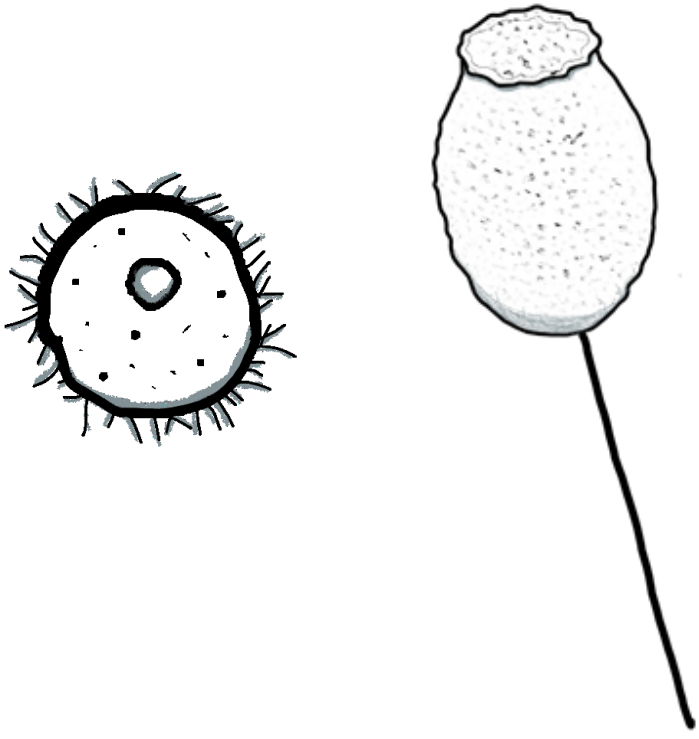
Benthic Megafauna from the North Pacific Abyss

Phylum **Porifera**



catalogue v.1

Abyssal Pacific seafloor image-based megafauna morphotype catalogue v.1

Porifera

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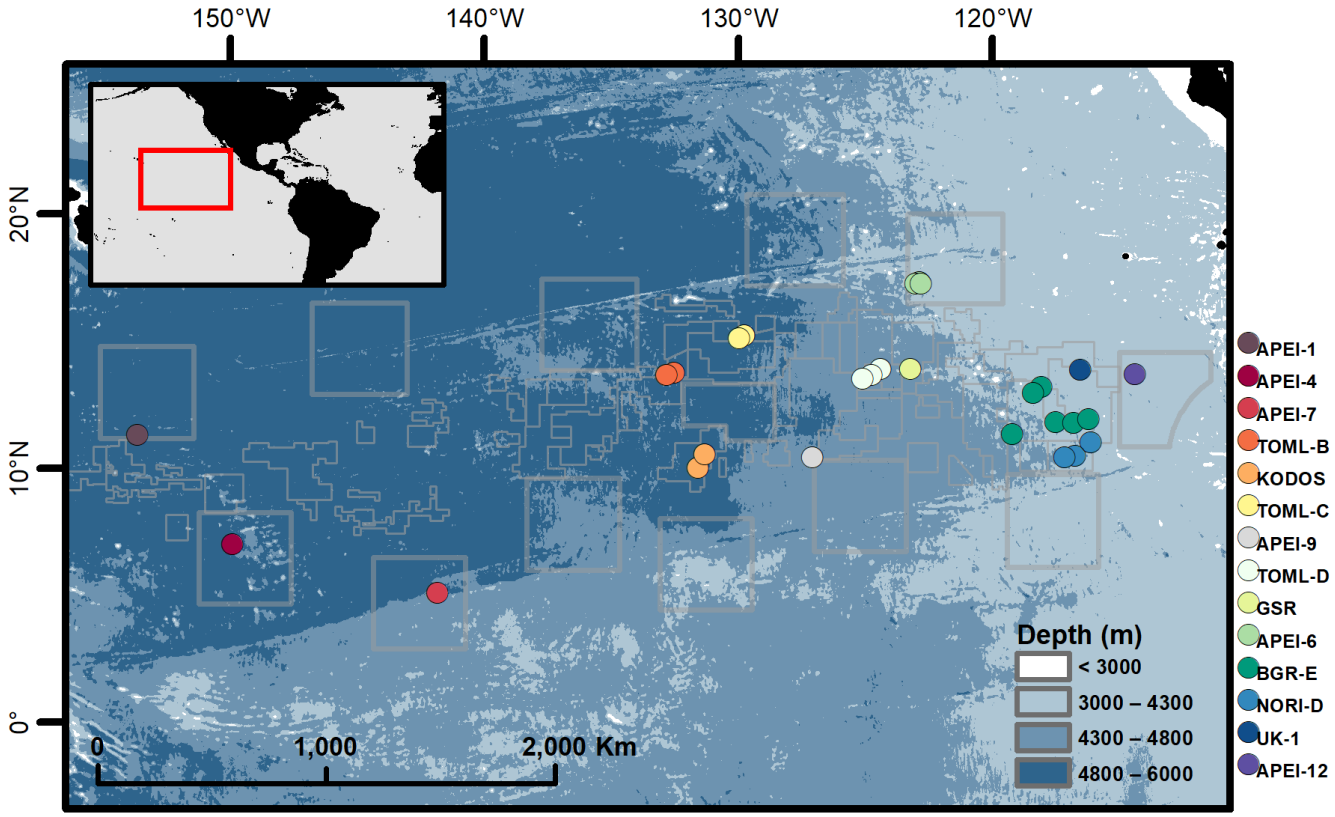
Standardised taxonomic catalogue used to develop (please cite as): [insert paper citation/doi]

Catalogue generation

The code-based abyssal megafauna (invertebrates > 1 cm) morphospecies catalogue was developed by morphological and taxonomical alignment of specimens encountered in seabed imagery collected across multiple polymetallic nodule field locations across the Clarion Clipperton Fracture Zone, in the NE Pacific basin (See map below and Simon-Lledo et al [in review] for further details). This work was conducted during a range of scientific workshops (between 2016 and 2021) in collaboration with taxonomic experts (see acknowledgements, end of the document) and by reference to existing literature. The catalogue follows the Horton, et al. 2021 open nomenclature (e.g. 10.3389/fmars.2021.620702) to report the taxonomic resolution reached in the identification of each classified morphotype. Each morphotype was also assigned a unique 7 character identification code (i.e. "XXX_nnn"). All taxa identified were deemed as sufficiently different morphologically by taxonomic experts to be confidently considered separate species.



Map of the Clarion Clipperton Zone in the North Pacific basin with detail on locations surveyed with photographic and video cameras mounted on autonomous underwater vehicles (AUVs), remotely operated vehicles (ROVs), and towed cameras; between 2010 and 2021. Areas managed by the International Seabed Authority: Thick polygons, Areas of Particular Environmental Interest, and; Thin polygons, polymetallic nodule exploration licensed sites.

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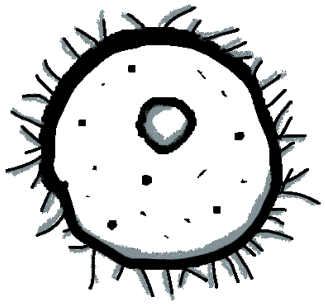
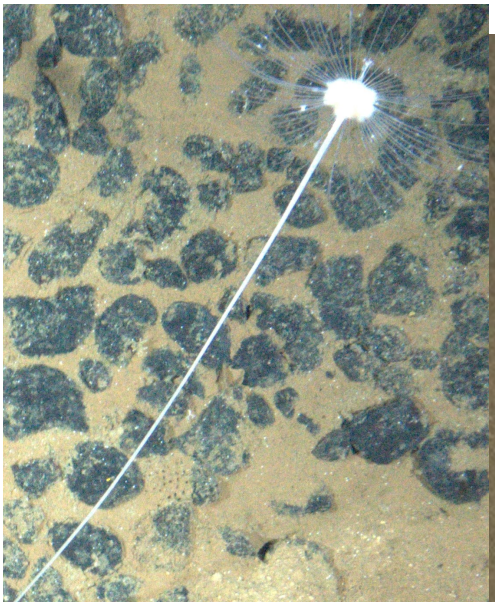
Phylum Porifera

Class Demospongiae



DES_002

Axoniderma mexicana sp. inc.



Morphology: Parasol-shaped sponge, on long stalk. Variable body shape; can retract parasol (e.g. doi.org/10.1016/j.dsr2.2019.104729; time-lapse)

Notes: Carnivorous, can be found growing on nodules or sediment. Can have associated basal anemone (see ACT_093)

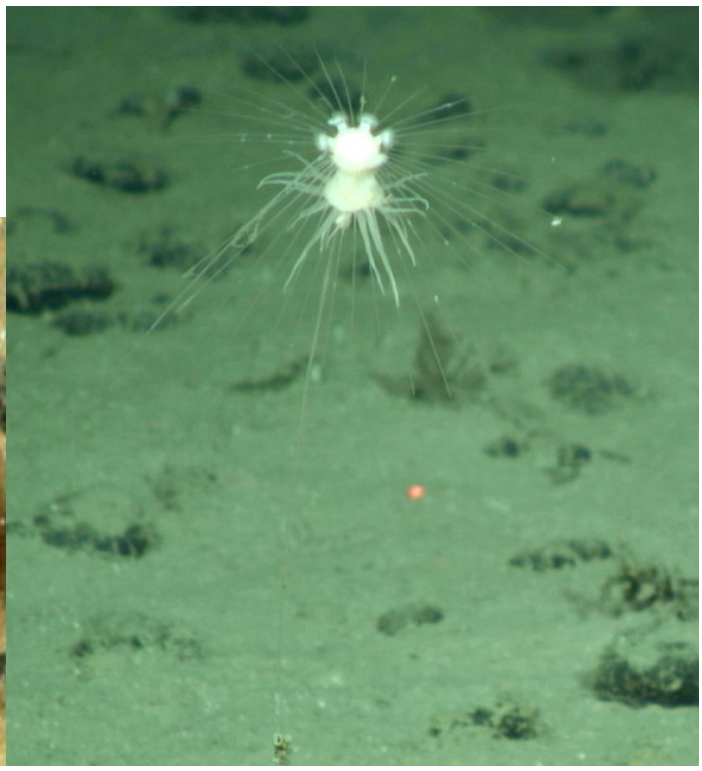
DES_003

Axoniderma kensmithi sp. inc.

Morphology: Parasol-shaped sponge on long stalk. Two to four (spermatocyst-bearing) apical discs on short thin stalks

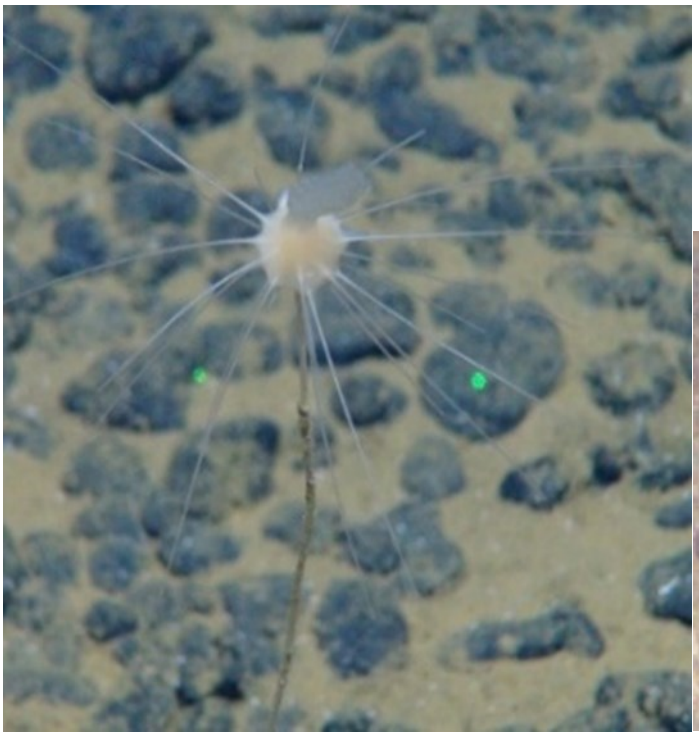
Notes: Carnivorous, can be found growing on nodules or sediment. Can have associated basal anemone (see ACT_093).

