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## Brachiopods from Terebratula Bed from the Upper Muschelkalk in the Grotów P–11 borehole (SW Poland)

Morphologic studies on the brachiopod assemblage from the Terebratula Bed from the Upper Muschelkalk in the Grotów P–11 borehole showed the occurrence of *Coenothyris vulgaris* (Schlotheim), *C. cycloides* (Zenker) and "*Coenothyris*" sp. Specimens of *C. cycloides* (Zenker) are distinctly dominant in the shell conglomerate. In comparison to the material known from Thüringen, Württemberg and the Holy Cross Mts. the studies done have proved that in the territory of Poland the Terebratula Bed — an equivalent to *Cycloidesbank*  $\gamma$  — contains more than one brachiopod species.

### INTRODUCTION

The occurrence of the Terebratula Bed (Fig. 1) has been stated in the uppermost part of the Upper Muschelkalk in the Grotów P–11 borehole done in 1976 by the former Department of Ore Deposits Geology (Państwowy Instytut Geologiczny — Polish Geological Institute, Warsaw). That bed is an equivalent to *Cycloidesbank*  $\gamma$  which in the area of Germany separates the middle Ceratites beds of the Upper Muschelkalk from the upper ones. In the south-eastern Poland the upper Ceratites beds are developed in the Keuper facies (I. Gajewska, 1978; T. Orłowska-Zwolińska, 1983; H. Senkowiczowa, 1985) while the Terebratula Bed has been formed in the last phase of the Muschelkalk facies.

The Grotów P–11 borehole was situated on the Żary Pericline. The Lower Keuper greenish-grey claystone, in parts grey with quartz sand lenses, ashy, locally with mica accumulations, occurs over the Terebratula Bed. Estheria and fish remnants are being found there. Towards the top the claystone passes into the beige dolomitic limestone.

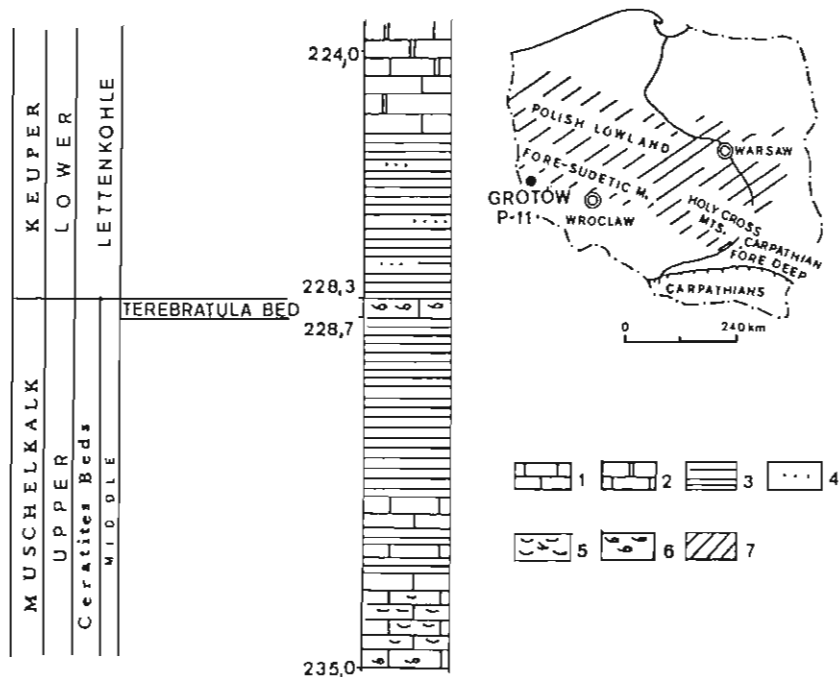


Fig. 1. Localization and lithologic section of the uppermost part of the Upper Muschelkalk in the Grotów P-11 borehole

1 — limestones; 2 — dolomitic limestones; 3 — claystones; 4 — sand-richness of deposit; 5 — organodetrritic limestones; 6 — Terebratula Bed; 7 — occurrence of Terebratula Bed in Poland

Lokalizacja i profil litologiczny najwyższej części górnego wapienia muszlowego w otworze wiertniczym Grotów P-11

1 — wapień; 2 — wapień dolomityczny; 3 — ilowce; 4 — zapiaszczenie osadu; 5 — wapień organodetrytyczny; 6 — ławica terebratulowa; 7 — występowanie ławicy terebratulowej na terenie Polski

The Terebratula Bed occurs at the depth of 228.3–228.7 m. It represents a conglomerate of the debris of brachiopod shells, among which *Coenothyris cycloides* (Zenker), *C. vulgaris* (Schlotheim) and one not identified species were recognized. Bigger shell fragments and whole specimens are very rare in that conglomerate. That is why the detailed determination of the species assemblage in the bed is difficult. The rock is cemented by the beige limestone. The fish remnants are hardly found in the complex. The Terebratula Bed displays the thickness of 40 cm being in that comparable with the corresponding beds in the other areas.

