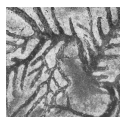


Not all Plants: Graptolites in Heinrich Göppert's Palaeozoic "fossile Flora"

JÖRG MALETZ & RUDY LEROSEY-AUBRIL



A number of graptolites were mistakenly identified in Heinrich Göppert's (1860) monograph on Palaeozoic plants, including the type material of *Ptilograptus reussianus*, *Cyclograptus scharyanus*, *Dendrograptus?* *subarticulatus*, *Dendrograptus?* *fruticulosus*, *Dictyonema?* *hisingeri* and specimens assigned preliminarily to *Thallograptus?* sp. from the Silurian of the Czech Republic. The specimens were rediscovered, more than 160 years after their original description, in the collection of the Museum of Comparative Zoology, Harvard University, USA, and are here re-described. The type specimen of *Ptilograptus reussianus* provides unique, detailed information on tubarium construction in *Ptilograptus*. The tubarium shows a distinct monoproggressive branching, with first-order stipes giving rise to unbranched second-order stipes. Some second-order stipes subsequently develop into first-order stipes, producing additional second-order stipes. The thecal organization unequivocally supports assignment to the Dendrograptidae. • Key words: Heinrich Göppert, Silurian, Czech Republic, graptolites, plants.

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Museum collections today are full of fossil materials assembled over centuries, much of which has been little investigated, misinterpreted in earlier studies, or subsequently forgotten. As a result, important fossil specimens are still commonly rediscovered in historical collections, as exemplified by the famous record of the first conodont animal by Briggs *et al.* (1983), as well as by numerous findings in other fossil groups, both vertebrates and invertebrates. The recently rediscovered graptolites described by Suess (1851) from the Bilimek collection in Vienna, Austria, provide another such example (Hopfensperger *et al.* 2021, Lukeneder *et al.* 2025). The publication of Suess (1851) represents one of the earliest studies of graptolites from the Czech Republic (Bohemia) and was produced more or less contemporaneously with the seminal work of Barrande (1850), leading to heated debates (*cf.* Barrande 1850, 1852). New taxa continue to be discovered within the extensive historical graptolite collections housed in museums worldwide.

Fossils are commonly misidentified and subsequently obscured due to inappropriate labels in museum collections. A well-known example is the frequent confusion between graptolites and plant remains in older literature. One of the most famous cases concerns the record of

Ordovician graptolites from a small island – now known as Graptolite Island – in the South Orkney Island Complex of Antarctica. This putative graptolite material was initially identified by Gertrude Elles (*in* Pirie 1905), but was later reinterpreted as Carboniferous plant material by Strachan (*in* Adie 1957, p. 22), rendering the name Graptolite Island inappropriate. Another example involves reports of Silurian plants from Germany by Hundt (1948, 1949, 1952, 1965), which were later shown to represent graptolites or indeterminate fragments of uncertain value. Maletz (2023, p. 471) discussed Hundt's material, but also reassigned taxa previously regarded as graptolites to the macroalgae. Numerous dasycladacean algae have likewise been misidentified as graptolites (LoDuca 1990, LoDuca *et al.* 2017, and others), including the recently described *Podoliagraptus* (Skompski *et al.* 2023). Initially interpreted as an epibiont on the alga *Voronocladus*, this taxon has since been recognized as an integral part of the alga itself (LoDuca 2024). Bouček (1941) also struggled with distinguishing between plant fossils and graptolites. He initially assigned *Palmatophycus kettneri* Bouček, 1941 and *Palmatophycus contractus* Bouček, 1941 to the algae, but later reinterpreted them as benthic graptolites (Bouček 1957). This view was not followed by LoDuca

et al. (2017) and Bykova *et al.* (2020), who both listed *Palmatophycus* as a Silurian non-calcified marine alga, reflecting the most recent shift in opinion regarding these fossils.

Although the first graptolite was mentioned by von Bromell (1727), the term graptolite (originally *Graptolithus*) was coined by Linnæus (1735), who also provided the first illustration of a graptolite some 15 years later (Linnæus 1751). At that time, graptolites were not recognized as fossil organisms, and their proper interpretation began only with Bronn (1849). Earlier, Brongniart (1828) had described and illustrated several graptolites from Quebec, eastern Canada, interpreting them as plant fossils. He described *Fucoides dentatus* – now *Levisograptus dentatus* (see Maletz 2011) – and *Fucoides serra* – now *Tetragraptus serra* (see Cooper & Fortey 1982) – as plants, later assigning them to the genus *Amansites* (Brongniart in d’Orbigny 1849, p. 58). Both species are still listed as algae in the algae database under the names *Amansites serra* and *Amansites dentatus* (Guiry & Guiry 2020), which illustrates how outdated interpretations may persist in recent databases even after the material has been revised and reassigned to entirely different taxa. Maletz (2023, p. 461) discussed the genus *Amansites* as used in the independent taxonomy of plants (International Code of Nomenclature for algae, fungi, and plants; Madrid Code; <https://www.iaptglobal.org/functions/code>). Were *Amansites* to be treated as an animal genus (guided by ICZN: International Commission on Zoological Nomenclature; <https://www.iczn.org>), it would constitute a senior synonym of either *Tetragraptus* or *Levisograptus*.

