CONTENTS

Page

Introduction 273
Tetraxonida 277
Astrophora 277
Family Thenecidae 277
Thenea Gray 278
grayi Sollas 278
grayi, var. sulcata, new variety 280
Sphinctrella Schmidt 280
bifacialis, new species 280
Poecillastra Sollas 282
ciliata, new species 282
Characella Sollas 284
abbreviata, new species 284
Family Stellettidae 285
Subfamily Stellettinae 285
Myriastra Sollas 287
clavosa (Ridley) 287
siemensi (Keller) 291
Stelletta O. Schmidt 293
radicifera, new species 294
radicifera, var. robusta, new variety 296
Ecionemia Bowerbank 296
cribrosa Thiele 297
Subfamily Tethyopsinae 300
Tethyopsis Stewart 300
dubia, new species 300
Family Geodiidae 302
Erylus Gray 304
cornutus, new species 306
Geodia Lamarck 308
philippinensis, new species 311
sparsa, new species 314
japonica (Sollas), var. spherulifera, new variety 317
Sidonops Sollas 319
microspinosa, new species 320
Geodinella Lendenfeld 322
spherastrosa, new species 322
Hadromerina 326
Family Epipolasidae 326
Asteropus Sollas 327
simplex (Carter) 327
Jaspis Gray 329
serpentina, new species 330
Spongosorites Topsent 331
suluensis, new species 331

Tetraxonida—Continued.

Hadromerina—Continued.

Page

Family Donatiidae 333

Donatia Nardo 335

ingalli (Bowerbank), var. seychellensis (E. P. Wright) 335

Tuberella Keller 340

ciliata, new species 341

Family Spirastrellidae 342

Spirastrella O. Schmidt 343

vagabunda Ridley 343

Placospongia Gray 346

melobesioides Gray 346

Family Polymastidae 347

Trichostemma Sars 347

straticulatum, new species 347

Family Suberitidae 351

Rhizaxinella Keller 351

nuda, new species 352

Family Clionidae 353

Family Stylocordylidae 353

Family Chondrosidae 353

Family Astraxinellidae 354

Sigmatophora 355

Family Samidae 355

Family Tetillidae 355

Tetilla O. Schmidt 355

dactyloidea Carter 358

ciliata, new species 360

spinosa, new species 361

(Tetilla) Cinachyrella, new subgenus 363

(Cinachyrella) hirsuta Dendy 363

(Cinachyrella) clavigera (Hentschel) 365

(Cinachyrella) crustata, new species 367

(Cinachyrella) crustata, forma hispida, new form 370

(Cinachyrella) crustata, var. aperta, new variety 371

(Cinachyrella) crustata, var. patellae-spinosae, new variety 373

(Cinachyrella) paterifera, new species 375

Craniella O. Schmidt 377

C. simillima (Bowerbank) 378

Paratetilla Dendy 380

arcifera, new species 380

Cinachyra Sollas 383

Amphitethya Lendenfeld 384

Fangophilina O. Schmidt 385

(Tethyopsilla Lendenfeld) 385

Craniellopsis Topsent 385

Halichondrina 385

Family Haploscleridae 386

Subfamily Gelliinae 386

Gellius Gray 387

varius (Bowerbank), var. fibrosa, new variety 388

angulatus (Bowerbank), var. vasiformis, new variety 390

Tetraxonida—Continued.
Halichondrina—Continued.
Family Haploscleridae—Continued.
Subfamily Gelliinae—Continued.

