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## SPONGOPHYLLIDAE (RUGOSA) OF BOHEMIAN SILURIAN AND DEVONIAN

Předložená práce podává revizi čeledi *Spongophyllidae* ze siluru a devonu Českého masívu. Jsou popsány dva rody se třemi druhy, z nichž jeden je považován za nový: *Carlinastraea kettneri* (PRANTL, 1951), *Carlinastraea martinae* sp. nov. a *Kozlowiaphyllum inficetum* (POČTA 1902). Jsou diskutovány jejich vztahy k evropským a některým severoamerickým a asijským faunám.

The family *Spongophyllidae* from the Silurian and Devonian of Bohemian Massif is reviewed. Two genera with three species, one of them new, are described: *Carlinastraea kettneri* (PRANTL 1951), *Carlinastraea martinae* sp. nov., and *Kozlowiaphyllum inficetum* (POČTA 1902). Their relations to European and some North American and Asian faunas are discussed.

### INTRODUCTION

Spongophyllid corals are relatively rare in the faunas of the Paleozoic of Bohemian Massif. Most of the spongophyllids of Bohemian Silurian and Devonian are described by POČTA (1902) and PRANTL (1951). The revision of the fauna of Central Bohemian Silurian and Devonian is based mainly on Počta's and Prantl's types; minor part of the fauna was newly collected.

All the corals discussed here were studied by means of thin sections. The more economic method of acetate peels has not been employed due to unfavourable preservation of the Bohemian materials. The corallite diameter was measured from suture to suture.

The following abbreviations are used in the text: d = corallite diameter; dt = tabularium diameter; n = number of both major and minor septa; w = thickness of the wall; OR = overall range; N = number of measurements;  $\Sigma$  = sum;  $\bar{x}$  = mean value.

I am indebted to Dr. Rudolf Prokop and Mr. Antonín Skalický of the National Museum (Natural History), Prague, for the permission to study the Počta's and Prantl's material. My study was aided by discussions with Dr. William A. Oliver, Jr., (Washington), Dr. Alan E. H. Pedder (Calgary), and Dr. Rudolf Birenheide (Frankfurt am Main).

## SYSTEMATIC PART

*Ptenophyllina* WEDEKIND 1927

*Spongophyllidae* DYBOWSKI 1873

Type genus: *Spongophyllum* EDWARDS et HAIME 1851

Discussion: Reviewing the systematic of the family is beyond the scope of this paper. In the generic concept I follow PEDDER (1971a, b, 1978, 1980) as far as the genera discussed here are concerned, and HILL (1981) with an exception of *Kozłowiaphyllum* RUKHIN, 1938 which I recognize as the genus separate from *Xystriphyllum* HILL, 1933. I am differing from BIRENHEIDE (1978) in excluding the genera *Dendrostella* GLINSKI 1957, and *Battersbyia* EDWARDS et HAIME 1851, from the family.

*Carlinastraea* MERRIAM et McKEE 1976

Type species: *Carlinastrea tuscaroraensis* MERRIAM et McKEE 1976; Lower Devonian, Lochkovian, upper beds of Roberts Mountains Formation, Nevada, U. S. A.

Diagnosis (according MERRIAM et McKEE 1976): "Cerioid spongophyllid having slender, fairly thick walled corallites, a strong marginarium of large to very large, steeply inclined lonsdaleioid dissepiments, and a nonuniform pattern of partially aborted septa in the tabularium of some corallites."

Geographical distribution and stratigraphical range: Lower Devonian, Lochkovian of Nevada, Yukon and Bohemia; (?) lowermost Devonian, Ural Mountains; Lower Devonian, Tom-Chumysh Formation, Salair Mountains; Lowermost Zlíchovian, Bohemia.

*Carlinastraea kettneri* (PRANTL 1951)

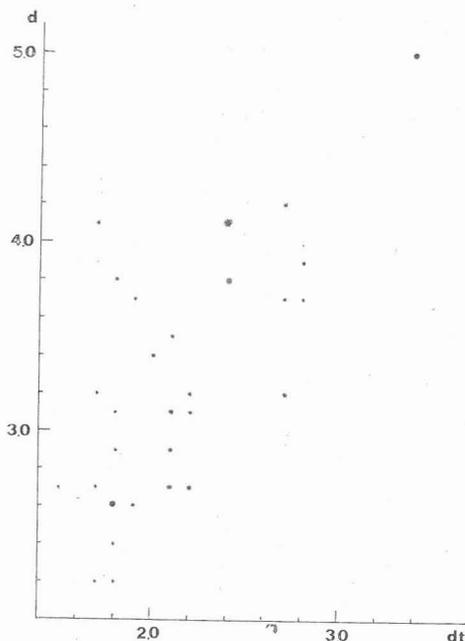
Pl. 1, figs. 1—3; pl. 2, figs 2, 3

1951 *Spongophyllum kettneri* nov. spec. — PRANTL, p. 235—237, pl. II, figs. 1, 2, text-fig. 3.

