LOWER CARBONIFEROUS MEGASPORES FROM THE CLARKE RIVER BASIN, NORTH QUEENSLAND, AUSTRALIA

by G. PLAYFORD

ABSTRACT. In this initial report of Australian Carboniferous megaspores, seven form species are described from continental clastic sediments of the Clarke River Formation, as exposed near the south-western extremity of the Clarke River Basin, north Queensland. The associated miospore flora, representative of the *Anapiculatisporites largus* Assemblage, dates the sediments as Early Carboniferous (Viséan). The following new species of megaspores are established: *Laevigatisporites subhorridus*, *Lagenicula clarkensis*, and *Sublagenicula jellii*. The other forms recognized are attributed to the genera *Tuberculatisporites*, *Lagenicula*, and *Setosisporites*; these are considered to represent new species, but are not formally named due to numerical insufficiency of specimens. The morphological complexion of the megaspore flora, dominated by lageniculate forms, accords generally with those of similar age recorded from elsewhere, and connotes derivation from chiefly arborescent lycopods.

PALAEOPALYNOLOGICAL investigations of Australian stratal sequences have focused mainly on dispersed small spores, pollen grains, and microphytoplankton which, as elsewhere, are often strikingly profuse and well-suited to biostratigraphic zonation and correlation. By contrast, fossil megaspores have received little attention, apart from Lower Mesozoic studies (Dettmann 1961; Helby and Martin 1965; Helby 1967; Scott and Playford 1985) and the Lower Cretaceous work of Cookson and Dettmann (1958). This is understandable in view of the markedly lesser abundance and restricted distribution of megaspores which render them of relatively minor stratigraphic import. So far as the Australian Early Carboniferous is concerned, megaspores are only rarely encountered, and then mostly fragmentarily, in the predominantly marine sequences that have been analysed in detail thus far (Playford 1985, and references cited therein). In fact, the present paper constitutes the first account of megaspores from the Australian Carboniferous.

Within the Gondwanan region, Early Carboniferous megaspores have been described only occasionally or incidentally mentioned; the main references are from northern Africa (Dijkstra 1971; Lachkar 1978; Candilier *et al.* 1982). Moreover, Carboniferous megaspore studies in the Laurasian regions have concentrated much more on the coal-productive Upper Carboniferous than on the earlier part of the system (Braman and Hills 1980). Hence from a global standpoint the literature on Early Carboniferous megaspores is not extensive. Increased knowledge of these larger palynomorphs could well be of considerable palaeobotanical, if not stratigraphical significance, shedding light for instance on the validity or otherwise of the oft-quoted supposed uniformity of Early Carboniferous floras on a more or less world-wide basis (Chaloner and Lacey 1973; Chaloner and Meyen 1973).

STRATIGRAPHIC OUTLINE

Predominantly continental sequences of Late Devonian–Carboniferous rocks are preserved in four sedimentary basins in the hinterland of Townsville, north-east Queensland (Day *et al.* 1983, pp. 80–83; map 7). From east to west, these are the Burdekin, Clarke River, Bundock, and Gilberton Basins (text-fig. 1), which may well have constituted a depositional or palaeogeographic entity that was disunited by subsequent diastrophism and erosion. In particular, the term Broken River Embayment is sometimes applied (e.g. Wyatt and Jell 1980) to the combination

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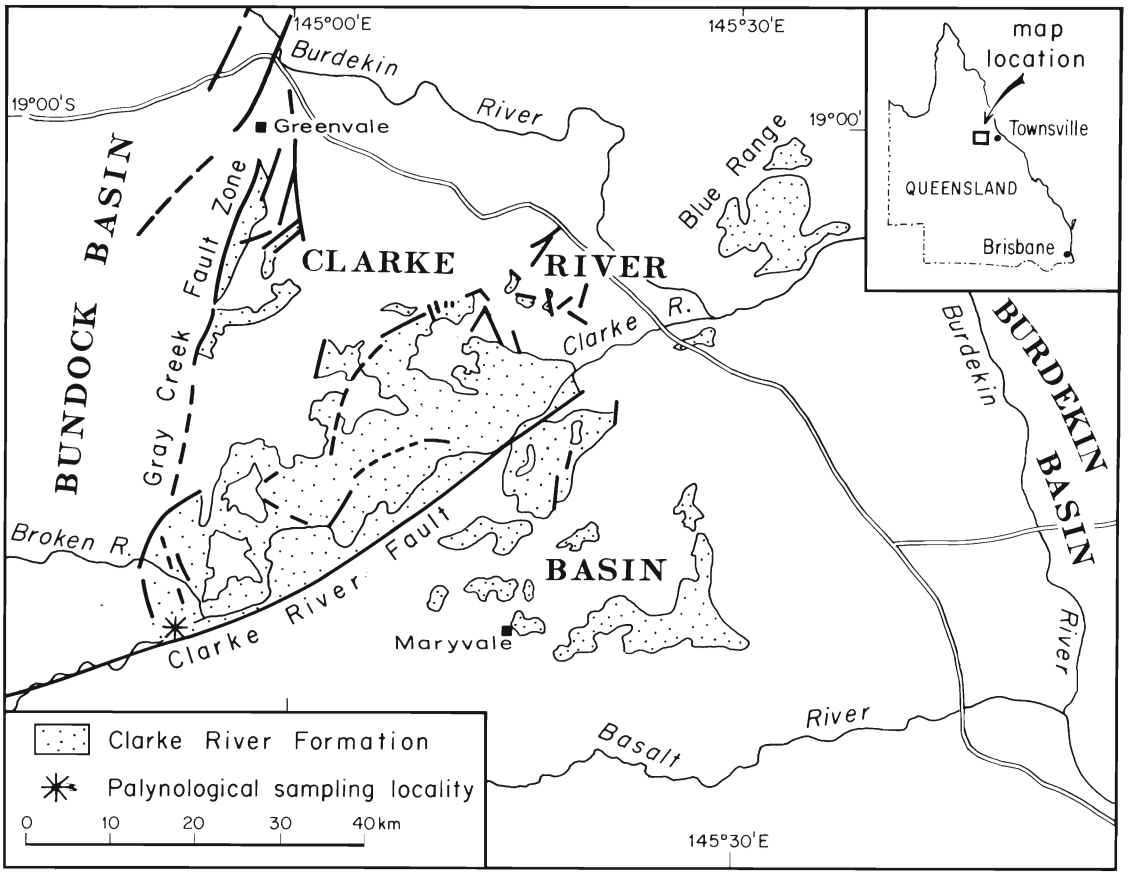


TEXT-FIG. 1. Locality map, Clarke River Basin, north Queensland, showing surface distribution of the Clarke River Formation and the palynological collecting site. Adapted from Jell and Playford (in Roberts 1985).

of the Clarke River Basin and the Bundock Basin, emphasizing their structural contiguity and stratigraphic similarity.

