

A REVISION OF THE GENUS *SARCOPHYTON* LESSON (OCTOCORALLIA, ALCYONACEA)

by

J. VERSEVELDT

Weteringpark 7-48, 8025 AM Zwolle, The Netherlands

With 39 text-figures and 24 plates

ABSTRACT

The author refers 35 valid species to the genus *Sarcophyton*. The holotypes of nearly all species could be examined; of only three species (*S. elegans*, *S. glaucum*, and *S. latum*) their depository is unknown. The holotypes of eight species were described earlier by the present author, in four cases in co-operation with other authors; the reader is referred to the literature given in the list of valid species. Among the species described in the present paper there is a new one: *S. buitendijki*. A list of invalid taxa is added. Four keys may help with the identification of the corals.

INTRODUCTION

This revision may be regarded as a sequel to my (1980) revision of the genus *Simularia*. The same reasons advanced in that paper for writing a revision hold good for the genus *Sarcophyton*. In the course of years so many species and varieties have been described, that one cannot see the wood for the trees. I counted eighty-one species and varieties described up to now. At present I regard thirty-four of these as valid, and no less than forty-seven as invalid or uncertain. In the lists below all valid and invalid (uncertain) taxa are enumerated. Furthermore, five nominal species referred to *Lobophytum* by Tixier-Durivault (*L. carnatum*, *L. radiatum*, *L. tenerum*, *L. undatum*, and *L. pulchellum*) must be assigned to the genus *Sarcophyton* (the first four are *S. crassocaule*, the fifth is *S. pulchellum*). One species of *Sarcophyton* (*S. proprium* Tixier-Durivault) is referred to *Lobophytum* in the present paper.

A colony from Pulau Weh, Sumatra, kept in RMNH, once referred to *S. latum* (by Verseveldt, 1960: 225), in fact represents a new species, viz., *S. buitendijki* sp. nov., named after Mr. P. Buitendijk, who collected the specimen in 1913.

ACKNOWLEDGEMENTS

It was, of course, of the greatest importance, to re-examine as many type specimens as possible, in which I succeeded very well. I greatly value the help and hospitality of Mrs. A. Tixier-Durivault and Mrs. M.-J. d'Hondt, Muséum National d'Histoire Naturelle, Paris (MNHN), of Dr. P. F. S. Cornelius, British Museum (Natural History), London (BMNH), of Dr. D. H. H. Kühlmann, Museum für Naturkunde der Humboldt-Universität, Zoologisches Museum, Berlin (ZMB), and of Dr. M. Dzwillo, Zoologisches Museum Hamburg (ZMH). I am also much obliged to Mr. J. C. den Hartog, Rijksmuseum van Natuurlijke Historie, Leiden (RMNH), and to Dr. R. W. M. van Soest, Instituut voor Taxonomische Zoölogie (Zoölogisch Museum), Amsterdam (ZMA).

I am thankful to Dr. M. Grasshoff, Natur-Museum und Forschungsinstitut "Senckenberg", Frankfurt am Main (SMF), who placed Schenk's type specimens at my disposal, and to Dr. K. W. Petersen, Zoologisk Museum, København (ZMK) for the loan of Tixier-Durivault's type specimen of "*Lobophytum pulchellum*."

I was greatly surprised to find that some important colonies are kept in the Naturhistorisches Museum Wien (NHMW). I found that in this museum there are a number of octocorals, which were bought in 1883 from the Museum Godeffroy (the old name of the Zoologisches Museum, Hamburg). Among them there are interesting type specimens. I feel indebted to Dr. E. Kritscher for the loan of some of these colonies.

It will surprise no one that Quoy & Gaimard's type of *S. glaucum*, and Dana's type of *S. latum* could not be found.

In my previous revision (1980) I mentioned my visits to the museums in Paris, London, and Berlin, and of the grants I received. A short time ago I paid a visit to the museums in Hamburg and Vienne, and, for the second time, Paris. For two of these journeys I received a grant from the Jan Joost ter Pelkwijk Fonds. Once again I express my gratitude to Prof. Dr. W. Vervoort, director of the Rijksmuseum van Natuurlijke Historie, Leiden, for his mediation.

Finally I am very grateful to Mr. W. ter Spill and to Mr. G. J. Vrijmoeth, who gave much of their valuable time to read the English text and to make the photographs.

GENERAL REMARKS

There are four or five genera of Alcyoniidae, which are usually easy to distinguish, but sometimes the shapes of the colonies resemble each other,

which may cause mistakes. In most cases the following simple key may be helpful.

- 1. Colony with monomorphic polyps 2
- Colony with dimorphic polyps 3
- 2. Sclerites in interior of stalk are large spindles, more than 2 mm long *Simularia*
- Sclerites in interior of stalk are less than 2 mm long *Alcyonium*
- 3. Capitulum of colony with plate- or finger-like, closed folds *Lobophytum*
- Colony mushroom-shaped, sometimes cup-shaped 4
- 4. Capitulum smooth or with open folds, mostly only at the periphery of the disc; autozooids numerous, smaller than in *Anthomastus* *Sarcophyton*
- Capitulum smooth, rarely slightly folded, usually spheroidal, sometimes inverted cone-shaped; autozooids much larger than in *Sarcophyton*, and less numerous *Anthomastus*

Instead of giving a short and, consequently, incomplete diagnosis of the genus *Sarcophyton*, I refer to the following remarks.

a. The shape of the colony. — Most *Sarcophyton* species have a mushroom-shaped colony. The polyp-bearing part is called disc or capitulum. It may extend more or less far beyond the sterile stalk. The disc may be rather flat and unlobed, but the margin may also be slightly or strongly folded. In some cases the capitulum is cup- or funnel-shaped. Mrs. A. Tursch (Brussels) told me that the shape of a colony can strongly transform in case of touch and/or preservation. Especially with *Sarcophyton* it happens that a colony with a flat disc rather rapidly changes into a cup- or funnel-shaped one. I asked her to write down her experiences. She was kind enough to do this:

“Observation in vivo for the last five years of soft corals on the reefs of Laing I. (N coast of Papua-New Guinea) points to noticeable changes in the shape and size of colonies according to their state of extension/contraction. Nearly all observed Alcyoniidae, Nephtheidae and Xeniidae go through an alternation of extension of the colony, its polyps and tentacles, and of polyp retraction (or, for Xeniidae, polyp shrinking), with or without contraction of the colony itself. The rhythm and the causes of this alternation are not clear yet.

In particular in the case of *Sarcophyton* three stages are observed:

- 1. *Extension*: polyps in “full bloom”, capitulum spread open.
- 2. *Semi-contraction*: polyps and tentacles retract partly or fully in the capitulum. This stage can be artificially induced by disturbing a colony in stage 1. The shape of the disc becomes hollower, depending on the species:

for instance in *S. ehrenbergi* the marginal folds point upwards and the disc becomes more funnel-shaped. On the other hand the shape of small thick flat discs such as with *S. crassocaule* hardly changes.

3. *Full contraction*: It cannot be induced by external means. The shape of the colony is compact, the polyps are retracted, the disc is swollen in its central part while the marginal folds are contracted and sometimes curled towards the stalk.

When a specimen is collected in stage 1. or 2. and then preserved in alcohol, it is liable to stay in a more funnel-like shape than the same species would if collected in stage 3."

So far Mrs. Tursch, to whom I express my best thanks for this contribution.

It is known that young colonies may be mushroom-like, and that the discs of adult colonies of the same species are much folded (e.g. Thomson & Dean, 1931: 54 and pl. 27 fig. 4). That is why I shrink from regarding the shape of small colonies as of taxonomical value. In my keys I make use of the form of the colony only in special cases.

b. The sclerites. — In the surface layer of the disc and of the stalk lie clavate sclerites. In many cases these clubs are rather indefinite: the heads are narrow and only indicated by slightly more processes at the broader end. However, other clubs are clearly entitled to this name. Sometimes a central wart is present.

In the interior of the disc there are slender spindles, rods, or needles, with relatively few conical or wartlike processes; in very few cases they are of some taxonomical value.

The sclerites in the coenenchyme of the sterile stalk are much more important. The size and shape are more or less typical of the species.

c. The autozooids and siphonozooids. — The autozooids are retractile, but the degree of contraction and retraction is different. With certain species, e.g., with *S. glaucum*, the autozooids are usually only partly retracted. In most cases, however, the retraction is complete. Their places are indicated by more or less distinct pits. Their mutual distance is found by measuring the distance between the centres of these pits.

The siphonozooids are always retracted. Their visibility varies from clearly visible to invisible. In the latter case one should make a section with a razor just under the surface and parallel to the surface of the disc; the difference between the narrow coelenterons of the siphonozooids and the wide ones of the autozooids is distinct.

Near the edge of the disc the distance between two autozooids is always short, less than about 1 mm, and, consequently, the number of siphonozooids

between them is always nought to one. The distance of the autozooids and the number of siphonozooids near the edge is therefore without value. In the central part of the disc, however, the distance and the number may be of some taxonomical importance.

The farther the autozooids are apart, the more siphonozooids are found between them. Some authors state that there are, e.g., three to four siphonozooids "in a straight line (drawn) between two autozooids". This should be taken with a grain of salt, for the siphonozooids are never arranged in straight lines. For that reason, counting the number of siphonozooids between two autozooids is always an approximation.

LIST OF VALID *SARCOPHYTON* SPECIES

In the following list the numbers I to IV refer to the Keys to which the species belongs. The abbreviations RMNH, etc., refer to the museum in which the holotype is kept. The holotypes of new species described by the present author in former papers are kept in the Zoological Museum, Department of Zoology, Tel-Aviv University, Tel-Aviv, Israel (ZMTA) and in the Musée Royal de l'Afrique Centrale, Tervuren, Belgium (MRAC).

If in the following list a reference to the original description of the holotype is given behind the author's name (see, e.g., with *auritum*) the species in question was described a short time ago; in that case it is not found in the descriptive part of this paper, in which the species are discussed in alphabetical order.

- acutum* Tixier-Durivault, 1970a; IV; MNHN.
auritum Verseveldt & Benayahu, 1978: 60-62, fig. 2, pl. 1 fig. 3; I; ZMTA.
birkelandi Verseveldt, 1978: 50-52, fig. 1, pl. 1; II; RMNH.
boettgeri Schenk, 1896; III; SMF.
boletiforme Tixier-Durivault, 1958; III; MNHN.
buitendijki sp. nov.; IV; RMNH.
cherbonnieri Tixier-Durivault, 1958; IV; MNHN.
cinereum Tixier-Durivault, 1946; IV; MNHN.
cornispiculatum Verseveldt, 1971: 27-29, figs. 15, 16. pl. 1 fig. 2; IV; RMNH.
crassocaula Moser, 1919; I; ZMB.
crassum Tixier-Durivault, 1946; IV; MNHN.
digitatum Moser, 1919; II; ZMB.
ehrenbergi Von Marenzeller, 1886; IV; NHMW.
elegans Moser, 1919; IV; depository unknown.
flexuosum Tixier-Durivault, 1966a; III; MNHN.
gemmatum Verseveldt & Benayahu, 1978: 62-64, fig. 3, pl. 2, pl. 3 fig. 1; IV; ZMTA.
glaucum (Quoy & Gaimard, 1833); IV; depository unknown.
infundibuliforme Tixier-Durivault, 1958; I; MNHN.
latum (Dana, 1846); IV; depository unknown.
militatensis Verseveldt & Tursch, 1979: 138-140, fig. 3, pls. 2, 3; II; RMNH.

- pauciplicatum* Verseveldt & Benayahu, 1978: 64-66, fig. 4, pl. 4; I; ZMTA.
portentosum Tixier-Durivault, 1970a; I; MNHN
pulchellum (Tixier-Durivault, 1957); I; MNHN
regulare Tixier-Durivault, 1946; IV; MNHN.
roseum Pratt, 1903; I; BMNH.
serenei Tixier-Durivault, 1958; III; MNHN.
solidum Tixier-Durivault, 1958; III; MNHN.
spongiosum Thomson & Dean, 1931; I; ZMA.
stellatum Kükenthal, 1910; I; ZMB.
stolidotum Verseveldt, 1971: 29-31, fig. 17, pl. 3 fig. 2; II; RMNH.
subviride Tixier-Durivault, 1958; IV; MNHN.
tenuispiculatum Thomson & Dean, 1931; I; ZMA.
tortuosum Tixier-Durivault, 1946; IV; MNHN.
trocheliophorum Von Marenzeller, 1886; I; NHMW and ZMH.
turschi Versevedt, 1976: 501-503, fig. 2, plate fig. 1; IV; MRAC.

INVALID AND UNCERTAIN SYNONYMS AND SPECIES

The following species and varieties are identical with other *Sarcophyton* species, they do not belong to this genus, or their identity is uncertain.

- aberrans* Thomson & Henderson, 1906b = *Anthomastus aberrans* (Thomson & Henderson) according to Kükenthal, 1911b: 8.
acutangulum Von Marenzeller, 1886 = *ehrenbergi* Von Marenzeller, 1886.
 See p. 43 in this paper.
acutangulum var. *occidentalis* Thorpe, 1928 = ? *roseum* Pratt, 1903. See p. 70 in this paper.
agaricoides Thomson & Henderson, 1906b = *Anthomastus agaricoides* (Thomson & Henderson) according to Kükenthal, 1911b: 9.
agaricum (Stimpson, 1955) = ? *Anthomastus* sp.
ambiguum Wright & Studer, 1889 = *glaucum* (Quoy & Gaimard, 1883).
atlanticum Wright & Studer, 1889; identity uncertain.
bicolor Pratt, 1905 = *glaucum* (Quoy & Gaimard, 1833). See p. 56 in this paper.
certum Tixier-Durivault, 1970a = *trocheliophorum* Von Marenzeller, 1886.
 See p. 85 in this paper.
contortum Pratt, 1905 = either *infundibuliforme* Tixier-Durivault, 1958, or *ehrenbergi* Von Marenzeller, 1886.
convolutum Thomson & Dean, 1931 = *roseum* Pratt, 1903. See p. 71 in this paper.
decaryi Tixier-Durivault, 1948 = *trocheliophorum* Von Marenzeller, 1886.
 See p. 85 in this paper.
dispersum Schenk, 1896 = *trocheliophorum* Von Marenzeller, 1886. See p. 85 in this paper.
ehrenbergi var. *acutangulum* Von Marenzeller, 1886 = *ehrenbergi* Von Marenzeller, 1886. See p. 43 in this paper.

- ehrenbergi* var. *sansibaricum* May, 1899 = *ehrenbergi* Von Marenzeller, 1886. See p. 45 in this paper.
- ehrenbergi* var. *areolata* Burchardt, 1903 = *ehrenbergi* Von Marenzeller, 1886. See p. 45 in this paper.
- ehrenbergi* var. *stellatum* Kükenthal, 1910 = *stellatum* Kükenthal, 1910. See pp. 46 and 77 in this paper.
- fungiforme* Schenk, 1896 = *trocheliophorum* Von Marenzeller, 1886. See p. 85 in this paper.
- glaucum* var. *amboinensis* Burchardt, 1903 = *glaucum* (Quoy & Gaimard, 1833).
- glaucum* var. *pauperculum* Von Marenzeller, 1886 = *glaucum* (Quoy & Gaimard, 1833).
- glaucum* var. *tamatavense* Cohn, 1908 = *glaucum* (Quoy & Gaimard, 1833).
- globosum* Tixier-Durivault, 1966a = *crassum* Tixier-Durivault, 1946. See p. 37 in this paper.
- gracile* Burchardt, 1903 = *glaucum* (Quoy & Gaimard, 1833).
- implanum* Verseveldt, 1974 = *crassum* Tixier-Durivault, 1946. See p. 37 in this paper.
- latum* var. *voeltzkowi* Moser, 1919; identity uncertain.
- lobulatum* Lesson, 1834 = ? *ehrenbergi* Von Marenzeller, 1886.
- manifestum* Tixier-Durivault, 1970a = *trocheliophorum* Von Marenzeller, 1886. See p. 85 in this paper.
- molle* Tixier-Durivault, 1946 = *ehrenbergi* Von Marenzeller, 1886. See p. 47 in this paper.
- moseri* Roxas, 1933 = ? *ehrenbergi* Von Marenzeller, 1886
- mycetoides* Gravier, 1908 = *glaucum* (Quoy & Gaimard, 1833).
- nigrum* May, 1899 = *glaucum* (Quoy & Gaimard, 1833). See p. 56 in this paper.
- oligotrema* Pratt, 1905 = either *ehrenbergi* Von Marenzeller, 1886, or *infundibuliforme* Tixier-Durivault, 1958.
- pallidum* Cohn, 1908 = *trocheliophorum* Von Marenzeller, 1886.
- philippinensis* Wright & Studer, 1889 = *glaucum* (Quoy & Gaimard, 1833).
- plicatum* Schenk, 1896 = *boettgeri* Schenk, 1896. See pp. 18 and 85 in this paper.
- poculiforme* Tixier-Durivault, 1958 = *cinereum* Tixier-Durivault, 1946. See p. 27 in this paper.
- proprium* Tixier-Durivault, 1970a = *Lobophytum* sp.
- puertogalerae* Roxas, 1932 = *crassocaule* Moser, 1919. See p. 30 in this paper.
- pulmo* (Esper) Klunzinger, 1877 = ? *trocheliophorum* Von Marenzeller, 1886.
- reichenbachi* Schenk, 1896 = *ehrenbergi* Von Marenzeller, 1886. See p. 47 in this paper.

- reticulatum* Boone, 1938 = *glaucum* (Quoy & Gaimard, 1833).
tenuis Pratt, 1903 = *glaucum* (Quoy & Gaimard, 1833). See p. 57 in this paper.
tersum Roxas, 1933; identity uncertain. Tixier-Durivault's identification (1958: 49-52, figs. 47, 48, 50) cannot be right.
tongatabuensis Wright & Studer, 1889 = *glaucum* (Quoy & Gaimard, 1833).
trocheliophorum var. *amboinense* Von Marenzeller, 1886 = *trocheliophorum* Von Marenzeller, 1886.
trocheliophorum var. *australiensis* Thorpe, 1928; identity uncertain, but by no means *trocheliophorum* Von Marenzeller, 1886. See p. 86 in this paper.
trocheliophorum var. *intermedia* Burchardt, 1903 = ? *trocheliophorum* Von Marenzeller, 1886.
trocheliophorum var. *minus* Thomson & Dean, 1931 = *crassocaule* Moser, 1919. See p. 29 in this paper.
trocheliophorum var. *moluccanum* Schenk, 1896 = *trocheliophorum* Von Marenzeller, 1886. See p. 85 in this paper.
trochiforme Hickson, 1900 = *Anthomastus trochiformis* (Hickson, 1900) according to Kükenthal, 1911b: 6.

KEYS

In my opinion it may be expedient to give keys to aid the identification of *Sarcophyton* specimens, just as I gave keys for the genus *Sinularia*. But again I must warn against over-estimating the value of such keys. In case of doubt another key should be consulted. And a reference to the Survey of the Keys must always precede the use of the keys themselves.

In the keys, the term "clubs" means the clubs in the surface layer of the disc. The coenenchymal sclerites are always those in the sterile stalk unless otherwise indicated.

Survey of the Keys

1. Most coenenchymal sclerites are short, up to about 0.40 mm long Key I
- Most coenenchymal sclerites 0.50 mm long or longer 2
2. Colony with high, erect folds, fingerlike or flat, pointed or cut rectangularly, the margin curled outwards Key II
- Colony without high, erect folds; it is mushroom-shaped or cup-shaped 3
3. In surface disc are small sclerites (0.06-0.12 mm along with larger ones), which are not club-shaped, but rods, spindles, ovals or irregularly formed bodies Key III
- In surface disc all sclerites are clubs Key IV

KEY I

1. In stalk interior barrel-shaped sclerites predominate, with two whorls of big warts and two terminal clusters of warts 2
- Most coenenchymal sclerites fusiform, or irregular in shape; prominences usually in more girdles 3
2. Coenenchymal sclerites up to 0.25 mm long (fig. 9p-r); smaller clubs with weakly developed heads (fig. 9a-d) . . . *crassocaule* Moser
- Coenenchymal sclerites up to 0.28 or 0.35 mm long (fig. 37r-u); smaller clubs with typical shape, head distinct (figs. 37a-c, 38a-c)
. *trocheliophorum* Von Marenzeller
3. Coenenchymal sclerites irregularly shaped, often quadrangular; warts sometimes forming two terminal girdles (fig. 33i, n, o)
. *stellatum* Kükenthal
- Coenenchymal sclerites more or less spindle-shaped, with some girdles of prominences 4
4. Marginal folds of capitulum high, erect, with thick edges
. *auritum* Verseveldt & Benayahu
- Marginal folds of capitulum not high and erect; colony mushroom-shaped or cup-shaped 5
5. Colony cup- or funnel-shaped 6
- Colony about mushroom-shaped 7
6. Clubs 0.10-0.32 mm long, with few, rounded, sometimes foliaceous prominences (fig. 22a-d) *infundibuliforme* Tixier-Durivault
- Smaller sclerites in disc surface: rods, 0.06-0.08 mm long (fig. 28a, b); larger sclerites: clubs, 0.09-0.22 mm long, with central wart and girdles of small warts (fig. 28c-h) *roseum* Pratt
7. Clubs usually 0.08-0.12 mm long, with heads composed of leaflike prominences (fig. 25a-f); coenenchymal spindles up to 0.23 mm long
. *portentosum* Tixier-Durivault
- Clubs usually longer, more than 0.10 mm, heads without leaflike processes; coenenchymal sclerites up to 0.31 or 0.37 mm long 8
8. Clubs with distinct heads, often with a central wart 9
- Clubs with ill-defined heads, usually without distinct central wart 10
9. Margin of disc with few folds; in disc interior slender needles, smooth or with few spines; in stalk interior spindles with hemispherical prominences, or needles with few spines
. *pauciplicatum* Verseveldt & Benayahu
- Margin of disc strongly folded; in disc interior wide spindles with zoned warts; in stalk interior barrels and spindles
. *pulchellum* (Tixier-Durivault)

10. Coenenchymal sclerites with mostly 4 zones of cones or small warts, distant from one another (fig. 31r-s); clubs in stalk with few, low warts (fig. 31l-p); internal needles in disc 0.04-0.06 mm wide
 *spongiosum* Thomson & Dean
 — Coenenchymal sclerites with 4-5 zones of bigger, higher warts, more densely placed (fig. 35o-r); clubs in stalk with the same big, high warts (fig. 35k-n); internal needles in disc 0.03-0.05 mm wide
 *tenuispiculatum* Thomson & Dean

KEY II

1. Folds fingerlike; disc surface with spiny rods (0.06-0.10 mm) and long clubs (up to 0.32 mm) with very slender, nearly smooth handles; internal sclerites in disc thin, almost smooth needles (up to 0.45 mm); internal sclerites spindles (up to 0.80 mm), scarcely covered with small prominences *digitatum* Moser
 — Shape of colony and of sclerites different 2
 2. Autozooids distant from one another, in centre of disc up to 6 mm; smaller sclerites in disc surface rods with two girdles of cones, larger ones more clavate *stolidotum* Verseveldt
 — Autozooids closely set, distance less than 1.40 mm; clubs with high warts 3
 3. Folds flat, with more or less rectangular tip; clubs often with central wart, and below this a few girdles of high warts (0.09-0.37 mm); internal sclerites in disc needles (up to 0.50 mm) with conical processes; internal sclerites in stalk needles and spindles (up to 0.53 mm), covered with cones and warts *birklandi* Verseveldt
 — Folds pointed, often with secondary folds; clubs with irregularly placed, high warts (0.11-0.45 mm); internal sclerites in disc needles (up to 0.58 mm) with antlerlike prominences; internal sclerites in stalk (up to 0.65 mm) with high, spiny warts *militatensis* Verseveldt & Tursch

KEY III

1. Sclerites in disc surface with high, wartlike, often zoned processes (fig. 2a-c, e); autozooids 0.60-0.80 mm apart; one siphonozooid
 *boettgeri* Schenk
 — Sclerites in disc surface with low cones or irregularly placed, short processes 2

- 2. Sclerites in disc surface spindles, the smaller ones (0.09-0.15 mm) with two rows of low cones or small warts (fig. 19a-c), the longer ones are warty spindles (fig. 19g-i); clubs in stalk surface with big warts; coenenchymal sclerites warty spindles, up to 0.50 mm; autozooids closely set, distance 1 mm *flexuosum* Tixier-Durivault
- Sclerites in disc surface irregularly shaped rods and ovals; autozooids widely spaced, in centre of disc 4-5 mm apart 3
- 3. Sclerites in surface of disc and stalk small ovals, 0.05-0.09 mm (fig. 30a-d, j-m); in disc in addition clubs, 0.10- 0.65 mm (fig. 30e-i) *solidum* Tixier-Durivault
- In disc surface irregularly sculptured rods 4
- 4. Rods (and more clavate sclerites) with wartlike processes (fig. 3a-e); in interior disc smooth needles; coenenchymal sclerites up to 1.10 mm long *boletiforme* Tixier-Durivault
- Rods (and more clavate sclerites) with laterally flattened, volcano-shaped processes (fig. 29a-f); in interior disc needles, smooth except the ends; coenenchymal sclerites up to 1.70 mm long *serenei* Tixier-Durivault

KEY IV

- 1. Coenenchymal sclerites 1.30-2.30 mm long 2
- Coenenchymal sclerites shorter than 1.30 mm 3
- 2. Colony more or less funnel-shaped; autozooids in central part of disc up to 2.50 mm apart; most clubs 0.15-0.20 mm long, the longest one measures 0.70 mm; clubs with warty heads *cinereum* Tixier-Durivault
- Colony mushroom-shaped, with usually strongly folded margin; autozooids in central part of disc 3.50-5.00 mm apart; most clubs 0.10-0.17 mm long, rarely more than 0.35 mm; clubs with low, rounded processes *glaucum* (Quoy & Gaimard)
- 3. Colony funnel- or cup-shaped with sharp edge 4
- Colony not funnel- or cup-shaped, sometimes with hollow disc, but the edge is thick 5
- 4. Clubs thick, with rounded prominences; sclerites in disc interior usually with antlerlike processes (figs. 14n-q, 15 j, k); coenenchymal sclerites slender spindles, shorter than 0.50 mm, with zoned prominences *ehrenbergi* Von Marenzeller
- Clubs rather slender, with warts; sclerites in disc interior spindles, prominences not antlerlike (fig. 24 o, p); coenenchymal sclerites thick, warted spindles, up to 0.70 mm long *latum* (Dana)

5. Coenenchymal sclerites in disc absent; coenenchymal sclerites in stalk with phantastically shaped sclerites, up to 1.30 mm long
 *gemmatum* Verseveldt & Benayahu
- Coenenchymal sclerites in disc present; coenenchymal sclerites in stalk usually unbranched spindles 6
6. Clubs with pointed heads, more or less resembling those of *trocheliophorum* (cf. figs. 6a-d, 37a-d) 7
- Clubs different 8
7. Sclerites in stalk surface approximately oval, sometimes with a median waist, length 0.05-0.10 mm (fig. 6 i, j); spindles in disc interior unbranched *cherbonnieri* Tixier-Durivault
- Sclerites in stalk surface clavate; sclerites in disc interior spindles, often irregularly branched *cornispiculatum* Verseveldt
8. Some clubs in disc and stalk more than 0.40 mm long; coenenchymal sclerites pointed spindles (up to 1.20 mm), covered with spines
 *acutum* Tixier-Durivault
- Clubs in disc and stalk shorter than 0.35 mm; coenenchymal sclerites up to 1 mm 9
9. Autozooids in centre of disc 3-5 mm apart; siphonozooids in centre 6-8 between two autozooids 10
- Autozooids in centre of disc up to 2 mm apart; siphonozooids in centre up to 3 or 4 12
10. Coenenchymal sclerites (along with spindles) blunt, warty cylinders and ovals, up to 0.60 × 0.20 mm (fig. 34q-s); in disc interior slender rods and spindles, up to 0.30 mm; in stalk surface many ovals, 0.06-0.15 mm (fig. 34j-l) *subviride* Tixier-Durivault
- Coenenchymal sclerites pointed spindles and needles; in disc interior needles and spindles, up to 0.55 mm; in stalk surface clubs 11
11. Central part of disc not covered by folds; club heads with prominences often laterally flattened, pointing upwards (fig. 27a-e); coenenchymal sclerites up to 0.70 mm *regulare* Tixier-Durivault
- Central part of disc invisible by the numerous tortuous folds; club heads with few, distally placed warts (fig. 36a-h); coenenchymal sclerites rarely longer than 0.50 mm *tortuosum* Tixier-Durivault
12. Margin of disc weakly folded if at all; clubs 0.15-0.30 mm, their heads with spines directed upwards; heads of clubs in stalk wider, with coarser warts; coenenchymal sclerites pointed spindles, up to 0.65 mm, with bigger warts in the middle part *turschi* Verseveldt
- Margin of disc with many thick folds; clubs shorter, 0.09-0.15 mm 13

- 13. Clubs with narrow heads (fig. 12a-i); coenenchymal sclerites pointed spindles, up to 1 mm, covered with small, often zoned warts and spines
 *crassum* Tixier-Durivault
- Clubs with wider, warty heads, handles with zoned warts; coenenchymal sclerites blunt, wide cylinders and ovals 14
- 14. Coenenchymal sclerites (a) wide ovals and cylinders, densely covered with coarse warts, up 0.65 × 0.28 mm, and (b) spindles up to 0.60 × 0.14 mm (fig. 4r-v) *buitendijki* sp. n.
- Coenenchymal sclerites narrower cylinders and rods, less densely covered with warts, up to 0.80 × 0.14 mm (fig. 18q-t) . . . *elegans* Moser

DESCRIPTIONS

Sarcophyton acutum Tixier-Durivault, 1970

(fig. 1; pl. 1 fig. 1)

Sarcophyton acutum Tixier-Durivault, 1970a: 237, figs. 73-76.

The two syntypes have been represented at nearly natural size by Tixier-Durivault (1970a: fig. 73) and are figured once more in the present paper (pl. 1 fig. 1).

The colonies, which are basally attached one to the other, are dried-up now. The distance between two autozooids varies from 1.20 to 2.00 mm. The siphonozooids are hardly visible; only near the edge of the disc of one specimen they present themselves as very fine dots, one to three between two autozooids.

In the surface layer of the disc lie clubs, usually 0.07 to 0.15 mm long, with weakly developed heads, composed of some irregularly shaped and placed prominences (fig. 1a-d, h, i). In addition to these there are long, straight or curved clubs, up to 0.47 mm long; the handles are slender and scarcely spined, the heads are composed of stronger, sometimes wartlike processes (fig. 1e-g). In the surface layer of the sterile stalk the majority of the clubs have a length of 0.14 to 0.25 mm, but clubs up to 0.40 mm long are common. The shorter ones have many warts, which are accumulated at the end forming the head of the club (fig. 1j, l). The longer clubs have handles, which are wider than in the disc; the heads have more warts.

The interior of the disc contains straight or curved, weakly spined or almost smooth needles, up to 0.60 (or more) mm long and 0.020 to 0.035 mm wide. The sclerites in the coenenchyme of the stalk are spindles, up to 1.20 mm long. The larger ones have more and higher spines (fig. 1m, n), whereas the smaller ones bear few, low spines (fig. 1 o).

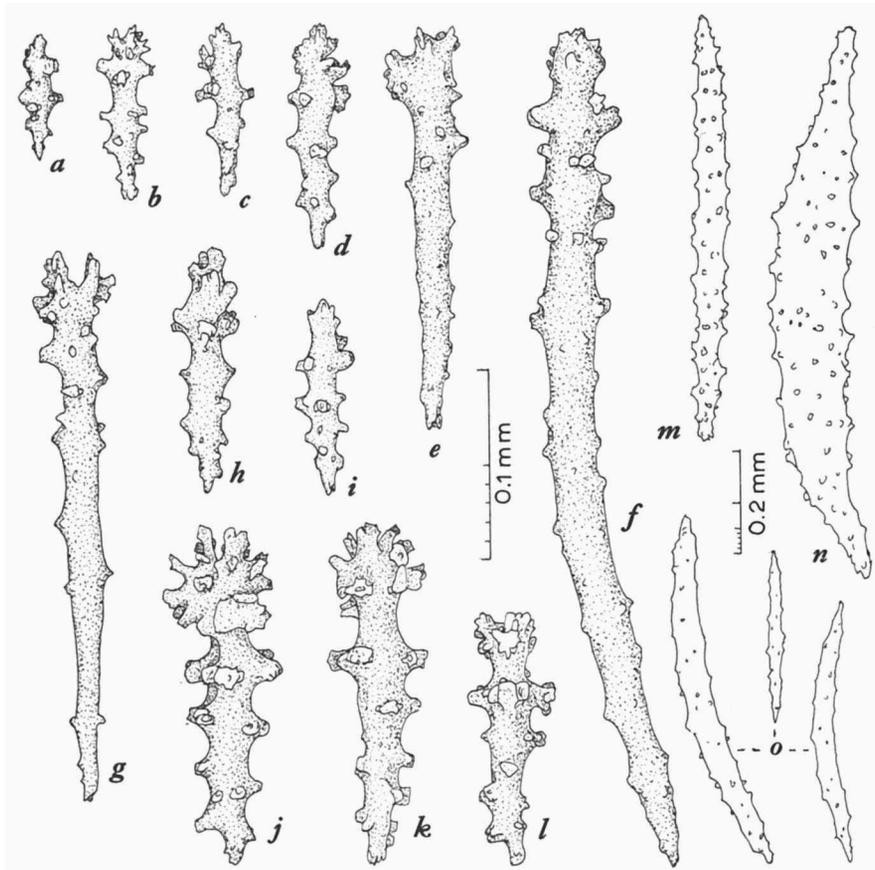


Fig. 1. *Sarcophyton acutum* Tixier-Durivault, syntype, MNHN. a-i, sclerites from surface layer of the disc; j-l, sclerites from surface layer of the stalk; m-o; sclerites from interior of the stalk. Enlargement of a-l indicated by 0.1 mm scale at e; that of m-o by 0.2 mm scale at m.

Tixier-Durivault (1970a: 237) holds the view that in configuration *S. acutum* looks like *S. cinereum*, but a comparison of pl. 1 fig. 1 with pl. 2 fig. 3 shows that the general shape of the two colonies is quite different.

Geographical distribution. — New Caledonia.

Sarcophyton boettgeri Schenk, 1896

(fig. 2; pl. 2 fig. 1)

Sarcophytum boettgeri Schenk, 1896: 72-73, pl. 2 fig. 9, pl. 4 figs. 28-30.

Sarcophytum plicatum Schenk, 1896: 76-77, pl. 2 fig. 12, pl. 4 fig. 40.

Not *Sarcophytum boettgeri*; Pratt, 1903: 511.

Not *Sarcophytum plicatum*; Roule, 1908: 174.

Not *Sarcophytum boettgeri*; Roule, 1908: 175-176.

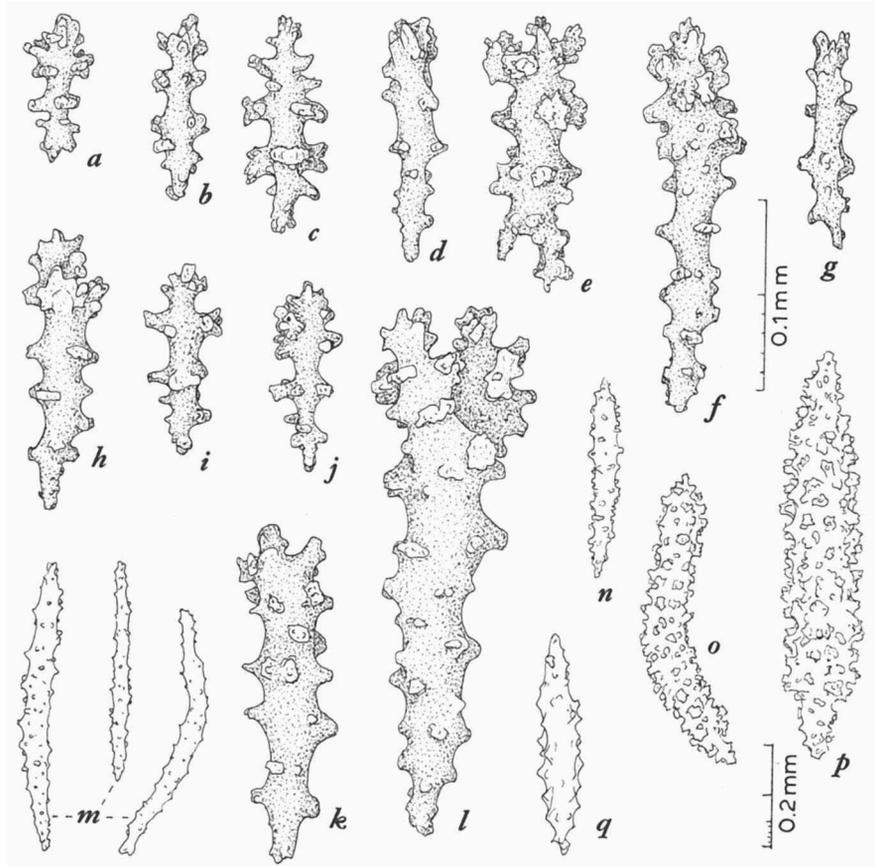


Fig. 2. *Sarcophyton boettgeri* Schenk, holotype, SMF no. 54. a-g, sclerites from surface layer of the disc; h-l, sclerites from surface layer of the stalk; m, sclerites from coenenchyme of the disc; n-q, coenenchymal sclerites from the stalk. Enlargement of a-l indicated by 0.1 mm scale at f; that of m-q by 0.2 mm scale at p.

I examined Schenk's holotype of *S. boettgeri*, SMF no. 54. It is very well pictured in Schenk's pl. 2 fig. 9. Our pl. 2 fig. 1 shows the same colony.

The autozooids are completely retracted. They neatly stand in rows; they are distinctly visible, the apertures are 0.50 to 0.60 mm wide. The centres are 0.60 to 0.80 mm apart. The siphonozooids are small, the diameter is about 0.15 mm; with the aid of a pocket-lens they are clearly visible. There is usually one siphonozooid between two autozooids.

The surface layer of the disc contains sclerites, which are sometimes slightly clavate (fig. 2a, d-f), but in many cases rodlike (fig. 2b, c, g). The length is 0.08 to 0.16 mm, sometimes up to 0.23 mm. They are covered with high

spines or simple warts giving the sclerite a coarse appearance; in other sclerites the processes are less densely placed, lower, more cone-shaped. The processes may be arranged in more or less distinct girdles. In the surface layer of the stalk the same sclerites occur; the length is up to 0.28 mm (fig. 2h-1).

In the coenenchyme of the disc lie spindles and thin rods, straight or curved, up to 0.55 mm long, and covered with low cones (fig. 2m). The sclerites in the interior of the stalk are stout, pointed, very warty spindles, and straight or curved cylinders, up to 0.80 mm long (fig. 2o, p). Smaller spicules with few, small warts (fig. 2n) or ornamented with low conical processes (fig. 2q) also occur.

The colour of the stalk is light grey, that of the disc slightly darker grey.

I also re-examined the holotype of Schenk's (1896: 76) *S. plicatum*. The shape of the colony is different (see Schenk's pl. 2 fig. 12). The specimen is bigger and probably older than that of *S. boettgeri* (Schenk's pl. 2 fig. 9). The thick margin of the disc extends markedly beyond the stalk, it is strongly folded and revolute. However, the spiculation is quite the same as in *S. boettgeri*, and this also holds for the autozooids and siphonozooids; the colour is light brown. In my opinion *S. plicatum* should be synonymized with *S. boettgeri*; the colony identified with *S. plicatum* by Roule (1908: 174), must be referred to *S. trocheliophorum* Von Marenzeller. Roule (1908: 175-176) also recorded several colonies of *S. boettgeri* from Amboina. Because of the incomplete description it is impossible to decide whether they belong to *S. glaucum* or to *S. boettgeri*. The specimen described by Pratt (1903: 511), identified with *S. boettgeri*, must be referred to *S. glaucum*.

In some respects (distribution of autozooids and siphonozooids, the sclerites) *S. boettgeri* approaches *S. latum* (Dana), but the shape of the colony is quite different. In *S. latum* the colony is "very broad explanate" and the margin of the disc "scarcely revolute" (Dana, 1846: 623; see also our pl. 16).

Moser (1919: 253) and Tixier-Durivault (1958: 61) synonymized *S. boettgeri* with *S. glaucum* (Quoy & Gaimard). This is incorrect, because in *S. glaucum* the number of siphonozooids between two autozooids is more than one, and the clubs in the surface layer of the disc are quite different.

Geographical distribution. — Ternate.

Sarcophyton boletiforme Tixier-Durivault, 1958

(fig. 3; pl. 2 fig. 4)

Sarcophyton boletiforme Tixier-Durivault, 1958: 70-72, figs. 73, 74, 78.

Tixier-Durivault's fig. 74A shows the holotype seen from aside; the enlargement is $\times 0.8$. Our pl. 2 fig. 4 is a photo of the colony seen from above, at natural size.

Near the edge of the disc the autozooids are 1.5 to 2.5 mm apart; in the central part the distance is very variable, reaching up to about 5 mm. It is not easy to count the number of siphonozooids between two autozooids, because these are not always distinctly visible. I estimate their number at five to thirteen.

The surface layer of the disc has clubs and rods, 0.06 to 0.12 mm long (fig. 3a-g). With the rod-shaped sclerites the heads are scarcely developed, if at all (fig. 3a, e). The prominences are small warts or truncated spines, but not infrequently they are foliaceous, with a sinuate edge (fig. 3d). Longer clubs, with a length of up to 0.38 mm, are also common (fig. 3h-j); their heads bear some warts or cone-shaped processes, whereas the handles have few, low cones. In the surface layer of the sterile stalk there are clubs, 0.09 to 0.40 mm long (fig. 3k-o). The prominences are more numerous and larger: warts, cones and spines.

The coenenchyme of the disc contains slender, nearly smooth needles, 0.60 (or more) mm long. In the stalk the coenenchyme has spindles, up to 1.10 mm long. The larger ones bear numerous small warts, which are sometimes arranged in transverse rows (fig. 3p, s). Smaller spindles have cones in varying numbers (fig. 3q, r). Such spindles are not at all typical of *S. boletiforme*; in other *Sarcophyton* species they are also found, e.g. with *S. acutum*.

Geographical distribution. — Gulf of Suez.

Sarcophyton buitendijki sp. nov.

(figs. 4, 5; pl. 3 fig. 3, pl. 4)

This new species is established for a colony, which I previously (1960: 225-227, fig. 2, pl. 7 figs. 2, 3) identified with *S. latum*. Now I consider this identification incorrect (see the description of *S. latum* in this paper, particularly p. 63). The colony in question (pl. 3 fig. 3) was collected at Pulau Weh (Sumatra) by P. Buitendijk in 1913; it is kept in RMNH, register no. Coel. 3002.

