4th INTERNATIONAL WORKSHOP ON **TAXONOMY OF ATLANTO-MEDITERRANEAN DEEP-SEA & CAVE SPONGES**

PROGRAM

MON, 10th September

09h00 – 09h30	BIENVENUE! WELCOME!
09h30 – 10h00	**Jean Vacelet** Sponges of underwater caves
10h00 – 10h30	**Linnet Busutil** Cuban Mesophotic Reef Sponges: Challenges, Novelties, and Opportunities – Part I: Major habitats and Haplosclerida (Demospongiae) diversity
10h30 – 11h00	Coffee-break (& setting up posters)
11h00 – 11h30	**María Cristina Díaz** Cuban Mesophotic Reef Sponges: Challenges, Novelties, and Opportunities – Part II: Demospongiae, Homosclerophorida, and Calcarea Diversity
11h30 – 12h00	**Tal Idan** Discovering local diversity hot spots: the community structure of four East-Mediterranean mesophotic sponge grounds
12h00 – 13h30	Lunch
13h30 – 17h30	Taxonomy session
18h30 – 20h30	Round Table on World Porifera Database (WPD): **Nicole Boury-Esnault** "Apéritif Marseillais" (welcome drink)

TUE, 11th September

09h00 – 09h30	**Joseph P. Botting** Taxonomy in deep time: palaeontological evidence for unexpected character evolution in sponge stem groups
09h30 – 10h00	**Paco Cárdenas** Surface microstructures of sterraster spicules, a new character for genera discrimination in the Geodiidae (Demospongiae), with remarks on sterraster fossils
10h00 – 10h30	Coffee-break & Posters
10h30 – 11h00	**Astrid Shuster** Tropical Western Atlantic 'lithistid' tetractinellid demosponges – systematics, phylodiversity and bathymetric distribution
11h00 – 11h30	**Pilar Rios** A new species of *Tedania* (*Tedaniopsis*) Dendy, 1924 from Orphan Knoll (NW Atlantic)
11h30 – 12h00	**Frine Cardone** Unusual sponge species from deep sea sector of Central Mediterranean Sea
12h00 – 13h30	Lunch
13h30 – 17h30	Taxonomy session Round-Table on 'Sponges without skeleton: new challenges?' **María Cristina Díaz**

WED, 12th September

	Visit of the 'Calanques National Park' by boat, snorkelling and scuba diving. Lunch on the boat

THU, 13th September

09h00 – 09h20	**Fernando Moraes** Diversity and distribution of Porifera at mouth of the Amazon River: building-up knowledge from trawling to manned submersible sampling
09h20 – 09h40	**Eduardo Hajdu** Sponges of the Amazon Reef System
10h00 – 10h30	Coffee-break
10h30 – 11h00	**César Ruiz** Recent advances in the Taxonomy and Systematics of Homoscleromorpha sponges in marine caves under an Integrative approach
11h00 – 11h30	**Julio C.C. Fernandez** Unexpected characters in the family Tetillidae (Demospongiae, Spirophorina) from the deep-waters off Brazil
11h30 – 12h00	**Andreu Santín** Cryptic and rare sponges associated with cold-water corals of the Blanes Canyon (northwestern Mediterranean Sea)
12h00 – 13h30	Lunch
13h30 – 17h30	Taxonomy session Paleontology session: **Joseph P. Botting**
18h30 – 19h00	**Kamma Rosenbeck & Domitille Martin** Les Eponges entrent dans la danse….. (Art performance)
19h00	Reception

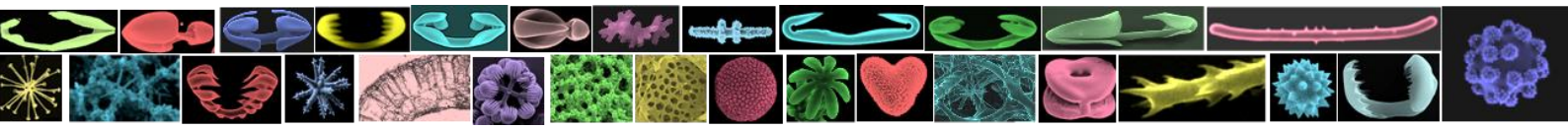
FRI, 14th September

09h30 – 10h00	**Dorte Janussen** Deep-sea glass sponges (Hexactinellida) from polymetallic nodule fields in the Clarion-Clipperton Fracture Zone (CCFZ), northeastern Pacific
10h00 – 10h30	**Christine Morrow** An integrative approach to investigating the taxonomic affinities of *Jaspis* and *Hemiasterella*
10h30 – 11h00	Coffee-Break
11h00 – 11h30	**Javier Cristobo** A new species of *Triptolemma* (Porifera, Tetractinellida) from the seamount Le Danois Bank, Cantabrian Sea
11h30 – 12h00	**Nicole de Voogd** A newly discovered subtidal cave in Taiwan with a possible relict sponge fauna
12h00 – 13h30	Lunch
13h30 – 17h30	Taxonomy session Round Table on: 'Tetractinellida: how could we get better supported family relationships?' **Paco Cárdenas**

SAT, 15th September

09h00 – 09h30	**Cristiana Castello-Branco** Integrative study of the widely distributed deep-sea Atlantic sponge *Desmacella annexa*
09h30 – 10h00	**Anaíra Lage** Overview of the diversity and distribution of the genus *Plakina* (Porifera, Homoscleromorpha)
10h00 – 10h30	**Coffee-break**
10h30 – 11h00	**Timothy Culwick** Fluid forcing on sponge morphology: a modelling approach
11h00 – 11h30	**Pierre Chevaldonné & Thierry Pérez** Marine caves of the Lesser Antilles: A preliminary community survey conducted during the 2015 PACOTILLES cruise with an emphasis on sponges
	Concluding remarks & When/Where to next?