Holotype: By monotypy, specimen No. L 17883, figured in PRANTL (1951) on pl. II, figs. 1, 2. Those thin sections have not been found, but the specimen is deposited in the National Museum (Natural History), Prague. Four additional thin sections numbered L 17883 a-d were prepared; they are figured here on pl. 1, figs. 1—3 and pl. 2, figs 2, 3. The holotype was collected in the Lochkov Limestone, Lochkovian, Černá rokle gorge near Kosoř, south of Prague.

Diagnosis: *Carlinastraea* with uni- or biserial-dissepimentarium, horizontal or concave tabularium, and septa usually strongly withdrawing from periphery.  $OR_d = 2.18 - 5.00$  mm,  $OR_n = 10-25$ .

Fig. 1. *Carlinastraea kettneri* (PRANTL, 1951). Variation in corallite diameter (d) and tabularium diameter (dt) in holotype.



Description: Corallum shape is unknown. Corallites are polygonal, mostly subtetragonal to hexagonal in the transverse section. Nonparicidal increase occurs in the lonsdaleoid dissepimentarium, mostly in the corners of the corallites. Septa are thin to thick in some places. They are carinated in some corallites, carinae being mostly very fine and low. Both majors and minors are mostly withdrawing from the periphery, but sometimes they join the corallite wall. Majors are reaching the axis, minor reach maximally  $1/2 r$ , but usually they are much shorter, being sometimes developed only as ridges on the corallite wall and on the surfaces for the dissepiments. Dissepimentarium is usually lonsdaleoid, built of one or two rows of large vertical dissepiments. Tabularium is formed of complete horizontal or slightly concave tabulae. Fine structure is very poorly preserved.

Dimensions:

|           | d         | dt        | d/dt      | n       |
|-----------|-----------|-----------|-----------|---------|
| OR        | 2.18—5.00 | 1.53—3.35 | 1.22—2.37 | 10—25   |
| N         | 31        | 30        | 30        | 29      |
| $\Sigma$  | 100.1     | 62.74     | 46.95     | 498     |
| $\bar{x}$ | 3.2290    | 2.0913    | 1.5650    | 17.1724 |

Discussion: *Carlinastraea kettneri* (PRANTL 1951) differs from the type species *Carlinastraea tuscaroraensis* MERRIAM et McKEE 1976, in the shape of the septa, which are thicker, sometimes carinated, and joining the corallite wall on some places in *C. kettneri*.

It differs from the other Bohemian species, *Carlinastraea martinae* sp. nov. (lowermost Zlíchovian), in the development of the uniserial dissepimentarium in *C. martinae*. Besides, it differs in the shape of the tabularium, which contains tent-like tabellae in *C. martinae*.

*Spongophyllum giganteum* SHURYGINA 1968 (? lowermost Devonian, Ural Mountains) differs from *Carlinastraea kettneri* (PRANTL 1951) in corallite diameter (up to 10 mm) and in multiserial dissepimentarium built of less steeply inclined dissepiments.

*Carlinastraea kettneri* (PRANTL 1951) differs from *Spongophyllum originale* ZHMAEV in KRAYEVSKAYA 1955 sensu SHURYGINA 1968, in strongly developed septa and biserial dissepimentarium.

Species *Carlinastraea* sp. (lower Lochkovian, Road River Formation, zone *Icriodus woschmidti hesperius*, Yukon), *Carlinastraea* sp. middle Lochkovian, the same locality and formation, between the zones *Icriodus woschmidti hesperius* and *Pedavis pesavis pesavis*), and *Carlinastraea* sp. cf. *S. rosiformis* (ZHELTONOGOVA 1960) (upper Lochkovian, the same locality, zone *Pedavis pesavis pesavis*), described by PEDDER (1978), differ from *Carlinastraea kettneri* in the weakly developed septa.

*Neophyma rosiformis* ZHELTONOGOVA 1960 (Tom-Chumysh Formation, Sarlair Mountains) differs from *Carlinastraea kettneri* in uniserial slightly everted dissepimentarium.

PRANTL (1951) introduces the holotype as the only specimen known. Its dimensions (95 × 85 × 40 mm) coincide with those of the specimen L 17883. Unfortunately, the thin sections figured on Prantl's pl. II, figs. 1, 2 have not yet been traced. Instead, four unfigured thin sections have been found with the hand specimen. It seems obvious that the specimen L 17883 is identical with Prantl's holotype.

