

STONY CORALS OF THE EASTERN PACIFIC
COLLECTED BY THE *VELERO III*

AND
VELERO IV

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INTRODUCTION

Since 1931 the motor cruisers *Velero III* and *Velero IV* of Captain Allan Hancock have been employed in marine biological explorations of the Eastern Pacific, dredging, taking bottom samples of various types, and collecting by means of shore parties. As a result of this work, a relatively large number of stony corals has been gathered together. Including those species previously recorded, a total of 98 species is now known from the area. Of the above total, 33 are here recorded for the first time, and of these, 25 are described as new and include one new genus. The new distributional records greatly aid in the delimitation of the geographical and bathymetric occurrence of many previously described species. Nevertheless, examination of the results of the present study indicates that there is much information yet to be obtained about the composition and distribution of the Recent coral fauna of the Eastern Pacific.

The fragments of pavonid, leptoserid, and agaricid reef corals obtained, the single specimens representing the genera, *Ceratotrochus*, *Dendrosmlia*, *Lophelia*, *Lophosmlia*, *Solenastrea*, and the new genus *Nomlandia*, fragments of indeterminate genera and species, and the records of a number of species and genera from single localities, all these facts indicate the presence of numerous fertile fields for further investigation. Nevertheless, the new data presented in this study appear to indicate fairly well the broad outlines of the composition, geographic distribution, and bathymetric range of the fauna, particularly with respect to some of the previously described species. The extensive collecting of the *Velero III* in the Galapagos Islands has furnished what is apparently a fairly comprehensive picture of the moderate depth fauna there, but it also seems to indicate that there is still extensive collecting to be done in waters of less than 20 fathoms depth with rocky bottom. The results obtained elsewhere also indicate the need of much more exploration in this interval throughout the Eastern Pacific.

The literature on the coral faunas of the Panamic, Gulf of California, and North Pacific areas has been summarized by Durham (1947, p. 2), who discussed extensively all the available data on the corals of the Gulf of California and North Pacific areas. In addition to the papers

noted by Durham, Pourtalès (1875) recorded the first corals from the Galapagos, and Vaughan (1906) described some additional material from the same region. Duncan (Proc. Zool. Soc. London, 1876, pp. 441-442) described *Placopsammia* (now *Lobopsammia*) *darwini* from the Galapagos Islands.

We wish to express our appreciation at this time to Captain Allan Hancock, director of the Foundation, for the opportunity to study and report on the stony coral material, and to Dr. Irene McCulloch for her interest and help in preparing this paper. Dr. John W. Wells has kindly aided in the identification of three of the genera. We also wish to thank Dr. Stanley C. Ball of the Zoological Division of the Peabody Museum of Natural History, Yale University for the loan of A. E. Verrill's type material of three species of *Astrangia*, of which lectotypes are designated herein. The writers are indebted to Mr. Daniel H. Chapman for making the photographs.

COMPOSITION AND RELATIONSHIPS OF THE EASTERN PACIFIC FAUNA

Table 1¹ shows that the Eastern Pacific coral fauna now consists of 98 living species representing 39 genera. Of these species 6 are as yet indistinct, the material not being satisfactory for full analysis. The "additional coral genus" of Crossland (1927, p. 537) will probably never be identified and might represent either an as yet undescribed species, or it might be one of the new forms here recorded. As a result it is not included in the above figures. Crossland's *Psammocora* sp. is here replaced in the tables by *P. (Stephanaria) stellata* (Verrill).

Of the total number recorded, twenty-five species and one genus are here described as new, while nine species are recorded from this area for the first time. In addition, fourteen genera and one subgenus are added to the previously known 25 occurring in the Eastern Pacific.

The 98 species are distributed thus: North Pacific Coast, 19 species in 12 genera, with one species also occurring in the Panamic fauna, and one in the Gulf of California; Gulf of California, 34 species in 18 genera with 16 species common to the Panamic fauna; 16 species are restricted to the Gulf, and 5 species are common to both the Panamic and the

¹ In compiling Table 1, the North Pacific area includes all records from Cape San Lucas northward along the outer coast; the Gulf of California area is restricted to the region within the Gulf of California proper; the Panamic area extends southward from the Gulf of California to about the latitude of the Peruvian-Ecuadorian border, and includes all offshore records in these latitudes except for those in the Galapagos Islands region; the Galapagos Islands area is restricted to the Galapagos high, a large share of which lies in depths of less than 200 meters, with the remainder largely less than 500 meters in depth, while the entire region is separated by depths of more than 3000 meters from the South and Central American mainlands.

Galapagos faunas; the Panamic fauna consists of 50 species in 24 genera of which 14 species are common to the Galapagos area; the Galapagos fauna totals 28 species, of which 13 have not been recorded elsewhere.

Twenty-seven of the listed species belong to the hermatypic group of corals—that is, forms which are usually considered as being able to form reefs under the proper conditions. The hermatypic species belong to the genera *Agaricia*, *Cycloseris*, *Leptoseris*, *Montipora*, *Pavona*, *Pocillopora*, *Porites*, *Psammocora* (*Stephanaria*), *Solenastrea*, and *Tubastrea*. In contrast, Vaughan (1907) lists 54 species of hermatypic corals from the Hawaiian Islands and Laysan. Thus it is apparent that either the Eastern Pacific coral fauna is impoverished with respect to the hermatypic corals, or else that the collecting has been highly inadequate. In this last respect it is to be noted that as yet there have not been any extensive coral reefs recorded, although Durham (1947, pp. 11-12) recorded the occurrence of a few living reefs and some fossil ones within the Gulf of California area.

The Hawaiian hermatypic genera *Psammocora* (*ss.*), *Leptastrea*, *Cyphastrea*, *Coelastrea*, *Favia*, *Fungia*, and *Alveopora* have not yet been reported from the Eastern Pacific. Of these, *Favia* is known from Brazil, the Red Sea, the Indo-Pacific, and fossil in the early Tertiary of California (Durham, 1947, p. 7), so that it appears possible, if not probable, that it will eventually be discovered here. The genus *Montipora*, which is well represented in the Hawaiian region, is recorded from the Gulf of California area on the basis of a single specimen described by Verrill. The species has not been re-collected since and there may be some doubt as to its origin. The genera *Pocillopora*, *Leptoseris*, *Psammocora* (*Stephanaria*), *Pavona*, *Porites*, and *Tubastrea* are well represented, at least in number of species, in both the Hawaiian and Eastern Pacific areas.

With respect to the absence of coral reefs on the Pacific shores of the Americas and the adjacent islands, it may possibly be more apparent than real. During the various trips of the *Velero III* and *Velero IV*, no special effort has been made to collect corals, and the resultant material has come in merely as part of the general collections. It is notable that the species of all hermatypic genera except *Pocillopora* are represented in the *Velero III* and *Velero IV* collections by small, usually fragmentary specimens, and that the genus *Porites* which is very abundant in the Gulf of California area, and apparently forms reefs there (Durham, 1947, p. 11), is represented by only 9 specimens. Of the four species of *Pocillopora* present in the collections, only two are represented by more than two or three specimens, and these two species (*P. robusta*, and *P. damicornis* var. *cespitosa*) are represented mostly by specimens collected from the intertidal zone by shore parties.

It appears highly probable that an expedition which was primarily concerned with collecting corals would bring in much more material, both in quantity and in variety. The numerous species and genera which are represented by single specimens are probably not indications of the paucity of the coral fauna, but rather indications of the lack of proper collecting.

The occurrence of the Caribbean genus *Agaricia* is anomalous, and because of this, the small poorly preserved specimen has been carefully scrutinized to see if it is possible to refer it to some other genus. Its occurrence in the Panamic region should be verified by additional work, but close relationships with the Caribbean fauna are indicated by the occurrence of *Madracis asperula* and *Cladocora debilis* in both areas. Similarly the occurrence of species of the genera *Phyllangia*, *Lophelia*, *Thecopsammia* and *Solenastrea* in the two regions indicates past intercommunication. In view of the occurrence of the genera *Dichocoenia*, *Diploria*, *Eusmilia*, and *Siderastrea* in the lower Pliocene of the Gulf of California (Durham, 1947, p. 14), it is not improbable that they may eventually be found living in the Eastern Pacific. *Eusmilia* and *Siderastrea* are also known in the earlier Tertiary of the Pacific Coast Region (Durham, 1947, p. 7).

The large number of species of the genus *Astrangia* recognized, raises some doubt as to the validity of the specific criteria used in determining them. For this reason they should be restudied when more material is available. However, it is to be noted that all of the specimens from any single locality appear to be moderately restricted in the individual variation present, thus tending to confirm the limited specific variation recognized. In explanation of the large number of species it may be suggested that possibly conditions in the Eastern Pacific are highly favorable to this genus, and that the planulae may have a very short motile stage, with the consequent development of numerous local endemic species.

Despite the fact that 13 of the species here listed from the Galapagos Islands have not been recorded elsewhere in the Eastern Pacific, there is little known about the fauna to indicate any great degree of isolation. These 13 species include representatives of the genera *Astrangia*, *Balanophyllia*, *Desmophyllum*, *Flabellum*, *Kionotrochus*, *Lophosmilia*, *Madracis*, *Madrepora*, *Pavona*, and *Thecopsammia*. Of the preceding, it is only the species of the genus *Kionotrochus* that might be significant; it has been recorded from several localities in the islands but not elsewhere in the Hancock collections. The species of *Madracis* seems to be identical with *Madracis asperula* of the Caribbean, while the remaining species are usually known from but a single locality and thus probably have no significance.

Despite the known abundance of the genus *Porites* in the Gulf of California and Panamic areas, it has been reported previously from the Galapagos only by Pourtales (1875), and is represented in the present collections by only a single beachworn specimen. As noted above, however, the *Velero III* material is notably poor in material representing this genus, and as a result its rarity here is probably not significant.

Among the more notable discoveries in the *Velero III* and *Velero IV* collections is the occurrence of the genus *Dendrosmilia* in the Channel Islands, off the coast of California. Previously the genus has been known only by a single species from the Eocene-Oligocene of the Paris basin (Vaughan and Wells, 1943, p. 218). The Channel Islands specimen has been examined by Dr. John W. Wells who reports (in litt.) that it agrees in all its characters with the genotype which he has also examined. In 1917, Nomland (p. 186) described the fossil coral *Astrangia boreas* from the Pleistocene near Juneau, Alaska. Comparison of Nomland's types with the specimen from the Channel Islands indicates that they are congeneric. Thus there is a third species of the genus *Dendrosmilia*. It is unfortunate that the living species is as yet known only from a single specimen.

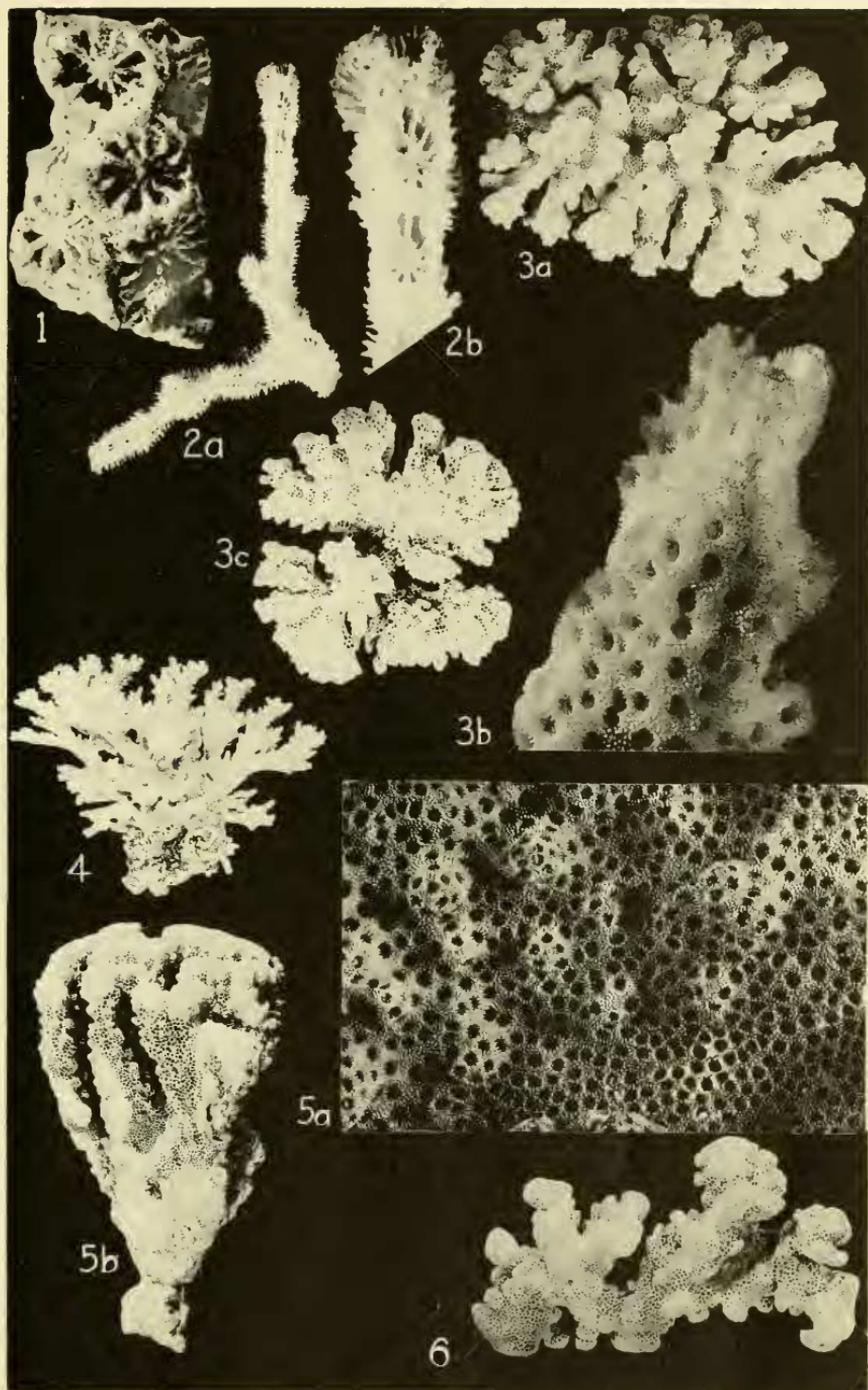
Another notable record is the occurrence of the genus *Heterocyathus* in the Eastern Pacific region. Vaughan and Wells (1943, pp. 89-90, 207) cite this genus as one characteristic of shallower water in the Indian Ocean and the Western Pacific Ocean. Similarly the genus *Kionotrochus* has previously been recorded in the Recent fauna only from Japan and New Zealand. The rare genus *Lophosmilia* has been known in the living fauna only from the Mediterranean and the Hawaiian Islands. The genus *Thecopsammia* has been recorded previously (Vaughan and Wells, 1943, p. 240) only from the Caribbean and the Atlantic.

Table 2 shows the relationship of the Eastern Pacific genera with those of other areas. Seventeen of these are cosmopolitan, 15 are preponderantly Indo-Pacific, 4 are found only in the Atlantic and Caribbean, and 2 are limited to the Eastern Pacific. It is seen from these figures that the affinities of the Eastern Pacific coral fauna are predominantly with the Indo-Pacific area; the presence of 4 species identical with Hawaiian Island material and 2 other species whose affinities are closely tied to the Indo-Pacific further substantiates this conclusion.

However, 21 genera of Eastern Pacific corals may also be found in the Caribbean and 2 species are common to both sides of the Isthmus (*Cladocora debilis* and *Madracis asperula* (?)). One genus, *Agaricia*, previously recorded only in the West Indies, is now represented in the Eastern Pacific by a worn fragment in the bottom sample material.

PLATE 1

- Fig. 1. *Madracis* sp.? Bottom sample 453, Gardner Bay, Hood Island, Galapagos, 35 fms. x 9, p. 15.
- Fig. 2a. *Madracis asperula* Milne Edwards and Haime. Station 201-34, off Gardner Bay, Hood Island, Galapagos, 25-35 fms. x 2, p. 14.
- 2b. *Madracis asperula* Milne Edwards and Haime. Portion of colony enlarged. x 5.
- Fig. 3a. *Pocillopora damicornis* var. *cespitosa* Dana. Station 252-34, Secas Islands, Panama, shallow water. x 0.5, p. 20.
- 3b. *Pocillopora damicornis* var. *cespitosa* Dana. Station 252-34, x 0.5.
- 3c. *Pocillopora damicornis* var. *cespitosa* Dana. Station 80-33, Duncan Island, Galapagos, shallow water. x 0.5.
- Fig. 4. *Pocillopora lacera* Verrill. Station 201-34, off Gardner Bay, Hood Island, Galapagos, 25-35 fms. x 0.3, p. 20.
- Fig. 5a. *Pocillopora robusta* Verrill. Station 289-34, Southeast of Cape Rule, Socorro Island, 4-15 fms. x 5, p. 26.
- 5b. *Pocillopora robusta* Verrill. Station 289-34, x 0.4.
- Fig. 6. *Pocillopora robusta* var. *pumila* Verrill. Station 80-33, Duncan Island, Gallapagos, shallow water. x 0.5, p. 27.



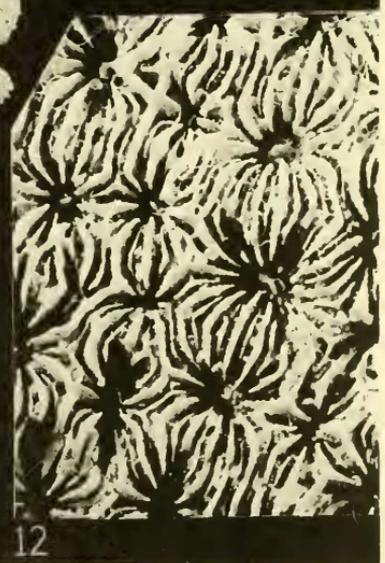
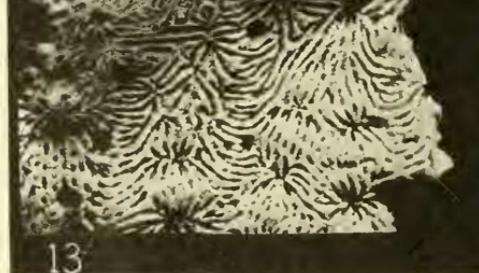
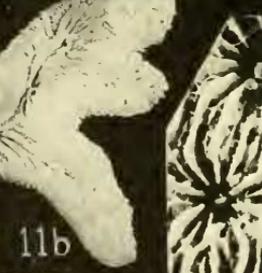
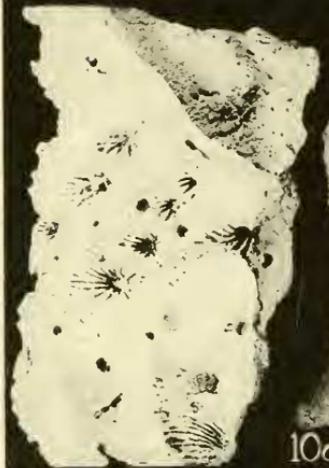
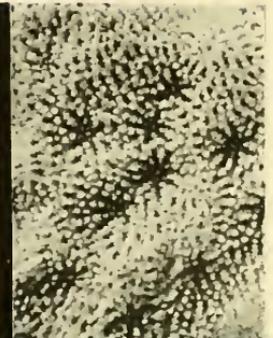
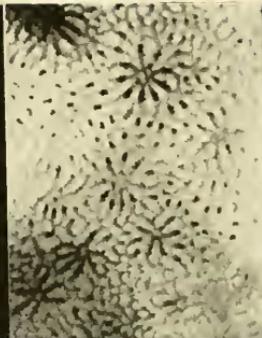
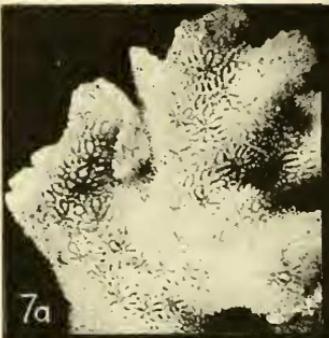


PLATE 2

- Fig. 7a. *Psammocora (Stephanaria) brighami* (Vaughan). Station 80-33, Duncan Island, Galapagos, shallow water. x 2, p. 29.
- 7b. *Psammocora (Stephanaria) brighami* (Vaughan). Station 80-33, Duncan Island, Gallapagos shallow water. x 5.
- Fig. 8. *Psammocora (Stephanaria) stellata* (Verrill) Station 80-33, x 5, p. 29.
- Fig. 9. *Agaricia* sp. Bottom sample 341, 10 mi SW of South of Secas Islands, Panama, 30 fms. x 3.8, p. 31.
- Fig. 10a. *Leptoseris digitata* Vaughan. Station 23-33, off La Plata Island, Ecuador, 10 fms. x 4, p. 31.
- 10b. *Leptoseris digitata* Vaughan. Bottom sample 306, Chatham Bay, Cocos Island, 17 fms. x 4.
- Fig. 11a. *Leptoseris panamensis* Durham and Barnard, new species. Station 113-33, Bahia Honda, Panama, 5-8 fms. x 3.5. Holotype, p. 36.
- 11b. *Leptoseris panamensis* Durham and Barnard, new species. Station 113-33, x 3.5. Holotype.
- Fig. 12. *Pavona (Pavona) clivosa* Verrill. Station 23-33, off La Plata Island, Ecuador, 10 fms. x 8, p. 37.
- Fig. 13. *Pavona* cf. *explanulata* (Lamarck). Bottom sample 427, Clipperton Island. x 8, p. 42.

TABLE 1
BATHYMETRIC, GEOGRAPHIC, AND STRATIGRAPHIC
DISTRIBUTION OF EASTERN PACIFIC CORALS.

	North Pacific	Gulf of Calif.	Panamic	Galapagos	Fossil	AHF Coll.	Depth (meters)	
							Max.	Min.
<i>Agaricia</i> sp.			x			x	54.9	
<i>Astrangia browni</i> Palmer			x					0
<i>californica</i>			x			x	29.3	
<i>concepcionensis</i> Durham		x			x	x	73.2	0
<i>concinna</i> Verrill		x	x			x	64.1	0
<i>coronadosensis</i> Durham		x			x	x	16.5	
<i>cortezi</i> n. sp.		x				x	32.0	
<i>costata</i> Verrill		x	x				31.0	
<i>dentata</i> Verrill		x	x					
<i>equatorialis</i> n. sp.				x		x		7.3
<i>gardnerensis</i> n. sp.				x		x	7.3	0
<i>haimei</i> Verrill			x					0
<i>hancocki</i> n. sp.			x			x	13.7	
<i>hondaensis</i> n. sp.			x	x		x	84.2	54.9
<i>howardi</i> n. sp.			x			x	91.5	54.9
<i>lajollaensis</i> Durham	x					x	53.1	0
<i>oaxacensis</i> Palmer			x					0
<i>pedersenii</i> Verrill		x					9.2	
<i>pulchella</i> Verrill			x					0
<i>sanfelipensis</i> n. sp.		x				x		4.6
<i>tangolaensis</i> Durham			x					9.2
<i>conferta</i> Verrill		x	x			x	21.1	
<i>Balanophyllia cedrosensis</i> Durham	x					x	98.8	89.7
<i>elegans</i> Verrill	x					x	587.4	0
<i>galapagensis</i> Vaughan				x			183.0	
<i>osburni</i> n. sp.			x	x		x	109.8	82.4
<i>tiburoniensis</i> Durham		x	x			x	73.0	18.3
<i>Bathycyathus consagensis</i> n. sp.		x				x	82.4	18.3
<i>Caryophyllia alaskensis</i> Vaughan	x					x	420.9	36.6
<i>arnoldi</i> Vaughan	x				x	x	252.5	78.7
<i>diomedea</i> von Marenzeller			x	x		x	1043.0	54.9
sp. von Marenzeller			x				252.0	
<i>Ceratotrochus franciscana</i> n. sp.		x				x	79.6	
<i>Cladocora debilis</i> Milne Edwards and Haime			x	x		x	274.5	45.8
<i>Coenocyathus bowersi</i> Vaughan	x	x				x	203.1	27.5
<i>Cyathoceras foxi</i> n. sp.	x					x	82.4	
<i>quaylei</i> Durham	x					x	292.8	36.6

TABLE 1, Continued

	North Pacific	Gulf of Calif.	Panamic	Galapagos	Fossil	AHF Coll.	Depth (meters)	
							Max.	Min.
<i>Cycloseris elegans</i> (Verrill)		x	x			x	36.6	23.8
<i>mexicana</i> Durham		x	x	x		x	146.4	0
<i>Dendrophyllia californica</i> Durham	x					x	173.9	42.1
<i>cortezi</i> n. sp.			x			x	151.9	128.1
<i>oldroyi</i> Faustino	x						366.0	
<i>Dendrosmilia nomlandi</i> n. sp.	x					x	178.4	
<i>Desmophyllum crista-galli</i> Milne Edwards and Haime	x		x			x	861.0	102.5
<i>galapagense</i> Vaughan				x			549.0	
<i>Endopachys vaughani</i> Durham		x	x	x		x	402.6	36.6
<i>Flabellum daphnensis</i> n. sp.				x		x	100.7	
(?) <i>montereyense</i> Durham	x					x	170.2	82.4
<i>tannerense</i> n. sp.	x					x	83.3	
<i>sp. von Marenzeller</i>			x				252.0	
<i>Fungiacyathus symmetrica</i> Pourtalès			x				3143.0	2128.0
<i>marenzelleri</i> Vaughan			x	x			5872.5	3682.0
<i>Heterocyathus aequicostatus</i> Milne Edwards and Haime		x	x			x	73.2	20.1
<i>Kionotrochus</i> (?) <i>avis</i> n. sp.				x		x	109.8	
<i>hoodensis</i> n. sp.				x		x	183.0	91.5
<i>Leptoseris digitata</i> Vaughan (?)			x			x	84.2	18.3
<i>panamensis</i> n. sp.			x			x	100.7	9.2
<i>Lobopsammia darwini</i> (Duncan)				x				
<i>Lophelia californica</i> Durham	x							
<i>Lophosmilia wellsii</i> n. sp.				x		x	58.6	
<i>Madracis asperula</i> Milne Edwards and Haime (?)				x		x	54.9	
<i>sp.</i>			x	x		x	64.1	
<i>Madrepora galapagensis</i> Vaughan				x			549.0	
<i>oculata</i> Linnaeus			x				742.0	
<i>Montipora fragosa</i> Verrill		x						
<i>Nomlandia californica</i> n. sp.	x					x	82.4	
<i>Oculina</i> <i>sp.</i> Vaughan			x					
<i>Oulangia bradleyi</i> Verrill			x				54.9	0
<i>Paracyathus caltha</i> Verrill	x						40.2	
<i>humilis</i> Verrill		x	x				104.3	0?
<i>montereyensis</i> Durham	x						146.4	
<i>stearnsii</i> Verrill	x				x	x	366.0	0
<i>tiburonensis</i> Durham		x				x	73.0	0
<i>Pavona clivosa</i> Verrill			x			x	34.8	0
<i>cf. explanulata</i> Lamarck			x			x	78.7	

TABLE 1, Continued

	North Pacific	Gulf of Calif.	Panamic	Galapagos	Fossil	AHF Coll.	Depth (meters)	
							Max.	Min.
<i>gigantea</i> Verrill		x	x		x	x	12.8	0
cf. <i>varians</i> Verrill		x				x	20.1	
sp. Pourtalès				x				0
<i>galapagensis</i> n. sp.			x	x		x	34.8	0
<i>Phyllangia dispersa</i> Verrill			x					0
<i>Pocillopora capitata</i> Verrill		x	x					0
<i>damicornis</i> var. <i>cespitosa</i> Dana			x	x		x		0
<i>lacera</i> Verrill			x	x		x	9.2	0
<i>porosa</i> Verrill		x	x			x	32.9	
<i>robusta</i> Verrill		x	x	x	x	x	36.6	0
<i>Porites californica</i> Verrill		x			x	x	9.2	0
<i>excavata</i> Verrill			x				11.9	
<i>nodulosa</i> Verrill		x			x	x	36.6	0
<i>panamensis</i> Verrill			x					0
<i>sverdrupi</i> Durham		x				x	27.5	14.6
<i>Psammocora brighami</i> (Vaughan)		x				x	23.8	11.0
<i>stellata</i> (Verrill)		x	x	x	x	x	100.7	0
<i>Rhizosammia pulchra</i> Verrill			x					0
<i>Solenastrea ecuadoriana</i> n. sp.			x			x		0
<i>Sphenotrochus hancocki</i> n. sp.		x		x		x	274.5	18.3
<i>Thecopsammia pourtalesi</i> n. sp.				x		x		
<i>Tubastrea surcularis</i> (Verrill)			x				12.8	
<i>tenuilamellosa</i> Milne Edwards and Haime		x	x	x		x	109.8	0

SYSTEMATIC DESCRIPTIONS

Velero station numbers are to be found tabulated in Volume 1, number 3, of the Allan Hancock Pacific Expeditions Publications. Bottom sample numbers may be found in Volume 6 of the same series. Accession numbers indicate Allan Hancock Foundation items other than *Velero* records and are found in a table following the taxonomic descriptions.

