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# SERPULIDAE FROM THE DANO-MONTIAN BORE-HOLE AT BORYSZEW, POLAND

*Abstract.* — Three species of Serpulidae (including a new one), belonging to three different genera which represent the subfamilies: Filograninae Rioja, Serpulinae Rioja and Ditrupinae Regenhardt, are described in the present paper. The material comes from the heap of the Boryszew (near Sochaczew) bore-hole, from depths of 193—207 m, where deposits are assigned to the boundary between Danian and Montian.

## INTRODUCTION

The material for the present work, kindly made available to me by Prof. K. Pożaryska, comes from the heap of the Boryszew bore-hole at depths of 193 to 207 m. It has been enriched by sifting.

Serpulide tubes are not marked by any particular morphological differentiation. Of 200 examined tubes, only 3 species have been identified, belonging to 3 different genera which represent the following subfamilies: Filograninae Rioja, Serpulinae Rioja and Ditrupinae Regenhardt. These species are not sufficiently representative fossils to constitute stratigraphic indexes and it would be impossible to determine, on their basis, the age of beds from the Boryszew bore-hole. They are characterized by a fairly extensive stratigraphic range, the upper boundary of their occurrence being reached in Upper Danian. It is only *Ditrupa (Ditrupa) schlotheimi* Rosenkrantz that is known only from the Middle and Uppermost Danian.

The faunal assemblage, accompanying serpulides, turned out to be variable and more suitable for stratigraphic conclusions. Corals (Różkowska, 1955), spines of echinoids (Kongiel, 1958), foraminifers (Brotzen & Pożaryska, 1957; Pożaryska, 1965), brachiopods (Rosenkrantz, 1964) and bryozoans (Voigt, 1964), described from this locality, although did not suggest univocal conclusions, allowed one to recognize the position of layers at Boryszew as that, situated on the boundary between Danian

and Montian. Kongiel and Rosenkrantz believed that the remains of echinoderms and brachiopods testified to the Danian age of these sediments, whereas Pożaryska and Brotzen, on the basis of an analysis of foraminifers, and Różkowska, on the basis of corals, concluded that in this locality they had to do with the Montian deposits.

A comparative material, concerning the genus *Ditrupa* from Danian of Denmark, which I received from Prof. A. Rosenkrantz, turned out to be very useful to my studies on serpulides from the discussed beds. In addition, when visiting Poland in 1965, Prof. A. Rosenkrantz looked through my material and made several valuable remarks.

I would like to extend my warmest thanks to both Prof. K. Pożaryska and Prof. A. Rosenkrantz for their favours I enjoyed. My gratitude is also due to Miss L. Łuszczewska for taking photographs.

The material described is part of the collections of Palaeozoological Institute of the Polish Academy of Sciences, for which the abbreviation Z. Pal. A. II/1—24 is used.

## Family **Serpulidae** Burmeister, 1837
## Subfamily **Filograninae** Rioja, 1923
## Genus *Glomerula* Nielsen, 1931
## *Glomerula gordialis* (Schlotheim, 1820)

(Pl. I, Figs. 5—10; Pl. II, Fig. 4; Pl. III, Fig. 1)

1826—1833. *Serpula gordialis* Schlotheim; A. Goldfuss, Petrefacta..., p. 234, Fig. 8 a—c; p. 240, Fig. 4.
1956. *Serpula (Cycloserpula) gordialis* (Schlotheim); K. Parsch, Die Serpulidenfauna..., pp. 214—215, Pl. 20, Figs. 15—16.
1961. *Glomerula gordialis* (Schlotheim); H. Regenhardt, Serpulidae..., pp. 26—27, Pl. 1, Fig. 2.
1961. *Glomerula scitula* Regenhardt; H. Regenhardt, *Ibid.*, pp. 27—28, Pl. 1, Fig. 1.
1961. *Glomerula saucia* Regenhardt; H. Regenhardt, *Ibid.*, p. 28, Pl. 1, Fig. 3.
1963. *Glomerula gordialis* (v. Schlotheim); A. Müller, Lehrbuch..., p. 402, Fig. 517.
1964. *Glomerula gordialis* (v. Schlotheim); A. Müller, Ein weiterer Beitrag..., pp. 620—622, Figs. 5—6.
1965. *Serpula (Cycloserpula) gordialis* (Schlotheim, 1820); H. Pugaczewska, Organismes sédentaires..., p. 82, Pl. 6, Figs. 1 a—b.
1965. *Glomerula gordialis* (Schlotheim); H. W. Rasmussen, The Danian affinities..., pp. 35, 38, Pl. 8, Fig. 27.

