

Badenian (Middle Miocene) bryozoan fauna of Hungary; basic data of localities and samples

By

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Abstract — The biodiversity, biogeography and environmental significance of the Badenian bryozoan fauna of Hungary were recently published by MOISSETTE et al. (2006, 2007). Seventy-one bulk samples, collected at 18 localities (16 outcrops and 2 boreholes) yielded a total number of 238 bryozoan species. This is the most diverse known bryozoan fauna from the Miocene of the Central Paratethys. However, in the above mentioned papers only the summarised lists of species were published, sorted according to palaeogeographical affinities or colonial growth forms. The basic data of each locality and sample, as well as the species lists of all studied samples are given in this paper. Detailed descriptions of the identified bryozoan species are not included and only the most common and most characteristic species are illustrated.

Key words — Bryozoa, Middle Miocene, Badenian, Central Paratethys, Hungary

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Introduction

The Paratethys was an epicontinental sea that developed as a relict of the ancient Tethys Ocean. It consisted of a series of basins, which were intermittently connected to the Mediterranean and the Indo-Pacific (RÖGL 1998; MEULENKAMP & SISSINGH 2003). The area from the present-day Austria to Poland and Romania is called the Central Paratethys. The Badenian is a regional stage used in the Central Paratethys for part of the Middle Miocene (Langhian to Middle Serravallian) (PAPP et al. 1978; NAGYMAROSY & MÜLLER 1988).

The Badenian sedimentation of the Central Paratethys is of a mixed siliciclastic-carbonate type. A relatively high terrigenous clastic influx came from the uplifting Alpine chains around the basin (ROYDEN & BÁLDI 1988; VAKARCS et al. 1998). Platforms and other shallow areas, placed distally or isolated from areas with siliciclastic input were characterised by limestone formation (so-called Leitha Limestone, see e.g. FRIEBE 1988). In Hungary, its various facies were subdivided into different formations (CSÁSZÁR 1997). Deeper water sediments (marls and silts) are widespread in basinal settings.

Although their presence and abundance is often mentioned in geological and palaeontological papers (e.g.

STRAUSZ 1928), until recently the Badenian bryozoans of Hungary have never been studied. However, they are abundant and diverse in various marine facies and offer useful tools for palaeoenvironmental reconstructions. The relatively high biodiversity observed in the Hungarian Badenian is partly the result of the availability of various types of habitats: algal crusts and rhodoliths, skeletal macrofaunas, rocky and soft bottoms at various depths, and possibly seagrasses and seaweeds.

The shallow-water deposits of the Paratethys are generally devoid of any planktonic fossils, thus their age is extremely difficult to determine (PAPP et al. 1978). A simple bipartitional subdivision of the Badenian stage (Early and Late) is consequently used in this paper. Even if the exact age of some of the deposits remains a matter of controversy, the following age assignments have been adopted. Most localities (Figure 1) are considered as Early Badenian (Borsodbóta, Kemence, Kishajmás, Kovácsszénája Lake, Mátraszőlős, Mátraverebély, Nagymaros-Törökmező, Sámsonháza, Szob, Szokolya-2 borehole, Várpalota, Visegrád, Zebevény), whereas only four outcrops and one borehole are attributed to the Late Badenian (Diósd, Fertőrákos, Budapest-Örs vezér tere, Budapest-Rákos and Tengelic-2 borehole).

Material

Most of the studied material (59 samples taken from 16 sections or isolated outcrops) was collected by the authors during field excursions in 1996, 1997, 2000 and 2001. The Hungarian Geological Survey realised in the 1950s and 1960s a great effort of coring over the whole Hungarian territory. We were able to sample the Badenian interval of one of the cores (Tengelic-2) made in predominantly argillaceous sediments (25 samples but only 8

contain bryozoans). Another core (Szokolya-2) also yielded some bryozoans in 18 samples. Material from the Hungarian Natural History Museum (Department of Palaeontology and Geology, Budapest) was also used to complement the biodiversity aspect of our studies. Most museum specimens came from outcrops we ourselves sampled, but in some cases this material helped us to find unknown or poorly explored fossil deposits. Well-preserved

museum specimens were also used for an easier identification of some species and for SEM micrographs.

All studied bryozoans are housed in the collection of the

Hungarian Natural History Museum, Budapest (inventory numbers: M 2009.699.1.–M 2009.2333.1. for newly collected materials, and various numbers for older collections).

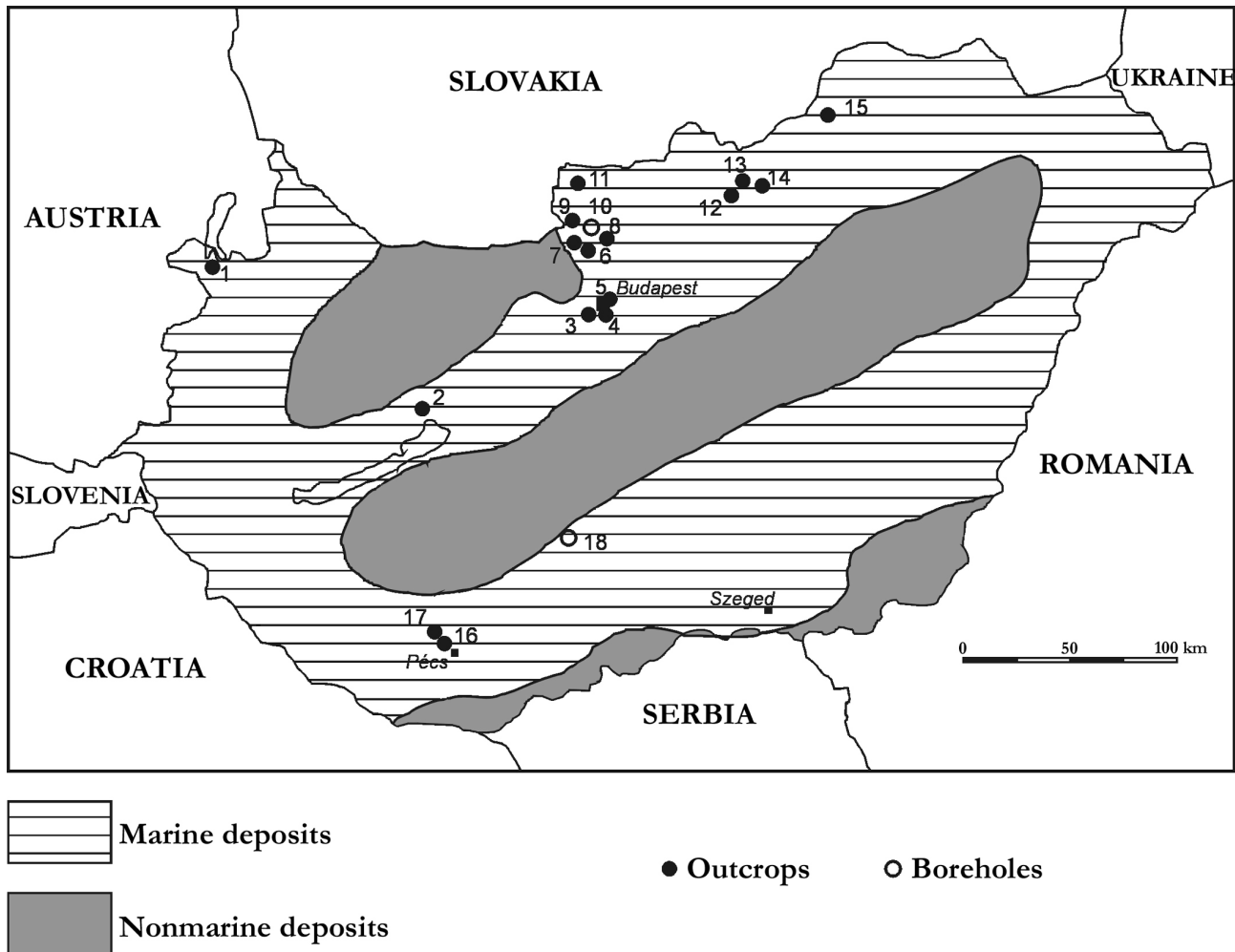


Figure 1 – Map of Hungary showing the distribution of marine deposits during Badenian times and the location of sampling sites (modified from Nagymarosy & Müller 1988). — Numbers correspond to studied localities and cores; 1: Fertőrákos; 2: Várpalota; 3: Diósd; 4: Budapest, Rákos; 5: Budapest, Örs vezér tere; 6: Visegrád; 7: Zebegény; 8: Nagymaros, Törökmező; 9: Szob; 10: Szokolya-2; 11: Kemence; 12: Mátraszőlős; 13: Sámsonháza; 14: Mátraverebély; 15: Borsodbóta; 16: Kishajmás; 17: Kovácsszénája Lake; 18: Tengelic-2.

Biodiversity, palaeobiogeographical and palaeoenvironmental significance

A total of 238 bryozoan species were identified among the collected material: 176 cheilostomes, 59 cyclostomes and 3 (boring) ctenostomes (MOISSETTE et al. 2006). A fairly large number of extant or fossil species were reported for the first time from the Paratethys (31). From a palaeoclimatic point of view, most of the species identified in the Badenian of Hungary are temperate or warm-temperate. However, the tropical taxa are relatively numerous (20) and some of them are even abundant in a number of samples (e.g. *Metrarabdotos maleckii*, *Steginoporella* spp., *Tremopora radiciifera*). On the contrary, the cold-water (boreal) species (e.g. *Palmicellaria skenei*, *Amphiblestrum trifolium*) are not diverse and are always rare in the studied assemblages (MOISSETTE et al. 2006). An analysis of the temporal distribution of the Badenian bryozoans of Hungary reveals that 110 species occur only in Early Badenian deposits, 105 species are found in both Early and Late Badenian, whereas 23 are limited to the

Late Badenian. This decrease in diversity is accompanied by the conspicuous absence of most tropical taxa from the Upper Badenian sediments (MOISSETTE et al. 2006). On the basis of their present-day and fossil distributions, the 238 bryozoan species have been distributed into six (palaeo)biogeographical groups: 1. Eastern Atlantic/Mediterranean species (73); 2. Endemic Mediterranean species (55); 3. Endemic Paratethyan species (50); 4. Cosmopolitan species (30); 5. Indo-Pacific species (10); 6. Species of unknown or dubious origin (20) (MOISSETTE et al. 2006).

MOISSETTE et al. (2007) investigated the composition of the diverse fauna using a combination of statistical and palaeoecological methods. The statistical analyses make use of Cluster Analysis and Non-metric Multi-Dimensional Scaling. The palaeoecological approaches are based on the known ecological requirements of the bryozoan colonial growth forms (Figures 2–3: membraniporiform, cellepori-

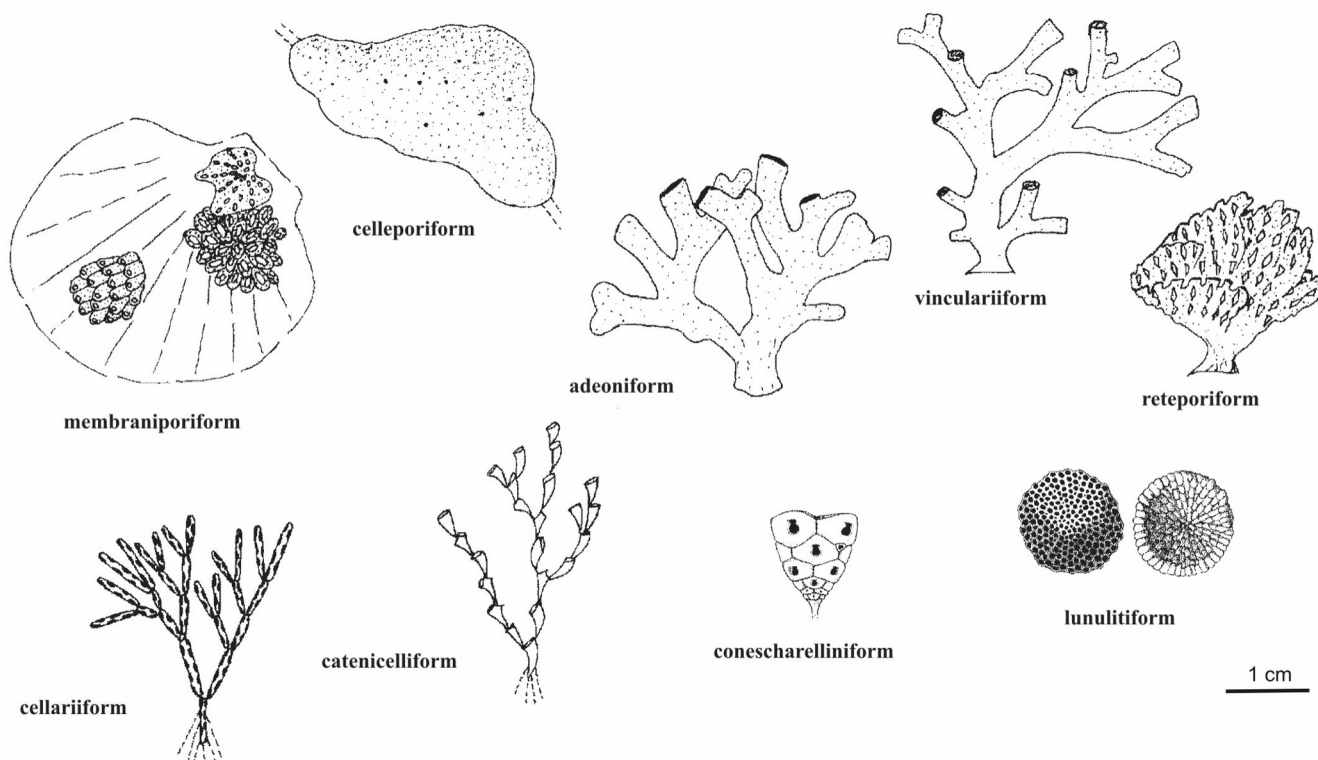


Figure 2 — Schematic diagrams of the zoarial forms used in the palaeoecological analysis (after MOISSETTE 2000).

Zoarial forms	Environmental conditions			CURRENTS			SEDIMENTATION			DEPTH		
	SUBSTRATUM			low	moderate	strong	slow	moderate	rapid	shallow	moderate	great
ENCRUSTING												
membraniporiform	●		●	●	●	●	●			●	●	
celleporiform	●		●	●	●	●	●			●	●	
ERECT, RIGID												
adeoniform	●			●	●		●	●		●	●	●
vinculariiform	●			●			●	●		●	●	●
reteporiform	●			●	●	●	●	●		●	●	
ERECT, JOINTED												
cellariiform	●	●	●	●	●	●	●	●	●	●	●	●
catenicelliform	●		●		●	●	●	●		●	●	
ERECT, CONICAL												
conescharelliniform		●	●	●	●		●	●	●		●	●
FREE												
lunulitiform		●		●	●		●	●	●	●	●	

Figure 3 — Relations between zoarial forms and environmental factors. A small black circle indicates an occasional relation, a large circle a frequent relation (after MOISSETTE 2000).

form, vinculariiform, adeoniform, reteporiform, cellariiform, catenicelliform, lunulitiform, conescharelliniform; e.g. MOISSETTE 2000) and of the numerous extant species (86 out of 238). Five facies have been differentiated on the basis of sedimentological and palaeontological features: coral build-ups (Diósd, Visegrád, Budapest-Rákos), coralline algal limestones (Kishajmás, Nagymaros-Törökmező, Budapest-Rákos, Visegrád, Zebegény), biocalcarenites (Diósd, Fertőrákos, Kemence, Mátraszőlős, Mátraverebély, Budapest-Örs vezér tere, Sámsonháza, Visegrád), sands (Borsodbóta, Budapest-Örs vezér tere, Szob, Várpalota) and marls (Szokolya-2, Tengelic-2 boreholes). The palaeoecological, statistical and facies analyses further permitted to identify four depositional settings: carbonate platform (distal and proximal), terrigenous platform, slope and basin. These environments developed at depths between 0 to about 300 m in a mixed carbo-

nate-siliciclastic depositional system. The shallowest environments are those of the coral reefs (0–20 m) followed, somewhat deeper, by some of the biocalcarenite deposits (Fertőrákos, Visegrád, around 30 m) and by the coralline algal facies (10–60 m). The mostly quiet slope environment is represented by biocalcarenite facies. The depth of deposition of the deepest biocalcarenite samples is estimated at about 80 m (Kemence, Mátraverebély, Sámsonháza, Mátraszőlős). The sands and sandstones correspond either to beach environments where skeletal remains from various depth intervals accumulated (Várpalota) or to depressions receiving material from the upper shelf (Borsodbóta), or to quieter environments where in situ faunas lived at 30–60 m depths (Szob, Szokolya). Basinal marly facies indicate quiet and relatively deep depositional environments of about 100 to possibly 300 m (MOISSETTE et al. 2007).

Localities and faunal lists

Early Badenian localities

The Early Badenian palaeogeography of the Central Paratethys is characterized by transgressions from the Mediterranean via Slovenia and northern Croatia (KOVÁČ et al. 2007). On the basis of a detailed study of Early Badenian and Chokrakian bivalve faunas, STUDENCKA et al. (1998) found that the Eastern Paratethys was cut off intermittently from communication with the Central Paratethys. The species composition of Early Badenian bivalve assemblages indicates a wide connection between the Central Paratethys and the Mediterranean. The water circulation during the Early Badenian was of an antiestuarine type with shallow water inflow (BÁLDI 1997). The Badenian climate is fairly uniform due to the Miocene climatic optimum (BÖHME 2003) which resulted in the presence of small coral patch reefs up to the Carpathian Foredeep Basin (PISERA 1996, GÓRKA 2002). The maximum of foraminifer genera, the diversified mollusc fauna and algal limestones reflect a stable subtropical marine environment in the Lower Badenian sediments (KOVÁČ et al. 2007).

Kishajmás — The Miocene geology of the Mecsek Mountains was studied in detail by VADÁSZ (1935), HÁMOR (1970) and more recently by CHIKÁN (1991). However, the two studied localities in the Mecsek Mountains are relatively poorly known both from the geological and palaeontological point of views. An exposure of Lower Badenian sandstones is situated in a railway-cut between the stations Husztót and Kishajmás-Szatina, along the railway line Budapest-Pécs. Some decapods were described by MÜLLER (1984) from this locality. STRAUSZ (1928) listed a diverse bryozoan fauna from Kishajmás (e.g. *Membranipora*, *Schizoporella*, *Poristoma*, *Defrancia*, *Salicornaria*, *Cellaria*, *Scrupocellaria*, *Retepora*, *Hornera*, *Idmonea*, *Filisparsa*, *Crisia*, *Entalophora*). Lower Badenian algal limestones cropped out in the abandoned quarry, located just at the northern margin of the village Kishajmás (Pécsszabolcs Formation, CSÁSZÁR 1997). At the lower part of the section a grey sandstone followed by white sand/sandstone with abundant fossils (coralline algae, molluscs, echinoids and foraminif-

fers), while the upper part is a hard algal limestone. For bryozoan studies two samples were collected from the algal sandstone and the algal limestone (Figure 4).

Mecsek-1 sample yielded 1524 specimens and 32 species/28 genera. The most frequent species are *Crisia denticulata* and *C. eburnea*, but *Pleuronea*, *Tervia* and *Ybselosocia* are also common. More than half of the specimens are cellariiforms (62.8%). Vinculariiforms are also frequent (32%), while membraniporiforms (2.6%), reteporiforms (2.2%), celleporiforms (0.3%) and adeoniforms (0.1%) are not so significant.

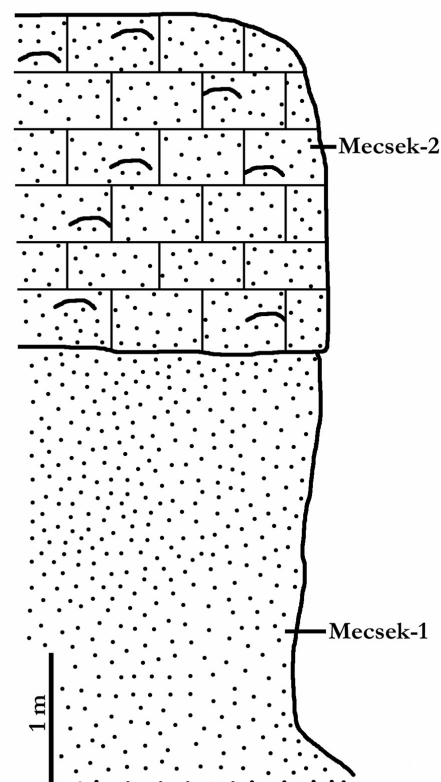


Figure 4 — Simplified section of Kishajmás locality, with estimated position of the studied samples.

Kishajmás, Mecsek-1 (sample size: 500 g)	specimen number
<i>Annectocyma major</i> ?	19
<i>Buffonellodes incisa</i>	2
<i>Canda rectangularata</i>	8
<i>Cellaria salicornioides</i>	81
<i>Celleporina costazi</i>	2
<i>Celleporina minuscula</i> ?	1
Celleporiforms indet.	3
<i>Crepidacantha odontostoma</i>	1
<i>Crisia denticulata</i>	490
<i>Crisia eburnea</i>	324
<i>Crisia baueri</i>	16
<i>Electra monostachys</i>	1
<i>Ellisia gantieri</i>	3
<i>Entalporoecia fasciculifera</i>	85
<i>Escharina vulgaris</i>	1

<i>Froncipora verrucosa</i> ?	1
<i>Hippodiplosia</i> sp.	1
<i>Hippoporina sulcifera</i> ?	2
<i>Idmidronea atlantica</i>	54
<i>Iodictyum rubeschi</i>	6
<i>Margaretta cereoides</i>	14
<i>Microporella ciliata</i>	1
<i>Onychoecella angulosa</i>	2
<i>Pleuronea pertusa</i>	121
<i>Reteporella cellulosa</i>	28
<i>Rhagasostoma stenostoma</i>	2
<i>Schizoporella geminipora</i>	2
<i>Scrupocellaria elliptica</i>	32
<i>Ternia irregularis</i>	114
<i>Tubulipora partschi</i>	2
<i>Umbonula macrocheila</i>	1
<i>Yselsocella typica</i>	104

Mecsek-2 sample yielded 129 specimens and 24 species /20 genera. The most abundant genera are *Crisia*, *Cellaria* and *Margaretta*. More than half of the specimens are cellari-

forms (54.3%). Membraniporiforms are also frequent (32.6%) while vinculariiforms (5.4%), reteporiforms (3.9%), celleporiforms (3%) and adeoniforms (0.8%) are not so significant.