TALKS



Taxonomy in deep time: palaeontological evidence for unexpected character evolution in sponge stem groups

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The modern sponge classes are separated by consistent features that define each group, and these class-level characteristics are frequently assumed to have evolved separately from each other. The traditional interpretation assumes aspiculate, morphologically simple stem lineages that acquired modern characters progressively through the late Precambrian, eventually biomineralizing as distinct classes. Recent discoveries in palaeontology, however, have overturned this view and undermined the distinctness of many class-level characters seen in extant sponges. Fossils revealing details such as spicule mineralogy and microstructure require unusual preservational conditions, but anomalous character combinations are now being revealed across many groups. For example, hexactins now appear to be a primitive feature of Porifera rather than a derived trait of the Hexactinellida, chancelloriids were early sponges that developed organic-walled spicules into projecting sclerites, and calcite and silica co-occurred within the same spicules in multiple early lineages. Even symmetry is more complex than previously recognised, with tetraradial symmetry being widespread in early fossil sponges. These new discoveries conform with the biological consensus on evolutionary topology, but provide a distinct line of evidence for the sequence of character acquisition and evolution, with numerous implications for the morphology of the earliest members of the phylum. Better integration of palaeontological evidence into biological data is essential to a full understanding of sponge evolution.

Cuban Mesophotic Reef Sponges: Challenges, Novelties, and Opportunities – Part I: Major habitats and Haplosclerida (Demospongiae) diversity

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A joint Cuba-U.S. research cruise was conducted from May 14 to June 12, 2017 to survey deep mesophotic reefs of Cuba during 42 dives at 35 unique sites. The extent and health of mesophotic reefs along the entire coastline of Cuba was characterized for the first time. Covering 27 km, ROV dives totaled 103 hours from 25-188 m deep producing 20,070 high digital still images of habitat and species. Three topographic areas, the Deep Island Slope (>150- 125 m), the Deep Fore-Reef Escarpment (the 'Wall', 50- 125 m), and the Deep Fringing Reef (30-50 m) harbor important and distinct sponge fauna. The major features of the sponge populations along this depth regions is shown. Initial interpretation of field observations and photographs allow to distinguish 296 Porifera morphospecies. 115 morphospecies have been recognized to a species level (39%) while the rest (61%) have received either a generic or higher taxa assignations. The order Haplosclerida was the most diversely represented with 29 morphospecies assigned to currently described species and 19 morphospecies assigned to genera, or familial taxa. We have initiated the taxonomic characterization these unknown species with the description of two thin branching *Callyspongia* species: *Callyspongia pedroi* and *Callyspongia alcoladoi*. Here we present the most abundant and intriguing representatives of the Haplosclerida encountered in our first Cuban mesophotic reef campaign and their main morphologic features and habitat. The challenges, advances and potential opportunities to advance in the understanding of Cuban and Caribbean sponge fauna is discussed.

Surface microstructures of sterraster spicules, a new character for genera discrimination in the Geodiidae (Demospongiae), with remarks on sterraster fossils

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The Geodiidae Gray, 1867 are a large family of demosponges with more than 280 extant species, geographically and bathymetrically widely distributed around the world. In tropical and parts of warm temperate waters, they are common at quite shallow depths, while in boreal/antiboreal and Arctic waters, they are usually deep-water species. Geodiidae species are currently distributed in two subfamilies (Cárdenas et al., 2011): Geodiinae (in which we find only one genus: *Geodia*) and Erylinae (which hold *Caminella, Erylus, Caminus, Melophlus*). Molecular phylogenetics suggest other genera belong to this family (*Rhabdastrella, Ecionemia, Stellettinopsis,* some *Stelletta and Calthropella*) so it is probably a much larger family than the one considered by the WPD today. Originally, Geodiidae genera all shared the possession of ball-shaped spicules called 'sterrasters': which is a synapomorphy of the group, although several genera have secondarily lost those sterrasters. The genesis and final morphology of these sterrasters are unique amongst demosponge spicules. This study tries to examine the surface of sterrasters in different genera in search of new characters that could help understand and link the evolutionary histories of these groups. We further discuss how this knowledge could be applied in paleontology, as well as when these sterrasters have appeared in the geological record.

This research has been performed in the scope of the SponGES project, which received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 679849. This document reflects only the authors' view and the Executive Agency for Small and Medium-sized Enterprises (EASME) is not responsible for any use that may be made of the information it contains.

Unusual sponge species from deep sea sector of Central Mediterranean Sea

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Some deep-sea sponge species with unusual spicules are here presented. The sponge samples were collect during recently oceanographic cruises conducted around the Central Mediterranean Sea by several Italian and European projects. In particular, two species of Pachastrellidae (Tetractinellida, Demospongiae), respectively from the bathyal plan of Montenegrin margin and from Santa Maria di Leuca Cold Water Coral habitats and one species of *Tretodictyum* (Sceptrulophora, Hexactinellida) collected in two different canyons from Montenegro and Sardinian Channel, are discussed. The Pachastrellidae species collected present the peculiarity of having spiny microxeas in their spicular set, a character typical of Vulcanellidae family, but usually not found in the Pachastrellidae.

Tretodictyum shows a spicule complement that clearly differs from that of species recorded in Mediterrnean Sea (*Tretodictyum* cf. *tubulosum* and *T. reiswigi*).

Integrative study of the widely distributed deep-sea Atlantic sponge *Desmacella annexa*

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Desmacella annexa Schmidt, 1870 was originally described from Florida (370 m depth), has subsequently been recorded from the Northeast and South Atlantic, Barbados, the Mediterranean (Aegean, Alboran and Adriatic Seas), and east Pacific (Panama). Some morphological variations were documented, but so far, no revision of this species has been undertaken. The main goal of the current study is to verify, through an integrative approach, whether specimens of *D. annexa* from deep-sea and shallow areas, distant from each other by thousands of kilometers, belong to a single species or not. This species is characterized by two categories of tylostyles as megascleres, and two categories of sigmas and one of toxas as microcleres (all microscleres with micro-spines at their ends). The D1-D2 region of the nuclear rRNA gene 28S and ITS2 were used, and the phylogenetic reconstruction recovered similar topologies with both markers. Four clades were retrieved: NE Atlantic deep-waters (1360 m depth), NE Atlantic shallow waters + Mediterranean shallow water (19 to 90 m depth), Pacific deep-water (1918 m depth) and South Atlantic deep-water (596 to 890 m depth). The only morphological variation found is about the megascleres' size, which separates *D. annexa* in two groups: deep and shallow waters, with the first one presenting mean size almost twice that of the second group.