In summary, graptolites were commonly misinterpreted as plants in the past (and *vice versa*) and, even today, may still be listed as such. During the early investigation of the group, graptolites were also repeatedly misassigned to various other organisms (see Maletz 2017, 2023). Consequently, it is unsurprising that early monographs on fossil plant remains – typically overlooked by graptolite specialists – also include graptolites. This is illustrated in the present contribution, which reinterprets as graptolites several Silurian fossils that were incorrectly described as plant remains in Göppert’s (1860) “Ueber die fossile Flora der Silurischen, der Devonischen und Unteren Kohlenformation oder des sogenannten Uebergangsgebirges”.

The Silurian plants of Heinrich Göppert

Johann Heinrich Robert Göppert (often spelled Goeppert) (1800–1884) was one of the most prominent botanists of the 19th century (Fig. 1A). His scholarly output comprises several hundred papers and monographs, reflecting an exceptionally broad range of scientific interests. In

palaeontology, where – together with Adolphe Théodore Brongniart (1801–1876) and Kašpar Maria Count of Šternberg (1761–1838) – he is regarded as a founder of phytopalaeontology, now termed palaeobotany (see extensive appraisal of his life and work in Conwentz 1884, Willisch 2009). Göppert described numerous new plant taxa, encompassing both extant and fossil forms. His research also includes studies on coal formation and the preservation of plant remains in amber (see reference list in Conwentz 1884).

Bouček (1957) recognized that Göppert’s (1860) monograph on Silurian to Carboniferous plants from central Europe also included illustrations of graptolites, but he was unable to locate the original material and hence substantiate his interpretation. A part of this original material originated from the Schary Collection in Prague, which included numerous fossils from the Silurian of Bohemia. Following information kindly provided by Petr Štorch (Prague, Czech Republic) that the Schary Collection had been transferred to the Museum of Comparative Zoology (MCZ), Harvard University (Cambridge, USA), and a search conducted by MCZ personnel, several of the suspected graptolite specimens illustrated in Göppert (1860) were located and made available for study. Others were not, as for instance the specimens of *Dictyonema hisingeri* illustrated in pl. 36, figs 4–11 and pl. 45, figs 3, 4 in Göppert (1860). The present revision of the rediscovered fossils includes their redescription, reassignment, and new illustrations presented alongside Göppert’s original figures (Fig. 1B–D). This direct comparison underscores the precision of Göppert’s drawings and the level of detail preserved in this Silurian material.

Systematic palaeontology

Remarks. – The systematics and taxonomy of the Graptolithina follow Maletz (2023). Higher-level taxonomic units are not listed here.

Repository. – The illustrated graptolite material is housed in the collections of the Department of Invertebrate Paleontology of the Museum of Comparative Paleontology, Harvard University, USA.

Subclass Graptolithina Bronn, 1849

Order Dendroidea Nicholson, 1872

Family Dendrograptidae Roemer in Frech, 1897

Genus *Ptilograptus* Hall, 1865

Remarks. – Maletz & Gutiérrez-Marco (2025) revised the genus *Ptilograptus* and discussed all included species.

