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Variation of tentacle number in *Membranipora membranacea* cultured under different environmental conditions

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In marine Bryozoa tentacle number is fixed early in ontogeny and is constant throughout the life of the polypide. For many years tentacle number has been regarded as a useful taxonomic character in marine species. It became apparent though that tentacle numbers in Bryozoa may vary a lot within one and the same species, even within one colony. This intracolony variation cannot be due to genetic differences since the zooids originate from asexual budding from a single ancestrula. Therefore environmental factors are expected to be, at least partly, responsible.

We have selected the common, north Atlantic intertidal bryozoan *Membranipora membranacea* in order to study variations in tentacle number under. The bryozoan was cultured under different conditions as temperature, food availability and salinity in order to find explanations for variations found in nature.

Mid-Miocene cheilostomes from Tanzania, and some general worries about the fossil record of tropical bryozoans

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Recent field work along the Tanzanian coast and on Zanzibar Island, as well as historical collections from Pemba and Mafia Island at the Natural History Museum London, have yielded several mid-Miocene bryozoan assemblages. All assemblages were recovered from silty to clayey, non-lithified sediments with varying amounts of bioclastic components, interpreted to reflect mid- to outer shelf conditions during deposition.

Some 25 cheilostome species were identified, most or all of them new to science, whereas several others were poorly preserved, presumably due to reworking, and excluded from this study. In general, the most conspicuous components are four species of *Margaretta*, the jointed colonies of which are occasionally entirely preserved, indicating sudden burial. Even more abundant are internodes of three species of *Vincularia*. On Pemba Island, erect colonies of *Adeonellopsis* and *Schedocleidochasma* are locally very common. Other already established genera present are *Nellia*, *Setosellina*, *Caberea*, *Poricellaria*, *Skylonia*, *Siphonicytara* and *Batopora*. Thus, except for *Setosellina* and a species of an as yet unidentified genus, all colonies present in the assemblages are erect and many of these are flexible and/or rooted.

Compared with records from other tropical regions, species-poor assemblages characterised by *Nellia* and *Vincularia* are often reported, always from fine-grained sediments. In contrast, descriptions of fossil reef-assemblages that mirror modern observations on diversity and ecology (e.g. encrusting bryozoans on shallow-water corals) are extremely rare. The reason for this detriment is certainly found in the strong diagenetic overprint of aragonite-dominated sediments in the tropical realm. The open pore space in these deposits permits water to percolate, promoting the dissolution of aragonite and the precipitation of calcite. Even in cases where aragonite is relatively slowly replaced by calcite, the (calcitic) skeletons of the epibiotic organisms are also affected and are then difficult to determine. Thus, a realistic image of the diversity and evolution of fossil bryozoans in the tropical realm is only expected to being retrieved from drowned reefs, in which the fine-grained interstitial sediments may prevent the aragonitic components from dissolution and recrystallisation.

Diversity, palaeobiogeography and palaeoecology of the Middle Devonian Bryozoa of the Rhenish Slate Massif, Germany

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Devonian strata in the Rhenish Slate Massif in Germany are known since more than two centuries for their abundant and perfectly preserved fossils. However, bryozoans were largely neglected both by researchers and private collectors. Own field work as well as investigation of existing museum collections revealed that bryozoans are abundant and diverse there. Approximately 70 species were identified from the Eifelian and Givetian of the Rhenish Slate after two years of research. From them 4 genera and more than 30 species are new. Many genera were identified for the first time in Europe: *Botryllopora*, *Fistuliphragma*, *Cliotrypa*, *Pinacotrypa*, *Microcampylus*, *Eostenopora*, *Fenestrapora*. They show palaeobiogeographic connections to the Middle Devonian of North America and Morocco.

Different bryozoan communities are characteristic for the Middle Devonian of Rhenish Slate Massif. The most widely distributed and most diverse is the *Intrapora variabilis* community, which contains ptilodictyine *Intrapora variabilis* and diverse smaller species, mainly cystoporates and trepostomes. Another typical community is *Eridopora orbicularis* community, which is characterized by presence of abundant discoidal, pizza-like colonies of cystoporate *Eridopora orbicularis*. This community is associated mainly with large fungiform stromatoporates. Reverse side of stromatoporates represents a suitable substrate for encrusting bryozoans. Less common is the *Fistuliphragma eifelensis* community, which is known from few localities and is characterized by presence of tubular encrusting bryozoans in clay-rich sediment. These hollow tubular colonies are represented by three different species, *Fistuliphragma eifelensis*, *Cyclotrypa cyclostoma* and *Eostenopora clivosa*. A monospecific *Eifelipora ramosa* community is also known from several localities and is characterized by the presence of abundant branched colonies of a new trepostome genus in fine-grained sediment. An exotic *Intrapora leunissenii-Leioclema ahuettensis* community is known only from one locality, and is represented by abundant and diverse bryozoan fauna, associated with extremely fine, clay-rich sediment.

Origin and development of the mesoderm in *Membranipora membranacea*

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The origin of the third germ layer in Bryozoa is still only insufficiently known. Earlier descriptive studies postulate the mesoderm to originate from a quartet of presumptive endodermal cells at the vegetal pole of the blastula. These cells are said to divide off cells into the blastocoel, which subsequently begin to proliferate. In addition to the lack of detailed documentation for this process, most observations were made in species with non-feeding larvae that are either gut-less or bear a non-functioning intestinal tract. As the planktotrophic cyphonautes larva is widely regarded to resemble the ancestral larval form in Bryozoa, the mode of mesoderm formation in such larvae is suggested to be of greater phylogenetic significance, especially in comparisons with other metazoan phyla.

I have conducted TEM and cLSM studies to trace origin and fate of mesodermal cells in developmental stages of the cheilostome bryozoan *Membranipora membranacea*. Shortly after gastrulation, one ectodermal cell from the prospective larval anterior pole ingresses into the primary body cavity. This cell gives rise to muscular cells that gain elongate shape and connect the basis of the developing apical organ to the anterior blastoporal rim, the presumptive site of the pyriform organ. Further muscles can be derived from the first set of cells. Undifferentiated mesodermal blastemal cells, that occur in later stages are unlikely to be derived from muscle cells, but are located directly underneath the outer epithelium and therefore likely to arise by repeated ingression or delamination of ectodermal material. Although initial mesoderm formation takes place in proximity to the ectoderm-endoderm boundary, proliferations from endoderm have not been observed. These results are compared to patterns of mesoderm formation in other metazoan groups.

