Upper Eocene Bryozoa from the Alpine Foreland Basin in Salzburg, Austria (Borehole Helmberg-1)

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Abstract: The Upper Eocene (Priabonian) bryozoan marl from borehole Helmberg – 1 (Salzburg, Austria) was studied. Altogether 121 species were identified and described. Three new species, *Zuzanella tomashi* n. sp., *Zuzanella kovaci* n. sp. and *Lagenicella helmbergensis* n. sp. as well as one new genus, *Zuzanella* gen. nov., was established. The described bryozoan fauna is very similar to that of the Buda Marl (Budapest, Hungary) and the Waschberg Zone (Austria). Among the Recent equivalents, those of the Mediterranean area are most similar. A cool-water and/or deep-water basin with rapid and large-scaled oscillations of relative sea level probably represents the original environment.

Zusammenfassung: Die obereozänen (Priabonium) Bryozoenmergel des Bohrkernes Helmberg-1 (Salzburg, Österreich) wurden taxonomisch bearbeitet. Insgesamt konnten 121 Arten bestimmt werden, darunter drei neue Arten (*Zuzanella tomashi* n. sp., *Zuzanella kovaci* n. sp. und *Lagenicella helmbergensis* n. sp.) sowie eine neue Gattung (*Zuzanella* gen. nov.). Die beschriebene Bryozoenfauna zeigt große Ähnlichkeiten mit den Faunen der Buda-Mergel (Budapest, Ungarn) und der Waschbergzone (Österreich). Außerdem zeigt ist sie vergleichbar mit den rezenten Vorkommen des mediterranen Raumes. Die beschriebene Fauna entstammt wahrscheinlich einem kühlen und/oder tief-marinen Ablagerungsraum, der stark von Meeresspiegelschwankungen beeinflußt war.

Keywords: Eocene, Bryozoa, Systematic, Comparison, Paleoecology, Salzburg.

Content

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1. INTRODUCTION

Upper Eocene bryozoan-sediments are common in the Alpine-Carpathian region. Bryozoans occur in three major sediment-types (bryozoan marls, calcareous sandstones and bioclastic marls with larger foraminifera). The highest diversity of the bryozoans is known from the bryozoan marls (ZÁGORŠEK & KÁZMÉR, 2000), where Bryozoa occur in rock forming quantities (more than 30 weight percent, ZÁGORŠEK, 1996b). The fauna of this facies is usually characterized by more than hundred bryozoan species (mostly erect growth form of the Cheilostomatida) often associated with echinoid fragments, planktonic foraminifers, small shells of the brachiopod *Argyrotheca* and rare bivalve fragments (ZÁGORŠEK & KÁZMÉR, 2000).

A rich Bryozoa association from bryozoan marls of the Upper Austrian Molasse Zone was reported by RASSER et al. (1999) and RASSER (2000). The current paper presents a detailed taxonomic study of this material.

2. MATERIAL AND METHODS

The studied material comes from the borehole Helmberg-1, 10 km north of Salzburg (Austria), drilled by the Rohöl AG, Vienna (Austria). The samples were collected in Pettenbach (Upper Austria), where the cores are stored. The studied and figured bryozoans of the current paper are stored at the Institute of Palaeontology, Vienna University, Austria.

Bryozoans occur at a depth range from 3198 to 3180 m in the core number 6; the richest bryozoan marl was found at a depth between 3194 and 3188 m. The sedimentary facies, the larger foraminifers and the nannoplankton were described in detail by RASSER et al. (1999). They attributed the studied sediments to the nannoplankton zones NP 19–20 (Late Eocene, Priabonian), after MARTINI (1971). Eight samples from different drilling depths were studied; the deepest sample is from 3198 m, the highest sample from 3187 m. All samples represent partly lithified, calcareous marl with a high content of Bryozoa. A new chemical method has been introduced to wash Bryozoa from lithified rocks. The samples were cut into small pieces, macerated in acetic acid of low concentration for one to four weeks, and subsequently soaked in 10% water solution of Quaternary "O"™ for one day. For details see ZÁGORŠEK & VÁVRA (2000).

Additionally, the original material of REUSS (1848, 1864, 1869a, 1869b and 1874) and STOLICZKA (1862), stored at the Natural History Museum in Vienna as well as the original material of MAŁECKI (1963) stored in the Institute of Basic Geology and Mathematics of the Mining and Metallurgy University in Krakow (Poland), was studied for comparisons with the material from Helmberg-1. The comparisons with these collections are mentioned in the remarks and distribution chapters within the species description.

Furthermore, bryozoans from Slovakia, Waschberg Zone (Austria) and Buda marls (Hungary) were studied. The publication of this material is in progress, but some results are quoted in this paper; they are mentioned in distribution chapter within the species description. Therefore, the distribution of Slovakia (without references given), Waschberg Zone (Austria) and Buda marls (Hungary), refers to unpublished data.

3. GEOLOGICAL BACKGROUND

The Austrian Molasse Zone is a part of the Alpine – Carpathian Foreland Basin. The Molasse sedimentation started during the Oligocene, and is characterized by the input of clastic sediments from the uplifted Alpine thrust front. Siliciclastic material of the studied Upper Eocene sediments derive from the Bohemian Massif (RASSER et al., 1999, RASSER, 2000), which therefore belong to the Molasse underground, or "Pre-Molasse". The transgression of studied sediments was caused by subsidence of the Alpine Foreland during the subduction of the European Plate under the Adriatic Plate. The advancing Alpine nappe system overthrusted the Rhenodanubic Flysch Zone, which was replaced by the Molasse basin during the Oligocene. Due to the overthrusting, the Eocene sediments of Austrian Molasse Zone are known only from deep wells. The material presented in the current paper is part of the Autochthonous Molasse Zone (RASSER et al., 1999; RASSER, 2000).

Within the Upper Eocene of the Austrian Molasse Zone, Bryozoans have only been reported from the deep well Helmberg-1. The lowest part of the Helmberg section is formed by quartzite sandstone, overlain by orthophragminid marl, bryozoan marl, and algal limestone. Recently, the rich association of Bryozoa has been found in the borehole Perwang-1 (ZAGORSEK, unpublished data), which is situated close to the studied area. A study of Perwang-1 fauna is in preparation by the author.

4. TAXONOMY

The systematic part is partly abridged. References are given for well-known species; the new species are described in detail. Short diagnoses or/and remarks are added for important species that are rare in the Eocene of the Alpine – Carpathians region, for species replaced into another genus as well as for any suggested taxonomic changes. For other species, only the most important synonymies are cited. Measurements are given only for the new species. The occurrence of the described species is given in Tab. 1.

The Systematic of Cyclostomatida is modified from BASSLER (1953) and VÁVRA (1977). The systematics of Cheilostomatida is modified from GORDON (1984, 1989). The distribution of the described species mainly refers to their occurrences in the Eocene sediments of the Alpine-Carpathian region (i.e., localities of Poland, Slovakia, Hungary, Romania, Italy, and Austria).

taxa/sample = depth of borehole	3198	3195	3194	3193	3192	3190	3189	3187
Adeonella minor (Reuss)	o	o	o	o	o	o	o	o
Adeonella ornatissima (Stoliczka)	o							
Adeonellopsis aff. *coscinophora* (Reuss)	o	o	o					
Adeonellopsis porina (Romer)	o	o	o	o	o	o	o	o
Alderina subtilimargo (Reuss)	o	o	o	o				
Amphiblestrum appendiculata (Reuss)	o	o	o	o				
Arthropoma rugulosa (Reuss)	o	o	o					
Aviculiera cf. *hungarii* Zágoršek	o	o						
Bactridium hagenowi Reuss	o	o	o					
Batopora multiradiata Reuss	o	o	o	o				
Biflustra savartii texturata (Reuss)	o	o	o					
Bobiesipora fasciculata (Reuss)	o							
Calpensia polysticha (Reuss)	o							
Castanophora callomorpha (Reuss)	o							
Cellaria reussi d'Orbigny	o							
Celleporaria globularis (Bronn)	o	o	o	o	o	o		
Cheilonella prominens Reuss	o	o						
Cheilopora orbifera Canu & Bassler	o							
Crassimarginatella macrostoma (Reuss)	o	o	o	o	o			
Crisia eburnea (Linnaeus)	o	o	o					
Crisia elongata Milne Edwards	o	o	o					
Crisia hoernesii Reuss	o	o	o					
Cyphonella nodosa Koschinsky	o							
Diastopora flabellum Reuss	o							
Diplosolen brendolensis (Waters)	o							
Diplosolen planum Canu & Bassler	o							
Disporella coronula (Reuss)	o	o						
Disporella grignonensis Milne Edwards	o	o						
Disporella radiata (Savigny-Audouin)	o	o						
Ditaxipora cf. *internodia* (Waters)	o							
Ditaxipora pannonensis Braga	o							
Ditaxiporina septentrionalis (Waters)	o							
Escharella grotriani (Stoliczka)	o	o	o					
Escharella tenera (Reuss)	o	o	o	o				
Escharoides aliferus (Reuss)	o	o	o					
Escharoides cocinea	o	o						
Exidmonea atlantica David et al.	o	o	o	o				
Exidmonea giebeli (Stoliczka)	o	o	o	o	o	o	o	
Exidmonea hoernesi (Stoliczka)	o	o	o	o	o	o	o	o
Exidmonea villaltae (Reguant)	o	o	o					

Tab. 1: List of all determined Bryozoa species from the borehole Helmberg-1. The species are listed in alphabetical order; the depths of the samples are given in meters.

taxa/sample = depth of borehole	3198	3195	3194	3193	3192	3190	3189	3187
Exochella? labiosa (Reuss)	o							
Exochoecia compressa (Reuss)	o	o						
Fedora bidentata (Reuss)	o							
Filisparsa tenella Stoliczka	o	o	o	o	o			
Galeopsis cf. *subquadrangularis* (Reuss)	o	o						
Gigantopora duplicata (Reuss)	o	o						
Gigantopora lyratostoma (Reuss)	o	o	o					
Gordoniella diporica Zágoršek	o	o						
Herentia hyndmanni (Johnston)	o	o	o	o				
Heteropora subreticulata Reuss	o	o	o	o	o			
Hippomenella bragai Zágoršek	o	o	o	o	o			
Hippomonavella bisulca (Reuss)	o							
Hippomonavella exarata (Reuss)	o	o	o					
Hippoporina cf. *globulosa* (d'Orbigny)	o							
Hornera concatenata Reuss	o	o	o					
Hornera frondiculata frondiculata Mong.	o	o	o	o	o	o	o	o
Hornera simplicissima Braga & Barbin	o	o	o					
Hornera verrucosa Reuss	o	o	o	o				
Iodictyum labellatum Zágoršek	o	o						
Kionidella excelsa Koschinsky	o	o	o	o	o	o		
Kionidella moravica Procházka	o							
Kylonisa triangularis Keij	o							
Lagenicella helmbergensis n. sp	o							
Margaretta cereoides (Ellis-Solander)	o	o						
Mecynoecia geinitzi Reuss	o	o						
Mecynoecia proboscidea (Milne Edwards)	o	o	o	o	o			
Mecynoecia pulchella	o	o						
Meniscopora syringopora (Reuss)	o	o	o	o				
Metradolium obliquum Canu & Bassler	o	o						
Metrarabdotos maleckii Cheetham	o	o	o	o	o			
Micropora hexagona (Zágoršek)	o	o						
Micropora urhidensis Zágoršek	o							
Nematifera susannae Zágoršek	o	o	o	o	o			
Ogivalina dimorpha (Canu)	o	o						
Oncousoecia biloba (Reuss)	o	o						
Onychocella subpyriformis (d'Archiac)	o	o	o	o	o			
Opaeomorpha michaliki Zágoršek	o							
Parasmittina saccoi (Canu)	o	o	o					
Perigastrella granulata Zágoršek	o	o	o	o				
Plagioecia rotula (Reuss)	o							
Polyascosoecia coronopus (Canu & Bassler)	o	o	o	o	o	o	o	

Tab. 1: continued.

taxa/sample = depth of borehole	3198	3195	3194	3193	3192	3190	3189	3187
Porella clavula (Canu & Bassler	o							
Poricellaria complicata (Reuss)	o							
Porina coronata (Reuss)	o	o	o	o	o	o	o	o
Porina peristomica Zágoršek	o	o						
Prenantia phymatopora (Reuss)	o	o	o	o	o	o		
Puellina (Cribrilaria) haueri (Reuss)	o	o						
Puellina (Cribrilaria) radiata (Moll)	o	o	o	o	o	o		
Reteporella simplex (Busk)	o	o						
Reteporella subovata (Stoliczka)	o	o	o	o	o			
Reteporella tuberculata (Reuss)	o	o	o	o	o			
Reussia cf. *regularis* (Reuss)	o	o	o	o	o	o		
Rosseliana rosselii (Audouin)	o							
Schizolepralia scrobiculata (Reuss)	o	o	o	o				
Schizoporella tetragona (Reuss)	o	o	o	o				
Smittina cervicornis (Pallas)	o	o	o	o	o	o		
Smittoidea excentrica (Reuss)	o	o	o					
Sparsiporina elegans (Reuss)	o							
Steginoporella aff. *montenati* David & Pouyet	o	o	o					
Steginoporella cucullata (Reuss)	o	o						
Steginoporella elegans chattiensis P. & D.	o	o						
Steginoporella haidingeri (Reuss)	o	o	o	o	o	o	o	
Stenosipora protecta (Koschinsky)	o							
Stenosipora reussi (Stoliczka)	o	o	o					
Stenosipora simplex (Koschinsky)	o	o	o	o	o			
Stephanollona otophora (Reuss)	o							
Stomatopora cf. *divaricata* (Reuss)	o							
Stomatopora sp.	o							
Tervia serrata (Reuss)	o	o	o	o	o	o	o	
Trochiliopora beyrichii (Reuss)	o							
Tubucella mammillaris (Milne Edwards)	o							
Tubucella papillosa (Reuss)	o	o	o	o	o	o	o	
Tubulipora dimidiata (Reuss)	o	o						
Tubulipora simplex Roemer	o							
Tychinella schreibersi (Reuss)	o		o	o	o			
Unifissurinella boulargeri Poignant	o							
Vavropora pupuliformis Zágoršek	o							
Vicariopora chelys (Koschinsky)	o							
Zuzanella kovaci n.sp.	o	o						
Zuzanella sp.	o	o						
Zuzanella tomashi n.sp.	o							
Total number of taxa 121	27	46	72	16	31	72	52	42

Tab. 1: continued.

Phylum Bryozoa EHRENBERG, 1831
Class Stenolaemata BORG, 1926
Order Cyclostomatida BUSK, 1852
Suborder Articulata BUSK, 1859
Family Crisiidae JOHNSTON, 1838
Genus *Crisia* LAMOUROUX, 1812
Crisia hoernesii REUSS, 1848

v. * 1848 *Crisia Hörnesii* m. – REUSS, p. 54, Pl. 7, Fig. 21, Pl. 11. Fig. 28
1920 *Crisia hörnesi* REUSS – CANU & BASSLER, p. 704, Pl. 141, Fig. 1–4 (cum. syn.)
1958 *Crisia hoernesii* REUSS – BOBIES, p. 155, Pl. 14, Fig. 9–13
v. 1975 *Crisia hoernesi* REUSS – BRAGA, p. 143, Pl. 1, Fig. 1
v. 1992 *Crisia hoernesi* REUSS – ZÁGORŠEK, p. 235, Pl. 1, Fig. 1

Remarks: The species is known up to the Recent (CANU & BASSLER, 1929). Already VÁVRA (1977) pointed out that species described from recent and fossils material are conspecific.
Eocene distribution: Italy (BRAGA, 1975), France (VÁVRA, 1977), Slovakia (ZÁGORŠEK, 1992), Austria (Waschberg Zone) and Hungary (Buda marls).

Crisia cf. *eburnea* (LINNAEUS, 1758)

1958 *Crisia eburnea* (LINNAEUS) – BOBIES, p. 151, Pl. 12, Fig. 2, 3

Remarks: A similar species is also known from the recent seas (e.g. HAYWARD & RYLAND, 1985). Although no gonozooecia have been found, visible features resemble this species.
Eocene distribution: France (VÁVRA, 1977), Romania (GHIURCA, 1987), Hungary (Buda marl) and Austria (Waschberg Zone).

Crisia elongata MILNE EDWARDS, 1838

1838a *Crisia elongata* spec. nov. – MILNE EDWARDS, p. 203, Pl. 7, Fig. 2
1958 *Crisia elongata* MILNE EDWARDS – BOBIES, p. 158, Pl. 13, Fig. 4, Pl. 15, Fig. 22, 23 (cum. syn.)
v. 1980 *Crisia elongata* MILNE EDWARDS – BRAGA, p. 35, Fig. 17
v. 1992 *Crisia elongata* MILNE EDWARDS – ZÁGORŠEK, p. 235

Eocene distribution: Italy (BRAGA, 1980), France (VÁVRA, 1977), Slovakia (ZÁGORŠEK, 1992), Austria (Waschberg Zone) and Hungary (Buda marls).

Suborder Tubuliporina MILNE EDWARDS, 1838
Family Diastoporidae GREGORY, 1899
Genus *Diastopora* LAMOUROUX, 1821
Diastopora flabellum REUSS, 1848
Pl. 1, Fig. 3

v. 1848 *Diastopora flabellum* m. – REUSS, p. 51, Pl. 7, Fig.9
v. 1977 *Diastopora flabellum* REUSS – VÁVRA, p. 20

Remarks: The species is well known from the Miocene to the Pliocene (VÁVRA, 1977). Eocene specimens are smaller, but the other features are identical.
Eocene distribution: Austria (Waschberg Zone).

Genus *Stomatopora* Bronn, 1825

Stomatopora cf. *divaricata* (Reuss, 1848)
Pl. 1, Fig. 1

v. * 1848 *Aulopora divaricata* m. – Reuss, p. 53, Pl. 7, Fig. 18

Diagnosis: The colony is uniserial, sub-tubular and branching in characteristic angles, ranging from 120° to 135°. The zooecia have nonporous frontal walls and circular apertures on the top of a very short peristome. Branches are often anastomosing, forming irregular windows. Gonozooecia are not known.

Remarks: Species designation among the genus *Stomatopora* requires the study their gonozooecia. However, the fossil gonozooecia of this genus are usually not preserved. (Bassler, 1953). Although the original material stored in Natural History Museum in Vienna also has no gonozooecia, it is almost identical with the described specimen. It has little longer peristomes and the end of branches is often biserial or triserial. The species determination is uncertain, as only one small fragment could be found.

Distribution: Unknown from other Eocene occurrences; described from Miocene of Austria (Vávra, 1977).

Stomatopora sp.
Pl. 1, Fig. 2

Diagnosis: Colonies are uniserial, subtubular branching in characteristic angles, from 110° to 125°. Zooecia have porous frontal wall with circular apertures without peristome. Branches are never anastomosing, gonozooecia are not known.

Remarks: The studied specimens are similar to *Stomatopora minima* Roemer, 1863 (p. 220, Pl. 37, Fig. 1). As it was impossible to study the original material and because of the unknown gonozooecia, the species determination remains uncertain.

Family Tubuliporidae Johnston, 1838

Genus *Tubulipora* Lamarck, 1816

Tubulipora dimidiata (Reuss, 1848)
Pl. 1, Fig. 4

v. * 1848 *Defrancia dimidiata* m. – Reuss, p. 39, Pl. 6, fig. 6
v. 1974 *Tubulipora dimidiata* (Reuss, 1848) – Vávra, p. 349, Pl. 1, Fig. 3

Remarks: The studied specimens have sometimes more zooecial rows in each fascicle as usual. The studied specimens usually have 3 rows (rarely 4) of zooecia in the one fascicle. Reuss (1848) and Vávra (1974), however, described specimens, which have only 2 rows of zooecia in each fascicle.

Eocene distribution: Slovakia (Zágoršek, 1992), Poland (Małecki, 1963).

Tubulipora simplex Roemer, 1863
Pl. 2, Fig. 1, 2.

1863 *Actinopora simplex* n. sp. – Roemer, p. 226, Pl. 37, Fig. 25
v. 1866 *Defrancia simplex* Roemer – Reuss, p. 192, Pl. 10, Fig. 10

Diagnosis: The colony is conical, pedunculate and has nonporous, smooth proximal part of the outer surface. The zooecia are tubular, straight and opened in the circular frontal area as well as at the outer surface of the distal end of the colony. The apertures are typically arranged in radial ridges – fascicles, growing out of the margin of the circular frontal area. The fascicles are prominent, biserial, towards the margin of the colony multiserial. The colonial centre is depressed, sometimes very deeply, nonporous and smooth. The gonozooecia are unknown.

Remarks: Specimens described by ROEMER (1863) have more prominent fascicles and the shape of colonies is more columnar than conical. REUSS (1866) described specimens almost identical with the studied material.

The species is listed under the *Tubulipora*, because it has zooecial apertures also on the outer surface of the colony; zooecia are arranged in the fascicles; the centre of the colony is nonporous.

Eocene distribution: Not known from the Alpine- Carpathians region, only described from Germany (ROEMER, 1863; REUSS, 1866).

Genus *Exidmonea* DAVID, MONGEREAU & POUYET, 1972

Exidmonea giebeli (STOLICZKA, 1862)

Pl. 2, Fig. 4

v. * 1862 *Idmonea giebeli* n. sp. – STOLICZKA, p. 81, Pl. 1, Fig. 6
v. 1963 *Ybselosoecia giebeli* (STOLICZKA) – MAŁECKI, p. 75, Pl. 4, Fig. 6
1969 *Exidmonea giebeli* (STOLICZKA) – MONGEREAU, p. 232, Pl. 20, Fig. 1–3, 9, 11
v. 1992 *Exidmonea giebeli* (STOLICZKA) – ZÁGORŠEK, p. 240, Pl. 1, Fig. 5

Eocene distribution: Poland (MAŁECKI, 1963), Slovakia (ZÁGORŠEK, 1992), Rumania (GHIURCA, 1987), Italy (STOLICZKA, 1862), Hungary (Buda marl) and Austria (Waschberg Zone).

Exidmonea atlantica DAVID, MONGEREAU & POUYET, 1972

1920 *Idmonea atlantica* JOHNSTON – CANU & BASSLER, p. 778, Pl. 140, Fig. 1–13 (cum. syn)
1969 *Exidmonea atlantica* Auct. – MONGEREAU, p. 216, Pl. 16, Fig. 1–11, Pl. 17, Fig. 1 (cum. syn)
v. 1977 *Exidmonea atlantica* Auct. – VÁVRA, p. 25
v. 1988 *Exidmonea atlantica* Auct. – BRAGA & BARBIN, p. 506, Pl. 1, Fig. 1
v. 1992 *Exidmonea atlantica* Auct. – ZÁGORŠEK, p. 238, Pl. 2, Fig. 7
1992 *Exidmonea atlantica* DAVID, MONGEREAU & POUYET – TAYLOR & VOIGT, p. 122

Eocene distribution: Argentina (VÁVRA, 1977), America (CANU & BASSLER, 1920), Poland (MAŁECKI, 1963), Italy (BRAGA & BARBIN, 1988), France (MONGEREAU, 1969), Slovakia (ZÁGORŠEK, 1992), Rumania (GHIURCA, 1987), Hungary (Buda marl) and Austria (Waschberg Zone).

Exidmonea hoernesi (STOLICZKA, 1862)

Pl. 3, Fig. 2

v. * 1862 *Idmonea Hörnesi* n. sp. – STOLICZKA, p. 82, Pl. 1, Fig. 7
1969 *Exidmonea hörnesi* (STOLICZKA) – MONGEREAU, p. 235, Pl. 18, Fig. 8, 9 (cum. syn)
v. 1992 *Exidmonea hörnesi* (STOLICZKA) – ZÁGORŠEK, p. 237, Pl. 1, Fig. 4

Eocene distribution: Poland (MAŁECKI, 1963 as *Idmonea cancelata*), France (MONGEREAU, 1969), Slovakia (ZÁGORŠEK, 1992), Rumania (GHIURCA, 1987), Hungary (Buda marl) and Austria (Waschberg Zone).

Exidmonea villaltae (REGUANT, 1961)

1961 *Idmonea villaltae* n. sp. – REGUANT, p. 223, Fig. 6, 7
1969 *Exidmonea villaltae* (REGUANT) – MONGEREAU, p. 252, Pl. 21, Fig. 4, 5, 10, 13 (cum. syn.)

Eocene distribution: Slovakia (ZÁGORŠEK, 1992), Romania (GHIURCA, 1987) and Hungary (Buda marl).

Family Oncousoeciidae CANU, 1918
Genus *Oncousoecia* CANU, 1918
Oncousoecia biloba (REUSS, 1848)
Pl. 2, Fig. 3

v. * 1848 *Hornera biloba* m. – REUSS, p. 43, Pl. 6, Fig. 21
v. 1988 *Oncousoecia biloba* (REUSS) – BRAGA & BARBIN, p. 508, Pl. 2, Fig. 1, 2 (cum. syn.).

Remarks: The found gonozooecia are large and have nonporous frontal wall rarely perforated by autozooecial tubes. The oeciopore is small, without any peristome and is open on the margin of the gonozooecium.
Eocene distribution: Romania (GHIURCA, 1987), Poland (MAŁECKI, 1963), Italy (BRAGA & BARBIN, 1988), Hungary (Buda marl) and Waschberg Zone.

Genus *Filisparsa* D'ORBIGNY, 1853
Filisparsa tenella STOLICZKA, 1862

v. * 1862 *Filisparsa tenella* n. sp. – STOLICZKA, p. 80, Pl. 1, Fig. 5

Diagnosis: The colony width is equal to the width of the 5 to 7 zooecial tubes. The zooecia are not arranged in the fascicles; the zooecial tubes are long and have porous, slightly convex frontal wall. Dorsal side of the colony smooth, slightly ribbed.
Remarks: The holotype in the Natural History Museum in Vienna has seven parallel zooecial tubes; other features are identical with described specimens.
Eocene distribution: Romania (GHIURCA, 1987) and Austria (Waschberg Zone).

Family Terviidae CANU & BASSLER, 1920
Genus *Tervia* JULLIEN, 1882
Tervia serrata (REUSS, 1869)
Pl. 3, Fig. 4

1869b *Hornera serrata* m. – REUSS, p. 285, Pl. 35, Fig. 10, 11
1972 "*Hornera*" *serrata* REUSS – MONGEREAU, p. 343, Pl. 9, Fig. 5, 10
1988 *Tervia serrata* (REUSS) – BRAGA & BARBIN, p. 508, Pl. 2, Fig. 3, 4 (cum. syn.)

Eocene distribution: Poland (MAŁECKI, 1963 as *Ybselosoecia typica*), France (MONGEREAU, 1972), Slovakia (ZÁGORŠEK, 1992), Rumania (GHIURCA, 1987), Italy (BRAGA & BARBIN, 1988) Hungary (Buda marl) and Austria (Waschberg Zone).

Family Entalophoridae REUSS, 1863
Genus *Mecynoecia* CANU, 1918
Mecynoecia proboscidea (MILNE EDWARDS, 1838)

1838b *Pustulopora proboscidea* n. sp. – MILNE EDWARDS, p. 219, Pl. 12, Fig. 2
1920 *Mecynoecia proboscidea* (MILNE EDWARDS) – CANU & BASSLER, p. 726, Pl. 108, Fig. 1–15 (cum. syn)

v. 1988 *Mecynoecia proboscidea* (Milne Edwards) – Braga & Barbin, p.509, Pl.2, Fig 5
v. 1992 *Mecynoecia proboscidea* (Milne Edwards) – Zágoršek, p. 240, Pl. 2, Fig. 8, Pl. 5, Fig. 3

Eocene distribution: America (Canu & Bassler, 1920), Poland (Małecki, 1963 as *Entalophora magnicella*), France (Vávra, 1977), Slovakia (Zágoršek, 1992), Rumania (Ghiurca, 1987), Italy (Braga & Barbin, 1988), Hungary (Buda marl) and Austria (Waschberg Zone).

Mecynoecia pulchella (Reuss, 1848)
Pl. 3, Fig. 1

v. * 1848 *Cricopora pulchella* m. – Reuss, p. 40, Pl. 6, Fig. 10
1988 *Mecynoecia pulchella* (Reuss, 1848) – Braga & Barbin, p. 509, Pl. 2, Fig. 6

Remarks: The colony is very large with 12 to 16 zooecial tubes arranged around the axis and is typically heavily calcified. The frontal walls are slightly convex, smooth and usually nonporous. The Reuss material is larger than specimens described from Helmberg-1.
Eocene distribution: Poland (Małecki, 1963 as ?*Spiropora pulchella* and *Entalophora subcompressa*), Italy (Braga & Barbin, 1988), Romania (Ghiurca, 1987), Slovakia and Austria (Waschberg Zone).

Mecynoecia geinitzi (Reuss, 1872)

1929 *Entalophora geinitzi* (Reuss) – Pazdro, p. 152, Pl. 1, Fig. 14
v. 1963 *Entalophora geinitzi* (Reuss) – Małecki, p. 73, Pl. 4, Fig. 5

Diagnosis: The colony is rod like and very large (length up to 10 mm, width up to 2 mm). The zooecia are arranged in regular rows; there are about 18 to 25 rows around the zooecial stem. The zooecial tubes are rhombic and exhibit on the surface as rhombic to hexagonal, rarely oval apertures. The frontal wall is porous, with slightly elongated lateral parts, but is usually not preserved. In the middle part of the stem, there is an area without apertures. This area is nonporous and slightly depressed. It might be a gonozooecium, although no oeciopore was found.
Remarks: The colony of *Mecynoecia geinitzi* (Reuss, 1872) differs from colonies of *M. pulchella* (Reuss, 1848) in having much larger colonies and larger rhombic zooecial tubes. Although the presence of gonozooecia is uncertain, the zooecial features allow to list this species under the *Mecynoecia*.
The original Reuss material has not been found within his collection at Natural History Museum in Vienna. Nevertheless, the description and illustration of Małecki (1963) is almost identical with the studied specimens and therefore I believe that they are conspecific.
Eocene distribution: Poland (Małecki, 1963) and Austria (Waschberg Zone).

Genus *Nematifera* Canu & Bassler, 1922

Nematifera susannae Zágoršek, 1992
Pl. 3, Fig. 3

v. * 1992 *Nematifera susannae* n. sp. – Zágoršek, p. 240, Pl. 3, Fig. 1–7

Remarks: The species differs from *Mecynoecia pulchella* (Reuss, 1848) in having a very long gonozooecium (about two to three times longer than the autozooecium), but it is narrow (same width as the autozooecium).

Eocene distribution: Slovakia (ZÁGORŠEK, 1992), Austria (Waschberg Zone) and Hungary (Buda marl).

Genus *Exochoecia* CANU & BASSLER, 1920

Exochoecia compressa (REUSS, 1848)

v. * 1848 *Idmonea compressa* m. – REUSS, p. 46, Pl. 6,Fig. 32
v. 1963 *Bicrisina compressa* (REUSS) – MAŁECKI, p. 57, Fig. 21
v. 1977 *Bicrisina ? compressa* (REUSS) – VÁVRA, p. 72 (cum. syn.)
v. 1988 *Exochoecia compressa* (REUSS) – BRAGA & BARBIN, p. 509, Pl. 3, Fig. 1, 2 (cum. syn)
v. 1992 *Exochoecia compressa* (REUSS) – ZÁGORŠEK, p. 240, Pl. 1, Fig. 9

Eocene distribution: Poland (MAŁECKI, 1963), Germany (VÁVRA, 1977), Slovakia (ZÁGORŠEK, 1992), Italy (BRAGA & BARBIN, 1988), Rumania (GHIURCA, 1987), Hungary (Buda marl) and Austria (Waschberg Zone).

