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DENDROID GRAPTOLITES OF THE ORDOVICIAN OF BOHEMIA

Předložená práce je revizí všech dosavadních dostupných nálezů dendroidních graptolitů v barrandienském ordoviku. Celkem je popsáno 31 druhů dendroidních graptolitů, z toho 4 nové a stanoven 1 nový rod.

Ze všech souvrství barrandienského ordoviku se dendroidní graptoliti vyskytují ve větší míře pouze v klabavských vrstvách (arenig). Ve fauně všech ostatních souvrství je podíl druhů dendroidních graptolitů nepatrný a jejich nálezy jsou velmi vzácné.

Zachování dendroidních graptolitů v barrandienském ordoviku lze obecně charakterizovat jako nepříznivé. Rabdosomy jsou většinou zploštělé, deformované a karbonatizované. Tato skutečnost nepříznivě ovlivňuje možnosti zpracování materiálu. V podstatě je možno podat popis jednotlivých druhů pouze na základě nejobecnějších charakteristik rabdosomů a vzácněji lze uvést i některé základní znaky ték.

INTRODUCTION

Dendroid graptolites are extremely rare in Ordovician strata of the Barrandian, except the Klabava Formation (Arenig) in which graptolites are more abundant than in other sequences.

F. POČTA (1894) was the first to study dendroid graptolites from the Ordovician of the Barrandian. This scientist described five species from the Šárka (Llanvirn) and Vinice (Caradoc) Formations, namely, *Ptilograptus glomeratus, P. ramosus, ?P. suavis, Desmograptus attextus* and *?Callograptus parvus.* J. PERNER (1895) reported the species *Dendrograptus(?) constrictus* from the Šárka formation (Llanvirn). This formation also yielded *Dendrograptus vokovicensis,* a species described by B. BOUČEK (1933). Records of species of *Dictyonema flabelliforme intermedium, Callograptus kodymi* and *Desmograptus* sp. from the Třenice Formation (Tremadoc) were made by F. PRANTL and A. PŘIBYL (1949). B. BOUČEK (1956) thoroughly studied abundant finds of graptolites at the Rokycany — Stráň locality in the Klabava Formation and identified new species of dendroids are as follows: *Dictyonema krafti, Callograptus*

(Callograptus) rokycanensis, Callograptus (Alternograptus) holubi, Dendrograptus horaki, D. klouceki, D. irregularis, Desmograptus callograptoides, Thamnograptus (?) rokycanensis, and a number of other rhabdosome remains determined only on generic level. Additional species of dendroid graptolites from the Klabava Formation were described by J. KRAFT (1972, 1973). These are: *Dictyonema rokycanense, D. hornyi, Callograptus undosus, Dendrograptus bouceki,* and *Reticulograptus? inusitatus.*

Several other papers also give an account of dendroid graptolite remains in various strata of the Ordovician in the Barrandian. In most cases these finds are only sporadical and cannot be determined in greater detail due to poor preservation, so that they are usually identified only on generic level or commonly referred to as "dendroid graptolites".

Dendroid graptolites generally show a poor state of preservation in Ordovician strata of the Barrandian. Rhabdosomes are largely flat, deformed and strongly carbonatized, forming fine graphitic films on bedding planes. Only rarely are some parts of the rhabodosome preserved in relief, but in most cases they do not display any distinct morphological details.

Importance must also be attached to the location of the rhabdosomes or their parts on a bedding plane. The rhabdosome stipes of dendroid graptolites are mostly located in a rock so that the dorsoventral thecal plane is perpendicular to the bedding plane. In these cases either the ventral or dorsal sides of the stipes may be observed. The situation of the rhabdosome is such that only the shape and width of the stieps are discernible due to generally poor preservation, except rarely distinct sections through thecal apertures.

Less commonly the stipes are located so as to permit the dorsoventral thecal plane parallel the bedding plane; the thecae may then be seen in profile and their essential characters can be examined.

The possibilities of studying the material now available are hampered by the phenomena just discussed in connection with the rare occurrence of dendroid graptolites in Ordovician strata of the Barrandian. Essentially the single species can be described on the basis of general characters of their rhabdosome (i.e., stipe width, angle of divergence, and the number of stipes per length unit). The possibility of providing some basic data on the thecae (i.e., number per length unit, angle of inclination, length width ratio etc.) is more restricted. The detailed morphological thecal structures upon which systematics is sometimes essentially based have not been preserved in the material under study. Furthermore, statistical methods have proved inadequate for studying the material because of the relatively small number of the single species members as yet found.

The stratigraphical division of the Ordovician follows the pattern used by V. HAVLÍČEK and J. VANĚK (1966).

This paper deals with all material available and placed in collections which have been abbreviated as follows: NM — National Museum, Prague (Department of Palaeontology); ÚÚG — Geological Survey, Prague; OMR — District Museum of Dr. B. Horák, Rokycany.

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Systematic part

Graptolithina Bronn, 1846
Dendroidea Nicholson, 1872
Dendrograptidae Roemer (in Frech), 1897
Dictyonema Hall, 1851
Dictyonema flabelliforme intermedium Prantl et Přibyl, 1949
(pl. 1, fig. 1)

1950 *Dictyonema flabelliforme intermedium* nov. subspec.; F. Prantl et A. Přibyl, p. 3-5, pl. 1, figs. 1-4.
Holotype: Specimen figured by F. PRANTL et A. PŘIBYL (1949) on pl. 1, figs. 2-3; (NM — akc. kat. 35 552). Figured here on pl. 1, fig. 1.
Stratum typicum: Třenice Formation (Tremadoc).
Locus typicus: Břežany — quarry „Na Chrástnici".
Materiál: Twenty-one fragments of rhabdosome.

Description: Rhabdosome broadly funnel-shaped. Stipes 0.4—0.5 mm wide, regularly wave-shaped, parallel, and on the average 0.3—0.4 mm apart. Branching dichotomous, the angle of divergence ranging from 50 to 60°. There are 12—16, rarely up to 18 stipes in 10 mm. Dissepiments about 0.2 mm wide, straight, perpendicular to stipe axes. Material not well enough preserved to determine with certainty what the spacing between the dissepiments is, but it is very likely that they occur at the rate of up to 10 in 10 mm. Fenestrules rectangular. Thecae observed only in cross section as shallow, circular depression attaining a diameter of 0.3 to 0.4 mm on stipes. There are 21—22 thecae in 10 mm.

Remarks: The description given above is distinguished from the original description of this subspecies essentially by two diagnostic characters: the greater number of stipes in 10 mm (12—16, rarely up 18 vs. 12—14) and especially in the greater number of thecae in 10 mm (21—22 vs. 14—15).

The subspecies *D. flabelliforme intermedium* is nearly identical with the subspecies *D. flabelliforme kulumbeense* Obut et Sobolevskaja in the shape of the stipes, their number in 10 mm, and the number of dissepiments in 10 mm. It differs from it in the somewhat wider stipes (0.4—0.5 mm vs. 0.3—0.4 mm), and in having more thecae over 10 mm (20—21 vs. 18—20).

Occurrence: Břežany — quarry "Na Chrástnici".

Dictyonema krafti Bouček, 1956
(pl. 1, figs. 2-4)

1956 *Dictyonema krafti* n. sp.; B. Bouček, p. 125—127, pl. 1, figs. 1-2, text-fig. 1a-b.
1972 *Dictyonema cf. krafti* Bouček; J. Kraft, p. 40.

Holotype: Specimen figured by B. BOUČEK (1956) on pl. 1, figs. 1-2, text-fig. 1a-b, (NM — L 7606). Figured here on pl. 1, fig. 2.
Stratum typicum: Klabava Formation (Arenig).
Locus typicus: Rokycany — Stráň (gully).
Material: Fifteen fragments of rhabdosome.

Description: Rhabdosome broadly funnel-shaped. Stipes parallel to subparallel, 0.25—0,4 mm wide, straight or having irregularly developed moderate curvature. The distance between the stipes is 0.2—1.5 mm, averaging 0.8—1.0 mm. Branching mostly dichotomous, although there are also certain irregularities represented by transitional forms between typically dichotomous and typically monopodial branching. The angle of divergence varies between 40 and 50 °, exceptionally attaining a value of 80°. There are 12—16 stipes in 10 mm. Dissepiments are hair-like, 0.1—0.15 mm wide, straight, less commonly gently curved, and mostly at or nearly at right angles to axis of stipe. There are 7—10 dissepiments in 10 mm. Fenestrules rectangular, of unequal size. Thecae narrow, tubular. The angle of inclination 20—30° in the proximal part of thecae, and 40—50° in their distal part. There are 15—16 thecae in 10 mm.

Remarks: The species *D. krafti* was established by B. BOUČEK (1956) on the basis of a single specimen found. Additional material made it possible to refine and essentially extend the original description of this species.

The affinities of this species with *D. rectilineatum* Ruedemann were studied by B. BOUČEK (1956). *D. krafti* Bouček has been found associated with *D. hornyi* Kraft, but differs in its wider stipes, smaller number of stipes in 10 mm, and by possessing less dissepiments in 10 mm.

Occurrence: Rokycany — Stráň (Valcha, gully), Volduchy — Kašparův vrch, and Volduchy — boreholes V 46 and V 57.

Dictyonema rokycanense Kraft, 1972
(pl. 2, figs. 1-4)

1956 *Dictyonema sp.* (C) B. Bouček, p. 128, text-fig. 1f.
1972 *Dictyonema rokycanense* sp. n.; J. Kraft, p. 39-40, pls. 1-2.
1974 *Dictyonema rokycanense* Kraft; J. Kraft, p. 54.
Holotype: Fragment of rhabdosome figured by J. KRAFT (1972) on pl. 1, (OMR — No. 7-5). Figured here on pl. 2, fig. 2.
Stratum typicum: Klabava Formation (Arenig).
Locus typicus: Rokycany — Stráň (quarry).
Material: Twenty-five fragments of rhabdosome.

Description: Rhabdosome probably narrow, funnel-shaped. Stipes parallel, 0.7—0.8 mm wide, and reach 1.0 mm in width where dissepiments take off. The distance between stipes roughly equals stipe width. Branching dichotomous, the angle of divergence being about 20°. There are 7—8 stipes in 10 mm. Dissepiments usually 0.25—0.7 mm wide, becomming broadened towards the margins and mostly being at right angles to axis of stipe. They are spaced irregularly, the rate being 5—8 in 10 mm. Fenestrules irregular, often rounded in corners. Thecae not apparent on the material studied. Only in two cases have the stipes been seen moderately curved over short distances, thereby indicating thecal

arrangement. Thecae would then occur at the rate of 9—10 in 10 mm.

Remarks: The relations of this species to species of *D. crassum* Girty and *D. quebecense* Ruedemann have been discussed by J. KRAFT (1972).

Occurrence: Rokycany — Stráň (quarry); Klabava — U starého hradu; Osek — borehole B 50; Ejpovice — boreholes E 34 and E 35; Mýto — U strážního domku.

Dictyonema hornyi Kraft, 1973
(pl. 3, figs. 1-2)

1956 *Dictyonema sp.* (A), *aff. shelvense* Bulman; B. Bouček, p. 127-128, text-fig. 1c-d.
1973 *Dictyonema hornyi* sp. n.; J. Kraft, p. 25-26, pl. 1, fig. 1.
Holotype: Fragment of rhabdosome figured by J. KRAFT (1973) on pl. 1, fig. 1, (OMR — No. 7-636). Figured here on pl. 3, fig. 1.
Stratum typicum: Klabava Formation (Arenig).
Locus typicus: Rokycany — Stráň (Valcha).
Material: Seven fragments of rhabdosome.

Description: The shape of rhabdosome is unknown. Stipes straight, parallel, 0.2—0.25 mm wide. The distance between stipes ranges from 0.2 to 0.4 mm. Branching dichotomous, the angle of divergence 40—50°. There are 20—22 stipes in 10 mm. Dissepiments 0.1—0.2 mm wide, perpendicular to axis of stipe. There are on the average 10—12, exeptionally up to 14 dissepiments in 10 mm. Fenestrules are mostly of regularly rectangular outline. No thecae have been seen.

Remarks. A characteristic feature of *D. hornyi* Kraft is the fine, dense tissue. This species has been found in association with *D. krafti* Bouček and differs from it particularly in the larger number of the stipes in 10 mm, smaller stipe width, the increased number of the dissepiments in 10 mm, and regular bifurcations. It may be distinguished from *D. shelvense* Bulman by the somewhat smaller stipe width, and also by the larger number of stipes in 10 mm but the smaller number of dissepiments over the same distance. *D. hornyi* Kraft also resembles species of *D. merriani* Ruedemann and *D. densum* Ruedemann from Ordovician strata of North America. The difference between the forms is that the two latter possess a little thinner stipes, generally more stipes in 10 mm, and especially an incereased number of dissepiments over 10 mm.

In addition, two small fragments of rhabdosome described and figured by B. BOUČEK (1956) as *Dictyonema sp.* (A), *aff. shelvense* Bulman are assigned to this species on the basic of identical diagnostic features.

Occurrence: Rokycany — Stráň (Valcha, gully); Sirá — borehole Zb III.

Dictyonema dubium Počta, 1894
(pl. 3, figs. 3-4)

1894 ?*Dictyonema dubium* n. sp.; F. Počta, p. 204, pl. VII, figs. 13-14.
Holotype: Fragment of rhabdosome figured by F. POČTA (1894) on pl. VII, figs. 13-14, (NM — ČD 154). Figured here on pl. 3, fig. 3.
Stratum typicum: Šárka Formation (Llanvirn).
Locus typicus: Osek.
Material: Six fragments of rhabdosome.

Description: The shape of rhabdosome is unknown. Stipes straight, parallel, 0.2—0.4 mm wide, and spaced 0.5—1.0 mm apart. Branching dichotomous, the angle of divergence varies between 35 and 65°, and rarely even more. There are 10—15 stipes in 10 mm, averaging 11—13. Dissepiments hair-like, 0.1 mm wide, usually at right angles to axis of stipe. There are 9—11 dissepiments in 10 mm. Fenestrules rectangular. Thecae are observable only in cross section as circular depressions 0.2 mm in diameter. There are 14—16 thecae in 10 mm.

Remarks: *D. dubium* Počta is similar to *D. barborae* sp. n. from the Dobrotivá Formation, but differs in having more stipes and thecae in 10 mm.

The larger number of both stipes and dissepiments over 10 mm distinguishes this species from the species *D. volchovense* Obut recorded in middle Ordovician strata of the Leningrad region.

R. RUEDEMANN (1947) placed the species *Dendrograptus dubius* Miller, 1889 from the Silurian of North America in the genus *Dictyonema* Hall. However, since the designation *D. dubium* (Miller, 1889) is a homonym of the species *D. dubium* Perner, it seems inevitable to coin a new name for the North American species.

Occurrence: Rokycany; Osek; Volduchy (siliceous concretions); Ejpovice — borehole E 59 (clay shales).

Dictyonema barborae sp. n.
(pl. 3, fig. 5)

Holotype: Fragment of rhabdosome figured on pl. 3, fig. 5, (OMR — No. 47-5).
Stratum typicum : Dobrotivá Formation (Llandeilo).
Locus typicus : Březina — borehole B 203.
Derivatio nominis: Barbora (English: Barbara), name used for species designation.
Material: Two fragments of rhabdosome.

Description: The shape of rhabdosome is unknown. Stipes straight or gently curved irregularly, parallel, 0.3—0.4 mm wide, and spaced 0.5—0.6 mm apart. Branching dichotomous, the angle of divergence being about 60°. There are 9—11 stipes in 10 mm. Dissepiments 0.1 mm wide, irregularly distributed and at right angles to axis of stipe. Fenestrules are usually elognate and rectangular in shape. Thecae not observed. A fuselar structure may be seen on some stipes of the holotype. There are about 37 fuselar segments in 1 mm indicating that the width of one segment attains a value of 0.027 mm.

