

BULLETIN

DU

Musée royal d'Histoire
naturelle de Belgique

Tome XVIII, n° 42.

Bruxelles, septembre 1942.

MEDEDEELINGEN

VAN HET

Koninklijk Natuurhistorisch
Museum van België

Deel XVIII, n° 42.

Brussel, September 1942.

SOME SPECIMENS OF POTONIEA FROM
THE CARBONIFEROUS (WESTPHALIAN) OF BELGIUM

by T. G. HALLE (Stockholm).

(With 2 Plates.)

The specimens to be described here are the property of the Musée royal d'Histoire naturelle de Belgique. They were recognized by Dr. F. STOCKMANS as belonging to the genus *Potoniea* Zeill. and were sent to me for examination owing to my previous work on that genus. The accompanying label gives the locality as « Pl. Mons, 1, Orig. Charb. du Levant du Flénu. Siège n° 19 à Cuesmes », with the added number 10947.

The material consists of carbonaceous remains (compressions) and corresponding impressions on one fairly large piece (about 24 × 14 cm.) and two small fragments of hard, dark grey shale. On the uneven surface of the large piece are seen the remains of some 25-30 spore-bearing organs, several of which are very fragmentary (Pl. I, fig. 1). A small part of this piece with two specimens was sawn off and dissolved in fluoric acid in order to separate the compressions; portions of the carbonized remains of some other specimens were also removed for maceration. The specimens contrasted but slightly to the dark surface of the rock, and had to be moistened to make the details stand out more clearly; the photographs published were taken while the slab was immersed in xylol.

The specimens had evidently been campanulate or cup-shaped in the natural state, agreeing in this respect most closely with

those figured under the name of *Potonia adiantiformis* by P. BERTRAND and A. CARPENTIER from northern France and by the present writer from Lorraine (see Bibliography). Their actual appearance as impressions or compressions varies much in shape, but this is mainly due to the preservation. When compressed in a plane at right angles to the axis (Pl. II, figs. 9, 10), the specimens appear oval or circular, with a diameter of 10-20 mm. When the plane of the compressed specimen is parallel to the axis (Pl. I, figs. 2, 4, 6; Pl. II, figs. 1, 3), the campanulate or cup-like shape is clearly shown; the maximum length of the specimens is in these cases about 20 cm. When the plane of the compression is more or less oblique to the axis, the specimen appears correspondingly shorter. Apart from these effects of the preservation, however, the relative width of the uncompressed specimens appears to have varied within rather wide limits. The specimens shown in Pl. I, fig. 4 and Pl. II, fig. 1, have both been compressed into a plane parallel to the axis, but the former is much broader and slightly shorter than the latter. The two specimens may possibly represent different stages of individual development, the cup-like body widening on maturity. This interpretation is somewhat supported by the fact that the carbonaceous substance of the narrower specimen was found to contain densely packed spores, whereas the wider specimen yielded comparatively few spores, the greater part of the spore-contents appearing to have been shed. The smallest and narrowest specimens are of about the same dimensions as ZEILLER'S type-specimens of *Potonia adiantiformis*, but the majority are larger and also relatively broader, and are therefore more comparable to those figured by CARPENTIER and P. BERTRAND (ll. cc.).

When viewed from above (Pl. II, figs. 9, 10), the upper surfaces of the specimens appear to be covered by the densely packed sporangium-like bodies which I have previously interpreted as corresponding merely to the exposed tops of much longer sporangia radiating from the bottom of the cup. In specimens compressed from the side these bodies are only visible where they project beyond the rim (Pl. I, fig. 4; Pl. II, figs. 1, 3). They then appear to be narrowly triangular, with a maximum length of about 2-3 mm. and a breadth of 1-1.3 mm. No trace can be seen of the median line observed in specimens from northern France and believed to mark a zone of dehiscence; but this may be due to the unsatisfactory state of preservation.

