

# ABSTRACTS & PROGRAM

*25<sup>th</sup> – 28<sup>th</sup> May 2017*

*University of Vienna*

*Vienna Austria*

## Welcome to the 14<sup>th</sup> Larwood Symposium in Vienna!

'Servus' as we Austrians say.

It's my pleasure to welcome almost 50 colleagues and friends from 15 different countries to Vienna, the capitol of Austria. It is the third time the IBA will come to this city for exchange of new scientific results and new ideas for future research projects. In 1983, Norbert Vávra first invited our community to the 6<sup>th</sup> international meeting followed 25 years later by the 8<sup>th</sup> Larwood meeting organized by Norbert Vávra and Andrew Ostrovsky. With this meeting, Vienna will be the venue with most IBA-meetings so far. Kind of surprising considering that the amount of active bryozoologists was never very high when compared to other locations.

Vienna is an extraordinary city and an excellent location for conferences and meetings. This is also reflected in the amount of international meetings in this city. Just in 2015 statistics count 3.685 congresses and business events. Organizing a meeting commonly turns out to be more work than expected and I'd like to thank all persons involved in making this meeting possible: Our secretaries Anita Morth and Doris Nemeth, our IT-technician Sonja Matus and my helping hands and students Hannah Schmibaur (who also designed the logo for this meeting), Nati Gawin, Philipp Pröts and Basti Decker.

I hope that everyone will have a pleasant stay in Vienna and look forward to an exciting new IBA-meeting.

Best wishes,

Thomas

## Scientific program

### Friday 26.05.2017

08:30-09:00 **Registration**

1<sup>st</sup> session chair: **Tim Wood**

09:00-09:10 **Thomas Schwaha**

*Welcome in Vienna*

09:10-09:25 **Paul Taylor & Loic Villier**

*Turnover time: bryozoans from the type Campanian (Upper Cretaceous) of south-west France*

09:25-09:40 **Mark Wilson et al.**

*Bioclaustrations in Upper Ordovician trepostome bryozoans: Evidence of parasitism or mutualism?*

09:40-09:55 **Andrej Ernst et al.**

*Carboniferous bryozoans of Egypt*

09:55-10:10 **Caroline Buttler et al.**

*The relationship between Silurian gastropods and encrusting trepostome bryozoans*

10:10-10:25 **Abby Smith & Katerina Achilleos**

*Patterns of distribution in shelf bryozoans of Southern New Zealand*

10:25-10:55 coffee break

2<sup>nd</sup> session chair: **Mark Wilson**

10:55-11:10 **Chiara Lombardi et al.**

*Low pH conditions impair modular plasticity in the bryozoan *Cryptosula pallasiana**

11:10-11:25 **Piotr Kuklinski et al.**

*LARVAE - Linking Annual cycle of Reproduction and recruitment to environmental variables in Arctic Epifauna – overview of the project*

11:25-11:40 **Tim Wood**

*Update on Digestion in Freshwater Bryozoans*

11:40-11:55 **Eva Ježková & Josef Rajchard**

*Experiments with the freshwater bryozoan *Pectinatella magnifica**

11:55-13:00 lunchbreak

3<sup>rd</sup> session chair: Hans Arne Nakrem

13:00-13:15 **Natalie Gawin** et al.

*The myoanatomy of Pectinatella magnifica and Cristatella mucedo (Bryozoa, Phylactolaemata)*

13:15-13:30 **Uliana Nekliudova** et al.

*New ultrastructural data on crisiid Cyclostomata*

13:30-13:45 **Elena Belikova** et al.

*Muscular system of the cyclostome bryozoan Crisia eburnea: preliminary data*

13:45-14:00 **Philipp Pröts** et al.

*Life in a tube: Morphology of Hypophorella expansa (Bryozoa, Ctenostomata).*

14:00-14:15 **Olga Kotenko** & Andrew Ostrovsky

*Myoanatomy of gymnolaemate larvae: searching for homologies*

14:15-14:45 coffee break

14:45-15:00 **Sebastian Decker** et al.

*The peculiar life cycle of the ctenostome bryozoan Pherusella cf. brevituba from the Mediterranean Sea*

15:00-15:15 **Heather Grant** et al.

*Transitions of reproductive strategies in the Cheilostomatida: repeated evolution or loss of embryonic incubation?*

15:15-15:30 **Andrea Waeschenbach** & Robyn Cumming

*Molecular systematics of Lanceoporidae*

15:30-15:45 **Lee Hsiang Liow** & Paul Taylor

*Bigger is better, so let's get bigger? A survey of zooid size through 100 million years*

15:45-16:00 **Marianne Nilsen Haugen**

*Molecular phylogeny and trait evolution of adeonid bryozoans*

16:00-16:30 coffee break

4<sup>th</sup> session chair: Andrew Ostrovsky

16:30-16:45 **Jonas Solnørdal Nærø**

*Bryozoan growth rates and life histories in the Arctic marine environment.*

16:45-17:00 **Emanuela DiMartino** et al.

*Differences in extinction rates explain contrasting regional diversity patterns in modern tropical bryozoans*

17:00-17:15 **Steven Hageman**

*Insights from the analysis of Adriatic bryozoan colony growth habits: summarizing complexity without losing clarity*

17:15-17:30 **Norbert Vávra**

*Bryozoan faunas from the Early Miocene of Austria indicating seaway connections: facts and possibilities.*

## Saturday 27.05.2017

session chair: Andrea Waeschenbach

09:00-09:15 **Vanessa Yepes Narváez**

*Deep Bryozoan community in Colombian Caribbean, Possible Habitat providers*

09:15-09:30 **Joanne Porter** et al.

*Biodiversity of Bryozoa at Lough Hyne Marine Nature Reserve, County Cork, Southern Ireland.*

09:30-09:45 **Mary Spencer Jones** & Consuelo Sendino

*Mining data - the NHM data portal*

09:45-10:00 Anna Koromyslova, **Silviu Martha** & Alexey Pakhnevich

*New species and wall morphology of Campanian-maastrichtian cheilostome bryozoans of the genus *Acoscinopectora* Voigt, 1956 as revealed by micro-CT*

10:00-10:15 **Ernie Gilmour** & Michael Toma

*Timanodictids and girtyporids – do they really belong in the Cryptostomida?  
(and do they even belong in the same order?)*

10:15-10:30 coffee break

10:30-10:45 **Urszula Hara**

*Early Cenozoic bryozoan records - are they good indicator of the climatic regimes in West Antarctic?*

10:45-11:00 **Antonietta Rosso et al.**

*Bryozoans from submarine caves of Lesvos Island, Eastern Mediterranean*

11:00-11:15 **Andrew Ostrovsky**

*White Sea Course announcement*

~11:30 **Departure for those participating to Eggenburg, 'Krahuletzmuseum'**

- *Guide through 'Krahuletzmuseum' & the surrounding area (details also depend on weather conditions)*
- *Visit to 'Fossilienwelt' in Stetten with guide through the locality*
- *Evening at Heuriger 'Feuerwehr Wagner' in Vienna*

## **Sunday 28.05.2017**

10:00 Tour through the inner city including historic background, architecture

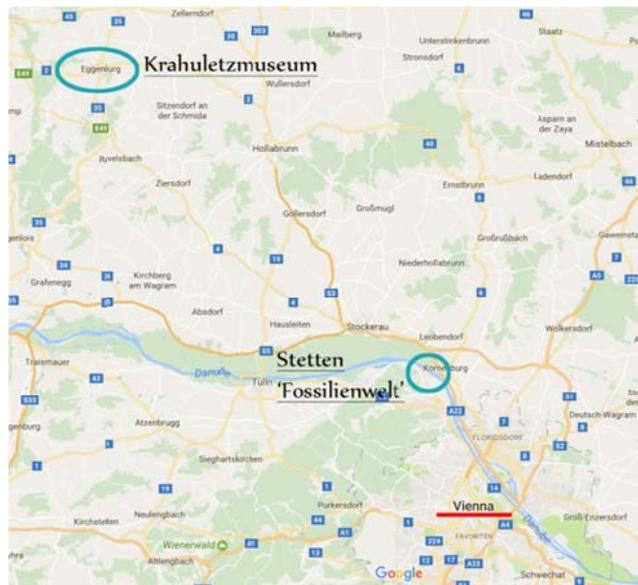
~12:30 Lunch

~14:00 Visit to the Natural History Museum

## Additional information for Saturday and Sunday excursions:

### SATURDAY:

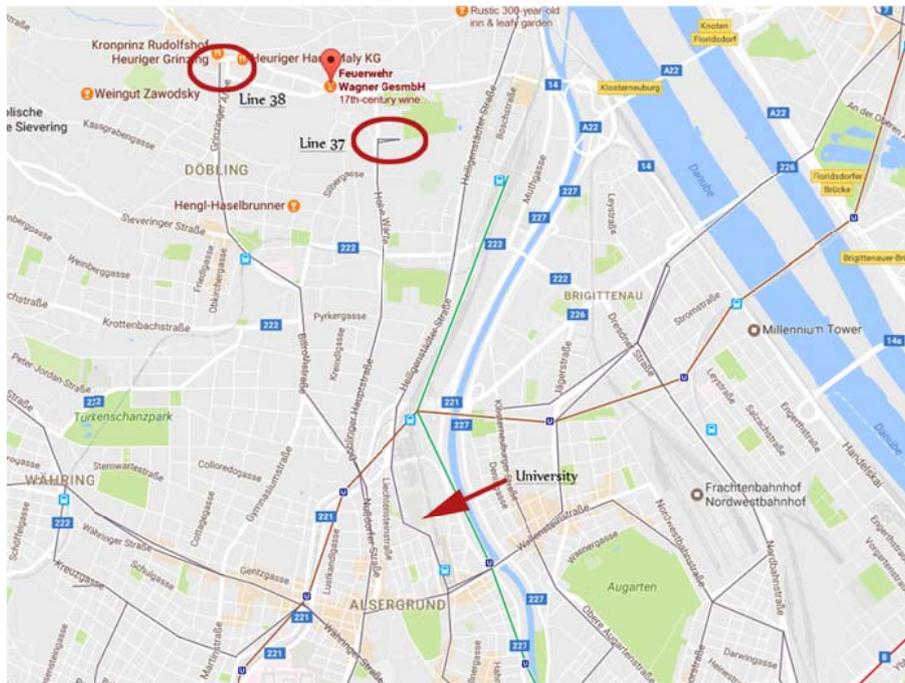
Everybody joining please grab your lunch-bag before getting on the bus. We should get on the bus as soon as possible after the initial session of talks, hopefully at around 11:30. We will then first drive to Eggenburg to visit the Krahuletzmuseum. It will take us approximately 1 hour to get there. The museum has a large and impressive collection of paleontological, geological, mineralogical and ethnological items. We will get a guided tour in the museum and on the cultural history of the area.



After Krahuletzmuseum, we will visit the 'Fossilienmuseum' close to Vienna where we will also get a guided tour for about an hour. The museum shows a large fossil oyster reef from the Miocene.



At last we will return to Vienna, to Grinzing, where we will go to a typical Viennese institution, the Heuriger. It's a place where people sit together, drink wine and grab food from the buffet. The Heuriger is 'Feuerwehr Wagner'. It is situated very close to two tram-lines, the 37 and 38, so it will be easy for everyone to get back.



## SUNDAY:

We will meet at 10:00am in the inner city. The exact location and meeting point will be given during the conference, probably on Friday. Depending on the weather I might have to adapt the tour – therefore I can't give a proper starting location yet. I will guide you for 2-3 hours through the old city and the 'ring' street and tell you more about the city's history and some of its architecture.

Afterwards we will visit the Natural History Museum of Vienna, but before that we will grab lunch. It's not easy to get a proper place for a large group of almost 40 people directly in the city. Therefore we will distribute in the 'Museumsquartier' just next to the museum where 9 different cafés/restaurants are located. Especially when the weather is nice, you can sit outside, grab a snack and just relax for a while there. Detailed information will be given on site.



Food/drink places in Museumsquartier

Check here for more information: <https://www.mqw.at/en/food-drink/>

After lunch we will head to the Natural History Museum of Vienna, where Nesrine Akkari will show us parts of the scientific collections and possibly the cellar and roof of the building. I estimate that we will be finished in the early afternoon where everyone is welcome to check the permanent exhibition of the museum.

## **Turnover time: bryozoans from the type Campanian (Upper Cretaceous) of south-west France**

Paul D. Taylor<sup>1</sup> & Loic Villier<sup>2</sup>

<sup>1</sup> Department of Earth Sciences, Natural History Museum, London SW7 5BD

<sup>2</sup> Centre de Recherche sur la Paléobiodiversité et les Paléoenvironnements, Université Pierre et Marie Curie, Paris

The Campanian Stage of the Upper Cretaceous marks the transition from cyclostome to cheilostome domination among bryozoans, both in terms of global genus diversity and local assemblage species richness. It is therefore important for an understanding of the evolutionary dynamics of bryozoans. The stage was established by Henri Coquand in 1857 based on his work in the Grande Champagne region of the Charente and Charente Maritime in south-west France, from Royan on the coast southeastwards to Aubeterre-sur-Dronne. The Campanian limestones outcropping in these departments contain bryozoan faunas that are very abundant and diverse but which remain poorly known. Recent field collecting and restudy of the type material of d'Orbigny and Ducasse has been aimed at establishing the full diversity of bryozoan species present and their stratigraphical ranges, as well as tracking details of the faunal turnover. Preliminary results show a decrease in the proportion of cyclostomes and a corresponding increase in anascan and particularly ascophoran cheilostomes from the older to the younger formations of the Campanian. The majority of cheilostomes in the type Campanian are onychocellids and other anascans possessing extensive cryptocysts, whereas the most abundant and ubiquitous cyclostome is the operculate eleid *Meliceritites royana*.