The stratal sequence in the Clarke River Basin has been rather broadly categorized as the Clarke River Formation, a lithologically heterogeneous assembly of conglomerate, siltstone, shale, limestone, sandstone, rhyolite, and tuffaceous sediments. The formation extends as fault-bounded remnants over an area of about 3500 km^2 and it unconformably overlies Silurian–Middle Devonian strata. The maximum thickness of the Clarke River Formation has been variously estimated at between *c.* 1200 m (Jell and Playford in Roberts 1985) and 2270 m (Swarbrick 1976; Levingston 1981). Mapping has so far been at reconnaissance level only; there seems little doubt that more definitive field studies will result in subdivision into two or more units of formational rank.

Apart from a restricted occurrence of Tournaisian fossiliferous marine carbonates and clastics intercalated within the basal Clarke River Formation, deposition appears to have been under continental conditions, with an appreciable volcanic influence (volcanolithic sandstone and siltstone, felsic-tuffaceous rocks) in concluding phases.

Plant megafossils, known from several collecting sites, include lepidodendrids, calamitalean stems, and rhacopterid-like fronds that are generally suggestive of the earlier Carboniferous. Preliminary palynological data, mainly from the subsurface, indicate that the Clarke River Formation spans much of the Carboniferous, as reported by Jell and Playford (in Roberts 1985). No Devonian

palynofloras have been encountered in available material, but it is not inconceivable that Clarke River sedimentation began, at least in some areas, during the 'Famennian–Tournaisian transgression' documented by Wyatt and Jell (1980) in the contiguous Burdekin Basin, Ukalunda Shelf, and Bundock Basin.

MATERIAL AND METHODS

The rock samples that yielded the megaspores described here were collected by Dr J. S. Jell (University of Queensland) from a cliff section forming the north bank of the Clarke River, about 2·5 km upstream from (i.e. south-west of) the latter's confluence with the Broken River (see text-fig. 1). The geographic co-ordinates of the collecting site are 769 369 on Wando Vale Sheet 7858, Australia 1 : 100 000 Topographic Survey. There some 15 m of relatively unweathered, carbonaceous and micaceous sandstone, siltstone, and shale are exposed close to the basin's southwestern limit. The sediments contain rather poorly preserved plant megafossils, chiefly lepidodendrid and calamitalean fragments. The associated miospore flora, as previously reported by Playford (1983), is however diverse and well-preserved and is clearly representative of the *Anapiculatisporites largus* Assemblage of Early Carboniferous (Viséan) age.

Several slabs of the well-lithified sediments, totalling *c.*7 kg, were coarsely broken and demineralized/disaggregated by immersion for five days in cold concentrated hydrofluoric acid. After careful decantation and washing, the resultant organic-rich residues were subjected to brief (5 min.) treatment in concentrated nitric acid and then, after washing to neutrality, were collected on a 175-μm screen. The megaspores proved to be rather sparsely represented in all residues examined; moreover, they were often fragmented (e.g. Pl. 26, fig. 5) and tended to be brittle, such that very careful picking of individual specimens was essential. Attempts to 'clear' the largely opaque megaspore exines in dilute basic solutions or clove oil were largely unsuccessful. Detailed observations of the megaspores were, therefore, conducted almost entirely by means of reflected-light microscopy and, more definitively, scanning electron microscopy. The latter was performed with Phillips 505 and Cambridge Stereoscan 600 instruments, using Kodak Tri-X 35 mm film for photographic documentation.

Repository for all types and other illustrated specimens is the micropalaeontological type collection of the Department of Geology and Mineralogy, University of Queensland, Brisbane. Individual specimen numbers (prefixed 'Y') refer to the official catalogue of that collection.

SYSTEMATIC PALAEONTOLOGY

Suprageneric classification of the megaspores follows the scheme initially proposed by Potonié and Kremp (1954) with certain revisions by Dettmann (1963) and Potonié (1970).

Anteturma PROXIMEGERMINANTES R. Potonié 1970
Turma TRILETES Reinsch emend. Dettmann 1963
Suprasubturma ACAVATITRILETES Dettmann 1963
Subturma AZONOTRILETES Luber emend. Dettmann 1963
Infraturma LAEVIGATI Bennie and Kidston emend. R. Potonié 1956
Genus LAEVIGATISPORITES Ibrahim emend. R. Potonié and Kremp 1954

Type species. Laevigatisporites primus (Wicher) R. Potonié and Kremp 1954; by subsequent designation of Potonié and Kremp (1954, p. 125).

Discussion. There is obvious morphological overlap between the megaspore genera *Laevigatisporites* Ibrahim emend. R. Potonié and Kremp 1954 and *Trileites* Erdtman ex R. Potonié 1956. For instance, Candilier *et al.* (1982, p. 87) utilized the former and Higgs and Scott (1982, pp. 85–86) the latter for essentially similar latest Devonian–Early Carboniferous megaspores. Indeed, the same species (*T. globuliferus* Dijkstra 1956) has been reallocated to *Laevigatisporites* by Lachkar (1978, p. 44) and to *Trileites* by Higgs and Scott (op. cit.).

The specimens described below are assigned to *Laevigatisporites* because of their relatively short laesurae, rather than to *Trileites*, the megaspores of which have laesurae that typically extend to, or nearly to, the equator.

Laevigatisporites subhorridus sp. nov.

Plate 24, figs. 1–7

Etymology. Latin *subhorridus*, somewhat rough.

Diagnosis. Megaspores radial, trilete. Amb circular, subcircular, or subtriangular with convex to almost straight sides and rounded apices. Laesurae approximately one-half of spore radius in length; the actual sutures obscured by elevated lips, rounded in cross-section, and 10–19 μm in overall width and in height. Contact areas, where evident, manifest by slight broad depressions in exine surface but without delimiting curvaturate ridges. Exine apparently single-layered, sometimes displaying one or two coarse compression-folds; surface (including laesurate lips) scabrate under light microscope, microrugulate to imperfectly microreticulate under scanning electron microscope, with diminutive rugulae/muri 0·4–1·0 μm in breadth and mutual separation.

