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ABSTRACTS

THE Ca ISOTOPE COMPOSITIONS OF BRYOZOANS

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Inorganic carbonate precipitation experiments as well as laboratory culture experiments of biogenic carbonates indicate a thermodynamic control over the Ca isotope system. The Ca isotope systematic has been therefore proposed as a promising tool for the reconstruction of temperature and Ca content of ancient oceans, both of which associated with the global CO_2 cycle. A number of studies to date are attempting to establish Ca isotopes as a paleo-thermometer by testing their sensitivity to temperature variations and by a calibration with established thermometers like oxygen isotopes and Mg/Ca ratios. Most of these studies are focused on the carbonate skeletons of corals and bivalves. However, corals and bivalves have gaps in their evolutionary history and are mostly restricted to tropical environments. Bryozoans, in contrast, provide a long, more than 400Ma old continuous evolutionary history and a wider geographic distribution, from polar to tropical regions. Although they have been recognized as important organisms through the Earth's and oceans' history, as yet, no Ca isotope data exist for bryozoans.

Here we report first Ca isotope data on the carbonate skeletons of recent bryozoans. We compare cyclostome as well cheilostome species, in order to check for species-dependent fractionation processes. Our results show a clear correlation between Ca isotopes and Mg concentrations with a decrease of Ca isotope fractionation with increasing Mg content. Also, we investigate potential Ca isotope variation along the growth axis in a colony specimen of the common and widespread *Flustra foliacea*. First data indicate a Ca isotope fractionation of 0.15‰ over a distance of 2 growth checks. We assume that this may also be related to an ontogenetic Mg decrease and/or to variations in growth rate.

In order to better understand the calcification process, we are conducting analyses of the ultrastructure and mineralogy. Our first SEM and TEM analyses may suggest the presence of amorphous calcium carbonate (ACC) and/or vaterite. Both have been also proposed and recently shown as first phases in the biomineralisation sequence of bivalve shells.

CALCIFICATION-INDUCING PROTEINS IN BRYOZOANS

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The biomineralic composition of bryozoan skeletons is highly variable consisting of calcite, magnesian-calcite, or aragonite. Aragonite and magnesian-calcite (Mg-calcite) are 50% more soluble in seawater than calcite thus bryozoans that form these types of calcium carbonate may be particularly vulnerable to ocean acidification. Therefore of critical concern is the impact of ocean acidification on bryozoans and their ability to produce a calcified skeleton under acidified conditions. One possible theory is that under such conditions, bryozoans will invest more heavily into the production of chitin. The objective of our research is to identify and locate the proteins involved in calcification in order to understand more clearly the underlying mechanisms of biomineralisation which will subsequently become a tool to understand the impact of ocean acidification on the biomineralisation process in bryozoans.

RE-COLONIZATION OF THE SOUTHERN NORTH SEA WITH TRAVELING BRYOZOA: NATURAL AND HUMAN-MEDIATED VECTORS OF INTRODUCTION

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Present author and Marco Faasse started monitoring marine bryozoans in Belgium and the Netherlands in 1999. In the past 12 years we observed the establishment of 7 alien species to this region: *Arachnidium lacourti*, *Bugula neritina*, *Bugula simplex*, *Tricillaria inopinata*, *Smittoidea prolifica*, *Pacificincola perforata* and *Fenestrulina delicia*. *Watersipora subtorquata* is reported as unestablished alien species in the Netherlands. About 40 species native to NW-Europe travel frequently through these waters in different ways but apparently only few succeeded to establish in the region.

The seafloor of the North Sea was dry land during the Ice Ages. This means that marine bryozoans were absent. In the past 6000 years, the area is re-colonized by about 120 species. For a long time the only way of travelling into the newly inundated area was the natural inflow of planktotrophic larvae and substrates carrying colonies. Spread within the area over long distances happens in the same way. Most species however produce lecithotrophic larvae which settle within a few hours of release.

We roughly estimate the natural growth rate of species account in the region to be about one species every 50 years. In recent times however, we recorded the settlement of approximately one alien species every 2 years.

Living colonies of alien or even native species travelling in a natural way on substrates are not likely to establish populations in new areas. In contrary, human-mediated vectors are very effective in introducing new aliens. In this region almost all alien bryozoans are primarily unintentionally introduced by shellfish import. The establishment of introduced species is facilitated by the larger number of colonies and/or larvae released, their tolerance for changing environmental conditions and the vacancy of ecological niches. Subsequently they are spreading in the region as hull fouling on yachts as marinas are numerous near the oyster beds and beyond.