## **Bioclaustrations in Upper Ordovician trepostome bryozoans: evidence of parasitism or mutualism?**

Mark A. Wilson<sup>1</sup>, George William Mallory Harrison IV<sup>1</sup>, Patrick N. Wyse Jackson<sup>2</sup>

<sup>1</sup> Department of Geology, The College of Wooster, Wooster, OH 44691 USA;

<sup>2</sup> Department of Geology, Trinity College, Dublin, Ireland

Small bioclaustration structures are common within trepostome bryozoan skeletons in the Cincinnati Group (Upper Ordovician, Katian) of the upper midwestern United States. These tubular structures, often called “chimneys”, are about 1 mm in diameter and scattered across the zoarial surfaces of several trepostome genera. They are parallel to the zooecia and formed by thickened zooecial walls, often extending up to a millimeter above the bryozoan surface. They were formed when the bryozoans grew skeletal tissue around soft-bodied, vermiform encrusting organisms (episkeletozoans). There are several varieties of these bioclaustration structures. They do not correlate with bryozoan taxa (that is, the same structures can be found in different bryozoan genera, and one genus may have different structures), so it appears the particular bioclaustration forms were controlled by the soft-bodied episkeletozoan, not the bryozoans. It is also evident that the episkeletozoans had symbiotic relationships with a variety of trepostome bryozoan taxa. We have two hypotheses for the significance of these bioclaustrations: (1) They represent filter-feeders on the bryozoan surfaces who stole food particles from the feeding currents and forced the bryozoans to expend skeletal tissue and zooecial space to compartmentalize them; or (2) they were commensals who extended a filtering apparatus above the bryozoan lophophores that enhanced the food stream for the zooids below. The first hypothesis is parasitism, the second mutualism. A test to help distinguish between these hypotheses would be to measure whether the bioclaustrations are distributed in a regular pattern that corresponded with colonial feeding excurrents or incurrents. If the structures are randomly distributed it is less likely they benefitted the bryozoan. If instead they appear to be correlated with feeding currents, they may have been mutualists. However, it is also possible that the larvae of the soft-bodied organisms preferentially survived ingestion by the zooids in these current areas and took up residence as either parasites or mutualists. In either case we have here a detailed example of symbiosis between a trepostome bryozoan host and a soft-bodied encrusted in the Late Ordovician.

## Carboniferous bryozoans of Egypt

Andrej Ernst<sup>1</sup>, Heba El-Desouky<sup>2</sup>, Hans-Georg Herbig<sup>3</sup>, Mahmoud Kora<sup>2</sup>, Patrick N. Wyse Jackson<sup>4</sup>

<sup>1</sup> Institut für Geologie, Universität Hamburg, Germany

<sup>2</sup> Department of Geology, University of Mansoura, Egypt

<sup>3</sup> Institut für Geologie und Mineralogie, University of Cologne, Germany

<sup>4</sup> Department of Geology, Trinity College, Dublin, Ireland

Bryozoans are often abundant and diverse in marine successions of the Carboniferous of Egypt. They occur in carbonate beds of formations ranging in age from Viséan to Westphalian. However, current information about the diversity and palaeogeographic links of these faunas is very restricted encompassing only a small number of contributions with patchy data on bryozoan taxonomy and distribution. We report results of a new study on bryozoans from various localities situated on both sides of the Gulf of Suez.

Bryozoans from the western side of the Gulf of Suez were collected from the Westphalian upper unit of the Rod El Hamal Formation of the Wadi Araba area. Thin fossiliferous limestone beds from the interbedded marl-limestone succession yielded *Fistulipora* spp., *Stenophragmidium* sp., *Rhombotrypella domodedovens* Gorjunova, 2002, *Ascopora triseriata* Schulga-Nesterenko, 1955, *Polypora martis* (Fischer de Waldheim, 1837), and *Polyporella pseudoborealis* (Nikiforova, 1938). The identified bryozoans show connections to approximately age-equivalent Moscovian–Kasimovian bryozoans of Russia.

Bryozoans on the eastern side of the Gulf of Suez come from various localities of the Um Bogma Formation (Mississippian, middle to early late Viséan) and from the Abu Durba Formation (Pennsylvanian, Westphalian B–C). Material from the Um Bogma Formation has been derived from marly dolostones and dolomitic limestones of its middle member, from the localities Wadi El Shallal, Gabal El Lahian, Khaboba, and Gabal Nukhul. It contains large trepostomes *Parastenodiscus redesdalensis* (Lee, 1912), and *Stenophragmidium granulosum* Dunaeva, 1964, cystoporates *Fistulipora* spp. Fenestrates reported previously from this unit (Abbass & El Gamal 1970; Kora 1995) have not been reassessed. The identified bryozoans show connections to the Viséan of the British Isles and the Ukraine.

Material from the Abu Durba Formation of the Abu Durba-Wadi Feiran area was sampled from the upper part of the Formation made up of dark grey shales interbedded with sandy dolostone to dolomitic sandstone beds. The dolomitic beds contain an abundant and diverse fauna of cystoporates (*Fistulipora*, *Cyclotrypa*), trepostomes (*Rhombotrypella*), cryptostomes (*Ascopora*) and fenestrates (*Rectifenestella*, *Polypora*). Unfortunately, this fauna is strongly silicified, therefore its use in a detailed taxonomic study is limited.

# **The relationship between Silurian gastropods and encrusting trepostome bryozoans**

Caroline Buttler<sup>1</sup>, Lesley Cherns<sup>2</sup>, Lucy McCobb<sup>1</sup> & Brittany Evans<sup>3</sup>

<sup>1</sup> Department of Natural Sciences, Amgueddfa Cymru – National Museum Wales, Cathays Park, Cardiff CF10 3 NP, Wales

<sup>2</sup> Department of Earth Sciences, Cardiff University, Cardiff, CF10 3XQ

<sup>3</sup> Aberdare Community School, Ynys Road, Aberdare, Rhondda Cynon Taff, CF44 7RP

Silurian gastropods from the Upper Leintwardine Formation, Ludlow Series collected in Delbury Quarry, Shropshire are all seen to be encrusted by trepostome bryozoans. This project looked at the relationship between these two organisms investigating if the bryozoans were using the dead, empty mollusc shells as a substrate, if they were living symbiotically with live gastropods or if the shells were inhabited by a non-gastropod host. Bryozoans were not found to encrust any other part of the shelly fauna found in the rocks and seemed to preferentially choose the gastropod shells. One specimen suggests that the bryozoan calcite may be overgrown by gastropod wall, indicating that in this case they may have been alive at the same time. However although the colonies are not found growing across the shell aperture they are observed slightly growing around into the inner edge. The trepostome colony encrusts the whole of the shell although not equally and they can develop into ramose forms near to the shell aperture. It is proposed that the bryozoans encrusted the shells of living gastropods but continued growing after the death of the mollusc.

The taphonomy of the encrusted gastropod shells includes various modes of preservation. Some of the gastropods are preserved only as internal sediment moulds or coarse sparry calcite fill inside the encrusting bryozoans. In specimens where the shell wall is preserved either completely or partially, some have the originally aragonitic shell recrystallized to microspar while in others coarse sparite crystals are continuous across the still clearly defined shell wall into the internal shell cavity.

# **Patterns of Distribution in Shelf Bryozoans of Southern New Zealand**

Abigail M Smith & Katerina Achilleos

Department of Marine Science, University of Otago, Dunedin, New Zealand

The continental shelf around southern New Zealand includes the southern South Island, Foveaux Strait, Stewart Island, Snares Platform, Puysegur Bank and Campbell Plateau (45-53°S, 165-172°E), forming the southern section of the submerged continent Zealandia. Bryozoans are the dominant calcifying taxon in this area, forming up to 90% of the carbonate sediment that blankets the bottom between 30 and 160 m water depth, as well as a large proportion of the living fauna commonly dredged up from those water depths. From 164 bottom samples collected in this area since 1995, over 100 bryozoan species were identified and combined with published occurrences to develop detailed distribution maps for major species. We will present some of these maps and discuss possible abiotic factors that influence bryozoan distribution on the southern New Zealand shelf, particularly water temperature and prevailing currents.

# Low pH conditions impair modular plasticity in the bryozoan *Cryptosula pallasiana*

Chiara Lombardi<sup>1</sup>, Paul D. Taylor<sup>2</sup>, Silvia Cocito<sup>1</sup>

<sup>1</sup> ENEA Marine Environment Research Centre, PO Box 224, 19100 La Spezia, Italy

<sup>2</sup> Department of Earth Sciences, Natural History Museum, Cromwell Road, London SW7 5BD, UK

Resulting from anthropogenically elevated levels of atmospheric carbon dioxide (CO<sub>2</sub>), Ocean Acidification (OA) has been manifested by a drop of 0.1 units in average surface seawater pH, as well as a reduction in carbonate ion concentration during the past 150 years. According to expected fossil-fuel consumption, a further pH decline of 0.3 - 0.5 units is predicted by 2100, and a cumulative drop of up to 0.7 units or more by 2300.

The ability of marine organisms to persist locally and globally in the face of elevated pCO<sub>2</sub> conditions can be facilitated by phenotypic plasticity (acclimatization) or the evolution of specific adaptations, including small size, moderate forms of metabolic depression, upregulation of calcification and other metabolic changes. In the marine realm, modular organisms are widespread and share many similar reproductive, defensive, competitive and life history traits. Plasticity in modular organisms such as bryozoans includes the relative partitioning of resources to sexual reproduction, colony growth, and maintenance of existing modules, including regeneration.

We have investigated the responses of the cheilostome *Cryptosula pallasiana* when cultured at seawater pH levels of 8.1 (ambient), 7.7, 7.4 and 7.0. Our findings show that lower pH results in: (1) reduction in colony growth rate, although positive growth was still detected even in the lowest pH treatment; (2) decrease in zooid length, with longer zooids at pH 8.1 ( $0.7 \pm 0.006$  mm) compared to pH 7.0 ( $0.63 \pm 0.005$  mm); (3) reduction in the proportion of active zooids in the colony; (4) decline in polypide regeneration; and (5) corrosion of the skeleton, especially the more soluble aragonitic outer layers.

In summary, the results of this experiment suggest that colonies of *Cryptosula pallasiana* cultured in low pH seawater reallocate resources from the maintenance of existing zooids to the budding of new zooids. Future ocean acidification may potentially have a profound effect on colonial organisms by changing how they allocate resources, with potentially serious impacts on life-history patterns and ecological interactions.

## **LARVAE - Linking Annual cycle of Reproduction and recruitment to environmental variables in Arctic Epifauna – overview of the project**

Kuklinski P<sup>1,2</sup>, Weydmann A<sup>3</sup>, Walczyńska K<sup>3</sup>, Bałazy P<sup>1</sup>, Søreide J<sup>4</sup>, Gabrielsen T<sup>4</sup>, Halsband C<sup>5</sup>, Ronowicz M<sup>1</sup>

<sup>1</sup> Institute of Oceanology, Polish Academy of Sciences, ul. Powstanców Warszawy 55, Sopot 81-712, Poland

<sup>2</sup> Natural History Museum, Cromwell Road, London SW7 5BD, United Kingdom

<sup>3</sup> University of Gdansk, Institute of Oceanography, Department of Marine Plankton Research, Al. Marszałka J. Piłsudskiego 46, 81-378, Gdynia, Poland

<sup>4</sup> The University Center in Svalbard, P.O. Box 156, 9171 Longyearbyen, Norway

<sup>5</sup> Akvaplan-niva AS, Framcenteret, Postboks 6606 Langnes, 9296 Tromsø, Norway

Here we present an overview of the project which began in year 2016 and will continue for two years to come. The main objective of the proposed project is to investigate seasonal changes in recruitment, colonization and succession processes of marine hard bottom invertebrate fauna in shallow waters of Isfjorden (west coast of Spitsbergen, Arctic). The goal of the study is to gain knowledge about structure and functioning of Arctic macrobenthic fauna colonizing sea bottom at initial stages of succession during the whole year. We also plan to investigate meroplanktonic communities just above sea bottom as this is the water mass layer about which we do not know much. This is the layer which potentially has the highest impact on processes taking place in benthic community. We will study meroplankton both with classical methods using light microscopy as well as with use of molecular methods that will allow to identify meroplanktonic larvae to the lowest possible taxonomic level. By combining investigation of benthic and planktonic communities we will be able to link process observed in water column and the ones which are taking place in benthic domain. In addition to above we also aim to study ecology and biology of still poorly known organisms including selected species of bryozoans.

These are some specific questions and aims which hopefully the project will enable us to answer / achieve: (1) What is the influence of different environmental factors (biological and physical) on recruitment and succession processes of epifauna in terms of species composition, domination structure, functional groups, abundance and diversity during four seasons; (2) What are seasonal changes in benthic and meroplanktonic larvae occurrence in a high Arctic fjord; (3) Development of molecular methods for identifying larval stages of the key Arctic benthic invertebrates; (4) What is the influence of seasonal changes in environmental conditions on recruitment and succession processes; (5) What is the influence of predators on epifaunal assemblages (cage experiment) (7) How sessile organisms survive during polar night when food resources are restricted?