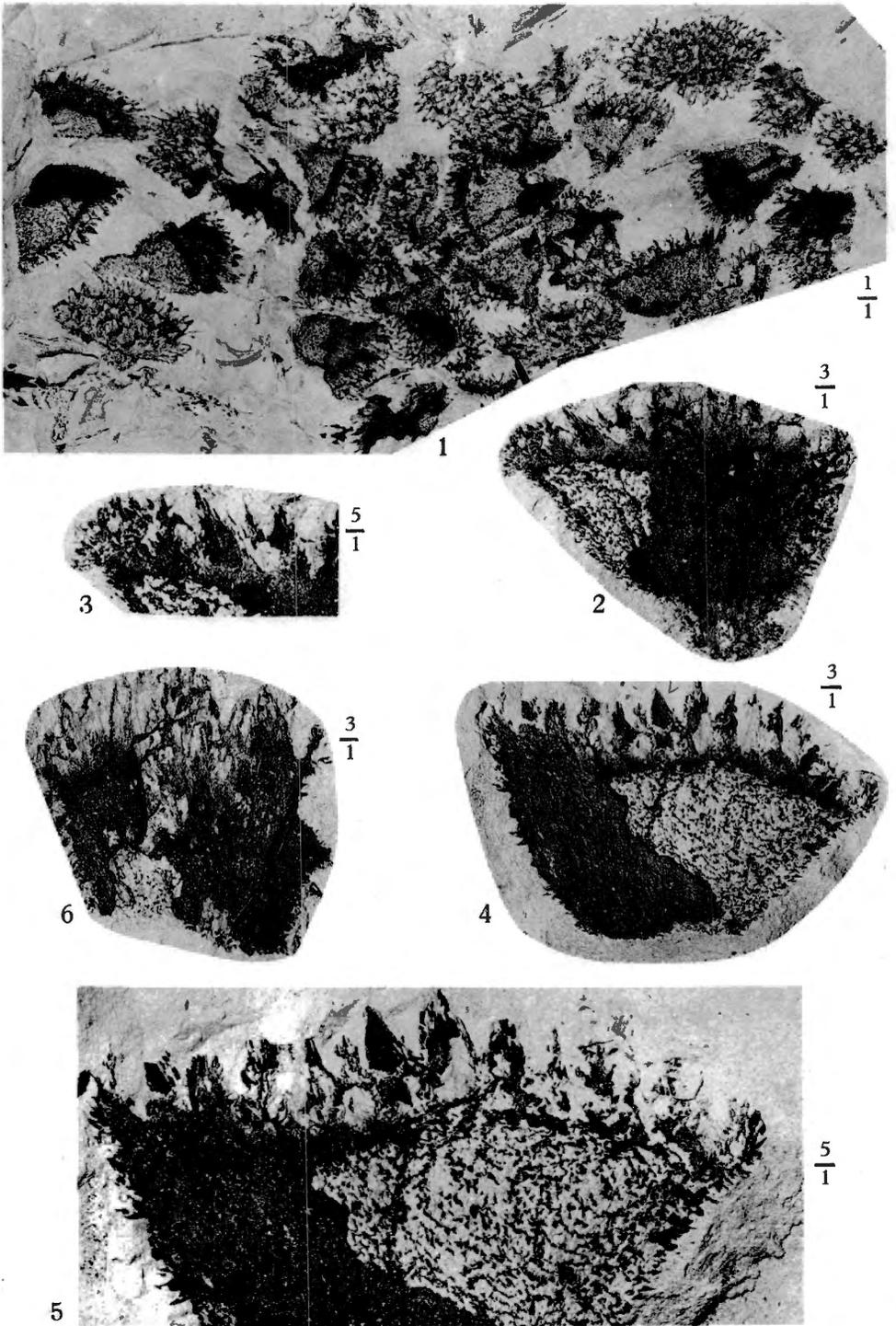
The Belgian specimens differ from those hitherto referred to *Potonia adiantiformis* by being covered with rather thick, short and pointed, bristle-like hairs. These hairs, which cover the whole surface of the campanulate body, are best seen at the edges of the compressions and on the exposed surfaces of the impressions, where they remain embedded in the matrix (Pl. I, figs. 4, 5; Pl. II, figs. 1-4). The hairs are perpendicular to the surface, or somewhat ascending, and are often slightly curved upwards; they may attain a length of 0.6-0.7 mm. but are generally shorter. Similar hairs occur on the sporangium-like bodies, but they are more adpressed there; at the tips of these bodies the hairs are narrower and form an ascending tentacle-like fringe (Pl. I, fig. 3; Pl. II, figs. 1, 3, 4).

