

## BRAZILIAN PALAEOZOIC ALGOMYCETES AND TASMANACEAE

by FRIEDRICH W. SOMMER *and* NORMA M. VAN BOEKEL

ABSTRACT. Synopsis of nature and distribution of Devonian marine plant microfossils from Brazil.

This paper comments on a series of plant microfossils found in Devonian marine strata in Brazil, which for various reasons have not received the attention and interest they deserve. Some of them have been known for a long time but the communications concerned did not catch the eye of modern palaeobotanists of the Northern Hemisphere. More recently there has been a language barrier, because papers on present-day Brazilian palaeobotanical research have been published in Portuguese. On the other hand Brazilian fossils, when mentioned, have not always been compared with the necessary accuracy, in part due to the geographical separation, but also because the early material has been lying eighty or more years in American and European institutions. Thus we offer the following synopsis because references to Brazilian plant fossils do not always correspond with more recent research results.

### Class ALGOMYCETES Kräusel 1941

*Description.* Thallophytes provided with pseudotissue (Scheingewebe) similar to mycelia of fungi; they possess simultaneously characters of fungi and algae, without fitting into either group.

### Order PROTOSALVINIALES Sommer 1962

(Foerstiales Kräusel 1941)

*Description.* With the characters of the class and spore tetrads present.

### Family PROTOSALVINIACEAE Sommer 1962

(Foerstiaceae Kräusel 1941)

*Description.* Spore tetrads present within the thallus.

### Genus PROTOSALVINIA Dawson 1884 emend. Sommer and van Boekel 1966

*Type species.* *Protosalvinia braziliensis* Dawson 1884.

*Description.* Thalloid bodies provided with tetrads of spores which may be visible or not; waxy covering present or not; variable in size and form, the surface may imitate a polygonal cellular pattern.

*Key.* A. Thalloid bodies with spore cavities clustered in the upper part; these are situated in subsurface depressions, the tetrads are visible without any laboratory treatment, and the walls are not covered with waxy material; spore cavities may be hidden under a 'lid' which falls easily out without applying any special device.

[Palaeontology, Vol. 10, Part 4, 1967, pp. 640-6.]

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- a. Not lobed or divided; thalloid bodies 'sessile', spherical to oval or reniform:

*Protosalvinia braziliensis* Dawson 1884

*Occurrence.* Middle Devonian, Curuá group; Amazon basin, Brazil.

- b. With two or more prominences (lobes); body more or less oval, reniform, 'sessile' to stalked:

*Protosalvinia bilobata* Dawson 1884 emend. Sommer 1962

*Occurrence.* Middle Devonian, Curuá group; Amazon basin, Brazil.

For the sake of comparison we present the North American representatives of the genus as they are known to us from literature:

- B. Thalloid bodies which do not show tetrads and spore cavities without aid by laboratory treatment; waxy covering present.

- a. Thalloid bodies with apical lobes surrounding the cluster of spore cavities (visible after laboratory treatment):

*Protosalvinia ravenna* (White and Stadnichenko 1923) Arnold 1954

- b. Thalloid bodies stalked, bilobed; spore cavities mostly in one row beneath apical groove (visible after laboratory treatment):

*Protosalvinia furcata* (Dawson 1888) Arnold 1954

- c. Thalloid bodies stalked, with swollen head, spore cavity usually single with one spore tetrad lying at the bottom of funnel-like depression at the apex of the head:

*Protosalvinia arnoldii* Bharadwaj and Venkatachala 1960

#### Order SPONGIOPHYTALES Sommer 1959

*Description.* Algomycete Thallophytes the tubiform stalks of which consist of a 'derm' of pseudoparenchymatous character and which, under examination, do not reveal the presence of chitin and the existence of spores.

#### Family SPONGIOPHYTACEAE Kräusel 1954

*Description.* Thallus simple, provided with lobes or branched dichotomously; external part of derm cellular, inner part of a 'tissue' similar to spongy hyphae.