At the base of the Terebratula Bed there occurs the greyish-green claystone with limestone intercalations (5.0 m) in its lower part. Both the rocks are underlain by the beige cryptocrystalline limestone, partly fine-pored with fauna accumulation (1.0 m) in places. Towards the bottom the abundance of the organic remnants increases and the rock passes into the shell-stone built of the strongly damaged brachiopod and

molluscs shells, among which *Nucula* sp. has been identified. Fish remnants (0.3 m) have been noticed, too.

The occurrence of the shell conglomerate composed mainly of terebratulids below the uppermost Terebratula Bed has been mentioned by different authors studying the Triassic in Poland and in Germany (M. Schmidt, 1928; E. Głowacki, H. Senkowiczowa, 1969; H. Senkowiczowa, 1970, 1985; H. Wiefel, J. Wiefel, 1980; G. Merz, 1987). In the Polish area the Terebratula Bed at the boundary of the Muschelkalk and Keuper occurs in the Polish Lowland and in the Holy Cross Mts. (H. Senkowiczowa, 1985; E. Popiel-Barczyk, H. Senkowiczowa, 1989) as well as in the Carpathian Foredeep (E. Głowacki, H. Senkowiczowa, 1969).

In the south-western Poland in the Forc-Sudetic Monocline the Terebratula Bed has been stated in numerous boreholes. The fauna, however, was poorly preserved which resulted in difficulties with its identification. Only the Grotów P-11 borehole contains the specimens which can be studied in point of view of the outer and inner morphology of their shells.

It can be stated due to a comparison of the brachiopod assemblage found in the borehole discussed and the analogical assemblages from the Holy Cross Mts. and Germany that representatives of *Coenothyris cycloides* (Zenker) species are the main component of the conglomerate. Only that one species has been cited by the different authors from the area of Thüringen and Württemberg (M. Schmidt, 1928; H. Wiefel, J. Wiefel, 1980). Due to the studies done in the Holy Cross Mts. (E. Popiel-Barczyk, H. Senkowiczowa, 1989) it appeared that parallelly to the dominant *C. cycloides* (Zenker) there occurs also cosmopolitic *C. vulgaris* (Schlotheim). In the Grotów P-11 borehole the third, unidentified species is also present. In that aspect the studies done in Poland give the evidence that the Terebratula Bed equivalent to *Cycloidesbank*  $\gamma$  comprises more than one brachiopod species in the Polish area.

The material studied has been catalogued in the Museum of Państwowy Instytut Geologiczny (Polish Geological Institute) in Warsaw under the number MUZ PIG 1607 (II).

## PALEONTOLOGICAL PART

Specimens studied come from the core fragments of the Terebratula Bed from the Grotów P-11 borehole from the depth of 228.7 m (Fig. 1). They are poorly preserved being mostly the moulds of the whole shells or their fragments. There occur also incomplete specimens with the crystallized interior of the shells or with the partly empty shell. Inside some specimens, calcite crystals are seen on the shell walls and on brachidium or its remnants (Pl. I, Figs. 1, 2). There occur also moulds of pedicle valves filled with the fragments of smaller shells cemented by greyish-beige limestone. The specimens display random occurrence in the deposit, some of them showing distinct traces of crushing.

38 specimens were separated to the studies. The length of their shells reached or exceeded 10 mm, being similar to their width. The thickness of those specimens equaled in general to the half of their length. Some specimens displayed distinct traces

of "pressing" of the brachial valve into the pedicle one (Fig. 4). 10 specimens were sectioned, the dimensions of their shells ranging from 9.8 to 17.8 mm. In the material from the Grotów P-11 borehole no early juvenile forms of *Coenothyris* were found. Such the forms were described by K. Usnarska-Talerzak (1988) from the accumulations of *C. vulgaris* (Schlotheim) from the Lower Muschelkalk in Dziewkowice (Upper Silesia).