Dimensions (12 specimens). Equatorial diameter 226 (314) 472 μm.

Holotype. Specimen Y.4659; Plate 24, figs. 1 and 2. Proximal aspect. Amb broadly rounded subtriangular, diameter 233 μm; laesurae of slightly unequal length, extending *c.* one-half of distance to equator, lips 10–11 μm in overall width, contact areas slightly depressed and showing slightly lesser sculptural modification than remainder of exine, which is microrugulate/imperfectly microreticulate (SEM).

Type locality. Queensland, Clarke River Basin; north bank of Clarke River, G. R. 769 369 (Wando Vale 1 : 100 000 topographic map); Clarke River Formation, sample A1975, Lower Carboniferous (Viséan).

Remarks. The minutely developed exine sculpture may well be accentuated by preservational factors (corrosion), but none the less appears to be a consistent attribute of this species.

No previously instituted species appears to show any definitive resemblance to the present form. For instance, *L. primus*, *L. glabratus* (Zerndt) R. Potonié and Kremp 1955, and *L. globuliferus* (Dijkstra) Lachkar 1978 are considerably larger, with essentially smooth exines, longer laesurae, and distinct contact areas. *L. subfulgens* (Dijkstra) Candilier *et al.* 1982 is closer to *L. subhorridus* sp. nov. in size [equatorial diameter 340 (581) 660 μm according to Dijkstra (1957, p. 8)] but has somewhat wavy laesurae, with higher lips, extending almost to equator. *Triletes fallax* Dijkstra (in Dijkstra and Piérart 1957) also has long and lipped laesurae, distinct contact areas, and a papillate exine, and is thus readily distinguishable from *L. subhorridus*.

Infraturma APICULATI Bennie and Kidston emend. R. Potonié 1956
Genus TUBERCULATISPORITES Ibrahim emend. Spinner 1968

Type species. *Tuberculatisporites tuberosus* Ibrahim 1933; by subsequent designation of Potonié and Kremp (1954, p. 138).

Tuberculatisporites? sp. A

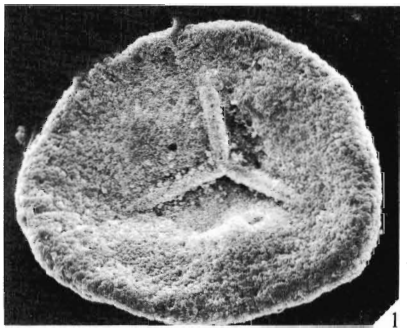
Plate 24, figs. 8 and 9

Description. Megaspores radial, trilete. Amb subtriangular with convex to almost straight sides and more or less rounded apices. Laesurae obscured by well-developed membraneous lips, 20–32 μm high at pole (height diminishing towards equator), with more or less acute crests 0·8–1·0 μm wide; lips extend at least four-fifths

EXPLANATION OF PLATE 24

Figs. 1–7. *Laevigatisporites subhorridus* sp. nov. 1 and 2, holotype, proximal surface (×200) and sculptural detail (×500); A1975/S1, Y.4659. 3, proximal surface, ×200; A1975/S4, Y.4660. 4, distal surface, ×100; A1975/S2, Y.4661. 5, proximal surface, ×200; A1975/S2, Y.4662. 6, proximal surface, ×200; A1974/S2, Y.4663. 7, proximal surface, ×200; A1975/S1, Y.4664.

Figs. 8 and 9. *Tuberculatisporites*? sp. A; proximal views, ×200. 8, A1974/S2, Y.4665. 9, A1974/S2, Y.4666.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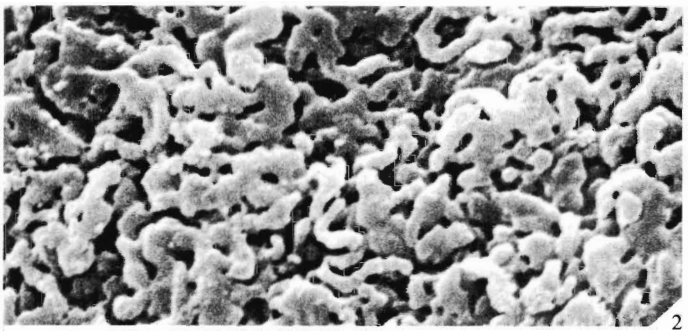
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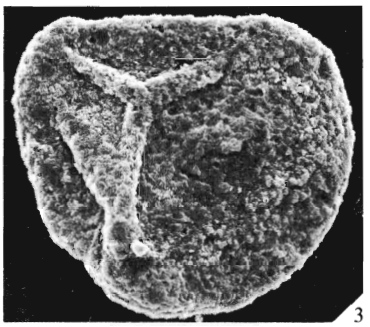
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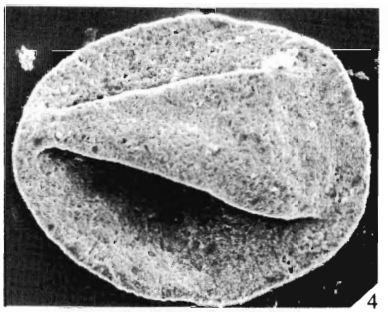
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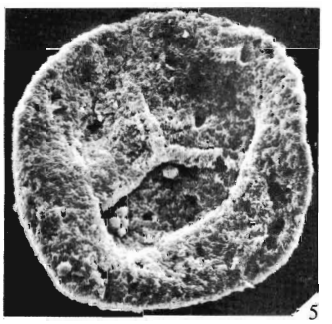
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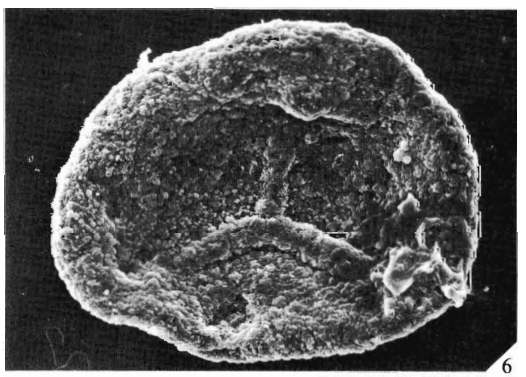
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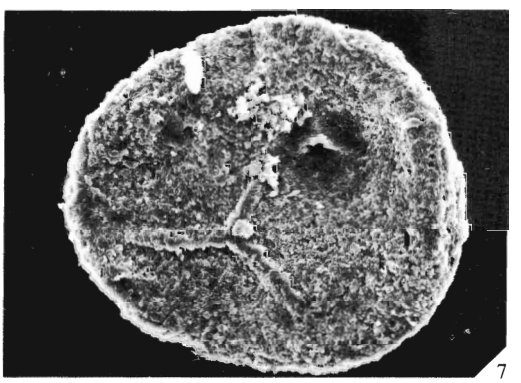
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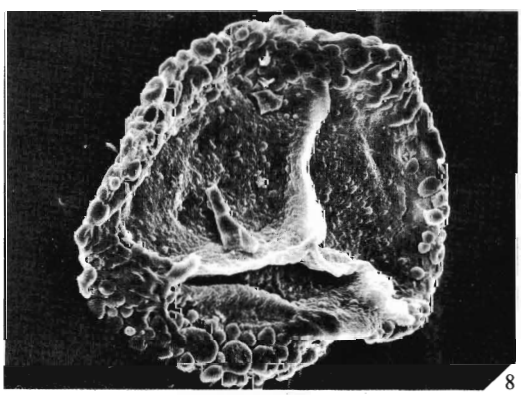
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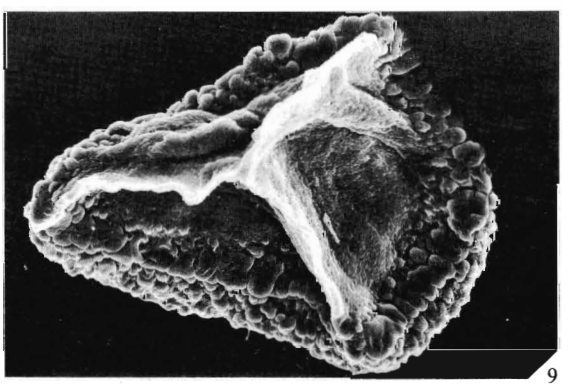
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PLAYFORD, Lower Carboniferous megaspores

