# REDESCRIPTION OF SOME FOSSIL FUNGAL SPORES

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## Abstract

New photographs of 27 species of fossil fungal spores from various publications, and new descriptions of eight of these, are presented in order to substantiate the basis for some nomenclatural changes in the *Synopsis of fossil fungal spores, mycelia and fructifications* (Kalgutkar and Jansonius, 2000).

### INTRODUCTION

Kalgutkar and Jansonius (2000) recently completed a major revision of the nomenclature of fossil fungal spores. The resulting rationalization of the nomenclature is documented in the *Synopsis of fossil fungal spores, mycelia and fructifications*, in which some 950 validly published species (attributed to some 230 fossil and 70 extant genera) were evaluated, and the original descriptions and diagnoses cited in full. By a more rigorous application, and occasional emendation of the parameters defining the individual genera, we made the content of each one more coherent. This resulted in some 350 new combinations, as well as 31 new names replacing junior homonyms. All species were illustrated, on 37 plates, by (mostly new) line drawings, that were electronically scaled to uniform magnifications.

Some of our interpretations were based not only on the original descriptions, but also on our (re)interpretation of the morphology shown in the original illustrations. While scrutinizing these, we sometimes had difficulty determining the true structure of a particular form (due, e.g., to poor reproduction techniques or too close cropping of photographs, or sometimes to opacity of the spore wall). In such cases we would contact the original author, where that seemed a practical possibility, and ask for new prints from the original negatives, new photographs, the loan of the type slide, or any further information. We were gratified by the response to our requests.

After we had seen the original material, we felt justified that our arguments for making the (sometimes drastic) nomenclatural changes were sound. However, we also realized that few colleagues would have a similar chance to examine these new data for themselves. For that reason, we here provide the evidence in the form of new photographs and descriptions of some types, or new prints from original negatives.

Specifically, we deal with four papers with some imperfect illustrations, for which we try to provide upgraded ones. We received type slides from Clarke (1965) and Mustard and Rouse (1994). We also received the negatives used in the study by Salard-Cheboldaeff and Locquin (1980), from which we could make new prints. We further received new Polaroid photographs of an original type from Traverse and Ash (1994).

The type slides of Clarke's paper (originally intended to be preserved in the Oklahoma Geological Survey) were still in possession of the author, who now has consented that they be entered into the permanent collections of the Geological Survey of Canada. Similarly, the type slides used by Mustard and Rouse also have been submitted to the collections of the Geological Survey of Canada; all these are now curated in Calgary (alongside the slides of Kalgutkar's studies, etc.). [The new names in Mustard and Rouse were not validly published; Rouse and Mustard (1997) validly published these names, with some technical corrections.] The negatives loaned by Dr. Salard-Cheboldaeff have been returned to Paris, France.

There were more papers where we had difficulty in understanding illustrated morphology, but we found it not practical to try and call all of these in.

It is of interest to note that two of the restudied type specimens (*Lacrimasporonites levis*, *Diporicellaesporites serratus*) appear to have changed appearance to such extent that, but for their location marked on the original slides, they would likely not have been recognized as being the same specimen.

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FUNGAL SPORES FROM VERMEJO FORMATION COAL BEDS (CLARKE, 1965)

The plate of microphotographs, as others from the University of Oklahoma of that period, reflects the preference of Dr. L.R. Wilson for the photographs of all specimens to be printed at closely similar size (which he thought made for a more esthetically pleasing plate). Magnifications ranged from x577 to x1200, which makes visualization of the role of size in taxonomy more difficult.

The specimens will now be curated in the permanent collections of the Geological Survey of Canada, Calgary, and accordingly have received a "GSC type number," which will facilitate retrieval for future re-examinations. For the type specimens re-illustrated on our Plate 1, these numbers are listed in the plate description. For those specimens not included in our Plate 1, these numbers follow below:

GSC type number #117206 — *Pluricellaesporites scabiosus* Clarke 1965
GSC type number #117207* — *Fractisporonites moniliformis* Clarke 1965
GSC type number #117208* — *Fractisporonites canalis* Clarke 1965
GSC type number #117212 — *Involutisporonites foraminus* Clarke 1965
GSC type number #117213 — *Dyadosporites ellipsus* Clarke 1965

[The *asterisk indicates specimens mounted on two slides that are still in the possession of the author (as a result of his recent retirement and moves, they are held back in off-site storage); however, the intention is that these will eventually be sent to Calgary, for curation with the other type slides.]

Genus *Ctenosporites* Elsik & Jansonius 1974

**Type.** *Ctenosporites eskerensis* Elsik & Jansonius 1974.

**Diagnosis (as here rephrased).** Multicellular comb-shaped conidiospores, that consist of a main stem of a few to several (commonly seven–nine) cells which carry joined lateral (secondary) septate branches (viz. hyphae or filaments) along one side of the main stem. Main stem and lateral branches straight to slightly curved; (distal) apex of the main stem may curve towards the side of the lateral branches; lateral branches may curve to the apex of the main stem. Basal (proximal) cell of the stem generally torn, may be thinner-walled than portion of the stem bearing branches. Branches have a few to several (commonly five–seven) cells, septa may be incomplete, but invariably the apical branch has fewer septa (in most cases none) than the more proximal branches; the progression commonly is one more septum in each adjacent, more proximal, branch. Apical cell(s) of the stem may mimic the most apical branch or may be lacking altogether.