Two species have been identified as well as the third described (basing on the inner and outer morphology). They are: *Coenothyris cycloides* (Zenker), *C. vulgaris* (Schlotheim) and "*Coenothyris*" sp., respectively. Affiliation of the last species to the *Coenothyris* genus has been concerned problematic due to morphologic differences in the pedicle valve.

Two first species display identic outer and inner features when compared with the corresponding features of *Coenothyris cycloides* (Zenker) and *C. vulgaris* (Schlotheim) from the Terebratula Bed from the Holy Cross Mts. (E. Popiel-Barczyk, H. Senkowiczowa, 1989). "*Coenothyris*" sp. differs from the above listed ones due to the occurrence of a distinct depressions running through the center of the pedicle valve surface and due to the different morphology of the interior of the umbonal part of that valve (Figs. 4, 5).

Family Dielasmatidae Schuchert, 1913  
Genus *Coenothyris* Douvillé, 1879  
*Coenothyris vulgaris* (Schlotheim), 1820  
(Figs. 2, 2a, Pl. I, Fig. 3a-d)

1989 *Coenothyris vulgaris* (Schlotheim, 1820); E. Popiel-Barczyk, H. Senkowiczowa: p. 98 (cum synon.)

**M a t e r i a l:** 12 specimens (2 sectioned).

**D i m e n s i o n s** in mm:

Length (L) — 13.5–14.2

Width (W) — 11.5–12.5

Thickness (T) — 6.4–7.5

**R e m a r k s.** Due to ovaly-elongated shell outline and rectimarginate anterior commissure the specimens studied are close to *Coenothyris vulgaris* (Schlotheim) from the Terebratula Bed from the Holy Cross Mts. They particularly correspond to the forms found in the outcrops in Jarugi, Stare Chęciny and Piekoszów which are concerned as the representative for the first morphological group distinguished in that area (E. Popiel-Barczyk, H. Senkowiczowa, 1989, p. 97; Pl. 1, Figs. 3–7; Pl. 4, Figs. 2, 3). Pattern of the elements in the hinge part of the interior of the shells in specimens from Grotów P-11 is in thin sections similar to that in the sections and reconstruction presented in the above quoted paper (*l.c.*, p. 99, Fig. 3). The specimens from Grotów display also similarity of the outer and inner shell morphology to the forms described from the Lower Muschelkalk in Strzelce Opolskie (E. Nowakowski, 1972, Pl. V, Fig. 1 (only) and Pl. VII, Figs. 1–7) and in Dziewkowice (K. Usnarska-Talerzak, 1988, p. 192, 193, Figs. 23–26). Images of the serial sections of the specimens from Dziewko-

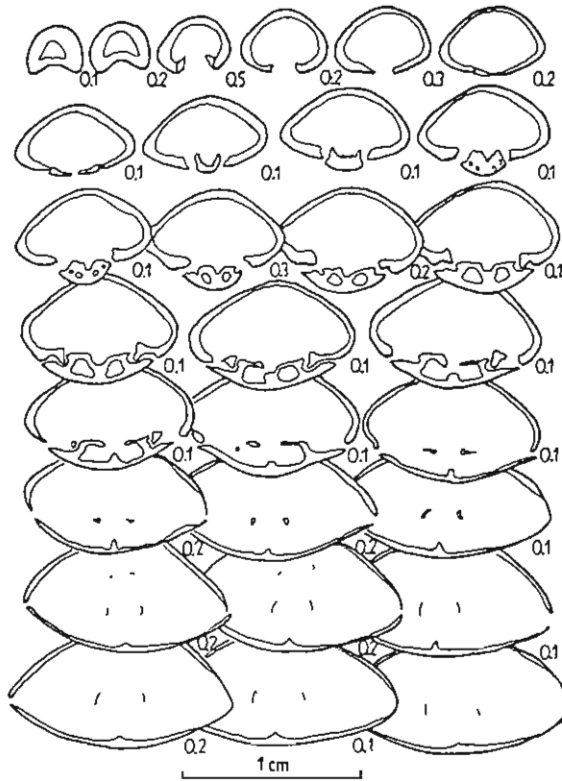


Fig. 2. Serial transverse sections of *Coenothyris vulgaris* (Schlotheim); MUZ PIG 1607 (II) 38; L = 13.5 mm, W = 12.3 mm, T = 6.4 mm

