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DESCRIPTIONS OF SPECIES OF THE HAPLOSCLERIDA (PORIFERA: DEMOSPONGIAE) OCCURRING IN TROPICAL WATERS OF THE GREAT BARRIER REEF.

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ABSTRACT

The taxonomic study reported in this paper concerns tropical Australian marine sponges assigned to the order Haplosclerida. Morphological characters of species from three families are described: the Chalinidae (*Haliclona amboinensis* (Lévi), *H. cymiformis* (Esper), and *Cladocroce aculeata* Pulitzer-Finali), Niphatidae (*Niphates nitida* n. sp., *Amphimedon paraviridis* n. sp., *A. lamellata* n. sp., *A. terpenensis* n. sp., *A. sulcata* n. sp., *Gelliodes fibulata* (Carter), *Aka mucosa* (Bergquist), and *A. paratypica* n. sp.) and Callyspongiidae (*Callyspongia muricina* (Lamarck), *C. aerizusa* Desqueyroux-Faundez, and *C. pseudoreticulata* Desqueyroux-Faundez). Of the fourteen species studied, six are described as new to science, and four are new species records for the region. Taxonomic problems addressed in this study include the difficulty with the ordinal and family location of the group of coral-boring sponges comprising the genus *Aka* de Laubenfels, 1936, and the few character states found to distinguish the closely related genera *Niphates* Duchassaing and Michelotti, 1864, and *Amphimedon* Duchassaing and Michelotti, 1864. The diagnoses of the genera *Haliclona* Grant, 1835, and *Callyspongia* Duchassaing and Michelotti, 1864, are modified as a result of a review of the literature and additional features recognised in this study.

KEYWORDS: Porifera, Demospongiae, Haplosclerida, Chalinidae, Niphatidae, Callyspongiidae, *Haliclona, Cladocroce, Niphates, Amphimedon, Aka, Gelliodes, Callyspongia,* Great Barrier Reef, taxonomy, new species.

INTRODUCTION

This is the second of a series of reports on the taxonomy of tropical Australian Haplosclerida and Petrosida (see Fromont 1991). In the previous paper an historical background to the separation of these two orders is provided, and Petrosida species from the Great Barrier Reef are described. Some authors (Wiedenmayer 1977, 1989, van Soest 1980, de Weerdt 1985, 1986) do not recognise the order Petrosida and retain species assigned to the Petrosida within the order Haplosclerida. In this study, on species of the order Haplosclerida, the basis of the classification used is that of van Soest (1980), but excludes the two families Oceanapiidae and Petrosiidae, which are discussed in more detail in the earlier paper (Fromont 1991).

The families included here in the Haplosclerida, Chalinidae, Niphatidae, and Callyspongiidae can be broadly defined using the following skeletal characters: gross architecture, spicule to spongin fibre ratio, regional differentiation of the skeleton, and type and size of spicules. The Chalinidae have simple reticulate skeletons, usually isodictyal, as well as a simple ectosomal skeleton which may or may not be present, and megascleres of one type and size. The Niphatidae includes species with robust fibre and spicule tracts, the presence of an ectosomal skeleton, and one type and size of megasclere. The Callyspongiidae have a less

developed mineral skeleton, small or vestigial spicules, and an enhanced organic fibre skeleton which may vary structurally between surface and internal regions of the sponges.

A number of problems are addressed in this study, including, on the basis of skeletal morphology, the ordinal and family placement of the genus *Aka*. This genus has been associated with genera from the order Haplosclerida, such as *Adocia* Gray, 1867, and with genera from the order Petrosida, for example *Oceanapia* Norman, 1869. Bergquist (1965) assigned *Siphonodictyon* Bergquist, 1965 (= *Aka*) to the Adociidae, but reported that it had similarites to *Phloeodictyon* Carter, 1882 (= *Oceanapia*). It also had features that clearly separated it from *Oceanapia* such as: lacking a bark-like dermal region and spongin development, producing mucus, a cryptic habit, and brushes of oxea in the dermal skeleton (Bergquist 1965). Wiedenmayer (1977) placed *Siphonodictyon* and *Oceanapia* in the family Nepheliospongiidae (= Petrosiidae and Oceanapiidae, order Petrosida), agreeing with Bergquist (1965) that the genera are closely related. Hartman (1982), Rützler and Stone (1986), and van Soest (*in litt.*) follow Wiedenmayer and assign both genera to the family Oceanapiidae. *Aka* was placed in the Niphatidae by van Soest (1980), Pulitzer Finali (1986), Kelly Borges and Bergquist (1988), and these authors are followed in this study.

Comparison of species from different genera, with similarities in gross morphological and/or skeletal features, such as *Amphimedon lamellata* n. sp. with *Haliclona simulans* (Johnston, 1842) and *Reniera* sp. Ridley, 1884, and *Niphates nitida* n. sp. with *Gelliodes carnosa* Dendy, 1889, and *Adocia pumila* Lendenfeld, 1887, highlight the difficulty of generic allocation, and the lack of clear familial boundaries, that can occur within the Haplosclerida.

The genera *Niphates* and *Amphimedon* have primarily been distinguished by their surface skeleton. Van Soest (1980) found that species of *Niphates* contain a paratangential ectosomal reticulation obscured by protruding tufts of the choanosomal primary tracts, while *Amphimedon* has relatively inconspicuous choanosomal primary fibres. In this paper these surface features are discussed, and additional character states are examined, to attempt to distinguish between these closely related genera.

Amended diagnoses of each family and genus represented in the study are given, and species descriptions are followed by discussion of closely related species. A glossary of terms is appended.

MATERIALS AND METHODS

Sponges were collected using SCUBA at various localities on the Great Barrier Reef, Queensland; they were photographed *in situ*, and preserved in 70% ethanol.

Skeletal architecture and spicule morphology were examined using light microscopy. Spicules were prepared by boiling small pieces of sponge, including the ectosome and choanosome, in concentrated nitric acid. This solution was centrifuged consecutively through two changes each of distilled water and absolute alcohol. The resultant spicule extract was dried on a glass slide and mounted in a polystyrene based mounting medium (DePeX, Gurr Products).

The skeleton was prepared by cutting a representative piece of sponge tissue at right angles to the surface of the sponge. This sponge fragment was dehydrated in ethanol, cleared in toluene, and infiltrated in paraffin wax at 56°C using an automatic tissue processor on a 9 hour cycle. The fragment was further infiltrated with paraffin under a vacuum of 635 mm Hg for 30 minutes prior to being embedded in paraffin wax. The paraffin blocks were sectioned at 100 μm thickness with a Leitz base-sledge microtome, and rolling of the sections was eliminated by placing filter paper, moistened with distilled water, on top of the block. Sections were placed on a glass slide smeared with egg albumin for adhesion, dried overnight at 60°C and decerated in two changes of xylene. The sections were mounted in either a low viscosity epoxy resin (Spurr's) polymerised overnight at 60°C, or more conveniently in DePeX and dried for 48 hours at 40°C. Liberal quantities of DePeX were required to prevent formation of air bubbles in the sections. Sections of the surface skeleton were prepared in the same manner, but cut parallel to the surface.

Illustrations of spicules and skeletons were prepared using an Olympus CH-2 microscope equipped with drawing apparatus. A calibrated micrometer eyepiece was used to measure skeletal details and spicule sizes. Photographs of these structures were taken with an Olympus BHS microscope and an automatic camera system.

The species descriptions presented here emphasize morphological characters that can be

recognised in the field. Wherever possible, the descriptions include the morphological variability that was observed within each species. The taxonomic characters reported are organisation of the skeleton, spicule morphologies and sizes, growth form of the sponges, their colour, texture, and surface appearance, habitat in which they were found, and distributions.

Primary importance is given to organisation and regional differentiation of the skeleton, spicule to spongin fibre ratio, and type and size of spicules. The type and size of spicules may help to describe a species, but only if the extent of variability of these characters is reported. Consequently, these characters were examined from as many specimens, from as many sites, as possible. Thin forms of the principal spicules were found in many of the sponges investigated, and these were considered to be developmental stages of the principal forms. In sponges where juvenile spicules were common they were treated as a separate category, to ensure that the mean size and range of the principal spicules were not skewed by the addition of measurements of less abundant thin forms. Microscleres were used as a character at the species level only; because of their uncommon occurrence they were not used to define generic and family levels.

Sponge growth form and colour, most useful for field identification, are difficult to document objectively. Therefore, colour photographs of all new species described here are provided in addition to the written descriptions. Some species were found to have wide variation in overall growth form, colour, and consistency. However, these species can be recognised easily when their taxonomic descriptions include the extent of variation in these characters. Pigmentation is known to vary with microhabitat and depth for some species, but the colour range of a haplosclerid species is often characteristic, and can be a useful guide for field identification (Bergquist and Warne 1980). Texture and consistency of sponges can be used for family allocation (Bergquist and Warne 1980) and, in many cases, are also species specific (de Weerdt 1985). These textural features are manifestations of the architectural components of the underlying skeleton. They may vary for a species over a large geographic range, but usually these features are recognisable for a particular species.

Habitat descriptions and species distributions are included. Some species were found to be restricted to specific environments, whereas others had large geographic ranges and occurred in many different habitats. The habitat where each species was found is described in general terms, such as fringing reef or reef front, and information on depth and substrate type is provided.

Type material and voucher specimens are lodged in the Museum of Tropical Queensland (MTQ), Townsville (registration prefix QM). Other abbreviations used in the text: BMNH, the Natural History Museum, London; JF, authors collection, MHNG, Muséum D'Histoire Naturelle de Genève; USNM, United States National Museum, Smithsonian Institution, Washington, D.C.; MSNG, Museum of Natural History, Genoa; MNHP, Muséum National d'Histoire Naturelle, Paris; NCI, National Cancer Institute.

SYSTEMATICS

Order Haplosclerida Topsent

Haplosclerida Topsent, 1928:66.

Diagnosis. Demospongiae with reticulate skeleton of primary tracts regularly connected by secondary tracts. Both tracts composed of spicules, spicule and fibre, or fibre. Skeletal pattern characteristically isodictyal or rectangular. Megasclere complement of one type: diactinal, usually oxeas. Microscleres, if present, sigmas and/or toxas. No regional size differentiation of spicules.

Family Chalinidae Gray

Chalinidae Gray, 1867:503; de Weerdt 1986:49.

Haliclonidae de Laubenfels, 1932:111; Griessinger 1971:121; Wiedenmayer 1977:79; Bergquist 1978:173; Bergquist and Warne 1980:12; van Soest 1980:6.

Adociidae de Laubenfels, 1936:65; Wiedenmayer 1977:110; Bergquist 1978:173; Bergquist and Warne 1980:19.

Renieridae Ridley, 1884:406; Griessinger 1971:118; Lévi 1973:618; van Soest 1980:6.

Diagnosis. (Modified after de Weerdt, 1986). Haplosclerida with delicate skeletal organisation, either a simple unispicular reticulation with spongin cementing the ends of spicules, or a network of fibres in which spicules are incorporated. Primary tracts may be multispicular and

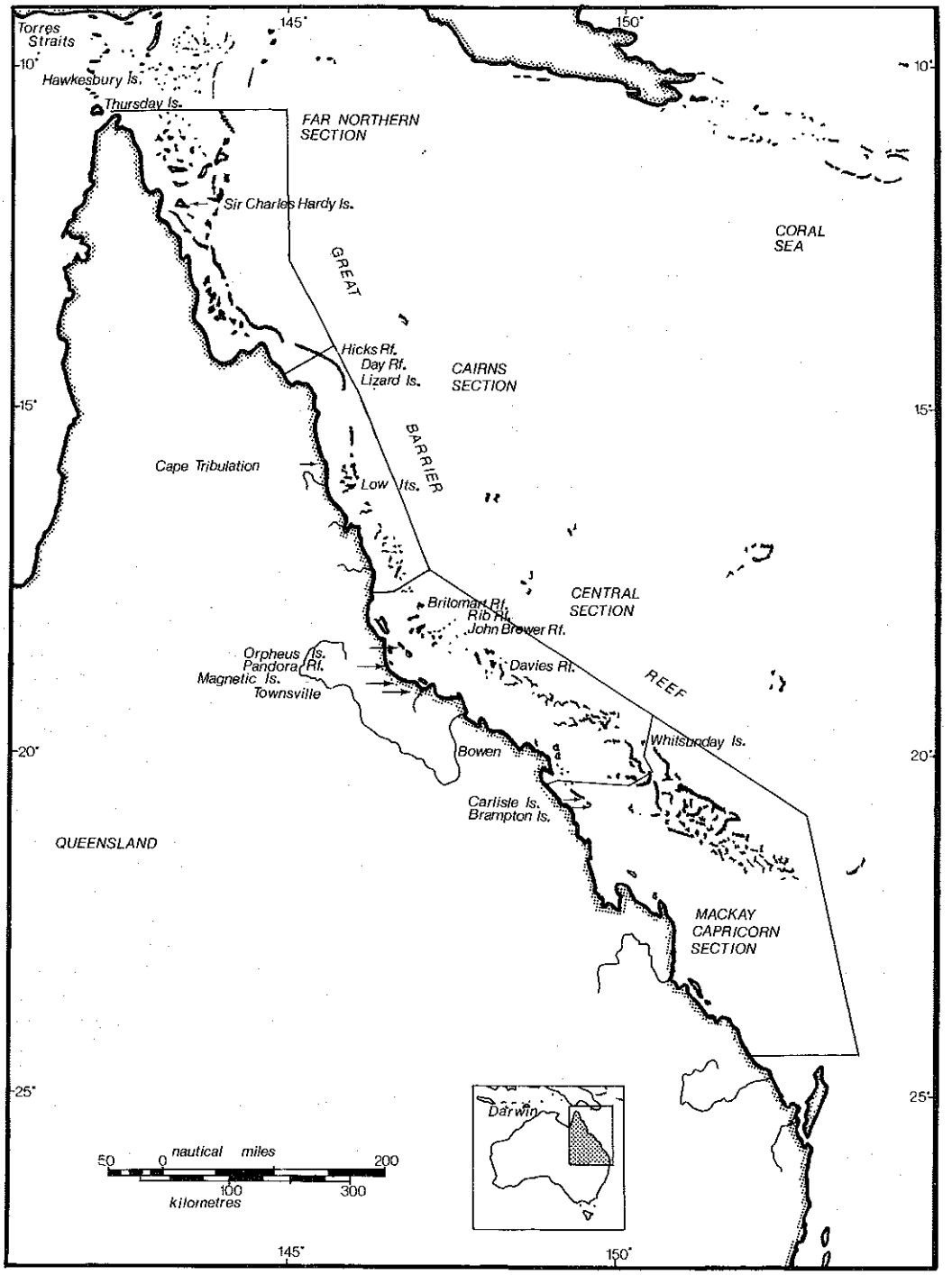

Fig. 1. Locality map of the Great Barrier Reef, Queensland, showing where sponges were collected for this study.

emphasised but reticulation of primary and secondary tracts never strongly developed or densely packed with spicules. Ectosomal skeleton, if present, a unispicular tangential reticulation. Megascleres usually oxeas, microscleres sigmas and/or toxas.

Remarks. The family name Chalinidae was resurrected by de Weerdt (1986) who found that

it was the oldest available family name for the group of sponges previously termed the Haliclonidae.

With the inclusion of the families Adociidae and Renieridae within the Chalinidae, many nominal genera, previously placed in the former families, are now located in the Chalinidae. Genera recognised by ectosomal features, such as *Adocia* Gray 1867 and *Reniera* Nardo, 1833, or by microsclere complement, such as *Sigmadocia* de Laubenfels, 1936 (with sigmas), *Toxadocia* de Laubenfels, 1936 (with toxa), and *Orina* Gray, 1867 (with sigmas and toxas), are not recognised by de Weerdt (1986). De Weerdt acknowledges only three valid genera, *Haliclona* Grant, 1835, *Acervochalina* Ridley, 1884, and *Dendroxea* Griessinger, 1971. In this study the genus *Cladocroce* Topsent, 1892, is retained in the Chalinidae because of distinctive skeletal features not found in other genera of this family.

Gray's (1867) definition of the family Chalinidae - "skeleton formed of regular, reticulated, anastomosing, horny fibres, which have one or more series of regular small siliceous spicules in the central lines"- was expanded by de Weerdt (1986) to include a description of the ectosomal skeleton, if present, as a unispicular tangential reticulation. In this study, the diagnosis of the Chalinidae includes the degree of fibre development mentioned by Gray, as well as fibre development that does not encase the spicules, but may cement the spicules only at the nodes of the reticulation.

Within this group of sponges, the design of the ectosomal skeleton is an important character as some authors previously used this character to classify sponges at the family level. Two closely related families were recognised, the Haliclonidae and the Adociidae (Wiedenmayer 1977; Bergquist and Warne 1980). Species of the Adociidae had an ectosomal skeleton that was clearly distinct from the choanosomal skeleton, whereas species of the Haliclonidae lacked a special ectosomal skeleton. Species belonging to the type genus *Adocia* contained extensive subectosomal spaces allowing the ectosomal skeleton to be easily detached (Wiedenmayer 1977; Bergquist and Warne 1980). However, Wiedenmayer (1977) maintained reservations about the usefulness of two families, when the design and amount of ectosomal specialisation were known to intergrade in some species from both families. This reservation was upheld by van Soest (1980) and Hartman (1982), who recognised only one family (Haliclonidae), and in this study.