PRANTL (1951) mentions that the specimen comes from the "black-grey, somewhat bituminous, fine-grained tentaculite limestone" with abundant tentaculite *Paranowakia intermedia* (BARRANDE), "from which none rugose coral have been reported". Actually, it is the only known specimen of colonial rugose coral in the Bohemian Lochkovian; Rugosa are not known in underlying Přídolian.

It is worth to mention that the locality of the holotype (Černá rokle gorge near Kosoř) is the originally defined stratotype of Lochkovian with exposed Lochkovian/Pragian boundary (CHLUPÁČ 1976a, b). Unfortunately, the exact collecting site of *C. kettneri* is unknown.

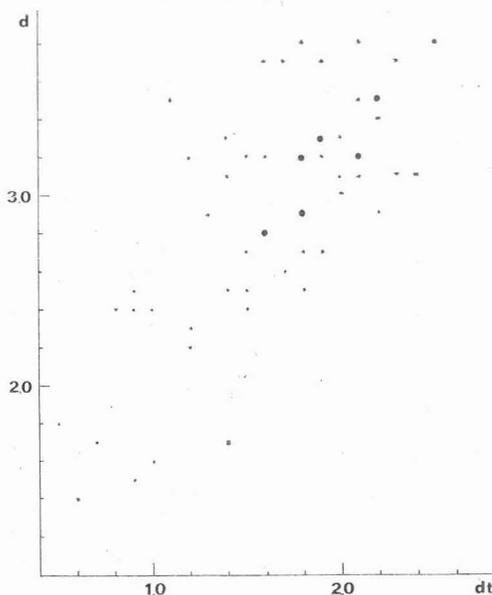
Geographical distribution and stratigraphical range: *Carlinastraea kettneri* (PRANTL 1951) is hitherto known only from the Lochkovian of Central Bohemia.

*Carlinastraea martinae* sp. nov.

Pl. 3, figs. 1—3, pl. 4, fig. 3

Holotype: Specimen No. AG 177, of which two thin sections were prepared. They are figured here on pl. 3, figs. 1—3 and pl. 4, fig. 3 and provisionally deposited in the author's collection, Institute of Geology and Geotechnics ČSAV, Prague. The holotype was collected in the Coral

Fig. 2. *Carlinastraea martinae* sp. nov.  
Variation in corallite diameter (d) and  
tabularium diameter (dt) in holotype.



Horizon of the Chapel in the basal beds of the Zlíčov Limestone (Zlíčovian) in Prague 5 — Zlíčov in the quarry “U Kapličky”.

Diagnosis: *Carlinastraea* with massive septal crests forming the wall, and occasionally with the septa on the surfaces of large lonsdaleoid dissepiments.  $OR_d = 1.17-3.82$  mm,  $OR_n = 10-20$ .

Description: Massive cerioid corallum is of hemisphaerical or irregular shape. Its diameter is approximately 250 mm. Increase is nonparricidal, offsets originate in the lonsdaleoid dissepimentarium. Corallite walls are massive, composed of two layers, septa usually well visible in the transverse section as massive blunt triangles with coalescent bases. Septa are present also between the dissepimentarium and tabularium, usually on a part of the tabularium perimeter only. Sometimes the septa are lacking. Dissepimentarium is continuous, uniserial, built of large elongated steeply inclined lonsdaleoid dissepiments. Tabularium is concave and built of periaxial horizontal, concave or tent-like tabellae, sometimes with additional peripheral tabellae steeply inclined adaxially. These peripheral, inclined tabellae are sometimes lacking; in this case, the horizontal or convex periaxial tabellae are developed throughout the tabularium. Tabellae are much less densely spaced than dissepiments.

Dimensions:

|           | d         | dt        | d/dt      | n       | w         |
|-----------|-----------|-----------|-----------|---------|-----------|
| OR        | 2.47—3.82 | 0.94—2.53 | 0.71—3.15 | 14—20   | 0.06—0.41 |
| N         | 42        | 42        | 42        | 15      | 41        |
| $\Sigma$  | 134.36    | 75.84     | 72.96     | 260     | 8.08      |
| $\bar{x}$ | 3.1993    | 1.8057    | 1.7371    | 17.3333 | 0.1971    |

Discussion: *Carlinastraea martinae* sp. nov. differs from the type species *Carlinastraea tuscaroraensis* MERRIAM et McKEE 1976, in a smaller corallite diameter (3—5 mm measured on photographs of *C. tuscaroraensis*), and in the septa, which are long and slender in the tabularium of the American species. Moreover, tent-like periaxial tabellae are never developed in *C. tuscaroraensis*.