**Remarks.** Structurally somewhat reminiscent of *Pesavis*, but in *Ctenosporites* the structure is one-sided and the lateral branches are not free; however, overall morphology and occurrence suggest that *Ctenosporites* and *Pesavis* could be related.

Lange and Smith (1975b) described a fungal mycelium bearing *Ctenosporites* from a fossil angiosperm anther containing *Proteacidites asperopolus* Stover & Evans from the Maslin Bay Flora, South Australia. After observation of large numbers of *Ctenosporites*-type structures they suggested that the entire range of variation of *Ctenosporites* can be produced by the same (type of) mycelium. *Ctenosporites* was compared to the extant genus *Dictyosporium* Corda 1836.

Martha Sherwood (letter to RMK and JJ, 1997) suggested that the specimen illustrated by Clarke (1965, pl. 1, fig. 8, Fungal Spore sp. A) actually could be a complete specimen of *Ctenosporites*, and that thus the description of the type species, *C. eskerensis* Elsik & Jansonius 1974, could be based on only half a spore. The complete spore, she proposes, is cheroid, bilaterally symmetrical, with two main filaments connected by a delicate, thin-walled basal cell, which nearly always breaks up during palynological extraction. Except in its possession of a single central filament rather than two, the spores of extant *Dictyosporium toruloides* are very similar, even to the thin-walled basal cell and thin-walled tips to the secondary branches. If this observation is confirmed, Fungal Spore sp. A will be the first recorded occurrence of *Ctenosporites* in the Upper Cretaceous; as well, an overall revision of the genus will be necessary. *Ctenosporites*, thus interpreted, would appear to be related to *Dictyosporium*; however, that would not automatically make it a junior synonym of *Dictyosporites* or *Dictyosporium*.

**Derivation of Name.** From Greek *kteis, ktenos* = comb.

*Ctenosporites sherwoodiae* Kalgutkar & Jansonius 2000
Plate 1, fig. 5

Fungal Spore sp. A — Clarke 1965, p. 93, pl. 1, fig. 8; holotype marked on slide OPC 833 M-1, in a numbered black ink ring (#11).

**Description.** Comb-shaped, multicellular fungal conidiospores; individual spore units divergent uniseriate, occurring in pairs; septa simple, cells 3–10 μm in diameter,

cell walls ca 0.2–0.5 μm thick, apparently thicker (because darker) where parts of the constituent cells overlie others; overall dimensions 51–56 μm.

**Remarks.** The two parts of the fungal spore are partly free; the three or four distalmost cells of the shaft of the left wing freely overlie the shaft of the right wing; the distalmost cell of the right shaft is broken away. More proximally, the shafts appear to be fused, as the septa and cell walls show evidence of fusing and affecting each other's outline. A few of the (transverse) septa show septal folds, indicating that septal pores may be present.

It is not clear, as only one complete (and two "fragmentary") specimens were found, whether this fusion is an unusual occurrence. However, we feel justified in naming the form as a new species, because it will help recognition of other specimens so far overlooked, as well as of Sherwood's broader interpretation of the inherent structure of this genus. See also our Remarks under the genus.

**Age.** Late Cretaceous (coals).

**Location.** Vermejo Formation coal beds, Fremount County, Colorado, USA.

## Genus *Inapertisporites* van der Hammen 1954

**Type.** *Inapertisporites pseudoreticulatus* van der Hammen 1954
(nom. corr. pro *Inapertisporites pseudoreticulatis* v.d.Hammen 1954).

**Diagnosis** (as emended by Elsik, 1968). Inaperturate, psilate fungal spores. One cell, no septa. Shape variable.

### *Inapertisporites clarkei* Kalgutkar & Jansonius 2000
Plate 1, fig. 4

*Inapertisporites clarkei* Kalgutkar & Jansonius, 2000, p. 147.(nom. nov.)
*Monoporisporites globosus* Clarke 1965, p. 87, pl. 1, fig. 11; holotype marked on slide OPC 830 A-3, in a numbered India ink ring (#4); England Finder O58/2-O59/1.
Non: *Inapertisporites globosus* Salard-Cheboldaeff & Locquin 1980.

**Description** (as emended by Kalgutkar and Jansonius, on basis of the single grain illustrated). The type is a globular medium-brown inaperturate fungal amerospore with a near-perfect circular outline that shows no trace of a hilum. The feature originally interpreted as a "pore" we consider to be mechanical damage incurred during fossilization, which resulted in a perforation with four cracks radiating out at more or less square angles, and a slight flattening of the outline. The type specimen is 26.5 μm in diameter; its wall is of even thickness (about 1.5 μm), smooth to faintly and minutely scabrous.

**Remarks.** As the spore appears to be inaperturate, Kalgutkar and Jansonius transfered it to the genus *Inapertisporites*. Since the binomial *I. globosus* was occupied, they proposed the new name *I. clarkei*, in recognition of the continuing efforts of Robert T. Clarke to provide palynologists with excellent printed documentation, through his role in the American Association of Stratigraphic Palynologists Foundation.