Page.
Strongylophora Dendy 391
corticata, new species 392
Subfamily Renierinae 394
Halichondria Fleming 394
panicea Johnston 394
variabilis Lindgren 396
Reniera Nardo 397
implexa Schmidt, var. baeri, new variety 398
Petrosia Vosmaer 399
testudinaria (Lamarck) 399
testudinaria, var. fistulophora, new variety 401
lignosa, new species 403
lignosa, var. plana, new variety 404
similis Ridley and Dendy, var. granulosa, new variety 406
crustata, new species 408
Trachyopsis Dendy 409
halichondrioides Dendy 409
Subfamily Chalininae 410
Pachychalina O. Schmidt 411
fibrosa Ridley and Dendy 411
fibrosa, var. gracilis, new variety 412
Siphonochalina O. Schmidt 413
fascigera Hentschel 413
crassifibra Dendy 414
Dactylochalina Lendenfeld 416
exigua (Lendenfeld), var. samarensis, new variety 417
Subfamily Phloeodictyinae 418
Phloeodictyon Carter 419
putridosum (?Lamarck, species) 419
cagayanense, new species 420
Family Desmacidonidae 421
Subfamily Tedaniinae 422
Subfamily Desmacellinae 422
Subfamily Merliinae 425
Subfamily Mycalinae 425
Mycale Gray 425
aegagropila Johnston 426
euplectellioides (Row), var. regularis, new variety 427
Myxilla O. Schmidt 429
crucifera, new species 430
Lissodendoryx Topsent 431
tawiensis, new species 432
Coelosphaera Wyville Thomson 433
toxifera, new species 435
Subfamily Hamacanthinae 436
Hamacantha Gray 436
esperioides (Ridley and Dendy), var. mindanaensis, new variety 437
Subfamily Ectyoninae 439
Clathria O. Schmidt 439
frondifera (Bowerbank), var. seto-tubulosa, new variety 439
fasciculata, new species 442

Tetraxonida—Continued.

Halichondrina—Continued.

Page.

Family Axinellidae 444
Axinyssa Lendenfeld 445
aculeata, new species 445
Lithistida 447
Family Theonellidae 447
Theonella Gray 447
swinhoei Gray 448
swinhoei, var. verrucosa, new variety 450
invaginata, new species 451
cylindrica, new species 454
Discodermia Bocage 455
emarginata Dendy 455
emarginata, var. lamellaris, new variety 456
Jereopsis O. Schmidt 457
fruticosa, new species 458
Family Coscinospongiidae 459
Coscinospongia Bowerbank 460
thomasi (Sollas) 461
Family Pleromidae 460
Costifer, new genus 461
vasiformis, new species 461
Family Scleritodermidae 463
Aciculites O. Schmidt 463
ciliata, new species 463
Family Leiodermatiidae 465
Leiodermatium O. Schmidt 465
pfeifferae (Carter) 465
Appendix to Leiodermatiidae 467
Taprobane Dendy 468
herdmani Dendy 468
Family Neopeltidae 469
Family Siphonidiidae 469
Family Vetulinidae 470
Family Desmanthidae 470
Lithistida incertae sedis 471
Brachiaster simplex, new genus and species 471
Macerated and unidentifiable lithistids 471
Lophacanthus Hentschel 472
Keratosa 472
Family Darwinellidae 473
Ianthella Gray 473
flabelliformis (Pallas) 474
basta (Pallas) 475
Family Spongelidae 475
Spongelia Nardo 476
fragilis (Montagu), var. fasciculata, new variety 476
Family Spongidae 479
Subfamily Eusponginae 479
Phyllospongia Ehlers 480
foliascens (Pallas) 480
aliena, new species 481
Euspongia Bronn 484
officinalis (Linnaeus) 484
irregularis Lendenfeld, var. suriganensis, new variety 486

Keratosa—Continued.

Family Spongidae—Continued.

Page.
Subfamily Aplysininae 487
Psammaplysilla Keller 487
kelleri, new species 488
Subfamily Stelosponginae 491
Hircinia Nardo 491
mutans, new species 491
variabilis F. E. Schulze 494
Bibliography 497
Explanation of Plates 507
Index 523

SILICIOUS AND HORNY SPONGES COLLECTED BY THE U. S. FISHERIES STEAMER "ALBATROSS" DURING THE PHILIPPINE EXPEDITION, 1907-1910

By H. V. Wilson

Kenan Professor of Zoology in the University of North Carolina

INTRODUCTION

The collection of Philippine sponges included only a few Calcarea. These are reserved for separate study. The Hexactinellids were placed in the hands of the late Professor I. Ijima, of the University of Tokio.

