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A NEW *DICTYONEMA* FAUNA FROM THE SALMIEN OF THE STAVELOT MASSIF

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PREFACE

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Le Salmien inférieur contient par endroit de nombreux gîtes fossilifères. C'est notamment le cas le long du chemin de Solwaster à Jalhay, dans la région de Solwaster. L'élargissement de ce chemin au nord du ruisseau Sawe a rendu visible une coupe de quelques centaines de mètres, contenant des couches à *Dictyonema* et à *Brachiopodes*. Le levé à partir du premier carrefour à 200 m au sud de la ferme de Gospinal, nous a donné le profil schématisé en fig. a.

Dans la section septentrionale, (direction général N45°E) il y a des plis légèrement déversés vers le nord. Ils font affleurer à plusieurs reprises, les mêmes niveaux fossilifères. Cette partie nous a donné uniquement des *Dictyonema flabelliforme*. Il y a parfois des exemplaires, qui ressemblent à *D. fl. sociale:* c'est notamment le cas pour les formes, qui ont leurs rhabdosomes parallèles à la ligne d'intersection de la schistosité et de la stratification.

Plus au sud, à environ 250 m du carrefour le profil montre un complex assez gréseux fort tectonisé de 30 m de longueur séparé par des failles longitudinales, qui délimitent des structures différentes: la schistosité se met plus ou moins horizontal, aussi bien que les plans axiaux des plis. Au sud affleurent des bancs quartzophylladeux foncés; il s'agit de couches renversées les plus inférieures du Salmien (D: N40°E; i: 70°S) et affectées par une deuxième schistosité (crenulation cleavage) subhorizontale. Le gisement fossi-

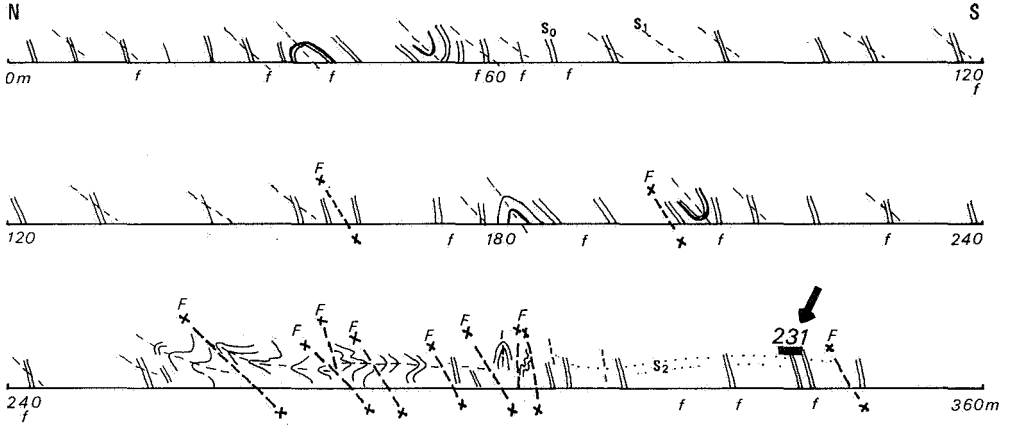

fig. a *Profil au sud de Gospinal*

lifère le plus méridional de ce complex affleure à environ 340 m du carrefour et contient deux niveaux fossilifères à 80 cm de distance correspondant aux numéros 231 et 231M, au nord (231M à quelques cm de 231) et le numéro 231S à 80 cm au sud.

Afin de supprimer toute incertitude paléonthologique, (J. M. GRAULICH, 1963 et F. GEUKENS, 1963) je me suis confié au Professeur O. M. BULMAN, spécialiste des graptolithes dendroides, qui a bien voulu examiner un grand nombre de spécimens du gîte 231, 231M en 231S, que je lui avais envoyés.