Remarks: *D. barborae* sp. n. closely resembles the species *D. volchovense* Obut from the middle Ordovician of the Leningrad region, but may be distinguished especially by the somewhat wider stipes and the increased number of the stipes in 10 mm. It may be distinguished from *D. dubium* Počta from the Šárka Formation (Llanvirn) by the smaller number of both stipes and dissepiments in 10 mm.

Occurrence: Březina—borehole B 203; Starý Plzenec — excavation for a well.

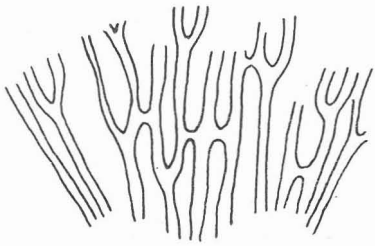
Dictyonema sp.
(text-fig. 1)

Material: One fragment of rhabdosome.

Description: The shape of rhabdosome is unknown. Stipes mostly straight, parallel, 0.25—0.4 mm wide, spaced on the average at the rate of 0.5 mm (extreme values: 0.2—0.8 mm). Branching dichotomous, the angle of divergence varies between 40 and 90 °. There are 11—13 stipes in 10 mm. Dissepiments are 0.1—0.25 mm wide, relatively sparse and at right angles to axis of stipe. Thecae are seen only in cross section as shallow, circular depressions 0.1 mm in diameter. There are about 20 dissepiments in 10 mm.

Remarks: The fragment of the rhabdosome described to some extent resembles the species *D. fluitans* Bulman from the British Ordovician (Caradoc), but may be distinguished especially by the greater number of both stipes and thecae in 10 mm.

Occurrence: Bohdalec Formation (Caradoc); locality: Řeporyje — Reiser's brickyard.



1. *Dictyonema* sp., x4, Bohdalec Formation (Caradoc), Řeporyje — Reiser's brickyard, (after NM — akc. kat. 30—964).

Callograptus Hall, 1865

Callograptus kodymi Prantl et Přibyl, 1949
(pl. 4, figs. 1-2)

1950 *Callograptus kodymi* n. sp.; F. Prantl et A. Přibyl, p. 5-6, pl. 1, figs. 5-6.
Holotype: Specimen figured by F. PRANTL et A. PŘIBYL, (1949) on pl. 1, fig. 5, (NM — akc. kat. 22 656). Figured here on. pl. 4, fig. 1.
Stratum typicum: Třenice Formation (Tremadoc).
Locus typicus: Břežany — quarry „Na Chrástnici".
Material: Four fragments of rhabdosome.

Description: The shape of rhabdosome is unknown. Stipes 0.75—0.85 mm wide, subparallel, moderately incurved, and on the average 0.5—0.7 mm apart. Branching dichotomous, the angle of divergence varies between 60 and 80 °. There are 6—7 stipes in 10 mm. Dissepiments occur sporadically, 0.75—0.8 mm wide, and perpendicular to axis of stipe. Thecae can be observed only in cross section as shallow, circular depressions 0.2—0.3 mm in diameter. There are about 18 thecae in 10 mm.

Remarks: The relations of this species to the species of *C. crassus* Decker and *C. tennesseensis* Ruedemann were earlier studied by F. PRANTL and A. PŘIBYL (1949).

Occurrence: Břežany — quarry „Na Chrástnici".

Callograptus rokycanensis Bouček, 1956
(pl. 4, fig. 3; pl. 5, fig. 1-2)

1956 *Callograptus (Callograptus) rokycanensis* n. sp.; B. Bouček, p. 130-131, pl. 1, figs. 3-5, text-fig. 1h-i.
1972 *Callograptus (Calograptus) rokycanensis* Bouček; J. Kraft, p. 40, fig. 1.
Holotype: Specimen figured by B. BOUČEK (1956) on pl. 1, figs. 4-5, text-fig. 1i; (NM — L 7578). Figured here on pl. 5, fig. 1.
Stratum typicum: Klabava Formation (Arenig).
Locus typicus: Rokycany — Stráň (gully).
Material: Eleven fragments of rhabdosome.

Description: Rhabdosome funnel-shaped. Stipes straight, 0.5—0.9 mm wide, locally wave-shaped, subparallel to parallel. The distance between the stipes approximately equel to stipe width. Branching dichotomous, the angle of divergence ranges from 40 to 60 °. There are 7—10 stipes in 10 mm, averaging 7—8. Dissepiments are irregularly sparsely distributed, 0.2—0.5 mm wide in central part and slightly widen towards their margins. They are perpendicular to axis of stipe. Thecae are seen in cross section as shallow, circular depressions 0.4—0.5 mm in diameter which are located alternatingly at the margin of the stipe. There are about 13—14 thecae in 10 mm.

Remarks. The relations of *C. rokycanensis* to *C. hopkinsoni* Bulman were earlier discussed by B. BOUČEK (1956). The former is known to occur in association with the species *C. undosus* Kraft from which it may be distinguished particularly by the wider stipes and the striking de crease in number of both thecae and stipes in 10 mm.

Occurrence: Rokycany — Stráň (Valcha, gully); Volduchy — borehole V 41; Starý Plzenec — Sv. Blažej.

Callograptus holubi Bouček, 1956
(pl. 4, fig. 4)

1956 *Callograptus (Alternograptus) holubi* n. sp. B. Bouček, p. 131-133, pl. 2, figs. 1-2, text-fig., 2a-c.
Holotype: Specimen figured by B. BOUČEK (1956) on pl. 2, figs. 1-2, text-fig. 2a, (NM — L 7589). Figured here on pl. 4, fig. 4.
Stratum typicum: Klabava Formation (Arenig).
Locus typicus: Rokycany — Stráň (quarry).
Material: Ten fragments of rhabdosome.

Description: Rhabdosome discoidal with radial arrangement of four (?) main stipes which are immediately bifurcated into 2-3 second-order stipes. The proximal part of the second-order stipes has characteristic "ptilograptid" habit: the third-order stipes projecting from second-order stipes at regular intervals of 1 mm are inclined at 50 ° to both sides. The first 2-3 stipes of the third order are relatively short (maximum 3 mm) and do not branch thereafter. Stipe width ranges from 0.35 mm to 0.45 mm. The angle of divergence varies between 50 and 80 °. There are 8-12 stipes in 10 mm. Dissepiments are rare, 0.2 mm wide, perpendicular to axis of stipe. Thecae seem to be elongate and tubular. There are 14—16 thecae in 10 mm.

Remarks. A characteristic feature of this species is the "ptilograptid" branching of the second-order stipes at proximal parts. From the fact

that the proximal parts of rhabdosome are extremely rare (as is illustrated by a single specimen as yet found, apart from holotype), it is apparent that this distinguishing feature is meaningless in practical identification. Most of the specimens sofar obtained are small fragments of the distal parts of rhabdosomes. These fragments may safely be determined using stipe width, the number of the stipes in 10 mm and the number of the thecae in 10 mm provided there are dissepiments in the specimens under study. However, in the absence of dissepiments at the distal parts of the rhabdosomes, the fragments cannot be practically distinguished from the memebrs of the genus *Dendograptus* Hall, particularly its species *D. horaki* Bouček found associated with *C. holubi* Bouček.

Occurrence: Rokycany — Stráň (quarry, gully).

Callograptus undosus Kraft, 1973
(pl. 5, figs. 3-5; pl. 6, fig. 1)

1956 *Callograptus (Callograptus) cf. expansus* Bulman; B. Bouček, p. 30, text-fig. 1g.
1973 *Callograptus (Callograptus) undosus* sp. n.; J. Kraft, p. 26, p. 2, fig. 1.
Holotype: Specimen figured by J. KRAFT (1973) on pl. 2, fig. 1, (OMR — No. 7-373). Figured here on. pl. 6, fig. 1.
Stratum typicum: Klabava Formation (Arenig).
Locus typicus: Rokycany — Stráň (gully).
Material: Sixty specimens comprising mostly fragments of rhabdosomes.

Description: Rhabdosome narrow, funnel-shaped. Stipes usually prominent, regularly wave-shaped, 0.3—0.5 mm wide, subparallel to parallel, 0.2—1.0 mm apart. Branching dichotomous, the angle of divergence highly varying between 30 and 90 °. There are 12—17 stipes in 10 mm, averaging 14—16. Dissepiments 0.2—0.35 mm wide, sparsely distributed, and perpendicular or nearly perpendicular to axis of stipe. Thecae can be observed only in cross section as circular or oval depressions having 0.2—0.3 mm in diameter. There are 16—17 thecae in 10 mm.

Remarks: *C. undosus* Kraft strongly resembles *C. salteri* Hall from Ordovician strata of North America. It differs from it in the higher number of the stipes in 10 mm and possessing wave-shaped stipes.

This species may be distinguished from *C. expansus* Bulman especially by the smaller number of the thecae in 10 mm and smaller stipe width.

The thinner stipes and the smaller number of both stipes and thecae over 10 mm particularly distinguish this species from *C. rokycanensis* Bouček with which it is foud in association.

B. Bouček (1956) described and figured small fragment of rhabdosome under the name *Callograptus (C.) cf. expansus* Bulman. Its essential diagnostic characters are those recognized in the species *C. undosus* Kraft.

Occurrence: Rokycany — Stráň (Valcha, gully, near the swimming pool); Volduchy — Kašparův vrch; Svojkovice — Závírka; Starý Plzenec — Sv. Blažej; Holoubkov — borehole Hb 1; Sirá — boreholes Zb II, Zb III and a shaft.

Callograptus hanzliki sp. n.
(pl. 7, figs. 1-2)

Holotype: Specimen figured on pl. 7, fig. 1, (OMR — No. 7-655).

Paratype: Fragment of rhabdosome figured on pl. 7, fig. 2, (OMR — No. 7-181).
Stratum typicum: Klabava Formation (Arenig).
Locus typicus: Rokycany — Stráň (Valcha).
Derivatio nominis: After the Hanzlíks, fossil collectors in lower and middle Ordovician strata in the Rokycany area.
Material: Three fragments of rhabdosome.

Description: Rhabdosome discoidal (?). Stipes 0.2—0.3 mm wide, straight or irregularly but moderately incurved, subparallel to parallel. Branching dichotomous, the angle of divergence ranging from 55 to 70 °. There are 13—16 stipes in 10 mm. Dissepiments sporadical, 0.1 mm wide. perpedicular or nearly perpendicular to axis of stipe. The thecae discernible only in cross section as circular depression having 0.2 mm in diameter. There are 16—18 thecae in 10 mm.
Remarks: The species *C. hanzliki* sp. n. generally resembles *C. tenuis* Bulman from the British Ordovician in possessing the same width of the stipes and number of the thecae in 10 mm, but differs from it in the markedly decreased number of stipes in 10 mm (13—16 vs. 21—22).
Occurrence: Rokycany — Stráň (Valcha, gully).

Callograptus jani sp. n.
(pl. 7, fig. 3)

Holotype: Fragment of rhabdosome figured on pl. 7, fig. 3, (OMR — No. 47-12).
Stratum typicum: Dobrotivá Formation (LIandeilo).
Locus typicus: Sklenná Huť — borehole B 294.
Derivatio nominis: Jan (English: John), name used for species designation.
Material: Holotype only.

Description: Stipes straight, gently irregularly curved, 0.6—0.8 mm wide, parallel to subparallel, and 0.2—1.0 mm apart. Branching mostly dichotomous (only in proximal part of rhabdosome monopodial), the angle of difergence 30—40 °. There are 9—10 stipes in 10 mm. Dissepiments rare, 0.3—0.4 mm wide, perpendicular to axis of stipe. Thecae not observed.

Fusellar structure can be seen at the distal part of the rhabdosome on some stipes. Fusellar segments occur at the rate of 20 to 22 in 1 mm, thereby indicating a width of 0.045—0.050 mm for one segment.
Remarks: This species resembles *C. attextus* (Počta) from the Vinice Formation of Ordovician strata in the Barrandian by the shape of rhabdosome, but differs from it in wider stipes.
Occurrence: Sklenná huť — borehole B 294.

Callograptus attexus (Počta, 1894)
(pl. 8, fig. 1)

1894 *Desmograptus attextus* n. sp.; F. Počta, p. 188, pl. III, figs. 3-4a.
Holotype: Specimen figured by F. POČTA (1894) on pl. III, figs. 3-4a, (NM — ČD 896). Figured here on pl. 8, fig. 1.
Stratum typicum: Vinice Formation (Caradoc).
Locus typicus: Trubín.
Material: Holotype only.

Description: Stipes straight or moderately undulating, 0.45—0.6 mm wide, densely parallel to subparallel, spaced 0.5 mm (distal part of rhab dosome) to 1.0—2.0 mm(proximal part of rhabdosome) apart. Branching

usually dichotomous, the angle of divergence ranging from 35 to 45 °, exceptionally attaining 60—70 °. There are 9—10 stipes in 10 mm (distal part of rhabdosome) or 6—8 stipes in 10 mm (proximal part of rhabdosome).Thecae seem to be narrow and conical. There are 12—13 thecae in 10 mm.

Remarks: F. POČTA (1894) assigned to the described fragment of the rhabdosome to the genus *Desmograptus* and stated that the stipes come into contact with each other so as to form "openings" (anastomoses). Studies of the holotype have revealed that the stipes come very near to one another at some places, but do not form true anastomoses, typical of the genus *Desmograptus* Hopkinson. Although no dissepiments were observed on our material due chiefly to poor preservation, the specimen is placed in the genus *Callograptus* Hall on the basis of the general habit of its rhabdosome.

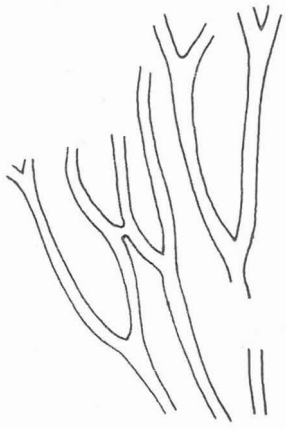
C. attextus (Počta) is similar to *C. jani* sp. n. from the Dobrotivá Formation (Llandeilo) in the Orodovician of the Barrandian in the general habit of the rhabdosome, but may be distinguished especially by the smaller width of its stipes.

Occurrence: Trubín.

Callograptus sp. A
(text-fig. 2)

Material: One fragment of rhabdosome.

Description: The fragment of the shrub-like, sparsely branched rhabdosome measures 2×3 cm. Stipes are 0.6—0.8 mm wide, straight or moderately curved, and subparallel. Branching dichotomous, the angle of divergence ranging from 55 to 78°. There are 4—5 stipes in 10 mm. Dissepiments occur sporadically, 0.4 mm wide, perpendicular to axis of stipe. Thecae not observed.



2. *Callograptus* sp. A, x2, Kabava Formation (Arenig), Volduchy — borehole V 62, (after OMR — No. 7—607).

Remarks: The subparallel orientation of the stipes which are extremely rarely connected by means of dissepiments justifies placing the fragmentary rhabdosome in the genus *Callograptus* Hall. As the specimen

is quite unique and rather poorly preserved, the identification on species level is left for further consideration. The characteristic which clearly distinguishes the fragment from all generic members of *Callograptus* Hall found associated with it is the lower number of stipes in 10 mm.