Szlify seryjne z *Coenothyris vulgaris* (Schlotheim)

wice (Lc., Figs. 23, 25) show the identical structure and pattern of the hinge plates. They may be also compared to septum with hinge elements of the specimens from Grotów. Relatively "low" placed crural processes in the reconstruction of brachidium (Fig. 2a) from the specimens from Grotów have the same development stage as the reconstructions of the specimens from Dziewkowice (K. Usnarska-Talerzak, 1988, Figs. 24, 26), Strzelce Opolskie (E. Nowakowski, 1972, Pl. IV, Figs. a, b) and from the Holy Cross Mts. (E. Popiel-Barczyk, H. Senkowiczowa, 1989, Fig. 5a) — from Stare Chęciny. Hinge plates in the specimens from Grotów are flat, almost parallel to the bottom of the brachial valve, divided by the bases of the crurs. They form relatively deep septalium (Fig. 2). No specimen observed displayed a whole preserved loop. Neither dental plates nor their traces were observed.

**Occurrence.** Lower Muschelkalk from the Lower and Upper Silesia (P. Assmann, 1915, 1937; E. Nowakowski, 1972; K. Usnarska-Talerzak, 1988), Lower and Upper Muschelkalk from the Polish Lowland (H. Senkowiczowa, 1985), Upper Muschelkalk from the Holy Cross Mts. (E. Popiel-Barczyk, H. Senkowiczowa, 1989), Upper Muschelkalk from the Fore-Sudetic Monocline (Grotów P-11), Muschelkalk



Fig. 2a. Interior of brachial valve reconstructed from serial transverse sections presented in Fig. 2

Rekonstrukcja wnętrza skorupki grzbietowej ze szlifów seryjnych z fig. 2

from Germany (M. Schmidt, 1907, 1928; H. Kirchner, 1934), Anisian from Italy (A. Specialc, 1967), Bulgaria (A. S. Dągis, 1974), Hungary (A. Török, 1992) and Romania (M. Jordan, 1992).

*Coenothyris cycloides* (Zenker, 1836)

(Fig. 3; Pl. I, Figs. 4a-c, 5a, b)

1989 *Coenothyris cycloides* Zenker, 1836; E. Popiel-Barczyk, H. Senkowiczowa: p. 105 (cum synon.)

**M a t e r i a l:** 12 specimens (2 sectioned).

**D i m e n s i o n s** in mm:

Length — 9.8–13.1

Width — 9.1–12.8

Thickness — 5.1–6.5

**R e m a r k s.** Due to the rounded shape of the shell, its small size, flat brachial valve and rectimarginate anterior commissure the specimens from Grotów resemble *Coenothyris cycloides* (Zenker) from the Terebratula Bed from the outcrops in Bliżyn, Lizawy and Polichno in the Holy Cross Mts. (E. Popiel-Barczyk, H. Senkowiczowa, 1989, Pl. 2, Figs. 1, 2, 6, 7). The flat brachial valve and the conicalness of the pedicle valve are well seen both in the serial transverse sections from Grotów (Fig. 3) and from the Holy Cross Mts. (E. Popiel-Barczyk, H. Senkowiczowa, 1989, p. 107, Fig. 9). Pattern of hinge elements in both the images mentioned displays a total consistence. The specimen from Grotów, however, does not have the total image of descending branches of loop. In the pedicle valves neither dental plates nor their traces were stated.

**O c c u r r e n c e.** Upper Muschelkalk in the Holy Cross Mts. (E. Popiel-Barczyk, H. Senkowiczowa, 1989), in the Fore-Sudetic Monocline (Grotów P-11) and in Germany (M. Schmidt, 1928; H. Kirchner, 1934; H. Wiefel, J. Wiefel, 1980; G. Merz, 1987).