De Weerdt (1986) examined material of *Adocia simulans* (Johnston, 1842) including one specimen (BMNH 1932.1.5.2a) designated the type species of the genus *Adocia* by Burton (1934:534). De Weerdt (1986) redescribed this species as *Haliclona simulans*. In this situation, the genus *Adocia* is a junior synonym of *Haliclona* and the family name Adociidae is consequently a junior synonym of the Chalinidae.

Genus *Haliclona* Grant, 1835

Haliclona Grant, 1835:6.

Chalina Grant, 1861:76.

(For further details of synonymy see Wiedenmayer 1977:80).

Type species. *Spongia oculata* Linnaeus, 1767, by monotypy, type locality, United Kingdom.

Diagnosis. (Modified after Bergquist and Warne, 1980). Sponges with unispicular, spongin-reinforced or spicule reinforced skeletal networks. Ectosomal skeleton, when occurring, a tangential unispicular reticulation. Megascleres usually oxeas, microscleres, if present, sigmas or toxas.

Remarks. *Haliclona amboinensis* Lévi and *H. cymiformis* (Esper) are here transferred to the genus *Haliclona*. Both species have sigmas, and an ectosomal skeleton which is an extension of the choanosomal skeleton and not distinct from it. These characters, previously used to distinguish the genus *Sigmadocia* de Laubenfels, 1936, are now included in the generic diagnosis of *Haliclona*, because of the variability in occurrence of these characters throughout the order Haplosclerida. In addition, the choanosomal skeletons of these species are isodictyal or rectangular, may be irregular, and do not differ from skeletons found in species of *Haliclona*. The genus *Sigmadocia* was previously referred to the nominal family Adociidae.

Haliclona amboinensis (Lévi) comb. nov.

(Figs 1-2)

Gellius couchi - Topsent, 1897:471 (Ambon Is., Indonesia).

Gellius amboinensis Lévi, 1961:143 (Vietnam); Desqueyroux-Faundez 1981:49, fig. 66 (Ambon Is., Indonesia).

Sigmadocia amboinensis - Kelly Borges and Bergquist 1988:146, pl. 5e (Motupore Is., Papua New Guinea).

Type material. Whereabouts unknown, type locality, Nha Trang, Vietnam, intertidal (Wiedenmayer, Hooper, and Racek, in press).

Material. QM G25024: Geoffrey Bay, Magnetic Island, Great Barrier Reef, 19°09'S 146°52'E, 22 April 1986, depth 7 m, coll. J. Fromont, SCUBA; JF1, Geoffrey Bay, Magnetic Island, Great Barrier Reef, 19°09'S 146°52'E, 19 September 1986, depth 5 m, coll. J. Fromont, SCUBA.

Distribution. Occurs in intertidal areas and reef flats around Magnetic Island (Fig. 1).

Habitat. Grows on rock or dead coral in cracks, crevices and beneath small boulders covered in the macroalga *Sargassum*. Occurs sympatrically with *Niphates nitida* n. sp. As mentioned by Kelly Borges and Bergquist (1988), some specimens grow over *Psammaplysilla purpurea* Carter, 1880, a thin, slippery, brilliant yellow encrusting sponge that turns dark purple in alcohol, often staining *H. amboinensis*.

Description. Encrusting species, spread in solid ramose branches (refer to Kelly Borges and Bergquist 1988; pl. 5e), or thick mats. Oscules raised on small nodes or ridges on upper surface.

Colour. Ice blue to sky blue, fawn internally, fawn in alcohol with purple blotches if stained by *P. purpurea*.

Texture. Firm, incompressible, brittle, easily broken into chunks.

Surface. Microscopically hispid, rough to touch. Reflects light, indicating some ectosomal skeletal organisation. Oscules, up to 3 mm across, have membranous layer internally.

Skeleton. Regular to confused isodictyal reticulation with 6-10 spicules coaxially in centre of sponge. Towards extremities, the number of spicules decreases to a unispicular reticulation

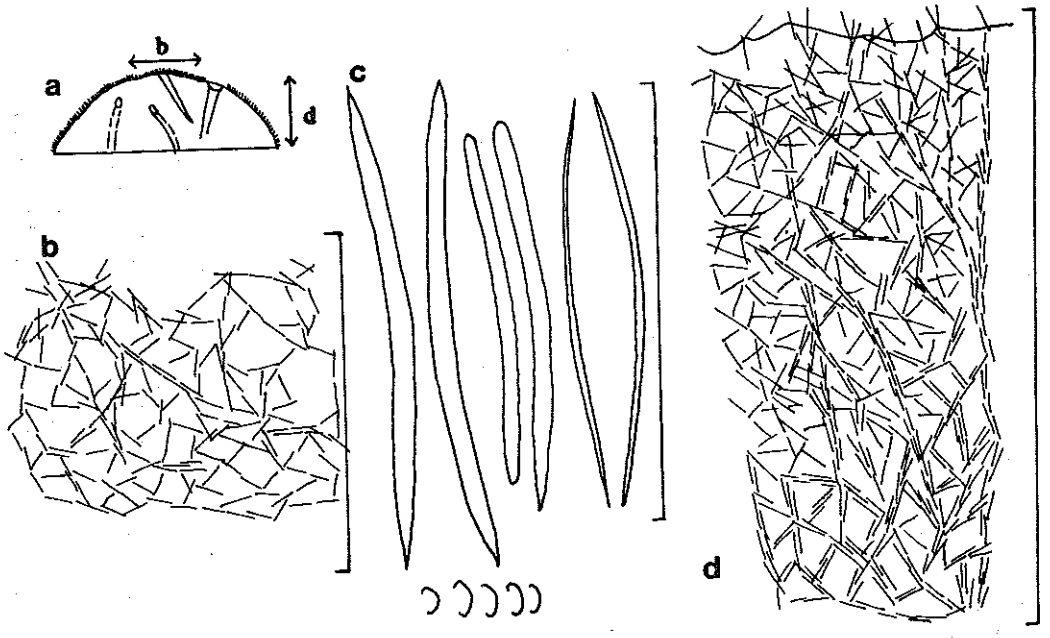

Fig. 2. Skeleton and spicules of *Haliclona amboinensis* (Lévi). **a**, plan view of sponge showing orientation of skeletal diagrams; **b**, tangential skeleton at the surface that is an extension of the choanosomal reticulation; **c**, principal oxeote megascleres, thinner oxeas and sigmas; **d**, choanosomal skeleton, showing the surface of the sponge at the top of the diagram, with a unispicular confused reticulation grading into primary tracts cored by 6-10 parallel spicules internally. Scale bars: b, 1000 µm; c, 200 µm; d, 2000 µm.

Table 1. Spicule measurements of *Haliclona amboinensis* (Lévi) (µm; n=10).

MATERIAL	LOCALITY	DEPTH	OXEAS		THIN OXEAS		SIGMAS	
			Mean	Range	Mean	Range	Mean	Range
QM G25024	Geoffrey Bay, Magnetic Island	7 m	250 x 11.9	222-269 x 8.4-16.0	209 x 5.8	164-239 x 4.2-7.6	16.9	14.7-20.0
JF1	Geoffrey Bay, Magnetic Island	5 m	230 x 9.3	210-250 x 8.4-10.1	205 x 5.0	185-218 x 3.4-6.7	17.1	14.7-18.9

(Fig. 2d). Spicules dense, mesh spaces very small, up to 50 µm wide, internal canals 150-750 µm wide. No spongin fibre development observed in specimens examined, although Kelly Borges and Bergquist (1988) mention nodal spongin. Sigmas occur throughout membranes around internal pores. Ectosomal skeleton, an extension of the choanosomal skeleton, a single layer of spicules parallel to the surface with erect single spicules extending beyond the parallel layer (Fig. 2b).

Spicules. (Measurements in Table 1). Principal megascleres thick sharply pointed oxeas, usually curved, occasionally straight. Strongylote and stylote modifications are found. Thin forms occur. Sigmas abundant, small c-shaped forms (Fig. 2c).

Remarks. The specimens from the Great Barrier Reef conform to the redescription by Kelly Borges and Bergquist (1988).

Haliclona cymiformis (Esper) comb. nov.
(Figs 1, 3)

Spongia cymiformis Esper, 1794:43 (Ceylon).
Isodictya cymaeformis - Ehlers 1870:24.
Gellius cymiformis - Ridley 1884:425, pl. XLI, fig. z (Torres Strait, Queensland); Lévi 1967:24, fig. 8 (New Caledonia); Vacelet and Vasseur 1971:112, fig. 71 (Tulear, Madagascar); Lévi 1978:311 (New Caledonia); Vacelet 1981:717 (Noumea lagoon, New Caledonia).
Sigmadocia symbiotica - Bergquist and Tizard 1967:183, fig. 1, pl. 4 (Darwin, Australia); Kelly Borges and Bergquist 1988:146, pl. 5a, b (Motupore Is., Papua New Guinea).

Type material. Holotype unknown, type locality, Ceylon.

Material. QM G25025: Geoffrey Bay, Magnetic Island, Great Barrier Reef, 19°09'S 146°52'E, 22 April 1986, depth 7 m, coll. J. Fromont, SCUBA. QM G25026: Brampton Island, Whitsunday Islands, Great Barrier Reef, 20°49'S 149°15'E, 6 September 1986, intertidal, coll. J. Fromont. QM G25027: Low Isles, Great Barrier Reef, 16°23'S 145°34'E, 18 October 1986, intertidal, coll. J. Fromont.

Distribution. Occurs intertidally and subtidally to 4 m depth on inshore fringing reefs from Cape Tribulation, 16°05'E 145°34'E, to the Whitsunday Islands, 20°19'S 149°03'E (Fig. 1).

Habitat. Attaches to rock platforms.

Description. Ramose sponge with solid branches frequently anastomosing to form large spreading mats up to 1 m across. Branches up to 2.0 cm wide, branching tips usually bifurcate. Sponge forms a thin encrustation that completely surrounds the red algae, *Ceratodictyon spongiosum*, in a symbiotic association (refer to Price *et al.* 1984; Price and Kraft 1991). Bulk of

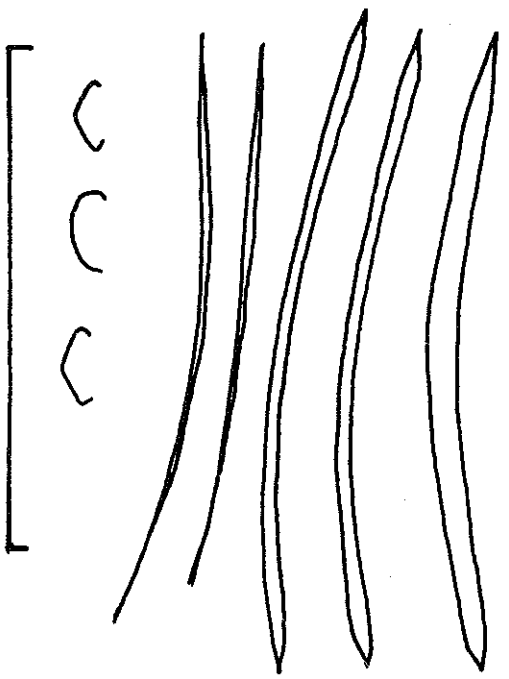

Fig. 3. Spicules of *Haliclona cymiformis* (Esper). Principal oxeote megascleres, thin oxeas and sigmas. (centrangulate sigmas, top and bottom, c-shaped sigma in centre). Scale bar: 100 µm.

Table 2. Spicule measurements of *Haliclona cymiformis* (Esper) (µm; n=10).

MATERIAL	LOCALITY	DEPTH	OXEAS		THIN OXEAS		SIGMAS	
			Mean	Range	Mean	Range	Mean	Range
QM G25025	Geoffrey Bay, Magnetic Island	7 m	129 x 3.6	101-147 x 2.9-42	128 x 1.9	105-147 x 1.1-2.5	18.5	14.3-21.0
QM G25026	Brampton Island	inter-tidal	127 x 3.4	117-135 x 2.9-3.9	111 x 1.8	99-120 x 1.3-2.6	16.6	14.3-18.2
QM G25027	Low Isles	inter-tidal	133 x 3.3	112-143 x 3.1-3.6	121 x 1.5	107-133 x 0.8-2.6	17.6	15.6-19.5

Table 3. Spicule measurements (μm)of *H. cymiformis* (Esper) from published descriptions.

AUTHOR	LOCALITY	OXEAS	SIGMAS	
Esper, 1794	Ceylon	-	-	
Ehlers, 1870	-	170	-	
Ridley, 1884	Torres Strait, Qld	150-160 x 5.5-7	20 x1-1.6	c-shape
Lévi, 1967	New Caledonia	130-160 x 5-11	14 -16	centrangulate
Bergquist & Tizard, 1967	Darwin, Australia	128-160 x 2-7.5 (142 x 4)	16 -20 (17.8)	c-shape
Vacelet & Vasseur, 1971	Tulear, Madagascar	140-160 x 2.2-6	17 -20	c-shape
Kelly Borges & Bergquist, 1988	Papua New Guinea	128-177 x 4.5-7.5 (155 x 7)	16.5-20 (18)	c-shape
This study	Great Barrier Reef	99 -147 x 0.8-4.2 (125 x 2.6)	14.3-21.0 (17.6)	centrangulate and c-shape

branches comprised of algal tissue.

Colour. Dark green throughout, in alcohol cream to fawn.

Texture. Firm, incompressible, tough, can be torn.

Surface. Microscopically hispid with algal fronds visible just beneath surface. One surface has small oscules, up to 2.0 mm in diameter, flush with the surface.

Skeleton. Sponge skeleton lies between algal fronds, which form an anastomosing network of thalli 200-500 μm across (refer to Kelly Borges and Bergquist 1988: pl. 5b). Between thalli, in spaces up to 300 μm wide, is spicule and spongin fibre reticulation. Fibres 40-100 μm wide, cored centrally by 2-6 spicules. Between fibres, and at the surface, is a unispicular isodictyal reticulation.

Spicules. (Measurements in Table 2). Thin curved, sharply pointed oxeas. Rare strongylote and stylote forms occur. Sigmas abundant, c-shaped and centrangulate (Fig. 3).

Remarks. The macroalga, *Ceratodictyon spongiosum*, is now known to be widespread in the tropical Indo-Pacific and, in the field, has always been associated with this particular sponge (Price and Kraft 1991). However, there has been confusion about the correct identification of the sponge species.

Ridley (1884) described *Gellius cymiformis* (Esper, 1794) from Torres Strait and Queensland. He found his specimens agreed well with the external characters described by Esper but not with the spiculation described by Ehlers (1870) who had reexamined Esper's material and assigned specimens to this species. Ehlers found more monactinal spicules than diactinal spicules, and did not mention the presence of sigmas. Ridley (1884) found sigmas in his specimens and a predominance of diactinal spicules. He noted the great quantity of fibrous algae associated with this sponge. Lévi (1967) described specimens of this species from New Caledonia and identified the symbiotic alga as *C. spongiosum*. In the same year, Bergquist and Tizard (1967) established the new species *Sigmadocia symbiotica* for a sponge growing intertidally in Darwin. This species was reported to be in symbiotic association with a red alga of the genus *Gracelaria*. Lévi (1979) synonymised *S. symbiotica* with *H. cymiformis*. Vacelet and Vasseur (1971) and Vacelet (1981) used the species name *H. cymiformis* when they described this sponge from the reefs of Tulear, Madagascar, and New Caledonia respectively. Kelly-Borges and Bergquist (1988) used the species name *S. symbiotica* for specimens from Papua New Guinea.

There seems little doubt that the specimens examined by Ridley, Lévi, Bergquist and Tizard, Vacelet and Vasseur, Vacelet, and Kelly-Borges and Bergquist are the same species (see Table 3). The common presence of the fibrous alga physically dominating the symbiotic association, the similarity of spicule dimensions, and distinctive external appearance of the sponge all support this view. Lévi (1967) depicts centrangulate sigmas while all other authors report c-shaped sigmas. In specimens examined in this study both forms of sigmas occurred and this is considered a character state that is variable within the species.

Apart from Ehler's redescription of Esper's type material, no previously published descriptions of *H. cymiformis* mention any examination of the type material. The locality of the type material is unknown, and it is doubtful the material still exists. Therefore, it was not possible to determine whether the recent descriptions of *H. cymiformis* agree with the type material.

Van Soest (1981) described *Sigmadocia*

symbiotica from the Hong Kong area but his specimen has an ectosome that gives off a lot of slime during preservation. This is not a common feature for this species. Frozen sponges may exude slime when placed in alcohol; this has been noted for species that, if placed only in alcohol, do not exude slime. This feature of the Hong Kong specimens may be a result of the preservation method.

Thomas (1979, pt.I) described *Sigmadocia fibulata* Schmidt, 1862, with the algal symbiont, *C. spongiosum*, and with a detachable ectosome, and (1979, pt.II) described a specimen of the species with the algal symbiont, but did not mention ectosomal features. The ectosome of *H. cymiformis* is not detachable from the main body of the sponge. Thomas' specimens were dry and this may account for the condition of the ectosome he reports. His use of the species name *S. fibulata* for specimens symbiotic with *C. spongiosum*, is most likely incorrect. Schmidt (1862) described *Reniera fibulata* and this species has been redescribed by de Weerdt (1986) as *Haliclona fibulata*. It is a species without an algal symbiont and clearly distinct from *H. cymiformis*.