Il reste pourtant à signaler un problème: le gîte 231 se situe à environ 540 m au sud de la ferme de Gospinal et le Revinien y est tout près; or M. LECOMPTE (1948) a signalé parmi le matériel de l'Institut royal des Sciences Naturelles à Bruxelles des *D. fl. sociale* provenant d'un gisement situé à 700 m au SSE de la ferme de Gospinal. A cette distance de la ferme, il n'y a que des prairies et aucun affleurement est visible; en tenant compte des renseignements environnants on est tenté à supposer la présence du Revinien à cet endroit. Il serait intéressant de connaitre la valeur stratigrafique du gisement 231 par rapport à *D. fl. sociale*.

I. INTRODUCTION.

The presence of the *Dictyonema flabelliforme* zone in the Salmien (Tremadoc) of the Ardennes has long been known (MALAISE 1874,1881, 1888) and more recently several subspecies have been described, including *D. flabelliforme flabelliforme* and *D. fl. sociale* (LECOMPTE 1948; GEUKENS 1950) from localities in the neighbourhood of Spa, Sart and Harzé. The precise horizon within the zone of *D. flabelliforme* represented by some of the material was ambiguous, for in the neighbourhood of Laroche (Brabant), the subspecies *D. fl. sociale* (which normally indicates a low level within the zone) occurred in association with trilobites which in England are not known below beds transitional between *D. flabelliforme* and the overlying *Clonograptus tenellus* zone (LECOMPTE 1948). Later, the subspecies *D. fl. anglica* was recorded from Genappe (LECOMPTE 1949) and from Cheneux, in the Lienne Valley, (GEUKENS 1954) and *D. f.* cf. *norvegica* from Schevenhutte, Germany; GEUKENS stated, moreover, that the general succession accords with that in England and Scandinavia, with *anglica* and *norvegica* occurring at levels (upper Sm_1a and Sm_1b) above that dominated by *D. f. flabelliforme*.

More recently, GRAULICH (1963) has recorded *D. f. sociale* and *D. f. parabola* from a locality by the Sawe River between Solwaster

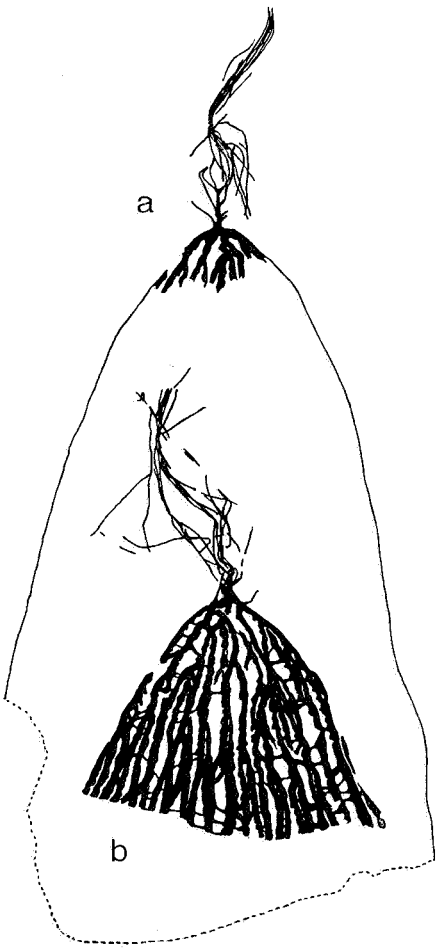

Fig. 1 *Dictyonema flabelliforme belgica* subsp. nov. *a*, holotype, specimen 33a; *b*, specimen 29. Horizon S231, × 2.

and Gospinal. A large collection of this material was kindly sent to me for determination some years ago by Professor GEUKENS in the belief that it was a new variety and also contained the anisograptid *Staurograptus*. (GEUKENS, 1963).

This material has seemed of sufficient interest to justify full palaeontological description. The dominant form, which resembles *D. f. parabola* in many respects, is thought sufficiently distinct to merit a separate subspecific name; the "anisograptid", though closely resembling *Staurograptus,* is believed to represent a particular preservational aspect of the immature rhabdosomes of this subspecies of *Dictyonema*; and the collection comprises many examples of what seem to be partly decomposed or macerated *Dictyonema* rhabdosomes.

