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Review of Palaeobotany and Palynology 106 (1999) 97–102

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Review of  
Palaeobotany  
& Palynology

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# *Grandispora* (al. *Contagisporites*) *permulta* (Daemon, 1974) Loboziak, Streelet Melo, *comb. nov.*, a senior synonym of *Grandispora riegelii* Loboziak et Streelet, 1989 — nomenclature and stratigraphic distribution

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Received 15 May 1998; revised version received 24 November 1998; accepted 17 December 1998

## Abstract

*Grandispora riegelii* Loboziak et Streelet, 1989 is shown to be a junior synonym of *Contagisporites permultus* Daemon, 1974, which in its turn is to be correctly assigned to the genus *Grandispora*. An emended diagnosis is therefore proposed for *Grandispora permulta*, and previous data on its geographic and stratigraphic distribution are discussed. *Grandispora permulta* can be regarded as a useful indicator of Middle and early Late Devonian ages in Western Gondwanan regions. Reported occurrences of the species from Famennian or younger rocks are attributed to reworking from older Devonian strata. © 1999 Elsevier Science B.V. All rights reserved.

**Keywords:** miospores; systematic; biostratigraphy; Western Gondwana; Devonian

## 1. Introduction

The main purpose of this paper is to revise the nomenclatural and systematic status, and to summarize the stratigraphic and geographic distribution of a large-sized, spinose, pseudosaccate miospore species, whose continued attribution to *Grandispora riegelii* Loboziak et Streelet, 1989 can no longer be accepted.

The proposed rejection is the consequence of a recent examination, by one of us (S.L.), of Daemon's (1974) reference palynologic materials housed in Museu Nacional, Rio de Janeiro, Brazil. It was veri-

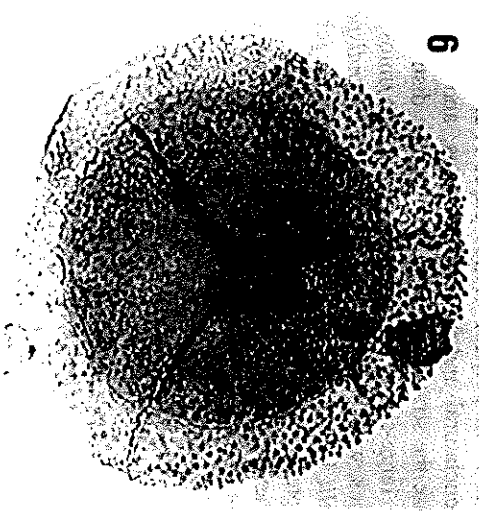
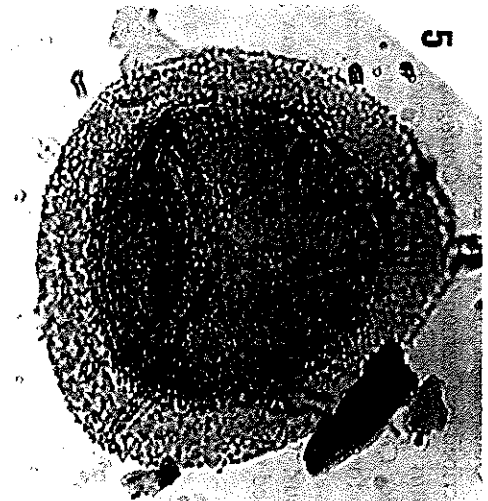
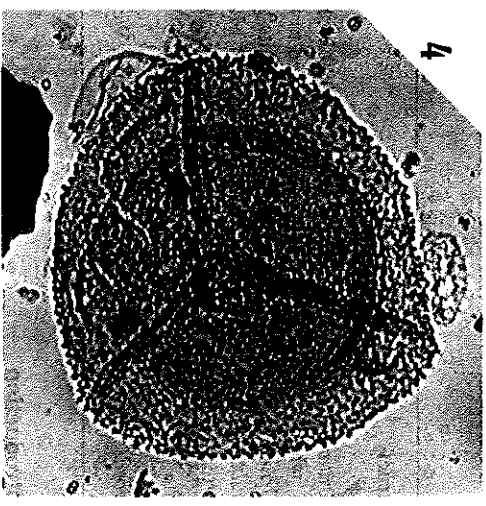
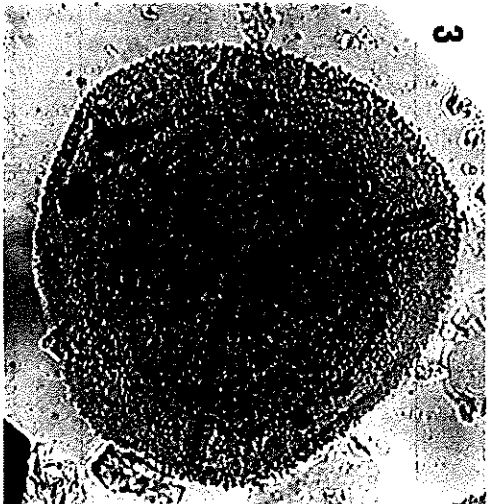
fied that *Grandispora riegelii*, a distinctive miospore widely distributed in Middle Devonian strata of several Gondwanan basins, corresponds to a species described by Daemon (1974) as *Contagisporites permultus*. However, the retention of Daemon's species under *Contagisporites* seems inappropriate, because the former lacks a thick exoexine and prominent curvature, which are characteristic features of that genus. Thus, a new generic assignment is now proposed to accommodate this miospore species.