DES_008
Cladorhizidae gen. indet.



Morphology: Parasol-shaped sponge on long stalk. Six to eight apical discs on short thick stalks

Notes: Carnivorous, can be found growing on nodules or sediment. Can host associated, downward-facing, basal anemone, e.g. both specimens above (see ACT_093)

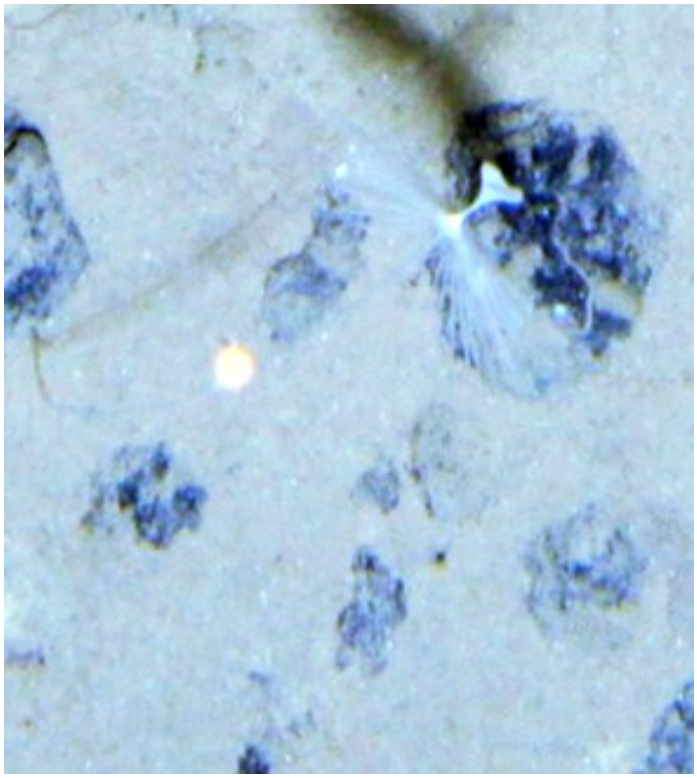


DES_017
Cladorhizidae gen. indet.

Morphology: Parasol-shaped sponge on long stalk. Amphora-shaped main body and parasol composed by few slender spines

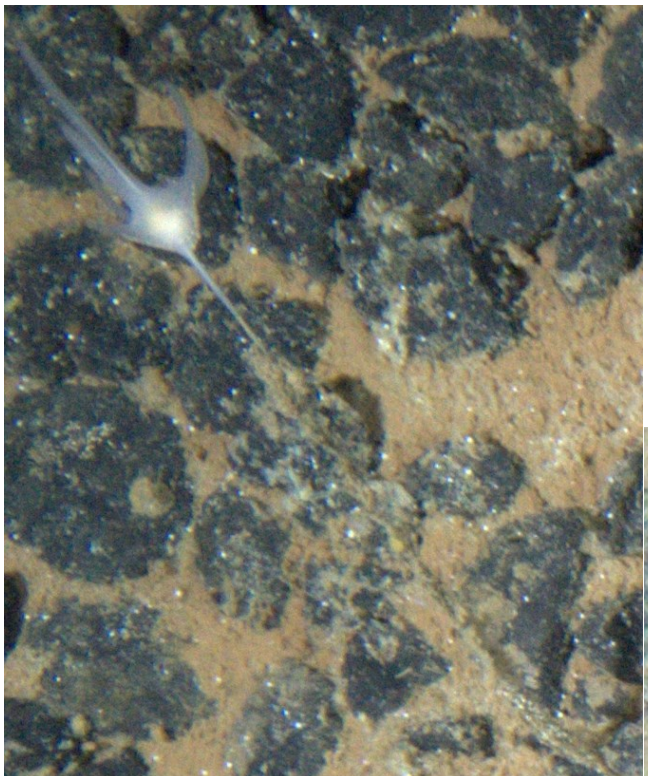
Notes: Carnivorous, can be found growing on nodules or sediment

DES_015
Cladorhizidae gen. indet.



Morphology: Parasol-shaped sponge on long stalk. Single tri-lobular apical disc on short stalk

Notes: Carnivorous, can be found growing on nodules or sediment



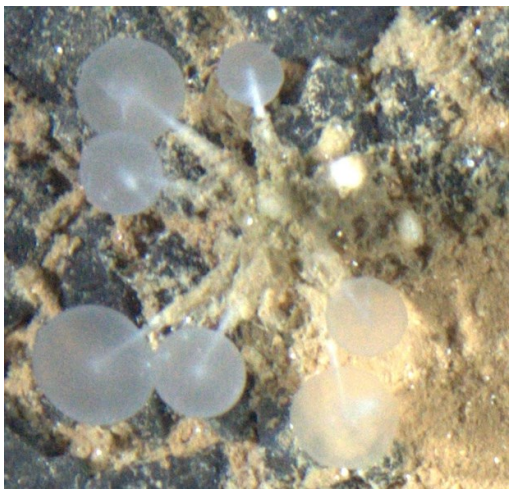
DES_019
Cladorhizidae gen. indet.

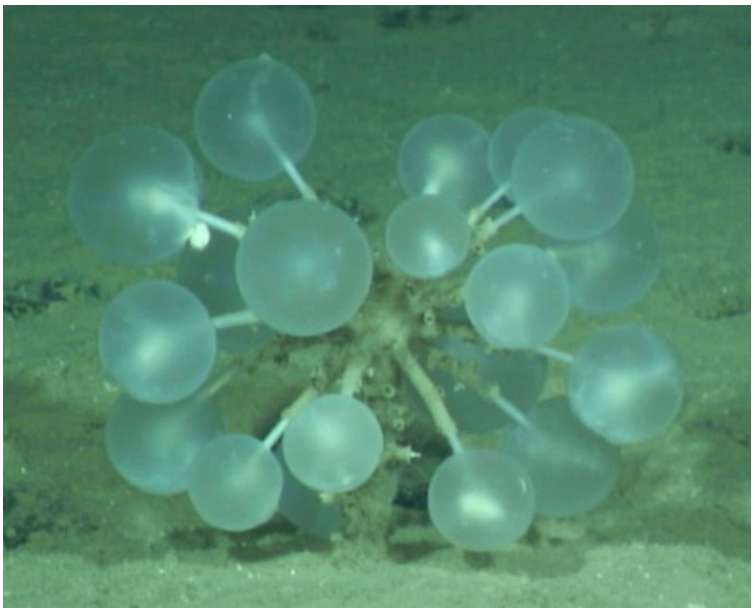
Morphology: Parasol-shaped sponge on long stalk. Round-shaped main body with long apical extension and parasol composed by few thick spines

Notes: Carnivorous, can be found growing on nodules or sediment

DES_004

Chondrocladia sp. indet.





Morphology: ‘ping-pong’ sponge; with branches that end in inflatable spheres, short or no stalk

Notes: Carnivorous, can be found growing on nodules or sediment

DES_016

Chondrocladia sp. indet.

Morphology: ‘ping-pong tree’ sponge; with branches stemming from a long stalk that end in inflatable spheres

Notes: Carnivorous, can be found growing on nodules or sediment

DES_014

Cladorhizidae gen. indet.

Morphology: Horizontal central stalk with equally spaced vertically growing branches with inflatable spheres

Notes: Carnivorous, can be found growing on nodules or sediment

DES_007

Poecilosclerida fam. indet.

Morphology: globular sponge with multiple small osculum pores homogeneously visible across "cotton-candy" body. Short to medium length stalk often not visible from vertical photography

Notes: Usually found growing attached to nodules

DES_005
Cladorhizidae gen. indet

Morphology: stiff thick spike-shaped branches growing (radiating) from a single main body point

Notes: Carnivorous, can be found growing on nodules or sediment

DES_018
Cladorhizidae gen. indet.

Morphology: stiff thick spike-shaped branches growing (radiating) along a central stalk

Notes: Carnivorous, can be found growing on nodules or sediment

DES_020
Cladorhizidae gen. indet.

Morphology: vertically elongated main body with bands of long thin horizontal spines stemming in all directions, supported by short stalk

Notes: Carnivorous, can be found growing on nodules or sediment

DES_021
Thenea sp. indet.

Morphology: Small, incrusting, somewhat dorsoventrally flattened round-shaped sponge

Notes: Found always growing on nodules or rocks. Likely to be a cryptic morphotype and can be easily confused with small anemones retracting tentacles in low resolution imagery.

POR_014
Cladorhizidae gen. indet.

Morphology: central stalk with 5 bands of long thin horizontal spines

Notes: Carnivorous, can be found growing on nodules or sediment.

POR_037
Cladorhizidae gen. indet.

Morphology: central stalk with 6 bands of long thin horizontal spines

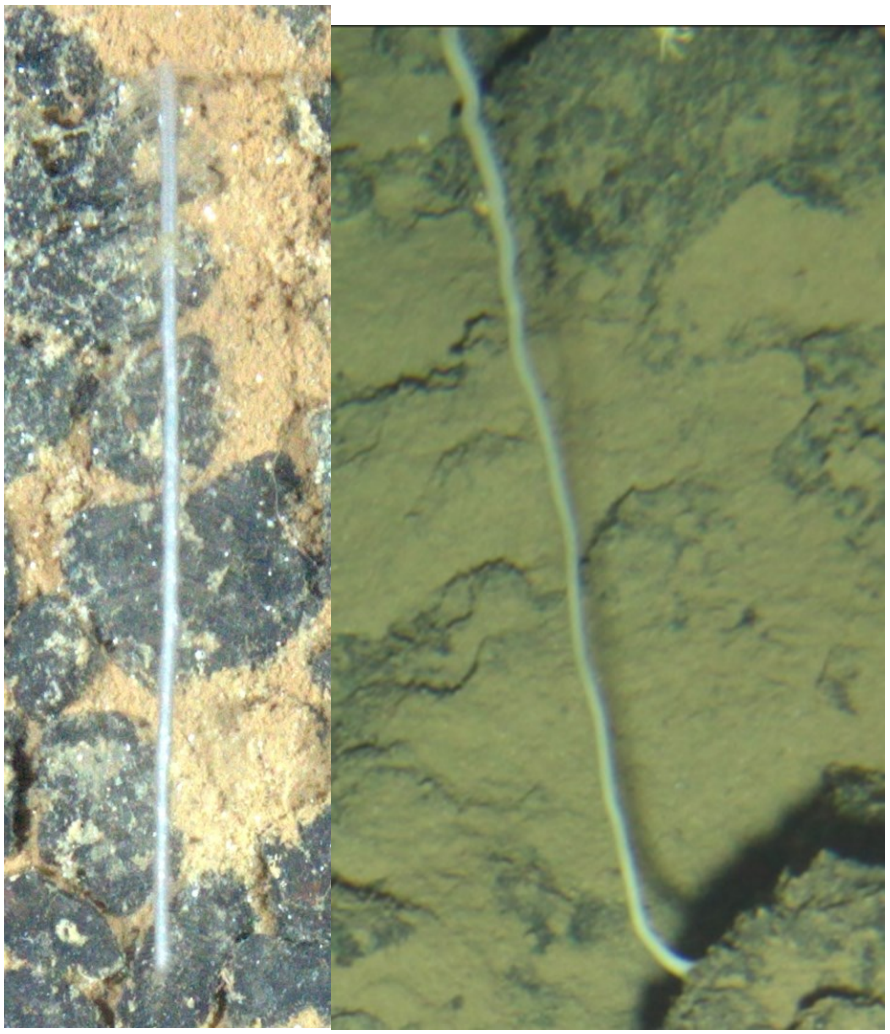
Notes: Carnivorous, can be found growing on nodules or sediment.

DES_001

Asbestopluma sp. indet.

Morphology: long central stalk with 4+ bands of short thin horizontal spines

Notes: Carnivorous, can be found growing on nodules or sediment.



POR_090

Cladorhizidae gen. indet.

