A proposal for the family level classification of Calcinea (Porifera, Calcarea)

Oliver Voigt 1, Fernanda Azevedo 2, Básśli Cóndor-Luján 3, Hans Tore Rapp 1, Gert Wörheide 1 4 & Michelle Klautau 2

1 Ludwig-Maximilians-Universität Munich, Paleontology and Geobiology, Department of Earth and Environmental Sciences, Richard-Wagner-Str. 10, 80333 Munich, Germany. oliver.voigt@lmu.de
2 Universidade Federal do Rio de Janeiro, Instituto de Biologia, Departamento de Zoologia, Avenida Carlos Chagas Filho, 373. CEP 21941-902. Rio de Janeiro, Brazil.
3 University of Bergen, Department of Biology and K.G. Jebsen Centre for Deep-Sea Research Thormühlenstr. 53 A/B, Bergen, Norway
4 Geobiocenter, Ludwig-Maximilians-Universität München, Richard-Wagner-Str. 10, 80333 München, Germany.

Integrative approaches have more recently advanced the understanding of the taxonomy and phylogenetic relationships of calcareous sponges of the subclass Calcinea. With the help of DNA phylogenetic analyses and morphological re-interpretation of characters several genera were revised. It became obvious that several classically recognized genera such as Clathrina and Guancha comprised species that sometimes were not particularly closely related to each other. As a result, several new genera were proposed, for example Artberea Klautau, Azevedo, Cóndor-Luján, Rapp, Collins & Russo, 2013, Boryjevica Klautau, Azevedo, Cóndor-Luján, Rapp, Collins & Russo, 2013, Brattegardia Klautau, Azevedo, Cóndor-Luján, Rapp, Collins & Russo, 2013, and Nicola Cóndor-Luján & Klautau, 2016. These revisions also led to the recognition of new synapomorphic morphological characters for the genera. Consequently, however, uncertainties about the family-level taxonomy of Calcinea exist. We analysed two nuclear DNA markers, the internal transcribed spacer region and the partial 28S ribosomal RNA gene from 18 genera of Calcinea. Based on the results of our phylogenetic analyses, we propose a revised family-level taxonomy for the subclass.

Cinachyrella australiensis (Carter, 1886) In The Indo- West Pacific: An Integrative Approach To Understanding A Complex Species Complex

Kathryn A. Hall1, Miranda E. Vidgen1 & John N.A. Hooper1

1 Biodiversity and Geosciences Program, Queensland Museum, South Brisbane, Queensland, Australia. kathryn.hall@qm.qld.gov.au

Species of Cinachyrella Wilson, 1925 (Demospongiae, Tetractinellida, Tettilidae), with their distinctive ball shapes and compliments of delicate tethrae protruding beyond their surfaces, are charismatic and conspicuous components of benthic marine sponge fauna. Within the large collection of sponges at Queensland Museum, several hundred specimens are identified provisionally as Cinachyrella australiensis (Carter, 1886), largely due to their yellow colouration and spherical habitus. Much of this material was collected by benthic trawls of locations spanning the entire length of the inter-reef seafloor of the Great Barrier Reef and Torres Strait. Additional material from tropical and temperate eastern Australia, Papua New Guinea and other western Pacific and eastern Indian Ocean locations supplements the GBR collection. The physical forces associated with the collection method, and subsequent handling of large volumes of material from the trawls, caused many sponges to be broken and fragmented, making identification using light microscopy alone extremely demanding.

Given the inadequacy of light microscopy for resolving the identities of the specimens within this large and problematic collection, it seemed the perfect candidate for an integrative taxonomy study, using DNA barcoding and detailed electron microscopy. Examinations using SEM demonstrated variation in the morphology of the specimens, suggesting that we did not have a homogenous set of samples, despite their macroscopic similarity. Although biological variation was evident, the partial COI mtDNA barcode sequences we obtained were insufficient to resolve satisfactorily any species limits within the sample. Consequently, we adopted a combined approach to the molecular examination, employing four additional markers: partial COII mtDNA, two mitochondrial intergenic spacers, and partial 28S rDNA.