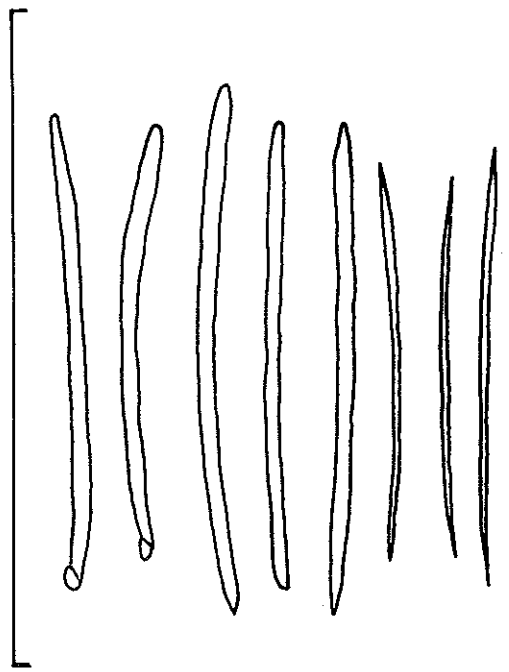

Fig. 4. Spicules of *Cladocroce aculeata* Pulitzer-Finali. Principal spicules showing the range of forms and thin oxeas. Scale bar: 200 µm.

Genus *Cladocroce* Topsent

Cladocroce Topsent, 1892:72; van Soest 1980:106.

Type species. *Cladocroce fibrosa* Topsent, 1892, by monotypy, type locality, North East Atlantic, 1300 m.

Diagnosis. (Modified after Topsent, 1892). Sponges with primary tracts accentuated to form a dendritic skeleton of spongin-encased spicules that occasionally anastomose. Between primary tracts the auxillary skeleton is an isodictyal reticulation typical of the family Chalinidae (Fig. 5a). Megascleres oxeas or strongyloxeas.

Remarks. Topsent (1892) did not include a description of the secondary skeleton in his definition of *Cladocroce*, but included the genus in the sub-family Renierinae because of the tendency of the skeleton to become renieroid towards the surface of the sponge. The Renieridae has been synonymised with the family Chalinidae (van Soest 1980), and *Cladocroce* placed by van Soest (1980) in this family.

Cladocroce aculeata Pulitzer-Finali
(Figs 1, 4, 5a, 6a)

Cladocroce aculeata Pulitzer-Finali, 1982:109, figs 20, 21.

Type material. MSNG 46939 and 46940, type locality, Lizard Island, Great Barrier Reef.

Material. QM G25028: Palfrey Island, Great Barrier Reef, 14°42'S 145°27'E, 7 October 1987, depth 15 m, coll. J. Fromont, SCUBA. QM G25029: North Point, Lizard Island, Great Barrier Reef, 14°39'S 145°27'E, 11 October 1987, depth 18 m, coll. J. Fromont, SCUBA. QM G25030: John Brewer Reef, Great Barrier Reef, 18°38'S 147°04'E, 9 July 1986, depth 13 m, coll. J. Fromont, SCUBA.

Distribution. Occurs from Lizard Island, 14°40'S 145°27'E, to John Brewer Reef, 18°38'S 147°04'E (Fig. 1).

Habitat. Found on rock and dead coral, on midshelf islands and reefs, in full light, at depths greater than 10 m.

Description. Erect, hollow, tubular sponges with 6 to 8 tubes interconnected basally (Fig. 6a). Large oscular cavities, up to 30 mm in diameter, at the apex of the tubes, tube walls 7 mm thick.

Colour. Salmon pink (Lizard Island, Fig. 6a) or mauve (John Brewer Reef) when alive, in alcohol fawn or cream.

Texture. Firm, compressible, soft to touch. Some specimens more springy than others. Sponges fragile, easily torn, exposing skeletal fibres.

Surface. Tube walls smooth, conulose, porous externally, smooth, porous internally. Thin membranous ectosome cannot be disconnected from choanosomal skeleton.

Skeleton. Ectosomal skeleton a unispicular isodictyal reticulation that is an extension of the choanosomal skeleton. Internally the reticulation is formed by up to 6 parallel spicules (Fig. 5a), with spongin occurring at nodes of the reticulation. Longitudinal primary spicule tracts, encased in a thin layer of spongin, extending from the base to apex of the tubes, are visible when the sponge is torn. No reticulation of these tracts occurs, they may anastomose and branch (Fig. 5a). Primary tracts 40-140 µm in diameter, cored by 7-35 spicules. Symbionts, probably cyanobacteria, abundant in choanosome.

Spicules. (Measurements in Table 4). Principal spicules strongyloxeas with constricted ends, occasionally pointed, with knobbed or clubbed ends (Fig. 4). Thin developmental forms occur, less abundant than principal forms.

Remarks. Small ophiuroids, all apparently belonging to the same species, were abundant over the external surfaces, and bases, of specimens of *Cladocroce aculeata*. Prior to Pulitzer-Finali's (1982) work the genus *Cladocroce* had only been reported from bathyal depths in the North East Atlantic. However, as *C. aculeata* agrees with the generic description, no new genus is established for this shallow water Great Barrier Reef species.

Family Niphatidae van Soest

Niphatidae van Soest, 1980:25; Desqueyroux-Faundez 1984:775.

Diagnosis. (Modified after van Soest, 1980). Haplosclerida with primary and secondary skeletons multispicular, forming dense reticulations of spongin fibres and spicule tracts. Ectosomal skeleton present, a reticulation of spongin fibres or spicule tracts. Megascleres of one type, usually oxeas. Microscleres, if present, sigmas or toxas. ?

Remarks. Van Soest (1980) established this family, removing the genera included in it from the Chalinidae, because niphatids have a three dimensional (paratangential) ectosomal skeleton and multispicular, fibrous choanosome.

The Niphatidae are distinguished from the Chalinidae principally in having multispicular primary and secondary tracts; the Chalinidae may have multispicular primary tracts but do not have robust development of the secondary skeleton (Figs 5b-f). The dense skeleton in the Niphatidae produces firm, incompressible or elastic sponges. Species of the Chalinidae, which retain unispicular secondary tracts (Figs 2, 5a) produce sponges that are softer and more compressible, or brittle. The development in the Niphatidae of a skeleton with increased spongin and mineral content, separates the Niphatidae from the Chalinidae by extent of skeletal development.

Van Soest's (1980) description of the ectosomal skeleton as paratangential or three dimensional is difficult to visualise and interpret, hence, it is not a feature included in the diagnosis. "Para" means "by the side of, beyond", and a tangential skeleton is one that is parallel to the surface. A paratangential skeleton may be an ectosomal skeleton intermediate between an erect spicule palisade and a tangential skeleton. The three dimensions van Soest refers to are thought to be as follows: 1, spicules or tracts parallel to the surface; 2, tracts or spicules below the surface and at right angles to it; and 3, tracts or spicules beyond the surface and at right angles to it. In some species, the ectosomal skeleton intergrades with the choanosomal skeleton, for example in species of *Amphimedon* Duchassaing and Michelotti, 1864, in this study (Figs 5c-f). In this case, a distinctive three dimensional ectosomal skeleton is difficult to distinguish from a tangential ectosomal skeleton intercepted by primary

Table 4. Spicule measurements of *Cladocroce aculeata* (Pulitzer-Finali) (µm; n=10).

MATERIAL	LOCALITY	DEPTH	STRONGYLOXEAS		THIN STRONGYLOXEAS	
			Mean	Range	Mean	Range
QM G25028	Palfrey Island	15 m	149 x 4.9	113-170 x 4.2-6.1	130 x 1.8	105-174 x 1.0-3.2
QM G25029	Magnetic Island North Pt, Lizard Island	18 m	141 x 5.1	107-166 x 4.7-5.7	116 x 1.8	104-138 x 1.0-3.9
QM G25030	John Brewer Reef	13 m	141 x 4.4	120-159 x 3.1-5.2	143 x 2.1	122-159 x 1.0-2.6

tracts of the choanosomal skeleton. Therefore, the generic definitions in this study refer to an ectosomal skeleton but do not attempt to describe it in three dimensions.

The principal character used to define the family Niphatidae in this study is the development, in the choanosome, of a fibre and multispicular reticulate skeleton. Van Soest's (1980) establishment of this family is supported, but no additional characters to further differentiate it from the Chalinidae were found in the Great Barrier Reef sponges examined.

The two genera *Niphates* Duchassaing and Michelotti, 1864, and *Amphimedon* are distinguished by the architecture of their skeletons. *Niphates* has thick primary tracts that extend beyond the surface and *Amphimedon* has primary fibres, less strongly developed at the surface than *Niphates*, that extend to the surface or slightly beyond it (cf. Figs 5b-f). The difference between extension of primary tracts to the surface, or beyond it, as a generic trait could not be evaluated as only one species of *Niphates* was described in this study. More species of this genus need to be examined to evaluate this character.

The difficulty in allocating the genus *Aka* de Laubenfels, 1936, to the Niphatidae is related to its cryptic growth habit. It is difficult to interpret which aspects in the design of the skeleton are adaptive to the excavating habit. The sponges of this genus occur inside coral heads or shells and the fistules extend into the water column for water exchange. The presence of fistules is therefore an adaptation to a cryptic habit and a homoplaseous character. Mucus production appears to function for killing coral polyps and protecting the larvae during settlement (Rützler 1971). Lack of spongin development and a pulpy interior may be related to the micro-habitat of the sponge, which would not require a skeleton for support when it is enclosed and protected inside a coral head. There is no requirement for an ectosomal skeleton, for protection or as a support system, when the sponge surface is not in direct contact with the external environment. The fistular habit, mucus production, lack of spongin development, pulpy interior and lack of an ectosomal skeleton are all features that distinguish *Aka* from typical niphatid genera. *Aka* has the characteristic niphatid multispicular reticulation of spongin fibres and spicules in the fistules. Therefore, in this study, the genus is retained in the Niphatidae until additional characters, less likely to be influenced by environmental parameters, can be examined to determine its correct familial position.

Four of the eight species examined from this family belong to the genus *Amphimedon*, one to *Niphates*, one to *Gelliodes* Ridley, 1884, and two to *Aka* de Laubenfels, 1936.

Genus *Niphates* Duchassaing and Michelotti

Niphates Duchassaing and Michelotti, 1864:93; van Soest 1980:35; Desqueyroux-Faundez 1984:775.

Type species. *Niphates erecta* Duchassaing and Michelotti, 1864, by subsequent designation (Wiedenmayer, 1977:95), type locality, St. Thomas, Virgin Is.

Diagnosis. (Modified after van Soest, 1980). Sponges with the ectosomal reticulation dominated by erect tufts of well developed choanosomal primary tracts. Megascleres diactinal, usually oxeas. Microscleres, if present, sigmas.

Remarks. Rare sigmas have previously been included as a feature of this genus (Wiedenmayer 1977; van Soest 1980), but the definition is here extended to include *Niphates nitida* n. sp., which consistently contains sigmas.

Previously, *Gelliodes* was the only genus in the family Niphatidae to contain sigmas, but that genus has a characteristic skeletal structure of accentuated primary fibres which may be fasciculate or anastomosing (Fig. 12b). *Niphates nitida* n. sp. lacks this specialised skeleton and is therefore precluded from *Gelliodes*. In this study, the skeletal character of accentuated primary fibres is considered diagnostic for *Gelliodes*. The presence or absence of sigmas is considered an unreliable generic character.

Niphates nitida n. sp. is a difficult species to place. It has a reticulate choanosomal skeleton with enhanced fibre and spicule development characteristic of the family Niphatidae, a well developed ectosomal skeleton, and a smooth surface. Most species assigned to *Niphates* have hispid or conulose surfaces. Duchassaing and Michelotti (1864) describe the surface of the type species, *N. erecta* Duchassaing and Michelotti, 1864, as well as that of *N. venosa* Duchassaing and Michelotti, 1864, as hispid, whereas the surface of *N. thomasiana* Duchassaing and Michelotti, 1864, is less hispid than the previous two species, and finely porous.

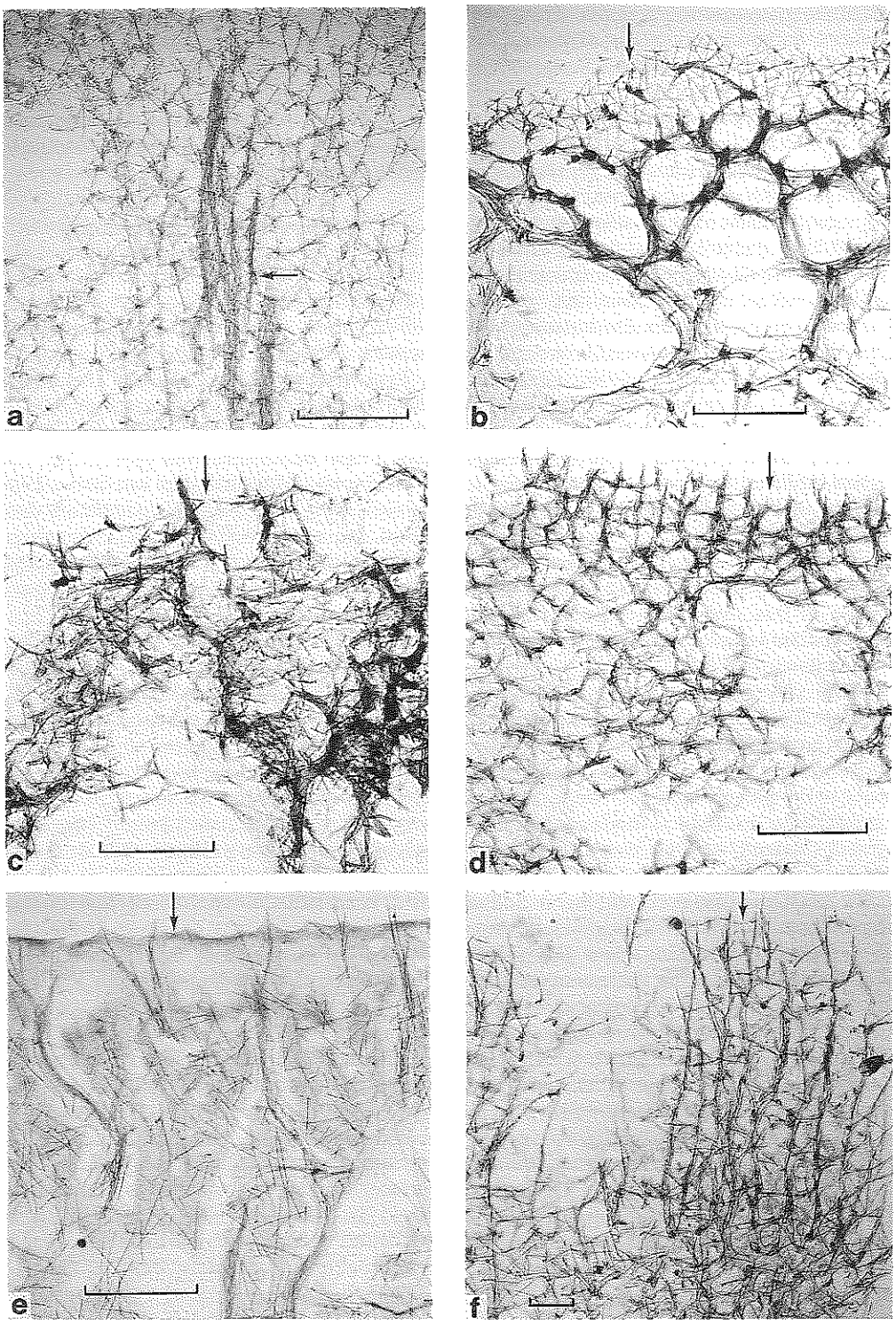

Fig. 5. Skeletons of species of the Haliclonidae and Niphatidae. **a**, *Cladocroce aculeata* Pulitzer Finali, l.s. primary tracts (arrow) and isodictyal reticulation of the choanosome; **b**, *Niphates nitida* n. sp. l.s. choanosome and surface (arrow); **c**, *Amphimedon paraviridis* n. sp. l.s. choanosome and ectosomal skeleton (arrow); **d**, *Amphimedon lamellata* n. sp. l.s. choanosome and ectosomal skeleton (arrow); **e**, *Amphimedon terpenensis* n. sp. l.s. choanosome and ectosomal skeleton (arrow); **f**,*Amphimedon sulcata* n. sp. l.s. choanosome and ectosomal skeleton (arrow). Scale bars: a-e, 500 µm; f, 200 µm.