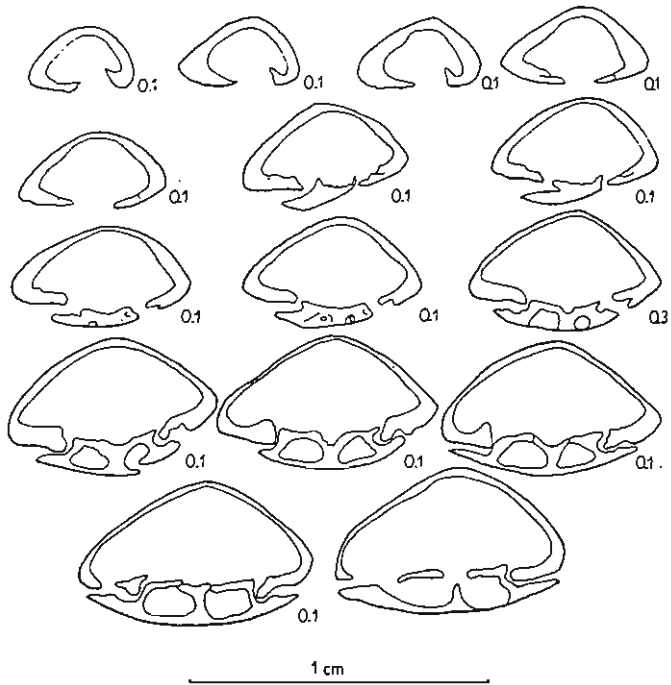


Fig. 3. Serial transverse sections of *Coenothyris cycloides* (Zenker); MUZ PIG 1607 (II) 28; L = 9.8 mm, W = 9.1 mm, T = 5.1 mm

Szlify scryjne z *Coenothyris cycloides* (Zenker)

"*Coenothyris*" sp.  
(Figs. 4, 5; Pl. I, Fig. 6)

Material: 14 specimens (6 sectioned).

Dimensions in mm:

Length — 12.5–17.8

Width — 9.0–17.7

Thickness — 5.0–8.5

Description. Specimens displaying ovaly-elongated shell outline have rectimarginate anterior commissure. In the central part of the pedicle valve — distinct depression running almost through  $2/3$  of the shell's length (Pl. I, Fig. 6).

Interior of the pedicle valve of the sectioned specimens (Figs. 4, 5) displays distinct triplicity and traces of umbonal chambers which occur in the forms with developed dental plates. Massive teeth, being displaced due to the flattening of the sectioned specimens, display distinct traces of swellings. Those swellings suggest a presence of dental plates, not seen, however, on the serial sections.

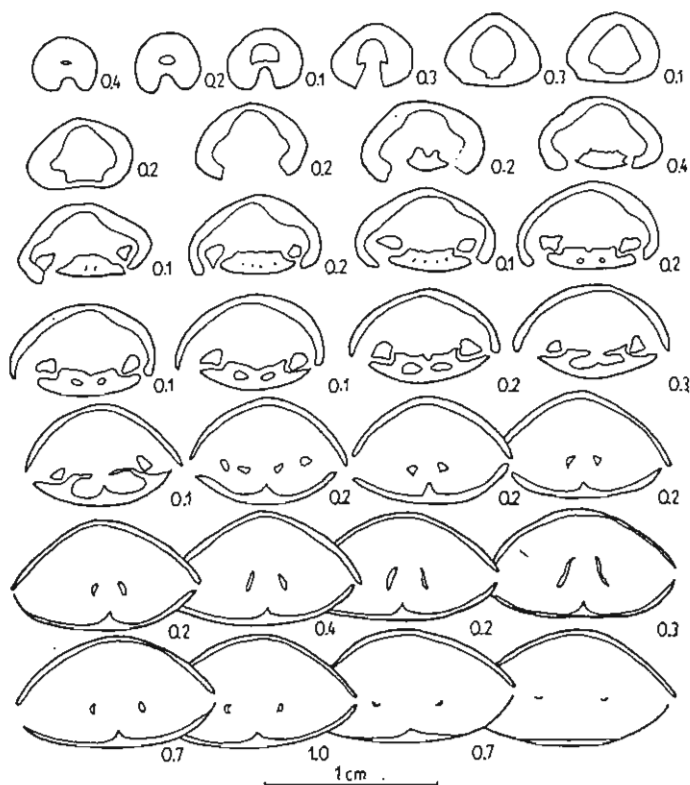


Fig. 4. Serial transverse sections of "*Coenothyris*" sp.; MUZ PIG 1607 (II) 24; L = 14.5 mm, W = 13.8 mm, T = 6.2 mm

Szlify seryjne z „*Coenothyris*” sp.

In the flat brachial valve hinge plates and septalium have the same shape as in *Coenothyris vulgaris* (Schlotheim). Crural processes short, relatively “low” placed, formed similarly to *C. vulgaris* (comp. Figs. 2a, 4a). Cardinal process well developed. Septum reaches almost half of the shell length. Lack of complete loop preserved in all the specimens.