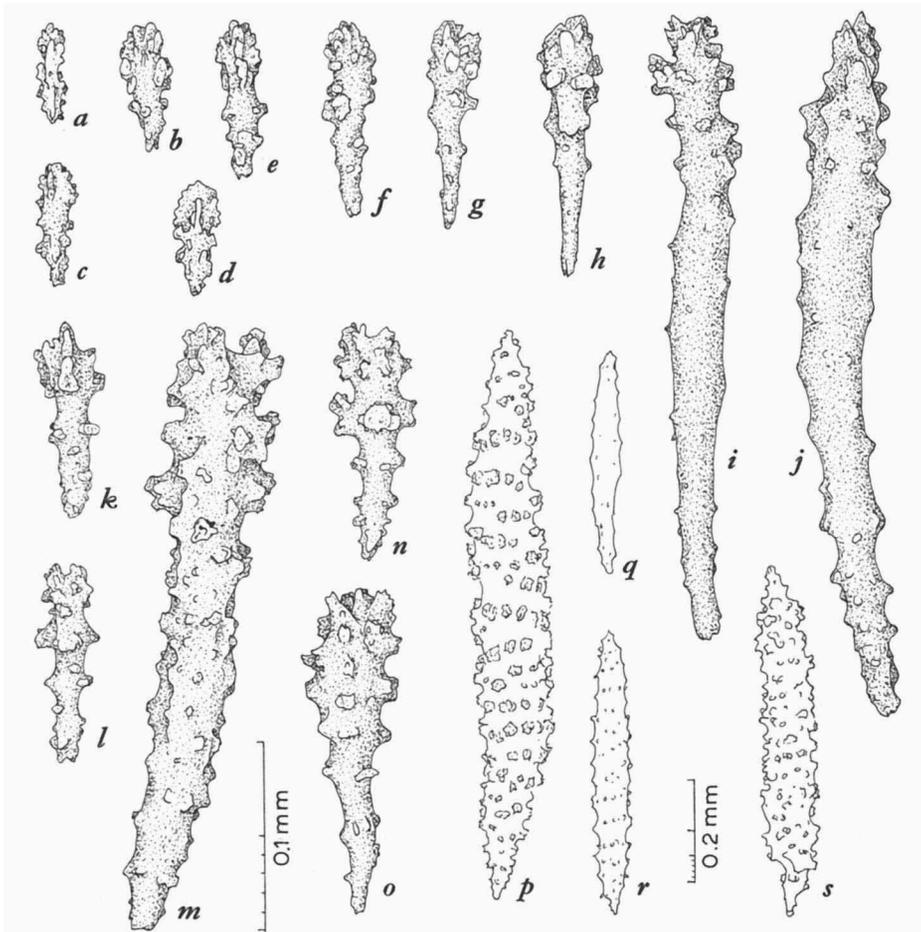


Fig. 3. *Sarcophyton boletiforme* Tixier-Durivault, holotype, MNHN. a-j, sclerites from surface layer of the capitulum; k-o, sclerites from surface layer of the stalk; p-s, sclerites from interior of the stalk. Enlargement of a-o indicated by 0.1 mm scale at m; that of p-s by 0.2 mm scale at r.

The specimen is stiff and rather hard. It is flattened laterally; the maximum diameter of the capitulum is 120 mm, the width is 35 to 40 mm. The capitulum is hollow. The margin is thrown into folds, which hang far downwards over the stalk.

The distribution of the autozooids and the siphonozooids is the same in all parts of the capitulum. The autozooids are 0.80 to 1.50 mm apart, the number of siphonozooids between two autozooids is one or two. A good many autozooids are not completely retracted; usually the incurved tentacles project just above the surface. The diameter of these polyps is about 0.90 mm.

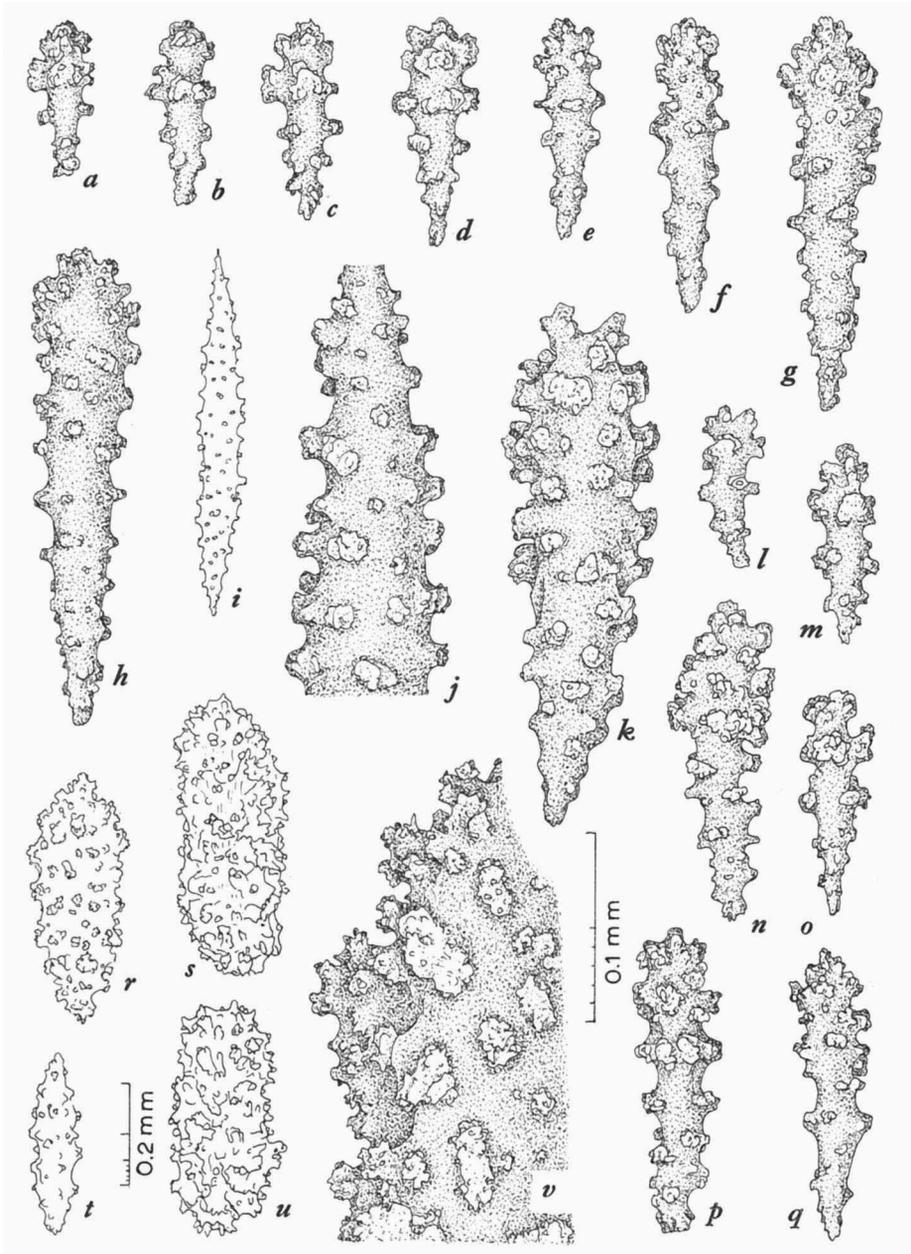


Fig. 4. *Sarcophyton buitendijki* sp. nov., holotype, RMNH Coel. no. 3002. a-h, sclerites from surface layer of the capitulum; i, j, sclerites from interior of the capitulum; k-q, sclerites from surface layer of the stalk; r-v, sclerites from interior of the stalk. Enlargement of a-h, j-q and v indicated by 0.1 mm scale below k; that of i and r-u by 0.2 mm scale at t.

A few anthocodiae project slightly farther. Their polyp walls are devoid of sclerites except in the distalmost part, right at the base of the tentacles and in the tentacles themselves. These sclerites are irregularly arranged, weakly spined rods, 0.10 to 0.15 mm long.

The surface layer of the capitulum has clubs, 0.08 to 0.21 mm long, a few attain a length of 0.31 mm (fig. 4a-h). The heads consist of a terminal cluster of warts and, below this, a girdle of relatively big warts. The handle bears smaller, often zoned warts. The clubs in the surface layer of the stalk have about the same length (fig. 4k-q). They make a slightly coarser impression.

In the interior of the disc there are pointed spindles, up to 0.65 mm long (fig. 4i, j). The prominences are irregularly placed warts; they look like having been cut off rectangularly. The coenenchyme of the stalk contains two types of sclerites: (1) broad ovals and round-ended cylinders, up to 0.55 mm long and 0.28 mm wide; they are densely covered with warts (fig. 4s, u, v), and (2) pointed spindles, up to 0.60 mm long and 0.14 mm wide; they are also covered with warts. Between these two types there are all kinds of transitional forms (fig. 4r, t).

The colour of the colony is greyish-brown.

A few years ago the present author (1977b: 174) reported on some *Sarcophyton* specimens from the Great Barrier Reef (FLMH nos. 2, 3, 40). Initially these were identified with *S. latum* (Dana), but now they must be called *S. buitendijki*. Pl. 4 shows the colony FLMH 40, RMNH Coel. no. 11661. The margin of the capitulum of this colony is thick, strongly folded, and overhanging, whereas the centre is hollow; the sterile stalk is short. The autozooids are placed in rows. Their mutual distance is 0.80 to 1.00 mm, but between the rows the distance is 1.10 to 1.30 mm. In the centre of the disc the autozooids are more irregularly distributed, their distance is 1.00 to 1.60 mm. At the periphery of the capitulum there are one or two siphonozooids between two autozooids, in the central part three to four. As to the spiculation (fig. 5) there is hardly any difference with the holotype. The thick sclerites in the interior of the stalk are sometimes longer, up to 0.67 mm (fig. 5t-w). The colour of the colony is creamy.

Geographical distribution. — Pulau Weh (Sumatra), Great Barrier Reef.

***Sarcophyton cherbonnieri* Tixier-Durivault, 1958**

(fig. 6; pl. 2 fig. 2)

Sarcophytum cherbonnieri Tixier-Durivault, 1958: 68-70, figs. 60, 71, 72.

Sarcophyton cherbonnieri; Tixier-Durivault, 1966a: 149-150, figs. 144-146.

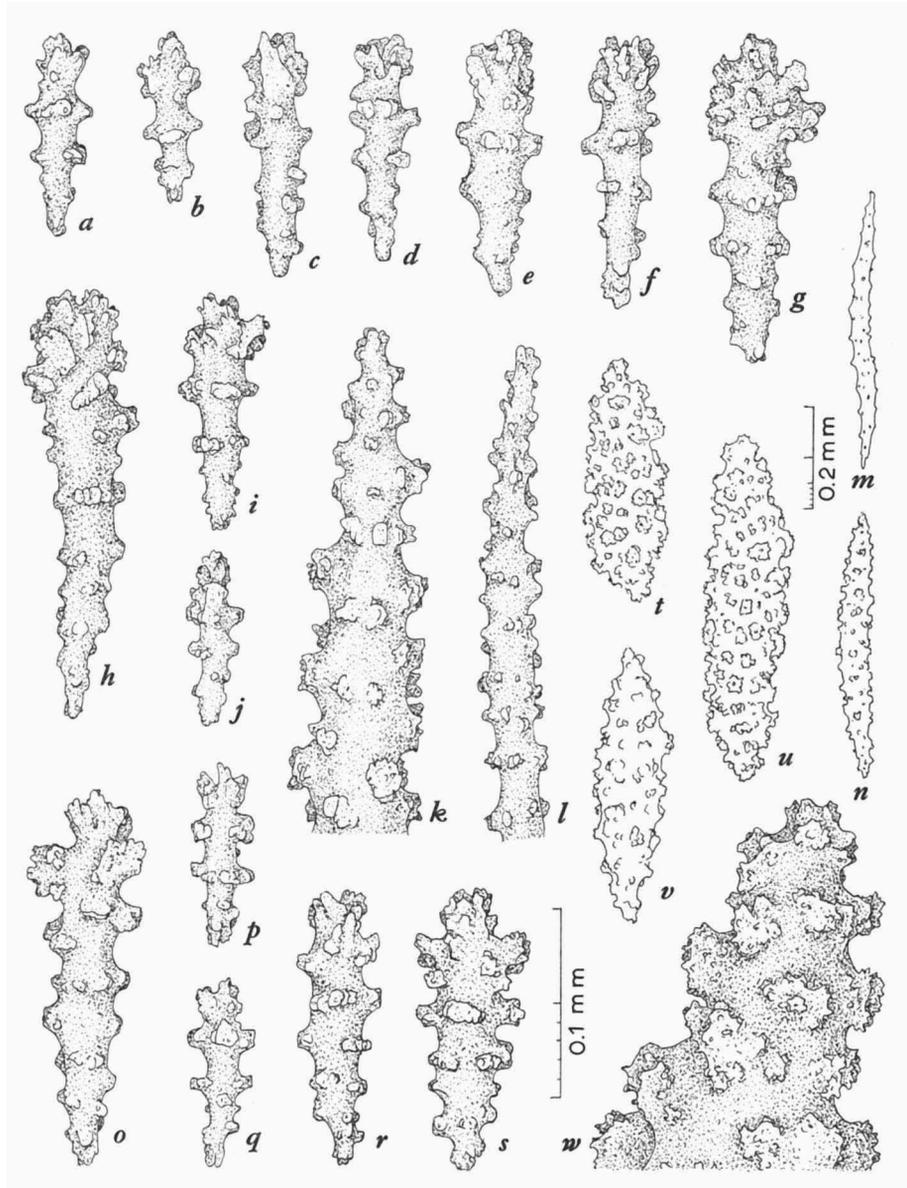


Fig. 5. *Sarcophyton buitendijki* sp. nov., RMNH Coel. no. 11661. a-j, sclerites from surface layer of the disc; k-n, sclerites from coenenchyme of the disc; o-s, sclerites from surface layer of the stalk; t-w, sclerites from coenenchyme of the stalk. Enlargement of a-l, o-s and w indicated by 0.1 mm scale at w; that of m, n and t-v by 0.2 mm scale at m.

Tixier-Durivault's fig. 60 (1958) is a drawing of the holotype, seen from aside. Our pl. 2 fig. 2 shows the same colony seen from above; in this photo the expanded autozooids are clearly visible. They are up to about 6 mm long. Only in the distalmost part of the anthocodia and in the rounded, contracted tentacles there are a few rods with wavy edges, in the tentacles 0.02 to 0.04 mm long, in the anthocodiae 0.04 to 0.08 mm. The distance between the centres of the autozooids is 1.5 to 3 mm. Between two autozooids there are two to five siphonozooids, in places possibly a few more, but this is hard to see.

In the surface layer of the disc there are clubs and rods, strongly varying in length: 0.08 to 0.40 mm (fig. 6a-h), but usually the length is 0.12 to 0.15 mm. The clubs are somewhat indefinite; the head is but a little wider than the handle, and consists of low, rounded prominences, which are more numerous than on the handle. The longest clubs are more fusiform, with an accumulation of processes at one end; they may be regarded as transitional forms to internal spicules. The sclerites in the surface layer of the stalk are distinctly different. A good many of them, 0.05 to 0.10 mm long, are approximately oval, sometimes with a median waist; they bear a few, now and then foliaceous prominences (fig. 6i-k). Longer sclerites, with a length of 0.10 to 0.25 mm, are more clavate (fig. 6l-p).

The coenenchyme of the disc contains slender spindles, up to 0.42 mm long, with rounded spines, which are more densely placed at one or at both ends of the spicule (fig. 6q). In the interior of the stalk the spicules are very warty, pointed or blunt-ended spindles, up to 0.95 mm long, sometimes with irregular protuberances (fig. 6r-t).

Geographical distribution. — Aldabra I. (N. of Madagascar).

Sarcophyton cinereum Tixier-Durivault, 1946

(figs. 7, 8; pl. 2 fig. 3, pl. 17 fig. 1)

- Sarcophytum cinereum* Tixier-Durivault, 1946: 81-82; 1958: 41-44, figs. 37, 38, 41.
Sarcophyton cinereum; Tixier-Durivault, 1966a: 130-133, figs. 123-125; 1970a: 236-237; 1970b: 131.
Sarcophytum poculiforme Tixier-Durivault, 1958: 44-46, figs. 39, 42-44.
Sarcophyton poculiforme; Tixier-Durivault, 1970a: 237-239; 1970b: 134.

I designate the biggest colony described and figured by Tixier-Durivault (1958: fig. 38A) as the lectotype. The enlargement of the specimen in the figure mentioned is $\times 0.75$. Our pl. 2 fig. 3 displays the colony at natural size; the diameter of the disc is 60 mm.

Near the edge of the disc the autozooids are 1.5 to 2.0 mm apart, in the

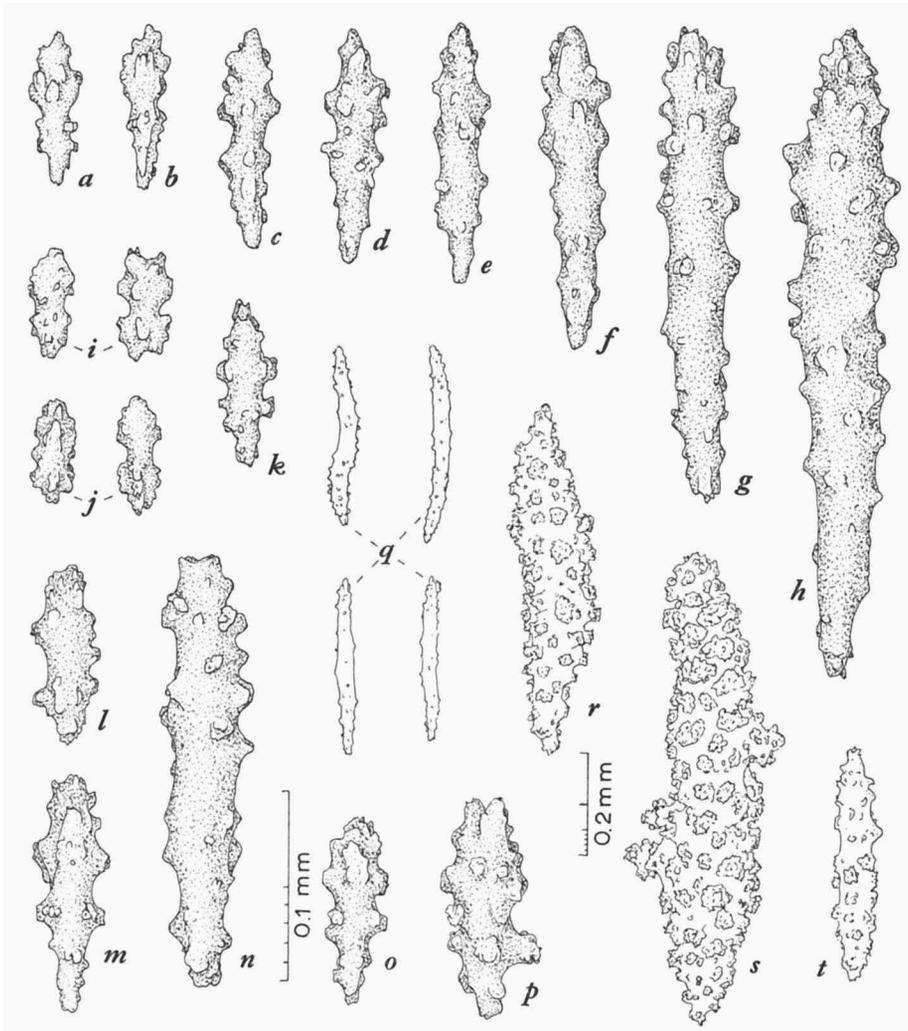


Fig. 6. *Sarcophyton cherbonnieri* Tixier-Durivault, holotype, MNHN. a-h, sclerites from surface layer of the disc; i-p, sclerites from surface layer of the stalk; q, sclerites from interior of the disc; r-t, sclerites from interior of the stalk. Enlargement of a-p indicated by 0.1 mm scale at n; that of q-t by 0.2 mm scale at r.

central part of it the distance is up to 2.5 mm. Near the periphery there are one to three, usually two siphonozooids between two autozooids, in the middle part up to four.

The clubs in the surface layer of the disc are strikingly long. The shorter ones are 0.13 mm (fig. 7a); the majority of them have a length of 0.15 to 0.20 mm (fig. 7b, c); quite a few are still longer, up to 0.50 mm (fig. 7d, e),

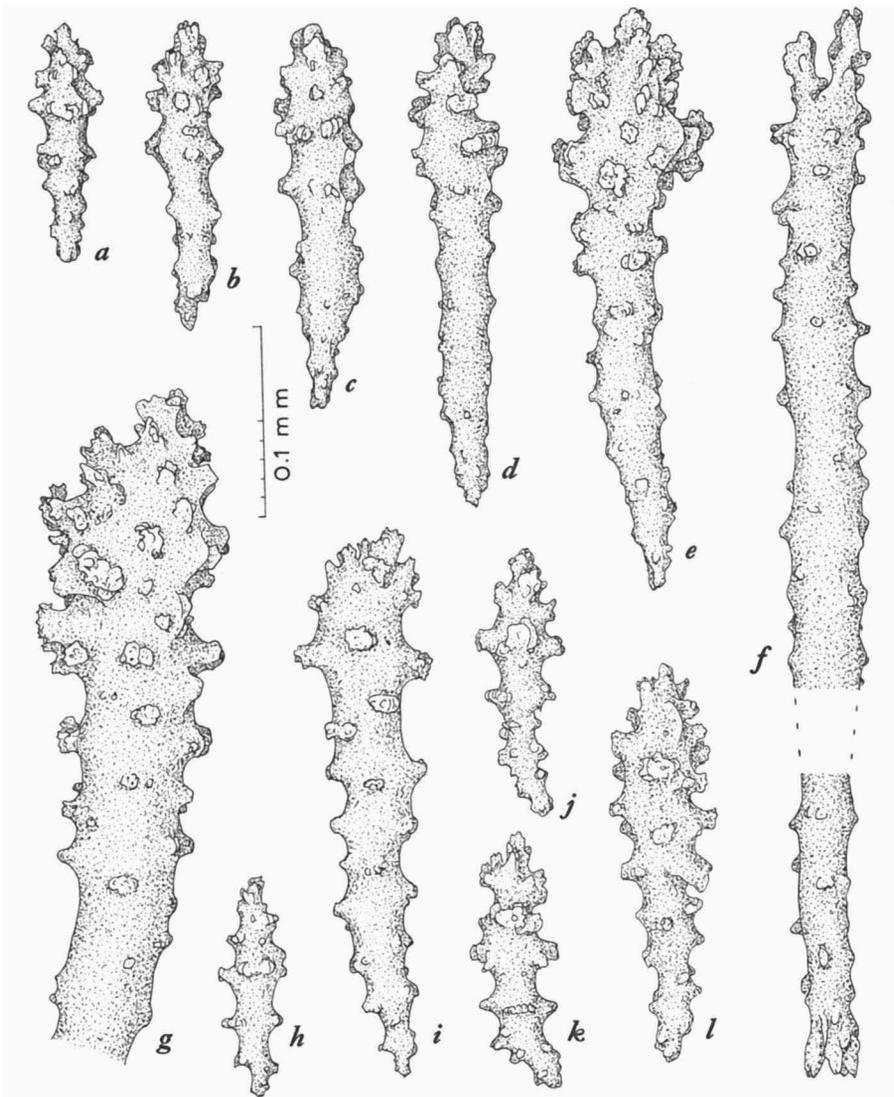


Fig. 7. *Sarcophyton cinereum* Tixier-Durivault, lectotype, MNHN. a-f, sclerites from surface layer of the capitulum; g-l, sclerites from surface layer of the stalk. All enlargements are the same; scale 0.1 mm.

but slender, clavate spicules, right up to 0.70 mm, are also common (fig. 7f). The warty heads are usually only a little wider than the handles, but clubs with a wide head also occur (fig. 7e). The handles bear rounded spines, with a tendency to zoning. The longest clubs (fig. 7f) have an accumulation of prominences at one end; they can be taken for intermediate forms between clubs and internal spicules.

The clubs in the surface layer of the stalk are wider and more warty (fig. 7g-l). The length varies from 0.12 to 0.58 mm, but usually they are up to 0.35 mm.

The coenenchymal spicules are very long. In the disc they are slender spindles and narrow rods. The spindles are longest, up to 1.40 mm (fig. 8a, c, g); they are often curved, and provided with truncated spines. The rods are very slender, needle-like (fig. 8f, h, i), with more prominences at their ends; they attain a length of 0.90 mm. Between both forms there are transitional types (fig. 8b, d, e).

The spicules in the interior of the stalk are all fusiform, straight or curved, with pointed, sometimes rounded ends. The bigger ones, up to 1.80 mm long, are rather densely covered with simple warts (fig. 8j, k, n). The smaller ones have widely spaced, low cones (fig. 8l, m, o).

This description of the spicules differs from that of Tixier-Durivault (1958). According to her the surface layer of disc and stalk only contains sticks ("baguettes"); clavate forms are not recorded, but they are represented in her fig. 41. Also in the dimensions of the sclerites I found considerable differences.

Tixier-Durivault's *S. poculiforme* must lapse as a synonym of her *S. cinereum*. As in the lectotype the disc is funnel-shaped; compare pl. 2 fig. 3 with pl. 17 fig. 1. Furthermore they agree one with the other in the mutual distances of the autozooids, the number of siphonozooids between the autozooids, the shape and the length (!) of the sclerites in all parts of the colonies.

Geographical distribution. — New Hebrides, Madagascar, New Caledonia, Bay of Nha Trang (Vietnam).

Sarcophyton crassocaule Moser, 1919

(figs. 9-11; pls. 5-8, pl. 9 fig. 1)

Sarcophyton crassocaule Moser, 1919: 243-244, fig. 6, pl. 5 fig. 10; Roxas, 1933: 375-376, pl. 1 fig. 4; Verseveldt, 1960: 224-225; 1971: 26; 1977a: 3 (listed only).

? *Sarcophyton crassocaule*; Tixier-Durivault, 1946: 82; 1958: 72-75, figs. 75, 79, 80.
? *Sarcophyton crassocaule*; Tixier-Durivault, 1966a: 150-154, figs. 147-149; 1970a: 240; 1970b: 131-132; 1972: 19.

Sarcophyton trocheliophorum Von Marenzeller var. *minus* Thomson & Dean, 1931: 62-63, pl. 2 fig. 11, pl. 22 fig. 5.

Sarcophyton puertogalerae Roxas, 1932: 78-79, pl. 1 fig. 1a-e; 1933: 376-377, pl. 1 fig. 5.
Not *Sarcophyton puertogalerae*; Tixier-Durivault, 1946: 170; 1958: 81-83, figs. 85, 87, 89; 1970a: 243.

Lobophytum carnatum Tixier-Durivault, 1956: 477-478; 1958: 110-113, figs. 106, 114, 117; 1970b: 125.

Not *Lobophytum carnatum*; Utinomi, 1977: 21, fig. 4, pl. 4 fig. 4.

Lobophytum radiatum Tixier-Durivault, 1957: 107; 1958: 113-114, figs. 115, 118, 119; 1970a: 217.

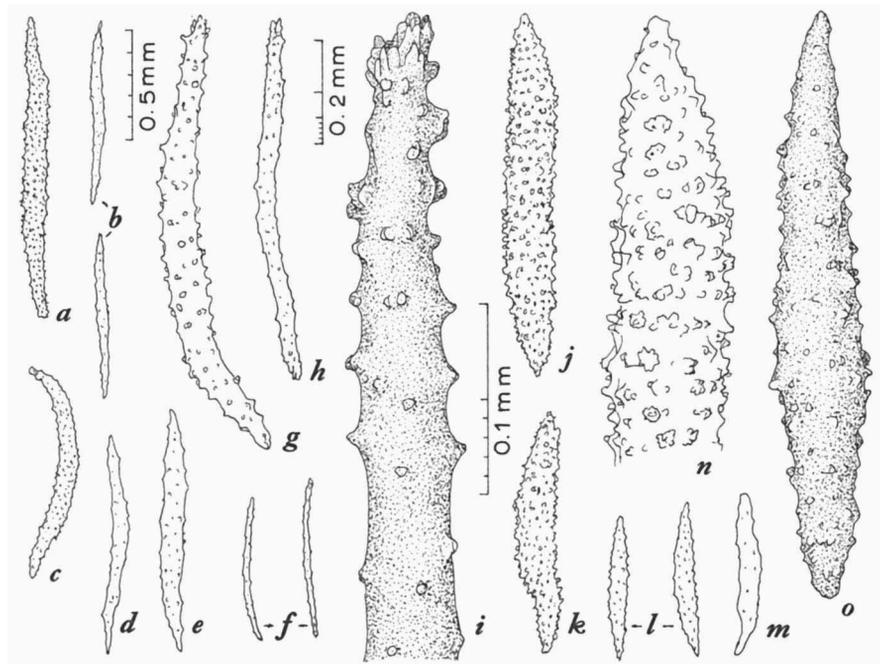


Fig. 8. *Sarcophyton cinereum* Tixier-Durivault, lectotype, MNHN. a-i, spicules from coenenchyme of the capitulum; j-o, spicules from coenenchyme of the stalk. Enlargement of a-f and j-m indicated by 0.5 mm scale above b; that of g, h, n, o by 0.2 mm scale above h; that of i by 0.1 mm scale above i.

Lobophytum tenerum Tixier-Durivault, 1957: 110; 1958: 107-110, figs. 105, 112, 113; 1970b: 130.

Lobophytum undatum Tixier-Durivault, 1957: 110; 1958: 118-119, figs. 122, 127, 128; 1970a: 216-217; 1970b: 130.

During my stay in the Berlin Museum I found three colonies named *Sarcophyton griffini* Moser. They are preserved in alcohol. The labels added to the bottle give the following data: "Register number 4607; *Sarcophyton trocheliophorum* Mar., Moser det. 1918; *Sarcophyton griffini* Moser, type, J. Moser det. 1919; Friedrich-Wilhelms-Hafen in Neu-Guinea, W. Schoede leg., erhalten 21-9-07".

It appears from all this, that at first, in 1918, Moser identified the colonies with *S. trocheliophorum*, and after that, in 1919, he established a new species, *S. griffini*. As far as I know, Moser never published this name. However, in his paper of 1919 Moser (p. 243) records as "Fundortsnotiz" of *S. crassocaule*: "Friedrich-Wilhelms-Hafen Neu-Guinea, Schoede S. (Mus. Berlin Nr. 4607, 4 Expl.)"; i.e. the same locality and the same museum number. Ultimately Moser apparently named the colonies *S. crassocaule*.

I examined two of these "*griffini*" specimens. I designate the specimen represented in pl. 5 figs. 2, 3 as the lectotype, and the "Siamese" twin, pl. 5 fig. 1, as the paralectotype.

The distance between the centres of the autozooids is 1.00 to 2.00 mm. Near the edge of the disc there are one or two, sometimes three siphonozooids between two autozooids.

The surface layer of the capitulum has sclerites with two girdles of volcano-shaped prominences; in most cases it is impossible to speak of clubs (fig. 9a-d). The length varies from 0.09 to 0.16 mm. Longer spicules are more club-shaped; they reach a length of 0.26 mm (fig. 9e-g). The clubs in the surface layer of the stalk are different (fig. 9j-n). The prominences, which are arranged in girdles as well, are higher and more wartlike. The length of these clubs is 0.09 to 0.18 mm.

The interior of the disc contains slender spindles, up to 0.47 mm long; they bear low cones (fig. 9h, i). In the coenenchyme of the stalk lie oval or oblong cylinders, 0.19 to 0.25 mm long, with two median girdles of warts and two terminal clusters of warts (fig. 9p-r). Besides, there are spindles, up to 0.32 mm long, with two to four median zones of warts, and irregularly placed, smaller processes at the ends (fig. 9o).

In a former paper (1960: 224) I defended Roxas' view that *S. trocheliophorum* var. *minus* Thomson & Dean is *S. crassocaulis*. Again I examined several syntypes of this variety, kept in the Amsterdam Museum, and numbered ZMA Coel. 3211, 3215, 3216, 3224 and 3225 (see: Van Soest, 1977: 87). It appears that these colonies, too, must be referred to *S. crassocaulis*. The colonies (pl. 7 fig. 2, pl. 9 fig. 1) are smaller than the Berlin specimens, and, for the rest, there are all kinds of differences between them. In most specimens the autozooids are more densely placed, the distance of their centres is not more than 1.00 mm. The number of siphonozooids between them is usually one, sometimes two. The internal spindles of the disc may be shorter, up to 0.30 mm, or longer, up to 0.65 mm; they may be slender, or wider and covered with warts. The clubs in the surface layer of the stalk may have thick, warty heads. The sclerites in the coenenchyme of the stalk may have a length of 0.17 to 0.18 mm, 0.17 to 0.20 mm, 0.20 to 0.24 mm; their median waist may be very short. The spindles in the stalk vary in length from up to 0.32 mm to 0.50 mm.

It is interesting to see that Thomson & Dean (1931: pl. 2 fig. 11) figured a colony consisting of three stalked capitula, so a set of triplets, whereas our pl. 5 fig. 1 shows a pair of "Siamese" twins. It may also be noted that both in Thomson & Dean's examples and in Moser's specimens the capitula are rather flat, that the margin is only slightly folded, and last but not least, that

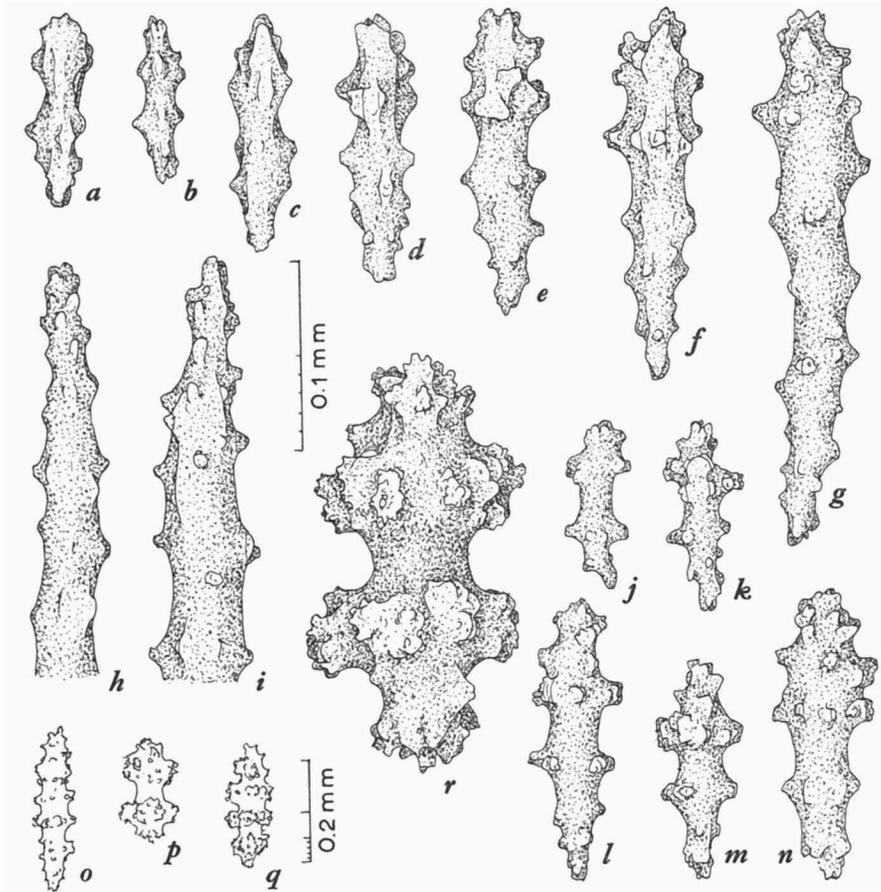


Fig. 9. *Sarcophyton crassocaule* Moser, syntype (= *S. "griffini"* Moser), ZMB no. 4607. a-g, sclerites from surface layer of the disc; h, i, parts of coenenchymal spicules from the disc; j-n, sclerites from surface layer of the stalk; o-r, sclerites from interior of the stalk. Enlargement of a-n and r indicated by 0.1 mm scale at c; that of o-q by 0.2 mm scale at q.

they show "a deep somewhat reniform incision at one side" (Thomson & Dean, 1931: 62).

Roxas (1932: 78) published the description of *S. puertogalerae*. He mentioned the following differences with *S. crassocaule*: (1) in his new species the disc is "more folded" and projects "slightly farther out of the stalk", and (2) in *S. crassocaule* the "zooids are very much larger and much more easily visible". The former difference is insignificant. As to the latter difference: in *crassocaule* (pl. 5 figs. 1-3) the autozooids are actually far from small. But the influence of the fixation on the width of the apertures left by the autozooids after retraction is unknown. See also the difference be-

tween the two colonies represented in pl. 7 fig. 2 and pl. 9 fig. 1, both referred to *S. trocheliophorum* var. *minus* by Thomson & Dean (1931: 62-63).

In the spiculation *S. puertogalerae* agrees very well with *S. crassocaule*; see also Roxas (1933: pl. 1 fig. 5).

A comparison of Tixier-Durivault's (1958: 81) description of *S. puertogalerae* with that by Roxas reveals that the former must be wrong. Ovals, 0.20 to 0.40 mm long, which are depicted in her figs. 85 and 89, do not occur in *S. puertogalerae*, and the cylinders with two distinct zones of big warts which are typical of *S. puertogalerae* (and also of *S. crassocaule*), are apparently absent in her specimen. On the other hand, the needles in the interior of the disc, up to 0.7 mm long (!), are unknown in *S. puertogalerae*.

Tixier-Durivault (1956, 1957, 1958) referred to the allied genus *Lobophytum* some colonies, the disc of which is more or less folded at the periphery and knobby on the upper side. These colonies show a marked resemblance to each other, also regarding the spiculation. Tixier-Durivault referred them to different species, viz., *L. carnatum*, *radiatum*, *tenerum* and *undatum*, but they all are conspecific with *S. crassocaule*.

Tixier-Durivault (1958) figured two colonies of "*Lobophytum carnatum*". The biggest one, which is represented in her fig. 114 (enlargement $\times 0.6$) and in our pl. 6, has a capitulum of 130 mm in major diameter. This fleshy capitulum has distinct, thick folds; the marginal ones project far beyond the wide stalk. The smaller colony is depicted in her fig. 106; enlargement $\times 0.75$. Our pl. 7 fig. 1 represents the same colony, which is mushroom-shaped, with a bumpy disc, whereas the thick margin shows the beginning of a few folds. The two colonies, and especially the big one (pl. 6), are much more like a *Sarcophyton* than a *Lobophytum*. The fleshy capitula (Latin *carnis* = flesh) also point in this direction.

In the bigger colony the mutual distances of the autozooids is 1.0 to 1.2 mm. On the marginal folds there is only one siphonozoid between them; more towards the centre there are one or two. Fig. 10 shows the sclerites of this specimen. The surface layer of the disc contains clubs varying in length from 0.08 to 0.20 mm. The smaller ones have less distinct heads; they bear rounded or stumpy spines (fig. 10a-f). Larger clubs have wider, warted heads; their handles have a few zoned warts (fig. 10g). The clubs in the surface layer of the stalk have the same length and shape; they are slightly wider (fig. 10k-p). In the disc interior there are spindles, usually 0.25 to 0.40 mm long, with stalked simple warts arranged in girdles (fig. 10h-j). In the axis of the spindles and in the girdles of the prominences a brown, granular substance occurs; in fig. 10j it is indicated by dots. In the interior of the stalk the

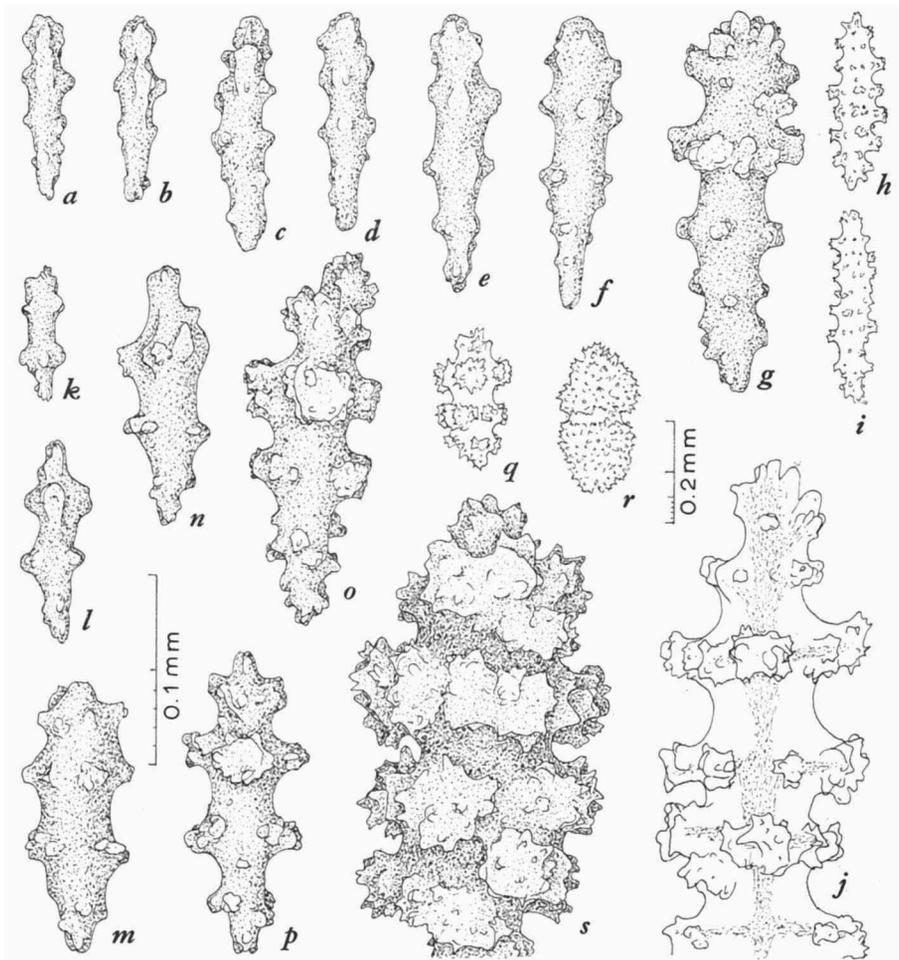


Fig. 10. *Sarcophyton crassocaule* Moser, syntype of "*Lobophytum carnatum*" Tixier-Durivault, MNHN. a-g, sclerites from surface layer of the disc; h-j, spicules from interior of the disc; k-p, sclerites from surface layer of the stalk; q-s, sclerites from interior of the stalk. Enlargement of a-g, j-p and s indicated by 0.1 mm scale at l; that of h, i, q and r by 0.2 mm scale at r.

majority of the sclerites are barrel-shaped, 0.25 to 0.27 mm long, and averagely 0.15 mm wide. They have two girdles of big, spiny warts, and two terminal clusters of warts (fig. 10q, s). A median waist is always discernable. There are also some oval bodies, averagely 0.28 mm long and 0.15 mm wide, with or without a waist, and completely or nearly completely covered with spiny warts (fig. 10r).

