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THE GENUS *DISCOCYCLINA* (FORAMINIFERIDA) FROM THE EOCENE OF THE TATRA MTS, POLAND

Abstract. — Twelve species of the genus *Discocyclina* Gümbel, 1868 from a series of dolomitic sandstones and siltstones are described, along with Upper Lutetian and Lower Bartonian organodetrital limestones from the area of Mt. Hruby Regiel in the Tatra Mts. The mode of life and environment of discocyclines are dealt with and burrows of crabs encased by tests of discocyclines described.

INTRODUCTION

The genus *Discocyclina* Gümbel, 1868 from the Eocene of the Tatra Mts (mostly from Mt. Hruby Regiel near Zakopane), the occurrence and some aspects of the mode of life and environment of discocyclines are described below. The studies included a series of dolomitic sandstones and organodetrital limestones containing the Upper Lutetian and Lower Bartonian fauna of foraminifers from the profiles of Mt. Hruby Regiel, Staników Stream and Kościeliska Valley. This series makes up part of the Eocene nummulitic deposits stretching along the northern margin of the Tatras. They transgress on folded deposits of the Mesozoic of sub-tatric-series and upwards turn into the deposits of the Podhale flysch. In the entire Tatra area, the nummulitic Eocene reaches the largest thicknes in the region of Mt. Hruby Regiel where it also represents a full stratigraphic profile.

The series of dolomitic sandstones and organodetrital limestones in the profile of Mt. Hruby Regiel reaches about 200 m in thickness. It overlies a series of red and gray conglomerates devoid of fauna which are assigned to the Eocene on the basis of their sedimentary connection with overlying beds (Sokołowski, 1959; Roniewicz, 1969). Upwards, the deposits of the nummulitic Eocene turn into clayey shales of Zakopane Beds. The dolomitic sandstones and organodetrital limestones contain a rich fauna of

nummulites, discocyclines, small foraminifers, calcareous algae and other organic remains. In the area of Mt. Hruby Regiel, specimens of the genus *Discocyclina* occur abundantly. In some profiles, there occur beds consisting almost exclusively of the test of this genus. Outside of this area, discocyclines are equally abundant in some beds of the Pod Capkami quarry. The state of preservation of discocycline tests in the deposit is fairly variable. They are mostly crushed, recrystallized and partly dissolved in the process of diagenesis. On the whole, they occur in very hard rocks and, therefore, are suitable for studies in thin sections only. Only part of them could be washed from deposit and examined directly. Since microspherical forms could not be separated from the rock, only macrospherical ones were studied.

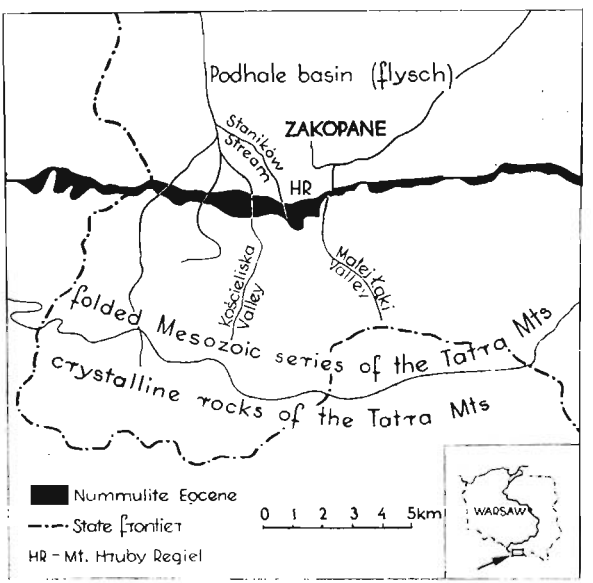

Fig. 1. — A schematic map of the occurrence of the nummulitic Eocene in the environs of Zakopane (the Tatra Mts.)

In the area of Tatra Mts, studies on large foraminifers were performed by F. Bieda (1928, 1959*a*, 1959*b*, 1963) who separated the following four nummultic subhorizons (hemerae, as he turned in 1963) of the Tatran Eocene:

IV. *Nummulites fabianii* subhorizon — Lower Bartonian
III. *Nummulites millecaput* subhorizon
II. *Nummulites perforatus* subhorizon — Upper Lutetian
I. *Nummulites brongniarti* subhorizon

As found by the present writer, the sequence of the first two subhorizons in the area of Mt. Hruby Regiel, in particular in the Hruby Regiel profile, is not kept. *Nummulites perforatus* occurs together with *Nummulites*

brongniarti as early as in nummulitic subhorizon I and, therefore, it is impossible to stratify accurately the Upper Lutetian of this area. This would be possible only after a detailed analysis of the sequence of nummulitic assemblages and small foraminifers, which is, however, very difficult so far due to a poor state of preservation of this fauna.

The writer's thanks are extended to Dr Piotr Roniewicz (Geological Institute, Warsaw University) for introducing her to the terrain of studies and for making available a part of his collection of discocyclines. Her gratitude is also due to Prof. Krystyna Pożaryska for critical review of the manuscript. The photographs of foraminifers have been taken by Miss M. Czarnocka and Miss M. Wąsak and figures drawn by Mrs K. Budzyńska (all from Palaezoological Institute, Polish Academy of Sciences, Warszawa).

The material studies is housed in the collections of the Palaeozoological Institute of the Polish Academy of Sciences (abbr. Z. Pal.)

REMARKS ON THE OCCURRENCE OF LARGE FORAMINIFERS IN THE AREA OF MT. HRUBY REGIEL

Nummulitic subhorizons I and II. — In the region of Mt. Hruby Regiel, mostly dolomitic sandstones and siltstones occur in these subhorizons. In the Hruby Regiel profile, this member reachers about 120 m in thickness which decreases westwards to 60 m in the Kościeliska Valley profile. In the lowermost part of this member, *Nummulites brogniarti* d'Archiac & Haime is most abundant in the sandstones occurring at the peak of Mt. Hruby Regiel and in the Staników Stream, but it has never been found in the Kościeliska Valley profile.

In the higher part of this member, the fauna of large foraminifers represents, according to Bieda (1963) the *Nummulites perforatus* subhorizon. In the Kościeliska Valley and Staników Stream profiles, vast accumulations are found by *N. perforatus perforatus* (Montfort). They become the main rock-forming component of which nummulitic limestones, locally replacing dolomitic sandstones, are composed.

Members more varying lithologically overlie dolomitic sandstones. These are mostly algal and organodetrital limestones, representing nummulitic subhorizons III and IV.

Nummulitic subhorizon III. — It is mostly represented by dolomitic siltstones and organodetrital limestones. In the area of Mt. Hruby Regiel, most discocyclines appear in this subhorizon, although in other Tatran areas some of them occur as early as in nummulitic subhorizon II and even I. The greatest accumulations of both specimens and species of the genus *Discocyclina* are recorded on the eastern slope of Mt. Hruby Regiel, on the slopes of the Mała Łąka Valley and in the Staników Stream. In

Table 1

The occurrence of large foraminifers in the area of the Mt. Hruby Regiel

Species	Profiles	Mt. Hruby Regiel Mała Łąka Valley				Staników Stream				Kościeliska Valley		
	Subhorizons	I	II	III	IV	I	II	III	IV	I	II	III
N. brongniarti d'Archiac et Haime												
N. perforatus (Montfort)												
N. puschi (d'Archiac												
N. semicostatus (Kaufmann)												
N. striatus (Bruguière)												
N. incrassatus de la Harpe												
N. kovacsiensis Hantken et Madarasz												
N. rotularius Deshayes												
N. anomalus de la Harpe												
N. millecaput Boubée												
N. variolarius (Lamarck)												
N. chavanesi de la Harpe												
N. fabianii Prever												
N. pulchellus de la Harpe												
D. douvillei (Schlumberger)												
D. chudeaui (Schlumberger)												
D. roberti Douvillè												
D. varians (Kaufmann)												
D. nummulitica (Gümbel)												
D. discus (Rütimeyer)												
D. scalaris (Schlumberger)												
D. augustae Weijden												
D. ephippium (Schlotheim)												
D. pratti (Michelin)												
D. fortisi (d'Archiac)												
D. umbo (Schafhautl)												
Ak. radians (d'Archiac)												
As. pentagonalis (Schafhautl)												
As. stellaris (Brunner)												
As. stellata (d'Archiac)												
As. stella Gümbel												
G. multifida Bieda												
G. reticulata (Rütimeyer)												
A. bosci (Defrance)												
A. elongata d'Orbigny												
Or. complanatus (Lamarck)												
O. alpina Douvillè												

N. — Nummulites, D. — Discocyclina, Ak. — Aktinocyclina,
As. — Asterocyclina, G. — Grzybowskia, A. — Alveolina,
Or. — Orbitolites, O. — Operculina

the Hruby Regiel profile, they mostly occur in dolomitic siltstones and limestones. In the area of Mała Łąka, this member is most typically developed (Roniewicz, 1969) reaching to 80 m in thickness, which decreases westwards to a few meters near the Kościeliska Valley. Dolomitic sandstones are filled with discocyclines while nummulits are less frequent.

