Tentaculites from the Givetian and Frasnian of the Holy Cross Mountains

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The Givetian and Frasnian strata of the Holy Cross Mountains, including chiefly biostromal sequence of the Kowala Formation, and the Dziewki Limestone of the Silesian Upland, yielded nine benthic and seven planktic tentaculite species. The tentaculites reveal strong affinities with coeval faunas of the East European Platform, and only two species from the oldest Givetian units (*Stringocephalus*-bearing strata), namely *Homoctenus hanusi* and *Nowakia postotomari*, are known primarily from the European Variscan belt. Stylioline succession allows recognition of the Middle/Late Devonian boundary in pelagic facies of the Kostomłoty area.

Key words: tentaculites, stratigraphical distribution, Devonian, Poland.

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Introduction

Tentaculites are known from the Devonian deposits of the Holy Cross Mountains since they were first described by Gürich (1896), but their knowledge is generally limited to short mentions of occurrences. Only Eifelian faunas of the Dąbrowa Horizon (Hajłasz 1967), Grzegorzewice Beds (Bouček 1964), and Skały Beds (Dzik 1981) have been systematically described.

This paper describes tentaculites from the Givetian to Frasnian succession of the southern Holy Cross Mountains, Kielce facies region. In addition, faunas from some sections of more northern part (Kostomłoty area) and from the Givetian of the Siewierz Anticline, Silesia Upland, have been investigated. They are particularly poorly known in these strata, although several species, especially of *Styliolina*, have been reported in the past (Filonowicz 1973; Hajłasz 1982; Racki *et al.* 1985).

Material and localites

Tentaculite-bearing samples which correspond to both Kielce and Łysogóry facies (Tab. 1) were taken from 20 geological sections in the south western part of the Holy Cross Mountains. Lithostratigraphic framework and the most important data on the localities are presented in Racki (1993).

The tentaculites occur at several levels associated predominantly with open-marine faunas within chiefly biostromal sequence (Kowala Formation) of the Kielce Region. The late Givetian Jaźwica Limestone Member, and associated strata at Posłowice, Jaźwica quarries, Marzysz and Sowie Górki are the most prolific. Rare tentaculites were found in the Middle Givetian *Stringocephalus* Beds at Jurkowice-Budy and coeval 'Dziewki Limestone' of the Siewierz hills, as well as in the early Frasnian units of the Kowala Formation at Kadzielnia, Kowala, and in Chęciny (e.g. Rzepka), and in the Frasnian detrital beds at Szczukowskie Górki.

Some layers are crowded with styliolines in various argillaceous deposits (Fig. 3P) in both Frasnian of the Kielce region (e.g. *Phlogoiderhynchus* Level; Filonowicz 1973), and Late Givetian-to-Frasnian succession of the Kostomłoty area and the Łysogóry part (Kościelniakowska 1967; Racki *et al.* 1985). To the most productive sites belong Kowala, Czarnów-Ślucho-wice and Kostomłoty.

The tentaculites have been collected mainly from marls and shales. Many specimens were studied only on the rock slab surfaces. Compact limestones such as at Kadzielnia and Jurkowice-Budy yielded tentaculites by washing the weathered rock; partial dissolution in a weak buffered acetic acid was successfull on samples from Siewierz and Sowie Górki. Pyritized steinkerns occuring in some residues are rarely suitable for taxonomic identifications, most being crushed, fragmented (especially large-sized specimens) and/or exfoliated.

The material, collected by Grzegorz Racki, is housed at the State Geological Institute in Warsaw (PIG).

Review of identified species

***Tentaculites maslovi* Lyashenko 1959** (Figs 1A, 2A-B).– More than twenty more or less fragmented shells were obtained from the Givetian Jaźwica Member at Jaźwica-Góra Łgawa, Marzysz and Sowie Górki. The type horizon of the species is the Givetian Vorobievka Subhorizon of Russia (Lyashenko 1959; current lithostratigraphic nomenclature and correlation taken from Rzhonsnitskaja 1988).