**R e m a r k s .** Although the ovaly-elongated shell outline of "*Coenothyris*" sp. suggests the affinity of this species to *Coenothyris vulgaris* (Schlotheim) from the first morphologic group distinguished in the material from the Holy Cross Mts., the presence of a distinct depression running through the center of the pedicle valve surface points also to the third group mentioned (E. Popiel-Barczyk, H. Senkowiczowa, 1989, p. 102, Pl. 3, Fig. 1). Similarly to the Holy Cross Mts. specimens, the samples from Grotów-11 are also close in their morphology to the specimens from the Gogolin Beds presented by P. Assmann (1937, Pl. 7, Fig. 6a) as *Waldheimia ladina* Bittner.



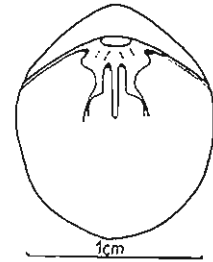


Fig. 4a. Interior of brachial valve reconstructed from serial transverse sections presented in Fig. 4

Rekonstrukcja wnętrza skorupki grzbietowej ze szlifów seryjnych z fig. 4

Images of the interior of pedicle valves are also in the specimens from Grotów (Figs. 4, 4a, 5) close to the interior image of *Coenothyris vulgaris* (Schlotheim) with distinct dental plates from Strzelce Opolskie (E. Nowakowski, 1972, Pl. V, Fig. 2). They are similar in their images of the sectioned interior to the corresponding pictures of *Coenothyris acuta* Radulović (V. Radulović et al., 1992, p. 73, Fig. 14) from the Carnian from Yugoslavia. Their similarity corresponds to distinct triplicity of the interior of umbonal part of the pedicle valve, massive dental teeth and position of crural processes in the brachial valve. Outer morphologic features of the shells of the Grotów specimens, however, allow their comparison with the juvenile specimens of *C. acuta* Radulović only (*l.c.*, p. 65, Pl. 1, Figs. 7a–d). In contrary to them the adult specimens of *C. acuta* Radulović (*l.c.*, p. 65, Pl. 1, Figs. 5, 6) have their shell outlines and anterior commissure very close to the corresponding features of *C. vulgaris* Schlotheim from the second morphological group from the Holy Cross Mts. (E. Popiel-Barczyk, H. Senkowiczowa, 1989, p. 97, 102, Pl. 1, Figs. 2, 8).

Triplicity of the interior of the umbonal part of the pedicle valve, position of the crural processes in the brachial valve as well suggest also the comparison of the “*Coenothyris*” sp. specimens from Grotów with *Dareithyris vulgaris* Siblik from the Anisian from Iraque (M. Siblik, 1991, p. 171, Figs. 3, 4, Pl. I, Figs. 7, 9). Still there occur differences between those species in their patterns and forms of hinge plates, crural bases and septalium (deeper in specimens from Grotów than in *D. vulgaris* Siblik). Those features in the Grotów specimens display closer similarity to the corresponding features in *C. vulgaris*.

Discussion on the taxonomic importance of the dental plates in the *Coenothyris* genus has not been completed yet (E. Popiel-Barczyk, H. Senkowiczowa, 1989, p. 97). Diagnosis of the genus *Coenothyris* Douvillé in the new description of the Upper Triassic brachiopod material from Yugoslavia has not solved the problem. That is why the poorly preserved specimens from Grotów which display the depression running through the center of the pedicle valve surface and distinct triplicity of the interior of the umbonal part of this valve, have been temporarily classified as “*Coenothyris*” sp. with no new species name.

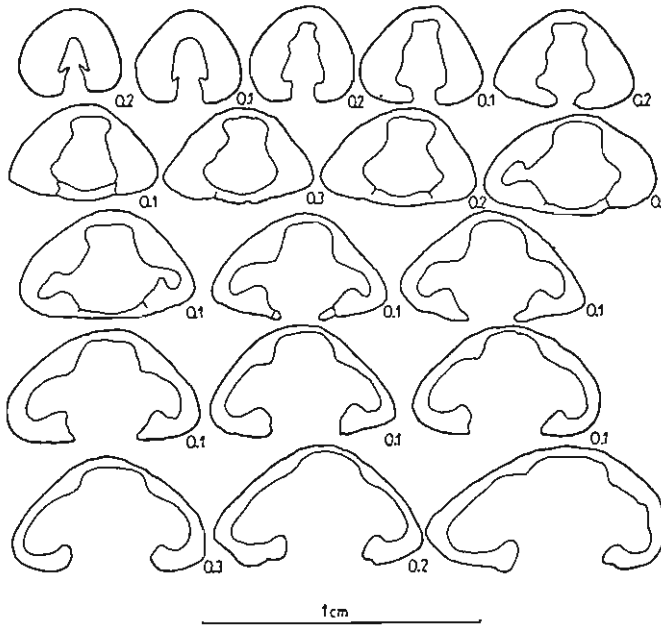


Fig. 5. Serial transverse sections of "*Coenothyris*" sp.; MUZ PIG 1607 (II) 14; L = 17.8 mm, W = 17.6 mm, T = 8.5 mm

Szlify seryjne z „*Coenothyris*” sp.

