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ON THE CARBONIFEROUS AND PERMIAN DASYCLADACEAE OF YUGOSLAVIA

With 9 plates and 7 textfigures

ABSTRACT

Twelve species of dasyclad calcareous algae and one problematical species have been recorded in the various districts of Yugoslavia. One genus *(Clavaporella)* and 6 species *(Anthracoporella vicina, Mizzia cornuta, Epimastopora alpina, E. likana, Clavaporella caliciformis* and *Diplopora pusilla)* are described as new. Besides *Vermiporella serbica,* which was published as nomen nudum, is supplied with a description, while *V. velebitana* is proposed to be rejected.

INTRODUCTION

Although the first investigations into some Palaeozoic Dasycladaceae from Yugoslavia, especially the cosmopolitic genus *Mizzia,* were published already at the beginning of the 20th century (R. Schubert, 1907, 1909), our knowledge of this very interesting group of fossils was completely insufficient up to the most recent times.

Numerous records of various forms, mostly in geological papers, were limited only to the well-known species *Mizzia velebitana, M. yabei* and *Anthracoporella spectabilis.* Besides, there were recorded in many localities remains that were described as *Vermiporella velebitana,* although its description was very incomplete. Further were mentioned *Epimastopora* sp. and *Vermiporella ? sumatrana,* but without any description.

Explorations of Young Palaeozoic sediments of various districts of Yugoslavia performed by M. Salopek and his assistants in Hrvatska (Croatia), by A. Ramovš in Slovenia, by V. Kostić in Bosnia, by M. Miladinović, V. Kostić, and V. Kochansky-Devidé in Crna Gora (Montenegro) etc. gave the opportunity for the collection of numerous samples of Carboniferous and Permian limestones and dolomites containing not only rich foraminiferal fauna but also numerous remains of calcareous algae.

Investigations into Fusulinids from all the mentioned districts were performed during the last ten years at least partially by V. Kochansky-Devidé on more than 2,000 slides. On this occasion, besides

the already known species of calcareous algae, also several new forms were noticed. But among them the species *Vermiporella velebitana* was not most frequently mentioned although the author possessed quantities of topotype material from Parića Livada.

All this suggested very interesting and complex problems in connexion with the dasyclads of the Young Palaeozoic of Yugoslavia.

That is why they became the subject of our consideration. During our studies of numerous thin-sections we encountered several problems that could only be cleared through a comparison of our material with specimens of P i a' s collection. We are indebted to Dr. E. G a s c h e, Chief of the Geological Department, Museum of Natural History, Basle, for the permission given to M. H e r a k to do it in his Department.

The slides are mainly kept in the collection of the Geological and Palaeontological Institute, University of Zagreb. Only the slides from Bled and Bohinjska Bela are the property of the Slovenian Academy (SAZU), Ljubljana, while the slides of the holotypes of *Vermiporella serbica* P i a and *Epimastopora alpina* n. sp. are to be found in P i a' s collection.

SYSTEMATIC DESCRIPTIONS[1]

Genus *Anthracoporella* P i a, 1920

This genus was established by J. P i a (1920) with the Carboniferous type-species *A. spectabilis*. For a long time this was the only known species. In the meantime were recorded Permian specimens (J. P i a 1937). Although they did not essentially differ from Carboniferous specimens, the author was not absolutely convinced that we are concerned with the same species.

Later three more species were described, viz. *A. kasachiensis* M a s l o v, *A. fragilissima* M a s l o v and *A. magnipora* E n d o. They all differ very much from the type-species. Our new species *A. vicina*, on the contrary, is very similar and mostly related to it.

Anthracoporella spectabilis P i a

Pl. I, fig. 6, pl. II, figs. 1–6

1937. *Anthracoporella spectabilis*, P i a, 2e. Congr. stratigr. carbon. Heerlen, 1935, C. R. 2, pp. 809 and 822. (Here also the older synonims).

1952a. *Anthracoporella spectabilis*, E n d o, Trans. Proc. Palaeont. Soc. Japan. N. S. No. 5, pp. 139–140, pl. 12, figs. 6–7.

1952b. *Anthracoporella spectabilis*, E n d o, Trans. Proc. Palaeont. Soc. Japan, N. S., No. 8, p. 244, pl. 23, Fig. 1.

[1] Explanation of symbols. L = length of segments, D = outer diameter of calcareous body, d = inner diameter of calcareous body, s = thickness of calcareous wall, p = pores (branches).

1953a. *Anthracoporella spectabilis*, Endo, Sc. Rep. Saitama Univ., (B), 1, No. 2, pp. 98–99, pl. 9, fig. 13.

1056. *Anthracoporella spectabilis*, Maslov, Trudi inst. geol. nauk, Akad. Nauk SSSR, 160, p. 56, pl. 14, fig. 1.

1958. *Anthracoporella spectabilis*, Horiguchi, Sc. Rep. Saitama Univ., (B), 3, No. 1, pp. 134–135, pl. 27, fig. 1, 2, 5.

Description: Our samples were found in different Carboniferous and Permian localities. All specimens in the numerous slides correspond to the topotype material.

The calcareous wall is distinctly and irregularly ramified. The dimensions vary in various degrees, especially the wall thickness (D = 1 — 4.6 mm, d = 0.5 — 3.7 mm, w = 0.16 — 0.80 mm). Specimens with a very thin wall were already recorded by J. Pia (1920, Taf. 1, Fig. 10). The pores are generally uniform, but in the longitudinal section somewhat irregular. In their proximal part they are somewhat more pressed together than in the distal part. Therefore in some sections they are of polygonal form. On each specimen their diameter is nearly constant. Conversely, among the various specimens, especially if they come from different localities, the variation in the pore diameter is great (0,040—0,070 mm). Our richly developed individuals possess somewhat larger pores than J. Pia's specimens. Concerning this characteristic, they agree more with some of Endo's specimens. Typical ramifications of the pores are seen in cross sections only exceptionally. In some specimens we recorded also double ramifications. The pores seem to be mostly open. Only in one slide there are several specimens whose pores possess »incrustations« (»cuticula«) at their distal end. Pia considered it to be the most frequent characteristic of this species. Therefore he believed that branches of *A. spectabilis* were of the phloiophorous type.

Dimensions:

	D	d	s	p(average)		
65	4.6	3.7	0.31	0.056	Carboniferous	Vinac
64	2.33	1.35	0.50	0.064	„	„
93	2.1	0.5	0.80	0.063	„	„
90	2.05	1.35	0.17	0.060	„	„
57	4.1	3.2	0.50	0.047	„	Pikovac
1836	3	2.05	0.50	0.052	„	Vitanje
820	1.88	1.18	0.36	0.047	Permian	Boč
830	1.94	1.45	0.19	0.057	„	„
1855	1.0 ca	0.5	0.26	0.048	„	Mrzla Vodica
37	1.98	1.1	0.40	0.046	„	Crne Grede

Although Permian specimens differ from Carboniferous ones by possessing smaller dimensions of the thallus and pores, it is impossible to separate them, as already suggested by J. Pia (1937), because they agree in all the main characteristics. Thus we are concerned with a long-lived species (Lower Carboniferous – Lower Permian), and therefore it is possible that Permian specimens, which are not so frequent as Carboniferous ones, are already somewhat degenerated.

Textfig. 1. Distribution of the Genus *Anthracoporella* in Yugoslavia.
Rastrostranjenost roda *Anthracoporella* u Jugoslaviji.

Occurence and Age (Textfig. 1 and 7): 1. Vinac near Brušani, northern cape of Velebit Mountain in Croatia. The accompanying fossils *Anthracoporella vicina* n. sp. and *Rugosofusulina cornplicata.* Age: Upper part of the Upper Carboniferous.

2. Pikovac, near Brušani; Age: Upper Carboniferous.

3. Jezersko, northern Slovenia; accompanied by *Rugosofusulina alpina*. Age: Upper Carboniferous.
4. Farm Okrožnik, WSW of Vitanje, N of Celje, Slovenia. The accompanying fossils: *Anthracoporella vicina* n. sp. and *Rugosofusulina* cf. *complicata*. Age: Upper part of the Upper Carboniferous.
5. Sovičev Vrh, NW of Cerovec, N of Rogaška Slatina, Slovenia. The accompanying fossils: *Anthracoporella vicina* and *Epimastopora* sp. Age: Upper Carboniferous.
6. Boč, NE of Celje, Slovenia; Age: Permian – probably Trogkofel grey limestone.
7. Dolžanova Soteska (German: Teufelsschlucht bei Neumarktl) Slovenia; Age: Permian – after Pia: Trogkofel red limestone.
8. Environs of Mrzla Vodica in Gorski Kotar (Croatia); a) Ciganski Jarak: together with *Zellia heritschi*. The limestone corresponds to the Upper Rattendorf – limestone of the Carnian Alps; b) Suhi Jarak; Age: Permian.
9. Robijača near Mali Kraj, Lika. Lower Permian – Upper Rattendorf limestone. Accompanied by *Epimastopora likana* and *Quasifusulina nimia*.
10. Crne Grede in mid-Velebit Mountain. The accompanying fossils: *Neoschwagerina craticulifera, Mizzia velebitana* and *Gymnocodium*. Age: Permian (middle or upper part).

Anthracoporella vicina n. sp.

Pl. 1, figs. 1–5

Description: The thallus is ramified, in general tube-shaped but irregular. The branches of the thallus are very long (measured to 16 mm. in length). The variation of the diameter is great (D = 1 — 4.5 mm, d = 0.7 — 2.2 mm). The wall is usually thin (cca 0.13 — 0.37 mm). The pores (branches) are mostly simple. Bifurcation is very rare. Their cross section is round; the diameter 0.025 — 0.046 mm. The pores are separated by very thin interpores, which can be partially resorbed (pl. 1, fig. 5). Owing to recrystalization in many specimens the fine structure of the wall is destroyed.

Dimensions:	D	d	s	p(average)
85	3.1	2.2	0.35	0.037
83	2.4	1.6	0.37	0.030
83a	cca4.5	—	0.14	0.030
83b	1.3	0.98	0.13	0.028
1835	4.4	4.0	0.20	0.032

Holotype: The specimen represented on plate I fig. 3 from Vitanje (Slovenia); slide 1835.

Occurence and Age (Textfig. 1 and 7): 1. Vinac, near Brušani, northern foot of Velebit Mountain in Croatia. Upper part of the Upper Carboniferous.

2. Farm Okrožnik, WSW of Vitanje, N of Celje, Slovenia. The accompanying fossils: *Anthracoporella spectabilis* and *Rugosofusulina* cf. *complicata*. Age: upper part of the Upper Carboniferous.

3. Sovičev Vrh, NW of Cerovec, N of Rogaška Slatina, Slovenia. The accompanying fossils: *Anthracoporella spectabilis* and *Epimastopora* sp. Age: Upper Carboniferous.

Remarks: In general our species is similar to *Anthracoporella spectabilis*. Both are to be found in the same slides; they are neighbours. This fact suggested the name of the species (vicina = female neighbour). As to the differences between them, the thallus of *A. vicina* is more irregular, the wall is thinner, as are the pores. It is most probable that the form described by J. P i a (1937, p. 810) under the title *Dasycladaceae indeterminatae*, which comes from the Carboniferous of the Alps, belongs to our species. The form *A. spectabilis* (?) P i a mentioned by M a h a e v (1940, p. 67) and M a s l o v (1956, p. 56) is also near related. This form was recorded in the Upper Carboniferous of the Northern Ural Mountains. Other Russian species are smaller, their pores finer.

Genus *Vermiporella* S t o l l e y, 1893

In his paper on the Silurian Siphoneae S t o l l e y (1893) gave in a descriptive way a complete diagnosis of the genus *Vermiporella*. However, many undefined and heterogeneous specimens were afterwards attributed to this genus. It will therefore be useful to repeat at first its main characteristics, and then to try to give an historical rewiew of the treatment of this genus in order to find the origin of the mistakes.

The main characteristics of the genus *Vermiporella* are as follows: calcareous remains shaped as a curved and branched tube 0.5–1 mm. in diameter; wall of varied thickness; central hollow very large; only primary branches in existence; pores either perpendicular to the main axis of the stem or more often oblique to it.