*Material.* — Fifteen coiled up and about 70, more or less straight, well-preserved tubes.

*Description.* — Tubes cylindrical, irregularly coiled in a bundlelike or meandroid manner, round in cross section. Sometimes, they form helically rising coils of a few whorls (Pl. I, Fig. 5). These whorls adhere to each other, more or less closely, but their lateral walls do not coalesce. Tubes coiled in a single plane, both irregularly and labyrinthically, occur

very seldom (Pl. I, Fig. 9; Pl. II, Fig. 4). Sometimes, a mixed manner of coiling up is observed on a single specimen and particular whorls are situated to each other in different planes (Pl. I, Fig. 7). The material examined contains 3 specimens which at first are coiled up in a bundle-like manner and, then, straighten and form a shorter or longer, slightly bent distal part (Pl. I, Fig. 8). Distal tube sections of this type are mostly met with separately, i.e. broken off. A hooklike bending of the tube or a slight thickening may sometimes be observed in the place of a fracture (Pl. I, Figs. 6, 10; Pl. III, Fig. 1). The tubes are marked by a small diameter of the canal and relatively thick walls. In the smallest specimens, the ratio of the canal diameter to the diameter of the entire tube amounts from 0.2 to 0.5 mm, and in the largest — 0.5 to 1.0 mm. The shape of the cross section through the tube and its inner canal is virtually uniform over the entire length of the tube. Certain deviations from this norm are sometimes observed only in irregularly coiled specimens. Both the thickness of walls and the canal diameter may change independently of each other even over a short section (Pl. II, Fig. 4). The values, given above, of both measured tube diameters are most often met with, but, as results from literature, this species may reach much larger dimensions (Parsch, 1956, p. 214). The outer surface of tubes is smooth, devoid of ornamentation, sometimes uneven or with traces of a small damage. The internal structure, studied on transverse and longitudinal sections, does not depart from that given with the description of *Ditrupa schlotheimi* Rosenkrantz and is identical with that in other representatives of the Serpulidae.

*Remarks.* — In one of my previous papers (Pugaczewska, 1965), I assigned *Glomerula gordialis* to the subgenus *Serpula (Cycloserpula)* Parsch. Then, I had at my disposal only two specimens and, besides, they were attached to the rostrum of a belemnoid. Thus, I could not study them in a more accurate manner. A round cross section through the tubes seemed to be a character sufficiently justifying such a classification. The present, abundant material, thoroughly investigated, induced me, however, to revise my former view and to assign the specimen under study to the genus *Glomerula* Nielsen, 1931. It is marked by a round shape of the cross section, uniform over the entire length of the tube, irregular coiling up of the tube, accompanied by a considerable variability and diversity of forms, a lack of a layer, cementing together particular whorls and a lack of external ornamentation. As a basis for his suggested classification, Parsch primarily adopted the shape of the cross section through the tube near its aperture (Parsch, 1956, p. 213). However, in the fossil material, it is only in exceptional cases that the apertural part of tubes are preserved. Mostly, we have to do with damaged specimens, broken at different distances from the aperture. The shape of the apertural

cross section through the tube cannot, therefore, constitute a criterion which would be sufficient, in practice, for erecting new taxonomic units.