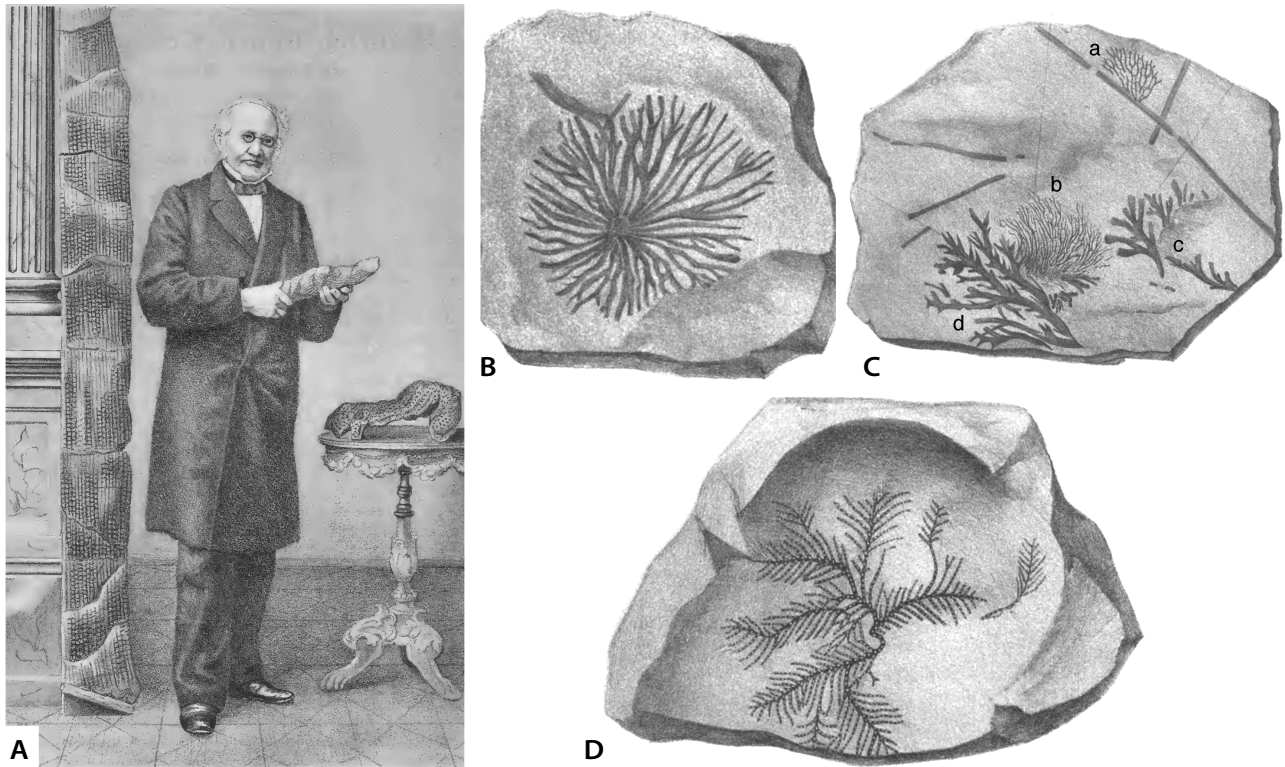


Figure 1. Göppert's graptolites. • A – Johann Heinrich Robert Göppert (25.07.1800–18.05.1884), after Conwentz (1884). • B–D – illustrations from Göppert's (1860, pl. 36) monograph of algal fossils here reinterpreted as graptolites. • B – *Sphaerococcites scharyanus* Göppert, 1860, MCZ.IP.202883. • C – *Dictyonema hisingeri* Göppert, 1860, MCZ.IP.202881 (a) and MCZ.IP.202882 (b), and *Thallograptus?* sp., MCZ.IP.202885 (c) and MCZ.IP.202884 (d). • D – *Callithamnion reussianum* Göppert, 1860 (= *Ptilograptus reussianus*), MCZ.IP.202747.

They also transferred the genus from the Callograptidae (Maletz 2020, 2023) to the Dendrograptidae based on thecal development.

Ptilograptus reussianus (Göppert, 1860)

Figures 1D, 2, 3A–H

- 1860 *Callithamnion Reussianum*; Göppert, p. 35, pl. 36, fig. 14a, b.
- 1867 *Callithamnion*, or *Callithamnites reussianus* Göppert. – Hall, p. 239 (referred the species to *Ptilograptus*, but did not discuss it further).
- 1957 *Ptilograptus reussianum* (Göppert). – Bouček, p. 137 (no illustration).
- 2025 *Callithamnion Reussianum* Göppert. – Maletz & Gutiérrez-Marco, p. 11, figs 1a, 3n.

Type material. – MCZ.IP.202747, an incomplete tubarium, the holotype and only known specimen.

Type locality. – According to Göppert (1860), the specimen originates from the upper Silurian of Bohemia and more specifically, from grey limestones of Barrande's stage E at Dlouhá Hora, SE of Beroun (see Chlupáč, 1999, for the correlation of Barrande's étages). A more precise

stratigraphic origin cannot be proposed, as the localities collectively referred to as Dlouhá Hora (in the vicinity of the Kosov Quarry) belong either to the Kopanina Formation (Ludlow) or to the Požáry Formation (Pridoli) (Petr Štorch, pers. comm. 2020).

Description. – The specimen covers an area of ca. 50 × 60 mm but is incomplete. The slab has been repaired and reassembled from several pieces, as seen in Figure 2. This damage is not apparent in the original illustration by Göppert (1860) and therefore likely resulted from later handling. The specimen is well preserved in partial relief and readily visible on the somewhat weathered sediment surface due to the strong contrast between the stipes and the surrounding matrix. Lighter weathering is expressed as a halo around the stipes, contrasting with the darker, less weathered sediment. The graptolite fossil may have been infilled with pyrite, as suggested by several areas where weathered pyrite is visible as yellow mineralization (Fig. 3C, D, G). Darker, silvery reflective areas may represent remnants of the original organic material.

Individual zigzag-shaped main stipes are up to 20 mm long and bear numerous unbranched second-order stipes. The latter may develop into first-order stipes through the distal addition of monoprogressive second-order stipes.



Figure 2. General morphology of *Ptilograptus reussianus* (Göppert, 1860). MCZ.IP.202747, holotype specimen photographed wet using variously polarized light. Red arrows indicate locations where second-order stipes develop into first-order stipes through the monoprogressive addition of unbranched stipes.

This transition is observable in several places (Fig. 2: red arrows). The onset of the monoprogressive branching may occur after a variable length of the initially unbranched second-order stipes. This distal transition from an unbranched secondary stipe to monoprogressive branching appears to be a diagnostic character of the species, as it has not yet been reported in any congeneric species.

The secondary stipes initially grow very straight at an angle of *ca.* 70° from the main stipes but may bend slightly

distally due to their flexibility (Fig. 3E). The original growth direction is best seen in the slenderer distal portions of the main stipes (Fig. 3C, D), whereas the more proximal regions are wider and more robust, probably reflecting extensive cortical overgrowth (Fig. 3G, H). In dorsally preserved stipes, the thin prothecal or stolonal parts can occasionally be distinguished (Fig. 3A, E: red arrows). In laterally preserved stipes, the thecal outline is visible, showing that all thecae are simple, aperturally widening tubes without a differentiated apertural structure (Fig. 3F).