Kishajmás, Mecsek-2 (sample size: 500 g)	specimen number
<i>Buffonellodes incisa</i>	2
<i>Calpensia nobilis</i>	3
<i>Cellaria salicornioides</i>	10
<i>Celleporina</i> aff. <i>lucida</i>	2
<i>Crisia denticulata</i>	20
<i>Crisia eburnea</i>	25
<i>Disporella hispida</i>	3
<i>Margaretta cereoides</i>	10
<i>Mollia patellaria</i>	1
<i>Nellia oculata</i>	5
<i>Onychoecella angulosa</i>	9

<i>Plagioecia sarniensis</i>	1
<i>Pleuronea pertusa</i>	2
<i>Reteporella cellulosa</i>	5
<i>Schizobrachiella sanguinea</i>	1
<i>Schizomavella auriculata</i>	6
<i>Schizomavella tenella</i>	5
<i>Schizoporella longirostris</i>	3
<i>Schizoporella unicornis</i>	5
<i>Smittina cervicornis</i>	1
<i>Ternia irregularis</i>	5
<i>Tubulipora plumosa</i> ?	2
<i>Tubulipora</i> sp.	1
<i>Turbicellepora coronopus</i>	2

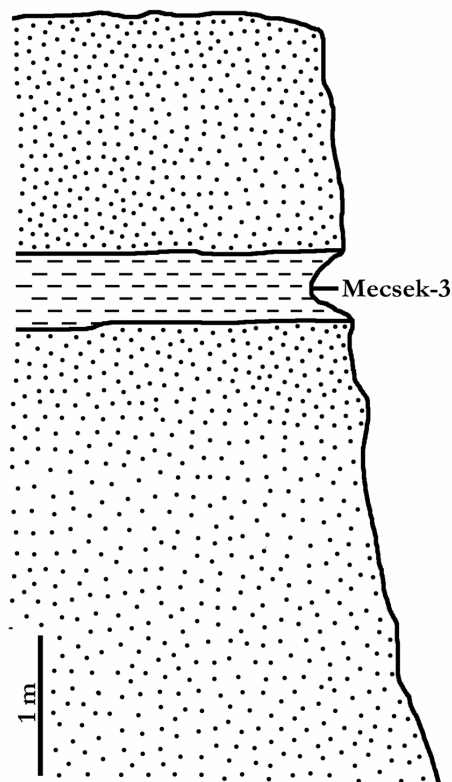


Figure 5 — Simplified section of Kovácsszénája Lake locality, with estimated position of the studied sample.

Kovácsszénája Lake — The collecting point is located along the northern border of Kovácsszénája Lake, at Kovácsszénája village (to the north of Pécs). The Badenian part of the section is poorly known, however the Sarmatian part was studied in greater details. VADÁSZ (1915) published a study on the echinoids from the locality, while KORDOS & SOLT (1984) mentioned some fish remains. This place is mainly known as a locality for a well-preserved Sarmatian dolphin (*Mediocris commenticus*) described by KAZÁR (2005). However, the geological background (BARABÁS 2001), the mollusc fauna (BOHN-HAVAS 2001), the organic-walled microplankton (SÜTŐ-SZENTAI 2001), as well as the foraminifers and ostracods (SZUROMI-KORECZ & SZEGŐ 2001) were also studied from the 15 meter thick Sarmatian porous limestone and calcareous marl section (Kozárd Formation). One sample (Mecsek-3) was collected from the Early Badenian algal limestone (Figure 5).

Mecsek-3 sample yielded 422 specimens and 43 species/34 genera. Most numerous are *Nellia*, *Crisia* and unidentifiable celleporiform fragments. Nearly half of the specimens are cellariiforms (41.5%). However, membraniporiforms (25.4%) and celleporiforms (25.1%) are also frequent, while vinculariiforms (7.3%) and adeoniforms (0.7%) are not so significant.

Kovácsszénája lake, Mecsek-3 (sample size: 500 g)	specimen number
<i>Aplousina bobiesi</i>	4
<i>Buffonellaria divergens</i>	1
<i>Calpensia nobilis</i>	29
<i>Cellaria salicornioides</i>	28
<i>Celleporaria palmata</i>	1
<i>Cellepora globularis</i>	4
<i>Celleporaria cerioporoides</i>	1
<i>Celleporina costazi</i>	15
<i>Celleporina</i> aff. <i>lucida</i>	27
Celleporiforms indet.	44
<i>Cribella cyclocephala</i>	1
<i>Crisia eburnea</i>	50
<i>Disporella hispida</i>	5
<i>Hippadenella regularis</i>	1
<i>Hippopleurifera hypsostoma</i>	1
<i>Hippopleurifera semicristata</i>	4
<i>Hippoporella bicornis</i>	1
<i>Idmidronea atlantica</i>	8
<i>Margaretta cereoides</i>	4
<i>Micropora coriacea</i>	1
<i>Nellia oculata</i>	74

Plate IV: 6

<i>Oncosoecia biloba</i>	9
<i>Onychoecia angulosa</i>	1
<i>Plagioecia patina</i>	14
<i>Plagioecia sarniensis</i>	9
<i>Pleuroecia pertusa</i>	1
<i>Ramponotus appendiculata</i>	1
<i>Rosseliana incompta</i>	1
<i>Schizobrachiella sanguinea</i>	2
<i>Schizomavella auriculata</i>	6
<i>Schizomavella tenella</i>	1
<i>Schizoporella longirostris</i>	10
<i>Scrupocellaria elliptica</i>	19
<i>Smittina cervicornis</i>	1
<i>Tervia irregularis</i>	13
<i>Talamoporella neogenica</i>	1
<i>Tremopora radicefera</i>	4
<i>Tubulipora dimidiata</i>	7
<i>Tubulipora partschi</i>	2
<i>Turbicellepora</i> cf. <i>compressa</i>	8
<i>Turbicellepora coronopus</i>	1
<i>Turbicellepora canaliculata</i> ?	5
<i>Umbonula macrocheila</i>	2

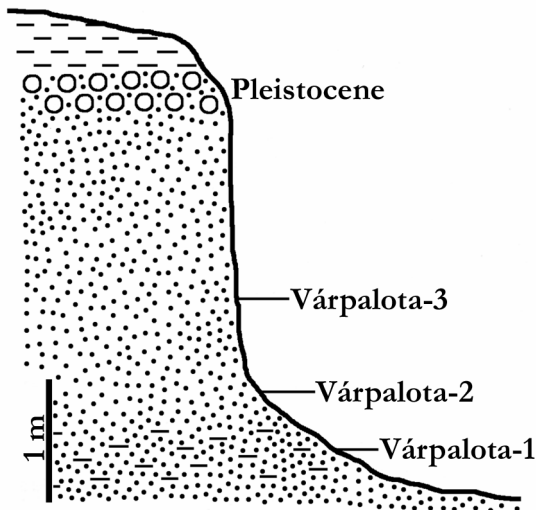


Figure 6 — Simplified section of Várpalota, Szabó-bánya locality, with estimated position of the the studied samples.

Várpalota, Szabó-bánya — A protected old sandpit can be found at the south-western part of the town of Várpalota. The classical Early Badenian locality is famous for its rich mollusc fauna (more than 400 species) which was studied by several authors (e.g. STRAUZ & SZALAI 1943; STRAUZ 1954; KECSKEMÉTI-KÖRMENDY 1962; KÓKAY 1988). The molluscs are well preserved, sometimes with their original shell colour. GÖRÖG & SOMODY (1988) studied the common and variable trace fossils on gastropods. Stratigraphical and palaeogeographical aspects of the Badenian sediments in the Várpalota Basin are given by KÓKAY (1987). On the basis of its mollusc fauna, the palaeoenvironment was reconstructed as littoral. Beyond the molluscs, the cross-bedded quartz sand contains also some foraminifers, coral fragments, balanids and bryozoans. At the upper part of the sequence, 2–3 m thick Pleistocene sediments were deposited discordantly on the Middle Miocene sands. Three samples were collected for bryozoan studies from the Lower Badenian sands (Figure 6).

Várpalota-1 (sample size: 500 g)	specimen number
<i>Arachnopusia</i> sp.	1
<i>Cellaria fistulosa</i>	38
<i>Celleporaria foraminosa</i>	21
<i>Celleporina costazi</i>	2
<i>Crisia denticulata</i>	23
<i>Cupuladria vindobonensis</i>	2
<i>Idmidronea atlantica</i>	163
<i>Margaretta cereoides</i>	5
<i>Nellia oculata</i>	71
<i>Patinella goldfussi</i>	1
<i>Reussirella haidingeri</i>	1
<i>Schedocleidochasma porcellanum</i>	1
<i>Schizostomella grinzingensis</i>	30
<i>Scrupocellaria elliptica</i>	8
<i>Smittina cervicornis</i>	2
<i>Terebripora</i> sp.	8
<i>Tervia irregularis</i>	24
<i>Turbicellepora coronopus</i>	2
<i>Turbicellepora</i> sp.	3
<i>Ybselosocia typica</i>	13

Várpalota-2 (sample size: 500 g)	specimen number
<i>Arachnopusia</i> sp.	1
<i>Cellaria fistulosa</i>	41
<i>Celleporaria foraminosa</i>	246
<i>Celleporaria palmata</i>	17
<i>Crisia baueri</i>	7
<i>Ellisina grandis</i> ?	1
<i>Idmidronea atlantica</i>	652
<i>Margaretta cereoides</i>	7
<i>Nellia oculata</i>	74
<i>Schedocleidochasma porcellanum</i>	10
<i>Schizostomella grinzingensis</i>	39
<i>Terebripora</i> sp.	11
<i>Turbicellepora coronopus</i>	58
<i>Turbicellepora</i> sp.	1
<i>Ybselosocia typica</i>	45

Várpalota-1 sample yielded 419 specimens and 20 species/19 genera. The most abundant genus is *Idmidronea*, but several species are represented by only one specimen. The most frequent morphotypes are vinculariiforms (47.9%) and cellariiforms (34.8%). Adeoniforms (7.7%) and celleporiforms (6.8%) are rare, while membraniporiforms and lunulitiforms

are insignificant (0.8%). Boring ctenostomes are also represented by some *Terebripora* (2%).

Várpalota-2 sample yielded 1210 specimens and 15 species/13 genera. The most numerous bryozoans are *Idmidronea* and *Celleporaria*. Most common colony morphotypes are vinculariiforms (57.6%), celleporiiforms (26.6%) and cellariiforms (10.7%). Adeoniforms (3.2%), membraniporiiforms (1%) and boring ctenostomes (0.9%) are insignificant.

Várpalota-3 sample yielded 305 specimens and 18 species/17 genera. The most numerous genera are *Idmidronea*, *Celleporaria* and *Nellia*. The three most common colony morphotypes are vinculariiforms (36.1%), cellariiforms (29.5%) and celleporiiforms (25.6%). All the other morphotypes are rare: adeoniforms (5.2%), boring ctenostomes (2.6%), membraniporiiforms (0.7%) and lunulitiiforms (0.3%).

Várpalota-3 (sample size: 500 g)	specimen number
<i>Cellaria fistulosa</i>	14
<i>Celleporaria foraminosa</i> Plate II: 8	46
<i>Celleporaria palmata</i>	18
<i>Celleporina costazi</i>	1
<i>Crisia baueri</i>	28
<i>Idmidronea atlantica</i>	72
<i>Margaretta cereoides</i>	1
<i>Nellia oculata</i>	43
<i>Reussirella haidingeri</i>	1
<i>Schedocleidochasma porcellanum</i>	1
<i>Schizoporella unicornis</i>	1
<i>Schizostomella grinzingensis</i>	9
<i>Scrupocellaria elliptica</i>	4
<i>Smittina cervicornis</i>	7
<i>Terebripora</i> sp.	8
<i>Tervia irregularis</i>	31
<i>Turbicellepora coronopus</i>	13
<i>Ybselosocia typica</i>	7

Visegrád, Fekete-hegy, sediment (sample size: 500 g)	specimen number
<i>Annectocyma indistincta</i> ?	4
<i>Annectocyma major</i>	21
<i>Aplousina bobiesi</i>	2
<i>Bobiesipora fasciculata</i>	4
<i>Buffonellodes incisa</i>	2
<i>Callopora fenestrata</i> ?	2
<i>Calpensia nobilis</i>	6
<i>Celleporina costazi</i>	45
<i>Celleporina minuscula</i>	41
Celleporiiforms indet.	45
<i>Chorizopora brongniarti</i>	2
<i>Crisia denticulata</i>	1873
<i>Crisia eburnea</i>	150
<i>Diplosolen obelium</i>	26
<i>Disporella hispida</i>	161
<i>Emballotheba longidens</i>	18
<i>Entalophoroecia pulchella</i>	511
<i>Froncipora verrucosa</i>	4
<i>Heteropora</i> sp.	11
<i>Hornera frondiculata</i>	58
<i>Margaretta cereoides</i>	170
<i>Metrarubdots maleckii</i>	75
<i>Oncosocia biloba</i>	6
<i>Onychoella angulosa</i>	4
<i>Patinella prolifera</i>	2
<i>Patinella radiata</i>	43
<i>Perigastrella</i> ?	4
<i>Plagioecia patina</i>	22
<i>Plagioecia rotula</i>	4
<i>Polyasocia coronopus</i>	152
<i>Reteporella cellulosa</i>	2030
<i>Schizobrachiella sanguinea</i>	4
<i>Schizomavella auriculata</i>	22
<i>Schizoporella longirostris</i>	9
<i>Scrupocellaria elliptica</i>	37
<i>Tervia irregularis</i>	26
<i>Tubulipora dimidiata</i>	4
<i>Tubulipora foliacea</i>	65
<i>Tubulipora partschi</i>	28
<i>Tubulipora pluma</i>	34
<i>Tubulipora plumosa</i> ?	380
<i>Umbonula monoceros</i>	88

Visegrád, Fekete-hegy — The main mass of the Visegrád Mountains is built by volcanic rocks (KARÁTSÓN et al. 2007), but poorly exposed Lower Badenian marly limestones can be recognized on the hill-side of the Fekete-hegy at Visegrád. The sequence was described by SCHAFARZIK & VENDL (1929), SCHOLZ (1970), BÁLDI & KÓKAY (1970)

and MÜLLER (1984). Tuffaceous layers with blocks of andesite are covered by the Badenian limestone, but fossils can be collected mainly from blocks scattered on the surface. The lack of good exposure precludes the exact study of the section, but some blocks are rich in hermatypic corals (SCHOLZ 1970), while others contain mainly calcareous red algae. Three samples were collected for bryozoan studies: coral patch reef, red algal limestone and biocalcarentic sediment in a small pit on the hillside.

The sample collected from the *sediment* yielded 6195 specimens and 42 species/30 genera. Two extremely numerous genera are *Reteporella* and *Crisia*. The most frequent morphotypes are cellariiforms (36%) and reteporiiforms (32.8%). Membraniporiiforms (16.1%) and vinculariiforms (12.2%) are also relatively frequent, while celleporiiforms (1.4%) and adeoniforms (1.5%) are not so significant.

Visegrád, Fekete-hegy, algal limestone	specimen number
<i>Annectocyma major</i>	2
<i>Aplousina bobiesi</i>	5
<i>Buffonellaria divergens</i>	2
<i>Buffonellodes incisa</i>	1
<i>Calloporina decorata</i>	1
<i>Calpensia nobilis</i>	5
<i>Celleporina costazi</i>	7
<i>Cheilopora campanulata</i> ?	5
<i>Chorizopora brongniarti</i>	1
<i>Cribellopora latigastrea</i>	3
<i>Cribrilaria innominata</i>	1
<i>Escharella peachi</i>	1
<i>Escharella reussiana</i>	5
<i>Escharoides coccinea</i>	1
<i>Escharoides megalota</i>	3
<i>Heteropora</i> sp.	4
<i>Hippoporella pauper</i>	1
<i>Micropora papyracea</i>	1
<i>Onychoella angulosa</i>	13
<i>Plagioecia rotula</i> ?	3
<i>Rampbonotus appendiculata</i>	1
<i>Rosselliana incompta</i>	2
<i>Schizobrachiella sanguinea</i>	3
<i>Schizomavella tenella</i>	2
<i>Schizoporella longirostris</i> ?	11
<i>Schizotheca fissa</i> ?	1
<i>Tremopora radiaifera</i>	1
<i>Tubulipora pluma</i>	2
<i>Umbonula macrocheila</i>	14
<i>Umbonula monoceros</i>	13

The bryozoan fauna collected from the red **algal limestone** yielded only 115 specimens but they represent a diverse fauna of 30 species/27 genera. However, all species are known only by a few specimens. Most numerous are *Umbonula*, *Onychocella* and *Schizoporella*. The huge majority of the specimens belong to the membraniporiform colony type (93.9%) complemented with some celleporiform colonies (6.1%).

Only 20 bryozoan specimens were found associated with the studied very limited **coral colonies**, but they represent 10 species/10 genera. Dominant genera can not be assigned. Just like in the algal limestone of the same

locality, the prevalent colony morphotype is the membraniporiform (85%), while the others belong to the celleporiforms (15%).

Visegrád, Fekete-hegy, coral colonies	specimen number
<i>Annectocyma major</i>	1
<i>Calloporina decorata</i>	1
<i>Celleporina castazi</i>	3
<i>Cheiloparina campanulata</i> ?	1
<i>Cribrilaria innominata</i>	1
<i>Disporella hispida</i>	3
<i>Ellisina gautieri</i>	2
<i>Escharella reussiana</i> ?	1
<i>Onychocella angulosa</i>	5
<i>Umbonula macrocheila</i> ?	2

Szokolya-2 borehole — The Miocene volcanic activity of the Börzsöny Mts was recently summarised by KARÁ-TSON et al. (2000). The volcanic formations are overlain by Lower Badenian sedimentary rocks along the western and southern margin of the mountains, including the sandy marls and marly sandstones at Szokolya. The rich mollusc fauna of the outcrops near Szokolya was studied in detail by BÁLDI (1960a, b). The borehole Szokolya-2 was deepened in 1971, and its simplified sequence can be seen in DULAI (2001). The marls and fine sandstones contain lots of gastropods and bivalves, accompanied by chitons, foraminifers, decapods, fish otoliths and bryozoans. Spora-pollen, nannoplankton, foraminifers and molluscs of Szokolya-2 borehole were studied by BÁLDI-BEKE et al. (1980).

Twenty samples from Szokolya-2 borehole (at depths between 43.1 m and 100 m) yielded 426 bryozoan specimens belonging to 16 species/14 genera. Some of them are very common (mainly *Reussirella*, but also *Crisia*, *Hornera*, *Cellaria*, *Cupuladria*), while the others are not numerous. The

most frequent colony morphotype is lunulitiform (58.9%) but cellariiforms (22.6%) and vinculariiforms (15.7%) are also common. Membraniporiforms (1.4%) and reteporiforms (1.4%) are rare.

Szokolya-2 borehole	specimen number
<i>Calpensia nobilis</i> ?	1
<i>Canda rectangularata</i>	1
<i>Cellaria fistulosa</i>	42
<i>Cellaria salicornioides</i>	1
<i>Cellaria sinuosa</i> ?	3
<i>Crisia hoernesii</i>	50
<i>Cupuladria rindobonensis</i>	33
<i>Escharoides coccinea</i>	1
<i>Hornera frondiculata</i>	47
<i>Lunulites androsaces</i>	1
<i>Pleuronea pertusa</i>	6
<i>Polyascosocia coronopus</i>	12
<i>Reteporella cellulosa</i>	6
<i>Reussirella haidingeri</i>	217
<i>Steginooporella</i> ? sp.	4
<i>Ybvelosocia typica</i>	1

Nagymaros, Törökmező — The geology of the Nagymaros area was first studied in detail by BÖCKH (1899) and later by STRAUZ (1924). A group of small exposures described shortly by MÜLLER (1984) and MIHÁLY (1986) are situated near to the hotel "Törökmező". Marly tuffaceous limestones crop out in a road cut, with the numerous larger foraminifers *Heterostegina giganteaformis* characteristic for the Lower Badenian deposits (MÜLLER 1984). In a small quarry 500 m north of the former one, the exposed limestone contains a diverse coral fauna. This fine-grained limestone also contains poorly preserved decapods and some bryozoans. One sample was collected for bryozoan studies from the Lower Badenian algal limestone.

This sample yielded only 70 specimens belonging to 17 species/14 genera. *Entalophoroecia*, *Sertella* and *Crisia* are relatively frequent but all the other genera are very rare. Four colony morphotypes are nearly equally numerous: cellariiforms (25.7%), vinculariiforms (25.7%), reteporiforms

(22.9%) and membraniporiforms (17.2%). Celleporiforms (7.1%) and adeoniforms (1.4%) are insignificant.

