New and redescribed encrusting species of *Alcyonium* from the Atlantic Ocean (Octocorallia: Alcyonacea: Alcyoniidae)

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Key words: Octocorallia; Alcyonacea; Alcyoniidae; *Alcyonium*; new species; redescriptions; Atlantic Ocean; deep water.
Three new species of *Alcyonium* are described and illustrated: *Alcyonium megasclerum* and *A. rubrum* from the Cape Verde Islands, and *A. profundum* from the Mid Atlantic Ridge. Two species are redescribed and figured: *A. grandiflorum* Tixier-Durivault & d'Hondt, 1975 and *A. maristenebrosi* Stiasny, 1937. *Pseudoalcyonium novum* Tixier-Durivault & d'Hondt, 1975 is synonymized with *Alcyonium bocagei* (Saville Kent, 1870).

Introduction

Four encrusting *Alcyonium* species are known from the Atlantic: *A. coralloides* (Pallas, 1766), *A. grandiflorum* (Tixier-Durivault & d'Hondt, 1975), *A. maristenebrosi* Stiasny, 1937, and *A. senegalense* Verseveldt & Ofwegen, 1992.

RMNH material, collected during CANCAP expeditions (see Van der Land, 1987), has been examined. Additionally, one specimen collected by the French CENTOB-Cruise was also examined. This material included specimens of *A. grandiflorum* and *A. maristenebrosi*, which are described here. Besides, three species new to science are presented, all from 1000 m deep or more. They are described, depicted, and compared with known species.

The following abbreviations are used: CENTOB = Centre National de Tri d'Océanographie Biologique, Brest, France; MNHN = Muséum National d'Histoire Naturelle, Paris, France; RMNH = National Museum of Natural History (NNM), formerly Rijksmuseum van Natuurlijke Historie, Leiden, The Netherlands.

Systematic part

Alcyonium grandiflorum (Tixier-Durivault & d'Hondt, 1975)
(figs 1a, 2-4c, 13)

Parerythropodium grandiflorum Tixier-Durivault & d'Hondt, 1975: 1373, figs 9-10 (Azores); Weinberg, 1977: 148.

Material examined.— RMNH Coel. 33874, one colony and three microscope slides, "Tydeman" Cape Verde Islands Expedition 1986, CANCAP-VII, sta. 7.140, S of Raso, 16°35'N 24°36'W, 1200 m, on an old

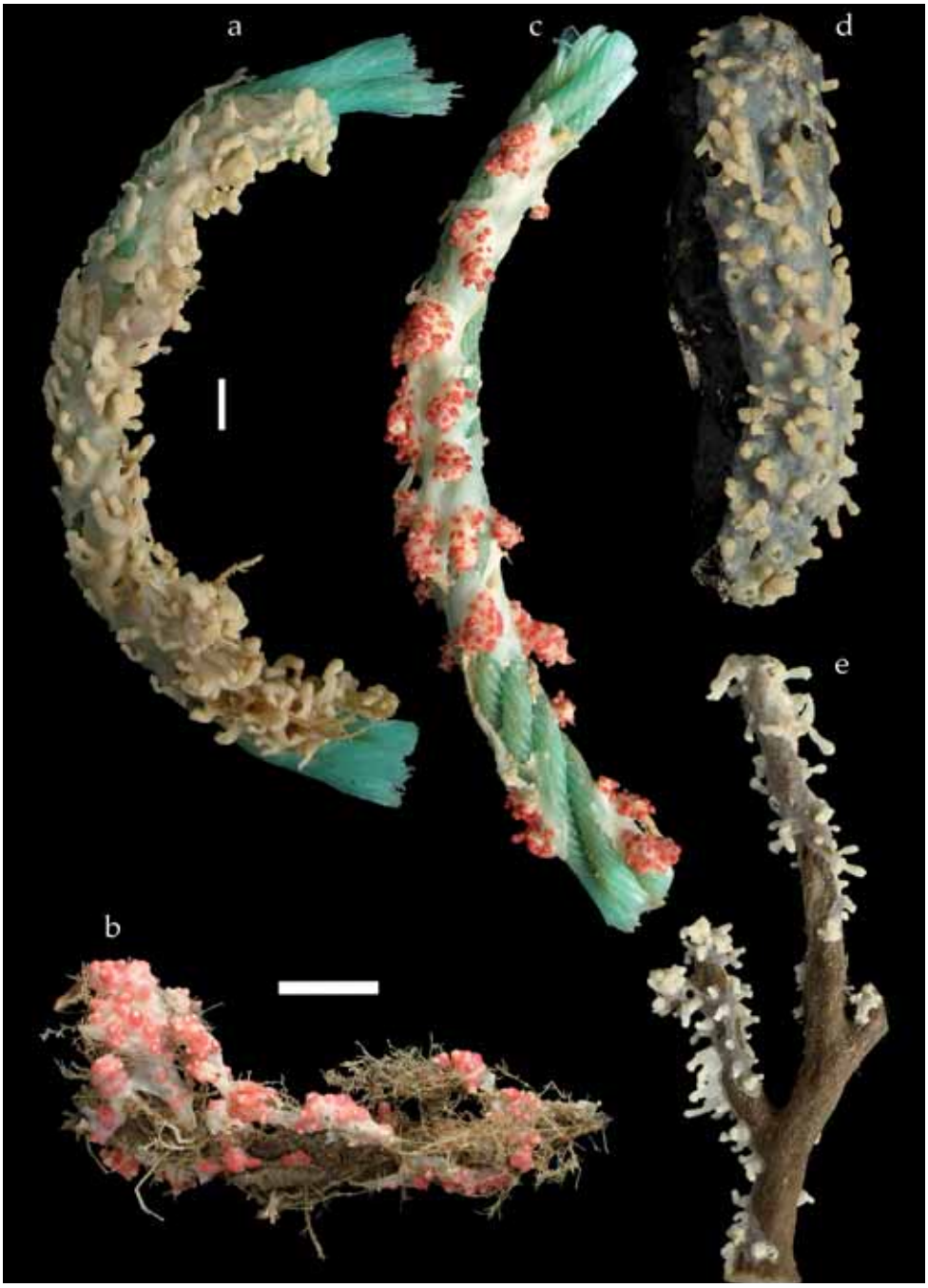

Fig. 1a, *Alcyonium grandiflorum* Tixier-Durivault & d'Hondt, 1975, RMNH Coel. 33874; b, *A. maristenebrosi* Stiasny, 1937, RMNH Coel. 33876; c, holotype *A. rubrum* spec. nov., RMNH Coel. 33879; d, holotype *A. profundum* spec. nov., MNHN; e, holotype *A. megasclerum* spec. nov., RMNH Coel. 33877. Scales 1 cm, that at b only applies to b.

lobsterpot with about 500 m nylon rope, with numerous epizoa, rectangular dredge, 4.ix.1986; RMNH Coel. 33875, one colony and three microscope slides, "Tydeman" Cape Verde Islands Expedition 1986, CANCAP-VII, sta. 7.003, SW of São Tiago, 14°54'N 23°38'W, 510 m, muddy sand with Pteropods, van Veen grab, 20.viii.1986.

Description.— Both colonies are membranous. RMNH Coel. 33874 is 14 cm long and 1 mm thick, completely surrounding a green nylon rope 1.5 cm in diameter (fig. 1a). It has a number of side branches where the colony encrusts dead gorgonian axes attached to the rope. RMNH Coel. 33875 has a similar colony shape but only grows on the axis of a gorgonian.

Polyps are evenly distributed over the membrane, standing 0.5-4.5 mm apart. Calyces are 2-6 mm high, the expanded polyps are 1.5-4 mm long and 1-3 mm wide; the tentacles are withdrawn.

Anthocodiae with many slender, sometimes slightly bent, spiny spindles, arranged en chevron; a real crown was not observed. These anthocodial spindles are up to 0.85 mm long (figs 2c-d, 4a). At the tentacle bases, slender clubs are present, up to 0.35 mm long (fig. 2a, 4c). These clubs are replaced distally by rods; the smallest only 0.05 mm long (fig. 2b).

