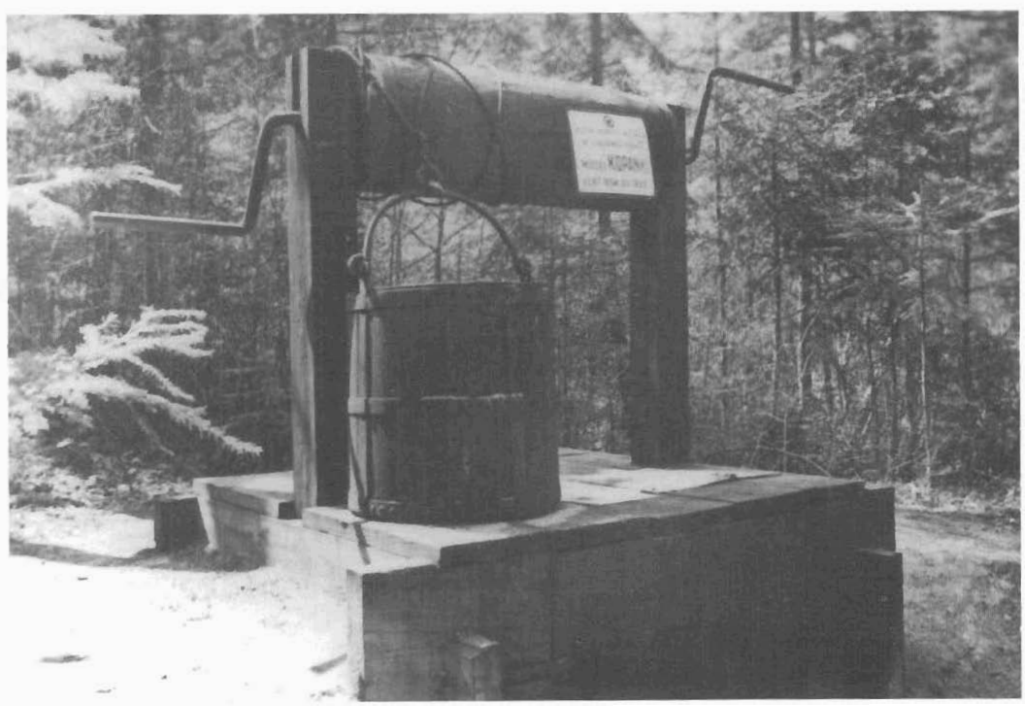

Model of a well used to extract crude oil at the Bóbrka field in 1854-1863.

The Foraminifera of oil-bearing beds in the vicinity of Krosno

by

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(with three plates)

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This study is a continuation of my work on a compilation of the microfauna of Carpathian sediments that I initiated, and includes, as the title indicates, the fauna of the oil-bearing deposits near Krosno.

Thanks to the development of the oil industry, deep drillings have completely replaced the older method of digging shafts. This change in technology has permitted detailed and more rigourous analyses of the sediments drilled. The geological literature in respect to the development of this industry has become poorer in both quantity and quality, and today we have comparatively fewer geological data than we had before. The importance of more detailed research on the oil-bearing deposits, especially today, when drill holes reach deeper horizons, convinced me to pursue the study of the foraminifera from the oil-bearing horizon in the vicinity of Krosno.

The top of the oil-bearing section in the Krosno region consists of the Menilite shales. These are exposed along a hilly ridge which extends from Krościenko Niżne [Lower Krościenko] to Potok, exposed on Góra Św. Wawrzyńca [Saint Lawrence Mountain] in Krościenko, in a few places in Białobrzegi, in Toroszówka [today Turaszówka] on the Wisłok river in so-called Malinowa Góra [Raspberry Hill] and in Potok where they create the so-called Wapienna Góra [Limestone Hill], as well as near the manor-house in this village. The upper part contains bedded cherts, the remainder of the Menilite shales are of the limey type, chocolate coloured, sometimes breaking in a fissile pattern.

The deeper layers[1] are everywhere covered with a thick cover comprised of diluvial and alluvial clays, which cover the wide valley in the vicinity of Krosno. Only in one locality, in Krościenko Niżne, the deeper layers are exposed and this allows us to compile a detailed profile. At the junction of the Śmierdziączka [Stinky] stream with the Wisłok river, from south to north (from top to bottom) the following layers are exposed:

1. Gray, granular sandstones, with abundantly disseminated mica, laminated in 20-30 cm thick layers, with intercalated gray claystones. These layers form the underlying beds for the Krosno beds as described by Dr. Tietze [1889] which are better exposed farther towards Krosno. Beneath the first layer lies :
2. calcareous, coffee-coloured Menilite shales with fish scales. Up to 20 m in thickness, these shales are exposed further in a western direction on St. Lawrence Mountain. Underneath the second layer lies:
3. light-coloured, marly claystones, up to 8 m in thickness. They form the syncline and anticline. The last layer in the base of the section is comprised of:
4. light-gray claystones, up to 10 m in thickness. Beneath them lies:

[1] *[i.e. the oil-bearing beds.]*

[Table 1. Lithology of the Société Anonyme well no. 1 in Krościenko Niżne.]

Depth (m)	Lithology	Depth (m)	Lithology
0 - 3	alluvium	214-222	hard sandstone & light-coloured shale
3 - 9	blue shaly clay	222-225	sandstone
9 - 83	gray shale	225-228	soft sandstone
83 - 84	gray clay	228-232	hard sandstone with ceresin wax
84 -107	gray shale	232-234	soft sandstone
107-109	light gray clay	234-243	green shale
109-123	red shaly clay	243-247	light-coloured shale
123-126	red and blue shaly clay	247-252	gray clay
126-139	blue shale	252-257	light grey clay
139-140	white stone	257-260	blue clay
	(sc.? sandstone)	260-266	light gray clay
140-147	light gray and gray clay	266-267	white, soft sandstone
147-153	gray clay	267-276	red shale
153-155	light gray clay	276-304	red shale
155-160	gray clay	304-308	gray shale
160-161	light gray shale	308-309	hard sandstone
161-163	white sandstone	309-329	gray shale
163-167	gray shales	329-330	blue shale
167-169	light-coloured clay	330-341	gray shale
169-185	gray shale	341-343	red shaly clay
185-188	light gray shale	343-347	gray shale
188-192	gray clay	347-358	blue shaly clay
192-199	hard, gray shale	358-362	light-coloured shale
199-200	hard sandstone	362-375	dark shale
200-203	blue shale	375-380	hard sandstone
203-204	hard sandstone	380-382	gray shale
204-214	soft sandstone	382-385	oil-bearing sandstone

5. red clays, up to 12 m thick, the base of which is not exposed.

These beds have a strike of 8-9 hours [2] with a southerly dip of 40 - 50 degrees.

Farther toward the basal part of the section there are no outcrops, only at one locality in Śmierdziączka stream do we find exposed light gray claystones, quite similar to the ones described above.

The deeper layers, containing oil, are known only from a cross-section of a shaft which was kindly provided by Mr. E. Merson, the manager of this mine. This Nr. 1 shaft belonging to the Société Anonyme penetrated the following layers (thickness in meters) [Table 1]:

We see that this is a complex of gray, light gray and red shales with intercalated sandstones.

We see analogous deposits in Potok. Beneath the Menilite shales which were drilled to different depths in several wells in the western part of the mine (the Sroczyński Mine, and Klobasa Mine), lies marly, gray shales, and then light gray and red clays with intercalated sandstones. The cross- sections of these wells fully agree with the cross-section from Krościenko, of course, with some modifications with regard to depths and thickness of individual members.

[2] *[Grzybowski reported stike in hours: 8-9 = 60°-90°.]*

It would be unproductive to list them all here.

From the first recognized horizon, the Krosno sandstones, we do not have any fossils. The second horizon, the Menilite shales from Krościenko contains a few. The basal part of the Menilite shales contains a thin (6-10 cm) sandstone layer full of organic debris, fragmented shells of molluscs and gastropods, fish bones, ichthyodorulites, teeth and scales, and foraminifera. The following fossilized remains were identified:

Fishes.

Lamna sp. ind. (tooth 4 cm long)
Otodus obliquus Agassis (2 cm long)
Odantaspis macrota var. *rustica*. Jaeckel (1.5 cm long)
Notidanus sp. (2 mm long)

Foraminifera.

Cristellaria cumulicostata Gümbel
Robulina rotulata Lamarck
Robulina gutticostata Gümbel
Glandulina laevigata d'Orbigny
Pulvinulina subumbonata Gümbel
Truncatulina granosa Hantken
Rotalia lithothammica Uhlig
Rotalia soldanii d'Orbigny
Pulvinulina partschiana d'Orbigny
Heterostegina grotriani Reuss
Nummulites budensis Hantken
Orbitoides cf. *stella* Gümbel

Foraminifera of the genus *Globigerina* are commonly found in the second horizon, the marly shales, with the predominant species *Globigerina triloba* Reuss and in addition, *Globigerina bulloides* d'Orbigny[3]. These species were the only type of foraminifera found in the marly shales from Krościenko. In Potok, I found them in wells where the Menilite shales were drilled through, where directly beneath these beds the genus *Globigerina* is found abundantly together with rare agglutinated forms.

Horizons 4 and 5 m. outcropping in Krościenko correlate with the beds encountered in the wells and both contain an identical fauna. In the course of two years I collected personally, or with the help of councillor H. Walter, and especially with the help of the managers of the mines who sent me samples as the drilling progressed, a rich material from the layers penetrated in several mines.

These samples (I refer here to the ones that contained foraminifera), at a average weight of 50 grams, come from the following mines [Table 2]:

Altogether, 243 samples from different depths have been included in this study; the deepest one reached in these mines being 720 m. Despite the fact that individual samples were rather small, in a raw or partially washed state containing on average 50 grams, the large number of samples studied guarantee us that the fauna of the oil-bearing beds from this region was thoroughly identified.

The fauna is contained primarily in various clays and shales, rarely in the sandstones, and is compiled in the following table. For comparison I compiled the species from the red clays of Wadowice, the green clays from Nikoltschitz and Brady's modern faunas [Table 3].

Of the 105 species accounted for [in Table 3], only 25 belong to calcareous forms, the rest consist of agglutinated and siliceous forms. Of the 25 above mentioned calcareous forms, 12 are present only in Krościenko, in the Menilite Shale beds, i.e. at the top of the oil-bearing beds, and two species, *Globigerina triloba* and *Globigerina bulloides*, are found just beneath the Menilite

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[3] *[Blaicher (1967) re-examined Grzybowski's samples from the "Globigerina Marls" and revised Grzybowski's determinations of the planktonic foraminifera. Blaicher reported that assemblages contain Subbotina ampliapertura, Catapsydrax perus, and Subbotina pseudoampliapertura, and correctly determined their age as uppermost upper Eocene to Oligocene. The precise age and zonal assignments of the "Globigerina Marls" were determined by Van Couvering et al. (1981), based on planktonic foraminifera, nannofossils and palynomorphs. Olszewska (1984) provided a complete description of the benthic foraminifera.]*

shales. Several forms are present together with the agglutinated foraminifera only in the deepest layers in the penetrated beds. These are: *Alveolina* cf. *melo*, *Nummulites* aff. *leymeriei* and *Amphistegina subparisiensis* in the Toroszówka, Duniecki mine

[Table 2. Sample localities]

Name of mine	No. of well	No. of samples	Abbreviation
	Potok		
The Hannover-Galicia Company mine	Wells No.: 22, 23, 27, 33, 34, 38, 39, 40, 41,	Total of 124 samples	(H)
Pyszyński mine	one well	8 samples	(Pysz)
Perkins mine	one well	1 sample	(Per)
Sroczyński mine	well no. 1	7 samples	(Srocz)
Wiktor mine	one well	2 samples	(Wikt)
Klobasa mine	wells no. 2,4,5,6,7,8	10 samples	(Klob)
Kalinka mine	one well	5 samples	(Kal)
	Toroszówka		
Duniecki mine	one well	18 samples	(Dun)
Markowski mine	one well	6 samples	(Mark)
Sroczyński mine	well no. 4 and 5	2 samples	(Srocz)
Wiśniowski mine	one well	2 samples	(Wisn)
Mac Garvey mine	well no. 7 and 8	20 samples	(M.G.)
	Bialobrzegi		
Douglas mine	one well	1 sample	(Doug)
Duniecki mine	one well	2 samples	(Dun)
	Krościenko Niżne		
The Noveau Monde mine	one well	10 samples and 4 samples from outcrops	(T.N.M.)

In addition, I have in my collection less abundant material from the following locations:

	Bóbrka		
MacGarvey mine	well no. 4	3 samples	(M.G.)
	Wietrzno		
Suszycki mine	well no. 5	1 sample	(Susz)
	Równe		
Flamand mine	well no. 2	2 samples	(Fl)
Gorayski mine	well no. 21, 29	2 samples	(Gor)
	Iwonicz		
Société Anonyme mine	well no. 11,12,13	10 samples	(Iwon)
	Ropianka		
Suszycki mine	well no. 8	3 samples	(Susz)

[Table 3 - Foraminiferal species from the Krosno region, compared with the species from the red clays of Wadowice, the green clays from Nikoltschitz and Brady's modern faunas]

	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. Keramosphaeri..ae			
3	*Keramosphaera irregularis* Gr>ybowski	X		
	2. Astrorhizid>			
	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.			

[Table 3 (Continued).]

	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. Cycloclypeinae			
105	*Orbitoides* cf. *stella* Gümbel			

at 451 m depth. The last mentioned species is also present in Białobrzegi at 223 m depth, and the remaining species are present in Potok in the Kalinki well at 600 m depth. The former forms occur together with the agglutinated forms only in the deepest layers of the drilled sediments.

If we exclude the few samples that contain calcareous forms located at the top and the base of the beds penetrated in these mines, we would be left exclusively with agglutinated foraminifera for the remaining 500 m of the oil-bearing deposits. This fauna is comprised of 21 genera with 80 species dominated by *Rhabdammina* with four species, *Reophax* with 10 species, *Haplophragmium* with six species, *Ammodiscus* with 15 species, *Trochammina* with 19 species and *Gaudryina* with three species. This fauna is very original and could not be compared with any other known assemblages except perhaps with Rzehak's green clay fauna from Nikoltschitz[1]. As I have already mentioned, this fauna is mainly present in the red, light gray and gray clays and shales. Similarities in petrography suggest that analogous conditions were present during the deposition of the Wadowice fauna and the fauna from red and light gray clays from Nikoltschitz described by Rzehak. However, both of these faunas contain many calcareous forms in addition to siliceous ones. In the Wadowice fauna the calcareous forms comprise 64% of the species, and in Rzehak's fauna the percentage is even greater. In the collection of Geology Department of the Jagiellonian University there is material, unstudied until now, containing fauna from red and light gray Carpathian clays from such localities as the Żywiec region, and from Deborzyn near Pilzno[4]. This fauna contains a sizable amount of calcareous species in addition to the agglutinated forms. This difference cannot be solely explained by bathymetry. The agglutinated forms such as *Trochammina, Cyclammina, Reophax, Rhabdammina,* although known mainly from depths greater than 1000 m, are also present at shallower depths up to 200 m in polar seas, and their presence at greater depths could also be explained by the low temperatures present there.