Threshold levels for nutrient influence on zooecia size in *Electra pilosa*

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The affect of food concentration on the skeletal morphology of *Electra pilosa* (Linnaeus 1767) was tested experimentally. A threshold effect was observed in the relationship between zooecium size and food concentration and was identified in published results of two other studies. Very low nutrient levels resulted in stunted colonies with small zooecia, but at low to intermediate concentrations a close relationship exists with zooecium size. Maximum zooecium size occurred at sub-maximum food concentration and sub-maximum zooecium size occurred at higher food concentrations. Previous studies that have reported no effect of nutrients on zooecium size used food concentrations above the threshold for inducible variation. In this study, variation in zooecia size was minimal and unchanging at moderate to high nutrition levels and the greatest variation was observed at the nutrient level producing the optimal mean zooecium size. Experimental nutrient levels are comparable to those in nature based on observed, equivalent chlorophyll *a* levels. We also show that the preservable phenotype of these specimens with induced environmental variation also records information with genetic significance.

Upper Badenian-Lower Sarmatian new bryozoan faunas (SE Poland – W Ukraine): preliminary overview

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The Middle Miocene (Upper Badenian – Lower Sarmatian) bryozoan assemblages from the SE Poland (Roztocze area) and Western Ukraine (Medobory Ridge) provide a new data on taxonomy and biogeographical connections within the Paratethys. The Middle Miocene (Badenian) of the Central Paratethys can be regarded as one of the classical areas of studies concerning bryozoan faunas from Neogene (Vávra 2001). The newly recognized bryozoan fauna from the Upper Badenian of Galuschintsi (Medobory region, Western Ukraine) represents rather low biodiversity assemblage with approximately 30 different taxa. The very characteristic are cyclostomes dominated by the massive zoaria of fungiform and spheroidal colonies such as *Bobiesipora*, whose zoarium consists of a circular or oval-shaped base, completely covered with kenozoecia with branches developing in radially arranged fascicles similar to those of Lichenoporidae. The very characteristic are *Lichenopora hipsida* (Fleming, 1828), *Tholopora* and *?Trochiliopora*. Among the cyclostomes occur also finger-shaped zoaria of *Crisia*, encrusting zoaria of *Tubulipora*, *Oncousoecia* and *Plagioecia*. Cheilostomes are represented by the most characteristic *Myriapora* and the other bryozoans such as, *Hippopleurifera*, *Schizoporella*, *?Steraechmella*; branched colonies of *Steginoporella*, and encrusting *Rhamphonotus* are also recognized. Reticulated zoaria of *Reteporella* are numerous. *Schizoretepora* which also occur is one of the element of the bryozoan fauna of the coralligenous biocenose being the richest circumlittoral bryozoan adapted for the life in the regions where wave action currents are strong. *Celleporaria* forms branching massive zoaria, whose length exceeds up to 10 cm in height.

The studied Sarmatian bryofauna from SE Poland - Western Ukraine shows an extreme low diversity among which the most common are cyclostomes and cheilostomes such as e.g. *Tubulipora*, *Schizoporella* - the most conspicuous which form a rigid organic framework composed of many growth layers, *Hippopleurifera* and *Celleporina*. The described, here bryozoan assemblages stress a sharp decline in the bryozoan biodiversity between the Upper Badenian and the Lower Sarmatian which probably reflects environmental changes during the Middle Miocene (e.g. hesitation or decrease in salinity and as well as climatic changes).

Bryozoan diversity in Sagami Bay estimated from historical collections

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Japanese marine bryozoan study has been beginning with the study by Busk (1884), and the first major report on a collection of Japanese bryozoans was Ortmann's monograph of specimens from Sagami Bay (Ortmann, 1890). Sagami Bay has been recognized as a locality of exceptionally high marine biodiversity. In the early 20th century, several researchers contributed to documentation of this diversity, including Edward S. Morse, Ludwig H. P. Döderlein, and Franz T. Doflein. Morse and Döderlein conducted faunal studies there more than 130 years ago. The first great monograph on Japanese bryozoans, that of Ortmann (1890), was based on Döderlein's specimens from 1880–1881. Subsequently, the German zoologist Doflein, who studied in Strasbourg under Döderlein and learned of the high biodiversity of Sagami Bay from the latter, traveled to Japan and studied the Sagami Bay fauna from 1904 to 1905; collecting specimens by plankton net and dredge. Several researchers studied Doflein's collection, and the results were published containing many original descriptions of Japanese deep-sea animals.

The fauna of Sagami Bay has been studied continually for over 100 years; the huge collection of specimens from Sagami Bay, made continuously for over a century. The old collections contain numerous type specimens of Japanese deep-sea animals, many of which have not been studied since their original description. Interest in Sagami Bay by Showa Emperor in the 20th century resulted in the devotion of considerable resources to both collecting in Sagami Bay and curation of the collections. Recently, the National Museum of Nature and Science of Japan has conducted faunal surveys in Sagami Bay and collected additional specimens. Those collection contains many bryozoan specimens; however, only few of the specimens have been studied to date (Buchner, 1924; Borg, 1933), due to the large amount of material and high species diversity involved.

We visited Zoologische Staatssammlung München in March 2007 and conducted a preliminary examination about 100 of the bryozoan specimens in Doflein's collection using light microscopy and SEM. We found more than 50 species among the specimens examined. We also examined sponge specimens in the Doflein's collection and found more than 10 bryozoan species on pebbles and shells attached to the sponges. Bryozoan-encrusted substrates attached to sponges were separated from the sponge, given a new specimen number, and registered in the museum collection. We examined bryozoan specimens collected by Döderlein which have preserved in Strasbourg Museum in France, and bryozoan collection of Showa Emperor which have preserved in Showa Memorial Institute in Tsukuba; compared with Doflein's collection and estimate the changes of bryozoan diversity in Sagami Bay over the past 100 years.

Distribution of minor elements in the frontal wall of *Pentapora* (Cheilostomata)

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As a cheilostome bryozoan, *Pentapora* is characterized by an hard mineral skeleton that originates from the cuticle or periostracum, the outer organic cover of the body wall. Four types of walls bound the quadrilateral box-like zooid, each one with specific composition, structure and function. However, the completeness of the cheilostome zooecium and the full range of skeletal layer succession are usually dependent on the nature of the mineral frontal wall.

Pentapora skeletal mineralogy has a bimineralic composition, i.e. a mixture of aragonite and calcite, with a dominance of aragonite mainly found within the frontal wall. This wall is composed by two calcified layers: an inner primary calcitic lamellar layer and an outer secondary layer, probably composed by acicular fibres of aragonite responsible of increasing the frontal wall thickness.