The calyces contain irregularly tuberculated capstans and rods, 0.10-0.12 mm long; also wart clubs are present, 0.14-0.17 mm in length (fig. 3a).

The membrane contains long spiny spindles, which can be branched; they are up to 0.75 mm long (fig. 3c). Capstans, wart clubs, and smaller spindles, all densely covered with high tubercles, also occur in the membrane (figs 3b, 4b). These sclerites are 0.12-0.25 mm long.

Colour.— Both colonies are whitish.

Remarks.— We compared the present specimens with a fragment of the holotype material of *A. grandiflorum* Tixier-durivault & d'Hondt, 1975 (MNHN) and found them to be very similar. As the description given by these authors is rather short, and the figures somewhat schematic, we present new descriptions for the present material.

Alcyonium grandiflorum is somewhat similar to *A. megasclerum* spec. nov., but the latter species has shorter spindles in the membrane (0.40 mm long versus 0.75 mm), it lacks the clubs in the tentacle bases, and it has wider anthocodial spindles.

Alcyonium maristenebrosi Stiasny, 1937
(figs 1b, 5, 6a, 7d-f, 13)

Parerythropodium maris-tenebrosi Stiasny, 1937: 3, fig. A, pl. 1 (Mauritania; Morocco); Tixier-Durivault, 1961: 239, figs 2-3 (Mauritania); Weinberg, 1977: 148; Groot & Weinberg, 1982: 310.
Alcyonium coralloides; Brito & Ocaña, 2004: 198, pls 7-8 (Canary islands).
Not *Alcyonium coralloides* (Pallas, 1766): 192.

Material examined.— RMNH Coel. 33876, several colony fragments and three microscope slides, CANCAP Stn 4.153, Canary Is, SW of Palma, 28°38'N 17°59'W, 200 m, 1.2 m Agassiz trawl, 3.vi.1980.

Description.— Colonies membranous, up to about 5 cm long and less than 1 mm thick, growing on an unknown species of Antipathidae. The largest fragment (fig. 1b) has a number of lobes 2 mm in height. Polyps are unevenly distributed over the colony;

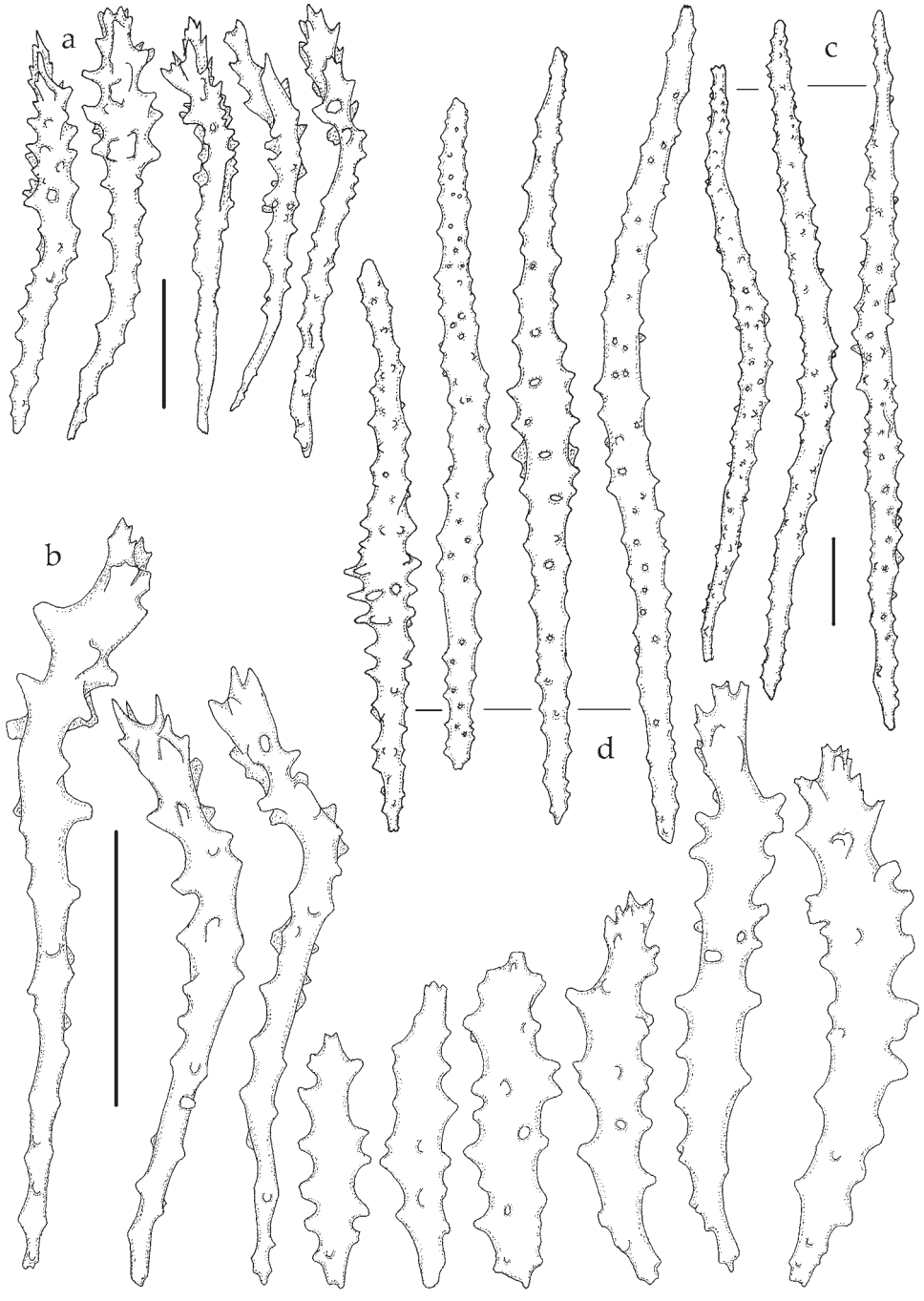

Fig. 2. *Alcyonium grandiflorum* Tixier-Durivault & d'Hondt, 1975, RMNH Coel. 33874; a, clubs of tentacle bases; b, clubs and rods of tentacles; c-d, anthocodial spindles. Scales 0.10 mm, scale at a also applies to d.