In the Staników Stream profile, vast accumulations mostly of discocyclines occur in dolomitic sandstones, and siltstones of subhorizon III where they locally form discocycline limestones. An identical foraminiferal assemblage and lithological development of the deposits of subhorizon III have also been found by the present writer on the right slope of the Kościeliska Valley.

Nummulitic subhorizon IV. — On the Mt. Hruby Regiel and in the Staników Stream, the index form *N. fabianii* Prever appears for the first time in the foraminiferal-algal limestones which here close the profile of the nummulitic Eocene. This subhorizon is not recorded on the right slope of the Kościeliska Valley.

PALAEOECOLOGICAL REMARKS

The environment settled by discocyclines was probably considerably calmer and somewhat deeper than that in which nummulits lived. This is indicated by a finer fraction of deposit — discocyclines occur most frequently in siltstones, and a very fragile structure of their tests. Contrary as it is the case with the nummulits, they never occur in diagonally bedded deposits or those displaying other characters indicating the mobility of water.

Douvillé (1922) believes that discocyclines led a planktonic mode of life, while Bieda (1963) maintains that the weight of their tests was too large to allow them to be drifted by water. The latter expresses the supposition that discocyclines settled a sea bottom covered with algae. In his opinion, the saddlelike shape of some discocyclines may be ascribed to ecological conditions and its purpose was to increase the adherence of the tests to plants.

This supposition does not seem to be quite correct. The deformations were probably mechanical in character. The saddlelike shape is mostly observed in *Discocyclina ephippium* and sometimes also in *D. discus* and *D. pratti* and therefore, this is a character of thin (and not lenticular) tests which may only have a small, nodular elevation in the middle. Resting on the bottom, they sagged in the saddlelike manner as an effect of their own weight. The tests of microspherical forms, thin but two or three cm in size, are bent irregularly. This might be caused by their tendency to adapt to the irregularities of the substrate.

Frequently observed is also mechanical damage of the tests of discocyclines. This may be best seen in equatorial section, as during the growth, following the damage, there occurred changes in the arrangement and size of equatorial chambers. After healing the injury, the arrangement of equatorial chambers and the direction of their growth changed only very slightly. Repeated injuries of tests are also frequent.

Many tests of discocyclines display the traces of parasitizing activity of other organisms. The tests are bored by canals, frequently about 0.5 to 1 mm in diameter, which may be ascribed to the activity of algae.

Characteristic arrangements of tests of large foraminifers, mostly discocyclines, are observed in dolomitic limestones, on the eastern slope of the Mała Łąka Valley, as well as in siltstones, and fine-grained dolomitic sandstones, beginning with the Mt. Hruby Regiel up to the Kościeliska Valley. The tests form a part of the casing of elongate burrows, perpendicular or oblique to the surface of beds (Pl. XVIII, Figs 1—5). The burrows, round in transverse section, have parallel walls and are opened towards the top of bed. In some cases, the lower part of a burrow is extended. The burrows are 6.0 to 15 cm long and 3 to 5 cm in diameter. The walls of burrows are formed by a single layer of overlapping tests. These are mostly the tests of discocyclines, 8 to 12 mm in size, representing macrospherical forms of the species *D. discus, D, ephippium, D. pratti* and *D. fortisi*. Most tests are saddlelike, with their concave surface facing the inside of the burrow, so that they closely adhere to each other. Flat nummulites, and asterocyclines are less frequent. The gaps are filled with small, elongate foraminifers, fragmentary valves of molluscs and, sometimes, flat pabbles. The tests, which form the walls of burrow, are mostly inclined to the inside of a burrow (Pl. XVIII, Figs 1, 4.), only very rarely lie flat and closely adhere to each other, with only a very small amount of sediment between them. The burrows are filled with a material identical with that of a surrounding rock. Inside the burrows, the tests are observed very rarely. The arrangement of this type occurs in both the deposit abounding in the foraminiferal fauna and rocks containing few foraminiferal tests. Damaged burrows, with parts of walls destroyed or torn-off and shifted a few cm away, may be observed sometimes. These fragments mostly consists of several test of discocyclines fused together and very rarely are formed by single tests.

Similar burrows, but composed of the tests of flat nummulites, were described by Holder (1958) from the Eocene of Monte Mariano, Dalmatia. However, he did not explain their genesis. Thin tubes composed of the remains of various animals were described by Myers (1970). These are burrows built by *Diopatra cuprea* (Bosc), Polychaeta. They differ from the Tatran ones primarily in size and the material of which they are composed.

The organisms which bored the burrows described above were marked by a high degree of motoric efficiency. Judging by the size of burrows, they reached a few cm in size. The burrows, lined with organic remains, were probably used as a habitat. To construct their shelters, they chose flat elements which could be easily stacked. These might be crustaceans, perhaps crabs (Roniewicz, 1969, 1970). Unfortunately, no remains which might confirm this hypothesis, have so far been found. Likewise, we do not know any Recent crabs which similarly encase their burrows.

SYSTEMATIC DESCRIPTION

Family **Discocyclinidae** Galloway, 1928
Genus *Discocyclina* Gümbel, 1868
Discocyclina douvillei (Schlumberger, 1903)
(Pl. XIV, Fig. 1)

1903. *Orthophragmina douvillei* Schlumberger; Ch. Schlumberger, Troisième note..., p. 283, Pl. 9, Figs 21—24.
1959. *Discocyclina douvillei* (Schlumberger); E. Belmustakov, Fosilite na Blgaria..., p. 51, Pl. 19, Figs 1, 2.
1963. *Discocyclina douvillei* (Schlumberger); F. Bieda, Duże otwornice..., pp. 117, 205, Pl. 18, Fig. 1 (here additional synonymy included).

Material. — Five poorly preserved specimens; tests recrystallized, with damaged surface.

Dimensions (in mm):

	Z. Pal. No. F XVI/1
Diameter of test	2.4
Thickness of test	1.3
Diameter of protoconch	0.12
Diameter of deuteroconch	0.24

Description. — Specimens with surface characters in conformity with those described by Bieda (1963).

Equatorial section. — Embryonic apparatus of the trybliolepidine type. Equatorial chambers small, square, about 0.05 mm high. Periembryonic chambers slightly larger than equatorial ones which follow them.

Variability. — Diameter of test varying within limits of 2.5 and 3 mm, thickness 1.0 to 1.5 mm. Diameter of protoconch 0.12 to 0.15 and of deuteroconch 0.19 to 0.24 mm.

Remarks. — Externally, *Discocyclina douvillei* strongly resembles *D. chudeaui*, which was emphasized by Neumann (1958). Specimens of *D. douvillei* are, however, smaller, have thicker tests and larger and more

distinct papillae. As this species is very rare in the area of Tatra Mts, it was impossible to study it in detail.

Occurrence. — Eocene of Spain, southern France, French Alps, Italy, Hungary, Bulgaria, Turkey, the Carpathian area of the USSR; Poland: the Middle and Upper Eocene (nummulitic subhorizons II to IV) of the Tatras.