The following report, it is hoped, will prove useful to zoologists entering upon the work of classification, as something of a guide to the contemporary taxonomy of sponges, more especially of the tetraxonid sponges, and to the literature dealing with this subject. It may be taken, at the date of writing, as an index to the families and genera of the Astrophora, Hadromerina, Sigmatophora, to the subfamilies of the Halichondrina, and to the families and genera of the Lithistida. In places I have gone more into detail, attempting for instance to list the species of Sigmatophora and Lithistida that have been established since 1903 (the date of the Tierreich synopsis, Lendenfeld, 1903). Doubtless there are omissions.

The phenomena that are roughly grouped under the head of variation force themselves upon the attention of all who undertake to classify sponges. As in former papers (especially 1904) I record, throughout the body of the report, considerable data that come under this head. Such data I am aware can not in themselves lead to any definite conclusions concerning the causes of change—namely, conditions under which changes appear. But they do add to our knowledge of the kinds of variations that occur. They contribute to what we may call the classification of variation phenomena, without a knowledge of which experimental work on the production of new races and the improvement or even the safeguarding of old ones can scarcely go far.

Variation phenomena in a group of such plastic organisms as sponges become involved, perhaps more directly than in many other groups, in the practical work of classification—that is, the setting up of categories or the assigning of bodies to categories already in use. As I point out under *Donatia* and *Tetilla*, it is only by arbitrarily disregarding variation that we can rigidly adhere to a mode of classification which splits genera into subgenera and species into subspecies, with the tacit understanding that there must be a subgroup into which each individual organism will fit. However foreign such a mode of classification is in the abstract to our ideas on the evolution of organisms, it is clear that in the actual work of classification it has to-day a considerable influence.

As to technical methods I can refer those who are not already familiar with such to a previous statement (Wilson, 1902, p. 378). I may add that for sections celloidin imbedding proves very convenient. Surface preparations of dermal and cloacal membranes are desirable. For boiling out spicules many prefer nitric acid to caustic potash. In the study of lithistid desmas the nitric acid is to be followed by hydrofluoric acid (Sollas 1888, p. CLXV). I may add that the crepis of the desma is sometimes more distinct in water than in balsam; I have also used to advantage pure glycerine and, again, cedar oil.

The customary methods are employed with respect to spicule measurements—that is, the aim is always to give an idea as to the characteristic size, namely, the common average, young forms and extremes being excluded. For this purpose sometimes the dimensions of selected representative spicules are given; sometimes an average is given covering a number of spicules of commonly occurring sizes. More often, perhaps, the common range of size, common minimum to common maximum, is given. With this understanding the qualifying word "about" has been usually omitted.

There is a minor linguistic matter in which English-writing zoologists should, it seems to me, reach an agreement. I refer to the formation of plurals in the case of words like desma, dragma, sigma, toxa (some of the dictionaries give toxon, but it is the made-over form, toxa, that has come into actual use in the literature, following Sollas, not the Greek singular), oxea, chela, etc. We use such words in the singular as English words and there is no valid linguistic reason for not following Sollas' example (1888, p. LIX) in using the "s" plural. Where the word has preserved its Latin form (as chela) we especially shrink from this plural, but I realize that if the terms are to be used freely by many, as should be the case, we must use them as English words and as we now say museums, so must we learn to say aquariums and chelas. In this reform spirit I have gone over my text and endeavored to bring it throughout into conformity with Sollas' principle. The singular forms clad, rhabd, which demand the "s" plural, are used instead of the Latin forms, cladus, rhabdus, etc.