When macerated, the carbonized remains of the fructifications were generally found to contain numerous spores (Pl. II, figs. 6, 7). These are rather badly preserved, but sometimes (Pl. II, fig. 6) show the tetrad-mark; they agree in shape and size with those previously described (HALLE 1933 a, b; FLORIN 1937). The largest pieces of the carbonaceous substance that could be removed from a specimen compressed into a plane parallel with the axis (Pl. II, fig. 1) measured about 7-8 mm. longitudinally. On maceration they split up lengthwise into long and narrow spore-groups, 0.7-1 mm. broad and of nearly the same length as the whole piece (Pl. II, fig. 5). Since every spore-band — which may be assumed to represent part of the spore-contents of one sporangium — was broken off at one or both ends, the sporangia were no doubt considerably longer. They were in any case much longer than the projecting bodies formerly regarded as representing the entire sporangia, and correspond in fact to $1/3-1/2$ of the entire length of the specimen from base to brim, thus confirming the view that the sporangia were long and tubular and radiated from the bottom of the cup. The stalk of the fructification probably formed a widened receptacle to which the sporangia were attached, but this cannot be ascertained. In the reconstruction, text-fig. 1, the fructification has therefore not been shown cut open right down to the base.

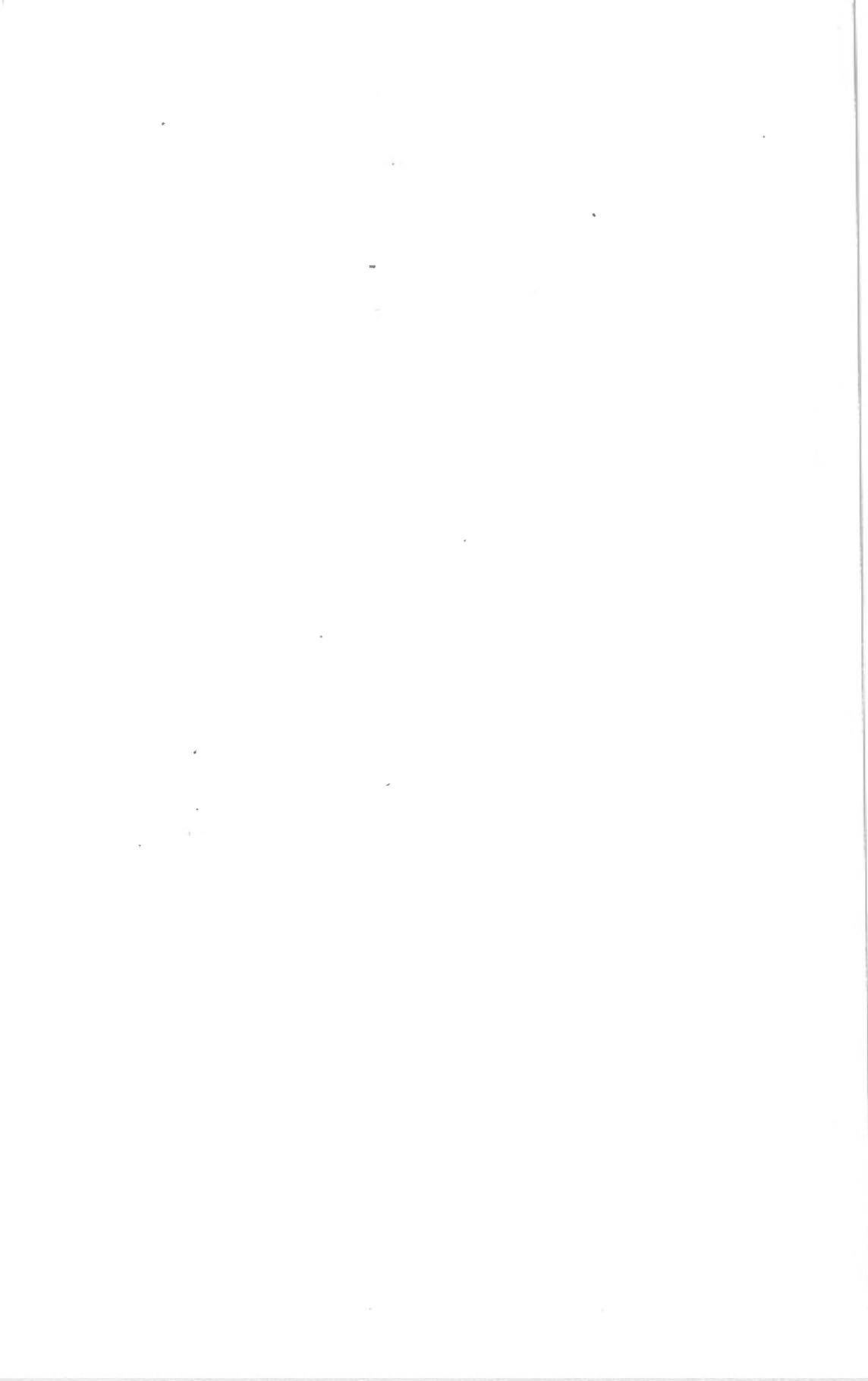
In the specimens from Lorraine which I examined in 1933 the relation between the sporangia and the envelope investing them was not clear. The envelope was interpreted as a pinnule and was represented in the reconstruction (HALLE 1933 a, p. 72, text-fig. 13 a; 1933 b, p. 199, text-fig. 1 a) as terminating in a definite margin below the free parts of the sporangia. This