In the smaller colony the mutual distance of the autozooids in the central part of the disc is greater, up to about 1.8 mm. The number of siphonozooids

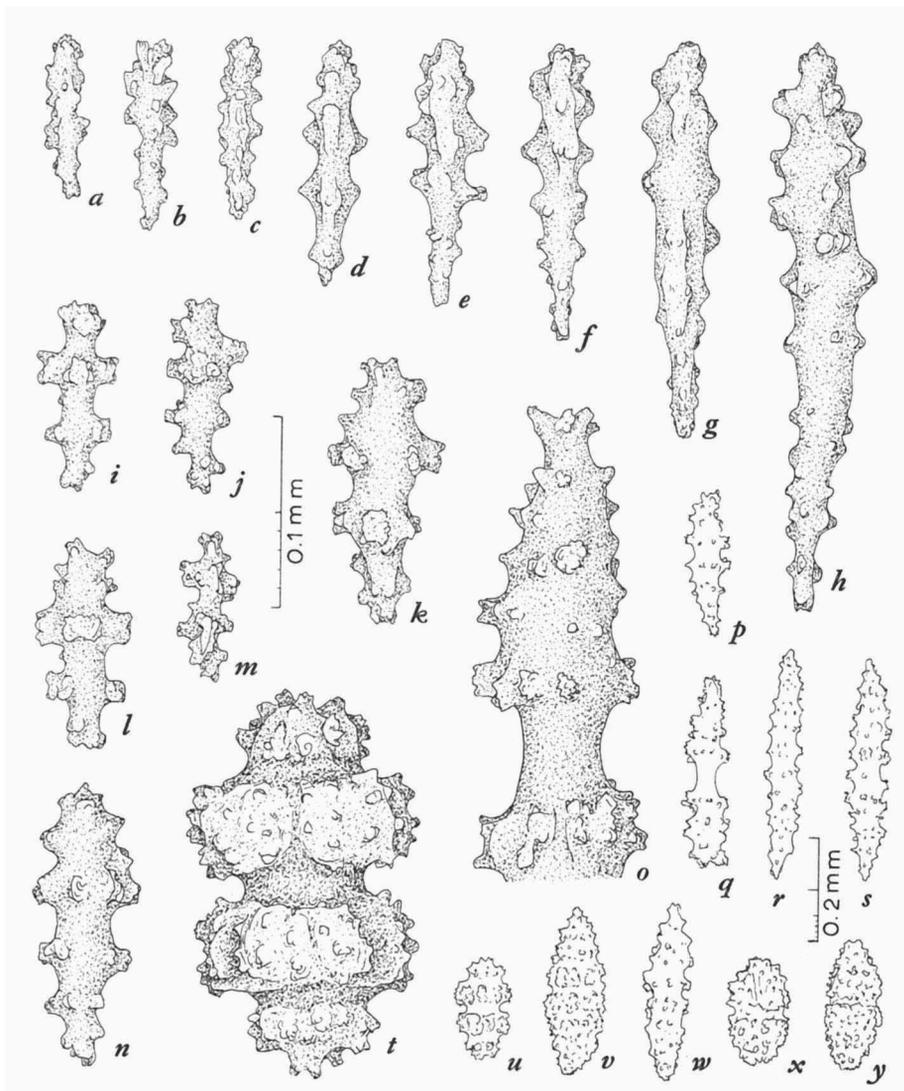


Fig. 11. *Sarcophyton crassocaule* Moser, type of "*Lobophytum tenerum*" Tixier-Durivault, MNHN. a-h, sclerites from surface layer of the capitulum; i-n, sclerites from surface layer of the stalk; o-s, sclerites from interior of the disc; t-y, sclerites from interior of the stalk. Enlargement of a-o and t indicated by 0.1 mm scale at j; that of p-s and u-y by 0.2 mm scale at r.

is also a little greater, up to three. The specimen has the same spiculation as the big one.

In the colony of "*Lobophytum radiatum*" (pl. 8) the sclerites in the coenenchyme of the stalk are slightly smaller: most of them are 0.20 to 0.22 mm long and 0.12 to 0.13 mm wide, but larger, more fusiform sclerites also occur, 0.27 mm long. In addition to these, a few, rather slender spindles, 0.29 to 0.32 mm long, are met with, and, finally, oval bodies, 0.15 to 0.23 mm in major diameter.

The nominal species "*Lobophytum tenerum*" (fig. 11) and "*Lobophytum undatum*" (Tixier-Durivault, 1958: fig. 122) fully agree with one another and with the specimens described above.

Moser (1919: 243) found more or less spherical sclerites in the interior of the stalk. His fig. 6 shows such a form. According to the scale of enlargement the major diameter of it is 0.10 mm. I also found such spherical, but usually oval, forms in other colonies, but not in all, and their number varies strongly. In "*griffini*" and in the smaller colony of "*carnatum*" they are absent. In the big colony of "*carnatum*" (fig. 101), in "*trocheliophorum* var. *minus*", in "*tenerum*" and in "*undatum*" they are far from scarce. The major diameter varies from 0.25 to 0.34 mm. Roxas (1932) found them in *S. puer-togaleræ*; he gives drawings of them in his pl. 1 fig. 1d. The diameter is 0.11 to 0.12 mm, nearly as large as the sphere in Moser's figure.

Utinomi (1977: 21) referred a colony from Okinawa to "*Lobophytum carnatum*". I regret to say that this identification is wrong. The disc seems to be covered with lobes, there are apparently no folds. The sclerites are quite different from those described above, see his fig. 4. The most striking feature is perhaps that the stalk interior contains "large plump spindles scattered with large warts, not forming any definite girdles".

Tixier-Durivault's (1958: 72) description of *S. crassocaulæ* makes me doubt the correctness of the identification. The internal sclerites in the stalk should be 0.20 to 0.40 mm long and 0.17 to 0.20 mm wide. In "*griffini*" and other *crassocaulæ* specimens (see above) the length is 0.17 to 0.27 mm (different with the various specimens). According to Tixier-Durivault's description the internal sclerites should have four girdles of warts, but her figures (fig. 79a-e) do not show anything of this. Needles, 1.0 to 1.5 mm long (!), should occur in the surface layer of the stalk, and the sclerites in the surface layer of the disc should be 0.15 to 0.52 mm (!) long (her fig. 80j-n).

Geographical distribution. — The species has been recorded from several places in the West-Pacific Ocean, i.e. Philippines, Bay of Nha Trang and Bay of Cauda (Vietnam), Indonesia (New Guinea included), and New Britain. It is also known from Christmas I.

Sarcophyton crassum Tixier-Durivault, 1946

(fig. 12; pl. 9 fig. 4)

Sarcophytum crassum Tixier-Durivault, 1946: 82-83; 1958: 39-41, figs. 32, 35, 36.*Sarcophyton crassum*; Tixier-Durivault, 1970a: 236.*Sarcophyton globosum* Tixier-Durivault, 1966a: 133-135, figs. 127, 128, 132.*Sarcophyton implanum* Verseveldt, 1974: 100-101, fig. 3, pl. 1 fig. 1.

The holotype, that I re-examined, has been represented by Tixier-Durivault (1958: fig. 32A); the enlargement in this figure is $\times 0.7$. Our pl. 9 fig. 4 shows the same colony at natural size.

The surface of the middle part of the disc (the middlemost hillock in pl. 9 fig. 4) is shrivelled; owing to this the autozooids in this part are not clearly visible. To the left and to the right of this hillock, however, the autozooids are distinct, and the same holds for the siphonozooids. It appears that most of the autozooids are retracted; in this state they have a diameter of 0.80 mm. On the margin of the disc the centres are 1.40 to 2.00 mm apart, more inward up to 2.50 mm. Expanded autozooids reach a length of 3.50 mm, tentacles included. The distal part of the anthocodia is armed with a good number of rodlike, blunt, nearly smooth spicules, densely arranged en chevron; the length is 0.20 to 0.30 mm. The tentacles are about 0.70 mm long and 0.50 mm wide (pinnules included). In the basal part of the tentacle lie numerous spicules, averagely 0.15 mm long. They spread out fan-shaped in the direction of the pinnules; in this direction they become shorter. There are about 10 to 12 pinnules on either side of the tentacle (not five as Tixier-Durivault mentioned); they seem to be arranged in two rows on either side. They are more or less digitiform; the length is 0.15 to 0.25 mm.

The distance between the centres of two siphonozooids varies from 0.30 to 0.50 mm. There are one to three siphonozooids between two autozooids (the number of ten, given by Tixier-Durivault, is much too high).

The surface layer of the disc contains clubs 0.09 to 0.31 mm long, but the majority are about 0.13 to 0.15 mm long (fig. 12a-i). The heads consist of small warts and cones, sometimes the prominences seem to be leaflike. The handles are rather blunt-ended; they bear cones and truncated spines. The clubs in the surface layer of the sterile stalk have the same length and the same shape, but the prominences may be slightly higher (fig. 12l-q).

In the interior of the disc lie slender spindles, up to 0.62 mm long, and sculptured with widely spaced, low, cone-shaped prominences (fig. 12j, k). The coenenchyme of the stalk has straight or curved, pointed spindles, reaching 1.03 mm in length. The bigger and wider ones are covered with small warts (fig. 12r, s), the smaller and narrower ones bear fewer and lower prominences (fig. 12t, u).

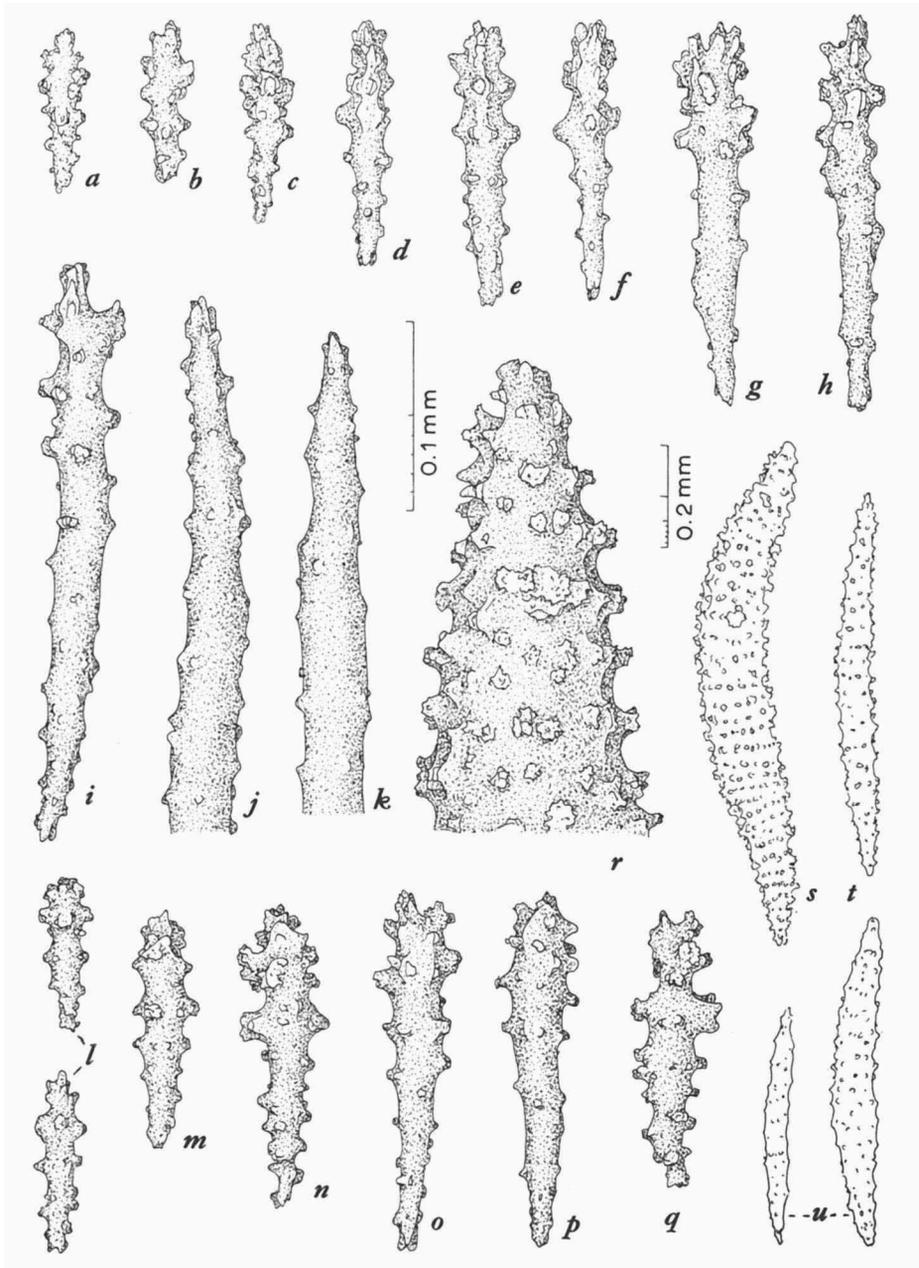


Fig. 12. *Sarcophyton crassum* Tixier-Durivault, holotype, MNHN. a-i, sclerites from surface layer of the capitulum; j, k, parts of coenenchymal spicules from the disc; l-q, sclerites from surface layer of the stalk; r-w, spicules from interior of the stalk. Enlargement of a-r indicated by 0.1 mm scale below d; that of s-u by 0.2 mm scale below f.

In 1974 I described *S. implanum* as a new species. Important differences with *S. crassum* were the distance between the autozooids (5 mm in *S. crassum* according to Tixier-Durivault) and the number of siphonozooids between two autozooids. As was said above, the autozooids are in fact 1.40 to 2.50 mm apart in *S. crassum* and the number of siphonozooids between two of them is one to three. These numbers apply to *S. implanum*. As to the spiculation there is no distinct difference between the two nominal species. The shape of the colonies does differ (compare Verseveldt, 1974, pl. 1 fig. 1, with pl. 9 fig. 4 in the present paper), but Tixier-Durivault's specimen is much smaller and probably younger. Consequently, the specific name *implanum* must be abandoned. The same applies to Tixier-Durivault's (1966: 133-135, figs. 127, 128, 132) *S. globosum*, because not any distinct difference can be found between this nominal species and *S. crassum*.

Geographical distribution. — Thursday I. (Torres Strait), Madagascar, New Caledonia.

Sarcophyton digitatum Moser, 1919

(fig. 13; pl. 9 figs. 2, 3)

Sarcophyton digitatum Moser, 1919: 249-252, fig. 10, pl. 5 fig. 8; Roxas, 1933: 380, pl. 1 fig. 8; Macfadyen, 1936: 41; Tixier-Durivault, 1966: 127-130, figs. 120-122; 1970a: 236.

Sarcophytum digitatum; Tixier-Durivault, 1946: 83-84; 1955: 125-126; 1958: 35-39, figs. 31, 33, 34.

Not *Sarcophyton digitatum*; Utinomi, 1956: 229, fig. 3n-x.

In the Berlin Museum I found one of Moser's syntypes, ZMB no. 6440. The label reads: "Philippinen; Moser det. 1915; Light, S.". From our pl. 9 figs. 2, 3 it appears that it is the same colony as that represented by Moser (1919: pl. 5 fig. 8).

Fig. 13 shows some spicules of this specimen. The surface layer of the disc contains some small warty or spiny rods, 0.06 to 0.10 mm long (fig. 13a-c), and clubs, up to 0.32 mm long (fig. 13e-i), but usually only 0.10 to 0.20 mm in length. The thin heads consist of some spines or simple warts. The handles are narrow; they are nearly smooth or they bear widely spaced, low cones. The longest clubs have a slightly stronger accumulation of prominences at one end, they are transitional forms to internal needles (fig. 13i). The clubs in the surface layer of the stalk are 0.11 to 0.35 mm long. They are wider than those in the capitulum. The heads consist of some high, simple warts; the handles have more prominences (fig. 13j-m).

The coenenchyme of the capitulum is very weak; it contains few sclerites. They are thin needles, weakly spined or almost smooth, and up to 0.45 mm

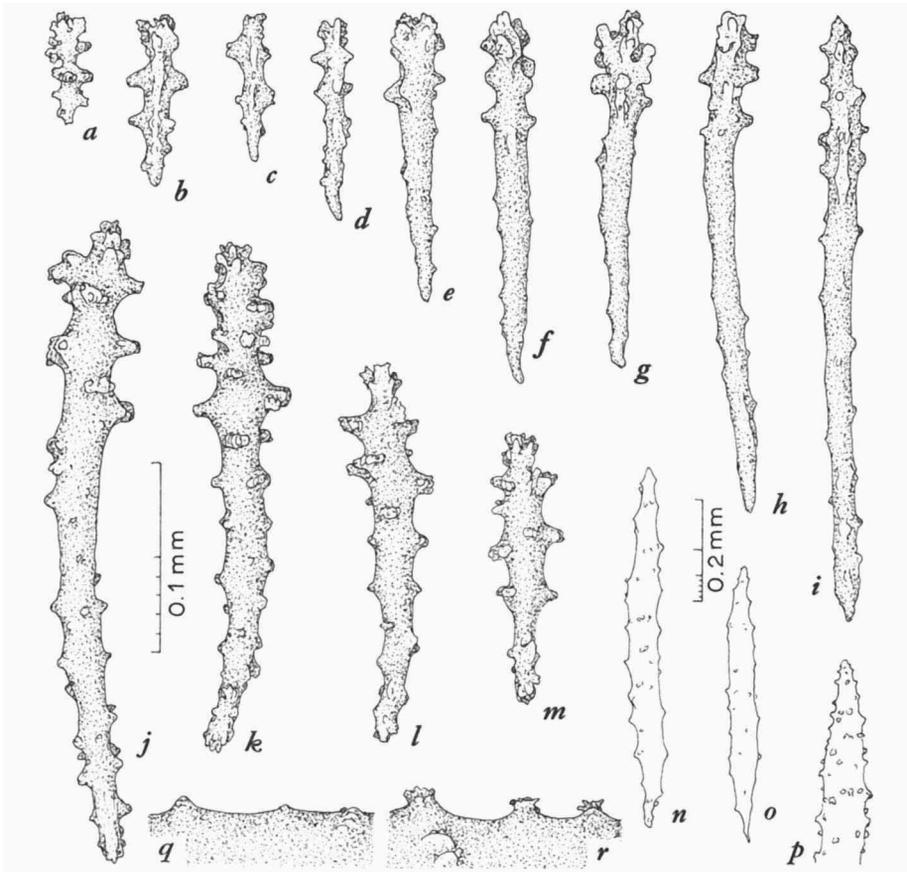


Fig. 13. *Sarcophyton digitatum* Moser, syntype, ZMB no. 6440. a-i, sclerites from surface layer of the disc; j-m, sclerites from surface layer of the stalk; n-p, spicules from coenenchyme of the stalk; q, r, details of coenenchymal sclerites from the stalk. Enlargement of a-m, q and r indicated by 0.1 mm scale at j; that of n-p by 0.2 mm scale at left of h.

long. In the interior of the stalk lie wider spindles, up to 0.80 mm long and 0.09 mm wide (fig. 13n-p). They are scarcely ornamented with low, sometimes truncated cones (fig. 13q), or with stumpy, small warts (fig. 13r).

Utinomi (1956: 229) identified two colonies from the Palau Islands with *S. digitatum*. In comparing his description and especially the drawings of the clubs (his fig. 3 o, s-u) with our description and our drawings, we see that his identification must be incorrect.

Moser (1919: 249) records that in the margin of the disc the autozooids are 1 to 2 mm apart and in the centre 3 to 5 mm, whereas there are 3 to 8 siphonozooids between two autozooids (he does not mention the place where

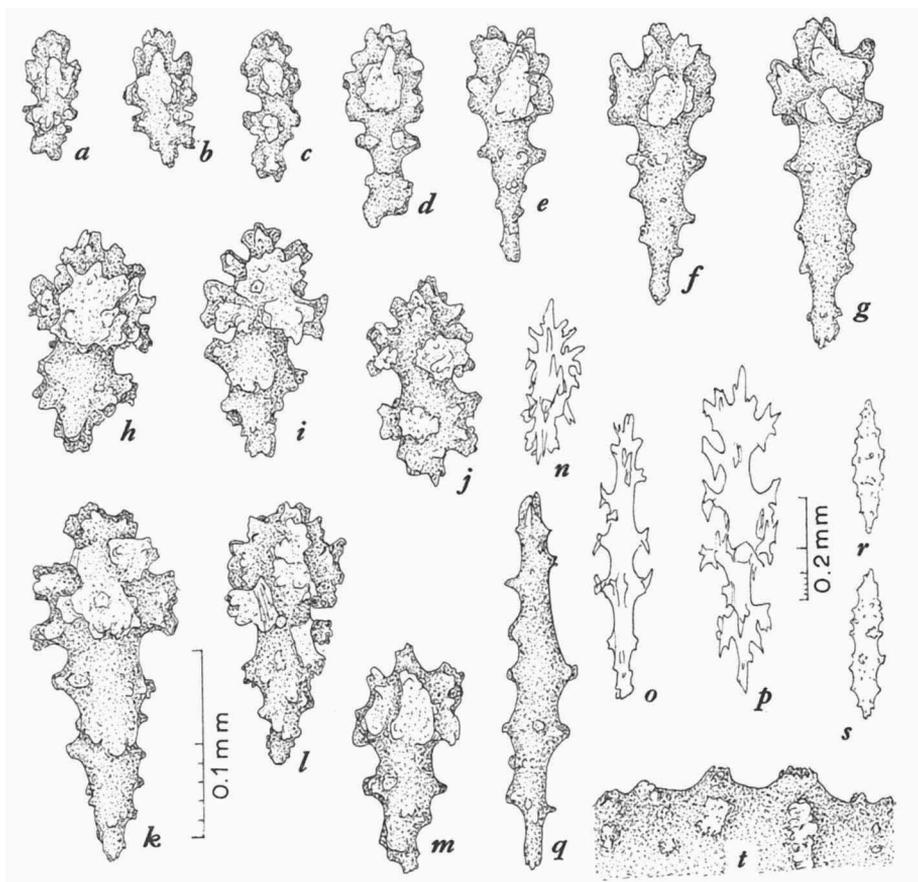


Fig. 14. *Sarcophyton ehrenbergi* Von Marenzeller, syntype, NHMW no. C2318. a-g, sclerites from surface layer of the disc; h-m, sclerites from surface layer of the stalk; n-q, sclerites from interior of the disc; r, s, sclerites from interior of the stalk; t, detail of coenenchymal sclerite from the stalk. Enlargement of a-q and t indicated by 0.1 mm scale at k; that of r, s by 0.2 mm scale at r.

this number is found, i.e. in the margin of the disc or in the central part). Macfadyen (1936: 41) indicates the same distance between the autozooids, i.e. 1 to 2 mm near the edge and up to 5 mm in the centre; she mentions 1 to 3 siphonozooids between two autozooids in the margin and 7 to 8 in the middle of the disc. In all her publications Tixier-Durivault has 4 to 5 siphonozooids between two autozooids in the middle of the capitulum and 7 to 8 in the margin, which, obviously, cannot be right.

Geographical distribution. — Philippines, Great Barrier Reef, Seychelles, Red Sea, Madagascar, New Caledonia.

Sarcophyton ehrenbergi Von Marenzeller, 1886

(figs. 14-17; pls. 10, 12 fig. 2, 13)

- Sarcophytum ehrenbergi* Von Marenzeller, 1886: 356-357, pl. 9 fig. 3; Hickson & Hiles, 1900: 504; Pratt, 1903: 508, pl. 28 figs. 1, 2; 1905: 252; Thomson & Simpson, 1909: 4; Thomson & Mackinnon, 1909: 176 (listed only); Kükenthal, 1910: 23-24; 1913: 10; Thomson & Dean, 1931: 55-56, pl. 9 fig. 1; Tixier-Durivault, 1946: 84-85; 1955: 124-125; 1958: 16-20, figs. 5, 11, 12.
- Sarcophytum ehrenbergi*; Moser, 1919: 240-242, fig. 4; Roxas, 1933: 374, pl. 1 fig. 3; Utinomi, 1959: 306; 1971: 91, pl. 15 fig. 4; 1977: 24, pl. 2 fig. 2; Verseveldt, 1965: 31; 1971: 25; 1974: 95 (listed only); 1976: 498 (listed only); 1977a: 3 (listed only); 1977b: 173 (listed only); Tixier-Durivault, 1966a: 112-114, figs. 102-104; 1966b: 707; 1970a: 232; 1970b: 132.
- Sarcophytum ehrenbergi* var. *acutangulum* Von Marenzeller, 1886: 357-359, pl. 9 fig. 4.
- Sarcophytum ehrenbergi* var. *sansibaricum* May, 1899: 114, pl. 5 fig. 7a-c.
- Sarcophytum ehrenbergi* var. *areolata* Burchardt, 1903: 677-679, pl. 55 fig. 7, pl. 57 figs. 10, 11.
- Not *Sarcophytum ehrenbergi* var. *stellatum* Kükenthal, 1911a: 310-312, figs. 1-5, pl. 19 fig. 1.
- Sarcophytum acutangulum*; Thomson & Dean, 1931: 54-55, pl. 16 fig. 6, pl. 27 fig. 4.
- Sarcophytum acutangulum*; Moser, 1919: 244-245, fig. 7; Roxas, 1933: 377-378; Verseveldt, 1960: 220-224; 1971: 24-25; 1974: 95 (listed only); 1977a: 3 (listed only); Tixier-Durivault, 1970a: 232-233; 1972: 19 (listed only).
- ? *Sarcophytum acutangulum*; Tixier-Durivault, 1946: 81; 1958: 21-24, figs. 14-16.
- ? *Sarcophytum acutangulum*; Utinomi, 1954: 51-52; 1956: 229; 1959: 306; 1977: 23.
- Not *Sarcophytum acutangulum*; Kükenthal, 1910: 25-29, figs. 2, 3, pl. 2 figs. 10, 11.
- Not *Sarcophytum acutangulum*; Utinomi, 1953: 153-155, fig. 3a-d, pl. 8 fig. 3; Tixier-Durivault, 1966a: 114-116, figs. 105-107.
- Not *Sarcophytum acutangulum* var. *occidentalis* Thorpe, 1928: 502-504, pl. 31 fig. 6, pl. 34 fig. 5.
- Sarcophytum reichenbachi* Schenk, 1896: 74-75, figs. 34-36 (not fig. 37).
- Sarcophytum molle* Tixier-Durivault, 1946: 168-169; 1958: 10-14, figs. 3, 7, 8.
- Sarcophytum molle*; Tixier-Durivault, 1966a: 110-112, figs. 99-101; 1970a: 231-232; 1970b: 133-134.

Von Marenzeller (1886: 356-357) recorded five colonies belonging to his new species, viz., two from the Red Sea, two from Port Denison (the harbour of Bowen, Queensland) and one from the Fiji Islands.

In the Viennese Museum I found a colony from Port Denison, identified with *S. ehrenbergi* by Von Marenzeller, so one of his syntypes, presumably his second described specimen from Port Denison. The register number is NHMW C2318; it is represented in our pl. 10.

The colony is flattened laterally; the capitulum is deep cup-shaped and compressed laterally. The centres of the autozooids are 0.60 to 1.00 mm apart. The anthocodiae often protrude; in their walls there are no sclerites. Between two autozooids there are no, one, or two siphonozooids.

The surface layer of the disc contains (1) irregularly shaped, more or less oval, warty sclerites, 0.07 to 0.08 mm long (fig. 14a-c), and (2) club-

shaped sclerites, 0.13 to 0.19 mm, seldom up to 0.23 mm long, with a wide, warty head and a handle with one or two distinct zones of blunt spines and, more basally, irregularly distributed, smaller prominences (fig. 14e-g). Fig. 14d shows a transitional form. The surface layer of the sterile stalk has wider, very warty sclerites, 0.10 to 0.20 mm long (fig. 14h-m). The smaller ones are often club-shaped (fig. 14h, i) or dumb-bell-shaped (fig. 14j), the longer ones are distinct clubs (fig. 14k-m).

The coenenchyme of the disc contains two types of spicules, with transitional forms. First there are spindles, 0.10 to 0.35 mm long, with irregularly placed, cone-shaped prominences (fig. 14q), and, secondly, numerous flat, translucent sclerites, 0.08 to 0.17 mm long, with strongly branched, antlerlike processes (fig. 14n-p). In the interior of the stalk there are spindles, 0.21 to 0.28 mm long (fig. 14r, s); they bear rounded or truncated, cone-shaped prominences; in the middle part of the spicules they are often arranged in a few girdles (fig. 14t). But sclerites like those depicted in fig. 14n-p are also met with.

Pl. 13 shows a colony from Madagascar, collected by Dr. A. G. Humes (no. 680; RMNH Coel. no. 6641). In my opinion the shape of this colony is typical of *S. ehrenbergi*. In the spiculation (fig. 15) there are some differences. In the coenenchyme of the capitulum the sclerites depicted in fig. 14n-p are absent (but in a specimen from the Moluccas (Humes no. 1968; RMNH Coel. no. 11945) I did find them). The spindles in the interior of the stalk are longer, 0.24 to 0.47 mm (fig. 15p-r).

Unfortunately the other original specimens described by Von Marenzeller were destroyed in the second world-war. From his description (1886), from Moser's (1919) and Tixier-Durivault's papers, and from my own observations I gather that the following characters are typical of *S. ehrenbergi*.

1. The centre of the capitulum is cup-shaped, see: General Remarks in this paper, p. 5.

2. The margin of the capitulum has folds; the edge is thin and projects slightly but distinctly beyond the stalk.

3. Near the edge of the disc the autozooids are densely placed, the centres are 0.50 to 1.00 mm apart; in the rest of the capitulum the distance is 0.90 to 1.20 mm, sometimes 1.50 mm.

4. At the periphery of the capitulum the number of siphonozooids between two autozooids is nil or one; towards the centre their number is one to three, sometimes four.

5. The clubs in the surface layer of the disc are 0.07 to 0.26 mm long. The heads are wide; they consist of big, blunt prominences and warts. The handles have spines, often zoned.

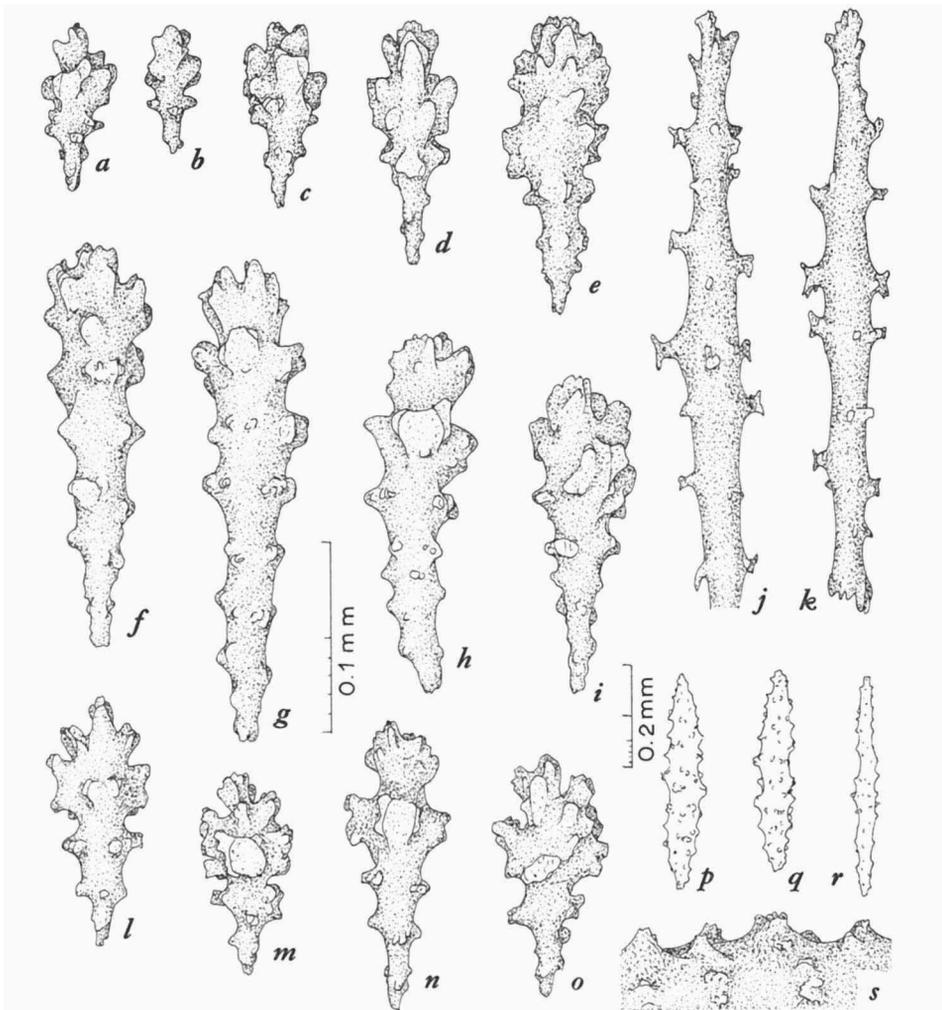


Fig. 15. *Sarcophyton ehrenbergi* Von Marenzeller, RMNH Coel. no. 6641. a-i, sclerites from surface layer of the capitulum; j, k, sclerites from interior of the capitulum; l-o, sclerites from surface layer of the stalk; p-r, spicules from coenenchyme of the stalk; s, detail of coenenchymal sclerite from the stalk. Enlargement of a-o and s indicated by 0.1 mm scale at g; that of p-r by 0.2 mm scale at i.

6. The coenenchyme of the disc contains slender spindles and rods or needles, covered with widely spaced, antlerlike prominences, which are not arranged in girdles. The spicules are usually not longer than 0.44 mm.

7. In the surface layer of the stalk there are clubs, the majority of which are 0.09 to 0.15 mm long. A striking feature is the wide head, composed of big warts.

8. The internal spicules in the stalk are spindles, thick or slender, up to 0.30 to 0.40 mm long, sometimes up to 0.45 mm. They are covered with volcano-shaped, sometimes wartlike prominences, which are zoned in the middle part of the spicule.

Again and again I have had difficulties in distinguishing *S. acutangulum* (*S. ehrenbergi* var. *acutangulum*) from *S. ehrenbergi*. Von Marenzeller's description of *acutangulum* is disappointing, and a re-examination of his type-specimens seemed necessary. I am glad to tell that I have had an opportunity to do this.

Von Marenzeller (1886: 357) records that in the Museum Godeffroy (the old name of the Zoologisches Museum, Hamburg) there are two colonies from Tonga, which he described under the name *S. ehrenbergi* var. *acutangulum*. Fortunately they are still present in that museum (register number for both colonies: C2428).

According to Von Marenzeller the most important difference with *S. ehrenbergi* lies in the shape of the folds. In his smaller specimen the folds are more numerous (fourteen primary ones) than in *S. ehrenbergi*; they are smaller, with usually two secondary folds at either side, giving the fold the shape of an oak-leaf. The folds extend up to the centre of the capitulum; owing to this the central part of the disc is invisible. The edge of the folds is strikingly sharp (hence the name *acutangulum*).

The second, bigger colony has much fewer folds (eight primary ones), which are slightly thicker, but the edge is also sharp.

As was said above, I investigated the two specimens. The bigger one is represented in pl. 12 fig. 2; in all probability it is the second specimen mentioned by Von Marenzeller (1886: 358). The diameters of the capitulum are about 110 × 90 mm; the height of the sterile stalk is different, at most 100 mm. The colony is fairly soft and fragile. The folds seem thick, but the edge is rather thin and extends only slightly beyond the stalk.

A large number of the autozooids is not completely retracted. On the curled margin and also in the deep cup the centres are 0.90 to 1.80 mm apart. The siphonozooids are almost invisible. A section parallel to the surface showed that there are one or two, in the centre of the capitulum sometimes three or four siphonozooids in a straight line between two autozooids.

The sclerites are depicted in fig. 16. They show a marked resemblance to those of *S. ehrenbergi* (see fig. 14). As a matter of fact Von Marenzeller already pointed out this affinity. In the bigger colony mentioned above I found the following:

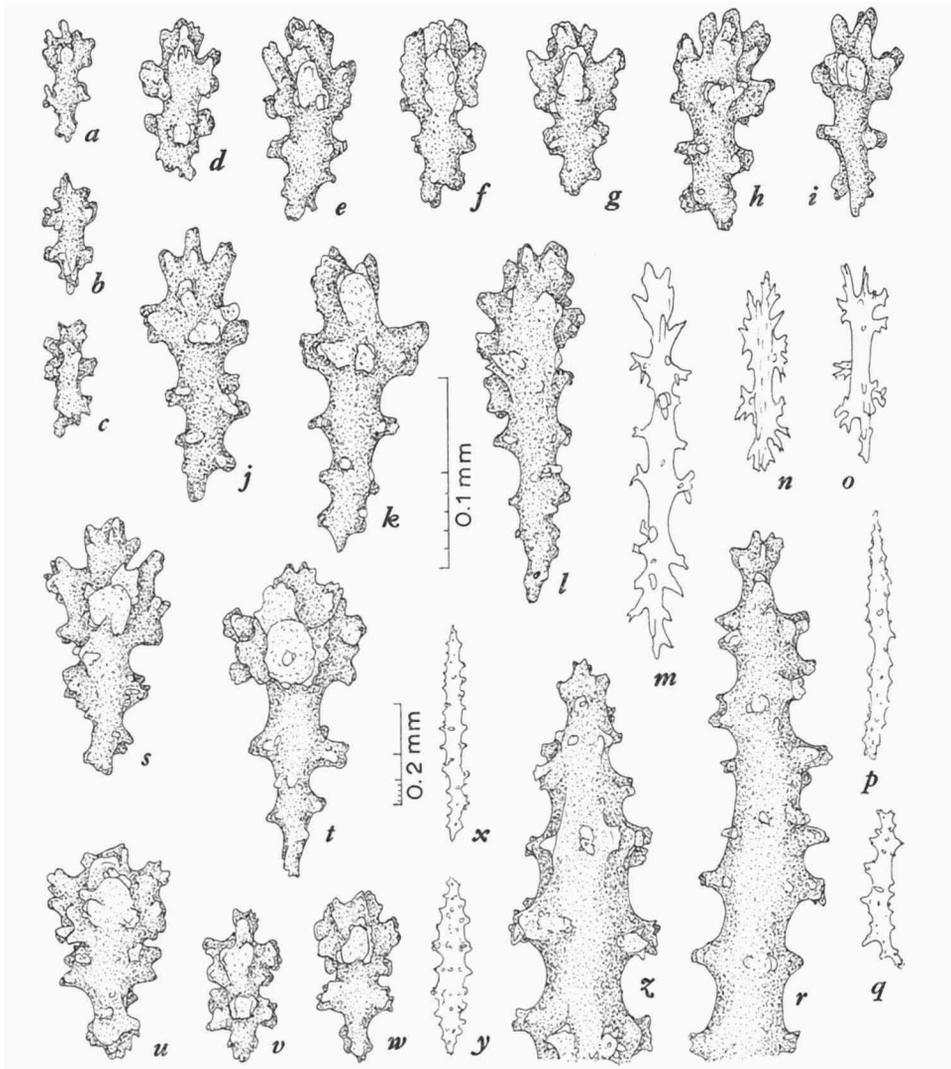


Fig. 16. *Sarcophyton ehrenbergi* Von Marenzeller, syntype of *S. ehrenbergi* "var. *acutangulum*" Von Marenzeller, ZMH no. C2428. a-l, sclerites from surface layer of the disc; m-r, sclerites from coenenchyme of the disc; s-w, sclerites from surface layer of the stalk; x-z, sclerites from coenenchyme of the stalk. Enlargement of a-o, r-w and z indicated by 0.1 mm scale at k; that of p, q, x and y by 0.2 mm scale at left of x.

In the surface layer of the disc there are (1) small, more or less clavate sclerites, 0.06 to 0.07 mm long (fig. 16a-c); (2) numerous clubs, 0.08 to 0.13 mm long, with wide, warty heads and thick handles with one zone of warts and a few other processes near the base (fig. 16d-i), and (3) some stouter clubs, up to 0.22 mm long (fig. 16j-l). The clubs in the surface layer of the stalk, 0.08 to 0.20 mm long, are wider (fig. 16s-w).

The interior of the disc contains (1) thin, transparent rods, 0.09 to 0.18 mm long, with strongly developed, antlerlike processes (fig. 16m-o), and (2) straight or curved spindles, up to 0.50 mm long, often with pointed processes (fig. 16p-r). The coenenchymal spicules in the stalk are slender spindles, up to 0.42 mm long (fig. 16x), and wider but shorter spindles, 0.25 to 0.35 mm long, with wartlike prominences, which are often zoned in the middle part of the spicule (fig. 16y, z).

From this description it follows that in the specimen just described the internal spicules in disc and stalk are slightly longer than those in *ehrenbergi* (as Von Marenzeller already put on record). But is this difference a sufficient ground for establishing a new variety or even a new species?

In Von Marenzeller's (1886) pl. 9 fig. 4 the sclerites with the dendritic prominences are not figured. This fits in with the fact, stated by Von Marenzeller himself, that in his smaller specimen these sclerites are absent, whereas they do occur in his bigger colony. The fact that these sclerites have not been figured by Von Marenzeller may have led many investigators, myself included, astray. They are excellently figured by Burchardt (1903: pl. 55 fig. 7b) and Moser (1919: fig. 4c). They occur both in *ehrenbergi* (see figs. 14 o, 15j, k) and in *acutangulum* (fig. 16m, r, 17m). Tixier-Durivault nowhere paid attention to these typical sclerites.

The smaller rods with fantastically developed, dendritic processes like those shown in fig. 14n, p, and in fig. 16n, o apparently occur in strongly varying numbers.

Finally, is the shape of the lobes a sufficient ground for separating *ehrenbergi* from *acutangulum*? In our photograph of *acutangulum* (pl. 12 fig. 2) the lobes have by no means the shape of oak-leaves.

In conclusion I feel confident that *acutangulum* cannot be considered a variety nor a species name.

An explanation of the list of synonyms, given in the beginning of this chapter on *S. ehrenbergi*, is needed. First of all I must point out that I have not been able to check the correctness of the identifications made by the authors mentioned. The list is, in fact, partly intended as list of references.