of distance to equator. Contact faces somewhat depressed; sculpturally distinct from remainder of exine, being scabrate to granulate or finely verrucate (elements < 5 μm in diameter). Outside contact areas, exine conspicuously and densely verrucate; verrucae variable in size (5–32 μm broad basally, 5–25 μm high), but always closely spaced, particularly adjacent to contact areas where an irregular knobbly ridge-like feature is characteristically developed.

Dimensions (4 specimens). Equatorial diameter 230–258μm.

Remarks. The generic assignment is tentative because, by reference to Spinner's (1968, p. 404) and earlier diagnoses (e.g. Potonié and Kremp 1954, p. 138), the laesurae of the present specimens extend further than two-thirds of the distance to the equator, and the spores are appreciably smaller than is usually reported for the genus. No morphologically allied form has been encountered in available literature.

Suprasubturma LAGENOTRILETES R. Potonié and Kremp 1954
Subturma GULATI Bhardwaj 1957
Genus LAGENICULA Bennie and Kidston emend. Piérart 1978

Type species. Lagenicula horrida Zerndt 1934; by subsequent designation of Potonié and Kremp (1954, p. 151).

Discussion. A working party of the Commission Internationale de la Microflore du Paléozoïque (C.I.M.P.), actively involving a number of European workers since 1976, has revised and clarified the morphology and taxonomy of gulate megaspores, as represented, often conspicuously, in Carboniferous palynofloras. Their results were promulgated in Dybová-Jachowicz *et al.* (1979, 1982, 1984), but initially as a summary preview (but none the less formally) by Piérart (1978). Consequently, the authorship of new genera and of emendations of previously established genera (such as *Lagenicula* Bennie and Kidston 1886) arising from the working party's deliberations should be credited primarily to Piérart (1978). This accords with Jansonius and Hills (1979) but not with Scott and Higgs (1982) or Candilier *et al.* (1982).

Lagenicula clarkensis sp. nov.

Plate 25, figs. 1–6; Plate 26, fig. 2

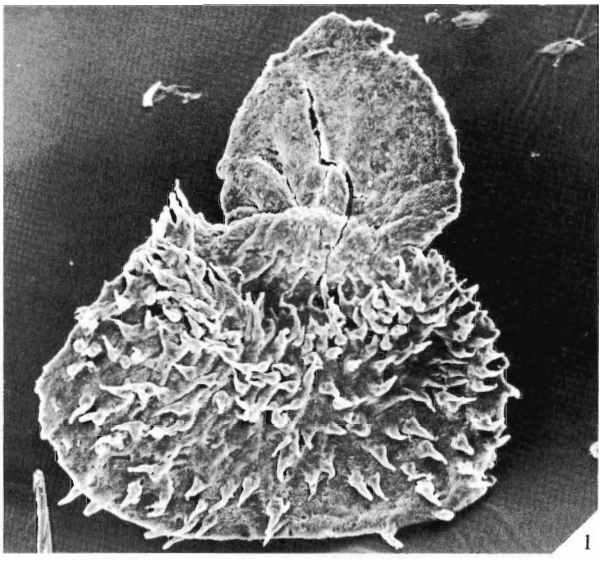
Etymology. After Clarke River, Queensland.

Diagnosis. Megaspores trilete, gulate; normally preserved in lateral (equatorial) compression which exhibits a more or less flask-shaped outline comprising spheroidal body surmounted by well-developed, undehisced apical prominence (hologula) on proximal side. Spore body itself is variable in outline: prolate, circular, to oblate. Hologula rounded triangular in outline (lateral view) with constricted base; laevigate; 120–420 μm high, 150–460 μm wide. Contact areas without bounding arcuate ridges; occupying about half of proximal surface; laevigate or with fine scattered spinae/coni. Proximo-equatorially and distally beyond contact areas, exine (*c.* 15–20 μm thick) bears discrete spinae that are fairly uniform in size and distribution on a given specimen but somewhat variable among specimens, of which the larger tend to bear the coarser spinae. Length of spinae 17–54 μm, basal diameter 6–36 μm, mutual (basal) separation 5–70 μm.