Marine caves of the Lesser Antilles: A preliminary community survey conducted during the 2015 PACOTILLES cruise with an emphasis on sponges

Pierre Chevaldonné, César Ruiz, Marie Grenier & Thierry Pérez & the PACOTILLES team

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Underwater marine caves are among the most promising reservoirs of novel biodiversity in the shallow marine realm. Also, entire groups of Porifera are still phylogenetically unsettled and are commonly reorganised at the supra-generic level. Recent explorations at several islands of the Lesser Antilles (Caribbean) focusing on sponges from marine caves and shaded habitats have allowed the gathering of an unprecedented collection. The "PACOTILLES" research cruise was organized in 2015 to survey by SCUBA diving the marine biodiversity of marine cave sponges of this geographic area from the Grenadines to Anguilla. A total of 8 significantly big and dark caves could be mapped, described and surveyed, of different sizes, shapes and environmental regimes. Among the most interesting caves that were rich in taxonomic novelties, the Full Moon Cave at Bequia, the Grenadines, the Cathedral Cave in Guadeloupe and Zeb cave in Martinique were particularly rich in Homoscleromorpha and Verongimorpha. They also harboured a typical 'semi-dark' to 'dark cave' community gradient and displayed an important compartment of mobile crustacean species (Mysida, Decapoda, Copepoda). Other significant caves include the Amedien cave in Guadeloupe and the Bat Cave at St Vincent, both characterized by a strong water movement regime that allowed the presence of lithistid sponges. Our efforts have improved tremendously the scope of species diversity among two Porifera classes, the Calcarea, and Homoscleromorpha. Targeting the preferred habitat (caves) of Homoscleromorpha allowed us to recover a high proportion of new species (9) that help understand the phylogenetic relationships within this still poorly-studied, difficult group. For calcareous sponges, we found 20 species in the caves, including at least five new species and two new genera. Most of this calcareous sponge community was represented by species of the subclass Calcinea (14 species), mainly *Clathrina* (7 spp.). The species found in the caves were also found outside caves, but frequently protected from the sunlight. We could confirm the rather common distribution of sponges with hypercalcified or hypersilicified skeletons in underwater caves (only Demospongiae). These preliminary investigations produced a great number of taxonomic novelties, not only at the species level, which was expected, but also at the levels of genera and perhaps also families.

A new species of *Triptolemma* (Porifera, Tetractinellida) from the seamount Le Danois Bank, Cantabrian Sea

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Triptolemma Laubenfels, 1955, is a rare genus with only six described species (Soest et al., 2018) from very different regions of the world from 0 to 999 m depth. *T. cladosum* (Sollas, 1888) from Indonesia (351 m); *T. endolithicum* van Soest, 2009 from Caribbean shallow waters (25 m); *T. incertum* (Kirkpatrick, 1903) from South Africa (146-182 m); *T. intextum* (Carter, 1876) from SW S. Vincent cap, Portugal (184 m) and Galicia Bank (999 m); *T. simplex* (Sarà, 1959) from Naples (Italy) (0-1 m) and *T. strongylata* Bertolino et al., 2011 from Japan (200 m) and Mediterranean Sea (30-40 m). The shapes are from encrusting, burrowing and penetrating on stones, corals or other sponges. We report two specimens from the seamount Le Danois Bank in the Cantabrian Sea (North of Spain) at 650 m depth; this is the most northern locality for the genus and the second deepest after the record of *T. intextum* from Galicia Bank from 999 m (Ríos et al, 2017). This cryptic genus of the family Pachastrellidae is defined by a skeleton formed by short-shafted meso(dicho)triaenes with diversely branched clads and frequently by monoaxonic megasclere (oxeas or strongyles) that support the skeleton. Microscleres include amphiasters, metasters transitional to spirasters and spiny microrhabds in one or two categories, which may be partially absent (Bertolino et al., 2011). A comparative study of the described species yielded the possibility to consider our samples as a new species. It is morphologically distinct from the other six species of the genus, especially with respect to its skeleton composition. Our sample has an encrusting shape, light brown or whitish in colour, 5 mm thick. Spicules are oxeas, dichomesotriaenes, mesocalthrops, dichotriaenes, and amphiasters. The new species differs from *T. strongylata* in that it has oxeas and not strongyles; differs from *T. cladosum* and *T. incertum* in the size of oxeas, clearly larger; and finally differs from *T. endolithicum*, *T. intextum* and *T. simplex* in the absence of microrhabds.

Bertolino, M.; Pica, D.; Bavestrello, G.; Iwasaki, N.; Calcinai, B. (2011). A new species of *Triptolemma* (Porifera: Pachastrellidae) from the Pacific Ocean with a revision of the genus. Journal of the Marine Biological Association of the United Kingdom 91 (2): 329-338.

Ríos, P., Xavier, J. & Cristobo, J. 2017. *Triptolemma intextum* (Carter, 1876) (Porifera), una rara esponja del banco de Galicia. In: Javier Cristobo y Pilar Ríos J (coord) Avances en estudios de biología marina: Spain, pp 135-143.contribuciones del XVIII SIEBM GIJON. Temas de Oceanografía vol. 10. Instituto Español de Oceanografía Mad

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Fluid forcing on sponge morphology: a modelling approach

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It has been observed for some time that the gross morphology of a sponges is related to environmental forcing it is subjected to. Differing body plans and structures are associated with flow and forcing regimes: massive and encrusting morphologies are seen to dominate in high energy sites and pedunculate, papillate and arborescent in low energy. Most studies on morphology have been observational either *in situ* or in an artificial laboratory setting. Here, we use a modelling approach to gain insight into the forcing mechanisms on sponge morphology. We created simplified 3D digital models of common sponge morphologies and subjected them to various simulated fluid regimes. We used a multiphysics approach combining the mechanical properties of the structure with the dynamic fluid forcing. Our approach will develop our understanding of the interactions between environmental forcing and morphologies, and will improve model sponge distribution within the oceans.

A newly discovered subtidal cave in Taiwan with a possible relict sponge fauna

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Marine caves are unique and vulnerable marine habitats which harbor a wealth of invertebrate species. Such caves are particularly abundant in the Mediterranean Sea. In the past years many rare and relict sponges have been described from several submarine caves from France, Italy and Greece, also highlighting the protection and conservation of marine caves.

In August 2018, we stumbled upon such a cave while snorkeling in a large tidal pool at a small island called Orchid or Lanyu island. Orchid island is located in the Pacific Ocean about 68 kilometers off the East Coast of Taiwan and about 140 kms from the northern Philippines. The island harbours many endemic terrestrial species, but little is known about the marine biodiversity, although 300 coral species have been observed so far.