CENOZOIC BRYOZOANS FROM SOUTHEAST ASIA: A CONTRIBUTION TO THE ORIGIN OF HIGH TROPICAL BIODIVERSITY

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A pioneering study of Cenozoic bryozoans in SE Asia is being undertaken as part of the Throughflow Project. Throughflow's aim is to reconstruct the origin of the high biodiversity of shallow marine habitats in the Indonesian Archipelago through the integration of geological, geochemical and palaeontological data. Geological fieldwork has started in the Kutai Basin, formed during the Middle to Late Eocene. The basin is characterized by the development of Oligocene to Miocene patch reef complexes associated with turbid environments of high siliciclastic sedimentation. Bryozoans at first seem scarce, with only a few specimens belonging to a restricted number of genera. Previous publications on Cenozoic bryozoans from the entire Indonesian Archipelago have reported a total of only 21 genera and 11 identified species. This paucity contrasts with the high diversity of reef-associated bryozoans living in the same area at the present day. The rarity of bryozoans could be related to difficulties in locating outcrops and stratigraphical sections with well-preserved specimens. Identification of new outcrops is constrained by the structural and tectonic complexity of the entire area, as well as the intense weathering of the limestones in the humid and rainy climate. According to a preliminary palaeoenvironmental reconstruction, the sections with most bryozoans correspond to the crest and the slope of a Burdigalian-Langhian reef. Bryozoan colonies are commonly found encrusting the bases of corals. Anascans and cribrimorphs are the most abundant groups. Fragments of erect branching species, probably *Nellia* spp., and some Phidoloporidae are present within the sediments or adhering to the coral surfaces.

A revision of some material at the NHM includes a large number of specimens of the Late Oligocene coral *Hydnophora* collected in Eastern Sabah (Malaysian Borneo). Bryozoans abundantly encrust the bases of these scleractinian corals. Preliminary observations already allow an increase in the recorded diversity of Cenozoic bryozoans in SE Asia from 21 to 32 genera.

ANTIFOULING ACTIVITY OF ANTARCTIC BRYOZOANS AGAINST *ESCHERICHIA COLI* AND *BACILLUS CEREUS*

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Few recent studies have tested whether Antarctic bryozoans contain antibacterial compounds. However, the presence of these kinds of compounds may influence the growth of other species which could settle near or over them. In recent years, it has been shown that changes in environment and technology may cause the emergence of pathogens with a broad resistance to antibacterial agents. For this reason, there is an urgent need for new molecules that could be developed as potential antibacterial drugs in order to reduce infectious diseases. We evaluated the antibacterial activity of lipophilic extracts of different species of Antarctic bryozoans, collected during several expeditions (ECOQUIM-2 project), against *Escherichia coli* (gram -) and *Bacillus cereus* (gram +). In the microbiology laboratories of the University of Barcelona, filter paper discs impregnated with 20 μL of solution were placed on the surface of inoculated plates. Each test consisted in one disc without any additive (negative control), one disc with chloramphenicol (positive control), one disc impregnated with the solvent (diethyl ether, negative control) and one disc impregnated with the extract from the bryozoan at natural concentration. Bacteria inoculums were incubated to get close to 0.5 McFarland standards for susceptibility testing. Each microorganism was inoculated for triplicate on the surface of Mueller-Hinton agar with the paper discs. Zones of growth inhibition greater than 7 mm were considered susceptible to crude extracts. The majority of marine bryozoan extracts tested displayed activity. Further work is still in progress to tests activity against cosmopolitan bacteria and to determine the compounds involved in the activity observed in these and other experiments conducted during our new project ACTIQUIM-II.

STUDYING THE POTENTIAL IMPACT OF OCEAN ACIDIFICATION ON BRYOZOANS IN THE SOUTHERN OCEAN

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Since the industrial revolution the ocean has absorbed about 35% of the CO_2 released into the atmosphere by anthropogenic emissions, and has lead to a global average reduction of pH by ~0.1 pH unit. Such changes in seawater carbonate chemistry are likely to have significant impacts on marine calcifiers due to the increased energy required to biomineralise though laboratory experiments have highlighted a complex response. Laboratory experiments are however, by their nature short-term, and thus long-term studies are important to determine if acclimatisation occurs and to understand the response of different bryozoans.

The Southern Ocean provides a natural laboratory in which to study the potential impact of ocean acidification due to its naturally low carbonate saturation. By using bryozoans collected prior to anthropogenic input of CO_2 into the ocean with modern day specimens collected in similar locales we can assess if there are already potential any responses to an ocean acidification of 0.1 pH units. By examining the life history and biomineralisation of bryozoans together with the geochemistry of their skeletons we will determine if organisms in the Southern Ocean have acclimatised or adapted to ocean acidification over the last 100 years.

We present an overview of the project. Preliminary measurements of variation of Mg and $\delta^{11}B$ in bryozoans indicate vital effects between 0.5 and 0.7 pH units raising the internal pH higher than ambient seawater, and hence suggesting strong physiological control on the pH of the calcifying fluid. Comparison amongst species will ascertain whether certain species spend more energy altering the internal pH.

INVESTIGATING POLYEMBRYONY IN CYCLOSTOME BRYOZOANS.

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Polyembryony is the cloning of multiple embryos from a single sexually produced zygote, resulting in the production of clonal broods of identical genotype. This combination of both asexual and sexual reproduction appears paradoxical, as the respective benefits of the two modes seem compromised by their contrasted disadvantages. Despite this apparent drawback, polyembryony has evolved numerous times among metazoans and is thought to occur in an entire order of bryozoans, the Cyclostomata. First proposed in bryozoans from microscopy of the late 19th and early 20th century, its occurrence has only recently been confirmed genetically in a single cyclostome species, *Crisia denticulata*. Investigating the occurrence of polyembryony among cyclostomes forms one aspect of my PhD research, and the approach taken in studying this will be the focus of this talk. Furthermore, I will introduce complementary investigations to be conducted into associated aspects of cyclostome reproduction, notably the control of brood chamber development and the role of sperm utilisation in inbreeding regulation.