Dimensions (18 specimens). Polar diameter, excluding hologula, 280 (494) 920 μm; equatorial diameter 333 (593) 973 μm.

EXPLANATION OF PLATE 25

Figs. 1–6. *Lagenicula clarkensis* sp. nov. 1, holotype, lateral aspect, × 120; A1975/S1, Y.4667. 2, lateral aspect, × 120; A1975/S2, Y.4668. 3 and 4, lateral aspect (× 100) and sculptural detail (× 400); A1975/S3, Y.4669. 5, lateral aspect, × 100; L4773/S2, Y.4670. 6, lateral aspect, × 100; L4773/S1, Y.4671.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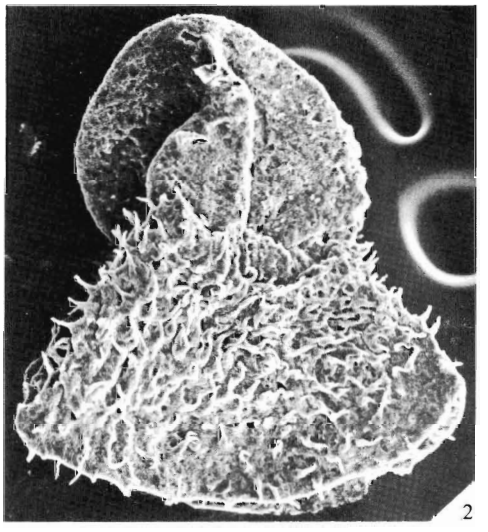
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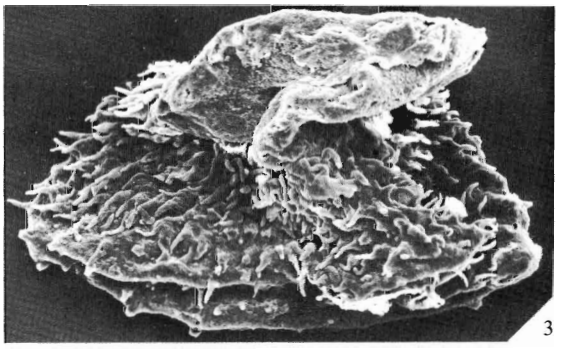
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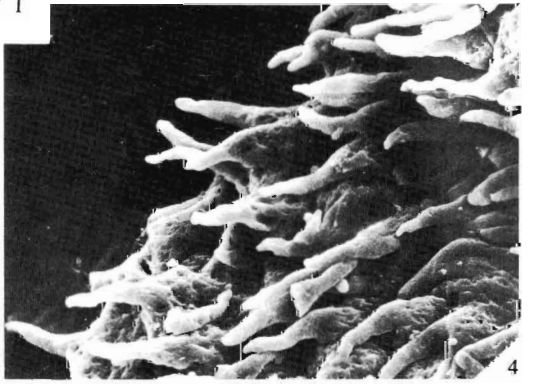
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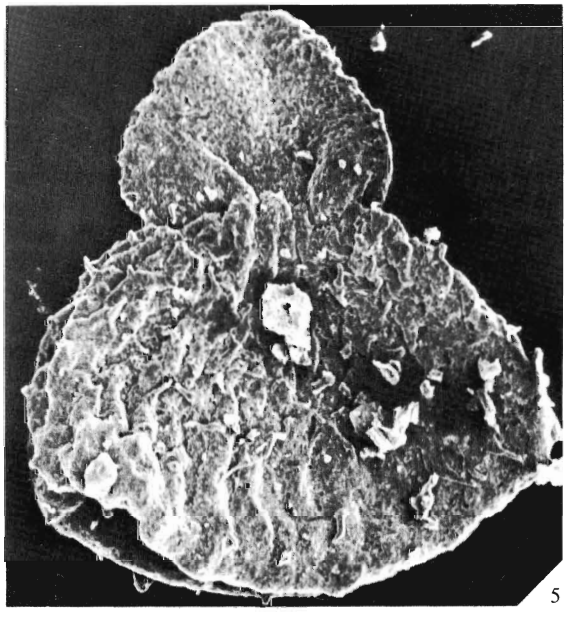
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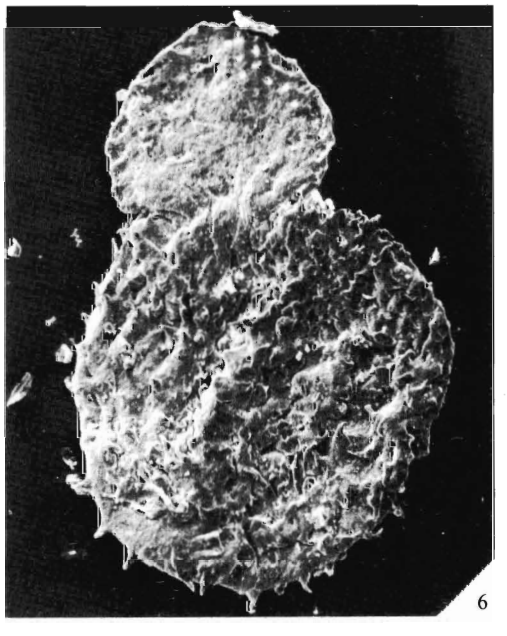
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PLAYFORD, Lower Carboniferous megaspores

Holotype. Specimen Y.4667; Plate 25, fig. 1. Equatorial aspect. Spore body oblate-ovate, 520 μm (equatorial axis) × 376 μm (polar axis); hologula rounded triangular with basal constriction, height 228 μm, breadth 233 μm; spinae of proximo-equatorial and distal exine 25–40 μm long, 8–18 μm broad basally, spaced 10–50 μm apart.

Type locality. Queensland, Clarke River Basin; north bank of Clarke River, G. R. 769 369 (Wando Vale 1 : 100 000 topographic map); Clarke River Formation, sample A1975, Lower Carboniferous (Viséan).

Remarks. Denuded specimens of *L. clarkensis* sp. nov. (e.g. Pl. 25, figs. 5 and 6) generally show blunted or broken spinae with irregularly pitted or channeled exine between the elements.