It will be one of the first Arctic year around investigation at such high latitude on such scale.

## Update on Digestion in Freshwater Bryozoans

Tim Wood

Wright State University, Dayton, Ohio USA

From all appearances digestion in freshwater bryozoans proceeds differently than in their marine relatives. This is suggested by the observation fact that most particles ingested by freshwater species emerge in the fecal pellet without any visible change, while in marine species the fecal pellets include few recognizable parts. The question of what provides nutrition in freshwater bryozoans is somewhat clarified by several recent findings. First, plumatellid bryozoans in tropical regions are now shown to digest the unsheathed cyanobacteria *Spirulina*, strengthening the idea that prokaryotes in general may be an important nutrition source. Second, the stomach surface area in phylactolaemate bryozoans is greatly enhanced by dense stands of long villi similar to those of other invertebrates with extracellular digestion. This indicates the capability of processing process food particles larger than individual bacteria. Finally, there is the curious presence of mineral concretions circulating rapidly between the stomach and gizzard in *Hislopia prolixa*. They appear to function in battering and crushing food particles. *Hislopia prolixa* is the only hislopiid known to occur outside tropical waters and is the only one having such mineral bodies in the gut. Although strictly circumstantial, this observation suggests that cooler waters may have a preponderance of food particles that are more easily digested following physical damage. Taken together, these findings indicate that freshwater bryozoans derive their nutrition from unprotected prokaryote particles, and that food digested extracellularly is absorbed through the stomach wall.

## Experiments with the freshwater bryozoan *Pectinatella magnifica*

Eva Ježková, Josef Rajchard<sup>1</sup>

Department of Biological Disciplines, Faculty of Agriculture, University of South Bohemia, České Budějovice, Czech Republic

Managing of the cultivation of this bryozoan is a long process. So far I have conducted several experiments with cultivation of *Pectinatella magnifica* from the statoblast and experiments with biomass of this bryozoan.

Now, I was able to cultivate zooids from the statoblasts but their lifespan is still only a few weeks. Different abiotic and biotic conditions are currently being tested in order to find out what the determining factors for hatching of the zooids and the subsequent creation of the colony could be. Many factors could have an impact on this fact but it is still unknown which of these is the major one.

The field experiment with biomass on the locality of occurrence was also conducted. We wanted to know how many statoblasts could a colony of *P.m.* of a different size release within a certain time. However, this experiment didn't show what we expected. The biomass of the colonies disconnected before the colonies became sufficiently mature. The colonies of *P.m.* could possibly demand a greater amount of oxygen and the water exchange might have not ensured enough oxygen supply required by these colonies.

Another experiments with the colonies were conducted in laboratory conditions. We wanted to achieve the growth of young colonies. Masses of *P.m.* were placed into a special aquarium culture system which was specially constructed for these experiments. At first, the colonies weighted more than at the beginning of the experiment but only for a couple days. After that the colonies started to lose their mass. Their lifespan was only several weeks without any enlargement of the biomass. This experiment been reported twice. Both attempts had the same result. It is really difficult to create conditions emulating the pond ecosystem.

### Acknowledgements

This contribution was processed under the project GAJU No. 081/2016/Z of the Grant Agency of the University of South Bohemia.

# **The myoanatomy of *Pectinatella magnifica* and *Cristatella mucedo* (Bryozoa, Phylactolaemata)**

Gawin N, Wanninger A, Schwaha T

University of Vienna, Department of Integrative Zoology, Althanstr. 14, 1090 Vienna

Phylactolaemate bryozoans occur exclusively in freshwater and are commonly regarded as the earliest branch within Bryozoa and thus the sister group to the other two classes of bryozoans. Therefore, they are important for the reconstruction of the ground pattern of bryozoans. In this study the myoanatomy of *Pectinatella magnifica* and *Cristatella mucedo* was analysed by means of histology, f-actin staining and confocal laserscanning microscopy in order to fill gaps in knowledge concerning the myoanatomy of Phylactolaemata. Two prominent bundles of longitudinal muscles form the retractor muscles. The entire musculature of the digestive tract is circular. The lophophore shows several types of musculature: frontal and abfrontal longitudinal muscle bands in the tentacles, longitudinal muscles in the lophophoral arms, musculature of the epistome and hitherto undescribed elements of the ring canal musculature. The epistome musculature differs between *Cristatella* and *Pectinatella*. In *Cristatella* smooth muscle fibers form a muscular basket, whereas *Pectinatella* shows additional fibers that traverse the coelomic cavity. The tentacle sheath possesses longitudinal and circular musculature. The bodywall in *Cristatella* has an outer circular layer and an inner longitudinal layer, whereas *Pectinatella* possesses a third diagonal layer. The aperture shows two types of musculature in both species, the duplicature bands and vestibulum dilators. In *Pectinatella magnifica* a vestibular pore surrounded by muscle fibers is associated with glandular tissue. In general the muscular system of both species is very similar with differences mainly in the body wall and epistome. Differences among phylactolaemate species are mainly in the tentacle sheath, epistome, bodywall, the base of the frontal tentacle musculature and the ring canal. This study is the first to reconstruct the ring canal musculature in Phylactolaemata. It provides a more complete image of the myoanatomy in Phylactolaemata by adding data from two additional families, the Cristatellidae and Pectinatellidae. This enables a more profound comparison of the myoanatomy of all three bryozoan taxa.

## **New ultrastructural data on crisiid Cyclostomata**

Uliana A. Nekliudova<sup>1</sup>, Thomas F. Schwaha<sup>1</sup>, Daniela Gruber<sup>1</sup>, Norbert Cyran<sup>1</sup>, Andrew N. Ostrovsky<sup>1,2</sup>

<sup>1</sup> University of Vienna, Austria, Vienna

<sup>2</sup> Saint Petersburg State University, Russia, Saint Petersburg

Our research is focused on ultrastructural details of the sexual reproduction, in particular, embryonic incubation in marine bryozoans. The central group is Cyclostomata, one of the most ancient bryozoan taxa, that is still diverse and abundant in modern seas. Unique combination of their reproductive traits includes intracoelomic incubation of embryos (viviparity), matrotrophic nourishment (via placentation) and polyembryony (multiple clonal development of embryos from a single fertilized egg). Only seven papers have been published on this topic, however, the most recent one being 90 years old. All of them were based on the light-microscopic observations often resulting in unclear, dubious or contradictory statements.

We studied two common boreal species, *Crisia eburnea* and *Crisiella producta* collected at the White Sea. Detailed study of gonozooidal anatomy and embryonic incubation accompanied by matrotrophy provided new interesting data on the embryo and placental ultrastructure. There are still a lot of questions but the information obtained adds greatly to our understanding of cyclostome zooidal structure, functioning of the placental analogue and embryonic development.

These new morphological data are also necessary in the light of current revision of cyclostome phylogeny since many skeletal morphological characters were shown to be homoplasious. Further research will include representatives of some other families. We hope that some of the revealed characters will prove to be phylogenetically significant.

## **Muscular system of the cyclostome bryozoan *Crisia eburnea*: preliminary data**

Elena V. Belikova,<sup>1</sup> Thomas F. Schwaha,<sup>2</sup> Andrew N. Ostrovsky<sup>1,2</sup>

<sup>1</sup> Saint Petersburg State University, Russia

<sup>2</sup> University of Vienna, Austria

Until now the muscular system of cyclostome bryozoans has been investigated using histological methods, and the only study employing the transmission electron microscopy (TEM) was that of Nielsen and Pedersen (1979). The reconstruction of the muscular system using these methods is a difficult task, however, because of the small size of the zooids as well as the general complexity of the system. The confocal laser scanning microscopy (CLSM) has opened the new opportunities for this work.

Autozooids of the common cyclostome *Crisia eburnea* were collected by SCUBA at the 5 m depth in the Chupa Inlet (Kandalaksha Bay, White Sea), fixed in paraformaldehyde, decalcified by EDTA and stained by Alexa Fluor 488 phalloidin. After scanning and using 3D reconstruction software the detailed scheme of the musculature was obtained. The main groups of the muscles recognized are the following: (1) thin ring muscles of orificial sphincter, (2) longitudinal muscles of vestibulum and tentacle sheath, (3) ring muscles of atrial sphincter, (4) paired longitudinal tentacle muscles, (5) two large striated retractor muscles and (6) 1-2 funicular muscles. Additional muscular cells have been recognized at the base of each tentacle. Musculature of digestive tract is presented by (1) thick muscle layer of pharynx, (2) thin and sparse ring and longitudinal muscles of midgut, and (3) rectal sphincter. The polypide is surrounded by membranous sac with numerous ring muscles. We were not able to find a firm evidence of the retractor muscle attached to the cardia. Also a number of details obtained contradict to the schemes of Nielsen & Pedersen (1979). We plan to check these discrepancies applying TEM to our CLSM data.

## **Life in a tube: Morphology of *Hypophorella expansa* (Bryozoa, Ctenostomata)**

Philipp Pröts, Andreas Wanninger, Thomas Schwaha

Department of Integrative Zoology, University of Vienna, Austria

Bryozoans are a large lophotrochozoan clade of colonial aquatic filter-feeders. *Hypophorella expansa* is a boring ctenostome bryozoan originally described by Ehlers in 1876 that has not been investigated for nearly 140 years. As a ‘stoloniferan’ ctenostome its colony is composed of elongated, branch-like stolons and food acquiring autozooids. *Hypophorella expansa* is unique in that its colonies inhabit parchment-like tubes of polychaetes. Originally found in tubes of *Lanice conchilega*, it was also reported to occur in the tubes of *Chaetopterus* sp. In the summer of 2015 live colonies were encountered in the tubes of the latter. To gain more insight about adaptations and peculiarities of this unique bryozoan, immunocytochemical stainings combined with CLSM and 3D-reconstruction techniques and TEM are used.

The colony forms elongated branch-like stolons with laterally attached autozooids. This resembles the general bauplan of a ‘stoloniferan’ ctenostome colony. Stolons show regular wrinkles in their cystid wall; a feature not known from any other stolonate ctenostome. Autozooids possess two fronto-lateral spherical structures that may provide space for the autozoid between the polychaete tube-wall layers. No muscular or nervous elements could be found in them. Between the spheres lies the apertural area which bears a boring apparatus that possibly facilitates movement/penetration of the tubes. At the lophophoral base *Hypophorella* possesses a basal transversal muscle that was not known for ctenostomes until now. The anus is situated at the vestibular region which differs from other ctenostomes. The nervous system has its center in the cerebral ganglion at the lophophoral base from which tentacle sheath nerves traverse distally. It also innervates the tentacles. Proximally from the ganglion a prominent mediovisceral nerve traverses through the pharynx. The final studies will particularly focus on the wrinkled stolons and the fronto-lateral spheres using TEM. This study confirms many findings of Ehlers and due to new methods used today it also provides new data about this ctenostome bryozoan.

# Myoanatomy of gymnolaemate larvae: searching for homologies

Olga N. Kotenko<sup>1</sup> & Andrew N. Ostrovsky<sup>1,2</sup>

<sup>1</sup> Saint Petersburg State University, Russia

<sup>2</sup> University of Vienna, Austria

Gymnolaemata show great variability in the arrangement of larval muscular system (MuS) and in most cases it is difficult to establish clear-cut homologies for their muscle groups. Aiming to find compatibility amongst different larval types we studied for the first time MuS of non-feeding larvae in four gymnolaemate species from different families by fluorescence labelling and confocal microscopy (namely, *Alcyonidium hirsutum*, *Tegella armifera*, *Rhizophostomella ovata*, *Celleporella hyalina*).

Significant differences between these larvae were detected in the arrangement of the body wall musculature (simple loose network of individual muscle fibers vs complex elaborated meshwork of closely interwoven longitudinal and circular fibers). Interestingly, we could not find distinct coronal ring muscle in the coronate larvae of *T. armifera*, *R. ovata* and *C. hyalina*. The musculature of non-feeding larvae of *Alcyonidium hirsutum* is very similar to MuS of pseudocyphonautes of *A. gelatinosum* and both show much more correspondence to feeding cyphonautes larvae than to coronate larval forms. Furthermore, larvae of all four studied species have a transversal muscle, connecting epithelium of the left and right lateral sides, and it is clearly homologous to the shell adductor muscle of the cyphonautes. From the other hand, in each of these four species we found some specific larval muscle groups for which we failed to determine any similarity to the muscles known for bryozoan larvae, although homology between some of them could be suggested by their position. These findings support the old idea that feeding cyphonautes should be considered close to the ancestral gymnolaemate larval type, while non-feeding (endotrophic) larvae originated many times throughout bryozoan evolution independently (following the shift in oogenesis and accompanied by a transition from spawning to brooding).