II. STRATIGRAPHICAL OCCURRENCE AND AGE OF THE FAUNA.

The material occurs at two levels (designated 231 and S231) separated by a thickness of about 80 cm of shale devoid of fossils except for one horizon containing some inarticulate brachiopods. The dip is steep and the strata are reported to be inverted, so that bed 231 (and M231) ,which appears to underlie S 231, is the higher horizon. Apart from a few badly preserved inarticulate brachiopods. the fauna is entirely graptolitic. The lower band (S231) is $\pm$ 4 cm in thickness, the upper (231 and M231) is $\pm$ 6 cm; lithologically the lower band is a somewhat blacker shale, with a slight cleavage and more strongly compressed (flattened) stipes, while in the upper band the stipes generally retain a slight relief and the bedding planes are distinctively iron-stained.

The presence of *D. f. parabola,* had it been confirmed, would have been a strong indication of a low zonal position, which would have been confirmed by the record of *Staurograptus*. The present determination of the material as a new subspecies, *D. f. belgica,* leaves the question of age undecided, for the identification of *D. f. flabelliforme* is too uncertain to carry much weight.

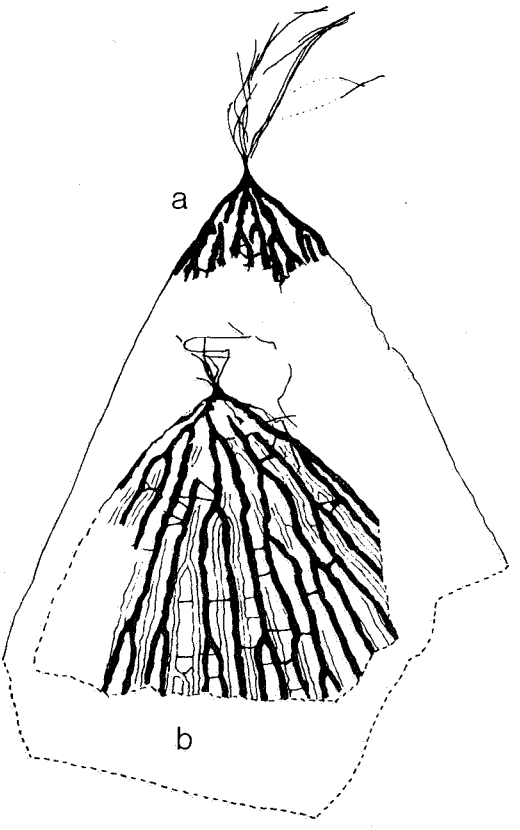

Fig. 2 *D. flabelliforme belgica. a,* specimen 63; *b,* specimen 2a; two specimens with typical nema threads end rather straight lateral margins. Horizon S231, $\times$ 2.

III. SYSTEMATIC DESCRIPTIONS.

a) The S231 fauna.

1. *Dictyonema flabelliforme belgica* subsp. nov.
PL. 1, figs. 2 - 4, 6 - 7; text - figs. 1 - 5.
1964. *Dictyonema flabelliforme* var. nov. BULMAN, figs. 7*c, d.*

Nema typically branched or multiple, producing an apical tuft of fibres; rhabdosome relatively broad, with curved lateral walls proximally, derived from 4 primary stipes; stipes 10 (9-11) per cm, 0.4 mm broad, separated by slightly wider interspaces; dissepiments slender, straight, somewhat irregular in spacing.

Holotype. Specimen 33a (fig. 1*a* + Pl. 1, fig. 2), horizon S 231.

