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VOLUME I.

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1866 TO 1871.

The spicula are white and smaller than in the other species of the genus. The most conspicuous are roughly warted spindles and double-spindles, varying from long slender acute forms to stout, blunt, and irregular ones. With these are many rough irregular crosses and irregularly branched spicula. The crooked spicula from the verrucæ are long and quite slender, acute, variously curved, often bow-shaped, covered with small distant warts. The polyp-spicula are smaller and straighter, with fewer warts. The larger spindles and double-spindles measure ·336^{mm} by ·096^{mm}, ·336 by ·072, ·288 by ·084, ·264 by ·108, ·264 by ·084, ·264 by ·072, ·252 by ·060, ·240 by ·096, ·240 by ·072, ·240 by ·060, ·228 by ·096, ·228 by ·072, ·222 by ·108, ·222 by ·102, ·216 by ·078, ·192 by ·072; the crosses ·144 by ·108, ·108 by ·084; the long curved spicula ·432 by ·042, ·360 by ·042, ·360 by ·036, ·336 by ·030, ·312 by ·030, ·244 by ·030.

La Paz, on shell with *Eugorgia nobilis, var. excelsa*, in 6 to 8 fathoms, one specimen,—J. Pedersen.

No. 7.—*On the Geographical Distribution of the Polyps of the West Coast of America.*

In the preceding article I have included all the species hitherto described by others from the west coast of America, as well as those examined by myself. It is certain, however, that many additional species remain to be discovered. The tropical region or Panamian province, extending from Cape Blanco, Peru, to Lower California, and including the Gulf of California, is the only portion of the coast from which even tolerably complete collections have been made, and yet in that great region only the littoral and shallow water species have been collected. Doubtless many new and interesting forms will hereafter be discovered in the deeper waters and on the submerged banks off the coast.

Concerning the polyp-fauna of the coast of Lower California, we know almost nothing. From the coast farther northward a few small collections have been brought, and the lists of species from those regions are certainly very imperfect. From the coasts of Peru and Chili a greater number of species, mostly Actinians, have been described, but many of these need reëxamination from living specimens, and many others doubtless remain undescribed. The polyps of the Araucanian and Galapagos provinces are entirely unknown. From the Fuegian region several species of Actinians were described in the

Report on the Zoöphytes of the United States Exploring Expedition, but it is probable that even there several other species will hereafter be found. It will, therefore, be useless to attempt any generalizations upon the extent and limits of the several faunæ occupying these coasts, but it appears desirable to bring together the species already known from each zoölogical province.

So far as can be judged from these imperfect lists, the faunal divisions are the same for the Polyps as for the Echinoderms, and since these were discussed in a previous article in this volume (pp. 336 to 339), it is unnecessary to give their limits or extent at this time.

Arctic Province.

Alcyonaria.

Primnoa compressa Verrill.
Aleutian Islands.

Alcyonium rubiforme Dana.
Behrings Straits and Arctic Ocean.

Actinaria.

Urticina crassicornis Ehr.
Arctic Ocean to Puget Sound.

Phellia arctica Verrill.
Arctic Ocean.

Of the four species known from this fauna two (*Alcyonium rubiforme* and *Urticina crassicornis*) are found also on the north Atlantic coasts of America and Europe. The latter also extends southward to the Oregonian fauna. The others are not known to occur south of the Aleutian Islands.

Sitchian Province.

Actinaria.

Urticina crassicornis Ehr.
Arctic Ocean to Puget Sound.

Evactis? xanthogrammica Verrill.
Sitcha.

The two species known from Sitcha afford but little evidence in regard to the character of the fauna, for the first is a species of wide distribution on all the northern coasts both of the Atlantic and Pacific, while the second is a doubtful species, which may prove identical with *E. artemisia* of the Oregonian fauna.

Oregonian Province.

Alcyonaria.

Ptilosarcus Gurneyi Gray.
Vancouver I., Puget Sound and Cape Flattery (80 feet) to Monterey.

ACTINARIA.

Urticina crassicornis Ehr
Arctic Ocean to Puget Sound.

Evactis artemisia Verrill.
Puget Sound.

Metridium fimbriatum Verrill.
Puget Sound to San Francisco.

Sagartia, several sp. ined.
Gulf of Georgia.