## **The peculiar life cycle of the ctenostome bryozoan *Pherusella* cf. *brevituba* from the Mediterranean Sea**

Sebastian Decker, Andreas Wanninger, Thomas Schwaha

University of Vienna, Department of Integrative Zoology, Althanstraße 14, 1090 Vienna

Bryozoans are colonial benthic filter-feeders that predominantly inhabit marine environments. Most common and known are the calcified forms – the Stenolaemata and gymnolaemate Cheilostomata. The uncalcified Ctenostomata are a lesser-known and small group of approximately 300 species. The genus *Pherusella* comprises three described species, *P. tubulosa*, *P. brevituba* and *P. flabellaris*. *P. brevituba* was originally described from the Pacific and forms large and commonly large, erect colonies. Over 10 years ago, *P. brevituba* was recorded as invasive species growing on *Posidonia* in the Mediterranean Sea. However, the colonies were always small and showed no erect growth at all. In the past years, samples were collected regularly from the Northern Adriatic. Colonies are quite abundant and mostly do not exceed colony sizes of 4-6 zooids. The ancestrula is easily identified in these colonies by remains of the two cuticular valves of the larvae. Larvae are easily detectable in colonies even with just two zooids. These are brooded within the maternal zooid and become lecithotrophic pseudo-cyphonautes larvae. When the larvae hatch, they swim for a short duration and settle again on *Posidonia* blades again. Colonies were so far not encountered on any other substrate. Consequently, the life cycle of this species is quite peculiar with only small colonies that immediately start to reproduce sexually. Future studies will focus on the morphology of this species as well as try to find out whether this is an undescribed species or not.

## Transitions of reproductive strategies in the Cheilostomatida: repeated evolution or loss of embryonic incubation?

Heather Grant<sup>1</sup>, Andrey N. Ostrovsky<sup>2</sup>, Olga N. Kotenko<sup>3</sup>, Dennis P. Gordon<sup>4</sup>, Andrea Waeschenbach<sup>1</sup>

<sup>1</sup>Department of Life Sciences, Natural History Museum, Cromwell Road, London, SW7 5BD, UK

<sup>2</sup>Institute for Palaeontology, University of Vienna, Althanstrasse 14, 1090 Vienna, Austria

<sup>3</sup>Department of Invertebrate Zoology, Saint Petersburg State University, Russia

<sup>4</sup>National Institute of Water & Atmospheric Research, Greta Point, Private Bag Box 14-901, Wellington, New Zealand

Bryozoans exhibit a range of reproductive strategies. Crucially, the transition between broadcast spawning and embryonic incubation (viviparity and brooding) is thought to have occurred several times throughout their evolution. Although brooding and viviparity is considered the result of a single evolutionary event, each, in the Phylactolaemata and Stenolaemata, respectively, embryonic incubation is thought to have evolved/been lost (depending on the ancestral condition) multiple times in the Gymnolaemata. Here, we focus on the order Cheilostomatida. Nine cheilostome species that perform parental care have been targeted for DNA sequencing and inclusion in the molecular phylogenetic framework. They are *Aetea* sp., (Inovicellina), *Eucratea loricata*, *Scruparia chelata*, *Leiosalpinx australis*, *Brettiopsis triplex* (Scrupariina), *Thalamoporella* sp. 1 & 2 (Thalamoporellina), *Tendra zostericola* (Tendrina), *Biflustra* sp. (Malacostegina). Furthermore, ‘*Membranipora*’ *pura* (Malacostegina?) is being included as a putative internal brooder. The molecular data are being generated by genome-skimming using next-generation Illumina sequencing. At the time of writing, samples had been submitted for sequencing. Concentrations of genomic DNA extracts for *B. triplex*, *L. australis* and ‘*M.*’ *pura* were very low; preservation history for *B. triplex* is unknown and the material is currently stored in IMS (an unsuitable preservative for molecular work) and tissue samples for *L. australis* and ‘*M.*’ *pura* were very small. Thus, although we are aiming to sequence complete mitogenomes and nuclear ribosomal operons for all taxa, success may be variable. Any newly generated sequences, alongside unpublished mitogenomes previously generated, will be added to the wider cheilostome phylogeny. Ancestral state reconstructions will be conducted to shed light on the directional evolution of either embryonic incubation from broadcast spawning or vice versa and how frequently these transitions have occurred.

## Molecular systematics of Lanceoporidae

Andrea Waeschenbach<sup>1</sup>, and Robyn L. Cumming<sup>2</sup>

<sup>1</sup>Department of Life Sciences, Natural History Museum, Cromwell Road, London, SW7 5BD, UK

<sup>2</sup>Museum of Tropical Queensland, Queensland Museum, 70-102 Flinders Street, Townsville, Queensland 4810, Australia

Although significant contributions to the taxonomy of tropical Australian bryozoans have been made in the recent past<sup>1,2</sup>, vast numbers of species remain to be discovered. Representatives of the family Lanceoporidae Harmer, 1957, are commonly found in the tropical waters of the Indo-Pacific with most of the diversity being found in the genus *Calypsotheca* Harmer, 1957. Recent publications added nine new *Calypsotheca* species to the Australian fauna<sup>3,4</sup>. Here we present a molecular phylogeny of lanceoporids collected in north-western Australia (Kimberly and Ningaloo Reef) and north-eastern Australia (Great Barrier Reef) based on mitochondrial genes *cox1*, *cytb* and 16S rDNA. The phylogeny is being used to study morphological synapomorphies that may define molecular clades of *Calypsotheca* species. Furthermore, we will test the monophyly, and thus the systematic validity of morphological characters that define the genus, in the wider context of cheilostome bryozoans, which was put into question in a previous molecular study<sup>5</sup>.

<sup>1</sup>Ryland JS & Hayward PJ (1992) Mem Queensl Mus 32: 223-301.

<sup>2</sup>Hayward PJ & Ryland JS (1995) Mem Queensl Mus 38: 533-573.

<sup>3</sup>Cumming RL & Tilbrook KJ (2014) Zootaxa 3827:147-169.

<sup>4</sup>Sebastian P & Cumming RL (2016) Zootaxa 4079:467-479.

<sup>5</sup>Knight et al. (2011) Mol Phylogenet Evol 61:351-362.

## **Bigger is better, so let's get bigger?**

### **A survey of zooid size through 100 million years**

Lee Hsiang Liow<sup>1</sup> & Paul D. Taylor<sup>2</sup>

<sup>1</sup> Natural History Museum, University of Oslo and the Centre for Ecological and Evolutionary Synthesis, Department of Biosciences, University of Oslo, Oslo, Norway

<sup>2</sup> Department of Earth Sciences, Natural History Museum, London, U.K.

The zooid is a fundamental functional unit of a bryozoan. One of the most commonly measured and information-rich traits of a zooid is its size. An autozooid needs to be large enough to contain and protect a polypide and at the same time function together with it. At the same time, there must be physiological constraints on how large an autozooid can be, given the lack of a circulatory system and a gaseous exchange system in bryozoans. In a recent, as yet unpublished study, we showed that encrusting cheilostome species with larger zooid sizes tend to overgrowth species with smaller zooid sizes. This result stands regardless of taxonomic identity and is consistent through a geological time interval spanning about 2.5 million years. If bigger is better, at least for competitive overgrowths, we might expect encrusting bryozoans to preferentially increase in zooid size through time, all other things being equal. This hypothesis need not necessarily hold for erect bryozoans. Using an archive of cheilostome scanning electron micrographs, we measured zooid sizes in colonies of diverse cheilostomes through about 100 million years of their history to begin to dissect the evolutionary dynamics of zooid sizes.

# Molecular phylogeny and trait evolution of adeonid bryozoans

Marianne Nilsen Haugen

Centre for Ecological and Evolutionary Synthesis, Department of Biosciences, University of Oslo, Norway.

There are huge knowledge gaps in our understanding of the phylogenetic relationships among bryozoans, and the family of Adeonidae is no exception. This family consists of 106 described extant species divided into 10 genera (Bock & Gordon, 2013), and represent very disparate morphologies. Species of adeonids can possess one of two types of significantly different frontal shields; umbonuloid and lepraliomorph (cryptocystidean). Due to this, the family was previously separated into two distinct families; Adeonidae and Adeonellidae, but have now been merged to a single family (Cook, 1973). My aim is to clarify and resolve some of the current questions regarding this family's phylogenetic relationships and evolutionary history.

To do so, I aim to sequence total cDNA from about 20 species from the genera *Adeona*, *Adeonella*, *Adeonellopsis* and *Reptadeonella* on a high-throughput sequencing platform (Illumina HiSeq). Using a genome skimming approach I hope to add new genes to the pool that is commonly used in studies, to increase the phylogenetic signal and hence to understand how this family is related to other cheilostome bryozoans and how species within this family are interrelated.

Bock, P. E., & Gordon, D. P. (2013). Phylum Bryozoa Ehrenberg, 1831. In : Zhang, Z.-Q. (Ed.) *Animal Biodiversity: An Outline of Higher-level Classification and Survey of Taxonomic Richness* (Addenda 2013). 2013, 3703(1), 8.

Cook, P. L. (1973). *Preliminary notes on the ontogeny of the frontal body wall in the Adeonidae and Adeonellidae (Bryozoa, Cheilostomata)*: British Museum.

# **Bryozoan growth rates and life histories in the Arctic marine environment**

Jonas Solnørdal Nærø

*Centre for Ecological and Evolutionary Synthesis, Department of Biosciences, University of Oslo, Norway*

Despite the ubiquity of bryozoan species among the benthic communities of the world, they remain largely understudied. There are major gaps in our knowledge of basic life history traits for most bryozoan species. This is unfortunate as such information is critical for several venues of studies, such as paleontological investigations into their evolutionary history, how they fit into the larger ecological and biogeochemical systems, and how they will respond to a changing environment or general human encroachment.

The aim of this study is to generate much-needed data on basic life history traits of extant arctic cheilostomes and to investigate the relationship between growth rates, zooid sizes and fecundity. The dataset is comprised of dried settlement plates which have been submerged in the Isfjord, Svalbard for up to 4 years. These plates are a part of a larger project of Piotr Kuklinski, associate professor at the IOPAN institute in Sopot, and provide snap-shots of colony development from year to year. The panels represent a wide variety of local bryozoan species, and 5 of the most abundant perennials will be studied in detail. The area coverage of encrusting cheilostomes is easily measured, and from the change of coverage across time, species-specific growth rates will be estimated. Most of the selected species also have visible ovicells, which enable estimates of fecundity. The approach for measuring zooid size and estimating fecundity are under development.

## **Differences in extinction rates explain contrasting regional diversity patterns in modern tropical bryozoans**

Emanuela Di Martino<sup>1</sup>, Jeremy B.C. Jackson<sup>2</sup>, Kenneth G. Johnson<sup>1</sup> & Paul .D. Taylor<sup>1</sup>

<sup>1</sup>Department of Earth Sciences, Natural History Museum, Cromwell Road, SW7 5BD, London, United Kingdom.

<sup>2</sup>Department of Paleobiology, Natural History Museum, Smithsonian Institution, Washington, DC 20013-7012.

The Indo-Australian Archipelago (IAA) is the global centre of tropical marine biodiversity where species richness of most major animal taxa is several times higher than anywhere else. However, when and why this difference arose is unknown. We have addressed this question using extensive new and museum collections of fossil cheilostomes from the IAA and the tropical western Atlantic (TWA).

Although incompletely studied, cheilostomes are well-preserved, diverse and abundant components of Cenozoic tropical sediments. Middle to upper Miocene cheilostome diversity was strikingly similar in the IAA and TWA, strongly implying that the modern disparity in species richness has arisen within the past 5 million years. However, Miocene cheilostome faunas were ecologically very different across the tropics, with encrusting species dominating in the IAA but erect and free-living species dominating in the TWA. Our results support the hypothesis that the modern biogeographical differences in diversity resulted primarily from differential extinction of erect and free-living species in the TWA rather than higher rates of diversification in the IAA. This view is supported by the well-documented regional extinction of cheilostomes and other major taxa in the TWA, associated with oceanographical changes due to the uplift of the Central American Isthmus.

## **Insights from the analysis of Adriatic bryozoan colony growth habits: summarizing complexity without losing clarity**

Steven J. Hageman

Department of Geology, Appalachian State University, Boone, North Carolina, 28608 USA

The modular nature of bryozoan growth allows for a diverse expression of colony form and construction. The full characterization of growth habit features, many of which are environmentally or phylogenetically constrained, results in complex and impractical classifications of colony forms and leads to a paradox: the more features identified (the more powerful the analysis), the more difficult the application. Historically, multiple schemes have been proposed to simplify the characterization of growth habits. Each of these classifications serve specific purposes, but most have an explicit goal of simplification of a complex system and as a result rely on apples-versus-oranges comparisons of functionally and phylogenetically unrelated features.

A refined form a comprehensive classification of bryozoan growth habits (12 variables, multiple categories in each) allows for an investigation of the relationships among character states. This classification results in 655.200.000 unique combinations of character states; however, about 90% of these combinations are topologically impossible or ecologically very highly unlikely. The remaining 10% results in about 61 million possible combinations. Clearly, only a small subset of this possible morphospace has actually ever been occupied by Bryozoa. Multiple Correspondence Analysis (MCA) applied to the Adriatic bryozoan fauna (Hayward & McKinney) allows for the identification of suites of commonly shared growth habit features, full characterization of archetypes and variation on those themes, the highlighting of the significance of rare outliers, as well as the correlation of specific character states with environmental parameters.