Family Diaperoeciidae CANU, 1918
Genus *Diplosolen* CANU, 1918

Diplosolen brendolensis (WATERS, 1892)
Pl. 4, Fig. 4

1892 *Diastopora brendolensis* n. sp. – WATERS, p. 155, Pl. 3, Fig. 1

Diagnosis: The colony is erect and has a flat cross section. The zooecia are arranged in more or less regular rows and are slightly shifted laterally. The adventitious tubes are situated along the zooecial tubes and are terminated below (proximally), sometimes also laterally from the zooecial aperture. The gonozooecia are not known.
Remarks: The species resembles *Exochoecia compressa* (REUSS), which, however, does not develop adventitious tubes.
Eocene distribution: Italy (WATERS, 1892) and Austria (Waschberg Zone).

Diplosolen planum CANU & BASSLER, 1920
Pl. 4, Fig. 3

1920 *Diplosolen planum* n. sp. – CANU & BASSLER, p. 747, Pl. 122, Fig. 14–16

Diagnosis: The colony is bilamellar and flat. The zooecial tubes are indistinct and terminated by short, distinct peristome. The adventitious tubes are not visible, only their apertures are situated approximately in the middle between adjacent zooecia. The gonozooecium is unknown.
Remarks: Although the species is known only from South Carolina, and no gonozooecia were found in studied material, I believe that the specimens are conspecific.
Eocene distribution: Not known from the Alpine Carpathian region, only described from Lenuds Ferry, South Carolina, USA (CANU & BASSLER, 1920).

Family Frondiporidae BUSK, 1875
Genus *Bobiesipora* VÁVRA, 1977

Bobiesipora fasciculata (REUSS, 1848)
Pl. 2, Fig. 5.

v. * 1848 *Apsendesia fasciculata* m – REUSS, p. 40, Pl. 6, Fig. 8
v. 1978 *Bobiesipora fasciculata* (REUSS) – VÁVRA, p. 230, Pl. 1, Fig. 3–6, Pl. 2, Fig. 1–4

v. 1984 *Bobiesipora fasciculata* (Reuss) – Vávra, p. 228, Pl. 1, Fig. 8–9
v. 1989 *Bobiesipora fasciculata* (Reuss) – Vávra, p. 92, Pl. 1, Fig. 5

Remarks: No complete colony was found in Helmberg-1. However, the characteristic structures (pores in rows with slightly developed depressions) presented on dorsal (backside) of the colony branch allow an exact determination.
Eocene distribution: Austria (Waschberg Zone) Hungary (Buda marls).

Family Plagiociidae Canu, 1918
Genus *Plagioecia* Canu, 1918

Plagioecia rotula (Reuss, 1848)
Pl. 3, Fig. 5.

v. * 1848 *Diastopora rotula* m. – Reuss, p. 51, Pl. 7, Fig. 8
1974 *Plagioecia rotula* (Reuss) – Vávra, p. 363, Pl. 2, Fig. 11

Remarks: This species are known from the Miocene (Vávra, 1977) only. The features presented in the studied specimens allow to refer them to *Plagioecia rotula* (Reuss, 1848).
Eocene distribution: Perhaps in Hungary (Buda marls).

Suborder Cancellata Gregory, 1899

Family Horneridae Gregory, 1899
Genus *Hornera* Lamouroux, 1821

Hornera concatenata Reuss, 1869
Pl. 4, Fig. 1

v. * 1869b *Hornera concatenata* m. – Reuss, p. 293, Pl. 35, Fig. 5–6.
1972 *Hornera concatenata* Reuss – Mongereau, p. 324, Pl. 3, Fig. 2–5 and 7
1988 *Hornera concatenata* Reuss – Braga & Barbin, p. 511, Pl. 2, Fig. 8–9
v. 1992 *Hornera concatenata* Reuss – Zágoršek, p. 242 Pl. 4, Fig. 2

Eocene distribution: Slovakia (Zágoršek, 1992), Italy (Braga & Barbin, 1988), Romania (Ghiurca, 1987) and Austria (Waschberg Zone).

Hornera verrucosa Reuss, 1866

1866 *Hornera verrucosa* m. – Reuss, p. 197, Pl. 9, Fig. 9
1972 *Hornera verrucosa* Reuss – Mongereau, p. 352
1988 *Hornera verrucosa* Reuss – Braga & Barbin, p. 512

Eocene distribution: Italy (Braga & Barbin, 1988), Romania (Ghiurca, 1987) and Austria (Waschberg Zone).

Hornera simplicissima Braga & Barbin, 1988

1988 *Hornera simplicissima* n. sp. – Braga & Barbin, p. 512, Pl. 3, Fig. 5

Eocene distribution: Italy (Braga & Barbin, 1988) and Austria (Waschberg Zone).

Hornera frondiculata Forbes in Johnson
Pl. 4, Fig. 2

v. 1963 *Hornera frondiculata* Auct. – Małecki, p. 80, Pl. 5, Fig. 2

1972 *Hornera frondiculata* Auct. – MONGEREAU, p. 329, Pl. 5, Fig. 6, Pl. 6, Fig. 7, Pl. 7, Fig. 6–8 (cum. syn)
1988 *Hornera frondiculata* Auct. – BRAGA & BARBIN, p. 511, Pl. 2, Fig. 3, 4 (cum. syn)
v. 1992 *Hornera frondiculata* Auct. – ZÁGORŠEK 242, Pl. 4, Fig. 3, 6–8

Eocene distribution: Poland (MAŁECKI, 1963), France (MONGEREAU, 1972), Slovakia (ZÁGORŠEK, 1992), Rumania (GHIURCA, 1987), Italy (BRAGA & BARBIN, 1988), Hungary (Buda marl) and Austria (Waschberg Zone).

Family Petaloporidae GREGORY, 1899
Genus *Polyascosoecia* CANU & BASSLER, 1920

Polyascosoecia coronopus CANU & BASSLER, 1922

v. 1848 *Idmonea cancellata* GOLDFUSS – REUSS, p. 46, Pl. 5, Fig. 25–27, Pl. 6, Fig. 33
1922 *Polyascosoecia coronopus* n. sp. – CANU & BASSLER, p. 126, Pl. 20, Fig. 1–8
1969 *Reteporidea coronopus* (CANU & BASSLER) – MONGEREAU, p. 240, Pl. 17, Fig 4, 6
v. 1977 *Reteporidea coronopus* CANU & BASSLER – VÁVRA, p. 59
1984 *Polyascosoecia coronopus* CANU & BASSLER – VOIGT, p. 407, Pl. 7, Fig. 8–13
1988 *Reteporidea coronopus* (CANU & BASSLER) – BRAGA & BARBIN, p. 513, Pl. 3, Fig. 8, 9
v. 1991 *Polyascosoecia coronopus* (CANU & BASSLER) – VÁVRA, p. 499, Pl. 1, Fig. 5, Pl. 2, Fig. 1–3

Eocene distribution: North America (CANU & BASSLER, 1920), Poland (MAŁECKI, 1963 as *Reteporidea cancelata*), France (MONGEREAU, 1969), Slovakia (ZÁGORŠEK, 1992), Rumania (GHIURCA, 1987), Italy (BRAGA & BARBIN, 1988), Hungary (Buda marl) and Austria (Waschberg Zone).

Suborder Cerioporina HAGENOW, 1851
Family Heteroporidae WATERS. 1880
Genus *Heteropora* BLAINVILLE, 1830

Heteropora subreticulata REUSS, 1869
Pl. 4, Fig. 5.

v. * 1869b *Heteropora subreticulata* m. – REUSS, p. 288, Pl. 36, Fig. 7
1988 *Heteropora subreticulata* REUSS – BRAGA & BARBIN, p. 513, Pl. 4, Fig. 2
v. 1992 *Heteropora subreticulata* REUSS – ZÁGORŠEK, p. 245, Pl. 4, Fig. 9

Eocene distribution: Slovakia (ZÁGORŠEK, 1992), Rumania (GHIURCA, 1987), Italy (BRAGA & BARBIN, 1988), Hungary (Buda marl) and Austria (Waschberg Zone).

Suborder Rectangulata WATERS, 1887
Family Lichenoporidae SMITT, 1866
Genus *Disporella* GRAY,1848

The species previously listed under the *Lichenopora* are here regarded as *Disporella*. *Lichenopora* has conical colonies with a nonporous outer surface (GORDON & TAYLOR, 1997), while *Disporella* has non-stalked colonies, with a nonporous basal part and with autozooecia arranged on the frontal part in radial fascicles and with kenozooecia situated between the autozooecia (BROOD, 1972).

Disporella coronula (REUSS, 1848)

v. * 1848 *Defrancia coronula* m. – REUSS, p. 38, Pl. 6, Fig. 5
v. 1963 *Lichenopora coronula* (REUSS) – MAŁECKI, p. 91, Pl. 8, Fig 4
v. 1992 *Lichenopora coronula* (REUSS) – ZÁGORŠEK, p. 245, Pl. 5, Fig. 8

Eocene distribution: Poland (MAŁECKI, 1963), Slovakia (ZÁGORŠEK, 1992), Rumania (GHIURCA, 1987), Hungary (Buda marl) and Austria (Waschberg Zone).

Disporella grignonensis MILNE EDWARDS, 1838
Pl. I., Fig. 5.

	1838b	*Tubulipore de Grignon* n. sp. – MILNE EDWARDS, p. 333, Pl. 13, fig. 2–2d
	1920	*Lichenopora grignonensis* MILNE EDWARDS – CANU & BASSLER, p. 818, Pl. 129, Fig. 1–11 (cum. syn)
v.	1963	*Lichenopora grignonensis* MILNE EDWARDS – MAŁECKI, p. 93, Pl. 8, Fig. 6
	1988	*Lichenopora grignonensis* MILNE EDWARDS – BRAGA & BARBIN, p. 514, Pl. 4, Fig. 1
v.	1992	*Lichenopora grignonensis* MILNE EDWARDS – ZÁGORŠEK, p. 245, Pl. 5, Fig. 7

Eocene distribution: North America (CANU & BASSLER, 1920), Poland (MAŁECKI, 1963 as *Reteporidea cancelata*), Slovakia (ZÁGORŠEK, 1992), Rumania (GHIURCA, 1987), Italy (BRAGA & BARBIN, 1988), Hungary (Buda marl) and Austria (Waschberg Zone).

Disporella radiata (SAVIGNY-AUDOUIN, 1826)

v.	1977	*Lichenopora radiata* (Savigny-AUDOUIN) – VÁVRA, p. 69 (cum. syn.)
	1988	*Lichenopora radiata* (Savigny-AUDOUIN) – BRAGA & BARBIN, p. 514, Pl. 4, Fig. 3, 4 (cum. syn)

Eocene distribution: Egypt (ZIKO, 1985), Poland (MAŁECKI, 1963 as *Lichenopora brongniarti*), Slovakia (ZÁGORŠEK, 1992), Rumania (GHIURCA, 1987), Italy (BRAGA & BARBIN, 1988), Hungary (Buda marl) and Austria (Waschberg Zone).

Genus *Trochiliopora* GREGORY, 1909

Trochiliopora beyrichi (REUSS, 1851)

v. *	1851	*Pelagia Beyrichi* m. – REUSS, p. 176, Pl. 9, Fig. 23, 24
v.	1866	*Defrancia Beyrichi* (REUSS) – REUSS, p. 193, Pl. 10, Fig. 7–9
v.	1992	*Lichenopora beyrichi* (REUSS) – ZÁGORŠEK, p. 245, Pl. 5, Fig. 9
	1997	*Trochiliopora beyrichi* (REUSS) – POUYET, p. 31, Pl. 2, Fig. 1–4

Eocene distribution: Poland (MAŁECKI, 1963), Slovakia (ZÁGORŠEK, 1992), Hungary (Buda marl) and Austria (Waschberg Zone).

Class Gymnolaemata ALLMAN, 1896

Order Cheilostomatida BUSK, 1852

Suborder Malacostegina LEVINSEN, 1902
Superfamily Membraniporoidea BUSK, 1852

Family Membraniporidae BUSK, 1852
Genus *Biflustra* D'ORBIGNY 1852

Biflustra savartii texturata (REUSS, 1848)

v. *	1848	*Vaginopora texturata* m. – REUSS, p. 73, Pl. 9, Fig. 1
v.	1862	*Biflustra clathrata* (PHILIPPI) – STOLICZKA, p. 85
	1923	*Acanthodesia savartii texturata* (REUSS) – CANU & BASSLER, p. 32, Pl. 5, Fig. 1–5, Pl. 46, Fig. 8, 9
	1974	*Biflustra savartii* forme *texturata* (REUSS) – DAVID & POUYET, p. 99, Pl. 3, Fig. 6

v. 1977 *Biflustra savartii texturata* (REUSS) – VÁVRA, p. 77 (cum. syn.)
1980 *Biflustra savartii texturata* (REUSS) – BRAGA, p. 44
v. 1988 *Biflustra savartii texturata* (REUSS) – BRAGA & BARBIN, p. 515, Pl. 4, Fig. 6
v. ? 1996c *Biflustra savartii texturata* (REUSS) – ZÁGORŠEK, p. 123, Pl. 1, Fig. 1–2

Eocene distribution: Egypt (ZIKO, 1985), North America (CANU & BASSLER, 1923), Italy (BRAGA & BARBIN, 1988), Romania (GHIURCA, 1987), Austria (Waschberg Zone) and probably also Slovakia (ZÁGORŠEK, 1996c).

Suborder Flustrina SMITT, 1868
Superfamily Calloporoidea NORMAN, 1903
Family Calloporidae NORMAN, 1903
Genus *Alderina* NORMAN, 1903

Alderina subtilimargo (REUSS, 1864)

v. * 1864 *Membranipora subtilimargo* m. – REUSS, p. 630, Pl. 9, fig.5
1974 *Alderina subtilimargo* (REUSS) – DAVID & POUYET, p. 106, Pl. 2, Fig. 4
1977 *Alderina subtilimargo* (REUSS) – VÁVRA, p. 82 (cum. syn.)
1988 *Alderina subtilimargo* (REUSS) – BRAGA & BARBIN, p. 516, Pl. 5, Fig. 5
v. 1996c *Alderina subtilimargo* (REUSS) – ZÁGORŠEK, p. 123, Pl. 1, Fig. 3–5

Eocene distribution: North America (CANU & BASSLER, 1920), Tunis (VÁVRA, 1977), Poland (MAŁECKI, 1963 as *Conopeum lacroixii*), Slovakia (ZÁGORŠEK, 1996c), Rumania (GHIURCA, 1987), Italy (BRAGA & BARBIN, 1988), Hungary (Buda marl) and Austria (Waschberg Zone).

Genus *Amphiblestrum* GRAY, 1848

Amphiblestrum appendiculatum (REUSS, 1848)
Pl. 5, Fig. 2

v. * 1848 *Cellepora appendiculata* m. – REUSS, p. 96, Pl. 11, fig.22
v. 1874 *Membraniporella appendiculata* REUSS – REUSS, p. 181, Pl. 9, Fig. 13 -16
1974 *Ramphonotus appendiculata* (REUSS) – DAVID & POUYET, p. 108, Pl. 1, Fig. 2, 6
v. 1977 *Ramphonotus appendiculata* (REUSS) – VÁVRA, p. 84
v. 1997 *Amphiblestrum appendiculatum* (REUSS) – ZÁGORŠEK, p. 403, Pl. 1, Fig. 1

Eocene distribution: Slovakia (ZÁGORŠEK, 1997), Romania (GHIURCA, 1987), Hungary (Buda marl) and Austria (Waschberg Zone).

Genus *Crassimarginatella* CANU, 1900

Crassimarginatella macrostoma (REUSS, 1848)

v. * 1848 *Cellaria macrostoma* m. – REUSS, p. 64, Pl. 8, Fig. 5–6
v. 1869b *Biflustra macrostoma* (REUSS) – REUSS, p. 274, Pl. 33, Fig. 12, 13
v. 1974 *Crassimarginatella macrostoma* (REUSS) – DAVID & POUYET, p. 107, Pl. 3, Fig. 3, 4
1977 *Crassimarginatella macrostoma* (REUSS) – VÁVRA, p. 83 (cum. syn.)
1988 *Crassimarginatella macrostoma* (REUSS) – BRAGA & BARBIN, p. 516, Pl. 4, Fig. 5, 8
v. 1996c *Crassimarginatella macrostoma* (REUSS) – ZÁGORŠEK, p. 123, Pl. 1, Fig. 6, Pl. 2, Fig. 1

Eocene distribution: France (VÁVRA, 1977), Poland (MAŁECKI, 1963 as *Membranipora macrostoma*), Slovakia (ZÁGORŠEK, 1996c), Rumania (GHIURCA, 1987), Italy (BRAGA & BARBIN, 1988), Hungary (Buda marl) and Austria (Waschberg Zone).

Genus *Ogivalina* CANU & BASSLER, 1917

Ogivalina dimorpha (CANU, 1907)
Pl. 5, Fig. 1

1966 *Ogivalina? dimorpha* (CANU) – CHEETHAM, p. 22, Fig. 1–3.

Diagnosis: The colony is erect and unilamellar, rarely bilamellar. The zooecia are arranged in regular longitudinal rows and are easily separable. The zooecia are dimorphic: the ordinary zooecia are oval to rectangular, with well-developed flat, granular cryptocyst. The opesium is oval, large as about one third of the zooecial length. The second type of zooecia is large, with a circular opesium and a narrow mural rim, without cryptocyst (CHEETHAM, 1966 called them "membraniporoid" zooecia). 3–5 communication pores in single rows perforate the lateral walls of the zooecium. The small avicularia are rarely situated among three zooecia. The ovicell is unknown.
Remarks: The second type of zooecia ("membraniporoid") is rare. Some of the "membraniporoid" zooecia have smaller opesia than regular ones, some of them have larger zooecia.
Eocene distribution: United Kingdom (Sussex, CHEETHAM 1966), Hungary (Buda marl) and Austria (Waschberg Zone).

Superfamily Microporoidea GRAY, 1848

Family Microporidae GRAY, 1848
Genus *Micropora* GRAY, 1848

Micropora hexagona (ZÁGORŠEK, 1994)

v.* 1994 *Calpensia hexagona* n. sp. – ZÁGORŠEK, p. 368, Fig. 6a, b, d, f
v. 1996a *Calpensia hexagona* ZÁGORŠEK – ZÁGORŠEK, p. 531, Pl. 4, Fig. 1, 2, 4

Eocene distribution: Slovakia (ZÁGORŠEK, 1994), Hungary (Buda marl) and Austria (Waschberg Zone).

Micropora urhidensis ZÁGORŠEK, 2001
Pl. 6, Fig. 4, Pl. 21., Fig. 3

? 1869b *Membranipora gracilis* (MÜNSTER) – REUSS, p. 291, Pl. 29, Fig. 13
v.* 2001 *Micropora urhidensis* sp. n. – ZÁGORŠEK, p. 35, Pl. 7, Fig. 3–5

Diagnosis: The colony is bilamellar or multilamellar, erect and branching, with an oval to circular cross section. The zooecia are arranged in 6 to 8 regular zooecial rows. They are rectangular, elongated with strongly porous cryptocyst. The cryptocyst is proximally flat, towards the opesia slightly convex and slightly granular. The lateral walls are prominent, preserved around zooecium, and smooth. There is a very narrow furrow between lateral walls of the neighbouring zooecia. The opesia are semilunar to oval, with straight proximal margins. The opesiules are of two sizes. The pair of the large opesiules is situated proximal to the opesia, usually at one third of the length of the zooecia. These opesiules are circular to oval and equal in size. The small, accessory, opesiules are situated around the margin of the cryptocyst. The ovicell is large as about one third of zooecium, globular, probably hyperstomial. The frontal wall of the ovicell is mostly flat, rarely convex, smooth and slightly porous. The ovicelled zooecia have smaller opesiae. The avicularia have not been observed.
Eocene distribution: Hungary (Buda marl).

Genus *Calpensia* JULLIEN, 1888

Calpensia polysticha (REUSS, 1848)
Pl. 6, Fig. 1

v. * 1848 *Cellaria polysticha* m. – REUSS, p. 61, Pl. 7, Fig. 33
v. 1869b *Eschara polysticha* (REUSS) – REUSS, p. 269, Pl. 32, Fig.3
1891 *Micropora polysticha* (REUSS) – WATERS, p. 14, Pl. 2, Fig. 7
1988 *Calpensia polysticha* (REUSS) – BRAGA & BARBIN, p. 518, Pl. 7, Fig. 5.

Remarks: I have found only a few specimens of this species. Studied colonies have 5 to 8 zooecial rows and are easily separable. The zooecia are extremely elongated, with strongly porous flat cryptocyst and smooth lateral walls. Two circular opesiules are situated proximal to the margin of the peristome. The syntypes deposited in the Natural History Museum in Vienna have a circular cross-section and more concave cryptocyst.
Eocene distribution: Italy (BRAGA & BARBIN, 1988), Romania (GHIURCA, 1987), Slovakia, Hungary (Buda marl) and Austria (Waschberg Zone).

Genus *Rosseliana* JULLIEN, 1888

Rosseliana rosselii (AUDOUIN, 1826)

1988 *Rosseliana rosselii* (AUDOUIN) – BRAGA & BARBIN, p. 517, Pl. 6, Fig. 4
v. 1996a *Rosseliana rosselii* (AUDOUIN) – ZÁGORŠEK, p. 529, Pl. 3, Fig. 6

Eocene distribution: Italy (BRAGA & BARBIN, 1988), Slovakia (ZÁGORŠEK, 1996a), Hungary (Buda marl) and Austria (Waschberg Zone).

Genus *Aviculiera* ZÁGORŠEK, 2001

Aviculiera cf. *hungarii* ZÁGORŠEK, 2001
Pl. 6, Fig. 2

? 1964 *Puncturiella* cf. *sculpta* (D'ORBIGNY) – VOIGT, p. 448, Pl. 7, Fig. 8 (cum. syn)
v.* 2001 *Aviculiera hungarii* sp. n. – ZÁGORŠEK, p. 37, Pl. 8, Fig. 1–4

Diagnosis: The colony is erect with a flat cross-section and 5 to 12 regular zooecial rows on one side. The zooecia are oblong, about four to three times longer than wide. The cryptocyst is flat perforated by numerous (about 30 to 45) large pores irregularly arranged. The lateral walls are thick, slightly elevated and smooth. The orifice is oval and has a straight proximal margin. Two large, circular opesiules are situated below the orifice. A circular avicularium is arranged distally from the opesia. The diameter of the avicularium is about one half and rarely more than one half of the diameter of the opesium. The ovicell is not known.
Remarks: The found specimens resemble *A. hungarii* in general shape and in having distal, circular avicularia. However, *A. hungarii* ZÁGORŠEK (2001) has an oval cross-section with only 5–8 zooecial rows.
Eocene distribution: Similar specimens were found in Hungary (Buda marls) and Austria (Waschberg Zone).

Family Poricellariidae HARMER 1926
Genus *Poricellaria* D'ORBIGNY 1852

Poricellaria complicata (REUSS, 1869)

1869a *Diplodidymia complicata* nov. gen., m. – REUSS, p. 23, Pl. 3, Fig. 6–9

Diagnosis: The colony is erect and has rectangular transverse section. The zooecia are asymmetrical, oval with circular orifice. The orifice is facing mostly on all sides of the internodes, but rarely only on one side. The cryptocyst is imperforate except for a double long opesiule. The distal opesiule is wider but shorter than the proximal opesiule. A large adventitious, drop-like avicularium without pivot is situated on the gymnocyst.
Remarks: REUSS (1869a) erected the genus *Diplodidymia*. However, according to BASSLER (1953), *Diplodidymia* is a junior synonym of *Poricellaria*. The original REUSS material was not found among his collection in Natural History Museum in Vienna. Nevertheless, the description and illustration are almost identical with studying specimens.
Eocene distribution: Italy (BRAGA, 1975), Hungary (Buda marl) and Austria (Waschberg Zone).

Family Onychocellidae JULLIEN, 1881
Genus *Onychocella* JULLIEN, 1882 (=*Semieschara* D'ORBIGNY, 1852)

Onychocella subpyriformis (D'ARCHIAC, 1846)

v. 1988 *Onychocella subpyriformis* (D'ARCHIAC) – BRAGA & BARBIN, p. 516, Pl. 5, Fig. 3, 4 (cum. syn)
v. 1996a *Onychocella subpyriformis* (D'ARCHIAC) – ZÁGORŠEK, p. 525, Pl. 1, Fig. 1–6, Pl. 8. Fig. 5, 6

Eocene distribution: North America (CANU & BASSLER, 1920), United Kingdom (Sussex, CHEETHAM 1966), Egypt (ZIKO, 1985), France (VÁVRA, 1977), Poland (MAŁECKI, 1963 as *Onychocella angulosa*), Slovakia (ZÁGORŠEK, 1996a), Rumania (GHIURCA, 1987), Italy (BRAGA & BARBIN, 1988), Hungary (Buda marl) and Austria (Waschberg Zone).

Family Steginoporellidae HINCKS, 1884
Genus *Steginoporella* SMITT, 1873

Steginoporella cucullata (REUSS, 1848)
Pl. 5, Fig. 3

v. * 1848 *Cellaria cucullata* m. – REUSS, p. 60, Pl. 7, Fig. 31
1974 *Steginoporella cucullata* (REUSS) – DAVID & POUYET, p. 124, Pl. 10, Fig. 4
v. 1977 *Steginoporella cucullata* (REUSS) – VÁVRA, p. 94 (cum. syn.)

Eocene distribution: Romania (GHIURCA, 1987), Hungary (Buda marl) and Austria (Waschberg Zone).

Steginoporella haidingeri (REUSS, 1848)

v. * 1848 *Cellaria haidingeri* m. – REUSS, p. 60, Pl. 7, Fig. 30
1979 *Steginoporella haidingeri* (REUSS) – POUYET & DAVID, p. 779, Pl. 1, Fig. 1
v. 1988 *Steginoporella haidingeri* (REUSS) – BRAGA & BARBIN, p. 519, Pl. 6, Fig. 9
v. 1996a *Steginoporella haidingeri* (REUSS) – ZÁGORŠEK, p. 531, Pl. 4, Fig. 6, 7

Eocene distribution: Italy (BRAGA & BARBIN, 1988), Slovakia (ZÁGORŠEK, 1996a), Poland (MAŁECKI, 1963 as *Steginoporella jacksonica*),Hungary (Buda marl) and Austria (Waschberg Zone).

Steginoporella elegans chattiensis POUYET & DAVID, 1979

1885 *Steginoporella elegans* (EDWARDS) – KOSCHINSKY, p. 33
v. 1963 *Steginoporella elegans* (EDWARDS) – MAŁECKI, p. 111, Pl. 11, Fig. 6
1979 *Steginoporella elegans chattiensis* n. sp., POUYET & DAVID, p. 777, Pl. 1, Fig. 2–3 (cum. syn.)

Eocene distribution: Germany (KOSCHINSKY, 1885), Poland (MAŁECKI, 1963), Romania (GHIURCA, 1987), Hungary (Buda marl) and Austria (Waschberg Zone).

Steginoporella aff. *montenati* David, Mongereau & Pouyet, 1972
Pl. 5, Fig. 4

? 1972 *Steginoporella montenati* n. sp. – David, Mongereau & Pouyet, p. 240, Pl. 15, Fig. 1, 6. Pl. 16, Fig. 1, 6.
? 1979 *Steginoporella montenati* David, Mongereau & Pouyet – Pouyet & David, p. 787, Fig. 3, Pl. 2, Fig. 8.

Diagnosis: The colony is erect, multilamellar and has oval transversal section. The zooecia are elongated and grow in regular rows; there are 4 to 10 zooecial rows on the each side of the colony. The autozooecia are elongated, about two times longer than wide and have wide mural rim. The avicularia are vicarious, very large, about three times longer than wide, and about two times larger than the autozooecia. The cryptocyst is deeply immersed, mostly visible only in its proximal part, distally running very deep towards the orifice. Therefore, the proximal margin of the orifice is hardly visible. The cryptocyst is perforated by large pores, there are about 10 to 20 pores on the autozooecial cryptocyst and about 7 to 15 ones on the avicularian cryptocyst. The autozooecial orifice is large without opesiules. The avicularian opesia is very large, occupying almost half of the whole zooecium and has large proximo-lateral corners, and no opesiules. The palate is concave, smooth, narrow, bordered distally by thick mural rim. The ovicell is unknown.
Remarks: *Steginoporella montenati* David, Mongereau & Pouyet, 1972 differs from the described specimens in having the almost flat cryptocyst perforated by very small pores. Also the size of the vicarious avicularia is much smaller than those visible in the studied specimens from the Helmberg-1.
Eocene distribution: Austria (Waschberg Zone).

Superfamily Cellarioidea Fleming, 1828
Family Cellariidae Fleming, 1828
Genus *Cellaria* Ellis-Solander, 1786

Cellaria reussi d'Orbigny, 1851
Pl. 6, Fig. 3

v. 1977 *Cellaria reussi* d'Orbigny – Vávra, p. 98 (cum. syn.)
1988 *Cellaria reussi* d'Orbigny – Braga & Barbin, p. 519, Pl. 6, Fig. 7
v. 1997 *Cellaria reussi* d'Orbigny – Zágoršek, p. 405, Pl. 1, Fig. 4, 6

Eocene distribution: Slovakia (Zágoršek, 1997), Rumania (Ghiurca, 1987), Italy (Braga & Barbin, 1988), Hungary (Buda marl) and Austria (Waschberg Zone).

Suborder Ascophorina Levinsen, 1909
Infraorder Acanthostegomorpha Levinsen, 1902
Superfamily Cribrilinoidea Hincks, 1879

Family Cribrilinidae Hincks, 1879
Genus *Puellina* Jullien, 1886
Subgenus *Cribrilaria* Canu & Bassler, 1929

Puellina (Cribrilaria) radiata (Moll, 1803)

1920 *Puellina radiata* Moll – Canu & Bassler, p. 294, Fig. 84/G-J, Pl. 41, Fig. 14–18 (cum. syn.)
1972 *Cribrilaria radiata* (Moll) – David, Mongereau & Pouyet, p. 30, Pl. 9, Fig. 3

v. 1977 *Cribrilaria radiata* (MOLL) – VÁVRA, p. 102
v. 1988 *Cribrilaria radiata* (MOLL) – BRAGA & BARBIN, p. 521
v. 1997 *Cribrilaria radiata* (MOLL) – ZÁGORŠEK, p. 407, Pl. 2, fig. 6–7

Eocene distribution: North America (CANU & BASSLER, 1920), France (DAVID, MONGEREAU & POUYET, 1972), Poland (MAŁECKI, 1963), Slovakia (ZÁGORŠEK, 1996a), Rumania (GHIURCA, 1987), Italy (BRAGA & BARBIN, 1988), Hungary (Buda marl) and Austria (Waschberg Zone).