The subtidal cave system itself is composed of several very shallow tunnels connected via several intertidal pool. We only explored the tunnels close to the pool and these were all very shallow. The tunnels and caves are decorated by a plethora of tiny calcareous sponges, but most interesting was the high abundance of the "sclerosponge" *Acanthochaetetes* aff. *wellsi* of which some specimen were about 20 cm in length. In addition, we found several new "lithistid" species belonging to the relatively rare genera *Manihinea* (family Theonellidae) and *Neophrissospongia* (family Corallistidae).

Cuban Mesophotic Reef Sponges: Challenges, Novelties, and Opportunities – Part II: Demospongiae, Homosclerophorida, and Calcarea Diversity.

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A joint Cuba-U.S. research cruise was conducted from May 14 to June 12, 2017 to survey deep mesophotic reefs of Cuba during 42 dives at 35 unique sites. Two hundred and ninety six morphospecies have been distinguished after interpretation of field observations and photographs, with only six species assigned to Calcarea, six as Homoscleromorpha, and 286 to Demospongia. 115 morphospecies have been recognized to a species level (39%) while the rest (61%) have received either a generic or higher taxa assignations. Here we will present the most conspicuous species identified within Demospongiae subclasses Verongimorpha (24 morphospecies of the order Verongiida, two Chondrillida and one Chondrosida), Keratosa (13 Dictyoceratida and one Dendroceratida), the Heteroscleromorpha orders: Agelasida (23 spp.), Axinellida (10 spp), Poecilosclerida (9 spp.), Clionaida (8 spp.), Tetractinellida (17 spp.) Suberitida (4 spp.), Scopalinida (3 spp.), Polymastiida (3 spp.), and the calcarean and homosclerophorida species encountered. Here we introduce a dozen of potential undescribed species from the mentioned orders. The challenges, advances and potential opportunities to advance in the understanding of Cuban and Caribbean sponge fauna is discussed.

Unexpected characters in the family Tetillidae (Demospongiae, Spirophorina) from the deep-waters off Brazil

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Even though molecular studies have been contributing to the understanding of poriferan systematics, sponge classification relays on traditional morfological characters, not only for species identification, but also for higher taxa diagnoses. Morphological characters, unusually found in tetillid sponges, are brought to light after the description of recently discovered species from the deep-waters off Brazil; *viz.*, one true category of strongyles and a not-fully-radial skeleton (radial only near the surface). These recently discovered characters and other tetillid characters are discussed here, as well as their usefulness in Tetillidae taxonomy. The diversity, distribution and bathymetry of tetillid sponges from Brazil are also discussed and our knowledge of the composition of deep-sea sponges (deeper than 100 m) off Brazil is updated.

Sponges of the Amazon Reef System

Eduardo Hajdu[1], Camille V. Leal[1, 2], Sula Salani[1], Maíra. V. Oliveira[1, 3], Fernando C. Moraes[1, 3] & Fabiano Thompson[4]

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A new surge of interest on the so-called Amazon reefs derives from the likelihood that drilling for oil will become widespread in the area, coupled to the decades old knowledge that a significant fisheries resource, in the form of a rich assemblage of reef fishes, occurs over dense sponge bottoms beneath the Amazon River sediment plume, and beyond its range in the northern Brazilian outer continental platform. Recent investigation efforts have focused on generating a sharper characterization of the ecosystems, including detailed description of communities and species, prominent among which, the knowingly abundant, albeit poorly known sponges. Here, a few case studies will be presented highlighting ongoing integrative taxonomic studies on Demospongiae obtained in 2012 and 2014 off the Amazon River mouth. 1) the *Arenosclera* / *Arenospicula*^{p} case, 2) the *Pseudosuberites* / *Dictyonella* / *Cymbaxinella*^{p} case, and 3) the *Oceanapia bartschi* / *Coelocarteria* case. In all three instances, conventional morphologic taxonomy has proven misleading for the establishment of accurate identifications.

Discovering local diversity hot spots: the community structure of four East-Mediterranean mesophotic sponge grounds

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In this study we examined recently-discovered East-Mediterranean mesophotic sponge grounds that lay on a submerged sandstone ridge at 100-130 m depth, using a remotely operated vehicle (ROV). On that extended ridge, three of the studied locations, Herzliya, Hadera and Atlit, have a form of a series of large pinnacles. The forth location, Haifa, is the underwater extension of the terrestrial Carmel mountain ridge. During quantitative surveys conducted at these locations, the ROV was used to take photo–quadrats and samples.

Based on these surveys we estimated that over 80 sponge species reside at these sites. Sponge cover was on average 30%, 11%, 32%, and 37%, in Herzliya, Hadera, Atlit and Haifa, respectively, and constitute ca. 80% of total live coverage in these locations. The sites were rich and divers, and differed significantly in all measures of diversity. Sponges are not only the most dominant phylum in these mesophotic sponge grounds, they also act as ecosystem engineers, increasing the structural complexity and creating niches for invertebrates and fish. Studying the sponge grounds richness, we came across taxonomic challenges, as many of the species are of the hard to identify Haplosclerida and Axinellida orders, and most were new to the Israeli coast.

From the mesophotic sponge ground we have so far collected 39 species, 29 of which are absent from the upper-photic zone of the Israeli coast, at least 14 of them are new to the Levantine Sea, and some may be novel species.

Some of the mesophotic species have disappeared decades ago from Israel's shallower coastal habitats and were re-discovered as flourishing in these much deeper environments. We suggest that the mesophotic sponge grounds may serve as refugia for species stressed by the rising temperatures in shallow waters, and by other anthropogenic disturbances affecting mostly the shallower coastal habitats. The study of these recently identified mesophotic sponge grounds provided the data needed for decision makers to declare them as MPA's, and thus helped their protection from threats such as bottom trawling and gas exploration.

