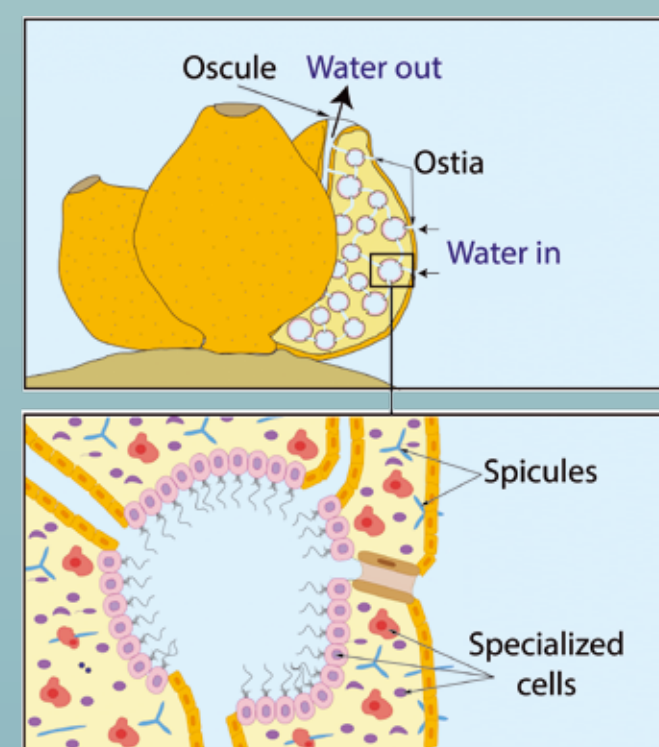


DEEP-SEA SPONGES OF THE MEDITERRANEAN SEA

SPONGES (PHYLUM PORIFERA)

Sponges are amongst the most ancient animals to have appeared in the world's oceans. Currently, more than 8 000 species are recognized but over 25 000 are estimated to exist. They are distributed at all depths and latitudes, and in some areas form highly structured habitats known as sponge grounds, aggregations, gardens or reefs, particularly so in the deep-sea. These habitats play key ecological roles such as: serving as shelter and nursery, and providing food for numerous other species of invertebrates and fish; mediating the transfer of energy between the benthic and pelagic systems; and participating in biogeochemical cycling processes. Unlike most other animals, sponges lack true tissues or organs. Instead, they have specialized cells carrying out specific functions and a body arranged around a canal system that filters water for food and oxygen.



The only exception are the carnivorous sponges (family Cladorhizidae) that feed directly on small crustaceans. The sponge skeleton is made up of mineral (siliceous or calcareous spicules) and/or organic (spongin, collagen) elements, although a few species lack a skeleton altogether. The surface of the sponge holds numerous inhalant and exhalant pores, known as ostia and oscules, through which the water enters and exits the sponge. Species identification is primarily based on the analyses of the skeleton, alongside with external characteristics. Sponges are divided into four classes, of which two, the Demospongiae and Hexactinellida, are the most common and important in the deep-sea.

SILICEOUS SPONGES – CLASS DEMOSPONGIAE

Demosponges, also known as siliceous sponges, represent the largest and most diverse class within Porifera, comprising 85%, more than 6 600, of all sponge species. Their shape and size range from thin crusts, to various sizes of globular, vase-, cushion-, tree-like and giant barrels more than 2 m high. Coloration, derived from pigments or symbiotic associates, covers a wide spectrum (from white to black) including yellow, orange, red, blue, green, purple, brown, etc. Consistency depends on the skeletal composition and varies between soft, compressible, elastic, to tough and rock hard. The surface texture varies from smooth, velvety to rugose, and hispid. Approximately 670 demosponge species are known to occur in the Mediterranean Sea.

Massive, hard sponges (*Geodia* spp.)

Massive sponges coming in a variety of shapes, from irregular to convoluted masses; younger specimens are usually (sub)spherical. Oscules are grouped together and located in depression areas located on the top surface of the sponge. Small inhalant pores (ostia) are also grouped together but found distributed across the overall surface. *G. barretti*, cream in colour, has an even and clean surface with a rubbery texture. *G. cydonium*, yellow in colour, has a hispid/harsh surface often covered with sediment. Both species have a tough but slightly compressible consistency.