Dendy[1] (1921, p. 101) takes particular exception to the use of oxea in the singular as "erroneous" and would use oxeon, plural

---

[1] The death of this eminent investigator, to whom we owe so much, was announced while this paper was passing through the press.

oxea. But oxea in the singular is now a well-recognized word, classified as modern Latin by the dictionaries, having arisen as a viable form through Professor Sollas' operation on the Greek adjective. Oxeon would seem to be a word of contemporary coinage and unnecessary. The adjective should then be oxeate and not oxeote.

For the precise location and characteristics of the stations at which sponges were taken I refer to United States Bureau of Fisheries Document No. 741 (Dredging and Hydrographic Records of the U. S. Fisheries Steamer *Albatross* during the Philippine Expedition, 1907–1910, Washington, 1910).

An outline of the classification followed in this report is here given:

Class Noncalcarea Vosmaer, 1887.

Order 1. Myxospongida Dendy, 1905 (Myxospongiae part Lendenfeld, 1885, history of term here reviewed; Myxospongiae Sollas, 1888, p. XCVIII).—Simple forms without a skeleton. Absence of skeleton primitive. The genera are *Halisarca* Dujardin, 1838, *Oscarella* Vosmaer, 1887, *Bajulus* Lendenfeld, 1886, *Hexadella* Topsent, 1896. With regard to the position of these sponges there is marked disagreement. Lendenfeld, 1889, 1894*c*, looks on *Halisarca* and *Bajulus* as degenerate derivatives of *Darwinella* and assigns them to his Hexaceratina (in the Triaxonia), to which group Topsent, 1896*b*, also assigns *Hexadella*. *Oscarella* is separated by Lendenfeld, 1889, 1903, 1906, from the other genera of the group, as here understood, and transferred as a family (Oscarellidae) to the Homosclerophora (Microsclerophora). Hentschel, 1909, 1912, follows the same practice and further combines *Hexadella* with *Oscarella*.

Order 2. Hexactinellida O. Schmidt, 1870 (Triaxonia, F. E. Schulze, 1887).—With triaxonid (characteristically hexactinellid) siliceous spicules.

Order 3. Tetraxonida Dendy, 1905 (Demospongiae Sollas, 1888, minus Ceratosa).—The characteristic form of spicule is a siliceous four-rayed sclerite, each ray representing a particular axis (tetraxonid or tetractinellid spicule). But in some groups these spicules have been lost.

Suborder 1. Homosclerophora Dendy, 1905. (Microsclerophora Sollas. 1888; Microsclerophora part Lendenfeld 1889).

Family 1. Plakinidae F. E. Schulze, 1880.—The genera are *Plakina* F. E. Schulze, 1880; *Plakortis* F. E. Schulze, 1880; *Plakinastrella* F. E. Schulze, 1880 (assigned by Sollas, 1888, to Theneidae, by Dendy, 1905, to Pachastrellidae); *Dercitopis* Dendy, 1905.

Family 2. Corticidae Vosmaer, 1887, Sollas, 1888.—Lendenfeld, 1903, deletes the family. The genera are *Corticium* O. Schmidt, 1862 (assigned by Lendenfeld, 1903, to the Plakinidae); *Calcabrina*, Sollas, 1888 (synonymous with *Stoeba* Sollas, 1888, according to

Dendy, 1905); *Corticella* Sollas, 1888 (merged by Lendenfeld, 1903, in *Calthropella* Sollas, 1888); *Rhacella* Sollas, 1888 (merged by Lendenfeld, 1903, in *Plakina*).

Family 3. Thrombidae. The only genus is *Thrombus* Sollas, 1888. Lendenfeld, 1903, transfers the genus to the Plakinidae, deleting Thrombidae.

(For the definitions and contents of the remaining groups which are given by name below, see the text.)

Suborder 2. Astrophora Sollas, 1888.