This fragment is fairly similar to distal portions of the rhabdosomes in *Dendograptus klouceki* Bouček in its general habit of rhabdosome and has been found associated with the latter. The presence of dissepiments would then be a decisive distinguishing feature in such cases, although the two species can easily be confused due to their sporadical occurence, particularly in small fragments of rhabdosomes.

Occurrence: Klabava Formation (Arenig) — locality: Voluchy — borehole V 62.

Callograptus sp. B
(pl. 7, fig. 4)

Material: Two fragments of rhabdosome.

Description: Rhabdosome discoidal (?). Stipes 0.4—0.6 mm wide, straight. Branching dichotomous, the angle of divergence varies between 50 and 70 °. There are about 6—8 stipes in 10 mm. Dissepiments occur sporadically, being 0.2—0.3 mm wide, perpendicular to axis of stipe. Thecae not observed.

Remarks: The fragments resemble the species *C. holubi* Bouček in the general habit of rhabdosome. These two species have been found together, and the former may be distinguished by the wider stipes and less frequent bifurcations in 10 mm. However, because of insufficient material available, the identification on species level is left open to further discussion.

Occurrence: Klabava Formation (Arenig) — locality: Sirá — borehole Zb III.

Dendrograptus Hall, 1858
Dendrograptus horaki Bouček, 1956
(pl. 8, fig. 2)

1956 *Dendrograptus horaki* n. sp.; B. Bouček, p. 134-136, pl. 3, fig. 1-2, text-fig. 3a-b.
1972 *Dendrograptus cf. horaki* Bouček; J. Kraft, p. 40.
Holotype: Specimen figured by B. BOUČEK (1956) on pl. 3, figs. 1-2, text-fig. 3a, (NM — L 7577). Figured here on pl. 8, fig. 2.
Stratum typicum: Klabava Formation (Arenig).
Locus typicus: Rokycany — Stráň (quarry).
Material: Ten fragments of rhabdosome.

Description: Rhabdosome shrub-like. Stipes 0.4—0.5 mm wide, straight or moderately incurved. Branching mostly dichotomous, exceptionally monopodial. The angle of divergence 50—70 °. There are 6—10 stipes in 10 mm, averaging 8. Thecae are probably of narrow tubular shape, numbering about 10 in 10 mm.

Remarks: It become impossible to add anything to the original description of the species (BOUČEK, 1956) because of small amount of the material obtained recently.

The relations of *D. horaki* Bouček to *D. hallianus* (Prout) were earlier discussed by B. BOUČEK (1956).

Occurrence: Rokycany — Stráň [quarry, gully, Valcha]; Klabava — U starého hradu; Volduchy — borehole V 62.

Dendograptus irregularis Bouček, 1956
(pl. 8, figs. 3-4)

1956 *Dendrograptus irregularis* n. sp.; B. Bouček, p. 136, pl. 3, fig. 5, text-fig. 3d-f.
Holotype: Fragment of rhabdosome figured by B. BOUČEK (1956) on pl. 3, fig. 5, text-fig. 3d-f, (NM — L 7574). Figured here on pl. 8, fig. 3.
Stratum typicum: Klabava Formation (Arenig).
Locus typicus: Rokycany — Stráň (quarry).
Material: Two fragments of rhabdosome.

Description: Rhabdosom shrub-like. Stipes 0.5—1.0 mm wide, irregularly incurved. Branching irregular, the angle of divergence varies between 40 and 90 °. There are 9—10 stipes in 10 mm (proximal part of rhabdosome) or 7—9 stipes in 10 mm (distal part of rhabdosome). The somewhat more regular wave-shaped stipesh in some shorter portions might indicate thecal arrangement, numbering about 15 in 10 mm.
Remarks: B. BOUČEK (1956) based the species on the description of a single specimen that was strongly mechanically damaged. Since then only one fragment of the proximal part of the rhabdosome assigned to the species has been recovered, but it is better preserved than the holotype, so that it proved possible to add essential characters to its original description.

D. irregulais Bouček is very similar in almost every respect to *D. striatus* Hall from Ordovician strata of North America. The major difference between the forms is that the former has more stronger curvature of the stipes and the more variable angle of divergence, on the average attaining a higher value than the latter.
Occurrence: Rokycany — Stráň (quarry).

Dendrograptus klouceki Bouček, 1956
(pl. 9, fig. 1; pl. 10. figs. 1-2)

1956 *Dendrograptus klouceki* n. sp.; B. Bouček, p. 137, pl. 3, figs. 3-4, pl. 6, fig. 5, text-fig. 4a-d.
1971 *Dendrograptus klouceki* Bouček; J. Kraft, p. 49-50.
1972 *Dendrograptus klouceki* Bouček; J. Kraft, p. 40.
Holotype: Fragment of rhabdosome figured by B. BOUČEK (1956) on pl. 3, fig. 4, text-fig. 4a, (NM — L 7587). Figured here on pl. 10, fig. 2.
Stratum typicum: Klabava Formation (Arenig).
Locus typicus: Rokycany — Stráň (gully).
Material: Eighty specimens, mostly fragments of rhabdosome.

Description: Broadly fan-like rhabdosome roughly has a semicircular outline and grows from a short, thick stem. The base of the stem is broadened and forms a basal disc of triangular shape in vertical section. The lower side of the disc measures 5 mm. The disc equally narrows distally up to a distance of 2 mm from the lower side where its width attains a value of 2 mm. Stem width is invariable over the next 3 mm and again broadens immediately before bifurcation. The total length of the stem from its base to the point of its first bifurcation is 7.5 mm. The width of stipes varies between 1.0 and 1.8 mm in the proximal part of rhabdosome. In distal part of rhabdosome it gradually decreases to

0.6 mm. Dorsoventral width of the stipes ranges from 1.1 to 1.4 mm. Stipes are 0.5—2.0 mm apart. Branching dichotomous, the angle of divergence 40—60 °. There are about 4 stipes in 10 mm (proximal part of rhabdosome) or 5—7 stipes in 10 mm (distal part of rhabdosome). Thecae are not unlike narrow, elongate tubes width circular apertures in section. They are inclined 40—50 °. Free thecal portions about 0.7 mm long. There are 15—17 thecae in 10 mm.

Remarks: The new material showing an extremely good state of preservation was an aid in supplying additional information on the original description by B. Bouček (1956). The previously described specimens are only fragments of the rhabdosome of the species which most likely can be derived from the central or distal parts of the rhabdosomes. This fact also indicates that the stem mentioned in the original description is merely part of a longer, undivided stipe.

The affinities of *D. klouceki* Bouček with *D. hallianus* (Prout) were earlier studied by B. BOUČEK (1956).

Occurrence: Rokycany — Stráň (gully, Valcha, near the swimming pool, southern slope); Volduchy — Kašparův vrch; Volduchy — boreholes V 32, V 39, V 16, V 46, V 63; Svojkovice — Závírka; Sirá — boreholes Zb II, Zb III; Holoubkov — borehole Hb V.

Dendrograptus bouceki Kraft, 1973
(pl. 10, fig. 3)

1956 *Dendrograptus* sp. (B); B. Bouček, p. 138-139, text-fig. 4e.
1973 *Dendrograptus bouceki* sp. n.; J. Kraft, p. 26—27, pl. 2, fig. 2.
Holotype: Fragment of rhabdosome figured by J. Kraft (1973) on pl. 2, fig. 2, (OMR — No. 7-492). Figured here on pl. 10, fig. 3.
Stratum typicum: Klabava Formation (Arenig).
Locus typicus: Rokycany — Stráň (Valcha).
Material: Twelve fragments of rhabdosome.

Description: Rhabdosome shrub-like. Stipes 0.45—0.55 mm wide, often moderately arched, ranging dorso-ventraly from 0.7 to 1.0 mm in width, on the average 0.7—1.0 mm apart. Branching dichotomous, the angle of divergence 30—40 °. There are on the average 9—10 stipes in 10 mm. The three values of the interval of bifurcation can be observed on the material under study. They are 10.0—12.0 mm, 5,5—6.5 mm, and about 4.0 mm. The outer thecal margin is characteristically incurved. The angle of inclination 20—23 ° in the proximal part of thecae and up to 60 ° in their distal part. The length of free thecal portion measures about 0.7 mm. There are 10 thecae in 10 mm.

Remarks: The species *D. bouceki* Kraft is characterized especially by thecal shape — a feature which clearly distinguishes it from all known members of the genus *Dendrograptus* Hall.

B. Bouček (1956) described under the designation *Dendrograptus* sp. (B) a fragment of rhabdosome of the *Dendrograptus* Hall generic member which is closely related to the species *D. bouceki* Kraft on the basis of diagnostic features such as the width of stipes, the number of thecae in 10 mm, thecal shape, and the interval of bifurcation.

Occurrence: Rokycany — Stráň (Valcha, gully).

Dendrograptus vokovicensis Bouček, 1933
(pl. 11, fig. 1)

1933 *Dendrograptus vokovicensis* n. sp.; B. Bouček, p. 9, fig. 3.
1971 *Dendrograptus vokovicensis* Bouček; J. Kraft, p. 57.
Neotype: Fragment of rhabdosome figured on pl. 11, fig. 1, (OMR — No. 46-137).
Stratum typicum: Šárka Formation (Llanvirn).
Locus typicus: Rokycany — Drahouš.
Material: Four fragments of rhabdosome.

Description: Rhabdosome shrub-like. Stipes straight, 0.9 mm wide in proximal part of rhabdosome but narrowing to 0.2 mm distally. Their width attains a value of 1.0—1.1 mm dorsoventrally. Branching dichotomous, the angle of divergence 30—40 °, exceptionally even 25 °. The number of stipes in 10 mm cannot be safely determined due to both deformation and mechanical damage of the rhabdosome. Thecae narrow, elongate, their outer margin being slightly curved. They are inclined 10 ° and 15 ° proximally and distally, respectively. There are approximately 8—9 thecae in 10 mm.
Remarks: Since the holotype seems to have been lost, it is inevitable to establish neotype. The specimen selected has not been taken from the same site as the holotype, but all its characters are conformable to those recognized in the original description by B. BOUČEK (1933).
Occurrence: Vokovice — brickyard; Rokycany — Drahouš; Ejpovice — borehole E 81; Holoubkov — borehole Hb III.

Dendrograptus? constrictus Perner, 1895
(pl. 10, fig. 4)

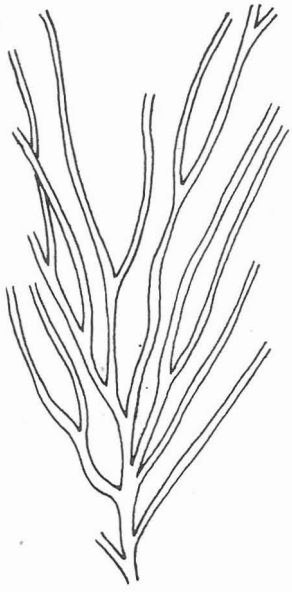
1895 *Dendrograptus (?) constrictus* n. sp.; J. Perner, p. 51, pl. 6, figs. 13-15.
Holotype: Fragment rhabdosomu figured by J. PERNER (1895) on pl. 6, figs. 13-15. (NM — ČD 97). Figured here on pl. 10, fig. 4.
Stratum typicum: Šárka Formation (Llanvirn).
Locus typicus: Krušná Hora.
Material: Holotype only.

Description: The shape of rhabdosome is unknown. Stipes straight or moderately incurved, being 1.2—1.5 mm wide dorso-ventrally and diverging at an angle of 25 °. Outer thecal margin markedly curved. Thecae inclined at 25—30 ° and 45 ° in proximal and distal parts, respectively. Free thecal part measures about 1.8 mm. There are 8—9 thecae in 10 mm.
Remarks: This species was introduced by J. PERNER (1895) on the basis of a fragment of rhabdosomes described. Because of its small size, reliable identification is impossible even on generic level.
Occurrence: Krušná hora.

Dendrograptus parvus (Počta, 1894)
(pl. 8, fig. 5; text-fig. 3)

1894 *?Callograptus parvus* n. sp.; F. Počta, p. 184, pl. III, fig. 2.
Holotype: Fragment of rhabdosome figured by F. POČTA (1894) on pl. III, fig. 2, (NM — ČD 902). Figured here on. pl. 8, fig. 5.
Stratum typicum: Vinice Formation (Caradoc).
Locus typicus: Trubín.
Material: Holotype only.

Description: Rhabdosome shrub-like. Stipes straight, 0.2—0.25 mm wide, up to 0.9 to 1.0 mm apart. Branching mostly dichotomous, exceptionally monopodial. The angle of divergence 35—40 °. There are 14—16 stipes in 10 mm. Thecae not observed.



3. *Dendrograptus parvus* (Počta), x4, Vinice Formation (Cardoc), Trubín, (after NM — ČD 902).

Remarks: F. POČTA (1894) tentatively assigned the fragment to the genus *Callograptus* Hall. According to his original description, the dissepiments are rare but subsequent studies have revealed that the dissepiments are completely lacking. For this reason, and on the basis of the general habit of rhabdosome, the species is placed in the genus *Dendrograptus* Hall.

Occurrence: Trubín.

Dendrograptus sp.
(text-fig. 4)

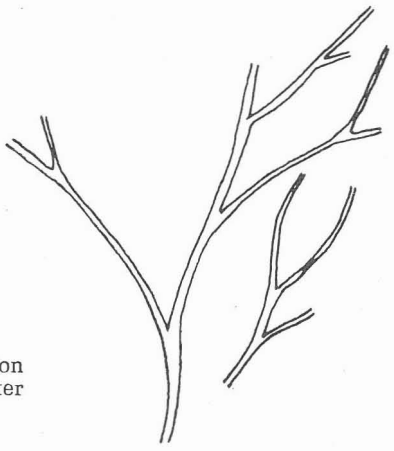
Material: One fragment of rhabdosome.

Description: Rhabdosom shrub-like. Stipes 0.4—05 mm wide proximally to rhabdosome, distinctly diminishing to 0.1—0.2 mm distally. Branches both dichotomous and monopodial, the angle of divergence varies between 30 and 60 °. Circular to oval depressions showing thecal sections can rarely be seen at proximal part of rhabdosome. There are 20—21 thecae in 10 mm.

Remarks: The fragment just described strongly resembles the species *D. vokovicensis* Bouček from the Šárka Formation (Llanvirn) particularly by the general shape of rhabdosome and by possesing stipes pronouncedly narrowing distally. It may be distinguished especially by the number

of thecae in 10 mm. Species identification is impossible due to the extremely poor preservation of the fragment.

Occurrence: Dobrotivá Formation (Llandeilo) — locality: Klabava — borehole K 10.



4. *Dendrograptus* sp. x4, Dobrotivá Formation (Llandeilo), Klabava — borehole K 10, (after ÚÚG — XA 369).

Desmograptus Hopkinson, 1875
Desmograptus callograptoides Bouček, 1956
(pl. 10, figs. 5-6; pl. 12, figs. 1-3)

1944 *Desmograptus callograptoides* n. sp.; B. Bouček, p. 233, pl. 2 (nomen nudum).
1956 *Desmograptus callograptoides* n. sp.; B. Bouček, p. 139-141, pl. 4, figs. 1-3, pl. 5, fig. 1, text-fig. 5a-e.
1971 *Desmograptus callograptoides* Bouček; J. Kraft, p. 50.
Holotype: Specimen figured by B. BOUČEK (1956) on pl. 4, figs. 1-2, text-fig. 5a, (NM — L 7592). Figured here on pl. 12, fig. 2.
Stratum typicum: Klabava Formation (Arenig).
Locus typicus: Rokycany — Stráň (gully).
Material: Eighty specimens, mostly fragments of rhabdosome.