Puellina (Cribrilaria) haueri (REUSS, 1848)
Pl. 18., Fig. 3, 4

v. * 1848 *Cellaria Haueri* m. – REUSS, p. 63, Pl. 8, Fig. 9
non.1974 *Figularia haueri* (REUSS) – DAVID & POUYET, p. 138, Pl. 5, Fig. 6
non.1977 *Figularia haueri* (REUSS) – VÁVRA, p. 103
v. 1988 *Cribrilaria haueri* (REUSS) – BRAGA & BARBIN, p. 521, Pl.7, Fig. 1

Diagnosis: The colony is erect, bilamellar and has 3 to 8 rows of zooecia. The zooecia are elongated, two times longer than wide. The frontal wall consists of about 10 pairs of smooth costae. The lateral costal fusions are developed, producing 5 to 6 pores (lacunae) between each two costae. The median lamella is not presented. The gymnocyst is very short or absent. The aperture is semicircular to oval with apertural spines and a narrow apertural bar. The ovicell is hyperstomial, oval, slightly elongated, with a smooth frontal wall. The avicularia were not observed.
Remarks: Although *Puellina (Cribrilaria) haueri* (REUSS, 1848) lacks avicularia, other features (nonporous ovicell frontal wall and very short gymnocyst) allow to list this species under the genus *Puellina*. REUSS (1848) described another cribrimorph species with the name "*haueri*" *(Cellepora haueri*, page 83, Pl. 10, Fig. 2). This species was correctly listed under the *Figularia* (DAVID & POUYET, 1974; VÁVRA, 1977) and it represents a different species than *Puellina (Cribrilaria) haueri* (REUSS, 1848). Moreover, *Figularia haueri* (REUSS, 1848) occurs typically only in the Miocene, while *Puellina (Cribrilaria) haueri* (REUSS, 1848) is known only from Eocene.
Eocene distribution: Romania (GHIURCA, 1987), Italy (BRAGA & BARBIN, 1988) and Hungary (Buda marl).

Genus *Vavropora* ZÁGORŠEK, 2001

Vavropora pupuliformis ZÁGORŠEK, 2001

v.* 2001 *Vavropora pupuliformis* sp. n. – ZÁGORŠEK, p. 44, Pl. 9, Fig. 5–7

Diagnosis: The zooecia are oval, growing in regular alternating rows. The zooecial frontal shield is composed of 6 to 8 pairs of costae, which form the zigzag or straight median lamella. Each costa has one small pore on the distal end. The costae are laterally contiguous; no lateral costal fusion or pores between costae are developed. The apertural bar is wide, without a pore. The aperture is oval and large. One or two pairs of the oral spines are situated on the distal margin of the aperture. The avicularia are large, interzooecial, with narrow, acute, long palate and no pivot. The palate is tapering laterally (right or left), never longitudinally. The ovicell is hyperstomial, deeply immersed to the distal zooecium. The frontal wall is reduced to the strongly porous and almost flat endoecium. The remnant of the ectoecium is preserved only as a narrow lateral hoop.
Eocene distribution: Hungary (Buda marl) and Austria (Waschberg Zone).

Genus *Vicariopora* ZÁGORŠEK, 2001

Vicariopora chelys (KOSCHINSKY, 1885)

Pl. 7, Fig. 3

1885 *Cribrilina chelys* n. sp. – KOSCHINSKY, p. 36
1891 *Cribrilina chelys* KOSCHINSKY – WATERS, p. 16, Pl. 2, Fig. 10
1991 *Cribrilaria chelys* (KOSCHINSKY) – BRAGA Tab. 1
v. 2001 *Vicariopora chelys* (KOSCHINSKY) – ZÁGORŠEK, p. 43, Pl. 12, Fig. 3–7

Diagnosis: The colony is encrusting, multilamellar, forming large, erect, columnar colonies (about 50 mm long and 5 mm thick). The zooecia are large, oval with well developed gymnocyst and small oval, costal shield. The frontal costal shield consists of 5–7 pairs of short, but wide costae. The lateral costal fusion is not developed. The one small pore is laying approximately in the middle of the each costa. The apertural bar is as wide as the regular costae, but has no pores.
The avicularia are of three types: the interzooecial avicularia with a pivot bar(4–6 avicularia around each zooecium in irregular position), the vicarious, very large avicularia (as large as regular zooecia, sometimes even larger and with the pivot bar), and the adventitious avicularia without the pivotal bar.
Eocene distribution: Italy (BRAGA, 1991), United Kingdom (Sussex, CHEETHAM 1966 as *Membraniporella radiata*), and Hungary (Buda marl).

Genus *Castanopora* LANG, 1916

Castanopora calomorpha (REUSS, 1866)

v. * 1866 *Lepralia calomorpha* m. – REUSS, p. 178, Pl. 11, Fig. 10

Diagnosis: The colony is encrusting. The zooecia have slightly convex costal shield. The costae are numerous (about 20 to 30) and each has 7 to 9 pores between costae and an equivalent number of lateral costal fusions. The pair of the small avicularia is situated near the aperture. The oral spines are rare, but may not be developed. Usually, there are about 2 spines located on the distal margin of the aperture. The ovicell is small, globular and recumbent on the distal neighbouring zooecium. The frontal wall of the ovicell is convex, smooth and nonporous. The ovicell is opened to the zooecial aperture.
Remarks: According to LARWOOD (1962), *Castanopora* has numerous costae perforated by numerous small pores and avicularia in pairs; therefore, *Lepralia calomorpha* REUSS, 1866 should be included in the genus *Castanopora*.
Although no ovicells have been observed on the Helmberg-1 material, the other features are identical with the holotype deposited in the Natural History Museum in Vienna.
Eocene distribution: Hungary (Buda marl).

Genus *Gordoniella* ZÁGORŠEK, 2001

Gordoniella diporica ZÁGORŠEK, 2001

Pl. 7, Fig. 1

v.* 2001 *Gordoniella diporica* sp. n. – ZÁGORŠEK, p. 46, Pl. 13, Fig. 1–5, Pl. 14, Fig. 1, 3, 5, Pl. 21, Fig. 4

Diagnosis: The colony is unknown; probably it is very easily separable into the individual zooecia. The zooecia are oval with cribriform frontal and smooth dorsal wall. About 6 to

8 pairs of wide costae perforated by one large pore and several small pores form the cribriform frontal wall. The aperture is oval and has two large oral spines on its distal margin. The apertural bar has the same width as the regular costae. The dorsal wall is smooth, flat and nonporous. The large orifice is arranged on the distal margin of the dorsal wall, very close to the aperture. The dorsal wall continuously forming the costae creates the lateral part of the zooecium. Each zooecium has two or rarely three communication pores on the each lateral side. The ovicell is globular, small, hyperstomial with smooth, nonporous frontal wall. The avicularia is unknown.
Remark: The function of the distalo-dorsal orifice is uncertain. It seems to be a communication pore with more distal zooecia, formed as a remnant of budding.
Eocene distribution: Hungary (Buda marl) and Austria (Waschberg Zone).

Superfamily Catenicelloidea Busk; 1852

Family Catenicellidae Busk, 1852

Genus *Ditaxipora* MacGillivray, 1895

Ditaxipora cf. *internodia* (Waters, 1881)
Pl. 8, Fig. 1

1953 *Ditaxipora internodia* (Waters) – Bassler, p. 222, Fig. 167/6a, b
1994 *Ditaxipora internodia* (Waters) – Gordon & Braga, p. 66, Fig. 5 a-c

Diagnosis: The colony is rod-like with alternating zooids. The zooecia are rectangular, with the distal margin little wider than the proximal margin. The orifice has the pair of the condyles. The frontal wall consists of median T-shaped gymnocystal ridge and two (symmetrical) cryptocystal areas with one row of pores. The avicularium is suboral with pivotal bar and triangular palate. The ovicell is large, with granular endoecium and smooth ectoecium.
Remarks: This species occurs only from Oligocene to Miocene of Australia (Victoria). The studied material has no ovicells, however the features of the zooecia are almost identical. The slight difference is in the size of the pores perforating cryptocystal areas; the Australian specimens (as described by Gordon & Braga, 1994) have more prominent pores than those presented on zooecia from Helmberg-1. These features are, however only within the species variability. No ovicells were found from the Eocene sediments and therefore the species attribution remains uncertain.
Eocene distribution: perhaps found also in Austria (Waschberg Zone).

Ditaxipora pannonensis Braga, 1980
Pl. 8, Fig. 3

1980 *Ditaxipora pannonensis* n. sp. – Braga, p. 60, Fig. 63–64
1994 *Ditaxipora pannonensis* Braga – Gordon & Braga, p. 68, Fig. 6 a-c

Diagnosis: The colony is rod-like with alternating zooids. The zooecia are rectangular to rhomboidal. The orifice has the pair of condyles. The frontal wall consists of the median gymnocystal ridge and two (asymmetrical) cryptocystal areas with one row of pores. The gymnocystal ridge has similar shape as a deformed T. The cryptocystal area, which is connected with the adjacent zooecium, is always smaller, than the outer cryptocystal area. The avicularium is suboral and has pivotal bar and triangular palate. The ovicell is large and has granular endoecium and smooth ectoecium.

Remarks: This species differs from *Ditaxipora internodia* (WATERS, 1881), in having more robust and slightly deformed T-shaped gymnocystal ridge and smaller and asymmetrical cryptocystal areas. Also the zooecia of *Ditaxipora internodia* (WATERS, 1881) are longer and more rectangular. These differences could however be regarded as species variability.
Eocene distribution: Italy (GORDON & BRAGA, 1994).

Genus *Ditaxiporina* STACH, 1935

Ditaxiporina septentrionalis (WATERS, 1891)

1891 *Catenicella septentrionalis* n. sp. – WATERS, p. 5, Pl. 1, Fig. 1–8
1994 *Ditaxiporina septentrionalis* (WATERS) – GORDON & BRAGA, p. 75, Fig. 10 a – d

Eocene distribution: Italy (GORDON & BRAGA, 1994), Hungary (Buda marl) and Austria (Waschberg Zone).

Infraorder Hippothoomorpha GORDON, 1989
Superfamily Hippothooidea BUSK, 1859

Family Pasytheidae DAVIS, 1934
Genus *Unifissurinella* POIGNANT, 1991

Unifissurinella boulangeri POIGNANT, 1991
Pl. 7, Fig. 2

1991 *Unifissurinella boulangeri* n. sp. – POIGNANT, p. 95, Pl. 1, Fig. 1–10.
v. 2000 *Unifissurinella boulangeri* POIGNANT – ZÁGORŠEK, p. 315, Fig. 1–3.

Diagnosis: The colony is erect flexible and articulated. The zooecia are symmetrical, from lateral view approximately triangular. The frontal wall is porous. The apertures are circular with sinus and with nonporous short peristome. The calcified stolon runs along the dorsal wall. The avicularia and ovicell are unknown.
Remarks: Due to the findings in Helmberg-1, the growth form could be estimated, and therefore the attribution to Bryozoa could be demonstrated. For detailed description and systematic affinities see ZÁGORŠEK (2000).
Eocene distribution: France (POIGNANT, 1991), Austria (Waschberg Zone).

Infraorder Umbonulomorpha GORDON, 1989
Superfamily Adeonoidea BUSK, 1884

Family Adeonidae BUSK, 1884
Genus *Adeonella* BUSK, 1884

Adeonella minor (REUSS, 1869)
Pl. 8, Fig. 4

v. * 1869b *Eschara minor* m. – REUSS, p. 272, Pl. 33, Fig. 4
v. 1988 *Adeonella syringopora* (REUSS) – BRAGA & BARBIN, p. 526, Pl. 9, Fig. 9
1991 *Adeonella minor* (REUSS) – BRAGA Tab. 1

Eocene distribution: Germany (VÁVRA, 1977), Poland (MAŁECKI, 1963 as *Adeonella polystomella*), Slovakia (ZÁGORŠEK, 1996b), Rumania (GHIURCA, 1987), Italy (BRAGA & BARBIN, 1988), Hungary (Buda marl) and Austria (Waschberg Zone).

Adeonella ornatissima (Stoliczka, 1862)
Pl. 8, Fig. 2

v. * 1862 *Eschara (Escharifora) ornatissima* n. sp. – Stoliczka, p. 86, Pl. 2, Fig. 7
1914 *Adeonella ornatissima* (Stoliczka) – Canu, p. 471, Pl. 15, Fig. 1–3

Diagnosis: The colony is erect, multilamellar, with 8 to 10 rows of zooecia. The zooecia situated at the edge of the colony are two times longer than those situated in the middle part of the colony. The frontal wall is smooth and has about 25 to 35 marginal areolar pores around each zooecium. The frontal wall is very narrow on the zooecia located in the middle part of the colony. The zooecia arranged on the marginal part of the colony are flat and slightly convex. The aperture is semilunar to oval. The diameter of the median pore (spiramen) is about half of the diameter of the aperture. Two small, circular, oral avicularia are placed on both sides of the aperture. The adventitious avicularia are not developed. The ovicell is unknown.
Remarks: Zooecia developed on the distal margin of the colony are larger and more longitudinal than the zooecia situated on the more proximal part. These distal zooecia are very similar to the marginal zooecia in proximal part of the colony. This part of the colony can be regarded as very similar to *A. minor*; the only difference is in the size of the avicularia (*A. ornatissima* has much larger avicularia as *A. minor*) and in fact that the distal part of colony with longitudinal zooecia is very short.
Eocene distribution: France (Canu, 1914), Germany (Stoliczka, 1862) and Austria (Waschberg Zone).

Genus *Adeonellopsis* MacGillivray, 1886

Adeonellopsis aff. *coscinophora* (Reuss, 1848)
Pl. 9, Fig. 1

? 1848 *Eschara coscinophora* m. – Reuss, p. 67, Pl. 8, Fig. 20.
? 1977 *Adeonellopsis coscinophora* (Reuss) – Vávra, p. 148 (cum. syn.)

Diagnosis: The colony is erect and has flat cross-section. The zooecia are arranged in about 6 to 10 zooecial rows and have regular oval elongated shape, separated one to each other with lines of small marginal areolar pores. The remains of the frontal wall is flat and not elevated. The aperture is semilunar to oval. The spiramen is small (typically smaller than apertures), oval and perforated by 2, rarely by 3 large pores. The large avicularium is situated between the aperture and the spiramen, almost as large as the aperture, circular and without pivot. The ovicell is not known.
Remark: The most specific features of *A.* aff. *coscinophora* (Reuss, 1848) are the presence of the aperture, the avicularium and the spiramen almost equal in size, and the presence of only 2–3 pores in the spiramen.
The described specimens could represent to a new species. Unfortunately, only one specimen has been found, therefore a new species cannot be established.
Eocene distribution: Austria (Waschberg Zone).

Adeonellopsis porina (Roemer, 1863)
Pl. 9, Fig. 2

1863 *Vincularia porina* n. sp. – Roemer, p. 204, Pl. 35, Fig. 2
1966 *Adeonellopsis porina* (Roemer) – Braga, p. 229, Pl. 29, Fig. 2–11 (cum syn.)
v. 1988 *Adeonellopsis porina* (Roemer) – Braga & Barbin, p. 527, Pl. 10, Fig. 3

Eocene distribution: Germany (ROEMER, 1863), Poland (MAŁECKI, 1963 as *Adeonellopsis punctata*), Slovakia (Štrba), Rumania (GHIURCA, 1987), Italy (BRAGA & BARBIN, 1988), Hungary (Buda marl) and Austria (Waschberg Zone).

Genus *Meniscopora* GREGORY, 1893

Meniscopora syringopora (REUSS, 1848)
Pl. 9, Fig. 3

v. * 1848 *Eschara syringopora* m. – REUSS, p. 68, Pl. 8, Fig. 23
v. 1977 *Adeonella syringopora* (REUSS) – VÁVRA, p. 148
v. 1988 *Meniscopora lontensis* (WATERS) – BRAGA & BARBIN, p. 527, Pl. 10, Fig. 1
1991 *Meniscopora syringopora* (REUSS) – BRAGA Tab. 1

Eocene distribution: Italy (BRAGA & BARBIN, 1988), Slovakia (Hybica), Poland (MAŁECKI, 1963 as *Adeonella folliculata*), Hungary (Buda marl) and Austria (Waschberg Zone).

Superfamily Lepralielloidea VIGNEAUX, 1949

Family Rhamphostomellidae KLUGE 1962
Genus *Porella* GRAY, 1848

Porella clavula (CANU & BASSLER, 1920)
Pl. 9, Fig. 4

1920 *Aimulosia clavula* n. sp. – CANU & BASSLER, p. 429, Pl. 9, Fig. 13–16

Remarks: GORDON (1989) discussed the morphological features of *Aimulosia* and pointed out that *Aimulosia clavula* CANU & BASSLER, 1920 does not belong to *Aimulosia*. The most similar genus seems to be *Porella* GRAY, 1848. According to HAYWARD & RYLAND (1979) and GORDON (1984), *Porella* GRAY, 1848 has only marginal areolar pores. The orifice has a lyrula and condyles variously developed, oral spines are lacking. The avicularium is suboral situated within the peristome. The ovicells are prominent, usually imperforate and not closed by the zooecial operculum. Although no ovicells have been found, all other mentioned features are visible in the studied material.
Eocene distribution: Romania (GHIURCA, 1987), Hungary (Buda marl) and Austria (Waschberg Zone).

Genus *Reussia* NEVIANI, 1895

Reussia cf. *regularis* (REUSS, 1866)
Pl. 10, Fig. 1, 2.

v. * 1866 *Eschara regularis* m. – REUSS, p. 185, Pl. 6, Fig. 13
1974 *Reussia regularis* (REUSS) – DAVID & POUYET, p. 193
v. 1977 *Reussia regularis* (REUSS) – VÁVRA, p. 140
1988 *Smittina (Reussia) regularis* (REUSS) – BRAGA & BARBIN, p. 524, Pl. 9, Fig. 4
v. 1994 *Reussia (Smittina) regularis* (REUSS) – ZÁGORŠEK, p. 362

Remarks: The colonies found in the Helmberg-1 rarely developed the zooecia with large adventitious avicularium. These zooecia usually have deformed shape, and larger apertures than the zooecia without avicularia. The adventitious avicularium is large oval occupying almost whole frontal wall of the zooecium and has an oval palate. The palate is sometimes wider than the central part of the avicularium. The direction of the palate is always proximal. Development of this unusual zooecia may either have an ecological background, or it is a new species. However, other features are identical with the "typical" *Reussia regularis* (REUSS).

Eocene distribution: *Reussia regularis* (REUSS) occurs in Italy (BRAGA & BARBIN, 1988), Slovakia (ZÁGORŠEK, 1994), Poland (MAŁECKI, 1963 as *Hippodiplosia falcifera*), Hungary (Buda marl) and Austria (Waschberg Zone). None of them have however the adventitious avicularia.

Family Romancheinidae JULLIEN, 1888

Genus *Escharella* GRAY, 1848

Escharella tenera (REUSS, 1874)

v. * 1874 *Lepralia tenera* m. – REUSS, p. 167, Pl. 2, Fig. 4
v. 1963 *Mucronella peachi* (JOHNSTON) – MAŁECKI, p. 122, Pl. 13, Fig. 6
1974 *Escharella tenera* (REUSS) – DAVID & POUYET, p. 187, Pl. 9, Fig. 6 (cum. syn)
v. 1977 *Escharella tenera* (REUSS) – VÁVRA, p. 137

Eocene distribution: Slovakia (Štrba), Poland (MAŁECKI, 1963 as *Mucronella peachi*), Hungary (Buda marl) and Austria (Waschberg Zone).

Escharella grotriani (STOLICZKA, 1862)

v. * 1862 *Lepralia Grotriani* n. sp. – STOLICZKA, p. 84, Pl. 2, Fig. 1
1869b *Lepralia Grotriani* STOLICZKA – REUSS, p. 43
1966 *Escharella grotriani* (STOLICZKA) – BRAGA, p. 226, Pl. 28, Fig. 4
1974 „*Eschara*" *grotriani* (STOLICZKA) – DAVID & POUYET, p. 228
v. 1977 *Escharoides grotriani* (STOLICZKA) – VÁVRA, p. 132

Remarks: The colonies found in the Helmberg-1 have zooecia with more prominent marginal areolar pores. Some of them also have some bulges between marginal areolar pores. Nevertheless I believe that this feature can be explained by the species variability.

Eocene distribution: Poland (MAŁECKI, 1963 as *Perigastrella semierecta*), Slovakia (Štrba), Hungary (Buda marl), Austria (Waschberg Zone).

Genus *Exochella* JULLIEN, 1888

Exochella? *labiosa* (REUSS, 1869)

Pl. 10, Fig. 4

v. * 1869b *Lepralia labiosa* m. – REUSS, p. 289, Pl. 30, Fig. 5
1991 *Escharoides labiosa* (REUSS). – BRAGA Tab. 1

Diagnosis: The colony is encrusting. The zooecia are oval and have large apertural parts. The frontal wall is slightly convex, smooth and with few, large lateral marginal areolar pores. There are about 7 marginal areolar pores around each zooecium. The aperture is circular to semilunar with wide, but short peristome. On the peristome, there are denticles and sometimes also oral spines. The large avicularium without pivot is situated just proximal to the aperture. The palate of the avicularium is directed laterally. The ovicell is recumbent with strongly porous frontal wall and with marginal areolar pores.

Remarks: The described specimens are identical with the syntypes deposited in the Natural History Museum in Vienna in the shape and size of the ovicells and position of the avicularia. However it differs in having more marginal areolar pores.

BRAGA (1991) listed this species under the genus *Escharoides*, however, the species has a recumbent ovicell, no spout-like peristome, and no paired oral avicularia. The most similar genus seems to be *Exochella* JULLIEN, 1888 in having denticles on the peristome, recumbent ovicells, and oral spines (GORDON, 1984).
Eocene distribution: Italy (BRAGA, 1991) and Hungary (Buda marl).

Genus *Escharoides* EDWARDS, 1836

Escharoides aliferus (REUSS, 1848)

v. * 1869b *Eschara alifera* m. – REUSS, p. 274, Pl. 33, Fig. 11
1968 *Escharoides aliferus* (REUSS) – CHEETHAM, p. 60, Pl. 16, Fig. 2
v. 1988 *Escharoides aliferus* (REUSS) – BRAGA & BARBIN, p. 524, Pl. 9, Fig. 1

Remarks: The holotype deposited in the Natural History Museum in Vienna is a large, erect colony, but the studied specimens form encrusting colonies. The other features (number of marginal areolar pores, features on avicularia and ovicells) are, however, identical with those visible in the material from Helmberg-1.
Eocene distribution: United Kingdom (Sussex, CHEETHAM 1966), Romania (GHIURCA, 1987), Italy (BRAGA & BARBIN, 1988), Hungary (Buda marl) and Slovakia (Štrba).

Escharoides coccinea (ABILDGAARD, 1806)
Pl. 10, Fig. 3

v. * 1874 *Lepralia coccinea* (ABILDGAARD) – REUSS, p. 155, Pl. 6, Fig. 11
1968 *Escharoides coccineus* (ABILDGAARD) – CHEETHAM, p. 61, Pl. 16, Fig. 4
1977 *Escharoides coccinea* (ABILDGAARD) – VÁVRA, p. 132 (cum. syn)
v. 1988 *Escharoides coccineus* (ABILDGAARD) – BRAGA & BARBIN, p. 524, Pl. 8, Fig. 5

Remarks: *Escharoides coccinea* (ABILDGAARD, 1806) differs from similar species in having ovicells with smooth, slightly porous frontal wall and usually prominent marginal areolar pores with ribs.
Eocene distribution: Romania (GHIURCA, 1987), Italy (BRAGA & BARBIN, 1988), Slovakia (Štrba), Hungary (Buda marl) and Austria (Waschberg Zone).

Family Umbonulidae CANU, 1904
Genus *Cheilonella* KOSCHINSKY, 1885

Cheilonella prominens (REUSS, 1869)
Pl. 11, Fig. 1, 2

1869b *Alysidota prominens* m. – REUSS, p. 45, Pl. 36, Fig. 8
1999 *Phylactella prominens* (REUSS). – BIZZARINI & BRAGA, p. 94, Pl. 1, Fig. 1

Diagnosis: The colony is uniserial encrusting, so called "running type". The zooecia are oval to drop-like with nonporous, smooth, convex frontal walls. No marginal areolar pores are developed. The aperture is circular and has a small lyrula, but no apertural spines. The peristome is short, circular, but thick. Neither avicularia nor ovicells are known.
Remarks: The holotype was not found within the Reuss collection deposited in the Natural History Museum in Vienna, but all features described and illustrated by Reuss are identical with specimens found in Helmberg-1.

KOSCHINSKY (1885) has described the genus *Cheilonella* as having running colonies with drop like zooecia, thick peristome and having a blunt hook in the middle of the aperture. The "blunt hook" can be regarded as small lyrula, and therefore I believe that described species belong to this genus.
Eocene distribution: Italy (BIZZARINI & BRAGA, 1999).

Genus *Perigastrella* CANU & BASSLER, 1917

Perigastrella granulata ZÁGORŠEK, 1994
Pl. 21., Fig. 4

v. * 1994 *Perigastrella granulata* n. sp. – ZÁGORŠEK, p. 376, Fig. 6e, 9d, e

Eocene distribution: Slovakia (ZÁGORŠEK, 1994) and Hungary (Buda marl).

Genus *Opaeomorpha* ZÁGORŠEK, 2001

Opaeomorpha michaliki ZÁGORŠEK, 2001
Pl. 11, Fig. 3

v.* 2001 *Opaeomorpha michaliki* sp. n. – ZÁGORŠEK, p. 54, Pl. 6, Fig. 6, 7

Diagnosis: The colony is encrusting. The zooecia are oval and usually grow in regular rows. The frontal wall is granular, nonporous, convex in the median part and somewhat concave in lateral margins. The circular marginal areolar pores perforate the concave part of the frontal wall. The marginal areolar pores are arranged in pairs, usually 5 to 6 pairs are developed in each zooecium; however ovicelled zooecia have 4 to 5 pairs. The lateral wall is slightly elevated above the frontal wall and forms a narrow "mural rim". The aperture is small, oval and wider than long. No oral spines are known. The avicularia are rare, vicarious, interzooecial with narrow, acute palate. The ovicell is hyperstomial, oval, large, sometimes deforming the distal zooecium. The frontal wall of the ovicell is smooth (not granular) and nonporous, flat or somewhat convex.
Eocene distribution: Hungary (Buda marl).

Family Metrarabdotosidae VIGNEAUX, 1949
Genus *Metrarabdotos* CANU, 1914

Metrarabdotos maleckii CHEETHAM, 1968
Pl. 11, Fig. 4

1968 *Metrarabdotos maleckii* n. sp. – CHEETHAM, p. 104, Pl. 14, Fig. 1–5
1974 *Metrarabdotos maleckii* CHEETHAM – DAVID & POUYET, p. 208, Pl. 8, Fig. 5 (cum syn.)
v. 1977 *Metrarabdotos maleckii* CHEETHAM – VÁVRA, p. 153 (cum. syn.)

Remarks: Although the described material has no ovicells, other morphological features (narrower proximal part of zooecia, shallow sinus, and oral avicularia) are identical with description by CHEETHAM (1968).
Eocene distribution: Romania (GHIURCA, 1987), Italy (BRAGA, 1991), Slovakia (Štrba) and Austria (Waschberg Zone).

Infraorder Lepraliomorpha GORDON, 1989
Superfamily Smittinoidea LEVINSEN, 1909

Family Smittinidae LEVINSEN, 1909
Genus *Smittina* NORMAN, 1903

Smittina cervicornis (PALLAS, 1766)

1974 *Porella cervicornis* (PALLAS) – DAVID & POUYET, p. 194 (cum. syn)
v. 1977 *Porella cervicornis* (PALLAS) – VÁVRA, p. 139 (cum. syn.)

Remarks: According to GORDON (1984, p. 90), the presence of a lyrula and median suboral avicularium in zooecia with a porous frontal wall, and ovicells with porous frontal are distinctive features of the genus *Smittina. Porella* has only marginal pores, and the frontal wall is smooth, nonporous (GORDON, 1984). The described species exhibits all the distinguished features except the ovicell, which is unknown. Nevertheless, the *Smittina* is the closest related genus.
Eocene distribution: Poland (MAŁECKI, 1963 as *Porella abdita* and *Hippomenella alifera*), Slovakia (Štrba), Rumania (GHIURCA, 1987), Hungary (Buda marl) and Austria (Waschberg Zone).

Genus *Parasmittina* OSBURN, 1952

Parasmittina saccoi (CANU, 1903)
Pl. 12, Fig. 2

1970 *Smittina saccoi* CANU – DAVID, MONGEREAU & POUYET, p.139, Fig. 17, Pl., Fig. 6–7

Diagnosis: The colony is erect, bilamellar with 6 to 8 zooecial rows on each side. The zooecia are elongated, with flat, smooth frontal walls. The marginal areolar pores are small. There are about 14 to 20 pores around each zooecium. The aperture is circular with condyles. The proximal part of the aperture is about two times smaller than the distal part. A small lyrula is developed inside the aperture. The lateral walls are sometimes slightly elevated. The avicularium is large and has flat, wide, long palate. The avicularium is situated on the frontal wall and usually occupies the complete frontal wall. The ovicell is globular and has smooth, convex frontal wall, perforated by few small pores.
Remarks: *Smittina* has no marginal areolar pores (GORDON, 1984), so this species cannot be *Smittina.* The most similar genus for these specimens seems to be *Parasmittina*, as redescribed by GORDON (1984). All of the specific features are present in the described specimens as well as in the description of DAVID, MONGEREAU & POUYET (1970). Therefore, this species is listed under *Parasmittina*.
Eocene distribution: France (DAVID, MONGEREAU & POUYET, 1970), Hungary (Buda marl).

Genus *Zuzanella* gen. nov.

Diagnosis: Colony erect and flat. Zooecia elongated oval with well-developed marginal areolar pores and smooth frontal walls. Apertures oval. Avicularia oral, immersed into the proximal margin of aperture. Ovicell probably hyperstomial or recumbent, deeply immersed into the distal zooecium with strongly porous frontal wall.
Derivatio nominis: After the name Suzanne, with Czech spelling: Zuzana.
Included species: Type species: *Zuzanella tomashi* n. sp.; *Zuzanella kovaci* n. sp., *Zuzanella* sp.

Comparison: The most similar genus is *Parasmittina* OSBURN, 1952 with respect to the general shape of colonies and zooecia. It differs mainly in having avicularia situated on the frontal wall, having lyrula and remarkable sinus in the aperture, and by its typically prominent ovicell.
The second very similar genus is *Smittoidea* OSBURN, 1952 (as described by GORDON, 1984). It has mainly encrusting colonies and large adventitious avicularia. It differs also in having lyrula in the aperture and that its ovicell is not closed by a zooecial operculum.
Drepanophora HARMER, 1957 (as described by WINSTON & HEIMBERG, 1986) is similar in having an avicularium deeply immersed inside the proximal part of the aperture and ovicell also immersed to distal zooecium. However, it has only few marginal pores and only the marginal pores perforate the ovicell.
Remarks: *Zuzanella* is listed under the family Smittinidae LEVINSEN, 1909 due to the development of strongly porous ovicell frontal walls and the presence of only marginal areolar pores.

