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TENTACULITES OF THE UPPER SILURIAN AND LOWER DEVONIAN OF POLAND

Abstract. — The tentaculites, described in the present paper, come from the Upper Silurian deposits of the Baltic coastal region and the Lower Devonian deposits of the Radom—Lublin region. The Upper Silurian assemblage of tentaculites allows one to compare and correlate the Upper Silurian deposits of Northern Europe. The Lower Devonian tentaculites are indicative of the Gedinnian and Siegenian age of the deposits under study and of their close correlations primarily with Podolia.

PART I

INTRODUCTION

In Poland, the tentaculites have not so far been described in detail. Gürich (1895) was the first to take an interest in the tentaculites occurring in this country. He described the following species from the Holy Cross Mountains: *Tentaculites* sp. cf. *intermedium* Barr., *T. multiformis* Sandb., *T. ornatus*? Sow., *T. schlotheimi* Koken., *T. polonicus* Gürich., *T. sandbergeri* Gürich, *T. tenuicinctus* Sandb., *Styliolites* sp.

From the same region, the following species were identified by Pajchlowa (1957): *Tentaculites schlotheimi* Koken., *Tentaculites* sp., *Styliolina laevis* Richter and *Styliolina* sp. The tentaculites of the species *Homoctenus tenuicinctus* (Roem.), *Homoctenus* sp., *Styliolina laevis* Richter and *Styliolina* sp. were distinguished by Kościelniakowska (1962—1967) in the Frasnian deposits of these region.

The present writer described the following Eifelian tentaculites from the Holy Cross Mts and the Cracow—Częstochowa Upland (Hajłasz, 1967): *Tentaculites schlotheimi* Koken., *T. subconicus* Geinitz, *T.*sp., and *Dricricoconus mosolovicus* (Ljasch.). Next, a list of species from Lower Devonian of the Lublin area was published (Hajłasz, 1968). Regions where tentaculites had been found in the Silurian and Devonian deposits in Poland are shown on Text-fig. 1.

Extensive geological studies, recently conducted in the Baltic coastal area (the Łeba Elevation) and in the Radom—Lublin region enabled col-

lecting an abundant paleontological material from the Upper Silurian and Lower Devonian deposits. Tentaculites are numerously represented in this material. Their relatively good state of preservation and diversity of species allowed the writer to prepare the present paper, containing the descriptions of 39 species, including three new ones.

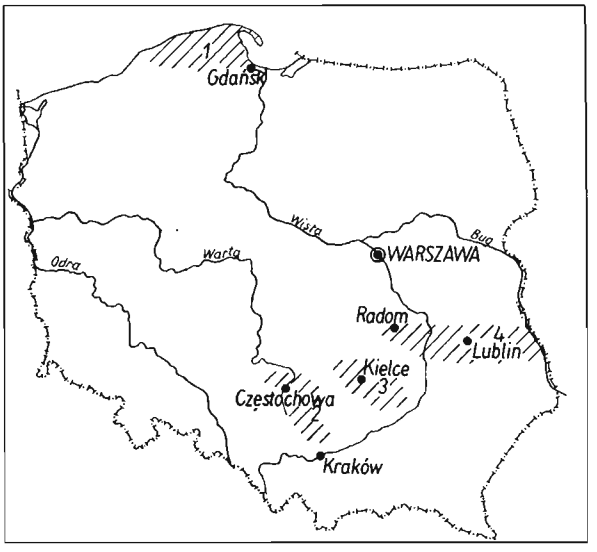

Fig. 1. Occurrence of tentaculites in the Silurian and Devonian deposits in Poland. Legend: 1 Baltic coastal region (Łeba Elevation); 2 Cracow—Częstochowa Upland; 3 Holy Cross Mts; 4 Radom—Kielce Region.

Tentaculites from boreholes situated in the Baltic coastal region were received by the writer for elaboration from Dr. H. Tomczyk, who also allowed her to make use of the profiles of the Silurian deposits from these borings.

Part of the paleontological materials concerning the Lower Devonian deposits from the Ciepielów IG-1 borehole were received by the writer from Dr. E. Tomczykowa and Dr. H. Tomczyk, an unpublished lithological description of this borehole from Dr. H. Tomczyk and L. Miłaczewski, M. Sc. and the rest of geological materials from the borings Krowie Bagno IG-1 and Zakrzew IG-3, along with their lithological profile — from L. Miłaczewski, M. Sc. (all from the Geological Institute, Warsaw).

The work has been prepared at the Laboratory of Stratigraphy, Geological Institute, Warsaw. The material is housed in the Archives of the Museum of the Geological Institute in Warsaw (abbr. as IG).

The tentaculites under study vary in the state of preservation. Those found in the Upper Silurian claystones from the Baltic coastal region and in the Lower Devonian claystone-mudstone deposits from the Radom—Lublin area (Krowie Bagno IG-1 and Zakrzew IG-3) have very well-pre-

served shells which can be easily prepared by means of needle, whereas those occurring in the Lower Devonian deposits from the Ciepielów IG-1 borehole are on the whole poorly preseved. In the latter case, to obtain a material suitable for identification, a method was used so far never applied to studies on the tentaculites. It consists in etching the shells embedded in rock with a diluted hydrochloric acid up to their complete dissolution. Thus obtained mold was subsequently filled with latex, which, formed an accurate cast. The inner structure of tentaculites shells was studied on several serial longitudinal sections.

ACKNOWLEDGMENTS

The writer's heartfelt gratitude is expressed to Dr. E. Tomczykowa, Dr. H. Tomczyk and L. Miłaczewski, M. Sc. for the materials and profiles made available to her.

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Mrs J. Modrzejewska has taken photographs and Mr. W. Rusek has drawn figures.

REMARKS ON THE TAXONOMY OF TENTACULITES

In the present paper the taxonomy has been adopted after Ljaschenko (1955), who erected for the tentaculites an artificial class, the Coniconchia, and in which she distinguished two superorders: the Tentaculitoidea Ljasch. and the Hyolitoidea Syssoyev, the latter occurring from the Ordovician through the Permian.

The shells of the hyolites are bilaterally symmetrical and may be pyramidal, conical or fusiform. The shell of a hyolite is composed of a ventral and dorsal part. The hyolites are similar to the tentaculites in having air chambers and being devoid of siphons, but differ from them in the form and ornamentation. Probably, they represent a separate group, which is not closely related to the tentaculites. The superorder Tentaculitoidea Ljasch. includes three orders, Tentaculitida, Novakiida and Styliolinida.

Forms belonging to the group of the thick-shelled tentaculites proper were assigned by Ljaschenko (1955) to the order Tentaculitida. The shells of this group are shaped like a straight or slightly bent cone. Their surface is covered with distinctly developed transverse rings. A transverse stria-

tion and longitudinal furrows are sometimes observed on it. In the contracted part of shell, connected with an early stage of growth, the internal cavity is usually divided by septa into chambers. The embryonic part is shaped like an obtusely terminating tube. According to Ljaschenko (1955), here belong two families: the Tentaculitidae Walcott and the Homectenidae Ljaschenko. The representatives of this order occur in the Silurian and Devonian the world over.

Forms having narrow, straight and small (of a few millimeters) conical shells were assigned by Ljaschenko (1955) to the order Novakiida. Their embryonic part is drop-like and the surface of their shell is covered with transverse ripplelike rings, separated by interring areas. In addition, longitudinal furrows or striation are observed sometimes on the shell. Shell walls vary in thickness and have a laminar structure. The inner surface of wall either repeats the external sculpture of shell, or is smooth. The embryonic part is separated by a septum from the rest of shell. Only one family, Novakiidae Ljasch., 1955, is assigned by Ljaschenko to the order Novakiida. The representatives of this order occur in the Silurian and Devonian deposits of Europe, Asia and America.

The third of the orders is the Styliolinida. These are tentaculites marked by a relatively simple structure of shell, shaped like a small and narrow, straight or slightly bent, cone, round in transverse section and with a smooth surface devoid of transverse rings or ripples. Longitudinal furrows or a striation are sometimes observed. Shell walls laminar. Embryonnic part drop-like. Only one family, Styliolinidae Grabau (1912), was assigned by Ljaschenko (1955) to this order. The representatives of the order Styliolinida occur in the Silurian and Devonian of the USSR (East-European Plaform, Ural Mts and Timan), Europe and America.

THE STRUCTURE AND ORNAMENTATION OF SHELL

The following part of shell are distinguished: 1 embryonic part; 2 proximal part connected with a juvenile stage of development; 3 distal part connected with an adult stage; 4 aperture (Text-fig. 2).

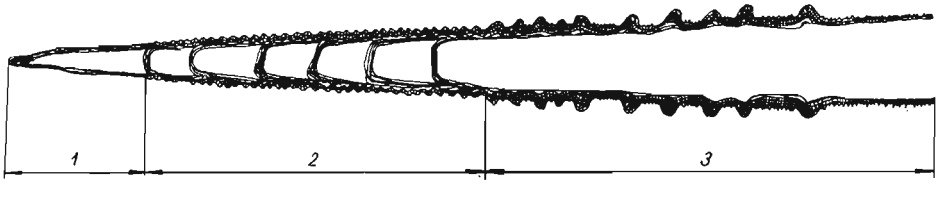


Fig. 2. A transverse section of a tentaculite shell of the group of thick-shelled tentaculites proper (Ljaschenko, 1959). Legend: 1 embryonic part; 2 proximal part of shell, juvenile stage; 3 distal part of shell, adult stage.

In the group of the tentaculites proper, the embryonic part is shaped like an elongate, straight and obtusely terminating cone (Text-fig. 3). Usually, it is filled with an organic substance, probably deposited in the animal's lifetime. The material under study included shells with embryonic parts on the whole very well preserved. The novakiids and styliolinids have a differently shaped embryonic part which is extended, rounded and provided with a thin neck. In the present writer's material, the shells of the novakiids and styliolinids have not embryonic parts preserved.

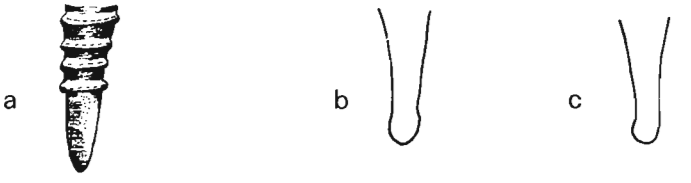


Fig. 3. Embryonic parts of: a *Tentaculites* Schlotheim b *Styliolina* Karpiński c *Novakia* Gürich

In the tentaculites proper, the proximal part of shell is divided inside by septa into chambers (Text-fig. 2). Species ocurring in the Silurian usually have thicker septa, composed of a larger number of laminae. Septa are situated perpendicularly or at a small angle to the axis of shell. In the Devonian forms, septa are rather thinner and sometimes they may even be not preserved at all. The novakiids and styliolinids are devoid of septa. As found by Novak (1880—1882), only the embryonic part in the novakiids is sometimes separated by a septum from the rest of shell.

The proximal part of shell, having septa, was called by Blind (1969) a phragmocone. Studies conducted by means of an electron microscope allowed him to find the presence of semicircular concavities on the proximal side of septa. An arcuate arrangement of calcite crystals, of which septa are composed, indicates that these concavities are an original element, formed in the animal's lifetime, and not resulting from fossilization. Blind does not express a conclusive opinion whether the funnel-like concavities are pathological characters or traces left by siphonal funnels. No funnel-like concavities were observed by the present writer, who thus considers them to be rather pathological changes in septa.

In all the three groups of tentaculites, the distal part of shell is shaped like an empty tube, round in transverse section.

A simple aperture, devoid of any notches and processes, is observed in the tentaculites proper, novakiids and styliolinids. It is usually situated perpendicularly to the longitudinal axis of shell. Tentaculites with well-preserved opercula were described by Blind. No opercula were, however, observed by the present writer, even despite the fact of the having at her disposal a relatively well-preserved and numerous material of tentaculites.

Perhaps, hinge plates were so poorly developed that they were relatively easily broken off the rest of shell together with an operculum.

The three groups of tentaculites mentioned above differ from each other in the sculpture of shell. The thick-shelled tentaculites proper have rings, the novakiids — transverse folds and interannular areas, and the styliolinids have smooth shells, sometimes covered only with growth lines. Longitudinal furrows or striation are also observed sometimes in the three groups. (Text-figs 7 and 8). In the tentaculites proper and novakiids, the rings are generally numerous, fairly uniformly distributed and usually of equal width. Their edges are sharp, rounded or blunted. They are situated in a plane almost perpendicular to the axis of shell, but there are also some departures from this rule. The case has been known in which the rings are arranged obliquely at an angle of 40° to the axis of shell as for example in *Tentaculites subconicus* Geinitz (Hajłasz, 1967). Sometimes, the rings are irregularly arranged in relation to the axis of shell, for example, in *Contractenus* sp. (Pl. X, Fig. 5). In some genera, the entire surface of shell is covered with rings of two types, narrower and wider (Pl. XIII, Fig. 3). Now and again, the surface of shell is nearly quite smooth between large rings as, for example, in *Tentaculites formosus* Hajłasz (Pl. VI, Fig. 4).

REMARKS ON THE OCCURRENCE OF TENTACULITES

According to Ljaschenko's (1959) observations, the representatives of the three groups of tentaculites occur without any difference in the deposits of various environments. These are deposits formed in zones rich in oxygen, or in deep-water, calm, marine zones marked by the dificiency of oxygen and, finally, even in environments saturated with hydrogen sulphite. The present writer shares the opinion, since in Poland the shells of tentaculites were found in deposits varying lithologically, such as black shales, gray mudstones and claystones and light-colored limestones. The tentaculites, novakiids and styliolinids are found as mass assemblages overfilling the calcareous layer as its main rock-forming component.

