Keys to Marine Invertebrates of the Woods Hole Region
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PHYLUM PORIFERA

By Willard D. Hartman

There are about ten common sponges in the Woods Hole region. Some are identifiable on sight by form and color; others must be carefully examined before an identification is ventured. Miner's "Field Book" contains inaccuracies and is almost useless for identification of sponges. De Laubenfels (1949) has a selection on methods of handling and observing sponges. Hartman (1958) has given a systematic account of southern New England sponges together with notes on their natural history.

Some knowledge of the terminology of sponge spicules is neccessary if the taxonomic literature on the group is to be read. In the following glossary, terms commonly used are defined to aid those who may go further in this field, as well as to make clear certain expressions used in the key. Most of these terms are illustrated in Plate 1.

GLOSSARY OF SPONGE TERMINOLOGY

Acantho-: prefix meaning spined.
Aniso-: prefix meaning unequal.
Anisochela: a chela with unequal ends.
Chela: a microsclere type resembling a pair of anchor flukes or a shovel with a blade at each end, the ends bent toward each other.
Isochela: a chela with equal ends.
Megascleres: the larger spicule types, comprising the major structural elements of a sponge skeleton.
Microscleres: relatively very small spicules of various form, characteristic of certain sponges.
Monaxon: an unbranched spicule.
Oxea: a monaxon spicule (megasclere) pointed at both ends, often slightly curved.
Sigma: a microsclere of C- or S- shape.
Spiraster: angulate rod-shaped microscleres provided with spines which may be aligned in a spiral course around the rod.
Spongin: proteinaceous horny skeletal material, either alone (as in bath sponges), or binding siliceous spicules together (as in Haliclona or Microciona).
Style: a monaxon spicule with one end pointed, other end blunt.
Subtylostyle: a monaxon spicule with one end pointed and the other with an indistinct swelling or knob (halfway between tylostyle and style).
Toxon: a bow-shaped microsclere (pl. toxa).
Triaene a spicule with 4 rays, one of which is much longer than the other 3 (known as clads). Anatriaenes have the clads directed backward; protriaenes have the clads directed forward.
Tylo: a prefix meaning a rounded or ball-shaped structure.
Tylote: a monaxon spicule with rounded knobs on both ends (e.g., in Lissodendoryx)
Tylostyle: a style with the blunt end in form of a little swelling or knob (e.g. in Cliona).

A Note on Microtechnique

Detailed studies of sponge anatomy may require the preparation of microscopic sections. For gross preservation 95% alcohol or neutralized formalin followed by 75% alcohol can be used. Neutral formalin is best prepared by adding hexamethylenetetramine (= hexamine) to commercial formalin (37 to 40% formaldehyde) in the proportion of one pound of hexamine to one gallon of formalin. This stock solution is then diluted with water (9 parts water; 1 part neutral formalin) to give 10% formalin or 4% formaldehyde. Formalin that has not been neutralized, or that has been neutralized with borax, should be avoided for preserving sponges since both may cause maceration. When formalin neutralized with hexamine is used, the sponges should be transferred to 75% alcohol after a few days. Fixation of small pieces of each species in standard histological fixatives

is desirable, as often histological work must follow. Thin, free-hand sections are readily made with a razor blade if the specimen has been hardened in alcohol. Sections perpendicular to the surface of the colony as well as tangential sections are useful. Such sections can be directly dehydrated, cleared in xylol, and mounted in piccolyte or damar or they can be stained with a saturated solution of basic fuchsin of safranin in 95% alcohol before clearing and mounting. In studying sections, the various types of spicules can be observed as well as their arrangement in the skeleton. Other structures to look for are a cortex, often packed with spicules of one category, subdermal spaces, tracts of spicules, and spongin fibers with or without enclosed spicules. In some cases the shapes and dimensions of the flagellated chambers are important.