In comparison with *L. horrida* Zerndt 1934 (see Dybová-Jachowicz *et al.* 1982, pp. 6–7; pls. 1–4), which is known widely from Dinantian to Westphalian strata of the northern hemisphere, *L. clarkensis* embraces mostly smaller megaspores, having proportionately more conspicuous, unsplit apical prominences and no development of small subsidiary distal spinae. *L. clarkensis* shows some resemblance to *L. rarispinosa* (Dijkstra) Dybová-Jachowicz *et al.* 1982 (as described by Dijkstra (1971) from the Lower Carboniferous of Chad, north-central Africa), but differs chiefly by possessing a more rounded apical prominence and markedly shorter, less broadly based spinae. Also comparable is *Triletes variabilis*, described by Winslow (1962, pp. 34–35, pl. 7, figs. 3 and 4); but *L. clarkensis* is usually smaller than Winslow's species, develops no arcuate ridges, and bears spinae that are entirely unconnected with each other.

Lagenicula sp. A

Plate 26, figs. 5 and 6

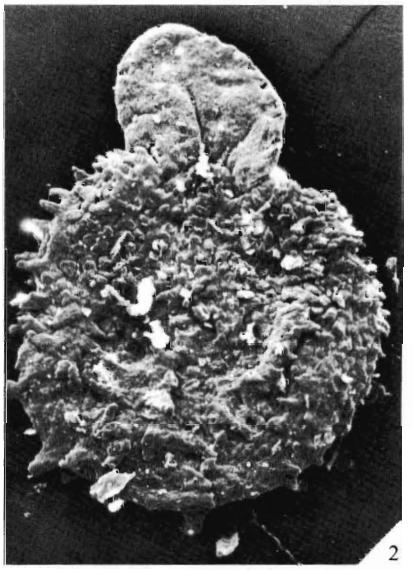
Description. Megaspores large, trilete, gulate. Outline (in solely observed lateral compressions) elongate flask-shaped, with prolate spore body exhibiting pointed distal extremity and broader, rounded to almost flat proximal side. From the latter projects an undehisced, laevigate, apical prominence that is relatively small but of the hologula type; rounded triangular in lateral view, 300–400 μm in height and width. Contact areas slightly depressed, extending interradially for a maximum of 20–30 μm beyond hologula, finely conate (coni up to *c.* 15 μm high, 15–20 μm in basal diameter) to almost laevigate; arcuate ridges perceptible. Remainder of exine (i.e. outside contact areas) bearing small discrete coni that are up to 30 μm high, 25 μm in basal diameter, 5–35 μm apart.

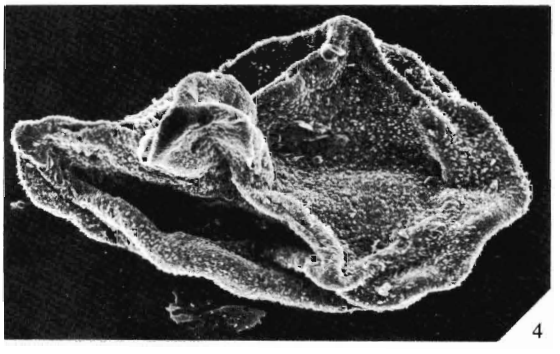
Dimensions (3 specimens). Polar diameter, excluding hologula, 1880–2500 μm equatorial diameter 1100–1850 μm.

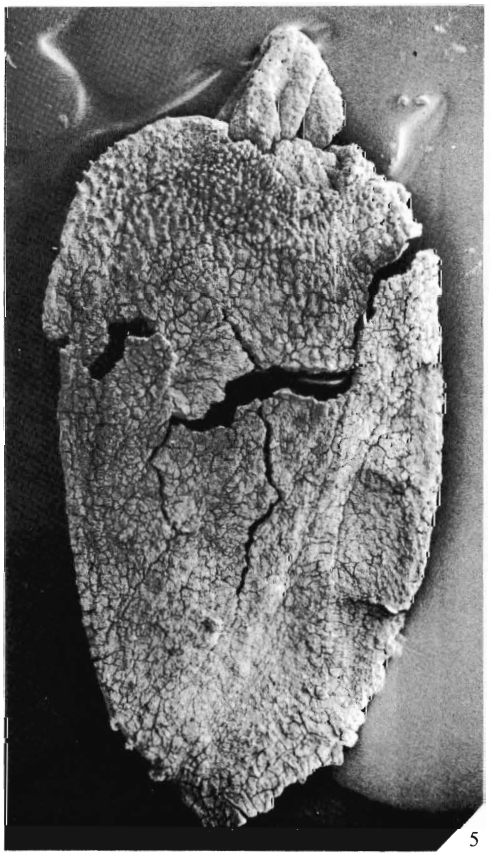
Remarks. This distinctive form, comprising the largest megaspores encountered in the palynoflora, can only be designated informally at this stage because of the small number of specimens available. Moreover, the specimen illustrated, albeit the best-preserved, exhibits a rather fragmented and distally denuded exine. Allocation to the genus *Lagenicula* rather than to *Sublagenicula* Piérart 1978 seems appropriate because the apical prominence, though relatively small, is a hologula rather than a subgula. No closely comparable species is evident in available literature.

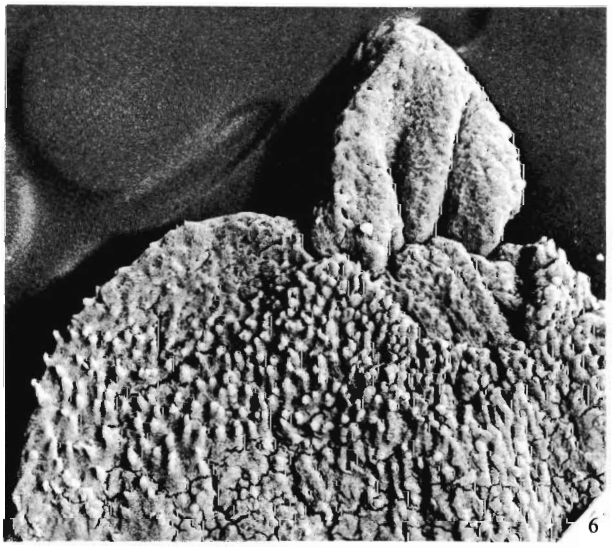
EXPLANATION OF PLATE 26

Fig. 1. *Lagenicula* sp. B. Lateral aspect, × 40; L4773/S3, Y.4673.
Fig. 2. *Lagenicula clarkensis* sp. nov. Lateral aspect, × 50; L4773/S3, Y.4672.
Figs. 3 and 4. *Setosisporites* sp. A. 3, lateral aspect, × 120; A1974/S1, Y.4680. 4, oblique proximal aspect, × 100; A1974/S2, Y.4679.
Figs. 5 and 6. *Lagenicula* sp. A. Lateral aspect, × 50 and × 100 respectively; A1975/S1, Y.4674.









