 1969
Cleistosphaeridium polypes (Cookson & Dettmann) Davey 1969 (Fig. 109)
Cleistosphaeridium polytrichum (Valensi) Davey *et al.* 1969
Cleistosphaeridium sp.
Coronifera oceanica Cookson & Eisenack 1958
Cribroperidinium muderongense (Cookson & Eisenack) Davey 1969
Cribroperidinium perforante (Cookson & Eisenack) Morgan 1980
Cyclonephelium (Tenua) aptiense Burger 1980
Cyclonephelium compactum Deflandre & Cookson 1955
Cyclonephelium distinctum Deflandre & Cookson 1955
Cyclonephelium (Tenua) pilosa (Ehrenberg) Sarjeant 1968 (Fig. 114)
Dingodinium cerviculum Cookson & Eisenack 1958 (Fig. 117)
Exochosphaeridium phragmites Davey *et al.* 1966
Fromea amphora Cookson & Eisenack 1958
Hystrichodinium pulchrum Deflandre 1935
Laciniadinium tenuistriatum (Eisenack & Cookson) Morgan 1977
Leptodinium simplex Burger 1980
Lithodinia helbyi Morgan 1980
Membranosphaera romaensis Burger 1980
Micrhystridium sp. (Figs. 118,119)
Microfasta evansi Morgan 1977
Muderongia mcwhaei Cookson & Eisenack 1958 (Fig. 110)
Muderongia staurota Sarjeant 1966
Odontochitina operculata (Wetzel) Deflandre & Cookson 1955 (Fig. 111)
Oligosphaeridium complex (White) Davey & Williams 1966
Oligosphaeridium pulcherrimum (Deflandre & Cookson) Davey & Williams 1966 (Fig. 112)
Palaeoperidinium cretaceum Pocock 1962
Protoellipsodinium denispinum Morgan 1980
Pterospermopsis aureolata Cookson & Eisenack 1958
Pterospermopsis australiensis Deflandre & Cookson 1955 (Fig. 120)
Pterospermopsis eurypteris (Cookson & Eisenack) Eisenack 1972
Spiniferites ramosus ramosus (Ehrenburg) Loeblich & Loeblich 1966
Spiniferites wetzeli (Deflandre) Sarjeant 1970
Tanyosphaeridium salpinx Norvick 1975 (Fig. 113)
Veryhachium reductum (Deunff) Jekhowsky 1961 (Fig. 121)

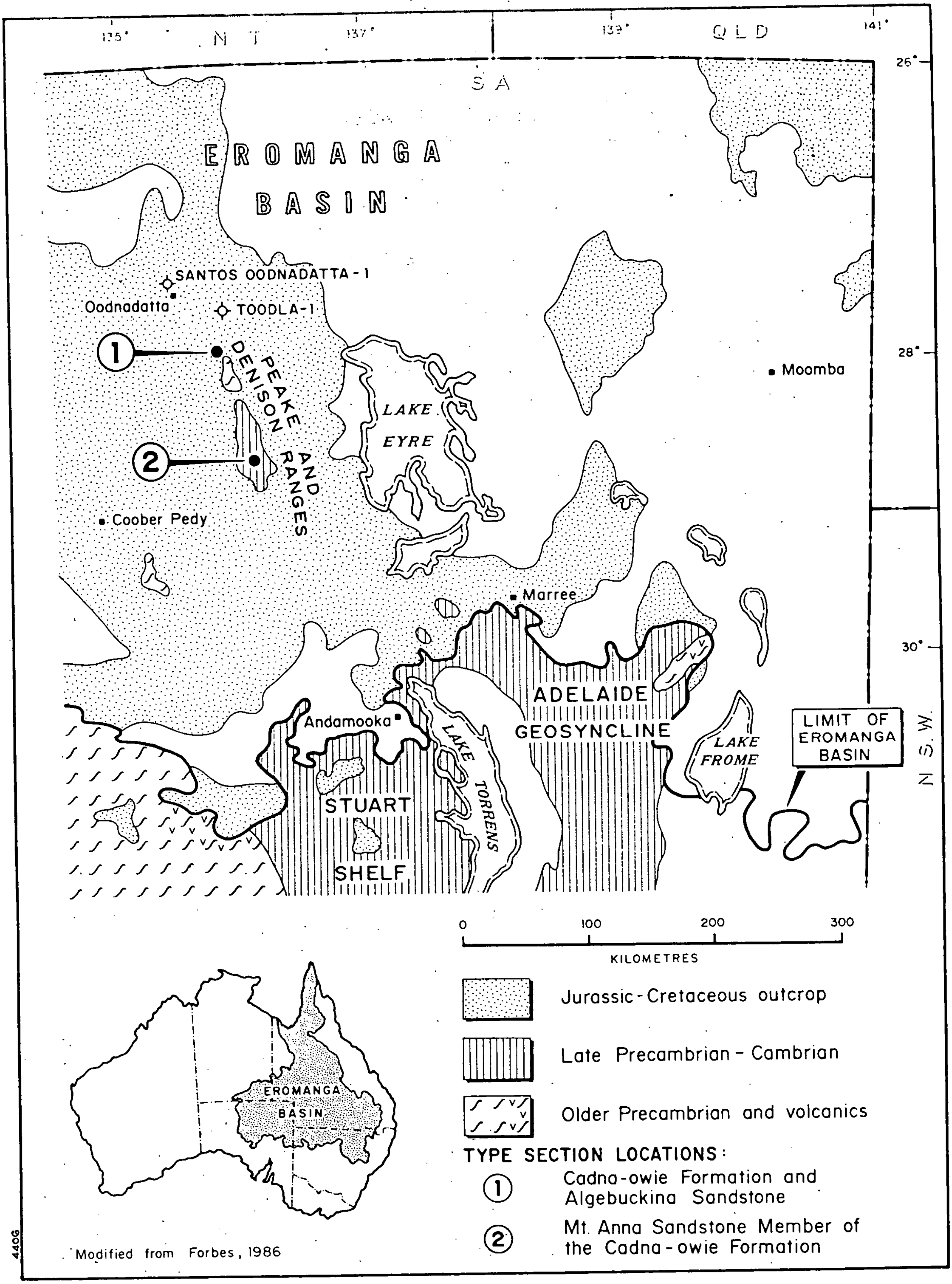
Veryhachium singulare (Firtion) Burger 1980
Wallodinium lunum (Cookson & Eisenack) Lentin & Williams 1973

Algae

Schizosporis reticulatus Cookson & Dettmann 1959
Schizosporis spriggii Cookson & Dettmann 1969

