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THE GENUS POLYCYATHUS

TWO NEW SPECIES OF THE GENUS
POLYCYATHUS (MADREPORARIA)
FROM THE MEDITERRANEAN SEA

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ABSTRACT

Two new species of Madreporaria, belonging to the genus *Polycyathus*, were found near Banyuls-sur-Mer (Pyr.-Or^{les}): *Polycyathus banyulensis* and *Polycyathus mediterraneus*. A description of both of them is provided and the status of the genus is discussed.

INTRODUCTION

During the summers of 1965 and 1966 I studied the Madreporaria from the region of Banyuls-sur-Mer, at the Laboratoire Arago. I used the laboratory's SCUBA-diving facilities for collecting live material on many excursions. Here I will report about two corals to be classified with *Polycyathus* Duncan, 1876, a genus that up to now has only been described from the central Atlantic (Senegal; St. Helena), the Gulf of Persia and the Andaman Sea (Mergui Archipelago). For the moment it is not possible to monograph *Polycyathus* as I cannot trace the type specimens of the earlier described species, while some of these older descriptions are short and far from complete.

THE GENUS *POLYCYATHUS*

The genus *Polycyathus* has first been described by DUNCAN in 1876. According to the most recent systematic classification of WELLS, 1956, the genus belongs to the family *Caryophyllidae*, subfamily *Caryophyllinae*. WELLS formulates the definition of *Polycyathus* as follows: "like *Paracyathus*, but forming low colonies by extratentacular budding from the edgezone of coenosarc". *Paracyathus*, then, is a solitary genus with a cosmopolitan distribution.

DUNCAN gives a rather accurate description of *Polycyathus atlanticus*, type species of the genus, found near St. Helena, which can be summarized as follows:

The colonies are small; the corallites arise close to the base of their neighbours and grow more distinct and distant with age. Their shape is cylindroconical with a broad base and an elliptical calice, which is circular in outline in young specimens. The septa are irregularly arranged, the primary and secondary septa are the most distinct and exsert. The columella is deeply-seated, small, and ends in a few papillose spines. The pali resemble the spines of the columella, but are usually larger and indeed longer than the smaller septa before which they are placed. The pali are situated in two rows before the secondaries and tertiaries, those of the latter being nearer the margin of the calice. Sometimes the pali are double or bilobed before these septa, but not before the secondaries. An epitheca is present. Measures: height ± 10 mm; $\pm 7,5$ mm.

For the comparison with the other species of *Polycyathus* it is regrettable that DUNCAN has not given more details about the colony and about the oecological data (e.g. depth) and that his drawings are quite indistinct.

Some more 19th century-species.

From the same region (St. Helena) DUNCAN mentions in his article (1876) the new genus *Agelecyathus*, comprising the new (type) species *A. helenae* and the new species *A. persicus* from the Gulf of Persia.

The only difference between *Agelecyathus* and *Polycyathus* is that the former genus has no epitheca, in contrast to the latter. DUNCAN himself considered *Agelecyathus* in 1885 as a subgenus of *Polycyathus*; GARDINER & WAUGH, 1938, even synonymized these genera, because the presence or absence of an epitheca should not be a main character of a genus, with which I do agree. Because *P. atlanticus* and *P. helenae* are found in the same area, both "on an *Ostrea* from St. Helena" it is possible that they are synonyms. *P. helenae* is a little smaller with a diameter of 5 mm, but for the rest no real differences are given by DUNCAN.

DUNCAN describes *A. percisus* as a corallum with small corallites (2,5 mm diameter). The pali are only present before the tertiary cycle of septa and sometimes before the secondary cycle.

In 1889 DUNCAN added two new species to the genus : *P. verrilli* and *P. difficilis*, found in the Mergui Archipelago. The description of colony and corallites responds to the characters of *Polycyathus*. Both species have small corallites (height 3 mm; diameter 3 mm) and seem to me in fact so much the same that they probably are synonyms : according to DUNCAN the pali of *P. difficilis* are only placed before the first and the second cycle of septa; *P. verrilli*, however, has pali before the first three cycles of septa.