Description: Rhabdosome broadly fan-shaped, growing from a short broad stem having 5.0—6.0 mm in length and averaging 0.6 mm in width. Stipes lie at a distance of 0.25—0.45 mm, rarely up to 0.55 mm. Branching dichotomous, the angle of divergence 40—50°. There are 9—12 stipes in 10 mm (on the average 10—11). The stipes are connected by means of anastomoses and dissepiments. The ratio between the occurrence of anastomoses and dissepiments varies: certain rhabdosomes or only their parts display dominant anastomoses, others dissepiments. Dissepiments are straight, occasionally moderately incurved, and usually of the same width as the stipes. They are perpendicular or nearly perpendicular to axis of stipe. The shape of fenestrules is highly variable and connot be generally characterized. Thecae observable as circular forms 0.2 mm in diameter on stipes. There are about 16 thecae in 10 mm.
Remarks: The relations between *D. callograptoides* Bouček and species of *D. cencelatus* (Hopkinson) and *D. intricatus* Ruedemann were earlier examined by B. BOUČEK (1956).

A certain problem is the variability in the nature of the connection of stipes — a phenomenon which markedly influences rhabdosome habit. Dissepiments and anastomoses have most commonly been found in equilibrium, but the stipes have not uncommonly been observed connected in only a single manner, with a habit peculiar to such rhabdosome. Whether the species *Desmograptus callograptoides* Bouček forms merely other variabilities is left for further consideration. It is required to obtain additional material of good quality to discuss the problem just mentioned.

Occurrence: Rokycany — Stráň (gully, Valcha); Volduchy — borehole V 33; Sirá — boreholes Zb II, Zb III.

Pseudoreticulograptus n. g.

Type species: Reticulograptus (?) inusitatus Kraft, 1973.
Stratum typicum: Klabava Formation (Arenig).
Derivatio nominis: After rhabdosome structure similar to that observed in the genus Reticulograptus Wiman.

Diagnosis: Rhabdosome funnel-shaped. Stipes parallel to subparallel, densely arranged, connected by anastomoses and dissepiments. Basal part of rhabdosome prominently narrowed, with a thin nema projecting from its apex.

Remarks: The representative of this newly established genus can be placed in the genus *Reticulograptus* Wiman on the basis of its generally similar structure of rhabdosome, i. e. subparallel to parallel stipes connected by anastomoses and dissepiments. However, the presence of nema indicating changes in both function and morphology of the sicula, fully justifies erection of a new genus.

Importance must be attached to the assignment of the genus to a higher systematic unit. Given the general accordance between the genera *Pseudoreticulograptus* n. g. and *Reticulograptus* Wiman in the general structure of rhabdosome, it is necessary to take into account new information on the genus *Reticulograptus* Wiman.

Most recently (Bulman et Rickards, 1966; Whittington et Rickards, 1968; Kozlowski 1970), the genus *Reticulograptus* Wiman has been referred to the order *Tuboidea.* Whittington et Rickards (1968) state that only the species with known morphology and thecal arrangement can safely be placed in the genus *Reticulograptus* Wiman. The other species assigned to the genus *Reticulograptus* Wiman on the basis of the general structure of rhabdosome have unknown morphology and thecal arrangement and the question of their identification on generic level is therefore left for further consideration.

As the detailed morphology and thecal arrangement is as yet unknown also in the specimens of the genus *Pseudoreticulograptus* n. g., it is ranged with caution to the order *Dendroidea* Nicholson, the family *Dendrograptidae* Roemer.

Pseudoreticulograptus inusitatus (Kraft, 1973)
(pl. 13, figs. 1-3)

1972 *Reticulograptus?* sp. n.; J. Kraft, p. 40-41.
1973 *Reticulograptus? inusitatus* sp. n.; J. Kraft, p. 27, pl. 1, fig. 2-3.

Holotype: Fragment of rhabdosome figured by J. KRAFT (1973) on pl. 1, fig. 2, (OMR — No. 7-472). Figured here on pl. 13, fig. 1.
Stratum typicum: Klabava Formation (Arenig).
Locus typicus: Rokycany — Stráň (Valcha).
Mterial: Twenty-four fragments of rhabdosome.

Description: Rhabdosome funnel-shaped. Stipes 0.45—0.7 mm wide, with their subparallel to parallel course to some extent disturbed in basal portions of the rhabdosome by an irregular arrangement. Stipes are up to 1 mm apart, and are mutually connected by anastomoses as well as dissepiments. There are 8—10 stipes in 10 mm. Dissepiments are 0.2—0.3 mm wide, straight or moderately incurved, and perpendicular or nearly perpendicular to stipe axis. Fenestrules are mostly narrow, elongate. Thecae 1.4—1.6 mm long and about 0.5 mm wide, thus being three times longer than wide. Their free part is 0.7—0.8 mm long. Thecae are inclined at an angle of 25—30 °. There are about 10—11 thecae in 10 mm. The basal part of the rhabdosome is conspicuously narrowed so as to form an elongate triangle, with a thin nema projecting from its apical part. This nema is 0.1—0.2 mm wide and its maximum length attains a value of 6.0 mm.
Remarks: *P. inusitatus* was first described by J. KRAFT (1972) under the tentative name *Reticulograptus?* sp. n. based on a single fragment of rhabdosome. Additional material made it possible to identify and assign the species provisionally to the genus *Reticulograptus* Wiman (Kraft, 1973).
Occurrence: Rokycany — Stráň (Valcha, gully, near the swimming pool, quarry); Volduchy — borehole V 57; Sirá — shaft; Sirá — boreholes Zb III, Hb IV.

Acanthograptidae Bulman, 1938
Acanthograptus Spencer, 1878
Acanthograptus havliceki sp. n.
(pl. 14, fig. 5)

Holotype: Fragment of rhabdosome figured on pl. 14, fig. 5, (ÚÚG—XA 368).
Stratum typicum: Šárka Formation (Llanvirn).
Locus typicus: Ejpovice — borehole E 41.
Derivatio nominis: After Dr. V. Havlíček, an outstanding expert in the Ordovician of the Barrandian region.
Material: In addition to holotype, four fragments of isolated stipes.

Description: Rhabdosome probably shrub-like. Stipes 0.8—1.0 mm wide, straight or gently curved. Branching monopodial. The angle of divergence 30—35 °. There are about 3—4 stipes in 10 mm. Thecae narrow, tubular, forming typical spiny fascicles (twigs), which are about 0.5 mm wide, up to 1.0 mm long, and inclined at 40—50 ° to axis of stipe. They seem to be arranged as spirals regularly, so that they occur as longitudinal lines on stipes. The individual spiny fascicles on a certain line are approximately 1.5—2.0 mm apart, thereby corresponding to about 6—8 spiny fascicles in 10 mm.
Remarks: The species *A. havliceki* sp. n. may clearly be distiguished from all known Ordovician members of the genus *Acanthograptus* Spencer.

Occurrence: Ejpovice — boreholes E 41 and E 44; Mníšek; Praha — Vokovice; Rokycany — Drahouš.

Acanthograptus sp. A
(pl. 14, fig. 6)

Material: Two fragments of rhabdosome.

Description: Stipes 0.5 mm wide. Thecae arranged into spiny fascicles (twigs), which are 0.2—0.6 mm wide and on the average 0.8 mm long. They make an angle of 35—45 ° with axis of stipe. The distance between the single fascicles ranges from 0.5 to 0.7 mm. There are about 9—10 fascicles in 10 mm.
Remarks: These specimens seem very likely to be a new species of the genus *Acanthograptus* Spencer, but they cannot be determined with certainty because of insufficient material.
Occurrence: Klabava Formation (Arenig) — localities: Klabava — U starého hradu; Rokycany — Stráň (gully).

Acanthograptus sp. B
(pl. 14, fig. 7)

Material: One fragment of rhabdosome.

Description: Rhabdosome probably shrub-like. Stipes about 0.3—0.35 mm wide. Branching dichotomous, the angle of divergence varies between 40 and 60°. Spiny fascicles 0.5—0.7 mm long, 0.2—0.3 mm wide and inclined at 40—45 ° to axis of stipe. There are about 15 fascicles in 10 mm.
Remarks: The fragment of rhabdosome just described most probably belongs to the genus *Acanthograptus* Spencer, but its small size and poor state of preservation prevented identification on species level.
Occurrence: Klabava Formation (Arenig) — locality: Rokycany — Stráň (Valcha).

Ptilograptidae Hopkinson, 1875
Ptilograptus Hall, 1865
Ptilograptus glomeratus Počta, 1894
(pl. 13, figs. 4-7; text-fig. 5a-e)

1894 *Ptilograptus glomeratus* n. sp.; F. Počta, p. 203, pl. VI, figs. 1-3.
1894 *Ptilograptus ramale* n. sp.; F. Počta, p. 203-204, pl. II, figs. 26-30.
1894 *?Ptilograptus suavis* n. sp.; F. Počta, pl. I, figs. 24-25.
?1951 *Ptilograptus* sp.; L. MAREK, p. 15a.
Lectotype: Specimen figured by F. POČTA (1894) on pl. VI, fig. 1, (NM — ČD 900). Figured here on pl. 13, fig. 6.
Stratum typicum: Vinice Formation (Caradoc).
Locus typicus: Trubín.
Material: Twelve fragments of rhabdosome.

Description: The main, first-order stipe is 0.3 mm wide proximally, diminishing to 0.25—0.2 mm distally. A characteristic feature of this stipe is the regular, moderate wavy shape. The inner angle between the single curvatures varies between 130 and 150 °. From the apical portions of the curvatures there project alternatingly second-order stipes to both sides, being 0.15—0.2 mm wide and inclined at about 50° to axis of main

stipe. They occur at an interval of 1.2—1.5 mm, exceptionally 1.6 mm on one side of main stipe. There are about 8—9 second-order stipes in 10 mm. From some of them the third-order stipes run out alternately on both sides. Their habit is perfectly conformable to that of the main stipe in having moderate wave curvature, the mode of branching, and in possessing the same rate of occurrence and divergence of lateral stipes. A minor difference is that they are a little narrower. In each incurature of the main stipe and the second-order stipes which are still subdivided there is located theca, so that the number of the thecae corresponds to the density of higher-order stipes on both sides of the stipe of a lower order. There are 17—18 thecae in 10 mm. The same number of thecae can also be observed on second-order stipes which do not further subdivide, and also on third-order stipes. Thecae were probably narrow, tubular, and locally may be observed on the material examined only in section as circular to oval depressions 0.1—0.2 mm in diameter.

Remarks: F. POČTA (1894) described two species of the genus *Ptilograptus* Hall from the Vinice Formation, namely, *P. glomeratus* and *P. ramale.* The main distinguishing feature given in his description is stipe width. However, revision of the original material has revealed that there are no differences between the two species. For this reason they are placed in one species for which the designation *Ptilograptus glomeratus* is retained on the basis of priority, because the description of *P. glomeratus* by F. POČTA (1894) preceded that of *P. ramale.*

To the species *P. glomeratus* Počta are also added five fragments of rhabdosome from the Dobrotivá Formation (Llandeilo) and one fragment of rhabdosome from the Libeň Formation (Caradoc). Their characteristic features are on the whole conformable to those recognized in specimens from the Vinice Formation.

Another fragment of rhabdosome assigned to this species is that from the Vinice Formation. F. POČTA (1894) considered it to be a member of the species *P. suavis* Počta, but subsequent studies have shown that it is entirely identical with the species *P. glomeratus* Počta.

L. MAREK (1951) described and figured a small fragment of rhabdosome from the Králův Dvůr Formation (Ashgil) as *Ptilograptus sp.* It principal diagnostic characters completely agree with those seen in the species *P. glomeratus* Počta to which it is assigned.

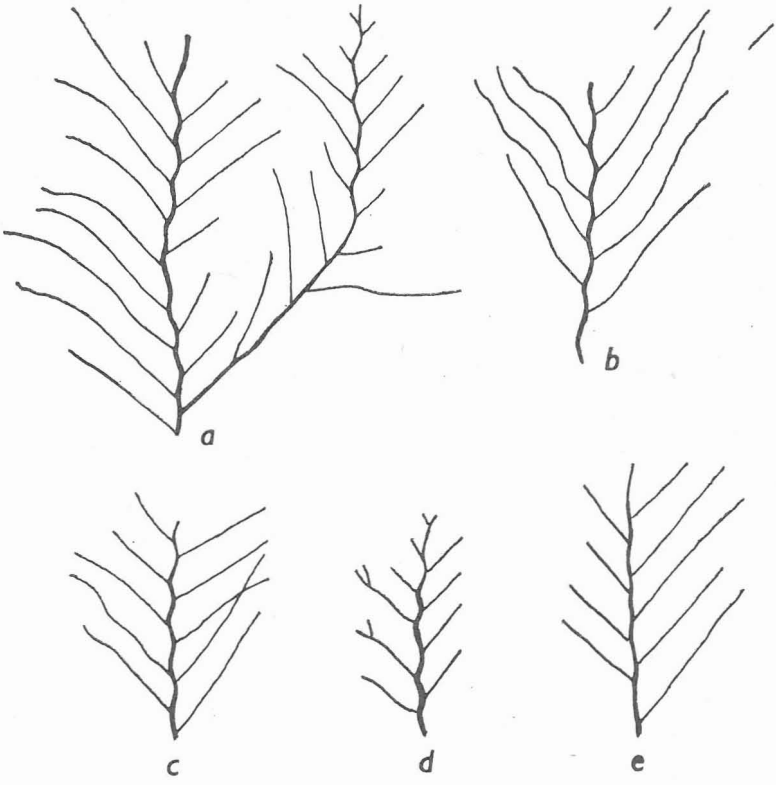
P. glomeratus Počta resembles *P. suavis* Počta from the Šárka Formation (Llanvirn) by general habit of rhabdosome and by possesing most of characteristic features. It differs in the narrower stipes and the somewhat higher number of the thecae in 10 mm.

P. glomeratus Počta is distinguished from *P. plumosus* Hall recorded in the Orodovician of North America by the smaller width of the main stipe and the reduced number of both stipes and thecae in 10 mm. It differs from *P. delicatulus,* a species also recorded from Ordovician strata of North America, in the smaller number of both stipes and thecae in 10 mm.

Although it seems higly importable that *P. glomeratus* Počta occurs throughout stratigraphical range comprising the Dobrotivá, Libeň, Vinice and Králův Dvůr Formations, the diagnostic features which can be used

on our material showing such a state of preservation do not permit *P. glomeratus* Počta to be distinguished into separate subspecies or new species.

Occurrence: Dobrotivá Formation (Llandeilo) — Svatá Dobrotivá; Mníšek — borehole Mi 10; Ejpovice — borehole E 40; Těně — borehole S 6. Libeň Formation (Cardoc) — Chrustenice (Na Židu). Vinice Formation (Caradoc) — Vinice, Trubín. Králův Dvůr Formation (Ashgil) — Dvorce.



5. *Ptilograptus glomeratus* Počta, x4, a — Vinice Formation (Caradoc), Vinice, (after NM — ČD 897); b — Dobrotivá Formation (Llandeilo), Mníšek, (after ÚÚG — XA 367); c — Vinice Formation (Caradoc), Trubín (part of lectotype — NM — ČD 900); d — Vinice Formation (Caradoc), Vinice specimen NM — ČD 901 designated by F. Počta (1894) as *?Ptilograptus suavis*; e — Libeň Formation (Caradoc), Chrustenice — Na Židu, (private collection of Dr. L. Marek).