Clarke stated that his monoporate/–hilate species was the most common fungal species in his preparations. We scanned the type slide, and found only two more similar specimens, of which one very clearly showed a (slightly aspidate) hilum (not unlike that in the, smaller, *M. neoglobosus* Kalgutkar & Jansonius). Its size and overall appearance resembled that of *I. clarkei*, but as the latter lacks a pore/hilum, these two forms should not be assigned to the same genus.

We contemplated describing this hilate form as a new species of *Monoporisporites*. However, there seemed to be no features to differentiate it from *M. novus* Chandra, et al. (20 μm), *M. traversii* (Ediger & Alisan) Kalgutkar & Jansonius (22.5 μm) or *M. keralensis* Ramanujam & Rao (28 μm). We did not see enough specimens to establish a size range for this 'monoporate' *I. clarkei*, and without that, we could see no point in formally naming this form.

**Age.** Upper Cretaceous.

**Location.** Colorado, U.S.A.

## Genus *Lacrimasporonites* Clarke 1965

**Type.** *Lacrimasporonites levis* Clarke 1965.

**Diagnosis** (as emended by Kalgutkar and Jansonius 2000). Unicellate smooth-walled fungal spores, mostly medium-sized, spatulate to lacrimate, rarely approaching elliptical; with both a flat hilar scar at one end, and a round pore at the opposite end of the spore.

**Remarks.** Kalgutkar and Jansonius proposed that amerospores with a single real pore (or pore-shaped hilum), irrespective of their overall shape, be included in a revised *Monoporisporites*. This entailed transferring a large number of species previously included in *Lacrimasporonites*.

Spores with both an apical pore and a basal attachment scar or hilum are assigned to *Lacrimasporonites*; the type of the latter, *L. levis*, was redescribed and illustrated after a new examination of the holotype. The above emendation largely agrees with observations of Elsik (1992,

unpubl.). Parsons and Norris (1999) followed Elsik's interpretation, but did not formally emend the generic diagnosis.

*Lacrimasporonites levis* Clarke 1965
Plate 1, fig. 7

*Lacrimasporonites levis* Clarke 1965, p. 87, pl. 1, fig. 10; holotype marked on slide OPC 833 M-1 by a numbered engraved ring (#12); England Finder K30/2.

**Original Description.** Fungal spores unicellular (amerosporous), elliptical, hilate or monoporate, "pore" diameter 1–2 μm, cell wall psilate, 1 μm thick, overall dimensions 12–15 x 20–27 μm.

**Description** (as emended by Kalgutkar and Jansonius, 2000). The type is a fusiform unicellate fungal spore, at one end showing a distinct hilum (developed as a small flat area underlain by a thickening of the spore wall), and at the opposite more tapered end showing a pore that is developed as a small invagination underlain by a thinner wall.

The designated type specimen (our Plate 1, fig. 7) measures 12 x 19.5 μm; the wall is 0.7 μm thick, 1 μm at the hilum, and ca 0.3 μm below the pore. Overall range given by Clarke is 12–15 x 20–27 μm; the hilum is ca 3.5–4.0 μm wide, the pore ca 2.5–3.2 μm.

**Remarks.** The dimensions of the type specimen here illustrated differ from those given for the type as illustrated by Clarke in 1965 (pl. 1, fig. 10; 14 x 25 μm). Also, the outline of the ringed type is slightly less slender than that illustration. It would appear that the ringed specimen may not be the same as that illustrated in pl. 1, fig. 10. (Could possibly the shape of the type have been affected by the mounting medium?) We found several additional specimens on the type slide, all corresponding closely to the specimens illustrated in 1965.

**Age.** Late Cretaceous.

**Location.** Canon City coal field, Colorado, U.S.A.

Genus *Pluricellaesporites* van der Hammen 1954

**Type.** *Pluricellaesporites typicus* van der Hammen 1954.

**Diagnosis** (as compiled from earlier emendations). Generally elongate, cylindrical or oval, fungal spores with three or more cells of more or less uniform size; cells aligned along a long axis that essentially also is a symmetry axis; wall smooth, scabrate or with low ornamentation; septa usually thin, but with a slight thickening of the septal bases; septa commonly split (at a central pore?), thus producing septal flaps; at one (the proximal) end with a single pore or hilum, but cell at distal end closed, rounded, its wall usually as thick as in other cells.

*Pluricellaesporites psilatus* Clarke 1965
Plate 1, fig. 21a, b

*Pluricellaesporites psilatus* Clarke 1965, p. 90, pl. 1, fig. 3.

**Remarks.** The holotype is closed at the distal end (bottom in pl. 1, fig. 3 of Clarke, 1965). The opposite end of the grain is overlain by a piece of opaque woody material. Under oil immersion, it appeared that this covered end is not rounded, but terminates with a flat surface.

In order to resolve this critical detail, we examined the type under a confocal laser microscope (Plate 1, fig. 21b). This resulted in the clear observation of a proximal hilum, consisting of a flat end with somewhat protruding corners (representing a shallow collar?), slightly off-center, as well as of a small septum, that apparently had fallen inwards from the hilum in response to compressional forces, and which shows a central pore surrounded by a circular thickening.

Clarke (1965, pl. 1, figs. 1–2) also assigned to this species two catenate spores, each consisting of five cells and mutually linked at a deeply incised septum, with their opposite free ends being flat and porate/hilate. This form is not conspecific with *P. psilatus*, and now would be assigned to *Diporicellaesporites*.

