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STYLASTERINA IN THE COLLECTION OF THE PARIS MUSEUM III. STYLASTER FLABELLIFORMIS (LAMARCK)

by

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With Plates X—XIII and 9 text-figures

The last description of the coral *Stylaster flabelliformis* (Lamarck) appeared a century ago (Milne Edwards & Haime, 1857, p. 129). The cited authors listed in the genus *Stylaster* six at the time well-defined species, two of which, *S. flabelliformis* and *S. gracilis,* were characterized by having the "calices" exclusively on the lateral surfaces of the branches. From a modern point of view in the cited publication the specific characters were little clearly defined, consequently Broch (1936, p. 11) had to observe that the identity of *S. flabelliformis* is uncertain.

Fortunately the species is well represented in the collections of the Paris Museum; during a visit in September, 1954, I made notes on the large colonies, while some small fragments were taken to Leiden for examination of the finer structures [1]).

Since the description of the coral (Lamarck, 1816) the name *Stylaster flabelliformis* (originally *Oculina flabelliformis*) has appeared in numerous papers, as shown in the following list (cf. Boschma, 1957, p. 9). Though the greater part of the references here noted are real synonyms, there are a few data of problematic reliability, as shown in the discussion following the list.

Stylaster flabelliformis (Lamarck, 1816)

Coralium album, lapideum, densum ac compactum; ramis laevibus, teretibus, multum divisis Seba, 1761, p. 204.

1) Acknowledgments are due to Dr. G. Ranson for placing the specimens of the Paris Museum at my disposal, and to the Nederlandse Organisatie voor Zuiver-Wetenschappelijk Onderzoek and the Centre National de la Recherche Scientifique for financial aid. Number I (*Distichopora gracilis* Dana) and number II (*Errina amoena* Boschma) of this series appeared in Proc. Kon. Ned. Akad. Wetensch. Amsterdam, series C, vol. 59, 1956.

Oculina flabelliformis Lamarck, 1816, p. 287; Deslongchamps, 1824, p. 575; De Blainville, 1825, p. 355; De Blainville, 1830, p. 345; Gray, 1831, p. 37; De Blainville, 1834, p. 380; Deshayes & Milne Edwards, 1836, p. 457; Milne Edwards, 1849, Atlas, Pl. 83bis; Milne Edwards & Haime, 1849, p. 69; Milne Edwards & Haime, 1850b, p. 95; Boschma, 1955, p. 136.

Stylaster flabelliformis Gray, 1831, p. 37; Milne Edwards & Haime, 1850b, p. 97; Rousseau & Devéria, 1853, Pl. 12; Milne Edwards & Haime, 1857, p. 129; Duchassaing & Michelotti, 1864, p. 69; De Pourtalès, 1867, p. 116; Figuier, 1868, p. 156; Kent, 1870, p. 122; De Pourtalès, 1871, p. 41; Studer, 1877, p. 643; Moseley, 1879, p. 480; Moseley, 1880, p. 86; Perrier, 1881, p. 302; Filhol, 1885, p. 268; Kirkpatrick, 1890, p. 12; Kirkpatrick, 1902, fig. 14; Hickson & England, 1905, p. 7; Hickson, 1912, p. 464; Broch, 1936, p. 11; Dawydoff, 1952, p. 56; Boschma, 1953, p. 166; Boschma, 1956a, p. 157; Boschma, 1956b, p. 281; Boschma, 1957, p. 9.

Oculina gemmascens Ehrenberg, 1834, p. 79; Deshayes & Milne Edwards, 1836, p .457.

Allopora flabelliformis Dana, 1848, p. 694; Milne Edwards & Haime, 1849, p. 69; Dana, 1859, p. 149; Johnson, 1862, p. 197.

Oculina (Stylaster) flabelliformis Milne Edwards & Haime, 1850, p. 99.

Stylaster flagelliformis Giebel, 1864, p. 299.

Occulina flabelliformis Figuier, 1868, p. 155.

Stylaster flabelfiformis Filhol, 1885, fig. 86.

Stylaster flavelliformis Casto de Elera, 1896, p. 838.

The original description (Lamarck, 1816, p. 287) reads:

3. Oculine flabelliforme. *Oculina flabelliformis.*

O. ramosissima, flabellata; ramulis ultimis minimis, brevissimis, crebris, stelliferis; stellis minutis, vix perspicuis.

Seba. mus. 3. tab. 110. f. 10.

Mus. n.°

Habite l'Océan des Indes orientales. Espèce grande, très-belle et extrêmement rare. On la prend, au premier aspect, pour un millépore.

Le *madrepora gemmascens*, Esper. suppl. 1. p. 60. t. 55, semble avoir quelque rapport avec notre espèce; mais l'exemplaire est fruste, très-incomplet.

When describing the species, Lamarck evidently had before him the large colony labelled "Mers des Indes" (Pl. X in the present paper), and probably some other specimens in the Paris Museum without data of locality and collectors. Perhaps Lamarck also examined the large colony collected at Mauritius ("Ile de France") by Péron & Lesueur (Pl. XI in the present paper), but he does not mention the locality. As a synonym Lamarck refers to the coral of Seba (1761, Pl. 110 fig. 10, copied in text-figure 1), *Coralium album, lapideum, densum ac compactum; ramis laevibus, teretibus, multum divisis.* In this coral, however, the manner of branching is different from that of *Stylaster flabelliformis,* the space between the branches not being so completely filled up with small branchlets. In Seba's coral the three main stems are independently diverging in different directions, though apparently more or less in the same plane, while the larger branches have a more acute angle with the main stems. The salient facts from Seba's short description of the coral are: surface of the larger branches smooth, colour of the

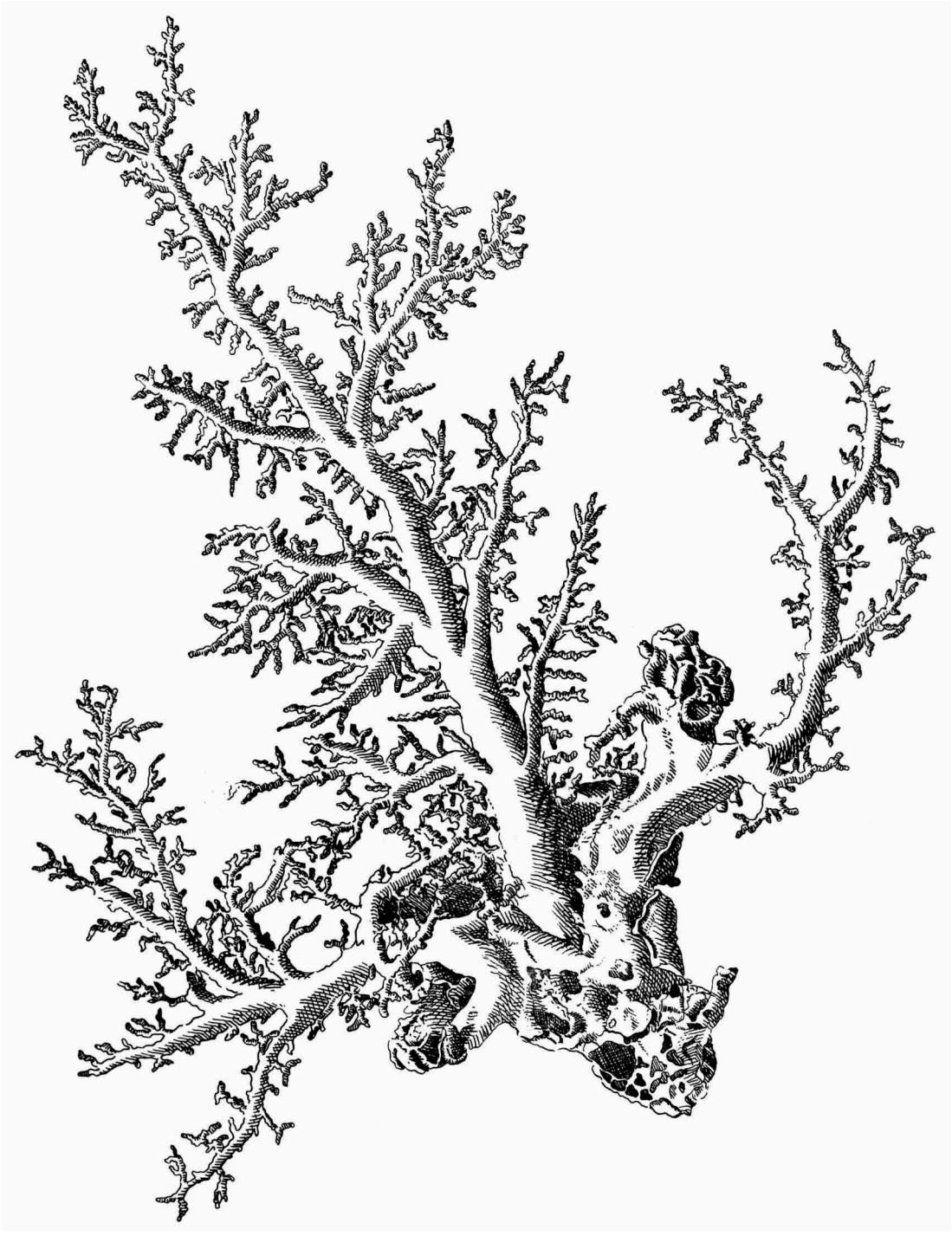

Fig. 1. *Coralium album, lapideum, densum ac compactum; ramis laevibus, teretibus, multum divisis* Seba, 1761, P!. 110 fig. 10. Original size.

coral entirely white, locality the East Indies, data that give no support for definite specific characters.