The structure and composition of *Pentapora* frontal wall is here tested by analyzing recent specimens from the English Channel (UK). Collection of the colonies was made during August 2005 from Plymouth area localities (Mewstone, Hand Deep, Persier Reef). Thin sections of the laminae were hand-built and morphological structures of the frontal wall were analyzed using a low vacuum SEM (LEO GEMINI-1530). Back scattered electron images at magnification ranging from 50x to 2000x were taken. SE (topographic), BSE (chemical) images and x-ray analysis were simultaneously obtained for the microelement mapping. The element composition was obtained by the microanalysis system INCA-200.

Mapping of minor elements and morphological analysis allowed us to recognize two distinct layers within *Pentapora* frontal wall. Vertical section of the frontal shield showed an inner thin layer that transitioned into an outer thicker one. Distribution of minor elements revealed that both layers are composed by calcium but the content of magnesium increased from the outer to the inner layer. Differently, the strontium content increased from the inner to the outer layer. The absence of Mg in presence of aragonite and the compatibility of aragonite with the Sr, whose content inhibits the alteration of aragonite to calcite under natural geologic conditions, allowed us to recognize and further confirm that the external mineralogical layer is composed by aragonite.

Giant avicularia as key characters in the species-level taxonomy of Pliocene *Pentapora* (Cheilostomata)

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The ascophoran cheilostome *Pentapora*, which includes two or three living species, first appears in the Upper Miocene of Morocco. During the Pliocene, the genus became more widespread, as revealed by the abundance of putative *Pentapora pertusa* (Milne-Edwards, 1836) in Atlantic and Mediterranean sedimentary basins. *P. pertusa* has the typical zooidal features found in recent species of *Pentapora* and possesses sporadic 'giant avicularia' that replace normal suboral avicularia and have a broad triangular rostrum. Giant avicularia occur also in some living populations of *P. fascialis* (Pallas, 1766) but here have spatulate rostra. It is becoming increasingly evident that avicularia, including giant avicularia, may be key characters in the discrimination of congeneric species of cheilostome bryozoans.

The efficacy of sporadic giant avicularia as taxonomic characters is here tested by a study of *Pentapora* from the Pliocene Coralline Crag Formation of Suffolk in eastern England. Collections of *Pentapora* specimens were made during August 2007 from several Coralline Crag localities (Aldeburgh Hall, Broom Pit, Sudbourne Park and SuttonKnoll), supplemented by study of the extensive material in the reference collections of the NHM. Morphological features were analyzed using a low vacuum SEM (LEO VP-1455). Back-scattered electron images at magnifications ranging from 70x to 1500x were taken for morphological comparison.

The morphology of the 'giant avicularia' allowed us to recognize two distinct species of *Pentapora* in the Coralline Crag. In addition to the well-known *P. pertusa*, a second species, which is new, has giant avicularia with drop-shaped rostra. Ovicells also differ between the two species, those of *P. pertusa* having a single large window in the ectoecium whereas those of the new species have numerous scattered pores. The morphologies of the autozooids and normal suboral avicularia are almost identical in the two species, underscoring the taxonomic necessity of obtaining reasonable-sized populations to ensure that giant avicularia and ovicells are present.

Bryozoans from the Pliocene Coralline Crag of Suffolk, England

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The Coralline Crag Formation is an Early Pliocene skeletal sand deposited at the margins of the North Sea Basin and largely consisting of cheilostome and cyclostome bryozoans. Outcropping over a very small area of Suffolk in eastern England, the Coralline Crag has great historical importance. For example, it featured prominently in Charles Lyell's seminal *Elements of Geology*. George Busk (1859) monographed the bryozoans of the Coralline Crag and the overlying Red Crag but the bryofauna as a whole has not been revised since. Busk described 117 bryozoan species from the Coralline Crag. A further 16 species have since been added, bringing the total bryozoan diversity to 133 species. Little is known about the distribution of these species between the three members of the Coralline Crag, the Ramsholt, Subdourne and Aldeburgh members.

Large collections of Coralline Crag bryozoans exist at the NHM, including type material described by Searles Wood and George Busk, plus considerable samples collected during the last 50 years by S. Whiteley, John Bishop and Kevin Tilbrook among others. A project to curate this material began recently. The aim is to sort and identify all of the collections, thereby providing data on the total diversity of bryozoans in the Coralline Crag and the distribution of species between members and localities. This poster illustrates some of the rich variety of bryozoans present in the NHM collections, including the large spheroidal cyclostomes which are particularly diagnostic of the Coralline Crag.

Using bacterial sensors to identify and quantify bioactive compounds

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Identifying novel bioactive compounds from natural sources is a key process in developing new drugs against the increasing bacterial resistance to today's medicines. Work between IBS and Summit has involved the use of microbiological and biochemical techniques to elucidate the chemical constituents of bryozoans *Flustra foliacea* and *Alcyonidium diaphanum*. In purifying compounds from extracts of these species it can be determined whether they contain bioactive compounds. Particular bioactive compounds of interest include those with antibacterial activities, quorum sensing (QS) blocking abilities and those with activity against naturally occurring bioluminescent marine strains and bioluminescent reporters of gene expression described by Winson *et al.*, (1998b). Assays have shown that the bioluminescent response to *F. foliacea* and *A. diaphanum* extracts is increased indicating the possible presence of QS signals.

Commercial production of bioactives from bryozoans would be unsustainable. Complementary research is pursuing the microbiological and molecular analysis of adult bryozoan bacterial endosymbionts and their associated larvae as a promising step towards lead compounds for the drug industry (Sharp *et al.*, 2007).

Permian bryozoans from the Canadian Arctic (Sverdrup Basin) – a preliminary report

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Bryozoans are among the most diverse and most common fossils in Carboniferous and Permian rocks of the present day Canadian Arctic (the Sverdrup basin). Here, as well as in Svalbard and Greenland, bryozoans are known to form small to medium sized reefs and bioherms, and they are distributed in large numbers especially in the carbonate rocks in these areas. The upper Paleozoic succession of the Sverdrup Basin, which is up to 5 km thick, is characterized by eight long-term sequences bounded by major unconformities at the basin margin, passing basinward into correlative conformities.

A significant collection of petrographic thin sections has been studied (originally prepared for various MSc and PhD studies during the last 25 years). Some samples have been thin sectioned for the current study to obtain oriented views of the bryozoans. Due to preservation problems (dolomitization and silicification) acetate peels did not provide good enough results.

The following formations (and their ages) have been studied: Raanes Fm. (Sakmarian), 27 genera; Great Bear Cape Fm. (Artinskian) > 35 genera; Sabine Bay Fm. (Kungurian) <10 genera; Assistance Fm. (Roadian – lower Wordian) 15 genera; Van Hauen Fm. (Roadian-Wuchiapingian) 5 genera; Trolld Fiord Fm. (Wordian-Wuchiapingian) 16 genera; Degerbøls Fm. (Wordian-Capitanian) 7 genera; Lindström Fm. (Wuchiapingian), 14 genera.