***Dicricoconus lanciformis* (Lyashenko 1959)** (Fig. 1B-C, 2M).– Six broken specimens of *D. lanciformis* display the tripartite arrangment of transverse ornamentation, distinctive for this larger-sized (up to 15 mm) species. In proximal and distal most parts there are uniform and densely

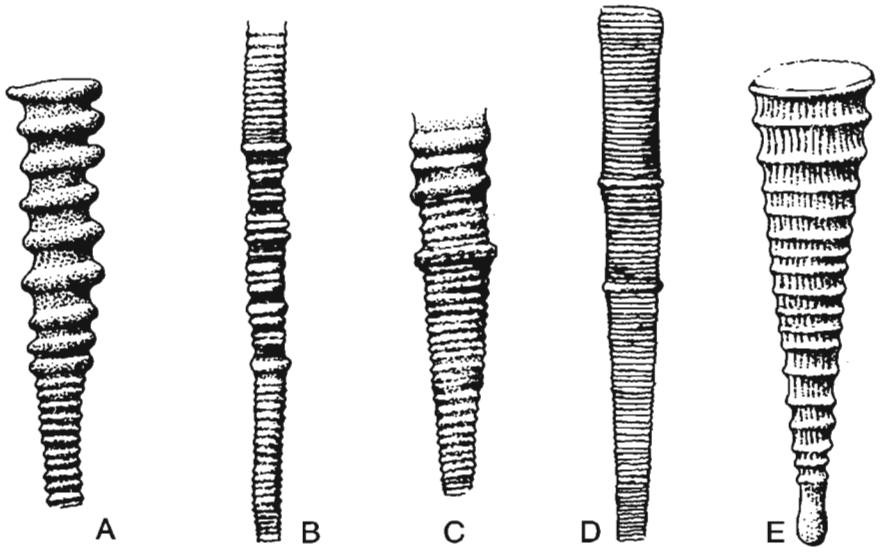


Fig. 1. Tentaculitids and a nowakiid from the Givetian (A-B and D-E) and Frasnian (C) of the Holy Cross Mts (A-D) and Silesian Upland (E); mostly composite drawings. ❑A. *Tentaculites maslovi* (Lyashenko 1959), Marzysz; × 23. ❑B-C. *Dicricoconus lanciformis* (Lyashenko 1959), Laskowa Góra (set B1; B, × 10) and Rzepka (C, × 18). ❑D. *Dicricoconus verchovensis* (Lyashenko 1959), Górno (set A); × 10. ❑E. *Nowakia* cf. *postotomari* Alberti & Salah 1980, Dziewki near Siewierz (set B); × 16.

placed rings, while rings alternate in size in the middle part. Another species of similar size known from the Holy Cross Mountains Devonian, *D. mesodevonicus* (Lyashenko 1959), differs in bipartite pattern of its sculpture with the middle and distal parts showing irregularly spaced thick rings divided by 2 to 17 smaller ones – in contrast to the uniformly undulated proximal part.

In the Holy Cross Mountains, the species occurs in the Givetian (Laskowa Góra Beds, type site) and Frasnian (upper Chęciny Beds; Rzepka, ?Góra Zamkowa - set I), but in Russia only in the Frasnian (Semiluki Horizon, Rudkino Beds; Lyashenko 1959).

***Dicricoconus mesodevonicus* (Lyashenko 1954)** (Fig. 2N).– The Late Givetian Jaźwica Member at Posłowice and Marzysz yielded more than a dozen fragmentary shells of *D. mesodevonicus*. The species was found also in the Givetian of Pomerania (borehole Jamno IG-1) and Russia (Vorobievka Subhorizon, Lyashenko 1959).

***Dicricoconus verchovensis* (Lyashenko 1959)** (Fig. 1D, 2L).– Six incomplete specimens of *D. verchovenis* come from the Givetian Laskowa Góra Beds of Górno. The species is a zonal marker of the latest Givetian of the eastern part of East European Platform (Kyn Horizon; see Lyashenko 1959; Rzhonsnitskaya 1988).

***Dicricoconus* aff. *tichomirovi* (Lyashenko 1959)** (Fig. 2F-G).– Four tentaculitid specimens from Kadzielnia and Kowala (set B) localities are

most closely similar to the Russian species *D. tichomirovi* from the Late Frasnian (Lower Voronezh Subhorizon; Lyashenko 1959), from which they can be distinguished by a markedly smaller number of thinner rings between the larger ones, namely at most 2 in Holy Cross Mountains specimens, and 3 to 5 in the Russian species.

