

II Workshop ABC/CNRS

(LIA-MARRIO)

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Centro - Rio de Janeiro - RJ - Brasil



Program and Book of
Abstracts

Program

Day 1 (Monday, 31th October 2016): Biodiversity and Biogeography

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Presenter: **Radovan Borojevic**.

11:40-12:00h: CNRS in Brazil and in South America

Presenter: **Olivier Fudym**

12:00-14:00h: Lunch

14:00-14:30h: The project MARRIO

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14:30-15:00h: Biodiversity and biogeography of calcareous sponges from the Caribbean and Brazil

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Biodiversity and biogeography of calcareous sponges from the Caribbean and Brazil

Fernanda Azevedo, Báslavi Córdor-Luján, Tayara Fontana, Raisa Rizzieri, Taynara Louzada, Pedro Leocorny, Thierry Pérez & Michelle Klautau

Tropical Western Atlantic, including the Caribbean Sea and the Eastern side of the South America represents one of the most impacted marine areas in the world according to Census of Marine Life. The knowledge gap in marine biodiversity makes this situation even more serious constraining the conservation of marine resources and the understanding of the origin and evolution of the biota in that region. As sponges represent one of the major benthic groups in marine ecosystems and they have limited ability to disperse by long distance, they constitute an excellent model for study. This study aim to determine the calcareous sponges biodiversity in the Lesser Antilles using morphological and molecular approaches. The analyzed material was collected by SCUBA and snorkeling (3- 30 m deep) in 2015, under the MARRIO Project. A total of 460 specimens were analyzed, resulting in 423 Calcineans including seven genera and 30 species and 37 Calcaroneans comprising six genera and 12 species. The genera belonging to Calcinea are: *Ascaltis*, *Ascandra*, *Ascoleucetta*, *Clathrina*, *Ernstia*, *Leucascus*, *Leucetta*. Among them, *Clathrina* (14 spp.) and *Ernstia* (11 spp.) are the richest genera. The genera within Calcaronea are: *Grantia*, *Leucandra*, *Leucilla*, *Paraleucilla*, *Sycetta* and *Sycon* and being *Leucandra* the richest genus. The species patterns of distribution will be also presented. Although preliminary, the present results provide an overall panorama of the diversity of calcareous sponges within the Lesser Antilles and consequently, contribute to fill in the knowledge gap of the Tropical Western Atlantic marine biodiversity.

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Homoscleromorpha classification revised through Integrative Systematics

César Ruiz & Thierry Pérez

Homoscleromorpha is one of the most challenging groups among the Porifera. Recently elevated to the rank of class, this group has seen a high rate of new descriptions over the last two decades. The development of an integrative taxonomic approach and the exploration of new marine ecosystems have revealed an even higher diversity, highlighting the importance of complementary datasets such as morphology, cytology, chemistry and genetics to clarify erroneous identifications, cases of alleged cosmopolitanism and unresolved species-complexes. Using this integrated approach, we studied the Homoscleromorpha sponges from marine caves. In the Caribbean Sea, several new species have been found. The analysis of worldwide fauna provides new insights into Homoscleromorpha classification, challenging the present systematics and allowing to re-define several taxa within the group. This initiative is the first step towards a more thorough revision of the group.

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Homoscleromorpha from Cabo Frio

Guilherme Muricy, Celso Domingos, Anaíra Lage, Mirelly Balbino, Emilio Lanna, Cristiane Hardoim, Marinella Laport, Carla Zilberberg, Philippe Willenz, Alexander Ereskovsky, Thierry Pérez & Dennis Lavrov

The Homoscleromorpha were considered to be very rare in the Southwestern Atlantic, with only one record of *Oscarella* sp. in the Cabo Frio - Búzios region. An exhaustive search for Homoscleromorpha in the Cabo Frio region allowed the discovery of a rich fauna of Homoscleromorpha, with at least six species belonging to the genera *Plakina* and *Oscarella*, most of them new to science. All species colonize the undersurfaces of boulders and corals, but in two different habitats: While some are restricted to the subtidal rocky shores in the coastal islands, others were found exclusively in a very shallow tide pool at Cabo Frio. Surprisingly, the two genera show opposite patterns of diversity in these two habitats: Two polychromatic species of *Plakina* and one monochromatic *Oscarella* live in the tide pool, while at least two polychromatic *Oscarella* and one monochromatic *Plakina* inhabit the subtidal rocky shores. These species are currently being distinguished and described using an integrative taxonomic approach with morphology, cytology and DNA sequencing (cox-1 and cit-b genes). A wider use of this approach, together with detailed further search in cryptic, sciaphilous habitats, will probably lead to a great increase in the known diversity of the Homoscleromorpha.

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Taxonomy of *Plakina*

Anaíra Lage & Guilherme Muricy

Plakina is the most representative genus of the class Homoscleromorpha, with 29 valid species occurring in hard substratum, mostly ceilings and walls of dark or semi-dark habitats. This genus is widely distributed although the regions of the Mediterranean Sea (8 spp.) and Caribbean Sea (5 spp.) record the greatest species richness. Two Mediterranean species, *Plakina monolopha* and *P. trilopha*, are cosmopolitan, but most records from outside the Mediterranean need revision, including the Brazilian records of *P. trilopha*. In this study, we described three new species of *Plakina* and the redescription of four others. Two species are from Marquises Island and are distinguished by: *Plakina* sp. nov. 1 with lophose calthrops exclusively trilophose and have all actines terminally spined and *Plakina* sp. nov. 2 with an peculiar lophose spicules with slightly spiralled, fused actines ('spirolophose calthrops'). *Plakina* sp. nov. 3 from Greece has trilophose and tetralophose calthrops with irregular shapes. The four species redescribed are *P. bowerbanki*, *P. crypta* and *P. weinbergi* with samples collected in Aegean Sea and the *P. coerulea* collected in the Cabo Frio (Búzios) region.