The generic composition is similar to time-equivalent units of Greenland, Svalbard, Novaya Zemlya and northern Russia, but also to Tethyan faunas during the Early Permian. Some rather common genera in Svalbard and Russia (e.g. *Coscinium* and “*Ascoporella*”, *sensu* Morozova & Kruchinina (1986)) are absent in the investigated material from the Sverdrup basin. Some genera have an older first occurrence in the Sverdrup basin (e.g. *Permoheloclema*, *Primorella*, *Clausotrypa*) as compared with the Svalbard area, whereas others found in the Sverdrup basin (e.g. *Spinofenestella*, *Phragmopora* and *Stenophragmidium*) are absent from the Svalbard/Russian equivalents. It should also be noted that the youngest Permian faunas of Svalbard are older than the youngest Permian faunas of the Sverdrup Basin. The distribution revealed so far will be presented in paleobiogeographic and biostratigraphic contexts.

Electrids of the Plio-Pleistocene Crag of East Anglia

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The fossil record of *Electra* and its close relatives is relatively poor because most species possess weakly mineralized skeletons and inhabit estuarine conditions, often growing on algae. Therefore fossil material containing electrids is of interest not only for bryozoology but also for taphonomy. The Plio-Pleistocene Crag of East Anglia are known to contain at least one electrid species (Bishop 1988). This is notable for being the only fossil bryozoan without a calcified frontal shield to preserve in-situ calcareous opercula.

Electrids encrusting bivalve shells from the Red Crag Formation (Late Pliocene) and Norwich Crag Formation (Early Pleistocene) of Essex, Suffolk and Norfolk in the collection of the Natural History Museum, London have been studied using uncoated SEM. The following species were detected in the Red Crag: *Einhornia* sp. nov. (figured by Bishop (1988, text-fig. 1C) as *Electra crustulenta*), *Einhornia crustulenta*, *Electra pilosa* and *Electra monostachys*. A fifth species, originally described as *Catenaria dentata* by Wood (1844), is characterized by a strongly uniserial colony form, very long and narrow caudae, pits on the gymnocyst, and mural spines. These features represent a unique combination and warrant the naming of a new genus. In the Norwich Crag Formation electrids are less common and only two species - *Einhornia* sp. nov. and *Electra monostachys* - were found.

Differences in the abundance of electrids between the Red Crag and Norwich Crag formations could be partly explained by different preservation modes. The uppermost Crag sediments were partially decalcified during Pleistocene warm stages when highly acidic soils developed in this area (Kendall and Clegg 2000). According to Energy-dispersive X-ray spectroscopy (EDX) and X-ray diffraction (XRD) analyses, Red Crag bryozoans are coated by Fe-oxide/hydroxide indicating oxidizing conditions after deposition. The thin ferruginous layer is possibly related to early diagenetic glauconite which gives non-oxidized Red Crag a green colouration at depth. Such layers favoured preservation of fine structures, even when the skeleton itself was subsequently completely dissolved. For example, the calcified opercula of *Einhornia* sp. can be affixed by ferruginous minerals to the distal edge of the mural rim, remaining in place after decomposition of the frontal membrane, while basally articulated spines may be preserved in-situ in other cheilostomes. Ferruginous coatings are very thin or absent in the Norwich Crag.

The electrids present in the Plio-Pleistocene of East Anglia are generally similar to those occupying the North Sea offshore of the region today.

Bryozoan diversity in the Adriatic Sea

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Today there are 290 bryozoan species recorded in the Adriatic Sea, belonging to 65 families and 129 genera. During the recent systematic study of hard bottom bryozoan diversity, 73 stations were surveyed along the entire Eastern (Croatian) Adriatic coast and compared for similarity. Altogether, 211 bryozoan species were recorded, 43 of them were for the first time recorded in the Adriatic Sea. The analyses of faunal similarity revealed two main biogeographical regions in the Adriatic. Most of the North Adriatic localities grouped closely together, while South Adriatic localities didn't differ from Central Adriatic. Very similar bryozoan fauna were along the cliffs of the distant islands, exposed to the open sea. In general, the similarity among hard bottom bryozoan assemblages along the Adriatic coast was very high. The most similar were bryozoan assemblages among Central and South Adriatic, while the most different were assemblages between North and Central Adriatic. The bryozoan depth distribution showed that 45% of recorded species mainly grew above 20 m depth, 48% mainly grew beneath 20 m depth, and only 7% of recorded species grow non-selectively in both, infralittoral and circalittoral zones.

**First study on bryozoan diversity on Maldives:
report on the field work.**

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Field work on the Maldives (around Vabbinfaru and Angsana Islands, North Malé Atoll) was undertaken using SCUBA-diving during 11-16 January 2008. Altogether six large samples including more than 200 specimens of the coral rubble and mollusk shells with bryozoan colonies were collected on the 5-37 meters depth. Living colonies were photographed to document pigmentation. Collected samples were partially fixed in 70% alcohol and Bouin's fluid for anatomical research on reproductive patterns, and partially dried for the study under the scanning microscope. Altogether recognized and preliminarily identified 38 bryozoan species, belonging to 27 genera and 20 families from the classes Gymnolaemata and Stenolaemata. Species identification is in progress.

Preliminary data on a bryozoan collection from the Phuket area (SW Thailand)

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Bryozoans from the Indian Ocean are generally poorly known, as also pointed out in recent papers (see Tilbrook, 2006, for instance) and, particularly, knowledge of marine Recent bryozoans from Thailand is completely lacking. Within such a scenario, new information is needed.

To partly fill this gap, the analysis of bryozoans from several bottom samples made available as the result of sampling in the frame of an Italian PRIN project, focusing on ecologic, sedimentologic and geochemical evaluation of environmental impact caused by the December 26th 2004 tsunami on the coastal soft bottoms of Khao Lak, North of Phuket Island (southwestern Thailand, Andaman Sea) has been undertaken.

Samples come from 0-15 m deep sandy-gravelly bottoms largely disseminated with pebbles, cobbles and large coral bioclasts from a dead fringing-reef. Isolated large-sized living corals and small coral bioconstructions are locally present. Such chiefly soft bottoms represent usually understudied and even overlooked habitats in tropical areas where taxonomic researches mostly focus on reefs and reef-related habitats.