# **Bryozoan faunas from the Early Miocene of Austria indicating seaway connections: facts and possibilities**

Norbert Vávra

University of Vienna. Institute of Palaeontology

Whereas bryozoan faunas from the Middle Miocene of Austria have been extensively studied since about 170 years already (Reuss, 1847), the number of investigations concerning faunas from the Early Miocene remained limited for a long time and started rather late indeed. Studies on the basis of collecting activities during the last four decades have yielded promising results however, especially in respect to possible seaway connections (e.g. Vávra, 2013 and the references given therein). Due to this rich material a few important taxonomical problems could also be solved: the description of *Ceriopora* – being among the more common Cyclostomata in our Early Miocene – can be completed by the find of the first gonocyst now. Celleporids, being the most common bryozoa among the Cheilostomata at many localities and showing generally a rather poor state of preservation only, can be attributed mostly to *Turbicellepora krahuletzki* now. This taxon having been described by Kühn already (Kühn, 1925) is obviously rather close to the Recent *Turbicellepora coronopus*. The first find of a colony of *Meandropora* yields one more indication of faunal affinities to Western European bryozoan faunas. So far a few highlights referring to taxonomy.

There are however a number of „prominent absences“ when comparing the bryozoan faunas of the Early and the Middle Miocene; the complete absence of *Margaretta* (very common in Middle Miocene faunas of Austria) is one of the more outstanding examples. Also the occurrence of *Metrarabdotos* (as reported by Kühn, 1925) could not be confirmed and is still open to discussion. These are but a few examples in respect to remarkable differences.

An ever-lasting problem concerns exact biostratigraphical data for important bryozoan localities; the fact that a number of these localities is now attributed to the Ottnangian (following the usual local stage concept) instead of the Eggenburgian, does not result in new problems however. In fact the comparison with bryozoan faunas from Bavaria and the still (unpublished) fauna from the Ottnangian of Upper Austria has become more convincing in this way.

Any comparison with bryozoan faunas from Western Europe (France) remains problematical however: the exact biostratigraphical position of bryozoan-rich „faunas“ remaining still a matter of discussion.

Realizing recent results, including additional bryozoan localities from the Early Miocene of Austria, can be summarized however by the statement that a lot of data and rather promising results could be achieved during the last few years.

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## **Deep Bryozoan community in Colombian Caribbean, Possible Habitat providers**

Vanessa Yepes Narvaez

University of Manchester; Instituto de Investigaciones Marinas y Costeras – INVEMAR

For over 10 years several off-shore research campaigns have been developed in the Colombian Caribbean by the Coastal and Marine Research institute (INVEMAR) in partnership with the Environmental Ministry, Natural National Parks and several academic and private institutions, between 10 to 3000 meters deep to describe the composition and behaviour of the deep water natural resources in the country. Recently three new marine protected areas have been named based on the discoveries of those expeditions; surprisingly for many investigators, not only coral reefs have been found as the main structuring organisms and habitat providers in those deep ecosystems. To date, 128 bryozoan species have recorded and from those around the 70% were found over the 200 meters deep. As part of the design of a management plan for the “Deep Corals National Park – PNNCP” three research expeditions were carried out from 2015 to 2016; one of the main preliminary findings is the abundant presence of bryozoans (34 species) living next to the structuring coral *Madracis myriaster* and holding a big percentage of associated fauna in just the 30% of the total biological material revised. In addition, ten genera and about 12 species have been recorded for the first time for Colombian Caribbean so far, strengthening the knowledge of this group in the country and increasing the bathymetric and geographical ranges for already described species for this Caribbean area.

## **Biodiversity of Bryozoa at Lough Hyne Marine Nature Reserve, County Cork, Southern Ireland.**

Joanne S. Porter<sup>1,2</sup>, Mary Spencer Jones<sup>2</sup> and Julia Nunn<sup>3,4</sup>

<sup>1</sup>*International Centre for Island Technology, Heriot Watt University Orkney Campus, Old Academy, Back Road, Stromness, KW16 3AW, Orkney Islands, Scotland*

<sup>2</sup>*Department of Life Sciences, Natural History Museum, Cromwell Road, London SW7 5BD, England*

<sup>3</sup>*Cherry Cottage, 11 Ballyhaft Road, Newtownards, Co. Down, Northern Ireland*

<sup>4</sup>*Centre for Environmental Data and Recording, National Museums Northern Ireland, 153 Bangor Road, Holywood, Co. Down, Northern Ireland*

Lough Hyne is a marine lake, situated on the coast of County Cork, Southern Ireland. The Lough is unusual in that there are multiple different habitat types found within a relatively small geographical area, due to local geology and to the prevalence of strong environmental gradients. These characteristics give rise to a high level of biodiversity across marine taxa. During a survey of Lough Hyne (July 2015) we identified 57 species of Bryozoa from 13 locations. Many of these were observed at multiple locations. There were several notable observations arising from the survey. Abundant colonies of *Reptadeonella violacea* were seen encrusting the boulders, cobbles and pebbles that lay on coarse gravel at the base of Whirlpool Cliff. These colonies were quite striking with the colour combination of the pale orange outer zooids of the colonies and the contrasting deep violet colouration of the central zooids. Another interesting species sampled was *Figularia figularis* found on small rocks at Western Cliff and Labhra Cliff; this is a species reaching the northern limit of its distribution. An additional species fitting into that category also recorded is *Schizotheca fissa* that was also observed at two locations in Lough Hyne. In the tidal rapids there were abundant growths of the Ctenostome bryozoan *Alcyonidium hirsutum*; this species was growing attached to the algae and colonies had the luxuriant growth form with elongated flattened lobes, an adaptation to living in high current flow environments. Three species of *Bugulina* were recorded. The cryptogenic species *Bugulina fulva* was recorded at Codium Bay West, the non-native species *Bugulina stolonifera* was recorded at Western (Kelly's) Quay and the infrequently recorded *Bugulina calathus* was recorded on silty boulders west of Codium Bay West. No invasive species of Bryozoa were recorded at Barloge Creek, an area popular with leisure boat traffic, despite extensive searching.

## **Mining data - the NHM data portal**

Mary Spencer Jones<sup>1</sup> & Consuelo Sendino<sup>2</sup>

<sup>1</sup>Department of Life Sciences, Natural History Museum, Cromwell Road, London SW7 5BD, England

<sup>2</sup>Department of Earth Sciences, Natural History Museum, Cromwell Road, London SW7 5BD, England

Data mining from online natural history collections databases are now being used to answer questions within biodiversity and conservation research. Many researchers, however, do not always approach relevant collections staff and question the scientific reliability of the data before its use. A lack of scientific rigour caused by non-specialists entering data, errors introduced by database manipulations, and a lack of historical and systematic knowledge about specific collections can occur. These databases are subsequently “mined” by other regional and global data portals, such as GBIF, continuing the spread of erroneous information.

The NHM collections portal currently has over 3.5 million records online. Roughly 44,000 records of Recent bryozoans and over 3000 fossil bryozoan records are presently on the site. Specimen details and images can be extracted and downloaded through a variety of fields and filters. Caution should be used if downloading data from the portal as many of the problems listed above will be inherent in mined data sets. If accessing the NHM portal for a major project, users need to consult the relevant curator for possible shortcomings. Feedback on any inaccurate records would be welcomed.

# New species and wall morphology of Campanian Maastrichtian cheilostome bryozoans of the genus *Acoscinopleura* Voigt 1956 as revealed by micro-CT

Anna V. Koromyslova<sup>1</sup>, Silviu O Martha<sup>2</sup>, Alexey V. Pakhnevich<sup>1</sup>

<sup>1</sup>Borissiak Paleontological Institute of the Russian Academy of Science, Profsoyuznaya St. 123, 117997, Moscow, Russia

<sup>2</sup>Senckenberg Forschungsinstitute und Naturmuseen, Sektion Marine Evertebraten III (Bryozoologie), Senckenberganlage 25, 60325 Frankfurt am Main, Germany

We studied type material of three coscinopleurid species from the Maastrichtian of northern Germany in the bryozoan collection of Ehrhard Voigt using combined scanning electron microscopy and X-ray microtomography. The original identity of two of these species, *A. foliacea* and *A. rugica*, remains unchanged. The type material of *A. fallax* is shown to belong to three different species. The holotype differs significantly from other colonies assigned to *A. fallax* in the original description by having numerous autozooecia with wide peripheral caverns and wide autozooecial chambers. Two new species are created for the material excluded from *A. fallax*. The first species differs from the holotype of *A. fallax* in having only few autozooecia with much smaller peripheral caverns, while the second species has caverns inside the cryptocyst completely surrounding the opesia tube and interconnected between all autozooecia. Additionally, two new species are described using unstudied material. One new species from the late Campanian of Belarus has small peripheral caverns proximally and small autozooecial chambers. The other new species is reported from the Maastrichtian of northern Germany. It has only few autozooecia with small peripheral caverns and shows very thick calcification of the cryptocyst and the vertical and basal walls.

Interzooidal communication in species of *Acoscinopleura* is done via septules located in the vertical and basal walls and connecting each zooecium with all neighboring zooecia. In the vertical walls, lateral channel-like cavities beginning on the level of the proximo- and centrolateral septules and transverse channel-like cavities beginning near the distal margin of the basal walls were observed. Arch-like cavities in the centrodial part of the vertical walls encircle the distal septules and are usually connected with the distal septules, channel-like cavities and ovicells. The majority of Recent cheilostome species have double lateral walls separated by an unpaired intercalary cuticle but single transverse vertical walls. It is therefore possible that the lateral and transverse channel-like cavities in *Acoscinopleura* were occupied during lifetime by the intercalary cuticle. However, in this case, transverse walls in *Acoscinopleura* should also have been double. Furthermore, channel-like cavities are interconnected, forming a network near the basal walls and with the arch-like cavities, the function and formation of arch-like cavities being unclear. The basal wall of some extant erect, bilaminar cheilostome bryozoans is double, indicating that the colony grew as two independent layers, back-to-back. However, species of *Acoscinopleura* have a single basal wall. Basal walls of autozooecia have a pair of septules located directly opposite of the opesia, while the basal walls of vibracularia lack these.

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## **Timanodictids and girtyporids – do they really belong in the Cryptostomida? (and do they even belong in the same order?)**

Ernest H. Gilmour<sup>1</sup> and Michael A. Toma<sup>2</sup>

<sup>1</sup>Professor Emeritus, Eastern Washington University, Cheney, WA 99004, USA

<sup>2</sup>423 N. 10<sup>th</sup> Street, Cheney, WA 99004, USA

Morozova (1966) erected the suborder Timanodictina that included two families, Timanodictidae Morozova, 1966, and Girtyporidae Morozova, 1966, and added it to the Order Cryptostomida Vine, 1883. Gorjunova established a new family Murengoloclemidae, 1994, and Morozova and others (2003) included this new family in the suborder Timanodictina. Gorjunova and others (2004) elevated the suborder Timandictina to the order Timandictida, which then removed the three families from the order Cryptostomida.

In our study of the timanodictids and girtyporids, we find little evidence that these two families should be placed in the same order. The only morphological features shared by the two families are the types of autozooeical budding and the presence of a large “stenostyle” structure in the exozonal wall. The structure, development, and arrangement of the normal smaller stenostyles, and the development of the autozooeica are very different in the two families. The presence or absence of heterozoids, peristomes, and autozooeical diaphragms is family specific. There is also no support for placing the three families (Timanodictidae, Murengoloclemidae, and Girtyporidae) in the order Cryptostomida as defined by Blake (1983, p. 445-446) in the *Treatise*.

In preparing the section on the timanodictids and girtyporids for the revision of the *Treatise on Invertebrate Paleontology* on Bryozoa, we have concluded that the families Timanodictidae and Murengoloclemidae should constitute the order Timanodictida Gorjunova, 2004, and the Girtyporidae be included in a new order Girtyporida.

# Early Cenozoic bryozoan records - are they good indicator of the climatic regimes in West Antarctic?

Urszula Hara

Polish Geological Institute-National Research Institute, Rakowiecka 4, 00-975 Warszawa, Poland

The earliest Cenozoic Antarctic bryozoan fossil records of the late Early Eocene (Seymour Island) are connected with the major phase of cheilostome evolution; clear preponderance of cerioporoid cyclostomes along with abundant microporoideans, umbonulomorphs and lepraliomorphs. The presence of the loose, small zoecia of the cheilostome bryozoans preserved as internal moulds in the lowermost part of the La Meseta Formation, systematically includes the buguloids and catenicelloideans represented by Beanidae, Catenicellidae, Savignyellidae and Calwelliidae, which in the present day are widely distributed in the tropical-warm temperate latitudes and interpreted as deposited in the shallow-water settings (Hara 2015). Undoubtedly, the occurrence of over 90% of mostly warm-loving taxa with multilamellar growth-form of relatively slow growth-rate represented by cyclostomes and cheilostomes is connected with a short-term episode in the lower part of the La Meseta Formation (Telm1), during a long period of their in situ evolution (Hara, 2001). The recently studied bryozoans from the middle part of the La Meseta Formation (Telm4 and Telm5) on the north-western side of the island, reveal a presence of the microporoideans of the *Micropora* as well as lunulitiform warm-loving, free-living bryozoans belonging to the *Lunulites* and *Otionellina* genera, which developed disc-shaped colonies. They dominate in the siliciclastic sediments of the Telm5, along with the new umbonulomorph of the family Brydonellidae *Uharella seymourensis* Taylor, Casadio, Rosa and Gordon, 2008 found as an epilithozoic, encrusting bryozoan occurring in a loose residuum of the clastic sediments. Environmentally, Recent, free-living lunulitids are known to occur in warm, shallow-shelf conditions, at temperatures of 10-29°C, on coarse, sandy to muddy bottom with low to moderate deposition in fairly high velocity current regime. They are overwhelmingly associated with sand fauna environments. The dominant part of the lunulitiform colonies in the Telm4-5 may suggest the shallow-water setting for the middle part of the La Meseta Formation, of the Bartonian age, which is characterized by the reappearance of nautiloids during a short-term return of environmental conditions.

