POLYZOA FROM WEST AFRICA
THE MALACOSTEGA
PART 1

BY

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British Museum (Natural History)

Pp. 113–160 ; 3 *Plates* ; 20 *Text-figures*

BULLETIN OF
THE BRITISH MUSEUM (NATURAL HISTORY)
ZOOLOGY Vol. 16 No. 3
LONDON: 1968

THE BULLETIN OF THE BRITISH MUSEUM (NATURAL HISTORY), *instituted in* 1949, *is issued in five series corresponding to the Departments of the Museum, and an Historical series.*

Parts will appear at irregular intervals as they become ready. Volumes will contain about three or four hundred pages, and will not necessarily be completed within one calendar year.

In 1965 *a separate supplementary series of longer papers was instituted, numbered serially for each Department.*

This paper is Vol. 16, *No.* 3 *of the Zoological series. The abbreviated titles of periodicals cited follow those of the World List of Scientific Periodicals.*

World List abbreviation
Bull. Br. Mus. nat. Hist. (Zool.).

TRUSTEES OF
THE BRITISH MUSEUM (NATURAL HISTORY)

Issued 26 *March*, 1968 *Price* £1 4*s.*

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CONTENTS

INTRODUCTION

THE Collections studied have been described by Cook (1964*a* : 44). They include the " Calypso " Collection I, from Senegal and the Bay of Biafra, and Collection II, from the Cape Verde Islands; the Marche-Marchad Collections from Senegal; and the Achimota Collection, from the coast of Ghana. In addition, records are included of species from the "Atlantide " and " Galathea " Expeditions to western Africa; the Mortensen Java–S. Africa Expedition (west African Stations); and other Collections stored at the Universitetets Zoologisk Museum, Copenhagen. Some records of species from the Collections of the Musée Royal de l'Afrique Centrale, Tervuren, Belgium, are also included. Material was treated with eau de javel for examination of calcareous parts, and decalcified and stained to show chitinous parts. The following measurements (in mm.) were made where possible:

Length of zooid	Lz	Width of zooid	lz
Length of operculum	Lop	Width of operculum	lop
Length of opesia	Lopes	Width of opesia	lopes
Length of avicularium	Lav	Width of avicularium	lav
Length of mandible	Lm	Width of mandible	lm
Length of ovicell	Lov	Width of ovicell	lov
Length of kenozooid	Lkz	Width of kenozooid	lkz

Specimens in the Collection of the British Museum are referred to by their registered numbers, thus: 1966.10.12.1.

Malacostega Levinsen

Malacostega Levinsen, Harmer, 1926 : 187, Bassler, 1953 : G 155.

The genera have been grouped into families, usually following Bassler (1953) or Osburn (1950). Waters (1898), reviewing the characters of the Membraniporidae, considered that " generic division is at present somewhat risky ", and study of these species has shown that today there are still no criteria which may be used exclusively to define many families and genera. In some cases, it has been extremely difficult to define species, as the characters hitherto considered diagnostic have been found to intergrade, particularly under certain conditions of growth (see pp. 123, and 153).

The generic groupings below have therefore been based upon the highest correlation of common characters; where there is great variation of characters within a genus or a species, this is discussed briefly.

MEMBRANIPORIDAE Busk

Membraniporidae Busk, Osburn, 1950 : 18.

MEMBRANIPORA de Blainville

Membranipora de Blainville, Osburn, 1950 : 19.

TYPE-SPECIES. *Flustra membranacea* Linnaeus.

Osburn (1950 : 19) reviewed the characters and history of the genus. He concluded that the genera *Biflustra*, *Nitscheina* and *Acanthodesia* were all synonymous with *Membranipora* s.s. Lagaaij (1952 : 18) also clarified the definition of *Biflustra*, of which he considered *Acanthodesia* to be a synonym. Lagaaij included *Flustra savartii* Audouin in *Biflustra*. This species is known to develop from a twinned ancestrula, as do all the species considered to belong to *Membranipora* s.s. Whatever the status of *Biflustra*, *F. savartii* is so similar in character to the other species described here under *Membranipora*, that it is included with them.

The amount of material available for study in the west African, the British Museum and the Copenhagen Museum Collections is very large, and exhibits a great range of variation. Considerable difficulty has been found in defining some of the forms described below satisfactorily; at the means of their ranges of variation they are easily distinguishable, but at the ends of these ranges their characters seem to merge. Several of the features hitherto considered to be diagnostic of certain species have been found in all of them, under certain conditions of growth. The type of substrate has also been found to affect the zoarial and zooidal characters of some of the species. The synonymies given below are therefore restricted, as it is possible that many previous records may, in fact, include more than one " species ". Much further work is needed, both on the larval form and early astogeny, and on the correlation of zoarial and zooidal variation with ecological conditions, particularly with regard to the effects of substrate and salinity.

The characters showing particularly wide variation are as follows:

Gymnocystal tubercles. These occur in specimens of all the species of *Membranipora* described below, but they may be absent, especially at the growing edges of the colony.

Cryptocyst. In all species where they have been observed, the periancestrular zooids have a well-developed proximal cryptocyst. Unless the colony also includes later-developed zooids, it is virtually impossible to distinguish young colonies specifically. The extent of the cryptocyst also varies in fully developed colonies. In *M. arborescens* it is not usually developed proximally, but zooids with a well-developed proximal cryptocyst do occur, and are very similar to some of the variants found in *M. commensale* and *M. tenuis*, which, conversely, frequently shows zooids with hardly any proximal cryptocyst at all. The variation in extent of the proximal cryptocyst in *M. tuberculata* is very large, and is correlated with the occurrence of internal cryptocystal denticles (see below). The variation in *M. tenuis* has been particularly studied by Osburn (1940, see p. 128).

Cryptocystal denticles. With the exception of *M. commensale* s.s., all the species described below may show denticles arising from the cryptocyst. In large numbers of zooids, these may, however, be completely absent.

Chitinous spinules. These small spinules occur on the frontal membrane, and have been considered diagnostic of *M. commensale.* In fact, they are rare, and often absent in this species, but have been found in profusion in the encrusting phase of *M. arborescens,* and are present in some colonies of *M. tenuis.*

Septulae. The range of intraspecific and interspecific variation in the position and nature (whether uniporous or multiporous) of the septulae has been found to be random and continuous in all species. There seems to be no correlation of the type of septulae with locality, substrate or zoarial form.

Commensalism. One species, *M. commensale,* is here defined as being consistently and exclusively commensal on gastropod shells, whether they are inhabited by the mollusc or by pagurid crabs. Two other species, *M. arborescens* and *A. tincta* (see pp. 121, 140) may be associated with gastropod shells, and seem to have a commensal relationship with the occupants, but this appears to be accidental, and these species also occur on other substrates. Certain modifications of zoarial and zooidal form occur in *M. arborescens,* which are dependent upon the type of substrate; but the form found on inhabited gastropod shells is the same as that found, for example, on dead lamellibranch shells. This form is specifically distinct from *M. commensale* s.s. (see p. 125).

The specimens described below have been assigned to species somewhat arbitrarily, pending further investigations of the relationships of the complex. The correlation of characters used as specific criteria for the west African specimens is as follows:

M. tuberculata. Zoarium encrusting algae and wood, occasionally on stone, worm tubes, etc. Cryptocyst well-developed distally, forming a shelf, little developed laterally, variable proximally. Branched denticles growing from the edge of, and from below, the cryptocyst. Large gymnocystal tubercles usually present.

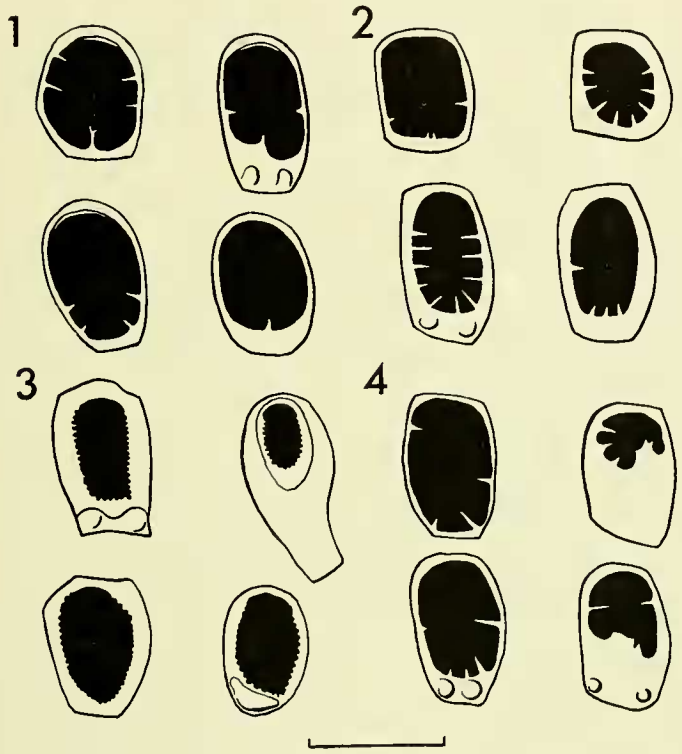
M. arborescens. Zoarium erect, tubular or bilaminar and foliaceous, on hydroids and algae, or encrusting, plurilaminar, on shell, worm tubes, or other Polyzoa. Cryptocyst slightly developed proximally, with a series of simple denticles developed laterally and proximally. Small gymnocystal tubercles sometimes developed. *Erect phase:* zooids nearly as wide as long, cryptocystal denticles numerous, chitinous spinules rare or absent. *Encrusting phase:* zooids more elongated, cryptocystal denticles reduced or absent, chitinous spinules and brown line outlining zooids present.

M. commensale. Zoarium encrusting gastropod shells, commensal with mollusc or pagurid crab, plurilaminar, never erect. Cryptocyst sometimes well-developed proximally, becoming much thicker in older zooids. No denticles on cryptocyst. Chitinous spinules and brown line outlining the zooids occasionally present. Large gymnocystal tubercles present.

M. tenuis. Zoarium encrusting shell. Cryptocyst well-developed proximally, finely tuberculate. Simple or branched cryptocystal denticles present in nearly all zooids. Gymnocystal tubercles rare.

M. annae. Zoarium encrusting wood and barnacle plates. Zooids with cryptocyst well developed proximally and laterally, with regularly spaced, long, simple denticles extending to the distal end of the opesia. Large vicarious avicularian individuals occasionally present. Found in waters of reduced salinity.

Although no specimens of *M. savartii* have been found so far from west Africa, it is included here in order that the variation in characters found may be compared with those seen in the other species of *Membranipora*. Zoarium encrusting, or erect, tubular. Cryptocyst often well-developed proximally, with a central proximal serrate denticle. Gymnocystal tubercles sometimes present.



FIGS. 1–4. Intra- and interspecific variation in *Membranipora*. Scale = 0·5 mm. 1. M. *tuberculata* (Bosc). 4 " non-typical " zooids, showing simple, reduced denticles and variation in the development of the proximal cryptocyst. 2. *M. arborescens* (Canu & Bassler). 4 zooids, some showing reduced denticles, and 1 (bottom left) with denticles similar to those of *M. annae*. 3. *M. commensale* (Kirkpatrick & Metzelaar). 4 zooids showing the variation in development of the cryptocyst and of the gymnocystal tubercles. 4. *M. tenuis* Desor. 4 zooids showing variation in the development of the cryptocyst, the denticles, and the gymnocystal tubercles.

Membranipora tuberculata (Bosc)

(Pl. 2, figs. C, D, text-fig. 1)

Nichtina tuberculata (Bosc) Harmer, 1926 : 208, pl. 13, fig. 10, East Indies.
Membranipora tuberculata (Bosc) Marcus, 1937 : 33, pl. 5, fig. 12 ; 1939 : 125, pl. 6, figs. 4A–B, Brazil. Osburn, 1950: 23, pl. 2, figs. 4, 5, 6. Maturo, 1957: 33, fig. 27, N. Carolina. Shier, 1964 : 609, N.W. Florida.

Material examined. " Calypso " Coll. I, Stn. 104, W. Annobon, B. de Santa Cruz, 4.vii.56, 8–12 m., C7A, C30A.

Achimota Coll. Stn. A, bottom net off Accra, 27.iv.51, 14 m., 1B; Stn. B, Winneba shore, 15.xi.49, 10B; Stn. D, as above, 30A; Stn. E, Christiansborg shore, 15.i.49, 34B; Stn. F, as above, 14.ii.49, 13D; Stn. G, as above, 19.xi.49, 38B; Stn. M, on antipatharian, 3 miles offshore, 2 miles W. of Densu River, 15 fath., 2.ii.49, 52A; Shore, no locality, A, B. Coll. II. Winneba, 22.xi.49, 20A, on worm tubes.

Zoologisk Museum, Copenhagen. " Galathea " Stn. 37, Rockpool, Christiansborg, Accra, 4.xi.50, rock and sand, with *Electra verticillata*, 50B. Stn. 38, Teshi, Accra, 24.xi.50, with *E. verticillata*, 34B.

Clausen Coll., Lagos, on algae, 16D, 95F.

Musée royal de l'Afrique Centrale, Tervuren, Belgium. Entre Banane et Moanda, Congo, on wood, No. 265A.

British Museum. A large number of specimens have been examined, including the following: San Pedro, west Africa, 1877.3.16.16; Angola, 1877.3.16.13; near Dixcove, Ghana, 1942.5.8.2; Algoa Bay, S. Africa, 1899.7.1.360; Aden, 1928.9.13.2. Labelled " *Membranipora denticulata* " Adriatic, 1899.5.1.431, Hincks Coll.

" John Murray Coll.", Stn. 44, N. of Khorya Morya Is, S. Arabian coast, at the surface, 29.x.33, Z172B.

Dimensions. Lz 0·41–0·57 mm., lz 0·17–0·38 mm., Lopes 0·26–0·43 mm.

Zoarium almost exclusively encrusting algae, especially *Sargassum*. Zooids with a pair of large tubercles on the gymnocyst, which may coalesce. Cryptocyst with a distinct distal shelf, narrow laterally, variably developed proximally. Branched denticles protruding into the opesia from the edge of, and from below, the cryptocyst.

The great majority of the specimens encrust algae, and are also associated on this substrate with colonies of *Electra verticillata* (see p. 132). The " Calypso " specimen encrusts stones and barnacle plates.

The specimens exhibit a large range of variation. The proximal tubercles are little developed in one of the specimens from San Pedro, but large in another slide from the same locality. Achimota 10B has little development of the proximal cryptocyst, which is extensive in specimen 1B and in 1899.5.1.431 (see below). The specimen from the Arabian coast is similar to that from Aden, which was described by Harmer (1926 : 210), in which the gymnocystal tubercles were not calcified distally, but covered by a membrane. Some scattered zooids from west Africa show a similar form of tubercle.

The paired, comb-like denticles, which protrude into the zooidal cavity from beneath the proximal cryptocyst, are well-developed in some of the west African

specimens, but apparently completely absent in others. They were first described by Waters (1898 : 675, pl. 48, figs. 6–8), and further discussed by Marcus (1939 : 125, pl. 6, figs. 4A, B). The occurrence of these structures seems to be postively correlated with a well-developed proximal cryptocyst, and they occur in the zooids of 1899.5.1.431, and Achimota Coll. 1 B.

The twinned ancestrula of *M. tuberculata* has been described by Hastings (1930 : 706, pl. 3, figs. 9, 10) and by Maturo (1957 : 35, text-figs. 25).

The specimen Achimota 1B, which encrusts algae, resembles that labelled as "*M. denticulata*" from the Adriatic. The zooids of both specimens have a greatly developed, irregularly denticulate, proximal cryptocyst (see pl. 2, fig. D). Paired, comb-like denticles are present beneath the cryptocyst, and the specimens are certainly referable to *M. tuberculata*, although greatly resembling *M. tenuis* in appearance. The specimens, Achimota II, 20A, encrusting worm-tubes, include zooids which show an unusually large range of variation. Comb-like denticles are present in a few zooids only, but branched denticles occur in many zooids both beneath and on the edge of the cryptocyst. As this type of branched denticle does not occur in any of the other species, their presence must be considered characteristic of *M. tuberculata*. In some parts of the colony the denticles are, however, simple and reduced in number to one or two per zooid. In other parts they are frequent and regularly spaced, and resemble those found in *M. arborescens*. The cryptocyst is well-developed proximally in some zooids, resembling *M. tenuis*, in others it is completely deficient. Gymnocyst tubercles vary from being absent to large and paired.

The cryptocyst in the majority of specimens forms a distinct shelf distally, a character which seems to distinguish *M. tuberculata* from the other species described here. It is not invariably present, however, and in its absence, together with the absence of comb-like denticles beneath the cryptocyst, it would be impossible to distinguish isolated zooids from some of those of *M. arborescens*, *M. tenuis* or *M. savartii*.

Membranipora arborescens (Canu & Bassler)

(Pl. 1, figs. B, C, D, pl. 2, fig. E, text-fig. 2)

Biflustra savartii (Audouin), Smitt, 1873 : 20, pl. 4, figs. 92–95, Florida; not *Flustra savartii* Audouin, see p. 129.

Acanthodesia arborescens Canu & Bassler, 1928*a* : 15, pl. 1, figs. 2–5, Cap Blanc, Mauritania, 20–40 m. Redier, 1965 : 381.

? Conopeum commensale Kirkpatrick & Metzelaar, Marcus, 1937 : 37, pl. 5, fig. 13, Brazil-1939 : 126, pl. 6, figs. 5A, B, C, Brazil; 1941 : 16, fig. 5. Osburn, 1950 : 30, pl. 2, figs. 12–15, N. Mexico to Ecuador. Maturo, 1957 : 37, text-fig. 29, N. Carolina. Soule, 1959 : 7, W. Mexico. Lagaaij, 1963 : 166, pl. 8, fig. 2, Gulf of Mexico. Not *C. commensale*, see p. 125.

Acanthodesia (*Biflustra*) *mogadori* Gantès & Balavoine, 1961 : 187, pl. 7, figs. 1–4.

MATERIAL EXAMINED. "Calypso" Coll. 1, Stn. 7, 9° 40′ N, 13° 53′ 5″ W, 17.v.56, 18 m., C4C; Stn. 8 entre I. Tamara & I. Cassa, 18.v.56, 7–8 m., C24A, tubular. Stn. 17, 5° N, 5° 28′ 30″ W, 21.v.56, 27 m., C34A, tubular. Stn. 18, 5° 2′ 5″ N, 5° 24′ 4″, 21.v.56, 20–25 m., C5A, tubular, anastomosing. Stn. 19, 5° 2′ 30″ N,

5° 24′ 40″ W, 21.v.56, 21–27 m., C57B, tubular arising from algae. Stn. 49, 4° 03′ N, 6° 12′ E, 26.v.56, 32 m., C49D, tubular. Stn. 56, 0° 38′ 25″ S, 8° 46′ E, 16.vi.56, 5 m., C22B, tubular. Stn. 104, B. de Santa Cruz, Annonbon, 4.vii.56, 8–12 m., C30A, encrusting.