## TERTIARY SEDIMENTARY ROCKS, SOUTHWESTERN BRITISH COLUMBIA. APPENDIX (MUSTARD AND ROUSE, 1994)

Genus *Fusiformisporites* Rouse 1962

**Type.** *Fusiformisporites crabbii* Rouse 1962.

**Diagnosis** (as emended by Elsik, 1968). Inaperturate, dicellate fungal spores bearing characteristic elongate striae, ribs, ridges or costae oriented parallel to the long axis of the spore. Wall of one or more layers. Inner surface of wall psilate to punctate or scabrate. Equatorial septum of two layers. Equatorial constriction of wall may or may not be present.

*Fusiformisporites lineatus* Rouse & Mustard 1997
Plate 1, fig. 1

*Fusiformisporites lineatus* Mustard & Rouse 1994, p. 142, pl. 13, fig. 1 (nom. nud.).
*Fusiformisporites lineatus* Rouse & Mustard, 1997, p. 207.

**Remarks.** Having had the opportunity to study the holotype, we noticed that the deep melanin-brown spore wall in this species, generally of a uniform thickness of ca 0.75–1.0 μm, has a slight thinning near the polar extremities, thereby differentiating what appears to be a polar cap that readily detaches or hinges open. The striations in this form, generally some 3–5 in each cell with a uniform width of 0.3–0.9 μm (and possibly a few additional narrower and shorter striae), are sharply drawn straight grooves cutting into and even through the sturdy and somewhat brittle spore wall (whereas in other species in this genus the striate pattern is more commonly caused by gradually thickening of the spore wall into ridges, leaving thinner walled regions between them). In the holotype there are about three to four striae on each cell, each ca. 0.4–0.8 μm wide, and most extending right to the polar caps. Dimensions for the species are 58–62 x 23–29 μm.

**Age.** (Index species for) Late Eocene to Early Oligocene.

**Location.** Western coast of North America.

Genus *Polycellaesporonites* Chandra et al. 1984

**Type.** *Polycellaesporonites bellus* Chandra, Saxena & Setty 1984.

**Diagnosis** (as emended by Kalgutkar and Jansonius, 2000). Muriform spores with a (proximal) hilum, and distally with an elongated, knob-like or beaked, extension; overall structure as that in modern *Alternaria*.

*Polycellaesporonites acuminatus* (Rouse & Mustard) Kalgutkar & Jansonius 2000
Plate 1, fig. 2

*Multicellaesporites acuminatus* Mustard & Rouse 1994, p. 142, pl. 4, fig. 15 (nom. nud.).
*Multicellaesporites acuminatus* Rouse & Mustard 1997, p.208.
*Piriurella acuminata* (Rouse & Mustard) Parsons & Norris 1999, p. 139.

**Original Description.** Fusiform fungal spores, consisting of 5–6 thin septa in each half; each septum with a small central pore; septa supporting an inner membranous body that is closely appressed to the outer wall in central regions, but contracted away from the outer wall towards the two pointed extremities; wrinkles occur sporadically on the inner wall that appear as elongate irregular plicae.

**Description** (as emended by Kalgutkar and Jansonius, 2000): Fusiform conidiospores, truncated at one (the proximal and hilate) end, and somewhat drawn out into a sharp point at the other. With about 9–12 transverse septa, and with a few longitudinal septa in the wider, central part of the spore. Spore wall and septa thin (up to 0.5 μm), with slightly thickened septal bases, the longitudinal septa very thin. In the holotype no septal pores can be distinguished. The spore wall shows a number of narrow longitudinal folds that mimic the longitudinal septa. Dimensions: range of length 62–68 μm; of diameter 17–25 μm.

**Remarks.** Parsons and Norris (1999, p. 139) found similar material as that of Mustard and Rouse, but much better preserved, in which one end of the spores (presumably the proximal end) is clearly truncated, showing a hilum or pore. These authors also showed the muriform septation, which Mustard and Rouse interpreted as plications of an "inner body." Kalgutkar and Jansonius did not agree with the transfer of this species to *Piriurella* by Parsons and Norris, but rather assigned it to *Polycellaesporonites*.

**Age.** Late Paleocene.

**Location.** Strait of Georgia, eastern Vancouver Island, the Fraser River lowlands of southwest British Columbia, and the northwestern Washington State, USA.

Genus *Spirotremesporites* Dueñas-Jimenez 1979

*Varisulcosporites* Rouse & Mustard 1997.

**Type.** *Spirotremesporites simplex* Dueñas-Jimenez 1979.

**Diagnosis** (as emended by Elsik, 1990). Psilate, aseptate fungal spores. The aperture is a single furrow at an angle to the axis of the spore, straight or curved to S-shaped or sigmoidal in outline, or spiral around the spore axis. The furrow can be short and straight, entirely visible on one face of the spore; longer and curved; or long and spiral around the outside of the spore. The spore wall is generally rigid. The spore outline is elongate elliptical to oval, sometimes somewhat reniform in side view, i.e. with bilateral symmetry. The ends of the spore can be similar or dissimilar; one end can be truncated by an attachment scar.

*Spirotremesporites eminens* (Rouse & Mustard) Kalgutkar & Jansonius 2000
Plate 1, fig. 3

*Varisulcosporites eminens* Mustard & Rouse 1994, p. 143, pl. 11, fig. 6 (nom. nud.).
*Varisulcosporites eminens* Rouse & Mustard 1997, p. 208.