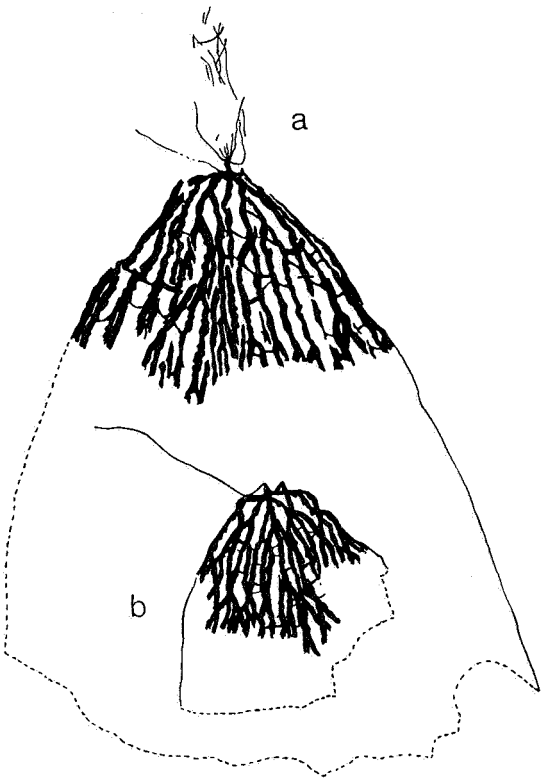

Fig. 3 *D. flabelliforme belgica. a,* specimen 72b; *b,* specimen 75 showing partially discoidal proximal end preservation. Horizon S231, × 2.

Description. A distinctive feature of the rhabdosome is the presence of a bundle or sheaf of fibres produced from the apex of the rhabdosome in place of a single nema (figs. 1-3). Commonly these originate at the apex of the sicula, but in certain examples (fig. 1*a*) some of them arise from what must be the metasicula, or even (fig. 1*b*) from the dorsal margin of one or more of the primary stipes. Comparable but more sparsely developed threads have been recorded (BULMAN 1929) in *Dictyonema flabelliforme* material from an unknown locality, and here also some fibres arose from the dorsal side of primary stipes. In *D. f. belgica,* these filaments may number as many as 10 or even more, and attain a length of 15 mm. It is uncertain whether this bundle of fibres represents an attachment organ or is related to a rhabdosome "float" of soft tissue.

In a few examples the nema bifurcates only once, or is undivided (fig. 3*b*) though of comparable length, 13-15 mm; early growth-stages generally show a single (undivided) nema.

Owing to the curvature of the lateral wall of the rhabdosome, especially at the proximal end, the length/breadth ratio depends to a considerable extent on the size of the rhabdosome, but the degree of curvature itself is also variable. Thus in relatively mature rhabdosomes, the breadth may vary from 3.0 cm (estimated) at length 4.5 cm (fig. 1*a*) to 3.5 cm (est.) at length 3.3 cm (fig. 2*a*). The straighter and broader rhabdosomes approximate to the shape more characteristic of *D. f. anglica,* while the others recall *D. f. parabola*; but the extremes are connected by intermediates. Most of the rhabdosomes in the collection are of the second type, with strongly rounded "shoulders" and a l/b ratio of 1.3-1.5: 1 (fig. 1) in mature colonies.

The rhabdosome originates in 4 primary branches, and the four subsequent divisions are rapid. Stipes number 9-11 per cm (usually 10) and have a width (flattened) of 0.4-0.5 mm; they are separated by interspaces slightly wider than the branches.

Dissepiments are not sufficiently well preserved for a reliable count, but they are slender and straight though commonly inclined (not at right angles to the stipes) and apparently somewhat irregular in spacing.

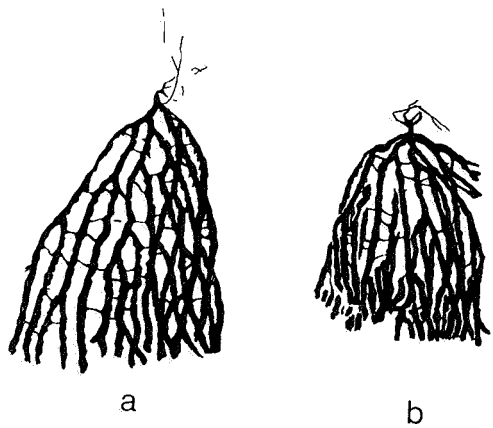

Fig. 4 *D. flabelliforme belgica. a,* specimen 1a; *b,* specimen 57. Horizon S231, × 2.