Some years later a new coral, dredged up in the Andaman Sea, was named by ALCOCK (1893) : *P. andamanensis*, a small colony-forming species from the same region as *P. difficilis* and *P. verrilli*. Again the corallites are small (height 3 mm, diameter 3-5 mm). The pali, in the form of strong denticulations, are distinct before all the septa. In the British Museum (Natural History) in London there are two specimens assigned to : *Paracyathus* (*Polycyathus*) *andamanensis* (no. 1950 - 1 - 9 - 1027 - 1030), collected by the John Murray Expedition at a depth of 73 m (Stat. 72, 73) that I could study. The only impression they made on me was that of being young *Polycyathus*-specimens; further determination is not possible (cf. GARDINER & WAUGH, 1938).

With the material of *Polycyathus* found in the 19th century, we can give a rather clear definition of the genus. But more data are needed about the development and oecological influence on this coral to classify the different species.

More recent data.

The next record of the genus I find is in 1938 by GARDINER & WAUGH, who describe some species of the genus *Paracyathus* dredged by the John Murray Expedition (1933-1934). One of these, found in the Arabian and Red Sea (Station 157, 229 m and St. 208, 732 m, is based on solitary and colonial specimens, forming colonies by " budding off the sides of the corallites ". So this new species, *Paracyathus conceptus*, was described as growing in small colonies with 2-6 or more upright calices, being no " colony " comparable to the " colonial corals " in that all the daughter polyps quickly become independent of parents and of one another. GARDINER & WAUGH know that there is a genus *Polycyathus* for colonial forms, but as " three species of this genus were described by him (= DUNCAN) on three specimens all seemingly young forms ", they thought such a genus not acceptable.

Now that new forms have been added (see below), *Polycyathus* seems corroborated and in view of the fact all the species of *Paracyathus* are said to be solitary, some doubts will arise concerning the status of *Paracyathus conceptus*.

This species has pali before the first three cycles of septa, those of the third cycle generally divided into lobes. The well developed corallites and their calices with a diameter of 15 mm are much larger than the earlier described species of *Polycyathus*. Although on the specific level it is well known that the deepwater form is often larger than the shallow

water form, in the light of the recent descriptions by RALPH and SQUIRES (1962) and WELLS (1964), who make no more mention of any colonial habitat, I think this large and strongly developed coral is to be referred as *Paracyathus*.

What *Polycyathus* lacked was modern material. This was first supplied by CHEVALIER in 1966 by the discovery of *P. senegalensis*. The description for this species is extensive, moreover I did examine the type-series. The specimens originate from the region of Dakar (depth 50-100 m). As they were museum material (only skeletons), nothing of the polyps could be described. *P. senegalensis* forms small colonies, consisting of about ten corallites, the height of a corallite is max. 15 mm, the diameter 3-6 mm.

The characters of *Polycyathus* as described by DUNCAN are easily recognized in this species. The small colony is phaceloid, in the corallites the pali are situated before the first three cycles of septa arranged in two crowns. The pali before the third cycle are stronger than those before the first two cycles.

SURVEY OF THE GENUS

Summarizing what is known about *Polycyathus* the following can be stated :

a. SPECIES' DISTRIBUTION (Fig. 1)

1. <i>P. atlanticus</i> Duncan, 1876	St. Helena
2. <i>P. helenae</i> (Duncan, 1876)	St. Helena
3. <i>P. persicus</i> (Duncan, 1876)	Gulf of Persia
4. <i>P. difficilis</i> Duncan, 1876	Mergui Archipelago
5. <i>P. verrilli</i> Duncan, 1889	Mergui Archipelago
6. <i>P. andamanensis</i> Alcock, 1893	Andaman Sea
7. <i>P. senegalensis</i> Chevalier, 1966 ...	Dakar, Senegal

b. GENERAL DIAGNOSIS

Small colonies, with the corallites on a common basis. The shape of the corallites is cylindro-conical with a broad base. There are four cycles of septa; the last one is often incomplete; the first two are rather exsert. The columella is deeply seated and ends in papillose spines. The pali resemble the spines of the columella and are placed more or less distinctly before several cycles of septa.