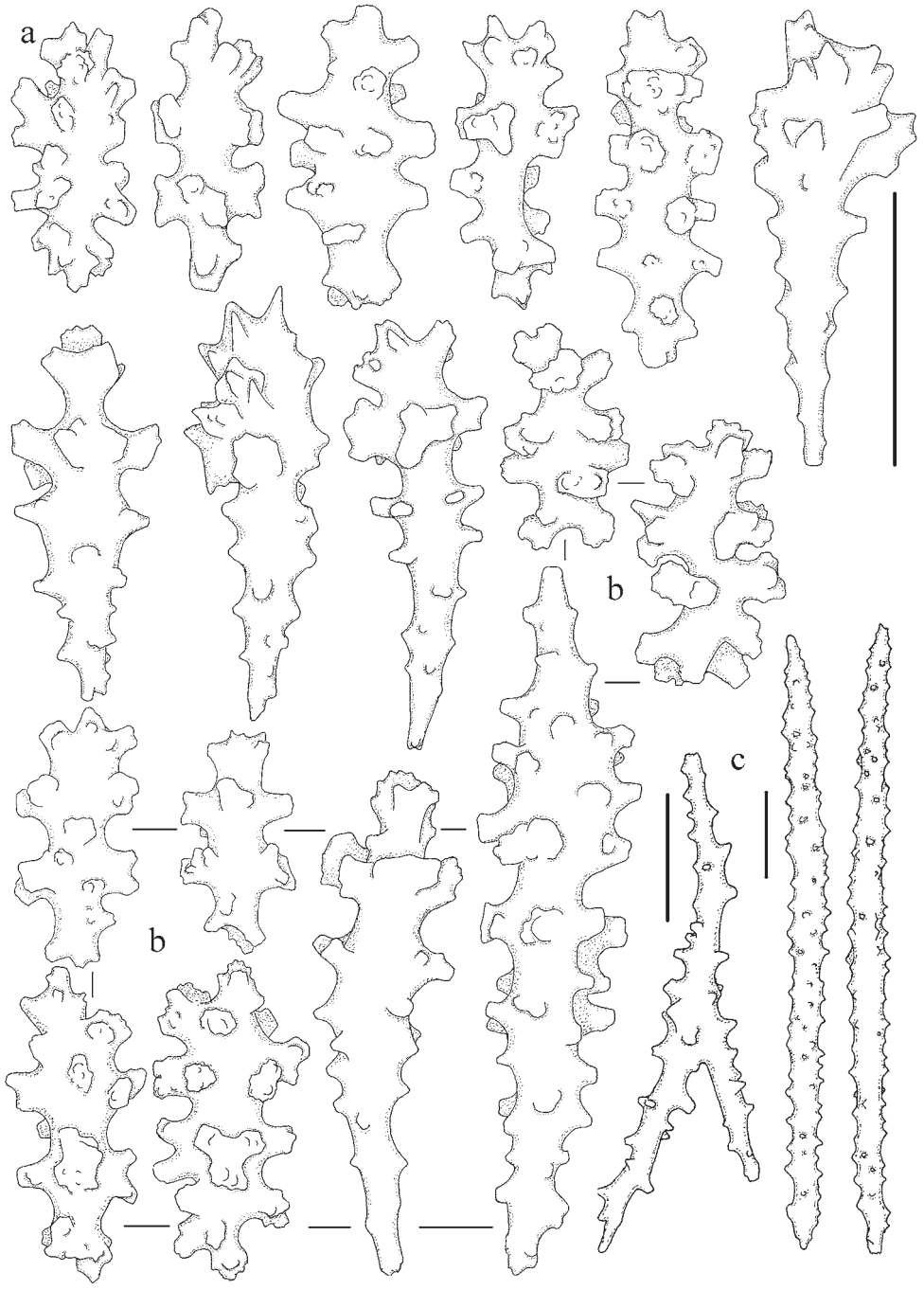

Fig. 3. *Alcyonium grandiflorum* Tixier-Durivault & d'Hondt, 1975, RMNH Coel. 33874; a, sclerites of calyces; b, c, sclerites of membrane. Scales 0.10 mm, scale at a also applies to b.

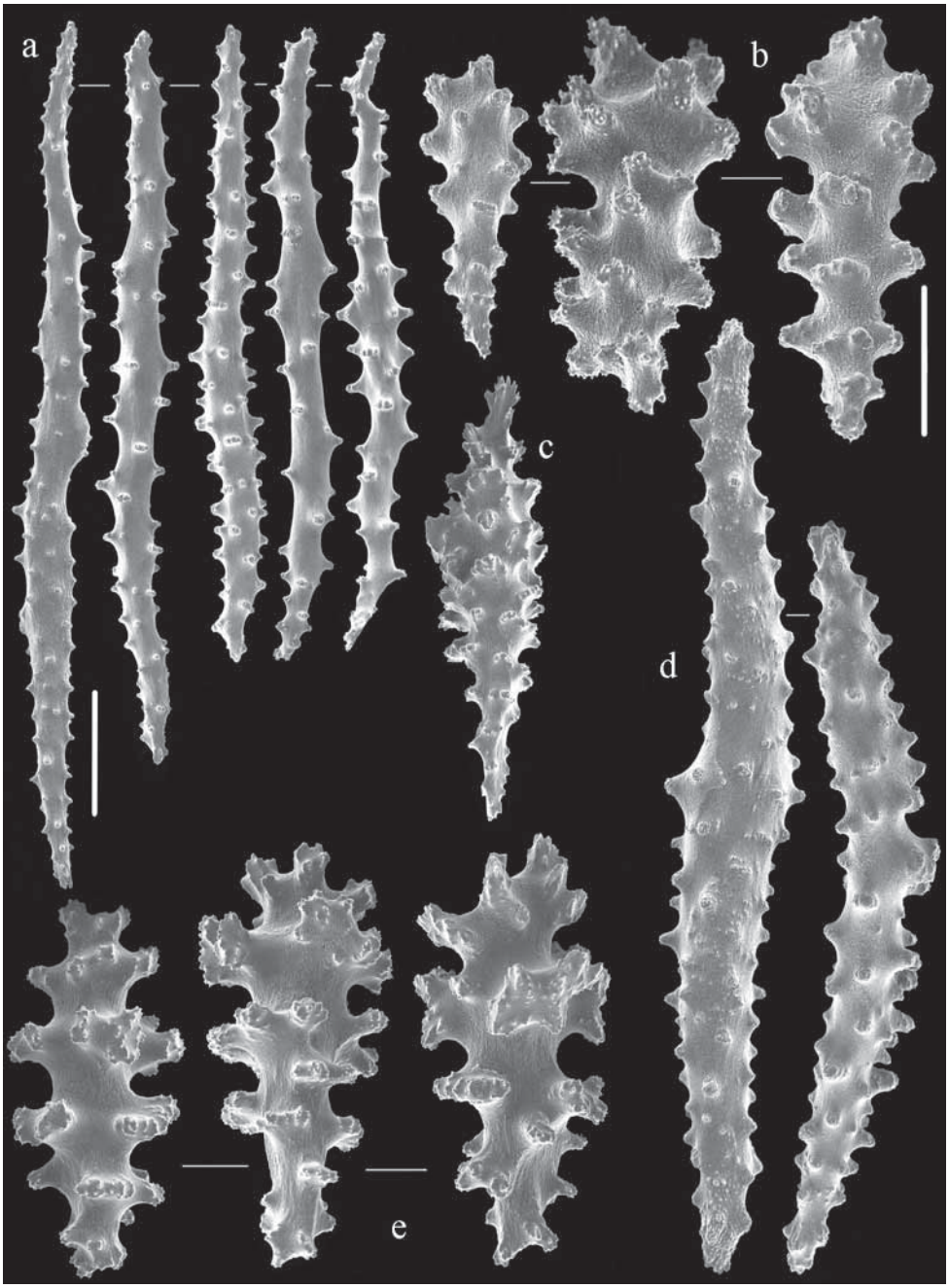

Fig. 4a-c. *Alcyonium grandiflorum* Tixier-Durivault & d'Hondt, 1975, RMNH Coel. 33874; d-e, RMNH Coel. 33877, holotype *A. megasclerum* spec. nov.; a, d, anthocodial spindles, b, e, rods and clubs of membrane, c, club of base of tentacles; Scale at a 0.10 mm applies to a, c-d, scale at b 0.05 mm applies to b, e.