Figures in parentheses after station records indicate numbers of specimens from each station.

Summaries under the head "Distribution" discuss only the material reported on in this paper.

TABLE 2

DISTRIBUTION OF EASTERN PACIFIC GENERA IN RECENT FAUNAS.

	Cosmopolitan	Caribbean Gulf of Mexico	Atlantic	Indo-Pacific
Agaricia		X		
Astrangia	X			
Balanophyllia	X			
Bathycyathus	X			
Caryophyllia	X			
Ceratotrochus	X			
Cladocora	X			
Coenocyathus			X	X
Cyathoceras	X			
Cyloseris				X
Dendrophyllia	X			
Dendrosmilia				
Desmophyllum	X			
Endopachys				X
Flabellum	X			
Fungiacyathus	X			
Heterocyathus				X
Kionotrochus				X
Leptoseris				X
Lobopsammia				
Lophelia			X	
Lophosmilia				X
Madracis	X			
Madrepora	X			
Montipora				X
Nomlandia				
Oculina	X			
Oulangia				X
Paracyathus	X			
Pavona				X
Phyllangia		X		X
Pocillopora				X
Porites	X			
Psammocora (Stephanaria)				X
Rhizopsammia				X
Solenastrea		X		
Sphenotrochus	X			
Thecopsammia		X	X	
Tubastrea				X
Total 39	17	4	3	15

Class ANTHOZOA

Order SCLERACTINIAE

Family Seriatoporidae

Genus MADRACIS Milne Edwards and Haime

Madracis Milne Edwards and Haime (1849), Comptes Rendus Acad. Sci. Paris, vol. 29, p. 70.

GENOTYPE: *Madracis asperula* Milne Edwards and Haime.

***Madracis asperula* Milne Edwards and Haime (?)**

Plate 1, figs. 2a, b

Madracis asperula Milne Edwards and Haime (1850), Ann. Sci. Nat., ser. 3, vol. 13, p. 101, pl. 4, figs. 2, 2a; Pourtalès (1871), Mem. Mus. Comp. Zool., vol. 2, no. 4, pp. 27-28, pl. 7, fig. 4; (1880), Bull. Mus. Comp. Zool., vol. 6, no. 4, p. 108.

Axhelia asperula (Milne Edwards and Haime), Vaughan (1902), Bull. U.S. Fish Comm. (for 1900), vol. 20, p. 294, pl. 1, fig. 4; pl. 17, fig. 2.

Description of hypotype: Corallum ramose, branches terete, slender, up to 2.5 mm in diameter, diverging at an angle of 120°; calices shallow, oval to oblong-oval, up to 1 by 2 mm in diameter; calices at ends of branches with high thecal rims, other calices not elevated; longitudinal axes of calices oriented with axis of branch; calices in roughly linear rows, about 3 rows to a branch; calices averaging two-thirds to once the width of a calice apart, somewhat farther apart at base of branch; septa 10 in number, equal, interspaces twice as wide as thickness of septa, no evident rudimentary septa in interspaces, although wall may bulge slightly and some costal development may be present; outer ends of septa slightly narrower than inner ends, at junction with wall of corallite becoming very exsert, producing a high, thin, flat spine with the inner margin concave and dentate; coenenchyma covered with similar processes, as tall as the septal spines, which vary from narrow and pointed to flat and truncate; these spines may reach a length of as much as 0.8 mm and are irregularly covered with pointed granules as are the septal faces, columella, and inner wall of corallite; the coenenchyma is relatively free of these granules; very faint costal ridges may be present, sometimes more apparent where rudimentary septa might be; inner ends of septa widen to form a very large columella one-half to three-fourths the width of the calice, from which projects a pointed, flattened style, thick at the

base and as tall as the surrounding spines; surface of columella only slightly depressed below coenenchyma; at union of inner ends of septa with columella there may be a rude marginal spinelet, apparently the fusion of several of the septal granules.

This species may be separated from *M. kauaiensis* Vaughan by the lack of well-developed costae. However, it is closely related to this species.

From the available figures of the cited references it appears that the coenenchymal spines of typical, *M. asperula* are not as tall as the exsert septal processes; thus the specimens herein described may need specific designation.

Hypotype: Cat. no. 1. 1 (Sta. 201-34).

Material examined: Stas. 201-34 (1), A 18-39 (1). Cat. nos. 1.1-1.2.

Distribution: Off Gardner Bay, Hood Island, 25-35 fms. The Atlantic station number is 8 mi. southwest of San Nicolaas Bay, Aruba, 23-24 fms.

Madracis sp.

Plate 1, fig. 1

There are 3 minute fragments from Bottom sample 453, the largest one with 7 calices preserved on it, and having the aspect of *M. duncani* Wells (1945) as exemplified by his Pl. 1, figs. 11, 12. The individual corallites are close to one another and have common walls; 10 major septa reach the columella and faint suggestions are present in the interspaces of secondary septa appearing as striae on the walls; the columella appears to have been styliform; the septal faces are granulated. Two extremely worn specimens from Bottom sample 541 may represent the same genus and species.

Hypotype: Cat. no. 2.1 (Bottom sample 453).

Material examined: Bottom samples 453 (3), 541 (2). Cat. nos. 2.1-2.2.

Distribution: Gardner Island, 35 fms; Watering Place, Gorgona Island, Colombia, 35 fms.

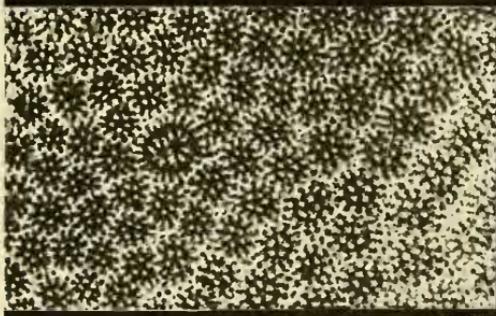
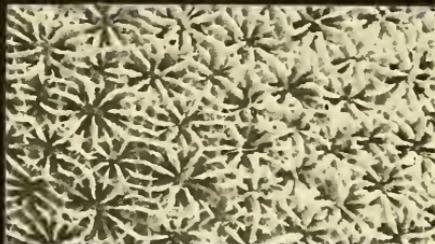
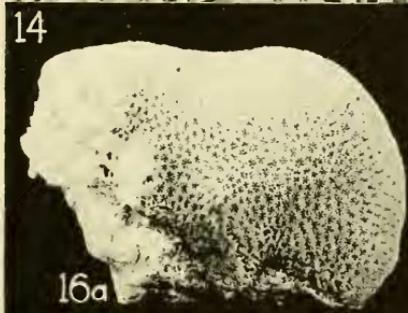
Genus **POCILLOPORA** Lamarck

Pocillopora Lamarck (1816), Hist. Nat. Anim. sans Vert., vol. 2, p. 273; Vaughan (1918), Carnegie Inst. Wash., Pub. Dept. Mar. Biol., vol. 9, p. 75.

Pocillipora Lamarck, Verrill (1870), Trans. Conn. Acad. Arts Sci., vol. 1, p. 519.

PLATE 3

- Fig. 14. *Pavona* (*Pavona*) *gigantea* Verrill. Accession no. 1095, Taboga Beach, Taboga Island, Panama, shore. x 6.6, p. 43.
- Fig. 15. *Pavona* (*Pavona*) cf. *varians* Verrill. Bottom sample 545, Port Utria, Colombia, 12 fms. x 5.8, p. 43.
- Fig. 16a. *Pavona* (*Pseudocolumnastrea*) *galapagensis* Durham and Barnard, new species. Station 47-33, Barrington Island, Galapagos, 2 fms. x 0.7. Holotype, p. 44.
- 16b. *Pavona* (*Pseudocolumnastrea*) *galapagensis* Durham and Barnard, new species. Station 47-33, x 6.5. Holotype.
- Fig. 17a. *Porites californica* Verrill. Station 1112-40, San Gabriel Bay, Espiritu Santo Island, Gulf of Calif., shore. x 0.4, p. 46.
- 17b. *Porites californica* Verrill. Station 1112-40, x 6.2.
- Fig. 18. *Porites nodulosa* Verrill. Station 1111-40, x 6.6, p. 46.
- Fig. 19. *Porites sverdrupi* Durham. Station 1093-40, Puerto Escondido, Gulf of Calif., 8-15 fms. x 7, p. 47.



14

15

16a

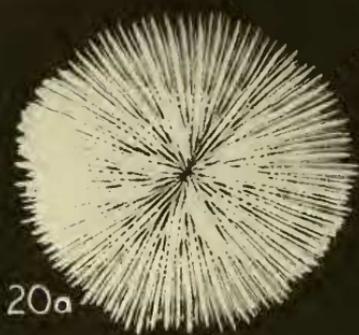
16b

17b

17a

19

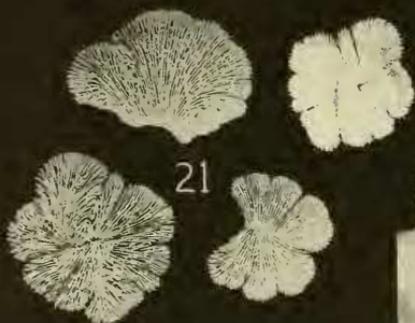
18



20a



20b



21



22a



22c



22b



22d



22e

PLATE 4

- Fig. 20a. *Cyloseris elegans* (Verrill). Station 1738-49, San Lorenzo Channel, Espiritu Santo Island, 13 fms. x 1.4, p. 52.
- 20b. *Cyloseris elegans* (Verrill). Station 1738-49, x 1.4.
- Fig. 21. *Cyloseris mexicana* Durham. Station 1093-40, Puerto Escondido, Gulf of Calif., 8-15 fms. x 5.1, p. 52.
- Fig. 22a. *Cladocora debilis* Milne Edwards and Haime. Station 143-34, off Wenman Island, Galapagos, 100-150 fms. x 5.1, p. 58.
- 22b. *Cladocora debilis* Milne Edwards and Haime. Station 143-34, x 1.
- 22c. *Cladocora debilis* Milne Edwards and Haime. Station 143-34, split corallite, x 6.
- 22d. *Cladocora debilis* Milne Edwards and Haime. Station 201-34, off Gardner Bay, Hood Island, Galapagos, 25-35 fms. x 8.
- 22e. *Cladocora debilis* Milne Edwards and Haime. Station 201-34, x 2.3.

GENOTYPE: *Pocillopora acuta* Lamarck.

***Pocillopora damicornis* var. *cespitosa* Dana**

Plate 1, figs. 3a, b, c

Pocillopora cespitosa Dana var., Vaughan (1906), Bull. Mus. Comp. Zool., vol. 50, no. 3, p. 64, pl. 3, figs. 1, 1a, 1b.

Pocillopora damicornis var. *cespitosa* Dana, Hoffmeister (1925), Carnegie Inst. Wash., Pub. Dept. Mar. Biol., vol. 22, pp. 16-17.

Corallum forming ovate clumps up to 180 mm in length, 80 mm in width and 130 mm in height, some of the colonies apparently living unattached, branches terete, often flattened, 5-17 mm wide, with ascending, irregular, varied, usually small verrucae; branches usually bluntly digitate at the ends, capped by small verrucae which are rounded at the ends; calices small, 0.5-0.75 mm in diameter, subcircular or oval, moderately deep, separated by distances varying from less than to equal the calicular diameters; calices crowded and angular at the ends of the branches; septa poorly developed, sometimes completely absent, but often 12 septa are represented by small spines on the calicular wall; in a few rare cases the 12 septa are better developed and more apparent; columella variable in development, usually just moderately developed, slightly styliform and situated on a directive ridge, in a few cases the columella is fairly prominent, at which time the directive ridge extends only half way across the calice; on the older parts of the corallum the directive ridge is better developed and just slightly raised; spinules of intercalicular surface about twice as high as their basal diameters, conical in shape but usually with a small tuft at the end; towards the ends of the verrucae the spinules are flattened.

This species is distributed widely on the reefs of the Indo-Pacific.
Hypotype: Cat. nos. 3.1 (Sta. 80-33), 3.2 (Sta. 252-34).

Material examined: Stas. 80-33 (1), 252-34 (19), "Hood Island, Galapagos, 1934" (19). Cat. nos. 3.1-3.3.

Distribution: The Galapagos Islands, and Secas Islands, Panama. Bathymetric range, shallow water.

***Pocillopora lacera* Verrill**

Plate 1, fig. 4

Pocillipora lacera Verrill (1869), Proc. Essex Inst., vol. 6, p. 100; (1870), Trans. Conn. Acad. Arts Sci., vol. 1, pp. 523-524.

Verrill's 1870 description is as follows:

"Coralla consisting of more or less irregular or rounded clumps of long, irregular, often crooked, rough, and much subdivided branches.

The branchlets are short and lacerately or digitately divided and lobed at the ends, the subdivisions small, variously shaped, often slender, but generally more or less compressed and obtuse at the tips, often having the appearance of elongated verrucae, while the lateral branchlets pass gradually into the verrucae, which are few, irregular, and distantly scattered on the larger branches. Lateral cells rather large, round, rather distant, often shallow; septa mostly 12, narrow, usually subequal, sometimes one is larger, often all are rudimentary or wanting. Columella rudimentary or wholly abortive. Coenenchyma abundant between the cells, firm, the surface finely and evenly spinulose.

"The larger specimens are 6 to 8 inches in diameter and height; the large branches .30 to .50 in diameter; and 2 to 6 long; the terminal branchlets mostly .10 to .30 long; .10 to .15 in diameter; the cells .03 to .04 of an inch in diameter.

"In life according to Mr. Bradley, the polyps are small, exsert, with twelve equal cylindrical tentacles, which are swollen at the tips; they are about equal in length to the diameter of the body, and they are arranged in a single circle around the margin, but six are held horizontally and six upright in expansion. The color of the polyps is dark brown, greenish brown, or dark green; tentacles dark brown, the tips white.

"In arrangement and form of tentacles this species closely resembles the accompanying *Porites* (*P. Panamensis*), which also has twelve cylindrical, light brown tentacles, with white tips, but the tips are not perceptibly swollen, and they are *not* held alternately upright and horizontally, as in *Pocillipora*. —F.H.B.

"Pearl Islands, Panama, and Acajutla,—F. H. Bradley. 'In more sheltered situations near the head of Panama Bay, this coral covers considerable surfaces, but further out it seems to be confined to sheltered spots, and occurs in scattered clumps.' —F.H.B.

"This species forms loose open clumps of rather slender and irregular branches, quite unlike those of the preceding species in appearance."

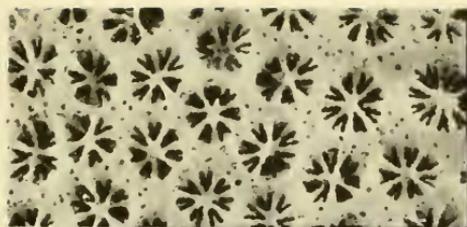
Intercalicular spinules tall, varying from pointed to flattened. This species is rather closely related to *P. damicornis* (Linnaeus), and is possibly one of its many variable forms. *P. lacera* is separated from the Eastern Pacific *P. damicornis* var. *cespitosa* by the longer, more slender, tapered branches, and their more finely divided verruciform tips.

Vaughan (1906), p. 1, reports this form from Panama Bay, between tides and to 1 fm.

Hypotype: Cat. no. 4.1 (Sta. 201-34).

PLATE 5

- Fig. 23. *Solenastrea ecuadoriana* Durham and Barnard, new species. Station 22-33, La Plata Island, Ecuador, shore. x 5.3. Holotype, p. 59.
- Fig. 24a. *Astrangia (Astrangia) californica* Durham and Barnard, new species. Station 1062-40, off Willard Point, Gonzaga Bay, Gulf of Calif., 16 fms. x 3.5. Holotype, p. 61.
- 24b. *Astrangia (Astrangia) californica* Durham and Barnard, new species. Station 1062-40, x 4.4. Holotype.
- Fig. 25a. *Astrangia (Astrangia) concinna* Verrill. Yale Peabody Museum No. 602, Panama. x 1, p. 62.
- 25b. *Astrangia (Astrangia) concinna* Verrill. Yale Peabody Museum No. 602. x 1.6.
- Fig. 26. *Astrangia (Astrangia) concepcionensis* Durham. University of California Museum of Paleontology, No. 14827, Concepcion Bay, Lower California, 7 fms, p. 62.
- Fig. 27. *Astrangia (Astrangia) gardnerensis* Durham and Barnard, new species. Station 31-33, Gardner Bay, Hood Island, Galapagos, 4 fms. x 3.6. Holotype, p. 70.
- Fig. 28a. *Astrangia (Astrangia) cortezi* Durham and Barnard, new species. Station 719-37, off Consag Rock, Gulf of Calif., 10-25 fms. x 1.2. Holotype, p. 68.
- 28b. *Astrangia (Astrangia) cortezi* Durham and Barnard, new species. Station 719-37, x 3. Holotype.



23



24b



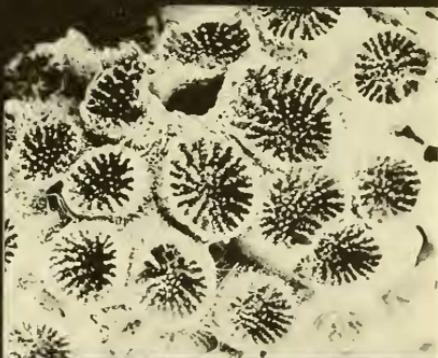
24a



25b



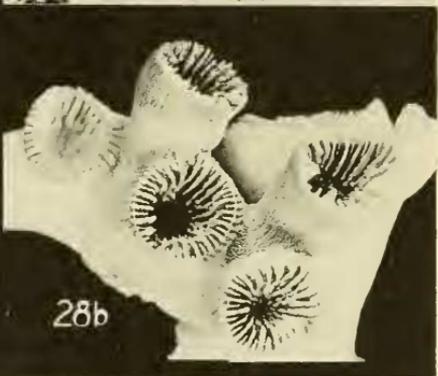
25a



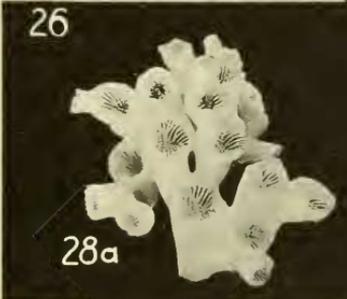
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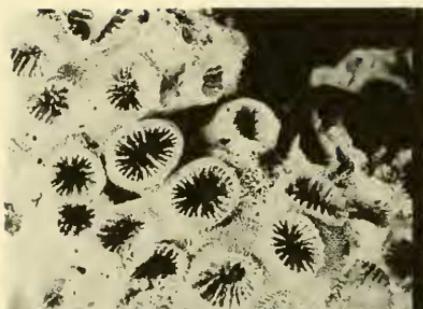
26



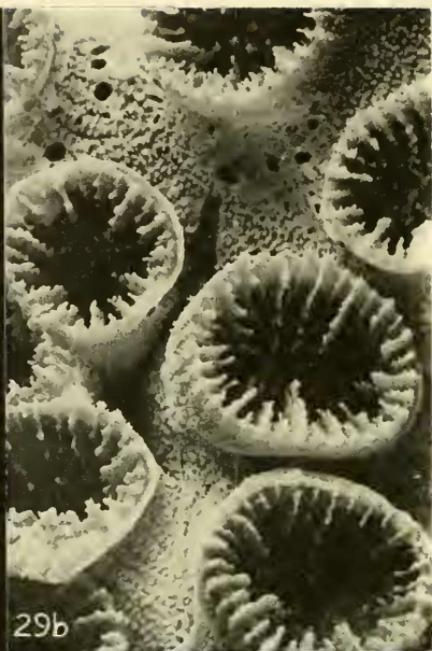
28b



28a



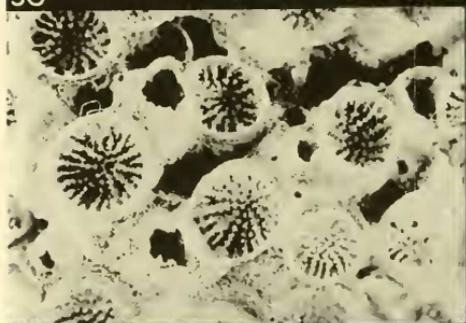
29a



29b



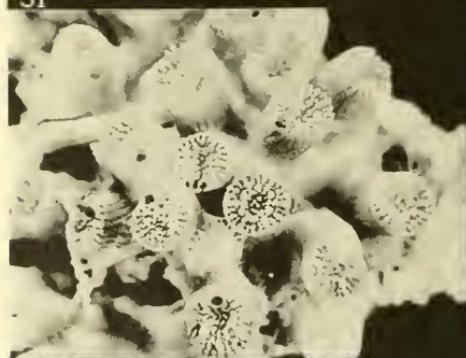
30



31



32a



32b



32c

PLATE 6

- Fig. 29a. *Astrangia (Astrangia) equatorialis* Durham and Barnard, new species. Station 31-33, Gardner Bay, Hood Island, Galapagos, 4 fms. x 2.5. Holotype, p. 69.
- 29b. *Astrangia (Astrangia) equatorialis* Durham and Barnard, new species. Station 31-33, x 10. Holotype.
- Fig. 30. *Astrangia (Astrangia) haimei* Verrill. Yale Peabody Museum no. 598, Bay of Panama. x 7.5, p. 71.
- Fig. 31. *Astrangia (Astrangia) hancocki* Durham and Barnard, new species. Station 763-38, off Black Rock, Cape Corrientes, Mexico, 5-10 fms. x 4. Holotype, p. 72.
- Fig. 32a. *Astrangia (Astrangia) hondaensis* Durham and Barnard, new species. Station 948-39, off Medidor Island, Bahia Honda, Panama, 30-35 fms. x 6.3. Holotype, p. 72.
- 32b. *Astrangia (Astrangia) hondaensis* Durham and Barnard, new species. Station 948-39, x 3.6. Holotype.
- 32c. *Astrangia (Astrangia) hondaensis* Durham and Barnard, new species. Station 948-39, x 10. Holotype.

Material examined: Hood Island, Galapagos (7). Accession no. 1097 (3). Cat. nos. 4.1-4.2.

Distribution: The Galapagos Islands, and Taboga Bay, Taboga Island, Panama. Bathymetric range, shallow water.

Pocillopora porosa Verrill

Pocillopora capitata var. *porosa* Verrill (1869), Proc. Essex Inst., vol. 6, p. 99; (1870), Trans. Conn. Acad. Arts Sci., vol. 1, p. 521.

Pocillopora porosa Verrill, Durham (1947), Geol. Soc. Am., Mem. 20, pp. 16-17, pl. 8, fig. 5; pl. 10, fig. 8.

This species has been recorded previously only from the recent fauna at La Paz.

Hypotype: Cat. no. 5.1 (Sta. 129-34).

Material examined: Sta. 129-34 (1 small specimen).

Distribution: Braithwaite Bay, Socorro Island, 14-18 fms.

Pocillopora robusta Verrill

Plate 1, figs. 5a, b, 6

Pocillopora capitata var. *robusta* Verrill (1870), Trans. Conn. Acad. Arts Sci., vol. 1, pp. 521-522.

Pocillopora capitata var. *pumila* Verrill (1870), Trans. Conn. Acad. Arts Sci., vol. 1, pp. 522-523.

Pocillopora capitata var. *robusta* Verrill, Palmer (1928), Proc. Am. Phil. Soc., vol. 67, p. 21, pl. 2, fig. 1.

Pocillopora palmata Palmer (1928), Proc. Am. Phil. Soc., vol. 67, p. 31, pl. 2, figs. 2, 3; pl. 3, fig. 1.

Pocillopora robusta Verrill, Durham (1947), Geol. Soc. Am., Mem. 20, pp. 17-18, pl. 7, figs. 1, 2; pl. 8, fig. 6.

The growth forms of this species are numerous and varied and several of them would be described as new species if intermediate types were not present.

The typical members form flattened, slightly clavate branches with almost even, meandroid, smooth tops. The verrucae are long (7-10 mm), ascending, slender, tapered, slightly flattened, varying from pointed to blunt. The columella, when present, is usually styliform; septa are not usually evident, except the directives which form a low ridge.

The first intermediate form has divided, flattened branches and the verrucae are elongated as in the typical specimens but are much smaller, ranging up to 5 mm in length. Twelve septa are evident, with a heavy directive ridge and a small columella situated on top of this ridge. The intercalicular spinules are typical.

The next intermediate is like the previous in branching form but the verrucae are still smaller (up to 3 mm), less elongated, and more perpendicular to the surface of the corallum. The intercalicular spinules are slightly coarser with a tendency toward tufted ends. Columella and septa as in preceding variation.

The next intergrade has slightly smaller and more irregularly developed verrucae which resemble nodules. The branches are very flattened, stout, and short, forming close hemispherical clumps. These specimens have the appearance of being rejuvenated or very old, with massive, dead, worn bases. The columella is larger and styliiform with the directive ridge less evident; twelve septal ridges are present. The intercalicular spinules vary from moderately slender and tufted to broadly flattened with very spinose ends.

The last variation noted consists of specimens with terete bases, and massive, flattened branches with nodular, perpendicular evenly spaced verrucae slightly larger than in the preceding variety (up to 4 mm in length). The intercalicular spinules are very broad and clavate, the ends greatly spinose, with gradations down to shorter, pointed granules. The directive ridge varies from low and narrow to massive and wide. A styliiform columellar spinule may project from this ridge. Septa when evident are 6 in number. This form resembles *P. elegans* Dana.