**Original Description** (Rouse and Mustard). Elliptical outline; spore wall levigate and dark melanin brown, about 0.5 μm in equatorial regions, thickened to about 1.25 μm at

the poles to form apical caps. Aperture a single sulcus (in holotype weakly oblique), or sometimes developed as an oblique sulcus, extended as a thin groove towards both poles, plus a second thin groove on the opposite side, also extending to the poles, possibly connecting at the poles with the two grooves coming off the main sulcus. Dimensions: range of length 22–46 μm; of width 18–20 μm.

**Description** (as emended by Kalgutkar and Jansonius, 2000). Unicellate spores, outline elliptic to elongate oval, with narrowly rounded ends; wall smooth, rigid, firm, fairly darkly pigmented, ca 0.7 μm thick in the central part, gradually thickening to ca 1.3 μm at the ends. Germinal(?) furrow about a third of the total length of the spore; holotype measures 43 x 18 μm, the furrow 15 μm, of which the middle third is open.

**Remarks.** The furrow runs slightly oblique to the long axis; in the holotype, we could not discern any indication of an extension of the furrow running to the poles, nor of a second groove running on the opposite side.

Transfer of this species, the type of the genus *Varisulcosporites*, to *Spirotremesporites*, makes *Varisulcosporites* a junior taxonomic synonym of the latter.

**Age.** Late Eocene–Early Oligocene.

**Location.** Strait of Georgia, eastern Vancouver Island, the Fraser River lowlands of southwest British Columbia, and northwestern Washington State, Canada and USA.

## FUNGAL SPORES FROM JURASSIC ROCKS OF HELL'S CANYON, IDAHO–OREGON (TRAVERSE AND ASH, 1994)

### Genus *Diporicellaesporites* Elsik 1968

**Type.** *Diporicellaesporites staceyi* Elsik 1968.

## PLATE 1

All figures magnified x1000 (except fig. 22?; see text); GSC numbers refer to curation roster.

1 *Fusiformisporites lineatus* Rouse & Mustard; GSC 116594.

2 *Polycellaesporonites acuminatus* (Rouse & Mustard) Kalgutkar & Jansonius; GSC 116461.

3 *Spirotremesporites eminens* (Rouse & Mustard) Kalgutkar & Jansonius; GSC 116571.

4 *Inapertisporites clarkei* Kalgutkar & Jansonius; GSC 117209.

5 *Ctenosporites sherwoodiae* Kalgutkar & Jansonius; GSC 117210.

6 *Lacrimasporonites fusoides* (Salard-Cheboldaeff & Locquin) Kalgutkar & Jansonius.

7 *Lacrimasporonites levis* Clarke; GSC 117211.

8a, b *Hypoxylonites africanus* Salard-Cheboldaeff in Kalgutkar and Jansonius (2000); two focal levels of same grain.

9a, b *Hypoxylonites ellipsoideus* Salard-Cheboldaeff in Kalgutkar and Jansonius (2000); two focal levels of same grain.

10 *Hypoxylonites xylarioides* Salard-Cheboldaeff in Kalgutkar and Jansonius (2000).

11 *Didymosporonites saccatus* Salard-Cheboldaeff & Locquin.

12 *Striadiporites boletelloides* Salard-Cheboldaeff & Locquin.

13 *Dictyosporites morularis* (Salard-Cheboldaeff & Locquin) Kalgutkar & Jansonius.

14 *Hilidicellites strangulatus* (Salard-Cheboldaeff & Locquin) Kalgutkar & Jansonius.

15 *Hilidicellites teleutosporoides* (Salard-Cheboldaeff & Locquin) Kalgutkar & Jansonius.

16 *Hilidicellites didymus* (Salard-Cheboldaeff & Locquin) Kalgutkar & Jansonius.

17 *Dyadosporites clarkii* (Salard-Cheboldaeff & Locquin) Kalgutkar & Jansonius.

18 *Dictyosporites dictyosus* (Salard-Cheboldaeff & Locquin) Kalgutkar & Jansonius.

19 *Dictyosporites ovoideus* Salard-Cheboldaeff & Locquin.

20a, b *Dictyosporites ovoideus* (Salard-Cheboldaeff & Locquin) Kalgutkar & Jansonius; two focal levels of same grain.

21a, b *Pluricellaesporites psilatus* Clarke. 21a: composite of two negatives of different focal levels; distal end is closed, proximal end is obscured by piece of opaque woody tissue. 21b: detail of proximal end, observed by confocal laser microscope. GSC 117205.

22 *Multicellites camerounensis* (Salard-Cheboldaeff & Locquin) Kalgutkar & Jansonius. (Magnification x520?)