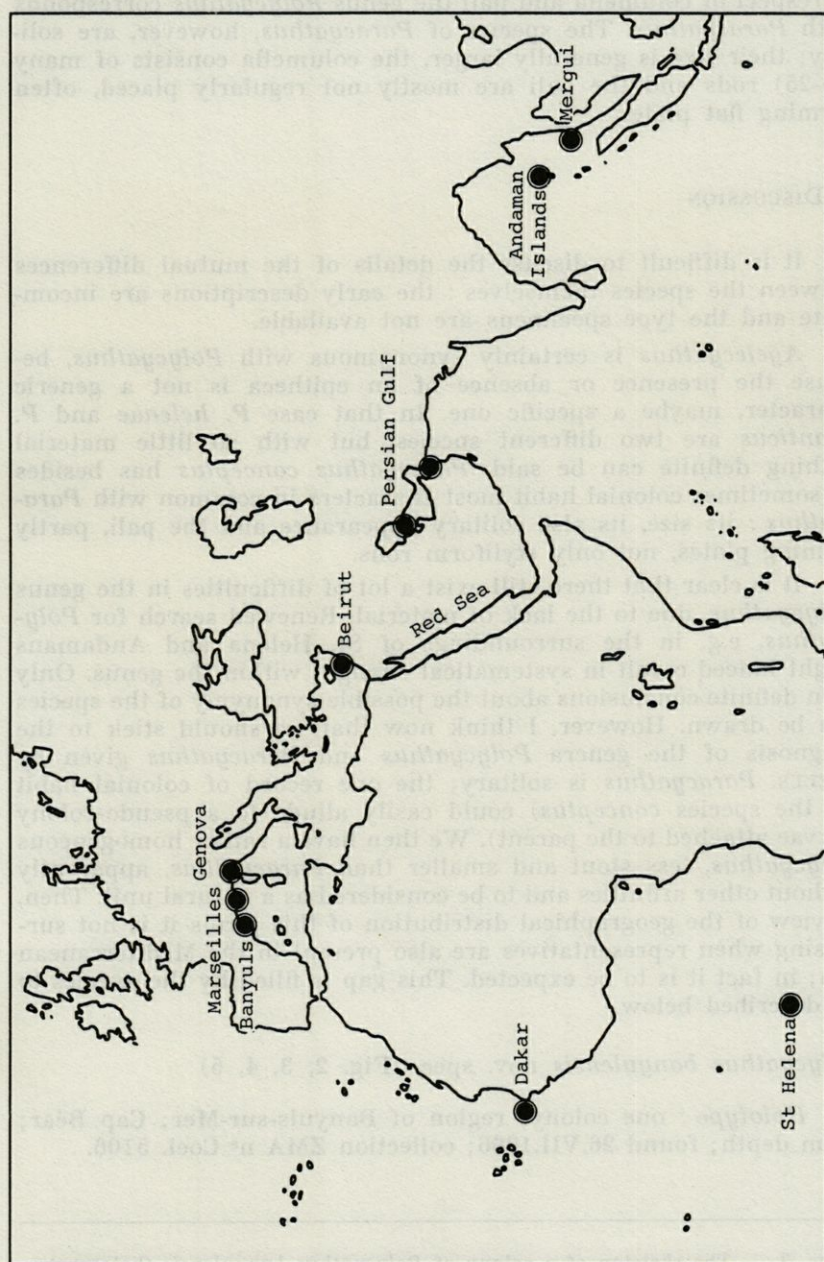


FIG. 1. — Geographical distribution of the genus *Polygyathus* (see text).

In respect of columella and pali the genus *Polycyathus* corresponds with *Paracyathus*. The species of *Paracyathus*, however, are solitary; their size is generally larger, the columella consists of many (15-25) rods and the pali are mostly not regularly placed, often forming flat plates.

c. DISCUSSION

It is difficult to discuss the details of the mutual differences between the species themselves : the early descriptions are incomplete and the type specimens are not available.