A first examination of living and dead bryozoans points to the presence of about 70 species, including several very poorly known taxa and some presumably new species needing to be described. Only a couple of taxa belong to cyclostomes, whereas the majority of species and specimens (more than 95%) belong to cheilostomes, some families among which Phydoloporidae, Celleporidae and Smittinidae being particularly diversified.

Most species develop unilaminar sheets and rarely multilaminar encrusting and celleporiform colonies on large coral, algae and mollusc bioclasts. Several colonies, above all those belonging to *Bryopesanser*, *Crepidacantha*, *Exechonella*, *Metacleidochasma*, *Parantropora*, "*Predanophora*", *Puellina* and *Thornelia* are usually small-sized. In contrast, species of *Celleporaria*, *Hippaliosina*, *Jelliella*, *Membranipora*, *Parasmittina*, *Pleurocodonellina*, *Rhynchozoon* and *Thalamoporella* form wide patches, mostly on the undersides of decimetre-sized substrata. Interestingly, some species belonging to *Characodoma* are able to colonize sand- and granule-sized clasts, which often become completely enveloped. Erect species are very subordinate mainly represented by flexible colonies mostly belonging to *Scrupocellaria*, *Caberea*, *Nellia*, *Poricellaria* and *Vasygniella*, fixed to the substratum by means of rhizoids or uniserial running networks. Finally, *Triphyllozoon mucronatum* seems the unique erect rigid species, able to withstand high hydrodynamics in such shallow water environments, through fenestration of its colonies.

All living colonies, sampled about one and half year after the tsunami event, have relatively small sizes, presumably reached within few months (see Jackson and Hughes, 1985, for instance) and possibly originated from recently settled larvae testifying the local recovery of environmental conditions.

Holocene bryozoans from Sicily

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Owing to its location in the central part of the Mediterranean Sea, Sicily has a relevant interest for geographical distribution analysis of marine species, among which bryozoans.

Although first accounts on some bryozoan species go back to the end of the nineteenth century, the core of present knowledge has been essentially built in the latest three decades and information on bryozoan colonization and distribution is still completely inadequate for wide areas. Nevertheless, data available allow some preliminary statements to be done.

Sicilian bottoms, mostly included within continental shelf environments, host some 270 species, which account for slightly less than 60% of the Mediterranean as a whole (Rosso, 2004) and about 80% of the bryozoan faunas of the Italian seas (see Chimenz, Rosso & Balduzzi, 2007). It is worth noting that ctenostomes account for a sensible portion of these “lacking species” whereas the remaining part is given by north Tyrrhenian Sea and north Adriatic Sea species, among which some particularly adapted for colonizing shallow water environments and even brackish waters or extreme deep-water environments, often in association to deep-water scleractinian coral bioconstructions as it is the case for the eastern Ionian Sea. Finally, a certain number of species, for which dead specimens have been repeatedly sampled, probably live in peculiar/extreme environments and/or are represented by rare, sparse colonies.

When the three Sicilian sides (northern coasts along the Tyrrhenian Sea, southern coasts along the Sicily Strait and eastern coasts along the Ionian Sea) are compared each other, it becomes obvious that bryozoan diversity reaches the highest values in the Ionian Sea with about 240 species, a feature which nearly doubles values from the Sicily Straits. This results appear congruent with the general distribution of habitats suitable for bryozoan colonization and also largely with research efforts, mostly performed along the east side of Sicily and focused on the bryozoan characterization for some benthic assemblages, such as the Coastal and Offshore Detritic Bottom assemblages, the Photophylic Algae assemblage and also communities from harbours and other shallow-water human substrata. Finally, it is worth noting that most data relate to zones which were or were selected for becoming marine protected areas, such as Ustica, the Eolian and Pelagian archipelagos and the Ciclopi Islands. Although distinction in total species richness, sounding differences from a biogeographical point of view can be envisaged only for several species whose records in Sicily waters mostly represent the known easternmost distribution boundary. Similarly, the Ionian Sea represents the westernmost site for *Monoporella fimbriata carinifera* (Chimenz, Boccia, Giovannini, 2004) and for *Cosciniopsis ambita*, recently discovered within cave environments from SE Sicily. Of special interest also the first recovery from deep-sea areas in the Sicily Straits of living specimens belonging to a species of *Gemellipora*, other than the “cosmopolitan” *G. eburnea* (Rosso, personal data) and the first occurrence of a *Catenicella* species (Rosso, 2007).

Taxonomical and ecological studies on bryozoans off the Jordan coast in the Gulf of Aqaba

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Located on the Gulf of Aqaba, the Marine Science Station in Aqaba (MSS) is the only marine research centre in Jordan. The MSS is jointly operated by the University of Jordan, Amman, and Yarmouk University, Irbid. It has the objective of monitoring ecological trends in coastal and marine habitats and species communities, with an emphasis on coral reefs. It provides facilities for academic training and conducts baseline research on coral reefs and reef-associated organisms, marine water quality and the impacts of selected pollutants on the marine environment. Accordingly, it plays an important role in the protection of the marine environment. Joint projects with German, French and English universities and research institutes were successfully executed over the past 20 years. In 1989, the MSS and the Senckenberg Research Institute signed a formal "Agreement on Scientific and Technical Co-operation". In the framework of this agreement, joint research is conducted and there is an active exchange programme for researchers and graduate students. The two institutions also co-operate in the field of graduate and postgraduate training.

Since April 1, 2006, the German Academic Exchange Service DAAD has been funding the cooperation project "Establishment of a Middle Eastern Biodiversity Research, Training, and Conservation Network". Cooperating partners are the Senckenberg Research Institute and Natural History Museum, Frankfurt, Germany, the American University of Beirut, Beirut, Lebanon, the University of Jordan/Yarmouk University, The Marine Science Station, Aqaba, Jordan, Sana'a University, Sana'a, Yemen, and the University of Tehran, Tehran, Iran. As a small part of the larger cooperational framework, the bryozoology in Senckenberg is concentrating on a taxonomical survey of bryozoans in the Gulf of Aqaba in Jordan.

The Red Sea a classic location for bryozoan studies ever since EHRENBERG separated "Bryozoa" from "Anthozoa" in 1831, on the grounds of collections and observations he made during his journey around Red Sea (1820 - 1826). The important study of WATERS (1909) on the grounds of the HARTMEYER collection of Red Sea bryozoans is still unsurpassed as an overview on the taxonomy of Red Sea bryozoans, and this report is now 100 years old. Therefore, taxonomy has to come first, and studies on how biotas are affected by geographical isolation and human made environmental changes will be a topic of the second stage of our activities.