The tentaculites which occur in abundance are oriented regularly or they are chaotically scattered on the surface of layers, thus indicating the presence or absence of definitely directed bottom currents in the places of sedimentation. The arrangement of shells, shown in Pl. XIII, Fig. 2 may be indicative of the presence of eddies during the formation of deposits.

The tentaculites mostly occur abundantly. Usually, they do not occur separately, but in association with groups of other organisms, such as brachiopods, gastropods, pelecypods, trilobites, ostracods, cephalopods (goniatites, orthocones), etc. Sometimes, however, the tentaculites, novakiids and styliolinids are the only fauna in a given layer.

STRATIGRAPHIC CONCLUSIONS

The Baltic coastal region. — The stratigraphic problems of the Upper Silurian deposits occurring in the Baltic coastal region (the Łeba Elevation) were studied by many authors (Tomczyk, 1962, 1968; Teller, 1968; Tomczykowa, 1971; Witwicka, 1967; Tomczykowa & Witwicka, 1972, 1974). They concern the highermost stratigraphic members of the Silurian, assigned either to the Podlasie Beds (Tomczyk, 1962, 1968; Tomczykowa, 1971; Tomczykowa & Witwicka, 1972, 1974), or generally to the post-Ludlovian (Teller, 1968).

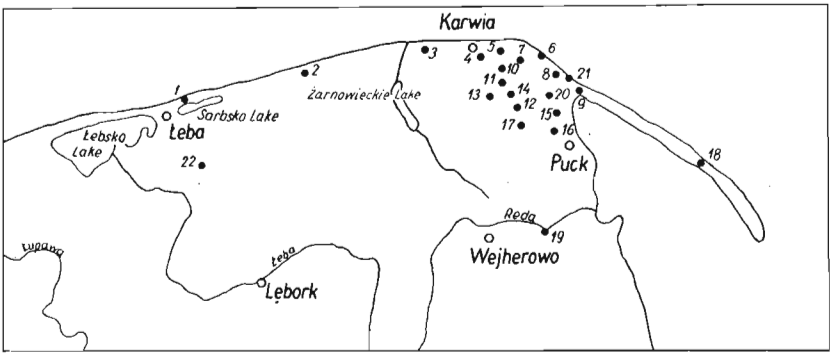


Fig. 4. Distribution of borings, in the Baltic coastal region (Łeba Elevation). Legend: 1 Łeba IG-1, 2. Kopalino IG-1a, 3. Dąbki IG-1, 4. Karwia IG-1, 5. Ostrowo IG-1, 6. Jastrzębia Góra IG-1, 7. Tupadła IG-1, Chłapowo IG-1, 9. Władysławowo IG-1, 10. Czarny Młyn IG-2, 11. Radoszewo IG-3, 12. Radoszewo IG-2, 13. Kłanino IG-1, 14. Starzyno IG-1, 15. Swarzewo IG-1, 16. Gnieżdżewo IG-1, 17. Werblinia IG-1, 18. Jastarnia IG-1, 19. Wejherowo IG-1, 20. Mieroszyno IG-6, 21. Cetniewo IG-1, 22. Białogarda IG-1.

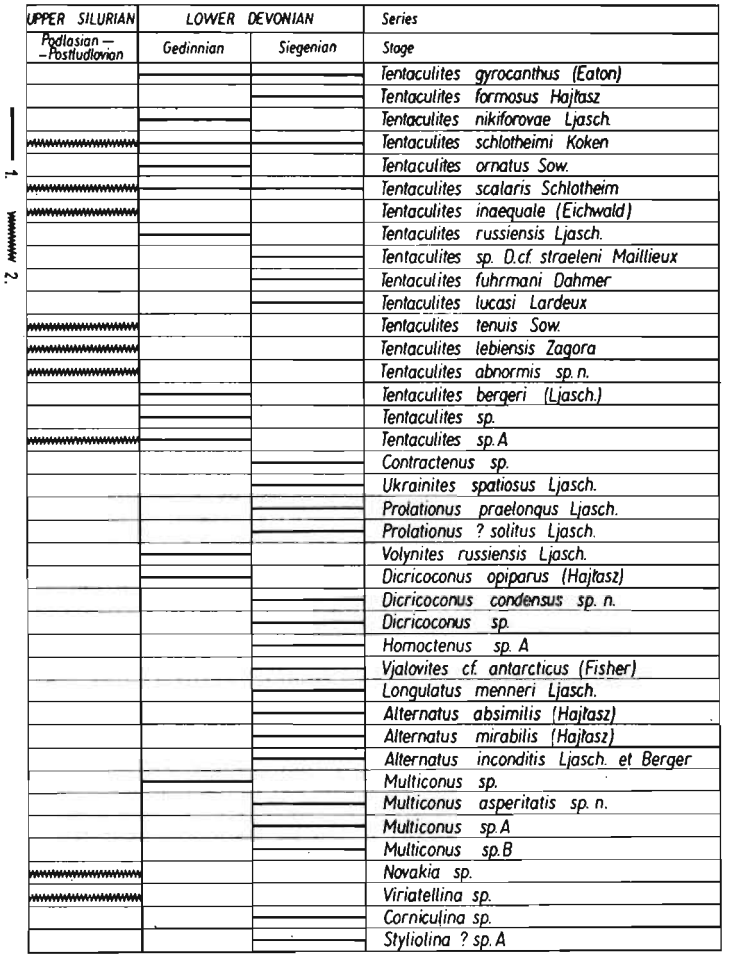
The Upper Silurian deposits sampled from boreholes shown in Text-fig. 4 are developed in the form of monotonous greenish claystones, containing a fairly numerous fauna, composed of tentaculites, trilobites, gastropods, ostracods, brachiopods, crinoids, bryozoans and conodonts.

On the basis of trilobites and ostracods, Tomczykowa & Witwicka (1974) distinguished the following five zones of the Podlasie Beds: (1) *Neobeyrichia incerta*; *Acastella prima*; (2) *Frostiella pliculata, Acaste dayiana*; (3) *Nodibeyrichia tuberculata*; (4) *Kloedenia wilckensiana*; (5) *Nodibeyrichia gadenensis.*

Only one tentaculite assemblage corresponds to these five horizons. This assemblage, which was found in several of the boreholes mentioned above, consists of the following species (Table I): *Tentaculites scalaris* Schlotheim, *T. inaequale* (Eichwald), *T. lebiensis* Zagora, *T. schlotheimi* Koken, *T. tenuis* Sowerby, *Novakia* sp. and *Viriatellina* sp. Except for the last-named two,these tentaculites are species known form Northern and Western Europe.

Table I

Vertical range of the tentaculites in the Upper Silurian and Lower Devonian deposits in the Baltic coastal region and the Radom—Lublin region.



1 Ranges of tentaculites in the Radom—Lublin region 2 Ranges of tentaculites in the Baltic coastal region (Łeba Elevation)

Tentaculites scalaris Schlotheim and *T. schlotheimi* Koken are species with an extensive stratigraphic range. *T. scalaris* occurs in the Upper Silurian and Lower Devonian deposits, while the range of *T. schlotheimi* is yet wider, reaching from the Silurian to the Middle Devonian. *T. scalaris* was described by Zagora (1969) from beyrichia limestones occurring as an erratic material in North Germany. Another locality of this species in the Silurian deposits of Northern Europe was described by Ljaschenko (1958). These are Ohessare Beds on the Island Saarema, Estonia. A species described from this locality under the synonimic name, *T. estonicus*

Ljaschenko, occurs with *T. inaequale* (Eichwald). The beyrichia limestones and the Ohessare Beds from Estonia are correlated by Tomczykowa & Witwicka (1972, 1974), on the basis of trilobites and ostracods, with the Podlasie Beds of the platformic Silurian of Poland. *T. lebiensis* Zagora was identified by Zagora (1972) from deposits coming from the Łeba borehole. This is the only locality of this species known so far. *T. tenuis* Sowerby was described by Lardeux (1969) from deposits, assigned by this author to the Upper Ludlovian, coming from the locality Monmouthshire, Great Britain.

The remaining two forms, *Novakia* sp. and *Viriatellina* sp. rarely occur in the Upper Silurian deposits of the Baltic coastal area. A specimen of *Novakia* sp. was found in the Upper Silurian deposits of Karwia IG-1 borehole and a specimen of *Viriatellina* sp. was found in the Upper Silurian deposits of Chłapowo IG-1 and Tupadła IG-1 boreholes each. Their relatively large size, exceeding the dimensions cited, in the two genera's descriptions, by Bouček (1964), Lardeux (1969), Alberti (1970—1971) and Zagora (1964, 1966), is a characteristic feature of the specimens of *Novakia* sp. and *Viriatellina* sp. found. The representatives of the genus *Viriatellina* Bouček have hitherto been known only from the Lower Devonian deposits (Bouček, 1964).

The Radom—Lublin area. — Marine deposits of the youngest members of the Silurian and of the oldest members of the Lower Devonian have been known in Poland from the Lublin area and the northern part of the Holy Cross Mts (Radom) (Text-fig. 5). These are clayey deposits, inter-

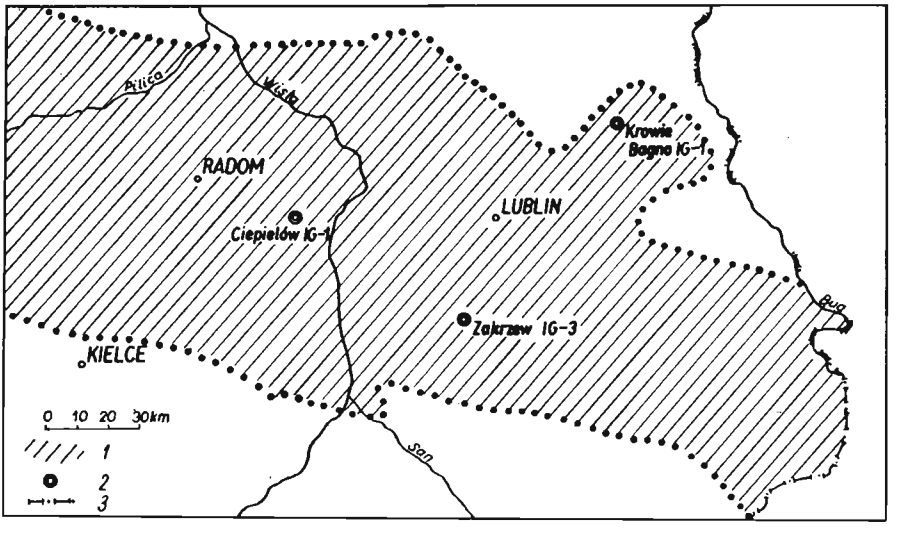


Fig. 5. The Radom—Lublin region, in which Lower Devonian deposits were sampled from boreholes: Ciepielów IG-1, Krowie Bagno IG-1 and Zakrzew IG-3. Legend: 1 The area of the occurrence of the Lower Devonian deposits; 2 boreholes in which Lower Devonian deposits were found; 3 state boundary (after Pajchlowa & Miłaczewski, 1974)

calated by marls, mudstones and sandstones. They contain fauna represented mostly by trilobites, ostracods, tentaculites, brachiopods, pelecypods, crinoids, pisciform vertebrates and gigantostracans.

No tentaculites occur in the deposits assigned to the uppermost Silurian. They appear only in the oldest deposits of the Lower Devonian. Abundantly occurring tentaculites, represented by 33 species, enable stratigraphic correlations.

Text-fig. 6 shows a fragmentary profile of the Lower Devonian deposits from Ciepielów IG-1 borehole, in which the tentaculites described were found (Table II). Two tentaculite assemblages occur in the deposits under study.

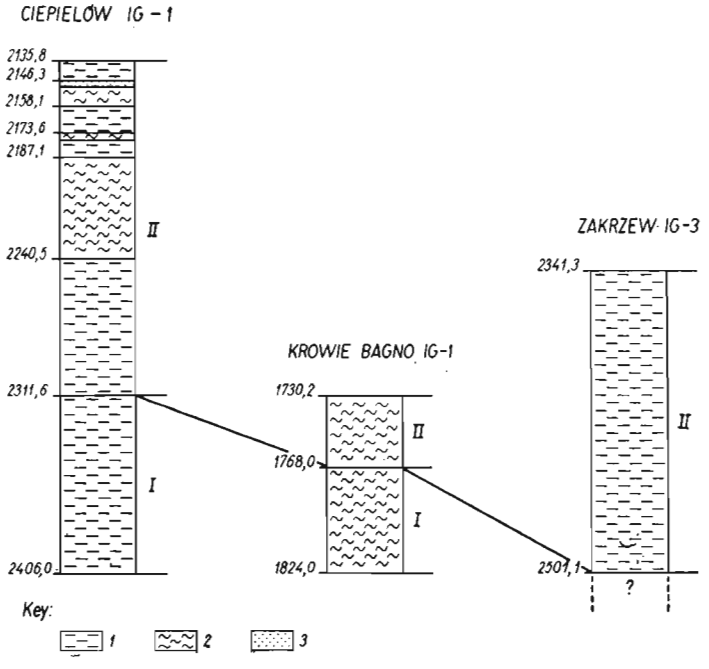


Fig. 6. Ranges of assemblages I and II in the deposits from boreholes situated in the Radom—Lublin region: Ciepielów IG-1, Krowie Bagno IG-1 and Zakrzew IG-3. Legend: 1 claystones 2 sandstones 3 mudstones

Assemblage I is situated in gray, calcareous claystones, intercalated by mudstones and thin layers of organodetrital limestones, occurring at a depth of 2.406 to 2.311.6 m. In addition to tentaculites, these deposits contain pelecypods, ostracods, nautiloids, crinoids, trilobites, brachiopods and gigantostracans. The size of tentaculite shells fluctuates within limits of 2.5 and 17 mm. The tentaculites occur either as single specimens, or in banks. This assemblage includes six species of tentaculites (Table II).