In sections, certain spicule categories may be overlooked, and it is usually desirable to make slides which have been freed from the cellular elements of the colony. This can be done by treating a small part of the specimen with sodium hypochlorite (clorox will serve) until the spicules are free. For temporary mounts a piece of the sponge can be placed on a microscope slide with a drop or two of clorox. After disintegration of the cells a cover slip is added and the spicules are ready for examination. If permanent mounts are desired, a piece of sponge can be placed in a centrifuge tube along with a small amount of clorox. After disintegration of the cells, the sample is then washed several times with water, centrifuging between washings to make certain that the minute microscleres have settled. Finally the water can be replaced by 95% alcohol, and the suspension of the spicules poured onto a slide and allowed to dry on a warming plate (or the alcohol can be ignited). A drop of xylene is added to the dry preparation, followed by piccolyte or damar and a cover slip. A slide of clean spicules is now available for study and measurement of spicule types.

KEY TO COMMON SPONGES

(Figure references are to Plate 1)

1. Structure of sponge simple; tubular to urn-shaped; pale tan to whitish; spicules calcareous (test with 10% acetic acid under coverslip) 2
1. Structure massive, fleshy, or spongy; encrusting or branching; color various; spicules siliceous 3

2. Sponges in form of branching, cylindrical, pale tubes (fig. 1) . . . . . *Leucosolenia* sp.
2. Sponges in form of little urns or vases, usually clustered, with fringe of spicules around the terminal osculum (fig. 2) . . . . . *Scypha* sp.

3. Sponges obviously boring into and sometimes overgrowing shells and other calcareous material; color brilliant sulfur-yellow to pale yellow . . . . . *Cliona* 4
3. Sponges not boring; form and color various 7

4. Sponge brilliant sulfur-yellow, boring into calcareous substrate or massive and free-living; external perforations in substrate large (incurrent, 0.8-2.5 mm across; excurrent, 2.0-4.5 mm across); tylostyles only (fig. 3) . . . . . *Cliona celata*
4. Sponge light or pale yellow, always boring into calcareous substrate; external perforations small (incurrent, 0.2-0.5 mm across; excurrent, 0.6-1.6 mm across); microscleres present in addition to tylostyles 5

5. Spirasters only as microscleres (fig. 4) . . . . . *Cliona lobata*
5. Spined or smooth oxeas present as well as spirasters 6

6. Spirasters usually angulate and larger (6-23μ x 1,0-3.8μ) (fig. 5); external perforations in substrate often arranged in circular patterns . . . . . Cliona vastifica
6. Spirasters less distinctly angulate and smaller (6-15μ x 0.5-3.2μ); tends to occur in brackish water . . . . . Cliona truitti

7. Megascleres oxeas only 8
7. Megascleres other than oxeas 12

8. Megascleres smaller (<200μ in length) and conspicuously joined together by more or less spongin to form a network or a system of tracts (fig. 6); dermal skeleton absent . . . . . Haliclona 9
8. Megascleres larger (mean length>200μ), arranged in loose tracts with little spongin or occurring at random; distinct dermal skeleton present (figs. 9, 10) . . . . . Halichondria 11

9. Form branching into rounded or flattened fingers arising from a narrow stalk; oscules distributed along sides of branches; color yellowish to tan, often tinged with violet . . . . . Haliclona oculata
9. Form encrusting, often with low tubules arising from a basal encrusting mass 10

10. Sponge a flat encrustation; oscules not raised on tubules; excurrent channels converge on oscules to provide conspicuous stellate patterns beneath surface; gemmules absent; color light buff or tan to brown or gold . . . . . Haliclona canaliculata
10. Sponge an encrustation from which arise numerous low tubules often bearing terminal oscules, consistency very soft; white gemmules form at base of sponge in late summer; color dark tan to gold, often tinged with pink or lavender (figs. 6-8) . . . . . Haliclona loosanoffi