In earlier times quite another interpretation had been given of Seba's coral. In the tenth edition of his Systema Naturae Linnaeus (1758, p. 791) gave the

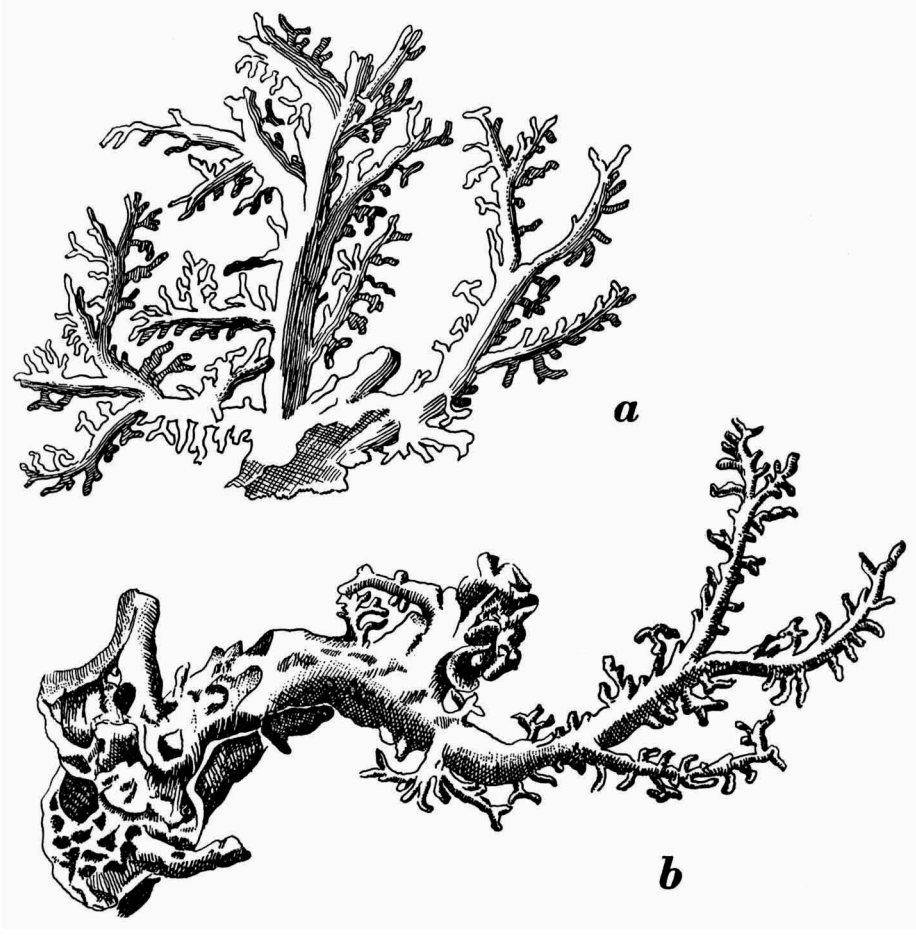

Fig. 2. *Millepora lichenoides* Linnaeus. a, Boddaert, 1768, Pl. 8 fig. 2; b, Wilkens, 1787, Pl. 12 fig. 42. Original size.

name *Millepora lichenoides* to a coral from unknown locality, without any references to other literature. Some years afterwards Pallas (1766, p. 245) again described *M. lichenoides* at some length, adding as references some figures of Marsilli (1725), the coral of Seba's Pl. 110 fig. 10, a figure of Ellis (1755, Pl. 35 fig. B), and the original description of Linnaeus. Pallas

noted that the coral occurs in the Mediterranean and has also been observed at the coasts of Iceland and Norway. Some of Marsilli's figures, based on specimens from the Mediterranean, indeed show a superficial resemblance to Seba's coral; the specimen figured by Ellis, however, is rather strikingly different. In the twelfth edition of his Systema Naturae Linnaeus (1767, p. 1283) cites under *Millepora lichenoides* the data of Marsilli, Ellis, Seba, and Pallas, referred to above, and notes as localities the Mediterranean and Norway. In Boddaert's work, which is largely a translation of Pallas's Elenchus, there is a figure of *M. lichenoides* (1768, Pl. 8 fig. 2, copied in fig. 2a of the present paper), which is based on Marsilli's figures and certainly has some resemblance to the coral of Seba (cf. fig. 1 in the present paper). The same holds, even more distinctly, for a figure of Wilkens (1787, Pl. 12 fig. 42, copied in fig 2b of the present paper), which in the explanation of the plates is noted as an original figure of *M. lichenoides*.

The concept of the species *Millepora lichenoides* apparently was based on heterogeneous elements, the Mediterranean specimens of unknown systematic position (the figures of Marsilli and of Boddaert), the entirely different coral figured by Ellis, and the Stylasterine coral described by Seba, while Wilkens's figure to all appearances may represent a Stylasterine coral of a similar shape, all the forms here being dealt with presenting distinct differences from *Stylaster flabelliformis*.

Some years after Lamarck described the species *Oculina flabelliformis* a description of this coral was published by Deslongchamps (1824, p. 576), proving that this author had examined actual specimens, the particulars here noted in some respects supplementing those of Lamarck:

> Flabelliforme; tiges grosses, à surface un peu inégale; rameaux subdichotomes, les uns et les autres sans cellules; ramuscules petits, très-élégans, naissant latéralement des tiges et des rameaux, portant de chaque côté de petites cellules striées antérieurement, alternes, et faisant paroître comme dentelés en leurs bords les ramuscules qui ne sont point coalescens comme dans l'espèce précédente. [*Oculina infundibulifera*].

The description of the genus *Stylaster* (Gray, 1831, pp. 36/37) reads (notes on comparison with certain Madreporarian corals omitted):

> Gen. STYLASTER.
>
> Coral subcylindrically branching with scattered cells; cell deep cylindrical, base with a central, subcylindrical tubercle with a rounded end about one half of the height of the cell; edge with a raised rim, with numerous small notches in its inner edge, each ending in a pore; surface of the coral scattered with minute simple pores and vesicular tubercles.
>
> Two species may be referred to this genus.
>
> *Oculina rosea.* Rose coloured, with the cells scattered on the whole surface.
>
> *Oculina flabelliformis.* Pale yellowish red. The coral fanshaped, the branches compressed, with the cells forming series along each side.

It is interesting to note that Gray characterizes *Stylaster roseus* as having the cyclosystems scattered on the whole surface; this proves that he examined specimens corresponding with the data published on the species in the later part of the eighteenth century (cf. Boschma, 1955). On the other hand Gray's identification of *Stylaster flabelliformis* is not altogether certain, for he notes the colour as pale yellowish red instead of pure white, though the statement of the cyclosystems being arranged in series along each side is characteristic of the species.

Ehrenberg (1834, p. 79) followed Lamarck by erroneously identifying *Oculina flabelliformis* with "*O. gemmascens* Auct." and placing as synonyms Seba's coral and Esper's *Madrepora gemmascens*. Ehrenberg's description of the specimen in the Berlin Museum (Octo pollices lata, 3 alta, ramosissima, flabellata, eburnea, ramulis ultimis minimis, brevissimis, crebris, stelliferis, stellis minutis, vix perspicuis, lamellis exsertis, revolutis) is too concise to determine the exact status of the coral.