Nagymaros, Törökmező (sample size: 500 g)	specimen number
<i>Annectocyma major</i>	1
<i>Bobiesipora fasciculata</i>	2
<i>Buffonellodes incisa</i>	1
Celleporiforms indet.	5
<i>Crisia denticulata</i> ?	14
<i>Disporella hispida</i>	1
<i>Entalophoroecia pulchella</i>	18
<i>Escharella reussiana</i> ?	1
<i>Margaretta cereoides</i>	4
<i>Patinella prolifera</i>	1
<i>Plagioecia patina</i> ?	1
<i>Reteporella cellulosa</i>	16
<i>Schizomavella tenella</i>	1
<i>Schizotheca fissa</i>	1
<i>Tubulipora pluma</i>	1
<i>Umbonula macrocheila</i>	1
<i>Umbonula monoceros</i>	1

Zebegény — The geology of the Zebegény area was studied by STRAUZ (1924). A huge, active quarry north of Zebegény (Plate I: 1), called Bakókút or Bószob (DULAI 2007a). An 18–20 m thick, red algal marly limestone is

intercalated with two 2–2 m thick hard layers. This hard micritic calcarenite is full of moulds of small, branching corals (*Porites*, *Tarbellastraea*) with *Lithophaga* moulds. However, the bulk of the quarry was built not by corals,

but by coralline red algae. The microfacies of the Zebegény limestones were studied by RANDAZZO et al. (1999), and bioclastic grainstone, packstone and wackestone, as well as algal rudstone/floatstone facies were distinguished. The hard limestone contains some decapods within the coral colonies indicating a water depth of less than 10 m (MÜLLER 1984). Bivalves (*Pecten*, *Spondylus*, *Pholadomya*) and echinoids (*Chyaster*) are frequent in the algal limestone, while brachiopods are rather rare (DULAI 2005; BITNER & DULAI 2004). Vertebrates are represented by shark teeth and *Sirenia* ribs. Three samples were collected from the Lower Badenian algal limestone for bryozoan studies (Figure 7).

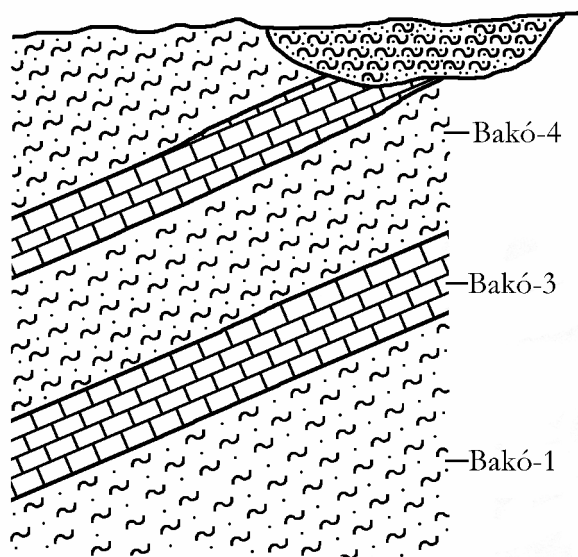


Figure 7 — Simplified section of Zebegény quarry, with estimated position of the studied samples.

Zebegény, Bakó-1 (sample size: 500 g)	specimen number
<i>Annectocyma indistincta</i> ?	2
<i>Aplousina bobiesi</i>	6
<i>Buffonellodes incisa</i>	2
<i>Calpensia nobilis</i>	5
<i>Cellaria salicornioides</i>	74
Celleporiforms indet.	18
<i>Cribrilaria innominata</i>	3
<i>Crisia denticulata</i>	230
<i>Crisia eburnea</i>	660
<i>Disporella hispida</i>	2
<i>Entalophoroecia anomala</i>	3
<i>Entalophoroecia pulchella</i>	25
<i>Figularia haueri</i>	2
<i>Fron dipora verrucosa</i>	4
<i>Hornera frondiculata</i>	92
<i>Margaretta cereoides</i>	60
<i>Metrarabdotos maleckii</i>	87
<i>Onychoecia angulosa</i>	1
<i>Patinella prolifera</i>	3
<i>Pleuronea pertusa</i>	1
<i>Polyascosoecia coronopus</i>	14
<i>Puellina gigantea</i>	2
<i>Reptomulticava parviporosa</i> ?	8
<i>Reteporella beaniana</i> ?	8
<i>Reteporella cellulosa</i>	52
<i>Schizobrachiella sanguinea</i>	1
<i>Scrupocellaria elliptica</i>	10
<i>Tervia irregularis</i>	22
<i>Tubulipora dimidiata</i>	1
<i>Tubulipora pluma</i> ?	4
<i>Ybselosocia typica</i>	4

Bakó-1 sample yielded 1406 specimens belonging to 31 species/25 genera. *Crisia* is very frequent, but *Hornera*, *Metrarabdotos* and *Cellaria* are also numerous. The dominant colony morphotype is cellariiform (73.5%). Vinculariiforms are also relatively frequent (11.8%), while all the other morphotypes are rare: adeoniforms (6.2%), reteporiforms (4.3%), membraniporiforms (2.4%) and celleporiforms (1.8%).

Bakó-3 sample yielded 4143 specimens belonging to 42 species/33 genera. The dominant genus is *Crisia* (mainly *C. denticulata*), but *Cellaria*, *Tervia*, *Hornera* and *Scrupocellaria* are also frequent. More than four-fifth of the specimens belongs to the cellariiform morphotype (81.6%) and vinculariiforms are also relatively numerous (11.3%). All the other morphotypes are rare: reteporiforms (3%), membraniporiforms (1.9%), adeoniforms (1.8%), celleporiforms (0.3%) and cate nicelliforms (0.1%).

Zebegény, Bakó-3 (sample size: 500 g)	specimen number
<i>Annectocyma major</i> ?	20
<i>Buffonellaria divergens</i>	1
<i>Buffonellodes incisa</i>	5
<i>Canda rectangulata</i>	60
<i>Catencella elegans</i>	2
<i>Cellaria salicornioides</i>	262
Celleporiforms indet.	2
<i>Cribrilaria innominata</i>	1
<i>Crisia denticulata</i>	2395
<i>Crisia eburnea</i>	604
<i>Crisia boernesii</i>	3
<i>Entalophoroecia gracilis</i> ?	45
<i>Entalophoroecia pulchella</i>	29
<i>Escharoides coccinea</i>	1
<i>Fron dipora verrucosa</i>	1
<i>Hincksipora porosa</i> ?	1
<i>Hornera frondiculata</i>	109
<i>Idmidronea atlantica</i>	22
<i>Margaretta cereoides</i>	14
<i>Metrarabdotos maleckii</i>	77
<i>Onychoecia angulosa</i>	10
<i>Patinella radiata</i>	3
<i>Patinella prolifera</i>	3
<i>Plagioecia rotula</i> ?	1
<i>Pleuronea pertusa</i>	13
<i>Polyascosoecia coronopus</i>	47
<i>Reptomulticava parviporosa</i> ?	9
<i>Reteporella beaniana</i> ?	39
<i>Reteporella cellulosa</i>	84
<i>Schizomavella auriculata</i>	1
<i>Schizomavella tenella</i>	1
<i>Schizoporella longirostris</i>	2
<i>Schizotheca fissus</i>	9
<i>Scrupocellaria elliptica</i>	105
<i>Tervia irregularis</i> Plate VI: 5	120
<i>Tremogasterina areolata</i>	2
<i>Trypostega rugulosa</i>	1
<i>Tubulipora dimidiata</i>	5
<i>Tubulipora partschi</i>	1
<i>Tubulipora</i> sp. 2	4
<i>Umbonula monoceros</i>	8
<i>Ybselosocia typica</i>	21

Bakó-4 sample yielded 941 specimens belonging to 44 species/38 genera. With much less specimens, this fauna is however more diverse than the Bakó-1 and Bakó-3 samples. The prevailing genus is *Crisia*, but *Scrupocellaria*, *Margaretta* and *Entalophoroecia* are also relatively frequent. The dominant morphotype is cellariiform (68.9%) but not so prominent than in the earlier Zebegény samples.

However, aside from vinculariiforms (13.7%) membrani-poriforms are also frequent (11.8%), while reteporiforms

(3.7%), celleporiforms (1.4%) and adeoniforms (0.5%) are quite rare.

Zebegény, Bakó-4 (sample size: 500 g)	specimen number
<i>Annectocyma indistincta</i> ?	1
<i>Aplousina bobiesi</i>	4
<i>Buffonellaria divergens</i>	3
<i>Buffonellodes incisa</i>	6
<i>Calpensia nobilis</i>	5
<i>Canda rectangulata</i>	20
<i>Cellaria salicornioides</i>	2
Celleporiforms indet.	9
<i>Coleopora insignis</i> ?	4
<i>Copidozoum tenuirostre</i>	1
<i>Cribrilaria innominata</i>	3
<i>Crisia denticulata</i>	320
<i>Crisia eburnea</i>	224
<i>Entalophorecia pulchella</i> Plate III: 6	45
<i>Hippopleurifera semicristata</i>	1
<i>Hippoporella bicornis</i>	2
<i>Hornera frondiculata</i>	7
<i>Iodictyum rubeschi</i> ?	12
<i>Margaretta cereoides</i> Plate IV: 3	49
<i>Metrarabdotos maleckii</i>	5
<i>Microoporella ciliata</i>	1

<i>Onychocella angulosa</i>	34
<i>Patinella goldfussi</i>	7
<i>Patinella prolifera</i>	4
<i>Plagioecia patina</i>	1
<i>Pleuronea pertusa</i>	11
<i>Polyascosocia coronopus</i>	1
<i>Puellina gigantea</i>	1
<i>Reptomulicava parviporosa</i> ?	4
<i>Reteoporella beaniana</i> ?	23
<i>Schizobrachiella sanguinea</i>	4
<i>Schizomavella auriculata</i>	2
<i>Schizomavella tenella</i>	2
<i>Schizoporella longirostris</i>	4
<i>Schizotheca fissa</i>	2
<i>Scrupocellaria elliptica</i>	53
<i>Smitina platystoma</i>	3
<i>Steginoporella reussi</i>	4
<i>Steginoporella tuberculata margaritae</i>	1
<i>Ternia irregularis</i>	35
<i>Tubulipora pluma</i>	4
<i>Tubulipora partschi</i>	1
<i>Umbonula monoceros</i>	6
<i>Ysbelosocia typica</i>	10

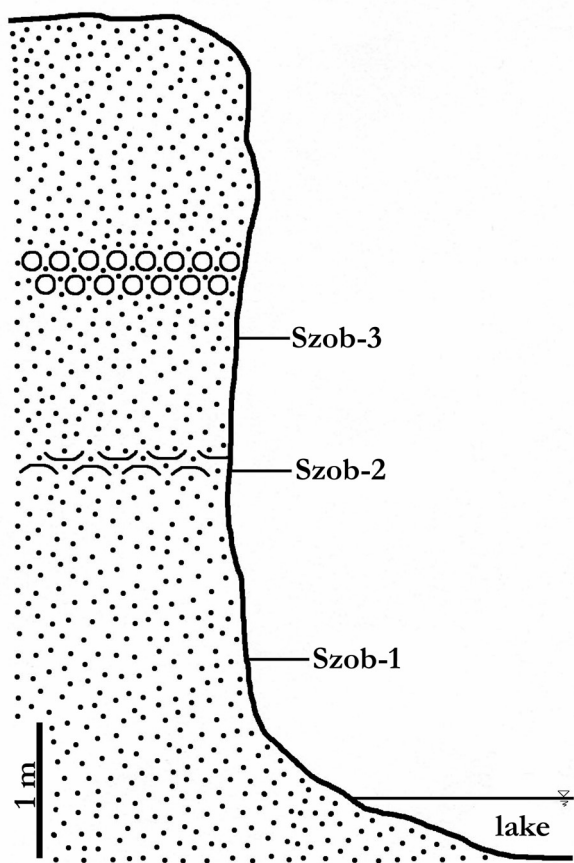


Figure 8 — Simplified section of Szob locality, with estimated position of the studied samples.

Szob — The classical section is situated on the SW slopes of the Börzsöny Mts. The old sandpit is at NW of Szob on the left bank of the Ipoly River, above the small Damásd creek (Plate I: 3). Owing to their rich mollusc fauna, the fossils of the yellowish-grey sand were already studied during the mid-19th century (see details in DULAI 2007b).

After several smaller papers, the mollusc fauna was studied monographically by CSEPREGHY–MEZNERICS (1956). The taxonomic composition and the palaeoecological features of the bivalve fauna were given by DULAI (1996). Drilling predation by muricid and naticid gastropods was frequent (DUDÁS 1999). Fish otoliths represent 19 species/17 genera with dominant shallow-water species (BOSNAKOFF 2001). Rare decapods were mentioned by MÜLLER (1984). On the basis of nannoplankton studies, NAGYMAROSY (1980) identified the upper part of the Early Badenian at this locality. Regarding the bryozoans, only lunulitiform species were previously described by DULAI (1995). The lowest layer is a grey and yellow sandstone (about 6 m thick) with sporadic molluscs. It is covered by a 0.1 m thick lumachella-like sand and by a 0.5 m thick brown tuffaceous silt. Three samples were collected for bryozoan studies from the Lower Badenian argillaceous sand (Figure 8).

Szob-1 sample yielded only 54 specimens belonging to 4 species/3 genera. *Reussirella* and *Cupuladria* are frequent, while *Crisia* is very rare. The absolutely dominant colony morphotype is lunulitiform (96.3%), while cellariiforms are only accessorial elements (3.7%).

Szob-1 (sample size: 500 g)	specimen number
<i>Crisia denticulata</i>	1
<i>Crisia haueri</i>	1
<i>Cupuladria vindobonensis</i>	20
<i>Reussirella baidingeri</i>	32

Szob-2 (sample size: 500 g)	specimen number
<i>Celleporaria foraminosa</i>	37
<i>Crisia denticulata</i>	3
<i>Crisia haueri</i>	15
<i>Cupuladria vindobonensis</i>	180
<i>Idmidronea atlantica</i>	1
<i>Reussirella baidingeri</i>	143
<i>Schizostomella grinzgensis</i>	5

Szob-2 sample yielded 384 specimens belonging to 7 species/6 genera. Outside of the dominant lunulitiform genera (*Cupuladria*, *Reussirella*) only *Celleporaria* is relatively frequent. Lunulitiforms are dominant (84.1%), celleporiforms (9.6%) and cellariiforms (4.7%) are moderately frequent, while adeoniforms (1.3%) and vinculariiforms (0.3%) are very rare.

Szob-3 sample yielded 32 specimens belonging to 6 species/5 genera. None of them are numerous but *Cupuladria* and *Celleporaria* are relatively frequent. Lunu-

litiform (43.8%) is the dominant type among the colonial forms, but all the other three are also numerous: celleporiforms (25%), adeoniforms (18.7%) and cellariiforms (12.5%).

Szob-3 (sample size: 500 g)	specimen number
<i>Celleporaria foraminosa</i>	8
<i>Crisia denticulata</i>	1
<i>Crisia baueri</i>	3
<i>Cupuladria vindobonensis</i>	11
<i>Reussirella haidingeri</i>	3
<i>Schizostomella grinzingeris</i>	6

Kemence — This village is situated in the north-western part of the Börzsöny Mts and its localities represent the Lower Badenian sediments deposited after the volcanic activity. This region is famous for its echinoderm fauna, as Kemence was one of the most important localities of VADÁSZ (1915) Echinoidea monograph. The geology of the wider area was studied by MAJER (1915) and later in an unpublished MSc thesis by DON (1980). MIHÁLY (1983) described crinoid stalk fragments from Kemence. Additionally to the rich Museum material, our samples for bryozoan studies are from the north-eastern side of the Kálvária Hill, and from

the cellar row of the village (both biocalcarenite).

The palaeontological collection of the Hungarian Natural History Museum contains a very rich bryozoan fauna from Kemence (but mostly without more exact locality indication). The 487 specimens belong to 75 species/60 genera. Generally, all species are represented by only a few specimens, but *Smitina*, *Adeonella* and *Turbicellepora* are relatively numerous. The dominant colony morphotypes are membraniporiforms (36.3%) and adeoniforms (26.9%). Vinculariiforms (16%) and celleporiforms (14.8%) are moderately frequent, while reteporiforms (3.7%) and cellariiforms (2.3%) are quite rare.

Kemence, Museum material	specimen number
<i>Adeonella polytomella</i>	49
<i>Annectocyma indistincta</i> ?	2
<i>Annectocyma major</i>	2
<i>Aplousina bobiesi</i>	5
<i>Biflustra savarti</i>	2
<i>Bobiesipora fasciculata</i>	2
<i>Buffonellaria divergens</i>	3
<i>Buffonellodes incisa</i>	9
<i>Callopora fenestrata</i>	3
<i>Calloporina decorata</i>	3
<i>Calpensia nobilis</i>	1
<i>Cellaria salicornioides</i>	6
<i>Celleporaria cerioporoides</i>	1
<i>Celleporaria palmata</i>	31
<i>Cribellopora latigastrea</i>	2
<i>Cribrilaria innominata</i>	10
<i>Cribrilaria kollmanni</i>	1
<i>Crisidmonea foraminosa</i>	19
<i>Disporella hispida</i>	11
<i>Ellisina</i> cf. <i>antarctica</i>	7
<i>Entalophorecia clavula</i>	1
<i>Entalophorecia pulchella</i>	3
<i>Escharella tenera</i>	1
<i>Escharina polyomma</i>	5
<i>Escharoides megalota</i>	2
<i>Figularia manzonii</i>	2
<i>Fron dipora verrucosa</i>	1
<i>Herentia hyndmannii</i>	1
<i>Hippoporella bicornis</i>	1
<i>Hippoporella pauper</i>	11
<i>Hippoporina rarepunctata</i>	2
<i>Hornera frondiculata</i>	14
<i>Hornera subannulata</i>	2
<i>Idmidronea atlantica</i>	15
<i>Iodictyum rubeschi</i>	6
<i>Lacerna fuchsii</i>	3
<i>Margaretta cereoides</i>	5

The **Kemence, cellar row, upper sample** yielded 11.541 specimens belonging to 73 species/53 genera. The most frequent bryozoans are *Crisia*, *Cellaria*, *Idmidronea*, *Hornera* and *Reteporella*. The dominant colonial morphotype

<i>Membraniporella ungeri</i>	2
<i>Metrarabdotos maleckii</i>	13
<i>Micropora papyracea</i>	10
<i>Microporella ciliata</i>	4
<i>Microporella inamoena</i>	2
<i>Onychoella angulosa</i>	7
<i>Patinella prolifera</i>	4
<i>Plagioecia platydiscus</i>	2
<i>Plagioecia rotula</i> ?	2
<i>Pleuronea pertusa</i>	1
<i>Polyascosoecia coronopus</i>	15
<i>Pseudofron dipora davidi</i>	1
<i>Puellina gigantea</i>	3
<i>Puellina kollmanni</i>	2
<i>Ramphonotus appendiculata</i>	4
<i>Reteporella cellulosa</i>	12
<i>Rosseliana incompta</i>	1
<i>Schizobrachiella sanguinea</i>	1
<i>Schizomavella auriculata</i>	7
<i>Schizomavella tenella</i>	3
<i>Schizoporella geminipora</i>	4
<i>Schizoporella longirostris</i>	8
<i>Schizoporella tetragona</i>	2
<i>Schizotheca fissa</i>	1
<i>Smitina cervicornis</i>	63
<i>Steginoporella cucullata</i>	4
<i>Stomatopora subdivaricata</i>	1
<i>Ternia irregularis</i>	2
<i>Tremogasterina areolata</i>	4
<i>Trypostega rugulosa</i>	4
<i>Tubulipora flabellaris</i> ?	1
<i>Tubulipora partschi</i>	1
<i>Tubulipora pluma</i>	1
<i>Turbicellepora coronopus</i>	40
<i>Umbonula austriensis</i> ?	1
<i>Umbonula macrocheila</i>	1
<i>Umbonula monoceros</i>	8
<i>Vibracella trapezoidea</i>	1

is cellariiform (61.5%) but vinculariiform species are also frequent (24.7%). Reteporiforms (6.7%) and adeoniforms (4.3%) are moderately frequent, while celleporiforms (1.9%) and membraniporiforms (0.9%) are not significant.