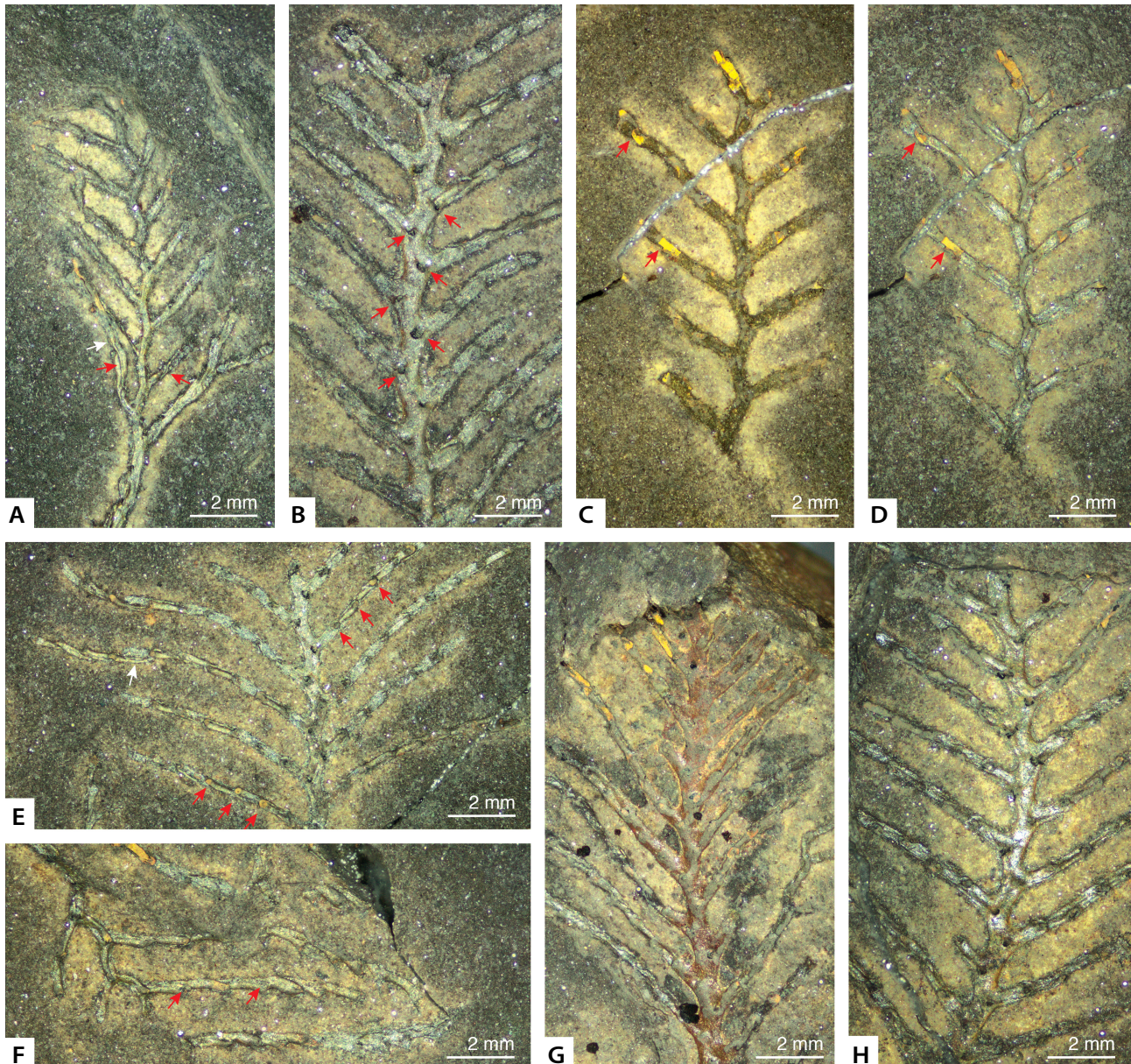


Figure 3. Detailed morphology of *Ptilograptus reussianus* (Göppert, 1860). MCZ.IP.202747, holotype specimen photographed wet using polarized or cross-polarized light. A – dorsal view showing slender prothecal tubes (red arrows). B – ventral view showing apertures of the zigzag main stipe (red arrows). C, D – slender distal stipe with limited cortical cover showing weathered pyritic infill (red arrows). E – ventral view showing thecal apertures (red arrows). F – lateral view showing thecal morphology and possible bithecae (red arrows). G – dorsal view of robust stipe with cortical cover. H – ventral view of robust stipe showing thecal apertures.

In this view, a few possible bithecae may also be identified (Fig. 3F: red arrows).

The ventral side of the stipes reveals the succession of thecae and allows recognition of thecal apertures. In thick main stipes, the thecal apertures are represented by dark dots disposed following a subtle zigzag pattern (Fig. 3B: red arrows). In dorsal view, thecal apertures are not visible (Fig. 3G). In these wide stipes, cortical outgrowth commonly obscures both the apertures of the main stipe and their zigzag shape (*cf.* Fig. 3G, H). In ventral

view, thecal apertures are often discernible (Fig. 3E: red arrows), although their recognition is hampered by partial flattening, which presses the thecal apertures against the stipe surface.