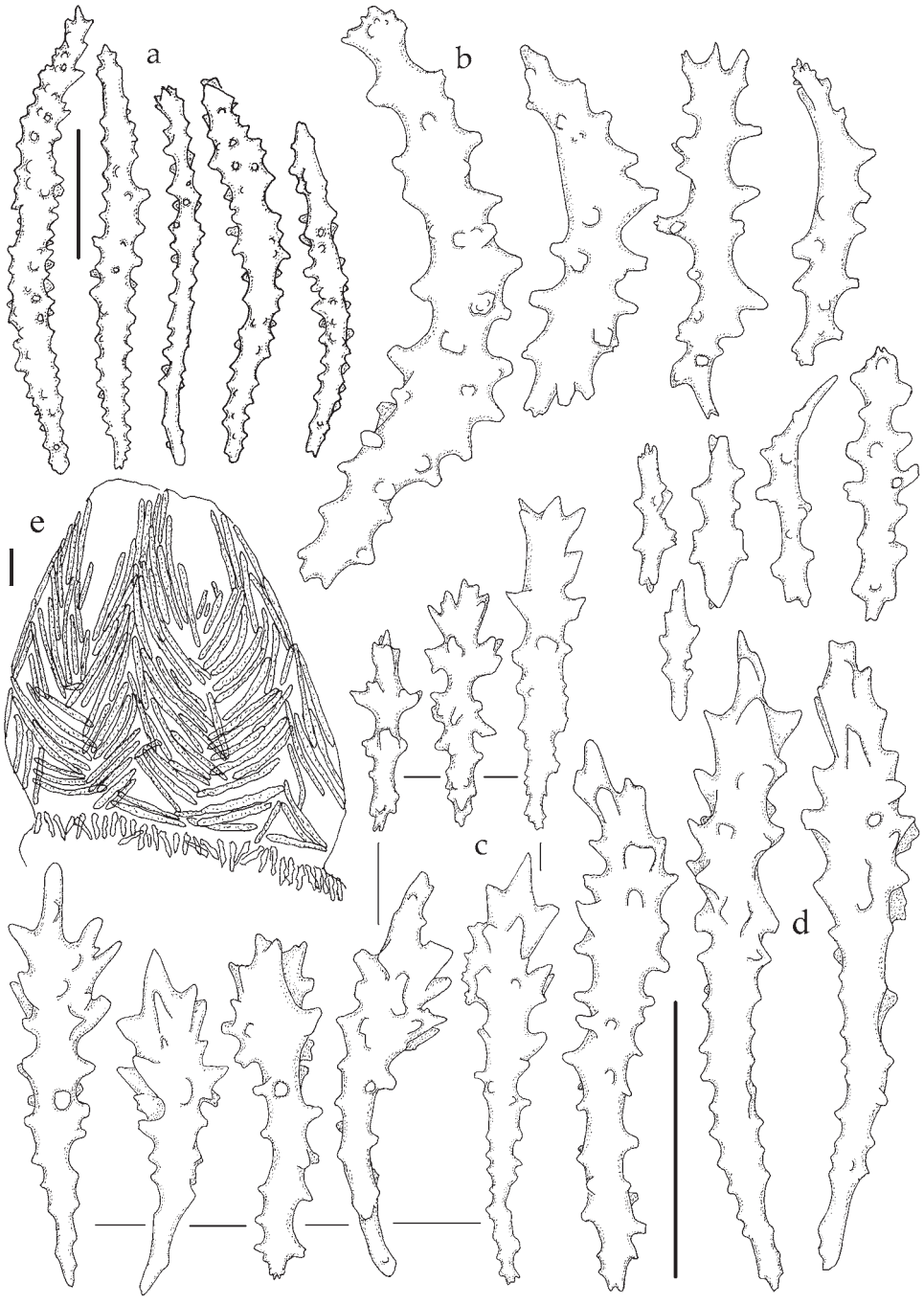

Fig. 5. *Alcyonium maristenebrosi* Stiasny, 1937, RMNH Coel. 33876; a, anthocodial spindles, b, tentacular sclerites, c, clubs of calyx, d, anthocodial clubs, e, lateral view of polyp armature. Scales 0.10 mm, scale at d applies to b-d.

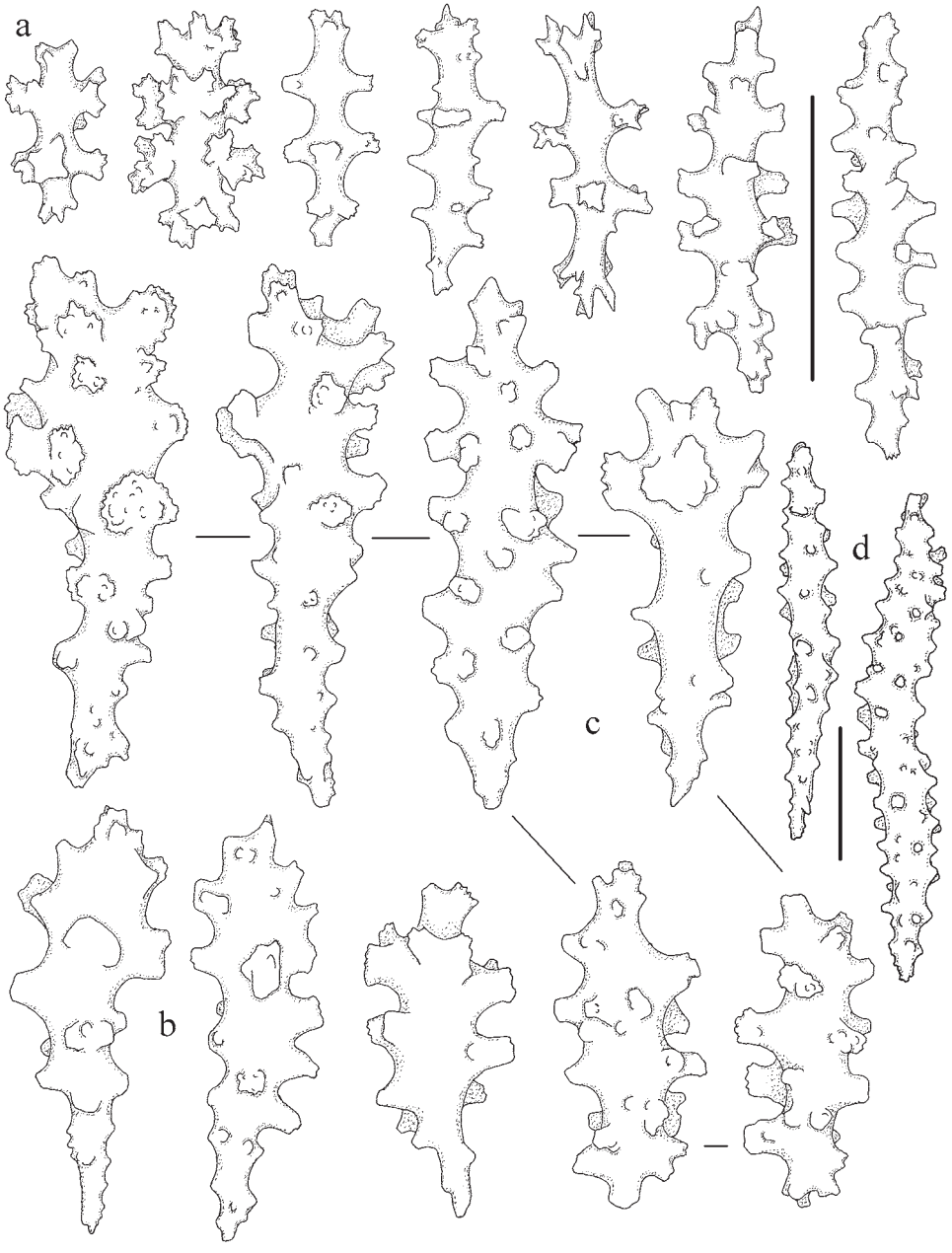

Fig. 6a. *Alcyonium maristenebrosi* Stiasny, 1937, RMNH Coel. 33876; sclerites of membrane; b-d, holotype *Alcyonium megasclerum* spec. nov., RMNH Coel. 33877; b, clubs of calyx, c, rods and clubs of membrane, d, spindles of membrane. Scales 0.10 mm, that at a applies to a-c.