In the two areas mentioned above, [from the deepest layers of the drilled sediments in Białobrzegi 233 m and in Potok Kalinka 600 m] the fauna completely lacks the deep calcareous forms that are normally present together with the agglutinated ones, but contains agglutinated forms that are associated with typical near-shore forms like *Alveolina* and *Amphistegina*. The answer to the question of what kind of specific conditions existed at the time this fauna first originated cannot be provided by this study. We must wait until such time when microfaunal studies will encompass additional stages and localities, and here we will restrain ourselves only to calling attention to the uniqueness of this fauna.

Returning to the question of the age of the oil-bearing beds, we observe that the Menilite shales form their upper boundary. In Krościenko they [Menilite shales] yield few fossils, foraminifera and fish remains. Of the studied foraminifera, *Robulina rotulata, Glandulina laevigata, Pulvinulina partschiana* are Recent species; *Cristellaria cumulicostata, Robulina gutticostata and Pulvinulina subumbonata* are known from the Eocene of Kressenberg; *Heterostegina grotriani* is known from the Septarian clays; and *Truncatulina granosa, Rotalia soldanii, Nummulites*

1* In his list of foraminifera published from the clays at this locality, Rzehak (1887, Verh. d. G. R. A., p. 87) lists one calcareous form among 23 agglutinated forms. However in a previous report (ibid. 1881, p. 212) he mentions that this fauna contains predominently agglutinated forms and rare *Cristellaria* and *Nodosaria*.

4 *[Grzybowski is referring here to the assemblages from the Upper Cretaceous marls from the Subsilesian Unit of the Carpathians, which contain numerous calcareous forms. These faunas have been described in detail by Huss (1966), Liszkowa (1967) and Hanzlikova (1972)]*

budensis are known from the *Clavulina szaboi* beds. We know *Orbitoides stella* from the Eocene and Oligocene, and *Rotalia lithothammica* from the Bartonian/Ligurian stage of the Carpathians. Here we also see the Oligocene foraminifera in addition to the Eocene ones and this fauna, though minute, must be given the same consideration with the Carpathian fauna known to us from Wola Luzanska and Folusz, therefore Bartonian-Ligurian fauna. Due to the occurrence of *Nummulites budensis* which is present in the upper part of the *Clavulina szaboi* beds, we can already regard, with some reservations, the age of these layers as early Oligocene[5].

With regard to the fish remains found in this fauna, *Otodus obliquus* is known from the Eocene of London and Paris. *Odantaspis* var. *rustica* occurs in the lower Oligocene in southern Russia, and therefore confirms [that this fauna is] a Bartonian/Ligurian fauna but does not yield more detailed information. The fauna of the submenilite beds yields fewer data for comparison since we know of no analogous faunas.

Of the 80 identified species, 40 or 50% are new to science. Of the 40 remaining, 18 belong to modern species, and the others are known from the Oligocene faunas from Wadowice[6], and Nikoltschitz in Moravia[7]. There are 26 species in common with the Wadowice fauna, and 18 in common with the fauna from Moravia. We can undoubtedly state that we are dealing here with the Tertiary. We have two arguments to support this: on the one hand, we have the uniformity and continuity of the fauna in the whole complex; on the other hand, the fauna present at the base of this complex has a markedly Tertiary aspect.

In particular, at three localities the drillings reached layers containing a different type of fauna.

In the Kalinka Mine in Potok, after penetrating through layers containing typical agglutinated foraminifera, identical to the ones present at other localities in this area, at 600 m red clays were reached which contain, in addition to the nine agglutinated species, one or two specimens of the following calcareous forms:

Lagena apiculata Reuss.
Nodosaria radicula Linneus
Nodosaria kreutzi n.sp.
Dentalina n.sp. ind.
Cristellaria elegans Hantken
Cristellaria konneni Reuss
Globigerina sp.
Discorbina pusilla Uhlig
Truncatulina subakneriana n.sp.

and also the following Ostracoda:

Bairdia subdeltoidea Jones
Cytherella sp. aff. *compressa* Münster.

In the Duniecki mine at Toroszówka, beneath the complex containing the agglutinated fauna, at a depth of 451 m, clays were penetrated which in addition to four agglutinated species, contain :

Alveolina cf. *melo* d'Orbigny
Amphistegina subparisiensis n.sp.
Nummulites cf. *Leymeriei* d'Archiac.[8]

Finally, in the Duniecki mine at Białobrzegi, at a depth of 225 m, in identical conditions, we find *Amphistegina subparisiensis* in addition to six agglutinated forms.

Undoubtedly, at these three localities different deeper layers were reached, since

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[5] *[Grzybowski correctly ascertained the age of the Menilite shales, although he apparently was confused by the presence of faunal elements redeposited from Eocene strata. Olszewska (1985) undertook detailed studies of the foraminifera from the Menilite beds.]*

[6] *[Grzybowski refers to his Wadowice fauna here as Oligocene, but his material is actually a mixture of Campanian and Paleocene assemblages.]*

[7] *[The fauna from Nikoltschitz was revised by Pokorny (1950).]*

[8] *[correct citation is N. leymeriei d'Archaic and Haime, 1853.]*

the characteristic fauna started to change. These beds also belong in the Tertiary. Of the specimens listed above, disregarding *Lagena apiculata* which is known from the Cretaceous to Recent, and *Nodosaria radicula* which is still living today, we find that *Cristellaria elegans* is known from the *Clavulina szaboi* beds, *Cristellaria konneni* is present in the Septarian Clays, and *Discorbina pusilla* occurs in the beds at Wola Łużańska and Folusz. The new forms have closest affinities with the Tertiary fauna. *Alveolina* is known from the Tertiary to the Recent. *Amphistegina* does not range below the Tertiary except for one questionable species present in the Carboniferous, and the species from our fauna has its closest analog in the Eocene of Paris. The nummulite plays the most decisive role. These three occurrences at the base of the oil-bearing deposits indicate that this complex of beds belongs in the Tertiary, and most utterly excludes the hypothesis that the oil in this region is derived from the Ropianka Beds, and therefore from the Cretaceous. The argument for the Tertiary age of our fauna has even greater impact in that the fauna of the oil-bearing deposits at Ropianka, (the place that gave its name to this formation which until now was dated as Cretaceous), is identical to the one from Potok. Therefore, the oil-bearing deposits from Ropianka undoubtedly belong in the Tertiary.

It would be more difficult to stratigraphically define the lower boundary of the drilled beds known to this date. Here, we find forms present in Bartonian-Ligurian horizons as well as in the Oligocene, but there are too few forms to make a more conclusive statement.

The single nummulite found at the base of the formation was not preserved well enough to be more precisely identified. It is closest to *Nummulites leymeriei* d'Archiac, a species that according to the monograph of de la Harpe [1881-1883], belongs to the fourth nummulite horizon counting from the bottom, and therefore to the lower or middle Eocene. There is no doubt that *Nummulites leymeriei* is closely related to *Nummulites madaraszi* Hantken known from the lower Oligocene of Hungary. This is clearly visible when comparing drawings and descriptions of the two species, a fact which de la Harpe also points out in his study. Since the form found in our material shows affinity to both of these species, it could be new transitional form between them, which is most likely.

The hypotheses of a middle Eocene age for our fauna would not be fully justified only by this occurrence, and other forms as well do not lend any support. Without solving this question at the moment, we can accept that the oil-bearing beds in the vicinity of Krosno, which lie beneath the Menilite Beds: the age of which we determined to be Bartonian-Ligurian or perhaps even Oligocene, therefore represent the upper Eocene.

In view of the taxonomy, the occurrence of new types of the genus *Haplophragmium* deserve notice[9]. This form displays a tendency toward trochoid coiling. In modern faunas, this type is replaced by one species, *Haplophragmium turbinatum* Brady, in which trochoid coiling is not clearly marked. In the investigated fauna, this type is represented by three species: *Haplophragmium subturbinatum, Haplophragmium walteri,* which has the most distinctive trait, and *Haplophragmium immane.* The type of test construction as in *Globigerina* for which I proposed the name *Reussina,* is poorly represented in this fauna.

It is also worth noting the occurrence of new types of the genus *Ammodiscus*[10] In addition to already known planispiral, glomospiral and intermediate types, there is also new type in which the tube is irregularly bent (*Ammodiscus irregularis, Ammodiscus glomeratus*); a type similar to planispiral forms with a trend toward the irregular coiling (*Ammodiscus serpens*); and a type that dis-

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[9] *[Grzybowski means "Haplophragmium" in the old sense. In current usage, these forms belong in Recurvoides and Haplophragmoides.]*

[10] *[In the following discussion, Grzybowski means "Ammodiscus" and "Trochammina" in the old sense. In current usage, these forms belong in Glomospira, Trochamminoides, and Paratrochamminoides.]*

plays an initial globular inflated, tube (*Ammodiscus umbonatus*). This last observation is important because of the phylogeny that is also present in the tubular genus *Hyperammina*. There is also a type that shows a tendency towards constrictions, which makes this genus appear similar to the genus *Trochammina*. The presence of the distinct species *Ammodiscus bornemanni* (= *Cornuspira bornemanni*) suggests an irrational separation of the genera *Cornuspira* and *Ammodiscus* by Brady. Different planispiral, trochospiral and dimorphic types are also found in the genus *Trochammina*. It is also important to mention the occurrence of the fossilized forms such as *Dendrophrya* and *Sorosphaera*, which have only been known until now from modern faunas.

Overall, the preservation of the species is rather good except for some of the thin, tubular forms that could only be found in fragments (*Rhabdammina*, *Hyperammina*, *Dendrophrya*). After I started using Schöne's apparatus for preparing samples which is gentler to the samples, I was able to preserve large fragments up to 5 and 6 mm in length. The specimens preserved only the colour of the environment in which they were present, therefore the ones found in red clays are red, and ones from green clays are greenish. It is worth pointing out the fact that some of the specimens have deformed tests. This deformation can not be identified as a pathological condition but must have occurred later, due to the pressure applied upon the test which made it lose its original shape. For example, spherical or ellipsoidal forms were flattened (*Reophax difflugiformis*, *Reophax grandis*). This can be identified by the irregularly wrinkled surfaces and variously located apertures on the tests.

In multichambered forms, such as *Trochammina*, deformation is manifested by the compression of the entire test in a given direction, either conforming to its natural compression or in an opposite direction. For example in *Trochammina contorta*, the test, which in its natural condition is compressed perpendicular to its axis of coiling, is sometimes flattened obliquely or displays compression or deformation of only the larger, outer chambers. This deformation can be attributed to pressure applied at a later stage. Under conditions in which solid siliceous or calcareous tests would have been broken into fragments, among agglutinated tests it is possible that individual grains of sand comprising the test could have moved around one another without losing their mutual bonding, if deformation occurred some time before the chitinous substance that binds them together was destroyed. If, however, deformation occurred after the chitinous cement was destroyed, and individual components were always adjacent to one other despite changes in their relative position, even if this deformation did occur, water circulating through the sediments could have cemented them again with silica or calcium carbonate without leaving any traces of this action. The presence of deformed specimens makes the identification of species extremely difficult and at times even impossible, forcing a very detailed and tedious process of trying to reconstruct the building plan of every deformed individual.

Before I start to describe the species, where as in my previous works I used Brady's systematics, let me thank Prof. Dr Szajnocha who in this study has been very supportive, as always. I would also like to thank Councillor H. Walter, whose untiring work enabled me to collect this rich material, as well as the owners and managers of mines who willingly sent me samples and made this study possible.

Table 4 (in nine parts). Microfossils recorded in samples from the Krosno region.

SAMPLE	Species number:																																	
LOCALITY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35
Potok																																			
H - 22 24m													2	2		1																			
H - 22 43m													3	2		1													3						
H - 22 54m														3					2		2								2						
H - 22 54-65m																																2			
H - 22 70m																2																			
H - 22 100m																2													2	2					
H - 22 110m													3	2		3			2	2	2			2					2				2	2	
H - 22 198m													2			2													2						
H - 22 240m																			3																
H - 22 317m													2											1											
H - 22 320m													2		2				1									2	1						1
H - 22 328m																													3						
H - 22 350m																													3						
H - 22 386m				2								2																							
H - 23 20m													3						1									2	2				2		
H - 23 26m													3			1				2		2		2					2				2		
H - 23 46m													3			3						2											2		
H - 23 66m													2	2					2						2	2	2	1				2			
H - 23 82m												2		2						1												3			
H - 23 106m																																2			
H - 23 160m																																			
H - 23 110m												2				2																			
H - 23 187m												3				1																			
H - 23 217m																												1							
H - 23 226m												3		2					2	3												2			
H - 23 237m												3	2																						
H - 23 245m												2	2																						
H - 23 246m													2			•			1																
H - 23 260m														3																					
H - 23 313m												2																							
H - 23 327m														3					2			1							3						
H - 23 360m				2	3																									1					
H - 26 42m																4																			
H - 26 95m													3			4																			
H - 26 180m																			1																
H - 26 195m													3	2					3										3				2		1
H - 26 338m													3								•								2						2
H - 27 30m													2	3		3																			
H - 27 80m				2								3	2	2		2					2							3	2						
H - 27 130m													1			3																			
H - 27 150m												2	2															2							
H - 27 180m													2			1												1							
H - 27 194m																1				1								1	1						
H - 27 195m														2																					
H - 27 204m				2								2																							
H - 27 312m												3	1			1																			
H - 33 25m												3	3	3						3					1							3	3		1
H - 33 30m														2		1			1	1								2				1			
H - 33 50m													1								1							1							
H - 33 85m			2	2									2			1												2							
H - 33 142m													2															3	3						
H - 33 170m												3	4	4		1				2		1		1								1			
H - 33 170-203													3	1		1												2	2	2		1			
H - 33 203m													3															2	3			1			
H - 33 210m													2							2				1				1				1			
H - 33 227m									1	•		1	2	3	1	2			3	4								2					1		
H - 33 277m												1	1			2												2							
H - 33 287m													1	3		1								1				3	2						
H - 33 298m												2	3			2				3	1			2			2	3				1	1		
H - 33 302m												2	3						1	2							1	4	2			1			
H - 33 317m												2	2			2				2								1	3			1			
H - 33 329m												1		1		2												2							
H - 33 355m													1			4																			
H - 33 370m																6																			
H - 33 424m												4				1												3	2						
H - 33 427m																			1									3			1				
H - 33 436m				3								3	2	2		1			1									2	2						
H - 33 445m																2			1	2								4	4						
H - 33 460m				3																								2	1						
H - 33 470m				2								3																							
H - 33 480m													3	2														2							
H - 34 15m													4	3		2			3	3				2				3	2			1	2		
H - 34 25m													4	2		3				2												1			
H - 34 45m												2	4	3		3				3								1	1						1
H - 34 91m													3	2		2				2								2	2			1			
H - 34 140m			2										3	4		3				2				2	2	2		2	1			2			
H - 34 175m													2			3			1	2	2							3				2			
H - 34 185m														2		3				3							2	3	3			3			
H - 34 255m													3																						
H - 34 265m			2						2			2		4		3			2	3		2	2	2				4	2			2	2		
H - 34 280m													2			2			2									3							
H - 34 290m													2									1		1				4	2			2			1
H - 34 320m												4		4		3								1				4	4			2			
H - 34 328m																6																			
H - 34 334m													2			4																			
H - 34 345m			2																																
H - 34 370m													2			4																			
H - 34 384m													2	4																					
H - 34 390m								3																											
H - 34 391m																6																			
H - 34 402m													2															3				1			
H - 34 407m													2															1				1			
H - 34 425m												2																2							
H - 38 24m													2	3		3												1					2		
H - 38 70m				3									2	3		2			2	2		2						2							1
H - 38 120m													2			2												2				2			