Remanie

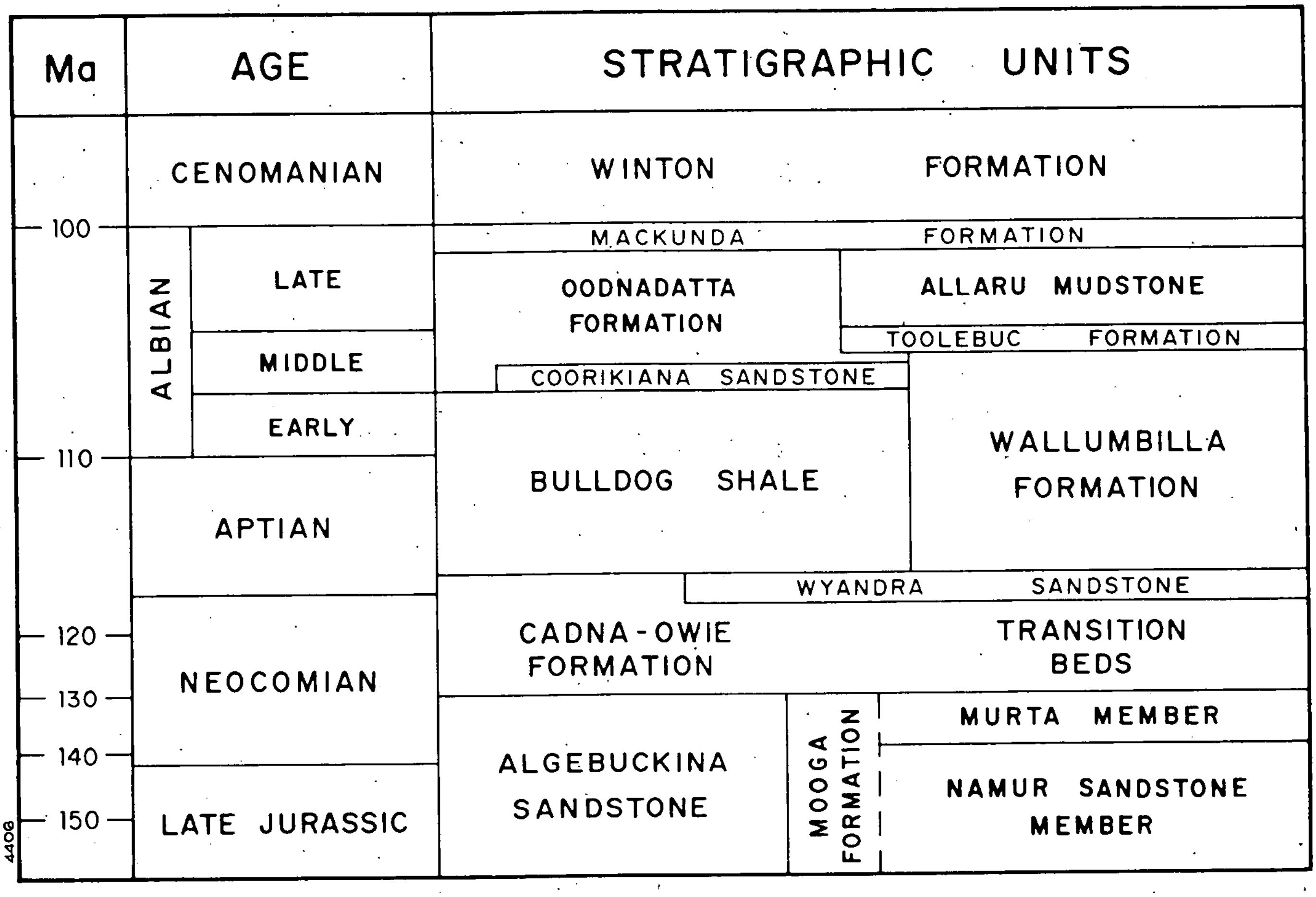
Alisporites cf. *A nuthallensis* Clarke 1965
Cycadopites follicularis Wilson & Webster 1946
Dulhuntispora parvithola (Balme & Hennelley) Potonié 1969
Potonieisporites balmei (Hart) Segroves 1969
Pseudoreticulatus pseudoreticulatus (Balme & Hennelly) Bharadwaj & Srivastava 1969
Striatoabieites multistriatus (Balme & Hennelley) Hart 1964
Weylandites lucifer (Bharadwaj & Saluga) Foster 1975