Discocyclina chudeaui (Schlumberger, 1903)
(Pl. XIV, Figs 2—3)

1903. *Orthophragmina chudeaui* Schlumberger; Ch. Schlumberger, Troisième note..., p. 282, Pl. 9, Figs 18—20; Text-fig. E.
1958. *Discocyclina chudeaui* (Schlumberger); T. Kecskeméti, Bis jetzt in Ungarn..., p. 39, Pl. 1, Figs 1—5; Text-fig. 1.
1963. *Discocyclina chudeaui* (Schlumberger); F. Bieda, Duże otwornice..., pp. 118, 205, Pl. 18, Figs 2—4 (here additional synonymy included).

Material. — Nine recrystallized specimens with damaged surface.

Dimensions (in mm):

	Z. Pal. No. F XVI/2	Z. Pal. No. F XVI/3
Diameter of test	2.6	2.5
Thickness of test	1.6	1.5
Diameter of protoconch	0.19	
Diameter of deuteroconch	0.52	

Description. — Test lenticular. Central umbo almost invisible. Papillae irregular in size, not very conspicuous. Large papillae, interspaced by small, occur in the central part of test, while in the periphery all of them are small. Five to seven large lateral chambers, shaped like rhomboid of irregular polygons, occur in rosettes.

Equatorial section. — Embryonic apparatus of the trybliolepidine type. Protoconch slightly elliptical, surrounded by a subspherical deuteroconch. Embryonic chambers considerably larger (0.1 mm high) and wider than the next equatorial chambers. Main auxiliary larger than lateral auxiliary chambers. Periauxiliary chambers slightly larger than the next equatorial chambers.

Axial section. — Near embryonic chamber, equatorial chambers are subsquare, their length and height increasing towards the periphery. Near embryonic chamber they are about 0.035 and in the peripheral part of test about 0.09 mm high. Lateral chambers very large, about 0.04 mm high and variable in length which increases towards the periphery. The thickness of roofs and floors amounts to about 0.01 mm.

Variability. — Diameter of test varying within limits of 2.2 and 3.5 mm, thickness 1.2 to 1.6 mm. Diameter of protoconch varying from 0.17 to 0.19 mm and of deuteroconch from 0.44 to 0.53 mm.

Remarks. — Specimens of *D. chudeaui* described by Neumann (1958) and Bieda (1963) are marked by a somewhat larger diameter of test. Due to a considerable degree of the destruction of test and lack of the youngest whorls, those from the area of Mt. Hruby Regiel are smaller. Likewise, the dimensions of the embryonic apparatus are larger than those given by Bieda (1963). In the area of Mt. Hruby Regiel, this species is very rare.

Occurrence. — Middle Eocene of central and southern France, Spain, Italy, Hungary, Turkey, USSR: the Carpathians, Georgia, Armenia; Poland: Middle and Upper Eocene of the Tatra Mts (nummulitic subhorizons III to IV). In nummulitic subhorizon III, this species occurs only in the Hruby Regiel profile (Bieda, 1963).

Discocyclina roberti Douvilleé, 1922
(Pl. XIV, Fig. 4)

1922. *Discocyclina roberti* Douvillé; H. Douvillé, Révision des Orbitoides..., p. 72, Pl. 4, Fig. 10.

1953. *Discocyclina roberti* Douvillé; J. Schweighauser, Mikropaläontologische und stratigraphische..., p. 60, Pl. 9, Fig. 8; Pl. 10, Figs 12, 13; Text-fig. 45.

1958. *Discocyclina roberti* Douvillé; M. Neumann, Révision des Orbitoididés..., p. 103, Pl. 20, Figs 1—7; Text-fig. 31.

1959. *Discocyclina roberti* Douvillé; E. Belmustakov, Fosilite na Blgaria..., p. 52, Pl. 19, Figs 3—5.

1963. *Discocyclina roberti* Douvillé; F. Bieda, Duże otwornice..., pp. 123, 208, Pl. 20, Fig. 5.

Material. — Four recrystallized specimens.

Dimensions (in mm):

	Z. Pal. No. F XVI/4
Diameter of test	2.5
Thickness of test	1.5
Diameter of protoconch	0.13
Diameter of deuteroconch	0.25

Description. — see Bieda (1963).

Variability. — Diameter of test variable within limits of 3.0 to 4.0 and thickness of 1.5 to 2.0 mm. Diameter of protoconch 0.13 to 0.15 and of deuteroconch 0.24 to 0.30 mm.

Occurrence. — Middle and Upper Eocene of Spain, France, Italy, Bulgaria; Poland: Middle and Upper Eocene (nummulitic subhorizons III and IV). Very rare in the Tatras.

Discocyclina varians (Kaufmann, 1867)
(Pl. XIV, Figs 5—7)

1867. *Orbitoides varians* Kaufmann; F. J. Kaufmann, Der Pilatus..., p. 158, Pl. 10, Figs 1—10.
1959. *Discocyclina varians* (Kaufmann); E. Belmustakov, Fosilite na Blgaria..., p. 52, Pl. 19, Figs 7, 8, 9.
1963. *Discocyclina varians* (Kaufmann); F. Bieda, Duże otwornice..., pp. 119, 206, Pl. 18, Fig. 5; Pl. 19, Figs 1—4 (here additional synonymy included).

Material. — Seventy-five variosly preserved specimens, most of them having tests with damaged surfaces.

Dimensions (in mm):

	Z. Pal. No. F XVI/5	Z. Pal. No. F XVI/6	Z. Pal. No. F XVI/7
Diameter of test	3.5	3.0	6.0
Thickness of test	1.5	2.0	1.5
Diameter of protoconch	0.17	0.18	
Diameter of deuteroconch	0.34	0.30	

Description. — Surface characters — see Bieda (1963).

Equatorial section. — Embryonic apparatus trybliolepidine. Periembryonic chambers slightly higher (0.04 mm high) than the next equatorial chambers. Equatorial chambers subsquare, sligtly extended on the periphery.

Axial section. — Equatorial chambers subelliptical, their height very slightly increasing towards periphery.

Variability. — Diameter of tests in *D. varians* varying from 3.0 to 6.0 and thickness from 1.0 to 2.0 mm. Diameter of protoconch 0.16 to 0.20, of deuteroconch 0.3 to 0.4 mm.

Remarks. — Specimens described by Bieda as *D.* aff. *varians* (1963, p. 121) do not occur in the area of Mt. Hruby Regiel.

Occurrence. — Middle and Upper Eocene of the French Alps; Italy, Switzerland, Bulgaria, Turkey, USSR: Armenia; Poland: Middle and Upper Eocene, (nummulitic subhorizons III to IV) of the Tatras where the species is very common.

Discocyclina nummulitica (Gümbel, 1868)
(Pl. XV, Figs 1—3)

1868. *Orbitoides (Rhipidocyclina) nummulitica* Gümbel; C. W. Gümbel, Beiträge zur Foraminiferenfauna..., p. 702, Pl. 4, Figs 1—3, 16—18.

1959. *Discocyclina nummulitica* (Gümbel); E. Belmustakov, Fosilite na Blgaria..., p. 53, Pl. 19, Figs 10—14.

1959. *Discocyclina nummulitica* (Gümbel); T. Kecskeméti, Die Discocycliniden..., p. 53, Pl. 3, Figs 9, 10, 12; Text-fig. 15.

1962. *Discocyclina nummulitica* (Gümbel); B. F. Zerneckij, Numuliti ta orbitoidi..., p. 67, Pl. 16, Fig. 1.

1963. *Discocyclina nummulitica* (Gümbel); F. Bieda, Duże otwornice..., pp. 124, 209, Pl. 20, Figs 6—8 (here additional synonymy included).

1965. *Discocyclina nummulitica* (Gümbel); N. Barchatova, G. Nemkov, Krupnye foraminifery..., p. 85, Pl. 17, Fig. 1.

Material. — Fifteen poorly preserved specimens, with tests damaged on the surface.

Dimensions (in mm):

	Z. Pal. No. F XVI/8	Z. Pal. No. F XVI/9	Z. Pal. No. F XVI/10
Diameter of test	5.6	3.2	4.0
Thickness of test	1.4	1.8	1.5
Diameter of protoconch		0.17	
Diameter of deuteroconch		0.32	

Description. — Surface characters — see Bieda (1963).

Equatorial section. — Embryonic apparatus of the eulepidine type. Protoconch together with deuteroconch which completely envelops it, are spherical. Periembryonic chambers rectangular, slightly longer than the next equatorial chambers which are subsquare and extend peripherally.