Two varieties of *ehrenbergi*, viz., var. *sansibaricum* May (1899) and var. *areolata* Burchardt (1903), have been synonymized with the forma typica of *S. ehrenbergi* by previous authors. I agree with this, adding here a note concerning Burchardt's description of his var. *areolata*. According to the text the clubs in the surface of disc and stalk (called "Pyramiden" by Burchardt) are 0.125 to 0.14 mm long, but the club pictured in his pl. 55 fig. 7, just above letter a, is 0.23 mm long (14/60 mm); the club above b, to the right

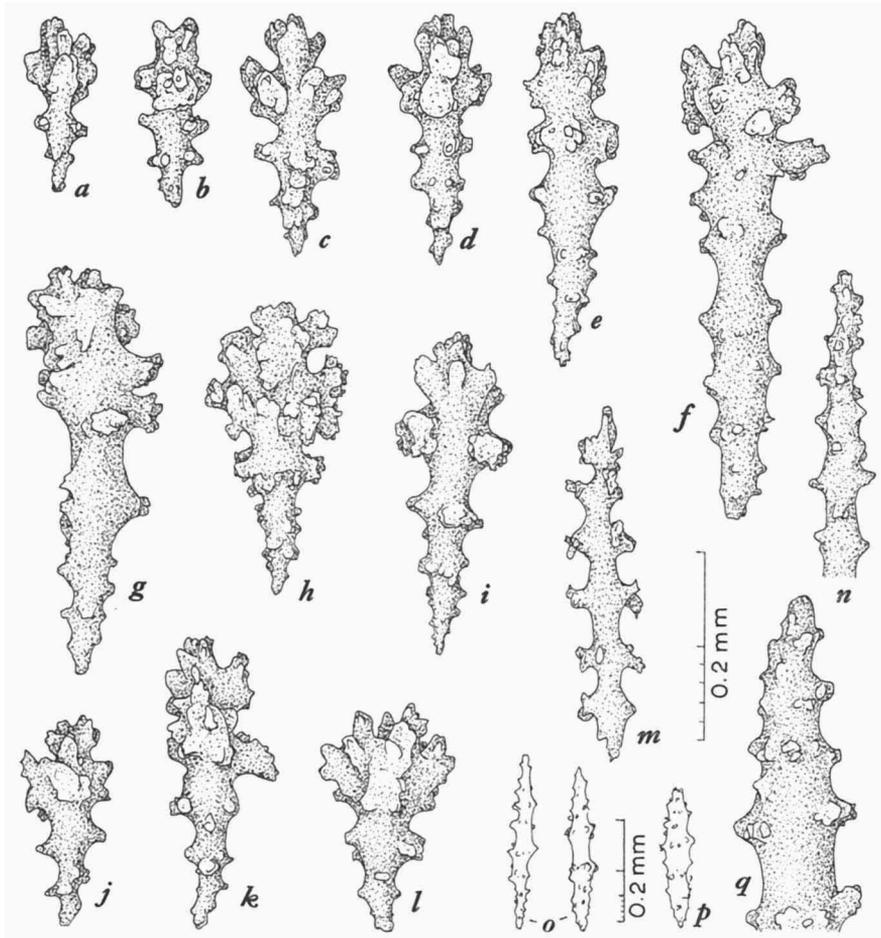


Fig. 17. *Sarcophyton ehrenbergi* Von Marenzeller, holotype of "*S. reichenbachii*" Schenk, SMF no. 1292. a-f, sclerites from surface layer of the capitulum; g-l, sclerites from surface layer of the stalk; m, n, sclerites from interior of the capitulum; o-q, spicules from interior of the stalk. Enlargement of a-n and q indicated by 0.1 mm scale at m; that of o, p by 0.2 mm scale at left of p.

measures 0.18 mm. The internal spicules of the stalk should be 0.324 mm long, but the curved spindle to the right of a is 0.38 mm.

I changed *S. ehrenbergi* var. *stellatum* Kükenthal (1911) into *S. stellatum* (Kükenthal): the sclerites differ too much from those of *ehrenbergi*.

I doubt the correctness of Utinomi's and Tixier-Durivault's identifications. At any rate Kükenthal's (1910) and Utinomi's (1953) identifications must be wrong: the spiculation is different.

Thorpe (1928: 502) considered a specimen from Long Island (Abrolhos

Is. = Houtman Rocks, Western Australia) to be a variety of *acutangulum*: var. *occidentalis*. Roxas (1933: 377) and Tixier-Durivault (1958: 21) synonymized it with *S. acutangulum*, but I think it must be identified with *S. roseum*.

I re-examined the holotype of *S. reichenbachi* Schenk (1896: 74), kept in the Natur-Museum Senckenberg, Frankfurt am Main (register no. SMF 1292). The shape of the colony (Schenk, 1896: pl. 2 fig. 11) recalls that of *ehrenbergi*; the spiculation is practically identical with that of *ehrenbergi* (fig. 17), taking into account that there is a certain variability as to the shape and the dimensions of the sclerites and their processes. In the coenenchyme of the capitulum there are slender spindles, up to 0.47 mm long, and covered with simple cone-shaped processes (fig. 17n) or with processes which are branched or bifurcated (fig. 17m), but they are not so distinctly antlerlike.

Unfortunately Schenk's (1896) pl. 4 fig. 37 is deceptive, for oval sclerites as those pictured in this figure are not found in the colony. Schenk himself (1896: 75) said that the sclerites in the distal part of the stalk are identical with those in the base; a re-examination of Schenk's holotype proved this to be right: in all parts of the stalk the same fusiform spicules as represented in our fig. 17 o-q are found. The fact that previous authors (Moser, 1919; Tixier-Durivault, 1958) identified *S. reichenbachi* with *S. trocheliophorum* must presumably be blamed on Schenk's wrong figure. I consider *S. reichenbachi* identical with *S. ehrenbergi*.

With some hesitation I include *S. molle* Tixier-Durivault, 1946, within *S. ehrenbergi*. A re-examination of Tixier-Durivault's (1958: fig. 3A) type specimen revealed that the spicules in the two forms are identical; in *S. molle* the coenenchymal spindles in the disc also bear the typical antlerlike prominences. A striking difference, however, is the shape of the colony: the disc is flat, not cup-shaped, in *S. molle*. Tixier-Durivault (1958: 13) mentions another colony, which was rather damaged. Its capitulum is extended ("étalé"); the margin is strongly folded. It is not stated whether the centre is hollow (I have not seen this specimen).

Former authors identified *S. roseum* Pratt (1903: 512), *S. contortum* Pratt (1905: 251) and *S. oligotrema* Pratt (1905: 250) with *acutangulum* or *ehrenbergi*. *S. contortum* and *S. oligotrema* both seem allied to *S. ehrenbergi* and to *S. infundibuliforme*. A re-examination of their types is desired, but their depository is unknown to me. I did examine the holotype of *S. roseum* (BMNH no. 1962.7.20.89). The sclerites differ so distinctly from those of *ehrenbergi*, that an identification with *acutangulum* (= *ehrenbergi*) cannot be maintained. It also differs from *S. infundibuliforme*; in my opinion it is a valid species.

In a previous paper the present author (1960: 220) discussed the validity of *S. convolutum* Thomson & Dean (1931: 63). He concluded that *S. convolutum* belongs to *S. acutangulum* and not to *S. elegans*, as Macfadyen (1936: 42), Tixier-Durivault (1958: 28) and Utinomi (1954: 52) supposed. Now I refer this nominal taxon to *S. roseum* Pratt, 1903.

Geographical distribution. — The species has been reported from the tropical areas of the Indo-Westpacific Oceans.

***Sarcophyton elegans* Moser, 1919**

(fig. 18; pl. 3 figs. 1, 2)

Sarcophyton elegans Moser, 1919: 252-253, fig. 11, pl. 5 fig. 9; Roxas, 1933: 380-381, pl. 1 fig. 9; Macfadyen, 1936: 42; Utinomi, 1954: 52-53, fig. 7; Verseveldt, 1960: 220-222; 1974: 95 (listed only); 1976: 498 (listed only); Tixier-Durivault, 1966a: 119-122, figs. 111-113; 1970a: 235; 1970b: 132-133; 1972: 20 (listed only).
Sarcophytum elegans; Tixier-Durivault, 1946: 86; 1958: 28-30, figs. 18, 22, 23.

It is a pity that the depository of Moser's type specimens of *S. elegans* is unknown, at least to me, for a re-examination of them is not superfluous. In my opinion every identification of colonies with this species cannot be absolutely safe at present. Nevertheless I give a description of a colony, of which I think that it agrees with Moser's description in most respects.

The colony was collected by Mrs. A. Tursch at Laing I., Papua-New Guinea, 15 November 1978; collection no. SAR 64bis, RMNH Coel. no. 13974 (pl. 3 fig. 2). The stalk is slightly bottle-shaped, curved, flat, 40 to 50 mm high and about 30 mm wide; it has fine longitudinal grooves. The disc is flat and inclined (through pressure?). The central part has a funnel-shaped depression. The margin extends distinctly beyond the stalk and is sculptured with a number of semi-circular lobes; the edge is thin.

The autozooids are retracted, but clearly visible; their diameter is 0.80 mm. In places they are arranged in rows. The centres of the autozooids of one row are 0.80 to 1.50 mm apart; the distance between the rows is 1.40 to 2.20 mm. The anthocodial armature consists of many rods, 0.12 to 0.19 mm long.

The siphonozooids are very indistinct; their presence and number can only be ascertained by making a section parallel to the surface. In doing so it appears that at the margin of the disc there is not more than one siphonozooid between two autozooids. Towards the centre their number slightly increases up to four.

The surface layer of the disc contains clubs, 0.09 to 0.30 mm long; the majority are 0.09 to 0.20 mm long (fig. 18a-h). The heads consist of a number

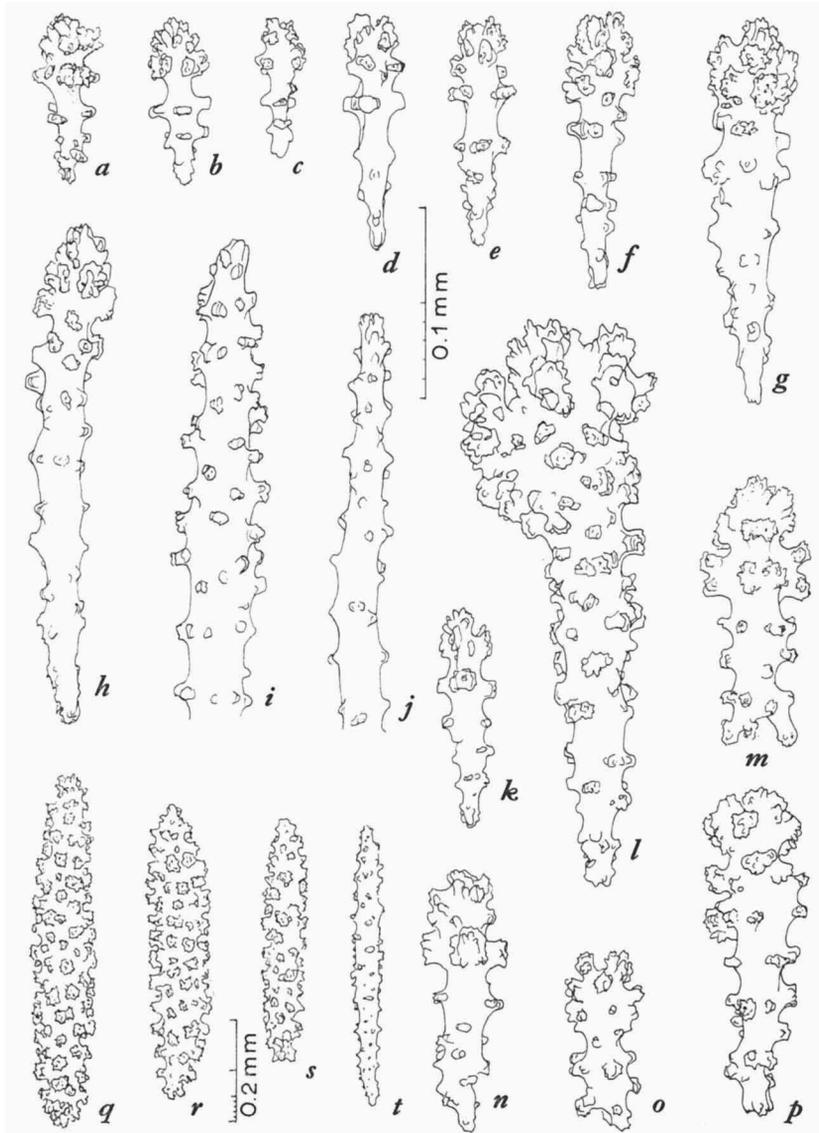


Fig. 18. *Sarcophyton elegans* Moser, Tursch SAR 64bis, RMNH Coel. no. 13974. a-h, sclerites from surface layer of the capitulum; i, j, parts of coenenchymal sclerites from the capitulum; k-p, sclerites from surface layer of the stalk; q-t, sclerites from coenenchyme of the stalk. Enlargement of a-p indicated by 0.1 mm scale at d; that of q-t by 0.2 mm scale at r.

of warts. The handles also bear simple warts, which, in the middle part of the club, are often arranged in girdles. The clubs in the surface layer of the stalk are bigger, the warts are stouter and rougher, but the length of the clubs is nearly the same (fig. 18k-p).

The interior of the disc has rods and spindles, up to 0.50 mm long, with numerous prominences, which may be high, stumpy spines, or lower and more conical (fig. 18i, j). The spicules in the stalk are blunt cylinders and spindles, in the base of the stalk up to 0.80 mm long. They are covered with many simple, spiny warts (fig. 18q-s). Besides, there are narrower spindles with fewer prominences; the length is up to 0.65 mm (fig. 18t).

The colour of the disc is light greyish-brown, the autozooids contrast as white spots. The distal part of the stalk is light brown, the basal part is darker brown.

Field-note: "Laing I., lagoon inlet N; colony consists of two colonies connected with each other by a bridge from capitulum to capitulum; height 100 mm, diameter about 80 mm; general colour tan; polyps very thin, about 6 to 8 mm long; tentacles white, thin; interior yellowish".

It is clear that pl. 3 fig. 2 shows one of the two colonies just mentioned.

The specimen described above agrees well with Moser's description and his fig. 11. Important is the agreement in spiculation, especially regarding the clavate sclerites with their warty heads. There are, however, also notable differences: in Moser's type the autozooids stand on elevations, and there are 5 to 12 siphonozooids between two autozooids. To my mind this standing on elevations has no taxonomical value. But what about the number of siphonozooids? A re-examination of Moser's colonies is desirable.

Another colony, also from Laing I. (Tursch's collection no. SAR 42; RMNH Coel. no. 12946), has a nearly flat disc with a thin, festooned margin, which extends far beyond the stalk. The stalk is bottle-shaped just like that of Moser's type (his pl. 5 fig. 9). It is 70 mm high; just under the middle it is widest, 23 mm. The colour is like the other specimen.

Field-note: "Laing I., S point, depth 6-8 m, on dead coral; stalk 50-70 mm high, diameter 40 mm, pale yellow, yellow line above incrustation; capitulum diameter about 200 mm, undulated, with lilac, round festoons; polyps numerous, short (2-3 mm), small dull-white stars; interior yellow; colony not slimy".

Our pl. 3 fig. 1 shows a colony of *S. elegans* from the Seychelles (RMNH Coel. no. 11117), which I previously identified with *S. acutangulum*.

Tixier-Durivault (1958: 30) records two to three siphonozooids between two autozooids near the edge of the capitulum and ten to twelve in the centre. In a later paper (1966a; 121) she indicates five to twelve and two to twelve.

In this last paper a (dried) colony is depicted (fig. 111), which I re-examined. It appeared that at the periphery there are one to three, in the central part up to four siphonozooids between two autozooids.

Geographical distribution. — Philippines, Great Barrier Reef, Madagascar, Seychelles, Japan, Vietnam, New Caledonia, Laing I. (N. coast of Papua-New Guinea).

***Sarcophyton flexuosum* Tixier-Durivault, 1966**

(fig. 19; pl. 14 fig. 3)

Sarcophyton flexuosum Tixier-Durivault, 1966a: 116-117, figs. 108-110.

The holotype of this species is pictured in Tixier-Durivault's (1966a) fig. 108; the enlargement is $\times 1.3$. Our pl. 14 fig. 3 shows the same colony at natural size.

The distance between two autozooids is about 1 mm. Between two autozooids there is usually one siphonozooid.

Tixier-Durivault (1966a: 117) recorded clubs in the surface layer of the capitulum (her fig. 110 G, O, S, U). In my preparations I looked for them in vain. I only found two types of spindles: those with volcano-shaped prominences (fig. 19a-c, e-g), and those with warts (fig. 19d, h, i). In both the prominences are usually zoned, especially in the middle part of the spicule. The smaller spindles, 0.09 to 0.15 mm long, have two zones of volcano-shaped processes (fig. 19a, b, e). The longer ones, up to 0.50 mm, have more girdles, but the processes may also be irregularly distributed and sometimes irregularly shaped (fig. 19j). The interior of the disc contains the same spindles (fig. 19j-o).

I did find clubs in the surface layer of the sterile stalk. They are 0.11 to 0.21 mm long (fig. 19p-s). They have two or more zones of big warts. The coenenchyme of the stalk has spindles up to 0.50 mm long, which are stouter than those in the disc, the warts are much bigger (fig. 19t).

Geographical distribution. — Madagascar.

***Sarcophyton glaucum* (Quoy & Gaimard, 1833)**

(figs. 20, 21; pl. 11, pl. 14 figs. 1, 2)

Alcyon(i)um glaucum Quoy & Gaimard, 1833: 270-271, pl. 22 figs. 11, 12; Dana, 1846: 623, pl. 58 figs. 4, 5, pl. 59 fig. 6; Milne Edwards & Haime, 1857: 121-122.

Sarcophytum glaucum; Verrill, 1864: 39 (listed only); Von Marenzeller, 1886: 352-354, pl. 9 fig. 1; Studer, 1878: 634; Wright & Studer, 1889: 248-249, pl. 42 fig. 2; Whitelegge, 1897: 214; May, 1898: 26-27; 1899: 112-114; Hickson & Hiles, 1900: 505; Burchardt, 1903: 32-33, pl. 55 fig. 3, pl. 57 fig. 7; Pratt, 1903: 509-510, pl. 28 figs. 3, 4;

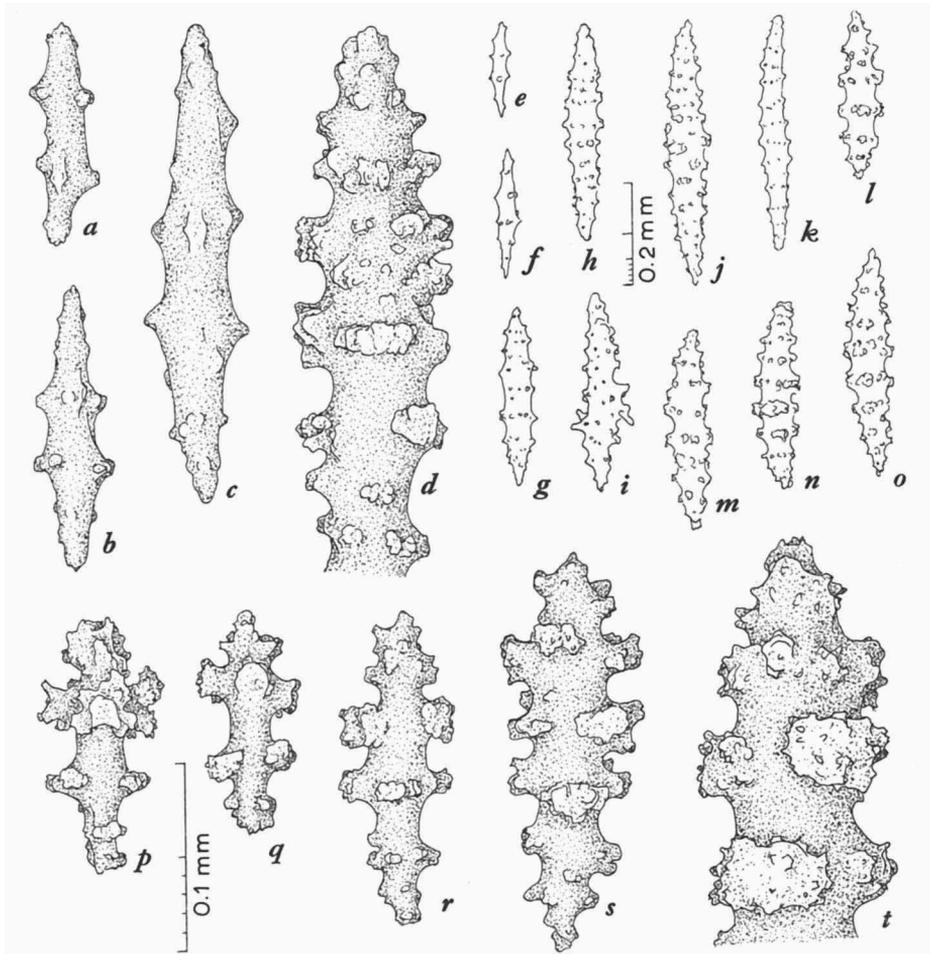


Fig. 19. *Sarcophyton flexuosum* Tixier-Durivault, holotype, MNHN. a-i, sclerites from surface layer of the disc; j-o, spicules from interior of the disc; p-s, sclerites from surface layer of the stalk; t, part of coenenchymal sclerite from the stalk. Enlargement of a-d and p-t indicated by 0.1 mm scale at p; that of e-o by 0.2 mm scale at h.

Thomson & McQueen, 1907: 52-53, pl. 5 fig. 5; Cohn, 1908: 215-216; Kükenthal, 1910: 13-14; Dean, 1929: 709; Thomson & Dean, 1931: 57-60, pl. 8 fig. 6, pl. 16 fig. 7; Tixier-Durivault, 1946: 165-167; 1955: 126-127; 1958: 61-66, figs. 67, 68.
 Not *Sarcophytum glaucum*; Tixier-Durivault, 1958: 63-65, figs. 58, 63, 66, Quoy & Gaimard's "cotype".
Sarcophyton glaucum; Gray, 1869: 125 (listed only); Moser, 1919: 253-256, fig. 12; Roxas, 1933: 381-382, pl. 1 fig. 10; Macfadyen, 1936: 42; Utinomi, 1956: 229; 1959: 307, fig. 2; 1971: 92; 1977: 22-23; Verseveldt, 1965: 31-32, fig. 1; 1971: 23-24; 1974: 95 (listed only); 1976: 498 (listed only); 1977a: 3 (listed only); 1977b: 173; 1978: 49 (listed only); Tixier-Durivault, 1966a: 142-146, figs. 138-140; 1970a: 239-240; 1970b: 133; 1972: 20 (listed only).

- Sarcophytum glaucum* var. *pauperculum* Von Marenzeller, 1886: 354-356, pl. 9 fig. 2; Burchardt, 1903: 675-676, pl. 55 fig. 4, pl. 57 fig. 8; Cohn, 1908: 217.
- Sarcophytum ambiguum* Wright & Studer, 1889: 247-248, pl. 41 fig. 12.
- Sarcophytum philippinensis* Wright & Studer, 1889: 246-247, pl. 38 fig. 1, pl. 41 fig. 9.
- Sarcophytum tongatabuensis* Wright & Studer, 1889: 245, pl. 41 fig. 10.
- Sarcophytum nigrum* May, 1899: 117-118, pl. 5 figs. 8a, b.
- Sarcophytum glaucum* var. *amboinensis* Burchardt, 1903: 676-677, pl. 55 figs. 5, 6, pl. 57 fig. 9.
- Sarcophytum gracile* Burchardt, 1903: 673-674, pl. 55 fig. 2, pl. 57 figs. 5, 5a.
- Sarcophytum boettgeri*; Pratt, 1903: 511.
- Sarcophytum tenuis* Pratt, 1903: 512-513, pl. 28 fig. 6, pl. 29 fig. 9.
- Sarcophytum bicolor* Pratt, 1905: 249-250, pl. 2 figs. 1, 2.
- Sarcophytum glaucum* var. *tamatavense* Cohn, 1908: 220-221.
- Sarcophytum mycetoides* Gravier, 1908: 182-184, pl. 5 figs. 1-20, pl. 6 figs. 22-38, pl. 10 figs. 87-90.
- ? *Sarcophytum plicatum*; Thomson & Simpson, 1909: 3.
- Sarcophytum reticulatum* Boone, 1938: 64-66, pls. 15-17.

I presume that in many libraries Quoy & Gaimard's publication (1833) is not available. I therefore quote their description of *S. (Alcyonum) glaucum*; our pl. 11 shows the original drawings. The description runs as follows:

"Alcyonum, carnosum, pediculatum, plano-lobatum, virescens, luteo et fusco punctatum; polypis fuscis longitrorsum striatis, quincunci ordinatis; tentaculis virescentibus, obtusiusculis.

Espèce formant de larges plaques charnues, à gros pédicules courts, et dont les bords arrondis, ondulés, sont quelquefois lobulés. Ces expansions, épaisses de cinq à six lignes, sont d'un beau glauque, avec des teintes jaunes et des points grisâtres assez régulièrement alignés en forme de quinconces; ce sont les oscules par où sortent les animaux, qui, nombreux et rapprochés, modifient, lorsqu'ils sont sortis, la couleur que nous venons d'indiquer, parce qu'ils ont leur tentacules verdâtres, et leur tige brune avec des stries en long. Ces Polypes n'ont guère plus d'une ligne dans leur plus grand développement. Les huit rayons de leur étoiles sont grêles, obtus et lisses.

Quelques-uns de ces Alcyons présentent quelque variété dans leur teinte, qui est plus ou moins grisâtre ou verdâtre.

On les trouve sur les plages, que la mer laisse à découvert, de l'îlot de Panhi-Modou, à Tonga. Ils rendent les places qu'ils recouvrent très-glissantes. Il semble qu'on marche sur des coussins charnus enduits d'une matière albumineuse."

Many investigators already pointed out the great variability found in this species, especially with respect to shape and size of the colony, and shape and dimensions of the coenenchymal sclerites in the stalk. This variability

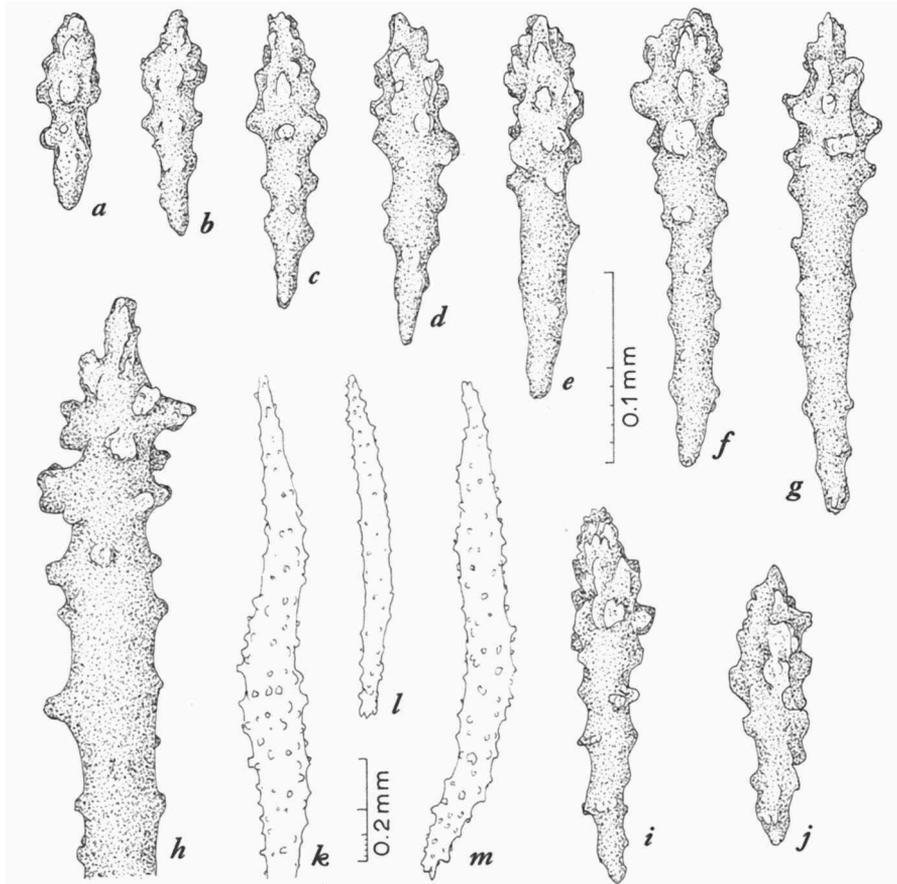


Fig. 20. *Sarcophyton glaucum* (Quoy & Gaimard), Tursch SAR XI 2, RMNH Coel. no. 13975. a-j, sclerites from surface layer of the capitulum; k-m, sclerites from interior of the capitulum. Enlargement of a-j indicated by 0.1 mm scale at e; that of k-m by 0.2 mm scale at k.

explains why so many authors established new species and varieties, which after all must be referred to a single species: *S. glaucum*.

The diameter of the capitulum varies from small to 1 m and more.

It struck me that in so many preserved colonies the autozooids are not retracted, see pl. 14 figs, 1, 2. Curiously enough, the colony figured by Quoy & Gaimard (pl. 11 fig. 11 in the present paper) also shows the autozooids protruding above the surface of the disc. According to information from Mrs. Anita Tursch (Brussels, Belgium) the anthocodiae in living colonies may reach a length of 40 mm. Near the edge of the disc the distance between the centres of the autozooids is about 1.0 to 1.7 mm, in the central part up

to 3.5 or 5.0 mm (in bigger colonies). A character of *S. glaucum* (along with other species) is the number of siphonozooids between two autozooids: at the periphery there are one to three or four, in the centre normally three to eight.

I shall now give a description of the sclerites in a medium-sized colony from Laing Island (Papua-New Guinea), collected by Mrs. A. Tursch in 1978 (Tursch SAR XI 2, RMNH Coel. no. 13975).

In the surface layer of the disc the clubs are 0.10 to 0.50 mm long (fig. 20a-j). The ill-defined heads bear small warts and rounded spines or cones. The handles have few, low, rounded prominences. The clubs in the surface layer of the stalk, 0.09 to 0.28 mm long, are coarser and on their heads they bear higher, wartlike prominences (fig. 21a-h).

The interior of the disc contains spindles, up to 0.75 mm long, rarely up to 1.20 mm; they are covered with blunt spines (fig. 20k-m). In the stalk the sclerites are up to 2.30 mm long (fig. 21i-n); they strongly vary in shape and in size, and a lot of them have side-branches.

In the past I examined several specimens, which I identified with *S. glaucum*. As to the spiculation the variability is very great indeed. In many colonies I found clubs like those depicted in fig. 20a-g. Sometimes the handles are nearly smooth. The clubs in the sterile stalk may be longer, up to 0.40 mm. The spindles and rods in the interior of the disc vary in maximum length from 0.50 to 1.20 mm; in many cases they are almost smooth. The big sclerites in the coenenchyme of the stalk may reach a length of 2.60 mm, but usually they are much shorter, up to 0.70 mm or 1.30 mm or 1.80 mm. The tubercles are also variable: they are small and distant as with the sclerites represented in fig. 21i-n, or they are big and more or less compound (see Moser, 1919: fig. 12c). As to the shape of the sclerites there is also much variability, even within a single colony. The sclerites in fig. 21i, j are found in the middle of the stalk, the sclerites in fig. 21k-m in the basal part. Also in other colonies I found differences between the internal sclerites in the distal and those in the basal part of the stalk. In studying specimens of *S. glaucum* one should take these differences into account.

Tixier-Durivault (1958: 63) records that in the collection of the Paris Museum there are two "cotypes" of Quoy & Gaimard, which were not described by these authors in 1833.

I examined the specimen figured in her fig. 58 (see our pl. 12 fig. 1). I found that the spiculation differs distinctly from that of *S. glaucum*, but fully agrees with that of *S. trocheliophorum*, q.v. I doubt whether it is certain that Quoy & Gaimard themselves identified these colonies with their *S. glaucum*. The internal sclerites in the stalk differ strongly from those figured by Quoy & Gaimard in their pl. 22 figs. 11'.

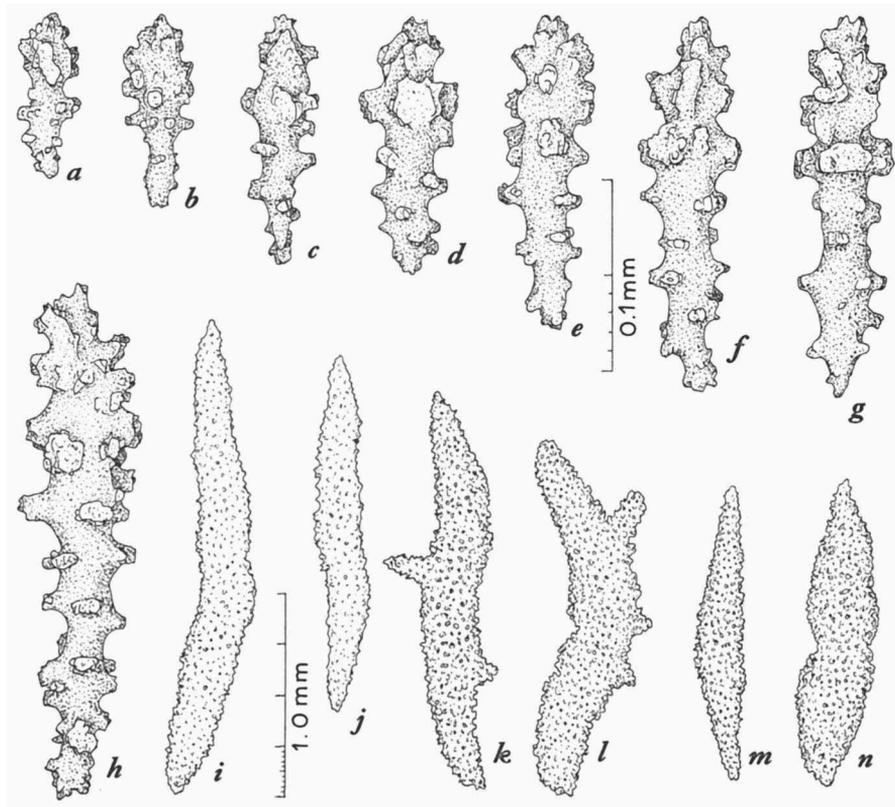


Fig. 21. *Sarcophyton glaucum* (Quoy & Gaimard), Tursch SAR XI 2, RMNH Coel. no. 13975. a-h, sclerites from surface layer of the stalk; i, j, sclerites from interior of the middle part of the stalk; k-n, sclerites from interior of the base of the stalk. Enlargement of a-h indicated by 0.1 mm scale at e; that of i-n by 1.0 mm scale at i.

Several authors (Kükenthal, 1910: 15; Moser, 1919: 253; Roxas, 1933: 371; Tixier-Durivault, 1958: 61) referred *S. boettgeri*, *S. fungiforme* and *S. plicatum* to *S. glaucum*. *S. boettgeri* and *S. plicatum* are synonyms (see p. 18); the spiculation of *S. boettgeri* differs distinctly from that of *S. glaucum* (compare fig. 2 with figs. 20, 21). *S. fungiforme* should be brought to *S. trocheliophorum*.

In the collection of the Museum für Naturkunde, Zoological Museum, Berlin, I found May's holotype of *S. nigrum* (ZMB 2362). After examination of the colony it appeared that Moser (1919: 253) is right in synonymizing it with *S. glaucum*.

In the collection of the British Museum (Natural History) I found a syntype of Pratt's *S. bicolor* (BMNH 1962.7.20.152). Tixier-Durivault

(1958: 72) referred this nominal taxon to *S. crassocaule*, but a re-examination of the colony revealed that it belongs in the synonymy of *S. glaucum*.

In the collection of the British Museum (Natural History) there is also the holotype of *S. tenuis* Pratt, 1903 (BMNH 1962.7.20.90). It must be the specimen "with the lower portion of the stalk missing" (Pratt, 1903: 512). At present this "colony" consists of an almost black, flattened disc. An investigation of the sclerites revealed that the colony must be referred to *S. glaucum*, and not to *S. ehrenbergi* as Moser (1919: 211) and Tixier-Durivault (1958: 17) supposed. Besides, Pratt's drawing of the disc (pl. 29 fig. 9) bears more resemblance to that of *S. glaucum* than to that of *S. ehrenbergi*.

In the collection of the Vienna Museum a very small specimen of *S. glaucum* var. *pauperculum* Von Marenzeller is kept (NHMW C2324). In the Zoologisches Museum Hamburg, there is a small specimen of the same variety (ZMH C2439). Both colonies are from the Fiji Islands, and they are mentioned by Von Marenzeller (1886: 354-356). Having studied both colonies I consider them conspecific with *S. glaucum*.

Geographical distribution. — The species is very common in the warm Indian Ocean (the Red Sea included) and the West Pacific Ocean.

***Sarcophyton infundibuliforme* Tixier-Durivault, 1958**

(figs. 22, 23; pl. 15 figs. 1, 2)

Sarcophytum infundibuliforme Tixier-Durivault, 1958: 34-35, figs. 27, 29, 30.

According to personal information, Mrs. M.-J. d'Hondt (Paris) found two specimens of *S. infundibuliforme* in the Muséum National d'Histoire Naturelle, viz., the specimen figured in our pl. 15 fig. 1 (this specimen had been designated as type, most likely by Tixier-Durivault), and a small specimen from New Caledonia. Tixier-Durivault (1958: fig. 27; 1966: fig. 117) depicted a third colony, which cannot be traced in the Paris Museum, however. Consequently its re-examination is impossible.

While investigating the type specimen (pl. 15 fig. 1), I found that its spiculation is distinctly unlike that of the specimen described by Tixier-Durivault (1958). The distribution of the autozooids and the number of siphonozooids between them is also different. So we have to do with two different species. Since the specimen represented in our pl. 15 fig. 1 is present in the Paris Museum, and inasmuch as it has been designated as type I shall consider it the holotype of *S. infundibuliforme*. Its description follows.

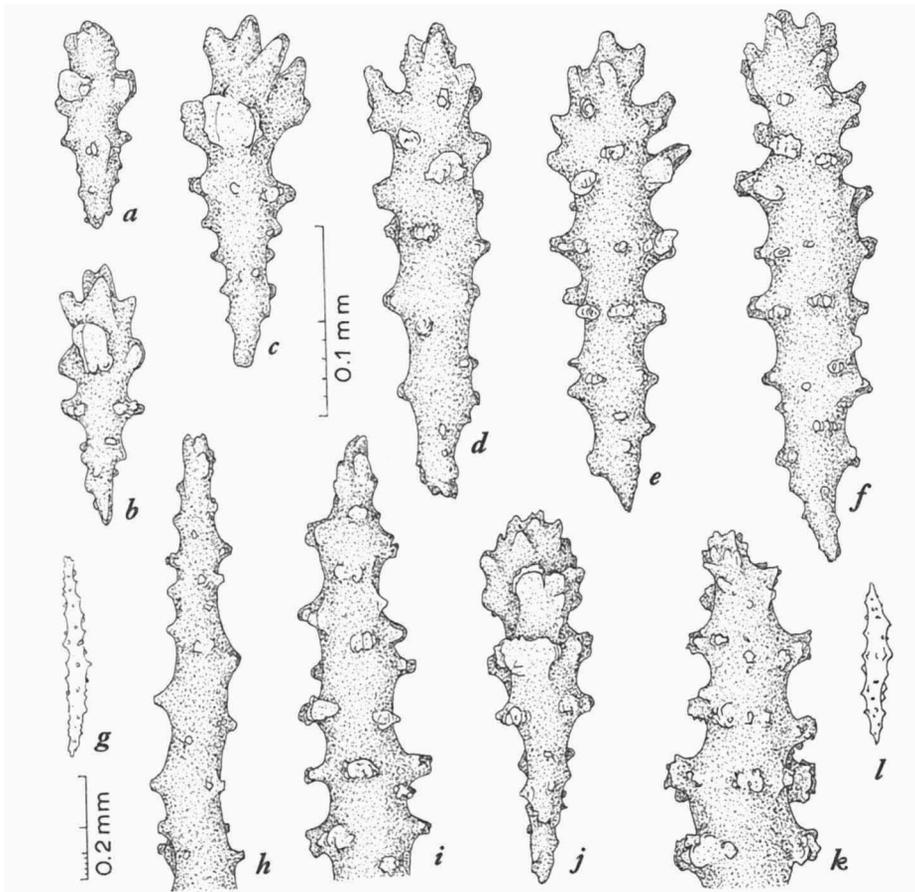


Fig. 22. *Sarcophyton infundibuliforme* Tixier-Durivault, type specimen, MNHN. a-f, sclerites from surface layer of the disc; g-i, sclerites from coenenchyme of the disc; j, sclerite from surface layer of the stalk; k, l, sclerites from interior of the stalk. Enlargement of a-f and h-k indicated by 0.1 mm scale at c; that of g, l by 0.2 mm scale at g.

Near the edge of the disc the distance between the centres of the autozooids is 1.5 to 2.0 mm; the number of siphonozooids between them is one, sometimes two. In the depth of the concave disc the numbers and distances are scarcely greater.

The surface layer of the disc includes clubs, 0.10 to 0.32 mm long (fig. 22a-f). In many cases their heads consists of rounded spines directed upwards; in other clubs the head has some, usually zoned warts. The surface layer of the stalk contains the same clubs, 0.10 to 0.20 mm long (fig. 22j).