## 2. Systematic palynology

Genus *Grandispora* Hoffmeister, Staplin et Malloy, 1955 emend. McGregor, 1973

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PLATE I



*Type:* *G. spinosa* Hoffmeister, Staplin et Malloy, 1955, pl. 39, fig. 10.

*Diagnosis* (after McGregor, 1973, p. 58): "Trilete, camerate miospores. Equatorial outline of intexine and exoexine subcircular and broadly triangular. Intexine laevigate or with minute structure or sculpture. Exoexine not greatly thickened, in polar compression extending beyond the intexine as a pseudoflange, with an ornament of prominent verrucae, spinae, coni or bifurcated elements. Ornament predominantly located on the distal surface, but may also extend onto the more equatorial portions of the proximal surface".

*Remarks:* Following Playford (1991, p. 106), and for the same reasons as stated in McGregor and Camfield (1982, p. 43), we favor McGregor's generic emendation, rather than that by Neves and Owens 1966, p. 346).

*Grandispora permilla* (Daemon, 1974) Loboziak, Streeel et Melo, *comb. nov.* (Plate I)

*Basionym:* *Contagisporites permillus* Daemon, 1974, An. Acad. Brasil. Ci. 46 (3–4), 574, pl. 3, figs. 4, 5.

*Synonyms and selected references:*

1967 *Calyptosporites* sp. A in Daemon et al., p. 114, pl. 3, figs. 31–34.

1967 *Calyptosporites* sp. B in Daemon et al., p. 114, pl. 3, figs. 35, 36.

1989 *Grandispora riegelii* Loboziak et Streeel, p. 190, pl. 5, figs. 1–5; pl. 9, figs. 10–13.

*Holotype:* Daemon, 1974, pl. 3, fig. 5 (Plate I, 1),

slide M.N. no. 5227-1, Petrobras no. 5059/DESL. Outcrop sample Serstra no. 510, Ponta Grossa Formation, Paraná Basin, Brazil.

*Repository:* Departamento de Geologia e Paleontologia (D.G.P.), Museu Nacional, Rio de Janeiro, Brazil. *Original diagnosis* (translated from Daemon, 1974, p. 574): "Camerate trilete spores, diameter of exoexine ranging from 95  $\mu\text{m}$  to 125  $\mu\text{m}$ , and diameter of intexine from 65  $\mu\text{m}$  to 91  $\mu\text{m}$ . Equatorial outline subtriangular with convex sides and rounded apices, intexine subcircular to subtriangular. Distal surface densely sculptured and completely covered with spinae, stout cones, verrucae and clavae, 1–3  $\mu\text{m}$  high and 0.5–3.7  $\mu\text{m}$  wide. Proximal surface laevigate. Triradiate folds reach equatorial outline; trilete mark confined to the intexine, but may go beyond".

*Emended diagnosis* (after the diagnosis of *Grandispora riegelii* in Loboziak and Streeel, 1989, p. 190): Trilete camerate miospores with subtriangular to roundly triangular amb. Intexinal body conformable to or slightly more circular than the exoexinal amb. Laesura arms straight, up to 6  $\mu\text{m}$  high, generally reaching the equator. Intexine laevigate, sometimes with arcuate folds near the margin. Exoexine thinner than intexine. laevigate in contact areas, sculptured proximo-equatorially and distally with dominant mammillate and bifurcated elements, but also grana, verrucae and coni, 1–3  $\mu\text{m}$  high and 1–4  $\mu\text{m}$  wide, irregularly distributed, sometimes closely spaced.