R. S c h u b e r t (1907) believed to have been concerned regarding samples from Velika Paklenica (Velebit) with a new genus. He named it *Stolleya*. Two years later (1909) he changed the name of the genus into *Stolleyella*, and described shortly the species *S. velebitana*. As he possessed only fragmentary remains, he was not able to give a complete diagnosis of the species. Moreover, his brief description as well as his figures do not make possible a reconstruction of the main characteristics either of the genus or of the species. The author only mentions that we are concerned with cylindrical fragments of a fine sculpture, which are pressed together and preserved only in the limy shales. He makes no mention of the genus *Vermiporella*.

K a r p i n s k i (1909) reproduced in a paper, which was actually published after S c h u b e r t 's second paper, in the plate XV, fig. 8. besides the genus *Mizzia* also the species *Stolleyella velebitana* (one tangential section). But with this reproduction he did not increase our

knowledge of the species. It is worth emphasizing that even in the part of the calcareous wall that was longitudinally cut the pores are rounded like those in the tangential section, which shows that we are concerned with pores that are of irregular shape and position.

All that has been mentioned above would be unimportant if Negris and then Pia (1920) had not transferred the specimens described as *Stolleyella velebitana* to the genus *Vermiporella.*

Pia (1920) gives a new description and a reconstruction of the genus *Vermiporella.* The pores in his reconstruction are rounded and irregularly distributed. As to the shape, Pia believed that it was not straight but creeping. In the description of the species *Vermiporella velebitana* he emphasizes the irregularity of the pores. Some of them ought to be curved and like »pressed together«. As a documentary material he reproduced three drawings (after the thin sections). In such a situation it is not surprising that J. Pia was not convinced that more regular Greek specimens belonged to the species *V. velebitana.*

As already seen, neither Schubert nor Pia succeeded in discovering distinctive characteristics of the species *V. velebitana,* which would make it possible to attribute to this species all specimens that have an identical organization generally.

The further history of the species was in accordance with undetermined basis on which it was established. Nor did new records improve the concept of its organization (Ogilvie Gordon 1927, F. Koch 1933 etc.). All the reproduced specimens were as doubtful as are the specimens above mentioned.

In consequence fossil remains of the genus *Vermiporella* with better defined characteristics were regarded as representatives of new species. Consequently, *Vermiporella serbica* and *V. sumatrana* were established (both without descriptions), and later on *V. nipponica.* That the last-mentioned species belongs the genus *Vermiporella* was not sure (Endo & Kanuma 1954). Most probably Endo did not posses Stolley's paper. This we must assume because of his statement that the genotype species »was *V. velebitana,* which was found in the Upper Silurian strata.« Although Endo's description of the species *V. nipponica* is incomplete, his text and figures make possible a reconstruction of the main characteristics of his species. It is therefore possible to consider *V. nipponica* as valuable published. Conversely, *V. serbica* and *V. sumatrana* lack descriptions. As to *Vermiporella velebitana,* very important is the fact that – in spite of numerous attempts at recording typical remains that would clearly show the characteristics of the genus *Vermiporella* as well as the specific features of the species – this did not succeed. Nor were we able to succeed in it, in spite of the fact that we had quantities of topotype material from Parića Livada in Velika Paklenica as well as from the neighbouring localities. In our opinion, the topotype material which corresponds to the reproduced specimens of *Stolleyella velebitana* (in Schubert and Karpinsky) and *Vermiporella velebitana* (in Pia) shows features of the species *Gymnocodium bellerophontis.*

Textfig. 2. Distribution of the Genus *Vermiporella* in Yugoslavia.
Rasprostranjenost roda *Vermiporella* u Jugoslaviji.

Therefore we are convinced that the only rational and real thing remaining is to reject the species *Vermiporella velebitana* as unvalidly published.

Some of the just discussed problems were already noticed by G. F. Elliot (1958). But his conclusion was different; he did not reject the »species« *V. velebitana* in order to purify the genus from doubtful and obscure specimens, but he established a new genus *(Pseudovermiporella)*. However, the main features of the genus as they are to be seen in the specimens of the species *V. fragilis, V. nipponica, V. serbica* and *V. sumatrana* are of such a kind that, in our opinion, they correspond to a great extent to the specimens described by Elliot as *Pseudovermipo-*

rella sodalica. The only appreciable difference is the presence of »a free inner thin compact-walled tube«. Even the preservation is the same (»appearing white by reflected light and dark in thin section«). Elliot's remark that »*Vermiporella* (?) *nipponica* appears to show both forms of preservation« should rest on a mistake because of lack of precise information about the conditions in which Endo's figures were obtained. As to our experience with our remains of *Vermiporella* Endo's fig. 4. in pl. 13 (Endo & Kanuma, 1954) was taken in transmitted light, and figs. 2, 3 and 5 in reflected light. The preservation, however, was the same. The same was done with our figures (see explanation of figures).

As to the inner compact-walled tube in *Pseudovermiporella*, it needs not be of prevailing significance for the taxonomy, for even according to the author's statement in this case we are only concerned with different developmental stages of the thallus. The author also attributes some specimens to *Pseudovermiporella sodalica*, although they have no inner wall tube. Consequently, Elliot's description and interpretation of the material coming from Oman (Arabia) should be considered a precious contribution to the knowledge of the genus *Vermiporella* rather than a basis for establishing a new genus. However, the taxonomical position of the genus *Vermiporella* remains unclear.

Vermiporella nipponica Endo

Pl. II. figs. 7–9, Pl. III, figs. 1–6.

1954. *Vermiporella (?) nipponica*, Endo in Endo & Kanuma, VII, Sc. rep. Saitama Univ. (B), 1, No 3, p. 191, pl. 13, figs. 2–5.

1954. *Vermiporella sumatrana*, Kochansky-Devidé & Ramovš, Razprave sloven. akad. 2, pp. 332, 333, 334, 338, 339.

1958. ? *Vermiporella sumatrana*, Ramovš, Razpr. sloven. akad., 4, pp. 566, 568, 570, 571, 572, 573, 574, 605, 607.

1958a. *Vermiporella ? sumatrana*, Kochansky-Devidé, Geol. vjesn. 11, p. 46.

1958b. *Vermiporella ? sumatrana*, Kochansky-Devidé, Geol. vjesn. 11, pp. 26, 27, 34.

Our specimens of this species are in conformity with the earlier published material. The calcareous remains are irregularly meanderform, creeping, attached to a basis which can consist also of parts of a calcareous wall of other calcareous algae such as *Mizzia*, *Gymnocodium* etc. But in general, when the tube is free, its cross-section is circular. The proximal portion of the stem, by which the calcareous wall is attached to the basis, is thinly calcified and without pores.

The largest measured tube is cca. 5 mm. in length. But most probably still larger specimens are to be found. The outer diameter (D) varies from 0.27–0.70 mm., the inner diameter (d) from 0.20–0.48 mm. The thickness of the calcareous wall is also rather varied (0.05–0.13 mm.). Because irregular sections are frequent, the wall very often seems to be larger than it really is.

The calcareous wall is pierced by numerous closely set pores. In general, they are situated at a right angle to the axis of the tube. Sometimes their distal portion slightly widens. We consider them open, believing that the same is to be seen in E n d o's reproduced figures. Therefore his statement that they should be closed seems to be a mistake, and also his consideration that they are arranged in whorls.

The diameter of the pores amounts 0.014–0.041 mm. The interpore wall material is usually somewhat smaller than the pores. It measures 0.005–0.020 mm. (most frequently 0.015 mm).

On the inner side of the pored calcareous wall there is very often to be found a continuous solid layer not pierced by pores. Such a layer exists also in the silurian specimens of *Vermiporella* (S t o l l e y 1893, pl. VIII, figs. 4 and 8).

Dimensions:

No.	D	d	calc. wall	pores	interpores
746	0.58	0.30	0.09	0.025	0.015
1763	0.70	0.48	0.09	0.041	0.015
1764	0.32	0.22	0.07	0.023	0.020
741	0.52	0.25	0.13	0.025	0.015
742	0.44	0.25	0.10	0.032	0.017
746a	0.58	0.30	0.09	0.025	0.005—0.015
292	0.33	0.21	0.07	0.016	0.013
147	0.43	0.23	0,067	0.025	0.018

As visible, only in some cases do the dimensions exceed slightly those of E n d o's specimens. We noticed in some examples a larger outer diameter, smaller pores and a thinner wall.

Occurrence and age (Textfigs. 2 and 7): Generally *U. nipponica* is most frequent and characteristic in the dark bitumenous limestones of the Upper Permian. Numerous localities were recorded in Slovenia, Croatia and Crna Gora (Montenegro):

1. Bohinjska Bela, Slovenia; the species is rare and accompanied by *Neoschwagerina* – fauna and *Mizzia velebitana.* (Upper part of the Middle Permian).

2. Mountains of Škofja Loka and Polhov Gradec (Vrzdenec, Samija, Žažar, Cerkno, Škofje, Volaka and above Tisovnik), Slovenia. The specimens were recorded in the 1st and 4th–8th horizons (12 in all) of the Žažar stage (after A. R a m o v š, 1958). In the first horizon it is accompanied by *Palaeofusulina nana;* in the 4th–8th horizons *Gymnocodiaceae* are very frequent. Upper Permian.

3. Lika and Velebit Mountain, Croatia:

a) Crne Grede, near Oštarije in northern Velebit Mountain (first zone of dark limestone, after M. S a l o p e k, 1942).

b) Brušane (third zone of limestone, after M. S a l o p e k, 1942).

c) At the foot of Zvonik SW of Raduč; the rare remains are preserved in dolomite. They are accompanied by *Mizzia yabei* and *M. velebitana.*

d) Parića Livada and Kontinovo Vrelo (spring), Velika Paklenica. The remains are frequent and accompanied by *Mizzia velebitana* and representatives of *Gymnocodiaceae* (earlier partially considered to be *Vermiporella velebitana).*

Age: Middle or Upper Permian.

4. Southern Crna Gora (Montenegro): in the boulders of conglomerates (not in situ). The samples correspond to the various horizons of the Permian:

a) Matković, near Bar. The species is accompanied by the primitive *Neoschwagerina*-fauna, further by *Mizzia cornuta* and *Clavaporella caliciformis.* Age: Middle Permian.

b) Rabik, not far of Buljarica, accompanied by *Polydiexodina.* Age: Upper Permian.

5. Šabačka Kamenica and Đukovine, W Serbia. Accompanied by *Permocalculus.* Upper Permian.

Remarks: A comparison of *V. nipponica* with other species of the genus shows that this species is mostly similar to *V. fragilis.* However, the interpores of this last mentioned species seem to be somewhat larger than the pores. Other features are difficult to be distinguished. The comparison with *V. serbica* will be discussed below. *V. sumatrana* is larger, with a relatively thinner wall. Finally, it will be worth while mentioning the similarity between *V. nipponica* and the above discussed *Pseudovermiporella sodalica.*

Vermiporella serbica P i a

Pl. III. figs. 7, 8.

This species was first published by J. P i a (1937, p. 816) as nomen nudum. It was named after Serbia, where holotype specimens were recorded. The second author had the opportunity to study the original specimens in P i a' s collection of thin sections, and thus it is possible for us to supply a description.

Description: As is the case with all representatives of the genus *Vermiporella,* fossil remains consist of gregorious, frequently irregular calcareous tubes pierced by numerous open pores. The thallus was creeping and attached to a basis. The sections of the calcareous bodies are mostly somewhat irregular.

The calcareous wall is very thin. The pores are somewhat larger than the interpores, or they are approximately equal. In proportion to the stem they are smaller, and therefore they are more numerous than in *V. nipponica.*

Measurements:

D	d	Calc. wall	pores	Locality
0.20	0.09	0.050	0.008–0.014	Matković
0.14–0.27	0.103–0.151	0.023–0.063	0.013–0.027	(Holotype), Stira p.

		D	d	s	p	Inter-pores
Uermiporella fragilis Stolley, 1893	Silurian	0.5–1	—	—	narrower	broader than the pores
U. fragilis after: Mahaev, 1940	Silurian	0.70	0.48	—	0.025	somewhat broader
U. fragilis (?) after: Maslóv, 1956	Silurian	0.35–1.35	0.20–0.85	—	0.035–0.070	0.040–0.080
U. doneziana after: Mahaev, 1940	Carboniferous	0.38	—	—	0.045	3 × narrower
U. sumatrana Pia	Permian	0.33–0.65	—	0.063	0.021	broader
U. serbica Pia	Permian	0.14–0.27	0.103–0.151	0.023–0.063	0.013–0.027	0.0041–0.0062
U. serbica	Permian	0.20	0.09	0.05	0.008–0.014	0.010–0.012
U. (?) *nipponica* Endo, 1954	Permian	0.468–0.520	0.26–0.338	0.109–0.13	0.039–0.052	narrower
U. nipponica	Permian	0.27–0.70	0.20–0.48	0.05–0.13	0.020–0.041	0.005–0.020
Pseudovermiporella sodalica Elliot, 1958	Permian	1–1.4	—	—	0.030–0.040	—

Holotype: The specimen shown on pl. III. fig. 8. from Stira Potok above Zajača, NW Serbia. (Upper Permian); slide 144 (P i a' s collection).