Axial section. — This is a very characteristic form in axial section. Periembryonic chambers about 0.05 mm high and subsquare. Near them, equatorial chambers equal them in height. The increase in the height of equatorial chambers towards periphery, which amounts to 0.25 to 0.30 mm, is very characteristic of this species. Lateral chambers 0.09 to 0.1 mm high and about 0.03 mm thick. The thickness of their roofs and floors amounts to about 0.02. Pillars are very wide near the surface of test and sharply narrowing towards its center.

Variability. — Diameter of specimens varying from 2.3 to 5.5 mm and thickness of test from 1.2 to 1.5 mm. Diameter of protoconch 0.17 to 0.29 mm and of deuteroconch 0.3 to 0.48 mm.

Occurrence. — Lower and Middle Eocene of southern France, the Swiss Alps, Italy, Austria, Hungary, Bulgaria, Rumania, Turkey, USSR: Crimea, Black Sea Lowland, the Carpathians, Armenia, Georgia; Poland: Middle and Upper Eocene (nummulitic subhorizons III to IV) of the Tatras where it is very common.

Discocyclina discus (Rütimeyer, 1850)
(Pl. XV, Figs 4—6)

1850. *Orbitolites discus* Rütimeyer; L. Rütimeyer, Über das schweizerische Nummulitenterrain..., p. 116 (fide Ellis et Messina: Catal. of Foram.).

1963. *Discocyclina discus* (Rütimeyer); F. Bieda, Duże otwornice..., pp. 126, 209, Pl. 21, Figs 1—5 (here additional synonymy included).

Material. — Thirty-five variously preserved specimens, large ones mostly broken.

Dimensions (in mm):

	Z. Pal. No. F XVI/11	Z. Pal. No. F XVI/12	Z. Pal. No. F XVI/13
Diameter of test	8.2	6.0	12.0
Thickness of test	2.0	1.5	2.0
Diameter of protoconch	0.42	0.61	
Diameter of deuteroconch	1.26	1.34	

Description. — Characters of surface and equatorial section — see Bieda (1963).

Axial section. — Equatorial chambers about 0.06 mm high. Lateral chambers large, about 0.17 mm long and about 0.015 mm high. The thickness of roofs and floors of lateral chambers almost the same as their height.

Variability. — Diameter of tests varies in *D. discus* from 6.0 to 15.0 mm and thickness from 1.5 to 2.0 mm. Diameter of protoconch 0.40 to 0.65 and of deuteroconch 1.0 to 1.40 mm.

Occurrence. — Middle and Upper Eocene of southern France, the French Alps and Italy; Poland: Middle and Upper Eocene (nummulitic subhorizons II to IV) of the Tatras where it is common.

Discocyclina scalaris (Schlumberger, 1903)
(Pl. XVI, Figs 1, 2.)

1903. *Orthophragmina scalaris* Schlumberger; Ch. Schlumberger, Troisième note..., p. 277, Pl. 8, Fig. 4; Pl. 9, Figs. 12, 13.

1922. *Discocyclina scalaris* (Schlumberger); H. Douvillé, Révision des Orbitoïdes..., p. 68, Text-fig. 8.

1958. *Discocyclina scalaris* (Schlumberger); M. Neumann, Révision des Orbitoïdides..., p. 104, Pl. 21, Figs 1—6; Pl. 25, Figs 3, 4; Text-fig. 32.

1959. *Discocyclina scalaris* (Schlumberger); E. Belmustakov, Fosilite na Blgaria..., p. 49, Pl. 17, Figs 5—7.

1963. *Discocyclina scalaris* (Schlumberger); F. Bieda, Duże otwornice..., pp. 122, 207, Pl. 20, Figs 2—4.

Material. — Eight poorly preserved specimens with recrystallized tests. Dimensions (in mm):

	Z. Pal. No. F XVI/14	Z. Pal. No. F XVI/15
Diameter of test	3.5	3.5
Thickness of test	1.6	1.55
Diameter of protoconch		0.35
Diameter of deuteroconch		0.70

Description. — Characters of surface and equatorial section — see Bieda (1963).

Variability. — Diameter of test varying within limits of 3.5 and 6.0 mm, thickness 1.0 and 1.6 mm. Diameter of protoconch 0.25 to 0.35, of deuteroconch 0.5 to 0.7 mm.

Remarks. — Specimens of *D. scalaris* from the area of Mt. Hruby Regiel considerably differs in the dimensions of this embryonic apparatus from those described by Bieda (1963). They are most similar to those described by Neumann (1958).

Occurrence. — Eocene of Spain, southern France, Italy, Bulgaria, Turkey; Poland: Upper Eocene (nummulitic subhorizon IV) of the Tatras where it is, however, rare.

Discocyclina augustae Weijden, 1940
(Pl. XVI, Figs 3—5)

1868. *Orbitoides (Discocyclina) papyracea* (Boubée); C. W. Gümbel, Beiträge zur Foraminiferenfauna..., p. 690.
1883. *Orbitoides nudimargo* Schwager; C. Schwager, Die Foraminiferen..., p. 139, Pl. 29, Figs 8*a—e*.
1903. *Orthophragmina pratti* (Michelin); Ch. Schlumberger, Troisième note..., p. 274, Pl. 8, Figs 2, 3, 8, 9; Text-fig. A.
1922. *Discocyclina archiaci* (Schlumberger); H. Douvillé, Révision des Orbitoïdes..., pp. 57, 65, 67, Fig. 2.
1940. *Discocyclina augustae* Weijden; W. J. M. Van der Weijden, Het genus Discocyclina..., p. 23, Pl. 1, Figs 4—8; Pl. 2, Figs 1, 2.
1962. *Discocyclina augustae* Weijden; B. F. Zernerckij, Numuliti ta Orbitoidi..., p. 61, Pl. 14, Figs 3, 4 (non Pl. 15, Figs 1—3) (here additional synonymy included).

Material. — Eleven specimens with recrystallized tests.

Dimensions (in mm):

	Z. Pal. No. F XVI/16	Z. Pal. No. F XVI/17	Z. Pal. No. F XVI/18
Diameter of test	5.4	3.5	5.7
Thickness of test	1.2	1.3	1.1
Diameter of protoconch	0.18	0.12	0.16
Diameter of deuteroconch	0.33	0.25	0.30

Description. — Test flat, fairly thin, with a small, nodular elevation in the center, whose diameter amounts to 1.1 to 1.2 mm. In some cases, the periphery of test may be slightly swollen. In the central part of test, papillae are about 0.06 to 0.08 mm in diameter. On the periphery, they are smaller. Five to seven lateral chambers occur in rosettes.

Equatorial section. — Embryonic apparatus of the nephrolepidine type. Periembryonic chambers almost do not differ in size from the next equatorial chambers, which are square near the embryonic apparatus and extend in the periphery where their height amount to about 0.15 mm.

Variability. — Diameter of test varies within limits of 4.0 and 5.0 mm, thickness 0.7 and 1.3 mm. Diameter of protoconch 0.12 to 0.18 and of deuteroconch 0.25 to 0.34 mm.

Remarks. — Due to its considerable similarity in external appearance, *D. augustae* was frequently confused with *D. pratti* (Schlumberger, 1963), from which it differs, however, in the structure of embryonic apparatus and in size and spacing of papillae. Specimens of *D. augustae* from the Tatra Mts. are most similar in shape and size to those described by Neumann (1958) from France.

Occurrence. — Eocene of France, Spain, Italy, Bulgaria, Hungary, USSR; Poland: Middle and Upper Eocene (nummulitic subhorizons II to IV) of the Tatras, where, however, this species has hitherto been unknown.

Discocyclina ephippium (Schlotheim, 1820)
(Pl. XVII, Figs 1, 2)

1820. *Lenticulites ephippium* Schlotheim; E. F. Schlotheim, Nachträge zur Petrefactenkunde, p. 89 (fide Ellis et Messina: Catal. of Foram.).

1959. *Discocyclina sella* (d'Archiac); T. Kecskeméti, Die Discocycliniden..., p. 42, Pl. 1, Figs 4, 6, 9; Text-Fig. 7.

1962. *Discocyclina sella* (d'Archiac); B. F. Zerneckij, Numuliti ta Orbitoidi..., p. 66, Pl. 16, Figs 5, 6.