**O c c u r r e n c e .** Upper Muschelkalk in the Fore-Sudetic Monocline (Grotów P-11).

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#### RAMIENIONOGI Z ŁAWICY TEREBRATULOWEJ GÓRNEGO WAPIENIA MUSZLOWEGO W OTWORZE GROTÓW P-11 (POLSKA SW)

#### Streszczenie

Przedstawiono wyniki badań ramienionogów z ławicy terebratulowej w otworze wiertniczym Grotów P-11 w najwyższej części górnego wapienia muszlowego. Metodą szlifów seryjnych zbadano trzy gatunki

ramienionogów: *Coenothyris vulgaris* (Schlotheim), *C. cycloides* (Zenker) i „*Coenothyris*” sp. (fig. 2–5, tabl. 1).

Stwierdzono duże podobieństwo dwóch pierwszych gatunków do ich odpowiedników z ławicy terebratulowej z Gór Świętokrzyskich (E. Popiel-Barczyk, H. Senkowiczowa, 1989). Trzeci gatunek — „*Coenothyris*” sp. — przypomina morfologią zewnętrzną okaz ilustrowany przez P. Assmanna (1937, tabl. 7, fig. 6a) jako *Waldheimia ladina* Bittner z warstw gogolińskich dolnego wapienia muszlowego Górnego Śląska. Jego morfologia wewnętrzna jest zbliżona do wnętrza *Coenothyris vulgaris* (Schlotheim) z dolnego wapienia muszlowego ze Strzele Opolskich (E. Nowakowski, 1972, tabl. V, fig. 2). Bardzo słaby stan zachowania okazów z Grotowa P-11 nie pozwolił na jego pewne określenie.

Mimo słabego stanu zachowania skład systematyczny zespołu ramienionogów z ławicy terebratulowej z Grotowa jest najbogatszy w porównaniu ze składem tej fauny z odpowiadającej jej *Cycloidesbank*  $\gamma$  w Niemczech (M. Schmidt, 1928; H. Wiefel, J. Wiefel, 1980) i z ławicy terebratulowej górnego wapienia muszlowego w Górach Świętokrzyskich (E. Popiel-Barczyk, H. Senkowiczowa, 1989). Głównym komponentem zlepu są przedstawiciele *Coenothyris cycloides* (Zenker).

#### PLATE I

Figs. 1, 2. Preservation of brachiopod shell interior

1 — longitudinal section of shell; calcite crystals well seen on internal sides of valves and on brachidium, MUZ PIG 1607 (II) 33; 2 — longitudinal section of shell and pedicle valve view on brachidium, MUZ PIG 1607 (II) 37

Stan zachowania wnętrza muszli ramienionogów

1 — przekrój podłużny muszli z widocznymi kryształami kalcytu na wewnętrznych stronach skorupki i na ich brachidium; 2 — przekrój podłużny muszli oraz widok na brachidium od strony skorupki brzusznej

Fig. 3a–d. *Coenothyris vulgaris* (Schlotheim), MUZ PIG 1607 (II) 42

a — brachial valve view, b — pedicle valve view, c — lateral view, d — anterior view

a — widok od strony skorupki grzbietowej, b — widok od strony skorupki brzusznej, c — widok z profilu, d — widok od strony brzegu czołowego

Figs. 4a–c. *Coenothyris cycloides* (Zenker), MUZ PIG 1607 (II) 36

a — brachial valve view, b — pedicle valve view, c — lateral view

a — widok od strony skorupki grzbietowej, b — widok od strony skorupki brzusznej, c — widok z profilu