Epiactis prolifera Verrill.
Puget Sound.

MADREPORARIA.

Balanophyllia elegans Verrill.
Puget Sound to Monterey.

Allopora venusta Verrill.
Neah Bay.

Of the seven described species in this list, three are not known to occur elsewhere. Three extend southward into the Californian province, and *U. crassicornis* extends northward to the Arctic Ocean.

CALIFORNIAN PROVINCE.

ALCYONARIA.

Ptilosarcus Gurneyi Gray.
Vancouver Island to Monterey.

(?) *Virgularia gracilis* Gabb.
Monterey.

Stylatula elongata Verrill.
San Francisco to Monterey.

Leptogorgia Caryi Verrill.
(?) Near San Francisco.

ACTINARIA.

Metridium fimbriatum Verrill.
San Francisco to Puget Sound.

Sagartia, sp.

MADREPORARIA.

Paracyathus caltha Verrill.
Monterey.

P. Stearnsii Verrill.
Monterey.

Balanophyllia elegans Verrill.
Monterey to Puget Sound.

Among the eight species described from this fauna there are three that are found also in the Oregonian. The rest have not yet been recorded from beyond the limits of the fauna.

PANAMIAN PROVINCE.

ALCYONARIA.

Renilla amethystina Verrill.
San Salvador to Zorritos.

Leioptillum undulatum Verrill.
Gulf of California to Gulf of Fonseca.

Stylatula gracilis Verrill.
Cape St. Lucas to Panama.

Leptogorgia Floræ Verrill.
Panama Bay.

L. Agassizii Verrill.
Gulf of California to Acapulco.

L. media Verrill.
Gulf of California to Nicaragua.

L. Adamsii Verrill.
Nicaragua to Zorritos, Peru.

L. pulchra V., and *var. exilis* V.
Gulf of California.

L. rutila Verrill.
Acapulco.

L. eximia Verrill.
Bay of Panama.

L. tenuis Verrill.
Gulf of California.

L. stenobrochis Verrill.
San Salvador to Zorritos.

—— *var. Englemanni* Horn.
Mazatlan and Acapulco to Panama

L. ramulus Verrill.
San Salvador to Zorritos.

L. labiata Verrill.
Guaymas and Tehuantepec to Nicaragua.

L. pumila Verrill.
Zorritos.

L. diffusa Verrill.
Gulf of Nicoya and Panama Bay.

L. Californica Verrill.
Margarita Bay and Cape St. Lucas.

L. alba Verrill.
Guaymas to Panama.

L. flexilis Verrill.
San Salvador to Panama Bay.

L. rigida Verrill.
Gulf of California to San Salvador.

L. cuspidata Verrill.
Cape St. Lucas to Acapulco.

L. exigua Verrill.
Guaymas to Nicaragua and Zorritos.

Eugorgia ampla Verrill.
Margarita Bay and Gulf of California.

—— *var. purpurascens* Verrill.
Nicaragua to Zorritos.

E. nobilis Verrill.
Nicaragua and Bay of Panama.

—— *var. excelsa* Verrill.
Gulf of California and Acapulco.

E. Bradleyi Verrill.
Gulf of Nicoya to Panama Bay.

E. Daniana Verrill.
Gulf of Nicoya and Bay of Panama.

E. multifida Verrill.
La Paz and Mazatlan to Acapulco.

E. aurantiaca Verrill.
Gulf of California to Acapulco.

Phycogorgia fucata Val.
Mazatlan.

Psammogorgia arbuscula Verrill.
Gulf of Nicoya to Panama Bay.

—— *var. Dowii* Verrill.
San Salvador and Pearl Islands.

—— *var. pallida* Verrill.
Pearl Islands.

P. teres Verrill.
Guaymas (Dr. E. Palmer) to Panama Bay.

P. fucosa Verrill.
Mazatlan.

P. gracilis Verrill.
Pearl Islands.

Muricea acervata Verrill.
Panama.

M. tubigera Verrill.
Bay of Panama.

M. hispida Verrill.
Panama.

M. squarrosa Verrill.
Panama Bay.

M. crassa Verrill.
Panama Bay.

M. echinata Val.
Bay of Panama.

—— *var. flabellum* Verrill.
Panama Bay.