1963. *Discocyclina ephippium* (Schlotheim); F. Bieda, Duże otwornice..., pp. 127, 210, Pl. 22, Fig. 1 (here additional synonymy included).

Material. — Ten poorly preserved specimens with very strongly damaged surfaces of tests. Due to their saddlelike shape, it was difficult to separate them from the rock.

Dimensions (in mm):

	Z. Pal. No. F XVI/19	Z. Pal. No. F XVI/20
Diameter of test	8.9	10.6
Thickness of test	1.4	1.1
Diameter of protoconch	0.17	
Diameter of deuteroconch	0.35	

Description. — Characters of surface and equatorial section — see Bieda (1963).

Axial section. — Lateral chambers about 0.03 to 0.04 mm high. Equatorial chambers of equal height over the entire length of test.

Variability. — Diameter of test varying within limits of 6.0 and 12.0 mm, thickness 1.0 to 2.0 mm. Diameter of protoconch 0.17 to 0.20, of deuteroconch 0.40 to 0.55 mm.

Occurrence. — Middle and Upper Eocene of western Europe, Hungary, Bulgaria, Turkey; USSR: Middle Eocene of the Crimea, the Carpathians, Black Sea Lowland and Middle and Upper Eocene of Armenia, Georgia and Azerbaijan; Poland: Middle and Upper Eocene (nummulitic subhorizons II to IV) of the Tatras.

Discocyclina pratti (Michelin, 1846)

(Pl. XVII, Figs 3, 4)

1864. *Orbitolites pratti* Michelin; A. Michelin, Iconographie zoophytologique, p. 278, Pl. 62, Fig. 14 (fide Ellis & Messina: Cat. of Foram.).
1903. *Orthophragmina pratti* (Michelin); Ch. Schlumberger, Troisième note..., p. 274, Pl. 8, Fig. 1 (non Pl. 8, Figs 2, 3, 8, 9; Text-fig. A).
1959. *Discocyclina pratti* (Michelin); T. Kecskeméti, Die Discocycliniden..., p. 43, Pl. 1, Figs 8, 10, 11; Pl. 2, Figs 1—5; Text-figs 8, 9.
1962. *Discocyclina pratti* (Michelin); B. F. Zerneckij, Numuliti ta Orbitoidi..., p. 64, Pl. 14, Figs 1, 5.
1963. *Discocyclina pratti* (Michelin); F. Bieda, Duże otwornice..., pp. 129, 211, Pl. 22, Figs 1, 2, 4; Text-fig. 10 (here additional synonymy included).

Material. — Forty variously preserved specimens, most test recrystallized, many damaged.

Dimensions (in mm):

	Z. Pal. No. F XVI/21	Z. Pal. No. F XVI/22
Diameter of test	8.6	7.5
Thickness of test	1.5	1.4
Diameter of protoconch	0.18	
Diameter of deuteroconch	0.42	

Description. — Surface characters — see Bieda (1963).

Equatorial section. — Embryonic apparatus of the trybliolepidine type. Protoconch spherical. The wall of deuteroconch slightly undulate. Periembryonic chambers considerably higher than the next equatorial chambers, whose height increases towards peryphery, near the embryonic apparatus reaches about 0.07 mm and becomes considerably larger than the width.

Axial section. — Equatorial chambers slightly elliptical, peripherally subsquare. Lateral chambers regularly arranged, about 0.1 mm long, their roofs and floors very thin.

Variability. — Diameter of test varying from 6.0 to 12.0 mm, thickness from 1.2 to 1.5 mm. Diameter of protoconch 0.16 to 0.20, of deuteroconch 0.3 to 0.6 mm.

Remarks. — Due to their similar shape, the specimens of *D. pratti* were frequently confused with *D. augustae,* which are, however, covered with more closely spaced papillae and are considerably larger. In addition, the embryonic apparatus and equatorial chambers of *D. augustae* are considerably smaller.

Occurrence. — Eocene of Spain, southern France, Italy, Turkey, Hungary; USSR: Lower and Middle Eocene of the Black Sea Lowland and the Crimea, as well as Middle Eocene of Armenia, Georgia and Mangyshlak Peninsula; Poland: Middle and Upper Eocene (nummulitic subhorizons II to IV) of the Tatras where it is very common.

Discocyclina fortisi (d'Archiac, 1850)
(Pl. XVI, Fig. 6; Pl. XVII, Figs 5, 6)

1850. *Orbitolites fortisi* d'Archiac; E. d'Archiac, Description des fossiles..., p. 404, Pl. 8, Figs 10—12 (fide Ellis et Messeina: Catal. of Foram.).

1963. *Discocyclina fortisi* (d'Archiac); F. Bieda, Duże otwornice..., pp. 130, 211, Pl. 23, Fig. 1 (here additional synonymy included).

Material. — Fifteen poorly preserved specimens with recrystallized tests.

Dimensions (in mm):

	Z. Pal. No. F. XVI/23	Z. Pal. No. F XVI/24	Z. Pal. No. F XVI/25
Diameter of test	7.1	8.2	11.0
Thickness of test	1.1	1.5	2.0
Diameter of protoconch		0.80	
Diameter of deuteroconch		1.55	

Description. — Surface characters — see Bieda (1963).

Equatorial section. — Embryonic apparatus of the trybliolepidine type. Periembryonic chembers differ in size from the next equatorial chambers, which are higher than wide.

Variability. — Diameter of test variable within limits of 10.0 and 12.00 mm and thickness 1.2 and 2.00 mm. Diameter of protoconch 0.7 to 0.8 and of deuteroconch mostly 1.2 to 1.6 mm.

Occurrence. — Middle and Upper Eocene of France and Italy; Poland: Middle and Upper Eocene (nummulitic subhorizons II to IV) of the Tatras.

Discocyclina umbo (Schafhautl, 1863)
(Pl. XVII, Figs 7, 8)

1863. *Hymenocyclus umbo* Schafhautl; K. E. Schafhautl, Sud-Bayerns, p. 106, Pl. 14, Figs 5*a*—*k* (fide Ellis et Messina: Cat. of Foram.).

1922. *Discocyclina umbo* (Schafhautl); H. Douvillé, Révision des Orbitoïdes..., p. 85, Text-figs 12, 26, 27.

1958. *Discocyclina fortisi* (d'Archiac); M. Neumann, Révision des Orbitoididés..., p. 94 (partim).

1959. *Discocyclina umbo* (Schafhautl); E. Belmustakov, Fosilite na Blgaria..., p. 50, Pl. 8, Figs 3—6.

1963. *Discocyclina umbo* (Schafhautl); F. Bieda, Duże otwornice..., pp. 131, 211, Pl. 22, Figs 3, 5, 6; Pl. 23, Figs 2—6.

Material. — Fifteen specimens with recrystallized tests.

Dimensions (in mm):

	Z. Pal. No F XVI/26	Z. Pal. No. F XVI/27
Diameter of test	6.0	7.1
Thickness of test		1.3

Description. — Surface character — see Bieda (1963).

Equatorial section. — Embryonic apparatus of the eulipidine type. The walls of protoconch and deuteroconch mostly undulate. Periembryonic chambers very high (0.12—0.17 mm) and considerably higher than the next equatorial chambers, which are about 0.08 to 0.10 mm high and mostly irregularly arranged. Sometimes, a ring of chambers lower by half occurs between the rings of very high chambers.

Variability. — Diameter of test varying from 7.0 to 10 mm and thickness from 2.0 to 2.2 mm. Diameter of protoconch 0.5 to 0.6 and of deuteroconch 1.1 to 1.5 mm.

Remarks. — *D. umbo* was included by Neumann (1958) in the synonymy of *D. fortisi* (d'Archiac). Bieda (1963) proves, however, that these species differ from each other in a different development of the external surface of test. *D. umbo* has a large, extensive elevation, while only a small, nodular convexity is observed in *D. fortisi*. These species also differ in the thickness of test, considerably larger in *D. umbo*.

Occurrence. — Middle and Upper Eocene of France, Italy, Bulgaria; Poland: Middle and Upper Eocene (nummulitic subhorizons II to IV) of the Tatras where it is a fairly common species.