Marche-Marchad Coll. I. 2C, Konakrey, Guinée Ise, tubular. 4B, C, Cap Matakong, Guinée Ise, encrusting and erect on *Pecten* shell with *Clcidochasma oranense, C. porcellanum*, and many other species. 26K, S.W. Madeleines, 9.i.54, 45–46 m., tubular. 41A, S.W. Cap de Bald, 31.iii.54, 18 m., encrusting and erect, foliaceous. 48A, Pointe de Fomone, 13.iv.54, 10 m., foliaceous and tubular.

Coll. II, 12D, Large de Gorée, 5.vii.55, 50 m., foliaceous. 18A, M'Bour, 19.v.49, 25 m., tubular. 32B, Pointe de Formone, 13.iv.54, 10 m., foliaceous. 38A, Est de Gorée, 24.xi.53, 48 m. tubular. 43E, Sud de Gorée, 13.xi.53, 34–37 m., tubular. 44A, Par de travers de Joal, 11.v.55, 18–32 m., foliaceous. 45A, Bourée de Persée, S. Gorée, 10.xi.55, 15 m., foliaceous. Coll. III, 2A, Sud de presque l'île du Cap Vert, 18.2.54, 46–50 m., encrusting.

Achimota Coll. Stn. E, Christiansborg shore, 15.i.49, 34G, foliaceous. Stn. F as above, 14.ii.49, 13E, encrusting. Stn. G, as above, 19.xi.49, 38A, encrusting worm tubes. Christiansborg, 13.x.50 on *Eucidaris*, 94D (see p. 141). Stn. K, on trawl debris, 1 mile offshore, 2 miles W. of Densu River, 8 fath., 2.iii.49, 36A, on *Pecten* shell, and 44A on shell inhabited by Acrothoracid Cirripede. Stn. S, shore seine, Chorkor, March 1949, on shell, 39A. Stn. W, Apam shore, 16.ii.49, 66G, foliaceous. Stn. 56, 15.i.51, 16 m, 90 II C, encrusting shell. Stn. 117, 5.iv.51, 64 m., 32 R + S, foliaceous. Stn. 123, 11.iv.51, 9 m., 89 I C, on Pecten shell. Stn. 126, 12.iv.51, 20 m., 37A, on Pecten, with many other species. [? Stn. 89.7.ii.51, 16 m., 76A, Stn. 93, 12.iii.51, 12 m., 2A, and Stn. 103, 29.iii.51, 85. I B, see below.]

Zoologisk Museum, Copenhagen " Atlantide " Coll. Stn. 44, 10° 22′ N, 16° 22′ W, 17.xii.45, 41 m., 63 G + L, encrusting and tubular. Stn. 45, 9° 23′ N, 15° 07′ W, 18.xii.45, 34 m., 14B, tubular, 14C, encrusting shell. Stn. 55, 6° 03′ N, 10° 25′ W, 8.i.46, 44 m., 31A, tubular. Stn. 85, 5° 37′ N, 0° 38′ E, 30.i.46, 50 m., 29E, 108a, tubular. Stn. 96, off Lagos, 14.ii.46, 40–51 m., 104A, tubular. Stn. 109, Dowes Island, Niger Delta, 21.ii.46, 59A, worm, encrusting stone. Stn. 133, 7° 19′ S, 12° 40′ E, 16.iii.46, 47 m., 43B, tubular. Stn. 136, 8° 30′ S, 13° 14′ E, 18.iii.46, 45 m., 3A, foliaceous. Stn. 145, 9° 20′ N, 14° 15′ W, 13.iv.46, 32 m., 44K and 110F tubular on hydroids and *Jullienella*, and 110G encrusting Polyzoa and worm tubes. Stn. 146, 9° 27′ N, 14° 48′ W, 13.iv.46, 51 m., 72 I, tubular and 107E tubular and encrusting. Stn. 147, 9° 28′ N, 14° 58′ W, 14.iv.46, 45 m., 77B, tubular. Stn.1 48, 9° 57′ N, 15° 22′ W, 14.iv.46, 25 m., 10C, tubular and encrusting, shell inhabited by Pagurid crab.

Naturhistoriska Riksmuseet, Stockholm, Lå 19, 283, 1860, Florida, 29 fath., figured specimen of *Biflustra savartii* Smitt, not Audouin, Smitt 1873, pl. 4, figs. 92, 93.

British Museum. As *Conopeum commensale*, 1947.3.28.1, Hancock Stn. 136, Clarion Is., Osburn Coll.

Dimensions. Lz 0·34–0·55 mm., lz 0·23–0·47 mm., Lopes 0·26–0·43 mm.

Zoarium with zooids very regularly shaped. Cryptocyst slightly developed

proximally, with small simple denticles growing laterally and proximally round the opesia. Occurring in two phases:

1. Zoarium erect, arising from a small, unilaminar base surrounding hydroids or algae; foliaceous and bilaminar, or tubular, branching and anastomosing. Zooids almost square, opesiae regularly oval or almost circular. Simple denticles arising from the edge of the cryptocyst, proximally and laterally, not extending beyond the distal third.

2. Zoarium encrusting, on shell, other Polyzoa, etc., occasionally accidentally commensal with gastropod molluscs, or with pagurids inhabiting gastropod shells, plurilaminar. Zooids regularly rectangular, opesiae elongated oval. Small cryptocystal denticles usually present proximally, and laterally. The denticles may be absent over large areas of the colony, but are always present in a few zooids. Zooids outlined by a dark brown line, frontal membrane covered by small chitinous spinules, which are occasionally rare or absent.

The occurrence of two distinct phases in this species which are superficially quite unlike each other (see pl. 2, figs. A and E), seems to be positively correlated with the type of substrate settled upon by the larvae. The two forms may occur from the same Station, but generally the preponderance of specimens of the erect type is found where the available stable substrate is reduced by the muddy or sandy seabottoms of the Gulf of Guinea to algal and hydroid stems. The zooidal characters of the two forms also differ, but their ranges of variation overlap considerably, and they are therefore assigned to the same species.

The encrusting phase has been confused in the past with *M. commensale*. It differs in the presence of cryptocystal denticles, which never occur in *M. commensale* s.s. (see below), and in the abundance of chitinous spinules on the frontal membrane, which are rare in *M. commensale*. The brown line outlining the zooids is usually present in the encrusting phase of *M. arborescens*, but is frequently absent in *M. commensale*.

The two species also differ in their form of growth on shell. *M. arborescens* grows in large, regular sheets. Where two growing edges meet there is little distortion of the zooids, and few kenozooids are produced. The zoarium usually continues to grow as a bilaminar expansion at right angles to the original directions of growth. In *M. commensale* the zooids are budded in fan-shaped groups, and seem incapable of producing erect expansions where two growing edges meet. The zooids of the plurilaminar colonies are therefore irregular in shape and arrangement, and large groups of kenozooids are present at points of pressure.

Many American records of *M. commensale* are almost certainly referable to the encrusting phase of *M. arborescens*, which may be commensal with gastropods shells. *M. commensale* is not found on any other substrate, and thus records listing gorgonid stems, stones and algae, etc., may perhaps be referred to *M. arborescens*. Many descriptions and figures by American authors also show cryptocystal denticles and large numbers of chitinous spinules, both characters typically found in encrusting *M. arborescens*. Without examination of all the described material, it is not possible to be certain of the identity of previous records, but the material from American waters which has been seen, has proved to be assignable to species other than *M.*

commensale s.s. For example, a specimen from Brazil labelled "*C. commensale*", from the Marcus Collection (1942.2.16.36), appears to belong to *M. savartii*, and another from Western Mexico, from the Osburn Collection (1947.3.28.1, Hancock Stn. 136, Clarion Is.), is referable to *M. arborescens*.

Recent specimens from N. Carolina and Louisiana, and fossil material from Jackson Bluff sent by Dr. R. Scolaro have shown there may be intergradation between the American forms here associated with *M. arborescens* and *M. tenuis* (see p. 127). Dr. Scolaro's specimens are here discussed under *M. tenuis*, but it must be noted that large areas of zooids in the colonies are indistinguishable from encrusting *M. arborescens*, and, if they had been isolated, would have been assigned to that species. Smitt's figured specimen of *B. savartii* has been re-examined. It consists of an erect tubular, branching fragment. The cryptocyst has simple denticles, and a brown line outlines the zooids. The specimen would appear to be typical erect *M. arborescens* (see pl. 1, fig. E).

A. mogadori is certainly the same species as *M. arborescens*. Gantés & Balavoine described the zoarium as very large, 5 cm. wide and 3·5 cm. high. One of the zoaria from the Marche-Marchad Collection (Coll. I 48A) measures 11 cm. × 6 cm., as does one from the "Atlantide" Collection (45A). The zoaria are foliaceous and arise from gorgonid stems. Superficially, the tubular zoaria of *M. arborescens* resemble the erect parts of the colonies of *Crassimarginatella falcata* (see p. 153), and the two species occur together in samples from Senegal.

The specimens in the "Atlantide" Collection best show the dual nature of *M. arborescens* (see pl. 1, figs. C, D). The encrusting form of zoarium occurs on shells (fully commensal from Stn. 148, 10C), and on other Polyzoa, particularly *Cleidochasma oranense* and *Triporula stellata*. These last 2 species themselves encrust hydroid stems, often forming large plurilaminar masses. The form of *M. arborescens* associated with them is not, however, the erect, tubular type which grows directly from hydroid stems (pl. 1, fig. D), but is exactly the same as that found encrusting shell. All these 3 types of substrate, and both forms of *M. arborescens*, occur at Stn. 145. Specimen 63L, from Stn. 44, combines both forms of growth; it is encrusting, with unilaminar expansions.

The specimen from the "Atlantide" Coll., 10C, is fully commensal, with a pagurid crab, inhabiting a small gastropod shell. The zooids are thickly covered with chitinous spinules and outlined by a brown line. The cryptocyst is thick and the opesiae almost circular, like those of the specimen from Clarion Island. Cryptocystal denticles are present proximally and occasionally laterally, and paired gymnocystal tubercles occur on most of the zooids.

The specimens from the Achimota Collection, 85 I B and 2A encrust small pieces of wood. The colonies are very young, and all have twinned ancestrulae and periancestrular zooids with well-developed proximal cryptocysts. Small but distinct gymnocystal tubercles are present in some zooids, as are single series of chitinous spinules on the frontal membranes. The proximal cryptocyst is symmetrical and not denticulate (cf. *M. tenuis*, p. 127). The specimen 76A includes another young colony with a twinned ancestrula. The periancestrular zooids have symmetrical proximal cryptocyst, with no trace of a denticle, and the later developed zooids

greatly resemble those of encrusting *M. arborescens*. Small chitinous spinules are present on the frontal membranes of the zooids. Although these specimens cannot be identified with certainty, it seems possible that they may belong to *M. arborescens*.

Membranipora commensale (Kirkpatrick & Metzelaar)

(Pl. 1, fig. A, text-fig. 3)

Conopeum commensale Kirkpatrick & Metzelaar, 1922 : 985, pl. 1, fig. 2, Capo Blanco, West Africa. Not *C. commensale* auctt., see *M. arborescens*.

not *C. commensale* Kirkpatrick & Metzelaar, Marcus, 1938 : 16, pl. 3, fig. 6A, B, C = *M. tuberculata*.

Membranipora fusca Canu & Bassler, 1925 : 11, pl. 2, figs. 6–8, Mauritania. Buge & Lecointre, 1962*a* : 555, pl. 18, figs. 3, 4, 6–8, pl. 19, figs. 1–4, 6, 7, Quarternary and Recent, Mauritania. 1962*b* : 244–5, Rio de Oro, Spanish Sahara. Lecointre, 1963 : 30, Quaternary, Spanish Sahara.

not *Membranipora fusca* Osburn, 1950 : 25, pl. 1, fig. 14, an independent introduction of the name.

MATERIAL EXAMINED. Holotype, B.M. 1922.9.9.1, Capo Blanco, 5–10 fath., Metzelaar Coll.

Achimota Coll. The great majority of the specimens encrusts *Turritella* shells. Stn. A, off Accra, 14 m., 27.iv.51, 1A. Stn. G. Christiansborg, 19.xi.49, 38A, on *Thais haemostoma*, inhabited by the Mollusc. Stn. 5, 9.xi.50, 13 m., 88A. Stn. 10, 19.xi.50, 14 m., 47A, ancestrula present (B.M. 1965.8.10.4). Stn. 11, as above, 13 m., 23A. Stn. 12, as above, 16 m., 74A, ancestrula present. Stn. 14, 26.xi.50, 26 m., 25A. Stn. 15, 28.xi.50, 20 m., 9A, 16A. Stn. 20, 30.xi.50, 20 m., 72A. Stn. 21, as above, 11 m., 78A. Stn. 23, 7.xii.50, 14 m., 35A. Stn. 26, 90 I A, II A, IV A. Stn. 29, 20.xii.50, 13 m., 82 I A. Stn. 47, 4.i.51, 44 m., 14c. Stn. 58, as above, 20 m., 4A. Stn. 59, as above, 24 m., 55A, 92A. Stn. 83, 26.ii.51, 15 m., 29A. Stn. 84, 26.ii.51, 77A. Stn. 85, as above, 21 m., 17A. Stn. 86, 28.ii.51, 8A. Stn. 90, as above, 21 m., 71A. Stn. 93, 12.iii.51, 12 m., 2A. Stn. 94, as above, 17 m., 56A. Stn. 95, 12.iii.51, 17 m., 86A. Stn. 97, 14.iii.51, 20 m., 6A, 83 I A. Stn. 98, as above, 25 m., 3A, 83 II A. Stn. 99, as above, 28 m., 69A, 83 III A. Stn. 106, as above, 19 m., 5 A. Stn. 107, 30.iii.51 m., 23 m., 91A. Stn. 121, 11.iv.51, 8 m., 93A. Stn. 123, as above, 9 m., 89 I A. Stn. 124, 12.iv.51, 11 m., 18A. Stn. 125, as above, 16 m., 24A. Stn. 127, 14.iv.51, 17 m., 12A. Stn. 130, 26.iv.51, 32 m., 70A. Stn. 131, 2.v.51, 37 m., 43B. Coll. II 3A, on shell fragments, near petrol barge, off Accra, 9.i.52.

Zoologisk Museum, Copenhagen. " Atlantide " Coll. Stn. 85. 5° 37′ N, 0° 38′ E, 29.i.46, 50 m., 108I. Brinkmann Coll., Dakar 82A.

British Museum. Paratypes, 1922.9.9.2.3; 1922.9.9.9 and 15, 1922.9.9.4–6, Archimedes Bay, 18 fath. Metzelaar Coll. Faux Cap, west Africa, 1967.7.11.1, and Malacostraca Section registration, 1954.6.20.42, Rio de Oro, Marche-Marchad Coll., with *Pseudopagurus granulimanus* (Miers).

Zoarium encrusting, plurilaminar, sometimes massive, growing on gastropod shells, commensal either with the mollusc or pagurid crab. Zooids rectangular, frequently distorted. Gymnocyst with paired, occasionally coalescent tubercles. Cryptocyst granular, often well-developed proximally, variable in extent but regularly serrate.

Cryptocystal denticles absent. Chitinous spinules rarely present on the frontal membrane, zooids more frequently outlined by a brown line.

Dimensions. Lz 0·32–0·45 mm., lz 0·26–0·38 mm., Lopes 0·26–0·35 mm.

Kirkpatrick & Metzelaar first described the association between *M. commensale* and shells inhabited by pagurid crabs from west Africa (Cf. Buge & Lecointre, 1962b: 557). The pagurid most commonly present was *Pseudopagurus granulimanus* (Miers), a species also frequently found associated with the Polyzoan genus *Hippoporidra* (see Cook, 1964*b* : 22). Kirkpatrick & Metzelaar found that small shells were encrusted by the Polyzoan " A few layers thick near the orifice ". Larger shells were encrusted by so many layers that the specimens were 6 cm. in diameter, and globular (see below). Canu & Bassler (1925) described *Membranipora fusca* as symbiotic with " grands gastropodes ", and mentioned that the zoarium was plurilaminar. Their specimens frequently had one gymnocystal tubercle extending across the zooids, but paired tubercles were also present. Marcus (1937 : 35) placed *M. fusca* in the synonymy of *C. commensale*. Canu & Bassler distinguished their species from *M. tuberculata*, which, they stated, had " deux tubercles distants ". The tubercles in *M. tuberculata* are, in fact, proximal in origin. *M. commensale* differs from *M. tuberculata* in the form and extent of the cryptocyst, and in the absence of cryptocystal denticles. The specimen figured as *C. commensale* by Marcus (1938, pl. 3, fig. 6) shows internal cryptocystal denticles and is referable to *M. tuberculata*.

Buge & Lecointre (1962*a*) redescribed Canu & Bassler's specimen of *M. fusca* together with Quaternary specimens from the Spanish Sahara. The majority of the specimens was massive and plurilaminar, like the type specimens of *M. commensale* and the Malacostraca Section specimen listed above. One Recent specimen (Port Étienne, pl. 18, fig. 8) resembles the majority of the Achimota Collection specimens from the Gulf of Guinea, in having only a few layers of zooids.

As stated above, material described by American authors as " *Conopeum commensale* " is almost certainly all referable to *M. arborescens* or *M. tenuis*. *M. commensale* s.s. would appear to be confined in distribution to the west African coast.

The range of variation in zooidal characters is large, and may frequently be found either within a single specimen, or within a population from one locality.

The operculum has a thickened rim, and is often dark brown. A brown line may outline the zooids, in some cases also outlining the opesiae. The small brown, chitinous spinules do not occur profusely in any of the specimens examined, and they are rare in the type material, being restricted to a pair situated at the base of the operculum.

The gymnocystal tubercles are large, and coalescent in some specimens, notably 1922.9.9.9, and Achimota Collection 1A. Large areas of the same specimens have, however, no trace of tubercles. The cryptocyst is granular, and finely serrate, particularly in young zooids, but is never denticulate. In older zooids it becomes massive and ridged.

M. commensale does not produce erect " arms " as does *Antropora tincta* (see Osburn, 1950 : 54), *Hippoporidra senegambiense* and *H. picardi*, all species which are commensal with gastropods or hermit-crabs (see Cook, 1964*b* : 23). There is, how-

ever, as in *Hippoporidra*, a difference in colonial form, which is apparently correlated with the type of shell encrusted by the Polyzoan. The thick, massive, plurilaminar colonies appear to be most frequently associated with short-spired shells; the single, or few-layered colonies with long-spired, *Turritella* shells.