SAMPLE	Species number:																																	
LOCALITY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35
H - 38 248m													1																						
H - 38 255m													3	3		2			2	2								3	2	2			3		
H - 38 302m																3			2	2				2	2	2		3	2			2			
H - 38 313m													2															3							
H - 38 350m																																			
H - 39 24m																			3																
H - 39 35m				1									2	3		3								2				1				3			
H - 39 82m												2	2			2			2	2							2	2		2		2			
H - 39 150m													2	3		3																			
H - 39 160m				2									2			6											1					1	1		
H - 39 250m				3									2			3			1									1				2			
H - 40 15m													2	2		2				2				2	2	2	2	4	4						1
H - 40 24m																																3			
H - 40 38m													4			2							2					3	1				2		
H - 40 52m			1										2	3		2			2									3	2				1		
H - 40 80m												1		1		5												1							
H - 40 90m												2	2	3								1						1				2	3		
H - 40 96m																													1						
H - 40 120m													1			6																			
H - 40 150m														2		3			1									1							
H - 40 165m													2	1		6																			
H - 40 171m																			1																
H - 40 320m																			1																
H - 41 17m														3		3				3				1				3	3				1		
H - 41 25m																																2			
H - 41 108m													3			2				2				2				2	2						
H - 41 171m													3	3		1								1				2	2			2	2		
H - 41 189m				4									3			2				2								2	2				1		
H - 41 193m																				2								3	2						
H - 41 203m				2									1			2												2							
H - 41 232m													1	2		6						2						3	3				2		2
H - 41 278m														1																					
H - 41 315m														1														4				1			
H - 41 318m													1			3												2							
H - 41 320m													4	2		3												3				3	2		
H - 41 370m												4																1	1						
H - 52 560m					6							2				1																			
H - 52 720m					1							2				1														1					
Pysz 400m													3			2				1		2		1								2	2		
Pysz 420m												3				2																			
Pysz 430m													4						2									3					3		
Pysz 451m																2								1				2	2				1		
Pysz 490m																5																			
Pysz 525m					2							3	3	3		5			2														1		
Pysz 600m													1	3																					
Pysz 680m												3	2	2		2													2						
Pusz 706m													2																						
Per 130m												2		1						2								2				2			1
Srocz - 1 13m													1																			1			
Srocs - 1 42m													1			1																			
Srocz - 1 80m													4	4						1								4	3			1			
Srocz - 1 137m													1			1					1							1							
Srocz - 1 138m																													3						
Srocz - 1 220m																																	3		
Srocz - 1 450m												3																							
Srocz - 1 520m																2																			
Srocz - 1 523m																5																	1		
Srocz - 1 525m																3																			
Wikt 150m														2																					
Wikt 260m													3			2				1															
Wikt 450m													2			3				2				2				2				2			
Klob - 2 444m													1																						
Klob - 4 8m																																			
Klob - 4 560m					4								3											1				1							
Klob - 5 130m																																3			
Klob - 5 190m													2			3			2	3								2					2		
Klob - 5 530m													2			1																			
Klob - 5 561m					4																														
Klob - 6 479m													3									1						2	2						
Klob - 7 87m													4			3			1									2							
Klob - 7 560m													2						3									3							
Klob - 7 561m																																	1		
Klob - 8 117m				*								3	3			2				2									2				1		1
Kal 150m													3			2			3	2													3		3
Kal 250m														2																					
Kal 400m																2																			
Kal 453m					2								4	4		3			3	3				2								2			2
Kal 500m					2		3						1																			1	1		1
Toroszowka																																			
Dun 50m												1				1																			
Dun 60m																			2													1			
Dun 80m																																			
Dun 100m													1	1		2				2					2	*		3				2			
Dun 145m																1			2																
Dun 160m												2	3			2												2				1			
Dun 187m																1				2								3	2						
Dun 195m												3				5				2									2			1			
Dun 205m													1			3								1											
Dun 225m													2			2				1								2							
Dun 250m																3																			
Dun 253m													2															1							
Dun 265m				2								2				3																	1		
Dun 275m																4												2							
Dun 320m												2																2							
Dun 325m																												2							
Dun 392m												3																							
Mark 297m													1	1						2													1		

SAMPLE	Species number:																																	
LOCALITY	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35
Mark 350m														4																					
Mark 358m													4			4				1								3							
Mark 385m																1												1							
Mark 392m													4	4		2												4		1					
Srocz - 4 302m																				1									2						
Srocz - 5 170m																				3									2			1			
Wisn 400m							2									1													1						
Wisn 569m					3							3						3											2						
M.G. - 7 40m																																			
M.G. - 7 148m																												2							
M.G. - 7 170m							3									1																			
M.G. - 7 205m												2																1							
M.G. - 7 215m																				1															
M.G. - 7 225m																1																			
M.G. - 7 240m			1	2									2																						
M.G. - 7 250m												3	2															1	3			1			
M.G. - 7 256m				1																															
M.G. - 7 260m				3																															
M.G. - 7 268m																			1									2							
M.G. - 7 270m				2																													1		
M.G. - 7 280m					4													3																	
M.G. - 7 300m					4							2							2									2	2						
M.G. - 7 310m					3							2							1			1													
M.G. - 7 320m																																	2		
M.G. - 8 25m												3	3	4		3			3	3								3		2					
M.G. - 8 160m													3	2		2				1								1				2			
M.G. - 8 210m													4	2		5			2													2			
M.G. - 8 235m																3																			
M.G. - 8 250m																																			
M.G. - 8 265m			2													4																			
M.G. - 8 270m							3									4																			
Bialobrzegi																																			
Doug 131m													3																						
Doug 280m																		3																	
Doug 380m																1																	3		
Doug 390m					3																														
Dun 131m					5									3		2			2			2		2				3							3
Dun 225m					3	4																						1	2						
Dun 255m																		5																	
Krosciemko																																			
T.N.M. 10m				3												2																			
T.N.M. 30m				2												2																			
T.N.M. 50m				2										2		3												2	2						
T.N.M. 81m																4																			
T.N.M. 107m				2							3					3												2	2						2
T.N.M. 110m														2		3																			2
T.N.M. 117m																		3																	
T.N.M. 120m														2		3			1														2		1
T.N.M. 230m				2																															
T.N.M. 243m														2														2							
T.N.M 330m																												2				2			
T.N.M. 347	2			2																															
red clays												4		3	2																	3		3	
gray clays								2				2	3	3	2	2				2				2								2	3		
menelite shale																																			
marls below menl																																			
Bobrka																																			
M.G. - 4 570m																																			
M.G. - 4 571m																3																			
M.G. - 4 593m																1																			
M.G. - 4 609m				*								2	3	3		3					2							2							
Wietrzno																																			
Susz - 5 415m				*								3																							1
Rowne																																			
Fi - 2 400m													3	2						2								2							
Fi - 2 450m													3			2				1															2
Gor - 21 100m				3								*		2					3															
Gor - 29 126m													2	3					2	2								2	2						
Iwonicz																																			
Iwon - 11 130m									2			2		2							2			1					2					2	
Iwon - 11 240m													2	3		1			1																
Iwon - 11 282m													2							1															
Iwon - 12 231m																					2								2						
Iwon - 12 246m				2								3	3								2							2	2	1					
Iwon - 12 282m																2																			
Iwon - 13 47m													2	4														2							
Iwon - 13 125m				3									3						2										*						
Iwon - 13 140m																																			
Iwon - 13 195m												3																							
Iwon - 13 223m													3	3														*							
Iwon - 13 225m																				*															
Iwon - 13 246m																2																			
Roplanka																																			
Susz - 8 7m												2																							
Susz - 8 22m					2								2	2					2	2															
Susz - 8 400m				2								3																							

SAMPLE	Species number:																																
LOCALITY	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70
Potok																																			
H - 22 24m																																			
H - 22 43m												2			1																				
H - 22 54m									1									2												1			1		
H - 22 54-65m																																			
H - 22 70m																												1							
H - 22 100m									2																										
H - 22 110m						2		2									2	3					2							2		2			
H - 22 198m																		2										2							
H - 22 240m																	2													2					
H - 22 317m																																			
H - 22 320m						2	1			2	1				2		1	2							2										
H - 22 328m						4																													
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H - 23 20m																	2				2	2													
H - 23 26m						2											1				2							2				2			
H - 23 46m				1		2								2														2							
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H - 23 82m						2	1															2													
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H - 23 160m																																1			
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H - 23 313m						1												2																	
H - 23 327m						2											2	3		1						2									
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H - 26 195m						2	2			1								2															2		
H - 26 338m						2				2													1										1		
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H - 27 80m			1			4					1			1			3	3					2			2		2							
H - 27 130m																																			
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H - 27 180m						1												1										2							
H - 27 194m						1									1							2													
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H - 27 204m																																			
H - 27 312m																																			
H - 33 25m	3	3				3	3		3	1	2	1					1	1								2		1							
H - 33 30m																	1	1					2					2					2		
H - 33 50m	2		1			1												2															1		
H - 33 85m						1																													
H - 33 142m						1																			2								2		
H - 33 170m						1			1		1						2	1		1			1							2					
H - 33 170-203						1			1																							1	1		4
H - 33 203m																	2						2				2								5
H - 33 210m						3			1								2	2									2					1	2		5
H - 33 227m						1								1				1			1							1		1					3
H - 33 277m																							1												
H - 33 287m			1			2			1								2	2					2									1			
H - 33 298m																																2			
H - 33 302m						2											1						1									2			
H - 33 317m								1									2				2											3			
H - 33 329m																1																			
H - 33 355m									1																										
H - 33 370m																																			
H - 33 424m						1											2																		
H - 33 427m																																			
H - 33 436m									1								2														1				
H - 33 445m				1		1											3	3					2									1			
H - 33 460m								1																											
H - 33 470m																							2												
H - 33 480m				1		1			1																										
H - 34 15m	1		1			1	1		1								3	2	1				3				1				2		1		
H - 34 25m		1							2									1								1							1		
H - 34 45m						2		1		2								2									2						1		
H - 34 91m						1									2			2					1		1						1		1		1
H - 34 140m						1								1									2												
H - 34 175m						2			1																			2				2			
H - 34 185m									1											1			3												3
H - 34 255m																																			
H - 34 265m						2					2			2			3	2					3							2			3		
H - 34 280m																	1						1												
H - 34 290m			1			3			1	1							2	1				2	3									3			
H - 34 320m						3			1								1															1	1		
H - 34 328m																																			
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H - 34 425m																	1																		
H - 38 24m																																			
H - 38 70m		2				2		1	2	1												1	2							1					
H - 38 120m								1																											

SAMPLE	Species number:																																
LOCALITY	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70
H - 38 248m																																			
H - 38 255m						1											2	2				2	3								1	3	3		4
H - 38 302m																	1	1					2									1	2		
H - 38 313m																	1	2				2													
H - 38 350m																				1															
H - 39 24m																																			
H - 39 35m																																			
H - 39 82m									1																							2	2		1
H - 39 150m																																			
H - 39 160m						2	1													2															
H - 39 250m																							2			2						1			
H - 40 15m				1		4				1							2	1		1			1							1		2	2		
H - 40 24m																																			
H - 40 38m						3																			1								2		
H - 40 52m						1											2											1		1		1	1		
H - 40 80m																		1				3	3						1			1			1
H - 40 90m						2																								3					
H - 40 96m																																			
H - 40 120m																																			
H - 40 150m						1								1																					
H - 40 165m																																			
H - 40 171m																																			
H - 40 320m																																			
H - 41 17m						1	1													1			2	2			1					1			
H - 41 25m																																			
H - 41 108m																		2					2							1		4			1
H - 41 171m						2												2		1				1			1	1				2			2
H - 41 189m						2	2		1														1												
H - 41 193m																	1																		
H - 41 203m						1												1																	
H - 41 232m		1							1	2							1	1		1			2	1						1		2			
H - 41 278m						1											1						2												
H - 41 315m		1																																	
H - 41 318m																																			
H - 41 320m			1			2			2								1						3												
H - 41 370m																																			
H - 52 560m																																			
H - 52 720m																					2	1						2			3				
Pysz 400m						2																					2								
Pysz 420m																																			
Pysz 430m	1					3												1						2						1	2				
Pysz 451m						2			2								2						1				1								
Pysz 490m																																			
Pysz 525m						1																			2							1			
Pysz 600m																																			
Pysz 680m						1											2					2		2											
Pusz 706m																																			
Per 130m						1		1		1								2						1											3
Srocz - 1 13m																																			
Srocs - 1 42m																																			
Srocz - 1 80m						1																					1				1	1			1
Srocz - 1 137m																				1											1				2
Srocz - 1 138m																																			
Srocz - 1 220m																																			
Srocz - 1 450m																																			
Srocz - 1 520m																																			
Srocz - 1 523m																																			
Srocz - 1 525m																																			
Wikt 150m																																			
Wikt 260m																															1				
Wikt 450m						2																		2								1			2
Klob - 2 444m																																			1
Klob - 4 8m																																			
Klob - 4 560m						2											1			2			2	2											
Klob - 5 130m																																			
Klob - 5 190m						2				1							3	3				2	2	3								2	4		4
Klob - 5 530m																																			
Klob - 5 561m																																			
Klob - 6 479m						2																													
Klob - 7 87m																	1	1														2			3
Klob - 7 560m																	3					1									1				
Klob - 7 561m																								1											
Klob - 8 117m																											1								2
Kal 150m	2													2			2	3		2			2												
Kal 250m																																			
Kal 400m																																			
Kal 453m	1						1										3	1		2															
Kal 600m																		3			1								1				2		
Toroszowka																																			
Dun 50m																																			
Dun 60m																							2												
Dun 80m						1																													
Dun 100m						1											1															3	2		
Dun 145m																																			
Dun 160m						1																											2		
Dun 187m																																			
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Dun 225m																																			
Dun 250m																																			
Dun 253m																																			
Dun 265m																																			
Dun 275m																																			
Dun 320m																																			
Dun 325m																						1													
Dun 392m	2					3																													
Mark 297m																	1				2		2								2				