EFFECT OF OCEAN ACIDIFICATION ON ZOOIDAL DEVELOPMENTAL PATTERNS OF THE MEDITERRANEAN BRYOZOAN *CALPENSIA NOBILIS* (ESPER, 1796)

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Changes in seawater pH and chemical balance due to increased anthropogenic CO_2 emissions are predicted to worsen over the next few decades, with consequences on marine ecosystems and especially on calcifying marine organisms such as bryozoans. Growth of bryozoan colonies and zooids can provide useful information in understanding the ecology of the species in different environmental conditions, but little is known about the effects that ocean acidification can induce in colony development. The aim of the present research is to describe the developmental patterns of a Mediterranean bryozoan species and to detect changes in the developmental model for colonies grown in a naturally acidified site off Ischia Island (Tyrrhenian Sea, Italy). Colonies of the cheilostome bryozoan *Calpensia nobilis* (Esper, 1796) were collected from a *Posidonia oceanica* meadow at Ischia Island, then transplanted into a CO_2 vent area (Castello Aragonese) in cages subjected to normal (mean pH: 8.10) and 'below normal' pH (mean pH: 7.83) conditions. Four colonies were collected from each site after 16, 34, 48, 57 and 87 days. Zooidal developmental patterns at growing edges were described up to the 5th generation and compared between colonies exposed to normal and acidic conditions. Morphological modifications occurred throughout the period were used to set up a developmental model. Differences in developmental patterns of normal and acidic colonies were reflected in the number of zooidal generations at the active growing edges. In colonies exposed to acidic conditions for 57 days onwards, 1st and 2nd generation were not distinguishable and intermediate generations, 3rd and 4th, were totally missing. This fast growing species is an ideal organism for describing developmental patterns. Further studies should be performed, both in the field and in lab, to test combined and separate effects of OA, hypoxia and temperature on the development of *C. nobilis* to make predictions for future oceanic scenarios.

GENOTYPIC AND PHENOTYPIC VARIATION IN THE CALCIFICATION OF MARINE INVERTEBRATES AS A RESPONSE TO CHANGING ENVIRONMENTAL CONDITIONS

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Since the industrial revolution the increase in atmospheric CO_2 released from the burning of fossil fuels has had wide ranging climatic impacts worldwide.

Climate change has been particularly significant for the marine environment where the rise in atmospheric CO_2 over the last century has led to sea temperature rises, an increase in oceanic acidification and a corresponding decrease in seawater carbonate saturation.

Organisms with calcium carbonate skeletons and shells are susceptible to dissolution by ocean acidification however the effects of changing environmental conditions on carbonate deposition, mineralogy and calcification processes are not yet well understood for all calcifying organisms.

This study aims to bridge part of this knowledge gap by investigating the relationship between environmental conditions and calcification processes in marine Bryozoa using a multidisciplinary approach of mineralogical examination and proteomic and gene expression analysis.

The phylum Bryozoa comprises sessile, suspension feeding invertebrates which are crucial components of benthic marine ecosystems and are vital for the acid buffering capacity of our oceans. Bryozoan skeletons exhibit varying combinations of the calcium carbonate polymorphs, aragonite and calcite, within their skeletons and can incorporate different minerals within deposited calcite. The large mineralogical and geochemical skeletal spectrum exhibited by bryozoans makes them an ideal model organism for investigating both genotypic and phenotypic changes in calcification caused by climate change.

In understanding the vulnerability of calcium carbonate and the calcification processes to changing environmental conditions we will be in a far better position to gauge the potential future impacts of climate change on our marine communities.

STRUCTURE AND FUNCTION OF THE PLACENTAL ANALOGUE OF *BICELLARIELLA CILIATA* (BRYOZOA, CHEILOSTOMATA)

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Matrotrophy that is providing embryos with nutrients by extra-embryonic nutrient transfer is found within all three classes of the Bryozoa. Among the Gymnolaemata, the Cheilostomata most likely have evolved the nutrition of the embryo involving placenta-like analogues multiple times and convergently. Only a few morphological studies have dealt with the nutritional relationship between the parent and the embryo during the time of embryonic incubation. In order to analyse the mechanisms involved in nutrient transfer and to compare them with the little data available, we analysed the formation of the embryophore during the embryonic development of the cheilostome *Bicellariella ciliata* - a species known to be matrotrophic, but not properly studied by light- or electron microscopy so far. In the current analysis, preliminary results on the different developmental stages and their corresponding nutritive epithelia including early cleavage stages, gastrulation, early larval and late larval stages are presented.