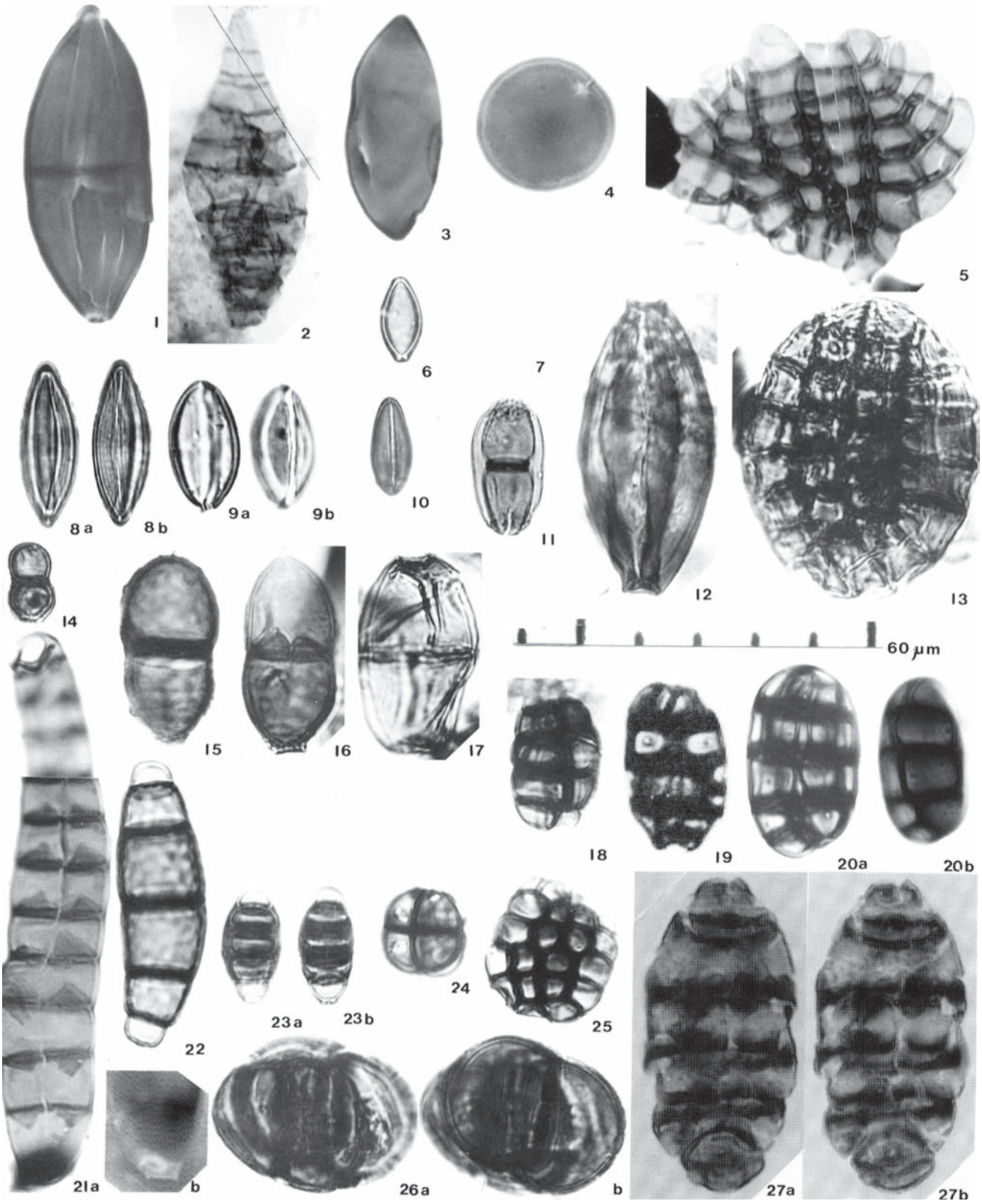
23a, b *Pluricellaesporites heterosporus* (Salard-Cheboldaeff & Locquin) Kalgutkar & Jansonius. Two focal levels of same grain.

24 *Octosporites stauroides* Salard-Cheboldaeff & Locquin.

25 *Dictyosporites moruloides* (Salard-Cheboldaeff & Locquin) Kalgutkar & Jansonius.

26a, b *Dremuspora cucurbitaria* Slard-Cheboldaeff & Locquin. Two focal levels of the same grain.

27a, b *Diporicellaesporites serratulus* Traverse & Ash, focused respectively slightly above and slightly below mid-grain.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*Diporicellaesporites serratulus* Traverse & Ash 1994
Plate 1, fig. 27a, b

**Remarks.** The published photograph of the type of this species (1994: fig. 3.11) was accidentally cropped too closely, which caused the extremities of this spore to be not shown. Therefore, we could not determine whether the type was diporate, monoporate or inaperturate.

Traverse (letter to JJ, Feb. 1999) sent new Polaroid photographs of the type specimen, taken with a x54 oil immersion fluorite objective at four focal levels, the middle two of which we include in our plate. Although these new photographs look different from those taken with a dry x40 fluorite objective in 1991, they are indeed of the same specimen, as Traverse vouches, but visibly deteriorated, with "considerable additional cracking and squashing."

Traverse states that the more tapered end of the spore is pointing up in the 1994 photograph. It now shows a pore-like structure with an annulus and an operculum (Plate 1, fig. 27b), but no longer shows the small "tooth-like projections" mentioned in 1994. The terminal cell at the opposite end is also more squashed down, but what appeared to be a single cell in 1994 now is seen to actually be two cells, of which the terminal one also has a circular pore (best seen in high focus, Plate 1, fig. 27a). Thus, Traverse now counts a total of eight cells in this specimen; the terminal 'septal bases,' poorly visible in the 1994 figure, are now interpreted as 'annuli.' The species appears to be correctly assigned to *Diporicellaesporites*.