Contrary to that, the bryozoan fauna recognized in the upper part of the La Meseta Formation (Telm7) is composed of the impoverished bryozoan biota of the scarce lepraliomorphs represented by cheilostomes and fragmented, poorly preserved cyclostome zoaria, which are abundantly accompanied by the invertebrates of crinoids and brachiopods as well as gadiform fish remains, penguin bones and whales.

A sharp decrease in diversity near the contact between the Telm5 and Telm6 was probably connected with the climatic cooling event, which culminated at the time of deposition of the upper part of the La Meseta Formation.

The well-documented changes in the biotic diversity of the bryozoan fauna in the stratigraphical profile of the La Meseta Formation illustrate the successive climatic phases such as the Early Eocene Climatic Optimum (EECO), Middle Eocene Climatic Optimum (MECO) as well as the EOT.

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## Bryozoans from submarine caves of Lesvos Island, Eastern Mediterranean

Antonietta Rosso <sup>1</sup>, Rossana Sanfilippo <sup>1</sup>, and Vasilis Gerovasileiou <sup>2</sup>

<sup>1</sup> Catania University Department of Biological, Geological and Environmental Sciences

<sup>2</sup> Institute of Marine Biology, Biotechnology and Aquaculture, Heraklion, Crete

Bryozoans from submarine caves of the Eastern Mediterranean Sea are still poorly known. Here, we present data on composition and distribution of this group in two submarine caves, i.e. Fara and Agios Vasilios caves, located between 11 and 40 m depth in Lesvos Island (Aegean Sea).

The former cave is a 32 m long tunnel ending into a dark chamber connected through a fissure with a second cave. The latter cave is wide near the entrance and narrows before its blind end at about 20 m.

A total of 30 square surfaces of 400 cm (20x20 cm) were scraped from the walls and ceilings, at progressive distance levels from the entrances.

A total of 66 living bryozoan taxa were identified to which further 7 taxa add, when considering species represented by dead colonies. Cheilostomes largely prevail with 58 spp. (54 living) over cyclostomes 14 spp. (11 living) and ctenostomes, represented by only one living species. Almost half of the species found (31 spp., 28 living) are shared by both caves. The Agios Vasilios Cave, including 66 species (62 living), shows a higher species richness in comparison to the Fara Cave hosting a total of 38 species (32 living ones). Bryozoans had considerable coverage. Several species presented few specimens in a small number of samples whereas only 20 species made up the bulk of the bryozoan assemblages, representing typical dwellers of cryptic habitats.

Living communities point to high spatial heterogeneity whereas thanatocoenoses show a significant increase in species richness and diversity, as well as in colony abundances inwards.

The vast majority of taxa are new records for the cave fauna of the eastern Mediterranean Sea, but they were already known as typical of marine cave habitats from the western sector of the basin. A few species are new and deserve to be described.

Encrusting morphotypes largely prevail with uni-to multilaminar and celleporiform hemispherical colonies. Spot-like species and runners were also observed.

Several bryozoan species form nodular, fungiform and crest-like bioconstructions comparable to those described by Harmelin for caves of the Marseille region. *Hippaliosina depressa*, *Rhynchozoon neapolitanum* and *Parasmittina rouvillei* structures reach 3-4cm in height and diameter, whereas *Onychocella marioni*, *Hippomenella mucronelliformis*, *Hippopodina ambita*, *Therenia rosei* and *Anarthropora monodon* form smaller nodules.

**ABSTRACTS FOR POSTERS (in alphabetical order of the last name of the first author)**

**Experimental evidence of chemical defence mechanisms in Antarctic bryozoans**

Blanca Figuerola<sup>1</sup>, Carlos Angulo-Preckler<sup>1</sup>, Laura Núñez-Pons<sup>2</sup>, Juan Moles<sup>1</sup>, Laura Sala-Comorera<sup>3</sup>, Cristina García-Aljaro<sup>3</sup>, Anicet R. Blanch<sup>3</sup>, Conxita Avila<sup>1</sup>

<sup>1</sup> Department of Evolutionary Biology, Ecology, and Environmental Sciences & Biodiversity Research Institute (IrBIO), University of Barcelona, Av. Diagonal 643, 08028 Barcelona, Catalonia, Spain

E-mail: bfiguerola@gmail.com

<sup>2</sup> Department of Biology and Evolution of Marine Organisms (BEOM), Stazione Zoologica 'Anton Dohrn' (SZN), Villa Comunale 80121, Naples, Italy

<sup>3</sup> Department of Genetics, Microbiology and Statistics, University of Barcelona, Av. Diagonal 643, 08028 Barcelona, Catalonia, Spain

Bryozoans are among the most abundant and diverse members of the Antarctic benthos, however the role of bioactive metabolites in ecological interactions has been scarcely studied. To extend our knowledge about the chemical ecology of Antarctic bryozoans, three ether extracts (EE) and three butanol extracts (BE) obtained from two Antarctic common species (*Cornucopina pectogemma* and *Nematoflustra flagellata*), were tested for antibacterial and repellent activities. The extracts were screened for quorum quenching and antibacterial activities against four Antarctic bacterial strains (*Bacillus aquimaris*, *Micrococcus* sp., *Oceanobacillus* sp. and *Paracoccus* sp.). The Antarctic amphipod *Cheirimedon femoratus* and the sea star *Odontaster validus* were selected as sympatric predators to perform anti-predatory and substrate preference assays. No quorum quenching activity was detected in any of the extracts, while all EE exhibited growth inhibition towards at least one bacterium strain. Although the species were not repellent against the sea star, they caused repellence to the amphipods in both extracts, suggesting that defence activities derive from both lipophilic and hydrophilic metabolites. In the substrate preference assays, only one of each EE and BE from *C. pectogemma*, were active. This study shows also intraspecific variability of chemical defences and supports the fact that chemically mediated interactions are common in Antarctic bryozoans, as means of protection against fouling and predation.

# Settlement patterns of bryozoan growth communities on unstable substrate from the Gehrden Formation (middle Santonian) in the eastern Lower Saxony Basin (Germany)

Sandra J. Huber<sup>1</sup>, Silviu O. Martha<sup>1</sup>, Joachim Scholz<sup>1</sup>

<sup>1</sup>Senckenberg Forschungsinstitute und Naturmuseen, Sektion Marine Evertebraten III (Bryozoologie), Senckenberganlage 25, 60325 Frankfurt am Main, Germany; e-mail: sandra.huber@senckenberg.de, silviu.martha@senckenberg.de, joachim.scholz@senckenberg.de

The abandoned iron ore mines in the Peine region of Lower Saxony, northern Germany play an important role in the industrial evolution of Germany. However, they are also famous for their fossil-rich layers that have intensely been studied over the last 150 years. One hobby palaeontologist, Hermann Heinrich Brandes (1855–1940), collected fossils in the Peine region over several decades and established a remarkable collection that was well-known to contemporaneous palaeontologists and source for many studies. The Brandes collection was bought after his death by the Geological Institute of the University of Hamburg and the bryozoans from this collection were re-located to the Senckenberg Museum in Frankfurt am Main in March 2002. The Brandes Collection was now digitised within a DFG-LIS project and material from this collection was focus of a bachelor thesis by S.J.H.

In a palaeoecological work, 300 randomly chosen bryozoan colonies encrusting on residual brown iron-ore conglomerates from the former iron-ore mines Bülten-Adenstedt and Lengede-Broistedt were examined. In both outcrops, the same succession is exposed, which belongs to the middle Santonian (*Goniot euthis westfalica* belemnite Zone) Gehrden Formation. Preservation of the bryozoans is poor to moderately well. Colony size and growth forms were determined in order to get information about substrate stability and competition for substrate between cheilostomes vs. cyclostomes.

At both localities, we found cheilostome and cyclostome sheets, cyclostome runners, cheilostome and cyclostome spots. Early astogenetic sheets and runners dominate the fauna (ca. 66 %). Large colonies (> 501 zooids) were found only among onychocellid cheilostomes and plagioeciid cyclostomes. Overall, cheilostomes formed significantly larger colonies than cyclostomes. While the high amount of early astogenetic sheets and runners indicates a facies with low substrate stability, large colonies show that substrate stability should have been high at some places or at some time. Predation seems to not have been a major selection driver as no traces of predation were found in any of the colonies. Overgrowth interaction on the conglomerates was rare indicating that competition for space must have been limited. In 22 overgrowth interactions between cheilostomes vs. cyclostomes, Cheilostomata win with 55 % over Cyclostomata. The middle Santonian fauna of encrusting bryozoans at both localities is dominated by Cheilostomata, which produce not only larger colonies, but also make up two thirds of the colonies found. This is surprising taking into consideration that Cheilostomata outnumbered the Cyclostomata in other localities not earlier than the late Campanian.

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# **Bryozoans from Terra Nova Bay (Ross Sea, Antarctica) and their implications in climate change research**

Chiara Lombardi <sup>1</sup>, S. Cocito <sup>1</sup>, P. Kuklinski <sup>2</sup>

<sup>1</sup>ENEA Marine Environment Research Centre, PO Box 224, 19100 La Spezia, Italy

<sup>2</sup>Institute of Oceanology, Polish Academy of Sciences Ul. Powstancow Warszawy 55, Sopot 81-712, Poland

The climate of the Antarctic Peninsula is the most rapidly changing in the southern hemisphere; therefore, the Southern Ocean (SO) is expected to be vulnerable to changes in carbon export forced by anthropogenic climate warming and the extensive effects of ocean acidification are predicted to be first observed in high latitude seas. The biological diversity and richness of Antarctica and the extraordinary adaptations shown by the majority of species give this environment a particular relevance for adaptive studies. Among calcifying bioconstructional taxa, bryozoans are of special interests because of their plasticity and ability to enhance marine biodiversity.

Species-rich and widespread in the Ross Sea, characterized by the highest productivity of the SO, bryozoans have a recognized potential for climate change studies and for 'Blue Carbon' storage. In the past 30 years, the Italian National Program for Antarctic Research (PNRA) has developed several studies on benthic organisms, including bryozoans. However, an updated list of the bryozoan fauna, including the most recent campaigns conducted in Terra Nova Bay (TNB) is missing.

This research provides the updated list of Terra Nova Bay bryozoan fauna by combining data from literature (Italian Antarctic campaigns: 1987-1995) and new data from collections stored at the Italian National Antarctic Museum (MNA, Sect. of Genova) and National Research Council (CNR-ISMAR). The updated list includes 134 taxa, with 34 new records for TNB, and few fossil specimens from Cape Russell outcrops. Taxonomic misidentifications have also been clarified and, among the recent taxa, a dominance of strong calcified species (102) has been highlighted with few bioconstructional species among encrusting (56) and erect-rigid (45) species. The present research contributes in filling the gap of Antarctic bryozoan knowledge, highlights organism potential for adaptive studies and thus validate their importance as proxy of environmental variables (temperature, pH).

# **Results of the DFG LIS-project Enhancing documentation and digitalization of the Bryozoa collection donated by Professor Voigt (1905-2004) to the Senckenberg Research Institute, Frankfurt am Main, Germany**

Silviu O. Martha, Joachim Scholz, Brigitte H. Lotz, Sandra J. Huber, Christoph Neu

Senckenberg Forschungsinstitute und Naturmuseen, Sektion Marine Evertebraten 3 (Bryozoologie),  
Senckenberganlage 25, 60325 Frankfurt am Main, Germany

The bryozoan collection of Prof Dr Ehrhard Voigt (1905–2004) was relocated to the Senckenberg Museum in Frankfurt am Main from the University of Hamburg on February 4<sup>th</sup>, 2005 after Professor Voigt passing away. The DFG funded over 4.5 years a project that was aiming at the digitization and documentation of the most important parts of the Voigt Collection. All type specimens and published originals (2,666 specimens), which were the project's top priority, were digitized. Furthermore, we digitized ca. 14,800 cavity slides, the whole Brandes Collection (2,803 specimens) and ca. 600 specimens from Voigt's "*Urzelle*". Digitization was performed using the object-oriented collection management system SeSam. Since a new system, called AQUiLA, was developed at the Senckenberg Institute meanwhile, all entries have been transferred to the new database system and are accessible online (<https://search.senckenberg.de/aquila-public-search/search>). Holotypes and neotypes from the Voigt Collection in Frankfurt are well documented and imaged in a printed type catalogue that is currently prepared to be submitted. This type catalogue depicts almost 250 bryozoan species, almost exclusively from the Cenomanian to Danian, and shall serve as a guide for future generations of bryozoan researchers. The legacy of Ehrhard Voigt (correspondence, [unpublished] manuscripts, notes, file cards and other documents) was thoroughly sorted and repacked in accordance with archival standards and inventoried using an Access database. Furthermore, a permanent exhibition of Santonian bryozoans was suggested for the UNESCO Harz – Brunswick Land – Eastphalia National Geopark, to be shown in the geopark's information centre.