RECORDS OF FOSSIL BRAZILIAN BRYOZOANS

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Brazil has expressive sedimentary paleobasin with several fossil records of both vertebrates and invertebrates. Information about fossil Brazilian bryozoans were published for the first time in 1887 by White, whose study recorded *Lunulites pileolus* ocurring together with moluscs collected in Pirabas River (Pará State), in North Brazil. Other studies following White's one such as: Derby (1894), Katzer (1903), and Maury (1924), all them studied the bryozoan fauna in the North Brazil, and Beurlen (1954) in South Brazil. The most important fossil studies from Brazilian bryozoans were made by Maria Marta Barbosa, geologist from Museu Nacional. Your studies were concentred at North and South Brazil. The Paleoinvertebrates Collection located in the Geology department at Museu Nacional has aproximatelly 40 samples of fossil Brazilian bryozoan been almost twenty species and five holotypes (*Lunulites pirabicus* Barbosa, 1959; *Steginoporella pirabensis* Barbosa, 1959; *Monticulipora brasiliensis* Barbosa, 1965; *Septopora katzeri* Barbosa, 1965; *Polypora derbyi* Barbosa, 1965). Other institutions have also fossil bryozoans in your collections: Instituto de Geociências of Universidade Federal do Rio de Janeiro (3 samples), CPRM (6 samples), and DNPM (2 samples). These samples were collected in different states from Brazil: Amapá, Pará, Maranhão, Rio Grande do Norte, and Rio Grande do Sul States. The specimens were studied long time ago and their classification need be reviewed. The actual situation of the bryozoology in Brazil points to an increasing expansion of specialists in recent organisms while studies of fossil ones show a retraction. Maria M. Barbosa was the last specialist of expression publishing specific articles up to 1967, since samples storaged during 70, 80, 90, and 2000 decades were collected for generalist paleontologist who studing the geologic formation recording all fossil organisms found, without paying attention to bryozoan taxonomy.

BRYOZOANS FROM MID-OCEANIC RIDGE – PRELIMINARY RESULTS OF MAR-ECO SOUTH-ATLANTIC PROGRAM

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Organisms that inhabit the mid-oceanic ridge of Atlantic ocean have been aim of study in the Mar-Eco programm (*Patterns and Processes of the Ecosystems of the Northern Mid-Atlantic - Census of Marine Life,* – www.coml.org). This project includes several national and international institutions and it carried out collections across the North and South Atlantic. Mar-Eco South Atlantic program aims to identify the organisms that live on mid-oceanic ridge of the South Atlantic and its adjacent submarine mountains, to understand the trophic relations between these organisms and their environmental, and to explorer the dispersion process of deep sea fauna among Pacific, Indian, Antarctic and North Atlantic oceans and between South America and the African continents. Bryozoan species were collected during Mar-Eco program during October-November 2009, on mid-oceanic ridge of South Atlantic (Superstation 7, local station 201; superstation 10, local station 201), using the oceanographic ship Akademik Ioffe (Shirshov Institute, Russian). The material was analysed and identified at Laboratório Biologia de Porifera of Museu Nacional, Rio de Janeiro Federal University. Preliminary results show the presence of ten taxa distributed on the following families: Farciminariidae (*Columnella* sp.), Bugulidae (*Camptoplites* sp., *Cornucopina* sp., *Himantozoum* sp. and *Kinetoskias* sp.), Candidae (*Notoplites*), Cellariidae, Calwelliidae (*Onchoporoides* sp.), and two specimens unidentified belong to Ascophora infraorder. These results show one fauna representative of organisms of deep sea. *Onchoporoides* genus is recorded from Kermadec Island (Pacific Ocean), been this first record of the genus to South Atlantic, increasing its geographic distribution. The other genera have been previously recorded from Atlantic Ocean. A more detailed taxonomy of these bryozoans will add new information about the geographic distribution and ecology of these species, and will also to document for the first time the composition of the bryozoan fauna from mid-oceanic ridge of South Atlantic.

THE GENUS *CREPIS* JULLIEN (BRYOZOA: CHEILOSTOMATIDA)

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The genus *Crepis* was created to place the species *C. longipes*, described from material collected in the sampling survey by the *Travailleur* in deep waters of the North West of the Iberian Peninsula. This species was later recorded in shallow waters in the Indo–Pacific region. Much later, it was found again in its original area and in the Straits of Gibraltar. Only two other species, both from the Indo-Pacific region, were assigned to the genus *Crepis*: *C. verticillata* and *C. decussata*.

The study of the currently preserved original material of these species lets us re-define the genus *Crepis*, which includes five species. The material previously identified as *C. longipes* actually matches up with four different species, three of them new to science. *C. verticillata* shows a particular morphology, which however allows to keep it in this genus. The presence of ovicells in the *Crepis* material collected from the North-Eastern Atlantic, as well as other features of the genus, let us place it in the Family Microporidae, as suggested by other previous authors. However, *C. decussata*, which must be divided in two different species, shows such different features from other species of *Crepis* that, from our point of view, should be placed not only in a different genus but also in its own Family, of uncertain affinities.

The diagnosis of the Family Chlidoniidae, which up to now included the genera *Chlidonia* and *Crepis*, must be modified to exclusively keep up to the first genus features.

This work was supported by the projects "*Fauna Ibérica: Briozoos I (Ctenostomados y Queilostomados Anascos)*" (CGL2006-04167), and "*Fauna Ibérica: Briozoos II (Familia Cribrilinidae – Familia Watersiporidae)*" (CGL2010-22267-C07-02), co-financed by the Ministerio de Ciencia e Innovación, Spanish Government and FEDER.