The type-specimens are large (the diameter of the colonies ranges from 55–68 mm.), and plurilaminar. More than 50 layers of zooids may be seen in a section of specimen 1922.9.9.8B. Most of the Achimota Collection material encrusts *Turritella* shells, and is only 1–3 layers thick. The zooidal characters of the two forms are very similar. The growing edge of laminae in both forms have zooids with finely serrate cryptocysts, and the gymnocystal tubercles are very small or absent. In older zooids there is progressively greater calcification of the cryptocyst and gymnocyst.

The plurilaminar type-specimens are each associated with a hermit-crab. The layers of Polyzoan are encrusted by sessile barnacles, and inhabited by large numbers of boring bivalve mollusca. Kirkpatrick & Metzelaar (1922 : 983–4) described the associated sessile fauna. The specimens from Rio de Oro are also plurilaminar, and associated with the crab, *Pseudopagurus granulimanus*. Specimen 38A (on *Thais haemostoma*, with a short-spired shell) has plurilaminar colonies. In this case, the shells are occupied by the Mollusc. Specimen 70A has similar colonies which encrust empty shells.

The specimen from Archimedes Bay has only 1–3 layers and encrust a *Turritella* shell, which is occupied by *P. granulimanus*. Most of the remaining west African specimens encrust *Turritella* shells, and have few layers of zooids.

M. commensale is one of the dominant species of Polyzoan from the Gulf of Guinea. Many of the Stations in the Achimota Collection especially those from the " silty sand " and " sandy silt " communities described by Buchanan (1958) had no other Polyzoan present. Several hundred *Turritella* shells have been examined, and the great majority are inhabited by pagurid crabs or are empty. Although *M. commensale* is found associated with the mollusc, it would appear that it is principally commensal with hermit-crabs.

Membranipora tennis Desor

(Pl. 2, fig. B, text-fig. 4)

?Hemiseptella africana Canu & Bassler, 1930*b* : 29, pl. 1, fig. 7, Tunisia.
Acanthodesia tenuis (Desor), Osburn, 1940 : 353, pl. 3, figs. 22–30, Porto Rico. Marcus, 1941 : 17, fig. 7, Brazil. Maturo, 1957 : 35, text-fig. 28, North Carolina.

MATERIAL EXAMINED. Achimota Coll. Stn. X, Hospital Reef, Axim, 7.i.51, on worm-tubes and shell, 68 G + H.

Scolaro Coll. Upper Miocene, Jackson Bluff, Florida, *Ecphora* facies. Recent, Rivers Island, Beaufort, North Carolina, and between Creole and Cameron, Louisiana.

Zoologisk Museum, Copenhagen. " Atlantide " Coll. Stn. 148, 9° 57′ N, 15° 22′ W, 14.iv.46, 25 m., 10D, on shell, ancestrula present.

Zoarium encrusting, with unilaminar expansions. Zooids with well-developed, often asymmetrical proximal cryptocyst. Denticles present on cryptocyst, one lateral pair being frequently elongated. Gymnocystal tubercles occasionally present.

Dimensions. Lz 0·44–0·60 mm., lz 0·23–0·50 mm., Lopes 0·24–0·37 mm.

The range of variation in the form of the cryptocyst of *M. tenuis* is very large, and was illustrated by Osburn (1940). Some zooids of Achimota Coll. 68 G + H have very little proximal cryptocyst, and a few simple denticles; they are outlined by a brown line, and are indistinguishable from those of *M. arborescens* (see pl. 2, fig. B). Other zooids in the same colony, have a well-developed proximal cryptocyst with a serrate proximal denticle, and greatly resemble *M. savartii*. Generally, the proximal cryptocyst is asymmetrically developed, and one pair of lateral denticles is longer than the rest, as figured by Osburn (1940, pl. 3, fig. 22). The " Atlantide " specimens have the majority of the zooids of this type. *Hemiseptella africana* Canu & Bassler (1930*b*) appears to be referable to *M. tenuis*. The figured zooids have a well-developed proximal cryptocyst, with proximal and lateral denticles, which resemble some of those on pl. 2, fig. B.

The specimens from Dr. R. Scolaro show complete intergradation between " typical " *M. tenuis* and the type of zooids here associated with *M. arborescens* from American localities. The zooids have no chitinous parts, but some show traces of a brown line. The proximal cryptocyst is frequently fairly well-developed, with an asymmetrical proximal denticle, and a few lateral denticles. In large areas of these colonies, however, the cryptocyst is small, and only simple lateral denticles are present. These zooids are indistinguishable from those of *M. arborescens*.

It must be stressed, that were any one of the groups of zooids from both the west African or American colonies isolated, it could be confidently referred to *M. arborescens*, *M. savartii* or *M. tenuis*, depending upon the degree of variation displayed. Further, zooids from adjacent groups in the same colony could be referred to different species.

The periancestrular zooids of *M. tenuis* (" Atlantide " 10D), differ from those of *M. arborescens* only in their asymmetrical proximal cryptocysts, which may be denticulate. The periancestrular zooids of *M. savartii* are so similar to those of *M. tenuis*, that the two forms are indistinguishable in the absence of later-developed zooids (see below).

Membranipora annae (Osburn)

Acanthodesia serrata (Hincks) Hastings, 1930 : 707, pl. 4, figs. 13–15. Balbao, Panama (not *M. membranacea* form *serrata* Hincks).

Membranipora hastingsae Osburn, 1950 : 29, pl. 2, fig. 1, Balbao and Perlas Is., Gulf of Panama (preoccupied by *M.* (*Electra*) *hastingsae Marcus*, 1940).

Membranipora annae Osburn, 1953 : 774.

Material examined. Zoologisk Museum, Copenhagen. " Galathea " Stn. 54, bouy off Victoria 1.xii.50.

Museum royal de l'Afrique Centrale, Tervuren, Moanda, Congo, on wood, Nos. 163A, 164A. Entre Banane et Moanda, on wood, No. 264A. Cotonou, Dahomey, Nos. 278A, 279A, 280A, with *Hippoporina americana*.

British Museum. From S.T. " Harpula ", docked in Bonny River for 6 weeks, on Cirripedes and Mollusca, 1960.5.12.1.

Bonny river, Nigeria, 25 ft., 28.1.58, 1959.2.20.2, Stubbings Coll.

Balboa, Panama, St. George Coll., 1929.4.26.61, 62, 64.

M. annae is not present in the "Calypso", "Atlantide", Marche-Marchad or Achimota Collections.

Zoarium encrusting. Zooids with well-developed cryptocyst, with long, regularly spaced denticles and spinules. Large vicarious avicularia, sometimes present, with rounded mandibles and polypides.

Dimensions. Lz 0·42–0·60 mm., lz 0·20–0·34 mm., Lopes 0·24–0·42 mm., Lav 0·50–0·70 mm., Lm 0·27–0·31 mm.

The remarkable avicularia were described by Hastings (1930); they are present in specimens 278A, 279A and 280A from Moanda, and in the specimens from the Bonny River. The species is here retained in *Membranipora* pending the discovery of its ancestrula and form of early budding.

The variability of development of the cryptocyst is considerable, the zooids of some specimens, notably No. 264A, Moanda, approaching those of the young, encrusting phase of *M. arborescens*. Some consistent differences are apparent in well-preserved material, but it would be virtually impossible to distinguish some forms of the two species in a fragmentary or worn condition. The distal rim of the zooids in *M. annae* are raised, and the small proximal gymnocyst has two areas of thin calcification (lacunae), which later develop small tubercles. These lacunae are not present in young *M. arborescens*, but they may occur in some young zooids of *M. tuberculata*, also before the gymnocystal tubercles develop. The proximal cryptocyst of specimen No. 264A is only slightly developed, and the opesia is surrounded by a series of numerous, long spinules. These are present in the distal half of the opesia and the median lateral pair are longer than the others, resembling zooids of some specimens of *M. tenuis*. The zooids are narrower than those of *M. tenuis*, and differ from those of *M. arborescens* in that the spinules reach the distal part of the opesia. They may, however, be as long as, and nearly as numerous in some specimens of *M. arborescens* (see 110F, on *Jullienella*).

M. annae is found in warm shallow waters, where the salinity is reduced or variable.

Membranipora savartii (Audouin)

Flustra savartii Audouin, 1826 : 240, pl. 10, figs. 10^1, 10^2, ? Red Sea.
Acanthodesia savartii (Audouin), Harmer, 1926 : 213, pl. 13, figs. 8, 13, 14, 16, East Indies.
Marcus, 1937 : 40, pl. 7, figs. 16 A–C; 1938 : 66, pl. 14, fig. 36, Brazil.
Membranipora savartii (Audouin), Maturo, 1957 : 35, text-fig. 27. Shier. 1964 : 607, Florida.
not *Biflustra savartii* (Audouin), Smitt, 1873=*M. arborescens*, see p. 121.

Material examined. British Museum. Aden, on shell, 1966.1.2.1, 2, Sgt. Cambridge Coll. 1966.7.2.1, Kor Dongola, Red Sea, specimen from Waters, O'Donoghue Coll. N. Straits of Malacca, 30–34 fath, 1877.5.21.108.

Zoarium encrusting on weed or shell, or erect, tubular. Zooids with a variously developed proximal cryptocyst, with a median serrate denticle, or small tooth.

M. savartii has not been found in the west African Collections. A description is included here for comparison with those of *M. arborescens* and *M. tenuis* some characters of which may be extremely similar to those of *M. savartii*.

The zoarium occurs in two forms, like that of *M. arborescens*. In most erect zoaria, the median proximal cryptocystal denticle is reduced, or is directed downward into the zooidal cavity, as the cryptocyst descends steeply. The denticle is therefore often difficult to see, and zooids of *M. savartii* in this form would be indistinguishable from those of an erect colony of *M. arborescens* in which the cryptocystal denticles were deficient. In this connection, it is important to note that the fauna of Recent west Africa has much in common with that of Pliocene southern Europe, and that it is possible that some Pliocene records of erect *M. savartii* may be referable to *M. arborescens*. In worn specimens, where the finer structure of the cryptocyst was no longer present, it would be impossible to distinguish between the two forms.

Encrusting specimens of *M. savartii* usually have a well-developed median proximal serrate denticle, as figured by Marcus (1937, 1938). Savigny did not figure the denticle, and it is often reduced even in encrusting specimens from the Red Sea, which is presumed to be the type locality. Savigny's figure shows confused, plurilaminar growth on lamellibranch shell. The specimen from Aden has exactly this form, and its zooids are very similar to those of Savigny's magnified figure. This specimen also has a twinned ancestrula, as has that from Malacca Straits. The periancestrular zooids have well-developed proximal cryptocysts with median denticles, which may, however, tend to be asymmetrical. The zooids thus greatly resemble the periancestrular zooids of *M. tenuis* (see above), and, in the absence of later-developed zooids, would be difficult to assign with certainty to either species.

CONOPEUM Gray

Conopeum Gray, Harmer, 1926: 210. Bobin & Prenant, 1962.

Type-species. *Millepora reticulum* Linnaeus.

Conopeum tenuissimum (Canu)

(Pl. 1, fig. F)

Membranipora tenuissima Canu, 1908 : 253, pl. 2, figs. 9, 10. Holocene, Bahia Blanca, Argentine. Lagaaij, 1963 i 165, pl. 1, fig. 2. Pleistocene, Gulf of Mexico, Recent, Texas coast, Louisiana coast and Sabine Bank (4–74 ft.).

Material examined. Achimota Coll. Stn. N, Densu Estuary, ½ mile from the sea, on mangrove " stems ", 19A.

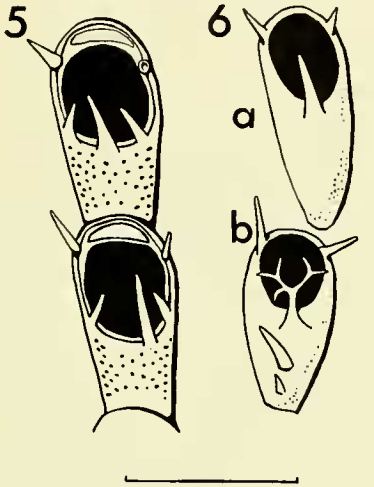
British Museum. Pt. Harcourt, Nigeria, 5.xi.57, in dead oyster shells. Stubbings Coll. 1959.2.20.7.

Dimensions. Lz 0·42–0·51 mm., lz 0·23–0·34 mm., Lopes 0·28–0·35 mm., lopes 0·15–0·20 mm.

Zoarium encrusting. Zooids with a finely granular cryptocyst. Gymnocyst small. One pair of small distal spines occasionally present. Some zooids with a calcareous lamina closing the opesia beneath the thickened frontal membrane.

C. tenuissimum is found in waters of reduced salinity. The west African specimens encrust the rooting " stems " of mangroves collected half a mile up the Densu river estuary, and oyster shells from Port Harcourt, about 20 miles up-river in the Niger Delta. Lagaaij's material from the Gulf of Mexico was almost all from " very shallow brackish inshore and offshore waters".

The fully closed zooids described by Lagaaij, in which the opesia is reduced by a calcified lamina to a small central pore, and where the former position of the operculum is marked by a cresentic scar in the lamina, do not occur in the west African specimens.[1] The early stages of the development of the calcareous lamina as an extension of the cryptocyst, and the thickening of the frontal membrane, have been



FIGS. 5–6. *Electra* Scale = 0·5 mm. 5. *E. verticillata* (Ellis & Solander). 2 zooids, showing the elongated, porous gymnocyst, Achimota Collection, 10A. 6. *E. bellula* (Hincks). a. 1 zooid with a simple proximal spine, 1959.2.12.6, b. 1 zooid with a branched proximal spine and subsidiary spines, 1963.2.12.60.

seen. These phenomena are exactly the same as those found in *Conopeum seurati* (Canu) and *Conopeum laciniosum* (Shier) which are also species inhabiting waters of reduced salinity (see Cook & Hayward 1966).

The distal spines are minute and infrequent, unlike those of *C. seurati* which are long. *C. seurati* may have lateral spines (see Bobin & Prenant 1962*b* and Sacchi, 1961 : 31, fig. D (as *Membranipora spiculata*)). *C. seurati* and *C. laciniosum* have been referred to *Conopeum* because of the form of their early astogeny (see Cook & Hayward, 1966). No young colonies with ancestrulae have yet been described in *C. tenuissimum*, and none have been found in this material.

[1] A large number of closed zooids, at a slightly later stage of development, are present on mangrove stems and the barnacle, *Balanus pallidus* Darwin, from Stn. N, B.M. Entomostraca Collection. No ancestrulae are present.

ELECTRIDAE Stach

Electridae Stach, Lagaaij, 1952.

ELECTRA Lamouroux, 1816

Electra Lamouroux, Harmer, 1926 : 206.

Type-species, *Flustra verticillata* Ellis & Solander.

Electra verticillata (Ellis & Solander)

(Text-fig. 5)

Electra verticillata (Ellis & Solander), Canu & Bassler, 1925 : 12, pl. 2, figs. 1–3, Fedhala, Atlantic coast of Morocco. Bobin & Prenant, 1960 : 121–156, figs. 2, II; 3, IV–IX; 4; 5; 6; 7; 8, II; 9; 10; 11, Roscoff.

Material examined. Marche-Marchad Coll. I. 44A. Presque l'île du Cap Vert, 15.v.53. Coll. II, 46A, M'Bour, Senegal.

Achimota Coll. I. Stn. B, Winneba Shore, 15.xi.49, 10A. Stn. D, as above, 22.xi.49, 30C. Stn. E, Christiansborg shore, 15.i.49, 34E. Stn. F, as above, 14.ii.49, 13C. Stn. G, as above, 19.xi.49, 38C. Achimota, 1947 specimen A, A. Coll. II, Chorkor, seine net, 8A.

Zoologisk Museum, Copenhagen, " Galathea " Coll. Stn. 37, Rockpool, Christiansborg, Accra, 4.xi.50, 50C. Stn. 38, Teshi, Accra, 24.xi.50, 34A.

Clausen Coll., Lagos, 16C and 95A.

British Museum. West Africa, 1952.5.8.1. Senegambia, 1899.7.1.1297, Busk Coll. Algiers, 1899.5.1.696, Hincks Coll. Morra des Lagostas, Angola, 1877.3.7 15, and many other specimens.

Zoarium erect, arising from an encrusting base, or from a complex of kenozooidal stolons. Zooids arranged round an imaginary axis in whorls. Zooids with from 4–7 spines, usually 5, the most proximal frequently greatly enlarged. Gymnocyst very long, porous.

Dimensions. Lz 0·43–0·55 mm., lz 0·18–0·30 mm., Lopes 0·20–0·23 mm.

The complex of forms which have in the past been assigned to *Electra pilosa* requires further investigation. Bobin & Prenant (1960) studied *E. pilosa* and *E. verticillata* from the Roscoff area, and concluded that the two forms were specifically distinct. *E. pilosa* is capable of a great range of variation, which appears to be continuous. It is normally encrusting, but Norman (1894 : 114–122) described several forms with free, erect zoaria. His specimens show that the varieties he named merge, varying from colonies where the preponderance of zooids is in single chains, to others where the greater part of the growth of the colony is cellariiform. Colonies of *E. verticillata* also vary from sheets of zooids encrusting algae, to erect, free, strap-shaped bilamellar lobes and cellariiform branches.

The encrusting parts of *E. verticillata* either consist of irregular kenozooidal stoloniferous growth, or regular rows of zooids, which are not arranged in quincunx. The network of stolons which apparently anchor the erect parts of the colony in

sandy conditions may be purely an ecological adaptation, characteristic of certain areas and conditions. *E. pilosa* may produce similar stolons, and they are present in Norman's variety *eucrateiformis*, but they do not appear to give rise to cellariiform erect branches.

Encrusting colonies of *E. pilosa* have the zooids arranged in quincunx, and apparently erect branches have in fact been found to encrust algal and hydroid stems in all the many specimens examined. Some of these " erect " zoaria, notably those from Australia labelled " var. *flagellum* " (1897.5.1.482, 483, 484, and 1899.5.1.701) greatly resemble *E. verticillata*. The zooids do not, however, have elongated gymnocysts, and are arranged in a spiral pattern around the algal stem they encrust. Spirally arranged, encrusting colonies of *E. verticillata*, however, do occur in specimens from South Africa (1923.7.26.8, O'Donoghue Collection).

Bobin & Prenant found that the number of spines in their material of *E. verticillata* was invariably 5. Specimens from South Africa in the British Museum show that the number may vary from 4–7, but that in the great majority of zooids it is 5. The range of variation in *E. pilosa* is larger, but a count of spines from 650 zooids from 16 specimens each, of both *E. verticillata* and *E. pilosa*, gave an average of 5·2, range 4–7, in *E. verticillata*, and 5·6, range 3–11, in *E. pilosa*.