They are more abundant distally than at the proximal end.

Traces of thecae are so rare that no reliable estimate of their number can be given; in two examples, however, there appear to be 5 in 3.2 and 3.3 mm.

Resemblances. The general form of the rhabdosome resembles that of *D. f. parabola,* but the subspecies differs in the nature of the dissepiments, which are notably irregular in *D. f. parabola.* Rhabdosomes with straighter sides approximate to the shape of *D. f. anglica,* but the stipes are more numerous and there are 4 primary branches, so that the branches at the proximal end are more crowded. The material most strongly resembles the form which occurs in the Baltic island of Bornholm (pl. 1, fig. 1); few of the rhabdosomes from that locality available to me are complete proximally, but of these none show the remarkable modifications of the nema characteristic of the Belgian material.

Staurograptid preservation. It is generally assumed that the genus *Staurograptus* arose from a 4-stiped *Dictyonema* ancestor (and similarly *Anisograptus* from a 3-stiped *Dictyonema*) by loss of dissepiments and a change from declined to a more horizontal habit of growth. But the relative lack of dissepiments at the proximal end of *D. f. belgica* and the wide initial angle of its conical rhabdosome would facilitate the preservation of early growth stages and young rhabdosomes with a discoidal orientation; and specimens so preserved would be virtually indistinguishable from *Staurograptus.* It appears to me that the *Staurograptus* material from the Sawe River exposure, though understandably identified provisionally as such by GEUKENS (1963), is to be regarded as immature *D. f. belgica* in discoidal preservation (fig. 5). Somewhat larger, undoubtedly *Dictyonema,* rhabdosomes with this orientation are shown in Pl. 2, fig. 4; and there are several instances (e.g., fig. 3*b*) where still more mature rhabdosomes show at least a tendency towards the same, the sicula being no longer apical in position, though the more numerous dissepiments and cylindrical shape of the mature colony prevents a completely discoidal preservation. It is probably unjustified to suggest that *Staurograptus* is an invalid genus, but this Belgian material does emphasize the rather arbitrary distinction between *Dictyonema* and *Staurograptus,* as well as the practical difficulty which may arise in identification.

Other comments on preservation. In a considerable number of specimens from the S231

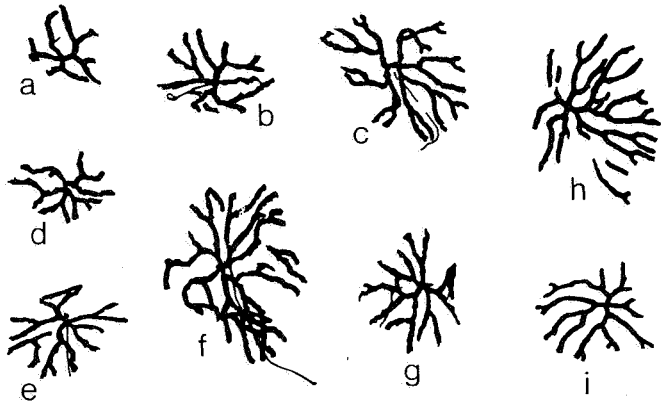

Fig. 5 Discoidal (staurograptid) preservation of immature proximal ends of *D. flabelliforme belgica. a,* specimen 172b; *b,* specimen 172a; *c,* specimen 177b; *d,* specimen 172a; *e,* specimen ♀; *f,* specimen 176b; *g,* specimen 171b; all from horizon S231, × 2. *h,* specimen 3b; *i,* specimen 3b; horizon 231, × 2.

horizon the entire bedding plane is covered with rhabdosomes in the condition shown in Pl. 1, figs. 6.7. The stipes are more slender (generally not exceeding 0.3 mm), flexuous, and dissepiments are often invisible. Stipes of both sides of the rhabdosome are present on the same shale parting, may be somewhat displaced or entangled, and the rhabdosomes vary considerably in shape. These "shrivelled" specimens are suggestive of some decay and partial maceration prior to burial, perhaps related to interrupted sedimentation.