Suborder 3. Hadromerina Topsent, 1898. (Hadromerina Topsent, 1898*c*, plus Chondrosidae; Pseudotetraxonina Vosmaer, 1887, plus Clavulina Vosmaer, 1887, plus Oligosilicina part Vosmaer, 1887, plus; Clavulina Vosmaer, Ridley and Dendy, 1887, plus; Spintharophora Sollas, 1888, minus Axinellidae plus Epipolasidae Sollas, 1888, plus Placospongidae Sollas, 1888, plus; Astromonaxonellida Dendy, 1905.)

Suborder 4. Sigmatophora, Sollas, 1888.

Suborder 5. Halichondrina Vosmaer, 1887 (Halichondrina Authors, Sigmatomonaxonellida Dendy, 1905.)

Suborder 6. Lithistida O. Schmidt, 1870.

Order 4. Keratosa Grant, 1826, 1861.

A close linkage of the Astrophora and Hadromerina on the one hand, under the designation Astrotetraxonida (Hentschel, 1909), and of the Sigmatophora and Halichondrina on the other, under the designation Sigmatotetraxonida (Hentschel, 1911*a*), has come into extensive use in recent years (Dendy, Hentschel, and others; also the Zoological Record). It has not been, however, by any means universally adopted (see Topsent, Thiele), and I am now inclined to believe that it rests on too many assumptions. And yet it is generally recognized that many of the Hadromerina give indication of their descent from the Astrophora, the relationship between the two being fully as close as, if not closer than, that between the Astrophora and Sigmatophora. This makes somewhat artificial the maintenance of the older groups Tetractinellida, comprising the Astrophora and Sigmatophora, and Monaxonida, comprising the Hadromerina and Halichondrina, for we are very much in the dark as to the genetic relationship between the two latter subdivisions. Under these circumstances recourse may be had to the noncommittal method of arranging the subgroups (Astrophora, Hadromerina, Sigmatophora, Halichrondina) serially, and this to-day seems to me the best practice.

The collection is deposited in the United States National Museum.

Since the manuscript of this report was completed, several memoirs of importance have appeared, but the writer believes that the data in them, however valuable, do not necessitate changes in the views on classification here adopted.

SYSTEMATIC DESCRIPTION.

Order TETRAXONIDA.

Demospongiae Sollas, 1888, minus *Ceratosa*.
Tetraxonida Dendy, 1905.

The characteristic form of spicule is a silicious four-rayed sclerite, each ray representing a particular axis (tetraxonid or tetractinellid spicule). But in some groups these spicules have been lost.

Suborder ASTROPHORA.

Astrophora Sollas, 1888.

With tetraxonid megascleres and astrose microscleres; without desmas.

The families are: Theneidae, Stellettidae, and Geodiidae.

Family THENEIDAE.

Theneidae Sollas plus *Pachastrellidae* (Carter), Sollas, 1888.
Asterostreptidae Topsent, 1902*b*.
Stellettidae part plus *Pachastrellidae* Lendenfeld, 1903.
Theneidae plus *Pachastrellidae* Lendenfeld, 1906.
Pachastrellidae Hernandez, 1914.

The characteristic astrose microscleres are streptasters; oxyasters occur also in some species. The ectosome does not form a cortex.

I follow Topsent in combining the Theneidae and Pachastrellidae, but it does not appear that the new name Asterostreptidae is necessary, unless the old groups are retained as subfamilies. But it seems clear that the genera can not at present be successfully thrown into groups. The family is therefore to be directly divided into genera. As to the choice of name for the combined group, *Thenea* Gray (1867) antedates *Pachastrella* Schmidt (1868).

In addition to the component genera recognized by Topsent, 1902*b* (*Thenea* Gray, *Sphinctrella* Schmidt, *Poecillastra* Sollas, *Pachastrella* Schmidt, *Nethea* Sollas, *Triptolemus* Sollas, *Characella* Sollas) are to be added *Chelotropaena* Lendenfeld (1906, p. 231), and *Yodomia* Lebwohl (1914, p. 63; Dendy, 1916, p. 232).