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Towards a clearer picture of sponge distributions in the Tropical Western Atlantic

Eduardo Hajdu

How much discontinuous can possibly be marine sponge distributions in reality? Many historical examples of species thought widely distributed and largely discontinuous have proven to be artefacts of conservative taxonomy and/or conservative morphology, and those not proven so, are now regarded doubtfully. Distribution gaps have traditionally been explained by lack of inventory/taxonomy effort, or lack of convenient habitat. In any case, biogeographic analyses are seriously hampered by this incomplete picture of sponge distributions, further blurred by each species evolutionary chance events. One way to overcome this problem is to invest manpower in inventorying apparent distribution gaps, keeping in mind that even hotspot areas may have their own inventory gaps for a variety of reasons. Prominent among these, failure to apply as wide as possible an array of inventory strategies. Brazil stands out in this effort to sharpen the focus on species distributions, thanks to a collection of favourable factors succeeding each other in the past couple of decades. Notably among these (not in order), 1) inventory of sponge distribution in the rocky coasts of SE and S Brazil, 2) in oceanic islands, 3) off the mouth of the Amazon, 4) Project REVIZEE, 5) bioprospecting expeditions, 6) CENPES/PETROBRAS' baseline biodiversity projects (w & w/o ROVs), 7) intertidal sampling in NE Brazil, 8) integrative studies, and above all, 9) training of new generations of sponge taxonomists. Allegedly artificial absence of species from apparent range gaps, as a consequence of the insufficiency of the taxonomic effort, becomes less and less likely every year.

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An overview of South Atlantic deep-sea Astrophorina sponges

Cristiana Castello-Branco & Eduardo Hajdu

The abundance and richness of records of Astrophorina sponges from the deep North Atlantic are remarkable. Indeed, such is the abundance at places that a series of sponge grounds were delimited in the past few decades. But when it comes to South Atlantic deep-sea Astrophorina, no evidence of sponge grounds has ever been publicized. Despite the fact that only 30 species (deeper than 150 m) are described from the region, a database search for South Atlantic deep-sea Astrophorina deposited at the MNRJ collection suggests that up to 50 species occur in the area. These materials were obtained by the Marion Dufresne (MD-55), REVIZEE, CENPES/PETROBRAS, SA MAR-ECO, and PROERG expeditions. Geodiidae comprised 55%(24spp) of the Astrophorina species from South Atlantic, Ancorinidae 18% (8 spp), Pachastrellidae 11% (5 spp), Calthropellidae 7% (3 spp) and 2% for Corallistidae, Theneidae, Thrombiidae and Vulcanellidae (1 sp each). Most of the records are from the SW Atlantic (36spp), while nine species were recorded from the SE Atlantic, and one from Tristan da Cunha (*Pachastrella abyssii*). Only three of these species have allegedly amph-South Atlantic distributions (*Jaspis johnstoni*, *Pachastrella monilifera* and *Thenea fenestrata*). Three new *Erylus* and three new *Jaspis* have recently been described from intermediate depths on the Brazilian outer shelf, upper slope and seamounts. New *Calthropella*, *Characella*, *Geodia*, *Rhabdastrella* and *Stelletta* are under description.

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Taxonomic revision of Brazilian Petrosiidae Van Soest, 1980 (Haplosclerida,
Demospongiae, Porifera)

Lívia Rocha & Eduardo Hajdu

The taxonomic study of Brazilian Petrosiidae samples deposited at Museu Nacional/UFRJ found eight species. *Neopetrosia carbonaria*, first record for the Brazilian coast (Alagoas); *Neopetrosia proxima*, previously known from AP, MA, RN and SE, with new record for BA; *Neopetrosia sulcata*, previously known from RN, with new record for RJ; *Petrosia (Petrosia) weinbergi*, from RN, PE, ES and BA; and *Xestospongia muta*, registered from MA, RN, PE and BA, and now to CE. Three new species were found. *Neopetrosia* sp.nov. (Fernando de Noronha, RN, CE and PA, 4–19.5 m depth), with encrusting to massive habit, subectosomal lacunae obscured by translucent membrane, often reticulated, color white to cream, oxeas 112–167 x 2–5.3 µm. *Petrosia (P.)* sp.nov. I (BA and AL, 5–10 m depth) with massive cavernous habit, white color with or without purple spots, oxeas I, 133–185 x 5–12 µm, oxeas II, 66–106 x 2–12 µm. *Petrosia (P.)* sp.nov. II (PE, BA, RJ and ES, 15.8–270 m depth.), ramose, palmate or massive habit, color varies from pink to red-wine, and white, brown, yellow or beige, with or without red-wine or lilac spots next to oscula., oxeas I, 102–305 x 4.8–19.4 µm, oxeas II, 39–97 x 4.8–9.7 µm. The latter was one of the most abundant sponges in the Central V cruise of REVIZEE Program, and thus, a hitherto remarkable gap in Brazil's inventory of its sponge fauna. In addition, *Xestospongia grayi* is considered a junior synonym of *X. muta*.