The thecal spacing (2TRD) is about 2.3–2.5 mm on all stipes. This number is also responsible for the spacing of the secondary stipes, as each theca on a main stipe produces a single secondary stipe. Thus, the distance between the secondary stipes on one side of a main stipe is about 2.3–2.5 mm, corresponding closely to the 2TRD. The

dorso-ventral width of the stipes varies from 0.6–0.7 mm in main stipes including a strong cover of cortical material to 0.3–0.4 mm in slender distal stipes. The lateral width of the stipes, measures 0.8–0.9 mm across the thecal apertures.

Owing to flattening of the colony, the precise spatial arrangement of the stipes cannot be reconstructed. Main stipes bearing secondary stipes appear to have been disposed within a single plane, forming a fan-like structure. It remains unclear whether later-formed secondary stipes were oriented within the same plane. It is more likely, however, that the colony exhibited a complex three-dimensional organization. Otherwise, stipes may have been interfering with each other. As most *Ptilograptus* specimens are small, isolated fragments (see Maletz & Gutiérrez-Marco 2025), the three-dimensional organization of the colonies cannot be reconstructed. The holotype specimen of *Ptilograptus reussianus* represents the largest colony known for the genus *Ptilograptus*, despite the tubarium and its overall shape being incompletely preserved.

Remarks. – Hall (1867, p. 239) regarded this species as a member of his genus *Ptilograptus*. This view was shared by Bouček (1957, p. 137), although he also considered the possibility that it might represent an independent species, which he could not substantiate due to a lack of access to the original material.

Maletz *et al.* (2025) discussed the genus *Ptilograptus* in the context of distinguishing graptolites, algae, and hydroids in the fossil record. They noted that descriptions are often based on small, fragmentary remains that are difficult – if not impossible – to assign confidently to known species, and in many cases even to higher taxonomic units due to the limited number of discernible characters. This situation is exemplified by the material described as *Plumalina* sp. 1 and *Plumalina* sp. 2 in Maletz *et al.* (2025). Although interpreted as benthic graptolites, no evidence of thecal development is preserved in these fossils to support this assignment. In contrast, *Ptilograptus reussianus* displays numerous characteristic features of stipe development, as well as clear thecal morphology shape and construction, confirming its placement in the Graptolithina and, more specifically, the Dendrograptidae (Fig. 3).

***Dendrograptus? subarticulatus* (Göppert, 1860)**

Figure 4A

1860 *Chondrites fruticulosus* var. *subarticulatus*; Göppert, p. 26, pl. 35, fig. 5.

Material. – Göppert (1860) illustrated a single specimen under this name, MCZ.IP.202879, collected by Brauermeister Schary in Prague. The material originated from

Silurian strata at Loděnice (β aus Loděnice), and more specifically calcareous shales belonging to the Barrande's stage E (Göppert 1860, p. 26) and therefore lower Silurian in age.

Description. – The specimen is an incomplete tubarium preserved as a carbonaceous compression in weathered yellow mudstone. The fragment slightly exceeds 15 mm in length. Stipes are *ca.* 0.3 mm wide and lack visible thecal details. Branching is irregular, with divisions spaced 1–5 mm apart. In a few areas, indications of very fine dissepiments are present.

Remarks. – Göppert (1860) distinguished this form from *Dendrograptus? fruticulosus* by the more outwardly inclined stipes. The branching angles of both are identical (*ca.* 45°), but in *Dendrograptus? subarticulatus*, the stipes quickly attain a parallel orientation. *Dendrograptus? subarticulatus* further differs in having slenderer stipes, a denser branching, and thin dissepiments (Fig. 4A). The taxonomic assignment remains uncertain due to the absence of observable thecal details.

***Dendrograptus? fruticulosus* (Göppert, 1860)**

Figure 4B

1860 *Chondrites fruticulosus*; Göppert, p. 26, pl. 35, figs 3, 4.

Material. – Göppert (1860) illustrated two specimens under this name, collected by Brauermeister Schary in Prague. Of these, only one specimen has been identified, MCZ.IP.202880 (Göppert, 1860, pl. 35, fig. 3). The material originated from Silurian strata at Loděnice (β aus Loděnice), and more specifically calcareous shales belonging to the Barrande's stage E (Göppert 1860, p. 26) and therefore lower Silurian in age.

Description. – This incomplete tubarium is a carbonaceous compression in a yellowish weathered mudstone, probably preserving remains of the original organic material (“braune Haut” of Göppert 1860, p. 26, meaning brown skin). The fossil is *ca.* 30 × 30 mm in size and represent a fragment of a fan-shaped colony. Stipes are *ca.* 0.5 mm wide proximally, tapering slightly to *ca.* 0.4 mm distally. Branching appears dichotomous and irregularly spaced, with distances between branching divisions ranging from 2 to 6 mm. Details of the thecae and their development are not discernible.