Zuzanella tomashi n. sp.
Pl. 13, Fig. 1–4

Diagnosis: Colonies erect, flat. Zooecia elongated oval with well-developed marginal areolar pores and smooth frontal wall. Apertures oval. Avicularia oral, immersed into the proximal margin of aperture. Ovicell probably hyperstomial, deeply immersed and with strongly porous frontal wall.
Holotype: The specimen number 1768, deposited in the Institute of Palaeontology of Vienna University (Austria), depicted in Pl. 13, Fig. 3, 4, from a depth of 3194 m.
Paratypes: 5 specimens numbers 1769–1773, deposited in the Institute of Palaeontology of Vienna University (Austria), from a depth of 3194 m.
Derivatio nominis: After the name Tomáš, with transcription tomash.
Locus typicus: borehole Helmberg-1, depth 3194 m.
Stratum typicum: Eocene – Priabonian.
Dimensions: (in micro meters = µm; x = average; details see Tab. 2 and Fig. 1):
length of colony: 1702–2692, x = 1924
width of colony: 1148–1867, x = 1597
length of zooecia: 418–637, x = 498
width of zooecia: 178–306, x = 258
length of zooecial aperture: 83–132, x = 105
width of zooecial aperture: 139–173, x = 155
length of ovicell: 140–197, x = 162
width of ovicell: 117–198, x = 156
diameter of areolar pores: 21–41, x = 31
width of avicularium: x = 70–115, x = 92
Description: The colony is erect, flat with up to six zooecial rows on each side. The zooecia are elongated oval with smooth, nonporous, flat, rarely slightly convex frontal wall. The marginal areolar pores are well developed, large, and unequal in size. There are about 8 to 10 marginal pores around each zooecium. The aperture is circular to oval with straight, or slightly concave proximal margin. The sinus is not developed. The avicularia are oral, oval to drop like and deeply immersed into the proximal margin of the aperture. The pivotal bar may be developed. The proximal margin of the aperture is often deformed (i.e. it is not straight)

by the avicularium. The ovicell is probably hyperstomial or recumbent, deeply immersed into the space between mature zooecium and distal zooecium. The distal zooecium is however rarely deformed by the ovicell. The frontal wall of the ovicell is slightly convex, strongly porous with small circular pores, more or less equal in size and shape.
Comparison: The most similar species is *Smittoidea zelandiae* (Brown, 1952) as described by Gordon (1984). This species has small avicularium placed very close to the proximal margin of aperture and deeply immersed ovicell with porous frontal wall. The main differences are the smaller marginal areolar pores, the presence of the oral spines on the distal edge of the aperture and the development of the lyrula.
In having deeply immersed ovicell with porous frontal wall this species is also similar to *Smittoidea curtisensis* Gordon, 1984. However, it has very large vicarious avicularia situated on the frontal wall.
Parasmittina tubula (Kirkpatrick, 1888) as described by Gordon, 1984 is similar with described species in having immersed ovicells with porous frontal wall and small avicularia situated near to the aperture. Nevertheless, the avicularium is never oral and this species develops oral spines and prominent sinus on the aperture.
Occurrence: The borehole Helmberg-1 at a depth of 3194 m.

Zuzanella kovaci n. sp.
Pl. 14, Fig. 3

Diagnosis: Colonies encrusting. Zooecia short oval with well-developed large marginal areolar pores and reduced smooth frontal wall. Apertures oval. Avicularia oral, immersed

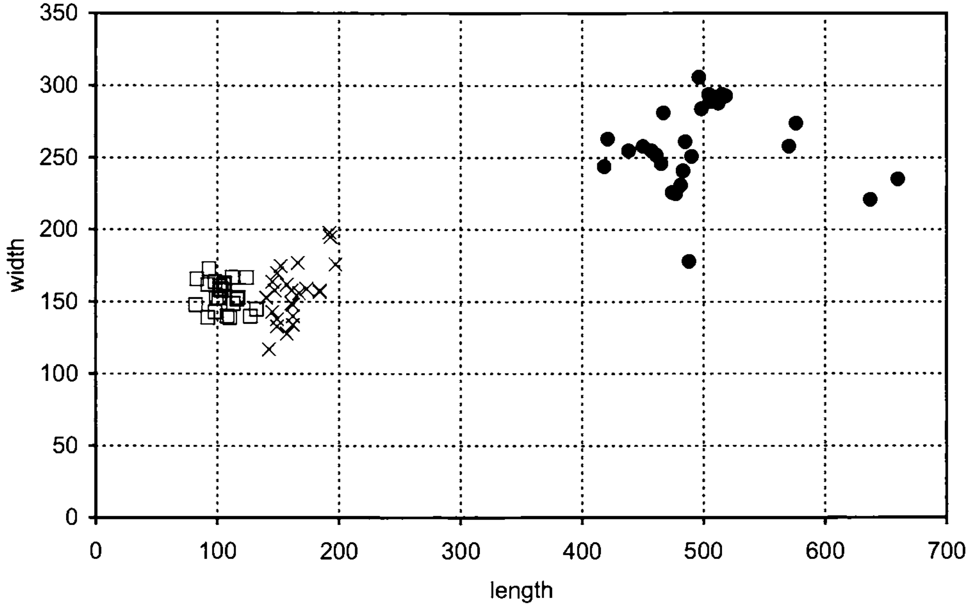

Fig. 1: Chart showing length and width of the zooecia, ovicells and apertures in *Zuzanella tomashi* n. sp. Symbols: ● zooecium; × ovicell; □ aperture.

	len-zoa	wid-zoa	len-zooe	wid-zooe	len-aper	wid-aper	len-ovic	wid-ovic	dia areolae	wid-avi
holotype	1702	1480	637	221	103	159	184	158	37	67
			518	293	99	153	149	138	36	71
			481	231	98	143	167	156	39	70
			450	258	101	153	145	143	27	84
			477	225	92	139	184	157	29	81
			483	241			145	164	33	89
paratype 1	2692	1867	485	261	105	162	193	195	34	99
			421	263	83	166	140	153	41	93
			465	246	106	158	157	128	40	96
			438	255	102	159	149	133	29	97
			461	252	82	148	161	158	31	105
			496	306	103	158	162	148	27	115
paratype 2	1725	1148	467	281	110	139	147	158	30	86
			660	235	98	164	197	176	25	89
			576	274	108	140	162	134	21	90
			418	244	112	167	142	117	26	91
			488	178			162	140	25	
paratype 3	1761	1723	490	251	117	153	173	159	28	105
			515	294	124	167	192	198	27	99
			570	258	127	140	157	162	31	85
			457	255	102	161	161	149	29	103
			474	226	106	163	166	177	45	93
paratype 4	1739	1768	498	284	93	173	152	175	35	98
			505	289	116	152	149	170	35	95
			504	294	113	149			32	73
			512	288	92	162			24	86
					132	145			22	92
average	1924	1597	498	258	105	155	162	156	31	90

Tab. 2: The complete measurements of *Zuzanella tomashi* n. sp. All sizes in μm. Abbreviations: len-zoa = length of colony; wid-zoa = width of colony; len-zooe = length of zooecium; wid-zooe = width of zooecium; len-aper = length of aperture; wid-aper = width of aperture; len-ovic = length of ovicell; wid-ovic = width of ovicell; dia areolae = diameter of marginal areolar pores; wid-avi = width of avicularium.

into the proximal margin of aperture. Ovicell probably recumbent, deeply immersed with strongly porous frontal wall.

Holotype: The specimen 1763, deposited in the Institute of Palaeontology of Vienna University (Austria), depicted in Pl. 14, Fig. 3, from a depth of 3194 m.

Paratypes: 2 specimens 1764 and 1765, deposited in the Institute of Palaeontology of Vienna University (Austria), from a depth of 3194 m.

Derivatio nominis: After Prof. Kováè, a head of Department of Geology and Palaeontology, Comenius University, Bratislava – Slovakia.

Locus typicus: borehole Helmberg-1, depth 3194 m.
Stratum typicum: Eocene – Priabonian.
Dimensions: (in micro meters = µm; x = average; details see Tab. 3 and Fig. 2):
length of zooecia: 280–451, x = 340
width of zooecia: 171–377, x = 269
length of zooecial aperture: 52–114, x = 79
width of zooecial aperture: 104–176, x = 146
length of ovicell: 120–157, x = 139
width of ovicell: 93–171, x = 154
diameter of areolar pores: 32–74, x = 44
width of avicularium: x = 82–102, x = 92
Description: The colony is encrusting, the zooecia are growing in the irregular rows. The zooecia are short oval and have usually reduced frontal wall. The frontal wall is smooth, nonporous, flat or rarely slightly convex. The marginal areolar pores are well developed, very large, and unequal in size. About 5 to 9 marginal pores are arranged around each zooecium. The aperture is circular to oval with straight, or slightly concave proximal margin. The sinus is not developed. The avicularia are oral, oval to drop like and deeply immersed into the proximal margin of aperture. The pivotal bar is usually prominent. The proximal margin of the aperture is deformed by the development of the avicularia. The ovicell is probably recumbent or hyperstomial, deeply immersed into the space between the mature zooecium and the distal zooecium. The frontal wall of the ovicell is slightly convex and strongly perforated by small circular pores, more or less equal in size and shape.
Comparison: The most similar species is *Zuzanella tomashi* n. sp. in general shape, development of avicularia and ovicells. *Zuzanella kovaci* n. sp. differs mainly in short zooecia with reduced frontal wall, smaller, more recumbent ovicells and encrusting colonies.
Occurrence Borehole Helmberg-1 at a depth of 3194 m, probably also at a depth of 3190 m and Austria (Waschberg Zone).

Zuzanella sp.
Pl. 14, Fig. 1, 4.

Diagnosis: The colony is erect and flat. The zooecia are elongated oval with well-developed small marginal areolar pores and smooth, convex frontal wall. The apertures are circular and developed oral spines. The avicularia are oral immersed inside the aperture. The ovicell is probably hyperstomial, deeply immersed with strongly porous frontal wall.
Remarks: The specimen resembles *Zuzanella* in general shape, development of marginal pores, and in having deeply immersed avicularia and ovicells with porous wall. It differs from *Zuzanella tomashi* n. sp. mainly in having oral spines, and from *Zuzanella kovaci* n. sp. in having erect colonies, small marginal areolar pores and well developed frontal wall. Because only one poorly preserved specimen has been found, the species attribution remains uncertain.

Genus *Smittoidea* Osburn, 1952
Smittoidea excentrica (Reuss, 1864)
Pl. 12, Fig. 4

1864 *Lepralia excentrica* m. – Reuss, p. 641, Pl. 15, Fig. 4
v. 1866 *Lepralia excentrica* Reuss – Reuss, p. 175, Pl. 8, Fig. 2

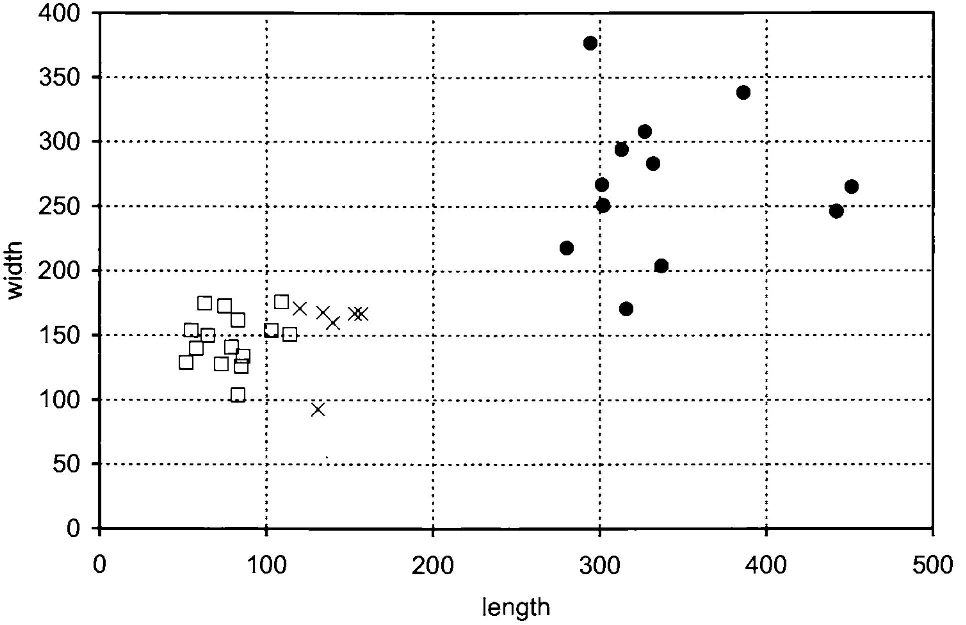

Fig. 2: Chart showing length and width of the zooecia, ovicells and apertures in *Zuzanella kovaci* n. sp. For symbols see Fig. 1.

1869b *Lepralia excentrica* Reuss – Reuss, p. 256.
1963 *Umbonula excentrica* (Reuss) – Braga, p. 225, Pl. 28, Fig. 3

Diagnosis: The colony is erect with flat to oval cross-section. The zooecia are oval and about three times longer than wide. The frontal wall is smooth and slightly convex. The marginal areolar pores are large, 12 to 14 pores are arranged around each zooecium. The aperture is oval to semilunar with condyles and lyrula. In the middle of the frontal wall, near the distal end of the aperture, there is a strongly convex avicularian chamber. The avicularia are circular, with pivot. The ovicell is small, hyperstomial, with smooth, evenly slightly porous frontal wall.
Remarks: The species resemble *Smittoidea* in marginal areolar pores, aperture with condyles and lyrula, and hyperstomial ovicell, with slightly porous frontal wall.
Eocene distribution: Italy (Braga, 1963), Romania (Ghiurca, 1987), Hungary (Buda marl) and Austria (Waschberg Zone).

Genus *Prenantia* Gautier, 1962

Prenantia phymatopora (Reuss, 1869)
Pl. 12, Fig. 1

v. * 1869b *Eschara phymatopora* m. – Reuss, p. 60, Pl. 33, Fig. 1
v. 1963 *Schizoporella phimatopora* (Reuss) – Braga, p. 33, Pl. 4, Fig. 3

	len-zooe	wid-zooe	len-aper	wid-aper	len-ovic	wid-ovic	dia areolae	wid-avi
holotype	301	267	65	150	140	160	41	101
	332	283	63	175	153	167	51	94
	302	251	79	141	120	171	47	82
	327	308	75	173	157	167	47	82
	294	377	109	176			43	102
			85	126			43	
paratype 1	316	171	83	104	131	93	34	96
	451	265	83	162			32	
	337	204	86	134			38	
	280	218	55	154			40	
			52	129			32	
			73	128			38	
paratype 2	386	338	114	151	134	168	28	84
	313	294	103	154			42	
	442	246	58	140			35	
							29	
average	340	269	79	146	139	154	39	92

Tab. 3: Dimensions of *Zuzanella kovaci* n. sp. All sizes in µm. For abbreviations see Tab. 2.

Remarks: The species belongs to *Prenantia* because of the presence of porous frontal wall, aperture with pseudosinus and condyles and immersed ovicell with porous frontal wall.
Eocene distribution: Italy (Braga, 1963), Slovakia (Štrba), Rumania (Ghiurca, 1987), Hungary (Buda marl) and Austria (Waschberg Zone).

Family Bitectiporidae MacGillivray, 1895

Genus *Hippomonavella* Canu & Bassler, 1934
Hippomonavella exarata (Reuss, 1848)

v. * 1848 *Cellaria exarata* m. – Reuss, p. 61, Pl. 7, Fig. 32
1891 *Smittina exarata* (Reuss) – Waters, p. 22, Pl. 3, Fig. 6
1991 *Hippoporina exarata* (Reuss) – Braga Tab. 1

Remarks: This species can be listed under *Hippomonavella* due to the presence of the marginal areolar pores and the concave margins of the aperture and condyles. The genus replacement is proofed also by lacking the peristome and the oral spines on this species (Gordon, 1984).
Eocene distribution: Italy (Braga, 1991), Slovakia (Štrba), Hungary (Buda marl) and Austria (Waschberg Zone).

Hippomonavella bisulca (Reuss, 1869)
Pl. 12, Fig. 3

v. * 1869b *Eschara bisulca* m. – Reuss, p. 270, Pl. 32, Fig. 10
1891 *Lepralia bisulca* (Reuss) – Waters, p. 18, Pl. 2, Fig. 16–18, Pl. 3, Fig.1
1988 *Schizoporella bisulca* (Reuss) – Braga & Barbin, p. 523, Pl. 8, Fig. 6

Remarks: The distinctive features of *Hippomonavella* CANU & BASSLER, 1934 (as described in GORDON, 1984) are the presence of marginal areolar pores, concave margin of the aperture, presence of condyles and absence of peristome and oral spines. The *Eschara bisulca* REUSS, 1869 is listed under this genus because of presence of all these distinguished features.
Eocene distribution: Romania (GHIURCA, 1987), Italy (BRAGA & BARBIN, 1988), Slovakia (Štrba) and Austria (Waschberg Zone).

Genus *Hippoporina* NEVIANI, 1895

Hippoporina cf. *globulosa* (D'ORBIGNY1851)
Pl. 16, Fig. 3

1966 *Hippoporina globulosa* (D'ORBIGNY) – CHEETHAM, p. 80, Text-figs. 58, 59

Diagnosis: The colony is erect, with 5 longitudinal rows of pentagonal to rhomboidal zooecia. The frontal wall is strongly porous. The aperture has remarkable condyles. The oral avicularia is arranged in pairs and has developed pivotal bar. The ovicell is large, globular, with perforated frontal wall.
Remarks: The zooecia are very similar, almost identical, with those described by CHEETHAM (1966). He described only encrusting colonies with prominent globular ovicell. I have found only two specimens, with an insufficient preservation of the important features (the ovicell is not observed in the studied material). Therefore, the species attribution remains uncertain.
Eocene distribution: United Kingdom (Sussex, CHEETHAM 1966)

Superfamily Schizoporelloidea JULLIEN, 1883

Family Teuchoporidae NEVIANI, 1895
Genus *Lagenicella* CHEETHAM & SANDBERG, 1964

Lagenicella helmbergensis n. sp.
Pl. 15, Fig. 1–3

Diagnosis: Colonies encrusting. Zooecia oval to rhombic with strongly porous frontal and nonporous prominent peristome. Avicularia not observed. Ovicell with porous frontal wall, deeply immersed to the distal zooecium and into the peristome.
Holotype: The specimen number 1707, deposited in the Institute of Palaeontology of Vienna University (Austria), depicted in Pl. 15, Fig. 1–2, from a depth of 3190 m.
Paratypes: 2 specimens numbers 1708 and 1709, deposited in the Institute of Palaeontology of Vienna University (Austria), from a depth of 3190 m.
Derivatio nominis: After the name of locality Helmberg-1.
Locus typicus: borehole Helmberg-1, depth 3190 m.
Stratum typicum: Eocene – Priabonian.
Dimensions: (in micro meters = μm; x = average, details see Tab. 4 and Fig. 3)
length of colony: 1814–2032, x = 1945
width of colony: 1313–1560, x = 1466
length of zooecia: 413–642, x = 488
width of zooecia: 206–427, x = 294
length of zooecial aperture: 77–237, x = 155
width of zooecial aperture: 137–192, x = 156

length of ovicell: 68–150, x = 99
width of zooecia: 141–168, x = 154
diameter of pore on frontal wall: 19– 59, x = 35
diameter of pore on ovicell: 4–9, x = 6
thickness of wall forming peristome: 27–51, x = 40

Description: The colony is encrusting with zooecia in almost regular longitudinal rows. The zooecia are oval to rhombic, sometimes the shape of the zooecia is indistinct. The zooecial frontal wall is strongly perforated by large pores, irregular in shape and size, so the frontal wall is reduced to a threads between the pores. A long, thick, nonporous peristome is raised from the distal half of the zooecium. The peristome is heavily calcified, smooth with no avicularia. The aperture is circular without any visible condyles or lyrula. The avicularia are not observed. The ovicell is peristomial, deeply immersed into the distal zooecium. Only a narrow semilunar part of the ovicell frontal wall is exposed. It is rounded by smooth, slightly prominent calcified rim and perforated by small pores.

Comparison: The most similar species is *Lagenicella neosocialis* Dick & Ross, 1988 as described by Soule, at. al. (1995). This species has however small avicularia placed very near to the lateral margins of the aperture and its ovicell is prominent with nonporous ectoecium. *Lagenicella lacunosa* (Bassler, 1934) as described by Gordon, 1984 is also similar to the described species, in having immersed ovicell and in lacking avicularia. Nevertheless, the ovicell of *Lagenicella lacunosa* (Bassler, 1934) has nonporous frontal wall and the peristome is much shorter than the peristome of *Lagenicella helmbergensis* n. sp.

Remarks: Gordon (pers. com., 2000) suggested the genus *Teuchopora* Neviani, 1895 for this species. The type species *Teuchopora castrocarensis* (Manzoni, 1875) as described by Neviani, 1895 is similar to *Lagenicella helmbergensis* n. sp. in having long nonporous peristome. The original description however does not include the description of ovicells, which are very important. Poluzzi (1977) redescribed the type material and found peristomial ovicells with perforated frontal wall. However, *Teuchopora* has only uniserial or biserial colonies, very prominent ovicells with small apertures and perforated hood. The apertures can be very long (as visible in the paratype 2 depicted in the Tab. 4), but this could be perhaps explained by the preservation. Other features in the paratype 2 are the same as in the holotype.

Occurrence: The borehole Helmberg-1, depth 3190 m and Austria (Waschberg Zone).

Family Schizoporellidae Jullien, 1883

Genus *Schizoporella* Hincks, 1877 (=*Multiporina* d'Orbigny, 1852)

*Schizoporella tetragona (*Reuss, 1848)

Pl. 21., Fig. 1

v. * 1848 *Cellepora tetragona* m. – Reuss, p. 78, Pl. 9, Fig. 19
1974 *Schizoporella tetragona* (Reuss) – David & Pouyet, p. 156, Pl. 15, Fig. 1
v. 1989 *Schizoporella tetragona* (Reuss) – Schmid, p. 43, Pl. 12, Fig. 8

Diagnosis: The colony is encrusting. The zooecia are hexagonal to oval with strongly porous, slightly convex frontal wall. The pores, which perforate the frontal wall, are sometimes rhombic. The aperture is oval with slightly visible sinus. The avicularium is small and has no pivot. Usually only one suboral avicularium is arranged near to the aperture. The ovicell is unknown.

Remarks: The syntypes stored in Natural History Museum in Vienna are identical with the described material in shallow sinus, small avicularium without pivotal bar and in not developing ovicells. It differs in having rarely developed small umbo on the frontal wall and the pores, perforated the frontal wall, are much larger than those in the studied specimens. These features could, however, be regarded only as within species variability.
Eocene distribution: The species is known only from the Miocene of Nussdorf (Austria, SCHMID, 1989), however, the important features were distinguished also in specimens found in the Helmberg-1. A similar specimen was found also in Slovakia (Štrba).

Genus *Schizolepralia* ZÁGORŠEK, 2001

Schizolepralia scrobiculata (REUSS, 1848)
Pl. 15, Fig. 4

v. * 1848 *Cellaria scrobiculata* m. – REUSS, p. 63, Pl. 8, Fig. 4
1991 *Schizoporella scrobiculata* (REUSS) – BRAGA Tab. 1
v. 1994 *Schizoporella*? cf. *scrobiculata* (REUSS) – ZÁGORŠEK, p. 372, Fig. 7a, b
v. 2001 *Schizolepralia scrobiculata* (REUSS) – ZÁGORŠEK, p. 62, Pl. 24, Fig. 1–5

Remarks: BRAGA (1991) listed the species under *Schizoporella*. However, oral avicularia are not present and the zooecia are much longer as is typical for *Schizoporella*. BRAGA did not describe any ovicells. The syntypes as well as studied material from the Helmberg-1 have, however, nonporous ovicells. Therefore, this species is listed under *Schizolepralia* ZÁGORŠEK.
Eocene distribution: Italy (BRAGA & BARBIN, 1988), Romania (GHIURCA, 1987), Slovakia (ZÁGORŠEK, 1994) and Hungary (Buda marl).

Family Stomachetosellidae CANU & BASSLER, 1917
Genus *Metradolium* CANU & BASSLER, 1917

Metradolium obliquum CANU & BASSLER, 1920
Pl. 16, Fig. 2, 4.

1920 *Metradolium obliquum* n. sp. – CANU & BASSLER, p. 446, Pl. 57, Fig. 4–10

Diagnosis: The colony is erect with flat to circular transverse section. The zooecia are indistinct, oval with short, convex frontal wall perforated by few large pores. The zooecia are arranged in 6 to 8 regular zooecial rows around the colony stem. The aperture is circular, large and deeply immersed into the frontal wall. A very narrow semilunar, unsymmetrical spiramen is situated just below (proximally) the aperture. It is typically slightly shifted laterally, not in the median position. The avicularium is suboral, large as about half of the aperture sometimes even larger, circular and tapering usually laterally. It is situated on the prominent umbo, which is slightly shifted laterally. The ovicell is globular, deeply immersed and opened by the narrow lunar oeciopore.
Remarks: CANU & BASSLER (1920) referred two avicularia from his specimens. The specimens from Helmberg-1 have only one large avicularium, like those found in Austria (Waschberg Zone). Other features of the studied specimens are identical with the type material.
Eocene distribution: North America (CANU & BASSLER, 1920) and Austria (Waschberg Zone).

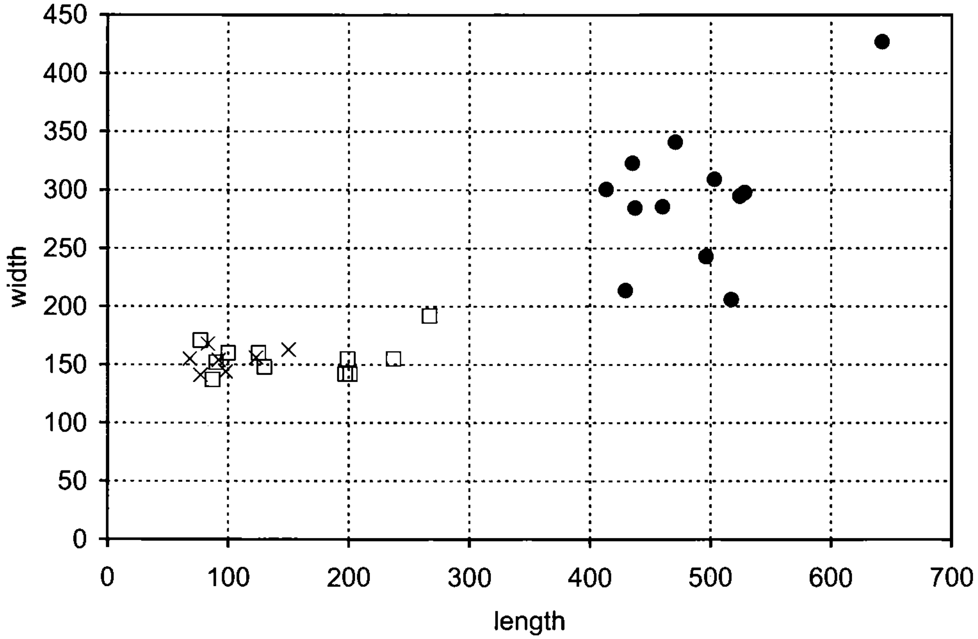

Fig. 3: Chart showing length and width of the zooecia, ovicells and apertures in *Lagenicella helmbergensis* n. sp. For symbols see Fig. 1.

	len-zoa	wid-zoa	len-zooe	wid-zooe	len-aper	wid-aper	len-ovic	wid-ovic	dia pore	diapo-reovicl	thickn. of peristome
holotype	1814	1313	429	214	77	171	98	144	36	5	
			642	427	90	152	123	156	19	6	
			517	206			92	154	32	4	
paratype 1	1988	1560	413	301	125	160	83	168	20	6	48
			435	323	87	137	68	155	26	9	39
			496	243	100	160	77	141	53	5	27
			460	286					42	5	
paratype 2	2032	1526	524	295	130	148	150	163	32	6	49
			437	285	199	155			43	7	51
			528	298	201	142			42	7	27
			471	341	197	142			45	5	
			503	309	237	155			24		
					267	192			33		
average	1945	1466	488	294	155	156	99	154	34	6	40

Tab. 4: Dimensions of *Lagenicella helmbergensis* n. sp. All sizes in µm. Abbreviations: dia-pore = diameter of frontal pores; dia-pore-ovic = diameter of pores in ovicell. For other abbreviations see Tab. 2.

Family Porinidae D'ORBIGNY, 1852
Genus *Porina* D'ORBIGNY, 1852

Porina coronata (REUSS, 1848)

v. * 1848 *Cellaria coronata* m. – REUSS, p. 62, Pl. 8, Fig. 3
1980 *Porina coronata* (REUSS) – BRAGA, p. 51, Fig. 45–48
v. 1988 *Porina coronata* (REUSS) – BRAGA & BARBIN, p. 521, Pl. 7, Fig. 4 (cum. syn)

Eocene distribution: Poland (MAŁECKI, 1963), Slovakia (ZÁGORŠEK, 1994), Rumania (GHIURCA, 1987), Italy (BRAGA & BARBIN, 1988), Hungary (Buda marl) and Austria (Waschberg Zone).

Porina peristomica ZÁGORŠEK, 2001
Pl. 16, Fig. 1

v.* 2001 *Porina peristomica* sp. n. – ZÁGORŠEK, p. 64, Pl. 25, Fig. 6–8

Diagnosis: The colony is erect, articulated and columnar. The zooecia are arranged in quadriserial longitudinal rows, alternating back-to-back. The found fragment is composed of 2–3 zooecia in each row. The zooecia are indistinct and have elongated oval shape with porous, convex frontal walls. The aperture is circular to oval obscured by a wide peristome, often very long. The proximal margin of the peristome is elevated from the frontal wall. On the peristome, there are 3 to 5 large suboral avicularia and several smaller avicularia. The ascopore is circular, usually as small as the regular pores on frontal wall, rarely little larger and situated midfrontaly, near to the base of the peristome. The ovicell was not observed.
Comparison: *Porina duplicata* (REUSS, 1869) is very similar in similarly arranged suboral avicularia and ascopore. It differs, however, in having zooecia arranged in several rows and in lacking peristomes.
Remark: Due to the growth form, this species looks like *Margaretta*, which has never suboral avicularia. The presence of suboral avicularia on the peristome is the most distinctive feature of the genus *Porina*. Although no ovicells were found, the other features allow designation to *Porina*.
Eocene distribution: Hungary (Buda marl).

Genus *Cyphonella* KOSCHINSKY, 1885

Cyphonella nodosa KOSCHINSKY, 1885
Pl. 17, Fig. 2

1885 *Cyphonella nodosa* n. sp. – KOSCHINSKY, p. 60, Pl. 6, Fig. 1

Diagnosis: The colony is erect and bilamellar. The zooecia are oval with strongly porous frontal wall and umbo, near to the aperture. There are neither avicularia, nor pores in the top of the umbo. The aperture is oval with peristome slightly protruded in front. The avicularia and the ovicell are not known.
Eocene distribution: Germany (KOSCHINSKY, 1885) and Hungary (Buda marl).

Family Hippopodinidae LEVINSEN, 1909
Genus *Hippomenella* CANU & BASSLER, 1917

Hippomenella bragai ZÁGORŠEK, 1994

v. * 1994 *Hippomenella bragai* n. sp. – ZÁGORŠEK, p. 373, Fig. 8 a, b, c, Fig. 9a, b

Diagnosis: The colony is erect, columnar and has 6 to 8 longitudinal rows of the zooecia around the whole stem. The zooecia are oval with slightly convex frontal wall, which is marginally perforated by areolar pores (about 20 pores on the each zooecium). The aperture is large, with straight proximal edge and with 3 to 4 oral spines. The avicularia with pivot are paired and laterally adjacent to the aperture. The hyperstomial ovicell is spheroidal, bordered by 12 to 15 areolar pores with two circular windows in ectoecium. The ectoecium is smooth and nonporous; the strongly porous endoecium is visible through the windows.
Remarks: Although no ovicelled zooecia were found in Helmberg-1, the characteristic features for this species (large apertures with adjacent pair of avicularia) have been observed.
Eocene distribution: Slovakia (ZÁGORŠEK, 1994) and Austria (Waschberg Zone).