Kemence, cellar row, upper sample (sample size: 500 g)	specimen number
<i>Adeonella polystomella</i> Plate II: 1	281
<i>Annectocyma indistincta</i> ?	1
<i>Annectocyma major</i>	1
<i>Aplousina bobiesi</i>	1
<i>Biflustra savarti</i>	2
<i>Bobiesipora fasciculata</i>	30
<i>Buffonellaria divergens</i>	6
<i>Callopora fenestrata</i>	1
<i>Calloporina decorata</i>	1
<i>Canda rectangulata</i> Plate II: 5	290
<i>Cellaria fistulosa</i> Plate II: 6	613
<i>Cellaria salicornioides</i>	2096
<i>Celleporaria cerioporoides</i>	20
<i>Celleporaria palmata</i>	9
<i>Celleporina costazi</i>	14
Celleporiforms indet.	135
<i>Cribellopora latigastra</i>	1
<i>Cribrilaria inominata</i>	3
<i>Cribrilina messiniensis</i>	1
<i>Crisia denticulata</i> Plate III: 1	3020
<i>Crisia eburnea</i> Plate III: 2	838
<i>Crisia baueri</i>	90
<i>Crisia boernesii</i>	178
<i>Crisia lecontrei</i>	18
<i>Crisidmonea foraminosa</i>	17
<i>Disporella hispida</i>	12
<i>Entalophoroecia anomala</i>	37
<i>Entalophoroecia fasciculifera</i>	14
<i>Entalophoroecia gracilis</i> ?	12
<i>Entalophoroecia pulchella</i>	55
<i>Entalophoroecia robusta</i> ?	8
<i>Escharina polyomma</i>	21
<i>Escharoides coccinea</i>	2
<i>Fron dipora verrucosa</i> ?	6
<i>Hagiosynodus latus</i>	2
<i>Heteropora</i> sp.	1
<i>Hornera frondiculata</i>	650
<i>Hornera lichenoides</i> ?	8
<i>Hornera subannulata</i>	257
<i>Idmidronea atlantica</i>	907
<i>Idmidronea disticha</i>	17
<i>Iodictyum rubeschi</i>	84
<i>Lagenipora lepralioides</i>	1
<i>Margaretta cereoides</i>	55
<i>Mesenteripora meandrina</i>	29
<i>Metrarabdotos maleckii</i>	23
<i>Micropora parvicella</i>	1
<i>Onychocella angulosa</i>	9
<i>Patinella prolifera</i>	1
<i>Pleuronea pertusa</i>	32
<i>Polyascosocia coronopus</i>	66
<i>Reptomulticava parviporosa</i> ?	2
<i>Reteporella beaniana</i> Plate V: 2	281
<i>Reteporella cellulosa</i>	407
<i>Rosseliana incompta</i>	7
<i>Schizomavella tenella</i>	1
<i>Schizoporella geminipora</i>	11
<i>Schizotheca fissa</i>	2
<i>Scrupocellaria elliptica</i>	194
<i>Smittina cervicornis</i> Plate VI: 3	117
<i>Steginoporella cucullata</i>	32
<i>Steginoporella intermedia</i>	1
<i>Tervia irregularis</i>	417
<i>Tremogasterina areolata</i>	1
<i>Tremopora radificera</i>	2
<i>Trochilopora beyrichi</i>	1
<i>Tubulipora dimidiata</i>	1
<i>Tubulipora partschi</i>	1
<i>Turbicellepora canaliculata</i> ?	8
<i>Turbicellepora coronopus</i>	25
<i>Umbonula macrocheila</i>	20
<i>Vibracella trapezoidea</i>	7
<i>Ybselosocia typica</i>	27

Kemence, cellar row, lower sample (sample size: 500 g)	specimen number
<i>Adeonella polystomella</i>	41
<i>Annectocyma indistincta</i> ?	3
<i>Annectocyma major</i>	4
<i>Bobiesipora fasciculata</i>	1
<i>Buffonellaria divergens</i>	3
<i>Calloporina decorata</i>	1
<i>Canda rectangulata</i>	39
<i>Cellaria fistulosa</i>	168
<i>Cellaria salicornioides</i>	729
<i>Celleporaria cerioporoides</i>	5
<i>Celleporaria palmata</i>	6
<i>Celleporina costazi</i>	16
Celleporiforms indet.	20
<i>Cribellopora latigastra</i>	1
<i>Cribrilaria rarecostata</i>	1
<i>Crisia denticulata</i>	503
<i>Crisia eburnea</i>	567
<i>Crisia baueri</i>	21
<i>Crisia boernesii</i>	69
<i>Crisia lecontrei</i>	6
<i>Crisidmonea foraminosa</i>	12
<i>Disporella hispida</i> ?	4
<i>Emballotheca longidens</i>	1
<i>Entalophoroecia anomala</i>	6
<i>Entalophoroecia fasciculifera</i>	11
<i>Entalophoroecia gracilis</i> ?	11
<i>Entalophoroecia pulchella</i>	36
<i>Escharina polyomma</i>	8
<i>Escharina vulgaris</i>	1
<i>Fenestulina barmelini</i>	1
<i>Fron dipora verrucosa</i>	9
<i>Herentia byndmannii</i>	1
<i>Heteropora</i> sp.	19
<i>Hippoporella pauper</i>	1
<i>Hornera frondiculata</i>	366
<i>Hornera lichenoides</i> ?	14
<i>Hornera subannulata</i>	84
<i>Idmidronea atlantica</i> Plate IV: 1	585
<i>Idmidronea disticha</i>	5
<i>Iodictyum rubeschi</i>	22
<i>Margaretta cereoides</i>	7
<i>Mesenteripora meandrina</i>	19
<i>Metrarabdotos maleckii</i>	13
<i>Onychocella angulosa</i>	8
<i>Patinella prolifera</i>	3
<i>Phylactella uniserialis</i>	1
<i>Pleuronea pertusa</i>	29
<i>Polyascosocia coronopus</i>	104
<i>Pseudofron dipora davidi</i>	1
<i>Reptomulticava parviporosa</i> ?	1
<i>Reteporella beaniana</i>	60
<i>Reteporella cellulosa</i>	90
<i>Schizoporella geminipora</i>	5
<i>Schizoporella</i> sp.	1
<i>Scrupocellaria bertholetti</i> ?	4
<i>Scrupocellaria elliptica</i>	58
<i>Scrupocellaria</i> sp.	4
<i>Smittina cervicornis</i>	31
<i>Steginoporella cucullata</i>	15
<i>Steginoporella intermedia</i>	4
<i>Tervia irregularis</i>	187
<i>Tremogasterina areolata</i>	1
<i>Tremopora radificera</i>	1
<i>Trochilopora beyrichi</i>	1
<i>Tubulipora pluma</i> ?	1
<i>Turbicellepora coronopus</i>	23
<i>Umbonula macrocheila</i>	5
<i>Vibracella trapezoidea</i>	1
<i>Ybselosocia typica</i>	29

The *Kemence, cellar row, lower sample* yielded 4108 specimens belonging to 69 species/49 genera. The most common genera are *Crisia*, *Cellaria*, *Idmidronea* and *Hornera*. The

dominant morphotype is cellariiform (52%) but vinculariiform species are also common (37.6%). All the other colony morphotypes are rare: reteporiforms (4.2%), adeoniforms (3%), celleporiforms (1.7%) and membraniporiforms (1.5%).

The **Kemence, Kálvária-hegy** (Plate I: 2) sample is from the north-eastern side of the Kálvária Hill, from a small road-

cut. The 6746 specimens belong to 73 species/56 genera. The most frequent genera are *Crisia*, *Entalophoroecia*, *Reteporella* and *Margaretta*. The dominant morphotype is cellariiform (52.5%) but vinculariiforms (24.3%) and reteporiforms (17.2%) are also common. The membraniporiforms (3.6%), celleporiforms (2.1%) and adeoniforms (0.3%) are quite rare.

Kemence, Kálvária-hegy (sample size: 500 g)	specimen number
<i>Aetea sica</i>	1
<i>Annectocyma major</i> ?	21
<i>Aplousina bobiesi</i>	8
<i>Biflustra savarti</i>	1
<i>Bobiesipora fasciculata</i>	8
<i>Buffonellaria divergens</i>	4
<i>Buffonellodes incisa</i>	23
<i>Canda rectangulata</i>	287
<i>Cellaria salicornioides</i> Plate II: 7	250
<i>Celleporaria cerioporooides</i>	1
<i>Celleporaria palmata</i>	21
<i>Celleporina costazi</i>	80
<i>Celleporina minuscula</i>	1
<i>Ceriopora tumulifera</i> ?	1
<i>Chorizopora brongniarti</i>	1
<i>Copidozoum tenuirostre</i>	1
<i>Cribrilaria innominata</i>	3
<i>Crisia denticulata</i>	1958
<i>Crisia eburnea</i>	413
<i>Crisi haueri</i>	63
<i>Crisia boernesii</i>	108
<i>Crisidmonea foraminosa</i>	27
<i>Diplosolen obelium</i>	1
<i>Disporella hispida</i>	11
<i>Electra monostachys</i>	1
<i>Entalophoroecia</i> ? <i>clavula</i>	1
<i>Entalophoroecia gracilis</i> ?	95
<i>Entalophoroecia pulchella</i>	1035
<i>Escharella arrecta</i> ?	1
<i>Escharoides megalota</i>	1
<i>Froncipora verrucosa</i>	1
<i>Hemicyclopora collarina</i>	1
<i>Hippopleurifera semicristata</i>	1
<i>Hippoporella bicornis</i>	1
<i>Hippoporella pauper</i>	6

<i>Hippochoa flagellum</i>	1
<i>Hornera frondiculata</i>	27
<i>Todictyum rubeschi</i> ?	58
<i>Margaretta cereoides</i>	747
<i>Metrarabdotos maleckii</i>	5
<i>Micropora parvicella</i>	1
<i>Microporella ciliata</i>	4
<i>Microporella inamoena</i>	1
<i>Mollia patellaria</i>	1
<i>Oncosoecia biloba</i>	61
<i>Onychoecia angulosa</i>	12
<i>Patinella goldfussi</i>	1
<i>Patinella prolifera</i>	13
<i>Patinella radiata</i>	32
<i>Plagioecia rotula</i> ?	1
<i>Polyasosoecia coronopus</i>	102
<i>Porella cheilopora</i>	5
<i>Puellina gigantea</i>	7
<i>Reteporella beaniana</i> ?	232
<i>Reteporella cellulosa</i>	873
<i>Rhambphonotus appendiculata</i>	1
<i>Reptomulticava parviporosa</i> ?	11
<i>Schizobrachiella sanguinea</i>	3
<i>Schizomavella auriculata</i>	15
<i>Schizomavella tenella</i>	2
<i>Schizoporella longirostris</i>	9
<i>Schizoporella tetragona</i>	6
<i>Schizotheca fissa</i>	1
<i>Smittina cervicornis</i>	1
<i>Steginoeporella cucullata</i>	3
<i>Stereochmella buski</i>	2
<i>Stomatopora subdivaricata</i>	8
<i>Tubulipora dimidiata</i>	1
<i>Tubulipora partschi</i>	6
<i>Tubulipora pluma</i>	11
<i>Tubulipora plumosa</i> ?	1
<i>Turbicellepora coronopus</i>	27
<i>Umbonula macrocheila</i>	17

Mátraszőlős — The geology of the Cserhát area was summarized by NOSZKY (1940) and more recently by HÁMOR (1985). VITÁLIS (1915) described the mollusc, echinoid and vertebrate fauna of the limestone quarry at Mátraszőlős. STRAUZ (1928) mentioned also bryozoans along echinoids and molluscs from the “lithothamnium” limestone: from Rednek-hegy he listed the presence of *Scrupocellaria*, *Cellaria*, *Porella* and *Idmonea*. BOGSCH (1943a) studied the geology of the Mátraszőlős area, and he also mentioned bryozoans without identification from “Nagy Rednek-hegy”. The rich mollusc fauna of the Eastern Cserhát (including Mátraszőlős) was studied by CSEPREGHY–MEZNERICS (1954). More recently, the diverse Middle Miocene vertebrate and freshwater mollusc fauna was described from localities near to the Rákóczi chapel at Mátraszőlős (GÁL et al. 1998–1999, 2000). The Lower Badenian Leitha limestone (Sámsonháza Formation) crops out in an abandoned quarry at the western border of the village. The biocalcarenic limestone is rich in marine fossils (gastropods, bivalves, echinoids, bryozoans, shark teeth), but sometimes contains also transported terrest-

rial vertebrates (e.g. deer and rhinoceros teeth). Four samples were collected from the quarry for bryozoan studies (Figure 9).

Mátraszőlős, Mátra-1 (sample size: 500 g)	specimen number
<i>Cellaria fistulosa</i>	34
<i>Cellaria salicornioides</i>	95
<i>Crisia denticulata</i>	39
<i>Crisia eburnea</i>	34
<i>Crisia boernesii</i>	1
<i>Hornera frondiculata</i>	7
<i>Idmidronea atlantica</i>	15
<i>Scrupocellaria elliptica</i>	1
<i>Smittina cervicornis</i>	27
<i>Tervia irregularis</i>	6
<i>Turbicellepora coronopus</i>	1

Mátra-1 sample yielded 260 specimens belonging to 11 species/8 genera. The most frequent genera are *Cellaria* and *Crisia*. The prominently dominant colony morphotype is cellariiform (78.5%). Vinculariiforms (10.8%) and adeoniforms (10.3%) are moderately frequent, while celleporiforms are not significant (0.4%).

Mátraszőlős, Mátra-2 (sample size: 500 g)	specimen number
<i>Adeonella polystomella</i>	6
<i>Annectocyma indistincta</i> ?	1
<i>Annectocyma major</i> ?	1
<i>Buffonellodes incisa</i>	3
<i>Cellaria fistulosa</i>	91
<i>Cellaria salicornioides</i>	128
<i>Celleporaria foraminosa</i>	4
<i>Celleporaria palmata</i>	2
<i>Celleporina costazi</i>	2
Celleporiforms indet.	21
<i>Crisia denticulata</i>	328
<i>Crisia eburnea</i>	154
<i>Crisia baueri</i>	76
<i>Crisidmonea foraminosa</i>	2
<i>Disporella bispida</i>	1
<i>Electra monostachys</i>	1
<i>Entalophoroecia pulchella</i>	37
<i>Hippoporella pauper</i>	1
<i>Hornera frondiculata</i>	108

<i>Idmidronea atlantica</i>	84
<i>Iodictyum rubeschi</i>	1
<i>Margaretta cereoides</i>	1
<i>Metrarabdotos maleckii</i>	7
<i>Multigalea</i> ? sp.	1
<i>Onychoecia angulosa</i>	8
<i>Palmiskeneia skenei</i> ?	1
<i>Patinella goldfussi</i>	7
<i>Pleuronea pertusa</i>	12
<i>Polyascosoecia coronopus</i>	12
<i>Reteporella cellulosa</i>	70
<i>Reussirella haidingeri</i>	1
<i>Schizomavella auriculata</i> ?	1
<i>Schizoporella geminipora</i>	1
<i>Schizoporella tetragona</i>	2
<i>Scrupocellaria elliptica</i>	46
<i>Smittina cervicornis</i>	16
<i>Smittina</i> sp.	1
<i>Tervia irregularis</i>	37
<i>Tubulipora partschi</i>	6
<i>Ybselosocia typica</i>	21

Mátraszőlős, Mátra-3 (sample size: 500 g)	specimen number
<i>Adeonella polystomella</i>	1
<i>Canda rectangularata</i>	10
<i>Cellaria fistulosa</i>	36
<i>Cellaria salicornioides</i>	281
<i>Celleporaria palmata</i>	1
<i>Celleporina costazi</i> ?	1
Celleporiforms indet.	11
<i>Crisia denticulata</i>	362
<i>Crisia eburnea</i>	97
<i>Crisia boernesi</i>	31
<i>Crisidmonea foraminosa</i>	4
<i>Entalophoroecia anomala</i>	6
<i>Entalophoroecia pulchella</i>	12
<i>Escharina polyomma</i>	3
<i>Fron dipora verrucosa</i>	2

<i>Heteropora</i> sp.	1
<i>Hornera frondiculata</i>	34
<i>Hornera subannulata</i>	5
<i>Idmidronea atlantica</i>	34
<i>Iodictyum rubeschi</i>	3
<i>Metrarabdotos maleckii</i>	3
<i>Mesenteripora meandrina</i> ?	1
<i>Pleuronea pertusa</i>	8
<i>Polyascosoecia coronopus</i>	6
<i>Reteporella cellulosa</i>	151
<i>Smittina cervicornis</i>	11
<i>Tervia irregularis</i>	22
<i>Tremogasterina areolata</i>	5
<i>Umbonula macrocheila</i>	1
<i>Vibracella trapezoidea</i>	1
<i>Ybselosocia typica</i>	6

Mátraszőlős, Mátra-4 (sample size: 500 g)	specimen number
<i>Adeonella polystomella</i>	26
<i>Aplousina bobiesi</i>	1
<i>Biflustra savarii</i>	17
<i>Bobiesipora fasciculata</i>	6
<i>Buffonellaria divergens</i>	1
<i>Calpensia nobilis</i>	2
<i>Cellaria fistulosa</i>	132
<i>Cellaria salicornioides</i>	158
<i>Celleporaria cerioporoides</i>	20
<i>Celleporaria palmata</i>	15
<i>Celleporina costazi</i>	17
<i>Celleporina minuscula</i>	2
Celleporiforms indet.	127
<i>Ceriopora tumulifera</i> ?	1
<i>Cribrilaria innominata</i> ?	1
<i>Crisia denticulata</i>	49
<i>Crisia eburnea</i>	35
<i>Crisidmonea foraminosa</i>	12
<i>Entalophoroecia anomala</i>	2
<i>Entalophoroecia pulchella</i>	16
<i>Escharella variolosa</i> ?	2
<i>Escharina polyomma</i>	10
<i>Escharoides coccinea</i>	1
<i>Fron dipora verrucosa</i>	7
<i>Hippopleurifera ampla</i>	1
<i>Hornera frondiculata</i>	102

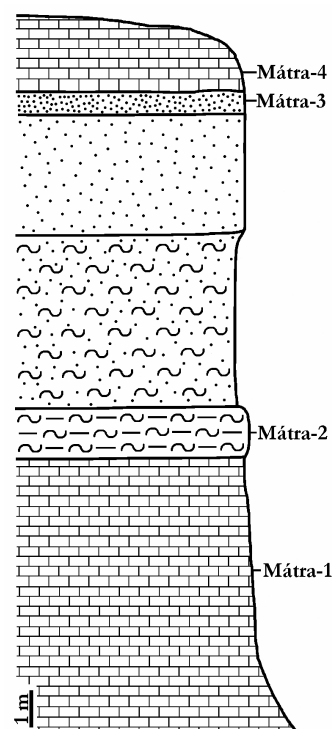
<i>Hornera subannulata</i>	5
<i>Idmidronea atlantica</i>	157
<i>Iodictyum rubeschi</i>	35
<i>Margaretta cereoides</i>	19
<i>Metrarabdotos maleckii</i>	14
<i>Myriapora truncata</i>	9
<i>Omalosecosa ramulosa</i>	3
<i>Onychoecia angulosa</i>	3
<i>Pleuronea pertusa</i>	81
<i>Polyascosoecia coronopus</i>	25
<i>Ramphomotus appendiculata</i>	2
<i>Reptomulticava parviporosa</i> ?	16
<i>Reteporella beaniana</i>	65
<i>Reteporella cellulosa</i>	221
<i>Rhagasostoma stenostoma</i>	1
<i>Schizomavella tenella</i>	1
<i>Schizoporella geminipora</i>	6
<i>Smittina cervicornis</i>	68
<i>Steginoporella cucullata</i>	3
<i>Steginoporella reussi</i>	1
<i>Tervia irregularis</i>	76
<i>Tremogasterina areolata</i>	1
<i>Tetrocyloecia dichotoma</i>	1
<i>Tubulipora pluma</i> ?	4
<i>Turbicellepora coronopus</i> ?	4
<i>Umbonula macrocheila</i>	2
<i>Vibracella trapezoidea</i>	2
<i>Ybselosocia typica</i>	29

Mátra-2 sample yielded 1303 specimens belonging to 40 species/32 genera. The most common bryozoans are *Crisia*, *Cellaria* and *Hornera*. The dominant colonial morphotype is cellariiform (63.2%), but vinculariiforms

are also frequent (24.1%). All the other morphotypes are insignificant: reteporiforms (5.5%), membraniporiforms (2.5%), adeoniforms (2.3%), celleporiforms (2.3%) and lunulitiforms (0.1%).

Mátra-3 sample yielded 1150 specimens belonging to 31 species/25 genera. The most common bryozoans are *Crisia*, *Cellaria* and *Reteporella*. The dominant colonial morphotype is cellariiform (70.2%). Reteporiforms (13.4%) and vinculariiforms (12.5%) are also relatively frequent, while adeoniforms (2.3%), celleporiforms (1.1%) and membraniporiforms (0.5%) are quite rare.

Mátra-4 sample yielded 1617 specimens representing 54 species/45 genera. The most frequent bryozoans are *Cellaria*, *Reteporella* and *Idmidronea*. There is no really dominant colony morphotype, as three different types are similarly numerous: vinculariiforms (33%), cellariiforms (24.3%) and reteporiforms (19.9%). Celleporiforms (12.5%) and adeoniforms (7.5%) are relatively common, while membraniporiforms (2.8%) are rare.



⇒

Figure 9 – Simplified section of Mátraszőlős quarry, with estimated position of the studied samples.

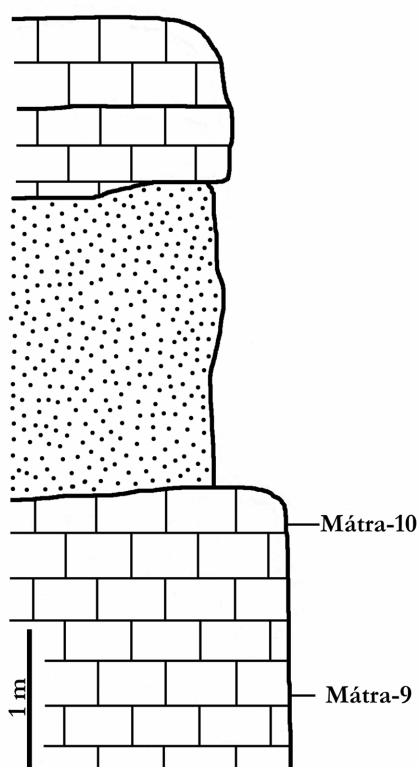


Figure 10 – Simplified section of Sámsonháza, Kis-Zagyva valley locality, with estimated position of the studied samples.