In the coenenchyme of the capitulum there are spindles, up to 0.40 mm long; the narrow, elongated ones have conical spines (fig. 22g, h), the

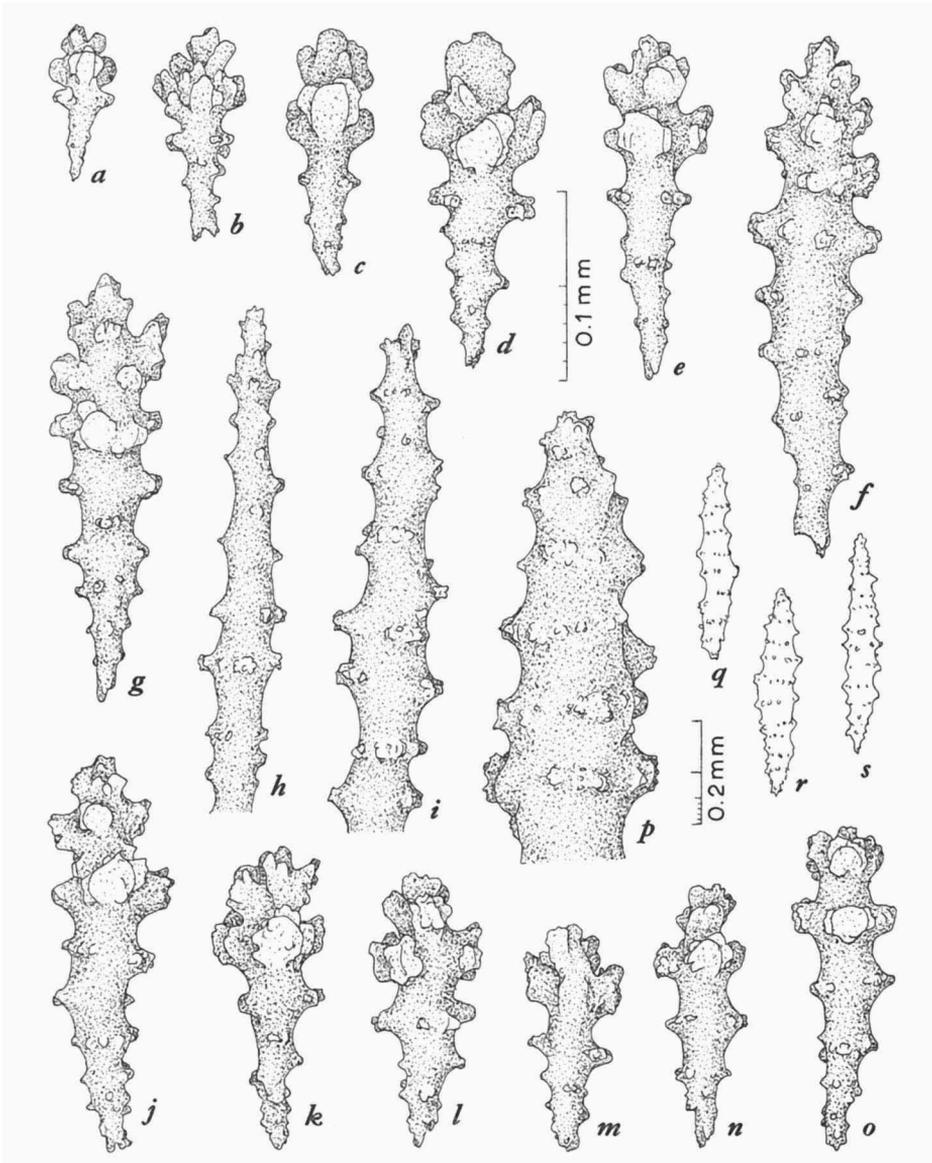


Fig. 23. *Sarcophyton infundibuliforme* Tixier-Durivault, RMNH Coel. no. 6649. a-g, sclerites from surface layer of the capitulum; h, i, parts of coenenchymal sclerites from the disc; j-o, sclerites from surface layer of the stalk; p-s, spicules from interior of the stalk. Enlargement of a-p indicated by 0.1 mm scale at d; that of q-s by 0.2 mm scale below q.

wider spicules have simple warts, often placed in girdles (fig. 22i). The spicules in the stalk are wider and more warty; their length is up to 0.35 mm (fig. 22k, l).

As was said above, the colony examined by Tixier-Durivault differs distinctly from the one just described. It is doubtful whether the specimen from New Caledonia (Tixier-Durivault, 1970a: 235) must be referred to *S. infundibuliforme*.

S. contortum Pratt, 1905, should probably be referred to *S. infundibuliforme*, and not to *S. acutangulum* (= *S. ehrenbergi*) as Kükenthal (1910: 63) supposed. To be sure of this, a re-examination of Pratt's type specimen is necessary, but this specimen was not found in BMNH.

The present author (1971: 25) identified several colonies from Madagascar with *S. acutangulum*, but at least one of them must be referred to *S. infundibuliforme*; it is one of the colonies with collection number A. G. Humes no. 1179, RMNH Coel. no. 6639 (see fig. 23 and pl. 15 fig. 2).

Geographical distribution. — Aldabra I. and Nosy Bé (Madagascar), Ceylon.

***Sarcophyton latum* (Dana, 1846)**

(fig. 24; pl. 16)

Alcyonium latum Dana, 1846: 623-624, pl. 58 figs. 6a, b, b', 7; 1859: 125; Milne Edwards & Haime, 1857: 121.

Not *Sarcophytum latum*; Whitelegge, 1897: 215, pl. 10 fig. 1a-f; Pratt, 1903: 510-511; Kükenthal, 1910: 21-23, fig. 1, pl. 2 fig. 9.

? *Sarcophytum latum*; Thomson & Mackinnon, 1910: 176 (listed only).

Sarcophyton latum; Moser, 1919: 236-238, figs. 1, 2, pl. 5 fig. 1, pl. 6 fig. 15; Roxas, 1933: 372-373, pl. 1 fig. 1; Tixier-Durivault, 1966a: 160-164, figs. 156-158; 1970a: 243-244.

Sarcophytum latum; Tixier-Durivault, 1946: 167-168; 1955: 127-128; 1958: 83-86, figs. 86, 88, 90.

Not *Sarcophyton latum*; Verseveldt, 1960: 225-227, fig. 2, pl. 7 figs. 2, 3; 1977b: 174 (listed only).

Dana's type specimen is lost. His diagnosis (1846: 623) runs as follows: "Rather rigid, very stout stipitate and very broad explanate, margin sinuously undulate, scarcely revolute; polyps about a line distant, and surrounded by a series of points". These "points" are the siphonozooids.

Dana continues: "This explanate species covers areas several feet square, and has a broadly plaited margin. It is more rigid in texture than the *glaucum*, and grows to a much larger size. Fig. 7, plate 58, represents a specimen from Tongatabu, probably of this species". [Tongatabu lies SE of the Fiji Islands].

Dana's colony (his pl. 58 fig. 7) seems to consist of two parts, connected at their base. Our pl. 16 shows the right-hand part and a portion of the left-hand part; in addition I give a reproduction of Dana's fig. 6a, with the caption "polyps..... surrounded by a series of points". His figs. 6b and 6b', drawings of polyps (autozooids) are omitted.

Dana apparently investigated more than one colony, and his fig. 7 does not show his holotype, for, according to him, that colony "probably" belongs to the species. This fact complicates matters, but I think three characteristics are marked: 1, the colony is rather rigid; 2, the capitulum is hollow, funnel-shaped; the thin, undulated margin scarcely projects beyond the stalk (conclusion drawn from Dana's fig. 7); 3, there is one girdle of about ten siphonozooids all around each autozooid, so there is one siphonozooid between two autozooids (see our pl. 16 fig. 6a).

It stands to reason that the first mentioned feature is insignificant for identification. So two characteristics remain. In my opinion feature 3 is a dubious one. In the chapter "General Remarks" (p. 6) I pointed out that near the edge of the capitulum the number of siphonozooids between two autozooids is always nil to one, and that in the central part of the capitulum their number may increase. I therefore wonder whether Dana's drawing fig. 6a only applies to the margin of the disc or also to the central part, deep in the funnel. In the former case the characteristic is without value. The feature that remains is the shape of the colony, which strongly resembles that of *S. ehrenbergi*. *S. latum* and *S. ehrenbergi* might be conspecific, which could be indicated by the sclerites, but Dana did not say anything about the spiculation, and, therefore, the determination of new samples remains uncertain as long as Dana's type(s) are not found.

As was said above, the colony figured by Dana apparently is funnel-shaped, but it is questionable whether a young colony also has this shape. Kükenthal (1910: 22) reported on a young colony, 30 mm high. Its stalk is inverted cone-shaped. The capitulum is about quadrangular with rounded corners, the margin is weakly wavy, the edge is sharp, the centre slightly concave. The number of siphonozooids, ten to eleven round an autozooid, fits in with Dana's observation ("10-11 um jedes Siphonozooid" [Kükenthal, 1910: 22] is a slip of the pen). But the colony depicted in Kükenthal's pl. 2 fig. 9 is not a bit like Dana's colony, and the sclerites differ from those figured by Moser and Tixier-Durivault (see below).

Moser (1919: 237) had also small colonies, the biggest one with a disc-diameter of 50 mm. The specimens have rather flat, in the centre slightly concave capitula. Regarding the sclerites there are notable differences with Kükenthal's data. According to this author the clubs in the disc surface have

heads consisting of spines directed upwards (Kükenthal's fig. 1a); the average length of the clubs is 0.18 mm. The clubs in Moser's specimen(s) (his fig. 1a) have warts; the length is about 0.13 mm. The coenenchymal spicules in the stalk are, according to Kükenthal, up to 0.30 or 0.40 mm long; they bear pointed spines (Kükenthal's fig. 1c). In Moser's specimens these spicules are up to 1 mm long, and they are covered with big warts (Moser's fig. 1d).

Roxas (1933: 372-373) reported on colonies of *S. latum* from the Philippines. His data are, remarkable enough, quite identical with those of Moser. But his figures of the sclerites (his pl. 1 fig. 1) are original, not borrowed from Moser.

Although every identification with *S. latum* will be uncertain unless type-specimens of this nominal taxon are re-found, I suggest to consider Moser's (1919) and Tixier-Durivault's (1946, 1955, 1958, 1966a, 1970a) descriptions the most correct ones, and to take the specimens described by these authors as belonging to Dana's species. Both investigators record that the disc scarcely projects beyond the stalk; the edge is sharp, the margin is not or slightly undulated. In the centre the disc is a little hollow (Moser) or flat (Tixier-Durivault).

Tixier-Durivault (1958: 83) had ten colonies of *S. latum*. Her fig. 88 shows a colony from Anjouan Island (Comores), seen from above; the enlargement is $\times 0.55$. I examined this specimen. It is flat, almost without stalk (probably post mortem?). Near the edge the distance between the centres of the autozooids is 0.8 to 1.0 mm; towards the centre it is 1 to 2 mm. The number of siphonozooids is one or two, in the central part two or three. (Tixier-Durivault, 1958: 84, "1 à 10 rangées de siphonozoïdes entre 2 autozoïdes" cannot possibly be correct, of course.)

The surface layer of the disc contains clubs, usually 0.12 to 0.22 mm long, but shorter ones (0.08 mm) and longer ones (up to 0.28 mm) also occur (fig. 24a-g). The heads have many small warts and rounded tubercles (quite different from Kükenthal's club in his fig. 1a, but not unlike that in Moser's fig. 1a). The handles also have small warts and blunt cones, which are often zoned. The clubs in the surface layer of the stalk may bear a few more warts, but for the rest they are like those in the disc (fig. 24h-n).

In the interior of the disc there are slender, spiny rods and a little wider, more warty spindles, 0.25 to 0.55 mm long (fig. 24 o, p); wider, pointed spindles like those figured in fig. 24r, s are also found. The coenenchyme of the stalk contains thick, usually pointed spindles, up to 0.75 mm long and 0.22 mm wide (fig. 24q-s). They are heavily warted, and resemble those represented by Moser (1919: fig. 1d).

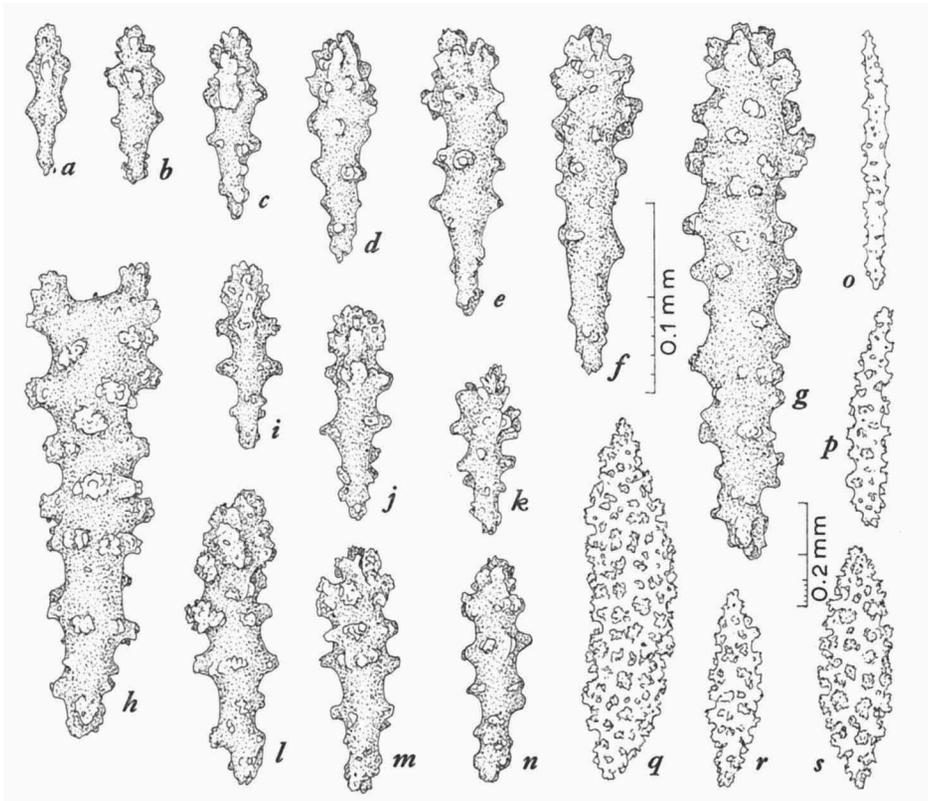


Fig. 24. *Sarcophyton latum* (Dana), MNHN. a-g, sclerites from surface layer of the disc; h-n, sclerites from surface layer of the stalk; o, p, spicules from coenenchyme of the disc; q-s, spicules from coenenchyme of the stalk. Enlargement of a-n indicated by 0.1 mm scale at f; that of o-s by 0.2 mm scale at p.

From Dana's pl. 58 fig. 7 (our pl. 16 fig. 7) it appears that the edge of the disc is sharp, and that the margin hardly projects beyond the stalk. Moser (l.c.) and Tixier-Durivault (l.c.) record the same. Previously I (1960: 225) reported on a colony from Pulau Weh (Sumatra). The photograph of this colony (pl. 3 fig. 3) shows that the disc has a thick edge, which projects beyond the stalk. A few years ago (see Verseveldt, 1977b: 174) I examined a few colonies from Ellison Reef and Feather Reef (Great Barrier Reef) with a much convoluted, thick margin of the capitulum (pl. 4). I identified them all with *S. latum*, as the sclerites agree with those in Moser's and Tixier-Durivault's specimen (cf. fig. 5 and fig. 24). But now I deny the correctness of my identifications, because the colonies with their thick, convoluted margins show quite a different mode of growth (see p. 19, *S. buitendijki* sp. nov., for additional data).

Geographical distribution. — Fiji Is., ? Salomon Is., Palawan (Philippines), Australia, Comores, Nosy Bé (Madagascar), Red Sea, and New Caledonia.

Sarcophyton portentosum Tixier-Durivault, 1970

(fig. 25; pl. 1 fig. 2)

Sarcophyton portentosum Tixier-Durivault, 1970a: 230-231, figs. 67-69.

In Tixier-Durivault's fig. 67 and in our pl. 1 fig. 2 the holotype is represented from different sides. In the former figure the enlargement is slightly more than $\times 1$. Our pl. 1 fig. 2 distinctly shows the weakly undulated disc and one of the buds arising from the stalk. The apertures left by the retracted autozooids are also clearly visible. They are 1.30 to 2.00 mm apart, in the centre of the disc up to 2.50 mm. There are usually two to three siphonozooids between two autozooids; at certain places, however, their number is up to six.

The surface layer of the disc contains clubs, 0.08 to 0.12 mm long (fig. 25a-f). Their heads consist of some leaflike prominences pointing towards the summit of the head. Below a median constriction the handle has one girdle of blunt spines (these clubs show a marked resemblance to those of *S. trocheliophorum*). Along with these clubs there are clubs up to 0.35 mm long, with a knobby head and a pointed or blunt handle (fig. 25g, h). In the surface layer of the stalk the same small clubs are met with (fig. 25m-o); the longest ones measure 0.17 mm.

In the coenenchyme of the disc thin needles occur, up to 0.35 mm long (fig. 25i-l). They bear cone-shaped or wartlike prominences, sometimes they are antlerlike. The interior of the stalk contains short rods and spindles, up to 0.23 mm long, with small, high warts, sometimes arranged in zones (fig. 25p, q).

I remark here that the stalk of the (dried) colony is so strongly flattened that it is impossible to examine surface layer and coenenchyme separately. I could only make a mounted microscope slide containing both superficial and internal sclerites.

I again call attention to the close resemblance of the clubs in *S. portentosum* to those of *S. trocheliophorum*. The former species differs from the latter in the following respects: 1, the colony has buds on the sterile stalk; 2, the autozooids are further apart and the number of siphonozooids is greater; 3, the sclerites in the coenenchyme of the stalk are quite different. A close relationship between the two species can be assumed.

Geographical distribution. — New Caledonia.

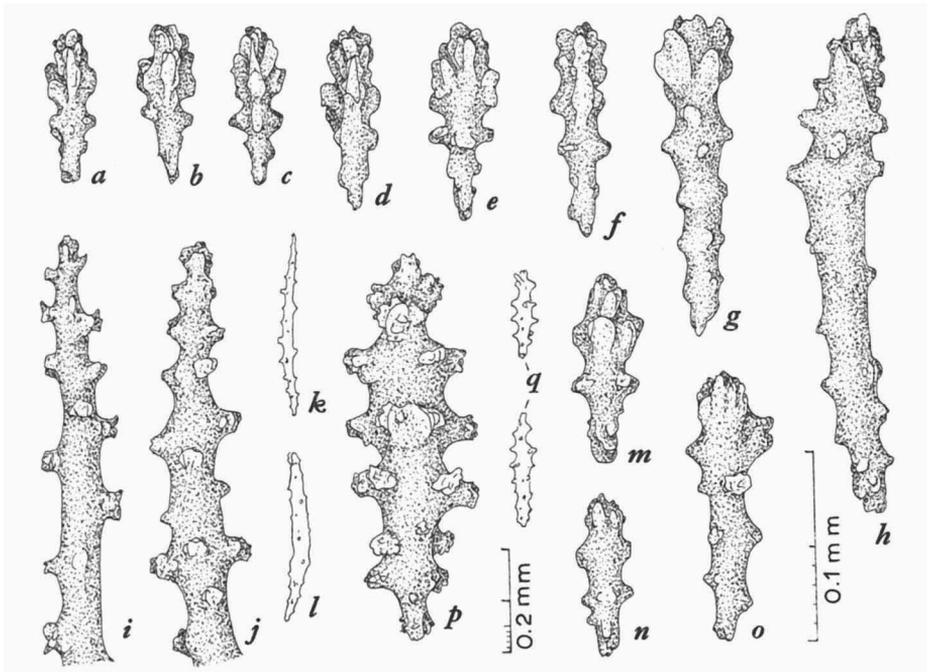


Fig. 25. *Sarcophyton portentosum* Tixier-Durivault, holotype, MNHN. a-h, sclerites from surface layer of the capitulum; i-l, sclerites from interior of the disc; m-o, sclerites from surface layer of the stalk; p, q, sclerites from interior of the stalk. Enlargement of a-j and m-p indicated by 0.1 mm scale at o; that of k, l and q by 0.2 mm scale at right of p.

Sarcophyton pulchellum (Tixier-Durivault, 1957)

(fig. 26; pl. 18)

Lobophytum pulchellum Tixier-Durivault, 1957: 106; 1958: 152-154, figs. 177, 181, 182.

In the Zoologisk Museum at København Tixier-Durivault's holotype of "*Lobophytum pulchellum*" is kept; the specimen was collected at Onrust, Java Sea, by Dr. Th. Mortensen in April 1929. It is attached to a piece of stony coral (pl. 18).

The height is nearly 50 mm. The stalk, a good 30 mm high, is narrowest in the middle (25 mm), and widens slightly upwards and downwards. The capitulum is lop-sided, it completely covers the stalk on one side; it measures about 50 mm in diameter. The central part is bumpy. The margin consists of a ring of folds, which look like more or less egg-shaped hillocks (see pl. 18 fig. 2).

The bulk of the autozooids protrude above the surface of the disc. Their centres are 0.80 to 1.20 mm apart. In many cases the anthocodiae are cylin-

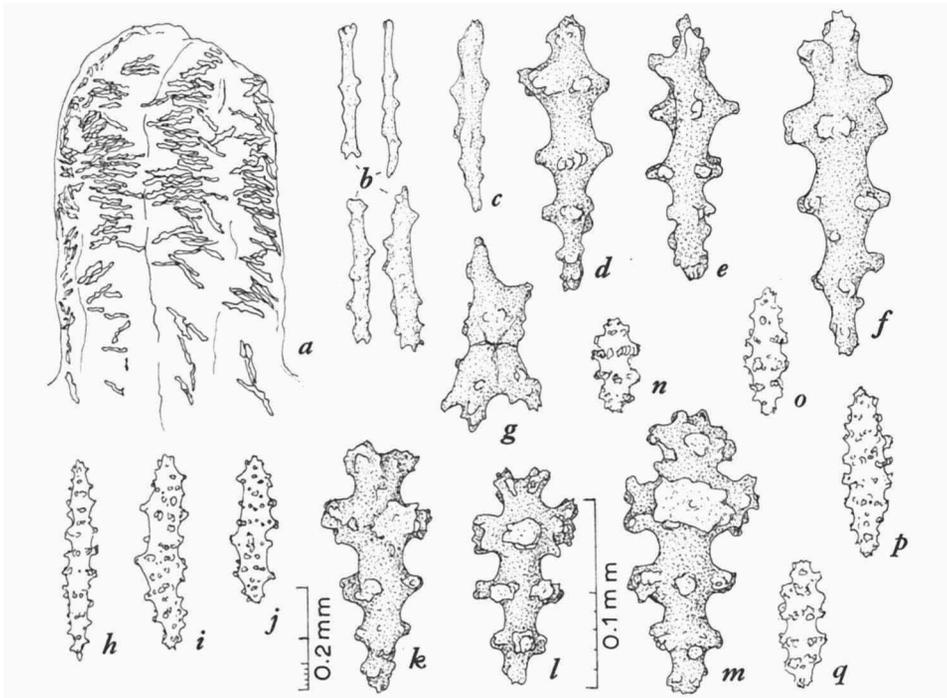


Fig. 26. *Sarcophyton pulchellum* (Tixier-Durivault), holotype, ZMK. a, autozoid; b, anthocodial sclerites; c-g, sclerites from surface layer of the disc; h-j, sclerites from interior of the disc; k-m, clubs from surface layer of the stalk; n-q, sclerites from interior of the stalk. Enlargement of a, h-j and n-q indicated by 0.2 mm scale at j; that of b-g and k-m by 0.1 mm scale at l.

drical, approximately 0.40 to 0.70 mm long and 0.30 to 0.50 mm wide. Sometimes a more proximal and more cone-shaped part of the anthocodia also protrudes. The anthocodial armature consists of eight longitudinal rows of transversely placed or sloping sclerites, 0.08 to 0.10 mm long (fig. 26a, b). In many places the siphonozooids are scarcely visible. Between two autozoids there is often hardly any room for a siphonozooid; in other places there are one to three siphonozooids between two autozoids.

The surface layer of the disc contains slender clubs, 0.10 to 0.18 mm long, but longer clubs, up to 0.25 mm, also occur (fig. 26c-f). They bear girdles of simple, rounded warts. Irregularly shaped sclerites and crosses also occur (fig. 26g). In the coenenchyme of the disc there are narrow or wide, sometimes slightly irregularly curved spindles, up to 0.40 mm long (fig. 26h-j). The small warts are arranged in whorls or distributed irregularly.

The clubs in the surface layer of the stalk are rather like those in the disc, but they are wider, the warts are often bigger, the length varies from 0.11 to

0.16 mm (fig. 26k-m). The interior of the stalk has short, barrel-shaped sclerites, 0.18 to 0.22 mm long, with two to four girdles of small warts (fig. 26n), and fusiform spicules, up to 0.33 mm long, and covered with warts, which are arranged in four or more girdles (fig. 26 o-q).

Tixier-Durivault assigned the species to the genus *Lobophytum*. However, a side-view of the disc (pl. 18 fig. 2) shows that the "lobes" on the margin of the disc are nothing else but the upper side of folds, and that is why I refer the species to the genus *Sarcophyton*.

Geographical distribution. — Java Sea.

***Sarcophyton regulare* Tixier-Durivault, 1946**

(fig. 27; pl. 19 fig. 1)

Sarcophytum regulare Tixier-Durivault, 1946: 170-171; 1958: 30-34, figs. 24-26, 28.

Sarcophytum regulare; Tixier-Durivault, 1966a: 122-124, figs. 114-116; 1970a: 235; 1972: 20 (listed only).

Tixier-Durivault (1946, 1958, 1966a) recorded four colonies belonging to this species. She gave a drawing of one of them (1958: fig. 25, enlargement $\times 0.5$; 1966a: fig. 114, enlargement over $\times 0.5$). Pl. 19 fig. 1 shows the same colony, which I designate as the lectotype.

The colony is low; the over-all height is about 40 mm, the stalk is 15 mm high.

On the folds the distance between two autozooids is 2 to 3 mm, in the flat central part about 5 mm. At the periphery there are two to three siphonozooids between two autozooids, in the centre seven to eight.

The surface layer of the disc contains somewhat indefinite clubs, varying in length from 0.08 to 0.25 or 0.30 mm (fig. 27a-g). The broader end bears more numerous prominences, which are cones or truncated spines, often flattened laterally. The longer, slightly clavate sclerites have almost smooth handles (fig. 27g); they are transitional forms to coenenchymal spicules. The latter are needles and delicate spindles, up to 0.55 mm long; they are nearly smooth, often with an accumulation of prominences at one end or at both ends, or with one bifurcated end (fig. 27h, i).

The surface layer of the sterile stalk has clubs, 0.07 to 0.22 mm long, with higher spines, cones, or simple warts, which are often arranged in zones (fig. 27j-p). The coenenchyme of the stalk contains straight or slightly curved needles and spindles, strongly varying in width (fig. 27q-u). The wider ones, up to 0.70 mm long and 0.12 mm wide, bear truncated spines (fig. 27q) or few, low cones (fig. 27r). The thinner ones resemble those in the interior of the capitulum (fig. 27s, t).

Geographical distribution. — Seychelles, New Caledonia, Madagascar.

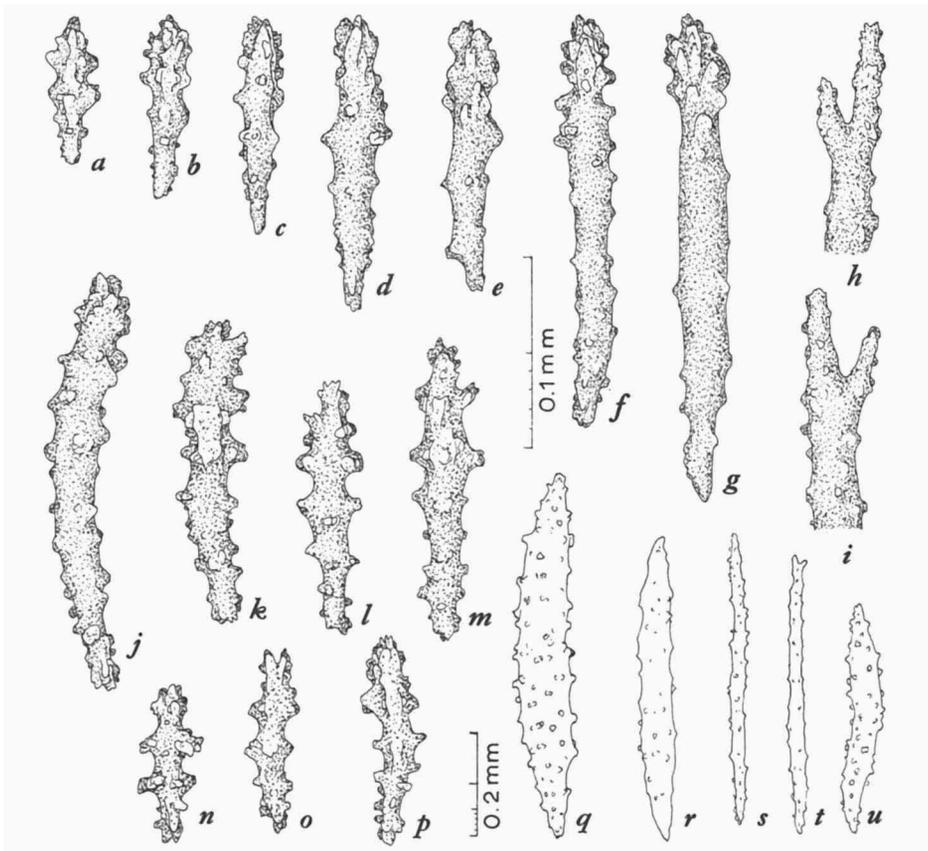


Fig. 27. *Sarcophyton regulare* Tixier-Durivault, lectotype, MNHN. a-g, sclerites from surface layer of the disc; h, i, parts of coenenchymal sclerites from the disc; j-p, sclerites from surface layer of the stalk; q-u, spicules from interior of the stalk. Enlargement of a-p indicated by 0.1 mm scale at e; that of q-u by 0.2 mm scale at right of p.

Sarcophyton roseum Pratt, 1903

(fig. 28; pl. 17 figs. 2, 3)

Sarcophytum roseum Pratt, 1903: 512, pl. 29 figs. 10, 11; Kükenthal, 1910: 32.

Sarcophytum acutangulum; Kükenthal, 1910: 25-29, figs. 2, 3, pl. 2 figs. 10, 11.

Not *Sarcophytum ehrenbergi* var. *acutangulum* Von Marenzeller, 1886: 357-359, pl. 9 fig. 4.

Sarcophytum acutangulum; Tixier-Durivault, 1966a: 114-116, figs. 105-107.

? *Sarcophytum acutangulum* var. *occidentalis* Thorpe, 1928: 502-504, pl. 31 fig. 6, pl. 34 fig. 5.

Sarcophytum convolutum Thomson & Dean, 1931: 63-64, pl. 11 fig. 7, pl. 23 fig. 1.

The holotype (BMNH no. 1962.7.20.89) is a fragment of a deep cup-shaped or funnel-shaped colony. It measures 55 mm in height, so the enlarge-

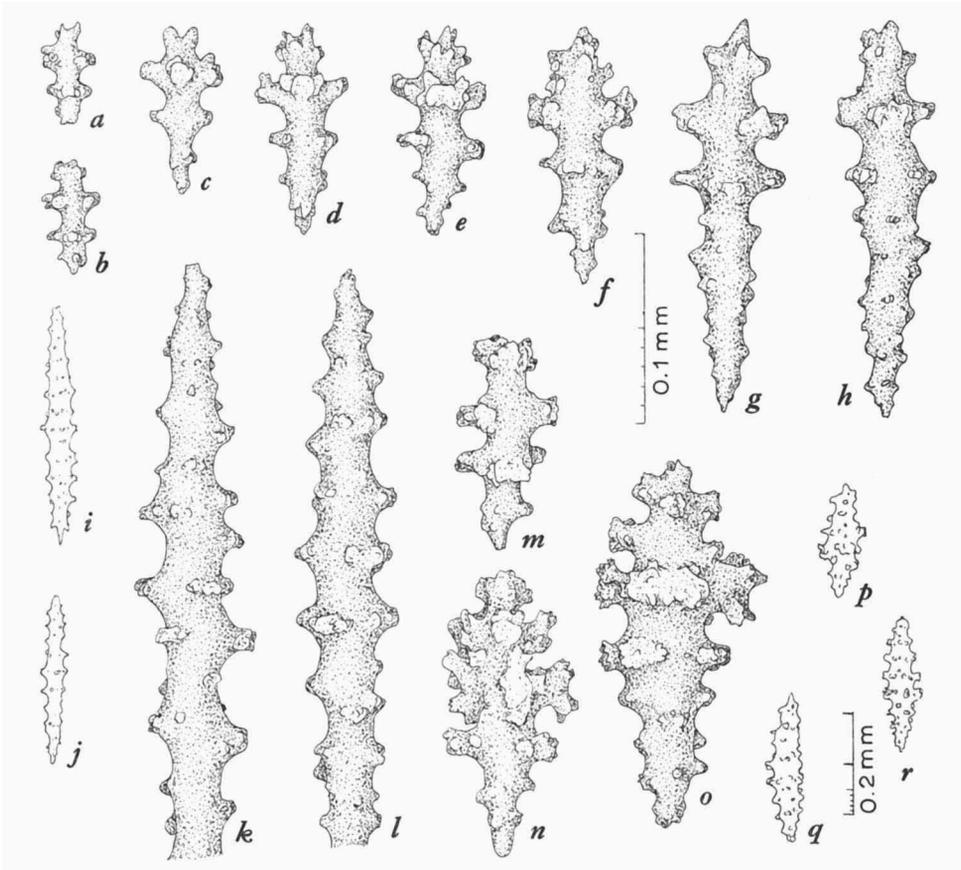


Fig. 28. *Sarcophyton roseum* Pratt, holotype, BMNH no. 1962.7.20.89. a-h, sclerites from surface layer of the disc; i-l, sclerites from interior of the disc; m-o, sclerites from surface layer of the outside of the basal part; p-r, sclerites from the interior (?) of the basal part of the specimen. Enlargement of a-h and k-o indicated by 0.1 mm scale at f; that of i, j and p-r by 0.2 mm scale at q.

ment of the specimen in Pratt's fig. 11 is $\times 1.5$. Our pl. 17 fig. 2 shows the specimen at natural size.

A striking feature is that the pits left by the retracted autozooids are very distinctly visible, and that they are far apart. Pratt (1903: 512) said: "On that portion of the capitulum which is farthest from the margin the autozooids are 7 to 10 mm apart; near the margin they are much more numerous and often less than .5 mm apart." It is not unusual to find that near the margin the autozooids are closely set, but the widely spaced autozooids in the centre of the capitulum are remarkable indeed. Our photograph (pl. 17 fig. 2) shows distances of 5 to 8 mm. It stands to reason that, consequently,

the number of siphonozooids increases towards the centre. Pratt (1903) records no numbers. From our photograph it appears that near the edge there are one or two siphonozooids between two autozooids, but in the central part I see up to twelve and even more.

In the surface layer of the capitulum there are clubs measuring 0.06 to 0.22 mm in length. The smaller ones, 0.06 to 0.08 mm long, are more rod-shaped, with two zones of blunt spines or small warts (fig. 28a, b). The larger ones are distinctly club-shaped (fig. 28c-h). The heads are composed of a central wart and, below this, a girdle of warts. The pointed handles have rounded spines and small warts, arranged in girdles except in the basal part. In the surface layer of the outside of the fragment there are clubs, 0.11 to 0.20 mm long, with much coarser, bigger, often zoned warts (fig. 28m-o).

The coenenchyme of the capitulum contains slender spindles, 0.30 to 0.46 mm long, with high, rounded spines or simple warts, usually placed in girdles (fig. 28i-l). It is a pity that the basal part of the colony is missing; hence it is impossible to be sure of the shape and other details of the internal sclerites in that part. A mounted slide of the sclerites in the surface layer of the basal part of the fragment contains, along with the clubs mentioned above, spindles usually 0.20 to 0.35 mm long and averagely 0.08 mm wide; they bear zoned warts (fig. 28p-r).

The cup- or funnel-shaped colony of *S. roseum* shows a close resemblance to that of *S. ehrenbergi* (var. *acutangulum* included); there is also some resemblance to *S. infundibuliforme* and to *S. poculiforme*.

S. poculiforme stands out from the other ones by the extremely long spicules in the coenenchyme of capitulum and stalk (length 1 to 2 mm).

S. ehrenbergi and *S. infundibuliforme* are distinguished from *S. roseum* by the distribution of the polyps: in the central part of the capitulum of these species the mutual distances of the autozooids are 1.50 to 2.00 mm, and the number of siphonozooids between them is up to two or three. In *S. roseum* the distance of the autozooids is 5 to 8 mm (Pratt (1903) gives 7 to 10 mm), and the number of siphonozooids is up to about twelve.

Kükenthal (1910: 25) and Tixier-Durivault (1966a: 114) described specimens of "*acutangulum*", which I consider *S. roseum*, for the distance of the autozooids is 4 or 5 mm and the number of siphonozooids up to six. Besides, the spicules in the interior of the capitulum are covered with prominences, which are not branched antlerlike.

S. acutangulum var. *occidentalis* Thorpe (1928: 502) has the autozooids 5 to 6 mm apart in the centre of the disc; the siphonozooids are "numerous", a number is not recorded. The variety approaches *S. roseum*, but a re-examination of Thorpe's type is desirable.

S. convolutum Thomson & Dean (1931: 63) must be referred to *S. roseum* (pl. 17 fig. 3). The autozooids are up to 5 mm apart, the number of siphonozooids is up to ten. The prominences on the coenenchymal spindles of the stalk are zoned and not antlerlike.

Geographical distribution. — Maldives, West coast of Australia, Madagascar, Malay Archipelago.

***Sarcophyton serenei* Tixier-Durivault, 1958**

(fig. 29; pl. 20)

Sarcophytum serenei Tixier-Durivault, 1958: 54-56, figs. 53-55.
Sarcophyton serenei; Tixier-Durivault, 1970b: 134.

Pl. 20 shows the colony designated as "type" by Mrs. Tixier-Durivault herself, so it is the holotype. The specimen represented in her fig. 55 (1958) is another colony. In the holotype the maximum diameter of the capitulum is slightly over 180 mm.

Most of the autozooids are not retracted; their length is up to 6 mm. Near the edge of the capitulum their distance is 1.5 to 2.0 mm, with one or two siphonozooids between them. In the central part the distance is 2 to 4 mm; there are six to seven siphonozooids between them (eight to ten as Tixier-Durivault mentions, is too much).

The anthocodiae of the extended autozooids reach a length of 6 mm. From the base upwards they contain numerous rodlike, almost smooth spicules. Up to a height of 4 to 5 mm they are transversely placed. In the basal part they are not so densely arranged, their length is up to 0.20 mm. More distally they are longer, up to 0.30 mm, and more tightly packed. In the distalmost part (about 1.00 to 1.20 mm long) they are up to 0.40 mm long, and steeply and compactly arranged en chevron. The tentacles (in my preparations about 0.70 mm long) are densely filled with rods, 0.12 to 0.20 mm long, and more or less transversely placed.

The surface layer of the capitulum contains two types of clubs, called (a) and (b) here. (a) Small sclerites, 0.06 to 0.10 mm long, with a constriction between head and handle (fig. 29a-g). The heads of these remarkable clubs consist of prominences, which are apparently leaflike; they stand upright, parallel with the longitudinal axis of the sclerites. The handle, too, consists of flat processes, volcano-shaped seen from aside. (b) Longer clubs, up to 0.38 mm in length, without such constrictions (fig. 29h-k). Heads and handles bear the same flat, volcano-shaped processes; those composing the heads are bigger and more numerous.

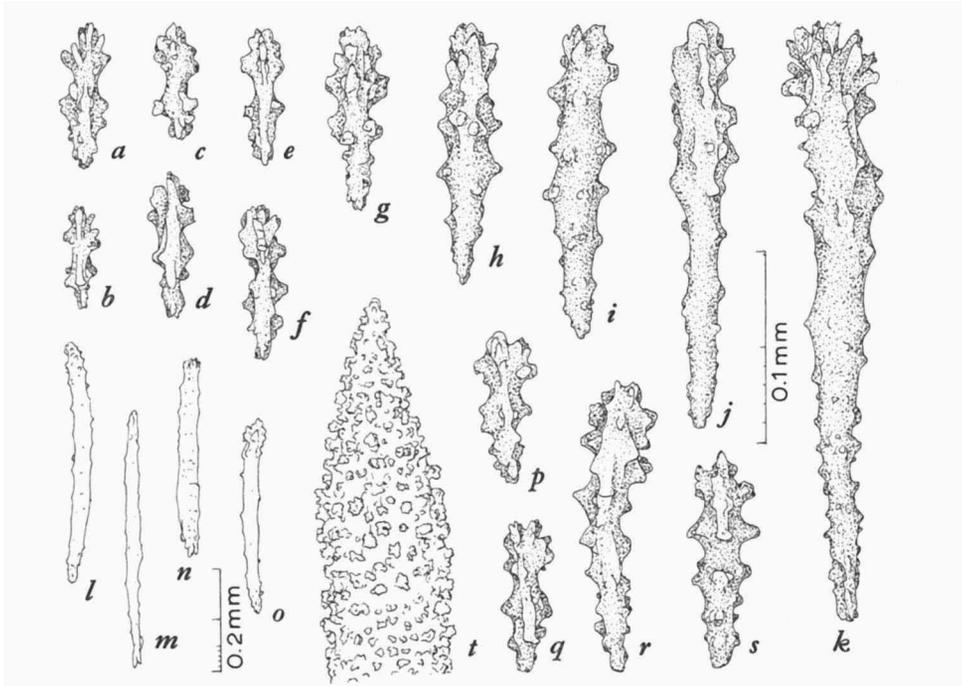


Fig. 29. *Sarcophyton serenei* Tixier-Durivault, holotype, MNHN. a-k, sclerites from surface layer of the capitulum; l-o, spicules from interior of the disc; p-s, sclerites from surface layer of the stalk; t, part of coenenchymal sclerite from the stalk. Enlargement of a-k and p-s indicated by 0.1 mm scale at j; that of l-o and t by 0.2 mm scale at m.

In the surface layer of the sterile stalk there are the same clubs with a distinct waist; most of them are 0.06 to 0.16 mm long (fig. 29p-s). Longer clubs, up to 0.23 mm, resemble those in the disc.

The coenenchyme of the capitulum has straight or slightly curved rods and needles, up to 0.50 mm long. They are almost smooth except the ends (fig. 29l-n). A number of them is club-shaped (fig. 29o). The coenenchymal spicules in the stalk look quite different. They are pointed, straight or bent spindles, up to 1.70 mm long and 0.30 mm wide (fig. 29t). They are covered with small warts.

Geographical distribution. — Vietnam.

Sarcophyton solidum Tixier-Durivault, 1958

(fig. 30; pl. 21)

Sarcophyton solidum Tixier-Durivault, 1958: 52-54, figs. 49, 51, 52.

Sarcophyton solidum; Tixier-Durivault, 1966a: 138-141, figs. 126, 133, 134.