SAMPLE	Species number:																															
LOCALITY	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70
Mark 350m																																			
Mark 358m																																			4
Mark 385m																																			2
Mark 392m																	2			2			3				1					2	2		5
Srocz - 4 302m																																			
Srocz - 5 170m						1											2	2					2	2											5
Wisn 400m																	1						1												1
Wisn 569m																				2															
M.G. - 7 40m																		3																	
M.G. - 7 148m						2											1						2												
M.G. - 7 170m																																			
M.G. - 7 205m						2												2					2												
M.G. - 7 215m						3											2						2												
M.G. - 7 225m						1																	2												
M.G. - 7 240m						1											3	2				2	3	2											
M.G. - 7 250m						2				1								4		2			3								1				1
M.G. - 7 256m																																			
M.G. - 7 260m																																			
M.G. - 7 268m																	2																		
M.G. - 7 270m																																			
M.G. - 7 280m																				2			2										2		
M.G. - 7 300m																				1											1				
M.G. - 7 310m																		3		2				1											
M.G. - 7 320m																																			
M.G. - 8 25m	1					2			1	2			1				2	2									3			1		2	3		4
M.G. - 8 160m																						2													2
M.G. - 8 210m						2																1													2
M.G. - 8 235m																																			
M.G. - 8 250m																																			
M.G. - 8 265m																																			
M.G. - 8 270m																																			
Bialobrzegi																																			
Doug 131m																																			
Doug 280m																																			
Doug 380m																																			
Doug 390m																																			
Dun 131m																				2															
Dun 225m																		1																	
Dun 255m																																			
Kroscienko																																			
T.N.M. 10m						2																						2		1			2		
T.N.M. 30m						2																													
T.N.M. 50m						2		2									2											2		1					
T.N.M. 81m																																			
T.N.M. 107m						2																		1				2							
T.N.M. 110m																																			
T.N.M. 117m																																			
T.N.M. 120m									2					2																					
T.N.M. 230m																																			
T.N.M. 243m						2											2																		
T.N.M 330m														2								2						1							
T.N.M. 347m						1											1					2													
red clays	3		2			2			3	2		2		1			3	3					2							2					3
gray clays	2	2				3	2		2	2				1			2	3	1		1		2										2		
menelite shale																																			
marls below menl																																			
Bobrka																																			
M.G. - 4 570m						2																													
M.G. - 4 571m																		•																	
M.G. - 4 593m																	1																		
M.G. - 4 609m																	2								2										
Wietrzno																																			
Susz - 5 415m																							2												
Rowne																																			
Fl - 2 400m																																			
Fl - 2 450m																												2				2			
Gor - 21 100m																	2	2				2		2											2
Gor - 29 126m			1														3	2					3	2										2	4
Iwonicz																																			
Iwon - 11 130m						4									2		3	3					2												
Iwon - 11 240m						1			1								1					2													
Iwon - 11 282m																		2														2			
Iwon - 12 231m						3											1																		
Iwon - 12 246m									2								1			2	2											4			
Iwon - 12 282m																																			
Iwon - 13 47m																	3																		
Iwon - 13 125m																																			
Iwon - 13 140m						1																	1	1											
Iwon - 13 195m																																			
Iwon - 13 223m						1												2				3	2									2			
Iwon - 13 225m																																			
Iwon - 13 246m										1																									
Ropianka																																			
Susz - 8 7m																																			
Susz - 8 22m						2		1		2							2	2		2															
Susz - 8 400m																																			

SAMPLE	Sample number:																															
LOCALITY	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100	101	102	103	104	105
Potok																																			
H - 22 24m																																			
H - 22 43m										1																									
H - 22 54m																																			
H - 22 54-65m																																			
H - 22 70m									2																										
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H - 22 110m									3		2																								
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H - 26 338m									2	1																									
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H - 27 204m																																			
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H - 33 85m									1																										
H - 33 142m																																			
H - 33 170m				2	2																														
H - 33 170-203																																			
H - 33 203m					3																														
H - 33 210m										3																									
H - 33 227m					2				3	3	2																								
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H - 33 298m								2	3	2																									
H - 33 302m								2																											
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H - 34 175m								1	3																										
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H - 34 255m																																			
H - 34 265m		1			1	3		4			3																								
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H - 34 290m								1	4																										
H - 34 320m								1																											
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H - 34 384m										1																									
H - 34 390m																																			
H - 34 391m																																			
H - 34 402m									2																										
H - 34 407m									1																										
H - 34 425m								1	1																										
H - 38 24m										1																									
H - 38 70m									1	1																									
H - 38 120m																																			

SAMPLE	Sample number:																															
LOCALITY	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100	101	102	103	104	105
H - 38 248m									1																										
H - 38 255m								2	3																										
H - 38 302m									2																										
H - 38 313m									2																										
H - 38 350m																																			
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H - 39 82m								1	2																										
H - 39 150m										1																									
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H - 40 15m						1			4																										
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H - 41 17m									4																										
H - 41 25m																																			
H - 41 108m	1							2	3																										
H - 41 171m									2	1																									
H - 41 189m									4	3	2																								
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Pysz 400m									1																										
Pysz 420m																																			
Pysz 430m																																			
Pysz 451m																																			
Pysz 490m																																			
Pysz 525m									2																										
Pysz 600m																																			
Pysz 680m																																			
Pusz 706m																																			
Per 130m									1	1																									
Srocz - 1 13m																						6													
Srocs - 1 42m																						6	5												
Srocz - 1 80m								1	1																										
Srocz - 1 137m																																			
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Wikt 150m																																			
Wikt 260m																																			
Wikt 450m									2																										
Klob - 2 444m																																			
Klob - 4 8m																						6	4												
Klob - 4 560m																																			
Klob - 5 130m																																			
Klob - 5 190m			1						4	2																									
Klob - 5 530m									1																										
Klob - 5 561m																																			
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Klob - 8 117m																																			
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Kal 400m																																			
Kal 453m																																			
Kal 600m												1		1	1	1		1	1					1		1									
Toroszowka																																			
Dun 50m																																			
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Dun 100m									2																										
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Dun 160m																																			
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Dun 275m										2																									
Dun 320m									1																										
Dun 325m																																		1	
Dun 392m																																			
Mark 297m																																			

SAMPLE	Sample number:																															
LOCALITY	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100	101	102	103	104	105
Mark 350m																																			
Mark 358m				3	1	1				2																									
Mark 385m																																			
Mark 392m																																			
Srocz - 4 302m										2																									
Srocz - 5 170m						1		1		2																									
Wisn 400m								1																											
Wisn 569m																																			
M.G. - 7 40m																																			
M.G. - 7 148m																																			
M.G. - 7 170m																																			
M.G. - 7 205m																																			
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M.G. - 7 256m																																			
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M.G. - 7 268m					2																														
M.G. - 7 270m																																			
M.G. - 7 280m																																			
M.G. - 7 300m										1																									
M.G. - 7 310m																																			
M.G. - 7 320m																																			
M.G. - 8 25m				3	3	3																													
M.G. - 8 160m									2																										
M.G. - 8 210m																																			
M.G. - 8 235m																																			
M.G. - 8 250m									1																										
M.G. - 8 265m																																			
M.G. - 8 270m																																			
Bialobrzegi																																			
Doug 131m																																			
Doug 280m																																			
Doug 380m																																			
Doug 390m																																			
Dun 131m																																			
Dun 225m																															3				
Dun 255m																																			
Krosciemko																																			
T.N.M. 10m																																			
T.N.M. 30m																																			
T.N.M. 50m																																			
T.N.M. 81m																																			
T.N.M. 107m										2																									
T.N.M. 110m																																			
T.N.M. 117m																																			
T.N.M. 120m																																			
T.N.M. 230m																																			
T.N.M. 243m										2																									
T.N.M 330m																																			
T.N.M. 347m									1	2																									
red clays							2																												
gray clays																																			
menelite shale													1				2			2	2				2		1	1	2	1		1	3		*
marls below menl																						6	4												
Bobrka																																			
M.G. - 4 570m																																			
M.G. - 4 571m																																			
M.G. - 4 593m																																			
M.G. - 4 609m																																			
Wietrzno																																			
Susz - 5 415m								1																											
Rowne																																			
Fi - 2 400m																																			
Fi - 2 450m																																			
Gor - 21 100m																																			
Gor - 29 126m										2																									
Iwonicz																																			
Iwon - 11 130m										2																									
Iwon - 11 240m										1																									
Iwon - 11 282m																																			
Iwon - 12 231m																																			
Iwon - 12 246m																																			
Iwon - 12 282m																																			
Iwon - 13 47m									1																										
Iwon - 13 125m									1	1																									
Iwon - 13 140m																																			
Iwon - 13 195m																																			
Iwon - 13 223m																																			
Iwon - 13 225m																																			
Iwon - 13 246m																																			
Ropianka																																			
Susz - 8 7m																																			
Susz - 8 22m																																			
Susz - 8 400m																																			

Class: Foraminifera

Family Miliolidae
Subfamily Nubecularinae
Genus ***Nubecularia*** Defrance

1. ***Nubecularia tibia*** Jones and Parker

Nubecularia tibia Jones and Parker. Grzybowski, 1896, p. 273[11], pl. 8, fig. 10, 11.

This species is known to me in the form of single segments from Wadowice. I found it here as small two- and three-chambered fragments with smaller dimensions. The length of the three-chambered fragment is 1.5 mm.

Subfamily Alveolininae
Genus ***Alveolina*** d'Orbigny

2. ***Alveolina*** **sp...?** (*Alveolina melo* d'Orbigny)

A fragment of a test with spherical shape that allows us to speculate about its affinity to *Alveolina melo*.

Subfamily Keramosphaerinae
Genus ***Keramosphaera*** Brady

3. ***Keramosphaera irregularis*** Grzybowski

Keramosphaera irregularis Grzybowski, 1896, p. 273, pl. 8, fig. 12, 13.

Accompanying the small, spherical tests, entirely identical to the ones from Wadowice, there sometimes occur larger, very slightly roughened tests with a diameter up to 1.2 mm. Here also belong small balls of pyrites that show on there surface very delicate reticulation but their inner structure is lost.

Family Astrorhizidae
Subfamily Astrohizinae
Genus ***Dendrophrya*** T.S. Wright

4. ***Dendrophrya excelsa*** **n.sp.**
pl. 10, fig. 1 - 4

Test tubular, flattened, dendritically branched, finely agglutinated with siliceous cement. At the ends of the branches small apertures are sometimes visible. This species is very similar to *Dendrophrya erecta*. T.S. Wright (Brady, 1884, p. 239 pl. 27A, fig. 7-9) but differs from it markedly in size. I know it only from fragments, which are rather common and up to 2.5 mm in length and 0.6 to 1.0 mm in width, whereas Brady reports a length of 3.5 mm for the entire branched test in *Dendrophrya erecta*.

5. ***Dendrophrya robusta*** **n.sp.**
pl. 10, fig. 7

I am assigning to this species fragments of flattened tubular tests distinguished by their unusually thick walls, which are very finely agglutinated with siliceous cement. The surface of the test is almost smooth or only very slightly roughened. Length of fragments 2 - 5 mm, width 0.7 - 1.5 mm.

6. ***Dendrophrya latissima*** **n.sp.**
pl. 10, fig. 8

Test tubular, completely compressed. Walls very thin, finely agglutinated with siliceous cement. Width of test 2 mm, thickness 0.3 mm. I have found only fragments, which sometimes attain a length of 7 mm.

Subfamily Saccammininae
Genus ***Sorosphaera*** Brady

7. ***Sorosphaera confusa*** Brady
pl. 12, fig. 26 - 28

Sorosphaera confusa Brady, 1884, p. 251, pl. 18, fig. 9, 10.

Test multichambered, comprised of several spherical chambers placed one upon the other without any particular order, without any visible passages, nor a common aperture. Small openings are visible on some of these chambers which are probably apertures of the individual chambers. Test finely agglutinated.

Genus ***Saccammina***

8. ***Saccammina sphaerica*** Brady

Saccammina sphaerica Brady. Grzybowski, 1896, p. 274, pl. 8, fig. 15.

Identical to the forms known from Wadowice. I have also found specimens transformed into pyrite.

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[11] *[Grzybowski consistently cited the pagination of the reprint, not the journal. The page numbers of these and other citations have been corrected here.]*

Subfamily Rhabdamminae
Genus ***Hyperammina*** Brady
9. ***Hyperammina vagans*** Brady
Hyperammina vagans Brady. Grzybowski, 1896, p. 275, pl. 8, fig. 18.
This species is identical to the ones known from Wadowice and occurs here in somewhat larger fragments attaining a length of 1.4 mm.

10. ***Hyperammina nodata*** Grzybowski
Hyperammina nodata Grzybowski, 1896, p. 275, pl. 8, fig. 16.
This species as well does not differ in any way from the ones previously described.

11. ***Hyperammina subnodosiformis*** **n.sp.**
pl. 10, fig. 5, 6
Test tubular, compressed, constricted at irregular intervals, but not divided into chambers. It probably branches at times, because some fragments are broadened at one side and show constrictions as if there had been two branches diverging at an acute angle. It is known to me only in fragments, which are up to 1.2 mm wide and up to 3.0 mm long. It is very similar to *Hyperammina subnodosa* Brady.

Genus ***Rhabdammina*** Sars.
12. ***Rhabdammina abyssorum*** M. Sars
Rhabdammina abyssorum M. Sars. Grzybowski, 1896, p. 275, pl. 8, fig. 1-4.
Fully agrees with the one described from Wadowice.

13. ***Rhabdammina subdiscreta*** Rzehak[12]
Rhabdammina subdiscreta Rzehak. Grzybowski, 1896, p. 275, pl. 8, fig. 5, 6.
This is one of the most abundant species.

14. ***Rhabdammina linearis*** Brady
Rhabdammina linearis Brady. Grzybowski, 1896, p. 15, pl. 8, fig. 7.

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

In addition to straight, thin tubes we also find rather common tubes with a slight inflation in the middle which creates an oval chamber.