Family Margarettidae HARMER, 1957
Genus *Margaretta* GRAY, 1843

Margaretta cereoides (ELLIS-SOLANDER, 1786)

1848 *Cellaria Michelini* m. – REUSS, p. 61, Pl. 8, Fig. 1, 2
v. 1874 *Cellaria cereoides* (SOL. et ELLIS) – REUSS, p. 146, Pl. 11, Fig. 11–15, Pl. 12, Fig. 12.
1974 *Margaretta cereoides* (ELLIS-SOLANDER) – DAVID & POUYET, p. 196, Pl. 10, Fig. 7
1975 *Margaretta ceroides* (ELLIS-SOLANDER) – BRAGA, p. 147, Pl. 2, Fig. 15, 16.
v. 1977 *Margaretta cereoides* (ELLIS-SOLANDER) – VÁVRA, p. 143 (cum. syn)
v. 1988 *Margaretta ceroides* (ELLIS-SOLANDER) – BRAGA & BARBIN, p. 525, Pl. 10, Fig. 5

Remarks: DAVID & POUYET, 1974 pointed out, that *Cellaria Michelini* REUSS, 1848 is a junior synonym of this species.
Eocene distribution: Italy (BRAGA & BARBIN, 1988), Poland (MAŁECKI, 1963 as *Tubucellaria parviporosa*), Romania (GHIURCA, 1987), Slovakia (Štrba), Hungary (Buda marl) and Austria (Waschberg Zone).

Family Gigantoporidae BASSLER, 1935
Genus *Gigantopora* RIDLEY, 1881

Gigantopora duplicata (REUSS, 1848)
Pl. 17, Fig. 1

v. * 1848 *Cellaria duplicata* m. – REUSS, p. 62, Pl. 7, Fig. 34
v. 1869b *Eschara duplicata* (REUSS) – REUSS, p. 273, Pl. 33, Fig. 8–10
1891 *Porina duplicata* (REUSS) – WATERS, p. 25, Pl. 3, Fig. 14
1963 *Gigantopora duplicata* (REUSS) – BRAGA, p. 31, Pl. 4, Fig. 1
v. 1988 *Gigantopora duplicata* (REUSS) – BRAGA & BARBIN, p. 522, Pl. 7, Fig. 8

Eocene distribution: Italy (BRAGA & BARBIN, 1988), Poland (MAŁECKI, 1963 as *Porina coronata*), Romania (GHIURCA, 1987), Slovakia (Štrba), Hungary (Buda marl) and Austria (Waschberg Zone). In the Austria (Waschberg Zone) and Slovakia only uncertain specimens have been found.

Gigantopora lyratostoma (REUSS, 1866)

v. * 1866 *Lepralia lyratostoma* m. – REUSS, p. 172, Pl. 11, Fig. 9
1980 *Hippoporina lyratostoma* (REUSS) – BRAGA, p. 50, Fig. 50

Remarks: This species is listed under the *Gigantopora* because of the presence of perforation in the peristome.
Eocene distribution: Italy (BRAGA, 1980), Romania (GHIURCA, 1987), Slovakia (Štrba), Hungary (Buda marl) and Austria (Waschberg Zone).

Family Cheiloporinidae BASSLER, 1936
Genus *Cheilopora* LEVINSEN, 1909

Cheilopora orbifera CANU & BASSLER, 1920
Pl. 17, Fig. 3

1920 *Cheilopora orbifera* sp. n. – CANU & BASSLER, p. 526, Pl. 14, Fig. 16

Diagnosis: The colony is encrusting or unilamellar. The zooecia are rhombic to square in shape. The frontal wall is strongly porous with about 30 large pores. A small rim is situated around the each pore. The aperture is oval to circular with small peristome and without sinus. The oral spines are missing. The avicularium is small and situated in the corner of the frontal wall. Sometimes there are two or three avicularia on the one zooecium. The avicularia have developed pivotal bar. The ovicell is not observed.
Remarks: The genus *Cheilopora* should have an endozooecial ovicell (BASSLER, 1953), which has not been found in the studied specimens. Although this species was originally described from the Eocene (Claibornian) of Alabama (USA), it has very similar morphological features as the Helmberg-1 specimens. Due to the description and illustrations of this species by CANU & BASSLER (1920) I assume it as conspecific with the studied specimens. The umbonuloid genus *Arachnopusia* JULLIEN, 1888 also exhibits similar features in the frontal wall perforated by numerous large pores, and adventitious avicularia on the frontal wall. However, it has recumbent ovicells and oral spines or/and a single long spine running from one side of the aperture (GORDON, 1984). These features are not present in *Cheilopora orbifera* CANU & BASSLER, 1920.
Eocene distribution: North America (CANU & BASSLER, 1920) and Hungary (Buda marl).

Family Lacernidae JULLIEN, 1888
Genus *Arthropoma* LEVINSEN,1909

Arthropoma rugulosa (REUSS, 1874)
Pl. 17, Fig. 4

v. * 1874 *Lepralia rugulosa* m. – REUSS, p. 169, Pl. 3, Fig. 2
1974 *Hippoporina rugulosa* (REUSS) – DAVID & POUYET, p. 142, Pl. 6, Fig. 6
1977 *Hippoporina rugulosa* (REUSS) – VÁVRA, p. 1977
v. 1989 *Hippoporina rugulosa* (REUSS) – SCHMID, p. 53, Pl. 11, Fig. 1

Remarks: Due to the presence of U-shaped sinus, regularly perforated frontal shield, rare avicularia and imperforate, smooth ovicells and the absence of oral spines, this species belong to *Arthropoma*.
Eocene distribution: Austria (Waschberg Zone).

Family Tetraplariidae HARMER, 1957
Genus *Tychinella* ZÁGORŠEK, 2001

Tychinella schreibersi (REUSS, 1848)

v. * 1848 *Cellaria Schreibersi* m. – REUSS, p. 63, Pl. 8, Fig. 8

v. 1869b *Cellaria Schreibersi* Reuss – Reuss, p. 262, Pl. 24, Fig. 5–6
1963 *Tetraplaria schreibersi* (Reuss) – Braga, p. 39
v. 1977 *Tetraplaria schreibersi* (Reuss) – Vávra, p. 151
v. 1988 *Hippopleurifera (?) schreibersi* (Reuss) – Braga & Barbin, p. 522
v. 2001 *Tychinella schreibseri* (Reuss) – Zágoršek, p. 63, Pl. 18, Fig. 3, 4

Diagnose: The colony is quadriserial, erect, rod-like, and narrow and dichotomously branching. The zooecia are arranged in pairs, which are attached with their dorsal walls and turned around the colony axis of 90°. The zooecia are elongated, with porous, convex frontal wall and nonporous proximal edge. The aperture is oval with one pair of small oral avicularia. The avicularium has the pivot. The ovicell is unknown.
Eocene distribution: Rumania (Ghiurca, 1987), Italy (Braga & Barbin, 1988), Slovakia (Štrba), Hungary (Buda marl) and Austria (Waschberg Zone).

Superfamily Siphonicytaroidea Harmer, 1957

Family Siphonicytaridae Harmer, 1957

Genus *Tubucella* Canu & Bassler, 1917

Tubucella papillosa (Reuss, 1848)

v. * 1848 *Eschara papillosa* m. – Reuss, p. 68, Pl. 8, Fig. 22
1920 *Tubucella papillosa* (Reuss) – Canu & Bassler, p. 547
v. 1977 *Tubucella papillosa* (Reuss) – Vávra, p. 144
1980 *Tubucella papillosa* (Reuss) – Braga, p. 55, Fig. 59–60
v. 1988 *Tubucella papillosa* (Reuss) – Braga & Barbin, p. 525, Pl. 9, Fig. 5

Eocene distribution: North America (Canu & Bassler, 1920), Egypt (Ziko, 1985), Poland (Małecki, 1963), Slovakia (Zágoršek, 1994), Rumania (Ghiurca, 1987), Italy (Braga & Barbin, 1988), Hungary (Buda marl) and Austria (Waschberg Zone).

Tubucella mammillaris (Milne Edwards, 1836)

1920 *Tubucella gibbosa* sp. n. – Canu & Bassler, p. 548, Pl. 71, Fig. 1–9
1966 *Tubucella mamillaris* (Milne Edwards) – Cheetham, p. 85, Fig. 62–64
1985 *Tubucella mammillaris* (Milne Edwards) – Ziko, p. 78, Pl. 17, Fig. 4, Pl. 19, Fig. 5–8

Remarks: *Tubucella gibbosa* Canu & Bassler, 1920 exhibits all the features of *Tubucella mammillaris* (Milne Edwards, 1836) as described by Cheetham (1966). Therefore I assume that it is the same species.
Eocene distribution: North America (Canu & Bassler, 1920), Egypt (Ziko, 1985), Slovakia (Štrba), United Kingdom (Sussex, Cheetham 1966), Hungary (Buda marl) and Austria (Waschberg Zone).

Superfamily Mamilloporoidea Canu & Bassler, 1927

Family Ascosiidae Jullien, 1883

Genus *Fedora* Jullien, 1882

Fedora bidentata (Reuss, 1869)

Pl. 21., Fig. 5.

v. * 1869b *Cupularia bidentata* m. – Reuss, p. 277, Pl. 29, Fig. 1–2
1980 *Fedora bidentata* (Reuss) – Braga, p. 62, Fig. 70–71
v. 1988 *Fedora bidentata* (Reuss) – Braga & Barbin, p. 528, Pl. 9, Fig. 2

Eocene distribution: Romania (GHIURCA, 1987), Italy (BRAGA & BARBIN, 1988), Slovakia (Štrba) and Hungary (Buda marl).

Genus *Kionidella* KOSCHINSKY, 1885

Kionidella excelsa KOSCHINSKY, 1885
Pl. 19, Fig. 4

1885 *Kionidella excelsa* n. sp. – KOSCHINSKY, p. 68, Pl. 7, Fig. 5–12
1891 *Fedora excelsa* (KOSCHINSKY) – WATERS, p. 29, Pl. 4, Fig. 6
1920 *Fedora excelsa* (KOSCHINSKY) – CANU & BASSLER, p. 623, Fig. 187 d – l
1975 *Kionidella excelsa* KOSCHINSKY – BRAGA, p. 147, Pl. 3, Fig. 6–7
v. 1988 *Kionidella excelsa* KOSCHINSKY – BRAGA & BARBIN, p. 528, Pl. 10, Fig. 4

Eocene distribution: Germany (KOSCHINSKY, 1885), North America (CANU & BASSLER, 1920), Italy (BRAGA & BARBIN, 1988), Slovakia (Štrba), Hungary (Buda marl) and Austria (Waschberg Zone).

Kionidella moravicensis PROCHÁZKA, 1894
Pl. 18, Fig. 1, 2

1894 *Kionidella moravicensis* n. sp. – PROCHÁZKA, p. 54, Pl. 12, Fig. 8a-d.
1894 *Kionidella moravica* n. sp. – PROCHÁZKA, p. 68, Pl. 12, Fig. 8a-d.

Diagnosis: The colony is free and conical. The zooecia are hexagonal to oval with terminal aperture bearing remarkable condyles. Each zooecium has one avicularium. The avicularia have pivotal bar and are oval to elliptic, rarely elongated with long palate. The ovicell is hyperstomial, small, immersed and has strongly porous frontal wall.
Remarks: PROCHÁZKA (1894, p.54) described *Kionidella moravicensis* as a new species in Czech language. In the German translation (page 68) is the same species named *Kionidella moravica* however. Because the Czech description is the first, I use here the name of first description – *K. moravicensis* n. sp.
The specimens described by PROCHÁZKA (1894) have only oval avicularia, never elongated with long palate. The avicularia with long palate were often found in ovicelled zooecia. I have, however, found a colony, which has zooecia with both types of avicularia: small oval types and forms with the long palate. Although *K. moravicensis* is known only from the Miocene, I assume that the described specimens belong to this species.
K. moravicensis differs from *Kionidella excelsa* KOSCHINSKY, 1885 in having always only one avicularium per zooecium instead of two. The ovicell has not yet been found in *K. moravicensis.*
Eocene distribution: Not known from Eocene, in the Miocene found in south Moravia (Czech Republic, PROCHÁZKA, 1894).

Genus *Stenosipora* CANU & BASSLER, 1927

Stenosipora simplex (KOSCHINSKY, 1885)

1885 *Stichoporina simplex* n. sp. – KOSCHINSKY, p. 64, Pl. 6, Fig. 4–7
1891 *Stichoporina simplex* KOSCHINSKY – WATERS, p. 31, Pl. 4, Fig. 16–18
1974 *Stenosipora simplex* (KOSCHINSKY) – DAVID & POUYET, p. 216
v. 1977 *Stenosipora simplex* (KOSCHINSKY) – VÁVRA, p. 160
v. 1988 *Stenosipora simplex* (KOSCHINSKY) – BRAGA & BARBIN, p. 529, Pl. 11, Fig. 3

Diagnosis: The zooecia have one large lateral avicularium. The avicularium has pivot bar and sharp palate. Rarely, the adventitious avicularium is presented.
Eocene distribution: Italy (BRAGA & BARBIN, 1988), Poland (MAŁECKI, 1963 as *Trochopora* cf. *bouei*), Slovakia (Štrba), Hungary (Buda marl) and Austria (Waschberg Zone).

Stenosipora protecta (KOSCHINSKY, 1885)

1885 *Stichoporina protecta* n. sp. – KOSCHINSKY, p. 65, Pl. 6, Fig. 8–11

Diagnosis: The zooecia have two large lateral avicularia. The avicularia have pivot bar and oval palate.
Eocene distribution: Germany (KOSCHINSKY, 1885) and Italy (BRAGA, ZÁGORŠEK & KÁZMÉR, 1995).

Stenosipora reussi (STOLICZKA, 1862)

v. * 1862 *Stichoporina reussi* n. sp. – STOLICZKA, p. 93, Pl. 3, Fig. 6
1980 *Stenosipora reussi* (STOLICZKA) – BRAGA, p. 62

Diagnosis: The zooecia have terminal apertures bearing 2 cardelles. The avicularia are usually not developed.
Eocene distribution: Germany (STOLICZKA, 1862), Italy (BRAGA, 1980) and Hungary (Buda marl).

Superfamily Lepralielloidea VIGNEAUX, 1949

Family Lepraliellidae VIGNEAUX, 1949

Genus *Celleporaria* LAMOUROUX, 1821

Celleporaria globularis (BRONN, 1837)
Pl. 20, Fig. 4

v. 1848 *Cellepora globularis* BRONN – REUSS, p. 76, Pl. 9, Fig. 11–12
1869b *Celleporaria globularis* BRONN – REUSS, p. 264
? 1973 "*Cellepora*" *globularis* (BRONN) – POUYET, p. 124, Pl. 2, Fig. 12
v. 1977 "*Cellepora*" *globularis* (BRONN) – VÁVRA, p. 158 (cum. syn.)
1980 "*Cellepora*" *globularis* (BRONN) – BRAGA, p. 59, Fig. 62
v. 1988 "*Cellepora*" *globularis* (BRONN) – BRAGA & BARBIN, p. 527, Pl. 11, Fig. 1

Remarks: This species belongs to the so-called "celleporoids", which is a group of hardly determinable Bryozoans, mostly listed as undeterminably material. I believe that this species can be listed under the *Celleporaria* due to the presence of smooth frontal walls perforated by few marginal pores, aperture with shallow pseudosinus and hyperstomial ovicells. The REUSS collection however contains several different specimens determined as *Cellepora globularis* BRONN. POUYET (1973) described specimens with very large colonies (up to 30 mm in diameter), where the shape of zooecia is hardly visible as well as colonies with about 2–3 mm in diameter and with clear zooecial shape. There are no "medium size" colonies (about 7 to 20 mm). Although I have no original material described by BRONN, I believe that only the small colonies with visible zooecial shape belong to *Celleporaria globularis* (BRONN). The large colonies represent probably a different species and/or genus.
BRAGA (pers. com, 2000) suggested to listed this species within Incertae sedis family, because of presence of small kenozooecia. GORDON (1984, pers. com, 1998) however listed this genus in Celleporidae and subsequently in Lepraliellidae. I agree with GORDON,

that the development of the frontal wall with few scattered marginal pores and aperture with shallow pseudosinus allow us to list this genus within the Lepraliellidae.
Eocene distribution: Romania (Ghiurca, 1987), Italy (Braga & Barbin, 1988), Poland (Małecki, 1963 as *Holoporella damicornis*), Slovakia (Štrba), Hungary (Buda marl) and Austria (Waschberg Zone).

Superfamily Celleporoidea Johnston, 1838

Family Celleporidae Johnston, 1838

Genus *Galeopsis* Jullien, 1903

Galeopsis cf. *subquadrangularis* (Reuss, 1869)

Pl. 19, Fig. 1

? 1869a *Eschara subquadrangularis* m. – Reuss, p. 477 Pl. 4, Fig. 7

Diagnosis: The colony is erect, bilamellar, flat and large. The zooecia are rhomboidal to oval hexagonal. The frontal wall is smooth, nonporous, convex and sometimes reduced. A pair of the large pores always occurs at the proximal end of the each zooecium. These pores could be regarded as basal kenozooecia (sense Gordon, 1984). The marginal pores are large and rarely present around some zooecia. The aperture is large with shallow sinus and straight proximal margin. The peristome is short but wide, sometimes occupying almost the whole frontal area. The spiramen is circular, with diameter usually about two times smaller than the aperture. The avicularia are small, circular without pivot very closely arranged one to each other. The oral spines are not developed. The ovicell is globular and immersed to the distal zooecium. The frontal wall of the ovicell is not known, not preserved.
Remarks: The species determination remains uncertain, as the syntypes have not been found within the Reuss material stored in Natural History Museum in Vienna. However the illustration made by Reuss (1869b) shows all features visible in studied material. Although no frontal wall of the ovicells was observed, the other features (according to Gordon, pers. comm. 1999) allow to list this species among *Galeopsis*.
Eocene distribution: Austria (Waschberg Zone).

Family Phidoloporidae Gabb & Horn, 1862

Genus *Stephanollona* Duvergier, 1920

Stephanollona otophora (Reuss, 1848)

Pl. 19, Fig. 2

v. 1848 *Cellepora otophora* m. – Reuss, p. 90, Pl. 11, Fig. 1
v. 1864 *Lepralia otophora* m. – Reuss, p. 638, Pl. 15, Fig. 1
v. 1874 *Lepralia otophora* Reuss – Reuss, p. 164, Pl. 8, Fig. 5
1974 *Escharina otophora* (Reuss) – David & Pouyet, p. 165, Pl. 11, Fig. 9
1977 *Escharina otophora* (Reuss) – Vávra, p. 122

Remarks: The specific feature of this species is presence of two narrow slits on the proximal edge of the ovicell. The holotype stored in the Natural History Museum in Vienna has almost identical zooecia and avicularia, but unfortunately only one poorly preserved ovicell and the slits are not visible. Studied specimens differ from holotype in longer peristome. The other syntypes of Reuss have a more convex frontal wall and almost no oral spines. However all the Reuss specimens are very poorly preserved.

Therefore I suggest that all the differences are regarded as within species variations and refer all these specimens to *Stephanollona otophora* (REUSS, 1848).
According to GORDON (1994) *Stephanollona* DUVERGIER, 1920 has condyles, unequal size of aperture parts, marginal areolar pores, oral spines, and large adventitious avicularia with pivot bar. Due to the presence of these specific features this species is listed under the genus *Stephanollona*.
Eocene distribution: Hungary (Buda marl).

Genus *Iodictyum* HARMER, 1933

Iodictyum labellatum ZÁGORŠEK, 2001

Pl. 20, Fig. 3

? 1989 *Iodictyum rubeschi* (REUSS) – SCHMID, p. 54, Pl. 16, Fig. 1–5
v.* 2001 *Iodictyum labellatum* sp. n. – ZÁGORŠEK, p. 70, Pl. 32, Fig. 1–4, Pl. 33, Fig. 1–3

Diagnosis: The colony is unilamellar with 4 to 5 regular zooecial rows. The zooecia are rhomboidal with elongated distal part and ending with aperture. Very narrow, distinct lateral furrows separate them. The frontal walls are slightly convex or flat, smooth and without spiramen. The aperture is oval to circular and situated on the short peristome. Around the aperture there are oral spines developed. The ovicell is hyperstomial or recumbent and globular in shape. The frontal wall of the ovicell is formed by large, flat, smooth labellum, which is oval and runs directly from the aperture. The large and narrow avicularia are sometimes present on the frontal wall. The pivot bar is not developed.
Comparison: SCHMID (1989) describes the most similar specimens as *Iodictyum rubeschii* (REUSS, 1848). The SCHMID's material is characterized almost identical shape of zooecia, but differing in shape of the ovicell and avicularia. The ovicell described by SCHMID (1989) has no preserved frontal wall and their avicularia have pivots and are significantly wider than in the studied material.
Eocene distribution: Hungary (Buda marl).

Genus *Reteporella* BUSK, 1884

Reteporella tuberculata (REUSS, 1869)

Pl. 20, Fig. 1

v. * 1869b *Retepora tuberculata* m. – REUSS, p. 267, Pl. 31, Fig. 9, 10
1963 *Retepora tubercolata* (REUSS) – BRAGA, p. 36, Pl. 4, Fig. 5
v. 1988 *Sertella tuberculata* (REUSS) – BRAGA & BARBIN, p. 526, Pl. 9, Fig. 6

Eocene distribution: Poland (MAŁECKI, 1963 as *Sertella cellulosa* and *Retepora ramosa*), Slovakia (Štrba), Rumania (GHIURCA, 1987), Italy (BRAGA & BARBIN, 1988), Hungary (Buda marl) and Austria (Waschberg Zone).

Reteporella simplex (BUSK, 1859)

1859 *Retepora simplex* m. – BUSK, p. 76, Pl. 12, Fig. 3
1884 *Retepora simplex* n. sp. – BUSK, p. 118, Fig. 28, Pl. 28. Fig. 4
1869b *Retepora simplex* (BUSK) – REUSS, p. 54, Pl. 31, Fig. 7
1963 *Retepora simplex* (BUSK) – BRAGA, p. 36

Eocene distribution: Romania (GHIURCA, 1987), Italy (BRAGA, 1963), Hungary (Buda marl), Austria (Waschberg Zone) and one probable specimen is known also from Slovakia (Štrba).

Reteporella subovata (STOLICZKA, 1862)
Pl. 20, Fig. 2

v. * 1862 *Eschara subovata* n. sp. – STOLICZKA, p. 87, Pl. 2, Fig. 9

Remarks: This species is listed under the genus *Reteporella* due to the presence of unilamellar colonies, spiramen in frontal wall and frontal avicularia.
Described specimens are almost identical with the syntypes deposited in the Natural History Museum in Vienna. Some of the syntypes probably belong to a new species, because of porous frontal wall and larger colonies.
Eocene distribution: Hungary (Buda marl) and Austria (Waschberg Zone).

Genus *Sparsiporina* D'ORBIGNY, 1852

Sparsiporina elegans (REUSS, 1848)

1848 *Retepora elegans* m. – REUSS, p. 48, Pl. 6, Fig. 38
1891 *Retepora elegans* REUSS – WATERS, p. 30, Pl. 4, Fig. 9, 10
v. 1975 *Sparsiporina elegans* (REUSS) – BRAGA, p. 147, Pl. 2, Fig. 7
1977 *Sparsiporina elegans* (REUSS) – VÁVRA, p. 146
1980 *Sparsiporina elegans* (REUSS) – BRAGA, p. 57, Fig. 42
v. 1988 *Sparsiporina elegans* (REUSS) – BRAGA & BARBIN, p. 526, Pl. 9, Fig. 8

Eocene distribution: Italy (BRAGA & BARBIN, 1988), Slovakia (ZÁGORŠEK, 1994), Hungary (Buda marl) and Austria (Waschberg Zone).

Superfamily Biporidae GREGORY, 1893

Family Batoporoidea NEVIANI, 1900
Genus *Batopora* REUSS, 1867

Batopora multiradiata REUSS, 1869

v. * 1869b *Batopora multiradiata* m. – REUSS, p. 265, Pl. 31, Fig. 1–4
1976 *Batopora multiradiata* REUSS – COOK & LAGAAIJ, p. 350, Pl. 4, Fig. 4–6
1980 *Batopora multiradiata* (REUSS) – BRAGA, p. 65, Fig. 61
v. 1988 *Batopora multiradiata* (REUSS) – BRAGA & BARBIN, p. 530, Pl. 11, Fig. 4, Pl. 12, Fig. 1, 2
v. 1992 *Batopora* cf. *multiradiata* (REUSS) – ZÁGORŠEK, p. 378, Fig. 7c, e

Eocene distribution: Poland (MAŁECKI, 1963), Slovakia (ZÁGORŠEK, 1992), Rumania (GHIURCA, 1987), Italy (BRAGA & BARBIN, 1988), Hungary (Buda marl) and Austria (Waschberg Zone).

Family Incertae sedis
Genus *Bactridium* REUSS, 1848

Bactridium hagenowi REUSS, 1848

v. * 1848 *Bactridium hagenowi* gen. nov., m. – REUSS, p. 57, Pl. 5, Fig. 28
1869b *Bactridium hagenowi* REUSS – REUSS, p. 266, Pl. 31, Fig. 5–6
1891 *Bactridium hagenowi* REUSS – WATERS, p. 7, Pl. 1, Fig. 18–19
v. 1988 *Bactridium hagenowi* REUSS – BRAGA & BARBIN, p. 524, Pl. 8, Fig. 3

Eocene distribution: Romania (GHIURCA, 1987), Italy (BRAGA & BARBIN, 1988), Hungary (Buda marl), Austria (Waschberg Zone) and perhaps also Slovakia.

Genus *Herentia* GRAY, 1848

Herentia hyndmanni (JOHNSTON, 1847)

Pl. 19, Fig. 3, Pl. 21, Fig. 2

? 1891 *Schizoporella phymatopora* (REUSS) – WATERS, p. 28
? 1920 *Schizolavella phymatopora* (REUSS) – CANU & BASSLER, p. 358
non.1988 *Escharina (Schizolavella) phymatopora* (REUSS) – BRAGA & BARBIN, p. 523, Pl. 8, Fig. 2
v. 1989 *Herentia hyndmanni* (JOHNSTON) – SCHMID, p. 45, Pl. 13, Fig. 1, 2, 4

Diagnose: The colony is encrusting. The frontal wall is centrally nonporous, with marginal areolar pores. The aperture has sinus and oral spines. The avicularia are oval, single, vicarious and are situated on the frontal wall. The ovicell is deeply immersed, hyperstomial or recumbent and has nonporous frontal wall.

Remarks: SCHMID (1989) argued that *Herentia* GRAY, 1848 is a valid genus differing from *Escharina* MILNE EDWARDS, 1836. *Herentia* differs from *Escharina* mainly in having only one avicularium with oval palate and ovicells are deeply immersed. For detailed descriptions of differences between these two genera see SCHMID (1989).

Specimens depicted in BRAGA & BARBIN (1988) have about 14 marginal areolar pores, the aperture has a wide, short peristome, and small globular ovicells. Due to the last mentioned fact may these specimens belong to a new species of the genus *Escharina* MILNE EDWARDS, 1836.

WATERS (1891) and CANU & BASSLER (1920) did not figure their specimens. According to their descriptions however, their specimens could also perhaps belong to *Herentia hyndmanni* (JOHNSTON).

Eocene distribution: Poland (MAŁECKI, 1963 as *Hippomenella oligostigma*), Hungary (Buda marl) and Austria (Waschberg Zone). The species occurs probably also in Italy (WATERS, 1891) and North America (CANU & BASSLER, 1920).

Genus *Kylonisa* KEIJ, 1972

Kylonisa triangularis KEIJ, 1972

Pl. 14, Fig. 2

1972 *Kylonisa triangularis* n. sp. – KEIJ, p. 8, Pl. 3, Fig. 1–7

Diagnose: The colony is erect flexible and the internodes are triangular. Each internode consists of three to four zooecia. The apertures are circular and situated in the centre of the zooecial frontal wall. The frontal wall is concave and smooth, in some cases it could be ornamented by prominent ridges. The distal kenozooecia are developed.

Remarks: Only several poorly preserved specimens were found, which do not allow any detailed description. The visible features are however identical with those described by KEIJ (1972), which is a reason to believe that the found specimens are conspecific with KEIJ's ones.

Eocene distribution: France (KEIJ, 1972).

5. COMPARISONS

Bryozoans are common allochems within the Eocene sediments of the Alpine-Carpathians region. Sediments with colonies of Bryozoa in rock forming quantities are, however, rare. The first marls rich in bryozoan zooecia, were described by HOFMANN (1871) from the Priabonian of the Buda Hills, Hungary. Since this time, many comparable occurrences have been described from Alpine – Carpathian localities: Southern Alps (Italy), Liptov basin (Slovakia), Transylvanian basin (Romania) and borehole Helmberg-1 (Molasse Zone, Austria).

The best-known associations are known from the Southern Alps. The localities Brendola, Brentonico, Val di Lonte, and Pannone have been studied since 1848, (among others: REUSS, 1848, 1869b; WATERS, 1891; BRAGA, 1963, 1966; BRAGA & BARBIN, 1988). 100 species have been reported from these localities (ZÁGORŠEK & KÁZMÉR, 2000). The sediments are easily washable clays, dominated by Bryozoa fragments with rare specimens of brachiopod of *Argyrotheca*. The remains of echinoids are very rare.

Localities Hybica and Štrba (Liptov basin, Slovakia) have been systematically studied during the last few years (ZÁGORŠEK, 1992, 1994, 1997). The descriptions and documentation of all found species are, however, still in preparation. These localities yielded altogether 95 bryozoan species. Bryozoa marls from these localities are litified, and chemical methods have to be used to dissolve it. The washed residuum contains Bryozoa, fragments of molluscs, remains of echinoids and fragments of the brachiopod *Argyrotheca*.

Only poor descriptions of material from the localities Cluj-Napoca – Brebi (Transylvanian basin, Romania) without illustrations are available (PERGENS, 1887; KOCH, 1894; GHIURCA, 1987). As the descriptions are old and they use many synonyms, it is very difficult to estimated the number of species from these occurrences. The number of known species could be estimated with 91 species (ZÁGORŠEK & KÁZMÉR, 2000). The host rock is represented by easily washable clay with Bryozoa, fragments of molluscs and scarce remains of echinoids. The brachiopod *Argyrotheca* is absent.

Recently, a detailed description of bryozoans from the Buda marls (Hungary) of the localities Mátyáshegy, Úrhida and Ürom was studied by ZÁGORŠEK & KÁZMÉR (2001). We determined and described 126 Bryozoa species from these localities. Additional components are the remains of echinoids and rare shells of *Argyrotheca*.

The above described bryozoan marls usually occur in deepening-upward sequences. The succession starts with bioclastic limestones, represented by coral limestone and/or corallinacean algae and larger foraminifers up to 100 m thick, which are overlain by *Discocyclina* limestone and marls. The overlaying bryozoan marl is up to 20 m thick. The topmost part of the succession is represented by *Globigerina* marl (KÁZMÉR et al., 1993).

