Otwornice czerwonych iłów z Wadowic.

Przez

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(Z czterema tablicami).

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Original title page of Grzybowski's (1896) Wadowice study

The Foraminifera of the Red Clays from Wadowice

by

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(with four plates)

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Until recently, fossils from the Carpathian flysch were unknown, except for a few specimens from the Carpathian Cretaceous, some fossil fish from the Menilite beds, and some rather rare nummulites. However, the Carpathian flysch does harbour a rich fauna of microscopic organisms that are more or less abundantly represented in nearly all of its layers.

Inconspicuous to the unaided eye, they almost never reveal their presence and for this reason, no attention was paid to them for a long time. At first the larger species, those which can be seen with the naked eye, such as *Nummulites, Alveolina, Cristellaria* where observed. Thanks to these species and especially to the nummulites, we could clarify various hypotheses about the age of the Carpathian sandstone and correctly place it in the Tertiary, thereby disproving the hypothesis of a supposed Paleozoic age that was popular during Pusch's time in the first half of this century.

Because of their relatively small size, nummulites require careful observations of the rocks that contain them. For this reason, other forms visible to the naked eye were also recognized. In the recent Carpathian literature we often find passing references to foraminifera in the works of Dr. Szajnocha, Dr. Kreutz, Dr. Zuber, Dr. Dunikowski, councilman Walter, as well as in the works of the German geologists working in the Galician Carpathians during the last twenty years.

Uhlig (1886) was the first to pay close attention to these small organisms. In the conglomerate from Wola Łużańska, which is full of fragments of *Lithothamnia, Orbitoides* and *Nummulites*, he discovered and described other smaller foraminifera. The petrographic similarity between the deposits from above mentioned locality and the Folusz beds near Dukla was brought to attention by Prof. Szajnocha. The results were presented in a second publication about the Carpathian microfauna [Grzybowski, 1894].

The lack of distinctive fossils has inspired attempts to search for microscopic palaeontological material in other flysch deposits, although not in the Carpathians.

Feliks Karrer, one of the best known foraminifera experts, had the insight to look for foraminifera in clays and marls of the Vienna sandstones. In his publication, Karrer (1865) states:

> " Der nahezu vollständige Mangel an grösseren thierischen Versteinerungen, welcher die in der Umgebung unserer Residenz befindlichen Partien des Wiener-Sandsteins auszeichnet, veranlasste mich den Versuch zu machen, durch vorsichtiges Schlämmen der in den kalkigen Zonen mitunter gar nicht umbedeutenden margeligen Zwischenlagen, wenigstens kleine mikroskopische Organismen, namentlich Foraminiferen zu erlangen". And

farther down: "Der Erfolg war aber kein günstiger" etc.

Karrer inspected the fauna from several localities but only in the sample from Hüttendorf did he find a poor assemblage of foraminifera consisting of a dozen or more mainly new species. He did not continue this research any further.

Prof. Rzehak from Brno studied the foraminifera in greater detail. He studied the nummulite and orbitoides beds in Moravia and Lower Austria, as well as the gray and blue clays (they are comparable to red clays from the Galician Carpathians). As a result, he published a few papers in the Annalen des Hofmuseums (1888, 1891) and an index of species plus several notes in the Verhandlungen der geolog. Reichsanstalt (1982, 1887, 1888).

Encouraged by the results of the pioneer microfaunal studies, I began paying closer attention to the foraminifera. As previously, I tried to locate sites similar to the beds from Wola Luzanska and Folusz. Unfortunately, the results were not promising. It was not until I examined the drilling material from oil wells that the search yielded better results. H. Walter, the councillor for the mining affairs, suggested to the State Council to initiate active support of foraminiferal research. These results can be utilized by the petroleum industry. Thanks to the financial support from the State Department, encouragement from Prof. Dr. Szajnocha, and the help of Mr. H. Walter, the geological department of the Jagiellonian University has in its possession a large collection of foraminifera from many localities in Galician Carpathians, including material from the oil wells and outcrops.

A complete compilation of all this material is behind the scope of a single publication. Under the different circumstances, where only the species identification and description would be given, it might be possible to compile related material from various localities in one publication. Although in our case, where the foraminifera are the only palaeontological material, we will describe them separately to present detailed and systematic studies of given beds and the superposition of beds with regard to their ages. Any other approach, such as compiling forms from different levels in a single publication would lead to disarray. I will begin with the localities already described.

In 1893 digging began in Wadowice on an exploratory shaft, since coal was believed to occur at this locality. By the following year, however, after digging down to 84 m the work was halted. The exploratory coal shaft is located not far from the town of Wadowice on a hill about 500 m to the southwest of the courthouse.

Thanks to councillor Walter and attorney Dr. J. Daniel from Wadowice who collected and sent samples of the recovered material to our geological department, we were able to compile the following profile of layers in this shaft.

1 - 26 m.	Thin-bedded sandstones alternating with sandy shales rich in muscovite, containing sphaerosiderites in the lowermost part. The same layer can be sampled in an outcrop located by the road farther down in the north-west direction on the side of the same hill.
26 - 64 m.	Gray claystone with intercalated marls, with lustrous smooth surface, and with partings of green clay with abundant pyrite.
64 - 70 m.	Red clays with intercalated white sugary-grained sandstone.
70 - 80 m.	Black bituminous shales.
80 - 84 m.	Menilite shales. Drilling was stopped at this layer.

The direction of the beds in the pit is 14 hours[1] with a weak dip towards the south.

The uppermost layers of this sandstone do not show any characteristic traits. Although the occurrence of white marls among the gray claystones is rather rare for the Carpathians. I only know of one other locality in the central

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[1] *[Grzybowski used the "hour" notation. 14 hours = 210°]*

Carpathians in the village of Bezmichowa near Lisko, where intercalations of pyritic marls are found overlying the red claystones.

Pyrite occurs in intercalated lustrous, green, dense, clay. They are interspersed in this clay as grains of different size, starting from ones the size of a poppy seed up to ones that look like rounded or kidney-shaped fist-sized clumps.

The red clays are like homogeneous layers of dense, hard material, which can be rolled and polished when dry. Their colour is uniform, more pink than red. In this clay a 5-cm-long piece of belemnite was found that must have been redeposited. There are other instances of belemnites found at other localities in the Carpathians but not very often. A belemnite was also found in the Silesian Carpathians within the Eocene sandstone, and Alth also cites a similar discovery from Rungurska Sloboda.

The black bituminous shales with smooth and lustrous bedding planes already belong to the Menilite shales. These shales contain numerous fish remains. In the Geological Department Collection we have a large, 2-cm-long fish tooth marked by Prof. Szajnocha as *Lamna cuspidata* Agassis. Among other indeterminate remains, we have two specimens marked by Prof. Szajnocha as the main plate from *Echeneis* sp. These plates are 4 cm long, ca. 1-3 cm wide, and have distinct ornamentation.

The Menilite shales proper, which form the lowest layer in the Wadowice shaft, are present here in their limey facies. After they have been weathered, they become light gray in colour and they are easily visible on the top of the tailings heap. On freshly broken surfaces, their colour remains light chocolate brown. These shales contain many small fish remains such as scales, rare fin ichthioliths, jaws and gill arches. On one of these fragments, we found a small, ca. 3-cm-long fish specimen that could not be clearly identified. The gray colour of these shales is interrupted by ribbons of lighter coloured shale. The same type of shales were also found 1.5 km west of the shaft in the village of Choczew on the way to Andrychów, in the streambed just above the bridge over the Choczewka River. These shales contain intercalated cherts, 2-10 cm in thickness. Their stratigraphic position is in agreement with the one observed in the shaft, 14 h. [210°], 15°S, but neither the bottom nor the top of these shales is visible in the river banks. Judging by the strike and the dip of these shales, they most likely represent the more cherty, lower part of the Menilite beds occurring in the exploratory shaft, but which I did not find on the tailings heap. I observed a similar type of Menilite beds in Turza and Sietnica on the road from Bobowa towards Skolyszyn near Jaslo and in the town of Srogowa south of Sanok, where the Menilite beds contain similar fish remains, and in Poreba south of Tarnów.

The layer that contains the greatest number of foraminifera in the Wadowice exploratory shaft is the red clay. Once wetted, the clay disaggregates first into small platey fragments and then after repeated boiling for a few hours it dissaggregates completely into a fine suspension, which when sieved through a fine batist cloth passes through almost completely, leaving only 0.1% of coarser particles comprised almost exclusively of organic remains. Even the few loose quartz grains that were left behind probably belonged to damaged tests of agglutinated foraminifera. The foraminifera are less abundant in the marls lying on top of the red clay layer and are least abundant in the green pyrite-bearing clays. These marls are compact and hard, difficult to wash, and did not disaggregate until after several freezings and boilings. The green clay disaggregates easily, leaving small grains of pyrite with a few foraminifera after sieving. The black bituminous shales would not soften at all despite numerous attempts, and in the small amount of residue generated during this process only fish remains were found, without even a trace of foraminifers. The Menilite shales examined in thin section showed a large amount of small indeterminate tests belonging to the genus *Globigerina*.

The microfauna of the above mentioned layers consists exclusively of foraminifera.[2] The fauna of the green pyrite-bearing clays and the marls is very similar. These layers occur only as intercalations in the gray clays and for this reason I presented them together, separating from them the quite different fauna of the red clays. Of the 112 recognised species, 77 belong to the red clays, and 44 species belong to the marls and the green clays. Only nine species were common to both horizons. Of these species, *Cristellaria cymboides* and *Sphaeroidina austriaca* are known from the upper Eocene to the Miocene. *Nodosaria calomorpha* characterizes the Oligocene; *Reophax pilulifera* still occurs in modern seas, and the rest have more restricted occurrences. These 112 species belong to 39 genera, all of which are represented in the classification of Brady except the Gromidae, Chilostomellidae and Nummulitidae.

Miliolidae are found only in two genera and species, one of which is very rare, and the second, *Keramosphaera irregularis* n.sp. belongs to the typical foraminifers of marls and green clays due to its common occurrence.

The Astrorhizidae, with four genera and nine species, are also rare. Only *Rhabdammina* is more abundant. This family occurs mostly in the red clays. I only found two of these species in the marls, one of which occurred commonly in the red clays.

Lituolidae consist of five genera in 26 species also mostly belonging to the red clays. In the marls, there are only 10 species, two of which were also common in the red clays. They are very sparse in the marls except for *Ammodiscus charoides*, which is very typical of these layers. In the subfamily Loftusinae, we have one genus and four species, equally separated into two levels. Their most common genera are *Cyclammina suborbicularis* Rzehak and *Cyclammina retrosepta* n.sp.

Textularidae are very common, and have 10 genera with 20 species. Almost all the dominant forms in the red clays belong to this family such as *Textularia subhaeringensis* n.sp. *Verneullina abbreviata* Rzehak, *Verneullina szajnochae* n.sp. The genus *Gaudryina* with its three species belongs exclusively to the marls.

Lagenidae are represented by 10 genera with 27 species, and are typical of the red clays. They are rather rare because only three forms are commonly found: *Dentalina laticollis* n.sp., *Robulina cincta* and *Robulina pectinata*. There are only eight species in the marls, two of them are in common with the red clays. but overall, all of them rare.

Globigerinidae which have three genera and five species are typical of the upper levels. *Globigerina triloba* is commonly found in this level. Also an abundant species in this level is *Sphaeroidina austriaca*, which is the only representative of this family in the red clays.

Rotalidae consist of four genera with 13 species, out of which nine are present, rarely, in the marls and five in the red clays. These are more abundant in the clays, especially two species: *Truncatulina hantkeni* and *Pulvinulina subcandidula*.

The characteristic feature for the Wadowice fauna is the abundance of siliceous and agglutinated forms. These comprise 48% of all species and the majority of them belong to deep water forms, which allows us to conclude that these are deep water sediments.

As far as systematics and phylogeny of foraminifera is concerned, it is noteworthy to mention the presence of the new types such as *Lagena*, which could not be placed in the present definition of this genus. I proposed the new name *Cidaria* for the fourth subgenus of *Lagena*. It is also worth noting the more abundant occurrence of the genus *Haplophragmium*, a form built like a variety of *Globigerina*. Until now, only one form of this genus, *H. globigeriniforme* Brady, was known from the modern seas. To clarify the description and to show the genetic connections, it would be necessary to separate this form into a subgenus,

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[2] *[A taxonomic revision of this fauna was carried out by Liszka and Liszkowa (1981).]*

which I call *Reussina*[3]. This fact would be very helpful for the future taxonomist because forms with a similar structure are also found in the genus *Trochammina* (*T. pauciloculata* Brady). This observation also could provide useful material for a further elaboration of Neumayer's hypothesis (Die Stamme des Thierreiches, Foraminifera) about the genetic connection of isomorphic calcareous and agglutinated foraminifers[4].

In regard to the age of the Wadowice fauna there are two known horizons that show close similarity to the Wadowice fauna. These are the green clays from Nikoltschitz, that according to Rzehak correlate with the lower Ligurian stage[5], and the Septarian Clays that belong to the upper Tongrian[6] stage. There are also certain analogies with the Bartonian *Clavulina Szaboi* beds described by Hantken. The numeric relations are presented in the following table [Table 1].

The Wadowice fauna has 27 occurrences in common with the Nikoltschitz fauna. These consist of 50% species previously known and described (in the Wadowice fauna out of 112 species, there are 55 new). The Wadowice fauna shares 21 species in common (or 37%) with the Septarian Clays, 10 species (or 17%) with the Bartonian fauna, six (or 10%) with the lower layers, and 12 (or 21%) with the Miocene. Therefore the Wadowice fauna has most in common with the Nikoltschitz fauna and the Septarian Clays. From this we can conclude that the Wadowice fauna belongs between these two layers, but is closer to the Nikoltschitz fauna.

For comparative studies we can only utilize the last four families from the list given above. The previous families, despite the large number of species (40), are nearly absent from the Septarian Clays. We cannot take into account the three species of *Haplophragmium*, and of the Miliolidae only two genera and species are known in Wadowice, whereas different species are present in the Septarian Clays. These families are facies-dependent forms, which is already evident from the petrographic characteristics of these sediments. After separating out the first set of families, the numerical relations look quite different. Of the 35 previously known species, there are 10 (or 28%) in common with the Nikolschitz fauna, 19 (or 54%) in common with the Septarian Clays and eight (or 23%) with the Bartonian fauna. The families Textularidae, Lagenidae, Globigerinidae, Rotalidae are well represented in all known lower Tertiary faunas, and as such can be used for comparison. Now the numbers speak in favour of a higher level. Taking into account the fact that the Wadowice fauna lacks completely the Nummulitidae family, and that 12 of the known species (21%) are also present in Miocene, we can more likely conclude that the Wadowice fauna represents the Tongrian stage, and namely its lower part, while the Septarian Clays correspond to its upper part.