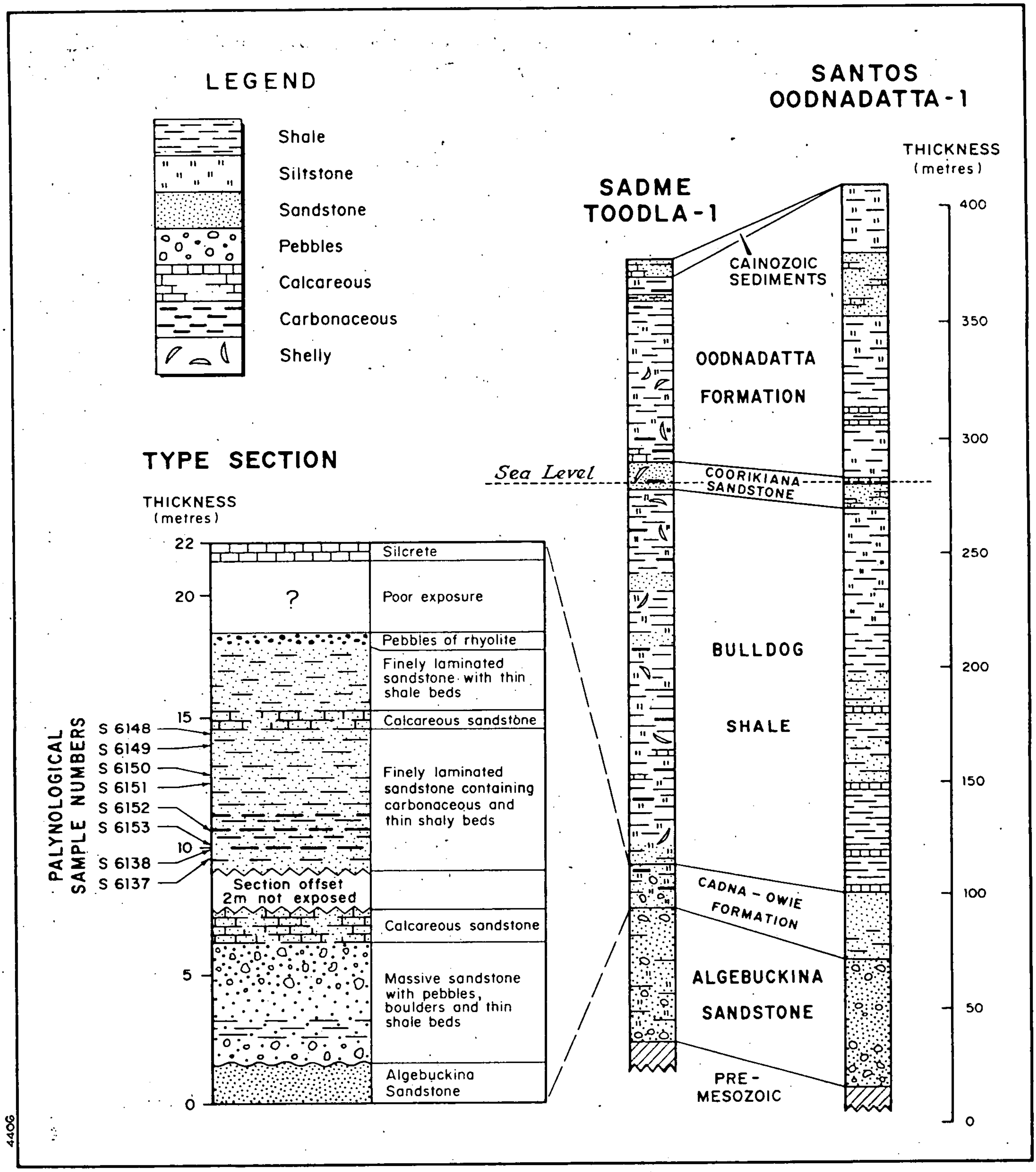
GEOLOGICAL SETTING OF THE SOUTHWESTERN PORTION OF THE EROMANGA BASIN

SADME S19832

Figure 1



STRATIGRAPHIC UNITS EMPLOYED FOR THE EARLY CRETACEOUS IN THE EROMANGA BASIN



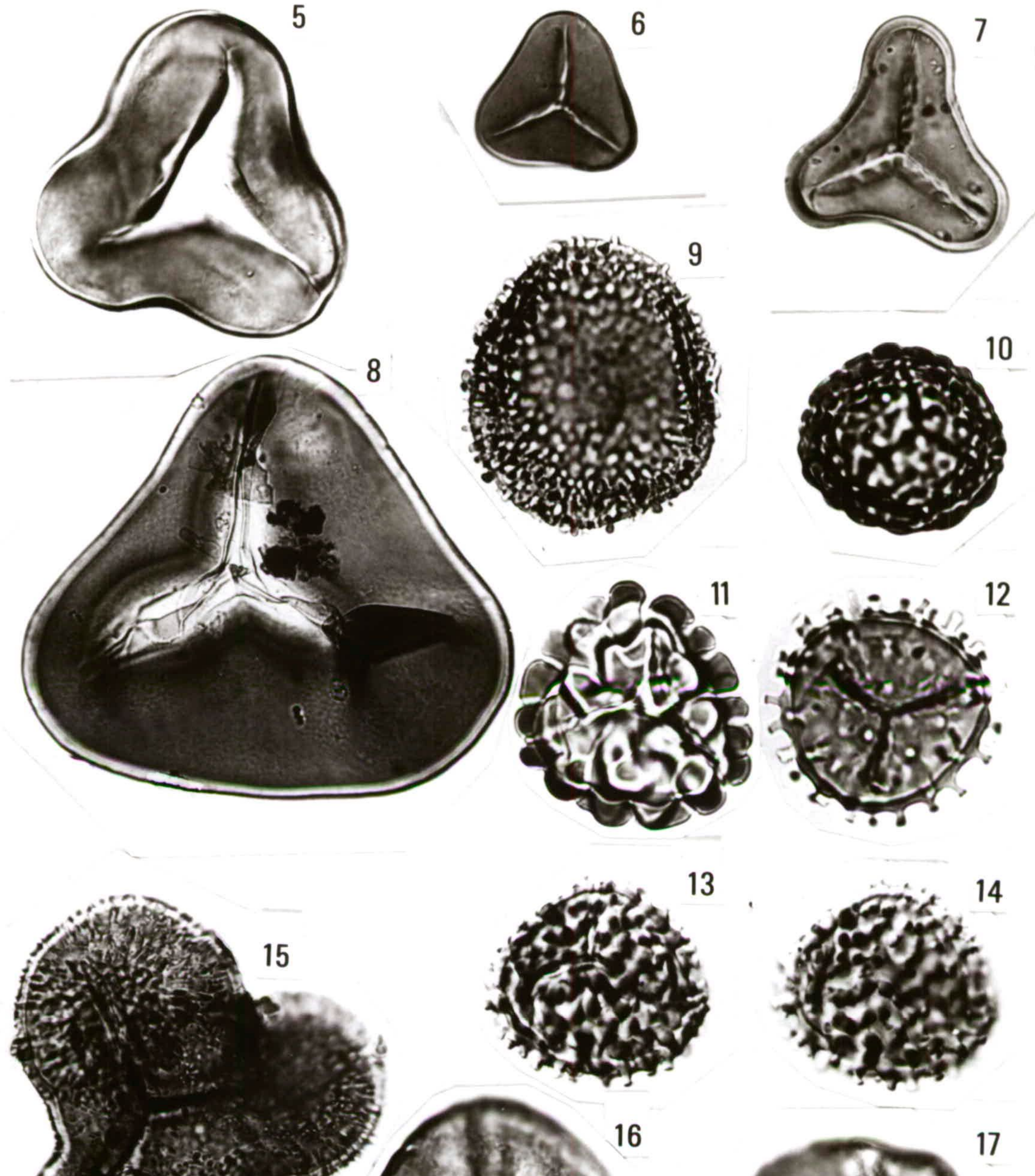
STRATIGRAPHY OF THE TYPE SECTION OF THE CADNA-OWIE FORMATION AND GENERAL STRATIGRAPHY OF SADME TOODLA 1 AND OODNADATTA 1

AGE (after Morgan 1980b)	SPORE-POLLEN UNITS (after Helby *et al*, 1987)	SPORE-POLLEN UNITS (after Price *et al*, 1985)		MICRO-PLANKTON UNIT (after Morgan 1980b)		EROMANGA BASIN SOUTH-WEST	EROMANGA BASIN CENTRAL and NORTHERN	CARPENTARIA BASIN	
APTIAN	*Cyclosporites hughesii*	PK3	PK3.2	*Odontochitina operculata*	*c*	BULLDOG SHALE	WALLUMBILLA FORMATION	WALLUMBILLA FORMATION	
			PK3.1		*b*	MT. ANNA S/S and WYANDRA S/S			
					a		CADNA-OWIE FORMATION	GILBERT RIVER FORMATION	COFFIN HILL MEMBER
LATE NEOCOMIAN	*Foraminisporis wonthaggiensis*	PK 2	PK2.2	Non - marine		CADNA-OWIE FORMATION	CADNA-OWIE FORMATION / TRANSITION BEDS		
			PK2.1						YAPPAR MEMBER
EARLY NEOCOMIAN	*Cicatricosisporites australiensis*	PK 1	PK1.2			ALGEBUCKINA SANDSTONE	MURTA MEMBER		
			PK1.1				HOORAY SANDSTONE / MOOGA FORMATION		
LATE JURASSIC	*Retitriletes watherooensis*	PJ 6						HOORAY SANDSTONE	