***Homoctenus hanusi* Bouček 1964** (Fig. 2J).– Several strongly fragmented specimens of *H. hanusi* from the *Stringocephalus* Beds of Jurkowice-Budy exhibit peculiar sculpture composed of very narrow smooth annulations, which allows to attribute the poorly preserved material from the Holy Cross Mountains to this widespread species.

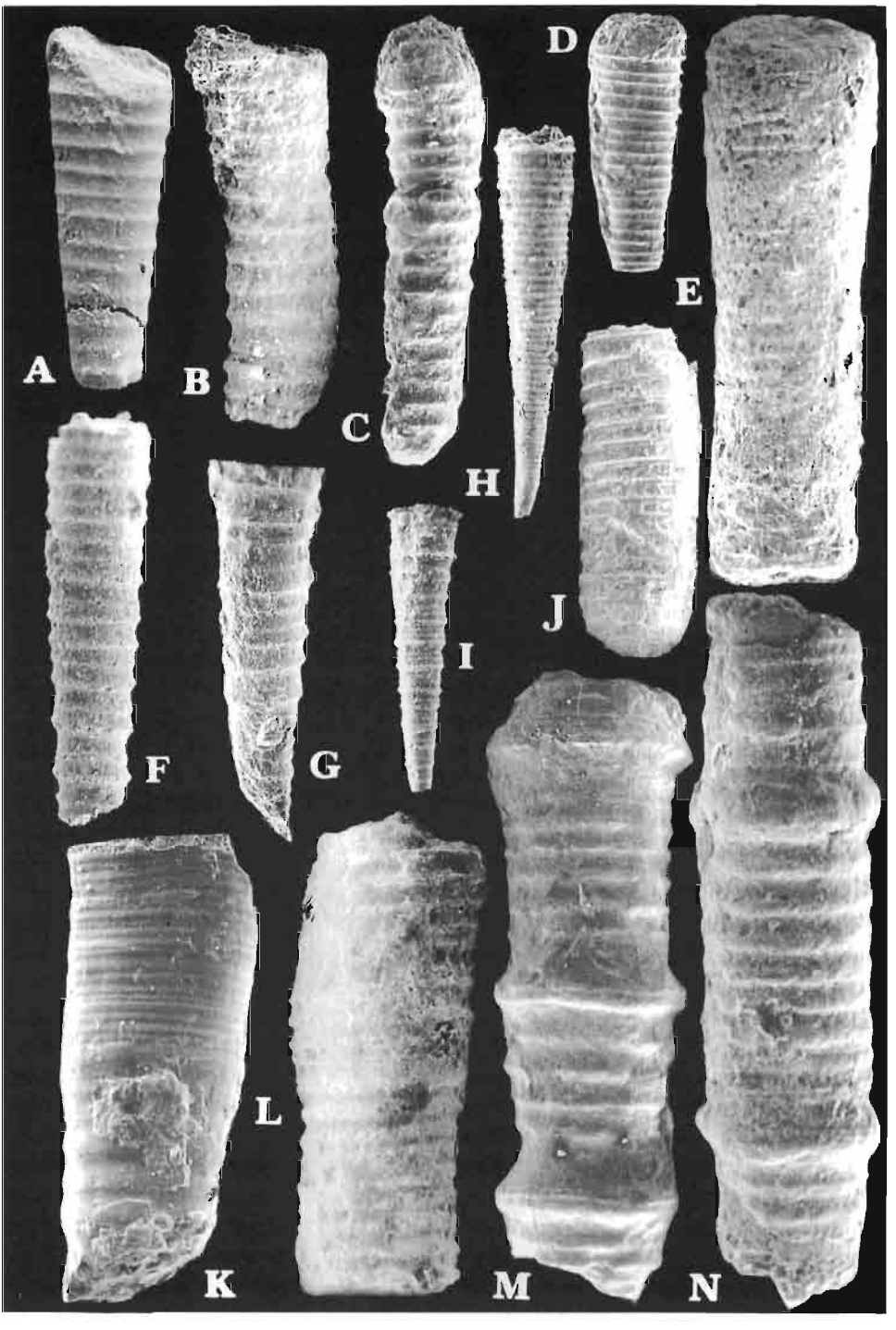
H. hanusi has been hitherto reported from the Holy Cross Mountains (Eifelian Grzegorzowice Beds; Bouček 1964), Silesia Upland (Givetian to ?Frasnian, borehole Solarnia IG-1; Hajłasz 1982), Bohemia (Emsian to Eifelian, Daleje Shales, Choteč Limestone, and Třebotov Limestone; Bouček 1964), and Thuringia (Eifelian *Tentaculites* Shale, Zagora 1964). A similar form is known from Algieria (Lardeux 1969).