The number of spines on the ancestrula of *E. pilosa* and *E. verticillata* is also not a consistently differing character between the two forms, and both their ancestrulae and early astogeny are similar. In this respect, the otherwise closely similar species *E. posidoniae* Gautier differs completely from both *E. pilosa* and *E. verticillata* (see Cook & Hayward, 1966 : 440).

When a large amount of material from widely different localities and substrates is examined, the other characters considered by Bobin & Prenant, such as the form of the opercular sclerites, the size of the pores on the gymnocyst, and the absolute size and proportions of the zooids, show a continuous range of variation between the two species. However, using the correlation of characters given above, *E. verticillata* does appear to be specifically distinct.

The distribution of *E. verticillata* is interesting. Bobin & Prenant (1960) found it associated with the alga, *Gracilaria verrucosa* and with sandy sea-bottoms off Roscoff. Bobin & Prenant concluded (p. 154), that " Sa bionomie est très spéciale, car elle vit en des stations peu nombreuses et précises, liées à quelques algues définis et au sable fin nécessaire au réseau stolonial." Gautier (1962 : 34) had already emphasized the association of the alga, *Posidonia* and *E. posidoniae* in the Mediterranean.

In the British Museum Collections *E. verticillata* occurs from Algiers, from West and South Africa, New Zealand, and the Atlantic coasts of France and Portugal. The encrusting parts of the colonies are all associated with algae. With one exception (Manorbeer, Tenby, 1899.7.1.1286 Busk Coll.), there is no record of *E. verticillata* from the British coast (see also Norman, 1894 : 116).

The specimen from Lagos (Clausen Coll.) arises from a base encrusting Rhodophycae. The fronds measure 75 mm. in length. The specimen from Senegal (Marche-Marchad Coll. II, 46A) arises from an accretion of calcareous fragments, and shows stolons at its base. The specimen labelled " Senegambia ", from the Busk Collection, has encrusting zooids, whereas that from Algiers, from the Hincks Collection, has

narrow erect fronds like those described by Bobin & Prenant. The specimen from Angola has wide, strap-like fronds.

Electra bellula (Hincks)

(Text-figs. 6*a*, *b*)

Electra bellula var. *bicornis* (Hincks) Hastings, 1930 : 706, pl. 2, fig. 8; Galapagos and Panama.
Electra bellula (Hincks) Marcus, 1937 : 37, pl. 6, figs. 14A–F (synonymy); 1955 : 280, Brazil-Lagaaij, 1963 : 170, Gulf of Mexico; Shier, 1964 : 611 (synonymy) Florida.

Material examined. Marche-Marchad Coll. II 26C, 20–25 milles au large de Saloum, 8.3.55, 35–37 m.

Zoologisk Museum, Copenhagen. Lagos, Clausen Coll., 16B, 73B and 95B.

British Museum. Lagos, University College Coll. 1, 1959.2.12.6; Cape Verde Islands, 1899.7.1.1277, Busk Coll., 1926.12.9.2, 2a, and 1963.2.12.60.

E. bellula is not present in the " Calypso " or Achimota Collections.

Dimensions. Lz 0·32–0·53 mm., lz 0·17–0·22 mm.; Lopes 0·19–0·32 mm., L proximal spine 0·26–0·50 mm.

Zoarium encrusting and erect, branching dichotomously. Zooids with a well-developed gymnocyst. One pair of lateral oral spines, one large proximal spine, and subsidiary spines arising from the gymnocyst.

Marcus (1937) included both of Hincks's varieties (var. a, *bicornis*, and var. b, *multicornis*) in the species. Specimens from the Cape Verde Islands encrust algae and have the majority of their proximal spines branched; those from Senegal and Lagos are erect and have unbranched proximal spines like those figured by Marcus (1937, pl. 6, fig. 14F) in specimens from Brazil.

The colonies from Senegal arise from calcareous worm-tubes and sponges, they measure up to 20 mm. high and 18 mm. across.

ASPIDELECTRA Levinsen

Aspidelectra Levinsen, 1909 : 160.

Type-species. *Lepralia melolontha*, Landsborough.

Zooids with the frontal membrane covered by flattened spines arising round the opesia. No avicularia, no ovicells.

Marcus (1940 : 199), placed *Aspidelectra* in the Cribrilinidae. It was included, with *Tendra* Nordman and *Heterooecium* Hincks, in the Electridae by Bassler (1953 : G157–158). The type species, *Lepralia melolontha* Landsborough is found from localities of reduced salinity bordering the North Sea, see Hastings (1966 : 63).

A. melolontha has a well-developed gymnocyst, 13–17 lateral spines, and one pair of oral spines. Dimensions of British specimens are : Lz 0·35–0·55 mm., lz 0·25–0·30 mm., Lopes 0·30–0·41 mm., L "orifice" 0·07–0·08 mm., l "orifice" 0·10–0·11 mm., cf. *A. densuense* below.

Aspidelectra densuense n. sp.[1]

(Text-fig. 12)

MATERIAL EXAMINED. Holotype. 89B,[1] Stn. 123, Achimota Coll. Trawl 3, 11.4.51, 8 m., off Densu R. on shell. (British Museum.)

Paratypes. As above, remaining material from Stn. 123.

Achimota Coll. Stn. K on trawl debris 1 mile offshore, 2 miles beyond Densu River, 4 fath., 2.iii.49, 36L, 44N. Stn. 121, 11.4.51, 8 m., off Densu River, 93B. Stn. 126, 12.4.51, 20 m., 37J.

DIMENSIONS. Lz 0·30–0·43 mm., lz 0·18–0·24 mm., L opes 0·26–0·30 mm., L " orifice " 0·05–0·07 mm., l " orifice " 0·05–0·07 mm.

Zoarium encrusting shells, colonies fan-shaped. Gymnocyst very small or absent. Frontal membrane covered by 11–14 over-arching, flattened spines, fused centrally. 2–3 pairs of oral spines.

A. densuense is very similar in character to *A. melolontha*, but shows the following consistent differences. The zooids are shorter, but proportionately broader, and the opesiae are proportionately longer, than those of *A. melolontha*. The gymnocyst is vestigial in the majority of zooids. The number of spines covering the frontal membrane is smaller than in *A. melolontha*, and the spines are flatter and definitely fused at the tips. The most proximal spine is not enlarged and erect, as it is frequently in *A. melolontha*. The oral spines differ in that there are always 2, and occasionally 3 pairs present. The spines have stout, swollen, hollow bases, and curved, dark brown chitinous tips. An ancestrula is present in the holotype; it is broken, but was apparently membraniporan, as is that of *A. melolontha*, which, however, has a more distinct gymnocyst. The ancestrula gives rise to 2 distal zooids which later bud 2 series of zooecia, forming the characteristic fan-shaped colony in both species.

A. melolontha has been found only in waters of reduced salinity, bordering the North Sea (see Hastings, 1966 : 63). The waters in which *A. densuense* has been found may be fully marine, but Stns. K, 121, and 123 are off or near the mouth of the Densu River, in shallow water, and the area may be subject to some seasonal reduction in salinity of the water. Both *A. melolontha* and *A. densuense* are found encrusting the inner side of shells.

FLUSTRIDAE Smitt

Flustridae Smitt, Silén, 1941 : 49.

CHARTELLA Gray

Chartella Gray, Harmer, 1923 : 304.

TYPE-SPECIES, *Flustra papyracea* Ellis & Solander.

Chartella and *Terminoflustra* Silén have similar characters, and *C. elongata* (see below) could be referable to *Terminoflustra*. The nature of its ovicells is, however, unknown, and it is here included in *Chartella* due to its affinity with *C. tenella* Hincks.

[1] Named after the River Densu, Ghana.

Flustrine species are rare in these Collections, and the 2 species described below are from the same station, off Cap Blanc, Mauritania. Canu & Bassler (1925) recorded only 2 species from the Moroccan coast, *C. papyracea* and *Spiralaria stricto-cella*, which last has not been found in these Collections.

Chartella papyracea (Ellis & Solander)

Flustra papyracea Ellis & Solander, Hincks, 1880*a* : 118, pl. 16, figs. 2, 2*a*, southern coasts of Britain and Ireland.
Flustra (*Chartella*) *papyracea* Ellis & Solander, Canu & Bassler, 1925 : 14, Morocco.
Carbasea papyracea (Solander), Prenant & Bobin, 1966 : 183, text-figs. 48, VIII; 55.

Material examined. " Calypso " Coll. I, Stn. 1, 21° 05′ N, 17° 14′ W, 10.v.56, 43–45 m. C51E. *C. papyracea* is not present in the Marche-Marchad, Achimota or " Atlantide " Collections.

Zoarium erect, bilamellar, lobes dividing dichotomously. Zooids with a pair of oral spines. Edges of lobes bordered by kenozooids. Ovicells endozooecial. Avicularia absent.

Dimensions. Lz 0·41–0·50 mm., lz 0·17–0·24 mm., L marginal Kz 0·80 mm., Lov 0·14–0·16 mm., lov 0.12–0·17 mm.

The 6 specimens arise as small, undivided lobes, from bases encrusting hydroid stems. The lobes average 8 mm. in height and 2·5 mm. in width. Embryos are present in the ovicells, average diameter 0·12 mm.

C. papyracea occurs in the eastern Atlantic. The British Museum possesses specimens from the south-western British coasts, from western France and from Spain. Canu & Bassler (1925) recorded it as common at Fedhala (Fédala, south of Rabat), Morocco. These specimens from northern Mauritania appear to the most southerly so far recorded.

Chartella elongata n. sp.[1]

(Text-fig. 7)

Material examined. Holotype, 31A,[1] see below, rest of material paratypes. (Museum National d'Histoire Naturelle, Paris). " Calypso " Coll. I, Stn. 1, 21° 05′ N, 17° 14′ W, 10.v.56, 43–45 m., C 31A.

C. elongata is not present in the Marche-Marchad, Achimota or " Atlantide " Collections.

Zoarium erect, bilamellar, lobes dividing dichotomously. Spines absent. Edges of lobes bordered by kenozooids. Avicularia within kenozooids, occupying the position of the distal bud of a pair where the zooidal rows bifurcate. Mandible semicircular, directed distally. Ovicells not seen. Tentacle number 12–14.

Dimensions. Lz 0·90–1·15 mm., lz 0·15–0·20 mm., L marginal kz 2·5 mm., L av kz 0·17–0·20 mm., Lm 0·06 mm., lm 0·10 mm.

The 6 colonies have an average height is 70 mm., the lobes being 2–2·3 mm. in width. The colour (preserved in spirit) is brown, with light yellow growing tips.

[1] Latin, *elongatus*, prolonged; referring to the long zooids of this species.

The tentacles are extremely long, and, even when completely retracted, are curled round each other at the tip (see Text-fig. 7). Each colony arises as a narrow frond composed of kenozooids with thickened walls which bifurcates several times, forming about 8 lobes. One colony is entire, the part proximal to the kenozooids being composed of rootlets, to which adhere sand grains, small fragments of shell and Foraminifera. It seems possible that *C. elongata* is capable of growing directly from sandy substrates.

C. elongata differs from *C. tenella* (Hincks, 1887 : 313, pl. 9, fig. 1, from the Mediterranean and Adriatic), in its more elongated, narrower zooecia. Those of *C. tenella* average 0·68 mm. in length, and have a pair of oral spines. The mandibles of *C. tenella* are acute, triangular, and directed obliquely (see Gautier, 1962 : 48).

HINCKSINIDAE Canu & Bassler

Hincksinidae Canu & Bassler, Bassler, 1953 : G159.

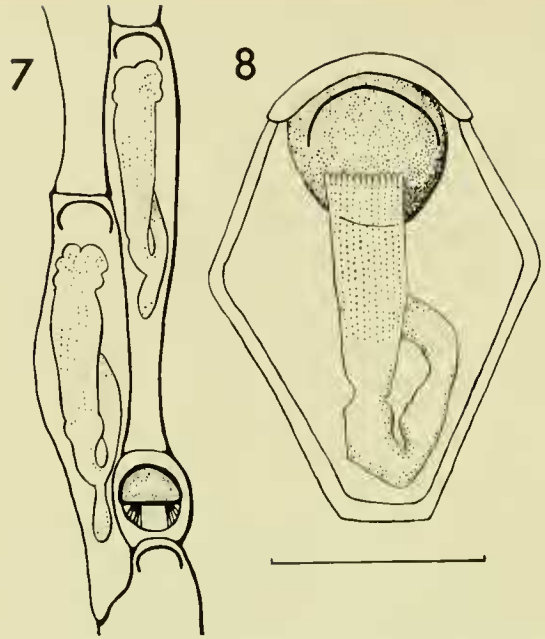
ANTROPORA Norman

Antropora Norman, 1903 : 87. Osburn, 1950 : 51.

Type-species, *Membranipora granulifera* Hincks.

The diagnosis given by Norman specified the presence of dietellae and of a well-developed proximal cryptocyst. *A. granulifera*, the type species, *A. papillata* and *A. minus* (which last have in the past been referred to *Membrendoecium*), have these characters. *A. nigra* (Hincks) does not have dietellae, and has large vicarious avicularia, like those of *A. marginella* (Hincks), which otherwise do not appear to be present in other species of *Antropora* s.s. Canu & Bassler (1929: 93) expressed doubts that *M. nigra* was congeneric with *A. granulifera*. Harmer (1926 : 233) described large vicarious avicularia in *A. granulifera*, but two of the specimens in which they occurred (Skikoku Is., Japan, 1928.9.13.17, and Sumbawa, E. 1928.3.6.49) differ from the rest of the material available for examination in the British Museum, in some important respects. These specimens have no dietellae, and the avicularian chambers reach the basal lamina between the zooids. The proximal cryptocyst is is not well-developed. Another specimen with similar characters in the British Museum is from Mauritius (1934.10.8.9). Most of Harmer's specimens of *A. marginella* also differ considerably from Hincks's type material. The slides from Siboga Stn. 164 (New Guinea, 1928.3.6.51), Stn. 81 (Borneo Bank, 1928.3.6.50) and Torres Straits (1928.9.13.18) are not the same species as that from Torres Straits (1928.9.13.19), which alone appears to be referable to *A. marginella* s.s. (see Powell, 1967 : 164). The zooids of the aberrant specimens also have no dietellae, and it is possible that all of them, and those mentioned above under *A. granulifera*, should be referred to species of *Crassimarginatella*. It is hoped to revise all these records fully in the near future.

Osburn (1950 : 51), considered that there was no distinction between *Antropora*, *Membrendoecium*, *Dacryonella* and *Canua*. Certainly the type-specimen of *Membranipora papillata*, which is the type-species of *Membrendoecium*, is congeneric



FIGS. 7–8. *Chartella* and *Aplousina*. Scale = 0·5 mm. 7. *Chartella elongata* n. sp. 2 zooids and an avicularium, " Calypso " Collection, C 31A. 8. *Aplousina major* (Calvet). 1 zooid with embryo beneath the retracted tentacles, " Calypso " Collection, C10C.

with *Antropora minus* (see below). Both species have very small zooids, vestigial ovicells, and avicularia whose chambers reach the basal layers of the colony between the zooids. The principal difference between them and *A. granulifera* is that the avicularian chambers are not in series with the dietellae (see below). *Amphiblestrum papillatum*, as described by Canu & Bassler (1929 : 104, pl. 7, fig. 8, specimen examined from Stn. 5179, " Albatross ", Philippines, 1931.12.30.25) is not Busk's species. The gymnocyst is elongated, the opesial rim is greatly raised, the ovicells are hyperstomial, and spines are present.

Antropora granulifera (Hincks)

(Text-fig. 9)

Membranipora granulifera Hincks, 1880*b* : 72, pl. 9, fig. 4, Madeira.
Antropora granulifera (Hincks), Osburn, 1950 : 52, pl. 4, fig. 5.

MATERIAL EXAMINED. " Calypso " Coll. I. Entre Pta da Mina & Pta Novo Destino, 26.vi.56, 6 m. (worn), C47B. Coll. II. Stn. 16, an N.W. Pta Geneanes, 17.xi.59, 235–400 m., C70H, Stn. 31, 14° 53′ 35″ N, 23° 29′ 58″ W, 19.xi.59, 70–170

mm., C66Q, Stn. 35, 45–55 m., C105E, C112E. Stn. 50, ile Brava, Porto dos Ferreiros, 21.i.59, 30–50 m.,

Zoologisk Museum, Copenhagen. Mortensen Coll., La Luz, Canary Is. 28.iii.30, 50 m., 90H.

British Museum. Madeira, 1879.5.28.6, and 1919.6.25. 23 and 24. Norman Coll.

Zoarium encrusting. Zooids with paired distal avicularia, their chambers in series with, and replacing, two dietellae. Rostrum acute, directed inwardly. Ovicells vestigial or very small, closed by the operculum.

Dimensions. Lz 0.40–0·58 mm., lz 0·27–0·40 mm., Lopes 0·20–0·32 mm., Lav 0·11–0·15 mm., Lm 0·07–0·10 mm.

This species was originally described from Madeira, and these specimens agree well with those from the Norman collection listed above. Each of the avicularian chambers replaces a dietella and the avicularia are thus interzooecial in the sense used by Hastings (1963 : 181). Harmer's (1926) and Osburn's (1950) description of the avicularia as " belonging to the succeeding zooecium ", and not belonging " to either zooecium ", respectively, are thus not strictly accurate. Lacunae in the basal wall were described by Norman (1903 : 88), they are present in all these specimens. The ovicells are vestigial in some zooids, slightly more developed in others. The avicularia in fertile zooids are directed distally, and the tips of their rostra do not tend to approach each other as they do in the other zooids.

Specimens from the Indo-Pacific region have larger zooids than those from Panama, Madeira and west Africa (Lz 0·05–0·08 mm.), but are similar in all other characters. The opercula of their fertile zooids show slight dimorphism, being wider and darker in colour than those of the other zooids.

Antropora minus (Hincks)

(Text-fig. 10)

Membranipora trifolium var. *minor* Hincks, 1880c : 87, pl. 11, fig. 6, Bahia.
Membrendoecium minus (Hincks), Marcus, 1937 : 50, pl. 19, figs. 22A, B, Brazil.

Material examined. " Calypso " Coll. I, Stn. 108, Ise Tortuga, face N.W., Annobon, N.E. 4.vii.56, 15–40 m., C6B, on echinoderm spine. Achimota Coll. Stn. X, Atim, Hospital Reef, 68A, on *J. foetida*, shell and stones.

British Museum. Bahia, 1899.5.1.654, Hincks Coll., Type. Fernando Noronha, 1888.4.16.9.