Dana (1848, pp. 694/695) placed the species *flabelliformis* in the genus *Allopora,* while mentioning Seba's coral as a synonym, adding that in the Boston City Museum there is a specimen closely resembling this coral. The measurements given by Dana (whole colony eight inches high (about 18 cm), cyclosystems one-sixth of a line in diameter (about 0.35 mm), the zigzag appearance of the smaller branches, as represented in Dana's Pl. 60 fig. 7) correspond sufficiently with the characters of the large colonies in the Paris Museum to provisionally regard the identification as correct.

In the "Disciples' Edition" of Cuvier's Règne Animal the part dealing with the Zoophytes, by Milne Edwards, appeared from 1836 to 1849. According to Sherborn (1922) the pages 129-160 were published in 1849, accordingly the passage dealing with the Oculinidae (l. c., p. 138) dates from the cited year. Here the only note of any importance is the explanation of the Plate 83bis:

Fig. 1. Oculine flabelliforme. *Oculina flabelliformis*. Lam. Portion du polypier de grandeur naturelle, d'après l'exemplaire de la collection du Muséum décrit par Lamarck.
Fig. 1a. Portion d'une des branches, grossie pour montrer la disposition des cellules.

The larger figure of Plate 83bis is an accurate drawing of the greater part of the large colony of *Stylaster flabelliformis* from Mauritius ("Ile de France"), collected by Péron & Lesueur (Pl. XI of the present paper). The drawing represents the coral at about 15/22 the natural size. As Péron died in the year 1810, the colony from Mauritius to all appearances formed part of the collections of the Paris Museum at the time Lamarck (1816) wrote his description of the species. In this description he noted "Habite l'Océan des Indes orientales", and as in the Paris Museum there is a large colony

bearing a label with the locality "Mer des Indes" (Pl. X in the present paper) it is probable that the last mentioned specimen formed the base for Lamarck's description, and not the colony from Mauritius indicated by Milne Edwards as the specimen described by Lamarck.

Fig. 1a of Milne Edwards's Plate 83bis (copied in text-figure 3 of the present paper) is an enlarged view of a small branch, seen from the anterior or the posterior surface. The figure shows that the cyclosystems, except the terminal ones, rise very little above their surroundings (cf. also Pl. XIII in the present paper). The figure, however, gives a wrong impression in so far as most of the non-terminal cyclosystems seem to be incomplete, the adcauline dactylopores not having been drawn. Moreover, the cyclosystems are not drawn in a distinctly sideways direction, as this invariably occurs in the actual specimens. The figure shows five cyclosystems with 8 dactylopores, two with 9, six with 10, three with 11, and one with 12, yielding an average

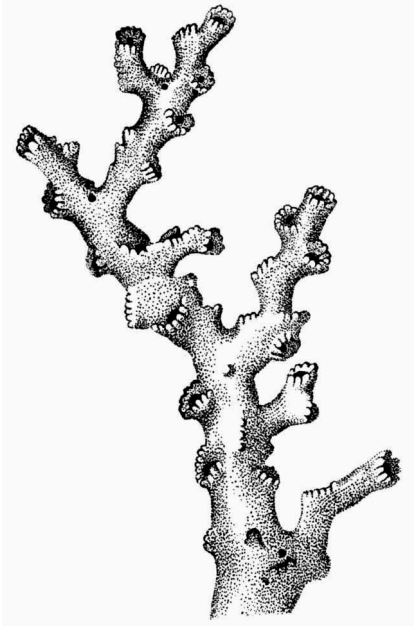

Fig. 3. *Oculina flabelliformis* Lamarck. After Milne Edwards, 1849, Pl. 83bis fig. 1a. 1½ × original size.

of 9.6 dactylopores in a cyclosystem, a slightly smaller value than the figure obtained as an average of 100 cyclosystems (10.33) in fragments of the colony from Mauritius, the smaller number obviously being due to the omission of the adcauline dactylopores. The figure is further interesting as

it shows a few of the blunt spines as they occur on the anterior and the posterior surfaces of the larger branches.

Milne Edwards & Haime (1849) mention the species *Oculina rosea* and *flabelliformis* as examples of the genus *Allopora* Ehrenberg (*Stylaster* Gray). Another publication of the same authors (Milne Edwards & Haime, 1850a) is of great importance as it contains a short diagnosis of the genus *Stylaster,* followed by the remark (l.c., p. xxii): "Typ. sp., *Stylaster rosea,* Gray, loc. cit.; *Oculina rosea,* Lamarck, op. cit., t. xi, p. 287; Esper., tab. xxxvi." Though the cited authors in all probability only intended to mention a representative (typical) species of the genus, the statement "Typ. sp." later has been interpreted as a designation of the type species of the genus, and *Stylaster roseus* has to stand as such. It is to be regretted that as the type of the genus *Stylaster* a species has been selected that only in a restricted sense shows the peculiarities in which the genus differs from the closely allied genus *Allopora.* In many species of the genus *Stylaster,* e.g., *S. flabelliformis,* the cyclosystems occur practically exclusively on the lateral surfaces of the branches, while in the species of *Allopora* the cyclosystems are scattered all over the branches. Unfortunately *Stylaster roseus* shows the typical characters of the genus in its smaller branches only, the larger branches having an arrangement of the cyclosystems as it occurs in the genus *Allopora* (cf. Boschma, 1955). The coral therefore occupies a more or less intermediate position between the genera *Stylaster* and *Allopora,* and is accordingly badly chosen as the type of the genus *Stylaster.* As mentioned above, Gray (1831) already noted that in *S. roseus* the cyclosystems are scattered over the whole surface while in *S. flabelliformis* they are confined to the sides of the branches.

In the literature dealing with the coral *Stylaster flabelliformis* the most detailed description of the species is the one by Milne Edwards & Haime (1850b, p. 97):

> *Polypier* flabelliforme, à rameaux très inégaux suivant leur ordre de succession, naissant le plus souvent à angle très ouvert, très serrés, mais non coalescents, les calices ne se présentant que sur deux rangées opposées, et jamais sur les faces latérales des rameaux. La surface des grosses branches est lisse, et montre au microscope des stries granulées extrêmement fines. Les branches moyennes sont couvertes de petites pointes; mais on n'observe jamais de tubercules vésiculaires. *Calices* circulaires profonds. Une douzaine de cloisons peu développées et très légèrement débordantes. Diamètre des plus gros rameaux, 1 centimètre; des calices, un peu plus de ½ millimètre.
>
> Habite l'île Bourbon. Elle y a été prise par M. Louis Rousseau, par 160 brasses de profondeur. Elle est des Indes orientales, suivant Lamarck. — Musée de Paris, Michelin.

The "faces latérales" are what at present are named the anterior and the posterior surfaces; the "petites pointes" are the blunt wart-like spinules occurring on the larger branches; the "tubercules vésiculaires", not found by

the cited authors, are the ampullae, which are of very small size in the species (0.3-0.5 mm in diameter). Several cyclosystems indeed have a number of twelve dactylopores ("une douzaine de cloisons"), but the average in a large colony from Réunion ("Ile Bourbon") is 10.74. The diameter of the cyclosystems (½ millimeter) closely corresponds with the average of the 26 figured cyclosystems of the large colony of Réunion (fig. 5 in the present paper; average diameter of the cyclosystems 0.56 mm). Milne Edwards & Haime examined one or more of the colonies from Réunion (Ile Bourbon), collected by Rousseau. They further state that the species is represented in the Michelin Collection; this was the colony labelled "Mer des Indes" (Pl. X in the present paper).

A photograph of the large colony from Mauritius, collected by Péron & Lesueur (Pl. XI in the present paper), on slightly over half the natural size, appeared in a work by Rousseau & Devéria (1853, Pl. 12 of the first series).

The description of *Stylaster flabelliformis* in Milne Edwards & Haime (1857, p. 129) does not noticeably differ from the one of 1850 b cited above. Here again the coral of Seba's Pl. 110 fig. 10 is listed as a synonym of the species.

Figuier (1868, fig. 69) has a figure of *Stylaster flabelliformis* showing a part of one of the large colonies in the Paris Museum, evidently of the specimen of Péron & Lesueur from Mauritius.