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Taxonomy of Hymedesmiidae (Porifera, Poecilosclerida) from the Brazilian Coast

Sula Salani, Philippe Willenz & Eduardo Hajdu

Hymedesmiidae comprises five species records for Brazil: four species of *Phorbas* (*P. amaranths*, *P. capixaba*, *P. fusifer* and *P. hechteli*) and one of *Hemimycale* (*H. insularis*). In this work 15 species were identified, ten of which are new to science, including the first records of *Acanthancora* for the Brazilian coast. Identification of the material was made through spicules and skeletal characters. The hymedesmioid architecture does not allow the differentiation of genera in the family, while the skeleton of pore fields proved to be aspecific character. Despite the great affinity between the Caribbean and the Brazilian marine biota, this pattern was not found in Hymedesmiidae. Only one species occurred both in Brazil and the Caribbean, *P. amaranthus*. Eight species are from the Tropical Southeast Atlantic province, and eight from the Warm Temperate Southwest Atlantic province. The large number of new species found in this family illustrates the importance of studying incrusting species of Porifera, mostly occurring in cryptic microhabitats (sciophilous). The results highlight the richness of the rocky shores of southeastern Brazil and the potential for new species discoveries.

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A synopsis of Brazilian *Haliclona* (Demospongiae: Haplosclerida: Chalinidae)

André Bispo, Monica Dorigo Correia, João L. Carraro & Eduardo Hajdu

The species of the genus *Haliclona* occurring in the Brazilian coast are revised. Twenty species are recorded or (re)described, 7 of which are new to science: *Haliclona (Gellius)* sp. nov., *Haliclona (Halichocona)* sp. nov., *Haliclona (Reniera)* sp. nov. 1, *Haliclona (Reniera)* sp. nov. 2, *Haliclona (Rhizoniera)* sp. nov., *Haliclona (Soestella)* sp. nov.1 and *Haliclona (Soestella)* sp. nov. 2. We also redescribed the holotypes of *Haliclona (Gellius) catarinensis*, *Haliclona (Rhizoniera) lilacea*, *Haliclona (Rhizoniera) mammillaris*, and *Haliclona (Soestella) melana*. In addition, we present new records of *Haliclona (Halichocona) vansoesti*, *Haliclona (Reniera) chlorilla*, *Haliclona (Reniera) implexiformis*, *Haliclona (Soestella) caerulea*, and *Haliclona (Soestella) melana*. We present a key to all the shallow-water species of *Haliclona* occurring in the Brazilian coast. The biodiversity and biogeographic affinities of Brazilian *Haliclona* are discussed.

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Integrative systematics of *Mycale* from the Tropical Western Atlantic

Dora Leite, Thiago de Paula & Eduardo Hajdu

The immitis species-group comprises 18 species within *Mycale* (*Mycale*), characterized by the possession of an anisochela that is markedly curved in profile, and relatively short head, with only about 25–35% of the whole microsclere length. The aim of this study is to describe a new record of this species-group found at Martinique in 2013, whose assignment to this group was already suspected in the field from its surface pore-grooves, fluffy consistency, and cavernous habit. Specimens are preserved in 80% ethanol, and were identified based on preparations of dissociated spicules and thick paraffin sections. The largest specimen is encrusting (ca. 1.3 mm thick). The preserved material is compressible, with slightly hispid surface, no visible apertures, and cream color. Choanosomal skeleton with dispersed rosettes of anisochelae I, and mycalostyles in bouquets piercing the ectosome. Megascleres two types of fusiform mycalostyles: I, choanosomal, straight, 436–683 x 9.6–15.2 μm ; II, ectosomal, curved, 387–605 x 10.1–18.8 μm). Microscleres are three categories of anisochelae (I, 54–68 μm ; II, 23–32 μm ; III, 16–21 μm), two of sigmas (I, 36–48 μm ; II, 17–24 μm , N=10), and trichodragmas composed of raphides (50–88 μm). This material is provisionally identified as *Mycale* (*M.*) cf. *alagoana*, distinguishing itself from the northeastern Brazilian species only by the apparent lack of a third category of sigmas. Currently we are assaying the obtainment of molecular markers to verify the conspecificity of Martinique and Brazilian samples.

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Sponge bottoms off the Amazon River mouth revisited: filling gaps after 40 years

Fernando Moraes, Camille Leal & Eduardo Hajdu

The Amazon River strongly influences oceanographic processes at the Atlantic Ocean, changing the environmental conditions along yearly and geological periods to build up a powerful biogeographical filter to reef organisms. This unique interface river-ocean creates a complex scenario for marine life. The discovery of the emblematic “sponge bottoms off the mouth of the Amazon river” by Collette & Rützler (1977) enhanced the instigation of scientists for the so postulated biogeographical “Amazon Barrier”. This shed light to a puzzling benthic community with unexpected reef species under the river plume. The most recent update on this topic involved a multidisciplinary team that carried out three expeditions on board of R/V Knorr (May 2010), R/V Atlantis (July 2012), and NHoCruzeiro do Sul (September 2014) from French Guiana border to Maranhão State in Brazil, bottom sampling from 23 to 120 m. A total of 90 samples was deposited at the Museu Nacional Porifera Collection – UFRJ, representing more than 61 taxa, and including two new records to Brazil that were previously known to either East Atlantic or Caribbean. At least four sponge species are new to science. The sampling design and the quality/ amount of biological material recovered have contributed to a better understanding of the ecological, evolutionary and biogeographical processes in this singular environment. These specimens are also potential sources of new bioactive compounds. More than 1.100 images of field procedures and fresh material have been useful to taxonomy and to worldwide science popularization, creating international conservation awareness on the Amazon reef system.