Our results to date support previous studies (1), which suggest that, for tetellid sponges at least, COII and the intergenic spacers have faster rates of evolution than the COI barcoding region, and are useful for taxonomic studies. Given the very large collection housed at Queensland Museum, we are amassing a substantial data-base of sequences for these regions. Preliminary phylogenetic analysis indicates broad agreement among the mitochondrial and ribosomal gene trees, and further, that these trees are consistent with observed morphological variation. Given that these four additional markers are quicker and easier to amplify compared to COI (50–70% success rate, compared to 25% for COI), and have a higher information content because they are more rapidly evolving, we advocate strongly for a multilocus approach to the “barcoding” of tetellid sponges. Although the study is still in infancy, already our data show that at least 10 MOTUs hide within the C. australiensis species complex.

References

TAXONOMY OF DEEP-SEA SponGES LIVING ON POLYMETALLIC NODULE FIELDS IN THE CLARION- CLIPPERTON FRACtON ZONE (CCFZ), EAST PACIFIC

Daniel Kersken1 2, Dorte Janussen1 2 & Pedro Martinez Arbizu

1 Senckenberg Research Institute and Natural History Museum (SGN), Department of Marine Zoology, Senckenberganlage 25, D-60325 Frankfurt am Main, Germany. daniel.kersken@senckenberg.de
2 Senckenberg am Meer, German Centre of Marine Biodiversity Research (DZMB), Am Südrand 44, D-26382 Wilhelmshaven, Germany.

Up-to-date knowledge on the deep-sea sponge fauna (Porifera) of the Clarion-Clipperton Fracton Zone (CCFZ) in the eastern Pacific is relatively scarce and needs to be extended, because the CCFZ is one of the worldwide biggest potential deep-sea mining areas for industrial mining of polymetallic nodules. The framework of this project is the Joint Programming Initiative Oceans (JPIO), which focuses on the ecological aspects of deep-sea mining. The project-related research expedition SO239 EcoResponse by RV Sonne was focused on the study of benthic deep-sea communities living in polymetallic nodule field systems. During this expedition, 68 deep-sea sponges of 18 morphotypes and 35 species were collected in depths from 1700 to 5000 m by deployment of a Remotely Operated Vehicle (Figure 1). Main objective of this project is the establishment of a picture-based species catalogue of the deep-sea sponge fauna in the CCFZ. Further main objectives are DNA-Barcoding with four genetic markers (16S, 18S, 28S and COI) and software-based annotation of video material from RV transect dives. The presentation during this workshop includes preliminary results of the deep-sea sponge taxonomy with additional project-specific information, e.g. on species distribution within the CCFZ or potential occurrence of new deep-sea species.

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Calcareous sponge fauna of the eastern Mediterranean Sea

Vasilis Gerovasileiou1, Tayara Fontana1, Fernanda Azevedo2, Chryssanthi Antoniadou1, Elena Voultsiadiou3 & Michelle Klautau2

1 Institute of Marine Biology, Biotechnology and Aquaculture, Hellenic Centre for Marine Research, Heraklion, Greece. vgero@hcmr.gr
2 Universidade Federal do Rio de Janeiro, Instituto de Biologia, Departamento de Zoologia, Rio de Janeiro, Brazil.
3 Department of Zoology, School of Biology, Aristotle University of Thessaloniki, Thessaloniki, Greece.