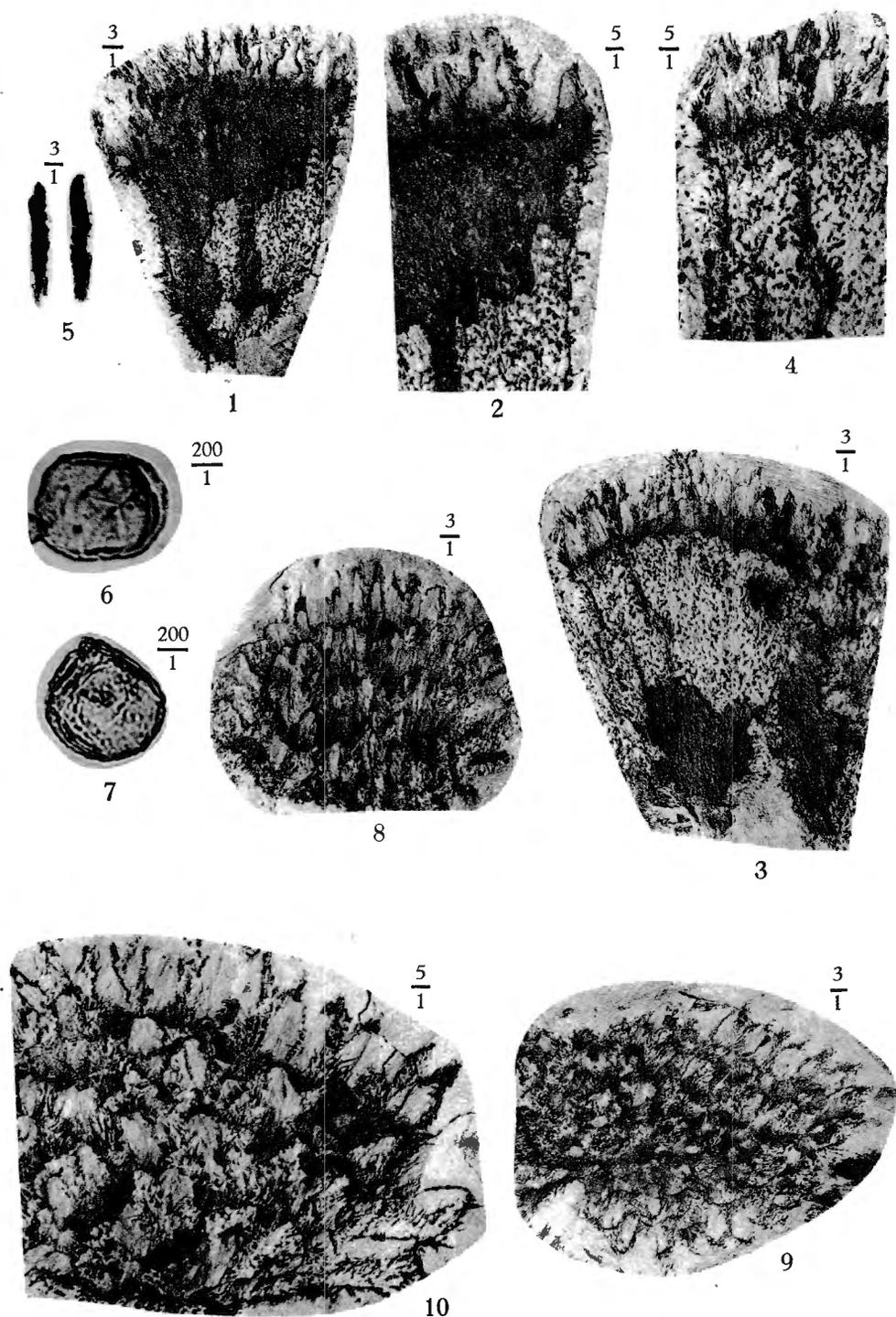
margin was not clearly defined, though traces of it were believed to be present in at least one of the specimens (HALLE 1933 a, Pl. II, fig. 4), nor is it shown in the illustrations given by P. BERTRAND and CARPENTIER. Its existence was mainly inferred from the fact that the envelope was evidently continuous, and therefore supposed to terminate in a definite margin independent of the sporangia. The present specimens seem to prove that no such margin existed. It is true that a few of them (Pl. I, fig. 4 and Pl. II, fig. 3) show some indication of a break between the envelope and the projecting parts of the sporangia. But this is probably due to the fact that the thick coaly layer has been broken off along the upper limit of the continuous surface of the envelope, while the carbonaceous substance still adheres to the impressions of the sporangia. In other places the envelope can be more or less clearly observed actually to run out into terminal lobes similar to the sporangium-like bodies. This can best be seen at the edges of specimens compressed from the side, as in Pl. II, fig. 2 (on the right) and Pl. I, figs. 4, 5 (on right and left). The characteristic hairs on the surface of the envelope continue on to its terminal lobes as well as to the exposed parts of the sporangia, though, as remarked above, they become finer and more ascending towards their tips. In the illustrations of *Potoniea adiantiformis* given by ZEILLER (1899; Pl. 4, figs. 19, 19 a) and GOTHAN (1913; Pl. 44, figs. 5, 6; Pl. 46, fig. 3) the envelope also appears to terminate in marginal lobes similar to the free parts of the sporangia.