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Calcareous sponges from Bahia

Fernanda F. Cavalcanti, Cleslei Chagas Souza, Bruna Bahiana & Francine Brandão

Bahia is located in northeastern Brazil and it has the longest coastline among the Brazilian states. Most of our current knowledge on Bahian sponges comes from studies focusing on Demospongiae, and only few species of Calcarea are known. The first records of calcareous sponges to Bahia were made at the end of the 19th century, followed by an isolated publication at the 1940's decade. After that, important contributions were provided by professors Solange Peixinho and Radovan Borojevic in 1976, but Calcarea from Bahia remained forgotten for a long period of time, reappearing in the literature only in the last years. Currently, 13 species are recorded, suggesting that a greater taxonomic effort is needed. Recently, our research group was created, and exciting results started to flourish. Our preliminary results revealed the occurrence of *Leucandra serrata* and *Vosmaeropsis recruta*; the former had a large lacuna in its distribution and the latter species was endemic to Rio de Janeiro. *Sycon*, *Leucilla*, *Clathrina* and *Borojevia* are abundant, although these last calcinean genera had never been recorded to Bahia. Finally, a species of *Heteropia* has been found in marinas, with a suspicion of being an introduced species. Thus, the diversity of Calcarea in Bahia appears to be high, as expected before, and the number of species described to this region will probably duplicate in the next two years. An interesting diversity is being revealed, stimulating undergraduate and graduate students, and helping to fill the lacuna we still have on the knowledge of this fascinating sponges.

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Biodiversity and structural dynamic of marine sponges assemblages of Ilha Grande and environs, Rio de Janeiro, Brazil

Humberto Fortunato, Thiago de Paula, Eduardo Esteves, Guilherme Muricy, Gisele Lôbo-Hajdu

Marine sponges are essential components of marine benthic habitats and its distribution and abundance can be influenced by several biotic and abiotic factors. In the present study, we describe for the first time the community structure of sponges from Ilha Grande Bay (IGB), a hotspot of marine biodiversity in southwestern Brazil. Sponge communities were evaluated by photo-quadrats at six sites, evenly distributed between sides facing oceanic waters and inner bay (hydrodynamics), in rocky and sandy substrates (type of substrate). A total of 2941 individuals of marine sponges comprising 46 OTUs were registered, and 17 species are new records for IGB. *Tedania ignis*, *Scopalina ruetzleri* and *Lotrochota arenosa* composed 48.49% of the sponge community, as shown by SIMPER analysis. Statistical differences for the traditional ecological descriptors (abundance, richness, diversity and evenness) were found by ANOVA, for both abundance and coverage area. Moreover, multivariate analysis indicated type of substrate as first structuring factor followed by hydrodynamics for the sponge assemblage at Ilha Grande Bay.

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How much marine sponge bioinvasion is there in Brazilian SE?

Thiago de Paula

Marine bioinvasions are responsible for transforming several habitats worldwide by displacing native species, changing both structure and functioning of ecosystems, impacting seafood natural populations, and fouling ships, platforms, and intake pipes. The significance of marine sponges' bioinvasions is still unclear. The lack of sponge species among reports and monitoring surveys of invasive species in benthic environments is prevalent. It is the taxonomists' job to provide clear, accurate guides to non-specialists in order to improve field identifications and monitoring practices. Three studies conducted by our research group suggest the introduction of alien species to the coast of Rio de Janeiro, Brazil. Although preliminary, these findings are suitable to discuss the prevalence of bioinvasions among marine sponges. Efforts in this matter are still inferior to the global challenges brought by other animal groups. In short, these putatively introduced species found by our research group along the coast of Rio de Janeiro should increase the scientific community's awareness about bioinvasions of marine sponge species along the Brazilian coast. It is for the best that reports and distribution ranges of sponge species raising 'red flags' (i.e., species poorly known, widely distributed, hugely plastic, etc) are reevaluated, ideally by molecular data, in order to improve and/or propose conservation policies. Finally, this is a plea to the international sponge research community to promote, stimulate, and conduct collaborative studies to generate molecular data for marine sponge topotypes (i.e., specimens from type-localities), in order to begin the difficult task of tracking native and invasive species worldwide.

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Phylogeography and population demography of Calcareous sponges within the Tropical Western Atlantic: *Leucetta floridana* and *Clathrina* sp. nov.

Báslavi Córdor-Luján, Jaaziel García-Hernández, Nikolaos Schizas, Thierry Pérez & Michelle Klautau

Sponges have short-time planktonic larvae which constrain their dispersion and consequently, restrict their geographic distribution. However, some calcareous species as *Leucetta floridana* and *Clathrina lutea* are widespread within the Tropical Western Atlantic (TWA). In order to elucidate the historical processes that originated the current distribution of these species, phylogeographic and demographic analyses based on ITS sequences were performed. A total of 162 *L. floridana* and 141 *Clathrina* sp. nov. from different localities (Florida, Puerto Rico, Lesser Antilles, Panama, Colombia, Curazao and Brazil) were studied. Genetic variation was assessed through sequence-type and nucleotidic diversity indexes. A rooted phylogeny and a MJ network were constructed to explore the genealogical relationships among the individuals. To determine the population structure, pairwise F_{ST} comparisons and AMOVA were performed. Neutrality tests, mismatch distribution and Bayesian skyline plots were conducted to infer demography patterns. The phylogenetic trees as well as the networks showed high structured lineages within both species: one lineage widespread in the TWA and at least, another one restricted to Caribbean localities. These results are consistent with the obtained values for F_{ST} and AMOVA and they evidenced (1) a panmitic population maintaining connectivity despite the geographical distance and the outflow of freshwater and sediments from the Amazon and Orinoco Rivers and (2) the presence of barriers constraining gene flow within the Caribbean Sea. Demography analyses indicated an event of population expansion in the Caribbean Sea during the late Pleistocene (25 kya) for *Leucetta floridana* which could be related to the changing conditions during that time.

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Population structure of *Clathrina aurea* (Porifera, Calcarea) in the Southwestern Atlantic.