In his report on certain corals obtained by the "Gazelle" Studer (1877, p. 635) lists the species *Stylaster flabelliformis*, adding only the following remark: "Feine Ästchen dieser zierlichen Art wurden in Bougainville, Salomonsinseln, erlangt." The identification needs confirmation, because the only localities from which the species is known are the Mascarene Islands in the southwestern part of the Indian Ocean.

Perrier (1881, p. 302) and Filhol (1885, p. 268) mention *Stylaster flabelliformis*, and have illustrations made after Plate 83bis of Milne Edwards (1849).

Kirkpatrick (1890) records *Stylaster flabelliformis* from Garvan Reef in the China Sea, mentioning the species by name only. Provisionally this record must remain doubtful. The same applies to the note on the species by Casto de Elera (1896, p. 838), who mentions Cebu in the Philippine Islands as a new locality, apparently based on a specimen in the Manila Museum, now destroyed.

The identification of a specimen in the British Museum, locality not noted (Kirkpatrick, 1902, fig. 14), seems to be correct, the figure showing the manner of branching as it is characteristic of the species.

Broch (1936, pp. 10/11) points to the lack of reliability of the data of older authors concerning the number of dactylopores in the cyclosystems of *Stylaster* and *Allopora*, and cites as one of his examples the "douzaine de cloisons" as noted by Milne Edwards & Haime for *Stylaster flabelliformis*. As far as this species is concerned he concludes that the specific identity still remains uncertain.

In his inventory of the benthic animals collected by him in the maritime region of Indochina Dawydoff (1952, p. 56) mentions the species *Stylaster flabelliformis*. This record again must remain uncertain as long as no data are available in support of the identification.

The data listed above lead to the conclusion that up to the present time the species *Stylaster flabelliformis* is known to occur only in the Mascarene Islands Mauritius and Réunion. Lamarck's vague locality "Océan des Indes orientales" was based upon the label "Mer des Indes" of the specimen in the Michelin Collection. As "Mer des Indes" undoubtedly includes the south-western part of the Indian Ocean, the type locality of the species may be restricted to Mauritius, the locality of the largest colony in the Paris Museum.

Specimens examined

The following is an annotated list of the specimens in the collection of the Paris Museum, each preceded by an arbitrary number (259, etc.) that is also used on following pages to avoid lengthy indications of the various specimens.

No. 259 (Pl. XI, Pl. XIII fig. 1, text-figs. 3, 4, 7a-d). Labelled "*Stylaster flabelliformis* (Lmk.), Ile de France, Mrs. Péron et Lesueur". Colony nearly completely in one plane, anterior surface (Pl. XI) slightly concave, posterior surface slightly convex. Height 40½ cm, breadth 37½ cm, basal parts of main stems 1 cm in diameter or slightly thicker. Many of the small branchlets bear a fairly large number of ampullae, on the posterior surface these are slightly more numerous than on the anterior surface.

No. 260 (Pl. XII, Pl. XIII fig. 3, text-figs. 5, 8a-f). Labelled "*Stylaster flabelliformis* (Lmk.), Ile Bourbon, Mr. L. Rousseau". Colony nearly completely in one plane, attached to the stem of a Gorgonian coral. Height (measured perpendicular to the stem of the Gorgonian coral) 19½ cm, breadth (greatest spreading) 24½ cm. Basal part of main stem about 8 mm in diameter. Ampullae more numerous on the posterior surface (Pl. XII) than on the anterior surface.

No. 261. Labelled "*Stylaster flabelliformis* (Lmk.), Ile Bourbon, Mr. L. Rousseau". A rather damaged colony consisting of the lower parts of two main stems with a number of side branches. Height 14 cm, breadth

15½ cm. The whole colony practically in one plane; on one of the surfaces the ampullae are somewhat more numerous than on the other, the last mentioned apparently being the anterior surface.

No. 262. Labelled "*Stylaster flabelliformis* (Lmk.), Rade de Saint-Denis, Mr. L. Rousseau". One main stem with numerous side branches, upper part of the colony broken off. Height 20½ cm, breadth 16 cm, diameter of basal part of main stem 1 cm approximately. The whole colony practically spreading in one plane. Both surfaces bear numerous ampullae, though on the slightly convex (posterior) surface they occur in greater number than on the slightly concave (anterior) surface. As a rule the ampullae of this colony are covered with a few small blunt spines.

No. 264 (Pl. X, Pl. XIII fig. 2, text-figs. 6, 8g-i). Labelled "*Stylaster flabelliformis,* Mer des Indes, Coll. Michelin". Colony nearly completely in one plane, anterior surface (Pl. X) slightly concave, posterior surface slightly convex. Height 24 cm, breadth 21½ cm; basal part of main stem approximately 6 mm in diameter. Ampullae numerous on both surfaces of the colony, though decidedly more plentiful on the posterior surface than on the anterior. The ampullae are hemispherical, with a smooth surface or covered with a few small blunt spines.

No. 267. Without label, on wooden pedestal in bell-glass. Main part of the colony in one plane, some small fan-like parts before or behind the main part. Height of the colony approximately 23 cm (extreme basal part in pedestal), breadth 15 cm, basal part of main stem 15 mm in diameter. A great number of ampullae on both surfaces of the colony, chiefly on the smaller branches (difference in occurrence on the two surfaces not noted).

No. 325. Labelled on wooden support "*Oculina flabelliformis* mus.", on paper labels "*Stylaster flabelliformis,* Echant^{on} de Lamarck" and "*Oculina flabelliformis* Lamarck, t. II, p. 287, 1816 — 2e édit. p. 457". In the Paris Museum the specimen is preserved in the type collection of the species described by Lamarck. It is a small fragment consisting of two nearly parallel main branches that have united in several places and bear a small number of minute side branches. The manner of branching and the ampullae closely correspond with what is to be observed in the large colony from Mauritius (no. 259). The larger branches are minutely striated, just as in the other specimens. The fragment has a length of 105 mm, its breadth is 32 mm, the larger branches are up to 5 mm thick.

No. 335 (Pl. XIII fig. 4). Labelled "*Stylaster flabelliformis* M. Edw. et J. Haime". A fragment, 57 mm long, 20 mm broad. The surface of the branches is minutely striated, on the small branchlets there are many ampul-

lae, some of which bear a number of small blunt spines; the large branches show numerous small tubercles.

As far as the localities are concerned, no. 259 is from Mauritius, nos. 260, 261, and 262 are from Réunion, no. 264 is from "Mer des Indes", nos. 267, 325, and 335 are from unknown localities.

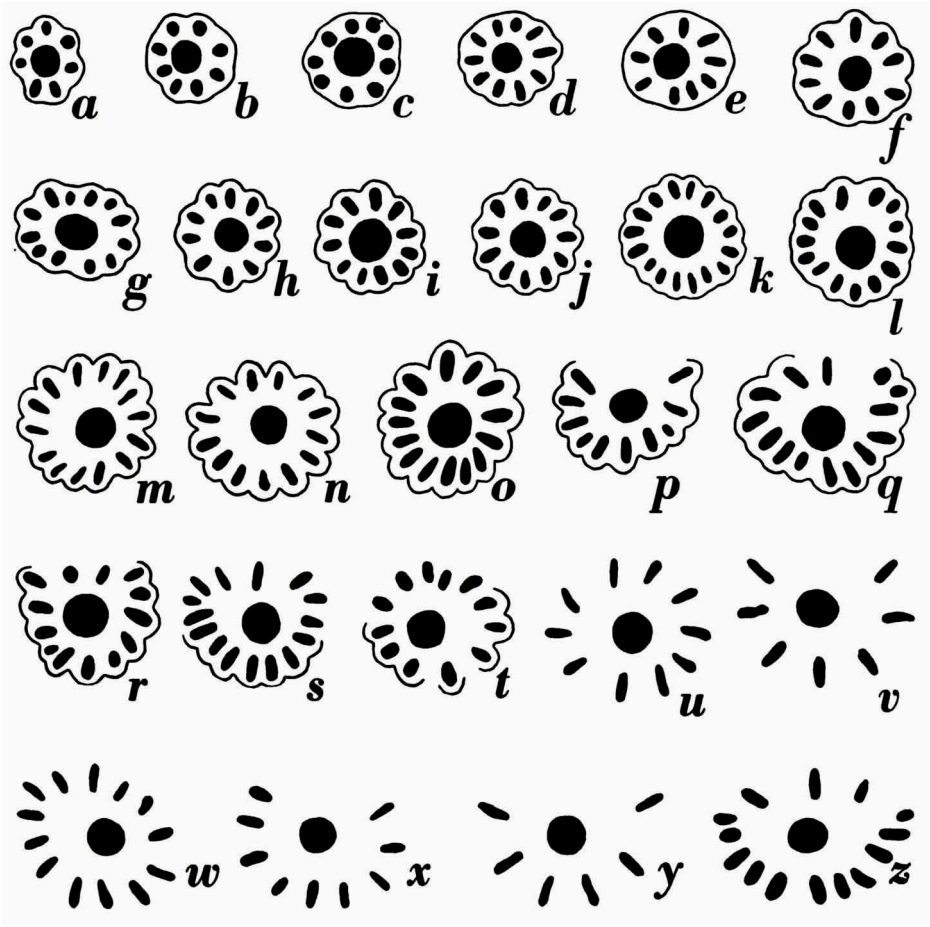

Fig. 4. *Stylaster flabelliformis* (Lamarck), specimen no. 259 (Mauritius). Top view of twenty-six cyclosystems, gastropores and dactylopores represented in black. × 30.