Remarks. – One of the two original specimens (Göppert 1860, pl. 35, fig. 3), MCZ.IP.202880, has been identified in the Schary collection at the MCZ (Fig. 4B), based on close correspondence with Göppert's drawing. It is here



Figure 4. Dendrograptidae. • A – *Dendrograptus? subarticulatus* (Göppert, 1860), MCZ.IP.202879, small incomplete tubarium with thin dissepiments, originally identified as *Chondrites fruticulosus* var. *subarticulatus* by Göppert, 1860 (pl. 35, fig. 5). • B – *Dendrograptus? fruticulosus* (Göppert, 1860), MCZ.IP.202880, incomplete tubarium, originally identified as *Chondrites fruticulosus* by Göppert (1860, pl. 35, fig. 3).

designated as the lectotype of the species. The second specimen (Göppert 1860, pl. 35, fig. 4) is identified as the paralectotype, but has not been recognized in the collection.

The specimens are similar in outline to *Dendrograptus* (*Dendrograptus*) *plasi* Bouček, 1957, but this identification cannot be verified owing to the lack of thecal details. Also, the generic assignment of *Dendrograptus? fruticulosus* is only tentative, as a placement within the genus *Callograptus* would also be possible if this species proves to possess isolated thecal apertures similar to *Dendrograptus* (*Dendrograptus*) *pennatus* Bouček, 1957 and *Dendrograptus* (*Dendrograptus*) *plasi* Bouček, 1957. In the latter two species, these thecal features indicate affinities with the Callograptidae, rather than the Dendrograptidae (see Maletz 2023).

Genus *Dictyonema* Hall, 1851

Remarks. – Maletz (1919b, 2023) transferred *Dictyonema* from the Dendrograptidae to the Callograptidae based on thecal development within the genus. However, a comprehensive revision of the hundreds of species historically assigned to this genus has yet to be undertaken and is generally precluded by the poor preservation of

most available material. Consequently, the material discussed here is provisionally retained within the Dendrograptidae.

Dictyonema? hisingeri (Göppert, 1860)

Figures 1Ca, b; 5C, E, F

1860 *Dictyonema Hisingeri*; Göppert, p. 31, pl. 36, fig. 2c (?pl. 36, figs 4–11; pl. 45, figs 3, 4).

Material. – Göppert (1860) illustrated two specimens from a slab bearing material identified by him as *Cyclograptus scharyanus* but later referred to *Thallograptus* sp. by Bouček (1957). A number of additional fragments, mostly from Scandinavia, may represent the planktic *Rhabdinopora flabelliformis* from the basal Ordovician. The two Czech specimens are here designated as the lectotype MCZ.IP.202881 (Figs 1Ca, 5E) and paralectotype MCZ.IP.202882 (Figs 1Cb; 5C, F) of this species. The remaining specimens illustrated by Göppert (1860, pl. 36, figs 4–11; pl. 45, figs 3, 4) have not been identified.

Description. – Both specimens represent small fragments of tubaria of uncertain morphology, probably fan-shaped,

measuring less than 30×30 mm in size. The smaller specimen is spread out (Fig. 5E), with lateral distances between stipes of up to 1 mm. The larger specimen shows an overlapping of the flexible stipes indicative of pre-burial transport, which obscures the original spacing between stipes. Nevertheless, both specimens are considered as conspecific based on their slender stipes and the presence of delicate dissepiments (Fig. 5E, F: red arrows). These thin dissepiments are visible only in a few areas, probably owing to limited preservation elsewhere. Thecae are not discernible; the stipes are slender and display parallel margins suggestive of them being exposed in dorsal view. As a consequence, thecal density cannot be assessed. Dichotomous branching is present at irregular intervals.

Remarks. – The specimens may be compared with *Dictyonema* (*Dictyonema*) *delicatulum* Lapworth, 1881 from the Upper Wenlock of Bohemia, as first noted by Bouček (1957, p. 55), but an assignment of Göppert's specimens to this species remains tentative. Additionally, these graptolite specimens from the Wenlock of the Czech Republic most likely represent a species distinct from the noticeably older *Dictyonema delicatulum* Lapworth, 1881, the type material of which originates from the Llandovery of Britain.

Occurrence. – Bouček (1957, p. 143) assigned the specimens associated with *Cyclograptus scharyanus* to the *Monograptus flexilis* Biozone (equivalent to the mid-Sheinwoodian *Monograptus belophorus* Biozone of Štorch 2023). The remaining, currently unrecognized specimens illustrated by Göppert (1860) may belong to other taxa.

Family Cyclograptidae Bulman, 1938

Genus *Cyclograptus* Spencer, 1883

Remarks. – According to Maletz (2019a, p. 15) and Maletz (2023, p. 228), Bulman (1970) synonymized the genera *Cyclograptus* Spencer, 1883 and *Rodonograptus* Počta, 1894. However, this synonymy had already been proposed by Bouček (1957, p. 141), who should therefore be credited with it.

Cyclograptus scharyanus (Göppert, 1860)

Figures 1B, 5A

- 1860 *Sphaerococcites Scharyanus*; Göppert, p. 30, pl. 36, Fig. 1 (*non* pl. 35, fig. 6b; pl. 36, figs 2, 3).
- 1894 *Rodonograptus asteriscus*; Počta, p. 206, pl. 5, figs 5–11.