The tentaculites occurring in assemblage I resemble an assemblage described by Ljaschenko from Podolia. *Tentaculites russiensis* Ljasch. was described from Borshchov horizons, Podolia, whereas *T. gyrocanthus* (Eaton), *T. nikiforovae* Ljasch. and *T. ornatus* Sow. were described from Chortkov horizons which in Podolia overlie the Borshchov horizons (Ljaschenko, 1958).

The tentaculites of assemblage I occurring in Ciepielów IG-1 borehole enable a stratigraphic correlation of this boring from a depth of 2.406 m to 2.311.6 m with the deposits of the Borshchov and Chortkov horizons in Podolia (Hajłasz, 1968). It is impossible, however, to determine on the basis of tentaculites a boundary between a complex of beds corresponding to Borshchov horizons and a complex corresponding to Chortkov horizons.

Assemblage II occurs in Ciepielów IG-1 borehole at a depth of 2.311.6 m to 2.135.8 m. The deposits of this interval are represented by mudstones and claystones. In the lower part of the profile, tentaculites occur abundantly and in the upper part only sporadically. Their accompanying fauna, represented by pelecypods, brachiopods, trilobites and pisciform vertebrates, becomes poorer and poorer in the upper part of the profile. The size of tentaculites in assemblage II fluctuates within limits of 7 and 17 mm. The fauna of this assemblage appears in mudstones and claystones, which at first are somewhat dolomitic and then decalcified. The most abundant occurrence of tentaculites is recorded at depths ranging between 2.311.6 and 2.212.9 m. The impoverishment of species, both quantitative and qualitative, is a characteristic feature of assemblage II. This phenomenon may be observed from a depth of 2.212.9 m. Only two species from assemblage I, that is, *T. gyrocanthus* (Eaton) and *T. scalaris* Schlotheim, also occur in assemblage II consisting of six species. The rest of them are limited to assemblage II only (Table II).

T. gyrocanthus and *T. scalaris* have an extensive range (the Silurian through the Devonian). *Vjalovites antarcticus* (Fisher) was found in Antarctica in the deposits whose stratigraphic interval was determined as younger than the Gedinnian and older than the Givetian (Fisher, 1965). The remaining tentaculites are new species. Of interest is the fact that the genus *Alternatus* Ljasch., which in Podolia occurs in deposits assigned to the Ivane horizons, younger than Chortkov horizons, appears in tentaculite assemblage II.

We may suppose that differences existing in the assemblage of tentaculites were caused by changes in ecological conditions resulting from a gradual decrease in the range of the Lower Devonian sea. The complete disappearance of tentaculites and the accompanying fauna is also connected with a change from a marine to a continental environment.

The problem of a stratigraphic boundary between the Gedinnian and the Siegenian has not as yet been elucidated to the full. All the same, the appearance in assemblage II of new species, known in other regions of the

world from deposits younger than the Gedinnian, such as *Vjalovites* cf. *antarcticus* (Fisher) and *Alternatus* Ljasch., enables the suggestion that at Ciepielów IG-1 one should reckon with the presence of the Siegenian deposits above a depth of 2.311.6 m.

Much the same as in the Lower Devonian deposits of Ciepielów, the present writer has also distinguished two tentaculite assemblages in the Lower Devonian deposits of the borehole Krowie Bagno IG-1.

Tentaculite assemblage I occurs from a depth of 1.824 to a depth of 1.768.3 m and assemblage II between 1.768.3 and 1.730.2 m. The deposits containing tentaculites are very monotonous lithologically throughout the interval under study. These are gray-greenish, sandy and clayey mudstones, containing a rich accompanying fauna of brachiopods, trilobites, ostracods, crinoids, pelecypods, gigantostracans and pisciform vertebrates. The shells of tentaculites are very well-preserved, in fact much better than those found in the Lower Devonian deposits of Ciepielów IG-1 borehole. They occur either as single specimens, or are accumulated in the form of layers.

Assemblage I, occurring in Krowie Bagno IG-1 borehole at depths ranging between 1.824 and 1.768 m, includes eleven species (Table II). *Tentaculites russiensis* Ljasch. was described by Ljaschenko (1958) from the Borshchov horizons, Podolia. *T. ornatus* Sow., *T. nikiforovae* Ljasch., *T. gyrocanthus* (Eaton) and *T. bergeri* (Ljasch.) were identified and described by Ljaschenko (1958, 1969) from deposits which are assigned in Podolia to the Chortkov horizons. *Dicricoconus opiparus* (Hajłasz) was described by the present author from Ciepielów IG-1 borehole's assemblage I, which corresponds stratigraphically to Chortkov horizons (Hajłasz, 1968).

In view of unquestionable relationships to the assemblages from Podolia, we may suppose that assemblage I from Krowie Bagno IG-1 borehole equals in age the Borshchov and Chortkov horizons and that the deposits, found at a depth of 1.824 to 1.768 m in the Krowie Bagno IG-1 borehole, represent, therefore, the Gedinnian.

Tentaculite assemblage II, occurring at a depth ranging between 1.768 and 1.730.2 m, consists of fourteen species (Table II), of which the most important stratigraphically are: *Tentaculites* sp. *D.* cf. *straeleni* Mailieux, *T. fuhrmani* Dahmer, *Longulatus menneri* Ljasch., *Prolationus praelongus* Ljasch., *P.* ? *solitus* Ljasch. and *Alternatus inconditis* Ljasch. & Berger.

Tentaculites sp. *D.* cf. *straeleni* Mailieux was described by Lardeux from the Lower Devonian-Siegenian deposits of the Massif Armoricain and *T. fuhrmani* Dahmer from the Emsian (Harz) (Lardeux, 1969). Two of the remaining species, *Prolationus praelongus* Ljasch. and *Alternatus inconditis* Ljasch. & Berger., were described by Ljaschenko (1969) from the deposits of the Ivane horizons, Podolia. *Longulatus menneri* Ljasch.

Stratigraphic range of tentaculites in the Radom—Lublin region

Table II

B. Hajłasz (1968) Poland		G. Ljasch. (1969) Podolian	Radom—Lublin Area		
			Ciepielów IG-1	Krowie Bagno IG-1	Zakrzew IG-3
Lower Devonian	Siegenian	Ivane horizons	*Tentaculites scalaris* Schloth.	*Tentaculites scalaris* Schlotheim *Tentaculites gyrocanthus* (Eaton) *Tentaculites* sp. *D.* cf. *straleni* Mailieux	*Tentaculites scalaris* Schlotheim *Tentaculites gyrocanthus* (Eaton) *Tentaculites schlotheimi* Koken
			Tentaculites gyrocanthus (Eaton)	*Tentaculites fuhrmani* Dahmer *Tentaculites lucasi* Lardeux *Vjalovites* cf. *antarcticus* (Fisher)	*Ukrainites spatiosus* Ljasch. *Prolationus praelongus* Ljasch. *Vjalovites* cf. *antarcticus* (Fisher)
			Tentaculites formosus Hajłasz	*Contractenus* sp. *Prolationus praelongus* Ljasch. *Prolationus* ? *solitus* Ljasch.	*Longulatus menneri* Ljasch. *Multiconus asperitatis* sp. nov. *Multiconus* sp. A.
			Alternatus obsimilis (Hajłasz)	*Dicricoconus condensus* sp. nov. *Dicricoconus* sp. *Homoctenus* sp. A.	*Dicricoconus condensus* sp. nov. *Dicricoconus* sp. *Corniculina* sp.
			Alternatus mirabilis (Hajłasz) *Vjalovites* cf. *antarcticus* (Fischer)	*Longulatus menneri* Ljasch. *Alternatus inconditis* Ljasch. & Berger	*Styliolina* sp. A. *Alternatus inconditis* Ljasch & Berger
	Gedinnian	Borshchov and Chortkov horizons	*Tentaculites gyrocanthus* (Eaton)	*Tentaculites gyrocanthus* (Eaton) *Tentaculites nikiforovae* Ljasch.	
			Tentaculites nikiforovae Ljasch.	*Tentaculites scalaris* Schlotheim *Dicricoconus opiparus* (Hajłasz)	
			Tentaculites scalaris Schlotheim	*Tentaculites ornatus* Sow. *Tentaculites schlotheimi* Koken	
			Dicricoconus opiparus (Hajłasz)	*Tentaculites bergeri* (Ljasch) *Tentaculites* sp. A. *Tentaculites* sp. B.	
			Multiconus sp. *Tentaculites russiensis* Ljasch.	*Tentaculites russiensis* Ljasch. *Volynites russiensis* Ljasch.	

was described from the Lower Devonian deposits of Siberia and *P.* ? *solitus* Ljasch. from the Lower Devonian deposits of Moldavia (Ljaschenko, 1969). On the basis of the stratigraphic range of the species cited above, we may suppose that deposits between depths 1.768.3 and 1.730.2 m, containing tentaculite assemblage II, correspond to the Siegenian. The stratigraphic conclusions, based on the tentaculites, are also confirmed by Nehring's (1972) studies. Describing ostracods from Krowie Bagno IG-1 borehole, she also found the species indicating a possibility of correlating these beds of the Lower Devonian with the Borshchov, Chortkov and Ivane horizons in Podolia, USSR.

Zakrzew IG-3 borehole (Text-fig. 6, Table II) is the last of the borings from which the tentaculite fauna of the Lower Devonian has here been described. The range of the tentaculites, described in the present paper, is contained between depths of 2.341. and 2.501 m. Within this interval of depths occur claystones. The shells of tentaculites are very well-preserved. The accompanying fauna includes ostracods, trilobites, pelecypods, brachiopods and crinoids. The shells of tentaculites either occur as single specimens scattered in rock, or form layers. Fourteen species were identified and described from this locality (Table II), including *Longulatus menneri* Ljasch., described by Ljaschenko (1969) from the Lower Devonian deposits of Siberia and *Ukrainites spatiosus* Ljasch. in an assemblage with *Alternatus inconditis* Ljasch. & Berger, described by Ljaschenko (1969) as index species from layers included in the Ivane horizons in Podolia. Their occurence allows one to correlate the deposits from Zakrzew IG-3 with those from Ivane horizons representing the Siegenian.

PART II

DESCRIPTIONS

Type **Mollusca**
Class **Coniconchia** Ljaschenko, 1955
Order **Tentaculitida** Ljaschenko, 1955
Family **Tentaculitidae** Walcott, 1886
Genus *Tentaculites* Schlotheim, 1820

Tentaculites gyrocanthus (Eaton, 1832)
(Pl. VI, Figs 1, 2)

1948. *Tentaculites gyrocanthus* (Eaton); H. W. Shimer & R. Shrock, p. 526, Pl. 214, Figs 41, 42.
1958*b*. *Tentaculites gyrocanthus* (Eaton); G. P. Ljaschenko, p. 23, Pl. 3, Figs 1, 2.
1967. *Tentaculites gyrocanthus* (Eaton); M. Iordan, p. 380, Pl. 5, Fig. 5; Pl. 4, Fig. 5.
1968. *Tentaculites gyrocanthus* (Eaton); B. Hajłasz, p. 815, Pl. 2, Figs 8—10; Pl. 8, Fig. 40.

Material. — Thirty-five specimens.

Dimensions (in mm):

	Specimen 1	Specimen 2
Length of shell	17	11
Total number of rings	29	20
Width of shell, proximal part	0.9	0.5
Width of shell, distal part	2	3
Apical angle	3°	4°

Description. — Shell large, narrow, conical. Rings large, interring areas irregular, covered with transverse striae. Diameter of rings increasing commensurably to the growth of shell, with rings of the proximal part of shell having a very small diameter. Interring areas increase irregularly with the growth of shell. The sculpture of inner shell wall do not repeat the outer sculpture. Four to five laminar septa.

Comparison. — *Tentaculites gyrocanthus* (Eaton) is related to *T. ornatus* Sow., from which it differs in smaller dimensions and more angular rings.

Occurrence. — Poland: Gedinnian, assemblage I and Siegenian — assemblage II, Radom—Lublin region (Ciepielów IG-1 and Krowie Bagno IG-1). The USA: Upper Helderbergian, the State of New York (Eaton, 1832). The USSR: Chortkov horizons, Podolia (Ljaschenko, 1958).

Tentaculites formosus Hajłasz, 1968
(Pl. VI, Fig. 4)

1968. *Tentaculites formosus* Hajłasz; B. Hajłasz, p. 816, Pl. 2, Fig. 12, Pl. 7, Fig. 33.

Material. — Five specimens.

Dimensions (in mm):

	Specimen 1	Specimen 2
Length of shell	16	13
Total number of rings	40	31
Width of shell, proximal part	0.3	0.3
Width of shell, distal part	2	1.8
Apical angle	11°	11°

Description. — Shell narrow, conical. Proximal part covered with closely spaced rings. In the middle part they are less closely and in the distal very widely spaced. Interring areas are covered with slightly marked striae in the distal part only. The rest of these areas are smooth. Shell wall thick, laminar.

Comparison. — *T. formosus* Hajłasz is related to *T. scalaris* Schlotheim, from which it differs in narrower and more closely spaced rings in the distal part of shell. Its interring areas are nearly quite smooth, while those in *T. scalaris* have a very well developed transverse striation.

Occurrence. — Poland: Siegenian, assemblage II in Radom—Lublin region (Ciepielów IG-1).

Tentaculites nikiforovae Ljaschenko, 1958
(Pl. VI, Fig. 6)

1958*b*. *Tentaculites nikiforovae* Ljasch.; G. P. Ljaschenko, p. 21, Pl. 2, Figs 1, 2.
1968. *Tentaculites nikiforovae* Ljasch.; B. Hajłasz, p. 818, Pl. 4, Figs 20—22; Pl. 6, Fig. 29; Pl. 8, Fig. 41.