Deep-sea glass sponges (Hexactinellida) from polymetallic nodule fields in the Clarion-Clipperton Fracture Zone (CCFZ), northeastern Pacific

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Glass sponges (Porifera, Hexactinellida) represent one of the major groups in megabenthic deep-sea communities. During the deep-sea research expedition SO239 EcoResponse 10.03.-30.04.2015 to the Clarion-Clipperton Fracture Zone (CCFZ) in the equatorial northeastern Pacific with R/V Sonne, 67 voucher specimens of deep-sea glass sponges were collected at 15 ROV (Remotely Operated Vehicle) sample stations in the BGR, GSR, IOM and IFREMER licence area as well as APEI 3 (Area of Particular Environmental Interest). Two taxonomical studies of these sponges so far focus on the taxonomy of Amphidiscophora and the Hexasterophora amphidiscophorid sponges (Hexactinellida,) from the CCFZ. They include descriptions of 15 species known from literature and 8 species new to science and give insights into the distribution and ecology of the described sponges (Kersken et al. 2017, 2018a). A third study provides first insights into the phylogeny of deep-sea glass sponges from the CCFZ. This study presents a set of new primers for sequencing mitochondrial 16S rDNA as well as nuclear 18S and 28S rDNA of glass sponges, first DNA sequencing data for six hexactinellid genera and 19 species and the most comprehensive phylogenetic tree of hexactinellid sponges to date including data available from previous studies (Kersken et al. 2018b). Sponge communities from polymetallic nodule fields, reference areas and seamounts were compared, species of widely distributed genera like Caulophacus Schulze, 1886 and Hyalonema Gray, 1832 are typical representatives of nodule communities, some of them are nodule-specific. Sponge-associated fauna was analysed based on ROV still images, common associates are actiniarians, cirripeds and crionids. The expected mining impact on glass sponges was discussed based on data from ROV still images and preliminary results of radiocarbon age dating. These results are of crucial importance to understand the ecological impact of deep-sea mining on benthic communities and for the development, performance and assessment of future monitoring strategies and pre-mining actions in the CCFZ.

Kersken D, Janussen D and Martinez Arbizu P (2017): *Deep-sea glass sponges (Hexactinellida) from polymetallic nodule fields in the Clarion-Clipperton Fracture Zone, northeastern Pacific: Part I – Amphidiscophora*. Marine Biodiversity, 48 (1), 575 – 580. DOI: 10.1007/s12526-017-0727-y. ISSN 1867-1624 (printed 2018).

Kersken D, Janussen D and Martinez Arbizu P (2018a): *Deep-sea glass sponges (Hexactinellida) from polymetallic nodule fields in the Clarion-Clipperton Fracture Zone, northeastern Pacific: Part II – Hexasterophora*. Marine Biodiversity ISSN 1867-1624 .

Overview of the diversity and distribution of the genus *Plakina* (Porifera, Homoscleromorpha)

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In this study, we revise the knowledge about the diversity and distribution of the genus *Plakina*. *Plakina* is the most diverse genera of the class Homoscleromorpha with 34 currently valid species. The Mediterranean Sea harbors the highest species richness of *Plakina* with 13 species followed by the Atlantic Tropical Occidental with nine species and Eastern Pacific Ocean with eight species. Five species of the genus were recorded from Western Pacific, four from the Indian Ocean and three from Temperate Atlantic Ocean. Most species of *Plakina* have a restricted distribution, usually they occur only in type locality or have a few records in surrounding regions (e.g.: *P. arletensis*, *P. crypta, P. endoumensis, P. elisa, P. jani and P. muricyae*). The species *Plakina monolopha* and *P. trilopha* are supposedly cosmopolitan. However, the records of both species from outside the Mediterranean need to be revised. *Plakina* occurs in hard substrates, mostly in dark or semi-dark habitats (submarine caves, tunnels and overhangs) and only few species were reported from the deep sea such as *P. brachylopha* at 2460 m and *P. corticolopha* at 410 m depth. Furthermore, increasing efforts to explore regions poorly known such as the submarine caves in the Aegean Sea, Caribbean and New Caledonia allowed description of several new *Plakina* species. These studies showed that *Plakina* is more diverse than previously thought.

Diversity and distribution of Porifera at the Amazon River mouth: building-up knowledge from trawling to manned submersible sampling

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The Amazon River strongly influences oceanographic processes at the Atlantic Ocean, determining the environmental conditions along the year and geological periods to build up a biogeographical filter to reef organisms. This outstanding river-ocean interface creates a complex scenario for benthic communities. Since the 1960`s, fishing fleets (*e.g.*, Red Snappers - *Lutjanus* spp.) used to recognize bottoms covered by colored tridimensional sponges as the most profitable fishing grounds off Pará State. The discovery of the emblematic "reef fishes over sponge bottoms" off the mouth of the Amazon River (Collette & Rützler, 1977) revealed that the postulated biogeographical "Amazon Barrier" could support an unexpected sponge community as a "sponge corridor" between the Caribbean and Brazil. Three expeditions were recently conducted to map and sample the bottom over the Brazilian Equatorial Margin, between the French Guiana border and Maranhão State (RV/ Atlantis - 2012, NHo Cruzeiro do Sul - 2014 and RV/ Alucia - 2017), which recovered a total of 311 sponge specimens that were housed at the Porifera Collection of Museu Nacional/ UFRJ. Other 116 sponge specimens sampled by NOc. Almirante Saldanha 1960`s expeditions have also been studied. Dredging and bottom trawling recovered a diversified and abundant sponge fauna, while manned submersible dives and drop camera imagery revealed a complex mosaic of benthic scenarios dominated by sponges. A total of 80 sponge species have been recorded, ranging from thinly encrusting to large massive functional growth forms. Hexactinellida species (*Dactylocalyx* sp., *Farrea occa*, and *Hyalonema* sp.) are firstly recorded for the region and were abundant in some deeper muddy and rocky areas (150-250 m deep), while a diversified assemblage of Demospongiae flourished at the shallower sites associated to rhodolith beds (55 m deep). Different species composition and abundance were seen along depth and river plume influence gradients. The collected specimens are also potential sources of new bioactive compounds, due to the unique environmental conditions imposed by the Amazon plume regime. The improvement of the taxonomic and biogeographic knowledge on the sponge communities of the Amazon River mouth, including the description and identification of rare, new and endemic species, have been useful to marine planning in the region. Our results also contributed to general public outreach, creating international conservation awareness on the extensive Amazon reef system.