The main tasks for our bryozoan studies are:

- * Compilation of a species inventory for the study areas
- * Analysis of species composition and diversity at selected locations

- * Mapping of bryozoan microhabitats present in the different sites, and monitoring of the most important physical parameters
In the second phase of our activities we aim at:
- * Comparisons of indopacific communities. Such comparison is needed to assess the degree of endemism
- * to demonstrate the true geographic range of selected bryozoan species
- * Providing information on ecology and distribution and to provide means of identification for all species monitored
- * to redescribe selected types in historical collections all over the northern equatorial realm of the Indo-Pacific, depending on project intermediate results
- * Contribution to the general understanding of biodiversity patterns in the transition of reefal and non-reefal communities

Bryozoans were collected from four different sites located in front of the area of the Marine Science Station Aqaba:

- 1) 23.III.2007; coral rubble; 0-2 m
- 2) 23.III.2007; coral rubble; 13 m
- 3) 24.III.2007; coral rubble & small stones; 16,5 m
- 4) 25.III.2007; sea-grass meadow (*Halophila stipulacea*); 22,5 m; collecting done with underwater compressed-air suction tube (targeting polychaetes, not bryozoans)

Collecting sites were chosen to cover to different depths and substrates in order to obtain a greater variety of specimens and species, respectively. Sampling was done by snorkeling in shallow water (site 1) and by scuba-diving (sites 2-4). During scuba-diving samples were taken by filling buckets with substrate whether by hand or by aid of shovels. At site 4, the sea-grass meadow, a suction-tube was used, constructed by Mr. Yousef Ahmed, Marine Science Station, Aqaba.

In the talk, a preliminary overview on the taxonomical results is given. Furthermore, some first results on bryozoan growth forms indicating environmental stress in the Aqaba region will be given. Although the condition of reef growing off the Aqaba station is not really good, the bryozoan fauna turned out to be surprisingly diverse. It may be safe to assume that the overall diversity of bryozoan species will range in the vicinity of 150 species, once the study has been finished.

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Bryozoan affinities – searching for phylogenetic characters with new techniques.

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The phylogenetic position of bryozoans remains enigmatic. Current molecular phylogenetic analyses place bryozoans ambiguously within the metazoan phylogeny. Morphological research currently focuses more on taxonomic characters, especially on the cystid structures of marine bryozoans. For better understanding of bryozoan form and function and to acquire morphological characters for phylogenetic conclusions, scanning electron microscopy, micro-CT imaging, 3D-reconstruction techniques and high-speed cinematography are applied on freshwater bryozoans. Special emphasis is placed on the process of budding as well as on the structure and function of the retractor muscles. A short outline of preliminary results will be presented.

**Will the real *Pentapora* stand up!
(a historical review of *Pentapora fascialis*)**

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A historical review of *Pentapora fascialis* (Pallas, 1766) is presented, covering the major partitioning of the *fascialis* against *foliacea* growth forms. Over the years controversy has reigned regarding the status of the taxa *Pentapora fascialis* and "*Pentapora foliacea*". Many authors have shown a preference for distinguishing between the two for biogeographical and ecological reasons. Ellis (1755) was the first to comment that the "*Cells*" were similar and more recently Hayward & Ryland (1999) synonymised the forms, regarding *P. foliacea* (Ellis & Solander, 1786) as a junior synonym of *P. fascialis* (Pallas, 1766). Genetic studies are in progress.

***Plumatella viganoi* n.sp. (Bryozoa, Phylactolaemata)**

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A new species of phylactolaemate is described from Italy. It was sampled from Lake Trasimeno (Perugia, Umbria) during the years 1967, 1969 and 2005. The new species is characterized by rather encrusted zoecial tubules having a circular-section and hyaline ectocyst, which is yellowish when it is older. The septa are absent and the keel is visible only occasionally. The floatoblast is elliptical and the dorsal fenestra is round. The annulus polar width is almost double than laterally.

Previously the statoblast of this new species was probably confused with that of *Plumatella repens* or with “*P. repens*” and “*P. vaihira*” forms described by Lacourt (1968) for *P. casmiana* and with also the pycnoblast of the same species described by Wiebach (1963).

rDNA ITS region to type freshwater bryozoans (Bryozoa, Phylactolaemata)

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The limited morphological differences exhibited by colonies and statoblasts of most of the freshwater bryozoan species make remarkably difficult the certain species identification, particularly within Plumatellidae. The analyses of 18s nuclear rDNA and 16s and 12s mitochondrial rDNA genes have been recently performed to assess the phylogenetic relationship among freshwater bryozoans at different taxonomical levels (Wood and Lore, 2005; Okuyama *et al.* 2006). However, due to the low genetic variability of these genomic regions the phylogenetic relationship within plumatellids is still to be resolved. In this study, we have developed a fast and reliable protocol to isolate and amplify DNA from colonies and statoblasts from different environments. Primers that allow the selective amplification of the fast evolving Internal Transcribed Spacer (ITS) region of nuclear rDNA from freshwater bryozoans were then designed. The alignment of the ITS sequences from seven Phylactolaemata species, five of which belonging to the Plumatellidae, revealed a high level of genetic polymorphism. Thus, the ITS region might represent a valuable genetic marker to type morphologically similar bryozoan spp. and shed light into the phylogenetic relationship among Plumatellidae.

Microcomputed tomography X-Ray microscopy of cyclostome bryozoan skeletons

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The internal morphologies of cyclostome and other stenolaemate bryozoan skeletons are traditionally studied using oriented thin sections or acetate peels that provide two-dimensional information. In some studies, serial thin sections or acetate peels have been employed to reconstruct three-dimensional internal morphology. However, serial sectioning is not only destructive but can be very time-consuming and suffers from limitations in resolution imposed by the intervals between successive sections. The advent of CT scanning has had a major impact on studies of macromorphology but, apparently, has not been applied to bryozoans, probably because of their small size. Microcomputed tomography X-ray microscopy (microCTXRM), however, represents a new technique with great promise for bryozoans.

The Gatan SEM-XRM is an SEM-hosted X-ray microscope which provides an internal view of the structure of samples without the need for cross-sectioning. The XRM adds the third dimension to scanning electron microscopy, at a resolution unachievable by conventional CT scanning. A point-like x-ray source is formed by focusing the electron beam onto a suitable target. The resultant x-rays are transmitted through the sample and projected onto a high resolution, high sensitivity x-ray camera to form an image. Three-dimensional solid models of samples can be reconstructed from rotational datasets using x-ray microtomography reconstruction algorithms. This allows the arrangement of internal structures to be analyzed by “virtual slicing” without ever having to physically dissect the sample. XRM image resolutions of 500nm and below are achievable.