The variation in this species ranges from the prominent verrucae of the typical members to the smallest verrucae of type number 4, with the verrucae of type number 5 slightly inflated and more even. The intercalicular spinules range from slender with simple tips to broadly flattened with lacerated and granular ends.

Specimens from Sta. 638-37 have been deformed by the gall-crab *Hapolocacnus marsupialis* Stimpson. Schmitt (1936, Expls. and Field-Work Smithsonian. Inst. in 1935, pp. 34-36, fig. 36) reports the occurrence of this crab on corals at Sta. 414-35 (Port Utria, Colombia). The gall-crabs have altered the symmetry of *P. robusta* considerably, producing leaf-like projections and large galls which completely enclose the crabs except for a line of perforations where two projections have fused.

The variety *pumila* of *P. robusta* is differentiated by its mode of growth due to regeneration of the colony. The colony branches exhibit a nodular and clavate growth form, the verrucae becoming fewer and enlarging into globose branchlets. (Pl. 1, fig. 6)

The forms of *Pocillopora robusta* resemble several Hawaiian and Indo-Pacific species and eventually they may be found to be identical with one or more of these.

This species has been recorded previously in the Pleistocene from Carmen Island to the coast of Oaxaca, Mexico. It is found in the recent fauna from La Paz to Oaxaca, Mexico, depth 3-6 fms.

Hypotypes: Cat. nos. 6.5 (Sta. 80-33), 6.9 (Sta. 289-34), 6.10 (Sta. 290-34).

Material examined: Stas. 22-33 (1), 42-33 (1), 46-33 (1), 69-33 (1), 80-33 (5), 97-33 (frags.), 125-33 (3), 128-34 (1), 289-34 (5), 290-34 (2), 419-35 (1), 501-36 (8), 582-36 (1), 638-37 (7), 972-39 (8), 973-39 (2), 1110-40 (2), 1727-49 (1), 1734-49 (2), 1737-49 (2). Cat. nos. 6.1-6.20.

Distribution: Stas. 501-36, 582-36, 638-37, 1110-40, 1727-49, 1734-49, and 1737-49 are in the Gulf of California north to San Marcos Island, shallow water to 20 fms; Stas. 289-34, 290-34 are southeast of Cape Rule, Socorro Island, 4-15 fms; Stas. 125-33, 972-39, and 973-39 are at Isabel Island or in the Tres Marias Islands, shore and shallow water; Stas. 22-33, 419-35 are at La Plata Island, Ecuador and Port Utria, Colombia, shore and shallow water; the rest of the stations are in the Galapagos Islands, shore to 10 fms.

Family **Thamnasteriidae**Genus **PSAMMOCORA** Dana

Psammocora Dana (1846), U.S. Expl. Exped., Zooph., pp. 344-345.

GENOTYPE: *Pavona obtusangula* Lamarck.

Subgenus **Stephanaria** Verrill

Stephanocora Verrill (1866), Proc. Boston Soc. Nat. Hist., vol. 10, p. 330, *non* Ehrenberg (1834).

Stephanaria Verrill (1867), Trans. Conn. Acad. Arts Sci., vol. 1, p. 340; Vaughan (1907), U.S. Nat. Mus., Bull. 59, p. 142.

SUBGENOTYPE: *Stephanocora stellata* Verrill.

Psammocora (Stephanaria) brighami (Vaughan)

Plate 2, figs. 7a, b

Stephanaria brighami Vaughan (1907), U.S. Nat. Mus., Bull. 59, pp. 143-144, pl. 43, figs. 4, 4a, 5.

Vaughan notes well the differences between this species and *P. (Stephanaria) stellata*. Occasional calices of both species approach those of the other but no definite intergradation is found.

This species was recorded previously only from the type locality, Kahana, Oahu, at depths of 3-6 ft.

Hypotype: Cat. no. 7.1 (Sta. 1111-40).

Material examined: Stas. 1111-40 (40), 1738-49 (3). Cat. nos. 7.1-7.2.

Distribution: San Lorenzo Channel, west of Espiritu Santo Island, Gulf of California, depth 6-13 fms.

Psammocora (Stephanaria) stellata (Verrill)

Plate 2, fig. 8

Stephanocora stellata Verrill (1866), Proc. Boston Soc. Nat. Hist., vol. 10, p. 330.

Stephanaria stellata Verrill (1870), Trans. Conn. Acad. Arts Sci., vol. 1, pp. 545-546, pl. 9, figs. 4, 4a; Vaughan (1907), U.S. Nat. Mus., Bull. 59, pp. 142-143, pl. 43, figs. 2, 2a, 2b, 3, 3a.

Psammocora (Stephanaria) stellata (Verrill), Durham (1947), Geol. Soc. Am., Mem. 20, p. 19, pl. 8, figs. 1, 2; pl. 13, fig. 1.

This species has been recorded in the Recent fauna from La Paz, Panama, the Pearl Islands and in the Hawaiian Islands by Vaughan. It is found in the Pleistocene on Coronados Island, Gulf of California. Depth, 3-6 ft. in the Hawaiian Islands.

Quelch (1886, p. 129) refers 2 specimens to this species from Honolulu and Kandavu, Fiji.

Hypotype: Cat. no. 8.5 (Sta. 80-33).

Material examined: Stas. 5-33 (4), 23-33 (2), 30-33 (3), 59-33 (1), 80-33 (2), 113-33 (10), 411-35 (frags.). Bottom samples 308 (1)?, 328 (1)?, 329 (frags.)?, 503 (frags.)?, 518 (2)? . Cat. nos. 8.1-8.12.

Distribution: Bottom samples 328 and 329 are from Chatham Bay, Cocos Island, 14-46 fms; Stas. 30-33 and 59-33 are in the Galapagos Islands, shore to 13 fms; the rest of the stations range in the Panamic area from Bahia Honda south to La Libertad, Ecuador, shore to 55 fms. The question marks indicate questionable identifications of worn materials.

Family **Agariciidae**Genus **AGARICIA** Lamarck

Agaricia Lamarck (1801), Syst. Anim. sans Vert., p. 373.

GENOTYPE: *Madrepora undata* Ellis and Solander.

Agaricia sp.

Plate 2, fig. 9

A small, slightly worn fragment is referred to this genus. Calices deep, arranged in linear rows, with high ambulacra separating the rows; septa equal in size, continuous on the ambulacra, about 20-24 per calice; septal faces with rather large granules; bottoms of calices incrustated with sand, columellar structures not clear.

Hypotype: Cat. no. 9.1 (Bottom sample 341).

Material examined: The hypotype.

Distribution: 10 mi. southwest of south of Secas Islands, 30 fms.

Genus **LEPTOSERIS** Milne Edwards and Haime

Leptoseris Milne Edwards and Haime (1849), Comptes Rendus Acad. Sci. Paris, vol. 29, p. 72.

GENOTYPE: *Leptoseris fragilis* Milne Edwards and Haime.

Leptoseris digitata Vaughan (?)

Plate 2, figs. 10a, b

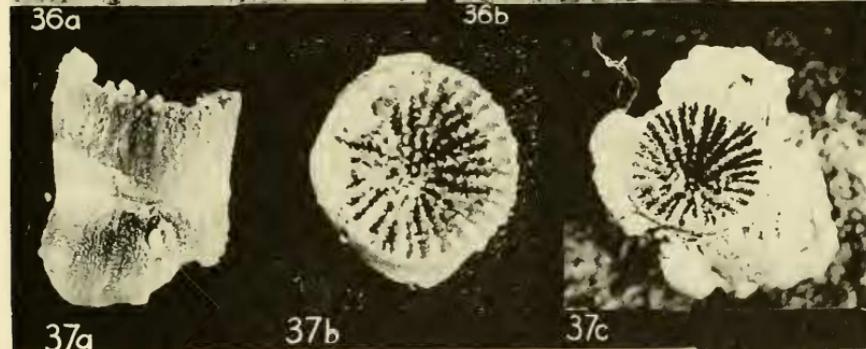
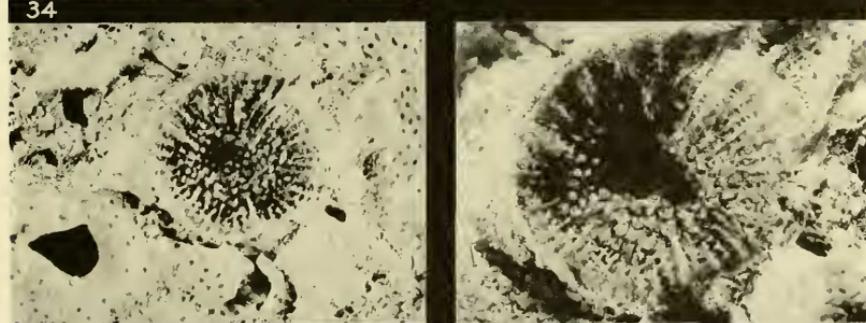
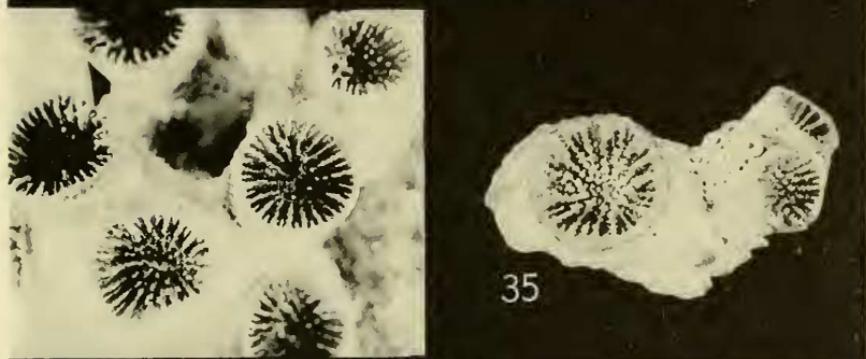
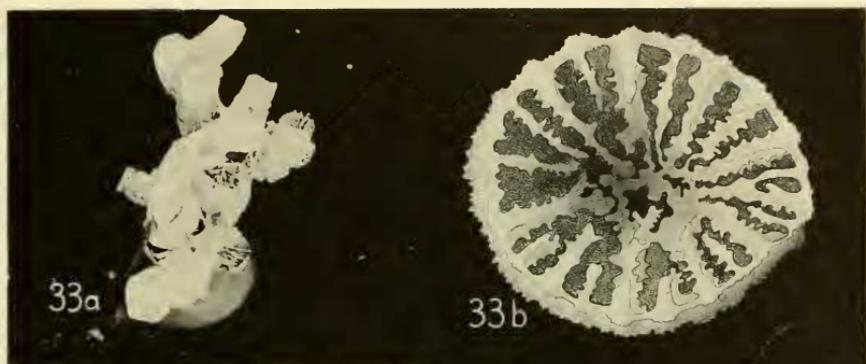
Leptoseris digitata Vaughan (1907), U.S. Nat. Mus., Bull. 59, pp. 140-141, pl. 42, figs. 1, 2.

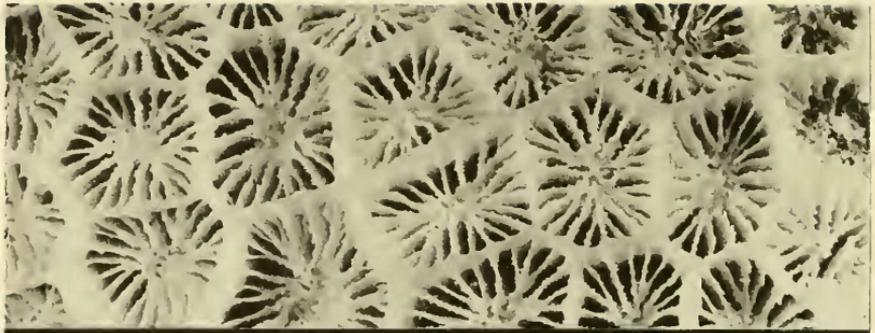
The specimens referred to this species do not show any calices, are very thin orally to adorally, and have curled margins; costae subequal, rounded, with narrow interspaces; septocostae of the lower parts of the corallum continue adorally, while the costae from the higher parts of the corallum fuse or die out; septa subequal, interspaces 2-3 times as wide as thickness of larger septa, faces minutely granulated, occasionally with a slight amount of granular fusion to form ledges. The specimens are much smaller than those figured by Vaughan. Van der Horst (1921) has suggested that the present species and *L. papyracea* Dana are the same. The present material is inadequate to state definitely that it is specifically identical with Vaughan's species.

Two other specimens from Bottom samples 329 and 330 have calices similar to *L. digitata* but have low, broad, adoral costae which are some-

PLATE 7

- Fig. 33a. *Astrangia (Astrangia) howardi* Durham and Barnard, new species. Station 948-39, off Medidor Island, Bahia Honda, Panama, 30-35 fms. x 1.5. Holotype, p. 73.
- 33b. *Astrangia (Astrangia) howardi* Durham and Barnard, new species. Station 948-39, x 14.6. Holotype, drawing.
- Fig. 34. *Astrangia (Astrangia) lajollaensis* Durham. Station 885-38, San Luis Obispo Bay, California, 8-14 fms. x 4, p. 74.
- Fig. 35. *Astrangia (Astrangia) coronadosensis* Durham. Station 1044-40, S. of Tiburon Island, Gulf of Calif., 2-16 fms. x 6, p. 63.
- Fig. 36a. *Astrangia (Astrangia) pulchella* Verrill. Station 1071-40, San Felipe Bay, Gulf of Calif., 2½ fms. x 7.5, p. 75.
- 36b. *Astrangia (Astrangia) pulchella* Verrill. Station 1071-40, x 15.
- Fig. 37a. *Astrangia (Astrangia) sanfelipensis* Durham and Barnard, new species. Station 1071-40, San Felipe Bay, Gulf of Calif., 2½ fms. x 7. Holotype, p. 76.
- 37b. *Astrangia (Astrangia) sanfelipensis* Durham and Barnard, new species. Station 1071-40, x 7. Holotype.
- 37c. *Astrangia (Astrangia) sanfelipensis* Durham and Barnard, new species. Station 1071-40, x 4.5. Paratype.

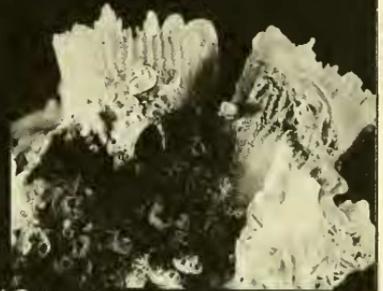




38



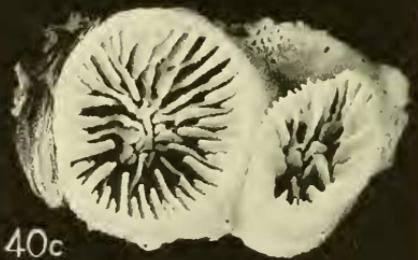
39



40a



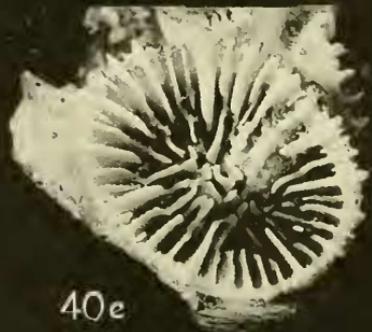
40b



40c



40d



40e

PLATE 8

- Fig. 38. *Astrangia (Coenangia) conferta* Verrill. Station 1787-49, ½ mi SE of Hughes Point, Santa Maria Bay, Lower California, 5-18 fms. x 4.2, p. 77.
- Fig. 39. *Oulangia bradleyi* Verrill. Station 275-34, West of Islets off Navidad Head, Tenacatita Bay, Mexico, 25-35 fms. x 3, p. 77.
- Fig. 40a. *Bathycyathus consagensis* Durham and Barnard, new species. Station 719-37, off Consag Rock, Gulf of Calif., 10-25 fms. x 2.8. Holotype, p. 79.
- 40b. *Bathycyathus consagensis* Durham and Barnard, new species. Station 719-37, x 3.6. Holotype.
- 40c. *Bathycyathus consagensis* Durham and Barnard, new species. Station 1067-40, off Consag Rock, Gulf of Calif., 40-45 fms. x 3.3. Paratype.
- 40d. *Bathycyathus consagensis* Durham and Barnard, new species. Station 1062-40, off Willard Point, Gonzaga Bay, Gulf of Calif., 16 fms. x 4.2. Another Paratype.
- 40e. *Bathycyathus consagensis* Durham and Barnard, new species. Station 1067-40, x 4. Paratype.

what worn. Slightly developed lateral septal ledges may be present. Better material may show that these specimens represent a new species.

Vaughan's material came from the Hawaiian Islands, depth 13-43 fms. Matthai (Mem. Ind. Mus., vol. 8, no. 1, p. 52, 1924) records it from the Andaman Islands, 15 fms.

Hypotype: Cat. no. 10. 1 (Sta. 23-33).

Material examined: Sta. 23-33 (1). Bottom samples 306 (1), 329 (frag.), 541 (frag.). Cat. nos. 10.1-10.4.

Distribution: La Plata Island, Ecuador; Gorgona Island, Colombia; Chatham Bay, Cocos Island. Bathymetric range, 10-46 fms.

***Leptoseris panamensis* Durham and Barnard, new species**

Plate 2, figs. 11a, b

Corallum small, digitiform, the branches thicker orally to adorally and more slender than in *Leptoseris digitata* Vaughan, with the edges not as curled as and more rounded than in that species, margins of branches not lobed (similar to *L. gardineri* van der Horst); calices unifacial, varying from 1-4 mm apart, averaging 0.75 mm in diameter, superficial in appearance except in the crotches of branches where they are deeper; septa 12-14 per calice (excluding 8-12 marginal septocostae per calice), all approximately equal in size, interspaces twice as wide as thickness of septa; septa with projecting lateral shelves or ledges composed of fused granules, margins of ledges dentate; ledges more highly developed on septa which reach columella; near the latter, the septa superficially appear to be 3-4 times as thick as the interspaces, but actually, excluding the septal ledges, the interspaces are almost twice the thickness of the septa; towards edge of corallum the shelves are reduced to sharp lines of granules; septa may have additional granules besides the shelves; at the top of each branch of the corallum, the septocostae extend adorally to become faint, granular costae with narrow interspaces; basally on corallum, the costae may become lines of granules; septocostae of the lower parts of the corallum meet adoral costae at right angles where the former's identity is lost; columella composed of a single upright plate which is occasionally twisted and contorted.

Remarks: This species may be distinguished from *L. digitata* Vaughan by the thicker corallum, the lateral septal ledges, and the smaller columella. It is separated from *L. gardineri* van der Horst by being only one calice wide, by having fewer definitive septa (in the above description, marginal septocostae are omitted in the septal number because all calices are marginal due to the slender corallum), by the pro-

nounced septal ledges, and by the lack of any great differentiation in the size of alternate septa. The calices of *L. gardineri* as figured by Gardiner (Fauna and Geog. Maldive and Laccadive Arch., vol. 2, supp. 1, pl. 92, fig. 23, 1905), are decidedly protuberant. The corallum of *Folioseris papyracea* figured by Rehberg (Abh. Geb. Naturwiss, Verein Hamburg, vol. 12, pt. 1, pl. 2, fig. 8; pl. 4, fig. 2, 1892) and placed in the synonymy of *L. gardineri* by van der Horst, has some superficial calices, and septal ledges are mentioned as occurring. However, the septa alternate in size.

The specimen at hand is somewhat encrusted with sand. Being very small, it is probably young and the adult form of the species may approach *L. gardineri*.

Dimensions of holotype: Height 25 mm (two broken pieces), length of a branch 7 mm, width of same branch 3 mm.

Holotype: AHF no. 1.

Type locality: Sta. 113-33, Bahia Honda, Panama, 5-8 fms.

Material examined: Sta. 113-33 (1). Bottom sample 518 (3 frags.). Cat. nos. 11.1-11.2.

Distribution: The type locality and La Plata Island, Ecuador, 45-55 fms.

Genus PAVONA Lamarck

Pavona Lamarck (1801), Syst. Anim. sans Vert., p. 372.

GENOTYPE: *Pavona cristata* Lamarck.

Subgenus Pavona s.s.

Pavona (*Pavona*) *clivosa* Verrill

Plate 2, fig. 12

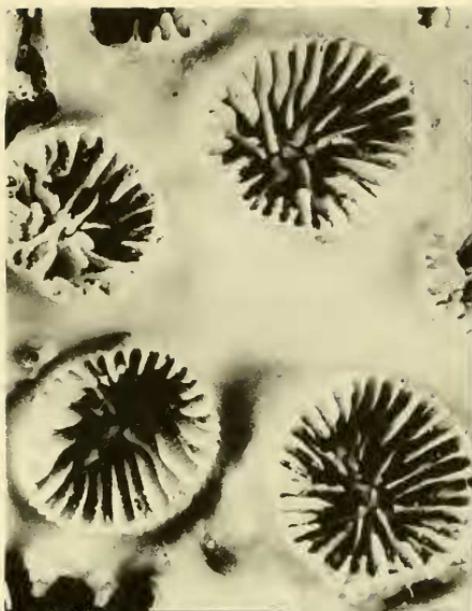
Pavonia clivosa Verrill (1869), Proc. Boston Soc. Nat. Hist., vol. 12, pp. 395-396; (1870), Trans. Conn. Acad. Arts Sci., vol. 1, pp. 544-545, pl. 9, fig. 8.

Verrill's 1870 description is as follows:

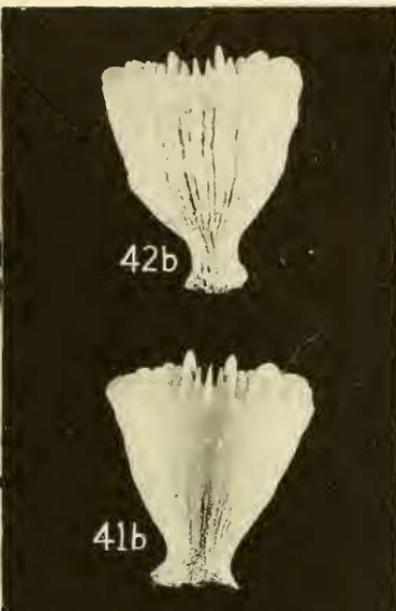
"Corallum thick and massive, lobed, or rising into very large rounded eminences or oblong ridges, thickly covered with stellate cells, which are smaller and nearer together than in the preceding species [*Pavona gigantea*]. Cells mostly uniformly scattered, often closely crowded and contiguous on the summits of the prominences, usually separated on other parts at distances about equal to their own diameter. Septa generally from sixteen to twenty-four, alternately larger and smaller; the larger

PLATE 9

- Fig. 40f. *Bathycyathus consagnesii* Durham and Barnard, new species. Station 1965-50, off Magdalena Bay, Lower Calif., 28-34 fms. x 2.6, p. 79.
- Fig. 41a. *Caryophyllia alaskensis* Vaughan. Station 1429-41, 2½ mi SE of Seal Rocks, Catalina Island, 87-95 fms. x 2, p. 81.
- 41b. *Caryophyllia alaskensis* Vaughan. Station 1429-41, x 2.1.
- Fig. 42a. *Caryophyllia arnoldi* Vaughan. Station 1390-41, 4.5 mi SW x ½ W of E Point, Santa Rosa Island, 43-45 fms. x 2, p. 81.
- 42b. *Caryophyllia arnoldi* Vaughan. Station 1429-41, 2½ mi SE of Seal Rocks, Catalina Island, 87-95 fms. x 2.
- Fig. 43. *Caryophyllia diomedea* von Marenzeller. Station 948-39, off Medidor Island, Bahia Honda, Panama, 30-35 fms. x 5, p. 82.
- Fig. 44a. *Ceratotrochus franciscana* Durham and Barnard, new species. Station 1106-40, off San Francisco Island, Gulf of Calif., 43-44 fms. x 1.7. Holotype, p. 82.
- 44b. *Ceratotrochus franciscana* Durham and Barnard, new species. Station 1106-40, x 1.7. Holotype.

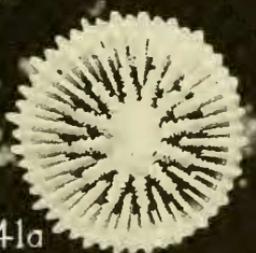


40f

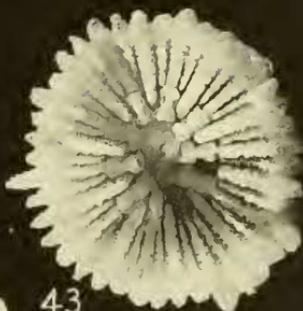


42b

41b



41a



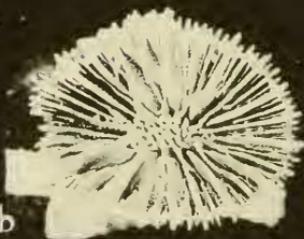
43



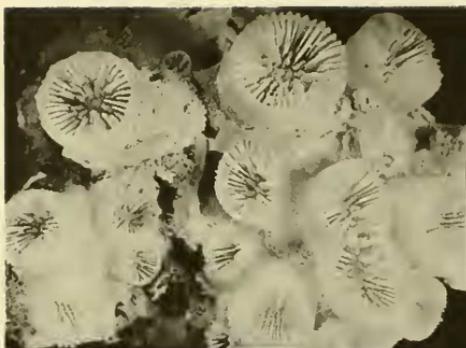
42a



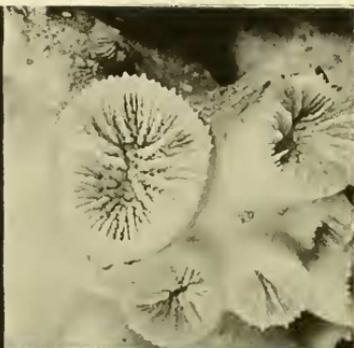
44a



44b



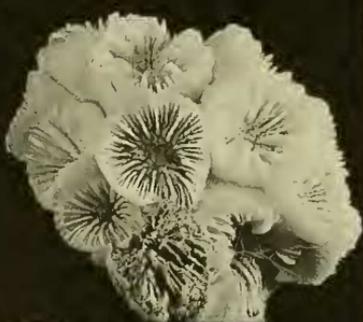
45a



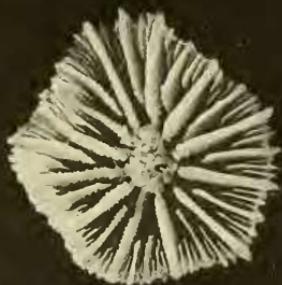
45b



45c



45d



46a



46b



47

PLATE 10

- Fig. 45a. *Coenocyathus bowersi* Vaughan. Station 978-39, East of Gull Island, Channel Islands, 21-28 fms. x 2.5, p. 83.
- 45b. *Coenocyathus bowersi* Vaughan. Station 1279-41, 1.8 mi NE of San Miguel Island, 40-47 fms. x 3.3.
- 45c. *Coenocyathus bowersi* Vaughan. Station 593-36, Puerto Escondido, Lower Calif., 5 fms. x 2.
- 45d. *Coenocyathus bowersi* Vaughan. Station 1280-41, 2½ mi E of S Point, Santa Rosa Island, 15-21 fms. x 1.9.
- Fig. 46a. *Cyathoceras foxi* Durham and Barnard, new species. Accession no. 1236, off Richardson Point, San Miguel Island, 45 fms. x 2.3, p. 84.
- 46b. *Cyathoceras foxi* Durham and Barnard, new species. Accession no. 1236, x 2.3.
- Fig. 47. *Dendrosmilium nomlandi* Durham and Barnard, new species. Station 1172-40, 5½ mi SE of Catalina Island, 145-150 fms. x 2, p. 85.

ones rather thin, only little thickened even at the margin, roughly granulous on the sides; their costal prolongations elevated and rather thin. Smaller septa about half as wide, a little thinner and less elevated, as are also their costal prolongations. Columella a small tubercle, often prominent, sometimes flattened. Internal structure as in the preceding, but the transverse septa are nearer together.