*Glomerula gordialis* is marked by a broad range of variability, manifested by a different manner of coiling up of tubes and, therefore, in my opinion, there is no need whatever for erecting, on this basis, two new species, as it has been done by Regenhardt (1961). *Gl. scitula* Reg. represents a form, coiled up in a bundlelike manner, while *Gl. saucia* Reg. forms whorls which rise around an initially straightened tube. Both these forms are contained within the variability range of *Gl. gordialis* and, therefore, I included them in the synonymy of this species. My opinion in this respect is in a complete conformity with Müller's view (1964, pp. 621—622). The variability of this type depends on the influence exerted by the environment to which serpulides react in a very lively manner (Grassé, 1959, p. 704; Müller, 1964, p. 622). Different manners of coiling up the tube of an organism in different stages of its ontogeny, are illustrated by Müller by means of a well-preserved material. At the beginning of the development, the tube is straight, afterwards, twists in meandroid whorls and, finally, forms coils with irregular whorls (Müller, 1964, Figs. 5, 6).

The assignment of the genus *Glomerula* to the subfamily Filograninae Rioja is justified by such characters as the variability of manners in which the tube is coiled up, the round cross section, uniform over the entire tube length, the lack of a layer cementing particular whorls, the abundant occurrence etc. The presence or absence of 1 or 2 opercula is also mentioned in the modern, zoological characteristics of the subfamily Filograninae. In the fossil material, however, such opercula have not been found so far (Regenhardt, 1961, p. 23).

*Occurrence.* — The tubes of *Gl. gordialis* have a very wide geographic and stratigraphic range. They are known from the Lias to the Uppermost Danian. It is in particular in the Cretaceous that it occurs on the areas of transgressive coastal regions of great massifs of Westphalia, Saxony, Harz Mountains, Silesia, England and France. In Denmark, it is known from the Uppermost Danian, whereas in Belgium — from the "Tuffeau de Ciply" formations of the Middle Danian and, in the Netherlands — from the Upper Maastrichtian (Rasmussen, 1965, p. 35). In Poland, it occurs in the Upper Cretaceous of the environs of Mielnik on the Bug, in numerous outcrops of the middle course of Vistula and in the Dano-Montian formations of the Boryszew bore-hale.

Subfamily **Serpulinae** Rioja, 1923

Genus *Cementula* Nielsen, 1931

*Cementula boryszewiensis* n.sp.

(Pl. III, Figs. 2—5)

*Holotype*: The tube of a serpulide; Pl. III, Figs. 5 a—b (Z. Pal. A. II/1.

*Type horizon*: Boundary layers between the Danian and Montian, glauconite sands.

*Type locality*: Bore-hole at Boryszew near Sochaczew; depth of 193—207 m.

*Derivation of the name: boryszewiensis* — after the locality Boryszew.

*Diagnosis.* — Tubes cylindrical, attached to the substratum and forming numerous whorls perpendicular to each other; they are round in cross section and encircled by an outer layer with uneven surface.

*Material.* — Ten tubes, more or less fragmentary, one of them almost complete.

*Description.* — Tubes cylindrical, round in cross section which decreases together with the animal's growth. They are coiled up, forming numerous whorls with a characteristic course. The first whorl, about 8 mm in diameter, lies in a horizontal plane. The next is perpendicular to it. Both these whorls are loosely coiled and, despite a thick cementing layer, the boundary between them is distinct. The next three whorls, with ever decreasing diameter and very closely adhering to each other, are formed in the same position as the first two. The cementing layer covers them on the outside with a uniform coating, so that the boundaries are visible only after the destruction of this layer. These whorls display a trochoidal coiling up (Pl. III, Fig. 5a).

The cementing layer also forms a base with which the tubes are attached to the substratum. It lines the first whorl from the bottom side and — on its margin — forms a drooping fold. In loose whorls and at the base, this fold is the thickest (0.6 mm), while in internal whorl the thickness decreases to 0.4 mm (Pl. III, Figs. 5 a—b). Both the thickness of the tube and diameter of its canal decrease with the growth of serpulide. The diameter of external whorls amounts to 1.5 mm and of internal — to 1.0 mm. The diameter of the canal decreases from 1.0 to 0.6 mm respectively.