***Homoctenus krestovnikovi* (Lyashenko 1957)** (Fig. 2D).– One fragmented *H. krestovnikovi* has been found in the Kostomłoty Beds at Radlin. This homoctenid is known from Russia (Frasnian Semiluki Horizon, Domanik Suite; Lyashenko 1959), Rhenish Slate Mountains (Late Frasnian) and possibly also from the Armorican Massif and Australia (*fide* Sauerland 1983: p. 26).

***Homoctenus tokmovensis* Lyashenko 1959** (Fig. 2E).– Few mostly broken specimens of *H. tokmovensis* have been collected from the Frasnian Szydłówek Beds (Kostomłoty-Małe Górki) and Kostomłoty Beds (Radlin). The Frasnian species was originally described from the central Russia (Semiluki Horizon, Rudkino Beds) and Timano-Pechora area (Rechitsa Horizon, Lya-Yol Beds).

***Polycylindrites tenuigradatus* Lyashenko 1959** (Fig. 2H-I).– More than 30 variably preserved specimens of *P. tenuigradatus* were derived from the Late Frasnian marly beds of the Kowala sites. They fit well Lyashenko's (1959) Frasnian species occurring as they do in the Timano-Pechora area and eastern East European Platform (Domanik Formation).

Fig. 2. Givetian (A-B, J and L-N) and Frasnian (C-H and K) tentaculitids from the Holy Cross Mts. ❑A-B. *Tentaculites maslovi* Lyashenko 1959, mostly distal conch portions, Góra Łgawa (set F; A) and Marzysz (B). ❑C. *Dicricoconus* sp., Dębska Wola. ❑D. *Homoctenus krestovnikovi* (Lyashenko 1959), pyritized incomplete conch, Radlin (set B). ❑E. *Homoctenus tokmovensis* Lyashenko 1959, fragment of a conch from Kostomłoty (Małe Górki set B_3). ❑F-G. *Dicricoconus* aff. *tichomirovi* (Lyashenko 1959), Kadzielnia (set A; F) and Kowala (railroad cut, set B; G). ❑H-I. *Polycylindrites tenuigradatus* Lyashenko 1959, pyritized conchs from Kowala (quarry, set H). ❑J. *Homoctenus hanusi* Bouček 1964, fragment of a conch, Jurkowice-Budy (set E). ❑K. ?*Guerichina* sp., proximal conch part from Dębska Wola (set F). ❑L. *Dicricoconus verchovensis* (Lyashenko 1959), proximal conch part, Górno (set A). ❑M. *Dicricoconus lanciformis* (Lyashenko 1959), middle part of a conch from Laskowa Góra (set A_2). ❑N. *Dicricoconus mesodevonicus* (Lyashenko 1959), fragment of a conch, Posłowice (set B). All × 40 except for L and M that are × 20.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***Nowakia* cf. *postotomari* Alberti & Salah 1980** (Fig. 1E).– Three more or less complete shells of medium size (up to 7 mm) have been found in the Dziewki Limestone in Dziewki, Silesian Upland. The longitudinal riblets which number about 30 on the circumference, are less densely striated than in *N. otomari* but more densely than in *N. postomari* (Alberti & Salah 1980). In this respect they resemble another Givetian nowakiid, *N. murphyi* Lütke 1985 which has less prominent annulations.

Closely related, probably ancestral, *N. otomari* has been reported from the Holy Cross Mountains Late Eifelian Skały Beds (Dzik 1981) and is almost cosmopolitan (Bouček 1964; Alberti 1979; Truyols-Massoni *et al.* 1990; Klishevitch 1985; Kim 1984; Lardeux 1969; Mu & Ruan 1983; Lütke 1985).