"The largest specimens are ten inches to two feet in diameter; and often a foot thick or high; some of the prominences or lobes are from four to six inches in diameter, and nearly as high; diameter of cells mostly .05 to .06; distance between them ordinarily .05 to .08.

"Pearl Islands, at extreme low-water of spring tides,—F. H. Bradley."

The specimens from Sta. 23-33 is a small frondose fragment which is epithecate on one side, possibly indicating early stages of growth before the corallum becomes massive.

Hypotype: Cat. no. 12.1 (Sta. 23-33).

Material examined: Sta. 23-33 (1). Bottom sample 503 (frag.). Cat. nos. 12.1-12.2.

Distribution: Off La Plata Island and La Libertad, Ecuador. Bathymetric range, 10-19 fms.

Pavona (Pavona) cf. explanulata (Lamarck)

Plate 2, fig. 13

Agaricia explanulata Lamarck (1816), Hist. Nat. Anim. sans Vert., vol. 2, p. 244; Milne Edwards and Haime (1851), Ann. Sci. Nat., ser. 3, vol. 15, p. 124.

Lophoseris explanulata Lamarck, Milne Edwards (1860), Hist. Nat. Corall., vol. 3, p. 69, pl. D 11, fig. 2.

Two small fragments appear to resemble Lamarck's species. Calices small, the largest being 2 mm in diameter, separated by gently convex ambulacra; septa 20-22, subequal, granulated, about half extending to the center of the calice; columella small, styliform. Better material might show this to be a new species.

Worn, fragmentary materials representing 4 or 5 species of pavonid and leptoserid corals are present in Bottom sample 329.

Pavona explanulata is an Indo-Pacific species.

Hypotype: Cat. no. 13.2 (Bottom sample 427).

Material examined: Bottom samples 329 (1), 427 (1). Cat. nos. 13.1-13.2

Distribution: Chatham Bay, Cocos Island, 40-46 fms; Clipperton Island, no bathymetric data.

Pavona (Pavona) gigantea Verrill

Plate 3, fig. 14

Pavonia gigantea Verrill (1869), Proc. Boston Soc. Nat. Hist., vol. 12, pp. 394-395; (1870), Trans. Conn. Acad. Arts Sci., vol. 1, pp. 543-544, pl. 9, fig. 7.

Pavona gigantea Verrill, Durham (1947), Geol. Soc. Am., Mem. 20, p. 20, pl. 3, figs. 1, 2, 7.

Verrill described this species from the Pearl Islands at a depth of 7 fms. Durham records it in the recent fauna of Escondido Bay, Gulf of California; Oaxaca, Mexico; and in the Pleistocene of Salinas Bay, Carmen Island.

Hypotype: Cat. no. 14.2 (Acc. no. 1095).

Material examined: Bottom sample 427 (frag.). Acc. no. 1095 (1). Cat. nos. 14.1-14.2.

Distribution: Clipperton Island; Taboga Beach, Taboga Island, Panama.

Pavona (Pavona) cf. varians Verrill

Plate 3, fig. 15

Pavonia varians Verrill (1864), Bull. Mus. Comp. Zool., vol. 1, no. 3, p. 55.

Pavona varians Verrill, Vaughan (1907), U.S. Nat. Mus., Bull. 59, p. 135, pl. 38, figs. 1, 1a; (Verrill), Vaughan (1918), Carnegie Inst. Wash., Pap. Dept. Mar. Biol., vol. 9, pp. 138-139, pl. 57, figs. 1, 1a, 2, 2a, 3, 4, 4a.

Corallum incrusting, slightly worn, surface rising into short, angular crests or hillocks; septocostae continuous to tops of crests where they meet a laminar ridge; calices small, distances between centers about 2 mm; septa of best 2 calices 20-22, subequal, sides granulated, continuous from calice to calice where not interrupted by the hydno-phoroid protuberances; septothecal wall separating at least 2 calices, evident only because of worn surface; columella small, styliform.

This species was recorded previously from the Hawaiian Islands and the Southwest Pacific.

Hypotype: Cat. no. 15.1 (Bottom sample 545).

Material examined: The hypotype.

Distribution: Port Utria, Colombia, 12 fms.

Subgenus *Pseudocolumnastraea* Yabe and Sugiyama

Pseudocolumnastraea Yabe and Sugiyama (1933), Jap. Jour. Geol., vol. 11, p. 15.

SUBGENOTYPE: *Pseudocolumnastraea yamanarii* Yabe and Sugiyama.

Pavona* (*Pseudocolumnastraea*) *galapagensis

Durham and Barnard, new species

Plate 3, figs. 16a, b

Corallum massive, forming a moderately large colony rising into several gibbous knobs; corallites circular, ranging in size from slightly less than a millimeter to 2 mm, averaging 1.5 mm; larger corallites on top surface of corallum may be as much as 1 mm apart, mostly less; occasional ones may have confluent or closely appressed thecae; corallites on lateral surfaces of corallum consistently have closely appressed or confluent thecae; septa 12-20, mostly 12, rather occasionally with 14-16, infrequently with 18-20; half of the septa extend to the columella, the other half extend one-third to one-half the distance to the columella; septal interspaces 2-3 times as wide as thickness of major septa; secondary septa slightly thinner than primary septa; all septa thicken toward thecal wall; all septa equally exsert (0.5 mm), primary septa with inner edges vertical and top edges flat, septa of secondary system with inner edges oblique and upper edges somewhat rounded, becoming flat if extending far out over peritheca; margins of septa smooth, septal faces with numerous small, pointed granules deep within the calice, septocostae of basal corallites with granular faces; costae extend from calice to calice; occasionally, individual costae from 3 calices meet and fuse tripartitely; thecal wall consisting of synapticulae between septa; endo- and exothecae well-developed, dissepiments averaging 1 mm apart; exothecal tabulae slow to develop near surface of corallum, causing a pitted appearance of the peritheca; columella composed of a single, elevated contorted piece. Corallites at base of corallum may be elongated and have more septa and more pieces to the columella.

Remarks: This species is very closely related to *Pavona maldivensis* (Gardiner) but differs in having about 4 less septa per comparable calice, thinner septa, and a more twisted columella. Gardiner's species is very polymorphic, exhibiting 3 distinct types of calices, only one of which has the *Pseudocolumnastraea*-form. The only calices on the new species which do not exhibit synapticulothecae are occasional basal ones, the exothecae of which have filled up, obliterating the separate walls.

The holotype is comparable to Vaughan's figures (1918, pl. 56, figs. 3, 3b) but has thinner and more exsert septa and less septa per calice. Vaughan's fig. 3a does not represent any calices found on the new species.

Although this species has only slight resemblance to the figured holotype of *Pseudocolumnastraea*, it is nevertheless provisionally referred to that subgenus because of the distinct thecal walls separating the corallites.

Dimensions of holotype: Height 45 mm, length 65 mm, width 33 mm, diameter of a calice 1.5 mm.

Holotype: AHF no. 2.

Type locality: Sta. 47-33, Barrington Island, Galapagos Islands, 2 fms.

Material examined: Stas. 30-33 (1 beach-worn specimen), 47-33 (1). Bottom sample 503 (frag.). Cat. nos. 16.1-16.3.

Distribution: The Galapagos Islands, shore to 2 fms; the bottom sample record is from La Libertad, Ecuador, 19 fms.

Family **Poritidae**Genus **PORITES** Link

Porites Link (1807), Beschreib. Natur. Samml. Rostock, p. 162.

GENOTYPE: *Madrepora porites* Pallas.

Porites californica Verrill

Plate 3, figs. 17a, b

?*Porites* sp. Grewingk (1848), Verh. Russisch-Kaiserl. Miner. Gesellsch. St. Petersburg, Jahr 1847, p. 146.

Porites Californica Verrill (1870), Trans. Conn. Acad. Arts Sci., vol. 1, p. 504.

Porites porosa Verrill (1870), Trans. Conn. Acad. Arts Sci., vol. 1, p. 504; Bernard (1905), Brit. Mus. (Nat. Hist.), Cat. Madreporarian Corals, vol. 5, pt. 1, p. 107.

Porites californica Verrill, Bernard (1905), Brit. Mus. (Nat. Hist.), Cat. Madreporarian Corals, vol. 5, pt. 1, pp. 106-107; Durham (1947), Geol. Soc. Am., Mem. 20, pp. 20-21, pl. 13, figs. 3, 5, 6; pl. 14, figs. 1-5.

The type locality of this species is La Paz. It was recorded from the Pliocene, Pleistocene, and recent in the Gulf of California by Durham from Angel de la Guardia Island southward; and in the Pleistocene at Magdalena Bay. Verrill's specimens were from a depth of 4-5 fms. Other specimens came from gravelly beaches.

One massive, beach-worn specimen of a *Porites* is present from Sta. 47-33 (Barrington Island, Galapagos, 2 fms). Several of the best-preserved corallites have up to 18 septa. This might represent the form described by Verrill as *Porites excavata*.

Hypotype: Cat. no. 17.3 (Station 1112-40).

Material examined: Stas. 449-35 (1), 1104-40 (1), 1112-40 (5). Cat. nos. 17.1-17.3.

Distribution: Agua Verde Bay; San Gabriel Bay, Espiritu Santo Island, Gulf of California, shore. Secas Islands, Panama, 25 fms.

Porites nodulosa Verrill

Plate 3, fig. 18

Porites nodulosa Verrill (1870), Trans. Conn. Acad. Arts Sci., vol. 1, pp. 505-506; Bernard (1905), Brit. Mus. (Nat. Hist.), Cat. Madreporarian Corals, vol. 5, pt. 1, p. 107; Durham (1947), Geol. Soc. Am., Mem. 20, pp. 22-23, pl. 12, figs. 1-3; pl. 13, fig. 4.

Verrill described this species from La Paz. Durham recorded it living only in the Gulf of California and occurring in the Pleistocene of Magdalena Bay.

Hypotype: Cat. no. 18.2 (Sta. 1111-40).

Material examined: Stas. 582-36 (1), 1111-40 (1). Cat. nos. 18.1-18.2.

Distribution: South of San Marcos Island, Gulf of California; San Lorenzo Channel. Bathymetric range, 6-20 fms.

Porites sverdrupi Durham

Plate 3, fig. 19

Porites sverdrupi Durham (1947), Geol. Soc. Am., Mem. 20, p. 23, pl. 12, fig. 4; pl. 13, fig. 2.

This species was recorded by Durham from Salinas Bay, Carmen Island; Agua Verde Bay; Univ. Calif. Mus. Paleo. loc. A 3985 (depth 11.5 fms), in the Gulf of California.

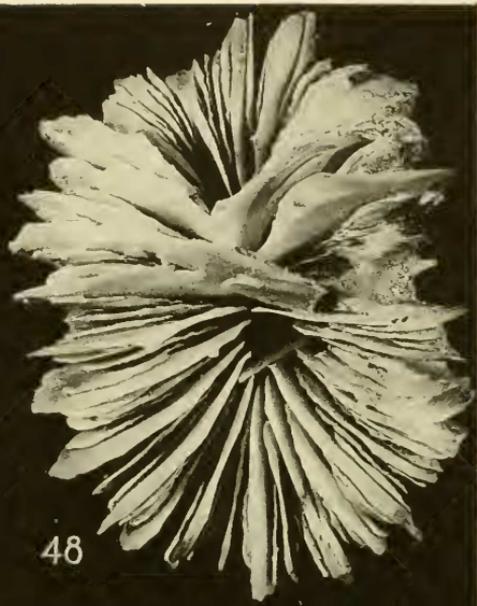
Hypotype: Cat. no. 19.1 (Sta. 1093-40).

Material examined: The hypotype.

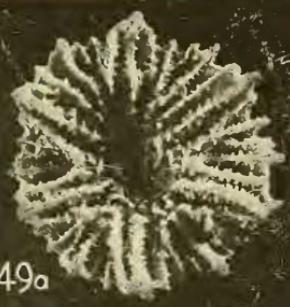
Distribution: Puerto Escondido, 8-15 fms.

PLATE 11

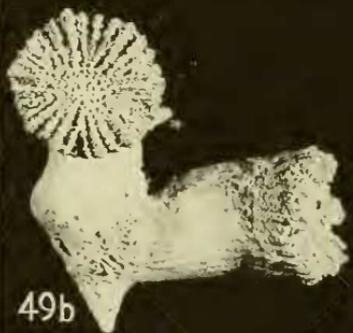
- Fig. 48. *Desmophyllum crista-galli* Milne Edwards and Haime. Station 1848-49, 4 mi SE of E end, Catalina Island, 104-135 fms. x 1.7, p. 86.
- Fig. 49a. *Heterocyathus aequicostatus* Milne Edwards and Haime. LACM 375, Banderas Bay, Mexico, 20-40 fms. x 9, p. 87.
- 49b. *Heterocyathus aequicostatus* Milne Edwards and Haime. LACM 375, x 3.5.
- 49c. *Heterocyathus aequicostatus* Milne Edwards and Haime. LACM 375, x 2.9.
- 49d. *Heterocyathus aequicostatus* Milne Edwards and Haime. LACM 375, x 2.7.
- Fig. 50a. *Kionotrochus* (?) *avis* Durham and Barnard, new species. Station 55-33, Northeast of Charles Island, Galapagos, 60 fms. x 4.7. Holotype, p. 88.
- 50b. *Kionotrochus* (?) *avis* Durham and Barnard, new species. Station 55-33, x 3.3. Holotype.



48



49a



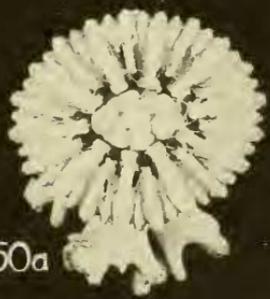
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49c



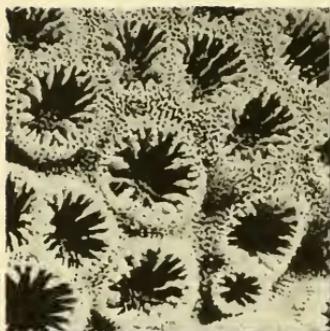
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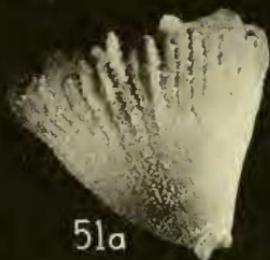
50a



50b



50d



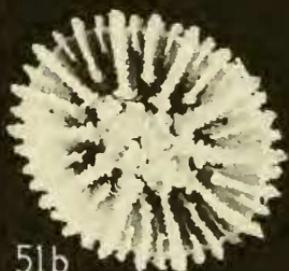
51a



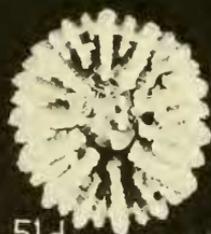
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51c



51b



51d



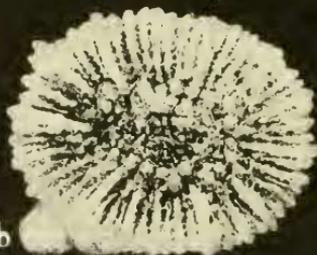
53



52



54a



54b

PLATE 12

- Fig. 50c. *Kionotrochus* (?) *avis* Durham and Barnard, new species. Station 55-33, Northeast of Charles Island, Galapagos, 60 fms. x 4.4. Paratype, p. 88.
- 50d. *Tubastrea tenuilamellosa* Milne Edwards and Haime. Station 155-34, off Tagus Cove, Albemarle Island, Galapagos, 50-60 fms. x 2, p. 105.
- Fig. 51a. *Kionotrochus* (?) *hoodensis* Durham and Barnard, new species. Station 816-38, North of Hood Island, Galapagos, 50-100 fms. x 4.5. Holotype, p. 89.
- 51b. *Kionotrochus* (?) *hoodensis* Durham and Barnard, new species. Station 816-38, x 4.6. Holotype.
- 51c. *Kionotrochus* (?) *hoodensis* Durham and Barnard, new species. Station 190-34, East of south end of Albemarle Island, Galapagos, 58-60 fms. x 3.9. Paratype.
- 51d. *Kionotrochus* (?) *hoodensis* Durham and Barnard, new species. Station 190-34, x 5. Paratype.
- Fig. 52. *Lophosmilia wellsii* Durham and Barnard, new species. Station 170-34, Stephens Bay, Chatham Island, Galapagos, 32 fms. x 4.2, p. 90.
- Fig. 53. *Nomlandia californica* Durham and Barnard, new genus, new species. Accession no. 1236, off Richardson Point, San Miguel Island, 45 fms. x 4.2, p. 91.
- Fig. 54a. *Paracyathus humilis* Verrill. Station 137-34, Sulphur Bay, Clarion Island, 57 fms. x 2.1, p. 92.
- 54b. *Paracyathus humilis* Verrill. Station 137-34, x 4.8.

Family Fungiidae

Genus CYCLOSERIS Milne Edwards and Haime

Cycloseris Milne Edwards and Haime (1849), Comptes Rendus Acad. Sci. Paris, vol. 29, p. 72.

GENOTYPE: *Fungia cyclolites* Lamarck.

Cycloseris elegans (Verrill)

Plate 4, figs. 20a, b

Fungia elegans Verrill (1870), Am. Jour. Sci., ser. 2, vol. 49, p. 100; (1870), Trans. Conn. Acad. Arts Sci., vol. 1, p. 542, pl. 10, figs. 1, 2.

Cycloseris elegans (Verrill), Vaughan (1907), U.S. Nat. Mus., Bull. 59, pp. 115, 116, 127, 128; Durham (1947), Geol. Soc. Am., Mem. 20, p. 24, pl. 9, figs. 1-3, 5, 6, 11, 12.

It is surprising that the *Velero* has not collected more than 2 specimens of this species considering the rather large collection of its relative, *C. mexicana* Durham. The specimen from Sta. 1738-49 was found associated with a large number of *C. mexicana*.

Recorded previously from La Paz, Clarion Island, and Panama.

Hypotype: Cat. no. 20.2 (Sta. 1738-49).

Material examined: Stas. 304-34 (1), 1738-49 (1). Cat. nos. 20.1-20.2.

Distribution: Off Sulphur Bay, Clarion Island, 20 fms; San Lorenzo Channel, Espiritu Santo Island, 13 fms.

Cycloseris mexicana Durham

Plate 4, fig. 21

Diaseris sp. Vaughan (1907), U.S. Nat. Mus., Bull. 59, pp. 118, 119, 120.

Cycloseris mexicana Durham (1947), Geol. Soc. Am., Mem. 20, pp. 24-25, pl. 9, figs. 4, 7-10.

Numerous complete corallites are present in the *Velero* collections. The quantitative figures after the station numbers do not necessarily mean that all are complete specimens, but indicate the larger pieces.

All previous records of this species are in the Gulf of California north to Carmen Island, with one depth of 31 m indicated.

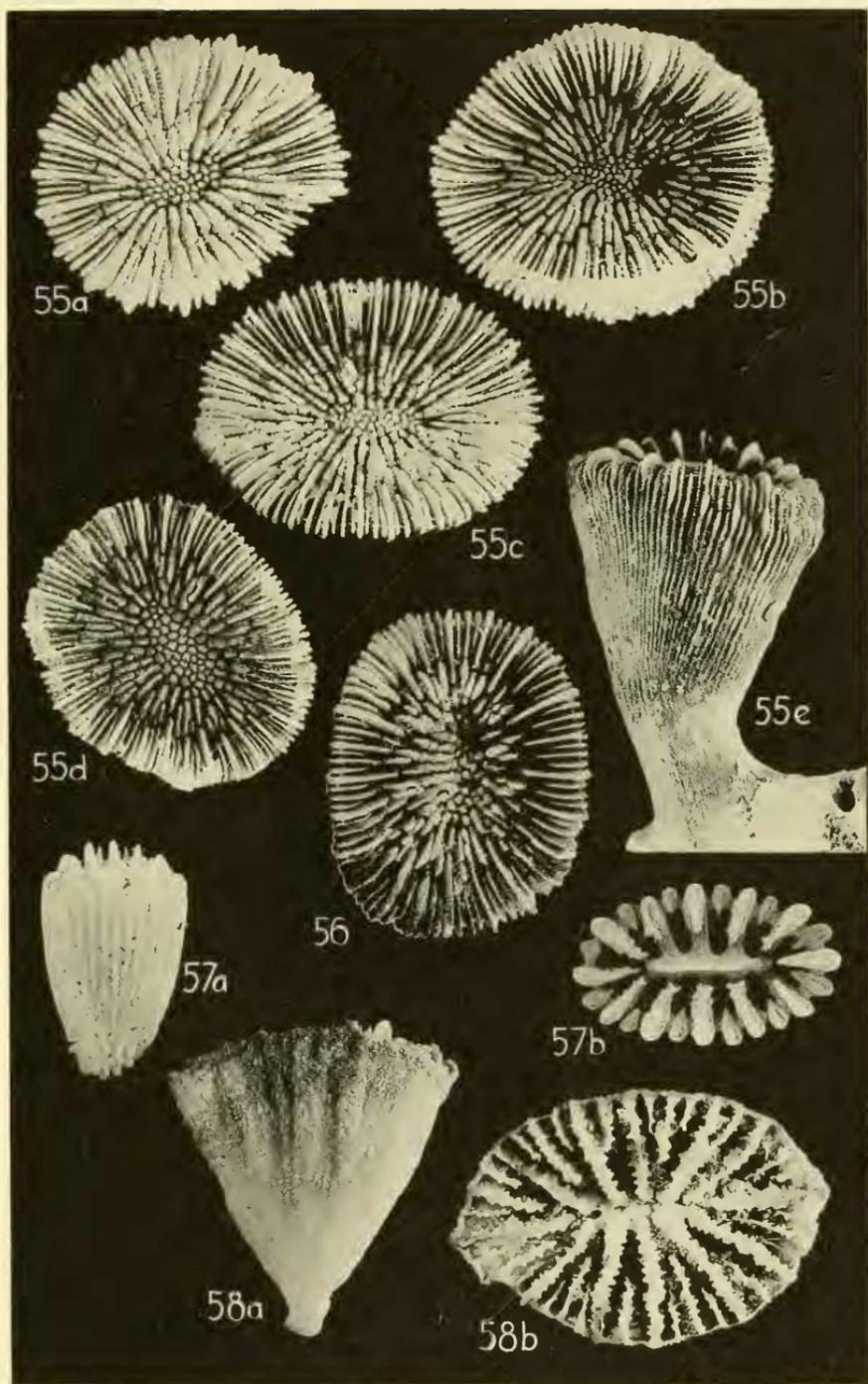
Hypotypes: Cat. no. 21.6 (Sta. 1093-40).

Material examined: Stas. 23-33 (1), 253-34 (23 frags.), 257-34 (1), 397-35 (3), 858-38 (1), 1093-40 (65), 1097-40 (1), 1111-40 (1), 1738-49 (60). Bottom samples 307 (frags.), 308 (frags.), 311 (frags.), 312 (frags.), 313 (frags.), 328 (frags.), 329 (frags.), 330 (frags.), 418 (frags.), 439 (frag.), 503 (frag.), 518 (frags.), 584 (frag.), 2188 (1), 2190 (1), 2191 (1).

Distribution: Bottom samples 418 and 439 are in the Galapagos Islands, 17-20 fms; Bottom samples 328-330 are at Chatham Bay, Cocos Island, 14-47 fms; Stas. 1093-40, 1097-40, 1111-40, 1738-49, and Bottom samples 2188, 2190, 2191, are in the Gulf of California at 6-25 fms; the rest of the station numbers range along the Central and South American coasts from Port Culebra south to La Libertad, Ecuador, 3-80 fms. Most of the records stand between 8 and 35 fms. The best material comes from Sta. 1093-40 with a depth of 8-15 fms. Deeper water material is more fragmentary.

PLATE 13

- Fig. 55a. *Paracyathus stearnsii* Verrill. Station 1254-41, 8 mi SW of Cedros Island, Mexico, 63-65 fms. x 2.7, p. 92.
- 55b. *Paracyathus stearnsii* Verrill. Station 1012-41, S of Pyramid Cove, San Clemente Island, 55-69 fms. x 2.3.
- 55c. *Paracyathus stearnsii* Verrill. Station 1418-41, 3½ mi NE of San Pedro Point, Santa Cruz Island, 46-47 fms. x 2.3.
- 55d. *Paracyathus stearnsii* Verrill. Station 1012-41, x 2.4.
- 55e. *Paracyathus stearnsii* Verrill. Station 1012-41, x 2.3. Lateral view, same as b.
- Fig. 56. *Paracyathus tiburonensis* Durham. Station 1046-40, Puerto Refugio, Angel de la Guardia Island, Gulf of Calif., shore. x 2.4, p. 94.
- Fig. 57a. *Sphenotrochus hancocki* Durham and Barnard, new species. Station 170-34, Stephens Bay, Chatham Island, Galapagos, 32 fms. x 10. Holotype, p. 94.
- 57b. *Sphenotrochus hancocki* Durham and Barnard, new species. Station 170-34, x 17. Holotype, drawing.
- Fig. 58a. *Flabellum daphnense* Durham and Barnard, new species. Station 788-38, southeast of Daphne Major Island, Galapagos, 55 fms. x 3.3. Holotype, p. 96.
- 58b. *Flabellum daphnense* Durham and Barnard, new species. Station 788-38, x 4.3. Holotype.