The external ornamentation of the tube consists of numerous, fine, concentrical growth lines which are visible only on the inner surface of the cementing layer (Pl. III, Fig. 2). The surface of this layer, covering the tubes, is uneven with fine granulation or asymmetrical tubercles often observed on it. Sometimes, there occur transverse wrinkles or longitudinal thickenings. All these elements were formed as a result of a strong differentiation of the cementing layer and, under such circumstances, there is hardly any proper ornamentation to speak about. Most often, there are three longitudinal thickenings occurring on relatively short sections of the convex part of a whorl. Sometimes, these are uniform ridges, sometimes differently sized tubercles, closely adhering to each other (Pl. III, Fig. 4). Some tubes of *C. boryszewiensis* display disturbances in the uniformity of the increase of their length and width. This is manifested by the formation of considerable contractions, which

are probably related to the periods of rest (Pl. III, Fig. 3), during which the increase in the tube width is arrested.

*Remarks.* — *Cementula boryszewiensis* n.sp. does not resemble any other of the described species of the genus *Cementula*. It is distinguished by several characters. The manner of coiling up of the tube from the outside to the centre occurs also in *Spiraserpula adunca* Regenhardt (Regenhardt, 1961, p. 44), but its whorls are disposed planispirally and it is only the apertural part that rises vertically. *Cementula contorta* Nielsen (Nielsen, 1931, p. 108, Pl. 3, Fig. 5) is truly enough coiled in two planes perpendicular one to another, but its internal whorls are directed downwards and represent a regular spiral. The layer cementing together the whorls has never been observed to be as strongly developed and to display as variable shaping of the surface as it is recorded in *C. boryszewiensis*.

The assignment of *C. boryszewiensis* to the genus *Cementula* Nielsen (Nielsen, 1931, p. 85) seems to be justified by all means. This genus is characterized by an irregular manner of coiling up of the tube and by a strongly developed cementing layer, which obliterates the boundaries between particular whorls. In addition, it includes serpulides which attach themselves to the substratum. In diagnosis of this genus, Nielsen mentions one more character, i.e. a uniform cross section of the tube over its entire length. However, a slight decrease in the tube diameter with the growth of the animal, recorded in *C. boryszewiensis*, cannot be a sufficient reason for erecting a new genus for this Polish species.

*Occurrence.* — Boryszew near Sochaczew; Dano-Montian glauconite sands.

## Subfamily **Ditrupinae** Regenhardt, 1961
## Genus *Ditrupa* Berkeley, 1835
## Subgenus *Ditrupa (Ditrupa)* Regenhardt, 1961
## *Ditrupa (Ditrupa) schlotheimi* Rosenkrantz, 1961

(Pl. I, Figs. 1—4; Pl. II, Figs. 1—3)

1920. *Ditrupa Schlotheimi* Rosenkrantz; A. Rosenkrantz, Craniakalk..., p. 25, Pl. 2 Figs. 8—9.
1931. *Ditrupula Schlotheimi* (Rosenkrantz); K. Nielsen, Serpulidae..., p. 95.
1958. *Ditrupula schlotheimi* (Ros.); R. Kongiel, O kolcach jeżowców..., p. 3.
1961. *Ditrupa (Ditrupa) schlotheimi* Rosenkrantz; H. Regenhardt, Serpulidae..., p. 72 p. 104.
1965. *Ditrupa schlotheimi* Rosenkrantz; H. W. Rasmussen, The Danian affinities..., pp. 35, 38, Pl. 8, Fig. 26.

*Material.* — About 100, more or less damaged tubes. Some of them with apertural parts preserved. Initial parts have not been found.

*Description.* — External morphology (Pl. I, Figs. 1—4). Tubes more or less long, cylindrical, slightly arcuate, open at both ends, round in cross section, which increases with the growth. In the middle of a convex tube, or slightly laterally, there are often visible elongated furrows, variable in length, width and depth. Sometimes, these furrows stretch over a considerable length of the tube below the apertural section (Pl. I, Fig. 4) or, in other cases, their trace may be discontinuous and, hereafter, either continued, along the same line, or slightly deviate from it (Pl. I, Fig. 3). More often, there are observed short, deeper furrows which give the impression of being rather the result of an accidental damage of the tube surface, and not the proper furrows (Pl. I, Fig. 1). Most frequently, the outer surface of tubes is rough, devoid of ornamentation and having only slightly outlined transverse folds, thickenings or poorly visible growth lines (Pl. I, Fig. 2). A short apertural part, tapering in a funnellike manner, may be observed in better-preserved specimens. Sometimes, it is covered with a thickened ring which, however, easily comes away (Pl. I, Fig. 2).