The colour of all the specimens examined is pure white.

Remarks on the finer structures

The youngest, terminal cyclosystem of each branchlet is distinctly stalked (Pl. XIII), the next cyclosystem develops on the top of the growing branch-

let, arising at the margin of the previous one, the latter thereby becoming sessile. The youngest branchlets are slightly zigzag-shaped, during further growth they become straight. On the smaller branchlets all the cyclosystems

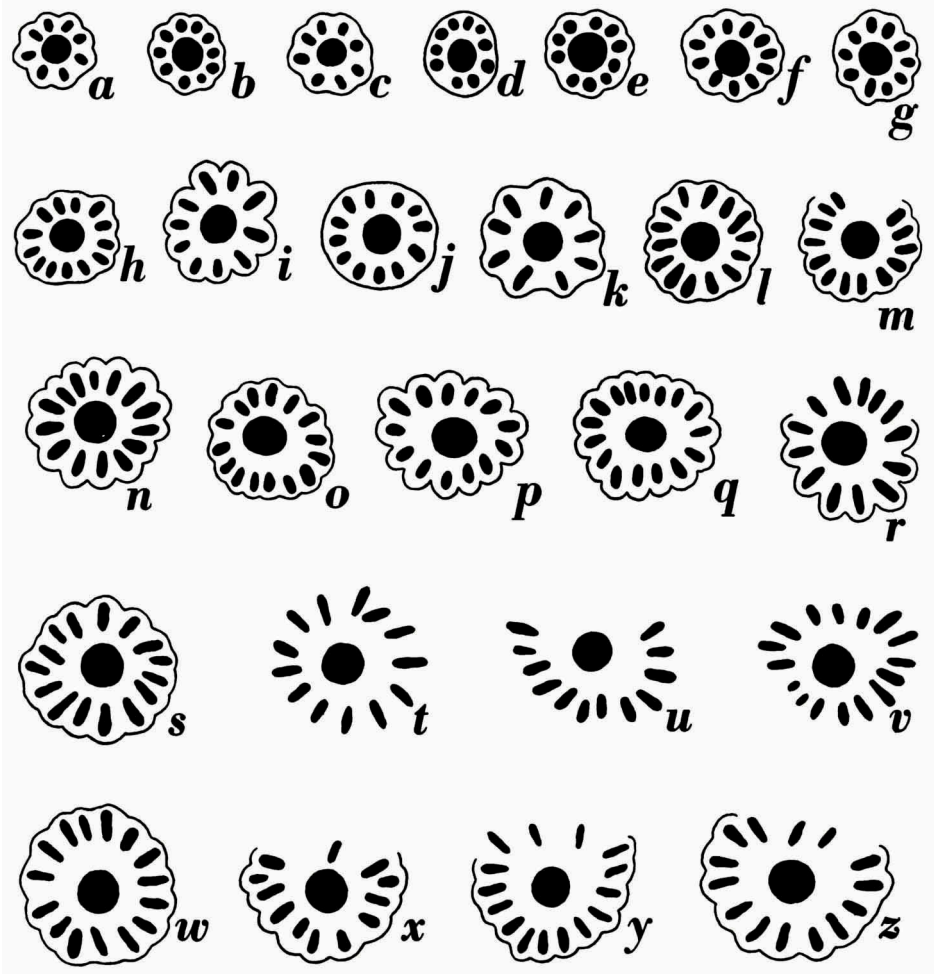

Fig. 5. *Stylaster flabelliformis* (Lamarck), specimen no. 260 (Réunion). Top view of twenty-six cyclosystems, gastropores and dactylopores represented in black. × 30.

remain complete, on the larger branches some of the cyclosystems have become incomplete, because the adcauline dactylopores of the older cyclosystems have a tendency to disappear.

Twenty-six cyclosystems, selected at random from various parts of the colony no. 259, are drawn in fig. 4, more or less diagrammatically, showing

the gastropores and the dactylopores in black. The sequence of the figures approximately shows the gradual development from young cyclosystems to older ones, coupled with a distinct increase in size, the young cyclosystems having a diameter of 0.3 to 0.5 mm (fig. 4 a-f), the oldest of 0.7 to 0.9 mm

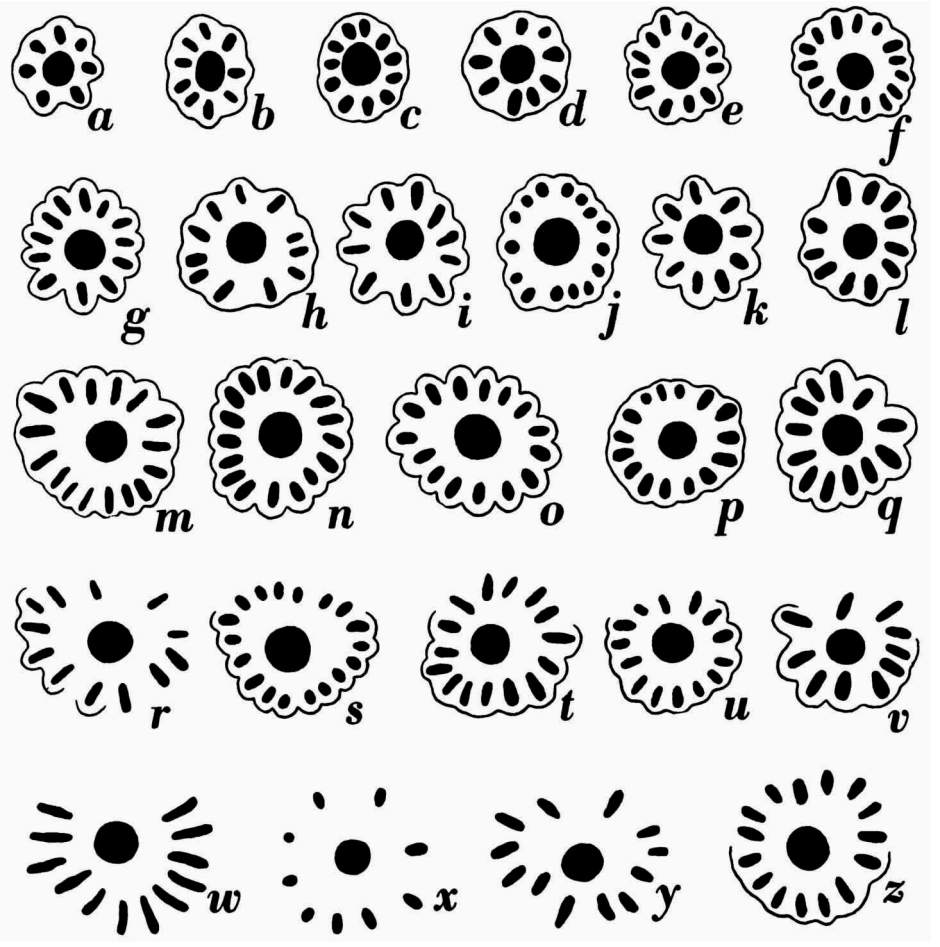

Fig. 6. *Stylaster flabelliformis* (Lamarck), specimen no. 264 ("Mer des Indes"). Top view of twenty-six cyclosystems, gastropores and dactylopores represented in black. × 30.

(fig. 4 u-z). The young cyclosystems have 6 to 10 dactylopores closely joining the gastropore, the dactylopores themselves being circular or slightly elliptical in top view (fig. 4 a-f); during further growth the dactylopores diverge from the gastropore, and become more distinctly elliptical (fig. 4 m-t), while in still older cyclosystems the dactylopores often become comparatively long narrow slits, rather widely separated from the gastropore (fig. 4 u-z).