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EWA OLEMPSKA

RODZAJ *DISCOCYCLINA* (FORAMINIFERIDA) W EOCENIE HRUBEGO REGLA W TATRACH

Streszczenie

Opisano rodzaj *Discocyclina* Gümbel, 1868 z eocenu Tatr (głównie z obszaru Hrubego Regla, okolice Zakopanego), oraz poruszono niektóre zagadnienia trybu życia i środowiska dyskocyklin. Badaniami została objęta seria piaskowców dolomitowych i wapieni organodetrytycznych zawierających faunę otwornicową górnego lutetu i dolnego bartonu w profilach Hrubego Regla, Staników Potoku i Doliny Kościeliskiej. Seria ta stanowi część utworów tzw. eocenu numulitowego, ciągnącego się wzdłuż północnego brzegu Tatr. Eocen numulitowy w rejonie Hrubego Regla osiąga największą miąższość z całego obszaru Tatr i reprezentuje pełen profil stratygraficzny. W eocenie tatrzańskim Bieda (1963) wydzielił cztery podpoziomy numulitowe. Autorka stwierdziła, że kolejność występowania dwóch pierwszych podpoziomów na obszarze Hrubego Regla nie jest zachowana. *Nummulites perforatus* (Montfort) występuje tu łącznie z *Nummulites brongniarti* d'Archiac et Haime już w I podpoziomie numulitowym, dlatego nie jest możliwe dokładne rozpoziomowanie górnego lutetu na tym obszarze.

Stwierdzono, że środowisko które zasiedlały dyskocykliny było prawdopodobnie znacznie spokojniesze i nieco głębsze niż to, w którym żyły numulity. Wskazuje na to drobniejsza frakcja osadu, oraz bardzo delikatna budowa skorupek dyskocyklin. Nie zaobserwowano również aby skorupki dyskocyklin podkreślały zarysy warstwowania skośnego, co u skorupek numulitów jest zjawiskiem dość częstym, nie występują one również w osadach skośnie warstwowanych czy mających inne cechy wskazujące na ruchliwe wody. Według Biedy (1963) siodłowaty kształt niektórych dyskocyklin związany jest z warunkami ekologicznymi i miał umożliwiać utrzymywanie się skorupek na roślinach. Wydaje się, że deformacje te mają raczej charak-

ter mechaniczny. Siodłowato wygięte są skorupki cienkie, nie soczewkowate. Być może wyginały się siodłowato, leżąc na dnie, pod wpływem własnego ciężaru.

W wapieniach dolomitycznych na wschodnim zboczu Doliny Małej Łąki oraz w mułowcach dolomitowych poczynając od Hrubego Regla aż po Dolinę Kościeliską występują charakterystyczne ułożenia skorupek dużych otwornic, głównie dyskocyklin. Skorupki wchodzą w skład obudowy podłużnych norek, pionowych i ukośnych w stosunku do powierzchni warstwy. Ścianki norki zbudowane są z jednej warstwy dachówkowato na siebie nałożonych skorupek dyskocyklin o wielkości 8—12 mm. Najczęściej są to makrosferyczne formy gatunków *Discocyclina discus, D. ephippium, D. pratti, D. fortisi.* Organizmy, które zbudowały opisane tu norki odznaczały się wysoką sprawnością ruchową. Sądząc po wielkości norek osiągały wielkość kilku centymetrów. Do budowy schronienia wybierały płaskie elementy, dające się z łatwością układać. Mogły to być skorupiaki, być może kraby (Roniewicz 1969, 1970).

ЭВА ОЛЕМПСКА

РОД *DISCOCYCLINA* (FORAMINIFERIDA) В ЭОЦЕНЕ РАЙОНА ГРУБЫ-РЕГЕЛЬ В ТАТРАХ, ПОЛЬША

Резюме

В работе дано описание рода *Discocyclina* Gümbel, 1868 из эоцена Татр (главным образом из района Грубы-Регель близ Закопане) и рассмотрены некоторые вопросы, касающиеся образа жизни и условий обитания дискоциклин. Исследования охватывали толщу доломитовых песчаников и органогенно-обломочных известняков, содержащих фораминиферовую фауну верхнелютетского и нижнебартонского возраста, по обнажениям Грубы-Регель, Станикув-Поток и Косцелиская долина. Эта толща входит в состав так наз. нуммулитового эоцена, распространенного вдоль северного края Татр. В районе Грубы-Регель наблюдается самая большая на всей территории Татр мощность и полный стратиграфический разрез нуммулитового эоцена. Весь эоцен Татр подразделяется Бедой (1963) на четыре нуммулитовых подзоны. Автором констатировано, что в районе Грубы-Регель не сохранена последовательность в распространении двух первых подзон. В этом районе *Nummulites perforatus* (Montfort) встречается совместно с *Nummulites brongniarti* d'Archiac et Haime уже в I нуммулитовой подзоне и поэтому детальное расчленение верхнелютетского подъяруса в этом районе невозможно.

Предполагается, что дискоциклины обитали в более спокойной и более глубоководной среде, по сравнению со средой обитания нуммулитов. Такой вывод можно сделать на основании мелкозернистого состава осадков и очень нежного строения раковин дискоциклин. Не наблюдалось также явление распределения раковинок дискоциклин согласно с косой слоистостью, что представляет довольно частый признак в распространении раковин нуммулитов. Кроме того, дискоциклины не встречаются в осадках с косой или другой слоистостью, показывающей условия подвижных вод. По мнению Беды (1963), седловидная форма некоторых идскоциклин отражает экологические условия. Она способствовала прикреплению раковин к растениям. Однако, автор предполагает, что эти деформации образовались механическим путем. Седловидные изгибы наблюдаются у тонких, не линзообразных раковин. Возможно, что они изгибались покоясь на дне под влиянием собственного веса.

В доломитовых известняках восточного склона долины Мала-Лонка и в доломитовых алевролитах, на протяжении от района Грубы-Регель по Косцелискую долину, наблюдается характерное распределение раковин крупных фораминифер, главным образом дискоциклин. Раковины величиной 8—12 мм слагают здесь стенки каналов, ориентированных перпендикулярно или косо к напластованию. Стенки этих каналов состоят из одного слоя раковин, чрепитчатым образом перекрывающих друг друга. Как правило, они представлены макросферическими формами видов *Discocyclina discus, D. ephippium, D. pratti, D. fortisi.* Организмы, которые просверлили упомянутые каналы, отличались большой подвижностью и, судя по размерам каналов, достигали по величине несколько сантиметров. Для постройки своего укрытия они использовывали пластинчатые обломки, дающиеся легко укладывать. Педполагается, что этими организмами были ракообразные, возможно крабы (Роневич, 1969, 1970).

EXPLANATION OF PLATES

Plates XIV—XVIII

All specimens from the Mt. Hruby Regiel in the Tatra Mts, shown in Pls XIV—XVIII come from the Middle and Upper Eocene.

Plate XIV

Discocyclina douvillei (Schlumberger)

Fig. 1. Surface of the specimen Z. Pal. No. F XVI/1, × 20.

Discocyclina chudeaui (Schlumberger)

Fig. 2. a — Surface of the specimen Z. Pal. No. F XVI/2, × 18;
b — equatorial section, × 21.
Fig. 3. Axial section, specimen Z. Pal. No. F XVI/3, × 10.

Discocyclina roberti Douvillé

Fig. 4. Surface of the specimen Z. Pal. No. F/XVI/4, × 20.

Discocyclina varians (Kaufmann)

Fig. 5. Equatorial section, Z. Pal. No. F XVI/5, × 25.
Fig. 6. Axial section, Z. Pal. No. F XVI/7, × 10.
Fig. 7. Surface of the specimen Z. Pal. No. F XVI/6, × 20.

Plate XV

Discocyclina nummulitica (Gümbel)

Fig. 1. a — Surface of the specimen Z. Pal. No. F XVI/8; × 10;
b — part of surface, × 36.
Fig. 2. Axial section, Z. Pal. No. F XVI/10, × 10.
Fig. 3. Equatorial section, Z. Pal. No. F XVI/9, × 20.

Discocyclina discus (Rütimeyer)

Fig. 4. a — Surface of the specimen Z. Pal. No. F XVI/11, × 5;
b — part of surface, × 8.
Fig. 5. Axial section, Z. Pal. No. F XVI/13, × 10.
Fig. 6. Equatorial section, Z. Pal. No. F XVI/12, × 23.