Agelecyathus is certainly synonymous with *Polycyathus*, because the presence or absence of an epitheca is not a generic character, maybe a specific one. In that case *P. helenae* and *P. atlanticus* are two different species, but with so little material nothing definite can be said. *Paracyathus conceptus* has besides its sometimes colonial habit most characters in common with *Paracyathus* : its size, its also solitary appearance and the pali, partly forming plates, not only styliform rods.

It is clear that there still exist a lot of difficulties in the genus *Polycyathus*, due to the lack of material. Renewed search for *Polycyathus*, e.g. in the surroundings of St. Helena and Andamans might indeed result in systematical changes within the genus. Only then definite conclusions about the possible synonymy of the species can be drawn. However, I think now that we should stick to the diagnosis of the genera *Polycyathus* and *Paracyathus* given by WELLS. *Paracyathus* is solitary; the one record of colonial habit (in the species *conceptus*) could easily allude to a pseudo-colony (larvae attached to the parent). We then have a rather homogeneous *Polycyathus*, less stout and smaller than *Paracyathus*, apparently without other affinities and to be considered as a natural unit. Then, in view of the geographical distribution of this genus it is not surprising when representatives are also present in the Mediterranean Sea; in fact it is to be expected. This gap is filled by the species to be described below.

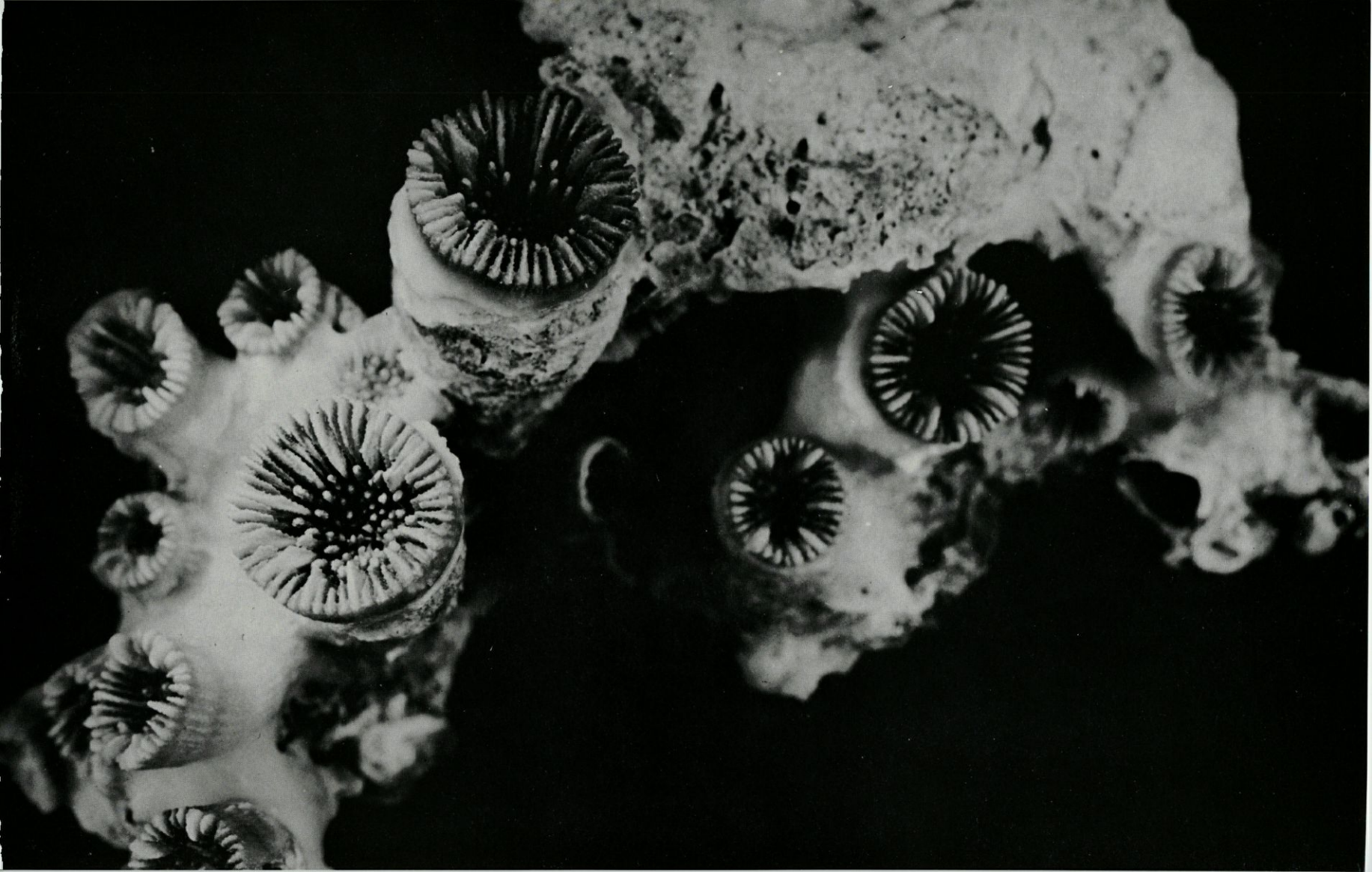
Polycyathus banyulensis nov. spec. (Fig. 2, 3, 4, 5)