15. ***Rhabdammina annulata*** Rzehak[13]
Rhabdammina annulata Rzehak. Grzybowski, 1896, p. 276, pl. 8, fig. 8, 9.
This species agrees with the one described in Wadowice but its constrictions are not as deep.

Family Lituolidae
Subfamily Lituolinae
Genus ***Reophax*** Montfort
16. ***Reophax placenta*** **n.sp.**[14]
pl. 10, fig. 9, 10
Test unilocular, circular, compressed, discoidal, occasionally with periphery thickened and at the same time with a dish-like depression in the centre. This depression is sometimes less regular, and may lie off-centre. Test finely agglutinated, surface rough; in rare cases, if the sand is very fine, the surface is almost smooth. This species, which Rzehak found in material from Nikoltschitz, was indicated by him as *Trochammina placenta*, but it is monothalamous, as I have seen in many sections, not segmented, and must therefore be assigned to the genus *Reophax*. Diameter 0.5 - 1.2 mm; thickness 0.2 - 0.4 mm.

17. ***Reophax difflugiformis*** Brady[15]
pl. 10, fig. 11, 12
Reophax difflugiformis Brady, 1884, p. 251, pl. 31, fig. 1, 2, 3.
Test flask-shaped, flattened, with the upper end stretched out into a neck, where the aperture, as a simple opening, is located on its very end. The specimens from my material differ

[13] *[Authorship of this species has been transfered to Grzybowski under Article 21 of the ICZN.]*
[14] *[Majzon (1943) designated R. placenta the type species of the new genus Placentammina. This generic name was synonymized under Saccammina by Loeblich and Tappan (1964), but recognized as a valid genus by Loeblich and Tappan (1988).]*
[15] *[Grzybowski's figure of R. difflugiformis was synonymized under the new species Reophax grzybowskii by Schubert (1902) (= Saccammina grzybowskii of later authors)].*

from the ones described by Brady in their greater compression, which could have occurred later as a result of pressure.

18. ***Reophax grandis*** **n.sp.**
pl. 10, fig. 13, 13a, 14, 15

Test with very thin and finely agglutinated walls, with a rough surface; unilocular. The aperture is a simple opening at the end of a broad and short tube. Shape of the test probably spherical or ellipsoidal. In my material all individuals exhibit extreme compression, so that they resemble thin discs, but the aperture is often situated in various places, sometimes in the centre (as in fig. 14), at other times at the edge (fig. 13). Furthermore, the surface shows irregular wrinkles, from which we may conclude that the originally more or less spherical test has been flattened subsequently, as a result of pressure. Diameter 1.6 - 2.4 mm.

19. ***Reophax duplex*** Grzybowski

Reophax duplex Grzybowski, 1896, p. 276, pl. 8, fig. 23, 24.

I found both varieties of this species described as var. a and var. b in the above-cited study. I also found numerous intermediate forms; from those in which the difference in the size of both chambers was very small, to forms in which one of the chambers was 1/6th of the size of the second chamber. Compressed specimens were found in addition to the normal specimens.

20. ***Reophax pilulifera*** Brady

Reophax pilulifera Brady. Grzybowski, 1896, p. 277, pl. 8, fig. 27, 28.

Very often flattened specimens occur in addition to the normal ones. This flattening can be attributed to pressure, often the last, largest chamber is only affected, and the degree of compression varies.

21. ***Reophax guttifera*** Brady
pl. 10, fig. 18a

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

Test siliceous, or finely agglutinated, comprised of a row of chambers, placed one on top of the other as in the genus *Nodosaria*. Chambers spherical, separated by deep constrictions, sometimes connected by a short neck.

22. ***Reophax guttifera*** var. ***scalaria*** Grzybowski

Reophax guttifera var *scalaria* Grzybowski, 1896, p. 277, pl. 8, fig. 26.

Very similar to the species described from Wadowice. Here, the specimens also occur as fragments of three to seven chambers.

23. ***Reophax splendida*** **n.sp.**
pl. 10, fig. 16

Test finely agglutinated, surface rough, similar in structure to the genus *Dentalina*. Sutures between the chambers depressed. The test as a whole is compressed at right angles to the longitudinal axis. Length of three-chambered fragments, 1.3 mm.

24. ***Reophax subnodulosa*** **n.sp.**
pl. 10, fig. 17, 18

Test finely agglutinated or siliceous, with a rough surface, similar in structure to *Dentalina*. Chambers numerous, ovate. The interior, as seen in balsam preparations, consists of a row of pear-shaped cavities joined by narrow neck-like passages. This structure is similar to that of the species *Reophax nodulosa* Brady (Brady, 1884, p. 294, pl. 31, fig. 1- 9), from which our species differs markedly in size, being very small. Length of a seven-chambered fragment, 1 mm.

25. ***Reophax elongata*** **n.sp.**
pl. 10, fig. 19, 20

Test siliceous or finely agglutinated, with an almost smooth surface, nodosarian in structure. Chambers distinct, elongate, oval. Sutures depressed. Length of individual chambers up to 0.8 mm. Found only in fragments.

Genus ***Haplophragmium*** Reuss

26. ***Haplophragmium turpe*** Grzybowski

Haplophragmium turpe Grzybowski, 1896, p. 277, pl. 8, fig. 9.

In addition to forms that are identical with the one described from Wadowice we also find finely agglutinated specimens with rough surface and more distinct sutures.

27. ***Haplophragmium fontinense*** Terquem
pl. 10, fig. 21, 22

Haplophragmium fontinense Terquem.[16] Brady, 1884, p. 305, pl. 35, fig. 1.

Test coiled inside (nautiloid). Two whorls are visible, the inner one only partially and indistinctly visible. The outer whorl displays five to eight chambers with distinct, deeply, separated sutures. The last chamber is often elongated and does not touch the older part of the test with its inner margin. Surface rough. Length 0.8 - 1.2 mm.

28. ***Haplophragmium subturbinatum*** **n.sp.**[17]
pl. 10, fig. 23

Test siliceous or very finely agglutinated with siliceous cement, surface smooth, rarely slightly roughened. Coiled in a truncatuline manner in a trochoid spire. On the spiral side, the inner whorl is visible, consisting of three or four chambers separated by flush sutures, and the peripheral portion of the outer whorl, consisting of four or five chambers with slightly depressed sutures. On the umbilical side, only the final whorl is visible, two chambers with depressed sutures extending to the centre of the test. Aperture under the edge of the last chamber near its contact with the earlier portion of the test. Shape generally spherical. Diameter 0.3 - 0.6 mm. Similar to *Haplophragmium turbinatum* Brady[18] (Brady, 1884, p. 312. pl. 35, fig. 9). In the latter, however, the truncatuline type of coiling is barely distinguishable.

29. ***Haplophragmium walteri*** **n.sp.**
pl. 10, fig. 24

Test similar in structure to the preceding species [*Haplophragmium subturbinatum*], spherical. On the spiral side there is a distinct inner whorl with five chambers separated by flush sutures, and a distinct central chamber. Sometimes instead of a single central chamber, there are two or three smaller ones. The chambers of the last whorl are separated by depressed sutures. On the umbilical side, five or six chambers are visible, with depressed sutures. Aperture similar to that of the preceding species. Size 0.8 - 1 mm.

30. ***Haplophragmium immane*** **n.sp.**
pl. 10, fig. 25

Test finely agglutinated, surface rough, very similar to the preceding species [*Haplophragmium walteri*], but the inner whorl is barely visible on the spiral side, being covered to a large extent by two chambers of the final whorl, which are separated by depressed sutures. In the final whorl there are eight chambers, triangular in shape on the umbilical side; here the sutures reach the centre, where they form a small depression. Aperture as in the preceding species. Size 1 - 1.5 mm.

Genus ***Reussina*** Grzybowski.

31. ***Reussina quadriloba*** Grzybowski

Reussina quadriloba Grzybowski, 1896, p. 278, pl. 8, fig. 31.

In perfect agreement with the one described from Wadowice, only of somewhat larger size.

Subfamily Trochammininae

Genus ***Ammodiscus*** Reuss

32. ***Ammodiscus polygyrus*** Reuss

Ammodiscus polygyrus Reuss. Grzybowski, 1896, p. 280, pl. 8, fig. 37.

This species conforms completely to specimens described from Wadowice belonging among the most widely distributed forms, but it is not very abundant in terms of the number of specimens.

33. ***Ammodiscus angygyrus*** Reuss

Ammodiscus angygyrus Reuss. Grzybowski, 1896, p. 280, pl. 8, fig. 34.

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[16] *[= Haplophragmium fontinensis Terquem, 1870, p. 337, pl. 24, figs. 29-30b.]*

[17] *[Pokorny (1951) designated this species as the genotype of Thalmannammina.]*

[18] *[= Lituola (Haplophragmium) turbinatum Brady, 1881]*

In addition to normal specimens, there are also some forms with an oval outline. In the latter specimens the compressed margins of the test are clearly visible.

34. ***Ammodiscus involvens*** Reuss

Ammodiscus involvens Reuss. Grzybowski, 1896, p. 279, pl. 8, fig. 38.

Rare forms found in this material sometimes possess only 6 - 7 whorls.

35. ***Ammodiscus tenuissimus*** **n.sp.**[19]

pl. 10, fig. 35

Test siliceous, planispirally coiled in six convolutions, of which the last is very broad, occupying almost one-third of the diameter. Test is extraordinarily thin, in which it differs from *Ammodiscus involvens* (Reuss)[20]. In older individuals the central portion is indistinct; in young specimens, which are very thin, it is distinctly marked. It is probable that the specimen found in Wadowice and mentioned under no. 24 in the description of that fauna as *Ammodiscus* sp. (pl. 8, fig. 35) belongs to this species. Diameter 0.8 - 1 mm.

36. ***Ammodiscus latus*** **n.sp.**

pl. 10, fig. 27, 28

Test siliceous or finely agglutinated, surface smooth or slightly rough; planispirally coiled. Two and one-half distinct, thick coils. Periphery rounded, the end of the final whorl sometimes uncoiling. Diameter 0.8 mm.

37. ***Ammodiscus umbonatus*** **n.sp.**

pl. 10, fig. 29, 30

Test siliceous or finely agglutinated, planispirally coiled. Two and one-half to four distinct whorls. In the centre there is a great inflation of the tube into a spherical central chamber, in which this species differs from the preceding [*Ammodiscus latus*]. Periphery rounded. Diameter 0.8 - 1.2 mm.

38. ***Ammodiscus gorayskii*** **n.sp.**

pl. 11, fig. 5

Test finely agglutinated, surface rough; comprised of a thick tube, planispirally coiled. Only the final whorl is distinct; of the inner whorls, one or one and one-half are visible, irregularly arranged, sometimes appearing inflated in places. Diameter 0.7 - 1.0 mm.

39. ***Ammodiscus septatus*** **n.sp.**

pl. 11, fig. 1

Test finely agglutinated, surface rough, consisting of a thick tube, planispirally coiled in two and one-half whorls. Whorls partly involute, the last one occupying almost half the diameter; it exhibits three to five constrictions at regular intervals, which are incised, but which do not decrease the lumen of the tube or do so only to a slight degree. Periphery rounded. Diameter 1 - 1.2 mm; thickness 0.4 - 0.5 mm.

40. ***Ammodiscus bornemanni*** (Reuss)

Cornuspira bornemanni Reuss, 1863, pl. 1, fig. 3.

I only have a fragment consisting of one half of the siliceous test, planispirally coiled in 6 - 7 whorls. The last whorl is the widest and shows distinct, closely spaced, delicate striations in the direction of the radius. Sharp periphery.

41. ***Ammodiscus charoides*** (Jones and Parker)[21]

pl. 10, fig. 26

Ammodiscus charoides (Jones and Parker). Grzybowski, 1896, p. 280, pl. 8, fig. 39-43.

In addition to the specimens described from Wadowice, there are other forms in which the tube, after completing two rows of whorls, starts to coil in a direction intersecting with the previous coils, embracing the whole test as shown in the included figure[22]. Often pathological forms are found, of which the

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[19] *[This species is a subjective junior homonym of Spirillina tenuissima Gümbel, 1862 (= Ammodiscus tenuissimus of subsequent authors).]*

[20] *[= Operculina involvens, 1850]*

[21] *[Grzybowski erroneously listed the authorship of this species as "Parker and Jones".]*

[22] *[This variety was later described as Glomospira saturniformis by Majzon (1943), who placed Grzybowski's drawing in his synonymy.]*

first row of coils is very small, the second one coiled only in the equatorial plane, and is comprised only of two wide whorls[23].

42. ***Ammodiscus gordialis*** (Jones and Parker)
Ammodiscus gordialis (Jones and Parker). Grzybowski, 1896, p. 281, pl. 8, fig. 44-45.
In view of the presence in my material of common pathological forms of *Ammodiscus charoides*, which however, always preserves its characteristic double row of coils, of which one or the other [row] undergoes changes, I must change my opinion stated in my previous study, mentioned above, that *Ammodiscus gordialis* is a pathological form of *Ammodiscus charoides*. The tube in this species coils in many directions like in a ball of yarn.

43. ***Ammodiscus demarginatus*** **n.sp.**
pl. 10, fig. 34
Test finely agglutinated, surface rough. The tube is at first coiled in two to three small whorls, then runs in a direction oblique to the earlier whorls and embraces them, broadening markedly, forming two to two and one- half whorls. The end of the tube then uncoils and projects somewhat. Diameter 0.6 - 0.9 mm.

44. ***Ammodiscus serpens*** **n.sp.**
pl. 10, fig. 31 - 33
Test finely agglutinated, surface rough. The thick tube forms two or three elliptical whorls, of which the last two are distinct, the third one partly covered. Sometimes the end of the tube uncoils and lies adjacent to the preceding whorl for a certain distance, then extends in an opposite direction. Size 0.8 - 1 mm.

45. ***Ammodiscus irregularis*** **n.sp.**
pl. 11, fig. 2, 3
Test finely agglutinated, surface rough; comprised of a thick round tube of uneven thickness, coiled irregularly. Size 0.8 mm.

46. ***Ammodiscus glomeratus*** **n.sp.**
pl. 11, fig. 4
Test siliceous, surface smooth; comprised of a thin tube which forms several S-shaped curves, with the whorls touching each other. Size 0.6 mm.

Genus ***Agathammina*** Neumayer
47. ***Agathammina dubia*** Grzybowski.
Agathammina dubia Grzybowski, 1896, p. 282, pl. 8, fig. 49.
In addition to the forms quite similar to the Wadowice specimens, there are those which have two distinct inner whorls. The constriction of the tube at the ends of the longer, oval axis of the sometimes pointed test is markedly visible in the balsam preparations. The compressed, flattened tube narrows rapidly at the end of the axis, turning into a thin, short passage which then rapidly broadens into a uniformly narrow, long chamber[24].