PALYNOSTRATIGRAPHIC ZONATIONS AND CORRELATIONS OF EARLY CRETACEOUS UNITS IN THE EROMANGA BASIN

SADME S 19835

Figure 4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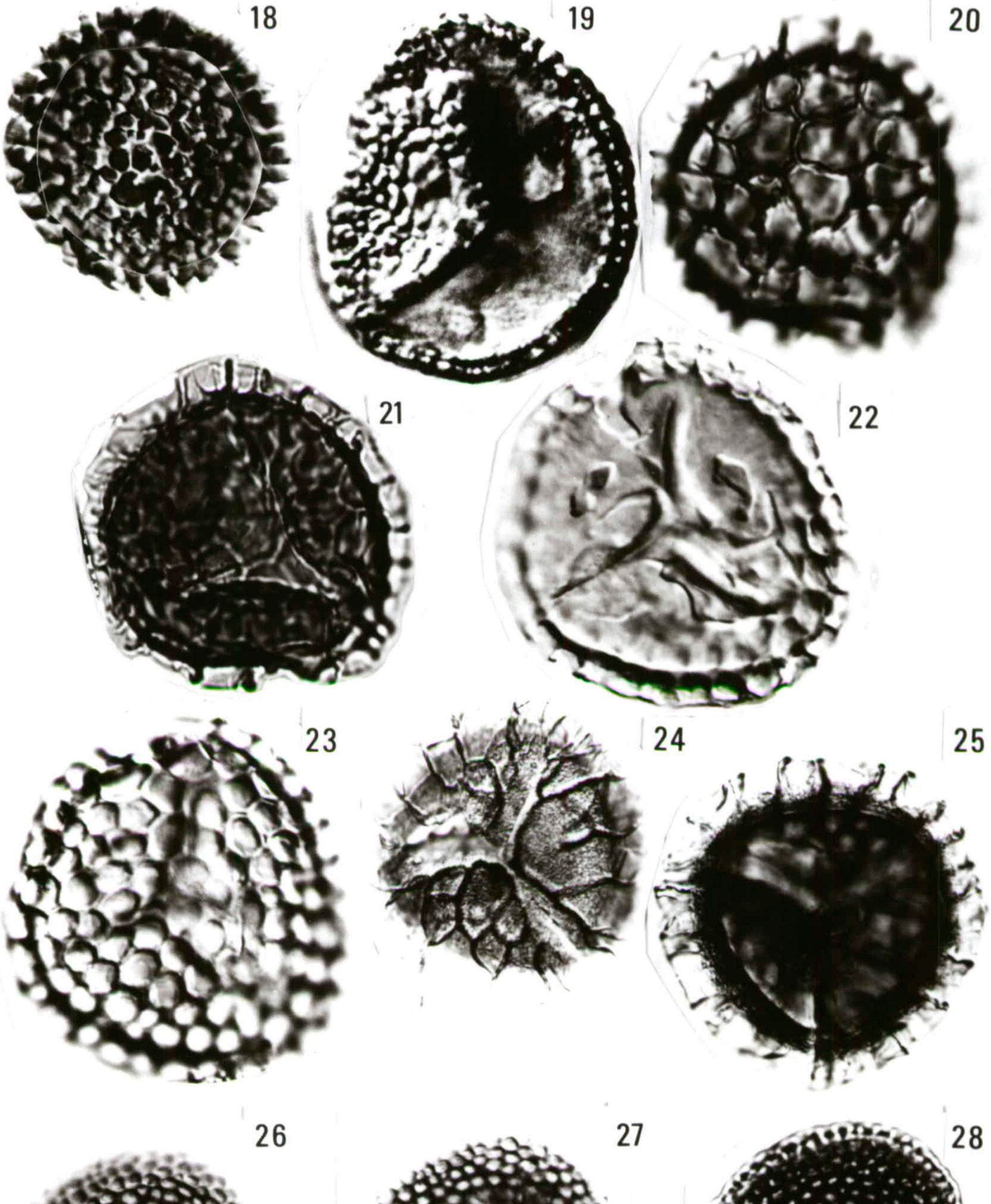
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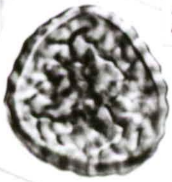

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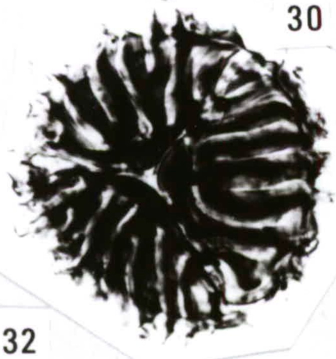

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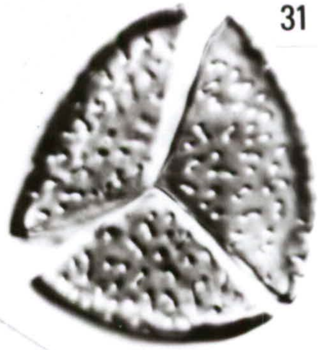

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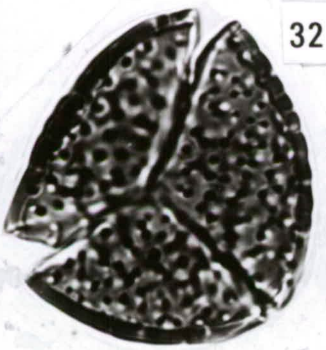

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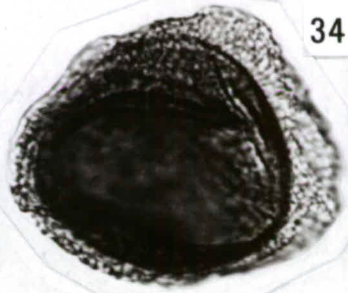

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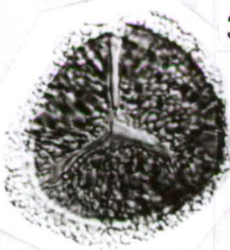

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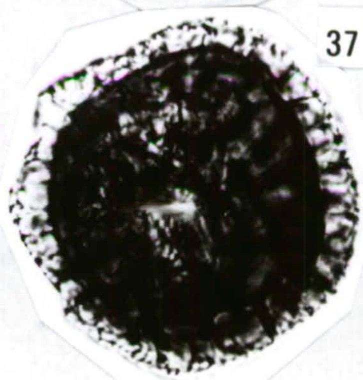

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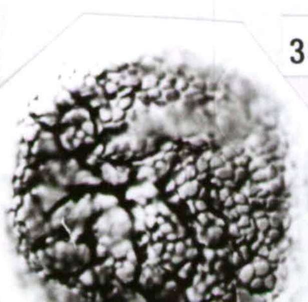