- 1894 *Sphaerococcites Scharyanus* Göppert (pars). – Počta, p. 206.
- 1957 *Cyclograptus scharyanus* (Göppert). – Bouček, p. 142, pl. 38, figs 2–4; text-fig. 67a, b.
- 2019a *Cyclograptus asteriscus* Počta. – Maletz, p. 15, fig. 12.4b. (misspelling of species name)
- 2023 *Cyclograptus asteriscus* Počta. – Maletz, p. 228, fig. 143.4b (misspelling of species name)

Material. – Göppert (1860) illustrated three specimens under this name, collected by Brauermeister Schary in Prague. The material originated from the Silurian strata at Loděnice, more specifically from calcareous shales belonging to Barrande's Stage D. Of these three specimens, only one was located in the Schary collection at Harvard University, MCZ.IP.202883 (Figs 1B, 5A). This specimen is here designated as the lectotype of the species. It represents the counterpart of the specimen originally illustrated by Göppert (1860, pl. 35, fig. 1), which could not be located.

Description. – The specimen is a subcomplete tubarium preserved as a weathered carbonaceous compression on a yellow-brown mudstone slab. It represents a 40 mm-wide colony, which is subcircular in outline and exposed from below. Indeed, the specimen exhibits a slightly elevated central area with a lighter-coloured, *ca.* 2 mm wide spot, which is interpreted as the attachment site from which the 1.0–1.5 mm-wide stipes originate. Precise length stipes cannot be measured owing to their fusion into a compact mass of carbonaceous material centrally. These stipes branch repeatedly and dichotomously, resulting in the discoid – probably conical originally – shape of the colony. The spacing between branching points cannot be determined accurately. No details of the thecal construction are preserved.

Remarks. – Bouček (1957, p. 143) regarded only one of Göppert's original specimens (Göppert 1860, pl. 36, fig. 1) as belonging to this species, tentatively assigning the other two specimens to the genus *Thallograptus*.

Počta (1894, p. 206) surprisingly created the new species *Rodonograptus asteriscus*, while acknowledging its synonymy with *Cyclograptus scharyanus*. This was corrected by Bouček (1957), who regarded *Rodonograptus asteriscus* Počta, 1894 to be a junior synonym of *Cyclograptus scharyanus* (Göppert, 1860), a view followed here. Bouček (1957, p. 142) designated a specimen of *Rodonograptus asteriscus* from Počta (1894, pl. 5, fig. 8) as the neotype of *Cyclograptus scharyanus* (Göppert, 1860), assuming that the original material of Göppert (1860) was lost. This neotype designation is here superseded by the recognition of Göppert's original specimen in the Schary Collection at Harvard University.