The bryozoan marl from borehole Helmberg-1 has an exceptional position compared to other described localities. The succession starts with sandstone to foraminiferal sandstone, intercalated with corallinacean algae detritus limestones. Their total thickness is up to 25 m. Above the sandstone facies, there are layers formed by orthophragminid limestones and marls, which are about 12 m thick. The succession continued by about 6 m thick layer of bryozoan marl, topped by algal limestone (RASSER, 2000). The Globigerina marls are missing in this succession, but they are known from the boreholes close to the studied one (RASSER, 2000).

The fauna of Helmberg-1 was compared with other occurrences using a similarity coefficient "Sk", which is the percentage of joint species from all known species. Similarity coefficient between locality A and locality B was counted as

$Sk = (100xC)/D$

where

C = number of species common both to locality A and B (joint species)

D = number of species common both to locality A or B (total number of species occurring in both localities)

The fauna of Mátyáshegy at Budapest, where the host rock is also a bryozoan marl, represents the bryozoan association most similar to that described from deep well Helmberg-1. These two localities have 158 species in total and 78 of them occur at both localities. The similarity coefficient is therefore 49,4.

Reingruberhöhe (in the Waschberg Zone, Austria) is another very similar locality to the Helmberg-1. The sediment of the Reingruberhöhe is represented by calcareous sandstone, containing fragments of algae, mollusc shells, fragments of foraminifers and bryozoans. Among 163 common species, 74 occur in both localities (the similarity coefficient is 45,4).

A complete table with number of common species, number of known species and similarity coefficients are given in Tab. 5.

I was also looking for the most similar Recent equivalent of the fauna from Helmberg-1. The number of species that survived from the Eocene to the Recent is, however, limited (only 10 Helmberg-1 species are known from Recent seas). Therefore, a comparative study on the presence of families has been performed. The most similar area is the Mediterranean Sea (Zabala & Maluquer, 1988), where 29 families identical with the Helmberg-1 material occur. Also the fauna from the British Islands (Ryland & Hayward, 1977 and Hayward & Ryland, 1979) is very similar to studied one. I have noticed 25 common families in 91 families known from both localities. The complete comparative list of recent families is given in Tab. 5.

	fossil localities					
Helmberg-1	H + S	BM	IT	Ro	WZ	
1. number of known taxa	95	126	100	91	127	
2. common together	162	168	168	156	173	
3. number of common taxa	55	80	54	57	75	
4. similarity coefficient	33.9	49.4	32.1	36.5	45.4	

	Recent localities							
	deep S.Af.	shall S.Af.	British Isl.	Medit	S Pacific	Antarktic	N.Z. N. Isl.	N.Z. S. Isl
1.	28	39	40	49	28	33	40	47
2.	77	90	91	98	78	78	86	89
3.	15	24	25	29	18	15	17	14
4.	25.5	33.3	33.3	34.5	31.3	28.8	29.3	21.9

Tab. 5: Comparisons between faunas of Helmberg-1 and other Eocene and Recent localities. 'Common together' means number of taxa common together in both localities. Abbreviations: H + S = localities Hybica and Štrba (Slovakia); BM = localities in Buda marls (Hungary); IT = localities in Italy (Braga, 1963, 1966, 1975, 1980 and Braga & Barbin, 1988); Ro = localities in Romania (Ghiurca, 1987); WZ = localities in Waschberg Zone (Austria); deep S. Af = deep south African shelf (Hayward & Cook, 1979); shall S. Af. = shallow south African shelf (Hayward & Cook, 1983); British Isl. = British islands (Hayward & Ryland, 1979 and Ryland & Hayward, 1977); Medit = Mediterranean sea (Zabala & Maluquer, 1988); S. Pacific = south Pacific (Soule & Soule & Chaney, 1995); Atlantic = Antarctic (Hayward, 1995); N.Z. N. Isl. = New Zealand, north island (Gordon, 1984, 1986); N.Z. S. Isl. = New Zealand, south island (Gordon, 1984, 1986).

Similarity indices suggest that the associations in nearby localities are more similar than in far-away ones, even in cases where the sediments of the more distant locality are more similar. Therefore, the fauna of Helmberg-1 seems more similar to the Waschberg Zone (Austria) than to Italy or Romania, although these localities revealed more similar sedimentary facies.

The same rule might be applicable for comparisons with Recent occurrences. The most similar localities are the geographically nearest ones, although the environmental conditions are very different (Mediterranean with temperate water and British Island with cool to cold water). This rule is probably caused by a dominance of Cheilostomatida with common ovicells during the Late Eocene of the studied areas. As ovicells store the larvae during the ontogenetic development, their number increases the survival probability of larvae. On the other hand, the larvae were not able to swim (or float) over long distances, which perhaps limits the radiation of Cheilostomatida. This interpretation can be proofed by comparison with the Cyclostomatida, which build gonozooecia (ovicells) very randomly. Therefore they have a more cosmopolitan distribution than cheilostomatous Bryozoa. BRAGA (1987) argued that although the dispersal of deep-water bryozoan faunas is unlimited (i.e. not disturbed by any geographic barrier), their lecitotrophic larvae were not able to survive long-distance planktonic transport.

The localities Helmberg-1 and Waschberg Zone, for example, have 75 common species, from which 21 belong to Cyclostomatida. However, from 173 species occurring together in both localities, only 35 are cyclostomatous. The ratio of Cyclostomatida is larger in common species, which proofs their more cosmopolitan distribution.

Faunas hosted by bryozoan marls represent deep or cool water environments (ZÁGORŠEK, 1993, 1996b). Because the fauna of Helmberg-1 is highly similar to other localities with bryozoan marls, the environmental conditions were perhaps very similar. The appearance of deep-water faunas in successions of continental shelves has been explained by upwelling of cold water in a time of global climate deterioration (ZÁGORŠEK, 1996b) and/or by filling of the ecological niches of decimated larger foraminifer faunas on the same shelves (KÁZMÉR, 1999). RASSER (1999) argued that the succession of sediments in Helmberg-1 can be interpreted by an ongoing relative rise of sea level, reflecting the ongoing subsidence of the Alpine Foreland Basin.

6. CONCLUSION

Altogether 121 species of Bryozoa were determined from sediments of borehole Helmberg-1. Among them, 87 species are cheilostomatous and 34 belong to the order Cyclostomatida. Three new species and one genus were established and described in detail.

72 species were determined in the samples from depths of 3190 m and 3194 m, where the richest association was found. The varying frequency of bryozoan species can, however, be affected by different kinds of preservation as well as cleaning and dissolving of samples.

The main difference between the succession of Helmberg-1 and other occurrences is the algal limestone overlaying the bryozoan marl. Since bryozoan marls represent deep-water and/or cool water environments (ZÁGORŠEK, 1996b), the occurrence of algal limestone over the bryozoan marl can be caused by sea level change or by environmental changes.

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Plate 1

Fig. 1: *Stomatopora* cf. *divaricata* (Reuss, 1848), scale bar 100 µm

Fig. 2: *Stomatopora* sp., scale bar 100 µm

Fig. 3: *Diastopora flabellum* Reuss, 1848, scale bar 100 µm

Fig. 4: *Tubulipora dimidiata* (Reuss, 1848), scale bar 1 mm

Fig. 5: *Disporella grignonensis* Milne Edwards, 1838, scale bar 100 µm

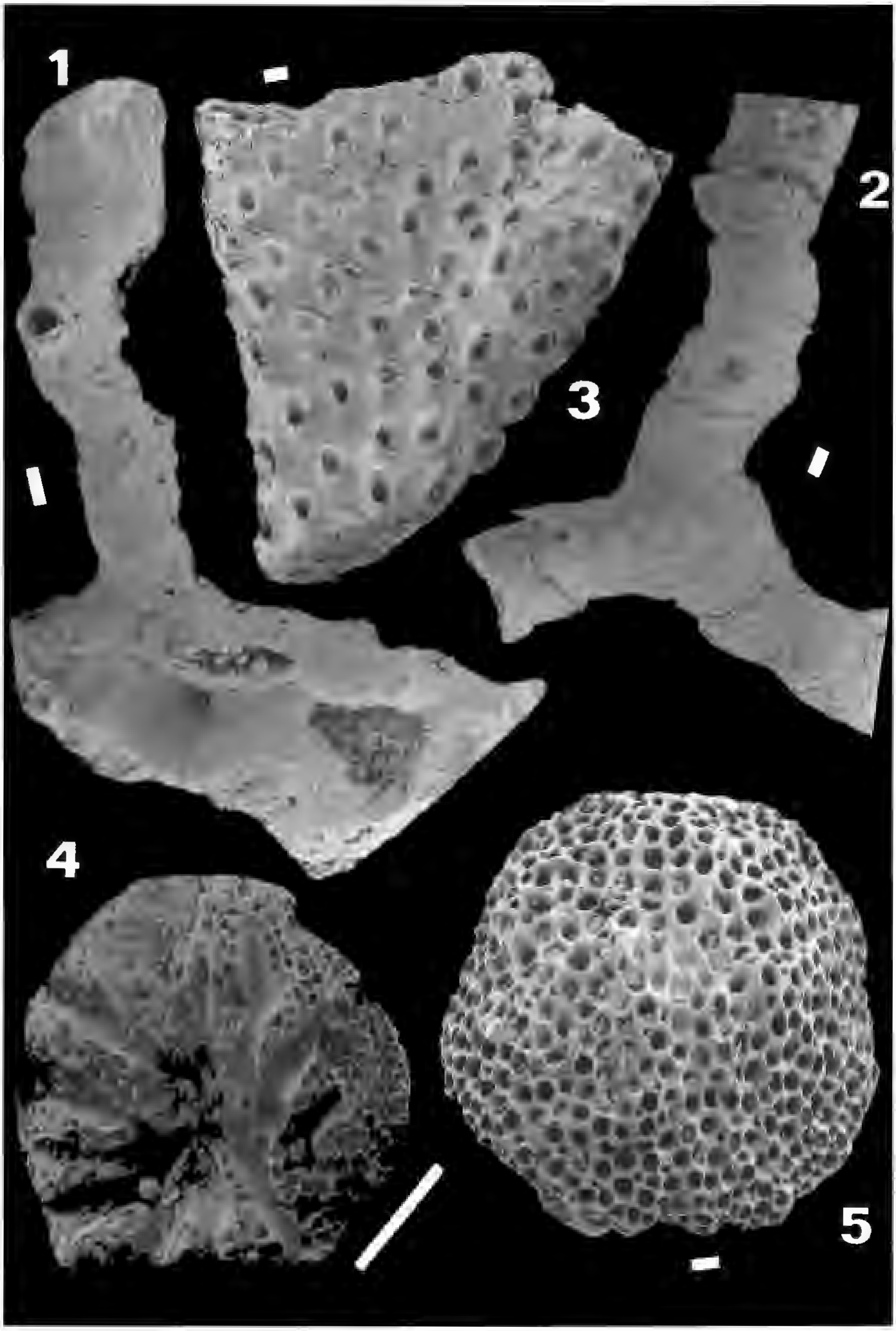
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Plate 2

Fig. 1: *Tubulipora simplex* ROEMER, 1863, lateral view, scale bar 1 mm

Fig. 2: *Tubulipora simplex* ROEMER, 1863, frontal view, scale bar 100 µm

Fig. 3: *Oncousoecia biloba* (REUSS, 1848), frontal view of gonozooecium, scale bar 100 µm

Fig. 4: *Exidmonea giebeli* (STOLICZKA, 1862), scale bar 100 µm

Fig. 5: *Bobiesipora fasciculata* (REUSS, 1848), dorsal view with typical pores, scale bar 100 µm

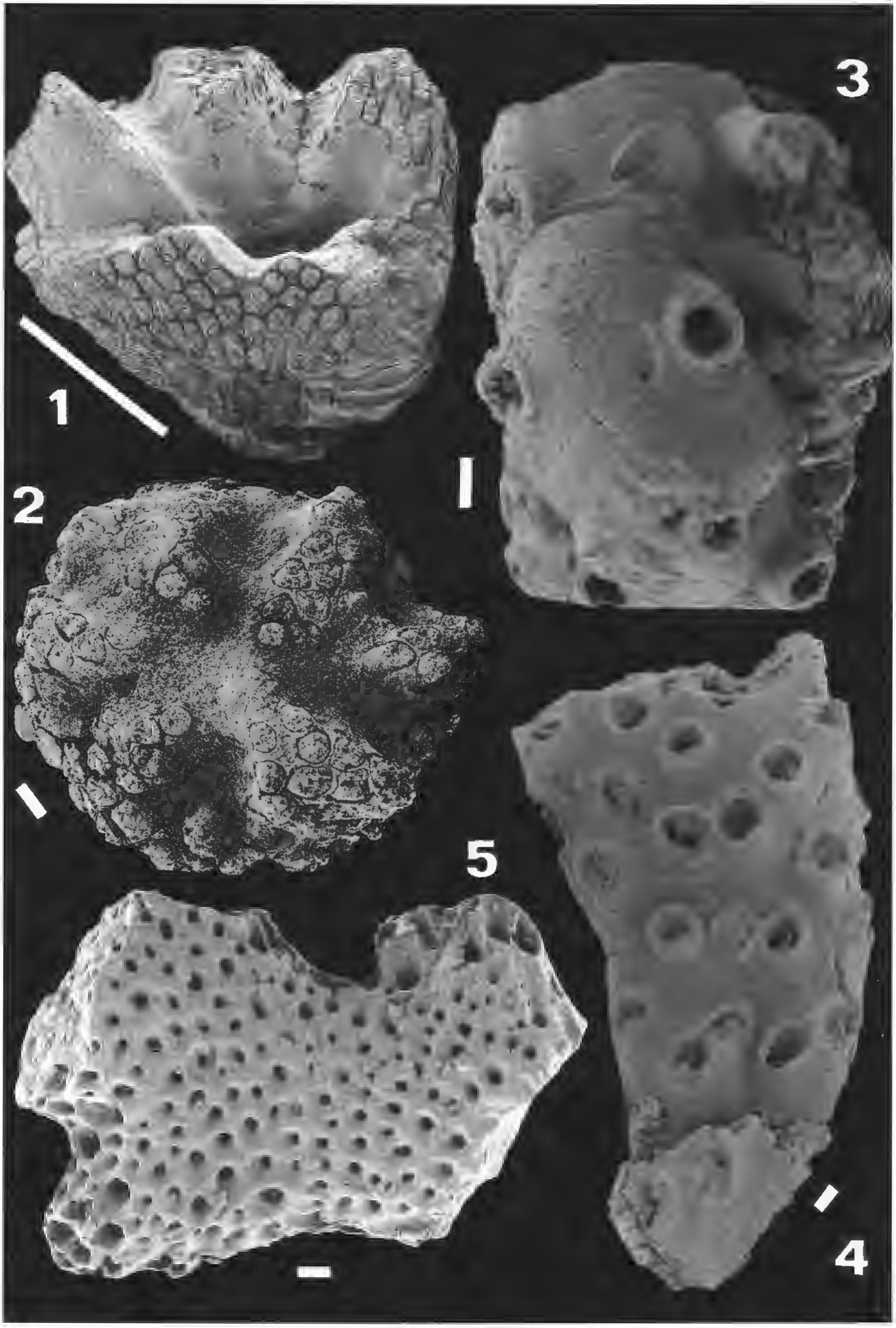
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Plate 3

All scale bars 100 µm

Fig. 1: *Mecynoecia pulchella* (Reuss, 1848)

Fig. 2: *Exidmonea hoernesi* (Stoliczka, 1862)

Fig. 3: *Nematifera susannae* Zágoršek, 1992

Fig. 4: *Tervia serrata* (Reuss, 1869)

Fig. 5: *Plagioecia rotula* (Reuss, 1848)

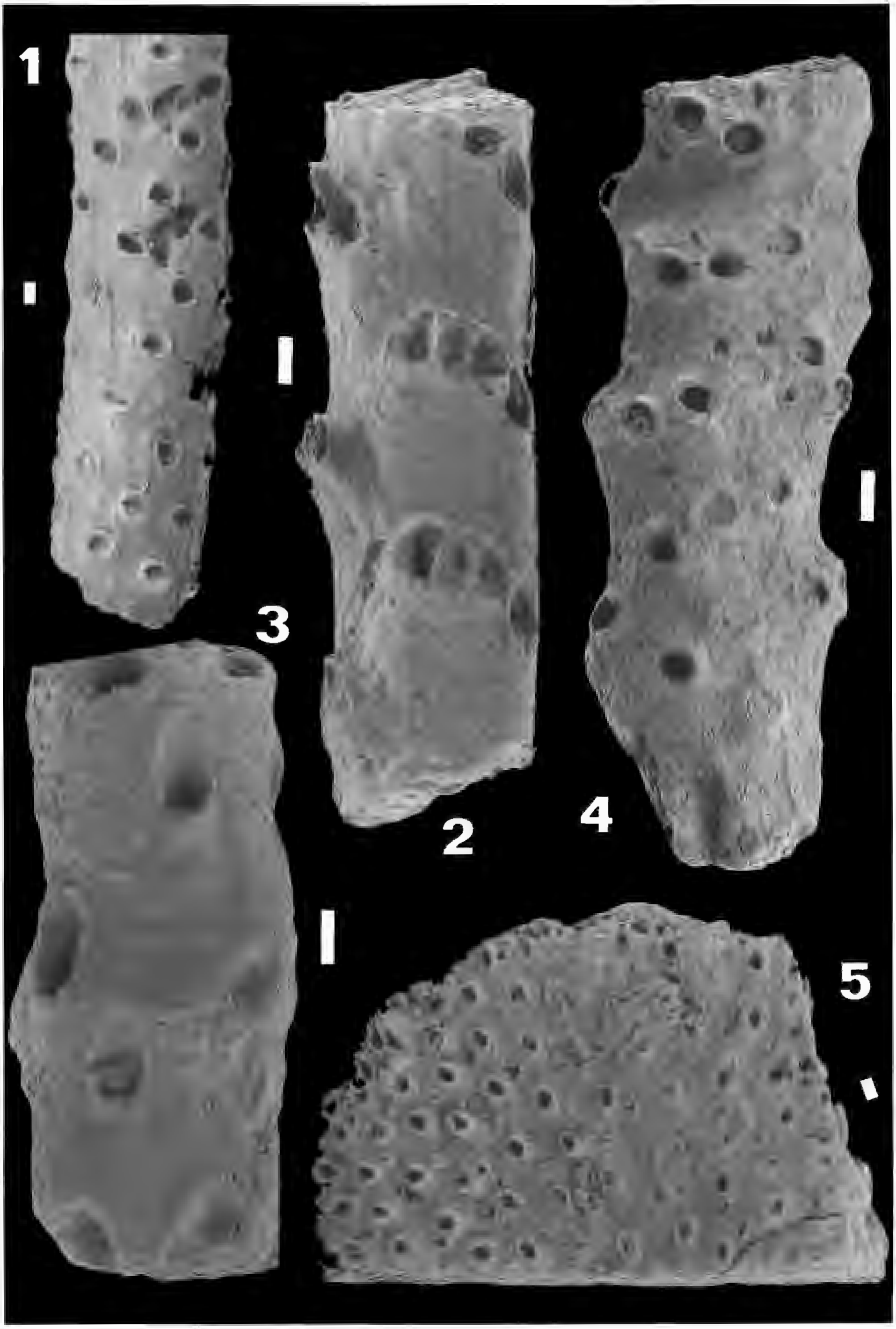
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Plate 4

All scale bars 100 µm

Fig. 1: *Hornera concatenata* Reuss, 1869

Fig. 2: *Hornera frondiculata* Forbes in Johnson

Fig. 3: *Diplosolen planum* Canu & Bassler, 1920, note additional tubes below the aperture.

Fig. 4: *Diplosolen brendolensis* (Waters, 1892), note additional tubes below the aperture.

Fig. 5: *Heteropora subreticulata* Reuss, 1869

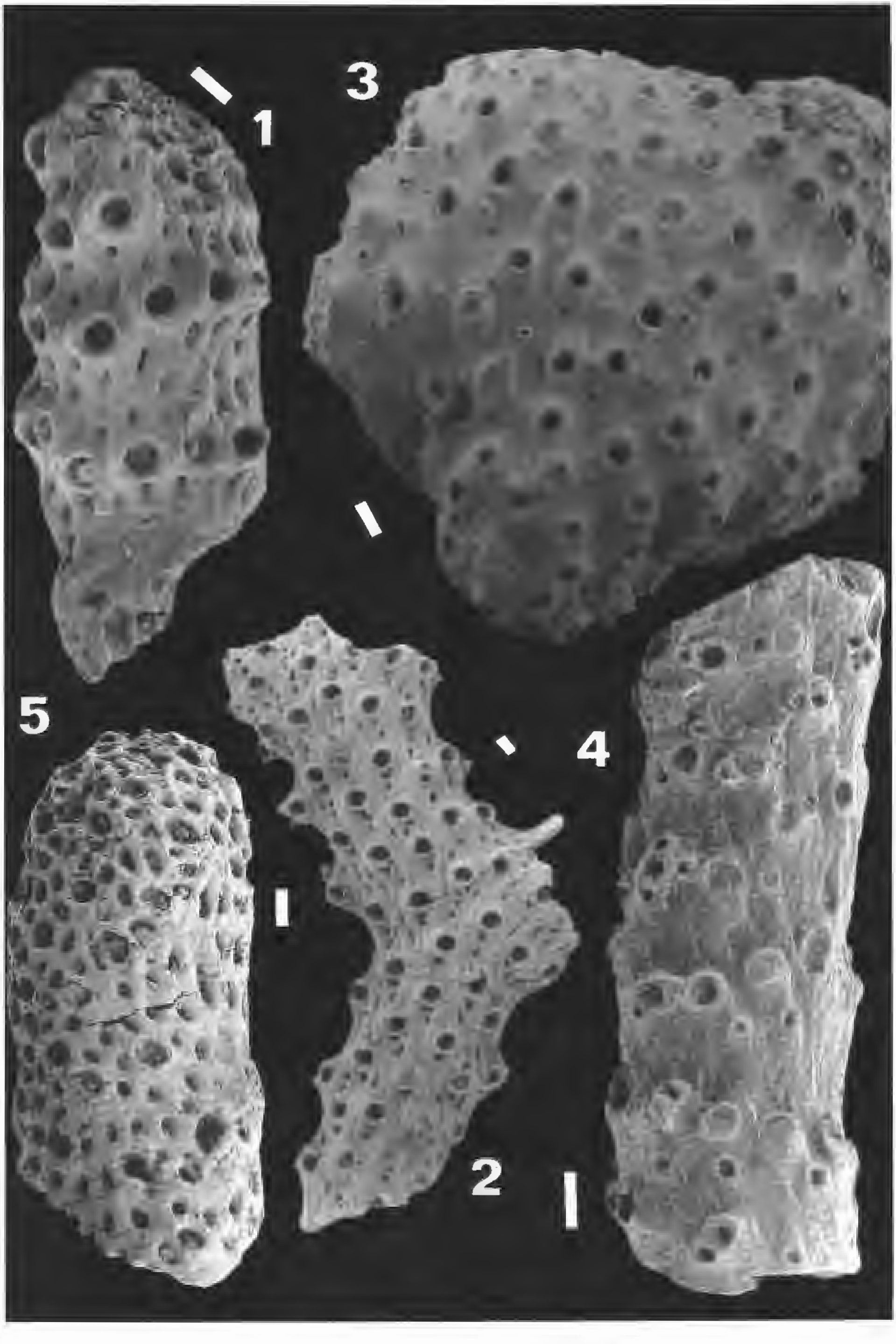
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Plate 5

All scale bars 100 µm

Fig. 1: *Ogivalina dimorpha* (CANU, 1907) with two types of zooecia.

Fig. 2: *Amphiblestrum appendiculatum* (REUSS, 1848)

Fig. 3: *Steginoporella cucullata* (REUSS, 1848)

Fig. 4: *Steginoporella* aff. *montenati* DAVID, MONGEREAU & POUYET, 1972

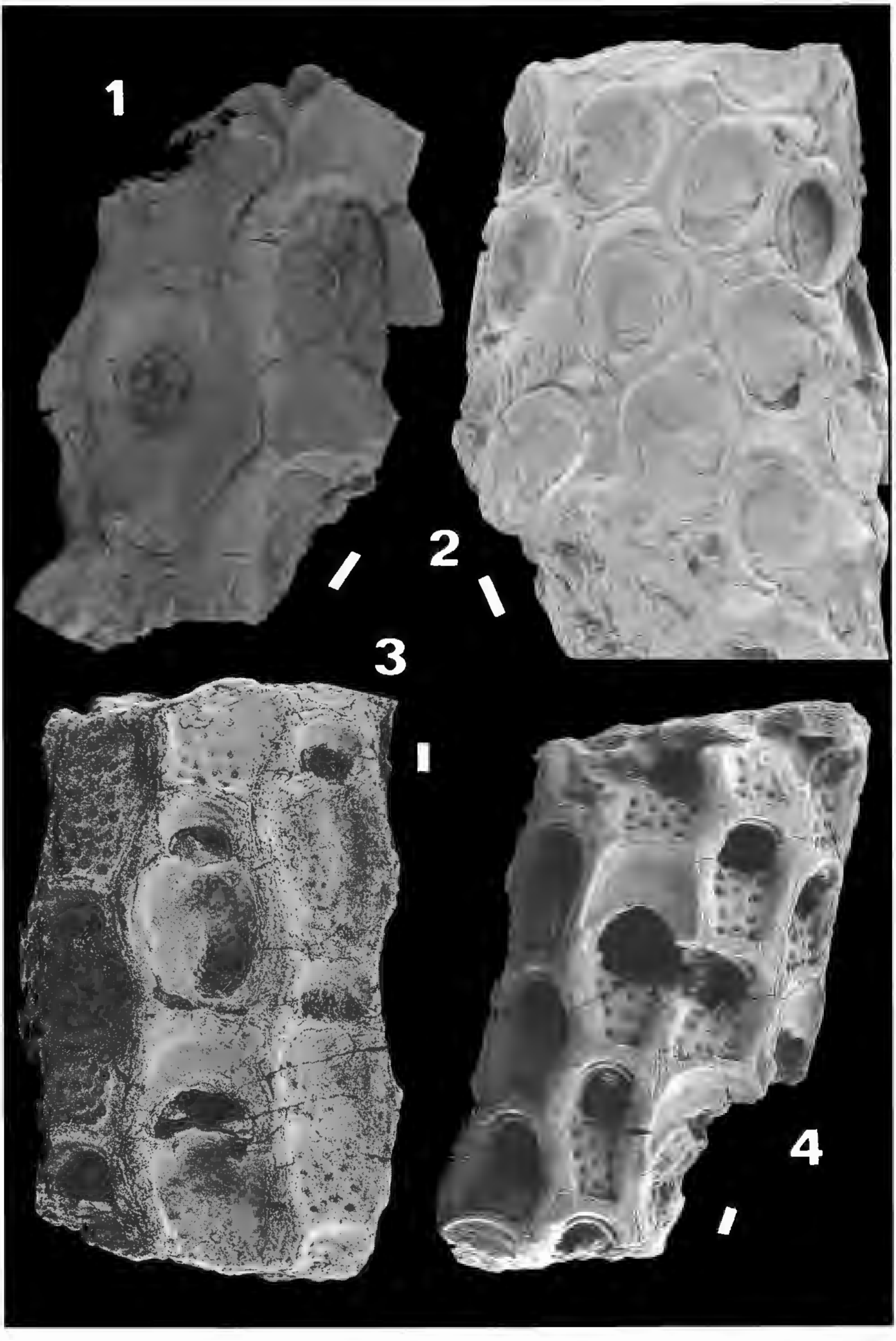
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Plate 6

Fig. 1: *Calpensia polysticha* (REUSS, 1848), scale bar 1 mm

Fig. 2: *Aviculiera* cf. *hungarii* ZÁGORŠEK, 2001

Fig. 3: *Cellaria reussi* D'ORBIGNY, 1851, scale bar 100 µm

Fig. 4: *Micropora urhidensis* ZÁGORŠEK with ovicell; note the opesiules also along the lateral walls, scale bar 100 µm

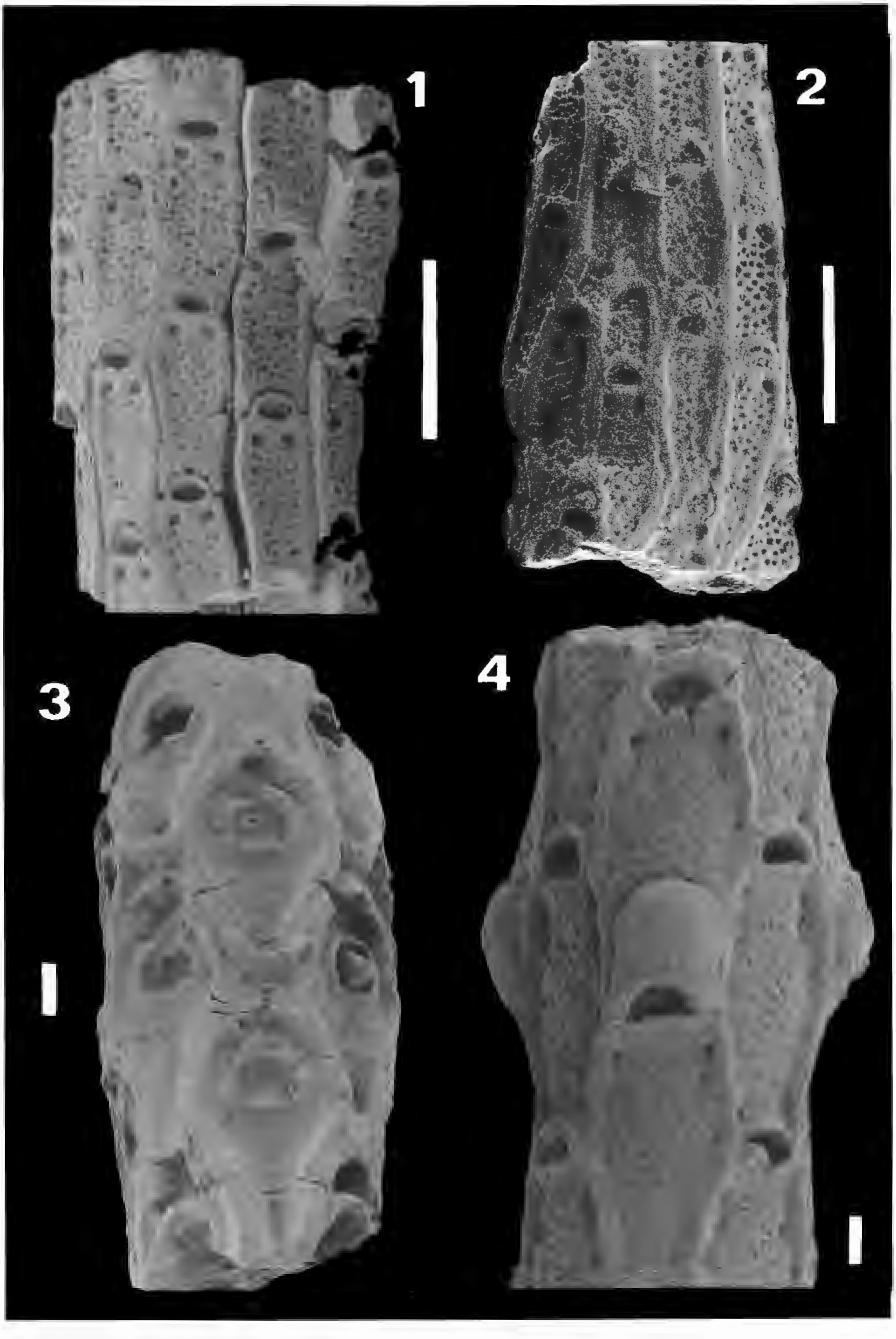
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Plate 7