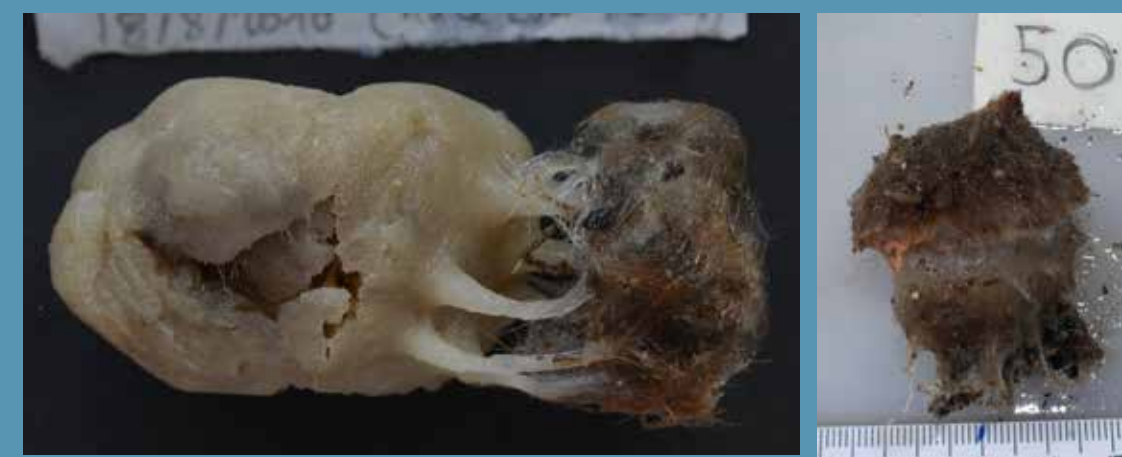


Geodia barretti *Geodia cydonium*

Size: up to 50 cm in diameter **Depth and substrate:** 300–2 000 m; mixed or rock

Globular sponges with rooting structures (*Thenea muricata*)

Globular to egg-shaped sponges with one or few apical oscules. They are characterized by a distinct groove around the mid-section of the body, where inhalant pores (ostia) are located, and root-like structures projecting from the base, by means of which they attach to soft substrate. Consistency is slightly compressible and texture is smooth. Colour is white to brownish/greyish.



Thenea muricata

Size: up to 5–6 cm in height/diameter **Depth and substrate:** 300–2 000 m; sand or mud

Lollipop sponges

Lollipop-shaped sponges with a large, circular (*Stylodordyla pellita*) to oval and apically compressed (*Rhizaxinella pyriferia*) "head" and a slender stalk. One oscule is visible at the top of the head. *S. pellita*, grey or cream in colour, has a smooth and flexible stalk, and is attached to hard substrates by means of a rounded disc while *R. pyriferia*, dull yellow, has an occasionally knobbed or branched rigid stalk, and lives in soft sediment thanks to a branching root-like structure.



Stylodordyla pellita *Rhizaxinella pyriferia*

Size: less than 15 cm in height **Depth and substrate:** 250–800 m; sand or rock

Stalked, fan-shaped sponges (*Phakellia* spp.)

Thin, cup- or fan-shaped sponges attached to the substrate by a fairly narrow stalk, with a smooth surface and small oscules on one side. Specimens of *Phakellia ventralum* are whitish beige and have thin and frayed edges with a characteristic pattern of vein-like lines fanning out. *Phakellia robusta* is rather similar but has a more ochre-yellow coloration, a thicker blade and more textured surface. They are both quite flexible.



Phakellia ventralum *Phakellia robusta*

Size: up to 30 cm in height/width **Depth and substrate:** 200–800 m; rock, gravel beds

Fan-shaped, white and orange sponges (*Pachastrella*, *Poecillastra*)

Laterally flat, massive sponges with a hard but friable consistency and a rather thick appearance. Surface more or less smooth with flat, visible oscules. *Pachastrella monilifera* is light coloured, whitish, more hispid and often partially covered by sediment. *Poecillastra compressa* is usually bright orange, although whitish specimens are known. It has larger oscules concentrated on one of the two sides. Occasionally cup-shaped.



Pachastrella monilifera *Poecillastra compressa*

Size: up to 20 cm wide **Depth and substrate:** 50–800 m; rock, coral rubble

Globular sponges with apical oscula (*Suberites* spp.)