Fig. 5a–b. *Coenothyris cycloides* (Zenker), MUZ PIG 1607 (II) 35

a — brachial valve view, b — lateral view

a — widok od strony skorupki grzbietowej, b — widok z profilu

Fig. 6. „*Coenothyris*” sp., MUZ PIG 1607 (II) 18

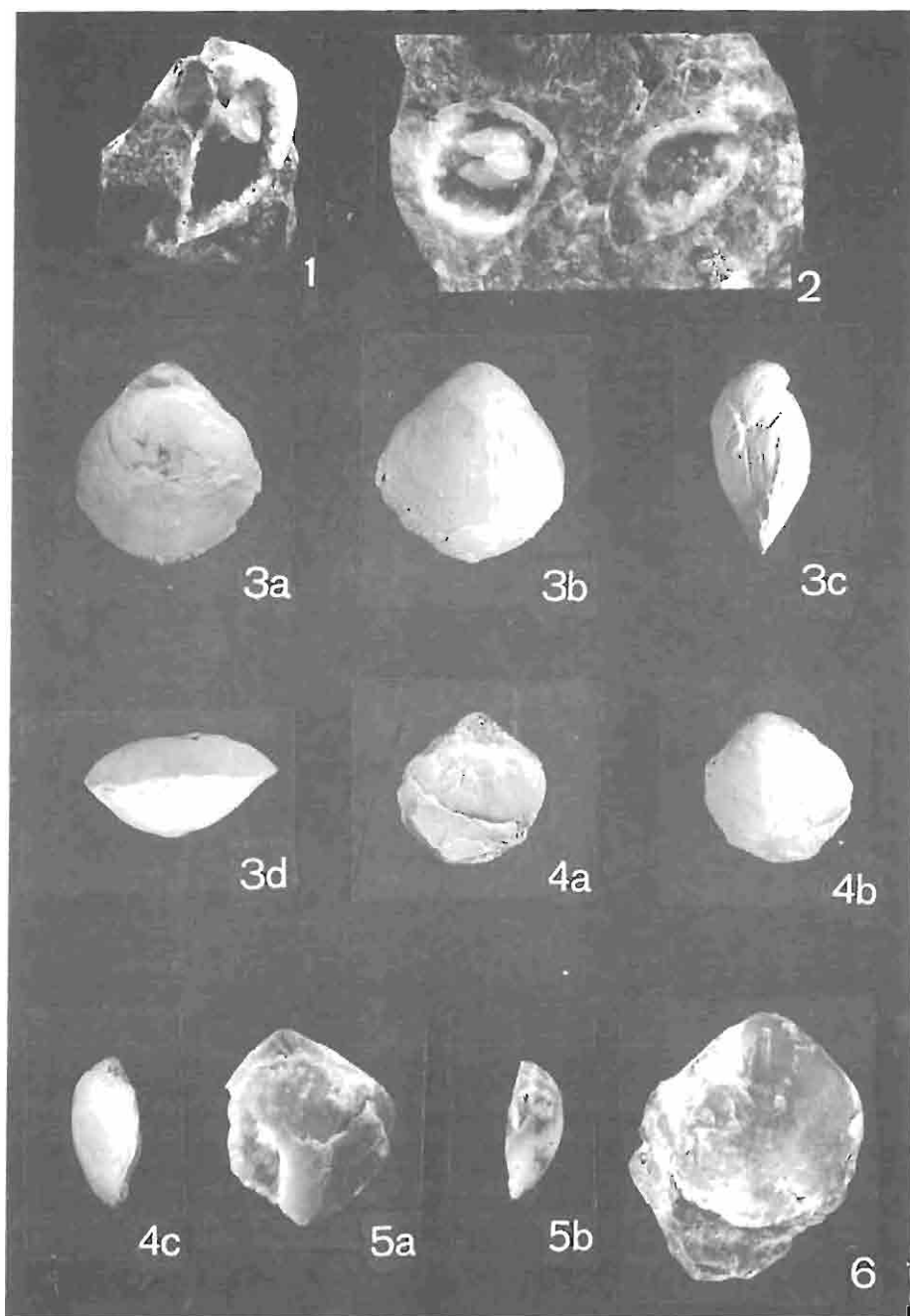
Pedicle valve view showing the depression in the surface center of valve

Widok od strony skorupki brzusznej, w centralnej części bruzda

The Terebratula Bed from the Grotów P-11 borehole, depth of 228.7 m, x 2

Ławica terebratulowa z otworu Grotów P-11, głęb. 228,7 m, 2x

Figs. 1, 2, 5, 6 — phot. L. Dwornik; Figs. 3, 4 — phot. J. Modrzejewska



Hanna SENKOWICZOWA, Ewa POPIEL-BARCZYK — Brachiopods from Terebratula Bed from the Upper Muschelkalk in the Grotów P-11 borehole (SW Poland)