Holotype : one colony; region of Banyuls-sur-Mer; Cap Béar; 32 m depth; found 26.VII.1966; collection ZMA n° Coel. 5106.

FIG. 3. — The skeleton of a colony of *Polycyathus banyulensis* (holotype).



FIG. 2. — Living colony of *Polycyathus banyulensis*.



Paratypes : two colonies; same locality and data; collection ZMA, one colony in the collection Laboratoire Arago, Banyuls-sur-Mer.

Description of colony and corallites :

The corallum of the holotype consists of eighteen corallites in different stadia of development (Fig. 3); the colony is phaceloïd. They are located close to each other on a common basis and the reproduction takes place by extratentacular budding. The epitheca is always present in older corallites, but it fails sometimes in young ones. The costae are covered by the epitheca and only to be seen around the calice. The upper part of the corallite is of a remarkable brown colour, in striking contrast with the white epitheca. The most developed corallite of this corallum has a calice diameter of 8 mm, the form is slightly oval and the height is 15 mm. There are four cycles of septa; the primaries and secondaries are the largest and the most exserted ones; the tertiaries are smaller, the fourth cycle is the smallest and only in the largest corallites complete. All septa are granulated.

The most characteristic feature of the skeleton structure is the complex of the pali. These are placed as rods before all septa, reaching upwards from a deep fossa; the pali of the third cycle of septa (often bilobed) are enclosed by the septa of the primary and secondary order, reaching higher up than the pali before the first and second cycle of septa. The regularity of this skeleton structure is variable within the corallite, therefore it is my opinion that it is not of specific importance. The columella consists of many spines (± 15), resembling the ones forming the pali. Therefore in young corallites the pali before the first and second cycle of septa can hardly be distinguished from the columella. In older corallites, however, the pali grow higher up in the calice. The colour of the polyp is light brownish, the tentacles are very long (when fully expanded they can reach up to 15 mm) and blue green of colour. The oral disc is darker brown and ends in the form of a star in the tentacles (fig. 2). The nematocysts have been studied; those in the tentacles can be described with the help of the classification of WEILL (1930, 1934) as the following three types :

- holotrichous isorhizae 0,035 mm length
- microbasic mastigophores 0,035 mm »
- spirocysts 0,030 mm »

In the mesenterial filaments two types were found :

- holotrichous isorhizae 0,035 mm length
- microbasic mastigophores 0,025 mm »

Ecology

I found the types of this species living on an isolated pile of rocks (about 1 m high) surrounded by sand, at a depth of 32 m. This rock was of a very capricious form. Because there were no vertical walls, the corals lived on horizontal edges under overhanging parts, apparently to avoid the sedimentation. The other coral species which I saw during the same excursion in this area were :

Flabellum anthophyllum (Ehrenberg, 1834)

Caryophyllia smithi Stokes & Broderip, 1818

Leptopsammia pruvoti Lacaze-Duthiers, 1898

Coenocyathus dohrni Döderlein, 1913

All corals were fixed on the rocks with a strong basis and also as far as the rest of the skeleton is concerned they were strongly developed, probably the result of a coldwater stream which is to be found near Cap Béar.