Morphology: thick and very long central stalk with short thin horizontal spines

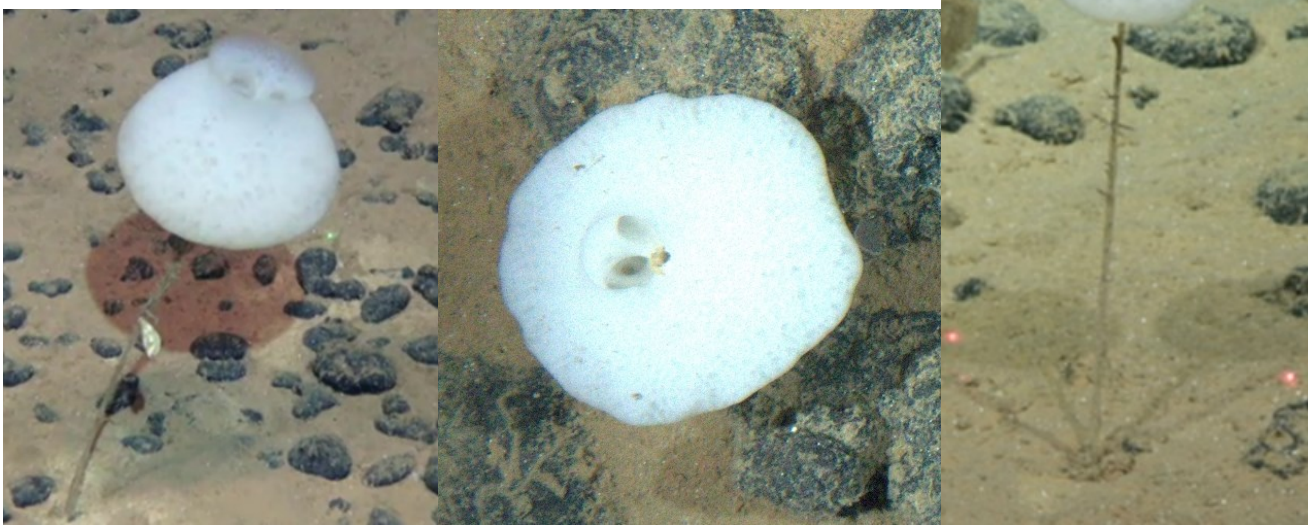
Notes: Carnivorous, can be found growing on nodules or sediment.

Phylum Porifera

Class Hexactinellida

HEX_002

Hyalonema sp. indet.

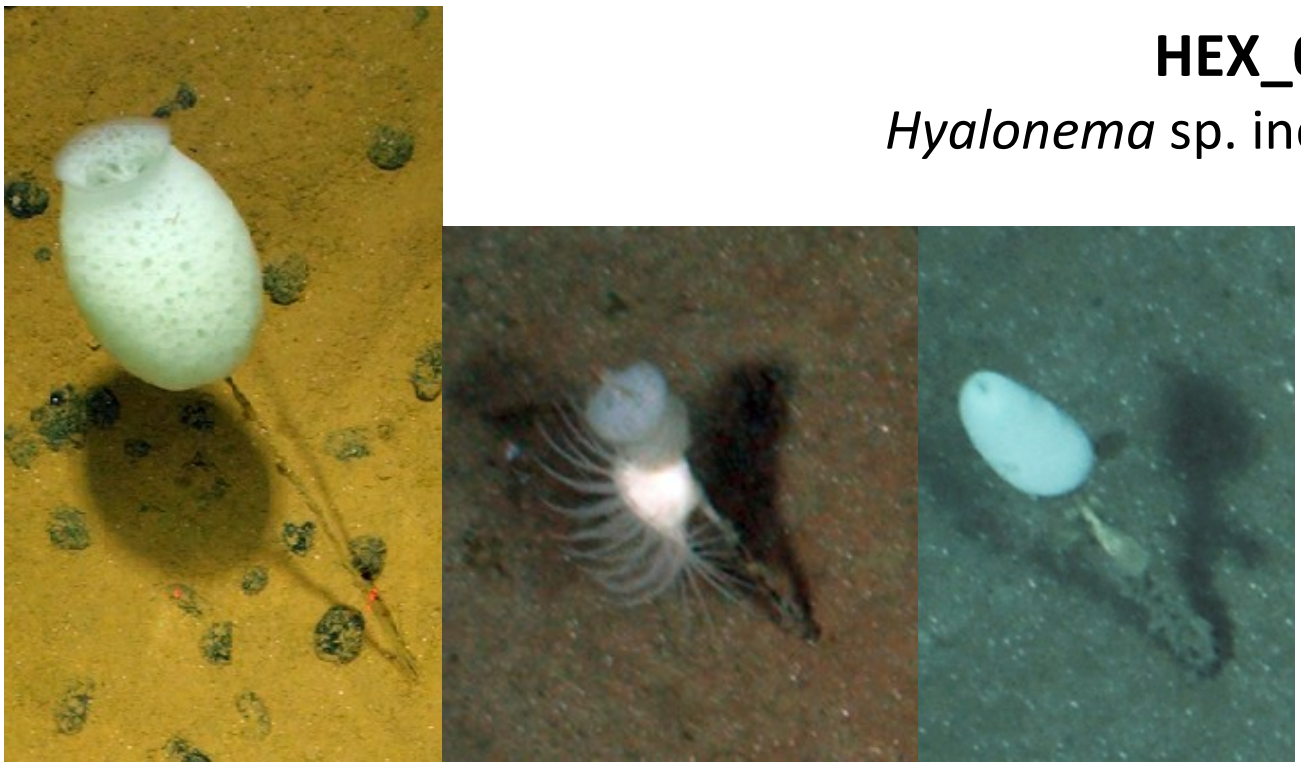


Morphology: long stalk; ovoid white body (width ~ length) with central osculum exhibiting variable width of aperture (though typically less than whole body width, e.g. as opposed to HEX_001). Osculum surrounded by a smooth, thin margin; atrial cavity subdivided by radial septa merging into an apical cone.

Notes: Can be found growing on sediment

HEX_003

Hyalonema sp. indet.



Morphology: long stalk; bell-shaped white body (width < length) with central osculum typically exhibiting variable width of aperture (though less than whole body width) or none at all, i.e. variable shape; can retract/expand (e.g. doi.org/10.1016/j.dsr2.2019.104729). Osculum surrounded by a smooth, thin margin; atrial cavity subdivided into several compartments.

Notes: Can be found growing on sediment

HEX_030

Hyalonema depressum sp. inc.

Morphology: no stalk, ovoid white body (width > length) with central osculum typically exhibiting variable width of aperture (though typically less than whole body width). Atrial cavity subdivided by radial septa merging into an apical cone.

Notes: Can be found growing on sediment or nodules

HEX_038

Hyalonematidae gen. indet.

Morphology: horizontally growing (or usually found as such), very long and often multiple thick stalk(s) supporting large ovoid white body (width > length) with no obvious central osculum

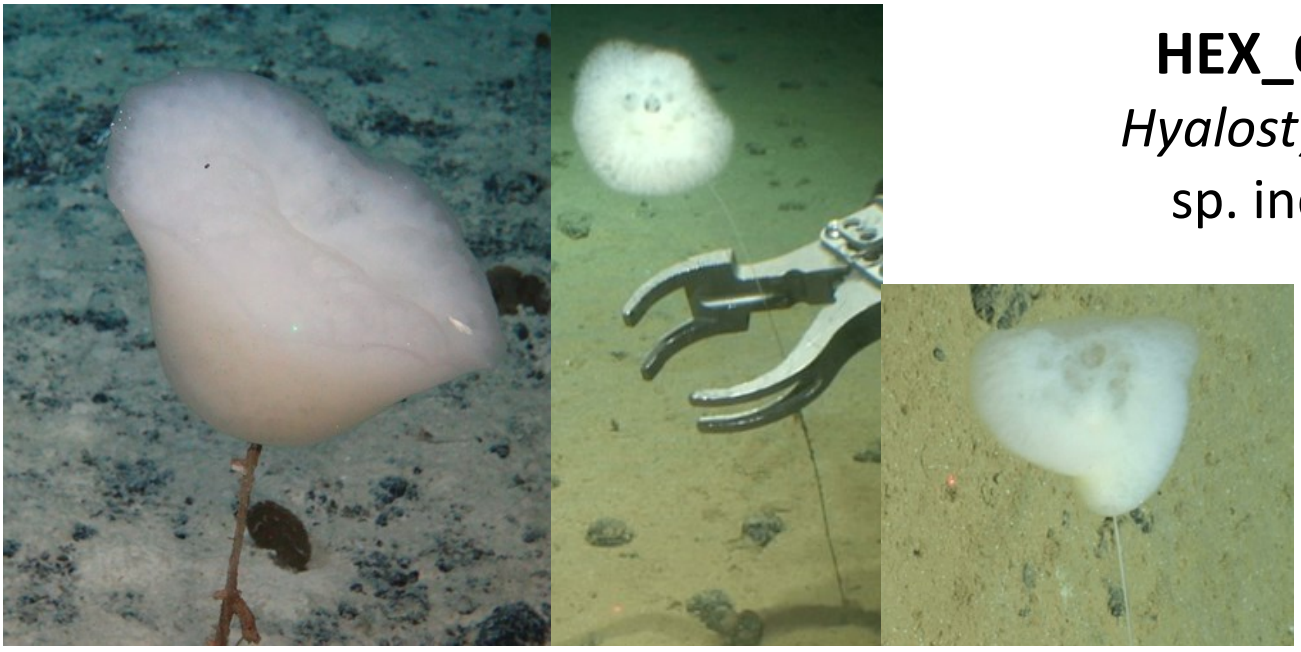
Notes: Can be found growing on sediment

HEX_001

Hyalonema sp. indet.

Morphology: thin long stalk; cup-shaped white body (width < length) with central osculum exhibiting large width of aperture. Osculum surrounded by a smooth, thin margin; atrial cavity subdivided by radial septa

Notes: Can be found growing on sediment



HEX_026

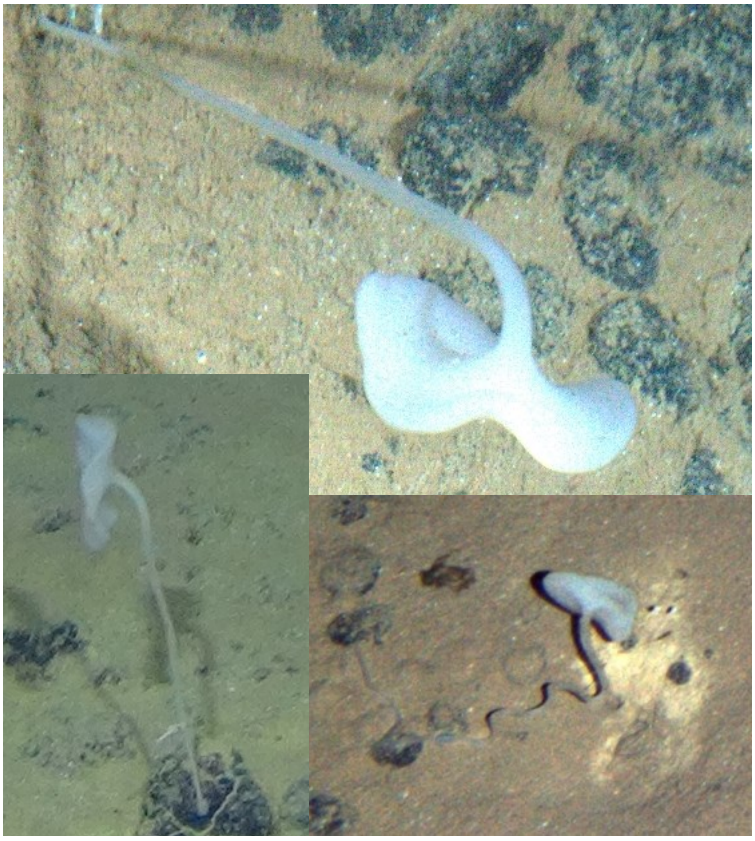
Hyalostylus sp. indet.