Other genera classed by some in the Theneidae or Pachastrellidae, but in actual fact (namely, without employing phylogenetic interpretation) excluded from the combined family as here defined, are:

Stoeba Sollas (1888, p. 102). Of uncertain position. Assigned by Sollas to the Theneidae, by Dendy (1905) to the Pachastrellidae; merged by Topsent (1902) and Lendenfeld (1903) in *Dercitus* Gray.

Dercitus Gray (1867, p. 542). Of uncertain position. Assigned by Sollas (1888), Lendenfeld (1903), Hentschel (1909), and Lebwohl (1914) to the Pachastrellidae; by Topsent (1902) to the Stellettidae.

Ancorella Lendenfeld (1906, p. 247).

Pacamphilla Lendenfeld (1906, p. 251). (See Hentschel, 1912, p. 308.)

Calthropella Sollas (1888, p. 107). Assigned to Pachastrellidae by Sollas and by Lendenfeld (1903); by Topsent (1902) to Stellettidae and merged in *Corticella* Sollas; by Lendenfeld (1906, p. 301) to his new family Calthropellidae, a family of doubtful value, which I prefer not to use. Genus, I believe, is best assigned to the Stellettidae.

Chelotropella Lendenfeld (1906, p. 302). Likewise best assigned to the Stellettidae, if, indeed, the genus is to be used.

Pachastrissa Lendenfeld (1903, p. 80). Genus of doubtful value.

Scutastra Hernandez (1912, p. 12; 1914, p. 8). Assignable to Geodiidae.

Genus THENEA Gray (1867).

Thenea Gray, 1867, p. 541.

Of more or less symmetrical shape; with one or more conspicuous oscula and with specialized lateral pore areas in addition to scattered pores. With rootlets. The characteristic megascleres are dichotriaenes, arranged with other megascleres (triaene forms and oxeas) radially.

THENEA GRAYI Sollas.

Plate 45, figs. 1 and 2.

Thenea grayi Sollas, 1888, p. 65.

Three small specimens, one each from stations 5127, 5424, and 5425, are referable to this species, and indeed to the typical form *T. grayi grayi* (Lendenfeld, 1903). They range in diameter from 12 to 15 mm. As in Sollas' type (1888, p. 65, pl. 6, figs. 21, 22), the upper surface is flattened and without an osculum. The under surface is rounded or somewhat conical and bears several bundles of root spicules, the longest 20 mm. in length. As in the type there are two large, lateral, depressed, fringed aquiferous areas opposite one another; the fringes much longer along the upper margin, projecting here 10–13 mm. The upper surface of the sponge is more or less hirsute with spicules that project about 2 mm.

Sollas interprets one of the aquiferous areas as oscular, the other as inhalent. This interpretation is supported by my specimens, in which there is a constant anatomical difference between the two areas. Both are shallow, cloacalike spaces into which open numerous canals. But whereas the exhalent space is covered in with a coarsely fenestrated membrane the inhalent space is covered in with a much finer fenestrated membrane, the apertures in the latter ranging from about 150 to 250 μ in diameter. Nevertheless, the inhalent membrane may include a few larger apertures, which seem to be natural. It is a curious fact that directly in the center of the inhalent membrane there opens a canal coming from the interior of the sponge and quite unconnected with the surrounding vestibular space, that is roofed over by the membrane. The areas are different again in that the inhalent one is in all specimens considerably larger than the exhalent. Both are circular or ellipsoidal in outline.

Spicules.—1. Dichotriaenes, abundant, clads overlapping; rhabdome 1,800–3,500 by 70 μ, protoclad 200 by 70 μ, deuteroclads 1,000–1,150 μ long.