Preliminary research on the applicability of microCT XRM to bryozoans has focused on five erect cyclostome genera with narrow branches: *Crisia*, *Hornera*, *Idmidronea* and *Mesonea* from the Recent, and *Semielea* from the mid-Cretaceous. Results clearly demonstrate the massive potential of this technique for investigating aspects of three-dimensional skeletal morphology. For example, the complete lengths of the tubular zooids can be seen, from their origin as new buds to their distal apertures opening on the colony surface. Budding loci can be characterized, and the sizes of the zooids fully and accurately quantified. In addition, the origins and three-dimensional morphologies of cancelli in cancellate cyclostomes can be visualized, providing data relevant to the problem of whether these tubular structures are polymorphic zooids or elongated, canal-like communication pores. The distributions and numbers of communication pores penetrating the walls between adjacent zooids can be evaluated. Furthermore, microCT three-dimensional XRM images are visually striking and valuable in communicating bryozoan morphology to non-specialists.

First record of *Manzonella exilis* (Manzoni, 1896) from Gallina (Reggio Calabria), Pleistocene of southern Italy and description of unusual arrowed-shaped avicularia

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The first record of *Manzonella exilis* (Manzoni, 1896), the type species of the genus, from the Pleistocene of southern Italy associated to the brachiopod *Terebratula scillae* tanahocoenosis is reported and the most significant features of the species are described in detail. Particular attention is given to the unusual arrow-shaped vicarious avicularia occurring on the colony.

The original description of the type species of this genus by Manzoni doesn't figure the characteristic avicularia, although El Hajjaji (1992) does figure very similar avicularia in his Moroccan material noting that *M. exilis* occurs in the Miocene of Morocco and the Pliocene of Spain and Italy. This record appears to be the youngest for the species from the Mediterranean Region.

Molecular phylogenetics of marine Bryozoa based on 18S rDNA gene

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The current systematic status of Bryozoa and phylogenetic relationships between its orders (Cheilostomata, Ctenostomata, Cyclostomata) and within their families are uncertain. Their present classification is based on the zooid frontal wall and fossil record data, however there is an inconsistency with molecular 16S rDNA gene data Dick *et al.* (2000) where ctenostomes, cyclostomes and cheilostomes were shown to be paraphyletic. Larval morphology has also been emphasised as an area lacking sufficient information.

In the present study molecular sequence data for the 18S rDNA gene have been collected for over 30 species of Bryozoa, based on material collected in South Wales. Bryozoa specific oligonucleotide primers for 18S rDNA were developed, tested and optimised.

Based on the collected 18S rDNA sequences and the secondary structure alignment of the sequences a phylogenetic analysis was performed using Bayesian methods. A mixed evolutionary model was used for different regions of the alignment of 18S rDNA, including an rRNA-specific model.

The resulting trees suggest a monophyletic Cyclostomata. The position of Cheilostomata and Ctenostomata are uncertain and vary depending on whether a sequence of *Alcyonidium gelatinosum* is or is not included in the analysis. Without *A. gelatinosum*, Ctenostomata are a monophyletic clade within paraphyletic Cheilostomata. Addition of *A. gelatinosum* makes Ctenostomata paraphyletic incorporating monophyletic Cheilostomata. In addition, a secondary structure model for *Bugula turbinata* is presented. This is the first bryozoan 18S rRNA structure model and should be of utility in future systematics studies.

A method of larval analysis and visualisation was evaluated using confocal laser microscopy. This method facilitates observation of the external morphology of larvae including a partial 3D reconstruction so that their morphotype based on the Zimmer and Woolacott (1977) system can be identified. This method is superior to previously used epi-fluorescent microscopy approaches due to its much higher resolution and the lower number of artefacts encountered.

From August E. Reuss to Gilbert Larwood: bryozoan studies in Austria

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The very first who published detailed studies on fossil bryozoa from Austria has been August Emanuel REUSS (1811 – 1873), physician, mineralogist and – together with D'ORBIGNY and EHRENBERG - one of the early pioneers of micropalaeontology. REUSS started his career as a physician in Bohemia (Bílina) and became finally full professor of mineralogy at the University of Vienna. Under the title 'Die fossilen Polyparien des Wiener Tertiärbeckens' he described bryozoa, corals and also '*Nullipora ramosissima*', a coralline alga (1847). After numerous publications on minerals, bryozoa, corals, foraminifera, and ostracods he was about to prepare a revision of the bryozoa from the Austrian Neogene which has been issued not until after his death (1874). This revision was finally finished by means of two publications by Angelo MANZONI (1877, 1878). Except for two publications (a faunal list by CANU in 1913 and the description of a limited number of taxa from Eisenstadt, Steinebrunn and Porzteich by CANU & BASSLER, 1925) only a few studies by KÜHN (1892 – 1969) can be mentioned from the following years: he published among others first informations about bryozoa from the Early Miocene and Danian of Austria. Detailed studies of fossil bryozoa from Austria have been done by Carl August BOBIES (1898 – 1958), the results having been published in a number of papers in the years 1925 – 1958.

The next essential step in modern bryozoan studies of Austrian faunas has been done by a 'bryozoan working group' at Lyon: DAVID, POUYET, MONGEREAU. Especially the detailed revision of the Cheilostomata from the Vienna Basin has to be mentioned in this connection (DAVID & POUYET, 1974).

The author of this present paper started his own studies in 1972, summarizing the state of knowledge of Austrian Neogene bryozoan faunas in a 'bryozoan catalogue' in 1977. During the last 30 years collecting activities especially in the area of Eggenburg (Early Miocene) and in the Neogene basin of Styria have yielded a lot of new results.

A highlight of bryozoology for Austria has been the Conference of the International Bryozoology Association held at Vienna in 1983. Gilbert LARWOOD having been president of the society at this time had developed a strong personal contact to Austria during a number of years. Together with the author of this paper he spent many days of field work especially to study Miocene sediments during his different visits to Austria.

Eocene bryozoa from Austria have been studied and described in extensive publications by Kamil ZÁGOR_EK (2001, 2003). A number of guest scientists contributed essentially to bryozoan research in Austria (e.g. XIA, Nanjing; OSTROVSKY, St.Petersburg). Detailed studies being results of various theses have sometimes been published at full length (SCHMID, 1989), or have at least been published partly (SCHATTLEITNER, 1991).

Finally it seems worth mentioning that an Austrian author had also been the very first to describe Recent bryozoa from the Adriatic Sea (HELLER, 1867). A lady who had also been engaged in Adriatic bryozoan studies (SIMMA-KRIEG) was the very first Austrian participant in an IBA Conference: Milano, 1968. Recent Phylactolaemata from Austria are extensively studied by WÖSS since more than twenty years – the results have been presented at IBA conferences since 1989 (Paris). She has moreover started public relation activities for the 'moss animals' by organizing an excellent international bryozoan exhibition (WOESS, 2005).