## CHAMPIGNONS PRÉSENTS AU TERTIAIRE...DE L'AFRIQUE CENTRAL (SALARD-CHEBOLDAEFF AND LOCQUIN, 1980)

**Remarks.** Pressure to meet tight publication deadlines and constraints of space explain the brevity of the descriptions in this French paper (which were cited in full by Kalgutkar and Jansonius, 2000). This made the visual clues of the photographs the more essential. Tight cropping of some of the photographs, however, prohibited optimal use of that source of information. Fortunately, M$^{me}$ Salard-Cheboldaeff was willing to loan negatives used in making the three plates of their publication. We studied several of these negatives to glean more structural information from the illustrations for making our line drawings.

For some of the more crucial cases, we also made new prints from these negatives, which here are mounted on our plate, mostly without further comments. This includes some specimens of taxa for which new names or binomials were proposed by Kalgutkar and Jansonius (2000), or by Dr. Salard-Cheboldaeff *in* Kalgutkar and Jansonius (ibid.).

The following species are thus represented:

Genus *Hypoxylonites* Elsik 1990 (March)

*Hypoxylonites* Salard-Cheboldaeff & Locquin 1980 (nom. nud.).
*Hypoxylonsporites* Kumar 1990 (May).

**Type.** *Hypoxylonites brazosensis* Elsik 1990.

*Hypoxylonites africanus* Salard-Cheboldaeff *in* Kalgutkar & Jansonius 2000
Plate 1, fig. 8a, b

*Hypoxylonites elongatus* Salard-Cheboldaeff & Locquin 1980, p. 185, pl. I, fig. 14a, b (nom. nud.).

**Remarks.** Two focal levels of the same specimen. The spore wall appears to have more than one layer.

If the nomen nudum *H. elongatus* were to be validated, the binomial would be a junior homonym of *H. elongatus* (Rouse) Elsik 1990.

*Hypoxylonites ellipsoideus* Salard-Cheboldaeff *in* Kalgutkar & Jansonius 2000 (nom. nov.)
Plate 1, fig. 9a, b

*Hypoxylonites ellipsoideus* Salard-Cheboldaeff & Locquin 1980, p. 185, pl. I, fig. 15a, b (nom. nud.).

**Remarks.** The figures represent two focal levels of the same specimen.

*Hypoxylonites xylarioides* Salard-Cheboldaeff *in* Kalgutkar & Jansonius 2000
Plate 1, fig. 10

*Hypoxylonites xylarioides* Salard-Cheboldaeff & Locquin 1980, p. 185, pl. I, fig. 16 (nom. nud.).

Genus *Lacrimasporonites* Clarke 1965

**Type.** *Lacrimasporonites levis* Clarke 1965.

*Lacrimasporonites fusoides* (Salard-Cheboldaeff & Locquin) Kalgutkar & Jansonius 2000
Plate 1, fig. 6

(orthogr. corr. pro *Amepiospora fusoidis* Salard-Cheboldaeff & Locquin 1980, pl. I, fig. 19.)

Genus *Striadiporites* Varma & Rawat 1963

**Type.** *Striadiporites reticulatus* Varma & Rawat 1963.

*Striadiporites boletelloides* Salard-Cheboldaeff & Locquin 1980, pl. I, fig. 27
Plate 1, fig. 12

Genus *Dyadosporites* van der Hammen ex Clarke 1965

*Dyadosporites* van der Hammen 1954 (nom. nud.).
*Dyadosporonites* Elsik 1968.

**Type.** *Dyadosporites ellipsus* Clarke 1965.

*Dyadosporites clarkii* (Salard-Cheboldaeff & Locquin) Kalgutkar & Jansonius 2000
Plate 1, fig. 17

*Psidimobipiospora clarkii* Salard-Cheboldaeff & Locquin 1980, pl. II, fig. 19.

*Dyadosporites hilatus* Kalgutkar & Jansonius 2000 (nom. nov.)
Plate 1, fig. 16

*Didymoporisporonites didymus* Salard-Cheboldaeff & Locquin 1980, pl. II, fig. 11;
non *Dyadosporites didymus* (Sheffy & Dilcher) Kalgutkar & Jansonius 2000.

Genus *Hilidicellites* Kalgutkar & Jansonius 2000

**Type.** *Hilidicellites appendiculatus* (Sheffy & Dilcher) Kalgutkar & Jansonius 2000.

*Hilidicellites teleutosporoides* (Salard-Cheboldaeff & Locquin) Kalgutkar & Jansonius 2000
Plate 1, fig. 15

*Didymoporisporonites teleutosporoides* Salard-Cheboldaeff & Locquin 1980, pl. II, fig. 12.

*Hilidicellites strangulatus* (Salard-Cheboldaeff & Locquin) Kalgutkar & Jansonius 2000
Plate 1, fig. 14

*Didymoporisporonites strangulatus* Salard-Cheboldaeff & Locquin 1980, pl. II, fig. 14.

Genus *Didymosporonites* Salard-Cheboldaeff & Locquin 1980

**Type.** *Didymosporonites saccatus* Salard-Cheboldaeff & Locquin 1980.

*Didymosporonites saccatus* Salard-Cheboldaeff & Locquin 1980
Plate 1, fig. 11

*Didymosporonites saccatus* Salard-Cheboldaeff & Locquin 1980., pl. II, fig. 16.