Globular sponges with usually one large apical oscule. Some species (e.g. *S. ficus*) have a short and thick peduncle. Consistency is firm yet slightly compressible. The surface is even and velvety. Colour varying from yellow to orange, red and brown. *S. domuncula* frequently associated to hermit crabs shell.

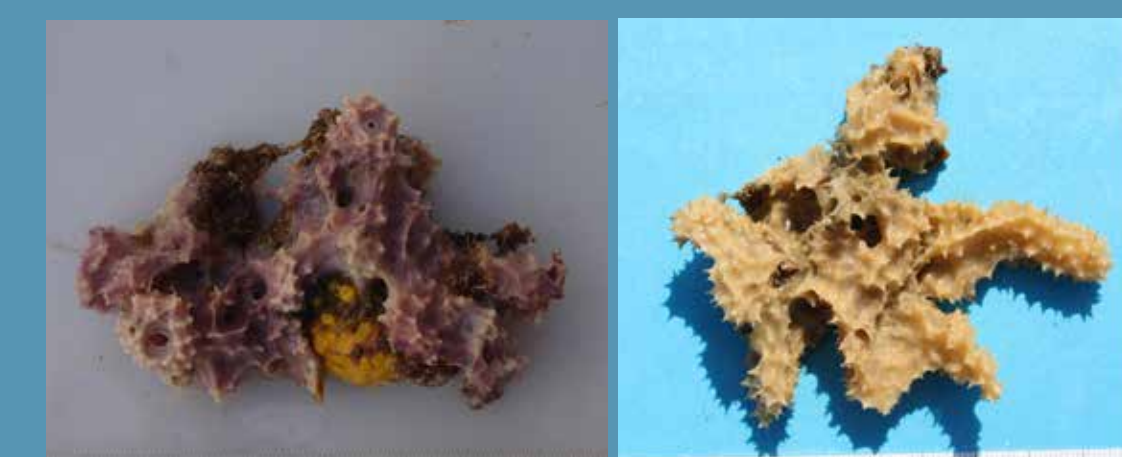


Suberites domuncula *S. ficus* *Suberites* sp.

Size: up to 10 cm in diameter **Depth and substrate:** 0–800 m; mixed; *S. domuncula* frequently associated to hermit crabs shell

Light coloured conulose sponges (*Dysidea* spp.)

Cushion-shaped, somewhat lobose, sponges. Oscules, variable in size (depending on the species), are usually scattered around the sponge. The surface is "spiky" (conulose) due to the lifting of the surface layer by spongin fibres. Consistency is elastic. Coloration whitish to yellowish but some species have a pink, violet or bluish tinge. The spikes are usually lighter in colour than the rest of the sponge.



Dysidea avara *Dysidea* sp.

Size: up to 20–30 cm across **Depth and substrate:** 0–300 m; rocky bottom

Mediterranean stony sponge (*Petrosia ficiformis*)

Massive lobose sponges with large sharp-edged oscules on the upper side. Consistency is hard but slightly compressible, crumbly inside. Texture is velvety. Outer coloration varies from dark red/burgundy (in shallower areas) to off-white (in deeper and darker areas) whereas inner coloration is always off-white.



Petrosia ficiformis (burgundy morph) *Petrosia ficiformis* (white morph)

Size: up to 50 cm across **Depth and substrate:** 0–800 m; rocky bottom

Massive, volcano-like sponges (*Haliclona magna*)

A massive, whitish sponge with large tubular or conical processes at times covered by sediment or by a cyanobacteria film giving it a purple-brownish coloration. Processes often with one or few major oscules reaching a large diameter. The rim of the oscules is thinner and somewhat transparent. Texture is smooth and consistency is soft turning brittle when dried.



Haliclona magna

Size: up to 40 cm in height **Depth and substrate:** 130–300 m; rock

Massive, tubular gold sponges (*Aplysina* spp.)

Massive sponges with a cushion-like base from which several finger-like tubes project. The tubes are somewhat flattened at the top and bear a single large oscule. Consistency is somewhat flexible and compressible. Texture is rubbery and slightly rugose. Colour is golden yellow when fresh, turning to greenish-blue black after a few minutes of exposure to air.