Plate XVI

Discocyclina scalaris (Schlumberger)

Fig. 1. Surface of the specimen Z. Pal. No. F XVI/14, × 18.
Fig. 2. Equatorial section, Z. Pal. No. F XVI/15, × 16.

Discocyclina augustae Weijden

Fig. 3. Surface of the specimen Z. Pal. No. F XVI/16, × 10.
Fig. 4. Equatorial section, Z. Pal. No. F XVI/17, × 18.
Fig. 5. Surface of the specimen Z. Pal. No. F XVI/18, × 8.

Discocyclina fortisi (d'Archiac)

Fig. 6. Equatorial section, Z. Pal. No. F XVI/24, × 6.

Plate XVII

Discocyclina ephippium (Schlotheim)

Fig. 1. Surface of the specimen Z. Pal. No. F XVI/19, × 5.
Fig. 2. Axial section, Z. Pal. No. F XVI/20, × 10.

Discocyclina pratti (Michelin)

Fig. 3. Equatorial section, Z. Pal. No. F XVI/21, × 50.
Fig. 4. Surface of the specimen Z. Pal. No. F XVI/22, × 5.

Discocyclina fortisi (d'Archiac)

Fig. 5. Surface of the specimen Z. Pal. No. F XVI/23, × 5.
Fig. 6. Axial section, Z. Pal. No. F XVI/25, × 10.

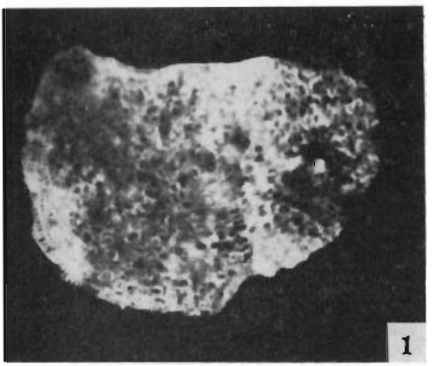
Discocyclina umbo (Schafhautl)

Fig. 7. Surface of the specimen Z. Pal. No. F XVI/26, × 5.
Fig. 8. Axial section, Z. Pal. No. F XVI/27, ×10.

Plate XVIII

Figs 1, 3, 4. Burrows composed of the tests of discocyclines, viewed in a section perpendicular to the surface of bed, Z. Pal. No. F XVI/28—30.
Fig. 2. A burrow, viewed in a section parallel to the surface of bed, Z. Pal. No. F XVI/31.
Fig. 5. A burrow arranged obliquely to the surface of bed, Z. Pal. No. F XVI/32