Material. — Fifteen specimens.
Dimensions (in mm):

	Specimen 1	Specimen 2
Length of shell	12.5	11
Total number of rings	40	37
Width of shell, proximal part	0.4	0.4
Width of shell, distal part	1.2	1
Apical angle	4°	3°

Description. — Shell narrow, conical. Proximal part covered with uniformly spaced, small, wide and low rings. Rings on the surface of distal part are larger, thick, high and wide and near aperture asymmetrical. Interring areas are sometimes wider than rings and covered with fine, thin, transverse striae. The anterior side of rings is also covered sometimes with a fine striation. In some specimens, interring areas reach a width of two or even four rings. Wall laminar. The sculpture of inner layer in the part adjoining the embryonic part do not repeat the outer sculpture, but do it near the aperture. Sometimes, the internal cavity of shell is divided by septa.

Comparison. — *T. nikiforovae* Ljasch. is similar to *T. ornatus* Sow., from what it differs, however, in wider rings and considerably narrower interannular areas in the distal part of shell.

Occurrence. — Poland: Gedinnian, assemblage I in the Radom—Lublin region (Ciepielów IG-1, Krowie Bagno IG-1). The USSR: Chortkov horizons, Podolia (Ljaschenko, 1958).

Tentaculites schlotheimi Koken, 1889
(Pl. VI, Fig. 3)

1896. *Tentaculites schlotheimi* Koken; G. Gürich, p. 197—199, Pl. 6, Figs 7, 8.
1967*a*. *Tentaculites schlotheimi* Koken; B. Hajłasz, p. 551, Pl. 2, Figs 6—9; Pl. 3, Figs 10—15; Pl. 4, Figs 16—18; Pl. 5, Figs 20—21.

Material. — A hundred and twenty-seven specimens.
Dimensions (in mm):

	Specimen 1	Specimen 2
Length of shell	4.5	10
Total number of rings	35	43
Width of shell, proximal part	0.2	0.2
Width of shell, distal part	0.6	0.9
Apical angle	7°	8°

Description. — Shell narrow, conical. Embryonic part shaped like an obtusely terminating tube. Proximal part of shell covered, near embryonic part, with fine, regular rings whose size increases towards the tip of shell. Interring areas irregular, covered with transverse striae which vary in number, for example, four or nine in successive areas. Rings varying in size and shape, very often arranged in pairs, with spaces between them varying in particular pairs. The sculpture of inner wall do not repeat the outer sculpture. Septa present.

Comparison. — *T. schlotheimi* Koken is related with *T. volynicus* Samson. (Samsonowicz, 1950; the Eifelian and Givetian of the Ukraine), from which it differs in considerably larger transverse rings and a larger apical angle (in *T. volynicus* being 3° to 4°).

Occurrence. — *T. schlotheimi* Koken is marked by a relatively extensive stratigraphical range (Silurian through Middle Devonian). Poland: Upper Silurian, Podlasian of the Baltic coastal region (Karwia IG-1, Wejherowo IG-1); Lower Devonian, Gedinnian — assemblage I, Siegenian — assemblage II in the Radom—Lublin region (Krowie Bagno IG-1, Zakrzew IG-3); Middle Devonian, Eifelian of the Cracow—Częstochowa Upland (Słomniki IG-1, Brudzowice IG-1; Hajłasz, 1967) and of the Holy Cross Mts (Hajłasz, 1967).

Tentaculites ornatus Sowerby, 1839
(Pl. XI, Fig. 7)

1958*b*. *Tentaculites ornatus* Sow.; G. P. Ljaschenko, p. 20, Pl. 1, Figs. 1—3.
1967. *Tentaculites ornatus* Sow.; M. Iordan, p. 381, Pl. 5, Fig. 3.
1968. *Tentaculites ornatus* Sow.; H. Lardeux, p. 42, Figs 25—26; Pl. 14, Figs 1—3.

Material. — Eight specimens.

Dimensions (in mm):

	Specimen 1	Specimen 2
Length of shell	10	15
Total number of rings	20	20
Width of shell, distal part	1.5	2.2

Description. — Shell large, subcylindrical; near embryonic part covered with large, flat, nearly uniform rings, and narrow interring areas, which in the distal part of shell may be several times as wide as rings. The areas are covered with thin, transverse striae. Shell wall consisting of many thin laminae.

Comparison. — *T. ornatus* Sow. resembles *T. semilucianus* Ljasch. from which it differs however in larger shells and a different outline of rings.

Occurrence. — Poland: Gedinnian assemblage I, Radom—Lublin region (Krowie Bagno IG-1). Great Britain: Devonian (Lardeux, 1969). North America: Silurian (Ljaschenko, 1958). The USSR: Chortkov horizons, Podolia (Ljaschenko, 1958).

Tentaculites scalaris Schlotheim, 1820

(Pl. VI, Fig. 7; Pl. VII, Figs 1—6; Pl. VIII, Fig. 1)

1958*b*. *Tentaculites estonicus* Ljasch.; G. P. Ljaschenko, p. 25, Pl. 5, Fig. 1.

1968. *Tentaculites estonicus* Ljasch.; B. Hajłasz, p. 819—820, Pl. 4, Fig. 23.

1968. *Tentaculites* cf. *attenuatus* Hall.; B. Hajłasz, p. 814, Pl. 1, Fig. 3; Pl. 7, Figs 31—32.

1968. *Tentaculites* sp.; B. Hajłasz, p. 816, Pl. 2, Fig. 11; Pl. 7, Figs 34, 35.

1969. *Tentaculites scalaris* Schl.; H. Lardeux, p. 46.

1969. *Tentaculites* sp. A. aff. *gedinnianus* Asselberghs; H. Lardeux, p. 35, Pl. 14, Figs 6, 7; Pl. 15, Figs 3, 6; Pl. 16, Fig. 1; Pl. 21, Fig. 3. Figs 19—22.

1969. *Tentaculites scalaris* Schl.; K. Zagora, p. 222—225, Pl. 1, 2; Pl. 2, Figs 1, 2; Pl. 3, Figs 1, 3.

Material. — Three hundred and ten specimens.

Dimensions (in mm):

	Specimen 1	Specimen 2
Length of shell	9	20
A total number of rings	18	32
Width of shell, proximal part	0.3	0.4
Width of shell, distal part	2	2.5
Apical angle	10°	15°

Description. — Shell narrow, conical, large, uniformly ornamented on the entire surface, except for a small smooth section of proximal part directly adjoining the embryonic part. The entire surface of shell is covered with regularly arranged rings, whose diameter increases with an increase in shell diameter. Interring areas are covered with transverse striae. Wall thick, laminar.

Comparison. — *T. scalaris* Schlotheim strongly resembles *T. ornatus* Sow., but differs from it in the outline of shell, which is conspicuously conical and in the development of rings which are more angular.

Occurrence. — Poland: Upper Silurian, Podlasian of the Baltic coastal region (common in all the region in boreholes); Gedinnian — assemblage I, Siegenian — assemblage II in the Radom—Lublin region (Ciepielów IG-1, Krowie Bagno IG-1, Zakrzew IG-3). The USSR: Ohesaare Beds, Saarema Island, Estonia (Ljaschenko, 1958). Germany: Beyrichia limestones (Zagora, 1969).

Tentaculites inaequale (Eichwald, 1860)

(Pl. VIII, Figs 2—4; Pl. IX, Figs 1—3)

1958*b*. *Tentaculites inaequale* (Eichwald); G. P. Ljaschenko, p. 25, Pl. 5, Fig. 2.

Material. — A hundred specimens.

Dimensions (in mm):

	Specimen 1	Specimen 2
Length of shell	9	8
Total number of rings	24	25
Width of shell, proximal part	0.2	0.2
Width of shell, distal part	1.5	1.3
Apical angle	12°	8°

Description. — Shell narrow, conical, medium-sized. Proximal part is covered, near embryonic part, with evenly spaced, fine, uniform rings. In the distal part, they are grouped in pairs, at first close to each other and only near aperture widely spaced. Both interring areas and surfaces of rings are covered with a transverse striation.

Comparison. — *T. inaequale* (Eichwald) closely resembles *T. schlotheimi* Koken, from which it differs on the whole in a more regular ornamentation.

Occurrence. — Poland: Upper Silurian, Podlasian of the Baltic coastal region (common in all the region in boreholes). The USSR: Ohesaare Beds, Saarema Island, Estonia (Ljaschenko, 1958).

Tentaculites russiensis Ljaschenko, 1958
(Pl. IX, Figs 4, 5)

1958*b*. *Tentaculites russiensis* Ljasch.; G. P. Ljaschenko, p. 24, Pl. 4, Figs 1—2.

Material. — Seven specimens.

Dimensions (in mm):

	Specimen 1	Specimen 2
Length of shell	16	14
Total number of rings	51	48
Width of shell, proximal part	0.2	0.15
Width of shell, distal part	1.3	1.5
Apical angle	7°	6°

Description. — Proximal part of shell covered with regularly spaced uniform rings. In addition to small rings, larger ones appear on the boundary between the proximal and distal part. Interring areas covered with transverse striae. Shell wall thick, laminar. Proximal part of shell divided by thick, laminar and nearly perpendicular septa.

Comparison. — *Tentaculites russiensis* Ljasch. differs from the related species *T. gyrocanthus* (Eaton) and *T. scalaris* Schlotheim primarily in its uniform sculpture of the proximal part of shell. As compared with the species mentioned above, *T. russiensis* Ljasch. has uniform rings occurring over a large area of shell surface.

Occurrence. — Poland: Lower Devonian, assemblage I in the Gedinnian of the Radom—Lublin region (Ciepielów IG-1, Krowie Bagno IG-1). The USSR: Chortkov horizons, Rava Russkaja, Podolia (Ljaschenko, 1958).

Tentaculites sp. *D* cf. *straeleni* Mailieux, 1931
(Pl. XII, Fig. 6)

1969. *Tentaculites* sp. *D.* cf. *straeleni* Mailieux; A. Lardeux, p. 50, Pl. 22, Figs. 1 and 2.

Material. — Three specimens.

Dimensions (in mm):

	Specimen 1	Specimen 2
Length of shell	12	12
Total number of rings	39	28
Width of shell, proximal part	0.5	0.6
Width of shell, distal part	2	2.5
Apical angle	10°	10°

Description. — Shell large, conical. Proximal part covered with closely spaced transverse rings. Interring areas extend commensurably to the growth of shell and develop a transverse striation. Rings relatively narrow, sharply outlined. Shell wall thick, laminar. Proximal part divided by thick, laminar septa nearly perpendicular or oblique to the axis of shell.

Comparison. — *T.* sp. *D.* cf. *straeleni* Mailieux is most closely related to *T. scalaris* Schlotheim, from which it, however, differs in more closely spaced rings in the middle and distal parts of shell.

Occurrence. — Poland: Lower Devonian, assemblage II in the Siegenian of the Radom—Lublin region (Krowie Bagno IG-1). France: Lower Devonian, Siegenian, Massif Armoricain—Nehon (Manche) (Lardeux, 1969).

Tentaculites fuhrmani Dahmer, 1943

(Pl. IX, Fig. 6; Pl. XII, Figs 1—3)

1969. *Tentaculites fuhrmani* Dahmer; H. Lardeux, p. 33, Pl. 15, Figs 1 and 2.

Material. — Six specimens.

Dimensions (in mm):

	Specimen 1	Specimen 2
Length of shell	8	14
Total number of rings	15	25
Width of shell, distal part	2	2

Description. — Shell large, conical. Rings irregularly distributed: in the proximal part, near embryonic part, smaller and closely spaced, on the rest of shell — larger in diameter and with wide interring areas covered with transverse striae. In the middle and entire distal part, rings are irregularly distributed and not always perpendicular to shell axis. Shell wall thick, laminar.

Comparison. — *T. fuhrmani* Dahmer is most closely related to *T. scalaris* Schlotheim, from which it differs primarily in an irregular distribution of rings in the middle and entire distal part.

Occurrence. — Poland: Lower Devonian, Siegenian assemblage II, Radom—Lublin region (Krowie Bagno IG-1). Germany: Emsian of the Harz Mts (Heiligenberg) (Lardeux, 1969).

Tentaculites lucasi Lardeux, 1969
(Pl. XIV, Fig. 1)

1969. *Tentaculites lucasi* Lardeux; H. Lardeux, p. 40, Pl. 18, Figs 1, 2, 24.

Material. — Three specimens.

Dimensions (in mm):

	Specimen 1	Specimen 2
Length of shell	15	16
Total number of rings	60	65
Width of shell, proximal part	0.3	0.3
Width of shell, distal part	1.5	1.5
Apical angle	3°	4°

Description. — Shell in the form of a long, narrow cone, in proximal part mostly slightly bent. This part of shell is covered with fine, transverse, fairly closely-spaced rings. Interring areas increase regularly towards the middle part of shell. In the middle and distal parts, rings are relatively small in diameter. Interring areas are covered on the entire shell with transverse striae. Rings are perpendicular to shell axis. Shell wall thick, laminar.

Comparison. — *T. lucasi* Lardeux is most closely related to *T. tenuis* Sow., from which it differs primarily in a regular distribution of rings.

Occurrence. — Poland: Lower Devonian, Siegenian assemblage II, Radom—Lublin area (Krowie Bagno IG-1). Siegenian, Emsian, Massif Armoricain at Joucen—Charnie (Lardeux, 1969).

Tentaculites tenuis Sowerby, 1839
(Pl. XI, Figs 4, 5)

1969. *Tentaculites tenuis* Sow.; H. Lardeux, p. 53, Pl. 13, Figs 5 and 6.

Material. — Twenty specimens.