Sámsonháza — A Lower Badenian stratovolcano section and the overlying marine sediments can be seen in an abandoned and protected quarry at the western border of the village (Plate I: 4). Homogeneous, not stratified andesite lava, stratified andesite tuff, thin paleosol and white Leitha limestone (Sámsonháza Formation) crop out in the

section. The biocalcarenic limestone is very fossiliferous (e.g. red algae, gastropods, bivalves, bryozoans). However, the studied samples were not collected in the protected quarry, but on the other side of the small creek (Kis-Zagyva) and the valley, where the same layers crop out (Figure 10). The two samples are from the Lower Badenian biocalcarenic near to the well observable “Perna-bed”. The mollusc fauna of this layer was studied by STRAUZ (1928), who also mentioned the presence of some bryozoans (*Membranipora*, *Schizoporella* and *Cellepora*). Geological notes on the Sámsonháza area were published by NOSZKY (1941). A more detailed geological description of this area was given by BOGSCH (1943c), who mentioned bryozoans without more precise identifications. A rich mollusc fauna was studied from different localities around Sámsonháza by CSEPREGHY–MEZNERICS (1954).

Mátra-9 sample yielded 349 specimens representing 12 species/9 genera. The most abundant bryozoans are *Crisia*, and unidentifiable celleporiform and adeoniform species. The most common colonial morphotype is cellariiform (30.9%), but several other morphotypes are also relatively numerous: vinculariiforms (19.2%), celleporiforms (14.3%), membraniporiforms (14%), adeoniforms (12%) and reteporiforms (9.6%).

Mátra-10 sample yielded 2814 specimens representing 93 species/69 genera. The most frequent bryozoans are *Reteporella*, *Cellaria*, *Smittina* and *Crisia*. Four colony morphotypes are nearly equally numerous: reteporiforms (24.7%), vinculariiforms (23.2%), cellariiforms (21.3%) and adeoniforms (18.3%). Two other morphotypes are much less significant: celleporiforms (7.4%) and membraniporiforms (5.1%). It is worth mentioning that 52% of the species are membraniporiform but all of these species are represented by very few specimens, therefore this morphotype is in fact the less abundant.

Sámsonháza, Mátra-9 (sample size: 500 g)	specimen number
Adeoniforms indet.	42
<i>Cellaria fistulosa</i>	17
Celleporiforms indet.	50
<i>Cribrilaria innominata</i>	8
<i>Crisia denticulata</i>	83

<i>Disporella hispida</i>	8
<i>Entalophoroecia pulchella</i>	33
<i>Fron dipora verrucosa</i>	17
<i>Hornera frondiculata</i>	17
<i>Margaretta cereoides</i>	8
Membraniporiforms indet.	33
<i>Reteporella cellulosa</i>	33

Sámsonháza, Mátra-10 (sample size: 500 g)	specimen number
<i>Adeonella polystomella</i>	43
<i>Annectocyma indistincta</i>	3
<i>Annectocyma major</i>	4
<i>Aplousina bobiesi</i>	1
<i>Biflustra savarti</i>	1
<i>Bobiesipora fasciculata</i>	9
<i>Buffonellaria divergens</i>	8
<i>Buffonellodes incisa</i>	1
<i>Callopora fenestrata</i>	1
<i>Calloporina decorata</i>	1
<i>Calpensia gracilis</i>	1
<i>Camla rectangulata</i>	5
<i>Cellaria fistulosa</i>	216
<i>Cellaria salicornioides</i>	165
<i>Celleporaria foraminosa</i>	1
<i>Celleporaria palmata</i>	63
<i>Celleporina costazi</i>	33
Celleporiforms indet.	59
<i>Coscinopsis ambita</i>	1
<i>Crassimarginatella diadema</i>	1
<i>Crassimarginatella macrostoma</i>	5
<i>Cribrilaria innominata</i>	2
<i>Crisia denticulata</i>	150
<i>Crisia eburnea</i>	17
<i>Crisia boermesi</i>	29
<i>Crisidmonea foraminosa</i>	15
<i>Diplosolen obelium</i>	1
<i>Disporella hispida</i>	18
<i>Emballotheba longidens</i>	17
<i>Entalophoroecia anomala</i>	1
<i>Entalophoroecia pulchella</i>	12
<i>Escharella reussiana</i>	3
<i>Escharella tenera</i>	1
<i>Escharina polyomma</i>	2
<i>Escharina vulgaris</i>	1
<i>Escharoides coccinea</i>	3
<i>Escharoides megalota</i>	1
<i>Fron dipora verrucosa</i>	11
<i>Heteropora</i> sp.	6
<i>Hippopleurifera ampla</i>	1
<i>Hippoporella bicornis</i>	1
<i>Hippoporella pauper</i>	2
<i>Hippoporina rarepunctata</i>	1
<i>Hornera frondiculata</i>	97
<i>Hornera subannulata</i>	5
<i>Idmidronea atlantica</i>	132

<i>Idmidronea disticha</i>	1
<i>Iodictyum rubesci</i>	84
<i>Lacerna fuchsii</i>	1
<i>Lagenipora lepralioides</i>	1
<i>Margaretta cereoides</i>	10
<i>Mesenteripora meandrina</i>	3
<i>Metrarabdotus maleckii</i>	98
<i>Micropora parvicella</i>	1
<i>Microporella inamoena</i>	1
<i>Myriapora truncata</i>	3
<i>Onychoecella angulosa</i>	6
<i>Patinnella prolifera</i>	1
<i>Patinella stellata</i>	9
<i>Pentapora</i> ? sp.	23
<i>Plagioecia patina</i>	3
<i>Pleuroecia pertusa</i>	31
<i>Polyscosoecia coronopus</i>	45
<i>Pseudofron dipora davidi</i>	5
<i>Ramphotonus appendiculata</i>	1
<i>Reptomulticava parviporosa</i> ?	6
<i>Reteporella beaniana</i>	501
<i>Reteporella cellulosa</i>	104
<i>Rhagostoma stenostoma</i>	12
<i>Schismoporella schizogaster</i>	1
<i>Schizobrachiella sanguinea</i>	1
<i>Schizomavella auriculata</i>	5
<i>Schizomavella tenella</i>	1
<i>Schizoporella geminipora</i>	12
<i>Schizoporella longirostris</i>	1
<i>Schizotheca fissus</i>	2
<i>Serropocellaria elliptica</i>	15
<i>Smittina cervicornis</i>	289
<i>Steginoporella cucullata</i>	10
<i>Tervia irregularis</i>	215
<i>Tremogasterina areolata</i>	1
<i>Tremopora radificifera</i>	5
<i>Trypostega rugulosa</i>	2
<i>Tubulipora dimidiata</i>	3
<i>Tubulipora partschi</i>	1
<i>Tubulipora pluma</i>	1
<i>Tubulipora plumosa</i> ?	1
<i>Turbicellepora coarctata</i>	21
<i>Turbicellepora coronopus</i>	26
<i>Umbonula macrocheila</i>	38
<i>Umbonula monoceros</i>	4
<i>Watersipora gonistoma</i>	1
<i>Ypselosoecia typica</i>	57

Mátraverebély — Mátraverebély-Szentkút is a classical locality in the northern part of the Cserhát Mountains (DULAI & MOISSETTE 2007). STRAUZ (1928), among other fossils, mentioned the presence of *Scrupocellaria*, *Cellaria*, *Retepora*, *Idmonea*, *Eschara*, *Lepralia* and *Filisparsa* from Mátraverebély. NOSZKY (1940) gave a detailed geological description of both Szent-László layers and Meszestető near to the monastic cave-dwellings. In his faunal list there are several bryozoans from the Bryozoa-Echinodermata sandy facies (*Schizoporella*, *Eschara*, *Diastopora*, *Entalophora*, *Hornera*, *Idmonea*, *Membranipora*, *Retepora*, *Crisia*, *Cellepora*, *Cellaria*, *Lepralia* – mainly REUSS's species). However, this bryozoan

fauna was never described or illustrated, so it was not possible to check the validity of the mentioned species. BOGSCH (1943b) published a small monograph on the mollusc fauna from the sandy facies of the locality. Several molluscs were also published from Mátraverebély localities by CSEPREGHY–MEZNERICS (1954). Crinoids were shortly mentioned by VADÁSZ (1915) and later revised by SZALAI (1925).

Four samples were collected for bryozoan studies from the Lower Badenian calcarenite: two samples from the so-called “Szent László layers” (Figure 11, Plate I: 5) and two samples from the level of the monastic cave-dwellings (Figure 12, Plate I: 6).

Mátraverebély, Mátra-5, "Szent László layers", lower (sample size: 500 g)	specimen number
<i>Annectocyma major</i>	1
<i>Aplousina bobiesi</i>	17
<i>Biflustra savartii</i>	8
<i>Buffonellaria divergens</i>	1
<i>Buffonellodes incisa</i>	6
<i>Cellaria fistulosa</i>	2
<i>Cellaria salicornioides</i>	63
<i>Celleporaria cerioporoides</i>	6
<i>Celleporaria palmata</i>	248
<i>Celleporina costazi</i>	3
<i>Cribrilaria innominata</i>	1
<i>Crisia eburnea</i>	383
<i>Crisia haueri</i> ?	1
<i>Crisia boernesii</i>	177
<i>Crisidmonea foraminosa</i>	1
<i>Disporella hispida</i>	1
<i>Emballotheba longidens</i>	8
<i>Escharoides coccinea</i>	11
<i>Figularia manzonii</i>	2
<i>Goodonia</i> sp.	2
<i>Herentia musensis</i>	1
<i>Heteropora</i> ? sp.	3
<i>Hippopleurifera</i> ? <i>aperta</i>	1
<i>Hippoporella bicornis</i>	5
<i>Hippoporella pauper</i>	2
<i>Hornera frondiculata</i>	111
<i>Hornera lichenoides</i> ?	15
<i>Idmidronea atlantica</i>	1
<i>Iodictyum rubeschi</i>	22
<i>Margaretta cereoides</i>	29
<i>Metrarabdotos maleckii</i>	140
<i>Onychoella angulosa</i>	5
<i>Pseudofrondipora davidi</i>	8
<i>Reteporella beaniana</i>	586
<i>Reteporella cellulosa</i>	658
<i>Rhagasostoma stenostoma</i>	1
<i>Schizobrachiella sanguinea</i>	3
<i>Schizomavella auriculata</i>	6
<i>Schizoporella geminipora</i>	3
<i>Scrupocellaria elliptica</i>	46
<i>Smittina cervicornis</i>	5
<i>Smittina</i> cf. <i>colleti</i>	1
<i>Tervia irregularis</i>	31
<i>Tremogasterina areolata</i>	3
<i>Trypostega rugulosa</i>	1
<i>Turbicellepora coronopus</i>	11
<i>Turbicellepora canaliculata</i> ?	1
<i>Umbonula macrocheila</i>	18
<i>Watersipora goniostoma</i>	1
<i>Ybselosocia typica</i>	5

Mátraverebély, Mátra-6, "Szent László layers", upper (sample size: 500 g)	specimen number
<i>Adeonella polystomella</i>	41
<i>Annectocyma major</i>	3
<i>Aplousina bobiesi</i>	7
<i>Biflustra savarti</i>	13
<i>Buffonellaria divergens</i>	16
<i>Buffonellodes incisa</i>	1
<i>Buskea</i> sp.	8
<i>Cellaria fistulosa</i>	395
<i>Cellaria salicornioides</i>	427
<i>Celleporaria cerioporoides</i>	19
<i>Celleporaria palmata</i> Plate II: 9	480
<i>Celleporina costazi</i>	36
<i>Celleporiforms</i> indet.	180
<i>Cribrilaria innominata</i>	12
<i>Crisia denticulata</i>	1955
<i>Crisia eburnea</i>	199
<i>Disporella hispida</i>	13
<i>Emballotheba longidens</i>	27
<i>Entalophoroecia anomala</i>	16
<i>Escharoides coccinea</i>	3
<i>Escharoides megalota</i>	1
<i>Goodonia</i> sp.	9
<i>Hagiosynodus latus</i>	8
<i>Heteropora</i> ? sp.	30
<i>Hippopleurifera ampla</i>	23
<i>Hippopleurifera semicristata</i>	3
<i>Hippoporella bicornis</i>	8
<i>Hippoporella pauper</i>	5
<i>Hippoporina rarepunctata</i>	1
<i>Hornera frondiculata</i>	144
<i>Idmidronea atlantica</i>	52
<i>Iodictyum rubeschi</i> Plate IV: 2	241
<i>Margaretta cereoides</i>	55
<i>Metrarabdotos maleckii</i>	402
<i>Onychoella angulosa</i>	27
<i>Plagioecia patina</i>	3
<i>Porella erecta</i> ?	8
<i>Pseudofrondipora davidi</i>	9
<i>Puellina gigantea</i>	1
<i>Reteporella beaniana</i>	1842
<i>Reteporella cellulosa</i>	1447
<i>Schizomavella</i> aff. <i>discoidea</i>	3
<i>Schizomavella auriculata</i>	7
<i>Schizomavella tenella</i>	53
<i>Schizoporella geminipora</i> Plate V: 7	140
<i>Scrupocellaria bertholetii</i> ?	20
<i>Scrupocellaria elliptica</i>	160
<i>Smittina cervicornis</i>	192
<i>Steginoporella cucullata</i>	12
<i>Steginoporella reussi</i>	1
<i>Stomatopora subdivaricata</i>	1
<i>Tervia irregularis</i>	70
<i>Thalamoporella neogenica</i>	1
<i>Tremogasterina areolata</i>	16
<i>Trypostega rugulosa</i>	25
<i>Tubulipora flabellaris</i> ?	1
<i>Turbicellepora canaliculata</i> ?	7
<i>Turbicellepora coronopus</i>	13
<i>Umbonula macrocheila</i>	57
<i>Ybselosocia typica</i>	44

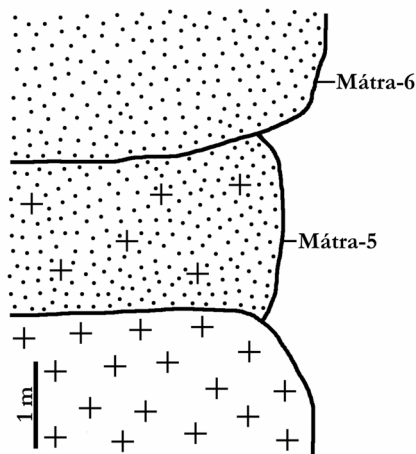


Figure 11 – Simplified section of Mátraverebély-Szentkút, Szent László layers locality, with estimated position of the studied samples.

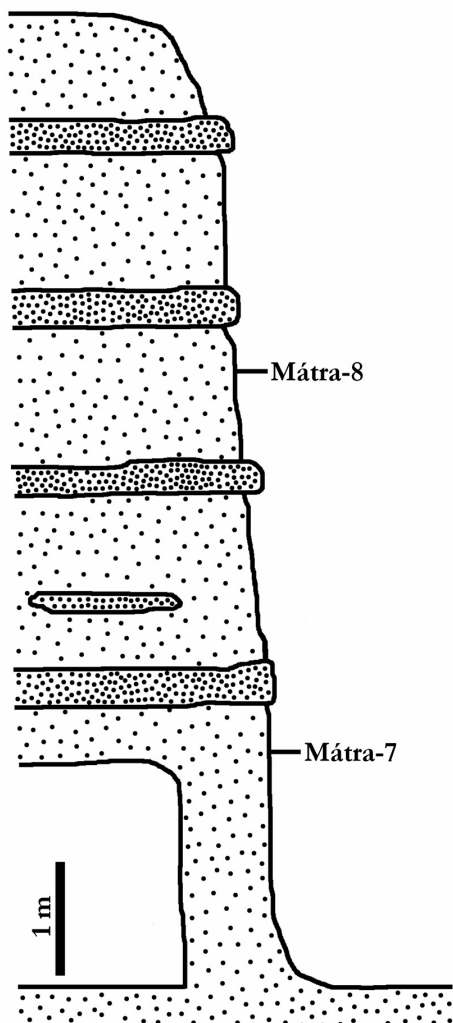
Mátra-5 sample yielded 2665 specimens representing 50 species/41 genera. The most common bryozoans are *Reteporella*, *Crisia* and *Celleporaria*. The most frequent colony morphotype is reteporiform (47.5%), but cellariiforms (26.3%) and celleporiforms (10.1%) are also important. The adeoniforms (6.5%), vinculariiforms (6.5%) and membraniporiforms (3.1%) are less significant.

Mátra-6 sample yielded 8993 specimens representing 60 species/47 genera. The most abundant bryozoans are

Reteporella, *Crisia*, *Cellaria* and *Celleporaria*. Among the colony morphotypes the reteporiforms (39.3%) and cellariiforms (35.7%) are the most numerous, while all the other morphotypes are less significant: adeoniforms (8.4%), celleporiforms (8.2%), vinculariiforms (4.3%) and membraniporiforms (4.1%).

Mátra-7 sample yielded 21.887 specimens representing 64 species/47 genera. The most abundant bryozoans are *Crisia*, *Cellaria* and *Reteporella*. The predominant colony morphotype is cellariiform (86.3%). The other morphotypes are rare (vinculariiforms: 6.5%, reteporiforms: 4.2%) or insignificant (adeoniforms: 1.4%, celleporiforms: 1.2%, membraniporiforms: 0.4%). At species level, the membraniporiforms are the most numerous (31 out of 64 species) but all of them are represented only by very few specimens.

Mátra-8 sample yielded 52.589 specimens belonging to 105 species/74 genera. The most abundant bryozoans are *Reteporella*, *Idmidronea* and *Crisia*, but *Cellaria*, *Celleporaria*, *Hornera* and *Smittina* are also significant. The colonial morphotypes are much more diverse than in the case of the Mátra-7 sample. The most common morphotypes are reteporiforms (29.1%) and vinculariiforms (28.3%), but cellariiforms (13.2%), membraniporiforms (10.3%), adeoniforms (9.9%) and celleporiforms (9.1%) are also significant. Lunulitiforms are very rare (0.1%).



Mátraverebely, Mátra-7, cave-dwellings, lower (sample size: 500 g)	specimen number
<i>Adeonella polystomella</i>	13
<i>Annectocyma indistincta</i> ?	1
<i>Annectocyma major</i>	1
<i>Aplousina bobiesi</i>	4
<i>Biflustra savarti</i>	2
<i>Buffonellaria divergens</i>	1
<i>Buffonellodes incisa</i>	1
<i>Callopora fenestrata</i>	1
<i>Calloporina decorata</i>	1
<i>Cellaria fistulosa</i>	6758
<i>Cellaria salicornioides</i>	375
<i>Celleporaria foraminosa</i>	20
<i>Celleporaria palmata</i>	10
<i>Celleporina bugaei</i>	2
<i>Celleporina costazi</i>	48
Celleporiforms indet.	78
<i>Cribrilaria innominata</i>	1
<i>Crisia denticulata</i>	3300
<i>Crisia eburnea</i>	3129
<i>Crisia haueri</i> Plate III: 3	3875
<i>Crisia hoernesii</i> Plate III: 4	1150
<i>Disporella hispida</i>	10
<i>Emballotbeca longidens</i>	1
<i>Escharella reussiana</i>	1
<i>Escharina dutertrei</i>	1
<i>Escharina polyomma</i>	20
<i>Escharoides coccinea</i>	1
<i>Hippopleurifera semicristata</i> ?	4
<i>Hornera frondiculata</i>	25
<i>Idmidronea atlantica</i>	810
<i>Metrarabdotos maleckii</i>	175
<i>Metroporella</i> ? sp.	5
<i>Microporella ciliata</i>	7
<i>Microporella inamoena</i>	1
<i>Onychocella angulosa</i>	5
<i>Pentapora</i> ? sp.	12
<i>Plagioecia patina</i>	3
<i>Pleuronea pertusa</i>	64
<i>Porella erecta</i> ?	1
<i>Puellina kollmanni</i> ?	1
<i>Reteporella beaniana</i>	890
<i>Reteporella cellulosa</i>	25
<i>Rosseliana incompta</i>	6
<i>Schizobrachiella sanguinea</i>	1
<i>Schizomavella grossipora</i> ?	1
<i>Schizomavella tenella</i>	1
<i>Schizoporella geminipora</i>	6
<i>Scrupocellaria bertboletti</i> ?	83
<i>Scrupocellaria elliptica</i>	229
<i>Smittina canavarii</i>	5
<i>Smittina cervicornis</i>	71
<i>Steginoporella cucullata</i>	13
<i>Ternia irregularis</i>	259
<i>Thalamoporella neogenica</i>	8
<i>Tetrocylococia dichotoma</i>	1
<i>Trypostega rugulosa</i>	2
<i>Tubulipora dimidiata</i>	4
<i>Tubulipora flabellaris</i> ?	2
<i>Tubulipora</i> cf. <i>foliacea</i>	5
<i>Turbicellepora coronopus</i>	74
<i>Turbicellepora aviculifera</i>	19
<i>Umbonilla macrocheila</i>	11
<i>Vibracella trapezoides</i>	5
<i>Ybselosocia typica</i> Plate VI: 7	247



Figure 12 – Simplified section of Mátraverebely-Szentkút, monastic cave-dwellings locality, with estimated position of studied samples.