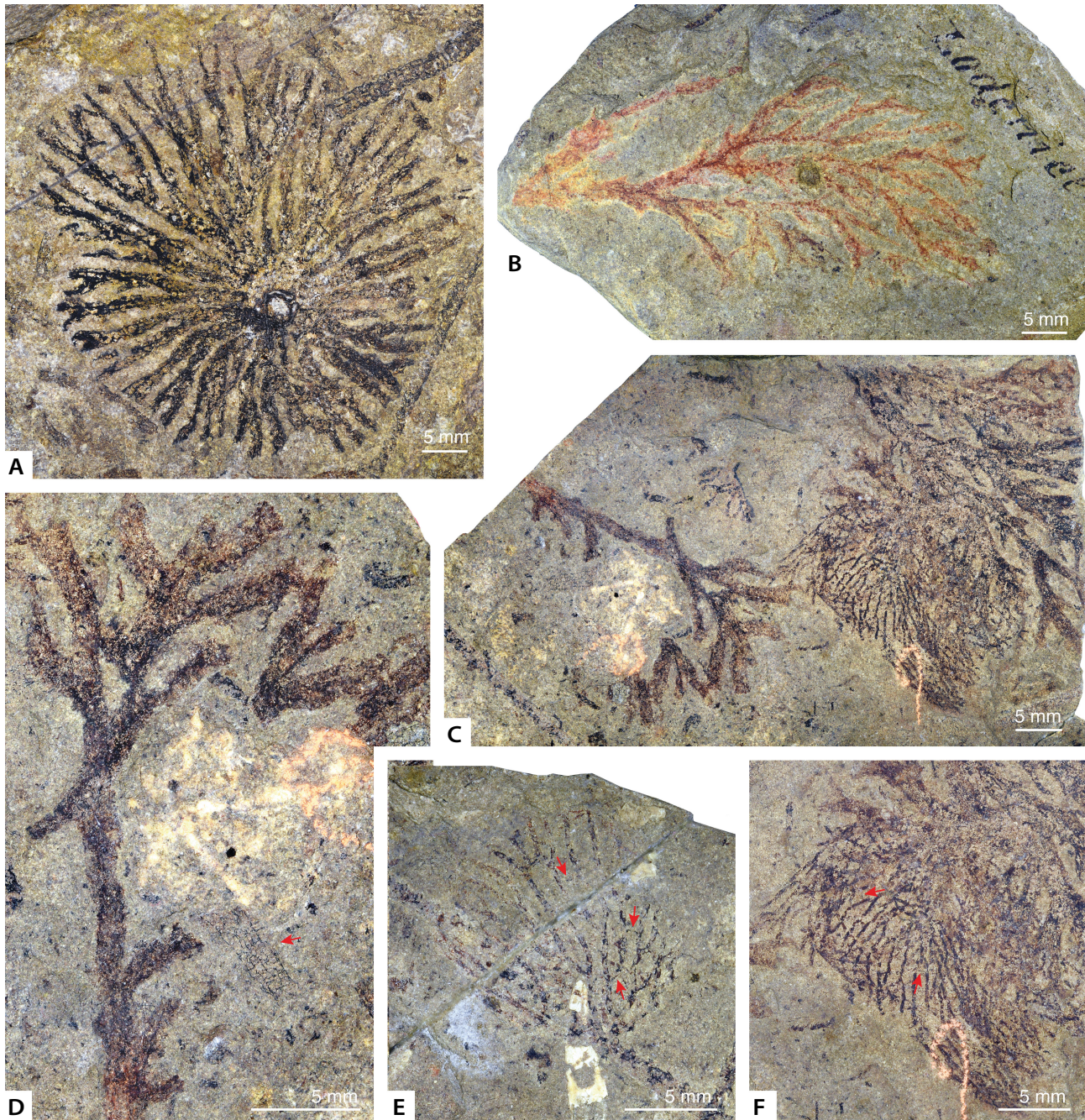


Figure 5. Additional species. • A – *Cyclograptus scharyanus* (Göppert, 1860), MCZ.IP.202883, newly designated neotype representing the counterpart of the holotype designated by Göppert (1860, pl. 36, fig. 1). • B – *Thallograptus?* sp. indet., MCZ.IP.202886, poorly preserved fragment originally identified as *Sphaerococcites Scharyanus* by Göppert (1860, pl. 36, fig. 3). • C – general view of slab bearing multiple graptolitic remains, including MCZ.IP.202882, MCZ.IP.202884, and MCZ.IP.202885 (Göppert 1860, pl. 36, fig. 2). • D – *Thallograptus?* sp. sensu Bouček, 1957, detail of C showing MCZ.IP.202885. • E, F – *Dictyonema? hisingeri* Göppert, 1860. E – MCZ.IP. 202881, lectotype, incomplete tubarium with dissepiments (red arrows) occurring on the slab illustrated in C (out of frame in C). F – detail of C showing MCZ.IP.202882, paralectotype, incomplete tubarium with dissepiments (red arrows).

Occurrence. – Bouček (1957, p. 143) reported this species as very common in the *Monograptus flexilis* Biozone (equivalent to the mid-Sheinwoodian *Monograptus belophorus* Biozone of Štorch 2023). Göppert's (1860) specimens likely originate from the same interval.

A number of poorly preserved retiolitids on the slab (red arrow in Fig. 5D) may belong to *Sokolovograptus textor* (Petr Štorch, pers. comm. 2026). Associated long monograptids on the slab are too poor for identification.

Dendroidea indet.

Genus *Thallograptus* Ruedemann, 1925

Remarks. – Maletz (2023, p. 470, fig. 310.5a, b) referred *Thallograptus* to the macroalgae based on its type species *Dendrograptus? succulentus* Ruedemann, 1904, but argued that numerous species previously assigned to this genus represent genuine benthic graptolites. These taxa would require reassignment to other genera within the Callograptidae.

Thallograptus? sp.

Figures 1Cc, d; 5B–D

1860 *Sphaerococcites Scharyanus*; Göppert, 1860, p. 30, pl. 35, fig. 6b; pl. 36, figs 2, 3 (*non* pl. 36, fig. 1; = *Cyclograptus scharyanus*).

1957 Fragments of a species of *Thallograptus*. – Bouček, p. 143 (remark on Göppert, 1860, pl. 36, figs 2, 3; not illustrated).

Material. – Two specimens, MCZ.IP.202884 (Figs 1Cd, 5C) and MCZ.IP.202885 (Figs 1Cc; 5C, D), are preserved on the same slab as incomplete tubaria of *Dictyonema hisingeri*. Göppert (1860) identified these two specimens as *Sphaerococcites scharyanus*, a view contested by Bouček (1957, p. 143), who referred to them to *Thallograptus* sp. instead.

Description. – Both specimens represent small colony fragments preserved as flattened carbonaceous remains. The original shape of the colony cannot be reconstructed. The stipes are up to 30 mm long and 1.5 mm wide, with possible thecal tubes widening aperturally to at least 2.0 mm. Fuselli are not discernible, and it remains uncertain whether the fragments represent graptolitic remains.

Remarks. – The specimens are provisionally referred to *Thallograptus?* sp., although they may belong to a different taxon. Notably, the putative thecal tubes and their strong apertural widening resemble those of some robust Cambrian taxa, such as *Sphenoecium* or *Archeolafoea* (e.g. Maletz 2024).

MCZ.IP.202886 (Fig. 5B), another specimen illustrated by Göppert (1860, pl. 36, Fig. 3), fits in its general shape with material referred to the genus *Thallograptus* by Bouček (1957), bearing branched stipes that taper distally. This specimen is poorly preserved and lacks thecal details, but it clearly represents a different taxon from the specimens identified as *Thallograptus?* sp. (i.e. MCZ.IP.202884 and MCZ IP.202885).

Occurrence. – The specimens originate from the mid-

Sheinwoodian (Wenlock, Silurian) *Monograptus belophorus* Biozone of the Czech Republic.

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