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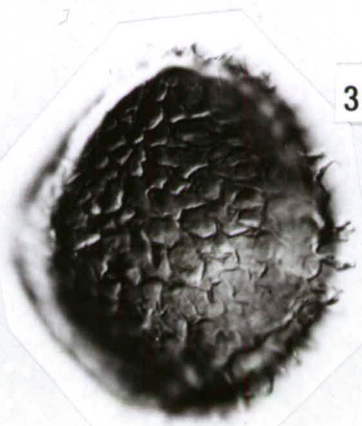

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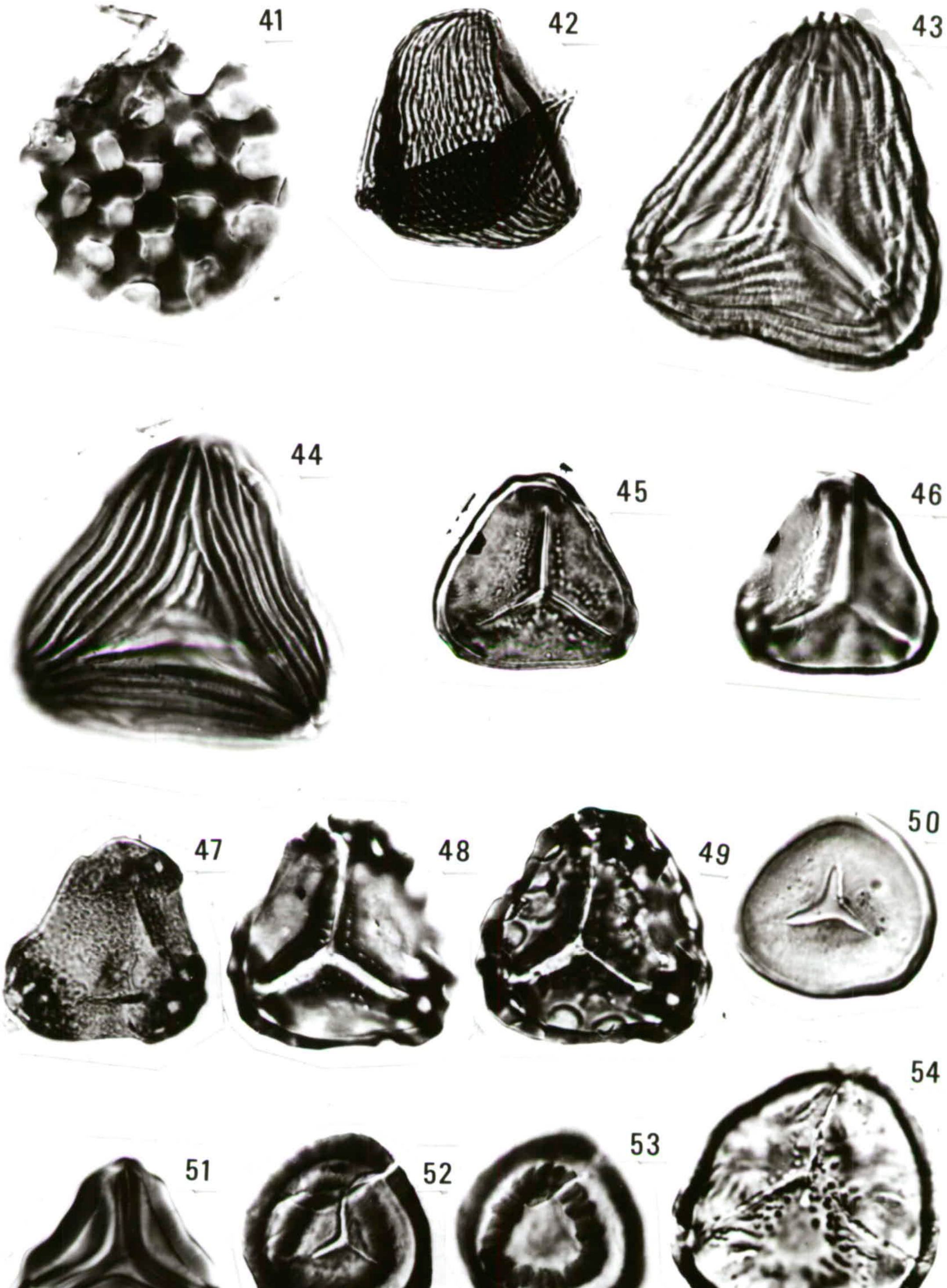