Mátraverebély, Mátra-8, cave-dwellings, upper (sample size: 500 g)	specimen number
<i>Adeonella polystomella</i>	887
<i>Annectocyma indistincta</i>	44
<i>Annectocyma major</i> Plate II: 2	137
<i>Aplousina bobiesi</i>	11
<i>Biflustra savarti</i>	83
<i>Bobiesipora fasciculata</i>	18
<i>Buffonellaria divergens</i> Plate II: 3	283
<i>Callopora fenestrata</i>	59
<i>Canda rectangularata</i>	74
<i>Cellaria fistulosa</i>	878
<i>Cellaria salicornioides</i>	1598
<i>Cellepora "pumicosa"</i>	22
<i>Celleporaria cerioporoides</i>	67
<i>Celleporaria palmata</i>	2535
<i>Celleporina bugei</i>	7
<i>Celleporina costazi</i> Plate II: 10	865
<i>Cribellopora latigastrea</i>	126
<i>Cribilaria innominata</i>	185
<i>Crisia denticulata</i>	2439
<i>Crisia eburnea</i>	443
<i>Crisia baueri</i>	406
<i>Crisia boernesii</i>	628
<i>Crisidmonea foraminosa</i>	4
<i>Diplosolen obelium</i>	4
<i>Disporella hispida</i>	135
<i>Distansescharella seguenzai</i>	4
<i>Electra monostachys</i>	4
<i>Emballotheba longidens</i>	63
<i>Entalophoroecia anomala</i> Plate III: 5	480
<i>Entalophoroecia pulchella</i>	111
<i>Escharella arrecta</i>	4
<i>Escharella circumornata</i>	7
<i>Escharella tenera</i>	54
<i>Escharella variolosa</i>	30
<i>Escharina polyomma</i> Plate III: 7	800
<i>Escharoides coccinea</i> Plate III: 8	135
<i>Escharoides megalota</i>	31
<i>Figularia manzonii</i>	11
<i>Fron dipora verrucosa</i>	54
<i>Goodonia</i> sp.	87
<i>Hagiosynodus latus</i>	44
<i>Hippopleurifera bianriculata</i>	122
<i>Hippopleurifera binata</i> ?	4
<i>Hippopleurifera semicristata</i>	4
<i>Hippoporella bicornis</i>	33
<i>Hippoporella pauper</i>	33
<i>Hornera frondiculata</i> Plate III: 10	2367
<i>Idmidronea atlantica</i>	7572
<i>Idmidronea disticha</i> Plate III: 11	342
<i>Iodictyum rubeschii</i>	495
<i>Lagenipora lepralioides</i> Plate IV: 4	240

<i>Margaretta cereoides</i>		37
<i>Metrarabdotos maleckii</i> Plate IV: 5		833
<i>Metroperiella</i> ? sp.		4
<i>Micropora parvicella</i>		44
<i>Microperella ciliata</i>		11
<i>Microperella inamoena</i>		79
<i>Myriapora truncata</i>		4
<i>Omalosecosa ramulosa</i>		74
<i>Onychocella angulosa</i>		67
<i>Patinella prolifera</i>		11
<i>Patinella stellata</i>		81
<i>Plagioecia patina</i>		15
<i>Plagioecia rotula</i>		7
<i>Pleuronea pertusa</i> Plate V: 1		1112
<i>Polyscosoecia coronopus</i>		120
<i>Porella erecta</i> ?		163
<i>Pseudofron dipora davidi</i>		26
<i>Puellina kollmanni</i>		7
<i>Rampbonotus appendiculata</i>		13
<i>Reteporella cellulosa</i> Plate V: 4		14791
<i>Reussia elongata</i> ?		18
<i>Rbagastoma stenostoma</i>		20
<i>Rosseliana incompta</i>		4
<i>Schizobrachiella sanguinea</i> Plate V: 6		148
<i>Schizomavella auriculata</i> Plate V: 3		488
<i>Schizomavella tenella</i> Plate VI: 1		647
<i>Schizomavella</i> aff. <i>discoidea</i>		702
<i>Schizoporella geminipora</i>		519
<i>Schizotheca fissa</i>		37
<i>Scrupocellaria bertoletti</i> ?		259
<i>Scrupocellaria elliptica</i>		259
<i>Smittina canavarii</i>		166
<i>Smittina cervicornis</i>		2019
<i>Smittina</i> cf. <i>colleti</i>		37
<i>Smittipora platystoma</i>		63
<i>Smittioidea reticulata</i>		55
<i>Steginoporella cucullata</i> Plate VI: 4		131
<i>Stenosipora simplex</i>		18
<i>Ternia irregularis</i>		1696
<i>Thalamoporella neogenica</i>		7
<i>Tremogasterina areolata</i>		4
<i>Tremopora radificera</i>		78
<i>Trypostega rugulosa</i>		33
<i>Tubulipora dimidiata</i>		15
<i>Tubulipora partschi</i>		18
<i>Tubulipora plumosa</i> ?		18
<i>Turbicellepora aviculifera</i>		52
<i>Turbicellepora</i> cf. <i>compressa</i>		48
<i>Turbicellepora coronopus</i> Plate VI: 8		1212
<i>Umbonula macrocheila</i> Plate VI: 9		321
<i>Umbonula monoceros</i>		118
<i>Vibracella trapezoidea</i>		44
<i>Watersipora gonistoma</i>		61
<i>Ybselosocia typica</i>		706

Borsodbóta — The Miocene geology of this area was studied by SCHRÉTER (1914) and JASKÓ (1952). The rich mollusc fauna (194 species) of Borsodbóta was discussed by KUTASSY (1928) and later in more detail by CSEPREGHY–MEZNERICS (1969, 1970). Recently, a new *Trivia* species was described by FEHSE & VICIÁN (2006). A *Zostera*-bryozoa-*Spirorbis* biocoenosis was mentioned from the Miocene of the Borsod Basin by RADÓCZ (1972). CSEPREGHY–MEZNERICS (1970) distinguished two facies in this area: tuffitic sand and tuffitic marl-clay and she mentioned solitary corals, *Cidaris* spines and also bryozoans without giving names along the numerous and diverse mollusc fauna. The sandy facies is dominant around Borsodbóta at three localities: Rendek valley quarry, a road cut along the road to Királd, and the row of cellars near to the road. Four samples were collected for bryozoan studies

from the Lower Badenian bioclastic gravely sand at the quarry and at the row of cellars above the road to Királd.

Borsodbóta-1 sample yielded 127 specimens belonging to 8 species/6 genera. The most abundant bryozoans are *Crisia* and *Cellaria*. Among the colonial morphotypes cellariiforms predominate (80.3%), while other morpho-

Borsodbóta-1 (sample size: 500 g)	specimen number
<i>Alysidotella</i> sp.	7
<i>Cellaria fistulosa</i>	7
<i>Cellaria salicornioides</i>	18
<i>Crisia eburnea</i>	59
<i>Crisia boernesii</i>	18
<i>Reussirella haidingeri</i>	7
<i>Schizostomella grinzingensis</i>	4
<i>Turbicellepora canaliculata</i> ?	7

types are less significant (membraniporiforms: 5.5%, celleporiforms: 5.5%, lunulitiforms: 5.5%, adeoniforms: 3.2%).

Borsodbóta-2 sample yielded only 48 specimens but a relatively diverse fauna (20 species/20 genera). *Lunulites* and *Cupuladria* are fairly abundant. Among the colonial morphotypes lunulitiforms (35.4%), membraniporiforms (25%) and adeoniforms (18.8%) are relatively frequent, while vinculariiforms (8.3%) celleporiforms (4.2%) and cellariiforms (2.1%) are less significant. Some boring bryozoans are also present (6.2%).

Borsodbóta-3 sample yielded 925 specimens belonging to 61 species/49 genera. The most abundant bryozoans are *Cellaria*, *Turbicellepora*, *Reteporella* and *Reussirella*. The dominant colonial morphotype is cellariiform (39.7%), but celleporiforms (16.1%), vinculariiforms (14.5%) and adeoniforms (12.5%) are also frequent. Lunulitiforms (7.2%), reteporiforms (5.5%), membraniporiforms (4.4%) and boring species (0.1%) are less significant.

Borsodbóta-2 (sample size: 500 g)	specimen number
<i>Alysidotella</i> sp.	4
<i>Amphiblestrum</i> aff. <i>trifolium</i>	1
<i>Antropora</i> cf. <i>granulifera</i>	1
<i>Arachnopusia</i> sp.	1
<i>Cellaria fistulosa</i>	1
<i>Celleporaria palmata</i>	1
<i>Cupuladria</i> sp.	5
<i>Ellisina gautieri</i>	2
<i>Escharina vulgaris</i>	1
<i>Entaloporoecia clavula</i>	1
<i>Hornera frondiculata</i>	1
<i>Lunulites androsaces</i>	8
<i>Metrarabdotos maleckii</i>	2
<i>Monoporella nodulifera</i>	1
<i>Orbigyopora archiaci</i>	2
<i>Pleuronea pertusa</i>	3
<i>Reussirella haidingeri</i>	4
<i>Schizostomella grinzingensis</i>	7
<i>Spathipora</i> sp.	1
<i>Turbicellepora canaliculata</i> ?	1

Borsodbóta-3 (sample size: 500 g)	specimen number
<i>Alysidotella</i> sp.	1
<i>Amphiblestrum</i> aff. <i>trifolium</i>	1
<i>Annectocyma major</i>	1
<i>Aplousina bobiesi</i>	1
<i>Biflustra savarti</i>	5
<i>Bobiesipora fasciculata</i>	1
<i>Cellaria fistulosa</i>	175
<i>Cellaria salicornioides</i>	144
<i>Celleporaria foraminosa</i>	1
<i>Celleporaria palmata</i>	24
<i>Celleporina costazi</i>	9
Celleporiforms indet.	18
<i>Schedocleidochasma porcellanum</i>	1
<i>Conopeum reticulum</i>	1
<i>Crisia denticulata</i> ?	7
<i>Crisia eburnea</i>	17
<i>Crisia haueri</i>	3
<i>Crisia boernesii</i>	16
<i>Crisidmonea foraminosa</i>	1
<i>Cupuladria vindobonensis</i>	3
<i>Diplosolen obelium</i>	1
<i>Emballothecha longidens</i>	10
<i>Escharella circumornata</i>	1
<i>Escharina vulgaris</i>	1
<i>Escharoides coccinea</i>	4
<i>Froncipora verrucosa</i>	3
<i>Hagosynodus latus</i>	1
<i>Herentia musensis</i>	1
<i>Hornera frondiculata</i>	36
<i>Idmidronea atlantica</i>	33

<i>Idmidronea disticha</i>	13
<i>Lunulites androsaces</i>	14
<i>Margarita cereoides</i>	1
<i>Metrarabdotos maleckii</i>	33
<i>Microporella ciliata</i>	2
<i>Nellia oculata</i>	3
<i>Onychocella angulosa</i>	7
<i>Patinella mediterranea</i> ?	1
<i>Patinella radiata</i>	1
<i>Pleuronea pertusa</i>	24
<i>Reptadeonella violacea</i>	1
<i>Reptomulticava parviporosa</i> ?	30
<i>Reteporella cellulosa</i>	51
<i>Reussirella haidingeri</i>	50
<i>Rosseliana incompta</i>	1
<i>Schizomavella auriculata</i>	1
<i>Schizomavella tenella</i>	1
<i>Schizostomella grinzingensis</i>	26
<i>Smittina cervicornis</i>	23
<i>Spathipora</i> sp.	1
<i>Tervia irregularis</i>	18
<i>Tremogasterina areolata</i>	2
<i>Tetrocycloecia dichotoma</i> ?	1
<i>Tubulipora partschi</i>	1
<i>Tubulipora pluma</i>	1
<i>Turbicellepora canaliculata</i> ?	29
<i>Turbicellepora coronopus</i>	37
<i>Turbicellepora crenulata</i> ?	1
<i>Umbonula macrocheila</i>	24
<i>Watersipora gonistoma</i>	1
<i>Ybselosocia typica</i>	5

Borsodbóta-5 (sample size: 500 g)	specimen number
<i>Alysidotella</i> sp.	1
<i>Biflustra savarti</i>	1
<i>Cellaria fistulosa</i>	303
<i>Cellaria salicornioides</i>	27
<i>Crisia boernesii</i>	18
<i>Cupuladria vindobonensis</i>	1
<i>Cupuladria</i> ? sp.	2
<i>Diplosolen obelium</i>	1
<i>Ellisina gautieri</i>	1
<i>Froncipora verrucosa</i>	3
<i>Hornera frondiculata</i>	50
<i>Idmidronea atlantica</i>	9
<i>Idmidronea disticha</i>	5

<i>Lunulites androsaces</i>	6
<i>Metrarabdotos maleckii</i>	2
<i>Omalosocosa ramulosa</i>	1
<i>Onychocella angulosa</i>	1
<i>Pleuronea pertusa</i>	55
<i>Polyascosocia coronopus</i>	1
<i>Reptomulticava parviporosa</i> ?	22
<i>Reussirella haidingeri</i>	29
<i>Schizostomella grinzingensis</i>	7
<i>Smittina cervicornis</i>	2
<i>Steginoporella tuberculata margaritae</i>	1
<i>Tervia irregularis</i>	38
<i>Turbicellepora canaliculata</i> ?	13
<i>Umbonula macrocheila</i>	1
<i>Ybselosocia typica</i>	2

Borsodbóta-5 sample yielded 603 specimens belonging to 28 species/25 genera. The most abundant bryozoans are *Cellaria*, *Pleuronea* and *Hornera*. The dominant colonial morphotype is cellariiform (57.7%)

however, vinculariiforms are also frequent (27.2%). Lunulitiforms (6.3%), celledoriforms (5.8%), adeoniiforms (2%) and membraniporiforms (1%) are less significant.

Late Badenian localities

The latest fully marine transgression reached the Central Paratethys during the Late Badenian, where normal marine environments are known from the Vienna Basin to the Podolian Massif (KOVÁČ et al. 2007). The water circulation changed to estuarine type with characteristic shallow-water outflow (BÁLDI 1997). The marine environment was affected by stress factors, such as stratification of the water column and hypoxic conditions at the basin bottom (SCHMID et al. 2001). Comparison of species composition

of Late Badenian and Konkian bivalve assemblages suggests active faunal interchange between the Central and Eastern Paratethys (STUDENČKA et al. 1998). The strong similarity between the Central Paratethyan Late Badenian fauna and the Middle Miocene fauna of the Mediterranean and Atlantic bioprovinces suggests the existence of open marine connection and faunal interchange. A cooling event in the Central Paratethys can be observed during the Late Badenian (KOVÁČ et al. 2007).

Fertőrákos	Quarry specimen number	HNHM specimen number
<i>Alderina nobilis</i> ?	1	5
<i>Annectocyma major</i>	8	4
<i>Aplousina bobiesi</i>	44	35
<i>Buffonellaria divergens</i>	21	12
<i>Buffonellodes incisa</i>	13	1
<i>Callopora dumerli</i> ?		1
<i>Callopora fenestrata</i>	15	23
<i>Calloporina decorata</i>	22	27
<i>Calpensia nobilis</i>	27	35
<i>Cellaria salicornioides</i>	31	
<i>Celleporaria cerioporoides</i>	6	
<i>Celleporaria foraminosa</i>	10	
<i>Celleporina bugei</i>	24	16
<i>Celleporina costazi</i>	11	
<i>Chorizopora bronniarti</i>	2	4
<i>Crepidacantha odontostoma</i> ?		1
<i>Cribellopora latigastrea</i>	7	9
<i>Cribrilaria innominata</i>	8	6
<i>Crisia denticulata</i>	19	
<i>Crisia eburnea</i>	9	
<i>Cryptosula pallasiana</i>	12	6
<i>Diplosolen obelium</i>	1	2
<i>Disporella hispida</i>	8	11
<i>Emballothecha longidens</i>	3	
<i>Ectaloporoecia pulchella</i>	3	
<i>Escharella reussiana</i>	7	2
<i>Escharina dutertrei</i>	17	16
<i>Escharina vulgaris</i>		7
<i>Escharoides coccinea</i>	40	20
<i>Escharoides megalota</i>	5	
<i>Hagiosynodus latus</i>	2	1
<i>Heteropora</i> ? sp.		
<i>Hinksina flustroides</i>	3	
<i>Hinksina loxopora</i>	1	
<i>Hippopleurifera hypostoma</i>	2	
<i>Hippopleurifera</i> sp.	4	2
<i>Hippoporella bicornis</i>	8	15
<i>Hippoporella pauper</i>	5	

<i>Hippoporina rarepunctata</i>	5	18
<i>Idmidronea atlantica</i>	4	
<i>Membranoporidra</i> sp.	6	
<i>Micropora papyracea</i>	29	28
<i>Microporella ciliata</i>	15	13
<i>Microporella inamoena</i>	8	3
<i>Mollia patellaria</i>	14	
<i>Myriapora truncata</i>	5	
<i>Oncousoecia biloba</i>	1	
<i>Onychoecia angulosa</i> Plate IV: 7 *	47 *	59
<i>Patinella stellata</i> ?	8	
<i>Plagioecia sarniensis</i>	27	16
<i>Pleuronea pertusa</i>	21	
<i>Prenantia</i> sp.	1	
<i>Reteporella cellulosa</i>	2	
<i>Rhambonotus appendiculata</i>	8	10
<i>Rosseliana incompta</i>	10	5
<i>Saetiella inermis</i>	5	10
<i>Schizobrachiella sanguinea</i> ?	9	2
<i>Schizomavella auriculata</i>	64	17
<i>Schizomavella tenella</i>	13	8
<i>Schizoporella dunkeri</i>	26	47
<i>Schizoporella longirostris</i>	15	2
<i>Schizoporella tetragona</i>	1	1
<i>Schizotheca fissus</i>	18	1
<i>Scrupocellaria elliptica</i>	5	
<i>Smittipora platystoma</i>	16	23
<i>Steginoporella tuberculata margarittae</i>	4	3
<i>Steraechnella buski</i>	10	1
<i>Thalamoporella neogenica</i>	3	2
<i>Trypostega rugulosa</i>	1	1
<i>Tubulipora dimidiata</i>	3	
<i>Tubulipora flabellaris</i> ?	2	
<i>Tubulipora foliacea</i>	14	
<i>Tubulipora partschi</i>	2	2
<i>Tubulipora plumosa</i> ?	2	
<i>Turbicellepora canaliculata</i> ?	21	
<i>Turbicellepora coronopus</i>	11	3
<i>Umbonula macrocheila</i>	45	34
<i>Umbonula monoceros</i>	19	13
<i>Watersipora goniostoma</i>	13	15

Fertőrákos — One of the most famous Hungarian Miocene localities is the protected Roman quarry at the northern border of Fertőrákos (Plate I: 7). The 40 m thick Upper Badenian Leitha Limestone (Rákos Formation, CSÁSZÁR 1997) crops out at the western margin of the Central Paratethys. The coarse-grained biocalcarene is rich in fossil fragments (red algae, foraminifers, gastropods, bivalves, echinoids and bryozoans). VENDL (1930) discussed in detail the geology of the Sopron area.

Recently, the more or less isochronous section of Leitha Limestone was studied in the Kummer quarry at St. Margarethen by SCHMID et al. (2001). On the basis of the extraordinary preservation of the fauna they suggested occasional hypoxic events along the sea bottom. From the palaeogeographical point of view, they proposed the term Fertőrákos Platform for the Fertőrákos-Ruster Hügelland area, separating it from the larger Leitha Platform (SCHMID et al. 2001).

The washed Upper Badenian biocalcarene sample from the quarry yielded 932 specimens belonging to 75 species/57 genera. The most abundant bryozoans are *Schizomavella*, *Umbonula* and *Onychozella*. The dominant colonial morphotype is membraniporiform (75.3%), while the other morphotypes are not so numerous: celleporiforms (8.9%), cellariiforms (6.9%), adeoniforms (5.2%), vinculariiforms (3.5%) and reteporiforms (0.2%).

A rich bryozoan fauna from Fertőrákos was also

found in the Palaeontological collection of Hungarian Natural History Museum. Most of these bryozoans are encrusting forms on oysters and pectinids. 598 specimens were identified belonging to 50 species/43 genera. The most numerous bryozoans in this material are *Onychozella*, *Schizoporella* and *Umbonula*. Among the colonial morphotypes membraniporiform (91.1%) is absolutely dominant, while adeoniforms (5.7%) and celleporiforms (3.2%) are not so significant.

Diósd — The Oligocene and Miocene stratigraphy of the Biatorbágy and Tétény area was studied by FÖLDVÁRI (1929). At the southern part of the Tétény-plateau there was a small outcrop, but unfortunately, this abandoned quarry recently was banked up with building debris. In the quarry Pannonian sands contacted tectonically with Upper Badenian and Sarmatian limestones. This locality was first described by MÜLLER (1994) and later a detailed study was accomplished by SAINT MARTIN et al. (2000). The compact, hard limestone contains a diverse mollusc fauna, accompanied by decapods, corals and bryozoans. The presence of microbial crusts (microbialites) was reported at Diósd for the first time from the Middle Miocene patch reefs of the Central Paratethys by SAINT MARTIN et al. (2000).

Two samples were collected from the Upper Badenian coral patch reef and from the surrounding biocalcarene. The relatively rare, low diversity bryozoan fauna is mainly from the internal part of cavities provided by the coral framework. Diósd-1 sample yielded 37 specimens belonging to 13 species/12 genera. The most abundant bryozoans are *Cheiloporina* and *Porella*. The membraniporiform colonial morphotype is dominant (73%), but cellariiforms (13.5%) and celleporiforms (10.8%) are also significant, while adeoniforms (2.7%) are rare. Diósd-2 sample yielded 196 specimens belonging to 20 species/20 genera. The most abundant bryozoans are *Crisia*, *Celleporina* and *Scrupocellaria*. The colony morphotypes are more balanced than in the Diósd-1 sample. Cellariiforms (41.3%) are dominant,

but vinculariiforms (24%), membraniporiforms (17.4%) and celleporiforms (15.8%) are also significant. Catenicelliforms (1.5%) are represented by a few specimens.