The number of dactylopores sometimes increases to 15 (fig. 4 s) or 16 (fig. 4 k); during further development as a rule the number decreases again, so that some of the older cyclosystems have very few dactylopores (7 in fig. 4 v, 6 in fig. 4 y). Further details of variation of the cyclosystems are apparent from the figures.

The young cyclosystems often have a more or less circular contour (fig. 4 c, e), in their further development the margin usually becomes distinctly crenulated (fig. 4 h-j, m-o). On the small branchlets all the cyclosystems are complete, on the larger branches there are to be found a few incomplete ones (fig. 4 p, v, x, y). Incomplete cyclosystems are comparatively rare, for many of the oldest cyclosystems still have a complete ring of dactylopores (fig. 4 u, w, z).

On the smaller branches the margins of all the cyclosystems extend somewhat above the surrounding parts, on larger branches often the adcauline region of the margin disappears (fig. 4 p-t), and on still larger branches often the whole of the margin vanishes (fig. 4 u-z). Cyclostystems without distinct margins as a rule have dactylopores of a pronouncedly elongated shape, the structures as a whole showing definite symptoms of reduction.

The cyclosystems of *Stylaster flabelliformis* do not have distinct pseudosepta, and there are no distinct dactylotomes, the dactylopores presenting themselves as simple openings in the marginal region only.

Altogether similar peculiarities are to be observed in the cyclosystems of the colony no. 260 (fig. 5). Here again there is a striking difference in size between young cyclosystems and older ones. Of the here represented cyclosystems the youngest (fig. 5 a-d) have 8 to 10 dactylopores, while among the older ones there are two with 16 each (fig. 5 q, v). Among the cyclosystems in which the marginal parts do not rise above the surface of the branch there is one with an incomplete ring of dactylopores (fig. 5 u), while in others the ring is still complete (fig. 5 t, v).

In the colony no. 264 the cyclosystems closely correspond with those of the other colonies. The youngest of the figured cyclosystems (fig. 6 a) has 7 dactylopores, among the older ones there are several with 15 (fig. 6 f, j, o, p, t, z), one with 16 (fig. 6 m), one with 17 (fig. 6 n), and one with 18 (fig. 6 s). One of the oldest cyclosystems has dactylopores that appear in top view as long narrow slits (fig. 6 w), in another the dactylopores are reduced to narrow openings often of nearly cicular shape (fig. 6 x).

The number of dactylopores was counted in 100 cyclosystems of no. 259, in 50 of no. 260, and in 50 of no. 264 (the cyclosystems not necessarily including those of figures 4-6). The result is shown in the following table.

Number of dactylopores in a cyclosystem	6	7	8	9	10	11	12	13	14	15	16	17	18	
No. 259	4	6	9	15	24	15	11	5	8	2	1			100 cyclosystems
No. 260		2	4	6	16	8	3	6	2	1	2			50 cyclosystems
No. 264		1	2	9	8	8	12	—	1	6	1	1	1	50 cyclosystems

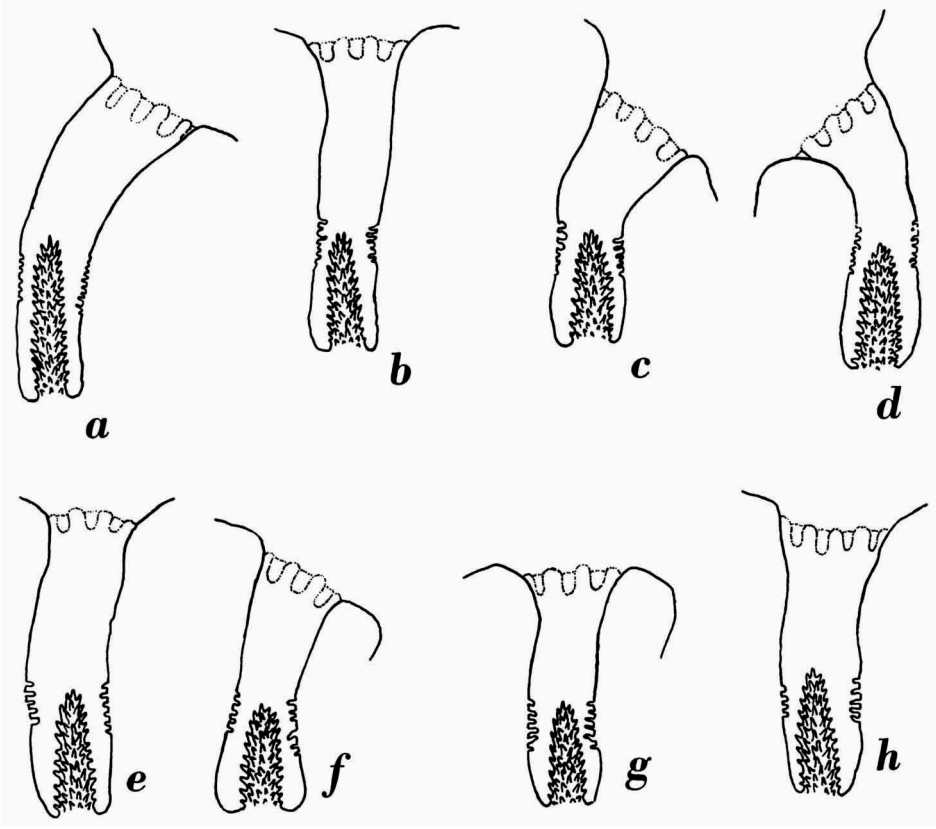

Fig. 7. *Stylaster flabelliformis* (Lamarck). Longitudinal sections of cyclosystems, showing the gastrostyles. a-d, specimen no. 259 (Mauritius); e-h, specimen no. 267 (locality unknown). × 54.

The average number is 10.33 for no. 259, 10.74 for no. 260, and 11.42 for no. 264.

Longitudinal sections were prepared of some cyclosystems of no. 259 (fig. 7 a-d), of no. 267 (fig. 7 e-h), of no. 260 (fig. 8 a-f), and of no. 264 (fig. 8 g-i). The figures show that the gastrostyle as a rule is about half to one-third as long as the depth of the gastropore. The wall of the gastropore has a rather broad girdle of well-developed spines surrounding the top

of the gastrostyle. The figures show that there is some variation in dimensions. Some of the gastropores have a comparatively small depth (0.5-0.6 mm, figs. 7 c, g, 8 c), others are much deeper (up to 0.9 mm, fig. 8 f, h, i). The length of the gastrostyle varies from 0.25 mm (fig. 7 f, g) to about 0.4 mm