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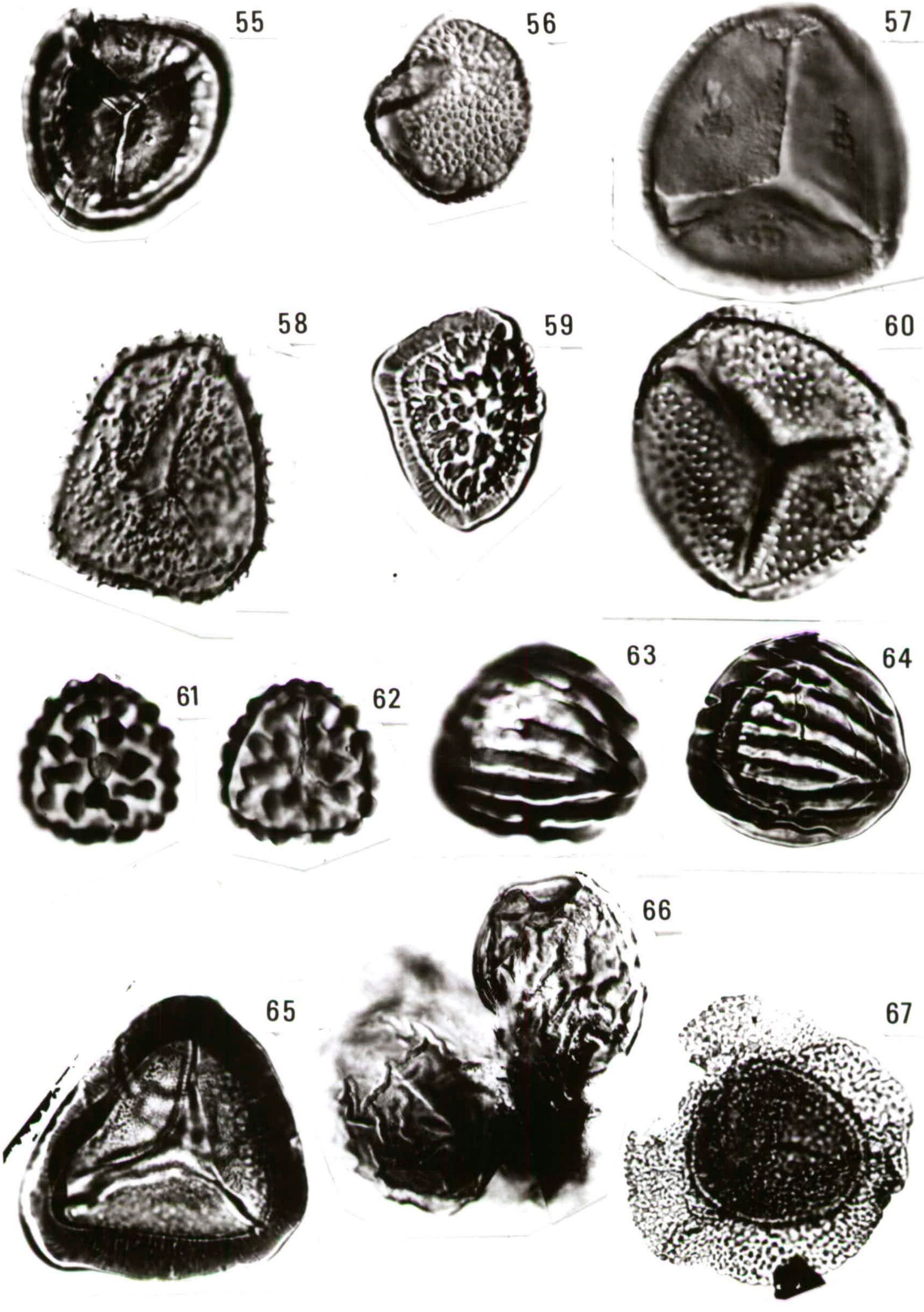
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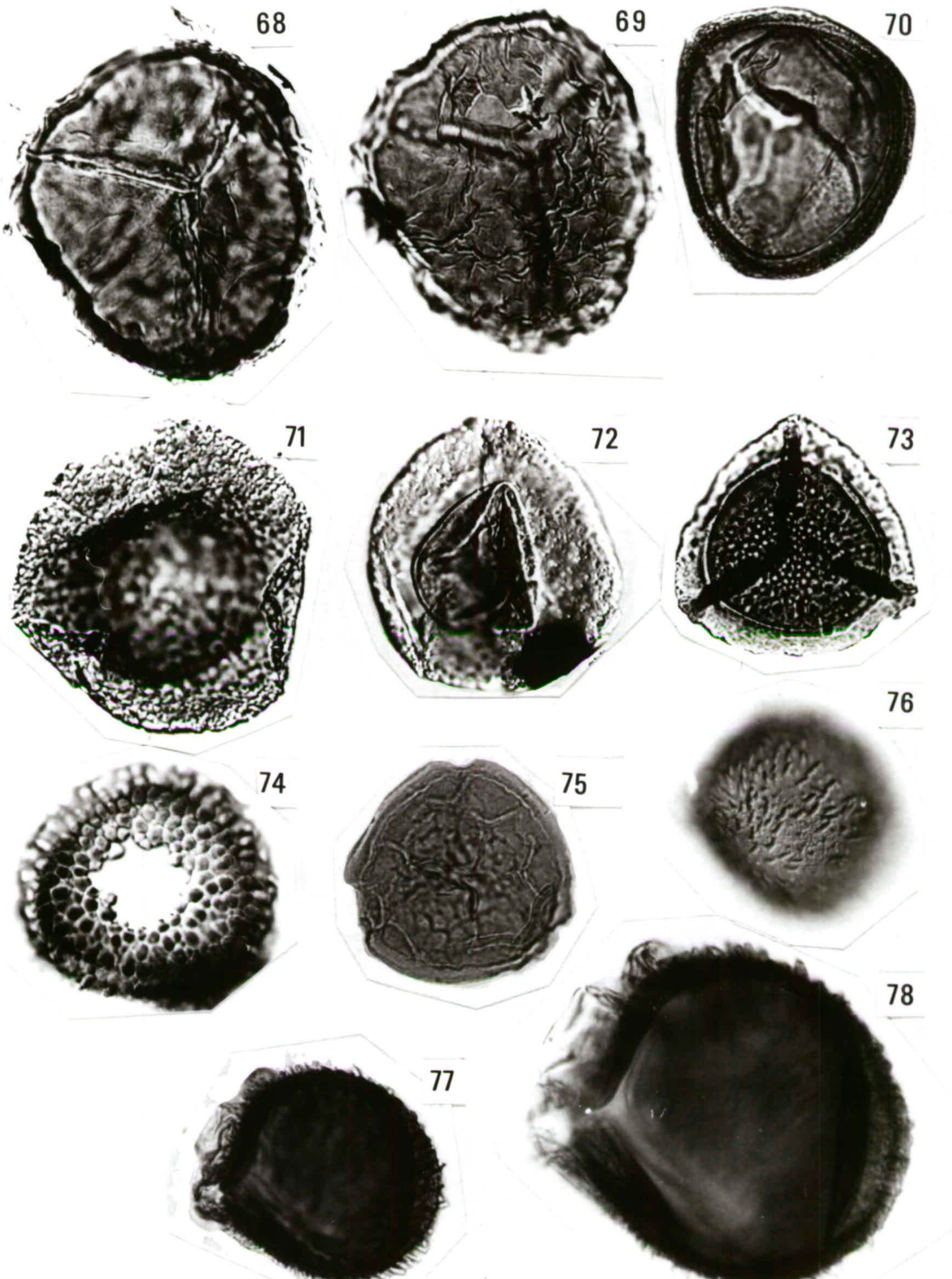