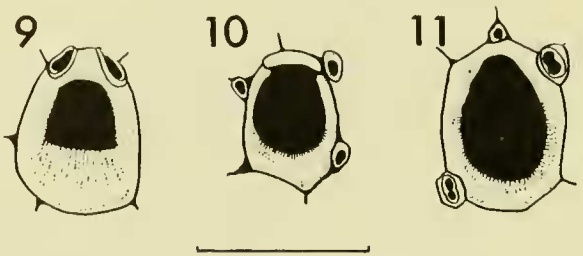
A. minus is not present in the Marche-Marchad or "Atlantide " Collections.

Zoarium encrusting. Zooids very small. Ovicells vestigial. Avicularia small, subrostral chambers reaching the basal lamina between the zooids.

Dimensions. Lz 0·25–0·33 mm., lz 0·17–0·20 mm., Lopes 0·15–0·23 mm., Lav 0·04–0·07 mm.

A. minus differs from *A. granulifera* principally in its smaller zooids, and in that the avicularia are less regular in position, being situated between the zooids, and not replacing dietellae. *A. minus* greatly resembles *A. papillata* (Busk), differing only in having smaller zooids and avicularia, and a less well-developed proximal crypto-

cyst. Measurements on the type specimen of *A. papillata* (Stn. 208, 1887.12.9.327, Challenger Coll.), may be compared with those for *A. minus* given above. Lz 0·30–0·42 mm., lz 0·15–0·23 mm., Lopes 0·12–0·15 mm., Lav 0·05–0·09 mm. *A. papillatum* Canu & Bassler is not referable to *Antropora*, see above.



FIGS. 9–11. *Antropora*. Scale = 0·5 mm. 9. *A. granulifera* (Hincks). 1 zooid with paired distal avicularia, "Calypso" Collection, C 105E. 10. *A. minus* (Hincks). 1 zooid with an ovicell, and 3 avicularia, Achimota Collection, 68A. 11. *A. tincta* (Hastings). 1 zooid with 2 avicularia and a distal kenozooid, "Atlantide" Collection, 107B.

Antropora tincta (Hastings)

(Text-fig. 11)

Crassimarginatella tincta Hastings, 1930 : 708, pl. 5, figs. 16–19, pl. 17, fig. 120, Balboa, Panama. Galapagos, Mexico.

Antropora tincta (Hastings) Osburn, 1950 : 54, pl. 4, fig. 7, pl. 29, figs. 7, 8. California to Peru and Galapagos.

MATERIAL EXAMINED. "Calypso" Coll. I. Stn. 25, 4° 36′ 5″ N, 1° 31′ W, 24.v.56, 50 m., C10M, Coll. II, Stn. 75, 16° 04′ 20″ N, 22° 58′ 10″ W, 25.xi.59, 45 m., C106C.

Achimota Coll. I. Stn. K, on trawl debris, 1 mile offshore, 2 miles beyond Densu R., 2.iii.49, 36J. Stn. 126, 12.iv.51, 20 m., 37C. Christiansborg, 13.x.50 on spines of *Eucidaris tribuloides* var *africana* Mortensen, 94C.

Zoologisk Museum, Copenhagen. "Atlantide Coll. Stn. 49, 7° 29′ N, 13° 38′ W, 30.xii.45, 74–79 m., 41B and 114C, on shell. Stn. 70, 4° 50′ N, 2° 49′ W, 15.i.46, 65 m., 76H on shell. Stn. 75, 4° 43′ N, 1° 41′ W, 23.i.46, 46 m., 51N on coral. Stn. 123, 2° 03′ S, 9° 05′ E, 5.iii.46, 50 m., 20B, on coral. Stn. 145, 9° 20′ N, 14° 15′ W, 13.iv.46, 32 m., 7F, 110T, on shell. Stn. 146, 9° 27′ N, 14° 48′ W, 13.iv.46, 51 m., 45I, 107B, on shell.

British Museum. Gorgona and Balboa, Panama, 1929.4.26.68–72, 74, "St. George" Coll.

Zoarium encrusting, plurilaminar, arising into irregular branches when in association with gastropod shells inhabited by Pagurid crabs. Dietellae present. Kenozooids and avicularia frequent between the zooids.

DIMENSIONS. Lz 0·35–0·52 mm., lz 0·29–0·36 mm., Lopes 0·19–0·34 mm., Lav 0·06–0·13 mm., Lm 0·03–0·07 mm.

Small dietellae are present in the type and in the west African material. They were not described by Marcus (1937 : 46, pl. 8, fig. 20A, pl. 9, figs. 20B, C), for *C. leucocypha*, but specimens of that species from Brazil in the Marcus Collection sent to the British Museum have small dietellae present. The ovicells of *A. tincta* are vestigial (see Hastings, 1930), as are those of *C. leucocypha* (see Marcus, 1937), and the two forms appear only to be separated by the frequency of occurrence of kenozooids, the size of the avicularia, and the shape of the avicularian mandible. The zooids show great variation in size, the primary individuals of a new lamina being large, and the succeeding zooids considerably smaller. The occurrence of kenozooids and avicularia is variable and sporadic. In some colonies, or parts of colonies, each zooid is surrounded by small kenozooids, and avicularia are frequent, in others, both are completely absent from areas of the zoarium.

The specimen encrusting the sea-urchin *E. tribuloides* var *africana*, was accompanied by *M. arborescens*, the zooids of which had the frontal membrane covered in small chitinous spinules. The colonies encrusted the large club-shaped spines of the sea-urchin to a depth of 3 layers, and covered even the spines surrounding the mouth. Associated Polyzoa were *Bowerbankia gracilis* Leidy and *Alcyonidium* sp. These four forms covered nearly every spine, and their diameter was increased by the Ctenostomes to nearly $\frac{3}{4}$ in. in some cases. The spines remained capable of movement, and the sea-urchin appears to have been alive when collected. *A. tincta* appears to be a frequent commensal of molluscs, but none of these specimens has shown any tendency to produce erect "arms", as described by Osburn (1950). *A. tincta* may thus appear superficially very similar when living commensally in shells, to both *Membranipora commensale* and *M. arborescens*. In areas of the colony where avicularia are absent, only the presence of diatellae distinguish *A. tincta*.

APLOUSINA Canu & Bassler

Aplousina Canu & Bassler, 1927 : 2.

Type-species. *A. gigantea*, Canu & Bassler.

Zoarium encrusting. Zooids very large. Gymnocyst and cryptocyst generally narrow. Ovicells endozooecial. Avicularia absent.

There are few criteria available for specific distinction in *Aplousina*, and some of these have now been found to show a hitherto unsuspected range of variation. The development of the proximal cryptocyst varies with the shape of the zooids, which are frequently very irregular in outline. The presence of a raised mural rim and of a lateral cryptocyst, may have specific value, but have been found to be very variable within a single colony. A pair of distal spines has been described in some forms but these seem to be variable in occurrence, even in those species in which they are known. The large range in size of the zooids within a colony has been noted by several authors (see Osburn, 1950, and Canu & Bassler, 1930), and although the species considered here fall roughly into two groups, one with larger zooids, on average, than the other, this does not seem to constitute a useful specific character. The ovicells are of 3 main types. The first is a fully-developed, endozooecial form. The distal wall of the ovicell protrudes beneath the proximal cryptocyst of the next succeeding

zooid (see Soule, 1959 : 11). The ovicell is closed by a special membrane, or by an extension of the frontal membrane distal to the operculum. The second form does not protrude into the cavity of the next zooid, but may produce a distinct swelling frontally. This type of ovicell is closed by the zooidal operculum. The third form intergrades with the second, and at one end of its range of variation is completely vestigial. The distal wall of the zooid is slightly concave, and the distal rim slightly raised and thickened. The embryos are seen beneath the retracted tentacles, at the distal end of the zooid, below the operculum (see Text-fig. 8).

The synonymies of the various described forms of *Aplousina* are in a confused state, and a large amount of material from many localities might show that these could be ascribed to at most 2 or 3 species. Until this can be studied, it is only possible to summarize the characters of some of the known species, and to indicate their possible range of variation.

Aplousina filum (Jullien & Calvet)

Membranipora filum Jullien & Calvet, 1903 : 41, pl. 5, fig. 4. Azores. Calvet, 1907, part : 386 (not var. *major*, see below).

A. filum was first described with paired distal spines and figured with a raised mural rim and narrow, but distinct crenulated lateral cryptocyst. Later records from the Azores and the Cape Verde Islands confirmed the presence of spines and described the ovicells, which were of the first type (see above) and were closed by a separate operculum.

A. capriensis (Waters 1898 : 690, pl. 47, fig. 6), appears to be distinguished from *A. filum* s.s. by the absence of spines and by its vestigial smooth lateral cryptocyst. The type of ovicell (see pl. 3, fig. D) and range in size of the zooids (specimen 1960.11.2.1, Mediterranean, Gautier Coll., Lz 0·50–0·90 mm.), is very similar to that of *A. filum* described by Jullien & Calvet (dimensions calculated from their figure, Lz 0·71–0·81 mm.). "*A. filum*" Gautier (1962) has a vestigial ovicell and is not referable to *A. filum* Jullien & Calvet (see below).

"*A. filum*" Canu & Bassler (1930*a* : 5, pl. 1, figs. 1, 2, Galapagos Islands), was described without distal spines, and the ovicell figured (pl. 1, fig. 2) is apparently vestigial. The material described as *A. filum* by Osburn (1950 : 47, pl. 4, fig. 7, from the Gulf of California to the Galapagos) may not be homogenous. His figure shows a vestigial ovicell, but he described it as " prominent, lunate, the aperture wide and closed by a special operculum ". His figured specimen is almost certainly "*A. filum*" Canu & Bassler, and it seems possible that there may be more than one species of *Aplousina* in the eastern Pacific. Neither the form with well-developed ovicells, nor the form with vestigial ovicells, is referable to *A. filum* s.s.

"*A. filum*" Gautier (1962 : 38) had been discussed by Bobin & Prenant (1961 : 165), as *Aplousina* sp., a specimen from the Mediterranean (1960.11.2.2, on shell and stone, Gautier Coll.) shows vestigial ovicells, and agrees with the figures given by Bobin & Prenant (see Pl. 3, fig. F). The zooids are very large, although not consistently as large as those of *A. major*, see below (Lz 0·70–0·85 mm., lz 0·47–0·60 mm., Lopes 0·55–0·72 mm., lop 0·21–0·25 mm., Lov 0·05–0·07 mm., lov 0·20–0·26 mm.). It is possible that this, so far unnamed, species of *Aplousina* may be found to inter-

grade with *A. major*, but the present specimens differ in their wider lateral cryptocyst, larger ovicell, and in the more proximal position of the operculum, as well as their slightly smaller dimensions.

Aplousina gigantea Canu & Bassler

(Pl. 3, fig. A, B, C)

Biflustra lacroixii Smitt, 1873, part : 18, pl. 4, figs. 85–87 (not fig. 88, ?=*Crassimarginatella tuberosa* q.v.).

Aplousina gigantea Canu & Bassler, 1927 : 2, pl. 1, fig. 1, 1928*b*, 20, pl. 2 fig. 6, text-fig. 3, S.W. Florida. Osburn, 1940 : 357, pl. 3, fig. 3, fig. 31, Porto Rico, 5 fath. Maturo, 1957 : 38, text-fig. 32, North Carolina.

MATERIAL EXAMINED. Naturhistoriska Riksmuseet, Stockholm. Smitt's figured material of *B. lacroixii*, Lå 19, 195, 1781, S.W. Tortugas, 60 fath.

British Museum, 1931.12.19.13, S. of Tortugas, 4.vii.31, 40 fath., Colman-Tandy Coll. 1932.3.7.94, "Albatross" Stn. 2405, 28° 45′ N, 85° 2′ W, Gulf of Mexico, 30 fath., Canu & Bassler Coll.

Zoarium encrusting. Zooids very large. Spines absent. Ovicells raised frontally, variable, not protruding into the cavity of the succeeding zooid, closed by the zooidal operculum.

A. giganteum	Lz (mm.)	lz (mm.)	lop (mm.)	Lov (mm.)	lov (mm.)
Canu & Bassler, 1927	1·10	—	—	0·15	0·35
Canu & Bassler, 1928*b*	0·84–0·90	0·60–0·64	0·18	—	—
Osburn, 1940	0·84–0·90	0·60–0·65	0·20	0·16	0·30
Maturo, 1957	0·77–1·10	0·44–0·66	0·20	—	—
Smitt specimen	0·70–1·3	0·60–0·80	0·21–0·28	0·10–0·18	0·35–0·42
B.M. Tortugas specimen	0·70–1·3	0·60–0·75	0·21–0·28	0·07–0·18	0·35–0·42

The specimens in the British Museum agree well with Canu & Bassler's description and figures of their species. The material shows a large amount of variation in the width of the mural rim and lateral cryptocyst. In some zooids the rim is smooth, and the cryptocyst descends steeply. In others both rim and cryptocyst are finely tuberculate, and the cryptocyst descends more gently, like that figured by Osburn (1940, pl. 3, fig. 31). The proximal cryptocyst is frequently well-developed in some zooids. The ovicell is well-developed frontally in Canu & Bassler's and Osburn's descriptions, and some of the ovicells in the specimen from Tortugas (1931.12.19.13), resemble their figures. Other ovicells in the same colony are, however, almost vestigial. Smitt's figured material has been examined; it belongs to *A. gigantea*. It shows the same range in cryptocyst and ovicell development. The ovicells tend to be less well-developed than in the other Tortugas specimen, but the ranges of variation are almost identical. The identity of Smitt's specimens has been discussed by Jullien & Calvet (1903),[1] and Hastings (1945), see also p. 151.

[1] *B. lacroixii* Smitt not Audouin, was considered to be a synonym of *M. filum* by Jullien & Calvet (1903), but the ovicells are entirely different. Another synonym included (1903 : 41, footnote, and Calvet, 1907 : 386), was *Membranipora reticulum* (L.), from Corsica. This record is referable to *Conopeum seruati* (Canu), see Gautier, 1962 : 39.

Generally the zooids of *A. gigantea* are larger than those of *A. filum* and of *A. capriensis*, but their range of variation overlaps the dimensions of both those two species, and those of *Aplousina* sp. and *A. major* (see below).

Aplousina errans Canu & Bassler (1928*c* : 60, pl. 1, figs. 3, 4, from Brazil), had a well-developed gymnocyst, thick, raised mural rims, and two distal tuberosities on ovicelled zooids. The ovicells figured were very small and vestigial.

Aplousina major (Calvert)

(Pl. 3, fig. E, text-fig. 8)

Membranipora filum var. *major* Calvet, 1907 : 386, Morocco.

Material examined. " Calypso " Coll. I, Stn. 25, 4° 36′ 5″ N, 1° 31′ W, 24.v.56, 50 m., C10C, on stone.

A. major is not present in the Marche-Marchad, Achimota or " Atlantide " Collections.

Zoarium encrusting. Zooids extremely large. Cryptocyst and gymnocyst vestigial laterally and proximally. Spines absent. Ovicells vestigial.

Dimensions. Lz 0·65–1·2 mm., lz 0·43–0·68 mm., lop 0·22–0·30 mm., lop (fertile) 0·25–0·40 mm.

Calvet noted that his specimens from N.W. Morocco from (717 m.) had zooids distinctly larger than those of typical *A. filum*. The zooidal walls were less robust than those of *A. capriensis*, the zooids larger, and spines and ovicells absent.

It appears that the specimen from the " Calypso " Collection belongs to this form, which is certainly specifically distinct from *A. filum*. The ovicells are so little apparent that unless the embryo is present, they are difficult to distinguish. The cryptocyst, too, is vestigial laterally and proximally. The large embryos (average diameter 0·30 mm.), can be seen beneath the retracted tentacles, just below the operculum, which is placed at the extreme distal edge of the zooid (see Text-fig. 8).

Aplousina major Osburn (1950 : 47, pl. 4, fig. 2), from California to Galapagos, was an independent introduction. The characters of the species show it to be very similar to *A. major* (Calvet). The zooids were very large (Lz 0·80–1·20 mm.), and the operculum wide (0·25 mm.). The ovicells were vestigial. It is possible that the species are identical although Osburn mentioned the presence of dietellae, which are specifically excluded in his diagnosis of *Aplousina*.

ALDERINIDAE Canu & Bassler

Alderinidae Canu & Bassler 1927 : 13.

CALLOPORA Gray

Callopora, Gray, Osburn 1950 : 63.

Type-species, *Membranipora lineata* Linnaeus.

Zooids with marginal spines. Dietellae present. Ovicells hyperstomial, not closed by the operculum.

The characters listed above limit a genus the species of which show a great diversity of character. One of the two species described below, *C. confluens*, shows close similarity with *Membraniporella*, from which it is only separated by the type of closure of the ovicell. A similar example of convergent characters in *Membraniporella* and *Callopora* has recently been described and discussed by Bobin & Prenant (1965), for *Membraniporella nitida* and *Callopora rylandi*.

Callopora depressa n. sp.[1]

(Text-fig. 15)

Material examined. Holotype, 45D,[1] Achimota Coll., Stn. 133, see below (British Museum).

Achimota Coll. St. 72, 24.i.51, 38 m., 61C. Stn. 110, 4.iv.51, 40 m., 48D. Stn. 111, as above, 43 m., 49M. Stn. 112, as above, 43 m., 60E. Stn. 131, 2.v.51, 37 m., 41E and 43Z. Stn. 133, 2.v.51, 51 m., 45D, all on *Jullienella foetida*.

Zoologisk Museum, Copenhagen. " Atlantide " Coll. Stn. 163, 13° 43′ N, 17° 23′ W, 25.iv.46, 65 m., 71B, on *J. foetida*.

" Galathea " Stn. 4, 22° 19′ 18″ N, 17° 05′ W, 2.xi.50, 62 m., 69E, on *J. foetida*.

Zooids with a raised mural rim, gymnocyst short but distinct, depressed. Cryptocyst absent. 10–14 short, slightly curved, flattened marginal spines, curving above the frontal membrane. Ovicells hyperstomial, raised, smooth or very finely tuberculate, imperforate. One distal and 2–3 lateral dietellae present. Avicularia absent.

Dimensions. Lz 0·45–0·56 mm., lz 0·30–0·37 mm., Lopes 0·37–0·46 mm., L spines 0·08–0·10 mm., Lov 0·13–0·16 mm., lov 0·20–0·22 mm.

C. depressa is not present in the " Calypso " or Marche-Marchad Collections.

The zooids are distinct, and the raised mural rims are separated by a smooth, depressed channel. The gymnocyst is variably developed, but when present, is at a lower level than the slightly raised rim of the next proximal zooid, and is concave. The spines are not present on all zooids, and frequently only the distal pair are present. The operculum opens at the extreme distal end of the frontal membrane. The ovicell is closed by a special membrane, distal to the operculum.

The species which most closely resembles *C. depressa* is *C. whiteavesi* Norman, an Arctic form, see Osburn (1950 : 70, pl. 6, fig. 6).