If we take into consideration the new species and their relationship to the ones previously described, we find in the Wadowice fauna similarity with six Bartonian species, eight Ligurian, six Septarian, and nine species from the Miocene. After excluding the first three families, this relation towards the Ligurian and Septarian layers changes. We have two species related to the first set of families and five related to the others. Here we also see closer numerical relationships to the younger layers.

The age of the red clays based on the palaeontological inferences is in agreement

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[3] *[Reussina was considered nomen nullum (void) by Loeblich and Tappan (1964).]*

[4] *[Grzybowski may be referring to the work of Neumeyer (1887), who was the first to suggest that calcareous foraminifers "the calcareous stage of development" had derived directly from agglutinated types displaying similar test morphologies.]*

[5] *[Pokorny (1950) revised this age based on Rzehak's original sample material. Pokorny found that Rzehak's sample contains Reticulophragmium amplectens and Nuttallides truempyi, which points to a middle Eocene age. Pokorny correlated the assemblage with the uppermost middle Eocene.]*

[6] *[Tongrian = lowermost part of Rupelian, corresponding to the basal Rupelian transgression]*

with the stratigraphic relations[7]. The red clays from Wadowice lie upon the Menilite shales, where the typical fossil is *Meletta crenata*. Layers containing *M. crenata* from the Alpine province also point to the Tongrian stage. The final, probably definitive, argument for the above conclusions should come from anticipated studies of the Carpathian fish fauna of the Menilite beds.

In the description of the forms I followed Brady's classification. However, for the nomenclature of the genera, I retained some of the older terms which Brady no longer uses, such as *Plecanium, Ataxophragmium, Dentalina, Glandulina*. On the one hand, as names for subgenera, they serve to clarify and occasionally shorten the descriptions. On the other hand, as terms for the agglutinated types that are isomorphic with calcareous forms, in my opinion, they ought not be discarded until the question of the genetic relationship between the isomorphic species can be fully resolved.

Finally, I would like to thank Prof. Dr. Szajnocha for his generous help offered me during the course of this work, and also Prof. Rzehak from Brno who loaned me the foraminiferal material from Nikoltschitz and Waschberg, such that I could utilize it more fully in this study than in my previous one.

Foraminifera

I. Family Miliolidae

a. Subfamily Nubecularinae

Genus *Nubecularia* Defrance

1. ***Nubecularia tibia*** Jones and Parker
pl. 8, fig. 10, 11

Nubecularia tibia Jones and Parker. Brady, 1884, p. 135. pl. 1. fig. 1-4.

Test comprised of flask-shaped segments, wider at the base and gently narrowing towards the terminal end, slightly bent. Aperture a wide, rounded opening at the narrow end. This form is only known to me from individual segments, which conform completely to the drawings and description of Brady. Test is solid, silicified. Length 0.8 mm. Very rare in red clays.

b. Subfamily Keramosphaerinae

Genus *Keramosphaera* Brady

2. ***Keramosphaera irregularis*** **n.sp.**[8]
pl. 8, fig. 12, 13

Test spherical, siliceous. Surface smooth, occasionally somewhat roughly finished. On the smooth surface, minute pores are sometimes observed. The interior of the test is infilled with a siliceous substance in which small chambers of various size are irregularly distributed. These chambers do not detract from its spiral or layered construction. Size 0.5 - 0.8 mm. Very common in marls and green clays.

II. Family Astrorhizidae

a. Subfamily Saccamminae

Genus *Psammosphera* Schultze

3. ***Psammosphera fusca*** Schultze
pl. 8, fig. 14

Psammosphera fusca Schultze. Brady, 1884, p. 249. pl. 8, fig. 1-8.

Test spherical, built of rather coarse sand grains, which gives it a rather rough and ruffled appearance. No distinct aperture. Diameter 0.4 mm. Very rare in red clays.

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[7] *[Ksiazkiewicz (1950) regarded the red marls overlying the Menilite beds in Grzybowski's shaft to be an overthrust tectonic cap. In their revision of Grzybowski's fauna, Liszka and Liszkowa (1981) assigned the red marls to be Campanian, and green clays to the Paleocene. These ages are accepted here.*

[8] *[Liszka and Liszkowa (1981) selected a lectotype for this species and transfered it to the genus Psammosphaera.]*

[**Table 1** *[On two pages]. A comparison between the microfauna from Wadowice and other faunas described from the literature.*]

	Species name	Wadow.	Nikol.	Recent
	1. Miliolide			
	a. Neubecularinae			
1	*Nubecularia tibia* Jones and Parker	X		X
	b. Alveolininae			
2	*Alveolina* cf. *melo* d'Orbigny			X
	c. Keramosphaerinae			
3	*Keramosphaera irregularis* Grzybowski	X		
	2. Astrorhizidae			
	a. Astrorhizinae			
4	*Dendrophrya excelsa* n.sp.			
5	*Dendrophrya robusta* n.sp.			
6	*Dendrophrya latissima* n.sp.			
	b. Saccammininae			
7	*Sorosphaera confusa* Brady			X
8	*Saccamina sphaerica* Brady	X	X	X
	c. Rhabdammininae			
9	*Hyperammina vagans* Brady	X		X
10	*Hyperammina nodata* Grzybowski	X		
11	*Hyperammina subnodosiformis* n.sp.			
12	*Rhabdammina abyssorum* M. Sars	X		X
13	*Rhabdammina subdiscreta* Rzehak	X	X	
14	*Rhabdammina linearis* Brady	X		X
15	*Rhabdammina annulata* Rzehak	X		
	3. Lituolidae			
	a. Lituolinae			
16	*Reophax placenta* n.sp.			
17	*Reophax difflugiformis* Brady		X	X
18	*Reophax grandis* n.sp.			
19	*Reophax duplex* Grzybowski	X		
20	*Reophax pilulifera* Brady	X	X	X
21	*Reophax guttifera* Brady			X
22	*Reophax guttifera* var. *scalaria* Grzybowski	X		
23	*Reophax splendida* n.sp.			
24	*Reophax subnodulosa* n.sp.			
25	*Reophax elongata* n.sp.			
26	*Haplophragmium turpe* Grzybowski	X		
27	*Haplophragmium fontinense* Turquem			X
28	*Haplophragmium subturbinatum* n.sp.			
29	*Haplophragmium walteri* n.sp.			
30	*Haplophragmium immane* n.sp.			
31	*Reussina quadriloba* Grzybowski	X		
	b. Trochammininae			
32	*Ammodiscus polygyrus* Reuss	X		
33	*Ammodiscus angygyrus* Reuss	X		
34	*Ammodiscus involvens* Reuss	X		X
35	*Ammodiscus tenuissimus* n.sp.			
36	*Ammodiscus latus* n.sp.			
37	*Ammodiscus umbonatus* n.sp.			
38	*Ammodiscus gorayskii* n.sp.			
39	*Ammodiscus septatus* n.sp.			
40	*Ammodiscus bornemanni* (Reuss)			
41	*Ammodiscus charoides* (Jones and Parker)	X	X	X
42	*Ammodiscus gordialis* (Jones and Parker)	X	X	X
43	*Ammodiscus demarginatus* n.sp.			
44	*Ammodiscus serpens* n.sp.			
45	*Ammodiscus irregularis* n.sp.			
46	*Ammodiscus glomeratus* n.sp.			
47	*Agathammina dubia* Grzybowski	X		
48	*Trochammina olszewskii* n.sp.			
49	*Trochammina lituiformis* Brady		X	X
50	*Trochammina vermetiformis* n.sp.			
51	*Trochammina heteromorpha* n.sp.			
52	*Trochammina contorta* n.sp.			

	Species name	Wadow.	Nikol.	Recent
53	*Trochammina subcoronata* Rzehak	X	X	
54	*Trochammina elegans* Rzehak		X	
55	*Trochammina folium* n.sp.			
56	*Trochammina intermedia* Rzehak	X	X	
57	*Trochammina variolaria* n.sp.			
58	*Trochammina deformis* n.sp.			
59	*Trochammina pauciloculata* Brady	X	X	X
60	*Trochammina conglobata* Brady			X
61	*Trochammina subtrullissata* Rzehak		X	
62	*Trochammina walteri* n.sp.			
63	*Trochammina lamella* n.sp.			
64	*Trochammina stomata* n.sp.			
65	*Trochammina tenuissima* n.sp.			
66	*Trochammina nuceolus* n.sp.			
	c. Loftusinae			
67	*Cyclammina suborbicularis* Rzehak	X	X	
68	*Cyclammina retrosepta* Grzybowski	X		
69	*Cyclammina setosa* Grzybowski	X		
70	*Cyclammina amplectens* n.sp.			
	4. Textularidae			
	a. Textularinae			
71	*Plecanium potocense* n.sp.			
72	*Plecanium caseiforme* n.sp.			
73	*Verneuilina propinqua* Brady		X	X
74	*Spiroplecta spectabilis* n.sp.			
75	*Spiroplecta brevis* n.sp.			
76	*Spiroplecta foliacea* Rzehak			
77	*Spiroplecta costidorsata* n.sp.			
78	*Gaudryina reussi* Hantken			
79	*Gaudryina coniformis* n.sp.			
80	*Gaudryina tenuis* n.sp.			
	b. Bulimininae			
81	*Virgulina digitalis* Grzybowski	X		
	5. Lagenidae			
	a. Lageninae			
82	*Lagena apicularis* Reuss			X
	b. Nodosarinae			
83	*Glandulina laevigata* d'Orbigny			X
84	*Nodosaria radicula* Linne			X
85	*Nodosaria kreutzi* n.sp.			
86	*Dentalina* sp. ind.			
87	*Cristellaria cumulicostata* Gümbel			
88	*Cristellaria elegans* Hantken			
89	*Cristellaria konneni* Reuss			
90	*Robulina rotulata* Lamarck			X
91	*Robulina gutticostata* Gümbel			
	6. Globigerinidae			
92	*Globigerina triloba* Reuss	X	X	
93	*Globigerina bulloides* d'Orbigny	X	X	
	7. Rotalidae			
	Rotalinae			
94	*Discorbina pusilla* Uhlig			
95	*Truncatulina granulosa* Reuss			
96	*Truncatulina subakneriana* n.sp.			
97	*Pulvinulina subumbonata* (Gümbel)			
98	*Pulvinulina partschiana* d'Orbigny			X
99	*Rotalia lithothamnica* Uhlig			
100	*Rotalia soldanii* d'Orbigny			
	8. Nummulitidae			
	a. Nummulitinae			
101	*Amphistegina subparisiensis* n.sp.			
102	*Heterostegina grotriani* Reuss			
103	*Nummulites budensis* Hantken			
104	*Nummulites* sp. (Leymeriei?)			
	b. Cyclocypeinae			
105	*Orbitoides* cf. *stella* Gümbel			

Genus *Saccammina* M. Sars

4. ***Saccammina sphaerica*** Brady[9]
pl. 8, fig. 15

Saccammina sphaerica Brady, 1884, p. 252. pl. 18, fig. 11-17.

Saccammina sphaerica Brady. Rzehak, 1887a, p. 87.

Test pear-shaped, finely agglutinated with a rough surface. Upper portion tapering into a neck with a visible central aperture, surrounded by a thin lip. Lower portion blunt, flattened in the centre with a minor depression towards the interior. Size 0.4-1.0 mm. Common in red clays.

h. Subfamily Rhabdamminiinae

Genus ***Hyperammina*** Brady

5. ***Hyperammina dilatata*** Rzehak[10]
pl. 8, fig. 17

Test finely agglutinated with a rough surface, outline obliquely conical with flattened sides, the terminal end tapering into a tube ending in an aperture (in my specimen this end is broken off). Segments faintly indicated by indistinct transverse lines. In one place only, at about one- third the length from the initial end, there is a more distinct constriction, appearing on one side as a transverse groove, deeper in the middle and shallower toward the periphery, and on the other side as a rounded depression. Rzehak's specimen from Nikoltschitz shows less distinct segments, the test is less inflated at the initial end, the depressions are shallower, and the groove is less clear on the second side. Nevertheless there is no reason to separate the two forms as different species. Length 0.9 mm. Very rare in red clay.

6. ***Hyperammina vagans*** Brady
pl. 8, fig. 18

Hyperammina vagans Brady, 1884, p. 260. pl. 24, fig. 1-9.

In the Wadowice material, only fragments of the test are found. These are tubular, rounded, usually bent, and very finely agglutinated with a nearly smooth, lustrous, surface; without distinct segmentation. This form is also found in the material of Rzehak from Nikoltschitz partly under the designation *Rhabdammina subdiscreta*. The size, shape and construction of the test corresponds entirely to *H. vagans* as described by Brady. Diameter 0.2 mm. Common in red clay.

7. ***Hyperammina nodata*** **n.sp.**
pl. 8, fig. 16

Entirely similar to the preceding species [*Hyperammina vagans*], but with distinct segmentation at regular intervals. Rare in red clay.

Genus ***Rhabdammina*** M. Sars.

8. ***Rhabdammina abyssorum*** M. Sars[11]
pl. 8, fig. 1-4

Rhabdammina abyssorum M. Sars. Brady, 1884, p. 266. pl. 21.

This is also found only in fragments. Tube is finely agglutinated, with a rough or jagged surface, straight or bent, without constrictions. Figure 3 corresponds to *R. abyssorum* var. *irregularis* Carpenter, given by Brady. In Rzehak's material from Nikoltschitz it is partly listed as *R. emaciata*. Diameter 0.2 - 0.6 mm. Length of fragments 0.8 - 1.2 mm, rarely up to 2 mm. Common in red clays.

9. ***Rhabdammina subdiscreta*** Rzehak[12]

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[9] *[Specimens preserved in the Grzybowski collection were shown by Liszka and Liszkowa (1981) to be fragments of Nodosaria.]*

[10] *[Rzehak (1887a,b) did not list "Hyperammina dilatata" in his list of foraminifera from Nikoltschitz. Grzybowski was evidently using Rzehak's collection of types. Because Grzybowski was the first author to provide illustrations and descriptions, the authorship of this species as well as others first recorded by Rzehak (1887) from Nikoltschitz has been attributed to Grzybowski under Article 21 of the ICZN.]*

[11] *[Mjatliuk (1970) placed these specimens in the synonymy of her new species Hyperammina nova Mjatliuk, 1970. Liszka and Liszkowa (1981) placed specimens with calcareous matrix in their new species Rhizammina grzybowskii.]*

[12] *[Authorship of this species has been transfered to Grzybowski under Art. 21 of the ICZN. Mjatliuk (1970) placed these specimens in the synonymy of*

pl. 8, fig. 5-6

Rhabdammina subdiscreta Rzehak, 1887a, p. 87.