Morphology: thin long stalk; funnel-shaped white body (width > length) with central osculum typically exhibiting very large width of aperture. Osculum surrounded by a smooth, thin margin; atrial cavity subdivided by radial septa

Notes: Can be found growing on sediment

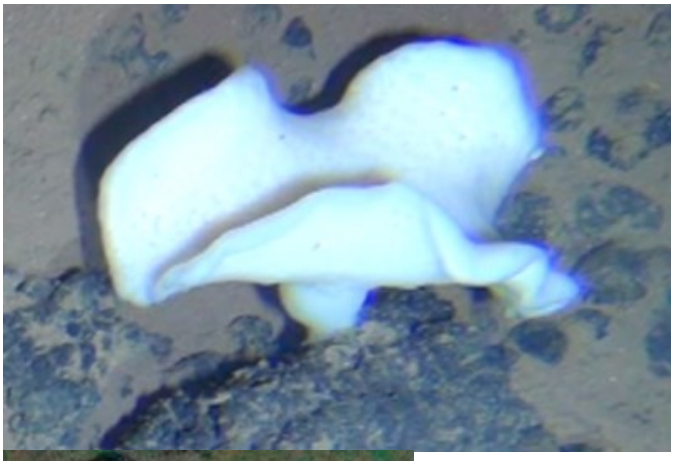
HEX_008

Sympagella clippertonae sp. inc.



Morphology: white long stalk (often curved) ending in leaf to mushroom-shaped white body

Notes: Can be found growing on sediment or nodules



HEX_009

Sympagella abysslineae sp. inc.

Morphology: leaf-shaped horizontally extending white sponge with carved edges

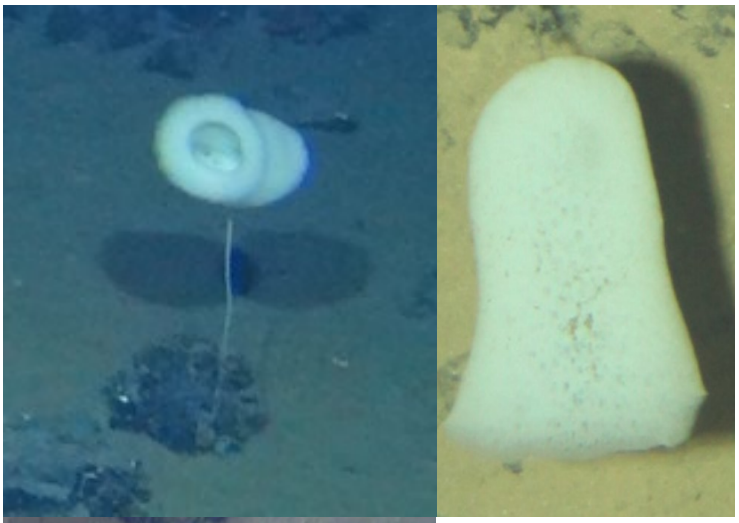
Notes: Can be found growing on sediment or nodules

HEX_010

Caulophacus sp. indet.

Morphology: white long stalk ending in leaf-shaped white body split in different lobes

Notes: Can be found growing on sediment or nodules



HEX_013

Euplectellidae gen. indet

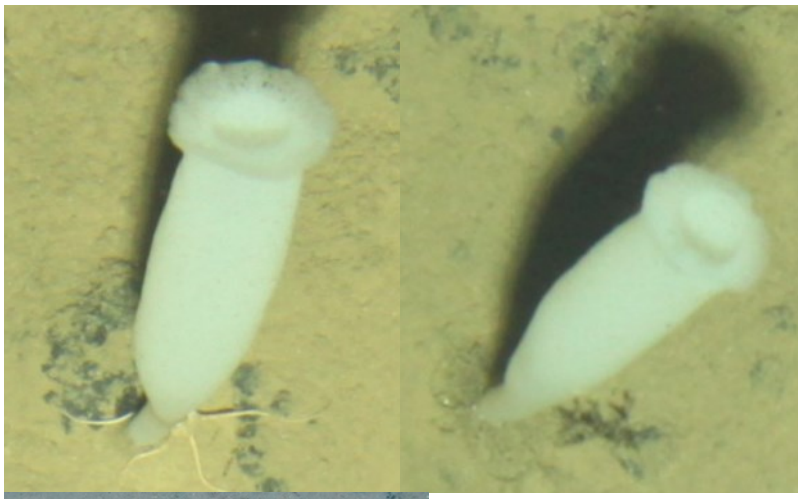
Morphology: thin long stalk; large elongated and thick cylindrical body with very wide, horizontally-facing, convoluted central osculum cavity. Stalk often not visible from vertical photography

Notes: Can be found growing on sediment or nodules

HEX_017
Euplectellidae gen. indet.

Morphology: thin stalk; large elongated and thick cylindrical body with very wide, vertically-facing, slightly convoluted central osculum cavity.

Notes: Can be found growing on sediment or nodules.



POR_060
Euplectellidae gen. indet.

Morphology: thick white stalk fused with tulip-shaped elongated (cylinder) main body, with wide, convoluted vertically-facing central osculum.

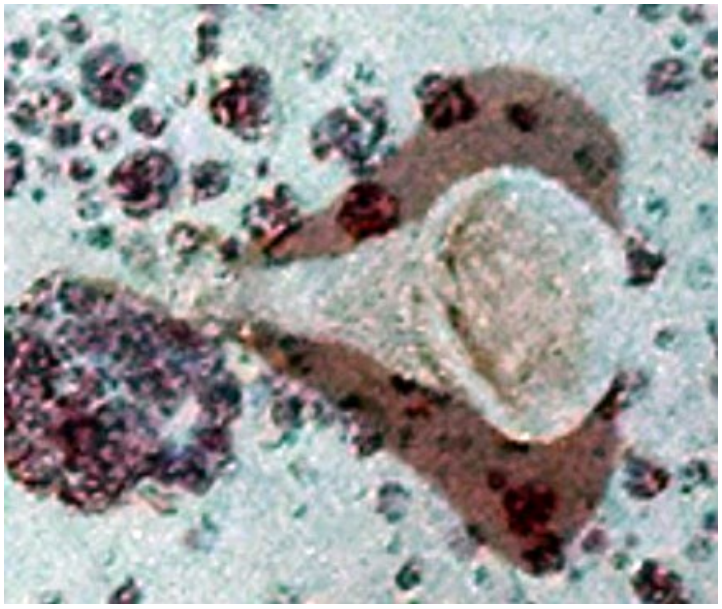
Notes: Can be found growing on sediment or nodules.

POR_063

Euplectellidae gen. indet.

Morphology: non-stalked white smooth funnel-shaped sponge; apical osculum diameter wider than the maximum width of the sponge body

Notes: Can be found growing on sediment or nodules



POR_111

Euplectellidae gen. indet.

Morphology: large non-stalked, brown (i.e. sediment coated), smooth funnel-shaped sponge with vertically-facing apical osculum. Osculum diameter much wider than the width of the sponge body

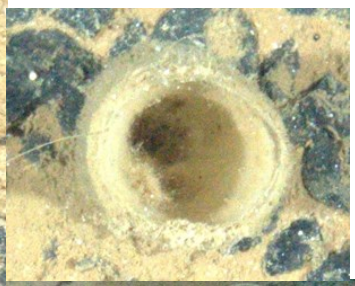
Notes: Can be found growing on sediment or nodules

HEX_022

Euplectellidae gen. indet.

Morphology: non-stalked white smooth cylinder-shaped sponge with vertically-facing apical osculum. Osculum diameter equal to the maximum width of the sponge body

Notes: Can be found growing on sediment or nodules

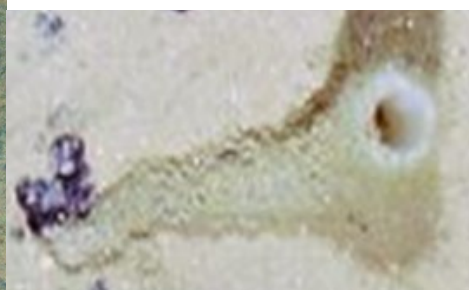


HEX_034

Euplectellidae gen. indet.

Morphology: large non-stalked, brown (i.e. sediment coated), smooth cylinder-shaped sponge with vertically-facing apical osculum. Osculum diameter equal or slightly larger than the maximum width of the sponge body

Notes: Can be found growing on sediment or nodules



HEX_023

Euplectellidae gen. indet.

Morphology: non-stalked white lumpy cylinder-shaped sponge with vertically-facing apical osculum. Osculum diameter smaller than the width of the sponge body, which can laterally flatten

Notes: Can be found growing on sediment or nodules

HEX_018

Holascus taraxacum sp. inc.

Morphology: white cylinder-shaped sponge with vertically-facing apical osculum and two basal Osculum diameter slightly smaller than the width of the sponge body, which can laterally flatten or constrict (i.e. ring-shaped constrictions). Small biped short stalk (often not visible from vertical imagery)

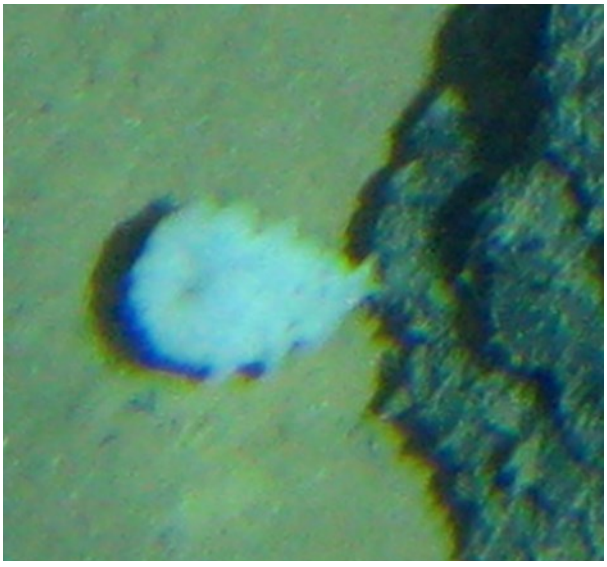
Notes: Can be found growing on sediment or nodules

HEX_011

Crateromorpha sp. indet.

Morphology: non-stalked lumpy cylinder-shaped white sponge with vertically-facing apical central osculum (diameter smaller than maximum sponge width). With multiple laterally-facing (smaller) slightly swollen osculum apertures. Can exhibit basal (brown, sediment coated) filaments

Notes: Can be found growing on sediment



POR_096

Rossellidae gen. indet.

Morphology: non-stalked lumpy funnel-shaped white sponge. With multiple slightly swollen osculum apertures.

Notes: Can be found growing on sediment

POR_034

Lyssacinosida fam. indet.

Morphology: long stalked lumpy cylinder-shaped white sponge. With multiple slightly swollen osculum apertures (both laterally and apically visible)

Notes: Can be found growing on sediment or nodules

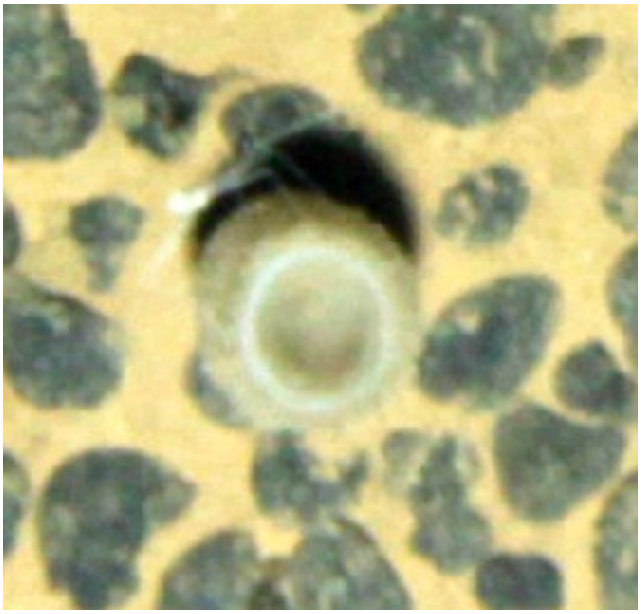
HEX_037

Lyssacinosida fam. indet.