Occurrence and Age (Textfigs. 2 and 7): 1. *U. serbica* was first recorded in three localities in western Serbia:

a) Stira Potok (brook), above Zajača, S of Loznica (near an antimony mine).

b. On the road Zavlaka–Osečina, W of Valjevo.

c. Bastav, between Bela Crkva and Pecka, W of Valjevo. The species is accompanied by remains of *Gymnocodiceae.*

All three localities are of Upper Permian age. The samples were recorded by H a m m e r and A m p f e r e r. The slides are to be found in P i a' s collection (no. 144, 148, 149).

2. Matković near Bar, Crna Gora (Montenegro). Age: Middle Permian (Upper Word).

Remarks: *U. serbica* shows the nearest relation to *U. nipponica.* The general constitution is the same. The differences manifest themselves mainly in the dimensions. Not only is the thallus smaller, but also the pores in proportion to the stem. This last feature seems to be most important for its separation. However, it is possible that in the future new fossil remains will connect this species with *U. nipponica* by more transitory forms.

Genus *Epimastopora* P i a 1922

Fossil remains described as *Epimastopora* are very frequent in numerous Carboniferous and Permian localities in Europe, Asia and America. Many authors have considered them since J. P i a (1922) established the genus. Let us mention only some of them. J o h n s o n (1946) draws our attention to the similarity (possibly even identity) with the genus *Koninckopora* established by L e e. However, he believes that it is better to leave them separated until better preserved specimens of *Epimastopora* are recorded. M a s l o v (1946), on the contrary, rejects the genus *Epimastopora,* considering the specimens described under this name as specimens of *Koninckopora.* He imagines its thallus as an irregular flat bladder consisting of rounded alternating cells. Although his idea is very suggestive, we prefer waiting until more complete specimens are at hand.

So far 6 species of *Epimastopora* have been established in Japan, 3 in America, 1 in Russia. Another 4 species have nomenclatura aperta.

However, the konwledge of this genus has not improved to any greater extent. We are still lacking in specimens that would show a complete organization of the thallus. Its cylindrical form is an assumption rather than a proven fact, etc. The described species were only established on the basis of partial characteristics without any knowledge of their variety within one species.

As to the European species (except the Russian one), they have not yet been described, although already G o r t a n i (1906) distinguished two forms under the name (?) *Gyroporella.*

We do not believe that the new established species will be a great contribution to the knowledge of the genus. Nevertheless, in the present situation the only thing left is to describe new forms if they differ in their morphological features from the already described »species«.

In the young Paleozoic of Yugoslavia we can distinguish three forms at least. Two of them may be described as new species, viz. *E. likana* n. sp. and *E. alpina* n. sp.

Epimastopora alpina n. sp.

Pl. IV, figs. 1–4

1937. *Epimastopora* sp., P i a, J., II. Congr. strat. carb., p. 828, pl. 13, fig. 4.

Description: The fragments of the calcareous wall are straight. The wall varies between 0.32–0.38 mm. The pores are densely and irregularly arranged. In the middle they are thickest (0.07–0.19 mm). Towards both ends they taper considerably. In the tangential sections they show various dimensions and shapes (circular, elliptioidal, irregular). The interpores amount to 1/4 to 1/2 of the width of the pores. In well-preserved specimens in the middle of the interpores are to be noticed dark lines forming a honeycomb figure.

Holotype: Figured specimen in P i a (1937) tab. 13 fig. 4, Col Mezzodi near Forni Avoltri in the Carnian Alps.

Occurrence and Age (Textfig. 7): Besides the mentioned locality in the Carnian Alps and in the Karavanke Mountains (cited by P i a, 1937) this species has been recorded only in one locality in Slovenia: Jezersko, N of Feuča in the Trogkofel-limestone (Middle Permian).

Remarks: Concerning the large pores *E. alpina* is mostly similar to *E. kanumai* E n d o. However, *E. alpina* has a thinner wall and considerably narrower interpores.

Besides, especially in respect of the diameter of the pores *E. alpina* is also similar to *E. likana.* But they differ in the general form of the fragments of the wall as well as in the arrangement of the pores.

Epimastopora likana n. sp.

Pl. IV. figs. 5–10

1906 ? *Gyroporella,* G o r t a n i, M., Pal. ital. 12, p. 7. pl. 1, fig. 2.

Description: The fragmentary fossil remains of the calcareous wall are more or less curved. The dimensions are relatively small. The thickness of the wall varies between 0.20–0.30 mm. (most frequently it is 0.25 mm). The branches seem to be oviform. The diameter of the pores measures as a maximum 0.7–0.10 mm. The length is usually greater, but sometimes it equals the width. Towards the upper and lower surfaces of

the wall they become considerably narrower (cca. 0.04 mm). Consequently, in the middle the interpores are very thin, towards the surfaces on both sides considerably extended.

Holotype: The specimen reproduced in pl. IV, fig. 5; slide 1731, sample from the Lower Permian of Stanište.

Occurence and Age (Textfig. 7): This species is to be found in the Lower Permian Rattendorf-layers in Lika (hence the name of the species), at the foot of Velebit Mountain in Croatia. The localities are as folows: a) Orljajec, Stanište, Plandište and Robijača, near Mali Kraj (Upper Rattendorf-layers). The accompanying fossils: *Zellia heritschi* and *? Anchicodium.* b) Under Medački Kuk, SW of Raduč (Middle Rattendorf-layers).

We also believe that G o r t a n i' s specimen reproduced in pl. 1, fig. 2 belongs to this species.

Remarks: Mostly similar to our species is *E. Kasakiensis* K o n i s h i from the Japanese early Middle Permian. However, its pores are larger and not so tapering towards the surface. Furthermore, its calcareous wall is somewhat thicker, as are the interpores. M a s l o v' s *Koninckopora macropora* from the Lower Carboniferous from Russia (Alajski hrebet) shows similar densely aranged pores, but generally they are thinner.

Epimastopora sp.

Pl. IV. fig. 11.

Some fragments of the calcareous wall from the Upper Carboniferous from Lika (Croatia) are somewhat irregularly curved. They are 0.25–0.40 mm. thick. The pores are large (0.10–0.20 mm) and irregularly arranged.

Occurrence and Age (Textfig. 7): Two localities near Brušani (Lika, Croatia) together with *Rugosofusulina complicata.* b) Vinac (Lika, Croatia) together with *Anthracoporella spectabilis* and *A. vicina.* c) ? Sovičev Vrh, NW of Cerovec, N of Rogaška Slatina, Slovenia. Accompanying: *Anthracoporella spectabilis, A. vicina.* Upper part of the Upper Carboniferous.

Genus *Mizzia* S c h u b e r t 1907

Investigations into this genus were performed on a rich topotype material from Parića Livada in Velika Paklenica (Southern Velebit Mountain, Croatia). In addition, material was collected in other localities in Velebit Mountain and in Lika in Croatia as well as in southern Crna Gora (Montenegro) and Slovenia (Bled). In all, the investigations and measurements were carried out on 150 specimens. Many of them are hard to be specifically determined for the reason that the dimensions tend to overlap. On the other hand, within each species there are considerable variabilities

In the whole of our country three species were recorded in all. (*M. velebitana*, *M. yabei* and *M. cornuta* n. spec.). In the calcareous wall were noted prolonged portions without pores, allready mentioned by Jablonszky (1919, p. 450) and Pia (1937, p. 824). They are to be found especially in small specimens. In some cases (pl. VI, figs. 3, 4, Pl.

Textfig. 3. Distribution of the Genus *Mizzia* in Yugoslavia.
Rasprostranjenost roda *Mizzia* u Jugoslaviji.

VII, figs. 4, 11, 14) such walls without pores connect two portions pierced by pores, without making a »rosette«.

The fact that the branches mostly protrude into the neighbouring portions of two segments shows that the equatorial regions of the segments are usually damaged.

Mizzia velebitana Schubert

Pl. V figs. 1–6, 9–12.

1937. *Mizzia velebitana*, Pia, Congr. strat. carbonif. Heerlen, C. R., II, p. 822, pl. IX, fig. 3.
1956. *Mizzia velebitana*, Maslov, Trudi inst. geol. nauk, Akad. nauk, 160, p. 57.
1956. *Mizzia velebitana*, Endo, Sc. Rep. Saitama Univ. (B), 2, No. 2, p. 227, pl. 22, figs. 3–8.
1957. *Mizzia velebitana*, Endo, Sc. Rep. Saitama Univ. (B), 2, No. 3, p. 283, pl. 37, figs. 4–5, pl. 44, fig. 3.

(In the cited papers other synonims are to be found.)[1]

In general the features of our specimens are congruent with descriptions already published by other authors. Therefore we do not intend to repeat them sistematically. We are going to take into account only some rare and less known characteristics. Noticed were dark boundaries (lines) among calcifications of the pores (pl. V, fig. 6). In the middle of the segments the branches were set perpendicularly to the main stem, while they were almost parallel to it in the upper portion of each segment. Porous covers on the surface of the branches are sometimes noticeable. Small pores are perpendicular to the surface. (pl. V, fig. 4).

The branches were aranged mostly in whorls, which usually alternate (tab. V, figs. 11, 12). But there are also segments with an irregular arrangement of the branches (pl. V, figs. 9, 10).

One piriform (pear-shaped) segment (L = 2.40 mm., D = 1.88 mm.) at the upper margin as well as at the lower margin of the segment contains 10 pores, in the equatorial plain 22, in the longitudinal section 13 whorls. Smaller segments bear 7–11 whorls.

The specimens in the limestones of Parića Livada usually consist of rounded segments. Contrariwise, segments of the specimens from the same locality which are preserved in the dolomite as well as specimens from other localities are mostly pear-shaped.

Occurrence and Age (Textfig. 3 and 7): 1. Velika Paklenica, Croatia:

a) Parića Livada: in limestone and light dolomite;
b) S of elevation 1617: in light dolomite;
2. Lika, Croatia:
a) Brušane, at the fishpond: in light dolomite;
b) Brušane, Kalvarija: in the third zone of dark limestone (after M. Salopek, 1942);
c. Brušane, Crne Grede: in the first and second zones of dark limestone;
d) Raduč, Palež Kameniti: in dark limestone;
e) Raduč, under Zvonik; in light dolomite.

[1] When this paper was already in print there was published the paper »Permian Algae from Saudi Arabia« by R. Rezak (J. Pal. 33, No 4, 531–539, 2 pl; July 1959), in which the author describes the species *Mizzia velebitana*, establishes a new species *M. bramkampi*, and emendates the description and taxonomic position of the genus. We could not take this paper into consideration.

Sediments of all the above-mentioned localities correspond to the upper part of the Middle Permian or the lower part of the Upper Permian.

3. Southern Crna Gora (Montenegro):

a) Sustaši, near Bar: in *Neoschwagerina* limestone and in limestone with *Palaeofusulina nana*. Age: Middle and Upper Permian;

b) Matković, near Bar: Boulders in the Anisian conglomerats. The accompanying fossils: *Clavaporella caliciformis* n. sp., *Diplopora pusilla* n. sp. and the most primitive *Neoschwagerina*-fauna. Age: Middle Permian.

c) Ilijino Brdo, near Crmnica: in *Neoschwagerina*-limestone. Age: Middle and Upper Permian;

4. Slovenia, Bohinjska Bela: in *Neoschwagerina*-limestone. Age: Upper Word. The locality in the Mountains of Škofja Loka and Polhov Gradec, which was mentioned by H e r i t s c h (1934, p. 17) was not verified, although we possessed numerous slides from that province. It is worth while noting that already J. P i a (1937, p. 824) suspected the mentioned locality.

Recorded were also localities in western Serbia (S i m i ć, 1933) and in Nikšićka Župa in Crna Gora (Montenegro) (K o c h, 1933). We did not see the material from these localities, however.