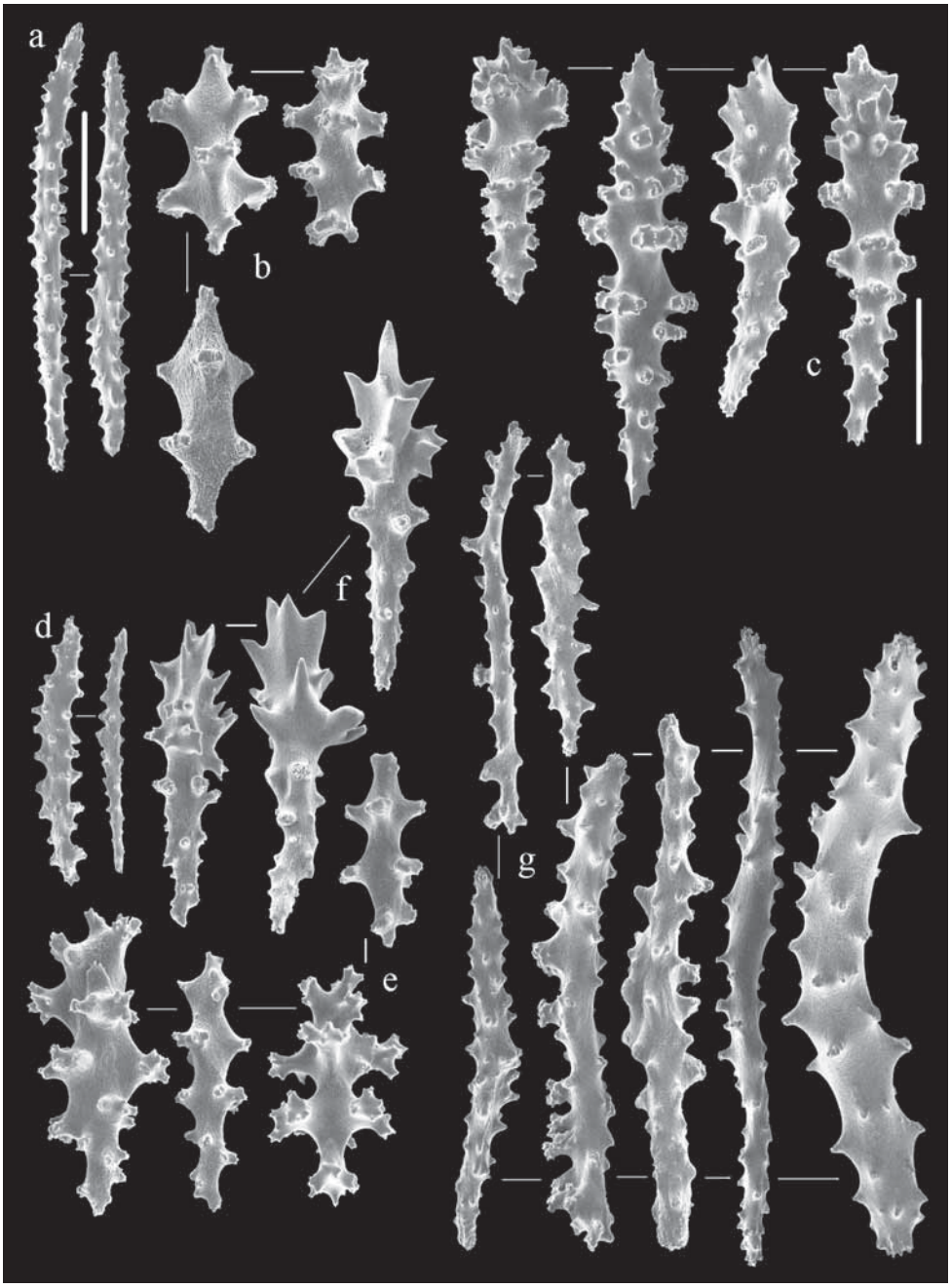

Fig. 7a-c. *Alcyonium rubrum* spec. nov., RMNH Coel. 33879; d-f, RMNH Coel. 33876, *A. maristenebrosi* Stiasny, 1937; g, MNHN, *A. profundum* spec. nov. a, d, anthocodial spindles, c, f, clubs of calyx, b, e, capstans from membrane; g, spindles from membrane and calyces. Scale at a 0.10 mm, applies to a, d, g; scale at c 0.05 mm, applies to b, c, e, f.

they are concentrated on the lobes, where they stand 0-5 mm apart, while on the membrane they stand 1-5 mm apart.

Calyces are 0.5-2 mm high, the expanded polyps are 0.5-2 mm long and 0.5-1.5 mm wide; the tentacles are withdrawn.

Anthocodiae with sometimes bent, spiny spindles and slender clubs (figs 5a, 7d), arranged en chevron; a crown composed of 2-4 rows of spindles was observed (fig. 5e). Anthocodial spindles are up to 0.35 mm long. At the tentacle bases slender clubs are present, 0.20-0.23 mm long (fig. 5d). These clubs are replaced distally by simple, spiny, rods (fig. 5b) 0.05-0.21 mm long.

The calyces contain clubs with spiny heads (figs 5c, 7f), and tuberculated spindles. These sclerites are up to 0.16 mm in length.

The membrane has tuberculated spindles, up to 0.15 mm long. Furthermore, eight radiates are present, up to 0.11 mm long; several are complexly tuberculated (figs 6a, 7e).

Colour.— Anthocodiae are red, membrane, calyces and tentacles white. Anthocodial sclerites are red, calyx with a mixture of red and colourless sclerites, all others colourless.

Remarks.— Because the figures given by Stiasny (1937) are somewhat schematic, we present sclerite drawings of RMNH Coel. 33876.

One other encrusting, white-red coloured *Alcyonium* species has been reported to occur in the Atlantic, viz. *A. coralloides* (Pallas, 1766). Weinberg (1977: 148) and Groot & Weinberg (1982: 310) doubted that *A. maristenebrosi* was different from *A. coralloides*. McFadden (1999), based on molecular data, recognized two different species in *A. coralloides*, and resurrected *A. hibernicum* (Renouf, 1931) previously synonymized with *A. coralloides* by Van Soest & Weinberg (1980). Unfortunately, McFadden had no material of *A. maristenebrosi* and further phylogenetic analysis of the Atlantic *Alcyonium* species is necessary to ascertain whether *A. maristenebrosi* also belongs to the *Alcyonium* species complex reported by her. Based on rather unsatisfactory illustrations of sclerites of *C. corralloides* (Weinberg, 1975, 1977; Groot & Weinberg, 1982; Weinberg & Ocaña, 2004) we maintain *A. maristenebrosi* as a separate species, being different from *A. coralloides* because of the clubs with spiny head present in the calyces, and the presence of complexly tuberculated eight radiates of the membrane.

Based on the description and figures presented by Brito & Ocaña (2004) for their *A. coralloides*, it is obvious that they had material of *A. maristenebrosi*.

Tixier-Durivault & d'Hondt (1975: 1367) described a new genus and species, *Pseudoalcyonium novum*, for an encrusting, white-red coloured soft coral from the Azores. We re-examined a holotype fragment of this species and found its sclerites to be in close agreement with those of *Alcyonium bocagei* (Saville Kent, 1870), and therefore we here propose to synonymize *Pseudoalcyonium novum* with *A. bocagei*. A good description of *A. bocagei* is given by Verseveldt & Bayer (1988: 14), although as a species of *Bellonella.* Recently this species was referred to *Alcyonium* (McFadden & Hutchinson 2004). Normally *A. bocagei* colonies have a finger-like colony shape, and the colonies described by Tixier-Durivault & d'Hondt undergo asexual propagation by forming stolons rather than having an encrusting colony shape. *A. maristenebrosi* differs from *A. bocagei* by having clubs with spiny heads in the calyx and anthocodiae, and the presence of complexly tuberculated eight radiates in the membrane.

A third encrusting, white-red coloured *Alcyonium* species is described and discussed below.

Alcyonium megasclerum spec. nov.
(figs 1e, 4d-e, 6b-d, 8, 13)

Material examined.— RMNH Coel. 33877, holotype and three microscope slides, "Tydeman" Cape Verde Islands Expedition 1982, CANCAP-VI, sta. 6.096, SW of Razo, 16°36'N 24°39'W, 1000-1350 m, rocky bottom with epifauna, rectangular dredge, 15.vi.1982.

Description.— Colony partly membranous and stoloniferous, 12 cm long and less than 1 mm thick (fig. 1e). Some colony parts are completely covering the axis of an unknown dead coral 6-8 mm in diameter.

Polyps are evenly distributed over the membrane, standing up to 0.8 mm apart. Calyces are 1–3.5 mm high, the expanded polyps are 1-4 mm long and 0.5-2 mm wide; the tentacles are withdrawn.

Anthocodiae with many, sometimes bent and branched, spiny spindles (figs 4d, 8a-b), arranged en chevron; a real crown was not observed (fig. 8d). These anthocodial spindles are up to about 0.75 mm long. Tentacle sclerites are simple spindles, replaced distally by flattened rods; also a relatively large number of crosses occur (fig. 8c). These tentacle sclerites are 0.05-0.15 mm long.

The calyces contain sometimes bent, spiny spindles, up to 0.75 mm in length. Furthermore, wart clubs occur, 0.12-0.15 mm long (fig. 6b).