Morphology: short stalked smooth wide cylinder-shaped white sponge (body width > length). With multiple small apical osculum apertures. Short stalk not visible in vertical imagery

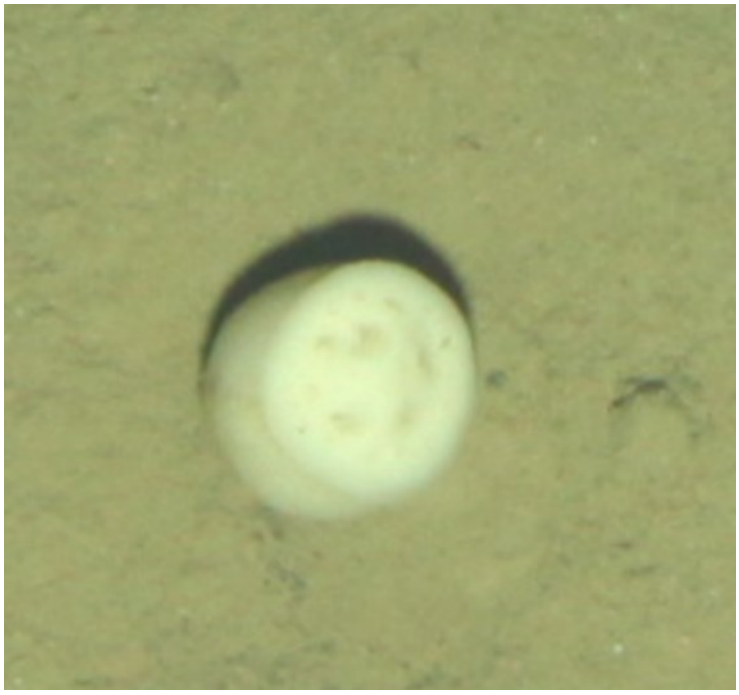
Notes: Can be found growing on sediment

POR_067
Amphidiscosida fam. indet.



Morphology: non-stalked, rough wide cylinder-shaped white to brownish sponge (body width > length). Thick body with no visible apical osculum apertures.

Notes: Can be found growing on sediment

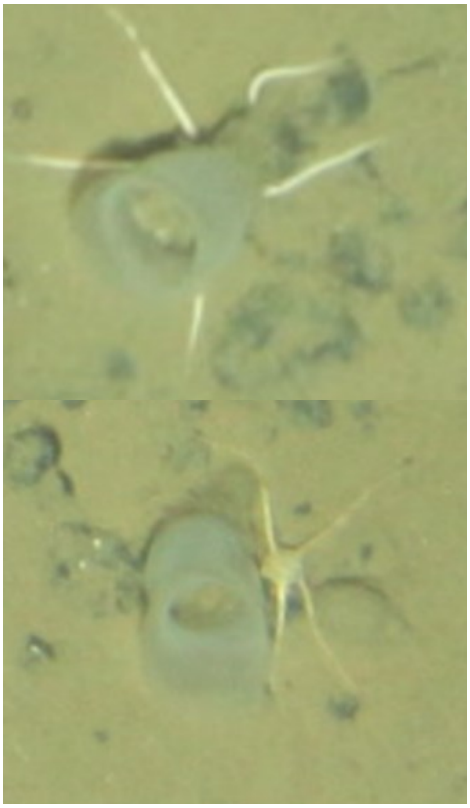


POR_092
Amphidiscosida fam. indet.

Morphology: non-stalked, smooth wide cylinder-shaped white sponge (body width > length). Thick body with few apical osculum apertures.

Notes: Can be found growing on sediment

POR_057
Amphidiscosida fam. indet.



Morphology: cylindrical semi-translucent sponge with whole-body-width and apically convoluted aperture (all the way to sea-bed), thin-walled body

Notes: Can be found growing on sediment or nodules

HEX_029
Amphidiscosida fam. indet.

Morphology: cylindrical white sponge with whole-body-width aperture (all the way to seabed); thick-walled body

Notes: Can be found growing on sediment or nodules

HEX_014

Holascus spinosus sp. inc.

Morphology: white to blueish collar-shaped body with extremely large central aperture (narrowing towards apical side, e.g. cone base). Thin-walled body. Can exhibit basal (brown, sediment coated) filaments

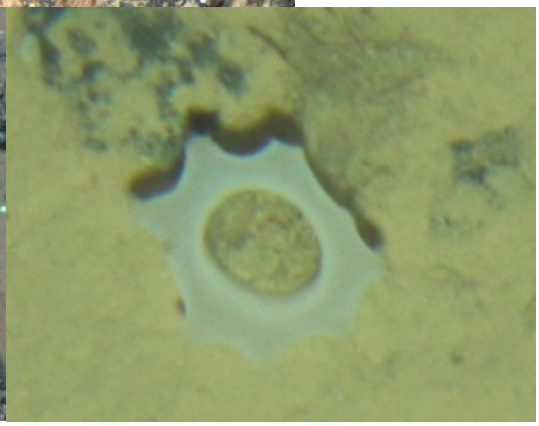
Notes: Can be found growing on sediment or nodules

HEX_019

Holascus euonyx sp. inc.

Morphology: white to blueish sponge with cylindrical (basal) body and wide (all the way to seabed) central aperture that is strongly convoluted apically. Thin-walled body

Notes: Can be found growing on sediment or nodules

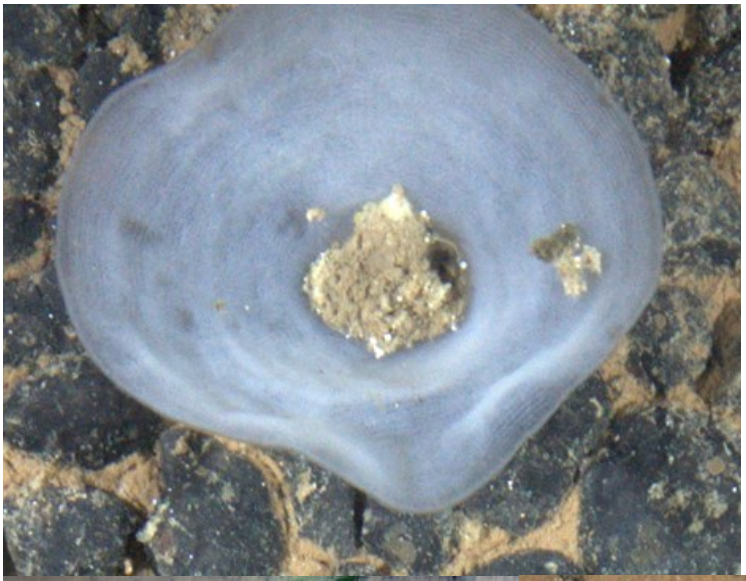


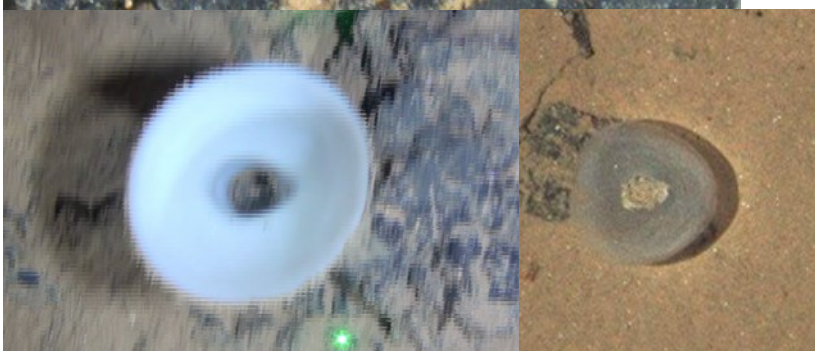
HEX_016

Docosaccus nidulus sp. inc.

Morphology: white to blueish cone-shaped body with wide central aperture delimiting clearly visible chambers. Thick-walled body

Notes: Can be found growing on sediment or nodules





HEX_004

Chonelasma sp. indet.

Morphology: cone-shaped thin-walled sponge with large central aperture (all the way to the seabed) but narrowing towards the base,

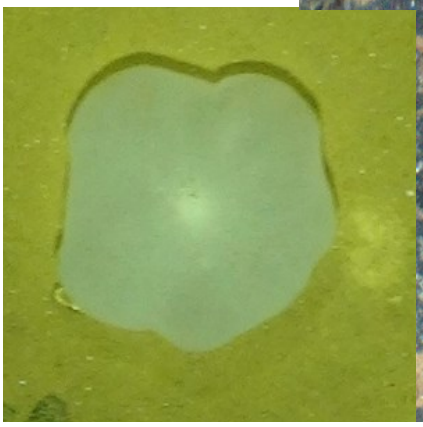
Notes: Notes: Can be found growing on sediment or nodules.

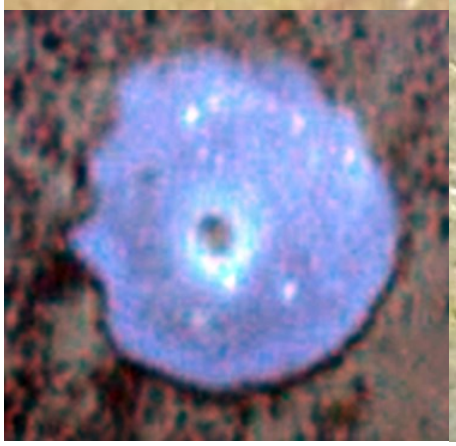
HEX_033

Rosellidae gen. indet.

Morphology: semi translucent plate-shaped sponge, growing horizontally. Body exhibiting somewhat pentagonal to round symmetry. Short stalk not visible in vertical imagery.

Notes: Can be found growing on sediment or nodules.





HEX_007

Bathydorus sp. indet.

Morphology: white (somewhat translucent) plate-shaped sponge growing horizontally with central apical osculum aperture. Body usually exhibiting round symmetry but often irregular edges and/or sediment coated basal filaments.

Notes: Can be found growing on sediment or nodules.

POR_046
Hyalonematidae gen. indet.

Morphology: white thick plate-shaped sponge growing horizontally. Body somewhat exhibiting round symmetry. Multiple small apical osculum apertures visible over the body surface.

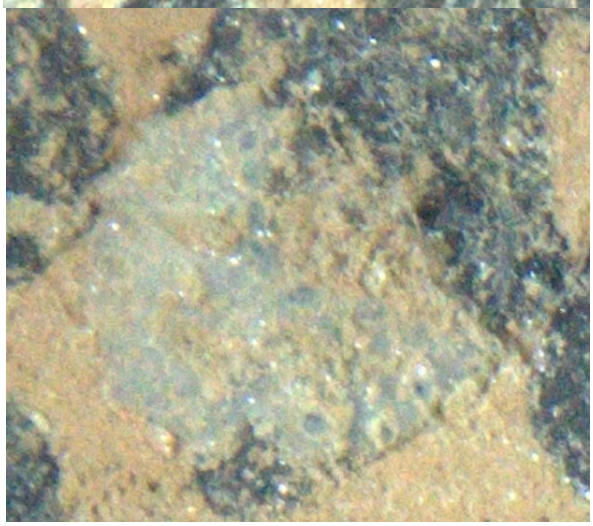
Notes: Can be found growing on sediment or nodules.

POR_104
Hexactinellida order. indet.

Morphology: white to blueish (i.e. light reflexing) thin and smooth plate-shaped sponge. Smooth body edges with punctual elongation.

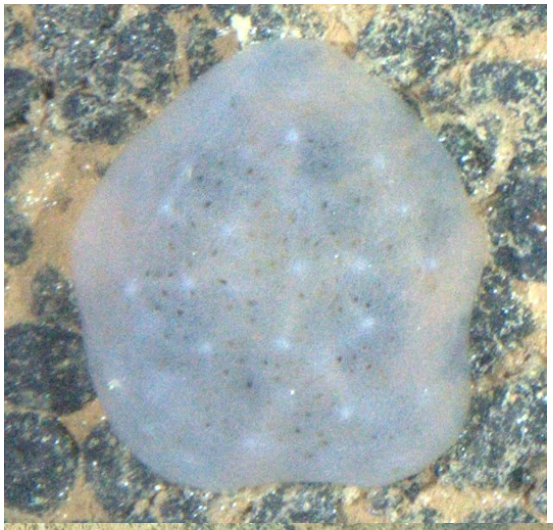
Notes: Can be found growing on sediment or nodules.