Besides this, the project resulted in several collaborations with foreign researchers and six publications describing material from the Voigt Collection have already been published with another three publications being currently under review and several other projects being in different stages of preparation. The focus of these works is bryozoan material from the Cenomanian and Santonian, two critical stages in the bryozoan evolution, as well as coscinopleurid cheilostomes. Two new genera and five new species are based on material from the Voigt Collection. Furthermore, one student (S.J.H.) successfully accomplished a bachelor thesis using bryozoan material from the Brandes Collection for a palaeoecological study.

Overall, the DFG project had a positive effect for the public image of the Voigt Collection and helped conditioning the largest collection of fossil bryozoans from the Late Cretaceous to Palaeocene in the world for future challenges.

Financial support by the DFG Project SCHO 581/12-1 "Enhancing documentation and digitalization of the Bryozoa collection donated by Professor Voigt (1905-2004) to the Senckenberg Research Institute, Frankfurt am Main, Germany" is gratefully acknowledged.

## **AQUiLA – a platform for biodiversity data. The online presentation of the bryozoan collection of Prof Dr Ehrhard Voigt (1905–2004)**

Lothar Menner, Joachim Scholz, Silviu O. Martha, Andreas Allspach

Senckenberg Forschungsinstitute und Naturmuseen, Sektion Marine Evertebraten 3 (Bryozoologie), Senckenberganlage 25, 60325 Frankfurt am Main, Germany, E-Mail: lothar.menner@senckenberg.de, joachim.scholz@senckenberg.de, silviu.martha@senckenberg.de, andreas.allspach@senckenberg.de

During the digitization of the bryozoan collection of Ehrhard Voigt, the IT sector at the Senckenberg Research Institute developed the new collection management system AQUiLA. AQUiLA will replace the older collection management system SeSam used for the digitization of the Voigt Collection and will thus serve as the new online presentation platform for the bryozoan collection of Prof Dr Ehrhard Voigt. AQUiLA is based on open source software and enables the user to create and manage databases that suit the user's requirements. The AQUiLA database is based on a generic data model with various powerful input elements. Subsequent addition of new fields is possible at any time. The combination of faceted and free text search functions facilitates the search for data. The search results are shown in tables with filter and sorting functions. AQUiLA is compatible with any operating system, requires no installation and operates in all common web browser. All circa 21,000 entries acquired during the DFG project SCHO 581/12-1 are accessible online for the public at <https://search.senckenberg.de/aquila-public-search/search>.

Financial support by the DFG Project SCHO 581/12-1 "Enhancing documentation and digitalization of the Bryozoa collection donated by Professor Voigt (1905-2004) to the Senckenberg Research Institute, Frankfurt am Main, Germany" is gratefully acknowledged.

# Morphological and molecular analyses to unveil species within the monotypic genus *Virididentula* (Cheilostomata, Bugulidae)

Karine Bianca Nascimento<sup>1</sup>, Leandro Manzoni Vieira<sup>2</sup>, Thais de Souza Sampaio<sup>1</sup> & Karin Hoch Fehlauer-Ale<sup>3</sup>

<sup>1</sup>Laboratório de Sistemática e Evolução de Bryozoa, Centro de Biologia Marinha, Universidade de São Paulo. Address: Rodovia Manoel Hypolito do Rego, km 131. 5, Praia do Cabelo Gordo, CEP 05588-000, São Sebastião, SP, Brazil

<sup>2</sup>Laboratório de Estudos de Bryozoa, Centro de Ciências Biológicas, Universidade Federal de Pernambuco. Address: Av. Prof. Moraes Rego 1235, Cidade Universitária, CEP 50670-901, Recife, PE, Brazil

<sup>3</sup>Laboratório de Bentos, Centro de Estudos do Mar, Universidade Federal do Paraná. Address: Avenida Beira-Mar, s/n, Caixa Postal 61, CEP 83255-976, Pontal do Sul, Pontal do Paraná, PR, Brazil

Several works have shown that integrating molecular phylogenies with morphological characters are useful in shading light on bryozoan systematics, at distinct taxonomic levels. Particularly within the Family Bugulidae Gray, 1848 (Cheilostomata), a recent study has found that the well-known genus *Bugula* was encompassing four genera: *Bugula* Oken, 1815 *sensu stricto*, *Bugulina* Gray, 1848, *Crisularia* Gray, 1848, and the monotypic *Virididentula* Fehlauer-Ale, Winston, Tilbrook, Nascimento & Vieira, 2015. The last genus was erected to accommodate *Bugula dentata* (Lamouroux, 1816); such decision was based on a Bayesian Inference (BI) phylogeny of the mitochondrial genes cytochrome *c* oxidase subunit 1 (COI) and the large ribosomal RNA subunit (16S), and on the combined presence of the following morphological characters: jointed outer distal spines and oecium with the ectooecium reduced except at the lateral proximolateral edges, with a membranous frontal area and smooth entooecium. *Virididentula dentata* (Lamouroux, 1816) has a global distribution, with reports from several localities, e.g. Australia, New Zealand, Brazil, Celebes Sea, Hawaii, Japan, Madeira, French Polynesia, Namibia and South Africa. However, intraspecific morphological variation (dimorphism and zooidal position of avicularia; orientation of oecia; joints and measurements of autozooids; and number, direction, size and shape of spines) as well highly divergent lineages based on COI and 16S sequences, have been found, both in the literature and in the specimens we are currently analyzing. Thus, evidences including i) widespread distribution, ii) morphological variation, and iii) DNA sequence divergence suggest that more than one species is being assigned to *V. dentata*. In this context, our aim is to delimit and describe the distinct suspected species within *V. dentata*, using morphological data retrieved from light microscopy and scanning electron microscopy, morphometry, and from COI and 16S DNA sequences. To accomplish our goal, we are analyzing data from previous studies (specimens from Australia, French Polynesia, South

Africa and Namibia); from specimens deposited in the Museum Victoria (MV - Australia) and the National Institute of Water and Atmospheric Research (NIWA - New Zealand); and from material collected by our group (Southeastern Brazil). *Preliminary results:* Based on morphological analyses, our preliminary results suggest that *V. dentata* encompasses seven morphotypes, as follows: morphotype 1, from Rio de Janeiro, Southeastern Brazil; morphotype 2, from São Paulo and Rio de Janeiro, Southeastern Brazil; morphotype 3, from Hawaii, in the USA; morphotype 4, from North Island, Northern New Zealand; morphotype 5, from Queensland, Northeastern Australia; morphotype 6, from Western Australia, Southwestern Australia; and morphotype 7, from Victoria and Tasmania, Southeastern Australia. Regarding molecular data, so far, we have sequenced the COI-5' segment (313-611bp) for nine specimens, COI-3' segment (591-674bp) for 15 specimens, and 16S (415-531bp) for 10 specimens. *Next steps:* after completing our sequence data matrix, we will perform a combined BI phylogenetic analysis to test the validity of the morphotypes. If our suspicion that they represent distinct nominal species is confirmed, we will describe each one of them, and will also redescribe the type species of the genus.

# **Encrusting littoral bryozoan from south Andaman island with special reference to an epibiont Bryozoa (*Thalamoporella* sp.) on a marine sponge**

Mohammed Naufal, P.J. & K.A. Jayaraj

Department of Ocean Studies and Marine Biology, Pondicherry University Brookshabad Campus, Chakkargaon  
P.O Port Blair – 744112

Bryozoans are sessile aquatic invertebrates, which are found in most marine habitats forming colonies composed of numerous units known as zooids. A study on the bryozoan distribution in three intertidal sites (Burmanallah, Kodyaghat and Chidiyapu) from the southeastern coasts of the Andaman Islands were carried out between June and August 2016. The present study is the first exclusive report on bryozoans from the intertidal zone of Andaman Islands. During the study period a total of twelve species were identified from both living and inert substratum. Bryozoans observed were belonging to the order Cheilostomata that bifurcate under suborders Anasca and Ascophora. Among the species identified, eight genera were new records from the island. Among the three different intertidal zones, Burmanalla which is featured by rocky environment possess most number of bryozoan colonies. The present study showed affinity of the bryozoans towards natural substratum particularly on the rocks, followed by the dead Molluscan shells. Among the molluscan shells, Tridacna shells host most species with crowded colonies. Out of the identified bryozoan species the *Thalamoporella* sp is reported as the one with maximum average length for the colony. The present study come across an interesting association in which the epibiont bryozoan *Thalamoporella rozierrii* adhere to the basibiont sponge *Placospongia* sp on big rocks. The main characteristics of the morphology of *Thalamoporella rozierrii* is described with SEM images.

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**Desert Bryozoans – Some Bryozoological Results of the *Red Sea Biodiversity Project* (King Abdulaziz University, Jeddah and Senckenberg Nature Research Society, Frankfurt)**

Christoph Neu<sup>1</sup>, Abdulmohsin A. M. Al-Sofyani<sup>2</sup>, Peter Prinz-Grimm<sup>3</sup>, Adnan Jameel Salama<sup>2</sup>, Joachim Scholz<sup>1</sup>

<sup>1</sup>Senckenberg Forschungsinstitute und Naturmuseen, Sektion Marine Evertibraten 3 (Bryozoologie), Senckenberganlage 25, 60325 Frankfurt am Main, Germany.

<sup>2</sup>Faculty of Marine Sciences, King Abdulaziz University, Jeddah, Saudi Arabia.

<sup>3</sup>Institut für Geowissenschaften, Goethe Universität Frankfurt, Altenhöferallee 1, 60438 Frankfurt am Main, Germany.

A first detailed investigation of the intertidal bryozoan fauna of the Saudi Arabian Red Sea coast was performed by the examination of 420 bryozoan colonies using light microscopy and secondary electron microscopy. As a result, a total bryozoan diversity of 50 species was revealed, covering 48 cheilostome and 2 cyclostome species. 50 species are first records for the intertidal zone of the Saudi Arabian Red Sea coast, while 47 are first records for Saudi Arabian Red Sea coast in general. Furthermore, a taxonomic description of 7 species of the superfamily Schizoporelloidea Jullien, 1883 resulted in two first records for the Red Sea, *Bryopesanser* cf. *grandicella* Tilbrook, 2012 and *Stylopoma* cf. *amboyna* Tilbrook, 2001. Morphological observations on schizoporelloidean species revealed a number of characteristics of the Red Sea intertidal specimens, of which some are suggested to be environmentally induced. It was notable that a significantly high number of the observed taxa show the biological potential to produce large zooids, which is here suggested to be induced by intertidal desiccation. To characterize the bryozoan fauna with respect to the importance of spatial competition, all observed bryozoan colonies were associated with 1 of 7 predetermined growth forms. Growth form analyses revealed a distinct pattern, which in some aspects significantly deviates from shallow water patterns of other regions, thus, suggesting to be controlled by local intertidal environmental conditions. The observed growth form pattern is consistent with a (for warm, shallow waters) relatively low abundance of smittinid bryozoans, combined with a significantly high abundance of rapidly reproducing, internal breeding species (primary *Exechonella* sp.). Overall, the observations revealed an only moderately competition-controlled bryozoan fauna.

The scientific research cooperation between King Abdulaziz University (KAU), Faculty of Marine Sciences (FMS), Jeddah, Saudi Arabia, and the Senckenberg Research Institute (SRI), Frankfurt, Germany, in the framework of the Red Sea Biodiversity Project, during which the present material was collected, was funded by KAU GRANT NO. "I/1/432-DSR". The authors acknowledge, with thanks, the technical and financial support provided by KAU and SRI.

## The ‘pearls’ of *Schizoporella errata*

Noga Sokolover<sup>1</sup>, Paul D. Taylor<sup>2</sup>, Micha Ilan<sup>3</sup>

1 The Steinhardt Museum of Natural History and National Research Center, Israel

2 Department of Earth Sciences, Natural History Museum, London SW7 5BD, UK

3 Department of Zoology, Tel Aviv University, Tel Aviv 69978, Israel

*Schizoporella errata* is a common cheilostome bryozoan forming multilaminar colonies due to frontal budding. While studying bleached *S. errata* colonies using scanning electron microscopy, we noticed unusual spherical structures within zooids in the primogenial layers. We hypothesized that the spheres (115µm average diameter) were brown bodies that had become mineralized, possibly due to the conditions inside the overgrown zooidal chambers. Accordingly, spheres were isolated from bleached *S. errata* colonies. Analyses of these structures were performed using low vacuum SEM (LEO 1455 VP SEM), high resolution SEM (Zeiss EVO 15LS SEM) with EDX (Energy dispersive X-ray detector), and Fourier Transformed Infra-Red (FTIR) Spectroscopy.

We found that the spheres were hollow, contained some internal matter (probably organic), and were composed of amorphous carbonated hydroxyapatite. Reports in the literature describe *Schizoporella* either with rind-like structures that thicken with age (1), or brown bodies encapsulated in a non-cellular material that was eventually calcified (2). In addition, palaeontological papers have described phosphatic calculi in Palaeozoic bryozoans, notably K. P. Oakley’s study of the Silurian “pearl-bearing Ceramoporidae” (order Cystoporata)(3,4). Although these fossil bryozoan pearls resemble in composition the spheres found in *Schizoporella errata*, they have a concentric internal structure not seen in the *Schizoporella* spheres.

We believe that the *Schizoporella* ‘pearls’ are brown bodies that served as nuclei for mineral precipitation, possibly facilitated by the diagenetic microenvironment of the multilayered colony and/or involving bacteriogenic processes .