All scale bars 100 μm

Fig. 1: *Gordoniella diporica* Zágoršek, 2001

Fig. 2: *Unifissurinella boulangeri* Poignant, 1991, joint specimen

Fig. 3: *Vicariopora chelys* (Koschinsky, 1885), note two different types of avicularia (the third type is not visible here)

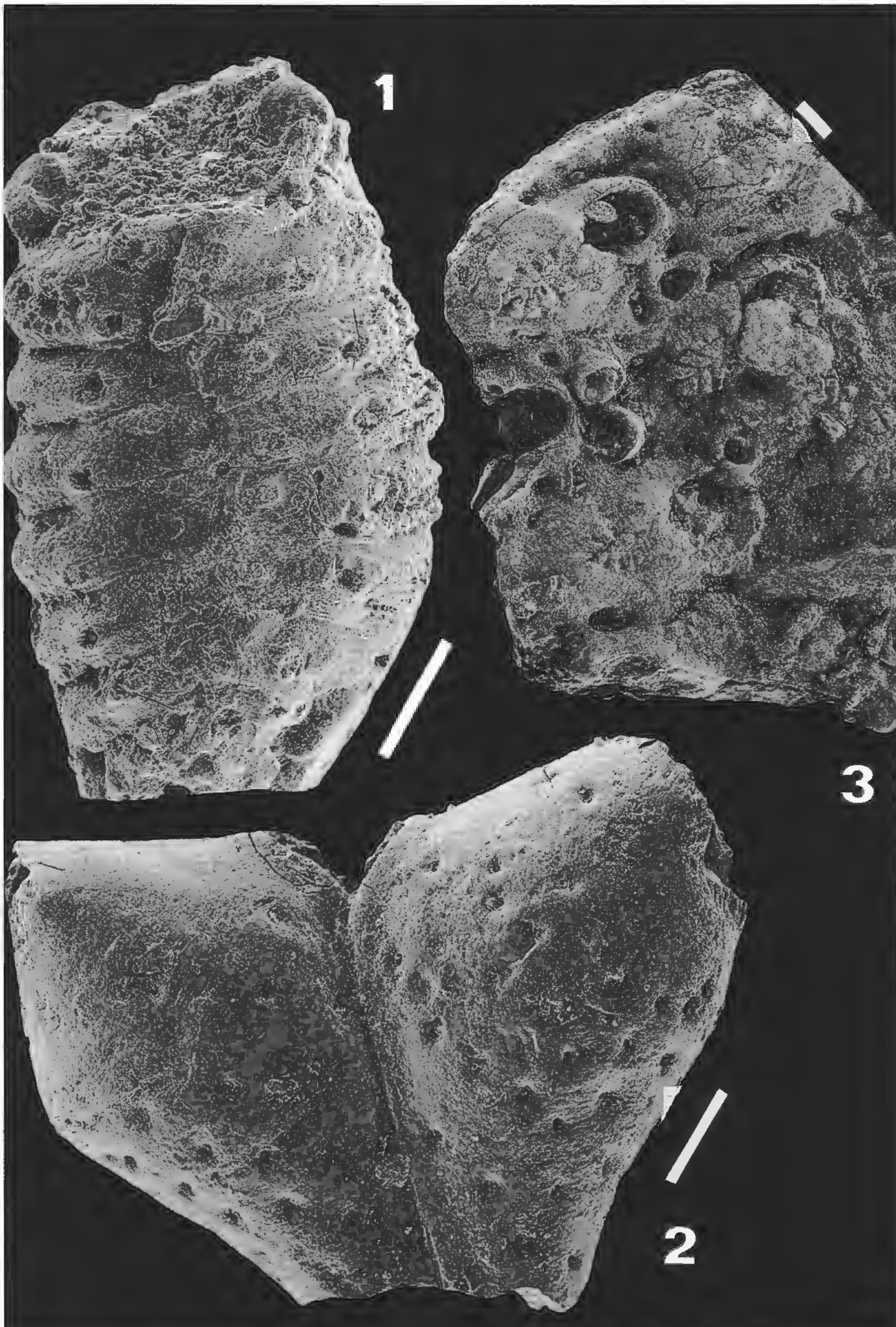
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Plate 8

All scale bars 100 μm

Fig. 1: *Ditaxipora* cf. *internodia* (WATERS, 1881)

Fig. 2: *Adeonella ornatissima* (STOLICZKA, 1862) with visible longer, marginal zooecia

Fig. 3: *Ditaxipora pannonensis* BRAGA, 1980

Fig. 4: *Adeonella minor* (REUSS, 1869)

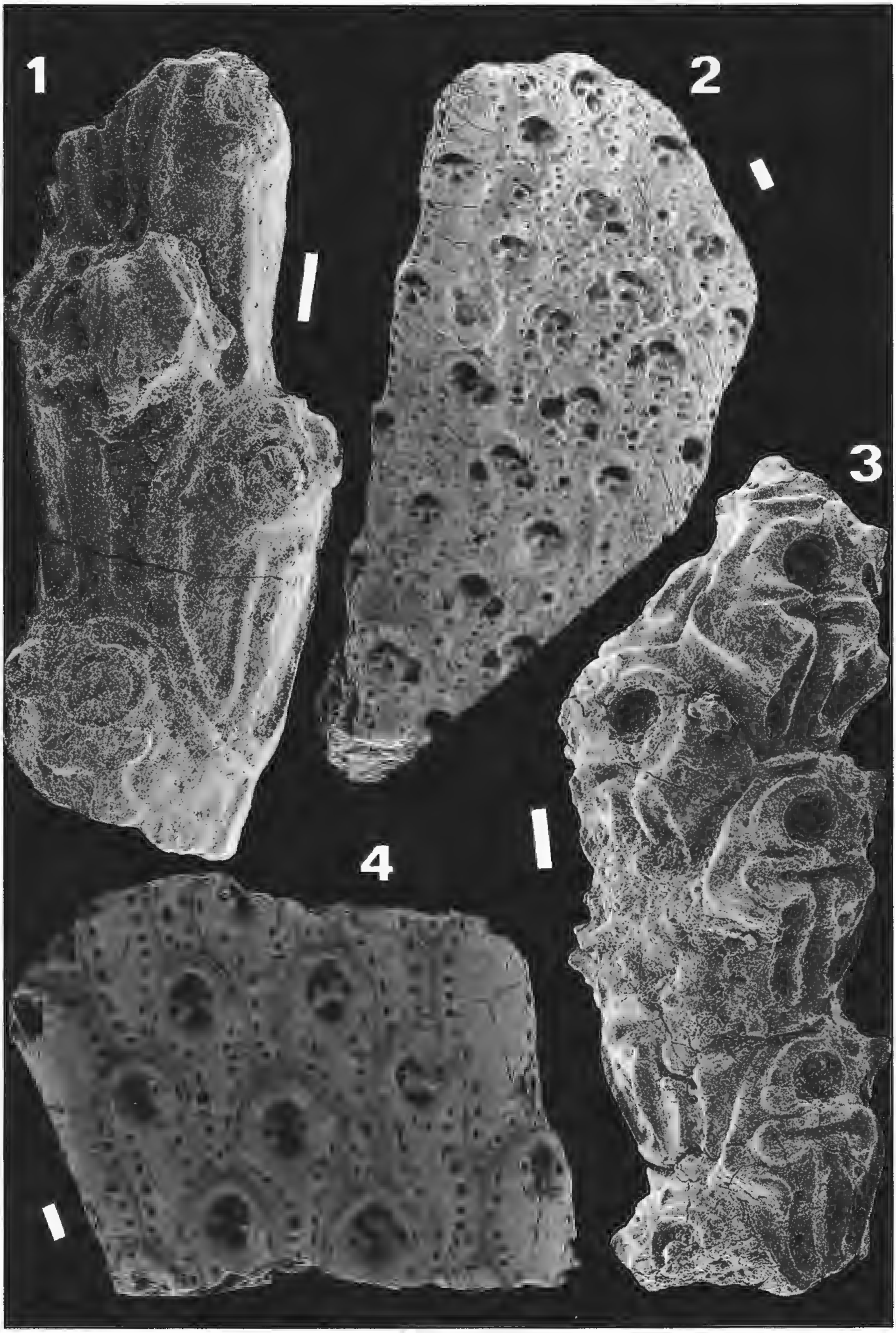
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Plate 9

All scale bars 100 μm

Fig. 1: *Adeonellopsis* aff. *coscinophora* (Reuss, 1848), note very small spiramen, often smaller than aperture.

Fig. 2: *Adeonellopsis porina* (Roemer, 1863)

Fig. 3: *Meniscopora syringopora* (Reuss, 1848)

Fig. 4: *Porella clavula* (Canu & Bassler, 1920)

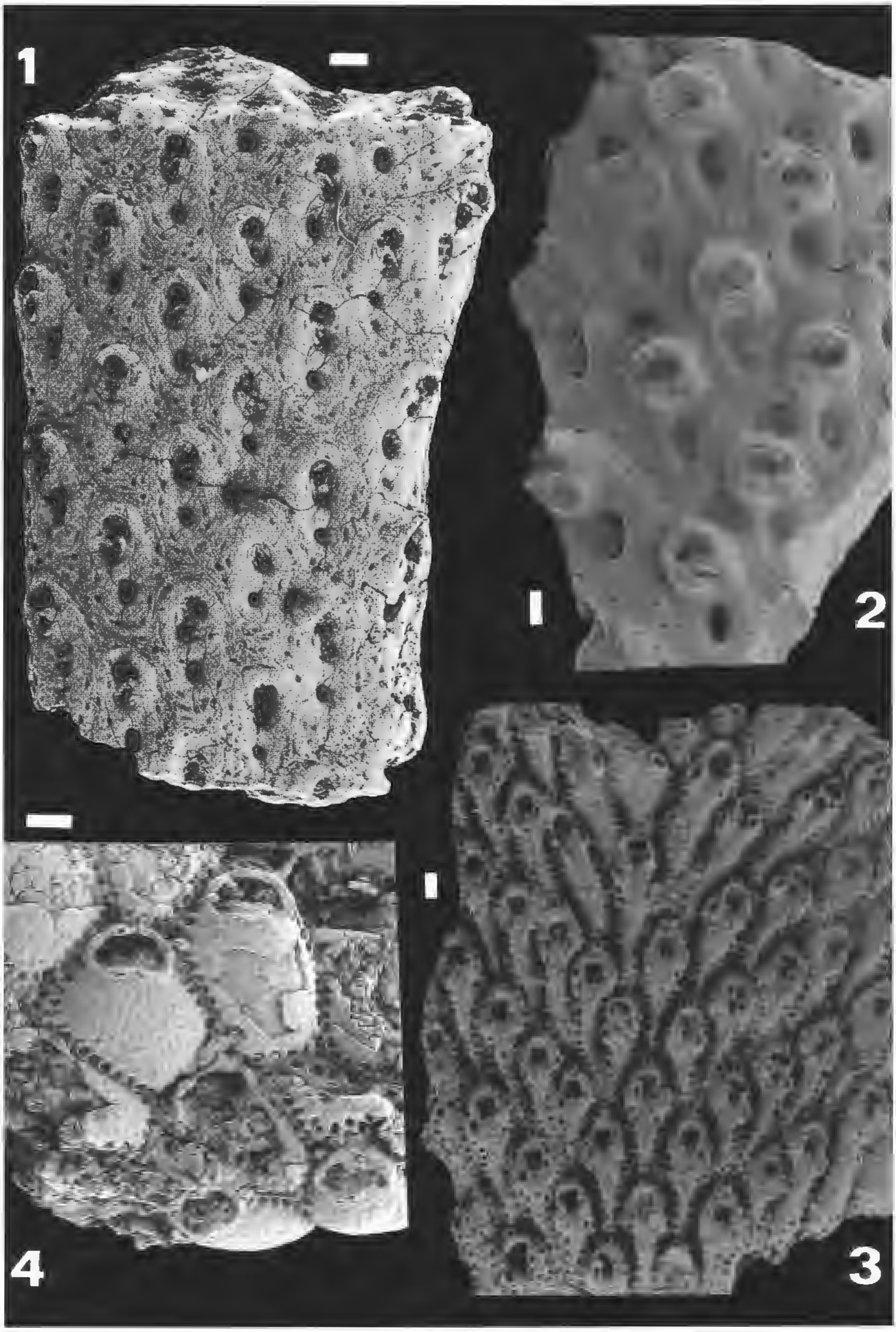
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Plate 10

All scale bars 100 µm

Fig. 1: *Reussia* cf. *regularis* (Reuss, 1866), columnar colony

Fig. 2: *Reussia* cf. *regularis* (Reuss, 1866) with large adventitious avicularium.

Fig. 3: *Escharoides coccinea* (Abildgaard, 1806)

Fig. 4: *Exochella*? *labiosa* (Reuss, 1869)

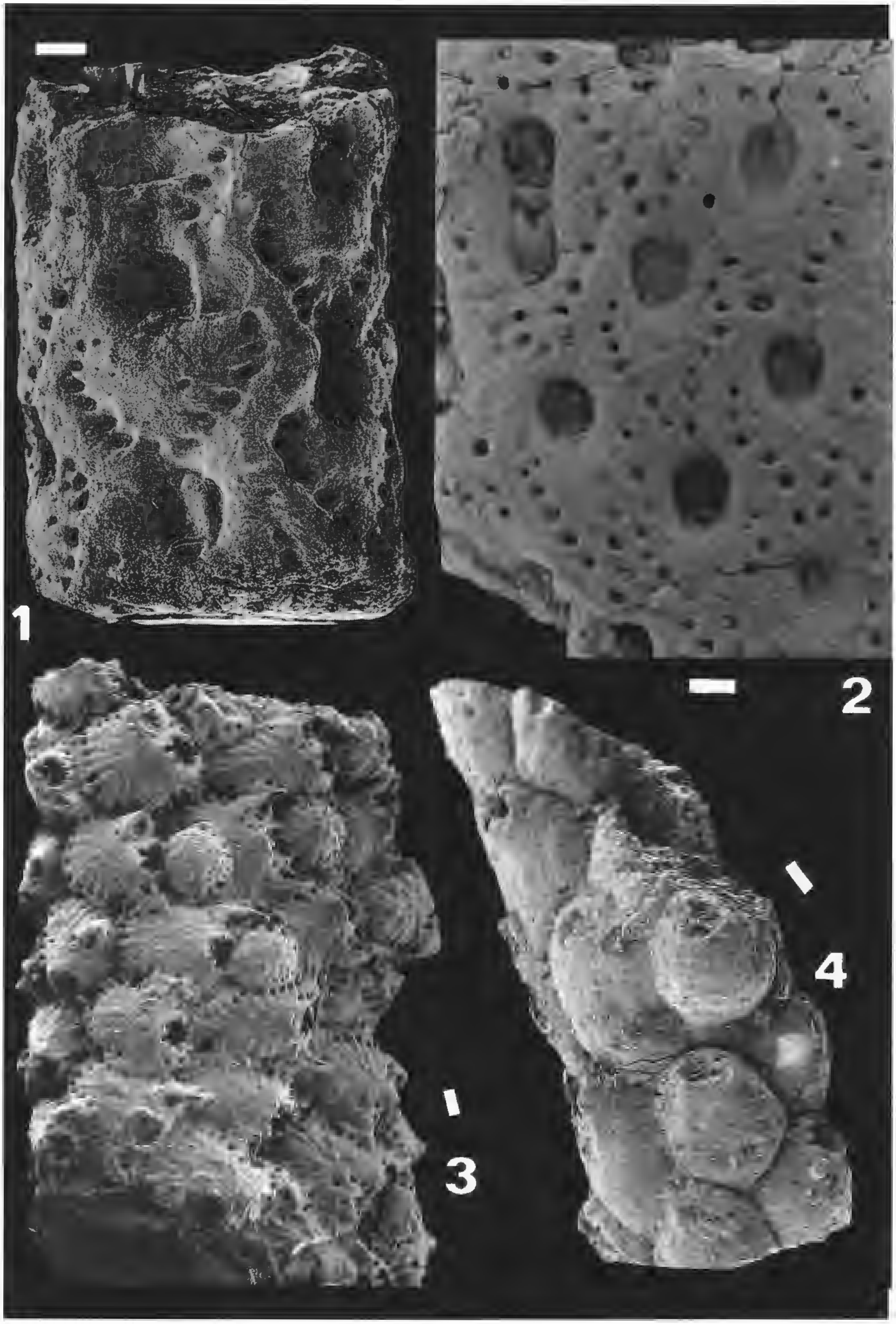
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Plate 11

Fig. 1: *Cheilonella prominens* (Reuss, 1869), scale bar 1 mm

Fig. 2: *Cheilonella prominens* (Reuss, 1869), detail of Fig. 1, scale bar 100 µm

Fig. 3: *Opaeomorpha michaeliki* Zágoršek, 2001, scale bar 100 µm

Fig. 4: *Metrarabdotos maleckii* Cheetham, 1968, a part of colony without avicularia, scale bar 100 µm

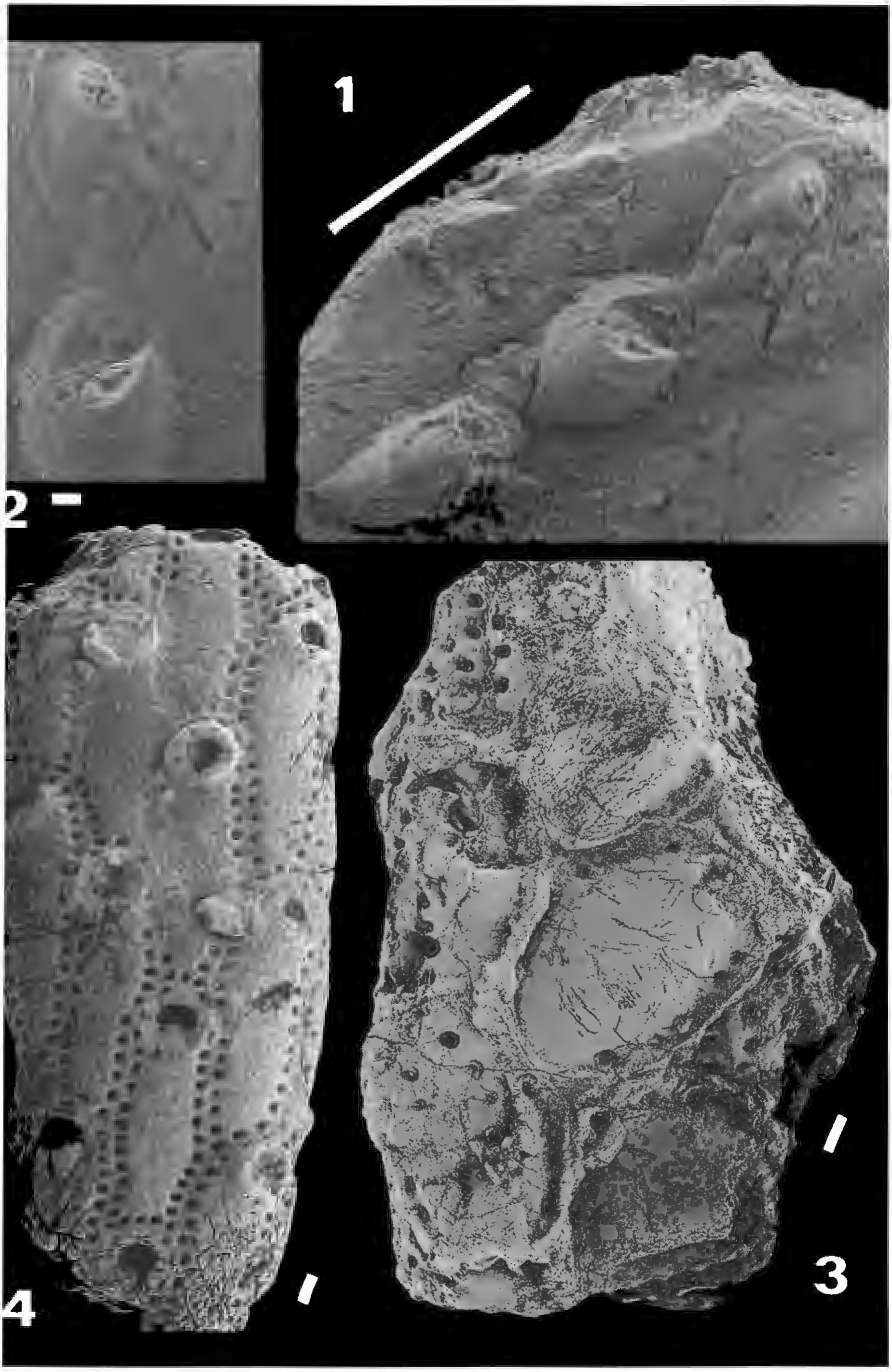
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Plate 12

Fig. 1: *Prenantia phymatopora* (Reuss, 1869), scale bar 1 mm

Fig. 2: *Parasmittina saccoi* (Canu, 1903), scale bar 100 µm

Fig. 3: *Hippomonavella bisulca* (Reuss, 1869), scale bar 100 µm

Fig. 4: *Smittoidea excentrica* (Reuss, 1864), scale bar 100 µm

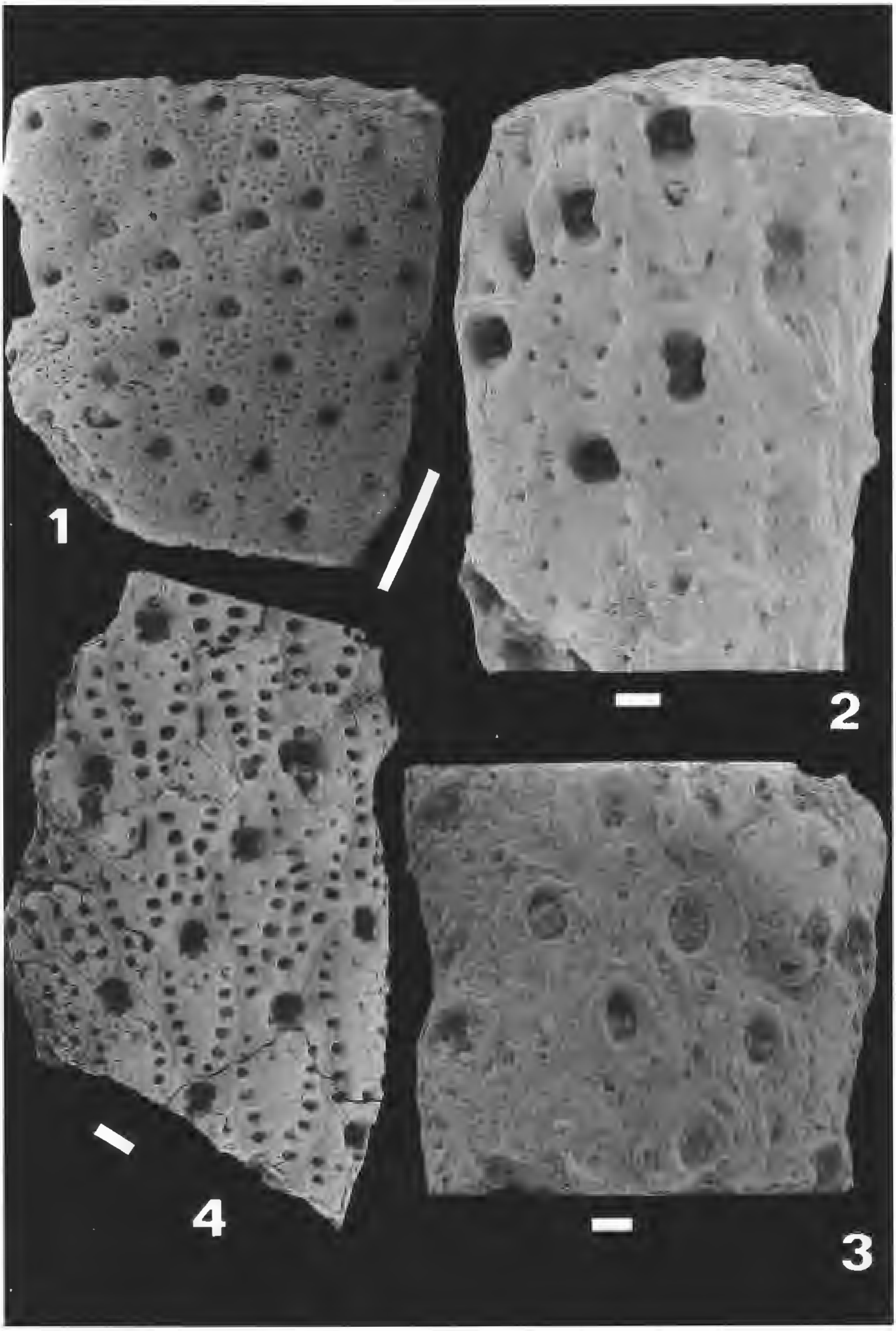
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Plate 13

All scale bars 100 μm

Fig. 1: *Zuzanella tomashi* n. sp., paratype with clearly visible deeply immersed ovicells and avicularia.

Fig. 2: *Zuzanella tomashi* n. sp., paratype, detail shown highly calcified frontal wall and ovicells.

Fig. 3: *Zuzanella tomashi* n. sp., detail of holotype.

Fig. 4: *Zuzanella tomashi* n. sp., holotype.

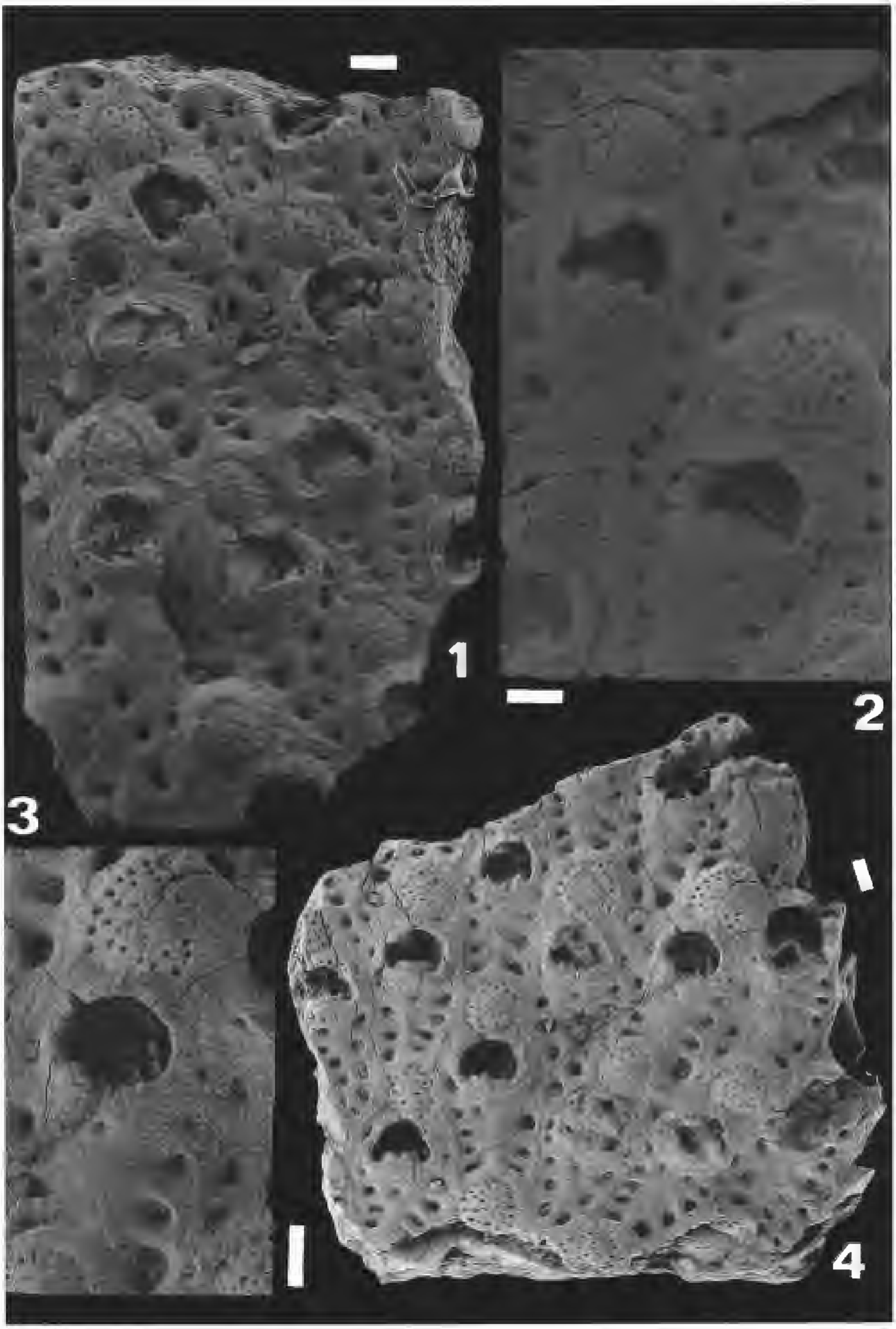
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Plate 14

Fig. 1: *Zuzanella* sp., note the number of marginal areolar pores, scale bar 1 mm

Fig. 2: *Kylonisa triangularis* KEIJ, 1972, whole specimen, scale bar 100 μm

Fig. 3: *Zuzanella kovaci* n. sp., note the size and shape of zooecia, scale bar 1 mm

Fig. 4: *Zuzanella* sp., detail of the ovicell and avicularium, note the size of the avicularium, scale bar 100 μm

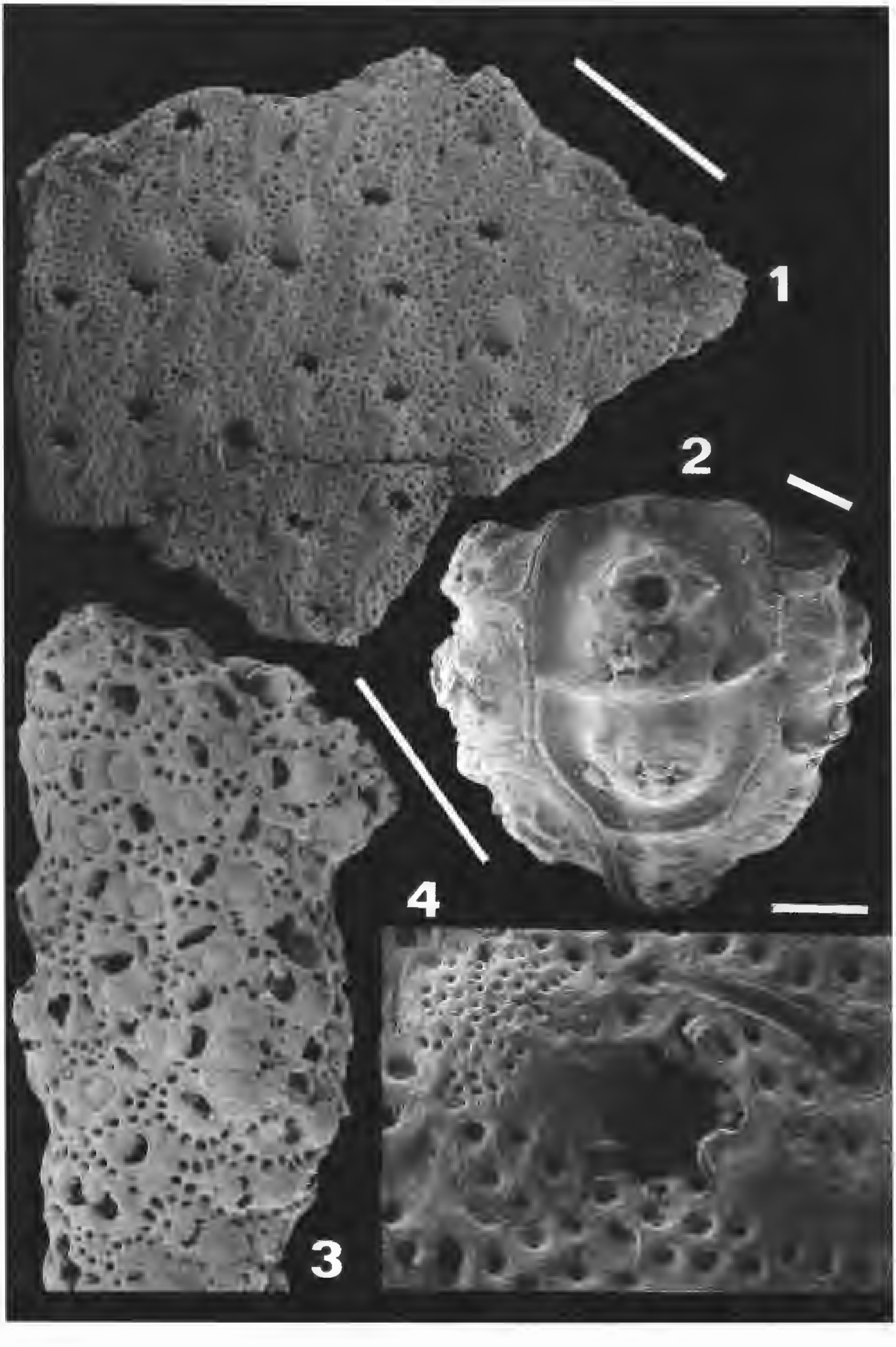
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Plate 15

All scale bars 100 µm

Fig. 1: *Lagenicella helmbergensis* n. sp., holotype

Fig. 2: *Lagenicella helmbergensis* n. sp., detail of holotype shown highly calcified and strongly porous frontal wall, deeply immersed ovicells and nonporous peristome.