M. fruticosa Verrill.
Bay of Panama.

—— *var. miser* Verrill.
Nicaragua to Bay of Panama.

M. austera Verrill.
Gulf of California to Bay of Panama.

M. retusa Verrill.
Pearl Islands.

M. formosa Verrill.
Zorritos.

M. robusta Verrill.
Acapulco.

M. albida Verrill.
Panama Bay.

M. hebes Verrill.
Acapulco to Bay of Panama.

M. purpurea Verrill.
Acapulco to Bay of Panama.

M. appressa Verrill.
Gulf of California to Panama and Zorritos.

—— *var. flavescens* Verrill.
Nicaragua to Zorritos.

M. tenella Verrill.
Nicaragua to Zorritos.

M. aspera Verrill.
Panama.

Heterogorgia verrucosa Verrill.
Bay of Panama.

H. tortuosa Verrill.
Bay of Panama.

H. papillosa Verrill.
La Paz.

Callipodium Pacificum Verrill.
Gulf of California to Zorritos.

C. aureum Verrill.
Panama.

Alcyonium? Bradleyi Verrill.
Panama.

Actinaria.

Lophactis ornata Verrill.
Panama Bay.

Asteractis Bradleyi Verrill.
Panama.

Cladactis grandis Verrill.
Nicaragua to Zorritos, Peru.

Anthopleura Dowii Verrill.
San Salvador to Panama Bay.

Bunodes (*?*), sp.
Pearl Islands.

Calliactis variegata Verrill.
Panama Bay.

Sagartia crispata Verrill.
Panama Bay.

S. carcinophila Verrill.
Panama Bay.

S. Panamensis Verrill.
Panama Reefs.

S. Bradleyi Verrill.
Panama Reefs.

Sagartia, sp. ined.
Panama.

Phellia inornata Verrill.
Panama Bay.

P. (*?*) *rubens* Verrill.
Zorritos.

P. Panamensis Verrill.
Panama.

Paractis (*?*) *nobilis* Verrill.
Panama.

Mammillifera Danæ Verrill.
Panama Bay.

M. nitida Verrill.
San Salvador.

M. conferta Verrill.
Acapulco and San Salvador.

Epizoanthus elongatus Verrill.
Panama Bay and Zorritos, (?) La Paz.

E. humilis Verrill.
Panama.

E. crassus Verrill.
San Salvador.

Antipathes Panamensis Verrill.
Panama Bay.

Madreporaria.

Montipora fragosa Verrill.
(?) Gulf of California.

Porites Californica Verrill.
Guaymas and La Paz.

P. porosa Verrill.
La Paz.

P. excavata Verrill.
Pearl Islands, Panama Bay.

P. Panamensis Verrill.
Panama Bay.

P. nodulosa Verrill.
La Paz.

Dendrophyllia surcularis Verrill.
Pearl Islands.

D. tenuilamellosa Verrill.
Panama Bay, Acapulco, La Paz.

Astropsammia Pedersenii Verrill.
La Paz.

Rhizopsammia pulchra Verrill.
Pearl Islands.

Allopora Californica Verrill.
(?) Gulf of California.

Pocillipora capitata Verrill.
La Paz and Socorro Islands to Panama Bay.

—— *var. porosa* Verrill.
La Paz.

—— *var. robusta* Verrill.
Near La Paz.

—— *var. pumila* Verrill.
Near La Paz.

P. lacera Verrill.
Acajutla to Panama Bay.

Astrangia Haimei Verrill.
San Salvador to Panama and Zorritos.

A. pulchella Verrill.
Panama Bay.

A. concinna Verrill.
Panama Bay.

A. dentata Verrill.
La Paz to San Salvador and Panama.

A. costata Verrill.
Panama Bay.

A. Pedersenii Verrill.
Guaymas and La Paz.

A. (Cœnangia) conferta Verrill.
Gulf of California.

Phyllangia dispersa Verrill.
Gulf of Nicoya and Panama Bay.

Ulangia Bradleyi Verrill.
Panama Bay.

Paracyathus humilis Verrill.
Pearl Islands.

Desmophyllum Cumingii E. and H.
South America.

Fungia elegans Verrill.
Gulf of California.

Pavonia gigantea Verrill.
Pearl Islands.