ALIEN BRYOZOANS AS SUBSTRATES FOR ALIEN CAPRELLIDS (CRUSTACEA: AMPHIPODA)

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The seasonal fluctuations of the caprellid fauna associated to the bryozoans *Bugula neritina*, *Zoobotryon verticillatum* and the recent invader *Tricellaria inopinata* were studied at the harbour of Cádiz, Southern Spain. Three species of caprellids were found, the non-native *Caprella scaura* and *Paracaprella pusilla* and the native *C. equilibra*. *Caprella scaura* was the dominant species in all the substrates during the whole year, in spite of the differences measured in water temperature, salinity and turbidity among seasons. While *B. neritina* was the dominant species in summer, *T. inopinata* was more abundant in winter and spring, reducing significantly the amount of *B. neritina* during these seasons. This contrasts with other harbours of Spain, where *T. inopinata* is absent and *B. neritina* is prevalent. The quantity of detritus retained by the bryozoans was significantly higher in *T. inopinata* and lower in *B. neritina*; this result could explain the higher abundances of caprellids found in *B. neritina*. On the other hand, *Caprella equilibra*, very common in other nearby harbours, was scarcely represented in the harbour of Cádiz, probably due to the presence of the invasive *C. scaura*, which shows a very aggressive behaviour and it is spreading very fast across the Mediterranean and Atlantic coast. The tropical species *P. pusilla*, which is recorded for the first time in European waters, was only present in *Z. verticillatum* and the hydroid *Eudendrium racemosum* in summer months, probably due to a higher water temperature during this period. The presence of this species in Southern Spain (temperate area) could be related to climatic change. This study reveals how bryozoans can be suitable substrates to host and maintain alien fouling species of epifaunal crustaceans in harbours. These results should be taken into consideration by politicians and authorities for adequate management and monitoring of harbours to avoid new invasions.

COLONIAL BUDDING IN A NEOGENE CUPULADRIID FROM ITALY

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Cupuladriids are highly specialised bryozoans whose larvae settle on sandy grains that become enclosed in the adult discoidal to dome-shaped colonies. Zooids open on the convex, upward-facing surface, each being associated to a vibracular heterozooid. Consequently, and unlike other bryozoans, cupuladriids are adapted to live free in soft bottoms and are able to withstand a considerable sedimentation rate and even burial.

New colonies usually result from larval settlement but some species clonally reproduce, mostly through fragmentation. In contrast, a few species are presently known that reproduce through colonial budding, implying the regeneration of buds first produced at the edge of the parental colonies. This peculiar reproductive strategy was so far known to occur in only two *Discoporella* and two *Reussirella* species, one from each genus being fossil: *Discoporella* sp. 20 from the Miocene and Pliocene of central America, and *Reussirella haidingeri* from the Miocene of northern Europe.

In Italy Cupuladriids are present in sediments from Late Miocene to Pleistocene, mostly from southern localities and record both sexual and asexual (fragmentation) propagation.

The recent examination of samples from central Italy gave the opportunity to discover several buds belonging to a *Reussirella* species, that lived in shallow water proximal settings during the Calabrian (and presumably the Gelasian) Stage. Most specimens were found in sands and silty sands deposited in moderate energy lower shoreface-to-offshore transition, and in sands from higher energy shoreface environments, in depths of 10-40 m. Few specimens were collected from offshore clays, where they were probably displaced.

This finding represents the second fossil record of cupuladriid colonial budding from the European region and the first for the Pleistocene time. The morphology of buds has been described and preliminary interpretations are suggested in relation to inferred palaeoenvironmental features and the knowledge of living species that reproduce through colonial budding.

BRYOZOA ON THE WEB: OBSCURITY TO ENLIGHTENMENT

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The importance of holistic faunal inventories and local baseline data are increasingly being recognised for biodiversity analysis. Available knowledge on biodiversity is expanding, and consequently new technologies are necessary to manage and access data. Furthermore, there is a growing interest in providing biodiversity information to the public and utilising amateur naturalists for data collection. With current pressures from climate change, habitat degradation and invasive species, there is a need to simplify the taxonomic understanding and raise awareness of little known, yet significant, marine groups such as bryozoans.

Both Scratchpad websites and the Encyclopedia of Life provide platforms for the dissemination of biodiversity and systematic information for "taxonomically challenging" groups, and allow for the consolidation of knowledge from members of the public and various content partners. Through an EOL Rubenstein Fellowship, 500 bryozoan species pages will be created for a scratchpad website and exported into EOL. These web pages will be easily updatable and accessible, and will provide the bryozoan community with an opportunity to promote interest in Bryozoa to a much wider scientific and public audience.