The agreement between the marginal lobes of the envelope and the tops of the sporangia in shape and surface-covering suggests a new morphogenetic interpretation of the fructification, tentatively expressed some years ago (HALLE 1937, p. 231). While the envelope may be compared to a pinnule, it may be phylogenetically explained as formed by the fusion of a peripheral whorl of telomes, homologous with the sporangia and closely resembling them as far as the free distal parts are concerned. The conerescent units of this peripheral whorl may originally have been sterile, *i. e.*, vegetative telomes forming a kind of cupule round the fertile telomes (sporangia). But another possibility is that they may represent sterilized sporangia, or even — though united with each other into a continuous envelope — carry spores in the same manner as the elements composing the cupule-like synangia of the *Whittleseyinae*. From a morphological point of view the difference between these alternatives is

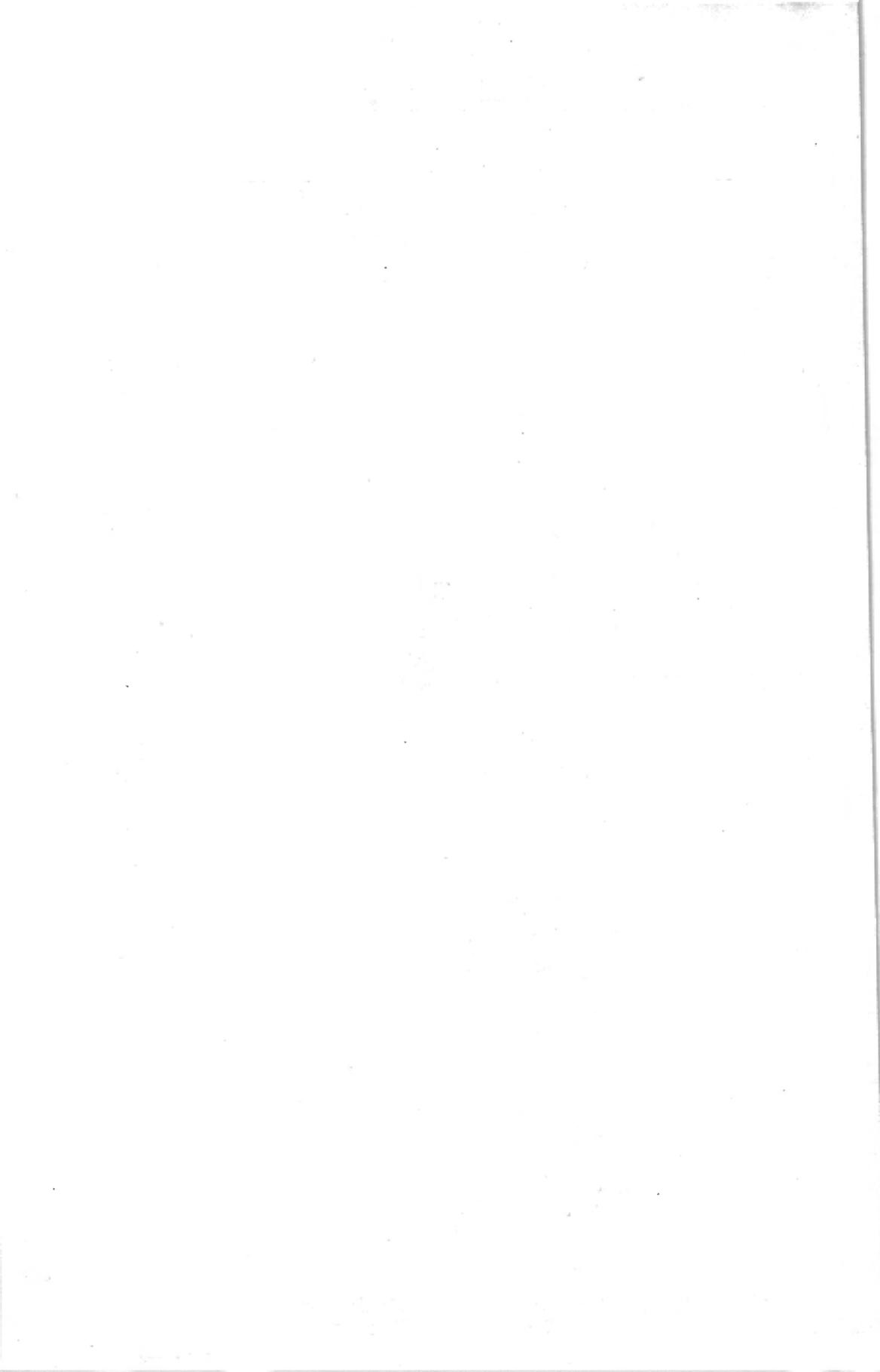


T. G. HALLE — Some specimens of *Potoniaea* from the Carboniferous (Westphalian) of Belgium.





T. G. HALLE. — Some specimens of *Potonia* from the Carboniferous (Westphalian) of Belgium.