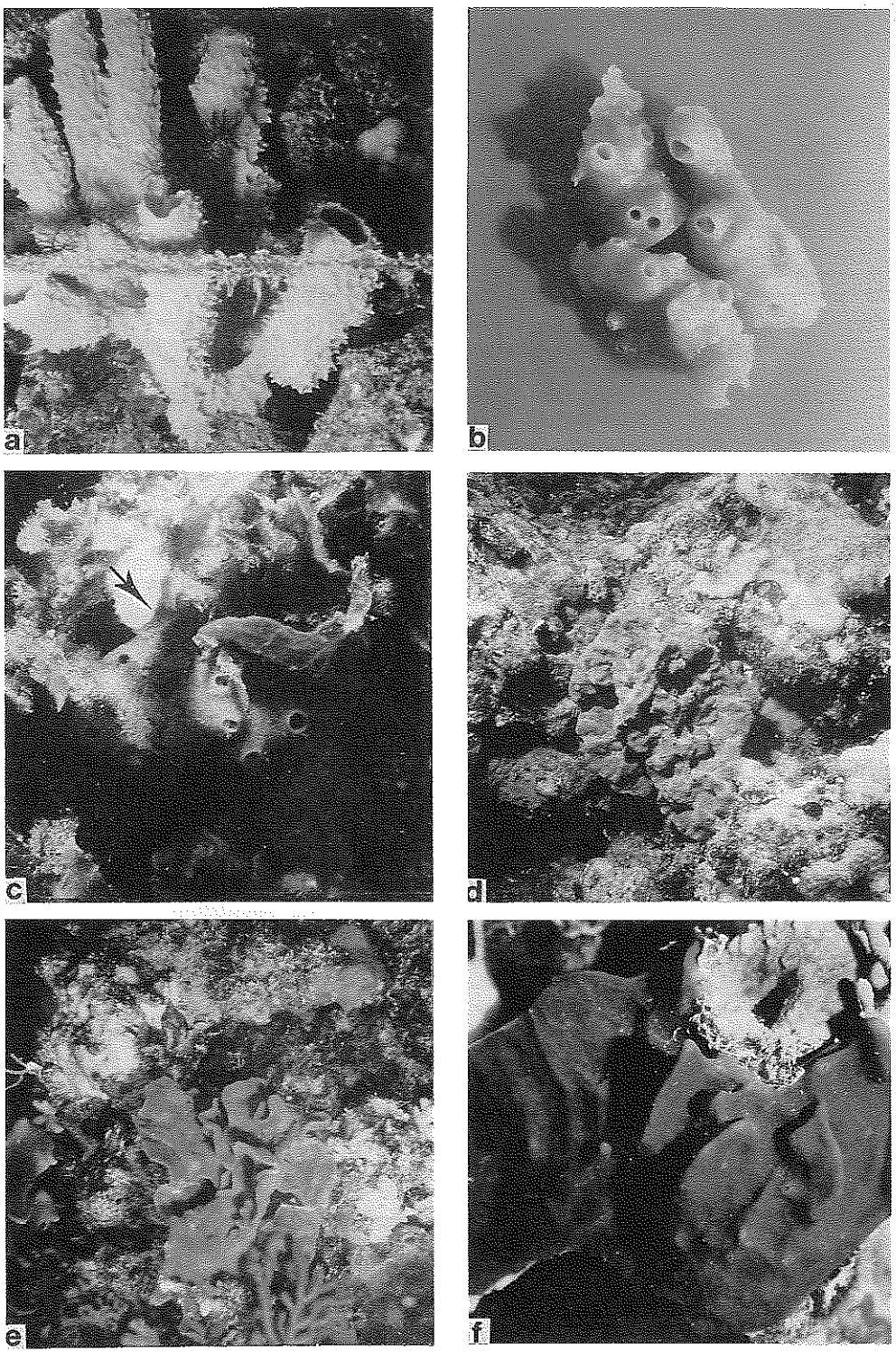

Fig. 6. **a**, *Cladocroce aculeata* Pulitzer Finali, *in situ*, Lizard Island; **b**, *Niphates nitida* n. sp. alcohol preserved specimen; **c**, *Niphates nitida in situ*, Magnetic Island; **d**, *Amphimedon paraviridis* n. sp. *in situ*, Whitsunday Islands; **e**, *Amphimedon lamellata* n. sp. *in situ*, Whitsunday Islands; **f**, *Amphimedon terpenensis* n. sp. *in situ*, John Brewer Reef.

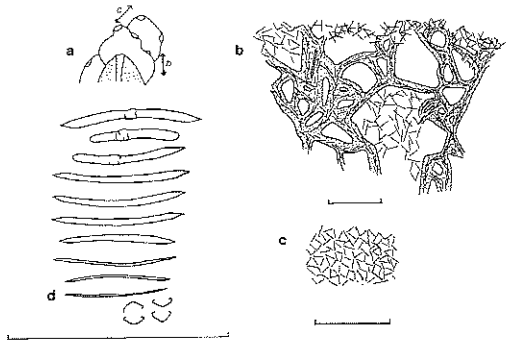

Fig. 7. Skeleton and spicules of *Niphates nitida* n. sp. **a**, plan view of sponge showing orientation of the skeletal diagrams; **b**, wide-meshed fibrous choanosomal reticulation; **c**, tangential view of unispicular isodictyal reticulation in the ectosome; **d**,principal oxeas, thin oxeas and centrangulate sigmas. Scale bars: b, c, 500 µm; d, 200 µm.

The figure of the latter species depicts a smooth surface. Van Soest (1980) redefines the genus as one having a paratangential ectosomal reticulation of fibres or tracts obscured by protruding tufts of the choanosomal primaries. In his redescription of material of the lectotype of *N. erecta* van Soest describes the surface as conulose with the ectosomal reticulation absent in most places. The ectosomal skeleton of *N. nitida* n. sp. is consistent over the surface of the sponge, except around the oscules, and the consequent smooth surface of this species is exceptional for the genus.

Niphates nitida n. sp. is placed in the genus *Niphates* because of robust multispicular fibres that support the ectosomal skeleton. *Niphates* may not be the correct generic allocation for this species, but it does not fit well into any other genus: it does not have slender supporting tracts at the surface, seen in species of *Amphimedon*, or long and narrow choanosomal meshes that characterise the related genus *Cribrochalina* Schmidt, 1870. It may be eventually necessary to establish a new genus for this species, but this option is not chosen here. Too few related species were examined to assess the reliability of this ectosomal skeletal character as diagnostic for a genus.

Niphates nitida n.sp.
(Figs 1, 5b, 6b-c, 7)

Type material. HOLOTYPE - QM G25031: Geoffrey Bay, Magnetic Island, Great Barrier Reef, 19°09'S 146°52'E, 22 April 1986, depth 7 m, coll. J. Fromont, SCUBA. PARATYPE - QM G25032: Geoffrey Bay, Magnetic Island, Great Barrier Reef, 19°09'S 146°52'E, 11 February 1987, depth 7 m, coll. J. Fromont, SCUBA.

Habitat. Shallow water to depths of 7 m on fringing reef flat, on the sides or tops of coral outcrops beneath *Sargassum* (Fig. 6c). Locally abundant; numerous small individuals can be found in Geoffrey Bay, Magnetic Island (Fig. 1).

Description. Small ramose encrusting sponge, individuals up to 5.0 cm high and 7.0 x 7.0 cm in extent (Fig. 6b).

Colour. Green in life, in alcohol fawn.

Texture. Firm, compressible, elastic, tough.

Surface. Oscules 2-4 mm diameter are at the centre of small erect lobes 5-20 mm apart. Oscules have raised collars, 1 mm high, of erect spicules. Surface smooth and glossy (Fig. 6b).

Skeleton. Choanosomal skeleton a wide meshed fibrous reticulation with rounded or triangular meshes, primary tracts 100-500 µm apart (Figs 5b, 7b). Primary fibres 104-146 µm wide, cored by up to 5 spicules, secondary fibres, 20-50 µm wide, cored by 2 or 3 spicules. Single oxeas and sigmas occur between fibres without orientation. Around oscules, primary spicules extend beyond the sponge surface. Primary fibres support a distinct ectosomal skeleton which is an isodictyal reticulation (Fig. 7c).

Spicules. (Measurements in Table 5). Short fat oxeas with occasional strongylote or stylote modifications, otherwise with pointed ends. Oxeas straight or curved centrally. Some spicules have central thickenings (Fig. 7d); this does not occur in all specimens. Less common thin oxeas occur, microscleres are centrangulate sigmas.

Etymology. The species name is derived from the characteristic smooth, polished surface of this species.

Table 5. Spicule measurements of *Niphates nitida* n. sp. (µm; n=10).

MATERIAL	LOCALITY	DEPTH	OXEAS		THIN OXEAS		SIGMAS	
			Mean	Range	Mean	Range	Mean	Range
QM G25031 (Holotype)	Magnetic Island	7m	128 x 5.6	109-148 x 3.9-7.3	108 x 2.5	99-117 x 2.1-3.1	19.0	15.6-20.1
QM G25032 (Paratype)	Magnetic Island	7m	124 x 6.3	92-141 x 4.2-8.0	112 x 2.6	97-120 x 2.0-3.8	19.2	16.8-21.0

Remarks. *Niphates nitida* is characterised by its thick encrusting habit, green, glossy surface, ectosomal isodictyal reticulation, and presence of centrangulate sigmas. *Niphates nitida* has only been observed at the type locality and not at other island fringing reefs investigated for this study.

This species resembles *Gelliodes carnosa* Dendy, 1889, in colour and surface characteristics but *N. nitida* never achieves the size of *G. carnosa* and the flabelliform or tubular branching habit. *Gelliodes carnosa* is 11.0 to 17.0 cm tall (Desqueyroux-Faundez 1984) while specimens of *N. nitida* are never greater than 5.0 cm and remain thickly encrusting. The species differ in aspects of their skeletal architecture, *G. carnosa* has multispicular primary fibres and reduced secondaries characteristic of the genus *Gelliodes*. *Niphates nitida* has some similarities with *Adocia pumila* Lendenfeld, 1887, such as a spicule complement of oxeas and sigmas and a tangential ectosomal skeleton. *Niphates nitida* lacks a distinctive area devoid of spongin in the ectosome, and does not develop a conulose surface or anastomosing branches - features found in *A. pumila*.

Genus *Amphimedon* Duchassaing and Michelotti

Amphimedon Duchassaing & Michelotti, 1864:78; van Soest 1980:26; Desqueyroux-Faundez 1984: 777.

Pachychalina Schmidt, 1868:7.

Type species. *Amphimedon compressa* Duchassaing and Michelotti, 1864, by subsequent designation (de Laubenfels, 1936:45), type locality, St. Thomas, Virgin Is.

Diagnosis. (Modified after van Soest, 1980). Sponges with an optically smooth surface due to a dermal membrane supported by slender choanosomal primaries barely penetrating the surface (Figs 5c-f, 8-11). Surface microscopically hispid if primary tracts protrude beyond it. Ectosomal tangential reticulation present. Microscleres, if present, sigmas.

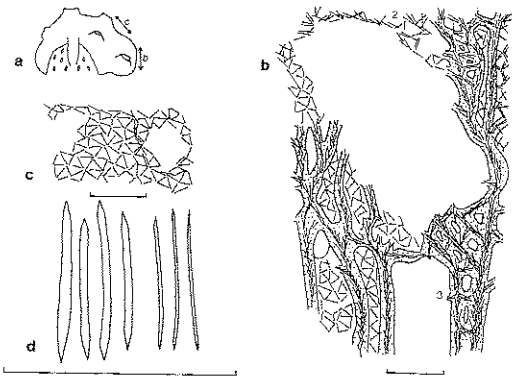

Fig. 8. Skeleton and spicules of *Amphimedon paraviridis* n. sp. **a**, a plan view of the sponge showing the orientation of the skeletal diagrams; **b**, choanosomal skeleton, a large subectosomal space (1) beneath the surface (2), and primary fibres with spongin development that are fasciculate deeper in the sponge (3); **c**,the tangential isodictyal reticulation of spicules in the ectosome; **d**, oxeas. Scale bars: b, c, 500 μm; d, 200 μm.

Remarks. The definition of this genus has been extended to include microscleres, as *Amphimedon sulcata* n. sp. from the Great Barrier Reef, consistently contains sigmas and has a skeleton which conforms to the definition of the genus *Amphimedon*. The presence of sigmas in this case is a good specific character.

Amphimedon paraviridis n.sp.

(Figs 1, 5c, 6d, 8)

Type material. HOLOTYPE - QM G25033: Geoffrey Bay, Magnetic Island, Great Barrier Reef, 19°09'S 146°52'E, 22 April 1986, depth 7 m, coll. J. Fromont, SCUBA. PARATYPES - QM G25034: Eagle Islet, Great Barrier Reef, 14°41'S 145°22'E, 9 October 1987, depth 4 m, coll. J. Fromont, SCUBA; QM G25035: Brampton Island, Whitsunday Islands, Great Barrier Reef, 20°49'S 149°15'E, 6 September 1986, depth 4 m, coll. J. Fromont, SCUBA; QM G25036: Carlisle Island, Whitsunday Island, Great Barrier Reef, 20°48'S 149°16'E, 7 September 1986, depth 12 m, coll. J. Fromont, SCUBA.

Table 6. Spicule measurements of *Amphimedon paraviridis* n. sp. (μm; n=10).

MATERIAL		LOCALITY	DEPTH	STRONGYLOXEAS		THIN STRONGYLOXEAS	
				Mean	Range	Mean	Range
HOLOTYPE	QM G25033	Magnetic Island	7 m	142 x 6.0	133-151 x 3.9-8.0	120 x 2.0	109-135 x 1.3-2.6
PARATYPE	QM G25034	Eagle Islet	4 m	129 x 4.9	114-140 x 3.9-5.3	105 x 2.2	91-112 x 1.6-2.6
PARATYPE	QM G25035	Brampton Island	4 m	156 x 7.8	143-170 x 6.3-10.5	124 x 2.5	107-139 x 1.3-3.8
PARATYPE	QM G25036	Carlisle Island	12 m	187 x 7.1	170-204 x 5.5-9.5	137 x 2.1	116-160 x 1.5-3.6

Distribution. From Lizard Island, 14°40'S 145°27'E, to the Whitsunday Islands, 20°49'S 149°16'E (Fig. 1).

Habitat. Shallow water in lagoonal areas and on reef flats or slopes at depths of 3-4 m. Grows firmly attached to hard substrata, usually limestone or dead coral. Individuals occur most often on slightly silted fringing reefs, where there is a prevalence of soft corals, small *Porites* bommies, and stands of the branching corals *Acropora* and *Montipora*.

Description. Thickly encrusting to ramose, approximately 20 mm thick, slightly raised oscules, 2-4 mm across, along upper surface ridge (Fig. 6d) spaced 10-15 mm apart.

Colour. Olive green alive, fawn in alcohol.

Texture. Very firm, slightly compressible, elastic.

Surface. Microscopically hispid, porous, ectosomal skeletal pattern visible.

Skeleton. Choanosomal skeleton dense, fibrous, irregular reticulation, small mesh spaces 100-300 µm, occasional large internal pores 400-1000 µm (Figs 5c, 8b). Primary fibres, cored by approximately 10 spicules, 50-160 µm wide. Widest fibres fasciculate (Fig. 8b-3). Secondary fibres 20-50 µm wide, cored by 5-10 spicules. Many interstitial spicules form a loose reticulation between fibres and around pore areas. Primary and secondary reticulation more regular at the surface, primary spicules extend the sponge surface giving a faint hispid texture (Fig. 5c). Subectosomal spaces 20-500 µm across (Fig. 8b-1, 2). Some spicules tangential to the surface form a reticulation (Fig. 8c), others are at right angles to the surface (Figs 5c, 8b-2).

Spicules. (Measurements in Table 6). Short fat oxeas with stepped or pointed ends. Less commonly, thin developmental forms occur (Fig. 8d). Spicules vary considerably in dimensions between sponges collected from different depths and localities across the continental shelf.

Etymology. The species name is derived from the similarity of this species, from the Great Barrier Reef, to the Caribbean species *A. viridis* Duchassaing and Michelotti, 1864.

Remarks. The type material of *A. viridis* was examined (BM 1928.11.12.35a) and the Great Barrier Reef species differs from *A. viridis* in the following characters: a much greater spongin component, thicker fibres, and larger mesh spaces between fibres. The spicules of both species are similar in shape but the spicules of the Great Barrier Reef species are thicker. These differences, and reproductive isolation, suggest that the Great Barrier Reef specimens cannot be synonymous with the Caribbean species, *A. viridis*.

Amphimedon paraviridis may be conspecific with Indo-Pacific specimens from New Caledonia referred to *A. viridis* by Desqueyroux-Faundez (1984). However, from comparison of the descriptions of the sponges, there are some differences between both groups of specimens in degree of spongin development in the skeleton (more in specimens from the Great Barrier Reef), thinner primary fibres, lack of fasciculation, and subectosomal spaces in the New Caledonian specimens. No thin oxeas are mentioned in the description of the New Caledonian material.

Amphimedon lamellata n.sp.

(Figs 1, 5d, 6e, 9)

Type material. HOLOTYPE - QM G25037: MacGillivray Reef, Lizard Island, Great Barrier Reef, 14°39'S 145°29'E, 15 October 1987, depth 9 m, coll. J. Fromont, SCUBA.

PARATYPE - QM G25038: Carlisle Island, Whitsunday Islands, Great Barrier Reef, 20°48'S 149°16'E, 7 September 1986, depth 12 m, coll. J. Fromont, SCUBA.

Distribution. Lizard Island, 14°40'S 145°27'E, to Whitsunday Islands, 20°48'S 149°16'E (Fig. 1).

Habitat. Occurs at depths of 10-15 m on reef slopes, attached to rocky substratum (Fig. 6e), not abundant.

Description. Undulating spreading fan or erect lamellate sponge (Fig. 6e) 5 mm wide at the thickest point, the short stem of attachment, and 2 mm thick at uppermost edge of fan.

Colour. Pale pink or mauve (Fig. 6e) in full sunlight when live, but shaded parts are fawn.

Texture. Slightly compressible, spongy.

Surface. Reflects light, appears shiny and smooth, but is faintly hispid. Choanosomal skel-

Table 7. Spicule dimensions of *Amphimedon lamellata* n. sp. (µm; n=10).