The ratio of the increase in the length of tubes to the increase in their width, is not always uniform. Frequently, some tube reaches, over a shorter length, the same width as another tube over twice as long a stretch. Mostly, however, these ratios are uniform and slight deviations fall within limits of the individual variability. In the material under study, the length of tubes does not exceed 12 mm, with a maximum diameter being 1.5 mm, and minimum — 0.8 mm. We may, therefore, assume that over a length of 12 mm, the width of the tube increases by about 0.7 mm. The dimensions of five tubes are given below (Table 1).

Table 1

Dimensions (in mm) of tubes of *D. (Ditrupa) schlotheimi* Ros.

| Cat. No. Z. Pal. A. II | 20 | 21 | 22 | 23 | 24 |
|---|---|---|---|---|---|
| Length . . . . . | 10.1 | 10.0 | 11.0 | 12.0 | 6.0 |
| The smallest diameter. . . | 0.8 | 0.8 | 0.9 | 1.0 | 1.0 |
| The largest diameter . . . | 1.1 | 1.2 | 1.4 | 1.2 | 1.5 |

*Internal structure* (Pl. II, Figs. 1—3). A bilamellar structure of tubes has been stated in the longitudinal and transverse sections. The thickness of the outer layer exceeds at least four times the thickness of the inner layer (Pl. II, Figs. 1—3). Both these layers are built of numerous, fine lamellae which — in the outer layer — are arranged in a parabolic system with the external branch of the parabola about twice as long as the internal one (Pl. II, Fig. 3; Müller, 1963, p. 398, Text-Pl. 6). The apex of parabola points in the direction of the tube aperture. Lamellae of the

inner layer run parallel to the external walls of the tube (Pl. II, Fig. 2). The cross section through the place, where the elongated furrow runs, illustrates the manner in which this furrow was formed, since some lamellae of the outer layer wedge out in this place and, depending on the number of such wedged out lamellae, the furrow may be deeper or shallower. The inner layer does not participate in the process of the formation of the furrow and its thickness is uniform over the entire length of the tube (Pl. II, Fig. 2). An apertural contraction of the tube is also formed at the cost of the outer layer, but, in this case, many lamellae of the outer layers wedge out around the tube, so that the ultimate thickness of both layers encircling aperture remains unchanged.

*Remarks.* — In the material examined, the length of tubes does not exceed 12 mm and their maximum cross section — 1.5 mm. However, they may reach a length of 40 mm, their cross section increasing simultaneously to 1.6 mm (Rosenkrantz, 1920, p. 25). Thus far, no tubes of this species have been found with preserved apical ends. Most authors presume that this was the end, by means of which they were attached to the substratum, or with which they were stuck in the sediment (Regenhardt, 1961, pp. 69, 70). Other authors believe that these were tubes open on both ends and free-laying on the bottom (Müller, 1963, p. 400; Nestler, 1965, p. 79). On the basis of more recent observations on the species *Ditrupa (Tetraditrupa) conteriata* (v. Hagenow), Müller (1964, p. 618) sets up a supposition that other species of the genus *Ditrupa* at first also attached themselves to the substratum and hereafter detached themselves and sealed up the aperture with calcite, secreted by anal glands. Such a manner of protecting and mending damaged parts is, according to Müller, known also in Recent serpulides. Consequently, these observations would knock the bottom out of the views, predominating so far, concerning the tubes of species of the genus *Ditrupa* being open on both ends. In the fossil material the most frequent are broken-off tubes, in particular those in which the fracture occurs in their apical parts.