Ptilograptus suavis Počta, 1894

(pl. 14, figs. 1-4)

1894 *?Ptilograptus suavis* n. sp.; F. Počta, p. 204, pl. 1, fig. 23, (non figs. 24-25).
Holotype: Specimen figured by F. POČTA (1894) on pl. I, fig. 23, (NM — ČD 156). Figured here on pl. 14, figs. 1-3.
Stratum typicum: Šárka Formation (Llanvirn).
Locus typicus: Osek.
Material: Four fragments of rhabdosome.

Description: Main stipe (? first order) is 0.2—0.4 mm wide, regularly and moderately wave-shaped. From its single curvatures there project stipes of the second order to both sides. They are 0.2—0.3 mm wide, 1.3—1.6 mm (average 1.4 mm) apart on one side of main stipe and inclined about at 40—50° to axis of main stipe. There are 8 stipes in 10 mm. Second-order stipes often subdivide so that from them the third-order stipes run out alternately on both sides. Their habit is entirely identical with that of the main stipe. In each curvature of the main stipe and the second order stipes which are still subdivided there is located theca visible on our material as a circular depression having 0.2—0.3 mm in diameter. There are 15—16 thecae in 10 mm. The same number of thecae is on second-order stipes (which do not further subdivide) and on third-order stipes.

Remarks: This species was established for the first time by F. POČTA (1894) under the name *?Ptilograptus suavis.* It included two fragments of rhabdosome: one from the Šárka Formation (Llanvirn), the other from the Vinice Formation (Cardoc). According to the description given by F. Počta, the general structure of the fragments corresponds to the genus Ptilograptus Hall, but the circular depression on stipes of the two remains may be compared with similar depressions observed in polyparia of Aulopora. For this reason F. Počta tentatively classified the species on generic level. By examining the members of this species from the Šárka Formation (Llanvirn) and comparing them with other specimens of the genus *Ptilograptus* Hall from Ordovician strata of the Barrandian, it became evident that two remains can safely be assigned to the genus *Ptilograptus* Hall. Circular or oval depressions on the stipes show thecal apertural sections seen in a certain position of the rhabdosome on the bedding plane. Indications of a similar preservation have also been observed in a specimen of the species *P. glomeratus* Počta included in Počta's original material.

Furthemore, it has been ascertained that *P. suavis* Počta is confined only to the Šárka Formation (Llanvirn). The specimen from the Vinice Formation (Cardoc), ranged by F. POČTA (1894) to the species *P. suavis* Počta on the basis of its circular depressions on the stipes, is, in fact, a fragment of rhabdosome belonging to *P. glomeratus* Počta.

P. suavis Počta differs from *P. glomeratus* Počta known from the Vinice Formation (Cardoc) in the greater width of the stipes and the greater number of the thecae in 10 mm. This species to some extent resembles *P. patens* Ruedemann from the Ordovician of North America by the general habit of rhabdosome but may be distinguished by the greater width of the main stipe, the higher number of both stipes and thecae in 10 mm, and the smaller angle of divergence.

Occurrence: Osek; Volduchy; Rokycany (generally siliceous concretions).

Incertae sedis

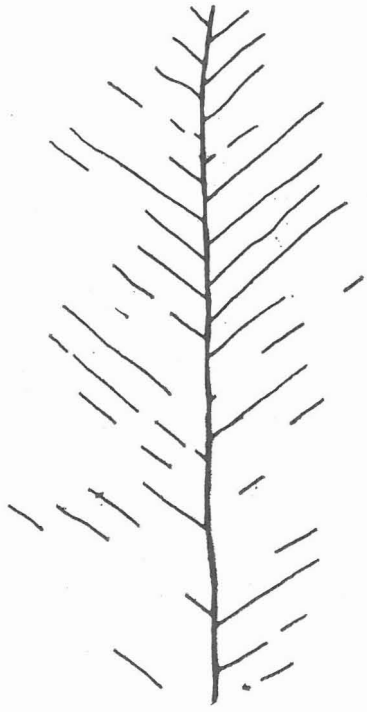
Thamnograptus Hall, 1859

Thamnograptus (?) rokycanensis Bouček, 1956

(text-fig. 6)

1956 *Thamnograptus (?) rokycanensis* n. sp.; B. Bouček, p. 142-144, text-fig. 6a.
Holotype: Specimen figured by B. BOUČEK (1956) on text-fig. 6a. Figured here on text-fig. 6.
Stratum typicum: Klabava Formation (Arenig).
Locus typicus: Rokycany — Stráň (gully).
Material: Holotype only.

Description (original diagnosis): Branch (of the second-order?) straight, thin, 0.15 mm thick, on both sides alternatingly ramified into shorter, straight capillary branchlets with a divergence of 50°, and branching off on both sides at distances of 1 mm.



6. *Thamnograptus ? rokycanensis* Bouček, x4, Klabava Formation (Arenig), Rokycany — Stráň (gully), (after B. Bouček, 1956).

Remarks: Since the holotype which is the unique specimen of the species as yet found seems to have been lost, original diagnosis a illustration given by B. BOUČEK (1956) is adopted in this paper.

The relations between this species to species of *Thamnograptus capillaris* (Emmons), *Mastigograptus tenuiramosus* (Walcott) and *Ptilograptus tenuissimus* Ruedemann were earlier discussed by B. BOUČEK (1956).
Occurrence: Rokycany — Stráň (gully).

NOTES ON OCCURRENCE AND ECOLOGY

Of all Ordovician sequences of the Barrandian only the Klabava Formation (Arenig) yielded a fairly large number of dendroid graptolites. The fauna from the other sequences contains an imperceptible amount of dendroid graptolites and the finds are very sparse.

The Klabava Formation is the only sequence of the Ordovician of the Barrandian to display a relatively marked development of dendroid graptolites. This formation is generally poor in paleontological records, but certain portions of the sequence contain accumulated remains of dendroids, gratoloideids and inarticulate brachiopods. These groups are dominant in the fauna from the Klabava Formation. The representatives of other groups such as trilobites, conulariids, cephalopods, gastropods, etc. are extremely rare.

J. KRAFT (1975) studied the mode of occurence of graptolites in the Klabava Formation and inferred some ecological conclusions from the information thus far obtained. As far as dendroid graptolites are concerned, it has been found that their rhabdosomes are fairly abundant and show a relatively good state of preservation in some parts of the succession. This leads us to the conclusion that the rhabdosomes very probably were fossilized at or near the point of their original attachment to the substratum. From the frequency of their occurrence it may be concluded that they formed sparse colonies in some parts of the sea floor at certain time intervals (for more information see J. Kraft, 1975).

(*Translated by J. Marek*)

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EXPLANATION OF PLATES

PL. 1

Dictyonema flabelliforme intermedium Prantl et Přibyl
1 — Březany — quarry „Na Chrástnici" x2, NM — akc. kat. 35 552. Holotype.

Dictyonema krafti Bouček
2 — Rokycany — Stráň (gully), x2, NM — L 7606. Holotype.
3 — Rokycany — Stráň (gully), x2, OMR — No. 7—15.
4 — Rokycany — Stráň (Valcha), x2, OMR ' No. 7—469.

PL. 2

Dictyonema rokycanense Kraft
1 — Rokycany — Stráň (quarry), x2, OMR — No. 7—95. Paratype.
2 — Rokycany — Stráň (quarry), x2, OMR — No. 7—5. Holotype.
3 — Ejpovice — borehole E 34, x2, ÚÚG — XA 370.
4 — Rokycany — Stráň (quarry), x4, OMR — No. 7—32.

PL. 3

Dictyonema hornyi Kraft
1 — Rokycany — Stráň (Valcha), x2, OMR — No. 7—654. Holotype.
2 — Rokycany — Stráň (Valcha), x2, OMR — No. 7—471.

Dictyonema dubium Počta
3 — Osek, x2, NM — ČD 154. Holotype.
4 — Osek, x2, OMR — No. 46—49.

Dictyonema barborae sp. n.
5 — Březina — borehole B 203, x2, OMR — No. 47—5. Holotype.

PL. 4

Callograptus kodymi Prantl et Přibyl
1 — Březany — quarry „Na Chrástnici", x2, NM — akc. kat. 22 656. Holotype.
2 — Březany — quarry „Na Chrástnici", x2, NM — akc. kat. 22 656.

Callograptus rokycanensis Bouček
3 — Voduchy — borehole V 41, x2, OMR — No. 7—614.

Callograptus holubi Bouček
4 — Rokycany — Stráň (quarry), x2, NM — L 7589. Holotype.

PL. 5

Callograptus rokycanensis Bouček
1 — Rokycany — Stráň (gully), x2, NM — L 7578. Holotype.
2 — Rokycany — Stráň (gully), x2, NM — L 7603. Paratype.

Callograptus undosus Kraft
3 — Holoubkov — borehole Hb 1, x2, ÚÚG — XA 352.
4 — Rokycany — Stráň (gully), x2, OMR — No. 7—367.
5 — Rokycany — Stráň (Valcha), x2, OMR — No. 7—390.

PL. 6

Callograptus undosus Kraft
1 — Rokycany — Stráň (gully), x2, OMR — No. 7—373. Holotype.

PL. 7

Callograptus hanzliki sp. n.
1 — Rokycany — Stráň (Valcha), x2, OMR — No. 7—655. Holotype.
2 — Rokycany — Stráň (gully), x2, OMR — No. 7—181. Paratype.

Callograptus jani sp. n.
3 — Sklenná Huť — borehole B 294, x2, OMR — No. 47—12. Holotype.

Callograptus sp. B
4 — Sirá — borehole Zb III, x2, ÚÚG — XA 365.

PL. 8

Callograptus attextus (Počta)
1 — Trubín, x2, NM — ČD 896. Holotype.
Dendrograptus horaki Bouček
2 — Rokycany — Stráň (quarry), x2, NM — L 7577. Holotype.
Dendrograptus irregularis Bouček
3 — Rokycany — Stráň (quarry), x2, NM — L 7574. Holotype.
4 — Rokycany — Stráň (quarry), x2, OMR — No. 7—701.
Dendrograptus parvus (Počta)
5 — Trubín, x2, NM — ČD 902. Holotype.

PL. 9

Dendrograptus klouceki Bouček
1 — Rokycany — Stráň (Valcha), x2, OMR — No. — 300.

PL. 10

Dendograptus klouceki Bouček
1 — Rokycany — Stráň (Valcha), x2, OMR — No. 7—234.
2 — Rokycany — Stráň (gully), x2, NM — L 7587. Holotype.
Dendrograptus bouceki Kraft
3 — Rokycany — Stráň (Valcha), x2, OMR — No. 7—492. Holotype.
Dendrograptus ? constrictus Perner
4 — Krušná Hora, x2, NM — ČD 97. Holotype.
Desmograptus callograptoides Bouček
5 — Rokycany — Stráň (gully), x2, OMR — No. 7—123.
6 — Rokycany — Stráň (Valcha), x2, OMR — No. 7—255.

PL. 11

Dendrograptus vokovicensis Bouček
1 — Rokycany — Drahouš, x2, OMR — No. 46—137. Neotype.

PL. 12

Desmograptus callograptoides Bouček
1 — Rokycany — Stráň (gully), x2, OMR — No. 7—368.
2 — Rokycany — Stráň (gully), x2, NM — L 7592. Holotype.
3 — Rokycany — Stráň (gully), x2, OMR — No. 7—365.

PL. 13

Pseudoreticulograptus inusitatus (Kraft).
1 — Rokycany — Stráň (Valcha), x2, OMR — No. 7—472. Holotype.
2 — Rokycany — Stráň (Valcha), x2, OMR — No. 7—195. Paratype.
3 — Rokycany — Stráň (Valcha), x2, OMR — No. 7—194.
Ptilograptus glomeratus Počta
4 — Vinice, x2, NM — ČD 897.
5 — ditto — negative, x2, NM — ČD 899.
6 — Trubín, x2, NM — ČD 900. Lectotype.
7 — Mníšek, x2, ÚÚG — XA 367.

PL. 14

Ptilograptus suavis Počta
1 — Osek, x2, NM — ČD 156. Holotype.
2 — ditto — negative, x2.
3 — ditto, x4.
4 — Díly, x2, OMR — No. 46—130.
Acanthograptus havliceki sp. n.
5 — Ejpovice — borehole E 41, x2, ÚÚG — XA 368. Holotype.
Acanthograptus sp. A
6 — Klabava — U starého hradu, x2, OMR — No. 7—702.
Acanthograptus sp. B
7 — Rokycany — Stráň (Valcha), x2, OMR — No. 7—253.

All photographs by V. Fikrle

Stratigraphical distribution of dendroid graptolites in the Bohemian Ordovician

Stages	Tremadoc		Arenig	Llanvirn	Llandeilo	Caradoc					Ashgil	
Formations	Třenice	Mílina	Klabava	Šárka	Dobrotivá	Libeň	Letná	Vinice	Zahořany	Bohdalec	Králův Dvůr	Kosov
Dictyonema flabelliforme intermedium Prantl et Přibyl	+											
Dictyonema krafti Bouček			+									
Dictyonema rokycanense Kraft			+									
Dictyonema hornyi Kraft			+									
Dictyonema dubium Počta				+								
Dictyonema barbarae sp. n.					+							
Dictyonema sp.										+		
Callograptus kodymi Prantl et Přibyl	+											
Callograptus rokycanensis Bouček			+									
Callograptus holubi Bouček			+									
Callograptus undosus Kraft			+									
Callograptus hanzliki sp. n.			+									
Callograptus jani sp. n.					+							
Callograptus attextus (Počta)								+				
Calograptus sp. A			+									
Callograptus sp. B			+									
Dendrograptus horaki Bouček			+									
Dendrograptus irregularis Bouček			+									
Dendrograptus klouceki Bouček			+									
Dendrograptus bouceki Kraft			+									
Dendrograptus? constrictus Perner				+								
Dendrograptus vokovicensis Bouček				+								
Dendrograptus parvus (Počta)								+				
Dendrograptus sp.					+							
Desmograptus callograptoides Bouček			+									
Pseudoreticulograptus inusitatus (Kraft)			+									
Acanthograptus havliceki sp. n.				+								
Acanthograptus sp. A			+									
Acanthograptus sp. B			+									
Ptilograptus suavis Počta				+								
Ptilograptus glomeratus Počta					+	+		+			?	