André Padua, Haydée Cunha & Michelle Klautau

Clathrina aurea is a calcareous sponge with wide distribution along the Brazilian coast. In the present work we compared morphology and genetic population structure among localities in Southwestern Atlantic (Southeastern Brazil), using a classic morphological approach and specific microsatellite *loci*. The external morphology was conservative, but spicule measurements were variable within and among populations. Excess of homozygotes were observed in two of the seven *loci* used, suggesting the presence of null alleles. Hence, for comparison, molecular analyses were conducted using sets of seven and five *loci*, both recovering similar results. F_{ST} indicated a strong structure of all localities/populations. On the other hand, other two different clustering analyses using Bayesian inference generated different results and pointed to three structured clusters: two in the Southeastern and one in the Southern portions of the Brazilian coast. The high genetic diversity, non-significant inbreeding coefficients, as the supposed distances and time of dispersion between localities can be considered surprising, once larvae were never observed and reproductive elements were rare in this species. Isolation by distance, a stepping-stones model and the influence of coastal currents and the marine landscape are discussed as possible explanations for the observed results.

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Past and present scenario of the sponge *Clathrina aurea* (Porifera, Calcarea): connectivity of Brazilian and Caribbean populations

Pedro Leocorny, Báslavi Córdor-Luján, Thierry Pérez & Michelle Klautau

Sponges are the principal components of coral reefs in the Caribbean. Although currents are hypothesized to maintain a homogenous sponge community composition at the region, recent works have been showing high genetic structure related to these animals' low dispersal capability. To understand the level of connectivity between populations is extremely important not only to comprehend the dynamics of Caribbean reefs, but also to delimit populations and identify genetic clusters, contributing to politics of conservation and management. *Clathrina aurea* Solé-Cava, Klautau, Boury-Esnault, Borojevic & Thorpe, 1991 is a yellow, tiny calcareous sponge widely distributed along the Brazilian coast and recent surveys also found the species in the Lesser Antilles. Its presence in Brazil and Caribbean brings the species as an excellent model organism to evaluate its capacity to maintain genetic flow across wide distances. Using genetic markers with different mutation rates, we are able to draw a past and present scenario of the species' genetic history along the region and also to assess how the Amazon river have shaped the connectivity between these two populations.

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Is there *Chondrosia reniformis* in the Western Atlantic?

Carla Zilberberg, Cristiano Lazoski, Antônio M. Solé-Cava & Nicole Boury-Esnault

Classical sponge taxonomy was traditionally based on skeletal characters. Yet, for species with few or no spicules, the identification was challenging and, therefore, many species were described as cosmopolitan. However, with the advance of molecular studies it was found that several of those supposedly cosmopolitan species were, in fact, cryptic species. *Chondrosia reniformis* Nardo, 1847 was one of those allegedly cosmopolitan species occurring in the Mediterranean, the Atlantic Ocean and the Indo-Pacific. Previous allozyme study identified only one species of *Chondrosia* along the Southwestern Atlantic (from Bermuda to Brazil), which is genetically different from the Mediterranean *C. reniformis*. In the present study the Follmer region of the COI mtDNA was used to validate the allozyme's findings. Additionally, specimens identified as *C. collectrix* (Schmidt, 1870) (deposited at the MNRJ) were also included. The results of the phylogenetic analyses confirmed the nuclear markers findings, demonstrating the presence of a cryptic species of *C. reniformis* in the Atlantic. Furthermore, specimens identified as *C. collectrix* from the Atlantic grouped with *Chondrosia* sp. Morphological analysis of cortex thickness also differentiated *C. reniformis* ($1.30 \pm 0.06\text{mm}$) from both *Chondrosia* sp. ($0.44 \pm 0.02\text{mm}$) and the specimens identified as *C. collectrix* ($0.41 \pm 0.05\text{mm}$), with the latter two having similar cortex dimensions. This study validates the presence of a new species of *Chondrosia* along the Southwestern Atlantic, which is different from the Mediterranean *C. reniformis*. Additionally, it demonstrates that specimens identified as *C. collectrix* belong to this new cryptic species (*Chondrosia* sp.). The description of *Chondrosia* sp. with morphological and cytological characters is urgently needed.

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Morphological and molecular taxonomy of marine sponges from Rio de Janeiro State

Eduardo Leal Esteves, Gisele Lôbo-Hajdu, Thiago de Paula & Rodolpho Albano

The Rio de Janeiro state is one of the richest localities for marine sponges in Brazil and may represent the southern limit of distribution for many Tropical Western Atlantic endemics. Indeed, the distribution of many species previously known as Tropical Atlantic endemics has been expanded southwards with the increase of taxonomic samplings in the south/southeastern coast of Brazil. With the purpose to fill this gap, we are doing a taxonomic inventory and developing a regional collection of marine sponges from central/southern islands off Southeast Brazil. Specimens were collected by SCUBA dive to a depth of about 12 meters from 2010 to 2016 in 12 localities at Ilha Grande Bay and Maricás Archipelago. Vouchers of some specimens were selected for molecular systematic. Almost 500 specimens have been collected and deposited at the Porifera collection of Rio de Janeiro State University (UERJPOR). Sequences of COI and 18S rRNA were generated from 30 specimens belonging to 21 species of Demospongiae and Calcarea. Approximately 50 species belonging to Demospongiae and Calcarea have been identified from Ilha Grande Bay and Maricás Archipelago; some of them are new records to Southeast Brazil or new to science. Our preliminary results suggest that the biodiversity of marine sponges from Rio de Janeiro state has been underestimated. Indeed, many sponge species recorded in the present study from central/southern islands off Rio de Janeiro may actually present a disjunct distribution between the Caribbean and the southeast Brazil or may actually comprise complex of species to be unrevealed.