MATERIAL		LOCALITY	DEPTH	OXEAS		THIN OXEAS	
				Mean	Range	Mean	Range
HOLOTYPE	QM G25037	MacGillivray Reef	15 m	122 x 3.6	111-130 x 2.5-4.4	113 x 1.8	105-126 x 1.3-2.1
PARATYPE	QM G25038	Carlisle Island	12 m	142 x 6.8	127-156 x 5.2-8.3	118 x 2.0	104-135 x 1.0-3.1

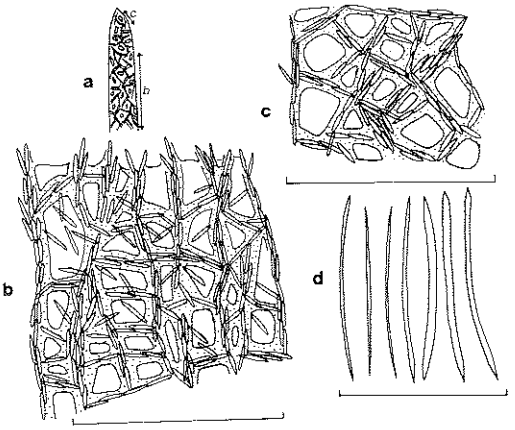

Fig. 9. Skeleton and spicules of *Amphimedon lamellata* n. sp. **a**,plan view of sponge cut longitudinally showing orientation of skeletal diagrams; **b**,choanosomal skeleton showing the spongin fibre reticulation cored by spicules, and interstitial spicules. The sponge surface is at the top of the diagram; **c**, tangential view of ectosomal skeleton; **d**, oxeas. Scale bars: b, c, 500 µm; d, 100 µm.

etal reticulation visible at surface, producing a round meshed pattern. Small oscules, 1 mm across, occur on slightly raised nodes at the sponge centre.

Skeleton. Choanosomal skeleton a regular spongin fibre reticulation, rectangular or isodictyal, cored by 1-5 spicules (Fig. 9b). Mesh size small, primary and secondary fibres spaced 80-150 µm apart. Primary fibres 20-35 µm wide, secondaries a greater range of widths, 10-35 µm across. Spicules also dispersed interstitially. Superficially, spicules of the primary tracts extend to, or slightly beyond, the surface, and secondary fibres are parallel to the surface (Figs 5d, 9c).

Spicules. (Measurements in Table 7). Principal megascleres thin, curved oxeas with long tapering points (Fig. 9d). Rare stylote modifications occur. The specimen from inshore waters, Carlisle Island, had longer and thicker spicules than those from the specimen from mid-shelf waters at MacGillivray Reef (Table 7).

Etymology. The species name is derived from the sponge growth form, consisting of undulating, thin layers (Fig. 6e).

Remarks. This species is characterised by its erect lamellate growth form and fine surface patterning. Its regular reticulate skeleton with small meshes and almost equally sized primary and secondary fibres are also characteristic features of the species. No other species of *Amphimedon* are known with these features.

Amphimedon lamellata is similar in skeletal design of the choanosome to the Northern Hemisphere species *Haliclona simulans* (Johnston, 1842), as depicted by de Weerdt (1986:67, Fig. 5). This similarity highlights the occasional difficulty in clearly assigning species to the Niphatidae or Chalinidae. The two species are distinct for a number of reasons: biogeographic distribution, considerable differences in external shape, and the secondary fibre is unispicular in *H. simulans* and multispicular in *A. lamellata,* hence the allocation to different genera. The surface skeleton of the former is an isodictyal unispicular reticulation, lacking the fibre development at the surface that is found in specimens of *A. lamellata.*

Ridley (1884:410) described a lamellate sponge from Torres Strait as *Reniera* sp. and this sponge is similar to *A. lamellata* in external morphology and skeletal detail. Differences between the species are as follows: the secondary fibres are unispicular in *Reniera* sp. and the oxeas are considerably larger (175 x 7.9 µm) than in *A. lamellata.* Ridley's material should be examined to determine if the specimen is a good species of *Reniera*, or incorrectly assigned to that genus.

Amphimedon terpenensis n.sp.
(Figs 1, 5e, 6f, 10)

Type material. HOLOTYPE - QM G25039: MacGillivray Reef, Lizard Island, Great Barrier Reef, 14°39'S 145°27'E, 15 October 1987, depth 19 m, coll. J. Fromont, SCUBA; PARATYPES - QM G25040: North Point, Lizard Island, Great Barrier Reef, 14°39'S 145°27'E, 11 October 1987, depth 20 m, coll. J. Fromont, SCUBA; QM G25041: John Brewer Reef, Great Barrier Reef,

Table 8. Spicule measurements of *Amphimedon terpenensis* n. sp. (µm; n=10).

MATERIAL		LOCALITY	DEPTH	OXEAS		THIN OXEAS	
				Mean	Range	Mean	Range
HOLOTYPE	QM G25039	MacGillivray Reef	19 m	237 x 8.7	218-319 x 6.7-12.6	266 x 3.4	210-294 x 2.5-4.2
PARATYPE	QM G25040	North Point	20 m	276 x 8.1	244-294 x 5.9-10.1	239 x 3.9	210-273 x 2.5-5.0
PARATYPE	QM G25041	John Brewer Reef	16 m	252 x 8.6	210-275 x 7.0-10.0	228 x 3.9	210-275 x 2.0-5.0
PARATYPE	QM G25042	Orpheus Island	13 m	305 x 9.5	265-335 x 9.0-10.0	246 x 3	220-270 x 2.0-5.0

18°38'S 147°04'E, 29 August 1986, depth 16 m, coll. J. Fromont, SCUBA; QM G25042: Pioneer Bay, Orpheus Island, Great Barrier Reef, 18°36'S 146°29'E, 19 February 1987, depth 13 m, coll. J. Fromont, SCUBA.

Habitat. Mid-shelf reefs and islands, 10 to 20 m depth, in full light on rock or dead coral.

Description. Tall erect lamellate and/or coalescing branches (Fig. 6f) up to 10 mm thick and 300 mm tall, sometimes with the appearance of flattened organ pipes.

Colour. Red-brown alive with a thin maroon band, approximately 1 mm thick, beneath the ectosome, fawn interior. The maroon band is caused partially by a sponge pigment and partly by a cyanobacterial symbiont (Dr. C. Battershill pers. comm.). When the sponge is dying it exudes a pink dye from this region. In alcohol, cream throughout.

Texture. Furry to touch, slightly compressible, elastic.

Surface. Smooth but microscopically hispid surface which looks like down or fur. Small oscules, up to 2 mm in diameter, occur on sponge edges, raised ridges or nodes.

Skeleton. Choanosomal skeleton fibro-reticulate with densest fibre development in the centre of the sponge and dense mesohyl development everywhere except for subectosomal spaces (Figs 5e, 10b-1, 2). Primary tracts cored by 4-8 spicules, 40-150 µm diameter, sinuous (Fig. 5e), can be fasciculate. Secondary tracts, 20-150 µm diameter, cored by 2-4 spicules, may ramify. Mesh spaces 200-450 µm wide. Primary tracts of spicules, in narrow fans, extend the sponge surface. Ectosomal skeleton supported by primary spicule fans and sparse tangential spicules (Fig. 5e).

Spicules. (Measurements in Table 8). Long slender oxeas usually centrally curved, evenly tapering to long points, also with stylote and strongylote modifications. Axial canal frequently visible (Fig. 10c).

Etymology. The species is named for the large proportion of terpenes: approximately 2% of sponge freeze dried weight, found in this sponge (Dr. M. Garson, pers. comm).

Remarks. The specimen from the inshore locality, Orpheus Island, has spicules that are longer and thicker than the specimens collected from midshelf reefs. *Amphimedon terpenensis* is characterised by its unique features of gross morphology, erect lamellate branches, red brown colour when alive, and dense mesohyl development. No other species is known with this combination of characters.

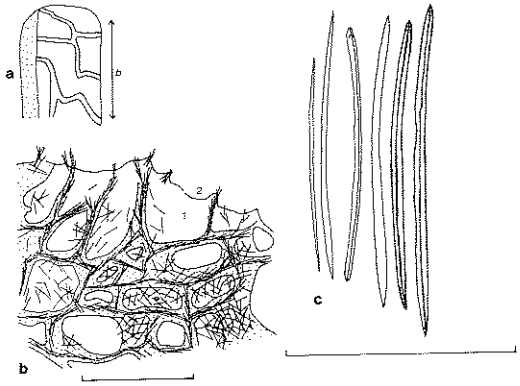

Fig. 10. Skeleton and spicules of *Amphimedon terpenensis* n. sp. **a**, plan view of the sponge showing orientation of the skeletal diagram; **b**, the fibro-reticulate skeleton with dense fibre and organic development except where there are subectosomal spaces (1), beneath the surface (2); **c**, long slender oxeas with stylote and strongylote modifications and frequently with the axial canal visible. Scale bars: b, 1000 µm, c, 200 µm.

Amphimedon sulcata n.sp.
(Figs 1, 5f, 11, 13a-b)

Type material. HOLOTYPE - QM G25043: Palfrey Island, Great Barrier Reef, 14°42'S 145°27'E, 7 October 1987, depth 14 m, coll. J. Fromont, SCUBA.

Distribution. Found on patch reefs, shallow reef crests on front and back reefs, and in lagoons. Distribution and abundance data for *A. sulcata* was recorded from the following localities: Palfrey Island, 14°42'S 145°27'E, 12 m; North Point Reef, 14°39'S 145°27'E, 9 m; Hicks Reef, 14°28'S 145°29'E, 12 m; Eagle Islet, 14°41'S 145°22'E, 9 m; Lizard Head, 14°41'S 145°28'E, 14 m; Blue Lagoon, Lizard Island, 14°41'S 145°27'E, 10 m; South Island, 14°42'S 145°27'E, 3 m; MacGillivray Reef, 14°39'S 145°29'E, 9 and 15 m. All sites near Lizard Island (Fig. 1). Because of the small size of specimens of this species, and their distinctive growth form (which facilitated ready recognition of the species in the field), specimens were not collected from these sites.

Habitat. Locally abundant small sponges found in a broad range of habitats, particularly reef slopes in full light (Fig. 13a), also under overhangs.

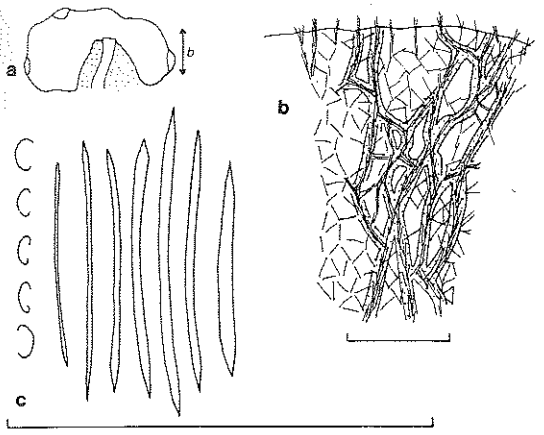

Fig. 11. Skeleton and spicules of *Amphimedon sulcata* n. sp. **a**, plan view of the sponge showing the orientation of the skeletal diagram; **b**, diagram of skeleton showing surface of the sponge and primary spicule tracts - in the choanosome is the plumo-reticulate fibre structure; **c**, principal oxeas, thin oxeas, and c-shaped sigmas. Scale bars: b, 500 µm; c, 200 µm.

Description. Small globular sponges, flat and pancake-shaped, or small cushions up to 20 mm tall and 10-20 mm diameter (Figs 13a, b).

Colour. Mauve alive, in alcohol cream or fawn.

Texture. Slightly compressible, elastic, easily torn.

Surface. Subsurface meandering parallel ridges, interspersed with spaces, give a convoluted or brain-like appearance to the surface. Ridges are hispid, spaces have tiny oscules 1 mm diameter. A fine membrane connects the ridges (Fig. 13b).

Skeleton. Choanosomal skeleton a fibrous reticulation with dense plumo-reticulate fibre centrally (Fig. 5f). Primary fibres 83 µm wide, cored by 2-4 spicules, secondaries, 20-45 µm across, cored by 1 or 2 spicules. Choanosomal meshes 100-200 µm wide, occasional internal cavities up to 800 µm across. Spicules also found haphazardly throughout choanosome. Primary fibres extend to the surface. Spicule ends protrude slightly beyond an ectosomal membrane spread between primary tracts and supported by tangential spicules (Figs 5f, 11b).

Spicules. Smooth straight or slightly curved oxeas with sharply pointed, faintly stepped ends (Fig. 11c). Mean: 139 x 4.5, range: 122-153 x 3.0-5.3 µm. Less common thin oxeas also occur, mean: 126 x 2.3, range: 94-140 x 1.6-2.6 µm. Microscleres elongate c-shaped sigmas, mean: 15.9, range: 13.0-16.9 µm.

Etymology. The species name is derived from the surface texture, which is furrowed or grooved, and characteristic of this species.

Remarks. *Amphimedon sulcata* is characterised by its external morphology, consistent external colour when alive and intricate surface patterning. In the choanosome it has a rectangular meshwork of primary and secondary fibres, and abundant sigmas.

Amphimedon sulcata is most similar in general appearance to *Gelliodes incrustans* Dendy, 1905, from the Gulf of Manaar, in external colour and spiculation. However *G. incrustans* lacks the typical niphatid dense plumoreticulate skeleton that is found in *A. sulcata.*

Genus *Gelliodes* Ridley

Gelliodes Ridley, 1884:427.

Type species. *Gelliodes fibulata* (Carter, 1881), by monotypy (Ridley, 1884:427), type locality, Bass Strait, Australia.

Diagnosis (New). Sponges where multispicular primary fibres or tracts predominate, interconnecting secondary fibres reduced in abundance (Fig. 12b). Interstitially a unispicular isodictyal or rectangular reticulation may occur. Megascleres usually oxeas, microscleres, sigmas. Ectosomal skeleton dominated by protruding tufts of primary and secondary tracts of the choanosome, surface hispid or spiny as a result.

Remarks. The genus *Gelliodes* is similar, in enhanced development of primary tracts, to the haliclonid genus *Cladocroce*. However, the skeleton of the genus *Gelliodes* has strong development of the primary tracts, which may be fasciculate and anastomosing, multispicular secondary tracts, a coarse texture, and incompressible consistency. The genus *Cladocroce* has a

Table 9. Spicule measurements of *Gelliodes fibulata* Carter (µm; n=10).

MATERIAL	LOCALITY	DEPTH	OXEAS		THIN OXEAS		SIGMAS	
			Mean	Range	Mean	Range	Mean	Range
QM G25044	Sir Charles Hardy Island	14 m	217 x 5.4	181-267 x 4.2-8.4	209 x 2.8	162-256 x 1.7-4.0	14.1	10.5-15.8
QM G25045	Orpheus Island	7 m	234 x 6.5	203-265 x 5.2-7.8	192 x 2.2	174-226 x 1.0-2.6	13.4	10.4-15.6

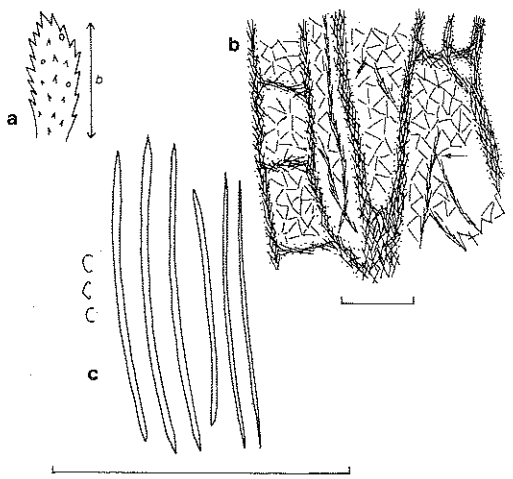

Fig. 12. Skeleton and spicules of *Gelliodes fibulata* (Carter). **a**, plan view of the sponge showing orientation of the skeletal diagram; **b**, the fibro-reticulate choanosomal skeleton with central plumoreticulate fibres, ladder reticulations surrounding them, and interstitial spicules occasionally forming tracts (arrow); **c**, long thin principal oxeas, very thin oxeas and sigmas. Scale bars: b, 500 µm; c, 200 µm.

dendritic primary skeleton and a secondary skeleton that is a unispicular isodictyal reticulation.

Gelliodes fibulata (Carter)
(Figs 1, 12)

Axos fibulata Carter, 1881:383, pl. 18, fig. 4, Bass Strait, Australia.

Gelliodes fibulata - Ridley 1884:427, pl. 39, fig. 1, pl. 41, fig. bb, Torres Strait, Queensland; Ridley and Dendy 1887:47, pl. 12, fig. 2, Torres Strait, Queensland; Topsent 1897:470, Ambon Is., Indonesia; 1932:114; Hentschel 1912:393, Aru Is., Indonesia; Lévi 1961:141, fig. 16, Vietnam; Wiedenmayer 1977:95; Desqueyroux-Faundez 1981:744, figs 56, 117, Ambon Is., Indonesia; 1984:780, figs 6, 51, 52, 58 & 61, New Caledonia; Hooper 1986:184, pl. 1e, figs 11,12, Northern Territory, Australia; Kelly Borges and Bergquist 1988:51, pl. 6a, Motupore Is., Papua New Guinea.

Type material: lost from BMNH collection (Burton, 1934:549); type locality, Bass Strait, Australia.

Material. QM G25044: Sir Charles Hardy Islands, Great Barrier Reef, 11°55'S 143°28'E, 2 May 1987, depth 14 m, coll. J. Fromont, SCUBA; QM G25045: North-East Reef, Orpheus Island, Great Barrier Reef, 18°34'S 146°29'E, depth 7 m, 20 February 1987, coll. J. Fromont, SCUBA, (Fig. 1).

Habitat. Fringing reefs and reef slopes, growing on sides of coral bommies. Orpheus Island sponge growing around branches of a coral colony of the genus *Millepora*.

Description. Erect or horizontally spreading solid branches, with firm central core, that may anastomose (refer to Kelly Borges and Bergquist 1988: pl. 6a).