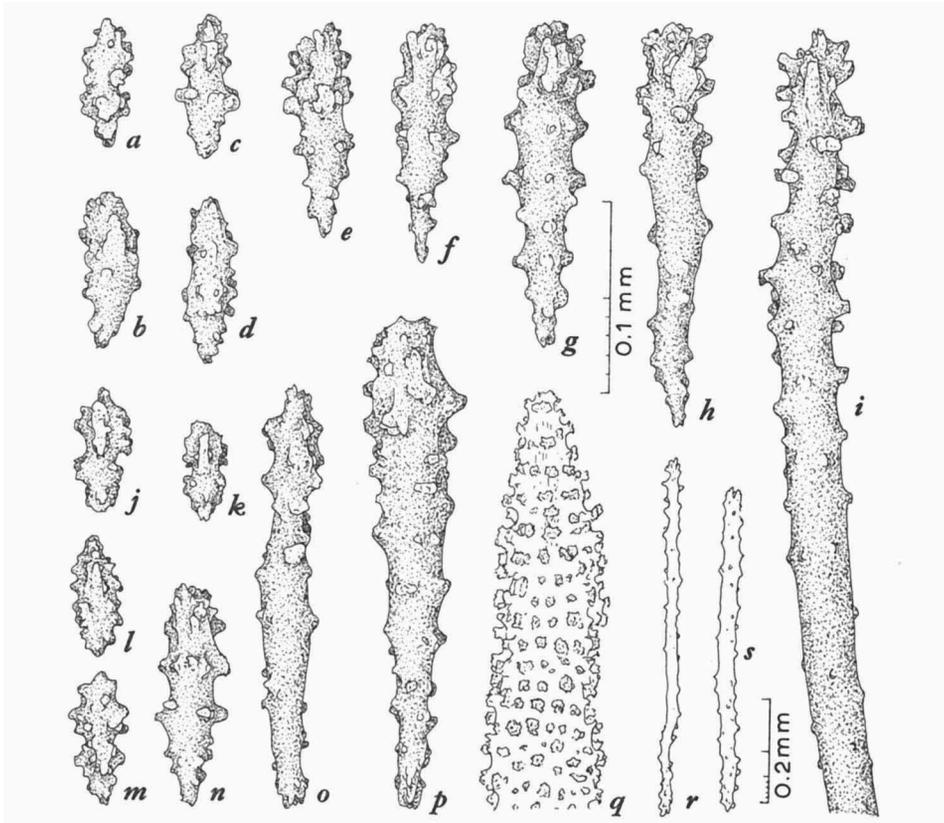


Fig. 30. *Sarcophyton solidum* Tixier-Durivault, holotype, MNHN. a-i, sclerites from surface layer of the disc; j-p, sclerites from surface layer of the stalk; q, part of coenenchymal spicule from the stalk; r, s, coenenchymal sclerites from the disc. Enlargement of a-p indicated by 0.1 mm scale at g; that of q-s by 0.2 mm scale at s.

The holotype, which was dish-shaped, consists of two big pieces now. Pl. 21 displays one of the parts seen from aside; a striking feature is the thick, strongly folded margin. Tixier-Durivault's (1958) fig. 49 shows a part of the other fragment; the enlargement of this drawing is $\times 0.6$.

On the marginal folds the autozooids are 1.5 to 2.0 mm apart, in the middle of the dish 3 to 5 mm. The number of siphonozooids between two autozooids is two to three and about five respectively.

In the surface layer of both capitulum and sterile stalk there are numerous remarkable sclerites: small bodies, more or less oval in outline, and sculptured with many rounded projections. In the capitulum they are 0.07 to 0.09 mm long (fig. 30a-d), in the stalk a lot of them are shorter, i.e. 0.05 mm long (fig. 30j-m). Some of them have a median constriction. In the capitulum

the longer sclerites are clavate, varying in length from 0.10 to 0.65 mm. Some of them, up to about 0.20 mm long, bear warts and rounded spines; the handle is pointed, the prominences show a tendency to zoning (fig. 30e-h). Others are very long, they are pseudo-clubs with a length of up to 0.65 mm (fig. 30i). Such "clubs" are also found in the interior of the capitulum; the "head" bears a number of small warts, the "handle" is almost free from projections. In addition to the ovals mentioned above the surface layer of the stalk contains clubs with a length of 0.11 to 0.35 mm and more (fig. 30n-p). They pass into spindles, 0.50 to 0.60 mm long and 0.06 mm wide averagely.

In the interior of the disc very thin needles and rods occur, up to 0.75 mm long, with widely spaced, tiny processes (fig. 30r, s), and, besides, the pseudo-clubs mentioned above. The coenenchyme of the stalk has pointed spindles, up to 1.10 mm long and 0.26 mm wide. A lot of them are covered with small warts (fig. 30q); others bear few, very low cones.

Geographical distribution. — Aldabra I. (N. of Madagascar).

***Sarcophyton spongiosum* Thomson & Dean, 1931**

(fig. 31; pl. 1 fig. 3)

Sarcophyton spongiosum Thomson & Dean, 1931: 64, pl. 21 figs. 3, 4.

Sarcophyton spongiosum; Verseveldt, 1960: 227-229.

Not *Sarcophyton spongiosum*; Tixier-Durivault, 1946: 171; 1958: 56-59, figs. 56, 61, 62.

Not *Sarcophyton spongiosum*; Tixier-Durivault, 1966a: 141-142, figs. 135-137; 1972: 20.

I re-examined the type specimen studied in 1960 (ZMA Coel. no. 3204), giving now a photo of this colony (pl. 1 fig. 3), which I designate as the lectotype.

The name *spongiosum* has been chosen correctly: the interior of capitulum and stalk is weak and spongy.

The autozooids are retracted just as far as the surface of the disc. The large anthocodiae are distinctly visible in the round or honeycomb-like apertures, 1.20 to 1.40 mm in diameter. These apertures are ringed in by very thin ridges. Near the edge of the disc the width of the partition-walls between the apertures is 0.40 to 0.60 mm, in the centre they are thicker. The siphonozooids are small and invisible to the unassisted eye. They are about 0.20 mm wide. At the margin there are between nil and two siphonozooids between two autozooids, in the central part there may be more, up to about four.

Thomson & Dean (1931: pl. 21) gave good pictures of the sclerites. In my previous paper (1960: 228) I described them more fully. Our present

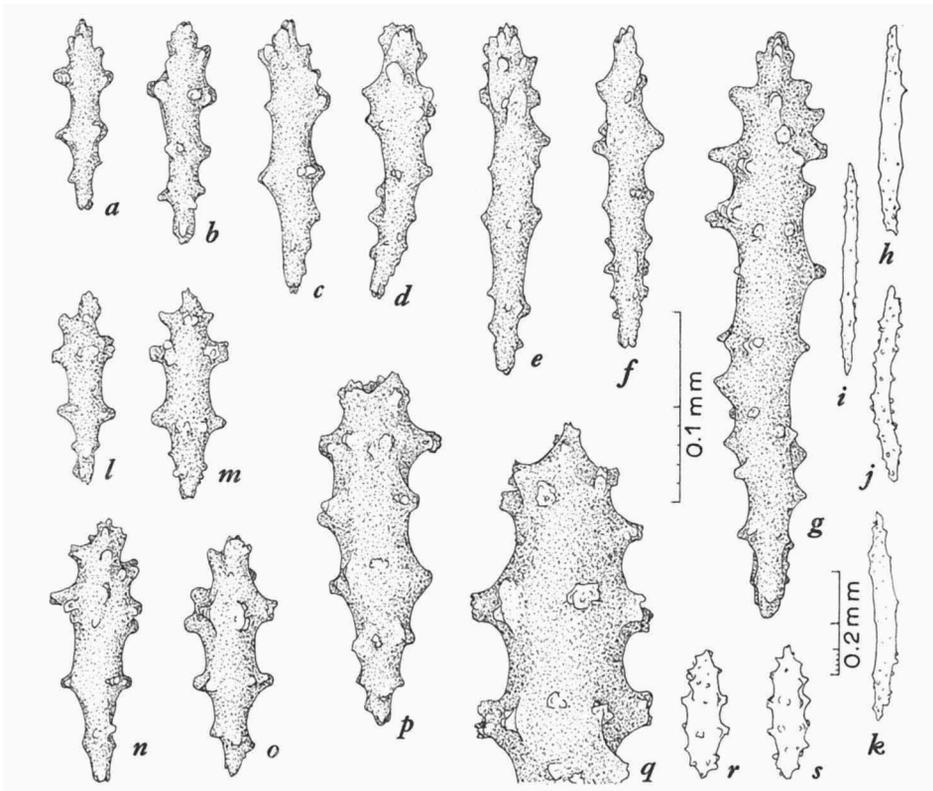


Fig. 31. *Sarcophyton spongiosum* Thomson & Dean, lectotype, ZMA Coel. no. 3204. a-g, sclerites from surface layer of the disc; h-k, spicules from coenenchyme of the disc; l-p, sclerites from surface layer of the stalk; q-s, sclerites from interior of the stalk. Enlargement of a-g and l-q indicated by 0.1 mm scale at f; that of h-k, r and s by 0.2 mm scale below g.

fig. 31 gives a not superfluous completion. A few additional remarks are desirable. The clubs in the surface layer of the disc are 0.08 to 0.30 mm long (fig. 31a-g); those with a length of 0.12 to 0.18 mm are most common. The length of the slender needles and spindles in the coenenchyme of the disc is up to 0.48 mm, the width is 0.04 to 0.06 mm (fig. 31h-k). The clubs in the surface layer of the stalk are 0.10 to 0.23 mm long (fig. 31l-p), the biggest ones have usually truncated heads (fig. 31p). The internal, more or less oval or tapering spindles in the stalk are mostly 0.20 to 0.32 mm long; the relatively small warts are distant from one another (fig. 31q-s).

In my previous paper (1960: 229) I doubted the rightness of Tixier-Durivault's identification of her specimen (1958: fig. 56; 1966a: fig. 135, the same colony) with *S. spongiosum*. A comparison of her drawings of the

sclerites with those in our fig. 31 shows that Tixier-Durivault's determination must be incorrect. Some measurements of the sclerites are also wrong: the clubs in the stalk are shorter than 0.20 to 0.30 mm, and the internal sclerites in the stalk are shorter than 0.30 to 0.60 mm.

I found that *S. spongiosum* is closely allied to *S. tenuispiculatum*; see p. 81.

Geographical distribution. — Obi Major (Moluccas).

***Sarcophyton stellatum* Kükenthal, 1910**

(figs. 32, 33; pl. 22 fig. 1)

Sarcophytum ehrenbergi var. *stellata* Kükenthal, 1910: 24-25; 1911a: 310-312, figs. 1-5, pl. 19 fig. 1.

Sarcophytum ehrenbergi var. *stellatum*; Moser, 1919: 242-243, fig. 5; Roxas, 1933: 374-375.

Sarcophytum ehrenbergi var. *stellatum*; Tixier-Durivault, 1946: 85-86; 1958: 20-21, figs. 6, 13.

In the Berlin Zoological Museum I found one of Kükenthal's syntypes, ZMB no. 6444 (pl. 22 fig. 1). The sterile stalk widens upwards. The disc is rather flat, the margin consists of some thick lobes, formed by stout folds.

The surface layer of the disc contains clubs, pseudo-clubs, rods and spindles. The (pseudo-)clubs and rods are usually 0.07 to 0.15 mm, rarely up to 0.20 mm long. They are irregularly shaped, more or less clavate, the head with flat prominences (fig. 32a-h, k). The spindles vary in length from 0.10 to 0.20 mm and bear few, often truncated cones (fig. 32i, j, m); the longer ones may be regarded as transitional forms to internal sclerites. In addition to these, there are all sorts of irregular bodies, such as four-rayed, often flat forms (fig. 32l).

According to Kükenthal (1911: 310, 311) the mouths of the siphonozooids are encircled by rings of small clubs and spindles standing perpendicular to the surface; seen from above they look like star-shaped bodies with a diameter of 0.03 mm. This is quite different from Tixier-Durivault's (1958: 20) report: "sclérites en étoiles (0.03 mm de long) au voisinage des siphonozoïdes".

The spindles mentioned above also occur in the coenenchyme of the disc (fig. 32n-q). They are up to 0.30 mm long, straight or curved, widest in the middle; the prominences are cones or small warts, not crowded.

In the surface layer of the sterile stalk there are very few clubs and irregularly shaped rods; the length varies from 0.08 to 0.10 mm (fig. 33a-e). The majority consists of warty rods, 0.10 to 0.20 mm long (fig. 33f, g), and

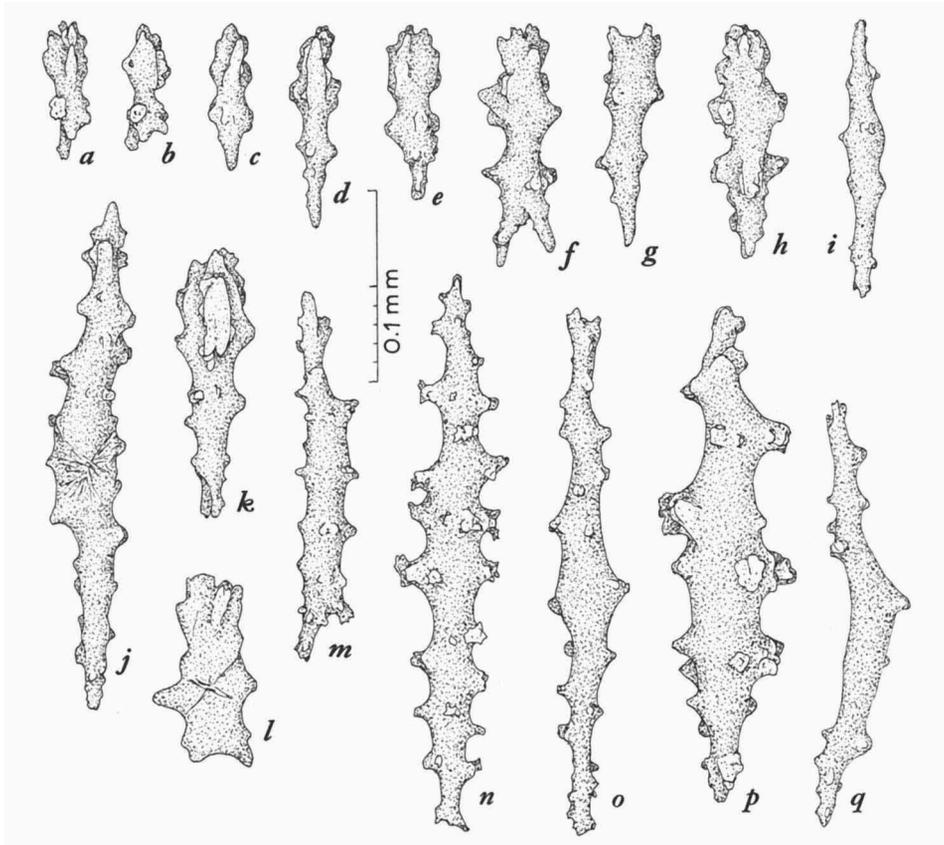


Fig. 32. *Sarcophyton stellatum* Kükenthal, syntype, ZMB no. 6444. a-m, sclerites from surface layer of the disc; n-q, sclerites from coenenchyme of the disc. All enlargements are the same; scale 0.1 mm.

wider ovals or fantastically shaped forms, 0.13 to 0.23 mm long, with big warts. These sclerites are transitional forms to coenenchymal sclerites, which are, in general, very warty ovals or cylinders, 0.16 to 0.29 mm long. In many cases the warts are more accumulated at both ends of the sclerite; as a result of this a more or less distinct median waist is formed (fig. 33h-l). Finally there are fantastically shaped sclerites (fig. 33m), and flat, rectangular or oblique-angled bodies, 0.10 to 0.20 mm in major diameter (fig. 33n-p).

The colony differs so widely from *S. ehrenbergi* in the shape of the colony and in the spiculation, that a raising of the variety to the rank of species is certainly justifiable.

Geographical distribution. — Aru Islands.

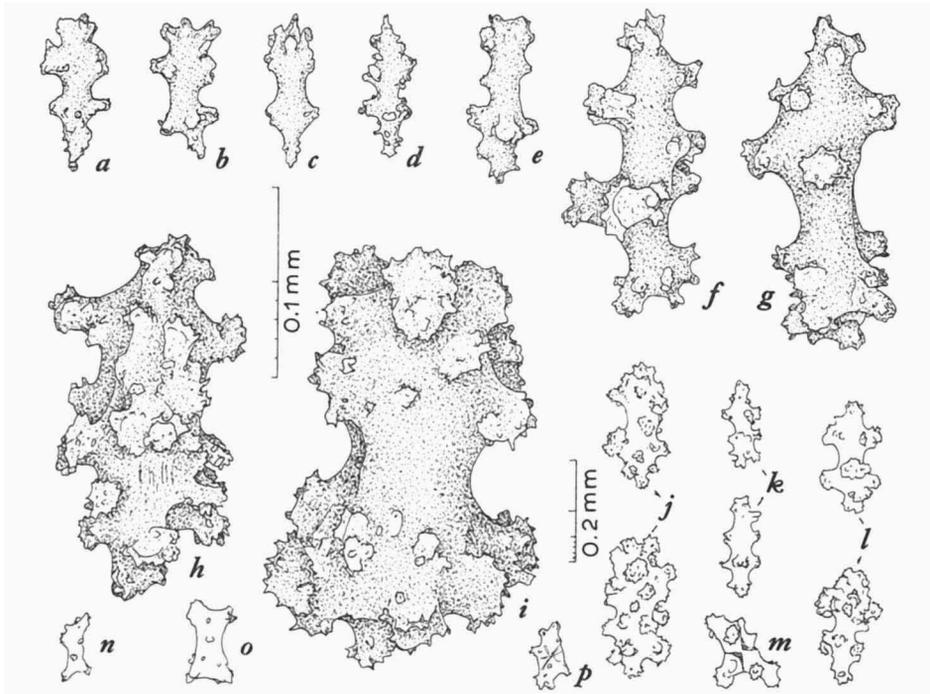


Fig. 33. *Sarcophyton stellatum* Kükenthal, syntype, ZMB no. 6444. a-g, sclerites from surface layer of the stalk; h-p, sclerites from coenenchyme of the stalk. Enlargement of a-i indicated by 0.1 mm scale below c; that of j-p by 0.2 mm scale at left of j.

Sarcophyton subviride Tixier-Durivault, 1958

(fig. 34, pl. 22 fig. 2)

Sarcophyton subviride Tixier-Durivault, 1958: 66-68, figs. 59, 69, 70.

Sarcophyton subviride; Tixier-Durivault, 1966a: 146-149, figs. 141-143.

According to the label added to the specimen the colony pictured in pl. 22 fig. 2 is Tixier-Durivault's "type", though it is smaller than the colony represented by Tixier-Durivault (1958: fig. 59).

At the margin of the capitulum the autozooids are 1.5 to 2.0 mm apart, in the middle 4 to 5 mm. The number of siphonozooids between them is two to three and seven to eight respectively.

A great number of autozooids is not retracted. Contrary to Tixier-Durivault's assertion (1958: 68) there are sclerites in the anthocodiae: in the distalmost part there are rods, up to 0.20 mm long, usually arranged en chevron, three to eight in a row. In the tentacles there are some flat rods, 0.03 to 0.08 mm long; they are irregularly distributed. In my preparations the tentacles are about 0.50 mm long; they bear six pinnules on either side.

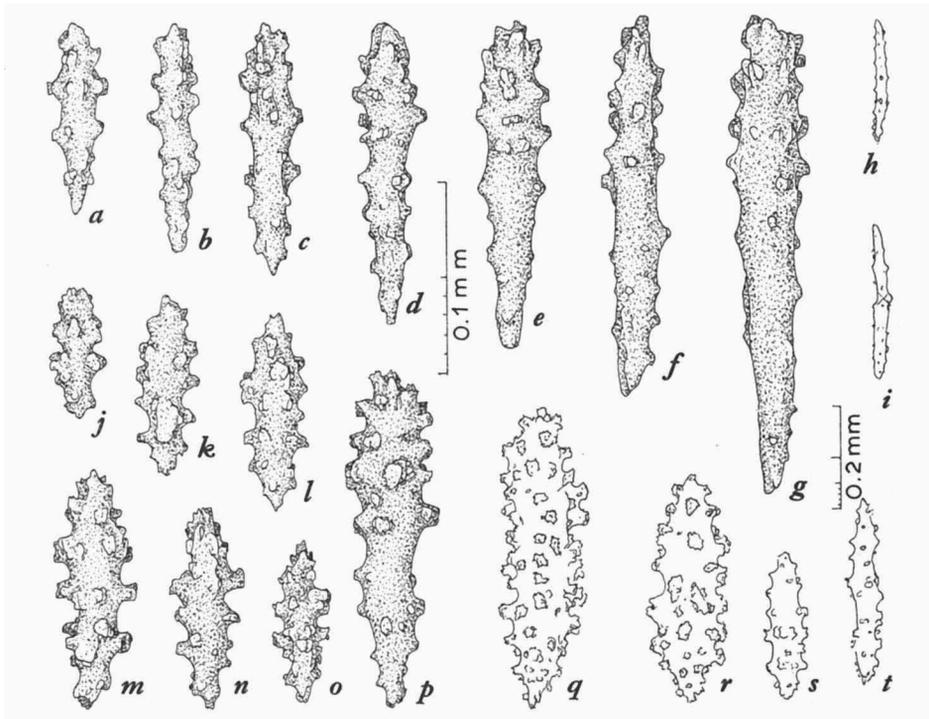


Fig. 34. *Sarcophyton subviride* Tixier-Durivault, type specimen, MNHN. a-g, sclerites from surface layer of the disc; h, i, spicules from interior of the disc; j-p, sclerites from surface layer of the stalk; q-t, sclerites from interior of the stalk. Enlargement of a-g and j-p indicated by 0.1 mm scale at d; that of h, i and q-t by 0.2 mm scale at g.

The surface layer of the disc contains slender clubs, 0.12 to 0.30 mm long (fig. 34a-g). Most prominences are truncated spines. The sclerites in the surface layer of the stalk are less clavate; a large number, especially the smaller ones, is more oval-shaped. The length of these smaller ones is 0.06 up to about 0.15 mm (fig. 34j-o). The longer ones, 0.15 to 0.30 mm in length, are often distinct clubs (fig. 34p), which pass into the numerous spindles, about 0.30 mm long and 0.07 mm wide.

The internal sclerites in the capitulum are slender spindles and rods, up to 0.30 mm long and 0.020 to 0.025 mm wide (without prominences; fig. 34h, i). The sterile stalk has irregular cylinders, ovals and spindles, up to 0.60 mm long and 0.20 mm wide (prominences included), with high, spiny warts and truncated spines (fig. 34q-t).

Geographical distribution. — Aldabra I. (N. of Madagascar).

Sarcophyton tenuispiculatum Thomson & Dean 1931

(fig. 35; pl. 1 fig. 4)

Sarcophyton tenuispiculatum Thomson & Dean, 1931: 64-65, pl. 22 fig. 6; Tixier-Durivault, 1946: 348; 1958: 24-25, fig. 19.

Sarcophyton tenuispiculatum; Verseveldt, 1960: 229-232, fig. 3; Tixier-Durivault, 1970a: 233.

Not *Sarcophyton tenuispiculatum*; Utinomi, 1956: 229-230, fig. 4.

In a previous paper (1960: 229) I described Thomson & Dean's holotype (ZMA Coel. no. 3205). For the sake of completeness I re-examined the colony, making new drawings of the sclerites (fig. 35), and I give a photo of the colony (pl. 1 fig. 4).

A description of the shape of the colony can be omitted. The distribution of the autozooids and the siphonozooids needs some further comment. As I wrote (1960: 230) the (retracted) autozooids often stand in rows. In each row the distance between the centres of the autozooids is 1.00 to 1.30 mm, but the intervals between two rows are greater, 1.50 to 2.00 mm, and, equally, the distances between two autozooids. In the central part of the disc the autozooids are not placed in rows; here the distance is also 1.50 to 2.00 mm. Near the edge of the disc the number of siphonozooids between two autozooids is one to three, in the centre of the disc about three to five.

The surface layer of the capitulum contains clubs, varying in length from 0.10 to 0.45 mm. The smaller ones, 0.10 to 0.15 mm long, have narrow heads, they are often more rod-shaped. The prominences, which are usually arranged in girdles, are low cones and truncated spines (fig. 35a-e). The longer spicules are distinct clubs; the heads bear spines and small warts (fig. 35f, g). The sclerites in the coenenchyme of the disc are needles and slender rods, up to 0.55 mm long and 0.03 to 0.05 mm wide (processes included; 0.020 to 0.035 mm, without processes) (fig. 35h, i). There are also big clubs, the same as those in the surface layer (fig. 35j).

In the surface layer of the stalk clubs and rods occur, 0.10 to 0.25 mm long (fig. 35k-n). The prominences are high warts, placed in zones. In the coenenchyme of the stalk ovals and spindles predominate, 0.23 tot 0.33 mm long (fig. 35 o-r). The high warts are usually arranged into four to five girdles, the ends of the sclerites are also covered with warts. In addition to these ovals and spindles there are thin rods, up to 0.60 mm long; they look like those in the interior of the disc.

In 1960 I considered it best to accept Utinomi's determination (1956: 229) as correct. But I am now of a different opinion, on the following grounds: 1, in the holotype the disc projects far beyond the stalk, and the apical portion of the stalk is tapering; 2, the number of 9-11 autozooids to a centimeter is

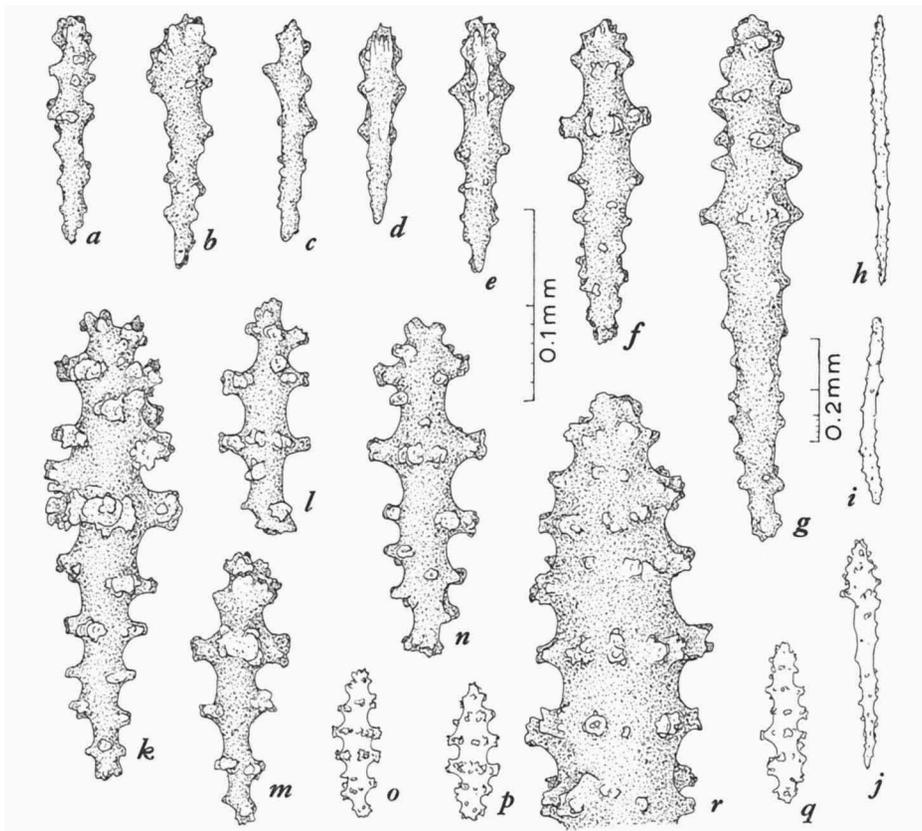


Fig. 35. *Sarcophyton tenuispiculatum* Thomson & Dean, holotype, ZMA Coel. no. 3205. a-g, sclerites from surface layer of the disc; h-j, spicules from coenenchyme of the disc; k-n, sclerites from surface layer of the stalk; o-r, sclerites from coenenchyme of the stalk. Enlargement of a-g, k-n and r indicated by 0.1 mm scale at e; that of h-j and o-q by 0.2 mm scale below h.

incorrect; 3, the siphonozooids are far from clear to the naked eye; 4, the sclerites from the surface layer of the disc and especially those of the stalk look quite different from those in the holotype; 5, in the disc interior of the holotype spicules like those represented in Utinomi's fig. 4m, o are absent. Only the coenenchymal sclerites occurring in the stalk look like those in the holotype.

There is a close relationship between *S. spongiosum* and *S. tenuispiculatum*. Thomson & Dean (1931: 64) based their new species *tenuispiculatum* "on its spiculation exclusively". I found that there are indeed differences between the two species. In comparing fig. 31 with fig. 35 we see that the prominences of the sclerites in the surface layer and in the interior of the stalk differ in

height and size, whereas in *S. tenuispiculatum* the needles in the interior of the disc are slightly thinner than in *S. spongiosum*. These are only gradual differences, however, and a colony may be found one day with more or less intermediate forms of sclerites. In that case one of the specific names would have to be dropped.

Geographical distribution. — Djampeah (Flores Sea), New Caledonia.

***Sarcophyton tortuosum* Tixier-Durivault, 1946**

(fig. 36; pl. 23 figs. 1-3)

Sarcophyton tortuosum Tixier-Durivault, 1946: 349; 1958: 25-28, figs. 17, 20, 21.

I designate the colony represented by Tixier-Durivault (1958: fig. 17; enlargement $\times 0.6$) and by the present author (pl. 23 fig. 1) as the lectotype; it is the specimen preserved in alcohol.

In the margin of the capitulum the autozooids are 1.0 to 1.5 mm apart, in the concave middle part 2 to 3 mm. On the folds the number of siphonozooids between two autozooids is three to four, in the middle five to six.

The surface layer of the capitulum contains slender clubs, 0.09 to 0.27 mm long (fig. 36a-h). The heads often have tiny spines at their top, for the rest the prominences are warts. The handles bear blunt spines, usually placed in girdles. The clubs in the surface layer of the stalk have about the same length, but the processes are higher, wartlike, often arranged in zones (fig. 36i-l).

In the coenenchyme of the disc lie straight, spiny rods and spindles, up to 0.55 mm long (fig. 36m). The interior of the stalk has slender, pointed spindles, usually 0.40 to 0.50 mm long; a few are up to 0.67 mm long. The majority has a width of 0.05 to 0.09 mm, but a width of 0.11 to 0.13 mm also occurs. They are covered with simple warts (fig. 36n-q).

To this species a few corals must be referred, collected by A. G. Humes and R. C. Halverson at New Caledonia, and identified with *S. acutangulum* by the present author some years ago (see my paper, 1974b: 95). The samples are: H(umes) & H(alverson) no. 1476, RMNH Coel. no. 10430; H. & H. no. 1491, RMNH Coel. no. 10431; H. & H. no. 1583, RMNH Coel. no. 10446; H. & H. no. 1600, RMNH Coel. no. 10432. Pl. 23 figs. 2, 3 shows two colonies from sample RMNH Coel. no. 10446. In alcohol the colour of the colonies is dark brown. Near the edge of the capitulum the distance between the centres of two autozooids varies from 0.90 to 1.30 mm; more towards the centre the distance is up to 2.20 mm. The siphonozooids are badly visible. In the margin there are two to three, in the centre three to seven between two autozooids.

Geographical distribution. — Fiji Is., New Caledonia.

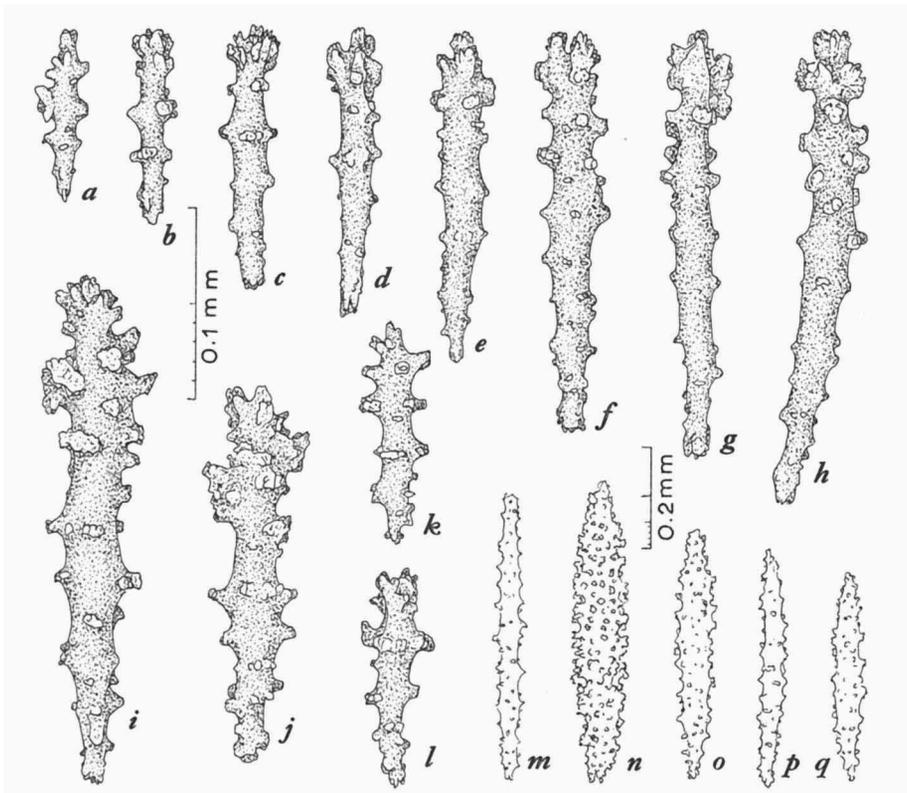


Fig. 36. *Sarcophyton tortuosum* Tixier-Durivault, lectotype, MNHN. a-h, sclerites from surface layer of the disc; i-l, sclerites from surface layer of the stalk; m, spicule from interior of the disc; n-q, spicules from interior of the stalk. Enlargement of a-l indicated by 0.1 mm scale at b; that of m-q by 0.2 mm scale at f.

***Sarcophyton trocheliophorum* Von Marenzeller, 1886**

(figs. 37-39; pl. 12 fig. 1, pl. 19 fig. 2, pl. 24 figs. 1, 2)

Sarcophytum trocheliophorum Von Marenzeller, 1886: 359-362, pl. 9 fig. 5; May, 1899: 114-115; Thomson & Dean, 1931: 60-62; Tixier-Durivault, 1946: 349-350.

Sarcophytum trocheliophorum; Moser, 1919: 246-249, figs. 8, 9; Roxas, 1933: 379, pl. 1 fig. 7; Macfadyen, 1936: 42-43; Utinomi, 1953: 155, fig. 3e-f, pl. 8 fig. 4; 1956: 231; 1959: 307-308; 1971: 92-93, text-fig. 4, pl. 15 fig. 5; 1977: 23, pl. 2 figs. 3, 4; Tixier-Durivault, 1958: 75-79, figs. 76, 82, 83; 1960: 360; 1966a: 155-158, figs. 150-152; 1970a: 240; 1970b: 134-135; Verseveldt, 1971: 25-27, fig. 14; 1974: 95 (listed only); 1977a: 3 (listed only); 1978: 49 (listed only).

Sarcophytum trocheliophorum var. *amboinense* Von Marenzeller, 1886: 361-362, pl. 9 fig. 6; Wright & Studer, 1889: 249, pl. 41 fig. 11; Studer, 1894: 121; Whitelegge, 1897: 215; May, 1898: 27-28; 1899: 115-117; Burchardt, 1903: 679-681, pl. 55 fig. 8, 9, pl. 57 fig. 12.

Sarcophytum trocheliophorum var. *moluccanum* Schenk, 1896: 77, 78.

Sarcophytum trocheliophorum forma *typica*; Kükenthal, 1910: 18-19.

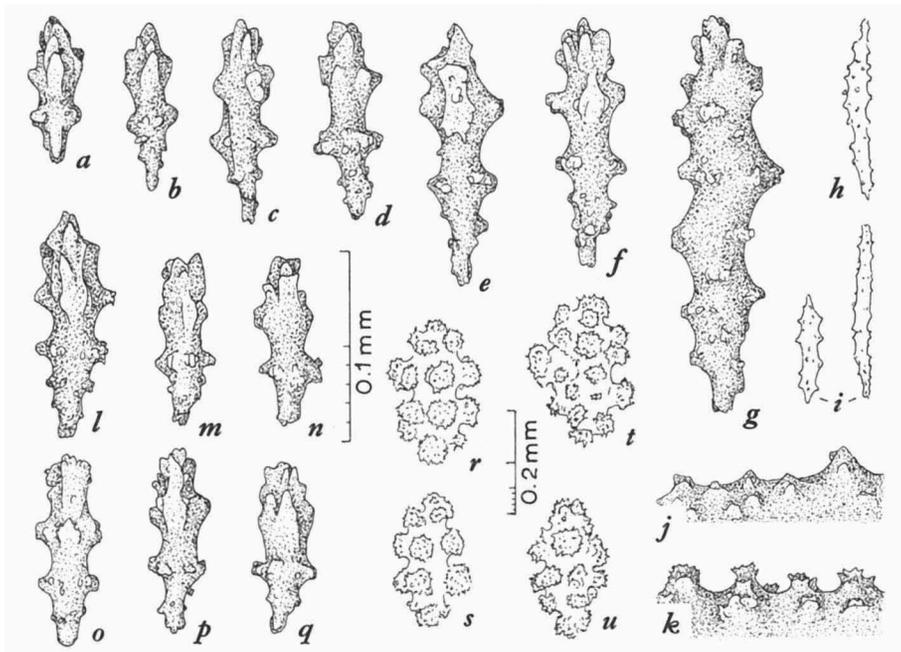


Fig. 37. *Sarcophyton trocheliophorum* Von Marenzeller, lectotype, NHMW no. C 2327. a-g, sclerites from surface layer of the capitulum; h, i, spicules from coenenchyme of the disc; j, k, details of coenenchymal spicules from the disc; l-q, sclerites from surface layer of the stalk; r-u, sclerites from interior of the stalk. Enlargement of a-g and j-q indicated by 0.1 mm scale at n; that of h, i and r-u by 0.2 mm scale at r.

Sarcophytum pulmo (Esper); Klunzinger, 1877: 28-29, pl. 1 fig. 8.

Sarcophytum dispersum Schenk, 1896: 75-76, pl. 4 figs. 38, 39.

Sarcophytum fungiforme Schenk, 1896: 73-74, pl. 2 fig. 10, pl. 4 figs. 31-33.

Not *Sarcophytum fungiforme*; Roule, 1908: 174.

Sarcophytum plicatum; Roule, 1908: 174.

Sarcophytum pallidum Cohn, 1908: 221, pl. 10 figs. 7-10; Kükenthal, 1910: 19-20.

Sarcophytum decaryi Tixier-Durivault, 1948: 83; 1958: 79-81, figs. 77, 81, 84.

Sarcophytum glaucum; Tixier-Durivault, 1958: 63, Quoy & Gaimard's "cotype".

Sarcophyton manifestum Tixier-Durivault, 1970a: 241-242, figs. 77-79.

Sarcophyton certum Tixier-Durivault, 1970a: 242-243, figs. 80-82.

Sclerophytum viride Thomson & Henderson, 1906a: 420-421, pl. 29 figs. 2, 3.

Von Marenzeller (1886: 359) described two colonies from Tonga, which were practically of the same size; the disc had diameters of 50×90 mm.

I recovered these two colonies in two different museums; in both they are labelled as "Typus". One of them I found in the Viennese Museum, register no. C2327; it is represented in pl. 19 fig. 2 and I designate this specimen as lectotype. The other specimen is in the Zoological Museum Hamburg, register no. C2442; I designate it as paralectotype (pl. 24 figs. 1, 2).

In the lectotype the autozooids are 0.90 to 1.30 mm apart; they are usually arranged in rows. The siphonozooids are clearly visible; there are one to three between two autozooids.

In the surface layer of the disc the clubs have a typical shape. In the middle there is a waist. The head above this waist consists of more or less leaflike prominences, pointing to the summit of the head. The pointed handle below the constriction has usually one girdle of higher, more or less cone-shaped processes; below this the spines are smaller and irregularly placed. Most of these clubs are about 0.08 to 0.11 mm long (fig. 37a-d). Larger clubs, up to 0.24 mm long, are also common (fig. 37e-g). The clubs in the surface layer of the sterile stalk have the same shape; they are generally 0.09 to 0.15 mm long (fig. 37l-q).

The coenenchyme of the disc contains straight or curved spindles, 0.20 to 0.35 mm long (fig. 37h,i), with conical prominences (fig. 37j) or with small warts (fig. 37k). In the interior of the stalk lie oval-shaped sclerites, averagely 0.24 to 0.28 mm long, sometimes up to 0.30 mm. Many of them have two girdles of spiny warts separated by a median constriction, and two terminal compound warts (fig. 37r, s). Others have irregularly distributed warts (fig. 37t, u).

As Von Marenzeller (1886: 360) rightly observed, the paralectotype (ZMH C2442) slightly differs from the specimen just described in the spiculation. The clubs in the surface layer of the disc are the same (fig. 38a-j). The clubs in the surface layer of the stalk are usually wider, and often more irregular in shape, but the median constriction is mostly present (fig. 38 o-q). The spindles in the coenenchyme of the disc are longer, 0.25 to 0.50 mm (fig. 38k-n). The wider they are, the higher are the prominences. The oval-shaped sclerites in the interior of the stalk are averagely 0.27 to 0.31 mm long, sometimes up to 0.41 mm (fig. 38r-t). A few spindles of the type represented in fig. 38k-m are also met with; the length is up to 0.56 mm.

Unfortunately the scale of the enlargements of Von Marenzeller's figures is not right. Scale 90/1 should be 120/1, and 70/1 should be 93/1.

Moser (1919: 247) rightly pointed out the variability in the size of the sclerites in the interior of the stalk. Consequently some new taxa described by several authors must be dropped. I examined the holotypes of *S. fungi-forme* Schenk (SMF no. 55), *S. dispersum* Schenk (SMF no. 56), *S. trocheliophorum* var. *moluccanum* Schenk (SMF no. 58), *S. decaryi* Tixier-Durivault, *S. manifestum* Tixier-Durivault, *S. certum* Tixier-Durivault (the last three kept in MNHN), and of *Sclerophytum viride* Thomson & Henderson (BMNH no. 1912.2.25.10). They all belong to *S. trocheliophorum*.