Very few of the colonies of this delicate species have escaped damage. Entire spines are rarely present, and the ovicells are frequently broken. It is easily recognized, however, even when worn, by the prominent dietellae, and the depressed, concave gymnocyst. Colonies of *C. depressa* have some similarity to those of *Parellisina curvirostris* (see p. 156), which, however, has characteristic avicularia.

All the specimens of *C. depressa* and many of *P. curvirostris* have been found growing on *Jullienella foetida* Schlumberger, a large, foliaceous Foraminiferan with an arenaceous test which is typically associated with sandy and muddy sea-bottoms off the west African coast (see Norvang, 1961).

[1] Latin, *depressus*, flat; referring to the depressed gymnocyst of this species.

Callopora confluens n. sp.[1]

(Text-fig. 13)

Material examined. Holotype, C57E pt, see below (Museum National d'Histoire Naturelle, Paris).

" Calypso " Coll. Stn. 19, 5° 2′ 30″ N, 5° 24′ 40″ W, 21.v.56, 21–27 m., C57E, on *Julienella foetida*, with *Parellisina curvirostris*.

C. confluens is not present in the Marche-Marchad, Achimota, or " Atlantide " Collections.

Zoarium encrusting. Zooids with one pair of distal spines and 5–7 pairs of thick, flattened, lateral and proximal spines, curved over the frontal membrane and fused at the tips, forming a frontal shield. One distal, and 1–2 lateral dietellae present. Ovicells globular, minutely porous and tuberculate. Avicularia between the zooids, the subrostral chambers reaching the basal lamina, rostra acute, linear, raised, directed distally. Mandibles long, setiform.

Dimensions. Lz 0·45–0·56 mm., Lz 0·22–0·29 mm., L spine 0·12–0·19 mm., Lov 0·15–0·18 mm., lov 0·15–0·19 mm., Lav 0·12–0·17 mm., Lm 0·16–0·25 mm.

The spines forming the frontal shield are wide, and the lacunae between them slit-like, unlike those of *C. rylandi*, which has fewer spines and correspondingly wider lacunae. The oral spines are also stout, and are directed upwards, but in some zooids they curve terminally and meet above the orifice. The operculum has a marginal sclerite. The ovicells are minutely porous, unlike those of *C. rylandi*, and resemble those of *Copidozoum tenuirostre* (see below). The avicularia are large, with a raised rostrum, the distal part of which is linear, with a narrow channel into which the setiform mandible fits. The avicularia have a pair of condyles, but no bar. The mandibles are hooked terminally.

C. confluens, like *C. rylandi*, resembles *Membraniporella nitida*, differing in the form of the avicularia, and in the closure of the ovicell. (See Bobin & Prenant, 1965, and Cook, 1967 : 330). *C. confluens* also shows superficial similarities with *Copidozoum tenuirostre*, the globose porous ovicells, the prominent oral spines, and the setiform avicularia being almost exactly the same in appearance in the two species.

C. confluens differs from *C. rylandi* in the number and form of its spines, and in its porous ovicell. The occurrence of two species of *Callopora*, both of which greatly resemble *Membraniporella*, suggests that the characters defining these genera, and indeed, their position in the classification, require further investigation. *M. nitida*, the type species of *Membraniporella*, possesses dietellae, like *Callopora*, but many of the other species referred to *Membraniporella* do not (see Cook, 1967 : 329). The ovicell in *Membraniporella* is closed by the zooidal operculum, unlike that of *Callopora* but the significance of this as a generic character has yet to be assessed. *Membraniporella* is usually considered to belong to the Division Cribrimorpha, but the similarities in structure of the frontal shield in *M. nitida*, *Callopora confluens* and *C. rylandi* suggest that there is no real division between the Divisions Cribrimorpha and

[1] Latin, *confluus*, place where two streams unite, referring to the convergence in character between *Callopora* and *Membraniporella* shown in this species.

Anasca. The development of such genera as *Tremogasterina*, *Triporula* and *Exechonella* indicate a similar intergradation in character between the Cribrimorpha and the Ascophora Imperfecta (see Powell & Cook, 1967 : 8, and Cook, 1967 : 334).

COPIDOZOUM Harmer

Copidozoum Harmer, 1926 : 226. Cheetham & Sandberg, 1964 : 1019.

Type-species, *Membranipora plana* Hincks.

Copidozoum tenuirostre (Hincks)

(Text-fig. 14)

Membranipora tenuirostris Hincks, 1880*c* : 70, pl. 9, fig. 3, Madeira.
Copidozoum tenuirostre (Hincks), Osburn, 1950 : 72, pl. 7, fig. 4, California to Peru & Galapagos Is. Cheetham, 1964 : 1019, text-figs. 10, 12, Louisiana. Bobin & Prenant, 1962*a* : 23, text-fig. 5.

Material examined. "Calypso" Coll. I. Stn. 19, 5° 2′ 30″ N, 5° 24′ 4″ W, 31.v.56, 21–27 m., C57J. Stn. 3, 13° 1′ N, 17° 24′ W, 15.v.56, C54B, on *J. foetida*. Coll. II. 15° 16′ 28″ N, 23° 47′ 24″ N, 18.xi.59, 40–45 m., on shells and Bryozoa, C61G. Marche-Marchad Coll. II, on shell with other spp, Boa Vista (Ile du C. Vert), 23.x.48, 30 m., 24D; Coll. III, Gérard Fréca, dr. 5, 18.ii.54, 27F. Achimota Coll. Stn. 35, 21.xii.50, 37 m., 59I. Stn. 45, 31.12.50, 32 m., 62B. Stn. 47, 4.i.51, 44m. ,14M. Stn. 72, 24.i.51, 38 m., 61B. Stn. 110, 4.iv.51, 37 m., 48C. Stn. 112, 4.iv.51, 48 m., 60E. Stn. 131, 2.v.51, 37 m., 41D and 43C. Stn. 132, 2.5.51, 44 m., 40O and 42C. Stn. 133, 2.5.51, 51 m., 45C, all on *J. foetida*.

Zoologisk Museum, Copenhagen, "Atlantide" Coll. Stn. 39, San Pedro Bay, St. Vincent, 10.xii.45, 41–50 m., 30A, on *Cupuladria*. Stn. 43, Bay of Praia, 13.xii.45, 8–25 m., 47K, on stone. Stn. 49, 7° 29′ N, 13° 38′ W, 30.xii.45, 74–79 m., 25I, on stone. Stn. 145, 9° 20′ N, 14° 15′ W, 13.iv.46, 32 m., 7J, 110d, on *J. foetida*. Stn. 146, 9° 27′ N, 14° 48′ W, 13.iv.46, 51 m., 107 g. Stn. 163, 13° 43′ N, 17° 23′ W, 25.iv.46, 65 m., 60F, 71A.

"Galathea" Coll. Stn. 4, 22° 19′ 18″ N, 17° 05′ W, 2.xi.50, 62 m., 69A, on *J. foetida*.

Brinkmann Coll., Dakar, 68C, on shell.

Zoarium encrusting. Zooids with a very small or vestigial gymnocyst, cryptocyst narrow, serrated. One distal and 2 lateral dietellae present. Operculum with a marginal sclerite. One pair of stout distal oral spines, and from 1–3 delicate lateral and proximal spines. Ovicells raised, globular, minutely porous and finely tuberculate. Avicularia between the zooids, the subrostral chambers reaching the basal lamina. Rostra with a linear distal channel, condyles spinous, occasionally meeting to form a bar, directed distally. Mandibles long, setiform.

Dimensions. Lz 0·35–0·49 mm., lz 0·25–0·49 mm., Lov 0·15–0·17 mm., lov 0·16–0·20 mm., Lav 0·18–0·25 mm., Lm 0·17–0·23 mm.

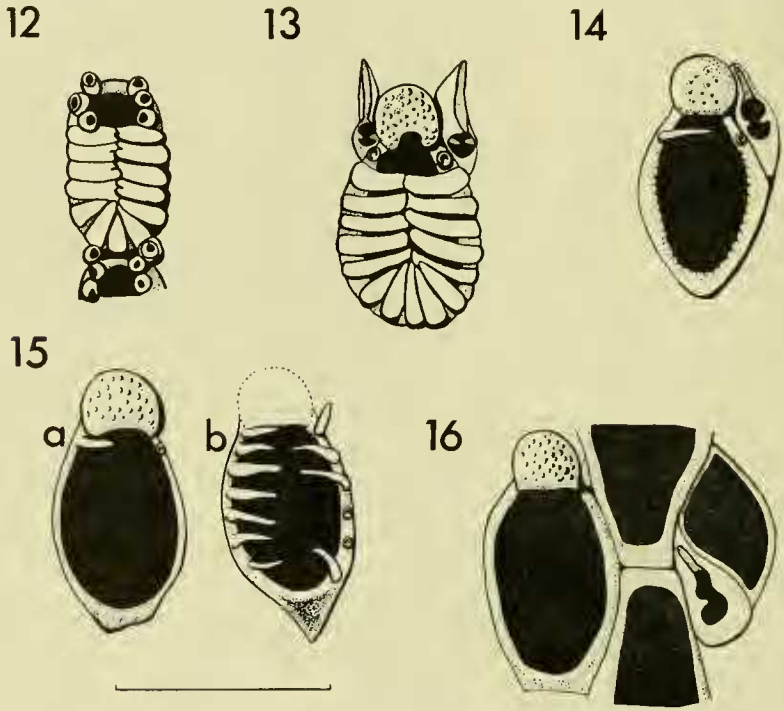
C. tenuirostre, and the closely related *C. planum*, have been defined and distinguished by Bobin & Prenant (1962*a*). *C. tenuirostre* has smaller zooids than

C. planum, which has no spines. Both species occur in the Mediterranean, but *C. tenuirostre* alone occurs from Madeira and west Africa.

The remarkable convergence of characters already noted between *Membraniporella nitida*, and *Callopora rylandi* and *C. confluens*, is repeated, to a lesser extent, between *C. confluens* and *Copidozoum tenuirostre*. The ovicells are very similar, and the hooked, setiform mandibles are almost identical in the two species.

The delicate lateral spines are not often present in the west African material, but the oral spines are large, and may be directed distally, upward, or occasionally curved proximally over the opesia, in a similar manner to those of *Crassimarginatella falcata*, see p. 153.

In the west African Collections *C. tenuirostre* is almost exclusively found encrusting *Jullienella foetida*.



FIGS. 12–16. *Aspidelectra*, *Callopora*, *Copidozoum* and *Parellisina*. Scale = 0·5 mm. 12. *Aspidelectra densuense* n. sp. 1 zooid showing oral and frontal spines, Achimota Collection, 89B. 13. *Callopora confluens* n. sp. 1 zooid with an ovicell and paired avicularia, " Calypso " Collection, C57E. 14. *Copidozoum tenuirostre* (Hincks). 1 zooid with ovicell and avicularium, Marche-Marched Collection, II, 14M². 15. *Callopora depressa* n. sp. a. 1 zooid with an ovicell and a pair of distal spines, b. 1 zooid with marginal spines. Note the concave gymnocyst (ovicell damaged), Achimota Collection, 45D. 16. *Parellisina curvirostris* (Hincks). 1 zooid with an ovicell, and an avicularium with large distal chamber, " Calypso " Collection, C 57J.

CRASSIMARGINATELLA Canu

Crassimarginatella (Canu), Hastings, 1945.

Type-species, *Membranipora crassimarginata* Hincks.

Zooecia with septulae, dietellae absent. Avicularian chambers reaching the basal lamina between the zooecia. Ovicells hyperstomial.

The characters given above are common to all species, and although there is great variability in other details, they appear to constitute a natural group. The avicularia, which vary considerably in size from species to species, all reach the basal lamina. The possession of a complete bar in the avicularia of *C. crassimarginatella* alone, does not seem to be of generic importance; some species have well developed avicularian condyles, other none (see below). Spines may be present or absent, and are also not of generic significance (see Hastings, 1945 : 70). The ovicells may be well-developed, or vestigial, great variation being found within a species, and occasionally within a specimen. For detailed notes on the occurrence of reduced and vestigial ovicells, including those of *Crassimarginatella* (see Hastings, 1964 : 250–252).

Of the 7 species of *Crassimarginatella* described here, 3 have been reported from the Cape Verde Islands. *C. crassimarginata* and *C. maderiensis* have a more northerly distribution, and do not seem to occur south of the Canary Islands.

The species described here show a range in variation in the development of the avicularium, extending from species in which it may be small in comparison with the the zooids, to those in which it may be hardly differentiated from them.

Key to Species Described Here

1 Avicularia apparently absent, distal spines forked, ovicells well-developed ***C. latens*** (p. 155)
– Avicularia present 2
2 Avicularia with a bar . . . . . ***C. crassimarginata*** (p. 149)
– Avicularia without a bar 3
3 Avicularian rostrum and manible acute 4
– Avicularian rostrum rounded, mandible rounded or spathulate 5
4 Avicularia frequent, smaller than the zooids, rostrum curved, polypide absent ***C. falcata*** (p. 153)
– Avicularia rare, as large as the zooids, manible triangular, polypide present ***C. similis*** (p. 154)
5 Zooids with lateral spines 6
– Zooids with a pair of distal spines only. Avicularia spathulate, ovicells vestigial ***C. tuberosa*** (p. 151)
6 Zooids and avicularia with distinct gymnocyst. Lateral spines simple ***C. maderensis*** (p. 150)
– Zooids and avicularia with vestigial gymnocyst. Lateral spines branched ***C. quadricornuta*** (p. 151)

Crassimarginatella crassimarginata (Hincks)

Crassimarginatella crassimarginata (Hincks) Norman, 1909 : 287, Madeira. Hastings, 1945 : 73, text-fig. 1A, not Calvet, 1931, see *C. tuberosa*.

Grammella crassimarginata (Hincks) Gautier (part), 1956 : 194, figs. 3, 4, 7–11 (not figs. 5, 6, see *C. maderensis*), west Mediterranean,

Material examined. Zoologisk Museum, Copenhagen. Mortensen Coll. La Luz, Canary Islands, 24.iii.30. 30–40 m., 88H.

British Museum. Teneriffe, 70 fath., 1967.7.11.3. Madeira, 1911.10.1.616, Norman Coll.; 1966.1.4.5 and 1964.7.28.1, Watson Coll. and 1967.7.11.2, Kirkpatrick Coll.

Zoarium encrusting. Zooids with well-developed, ridged cryptocyst. Gymnocyst small. 2 distal spines rarely present. Avicularia large, with a gymnocyst and ridged cryptocyst. Mandible variable in shape, hinged on a complete bar. Ovicells small, well-developed, smooth.

Dimensions. Lz 0·40–0·60 mm., lz 0·25–0·33 mm., Lopes 0·26–0·33 mm., Lov 0·15–0·20 mm., lov 0·21–0·26 mm., Lav 0·29–0·37 mm., Lav opes 0·14–0·19 mm.

C. crassimarginata does not occur in the " Calypso ", Marche-Marchad, Achimota or " Atlantide " Collections. It has not been found so far further south than the Canary Islands. The most distinctive character is that of the avicularia, which have a complete, robust bar across the opesia, against which the mandible is hinged.

Crassimarginatella maderensis (Waters)

Membranipora maderensis Waters, 1898 : 677, pl. 48, fig. 19, Madeira.
Hincksina maderensis (Waters) Norman, 1909 : 286, Madeira 40–70 fath. (note that the reference to Water's figure in the synonymy should read as above).
Grammella crassimarginata (Hincks) Gautier (part), 1956 : 192, text-figs. 5, 6, west Mediterranean.

Material examined. British Museum. Madeira, 1911.10.1.345, Norman Coll.; photographs of type material 1964.2.10.11; Adriatic, 1911.10.1.521, specimen received from Heller as *Membranipora lineata*.

C. maderensis is not present in the west African Collections.

Zoarium encrusting. Zooids with well-developed cryptocyst. Gymnocyst distinct, frequently long. Six straight distal spines, and 8–12 slightly curved lateral and proximal spines present. 2–3 lateral and 1 distal septula. Avicularia large, rostrum rounded and raised distally, small condyles present. Ovicells well-developed, wide, with a ridge across the front.

Dimensions. Lz 0·40–0·60 mm., lz 0·29–0·35 mm., Lopes 0·32–0·35 mm., Lav 0·60–0·70 mm., Lav opes 0·29–0·33 mm., Lov 0·12–0·15 mm., lov 0·23–0·26 mm.

The specimen from the Adriatic, sent by Heller to Norman as " *Membranipora lineata* " is certainly *C. maderensis*. Ovicells, spines and avicularia are present. Heller's description (1867 : 96) of *M. lineata* does not seem to refer to this specimen.

The specimens with distal spines and raised rostra, figured by Gautier from Grand Congloué, are referable to *C. maderensis*. Gautier later (1962 : 47) mentioned that his material consisted of a mixture *C. maderensis* and *C. crassimarginata*.

C. maderensis is very similar to *Membranipora tenuis* Jullien (1883 : 522, pl. 17, fig. 67, N.W. Spain, 1,000 m., see also Calvet 1907 : 390). *M. tenuis* had 6 distal spines only, but the lateral spines of *C. maderensis* are often absent. Jullien's specimen had no ovicells and avicularia, and the gymnocyst was generally less developed than in specimens of *C. maderensis*; the zooids were also larger (Lz 0·625 mm., lz 0·438 mm.).

C. maderensis resembles *C. spatulifera* Harmer (1926 : 223, pl. 14, figs. 2, 3, Nightingale Island and the East Indies), differing in the possession of spines and well-developed ovicells.

Crassimarginatella quadricornuta (Waters)

Membranipora quadricornuta Waters, 1918 : 9, pl. 1, fig. 8, Cape Verde Islands.

Material examined. British Museum. Cape Verde Islands, on clinker, 1926.10.1.11, Waters Coll. Porto Grande, St. Vincent, Cape Verde Islands, on coal, 10 fath., 1935.3.6.370–372, with *C. tenuirostre*, Vallentin Coll.

Zoarium encrusting. Zooids with narrow cryptocyst, small gymnocyst. One pair of branched oral spines, and from 2–4 branched lateral and proximal spines. Large vicarious avicularia present, with an elongated spathulate mandible. Ovicells not seen.

Dimensions. Lz 0·50–0·65 mm., lz 0·25–0·32 mm., Lav 0·50–0·55 mm., Lm 0·33–0·38 mm. *C. quadricornuta* is not present in the west African Collections.

It is possible that the material listed above is part of the type-material. 1926.10.1.11, has a label in Waters's hand, and the details of locality for 1935.3.6.370–372 are almost the same as those given by Waters for his specimens.

The frontal spines are all stout, and the lateral spines are branched terminally, and arched over the frontal membrane. They may fuse at the tips forming a partial frontal shield very similar to that of *Membraniporella marcusi* Cook (1967 : 331).