Aplysina cavernicola (freshly collected) *Aplysina aerophoba* (upon air exposure)

Size: up to 25 cm in height **Depth and substrate:** 0–300 m; rocky bottom

Arborescent yellowish sponges (*Antho dichotoma*)

Stalked arborescent sponge, dichotomously branched (i.e. each branch splits into two). The branches are flexible, much more so than the stalk. Oscules are not clearly visible. Consistency is firm and texture is finely hispid. Coloration is yellowish to light brown.



Antho dichotoma

Size: up to 30 cm in height **Depth and substrate:** 0–800 m; rocky bottom

Lamellate rock sponges (*Leioderma pfeifferae*)

Erect sponges with a lamellate shape, from irregular to convoluted masses. The convex (inhalant) side of the plate has many small evenly-distributed ostia, whereas the concave (exhalant) side has fewer larger elevated oscules. Consistency is rock-hard and texture is rough. Colour is off-white to light brown sometimes presenting a light blue tinge.



Leioderma pfeifferae

Size: up to 1 m across **Depth and substrate:** 300–2 000 m; mixed or rock

GLASS SPONGES – CLASS HEXACTINELLIDA

Hexactinellids, also known as glass sponges, constitute a predominantly deep-sea group, typically occurring at bathyal and abyssal depths (i.e. below 200 m). They are exclusively marine and comprise approximately 675 species worldwide, of which nine occur in the Mediterranean Sea. Their external morphology usually varies between vase, blade, cup or tube-shaped and both stalked and non-stalked forms exist. They attach to hard bottom using a basal disc or anchoring spicules, or to soft sediment by means of root-like structures. Coloration is mostly in shades of white, beige and yellow.

Birds' nest sponge (*Pheronema carpentieri*)

Globular to sub-cylindrical sponges possessing a wide and deep atrial cavity with a large apical oscule. The surface is "hairy" and shows an intricate network of spicules. Texture is fibrous and compressible. It is attached to the substrate by means of a basal tuft of spicules. Can be found in large numbers as the only species or alongside other sponge species, i.e. it forms sponge aggregations.



Pheronema carpentieri

Size: up to 20 cm in height **Depth and substrate:** 300–2 000 m; on soft or mixed substrate

Felt vase sponge (*Asconema setubalense*)

Vase sponge with a thin fibreglass-like wall, folding outwards at the top. Colour is off-white to grey or brownish with sediment. When collected by dredge/trawl, the appearance can be that of "felt" shreds. Can be found in large numbers, i.e. it forms sponge aggregations.



Asconema setubalense

Size: up to 1 m in height **Depth and substrate:** 300–2 000 m; on soft or mixed substrate

White bouquet sponge (*Farrea bowerbanki*)

Thin-walled reticulated tubes branching outwards from a basal attachment point to form a globular "bouquet". The tubes are open and increasingly wider and wavy at their extremity. Consistency is hard but fragile and texture is like fine sand paper. Coloration is crisp white.



Farrea bowerbanki

Size: up to 30 cm diameter **Depth and substrate:** 300–2 000 m; on rocky substrate

White funnel with finger-like projections (*Aphrocallistes beatrix*)

Funnel-shaped sponge with lateral finger-like projections often directed towards the base. The top of the sponge is covered with a rigid network-like plate. The surface has a very characteristic regular hexagonal honeycomb appearance. Consistency is hard but fragile and texture is like rough sand paper. Live coloration is bright white, whereas dead tissue appears brown.



Aphrocallistes beatrix (top view)

Aphrocallistes beatrix (lateral view)

Size: up to 20 cm in height **Depth and substrate:** 300–2 000 m; on hard substrate, often over corals or other sponge skeletons

SIMILAR LOOKING GROUPS (ALGAE, ANTHOZOANS, BRYOZOANS, ASCIDIANS)

Branched, arborescent and flexible sponges can be easily misidentified as gorgonian corals, but a close look will evidence the lack of polyps (one of the principal body form occurring in the group of corals and represented by a column with a crown of tentacles). Rock sponges are similar to scleractinian corals, whereas glass sponges with a rigid, reticulated and white skeleton can be mistaken for hard corals and bryozoans. Globular, rigid sponges can be misidentified as contracted solitary or colonial ascidians especially when oscules are still evident. Rigid sponges with a high density of spicules and cyanobacterial coverage can be mistaken for coralline algae.



Gorgonian

Gorgonian

Coralline algae

Coralline algae

Ascidian

Bryozoan

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