2. *Dictyonema flabelliforme* cf. *flabelliforme* (Eichwald)

PL. 1, fig. 5; text - fig. 6.

While the bulk of identifiable rhabdosomes belong to the subspecies described above, there is a small number which are doubtfully referable to *D. f. flabelliforme*. There is some uncertainty as to the number of primary

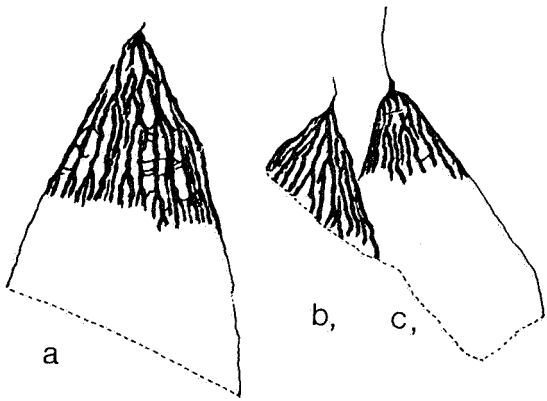

Fig. 6 *Dictyonema flabelliforme* cf. *flabelliforme* (Eichwald). *a*, specimen 94a; *b*, *c*, specimen 177b. Horizon S231, × 2.

braches; even if it can be demonstrated that there are only 3 (as in *D. f. flabelliforme*), the subdivision of at least one of these appears to be more than usually rapid. Thereafter the branching forms fairly distinct and well-spaced "zones" at about 2 1/2, 5 and 9 mm (fig. 5*a*), and the cone remains slender with l/b ratio about 1.3 : 1. Dissepiments are slender, straight, but somewhat irregular in spacing, and thecae number apparently 16 in 10 mm.

b) The 231 and M231 fauna.

1. *Dictyonema flabelliforme* cf. *belgica* subsp. nov.

PL. 2, figs. 1 - 4; text - fig. 7.

Specimens from this horizon are rather better preserved than those from S231, but none of them has any indication of the prominent and distinctive nema structures shown by typical *D. f. belgica*. Some rhabdosomes also attain greater size; that shown in Pl. 2, fig. 3, has a breadth of 5.5 cm and can scarcely have been less than 7.5 cm in length. The lateral margins are gently curved and the maximum curvature occurs at a somewhat greater distance from the apex than in *D. f. belgica* from S231, producing in consequence a broader rhabdosome. Certain examples from S231, however, approach the 231 material in this respect (e.g., fig. 2*b*). Stipes number 9-10 (usually 10) in 10 mm and have a width of 0.4-0.6 mm, equal to the interspaces between them. Dissepiments are slender, straight, rather irregular, but commonly number about 8 in 10 mm. The only traces of thecae detected show 4 in 3 mm. On several pieces of shale there are discoidally-preserved immature ("staurograptid") rhabdosomes (fig. 5*h*, *i*; Pl. 2, fig. 4).

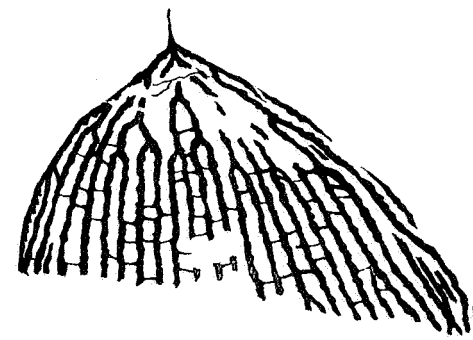

Fig. 7 *D. flabelliforme* cf. *belgica*. Specimen 6, horizon 231, × 2.

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17th of November 1970

PLATE 1

All figs. × 1 ½. Figs. 2-7, horizon S231.