Sponge research in the eastern Mediterranean Sea has mainly focused on demosponges. Calcareans have been scarcely studied in this area, especially when compared with the north-western Mediterranean basin and the Adriatic Sea. Recent sponge sampling in various habitat types of the Aegean Sea (e.g. shallow rocky beds, semi- and entirely submerged caves, artificial substrates), in the framework of different research projects, yielded several species of calcareous sponges. The examination of this material revealed 11 taxa, of which 6 species are new to science: Amphoriscus sp. nov., Sycantha sp. nov., Sycon sp. nov. and Ysmaseropsis sp. nov. 1-3. Furthermore, a detailed overview of the relevant scientific literature was performed and an updated checklist of the calcarean fauna of the eastern Mediterranean Sea was compiled. According to our results, the
new records included, the up-to-date calcarean fauna of the eastern Mediterranean consists of 32 species (40% of the Mediterranean Calcarea) belonging to 16 genera, 13 families, and 4 orders. Calcarea is the richest subclass, with 23 species, while Calcinea is represented with 9 species. The most diverse genus was Sycon (8). Most species were recorded in the Levantine Basin (17), North Aegean (12), and South Aegean Sea (6). Our review showed that most calcarean records from the eastern Mediterranean Sea were included in old publications and that the calcarean species found to date exclusively in the eastern Mediterranean make up 25% of its total calcarean fauna. This and the fact that recent research effort in the Aegean Sea yielded 6 new species indicate that further research could increase our knowledge on the calcarean diversity of the Mediterranean.

Three new and four poorly known species of *Plakina* (Porifera, Homoscleromorpha)  

**Anaíra Lage**, Vasilis Gerovasileiou2, Eleni Voutsisidou1, Thierry Pérez1, César Ruiz3 & Guilherme Muricy

1 Universidade Federal do Rio de Janeiro, Rio de Janeiro, Brazil; 2 Helicentrum for Marine Research, Greece; 3 School of Biology, Aristotle University of Thessaloniki, Greece;

*Plakina* is among the most representative genera of the class Homoscleromorpha, with 29 valid species occurring in substrata hard substrates, mostly ceilings and walls of dark or semi-dark habitats. The genus is widely distributed around the world, although the regions of the Mediterranean Sea (8 spp.) and Caribbean Sea (5 spp.) record the highest species richness. Two Mediterranean species, *Plakina monolopho* and *P. trilopha*, are allegedly cosmopolitan but most records from outside the Mediterranean need revision, including the Brazilian record of *P. trilopha* (Muricy et al., 1998, Domingos et al., 2016). In the present study, we describe three new species of *Plakina* and redescribe four others from different regions (Central Pacific, Aegean Sea, Antarctic, and Southwestern Atlantic). *Plakina* sp. nov. 1 from the Marquesas Island, Central Pacific, is distinguished by its lophose calthrops exclusively trilophose and with all actines terminally spined. *Plakina* sp. nov. 2 from Greece is massive, orange to red-pink with whitish borders in vivo, and has trilophose and tetralophose calthrops with very irregular shapes. *Plakina monolopho var.* *antarctica* Topsent, 1917 from Petermann Island, Antarctica, has monolophose calthrops with the basal actines bifurcated and the lophose actine ramified in a complicated 1m, 2d, ts pattern. Furthermore, its spicules are larger than those of Mediterranean *P. monolopho* (cf. Muricy et al., 1998). We thus propose to rename it as a new species, provisionally called *Plakina* sp. nov. 3. We also revised other four poorly known species of *Plakina* and added the following new characters to their descriptions: to *P. crypta*, the irregular shape and rare trilophose calthrops; to *P. weinbergi* details of spicule shape (regular and irregular, with blunt and micropinned tips); to *P. howeri* the presence of a marginal canal, circular oscules and basal cavities, and SEM analysis of spicules; and to *P. coerulea* the presence of a marginal canal, basal cavities and rare mono-, di- and trilophose calthrops. The geographic distribution of *P. crypta* from SW France is extended to the Aegean Sea, with its first record for Greece. The distribution of the Tropical Southwestern Atlantic species *P. coerulea* is extended to the *Malvinas* and its first record for Argentina. The species distribution in the Pacific is more diverse and that its species are more widely distributed than previously thought.