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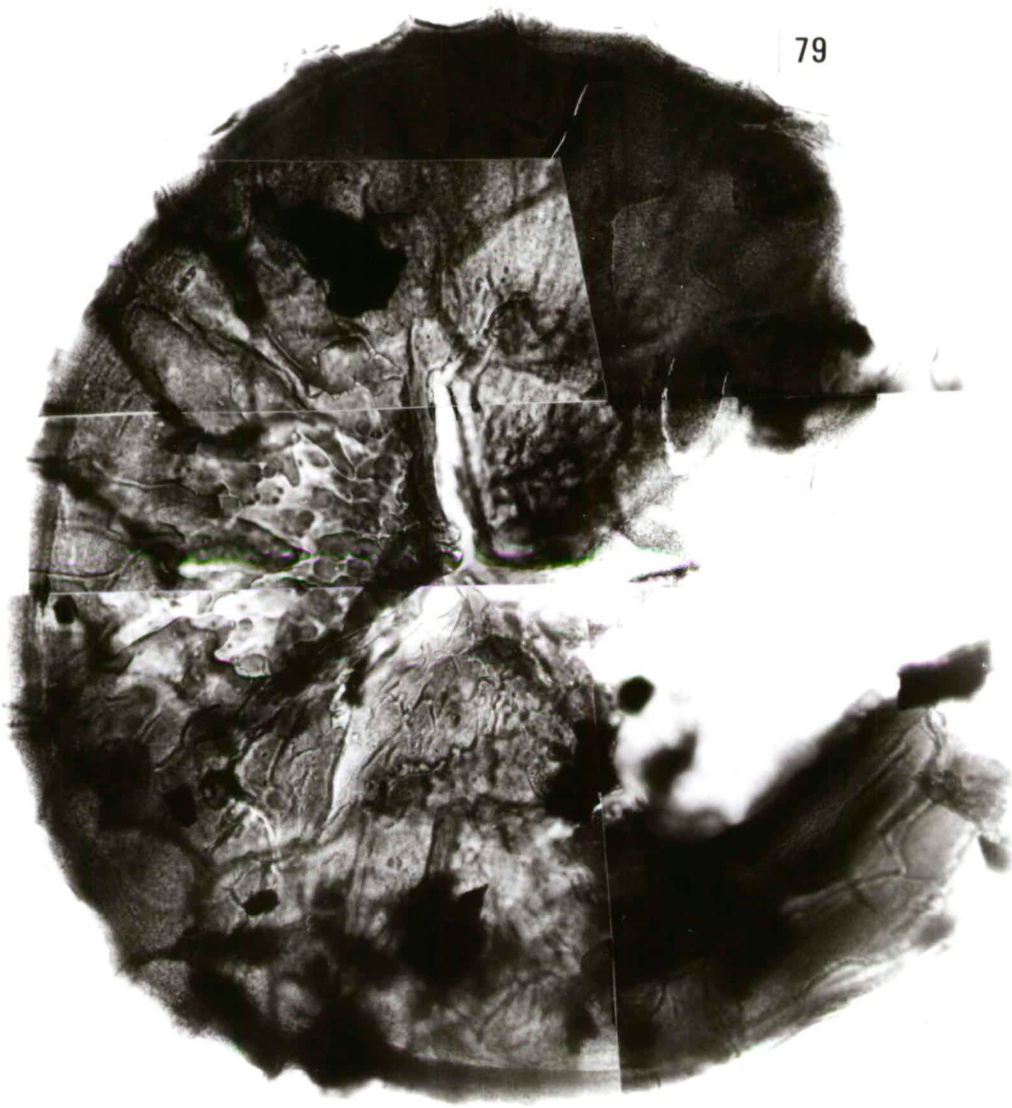
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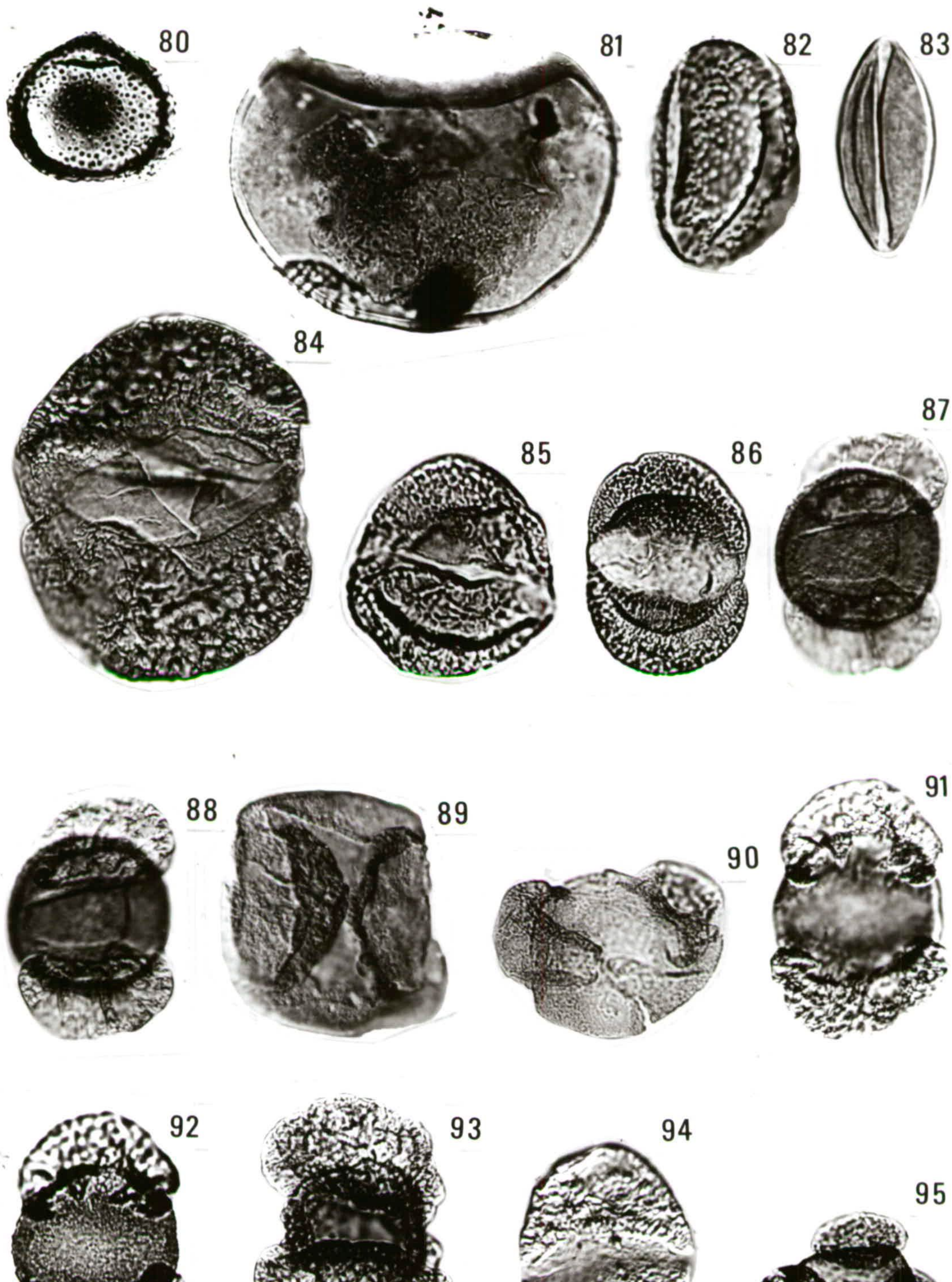
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