Colour. Bright blue alive, fawn in alcohol.

Texture. Firm, tough, slightly compressible.

Surface. Prickly, hispid, covered with spines up to 10 mm long with smaller spines extending at right angles. Oscules, at bases of spines, not easily visible.

Skeleton. Choanosomal skeleton fibro-reticulate, numerous spicules densely packed into primary fibres up to 400 µm diameter. Centrally the skeleton is plumo-reticulate with a peripheral ladder-like reticulation (Fig. 12b). Secondary tracts 50-200 µm across. Primary tracts extend beyond the surface forming long spines, secondary tracts form smaller spines. Interstitial spicules abundant, irregularly organised, may form narrow, longitudinal tracts of 3 to 5 spicules (Fig. 12b).

Spicules. (Measurements in Table 9). Principal megascleres long thin oxeas, thinner developmental forms occur, microscleres, sigmas (Fig. 12c).

Remarks. The Great Barrier Reef specimens agree with the redescription of the species provided by Kelly Borges and Bergquist (1988). This species is widespread in the Southern Hemisphere. It has been reported from Torres Strait, North Queensland, and Northern Territory, Australia, Indonesia, Papua New Guinea and New Caledonia.

Genus *Aka* de Laubenfels

Acca Johnson, 1899:461 (preoccupied).

Aka de Laubenfels, 1936:155; Thomas 1968:250; Rützler and Stone 1986:663; Reitner and Keupp 1991:102.

Siphonodictyon Bergquist, 1965:158; Rützler 1971:2; Kelly Borges and Bergquist 1988:154.

Type species. *Aka insidiosa* Johnson, 1899, by subsequent designation (de Laubenfels, 1936:155); type locality, Madeira, Atlantic Ocean.

Diagnosis. (Modified after Rützler, 1971). Sponges with a cryptic habit always burrowing

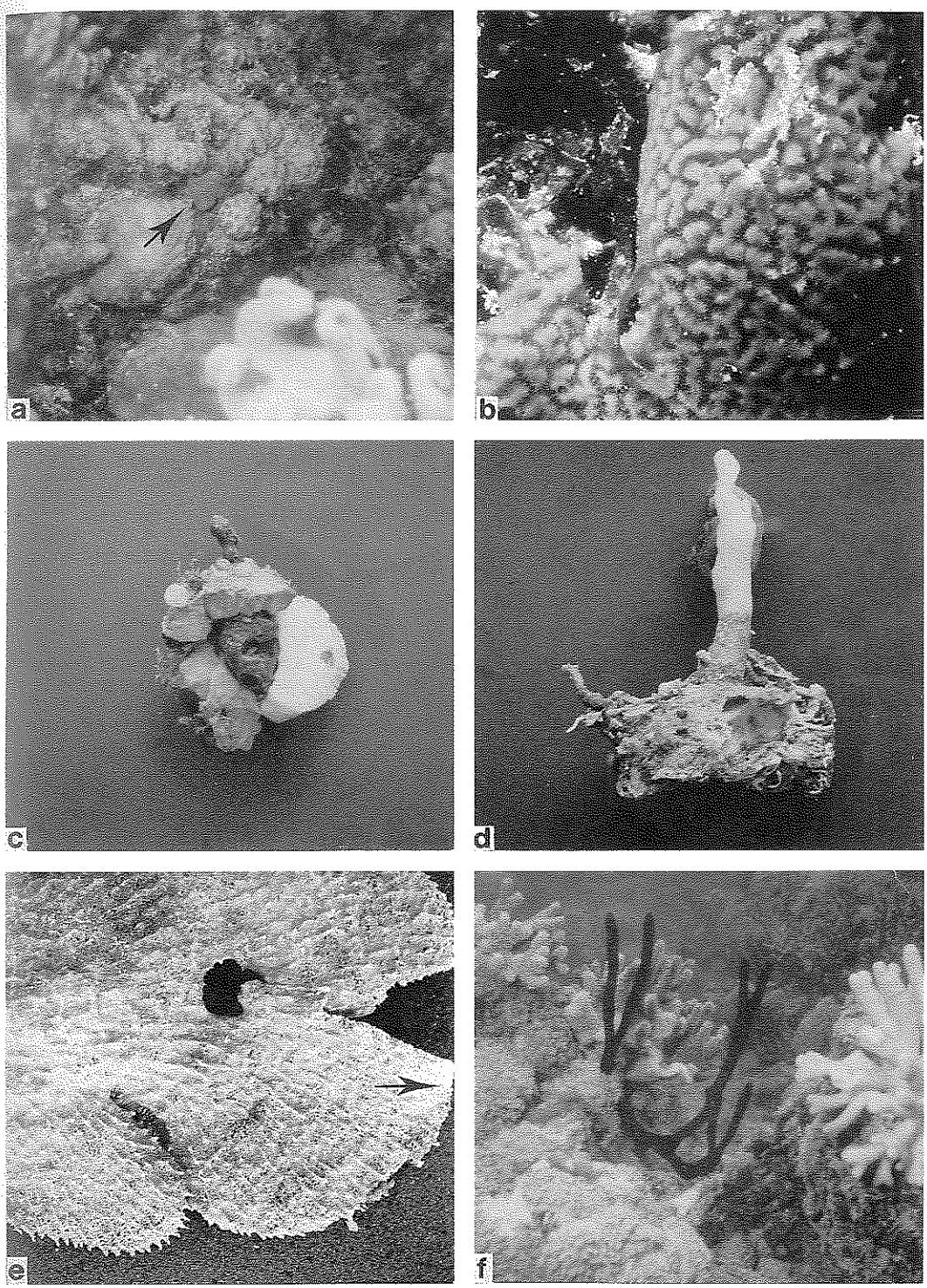

Fig. 13. **a**, *Amphimedon sulcata* n. sp. *in situ*, Lizard Island; **b**, *Amphimedon sulcata in situ*, close up of surface detail; **c**, *Aka mucosa* (Bergquist), alcohol preserved specimen; **d**, *Aka paratypica* n. sp., alcohol preserved specimen; **e**, *Callyspongia muricina* (Lamarck), freeze-dried specimen lying on its side, the arrow indicates the top of this fan-shaped sponge; **f**, *Callyspongia pseudoreticulata* Desqueyroux-Faundez, *in situ*, Lizard Island.

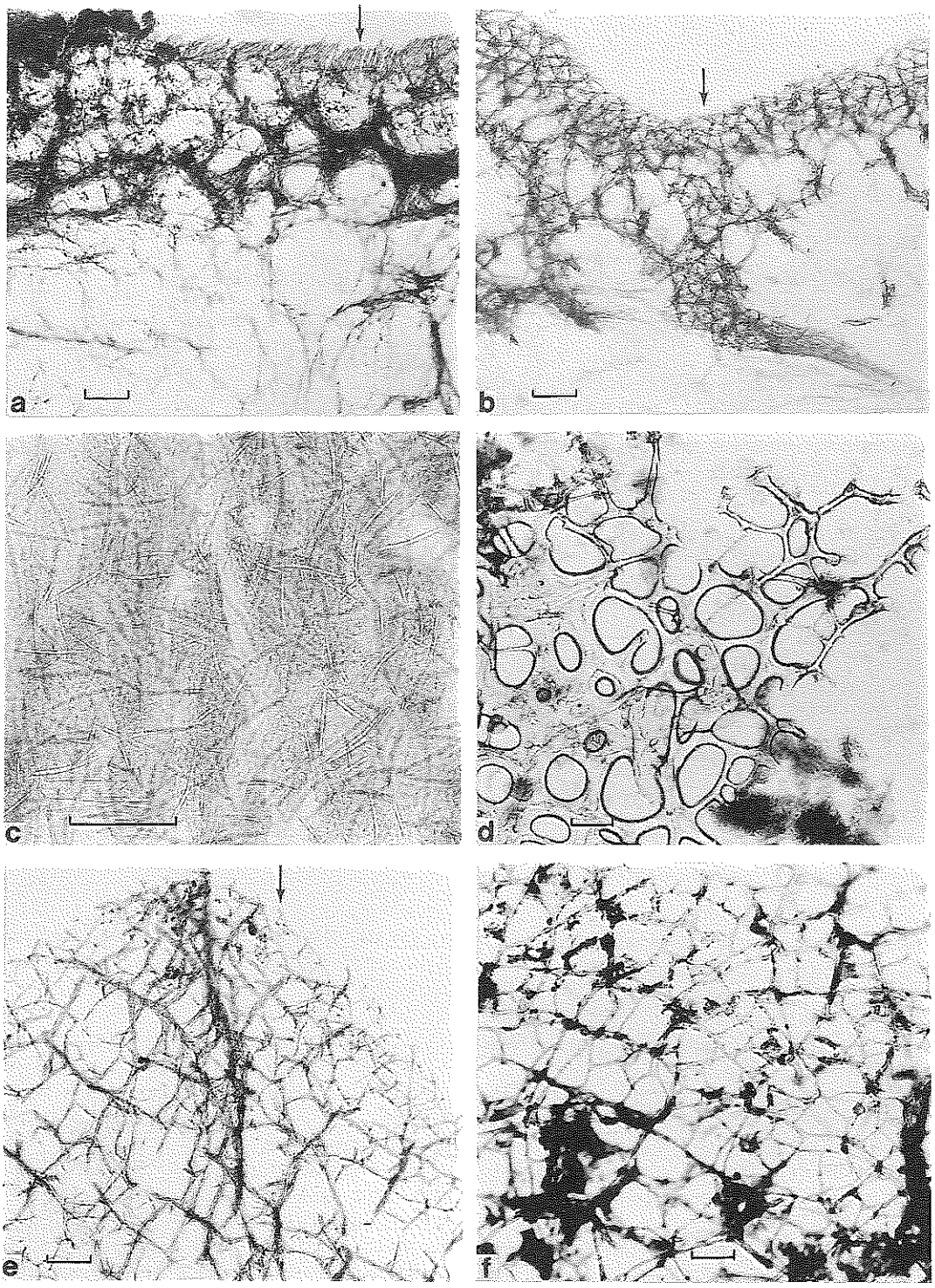

Fig. 14. Skeletons of species of the Niphatidae and Callyspongiidae, arrow = surface. **a**, *Aka mucosa* (Bergquist), l.s. of fistule skeleton; **b**, *Aka paratypica* n.sp., l.s. of fistule skeleton; **c**, *Aka paratypica*, l.s. isotropic choanosomal skeleton; **d**, *Callyspongia muricina* (Lamark), t.s. surface skeleton; **e**, *Callyspongia aerizusa* Desqueyroux-Faundez, l.s. choanosome and surface skeleton; **f**, *Callyspongia pseudoreticulata* Desqueyroux-Faundez, t.s. surface skeleton. Scale bars: 200 µm.

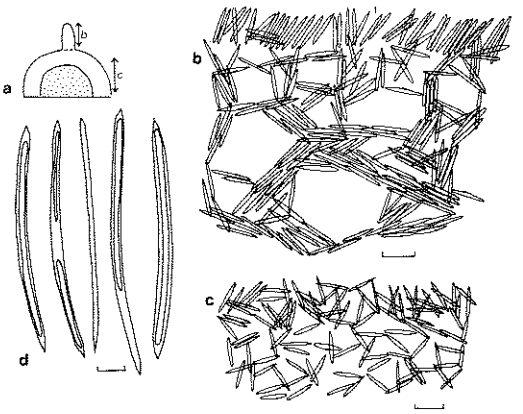

Fig. 15. Skeleton and spicules of *Aka mucosa* (Bergquist). **a**, plan view of the sponge showing orientation of the skeletal diagrams; **b**, the reticulate skeleton in the fistules displaying the erect spicule palisade at the surface, (1); **c**, the loosely organised choanosomal skeleton; **d**, thick and thin oxeas showing the central canal. Scale bars: b, c, 100 µm; d, 20 µm.

into calcified substrata, such as dead coral or shell, usually producing fistules which protrude above the calcareous substrate. Spicule tracts support the fistules; choanosomal skeleton isotropic, texture pulpy. Spicules oxeas with mucronate, stepped or rough ends. Reduced spongin fibre development; some species produce copious mucus.

Remarks. The generic name *Aka* was established by de Laubenfels (1936) to replace the preoccupied name *Acca* Johnson (1899). Species of this genus excavate calcareous material and have oxeas as spicules.

Bergquist (1965) established the new genus *Siphonodictyon* for *S. mucosa* Bergquist, 1965, from Palau. Rützler (1971) used this genus name for boring sponges from the Caribbean, Pulitzer Finali (1986) for species from the West Indies, and Kelly Borges and Bergquist (1988) for a new locality record of *S. mucosa* from Papua New Guinea.

Rützler and Stone (1986) synonymised *Siphonodictyon* with *Aka* (the former being a junior synonym of the latter). They based this synonymy on examination of type material of *Aka labyrinthica* (Hancock, 1849). The spicule mount of the type material contained oxeas of two size classes, 120x10 µm and 110x5 µm, and the larger category also had a characteristic shape - stout and curved with mucronate tips. They noted that these spicules agree well with the figures and descriptions of *A. insidiosa* by Johnson (1899) and with *S. obruta* Rützler, 1971. The substratum of all three species is calcareous, consisting of shells of species of *Ostrea* and *Chama* for *A. insidiosa*, shells of the giant clam, *Tridacna gigas*, for *A. labyrinthica*, and coral heads of various species for *S. obruta*.

Thomas (1968) described a new species of *Aka*, that bores into coral heads, from the Indo-Pacific, and Reitner and Keupp (1991) described recent and fossil species of *Aka*.

Aka mucosa (Bergquist)
(Figs 1, 13c, 14a, 15)

Siphonodictyon mucosa Bergquist, 1965:158, fig. 20a, b, Palau, Micronesia; Rützler 1971:2, fig. 1, 10a, pl. 1, Indonesia; Kelly-Borges and Bergquist 1988:154, Motupore Is., Papua New Guinea.

Type material examined. Holotype USNM 23697; type locality Palau, Micronesia.

Additional material. QM G25046: Pioneer Bay, Orpheus Island, Great Barrier Reef, 18°36'S 146°29'E, 25 July 1986, depth 2 m, coll. J. Fromont, snorkel.

Habitat. Found in bays on leeward side of Orpheus Island (Fig. 1), in shallow water to 2 m depth, boring into coral heads.

Description. Bores into coral, only erect black fistules visible above the substratum, up to 50 mm high, 7 mm diameter, fistule walls 1 mm thick. Choanosome within a cavity 5 mm inside coral head in most specimens examined (Fig. 13c). Interior of sponge only collected by breaking open the coral head.

Colour. In life black throughout, in alcohol, brown or black.

Texture. Fistules firm, brittle, choanosome soft, pulpy. Both parts exude mucus when collected.

Surface. Very finely hispid.

Skeleton. Fistules contain a reticulate skeleton (Fig. 14a) and an erect spicule palisade at the surface (Figs 14a, 15b). Choanosome has a dense organic component, no regular organisation of spicules (Fig. 15c).

Spicules. (Fig. 15d). Oxeas, two size categories, thick principal forms, mean: 174 x 6.1, n=10, range: 159-185 x 4.9-7.5 µm, thin forms, mean: 165 x 2.2, n=10, range: 156-179 x 1.3-3.9 µm. Axial canal frequently visible (Fig. 15d).

Remarks. The spicules of the specimens examined here are shorter and thinner than those of the type material, but in all other characters the sponges are identical. This species is recognised

by its burrowing habit, black coloration, erect fistules and production of mucus. This species has been reported previously from Palau, Indonesia, Darwin, and Papua New Guinea.

Aka paratypica n.sp.
(Figs 1, 13d, 14b-c, 16)

Type material. HOLOTYPE - QM G25047: Pioneer Bay, Orpheus Island, Great Barrier Reef, 18°36'S 146°29'E, 30 August 1987, depth 20 m, coll. J. Fromont, SCUBA. PARATYPE - QM G25048: Pandora Reef, Great Barrier Reef, 18°49'S 146°26'E, 30 October 1986, depth 10 m, coll. J. Fromont, SCUBA.

Habitat. Boring within coral heads on back fringing reefs.

Description. Boring sponge found within coral, visible only by erect, hollow, tapering fistules, 40-60 mm high, extending above substratum (Fig. 13d).

Colour. White fistules, creamy yellow sponge body alive, and after preservation in alcohol.

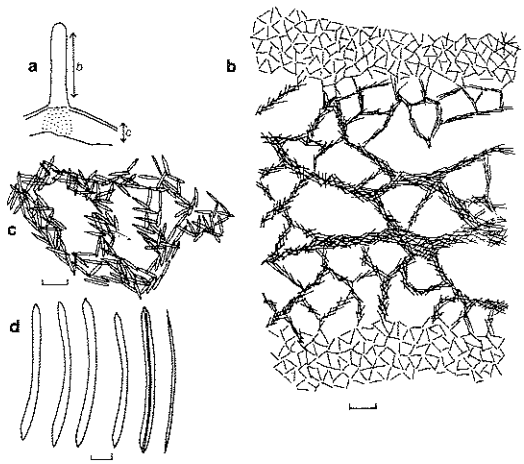

Fig. 16. Skeleton and spicules of *Aka paratypica* n. sp. **a**, plan view of the sponge showing orientation of skeletal diagrams; **b**, longitudinal section through a fistule displaying the well developed central skeleton and finer skeleton toward the edges; **c**, the loosely organised choanosomal skeleton; **d**, oxeas with rounded or stepped ends and terminating in a short or mammiform point. Scale bars: b, 200 µm; c, 100 µm; d, 20 µm.