Molecular evidence for the status and interrelationships between cyclostome bryozoan suborders

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Cyclostomata are the only extant order of the Class Stenolaemata, an ancient group of bryozoans with a fossil record extending back to the early Ordovician. Controversy surrounds the relationships between modern cyclostomes and extinct stenolaemates; some authors consider Cyclostomata to be monophyletic, while others regard them as polyphyletic, with different suborders being descended from “extinct” stenolaemate orders of the Palaeozoic. We have embarked on a research programme to test the monophyly of Cyclostomata. Initial work has been using complete large and small ribosomal subunit (LSU and SSU) DNA to infer the interrelationships between the five extant suborders of cyclostomes (Rectangulata, Articulata, Cerioporina, Cancellata, Tubuliporina). This has produced some surprising results.

New developments in serious fouling by freshwater bryozoans

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For over 100 years biologists have known that when fresh water is drawn from bryozoan habitats the bryozoans are likely to come along. Most civil engineers have yet to realize this simple principle; thus we often find pipelines, filters, and cooling water channels fouled by heavy growths of plumatellid bryozoans. The impact on human structures is greater than most people realize. A single bryozoan incident last year cost an international chemical company over \$12 million and released enough explosive gas to level several city blocks. The single phylactolaemate species most responsible for serious “bryofouling” is *Plumatella vaihiriae*, capable of building dense beds nearly 1 meter thick. Other nuisance species include *Plumatella emarginata*, *P. reticulata*, *P. rugosa*, *P. fungosa*, *P. bombayensis*, and *Paludicella articulata*. Unlike many other types of pests, bryozoans cannot be managed with a single generic strategy. Much depends on the exact species involved, the time of year, the source of water, the size of the system, geographic location, and even the local weather. Every management plan has its unique limitations. Chemical treatments can effectively kill entire colonies but they leave the statoblasts untouched. Fungal treatments can kill statoblasts, but they require several weeks to work. Many industries at risk for bryozoan fouling now employ special monitoring devices for anticipating problems before they reach crisis proportions.

Diagnostic characters of bryozoan statoblasts: an overview

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Phylactolaemate taxonomy has undergone major changes in recent years, especially due to an increase in species number in the family of Plumatellidae which comprise about 78 % of the phylum. As colony and zooid morphology do not offer enough reliable distinctive criteria, the different forms of resting stages (floatoblasts, sessoblasts and ptioblasts) have developed to a powerful working tool for species discrimination. Taxonomy has mainly been advanced through the SEM-examination of the sclerotized outer surface of the statoblasts (nodule, tubercle, reticulation, polar groove, central prominence etc.), although the inner structure of the resting stages (annulus cells, pores) has repeatedly been attracting attention as well. In several cases, the validity of these microstructures as specific features to define species still needs to be examined. The goal of this ongoing study is to implement a standardized catalogue of characters for SEM investigation of statoblasts for future comparative work. The assessment of the significance of outer and inner surface patterns of freshwater bryozoan resting stages also deserves highest interest under the aspect of integrating molecular data as independent markers in bryozoan phylogenetic studies.

Bryozoan event in Carpathian Foredeep

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Bryozoan events represent short in time but massive accumulation of Bryozoa which were described from different stratigraphical horizon. In Tertiary sedimentary succession in Carpathian Foredeep (and also in Vienna Basin) a sharp layer with boom of bryozoans may be distinguished inside carbonate sediments. Carbonate rocks in Miocene sequences have been usually formed by coralline algae, larger foraminifera and hermatypic corals, which were in isochronous level replaced by bryozoans. Later Molluscs dominated over bryozoans.

Bryozoan events in Miocene is characterized by short time interval (usually between zone M6 between FO of *Orbulina suturalis* and LO of *Praeorbulina circularis* it mean about 14.8 – 14.58 Ma). The event always started by very similar bryozoans association consists mainly from Cyclostomatous erect forms like *Tervia*, *Idmidronea* or *Exidmonea* sometimes with Reteporids. The terminal bryozoans association is also similar and is usually represents by cheilostomatous bryozoans like *Smittina*, *Metrarabdotos* and/or Celleporids.

Two paleoenvironmental changes may explain replacement of coral and algal accumulation by bryozoans. Common belief regards such bryozoan accumulations as indicators of short-time climate deteriorations. The second factor may represent changes of trophic condition. Algae and corals are adapted to oligotrophic conditions, while bryozoans prefer mesotrophic or eutrophic conditions.

Foraminifera and calcareous nannoplankton as environmental proxies of the “Bryozoan event” in the Middle Miocene of the Central Paratethys (Czech Republic)

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In order to improve the reliability of using bryozoans as an indicator of palaeoenvironment, a detailed study of the ancient environmental parameters of the Middle Miocene bryozoan event was carried out using foraminifera, calcareous nannoplankton and oxygen and carbon stable isotope data. Abundant occurrence of Bryozoa in the Middle Miocene of the Central Paratethys was an isochronous event which can be correlated with M6 Zone between FO of *Orbulina suturalis* and LO of *Praeorbulina circularis* (14.8 – 14.58 Ma).

The ecosystems of the Central Paratethys marine basins during this time were generally influenced by the Middle Miocene climatic optimum and the large transgression which covered the Central Paratethys basins with tropical-subtropical waters. These events triggered the expansion of Bryozoa which settled in the narrow shallow-water zone of the basin and were accompanied by epiphytic foraminifera such as *Asterigerinata*, *Lobatula* and *Elphidium* and large foraminifera such as *Amphistegina*, rarely cibicidoids. Although foraminiferal assemblages show only small palaeoenvironmental variations, bryozoan species compositions remarkably vary according to paleoenvironments. In this study, four clusters with differing bryozoan assemblages can be distinguished in shallow water environment as follows:

- 1) *Reteporella* - *Hornera verrucosa* assemblage, indicative of a high-energy environment,
- 2) *Buffonellodes* - *Rhynchozoon* assemblage, occurred on carbonate substratum with seagrass meadows influenced by the Middle Miocene warm-water incursion.
- 3) *Smittina* - *Metrarabdotos* assemblage, indicative of toleration of suboxic zone in sediment.
- 4) *Schizomavella tenella* - *Schizoporella tetragona* assemblage, recorded almost in all shallow water environments. This cluster probably represents species with high adaptation potential.

Exceptionally deeper-water conditions were inferred at one section, and represented by a *Tervia irregularis* dominated assemblage. This assemblage was only present for a short period of time.