Discussion

P. banyulensis has much resemblance in skeleton structure to *P. senegalensis*. Here we find the same construction of septa, pali and columella and also a brownish colour of the upper part of the calice. However, the corallites of *P. senegalensis* are smaller, their basis is narrower, the fossa is less deep and the costae better visible, as there is no epitheca. The characters mentioned already make clear that *P. banyulensis* does belong to the genus *Polycyathus*. It is not a synonym of *P. senegalensis* in view of the differences just stated. Whether it is synonymous with one of the other species of *Polycyathus* can only be made out on the basis of the original type specimens or topotypes.

The distinction from *P. mediterraneus* was first based on the habitus and colour of the polyps (see figs. 2-6). Concerning the skeleton structure there are some clear differences :

The corallites of *P. banyulensis* are larger, in *P. mediterraneus* the fourth cycle of septa is never complete. The skeleton structure of the first species is more regular, the septa are more exsert, the pali are better developed and before the third cycle often bilobed.

Polycyathus mediterraneus nov. spec. (see Fig. 6, 7)

Holotype : one colony; region of Banyuls-sur-Mer; Cap Rédéris; 10 m depth; 20.VI.1966; collection ZMA n° Coel. 5108.

Paratype : three colonies; region of Banyuls-sur-Mer and Cap Creus (Spain); Cap Rédéris; 10 m depth; 20-VI-1966; collection

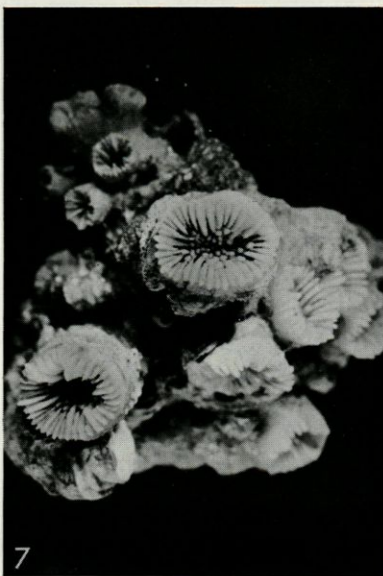
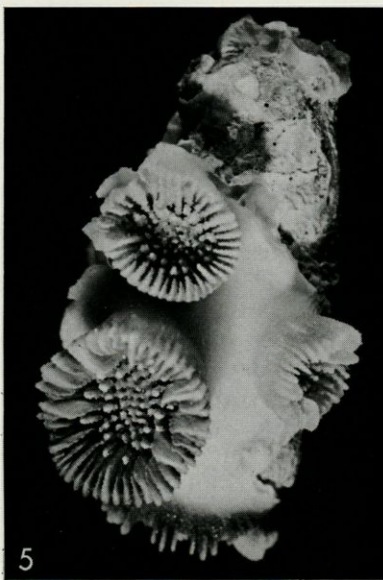
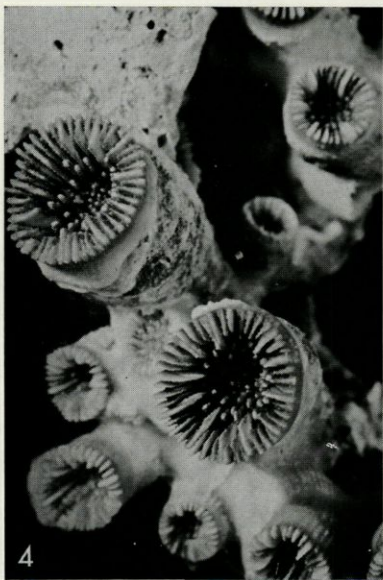


FIG. 4. — Some corallites of *Polycyathus bangulensis*. Take notice of the complex of the pali.