Dimensions (in mm):

	Specimen 1	Specimen 2
Length of shell	8	11
Total number of large rings	22	20
Width of shell, proximal part	0.1	0.1
Width of shell, distal part	1.2	1
Apical angle	3°	3°

Description. — Shell conical, strongly elongate. Ornamentation not uniform, in the form of thick transverse rings and clearly outlined transverse striae which also may pass for fine, transverse rings. Proximal part of shell has a more regular ornamentation in the form of about five groups of transverse rings. Interring areas between large rings are filled with two to seven fine, ringlike ripples, whereas the middle (on the boundary of the proximal and distal) and distal parts of shell are developed in the

form of irregularly arranged transverse rings. Interannular areas covered with transverse striae.

Occurrence. — Poland: Upper Silurian, Podlasian of the Baltic coastal region (Karwia IG-1). Great Britain: Upper Ludlovian, Monmouthshire (Lardeux, 1969).

Tentaculites sp.
(Pl. XI, Fig. 3)

Material. — One specimen.

Dimensions (in mm):

Length of shell	about 4
Total number of rings	23
Width of shell, distal part	0.5

Description. — Shell small, narrow, conical. Ornamentation heterogeneous. In the proximal part, rings widely-spaced.

Interring areas covered with transverse striae. In the distal part, rings larger, asymmetrical, irregularly distributed.

Comparison. — *Tentaculites* sp. is related with *T. schlotheimi* Koken, from which differs in a less regular arrangement of rings and in their asymmetry.

Occurrence. — Poland: Lower Devonian, Gedinnian assemblage I (Krowie Bagno IG-1) in the Radom—Lublin region.

Tentaculites lebiensis Zagora, 1972
(Pl. XI, Fig. 8)

1972. *Tentaculites lebiensis* Zagora; K. Zagora, p. 1196, Pl. 1, Figs 1—9.

Material. — One specimen.

Dimensions (in mm):

Length of shell	7
Total number of rings	29
Width of shell, proximal part	0.5
Width of shell, distal part	1

Description. — *T. lebiensis* Zagora strongly resembles *Volynites vela*- transverse rings of two types, larger and finer. Areas between large rings are covered with three to five smaller rings each. In addition, there are transverse striae which occur in interring areas.

Comparison. — *T. lebiensis* Zagora strongly resembles *Volynites velaini* (Munier—Chalmas), from which it differs in a sligthly different ornamentation of proximal part. From *Dicricoconus opiparus* (Hajłasz) it differs in the number of fine rings occurring in areas between large rings.

Occurrence. — Poland: Upper Silurian (Łeba borehole; Zagora, 1972) and Podlasian (Karwia IG-1) of the Baltic coastal region.

Tentaculites abnormis sp.n.
(Pl. X, Figs 1—3)

Holotype: IG 1307.II.14; Pl. X, Fig. 1.
Type horizon: Podlasian stage (Tomczykowa & Witwicka, 1974).
Type locality: Gnieżdżewo IG-1, depth 1.913 to 1.019.7 m.
Derivation of the name: *Lat. abnormis* = abnormal, after a less regular distribution of transverse rings on the surface of shell than in the tentaculites described thus far.

Material. — Ten specimens.
Dimensions (in mm):

	Specimen 1	Specimen 2
Length of shell	7	8
Total number of rings	18	15
Width of shell, proximal part	0.4	0.5
Width of shell, distal part	1.1	1.2
Apical angle	about 8°	about 8°

Description. — Shell medium-sized, narrow, conical. Ornamentation strongly variable, in the proximal part in the form of uniform, regularly spaced rings. It changes together with the growth of shell, rings start to differentiate and occur in pairs which are close to each other. In the distal part, three-ring groups occur, the geminate system disappears completely and interring areas increase. Over the entire length of shell, these areas are covered with transverse striae.

Comparison. — *T. abnormis* sp. n. strongly resembles in the outline of shell *T. inaequale* (Eichwald), from which it differs primarily in the occurrence of three-ring groups on the surface of the distal part of shell.

Occurrence. — Poland: Upper Silurian, Podlasian, Baltic coastal region, Łeba Elevation (Gnieżdżewo IG-1, Władysławowo IG-1, Jastrzębia Góra IG-1).

Tentaculites bergeri (Ljaschenko, 1969)
(Pl. X, Fig. 4)

1969*a*. *Turmalites bergeri* Ljasch.; G. P. Ljaschenko, p. 87, Pl. 4, Figs 7 and 8.

Material. — Five specimens.
Dimensions (in mm):

	Specimen 1	Specimen 2
Length of shell	12	12.5
Total number of rings	23	23
Width of shell, distal part	1.4	1.4
Apical angle	7°	7°

Description. — Shell medium-sized, shaped like a straight or slightly bent cone. Proximal part ornamented by heterogeneous, large rings, varying in height, angular or slightly roundish. The middle and distal parts

of shell have a more varied ornamentation than the proximal part. Rings irregularly distributed on the surface of shell. Interring areas covered with transverse striae, very wide in both middle and distal parts and occupying considerable part of the surface of shell.

Comparison. — The species under study strongly resembles in shape and ornamentation *T. gyrocanthus* (Eaton), from which it differs in a more regular arrangement of rings and interring areas.

Occurrence. — Poland: Lower Devonian, Gedinnian assemblage I, Radom—Lublin region (Krowie Bagno IG-1). The USSR: Chortkov horizons, Podolia (Ljaschenko, 1969).

Tentaculites sp. A
(Pl. VI, Fig. 5)

Material. — Two specimens.

Dimensions (in mm):

	Specimen 1	Specimen 2
Length of shell	12	16
Total number of rings	12	14
Width of shell, distal part	2	2.3

Description. — Shell medium-sized, conical. Rings irregularly distributed. Interring areas covered with strongly developed transverse striae. The development of these areas, which are wide, in particular one of them in the distal part, is very characteristic of *Tentaculites* sp. A. Shell wall thick, laminar.

Comparison. — *Tentaculites* sp. A strongly resembles *T. scalaris* Schlotheim, from which it, however, differs in an irregular arrangement of rings.

Occurrence. — Poland, Upper Silurian, Podlasie Beds, Baltic coastal region (Karwia IG-1); Lower Devonian, Gedinnian assemblage I, Radom—Lublin region (Krowie Bagno IG-1).

Genus *Contractenus* Ljaschenko, 1955
Contractenus sp.
(Pl. X, Fig. 5)

Material. — One specimen.

Dimensions (in mm):

Length of shell	10
Total number of rings	35
Width of shell, proximal part	0.2
Width of shell, distal part	0.3
Apical angle	5°

Description. — Shell medium-sized, narrow, conical. Rings large, very numerous. Interring areas narrow. Some rings display a certain underdevelopment and asymmetry, particularly so in the distal part of shell.

Comparison. — *Contractenus* sp. resembles most closely *C. markowskii* Ljasch., from which it differs in asymmetrically developed rings occurring in the distal part of its shell only.

Occurrence. — Poland: Lower Devonian, Siegenian assemblage II, Radom—Lublin region (Krowie Bagno IG-1).

Genus *Ukrainites* Ljaschenko, 1969
Ukrainites spatiosus Ljaschenko, 1969
(Pl. XVII, Fig. 4)

1969*a*. *Ukrainites spatiosus* Ljasch.; G. P. Ljaschenko, p. 82, Pl. 2, Figs 1 and 2.

Material. — Two specimens.

Dimensions (in mm):

	Specimen 1	Specimen 2
Length of shell	11	15
Total number of rings	42	45
Width of shell, proximal part	0.2	0.3
Width of shell, distal part	1.2	2

Description. — Shell large, shaped like a straight, narrow cone, covered with robust rings, parallel to each other, roundish or slightly angular. Their diameter increases with the growth of shell. Interring areas are covered with transverse striae, particularly so in the distal part of shell.

Comparison. — *Ukrainites spatiosus* Ljasch. resembles *Longulatus menneri* Ljasch., from which it differs in a more regular arrangement of rings and in a somewhat different general shape of shell.

Occurrence. — Poland: Lower Devonian, Siegenian assemblage II, Radom—Lublin region (Zakrzew IG-3). The USSR: Ivane horizons, Podolia (Ljaschenko, 1969).

Genus *Prolationus* Ljaschenko, 1969
Prolationus praelongus Ljaschenko, 1969
(Pl. XVII, Figs 2, 3)

1969*a*. *Prolationus praelongus* Ljasch.; G. P. Ljaschenko, p. 93, Pl. 8, Figs 1 and 2.

Material. — Five specimens.

Dimensions (in mm):

	Specimen 1	Specimen 2
Length of shell	8	21
Total number of rings	43	59
Width of shell, proximal part	0.3	0.3
Width of shell, distal part	1.2	2
Apical angle	about 5°	about 5°

Description. — Shell large, straight, shaped like a thin cone. Rings very numerous, not very prominent, wide, roundish. Interring areas are equal to them in width, smooth. In the distal part of shell, striae appear on rings and interring areas, which extend with the growth of shell. Sometimes, there are also sectors having asymmetrically developed rings or groups of smaller rings. Proximal part of shell divided by about ten septa. The middle and last septa are thick and laminar. The inner surface of wall smoth.

Comparison. — *Prolationus praelongus* Ljasch. is most closely related with *P. waigatschensis* Ljasch., from which it differs in the shape of rings and number of transverse striae occurring on anterior parts of rings and on interring areas.

Occurrence. — Poland: Lower Devonian, Siegenian assemblage II, Radom—Lublin region (Krowie Bagno IG-1). The USSR: Ivane horizons, Podolia (Ljaschenko, 1969).

Prolationus ? *solitus* Ljaschenko, 1969
(Pl. XVII, Fig. 1)

1969*a*. *Prolationus* ? *solitus* Ljasch.; G. P. Ljaschenko, p. 93, Pl. 8, Figs 3 and 4.

Material. — Thirty specimens.
Dimensions (in mm):

	Specimen 1	Specimen 2
Length of shell	12	12
Total number of rings	36	39
Width of shell, proximal part	0.5	0.3
Width of shell, distal part	1.5	1.5
Apical angle	6°	6°

Description. — Shell medium-sized, straight, narrow, conical. Rings very fine, interring areas nearly equalling them in width. Both rings and interring areas slightly increase with the growth of shell. Distal part of shell also covered with fine rings, but somewhat larger in diameter. Close to aperture, rings tend to be more widely spaced. Shell wall of medium thickness, its inner surface smooth, in the distal part bent in places where rings occur.

Comparison. — The species described is similar in the shape and ornamentation of shell to *Prolationus waigatschensis* Ljasch., from which it differs in smaller dimensions, smaller thickness of wall and in a different development of inner surface in the distal part of shell.

Occurrence. — Poland: Lower Devonian, Siegenian assemblage II, Radom—Lublin region (Krowie Bagno IG-1). The USSR: Lower Devonian, Ivane horizons, Moldavian SSR (Ljaschenko, 1969).

Family **Volynitidae** Ljaschenko, 1969
Genus *Volynites* Ljaschenko, 1957
Volynites russiensis Ljaschenko, 1957
(Pl. XV, Figs 2, 3)

1969*a*. *Volynites russiensis* Ljasch.; G. P. Ljaschenko, p. 260, Pl. 7, Figs 4—6.

Material. — Seven specimens.

Dimensions (in mm):

	Specimen 1	Specimen 2
Length of shell	9	5
Total number of rings	40	27
Width of shell, proximal part	0.3	0.2
Width of shell, distal part	1.4	0.9
Apical angle	9°	8°

Description. — Shell not very large, conical, narrow, straight or slightly bent. Proximal part covered with very fine, closely spaced transverse rings. Interring areas slightly marked. Distal part in most specimens covered with large rings, fine rings and transverse striae. Large rings are grouped here and there to form pairs. Sometimes, narrow rings with a smaller diameter occur between large double rings. Some specimens have single rings only. Shell wall of medium thickness, laminar.

Comparison. — *Volynites russiensis* Ljasch. differs from other species in its special ornamentation.

Occurrence. — Poland: Lower Devonian, Gedinnian assemblage I, Radom—Lublin region (Krowie Bagno IG-1). The USSR: Chortkov horizons, Podolia (Ljaschenko, 1969).

Family **Rosiidae** Ljaschenko, 1969
Genus *Dicricoconus* Fisher, 1962

The generic name *Heteroctenus* Ljasch., 1955, as preoccupied, was replaced by Fisher (1962) by *Dicricoconus* Fisher, 1962.

Dicricoconus opiparus (Hajłasz, 1968)
(Pl. XIII, Figs 1—3)

1968. *Heteroctenus opiparus* Hajłasz; B. Hajłasz, p. 280, Pl. 5, Figs 26—28; Pl. 6, Fig. 30.

Material. — Twenty-seven specimens.

Dimensions (in mm):

	Specimen 1	Specimen 2
Length of shell	7	4
Total number of rings	41	30
Width of shell, proximal part	0.2	0.2
Width of shell, distal part	0.9	0.9
Apical angle	6°	7°

Description. — Shell medium-sized, conical, narrow, slightly bent. Proximal part covered over a very short stretch, near embryonic part, with uniform, narrow rings. A further sector of proximal part and the entire distal part have an ornamentation in the form of rings of two types, smaller and larger. Interring areas of large rings are covered with fine rings, three to four of them in an interring area. Near distal end this number drops to two or even one.

Comparison. — *Dicricoconus opiparus* (Hajłasz) is related to *D. mosolovicus* Ljasch., from which it differs in a smaller number of rings and their different distribution. In *D. mosolovicus* the rings are nearly equal to each other over a relatively long sector of the proximal part of shell.

Occurrence. — Poland, Lower Devonian, Gedinnian assemblage I, Radom—Lublin region (Ciepielów IG-1, Krowie Bagno IG-1).

Dicricoconus condensus sp. n.
(Pl. XV, Figs 4, 5)

Holotype: IG 1312.II.2; Pl. XV, Fig. 5.
Type horizon: Siegenian, assemblage II.
Type locality: Krowie Bagno IG-1, depth 1.730.2 to 1.737.3 m.
Derivation of the name: *Lat. condensus* — having closely packed rings.