ARRIVAL, SPREAD AND SURVIVAL OF ALIEN SPECIES OF BRYOZOA ALONG ATLANTIC COASTS OF EUROPE

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With John D.D. BISHOP, Hans DE BLAUWE, Dan MINCHIN, Aliya EL NAGAR, Christine A. WOOD & Anna EL YUNNIE

Non-native bryozoan species (*Bugula neritina, Tricellaria inopinata, Watersipora subtorquata* and *Schizoporella* sp.) have been found recently, mainly in marinas, along Atlantic coasts of Europe. Two others (*B. simplex, B. stolonifera*) have been here for some decades but their current status is less clear. *B. neritina* was present in southern Britain and Brittany during the 20th century but became extinct. Now re-introduced (wherefrom is unknown) and rapidly spreading, it is present in Portugal, the Azores, NW Spain, northern France, and in sites from the southern North Sea to NE Ireland and SW Scotland. Live *B. neritina* (including that formerly present in Britain) generally has zooid walls of a distinctive translucent brown, while the polypide contains a purple pigment. Recently collected material, on the contrary, exists in purple and golden-brown colour forms and some has uncoloured walls and even unpigmented polypides. Other infra-specific differences (nucleotide sequences) within the *B. neritina* complex are recognized: only one is invasive. *T. inopinata*, of uncertain origin but first recognized in the Lagoon of Venice, is spreading in a similar way, having reached SW Scotland and the North Sea coast as far as Grimsby. *W. subtorquata* is present in two colour morphs, a largely orange one occurring in a few English Channel marinas, and a blackish one associated with Pacific oyster culture in western France. Both morphs are indistinguishable using SEM and have the same COI haplotype as invasive *W. subtorquata* elsewhere in the world. It has also recently been found in the Mediterranean. The black form is distinguishable from the similar *W. subovoidea* by haplotype, by morphology visible under the SEM, and by careful morphometrics. Though well-known in the Mediterranean, *W. subovoidea* was not known from Atlantic Europe (reported occurrences being based on misidentifications) but we report it from Cadiz and Cascais (near Lisbon). It is invasive in other parts of the world. A *Schizoporella* that resembles *S. japonica*, a species well established on the Pacific coast of North America, has recently been found accompanying an invasive ascidian in a Holyhead (North Wales) marina.

BROODING AND MATERNAL PROVISIONING IN CTENOSTOME BRYOZOANS

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Ctenostome bryozoans are a small group of predominantly marine, uncalcified animals. Sexual reproduction leads to the formation of either a planktotrophic or lecithotrophic larva. Species exhibiting lecithotrophic larvae commonly brood their embryos either within the tentacle sheath or in an invagination of the body-wall. Among the Ctenostomata a few of the brooding representatives were previously recognized to be matrotrophic, i.e. nourishing their embryos during brooding. These records are only available by showing an increase of the size of the embryos during ontogeny, which is one major indication for a species to be matrotrophic. Detailed information on the structure and function of placental analogues is currently wanting in the Ctenostomata. In the current study, we present first light and electron microscopy observations on the nutritive epithelia of matrotrophic ctenostomes.

CURATION OF LANG'S SPECIMENS IN THE FOSSIL BRYOZOAN COLLECTION AT THE NHM, LONDON

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Currently the bryozoan slide collection is being databased in the Palaeontology Department at the NHM. The significant collection studied by a former Keeper of the Department of Geology, William Dickson Lang (1878-1966), one of the most important proponents of the theory of orthogenesis, has been recorded. Lang's slides, with more than 2,800 specimens, date from the first half of the 20th century and include numerous type and figured Cretaceous cribrimorphs, important in illustrating Lang's ideas about the orthogenetic evolution of this group of cheilostomes. This data will be made available via the Internet portal of the NHM's KE EMu specimen catalogue. Eighty-six percent of the specimens are types (1210), figured (297), described or are cited in Lang's publications. Therefore this is one of the most important fossil bryozoan fossil slide collections in the NHM.

William Dickson Lang was born at the end of the 19th century in India, where his father was working as an engineer. He went to school at Harrow (London) and read Natural Sciences at Pembroke College, Cambridge. After finishing his degree he entered the NHM on 1 October 1902 as an assistant in charge of Protozoa, Coelenterates, Sponges and Polyzoa. Whilst there he began studying for his M.A. in 1903 and was awarded his PhD in 1919. His first papers on bryozoans, beginning in 1904, are on various Cretaceous cyclostomes and cheilostomes but he went on to focus on cribrimorph cheilostomes. He was made Deputy Keeper in 1927 and was Keeper from 1928 until 1938. In 1926 he was awarded the Lyell Medal of the Geological Society of London, and in 1929 was made a Fellow of The Royal Society. He retired as soon as he could, at the age of 60, moving to Charmouth in Dorset where he died in 1966.

Lang's slide collection comprises small fragments of colonies mounted in wooden cavity slides and stained with blue paint. This paint forms a thick coating on the surfaces of the colonies, obscuring details vital to the identification of the bryozoans. The paint was originally applied to emphasize morphological features, such as spines and pores, which are difficult to see in these very white specimens from the Chalk. Unfortunately, when coated specimens are studied using a scanning electron microscope spots of paint pigment dominate the images. Preliminary cleaning experiments have been undertaken using ultrasonic treatment in water, bleach and Quaternary-O. Dramatic results were obtained in all cases, the skeletal features of the bryozoans becoming clear for the first time.

MANUEL GERÓNIMO BARROSO (1887 – 1963), THE FIRST SPANISH BRYOZOOLOGIST

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The naturalist Manuel Gerónimo Barroso (1887 – 1963) was the first Spanish researcher devoted to the study of Bryozoan, basically the Iberian ones. This Doctor in Natural Sciences developed his research activity from 1912 to 1949, publishing 21 articles about coastal Bryozoan fauna, 4 articles about fossils Bryozoans, as well as 2 articles about Geology. Due to the approaching centennial of his first article publishing, "*Briozoos de la Estación de Biología Marítima de Santander*", we wish to carry out a brief biographical profile, referring specially to his contribution to the Bryozoan study. We hope to have it completed soon.