Test usually narrower than that of the preceding species [*Rhabdammina abyssorum*], similar in its other characters but with visible constrictions at irregular intervals. Common in red clays.

10. ***Rhabdammina linearis*** Brady[13]

pl. 8, fig. 7

Rhabdammina linearis Brady, 1884, p. 269. pl. 21, fig. 1-4.

A fragment of a thin, narrow, straight tube (without the swollen central portion) with a rough surface, and without constrictions. Diameter 0.2 mm. Rare in marls.

11. ***Rhabdammina annulata*** Rzehak[14]

pl. 8, fig. 8-9

Test oval in cross-section, tubular, often bent, finely agglutinated with a slightly rough surface. Distinct segmentation with irregular and rather deep constrictions. It is found in Rzehak's material from Nikoltschitz. Rare in marls and red clays.

III. Family Lituolidae

Subfamily Lituolinae

Genus ***Reophax*** Montfort [15]

12. ***Reophax ovulum*** **n.sp.**[16]

pl. 8, fig. 19-21[17]

Test very finely agglutinated, surface almost smooth or only very slightly rough. In my material there occur detached chambers, ovate in shape, with a single aperture at the narrower end, which is sometimes conically elongated. In balsam preparations, by transmitted light, one can see that the wall is thin, somewhat thickened only at the terminal and initial ends, so that the aperture forms a narrow tubular passage between the thickened walls of the chamber. In some specimens a similar structure is seen at the more rounded initial end, which allows the inference that these are detached segments of a multilocular form. Size 0.3-0.5 mm. Common in red clays.

13. ***Reophax lenticularis*** **n.sp.**[18]

pl. 8, fig. 22

Test circular, lenticular, finely agglutinated. Aperture a single opening on the rounded periphery. Diameter 0.3 mm. Very rare in marls.

14. ***Reophax duplex*** **n.sp.** var. α

pl. 8, fig. 23, 24

Test finely agglutinated, surface extremely rough, composed of two spherical segments of equal or only slightly different sizes, attached together by their broad sides with only a depressed constriction between them. The test is sometimes flattened. Size 0.5-1.5 mm. Rare in red clays.

Reophax duplex **n.sp.** var β

pl. 8, fig. 25

Test similar to the preceding form, except that one segment is large while the other one is very small and attached to it. Size 0.8 mm. Very rare in marls.

15. ***Reophax guttifera*** Brady, var. ***scalaria.*** **n.var.**

pl. 8, fig. 26

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her new species Hyperammina subdiscretiformis Mjatliuk, 1970.]

13 *[Glaessner (1937) placed Grzybowski's drawing in the synonymy of his new species Rhabdammina cylindrica Glaessner, 1937. Mjatliuk (1970) created the new subspecies Hyperammina cylindrica cylindrica (Glaessner).]*

14 *[Rzehak (1887a,b) did not list this species in his papers. Authorship of this species has been transfered to Grzybowski under Art. 21 of the ICZN. Liszka and Liszkowa (1981) determined that specimens preserved in the collection are fragments of Reophax.]*

15 *[Grzybowski used the spelling "Rheophax" throughout the text. Other authors used the same spelling, e.g. Egger (1895) and Perrier (1893).]*

16 *[Type species of the genus Carpathiella Mjatliuk, 1966.]*

17 *[the specimen illustrated in pl. 8, fig. 21 was subsequently refered to the new species Reophax ovuloides by Grzybowski (1901).]*

18 *[Shown by Geroch and Gradzinski (1955) to be the mould of a radiolarian.]*

Reophax guttifera Brady, 1884, p. 295. pl. 31, fig. 10-15.

I have one fragment consisting of three segments. Test finely agglutinated, surface rough. The individual segments are compressed and circular in outline, like slightly depressed bowls, and are attached in such a way that the edge of the convex side of the earlier segment joins the concave side of the latter segment, giving the test as a whole a step-like appearance. Length of the three-chambered fragment 1 mm; width 0.4 mm; thickness 0.1 mm. Very rare in red clays.

16. ***Reophax pilulifera*** Brady[19]
pl. 8, fig. 27, 28

Reophax pilulifera Brady, 1884, p. 292. pl. 30, fig. 12-17.

Reophax pilulifera Brady, 1887. p. 87. 1888. p. 191, 192.

Test comprised of three globular chambers, arranged as in *Dentalina*, finely agglutinated with a jagged surface. Chambers increase rapidly in size, such that the last one sometimes comprises half of the test. Aperture a rounded opening at the top of the last chamber. Length 0.5 - 1.5 mm. Very rare in marls and red clays.

Genus ***Haplophragmium*** Reuss

17. ***Haplophragmium wazaczi*** Rzehak[20]
pl. 8, fig. 29

Rzehak's material from Nikoltschitz.

Test coarsely agglutinated, surface rough. Early chambers four in number, spirally coiled. The following three chambers in a uniserial rectilinear series. The final chamber has the rounded opening of the aperture on its pointed end. The species is related to *Haplophragmium calcareum* Brady. Length 2.5 mm. Very rare in red clays.

18. ***Haplophragmium turpe*** **n.sp.**
pl. 8, fig. 30

Test coiled, involute (nautiloid), coarsely agglutinated, surface rough. On the exterior six segments are visible, separated by scarcely discernible sutures. The final chamber is the largest. Aperture in a groove between the older portion of the test and the septal face of the last chamber. Size 0.6-1.0 mm. Rare in marls.

19. ***Haplophragmium (Reussina)***[21] ***quadrilobum*** **n. sp.**
pl. 8, fig. 31

Test with a rough surface, comprised of four spherical chambers arranged in a pyramid. Three chambers lie in one plane, the fourth lies more or less symmetrically upon them. The aperture is a simple opening at the lower edge of the final chamber. Size 1.0 mm. Very rare in red clays.

20. ***Haplophragmium (Reussina) bulloidiforme*** **n. sp.** var. α
pl. 8, fig. 32

Chambers with a rough surface, arranged as in *Globigerina bulloides* d'Orbigny. From one side, four chambers are visible, lying more or less in a single plane, with a depression it the centre. From the other side a fifth chamber is visible in the centre resting upon the other chambers. It is slightly smaller than the others. Aperture as is in the preceding species [*Haplophragmium (Reussina) quadrilobum*]. Size 1.0 mm. Common in red clays.

Haplophragmium (Reussina) bulloidiforme **n. sp.** var. β
pl. 8, fig. 33

More compressed than the preceding form. Instead of one central chamber on the spiral

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19 *[Mjatliuk (1970) placed Grzybowski's drawings in the synonymy of her new species Reophax paraduplex Mjatliuk, 1970.]*

20 *[Authorship of this species has been transfered to Grzybowski under Art. 21 of the ICZN. Grzybowski used a upper-case letters for species names derived from personal names. We use lower-case letters throughout the test in accordance with the modern rules of zoological nomenclature.]*

21 *[The subgenus Reussina was considered nomen nullum by Loeblich and Tappan (1964) and included as a synonym of Trochammina]*

side, there is a group of three minute chambers. Size 0.8 mm. Rare in red clays.

This form resembles *Haplophrag-mium globigeriniforme* Parker and Jones (Brady, 1884, p. 312. pl. 35, fig. 10.). Both of these varieties, however, as well as *Haplophragmium quadrilobum*, are constructed in a globigerine fashion. It would be appropriate to separate them, and place them in a separate subgenus which I propose to name *Reussina* with the following description: "Test free, multichambered, coiled in a trochoid spiral as in *Globigerina*".

b. Subfamily Trochammininae
Genus *Ammodiscus* Reuss[22]

This genus created by Reuss for siliceous forms similar in shape to the genus *Cornuspira*, today comprises not only the planispiral forms coiled like *Cornuspira*, but also all other siliceous forms whose test resembles a long tube, unsegmented into separate chambers. Reuss needed to separate the *Cornuspira* and *Ammodiscus* forms because he used differences in the composition of the test as a basis for his divisions (Reuss, 1861, p. 355). Other taxonomists such as Schwager (1883), Carpenter et al. (1862), and Zittel in his "Handbuch der Palaeontologie", followed Reuss in placing both of these genera close to each other within one type. Brady (1884, p. 60) did not use this approach in his taxonomy of foraminifers. He placed less emphasis on the chemical composition of the test, basing the subdivision of his 10 groups on the manner in which the test is built and structured; such that [for example] the group Textularidae contains both siliceous and calcareous types. Moreover, one *Textularia* genus even contains agglutinated as well as calcareous forms. Despite this, *Cornuspira* and *Ammodiscus* are placed in separate groups: *Cornuspira* in group II; Miliolidae, the family Peneroplidae, and *Ammodiscus* in group IV; Lituolidae, the family Trochammininae. However, there are no distinct differences between those two genera and moreover, only the siliceous test distinguishes a species from one which could be described as *Cornuspira*.

I thought it was important to make the above remarks because in my material several species have identical structure to *Cornuspira* and could not be separated. For these species, I retained the genus *Ammodiscus*, because of their siliceous tests, but I assigned them species names that are used for their calcareous analogs belonging to *Cornuspira*. Before the final word can be said in this matter, this seems like the best approach to use at this time. I do not wish to complicate this matter further by creating new species.

21. ***Ammodiscus involvens*** [Reuss]
pl. 8, fig. 38

Operculina involvens Reuss, 1850, p. 370. pl. 46. fig. 30.

Cornuspira involvens Reuss, 1863a, p. 39. pl. 1, fig. 2.

Cornuspira involvens Reuss. Hantken, 1875, p. 19. pl. 2, fig. 2.

Test siliceous, planispirally coiled in eight whorls. In shape and arrangement of the test it conforms to Reuss's drawings and description. The whorls partially overlap; the last one is the largest and the widest, and occupies almost one-fourth the diameter of the test. The margins are wide, narrowly rounded toward the periphery. Lateral sides are concave. Diameter 0.8 mm. Rare in red clays.

22. ***Ammodiscus angygyrus*** [Reuss]
pl. 8, fig. 34

Cornuspira angygyra Reuss, 1850, p. 370. pl. 46, fig. 19.

Cornuspira angygyra Reuss, 1863a, p. 38.

This form does not differ in any aspect from the one described by Reuss from the Miocene and the Septarian clays. Like the other, it also has numerous low, flattened whorls, and a only slightly rough surface. Rare in marls and red clays.

23. ***Ammodiscus polygyrus*** [Reuss]
pl. 8, fig. 37

Cornuspira polygyra Reuss, 1863, p. 39. pl. 1, fig. 2.

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22 *[Mjatliuk (1970) placed Grzybowski's Ammodiscus angygyrus, A. polygyrus, and A. involvens in her new genus Grzybowskiella.]*

Cornuspira polygyra Reuss. Hantken, 1875, p. 19. pl. fig. 11.
Test relatively thin. Numerous, low whorls, periphery rounded; slightly concave on both sides. Rare in red clays.

24. *Ammodiscus* sp.
pl. 8, fig. 35
A young, thin specimen with a relatively large last whorl.. It may be a young form of *Ammodiscus involvens*, but it could as well be a different species because of its distinctly separated central part[23]. Size 0.3 mm. Rare in red clays.

25. *Ammodiscus* sp.
pl. 8, fig. 36
A young specimen. It could be either a pathological form of *Ammodiscus polygyrus* or one of the early stages of development of *Ammodiscus gordialis*. Size 0.3 mm. Rare in red marls.

26. *Ammodiscus charoides* (Jones and Parker)
pl. 8, fig. 39-43
Ammodiscus charoides (Jones and Parker). Brady, 1884, p. 334. pl. 38, fig. 10-16.
Trochammina proteus (pars) Karrer, 1866, p. 494. pl. 1. fig. 4.
Test comprised of a spirally coiled tube, with shape varying with growth. The tube initially coils into a conical serpentine spiral, slowly expanding the diameter of the whorl, and then again constricting, creating a barrel shaped test, comprised of eight closely placed whorls. The terminal end of the tube has the same diameter of the coil as the initial end. The tube at the terminal end expands again and encircles the existing part of the test in such a manner that it completely covers the earlier whorls. Plate 8, fig. 41 shows a young specimen with only one layer of coils, and the second layer has only a single whorl. Figure 43 shows a older specimen; a second layer of whorls already covers half of the old test, which is still partially visible. Figure 40 shows the next stage of development in which the diameter of the whorl starts to narrow; in side view the older part of the test are not visible any longer. Figure 39 shows a fully grown specimen, slightly irregular. Figure 42 shows an irregular young specimen.

In this material I did not find forms having a latter portion of the tube which crosses over the previous whorls, as described by Brady. Surface smooth. Diameter 0.4-0.5 mm. Common in marls, rare in green clays.

27. *Ammodiscus gordialis* (Jones and Parker)
pl. 8, fig. 44, 45
Ammodiscus gordialis (Jones and Parker). Brady, 1884, p. 333. pl. 38, fig. 7-9.
Test irregularly coiled around itself in varying directions, creating a twisted ball. Surface smooth or slightly rough. Perhaps they are pathological forms of *Ammodiscus charoides*. Size 0.4 mm. Rare in marls.

28. *Ammodiscus schoneanus* Siddall[24]
pl. 8, fig. 46
Ammodiscus schoneanus Siddall. Brady, 1884, p. 335. pl. 38, fig. 17-19.
Test finely agglutinated with siliceous cement, surface slightly rough in the form of a tube in a closely coiled spiral. A fragment 0.8 mm in length, 5 coils, initial portion missing. Very rare in green clays.

29. *Ammodiscus fallax* Rzehak[25]
pl. 8, fig. 47
The fragment found in my material agrees completely with the specimen found by Rzehak. It is a tube bent into a shape of a letter U, with the two arms tightly attached to each other, and with occasional constrictions. This form recalls *Rhabdamina* Sars, and perhaps represents a transition from that genus. The figure shows the fragment from Wadowice;

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23 *[In the following paper, Grzybowski (1898) placed this form in the synonymy of Ammodiscus tenuissimus Grzybowski, 1898.]*

24 *[The specimen preserved in the Grzybowski collection was shown by Liszka and Liszkowa (1981) to be a broken, biserial fragment of Karrerulina sp.]*

25 *[Authorship of this species has been transfered to Grzybowski under Art. 21 of the ICZN.]*

the outlined extension was taken from Rzehak's specimen. Length 0.8 mm Very rare in red clays.