Waters noted that there were " a considerable number of vicarious avicularia ". They are rare in these specimens, occurring with a frequency of approximately 1 av : 100 zooids. The avicularia are large, and have no spines. The proximal cryptocyst is thick and crenulated, and distally it forms a narrow shelf. The distal part of the rostrum is not as expanded as that of *C. tuberosa*. The specimens examined are all dried, but it does not appear that the avicularia possessed polypides, as in *C. similis*. The mandible is far more differentiated than in that species, being elongated and spathulate.

Crassimarginatella tuberosa (Canu & Bassler)

(Text-fig. 17)

? Biflustra lacroixii (Audouin) Smitt, 1873 (part), fig. 88, Tortugas.
Aplousina tuberosa Canu & Bassler, 1928*b* : 21, pl. 2, figs. 4, 5, Gulf of Mexico.
? Crassimarginatella crassimarginata (Hincks), Calvet, 1931 : 59, Cape Verde Islands, 875 m.
Crassimarginatella tuberosa (Canu & Bassler) Hastings, 1945 : 85 (not synonymy). Cheetham & Sandberg, 1964 : 1017, text-fig. 5, Louisiana.

Material examined. " Calypso " Coll. I, Stn. 45, 0° 25′ N, 9° 0′ E, 8.vi.56, 73 m., C55A.

Zoologisk Museum, Copenhagen. " Atlantide " Coll. Stn. 123, 2° 03′ S, 9° 05′ E, 5.iii.46, 50 m., 57I.

Naturhistoriska Riksmuseet. Lå 19, 282, Smitt's figured specimen of *B. lacroixii*, fig. 88, W. of Tortugas, Florida, 35 fath. on *Steganoporella magnilabris*.

British Museum. Gulf of Mexico, " Albatross " Stn. D2387, on *Steganoporella magnilabris*, 1932.3.7.95, Canu & Bassler Coll. Campeche Bank, Gulf of Mexico, 1961.11.2.54, Cheetham Coll.

C. tuberosa is not present in the Marche-Marchad or Achimota Collections. Zoarium encrusting. Zooids large, cryptocyst narrow, finely serrated. Gymnocyst small. Mural rim raised distally, with one pair of distal spines which may curve proximally. One distal and 2–3 lateralse ptulae. Avicularia spathulate, vicarious, nearly as large as the zooids. Avicularian cryptocyst well-developed proximally, and forming a wide shelf distally, opesia oval or pear-shaped. Ovicells vestigial.

Dimensions. Lz 0·55–0·75 mm., lz 0·35–0·51 mm., Lopes 0·47–0·64 mm., Lav 0·40–0·70 mm., lav 0·30–0·35 mm., Lav opes 0·25–0·34 mm.

Smitt's specimen consists of a young colony without either ovicells or avicularia, growing on *S. magnilabris*. The zooids greatly resemble those of Canu & Bassler's specimen of *C. tuberosa*, and have minute paired, distal spines bases, which were not mentioned by Smitt.

Calvet considered that his specimen from the Cape Verde Islands was perhaps *Membranipora crassimarginata* var. *crecta* Busk (1884 : 63, pl. 14, fig. 3, from Bass's Straits). This species has large, spatulate avicularia, but is referable to *Acanthodesia perfragilis* (see Hastings, 1966 : 65). Calvet particularly mentioned " Les avicularies avec leur mandibule largement spatulée ", and it seems probable that his specimen was *C. tuberosa*.

The avicularia of the west African colonies differ slightly from those from the Gulf of Mexico in being proportionately smaller, and less expanded distally. The condyles, which are formed from an ingrowth of the lateral walls (see Text-fig. 17) are also less well-developed in the west African material.

Cheetham discussed the similarities between *C. tuberosa* and *Aplousina*. The ovicells show similar ranges in variation in both genera, and those of *C. tuberosa* resemble those of " *A. filum* " Gautier (see p. 142). The paired distal spines are developed as two small tubercles flanking the ovicell, which consists of the raised distal rim of the zooids. Some of the ovicells in the material from the Gulf of Mexico are slightly more developed, with a frontal tubercle.

The specimens from west Africa are without chitinous parts. The colony from the " Calypso " Collection encrusts a bivalve shell ; that from the " Atlantide " Collection is plurilaminar, surrounding a fragment of *Schizammina reticulata* (see Nørvang, 1961). Both Canu & Bassler, and Osburn (1940 : 357), commented on the association of *C. tuberosa* with *Steganoporella*, but it has not been found on any specimens of *S. magnilabris* from west Africa, which is however frequently associated with *C. falcata*, see below.

C. tuberosa shows the smallest development of ovicells in the west African members of the genus. It most resembles *C. falcata*, differing in the development of the spines and the form of the avicularia. In *C. tuberosa*, the avicularia are found at the bifurcation of series of zooids; they are fairly common, occurring in the proportion of approximately 1 av: 10 zooids (cf. *C. falcata* and *C. similis*).

Crassimarginatella falcata n. sp.[1]

(Text-figs. 19*a*, *b*)

Material examined. Holotype. 40P,[1] Achimota Coll., see below (British Museum). Marche-Marchad Coll. I. Konakrey, Guinée Isc., 1J. Sud de Gorée, 27.x.53, 38–42 m., 9E, and 24.xi.53, 40–41 m., 11 I. S.W. Madeleines, 15.ix.53, 48 m., 18A and 9.i.54, 45–46 m., 26L. Sud de presque l'île de Cap Vert, 18.ii.54, 95 m., 33F. Coll. II. Au large de Goréc, 5.vii.55, 50 m., 8C, 27D. S.W. Madeleines, 15.ix.53, 48 m., 40D. Baie de Gorée, 50–100 m., 7J. Coll. III. Au large de Gorée, Stn. 55, 50 m., 18E. Drag 1, 18.ii.54, 23E. No information, 21E, 24E.

Achimota Coll. Stn. 132, 2.v.51, 51 m., 40P. Stn. 133, 2.v.51, 44 m., 20F. Jar C, specimen C, Achimota, on *Steganoporella magnilabris*.

Zoologisk Museum, Copenhagen. " Atlantide " Coll. Stn. 60, 5° 06′ N, 9° 34′ W, 9.i.46, 78 m., 54I. Stn. 85, 5° 37′ N, 0° 38′ E, 30.i.46, 40 m., 108P, on *Steganoporella magnilabris*. Stn. 163, 13° 43′ N, 17° 23′ W, 25.iv.46, 65 m., 60G.

C. falcata is not present in the " Calypso " Collection.

Zoarium encrusting, or erect, tubular, branching. Zooids with finely tuberculate, denticulate cryptocyst, occasionally well-developed proximally. Gymnocyst vestigial. One pair of large distal spines, arising from the raised distal rim of the zooecia, long, curved, directed proximally. One distal, and 1–2 large, lateral septulae. Avicularia at the bifurcations of series of zooecia. Avicularian cryptocyst well-developed, opesiae elongated. Rostrum acute, curved toward the sister zooid. Ovicells vestigial, sometimes with a small distal tubercle.

Dimensions. Erect zooids. Lz 0·50–0·70 mm., lz 0·35–0·45 mm., Lopes 0·35–0·50 mm., Lav 0·38–0·60 mm., Lav opes 0·23–0·30 mm., Lm 0·21–0·34 mm. Encrusting zooids. Lz 0·45–0·55 mm., lz 0·25–0·40 mm., Lopes 0·34–0·42 mm., Lav 0·45–0·55 mm., Lav opes 0·25–0·32 mm., Lm 0·20–0·35 mm., Lov 0·04–0·07 mm., lov 0·10–0·13 mm.

The specimens from Senegal are all fragments of erect, tubular zoaria; those from Ghana are all encrusting (on *Steganoporella magnilabris* in the majority of cases). The zooidal dimensions of the erect zoaria are, on average, slightly larger than those of the encrusting zoaria. The mandibles are dark brown and strongly curved. The avicularia are more numerous (1 : 4 zooids) in the encrusting, than in the erect (1 : 20 zooids) zoaria, and occur at the bifurcation of zooidal rows.

The distal spines of *C. falcata* are remarkable both for their length and for their recurved direction of growth. When fully developed, they extend proximally over the entire length of the opesia.

The erect tubular specimen (Marche-Marchad I 18A) has one ovicell, it has a small distal tubercle. The ovicells of the encrusting zooids have no tubercles.

C. falcata somewhat resembles *Hincksina velata* (Hincks), see Osburn (1950 : 44, pl. 5, figs. 3, 4), which, however, has dietellae and endozooecial ovicells, and lacks the remarkable spines of *C. falcata*.

[1] Latin, *falcatus*, sickle-shaped; referring to the distal spines in this species.

The tubular zoaria of *C. falcata* are superficially similar to the erect, tubular colonies of *Membranipora arborescens* (see p. 123), and they are frequently found together. *C. falcata* differs in the presence of distal spines and avicularia, and in the absence of denticles on the cryptocyst.

Crassimarginatella similis n. sp.[1]

(Text-figs. 18*a*, *b*)

Material examined. Holotype. 15B,[1] "Atlantide" Coll., see below (Zoologisk Museum, Copenhagen). "Atlantide" Coll., Stn. 44, 10° 22′ N, 16° 22′ W, 17.xii.45, 41 m., 63M. Stn. 145, 9° 20′ N, 14° 15′ W, 13.iv.46, 32 m., 7K, 15B, 110H. Stn. 146, 9° 27′ N, 14° 48′ W, 13.iv.46, 51 m., 107A.

C. similis does not occur in the "Calypso", Marche-Marchad or Achimota Collections.

Zoarium encrusting, plurilaminar. Zooids distinct, cryptocyst descending steeply, finely serrate. Gymnocyst small. One pair of long distal, and 2 pairs of lateral spines, curved very slightly over the opesia. One distal, 2 lateral septulae. Operculum dark brown, without proximal sclerite. Avicularia hardly differentiated, mandible slightly elongated, triangular, dark brown, with a proximal sclerite. Rostrum raised and pointed. Polypide present. Ovicells vestigial.

Dimensions. Lz 0·50–0·71 mm., lz 0·35–0·52 mm., Lopes 0·30–0·53 mm., Lav 0·53–0·72 mm., lav 0·33–0·40 mm., Lm 0·15–0·22 mm.

The specimens encrust *Jullienella foetida*, *Steganoporella magnilabris* and fragments of echinoderm test. The mural rims of the zooids and avicularia are raised and finely beaded. The spines are stout, and directed upwards, the lateral pair showing only a slight tendency to curve over the opesia (cf. *C. quadricornuta*). The ovicells are slightly more developed than in *C. tuberosa*, but are very shallow, consisting only of the raised, distal rim of the zooids.

The avicularian individuals are not common (approximately 1 av : 100 zooids) They are as large as the zooids, and have a polypide but no spines. The rostrum varies in shape, being pointed in some individuals, more rounded distally in others (cf. *C. latens*, below). The rostrum is slightly raised distally, but it has no distal cryptocystal shelf as in *C. tuberosa*. There are no condyles. The mandible is triangular, with a well-developed proximal sclerite.

The avicularia in *Crassimarginatella* may be very large, but none have so far been observed with polypides.

These avicularian individuals are particularly interesting in view of the occurrence in *C. latens* of hardly differentiated zooids which may be avicularian in nature (see below).

C. similis greatly resembles *C. quadricornuta*, from which it differs in the form of the avicularia and lateral spines.

[1] Latin, *similis*, like; referring to the similarity between autozooids and avicularia in this species.

Crassimarginatella latens n. sp.[1]

(Text-figs. 20*a*, *b*)

Material examined. Holotype. 76F part, Cape Verde Islands. (Museum d'Histoire Naturelle, Paris.) "Calypso" Coll. II. Cape Verde Islands, ile Brava. Porto dos Ferrieros, 21.i.59, 30–50 m., C76F.

C. latens does not occur in the Marche-Marchad, Achimota or "Atlantide" Collections.

Zoarium encrusting. Zooids distinct, with a raised mural rim. Gymnocyst distinct, cryptocyst thin, smooth. One pair of distal spines, recurved as in *C. falcata*, but shorter, and forked at the end. One proximal and from 1–2 pairs of curved lateral spines. Ovicells large, raised, finely tuberculate, with a frontal area, or tubercle, and an everted proximal lip. Avicularia apparently absent, but some zooids with a raised, everted distal rim, curved round the operculum, spineless.

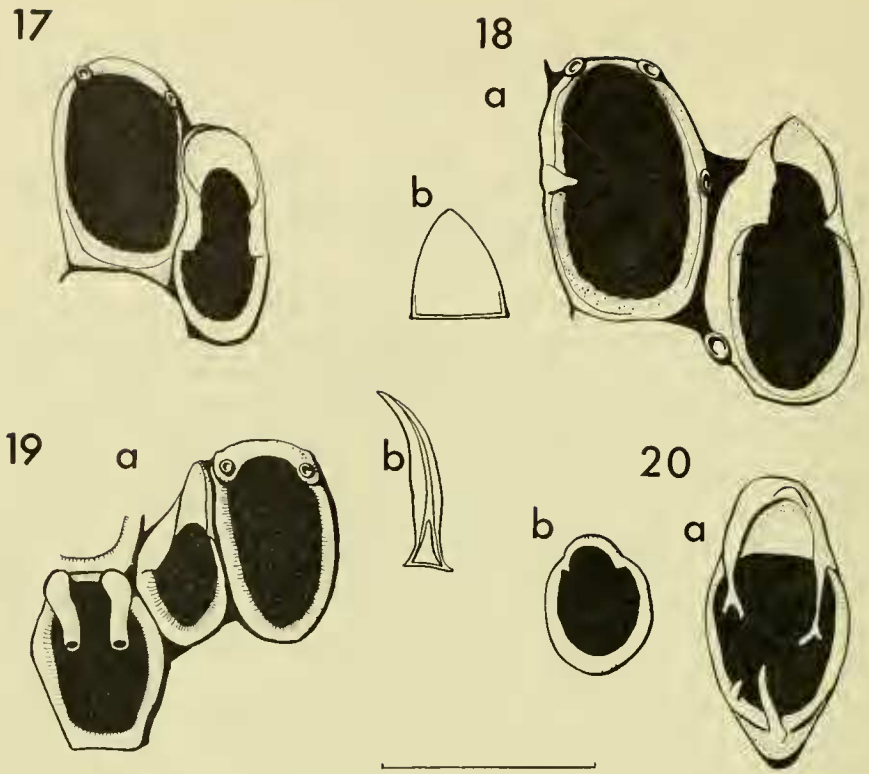
Dimensions. Lz 0·45–0·50 mm., lz 0·25–0·36 mm., Lopes 0·25–0·32 mm., Lov 0·15–0·22 mm., lov 0·20–0·27 mm., L spine 0·14–0·17 mm.

This small colony (of approximately 500 zooids), although similar in some characters to *C. falcata*, differs in presence of well-developed gymnocyst, ovicells and lateral spines, and in the apparent absence of avicularia.

The zooids have a distinct gymnocyst, and the opesiae have a raised rim. The distal spines are robust, and when undamaged, curve proximally over the opesiae and fork terminally. The remaining spines are finer and rarely present, but may be long and curved. The ovicells are rounded, well-raised, smooth at first, becoming finely tuberculate. A small frontal area, very variable in shape, and bounded by a raised ridge, may be present. Later, a frontal tubercle may develop, almost obscuring the frontal area. The distal spines are fused with the walls of the ovicell, and, where they are well-developed, a prominent everted lip is formed between them. The majority of the ovicells is consistently of this form, but 5 have been seen, containing embryos, which are vestigial, consisting only of a raised distal rim of the zooid, with the basal part of the distal spines forming the lateral walls of a shallow chamber. It is therefore possible that the "potential avicularia" described below, may be zooids with vestigial ovicells but without embryos. They differ, however, in the absence of distal and lateral spines, and in the curvature of the mural rim around the operculum, which is more distally placed than in the other zooids.

Only 4 zooids have been seen with these characteristics. The distal mural rim is raised, slightly elongated, and curved round the operculum. The operculum is not differentiated from those of other zooids to form a mandible, as it is in *C. similis*. Until plentiful material is available, so that the variation of this, and other species of *Crassimarginatella* may be studied, it is tentatively inferred that these zooids in *C. latens* may represent the end in a series of avicularian development in the west African species belonging to the genus.

[1] Latin, *latens*, hidden, latent; referring to the occurrence of "potential avicularia" in this species.



FIGS. 17–20. *Crassimarginatella*. Scale = 0·5 mm. 17. *C. tuberosa*, (Canu & Bassler). 1 zooid and 1 avicularium, "Atlantide" Collection, 67 I. 18. *C. similis* n. sp. a. 1 zooid and 1 avicularium. b. mandible, "Atlantide" Collection. 63N. 19. *C. falcata* n. sp. a. 2 zooids, one with long (broken) spines, with an avicularium and an ovicell, b. mandible, Achimota Collection, 20F. 20. *C. latens* n. sp. a. 1 zooid with spines and an ovicell, b. potential avicularium, "Calypso" Collection, C 76F.

PARELLISINA Osburn

Parellisina Osburn, 1940 : 360; 1949; 1950 : 75.

TYPE-SPECIES, *Membranipora curvirostris* Hincks.

Parellisina curvirostris (Hincks)

(Text-fig. 16)

Ellisina curvirostris (Hincks) Harmer, 1926 : 228, pl. 14, fig. 7, East Indies. Hastings, 1930 : 711, pl. 7, figs. 28–31, Galapagos.

Parellisina curvirostris (Hincks) Osburn, 1940 : 361, pl. 4, fig. 32, Porto Rico; 1950 : 75, pl. 8, fig. 8, Mexico to Galapagos Is. (synonymy). Cheetham & Sandberg, 1964 : 1020, text-fig. 6, Louisiana.

Material examined. " Calypso " Coll. I. Stn. 19, 5° 2′ 30″ N, 5° 24′ 40″ W, 21.v.56, 21–27 mm., C57J, on *J. foetida*. Stn. 110, Grand Frère, N.E., 1° 20′ 45″ N, 7° 17′ 37″ E, 7.vii.56, 25–40 m. (Ise Hermano Grande off Principe), C9H, on shell.

Zoologisk Museum, Copenhagen. " Atlantide " Coll. Stn. 85, 5° 37′ N, 0° 38′ E, 30.i.46, 50 m., 108L on *Steganoporella buskii*. Stn. 145, 9° 20′ N, 14° 15′ W, 13.iv.46, 32 m., 110u, on *S. magnilabris*. Stn. 146, 9° 27′ N, 14° 48′ W, 13.iv.46, 51 m., 72F, on sponge, and 107I, on *J. foetida*. Stn. 147, 9° 28′ N, 14° 58′ W, 14.iv.46, 45 m., 77L, on *J. foetida*.