*Spongophyllum giganteum* SHURYGINA 1968, probably from the lowermost Devonian of Ural Mountains, belongs, according to MERRIAM et McKEE (1976), to *Carlinastraea*. *C. martinae* sp. nov. differs from this species in a smaller corallite diameter (up to 10 mm in *S. giganteum*). Moreover, a multiserial dissepimentarium formed by a less steeply inclined dissepiments is developed in *S. giganteum*.

*Spongophyllum originale* ZHMAEV in KRAYEVSKAYA 1955 sensu SHURYGINA 1968, differs from *C. martinae* in slightly larger corallite diameter ( $OR_d = 2.5-3.75$  mm,  $\bar{d} =$  cca. 3 mm), in better developed septa, and in horizontal tabulae.

*Carlinastraea* sp. described by PEDDER (1978) from lower Lochkovian Road River Formation (zone *Icriodus woschmidti hesperius*), Royal Creek, Yukon, differs from *C. martinae* in longer septa, strongly convex dissepiments and horizontal or slightly concave tabulae.

Another PEDDER'S (1978) *Carlinastraea* sp. from the middle Lochkovian of the same locality (between the zones *Icriodus woschmidti hesperius* and *Pedavis pesavis pesavis*), differs from *C. martinae* in the tabularium built of complete horizontal tabulae, and in unthickened skeletal elements.

*Carlinastraea* sp. cf. *S. rosiformis* ZHELTONOGOVA sensu PEDDER 1978 from the upper Lochkovian of the same locality (zone *Pedavis pesavis pesavis*) differs from *C. martinae* in slightly smaller corallite diameter (cca. 2.4 mm on the photographs), in weakly developed septa, less thickened skeletal elements, multiserial dissepimentarium, and in tabularium built of mostly horizontal tabulae.

*Neophyma rosiformis* ZHELTONOGOVA 1960 from Tom-Chumysh Formation of Salair Mountains differs from *C. martinae* in the shape of dissepimentarium. It is flat or slightly convex on periphery, and anaxially steeply inclined towards the base in *N. rosiformis*. Tabularium is built of horizontal or slightly concave tabulae.

*Carlinastraea martinae* sp. nov. occurs very rarely in the basal beds of the Zlíchov Limestone, Coral Horizon of the Chapel, Zlíchovian, quarry "U Kapličky" in southern part of Prague. The „Kaplička“ assemblage comprise rich tabulates (PRANTL 1949, GALLE 1976), rugosans (PRANTL 1938, OLIVER - GALLE 1971b), bryozoans, brachiopods, trilobites and ostracodes (CHLUPÁČ 1976a, b). Its relations to the Pragian Koněprusy coral fauna (OLIVER - GALLE 1971a; GALLE 1978) are obvious. Nevertheless, the Kaplička corals as well as the brachiopods indicate an environment of relatively low energy if compared with Koněprusy.

Geographical distribution and stratigraphical range: *Carlinastraea martinae* sp. nov. occurs very rarely only in the basal beds of the Zlíchovian (Lower Devonian), at Zlíchov, southern part of Prague, Bohemia.

*Kozlowiaphyllum* RUHKIN, 1938

Type species: *Kozlowiaphyllum pentagonum* RUHKIN, 1938; ?Lower Devonian, Yasachnaya River, northeastern Siberia.

Diagnosis: Cerioid spongophyllid with multiserial, sometimes lonsdaleoid dissepimentarium and narrow tabularium of complete or incomplete tabulae.

Discussion: IVANOVSKY (1976) synonymized the genus with *Spongophyllum* EDWARDS et HAIME 1851. HILL (1981) listed it tentatively among synonyms of *Xystriphyllum* HILL 1940. The Bohemian material as well as the Canadian specimens figured by PEDDER (1978, pl. 16, figs. 1—4; pl. 18, figs. 1, 4; pl. 24, figs. 2, 3; pl. 29, figs. 2, 3, 5; pl. 31, figs. 9, 10) do not agree with the internal morphology of the type species *Spongophyllum sedgwicki* EDWARDS et HAIME 1851, figured by BIRENHEIDE (1962, pl. 9, fig. 8; pl. 10, fig. 10), PEDDER (1980, pl. 4, figs. 5—7) and HILL (1981, fig. 145).

Geographical distribution and stratigraphical range: ? Lower Devonian of northeastern Siberia; lower Přídolian to upper Lochkovian of Yukon; and ? Wenlockian of Central Bohemia.

*Kozlowiaphyllum inficetum* (POČTA, 1902)

Pl. 2, fig. 1; pl. 4, figs. 1, 2

1902 *Spongophyllum inficetum* POČTA. — POČTA, p. 153—154, pl. 102, fig. 1.

1902 *Cyathophyllum manipulatatum* POČTA. — (partim); POČTA, pl. 103, fig. 3.