Mizzia yabei (K a r p i n s k i)

Pl. V, fig. 7, 8; pl. VI, fig. 1–7.

1956. *Mizzia yabei*, E n d o, Sc. Rep. Saitama Univ. (B), 2, No. 2, p. 230, pl. 23, fig. 5. (Other synonims in E n d o' s cited paper)

The elliptical segments are more tightly connected with one another than in the species *M. velebitana*. Therefore in thin sections one can find specimens consisting of several joined segments. They are elongated and only slightly enlarged in the middle or in the upper portion, but never like the species *M. velebitana*. The dimensions are smaller. The pores are generaly closed. Their surface in some sections is somewhat bulging (semicircular).

Occurrence and Age (Textfigs. 3 and 7): 1. Velika Paklenica, Hrvatska (Croatia), S of point 1617 in light dolomite together with *M. velebitana* and *Uermiporella nipponica*.

2. Lika, Croatia:

a) At the foot of Zvonik, SW of Raduč in light dolomite, accompanying *M. velebitana* and *Uermiporella nipponica*.

b) Čitluk, S of Veliki Bešlinac, in light dolomite.

c) Brušane at the fishpond in light dolomite together with *M. velebitana* and *Neoschwagerina*-fauna.

3. Southern Crna Gora (Montenegro), Limljani in *Neoschwagerina* limestone.

The Age of all the mentioned localities is Middle Permian. Problematical localities: Parića Livada in V. Paklenica, and Sustaši in Crna Gora (Montenegro).

Mizzia cornuta n. sp.

Pl. VII, figs. 1–14, Tetxfig. 4.

Description: The fossil remains consist of rounded segments. The calcareous wall is relatively thick. However, the neighbouring portions between two segments are considerably thin. Therefore the segments are to be found mostly separated.

The dimensions – compared to those of the other species – are small. The diameter (D) does not exceed 1–4 mm. (usually 0.8–1.4 mm). The length is a little smaller (L/D = 0.98). The diameter of the main stem (d) amounts to only 0.28–0.85 mm., while the calcareous wall, as already stated, is relatively thick (0.20–0.54 mm).

The branches are proportionally large and oviform. Their brightness in the middle varies from 0.15 to 0.19 mm. We could note 9–15 branches in one whorl. On the surface they are usually closed. Moreover, the lime over the pores, which can amount to 0.25 mm, is hornlike (hence the name of the species). In the thin sections the pores can be cut in the different portions and therefore some of them do not show the mentioned »limy horns«. The furrows between the »horns« seem to be deeper along the segments than around them. Therefore they are better visible in cross-sections.

As in the previous mentioned species, noticed were prolongations of some smaller segments without pores (pl. VII, figs. 4, 11, 14).

Dimensions:

	D	d	s	pores	Member of branch		
1029	1.40	0.53	0.54	0.18	12	Matković	Lower Word or Upper Leonard
1070	0.86	0.33	0.28	0.15	—	„	„
1505	1.36	0.65	0.33	0.15	15	„	„
1477	1.07	—	—	0.19	9	„	„
1038	1.29	0.41	0.35	0.15	14	„	„
1479	1.03	0.28	0.41	0.17	10	„	„
1540	1.42	—	0.42	0.15	12	Turčini	Middle Wolfcamp
SA590	1.0	0.41	0.28	—	—	Boh. Bela	Upper Word
SA520	1.05	0.42	0.32	0.19	13	„	„

Holotype: The holotype specimen is reproduced on pl. VII. fig. 2; slide 1029; The sample comes from Matković (Upper Leonard or Lower Word).

Occurrence and Age (Textfig. 3 and 7): 1. In the mentioned locality, Matković, our species was found associated with primitive *Neoschwagerina*-fauna. Besides, *Clavaporella caliciformis* n. gen., n. sp., *Mizzia velebitana*, *Diplopora pusilla* n. sp., *Hicorocodium*, and others were recorded.

2. Turčini is the second locality in Crna Gora (Montenegro). Here is *M. cornuta* accompanied by a typical *Pseudoschwagerina*-fauna of the middle part of the Lower Permian (Grenzlandbänke) and by *Permocalculus tenellus*. Age: Middle Wolfcamp.

Textfig. 4. *Mizzia cornuta* n. sp. (× 20) Equivalents: plate VII. Localities (nalazišta): 1–9. Matković near Bar, 10–11. Crne Grede (Lika), 12. Bohinjska Bela.

	Form of segments	L	D	L/D	d	s	Thickness of branches	Number of branches
M. velebitana Yugoslav material	piriform or spherical	1.40–2.40 exceptionally 3.0	1.20–2.5 exceptionally 3.0	0.91–1.43	0.70–2.0	0.27–0.45	0.13–0.21	20–30
M. yabei Yugoslav material	ovoidal or ellipsoidal	1.50–2.73	0.79–1.57	1.28–1.97	0.44–0.97	0.22–0.27	0.12–0.14	10–26
M. cornuta Yugoslav material	spherical	0.70–1.35	0.80–1.40	cca 0.98	0.28–0.85	0.20–0.54	0.13–0.12	8–14
M. japonica	lowly barrel-shaped or spherical	0.96	1.40	0.68			0.31	cca 14
M. minuta	spherical	—	0.70–1.31		0.26–0.66	0.14–0.263	0.035–0.0875	13–16

3. Bohinjska Bela, Slovenia. Specimens are to be found in all known localities of *Neoschwagerina*-limestone, sporadically accompanied by *M. velebitana* and *Vermiporella nipponica*. Age: Upper Word.

It is also possible that our species is to be found in Boč, Slovenia (Trogkofel-limestone), furthermore in the limestone (first and second zone) from Crne Grede in Lika (Croatia), and finally in the limestone and dolomite from Parića Livada in V. Paklenica (Croatia).

Remarks: *M. cornuta* is mostly similar to *M. velebitana*, although our species is smaller. Its calcareous wall is proportionally thicker, the pores are less numerous and prolonged into the »limy horns«. Only sections of *M. velebitana* in the neighbouring portions of two segments can be considerably similar to sections of *M. cornuta*. However, even in this case the pores of *M. velebitana* are relatively smaller.

As to the dimensions, *M. cornuta* is very near *M. minuta* Johnson & Dorr. But differences are clearly to be seen, because the last mentioned species has a thinner wall, smaller pores and no limy prolongations.

The similarity between *M. cornuta* and the form published by Johnson & Konishi (1956) under the name »Dasycladacean algae Type B« from Mississipian of Canada is only seeming because the pores of the Mississipian alga are usually arranged per three in a group.

It is possible that the specimens with the hornlike branches from Dj. Tebaga, South Tunis (Emberger 1958) belong to our species.

Genus *Clavaporella* n. gen.

The fossil remains consist of small, cylindrical, somewhat curved tubes, composed of segments which are sometimes only slightly connected together.

The pores are often slightly ascending, and expanded at their distal end. They are arranged in whorls (euspondyl). In fact, most segments can be considered »composed whorls«, because the branches within them are gathered at their proximal portions. Therefore a certain irregularity is frequently to be observed.

Clavaporella shows several elements of the genus *Diplopora:* gathering of pores in longitudinal section and the type of pores similar to those of *Diplopora praecursor*. It differs from *Diplopora* in not having the pores definitely arranged in tufts, although some traces of it are sporadically noticed. It is possible that in this genus there is the origin of metaspondylity.

We have still to mention a great similarity between our genus and most Japanese Permian specimens of *Clavaphysoporella* Endo, 1958. Regrettably, we cannot consider this genus as validly published, for we believe that within the mentioned »genus« there is united heterogeneous material.

On the one side there are specimens described by J. Pia (1912, p. 45, fig. 18), as *Physoporella minutula* (and probably Endo's species *C.*

fluctuosa), on the other the japanese Permian specimens published by Endo as *C. elegantannulata* (Endo & Kanuma 1954, p. 200), *C. faceta* and *C. conforma* (Endo 1958, pp. 266, 268). The pores in the first form are pirifer. In the second form they are expended towards the surface. The gathering of whorls in *P. minutula* is such that the individuality of different whorls remains clear. In the Permian specimens, on the contrary, gathered branches seem to make »composed whorls« as already mentioned in connection with our specimens. Besides, there are differences in the dimensions, in the position of the pores in relation to the main stem etc. Therefore we are convinced that it is necessary to separate once again *P. minutula* from the mentioned Permian specimens and to join the last mentioned with our specimens within the new genus *Clavaporella.* As to the name, *Clavaphysoporella* would have priority. But because of the earlier mentioned reasons it is better to chose the name without reminding ourselves of *Physoporella.*

C. caliciformis n. sp. is considered a type species, for in its specimens all characteristics of the genus are clearly visible.

Clavaporella caliciformis n. sp.

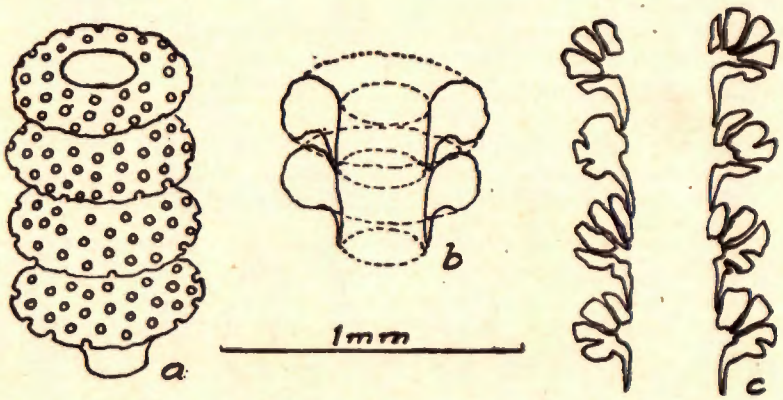
Pl. VIII, figs. 1–9, Tetxtfig. 5.

Description: The calcareous body is extremely segmented and considerably curved. The segments are hardly connected together. They are like a calix – hence the name of the species. On each segment we can distinguish two portions. The upper portion is rounded, proportionally thick-walled and pierced by numerous pores. The lower portion, which is usually inserted into the rounded portion of the preceeding neighbouring segment, is thin-walled and without pores. As visible on the longitudinal section, most pores are obliquely set to the main stem but not completely parallel to each other, for they can be a little curved. The pored portion of the segments is 0.24–0.35 mm. in length. The diameter varies markedly (D = 0.58–1.2 mm. d = 0.26–0.62 mm). The thickness of the wall (S) amounts to 0.21–0.27 mm. The lower portion of the segments measured in length is approximately like the upper portion. Consequently, the entire length of the segments can be 0.25 to 0.40 mm.

On the fossilized calcareous wall the pores are open, towards the exterior markedly expanded. The funnel-like distal portion measures 0.05–0.06 mm. in diameter, while their middle portions are 0.025–0.030 mm. in diameter. The dimensions of the proximal portions of the pores (branches) cannot be reconstructed because of the gathering of the branches at points of their connexion with the main stem. The gathering was such that there was no possibility for the depositing of lime among them. Therefore on the calcareous body on the inner side there are widened grooves from which the individualised pores diverge. The longitudinal section of a segment possesses in most cases 3–4 pores.

Holotype: The specimen reproduced on pl. VIII, fig. 5; slide 1501: sample from Matković.

Occurrence and Age (Textfig. 7): The fossil material comes from Matković NW of Bar. It was recovered in a Middle Permian boulder which belonged to an Anisian conglomerate. The accompanying fossils in the boulder are *Mizzia cornuta* n. sp. and primitive *Neoschwagerina*-fauna. Age: Leonard-Word.



Textfig. 5. *Clavaporella caliciformis* n. gen., n. sp. (× 40) a = Reconstruction, b = Connection of two segments (veza između dva segmenta), c = Longitudinal section (uzdužni prerez).

Remarks: Our species is extremely similar to the Japanese forms published by Endo (Endo & Kanuma, 1954) as *Clavaphysoporella elegantannulata* and *C. conforma*, especially concerning the type of the pores and their arrangement. As to the dimmensions, our specimens are somewhat smaller and the segments are almost independent, while their connection in Endo's specimens is very clear. Therefore we cannot speak either of typical annulation or of inner-annulation.

Genus *Diplopora* Schafhäutl, 1863

Diplopora pusilla n. sp.