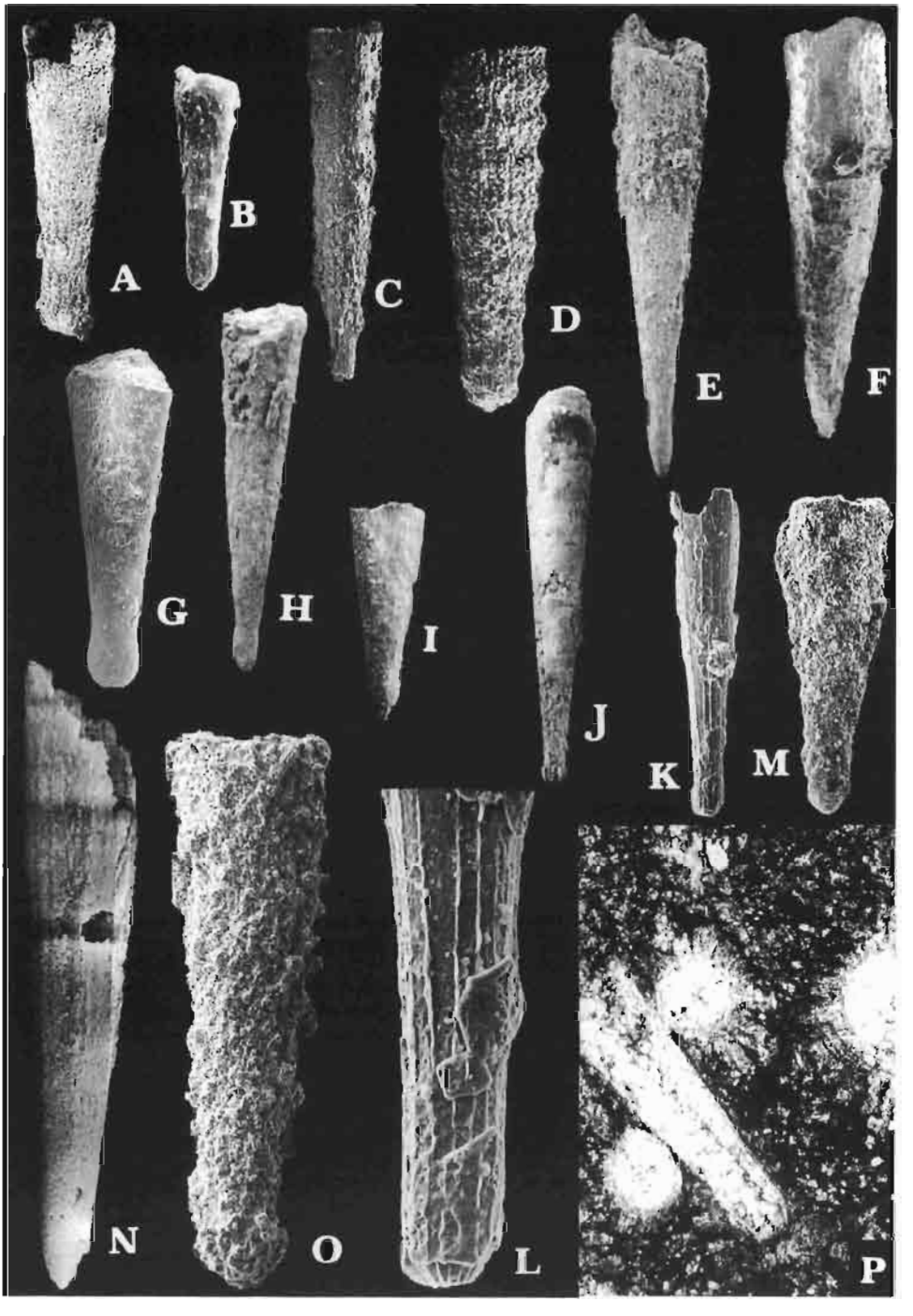
***Viriatellina* sp. A** (Fig. 3C).– Six specimens of *Viriatellina* of unknown specific affinity have been obtained from the Frasnian *Phlogoiderhynchus* Level of Sosnówka. These are small-sized (less than 3.5 mm), slender conchs with the apical angle of ca. 10° and a drop-like shaped embryonic chamber. Ornamentation consists of smooth transverse undulations characteristically flattened and densely arranged; the sculpture in the form of flat rings begins immediately in front of the embryonic shell.