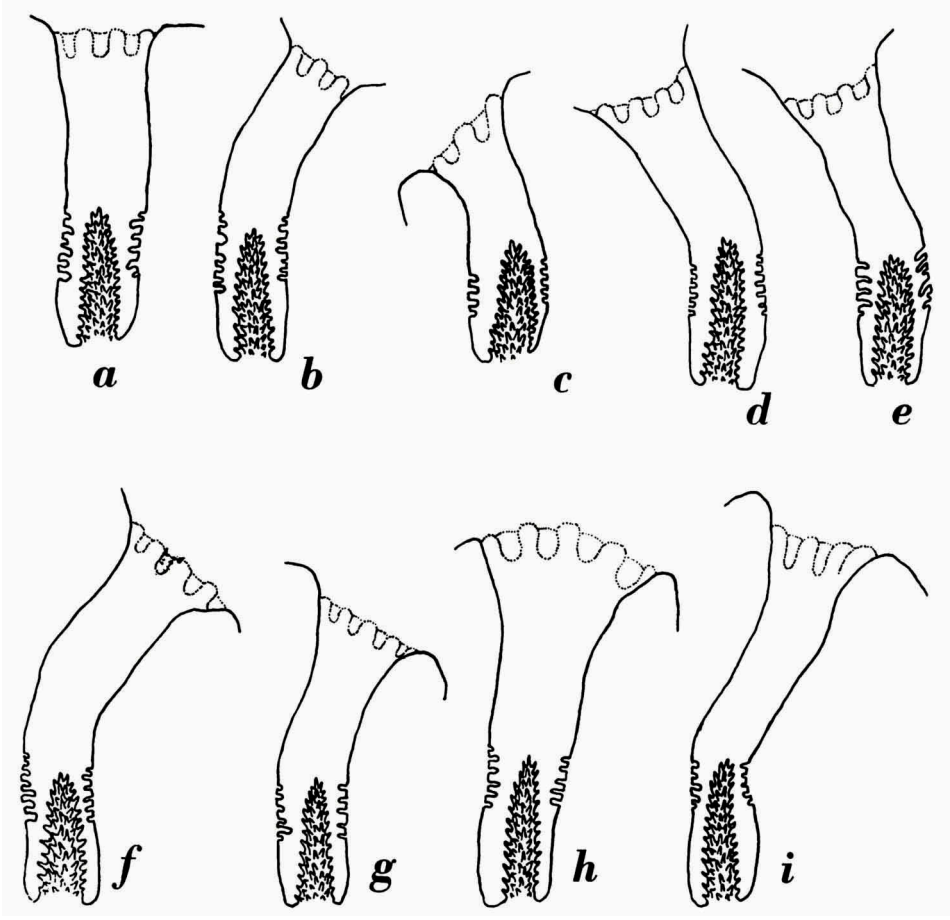

Fig. 8. *Stylaster flabelliformis* (Lamarck). Longitudinal sections of cyclosystems, showing the gastrostyles. a-f, specimen no. 260 (Réunion); g-i, specimen no. 264 ("Mer des Indes"). × 54.

(figs. 7a, 8d), its thickness from 0.08 mm (fig. 8 g, h) to 0.11 mm (figs. 7 d, 8 c). The gastrostyles are very slender, cone-shaped or nearly cylindrical with pointed top.

No dactylostyles could be observed, in all probability these do not occur in the species or are very indistinctly developed.

When describing the surface of the corallum, Milne Edwards & Haime

(1850b, p. 97) observed: "La surface des grosses branches est lisse, et montre au microscope des stries granulées extrêmement fines". This striation of the surface is brought about by longitudinal rows of minute pores of elliptical shape, their greatest width being in the long axis of the branch (fig. 9 c). The rows of pores open in shallow grooves, so that the narrow strips between each pair of rows are slightly elevated above the grooves.

Milne Edwards & Haime (l.c.) further remarked: "Les branches moyen-

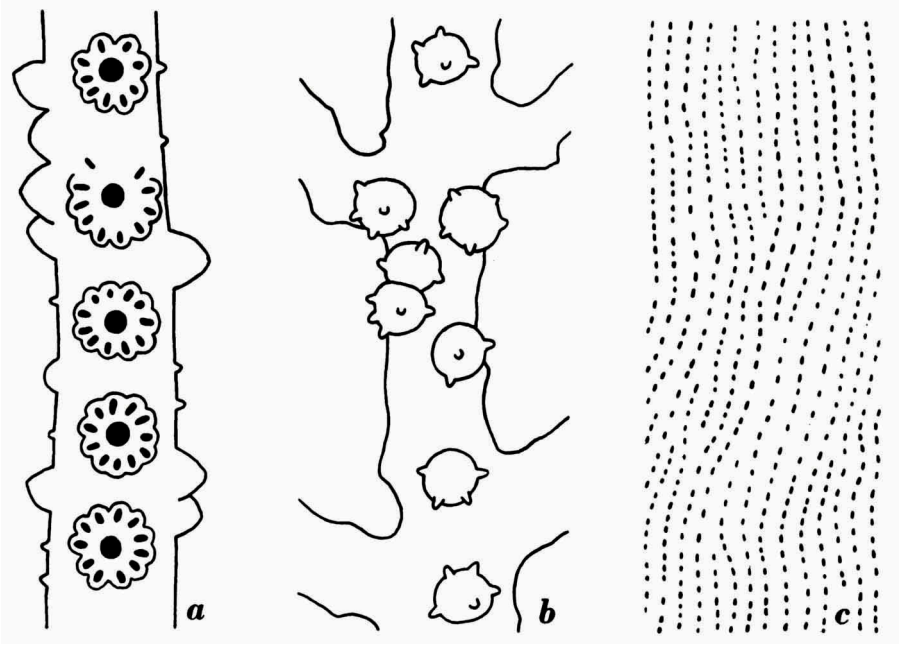

Fig. 9. *Stylaster flabelliformis* (Lamarck). a, specimen no. 259 (Mauritius), side view of a branch, showing ampullae and small tubercles projecting at the anterior and the posterior surfaces; b, specimen no. 264 ("Mer des Indes"), anterior view of a branch, showing ampullae with spines; c, specimen no. 335 (locality unknown), arrangement of minute pores on the surface of a branch. a, b, × 16; c, × 40.

nes sont couvertes de petites pointes; mais on n'observe jamais de tubercules vésiculaires". The small points, conical little warts or spinules, are distinctly visible on the larger branches of Pl. IV figs. 2 and 4; they are also represented in fig. 9a (the small protrusions to the right and the left of the branch). Not unfrequently on the smaller branches broadly conical or hemispherical bodies of distinctly larger size are to be observed, of at least three times the dimensions of the small points. These larger structures, which are distinctly visible on some of the branchlets in the upper part of Pl. XIII fig. 1, on the central branch of Pl. XIII fig. 3, and on some of the small

branchlets of Pl. XIII fig. 4, without any doubt are the ampullae, for they are the walls of distinct cavities. Those of the cited figures have a smooth surface, on the other hand the ampullae on the branchlets of Pl. XIII fig. 2 each bear a small number of minute blunt spines.

More or less diagrammatically the ampullae are drawn in fig. 9 a, b. The first figure shows at each side of a branch a number of protuberances with a smooth surface, of hemispherical or somewhat conical shape, representing ampullae of the usual structure in the species. Besides the ampullae the figure shows a few minute solid spines. Some ampullae with small blunt spines are drawn in surface view of a small branch in fig. 9 b.

The diameter of the ampullae is from 0.3 to 0.5 mm, their height is up to 0.3 mm. They are of such a small size that apparently Milne Edwards & Haime included them in their "petites pointes", for they state expressly that ampullae are not present ("on n'observe jamais de tubercules vésiculaires"). It has already been noted (under specimens examined) that in most of the colonies the convex (posterior) surface has a greater number of ampullae than the slightly concave (anterior) surface.

The specific characters of *Stylaster flabelliformis* (Lamarck) may be summarized as follows.

Colony growing to a large size (largest specimen known, 40½ by 37½ cm), spreading fan-wise almost entirely in one plane, being only slightly concave-convex. Large branches radiating in all directions, the space between them closely filled with smaller branches and branchlets, never showing anastomoses. Surface of the branches finely striated, the striae being rows of longitudinally arranged minute pores; on several branches there are a number of minute spines. Colour of the skeleton pure white.

Cyclosystems confined to the sides of the branches only, alternating on the small branchlets, these thereby becoming distinctly zigzag-shaped; older branches soon obtain a more or less straight shape. The cyclosystems rise very little above the surface of the branches, only their margin forming a slight rim. The diameter of young cyclosystems is from 0.3 to 0.5 mm, of the oldest from 0.7 to 0.9 mm. In young cyclosystems the 6 to 10 dactylopores closely surround the gastropores, in older cyclosystems the number of dactylopores increases (up to 18), while they diverge from the gastropore. In still older cyclosystems there is a tendency for reduction of the number of dactylopores, the cyclosystems then often becoming incomplete. The dactylopores of young cyclosystems have a circular opening, during further development the dactylopores become elliptical.

Gastropores varying in depth from 0.5 to 0.9 mm, gastrostyles slender,

conical or nearly cylindrical with pointed top, approximately half to one-third as long as the gastropores, length of the gastrostyles from 0.25 to 0.4 mm, thickness from 0.08 to 0.11 mm. Dactylostyles apparently not occurring.

Ampullae hemispherical to conical, diameter 0.3 to 0.5 mm, height up to 0.3 mm, with smooth surface or covered with a few blunt spines; as a rule rather more abundant on the convex (posterior) surface of the colony than on the concave (anterior) surface.

Type locality (restricted, present paper): Mauritius. The species is further known from Réunion. All other records of localities are indistinct ("Mer des Indes") or uncertain (Solomon Islands, China Sea, Philippine Islands, Indochina).

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EXPLANATION OF THE PLATES

Plate X

Stylaster flabelliformis (Lamarck), specimen no. 264, from "Mer des Indes". Natural size. Photo L. le Charles, Paris.