Material. — Three specimens.

Dimensions (in mm):

	Specimen 1	Specimen 2
Length of shell	8	12
Total number of rings	about 34	about 48
Width of shell, proximal part	0.1	0.3
Width of shell, distal part	1	1.4

Description. — Shell medium-sized, narrow, conical. Proximal part covered with closely spaced rings. Rings of two types, smaller and larger, appear in distal part. One to two rings of smaller diameter occur in interring areas of large rings.

Comparison. — *Dicricoconus condensus* sp. n. is most closely related to *D. opiparus* (Hajłasz) from which it differs primarily in a uniform ornamentation of proximal part.

Occurrence. — Poland: Lower Devonian, Siegenian assemblage II, Radom—Lublin region (Krowie Bagno IG-1, Zakrzew IG-3).

Dicricoconus sp.
(Pl. XI, Figs 1, 2)

Material. — Ten specimens.

Dimensions (in mm):

	Specimen 1	Specimen 2
Length of shell	10	12
Total number of rings	52	54
Width of shell, proximal part	0.3	0.3
Width of shell, distal part	1.3	1.3

Description. — Shell medium-sized, narrow, conical. Proximal part covered, near embryonic part, with closely spaced rings. Rings of two types, smaller and larger, appear on a further sector of shell. Two small rings each occur between large ones.

Comparison. — *Dicricoconus* sp. is most closely related to *D. opiparus* (Hajłasz), from which it differs primarily in a regular occurrence of smaller rings in proximal and distal parts, whereas in the latter species they occur in the distal part only singly. The density of the distribution of rings is also a character differing the two species. In *D. opiparus* (Hajłasz), they are less closely spaced and, consequently, the interring areas are wider.

Occurrence. — Poland: Lower Devonian, Siegenian assemblage II, Radom—Lublin region (Krowie Bagno IG-1, Zakrzew IG-3).

Family **Homoctenidae** Ljaschenko, 1955

Genus *Homoctenus* Ljaschenko, 1955

Homoctenus sp. A

(Pl. XI, Fig. 6)

Material. — One specimen.

Dimensions (in mm):

Length of shell	about 7
Number of rings	about 38
Width of shell, proximal part	0.1
Width of shell, distal part	0.6
Apical angle	4°

Description. — Shell small, narrow, conical, with a very uniform ornamentation formed by transverse rings, regularly increasing in diameter the growth of shell.

Comparison. — *Homoctenus* sp. A resembles *H. nanus* Ljasch., from which it differs in larger dimensions of shell and larger diameter of rings.

Occurrence. — Poland: Lower Devonian, Siegenian assemblage II, Radom—Lublin region (Krowie Bagno IG-1).

Genus *Vjalovites* Ljaschenko, 1969

Vjalovites cf. *antarcticus* (Fisher, 1965)

(Pl. XIV, Figs 2, 3)

1965. *Tentaculites antarcticus* Fisher; D. W. Fisher, p. 281, Pl. 18, Figs 1—4.
1968. *Tentaculites* cf. *antarcticus* Fisher; B. Hajłasz, p. 814, Pl. 1, Figs 5—7; Pl. 9, Figs 42—43.

Material. — Fifty-five specimens.

Dimensions (in mm):

	Specimen 1	Specimen 2
Length of shell	9	10
Total number of rings	37	40
Width of shell, proximal part	0.3	0.3
Width of shell, distal part	1.2	1.0
Apical angle	6°	7°

Description. — Shell large, straight, conical, completely covered with uniform, closely-spaced rings. Interring areas mostly very narrow, smooth, except for the distal part, where they are wider and covered with striae. Shell wall of average thickness, laminar. Its inner surface repeats the outer sculpture.

Comparison. — The form here described differs from *V. antarcticus* (Fisher) in wide interring areas observed in the distal part of shell. The specimens under study resemble the genus *Homoctenus* in the uniformity of rings and in the lack of striae in the proximal part. In the distal part, their shell loses the uniform structure as the result of the appearance of transverse striae between rings.

Occurrence. — Poland: Lower Devonian, Siegenian assemblage II, Radom—Lublin region (Ciepielów IG-1, Krowie Bagno IG-1, Zakrzew IG-3).

Genus *Longulatus* Ljaschenko, 1969

Longulatus menneri Ljaschenko, 1969

(Pl. XV, Fig. 7; Pl. XVI, Figs 4, 5)

1969b. *Longulatus menneri* Ljasch.; G. P. Ljaschenko, p. 113, Pl. 8, Figs 1—6.

Material. — Twenty specimens.

Dimensions (in mm):

	Specimen 1	Specimen 2
Length of shell	20	21
Total number of rings	28	43
Width of shell, proximal part	0.2	0.2
Width of shell, distal part	2	2.2
Apical angle	6°	6°

Description. — Shell large, in the form of a thin cone. Rings very numerous, regularly spaced, sometimes arranged at a certain angle to the main axis. Interring areas covered with very fine transverse striae. Shell wall thin, uniform in thickness. Proximal part of shell, near the embryonic part, divided by septa.

Comparison. — *L. menneri* Ljasch. resembles *Contractenus* sp. in the asymmetry of its rings which here and there are arranged at a certain angle to the main axis of shell.

Occurrence. — Poland: Lower Devonian, Siegenian assemblage II, Radom—Lublin region (Krowie Bagno IG-1, Zakrzew IG-3). The USSR:

Lower Devonian, Razvyedochinskaya svita, Norilsk region, Siberia (Ljaschenko, 1969).

Genus *Alternatus* Ljaschenko, 1969

Alternatus absimilis (Hajłasz, 1968)

(Pl. XIV, Fig. 7; Pl. XV, Fig. 1)

1968. *Tentaculites absimilis* Hajłasz; B. Hajłasz, p. 817, Pl. 2, Fig. 13; Pl. 3, Figs 14—18; Pl. 8, Fig. 39.

Material. — Forty specimens.

Dimensions (in mm):

	Specimen 1	Specimen 2
Length of shell	7	9
Total number of rings	38	32
Width of shell, proximal part	0.4	0.5
Width of shell, distal part	1.3	1.2
Apical angle	8°	9°

Description. — Shell conical, completely covered with fine, thin rings and fine transverse striae. Sculpture heterogeneous. Thin rings are locally arranged near each other and in some other places they are widely spaced. Interring areas completely filled with fine striae. In some specimens, relatively regularly distributed rings occur over the entire surface and interring areas are not very wide. In some others, rings are more closely spaced in the proximal part, near embryonic part, than in the distal which displays wide interannular areas.

Comparison. — *Alternatus absimilis* (Hajłasz) is similar to *A. inconditis* Ljasch. & Berger, from which it differs in thicker and better outlined rings.

Occurrence. — Poland: Lower Devonian, Siegenian assemblage II, Radom—Lublin region (Krowie Bagno IG-1, Zakrzew IG-3). The USSR: Ivane horizons, Podolia (Ljaschenko, 1958).

Alternatus mirabilis (Hajłasz, 1968)

(Pl. XIV, Fig. 6)

1968. *Tentaculites mirabilis* Hajłasz; B. Hajłasz, p. 818, Pl. 3, Fig. 19.

Material. — Three specimens.

Dimensions (in mm):

	Specimen 1	Specimen 2
Length of shell	10	9
Total number of rings	about 21	about 17
Width of shell, proximal part	0.5	0.5
Width of shell, distal part	1.1	1
Apical angle	about 7°	about 7°

Description. — Shell conical, with a very specific, irregular sculpture. Proximal part, near embryonic part, covered with strongly developed transverse striae. Rings appear only on a further sector of shell. In the distal part, wide rings are fairly closely-spaced. Interring areas covered with transverse striae.

Comparison. — *Alternatus mirabilis* (Hajłasz) is most similar to *A. absimilis* (Hajłasz), from which it differs primarily in the ornamentation of proximal part and in a slightly different development of distal part.

Occurrence. — Poland: Lower Devonian, Siegenian assemblage II, Radom—Lublin region (Ciepielów IG-1).

Alternatus inconditis Ljaschenko & Berger, 1969
(Pl. XIV, Figs 4, 5)

1969*a*. *Alternatus inconditis* Ljasch. & Berger; G. P. Ljaschenko, p. 99, Pl. 9, Figs 1—3.

Material. — Four specimens.
Dimensions (in mm):

	Specimen 1	Specimen 2
Length of shell	3	4
Total number of rings	about 53	about 50
Width of shell, proximal part	0.4	0.4
Width of shell, distal part	0.8	0.8
Apical angle	about 8°	about 8°

Description. — Shell medium-sized, conical, slightly bent. Rings numerous, very fine, arranged perpendicularly or slightly obliquely to shell axis. In addition, there also occur larger rings. Shell wall thick, varying in thickness. Proximal part of shell, near embryonic part, divided by thick, laminar septa. Inner surface of wall smooth, locally undulate. In shells devoid of septa wall is thin and its inner surface repeats the outer ornamentation.

Comparison. — *A. inconditis* Ljasch. & Berger resembles most closely *A. absimilis* (Hajłasz), from which it differs primarily in finer and less distinct rings.

Occurrence. — Poland: Lower Devonian, Siegenian assemblage II, Radom—Lublin region (Krowie Bagno IG-1, Zakrzew IG-3). The USSR: Ivane horizons, Podolia (Ljaschenko, 1958).

Genus *Multiconus* Ljaschenko, 1955
Multiconus sp.
(Pl. XII, Fig. 4, 5)

1967. *Multiconus* sp.; M. Iordan, p. 331, Pl. 4, Fig 5b; Pl. 5, Fig. 4.
1968. *Heteroctenus* sp.; B. Hajłasz, p. 821, Pl. 4, Fig. 25.

Material. — Two specimens.
Dimensions (in mm):

	Specimen 1	Specimen 2
Length of shell	2.5	3.5
Total number of rings	about 24	about 31
Width of shell, proximal part	0.2	0.3
Width of shell, distal part	0.9	1
Apical angle	11°	10°

Description. — Shell in the form of a narrow cone. Rings arranged in a manner characteristic of the genus *Multiconus* and giving an impression that shell consists of several cones overlapping each other. Transverse rings of larger diameter make up boundaries between these seeming cones.

Comparison. — *Multiconus* sp. in related to *M. asperitatis* sp. n., from which it differs in a more regular distribution of rings on shell.

Occurrence. — Poland: Lower Devonian, Gedinnian assemblage I, Radom—Lublin region (Ciepielów IG-1). Rumania: Lower Devonian, Mangalia (Iordan, 1967).

Multiconus asperitatis sp.n.
(Pl. XVI, Fig. 6)

Holotype: IG 1312.II.1; Pl. XVI, Fig. 6.
Type horizon: Siegenian.
Type locality: Zakrzew IG-3, depth 2.412.5 to 2.418 m.
Derivation of the name: *Lat. asperitas* — roughness.

Material. — Three specimens.
Dimensions (in mm):

Length of shell	6
Total number of rings	33
Width of shell, proximal part	0.2
Width of shell, distal part	0.8
Apical angle	7°

Description. — Shell gives an impression of being composed of several overlapping cones, which results from a characteristic distribution of rings. Proximal part, near embryonic part, is covered over a relatively short stretch by homogeneous, fine, transverse rings. On a further sector of shell, there appear rings of two types, smaller and larger. A pair of smaller rings, similar as in the genus *Dicricoconus*, appear each between three-ring groups of larger rings. It is only in the distal part that shell acquires the ornamentation characteristic of the genus *Multiconus* and the alleged structure of a cone in cone.

Comparison. — *M. asperitatis* sp.n. is similar to *Multiconus* sp., from which it differs in a more complex arrangement of rings on the surface of shell.

Occurrence. — Poland: Lower Devonian, Siegenian assemblage II, Radom—Lublin region (Zakrzew IG-3).

Multiconus sp. A
(Pl. XVI, Fig. 3)

Material. — One specimen.

Dimensions (in mm):

Length of shell	10
Total number of rings	0.3
Width of shell, proximal part	1.3
Total number of rings	40
Apical angle	about 7°

Description. — Shell seemingly consisting of two overlapping cones. Proximal part uniform in structure, covered with uniform rings. Distal part also displays a monotonous ornamentation consisting of uniform rings which are, however, larger than those in the proximal part. A boundary, between proximal and distal part simulates a complex structure of shell.

Comparison. — *Multiconus* sp. A is very similar in its outline to *M.* sp.B, from which it differs in a more varied arrangement of rings on the surface of shell.

Occurrence. — Poland: Lower Devonian, Siegenian assemblage II, Radom—Lublin region (Zakrzew IG-3).

Multiconus sp. B
(Pl. XV, Fig. 6)

Material. — One specimen.

Dimensions (in mm):

Length of shell	10
Total number of rings	about 50
Width of shell, proximal part	0.2
Width of shell, distal part	1.6
Apical angle	about 6°

Description. — Rings uniform in thickness, but varying in diameter, which gives an impression of a shell consisting of several overlapping cones. Proximal part, near embryonic part, having uniform rings. Two smaller rings each appear in areas between larger rings in the further sector of shell. Further on, shell is ornamented by eight uniform rings. In the distal part, two smaller rings each appear between larger rings.

Comparison. — *Multiconus* sp. B most strongly resembles *M. asperitatis* sp.n., from which it differs in a somewhat different distribution of rings on the surface of shell.

Occurence. — Poland: Lower Devonian, Siegenian assemblage II, Radom—Lublin region (Krowie Bagno IG-1).