Texture. Very soft, moist, compressible internally, like dense wet bread. Fistules compressible, brittle, easily broken.

Surface. Fistules smooth, microscopically hispid.

Skeleton. Fistule walls with reticulate skeleton of 30 to 60 spicules packed into tracts, 100-300 µm wide (Figs 14b, 16b). Tracts thinner, more closely spaced towards outer surface of wall, superficially making up a loose, isodictyal reticulation of 1-6 spicules. Choanosomal skeleton very loose network of spicules (Figs 14c, 16c) in vague tracts without orientation. Spicule tracts, 50-125 µm across, form round meshes approximately 100 µm across. Faint spongin fibre development.

Spicules. (Measurements in Table 10). Oxeas with rounded or stepped ends, terminating in a short point (mammiform, Fig. 16d). Axial filament through the centre of the spicules, frequently visible (Fig. 16d). Thinner forms occur, but they grade into the main size category of oxeas in the specimen from Pandora Reef.

Etymology. The species name is derived from the similarity of this species, from the Great Barrier Reef, to the Caribbean species *Aka coralliphagum* Rützler, 1971 var. *typica*.

Remarks. Thomas (1968:250) described *Aka diagnonoxea*, Thomas, 1968, from the Gulf of Manaar. This species is similar to *A. paratypica* in colour, and shape and size of oxeas, but is distinct in the features of its skeleton. *Aka diagonoxea* has fasciculate fibre development at the base of the fistules, and the fibres and reticulation of the skeleton are extremely large - the fibres are 750 µm wide and the mesh size of the reticulation 2070 µm. *Aka diagonoxea* has dichotomous or polychotomous fistules while fistules are singular in *A. paratypica*.

Pulitzer-Finali (1986:164) described *A. xamaycaense* Pulitzer-Finali, 1986, from deeper water, 40-45 m, in Jamaica. It has off-white fistules, and spicule tracts in the fistules of a similar size to those of *A. paratypica*. However, *A. xamaycaense* has very long fistules, 0.08-0.11 m compared to 0.04-0.06 m, the fistule skeleton meshes are also larger, and the ectosomal skel-

Table 10. Spicule measurements of *Aka paratypica* n. sp. (µm; n=10).

MATERIAL		LOCALITY	DEPTH	OXEAS		THIN OXEAS	
				Mean	Range	Mean	Range
HOLOTYPE	QM G25047	Pioneer Bay	20 m	130 x 5.8	109-140 x 4.7-7.8	128 x 2.1	120-133 x 1.3-2.6
PARATYPE	QM G25048	Pandora Reef	10 m	144 x 7.3	130-153 x 5.2-7.8	145 x 5.0	138-156 x 3.9-5.2

eton of tufts is not comparable to the isodictyal reticulation in *A. paratypica*.

Aka paratypica is closely allied to the Caribbean species *A. coralliphagum*. Rützler (1971) described four forms of *A. coralliphagum*, two of which lack fistules - *forma obruta* and *forma incrustans* - whereas *forma typica* and *forma tubulosa* possess them. *Forma typica* has single conical chimneys or tubes and small oxeas (142.1-156.3 x 5.0-6.4 µm; 129-142.9 x 2.2-2.7 µm). *Forma tubulosa* has clusters of ectosomal tubes and oxeas with dimensions of 165.9-169.3 x 6.1-6.9 µm and 144.5-152.2 x 2.2-3.2 µm. The Great Barrier Reef species most closely resembles *forma typica* in having single fistules and similar sized oxeas. *Aka paratypica* differs slightly from Rützler's description of *A. coralliphagum* in colour, having white fistules and a creamy yellow choanosome. Rützler (1971) describes the fistules of *A. coralliphagum* as deep yellow, lemon yellow to whitish yellow, and the choanosome as beige yellow to yellow tan with bright yellow embryos. In addition, these Caribbean and Great Barrier Reef species are separated by a long independent history and reproductive isolation.

Family Callyspongiidae de Laubenfels

Callyspongiidae de Laubenfels, 1936:55; van Soest 1980:46; Bergquist and Warne 1980:24; Desqueyroux-Faundez 1984:785; Wiedenmayer 1989:103.

Diagnosis. (Modified after Wiedenmayer, 1989). Haplosclerida with choanosomal skeleton a reticulation of spicules and spongin fibre; spongin always well developed, spicules may be sparse or absent. Megascleres small, usually very thin or vestigial oxeas or strongyles that core fibres, and may occur interstitially. Microscleres rare, but if they occur, toxas. Some genera incorporate foreign detritus in the skeleton.

Remarks. Species belonging to the Callyspongiidae have been given many generic names, the majority of which have at various times been synonymised with *Callyspongia* (see Wiedenmayer, 1989). Some of these genera have distinctive features such as a fibre skeleton incorporating foreign detritus, e.g. *Dactylia* Carter, 1885, or a complete lack of spicule elements in their skeleton, such as *Chalinopsilla* Lendenfeld, 1888. One genus, *Arenosclera* Pulitzer-Finali, 1982, has not been synonymised with *Callyspongia* to date. This genus is characterised by a skeleton which contains spicules and foreign material, and an ectosomal skeleton that is purely a network of foreign debris. In this study only species typical of the genus *Callyspongia* are described, and the validity of genera with character states like those mentioned above is not addressed.

Genus *Callyspongia* Duchassaing and Michelotti

Callyspongia Duchassaing and Michelotti, 1864:56; de Laubenfels 1936:55; van Soest 1980:46; Bergquist and Warne 1980:24; Desqueyroux-Faundez 1984:785; Wiedenmayer 1989:103.

Siphonochalina Schmidt, 1868:7; Synonym of *Callyspongia*: Wiedenmayer 1977:90; Bergquist and Warne 1980:24; de Weerdt and van Soest 1986:29.

Spinosella Vosmaer, 1885:342; Synonym of *Callyspongia*: Bergquist and Warne 1980:24; Wiedenmayer 1989:104.

(For full synonymy see Wiedenmayer, 1989:103).

Type species. *Callyspongia fallax* Duchassaing and Michelotti, 1864, by subsequent designation (Burton, 1934:539); type locality, St. Thomas, Virgin Islands.

Diagnosis. Choanosomal skeleton formed by a reticulation of spongin fibres with spicule axis. Specialised ectosomal skeleton of two forms, either a tangential reticulation of size-differentiated primary, secondary and sometimes tertiary tracts with organisation distinct from the choanosomal skeleton, or peripheral condensa-

Table 11. Skeletal characteristics of the three examined species of *Callyspongia* Duchassaing and Michelotti. F1, F2, F3, are primary, secondary and tertiary fibres respectively.

CHOANOSOMAL SKELETONS	SURFACE FEATURES		
	F1 and F2 differentiated	F1, F2 and F3 differentiated	Peripheral condensation
F1 fasciculate, F2 ramifying, skeleton irregular, F3 developed	*C. muricina*		
F1 fasciculate at conules, skeleton regular, F3 developed		*C. aerizusa*	
F1 fasciculate, skeleton regular, no F3 development			*C. pseudoreticulata*

tion with skeletal organisation an extension of the choanosomal skeleton but the mesh more compact. Megascleres oxeas or strongyles. Microscleres absent.

Remarks. Two genera, *Siphonochalina* and *Spinosella* - which are considered to be junior synonyms of *Callyspongia* in this study - have previously been merged or separated from *Callyspongia* by various authors, depending on the characters considered relevant for generic diagnoses.

Dendy (1890) considered that the genus *Siphonochalina* contained only smooth tubular sponges, whereas *Spinosella* included spiny tubular sponges. However, he questioned whether growth form was a valid diagnostic character, sufficient to separate the two genera.

Wiedenmayer (1977) used ectosomal features as a diagnostic character and retained *Spinosella* as a genus, but Wiedenmayer (1989) followed van Soest (1980) and treated *Spinosella* as a subgenus of *Callyspongia*. In his more recent publication, Wiedenmayer (1989) inferred that the diagnostic characters used by van Soest for the retention of *Spinosella* (=*Cladochalina*) Schmidt, 1870 (refer to Wiedenmayer 1989:105) as a subgenus, were impractical when applied to Indo-West Pacific and Australian material.

Wiedenmayer (1977) treated *Siphonochalina* as a junior synonym of *Callyspongia*, and concluded that *Callyspongia* species have peripheral condensation of the choanosomal skeleton at the surface of the sponge. On the other hand, species that were assigned to *Spinosella* have ectosomal skeletons formed by a tangential reticulation of size-differentiated fibres. These two groups are also distinguished by the organisation of their choanosomal skeletons: *Siphonochalina*-like species have an ordered, square-meshed, reticulation without fascicules, and *Spinosella*-like species have a disorientated choanosomal skeleton with fasciculate primary fibres (Wiedenmayer 1977).

Bergquist and Warne (1980) included both *Spinosella* and *Siphonochalina* as junior synonyms of *Callyspongia* disagreeing, with the diagnostic value, at generic level, of differences in the organisation of the skeletons at the sponge surface. These authors found that ectosomal skeletons often vary considerably, and that peripheral condensation and/or an ectosomal skeleton can be found in the same species or individual, depending on stage of growth or prevailing environmental conditions. They observed variable ectosomal skeletons, in specimens of two species from New Zealand: *C. ramosa* (Gray, 1843) and *C. fistulosa* (Kirk, 1911). Through re-examination of the type species of *Callyspongia*, *C. fallax*, Bergquist and Warne (1980) showed that this species has a tangential ectosomal skeleton as well as some peripheral condensation.

Van Soest (1980) concluded from a study of Caribbean haplosclerids that differences in skeletal construction of surface features are of minor importance, and are unreliable criteria for distinguishing genera. He divided the genus *Callyspongia* into two subgenera based on features of the choanosomal skeleton, as previously suggested by Wiedenmayer (1977). Van Soest (1980) recognised three types of skeletal organisation, in contrast to Wiedenmayer's two. He included in the nominotypical subgenus *Callyspongia* sponges with a regular choanosomal reticulation, and in the subgenus *Spinosella* sponges with fasciculate primary fibres. He retained the taxon *Siphonochalina* at the generic level, to include sponges with an irregular choanosomal skeleton in conjunction with an irregular ectosomal tangential reticulation not divided into distinctive primary and secondary fibres.

De Weerdt and van Soest (1986) reexamined material of the type species of *Siphonochalina*, *S. coriacea* Schmidt, 1868, and found that it conforms with the generic description of *Callyspongia*. Consequently, they synonymised the two genera, and I adopt their conclusion in this study.

Here, too, the genus *Spinosella* is included in synonymy with *Callyspongia* for the following reasons. Firstly, because the type material of

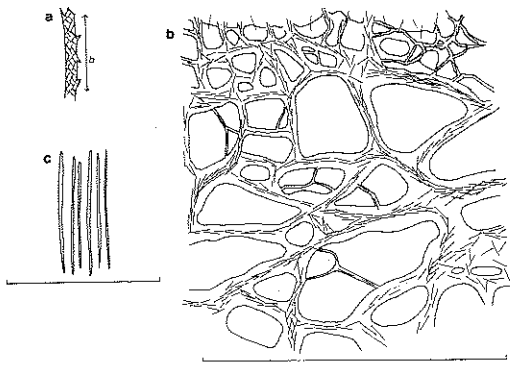

Fig. 17. Skeleton and spicules of *Callyspongia muricina* (Lamarck). **a**, plan view of sponge showing orientation of skeletal diagram; **b**, the choanosomal skeleton with the sponge surface at the top of the diagram - thick and fasciculate fibres occur centrally with thinner secondary and tertiary fibres around them; **c**, thin sharp strongyloxeas. Scale bars: b, 2000 µm; c, 100 µm.

Callyspongia, C. fallax, has both an ectosomal skeleton and peripheral condensation; hence these characters are unreliable for separation of genera (Bergquist and Warne, 1980). Secondly, the ectosomal skeleton of some sponges may vary as a result of environmental conditions; and thirdly, the two character states described by van Soest (1980) - the regular choanosomal skeleton in *Callyspongia* compared with fasciculation of primary fibres in *Spinosella* - both occur in *Callyspongia aerizusa* Desqueyroux-Faundez, 1984 (Table 11).

The three species of *Callyspongia* described here from the Great Barrier Reef all have some fibre fasciculation in their choanosomal skeletons, although the extent of this feature differs between species. *Callyspongia muricina* (Lamarck, 1813) has fasciculate primary and ramifying secondary fibres, *C. pseudoreticulata* Desqueyroux-Faundez, 1984, has fasciculate primary fibres and *C. aerizusa* has fasciculation only at the bases of the surface conules (Table 11, Fig. 14e). The choanosomal skeleton of *C. muricina* is irregular while those of *C. aerizusa* and *C. pseudoreticulata* are regular. The ectosomal skeletons of the three species also differ. *Callyspongia muricina* and *C. aerizusa* have tangential ectosomal skeletons consisting of size-differentiated fibres (i.e., primary, secondary, tertiary) and *C. pseudoreticulata* has peripheral condensation of the choanosomal skeleton (see Table 11).

Callyspongia muricina (Lamarck)

(Figs 1, 13e, 14d, 17)

Spongia muricina Lamarck, 1813:438, southern seas, Australia.

Siphonochalina confoederata - Lendenfeld 1887:803, West Australia.

Spinosella muricina - Topsent 1932:82, southern seas, Australia.

Callyspongia confoederata - Bergquist 1969:65, Heron Is., Great Barrier Reef.

Callyspongia muricina - Pulitzer-Finali 1982:115, Heron Is., Great Barrier Reef.

Type material. Holotype, MNHP DT587; type locality, southern seas, Australia.

Material. QM G25049: Rib Reef, Great Barrier Reef, 18°29'S 147°53'E, 31 October 1986, depth 7 m, coll. J. Fromont, SCUBA; QM G25050: Day Reef, Great Barrier Reef, 14°3'S 145°32'E, 8 October 1987, depth 10 m, coll. J. Fromont, SCUBA (Fig. 1).

Habitat. Mid-shelf and outer reefs at the base of shallow reef slopes in depths of 4-17 m. Occurs in full light between bommies of the massive coral, *Porites*, and stands of the branching coral, *Acropora*, on sand flats.

Description. Large erect fan (Fig. 13e) or tubular sponge up to 170 mm high by 130 mm across, thickness of sponge, 50 mm - 80 mm, becoming thinner apically.

Colour. Maroon to brown alive, fawn in alcohol (Fig. 13e).

Texture. Coarse, firm, compressible, requires some force to tear.

Surface. Microscopically hispid and differentiated with strong spines, 5 mm long, and pores on one side, and pores and no spines, on the other. Both surfaces feel rough. Choanosomal fibres protrude longitudinally to form slightly raised ridges and extend beyond the sponge surface in a palisade 5 mm tall. In tubular specimens the central oscular aperture is 5 mm diameter apically.

Skeleton. Thick primary fibres, 60-120 µm wide, which can be fasciculate (up to 650 µm across) beneath conules (Fig. 17b). Meshes 300-700 µm apart, with central quarter of fibres cored by up to 8 spicules. Thinner secondary fibres form a reticulation around primary fibres, are 30-120 µm wide, ramifying, and centrally cored with 3 to 4 spicules. Secondary skeleton connected by a fine network of tertiary fibres, 10-50 µm across, forming meshes 100-150 µm wide, fibres cored by 1-2 spicules. Ectosomal skeleton tangential reticulation of primary and secondary fibres forming triangular, square or polygonal

Table 12. Spicule measurements of *Callyspongia muricina* (Lamarck) (µm; n=10).

AUTHOR	MATERIAL	LOCALITY	DEPTH	OXEA	
				Mean	Range
Lendenfeld, 1887	-	Western Australia	-	93 x 0.9	-
Topsent, 1932	-	-	-	-	90-110 x 1.3-2.0
Bergquist, 1969	-	Heron Island GBR	4 m	-	60-72 x 1.0
Pulitzer-Finali, 1982	-	Heron Island GBR.	17 m	-	60-70 x 1.0
This study	QM G25049	Rib Reef	7 m	73 x 1.4	53-78 x 1.0-1.8
	QM G25050	Day Reef	10 m	76 x 1.7	70-81 x 1.3-2.1

meshes (Fig. 14d). Primary fibres 60-120 µm wide, mesh spaces 400-500 µm wide. Secondary fibres 30-60 µm across, tertiary fibres, rarely present, 10-30 µm wide. All fibres in the ectosomal skeleton sparsely cored by spicules.

Spicules. (Measurements in Table 12). Very thin degenerate oxeas with blunt points and wide axial canal (Fig. 17c).

Remarks. Previous taxonomic literature demonstrates the confusion that has existed regarding the two names *Callyspongia confoederata* (Lamarck, 1814) and *C. muricina*. Ridley (1884) described specimens collected from Torres Strait, northern Australia as: "*Tuba confoederata* (= ?*Spongia confoederata* Lamarck)". Ridley was correct in querying his assignment of these species to *T. confoederata*, as Lamarck's specimen (MNHN DT3364, lectotype) is of an arenaceous sponge, containing strongyles, sigmas (c- and s-shaped) and much spicule debris (Dr. J. Hooper pers. comm.). Lamarck's material is probably a good species of *Phoriospongia* and the name *confoederata* should be retained for his material. On the other hand, Ridley's material (BMNH 1826.10.31.5), reexamined in this study, is definitely a *Callyspongia* with primary, secondary and tertiary fibres abundantly cored by oxeas, 76-84 x 2-4 µm, and an ectosomal skeleton that consists of spicules surrounded by less developed fibre than in the main skeleton. Lendenfeld (1887) also assigned specimens, from Western Australia, which had extremely thin spicules (93 x 0.9 µm), to *C. confoederata*.