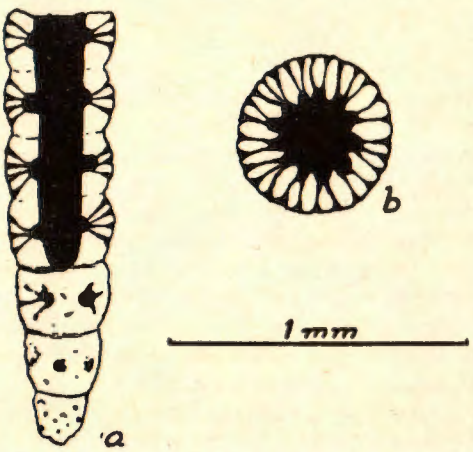
Pl. 9, figs. 1–8, Textfig. 7.

Description: The fossil remains are represented by cylindrical, calcareous, slightly annulated tubes. Some furrows between neighbouring segments are somewhat deeper. The main stem was very minute (= pusillus, hence the name of the species). Nevertheless, the dimensions vary considerably (D = 0.31–0.70., most frequently 0.45 mm.; d = 0.14–0.35 mm); thickness of the wall 0.04–0.13 mm; length of the segments 0.19–0.25 mm). The branches were arranged in whorls and tufts (metaspondyl). The tufts were situated on the protuberances of the main stem like the tufts of *Diplopora subtilis* of the Triassic of Bosnia (Pia, 1935).

The number of tufts in one cross-section seems to be around 12–14. Each tuft consists of mostly 5 branches, which are very small in the middle portion (0.013–0.022 mm). Towards the surface they are considerably funnel-shaped expanded (0.030–0.037 mm. in diameter). The diameter of the protuberances is about 0.27 mm. on the specimen with a inner diameter of 0.19 mm.

Holotype: The specimen reproduced on pl. IX, fig. 2, slide 1081, sample from Matković (Middle Permian, Leonard-Word).

Occurrence and Age (Textfig. 7): The already mentioned locality Matković near Bar in southern Crna Gora (Montenegro) is the only one for the present. The fossil remains were recorded in the boulders of an Anisian conglomerate accompanied by *Mizzia cornuta* n. sp., *Clavaporella caliciformis* n. gen. n. sp. and most primitive *Neoschwagerina* -fauna.



Textfig. 6. *Diplopora pusilla* n. sp. (× 40).
a = Oblique section (kosi prerez) after the Holotype, pl. IX, no 2 (prema holotipu na tab. IX. fig. 2). b = Reconstruction of cross-section (rekonstrukcija poprečnog presjeka).

Remarks: The other Permian species of the genus *Diplopora (D. latissima* Endo, *D. orientalis* Endo and *D. americana* Johnson) are 5–10 times larger. Only this would be sufficient for a separate treatment of our new species. However, there are to be found also differences in the shape of the branches etc.

As to the protuberances of the main stem, as already mentioned, our species is like *D. subtilis*. However, differences are to be found in the essential characteristics – the general shape of the calcareous wall, the form of the branches, the dimensions etc. While *D. pusilla* is slightly annulated, *D. subtilis* is without annulation; in *D. subtilis* the distal parts of the branches were extremely expanded in comparison with the major subtle part of them, whereas in *D. pusilla* are to be noticed transition zones between two analogous but less differenciated portions; the dimensions in *D. pusilla* are below the smallest in *D. subtilis* etc. This

shows that there exist two related but clearly individualized species of the same genus.

Our species shows some similarity also to *Clavaporella caliciformis* (included some Japanese forms), especially concerning the shape of the pores. However, their arrangement is not the same, for in *Clavaporella* they are euspondyl and not yet clearly metaspondyl as in our species. Therefore, in spite of the great similarity and a possible relation, they are treated as different genera.

PROBLEMATICA

Genus *Hicorocodium* Endo, 1951.

Hicorocodium elegantae Endo

Pl. IX, figs. 9–13.

In our slides from various localities we find numerous specimens which are identical with those published by Endo (1954 b, 1957) and Endo & Horiguchi (1957) and Horiguchi (1958) as *Hicorocodium elegantae*. However, it is necessary to note that in our opinion the organization cannot be regarded as a doubtlessly typical dasycladacean. A slight general similarity with Hydrozoa was the reason that some of our specimens were first published as »cf. *Carterina* sp.« or »*Stromatoporidae* gen. et sp. indet.« (Kochansky-Devidé & Ramovš 1955; Kochansky-Devidé 1958 a, 1958 b). Concerning some features there exists also a similarity to the stromatoporid *Amphipora* cfr. *asiatica* Cowper Reed from the Japanese Permian. Similar stromatoporids occur also in the Russian Devonian *(Amphipora* and *Paramphipora)*. All these facts prompted us to place this form under the problematica.

Occurrence and Age: In Yugoslavia *H. elegantae* was recorded in numerous localities in different horizons from the Lower Permian (upper Rattendorf-layers) to the Upper Permian *(Polydiexodina*-zone).

1. Slovenia: a) The environs of Bled and b) Bohinjska Bela (in the limestone of the upper part of the Middle Permian).
2. Gorski Kotar, Croatia: Ciganski Jarak near Mrzla Vodica (Lower Permian).
3. Lika (Croatia): Robijača near Mali Kraj (Lower Permian).
4. Southern Crna Gora (Montnegro): a) Matković (Upper Leonard-Lower Word). b) Zubci, Sustaši near Bar and a locality SE of Matković (light *Neoschwagerina* limestone, Upper Word). c) Rabik, Buljarica, Plano Brdo near Sutomore and Kurilo near Bar (Upper Permian, *Neoschwagerina* limestone with *Polydiexodina),* d) Bujači near Virpazar and Sustaši near Bar (Upper Permian, dark limestone with *Palaeofusulina nana*).

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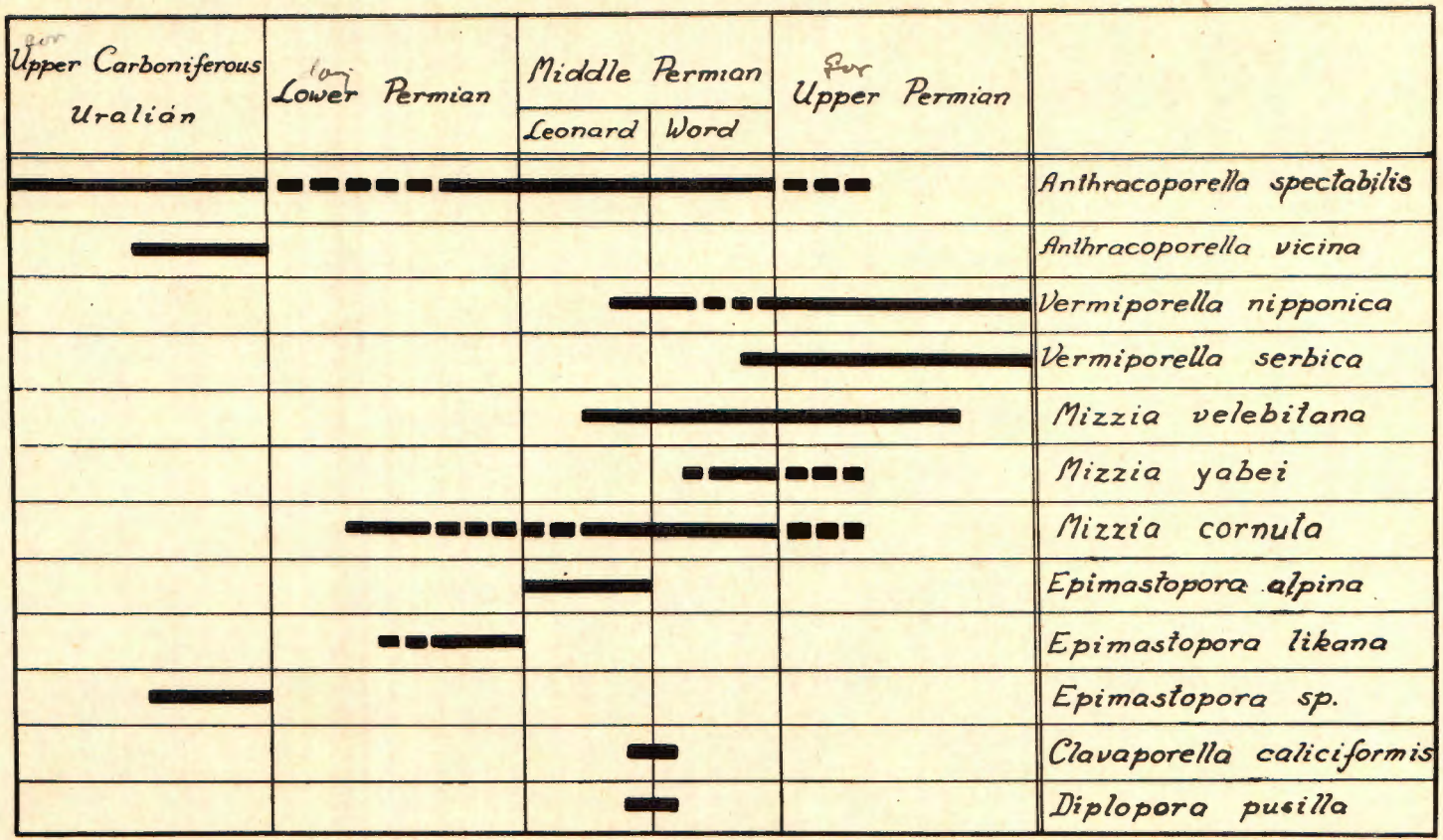

Textfig. 7. Time scale of the Young palaeozoic Dasyclads in Yugoslavia.
Vremenski raspon dasikladaceja mlađeg paleozoika u Jugoslaviji.

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KOCHANSKY, V. i HERAK, M.

O KARBONSKIM I PERMSKIM DASIKLADACEJAMA JUGOSLAVIJE

Prilikom istraživanja fuzulinida s različitih karbonskih i permskih nalazišta Jugoslavije nađene su u izbruscima i mnoge vapnenačke alge. Kako se pokazalo da ima dosta novih vrsta, dok neke druge, iako često spominjane, ustvari ne postoje, a treće je trebalo revidirati, pristupili smo zajednički njihovoj naučnoj obradi. Zbog brojnosti izbrusaka ograničili smo se za početak samo na familiju *Dasycladaceae*.

Opisano je 6 rodova i dvanaest vrsta a dodana je i jedna problematična. Od toga je nov jedan rod *(Clavaporella)* i 6 vrsta *(Anthracoporella vicina, Epimastopora likana* i *E. alpina, Mizzia cornuta, Clavaporella caliciformis, Diplopora pusilla)*. Kod revizije roda *Vermiporella* ispostavilo se da *V. velebitana* (Schubert) zapravo ne postoji. Pod tim su imenom, po našem mišljenju, opisani ostaci gimnokodija. S obzirom na to da je *Vermiporella serbica* Pia bila objavljena samo kao nomen nudum, mi smo u svrhu sačuvanja vrste na temelju originalnog materijala iz zapadne Srbije i novog materijala iz Crne Gore dali vrsti potreban opis i usporedbu s ostalim vrstama istoga roda.

Rasprostranjenost pojedinih vrsta rodova *Anthracoporella*, *Vermiporella* i *Mizzia* vidi se iz slika u engleskom tekstu. *Epimastopora alpina* dosada je u Jugoslaviji ustanovljena samo u okolici Jezerskoga u Sloveniji, a *E. likana* i *E.* sp. u Lici. *Clavaporella caliciformis* i *Diplopora pusilla* nađene su samo u permskim valuticama anizičkog vapnenačkog konglomerata kod Matkovića u Crnoj Gori. Problematični oblik *Hicorocodium elegantae* rasprostranjen je u čitavom permu okolice Bleda u Sloveniji, Mrzle Vodice u Gorskom Kotaru, Malog Kraja u Lici kao i na mnogo nalazišta u južnoj Crnoj Gori. Vremenski raspon opisanih vrsta vidi se iz priložene tabele (Sl. 7).