Order **Novakiida** Ljaschenko, 1955
Superfamily **Novakiidacea** Ljaschenko, 1969
Family **Novakiidae** Ljaschenko, 1955
Genus *Novakia* Gürich, 1896
Novakia sp.
(Text-fig. 7)

Material. — One fragmentary specimen, devoid of its proximal part. Dimensions (in mm):

Length of the fragmentary shell preserved	about 12
Largest diameter of shell	about 8
Number of longitudinal striae on the fragmentary shell	about 50
Number of ripplelike rings on the fragmentary	5

Description. — Shell large, with its surface covered with ripplelike rings and longitudinal riblike striae.

Occurrence. — Poland: Upper Silurian, Podlasie Beds, Baltic coastal region (Karwia IG-1).

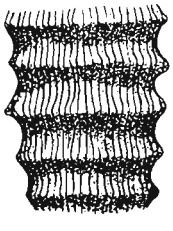


Fig. 7. *Novakia* sp. Specimen No IG 1307.II.3, Karwia IG-1, depth 939.4 to 945.1 m. ×3.

Genus *Corniculina* Klishevich, 1967
Corniculina sp.
(Pl. XVI, Fig. 2)

Material. — One specimen minus proximal part.

Description. — Shell rather small, dextrogyrate, roundish in transverse section. Surface covered with rings. Shell wall thin.

Occurrence. — Poland: Lower Devonian, Siegenian assemblage II, Radom—Lublin region (Zakrzew IG-3).

Superfamily **Viriatellinidacae** Ljaschenko, 1969
Family **Viriatellinidae** Ljaschenko, 1969
Genus *Viriatellina* Bouček, 1964

Viriatellina sp.
(Text-fig. 8)

Material. — Two specimens, both proximally damaged.
Dimensions (in mm):

	Specimen 1	Specimen 2
Length of shell	11	25
Total number of rings	10	20
Width of shell, distal part	3	8
Number of longitudinal striae on shell	7	9
Number of transverse ripplelike rings per 1 mm	2	2

Description. — Shell large, fusiform, increasing in diameter together with its growth. Sculpture in the form of transverse ripplelike rings and, very sharply and distinctly outlined, riblike striae. The number of longitudinal striae remains unchanged regardless of an extension or narrowing of shell. Shell wall thin. Inner surface of wall repeats the outer ornamentation.

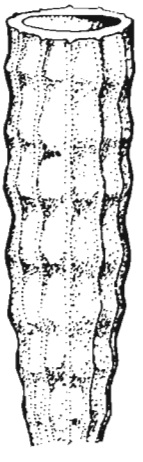


Fig. 8. *Viriatellina* sp. Specimen No IG 1307.II.18, Chłapowo IG-1, depth 1.307.4 to 1.043.9 m. ×8.

Comparison. — In its outline and sculpture of shell, *Viriatellina* sp. resembles such species as *V. gallinae* Bouček and *V. dalejenis* Bouček, from which it differs primarily in a considerably larger dimension.

Occurrence. — Poland: Upper Silurian, Podlasie Beds, Baltic coastal region (Chłapowo IG-1, Tupadła IG-1).

Styliolina ? sp. A
(Pl. XVI, Fig. 1)

Material. — One very poorly preserved specimen.

Description. — Shell rather small, shaped like a narrow cone. Embryonic part drop-like. Transverse section round. No sculpture occurring on the outer surface. Shell wall thin. Its inner surface smooth.

Occurrence. — Poland: Lower Devonian, Siegenian assemblage II, Radom—Lublin region (Zakrzew IG-3).

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BARBARA HAJŁASZ

TENTAKULITY GÓRNEGO SYLURU I DOLNEGO DEWONU POLSKI

Streszczenie

Opracowano tentakulity z 22 wierceń na terenie nadbałtyckim (Text-fig. 4) oraz z trzech wierceń usytuowanych w rejonie radomsko-lubelskim (Text-fig.5). Tentakulity pochodzące z wierceń nadbałtyckich są górno-sylurskie (podlasian), natomiast

tentakulity z obszaru radomsko-lubelskiego dolnodewońskie (żedyn, zigen). Z obszaru nadbałtyckiego pochodzi 8 gatunków (Tabela I). Niektóre z nich znane są z wapieni beyrychiowych (Zagora 1969) i z warstw Ohessare (wyspa Saarema-Estonia). Okazy *Viriatellina* sp. i *Novakia* sp. mają wymiary większe od podawanych w literaturze.

Tentakulity żedyńskie i zigeńskie występują w wierceniach Ciepielów IG I i Krowie Bagno IG I, natomiast tylko zigeńskie w wierceniu Zakrzew IG 3. Pierwszy zespół, żedyński, w wierceniu Ciepielów IG I zawiera 6 gatunków (Tabela II). Przypomina on zespół z warstw borszczowskich i czortkowskich na Podolu, szczególnie przez występowanie takich gatunków jak: *T. russiensis* Ljasch., *T. nikiforovae* Ljasch., *T. gyrocanthus* (Eaton). Drugi zespół, zigeński zawiera 6 gatunków (Tabela II). Wiek tego zespołu jest scharakteryzowany przez występowanie rodzaju *Alternatus* Ljasch., który jest znany na Podolu, w warstwach iwaniewskich, nie niżej.

Zespół żedyński z wiercenia Krowie Bagno IG I zawiera liczniejsze gatunki niż podobny zespół w wierceniu Ciepielów IG I. W skład jego wchodzi 11 gatunków (Tabela II). Zespół ten przypomina zespół występujący w warstwach borszczowskich i czortkowskich na Podolu. W skład zespołu zigeńskiego w wierceniu Krowie Bagno IG I wchodzi 14 gatunków (Tabela II). Zespół zigeński można skorelować z zespołem występującym na Podolu w warstwach iwaniewskich, z dolnodewońskimi zespołami Syberii i Mołdawii (Ljaschenko 1969), oraz jest on pokrewny tentakulitom występującym w osadach zigenu i emsu Masywu Armorykańskiego i Harcu (Lardeux, 1969). W otworze Zakrzew IG 3 odwiercone zostały tylko osady zigenu. W skład zespołu tentakulitów wchodzi 14 gatunków (Tabela II). Zespół te jest przede wszystkim pokrewny zespołom występującym w warstwach iwaniewskich na Podolu, z którymi ma wspólne takie przewodnie gatunki jak: *Ukrainites spatiosus* Ljasch. i *Alternatus inconditis* Ljasch. et Berger.

БАРБАРА ХАЙЛАШ

ТЕНТАКУЛИТЫ ВЕРХНЕГО СИЛУРА И НИЖНЕГО ДЕВОНА ПОЛЬШИ

Резюме

Иссследовались тентакулиты по разрезам 22 скважин, пройденных в прибалтийской части Польши (фиг. 4), и 3 скважин в Радомско-Люблинском районе (фиг. 5). Тентакулиты, найденные в разрезах скважин прибалтийской части относятся к вернхему силуру (подлясский ярус), а тентакулиты Радомско-Люблинского района — к нижнему девону (жединский и зигенский ярусы). В При-

балтике найдено восемь видов (табл. I). Некоторые из них известны по бейрихиевым известнякам (Загора, 1969) и слоям огессаре (о-в Саарема, Эстония). Экземпляры *Viriatellina* sp. и *Novakia* sp. характеризуются более крупными размерами по сравнению с данными, приведенными в литературе.

Жединские и зигенские тентакулиты представлены в разрезах скважин Цепелюв ИГ 1 и Крове-Багно ИГ 1, а единственно зигенсике — в скважине Закжев ИГ 3. Жединское сообщество в разрезе скважины Цепелюв ИГ 1 включает 6 видов (табл. II). Оно напоминает сообщество борщовских и чертковских слоев Подолии, особенно наличием таких видов как *T. russiensis* Ljasch., *T. nikiforovae* Ljasch., *T. gyrocanthus* (Eaton). Второе — зигенское сообщество охватывает 6 видов (табл. II). Возраст этого сообщества определяется присутствием рода *Alternatus* Ljasch., который в Подолии приурочен к иваневским слоям и не распространяется ниже.

Жединское сообщество в разрезе скважины Крове-Багно ИГ 1 содержит более многочисленные виды в сравнении с эквивалентным сообществом в скважине Цепелюв ИГ 1. Оно состоит из 11 видов (табл. II). Это сообщество напоминает фауну борщовских и чертковских слоев Подолии. Зигенское сообщество в разрезе скважины Крове-Багно ИГ 1 включает 14 видов (табл. II). Оно эквивалентно сообществу, представленному и иваневских слоях Подолии, и нижнедевонским сообществам Сибири и Молдавии (Ляшенко, 1969), а также сходно с тентакулитами, распространенными в зигенских и эмских отложениях Армориканского массива и Гарца (Лардо, 1969). В скважине Закжев ИГ 3 пройдены единственно зигенские породы. Сообщество тентакулитов охватывает здесь 14 видов (табл. II). Прежде всего оно с сообществами иваневских слоев Подолии содержанием одинаковых руководящих видов: *Ukrainites spatiosus* Ljasch. и *Alternatus inconditis* Ljasch. et Berger.

EXPLANATION OF PLATES

Plate VI

Tentaculites gyrocanthus (Eaton)

Fig. 1. Specimen IG 1304.II.45, x 10. Ciepielów IG-1, depth 2370.9 m. Lower Devonian.
Fig. 2. Specimen IG 1304.II.24, x 6. Ciepielów IG-1, depth 2323.6 m. Lower Devonian.

Tentaculites schlotheimi Koken

Fig. 3. Specimen IG 1307.II.21, x 10. Karwia IG-1, depth 1228, 1—1234.2 m. Upper Silurian.

Tentaculites formosus Hajłasz

Fig. 4. Specimen IG 1304.II.22, x 6. Ciepielów IG-1, depth 2280.7 m. Lower Devonian.

Tentaculites sp. A

Fig. 5. Specimen IG 1305.II.3, x 6. Karwia IG-1, depth 848.4—854.0 m. Upper Silurian.

Tentaculites nikiforovae Ljaschenko

Fig. 6. Specimen IG 1156.II.4, x 7. Ciepielów IG-1, depth 2354.4 m. Lower Devonian.

Tentaculites scalaris Schlotheim

Fig. 7. Specimen IG 1305.II.51, x 8. Starzyno IG-1, depth 1008—1014 m. Upper Silurian.

Plate VII

Tentaculites scalaris Schlotheim

Fig. 1. Specimen IG 1312.II.34, x 6. Krowie Bagno IG-1, depth 1756.1—1763.4 m. Lower Devonian.
Fig. 2. Specimen IG 1305.II.11, × 10. Karwia IG-1, depth 859.1—864.9 m. Upper Silurian.
Fig. 3. Specimen IG 1305.II.50, × 10. Starzyno IG-1, depth 1000.3—1005.4 m. Upper Silurian.
Fig. 4. Specimen IG 1307.II.8, × 6. Karwia IG-1, depth 859.1—864.9 m. Upper Silurian.
Fig. 5. Specimen IG 1305.II.26, × 6. Władysławowo IG-1, depth, 970.7—976.7 m. Upper Silurian.
Fig. 6. Specimen IG 1305.II.37, × 6. Jastarnia IG-1, depth 1143.3—1146.6 m. Upper Silurian.

Plate VIII

Tentaculites scalaris Schlotheim

Fig. 1. Specimen IG 1305.II.38, × 10. Jastarnia IG-1, depth 1154.6—1160.1 m. Upper Silurian.

Tentaculites inaequale (Eichwald)

Fig. 2. Specimen IG 1305.II.33, × 10. Cetniewo IG-1, depth 965.0—971.6 m. Upper Silurian.
Fig. 3. Specimen IG 1305.II.27, × 10, Władysławowo IG-1, depth 983.0—989.20. Upper Silurian.
Fig. 4. Specimen IG 1307.II.31, × 10. Władysławowo IG-1, depth 995.4—1000.0 m. Upper Silurian.

Plate IX

Tentaculites inequale (Eichwald)

Fig. 1. Specimen IG 1305.II.33, ×8. Cetniewo IG-1, depth 965.0—971.0 m. Upper Silurian.

Fig. 2. Specimen IG 1305.II.47, ×10. Gnieżdżewo IG-1, depth 1025—1031.7 m. Upper Silurian.
Fig. 3. Specimen IG 1307.II.16, ×10. Tupadła IG-1, depth 829,3—935,3 m. Upper Silurian.

Tentaculites russiensis Ljaschenko

Fig. 4. Specimen IG 1304.II.44, ×10. Ciepielów IG-1, depth 2170,9 m. Lower Devonian.
Fig. 5. Specimen IG 1312.II.72, ×5. Krowie Bagno IG-1, depth 1818.7—1824.7 m. Lower Devonian.

Tentaculites fuhrmani Dahmer

Fig. 6. Specimen IG 1312.II.31, ×8. Krowie Bagno IG-1, depth 1744.8—1750.7 m. Lower Devonian.

Plate X

Tentaculites abnormis sp.n.

Fig. 1. Specimen IG 1307.II.14, holotype, ×10. Gnieżdżewo IG-1, depth 1013.7—1019.7 m. Upper Silurian.
Fig. 2. Specimen IG 1307.II.10, ×10. Władysławowo IG-1, depth 976.7—983.0 m. Upper Silurian.
Fig. 3. Specimen IG 1307.II.26, 10. Gnieżdżewo IG-1, depth 1025.7—1031.7 m. Upper Silurian.

Tentaculites bergeri (Ljaschenko)

Fig. 4. Specimen IG 1312.II.28, ×6. Krowie Bagno IG-1, depth 1768.3—1775.3 m. Lower Devonian.

Contractenus sp.

Fig. 5. Specimen IG 1312.II.4, ×8. Krowie Bagno IG-1, depth 1744.8—1750.7 m. Lower Devonian.

Plate XI

Dicricoconus sp.

Fig. 1. Specimen IG 1312.II.7, ×8. Zakrzew IG-3, depth 2418.0—2424.0 m. Lower Devonian.
Fig. 2. Specimen IG 1312.II.8, ×8. Zakrzew IG-3, depth 2418.0—2424.0 m. Lower Devonian.