P. clivosa Verrill.
Pearl Islands.

Stephanaria stellata Verrill.
La Paz to Bay of Panama.

In this list there are 104 species, none of which have been found beyond the limits of the province. An examination of the list will show, however, that there are sufficient reasons for recognizing the three subdivisions of the fauna, already given in the case of the Echinoderms (p. 337). But the three subdivisions are not equally well known. The Actinians of the Mexican and Equadorian sub-provinces are almost wholly unknown, only one or two species having been examined from each, while from the Panamian division a considerable number are now made known, although there must be many additional ones. The shallow water Gorgonians and corals have been pretty fully collected in both the Mexican and Panamian regions, but from the Equadorian we have only the small collection obtained by Mr. Bradley at Zorritos. In the present state of our knowledge some of the species found in each of the three sub-provinces are peculiar to it, while many extend also to one of the other, and a considerable

portion are found in all three, or throughout the whole extent of this great province. Future explorations will undoubtedly reduce the number of species peculiar to each subdivision, as most of the late collections have done, for there can be no doubt but that part of the apparent differences in the faunæ are due to the incompleteness of the collections. Local peculiarities of the particular places at which the various collections have been made have also undoubtedly increased the apparent differences.

As the list now stands, there are known from the Mexican subdivision 42 species; of these, 20 species are peculiar to the region; 16 are found also in the Panamian subdivision; and 6 are found in both these and the Equadorian regions, ranging to Zorritos.

From the Panamian subdivision there are 80 species known; of these, 51 are peculiar to it (including 16 of Actinaria); 16 are found also in the Mexican district; 7 are common to the Panamian and Equadorian regions; and 6 range through the three sub-provinces.

Of the Equadorian polyp-fauna we know but 17 species; of these 4 are peculiar to it; 7 are found also in the Panamian; and 6 extend through both the Panamian and Mexican regions, even to the Gulf of California.

For convenience of reference some local lists are added, which will at least serve to illustrate the most common and conspicuous species of the several localities.

List of species collected at Guaymas by Dr. E. Palmer.

The following species are in the collection of the Chicago Academy of Sciences:

Leptogorgia Agassizii V.
L. media V.
L. alba V.
L. labiata V.
L. exigua V.
Psammogorgia teres V.
Astrangia Pedersenii V.
A. (Cœnangia) conferta V.
Porites Californica V.

List of species collected near La Paz by Capt. J. Pedersen.

Leptogorgia Agassizii V. Common.
L. media V. Not common.
L. pulchra V. Common.
—— *var. exilis* V. Common.
L. tenuis V. Very rare.
L. rigida V. Abundant.
Eugorgia nobilis, var. excelsa V. Common.
E. multifida V. Rare.
E. aurantiaca V. Common.
Muricea austera V. Not common.
M. appressa V. Common.

Heterogorgia papillosa V. Rare.
Callipodium Pacificum V. Rare.
Epizoanthus elongatus V. Rare.
Porites Californica V. Not common.
P. porosa V. Common.
P. nodulosa V. Common.
Dendrophyllia tenuilamellosa V. Rare.
Astropsammia Pedersenii V. Rare.
Pocillipora capitata V. Common.
—— *var. porosa* V. Not common.
—— *var. robusta* V. Common.
—— *var. pumila* V. Common.
Astrangia dentata V. Rare.
A. Pedersenii V. Not common.
Fungia elegans V. Rare.
Stephanaria stellata V. Rare.

The fauna at Cape St. Lucas appears to be similar to that of La Paz. The collections made there by Mr. J. Xantus include many of the species common at La Paz, especially *Leptogorgia rigida*, *L. Agassizii* and *L. media*, in abundance. He also collected a few additional species, although his collection was much less extensive than that of Capt. Pedersen. At Acapulco considerable collections, chiefly of Gorgonians, have been made by Mr. A. Agassiz, Mr. D. B. Van Brunt, and others. The common species are mostly the same as at La Paz, and there appears to be but little difference in the faunæ of the two localities, except what may be explained by the incompleteness of the collections received. A few species (*Leptogorgia rutila* V., *L. stenobrochis, var. Englemanni*, *Muricea robusta*, *M. purpurea*, etc.) common at Acapulco, have not been found at La Paz.