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Geološko-paleontološki institut,
Sveučilište u Zagrebu.
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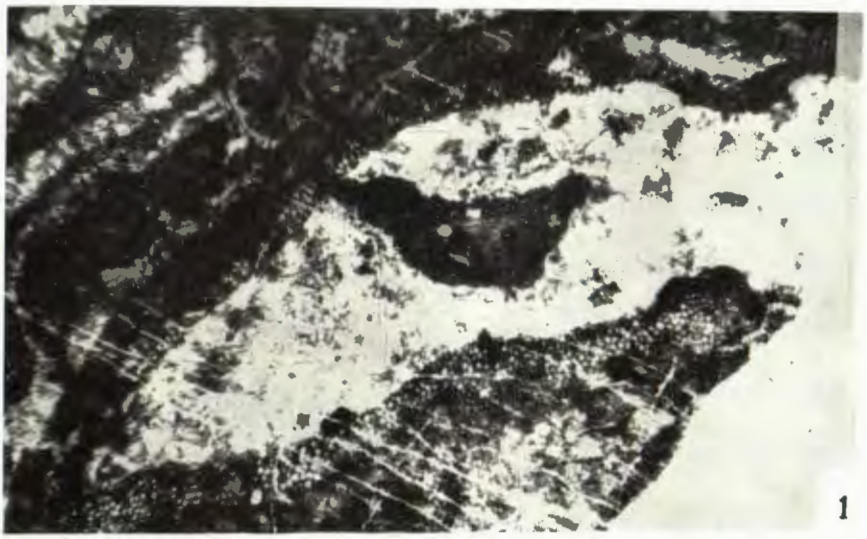
Plate – Tabla I.

1–5. *Anthracoporella vicina* n. sp. Carboniferous (karbon).

1. Oblique section; slide 83. (Kosi prerez; izbrusak 83). Vinac. × 20.
2. Longitudinal section; 1835. (Uzdužni prerez, 1835). WSW of Vitanje. × 20.
3. Tangential section; 1835; Holotype. (Tangencijalni prerez; 1835, holotip). WSW of Vitanje. × 20.
4. A piece of longitudinal section; 1835. (dio uzdužnog prereza; 1835). WSW of Vitanje. × 40.
5. A piece of tangential section; 85. (Dio tangencijalnog prereza; 85). Vinac. × 40.

6. *Anthracoporella spectabilis* P i a. Carboniferous (karbon).
A piece of cross- section, 43. (dio poprečnog prereza, 43). Vinac. × 40.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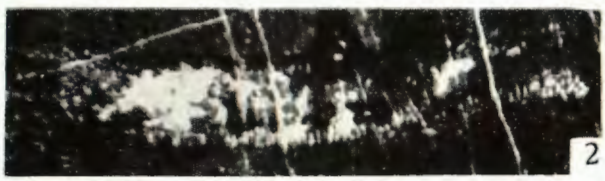
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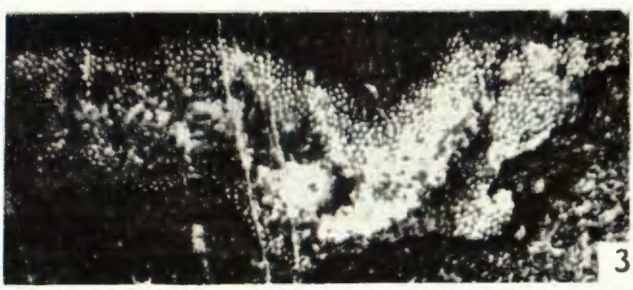
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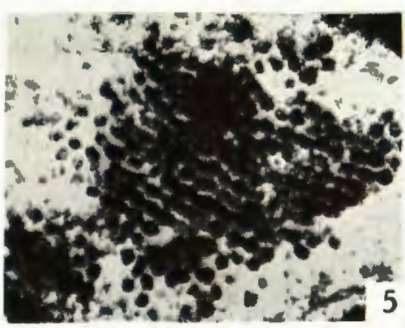
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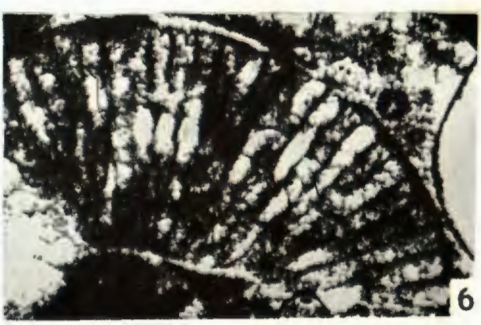
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Plate – Tabla II.

1–6. *Anthracoporella spectabilis* P i a.

1. Somewhat oblique longitudinal section; 64; Carboniferous. (Nešto kosi uzdužni prerezi; 64; karbon). Vinac. × 10.
2, 3. Cross-sections; 93. (Poprečni prerezi; 93). Vinac, Carboniferous (karbon) × 10.
4. Somewhat oblique cross-section; 37; Middle Permian. (Nešto kosi poprečni prerez; 37; sred. perm). Crne Grede. × 10.
5. Somewhat oblique cross-section; 820; Lower or Middle Permian. (Nešto kosi poprečni prerez; 820; donji ili srednji perm). Boč. × 10.
6. Cross section of specimen with very thin wall; 90; Carboniferous. (Poprečni prerez primjerka s vrlo tankom stijenkom; 90; karbon). Vinac. × 10.

7–9. *Vermiporella nipponica* E n d o. Upper Permian (gornji perm). Photographed in transmitted light. (Slikano u prolaznom svijetlu). × 40.

7. SW of Cerkno: 746.
8. Samija near Žažar; 742.
9. Parića Livada in Velika Paklenica; 1804.

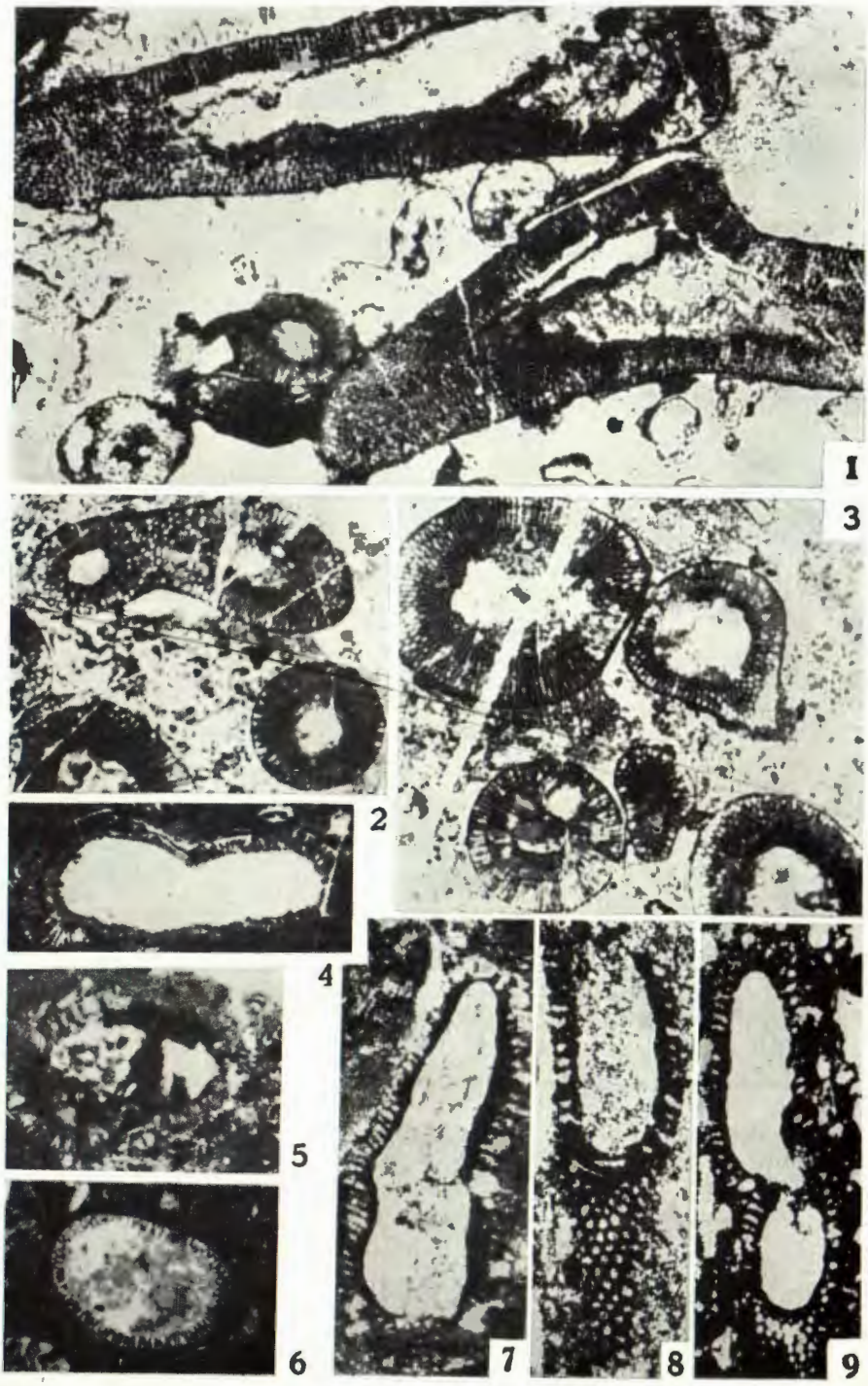
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Plate – Tabla III.

1–6. *Uermiporella nipponica* Endo. Upper Permian (gornji Perm). Photographed in reflected light. (Slikano u reflektiranom svijetlu).

1, 2. Cerkno; 745. × 20.

3. Vrzdenec; 1763. × 20.

4. Škofje near Cerkno; 700. × 20.

5, 6. Samija near Žažar; 742. × 40.

7–8. *Uermiporella serbica* Pia. × 40.

7. Matković near Bar; 1307; Middle Permian. (Srednji perm).

8. Pia's collection, 144 b; Holotype; Upper Permian; Stira Potok above Zajača. (Pijina zbirka, 144 b; holotip; gornji perm; Stira potok iznad Zajače).

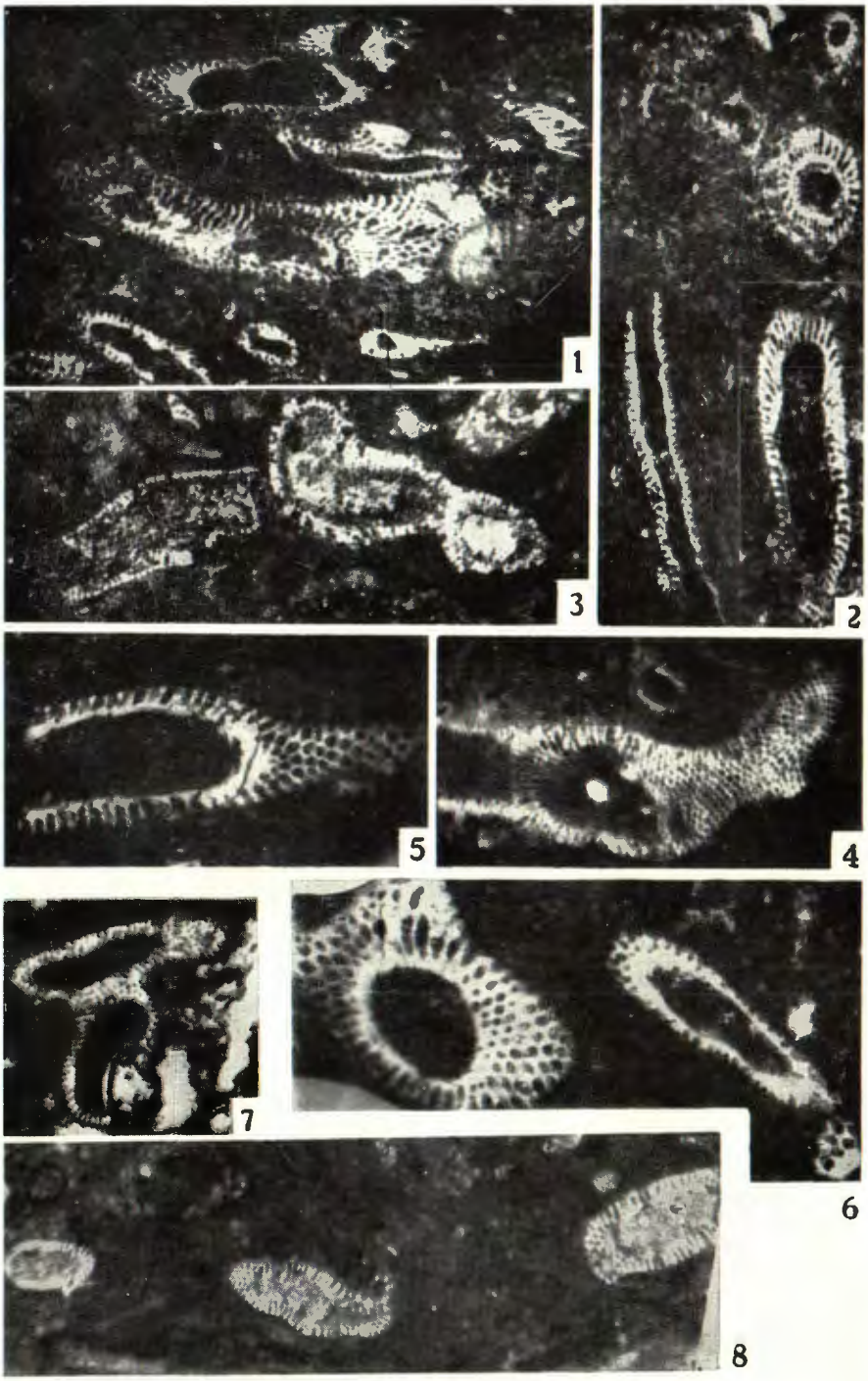
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Plate – Tabla IV.