Regenhardt (1961) has rightfully distinguished several subgenera within the genus *Ditrupa*. *Ditrupa* (*Ditrupa*) includes the forms with a round cross section and distinctly separated, tapering apertural part which, very often, is swollen in a nipplelike manner. Forms with a polygonal cross section, devoid of the separated apertural part, such as *Ditrupa (Triditrupa), D. (Tetraditrupa), D. (Pentaditrupa)* and others (Regenhardt, 1961, p. 69), represent other subgenera of the genus *Ditrupa*.

The comparative material from the Danian of Denmark displays identical specific characters with this from Poland material. Certain slight differences consist in somewhat larger dimensions of the specimens from Denmark, and a more frequent presence of concentrical folds on the tube surface.

*Occurrence.* — This species is known from the Uppermost Danian of Denmark, from the Middle and Upper Danian of Belgium and from the Dano-Montian beds of the Boryszew bore-hole in Poland.

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HALINA PUGACZEWSKA

## SERPULIDAE Z DANO-MONTU WIERCENIA W BORYSZEWIE

*Streszczenie*

W pracy opisano rurki 3 gatunków serpul: *Glomerula gordialis* (Schlotheim, 1820), *Cementula boryszewiensis* n.sp. i *Ditrupa* (*Ditrupa*) *schlotheimi* Rosenkrantz, 1961. Zbadano szczegółowo ich morfologię zewnętrzną i wewnętrzną, zmienność i stanowisko systematyczne. Rurki, pozbawione zewnętrznej warstwy pokrywającej, nie wykazują ornamentacji (*Glomerula gordialis* (Schloth.), niekiedy tylko zaznaczają się na ich powierzchni poprzeczne fałdki lub drobne linie przyrostu (*Ditrupa* (*Ditrupa*) *schlotheimi* Ros.). W przypadku występowania zewnętrznej warstwy pokrywającej, na powierzchni rurki występują poprzeczne fałdki, guzki i podłużne zgrubienia (*Cementula boryszewiensis* n.sp.). Analiza przekrojów poprzecznych i podłużnych rurek wykazała ich dwuwarstwową strukturę. Obie warstwy zbudowane są z cienkich blaszek, które w warstwie zewnętrznej mają układ paraboliczny, zaś w wewnętrznej równoległy do ścianek rurki. Wykazano także, iż kosztem warstwy zewnętrznej powstają zarówno podłużne bruzdki na powierzchni rurki, jak i jej przyujściowe zwężenie (*Ditrupa* (*Ditrupa*) *schlotheimi* Ros.). Szeroki zakres zmienności rurek serpul, przejawiający się w różnym sposobie ich zwinięcia, nie pozwala uznać za odrębne gatunków opisanych przez Regenhardta (1961): *Glomerula scitula* Reg. i *Gl. saucia* Reg., które autor niniejszej pracy włączył do synonimiki *Gl. gordialis* (Schloth.).

ГАЛИНА ПУГАЧЕВСКА

# ДАТСКО-МОНТСКИЕ SERPULIDAE ИЗ БУРЕНИЯ В БОРЫШЕВЕ, ПОЛЬША

*Резюме*

Автор описал трубки 3 видов серпуль: *Glomerula gordialis* (Schlotheim, 1820), *Cementula boryszewiensis* n. sp. и *Ditrupa (Ditrupa) schlotheimi* Rosenkrantz, 1961. Детально изучено их внешнюю и внутреннюю морфологию, изменчивость и систематическое положение. Трубки, которые лишены внешнего покрывающего слоя, не обнаруживают орнаментации (*Glomerula gordialis* (Schloth), иногда только на их поверхности выступают поперечные складочки, или же мелкие линии нарастания (*Ditrupa (Ditrupa) schlotheimi* Ros.). В случае наличия внешнего покрывающего слоя, на поверхности трубки выступают поперечные складочки, бугорки и продольные утолщения (*Cementula boryszewiensis* n. sp.). Анализ поперечных и продольных разрезов трубок обнажил их двуслойную структуру. Оба слоя построены из тонких пластинок, которые в наружном слое имеют параболическое расположение, а во внутреннем — параллельное к стенкам трубки. Указано тоже, что за счет наружного слоя образуются продольные бороздки на поверхности трубки и ее приустьевое сужение (*Ditrupa (Ditrupa) schlotheimi* Ros.). Широкий предел изменчивости трубок серпуль, проявляющийся в разном способе их свернутости, не позволяет считать, как особые, виды описанные Регенгардтом (Regenhardt, 1961): *Glomerula scitula* Reg. и *Gl. saucia* Reg.; формы эти включены автором настоящей работы в синонимику *Gl. gordialis* (Schloth.).