From the coasts of San Salvador and Nicaragua I have seen several collections, made by Capt. Dow, Mr. Bradley, Mr. J. A. McNiel, and others, but none of them can be considered as at all complete, even for the Gorgonians. So far as can be judged from these collections, the faunæ of those coasts are essentially the same as that of Panama Bay.

List of species collected on the coast of Nicaragua by J. A. McNiel.

The following species were collected by Mr. McNiel on the beach at Corinto, and by the aid of divers in the Gulf of Nicoya. Those species found only at one of these places are designated either by (C.) or (N.) according to the locality. The first series from this collection is in the Peabody Academy of Science, Salem, Mass., by which Mr. McNiel was sent out:

Leptogorgia media V. (C.)
L. Adamsii V. Large.
L. stenobrochis V.
L. ramulus V. (C.)
L. labiata V. (C.)
Psammogorgia arbuscula V. (N.)
Muricea fruticosa, var. miser V. (C.)
M. hebes V. (C.)
M. purpurea V. (C.)

L. diffusa V. (N.) Large.
L. alba V. Common.
L. exigua V. Common.
Eugorgia Daniana V. (N.) Large.
E. ampla, var. purpurascens V. (C.)
E. Bradleyi V. (N.) Yellow variety.
E. nobilis V. (N.)
M. appressa V.
—— *var. flavescens* V. (C.)
M. tenella V. (C.)
Cladactis grandis V. (C.)
Astrangia dentata V. (N.)
Phyllangia dispersa V. (N.)

Peruvian Province.

Alcyonaria.

Leptogorgia Peruana Verrill.
Callao.

(?) *Muricea horrida* Mobius.
"Peru." Perhaps this belongs to the Panamian Province.

Eugorgia rubens Verrill.
Paita.

Echinogorgia aurantiaca Verrill.
Callao.

Actinaria.

Oulactis concinnata E. and H.
Callao.

Bunodes papillosa Verrill.
Callao to Talcahuano, Chili.

B. pluvia Verrill.
San Lorenzo Island.

B. ocellata Verrill.
Paita.

Phymactis florida Edw. and H.
San Lorenzo Island.

Sagartia nivea Verrill.
Paita and Callao.

S. Lessonii Verrill.
Paita.

S. (?) Peruviana Verrill.
Paita.

Nemactis primula Edw. and H.
San Lorenzo Island.

N. Draytonii Edw. and H.
San Lorenzo I.

Anactis picta Ehr.
Paita.

Of the fifteen species in this list, only one (*Bunodes papillosa*) is known to extend its range beyond the limits of the fauna.

Chilian Province.

Alcyonaria.

Leptogorgia (?) Chilensis Verrill.
Algarrobo, south of Valparaiso.

L. (?) platyclados Verrill.
I. Santa Maria.

L. (?) arbuscula Verrill.
I. Santa Maria.

Actinaria.

Bunodes papillosa Verrill.
Talcahuano to Callao.

Cystiactis Eydouxi Edw. and H.
Chili.

Phymactis clematis Edw. and H.
Valparaiso.

Actinia (?) Mertensii Brandt.
Chili.

Sagartia ? nymphæa Verrill.
Valparaiso.

Nemactis ? Chilensis Verrill.
Bay of Talcahuano and Quiriquina Island.

S. ? rubus Verrill.
Valparaiso.

MADREPORARIA.

Bathycyathus Chilensis E. and H.
Chili.

Of the eleven species known from this province, none are known elsewhere, except *Bunodes papillosa*, which is also found in the Peruvian fauna.

FUEGIAN PROVINCE.

ACTINARIA.

Bunodes cruentata Gosse.
Orange Bay.

Metridium reticulatum E. and H.
Orange Harbor.

Cereus Fuegiensis Verrill.
Orange Harbor.

Sagartia impatiens Gosse.
Orange Harbor.

Sagartia lineolata Verrill.
Forge Cove, near Orange Harbor.

MADREPORARIA.

Astrangia, sp.
Straits of Magellan.

The six species known from this fauna appear to be peculiar to it.

For want of room, the lists, giving a detailed comparison between the tropical faunæ of the Atlantic and Pacific coasts and originally intended to accompany this article, have been reserved for the next volume.