PLAYFORD, Lower Carboniferous megaspores

Lagenicula sp. B

Plate 26, fig. 1

Description. Megaspore large, trilete, gulate. Outline (lateral compression) elongate-subcylindrical. Spore body markedly prolate with rounded polar 'ends' and near-straight to broadly convex 'sides'; at proximal polar region is developed a laevigate, undehisced hologula, rounded triangular in lateral view, 260 μm high, 390 μm broad basally. Contact areas without bounding arcuate ridges, only slightly depressed, sparsely and minutely conate. Remainder of exine, notably portion extending immediately beyond contact areas to about halfway to distal pole, bearing scattered, slender spinae, *c.* 30–90 μm long, 15–20 μm in basal diameter, 35–100 μm apart.

Dimensions (1 specimen). Polar diameter (length), excluding hologula, 1800 μm; width 780 μm.

Remarks. The strongly elongate body with relatively inconspicuous spinose sculpture renders this form distinct from other lageniculate members of the present palynoflora. It bears a superficial resemblance to some of the larger ('fertile') members of the 'seed megaspore' genus *Cystosporites* Schopf 1938. However, the latter's exine is structured by 'interlocking matted fibrils' not evident in the present specimen, which moreover is surficially spinose, not laevigate or reticulate as in *Cystosporites*. Also, the apical projection is more prominent in *Lagenicula* sp. B than is usual for *Cystosporites* (see, for example, Chaloner 1954, pl. 2, fig. 8).

Genus SUBLAGENICULA Piérart 1978

Type species. Sublagenicula nuda (Nowak and Zerndt) Jansonius and Hills 1979; by original designation. Note that Piérart's (1978, p. 371) putative combination of this species with *Sublagenicula* failed to conform with I.C.B.N. requirements by omitting to cite basionym reference fully.

Discussion. Piérart (1978, p. 371) and Dybová-Jachowicz *et al.* (1979, p. 415) proposed the same circumscription for this genus as part of lageniculate-megaspore taxonomic revisions undertaken comprehensively by a C.I.M.P. working group (cited previously under genus *Lagenicula*). The name *Sublagenicula* should, by priority, be attributed to Piérart, as noted by Jansonius and Hills (1979, card 3617), not to Dybová-Jachowicz *et al.* (cf. Higgs and Scott 1982; Candilier *et al.* 1982).

Sublagenicula jellii sp. nov.

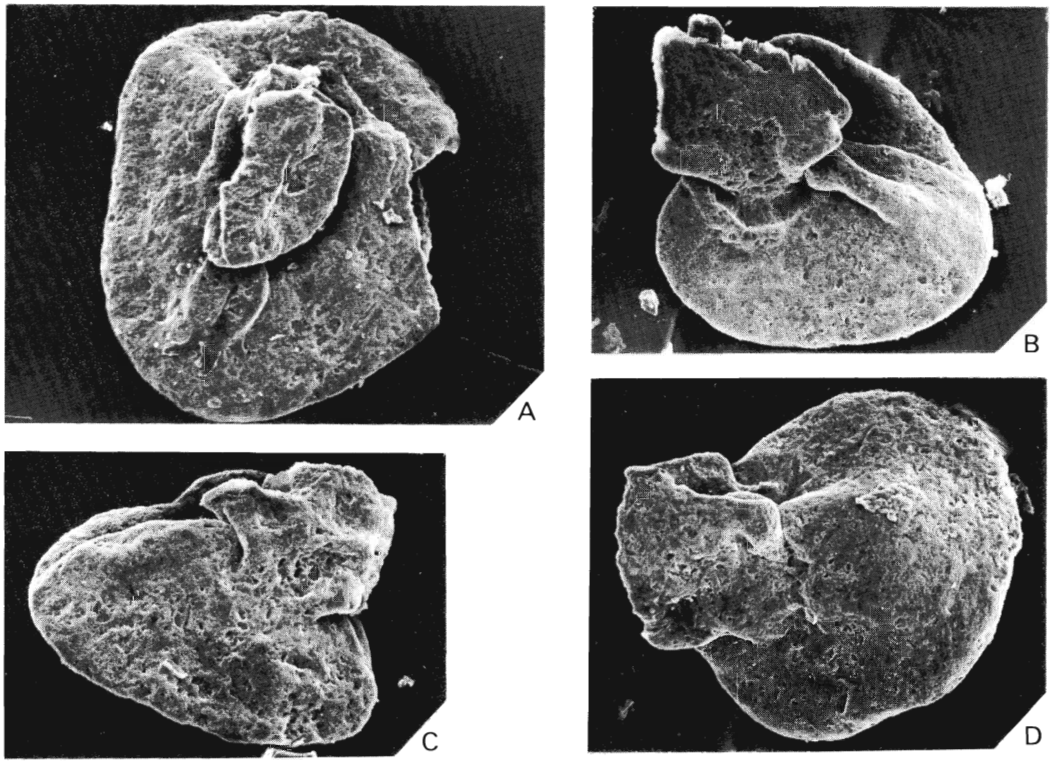
Text-fig. 2A–D

Etymology. After Dr J. S. Jell (see acknowledgements).

Diagnosis. Megaspores radial, trilete, gulate. Amb subtriangular with broadly rounded apices and slightly convex to straight sides; in lateral aspect, outline of spore body very slightly to distinctly oblate. Laesurae straight, extending at least three-quarters of distance to equatorial periphery, sometimes almost attaining the latter. Outer parts of laesurae with or without lips; when present, lips 30–35 μm high, individually 39–45 μm wide, not forming auricular expansions. Polar portions of laesurae (extending from pole to a maximum of about one-half of their full radial extent) associated with an abruptly elevated and distinctive apical prominence (subgula), whereon laesurae may be at least partly dehiscent or entirely non-dehiscent. Subgula more or less pyramidal (subtriangular in lateral aspect) with pointed to slightly rounded apex and conspicuously constricted base, producing overall an almost stalked or mushroom-like appearance to the polar structure. Height of subgula 160–310 μm; maximum width (i.e. above attenuated base) 210–295 μm. Contact areas not differentiated. Exine *c.* 12–15 μm thick, laevigate, apart from irregular corrosion-pitting.