Diósd	Diósd-1 specimen number	Diósd-2 specimen number
<i>Annectocyma major</i> ?		11
<i>Buffonellodes incisa</i>		1
<i>Calloporina decorata</i>	1	1
<i>Calpensia gracilis</i>		2
<i>Canda rectangularata</i>		10
<i>Catenicella elegans</i>		2
<i>Celleporina costazi</i>	4	31
<i>Cheiloporina</i> cf. <i>campanulata</i>	7	
<i>Crassimarginatella diadema</i>	1	
<i>Cribrularia innominata</i>	4	1
<i>Crisia eburnea</i>	3	66
<i>Crisia elongata</i> ?	2	
<i>Disporella hispida</i>		6
<i>Entalporoecia</i> sp.		14
<i>Escharina dutertrei</i>	3	
<i>Hagosynodus latus</i>		1
<i>Hippopleurifera hypostoma</i> ?		1
<i>Hippoporina sulcifera</i>		1
<i>Microporella ciliata</i>		2
<i>Onychozella angulosa</i>		5
<i>Plagioecia</i> sp.	1	
<i>Pleuronea pertusa</i>		10
<i>Reteoporella cellulosa</i>		3
<i>Savignyella lafonti</i>		1
<i>Schizomavella grossipora</i>	1	
<i>Schizoporella longirostris</i>	2	8
<i>Scrupocellaria elliptica</i>		15
<i>Smittina cervicornis</i>	7	
<i>Tubulipora</i> (?) sp.		1
<i>Umbonula macrocheila</i>	1	
<i>Ybselosocia typica</i>		13

Budapest, Örs vezér tere — A group of localities was situated at a distance of about 1 km from the famous Budapest, Rákos locality, around the square Örs vezér tere (MÜLLER 1984). Numerous temporary trenches and pits were excavated here during the last century. The group of localities was described in detail by MÜLLER (1979), KÓKAY et al. (1984) and KÓKAY (1985). The Karpatian Tar Dacite Tuff Formation is covered directly by the Upper Badenian Rákos Limestone Formation. The very rich mollusc, echinoid and decapod fauna was summarized by KÓKAY et al. (1984), while the decapods were monographically described in MÜLLER (1984) and the molluscs by KÓKAY (1985). Recently, the rare lingulide brachiopods and their stable isotopic compositions were studied by BITNER et al. (submitted). Four samples were checked for bryozoans, which were originally collected by P.M. MÜLLER from the Upper Badenian bioclastic sand

Budapest, Örs vezér tere-1	specimen number
Adeoniforms indet.	2
<i>Calpensia nobilis</i> Plate II: 4	60
<i>Catenicella elegans</i>	4
<i>Celleporina minuscula</i>	10
<i>Crisia denticulata</i>	99
<i>Crisia eburnea</i>	35
<i>Crisia haneri</i>	20
<i>Disporella hispida</i>	1
<i>Entalporoecia pulchella</i>	10
<i>Margaretta cereoides</i>	3
<i>Nellia oculata</i>	11
<i>Oncosocia biloba</i>	2
<i>Pleuronea pertusa</i>	3
<i>Reptadeonella violacea</i> ?	12
<i>Schizomavella auriculata</i> ?	1
<i>Schizoporella tetragona</i> Plate VI: 2	200
<i>Scrupocellaria elliptica</i>	4
<i>Turbicellepora coronopus</i>	1
<i>Tubulipora dimidiata</i>	1

(Örs vezér tere 1–4), and one sample from the biocalcarenitic yellow sand (Örs vezér tere 5) (Figure 13).

Örs vezér tere-1 sample yielded 479 specimens belonging to 19 species/16 genera. The most abundant bryozoans are *Schizoporella*, *Crisia* and *Calpensia*. The dominant colonial morphotype is the membraniporiform (59.5%), but the cellariiforms (35.9%) are also very common. All the other morphotypes are insignificant: vinculariiforms (3.2%), catenicelliforms (0.8%), adeoniforms (0.4%) and celleporiforms (0.2%).

Budapest, Örs vezér tere-2	specimen number
<i>Calpensia nobilis</i>	56
<i>Celleporina minuscula</i>	1
<i>Crisia denticulata</i>	31
<i>Crisia eburnea</i>	16
<i>Crisia baueri</i>	8
<i>Escharina vulgaris</i>	6
<i>Onychoecia angulosa</i>	1
<i>Pleuronea pertusa</i>	1
<i>Reptadeonella violacea</i> ?	1
<i>Schizobrachiella sanguinea</i>	1
<i>Schizoporella tetragona</i>	144
<i>Turbicellepora coronopus</i>	3

Örs vezér tere-2 sample yielded 269 specimens belonging to 12 species/10 genera. The most abundant bryozoans are *Schizoporella*, *Calpensia* and *Crisia*. The dominant colony morphotype is membraniporiform (78.1%). Cellariiforms (20.4%) are also very numerous, while celleporiforms (1.1%) and vinculariiforms (0.4%) are not significant.

Budapest, Örs vezér tere-3	specimen number
Adeoniforms indet.	1
<i>Calpensia nobilis</i>	5
<i>Celleporaria cerioporoides</i> ?	1
<i>Celleporina minuscula</i>	3
<i>Crisia denticulata</i>	39
<i>Crisia eburnea</i>	38
<i>Crisia baueri</i>	11
<i>Disporella hispida</i>	2
<i>Entalophorecia pulchella</i>	7
<i>Margaretta cereoides</i>	4
<i>Nellia oculata</i>	3
<i>Oncosoecia biloba</i>	1
<i>Pleuronea pertusa</i>	3
<i>Reptadeonella violacea</i> ?	2
<i>Schizoporella tetragona</i>	2

Örs vezér tere-3 sample yielded 122 specimens belonging to 15 species/11 genera. The most abundant bryozoans are the *Crisia* species. Among the colonial morphotypes the cellariiforms (77.9%) are dominant, but the membraniporiforms (11.5%) and vinculariiforms (9%) are also common. The celleporiforms (0.8%) and adeoniforms (0.8%) are insignificant.

Örs vezér tere-4 sample yielded 155 specimens belonging to 13 species/10 genera. The most abundant bryozoans are *Crisia* and *Schizoporella*. Among the colonial morphotypes the cellariiforms (54.2%) and membraniporiforms (40%) are dominant, while the vinculariiforms (5.2%) and adeoniforms (0.6%) are insignificant.

Örs vezér tere-5, yellow sand sample yielded 8637 specimens belonging to 29 species/24 genera. The most abundant bryozoans are *Cellaria*, *Crisia* and *Idmidronea* but *Smittina* and *Reteporella* are also common. Among the colonial morphotypes the cellariiforms (38.3%) and

vinculariiforms (29%) are dominant, but the adeoniforms (16.6%) are also common. The reteporiforms (7.5%), celleporiforms (7%) and membraniporiforms (1.6%) are not so significant.

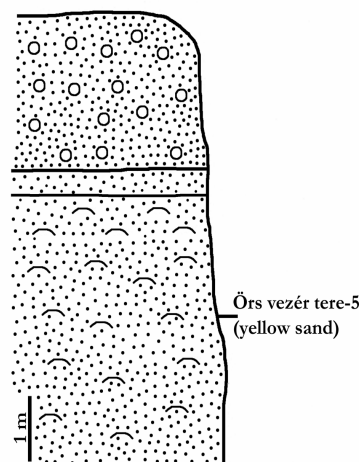


Figure 13 – Simplified section of Budapest Örs vezér tere, yellow sand locality, with estimated position of the studied samples.

Budapest, Örs vezér tere-4	specimen number
Adeoniforms indet.	1
<i>Calpensia nobilis</i>	11
<i>Celleporina minuscula</i>	2
<i>Crisia denticulata</i>	27
<i>Crisia eburnea</i>	32
<i>Crisia baueri</i>	16
<i>Entalophorecia pulchella</i>	5
<i>Margaretta cereoides</i>	2
<i>Nellia oculata</i>	4
<i>Pleuronea pertusa</i>	3
<i>Reptadeonella violacea</i> ?	1
<i>Schizoporella tetragona</i>	48
<i>Scrupocellaria elliptica</i>	3

Budapest, Örs vezér tere-5, yellow sand (sample size: 500 g)	specimen number
<i>Adeonella polytomella</i>	466
<i>Bobiesipora fasciculata</i>	50
<i>Cellaria fistulosa</i>	1279
<i>Cellaria salicornioides</i>	971
<i>Celleporaria cerioporoides</i>	82
<i>Celleporaria palmata</i>	96
<i>Celleporina costazi</i>	68
Celleporiforms indet.	69
<i>Crisia denticulata</i>	1059
<i>Disporella grignonensis</i> ?	15
<i>Entalophorecia pulchella</i>	93
<i>Escharina polyomma</i>	24
<i>Fron dipora verrucosa</i> Plate III: 9	301
<i>Hippoporella pauper</i>	1
<i>Hornera frondiculata</i>	419
<i>Idmidronea atlantica</i>	796
<i>Patinella prolifera</i>	1
<i>Pleuronea pertusa</i>	31
<i>Polyscosoecia coronopus</i> Plate IV: 8	478
<i>Pseudofron dipora davidi</i>	79
<i>Reteporella cellulosa</i>	647
<i>Schizoporella geminipora</i>	29
<i>Smittina cervicornis</i>	671
<i>Tetrocycloecia dichotoma</i> Plate VI: 6	312
<i>Trochilopora beyrichi</i>	16
<i>Tubulipora pluma</i> ?	22
<i>Turbicellepora coronopus</i>	91
<i>Turbicellepora crenulata</i> ?	197
<i>Umbonula macrocheila</i>	274

Budapest, Rákos — This exposure is a railway cut excavated in the second half of the 19th century and subsequently deepened and widened several times (Plate I: 8). Upper Badenian and Sarmatian layers can be seen at the still accessible locality. The section was described by SZABÓ (1879), FRANZENAU (1881), VADÁSZ (1906), SCHAFARZIK & VENDL (1929) and KÓKAY (1985).

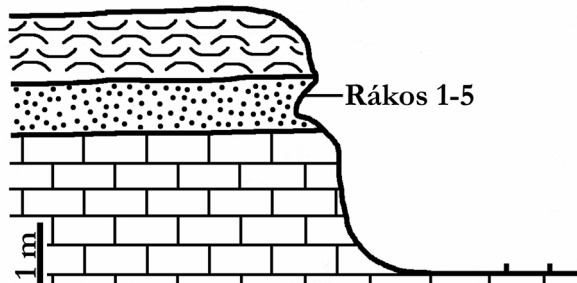


Figure 14 – Simplified section of Budapest Rákos locality, with estimated position of the studied samples.

A small *Porites* patch reef (MRZ in MÜLLER 1984) forms a 1.5-2 m thick lens at the eastern part of the railway cut. It was mainly built up by *Porites* sp. colonies which were preserved as moulds, mostly in living position. A few specimens of *Tarbellastraea* were also found. The coral branches are embedded in a tuffaceous limestone. Some of the corals are encrusted by calcareous red algae. The more or less mono-specific coral reef and the fine particles in the matrix indicate a shallow, muddy environment (MÜLLER 1984). Bryozoans are from samples collected originally by P.M. MÜLLER, therefore the sample numbers given in his monograph (MÜLLER 1984) were retained. Four samples were collected from the sandy algal limestone (Rákos 2–5 in MOISSETTE et al. 2007) and one sample from the coral patch reef (Rákos1 in MOISSETTE et al. 2007) (Figure 14).

Rákos MRZ sample yielded only 8 specimens belonging to 4 species/3 genera. The most “abundant” bryozoan is *Crisia*. The colonial morphotypes belong to cellariiforms (62.5%) and membraniporiforms (37.5%).

Budapest, Rákos, MRZ	specimen number
<i>Crisia denticulata</i>	4
<i>Crisia eburnea</i>	1
<i>Entalporoecia clavula</i>	2
<i>Onychoecella angulosa</i>	1

The patch reef is partly covered, partly replaced by sandstone layers (MR45 and MR8 in MÜLLER 1984). These sandstones are medium-grained, strongly bioturbated and sometimes nodular. Decapods are well preserved but disarticulated, while aragonite-shelled molluscs are rare (MÜLLER 1984).

Budapest, Rákos, MR8	specimen number
<i>Celleporina minuscula</i>	6
<i>Crisia denticulata</i>	132
<i>Crisia eburnea</i>	132
<i>Nellia oculata</i>	20
<i>Schizoporella tetragona</i>	11
<i>Scrupocellaria elliptica</i>	10

Rákos MR8 sample yielded 311 specimens belonging to 6 species/5 genera. The most abundant bryozoans are the two *Crisia* species. Among the colonial morphotypes, the cellariiforms (94.5%) are dominant, while the membraniporiforms (5.5%) are not so significant.

Sandy limestone layers characterised by the abundance of *Linga columbella* (MRL in MÜLLER 1984) and oysters (MRO in MÜLLER 1984) overlie the MR8 sandstone. The proportion of quartz grains and tuffitic particles decreases upwards.

Budapest, Rákos, MRL	specimen number
<i>Celleporina minuscula</i>	5
<i>Crisia denticulata</i>	111
<i>Crisia eburnea</i>	33
<i>Schizoporella dunkeri</i>	1
<i>Schizoporella tetragona</i>	7
<i>Turbicellepora kerabuletzji</i> ?	1

Rákos MRL sample yielded 158 specimens belonging to 6 species/4 genera. The only abundant bryozoans are the two *Crisia* species. Among the colonial morphotypes, the cellariiforms (91.2%) are dominant, while the membraniporiforms (8.2%) and celleporiforms (0.6%) are not so significant.

Rákos MRL-inf. sample yielded only 10 specimens belonging to 3 species/2 genera, from which *Crisia* is relatively abundant. Among the colonial morphotypes, the cellariiforms (80%) predominate, but the unidentified membraniporiforms (20%) are also significant.

Budapest, Rákos, MRL-inf.	specimen number
<i>Crisia denticulata</i>	5
<i>Crisia eburnea</i>	3
Membraniporiforms indet.	2

Rákos MRL-sup. sample yielded 80 specimens belonging to 5 species/4 genera. The only abundant bryozoan is *Crisia*. Among the colonial morphotypes the cellariiforms (91.2%) are dominant, while the membraniporiforms (8.8%) are not so significant.

Budapest, Rákos, MRL-sup.	specimen number
<i>Celleporina minuscula</i>	4
<i>Crisia denticulata</i>	63
<i>Crisia eburnea</i>	9
<i>Nellia oculata</i>	1
<i>Schizoporella tetragona</i>	3

The thickest layer in the Rákos railway cut is a fine-grained sandstone (MRF in MÜLLER 1984). Most of the grains are volcanic. Large pectinids, irregular echinoids and dense callianassid burrows (*Ophiomorpha*) are abundant (MÜLLER 1984).

Budapest, Rákos, MRF-1	specimen number
<i>Celleporina minuscula</i>	13
<i>Crisia denticulata</i>	594
<i>Crisia eburnea</i>	132
<i>Nellia oculata</i>	10
<i>Plagioecia patina</i>	1
<i>Schizoporella tetragona</i>	2
<i>Scrupocellaria elliptica</i>	11
<i>Turbicellepora kerabuletzji</i> ?	2
<i>Tubulipora dimidiata</i>	6

MRF-1 sample yielded 771 specimens belonging to 9 species/8 genera. The only abundant bryozoans are the two *Crisia* species. Among the colonial morphotypes, the cellariiforms (96.9%) are dominant, the membraniporiforms (2.8%) and celleporiforms (0.3%) are not so significant.

MRF-2 sample yielded 116 specimens belonging to 6 species/5 genera. The most abundant bryozoan is *Crisia*, but *Celleporina* and *Nellia* are also common. Among the colonial morphotypes, the celleporiforms (75%) are

dominant but the membraniporiforms (25%) are also significant.

Budapest, Rákos, MRF-2	specimen number
<i>Celleporina minuscula</i>	27
<i>Crisia denticulata</i>	30
<i>Crisia eburnea</i>	29
<i>Nellia oculata</i>	21
<i>Schizoporella tetragona</i>	2
<i>Scrupocellaria elliptica</i>	7

Tengelic-2 borehole — Tengelic-2 is a key geological borehole between the Transdanubian Central Range and the Mecsek Mountains. It was described in detail by HALMAI et al. (1982). The 1184 m deep borehole shows a section from the Ottnangian to the Holocene. The Badenian Szilágy Clay Marl Formation is between 723.1 and 853.3 m, and all of our samples are from this interval (724.0–823.9 m, see table below). Detailed palaeontological investigations were extended to palynomorphs, nannoflora, foraminifers, molluscs and ostracods by NAGY et al. (1982). On the basis of the quantitative palaeoecological analysis of foraminifers from borehole Tengelic-2, BÁLDI (1997) suggested a circulation pattern for the Central Paratethys during the Badenian. High-resolution palynological analysis on Tengelic-2 samples was

presented by JIMENEZ-MORENO et al. (2005) recognizing the Badenian climatic optimum and the Late Badenian-Sarmatian cooling event.

Eight samples were collected from the Upper Badenian marls (NN6 Zone according to NAGYMAROSY in NAGY et al. 1982). Tengelic samples yielded only 32 specimens belonging to 8 species/6 genera. The most abundant bryozoans are *Crisia* and *Cellaria*. Among the colonial morphotypes, the cellariiforms (62.5%) are dominant, but the vinculariiforms (28.1%) and conescharelliniforms (9.4%) are also significant. The deeper-water bryozoans *Batopora rosula* (conescharelliniform) and *Gemellipora eburnea* (cellariiform) occur only in these samples of the studied Hungarian Badenian material.

Tengelic-2 borehole; sample:	724.0	726.9	729.3	736.0	768.9	780.7	785.2	823.9
	specimen numbers							
<i>Batopora rosula</i>					1	1	1	
<i>Cellaria salicornioides</i>			5	1				
<i>Crisia denticulata</i>	3	2	1	1				2
<i>Crisia eburnea</i>			3					
<i>Crisia haueri</i>		1						
<i>Gemellipora eburnea</i>				1				
<i>Hornera frondiculata</i>	4							
<i>Idmidronea atlantica</i>	2		3					

* * *

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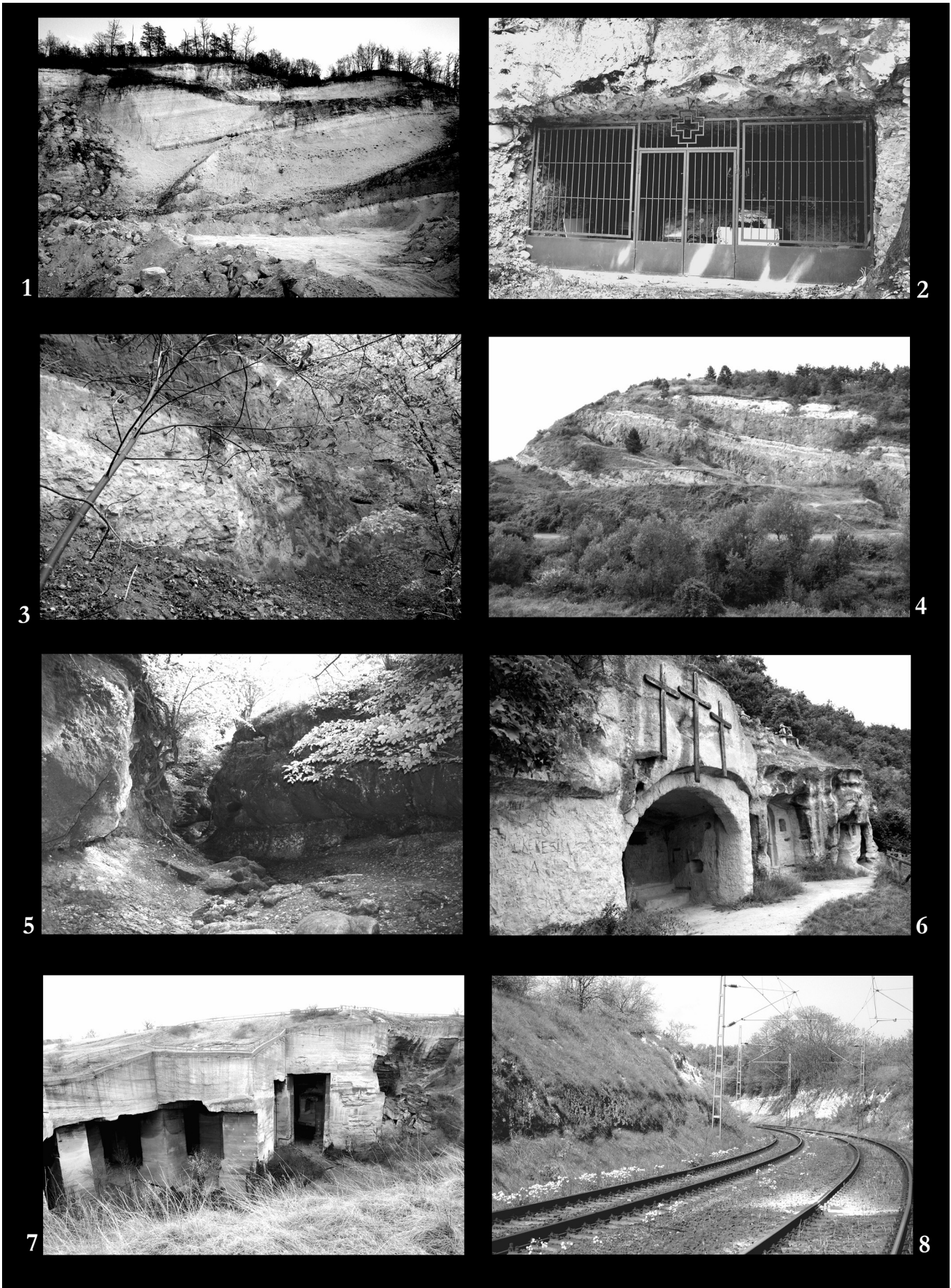
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Explanation to Plate I

Some of the studied outcrops — 1: Zebegeény, Bakó-quarry; 2: Kemence, Kálvária-hegy; 3: Szob; 4: Sámsonháza; 5: Mátraverebély, Szent László-layers; 6: Mátraverebély, cave dwellings; 7: Fertőrákos; 8: Budapest, Rákos.