not of fundamental importance. Another question which still remains obscure is whether the tubular sporangia are free or conerescent with each other and with the envelope, and thus form a solid body, as in *Dolerotheca*. As I have previously (1933, *a, b*) pointed out, observations on *Potonica Carpentieri* are rather in favour of the former alternative; but they are not conclusive, and it is worth noting that in the material now examined no sporangia were found to have separated, or even diverged, from the main body, as might have been expected to happen on the compression of fragmentary fructifications if the sporangia were free. A definite answer to these questions can probably only be given by the discovery of petrified material.

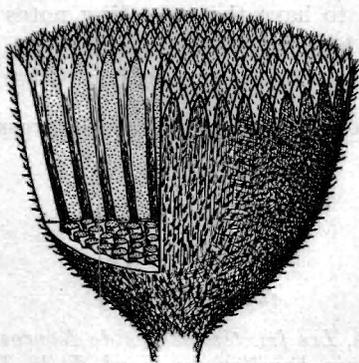


Fig. 1. — *Potonica strigulosa* n. sp.
Tentative restoration, cut open on left to show the sporangia, 3/1.

Though important points thus remain to be cleared up, *Potonica*, like the *Whittleseyinae*, is of considerable interest from a morphogenetic point of view. Its structure, and its relation to other comparable fructifications, can be most readily understood when viewed in the light of the *Psilophytales* and other primitive Pteridophytes. The interpretation here regarded as the most plausible agrees with the conception of the sporangium as a fertile telome. The sporangium is thus held to be homologous with the sterile ultimate ramifications of the plant-body as developed in the *Psilophytales* and other primitive vascular plants, irrespective of whether these ramifications belong to an undifferentiated thallus, a stem, or a leaf.