30. ***Ammodiscus aberrans* n.sp.**
pl. 8, fig. 48

Test irregularly oval, compressed, with a surface rough. The last visible whorl of uneven width, with occasional irregular constrictions, which makes it resemble *Ammodiscus fallax*. On both ends of the longer axis there are more distinct constrictions, which resemble the following genus [*Agathammina*]. Length 0.9 mm. Rare in marls.

Genus ***Agathammina*** Neumayer.

31. ***Agathammina dubia* n.sp.**
pl. 8, fig. 49

Test oval and compressed, finely agglutinated with a surface rough. Comprised of a flattened tube, planispirally coiled, constricted at the ends of the longer axis. This genus known from the Permian somewhat resembles a siliceous type of *Biloculina*. In *Agathammina dubia* only the last whorl is visible. Periphery acute, aperture as in *Ammodiscus*. Length 0.7 mm. Very rare in red clays.

Genus ***Trochammina*** Parker and Jones.

32. ***Trochammina subglobulosa* n.sp.**
pl. 8, fig. 50

Test ovate, finely agglutinated, slightly rough, spirally coiled (nautiloid), more or less identical on both sides. In the outer whorl there are six distinct chambers which increase in size and are separated by depressed sutures. The last chamber is the largest and embraces the earlier portion of the test, which is narrower. The aperture is a single opening on the periphery at the point of contact between the last chamber and the earlier portion of the test. The species is related to *Trochammina globulosa* Rzehak from Nikoltschitz, but has much smaller chambers at the beginning of the visible whorl. Size 0.4 mm. Rare in marls.

33. ***Trochammina intermedia*** Rzehak[26]
pl. 8, fig. 53

Trochammina intermedia Rzehak, 1887a. p. 88.

Test ovate, slightly compressed, finely agglutinated, with a slightly rough surface. From one side, five chambers are visible, one in the centre with a straight, rectangular outline and four around the margin. Sutures straight, depressed. From the other side two chambers are visible in the centre with straight outlines. Periphery rounded, with four indentations where the marginal chambers meet. Aperture a simple opening, at the place of contact of the largest (probably the last) chamber. Size 0.6-0.8 mm. Very rare in marls and red clays.

34. ***Trochammina pauciloculata*** Brady[27]
pl. 8, fig. 51, 52

Trochammina pauciloculata Brady, 1884, p. 344. pl. 41, fig. 1,2.

Test resembles *Globigerina triloba* in shape. On one side, three large globular chambers increasing in size. On the other side, between them, a small, triangular fourth chamber, and on this side an aperture at the margin of the last chamber. Sutures slightly depressed. Test finely agglutinated with siliceous cement, surface almost smooth. Size 0.5 mm. Common in red clays.

35. ***Trochammina carpenteri* n.sp.**
pl. 9, fig. 1

Test finely agglutinated, surface rough. Four segments are visible, coiled in an irregular serpentine spiral. Segments increasing in size, the last occupying almost two-thirds of the test; final chamber wider and flatter, forming a broad, flat dorsal surface. From the dorsal side two chambers are visible, the upper one broad, the lower one much smaller; from the frontal side, two chambers appear to be cemented onto the lower part of the test. Aperture a single opening at the lower edge of

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[26] *[Authorship of this species has been transfered to Grzybowski under Art. 21 of the ICZN.]*

[27] *[Mjatliuk (1966) placed Grzybowski's figures of this species in the synonymy of her new species Cystamminella pseudopauciloculata Mjatliuk, 1966.]*

the septal face of the last chamber, in a depression, just above the first visible chamber. Size 1 mm. Very rare in red clays.

36. ***Trochammina carpenteri*** var. ***angustior*** **n.var.**

pl. 9, fig. 2

In general, constructed like the preceding form, with four chambers in a bent serpentine coil. Sutures depressed. The last chamber is not, however, so large and broad, and consequently the dorsal surface is rounded. Aperture as in the preceding form. Size 0.8 mm Very rare in red clays.

37. ***Trochammina subcoronata*** Rzehak[28]

pl. 9, fig. 3

Trochammina subcoronata Rzehak, 1887a. p. 88.

Test oval, finely agglutinated with a rough surface, compressed. From one side, six round chambers are visible, flat discoidal in shape; from the other side seven can be seen. Chambers arranged in an irregular coil. Aperture poorly visible, under the embracing edge of the last chamber, which is the largest. Rzehak's specimens from Nikoltschitz have up to nine visible chambers; other than this, however, they do not show any difference in structure or appearance. Size 0.6-1.0 mm. Rare in marls.

38. ***Trochammina acervulata*** **n.sp.**

pl. 9, fig. 4

Test with a rough surface, flat on one side, convex on the other. In the flat (umbilical) side, eight chambers are visible, spherical in shape, increasing in size, arranged in a spiral and forming a depression in the centre; periphery rounded, lobate. On the convex (spiral) side, up to fourteen chambers are visible, arranged in an irregular serpentine coil, spherical in shape, becoming successively smaller toward the centre, and separated by depressed sutures. Aperture on the flat side, near the periphery, slit-like, and situated at the contact between the last chamber and the preceding whorl. Size 1.5 mm. Very rare in red clays.

c. Subfamily Loftusinae.

Genus ***Cyclammina*** Brady.

39. ***Cyclammina suborbicularis*** Rzehak[29]

pl. 9, fig. 5, 6

Test spherical, with numerous (9-10) triangular chambers, spirally coiled (nautiloid), increasing in size; sutures indistinct, sometimes slightly depressed. Periphery rounded, even. The septal face of the last chamber forms a right angle with the test wall, and embraces the older portion of the test in a sickle-shaped curve. Aperture a short horizontal slit at the base of the septal face, rarely visible. Test rather coarsely agglutinated, rough, with siliceous cement. Size 0.6-1.0 mm. Common in red clays, rare in marls.

40. ***Cyclammina retrosepta*** **n.sp.**

pl. 9, fig. 7, 8

Similar to the preceding form [*Cyclammina suborbicularis*] in general shape, but the chambers are very indistinctly separated; the last two or three chambers sometimes slightly overlap the older portion of the test on one side; the older portion of the test is never distinctly segmented. The septal face of the last chamber is convex, with an oblique depression toward the inner portion; at its contact with the periphery of the earlier portion of the test, there is a slit-like aperture. Size 0.6-0.8 mm. Common in red clays.

41. ***Cyclammina setosa*** **n.sp.**

pl. 9, fig. 9

Test coiled in a serpentine manner. Surface slightly rough or almost smooth. Periphery rounded, flattened in the youngest portion. Five to six chambers, rapidly increasing in size; sutures indistinct, flush. Aperture slit-like, at the base of the last septal face. Related to *Cyclammina suborbicularis*, but

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28 *[Authorship of this species has been transfered to Grzybowski under Art. 21 of the ICZN.]*

29 *[Authorship of this species has been transfered to Grzybowski under Art. 21 of the ICZN.]*

differs from it in the total aspect of the delicate test. Size 0.6 mm. Very rare in red clays.

42. *Cyclammina globulosa* **n.sp.**
pl. 9, fig. 10

Test spherical, spirally coiled. The last whorl is visible, consisting of four to five rapidly enlarging and embracing chambers. The two final segments occupy almost four-fifths of the entire test, resembling a hemisphere with a smaller hemisphere, composed of three earlier, very indistinctly separated segments, attached at the lower edge of the frontal side. The narrow septal face occupies two-thirds of the frontal surface, crescent-shaped and embracing the older portion almost entirely. The aperture is situated at the base of the septal face, just above the periphery of the earlier portion of the test. This form also belongs to the type of *Cyclammina orbicularis* Brady. Size 0.5 mm. Rare in red clays.

IV. Family Textularidae.
a. Subfamily Textularinae.
Genus *Textularia* Defrance.

43. *Textularia attenuata* Reuss
pl. 9, fig. 11, 12

Test lanceolate, comprised of numerous, low, somewhat diagonally descending chambers. Peripheral margin subacute. Sutures distinct, in the initial portion slightly depressed. Surface uneven. Figure 12 depicts a specimen which is not distinctly pointed at its initial end, but in other aspects has the same structure. Rare in red clays.

44. *Textularia subhaeringensis* **n.sp.** var. α
pl. 9, fig. 16

Test composed of low, arcuate chambers, pointing backward toward the initial end of the test. The small early chambers widen rapidly, alternating obliquely and overlapping at the sides, so that the test forms, in outline, a semicircle at the terminal end and a blunt triangle at the initial end. Ridges run along the sutures toward the sharp periphery, where they end in prominent spines slanting toward the initial end, so that the periphery is serrate. Aperture at the base of the last chamber, an oval slit. Brady (1984, p. 372. pl. 45, fig. 3) describes a very similar form as a young stage of *Bigenerina capreolus* (d'Orbigny) (syn. *Schizopora haeringensis*). However, because among several dozen specimens of the species in question (it is one of the most common), of different sizes, from 0.4 to 2 mm in length, I did not find a single one which showed the least trace of uniserial chamber arrangement, I cannot identify this form with Brady's, not so much because it might be an unfounded hypothesis, but because, in view of such great numbers and varying sizes, similar but only younger specimens should have been preserved. It was necessary, therefore, to separate this form as a distinct species. Since it is true, as can be seen from Brady's figures and description, that the earlier part of the test in *Bigenerina capreolus* is almost identical with the form in question, one should regard this species as the precursor to the species *Bigenerina capreolus*. Length 0.4 to 2 mm. Width about the same, sometimes even a little greater. Very common in red clays.

Textularia subhaeringensis **n.sp.** var. β
pl. 9, fig. 13

Test similar in structure to the preceding form, but more compressed and elongate, lanceolate in outline, initially more rounded. Sutural ridges form less elongate spines at the periphery. Because of the similarity in structure, I did not separate this form as a distinct species, although it has a different shape and outline; however, it cannot be regarded as identical with the preceding variety, because in spite of its common occurrence, there are no distinct links between the two varieties. Length 0.6-2 mm. Very common in red clays.

45. *Textularia flabelliformis* Gümbel
pl. 9, fig. 14

Textularia flabelliformis Gümbel, 1868, p. 647. pl. 2, fig. 83.

Test thick, compressed towards the periphery and initial end, almost circular. Early chambers are minute, and resemble a short spine. Chambers are low, and directed obliquely downward towards the initial end. Sutures

limbate, becoming thinner towards the periphery. Aperture normal.

Brady lists these species together with *Bigenerina capreolus*, even though it differs profoundly in the construction of its chambers and sutures. I believe it is more prudent to separate this form despite some apparent similarities. Common in red clays.

46. ***Textularia calix* n.sp.**[30]
pl. 9, fig. 17

Test short, bluntly conical in shape, with a sharp initial end. Chambers low, enlarging rapidly and overlapping each other alternately to a large degree. Sutures indistinct. The terminal end is flattened, with sharp edges; there is a slight elevation of the final chamber directly over the slit-like aperture, which is situated slightly to one side. A related form is *Textularia inconspicua* Brady (Brady, 1884, p. 357, pl. 42, fig. 6). Length 0.5, width 0.6 mm Very rare in red clays.

Genus *Plecanium* Reuss.

47. ***Plecanium sublime* n.sp.**
pl. 9, fig. 15

Test conical, finely agglutinated, surface is papillose and lustrous. Two alternating rows of high and wide chambers (up to 7) separated by flush sutures. Aperture as in *Textularia*, a narrow slit. Length 0.5 mm. Very rare in red clays.

Genus *Verneuilina*. d'Orbigny[31]

48. ***Verneuilina abbreviata*** Rzehak[32]
pl. 9, fig. 18

Rzehak's material from Michelsberg.[33]

Test conical, agglutinated with calcareous cement. Initial end rounded, terminal end somewhat concave. Chambers in three rows, forming a coil with about three chambers per whorl. Sutures arcuate, flush or sometimes slightly depressed. In the last whorl the first and last chambers are the largest; the second chamber, standing to one side, is smaller. Their septa, sloping toward the initial end, run into a channelled depression at the centre, where the slit-like aperture is situated beneath the edge of the final chamber. Length 0.6-1.0 mm Very common in red clays.

49. ***Verneuilina szajnochae* n.sp.**
pl. 9, fig. 19

Test with the principal axis slightly curved, trihedral, with slightly concave sides and three sharp edges. Chambers low, oblique; sutures marked externally by ridges, arcuate, meeting at the centre of each side, and uniting in pairs at the edges between the adjacent sides, they form sharp, projecting spines directed toward the initial end, so that the periphery is serrate. The embryonic chamber is sometimes also provided with a spine. The chambers of the final whorl are highly convex on the upper side; the aperture is a narrow oval opening at the edge of the last chamber. This form approaches *Verneuilina spinulosa* Reuss, from the Miocene of Vienna, but differs from it not only in its less slender outline but also in the limbate sutures, which are depressed in *Verneuilina spinulosa*. Length 0.5 - 1.0 mm. The greatest width slightly less. Very common in red clays.

Genus *Bigenerina* d'Orbigny.

50. ***Bigenerina fallax*** Rzehak[34]
pl. 9, fig. 20-21

Bigenerina fallax Rzehak, 1887b. p. 134.

Test finely agglutinated with calcareous cement, surface rough. Sutures inconspicuous and indistinct. In balsam preparations the embryonic chambers are minute, in two rows

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[30] *[Liszka and Liszkowa (1981) regarded this as a specimen of Marssonella crassa with a small piece of matrix attached to its apex.]*

[31] *[Grzybowski consistently used the spelling "Verneulina".]*

[32] *[Authorship of this species has been transfered to Grzybowski under Art. 21 of the ICZN.]*

[33] *[Rzehak did not list this species in his Michelsberg paper. It was recorded from Nikoltschitz.]*

[34] *[Authorship of this species has been transfered to Grzybowski under Art. 21 of the ICZN.]*

occupying one-fourth the length of the entire test, followed by four uniserial chambers. Length 0.6 mm. Common in red clays.

51. ***Bigenerina nuda* n.sp.**[35]
pl. 9, fig. 22, 23
Test calcareous, slender. The first five chambers are biserial, the following two uniserial, with oblique sutures, sloping in alternate directions at the initial end, and depressed. Aperture at the end of the last chamber, on a slightly projecting neck. This form is similar to *Bigenerina agglutinans* d'Orbigny. Figure 23 represents a young individual. Length 1 mm. Very rare in red clays.