Tentaculites sp.

Fig. 3. Specimen IG 1312.II.27, ×10. Krowie Bagno IG-1, depth 1804.0—1811.0 m. Lower Devonian.

Tentaculites tenuis Sowerby

Fig. 4. Specimen IG 1307.II, ×10. Karwia IG-1, depth 1228.2—1234.2 m. Upper Silurian.
Fig. 5. Specimen IG 1307.II.22, ×10. Karwia IG-1, depth 1228.2—1234.2 m. Upper Silurian.

Homoctenus sp. A

Fig. 6. Specimen IG 1312.II, ×10. Krowie Bagno IG-1, depth 1744.8—1750.7 m. Lower Devonian.

Tentaculites ornatus Sowerby

Fig. 7. Specimen IG 1312.II.35, ×8. Krowie Bagno IG-1, depth 1804.0—1811.0 m. Lower Devonian.

Tentaculites lebiensis Zagora

Fig. 8. Specimen IG 1307.II.5, ×10. Karwia IG-1, depth 1228.2—1234.2 m. Upper Silurian.

Plate XII

Tentaculites fuhrmani Dahmer

Fig. 1. Specimen IG 1312.II.32, ×12. Krowie Bagno IG-1, depth 1744.8—1750.7 m. Lower Devonian.
Fig. 2. Specimen IG 1312.II.14, ×5. Krowie Bagno IG-1, depth 1730.2—1737.3 m. Lower Devonian.
Fig. 3. Specimen IG 1312.II.30, ×5. Krowie Bagno IG-1, depth 1730.2—1737.3 m. Lower Devonian.

Multiconus sp.

Fig. 4. Specimen IG 1304.II.41, ×7. Ciepielów IG-1, depth 2359.4 m. Lower Devonian.
Fig. 5. Specimen IG 1304.II.40, ×7. Ciepielów IG-1, depth 2359.4 m. Lower Devonian.

Tentaculites sp. *D.* cf. *straeleni* Mailieux

Fig. 6. Specimen IG 1312.II.45, ×8. Krowie Bagno IG-1, depth 1730.2—1737.3 m. Lower Devonian.

Plate XIII

Dicricoconus opiparus (Hajłasz)

Fig. 1. Specimen IG 1312.II.11, ×9. Krowie Bagno IG-1, depth 1768.3—1775.3 m. Lower Devonian.
Fig. 2. Specimen IG 1304.II.32, ×10. Ciepielów IG-1, depth 2359.4 m. Lower Devonian.
Fig. 3. Specimen IG 1304.II.32, ×10. Ciepielów IG-1, depth 2359.4 m. Lower Devonian.

Plate XIV

Tentaculites lucasi Lardeux

Fig. 1. Specimen IG 1312.II.70, ×6. Krowie Bagno IG-1, depth 1730.2—1737.3 m (on the right — *Dicricoconus* sp.). Lower Devonian.

Vjalovites cf. *antarcticus* (Fisher)

Fig. 2. Specimen IG 1304.II.12, ×6. Ciepielów IG-1, depth 2234.5 m. Lower Devonian.
Fig. 3. Specimen IG 1312.II.48, ×4. Krowie Bagno IG-1, depth 1756.1—1763.4 m. Lower Devonian.

Alternatus inconditis Ljaschenko & Berger

Fig. 4. Specimen IG 1312.II.3, ×7. Zakrzew IG-3, depth 2341.3—2344.3 m. Lower Devonian.
Fig. 5. Specimen IG 1312.II.2, ×10. Krowie Bagno IG-1, depth 1744.8—1750.7 m. Lower Devonian.

Alternatus mirabilis (Hajłasz)

Fig. 6. Specimen IG 1304.II.13, ×5. Ciepielów IG-1, depth 2234.5 m. Lower Devonian.

Alternatus absimilis (Hajłasz)

Fig. 7. Specimen IG 1304.II.11, ×7. Ciepielów IG-1, depth 2234.5 m. Lower Devonian.

Plate XV

Alternatus absimilis (Hajłasz)

Fig. 1. Specimen IG 1304.II.17, ×6. Ciepielów IG-1, depth 2240.5 m. Lower Devonian.

Volynites russiensis Ljaschenko

Fig. 2. Specimen IG 1312.II.58, ×10. Krowie Bagno IG-1, depth 1818.7—1824.7 m. Lower Devonian.
Fig. 3. Specimen IG 1312.II.55, ×7. Krowie Bagno IG-1, depth 1818.7—1824.7 m. Lower Devonian.

Dicricoconus condensus sp.n.

Fig. 4. Specimen IG 1312.II.10, ×6. Zakrzew IG-3, depth 2407.4—2412.5 m. Lower Devonian.
Fig. 5. Specimen IG 1312.II.9, holotype, ×9. Krowie Bagno IG-1, depth 1730—1737,3 m. Lower Devonian.

Multiconus sp. B

Fig. 6. Specimen IG 1312.II.22, ×7. Krowie Bagno IG-1, depth 1744.8—1750.7 m. Lower Devonian.

Longulatus menneri Ljaschenko

Fig. 7. Specimen IG 1312.II.15, ×5. Krowie Bagno IG-1, depth 1744.8—1750.7 m. Lower Devonian.

Plate XVI

Styliolina sp. ? A

Fig. 1. Specimen IG 1312.II.26, ×10. Zakrzew IG-3, depth 2496.8—2501.0 m. Lower Devonian.

Corniculina sp.

Fig. 2. Specimen IG 1312.II.5, ×10. Zakrzew IG-3, depth 2485.1—2490.7 m. Lower Devonian.

Multiconus sp. A

Fig. 3. Specimen IG 1312.II.21, ×8. Zakrzew IG-3, depth 2407.4—2412.5 m. Lower Devonian.

Longulatus menneri Ljaschenko

Fig. 4. Specimen IG 1312.II.16, ×6. Zakrzew IG-3, depth 2341.3—2344.3 m. Lower Devonian.

Fig. 5. Specimen IG 1312.II.14, ×6. Krowie Bagno IG-1, depth 1730.2—1737.3 m. Lower Devonian.

Multiconus asperitatis sp.n.

Fig. 6. Specimen IG 1312.II.23, holotype, ×12 (right). Zakrzew IG-3, depth 2412.5—2418.0 m. Lower Devonian.

Plate XVII

Prolationus ? solitus Ljaschenko

Fig. 1. Specimen IG 1312.II.25, ×2,5. Krowie Bagno IG-1, depth 1730.2—1737.3 m. Lower Devonian.

Prolationus praelongus Ljaschenko

Fig. 2. Specimen IG 1312.II.65, ×4. Krowie Bagno IG-1, depth 1730.2—1737.3 m. Lower Devonian.

Fig. 3. Specimen IG 1312.II.14, ×5. Krowie Bagno IG-1, depth 1730.2—1737.3 m. Lower Devonian.

Ukrainites spatiosus Ljaschenko

Fig. 4. Specimen IG 1312.II.46, ×6. Zakrzew IG-3, depth 2341.3—2344.3 m. Lower Devonian.


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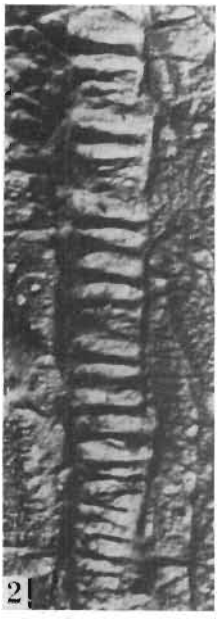
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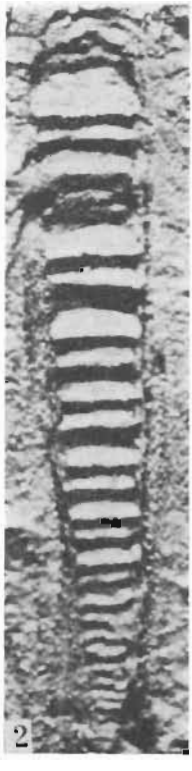
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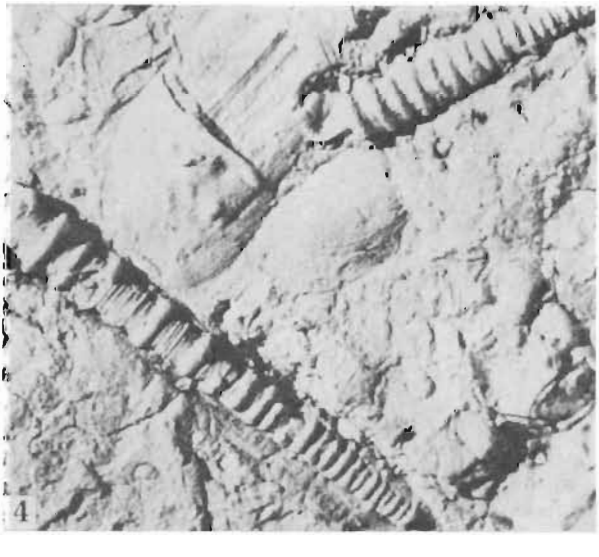
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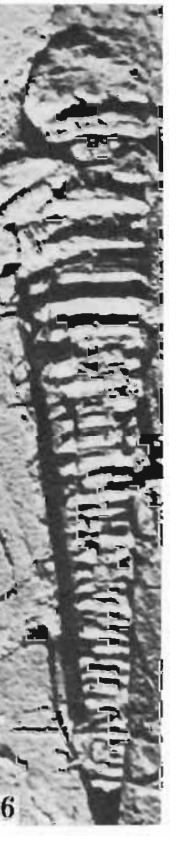
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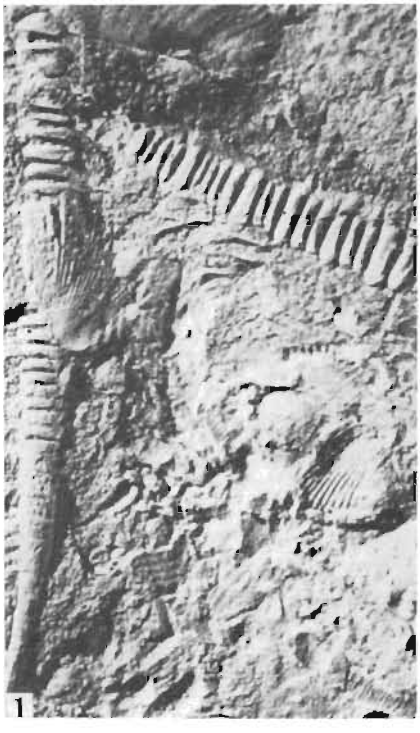
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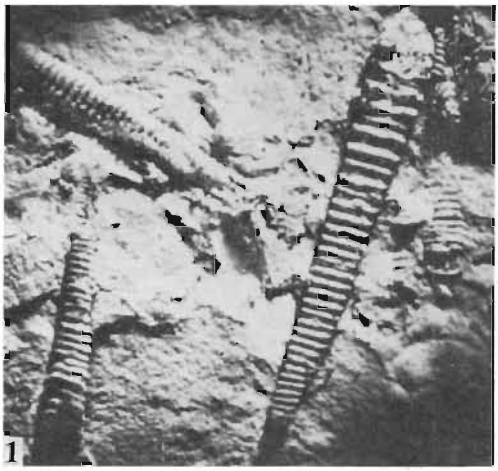
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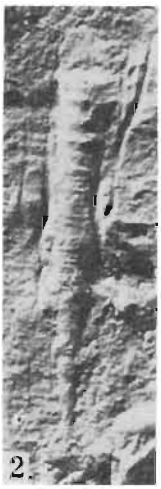
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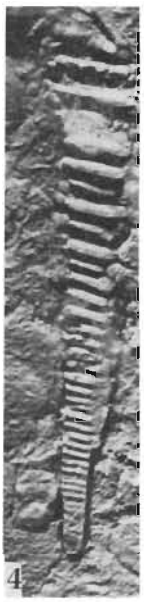
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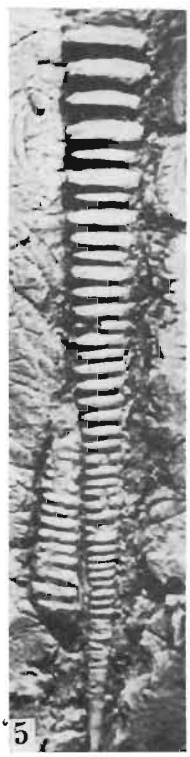
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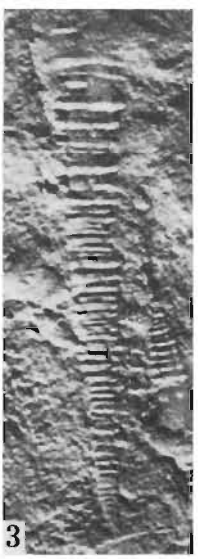
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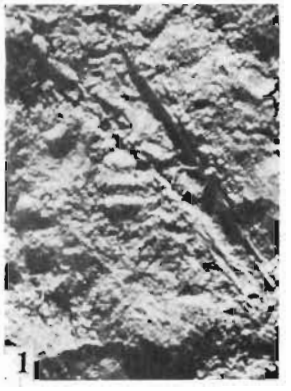
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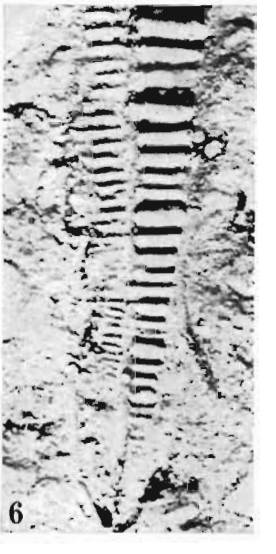
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