1951 *Spongophyllum inficetum* (POČTA, 1902) — PRANTL, p. 233—235, p. 1, fig. 2, text-fig. 2.

Lectotype: Specimen No. L 17877 figured by POČTA (1902) on pl. 102, fig. 1, and figured here on pl. 4, fig. 1 (and probably also 2). It was collected probably in the upper Wenlockian of the locality "V Kozle" on the left bank of the Berounka river between the sites Beroun and Srbsko.

Diagnosis: *Kozlowiaphyllum* with uni- to multiserial dissepimentarium, concave tabularium, and relatively long minor septa.  $OR_d = 5.12-7.06$  mm,  $OR_n = 28-34$ .

Description: Corallum shape is unknown. Corallites are polygonal in transverse section, nonparricidal increase occurs in lonsdaleoid dissepimentarium. Septa are thin, mostly withdrawing from the periphery, sometimes continuous and reaching to the corallite wall. Majors are reaching the axis, minors reach up to two-thirds of the length of majors. Dissepimentarium lonsdaleoid, built of one to several rows of elongate dissepiments. Tabularium is formed by densely arranged complete concave tabulae. It is rather broad, its diameter varies. Fine structure of all skeletal elements is poorly preserved.

Dimensions:

|           | d         | dt        | d/dt      | n           |
|-----------|-----------|-----------|-----------|-------------|
| OR        | 5.12—7.06 | 2.06—2.94 | 2.16—3.33 | (14—17) × 2 |
| N         | 10        | 10        | 10        | 10          |
| $\Sigma$  | 60.93     | 24.24     | 25.41     | 306         |
| $\bar{x}$ | 6.0930    | 2.4240    | 2.5410    | 30.6000     |

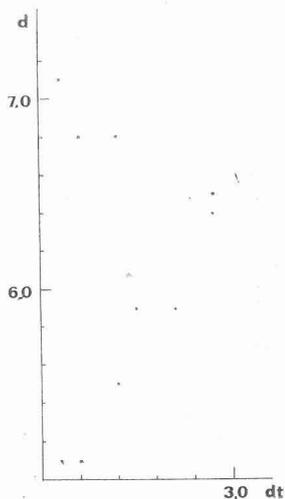


Fig. 3. *Kozlowiaphyllum inficetum* [POČTA, 1902]. Variation in corallite diameter (d) and tabularium diameter (dt) in holotype.

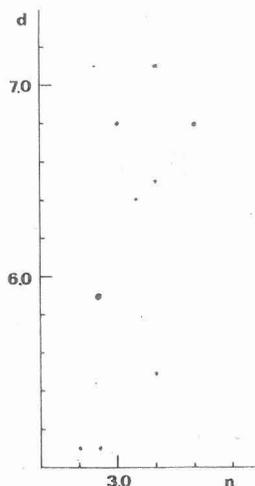


Fig. 4. *Kozlowiaphyllum inficetum* [POČTA, 1902]. Variation in corallite diameter (d) and number of septa (n) in holotype.

Discussion: Early Přídolian species *Kozlowiaphyllum pridolicum* (PEDDER) of Northern Yukon, as figured by PEDDER (1978, pl. 16, figs. 1, 3 and 2, 4) differ from the Bohemian species mainly in dimensions, their corallite diameter being, approximately 3–4 mm, while 5–7 mm in *K. inficetum*. Particularly the morphology of *Kozlowiaphyllum* sp. cf. *K. pridolicum* resembles strongly this of *K. inficetum*.

*Xystriphyllum pridolicum* PEDER, 1971, Přídolian, Prongs Creek Formation, northern Yukon, differs from *K. inficetum* in the shape of steeply inclined dissepimentarium, composed of large dissepiments, and in the corallite diameter, which is 4–6 mm, while 5–7 mm in *K. inficetum*.