S. plicatum Schenk, 1896, is a synonym of *S. boettgeri* Schenk, but the

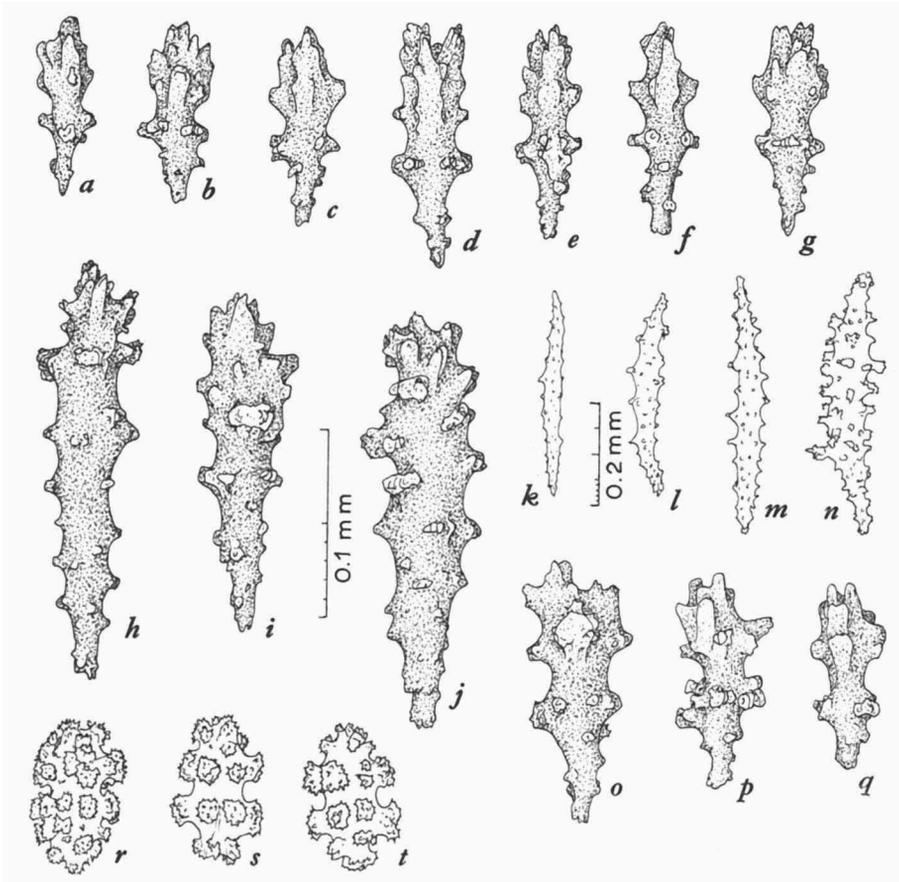


Fig. 38. *Sarcophyton trocheliophorum* Von Marenzeller, paralectotype, ZMH no. C 2442. a-j, sclerites from surface layer of the disc; k-n, sclerites from interior of the disc; o-q, sclerites from surface layer of the stalk; r-t, sclerites from interior of the stalk. Enlargement of a-j and o-q indicated by 0.1 mm scale at i; that of k-n and r-t by 0.2 mm scale at k.

colony of *S. plicatum* described by Roule (1908: 174) must be referred to *S. trocheliophorum*.

S. fungiforme Schenk must be synonymized with *S. trocheliophorum* (see above), but the specimen recorded by Roule (1908: 174) is *S. glaucum*.

S. reichenbachi Schenk (SMF no. 1292), identified with *S. trocheliophorum* by Moser (1919: 246) and by Tixier-Durivault (1958: 76) is a synonym of *S. ehrenbergi* (Von Marenzeller).

S. trocheliophorum var. *australiensis* Thorpe (1928: 500-502) is not identical with *S. trocheliophorum* (see Tixier-Durivault, 1958: 76), for Thorpe records the "absence of the typical oval spicules with prickly warts

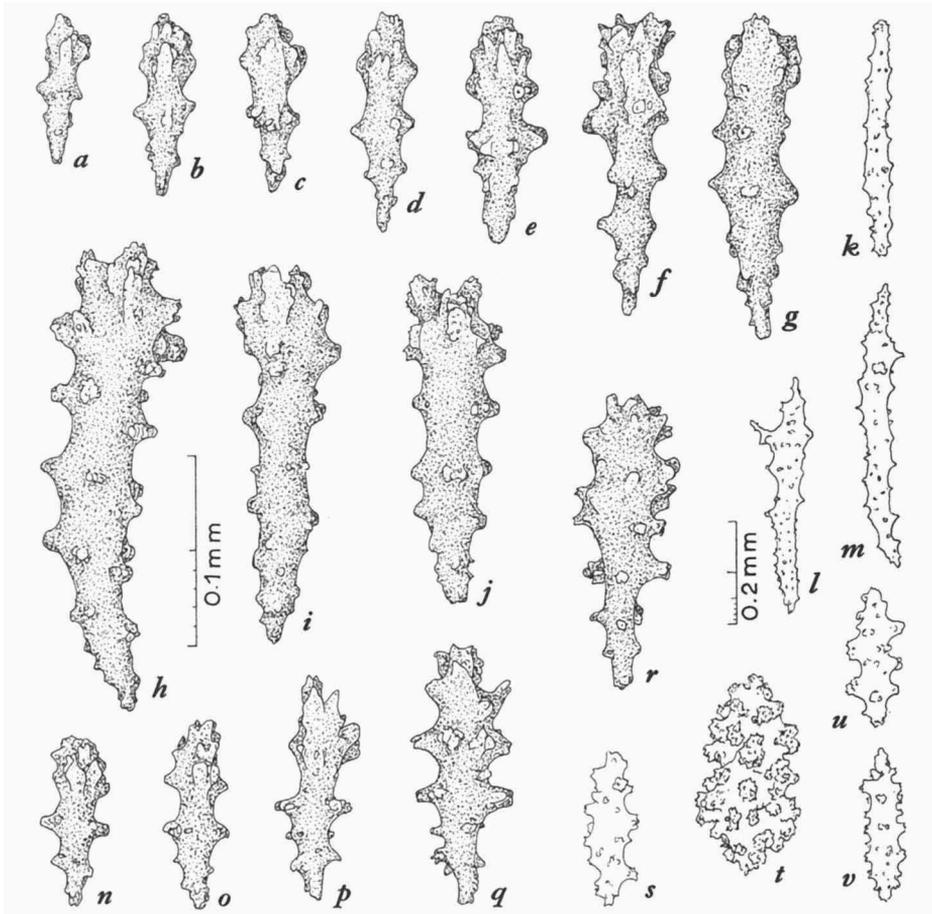


Fig. 39. *Sarcophyton trocheliophorum* Von Marenzeller, "cotype" of "*S. glaucum*" according to Tixier-Durivault (1958), MNHN. a-j, sclerites from surface layer of the disc; k-m, sclerites from interior of the disc; n-r, sclerites from surface layer of the stalk; s-v, sclerites from interior of the stalk. Enlargement of a-j and n-r indicated by 0.1 mm scale at h; that of k-m and s-v by 0.2 mm scale at l.

in the inside of the stalk". In my opinion the specimen cannot be regarded as a variety of this species either. Without closer examination of Thorpe's holotype it is impossible to say anything about its identity.

In the description of *S. glaucum* (this paper, p. 55) I pointed out that Tixier-Durivault (1958: 63) mentioned the presence of two small colonies of *S. glaucum* in the Paris Museum; the specimens should be Quoy & Gaimard's "cotypes". I have already said (l.c.) that I examined the specimen figured in Tixier-Durivault's fig. 58 (see our pl. 12 fig. 1). It appeared that at least in the specimen examined, the spiculation differs from that of *S.*

glaucum, but agrees with that of *S. trocheliophorum*. The following remarks may serve to demonstrate this.

The clubs in the surface layer of the disc (fig. 39a-j) and of the stalk (fig. 39n-r) have the typical shape and size mentioned above. The spicules in the interior of the disc, up to 0.55 mm long (fig. 39k-m) bear a striking resemblance to those in the paralectotype (fig. 38k-n). The sclerites in the interior of the stalk are not longer than 0.40 mm. A lot of them are more or less fusiform (fig. 39s, u, v); a few are thick and oval-shaped, and bear numerous big warts (fig. 39t). Besides, the white autozooids, up to 4 mm long, are about 1 mm apart. The siphonozooids are hardly visible; there are presumably one or two between two autozooids.

In the Zoologisches Museum Hamburg, there is a colony labelled *Sarcophyton expandum* Kölliker (ZMB Cz430); data regarding locality, collector, etc., are wanting. In the literature I could not find a publication by Kölliker on this animal, so I think it is only a label-name. At any rate the colony belongs to *S. trocheliophorum*.

Geographical distribution. — The species is widespread in the warm Indian Ocean (including the Red Sea) and the West Pacific area.

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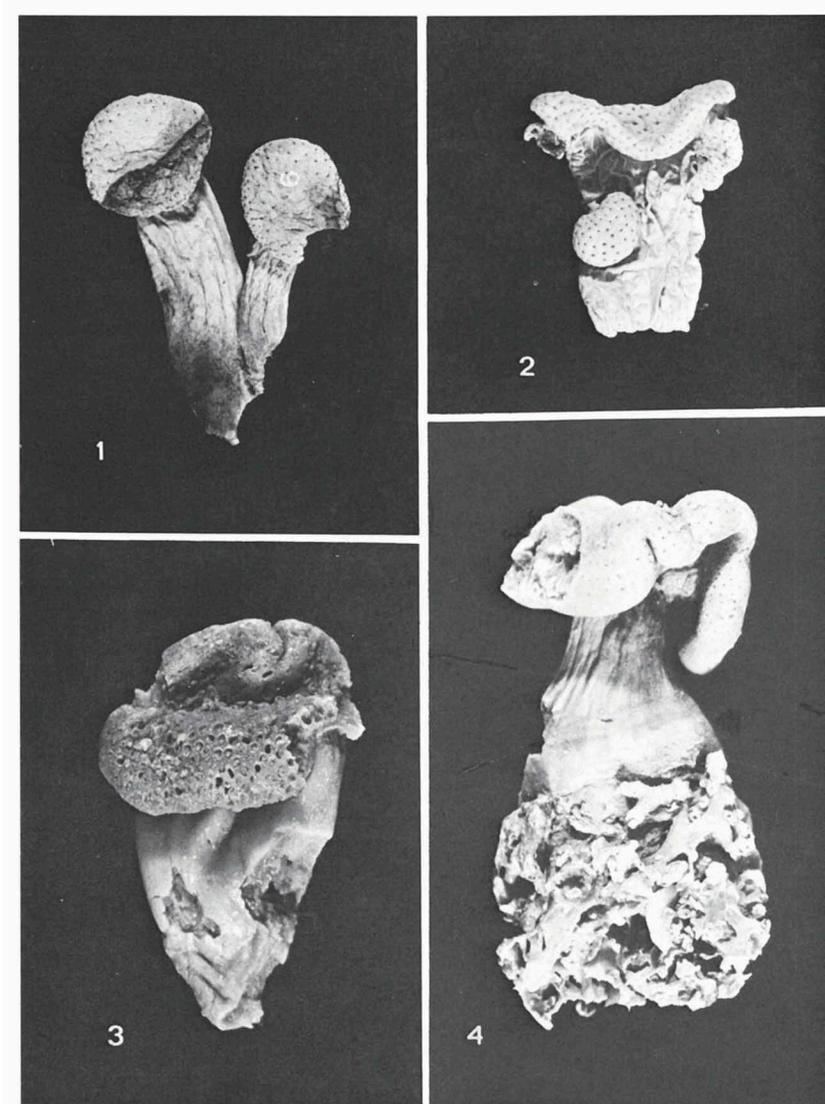


Fig. 1. *S. acutum* Tixier-Durivault, syntypes, MNHN; $\times 1$. Fig. 2. *S. portentosum* Tixier-Durivault, holotype, MNHN; $\times 1$. Fig. 3. *S. spongiosum* Thomson & Dean, lectotype, ZMA Coel. no. 3204; $\times 1$. Fig. 4. *S. tenuispiculatum* Thomson & Dean, holotype, ZMA Coel. no. 3205; $\times 1$.

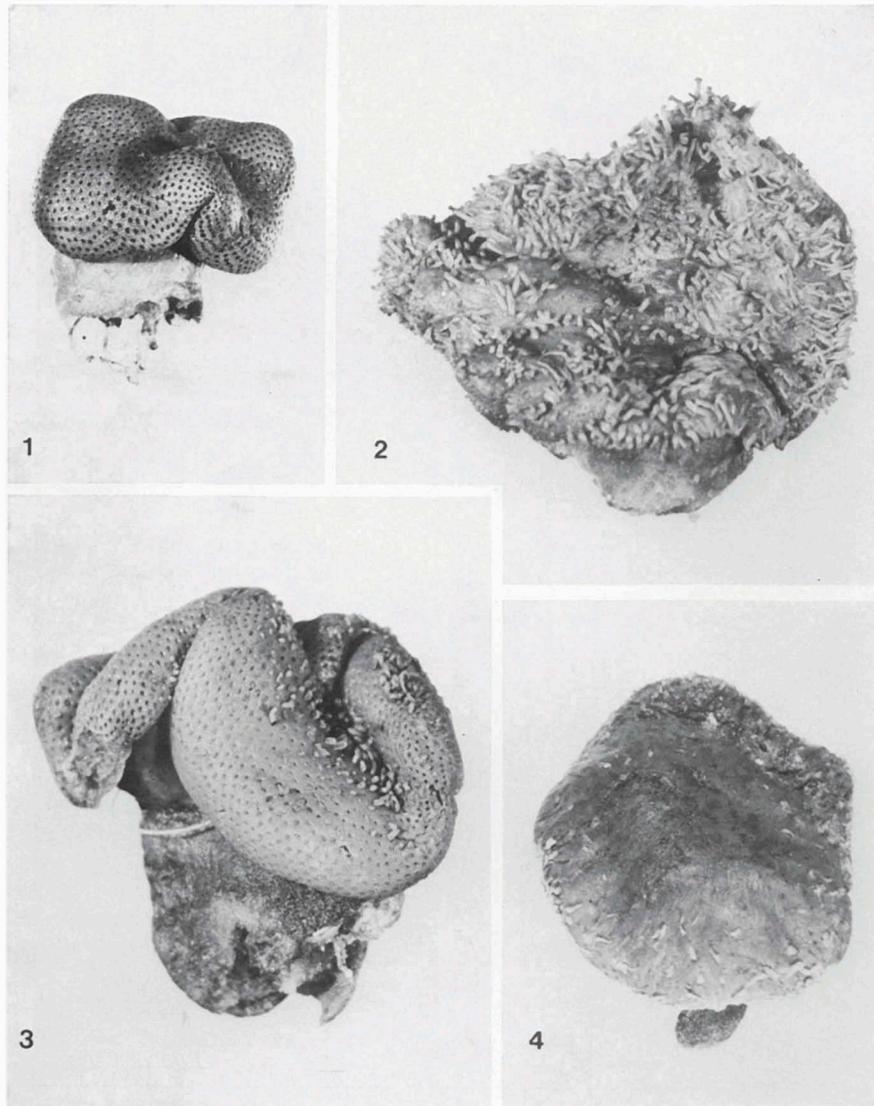
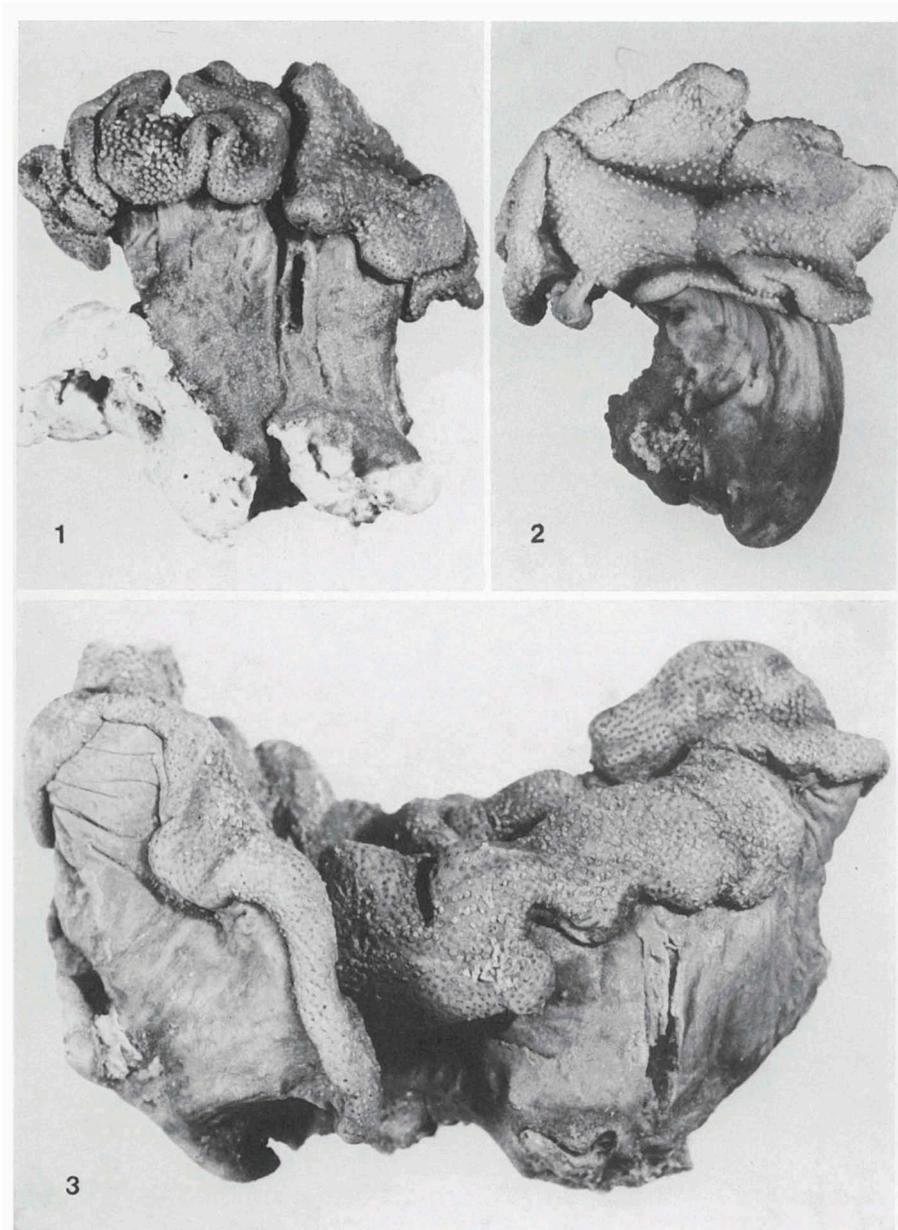
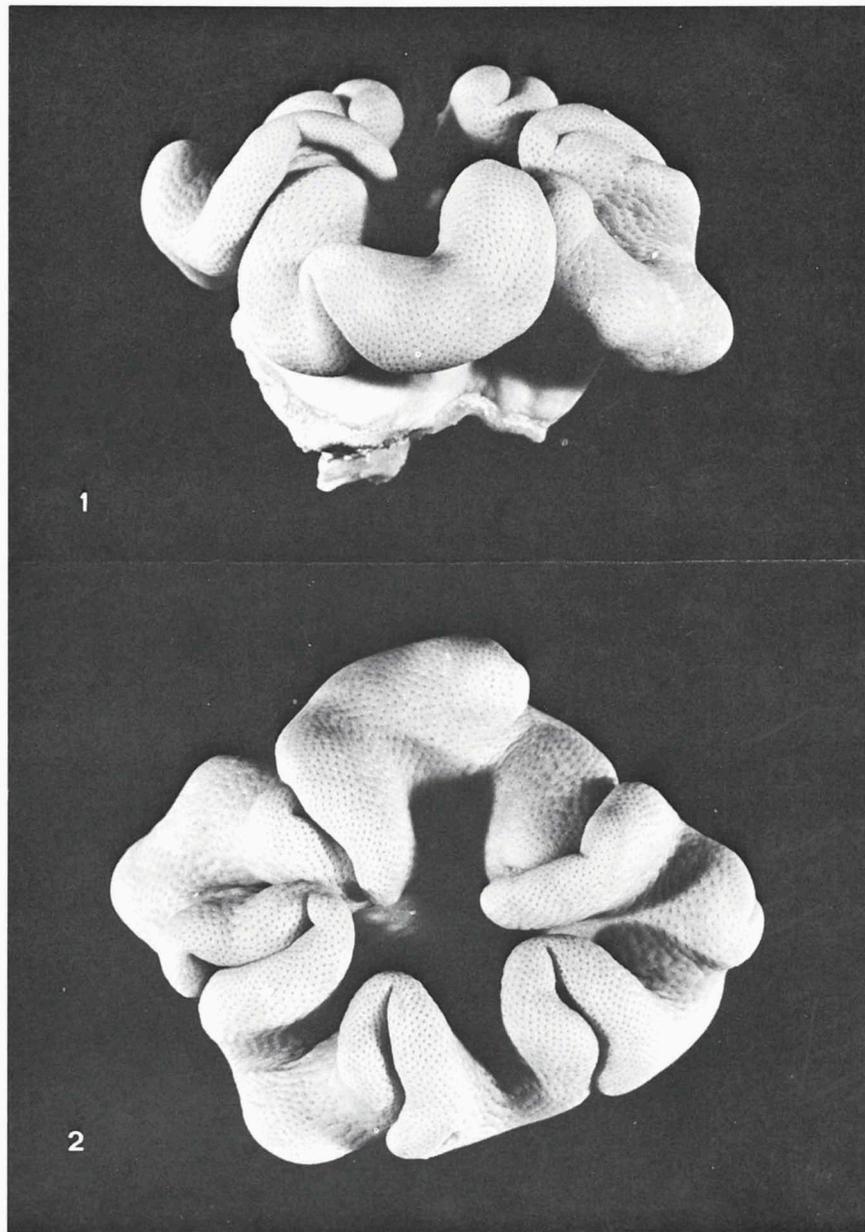


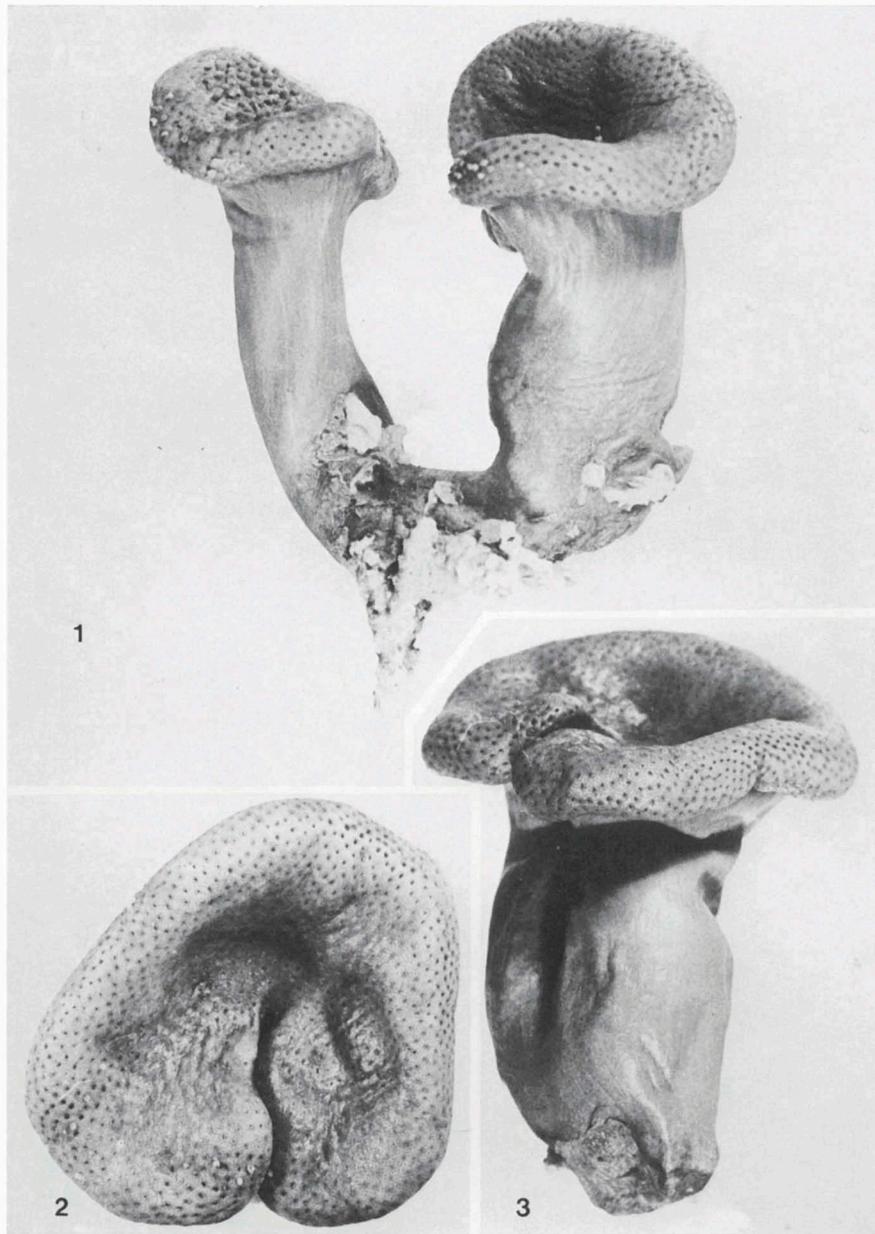
Fig. 1. *S. boettgeri* Schenk, holotype, SMF no. 54; \times 1. Fig. 2. *S. cherbonnieri* Tixier-Durivault, holotype, MNHN; \times 1. Fig. 3. *S. cinereum* Tixier-Durivault, lectotype, MNHN; \times 1. Fig. 4. *S. boletiforme* Tixier-Durivault, holotype, MNHN; \times 1.



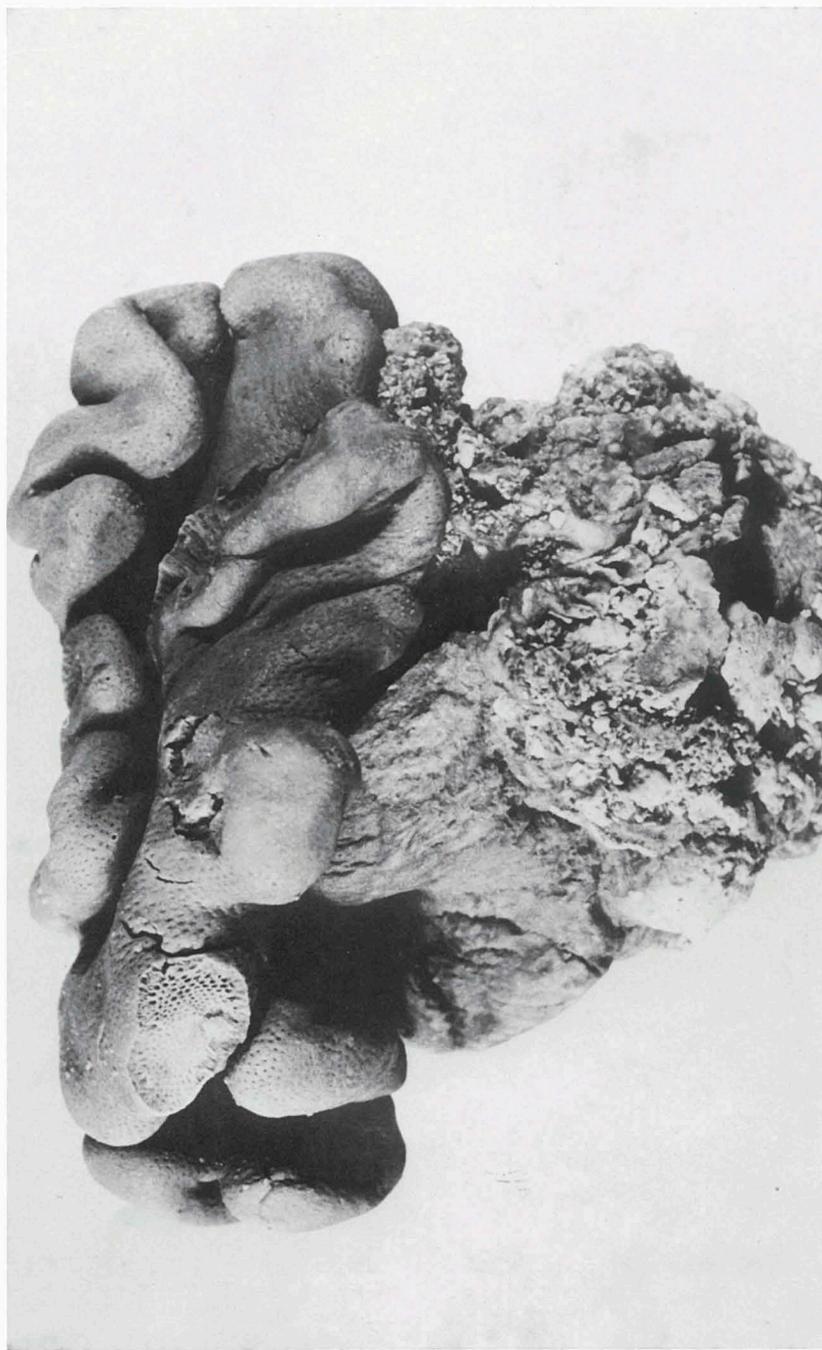
Figs. 1, 2. *S. elegans* Moser, RMNH Coel. no. 11117 and 13974, respectively; \times 1.
Fig. 3. *S. buitendijki* sp. nov., holotype, RMNH Coel. no. 3002; \times 1.



Figs. 1, 2. *S. buitendijki* sp. nov., RMNH Coel. no. 11661, in side-view (1) and seen from above (2).



Figs. 1-3. *S. crassocaula* Moser; × 1. 1, paralectotype, syntype of "*S. griffini*" Moser, ZMB no. 4607; 2, 3, lectotype, syntype of "*S. griffini*" Moser, ZMB no. 4607, seen from above (2) and in side-view (3).



S. crassocaulis Moser, syntype of "*Lobophytum carnatum*" Tixier-Durivault, MNHN; X 1.

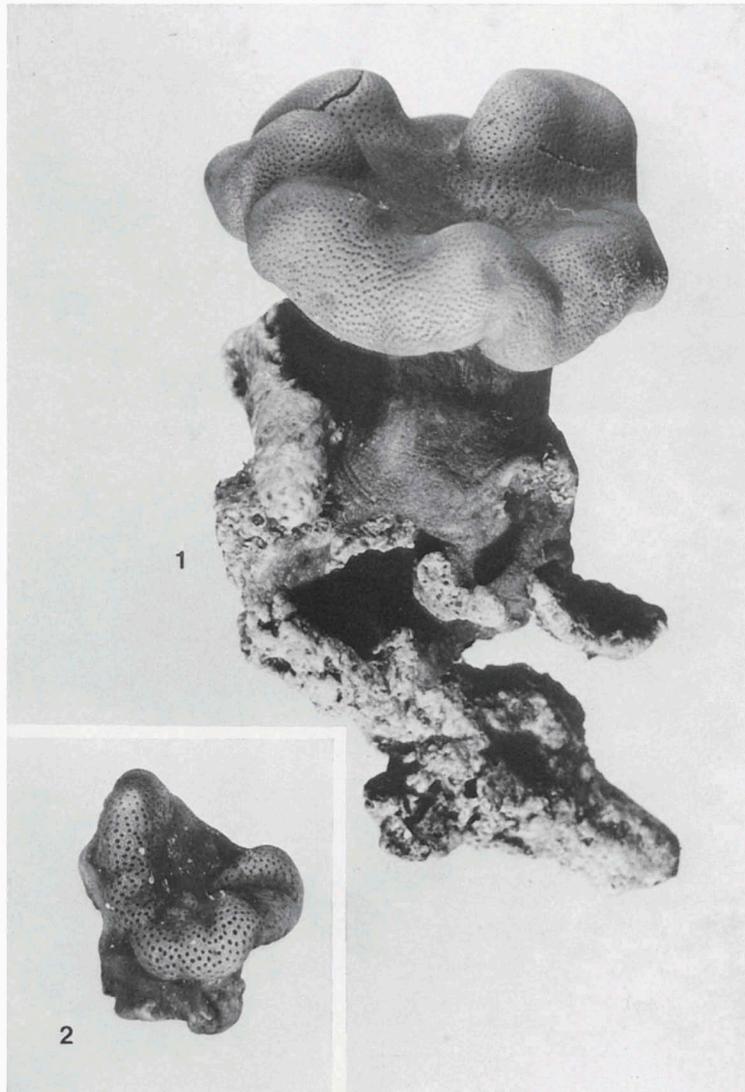
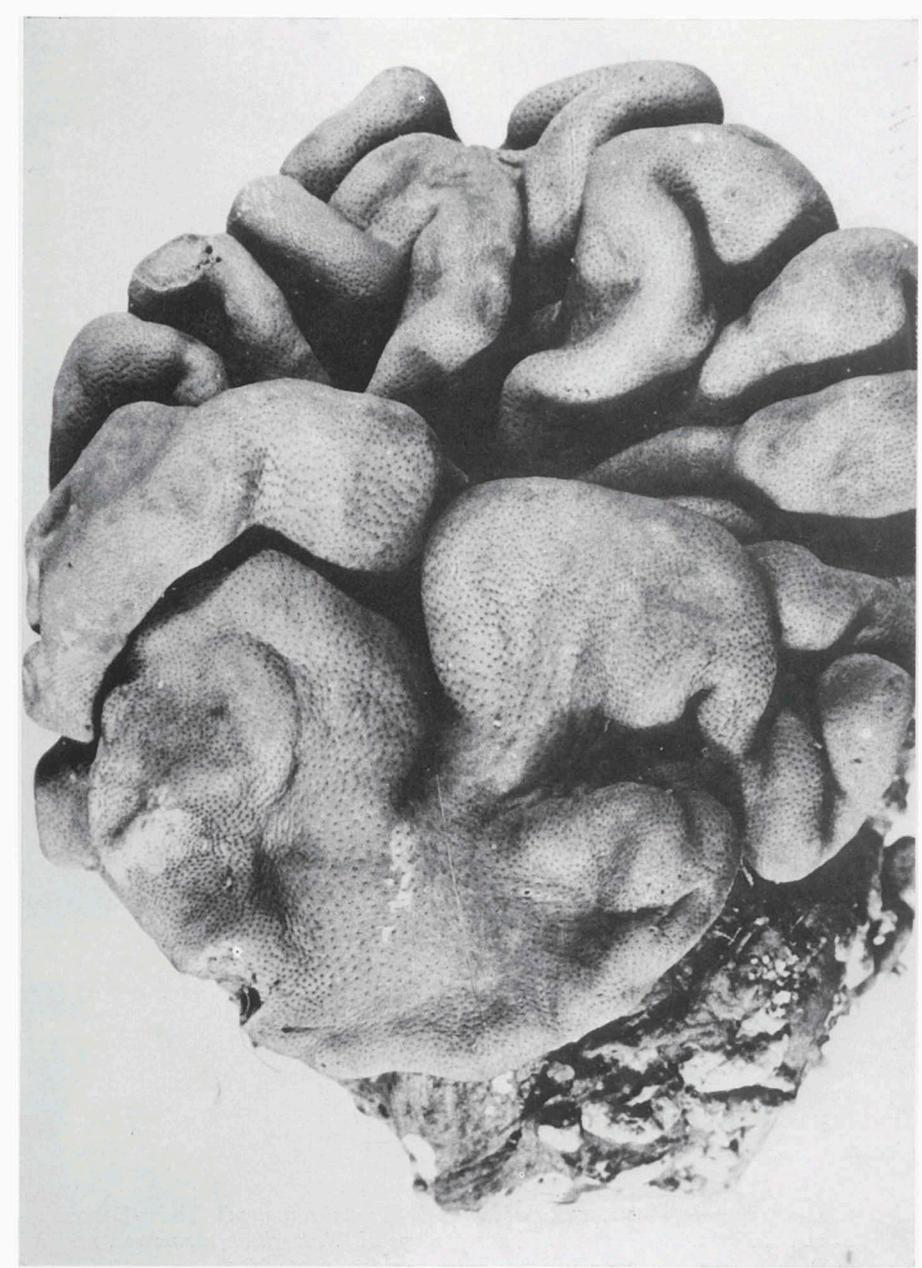


Fig. 1. *S. crassocaule* Moser, syntype of "*Lobophytum carnatum*" Tixier-Durivault, MNHN; \times 1. Fig. 2. *S. crassocaule* Moser, syntype of "*S. trochelioprorum* var. *minus*" Thomson & Dean, ZMA Coel. no. 3225; \times 1.



S. crassocaula Moser, type of "*Lobophytum radiatum*" Tixier-Durivault, MNHN; \times 1.

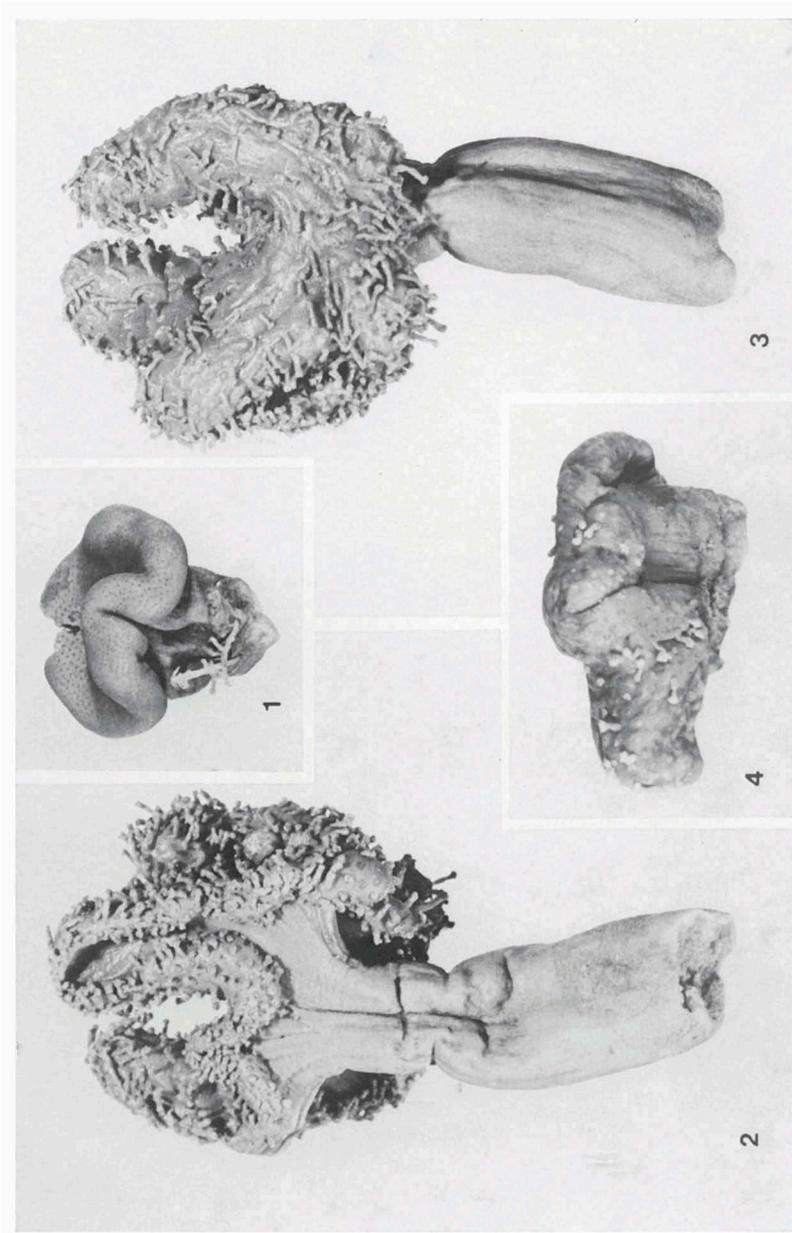
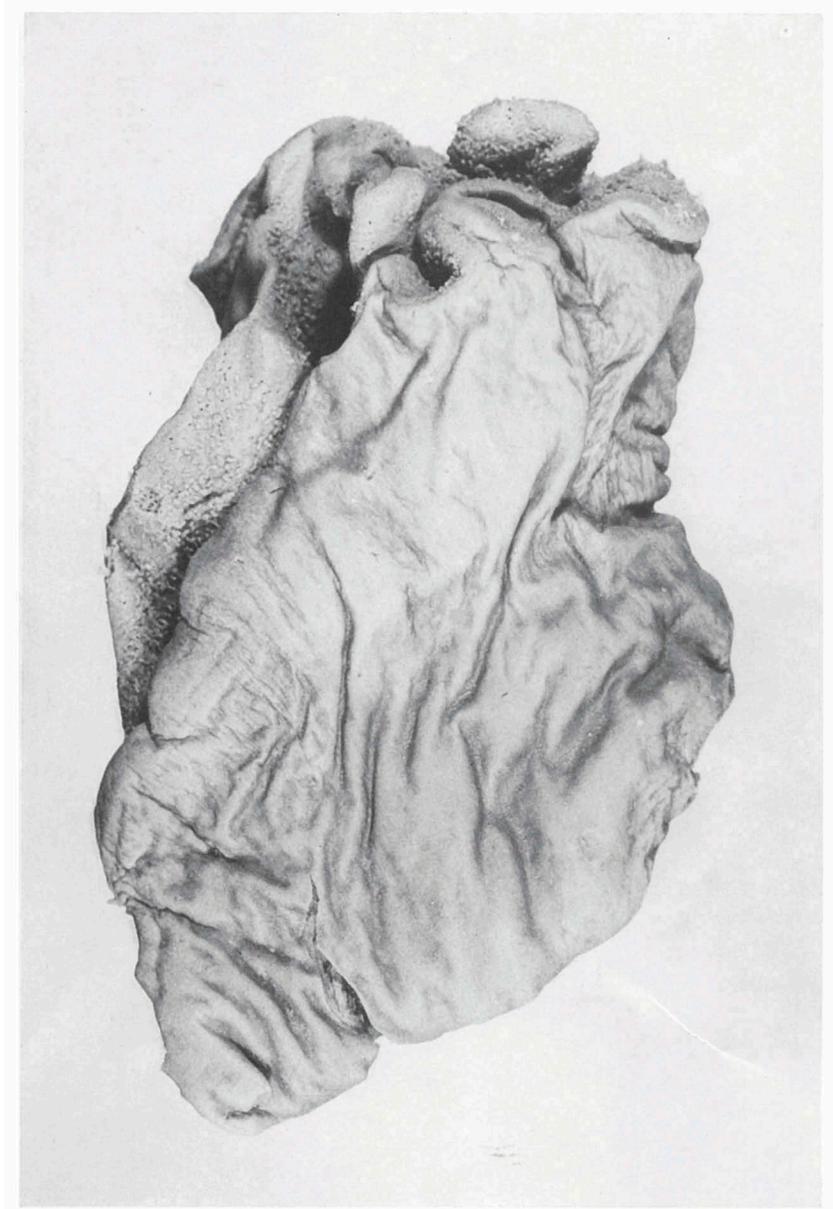
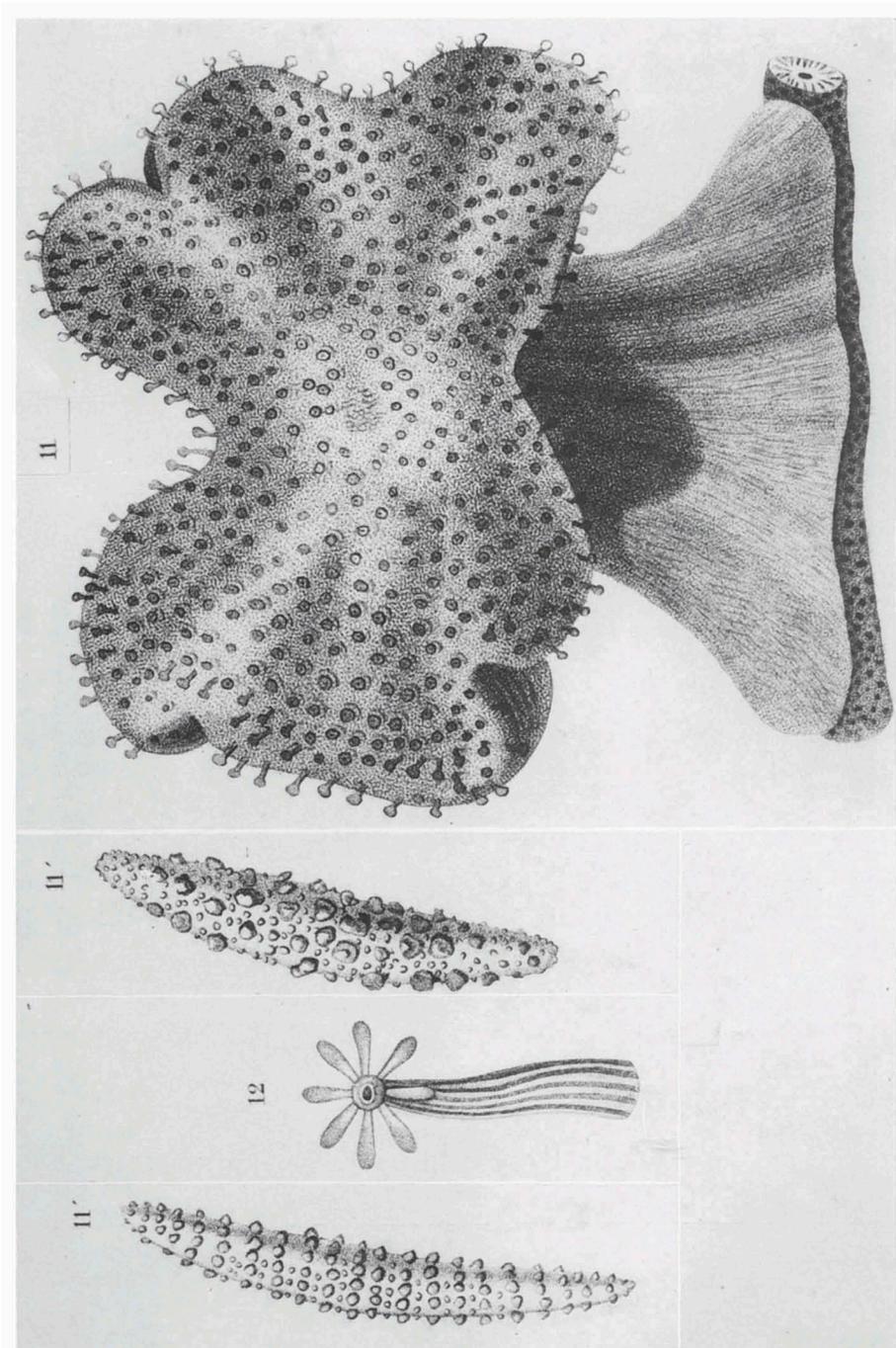


Fig. 1. *S. crassocaulis* Moser, syntype of "*S. trocheliophorum* var. *minus*" Thomson & Dean, ZMA Coel. no. 3211; X 1.
 Figs. 2, 3. *S. digitatum* Moser, syntype, ZMB no. 6440; X 1. Fig. 4. *S. crassum* Tixier-Durivault, holotype, MNHN; X 1.