The membrane contains spiny or tuberculated, sometimes bent spindles, up to 0.40 mm long (fig. 6d); also rods and wart-clubs occur (figs 4e, 6c), 0.11-0.15 mm long.

Colour.— The colony is white and all sclerites are colourless.

Etymology.— The anthocodial sclerites in this species are the second longest in the genus and certainly the widest. Therefore, the species is named *megasclerum.*

Remarks.— The species is similar to *Alcyonium grandiflorum* (Tixier-Durivault & d'Hondt, 1975) and *A. profundum* spec. nov.

A. grandiflorum has very similar clubs in the calyces and membrane, but differs in having much longer spindles in the membrane (0.75 mm long versus 0.40 mm), much more developed clubs in the tentacle bases, and more slender anthocodial spindles.

A. profundum differs in the complete absence of clubs in calyces and the membrane.

Alcyonium profundum spec. nov.
(figs 1d, 7g, 9-10, 13)

Material examined.— NMNH, the holotype, CENTOB-Cruise Marvel, PL 1199, 36°32'N 33°24'W, Famous, 2200-2600 m, Mid Atlantic Ridge, 26.viii.1997; RMNH Coel. 33878, three microscope slides of holotype.

Description.— Colony membranous, 11 cm long and less than 1 mm thick, covering one side of the axis of an unknown dead coral 3 cm in diameter.

Polyps are evenly distributed over the membrane, standing 0.5-7 mm apart. Calyces are 1–5 mm high, the expanded polyps are 1.5-4 mm long and 1–3 mm wide; the tentacles are withdrawn.

Anthocodiae with many, sometimes bent, tuberculated spindles; some of these spindles are unilaterally more developed (figs 7g, 9a). Spindles are arranged en chevron,

Fig. 8. *Alcyonium megasclerum* spec. nov., RMNH Coel. 33877; a-b, anthocodial spindles, c, tentacular sclerites, d, lateral view of polyp armature. Scales at a-c 0.10 mm; at d 0.20 mm.

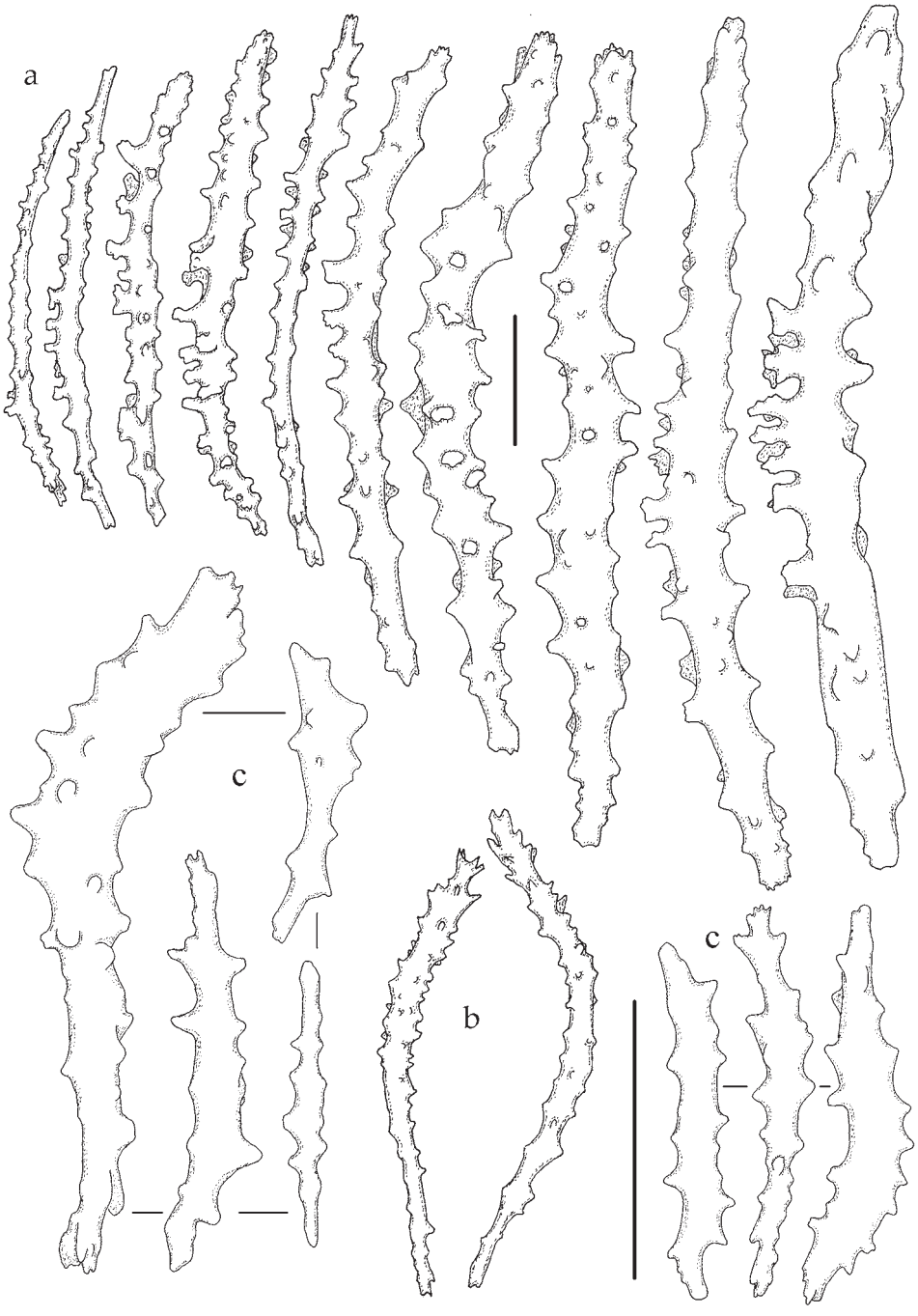

Fig. 9. *Alcyonium profundum* spec. nov., MNHN; a, anthocodial spindles, b, clubs of tentacle bases, c, club and rods of tentacles. Scales 0.10 mm, that at a also applies to b.

a real crown was not observed (fig. 10a). These anthocodial spindles are up to 0.70 mm long. At the tentacle bases slender clubs are present, 0.35 mm long (fig. 9b). These clubs are replaced distally by simple flattened clubs and rods; 0.11-0.24 mm long (fig. 9c).

The calyces contain similar sclerites as in the anthocodiae.

The membrane contains tuberculated spindles, which can be branched, these spindles are up to 0.60 mm long (fig. 10b).

Colour.— Whole colony is cream-white, sclerites are colourless.

Etymology.— The Latin "profunda", depths or abyss, refers to the depth where this species was found, deeper than all other species in the genus.

Remarks.— *Alcyonium profundum* is most similar to *A. grandiflorum* (Tixier-Durivault & d'Hondt. 1975) and *A. megasclerum* spec. nov., but can be distinguished from both of these species by the absence of wart clubs in the calyces and the membrane.