FIG. 5. — Some corallites of *Polycyathus bangulensis*. Take notice of the white epitheca and dark upper calice.

FIG. 6. — The skeleton of a colony of *Polycyathus mediterraneus* (holotype).

FIG. 7. — Some corallites of *Polycyathus mediterraneus*. Take notice of the well developed primary septa.

ZMA, n° Coel. 5109. Cap l'Abeille; 12 m depth; 4-VII-1966, collection
ZMA, n° Coel. 5110. Cap Creus; 15 m depth; 12-VIII-1966; collec-
tion ZMA, n° Coel. 5111.

Description of colony and corallites :

The corallum consists of several corallites (about 10-30), but they live encrusted in groups together; the colonies are phaceloïd. The corallites are placed close to each other, they are usually low with a broad base. An epitheca is present and gives the corallites a smooth wall, unless they are incrustated by other animals. The epitheca does not reach the calice, this upper part of the theca is ribbed and darkish of colour. The diameter of the calice is about 5 mm, it is round or oval and very irregular due to the different height of the exsert septa. The primary septa are the most exsert ones and by far the largest; they give the calice often a hexonal form. The second third and always incomplete fourth cycle are much smaller. All septa are granulated. The pali are less regularly placed than in *P. banyulensis*, the highest styliform lobes are located before the third cycle of septa; before the second they are a little lower, while the lobes before the first cycle reach about the same level as the columella. The columella consists of a dozen of paliform lobes.

The colour of the polyps is very light brown, they are very small and hardly ever extended. The tentacles are transparent and short. The nematocysts in the tentacles are of three different types (according to the classification of WEILL, 1930-1934) :

- holotrichous isorhizae 0,045 mm length
- microbasic mastigophores 0,045 mm »
- spirocysts 0,030 mm »

In the mesenterial filaments they are of two different types :

- holotrichous isorhizae 0,080 mm length
- microbasic mastigophores 0,065 mm »

Ecology

At the three capes mentioned the encrusting colonies were to be seen under overhanging rocks between 10 - 15 m depth. At Cap l'Abeille they were abundant because of the presence of favourable shady holes without much sedimentation. The other corals which I found regularly in these areas were :

Leptopsammia pruvoti Lacaze-Duthiers, 1898

Hoplania durotrix Gosse, 1860

Coenocyathus dohrni Döderlein, 1913.

Discussion

While smallness of the colonies, form of columella and styli-form pali before all cycli of septa induced me to include *P. mediterraneus* in *Polycyathus*, it is remarkable for its well developed primary septa, the subsequently hexonal habitus, and the constant lack of completeness in the fourth cycle of septa.

I may give some more comments on the species' distribution.

At first sight *P. mediterraneus* belongs to *Cladocora*; the fact, however, that *Cladocora* comprises only hermatypic corals (i.e. with zooxanthellae), while *Polycyathus* belongs to the ahermatypic *Caryophyllinae* unmasks this resemblance as superficial. Having read the description by Rossi (1957) of *Cladocora cespitosa*, "forma incrostante" and having studied her specimens (kindly lent to me by Prof. E. Tortonese), I think they should be referred to *P. mediterraneus*. The type of colony, way of placing of the pali and construction of the polyp, all these contrasting with HEIDERS' (1881) excellent description of *Cladocora* in all stages of development and to more recent descriptions of *Cladocora cespitosa* by e.g. DÖDERLEIN (1913), BROCH (1934) and PAX (1953), gave me this firm conviction. This opinion once accepted the distribution of the species can be extended to the Ligurian Sea (San Fruttuoso).

Next I want to make a brief mention of some small pieces of coral, which in my opinion should also be referred to *Polycyathus mediterraneus*.