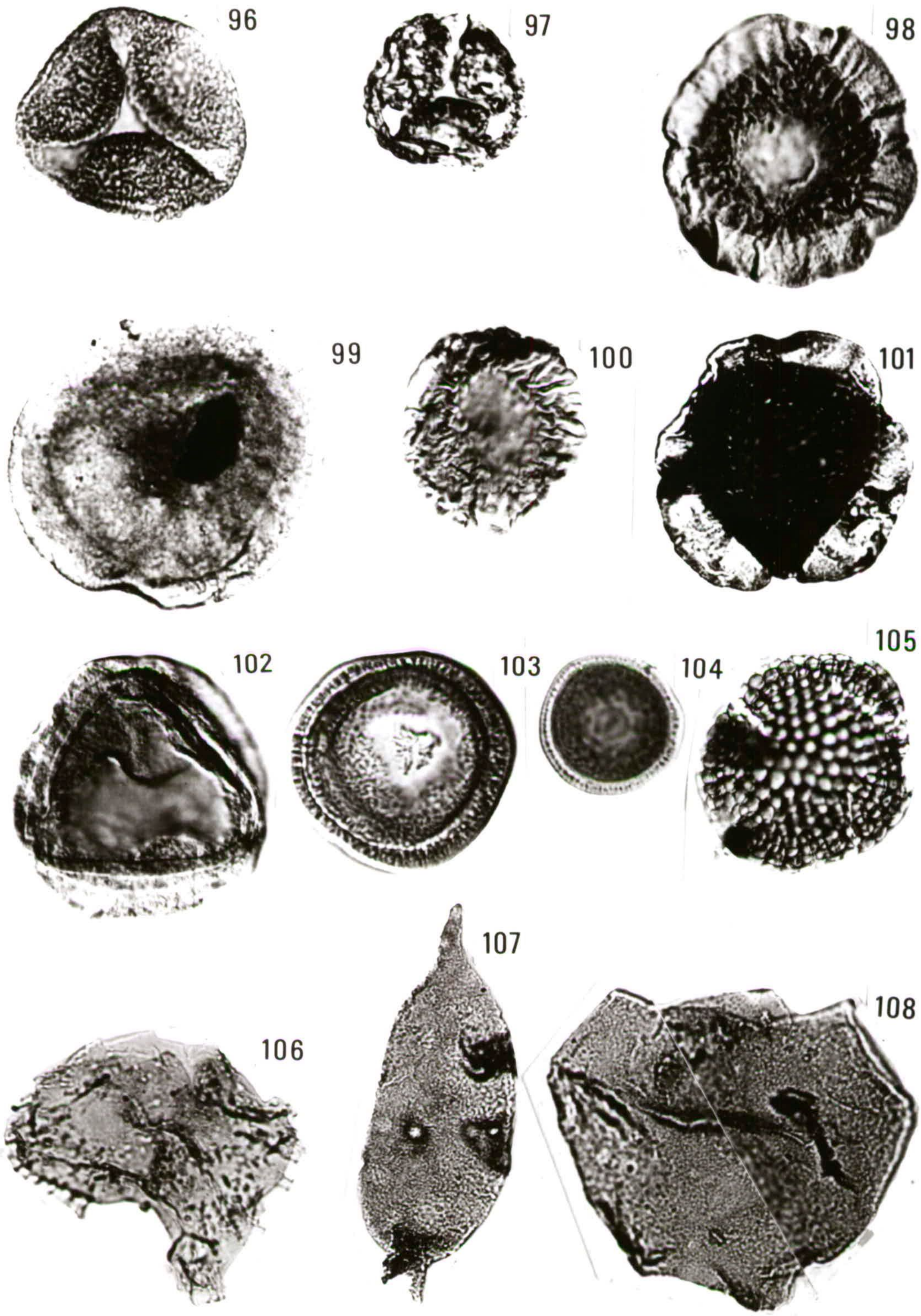
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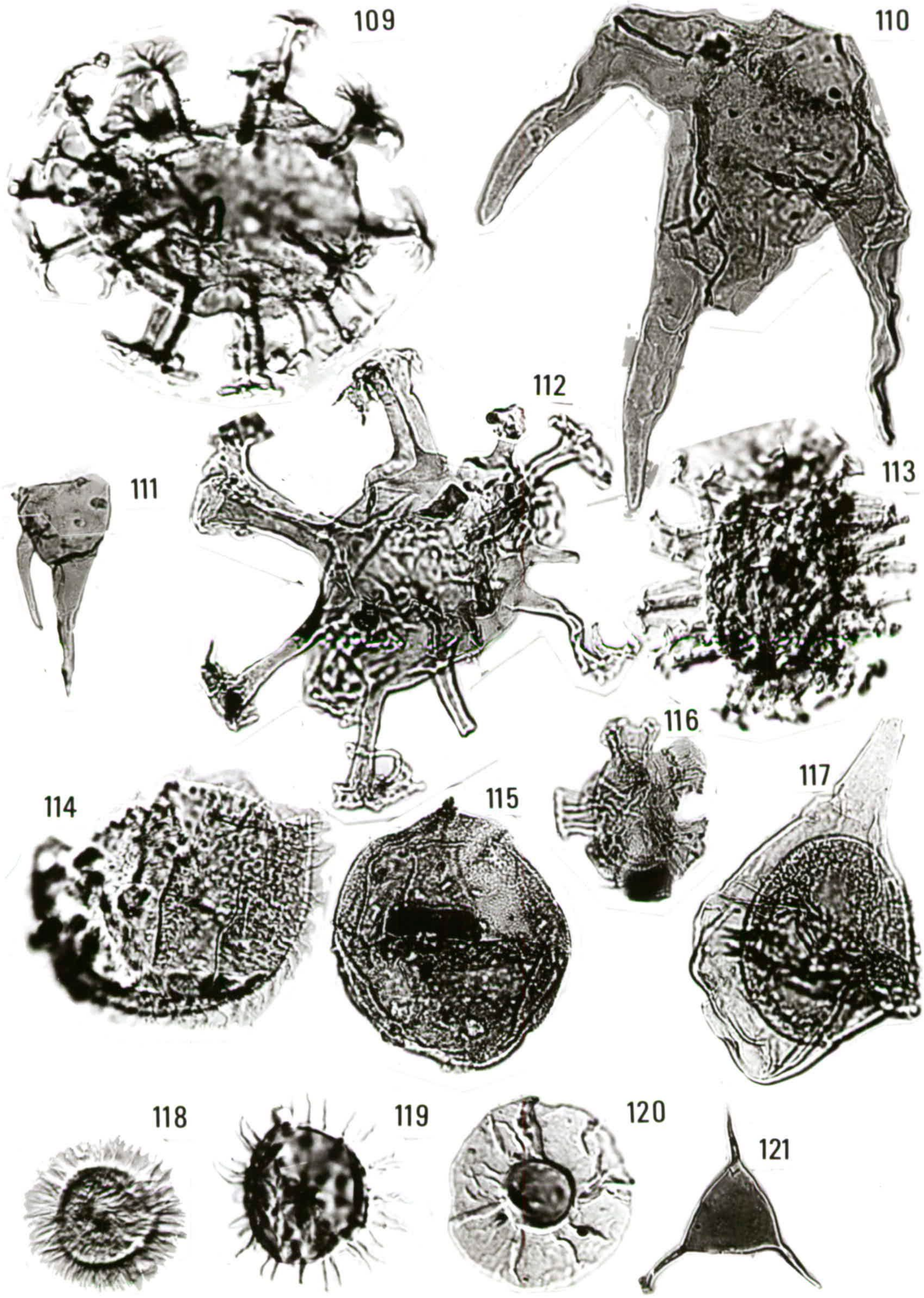
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