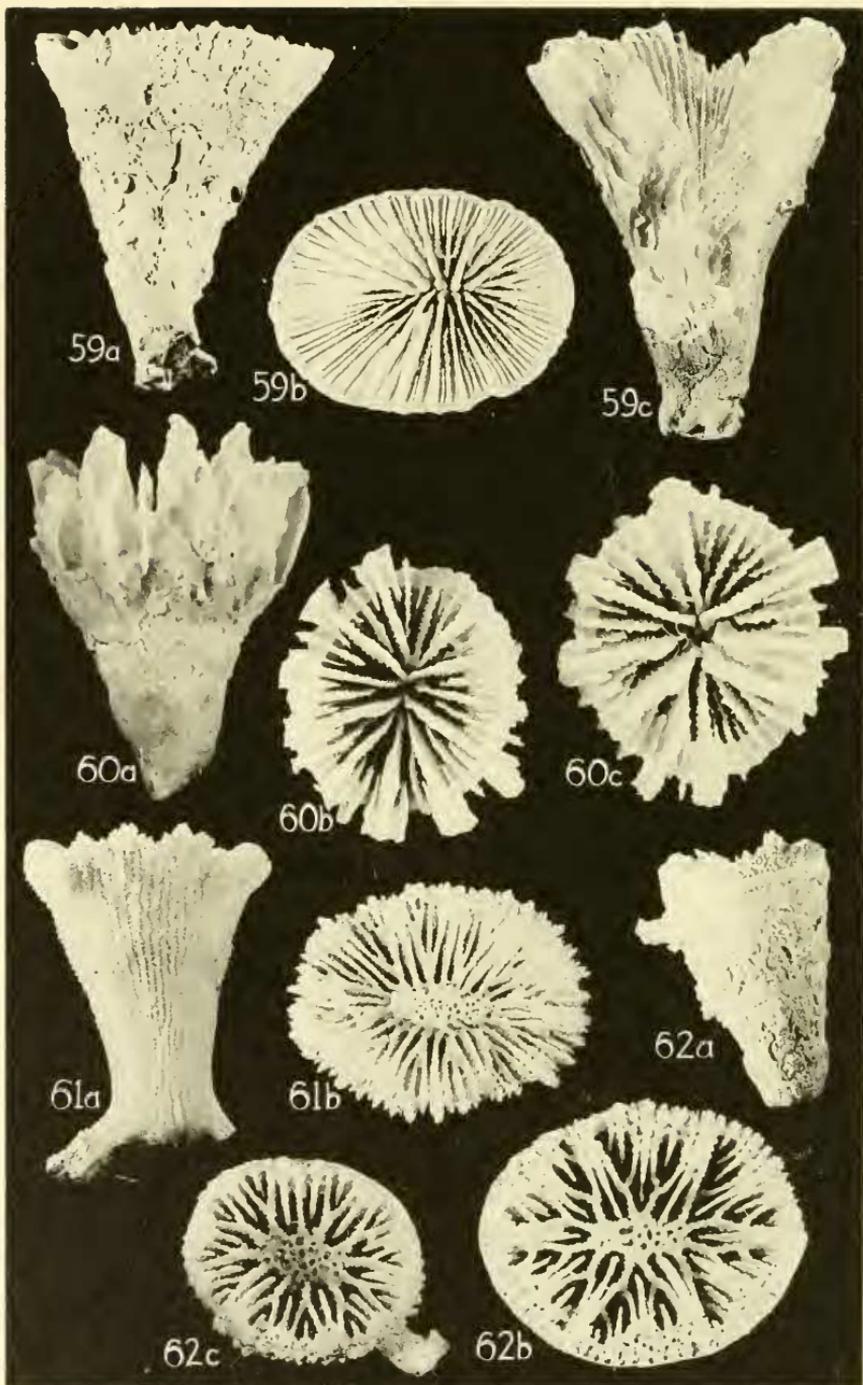


PLATE 14

- Fig. 59a. *Flabellum* (?) *montereyense* Durham. Station 1348-41, Tanner Bank, 45-46 fms. x 1.4, p. 97.
- 59b. *Flabellum* (?) *montereyense* Durham. Station 1348-41, x 1.6.
- 59c. *Flabellum* (?) *montereyense* Durham. Station 1348-41, x 1.5, split corallite.
- Fig. 60a. *Flabellum tannerense* Durham and Barnard, new species. Station 1348-41, x 3.3. Holotype, p. 97.
- 60b. *Flabellum tannerense* Durham and Barnard, new species. Station 1348-41, x 3.5. Holotype.
- 60c. *Flabellum tannerense* Durham and Barnard, new species. Station 1348-41, x 4.8. Paratype.
- Fig. 61a. *Balanophyllia cedrosensis* Durham. Station 1259-41, 8½ mi S of Dewey Channel, Mexico, 49 fms. x 2.2, p. 99.
- 61b. *Balanophyllia cedrosensis* Durham. Station 1259-41, x 2.5.
- Fig. 62a. *Balanophyllia elegans* Verrill. Station 1342-41, 9½ mi NW of Buoy, Cortes Bank, 50 fms. x 2.7, p. 99.
- 62b. *Balanophyllia elegans* Verrill. Station 1342-41, x 4.
- 62c. *Balanophyllia elegans* Verrill. Station 1468-42, Middle Bay, Cape Arago State Park, Oregon, shore. x 4.1.

Family **Faviidae**Genus **CLADOCORA** Ehrenberg

Cladocora Ehrenberg (1834), Corall. Roth. Meer., p. 309.

GENOTYPE: *Caryophyllia caespitosa* Lamarck (1816) = *Madrepora caespitosa* Linnaeus (1767) = *Madrepora flexuosa* Pallas (1766).

Cladocora debilis Milne Edwards and Haime

Plate 4, figs. 22a-e

Cladocora debilis Milne Edwards and Haime (1849), Ann. Sci. Nat., ser. 3, vol. 11, p. 308; Vaughan (1902), Bull. U.S. Fish. Comm. (for 1900), vol. 20, p. 298.

Cladocora debilis M.-Edw. & H., Pourtalès (1871), Mem. Mus. Comp. Zool., vol. 2, no. 4, p. 30; (1879), Bull. Mus. Comp. Zool., vol. 5, no. 9, p. 205.

The specimens at hand have the same growth form and average size as the specimens of *C. arbuscula* (Le Sueur) figured by Pourtalès (1880, pl. 3, fig. 1); however, examination of the calice shows that the paliform lobes are much more prominent than those figured by him (1880, pl. 3, fig. 5). According to Vaughan (1902, p. 298), the calices of *C. debilis* are shallower and have much better developed pali than typical *C. arbuscula*. According to that criterion, the present material is better referred to *C. debilis* than to *C. arbuscula*. If Pourtalès' suggestion (1871, p. 30), that *C. debilis* is merely a deeper water variety of *C. arbuscula* were to be verified by further investigation, then Le Sueur's name has priority. Lacking comparative material from the Atlantic, we are unable to find any characters by which the Pacific Coast material may be separated. The specimens are comparable to *C. arbuscula* as denoted by von Marenzeller (1904) but his material has not been examined by these authors.

Hypotypes: Cat. nos. 22.1 (Sta. 143-34), 22.2 (Sta. 201-34).

Material examined: Stas. 143-34 (27), 201-34 (1), 780-38 (1).
Cat. nos. 22.1-22.3.

Distribution: The Galapagos Islands; Cocos Island. Bathymetric range, 25-150 fms.

Genus **SOLENASTREA** Milne Edwards and Haime

Solenastrea Milne Edwards and Haime (1848), Comptes Rendus Acad. Sci. Paris, vol. 27, p. 494.

GENOTYPE: *Astrea turonensis* Michelin.

Solenastrea ecuadoriana Durham and Barnard, new species

Plate 5, fig. 23

The type is a single beach-worn specimen. Corallum subplocoid, individual corallites small (average diameter about 1 mm), closely appressed to one another, at times united by a common wall, at other times with a small amount of slightly pitted peritheca separating them; colony formation by intratentacular budding; upper surface of corallum worn so that the original surface characters are not preserved at any point, however, it appears that there were no costae and the calices probably were not exert from the corallum mass; septa in 2 complete cycles, with part of the third present, usually with about 8 major septa reaching the columella and 8 secondary septa extending half the distance to the columella; septal interspaces not quite as wide as thickness of major septa; in some calices the inner ends of the septa are definitely thickened as they approach the columella (these thickenings might indicate the presence of pali); septal faces highly granulated; dissepiments moderately abundant, averaging one-half mm apart; columella composed of anastomosing trabeculae from the inner ends of the 8 major septa.

Remarks: This species appears to be related rather closely to *Solenastrea fairbanksi* (Vaughan) and particularly so to the variety *minor*, but differs from the typical members of that species and the variety by the considerably smaller calices and the lesser number of septa.

Dimensions of holotype: Height of corallum 42 mm, length 70 mm, width 28 mm, diameter of a calice 1 mm.

Holotype: AHF no. 3.

Type locality: Sta. 22-33, La Plata Island, Ecuador, shore.

Material examined: The type.

Family **Astrangiidae**Genus **ASTRANGIA** Milne Edwards and Haime

Astrangia Milne Edwards and Haime (1848), Comptes Rendus Acad. Sci. Paris, vol. 27, p. 496.

GENOTYPE: *Astrangia michelinii* Milne Edwards and Haime.

KEY TO THE SPECIES OF *Astrangia* FROM THE EASTERN PACIFIC OCEAN

- | | |
|--|----|
| 1. No pali or paliform lobes present | 2 |
| 1. Pali or paliform lobes present | 3 |
| 2. Adjacent corallites with a common wall | |
| <i>A. (Coenangia) conferta</i> Verrill | |
| 2. Corallites not adjacent, connected by base only | |
| <i>A. (Astrangia) tangolaensis</i> Durham | |
| 3. All septa narrow, not rounded at top of calice | 4 |
| 3. At least primary septa well-rounded at top of calice | 17 |
| 4. Individual corallites submerged in a mass of coenenchyma | |
| <i>A. (Astrangia) browni</i> Palmer | |
| 4. Individual corallites not submerged, united only by their bases | 5 |
| 5. Corallites elongated <i>A. (Astrangia) howardi</i> , new species | |
| 5. Corallites relatively short | 6 |
| 6. Uppermost paliform lobes larger | |
| <i>A. (Astrangia) santelmoensis</i> Durham | |
| 6. Paliform lobes all of the same length | 7 |
| 7. Costae obsolete <i>A. (Astrangia) hancocki</i> , new species | |
| 7. Costae well-developed | 8 |
| 8. Septa 24 or less <i>A. (Astrangia) costata</i> Verrill | |
| 8. Septa 26-40 | 9 |
| 9. Paliform lobes slender | 10 |
| 9. Paliform lobes stout | 11 |
| 10. Paliform lobes simple, elongated | |
| <i>A. (Astrangia) equatorialis</i> , new species | |
| 10. Paliform lobes irregular in shape, fused, branched | |
| <i>A. (Astrangia) californica</i> , new species | |
| 11. Paliform lobes 2-4 | 12 |
| 11. Paliform lobes 5-10 | 15 |
| 12. Primary septa thickest | 13 |
| 12. Septa subequal in size | 14 |
| 13. Corallites diverging <i>A. (Astrangia) coronadosensis</i> Durham | |
| 13. Corallites not diverging, but somewhat submerged | |
| <i>A. (Astrangia) gardnerensis</i> , new species | |

14. Calice shallow	<i>A. (Astrangia) pulchella</i> Verrill	
14. Calice deep	<i>A. (Astrangia) pedersenii</i> Verrill	
15. Paliform lobes 5-7		16
15. Paliform lobes 8-10	<i>A. (Astrangia) lajollaensis</i> Durham	
16. All septa nearly equal in width	<i>A. (Astrangia) haimeii</i> Verrill	
16. Fourth cycle septa narrower than first		
.	<i>A. (Astrangia) sanfelipensis</i> , new species	
17. Primary and secondary septa much thicker and more exsert than remainder	<i>A. (Astrangia) dentata</i> Verrill	
17. All septa equal or subequal in thickness		18
18. All septa evenly exsert		19
18. Primary septa more exsert than remainder		20
19. Fourth cycle septa entire	<i>A. (Astrangia) concinna</i> Verrill	
19. Fourth cycle septa disappearing at depth		
.	<i>A. (Astrangia) cortezi</i> , new species	
20. Septa 20-24	<i>A. (Astrangia) hondaensis</i> , new species	
20. Septa 30-32	<i>A. (Astrangia) conceptionensis</i> Durham	

***Astrangia (Astrangia) californica* Durham and Barnard,**
new species

Plate 5, figs. 24a, b

Corallites low, height up to 6 mm, cylindrical to trochoid, connected at their bases, sometimes with extrathecal deposit between corallites, commensal worm tube in base; some corallites with a slight epitheca; calices subcircular, largest 4.5 by 5 mm; septa 38-42 in largest specimens, as few as 20 in smaller specimens, septa arranged in a Pourtalès plan, somewhat obscured by a large columella and numerous paliform teeth; septal interspaces 1-2 times as wide as thickness of primary septa; paliform teeth prominent, irregularly projecting, present on all except last cycle of septa; first and second cycles with 2-3 teeth, third cycle usually with 2 paliform teeth; septal margins above paliform teeth dentate; first cycle septa very exsert, later cycles slightly less exsert, with fourth cycle septa adjacent to first cycle taller than second cycle; septa rather narrow at top, sharply rounded from costal edge, descending obliquely into a moderately deep calice; inner edges of septa with occasional perforations; septal faces with fairly large, uniform, pointed or slightly blunt granules; costae subequal, low, broad, with moderately heavy granules, continuous to corallum base, interspaces one-fourth to one-third as wide as septa, columella not projecting above bottom of calice, composed of 12-14 interlacing paliform teeth.

Remarks: This species resembles *A. (Astrangia) equatorialis*, new species in the slender paliform teeth but differs by the shallow calice and form of the paliform teeth. The species also resembles *A. (Astrangia) haimi* Verrill but differs by the fewer number of paliform lobes. The commensal worm tube in the base causes a resemblance to the genus *Heterocyathus*, but the dentate upper margins of the septa place it in the genus *Astrangia*.

Dimensions of corallite: Height 6 mm, calices 4.5 by 5 mm, depth of calice 1.5 mm.

Holotype: AHF no. 4.

Type locality: Sta. 1062-40, off Willard Point, Gonzaga Bay, Gulf of California, 16 fms.

Material examined: The type.

***Astrangia (Astrangia) concepcionensis* Durham**

Plate 5, fig. 26

Astrangia (Astrangia) concepcionensis Durham (1947), Geol. Soc. Am., Mem. 20, pp. 26-27, pl. 4, fig. 5.

The specimens from Station 1071-40 are not quite typical in that they have one more paliform lobe per septum than is present in normal members of the species.

This species has been recorded in the Gulf of California north to Concepcion Bay at 11.5 fms and 31 m. It is in the Pleistocene at Santa Inez Bay.

Material examined: The holotype (Univ. Calif. Mus. Paleo. No. 14827, Concepcion Bay, Lower California, 7 fms) and Stas. 549-36 (numerous individuals), 1048-40 (numerous individuals), 1071-40 (3). Dawson Sta. 53 (1).

Distribution: Angel de la Guardia Island, 11-40 fms; San Felipe Bay, 2½ fms. Dawson Sta. 53 is at Cabeza Ballena, near Cape San Lucas, shore, Nov. 9, 1946.

***Astrangia (Astrangia) concinna* Verrill**

Plate 5, figs. 25a, b

Astrangia concinna Verrill (1866), Proc. Boston Soc. Nat. Hist., vol. 10, p. 331; (1870), Trans. Conn. Acad. Arts Sci., vol. 1, p. 331, pl. 9, fig. 5.

Astrangia (Astrangia) caboensis Durham (1947), Geol. Soc. Am., Mem. 20, p. 26, pl. 4, figs. 1, 2.

Verrill's 1870 description is as follows:

"The coralla consist of clusters of broad, low, cylindrical corallites, which are distant about their own diameter and connected by stolons or a thin basal expansion. Calicles not so deep as wide, cup-shaped, with a narrow papillose columella, forming the bottom. Septa from thirty-six to fifty, subequal, the primaries often a little broader, and those of the last cycle narrower than the rest. All are rounded at the top, and finely toothed, but at the middle the inner edge becomes more nearly perpendicular and has longer teeth, resembling pali, which blend with the papillae of the columella, which are fine and numerous. The tops of the septa are thin and project slightly above the wall, the primaries most so. Their sides are not so strongly granulated as in the preceding species, and they appear thinner and less crowded. Exterior granulated, slightly costate near the summit, often encrusted with Bryozoa, etc., to near the top.

"Diameter of the cups .18 to .22; height .10 to .15 of an inch.

"Panama and Pearl Islands, not common,—F. H. Bradley.

"Resembles the last [*Astrangia (Astrangia) pulchella*] but has much larger cells and more numerous septa, which are not so strongly granulated."

Remarks: The lectotype has the extrathecal areas covered with Bryozoa, usually up to the top of the calices. Examination of occasional corallites which are not so heavily encrusted shows the presence of distinct costae running to the base of the corallite and out over the basal expansion. Occasional corallites lack costae except for lines of granules which may be separated at the base into broad, rounded cords. The type consists of a cluster of closely aggregated corallites encrusting on a rock. The corallites of *A. (Astrangia) caboensis* Durham, encrusting on a gastropod shell, are separated by a broader basal expansion but otherwise differ in no respect from *A. (Astrangia) concinna* Verrill.

Lectotype: (here designated). Peabody Museum of Natural History Type no. 602, a group of corallites.

Type locality: Panama, F. H. Bradley, collector.

Material examined: The lectotype, and a specimen from Sta. 275-34 (1). Cat. no. 25.1.

Distribution: Sta. 275-34 is West of islets off Navidad Head, Tenacatita Bay, Mexico, 25-35 fms.

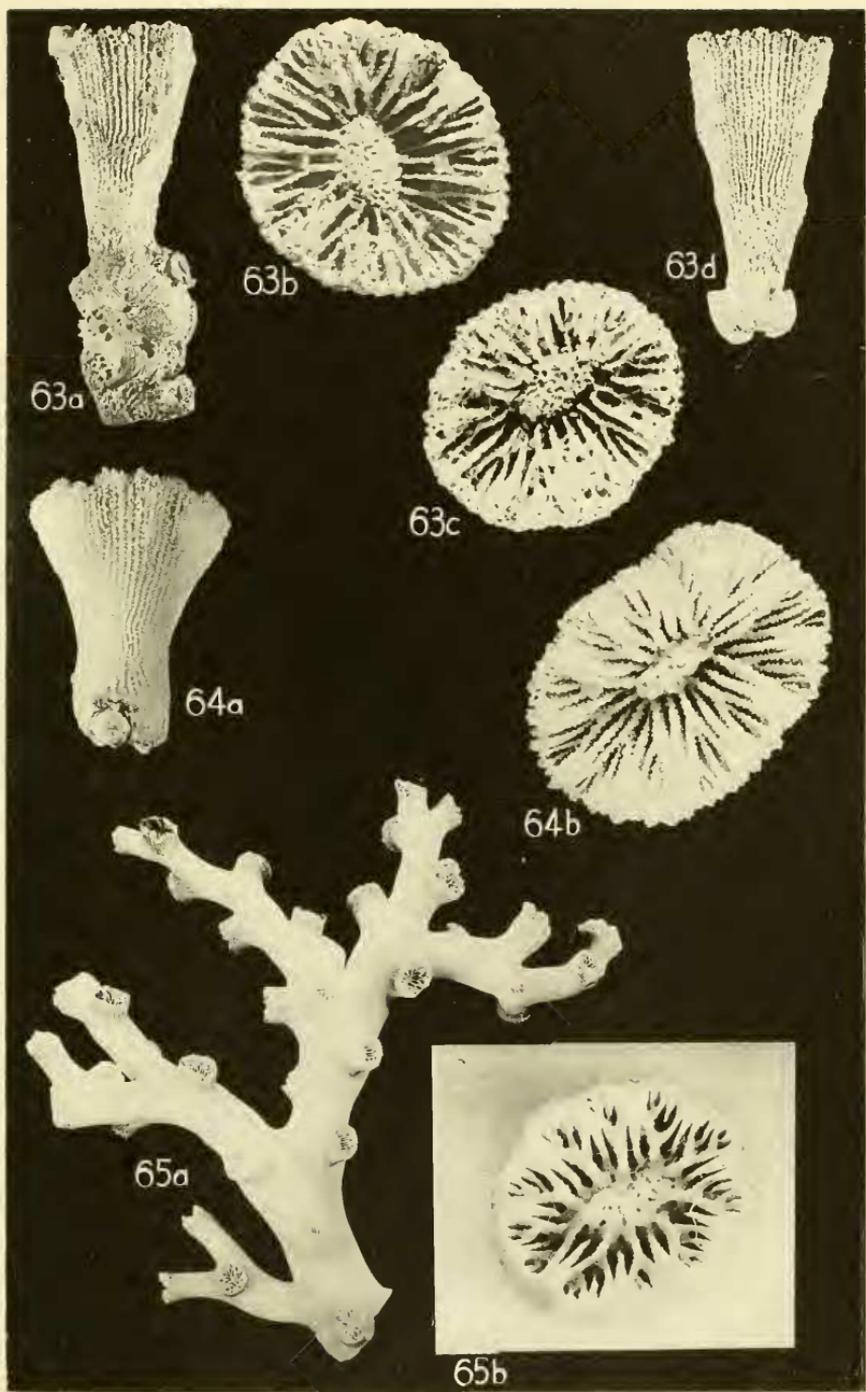
Astrangia (Astrangia) coronadosensis Durham

Plate 7, fig. 35

Astrangia (Astrangia) coronadosensis Durham (1947), Geol. Soc. Am., Mem. 20, p. 27, pl. 4, figs. 3, 4.

PLATE 15

- Fig. 63a. *Balanophyllia osburni* Durham and Barnard, new species. Bottom sample 450, E of S end of Albermarle Island, Galapagos, 60 fms. x 2.2. Holotype, p. 100.
- 63b. *Balanophyllia osburni* Durham and Barnard, new species. Bottom sample 450, x 4.6. Holotype.
- 63c. *Balanophyllia osburni* Durham and Barnard, new species. Bottom sample 450, x 4.4. Paratype.
- 63d. *Balanophyllia osburni* Durham and Barnard, new species. Bottom sample 450, x 2.4. Paratype.
- Fig. 64a. *Balanophyllia tiburonensis* Durham. Station 948-39, off Medidor Island, Bahia Honda, Panama, 30-35 fms. x 2.1, p. 101.
- 64b. *Balanophyllia tiburonensis* Durham. Station 948-39, x 3.6.
- Fig. 65a. *Dendrophyllia californica* Durham. Station 1254-41, 8 mi SW of Cedros Island, Mexico, 63-65 fms. x 0.5, p. 101.
- 65b. *Dendrophyllia californica* Durham. Station 1254-41, x 3.2.



63a

63b

63d

63c

64a

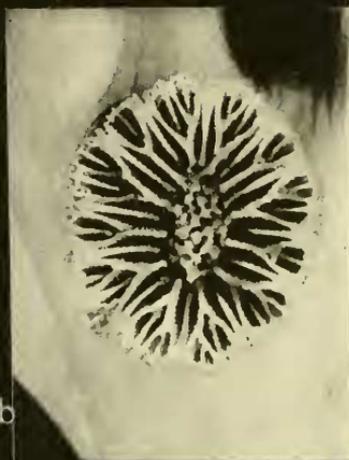
64b

65a

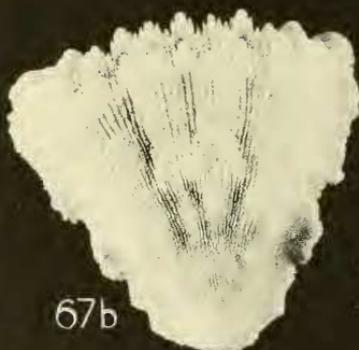
65b



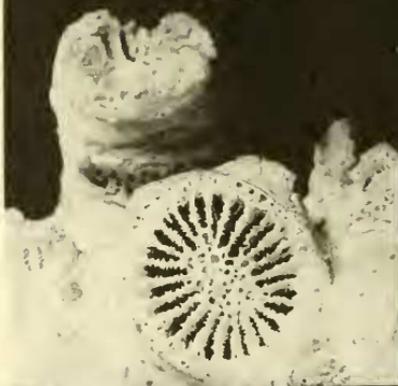
66a



66b



67b



68



67a

PLATE 16

- Fig. 66a. *Dendrophyllia cortezi* Durham and Barnard, new species. Station 561-36, South of Isla Partida, Gulf of Calif., 70 fms. x 0.6. Holotype, p. 102.
- 66b. *Dendrophyllia cortezi* Durham and Barnard, new species. Station 561-36, x 3.4. Holotype.
- Fig. 67a. *Endopachys vaughani* Durham. Station 816-38, North of Hood Island, Galapagos, 50-100 fms. x 1.2, p. 103.
- 67b. *Endopachys vaughani* Durham. Station 816-38, x 2.6.
- Fig. 68. *Thecopsammia pourtalesi* Durham and Barnard, new species. Station 12, 1932, West of South Seymour Island, Galapagos. x 4.1. Holotype, p. 104.

Several small corallites are present, the largest calice 3 mm in diameter, moderately deep and with 32-38 septa; first and second cycle septa with 2-3 even-sized, sharp paliform lobes, third and fourth cycles with 3-4; uppermost paliform lobe on first and second cycles with an upward projecting, pointed spine; upper parts of septa slightly serrate; septal faces with tall granules; columella small, papillose. Exterior of corallite covered with a stereomal deposit; costae when evident very low and diminishing towards base.

This species has been reported previously only in the Pleistocene of Coronados Island, Gulf of California.

Hypotype: Cat. no. 27.1 (Sta. 1044-40).

Material examined: Sta. 1044-40 (6).

Distribution: South of Tiburon Island, 2-16 fms.

***Astrangia (Astrangia) cortezi* Durham and Barnard, new species**
Plate 5, figs. 28a, b

Corallum colonial, poorly arborescent, composed of numerous corallites ranging from 8-10 mm in length, 3.5-5.5 mm in diameter; individual corallites scolecoïd to subtrochoïd, but closely attached to one another by peritheca; calices subcircular, usually 2-3 mm in depth; septa about 48 in number, slightly rounded at the top, then descending sharply to the bottom of the calice; septal interspaces twice as wide as thickness of first cycle septa; first 3 cycles of septa approximately uniform in size, fourth cycle narrow and apparent only in upper half of calice, disappearing at depth and somewhat dentate; inner edges of first 3 cycles of septa with 5-8 blade-like teeth which merge at the bottom with the columella; teeth with deep U-shaped notches between them, notches usually narrower than the teeth; third cycle septa usually fusing to adjacent second cycle septa near columella; first 3 cycles of septa approximately equally exsert, those of first cycle just slightly more exsert than others, fourth cycle less exsert than other cycles; septal faces with a moderate number of medium-sized granules; costae corresponding to septa, low, rounded, moderately granulated, intercostal spaces one-third or less the width of the costae, at top of corallum moderately deep, but shallow below; in main portion of corallum costae become obsolete and are only represented by a finely granulated surface; columella composed of 8-10 paliform teeth.

Remarks: This species appears to be closely related to *A. (Astrangia) caboensis* Durham, but may be separated from that species by the greater number of septa and by the fact that the fourth cycle septa

become obsolete at depth in the calice. The greater number of teeth on the earlier cycles of septa is also characteristic, as is the mode of growth.

Dimensions of corallite: Height 9 mm, diameter 4.5 mm, depth of calice 3 mm.

Holotype: AHF no. 5, with 2 paratypes.

Type locality: Sta. 719-37, off Consag Rock, Gulf of California, 10-25 fms.

Material examined: The types and 5 other specimens from the same station.