Genus *Multicellites* Kalgutkar & Jansonius 2000

**Type.** *Multicellites tener* (Ke & Shi) Kalgutkar & Jansonius 2000.

*Multicellites camerounensis* (Salard-Cheboldaeff & Locquin) Kalgutkar & Jansonius 2000
Plate 1, fig. 22 (magnif. x520 ?)

*Chaetosphaerites camerounensis* Salard-Cheboldaeff & Locquin 1980, pl. III, fig. 1.

**Remarks.** Although the scale on their pl. III indicates that all specimens were enlarged x1000, in their description Salard-Cheboldaeff and Locquin gave the dimensions of the type as 104 x 16 μm. If that statement is correct, the magnification of their pl. III, fig. 1 must be x520. We here give the figure at the same size as it is on their pl. III. (The descriptions of all other figures on pl. III agree with their indicated size at x1000 magnification.)

Genus *Pluricellaesporites* van der Hammen 1954

**Type.** *Pluricellaesporites typicus* van der Hammen 1954.

*Pluricellaesporites heterosporus* (Salard-Cheboldaeff & Locquin) Kalgutkar & Jansonius 2000
Plate 1, fig. 23a, b

*Dictyosporites heterosporus* Salard-Cheboldaeff & Locquin 1980, pl. III, fig. 6a, b.

**Remarks.** The two photographs are of the same specimen, at different focal levels.

Genus *Dremuspora* Salard-Cheboldaeff & Locquin 1980

**Type.** *Dremuspora cucurbitaria* Salard-Cheboldaeff & Locquin 1980.

*Dremuspora cucurbitaria*
Salard-Cheboldaeff & Locquin 1980
Plate 1, fig. 26a, b

*Dremuspora cucurbitaria* Salard-Cheboldaeff & Locquin 1980, pl. III, fig. 11, 12.

Genus *Dictyosporites* Felix 1894

**Type.** *Dictyosporites loculatus* Felix 1894

*Dictyosporites moruloides* (Salard-Cheboldaeff & Locquin) Kalgutkar & Jansonius 2000
Plate 1, fig. 25

*Pleosporonites moruloides* Salard-Cheboldaeff & Locquin 1980, pl. III, fig. 13.

*Dictyosporites ovoideus*
Salard-Cheboldaeff & Locquin1980
Plate 1, fig. 19

*Dictyosporites ovoideus* Salard-Cheboldaeff & Locquin 1980, pl. III, fig. 15.

**Remarks.** The round structures, looking like eyes peering out of a ski mask, are thickenings surrounding pores in the vertical septa. They are also seen in the specimens described immediately below.

*Dictyosporites ovoideus* (Salard-Cheboldaeff & Locquin) Kalgutkar & Jansonius 2000
Plate 1, fig. 20a, b

*Pleosporonites ovoideus* Salard-Cheboldaeff & Locquin 1980, pl. III, fig. 14a, b.

**Remarks.** Kalgutkar and Jansonius considered this species to be a taxonomic junior synonym of the previous species. The two photographs (figs. 20a, b) are of the same specimen, taken at drastically different focal levels.

*Dictyosporites dictyosus* (Salard-Cheboldaeff & Locquin) Kalgutkar & Jansonius 2000
Plate 1, fig. 18

*Pleosporonites dictyosus* Salard-Cheboldaeff & Locquin 1980, pl. III, fig. 17.

*Dictyosporites morularis* (Salard-Cheboldaeff & Locquin) Kalgutkar & Jansonius 2000
Plate 1, fig. 13

*Pleosporonites morularis* Salard-Cheboldaeff & Locquin 1980, pl. III, fig. 22.

Genus *Octosporites* Salard-Cheboldaeff & Locquin 1980

**Type.** *Octosporites stauroides* Salard-Cheboldaeff & Locquin 1980.

*Octosporites stauroides*
Salard-Cheboldaeff & Locquin 1980
Plate 1, fig. 24

*Octosporites stauroides* Salard-Cheboldaeff & Locquin 1980, pl. III, fig. 20.

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## APPENDIX

The paper by Mustard and Rouse (1994) was published in Bulletin 481 of the Geological Survey of Canada. It is GSC policy to assign a unique "type number" to all fossil specimens illustrated in its publications. Through an unfortunate oversight, this was not done in Bulletin 481. These numbers are central to the GSC system of documentation, curation and retrieval of specimens.

Retroactively, such numbers have been assigned manually in a GSC Curation copy of Bulletin 481, and some of these numbers are used in the plate description below. Here we include, for the record, the GSC numbers as they were written, in consecutive order of the figure numbers, on the 13 plates of Bulletin 481:

Plate 1 GSC 116394 — GSC 116415
Plate 2 GSC 116416 — GSC 116424
Plate 3 GSC 116425 — GSC 116446
Plate 4 GSC 116447 — GSC 116464
Plate 5 GSC 116465 — GSC 116481
Plate 6 GSC 116482 — GSC 116492
Plate 7 GSC 116493 — GSC 116509
Plate 8 GSC 116510 — GSC 116534
Plate 9 GSC 116535 — GSC 116548
Plate 10 GSC 116549 — GSC 116565
Plate 11 GSC 116566 — GSC 116580
Plate 12 GSC 116581 — GSC 116593
Plate 13 GSC 116594 — GSC 116604