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Biodiversity and phylogeography of *Chondrilla* along a N-S gradient in the
Tropical Western Atlantic: an integrative approach

Nicole Boury-Esnault, Alexander Ereskovsky, Cristiano Lazoski, Marinella Laport,
Cristiane Hardoim, Antônio Mateo Solé-Cava & Carla Zilberberg

The biodiversity of *Chondrilla* species along a N-S gradient in the Tropical Western Atlantic was studied and included new samples collected during the recent Pacotilles survey in the Eastern Caribbean, in addition to samples from Florida, Belize, Bahamas and localities along the Brazilian coast that were collected during previous works (Klautau et al 1999; Zilberberg 2006). The type species of *Chondrilla nucula* from the Mediterranean Sea was included and *Chondrilla australiensis* was added as outgroup in the phylogenetic analyses. To be able to detect the number of OTUs present in the samples, the Follmer region of the COI mtDNA, the spacer between COII and ATP6 mtDNA and the region encompassing the ITS1, 5.8S and ITS2 rDNA were used. For the phylogenetic analyses, the COI mtDNA had the best resolution, so this region was chosen for the haplotype network analysis. The phylogenetic and phylogeographic analyses demonstrate that in the Tropical Western Atlantic there are four species of *Chondrilla*, which are genetically different from *C. nucula*. A cytological study was done to compare the cytology of the Mediterranean *Chondrilla nucula* with samples from Eastern Caribbean, as well as the Brazilian coast (Cabo Frio). The cells with inclusions are particularly abundant. The morphology of the spherulous cells is typical of the genus *Chondrilla*. Granular cells of different types allow the discrimination between the Mediterranean and the Tropical Western Atlantic species. A type of symbiotic coccoid cyanobacteria seems to be characteristic of *Chondrilla* from the Western Tropical Atlantic. The cytological work needs to be completed with samples from NE Brazil/Trindade Island and from Florida/Belize.

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Two new *Arenosclera*-like species from Amazon reefs whose 28S do not cluster with the type species of the genus

Camille V. Leal, Fernando C. Moraes, Adriana Fróes, Ana Carolina Soares, Fabiano Thompson & Eduardo Hajdu.

Arenosclera has six accepted species in the IndoPacific (4), Red Sea (1) Brazil (1). The rich chemistry presented by the Brazilian species caught our attention about relationships among these species and inspired performing a phylogeny to verify if *Arenosclera* is monophyletic. Three specimens were dredged from Amazon reefs. Morphological taxonomy was made following Hajdu et al. (2011). Molecular analyses were done using the 28S marker, recovered from metagenomics results after blasting for 28S probes in Genbank. The latter was also source for additional 28S sequences to build a tree from. The alignment was undertaken with MAFFT 7 and the Maximum likelihood phylogeny with MEGA 7. The Amazon species feature delicate oxeads and sand in the fibers, with soft consistency and beige color. Differences between both species are the structure of the skeleton and morphology of the oxeads. Except by its arborescent habit, these species are very similar to other *Arenosclera* spp. But the phylogeny shows that not only Amazon reef species, as well as *Arenosclera brasiliensis* do not form a monophyletic group with *Arenosclera heroni*, type species of the genus. Brazilian species appear in a different clade, suggesting that these species represent a new genus. The confused systematics of the Haplosclerida hinders the objective classification of this new clade into the Haplosclerida. More studies using other Haplosclerida are necessary to better define this group.

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Sponge diversity of the French Mediterranean Sea, with a focus on semi-dark cave-dwelling species

Marie Grenier, Thierry Pérez, César Ruiz, Maïa Fourt, Maude Dubois, Mathieu Santonja, Jean Vacelet, Nicole Boury-Esnault & Michelle Klautau

Mediterranean sponges represent about 10% of the world sponge biodiversity, these sessile organisms dominating in terms of diversity and biomass most of the rocky bottoms shaded from light. After 60 years of intense study of the sponge diversity along the French coast, we present the first comprehensive reference list for this biogeographic area. A total of 386 sponge species are recorded, and 222 of them being known off the Marseille region. In this area, a particular attention was paid to species which are common at the entrance of submarine caves. Within this semi-dark community, an easy and rapid assessment method was developed with a selection of 65 representative species. This method, based on data acquisition with photoquadrats and their processing using a DataBase built with ACCESS, has been deployed in 13 studied sites. The dominance of certain species in the sponge assemblages is obvious, *Oscarella tuberculata*, *Dendroxea lenis*, *Agelas oroides*, *Crella pulvinar* and *Dysidea* sp. being the most common species. This study may thus represent a useful contribution for marine environment managers who might apply this rapid and easy assessment method in the framework of several EU Directives and international conventions.

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New records of the hypercalcified sponge *Plectroninia* (Calcarea,
Minchinellidae) in the Recent deep ocean

Jean Vacelet, Benjamin James & Helmut Zibrowius

Numerous small specimens of hypercalcified sponges of the genus *Plectroninia* (Jurassic to Recent) are recorded from deep littoral zone and mostly from bathyal depth from six different biogeographic Realms. The specimens were reduced to skeleton of linked calcareous tetractines attached on diverse hard substrata, mostly scleractinian skeleton, with incomplete free spicule complement and could not be identified at the species level. These observations show that *Plectroninia* spp. have a wide distribution on the hard substrata in the Recent bathyal zone, where they could represent the most abundant calcareous sponge.