1– 4. *Epimastopora alpina* n. sp. Jezersko. Lower part of the Middle Permian. (Donji dio srednjeg perma). × 20.

1–3. Longitudinal sections of wall; 916, 915, 912. (Uzdužni prerez kroz stijenku; 916. 915, 912).

4. Tangential section; 912. (Tangencijalni prerez; 912).

5–10. *Epimastopora likana n. sp.* Lower Permian. (Donji perm).

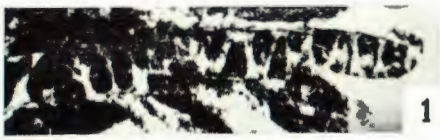
5. Longitudinal section of wall; Holotype; 1731. (Uzdužni prerez kroz stijenku; holotip; 1731). Stanište, Lika. × 20.

7. Longitudinal section; 1722. (Uzdužni prerez; 1722). Robijača, Lika. × 40.

8. Tangential section; 1699. (Tangencijalni prerez, 1699). Alanac, Lika. × 20.

9, 10. Tangential sections; 1738, 1745. (Tangencijalni prerezi, 1738, 1745). Stanište, Lika, × 20.

11. *Epimastopora* sp. Carboniferous (karbon); 387. Brušane, Lika. × 20.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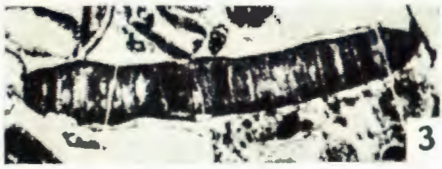
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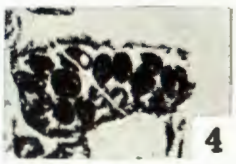
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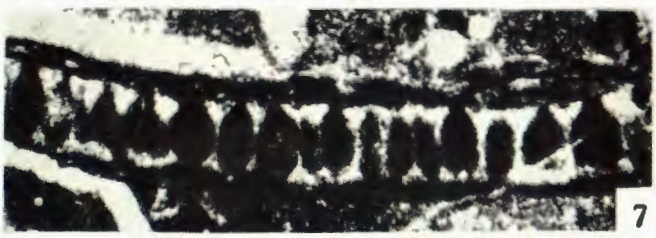
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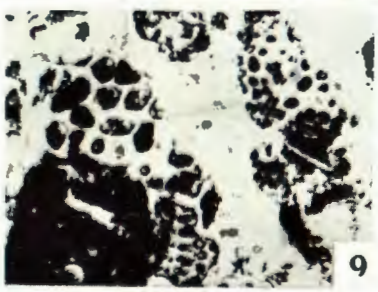
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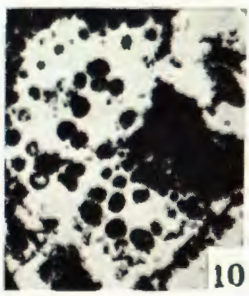
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Plate – Tabla V.

1–6. *Mizzia velebitana* Schubert. Permian (perm).

1. Longitudinal section of terminal segment from dolomite; 20. (Uzdužni prerez terminalnog segmenta iz dolomita; 20). Brušane. × 20.
2. Longitudinal section of two segments from the topotype material; 1805. (Uzdužni prerez dvaju segmenata iz topotipskog materijala; 1805). Parića livada, Velika Paklenica. × 10.
3. Longitudinal section of segment from the lower part of the Middle Permian; 167. (Uzdužni prerez segmenta iz donjeg dijela srednjeg perma; 167). Crne Grede, Lika. × 20.
4. A piece of wall with porous covers on the distal part of branches; 1796. (Dio stijenke s poroznim pokrovom distalnog dijela ogranka; 1796). Parića livada. × 40.
5. One cross-section and one oblique section from the upper part of the Middle Permian; 37. (Poprečni i kosi prerez iz gornjeg dijela srednjeg perma; 37). Crne Grede, Lika. × 10.
6. Tangential section; 1796. (Tangencijalni prerez; 1796). Parića livada, Velika Palenica. × 20.

7–8. *Mizzia yabei* (Karpinski) from dolomite. (Iz dolomita). Brušane. Fig. 7, × 20. Fig. 8, × 10.

9–12. *Mizzia velebitana* Schubert from dolomite; Brušane.

Segment with partially irregular arrangement of the branches. (Segment s djelomično nepravilnim rasporedom ogranaka). × 10.

10. Segment with irregular arrangement of the branches. (Segment s nepravilnim rasporedom ogranaka). × 20.

11–12. Segment with regular and alternating arrangement of the branches. (Segment s pravilno i izmjenično poredanim ograncima). × 20.

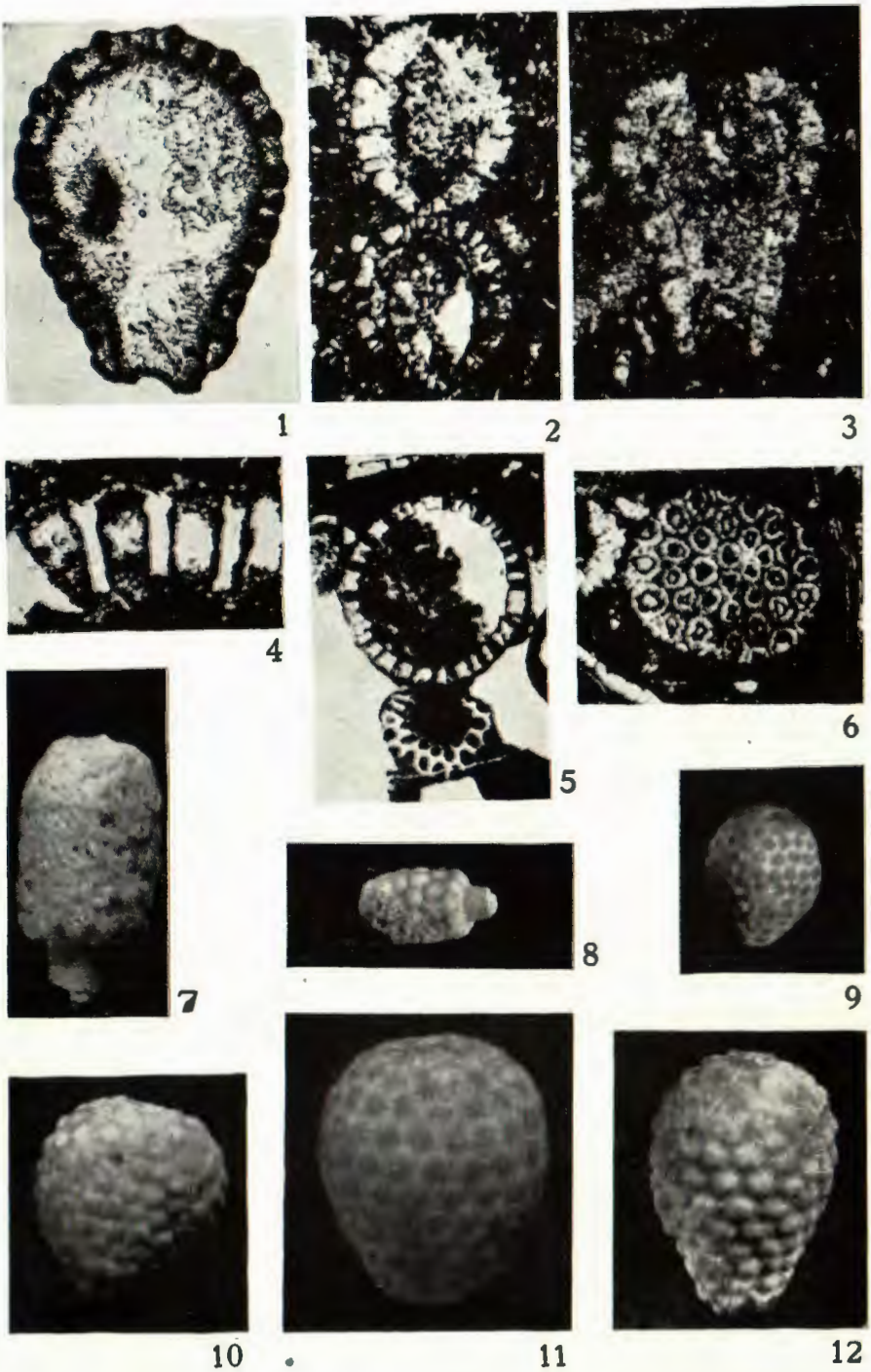
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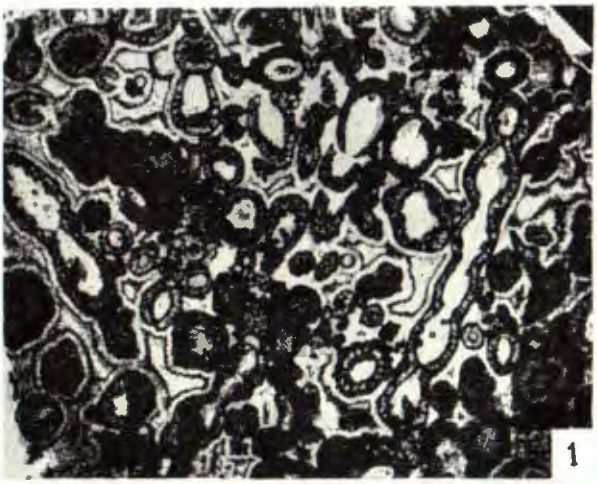
Plate – Tabla VI.

1–7. *Mizzia yabei* (K a r p i n s k i). Upper part of Middle Permian. (Gornji dio srednjeg perma).

1. Different sections from dolomite; 1814 at the foot of Zvonik near Raduč. (Razni prerezi u dolomitu; 1814; pod Zvonikom kraj Raduča). × 5.
2. Oblique section; 1556. (Kosi prerez; 1556). Limljani near Bar. (Limljani kod Bara). × 20.
3. Longitudinal, somewhat oblique section; one segment with prolongation without pores; 1815; at the foot of Zvonik near Raduč. (Uzdužni, nešto kosi prerez – jedan segment s produženjem bez pora; 1815; pod Zvonikom kraj Raduča). × 20.
4. Oblique sections. One segment with prolongation without pores; 1814; at the foot of Zvonik. (Kosi prerezi; jedan segment s produženjem bez pora; 1814; pod Zvonikom). × 20.
5. Cross-sections; 182; Čitluk, S of Veliki Bešlinac, Lika. (Poprečni prerezi; 182; Čitluk južno od Velikog Bešlinca, Lika). × 20.
6. Different sections; 184; Čitluk, S of Veliki Bešlinac, Lika. (Razni prerezi; 184; Čitluk, južno od Velikog Bešlinca, Lika). × 10.
7. Somewhat oblique cross-section; 1814; at the foot of Zvonik, near Raduč. (Nešto kosi poprečni prerez; 1814; pod Zvonikom kod Raduča). × 20.