Genus ***Trochammina*** Parker and Jones.
48. ***Trochammina olszewskii*** **n.sp.**
pl. 11, fig. 6
Test finely agglutinated, surface slightly rough. In structure it is very similar to the genus *Ammodiscus*; it consists of a tube divided into rounded segments by depressed incised sutures and coiled in three whorls. Of these, the central one is very small and poorly visible, the second is much broader, and the third, of equal size, is arranged spirally around it. Size 1.4 mm.

49. ***Trochammina lituiformis*** Brady
pl. 11, fig. 17 - 18
Trochammina lituiformis Brady, 1884, p. 342, pl. 40, fig. 4-7.
Test finely agglutinated, surface rough. Chambers partially spiral, (nautiloid), in the later formed part uniserial. In the spiral part, one whorl is comprised of 7 - 8 spherical chambers with depressed sutures, increasing in size. In the straight part, in my material,

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[23] *[This type can probably be referred to Glomospira diffundens Cushman and Renz, 1946.]*

[24] *[Grzybowski clearly describes here a specimen of Rzehakina epigona, but no specimens are preserved in his collection.]*

there are up to four chambers. Aperture a simple opening in the depression at the top of the last chamber. Size 1 - 1.8 mm.

50. ***Trochammina vermetiformis*** **n.sp.**
pl. 11, fig. 19
Test finely agglutinated, surface slightly rough; structure similar to that of the preceding species [*Trochammina lituiformis*], but the chambers are flattened and elongate, and in the whorl lie with their flat sides adjacent to one another. Sutures shallow, incised. Length 2 - 2.5 mm; width 0.5 mm.

51. ***Trochammina heteromorpha*** **n.sp.**
pl. 11, fig. 16
Test agglutinated, surface rough. Chambers spherical; the initial portion consists of seven minute chambers arranged in an irregular (trochoid) spire, then followed by three uniserial chambers. On one side of the test, both portions are visible, with all the chambers; on the other side, the straight portion partially conceals the earlier portion. Size 1.4 mm.

52. ***Trochammina contorta*** **n.sp.**
pl. 11, fig. 12 - 14
Test agglutinated, surface rough. Chambers flattened, elongate, spirally coiled (nautiloid) in such a way that the flat sides of the chambers lie adjacent to each other. Consequently the test is elongated in one direction. Aperture in a depression at the end of the final chamber. Sometimes there occur forms with shorter, oval chambers, which are irregular and often still more deformed as a result of pressure. Length 1 - 1.8 mm; width 0.5 - 0.8 mm.

53. ***Trochammina subcoronata*** Rzehak[25]
pl. 11, fig. 11
Trochammina subcoronata Rzehak. Grzybowski, 1896, p. 283. pl. 11, fig. 3.
In addition to the rather common, but atypical forms similar to those from Wadowice, there are specimens which are distinctly spiral, comprised of two whorls in their inner part, of which only the last whorl is clearly visible and partly covers the first whorl. Spherical chambers with deep sutures. Some specimens are deformed as a result of pressure.

54. ***Trochammina elegans*** Rzehak[26]
pl. 11, fig. 10
Trochammina elegans Rzehak, 1887a, p. 88.
Test agglutinated, surface rough; circular in outline, spirally coiled in two and one-half to three whorls. Chambers spherical, increasing in size, numerous, with depressed sutures; there are thirteen to fifteen of them in the last whorl. Aperture at the lower edge of the last chamber, just above the rounded periphery. Diameter 1.3 mm.

55. ***Trochammina folium*** **n.sp.**
pl. 11, fig. 7 - 9
Test agglutinated, surface rough, circular, flattened, spirally coiled (nautiloid); chambers elongate, broad, tightly appressed; two whorls visible, four to six chambers in the last whorl. The final chamber sometimes projects or even uncoils. Sutures shallow grooves. Periphery acute, lobate. Diameter 0.5 - 1.2 mm.

56. ***Trochammina intermedia*** Rzehak
Trochammina intermedia Rzehak. Grzybowski, 1896, p. 282, pl. 8, fig. 53.
Agrees with the one described from Wadowice. On one side, it sometimes has up to three distinct, inner chambers in the central portion.

57. ***Trochammina variolaria*** **n.sp.**
pl. 11, fig. 15
Test agglutinated, surface slightly rough, strongly compressed. Around the circumference there are four large, elongate chambers. In the

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25 *[Authorship of this species, as well as Trochammina elegans and Trochammina intermedia has been transfered to Grzybowski under Article 21 of the ICZN.]*

26 *[Because Trochammina elegans Grzybowski, 1898 was a primary junior homonym of T. elegans Egger, 1893, Kaminski and Geroch (1992) renamed it Trochamminoides grzybowskii.]*

centre there is one small chamber. The sutures are shallow grooves. It is similar to the preceding species [*Trochammina intermedia* Grzybowski], but differs in having only a single central chamber, in the extreme compression, and in the subacute, lobate periphery. Diameter 0.8 - 1 mm.

58. ***Trochammina deformis* n.sp.**
pl. 11, fig. 20 - 22

Test agglutinated, surface slightly rough; somewhat compressed. There are five or six peripheral chambers, of irregular shape and variable size, and one or two central ones, which are often displaced toward the margin because of the extreme increase in size of the peripheral chambers. Sutures depressed, periphery rounded and lobate. This species also belongs to the type of *Trochammina intermedia* Grzybowski. Size 0.7 - 1 mm. Often distorted by pressure, which is shown particularly by the larger chambers, which are often excavate in such cases.

59. ***Trochammina pauciloculata*** Brady

Trochammina pauciloculata Brady. Grzybowski, 1896, p. 283, pl. 8, fig. 51, 52.

In agreement with the species described from Wadowice. The four-chambered test is often deformed as a result of pressure.

60. ***Trochammina conglobata*** Brady
pl. 11, fig. 23

Trochammina conglobata Brady, 1884, p. 341, pl. 40, fig. 8, 9.

Test agglutinated, surface slightly rough, chambers spherical, arranged in an irregular (trochoid) spire similar to *Globigerina*. On one side three, smaller, spherical chambers are visible in the middle; five chambers on the periphery. On the other side, only the last five, large, spherical chambers are visible. Outline circular. Periphery rounded, lobate, depressed sutures. Size 0.8 mm. It differs from Brady's species only in the smaller number of chambers.

61. ***Trochammina subtrullissata*** Rzehak[27]
pl. 11, fig. 24

Trochammina subtrullissata Rzehak, 1887a, p. 88.

Test finely agglutinated, surface slightly rough; circular in outline, spirally coiled (nautiloid). Inner whorls only partly visible, as the outer whorls embrace them in part. In the final whorl there are six or seven spherical chambers with depressed sutures. Centre of the test depressed, periphery rounded and lobate. Aperture a narrow transverse slit at the base of the last chamber, near the periphery. Very similar to *Trochammina trullissata* Brady, as figured by Brady (1884) in figure 14 on plate 40. Diameter 0.6 mm.

62. ***Trochammina walteri* n.sp.**
pl. 11, fig. 31

Test agglutinated, surface smooth or slightly rough, outline circular, spirally coiled (nautiloid). The final whorl embraces the preceding ones entirely. There are eight or nine triangular chambers in the final whorl. The sutures are shallow, straight grooves, not reaching the centre, where there is a small umbilical depression. Periphery acute, slightly lobate; aperture on the periphery at the base of the terminal chamber, in the form of an elongate slit. Occasionally, on one side of the test a slight groove-like depression is seen near the periphery and extending parallel to it. Diameter 1.0 mm. This form is similar to *Trochammina trullissata* Brady (1884), in the form figured by him in figure 13 of plate 40.

63. ***Trochammina lamella* n.sp.**
pl. 11, fig. 25

Test agglutinated, surface rough; outline circular; compressed. One whorl visible, with four chambers which increase in size. Sutures shallow, incised, extending to the very centre. Periphery rounded, lobate. Diameter 0.7 mm. Aperture slit-like, at the base of the last chamber, on the periphery.

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

64. ***Trochammina stomata*** **n.sp.**
pl. 11, fig. 26, 27
Test agglutinated, surface smooth; outline circular; spirally coiled. The final whorl is visible, with eight triangular chambers. Sutures flush, slightly arcuate, meeting at the centre of the test. Periphery acute, even. Aperture on the periphery, a longitudinal slit; it is sometimes displaced from the base of the last chamber, where it is normally situated, to a higher position, so that it does not touch the periphery.

65. ***Trochammina tenuissima*** **n.sp.**
pl. 11, fig. 30
Test agglutinated, surface smooth; outline oval; spirally coiled. The last whorl is visible, with ten narrow triangular chambers; sutures flush, arcuate, meeting at the centre of the test[28]. Test extremely compressed, almost lamellate. Size 0.8 mm. Aperture very small, on the periphery at the base of the last chamber.

66. ***Trochammina nucleolus*** **n.sp.**
pl. 11, fig. 28, 29
Test agglutinated, surface slightly rough; outline circular, spirally coiled. On one side (the spiral one), the outer whorl is distinctly visible, but the inner one is scarcely distinguishable. On the other side only the last whorl is visible, with seven chambers. The sutures are very shallow, incised, extending on this side to the centre, where they form a slight depression. Periphery even, rounded. Sometimes the test as a whole is somewhat distorted. In its structure, this species recalls strongly the genus *Truncatulina*. Diameter 0.9 mm.

Subfamily Loftusinae
Genus ***Cyclammina*** Brady
67. ***Cyclammina suborbicularis*** Rzehak[29]
Cyclammina suborbicularis Grzybowski, 1896, p. 284, pl. 9, fig. 5, 6.
The rounded, almost spherical tests do not differ in any way from the ones described from Wadowice, though they are sometimes better preserved and show distinctly marked depressed sutures.

68. ***Cyclammina retrosepta*** Grzybowski
Cyclammina retrosepta Grzybowski, 1896, p. 284, pl. 9, fig. 7, 8.
The specimens that occur in this material vary only in their larger size, sometimes reaching 1 mm or even 1.2 mm in diameter.

69. ***Cyclammina setosa*** Grzybowski
Cyclammina setosa Grzybowski., 1896, p. 284, pl. 9, fig. 9.
Somewhat narrower that the one described from Wadowice, with more distinct sutures.

70. ***Cyclammina amplectens*** **n.sp.**
pl. 12, fig. 1 - 3
Test very finely agglutinated, surface smooth; spirally coiled (nautiloid). Only a single whorl visible, comprised of numerous (nine to fourteen) narrow triangular chambers separated by straight, incised sutures which extend to the centre of the test where there is a slight depression. In section, two whorls are visible, the inner one with very small chambers and a large central chamber. From the chambers, labyrinthically ramifying extensions diverge into the interior of the test wall (fig. 3), which are distinctly visible only in balsam preparations by transmitted light, and which are indicated on the exterior of the test by small, more brightly shining spots ornamenting the test along the sutures. The test is circular in outline, lenticular; diameter 0.5 - 1.5 mm; periphery slightly lobate, rounded. Aperture on the periphery, at the base of the septum of the final chamber. In external appearance, this form is very similar to *Cyclammina pusilla* Brady (1884, p. 353, pl. 37, fig. 20-23).

Family Textularidae
Subfamily Textularinae

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[28] *[Grzybowski writes "meeting at the center of the chamber", but this is probably a mistake. He most likely means "meeting at the center of the test".]*
[29] *[Authorship of this species has been transfered to Grzybowski under Article 21 of the ICZN.]*

Genus *Plecanium* Reuss

71. ***Plecanium potocense* n.sp.**
pl. 12, fig. 4

Test finely agglutinated, surface rough, outline oval, initial end acute. Chambers in two rows, with six or seven chambers in each row, separated by shallow sutures. Aperture normal. Length 1.0 mm; thickness 0.5 mm. This species is similar to *Plecanium gramen* d'Orbigny[30] (1846, p. 248. pl. 15, fig. 4-6), but differs from it in the round cross section.

72. ***Plecanium caseiforme* n.sp.**
pl. 12, fig. 5

Test rather coarsely agglutinated, surface rough. Broadly wedge-shaped with rounded terminal end, strongly compressed. Chambers in two rows, each row with five or six rapidly enlarging chambers. The large final chambers occupy almost two-thirds of the test. Sutures shallow, aperture normal. Length 1.4 mm. Width across the final chambers 1.0 mm. Thickness 0.2 mm.

Genus *Verneuilina* d'Orbigny[31]

73. ***Verneuilina propinqua*** Brady
pl. 12, fig. 6

Verneuilina propinqua Brady, 1884, p. 387, pl. 47, fig. 8-14.

Test coarsely agglutinated, surface rough, composed of three rows of rounded, enlarging chambers with depressed sutures. Aperture on the distal end of the test close to the meeting point of the last three chambers. Length 2.5 mm. Width at the last chambers 1.4 mm.

Genus *Spiroplecta* Ehrenberg

74. ***Spiroplecta spectabilis* n.sp.**
pl. 12, fig. 12

Test siliceous, surface smooth, compressed, uniformly narrow, periphery acute. In the spiral portion, which is only slightly wider than the rectilinear portion, there are a very small central chamber and five spirally arranged chambers. In the rectilinear stage there are two rows, each with ten to twelve chambers, with flush sutures which slope obliquely toward the initial end. Test acute at the terminal end. Length 2.0 - 2.5 mm; width 0.3 - 0.4 mm. Similar to *Spiroplecta annectens* Parker and Jones[32] (Brady, 1884, p. 376, pl. 45, fig. 22-23) but differs from it in the smaller size of the spiral stage.

75. ***Spiroplecta brevis* n.sp.**
pl. 12, fig. 13

Test siliceous, surface smooth; compressed, with parallel sides, periphery acute and provided with a very narrow keel. The spiral stage is not much broader than the straight portion, and is comprised of a large round central chamber and five spiral chambers separated by shallow, arcuate sutures. In the straight portion there are two rows of chambers with four or five chambers in each row. Chambers are broad, low with shallow sutures extending obliquely towards the initial end. Length 1.2 mm; width 0.7 mm.

76. ***Spiroplecta foliacea*** Rzehak[33]
pl. 12, fig. 14, 15

Spiroplecta foliacea Rzehak, 1887b, p. 134.

Test siliceous, surface smooth, outline narrow, lanceolate. Spiral stage very small, indistinct, comprised of four chambers. Straight portion slowly broadens, consisting of two rows of very numerous low chambers (20 - 25 chambers in each row), with flush sutures which extend obliquely toward the base. Toward the terminal end the test tapers again. Periphery acute. Occasionally the test as a whole slightly arcuate. Length 0.8 - 1.2 mm; width 0.2 mm.