## PLATE I

*Grandispora permilla* (Daemon, 1974) Loboziak, Streeel et Melo, *comb. nov.* Slide M.N. no. 5227-1 is housed at the Department of Geology and Paleontology (D.G.P.) of National Museum, Rio de Janeiro, Brazil. Slide 9603106 is housed in the palynologic slide collection of the Biostratigraphy and Paleocology Sector of Petrobras Research Centre (Cempes/Divex/Schipe), Rio de Janeiro, Brazil. Slides C8(1), 2760(1) and 1277(1) are housed in the palynologic collection of the Laboratory of Paleobotany, University of Lille, France. Slide 8052 is housed in the Palaeontological Collections of the Natural History Museum, London, England. Miospore locations on slides are based on England FINDER graticules. Magnification of illustrated specimens  $\times 500$ .

1. Holotype after Daemon (1974, pl. 3, fig. 5), rephotographed. Slide M.N. no. 5227-1, Petrobras no. 5059/DESL. F 54, outcrop sample Serstra no. 510, Ponta Grossa Formation, Paraná Basin, Brazil.
2. Slide 9603106: K49, outcrop sample Pro-17A, sidetur on highway BR-153 (Belém — Brasília), Mirante area, Pimenteira Formation, Paraná Basin, Brazil.
3. Slide C8(1): L34, core 8 at 2182.4 m, well MG-1, Aouinet III Formation, Hammadah Basin, Tunisia.
4. Holotype of *Grandispora riegelii* after Loboziak and Streeel (1989, pl. 5, fig. 4), rephotographed. Slide 2760(1): R33/2, core sample at 2232.60 m, well MG-1, Aouinet II Formation, Hammadah Basin, Tunisia.
5. Slide 1277(1): E29/1, core sample at 1277 ft, well A1-69, Hammadah Basin, Lybia.
6. *Grandispora riegelii* in Loboziak and Streeel (1993b, pl. 1, fig. 1), reproduced. Slide 8052: G60/4, cuttings from 1467 to 1496 ft, well TRBH-1, Saudi Arabia.

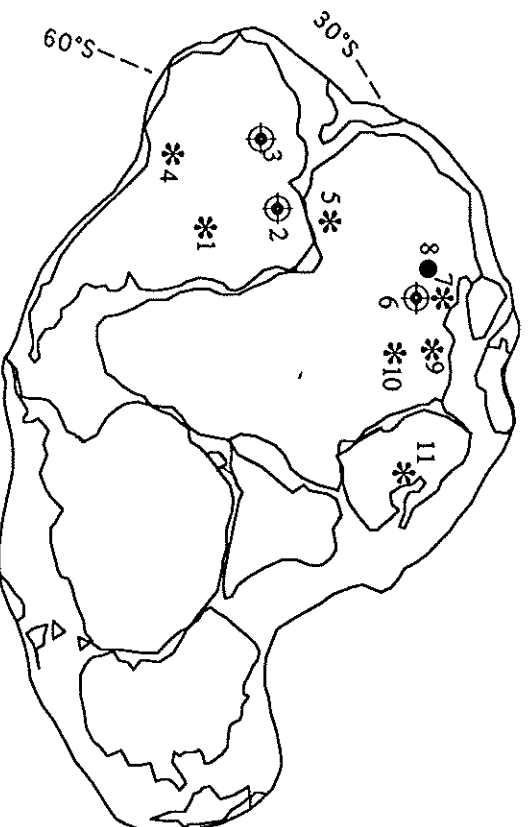
**Size:** 65–125 µm. Diameter of interaxial body: 60–89% of total spore diameter.

**Comparison:** *Grandispora inculta* Allen, 1965 is smaller and bears only conic. *Grandispora gabesensis* Loboziak et Streef, 1989 has spiniae and capilli in addition to conic and bifurcated elements. Its ornaments are also larger than in *Grandispora permulta*.