2. Protriaenes; rhabdome reaches 4.5 mm. by 70 μ; clads 700 μ in length, strong, curving.

3. Oxeas. In the fringes the spicules are of the length of the fringe and about 35 μ thick.

Similar slender oxeas, about 4 mm. long, often but not always accompanying the rhabdomes of the triaenes; also projecting generally from the surface, along with smaller ones down to 700 μ long. Stouter oxeas, usually somewhat curved, occur in interior, 4.5 mm. by 70 μ.

4. Anatriaenes. In the spicules of the body, clads 35–60 μ long, rhabdome long and slender.

Roots chiefly made up of very long, slender anatriaenes, with some oxeas. Clads of anatriaenes reach length of 0.5 mm., with a basal thickness about equal to that of rhabdome, 8–10 μ. Such anatriaenes were only seen near the ends of long roots; probably no such roots have been preserved in specimens of this species hitherto recorded.

5. Streptasters.

Plesiasters (pl. 45, fig. 1), very abundant throughout sponge, with 4 rays, ray length 80–140 μ.

Metasters (pl. 45, fig. 2, *a*, *b*), also very abundant throughout sponge; axis very short and curved, with 5–7 rays, ray length 20–36 μ.

Spirasters (pl. 45, fig. 2, *c*), total length 24–36 μ, ray length 10–16 μ; rays about 9–12 in number. Very abundant in the fenestrated membranes of the aquiferous areas; much less abundant in the general ectosome.

All three classes of streptasters grade into one another. But the intergrades are not numerous. The metasters, so designated by Sollas, have so small a number of rays that they differ only slightly, except in size, from the plesiasters.

Sollas' specimens (1888) came from Australian waters. Thiele (1898) records the type and eight subspecies from Japan. Lebwohl (1914) also records the type from Japan.

THENEA GRAYI, var. SULCATA, new variety.

A small specimen from station 5178, about 10 mm. in diameter, differs from the above in several points.

The upper surface is smooth and not hirsute, showing plainly under a lens the scattered pores. The under surface is well plastered with sand grains, etc.

The cloacal space is not covered in with a fenestrated membrane but is quite open; in other respects like that of the type. The inhalent area is expanded horizontally to such a degree that it extends more than halfway round the sponge in the shape of a long groove, much as in a specimen of *Thenea muricata* figured by Vosmaer (1882, pl. 1, fig. 1), or as in *T. pendula* Lendenfeld (1906, p. 210, pl. 22, figs. 11, 12.) The inhalent membrane is also more finely fenestrated than in the specimens of the type, the apertures ranging from 75 to 150 μ in diameter.

Several of the skeletal elements are smaller than those of the type. Thus in the 4-rayed plesiaster the common length of ray is only about 50 μ. In the metaster, with 6–7 rays, the common ray length is 16–20 μ. The dichotriaenes in the fragment examined had short deuteroclads, varying in length from 260 to 700 μ.

Genus SPHINCTRELLA Schmidt (1870).

Sphinctrella SCHMIDT, 1870, p. 65.

Massive, or lamellar, or sometimes incrusting forms. Without specialized pore areas. With one or many cloacal depressions fringed with long oxeas, into which numerous efferent canals open; cloaca may or may not be uniformly lined with a fenestrated membrane. Radially arranged triaenes are typically present over the whole or a part of the surface, but these may be absent. Similar triaenes, or the calthrops form, usually occur in the interior. Small oxeas (microxeas), varying considerably in size, represented sometimes by microtriads and microcalthrops, are scattered through the body.

SPHINCTRELLA BIFACIALIS, new species.

Plate 37, fig. 1; plate 45, figs. 4, 6.

Station D5543, one specimen.

Sponge massive, somewhat flattened from above downward; attached on the side to a coralline mass. The horizontal outline is roughly triangular; horizontal diameter 80 to 90 mm.; greatest vertical diameter 45 mm. One surface, doubtless the upper, bears a large cloacal depression about 10 mm. deep with an aperture 35 by 12 mm. The remaining surface represents the latero-inferior surface of the sponge.