1. *D. flabelliforme* aff. *belgica* subsp. nov. *Dictyonema* Shales, Limensgade, Bornholm. Original in the museum of the Geol. — Pal. Institut of the Humboldt University, Berlin.
2. *D. flabelliforme belgica* subsp. nov. Holotype, specimen 33a.
3. *D. flabelliforme belgica,* specimen 100a, with less curved lateral margins. The stipes of both sides of the rhabdosome are visible on the same shale parting.
4. *D. flabelliforme belgica.* Typical rhabdosomes, specimen 10b.
5. *D. flabelliforme* cf. *flabelliforme* (Eichwald). Specimen 94a.
6. *D. flabelliforme belgica.* Specimen 20b, partially macerated rhabdosomes.
7. *D. flabelliforme belgica.* Specimen 38, partially macerated rhabdosomes.

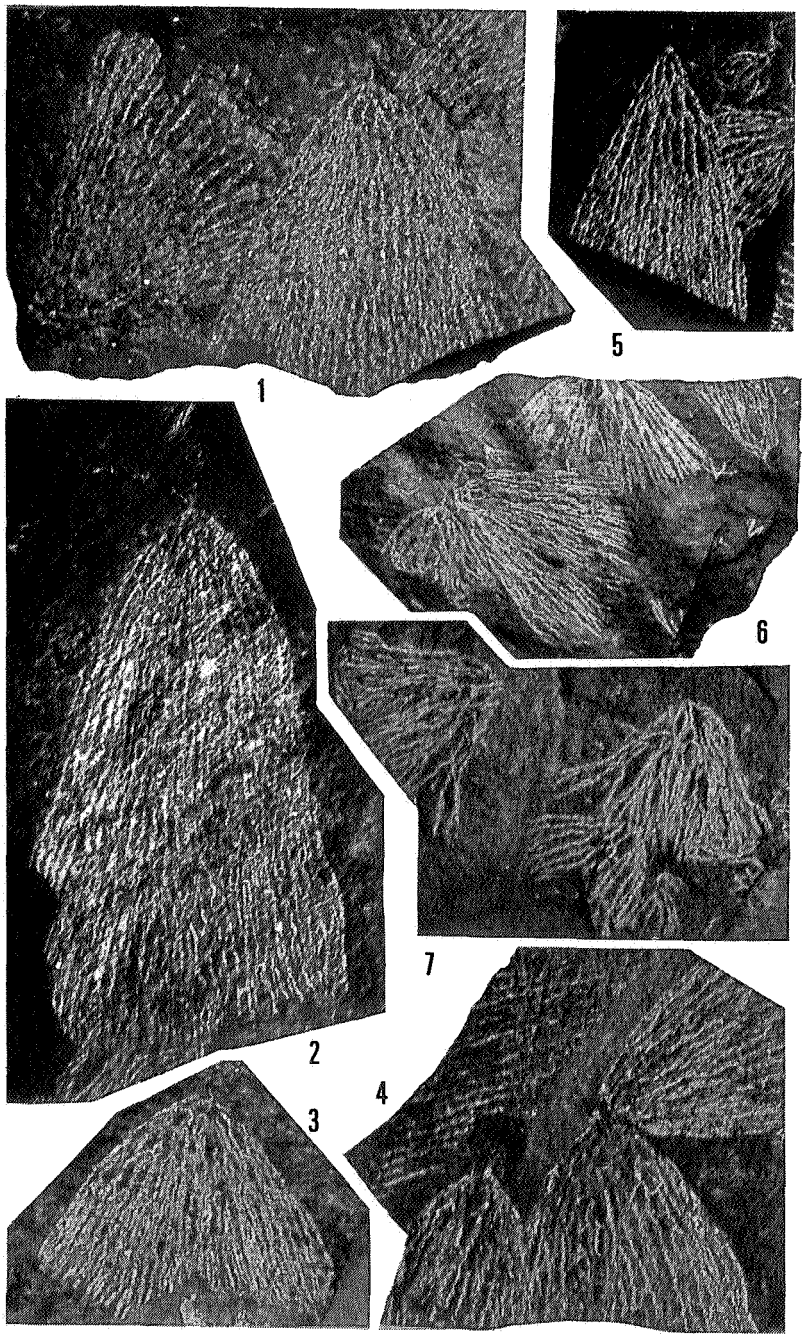
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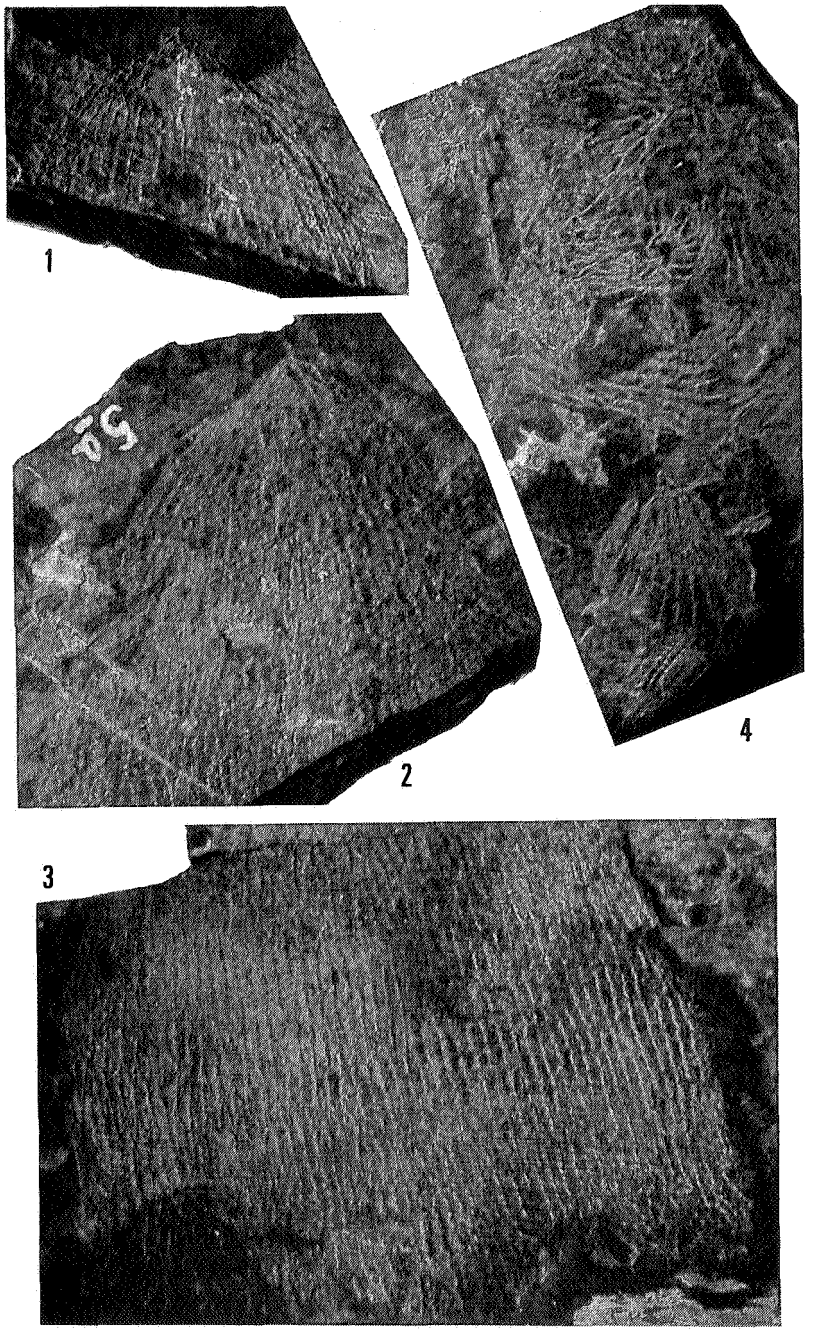
PLATE 2

All figs. × 1 ½, horizon 231.

1. *D. flabelliforme* cf. *belgica*, specimen 6, proximal end.
2. *D. flabelliforme* cf. *belgica*, specimen 5a, proximal end.
3. *D. flabelliforme* cf. *belgica*, specimen 1b, mature rhabdosome lacking the proximal end.
4. *D. flabelliforme* cf. *belgica*, specimen 6, group of immature rhabdosomes, several showing discoidal (staurograptid) preservation.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