Plate I

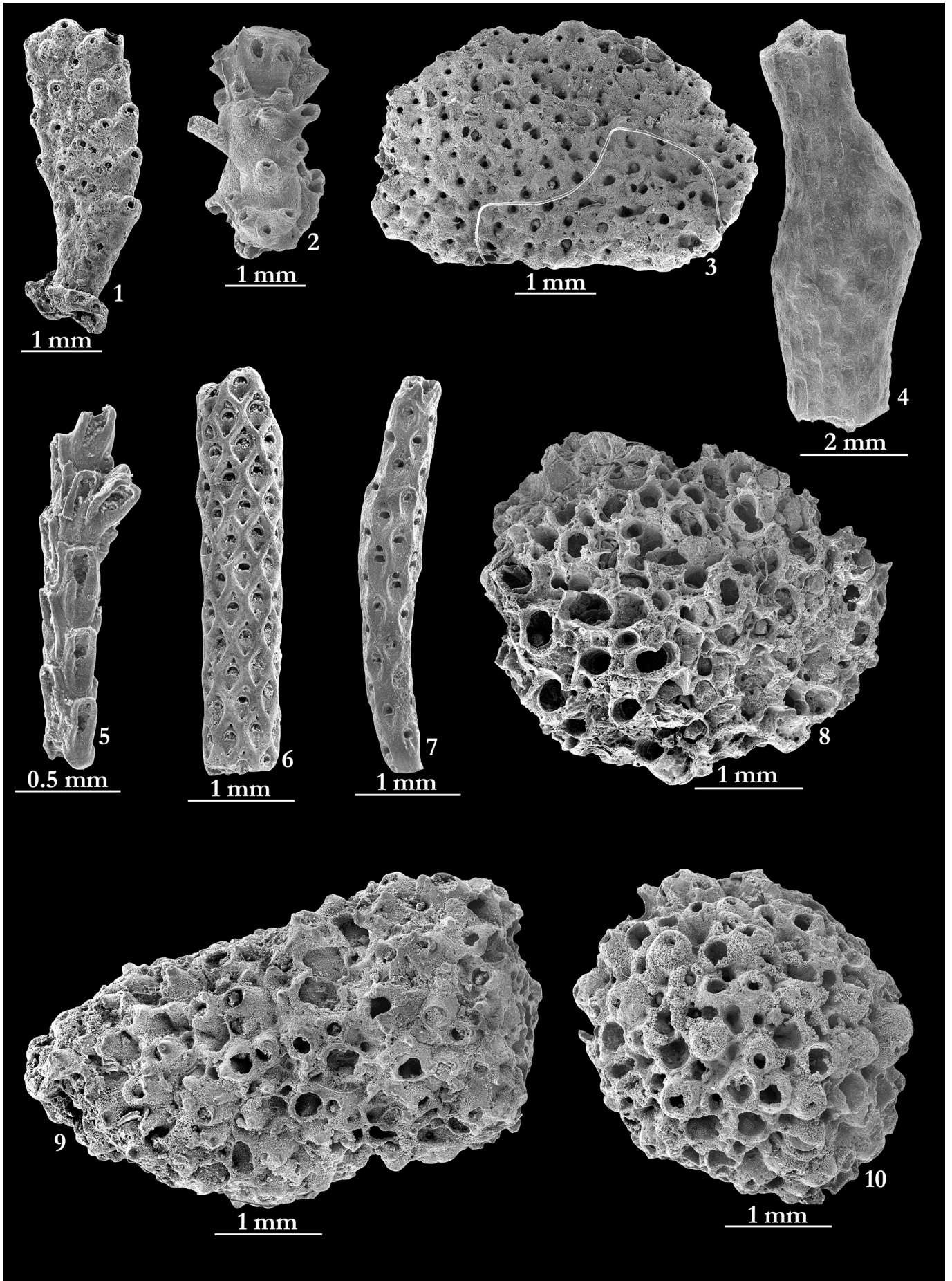


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Explanation to Plate II

- 1 *Adeonella polystomella* (REUSS, 1848) — Kemence, cellar row, upper sample, ×15.
- 2 *Annectocyma major* (JOHNSTON, 1847) — Mátraverebély, Mátra-8, cave dwellings, upper sample, ×15.
- 3 *Buffonellaria divergens* (SMITT, 1873) — Mátraverebély, Mátra-8, cave dwellings, upper sample, ×15.
- 4 *Calpensia nobilis* (ESPER, 1796) — Budapest, Örs vezér tere-1, ×10.
- 5 *Canda rectangularata* UDIN, 1964 — Kemence, cellar row, upper sample, ×40.
- 6 *Cellaria fistulosa* (LINNAEUS, 1758) — Kemence, cellar row, upper sample, ×20.
- 7 *Cellaria salicornioides* LAMOUREUX, 1816 — Kemence, Kálvária-hegy, ×20.
- 8 *Celleporaria foraminosa* (REUSS, 1848) — Várpalota-3, ×20.
- 9 *Celleporaria palmata* (MICHELIN, 1847) — Mátraverebély, Mátra-6, Szent László layers, upper sample, ×20.
- 10 *Celleporina costazi* (AUDOUIN, 1826) — Mátraverebély, Mátra-8, cave dwellings, upper sample, ×20.

Plate II

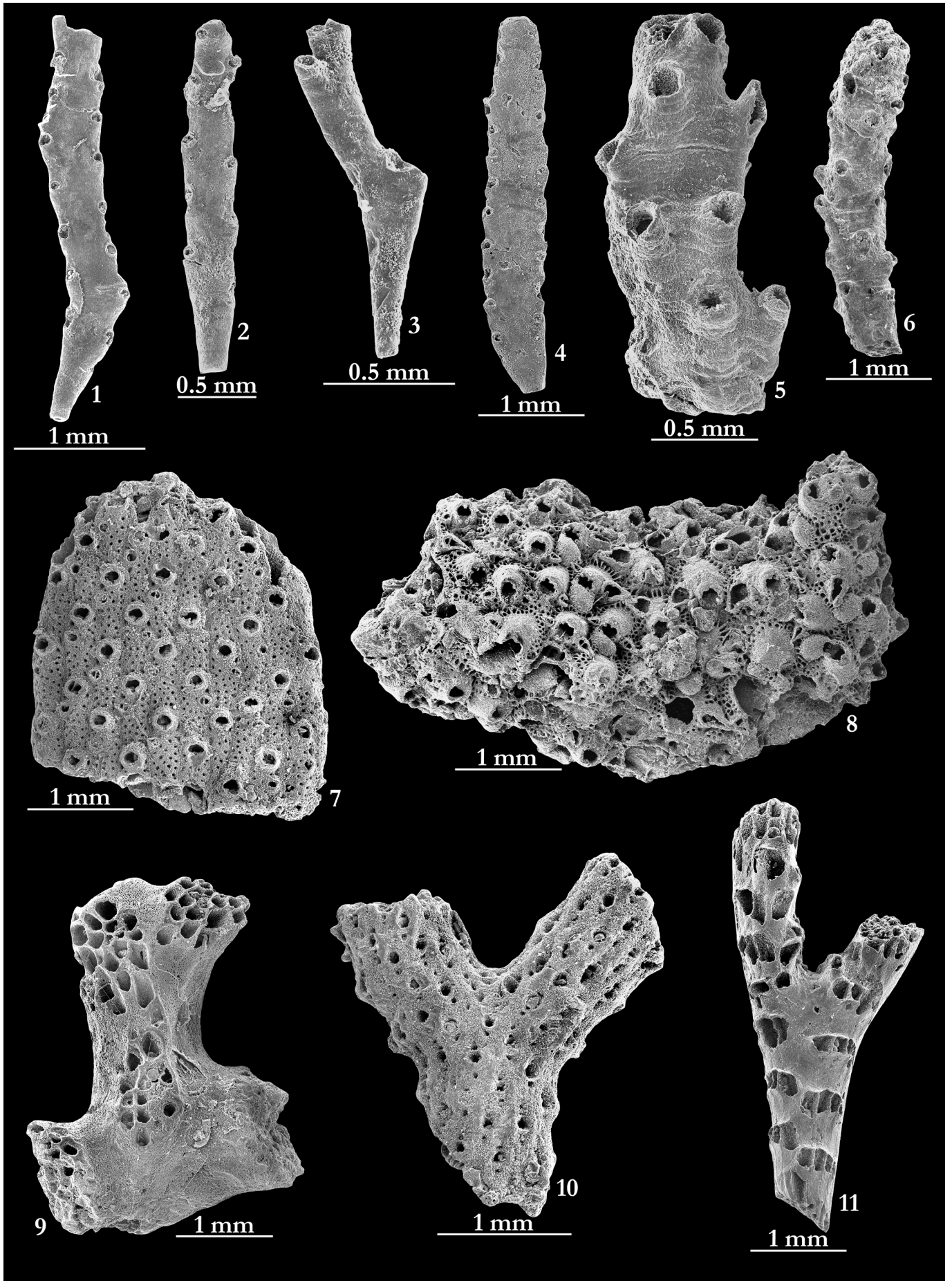


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Explanation to Plate III

- 1 *Crisia denticulata* (LAMARCK, 1816) — Kemence, cellar row, upper sample, ×25.
- 2 *Crisia eburnea* (LINNAEUS, 1758) — Kemence, cellar row, upper sample, ×30.
- 3 *Crisia baueri* (REUSS, 1848) — Mátraverebély, Mátra-7, cave dwellings, lower sample, ×50.
- 4 *Crisia boernesii* REUSS, 1848 — Mátraverebély, Mátra-7, cave dwellings, lower sample, ×20.
- 5 *Entalophoroecia anomala* (REUSS, 1848) — Mátraverebély, Mátra-8, cave dwellings, upper sample, ×40.
- 6 *Entalophoroecia pulchella* (REUSS, 1848) — Zebegény, Bakó-4, ×20.
- 7 *Escharina polyomma* (REUSS, 1848) — Mátraverebély, Mátra-8, cave dwellings, upper sample, ×20.
- 8 *Escharoides coccinea* (ABILGAARD, 1806) — Mátraverebély, Mátra-8, cave dwellings, ×20.
- 9 *Fron dipora verrucosa* (LAMOUREUX, 1821) — Budapest, Örs vezér tere, yellow sand, ×18.
- 10 *Hornera frondiculata* LAMOUREUX, 1821 — Mátraverebély, Mátra-8, cave dwellings, upper sample, ×25.
- 11 *Idmidronea disticha* (REUSS, 1848) — Mátraverebély Mátra-8, cave dwellings, upper sample, ×18.

Plate III



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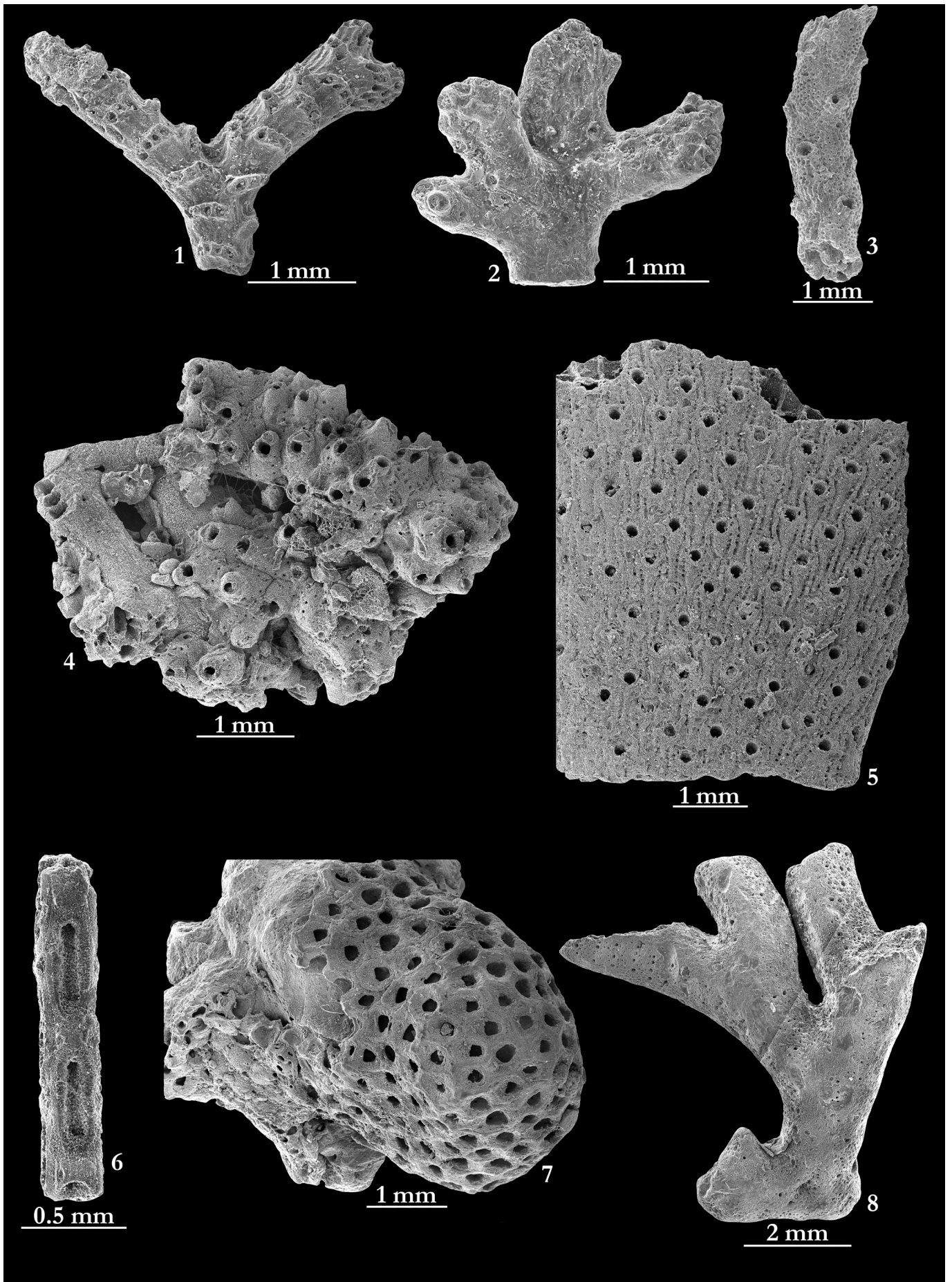
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Explanation to Plate IV

- 1 *Idmidronea atlantica* (FORBES in JOHNSTON, 1847) — Kemence, cellar row, lower sample, ×20.
- 2 *Iodyctium rubeschi* (REUSS, 1848) — Mátraverebély, Mátra-6, Szent László layers, upper sample, ×20.
- 3 *Margaretta cereoides* (ELLIS & SOLANDER, 1786) — Zebegény, Bakó-4, ×15
- 4 *Lagenipora lepralioides* (NORMAN, 1868) — Mátraverebély, Mátra-8, cave dwellings, upper sample, ×18.
- 5 *Metrarabdotos maleckii* CHEETHAM, 1968 — Mátraverebély, Mátra-8, cave dwellings, upper sample, ×10.
- 6 *Nellia oculata* BUSK, 1852 — Kovácsszénája Lake, Mecsek-3, ×40.
- 7 *Onychocella angulosa* (REUSS, 1848) — Fertőrákos, ×15.
- 8 *Polyascosoecia coronopus* (CANU & BASSLER, 1922) — Budapest, Örs vezér tere, yellow sand, ×10.

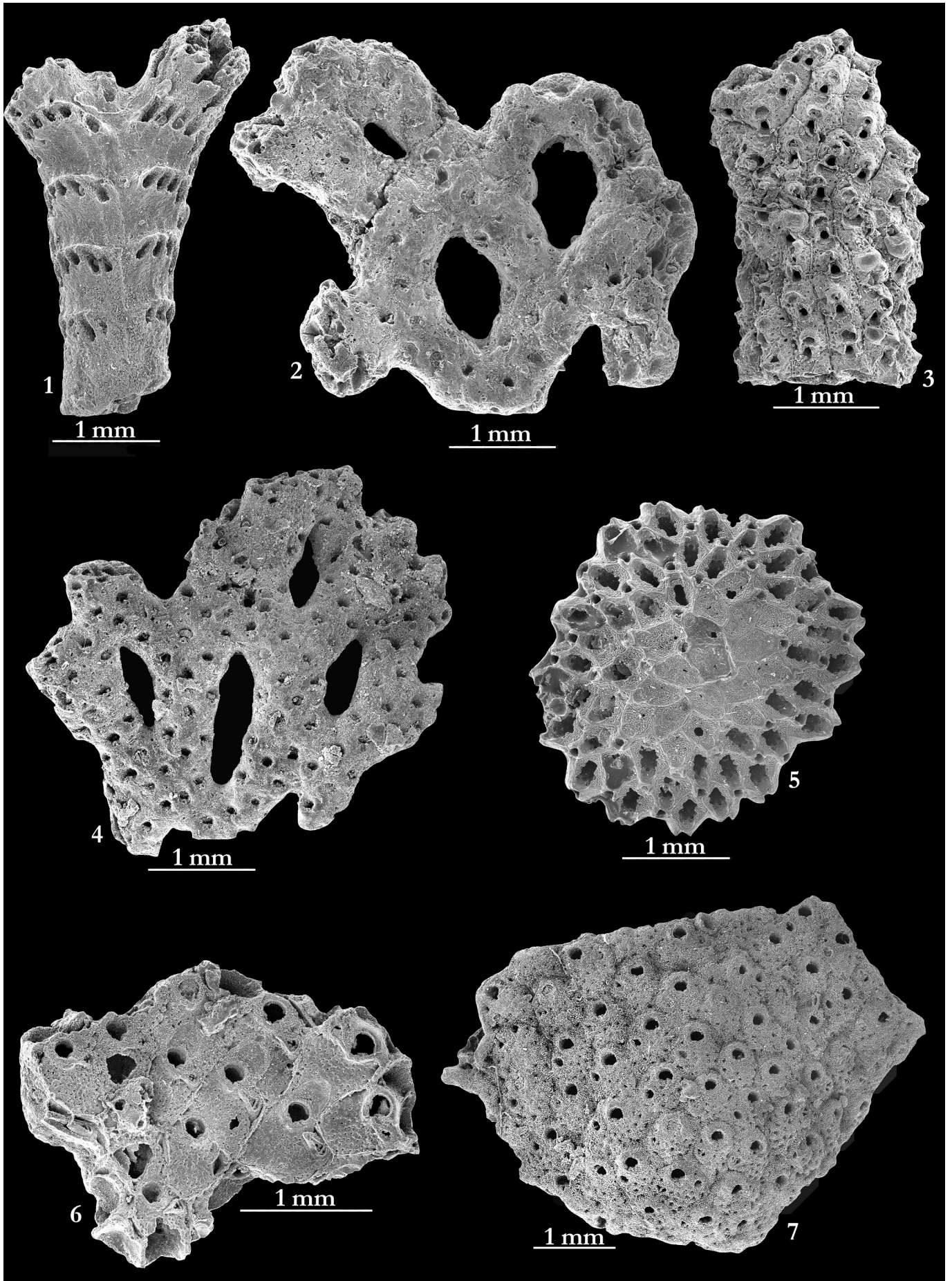
Plate IV



Explanation to Plate V

- 1 *Pleuronea pertusa* (REUSS, 1848) — Mátraverebély, Mátra-8, cave dwellings, upper sample, ×20.
- 2 *Reteporella beaniana* (KING, 1846) — Kemence, cellar row, upper sample, ×20.
- 3 *Schizomavella auriculata* (HASSALL, 1842) — Mátraverebély, Mátra-8, cave dwellings, upper sample, ×20.
- 4 *Reteporella cellulosa* (LINNAEUS, 1767) — Mátraverebély, Mátra-8, cave dwellings, upper sample, ×20.
- 5 *Reussirella baidingeri* (REUSS, 1848) — Szob-2, ×20.
- 6 *Schizobrachiella sanguinea* (NORMAN, 1868) — Mátraverebély, Mátra-8, cave dwellings, upper sample, ×25.
- 7 *Schizoporella geminipora* (REUSS, 1848) — Mátraverebély, Mátra-6, Szent László layers, upper sample, ×15.

Plate V



Explanation to Plate VI

- 1 *Schizomavella tenella* (REUSS, 1848) — Mátraverebély, Mátra-8, cave dwellings, upper sample, ×15.
- 2 *Schizoporella tetragona* (REUSS, 1848) — Budapest, Örs vezér tere-1, ×20.
- 3 *Smittina cervicornis* (PALLAS, 1766) — Kemence, cellar row, upper sample, ×6.
- 4 *Steginoporella cucullata* (REUSS, 1848) — Mátraverebély, Mátra-8, cave dwellings, upper sample, ×10.
- 5 *Tervia irregularis* (MENEHINI, 1845) — Zebegény, Bakó-3, ×20.
- 6 *Tetracycloecia dichotoma* (GOLDFUSS, 1827) — Budapest, Örs vezér tere, yellow sand, ×15.
- 7 *Ybselosoecia typica* (MANZONI, 1878) — Mátraverebély, Mátra-7, cave dwellings, lower sample, ×20.
- 8 *Turbicellepora coronopus* (WOOD, 1844) — Mátraverebély, Mátra-8, cave dwellings, upper sample, ×12.
- 9 *Umbonula macrocheila* (REUSS, 1848) — Mátraverebély, Mátra-8, cave dwellings, upper sample, ×20.

Plate VI