An integrative approach to investigating the taxonomic affinities of *Jaspis* and *Hemiasterella*

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The current study uses a combination of morphological, molecular and chemical data to investigate the taxonomic affinities of *Jaspis* (Ancorinidae: Astrophorina) and *Hemiasterella* (Hemiasterellidae: Tethyida). This is the first study to include molecular data from the type species of *Jaspis*, *J. johnstonii* (Schmidt, 1862). Although *Jaspis* (with 37 valid species) is the second largest genus of Ancorinidae, to date the only available DNA sequences are 18S rRNA data from *J. novaezealandiae* and 28S rRNA (D1–D2 region) from a *Jaspis* sp. from the coast of Israel.

In the current study a number of species that are currently classified as *Jaspis* and species that are classified as *Hemiasterella* (Hemiasterellidae: Tethyida) are shown to be closely related and others are shown to belong elsewhere in the classification. Chemical screening shows *Hemiasterella bouilloni* contains bengamides and bengazoles that are the same as those previously described from a species of *Jaspis* from Fiji and a species of *Hemiasterella* from Papua New Guinea contains jaspamides the same as those found in *Jaspis splendens*.

We present morphological and molecular data that supports the following changes to the classification of Heteroscleromorpha: the erection of a new order Jaspida ord. nov. for Jaspidae and Hemiasterellidae; the transfer of *Jaspis iacuitaster* and *Hemiasterella camelus* to *Paratimea* (Stelligeridae: Axinellida); the transfer of *J. novaezealandiae*, *J. gigoxea* and *J. corticomicroxea* to Astrophorina and the reassignment of *Plenaster* (Stelligeridae: Axinellida) to Jaspida ord. nov.

A new species of *Tedania* (*Tedaniopsis*) Dendy, 1924 from Orphan Knoll (NW Atlantic)

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Orphan Knoll is an isolated, drowned continental fragment 550 km northeast of Newfoundland in the Labrador Sea (NW Atlantic). The top of Orphan Knoll stands at 1800 to 2000 m and is marked by a series of protruding mounds at depths of between 1800–2300m. Physical properties indicate that mid-depth waters above Orphan Knoll are in a boundary region between outflow from the Labrador Sea (subpolar gyre) and northward flow of the North Atlantic Current (subtropical gyre). Near-bottom current measurements provide evidence for anti-cyclonic (clockwise) circulation around the knoll. A west-east gradient in nutrients was observed and is likely related to water mass differences between Orphan Basin and the region east of Orphan Knoll. The Orphan Basin-Orphan Knoll region is biologically rich and complex, and strongly influenced by local processes and advection. Coral and sponges have been observed using a remotely operated platform for ocean science (ROPOS) in the mission HUD2010-029 on board CCGS Hudson, in the summer of 2010.

One of these species is a new *Tedania* (*Tedaniopsis*) collected at 2999.88 m depth. This sample is characterised by long Styles (488.98-*513.91*-537.97 x 10.72-*12.41*-13.87µm), the typical Tornotes of the subgenus (412.19-*422.81*-434.49 x 6.05-*7.50*-8.61 µm) and two sizes of Onychaetes (203.3-*234.40*-268.02 µm and 65.54-*72.21*-81.39 µm). The external appearance is very peculiar because it is bush or tree-like with dichotomous branching, while the rest of the species in this subgenus are fundamentally massive, encrusting or laminar. The majority of species of this subgenus are in the Southern Ocean. Only *Tedania* (*Tedaniopsis*) *gurjanovae* Koltun, 1958 from North Pacific Ocean and *Tedania* (*Tedaniopsis*) *phacellina* Topsent, 1912 from Azores and Cape Verde, in the Atlantic Ocean, were found in the northern Atlantic.

Orphan Knoll has been closed to bottom contact fishing by the Northwest Atlantic Fisheries Organization since 1 January 2007 and will remain so until at least 31 December 2020 when the closed areas will be reviewed. This newly discovered species documents the rich biology of this area and will be used to determine if the protected areas need to be refined or expanded when they are reviewed.

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Recent advances in the Taxonomy and Systematics of Homoscleromorpha sponges in marine caves under an Integrative approach

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Marine caves are original habitats of ecological interest. Indeed they can be considered extreme due to marked physical gradients such as light, hydrodynamics and food availability which make them good mesocosms of deep sea ecosystems. Recent exploration of marine caves all around the world revealed similar faunistic traits and ecological functioning. Homoscleromorpha sponges are well represented in marine caves, and some species can be cave-exclusive. Our recent explorations in these habitats coupled to the development of an integrative approach have revealed an even higher diversity of this sponge class, 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. This study will present the recent advances in Homoscleromorpha taxonomy and systematics highlighting the most interesting examples from the darkest parts of underwater caves.

Cryptic and rare sponges associated with cold-water corals of the Blanes Canyon (northwestern Mediterranean Sea)

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Knowledge about sponges inhabiting cold-water coral reefs in the Atlanto-Mediterranean region has steadily increased in the past years, yet our knowledge about their diversity is still scarce. In the present work, we describe the sponge diversity associated with *Madrepora oculata* Linnaeus, 1758. Several fragments of this coral from the Blanes Canyon (Catalan Sea) at a depth of ca. 700m were examined, without discarding small cryptic individuals. This has allowed the recovery of poorly known or likely new species belonging to the classes Demospongiae, Hexactinellida and Calcarea. Taxonomic discussions are included.

Tropical Western Atlantic 'lithistid' tetractinellid demosponges – systematic, phylodiversity and bathymetric distribution

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Among all present demosponges, 'lithistids' represent a polyphyletic group with exceptionally well preserved fossils dating back to the Cambrian. Knowledge on their Recent diversity in particular in the Tropical Western Atlantic Ocean (TWA) is scarce making any comparison between present and past major 'lithistid' faunas difficult. In addition, the lack of sufficient molecular and morphological data hamper any predictions on phylogenetic relationships or phylodiversity from this region. Harbor Branch Oceanographic Institute (HBOI, Fort Pierce, Florida) holds the largest collection of TWA lithistid sponges worldwide, however, the majority remain to be taxonomically identified and revised. In this study we provide sequences of 249 lithistid demosponges using two independent molecular markers (28S rDNA and cox1 mtDNA) and morphological descriptions of 70 lithsitids. Our phylogenies suggest a new tetractinellid suborder, one new genus, and several new species are proposed including two new records of occurrences from the TWA. The higher-taxa relationships of desma-bearing tetractinellids are further discussed and topics for revisions suggested. Additionally, the phylodiversity in the Bahamas and Jamaica is higher than in other TWA regions. Families Theonellidae and Corallistidae dominate the TWA fauna, while Neopeltidae and Macandrewiidae are rare. Similar as in the Pacific, most TWA lithistid demosponges dominate deep water habitats (>300 m), but certain families like Theonellidae are more abundant in depths <300 m. This integrative approach increase our understanding of major 'lithistid' faunas, their relationships, bathymetric distributions and diversity, the latter suggested to be as high as it was in the Mesozoic.