***Astrangia (Astrangia) equatorialis* Durham and Barnard,**
new species

Plate 6, figs. 29a, b

Corallites short, cylindrical, connected by a common basal coenenchy-
ma, individual corallites 1.0-2.5 mm in height, 2.5-3.5 mm in diameter;
calices circular to oval, 2.3 mm deep; septa 26-36, usually about 30,
interspaces 2-3 times as wide as the thickness of the primary septa; all
septata moderately exsert, narrow at the top, those of the first cycle slight-
ly more prominent than the remainder; inner edges descend sharply to
bottom of fossa; first cycle septa usually with 3 or 4 distantly-spaced,
elongate, slender, paliform lobes which project towards the center of
the calice, later cycles with a lesser number of paliform lobes; first cycle
of septa projecting inwards about half the distance to the center of the
calice, second and third cycles of septa successively narrower, with third
cycle projecting in about one-third the distance to the calice center;
septal faces with relatively few and small granules; costae corresponding
to septa, indistinct, at top of corallite represented by a narrow row of
granules which becomes wider a short distance below, where the costae
are represented by broad, low ridges composed of granules; costal inter-
spaces on lower part of corallum about one-fourth the width of the
costae, somewhat granulated toward the top of the corallum; columella
moderately large but poorly developed, composed of 6-8 thin, distant,
elongate paliform teeth.

Remarks: This species may be separated from *A. (Astrangia)*
gardnerensis, new species by the extremely deep calices and sparse, slender
paliform lobes.

Dimensions of corallite: Height 2 mm, diameter 3 mm, depth of
calice 2.5 mm.

Holotype: AHF no. 6.

Type locality: Sta. 31-33, Gardner Bay, Hood Island, 4 fms.

Material examined: The type and 2 fragments from the same
station.

Astrangia (*Astrangia*) *gardnerensis* Durham and Barnard,
new species

Plate 5, fig. 27

Corallites low, cylindrical, with flaring bases, connected by a common basal coenenchyma, average height of corallites above coenenchyma 1.5-2.0 mm, diameter of corallites 2.0-3.5 mm, depth of calices 1.5-2.0 mm; septa 24-30 in number, interspaces about twice as wide as thickness of primary septa; septa slightly exsert, primary and secondary septa more exsert than later cycles; first and second cycle septa reach columella, later septa extend about half the distance to the columella; inner edges of second cycle septa with about 5 paliform lobes, those at top rather short and with lower lobes becoming successively longer as they approach the columella; first cycle septa rather narrow at top and for about half of the depth to the bottom of the fossa with 3 or 4 serrations, below this point with 2-3 paliform lobes; inner edges of third cycle septa moderately dentate, second and third cycle septa descending fairly sharply to bottom of fossa; septal faces with a moderate number of fairly prominent granules; costae corresponding to septa, highly granulated, moderately prominent when discernible, costal interspaces about two-thirds as wide as costae; columella composed of 6-8 anastomosing paliform lobes.

Remarks: This species may be readily distinguished from *A. (Astrangia) pedersenii* Verrill by the comparatively short corallites and by the variation and profile of the primary and secondary septa. The highly granulous character of *A. (Astrangia) gardnerensis* appears to be characteristic also. The new species is separated from *A. (Astrangia) coronadosensis* Durham by the closely set corallites and about 4 less septa per calice. The corallites of *A. (Astrangia) coronadosensis* are more diverging and isolated than in the new species. Some of the corallites of the latter approach the *A. (Astrangia) browni* Palmer form by being submerged to their tops in a mass of coenenchyma.

Dimensions of corallite: Height 2 mm, diameter 3 mm, depth of calice 2 mm.

Holotype: AHF no. 7.

Type locality: Sta. 31-33, Gardner Bay, Hood Island, 4 fms.

Material examined: Stas. 31-33 (1), 333-35 (1). Cat. nos. 30.1-30.2.

Distribution: The Galapagos Islands, shore to 4 fms.

***Astrangia* (*Astrangia*) *haime*i Verrill**

Plate 6, fig. 30

*Astrangia haime*i Verrill (1866), Proc. Boston Soc. Nat. Hist., vol. 10, p. 330; (1870), Trans. Conn. Acad. Arts Sci., vol. 1, pp. 526-527, pl. 9, figs. 6, 6a.

Verrill's 1870 description is as follows:

"Coralla encrusting, consisting of prominent cylindrical or turbinate corallites, sometimes rising more than half an inch above the surface of the basal expansion, which connects them together, and becoming slightly turbinate and divergent when highest.

"The corallites are distant from each other from .04 to .25 of an inch. The basal mural expansion is very thin, compact, and slightly granulated, having a smooth appearance, and usually without apparent striations. Septa from thirty to forty-eight, very narrow and thin, with the inner edges nearly perpendicular, forming a deep cup, narrow at the bottom; they are all, except those of the last cycle, which are more narrow, of nearly the same width, giving an even appearance to the cavity of the cup; they project slightly above the wall, about .01 of an inch, in the form of narrow points, alternately larger and smaller; the inner edges are thin, evenly and sharply dentate, the sides strongly granulated, but not crowded together, the spaces between them being equal to their thickness, or even wider. The columella is small, consisting of numerous even papillae, graduating into the teeth at the base of the septa. Walls thin, granulated exteriorly, with low, even costae on the upper part, which mostly disappear toward the base.

"Diameter of cups .10 to .18 of an inch; depth .06 to .10; height of corallites usually about .10 to .25, sometimes .40 to .55 of an inch.

"Panama and the Pearl Islands on the reefs, at low-water in pools; Zorritos, Peru; Acajutla; Realejo; La Union, San Salvador, common,—F. H. Bradley."

Remarks: The fourth cycle septa are less exert than the other cycles but the difference in width between the first 3 cycles and the fourth is very slight, so that the interior of the cup presents a very even appearance. The fourth cycle septa of *A. (Astrangia) sanfelipensis*, new species are much narrower than the first cycle and this character separates that species from *A. (Astrangia) haime*i.

The paliform teeth of *A. (Astrangia) haime*i number 5-7. The columella consists of 10-12 small, even papillae, and the septal faces possess scattered, small, blunt granules.

Lectotype: (here designated). Peabody Museum of Natural History Type no. 598, a cluster of corallites.

Type locality: Bay of Panama, F. H. Bradley, collector.

Material examined: Peabody Museum of Natural History Types nos. 593 and 598, Bay of Panama; Sta. 1044-40 (2). Cat. no. 31.1.

Distribution: Sta. 1044-40 is south of Tiburon Island, Gulf of California, 2-3 fms.

***Astrangia (Astrangia) hancocki* Durham and Barnard,**
 new species
 Plate 6, fig. 31

Corallites short, cylindrical, closely aggregated, connected by a basal coenenchyma; septa 24-40, interspaces about as wide as thickness of larger septa; septa slightly exsert, every alternate septum more exsert than remainder; alternate large septa extend to columella, the remainder extending one-third to one-half the distance to the columella; septa narrow at top, inner edges descending steeply to columella; larger septa with 6-7 fairly short paliform lobes, even in size, but slightly longer toward the columella, smaller septa with 3-5 paliform teeth; septal faces with irregularly distributed blunt granules; costae extremely faint, exterior of corallites nearly smooth; columella moderately large, consisting of anastomosing paliform lobes.

Remarks: This species closely resembles *A. (Astrangia) lajollensis* Durham but has fewer paliform lobes and lacks costae. It differs from *A. (Astrangia) sanfelipensis* new species, by the alternation of the septa and the presence of more paliform lobes on the earlier cycles of septa as well as the lack of costae.

Dimensions of corallite: Height 3 mm, diameter 3 mm, depth of calice 1.8 mm.

Holotype: AHF no. 8.

Type locality: Sta. 763-38, off Black Rock, Cape Corrientes, Mexico, 5-10 fms.

Material examined: Sta. 763-38 (7).

***Astrangia (Astrangia) hondaensis* Durham and Barnard,**
 new species
 Plate 6, figs. 32a, b, c

Corallites small, cylindrical to ceratoid, connected by a common basal coenenchyma, individual corallites varying from 3-9 mm in height and 1.5-3.0 mm in diameter; corallites with embedded worm tubes growing vertically next to thecal wall; calices rather shallow, usually about 1 mm deep; septa 20-24 in number, interspaces 1.5-2.0 times the thickness of the primary septa; first and second cycle septa reaching columella,

third cycle reaching about half way; inner ends of first and second cycle septa with one and occasionally two well-developed paliform lobes, the topmost lobe being better developed, third cycle of septa dentate; first cycle septa most exsert (0.75 mm), second cycle less so, third cycle about half as exsert as first cycle, septa well-rounded at top; septal faces coarsely granulated, granules near inner edges of septa becoming shelves parallel to upper edges of septa; coarseness of granules gives interior of calice a very crowded appearance; costae very low and broad, corresponding to septa, covered with numerous fine granules, interspaces very narrow and shallow; columella composed of about 6 anastomosing paliform lobes from deep within the calice.

Remarks: This species may be separated from *A. (Astrangia) pulchella* Verrill by the smaller size of the third cycle septa and the exsert character of the septa. It is separated from *A. (Astrangia) howardi*, new species by the much shallower calices, the heavier, more crowded septa and the better developed paliform lobes. It is rather closely related to *A. (Astrangia) santelmoensis* Durham but differs in the lesser number of septa, as well as having all the septa more exsert than in the latter.

Dimensions of corallite: Height 7 mm, diameter 2.5 mm, depth of calice 1 mm.

Holotype: AHF no. 9.

Type locality: Sta. 948-39, off Medidor Island, Bahia Honda, Panama, 30-35 fms.

Material examined: Sta. 948-39 (1). Bottom samples 329 (1 worn specimen), 453 (1 worn specimen). Cat. nos. 33.1-33.3.

Distribution: The type locality and questionably in the Galapagos Islands and Cocos Island, 35-46 fms.

***Astrangia (Astrangia) howardi* Durham and Barnard,**
new species
Plate 7, fig. 33

Corallites small, elongate, slender, forming a subphaceloid, arbore-scent aggregate; individual corallites ranging from 4-10 mm in length and usually varying from 2-3 mm in diameter; numerous individuals with repeated calicular rejuvenation are present, so that the resulting compound corallites may have lengths up to 20 mm; depth of calices 2.0-2.75 mm; septa 22-30 in number, usually 24-26, septal interspaces 1.5-2.0 times as wide as the thickness of the primary septa; first cycle septa moderately exsert (0.5-0.75 mm), others less so; first and second cycle septa equally prominent, third and occasionally fourth cycle members

about half as prominent as first and second cycle members; septa narrow at top, inner edges descend sharply to bottom of calice, inner edges of first and second cycle septa with about 5 moderately small teeth grading into the columella at the bottom which is composed of about 10-12 anastomosing paliform lobes; other septa slightly dentate; septal faces with moderately abundant fine granules; costae equal, corresponding to septa, broad, with narrow, shallow interspaces; surface of costae with moderately abundant small granules. Some of the corallites show a thin calcicular epitheca arranged in rings.

Remarks: This species may be distinguished readily from all other described Eastern Pacific species of *Astrangia* by the long, slender corallites, the low, uniform costae, and the extremely deep calices.

Dimensions of corallite: Height 7 mm, diameter 2.5 mm, depth of calice 2.5 mm.

Holotype: AHF no. 10, with 5 paratypes.

Type locality: Sta. 948-39, off Medidor Island, Bahia Honda, Panama, 30-35 fms.

Material examined: Sta. 948-39 (7). Bottom sample 332 (numerous worn specimens). Cat. nos. 34.1-34.2.

Distribution: The type locality and Bahia Honda, off North Island, 30-50 fms.

Astrangia (Astrangia) lajollaensis Durham

Plate 7, fig. 34

Astrangia (Astrangia) lajollaensis Durham (1947), Geol. Soc. Am., Mem. 20, pp. 28-29, pl. 2, figs. 14, 15, 18, 20, 21.

The diameter of this species ranges in size from 3 to 6 mm, the largest specimens coming from the Marcy Channel locality. The latter forms have more elongate corallites and shallower calices; the septa are more numerous (up to 48) and heavier, exhibiting a tendency toward the Pourtalès septal plan, with a columella only slightly papillose; the septal granules are heavier and more abundant than in the holotype. Specimens from Dewey Channel are intermediate in size between the holotype and the Marcy Channel forms, having still shallower calices, thicker septa and heavier paliform teeth. In the specimens from San Luis Obispo Bay, the upper parts of the first cycle of septa are not divided into paliform lobes. This character seems to vary in individual corallites.

This species is reported as abundant from Point Conception southward along the southern California coast to San Diego. It has also been found as far south as Santa Margarita Island, Magdalena Bay. It is found intertidally and in beach gravel.

Hypotype: Cat. no. 35.1 (Sta. 885-38).

Material examined: Stas. 885-38 (2), 1130-40 (3), 1260-41 (1), 1718-49 (5), 1719-49 (1). Cat. nos. 35.1-35.5.

Distribution: San Luis Obispo Bay, California; off Abalone Point, Laguna Beach, California; Dewey Channel, opp. Point San Eugenio; Marcy Channel, Magdalena Bay; east shore of Santa Margarita Island. Bathymetric range, shore to 29 fms.

Astrangia (Astrangia) pulchella Verrill

Plate 7, figs. 36a, b

Astrangia pulchella Verrill (1866), Proc. Boston Soc. Nat. Hist., vol. 10, p. 331; (1870), Trans. Conn. Acad. Arts Sci., vol. 1, p. 527.

Verrill's 1870 description is as follows:

"Coralla encrusting, consisting of patches of small, low, cylindrical corallites, scattered at distances varying from less than their diameter to more than a quarter of an inch, and connected together by a thin, calcareous, basal expansion, much like that of the preceding species, but smoother and with only minute granulations. Calicles shallow, conical, with a narrow center, their whole inner surface crowdedly papillose, the papillae of the columella being confused with the teeth of the septa, and very small. Septa twenty-four, projecting very slightly above the wall, or not at all, narrow at the top but broad within, all nearly equal, the edges evenly toothed, and the sides very strongly and roughly granulated, so that the granules of adjacent septa often touch, giving them a crowded appearance. Costae scarcely apparent, even at the summit. Diameter of the cups .08 to .10 of an inch; depth .03; height .05; sometimes more.

"Panama and Pearl Islands, with the last, common,—F. H. Bradley."

Remarks: Septa 24-28 in number, paliform lobes 4-5 per septum. Although this species is indicated in the key as being closely related to *A. (Astrangia) pedersenii* Verrill, it differs from that species markedly. The septa of *A. (Astrangia) pedersenii*, though not as differentiated as those of *A. (Astrangia) coronadosensis* Durham, are nevertheless unequal in size in comparison with those of *A. (Astrangia) pulchella*. The shallow fossae and crowded papillose condition of the interior of the calices further differentiates this species from *A. (Astrangia) pedersenii*.

Lectotype: (here designated). Peabody Museum of Natural History Type no. 5378, corallite here figured, Plate 7, figs. 36a-b.

Type locality: Pearl Islands, F. H. Bradley, collector.

Material examined: The lectotype and several other corallites on the same rock.

***Astrangia (Astrangia) sanfelipensis* Durham and Barnard,**
new species

Plate 7, figs. 37a, b, c

Corallites small, cylindrical, up to 4 mm in height; calices circular to subcircular, deep; septa 32-40, interspaces as wide as thickness of primary cycle of septa; inner edges of all septa strongly and nearly evenly dentate; first 2 cycles of septa with 4-6 teeth, later cycles with 6-7 teeth; none of the teeth strongly differentiated from each other, merging with a very small, concave columella; septa moderately exsert, primaries and secondaries equally so, later cycles slightly but successively less exsert; septal thicknesses not as differentiated as in *A. (Astrangia) dentata* Verrill; septa slightly rounded above, descending almost vertically into fossa; septal faces with moderately large, occasionally irregular pointed granules; costae variable in development, on one specimen almost obsolete, on another specimen moderately prominent, low, rounded, granulated; costal interspaces very narrow, shallow.

Remarks: This species is similar to *A. (Astrangia) dentata* Verrill in the number of septa but has less differentiation in the size of the septa of different cycles and none of the teeth are strongly differentiated from one another as in that species. It is separated from *A. (Astrangia) lajollensis* Durham by the lesser number of paliform lobes. It is rather closely related to *A. (Astrangia) haimei* Verrill but the fourth cycle septa are strikingly set off from the first cycle both in their exsertness and width, and the columella is considerably smaller.

Dimensions of corallite: Height 4 mm, calice diameter 4 mm, depth of calice 3 mm.

Holotype: AHF no. 11, with one paratype.

Type locality: Sta. 1071-40, San Felipe Bay, Gulf of California, 2½ fms.

Material examined: The types.

Subgenus **COENANGIA** Verrill

Coenangia Verrill (1870), Trans. Conn. Acad. Arts Sci., vol. 1, p. 530.

SUBGENOTYPE: *Astrangia (Coenangia) conferta* Verrill.

Astrangia (Coenangia) conferta Verrill

Plate 8, fig. 38

Astrangia (Coenangia) conferta Verrill (1870), Trans. Conn. Acad. Arts Sci., vol. 1, pp. 530-531; Durham (1947), Geol. Soc. Am., Mem. 20, pp. 30-31, pl. 6, figs. 1, 2.

A rather large specimen (90 mm long, 70 mm wide, and 65 mm high), with well-preserved calices is present in the collections. One large calice has 40 septa and the columella appears to be dividing in half. The station locality extends the range of this species north of the San Lucas faunal boundary.

This species has been recorded in the Gulf of California, Guaymas, Acapulco, and Tehuantepec, bathymetric occurrence unknown.

Hypotype: Cat. no. 38.1 (Sta. 1787-49).

Material examined: The hypotype.

Distribution: One-half mile southeast of Hughes Point, Santa Maria Bay, Lower California, 5-18 fms.

Genus **OULANGIA** Milne Edwards and Haime

Oulangia Milne Edwards and Haime (1848), Comptes Rendus Acad. Sci. Paris, vol. 27, p. 497.

Oulangia bradleyi Verrill

Plate 8, fig. 39

Oulangia bradleyi Verrill (1866), Proc. Boston Soc. Nat. Hist., vol. 10, p. 333; (1870), Trans. Conn. Acad. Arts Sci., vol. 1, pp. 534-535, pl. 9, fig. 10.

Corallum consisting of one broken corallite; corallum low, large, cylindrical; calice elongate-oval, deep; epithecal ring around top of calice; septa in 4 cycles, with some members of fifth cycle present, arranged in a Pourtalès plan; septal interspaces 1.0-1.5 times the thickness of the primary septa; first and second cycles of septa with 4 medium sized, even, spinulose paliform teeth, third cycle septa usually with 4, occasionally up to 6, fourth cycle with 4 or less paliform teeth; fifth cycle occasionally with large marginal granules; first and second cycle septa equally exsert, later cycles successively less exsert; first 2 cycles of septa well rounded above, descending obliquely to bottom of calice, slightly thicker than later cycles; septa with occasional perforations towards columella; septal faces with tall, blunt, irregularly distributed granules; costae irregularly developed, usually those of last cycle smaller;

costae low, rounded, irregularly granulated, with narrow interspaces which are occasionally flat; columella moderately small, consisting of interlacing paliform teeth.

Dimensions of corallum: Height 8 mm, narrow diameter of calice 10 mm, depth of calice 5 mm.

Remarks: Verrill's (1870) description of this species is very good; the present material agrees in all respects with it.

Hypotype: Cat. no. 39.1 (Station 275-34).

Material examined: The hypotype.

Distribution: West of islets off Navidad Head, Tenacatita Bay, Mexico, 25-35 fms.

Family **Caryophylliidae**Genus **BATHYCYATHUS** Milne Edwards and Haime*Bathycyathus* Milne Edwards and Haime (1848), Ann. Sci. Nat., ser. 3, vol. 9, p. 294.GENOTYPE: *Bathycyathus chilensis* Milne Edwards and Haime.**Bathycyathus consagensis** Durham and Barnard, new species

Plate 8, figs. 40a-e, pl. 9, fig. 40f

Corallum of medium size, scolecoïd to slightly ceratoid, corallites produced by basal budding; calice moderately deep, circular to suboval in cross-section.

Description of holotype: Calicular diameter 8 mm; septa in 4 cycles, interspaces about as wide as thickness of first cycle septa; septa of first cycle moderately exsert (2 mm), second cycle half as exsert, third cycle about one-quarter as exsert; exsertness of fourth cycle intermediate between that of adjacent cycles; first cycle septa moderately well-rounded above and descending almost vertically into calice, attached to columellar tangle only at depth; second cycle septa two-thirds as wide as primary septa, third cycle at depth continuous nearly to columella and fusing to included second cycle septa; higher up, third cycle septum divides with inner half becoming a prominent, somewhat irregular paliform lobe extending to about as high as top of columella, remaining half of third cycle septum about half the width of first cycle septa; fourth cycle septa very narrow, projecting inwards only a fraction of a millimeter from the wall; upper edges of septa microscopically dentate, septal faces with a moderate number of very fine granules; costae unequal, corresponding to septa, moderately well-rounded and granulated at top of corallum and disappearing towards base; costal interspaces about equal in size to costae; columella composed of a few irregular, contorted processes with some of the third cycle paliform lobes merging with it.

Descriptions of other specimens: From two localities in the same general vicinity as the type. The amount of variation in these specimens is such, that if they were from widely separated geographical areas, some of them undoubtedly would be described as new species.

Sta. 1062-40 (one adult and 2 immature specimens). Calicular diameter of adult 8 mm. The adult specimen has the first cycle septa extremely exsert (3 mm), and the columella is deep (5 mm) within the calice. It has one very abnormal second cycle septum which is much wider than the typical first cycle septa and has 3 small, short paliform

lobes on its inner edge; this abnormality is apparently caused by some parasitic or commensal organism within the calice, with the organism having been sealed off by a thin, calcareous partition. The costal inter-spaces of this specimen are flat-bottomed.

Sta. 1067-40 (2 adult and 2 immature prepared specimens and one adult specimen in alcohol with polyp). One of the adult prepared specimens is quite similar to the holotype, except that the first cycle septa are only 1.5 mm exsert, and one or two of the second cycle septa have a paliform lobe before them (this specimen also has a parasitic or commensal organism which is walled off by a thin calcareous deposit). The other adult prepared specimen from this locality has none of the septa exsert; the first and second cycle septa are of approximately the same size and descend obliquely from the top of the calice towards the bottom of the fossa. The fourth cycle of septa is incomplete, the third cycle septa with well-developed paliform lobes; columella fascicular but confused with the paliform lobes. This last specimen, if found by itself certainly would have been described as a new species, but it occurs in association with specimens which are almost typical and is from almost the same spot as the holotype.

Station 1965-50 (several specimens similar to the holotype and one aggregated specimen), off Entrada Point, Magdalena Bay, Lower California, 28-34 fms. The largest specimen (Plate 9, fig. 40) consists of a number of corallites, the largest of which is 10 mm in diameter; the corallites are connected with one another by a dense, smooth coenenchyma, above which the corallites may project 1-6 mm.

Remarks: This species may be distinguished from *Bathycyathus chilensis* Milne Edwards and Haime and *B. indicus* Milne Edwards and Haime, by having only 4 cycles of septa, and by the projection of the pali above the columella in the latter two species. It is separated from *B. maculatus* Pourtalès by the lesser number of septa and the more contorted columellar pieces.

Dimensions of holotype: Height 7 mm, calice 7 by 8 mm, depth of calice 2.5 mm.

Holotype: AHF no. 12, with 3 paratypes.

Type locality: Sta. 719-37, off Consag Rock, Gulf of California, 10-25 fms.

Material examined: Stas. 719-37 (6), 1062-40 (3), 1067-40 (5), 1965-50 (3). Cat. nos. 40.1-40.4.

Distribution: The type locality and off Willard Island, Gonzaga Bay, Gulf of California, 10-45 fms. Off Entrada Point, Magdalena Bay, Lower California, 28-34 fms.

Genus **CARYOPHYLLIA** Lamarck*Caryophyllia* Lamarck (1801), Syst. Anim. sans Vert., p. 370.GENOTYPE: *Caryophyllia cyathus* Lamarck.**Caryophyllia alaskensis** Vaughan

Plate 9, figs. 41a, b

Caryophyllia alaskensis Vaughan (1941), Jour. Paleont., vol. 15, no. 3, pp. 280-281, pl. 40, figs. 104; Durham (1947), Geol. Soc. Am., Mem. 20, p. 33, pl. 2, figs. 4, 8, 9, 12, 13.

This species ranges along the North American coast from Drier Bay, Prince William Sound, Alaska, to Point Loma, San Diego, depth 20-218 fms.

Hypotype: Cat. no. 41.20 (Sta. 1429-41).*Material examined*: Stas. 992-39 (1), 1022-39 (1), 1023-39 (1), 1027-39 (7), 1028-39 (6), 1137-40 (1), 1150-40 (4), 1151-40 (18), 1173-40 (2), 1213-40 (2), 1328-41 (1), 1348-41 (1), 1349-41 (2), 1350-41 (7), 1355-41 (1), 1385-41 (6), 1387-41 (1), 1390-41 (6), 1411-41 (2), 1429-41 (16), 1848-49 (13), 1937-40 (6), 1938-40 (2), 1940-50 (14). Bottom sample 1244 (3). East of Santa Barbara Island, July 30, 1919 (1).*Distribution*: The Channel Islands; off Redondo Beach, California. Bathymetric range, 40-230 fms, with most of the records between 80 and 170 fms.**Caryophyllia arnoldi** Vaughan

Plate 9, figs. 42a, b

Caryophyllia arnoldi Vaughan (1900), Proc. U.S. Nat. Mus., vol. 22, pp. 199-200, pl. 16, figs. 1, 2; (1903), Mem. Calif. Acad. Sci., vol. 3, p. 86, pl. 3, figs. 4, 4a; Durham (1947), Geol. Soc. Am., Mem. 20, pp. 33-34, pl. 2, figs. 3, 7, 16, 17.

This species was described from the Pleistocene at San Pedro Hill, California. It has also been recorded from off Point Pinos, Monterey Bay, and Point Loma, San Diego in depths of 93-111 fms.

Many of the specimens assigned here are so worn that it is difficult to place them in this species confidently.

Hypotype: Cat. nos. 42.7 (Sta. 1390-41), 42.12 (Sta. 1429-41).*Material examined*: Stas. 909-39 (1), 1028-39 (1), 1144-40 (3), 1151-40 (2), 1195-40 (1), 1213-40 (1), 1330-41 (1), 1350-41 (1),

1390-41 (3), 1393-41 (4), 1429-41 (3), 1659-48 (5). Cat. nos. 42.1-42.11.

Distribution: The Channel Islands and adjacent banks. Bathymetric range, 43-138 fms.

Caryophyllia diomedae von Marenzeller

Plate 9, fig. 43

Caryophyllia diomedae von Marenzeller (1904), Bull. Mus. Comp. Zool., vol. 43, no. 2, pp. 79-80, pl. 1, fig. 2.

The hypotype is a small specimen not over 8 mm in height which is identical with von Marenzeller's description and figure.

Von Marenzeller recorded this species from off Panama in 1043 m.

Hypotype: Cat. no. 43.2 (Sta. 948-39).

Material examined: Stas. 170-34 (2 worn specimens), 948-39 (1). Cat. nos. 43.1-43.2.

Distribution: Stephens Bay, Chatham Island; off Medidor Island, Bahia Honda, Panama. Bathymetric range, 30-35 fms.

Genus **CERATOTROCHUS** Milne Edwards and Haime

Ceratotrochus Milne Edwards and Haime (1848), Ann. Sci. Nat., ser. 3, vol. 9, p. 248.