**References**


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Calcareous Sponges From Palau And The Great Barrier Reef, Australia

Anita Mary George1, Merrick Ekins1, Sam McCormack2 & Michelle Klautau2  
1 Queensland Museum, South Brisbane, Queensland, Australia; 2 University of Waikato, Tauranga, New Zealand

Calcareous sponges are composed of calcium carbonate spicules that can be diactines, triactines, tetractines, and/or ptychactines. Their aquiferous system is very diverse, being asconoid, syconoid, syllithid, leuconoid or solenoid. Currently there is a dearth of taxonomists and knowledge in calcareous taxonomy in Australia. As part of acquiring taxonomic knowledge and updating the calcareous sponge collections from Queensland Museum, a set of 21 voucher samples from Palau and the Great Barrier Reef were examined at the first calcareous workshop conducted at the South Australian Research Development Institute (SARDI) Aquatic Sciences, Adelaide, South Australia. Four specimens were from Palau while the remaining specimens were from the Queensland coast with 12 collections exclusively from the Great Barrier Reef. Eighteen species were identified as calcareous sponges, of which, 12 species were from the subclass Calcinea and five from Calcarea. Order Clathrinida (Calcinea) was represented by the genera: *Arturia*, *Ascorhiza*, *Ascoleucetta*, *Clathrina*, *Lecanilis*, etc. A further clade was represented by *Grantiella*, *Leucandra*, etc. Of these, the widespread dominant genera were *Lecetella*, followed by *Ascoleucetta*. New species are expected from this collection for Australia and Palau.

Divergence between molecular and morphological data in Brazilian Arenosclera sponges (Haplosclerida, Demospongiae)

**Camille V. Leal**1, 2, 3, Fernando C. Moraes4, Adriana Froses2, Ana Carolina Soares3, Fabiano Thompson4 & Eduardo Hajdu1  
1 Universidade Federal do Rio de Janeiro, Rio de Janeiro, Brazil; 2 Universidade Federal do Rio de Janeiro, Instituto de Biologia, Departamento de Biologia Marinha, Rio de Janeiro, Brazil; 3 Graduate Program in Genetics, Universidade Federal do Rio de Janeiro; 4 Jardim Botânico do Rio de Janeiro, Rio de Janeiro, Brazil

*Arenosclera* has six accepted species in the Indo-Pacific (5): Australian (3), New Caledonia (1), Red Sea (1) and West Atlantic: Brazil (1). Recent expeditions to the Amazon reefs yielded three specimens assignable to *Arenosclera*, but seemingly quite distinct from the sole species this far known from Brazil, namely *A. brasiliensis*. The rich chemistry known from *A. brasiliensis* caught our attention about relationships among these species and inspired us to perform a phylogenetic analysis to verify if *Arenosclera brasiliensis* is monophyletic. We integrated morphological and metagenome derived molecular analyses (28S). Morphology was studied as usual, and metagenomes were extracted according to (1), and then sequenced with Illumina MySeq technology. A 28S Genbank database was compiled with sequences ≥80% similar to the complete 28S of *A. heroni* type species of *Arenosclera*. Metagenomes were compared with this database using BLASTN and only 28S-like sequences were saved. Following, we used CAP3 and SPADEs to assemble sequences in contigs, and sorted the largest contig for the phylogenetic analysis. The latter also used additional haploclerid 28S sequences collected from Genbank. Sequences were aligned with MAFFT 7 and the Maximum likelihood phylogeny obtained with RAxML. The Amazon species feature delicate oxas and sand in the fibers (carbonatic in one, siliclastic in the other), with soft consistency and beige color. Additional differences between both species are the structure of their callyspongiid skeleton and morphology of the oxas. Aside their arboreal habit, these species are very similar to other *Arenosclera* spp. However, the phylogeny retrieved shows that not only Amazon reef species, as well as *A. brasiliensis* do not form a monophyletic group with *A. heroni*. Brazilian species appear in a distinct clade, suggesting that these species represent a new genus. The confused systematics of the Haplosclerida hinders the objective classification of this new clade for now. Additional studies using other Haplosclerida and molecular markers are necessary to better define this group.

**References**