77. ***Spiroplecta costidorsata* n.sp.**
pl. 12, fig. 11

Test siliceous, surface smooth; outline lanceolate. Spiral portion very small, comprised of a

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[30] *[= Textularia gramen d'Orbigny, 1846]*

[31] *[Grzybowski consistently spells this genus as "Verneullina".]*

[32] *[= Textularia annectens Parker and Jones, 1863]*

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

small central chamber and four similarly small spirally arranged chambers. Rectilinear portion increasing slowly in width, with two rows of low chambers, fifteen chambers in each row, with incised sutures. The later chambers project slightly beyond the earlier chambers at their lower ends, resembling small teeth directed toward the initial end. Periphery acute, serrate. Length 1.0 mm; width 0.3 mm.

Genus **Gaudryina** d'Orbigny
78. ***Gaudryina reussi*** Hantken
pl. 12, fig. 8
Gaudryina reussi Hantken, 1875, p. 14, pl. 1, fig. 5.
Test agglutinated, surface rough, acute at the initial end, with parallel sides after the first one-third of its length. Cross-section circular or oval. In the initial part, chambers are triserial, after the first one-third of its length, chambers are biserial. Sutures in the biserial part are slightly depressed. Aperture as in *Textularia*. Length 1.0 - 1.2 mm.

79. ***Gaudryina coniformis*** **n.sp.**
pl. 12, fig. 7
Test agglutinated, surface rough, outline oval; more acute at the initial end, more rounded at the terminal end. Chambers initially triserial, for one-third to one-half the length, then biserial. Sutures flush, indistinct. Cross section rounded. Aperture small, elongate, at the contact between the two final chambers. Length 1.0 - 1.2 mm; width at two-thirds of the length, 0.6 mm.

80. ***Gaudryina tenuis*** **n.sp.**
pl. 12, fig. 9, 10
Test agglutinated, surface rough; long, narrow, oval in cross section, initial end acute. The triserial portion extends to one-fifth the length, with indistinct sutures. In the biserial portion, sutures are depressed, chambers spherical. Aperture normal. Length 0.6 - 1.0 mm; width 0.2 - 0.3 mm. Related to *Gaudryina filiformis* Berthelin.

Subfamily Bulimininae
Genus ***Virgulina*** d'Orbigny

81. ***Virgulina digitalis*** Grzybowski
Virgulina digitalis Grzybowski, 1896, p. 290, pl. 9, fig. 31.
In this material, [specimens are] sometimes greater in size than the ones described from Wadowice and reach 1.3 mm in length.

Family Lagenidae
Subfamily Lageninae
Genus ***Lagena*** Walker and Jacob
82. ***Lagena apiculata*** Reuss
Synonyms listed by Brady, 1884, p. 453.
Test ovoid, the terminal end narrows into a blunt neck, the initial end is somewhat acute.

Subfamily Nodosariinae
Genus ***Glandulina*** d'Orbigny
83. ***Glandulina laevigata*** d'Orbigny
Glandulina laevigata d'Orbigny, 1846, p. 29, pl. 1, fig. 4, 5.
Synonyms listed by Brady (1884, p. 490).
Specimen with five nearly equidimensional chambers.

Genus ***Nodosaria*** d'Orbigny
84. ***Nodosaria radicula*** Linné
pl. 12, fig. 18
Synonyms listed Brady (1884, p. 495).
Test comprised of four gradually enlarging chambers.

85. ***Nodosaria kreutzi*** **n.sp.**
pl. 12, fig. 16
Test comprised of five chambers, spherical at first, then becoming successively broader and more ovate. The last chamber, the largest, tapers terminally into a short neck bearing the apertural opening. Sutures depressed; from each suture ten to twelve small furrows extend toward the initial end, becoming gradually more shallow and slowly disappearing in the middle of the chamber. This form strongly resembles *Nodosaria soluta* Reuss[34] from the Septarian clay, and differs from it only in the furrows described above. Length 0.9 mm.

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[34] *[= Dentalina soluta, 1851]*

86. ***Dentalina*** n.sp. ind.
pl. 12, fig. 17[35]
I only have a fragment with the last chamber missing. The test in the younger part has spherical chambers with depressed sutures, in its older portion the sutures are flush. Chambers decreasing gradually in size so the proximal end is sharply acute. Length 1.2 mm.

Genus ***Cristellaria*** Lamarck
87. ***Cristellaria cummulicostata*** Gümbel
pl. 12, fig. 22[36]
Cristellaria cummulicostata Gümbel, 1868, p. 650. pl. 1, fig. 67.
Test with the ventral margin slightly concave, acute, with the dorsal margin convex, more blunt. The slightly protruding spiral portion is comprised of five chambers separated by indistinct, flush sutures. In the rectilinear portion comprised of five chambers, on the lateral sides the sutures form limbate ridges that do not reach the periphery of the test. Aperture less elongated than in the form described by Gümbel.

88. ***Cristellaria elegans*** Hantken
pl. 12, fig. 19[37]
Cristellaria elegans Hantken, 1875, p. 87, pl. 14, fig. 4.
Test narrow, with the dorsal and ventral margins sub-acute. The dorsal margin convex, the ventral one slightly concave. The spiral portion minute, indistinct sutures. The rectilinear portion comprised of five chambers, with flush sutures obliquely directed toward the ventral margin. The distal end is acute into a neck, on which there is weakly radial aperture. It differs from the Hantken's form by its slightly more pronounced curvature.

89. ***Cristellaria könneni*** Reuss
pl. 12, fig. 20[38]
Cristellaria könneni Reuss, 1866, p. 139, pl. 3, fig. 1.
Test with the dorsal margin convex, the ventral one slightly concave in the central portion. Three to four chambers in the rectilinear portion, with slightly depressed, oblique sutures, of which the last one does not touch the spiral portion. The dorsal margin less distinctly lobate than in the form described by Reuss.

Genus ***Robulina*** d'Orbigny[39]
90. ***Robulina rotulata*** Lamarck
Synonyms listed by Brady, 1884, p. 547.
Robulina rotulata Lamarck. Grzybowski, 1894, p. 194, pl. 2, fig. 15.

91. ***Robulina gutticostata*** Gümbel
Robulina gutticostata Gümbel, 1868, p. 643, pl. 1, fig. 74.
Badly preserved, especially the crushed keel, nodes on sutures, distinct in the middle of the test.

Family Globigerinidae
Genus ***Globigerina*** d'Orbigny[40]
92. ***Globigerina triloba*** Reuss
Globigerina triloba Reuss, 1850, p. 10, pl. 2, fig. 11.
Globigerina triloba Reuss. Hantken, 1875, p. 69, pl. 8, fig. 1.
Globigerina triloba Reuss. Grzybowski, 1896, p. 300.
This species occurs abundantly in the basal part of the Menilite shales.

93. ***Globigerina bulloides*** d'Orbigny
Globigerina bulloides d'Orbigny, 1846, p. 163. pl. 11, fig. 4 - 6.
Globigerina bulloides d'Orbigny. Hantken, 1875, p. 69, pl. 8, fig. 1.
Globigerina bulloides d'Orbigny. Grzybowski, 1896, p. 300.
This form always accompanies the previous species [*Globigerina triloba*] in abundance.

Family Rotalidae
Subfamily Rotalinae
Genus ***Discorbina*** Parker and Jones

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35 *[in text reported as fig. 82]*
36 *[in text reported as fig. 87]*
37 *[in text reported as fig. 84]*
38 *[in text reported as fig. 85]*

39 *[Grzybowski did not list the authorship.]*
40 *[Grzybowski did not list the authorship.]*

94. ***Discorbina pusilla*** Uhlig

Discorbina pusilla Uhlig, 1886, p. 42, pl. 5, fig. 12, 13.
Discorbina pusilla Uhlig. Grzybowski, 1894, p. 197, pl. 3, fig. 3 - 7.

This form agrees with the one described in samples near Dukla, but in this material it differs by its markedly smaller size.

Genus ***Truncatulina*** d'Orbigny

95. ***Truncatulina granosa*** Reuss

Truncatulina granosa Reuss, 1851, p. 75, pl. 5, fig. 30.
Truncatulina granosa Reuss. Hantken, 1875, p. 74, pl. 10, fig. 2.

96. ***Truncatulina subakneriana*** n.sp.
pl. 12, fig. 21

Test circular in outline, flattened on the spiral side, convex on the umbilical side. It is distinguished by the distinct, keel-like thickenings in the edges of the whorls and along the sutures on the spiral side, so that the chambers on the inner whorl are visible only as very small depressions in a porcelain-like substance. There are two whorls, of which only the last one is visible on the umbilical side, with sutures slightly depressed near the periphery, becoming indistinct toward the centre. Diameter 0.7 mm. Very similar to *Truncatulina akneriana* [d'Orbigny][41], as figured by Brady (1884, p. 663. pl. 94, fig. 8).

Genus ***Pulvinulina*** Parker and Jones

97. ***Pulvinulina subumbonata*** (Gümbel)

Rosalina subumbonata Gümbel, 1868, p. 657, pl. 2, fig. 98.

On the umbilical side of the lenticular test five chambers are visible, with depressed sutures. On the spiral side, two whorls are indistinctly marked. Periphery acute, lobate.

98. ***Pulvinulina partschiana*** d'Orbigny
pl. 12, fig. 25[42]

Pulvinulina partschiana d'Orbigny. Brady, 1884, p. 699, pl. 105, fig. 3 - 6.

Test rounded, lenticular. On the spiral side two and one-half whorls. At the edges of the whorls and on the sutures, there are thick ridges formed of porcelain-like substance [limbate sutures]. On the umbilical side, the peripheral keel is thick and wide, and displays a narrow depression at the earlier five chambers, which runs parallel to the periphery. The depressed sutures do not extend to the middle of the test, but slowly disappear near the nodular umbilical plug. This form slightly differs, especially on the spiral side, from the form reported by d'Orbigny, but it agrees with the description and drawings by Brady.

Genus ***Rotalia*** Lamarck

99. ***Rotalia lithothamnica*** Uhlig

Rotalia lithothamnica Uhlig, 1887, p. 195, pl. 5, fig. 9, 11.
Rotalia lithothamnica Uhlig. Grzybowski, 1894, p. 204, pl. 4, fig. 13, 14.

The specimens found here have a pronounced, lobate periphery.

100. ***Rotalia soldanii*** d'Orbigny
pl. 12, fig. 23 [given as fig. 88 in text]

Rotalia soldanii d'Orbigny, 1846, p. 155, pl. 8, fig. 10 - 12.
Synonymy given by Brady, 1884, p. 708.

It differs from forms described by d'Orbigny and Brady in its smaller number of visible whorls on the spiral side, only two are visible.

Family Nummulitidae
Subfamily Nummulitinae
Genus ***Amphistegina*** d'Orbigny

101. ***Amphistegina subparisiensis*** n.sp.
pl. 12, fig. 24[43]

Test circular in outline, asymmetrically lenticular. On the more convex side, the last whorl is visible, with fourteen chambers with flush sutures, which are strongly arched backward and do not reach the centre of the test, fading out near the umbilical plug. On the less convex side, the sutures near the

[41] *[= Rotalina akneriana d'Orbigny, 1846]*
[42] *[in text reported as fig. 90]*
[43] *[in text reported as fig. 89]*

periphery are strongly arched backward. Periphery acute. *Amphistegina parisiensis* Terquem (1882, p. 124, pl. 13, fig. 3) is a similar form, corresponding in the shape and number of chambers, but the inner whorl cannot be seen in our form; in section it is revealed as consisting of seven chambers. Diameter 0.7 - 1 mm.

Genus *Heterostegina* d'Orbigny
102. ***Heterostegina grotriani*** Reuss
Heterostegina grotriani Reuss, 1866, p. 164, pl. 4, fig. 18.
Test oval, thin, two and one-half whorls; the last one broad. Sutures provided with keels. Inner whorls minute, eight chambers in the last whorl, meshwork of secondary septae not visible from outside, in cross section only a few are visible. Size 3 mm.

Genus *Nummulites* Lamarck
103. ***Nummulites budensis*** Hantken
pl. 12, fig. 29[44]
Nummulites budensis Hantken, 1875, p. 85, pl. 12, fig. 4.
Very badly preserved surface shows indistinct radiating ridges. Three rapidly enlarging whorls identified in a thin section 2.5 mm in diameter. In last whorl there are fourteen broad, low, slightly arcuate chambers. The central chamber is minute. Walls and septae thin.

104. ***Nummulites*** sp. (aff. *leymeriei*? de la Harpe[45])
Very badly preserved single specimen with almost completely abraded surface; in thin section,which did not pass through the centre of the test, there are three enlarging whorls. There are 26 chambers in the last whorl. Chambers low, broad, with straight septae extending in the direction of the radius. Walls rather thick, septae thin. It is most similar to *Nummulites leymeriei*. Diameter 2 mm.

Subfamily Cyclodypidae
Genus ***Orbitoides*** d'Orbigny
105. ***Orbitoides*** cf. ***stella*** Gümbel
Orbitoides cf. *stella Gümbel*, 1868, p. 716 pl. 2, fig. 117.
Surface abraded, in this section, its cross-section fully agrees with the descriptions and drawings of Gümbel.

Class: Crustacea
Order: Ostracoda
Genus ***Bayrdia*** M. Coy
1. ***Bayrdia subdeltoidea*** Jones
pl. 12, fig. 30
Bayrdia subdeltoidea Jones. Bosquet, 1852, p. 29, pl. 1, fig. 13.
Bayrdia subdeltoidea Jones. Egger, 1858, p. 405, pl. 14, fig. 1.
Specimens agree fully with the described, but do not reveal the depression on the ventral side which is always depicted on the drawings. The ventral margin is regular, elliptical, rounded.

2. ***Cytherella*** sp. aff. ***compressa*** Münster
pl. 12, fig. 31
I only have one-half of a left valve, elongated, rhomboidal, somewhat thickened around the margins. Most similar to *Cytherella compressa* Münster, but somewhat larger and more elongate.