It is doubtful whether the Belgian fructifications should be referred to the type-species *Potonica adiantiformis* or not. They

are easily distinguished from all described and figured specimens of that species by the covering of characteristic bristle-like hairs, which presents the unusual feature of extending to the free parts of the sporangia. Since, moreover, the spore-groupes are somewhat broader and the sporangia therefore presumably wider than in *P. adiantiformis*, it seems better to refer the Belgian fructifications to a separate species, for which I propose the name *Potoniea strigulosa* n. sp. Both species are no doubt closely related. For the purpose of illustrating the probable general structure of the genus *Potoniea*, the restoration accompanying this paper (text-fig. 1) may therefore conveniently replace the probably incorrect restoration of *P. adiantiformis* which I have previously published.

For permission to have the preceding notes published in this Bulletin and for help with the manuscript I am much obliged to PROFESSOR V. VAN STRAELLEN and DR. F. STOCKMANS.

SWEDISH MUSEUM OF NATURAL HISTORY, STOCKHOLM, APRIL 1942.

BIBLIOGRAPHY.

- BERTRAND, P., 1913, *Les fructifications de Névroptéridées recueillies dans le terrain houiller du Nord de la France*. (Ann. Soc. Géol. du Nord, T. 42.)
- CARPENTIER, A., 1911, *Sur quelques fructifications et inflorescences du Westphalien du Nord de la France*. (Rev. Gén. de Botanique, T. 23.)
- 1913, *Contribution à l'étude du Carbonifère du Nord de la France*. (Mém. Soc. Géol. du Nord, T. 7 : 2.)
- 1927, *Sur des empreintes de graines et d'inflorescences recueillies en 1926 dans le Westphalien du Nord de la France*. (Rev. Gén. de Botanique, T. 39.)
- 1929, *Empreintes de fructifications trouvées en 1929 dans le Westphalien du Nord de la France*. (Rev. Gén. de Botanique, T. 41.)
- DEPAPE, G. et CARPENTIER, A., 1915, *Sur quelques graines et fructifications du Westphalien du Nord de la France*. (Rev. Gén. de Botanique, T. 27.)
- FLORIN, R., 1937, *On the morphology of the pollen-grains in some Palaeozoic Pteridosperms*. (Svensk Bot. Tidskr., Bd. 31, H. 3.)
- GOTHAN, W., 1913, *Die oberschlesische Steinkohlenflora*. (Abh. K. Preuss. Geol. Landesanst. N. F. H. 75.)

- HALLE, T. G., 1933 a, *The structure of certain fossil spore-bearing organs believed to belong to Pteridosperms.* (K. Svenska Vetensk. Akad. Handl., 3 Ser., Bd. 12, N° 6.)
- 1933 b, *Observations sur la structure de quelques échantillons carbonisés de Potonia du terrain houiller de la Lorraine.* (Ann. Soc. Géol. du Nord, T. 58.)
- 1937, *The position and arrangement of the spore-producing members of the Palaeozoic Pteridosperms.* (Compte rendu du deuxième Congrès pour l'avancement des études de Stratigraphie Carbonifère. Heerlen 1935, T. 1, pp. 227-235.)
- ZEILLER, R., 1899, *Etude sur la flore fossile du bassin houiller d'Héraclée (Asie Mineure).* (Mém. Soc. Géol. France, Pal., N° 21.)

EXPLANATION OF PLATES.

All the figures are from photographs taken by Mr. K. E. Samuelson. With the exception of the spores shown in Pl. 2, figs. 5-7, all the objects were photographed immersed in xylol.

Potonia strigulosa n. sp.

PLATE I.

- Fig. 1. — Part of a piece of shale with compressions or impressions of numerous fructifications; natural size.
- Figs. 2-6. — Specimens compressed from the side (plane of compression parallel to the axis), showing bristle-like hairs. Figs. 2, 4 and 6, 3/1. Figs. 3 and 5, parts of figs. 2 and 4, 5/1.

PLATE II.

- Figs. 1-4. — Specimens compressed from the side, showing hairs. Figs. 1 and 3, 3/1. Figs. 2 and 4, parts of figs. 1 and 3, 5/1.
- Fig. 5. — Two spore-groups from the middle of the left-hand part of the specimen in fig. 1, 3/1.
- Figs. 6-7. — Spores from another specimen, 200/1; fig. 6 showing tetrad mark.
- Fig. 8. — Obliquely compressed specimen, 3/1.
- Fig. 9. — Upper surface of specimen compressed into a plane at right angles to the axis, 3/1.
- Fig. 10. — Part of another similarly compressed specimen, showing hairs on sporangia, 5/1.
-

GOEMAERE, Imprimeur du Roi, Bruxelles.