### 3. Stratigraphic and geographic distribution

*Grandispora permulta* has been so far recorded only from Western Gondwanan basins (Fig. 1) where it is actually the most representative camerate miospore in Middle Devonian microfloras. The overall stratigraphic range and quantitative distribution of this species in relation to other morphologically elaborate miospores have been evaluated by Loboziak and Streef (1995a). The species' frequency

rises through the Eifelian, attains peak values in the Frasnian and strongly decreases in the early Famennian. *Grandispora permulta*, much like several other large-sized spiny zonates and pseudosaccates of similar stratigraphic range, has been occasionally recorded also in younger strata. It occurs sparsely in latest Famennian marine or glacio-marine sections of Gondwanan regions containing *Retispora lepidophyta*, as part of a reworked Middle Devonian microflora. This can be verified in palynologic subzones L7 and L8 of the Grand Erg Occidental, Algerian Sahara (as *Hymenozonitites* sp. no. 2972 in Lanzoni and Magloire, 1969, table D). Other examples are Illizi Basin units like the 'Complexe Argilo-Gréseux' of the Djebel Mlerène Formation (as? *Grandispora uyenoï* in Coquel and Moreau-Benoit, 1989, pl. 4, fig. 1), and the Issendjel Formation of Viséan age, comprised within palynozone IV (Abdesselam-Rouighi and Coquel, 1997, p. 53).



- \* *in situ* occurrence
- ⊙ *in situ* and reworked occurrences
- reworked occurrence

Fig. 1. Location of known occurrences of *Grandispora permulta* in Western Gondwana (paleogeographic reconstruction after Scotese and Barrett, 1990, fig. 9). 1 = Paraná Basin, after Daemon et al. (1967), Burjack et al. (1987) and Loboziak et al. (1988); 2 = Paranaíba Basin, after Daemon (1974) and Rodrigues et al. (1995); 3 = Amazon Basin, after Daemon et al. (1967), Daemon and Comteiras (1971) and ongoing investigations by present authors (unpublished data); 4 = Bolivia, after Perez-Leyton (1991); 5 = Ghana, after Bär and Riegel (1974); 6 = Illizi Basin, after Coquel and Moreau-Benoit (1989) and Abdesselam-Rouighi and Coquel (1997); 7 = Hammadah (Ghadamis) Basin, after Loboziak and Streef (1989) and Loboziak et al. (1992); 8 = Grand Erg occidental, after Lanzoni and Magloire (1969); 9 = Cyrenaica, after Paris et al. (1985) and Streef et al. (1988); 10 = Western Desert, after Schrank (1987); 11 = Saudi Arabia, after Loboziak and Streef (1995b).

Our current studies in northern Brazil also demonstrate that local occurrences of *Grandispora permulta* in highest parts of the Barreirinha Formation and in overlying rock units of the Amazon Basin, as well as coeval Famennian and Early Carboniferous sections from the Paranaíba Basin (documented by Daemon et al., 1967 and subsequent authors), are all due to reworking. Therefore, in situ occurrences of *Grandispora permulta* in Brazil are seemingly restricted to biozones of Eifelian to early late Frasnian age, such as biostratigraphic intervals V and VI in the Amazon and Paranaíba Basins (Daemon and Contreiras, 1971; Daemon, 1974)<sup>1</sup>, and intervals D3 or D4 to D5 in the Paraná Basin (Daemon et al., 1967).

#### 4. Conclusions

*Grandispora permulta* is one from a group of stratigraphically useful miospore species (also including *Craspedispora ghadamensis*, *C. paranaensis*, *Grandispora libyensis*, *G. daemonii*, *G. tabulata*, *Geminospora piliformis*) whose known distribution is geographically restricted to Western Gondwana. Because its range is well calibrated by associated zonal markers also recognized in Ardenné–Rhenish regions of Western Europe, this species can be regarded as a good indicator of Middle and early Late Devonian ages in Gondwanan areas. In these latter, it is often a numerically important constituent of local microfloras, especially in Givetian rocks, but also occurs in several latest Famennian sections due to reworking.

#### Acknowledgements

The authors are indebted to palaeontologist Vera Maria M. Fonseca (Museu Nacional, Rio de Janeiro) for facilitating our access to Daemon's reference

slide collection housed in that institution, to geologists Ilma M.R. Barriari and Mitsuru Arai (Petrobras/Cempes, Rio de Janeiro) for the constructive criticism and review of the manuscript, to Mme R. Netter (UPRESA de CNRS 8014, Lille, France) for typing the final version of the text, and to Petrobras–Petróleo Brasileiro S.A. for the permission to publish this note.

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<sup>1</sup> According to Petrobras former biozonation of the Amazon Basin, i.e., the palynomorph range chart of Daemon and Contreiras (1971, fig. 4), the species is present (as F-2065, *Calyprosporites* sp. 2065) in intervals V through VIII, thus implying a Middle Devonian to latest Famennian age span. However, its range extension into intervals VII and VIII of the Amazon and Paranaíba basins (also shown by Daemon, 1974, table 1) can be now attributed to reworking.

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