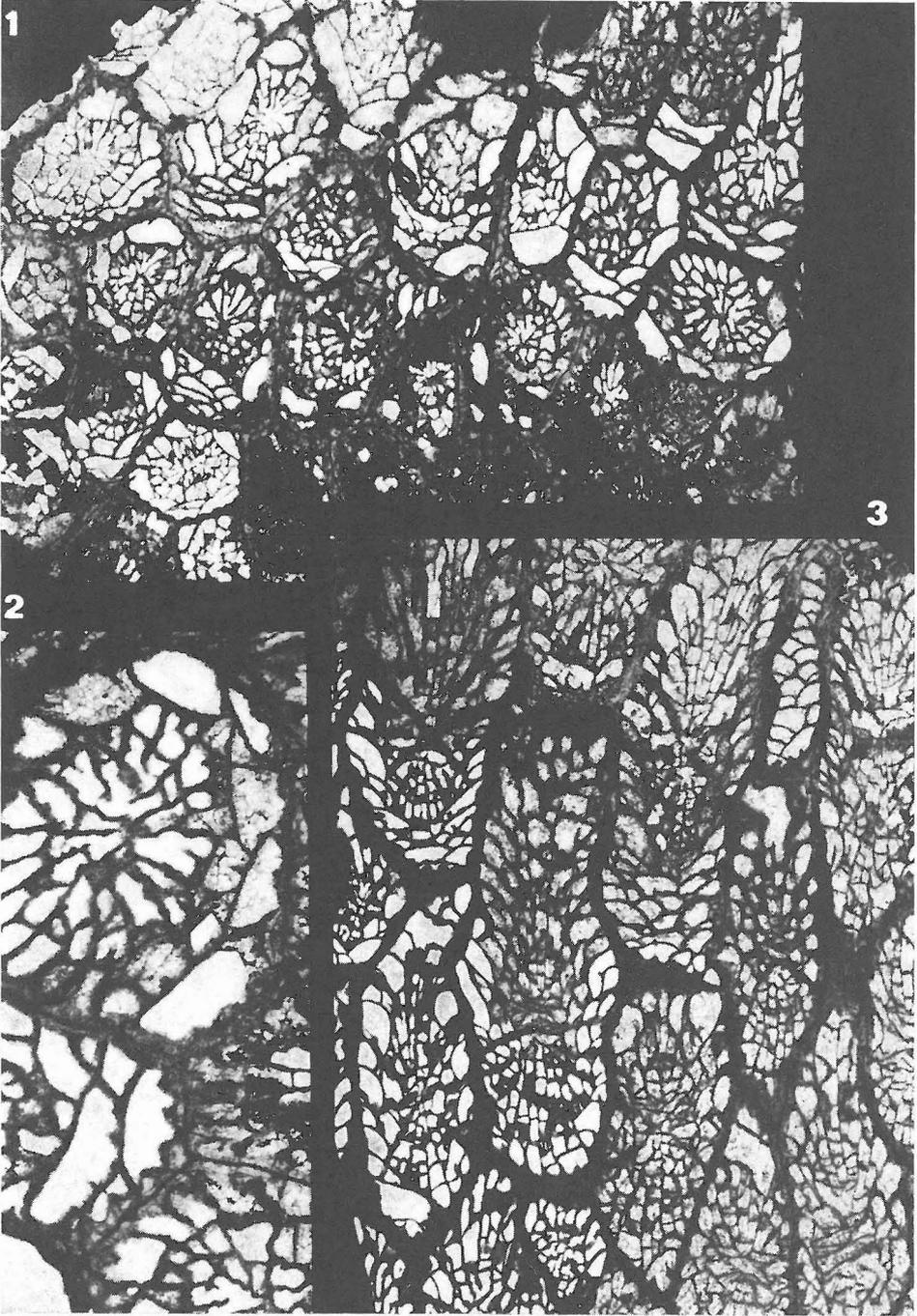
The hand specimen of the holotype of *Kozlowiaphyllum inficetum* has not been traced in the National Museum (Natural History), Prague. Thin sections with "ink" numbers 476 (POČTA'S "*C. manipulatum*", pl. 103, fig. 3) and 742 (unfigured) are numbered with the same "scratch" number 203 and they were most probably cut from the same specimen. On the other hand, the lectotype with "ink" number 495 (POČTA'S pl. 102, fig. 1) bears no "scratch" number, and thus it may or may not originate from the same specimen "scratch" number 203. Therefore, the Počta's pl. 102, fig. 1 was designated as the lectotype. The meaning of the "ink" and "scratch" numbers is given in OLIVER and GALLE (1971a).