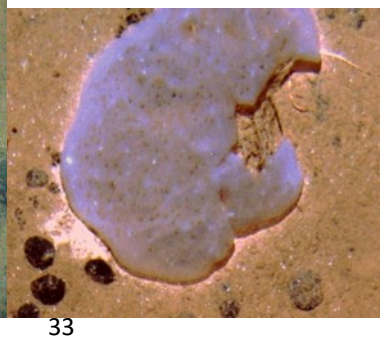
POR_112
Hyalonematidae gen. indet.



Morphology: bluish (i.e. light reflecting) irregular plate-shaped sponge, growing horizontally. With few relatively large oscula visible throughout apical body surface

Notes: Can be found growing on sediment or nodules.





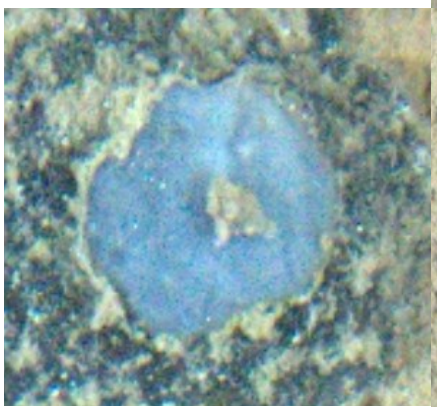
HEX_015
Docosaccus maculatus
sp. inc.

Morphology: semi transparent to bluish irregular plate-shaped sponge, growing horizontally. With small white spots and osculum visible throughout apical body surface

Notes: Can be found growing on sediment or nodules. Known to be capable to slowly move (e.g. doi.org/10.1016/j.dsr2.2019.104729)

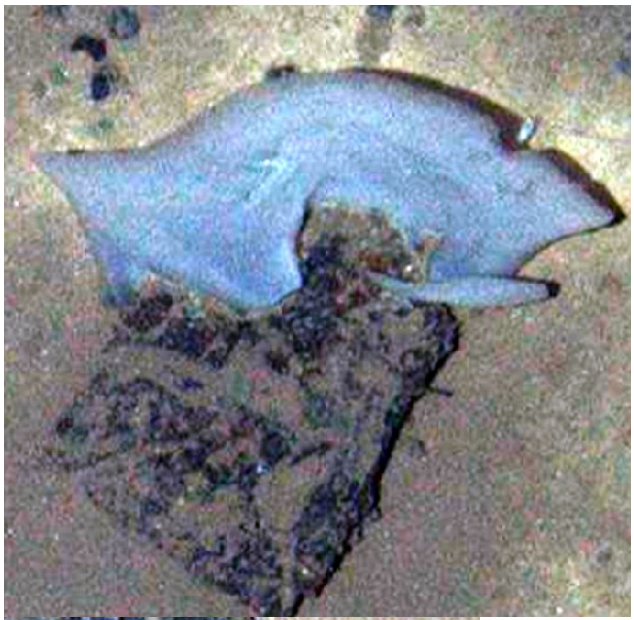
POR_101

Hexactinellida order. indet.



Morphology: dark blue (i.e. light reflecting) compact and incrusting plate-shaped sponge. Rough body surface

Notes: Can be found growing on sediment or nodules.



POR_110

Hexactinellida order. indet.

Morphology: blue (i.e. light reflecting) incrusting and irregular shaped sponge. Smooth body surface

Notes: Can be found growing on sediment or nodules.

HEX_005

Corbitella discasterosa sp. inc.

Morphology: white tubular sponge with central vertically facing central osculum, and protruding fistules with large tube-shaped terminal suboscula

Notes: Can be found growing on sediment or nodules.

POR_004

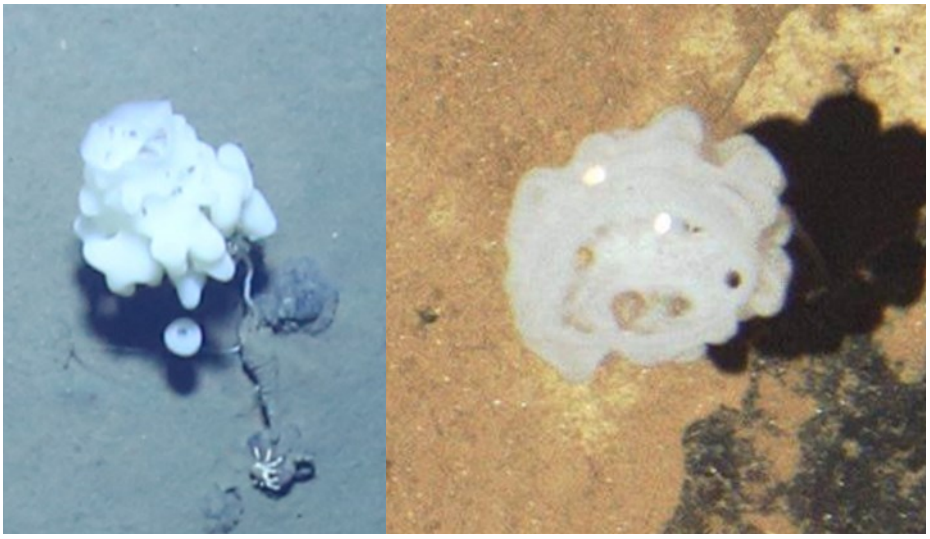
Farreidae gen. indet.

Morphology: non-stalked; white spherical, compact “brain-shaped” sponge

Notes: Can be found growing on sediment or nodules.

HEX_020

Saccocalyx
sp. indet.



Morphology: long stalk; funnel to cauliflower-shaped sponge with very large central atrial cavity (i.e. osculum) connected to smaller protruding lateral oscula.

Notes: Can be found growing on sediment or nodules.

POR_044

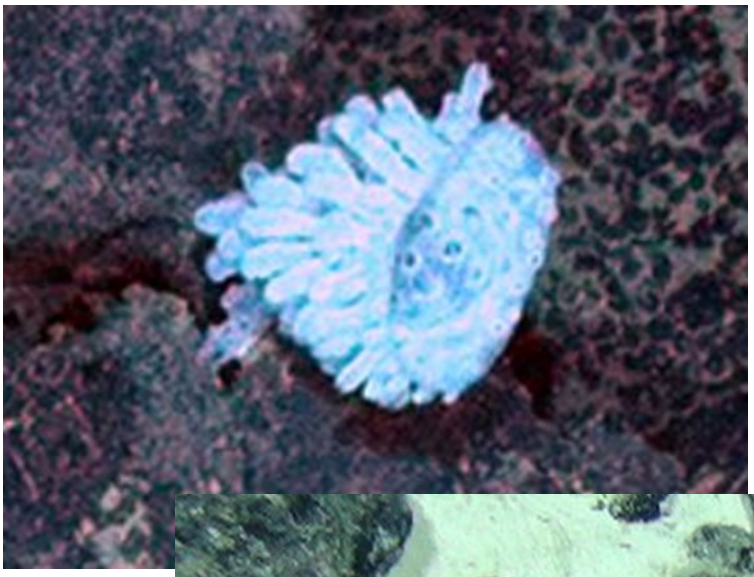
Saccocalyx microhexactin
sp. inc.

Morphology: long stalk; spherical to cauliflower-shaped sponge with large atrial cavity connected to smaller lateral oscula.

Notes: Can be found growing on sediment or nodules.

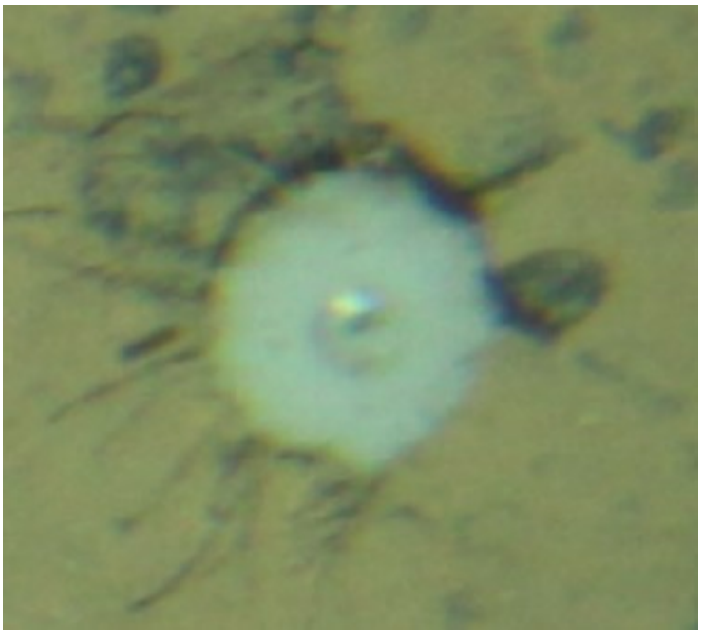
POR_059

Saccocalyx sp. indet.



Morphology: non-stalked; funnel to cauliflower-shaped sponge with very large central atrial cavity (i.e. osculum) connected to smaller protruding lateral oscula.

Notes: Can be found growing on sediment or nodules.



POR_080

Hexactinellida order. indet.

Morphology: non-stalked; spherical-shaped sponge with small central osculum and lumpy external body surface. Can be found on brown (sediment coated) basal filaments.

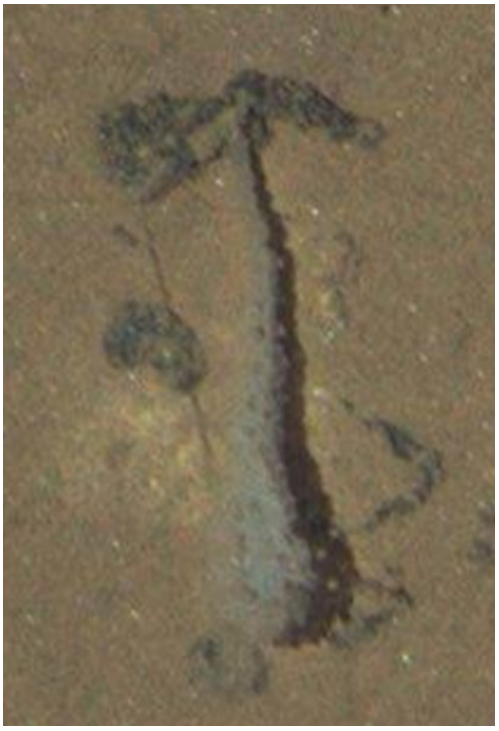
Notes: Can be found growing on sediment or nodules.

HEX_025

Bathyxiphus
sp. indet.

Morphology: Thin and elongated blade-shaped sponge. White (with blue reflexes) to brown (large specimens).

Notes: Can be found growing on sediment or nodules.



POR_109

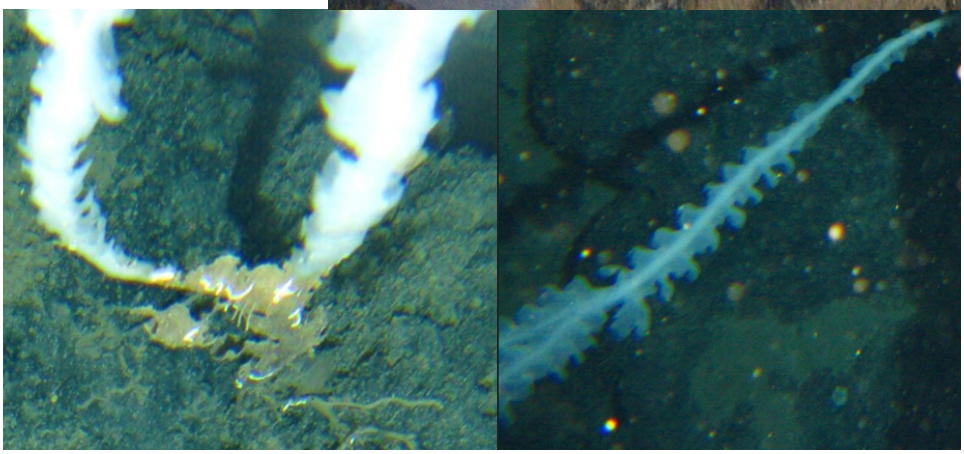
Sceptrulophora fam indet.