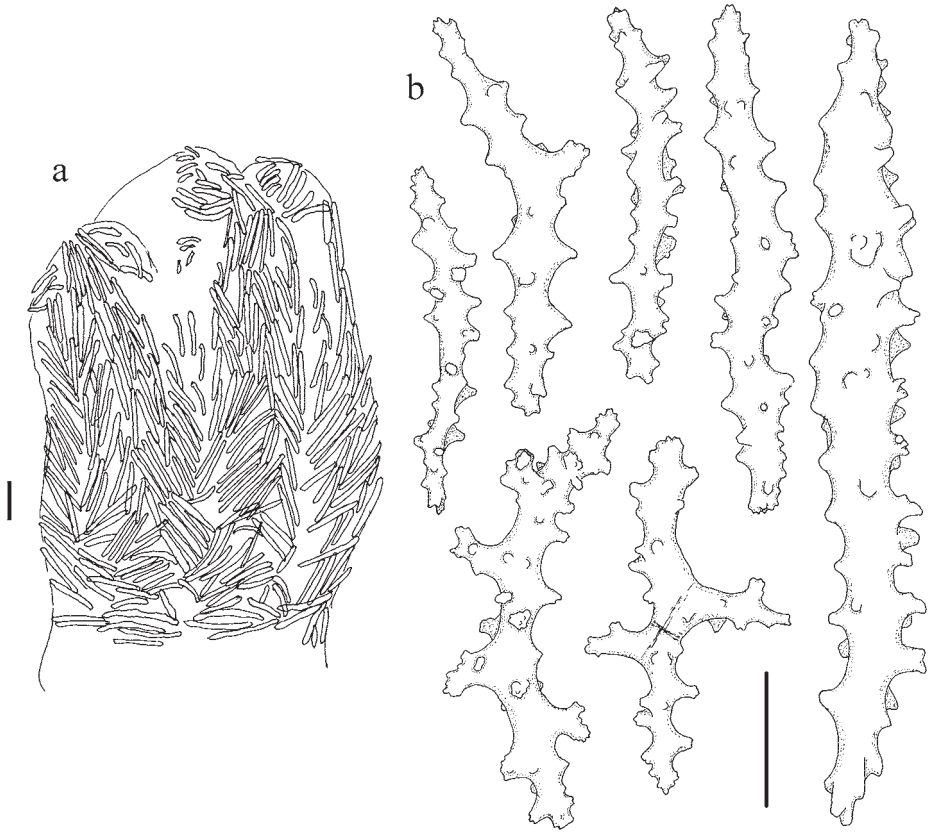

Fig. 10. *Alcyonium profundum* spec. nov., MNHN; a, lateral view of polyp armature, b, spindles of membrane. Scale of a 0.20 mm, that of b 0.10 mm.

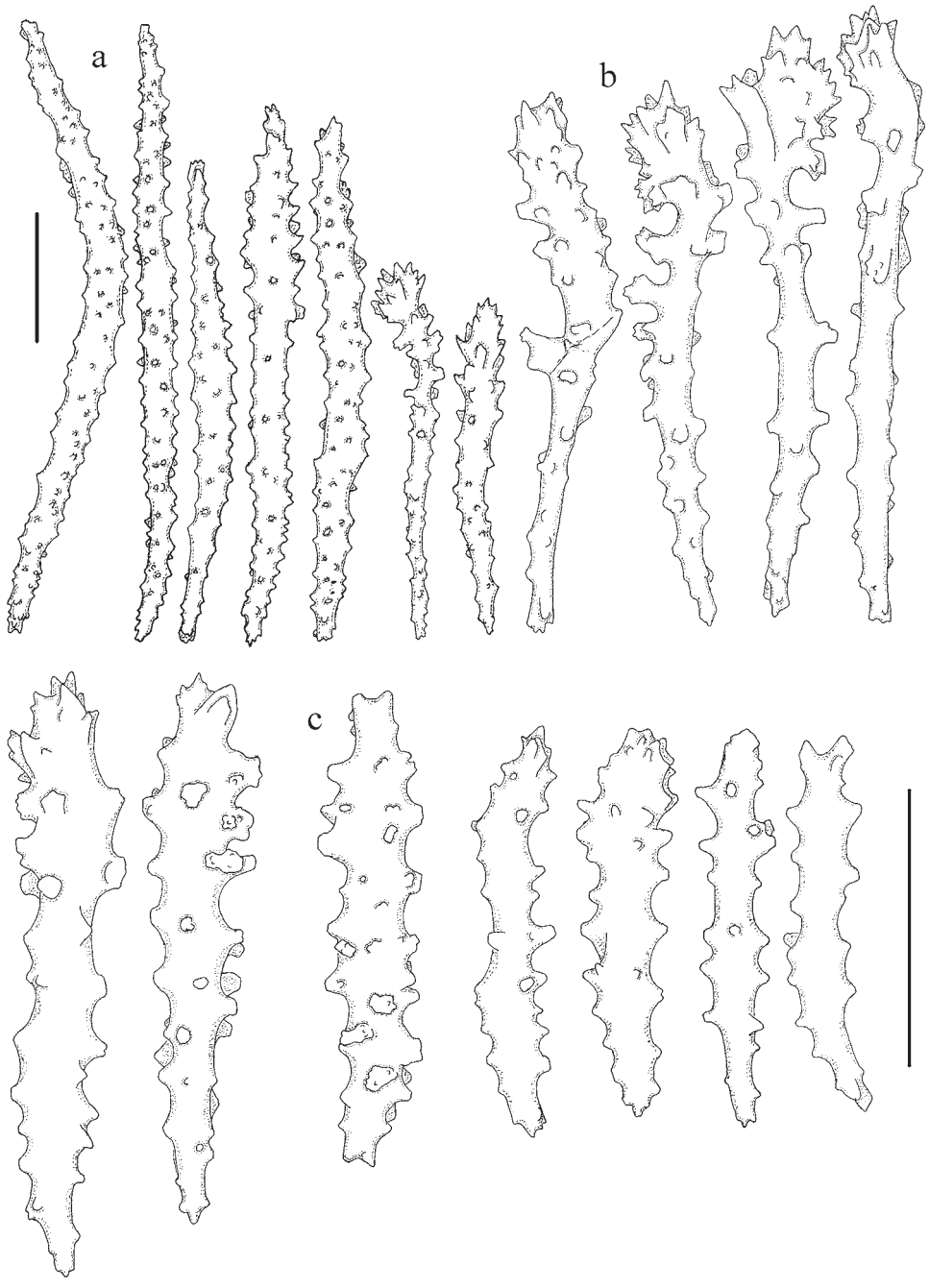

Fig. 11. *Alcyonium rubrum* spec. nov., RMNH Coel. 33879; a, anthocodial spindles and tentacle clubs, b, tentacle clubs, c, rods of tentacles. Scales 0.10 mm, that at c also applies to b.