#### Genus SPONGIOPHYTON Kräusel 1954

*Description.* Thallus simple, lobed, or dichotomized. Fundamental substance consisting of a tissue similar to branched hyphae of porous spongy aspect, provided with an outer layer of cellular aspect, where there are dark inclusions in form of buds, filling out small round spaces; besides these there are found larger elements, also dark of colour, composed of tissue which, when dissolved, leave holes of various forms and sizes.

*Type species.* *Spongiophyton lenticulare* (Barbosa 1949) Kräusel 1954.

*Spongiophyton lenticulare* (Barbosa) Kräusel 19541949 *Haplostigma lenticularis* Barbosa.

*Description.* Thallus (or parts of thallus?) with parallel margins, up to 7 mm. wide, sometimes wider, usually unbranched; a pedate surface of fixation; a 'parenchymatous' tissue of porous spongy character, with numerous longitudinal thicker trabeculae irregularly arranged, holes varying from slits to lenticular openings, directed longitudinally, 0.4–0.8 mm. long, in very variable number, irregularly distributed. Surface 'cells' elongated longitudinally.

*Occurrence.* Lower Devonian, Upper Ponta Grossa beds; State of Paraná, Brazil.

*Spongiophyton nanum* Kräusel 1954

*Description.* Thallus more or less dichotomous, the branches generally 1–2.5 mm. broad (rarely broader), the top ends occasionally elliptically rounded, constricted. Inner constitution as in type species but thickened lines less numerous, the holes more or less circular to elliptic, diameter mostly 150–250  $\mu$ , rarely 340  $\mu$ , surface 'cells' polygonally foveolate.

*Occurrence.* Lower Devonian, Upper Ponta Grossa beds; State of Paraná, Brazil.

*Spongiophyton minutissimum* Kräusel 1954

*Description.* Thallus small, only a few mm. in length, dichotomously lobed, margins strongly thickened. Inner constitution as in *S. nanum*, the numerous holes small, like needle punctures, with diameter generally 60–100  $\mu$ , rarely 150  $\mu$ , frequently transversally broadened. Surface 'cells' polygonally foveolate.

*Occurrence.* Lower Devonian, Upper Ponta Grossa beds; State of Paraná, Brazil.

*Spongiophyton articulatum* Kräusel 1954

*Description.* Thallus not completely known, 'parenchymatous' spongy tissue with numerous conspicuous thickened lines and many knob-like swellings, longitudinally corresponding on the outer derm with transverse creases.

*Occurrence.* Lower Devonian, Upper Ponta Grossa beds; State of Paraná, Brazil.

*Spongiophyton hirsutum* Kräusel 1954

*Description.* Thallus not completely known, 'parenchymatous' tissue spongy. Derm provided with appendages irregularly distributed, of variable length, beginning with broad base and ending in thorn or hair.

*Occurrence.* Lower Devonian, Upper Ponta Grossa beds; State of Paraná, Brazil.

*Other records.* To the knowledge of the authors of this paper, *Protosalvinia* has not been recorded in South America outside the Amazon sedimentary basin. *Spongiophyton*, in addition to its occurrence in the lower Devonian of Paraná, has so far been found in Devonian strata (*sensu lato*) of the states of Goiás, Piauí, and Maranhão. It seems that the Tocantins ridge somehow separated the two genera.

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Outside Brazil and North America, *Spongiophyton* has been recognized by Kräusel (*personal communication*) among Chinese plant fossils, and *Spongiophyton lenticulare* is known from Russian Devonian strata (Textbook: Gothan and Weyland 1964, p. 70).

## Class CHLOROPHYCEAE

## Order TASMANALES Sommer 1960

*Description.* Globoid organisms which may be deformed in deposition; surface without appendages.