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THE HINCKS COLLECTION AT THE NATURAL HISTORY MUSEUM, LONDON

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The Reverend Thomas Hincks (1818-1899) was one of the leading experts on zoophytes during the Victorian period, and his landmark publication *"A history of the British marine Polyzoa"* (1880) became the authoritative work on British bryozoans for well over 60 years.

In 1899 the vast proportion of the Hincks Collection was donated to the British Museum (Natural History), now the Natural History Museum, by his widow, Elizabeth. This extensive collection contained over 1600 specimens, both Recent and fossil, and was global in its coverage, as Hincks obviously "traded" specimens with other leading bryozoologists of the day.

The fossil collection comprises 110 specimens including type and figured material, which were mostly transferred from the Department of Zoology to the Department of Palaeontology in 1930, 41 years after their acquisition. . It appears that more than 52% of the Hincks determinations come from Miss Jelly. The fossils were mainly published by David Brown in 1952, in his work on Tertiary cheilostomes of New Zealand; other authors who published on material in this collection were Anna Hastings in 1946 and Paul Taylor in 2000.

In this talk we will discuss some aspects of the Hincks Collection, the sources of the specimens, Thomas Hincks' life, and his family's contributions to Victorian natural history.

THE CONTRIBUTION OF DEVONIAN BRYOZOANS TO THE GEOLOGICAL HERITAGE OF ARNAO SITE

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Arnao is a small village in the central coast of Asturias, NW Spain, in which a complicated history has lead to a singular geological setting with an important natural and historical heritage. The abandoned coal mine of Arnao, exploited at least since the XVI century, is the oldest one known at present in Spain, and preserved facilities have been declared as "Goods of cultural interest" by the regional government.

An old quarry provided a good exposure of Lower Emsian deposits, thus allowing the exploration of the site by early researchers such as Charles Barrois. Arnao became one of the historical outcrops in the study of the Paleozoic succession in Asturias. This section embraces a reefal succession with domal and branching tabulates, followed by shales and marls with crinoids, brachiopods, bryozoans, tabulate and rugose corals, bivalves and other fauna. Many crinoid calyxes were extracted from the outcrop. Didactic panels have been placed along touristic pathways, but the paleontological resources still lack effective protection.

Bryozoans were scarcely studied by researchers in comparison with other groups, but the phylum is represented in the outcrop by fenestrates, cystoporates, cryptostomes and branching, bifoliate and encrusting trepostomes. Zoaria are commonly recrystalized due to tectonical stresses, but large specimens can be observed. Among this diverse bryofauna, the fenestrate genus *Bigeyina* Suárez & McKinney, 2010 is remarkable due to its branching growth habit, which is extremely unusual in fenestrates. Colonies initially grew forming a narrow cone that flattens distally and eventually bifurcates into two divergent cones, occasionally three. These cones may be terminal, or bifurcate into new fenestrate branches, giving rise to slender dendroid to complex, bush-like morphologies. Vesicular tissue leaves only distal parts of the terminal cones available for feeding. The presence of numerous specimens of fenestrates with branching growth habit, such as *Bigeyina* in Arnao, is an exceptional case in the stratigraphical record, and supports the need for effective preservation of this outcrop and its paleontological heritage.

TEMPORAL TRENDS IN BRYOZOAN COLONY-FORMS

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Bryozoans have evolved a variety of colony-forms since their first appearance in the fossil record, most appearing independently on multiple occasions in different clades. Functional morphological arguments suggest that different colony-forms represent alternative adaptive strategies to living as a colonial epibenthic suspension feeding colony. Widespread use has been made of bryozoan colony-forms in palaeoenvironmental analysis, and the carbonate sediment producing capacity of bryozoans varies according to colony-form. Changes in the proportion of different colony-forms through geological time have been suggested previously from mostly anecdotal evidence. In order to investigate temporal trends in bryozoan colony-forms more fully, we have compiled data from 170 fossil bryozoan assemblages comprising 10 or more species, placing each species into one of nine basic colony-forms: encrusting, domal, foliose, palmate, fenestrate, delicately branched (<2 mm diameter), robustly branched (>2 mm diameter), articulated, and free-living. Striking differences are evident in the relative proportions of these nine colony-forms through time. For example, encrusters constitute about twice the proportion of species in post-Palaeozoic compared to Palaeozoic assemblages. Fenestrate colonies increase proportionally through the Palaeozoic, reaching more than one-third of species in Permian assemblages, before disappearing for much of the Mesozoic and returning in small numbers in the Cenozoic. Domes are significant only in the Ordovician-Devonian, whereas foliose colonies peak in the Jurassic but are unimportant elsewhere. Articulated colony-forms are rare and free-living colony-forms absent until the Cenozoic in our data. These trends raise questions about the extent to which bryozoans through geological time have inhabited a different array of environments, or whether the environmental distributions of particular colony-forms have changed.