Plate XI

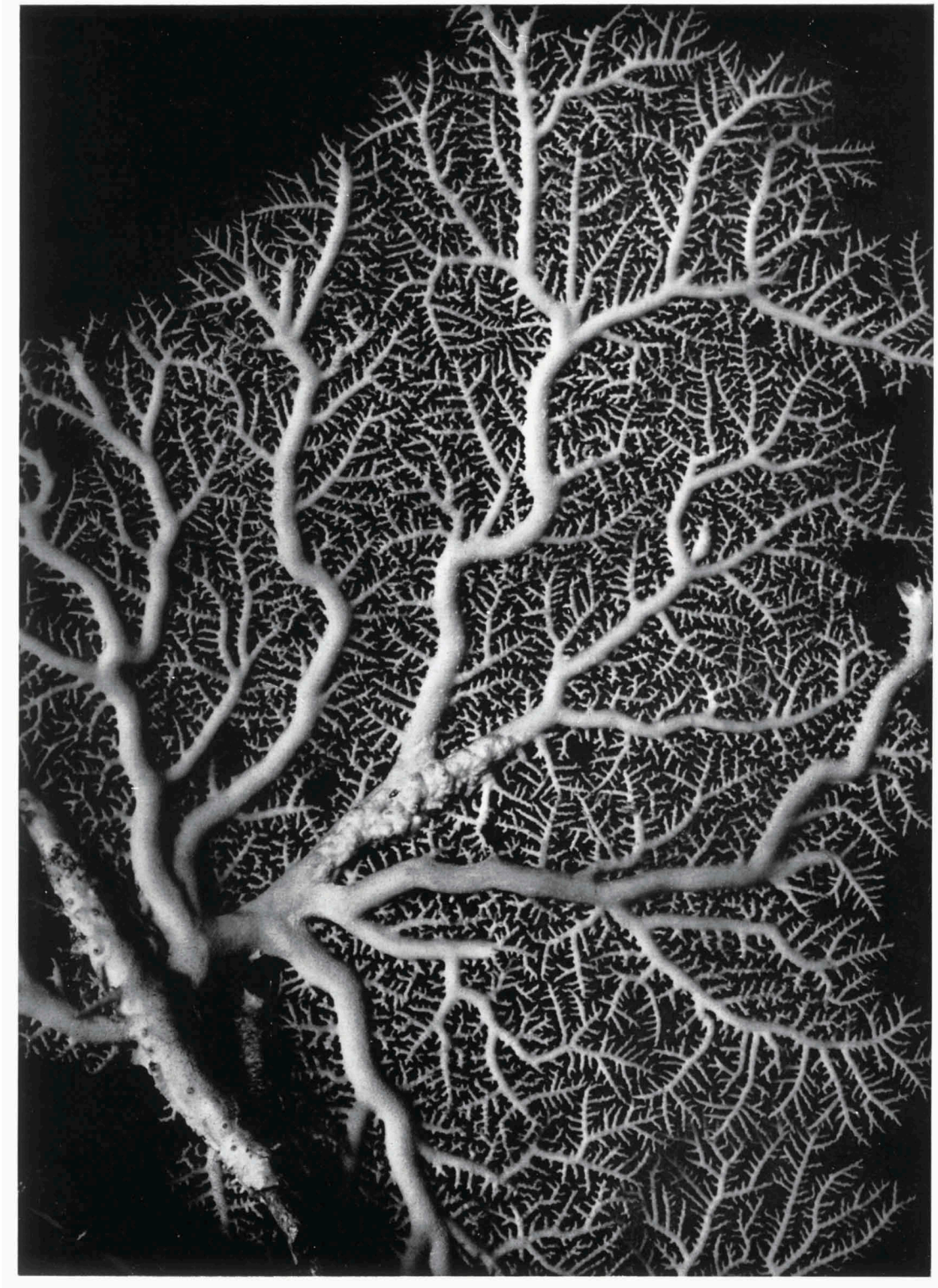
Stylaster flabelliformis (Lamarck), specimen no. 259, from Mauritius, collected by Rousseau. Natural size. Photo L. le Charles, Paris.

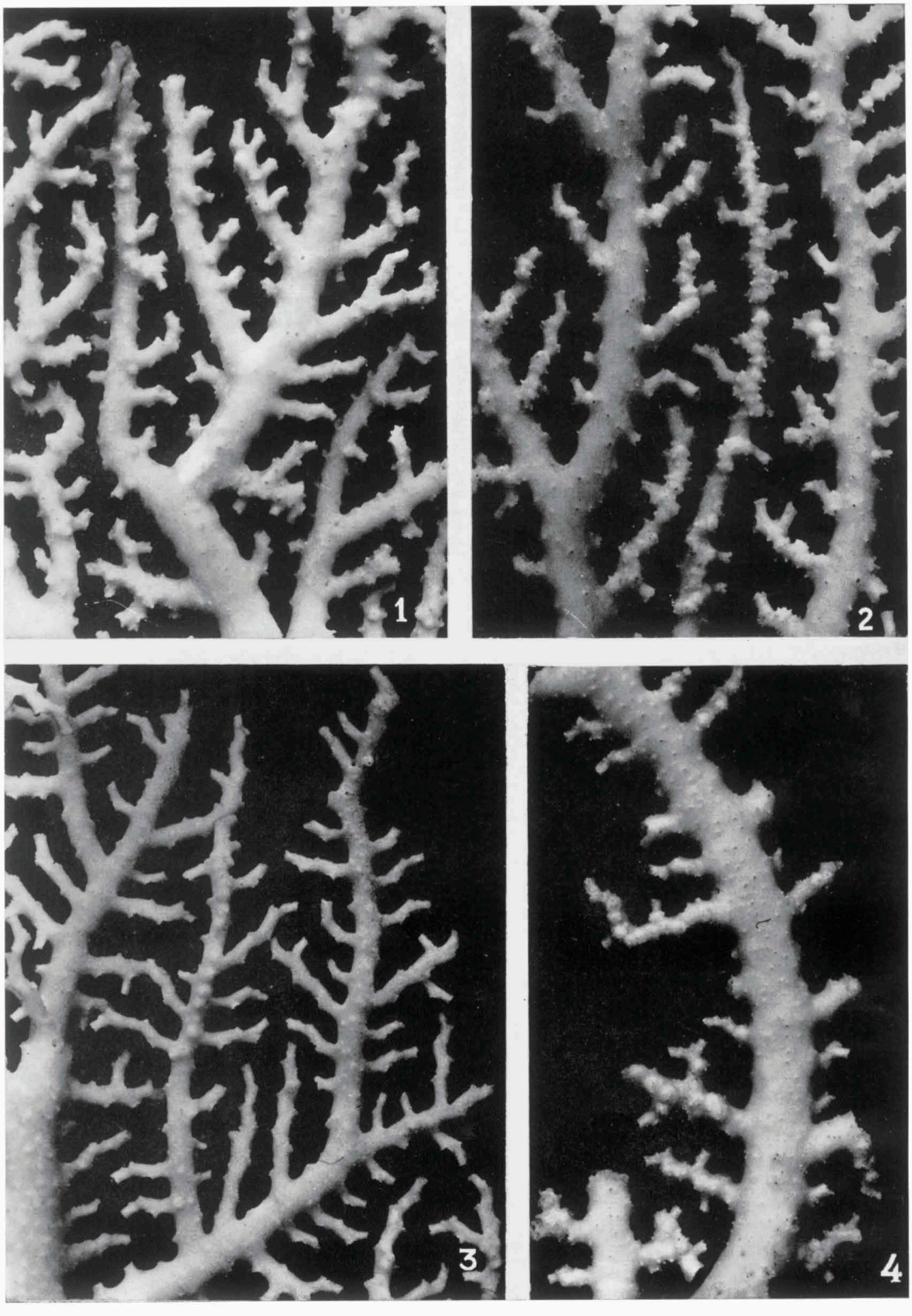
Plate XII

Stylaster flabelliformis (Lamarck), specimen no. 260, from Réunion, collected by Rousseau. Natural size. Photo L. le Charles, Paris.

Plate XIII

Stylaster flabelliformis (Lamarck)
Fig. 1, specimen no. 259, from Mauritius, collected by Péron & Lesueur.
Fig. 2, specimen no. 264, from "Mer des Indes".
Fig. 3, specimen no. 260, from Réunion, collected by Rousseau.
Fig. 4, specimen no. 335, from unknown locality.
All figures × 5.

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