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Redaktor: Ing. JIŘÍ ČEJKA, CSc.
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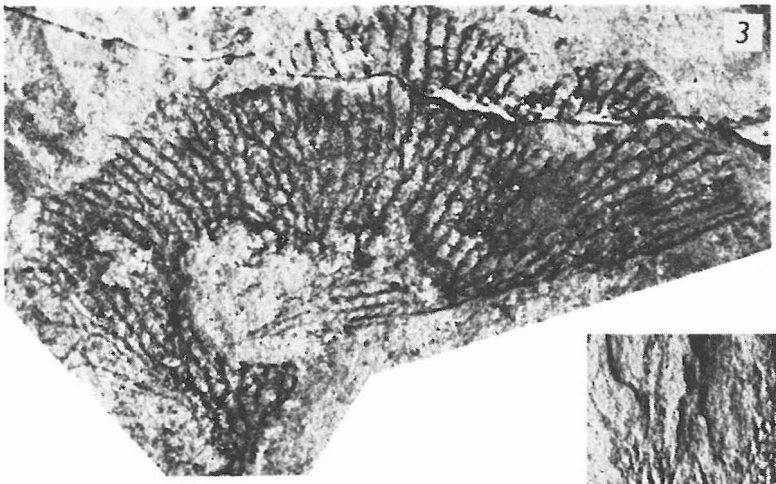
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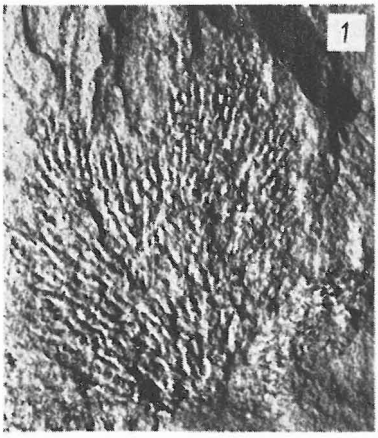
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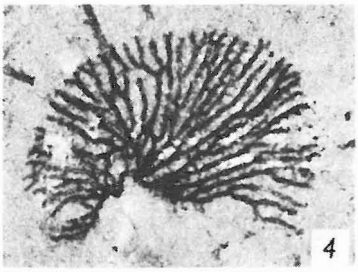
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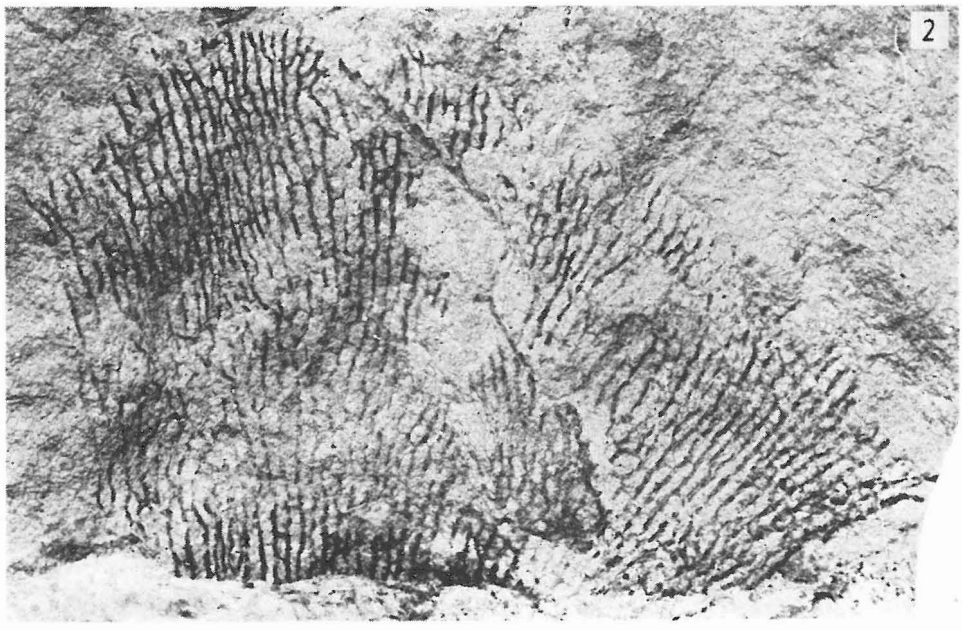
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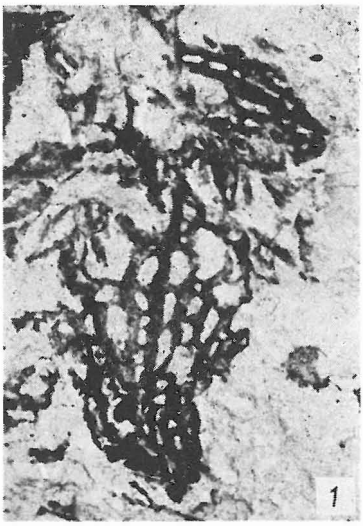
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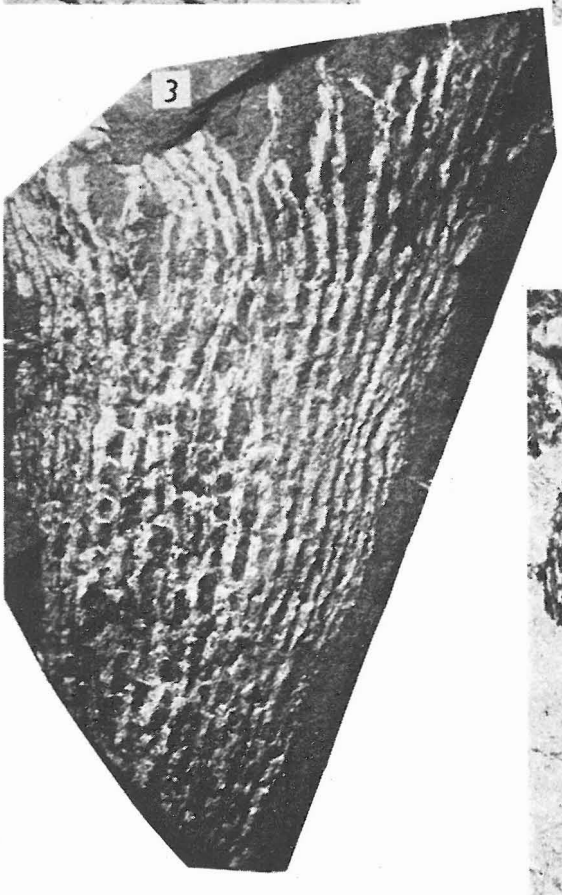
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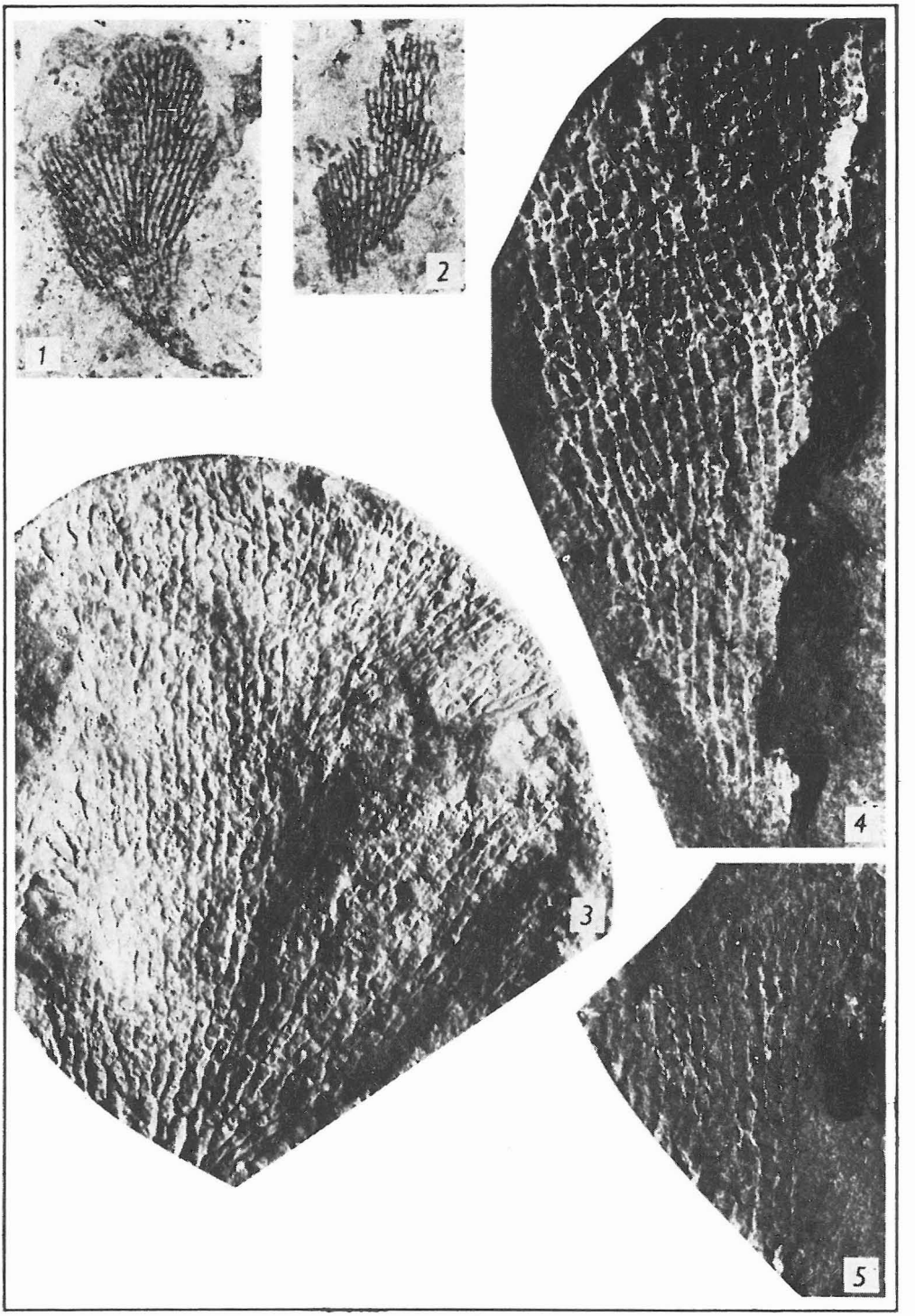
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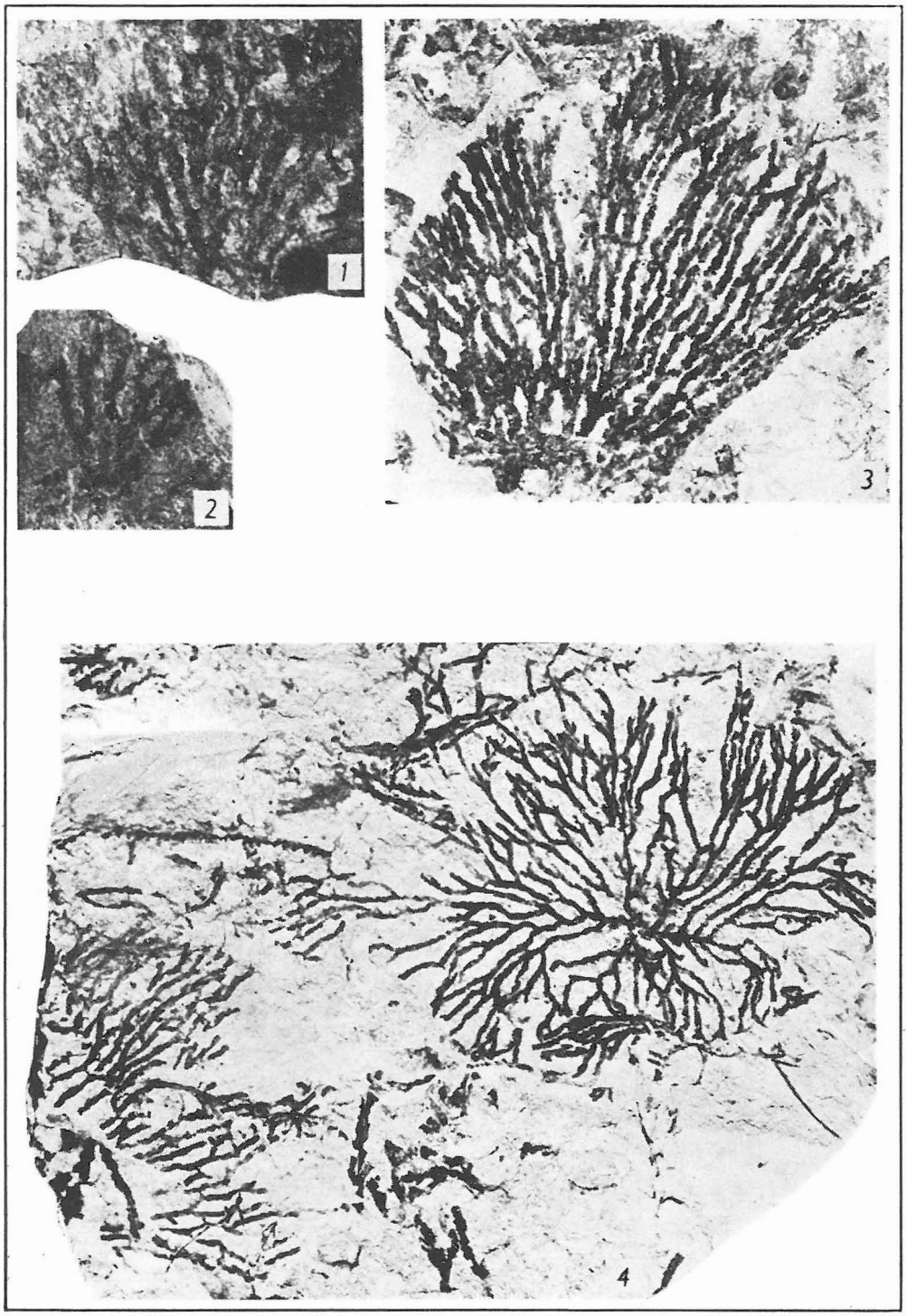
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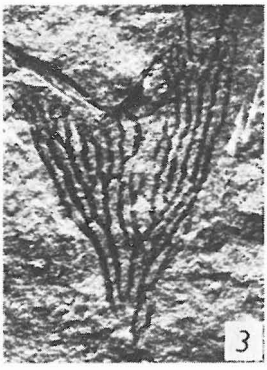