BRYOZOA FROM THE LOCALITY ŽIDLOCHOVICE

Tereza TOMAŠTÍKOVÁ

Židlochovice is situated 18 km south-east from the city Brno (Czech republic) and the locality consists of an old brickyard at the south-west slope of the Výhon hill at the north edge of the village (GPS of the central part of former brickyard 49° 02.499', 016° 37.303'). The brickyard is since 1978 internationally recognized stratotype locality (faciostratotype) for the upper part of Lower Badenian, local stage Moravian. The locality was described by many authors, which studied mainly molluscs and foraminifers. The detailed evaluation of bryozoan fauna was performed last (and first) time in the end of 19th century. The presented study should contribute to expanding of our knowledge of bryozoans from the locality Židlochovice.

Two boreholes were drilled recently in the vicinity of the old brickyard. Detail investigation of the samples, together with history of paleontological research at the locality, and subsequently field documentation of current state are the main aims of my study.

Both boreholes contain a very rich association of Bryozoa, which represented one of the most abundant microfossils in the locality. The results show the large number of bryozoans as cyclostomes (altogether 31 species) and cheilostomes (altogether 69 species). Altogether was determined exactly 100 species of bryozoans and 23 of them have been identified for the first time on the locality. Total number of erect species is 45, encrusting 53 and free living 2. The most common genera are *Reteporella*, *Cellaria*, *Crisia*, *Hornera*, *Exidmonea*, *Crisidmonea*, *Adeonella*, *Polyascosoecia*, *Margaretta*, *Metrarabdotos*, *Smittina*, *Tervia*, *Ybselosoecia*. In addition bryozoans is also evident in frequent occurrence of fragments of molluscs, foraminifera, sea urchin spines, remains of algal limestones, less of ostracods, needles of sponges and rare shark teeth.

Species composition corresponds to the environment predominantly shallow littoral waters with normal salinity and temperature and dynamic water which contributes to the abundant supply of food and oxygen.

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THE IDENTITY OF THE *SERTULARIA REPTANS* LINNAEUS, 1758, WITH COMMENTS ON OTHER BRITISH *SCRUPOCELLARIA* SPECIES

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Regarded as one of the most recognisable British bryozoans, *Scrupocellaria reptans* (Linnaeus, 1758) was described in *Systema Naturae* by Carl Linnaeus without illustration and with the unhelpful locality '*Habitat in Oceano*'. Despite recent descriptions and illustrations of this species, the type specimen, which is held in the collections of the Linnean Society of London, has never been described or figured.

We will look at the *Scrupocellaria* found in British waters, discuss the systematic history of *Scrupocellaria reptans* (L.) and examine whether the taxon is a widespread species with morphological variations or is a complex of species?

PALEONVIRONMENTAL RECONSTRUCTION OF THE NORTH-WESTERN MARGIN OF CARPATHIAN FOREDEEP IN EARLY MIOCENE: LOCAL CATASTROPHE NEAR PŘEMYSLOVICE (MORAVIA, CZECH REPUBLIC)

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Boreholes drilled close to Přemyslovice show relative deepening upwards environment of the coastal area.

First true marine fauna is represented by foraminifers dominated by *Melonis pompilioides* (Ficht. et Moll), *Heterolepa dutemplei* (d`Orb.), *Pullenia bulloides* (d`Orb.), followed by cyclostomatous bryozoans and opportunistic molluscs. Whole associations are characterized by presence of opportunistic and/or pioneer bryozoan species like *Reteporella, Tervia* and *Polyascosoecia,* similar to pioneer association described in section Kralice. However, this period was very short; recently it is represented only by few (5-15) centimetres of sediment.

The pioneer life was interrupted by catastrophe. Sediment does not contain any fossils, except very rare fragments of foraminifers, molluscs (*Anomia* sp.), brachiopods *Megathiris detruncata*, sponges, fragment of algae *Mesophyllum sancti-dionysii* overgrowing bryozoans and marine Dinophlagelata. All these fragments are showing long transport and probably do not represent original live remains. Surrounding dry land was probably overgrown by conifers.

Immobile minorite and trace elements clearly demonstrate that the sediment has volcanoclastics origin and are comparable with the Early Badenian tephra known from the Carpathian Foredeep and originate from paroxysmatic eruptions of rhyolitic to rhyodacitic volcanism. Redeposition of the volcaniclastic material from relative wider area should play an important role, because the thickness of tephra beds is relative larger in comparison with central/deeper parts of the basin. This layer of volcaniclastics is possibly correlated to the other Carpathian Foredeep sections, like Kralice and Hluchov (our own unpublished data). Therefore the sequence represents continuation of the transgression and relative deepening, with significant and rapid input of fallout tephra into the studied area.

The life came very fast to the studied area after stopping of input of volcanic material. The short period of second pioneer association was quickly replaced by well diversified foraminifers, bryozoans and molluscs characteristic for very shallow water environment within eutrophic conditions in warm (subtropical) temperatures developed. Bryozoan event association is well recognizable with less cool elements and higher water energy.

Reduction of siliciclastic input and deposition of sandy carbonates (red-algal limestones) is characteristic for the terminal sequence. Very shallow environment is

suggested. High energy of water may be indicated by the occurrence of many abraded foraminifer tests.

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