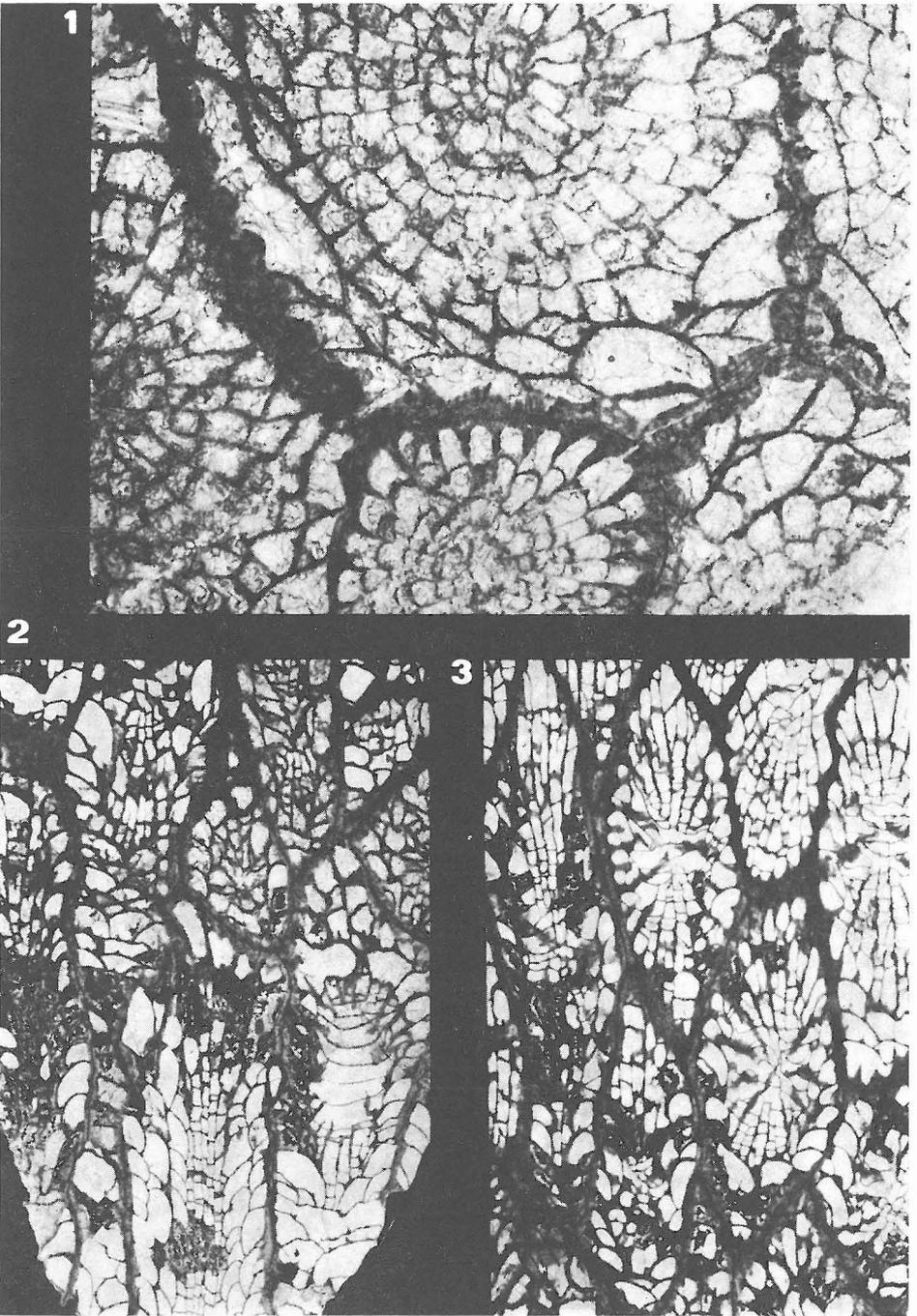
An exact collecting site of the lectotype is unknown, and therefore no information concerning the ecology and taphonomy is available. Moreover, the specimen may well be of post-Wenlockian age.

Geographical distribution and stratigraphical range: *Kozlowiaphyllum inficetum* (POČTA, 1902) is hitherto known probably from the upper Wenlockian Liteň Formation, Central Bohemia; its age may be much younger.