Genus ***Spiroplecta*** Ehrenberg.
52. ***Spiroplecta lenis* n.sp.**
pl. 9, fig. 24, 25
Test small, siliceous. The initial chambers indistinct, spirally arranged, followed by biserial portion. Round in cross section, surface slightly rough, lustrous. Aperture as in *Textularia* on the inner edge of the last chamber. Related to *Spiroplecta biformis* Parker and Jones. (Brady, 1884, p. 376. pl. 14, fig. 25). Length 0.4-0.8 mm. Common in marls.

53. ***Spiroplecta deflexa* n.sp.**
pl. 9, 26, 27
Similar to the preceding form, but distinguished by the arcuate curvature of the test. The aperture lies more to one side, because the final chamber extends out far beyond the preceding one. Length 0.8 mm. Rare in red clays.

Genus ***Gaudryina*** d'Orbigny.
54. ***Gaudryina pupoides*** d'Orbigny
Gaudryina pupoides d'Orbigny, 1846, p. 197. pl. 21, fig. 34-36.
Test conical, initial end rounded. The initial chambers inconspicuous, later chambers more distinct and staggered. Round in cross section. The last chamber extends far beyond the preceding one, creating an incision where the aperture is located. Rare in marls.

55. ***Gaudryina chilostoma*** Reuss
Gaudryina chilostoma Reuss, 1866, p. 120. pl. 1, fig. 5-7.
Rare in marls.

56. ***Gaudryina schwageri*** Rzehak[36]
pl. 9, fig. 28
Gaudryina schwageri Rzehak, 1887b. p. 134.
Test agglutinated with calcareous cement. Three rows of coiled chambers occupy three-quarters of the length of the test, forming one-half whorl. The final chambers are biserial and alternating; aperture slit-like, as in *Textularia*. Length 1.6-2.0 mm. Rare in marls.

Genus ***Clavulina*** d'Orbigny.
57. ***Clavulina subparisiensis* n.sp.**
pl. 9, fig. 30
Test comprised of sand grains of moderate size, surface slightly rough. Early chambers triserial; at the initial end they form a trihedral point with blunt edges. The last chamber is single, and is situated upon them at the centre of the test. Aperture central, a round opening.

This form resembles the variety of *Clavulina parisiensis* d'Orbigny figured by Schwager (1883, p. 116, pl. 26, fig. 18a-c) from the Eocene of the Libyan Desert. However, one cannot consider this as a young stage (since it has only one nodosarian chamber) because, in order to attain the proportions between the biserial and uniserial portions shown by the mature form, this form would have to reach a length six times greater. Length 1.3 mm, width 0.7 mm. Very rare in red clays.

b. Subfamily Bulimininae.
Genus ***Ataxophragmium*** Reuss.
58. ***Ataxophragmium conulus*** [Rzehak][37]
pl. 9, fig. 29
Bulimina conulus Rzehak, 1888b. p. 227.

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[35] *[Liszka and Liszkowa (1981) regarded this species to be a synonym of Elipsodimorphina subcompacta Liebus, 1922. Grzybowski's species, however, has priority.]*

[36] *[Authorship of this species has been transfered to Grzybowski under Art. 21 of the ICZN.]*

[37] *[Authorship of this species has been transfered to Grzybowski under Art. 21 of the ICZN.]*

Test conical, low; chambers coiled, about three to a whorl; up to three or four whorls can be counted; sutures indistinct. Aperture circular, at the edge of the last chamber. Test finely agglutinated. Rzehak reports an entirely similar form from Michelsberg, but it is calcareous[38]. Length 0.4 mm. Very rare in marls.

Genus *Virgulina* d'Orbigny.

59. ***Virgulina digitalis* n.sp.**
pl. 9, fig. 31

Test long, made of numerous chambers spirally arranged in its initial end. The later portion of the test, about 1/4 of its length, is clearly biserial, makes 4/5 of a turn, and resembles *Textularia* in this part, coiled around its long axis. Test finely agglutinated, surface rough, slit-like aperture at the edge of the last chamber. Length 1.0 mm, width 0.2. Rare in marls.

Genus *Pleurostomella* Reuss.

60. ***Pleurostomella wadowicensis* n.sp.**
pl. 10, fig. 1

Test fusiform, becoming acute at the initial end. Chambers (9-10) alternating, wedge-shaped, increasing relatively rapidly in size; the last chamber occupies one-third of the entire test. On the septal face of the last chamber there is a saucer-shaped depression, the edges of which extend forward a little and partially embrace the preceding chamber, but do not meet. Beneath the upper edge of the depression there is an oval, elongate aperture. Sutures slightly depressed; the chambers are consequently slightly inflated. This form appears to be related on the one hand to *Pleurostomella fusiformis* Reuss, from the Cretaceous of Westphalia, in the saucer-shaped depression and shape of the final chamber, while the earlier portion of the test belongs to the type of *Pleurostomella eocaena* Gümbel = *Pleurostomella alternans* Hantken[39], but differs from it in the greater size. Length 1.0 - 2.4 mm. Common in red clays.

61. ***Pleurostomella zuberi* n.sp.**
pl. 9, fig. 32-33

Test small, almost ellipsoidal, extended at the initial end into a sharp spine. The initial chambers are minute, arranged alternately, with oblique sutures, forming a spine-like appendage at the base of the test; the chambers immediately following widen out very rapidly, so that the last two, which are spherical and prominent, occupy almost the entire test; sutures flush, very indistinctly marked. The septal face of the last chamber is narrow and crescent-shaped in outline; aperture slit-like, beneath the crest formed by its edge. *Pleurostomella acuta* Hantken is a less inflated and less distorted form. A certain resemblance is also seen between our form and *Pleurostomella brevis* Schwager. Length 0.6 - 0.8 mm, width slightly less. Common in red clays.

62. ***Pleurostomella* sp.**
pl. 10, fig. 2

Young stage probably related to *Pleurostomella nodosa* Reuss or *Pleurostommella acuta* Hantken. Length 0.4 mm. Very rare in red clays.

Family Lagenidae.
Subfamily Lageninae.
Genus *Lagena* Walker and Jacob

63. ***Lagena globosa*** Walker & Jacob[40]

Lagena globosa Walker & Jacob. Reuss, 1863b, p. 318. pl. 1, fig. 1-3.

This form is known from the Senonian, Miocene, Pliocene and Recent. Rare in red clays.

64. ***Lagena subapiculata* n.sp.**
pl. 10, fig. 3

Test ovoid, the initial portion is constricted into a relatively long spine. The latter portion

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38 *[Buliminopsis conulus Rzehak, 1895]*

39 *[Grzybowski reported this species as "Pleurostomella alternans Hantken", but the correct citation is "Pleurostomella alternans Schwager".]*

40 *[Grzybowski listed this as "Lagena globosa Walk.". The correct citation of the authors is "Walker and Jacob".]*

ends in a more blunt neck, containing a round, radial aperture. This form is closely related to *Lagena apiculata* Reuss, known from the Senonian and Eocene, from which it differs in possessing the widest portion of the test near the aperture, and in its larger spines. Size: 0.2 mm. Rare in red clays.

65. *Lagena orbignyana* Seguenza
pl. 10, fig. 4

Lagena orbignyana Seguenza. Brady, 1884, p. 484. pl. 59. fig. 18-20, 24-26.

Test flask-shaped, somewhat flattened, rounded at the initial end, with an aperture on an elongated neck at the distal end. The test possesses a peripheral keel. This keel subdivides into two parts at the distal end, surrounding the aperture and producing short keels on flattened walls. These keels run down the neck, slowly become wider and flatter, and become less distinct before reaching the lower end of the neck. At the initial end, the peripheral keel reaching the widened portion of the test divides into three parts. One of the three parts of the keel runs centrally to the lower pole, while the two others diverge and run circularly in small arches under the initial end of the test. This form resembles best the specimen reproduced by Brady in fig. 18. Very rare in marls.

66. *Lagena (Cidaria) cidarina* n.sp.
pl. 10, fig. 5

Test approaching *Lagena apiculata* (Reuss)[41] in shape, tapering toward the terminal end, where it is ringed by a projecting ridge whose diameter is less than the greatest diameter of the test. A conical neck projects from the centre, at the end of which lies the aperture, a round opening. The sides of the conical neck are straight. Length 1.2 mm. Very rare in red clays.

67. *Lagena (Cidaria) coronata* n.sp.
pl. 10, fig. 6

Similar to the preceding form [*Lagena (Cidaria) cidarina* Grzybowski] in having a circular keel around the terminal end. However, it is much more cylindrical. The keel is of the same diameter as the test. The apertural cone is low and forms a channelled depression between its base and the keel. Aperture as in the preceding species. Length 0.5 mm. Rare in red clays.

The last two species have a hitherto unencountered structure for a single-chambered lagenid; in particular, the horizontal keel. Due to the insufficient material, I was hesitant to separate these forms as a fourth subgenus of Lagena (*Lagena, Fissurina, Entosolenia*), which would be consistent with the current definitions of this genus and its subgenera. If these forms are found in more occurrences and in more varieties, I would propose to establish a new subgenus called "*Cidaria*", because of their similarity to cidarian spines.[42]

Subfamily Nodosarinae
Genus *Glandulina* d'Orbigny

68. *Glandulina subinflata* n.sp.
pl. 10, fig. 18

This form exhibits, on the one hand, a certain similarity to *Glandulina laevigata* (d'Orbigny) var. *inflata* Bornemann[43] (Reuss, 1866, p. 136. pl. 2, fig. 29-31); on the other hand it recalls *Glandulina discreta* Reuss as figured by Hantken (1875, p. 41, pl. 13, fig. 16). Test with four visible chambers; initial chamber small, elongated at the base into a small blunt spine; second chamber higher and widening markedly. The diameter near the upper suture of this chamber is three times as great as the diameter near the lower suture. The third chamber is three times as high as the second, broadening rapidly at first, then tapering slightly toward the terminal end, so

41 *[Oolina apiculata Reuss, 1850]*

42 *[Grzybowski did not give a formal description of the new subgenus "Cidaria". Moreover, both species identified as the subgenus "Cidaria" have been shown to be fragments of nodosariids (Liszka and Liszkowa (1981). We consider the designation "Cidaria" to be nomen nudum.]*

43 *[Glandulina inflata Bornemann, 1855]*

that the suture separating it from the final chamber is depressed. Since the final chamber occupies one-half of the test, the form as a whole is spindle-shaped with a constriction in the middle; the final chamber is produced into a conical neck which bears the radiate aperture. Length 1 mm. Rare in marls.

Genus *Nodosaria* d'Orbigny.

69. *Nodosaria calomorpha* Reuss
pl. 10, fig. 31

Nodosaria calomorpha Reuss, 1866, p. 129. pl. 1, fig. 15-19.

This species, known only from the Oligocene, is present in here in two-chambered forms. Rare in red clays, very rare in marls.

70. *Nodosaria pungens* Reuss
pl. 10, fig. 9

Nodosaria pungens Reuss, 1866, p. 135. pl. 2, fig. 16.
Dentalina pungens (Reuss). Reuss, 1851a, p. 64. pl. 3, fig. 13.

I only possess the lower fragment of a test. Its characteristic surface ornamentation allows me to include it in this species. Rare in marls.

71. *Nodosaria simplicissima* n.sp.
pl. 10, fig. 7

Test elongate, equally narrow throughout, initial end rounded; six chambers, separated by indistinct, flush sutures. Aperture somewhat eccentric, faintly radiate. Length 1.3 mm, width 0.2 mm. Very rare in red clays.

72. *Nodosaria cornuta* Batsch
pl. 10, fig. 8

Nodosaria cornuta Brady, 1884, p. 509. pl. 64, fig. 1-5.

Test pear-shaped, comprised of three low and wide chambers, increasing in size. Last chamber almost as high as the two preceding ones together, twice as wide as the first one; at the distal end there is a rounded, button-like elevation with a circular aperture in its centre. The costae are characteristically arranged along the test from the lower pole to upper pole. Two early chambers have uniform costae with finer costae inserted between them on the first chamber, reaching halfway up the first chamber or somewhat higher. On the third chamber, at the suture, thicker costae begin which alternate with lower ones and reach the base of the button-like terminal elevation where they disappear. Length 1 mm, maximum width 0.8 mm. Very rare in red clays.

73. *Nodosaria alternans* n.sp.[44]
pl. 10, fig. 10

Test of the type of *Nodosaria calomorpha* Reuss. First chamber rounded at the base, somewhat broader than the following one, separated from it at the top by a depressed suture. The second chamber is very low, cylindrical, separated at the upper end by a faint, flush suture from the following chamber, which is spherical and somewhat longer than the initial chamber. The next chamber again is low, with a deep suture at its lower end and a flush one at its upper end, separating it from the final chamber which is elongate oviform. Aperture central, but because the apertural end of the test has been broken away, the shape and degree of projection of the aperture are unknown, and the only evidence of its central position is the impression of its inner side upon the an internal mold comprised of claystone. Length 1.2 mm. Rare in red clays.

Genus *Dentalina* d'Orbigny.

74. *Dentalina boueana* d'Orbigny

Dentalina boueana d'Orbigny, 1846, p. 47. pl. 2, fig. 4-6.

A fragment comprised of three chambers. Their elongated shape, rather convex chambers, and the aperture located on its pointed end indicates its affiliation in this species. Very rare in red clays.

75. *Dentalina subtilis* Neugeboren
pl. 10, fig. 11

Dentalina subtilis Neugeboren. Hantken, 1875, p. 33, pl. 3, fig. 13.

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[44] *[This species is a junior homonym of Nodosaria alternans Costa, 1856. [Costa, O.G., 1856. Paleontologia del regno di Napoli, Parte II. Accad. Pont. Napoli, Atti, 7(2), 113-378].*

Test comprised of six chambers. Early chambers equally high as wide, followed by elongated ones. All chambers separated by oblique, depressed sutures. The last chamber is the largest with a eccentrically radiate aperture on a short neck. Very rare in red clays.

76. *Dentalina indifferens* Reuss
pl. 10, fig. 12

Dentalina indifferens Reuss, 1863a, pl. 2, fig. 15, 16.
A fragment without the last chamber. Initial chamber rounded, larger than the following one. Subsequent chambers are as high as wide, square in cross-section with flush sutures, passing slowly into inflated chambers with depressed sutures. Very rare in red clays.