Sponges of underwater caves

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Since the development of SCUBA diving, it has been shown that underwater caves, especially the darker parts, have a special interest by a high diversity of the sponge fauna, and also by of some similarities with the bathyal fauna. In the semi-dark conditions near the entrance of caves, there is an exuberant fauna of sessile invertebrates, including numerous species of sponges that are there easily accessible. In the dark parts, the environmental conditions are somewhat similar to those of the deep-sea, with absence of light, low trophic level and low water motion. These dark caves could be considered as natural mesocosms of the bathyal zone, allowing in some cases colonization by a few bathyal species, which are there easier to study. The high diversity of encrusting species on rocky walls and overhangs is also more accessible in caves. Some examples will be recalled of progress in knowledge obtained in underwater caves, such as the discovery of relict hypercalcified sponges, carnivory in a family of deep-sea sponges, cytology and reproduction of deep-sea hexactinellids.

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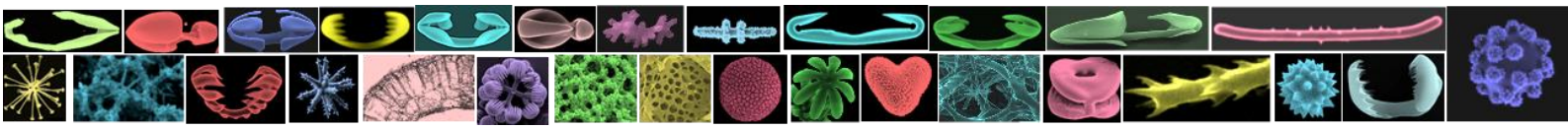

Phylogenetic relationships of the Thrombidae and suggestion of a new Tetractinellida sub-order

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The Thrombidae Sollas, 1888 is an enigmatic demosponge family with two unique microscleres forms: a tiny acanthose triaene-like 'trichotriaene', and a minute birotulate 'amphiaster' absent in some species. Prior to Lévi's (1973)[1] placement of Thrombidae in the order Astrophorida Sollas, 1887 (= suborder Astrophorina), the family was thought to be most closely associated with class Homosclerophorida Dendy, 1905. Although its phylogenetic relationships remained obscure, even in the Astrophorina, this position was followed in the *Systema Porifera*[2]. Today the family contains only six species distributed in two genera: *Thrombus* Sollas, 1886 and *Yucatania* Gómez, 2006. The discovery and sequencing of several new Thrombidae genera and species has provided us with the opportunity to conduct a molecular phylogenetic study, using three molecular markers (COI, 28S and 18S). Our analyses clearly indicate that: (1) the Thrombidae are the sister-group to the recently described family Stupendidae Kelly & Cárdenas, 2016[3] and most surprisingly (2) that the Thrombidae/Stupendidae clade is sister to the lithistid families Scleritodermidae Sollas, 1888,/Siphonidiidae Lendenfeld, 1903 /Azoricidae Sollas, 1888. We propose that this large new clade represents a new Tetractinellida suborder and we discuss which synapomorphies might support this clade.

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A first preliminary study of the sponge fauna associated to white coral banks from the Alboran Sea

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The scleractinians *Madrepora oculata* and *Lophelia pertusa* form, in deep water, three-dimensional structures which allow the settlement of a rich sponge community. The analysis of a white coral block with a surface area of about 360 cm^2, collected between 306 and 354 m depth from the Alboran Sea during the campaign MELCOR of 2012, allowed to identify 19 sponge species.
Sixty-six sponge specimens (demosponges and hexactinellids), associated to white corals were collected in total. Sponge samples may be attributed to the species, *Hymerhabdia oxytrunca* Topsent, 1904, *Hymerabdia* sp., *Acantheurypon pilosella* (Topsent, 1904), *Monocrepidium vermiculatum* Topsent, 1898, *Desmacella infundibuliformis* (Vosmaer, 1885), *Haliclona* (*Gellius*) *bioxeata* (Boury-Esnault, Pansini & Uriz, 1994), *Haliclona* (*Gellius*) *lacazei* (Topsent, 1893), *Haliclona* (*Reniera*) *cratera* (Schmidt, 1862), *Damiria curvata* (Vacelet, 1969), *Discorhabdella hindei* Boury-Esnault, Pansini & Uriz, 1992, *Anisocrella hymedesmina* Topsent, 1927, *Crella* (*Pytheas*) *alba* (Vacelet, 1969), *Hymedesmia* (*Hymedesmia*) *gracilisigma* Topsent, 1928, *Hymedesmia* (*Hymedesmia*) *zetlandica* Bowerbank, 1864, *Plocamionida ambigua* (Bowerbank, 1866), *Latrunculia* (*Biannulata*) *citharistae* Vacelet, 1969, *Podospongia lovenii* Barboza du Bocage, 1869, *Vulcanella gracilis* (Sollas, 1888) and, *Tretodictyum tubulosum* Schulze, 1886. *Haliclona* (*Gellius*) *bioxeata* and *Hymerhabdia oxytrunca,* with over 20 specimens collected, are the most abundant species. Thirteen species are new findings for the white coral assemblage, one is a new finding for the Mediterranean Sea and a species of *Hymerabdia* is probably new for science.
As to biogeography most of the species (53%) have atlantic-mediterranean distribution, 5% are only atlantic and 42% are Mediterranean endemics.
This is the first survey of sponges associated to deep coral reefs in the Alboran Sea and confirms that these habitats are hot spots of biodiversity on deep grounds.