## Family TASMANACEAE (Sommer) Sommer and van Boekel 1963

*Description.* Unicentric organisms, originally more or less spherical, generally compressed to a disc; haptotypic structures absent. Ornamentation mostly without high relief; where there is some sculpture, it is not exaggerated in detail or size as, for example, the spinae, clavae, capilli, etc., of spores or the multiform projections of the hystrichospheres. The Brazilian Tasmanaceae are divided into the two genera *Tasmanites* and *Tapajonites*.

Genus TASMANITES Newton 1875 emend. Schopf, Wilson, and Bentall 1944

## Group 1. With conspicuous outer ring:

*Tasmanites roxoi* (Sommer 1953) Sommer and van Boekel 1965

*Tasmanites avelinoi* (Sommer 1953) Sommer and van Boekel 1965

*Tasmanites lamegoi* Sommer 1956

*Tasmanites salustiano* (Sommer 1953) Sommer and van Boekel 1965

## Group 2. With conspicuous punctae or pores, no outer ring:

*Tasmanites tapajonensis* (Sommer 1953) Sommer and van Boekel 1965

*Tasmanites harttii* (Sommer 1953) Sommer and van Boekel 1965

*Tasmanites derbyi* (Sommer 1953) Sommer and van Boekel 1965

## Group 3. With conspicuous folds:

*Tasmanites mourae* (Sommer 1953) Sommer and van Boekel 1965

*Tasmanites erichsenii* Sommer and van Boekel 1963

## Group 4. Oval to spindle-shaped:

*Tasmanites euzebioi* (Sommer 1953) Sommer and van Boekel 1965

*Tasmanites sommeri* van Boekel 1963

## Genus TAPAJONITES Sommer and van Boekel 1963

*Description.* Unicentric discs, originally spherical, ranging approximately from less than 100  $\mu$  to more than 200  $\mu$  in diameter. Ornamentation consisting of rounded warts, lumps, or shields which extend beyond the outline of the disc or may be visible only when the specimen is manipulated under the low-power microscope and turned so as to 'stand' (in side view).

*Distinction.* *Tapajonites* is readily distinguished from *Tasmanites* by its relief and external ornamentation; wall about  $\frac{1}{25}$  diameter, compact, not membranaceous.

*Name derivation.* After the Tapajós river, State of Pará, Brazil.

*Type species.* *Tapajonites roxoi* Sommer and van Boekel 1963.

*Other species.* *Tapajonites moresii* (Sommer 1956) Sommer and van Boekel 1963.

#### REMARKS ON THE TASMANACEAE

The following comments on the Brazilian Tasmanaceae have been made by van Boekel (1966):

1. The same assemblages have been found in Devonian and Silurian strata of both banks of the Amazon river.

2. The species *Tasmanites salustiano*, *T. sommeri*, and *T. erichsenii* are limited to the Amazon sedimentary basin.

3. *Tasmanites mourae* is ubiquitous in all Silurian and Devonian sedimentary basins so far investigated; this suggests a wide palaeogeographic distribution and vertical persistence.

4. Some of the species are reliable index-fossils for lower, middle, and upper Devonian strata; they do not occur in Carboniferous or younger strata in Brazil.

5. Of the five species described from the Tucano–Jatobá basin (state of Pernambuco), four (*Tasmanites lamegoi*, *T. mourae*, *T. tapajonensis*, and *Tapajonites moresii*) were also found in the Devonian of Aragarças (state of Goiás).

6. A Devonian shale sample from eastern Bolivia (Sommer 1955, p. 183) provided an assemblage very similar to the one studied by the same author from a sample of Devonian shale from Jaguariaíva, state of Paraná.

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FRIEDRICH WILHELM SOMMER  
NORMA MARIA DA COSTA VAN BOEKEL  
Divisão de Geologia e Mineralogia,  
Departamento Nacional da Produção Mineral,  
Conselho Nacional de Pesquisas,  
Rio de Janeiro, Brazil

Typescript received 16 August 1966

#### ADDENDUM

In a recent paper, C. Downie (1967, *Rev. Paleobotan. Palynol.*, **1**, 279) registers *Tasmanites* as belonging to the Prasinophyceae.