11. Sponge encrusting and provided with numerous, low, upright tubules each terminating in an oscule; dermal skeleton tends to be a regular network of multispicular tracts (fig. 9); color orange-yellow to greenish . . . . . Halichondria panicea
11. Sponge encrusting to massive, usually provided with upright tubules which may bear terminal oscules; some colonies consist of masses of anastomosing branches; dermal skeleton tends to consist of a less regular network of multispicular tracts with larger meshes (fig. 10); color orange-brown to yellow-beige to olive-green . . . . . Halichondria bowerbanki

12. Color bright red to orange-brown; sponge encrusting to complexly branched; spicules include styles to subtylostyles with spined or smooth heads, short acanthostyles, toxa, and isochelas (fig. 11) . . . . . Microciona prolifera
12. Color never bright red; spiculation otherwise 13

13. Megascleres are tylostyles 14
13. Megascleres are otherwise 16

14. Microscleres absent; sponge a thin encrustation on rocks and algae; basal layer of tylostyles arranged with heads against substrate; color orange-brown, hazel, or olive-brown . . . . . Prosuberites epiphytum
14. Microscleres present 15

Plate 1

PORIFERA

Figs. 1,2,3,8 by Bruce Shearer; rest redrawn by Mrs. Emily Reid after Hartman (H); fig. 13 after Wilson. Scales as indicated on plate.

Fig. 1. Leucosolenia sp., fragment of a colony.

2. Scypha sp., three individuals.

3. Cliona celata, colony overgrowing a Mercenaria shell.

4. Cliona lobata: A. Tylostyles, B. Spirasters with spines (H).

5. Cliona vastifica: A. Tylostyles, B. Smooth and microspined oxeas, C. Spirasters and a microspined style.

6. Haliclona loosanoffi, spicule tracts joined by spongin (H).

7. Haliclona loosanoffi, spicules: oxeas, styles, strongyles (H).

8. Haliclona loosanoffi, specimen growing on shell of living Mytilus.

9. Halichondria panicea, dermis, with spicules and pores (H).

10. Halichondria bowerbanki, dermis, with spicules and pores (H).

11. Microciona prolifera: A. Megascleres, B. Toxa, C. Isochelas (H).

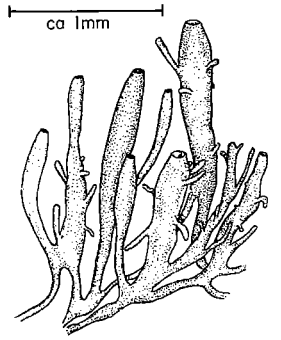
12. Suberites ficus: A. Styles and tylostyles, B. Microscleres (H).

13. Mycale fibrexilis: A. Megascleres tylostyles, B. Microscleres: sigmas, and anisochelas (after Wilson).

14. Lissodendoryx isodictyalis: A. Megascleres: styles and tylates, B. Microscleres: sigmas, C. Microscleres: isochelas (H).

15. Isodictya deichmannae: A. Megascleres: styles, strongyle, centrotylote oxea, B. Microscleres: Isochelas (H).

Plate I



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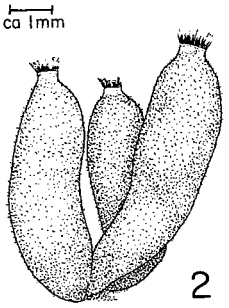

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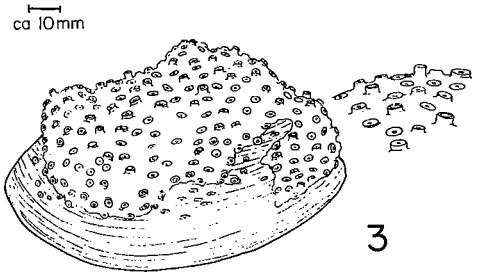

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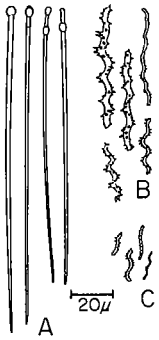