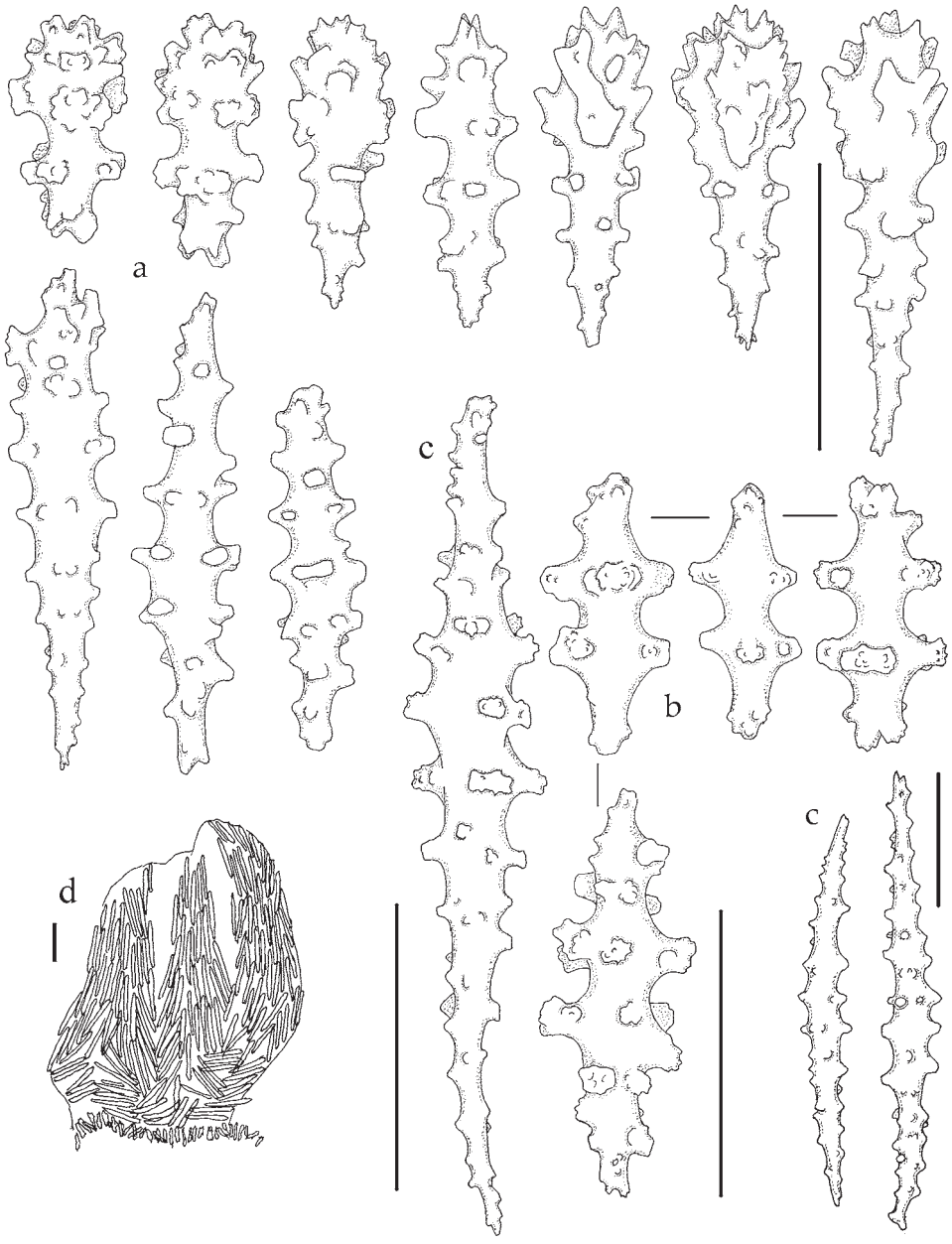

Fig. 12. *Alcyonium rubrum* spec. nov., RMNH Coel. 33879; a, clubs and spindles of calyces, b, capstans and one short spindle of membrane, c, long spindles of membrane, d, lateral view of polyp armature. Scale of d 0.20 mm, others are 0.10 mm.

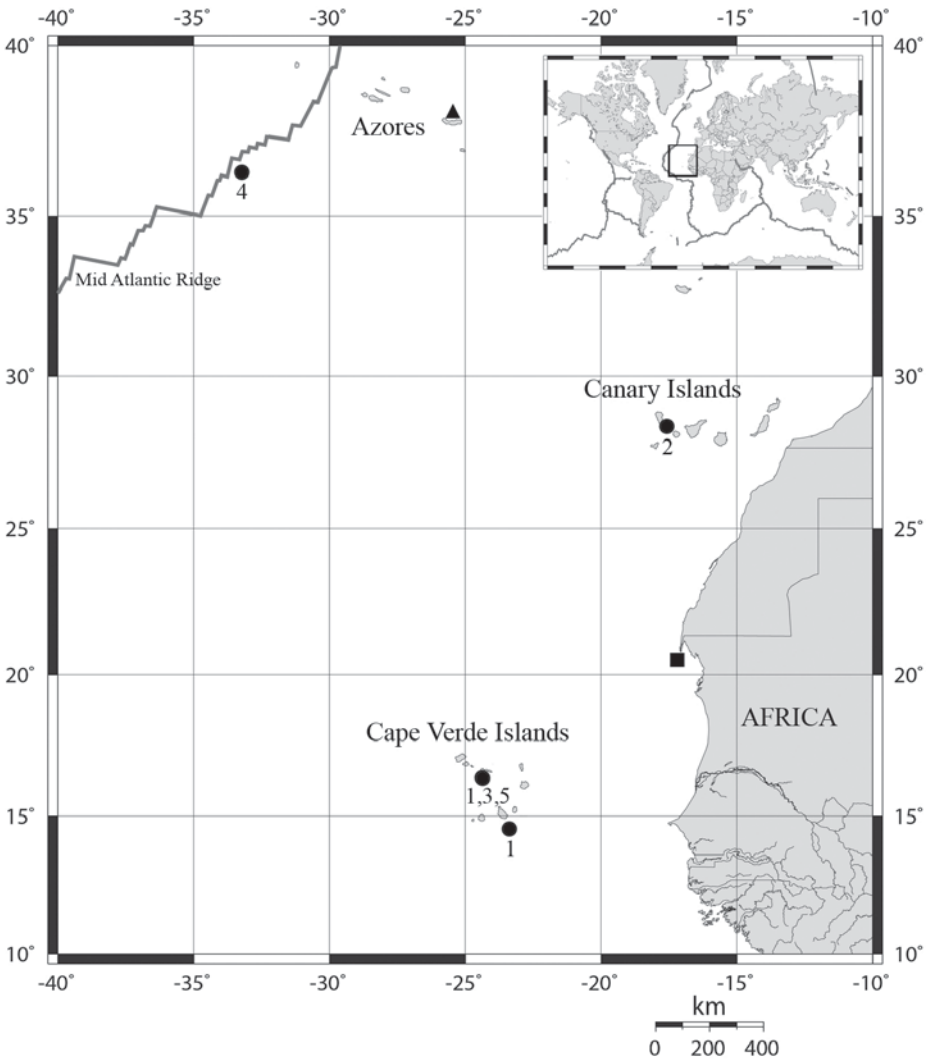

Fig. 13. Distribution of the *Alcyonium* species of this paper: ▲ = type locality of *A. grandiflorum* Tixier-Durivault & d'Hondt, 1975; ■ = type locality of *A. maristenebrosi* Stiasny, 1937; 1 = *Alcyonium grandiflorum*; 2 = *A. maristenebrosi*; 3 = *A. megasclerum* spec. nov.; 4 = *A. profundum* spec. nov; 5 = *A. rubrum* spec. nov.

Alcyonium rubrum spec. nov.
(figs 1c, 7a-c, 11-13)

Material examined.— RMNH Coel. 33879, holotype and seven microscope slides, "Tydeman" Cape Verde Islands Expedition 1986, CANCAP-VII, sta. 7.140, S of Raso, 16°35'N 24°36'W, 1200 m, on an old lobsterpot with about 500 m nylon rope, with numerous epizoa, rectangular dredge, 4.ix.1986; RMNH Coel. 33880, five paratypes, numerous loose fragments, and eight microscope slides, same data as holotype.

Description.— Holotype membranous, 15 cm long and 1 mm thick, completely surrounding a green nylon rope 1.5 cm in diameter (fig. 1c). The colony has a number of lobes 5-25 mm in height.

Polyps are unevenly distributed over the colony; they are concentrated on the lobes, where they stand up to 5.0 mm apart, while on the membrane they stand 3-10 mm apart. Calyces are 0.5-2 mm high, the expanded polyps are 0.5-2 mm long and 0.5-1.5 mm wide; the tentacles are withdrawn.

Anthocodiae with slender, sometimes bent, spiny spindles, arranged en chevron; a crown composed of 5-6 rows of spindles was observed (fig. 12d). These anthocodial spindles are up to 0.50 mm long (figs 7a, 11a). At the tentacle bases slender clubs are present, up to 0.45 mm long (fig. 11a-b). These clubs are replaced distally by spiny rods; up to 0.20 mm long (fig 11c).

The calyces contain small tuberculated spindles, clubs with spiny heads, and wart clubs (figs 7c, 12a). These sclerites are 0.09-0.17 mm long.

The membrane contains spiny spindles (fig 12b-c), up to 0.35 mm long. Furthermore, shorter, more tuberculated spindles and eight radiates occur in the membrane (figs 7b, 12b). These sclerites are 0.05-0.15 mm in length.

Colour.— Polyps are red, membrane and calyces are cream-white, polyp sclerites red, those of calyces red or colourless, others colourless.

Variation.— Some paratypes are completely cream-white, and can show pink stains.

Etymology.— The Latin "rubra", red, refers to the red coloured polyps.

Remarks.— *Alcyonium rubrum* spec. nov. is similar to *A. maristenebrosi* Stiasny, 1937. However, *A. maristenebrosi* has smaller anthocodial sclerites (0.35 mm long versus 0.50 mm) and membrane spindles (0.15 mm long versus 0.35 mm). Moreover, the clubs of the calyces have a different shape (compare fig. 7c with 7f).

Alcyonium rubrum spec. nov. is also similar to *A. coralloides* (Pallas, 1766), but differs in having overall more slender sclerites; and the large clubs at the tentacle bases are missing in *A. coralloides*.

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