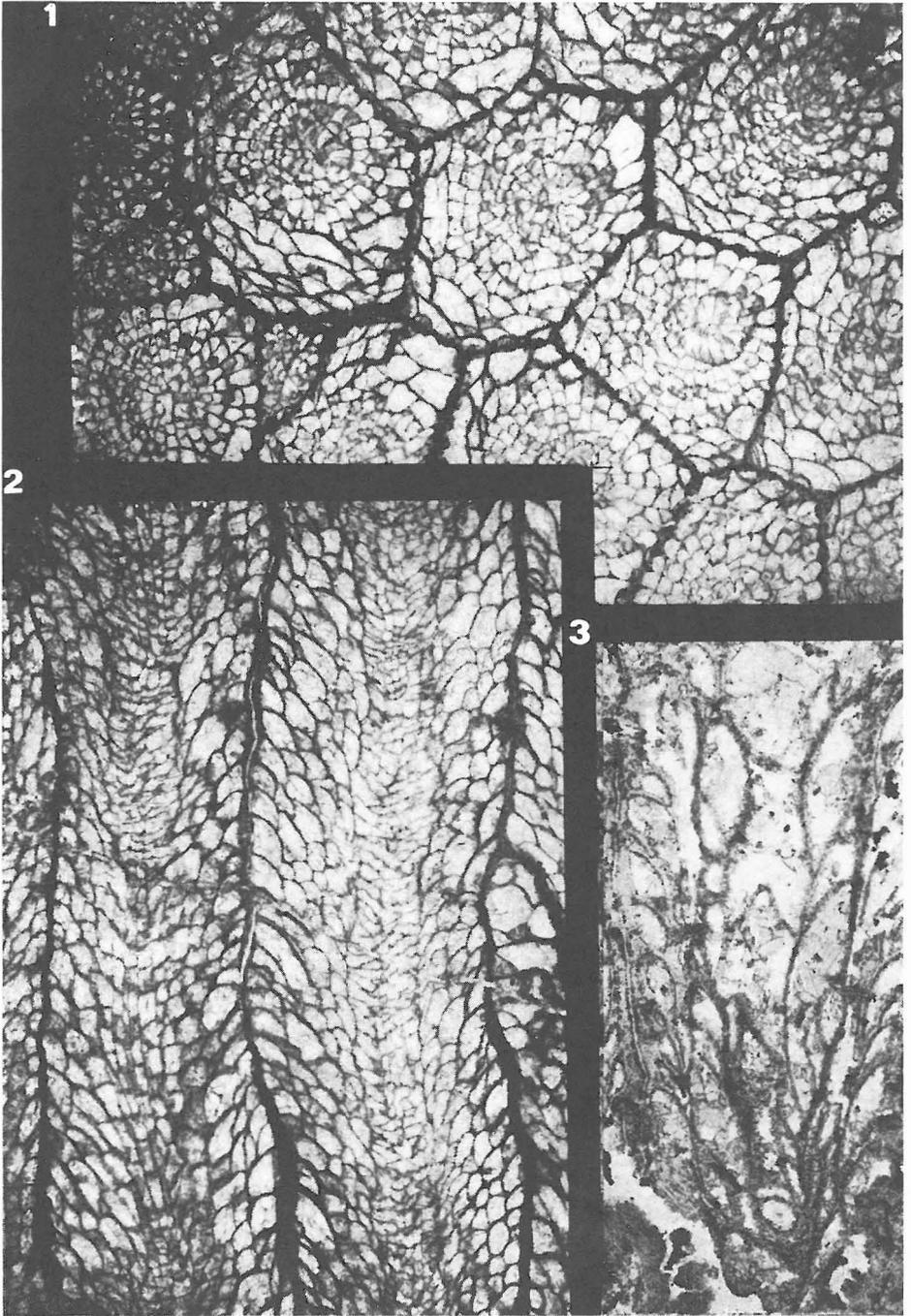
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## EXPLANATION OF PLATES

### Pl. 1

*Carlinastraea kettneri* (PRANTL, 1951); Lochkovian, Central Bohemia, Černá rokle gorge near Kosoř.

1. Holotype, NM No. L 17883, transverse section,  $\times 4$ .
2. The same section, detail of fig. 1;  $\times 11$ .
3. Holotype, NM No. L 17883, oblique longitudinal section;  $\times 4$ .

### Pl. 2

*Kozlowiaphyllum injicetum* (POČTA, 1902); ? Wenlockian, Central Bohemia "V Kozle" between Beroun and Srbsko.

1. Holotype, detail of transverse section figured here on pl. 4, fig. 1;  $\times 11$ .  
*Carlinastraea kettneri* (PRANTL, 1951); Lochkovian, Central Bohemia, Černá rokle gorge near Kosoř.
2. Holotype, NM No. L 17883, oblique longitudinal section,  $\times 4$ .
3. The same specimen, oblique transverse section with carinated septa;  $\times 4$ .

### Pl. 3

*Carlinastraea martinae* sp. nov., Zlíchovian, Central Bohemia, Praha-Zlíchov, quarry "U Kapličky".

1. Holotype, No. AG 177 B, longitudinal section through heavily silicified corallum;  $\times 6$ .
2. The same specimen, No. AG 177 A, transverse section;  $\times 6$ .
3. The same section, detail of fig. 2;  $\times 11.5$ .

### Pl. 4

*Kozlowiaphyllum injicetum* (POČTA, 1902); ? Wenlockian, Central Bohemia "V Kozle" between Beroun and Srbsko.

1. Holotype NM No. L 17877, thin section No. PV 33, transverse section figured in POČTA (1902) on pl. 102, fig. 1;  $\times 4$ .
2. The same specimen (?), thin section No. 476, longitudinal section figured in POČTA (1902) on pl. 103, fig. 3, as *Cyathophyllum manipulatum*;  $\times 4$ .  
*Carlinastraea martinae* sp. nov., Zlíchovian, Central Bohemia, Praha-Zlíchov, quarry "U Kapličky".
3. Holotype, detail of longitudinal section figured here on pl. 3, fig. 1;  $\times 11.5$ .

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