GENOTYPE: *Turbinolia multiserialis* Michelotti.

Ceratotrochus franciscana Durham and Barnard, new species

Plate 9, figs. 44a, b

Corallum large, trochoid, narrowing to a wide, flaring base; calice oval, fossa moderately deep (9 mm); septa in 5 cycles, interspaces 1.5 times the thickness of the primary septa; primary and secondary septa equally exsert (2.2 mm), later septa successively less exsert; septa sharply rounded from costae, descending sharply into fossa; inner edges of septa nearly vertical, straight; inner edges of first and second cycle septa smooth, inner edges of third and fourth cycle septa with paliform processes fusing to form columella at depth; fourth cycle septa occasionally meeting in front of third cycle septa; fifth cycle septa coarsely and broadly serrate; septal faces with low, fairly numerous, rounded granules; costae granulated, elevated at top of corallum but soon disappearing towards base into low, broad cords with narrow interspaces; costae of first 4 cycles subequal, costae of fifth cycle about half as prominent as other costae; costal interspaces at top of corallum flat-bottomed, becom-

ing V-shaped towards base, approximately as wide as first cycle septa; columella papillose, consisting of the granulated, somewhat irregular inner ends of the paliform lobes of the third and fourth cycle septa. The costae at one end of the corallum are nodose a short distance below the top of the calice, apparently representing a resting stage in the growth of the individual.

Remarks: This species is differentiated from *Ceratotrochus laxus* Vaughan by the large papillose columella, the greater number of septa, and the oval calice. It closely resembles certain fossil forms such as *Ceratotrochus duodecimcostatus* var. *gibbosus* Montanaro (Pal. Ital., vol. 31, p. 74, pl. 4, figs. 14a, 14b, 14c, 1931) which have the large columella, oval calice, and greater number of septa.

Dimensions of holotype: Height 23 mm, calice 16 by 22 mm.

Holotype: AHF no. 13.

Type locality: Sta. 1106-40, off San Francisco Island, Gulf of California, 43-44 fms.

Material examined: The type.

Genus COENOCYATHUS Milne Edwards and Haime

Coenocyathus Milne Edwards and Haime (1848), Ann. Sci. Nat., ser. 3, vol. 9, pp. 297-298.

GENOTYPE: *Coenocyathus cylindricus* Milne Edwards and Haime.

Coenocyathus bowersi Vaughan

Plate 10, figs. 45 a-d

Coenocyathus bowersi Vaughan (1906), Proc. U.S. Nat. Mus., vol. 30, no. 1477, p. 847, pl. 77, figs. 1-3; Durham (1947), Geol. Soc. Am., Mem. 20, p. 34.

This species is extremely variable in development, the corallites of one colony being large in diameter, of another small, of still another colony short and crowded, of a fourth long and diverging. Hypotype cat. no. 45.2 shows an example of typical intratentacular budding and hypotype cat. no. 45.1 exhibits multiple fission.

This species was recorded previously from northeast of Point Pinos Lighthouse, Monterey Bay, from the Channel Islands, and south to San Diego. It is found in depths of 30-111 fms.

Hypotypes: Cat. no. 45.1 (Sta. 593-36), cat. no. 45.2 (Sta. 978-39), cat. no. 45.7 (Sta. 1279-41), cat. no. 45.8 (Sta. 1280-41).

Material examined: Stas. 593-36 (2), 978-39 (1), 1081-40 (2 immatures), 1177-40 (1), 1190-40 (1), 1276-41 (1), 1279-41 (1),

1280-41 (1), 1316-41 (2), 1335-41 (2), 1338-41 (1), 1340-41 (1), 1662-48 (1), 1680-49 (1), 1903-49 (1), 1938-50 (1), 1942-50 (1), 1944-50 (1). Isthmus Cove, Santa Catalina Island, July 12, 1919 (2). Hubbs 47.13 B (1). Cat. nos. 45.1-45.19.

Distribution: In the Gulf of California north of Isla Partida and at Puerto Escondido in depths of 5-76 fms. In the Channel Islands and on adjacent banks in depths of 15-60 fms. Sta. 1944-50 is 6.5 mi southwest of San Carlos Point, Lower California, 20 fms.

Genus **CYATHOCERAS** Moseley

Cyathoceras Moseley (1881), Rep. Sci. Res. Voy. H.M.S. Challenger, Zool., vol. 2, p. 156.

GENOTYPE: *Cyathoceras cornu* Moseley.

Cyathoceras foxi Durham and Barnard, new species

Plate 10, figs. 46a, b

Corallum trochoid or subturbinate, attached by a well-defined base; calice angular, subcircular; septa thin, in 5 cycles, interspaces slightly narrower than thickness of primary septa; primary and secondary septa exsert (2.5-3.0 mm), tertiaries nearly as exsert, later cycles successively less exsert; primary and secondary septa attached to columella, occasional tertiary septum attached at depth; fourth and fifth cycle septa extend one-fourth to one-third the distance to the columella; septa well-rounded above, mostly broken, inner edges vertical, slightly crinkled, minutely granulated; septal faces with numerous, well-defined granules; costae granulated, evident only near top of corallum, granules running in lines to base; costae of earlier cycles, especially the first and second, much more evident than those of later cycles; costal interspaces granulated, somewhat flat-bottomed, irregular in development, usually one-half the width of the largest adjoining costa; columella small, fascicular, one-fifth the width of the calice, composed of a few finely and highly contorted, elevated pieces. Outer surface of corallum with occasional calcareous nodules.

Remarks: This species may be distinguished from *Cyathoceras quaylei* Durham by the smaller, elevated columella composed of finely divided and contorted pieces rather than twisted ribbons, and by the more prominent first and second cycle costae.

Dimensions of holotype: Height 15 mm, calice 14 by 16 mm.

Holotype: AHF no. 14.

Type locality: Acc. no. 1236, 1200 yds. off Richardson Point, San Miguel Island, on a sunken buoy in 45 fms, Dec. 1948, Earl Fox, collector.

Material examined: The type and one immature individual from Sta. 1172-40. Cat. nos. 61.1-61.2.

Distribution: The Channel Islands, 45-150 fms.

Genus **DENDROSMILIA** Milne Edwards and Haime

Dendrosmilium Milne Edwards and Haime (1848), Comptes Rendus Acad. Sci. Paris, vol. 27, p. 468.

GENOTYPE: *Dendrosmilium duvaliana* Milne Edwards and Haime.

Dendrosmilium nomlandi Durham and Barnard, new species

Plate 10, fig. 47

Corallum colonial, subdendroid, consisting of 5 corallites; colony formation appearing to be extratentacular; corallites irregularly oval, fossa deep; septa mostly broken, thin, 40 in the largest calice, 33 in the smaller well-preserved calice; septal interspaces varying from 1-2 times the thickness of the primary septa; primary and secondary septa reaching to columella, later cycles successively narrower; septa narrow above, all apparently slightly and equally exsert; inner edges of septa smooth, descending almost vertically to bottom of calice; septal faces with a moderate number of tall, irregularly distributed granules; exterior surfaces of colony covered with minute, evenly distributed granules; costae very faint when developed, equal, composed of lines of granules which fade out towards the base of each corallite; columella small, fascicular, composed of 2-3 highly twisted and contorted, elevated pieces.

Remarks: The genotype of *Dendrosmilium* from the Eocene-Oligocene of the Paris Basin and *Astrangia boreas* Nomland are the only other species known of this genus except for *Thamnocoenia oolitica* Tomes, doubtfully referred to this genus by Vaughan and Wells (1943). The extratentacular budding of the new species does not strictly alternate in a regular manner as in the genotype. This species is differentiated from *D. duvaliana* by the deeper calice and smaller columella and from *D. boreas* by the smaller calice and more prominent fourth cycle septa.

Dimensions of holotype: Height of colony 33 mm, calice of largest corallite 5 by 9 mm in diameter, depth of fossa 4 mm.

Holotype: AHF no. 15.

Type locality: Sta. 1172-40, 5½ mi southeast of Santa Catalina Island, 45-150 fms.

Material examined: The holotype.

Genus **DESMOPHYLLUM** Ehrenberg

Desmophyllum Ehrenberg (1834), Corall. Roth. Meer., p. 299.

GENOTYPE: *Desmophyllum crista-galli* Milne Edwards and Haime (1848) = *Desmophyllum dianthus* Ehrenberg (1834) non *Madrepora dianthus* Esper (1797).

Desmophyllum crista-galli Milne Edwards and Haime

Plate 11, fig. 48

Desmophyllum crista-galli Milne Edwards and Haime (1848), Ann. Sci. Nat., ser. 3, vol. 9, pp. 253-254, pl. 7, figs. 10, 10a; Döderlein (1913), Mittel. Zool. Sta. zu Neapel, vol. 21, pp. 126-127, pl. 8, figs. 45, 45a; Durham, (1947), Geol. Soc. Am., Mem. 20, pp. 36-37, pl. 1, figs. 6, 10, 15, 17.

Desmophyllum Cumingii Milne Edwards and Haime (1848), Ann. Sci. Nat., ser. 3, vol. 9, p. 254, pl. 7, fig. 11.

Desmophyllum costatum Milne Edwards and Haime (1848), Ann. Sci. Nat., ser. 3, vol. 9, p. 254.

Desmophyllum ingens Moseley (1881), Rep. Sci. Res. Voy. H.M.S. "Challenger," Zool., vol. 2, pp. 160-162, pl. 4, figs. 1-6a; pl. 5, figs. 1-4a.

Desmophyllum crista-galli E. H., von Marenzeller (1903), Wiss. Ergeb. Deutschen-Tiefsee Exped. Valdivia 1898-1899, vol. 7, pp. 267, 268, pl. 15, fig. 2; (1904), Bull. Mus. Comp. Zool., vol. 43, no. 2, p. 81.

The specimens from Santa Catalina Island consist of 2 broken mature individuals and one intact specimen.

There are 2 other specimens from Bottom sample 481 (Cartago Bay, Albemarle Island, 12 fms) the largest of which has a height of 9 mm and a calice diameter of 2.5 mm. They have 3 cycles of septa developed, with the primaries more exsert than the later cycles. Well-developed costae are present and extend to the base as lines of granules. The calicular fossa is very deep. These specimens might represent the young of the form described by Vaughan (1906) as *D. galapagense*.

On the Pacific coast, this species is known from Monterey Bay to Point Pinos at a depth of 56-145 fms; off Panama, 742-861 m. Also found in the Mediterranean, Indian, and Atlantic Oceans at depths ranging from 160-2000 m.

Hypotype: Cat. no. 48.2 (Sta. 1848-49).

Material examined: Stas. 1027-39 (1), 1848-49 (2). Cat. nos. 48.1-48.2.

Distribution: Sta. 1027-39 is 5 mi southeast of Santa Catalina Island, 140-150 fms; Sta. 1848-49 is 4 mi southeast of east end of Santa Catalina Island, 104-135 fms.

Genus **HETEROCYATHUS** Milne Edwards and Haime

Heterocyathus Milne Edwards and Haime (1848), Ann. Sci. Nat., ser. 3, vol. 9, pp. 323-324.

GENOTYPE: *Heterocyathus aequicostatus* Milne Edwards and Haime.

Heterocyathus aequicostatus Milne Edwards and Haime

Plate 11, figs. 49a-d

Heterocyathus aequicostatus Milne Edwards and Haime (1848), Ann. Sci. Nat., ser. 3, vol. 9, p. 324, pl. 10, fig. 8.

Heterocyathus aequicostatus Ed. and H., Gardiner (1905), Mar. Invest. So. Africa, vol. 3, pp. 105-112, pl. 3, figs. 1-43.

Description of hypotypes: Corallites ceratoid to trochoid, in groups of 3 or 4 attached to gastropod shells, with commensal worm tubes in base; calices circular, very shallow; height 8 mm, diameter of calice 5 mm, calice 2 mm deep; septa 30-40, arranged in a Pourtalès plan which is obscured by a large papillary columella; septal interspaces 1.0-1.5 times as wide as thickness of primary septa; septa with 2-4 even-sized, short, paliform lobes, columella composed of similar interlacing processes, very spongy deep within the calice; later cycles of septa highly perforated toward columella; septal margins above paliform lobes dentate; septa well-rounded above, descending obliquely into shallow calice; primary septa most exsert, other cycles successively less exsert, fourth cycle septa adjacent to first cycle septa almost as well-developed as the latter; granules of septal faces variable in development, sometimes heavy enough to almost obliterate the interseptal spaces, on other specimens only slightly developed; costae minutely granulated, subequal in width, rounded, occasionally V-shaped; costae of first 3 cycles usually more elevated; costae of all cycles extending to base on some specimens, on others becoming indistinct; costal interspaces one-fourth to one-third the width of the costae, somewhat flat-bottomed.

Remarks: Gardiner's Plate 3, figs. 39 and 43 (1905) are particularly representative of the material in the present collection (L.A.C.M. A375). The large variation seen in Gardiner's material is not evident here. In Harrison's classification (1911, p. 1025) these specimens would

fall as intermediates between types B and C. They differ from type B by the taller corallum and larger columella and from type C by having only 4 cycles of septa and the star-like appearance of the calice.

The specimens from Sta. 1048-40 lack the star-like septal pattern, have deeper calices, and possess faint, equal costae.

Hypotypes: Cat. no. 49.2 (L.A.C.M. A375).

Material examined: Sta. 1048-40 (8). L.A.C.M. A375 (12). Cat. nos. 49.1-49.2.

Distribution: Peurto Refugio, Angel de la Guardia Island, 11-22 fms; L.A. County Museum A375, dredged in Banderas Bay, Mexico, 20-40 fms, Feb. 13-14, 1938.

Genus **KIONOTROCHUS** Dennant

Kionotrochus Dennant (1906), Trans. Proc. Roy. Soc. So. Australia, vol. 30, pp. 154-155.

GENOTYPE: *Kionotrochus suteri* Dennant.

Kionotrochus (?) **avis** Durham and Barnard, new species

Plate 11, figs. 50a, b; pl. 12, fig. 50c

Corallum subturbinate to trochoid, moderately small, attached early in life and free in adult stage with point of attachment healed; calice slightly oval; septa moderately thin, in 4 cycles, interspaces twice as wide as thickness of primary septa; primary and secondary septa equally exsert (1.2 mm), third and fourth cycle septa successively less exsert; primary and secondary cycle septa reach columella but are not attached to it; third cycle septa extend two-thirds the distance to the columella, fourth cycle septa one-fourth to one-third the distance to the columella; septa well-rounded above, inner edges vertical and crinkled, undulations irregular and somewhat contorted at the vertices; septal faces with fine, blunt, scattered granules; costae granulated, prominent and rounded, costal interspaces one-third as wide as costae, V-shaped, extending to base, on some specimens interspaces approximately of same depth all the way to the base; columella fascicular, consisting of twisted and contorted pieces, one-third as wide as calice.

Remarks: This species is referred to the subfamily Turbinoliinae and the genus *Kionotrochus* because of the trochoid corallum being free in the ephebic stage and because of the costae extending to the base. This species is rather closely related to *Kionotrochus* (?) *hoodensis* new species but is distinguished by being unattached and by other means as noted under that species. The columella is considerably more developed than in other members of this genus.

Dimensions of holotype: Height 10 mm, calice 6.0 by 7.5 mm.

Holotype: AHF no. 16, with 2 paratypes.

Type locality: Sta. 55-33, northeast of Charles Island, Galapagos, 60 fms.

Material examined: Sta. 55-33 (4). Bottom sample 455 (1). Cat. nos. 50.1-50.2.

***Kionotrochus* (?) *hoodensis* Durham and Barnard, new species**

Plate 12, figs. 51a-d

Corallum turbinate to subtrochoid, moderately small, attached by a small pedicle which is usually broken; calice slightly oval; septa thin, in 4 cycles, septal interspaces 3 times as wide as thickness of primary septa; primary and secondary septa exsert (1.5 mm), third and fourth cycles successively less exsert; primary and secondary septa reach columella but are attached to it only by individual trabeculae; tertiary septa extend two-thirds the distance to the columella, quaternary septa extend one-fourth to one-third the distance to the columella; septa well-rounded above, inner edges vertical and crinkled, undulations usually regular in distances apart and somewhat contorted at the vertices, occasionally producing a blunt spinule; septal faces with well-spaced, fine, blunt granules; costae granulated, prominent and rounded, becoming indistinct towards base; costal interspaces irregular in width, usually as wide as costae at top of corallum, narrowing out towards base; at top of corallum they are flat-bottomed and contain incipient costal ridges; columella fascicular, composed of twisted and contorted pieces, approximately one-third the width of the calice.

Remarks: This species may be separated from *Kionotrochus avis* new species which it closely resembles, by being attached, by the flat-bottomed costal interspaces at the top of the corallum, the costae becoming somewhat indistinct towards the base, and by the incipient costae evident in the interspaces at the top of the corallum. Cat. no. 51.1 (Sta. 190-34) has very high, rounded, granulated costae which are much more in evidence towards the base than in other members of the species.

This species has been referred to the genus *Kionotrochus* because of the trochoid corallum, rounded costae which extend almost to the base of the corallum, and its close resemblance to *Kionotrochus avis*. The presence of a pedicle by which it is attached is contrary to the general definition of the subfamily Turbinoliinae, but the resemblance to the genus *Cyathoceras*, where it would be placed if put in the Caryophylliinae is lessened by the trochoid corallum, costal characteristics, and the color of the skeleton, which is chalk-white. The color of the specimens of the species at hand belonging to the Caryophylliinae is usually slightly ochraceous.

Several immature specimens of *Cyathoceras* come from Bottom samples 406 and 446 in the Galapagos Islands, 54-56 fms; their costal interspaces are somewhat flat-bottomed and they may belong to the presently described species.

Dimensions of holotype: Height 8 mm, calice 7 by 8 mm.

Holotype: AHF no. 17, with one paratype.

Type locality: Sta. 816-38, north of Hood Island, 50-100 fms.

Material examined: Stas. 190-34 (1), 816-38 (2). Bottom samples 450 (4). Cat. nos. 51.1-51.3.

Distribution: The Galapagos Islands, 50-100 fms.

Genus **LOPHOSMILIA** Milne Edwards and Haime

Lophosmilia Milne Edwards and Haime (1848), Comptes Rendus Acad. Sci. Paris, vol. 27, p. 467.

GENOTYPE: *Caryophyllia cenomana* Michelin.

Lophosmilia wellsii Durham and Barnard, new species

Plate 12, fig. 52

Type a group of slightly worn corallites. Individual corallites elongate-conical, resembling *Lophosmilia fusca* (Vaughan), up to 12 mm in length; calices subcircular to oval, deep, septa in 4 cycles, interspaces half as wide as thickness of primary septa; primary septa extend to columella which is sublamellar and formed by the separation of the inner edge of one of the septa; second cycle septa less than half as wide as first cycle; third cycle septa project only slightly from the wall and the fourth cycle septa are lines of faint trabeculae; first cycle septa very exsert (1 mm), later cycles successively less exsert; primary septa well-rounded above, descending almost vertically to columella; inner edges of septa smooth; septal faces with moderately small granules; costae corresponding to first 3 cycles of septa, well-developed near top of calice. Interior of calice cut by several tabular dissepiments separating the older and newer parts of the corallite. The outer surface of the corallum is shiny and appears to have some stereomal deposit.

Remarks: This species may be separated from *L. fusca* (Vaughan) by the lesser development of the septa.

Wells indicates the synonymy of and discusses this rare genus (Bull. Am. Paleo., vol. 26, no. 98, pp. 313-314, 1941).

Dimensions of corallite: Height 12 mm, calice 3.5 by 4.5 mm, depth of calice 3.5 mm.

Holotype: AHF no. 18.

Type locality: Sta. 170-34, Stephens Bay, Chatham Island, Galapagos, 32 fms.

Material examined: The type.

Genus **NOMLANDIA** Durham and Barnard, new genus

Corallum discoid, upper surface moderately arched, adherent to substratum by means of a basal plate; thecal wall absent; septal trabeculae in one fan system, paliform lobes irregularly present before third cycle of septa; columella fascicular, composed of a few broad, twisted lamellae, attached here and there to the inner ends of the first and second cycle septa.

Remarks: Except for the discoid shape and the lack of a thecal wall, this genus is similar to *Bathycyathus*.

Type species: *Nomlandia californica* Durham and Barnard, new species.

Nomlandia californica Durham and Barnard, new species

Plate 12, fig. 53

Corallum discoid, low, upper surface moderately arched, adherent to substratum by means of a basal plate; thecal wall absent; septa in 4 cycles, some members of the fifth cycle present; septal interspaces 1-2 times the thickness of the primary septa; septa of first cycle highest and broadly arched, following cycles each successively less exsert and less highly arched, with fifth cycle represented by low ridges; most of third cycle septa with moderately small, curled paliform lobes at their inner ends; septal faces covered with lines of large, flattened, shelf-like granules parallel to upper margins of septa, indicating successive growth stages; toward columella these granules may fuse between the septa; columellar fossa moderately deep, columella composed of a few, broad, twisted lamellae, attached here and there to the inner ends of the first and second cycle septa, not raised above the bottom of the fossa.

Dimensions of holotype: Diameters of corallum 7 and 10 mm, height 2.5 mm.

Holotype: AHF no. 19.

Type locality: Accession no. 1236, 1200 yds off Richardson Point, San Miguel Island, on a sunken buoy in 45 fms, Earl Fox, collector, Dec. 1948.

Material examined: The holotype.

Genus **PARACYATHUS** Milne Edwards and Haime

Paracyathus Milne Edwards and Haime (1848), Ann. Sci. Nat., ser. 3, vol. 9, pp. 318-319.

GENOTYPE: *Paracyathus stokesii* Milne Edwards and Haime.

Paracyathus humilis Verrill

Plate 12, figs. 54a, b

Paracyathus humilis Verrill (1870), Trans. Conn. Acad. Arts Sci., vol. 1, p. 538.

The specimens at hand have 4 cycles of septa with some of the fifth cycle present. Pali terete, tall, slender, "most of them with irregular sides from which are developed small rough lobes, projecting in various directions" (Verrill, 1870). Occasionally, the pali before the third cycle are divided. The costae and their interspaces are somewhat irregular in development, probably due to environmental circumstances. The costae are wide, with large and small granules, the large ones composed of fused smaller ones.

Verrill's material came from the Pearl Islands.

Hypotype: Cat. no. 54.1 (Sta. 137-34).

Material examined: Sta. 137-34 (1).

Distribution: Sulphur Bay, Clarion Island, 57 fms.

Paracyathus stearnsii Verrill

Plate 13, figs. 55a-e

Paracyathus Stearnsii Verrill (1869), Proc. Boston Soc. Nat. Hist., vol. 12, p. 393; (1870), Trans. Conn. Acad. Arts Sci., vol. 1, pp. 537-538.

Paracyathus pedroensis Vaughan (1903), Mem. Calif. Acad. Sci., vol. 3, pp. 88-90, pl. 3, figs. 1, 1a; Durham (1947), Geol. Soc. Am., Mem. 20, p. 35, pl. 3, figs. 3, 4.

Paracyathus stearnsii Verrill, Durham (1947), Geol. Soc. Am., Mem. 20, p. 35, pl. 2, figs. 1, 2, 5, 6.

Over 400 specimens from 89 stations are present in the Allan Hancock Foundation collections. This species is extremely variable, with calices usually oval but occasionally very elongate-elliptical.

Paracyathus pedroensis Vaughan was based on specimens with undivided pali, but intergrades show that the pali of these forms, when the corallum attains a larger size, begin to divide, with the later cycles dividing sooner. Occasionally, specimens may reach a fairly large size before their pali divide but specimens in association with these are typical *P. stearnsii*.

The depth of the calice is also a variable characteristic; usually associated with deep calices and vertical inner septal ends are thick, crowded, smooth, rounded pali and a rather dark corallum which does not bleach well in 5 per cent NaOCl. Specimens at the other extreme with rather shallow calices have thin, wide, heavily granulated pali with flat summits; these specimens bleach almost white.

A discussion of the costal characteristics is to be found under *P. tiburonensis* Durham.

This species has been previously recorded from British Columbia southward through the Channel Islands at depths of 12-200 fms; also reported in the Pleistocene of San Pedro, California.

Hypotypes: Cat. nos. 55.5 (Sta. 1012-39), 55.23 (Sta. 1254-41), 55.26 (Sta. 1271-41), 55.41 (Sta. 1325-41), 55.54 (Sta. 1418-41).

Material examined: Stas. 891-38 (1), 894-38 (7), 913-39 (5), 999-39 (2), 1012-39 (7), 1120-40 (7), 1122-40 (2), 1123-40 (5), 1154-40 (1), 1170-40 (1), 1177-40 (1), 1179-40 (20), 1181-40 (5), 1183-40 (1), 1190-40 (1), 1191-40 (8), 1207-40 (4), 1219-40 (10), 1232-41 (2), 1245-41 (1), 1250-41 (1), 1252-41 (1), 1254-41 (1), 1259-41 (17), 1270-41 (23), 1271-41 (9), 1276-41 (12), 1280-41 (14), 1281-41 (2), 1282-41 (1), 1283-41 (10), 1284-41 (9), 1287-41 (3), 1292-41 (5), 1295-41 (17), 1298-41 (6), 1300-41 (2), 1303-41 (1), 1309-41 (2), 1316-41 (16), 1325-41 (1), 1336-41 (1), 1338-41 (2), 1339-41 (2), 1340-41 (3), 1348-41 (4), 1350-41 (1), 1358-41 (1), 1365-41 (2), 1372-41 (1), 1374-41 (2), 1391-41 (5), 1416-41 (1), 1418-41 (3), 1419-41 (3), 1421-41 (3), 1426-41 (7), 1432-41 (1), 1624-48 (8), 1644-48 (4), 1659-48 (8), 1662-48 (23), 1886-49 (5), 1903-49 (2), 1920-49 (1), 1937-50 (8), 1938-50 (8), 1939-50 (1), 1942-50 (2), 1948-50 (5), 1990-50 (1), 2007-49 (1), 2042-51 (3), 2043-51 (17). Accession nos. 267 (2), 485 (1), 500 (1), 564 (4), 616 (3), 658 (2), 661 (5). Bottom samples 1221 (6), 1255 (1), 1257 (1), 2166 (2). Hubbs 47-85 (4). Burch 4026 (30). Off San Pedro, coll. by K. O. Emery, 10-13 fms (2). East of Santa Barbara Island, July 30, 1919 (1); Catalina, July 12, 1925 (2); off Rocky Point, Calif. 50 fms, Oct. 5, 1941 (1). 33° 27' 42" N, 119° 00' 45" W, in 132 ft (2).

Distribution: Southwest of Point Pinos, California, south through the Channel Islands to 8½ mi south of Dewey Channel, Lower California. Bathymetric range, shoal to 489 fms, most of the records occurring between 15 and 60 fms.

Paracyathus tiburonensis Durham (?)

Plate 13, fig. 56

Paracyathus tiburonensis Durham (1947), Geol. Soc. Am., Mem. 20, pp. 35-36, pl. 3, figs. 5, 6.