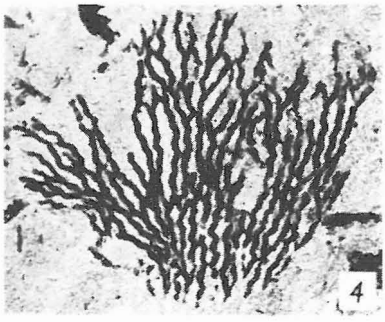

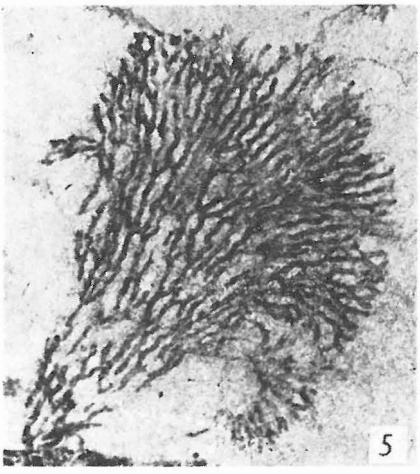

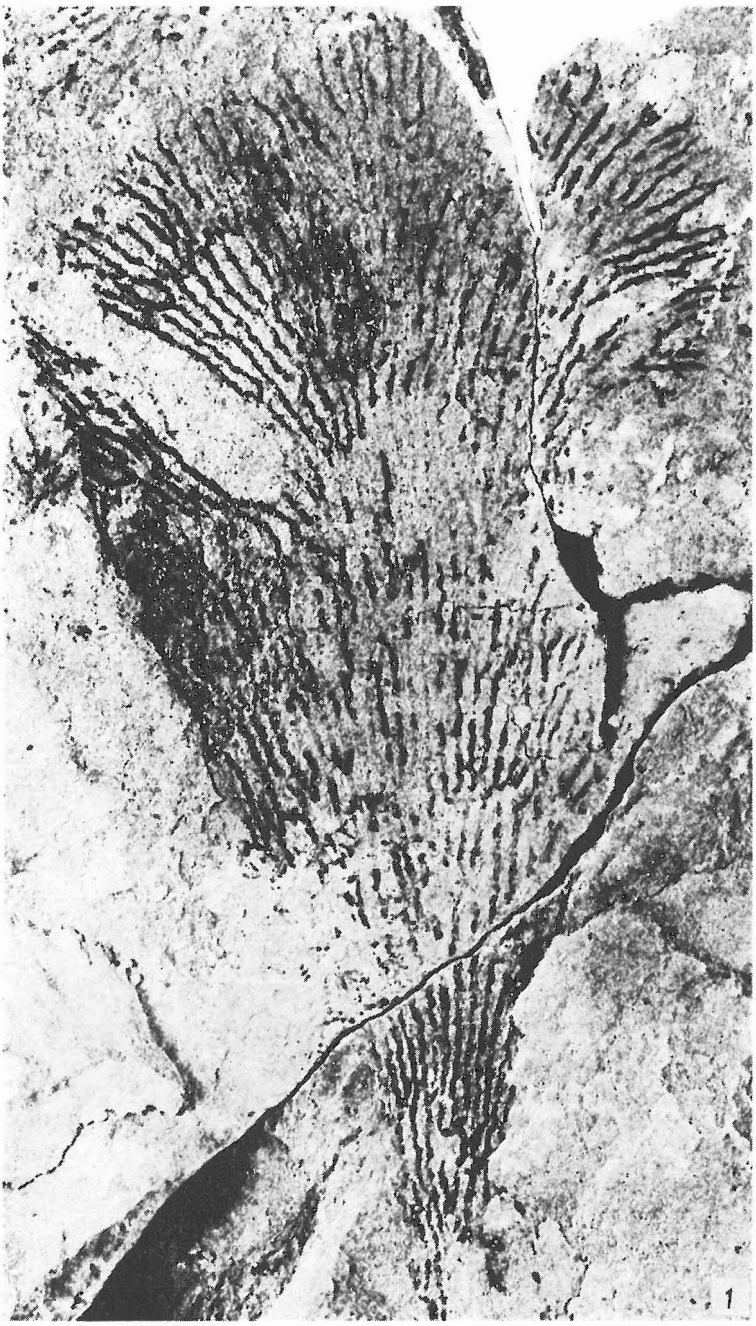
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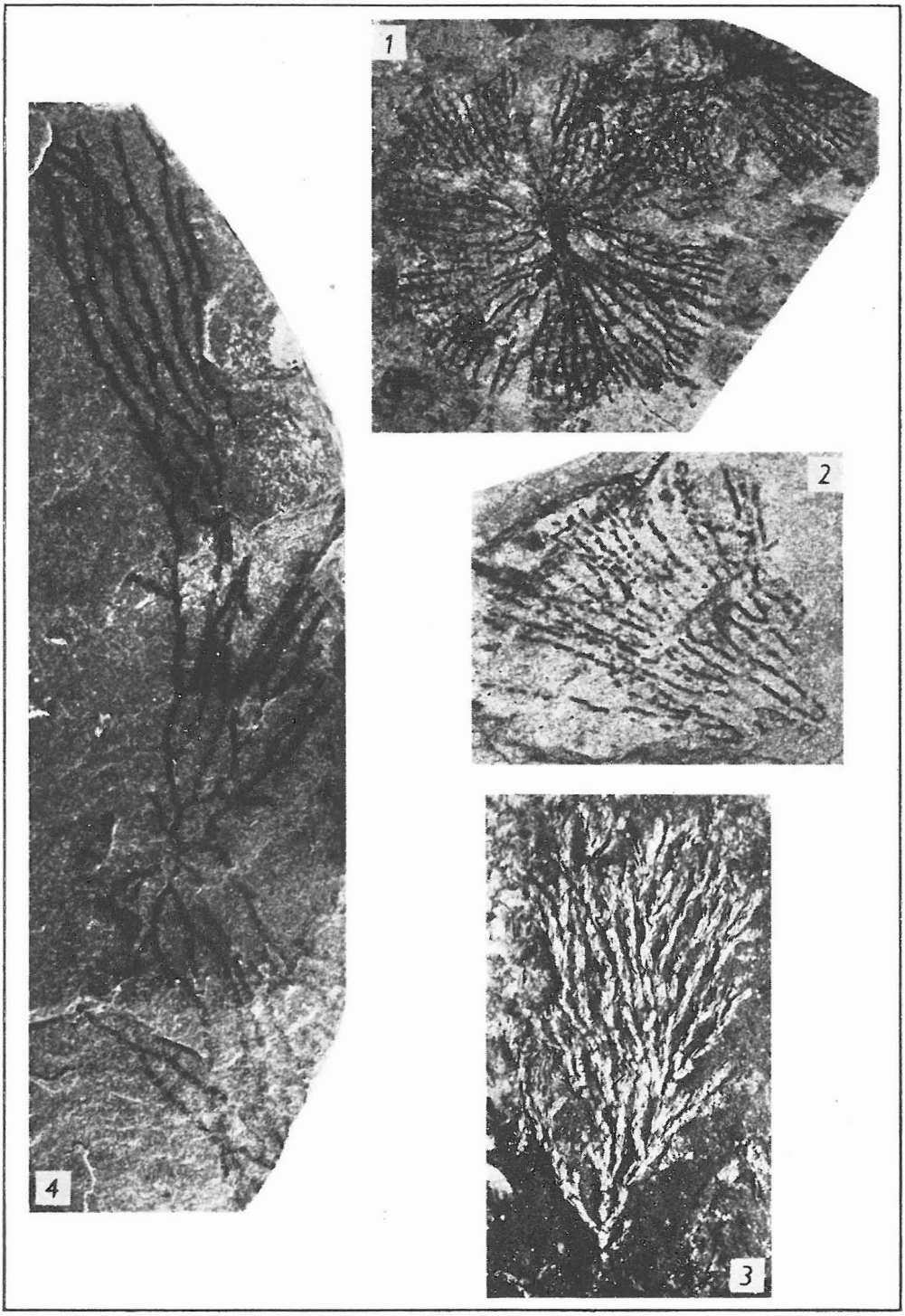
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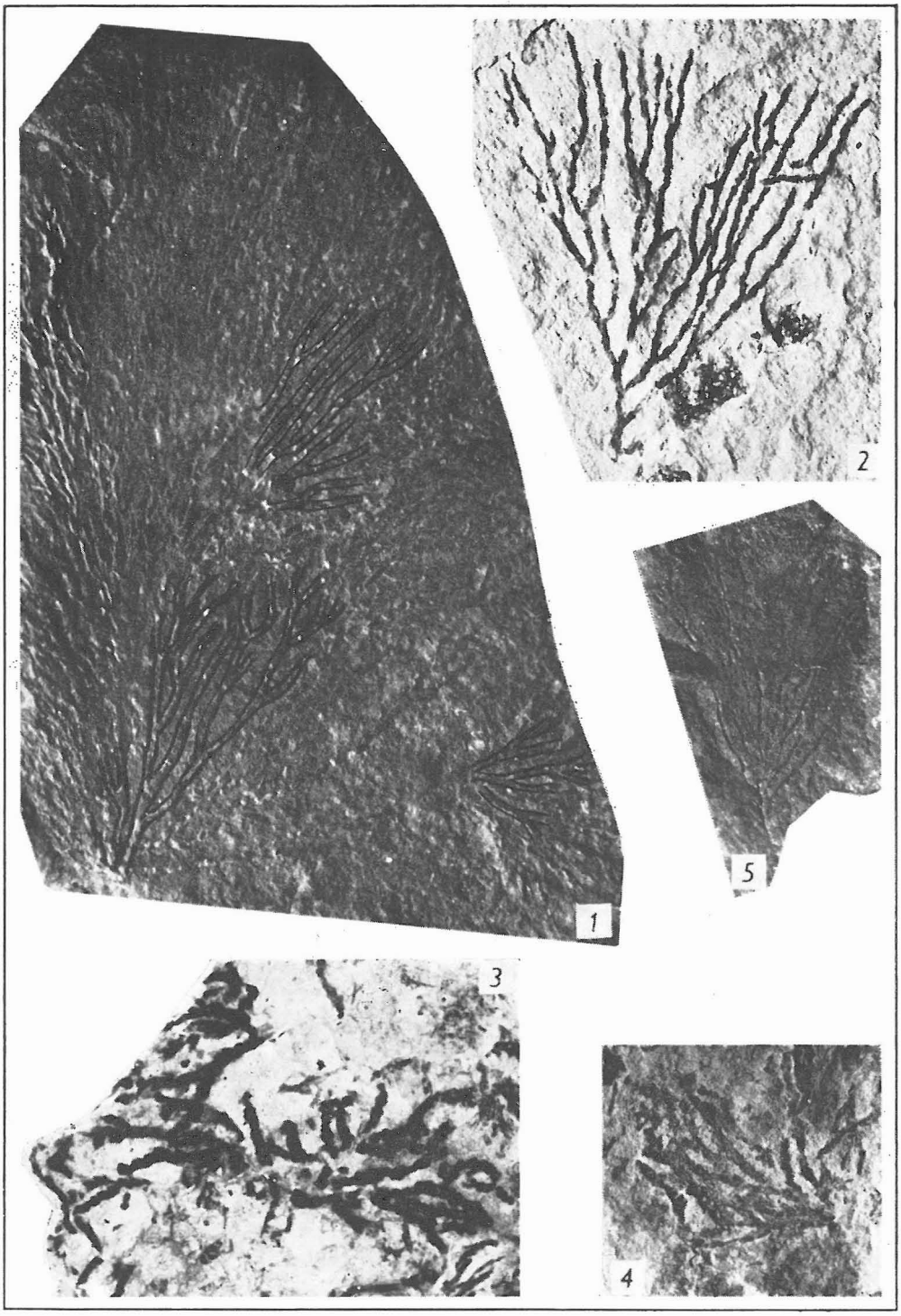
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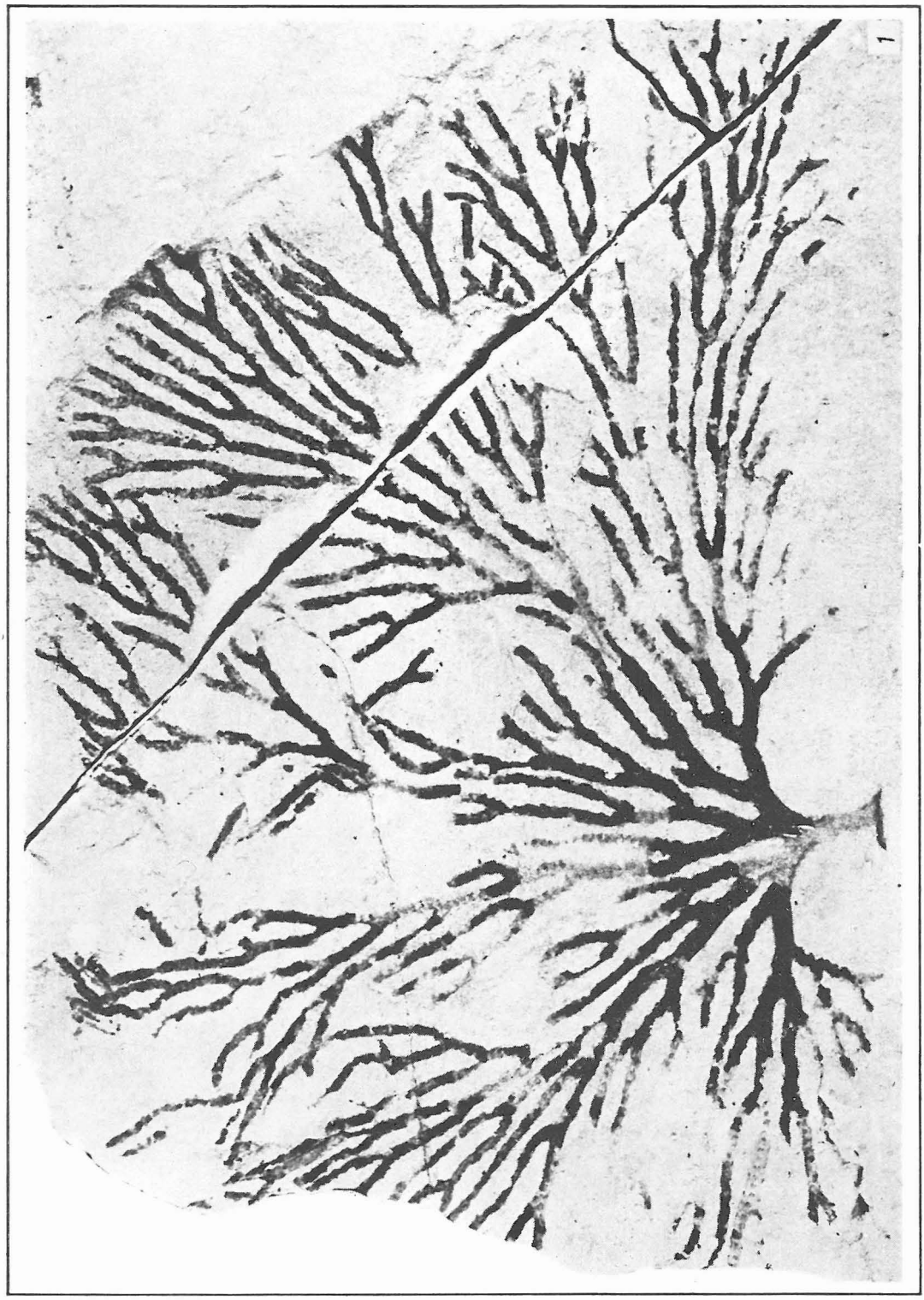