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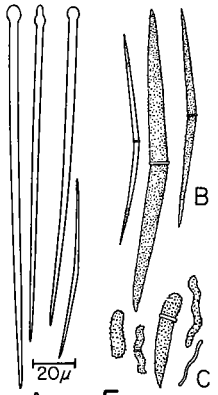

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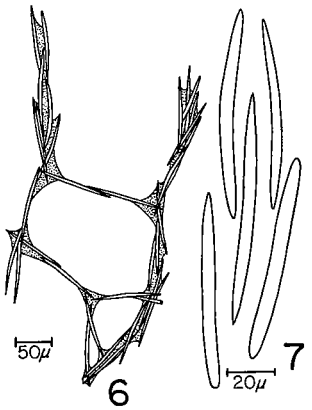

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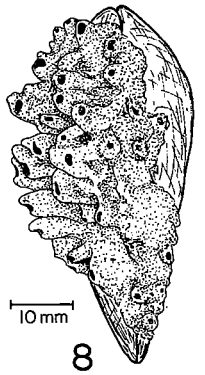

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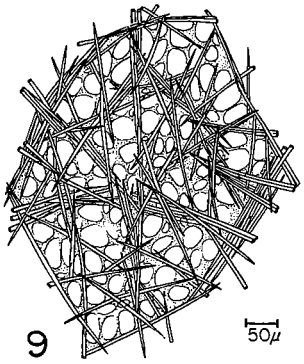

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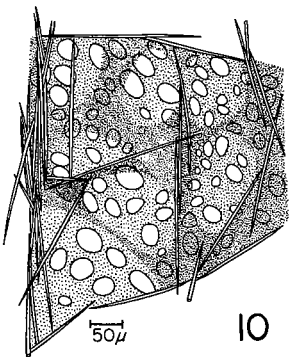

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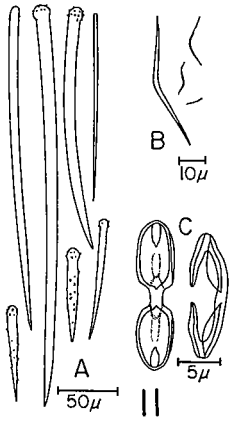

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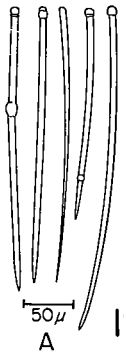

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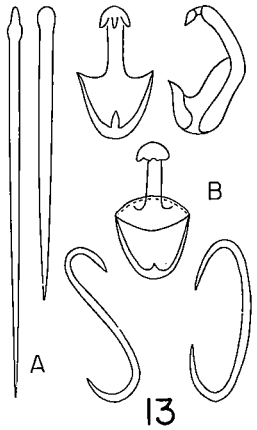

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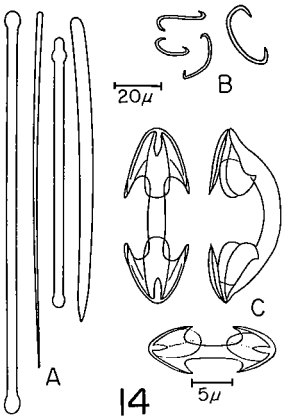

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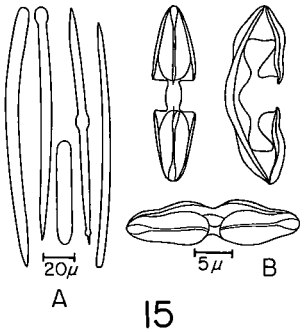

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15. Sponge massive, lamellate or lobate; microscleres small, rod shaped, with central swelling, spined or smooth, abundant near surface (fig. 12); color yellow to yellowish-gray . . . . . Suberites ficus
15. Sponge encrusting to massive; microscleres include sigmas, toxa, and anisochelas (fig. 13); color yellow-ochre, hazel-brown, olive-brown ranging to gray-tan, olive-gray to slate-gray . . . . . Mycale fibrexilis