# PLATES

## Plate I

*Ditrupa (Ditrupa) schlotheimi* Rosenkrantz

Fig. 1. Fragment of a tube contracted at the aperture, with a short, very deep furrow (Z. Pal. A. II/12).

Fig. 2. Fragment of a tube with an apertural swelling and transverse folds on the surface (A. II/13).

Fig. 3. Fragment of a tube with a discontinuous and rather shallow furrow (A. II/14).

Fig. 4. Fragment of a tube with a distinct, long and deep furrow (A. II/15).

*Glomerula gordialis* (Schlotheim)

Fig. 5. A tube with spirally rising whorls (A. II/6).

Figs. 6, 10. Fragments of tubes, slightly arcuate and with a hooklike or swollen trace of breaking off (A. II/7 and 11).

Fig. 7. A tube with two whorls perpendicular to each other (A. II/8).

Fig. 8. Part of a tube, coiled up in a bundlelike manner and with a straightened terminal fragment (A. II/9).

Fig. 9. A tube with labyrinthic whorls (A. II/10).

All figures ×13

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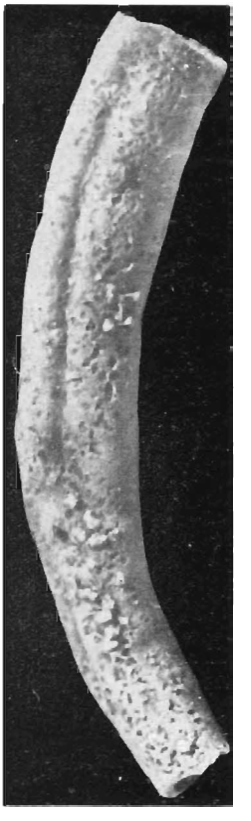

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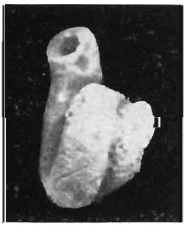

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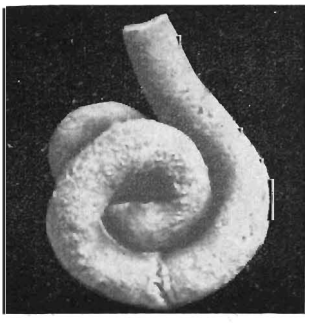

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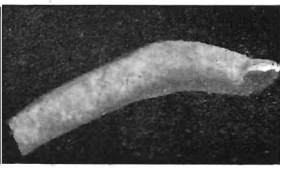

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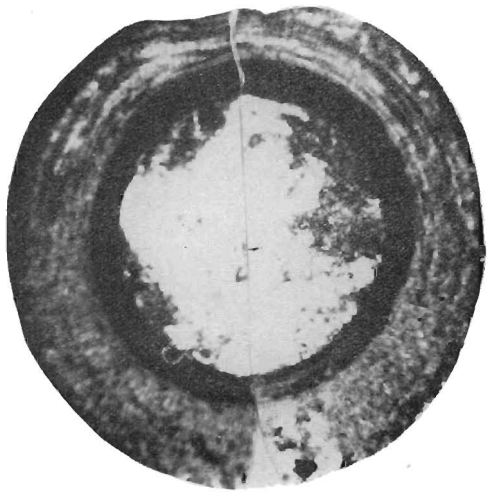