Two new species of *Sympagella* (Porifera: Hexactinellida: Rossellidae) collected during the ABYSSLINE expedition from the Clarion-Clipperton Zone, East Pacific

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Two new Hexactinellida species from the Clarion-Clipperton Zone (CCZ) in the East Pacific Ocean are described. They are the first described representatives of the genus *Sympagella* in this region. The new sponges were collected in 2013 during the ABYSSLINE Project´s first cruise AB01 on board the RV *Melville*. The CCZ is popular for its polymetallic nodules but still poorly known when it comes to the megafaunal biodiversity. Our findings suggest that the poriferan fauna of the eastern CCZ is both species rich and poorly known, and that substantially more sampling and taxonomic studies of the CCZ sponge fauna are required to establish a megafaunal biogeography and evaluate potential extinction risks resulting from polymetallic-nodule mining.

New unexpected Antarctic occurrences of Cladorhizidae in shelf and hydrothermal environments

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This study investigates taxonomical characteristics of carnivorous sponges from the Southern Ocean. The specimens were collected in 2007 and 2010 from the ANT-XXIII/8 expedition in the former Larsen shelf (Eastern Antarctic Peninsula) and from deep sea hydrothermal vents of the East Scotia Ridge during the RRS *James Cook* Cruise JC42, respectively. All here described species belong to the family Cladorhizidae. Three of them are probably new to science and belong two the genus *Abyssocladia*, one of which was found at the Antarctic Peninsulain ca. 200 m depth. This is the first time a specimen of this abyssal genus was found on the shelf less than 1000 m depth. Another of the described species (*Cladorhiza methanopila)*, which is also confirmed by molecular COI data, is already known from the Eastern Caribbean Barbados Trench. This is the first record of this species in the Southern Ocean. The appearance of this new discovered and also known species underlines the hypothesis that Cladorhizidae is the second most species-rich family of Demospongiae in the Southern Ocean.

Another unexpected discovery was made by ANT-XXVII/3 in 2011 at Larsen C: A specimen of the abyssal hexactinellid genus *Caulophacus* (family Rossellidae) hauled from just 300 m depth.

All specimens are subject to ongoing taxonomical investigations at the Marine Evertebrates section at the Senckenberg Institute Frankfurt am Main.

Sponges from marine caves in Brazil: an unexplored world

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Sponges often dominate benthic communities in marine caves, but few cave-dwelling sponges have been reported in Brazil (Tropical Southwestern Atlantic). In this study, the occurrence of sponges (Porifera) in submarine caves in Brazil is revised through a literature survey. Despite its huge coastline (over 8000 km long), four oceanic islands and the extensive coral reefs of the Abrolhos bank, only 15 relatively large marine caves and tunnels are known in Brazil. Their fauna is poorly studied and sponges were reported in only six of them (27%): Sapata Cave, Ilha do Meio Cave and Pedras Secas Tunnel at Fernando de Noronha Archipelago, Fendas Tunnel at Rocas Atoll, Siriba Cave at Abrolhos Archipelago, and Gruta Azul Cave at Arraial do Cabo. A total of 49 sponge species was reported from these caves: 20 from Pedras Secas Tunnel, eigth from Sapata Cave, four from Ilha do Meio Cave, 17 from Fendas Tunnel, one from Siriba Cave, and 15 from Gruta Azul Cave. Most species (34 spp. = 69%) occurred in a single cave, 14 occurred in two caves and only one occurred in three caves (*Diplastrella megastellata*). Only five species appear to be restricted to cave habitats. All these six sites are still poorly explored, especially Siriba Cave, and the sponges of the other caves in Brazil remain unstudied. However, unpublished collection data and personal observations indicate that marine caves and tunnels in Brazil harbor a rich sponge fauna that is largely unexplored.

Combining Metabarcoding and Metabolomics to better understand the ecological success of Homoscleromorpha sponges in underwater caves

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Underwater caves are original habitats of ecological interest. Indeed they can be considered extreme due to marked physical gradients such as light, hydrodynamics and food availability which make them good mesocosms of deep sea ecosystems. Underwater cave ecosystems were mostly studied in the few places of the Mediterranean Sea, often focusing on specific taxonomic groups. Overall, those studies revealed similar faunistic traits and ecological functioning. Homoscleromorpha sponges are well represented in underwater caves, and some species can be cave-exclusive. However, very little is known about the factors explaining their ecological success in such a constraining environment. We hypothesized that the microbiome and/or metabolome of these sponges may confer adaptation capability. On a large collection of samples from Mediterranean and Caribbean submarine caves, we undertook metabarcoding and metabolomic fingerprinting analyses to identify putative patterns in microbial and chemical diversity that may be related to sponges' ecological habit. Some of these patterns seem to be explained by the taxonomy of the sponge and/or the geographical area, so these two approaches can be used in integrative taxonomy. More interesting, we have found that ecological traits like habitat occupation inside caves (semi-obscure, obscure) or species distribution can be explained by the presence of particular microbial groups or the production of exclusive metabolites. Our results seem to confirm our former hypothesis, however the functional role of those microorganisms and metabolites must be analyzed to understand their contribution to the adaptation of Homoscleromorpha sponges to marine caves.

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Procaryotic communities associated with Antarctic deep-water sponges and functional prediction of xenobiotic biodegradation and secondary metabolite biosynthesis

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Marine sponges are holobionts that are hosting dense and diverse prokaryotic assemblages and their prokaryotic community compositions are usually host-species specific. Marine sponges are also important sources of natural bioactive products. Sponge-associated prokaryotes are known producers of many of these sponge-related bioactive compounds. In the present study prokaryotic communities from four sponge species, collected near the South Shetland Islands, were sequenced using 16S rRNA amplicon sequencing: *Antarctotetilla leptoderma* (n = 7), *Haliclona* sp. (n = 2), *Homaxinella balfourensis* (n = 2), *Isodictya bentarti* (n = 4). 31 prokaryotic phyla, including the candidate phylum Berkelbacteria and two archaeal phyla Euryarchaeota and Thaumarchaeota, were found within sponge specimens and seawater samples. The present prokaryotic host-specific patterns indicate that all four sponges belong to the low-microbial-abundance group. Secondary metabolism pathways of known antibiotics suggest that these sponge possess a broad range of biotechnologically and pharmacological relevant properties. In addition, xenobiotics-related degradation pathways are significantly enriched especially in *A. leptoderma* and *I. bentarti*.Therefore, sponge-associated prokaryotes may enhance the roles of sponges in bioremediation processes of environmental pollutants, in addition to their biosynthesis of secondary metabolites and detoxification of metabolic waste products.

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