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Molecular investigation of new Verongimorpha suggests several new taxa:
species, genera, families, etc

Maude Dubois, Cristina Diaz, Pierre Chevaldonne, César Ruiz, Marie Grenier, Sandrine
Chenesseau & **Thierry Pérez**

Verongimorpha (formerly Myxospongiae Maldonado, 2009) was established by Erpenbeck et al. (2012) for the clade initially combining verongids, chondrosids and halisarcids. It includes sponge taxa of heterogeneous morphologies, as they may possess spicules, spongin-only skeleton or no skeleton at all. Morrow and Cardenas (2015) then revisited the taxonomy within Verongimorpha containing 3 orders: Chondrillida, Chondrosiida and Verongiida, essentially based on molecular data. The skeleton, when present, provides the most important morphological character to identify and classify sponges. However, Verongimorpha's skeletal complexity and plasticity provides limited phylogenetic significance, being plagued by homoplasies or secondary losses (Erpenbeck et al., 2006). Verongiida (including all verongids) now comprises four families based on choanocyte chamber shape (eurypylous vs diplodal) and on the branching pattern of the spongin skeleton (reticulated vs dendritic). Chondrosiida (including *Chondrosia* spp) comprise sponges without skeleton but with a high concentration of collagen bundles in a "cortex". Chondrillida (including *Halisarca*, *Chondrilla*) are Verongimorpha in which the skeleton can be absent but with a high concentration of collagen. New specimens of sponges brought back from expeditions in shallow tropical reefs of the Caribbean and western Central Pacific, have led us to revisit the relationship within Verongimorpha. New approaches suggest that molecular information and choanocyte chambers arrangement are the most robust data to re-evaluate taxon validity and their phylogenetic relationships. Such an integrative approach was applied here by combining analyses of external morphology, histological observations and COI sequences. This work suggests that some rearrangements should be done at the genus and family levels within Verongiida, Chondrosida and Chondrillida.

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Cytological approaches for integrative taxonomy of sponges: Calcinea as an example

Alexander Ereskovsky

Sponge taxonomy traditionally based on skeleton morphology but in the past decade, taxonomists have been slowly adopting new concepts of the integrative taxonomy. This approach combine all kinds of data (external morphology, spicules, embryology, geography, genetic sequences, etc.) that now considered the most reliable and efficient way to evaluate the status of a species. Combination of molecular and morphology data now being more accessible and widespread while other data like cytology, microbes content, chemical fingerprint, reproduction, are more marginal (Cardenas et al. 2012). Using of cytological characters in sponge taxonomy in general has been neglected, and particularly developed for taxonomy of species without mineral or organic skeleton. Anyway, the development of cytological studies seems important also in spiculate taxa for which there are severe taxonomic problems. Among the different categories of cells some are present in all species and therefore do not bring any phylogenetic signal (e.g. pinacocytes, archaeocytes, lophocytes). Other such as the cells with inclusions (spherulous cells, granular cells, vacuolar, etc.) can be useful for taxonomy. Another useful ultrastructural character for the taxonomy of sponges is the morphology of prokaryotic or/and eukaryotic microsymbionts. Different sponge species from one genus can possess various microbesmorphotypes. These specific symbionts may be diagnostic to discriminate close species. In this work has been tested cytological approach in order to find differences in cell and microbes composition and morphology in Calcinean close species from the genera *Borojevia* and *Clathrina*.

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Interplay between systematics and natural products chemistry in marine invertebrates

Olivier P. Thomas

The systematics of marine invertebrates and especially sponges is still a challenge and a matter of controversy. For example, recently new data obtained from molecular biology have revolutionized this key field of research. Because most groups of marine invertebrates produce a wide array of so-called specialized metabolites mostly used for chemical defense several attempts have been made to use the chemical families of natural products to help in the classification of group of sponges. But the results were not always really satisfactory for most cases and chemotaxonomy has been strongly criticized due to a lack of proper identification of the species or a non-exhaustive chemical inspection and report. Due to the more recent development of metabolomics, a global approach combining a broad chemical analysis followed by statistical analysis of the data, we decided to apply this approach to different groups of invertebrates. We will assess the potential and limits of this method called phylometabolomics to help in the classification of groups of marine invertebrates including sponges but also zoantharians.

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Coupling metabarcoding and metabolomics to better understand the ecological success of Homoscleromorph sponges in underwater caves

César Ruiz & Thierry Pérez

Underwater caves are original habitats, sometimes considered extreme, that are of particular ecological interest because of the intensity of physical gradients such as light, hydrodynamics and food availability. Most of the studies of underwater cave ecosystems have been carried out in the Mediterranean Sea, often focusing on smaller regions or on specific taxonomic and functional groups. Studies revealed important ecological similarities between caves and deep-sea ecosystems. Homoscleromorph sponges represent one of the dominant groups inside underwater caves, in some cases, being cave exclusive species. However, very little is known about the mechanisms involved in the adaptation to caves. By analysing the Prokaryotic community associated to these sponges (Metabarcoding) and the chemical diversity produced by sponges, we attempted to reveal the patterns of microbial and chemical diversity (Metabolomics) associated to sponges inhabiting different parts of the cave, for instance, the entrance versus the inner parts. This is the first effort in order to understand the importance of sponge microbial symbionts and their role in the host metabolism to deal with adaptation to habitats such as underwater caves.

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What the chemistry of sponges tells us?

Roberto Berlinck

During over 50 years, marine sponges have been thoroughly investigated as a source of bioactive secondary metabolites. Marine sponges metabolites reveal some unique structural features. However, many of marine sponge polyketides and peptides are related to microbial metabolites. Considering that marine sponges are a consortium of a complex pool of microorganisms, time is over to understand if marine sponges metabolites are produced by sponge cells or by symbiotic or associated microbes. This presentation will focus on this topic, covering recent findings and future prospects.