British Museum. Type. Cornwall, 1899.5.1.564, Hincks Coll., 1911.10.1.548, Norman Coll.; Galapagos 1929.4.26.240, " St. George " Coll.; N. of Cuba, Albatross Stn. 2320, 1932.3.7.49, Canu & Bassler Coll.; New Harbour, Singapore, 1928.9.13.10, Hanitsch Coll.; Adelaide, 20–35 fath., 1928.9.13.12 Verco Coll.

P. curvirostris is not present in either the Marche-Marchad or the Achimota Collections.

Zoarium encrusting. Zooids with a very small gymnocyst and narrow cryptocyst. Septulae and dietellae present. Avicularia large, reaching the basal lamina of the colony, rostrum and mandible curved, acute. A large chamber, formed by a kenozooid, distal to each avicularium. Ovicell small, hyperstomial, finely tuberculate.

Dimensions. Lz 0·40–0·60 mm., lz 0·30–0·45 mm., Lav + kenoz 0·30–0·40 mm., Lm 0·20–0·25 mm., Lov 0·13–0·15 mm., lov 0·15–0·20 mm.

Parellisina was fully discussed by Osburn (1940 and 1949). The genus is easily recognized by the presence of the kenozooidal chamber distal to each avicularium (see Text-fig. 16).

Hastings has described the presence of both septulae and dietellae in this species. Several small septulae communicate between the avicularian chamber and the distal kenozooid (see also Waters, 1898, pl. 47, fig. 2); and lateral septulae communicate between the kenozooid and neighbouring zooids.

There is a great deal of variation in the size of the zooids. Those of the west African specimens are similar to those of the type specimen (Lz 0·45–0·60 mm., Lav + kenoz 0·40–0·50 mm.). Those from Singapore and Adelaide are smaller (Lz 0·30–0·45 mm., Lav + kenoz 0·28–0·33 mm.) as were those described by Cheetham & Sandberg (1964). The avicularian rostra of the type specimen are raised distally, those from west Africa are not.

P. centetica Marcus (1955 : 28, pl. 2, fig. 22, Brazil) differs from *P. curvirostris* in having lateral spines and larger ovicells.

SUMMARY

The fauna of " membraniporine " species in the " Calypso ", Marche-Marchad, Achimota, " Atlantide " and other west African Collections is extensive. Twenty-nine species of Malacostega are here described, 26 from west African waters, 24 of which have been found in the present collections.

The species here referred to *Membranipora* have shown considerable inter- and intra-specific variation, and the specimens have been classified somewhat arbitrarily,

following the highest correlation of certain variable characters, which are briefly discussed.

New species of *Aspidelectra* and *Chartella* are described, and the characters of the genera *Antropora* and *Aplousina* discussed. Two new species of *Callopora* are described, one of which, *C. confluens*, shows a striking convergence of characters with the genus *Membraniporella*. Seven species of *Crassimarginatella* have been found to occur from the west African area, of which 3 are considered to be new. An interesting series of avicularian development has been found in the species of this genus.

ACKNOWLEDGEMENTS

I should like to express my thanks to Dr. A. Anderson (Naturhistoriska Riksmuseet, Stockholm) and Dr. R. Scolaro (Tulane University, Louisiana), for the loan of specimens, and to Drs. J. Knudsen and Torben Wolff who arranged for the examination of the "Atlantide" Collection at the Universitetets Zoologisk Museum, Copenhagen, in 1965 and 1966. I am also very grateful for much help, both in correspondance and in discussion, from Dr. A. Cheetham (Smithsonian Institution, Washington), Dr. A. B. Hastings, and Dr. R. Lagaaij, (Shell Exploratie en Productie Laboratorium, The Netherlands). Finally, my thanks are due to the photographers, Mr. H. V. Christensen in Copenhagen, and Messrs. J. V. Brown and P. Green, at the British Museum (Natural History).

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PLATE 1

Membranipora commensale, *M. arborescens* and *Conopeum tenuissimum*

FIG. A. *Membranipora commensale* (Kirkpatrick & Metzelaar). Achimota Coll., Ghana, 1A. Zooids showing serrated cryptocysts. Note the irregular growth of the zooids, and the kenozooids at the junction of the growing edges. × 18.

FIG. B. *M. arborescens* (Canu & Bassler). Marche-Marchad Coll. 1, Senegal, 48A. Part of an erect foliaceous zoarium. Note the numerous cryptocystal denticles and the small lacunae proximal to the opesiae in some zooids. × 18.

FIG. C. *M. arborescens*. " Atlantide " Coll., French Guinea, 110G. Encrusting form, covering a Polyzoan colony, which originally grew over a hydroid stem. The colony is plurilaminar, with erect, bilaminar expansions. × 2·4.

FIG. D. *M. arborescens*. " Atlantide " Coll., French Guinea, 110F. Erect, tubular anastomosing form. This form arose directly from a hydroid stem. × 2·4.

FIG. E. *M. arborescens*. " *Biflustra savartii* ", part of the specimen figured Smitt, 1873, figs. 92, 93. Florida, 29 fath., Naturhistoriska Riksmuseet, No. 283, 1860. Note the brown line outlining the zooids, and the lateral and proximal cryptocystal denticles. × 42.

FIG. F. *Conopeum tenuissimum* (Canu). Achimota Coll., Densu estuary, Ghana, 19A. × 24.

Figures C and D photographed by Mr. H. V. Christensen, Zoologisk Museum, Copenhagen; figures A and B by Mr. P. Green, and E. and F by Mr. J. V. Brown, British Musuem (Natural History).

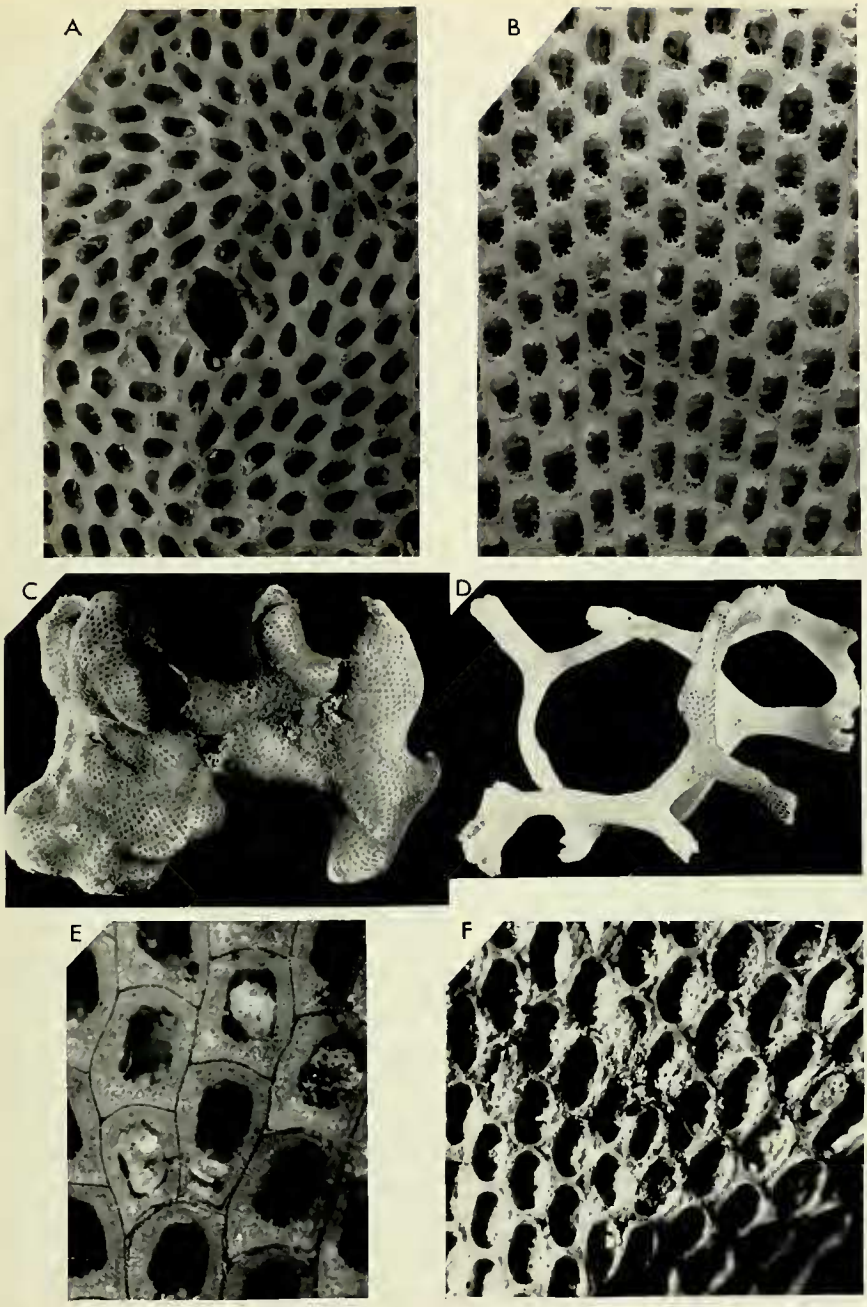
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PLATE 2

Membranipora arborescens, *M. tenuis* and *M. tuberculata*

FIG. A. *Membranipora arborescens* (Canu & Bassler). Achimota Coll., Ghana, 44A. Encrusting specimen, partially cleaned, showing the chitinous spinules and some zooids (marked x) with lateral and proximal cryptocystal denticles. × 24.

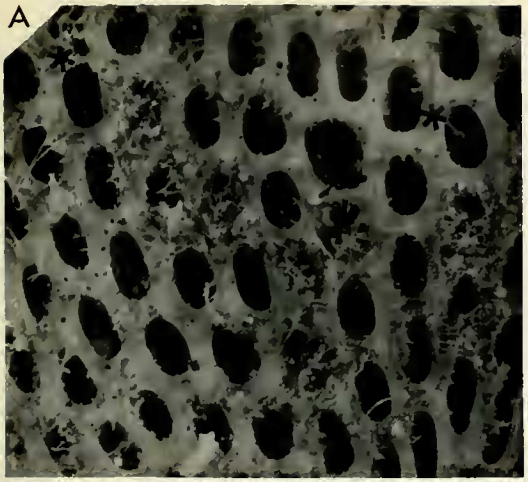
FIG. B. *M. tenuis* Desor. Achimota Coll., Ghana, 68G. Specimen showing zooids similar in character to those of *M. arborescens* in the proximal part of the fragment, and those of " typical " *M. tenuis* in the distal part. × 20.

FIG. C. *M. tuberculata* (Bosc). Achimota Coll., Ghana, 52A. Part of a " typical " specimen, showing the branched cryptocystal denticles, and large gymnocystal tubercles. Compare the development of the proximal cryptocyst in this specimen with that in figure D. × 28.

FIG. D. *M. tuberculata*. Achimota Coll., Ghana, 1B. Specimen encrusting algae, with a greatly developed proximal cryptocyst, and no gymnocystal tubercles. Compare the zooids with those in the distal part of the fragment in figure B, of *M. tenuis*. × 28.

FIG. E. *M. arborescens*. Marche-Marchad Coll. I, 48A. Part of an erect tubular branch. Note the large number of cryptocystal denticles, and the gymnocystal tubercles visible in profile on the left-hand side of the fragment. × 24.

Photographs by Mr. P. Green, British Museum (Natural History).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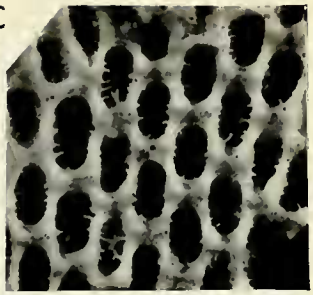
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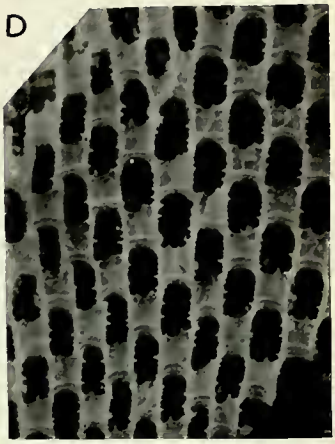
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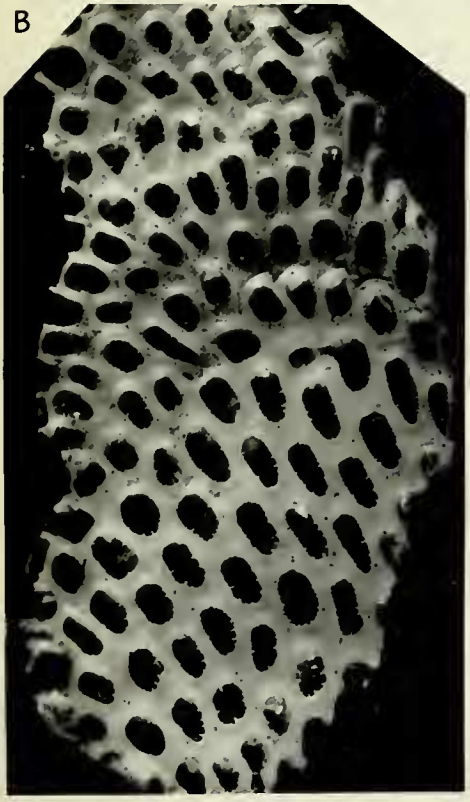
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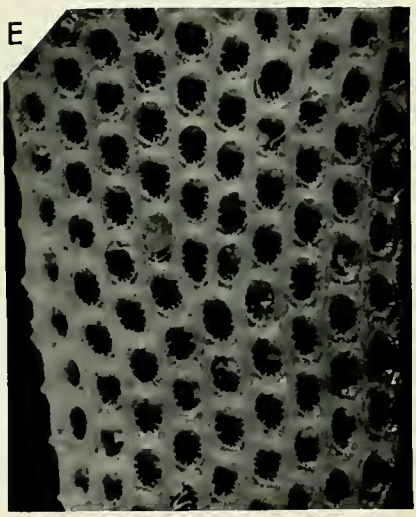
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PLATE 3

Aplousina

FIG. A. *A. gigantea* Canu & Bassler. "*Biflustra lacroixii*", Naturhistoriska Riksmuseet, No. 188, 1901, Tortugas, 13 fath. Specimen with ovicells (marked o). × 28.

FIG. B. *A. gigantea*. As above, No. 195, 1781, S.W. Tortugas, 60 fath., specimen figured by Smitt, 1873, fig. 87. Specimen without ovicells, showing the dried polpyides adherent beneath the frontal membrane, as figured by Smitt, compare with figures E and F. × 28.

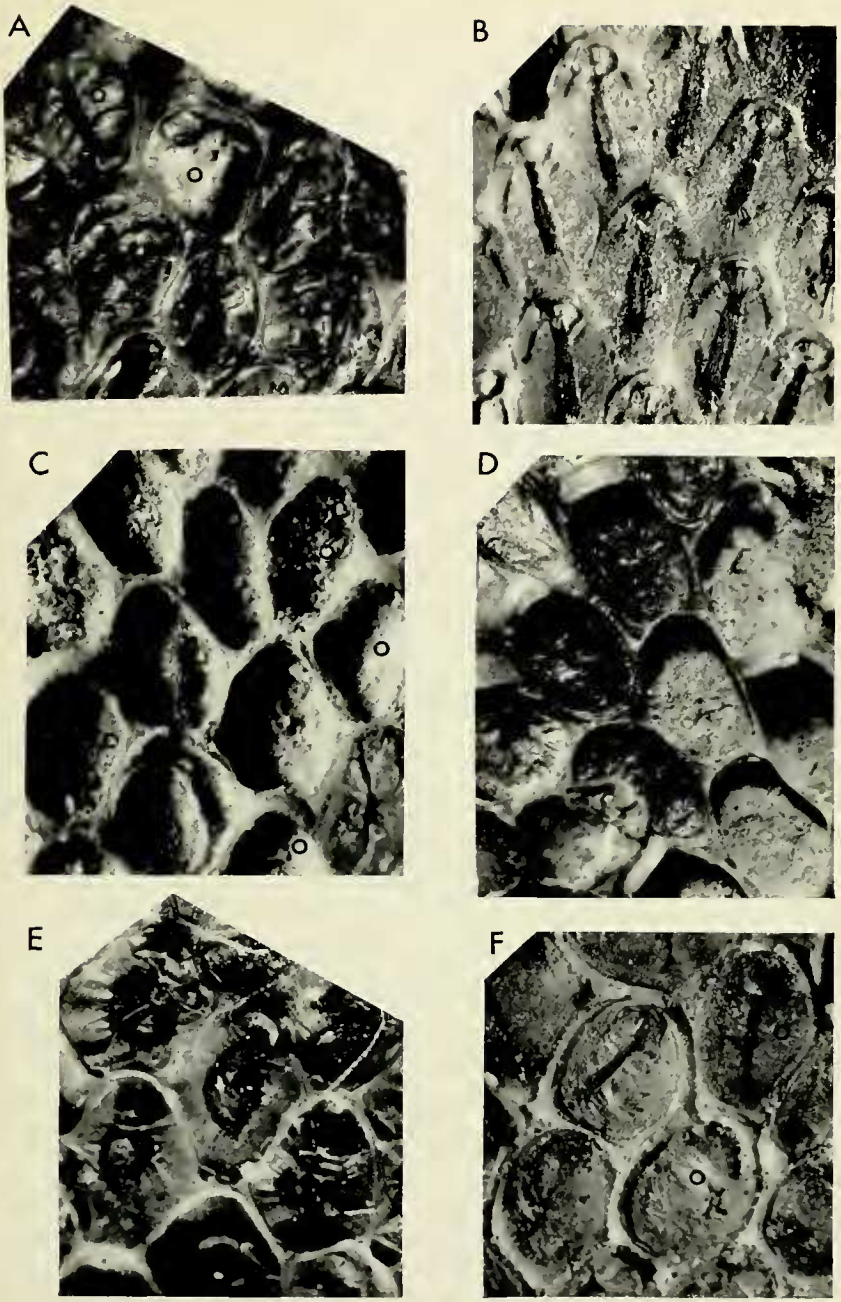
FIG. C. *A. gigantea*. Gulf of Mexico, 1932.3.7.94, Canu & Bassler Coll. Showing zooids with ovicells (marked o). × 28.

FIG. D. *A. capriensis* (Waters). Mediterranean, 1960.11.2.1, Gautier Coll. Showing the thin zooidal walls, with extremely narrow, smooth lateral cryptocyst, and the prominent ovicells, which protrude into the cavity of the next distal zooid. × 28.

FIG. E. *A. major* (Calvet). "Calypso" Coll., Stn. 25, C 10C. Showing the thin zooidal walls, see also Text-figure 8. × 28.

FIG. F. *Aplousina* sp., "*A. filum*" Gautier not Jullien & Calvet. Showing the thick zooidal walls and two ovicells (marked o). × 28.

Photographs by Mr. P. Green, British Museum (Natural History).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