The costae of *P. tiburonensis* are usually wider and more rounded than the comparative ones on *P. stearnsii* Verrill; the usual costae of *P. stearnsii* are quite V-shaped, with fewer and heavier granules on top of the ridge, while in *P. tiburonensis* the granules are more abundant, smaller, and uniform in size and distribution. On the occasional costae of *P. stearnsii* which are comparable to those of *P. tiburonensis*, an intermixture of numerous small granules and groups of granules fused into larger grains is present. The granules on *P. humilis* Verrill are like those of *P. stearnsii*, an intermingling of large and small grains.

The septa of the types of this species are more delicate than in the material at hand.

This species is recorded from southwest of Tiburon Island, depth, 73 m.

Hypotype: Cat. no. 56.1 (Sta. 1046-40), a group of individuals.

Material examined: The hypotype.

Distribution: Angel de la Guardia Island, shore.

Genus **SPHENOTROCHUS** Milne Edwards and Haime

Sphenotrochus Milne Edwards and Haime (1848), Ann. Sci. Nat., ser. 3, vol. 9, pp. 240-241.

GENOTYPE: *Turbinolia crispa* Lamarck.

Sphenotrochus hancocki Durham and Barnard, new species

Plate 13, figs. 57a, b

Corallum of small size, height up to 5 mm, slender, tapering slowly to base, young specimens attached, adults free, with attachment scars at base; calice variable, oval to compressed oval in cross-section, up to 2.5 mm in length and 1.5 mm in width; septa 24 in number, septal interspaces a little wider than thickness of primary septa, bottoms of interspaces flat; major septa may be divided into 4 triads, the terminal triads being composed of one primary and 2 proximal secondary septa, the secondary septa attached to the columella at depth, lateral triads composed of 2 primary cycle septa and one second cycle septum attached high up on the columella; the 2 terminal primary septa are slightly less developed than the remaining primaries and secondaries and do not

reach the columella; tertiary septa only slightly developed; primary and secondary septa approximately equally exsert, tertiaries half as exsert as primaries and secondaries; septa rounded above, inner edges of upper one-thirds vertical, below this, sharply concave while descending to columella; septal margins minutely flexuous and slightly granulated; septal faces finely granulated; costae high, smooth, equally developed, slightly wider than interspaces, primary costae usually extend to base of corallum, secondary costae extend to within a short distance of base, tertiary costae extend one-half to two-thirds the distance from the top of the corallum to the base, some costae becoming interrupted towards the corallum base; columella blade-like at top, protruding slightly above top of theca but not as far as primary and secondary septa.

Remarks: This species differs from *Sphenotrochus aurantiacus* von Marenzeller, by having only 3 cycles of septa and from *S. intermedius* (Münster), by the terminal septal triads being attached to the columella at depth. The specimens are comparable to *S. intermedius* as figured by Duncan (1874, pl. 41, figs. 1-5).

The costae are variable on some specimens and may be very narrow with wide interspaces.

Dimensions of holotype: Height 4 mm, calice 1.5 by 2.5 mm.

Holotype: AHF no. 20, with 2 paratypes.

Type locality: Sta. 170-34, Stephens Bay, Chatham Island, 32 fms.

Material examined: Stas. 143-34 (1), 170-34 (4), 1726-49 (2). Bottom samples 400 (2), 401 (1), 406 (5), 409 (3), 411 (5), 430 (1), 431 (1), 437 (11), 438 (2), 439 (5), 441 (1), 442 (1), 444 (9), 448 (13), 450 (7), 451 (1), 452 (3), 453 (21), 458 (2), 460 (3), 463 (7), 468 (2), 471 (1), 472 (1), 473 (16), 479 (1), 483 (1).

Distribution: The Galapagos Islands; Sta. 1726-49, 1¼ mi southwest of Cabeza Ballena, Lower California, 30 fms. Bathymetric range, 10-150 fms; 20 of the 29 records are between 15 and 45 fms.

Family **Flabellidae**Genus **FLABELLUM** Lesson

Flabellum Lesson (1831), *Illust. Zool.*, pl. 14.

GENOTYPE: *Flabellum pavoninum* Lesson.

Flabellum daphnense Durham and Barnard, new species

Plate 13, figs. 58a, b

Corallum conical, base narrowing to a small broken pedicle; calice elongate-oval, ratio of long to short axis 23-16; apical angle 55° ; calicular fossa deep (5 mm), wall thin, outer surface with broad, low pseudo-costae 2-3 septa wide, pseudocostal interspaces of same width; outer surface of corallum finely and evenly granulated, granules very close together, small, low, and rounded, lending a cobbled appearance; septa in 4 cycles, interspaces 3-4 times as wide as thickness of first cycle septa; primary and secondary septa mostly broken, apparently equally exsert (2 mm), tertiaries and quaternaries successively less exsert; septa well-rounded above, inner edges vertical and undulate, margins smooth, tops of septa slightly crinkled; primary and secondary septa reach to deep columella which merely consists of fused trabecular processes between the inner ends of the first and second cycle septa; tertiary septa extend two-thirds and the quaternary septa one-fourth the distance to the columella; septal faces moderately covered with large, rounded granules.

Remarks: The tops of all but 4 of the principal septa have been broken off of this fragile specimen. It is similar to *Flabellum patagonicum* Moseley, but does not have the transverse wavy accretion lines on the epitheca, the angle between the sides of the corallum is considerably less, and the septal granules are much more prominent than in *F. patagonicum*.

Dimensions of holotype: Height 18 mm, calice 8 by 12 mm, fossula 1.5 mm wide, 5 mm long, 5 mm deep.

Holotype: AHF no. 21.

Type locality: Sta. 788-38, Southeast of Daphne Major Island, 55 fms.

Material examined: The type.

Flabellum (?) montereyense Durham

Plate 14, figs. 59a-c

Flabellum (?) montereyense Durham (1947), Geol. Soc. Am., Mem. 20, p. 37, pl. 1, figs. 5, 9.

Deep within the calice the first and second cycle septa are connected by heavy processes forming a parietal columella. It is possible that this species should be referred to the genus *Gardinieria* but the columella is not as well-developed as in typical members of that genus.

This species has been recorded from Point Pinos, Monterey Bay to the Channel Islands, 50-93 fms.

Hypotype: Cat. no. 59.1 (Sta. 1348-41).

Material examined: Stas. 1348-41 (8), 1680-49 (1). Cat. nos. 59.1-59.2.

Distribution: Tanner Bank, 45-46 fms; 12 mi. off Laguna Beach, California, 58 fm bank, 60 fms.

Flabellum tannerense Durham and Barnard, new species

Plate 14, figs. 60a-c

Corallum of moderate size, subtrochoid, attached by a narrow base, slightly compressed laterally, in general appearance somewhat similar to *Flabellum alabastrum* Moseley; calice suboval in shape, ratio of long to short axis 19-16, lateral profile of calice slightly concave, apical angle of calice 45°, calicular fossa about 8 mm deep; septa in 4 cycles, septal interspaces about twice the thickness of the primary septa; septa of first and second cycles highly exsert (up to 3 mm), third cycle one-third to one-half as exsert as the primaries and secondaries, fourth cycle septa intermediate in height between third cycle and earlier cycles; first and second cycles of equal width, sharply rounded above from outer edges and descending steeply into narrow fossa; third cycle septa about two-thirds the width of first and second cycle septa; fourth cycle septa from one-fourth to one-third the width of the primary and secondary cycles; inner edges of septa smooth, slightly crinkled; septal faces with a few fine granules arranged in rows parallel to septal edges; columella not readily apparent, but very deep within the calice a few anastomosing trabeculae from the inner edges of the major septa are present. The wall was apparently originally epithecate and secondarily thickened by stereome on the inside; at the present time there are only patches of epitheca on the outside and near the upper edge of the calice the stereome is so abraded that the outer edges of the septa resemble costae; however, these outer ends are occasionally covered by epithelial fragments. The remaining outer surface of the corallum is eroded.

Remarks: This species, in general appearance, most resembles *F. alabastrum* Moseley, but the apical angle is only about one-third that of that species and in addition the calice is not nearly as compressed laterally. *F. deludens* von Marenzeller is another allied species but its apical angle is 120-180°.

If the present interpretation of the wall of these specimens as being eroded is incorrect, then this species should be referred to some other genus and family.

Dimensions of holotype: Height 15 mm, calice 8.0 by 9.5 mm, fossula 1.5 mm wide near top, pinching out below, 3 mm long, 8 mm deep.

Holotype: AHF no. 22, with one paratype.

Type locality: Sta. 1348-41, Tanner Bank, 45-46 fms.

Material examined: The types.

Family **Dendrophylliidae**

Genus **BALANOPHYLLIA** Searles Wood

Balanophyllia Searles Wood (1844), Ann. Mag. Nat. Hist., vol. 13, p. 11.

GENOTYPE: *Balanophyllia calyculus* Searles Wood.

Balanophyllia cedrosensis Durham

Plate 14, figs. 61a, b

Balanophyllia cedrosensis Durham (1947), Geol. Soc. Am., Mem. 20, pp. 40-41, pl. 11, figs. 3, 5; Fig. 2B.

This species has been recorded previously only from near Cedros Island, depth unknown.

Hypotype: Cat. no. 61.1 (Sta. 1259-41).

Material examined: Stas. 1259-41 (5), 1710-49 (1). Cat. nos. 61.1-61.2.

Distribution: South of Dewey Channel, 49 fms; 29 mi south of Abreojos Point, 54 fms.

Balanophyllia elegans Verrill

Plate 14, figs. 62 a-c

Balanophyllia elegans Verrill (1864), Bull. Mus. Comp. Zool., vol. 1, no. 3, p. 44; (1870), Trans. Conn. Acad. Arts Sci., vol. 1, pp. 511-512, pl. 10, fig. 3; Durham (1947), Geol. Soc. Am., Mem. 20, p. 41, pl. 1, figs. 7, 8, 11, 12; pl. 10, figs. 3, 4; Fig. 2A.

The specimens from Stas. 1342-41 and 1348-41 are taller and more trochoid than typical *B. elegans*, and an epitheca is well-developed to just below the top of the calice; but the character of the first and fourth cycles of septa and the columella is the same as some individuals of *B. elegans*.

This species is recorded from British Columbia southward to Point Conception and through the Channel Islands, from shore to 160 fms.

Hypotypes: Cat. nos. 62.2 (Sta. 1342-41), 62.4 (Sta. 1468-42).

Material examined: Stas. 1303-41 (2), 1342-41 (1), 1348-41 (5), 1468-42 (5), 1588-47 (2), 1674-49 (5), 1856-49 (2). Emerson-Barnard Stas. 7 (1), 27 (4), Menzies Sta. 90 (1), Burch 4026 (4). Cat. nos. 62.1-62.11.

Distribution: One-half mi north of Platt Point, Santa Cruz Island, 36-47 fms; 9½ mi northwest of Cortes Bank, 50 fms; Tanner

Bank, 45-46 fms; Middle Bay, Cape Arago State Park, Coos Co., Oregon, intertidal; Horseshoe Cove, 2 mi north of Bodega Head, Sonoma Co., Calif., shore; Santa Barbara Basin, 321 fms; Salmon Point, Mendocino Co., Calif., shore; Point Arena Reef, Mendocino Co., Calif., shore.

Balanophyllia osburni Durham and Barnard, new species

Plate 15, figs. 63a-d

Corallum of moderate size, ceratoid, attached by a small base; calice slightly oval in cross-section, fossa moderately deep, wall highly perforate; septa in 4 cycles, in typical balanophylloid pattern, septal interspaces 2-3 times as wide as thickness of primary septa; septa of first and second cycles slightly exsert, remaining cycles less so; first and second cycle septa sharply rounded at top and descending obliquely into bottom of fossa; inner edges of first and second cycle septa smooth, inner edges of third cycle slightly crenulate, with inner margins of third and fourth cycle septa highly dentate above their junction; first and second cycle septa slightly perforate, remaining cycles more abundantly so; septal faces with moderately abundant and prominent granules; costae corresponding to septa, those of first and second cycles slightly more prominent than the remainder, ornamented with numerous prominent, spinose granules; costal interspaces about one-half the width of costae, moderately deep; columella small, rounded, rising slightly above the floor of the calice.

Remarks: This species resembles *Balanophyllia cornu* Moseley, but the columella is not as prominent as in that species, no septa of the fifth cycle are present, and perforate septa are present in contrast to the imperforate septa of *B. cornu*. This species does not closely resemble any other described Eastern Pacific form.

It is distinguished from *B. galapagensis* Vaughan by the deeper fossa, the smaller columella, the thinner septa and the smaller septal granules.

Several specimens from Bottom sample 427 (the Galapagos Islands) may represent the young of this species. They have a complete third cycle of septa and some of the fourth present; the calice is deep and the columella is very small.

Dimensions of holotype: Height 19 mm, calice 7 by 8 mm, depth of calice 3 mm.

Holotype: AHF no. 23, with one paratype.

Type locality: Bottom sample 450, south of Indefatigable Island, Galapagos, 60 fms.

Material examined: Bottom samples 446 (1 immature), 450 (6), 554 (3 worn). Cat. nos. 63.1-63.3.

Distribution: The Galapagos Islands; Octavia Bay, Colombia. Bathymetric range, 45-60 fms.

Balanophyllia tiburonensis Durham

Plate 15, figs. 64a, b

Balanophyllia tiburonensis Durham (1947), Geol. Soc. Am., Mem. 20, pp. 41-42, pl. 10, figs. 5, 7; Fig. 2C.

This species has been recorded from south of Tiburon Island, 73 m.

Hypotype: Cat. no. 64.2 (Sta. 948-39).

Material examined: Stas. 23-33 (1), 948-39 (1). Cat. nos. 64.1-64.2.

Distribution: Off La Plata Island, Ecuador, 10 fms; off Medidor Island, Bahia Honda, Panama, 30-35 fms.

Genus DENDROPHYLLIA de Blainville

Dendrophyllia de Blainville (1830), Dict. Sci. Nat., vol. 60, p. 319.

GENOTYPE: *Madrepora ramea* Linnaeus.

Dendrophyllia californica Durham

Plate 15, figs. 65a, b

Dendrophyllia californica Durham (1947), Geol. Soc. Am., Mem. 20, pp. 37-38, pl. 10, figs. 2, 6.

As observed in the specimens here reported upon, the lateral calices of this species are usually 4-5 mm long and 8-11 mm in diameter. Occasionally the fused fourth cycle septa produce a large, blunt dentation.

The calices are shorter than in *D. oldroydi* Faustino and the columella is more elevated. In *D. oldroydi* the first and second cycle septa are considerably exsert; as a result, the edges of the calice have a distinct serrated appearance. In *D. californica* the same septa are only slightly exsert, thus the upper edge of the calice has a nearly smooth profile. The costae around the calice edge are much more prominent in *D. oldroydi* than in *D. californica*.

This species has been recorded previously from off the coast of Lower California in 23 fms.

Hypotype: Cat. no. 65.6 (Sta. 1254-41).

Material examined: Stas. 1010-39 (3), 1246-41 (3), 1247-41 (3), 1251-41 (2), 1252-41 (11), 1254-41 (8), 1258-41 (4), 1264-41

(1), 1948-50 (1). Bottom sample 2034 (1). Hubbs 47-13B (3). Cat. nos. 65.1-65.11.

Distribution: Off San Benito Islands; Ranger Bank, off Cedros Island; south-southwest of Natividad Island; 8.5 mi SSE Point Fermin; off Bird Rock, San Diego Co., Calif. Bathymetric range, 55-125 fms.

***Dendrophyllia cortezi* Durham and Barnard, new species**

Plate 16, figs. 66a, b

Corallum arborescent, of moderately large size, axial stalk solid except for commensal boring organism; calices large, terminal, individual lateral calices from 6-9 mm in length; walls of calices in terminal parts moderately porous, becoming solid below; calices subcircular to oval in cross-section with maximum diameters of from 10-13 mm, fossae 3-4 mm deep; septa subequal, in 4 cycles, with some members of fifth cycle present, in typical balanophylloid pattern; septal interspaces twice as wide as thickness of primary septa; septa slightly exsert, first and second cycles most prominently so, other cycles successively less exsert; first and second cycle septa well-rounded above, descending sharply into fossa and attached to columella somewhat at depth, upper edges of later cycles of septa irregular, third cycle septa not attached at depth to columella; septal faces well-covered with small granules; inner edges of third cycle septa coarsely dentate, fourth cycle septa occasionally very porous, inner edges of fifth cycle septa lacerate; costae granulated, corresponding to septa, those of first and second cycles slightly more prominent than those of later cycles; costal interspaces moderately deep, bottoms usually rounded and about half the width of the costae; columella elongate, of moderate size, about one-fourth to one-third the diameter of the calice, rounded and projecting slightly above bottom of fossa.

Remarks: This species may be distinguished from *D. californica* Durham by the inner margins of the third cycle septa being coarsely dentate, by the greater variation in the prominence of the costae, and by the longer lateral calices. It is separated from *D. oldroydi* Faustino by the dentate third cycle septa, by the longer and more slender calices, and by the upper margins of the calice being much less serrate in appearance. The inner edges of the third cycle septa are vertical in *D. cortezi*, while they are slanting in *D. oldroydi*. The wall of the latter is secondarily thickened with stereome up to the top of the calice; in *D. cortezi* it remains perforate for some distance below. There is less differentiation in the size of the costae of *D. cortezi* than of *D. oldroydi*.

Dimensions of holotype: Height of corallum 120 mm, length of a single corallite 23 mm, diameters 9 and 12 mm, depth of calice 4 mm.

Holotype: AHF no. 24, with 1 paratype.

Type locality: Sta. 561-36, south of Isla Partida, 70 fms.

Material examined: Stas. 561-36 (2), 1059-40 (1). Cat. nos. 66.1-66.2.

Distribution: The type locality and off Puerto Refugio, Angel de la Guardia Island, 75-83 fms.

Genus **ENDOPACHYS** Lonsdale

Endopachys Lonsdale (*pro parte*), (1845), Quart. Jour. Geol. Soc. London, vol. 1, p. 514; Milne Edwards and Haime (1848), Ann. Sci. Nat., ser. 3, vol. 10, pp. 81-82.

GENOTYPE: *Turbinolia maclurii* Lea.

Endopachys vaughani Durham

Plate 16, figs. 67a, b

Endopachys vaughani Durham (1947), Geol. Soc. Am., Mem. 20, pp. 39-40, pl. 11, figs. 6-8, 10, 11.

The specimens from the Galapagos Islands reach a larger size than those from the Gulf of California. The following table of selected hypotypes shows that no definite proportion exists in the calicular diameters or height relationships although the greater diameter of the calice is usually larger than the height:

Hypotypes:		Height	Greater diameter	Lesser diameter
Cat. no.	67.4	41 mm	42 mm	18 mm
	67.4	38 mm	34 mm	18 mm
	67.4	24 mm	27 mm	14 mm
	67.5	21 mm	22 mm	16 mm
	67.2	16 mm	19 mm	14 mm
	67.1	9 mm	10 mm	7 mm

Durham records this species from the mouth of the Gulf of California, 20-220 fms.

Hypotypes: Cat. nos. 67.1 (Sta. 147-34), 67.4 (Sta. 816-38).

Material examined: Stas. 147-34 (46), 560-36 (1), 814-38 (2), 816-38 (16), 1116-40 (1), 1726-49 (4). Bottom samples 330 (frag.), 2023 (1). Cat. nos. 67.1-67.8.

Distribution: West of Isla Partida, Gulf of California; 1¼ mi southwest of Cabeza Ballena, Lower California; the Galapagos Islands and Cocos Island. Bathymetric range, 20-100 fms.

Genus **THECOPSAMMIA** Pourtalès

Thecopsammia Pourtalès (1868), Bull. Mus. Comp. Zool., vol. 1, no. 7, p. 138.

GENOTYPE: *Thecopsammia socialis* Pourtalès.

Thecopsammia pourtalesi Durham and Barnard, new species

Plate 16, fig. 68

Corallites pseudocolonial in appearance, forming a rudely sub-phaceloid aggregate; individual corallites moderately small, usually 10-15 mm long, occasionally up to 20 mm in length, some individuals only about 5 mm; corallites scolecoïd to ceratoid, highly epithecate, epitheca developed up to within a short distance of the top of the calice; thecal wall highly porous; calice moderately deep, depth of fossa 2-3 mm, varying from circular to slightly oval in cross-section, calice diameter usually about 5 mm; septa thin, in 4 cycles, interspaces 4 times as wide as thickness of first cycle septa, traces of fifth cycle septa represented by faint trabeculae projecting in septal interspaces; septa arranged in Pourtalès plan, which is readily seen when the columella is small, but when the columella is large the Pourtalès plan may be obscured; septa slightly exsert, those of first cycle most prominently so; upper edges of septa sharply rounded, and then descending steeply into calicular fossa; inner edges of septa slightly and crudely serrate; septal faces with a moderate number of prominent granules; all cycles of septa are perforate, but the third cycle is more perforate than the first and second; costae ill-defined, corresponding to septa, rudely spinose; columella varying from one-fourth to one-half the diameter of the calice, not protruding above bottom of fossa, consisting of a number of interlacing trabeculae.

Remarks: This species may be distinguished from *Balanophyllia galapagensis* Vaughan, which individual corallites of it resemble, by the prominent columella of that species, by the much more perforate wall, and the deeper calicular fossa of the present species.

The new species is distinguished from *Thecopsammia fistula* (Alcock), by the more elongate calice and taller corallum of the latter, and from *T. socialis* Pourtalès by the more turbinate corallum, 5 cycles of septa, and the more compact columella of Pourtalès' species.

Dimensions of holotype: Height 6 mm (immersed by surrounding corallites), calice 5 by 6 mm, depth of calice 2 mm.

Holotype: AHF no. 25, with 4 paratypes.

Type locality: Sta. 12, 1932, west of South Seymour Island, the Galapagos Islands, no bathymetric data.

Material examined: 26 clusters from the type locality. Cat. no. 68.1.

Genus TUBASTREA Lesson

Tubastrea Lesson (1834), in Belanger, Voy. Indes-Orient., p. 515.

Coenopsammia Milne Edwards and Haime (1848), Ann. Sci. Nat., ser. 3, vol. 10, pp. 106-107.

Astropsammia Verrill (1869), Proc. Boston Soc. Nat. Hist., vol. 12, p. 392; (1870), Trans. Conn. Acad. Arts Sci., vol. 1, p. 509.

GENOTYPE: of *Tubastrea* and *Coenopsammia*, *T. coccinea* Lesson, (*Lobophyllia aurea* Quoy and Gaimard); of *Astropsammia*, *A. pedersenii* Verrill.

Tubastrea tenuilamellosa (Milne Edwards and Haime)

Plate 12, fig. 50d

Coenopsammia tenuilamellosa Milne Edwards and Haime (1848), Ann. Sci. Nat., ser. 3, vol. 10, p. 110, pl. 1, fig. 11.

Astropsammia Pedersenii Verrill (1869), Proc. Boston Soc. Nat. Hist., vol. 12, p. 392; (1870), Trans. Conn. Acad. Arts Sci., vol. 1, p. 509.

Dendrophyllia tenuilamellosa Verrill (1870), Trans. Conn. Acad. Arts Sci., vol. 1, p. 508.

Tubastrea tenuilamellosa (Milne Edwards and Haime), Durham (1947), Geol. Soc. Am., Mem. 20, pp. 38-39, pl. 11, figs. 1, 2, 4, 9; pl. 12, figs. 6, 7.

The deep-water specimen from Sta. 155-34 (50-60 fms), has calices varying from 4-8 mm in diameter and rising from 1-7 mm above the general mass of the corallum. In many respects it resembles the type of *Astropsammia pedersenii* Verrill, except that it is obviously not a worn specimen. The columella in some calices of this specimen is quite evident, in others it is almost obsolete; in all cases it is composed of interlacing trabeculae from the inner ends of the septa.

In the material available there appear to be specimens representing all gradations in size and projection of calices. The specimens from Station 31-33 have calices 10-12 mm in diameter and projecting as much as 13-17 mm from the corallum mass. Material from Station 155-34 has calices 5-7 mm in diameter and projecting 1-3 mm from the coenenchyma.

Material from Station 804-38 has calices with the columella almost obsolete, represented by only a very few interlacing trabeculae from deep within the calice; in material from station 331-33 the columella is quite prominent and composed of numerous, fine, interlacing trabeculae.

Most of the typical specimens appear from near shore or shallow water localities while the ones with smaller calices and *Astropsammia*-like corallum appear to be representatives of deeper water.

Van der Horst (1926, p. 47), has considered that *T. aurea* (Quoy and Gaimard) and *T. tenuilamellosa* (Milne Edwards and Haime) are identical. Durham (1947) separates the two species on the basis of the finer costal granules on *T. aurea*. This problem should be reinvestigated when large suites of each species are available for comparison.

T. surcularis (Verrill) may be an exceptionally large individual of this species.

This species has been recorded from Panama; Pearl Islands; Acapulco, Mexico; La Paz; Santa Isabella Island; the Galapagos Islands. Depth, shallow water.

Hypotypes: Cat. nos. 69.1 (Sta. 31-33), 69.5 (Sta. 155.34). (1), 804-38 (1). Cat. nos. 69.1-69.10.

Material examined: Stas. 31-33 (4), 48-33 (2), 69-33 (3), 152-34 (4), 155-34 (1), 194-34 (5), 333-35 (frag.), 465-35 (3), 796-38 (1), 804-38 (1).

Distribution: Sta. 465-35 is at Playa Blanca, Costa Rica, shore; the other stations are in the Galapagos Islands, shore to 60 fms.

DESCRIPTION OF ACCESSION NUMBER LOCALITIES

Acc. no. 267.	Off Long Beach, Trawl 54. March 14, 1914.
Acc. no. 485.	Santa Catalina Island, at Isthmus Cove, Trawl 142. June 16, 1916.
Acc. no. 500.	West of Catalina Harbor. Trawl 160. June 23, 1916.
Acc. no. 564.	Near Rocky Point, on Redondo Beach, Calif. side. August 5, 1923.
Acc. no. 616.	Dredge off Long Beach, Calif., in 16 fms. September 26, 1925.
Acc. no. 658.	Long Point, Santa Catalina Island, dredge in 17 fms. January 27, 1927.
Acc. no. 661.	25 mi southeast of lighthouse (San Pedro, Calif.), 14 fms. December 17, 1926.
Acc. no. 1095.	Taboga Beach, Taboga Island, Panama. July 20, 1947.
Acc. no. 1097.	Taboga Bay, Taboga Island, Panama, dredging 2-5 fms. July 24, 1947.
Acc. no. 1236.	1200 yds off Richardson Point, San Miguel Island, on a sunken buoy, 45 fms, Earl Fox, collector. December, 1948.
Dawson Sta. 53.	Cabeza Ballena, near Cape San Lucas, shore. November 9, 1946.
Emerson-Barnard Sta. 7.	Salmon Point, Mendocino Co., Calif., shore. June 10, 1949.
Emerson-Barnard Sta. 27.	Point Arena Reef, Mendicino Co., Calif., shore. July 1, 1949.
Hubbs Sta. 47-13B.	Off Bird Rock, San Diego Co., Calif., 60-70 fms. February 3, 1947.
Hubbs Sta. 47-85.	3.6 mi off south coast near east end of Santa Rosa Island. April 27, 1947.
Menzies Sta. 90.	Horseshide Cove, Calif., November 30, 1949.

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