During a short stay in the Station Marine d'Endoume (Marseille) in August 1967 I collected some colonies of *P. mediterraneus* from a depth of 15 m (Grotte de Jarre). They resemble much the Ligurian form.

Still farther East, in Beyrouth, Dr. L. LAUBIER of the Laboratoire Arago at Banyuls collected one colony of this species, now in the collection of the Laboratoire Arago (for further ecological data see BEST, 1966). The corallites are smaller and longer than the ones from Banyuls; for the rest the skeleton structure corresponds to that of *P. mediterraneus*.

The specific name *mediterraneus* alludes to these widespread localities within the Mediterranean Sea. The growth-form of this species from these four localities is variable, due to different ecological conditions, but this phenomenon is wellknown in this group of animals, so much depending on their habitat. But their basic features show that they form one species.

The differences from *P. banyulensis* have been enumerated above. Dr J.P. CHEVALIER compared at my request my material of *P. mediterraneus* with *P. senegalensis* Chevalier and wrote about

my new species (in litt., 1967) : « on n'observe jamais plus que 36 lames radiaires; les côtes sont moins saillantes au bord du calice; les pali sont moins allongés et les granules des faces latérales sont bien moins forts. Il faut cependant reconnaître que les deux espèces sont voisines. »

I introduced the two new species as filling a geographical gap in the generic distribution. Now they appear also to throw some light upon the individual development of *Polycyathus* and in that way also appear to give some indications about the earlier described species of this genus.

With the help of my own material, in which corallites of all different ages are present, I can state that the pali of the third cycle of septa, being the outer row, are easily told apart from the spines of the columella, even in young corallites. The inner row of pali, i.e. those before the first and second cycle of septa is in young corallites not at all distinguishable from the columella. With age the pali grow up higher in the fossa, the ones before the third cycle first, then the pali before the second and at last those before the first cycle of septa.

With this knowledge and the fact that the species of DUNCAN were probably based on young corallites (cf. GARDINER & WAUGH) one can conclude that the differences in arrangement of pali before the septa are just stages in development and not of specific importance, leaving us with only a few well defined species, linked perhaps by species and forms still to be discovered.

SUMMARY

A diagnosis is given of the genus *Polycyathus* comprising :

Polycyathus sensu Duncan (3 species);

Agelecyathus Duncan (2 species);

Polycyathus andamanensis Alcock;

Polycyathus senegalensis Chevalier.

It is stressed that some of the species of DUNCAN and ALCOCK may be synonymous. Two new species are described from the Mediterranean Sea, *Polycyathus banyulensis* and *Polycyathus mediterraneus*; in addition to a description of their skeleton, their polyps and nematocysts are described as well.

RÉSUMÉ

Une diagnose a été donnée du genre *Polycyathus*, comprenant :

Polycyathus sensu Duncan (3 espèces);
Agelecyathus Duncan (2 espèces);
Polycyathus andamanensis Alcock;
Polycyathus senegalensis Chevalier.

L'attention a été appelée sur le fait que quelques-unes des espèces de DUNCAN & ALCOCK peuvent être synonymes. Deux nouvelles espèces de la Méditerranée ont été décrites, *Polycyathus banyulensis* et *Polycyathus mediterraneus*; en plus d'une description de leur squelette l'auteur en donne une de leurs polypes et nématocystes.

ZUSAMMENFASSUNG

Es wird eine Diagnose gegeben von Genus *Polycyathus*, das die untenstehenden Arten umfasst :

Polycyathus sensu Duncan (3 Arten);
Agelecyathus Duncan (2 Arten);
Polycyathus andamanensis Alcock;
Polycyathus senegalensis Chevalier.

Es ist zu vermuten, dass einige der Arten von DUNCAN und ALCOCK synonym sind. Zwei neue Arten vom Mittelmeer werden beschrieben : *Polycyathus banyulensis* und *Polycyathus mediterraneus*; ausser einer Beschreibung ihres Skeletts werden zudem ihre Polypen und Nematocysten beschrieben.

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