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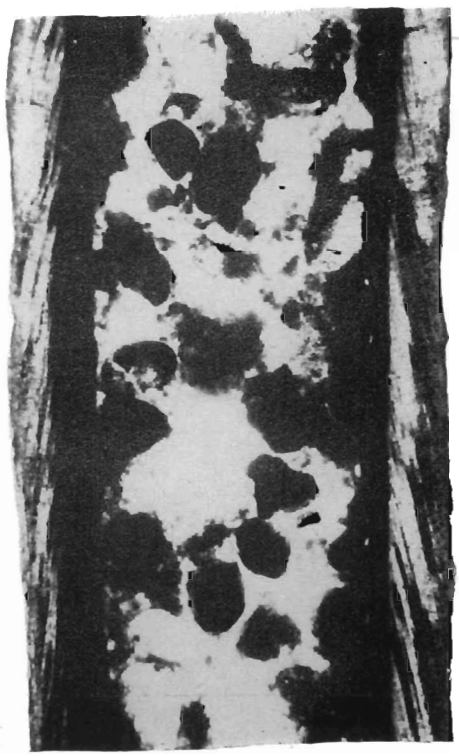

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## Plate II

*Ditrupa (Ditrupa) schlotheimi* Rosenkrantz

Fig. 1. Cross section showing the distinct microstructure of both layers, different in thickness (Z. Pal. A. II/16); ×45.

Fig. 2. Cross section in the place where the oblong furrow runs, showing wedged out lamellae of the outer layer (A. II/17); ×45.

Fig. 3. Longitudinal section, showing the oblique arrangement of lamellae of the outer layer (A. II/18); ×60.

*Glomerula gordialis* (Schlotheim)

Fig. 4. Longitudinal section of the tube, coiled in a bundlelike manner, showing the variable cross section and thickness of its walls (A. II/19); ×20.

## Plate III

*Glomerula gordialis* (Schlotheim)

Fig. 1. S-shaped fragment of a tube, slightly swollen in the place of fracture (Z. Pal. A. II/5).

*Cementula boryszewiensis* n.sp.

Fig. 2. Fragment of a cementing layer with impressed growth lines (A. II/2).
Fig. 3. Fragment of a whorl with distinct contraction, formed during the resting period (A. II/3).
Fig. 4. Fragment of a whorl, ornamented with a row of tubercles.
Fig. 5*a*. Fragment of a coil with whorls running in two planes. Inner whorls are coiled up trochoidally (A. II/1).
Fig. 5*b*. The same fragment, viewed from an opposite side, showing part of the base of attachment (A. II/1).

Figs. 1-4 and 5*b* ×13; Fig. 5*a* ×10.

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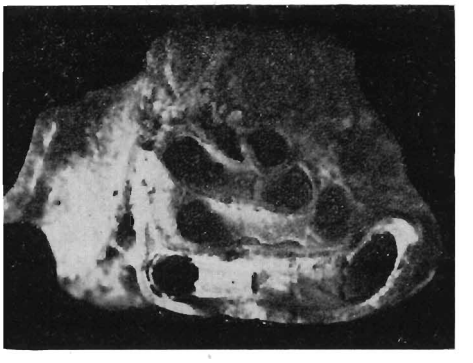

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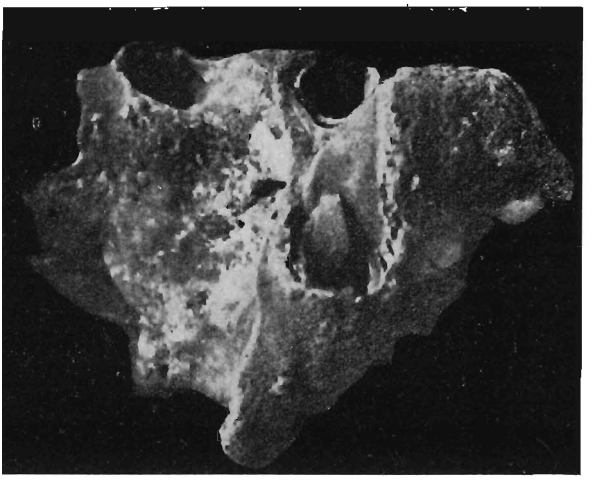

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