The specimens exhibit affinites with *Viriatella petrovi* Lyashenko 1959 from the Frasnian (Domanik Formation) of Russia (Lyashenko 1959) and Variscan Europe (cf. Lütke 1979: Fig. 1), but they are distinctly smaller and show the development of transversal ornament already in the apical part.

***Styliolina domanicense* Lyashenko 1959** (Fig. 4J).– *S. domanicense* counts several tens of specimens, mostly on surfaces of rock slices. The species occurs in the Givetian/Frasnian boundary beds to Frasnian Szydłówek Beds at Szydłówek, Czarnów, Kostomłoty-Małe Górki; Wietrznia Beds at Śluchowice, and was also reported from the Frasnian of the Silesian Upland (Hajłasz 1982), and Russia (Domanik Formation, Lyashenko 1959).

***Styliolina kirevae* Lyashenko 1957** (Fig. 3G-H).– Several tens of *S. kirevae* were collected from the Givetian Szydłówek Beds at Laskowa Góra and Górno. The species was previously described from the Givetian Vorobievka Subhorizon in Russia by Lyashenko (1959) and from Rhenish Slate Mountains Givetian and Middle Frasnian by Sauerland (1983).

Fig. 3. Dacryoconarids from the Givetian (A, D, H, K-L and N), Givetian to Frasnian passage beds (B, G and I-J), and Frasnian (C, E-F, M and O-P) of the Holy Cross Mts. ❑A. *?Viriatellina* sp., Sowie Górki (set C). ❑B, E-F and I. *Styliolina* ex gr. *nucleata* (Karpinsky 1884), representative conchs from Czarnów (set B; B and I), Kostomłoty (Małe Górki, set B_3) and Wietrznia-II (set C). ❑C. *Viriatellina* sp. A, Sosnówka (set D); ❑D - *Viriatellina* sp., Laskowa Góra (set A_2). ❑G-H. *Styliolina kirevae* Lyashenko 1957, conch varieties from Górno (set B) and Laskowa Góra (set B_1). ❑J. *Styliolina domanicense* Lyashenko 1959, very large-sized conch, Szydłówek (set A). ❑K-L. *Costulatostyliolina* sp., pyritized conch (K) and detailed view of its apical part (L), Laskowa Góra (set A_2). ❑M, O. *Styliolina* sp., different size conchs from



Radkowice (M) and Szczukowskie Górki (O). ❑N. *Styliolina philipovae* Lyashenko 1957, Laskowa Góra (set A_2). ❑P. *Styliolinids* in thin-section, Kostomłoty (Małe Górki, set B_3). All × 40 except for L that is × 150.

***Styliolina philipovae* Lyashenko 1957** (Fig. 3N).– Only four specimens of *S. philipovae* found came from the Givetian Laskowa Góra Beds type locality and lower Szydłówek Beds at Czarnów. *S. philipovae* is known from the Frasnian of the Silesian Upland (Hajłasz 1982), as well as from the Givetian Staryi Oskol Horizon in Russia (Lyashenko 1959) and Givetian to early Frasnian of the Rhenish Slate Mountains (Sauerland 1983).

***Styliolina* ex gr. *nucleata* Karpinsky 1884** (Fig. 3B, E-F, and I).– Lyashenko (1959) emended Karpinsky's original diagnosis of *S. nucleata* assuming that the species defined in such a way includes several other species. The range of intraspecific variability has to be established, however, in order to clarify the status of this commonly cited taxon.

The four species of *Styliolina* identified in the Holy Cross Mountains were known hitherto mainly from Eastern Europe. The most diagnostic characters from the taxonomic viewpoint comprise: (1) shell size ranging from less than 1.5 mm (*S. domanicense*) up to 3.5 mm (*S.* ex gr. *nucleata*), (2) apical angle, i.e. 4° to 6° in *S. philipovae*, and generally larger in the remaining species, and (3) distinctiveness of the embryonic chamber, the strongest in *S.* ex gr. *nucleata* and the weakest in *S. philipovae*; in addition this last species, and occasionally *S. kirevae*, are marked by faint longitudinal furrows on the shell surface.