Topsent (1932) examined Lamarck's material of *Spongia muricina* and *Spongia confoederata*, and Ridley's and Lendenfeld's specimens described as *C. confoederata*. Topsent found, as suggested above, that neither Ridley's nor Lendenfeld's material agreed with Lamarck's material of *Phoriospongia confoederata*. Furthermore, Lendenfeld's specimens differed from Ridley's material, and his West Australian material was re-assigned, by Topsent (1932), to *Callyspongia muricina*. In the future a new name will be required for Ridley's material described as *C. confoederata*.

However, since Topsent's work the name *C. confoederata* has been used for specimens collected and described by Burton, 1934, Lévi, 1961, Bergquist, 1969, Vacelet, Vasseur and Lévi, 1976, and Desqueyroux-Faundez, 1981, 1984. All of these specimens have skeletons that characterise them as belonging to the genus *Callyspongia*; some of these specimens conform to Ridley's material, some to Lendenfeld's material, but none have the skeletal characters of Lamarck's type material of *Phoriospongia confoederata*. In this situation, the above specimens should be reexamined and assigned to either a new species, in the case of those similar to Ridley's material, or included in synonymy with *C. muricina*, if the material agrees with Lendenfeld's specimens. The latter circumstance has been initiated by Pulitzer-Finali (1982), who described *C. muricina* from the Great Barrier Reef, and included in synonymy *C. confoederata* of Bergquist (1969), as well as Topsent's previous assignment of Lendenfeld's material.

The Great Barrier Reef specimens collected and described in this study were compared with Bergquist's material (AM Z3116) of *C.*

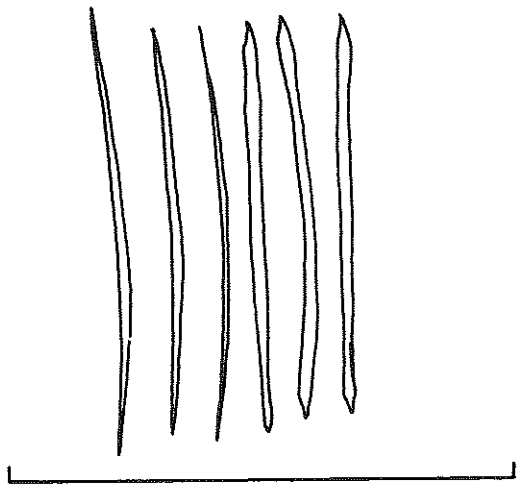

Fig. 18. Spicules of *Callyspongia aerizusa* Desqueyroux-Faundez. Thin hastate oxeas. Scale bar: 100 µm.

Table 13. Spicule measurements of *Callyspongia aerizusa* Desqueyroux-Faundez (µm; n=10).

MATERIAL		LOCALITY	DEPTH	OXEA	
				Mean	Range
PARATYPE	MNHG 976/280	New Caledonia	10-13 m	77 x 2.0	72-84 x 1.2-2.5
	QM G25051	Orpheus Island	13 m	84 x 2.4	78-88 x 1.6-2.9
	QM G25052	Orpheus Island	17 m	84 x 2.5	79-94 x 1.6-3.1
	QM G25053	Thursday Island	3 m	87 x 2.2	79-94 x 1.8-2.6

confoederata. These specimens agree, in details of the skeleton, with Bergquist's material, and Pulitzer-Finali's (1982) description of the material he collected. The choanosomal skeletons have primary, secondary, and tertiary fibre cored only in the central axis of the fibre by thin oxeote or strongyloxeote spicules, and well developed fibres in the ectosomal skeleton.

In contrast, the skeleton of Ridley's material (BMNH 1826.10.31.5) has many more spicules coring its choanosomal and ectosomal fibres, up to 20 across in the primary fibres, and only a small amount of spongin visible at the edges of the fibre. In addition, Ridley's material has thinner fibres (primary fibres up to 50 μm wide) than the Great Barrier Reef specimens.

It should be mentioned here that the oxeote spicules in Ridley's material are shorter and much thinner (76-84 x 2-4 μm) than he originally reported (100 x 6.3-7.5 μm).

Callyspongia aerizusa Desqueyroux-Faundez

(Figs 1, 14e, 18)

Callyspongia aerizusa Desqueyroux-Faundez, 1984:803, figs 18, 21, 129-136, 157-162.

Type material examined. PARATYPE - MNHG: 976/280, New Caledonia, 10-33 m.

Additional material. QM G25051: Pioneer Bay, Orpheus Island, Great Barrier Reef, 18°36'S 146°29'E, 2 January 1987, depth 13 m, coll. J. Fromont, SCUBA; QM G25052: Pioneer Bay, Orpheus Island, Great Barrier Reef, 18°36'S 146°29'E, 11 December 1986, depth 17 m, coll. J. Fromont, SCUBA; QM G25053: Thursday Island, Torres Strait, 10°35'S 142°13'E, 3 May 1987 (NCI no. Q66B 2201K), depth 3 m, coll. J. Fromont, SCUBA (Fig. 1).

Habitat. Found in high sediment areas with fine silt at the base of reef slopes. Uncommon.

Description. Erect sponge, either a fan or tube with spines, 7 mm long, on one side of fan or outside surface of tube, smooth but porous surface internally in tube or on opposite surface of fan (refer to Desqueyroux-Faundez 1984:figs 129, 130, 157, 158).

Colour. Fawn or blue-green alive, in alcohol fawn.

Texture. Soft, compressible, spongy, easily torn.

Surface. Prickly where spines extend, otherwise smooth, transparent, shiny. Primary tracts of spicules visible, supporting spines.

Skeleton. Regular, almost ladder-like reticulation of multispicular primary fibres interspersed with reticulation of thinner secondary and tertiary fibres cored by spicules. Primary fibres 50-80 μm wide, packed with 10-20 spicules, form meshes 200-400 μm wide. Primary tracts that support surface spines may be fasciculate (Fig. 14e). Secondary skeletal fibres 10-30 μm across, cored by 2-6 spicules, form rectangular or triangular meshes 50-150 μm wide. Tertiary fibres uni- or bispicular, 10-20 μm wide, form meshes 30-70 μm across. Surface skeleton is a compact reticulation of primary, secondary and tertiary spicule-cored fibres. Primary fibres, 50-80 μm wide, completely cored by spicules, radiate from the base of surface spines and form triangular meshes 100-350 μm wide. Within these meshes secondary fibres, 10-30 μm across, meshes 50-100 μm across, and numerous tertiary fibres, up to 10 μm wide, form a ladder-like reticulation.

Spicules. (Measurements in Table 13). Principal megascleres small hastate oxeas with abruptly constricted ends often terminating in sharp points (Fig. 18).

Remarks. The spicules of the Thursday Island sponge are slightly, but consistently, thinner than the Orpheus Island sponges, and the spines on the branches of the Thursday Island sponge

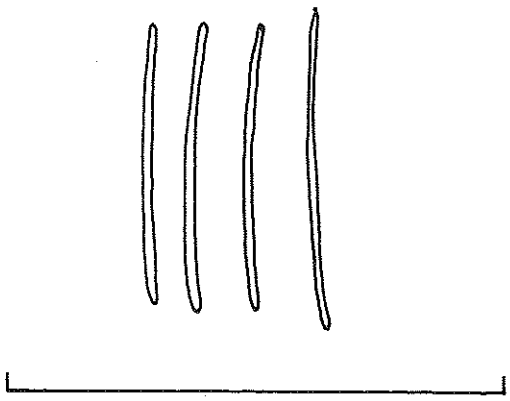

Fig. 19. Spicules of *Callyspongia pseudoreticulata* Desqueyroux-Faundez; thin blunt strongyloxeas. Scale bar: 100 μm.

Table 14. Spicule measurements of *Callyspongia pseudoreticulata* Desqueyroux-Faundez (μm; n=10).

MATERIAL	LOCALITY	DEPTH	STRONGYLOXEAS	
			Mean	Range
MNHG 976/282	New Caledonia	13-38 m	-	50-55 x 0.5
QM G25054	Lizard Island	9 m	60 x 1.0	57-65 x 0.8-1.3

are closer together. The Great Barrier Reef specimens have thicker primary fibres cored by more spicules than the specimen examined from New Caledonia (MHNG 976/280). Desqueyroux-Faundez (1984) described spicules from New Caledonian specimens as strongyloxeas but one of her specimens (MHNG 976/280), examined in this study, had oxeote spicules similar to the spicules of Great Barrier Reef specimens. The specimens from the Great Barrier Reef, in all other skeletal characters, conform with the description of *C. aerizusa*.

Callyspongia pseudoreticulata Desqueyroux-Faundez
(Figs 1, 13f, 14f, 19)

Callyspongia pseudoreticulata Desqueyroux-Faundez, 1984:809, figs 24, 175-181.

Type material examined. HOLOTYPE - MHNG: 976/282. PARATYPE - MHNG: 977/686, New Caledonia, 13-38 m.

Additional material. QM G25054: Lizard Island, Great Barrier Reef, 14°40'S 145°27'E, 7 October 1987, depth 9 m, coll. J. Fromont, SCUBA (Fig. 1).

Habitat. Common on reefs around Lizard Island in lagoonal areas and front and back reef slopes with high densities of hard coral. Common at depths between 3-9 m and less abundant in deeper water up to 15 m.

Description. Erect sponge with bifurcating branches up to 300 mm tall and 20 mm wide (Fig. 13f). Some branches dorsoventrally flattened are less than 10 mm thick in this plane.

Colour. Black or dark brown throughout alive (Fig. 13f), black or brown throughout in alcohol.

Texture. Soft, compressible, spongy, torn with minimum force.

Surface. Flat, reflects light, microscopically hispid. Oscules numerous, flush with surface, 1-2 mm diameter. Oscules occur on edges of branches and one side of branches that are dorsoventrally flattened.

Skeleton. Regular, ladder-like, spongin fibre reticulation with peripheral condensation at the surface, thick primary fibres, that may be fasciculate, in the choanosome. Tangential mesh at the surface formed by radiating secondary fibres, supported by choanosomal primary fibres, intersected by tertiary fibres (Fig. 14f). Secondary fibres at the surface 20-50 µm wide, form meshes up to 500 µm across, tertiary fibres slightly thinner, up to 20 µm wide, form meshes up to 130 µm across. Patches of pigment cells occur superficially (Fig. 14f). Peripheral condensation at the surface extends from the choanosome in narrow parallel layers. Beneath this superficial region the mesh size is 50-360 µm across, fibres 10-50 µm wide. In the centre of the sponge primary fibres become fasciculate, up to 175 µm wide, mesh sizes vary between 100-360 µm. Spicules rare, where they do occur it is singly within all parts of the fibre skeleton.

Spicules. (Measurements in Table 14). Spicules very thin, vestigial, blunt strongyloxeas (Fig. 19).

Remarks. The Great Barrier Reef specimens differ from Desqueyroux-Faundez' (1980) description of *C. pseudoreticulata* in the following features. They are black or very dark brown alive and not ochre to brown as described for the original material, and they are larger sponges with thicker branches, 10 mm diameter compared with 3-5 mm in the New Caledonian specimens reexamined for this study (MHNG 977/686 & 976/282). The choanosomal skeletons, in specimens from both localities, have identical architecture, but the fibres of the Great Barrier Reef sponges are thicker, possibly a structural modification to support the larger size of these sponges. In other skeletal characters, surface skeleton, spicule morphology and sizes, the Great Barrier Reef sponges conform with the species description.

DISCUSSION

This study of species of the Haplosclerida, conducted over several years, discovered a number of problems in the taxonomy of this order, the resolution of which are beyond the scope of the present study, but should be addressed in future work on the group. Some of the more pertinent findings are discussed briefly below.

Two species of *Sigmadocia* were transferred to the genus *Haliclona* because the ectosomal skeletons were an extension of the choanosomal skeleton and not distinct from it. A distinct ectosomal skeleton was previously considered to be the principal distinguishing character of the family Adociidae. Examination of other species previously assigned to this family, and other characters, would be instrumental in determining at what taxonomic level this character - presence of a distinct ectosomal skeleton - should be used.

The two genera *Niphates* and *Amphimedon* are not easily differentiated, as the principal difference between them is in the construction of the ectosomal skeleton and whether or not the principal spicule tracts extend beyond the surface. In this study, differentiation of the genera was primarily determined by the extent of development of the primary tracts at the surface as well as construction of the ectosomal skeleton. The new species of *Niphates* was provisionally assigned to this genus because the organisation of its primary tracts and ectosomal skeleton agree with the generic diagnosis. However, it is important that additional characters are found to distinguish and strengthen definitions of these genera.

The location of *Aka* within the Niphatidae is questionable, but this genus does not fit well into any other family in the Haplosclerida. It shares a number of skeletal characters with *Oceanapia* in the Petrosida. Some of these characters, such as presence of fistules and pulpy choanosome, are most likely a result of adaptations to a specialised niche (i.e. its cryptic growth habit), rather than any close relationship with species of *Oceanapia*. Examination of further species in both genera could resolve this problem. More conservative characters, other than those of their skeletons which are subject to environmental influences, may be informative.

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APPENDIX

GLOSSARY OF TERMS

Choanosome: The area of the sponge where choanocyte chambers occur and in general terms refers to the interior of the sponge.

Diactinal: A category of megasclere pointed at both ends, e.g. oxeas, Fig. 3.

Ectosome: The superficial region of a sponge, see Fig. 5.

Fasciculate: Fibres collected together in groups, a compound main fibre, e.g. Fig. 8b-3, 14e.

Fibre: A discrete column of spongin and/or spicules and one of the chief structural elements of the skeleton of many demosponges, e.g. Fig. 5b, 7b.

Fistule: A hollow erect structure like a pipe or reed and used to describe erect tubes extending vertically from the sponge surface, see Fig. 13d.

Hastate oxea: An oxea with sharp tapered points - shaped like spear ends, e.g. Fig. 18.

Hispid: Rough or bristly, see Fig. 5d, 13b.

Interstitial: Spaces or openings between the skeletal tracts.

Isodictyal: A skeletal network where the meshes are commonly triangular in all directions, and have sides one spicule long, Fig. 2b, d.

Isotropic: A reticulation without regular differentiation into primary or secondary tracts or lines, Fig. 14c.

Mammiform: A spicule ending in the shape of a breast, e.g. Fig. 16d.

Megasclere: The larger structural spicule, e.g. Fig. 2c.

Mesohyl: The intermediate or central area of the sponge body, corresponding to the mesenchyme of other metazoa.

Microsclere: A smaller spicule frequently of ornate shape and used for reinforcing membranes or for packing the skeleton, e.g. Fig. 2c.

Mucronate: A spicule with pointed ends, Fig. 15d.

Oscule: An aperture through which water leaves the sponge body, e.g. Fig. 6b.

Paratangential: An arrangement of ectosomal spicules intermediate between that of a palisade and tangential.

Oxea: A megasclere spicule pointed at both ends, Fig. 2c.

Plumoreticulate: A reticulate structure with some central radiating unbranched tracts, e.g. Fig. 5f.

Renierid: The type of reticulate structure in the family Haliclonidae i.e. a simple, tridimensional unispicular, isodictyal reticulation, Fig. 2d.

Reticulate skeleton: Skeletal architecture characterized by branching and anastomosing of fibres, tracts, or megascleres to form a ladder-like network, e.g. Fig. 9b, 10b.

Sigma: A c- or s-shaped type of microsclere, Fig. 2b.

Spicule: A discrete skeletal element consisting of silica in the Class Demospongiae.

Spongin: Collagenous material deposited in the form of fibres, Fig. 14d.

Strongyle: A megasclere with both ends blunt and rounded, Fig. 4.

Strongyloxea: An oxea with either one (anisostrongyloxea) or both ends blunt but not rounded - between an oxea and a strongyle, Fig. 17, 19.

Style: A megasclere with one end rounded and the other pointed, Fig. 2c.

Subectosomal space: An inhalent aquiferous cavity, Fig. 8b-1.

Tangential skeleton: Orientated parallel to the surface, Fig. 7b, c.

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MYCALE ESCARLATEI N.SP. AND *MYCALE UNGUIFERA* N.SP. (DEMOSPONGIAE) FROM THE TROPICAL-WESTERN ATLANTIC

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words: Porifera, Poecilosclerida, Mycalidae, Tropical-western Atlantic, Phylogeny

ABSTRACT

le escarlatei n.sp. is described from the coasts of Bahia and Rio de Janeiro in Brazil and from the Santa Marta area in mbia. It belongs to the subgenus *Aegogropila* and is distinguished from other congeners in the area, by slender chelae-II and possession of micracanthoxeas. *Mycale unguifera* n.sp. is found in the Islas del Rosario and Santa Marta in Colombia. It belongs to the subgenus *Grapelia* and is distinguished within this taxon, by its large and abundant sig- The specimen described by Carter (1886) as *Pseudoesperia enignatica*, is here proposed as neotype of *Grapelia australis*. nermore, we provide a phylogenetic discussion of centrally-thickened, centrotylote-like toxas, micracanthoxeas, nce of an ectosomal skeleton and anisochelae-III with a basal spur-like projection.

RODUCTION

nteen species of *Mycale* are currently known n the tropical-western Atlantic (Hajdu & queyroux-Faúndez, 1994; Hajdu & Rützler, rep., key included). Of these, seven occur along the Brazilian coast (three endemics), and six along the Colombian Caribbean coast (one endemic). Our article describes two additional species, both occurring along the Colombian