77. *Dentalina laticollis* n.sp.
pl. 10, fig. 13, 14

Test slightly arcuate; five to seven chambers; initial chamber spherical, the following chambers slightly smaller, as if forming a neck. The subsequent chambers are larger, all about the same size and separated by flush sutures. The test as a whole is nearly cylindrical. It is related on the one hand to *Dentalina tenuicollis* Reuss, from the Cretaceous of Mecklenburg, but that form has a much narrower neck. On the other hand, it is related to *Dentalina obtusata* Reuss from the Tertiary of Silesia, but differs in not having depressed sutures. Length 1.0-1.4 mm. Common in red clays.

78. *Dentalina acuticauda* Reuss

Dentalina acuticauda Reuss, 1851a, p. 62. pl. 3, Fig 8.
Dentalina acuticauda Reuss. Gümbel, 1868, p. 624. pl. 1, fig. 40.
The specimen from Wadowice corresponds better to Gümbel's drawings because of the more pronounced roundness of its latter chambers. Rare in marls.

79. *Dentalina deflexa*[45] n.sp.
pl. 10, fig. 15

Test comprised of eight or nine chambers separated by indistinct, flush sutures. Initial end acute, test very gently curving in a serpentine manner in one plane. Aperture on a small elevation, central, smooth. Length 1 mm. Rare in marls.

80. *Dentalina vermiculum* Reuss
pl. 10, fig. 17

Dentalina vermiculum Reuss, 1866, p. 135. pl. 2, fig. 14, 15.
Test small, very slightly bent, with 4-5 chambers of equal size, with flush sutures. Aperture somewhat eccentric. Rare in red clays.

81. *Dentalina* n.sp. ind.
pl. 10, fig. 16

Test only slightly bent, such that one margin (dorsal) is straight and the other is slightly convex. The preserved fragment contains three elongated chambers, gradually increasing in diameter (the initial part is missing). The last chamber is longer than the two preceding ones together, and is more inflated. Aperture is situated close to the dorsal margin, produced. This form is most similar to *Dentalina interlineata* Reuss from the Cretaceous of Mecklenberg, differing only in the lack of linear ornamentation on the sutures. Length of the fragment 0.8 mm. Very rare in red clays.

Among the numerous fragments of the genus *Dentalina* found in the red clays, there are probably, in addition to the ones described, many other species which cannot be clearly identified. Some of them might possibly correspond to *Dentalina gigantea* Hantken, from the Clavulina szaboi Beds, others probably belong in new species.

Genus *Lingulina* d'Orbigny.

82. *Lingulina dentata* n.sp.
pl. 10, fig. 19

Test compressed, arcuate, with the ventral side convex and the dorsal concave. Composed of five chambers, rapidly increasing in size, inflated, separated by slightly depressed horizontal sutures. First and second chambers minute, almost spine-like. Aperture oval, cen-

[45] *[Ellis and Messina (1940) reported this species as a junior homonym of Nodosaria (Dentalina) deflexa Reuss, 1863. However, Liszka and Liszkowa (1981) transfered this species to the genus Ellipsoidella.]*

tral. Related to *Lingulina tuberculosa* Gümbel[46] (1868, p. 629, pl. 1, fig. 52). The arcuation of the test may indicate a transition to the genus *Lingulinopsis* Reuss. Length 0.8 mm. Red clays, very rare.

Genus *Cristellaria* Lamarck

83. *Cristellaria cymboides* d'Orbigny
pl. 10, fig. 20

Cristellaria cymboides d'Orbigny. Hantken, 1875, p. 49. pl. 5, fig. 3.

Cristellaria cymboides d'Orbigny. Grzybowski, 1894, p. 13. pl. 2, fig. 1.

Specimens from Wadowice show certain deviations from d'Orbigny's form, and are more similar to the specimen figured by Hantken. They are characterized by a more pronounced narrowing of the initial portion of the test. In general, they are smaller than the forms from Folusz near Dukla. Rare in red clays, very rare in marls.

84. *Cristellaria lunaria*[47] n.sp.
pl. 10, fig. 21

Test similar in outline to *Dentalina*; arcuate; dorsal margin convex, more rounded, ventral margin concave, more acute in its lower portion. Four chambers are visible, increasing rapidly in size, almost triangular. Sutures flush, extending obliquely down from the dorsal margin toward the ventral margin. This species belongs to the type of *Cristellaria cymboides* d'Orbigny, and includes forms with a wholly concave ventral margin. Length 0.6 mm. Very rare in red clays.

85. *Cristellaria concava* n.sp.
pl. 10, fig. 22

Test with an acute dorsal margin, strongly convex, ventral margin rounded and concave in the later portion. Initial chambers completely coiled, later chambers uncoiling, the last two not touching the centre of the initial coil. Sutures flush, arcuate, in the later portion of the test extending obliquely toward the base of the test. Aperture radiate, at the acute end of the final chamber. Length 2.0 mm. Very rare in red clays.

86. *Cristellaria kochi* Reuss
pl. 10, fig. 23

Cristellaria kochi Reuss, 1866, p. 139. pl. 2, fig. 35.

Cristellaria kochi Reuss. Hantken, 1875, p. 53. pl. 5, fig. 7.

Fully agrees with Reuss's description, only the ventral margin is slightly less indented at its lower portion. Rare in red clays.

87. *Cristellaria abscisa* n.sp.
pl. 10, fig. 24

Test ovate, dorsal margin acute, frontal margin sharply truncate, merging gradually into the margin of the earlier chambers. Chambers numerous (nine visible), low, triangular. Sutures flush, straight, the last suture reaching the coil. Aperture radiate, on the acute terminal end of the test. The most similar form is *Cristellaria truncata* Reuss, from the Cretaceous of Lvov, but that species is more compressed and its final chamber does not touch the coil. Length 1.1 mm; width slightly less. Rare in red clays.

Genus *Robulina*. d'Orbigny

88. *Robulina kressenbergensis* Gümbel
pl. 10, fig. 25

Robulina kressenbergensis Gümbel, 1868, p. 641. pl. 1, fig. 71.

Slightly less convex than the one described by Gümbel. In this form there is a distinct central elevation which, however, does not form a distinct umbilical plug. Rare in red clays.

89. *Robulina subangulata* Reuss. var.

Robulina subangulata Reuss, 1863, p. 53. pl. 6, fig. 64.

Test round, strongly convex. Periphery acute. Sutures flush. It differs from Reuss's form in

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46 *[actually Lagena tuberosa Gümbel, 1868.]*

47 *[This species is a junior homonym of Cristellaria lunaria Kübler and Zwingli, 1866. [Kübler, J. and Zwingli, H., 1866. Mikroskopische Bilder aus der Urwely der Schweiz; Heft II: Winterthur, Bürgersbibl. Neujahrsbl. 1-28]. However, in their revision, Liszka and Liszkowa (1981) retained the species name and provisionally transfered it to the genus Lagena because the type specimen does not display subdivision into chambers.]*

having sutures ending at a slightly elevated umbilical plug, which is less distinct at the top, more visible at the bottom. Reuss does not mention this in his description, and only notes that the sutures do not reach the centre. Rare in red clays.

90. ***Robulina gracilis* n.sp.**
pl. 10, fig. 26

Test lenticular, convex, periphery carinate; six chambers visible, separated by flush sutures which extend in broad arcs tangentially to the umbilical region, which is slightly raised and indistinctly delimited. Aperture radiate, produced.

This form is related to *Robulina umbonata* Reuss. Bornemann (1855, p. 333, pl. 14, fig. 10) described a very similar form as a young stage of *Robulina angustimargo* Reuss from the Septarian clay. Diameter 0.7 mm. Rare in red clays.

91. ***Robulina cincta*** Grzybowski
pl. 10, fig. 30

Robulina cincta Grzybowski, 1894, p. 195. pl. 2, fig. 11.

The specimens from Wadowice are preserved better than the one from Folusz; umbilical plug more pronounced. Rare in red clays.

92. ***Robulina pectinata* n.sp.**
pl. 10, fig. 27

Test circular, much broader than thick, with eight or nine low chambers separated by sutures that are arcuate toward the initial end. Sutures distinct, slightly depressed, extending tangentially from the distinct, central umbilical plug. The periphery is acute, passing gradually into a thin keel which runs from the aperture or somewhat behind it all around the test and extends far up onto the septal face of the last chamber. This chamber is produced. Aperture slit-like, indistinctly radiate. This form belongs to the group of *Robulina cultrata* d'Orbigny[48] and resembles the latter very strongly. Diameter 0.6 mm. Common in red clays.

Genus ***Vaginulina*** Lamarck

93. ***Vaginulina* n.sp.** ind.
pl. 11, fig. 16

One incomplete specimen that could not be more precisely identified. In red clays.

Genus ***Flabellina*** Reuss

94. ***Flabellina*** n.sp. ind.
pl. 10, fig. 28

Test of a young specimen with six visible chambers, the initial chamber weakly coiled, the following ones uniserial, separated by raised, protruding sutures. The apex of each chamber creates a small neck, which is visible from the manner in which the sutures run. The last chamber envelops the whole test, and has a acute, ridged periphery at the bottom. The ridge divides approximately half way up the test and continues as two ridges on the front and back edges, which is now narrowing toward the top of the test, leaving a channelled depression between them. At the top, the ridges merge into the aperture which lies at the meeting point of the ridges, i.e. on the four-edged corner. This form is related to *Flabellina rugosa* d'Orbigny from the Miocene of Vienna. Length 0.5 mm. Very rare in red clays.

Subfamily c. Polymorphininae

Genus ***Polymorphina*** d'Obrigny

95. ***Polymorphina dubia* n.sp.**
pl. 10, fig. 29

Test conical. Initial chambers spirally arranged, partially involute, inflated from the beginning; at one-third the length of the test they become wedge-shaped and are arranged uniserially one upon the other; they are broader and narrower upon alternate sides, convex, the last chamber being spherical with a round, central aperture at the terminal end. This form closely approaches *Polymorphina nodosaria* Reuss from the Septarian clay, but is more conical than that species. It has more highly inflated chambers and a non-radiate aperture. It constitutes a transition to the

[48] *[Grzybowski erroneously cited the authorship of this species. The proper citation is Robulus cultratus Montfort, 1808.]*

genus *Dimorphina* d'Orbigny. Length 0.5 mm. Rare in red clays.

Family Globigerinidae
Genus *Globigerina* d'Orbigny
96. ***Globigerina triloba*** Reuss
Globigerina triloba Reuss, 1850, p. 10. pl. 2, fig. 11.
Globigerina triloba Reuss. Hantken, 1875, p. 69. pl. 8, fig. 1.
Minute specimens corresponding in size to Hantken's forms from the Clavulina Szaboi beds. Very common in marls, common in green clays.

97. ***Globigerina bulloides*** d'Orbigny
Globigerina bulloides d'Orbigny, 1846, p. 163. pl. 9, fig. 4-6.
Globigerina bulloides d'Orbigny. Hantken, 1875, p. 69. pl. 8, fig. 1.
Rare in marls and green clays.

Genus ***Sphaeroidina*** d'Orbigny
98. ***Sphaeroidina austriaca*** Reuss
Sphaeroidina austriaca Reuss, 1850, p. 807, pl. 51, fig. 3-19.
Sphaeroidina austriaca Reuss. Hantken, 1875, p. 62. pl. 10, fig. 14.
This form has only four, rarely five, chambers visible from the outside. Common in red and green clays.

Genus **Pullenia** Parker and Jones
99. ***Pullenia communis*** (d'Orbigny)
pl. 11, fig. 2
Nonionina communis d'Orbigny, 1846, p. 106. pl. 5, fig. 7-8.
Pullenia communis (d'Orbigny). Hantken, 1875, p. 59. pl. 10, fig. 10.
In shape it differs slightly from d'Orbigny's form and more closely resembles Hantken's form. It is more rounded than elliptical. In the shape and structure of the chambers it does not differ from the described forms. Rare in marls.

100. ***Pullenia compressiuscula*** var. ***quadriloba*** Reuss
pl. 11, fig. 1
Pullenia quadriloba Reuss, 1867, p. 71. pl. 3, fig. 8.
Test circular, comprised of four chambers spirally coiled. The chambers are large, inflated, convex, periphery rounded with incised sutures. Sutures depressed, arcuate with the convex side facing the younger chambers. This trait is not observed in Reuss's Miocene forms, which have straight sutures, but which can be seen in var. *quadriloba* from the Septarian clays. (Reuss, 1851a, p. 71. pl. 5, fig. 31.). Aperture slit-like, arcuate, located at the contact of the last chamber with the previous whorl. Diameter 0.4 mm. Rare in marls.

VII Family Rotalidae
Subfamily Rotalinae
Genus ***Truncatulina*** d'Orbigny
101. ***Truncatulina propinqua*** Reuss
pl. 11, fig. 3
Truncatulina propinqua Reuss, 1856, p. 24. pl. 4, fig. 53.
Truncatulina propinqua Reuss. Hantken, 1875, p. 71. pl. 8, fig. 9.
Test circular, lenticular, with acute periphery. On the umbilical side the last whorl is distinct, comprised of 12-13 chambers. Chambers are low, triangular, with straight sutures converging in a small umbilical depression. On the spiral side 2.5 whorls are visible, with a distinct central chamber. Aperture at the edge of the septal face of the last chamber, just above the periphery of the test. This form corresponds better to Hantken's specimens than to Reuss's. Rare in green clays.

102. ***Truncatulina hantkeni*** Rzehak
pl. 11, fig. 15
Truncatulina hantkeni Rzehak. Grzybowski, 1894, p. 200, pl. 3, fig. 17.
The specimens from Wadowice differ by their smaller size and smooth curvature of the test in one direction or the other. Diameter 0.5 - 0.8 mm. Very common in red clays.

103. ***Truncatulina mirabilis*** **n.sp.**
pl. 11, fig. 4
Test oval. Umbilical side highly convex, spiral side almost flat. Periphery acute, slightly lobate; on the umbilical side the final whorl, with five chambers, is visible Sutures are

depressed towards the periphery, flush near the centre. Chambers inflated, the final one the largest, embracing almost one-third of the test on the umbilical side. On the spiral side the outer whorl is very distinct. The final chamber on this side is high and narrow, the preceding ones are separated by indistinct, flush sutures. The inner whorl appears as a small, button-like elevation. Aperture on the periphery, on the umbilical side. Diameter 0.4 mm. Very rare in red clays.