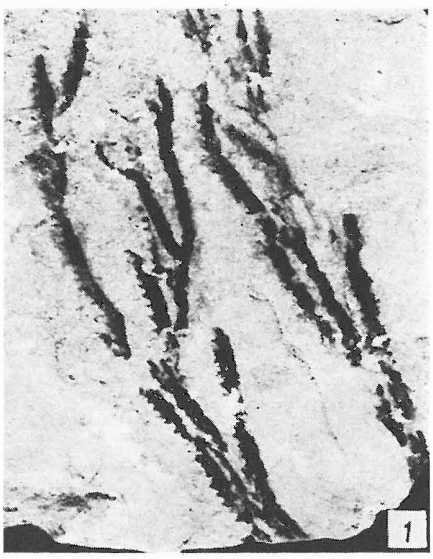
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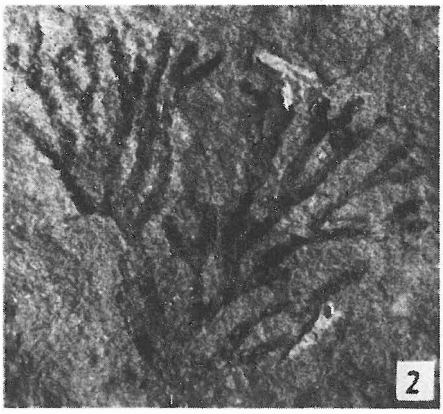
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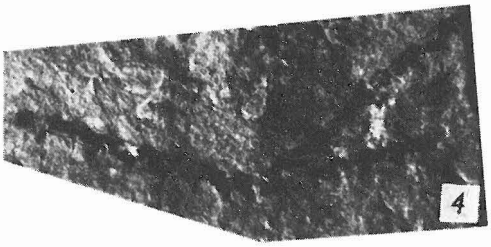
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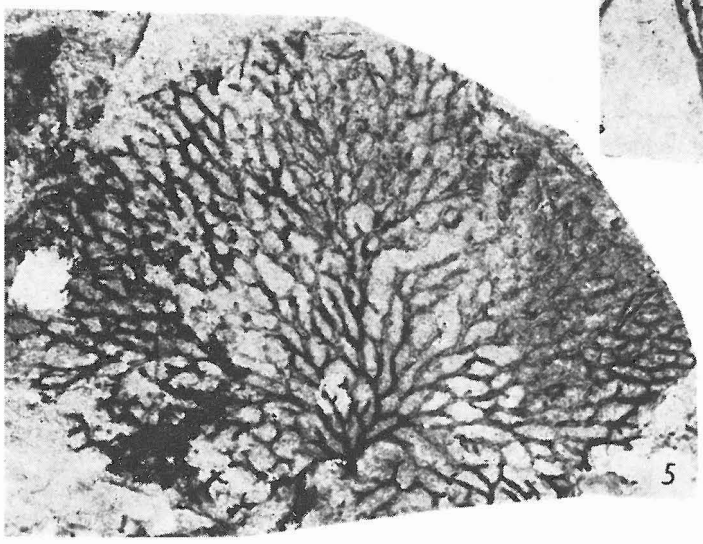
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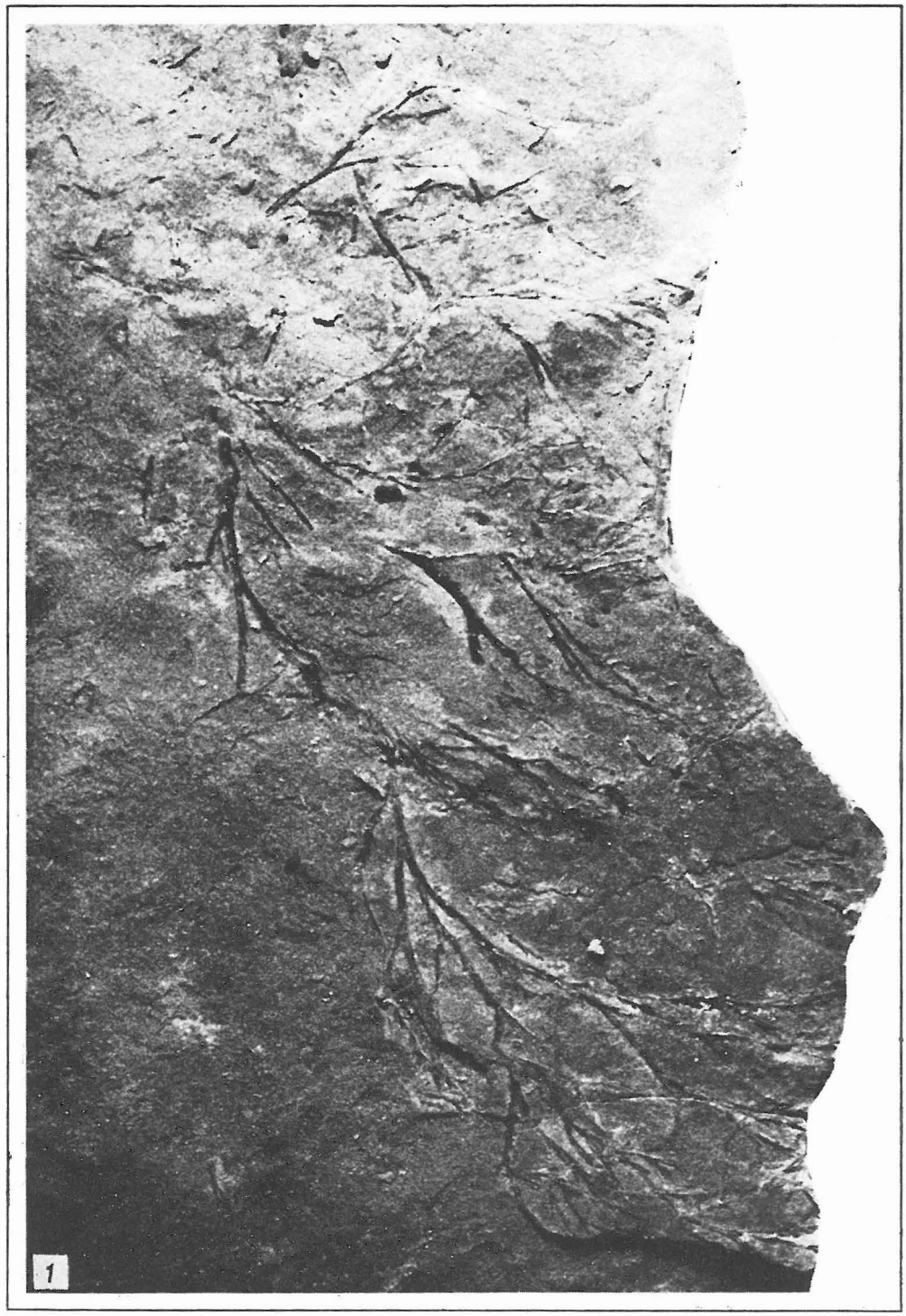
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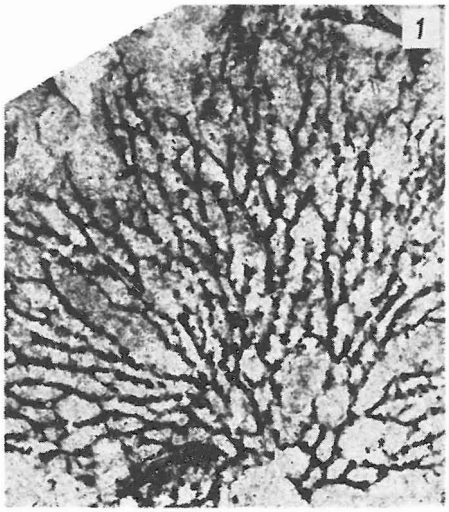
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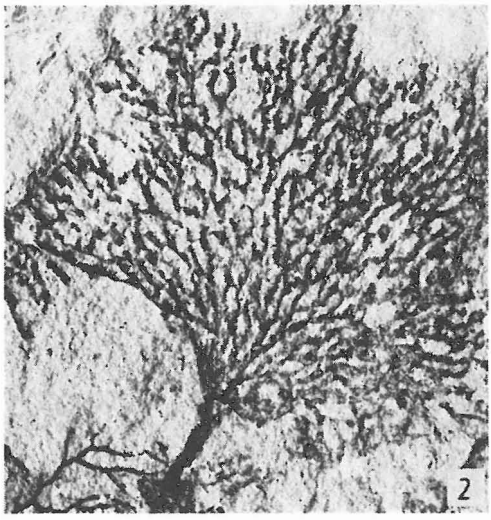
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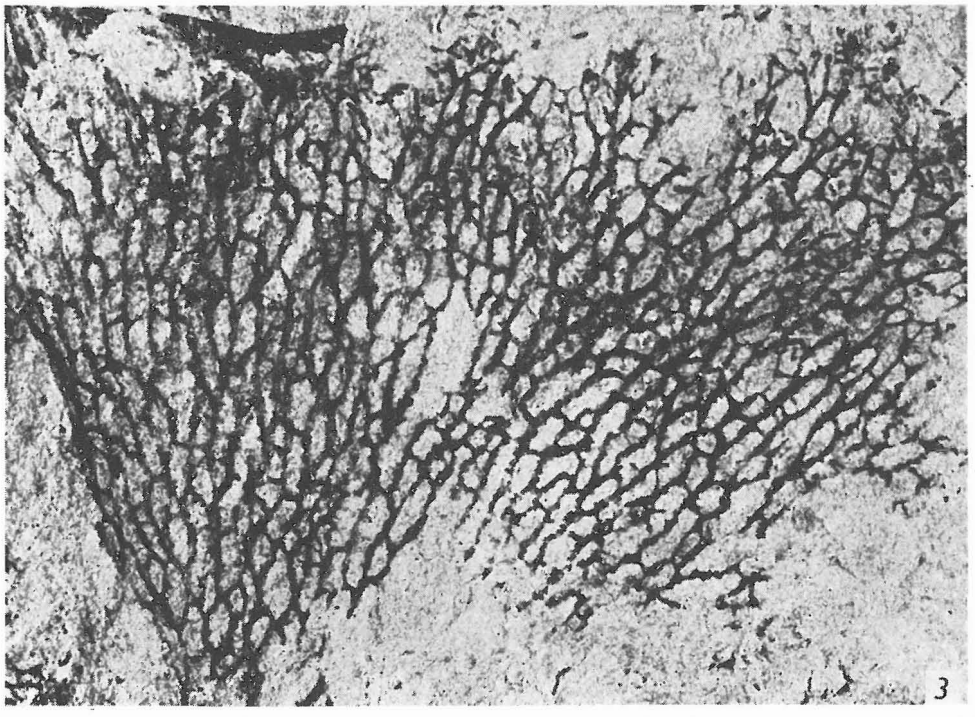
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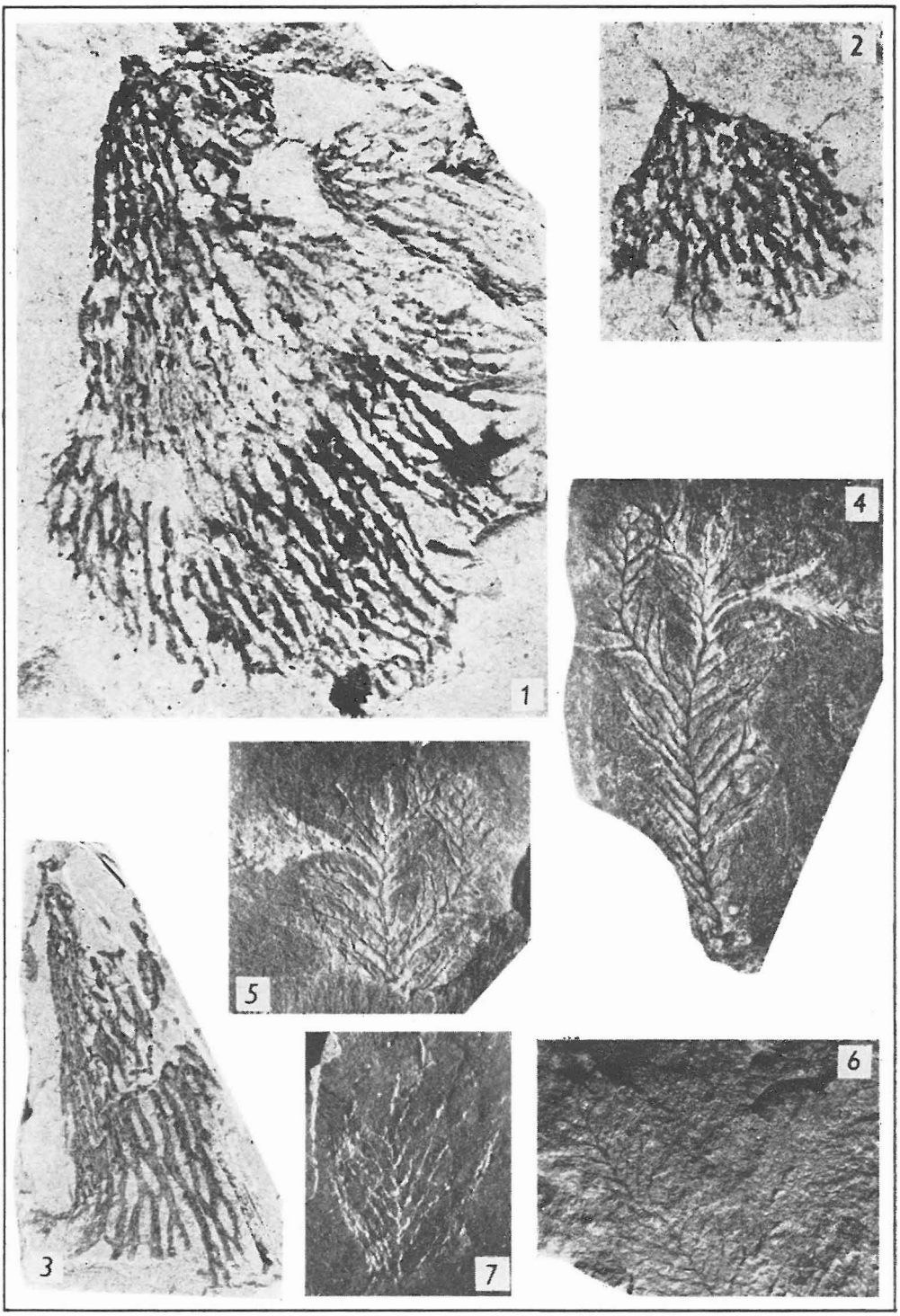
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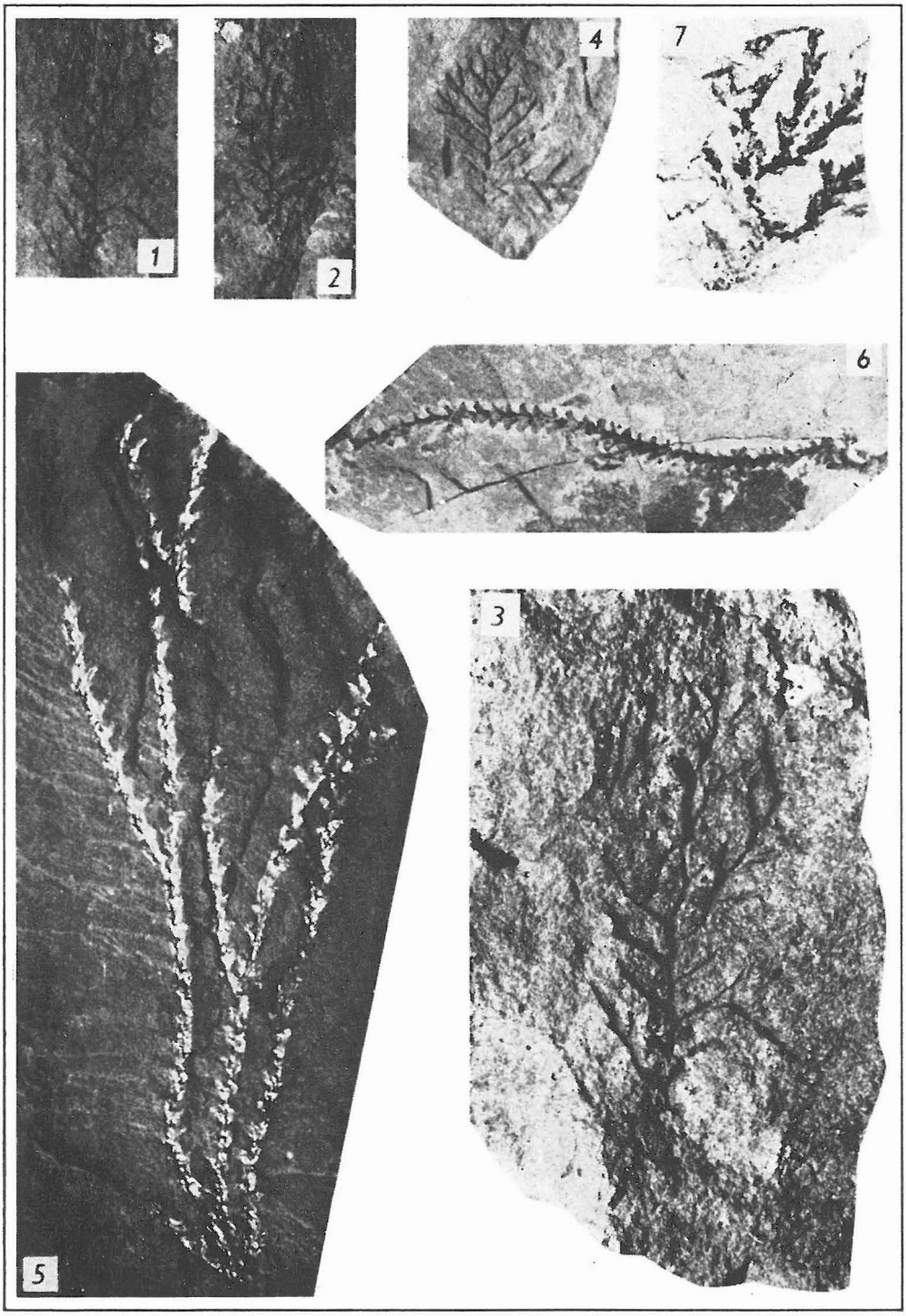
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