Fig. 3: *Lagenicella helmbergensis* n. sp. paratype with little smaller pores on frontal wall.

Fig. 4: *Schizolepralia scrobiculata* (Reuss, 1848) with avicularia situated on the frontal wall.

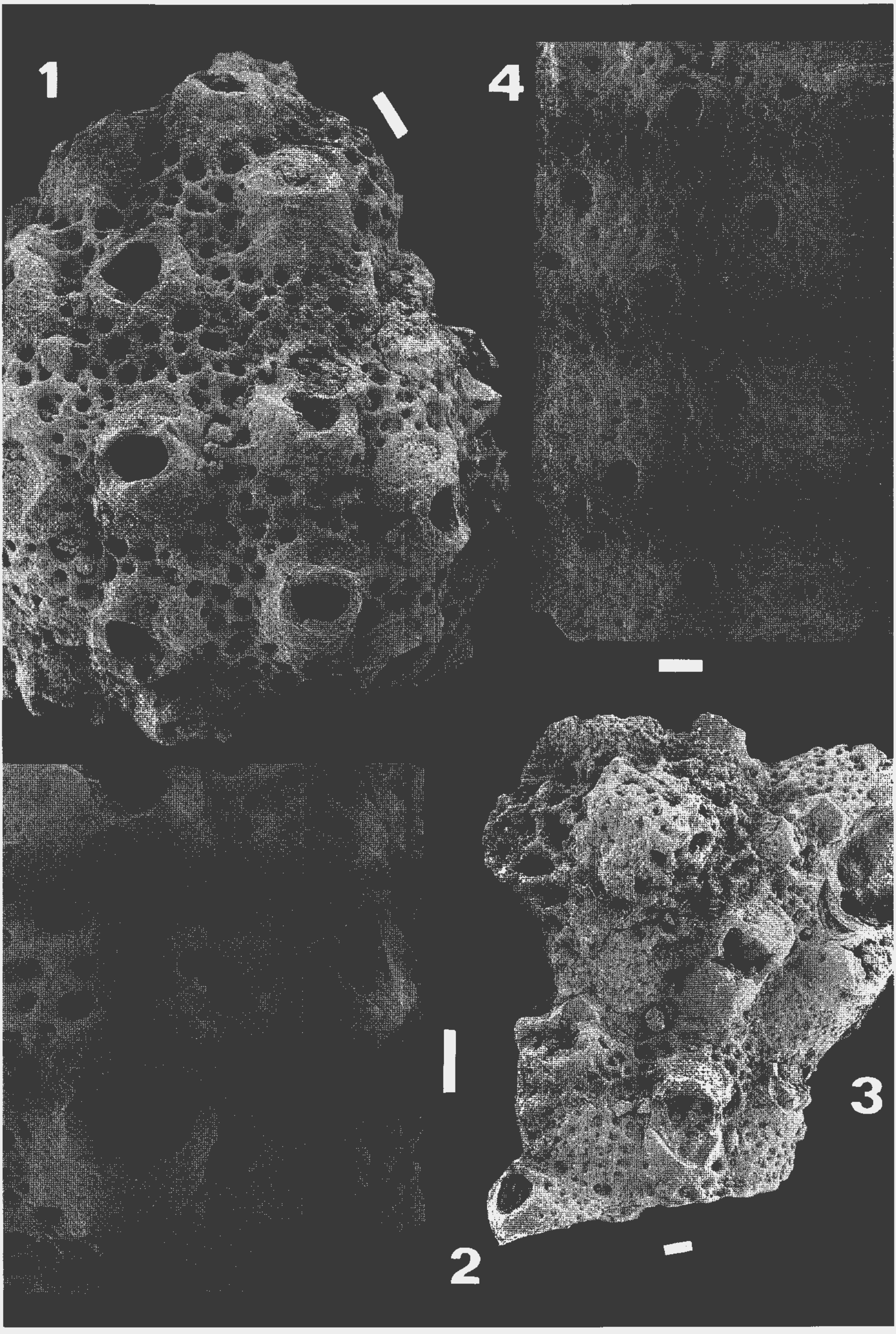
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Plate 16

Fig. 1: *Porina peristomica* Zágoršek, 2001, note short peristome around the aperture, scale bar 1 mm

Fig. 2: *Metradolium obliquum* Canu & Bassler, 1920, scale bar 1 mm

Fig. 3: *Hippoporina* cf. *globulosa* (d'Orbigny1851), with two avicularia and strongly porous frontal wall, scale bar 100 µm

Fig. 4: *Metradolium obliquum* Canu & Bassler, 1920, detail of Fig. 2 shown immersed oral avicularium, scale bar 100 µm

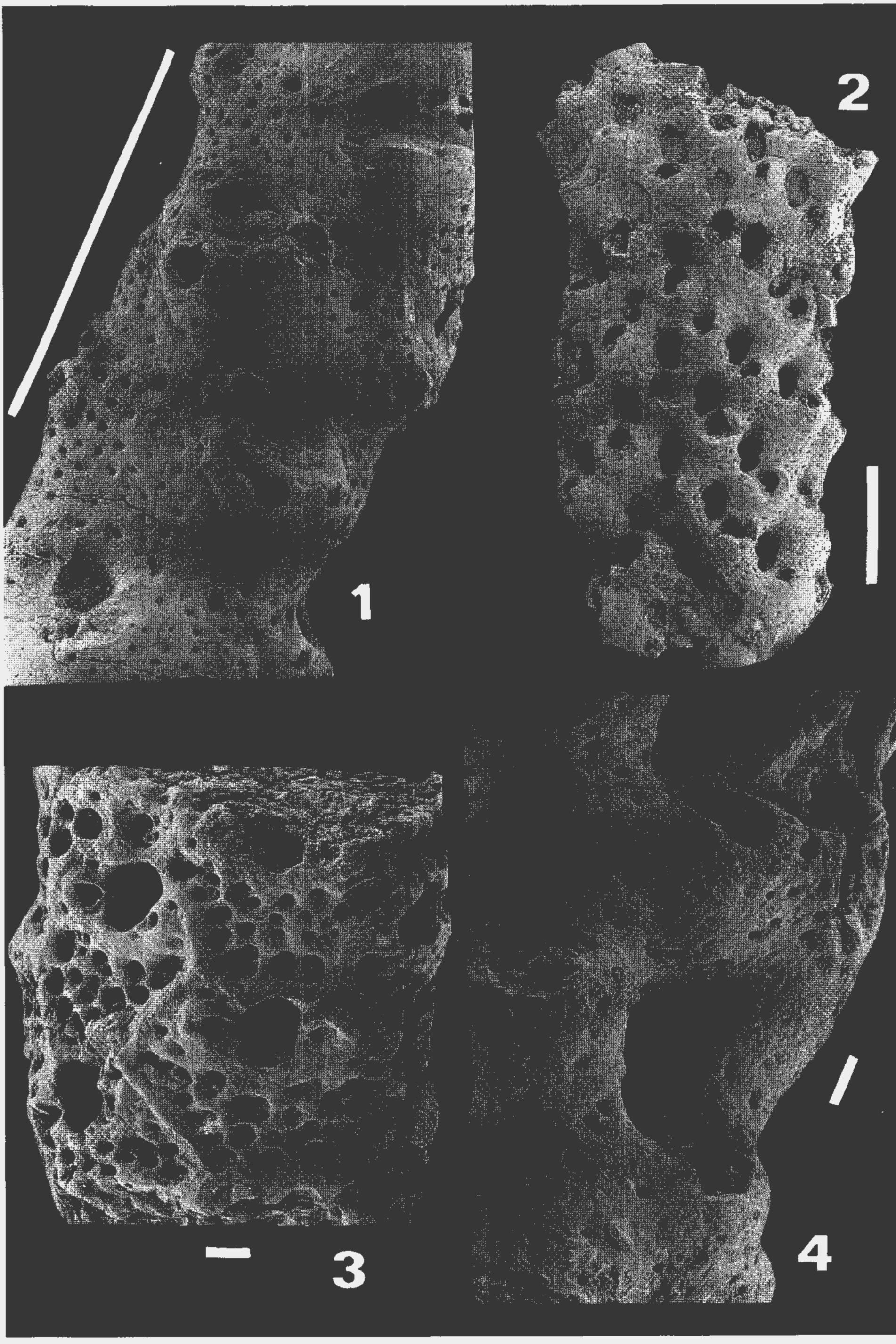
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Plate 17

Fig. 1: *Gigantopora duplicata* (Reuss, 1848), scale bar 100 µm

Fig. 2: *Cyphonella nodosa* Koschinsky, 1885, note two avicularia and nonporous umbo, scale bar 100 µm

Fig. 3: *Cheilopora orbifera* Canu & Bassler, 1920, scale bar 1 mm

Fig. 4: *Arthropoma rugulosa* (Reuss, 1874), scale bar 100 µm

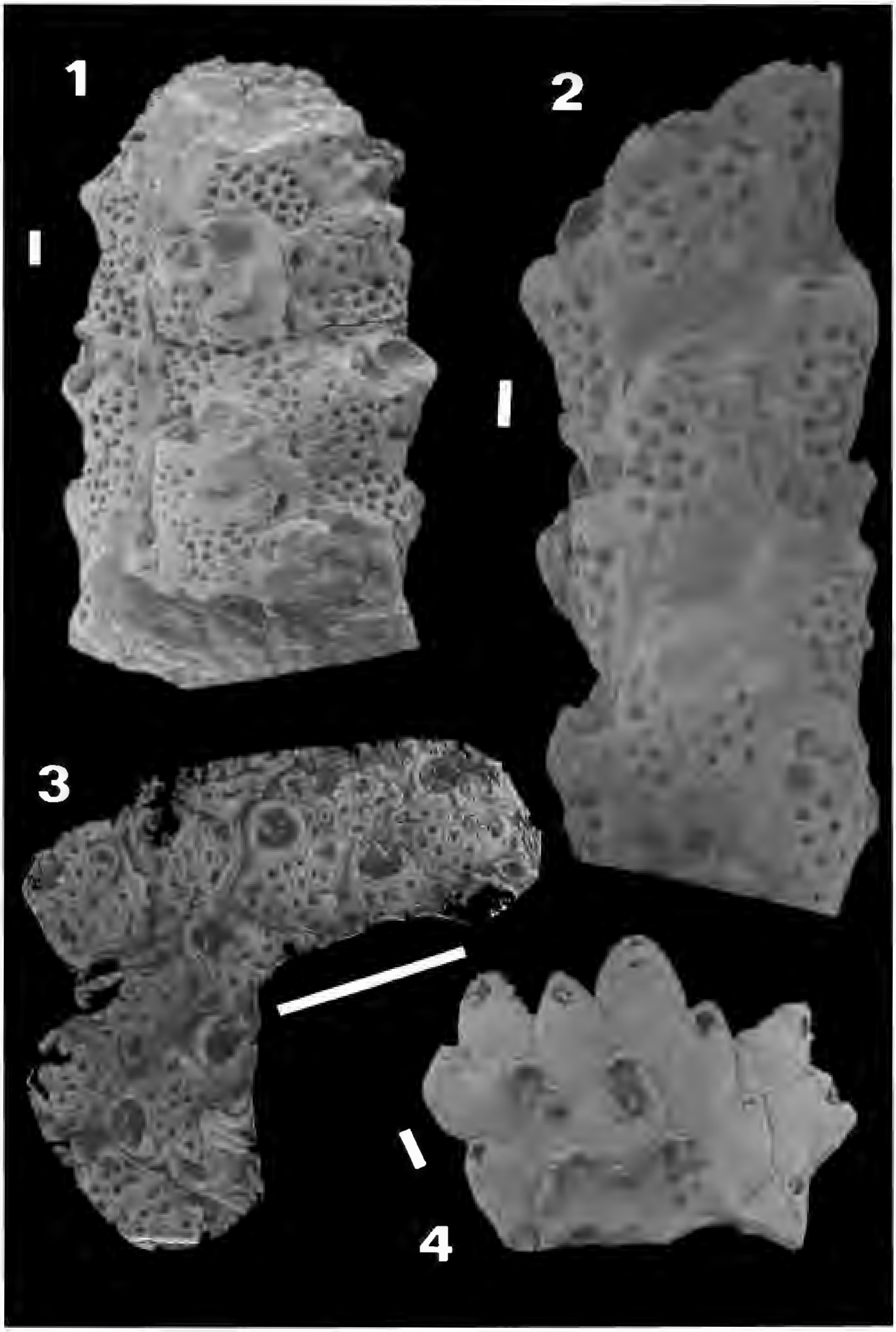
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Plate 18

Fig. 1: *Kionidella moravicensis* PROCHÁZKA, 1894, scale bar 1 mm

Fig. 2: *Kionidella moravicensis* PROCHÁZKA, 1894, detail of the ovicelled colony, scale bar 100 µm

Fig. 3: *Puellina (Cribrilaria) haueri* (REUSS, 1848), ovicelled colony, scale bar 1 mm

Fig. 4: *Puellina (Cribrilaria) haueri* (REUSS, 1848), detail of the ovicelled zooecium, scale bar 100 µm

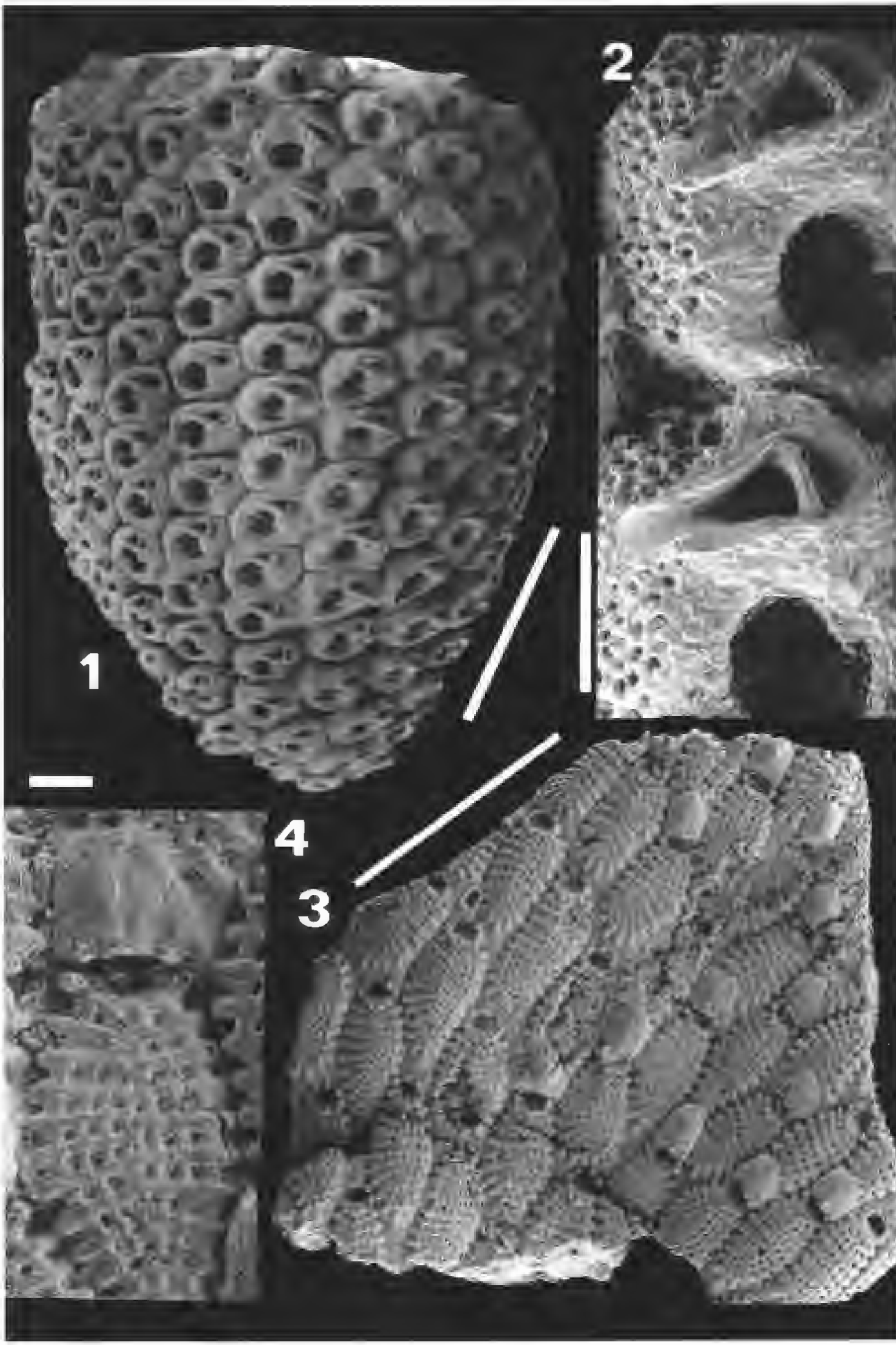
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Plate 19

All scale bars 100 μm

Fig. 1: *Galeopsis* cf. *subquadrangularis* (Reuss, 1869) shown three avicularia below the aperture.

Fig. 2: *Stephanollona otophora* (Reuss, 1848), poorly preserved ovicelled colony shown two slips perforated ovicells.

Fig. 3: *Herentia hyndmanni* (Johnston, 1847)

Fig. 4: *Kionidella excelsa* Koschinsky, 1885, note two avicularia per zooecium.

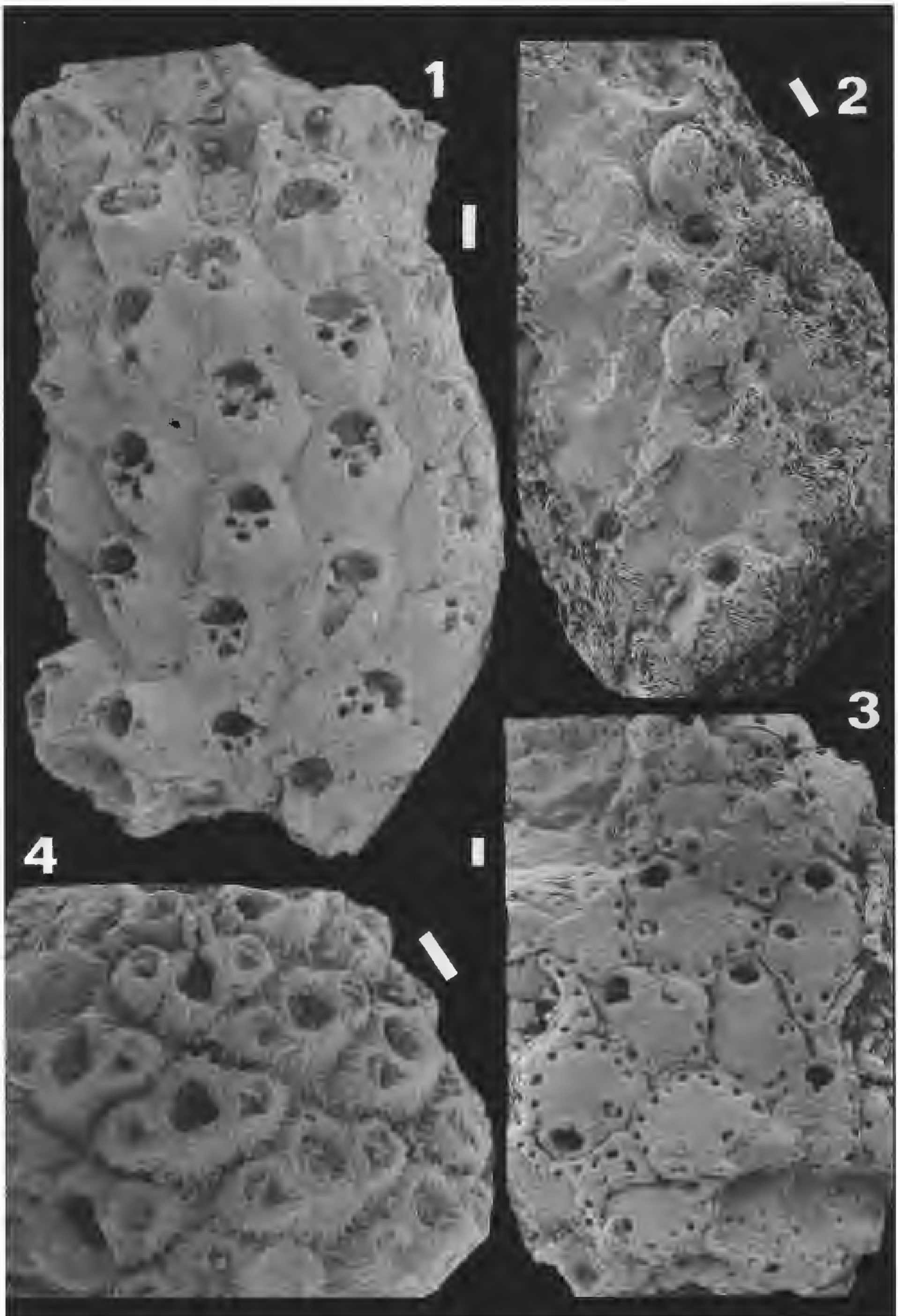
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Plate 20

Fig. 1: *Reteporella tuberculata* (Reuss, 1869), scale bar 100 µm

Fig. 2: *Reteporella subovata* (Stoliczka, 1862), note rare marginal pores, scale bar 100 µm

Fig. 3: *Iodictyum labellatum* Zágoršek, 2001), scale bar 100 µm

Fig. 4: *Celleporaria globularis* (Bronn, 1837) small globular colony shown small marginal areolar pores, scale bar 1 mm

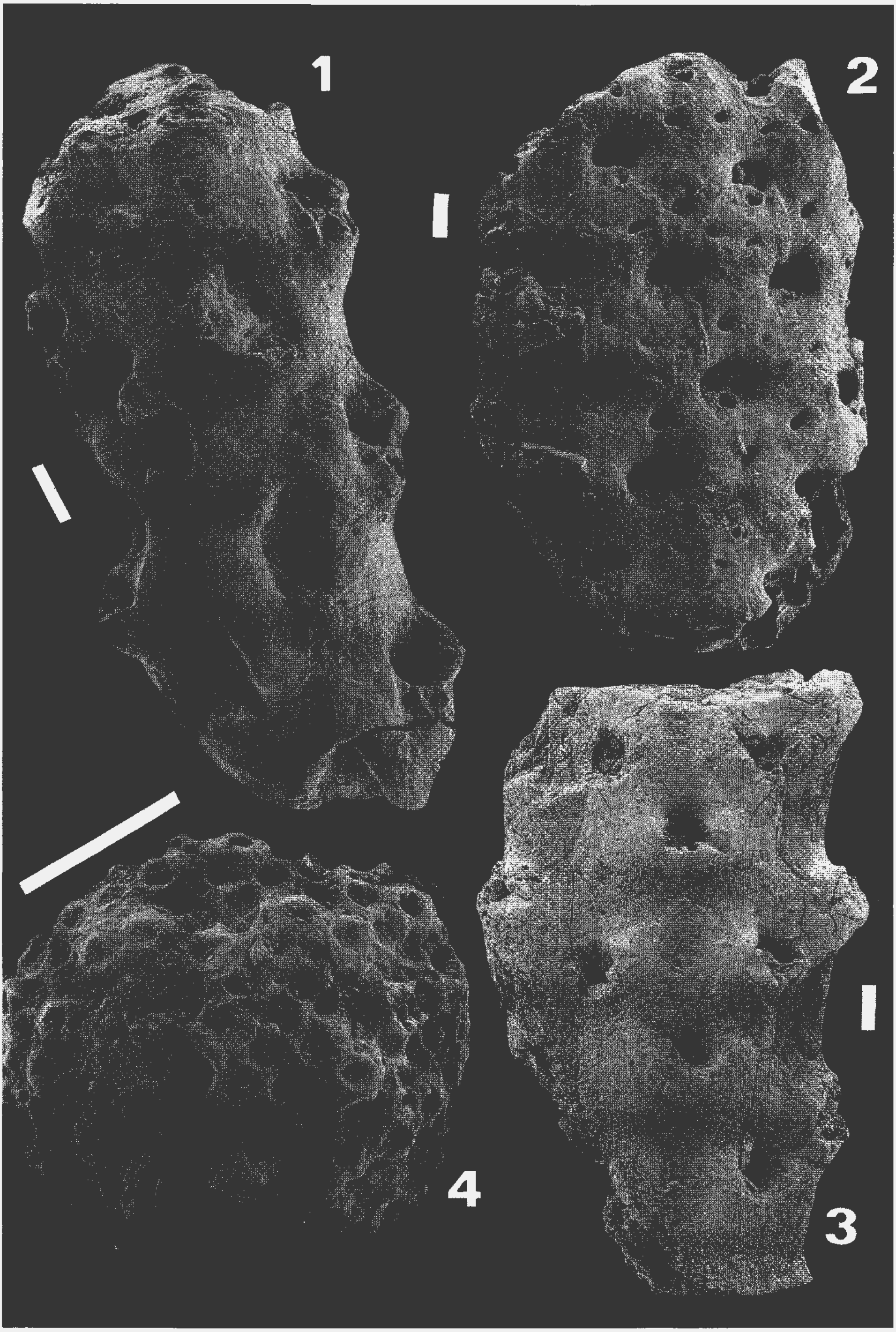
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Plate 21

All scale bars 100 μm

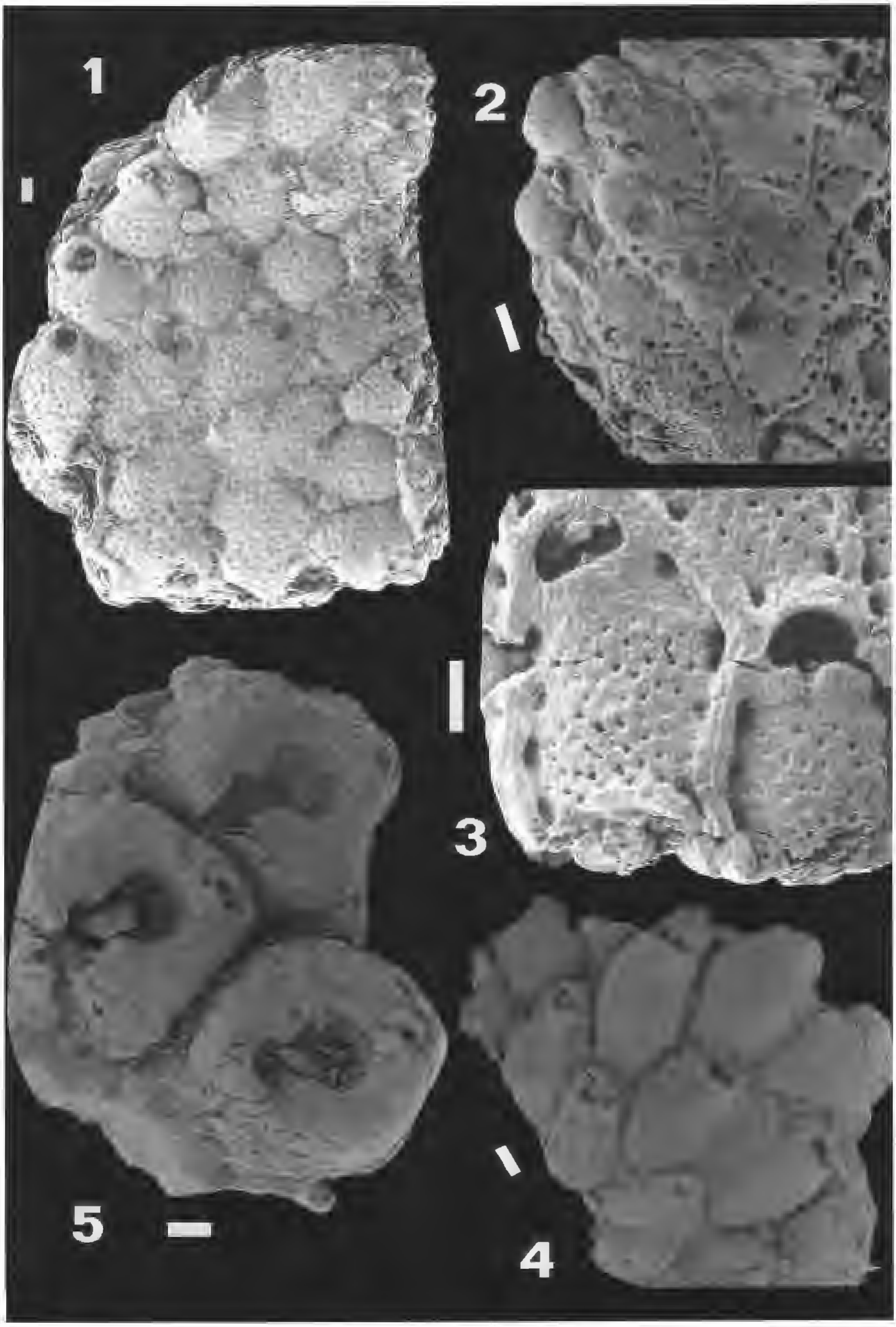
Fig. 1: *Schizoporella tetragona* (REUSS, 1848)

Fig. 2: *Herentia hyndmanni* (JOHNSTON, 1847), ovicelled colony

Fig. 3: *Micropora urhidensis* ZÁGORŠEK, 2001, note marginal opesiules.

Fig. 4: *Perigastrella granulata* ZÁGORŠEK, 1994

Fig. 5: *Fedora bidentata* (REUSS, 1869) with small avicularia.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