Dimensions (9 specimens). Equatorial diameter 400 (467) 580 μm; polar diameter, excluding subgula, 245 (316) 430 μm.

Holotype. Specimen Y.4676; text-fig. 2B. Oblique proximal aspect. Amb roundly subtriangular, equatorial diameter 446 μm; subgula with constricted base 90 μm in diameter, widening to 270 μm at *c.* 130 μm above



TEXT-FIG. 2. A–D, *Sublagenicula jellii* sp. nov. A, proximal surface, × 100; L4773/S1, Y.4675. B, holotype, oblique proximal aspect, × 100; A1975/S1, Y.4676. C, lateral aspect, × 120; A1975/S3, Y.4677. D, proximo-lateral aspect, × 100; A1975/S3, Y.4678.

base, then tapering regularly to bluntly pointed apex 273 μm above base, upper margin somewhat ragged towards apex; laesurae continue beyond subgula to near-equatorial limits and are flanked by fold-like lips, each *c.* 39 μm wide and 35 μm high; exine entirely laevigate, apart from some irregular preservational pitting.

Type locality. Queensland, Clarke River Basin; north bank of Clarke River, G. R. 769 369 (Wando Vale 1: 100 000 topographic map); Clarke River Formation, sample A1975, Lower Carboniferous (Viséan).

Remarks. *S. jellii* sp. nov. differs from *S. nuda* (Nowak and Zerndt) Jansonius and Hills 1979 and other laevigate members of the genus in the distinctive form of its subgula.

Genus SETOSISPORITES Ibrahim emend. Piérart 1978

Type species. *Setosisporites hirsutus* (Loose) Ibrahim 1933; by original designation.

Discussion. Since its original institution the circumscription of this genus has been variously modified by Potonié and Kremp (1954, p. 152), Spinner (1969, p. 445), Piérart (1978, p. 371), and Dybová-Jachowicz *et al.* (1979, p. 415). The two last-cited publications, representing the views of the C.I.M.P. megaspore working group mentioned previously (see genus *Lagenicula*), contain the same proposal for emendation (contrary to the statement by Jansonius and Hills 1980, card 3754), for which authorship by priority is thus attributed to Piérart.

Setosisporites sp. A

Plate 26, figs. 3 and 4

Description. Megaspores radial, trilete, gulate. Amb subtriangular; in lateral aspect, outline of spore body subspherical or slightly oblate (but distorted by compression). Laesurae more or less straight, extending almost to equator, flanked by rounded, elevated lips, individually 20–25 μm wide and high, becoming abruptly expanded and more elevated in polar one-quarter to one-third of laesurae constituting there an apical prominence (subgula) that is rounded triangular in lateral view, *c.* 150–175 μm wide, 100–160 μm high at pole itself, and shows slight basal constriction. Contact areas somewhat depressed, occupying bulk of proximal surface, bounded by rounded arcuate ridges, *c.* 18–30 μm high, 20–30 μm wide. Exine of contact areas, non-gulate lips, arcuate ridges, and remainder of exine finely conate-spinose to verrucate; elements outside contact areas tend to be slightly coarser (more protrusive) and of more distinctly conate to spinose (rather than verrucate) form. Height and basal diameter of sculpturing elements 2–7 μm, spacing up to 8 μm (some fused basally).

Dimensions. Equatorial diameter (2 specimens) 420–650 μm; polar diameter (1 specimen), excluding subgula, 370 μm.

Remarks. Setosisporites sp. A is distinguishable from *S. brevispinosus* (Zerndt) Brzozowska 1968 chiefly in possessing comprehensive apiculate sculpture, proportionately larger contact areas that are not radially undulant, and a relatively more prominent subgula. *S. indianensis* (Chaloner) Spinner 1969 has, compared to the Queensland form, a more or less circular amb, larger size, and coarser sculpture.

DISCUSSION

This quantitatively and qualitatively restricted megaspore assemblage of Viséan age is dominated by two of the species described above—*Lagenicula clarkensis* and *Laevigatisporites subhorridus*—associated with lesser numbers of *Sublagenicula jellii*. The other, informally designated species, attributed to the genera *Lagenicula*, *Setosisporites*, and *Tuberculatisporites*, are each represented by only occasional specimens.

In the absence of any previous Australian Carboniferous megaspore studies, no basis exists for comparison in a biostratigraphic context, at least on a local or regional scale. Moreover, as mentioned previously, Lower Carboniferous megaspore floras have not been extensively researched elsewhere. From the available literature the Queensland assemblage shows a very general similarity with described latest Devonian–Early Carboniferous assemblages, although there are no common denominators at species level. The similarity is in the relative plenitude and range of lageniculate forms encountered, although these do, of course, characterize the later Carboniferous as well (Dybová-Jachowicz *et al.* 1979).

So far as botanical alliances of the palynoflora are concerned, only broad generalizations are possible since none of the forms described is known from *in situ* occurrences. The conspicuous lageniculate component (*Lagenicula*, also *Sublagenicula*) would almost certainly have derived from lepidodendrid plants (see Felix 1954; Potonié 1962, pp. 49–61), which as previously mentioned are well-represented in the associated (albeit poorly preserved) megaflora. The relatively inconspicuously gulate form, termed *Setosisporites* sp. A, was also presumably a lycopod derivative of either arborescent (Bothrodendraceae) or herbaceous (cf. *Porostrobus*) nature (Potonié 1962, p. 63; Chaloner 1962, p. 83). The genus *Tuberculatisporites*, to which a few specimens of the subject palynoflora are tentatively ascribed, has long been regarded as allied with the Sigillariaceae (Potonié 1962, pp. 65–69, 1967, p. 44; Spinner 1968, p. 400). The same could also be true of *Laevigatisporites* (as represented herein by *L. subhorridus*). In general, therefore, the character of the megaspore assemblage implies derivation chiefly from heterosporous lycopods of arborescent type.

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