16. Megascleres are long oxeas and triaenes; microscleres are microspined sigmaspires; sponge biscuit shaped with terminal osculum and flattened base made up of matted oxeas and anatriaenes . . . . . Craniella gravida
16. Styloid megascleres present 17

17. Sponge encrusting to massive; color buff to olive-tan to gray-brown, slate gray, or bluish-gray; dermal tylotes present; microscleres are sigmas and isochelas (fig. 14) . . . . . Lissodendoryx isodictyalis
17. Sponge with upright flattened branches; oscules distributed along sides of branches; skeleton a reticulation of tracts of styles; microscleres are isochelas only (fig. 15) . . . . . Isodictya deichmannae

ANNOTATED LIST OF SPONGES OF THE WOODS HOLE REGION

Class Calcarea

Leucosolenia sp. An "asconoid" calcareous sponge, especially valuable in the laboratory. The specific identity of the common Leucosolenia at Woods Hole is at present uncertain.

Scypha sp. A "syconoid" calcareous sponge. Although often called (and sold as) "Grantia", it does not have the distinct dermal cortex and incurrent canals of Grantia. The Woods Hole species is not referable to the species lingua described by Haeckel (1872) from Newfoundland and needs a new name. Scypha is a prior name for Sycon, which is still used by many zoologists.

Class Demospongiae

Order Haplosclerida

Haliclona canaliculata Hartman, 1958. Not yet recorded from the Woods Hole region but to be expected as an encrustation on the lower surface of rocks.

Haliclona loosanoffi Hartman, 1958. Collected in run-out channel under bridge at Barnstable Harbor; records from Nonamesset Island and New Bedford area in the Gray Museum.

Haliclona oculata (Linnaeus, 1759). (= Chalina oculata of past authors). Seldom found intertidally; common in offshore waters.

Order Poecilosclerida

Isodictya deichmannae (de Laubenfels, 1949). (= Neosperiopsis deichmannae de L.) An offshore species.

Lissodendoryx isodictyalis (Carter, 1882). Fairly common, but in field may be confused with Halichondria. Excellent for demonstration of microscleres.

Microciona prolifera (Ellis and Solander, 1786). Common and easily recognized by color; assumes branching form in subtidal waters. Extends into somewhat brackish lagoons.

Mycale fibrexilis (Wilson, 1891). (= Esperella fibrexilis Wilson, 1891; = Carmia fibrexilis, de Laubenfels, 1949). Common on wharf pilings in the Woods Hole region; often as a thin encrustation that might be confused with Lissodendoryx; sometimes massive.

Order Halichondrida

Halichondria bowerbanki Burton, 1930. The common Halichondria in the Woods Hole region. Extends into brackish lagoons.

Halichondria panicea (Pallas, 1766). Probably occurs at Woods Hole but difficult to distinguish from the previous species. Common north of Cape Cod. (See discussion in Hartman, 1958).

Order Hadromerida

Cliona celata Grant, 1826. A common boring sponge which assumes a massive, free-living condition as it grows older. Easily distinguished from other local clionids by the large size of the openings in the calcareous substrate excavated for the incurrent and excurrent papillae.

Cliona lobata Hancock, 1849. Of common occurrence on oyster shells and other calcareous materials.

Cliona truitti Old, 1941. Not recorded as yet from Woods Hole, but may occur in brackish waters.

Cliona vastifica Hancock, 1849. Of common occurrence on oyster shells and other calcareous materials.

Prosuberites epiphytum (Lamarck, 1816). Not yet recorded from Woods Hole, but is to be expected as a thin encrustation on the lower surfaces of rocks.

Suberites ficus (Johnston, 1842). A common subtidal species.

Order Choristida

Craniella gravida (Hyatt, 1877). Reported common on mud bottoms in deeper waters of Buzzards Bay. De Laubenfels' synonymy (1949) of this species with the deep-water North Atlantic C. crania is in error.

REFERENCES IMPORTANT IN IDENTIFICATION OF WOODS HOLE SPONGES

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