Genus *Anomalina* Parker and Jones

104. ***Anomalina complanata*** Reuss var.
pl. 11, fig. 5

Anomalina complanata Reuss, 1851b, p. 36. pl. 4, fig. 3.
Anomalina complanata Reuss, 1861, p. 331.

Test small, rounded, spirally coiled, one side does not differ much from the other, differs from Reuss's Cretaceous forms. The chambers are not as wide and the periphery of the last chamber is a somewhat more rounded. Rare in green clays.

105. ***Anomalina parvula*** **n.sp.**
pl. 11, fig. 6

Test showing five rounded, inflated chambers in the final whorl; periphery rounded, lobate; sutures depressed. Aperture a slit-like opening at the lower edge of the final chamber, near the periphery. Diameter 0.5 mm. Rare in red clays.

106. ***Anomalina tenuis*** **n.sp.**
pl. 11, fig. 7

Similar to the preceding species [*Anomalina parvula*], but compressed. Periphery even, rounded. Seven chambers in the last whorl, triangular, with straight sutures, slightly depressed in the later stage. Sutures meet in the centre. Aperture a longitudinal slit, reaching the periphery. Diameter 0.4 mm. Rare in marls.

Genus *Pulvinulina* Parker and Jones

107. ***Pulvinulina karreri*** Rzehak[49]
pl. 11, fig. 8

Pulvinulina karreri Rzehak, 1888b. p. 228.

Test circular, lenticular. Spiral side somewhat more convex. Last whorl visible on the umbilical side, with six triangular, almost equilateral chambers and depressed, straight sutures. Periphery acute, slightly lobate. On the spiral side the distinct, narrow final whorl and traces of one and one-half to two other whorl can be seen. The latter form a convex, button-like plug. Sutures straight in the final whorl, slightly depressed in the terminal portion, separating the high, narrow chambers. Aperture normal. Diameter 0.5 mm. Rare in marls, common in green clays.

108. ***Pulvinulina haidingeri*** d'Orbigny
pl. 11, fig. 12

Pulvinulina haidingeri d'Orbigny, 1846, p. 154. pl. 8, fig. 7-9.
Pulvinulina haidingeri d'Orbigny. Hantken, 1875, p. 77. pl. 15, fig. 10.

Test circular, periphery acute, with a rounded outline. Umbilical side weakly convex. Spiral side markedly convex, almost conical. Last whorl on the umbilical side reveals six triangular chambers with sutures slightly depressed, almost straight, with a small umbilicus in the centre. On the spiral side there are three narrow whorls; sutures of chambers oblique, very distinct. Aperture normal. The illustrations of Hantken and d'Orbigny differ somewhat from one another regarding the number of chambers (eight in Hantken's illustration, six in d'Orbigny's). Hantken's specimen is also less convex on the spiral side. Forms from Wadowice have the same number of chambers as the Miocene ones, but are less convex on the umbilical side and their sutures are more distinct, as in Hantken's specimens. Diameter 0.5 mm. Rare in green clays.

109. ***Pulvinulina megastoma*** Rzehak[50]

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[49] *[Authorship of this species has been transfered to Grzybowski under Art. 21 of the ICZN.]*
[50] *[Authorship of this species has been transfered to Grzybowski under Art. 21 of the ICZN.]*

pl. 11, fig. 9

[*Pulvinulina megastoma* Rzehak, 1888b. p. 228.]

Test circular, lenticular. Spiral side very slightly convex. Umbilical side highly convex, almost hemispherical. Five chambers on the umbilical side, separated by sutures which are arcuate toward the initial end of the test and deeply depressed near the periphery, but only slightly depressed near the centre. The spiral side shows two whorls, the inner one indistinct. On this side the sutures are arcuate, flush, only the last one slightly depressed. The septal face of the last chamber is broad, with the elongate slit-like aperture at its base. Periphery acute, slightly lobate. Diameter 0.8-1.0 mm. Common in red clays.

110. ***Pulvinulina subcandidula* n.sp.**

pl. 11, fig. 10, 11

Test circular, lenticular, the spiral side less convex and the umbilical side more convex. Periphery acute, lobate; chambers inflated on the umbilical side, eight to ten in number. Sutures deeply depressed toward the periphery, more shallow towards the centre and disappearing gradually, forming a smooth surface in the centre. The spiral side shows only a single distinct whorl, with a distinctly outlined circle in the centre, bearing traces of one and one-half to two inner whorls. The chambers on this side are separated by arcuate sutures. Aperture slit-like, at the base of the large, distinct septal face near its contact with the previous whorl, about halfway between the centre and the periphery. The relationship between this form and *Pulvinulina candidula* Schwager (1883, p. 55. pl. 5, fig. 10) is very obvious, but in the latter species the outlines of the inner whorls are distinct, although the outer one is not so sharply defined and the spiral side is more convex. Diameter 0.6-0.9 mm. Very common in red clays, rare in marls.

Genus ***Rotalia*** Lamarck

111. ***Rotalia romeri*** Reuss

Rotalia romeri Reuss, 1856, pl. 4, fig. 12. p. 240.

Rotalia romeri Reuss. Grzybowski, 1894, p. 204. pl. 4, fig. 12.

The form agrees with the descriptions. Rare in marls, very rare in green clays.

112. ***Rotalia dunikowskii* n.sp.**

pl. 11, fig. 14

Test circular, lenticular. Umbilical side highly convex, flattened in the centre, periphery sharp, keeled, lobate. Only one whorl visible on the umbilical side, comprised of seven chambers separated by undulating, arcuate, depressed sutures. At the centre the small umbilicus is filled with a porcellaneous substance. On the spiral side there are two and one-half whorls; chambers narrow, elongate, oblique. Similar to *R. schraybersii* d'Orbigny[51]. Aperture normal. Diameter 0.6 - 0.8 mm. Common in marls.

113. ***Rotalia niedzwieckii* n.sp.**

pl. 11, fig. 13

Test circular, periphery acute and even. Umbilical side less convex, spiral side more convex. On the umbilical side there are eight triangular chambers with sutures arcuate toward the initial end of the test, very slightly depressed, almost flush. The central portion of the test is slightly flattened. On the spiral side there are two whorls with strongly arcuate sutures. Aperture near the periphery of the test. *Rotalia brückneri* Reuss, from the Cretaceous of Mecklenburg, is related to the present species, but differs from it in having entirely flush sutures and a centrally located aperture. Diameter 0.5 mm. Rare in green clays.

114. cf. sp?

pl. 11, fig. 17

At this time this specimen could not included into any of the known genera. Judging from the single chamber present in this specimen, one could suppose that it is some kind of monstrosity of the genus *Lagena*. One specimen from red clays.

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51 *[Spelling mistake on the part of Grzybowski. The correct name is Rotalia schreibersii d'Orbigny, 1846.]*

Plate 8.

1,2,4.	*Rhabdammina abyssorum M. Sars*
3.	*Rhabdammina abyssorum* var. *irregularis* Carpenter
5-6.	*Rhabdammina subdiscreta Rzehak*
7.	*Rhabdammina linearis* Brady
8-9.	*Rhabdammina annulata* Rzehak
10-11.	*Nubecularia tibia* Jones and Parker
12-13.	*Keramosphaera irregularis* **n.sp.** (fig. 13 is a section)
14.	*Psammosphaera fusca* Schultze
15a,b.	*Saccammina sphaerica* Brady
16.	*Hyperammina nodata* **n.sp.**
17a,b.	*Hyperammina dilatata* Rzehak
18.	*Hyperammina vagans* Brady
19-21.	*Reophax ovulum* **n.sp.** (fig. 21 is a section)
22.	*Reophax lenticularis* **n.sp.**
23-24.	*Reophax duplex* **n.sp.** var. α **n.var.**
25.	*Reophax duplex* **n.sp.** var. β **n.var.**
26a,b.	*Reophax guttifer* Brady var. *scalaria* **n.var.**
27-28.	*Reophax pilulifer* Brady
29a,b.	*Haplophragmium wazaczi* Rzehak x25
30a,b.	*Haplophragmium turpe* **n.sp.**
31.	*Haplophragmium (Reussina) quadrilobum* **n.sp.**
32a-c.	*Haplophragmium (Reussina) bulloidiforme* **n.sp.** var. α **n.var.**
33a-c.	*Haplophragmium (Reussina) bulloidiforme* **n.sp.** var. β **n.var.**
34a,b.	*Ammodiscus angygyrus* [Reuss]
35.	*Ammodiscus* sp.
36.	*Ammodiscus* sp.
37a,b.	*Ammodiscus polygyrus* [Reuss]
38a,b.	*Ammodiscus involvens* [Reuss]
39a-43c.	*Ammodiscus charoides* (Jones and Parker), x60
44a-45c.	*Ammodiscus gordialis* (Jones and Parker)
46.	*Ammodiscus schoneanus* Siddal
47.	*Ammodiscus fallax* Rzehak
48a-c.	*Ammodiscus aberrans* **n.sp.**
49a,b.	*Agathammina dubia* **n.sp.**
50a-c.	*Trochammina subglobulosa* **n.sp.**
51-52b	*Trochammina pauciloculata* Brady
53a-c.	*Trochammina intermedia* Rzehak

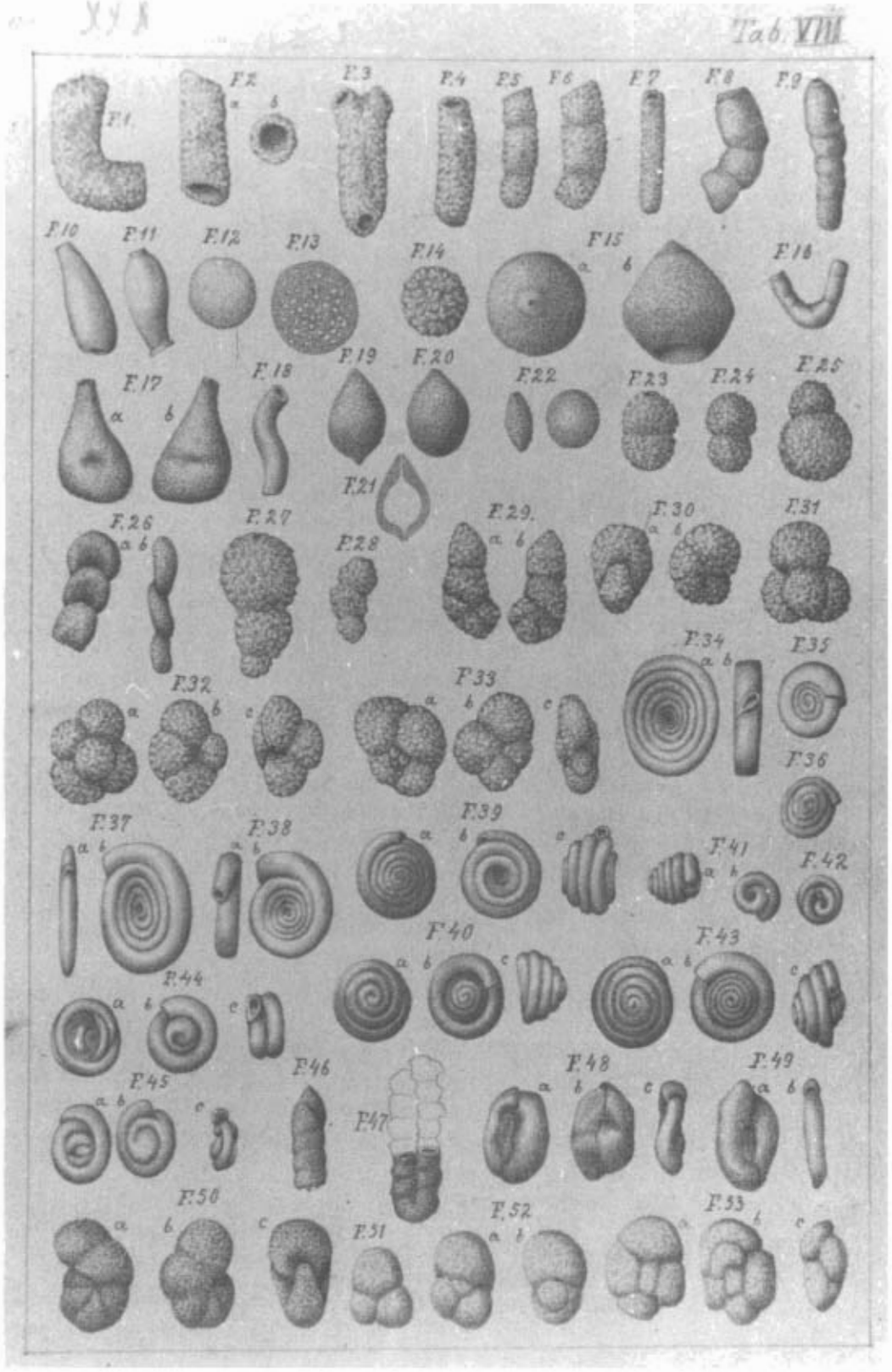
Tab. VIII
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Plate 9.