Morphology: white long and strongly ruffled sponge with long, wide central branch largely convoluted by small oscula on the sides

Notes: Can be found growing on sediment or nodules.

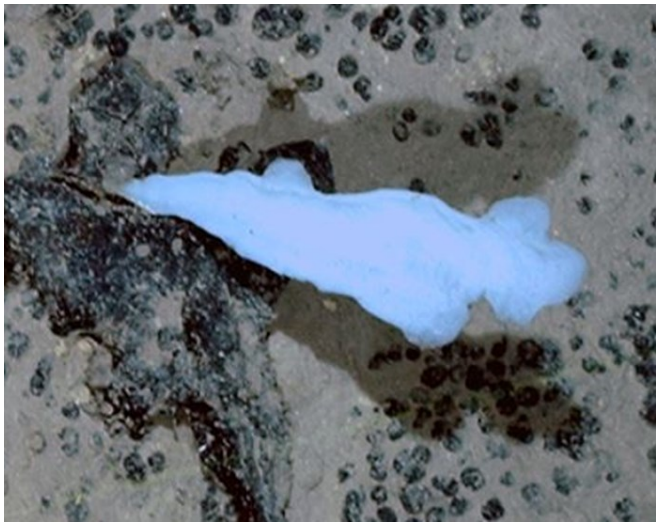
HEX_042

Farrea cordelli sp. inc.



Morphology: white ruffled sponge with very long central branch and small digitated oscula on the sides, can be multibranched.

Notes: Can be found growing on sediment or nodules.



HEX_035

Farreidae gen. indet.

Morphology: white long ruffled sponge with long, wide and thick central branch and small oscula on the sides

Notes: Can be found growing on sediment or nodules.

POR_061

Hexactinellida order. indet.

Morphology: non-stalked; white compact bifurcated 'woolly' sponge. Can have more than 2 branches.

Notes: Can be found growing on sediment or nodules.

HEX_024

Hexactinellida order. indet.

Morphology: non-stalked; white convoluted plate-shaped sponge with apical cavity. Thin-walled body

Notes: Can be found growing on sediment or nodules.

POR_108

Hexactinellida order. indet.

Morphology: non-stalked; white contorted plate-shaped sponge

Notes: Can be found growing on sediment or nodules.

HEX_039

Hexactinellida order. indet.

Morphology: non-stalked; white, spherical contorted plate-shaped sponge with several atrial cavities

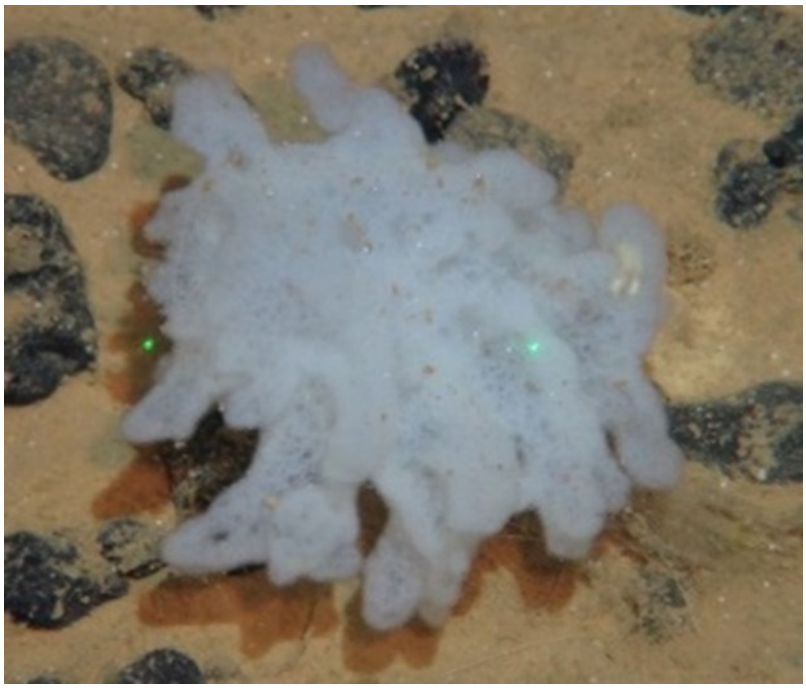
Notes: Can be found growing on sediment or nodules.

HEX_040

Hexactinellida order. indet.

Morphology: non-stalked; white, large flat and irregular plate-shaped sponge with several sparse atrial cavities (some of which crossing the whole sponge body all the way to seabed)

Notes: Can be found growing on sediment or nodules.



POR_049

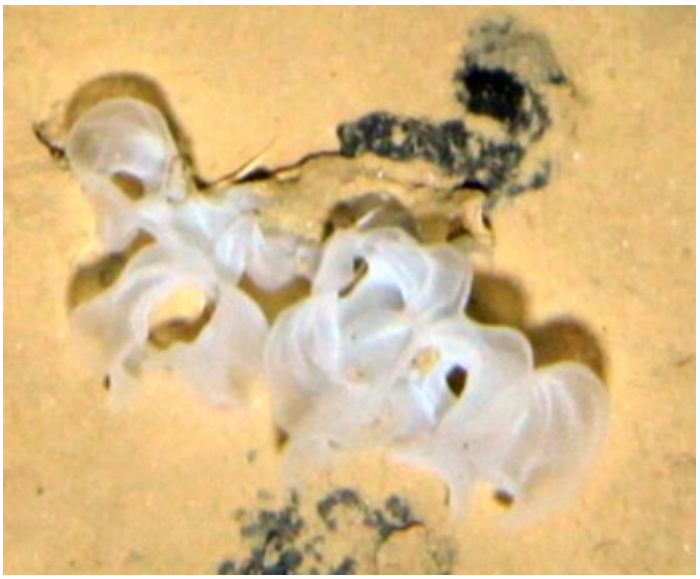
Hexactinellida order. indet.

Morphology: non-stalked; white, lumpy plate-shaped sponge

Notes: Can be found growing on sediment or nodules.

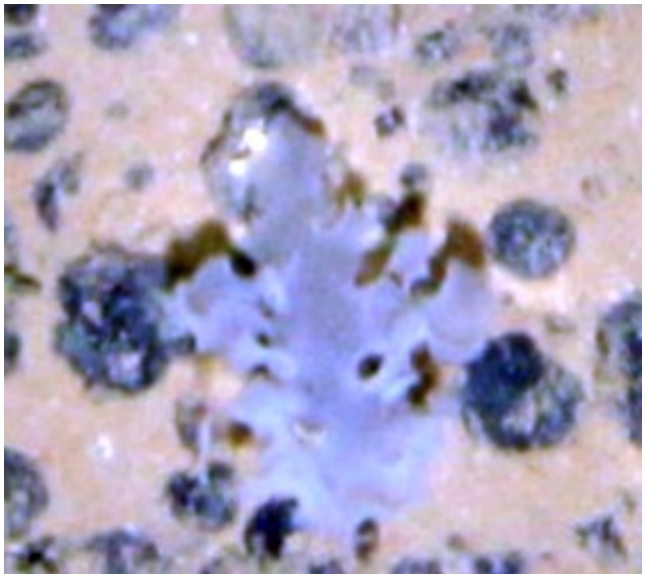
POR_077

Hexactinellida order. indet.



Morphology: non-stalked; white, strongly convoluted plate-shaped sponge. Thin-walled body

Notes: Can be found growing on sediment or nodules.



POR_078

Hexactinellida order. indet.

Morphology: non-stalked; white, crumbled plate-shaped sponge (i.e. 'lettuce' shape). Thin-walled body

Notes: Can be found growing on sediment or nodules.

POR_021
Hexactinellida order. indet.

Morphology: non-stalked; white, smooth mesh plate-shaped sponge. Thin-walled body

Notes: Can be found growing on sediment or nodules.

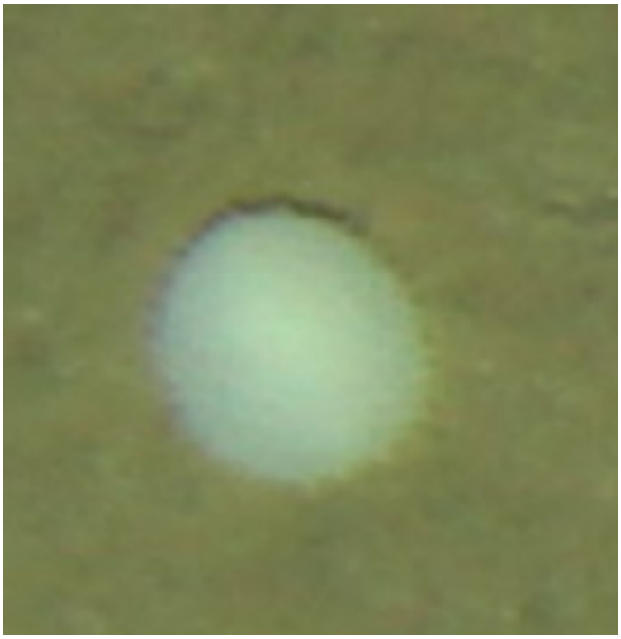
POR_087
Hexactinellida order. indet.

Morphology: non-stalked; white to blueish (i.e. light reflecting), smooth band plate-shaped sponge. Thin-walled body

Notes: Can be found growing on sediment or nodules.

POR_016

Hexactinellida order. indet.



Morphology: non-stalked; white egg-shaped sponge with (homogenously) rugged external body surface

Notes: Can be found growing on sediment

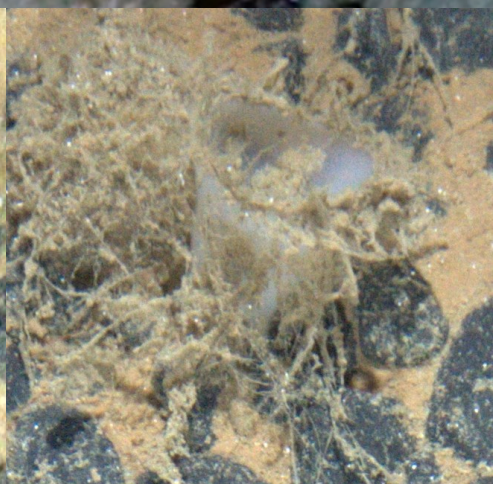
POR_028

Hexactinellida order. indet.

Morphology: non-stalked; white “fried-egg” shaped sponge with relatively rugged external body surface and a small central apical depression

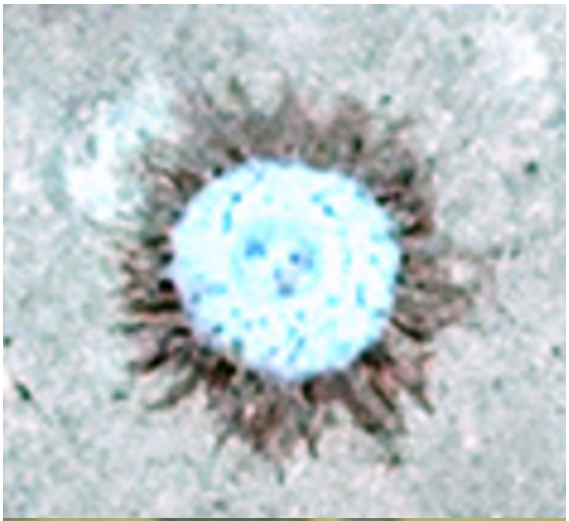
Notes: Can be found growing on sediment

POR_103
Rossellidae gen. indet.



Morphology: non-stalked; funnel-shaped white sponge with convoluted apical aperture. Typically found on large sparse mat of brown (sediment coated) basal filaments that can extend or even cover the apical cavity.

Notes: Can be found growing on sediment or nodules.