The collection includes more than 100 specimens of *S.* ex gr. *nucleata*, many of them compressed and partly embedded in rock slabs. The styliolinid ranges from the Givetian/Frasnian boundary beds to Frasnian Szydłówek Beds at Śluchowice, Czarnów, Szydłówek, and Kostomłoty; lowest Kostomłoty Beds at Kostomłoty, Radlin; *Phlogoiderhynchus* Level at Zamkowa Góra, Sosnówka, Kowala, and Wietrznia; marly and detrital beds at Kowala, set F (see also Filonowicz 1973 for other possible sites) in the Holy Cross Mountains. It occurs also in the Silesian Upland (Frasnian; Hajłasz 1982), and the Urals and Timano-Pechora area [Givetian Afoniny Horizon, Klishevitch 1985; Frasnian Semiluki (Domanik Formation) and Rechitsa (Lya-Yol Beds) Horizons, Lyashenko 1959], Russian Platform [Frasnian, Semiluki (Rudkino Beds, Domanik Suite) and Rechitsa (Mendym Suite) Horizons; Lyashenko1959] and Libya (Frasnian, Hajłasz *et al.* 1978).

Conclusions

The studied tentaculite faunas from the Holy Cross Mountains comprise 22 species (see Figs 1-3), with benthic thick-walled tentaculitids, and planktic styliolinids well represented, and annulated nowakiids sparse. Most of the species are known also (Lyashenko 1959) from the East European Givetian and Frasnian. Tentaculite assemblages typical of older strata of the Variscan Europe continue to the early Givetian *Stringocephalus* Beds in the Holy Cross Mountains and the coeval unit of Silesia (Hajłasz 1982). *Homoctenus hanusi* is a Bohemian and Thuringian species.

The first styliolinids are conspecific with those from the Rhenish domain (Sauerland 1983). Furthermore, *Nowakia otomari* occurrs in the Holy Cross Mountains latest Eifelian (Dzik 1981) and *N.* cf. *postotomari* from the Middle Givetian of the Silesian Upland, are well known cosmopolitan index species of the Eifelian/Givetian transition (Alberti 1979; Klishevitch 1985; Lütke 1985; Truyols-Massoni *et al.* 1990: p. 136).

The stratigraphic ranges of the tentaculite species in southern Poland are similar to those in other areas. Particularly significant appears to be *Dicricoconus verchovensis* (Lyashenko), the guide fossil for the latest Givetian (Rzhonsnitskaya 1988: p. 696). The most notable exceptions are *H. hanusi*, unknown above the Eifelian outside of Poland, and *Dicricoconus lanciformis*, a Frasnian species in Russia, but found in the Middle Givetian in the Holy Cross Mountains.

The succession of styliolines in the Kostomłoty facies zone starts with *S. philipovae*, which is succeeded by *S. kirevae*, and finally replaced by *S.* ex gr. *nucleata*, widespread in the area and associated in the lower part of its range with – or slightly preceded by – *S. domanicense*. The first species pair is known from the Givetian of Russia, and from the Rhenish Givetian and early Frasnian (Sauerland 1983); the latter two are markers of the Frasnian. This agrees with the current conodont datings of the Holy Cross Mountains sections, although the Frasnian-type styliolines possibly had appeared in the Kostomłoty basin already in the latest Givetian (in the recent usage of the stage boundary; see Racki 1993). Givetian occurrences of some related forms were quoted by Klishevitch (1985: p. 116) from the Urals.

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Streszczenie

Fauna tentakulitów z żywetu i franu Gór Świętokrzyskich i antykliny Siewierza wykazują duże analogie z jednowiekową fauną Europy Wschodniej (głównie Platformy Rosyjskiej), a jedynie stratygraficznie najstarsze gatunki (przede wszystkim *Homoctenus hanusi*), dowodzą związków z dewonem Czech i Niemiec. Wykazano znaczenie tych mięczaków dla korelacji utworów żywetu i franu oraz zarysowano możliwość wykorzystania sekwencji styliolin do rozpoznawania granicy żywetu z franem w basenowych facjach strefy kostomłockiej.