1a-c.	*Trochammina carpenteri* **n.sp.**
2a-c.	*Trochammina carpenteri* **n.sp.**var. *angustior* **n.var.**
3a,b.	*Trochammina subcoronata* Rzehak
4a-c.	*Trochammina acervulata* **n.sp.**
5a-6b.	*Cyclammina suborbicularis* Rzehak
7a-8b.	*Cyclammina retrosepta* **n.sp.**
9a,b.	*Cyclammina setosa* **n.sp.**
10a,b.	*Cyclammina globulosa* **n.sp.**
11a-12b.	*Textularia attenuata* Reuss
13a-c.	*Textularia subhaeringensis* **n.sp.** var. β
14a,b.	*Textularia flabelliformis* Gümbel
15a,b.	*Plecanium sublime* **n.sp.**
16a-c.	*Textularia subhaeringensis* **n.sp.** var. α
17a-c.	*Textularia calix* **n.sp.**
18a,b.	*Verneuilina abbreviata* Rzehak
19a,b.	*Verneuilina szajnochae* **n.sp.**
20-21.	*Bigenerina fallax* Rzehak (fig. 21 is a section)
22-23b.	*Bigenerina nuda* **n.sp.** (fig. 23 is an immature specimen)
24a-25.	*Spiroplecta lenis* **n.sp.** (fig. 25 is a section)
26-27.	*Spiroplecta deflexa* **n.sp.** (fig. 27 is a section)
28a-c.	*Gaudryina schwageri* Rzehak
29a,b.	*Ataxophragmium conulus* [Rzehak]
30a-c.	*Clavulina subparisiensis* **n.sp.**
31.	*Virgulina digitalis* **n.sp.**
32a-33.	*Pleurostomella zuberi* **n.sp.**

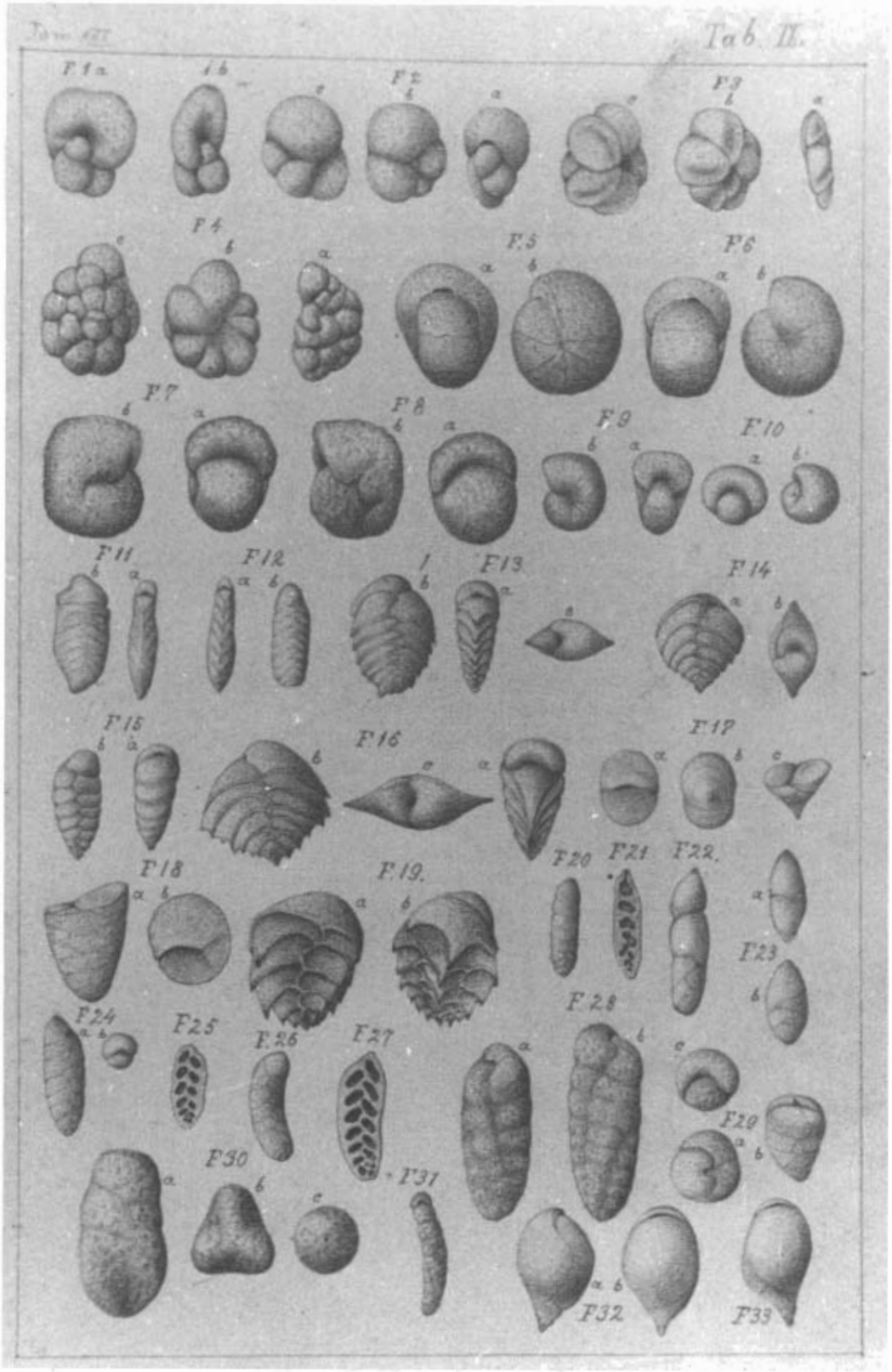
Tab. II.
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Plate 10.

1a,b.	*Pleurostomella wadowicensis* **n.sp.**
2a,b.	*Pleurostomella* sp.
3.	*Lagena subapiculata* **n.sp.**
4a,b.	*Lagena orgignyana* Seguenza
5a,b.	*Lagena (Cidaria) cidarina* **n.sp.**
6a,b.	*Lagena (Cidaria) coronata* **n.sp.**
7.	*Nodosaria simplissima* **n.sp.**
8.	*Nodosaria cornuta* Batsch
9.	*Nodosaria pungens* Reuss
10.	*Nodosaria alternans* **n.sp.**
11.	*Dentalina subtilis* Neugeboren
12.	*Dentalina indifferens* Reuss
13-14.	*Dentalina laticollis* **n.sp.**
15a,b.	*Dentalina deflexa* **n.sp.**
16a,b.	*Dentalina* **n.sp.** ind.
17.	*Dentalina vermiculum* Reuss
18.	*Glandulina subinflata* **n.sp.**
19a-c.	*Lingulina dentata* **n.sp.**
20a,b.	*Cristellaria cymboides* d'Orbigny
21.	*Cristellaria lunaria* **n.sp.**
22a,b.	*Cristellaria concava* **n.sp.**
23a,b.	*Cristellaria kochi* Reuss
24a,b.	*Cristellaria abscisa* **n.sp.**
25a,b.	*Robulina kressenbergensis* Gümbel
26a,b.	*Robulina gracilis* **n.sp.**
27a,b.	*Robulina pectinata* Grzybowski
28a-c.	*Flabellina* sp.
29a-c.	*Polymorphina dubia* **n.sp.**
30a,b.	*Robulina cincta* Grzybowski
31.	*Nodosaria calomorpha* Reuss

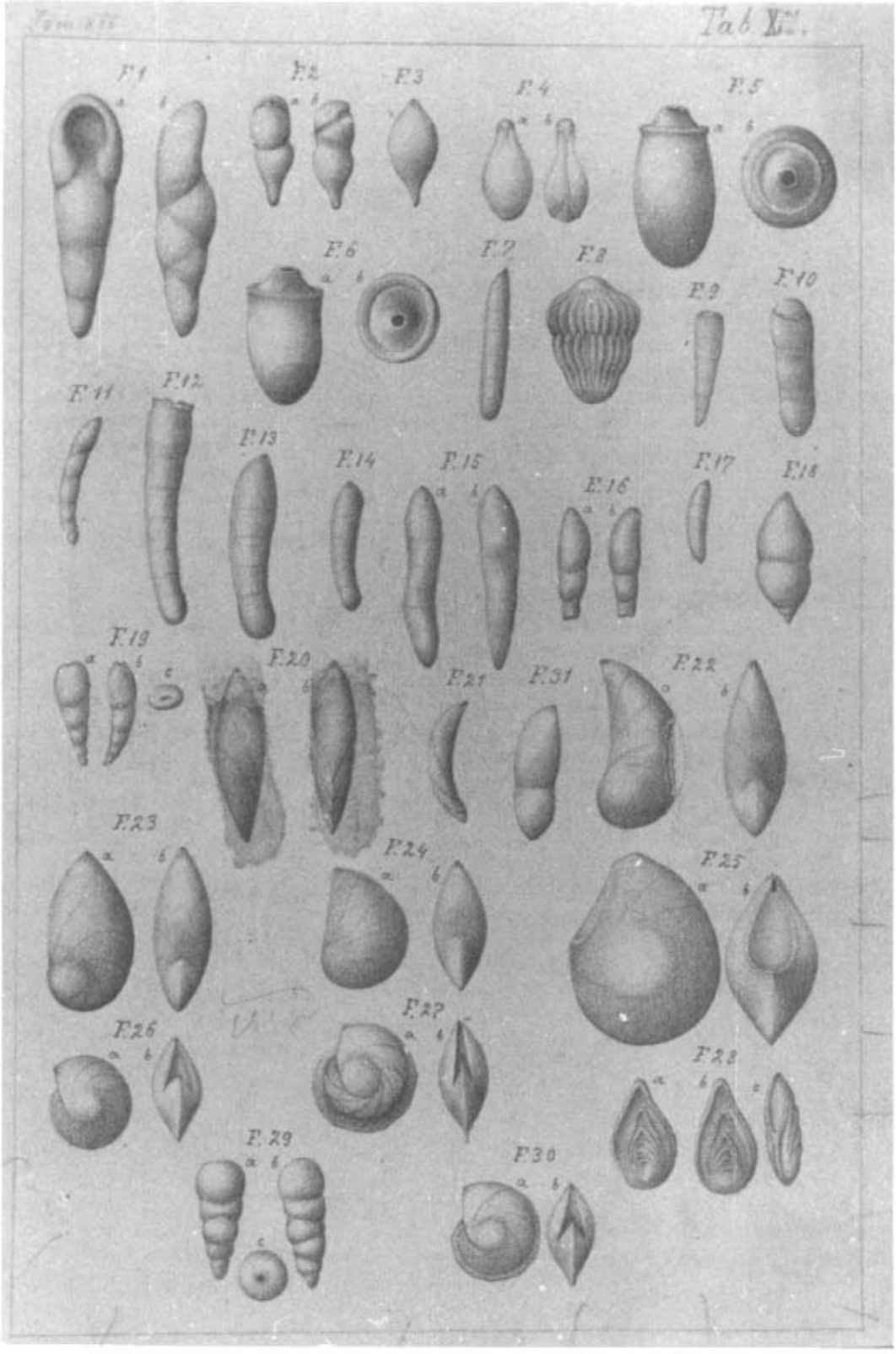
Tab. XI.
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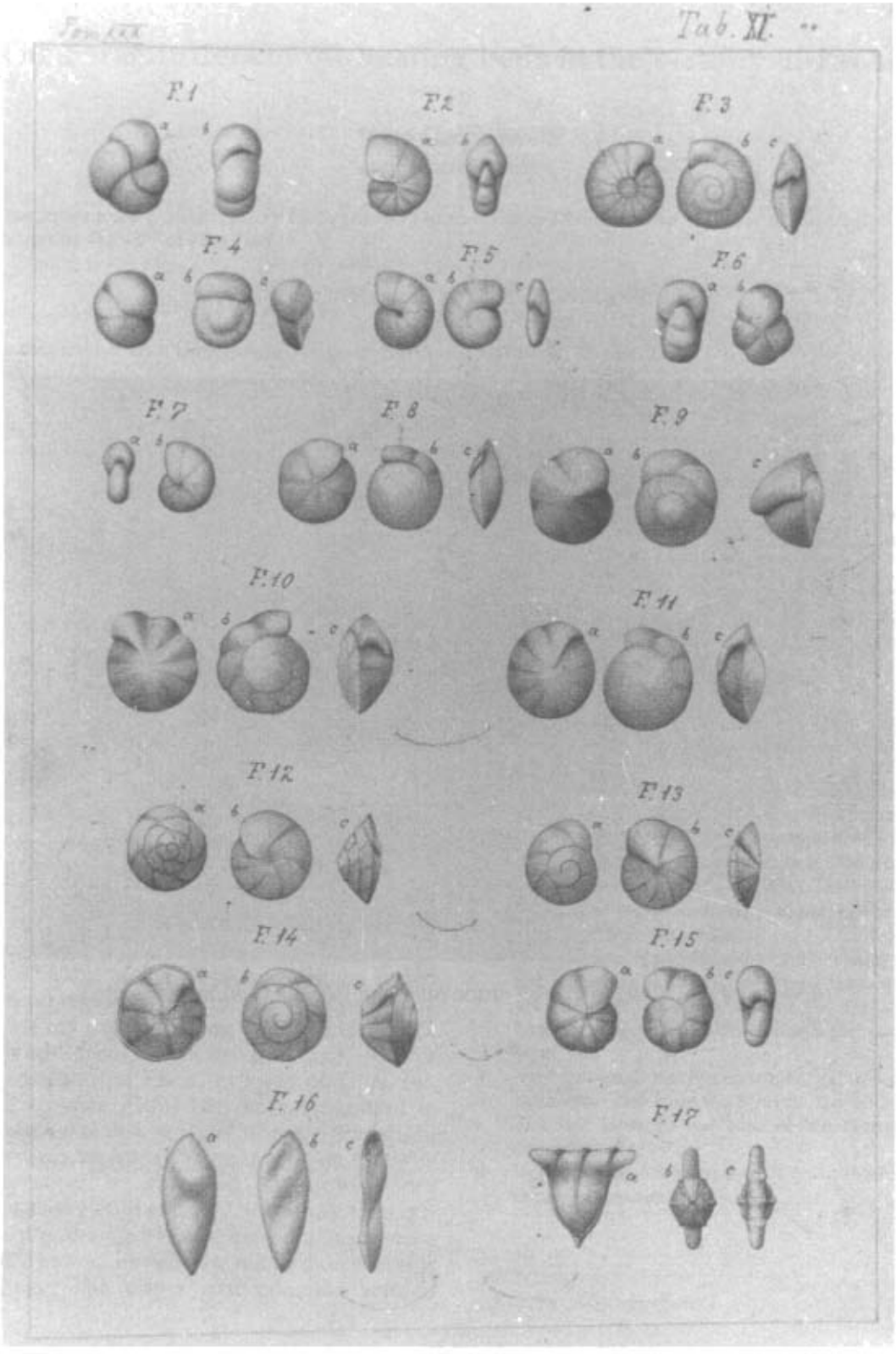
Plate 11.

1a,b.	*Pullenia compressiuscula* var. *quadriloba* Reuss
2a,b.	*Pullenia communis* d'Orbigny
3a-c.	*Truncatulina propinqua* Reuss
4a-c.	*Truncatulina mirabilis* **n.sp.**
5a-c.	*Anomalina complanata* Reuss var.
6a,b.	*Anomalina parvula* **n.sp.**
7a,b.	*Anomalina tenuis* **n.sp.**
8a-c.	*Pulvinulina karreri* Rzehak
9a-c.	*Pulvinulina megastoma* Rzehak
10a-11c.	*Pulvinulina subcandidula* **n.sp.**
12a-c.	*Pulvinulina haidingeri* d'Orbigny
13a-c.	*Rotalia niedzwieckii* **n.sp.**
14a-c.	*Rotalia dunikowskii* **n.sp.**
15a-c.	*Truncatulina hantkeni* Grzybowski
16a-c.	*Vaginulina* sp.
17a-c.	??


Tab. XI.
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