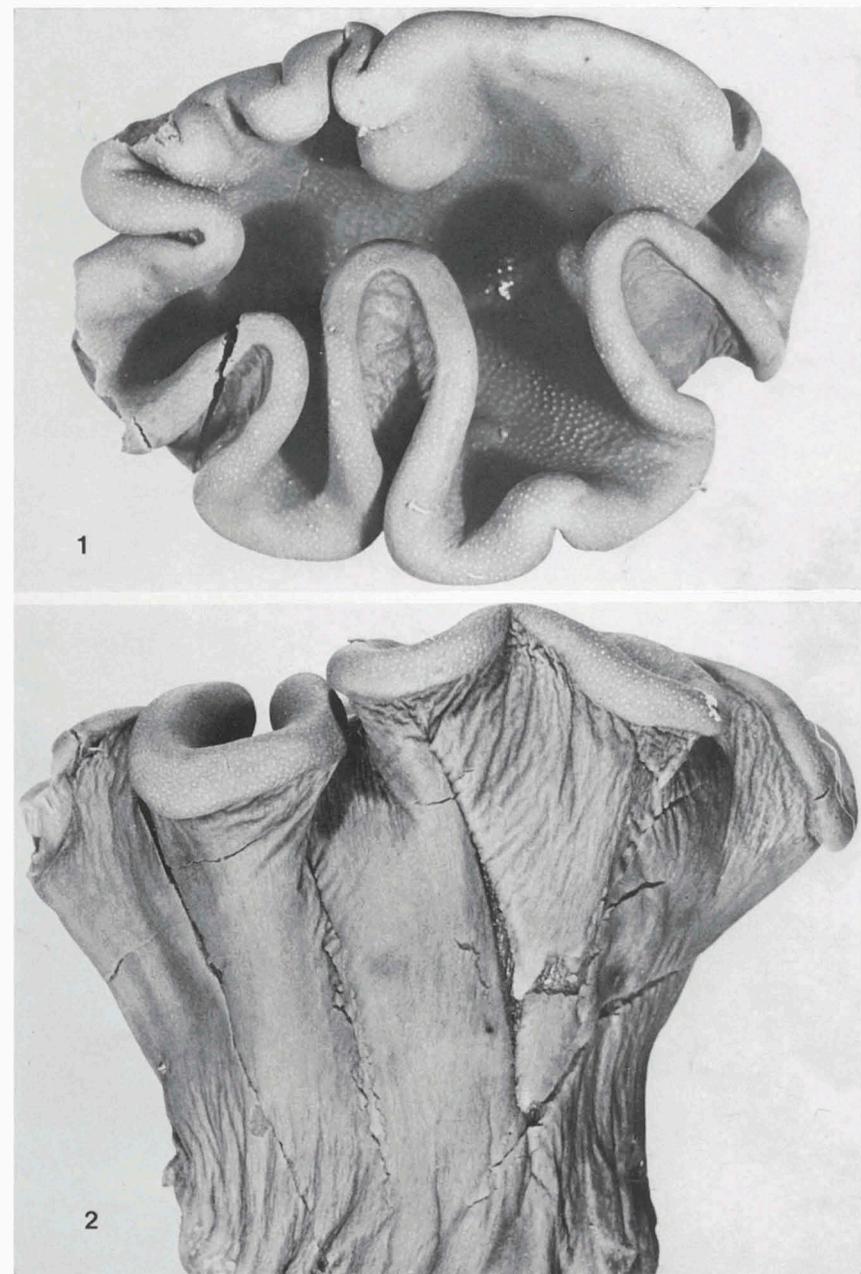
S. ehrenbergi Von Marenzeller, syntype, NHMW C2318; $\times 1$.



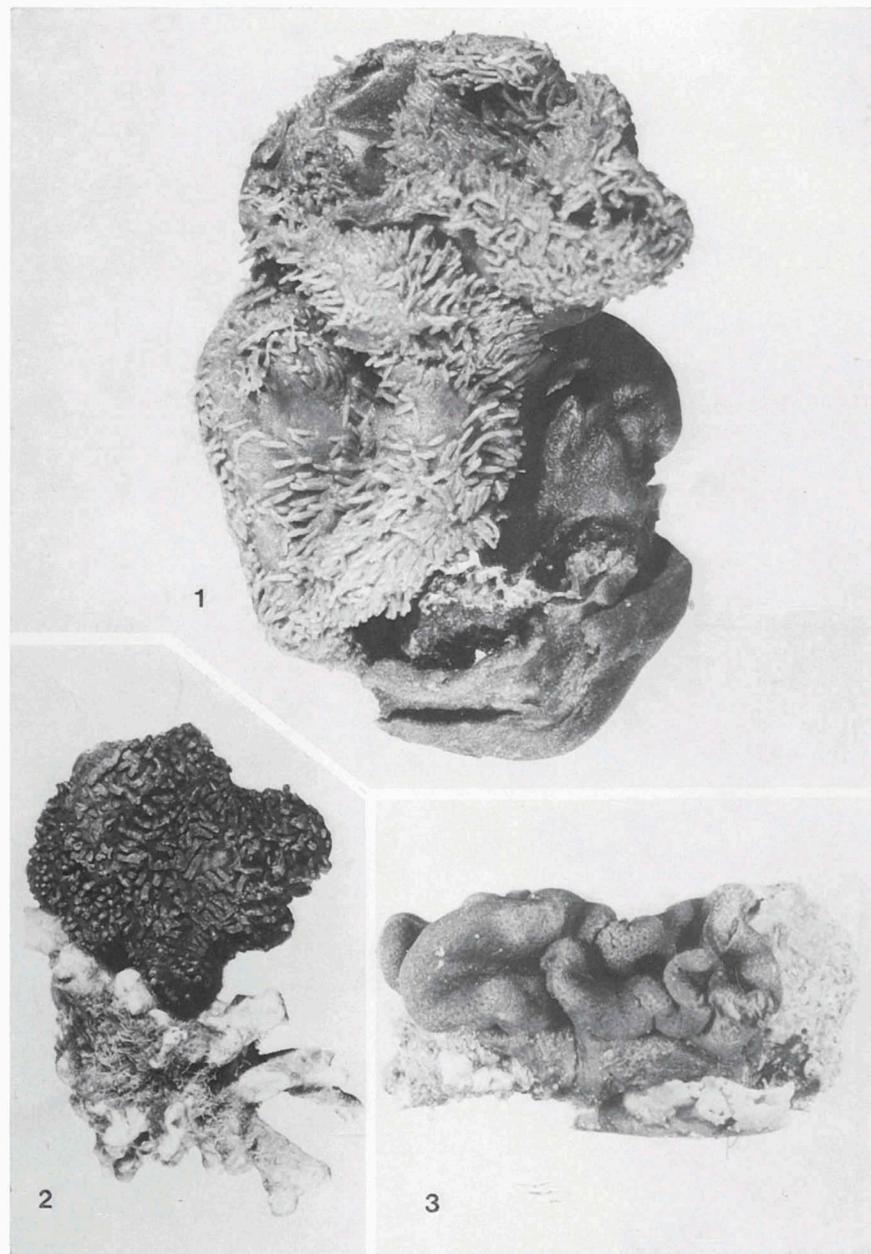
S. glaucum (Quoy & Gaimard), holotype; photograph taken from Quoy & Gaimard's (1833) drawing, pl. 22 figs. 11, 11', 11'', 12 (fig. 11, colony; fig. 11', sclerites; fig. 12, autozoid); X 1. (Photograph made by Mr. L. A. van der Laan, ZMA)



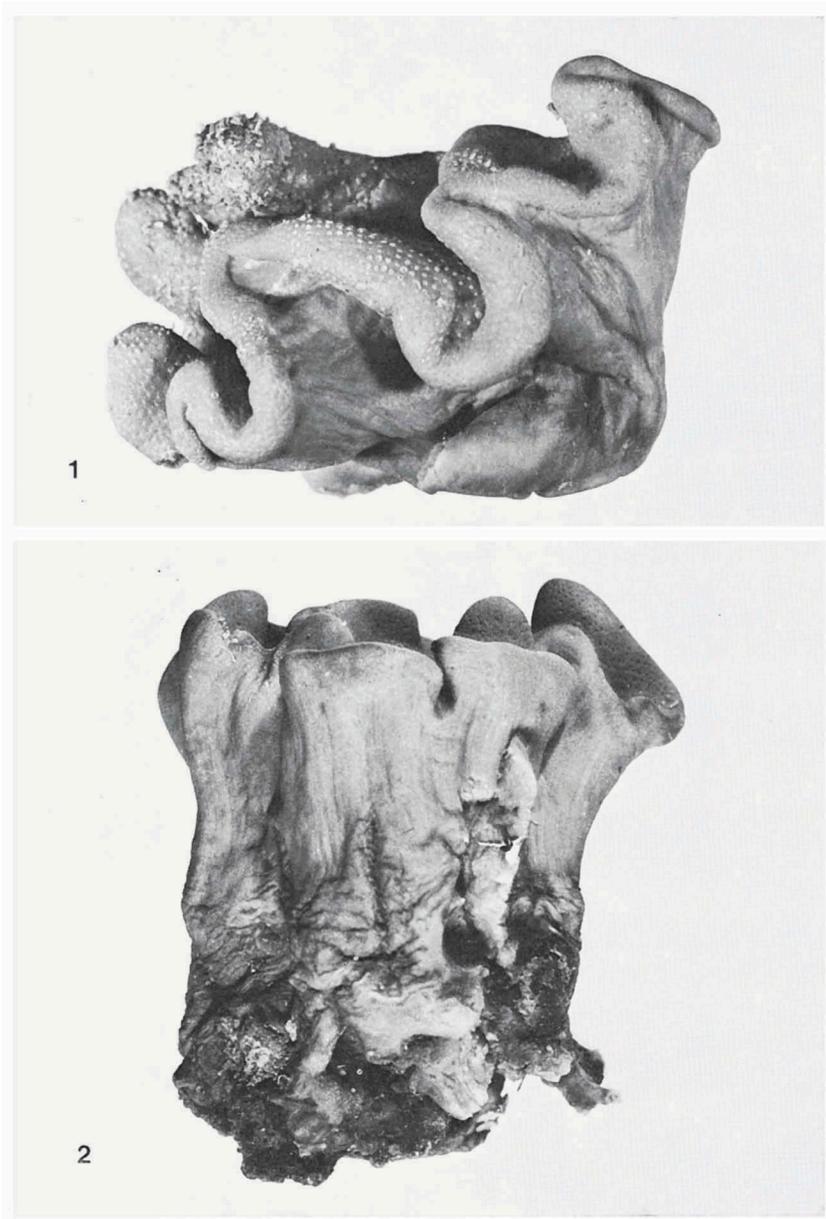
Fig. 1. *S. trocheliophorum* Von Marenzeller, "cotype" of "*S. glaucum*" (Quoy & Gaimard), MNHN; $\times 1$. Fig. 2. *S. ehrenbergi* Von Marenzeller, syntype of *S. ehrenbergi* var. "*acutangulum*" Von Marenzeller, ZMH no. C2428; $\times 1$.



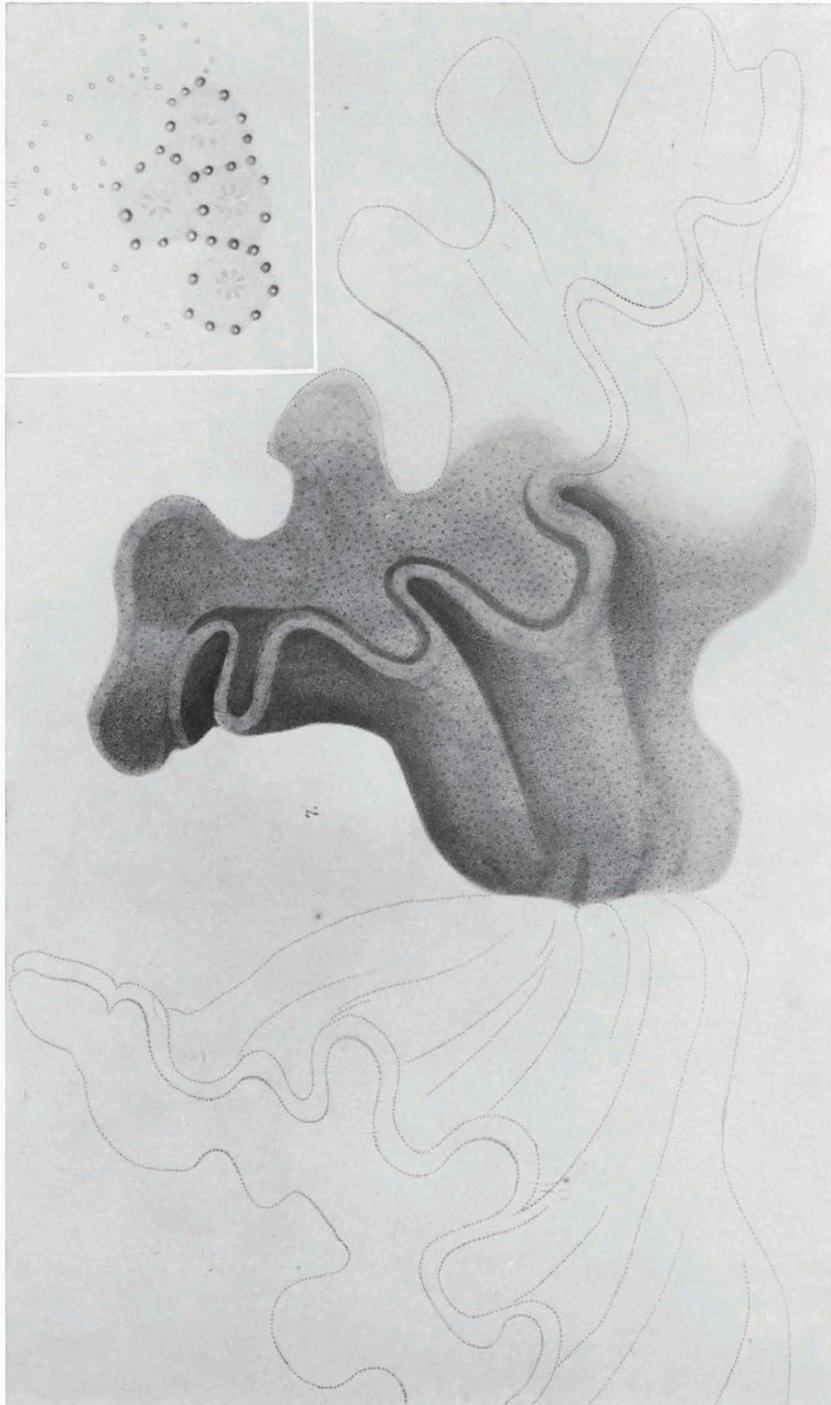
Figs. 1, 2. *S. ehrenbergi* Von Marenzeller, RMNH Coel. no. 6641. 1, seen from above, $\times 0.9$; 2, in side-view; $\times 1$.



Figs. 1, 2. *S. glaucum* (Quoy & Gaimard); $\times 1$. 1, RMNH Coel. no. 11062; 2, RMNH Coel. no. 12854. Fig. 3. *S. flexuosum* Tixier-Durivault, holotype, MNHN; $\times 1$.



Figs. 1, 2. *S. infundibuliforme* Tixier-Durivault; × 1. 1, holotype, MNHN; 2, RMNH Coel. no. 6639.



S. latum (Dana), syntype; photograph taken from Dana's (1846) drawing, pl. 58 figs. 6a and 7 (partly); X 1. (Photograph made by Mr. F. I. M. van Esch, RMNH).

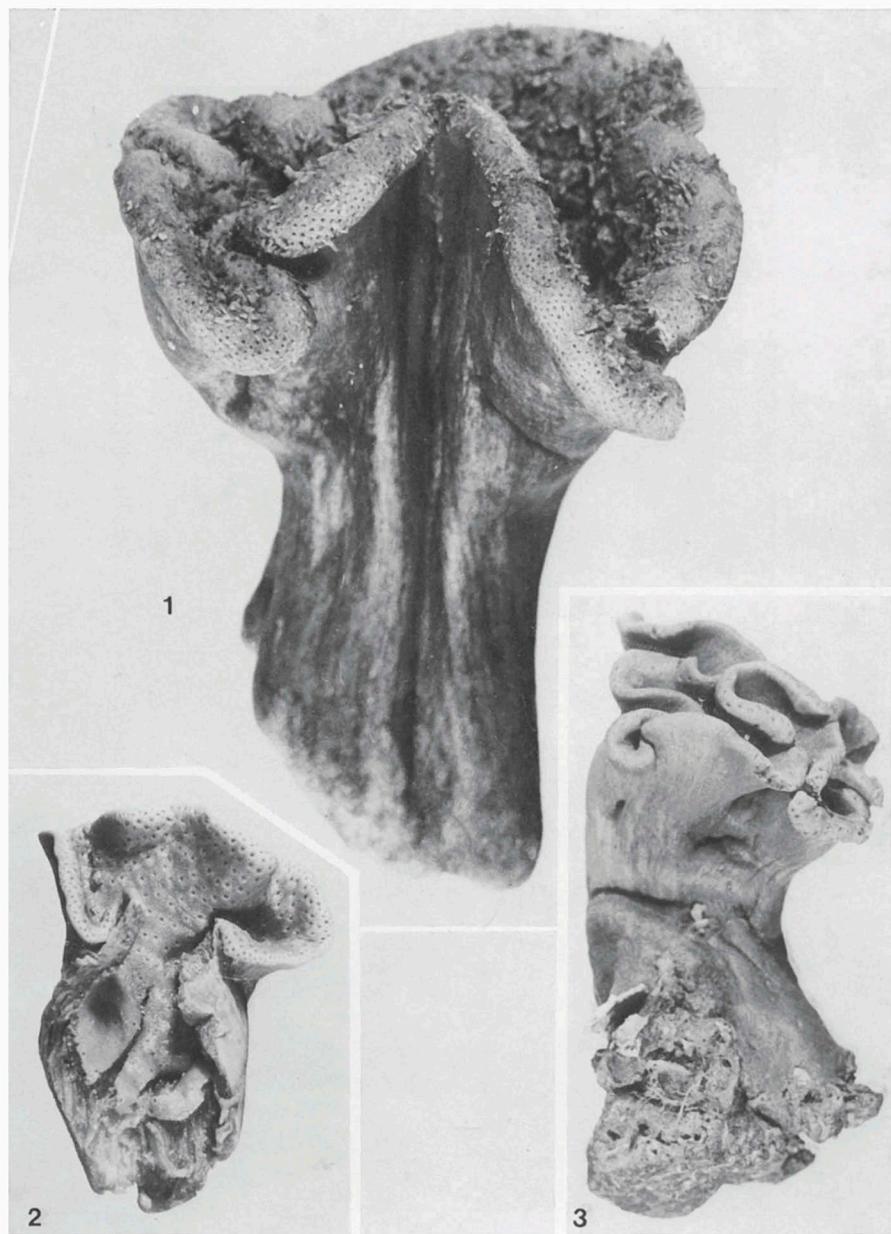
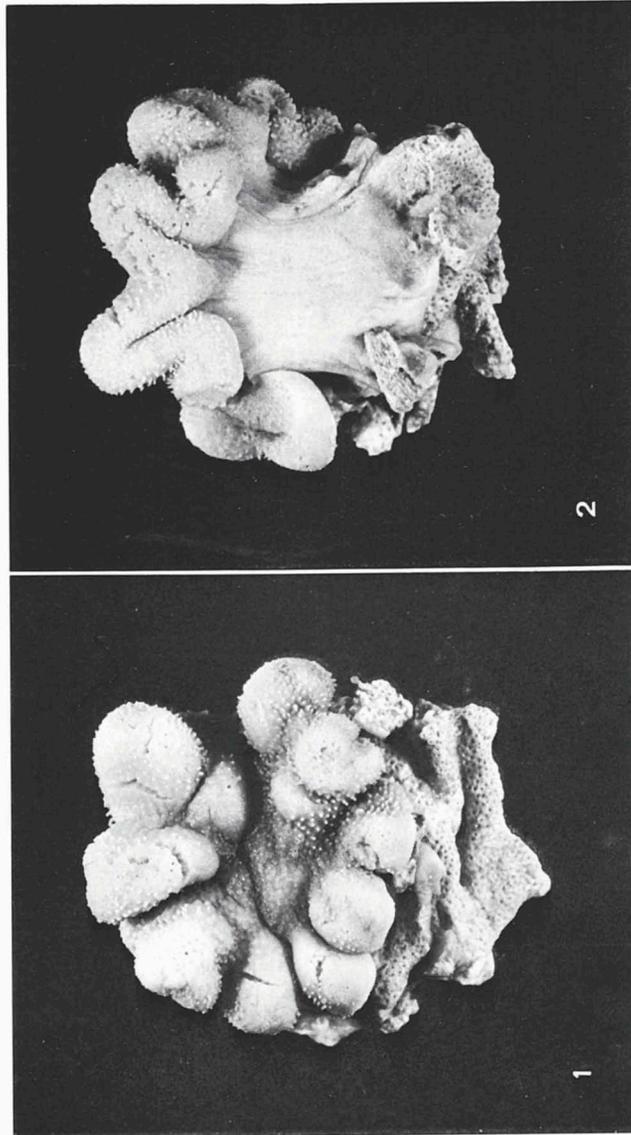


Fig. 1. *S. cinereum* Tixier-Durivault, holotype of "*S. poculiforme*" Tixier-Durivault, MNHN; $\times 1$. Figs. 2, 3. *S. roseum* Pratt; $\times 1$. 2, holotype, BMNH no. 1962.7.20,89; 3, syntype of "*S. convolutum*" Thomson & Dean, ZMA Coel. no. 3161.



Figs. 1, 2. *S. pulchellum* (Tixier-Durivault), holotype, ZMK; $\times 1$.

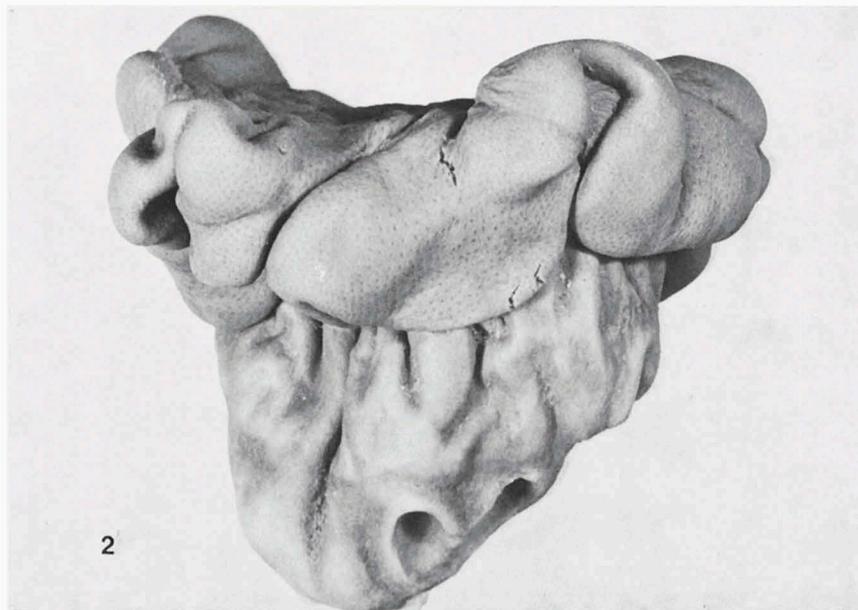
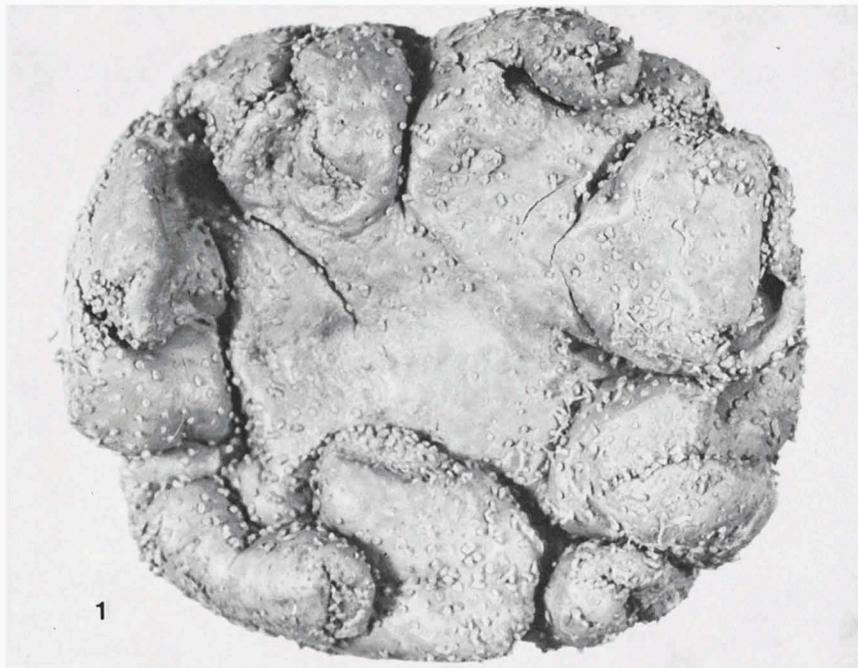
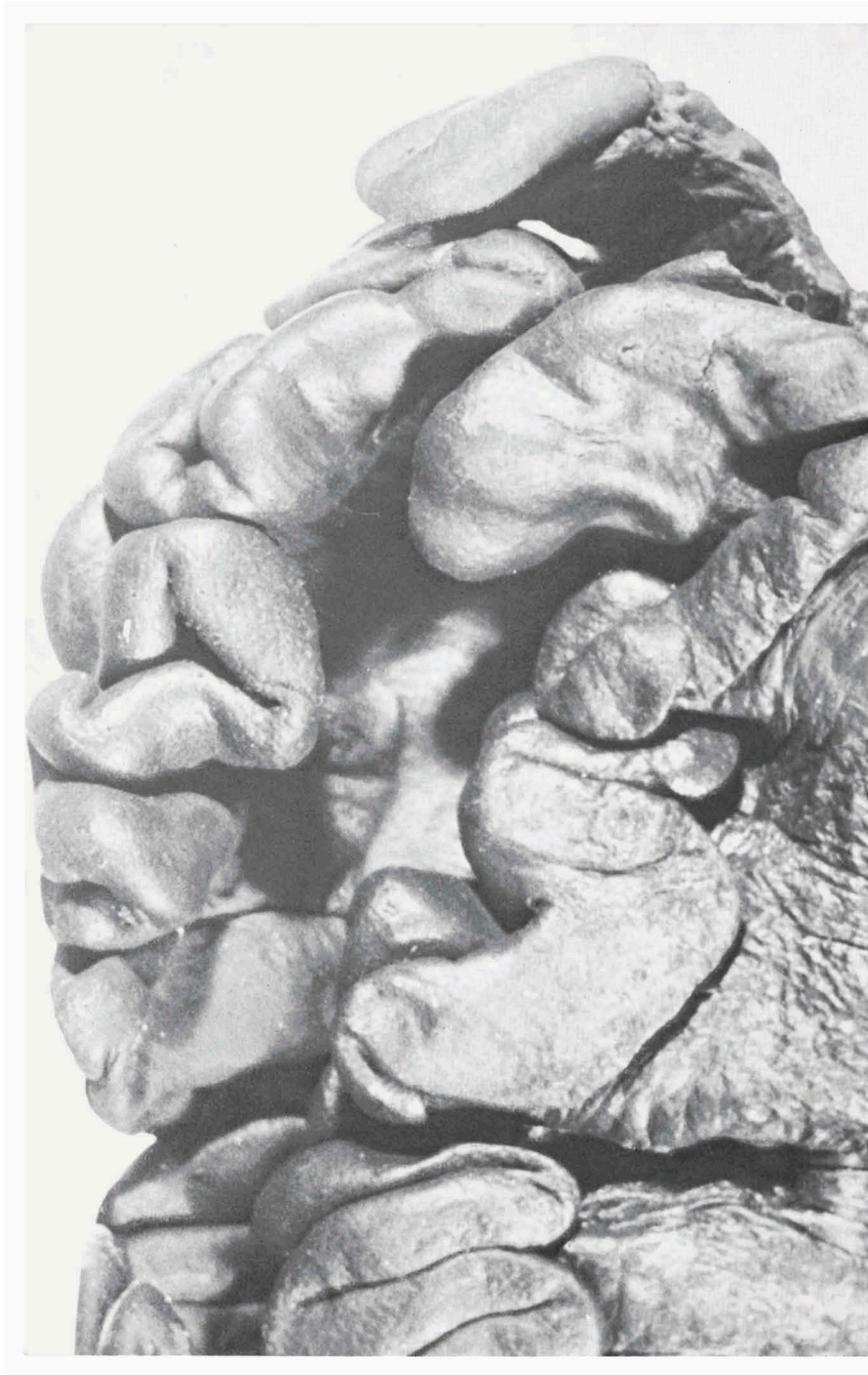


Fig. 1. *S. regulare* Tixier-Durivault, lectotype, MNHN; $\times 1$. Fig. 2. *S. trocheliophorum* Von Marenzeller, lectotype, NHMW no. C2327; $\times 1$.



S. serenei Tixier-Durivault, holotype, MNHN; X 1.



S. solidum Tixier-Durrivault, holotype, MNHN; X 1.

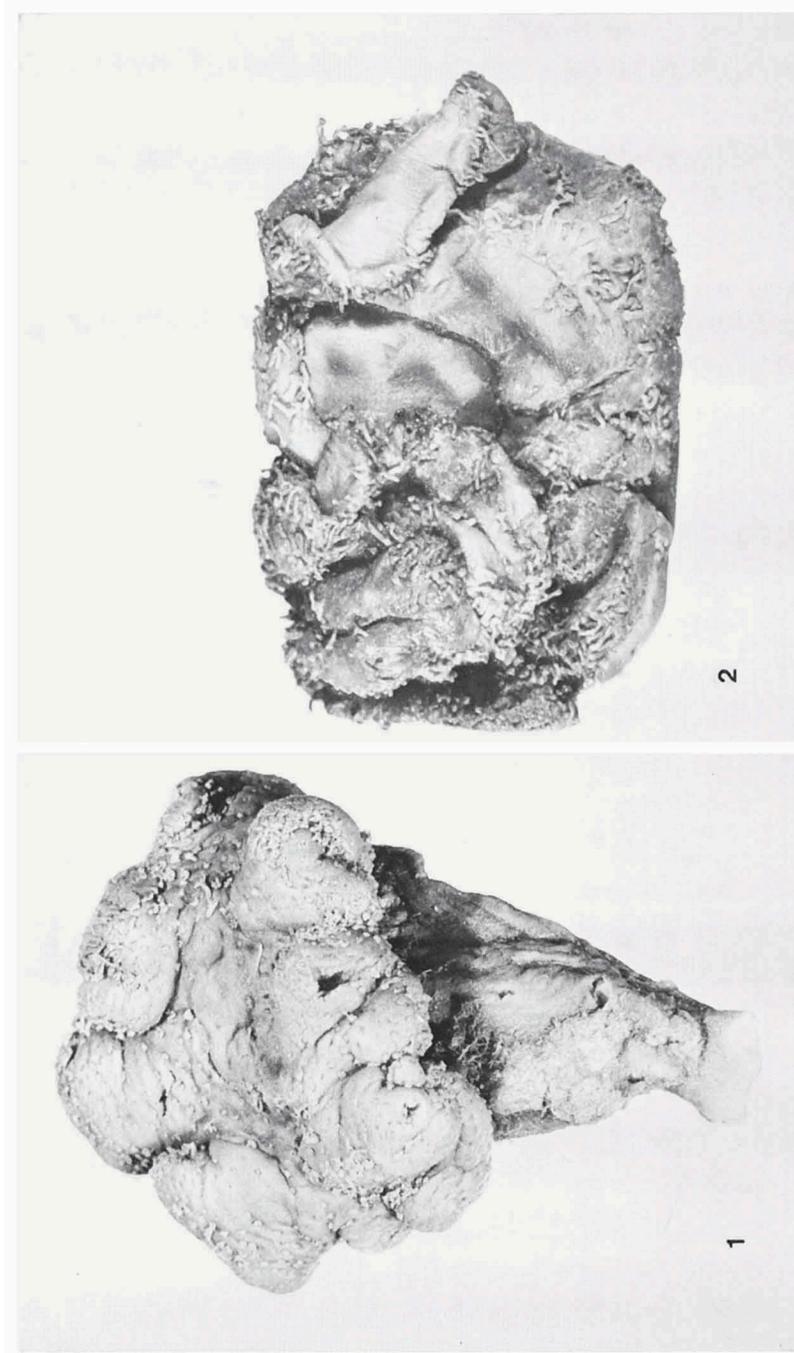
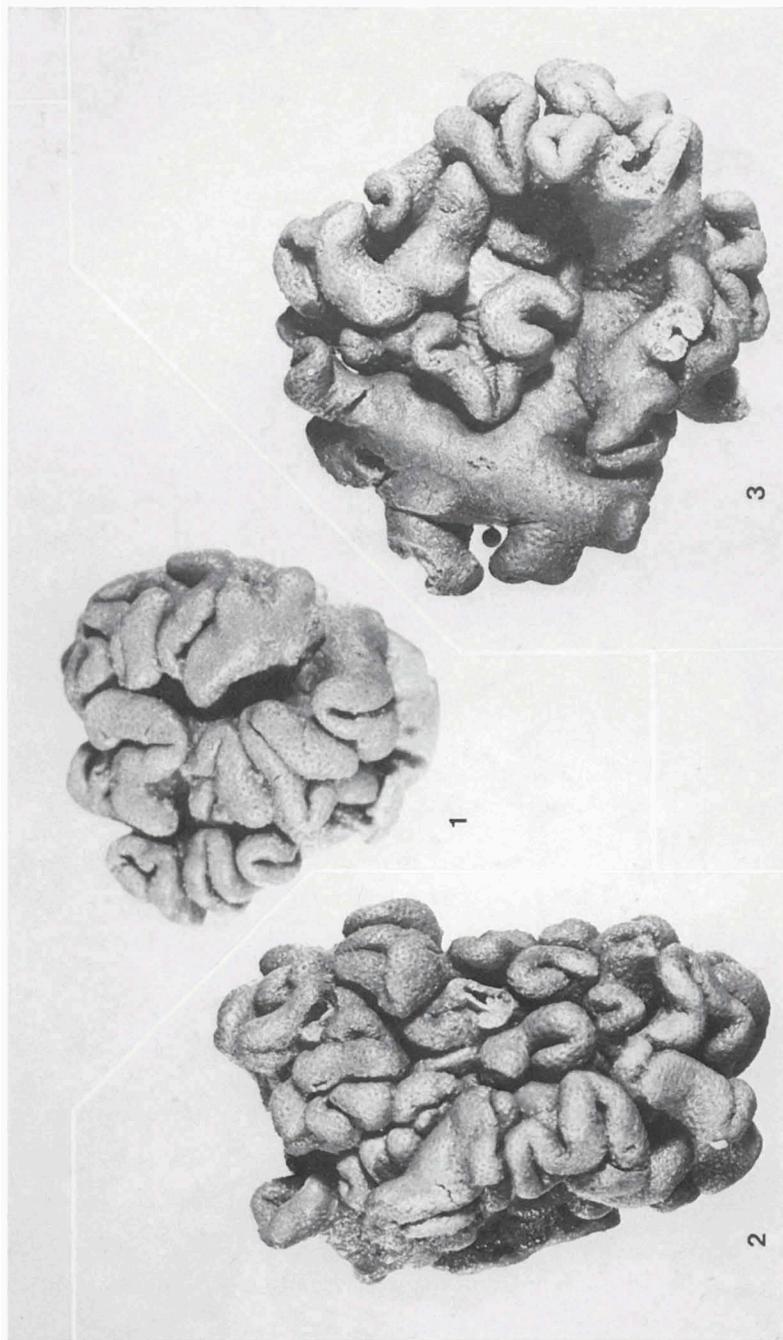
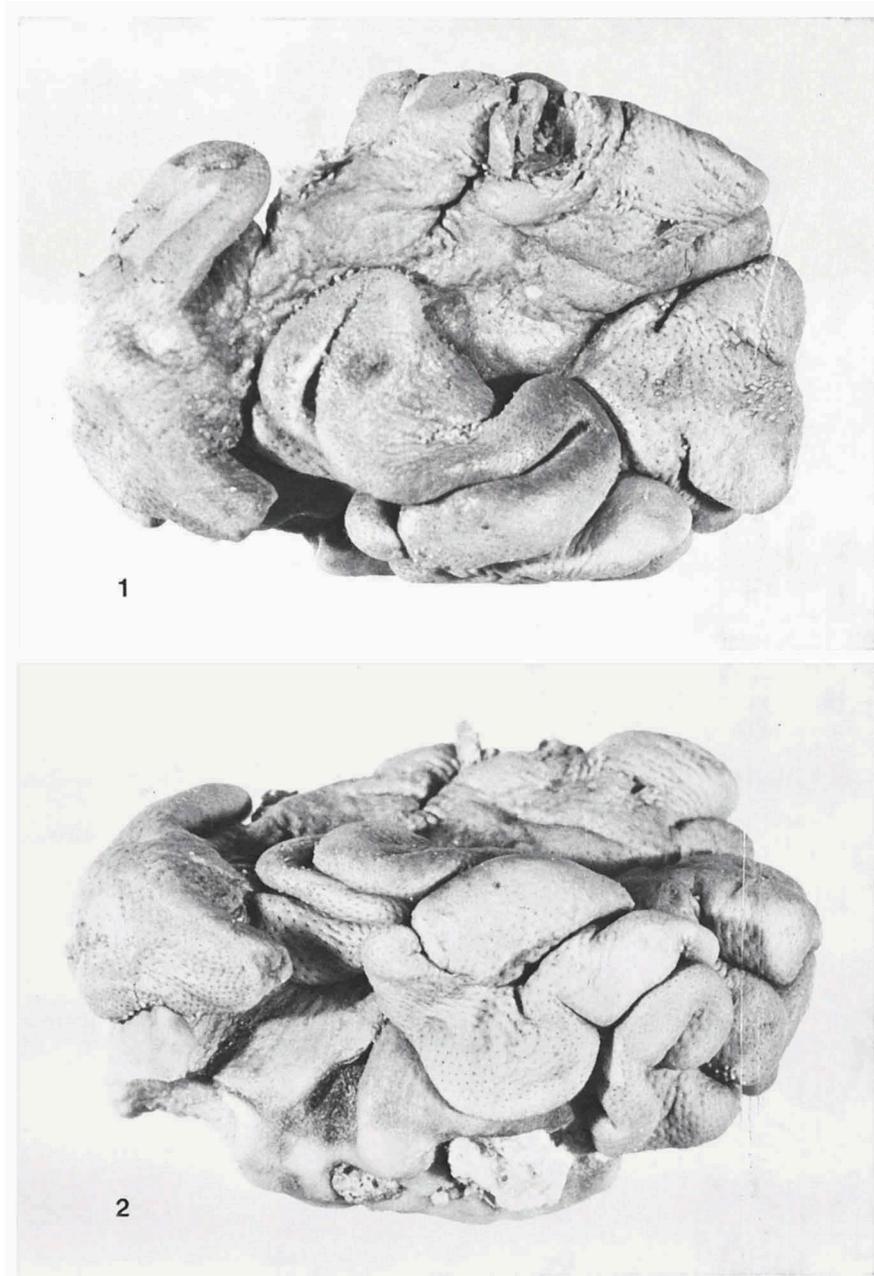


Fig. 1. *S. stellatum* Kükenthal, syntype, ZMB no. 6444; $\times 1$. Fig. 2. *S. subovoid* Tixier-Durivault, type, MNHN; $\times 1$.



Figs. 1-3. *S. tortuosum* Tixier-Durivault; X 1. 1, lectotype, MNHN; 2, 3, RMNH Coel. no. 10446.



Figs. 1, 2. *S. trocheliophorum* Von Marenzeller, paralectotype, ZMH no. C2442; $\times 1$.
(Fig. 2: side-view).