All — natural size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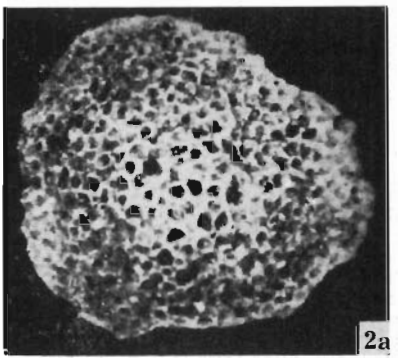
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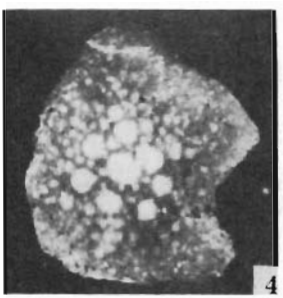
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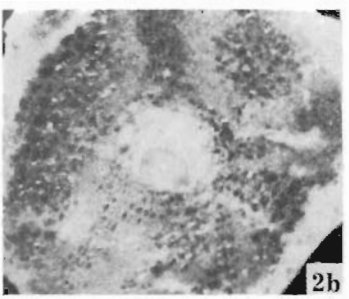
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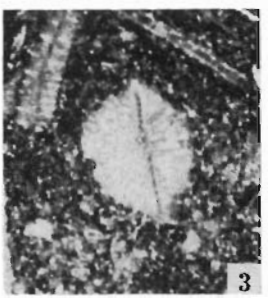
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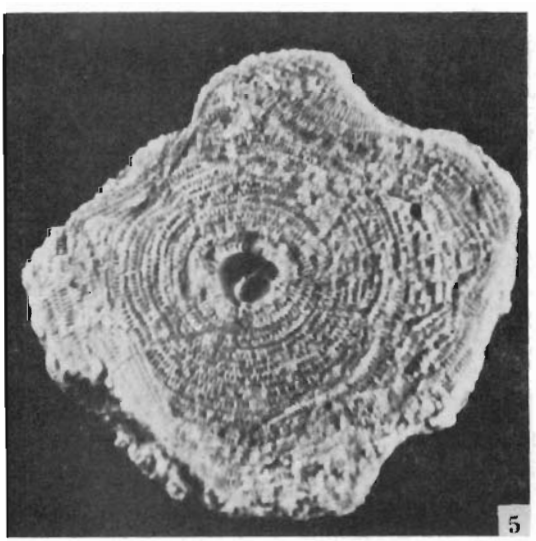
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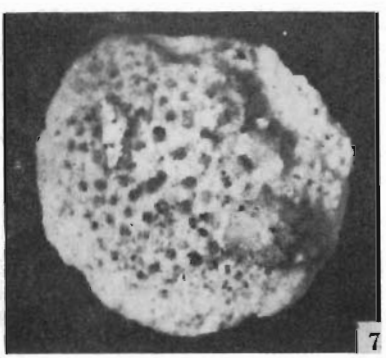
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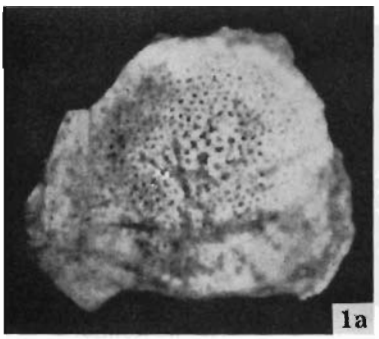
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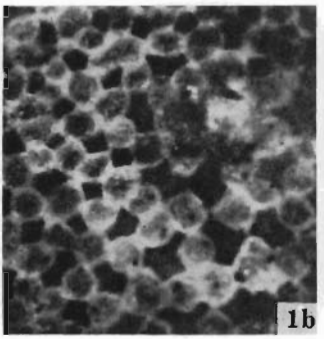
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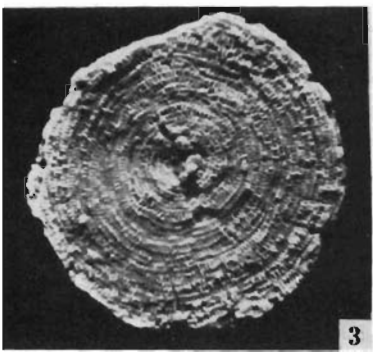
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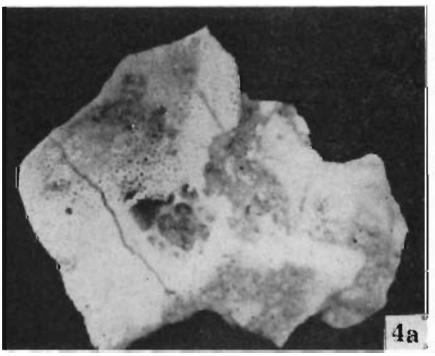
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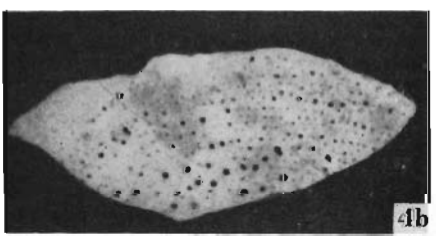
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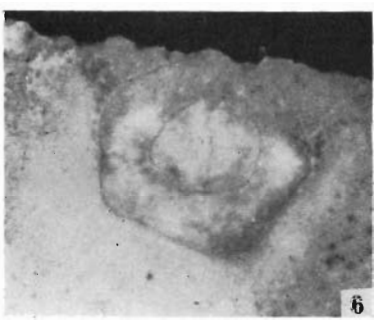
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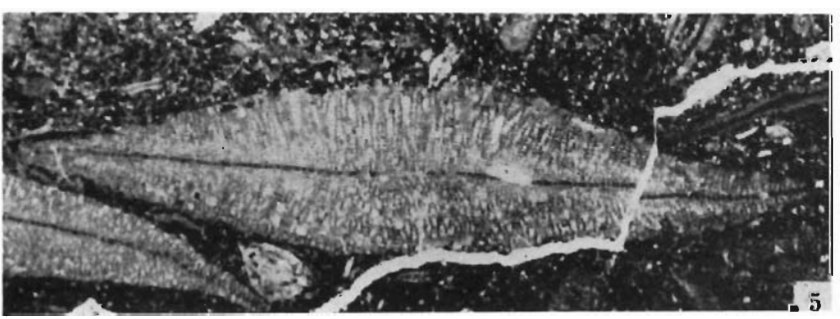
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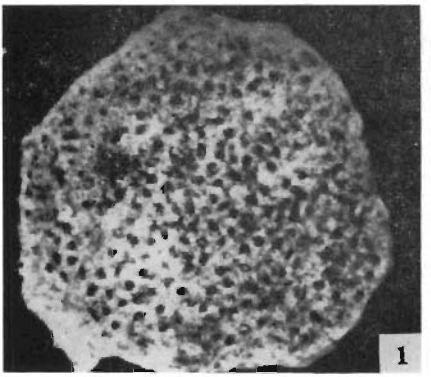
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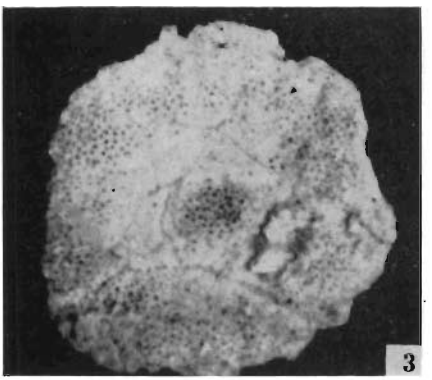
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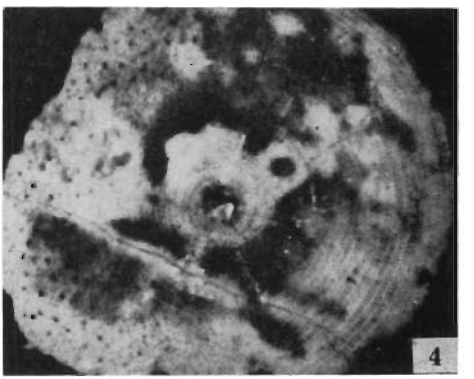
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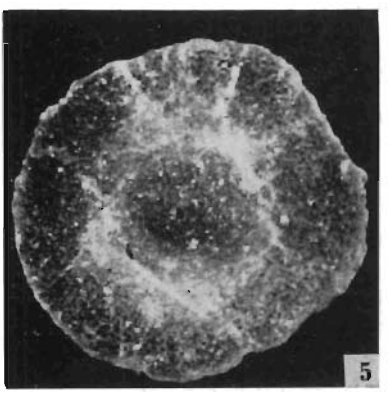
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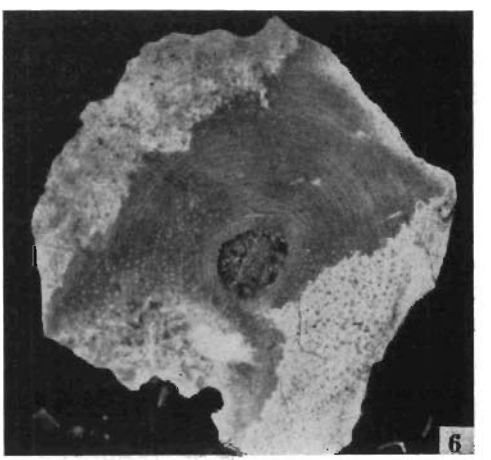
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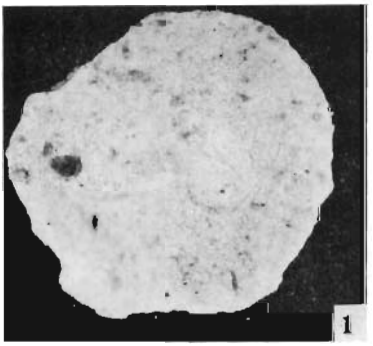
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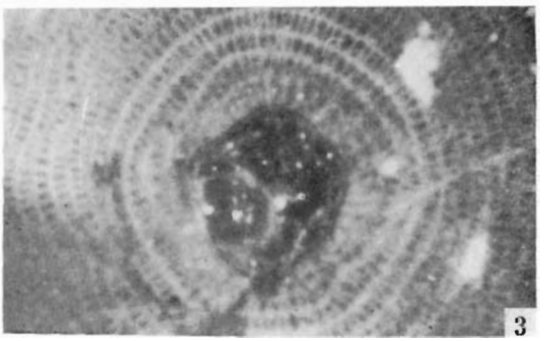
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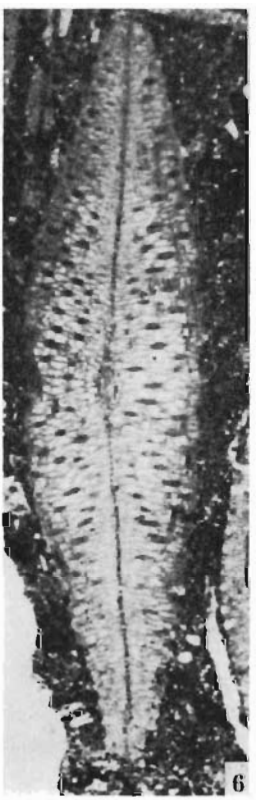
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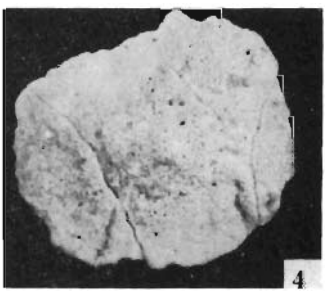
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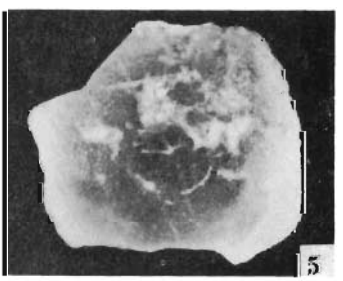
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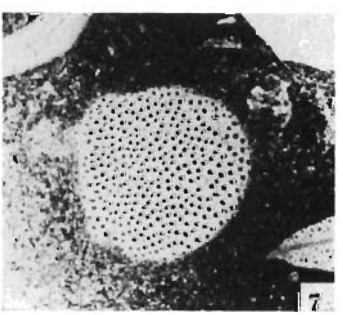
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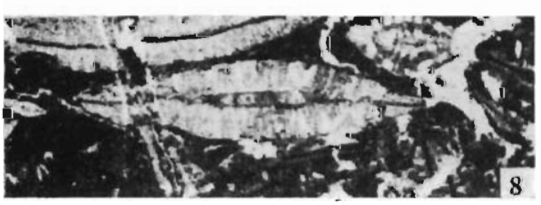
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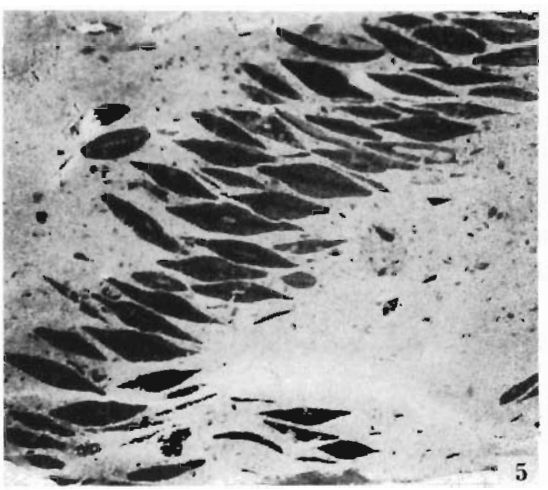
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