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# **Cheilostomata diversity from the Hayes Fracture, Mid-Atlantic Ridge.**

## **Preliminary results.**

Javier Souto

Institut für Paläontologie, Fakultät für Geowissenschaften, Geographie und Astronomie, Geozentrum, Universität Wien, Althanstrasse 14, 1090, Wien, Austria. javier.souto-derungs@univie.ac.at

During the campaign EMPC/LUSO 2016, two dives were conducted by the remote operate vehicle (ROV) LUSO in the north area of the Hayes Fracture Zone, Mid-Atlantic Ridge. During the dives the ROV was moving around the different substrate, mainly areas formed by pillow lavas and sand areas with big amount of biogenic substrate. Video images and photographs were taken to characterize the habitat. Beside, different abiotic data were collected by a CTD on board of the LUSO. Rocks were directly collected and substrate and fauna was sucked to collect the specimens. Samples were sorted on board and specimens of Bryozoans were fixed in alcohol or dry. Any ctenostomata was not recorded, but a considerable number of cheilostomata and cyclostomata specimens were sorted, although only the species of cheilostomata were included in these preliminary results.

Eighteen cheilostomata species were identified heretofore, included in fourteen families. Some of the identified species are know from the Azores deep water area as *Sarsiflustra abyssicola* (Sars G.O., 1872), *Jacculina blanchardi* Jullien & Calvet, 1903 or *Tessaradoma boreale* (Busk,1860), but other must be carefully revised and some will be described as new species from different genera. The more significant discovery is the presence of big colonies belonging to the genus *Quadricellaria*, included the incrusting portion, not described until now. This genus was describe to included fossils species from the Cretaceous, and only two recent species are known from the deep water of the Pacific and other species from the Caribbean.

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# **Articulation in the family Rhabdomesidae (Cryptostomata: Bryozoa) from the mississippian of Ireland**

Patrick N. Wyse Jackson<sup>1</sup>, Andrej Ernst<sup>2</sup> and Juan L. Suárez Andrés<sup>3</sup>

<sup>1</sup> Department of Geology, Trinity College, Dublin, Ireland

<sup>2</sup> Institut für Geologie, Universität Hamburg, Germany

<sup>3</sup> Soningeo, S.L. Pctcan, Santander, Spain

Articulation in erect bryozoans is known from the Ordovician to the Recent and is developed in a number of Palaeozoic Orders. In the Order Cryptostomata articulation is largely confined to some members of the Suborder Ptilodictyina and the Family Arthrostylidae of the Suborder Rhabdomesina, and was previously noted in the sole genus of the Family Bactroporidae. Articulation is reported herein in the Family Rhabdomesidae for the first time. A new genus from the Mississippian of Ireland is characterised by zoaria composed of branches with regular internodes and conical-shaped articulating terminations.

## List of participants:

### Elena Belikova

Saint Petersburg State University  
Universitetskaja nab. 7/9, 199034, Saint  
Petersburg, Russia  
[090189@mail.ru](mailto:090189@mail.ru)

### Björn Berning

Oberösterreichisches Landesmuseum, Geosciences  
Welser Strasse 20a  
4060 Leonding  
[b.Berning@landesmuseum.at](mailto:b.Berning@landesmuseum.at)

### Caroline Buttler

National Museum Wales  
Dept of Natural Sciences, Cathays Park  
Cardiff, CF10 3NP, Wales, UK  
[Caroline.Buttler@museumwales.ac.uk](mailto:Caroline.Buttler@museumwales.ac.uk)

### Sebastian Decker

University of Vienna, Dept. Integrative Zoology  
Althanstraße 14, 1090 Vienna, Austria  
[decker-s@gmx.de](mailto:decker-s@gmx.de)

### Emanuela Di Martino

Natural History Museum  
Cromwell Road, London SW7 5BD, UK  
[e.di-martino@nhm.ac.uk](mailto:e.di-martino@nhm.ac.uk)

### Andrej Ernst

Institute of Geology, University of Hamburg  
Bundesstr. 55, D-20146 Hamburg, Germany  
[Andrej.Ernst@uni-hamburg.de](mailto:Andrej.Ernst@uni-hamburg.de)

### Blanca Figuerola

University of Barcelona, Department of  
Evolutionary Biology, Ecology, and Environmental  
Sciences & Biodiversity Research Institute (IrBIO),  
Barcelona, Catalonia, Spain  
[bfiguerola@gmail.com](mailto:bfiguerola@gmail.com)

### Natalie Gawin

University of Vienna, Dept. Integrative Zoology  
Althanstraße 14, 1090 Vienna, Austria  
[natalie.gawin@gmx.at](mailto:natalie.gawin@gmx.at)

### Ernest H. Gilmour

Eastern Washington University, Cheney, WA  
99004, USA  
[egilmour@ewu.edu](mailto:egilmour@ewu.edu)

### Heather Grant

Natural History Museum, Department of Life  
Sciences  
Cromwell Road, London, SW7 5BD, UK  
[heather.grant11@imperial.ac.uk](mailto:heather.grant11@imperial.ac.uk)

### Steven J. Hageman

Appalachian State University  
Dept. of Geology, ASU Box 32067, Boone, NC  
28608, USA  
[hagemansj@appstate.edu](mailto:hagemansj@appstate.edu)

### Urszula Hara

Polish Geological Institute-National Research  
Institute  
Warszawa 00-975, ul. Rakowiecka 4, Poland  
[Uhar@pgi.gov.pl](mailto:Uhar@pgi.gov.pl)

### Marianne Nilsen Haugen

University of Oslo  
Kings gate 20, H405, 0457 Oslo, Norway  
[marinhau@student.ibv.uio.no](mailto:marinhau@student.ibv.uio.no)

### Sandra Huber

Senckenberg Forschungsinstitute und  
Naturmuseen  
Senckenberganlage 25, 60325 Frankfurt am Main,  
Germany  
[Sandra.Huber@senckenberg.de](mailto:Sandra.Huber@senckenberg.de)

### Helen Jenkins

The Marine Biological Association of the UK (MBA)  
The Laboratory, Citadel Hill, Plymouth, Devon, PL1  
2PB, UK  
[helenjenkins80@hotmail.com](mailto:helenjenkins80@hotmail.com)

### Eva Ježková

Faculty of Agriculture, University of South Bohemia  
in České Budějovice  
Studentská 1668, 370 05, České Budějovice, Czech  
Republic  
[hedgehog.eve@centrum.cz](mailto:hedgehog.eve@centrum.cz)

### Olga Kotenko

Saint Petersburg State University  
Universitetskaja nab. 7/9, 199034, Saint  
Petersburg, Russia  
[olgakotenko@gmail.com](mailto:olgakotenko@gmail.com)

### Piotr Kuklinski

Institute of Oceanology, Polish Academy of  
Sciences  
Ul. Powstancow Warszawy 55, Sopot 81-712,  
Poland  
[kuki@iopan.pl](mailto:kuki@iopan.pl)

### Lee Hsiang Liow

Natural History Museum and Centre for Ecological  
and Evolutionary Synthesis  
University of Oslo, Norway  
[l.h.liow@ibv.uio.no](mailto:l.h.liow@ibv.uio.no)

**Chiara Lombardi**

ENEA-Italian National Agency for New  
Technologies, Energy and Sustainable Economic  
Development  
Via Forte Santa Teresa, 19032 Pozzuolo di Lerici (La  
Spezia), Italia  
[chiara.lombardi@enea.it](mailto:chiara.lombardi@enea.it)

**Silviu O. Martha**

Senckenberg Forschungsinstitute und  
Naturmuseen  
Senckenberganlage 25, 60325 Frankfurt am Main,  
Germany  
[silviu.martha@senckenberg.de](mailto:silviu.martha@senckenberg.de)

**Jonas Solnørdal Nærø**

University of Oslo  
Trasopterrassen 47 0672 Oslo, Norway  
[jonassn@student.matnat.uio.no](mailto:jonassn@student.matnat.uio.no)

**Hans Arne Nakrem**

Natural History Museum, University of Oslo  
PO Box 1172 Blindern, NO-0316 Oslo, Norway  
[h.a.nakrem@nhm.uio.no](mailto:h.a.nakrem@nhm.uio.no)

**Karine Bianca Nascimento**

Center of Marine Biology, University of São Paulo  
Rodovia Manoel Hypólito do Rego, km 131.5, São  
Sebastião, SP, Postal Code 11600-000  
Brazil  
[kbnasc@gmail.com](mailto:kbnasc@gmail.com)

**Mohammed Naufal P.J**

Department of ocean studies and marine biology,  
Pondicherry University, Portblair, Andaman  
Islands, India  
[naufalpj@gmail.com](mailto:naufalpj@gmail.com)

**Uliana Nekliudova**

University of Vienna  
Althanstraße 14, 1090 Vienna, Austria  
[strannica218@yandex.ru](mailto:strannica218@yandex.ru)

**Christoph Neu**

Senckenberg Forschungsinstitute und  
Naturmuseen  
Senckenberganlage 25, 60325 Frankfurt am Main,  
Germany  
[christoph-neu@gmx.de](mailto:christoph-neu@gmx.de)

**Andrew Ostrovsky**

Saint Petersburg State University & University of  
Vienna  
Universitetskaja nab. 7/9, 199034, Saint  
Petersburg, Russia  
[oan\\_univer@yahoo.com](mailto:oan_univer@yahoo.com)

**Joanne Porter**

Heriot Watt University  
ICIT, HWU Orkney Campus, Back Road, Stromness,  
Orkney. KW16 3AW  
Scotland  
[j.s.porter@hw.ac.uk](mailto:j.s.porter@hw.ac.uk)

**Philipp Pröts**

University of Vienna, Dept. of Integrative Zoology  
Althanstraße 14, 1090 Vienna, Austria  
[a0325647@unet.univie.ac.at](mailto:a0325647@unet.univie.ac.at)

**Oscar Reverter-Gil**

University of Santiago de Compostela  
Spain  
[oscar.reverter@usc.es](mailto:oscar.reverter@usc.es)

**Antonietta Rosso**

Dipartimento di Scienze Biologiche, Geologiche e  
Ambientali  
Sezione di Scienze della Terra, Corso Italia, 57  
95129 – Catania  
[rosso@unict.it](mailto:rosso@unict.it)

**Hannah Schmidbaur**

University of Vienna, Dept. Integrative Zoology  
Althanstraße 14, 1090 Vienna, Austria  
[hannahschmidbaur@hotmail.de](mailto:hannahschmidbaur@hotmail.de)

**Joachim Scholz**

Senckenberg Forschungsinstitute und  
Naturmuseen  
Senckenberganlage 25, 60325 Frankfurt am Main,  
Germany  
[Joachim.Scholz@senckenberg.de](mailto:Joachim.Scholz@senckenberg.de)

**Thomas Schwaha**

University of Vienna, Dept. Integrative Zoology  
Althanstraße 14, 1090 Vienna, Austria  
Thomas.schwaha@univie.ac.at

**Abby Smith**

University of Otago  
P. O. Box 56, Dunedin, NZ  
[abby.smith@otago.ac.nz](mailto:abby.smith@otago.ac.nz)

**Noga Sokolover**

Tel Aviv University, Department of Zoology  
Ramat Aviv, Tel Aviv 6997801, Israel  
[nogasoko@gmail.com](mailto:nogasoko@gmail.com)

**Javier Souto**

University of Vienna, Department of Paleontology  
Althanstraße 14, 1090-Vienna  
[javier.souto@usc.es](mailto:javier.souto@usc.es)

**Mary Spencer Jones**

Natural History Museum  
Cromwell Road, London, UK  
[m.spencer-jones@nhm.ac.uk](mailto:m.spencer-jones@nhm.ac.uk)

**Paul Taylor**

Natural History Museum  
Cromwell Road, London SW7 5BD, UK  
[p.taylor@nhm.ac.uk](mailto:p.taylor@nhm.ac.uk)

**Norbert Vávra**

University of Vienna, Department of Paleontology  
Althanstraße 14, 1090-Vienna  
[norbertvavra@aon.at](mailto:norbertvavra@aon.at)

**Andrea Waeschenbach**

Natural History Museum  
Cromwell Road, London, SW7 5BD, UK  
[a.waeschenbach@nhm.ac.uk](mailto:a.waeschenbach@nhm.ac.uk)

**Andreas Wanninger**

University of Vienna, Dept. of Integrative Zoology  
Althanstraße 14, 1090 Vienna, Austria  
[andreas.wanninger@univie.ac.at](mailto:andreas.wanninger@univie.ac.at)

**Mark A. Wilson**

The College of Wooster  
944 College Mall, Department of Geology,  
Wooster, OH 44691, USA  
[mwilson@wooster.edu](mailto:mwilson@wooster.edu)

**Tim Wood**

Wright State University  
3640 Colonel Glenn Highway, Dayton, OH  
45435, USA  
[tim.wood@wright.edu](mailto:tim.wood@wright.edu)

**Patrick Wyse Jackson**

Trinity College Dublin  
Department of Geology, Trinity College,  
Dublin, Ireland  
[wysjcknp@tcd.ie](mailto:wysjcknp@tcd.ie)

**Vanessa Yepes Narvaez**

PhD Student  
6 St James Terrace, Heywood, Greater  
Manchester, OL10 3AB, UK  
[vanbryozoa@gmail.com](mailto:vanbryozoa@gmail.com)