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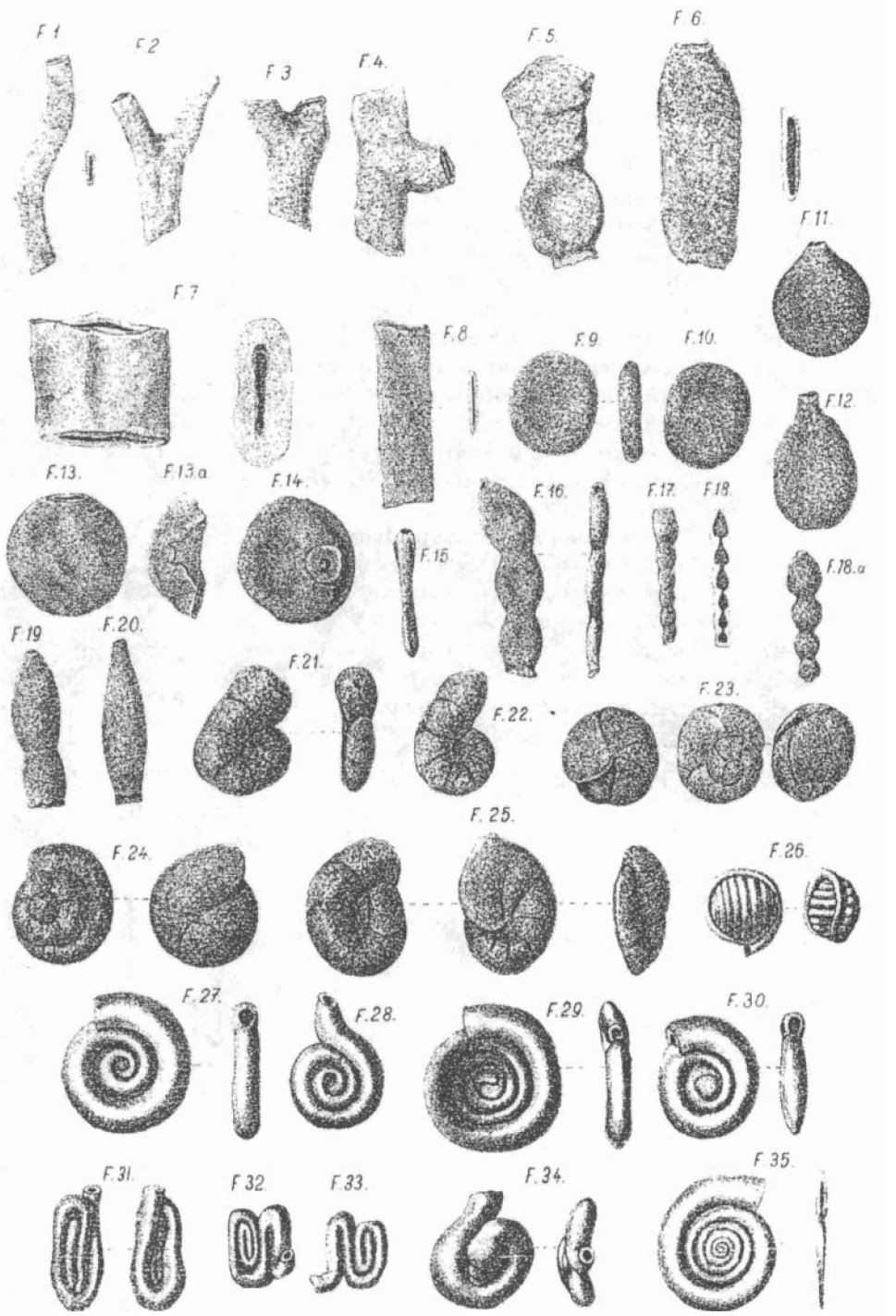
[44] *[in text reported as fig. 93]*
[45] *[In the introduction, Grzybowski listed the authorship of this species as d'Archiac. The correct citation is N. leymeriei d'Archaic and Haime.]*

Plate 10

All figures are x40 unless otherwise noted

1-4. *Dendrophrya excelsa* **n.sp.**
5-6. *Hyperammina subnodosiformis* **n.sp.**
7. *Dendrophrya robusta* **n.sp.**
8. *Dendrophrya latissima* **n.sp.**
9-10. *Reophax placenta* **n.sp.**
11-12. *Reophax difflugiformis* Brady
13-15. *Reophax grandis* **n.sp.**
16. *Reophax splendida* **n.sp.**
17. *Reophax subnodulosa* **n.sp.**
18. *Reophax subnodulosa* **n.sp.** in balsam preparation
18a. *Reophax guttifera* Brady
19-20. *Reophax elongata* **n.sp.**
21-22. *Haplophragmium fontinense* Terquem
23. *Haplophragmium subturbinatum* **n.sp.**
24. *Haplophragmium walteri* **n.sp.**
25. *Haplophragmium immane* **n.sp.**
26. *Ammodiscus charoides* Jones and Parker
27-28. *Ammodiscus latus* **n.sp.**
29-30. *Ammodiscus umbonatus* **n.sp.**
31-33. *Ammodiscus serpens* **n.sp.**
34. *Ammodiscus demarginatus* **n.sp.**
35. *Ammodiscus tenuissimus* **n.sp.**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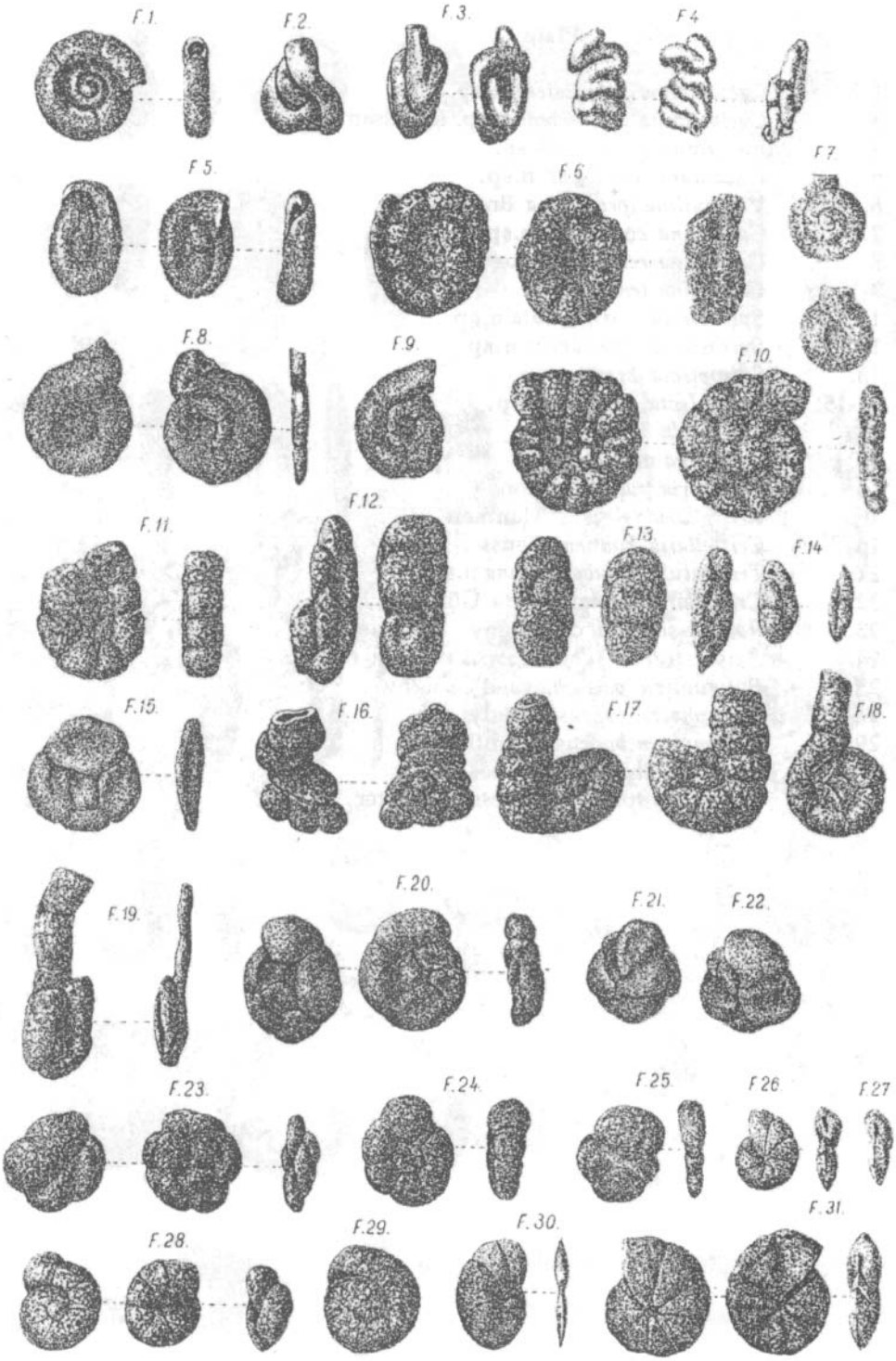
F. 33
F. 34
F. 35

Plate 11

1. *Ammodiscus septatus* **n.sp.**
2-3. *Ammodiscus irregularis* **n.sp.**
4. *Ammodiscus glomeratus* **n.sp.**
5. *Ammodiscus gorayskii* **n.sp.**
6. *Trochammina olszewskii* **n.sp.**
7-9. *Trochammina folium* **n.sp.**
10. *Trochammina elegans* Rzehak
11. *Trochammina subcoronata* Rzehak
12-13. *Trochammina contorta* **n.sp.**
14. *Trochammina contorta* **n.sp.** juvenile
15. *Trochammina variolaria* **n.sp.**
16. *Trochammina heteromorpha* **n.sp.**
17-18. *Trochammina lituiformis* Brady
19. *Trochammina vermetiformis* **n.sp.**
20. *Trochammina deformis* **n.sp.**
21-22. *Trochammina deformis* **n.sp.** deformed
23. *Trochammina conglobata* Brady
24. *Trochammina subtrullissata* **n.sp.**
25. *Trochammina lamella* **n.sp.**
26-27. *Trochammina stomata* **n.sp.**
28-29. *Trochammina nucleolus* **n.sp.**
30. *Trochammina tenuissima* **n.sp.**
31. *Trochammina walteri* **n.sp.**

Rozprawy wydz. mat. przyr. T. XXXIII. *Tab. XI.*



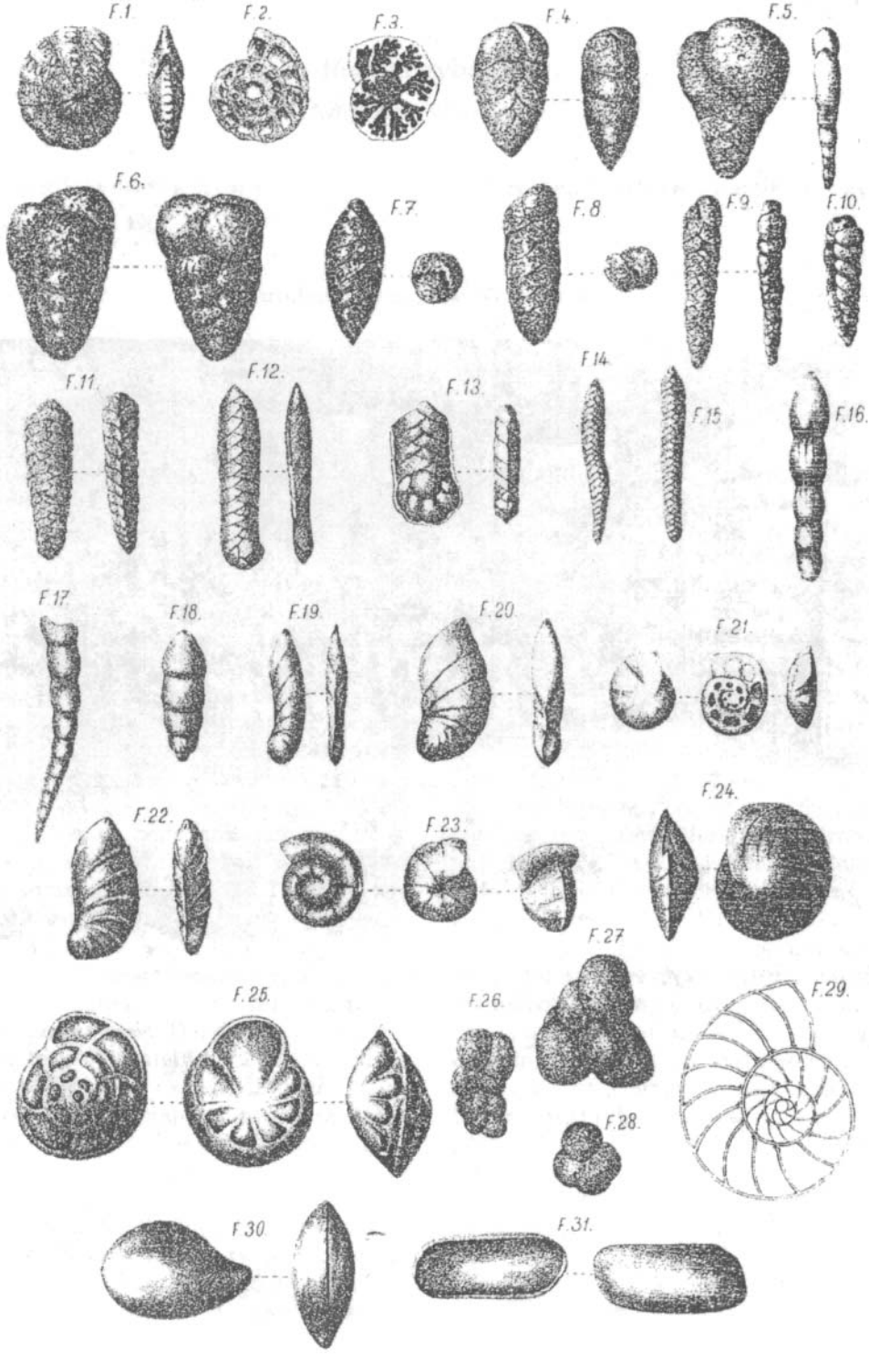
Del. ad nat. Aut.

Lit. A. Wrzesniowski Kraków

Plate 12

1-2. *Cyclammina amplectens* **n.sp.**
3. *Cyclammina amplectens* **n.sp.** in balsam
4. *Plecanium potocense* **n.sp.**
5. *Plecanium caseiforme* **n.sp.**
6. *Verneuilina propinqua* Brady
7. *Gaudryina coniformis* **n.sp.**
8. *Gaudryina reussi* Hantken
9-10. *Gaudryina tenuis* **n.sp.**
11. *Spiroplecta costidorsata* **n.sp.**
12. *Spiroplecta spectabilis* **n.sp.**
13. *Spiroplecta brevis* **n.sp.**
14-15. *Spiroplecta foliacea* **n.sp.**
16. *Nodosaria kreutzi* **n.sp.**
17. *Dentalina* **n.sp. ind.**
18. *Nodosaria radicula* Linné
19. *Cristellaria elegans* Hantken
20. *Cristellaria konneni* Reuss
21. *Truncatulina subakneriana* **n.sp.**
22. *Cristellaria cumulicostata* Gümbel
23. *Rotalia soldanii* d'Orbigny
24. *Amphistegina subparisiensis* **n.sp.**
25. *Pulvinulina partschiana* d'Orbigny
26-28. *Sorosphaera confusa* Brady
29. *Nummulites budensis* Hantken
30. *Bayrdia subdeltoidea* Jones
31. *Cytherella* sp. aff. *compressa* Münster

Rozprawy wydz. mat. przyr. T. XXXIII. *Tab. XII*



Del. ad. nat. Aut. *Lit. A. [illegible]*