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What are the weapons used? Invasive coral *Tubastraea* spp. competing with sponge *Desmapsamma anchorata*, Ilha Grande Bay, Southeastern Brazil

Amanda G. Silva, Lélis A. Carlos-Junior, Cristiano Y. S. Sato, Bruno G. Lages, Flavia M. Oliveira, Lenize F. Maia, Luiz Fernando C. Oliveira & Beatriz G. Fleury

Tubastraea coccinea Lesson, 1829 and *T. tagusensis* Wells, 1982 were the first scleractinian corals to invade the South Atlantic. These species have been successful on the Brazilian coast, but are not free from competitors like the sponge *Desmapsamma anchorata* Carter, 1882. This study aimed to understand the dynamics of competition for space between *Tubastraea* spp. and *D. anchorata*. We used microcosm and field experiments to investigate and separate the effects of chemical and physical defenses responsible for interactions between competitors, through allelopathy testing and contest. The competition trial used physical barriers to separate chemical and physical effects. The physical responses were assessed by the sponges' growth and if they had grown even in the presence of a physical barrier, stimulated by *Tubastraea* chemistry. The chemical composition was evaluated through the analysis of Raman spectroscopy. There were no significant allelopathic effects of *Tubastraea* spp. extracts on *D. anchorata*, nor extracts of *D. anchorata* on the metabolism of corals. About 80% of sponge specimens overlapped *Tubastraea* spp. In the microcosm, we observed the presence of mesenteric filaments of corals as well as the sponge's tissue projecting on *T. coccinea*. Spectroscopic analysis showed changes in the spectral profile of the sponges according to the treatments (with or without barrier). The results indicated that both the invasives as *D. anchorata* used the two defense mechanisms (physical and chemical); and *D. anchorata* overrides the invasives *Tubastraea* might cause choking or preventing coral raise funds in some specific places where the competition was found.

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Metabolomic fingerprints to assess macroalgal–coral interactions

Stéphane Greff, Olivier Thomas & Thierry Pérez

Macroalgal proliferations are considered as major threats in sub-tropical and tropical ecosystems. Their competition with corals are susceptible to modify the functioning and the structure of coral reefs. The genus *Asparagopsis* (Rhodophyta) is known to be widespread, introduced in many regions, and may be invasive like in Mediterranean Sea. Using metabolomic fingerprinting by high resolution mass spectrometry, our goals were 1) to assess the implication of the specialized metabolism of *A. taxiformis* on coral health, 2) to measure the modification of specialized metabolisms of interacting species, and 3) to understand the mechanisms involved in the interactions. Overall, no effects of *A. taxiformis* on corals could be evidenced both under temperate and tropical environments. These results kept macroalgal invasiveness under debate.

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Phenotypic Plasticity in Porifera

Gisele Lôbo-Hajdu, Thomáz Vieiralves & Thiago de Paula

Phenotypic plasticity is defined by the ability of organisms to respond to several environmental stimuli in different ways, changing their behavior, morphology or physiology. Classically, phenotypic plasticity promotes diversification because the developmental pathway which determines the phenotypes induced by the environment consists of multiple genes, responsive to the action of natural selection. However, environmental changes can induce differential expression of genes, by modifying the DNA without changing the allelic frequencies. Sessile organisms activate different genetic programs in response to environmental changes by large scale DNA methylation control and chromatin modification. One modified route can be fixed if the environment is stabilized, and the selected phenotype can be expressed this way as long as the environment is kept unchanged. This expressed phenotype can, and is, inherited, as long as the environment is selecting for it. This expression level phenotypic plasticity in sponges has been a source of difficulty for taxonomic analysis and species delimitation. Changes in the morphology of the sponges have been correlated with the action of the waves, the flow rate of current and sedimentation, the variation in water temperature, the water movement, and sedimentation of the substrate, the availability of silica, and biotics factors as predation. Currently, we observe non-random modifications in the oceans, a possible consequence of the Anthropogenic Age. Some proteins are undergoing exaptation process, under the pressure of climate change and pollution.

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Isolation, characterization and phylogeny of bacteria associated with Homoscleromorpha

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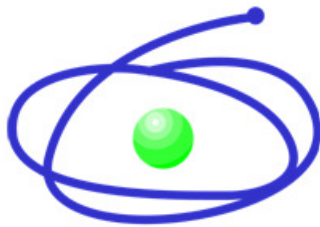
Marine sponges are important members of aquatic systems and are known for hosting dense and diverse microbial communities. Many sponges host up to 35% of their biomass in microbes, and they can establish diverse interactions, including nutritional, structural and defense. Therefore, the knowledge of sponges microbiota is essential to elucidate ecological and evolutionary processes as well as their dynamics. Sponge-associated bacteria microorganisms can act as a source for antibiotic and heavy metals resistance too, mainly in anthropogenic areas, and have a biotechnological potential unexplored. From the collection of marine sponges of *Oscarella* sp. and *Plakina* sp. genus on the coast of Cabo Frio (Rio de Janeiro, Brazil), some studies are being conducted to identify bacteriome associated using culture-dependent and independent approaches. Beyond that, prospection of resistance genes to antibiotics and heavy metals and analyzes of the biotechnology potential of substances with antimicrobial and antibiofilm activity and biosurfactants production by bacteria isolated from *Plakina* and *Oscarella* collected on the coast of Rio de Janeiro are being performed. So far, almost 1000 bacteria were isolated from 9 different culture media, 300 were identified by 16S rRNA sequencing and from 22 bacteria tested to antibiotic resistance, 16 were characterized as multiresistant. Furthermore, 39 were able to inhibit the growth of pathogenic bacteria and 10 were able to dissociate staphylococcal biofilm. These results suggest that bacteria sponge-associated are abundant, can be a rich sources of bioactive substances productions against relevance pathogenic bacteria and represent a reservoir of resistance genes.

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