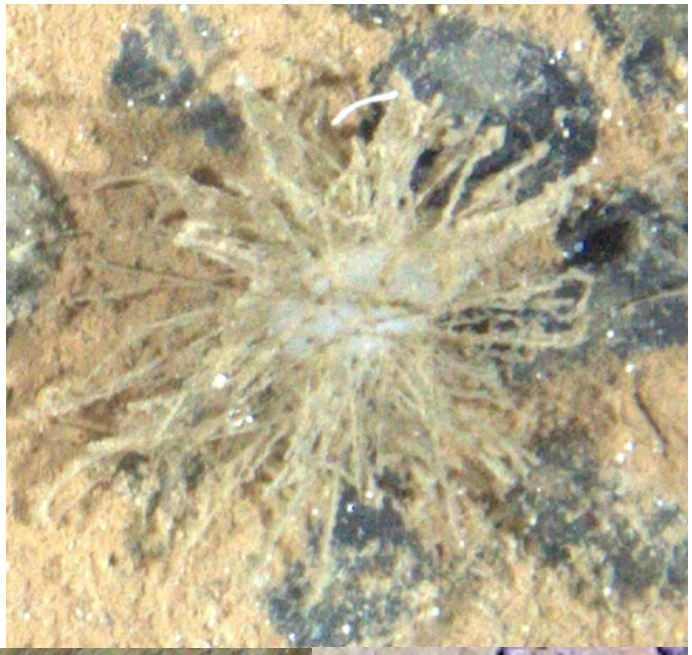


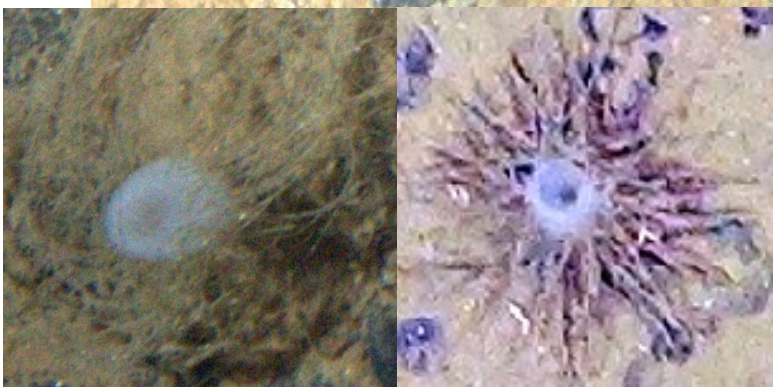
POR_081
Hexactinellida order. indet.

Morphology: non-stalked; compact spherical sponge with small apical osculum cavity subdivided by few septa. Typically found on thin sparse mat of brown (sediment coated) basal filaments.

Notes: Can be found growing on sediment or nodules.

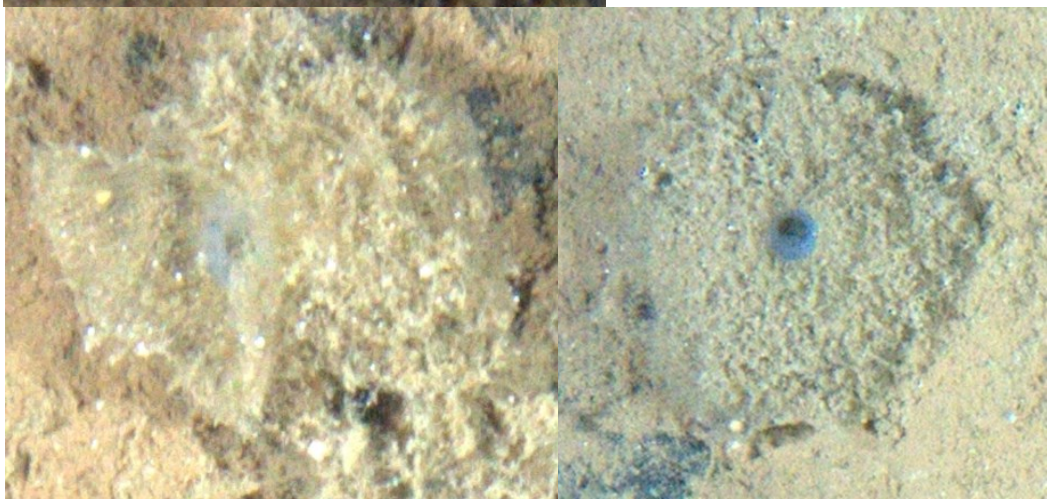
POR_082
Rossellidae gen. indet.





Morphology: non stalked; cylinder-shaped white sponge. Typically found on sparse mat of long brown (sediment coated) basal filaments that can extend or even cover the apical cavity

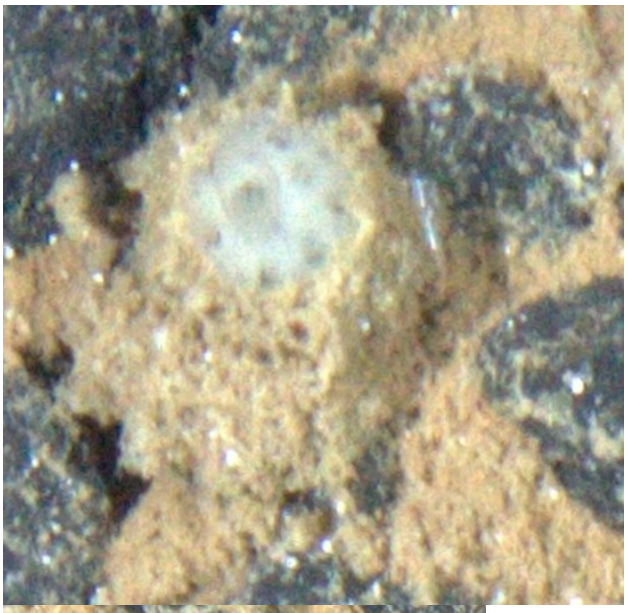
Notes: Can be found growing on sediment or nodules.

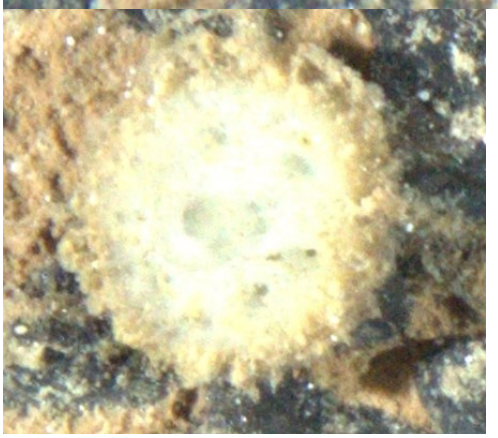


POR_009
Rhabdocalyptus sp. indet.

Morphology: non-stalked; egg-shaped (width ≥ height) white to blueish (i.e. light reflexing) sponge. Covered by thick mat of brown (sediment coated) filaments, often extending above apical cavity, generating a cone surrounding the osculum.

Notes: Can be found growing on sediment or nodules.





POR_114

Hexactinellida order. indet.

Morphology: non stalked; egg to cylinder-shaped white sponge. Typically found laterally coated by a thin brown (i.e. sediment) mat of short filaments leaving a few apical oscula exposed

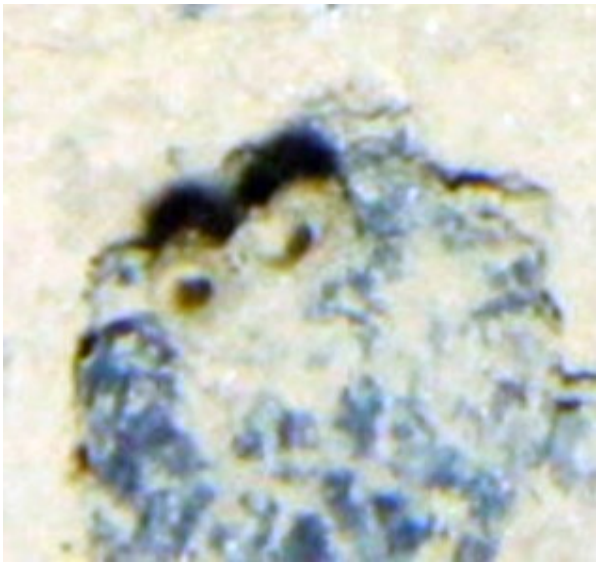
Notes: Can be found growing on sediment or nodules.

POR_094

Hexactinellida order. indet.

Morphology: non stalked; short cylinder-shaped brown sponge. Typically found laterally coated by a thin brown (i.e. sediment) mat of short filaments leaving the apical cavity exposed

Notes: Can be found growing on sediment or nodules.



POR_068
Hexactinellida order. indet.

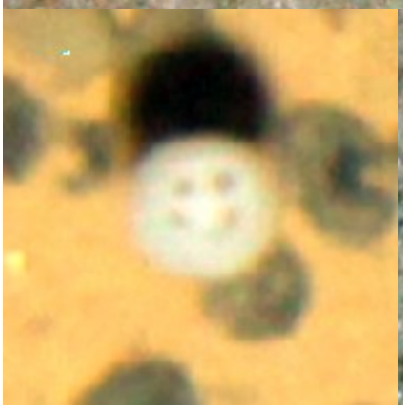
Morphology: white, stalked mushroom-shaped sponge with apical (relatively) sharped edge. Stalk can be long or short sized (i.e. not visible from vertical imagery).

Notes: Can be found growing on sediment or nodules.

POR_102
Hexactinellida order. indet.

Morphology: short-stalked white thick disk-shaped sponge with smooth external body surface

Notes: Found (to date) only growing on large nodules or rocks.



POR_035
Amphidiscosida fam. indet.

Morphology: short thin stalk; white, small cup-shaped sponge with central osculum exhibiting large width of aperture. Atrial cavity subdivided by two perpendicularly crossing septa.

Notes: Can be found growing on sediment or nodules.

Acknowledgements

We would like to thank all the taxonomic experts who helped in the classification of taxa during the generation of the standardised megafauna catalogue: Dhugal Lindsay, Saskia Brix, Sammy De Grave, Tina Molodtsova, Helena Wiklund, Daniel Kersken, Joana Xavier, Less Watling, Astrid Leitner, Jeff Drazen, Craig Young, Andrey Gebruk, David Pawson, Andrei Grischenko, Magdalini Christodoulou, Chriss Mah, Brian Bett, Andrew Gates. We would also like to thank Emma Knowles and Loic Van Audenhaege for their assistance in the generation of this field guide.

Funding

This work was part of the UK Natural Environment Research Council funded Seabed Mining And Resilience To EXperimental impact (SMARTEX) project (Grant Reference NE/T003537/1). DOBJ, ESL, NB, AMS, GBC, and AG also received support from TMC Inc. (The Metals Company) through its subsidiary Nauru Ocean Resources Inc.(NORI); this is contribution TMC/NORI/D/00X. SPR work was supported by funds from FCT/MCTES in the scope of the CEEC contract (CEECIND/00758/2017) and funds attributed to CESAM (UIDP/50017/2020, UIDB/50017/2020 and LA/P/0094/2020). Images from the BGR license area were made available by C. Rühlemann and A. Vink from the Federal Institute for Geosciences and Raw Materials (BGR) in Hannover. PMA and KU acknowledge EU JPIO-Oceans project Ecological Aspects of Deep-Sea Mining and MinigImpact-2 (German Ministry for Science and Education BMBF contract 03F0707E and 03F0812E.). The KODOS and APEI-9 datasets had been collected through environmental baseline studies for the polymetallic manganese nodules exploration contract of Republic of Korea (Ministry of Ocean and Fisheries' R&D #: 20160099). DC acknowledges funding from Mining2/0002/2017, Miniing2/0005/2017, granted by FCT/MCTES and DGPM and OP AZORES 2020 (01-0145-FEDER-000140 "MarAZ Researchers: Consolidate a body of researchers in Marine Sciences in the Azores" and funds attributed to Okeanos-UAç (UIDB/05634/2020, UIDP/05634/2020 and M1.1.A/REEQ.CIENTIFICOU I&D/2021/010).