PLATE VI – TABLA VI



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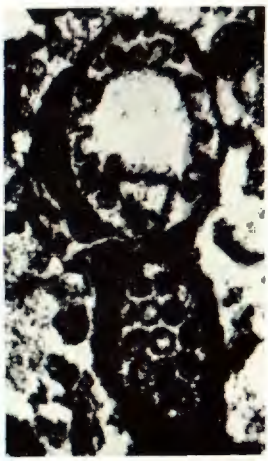

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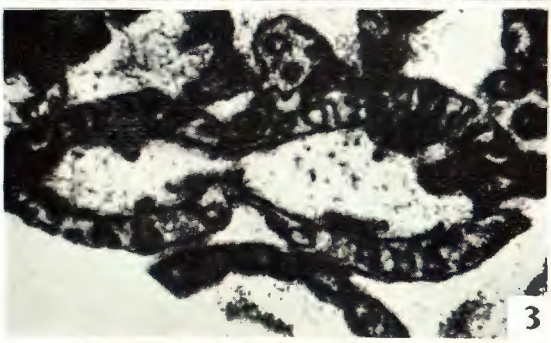

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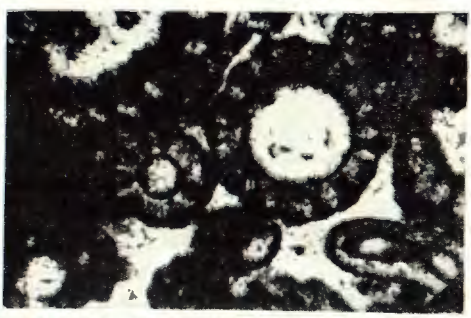

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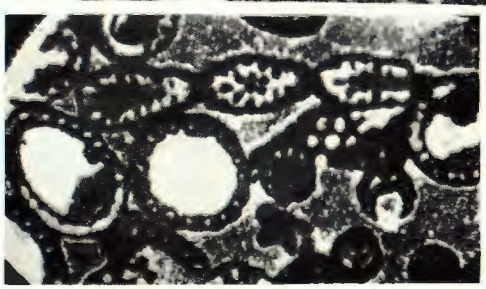

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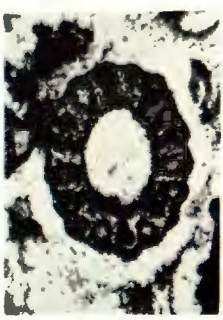

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Plate – Tabla VII.

1–14. *Mizzia cornuta* n. sp. × 20.

1–4, 7, 8, 11. Oblique sections from Matković near Bar; 1479, 1029 (Holotype fig. 2), 1051, 1477, (with prolongation without pores), 1038, 1477, 1486 (with prolongation without pores). Kosi prerezi iz Matkovića kraj Bara; izbrusci 1479, 1029 (holotip fig. 2), 1051, 1477 (s produženjem bez pora) 1038, 1477, 1486 (s produženjem bez pora). Middle Permian. (Srednji perm).

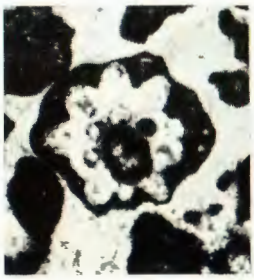
5. Cross-section from Matković; 1505. (Poprečni prerez iz Matkovića; 1505). Middle Permian. (Srednji perm).

6. Somewhat oblique section from Matković; 1070. (Nešto kosi prerez iz Matkovića; 1070. (Middle Permian. (Srednji perm).

9, 10. One cross-section and one oblique section from Bohinjska Bela; SAZU-520, SAZU-546. (Poprečni i kosi prerez iz Bohinjske Bele; SAZU-520, SAZU-546). Middle Permian. (Srednji perm).

12, 14. One oblique and one tangential sections from Crne Grede, Lika; 40. (Kosi i tangencijalni prerez iz Crnih Greda, Lika; 40. (Middle or Upper Permian. (Srednji ili gornji perm).

13. Somewhat oblique section from Turčini near Bar; 1540. (Nešto kosi prerez iz Turčina kod Bara; 1540). Lower Permian. (Donji perm).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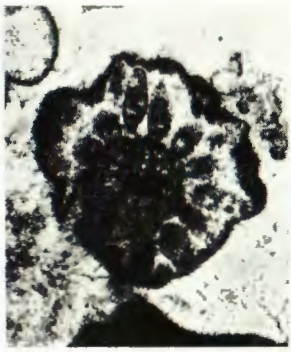
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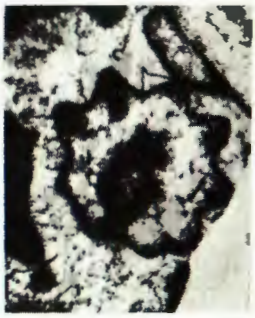
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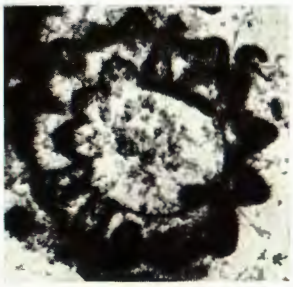
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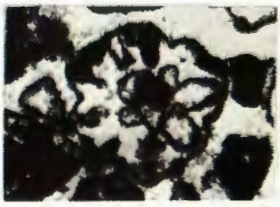
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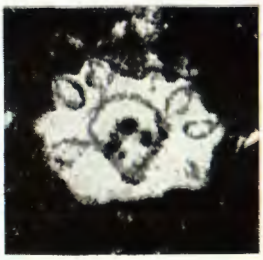
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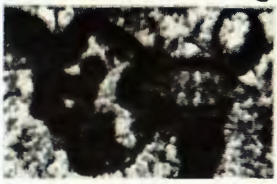
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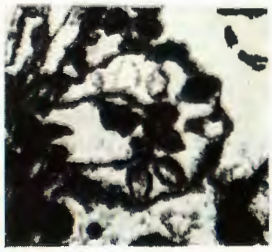
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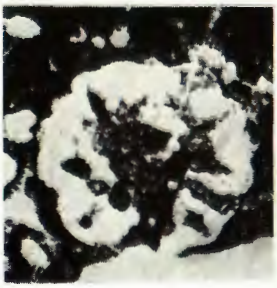
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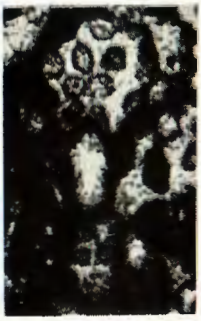
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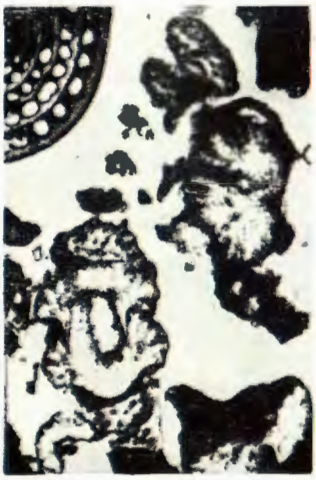
Plate – Tabla VIII.

1–9. *Clavaporella caliciformis* n. gen., n. sp. from Matković near Bar; Middle Permian. (Iz Matkovića kraj Bara; srednji perm).

1. Tangential and oblique sections of a curved specimen; 1086; (Tangencijalni i kosi prerez savinutog primjerka; 1086). × 20.

2–9. Different sections; 1500, 1073, 1049, 1501 (Holotype fig. 5) 1495, 1063, 1081, 1041. (Različiti prerezi: 1500, 1073, 1049, 1501 holotip, fig. 5, 1495, 1063, 1081, 1041). × 40.



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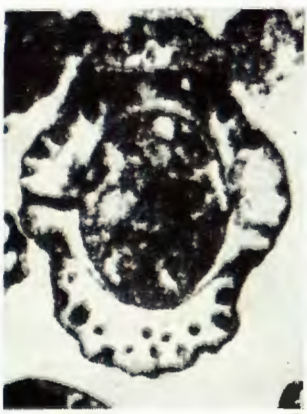

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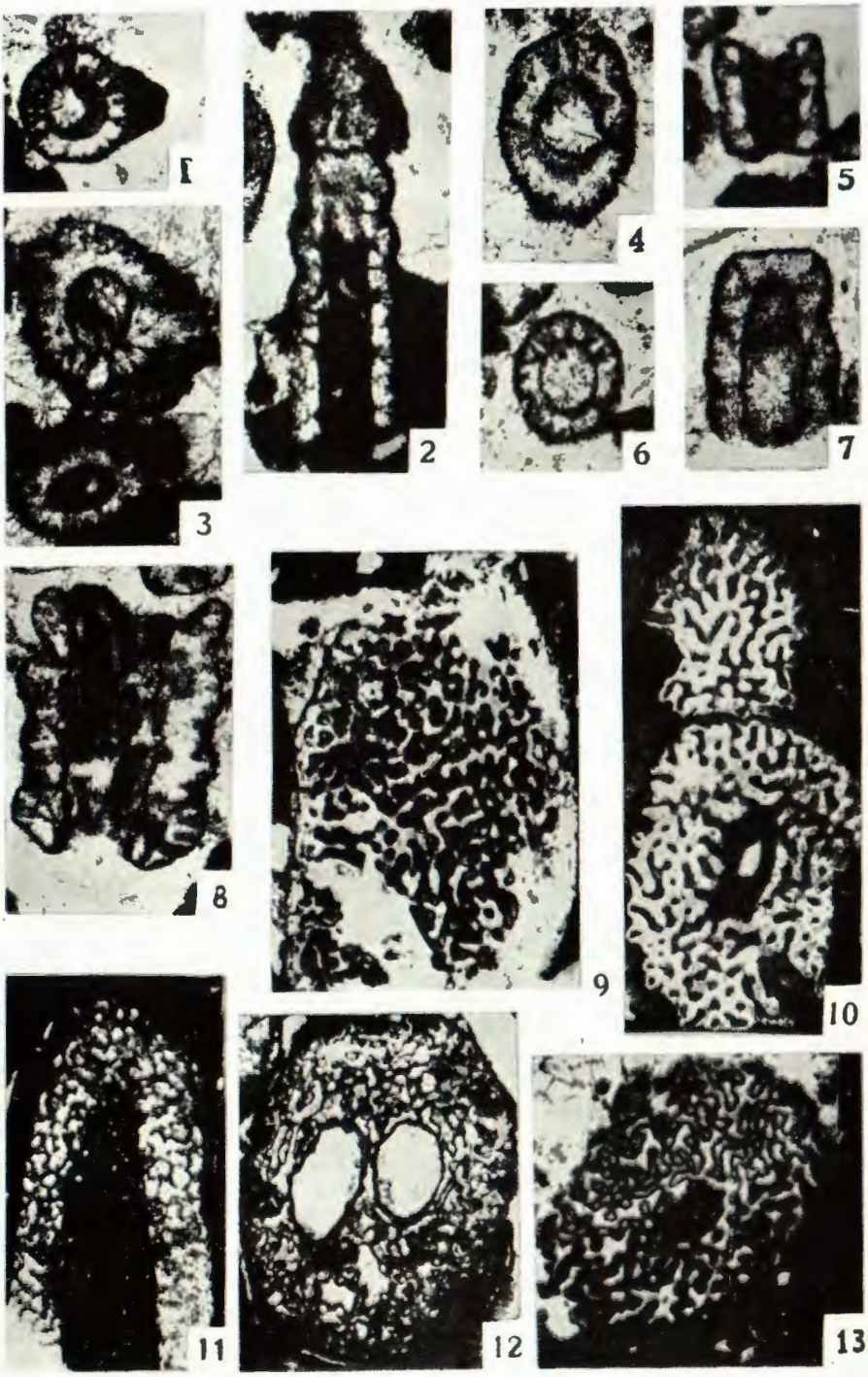
Plate – Tabla IX.

1– 8. *Diplopora pusilla* n. sp. from Matković near Bar; Middle Permian. (Iz Matkovića kod Bara; srednji perm). × 40.

Different sections; 1053, 1081 (Holotype Fig. 2), 1496, 1100, 1049, 1046, 1051, 1071. (Različiti prerezi; 1053, 1081 – holotip fig. 2, 1496, 1100, 1049, 1046, 1051, 1071).

9–13. *Hicorocodium elegantae* E n d o. × 10.

9. Zubci near Bar; 1208. Middle Permian (srednji perm).
10. Straža near Bled; SAZU-631. Middle Permian (srednji perm).
11. Ciganski jarak near Mrzla Vodica, Gorski Kotar; Lower Permian (donji perm).
12. Bohinjska Bela; SAZU-619. Middle Permian (srednji perm).
13. Matković near Bar; 1244. Middle Permian (srednji perm).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