The upper surface is thickly covered with projecting megascleres, protruding 2–3 mm. These prove to be long slender oxeas with a few of the large skeletal oxeas intermingled. Round the margin of the cloacal aperture (pl. 45, fig. 4, *c. m.*) these spicules, here somewhat longer, are inclined obliquely to the upper surface and radiate toward the center of the aperture, constituting a cloacal fringe. Much of the fringe has been destroyed, but in places it projects 4–5 mm.

The outer margin (pl. 45, fig. 4, *o. m.*) of the upper surface is a sharp edge which distinctly separates this surface from the latero-inferior surface of the sponge. At this edge the protruding spicules of the upper surface project radially outward and are longer than elsewhere, projecting in places 5–6 mm., constituting a marginal fringe which has been in large part destroyed.

The latero-inferior surface (pl. 45, fig. 4, *l. s.*) of the sponge is considerably injured. Nevertheless enough remains to show its character. It is smooth and is riddled with evenly scattered pores about 50 μ in diameter. Here and there long slender oxeas protrude.

The wall of the cloaca (pl. 45, fig. 4, *c. w.*) is smooth; not uniformly lined with a fenestrated membrane. It is largely occupied by the open apertures of canals 3–5 mm. in diameter, between which are the mouths of some smaller canals closed in with porous membranes. The sponge is fragile; excavated by numerous canals, many as large as 3–5 mm. in diameter.

The upper surface of the sponge is supported by the tangentially placed clads of abundant triaenes. These are absent over the latero-inferior surface, but a few are found in the interior of the sponge. The latero-inferior surface is supported by the ends of radially placed large oxeas (the strongyle variant is not infrequent), usually grouped in bundles of a few spicules. Through the interior the large skeletal and the long slender oxeas are freely scattered. The parenchyma is further supported by the microxeas with which it is densely filled.

Spicules.—1. Orthotriaene with short rhabdome. Clads 500–1100 by 50–80 μ, characteristic size about 900 by 60 μ; clads of a spicule frequently unequal in length. Rhabdome generally one-third to one-half the length of a clad, occasionally as long as a clad; commonly 250–350 by 50–70 μ.

2. Oxea, large skeletal form. Smooth, slightly curved, tapering evenly to points; 2.5–4.5 mm. by 60–90 μ, with smaller sizes down to 1800 μ by 35 μ. The large sizes are characteristic. The spicule is sometimes strongylate.

3. Oxea, slender form; 1.5–12 mm. by 10–20 μ; common lengths 2–7 mm. The spicule is occasionally strongylate.

4. Small oxea (microxea), about 250 μ by 4 μ.

5. Streptaster, very variable, ranging from the plesiaster to the spiraster; 16–40 µ long; all types abundant and intermingled. Abundant in the dermal membrane, cloacal wall, and canal walls; less abundant in the parenchyma between the canals. The following types are distinguishable:

(*a*) Extreme plesiaster (pl. 45, fig. 6, *a*); total length 40 µ, ray length 25 µ, number of rays 4–5, axis very short.

(*b*) Plesiaster with 5–6 rays (pl. 45, fig. 6, *b*); total length 32 µ, ray length 14–20 µ, axis very short.

(*c*) Metaster with about 9 rays (pl. 45, fig. 6, *c*); total length 24 µ, ray length 12 µ; axis short and curved.

(*d*) Spiraster (pl. 45, fig. 6, *d*); total length 16–20 µ, ray length 6–8 µ, number of rays about 10–12; axis elongated, showing one or two curves.

Holotype.—Cat. No. 21296, U.S.N.M.

In this species the differentiation of two surfaces, virtually an upper and a lower, is noticeable. One of the most marked features of this differentiation concerns the radial megascleres. If we conceive an earlier arrangement in this group to have been that of radial bundles consisting of oxeas grouped round the rhabdome of a triaene, as in species of *Thenea*, we may say that in the evolution of *Sphinctrella bifacialis* the radial bundles have split in two classes, in one of which the triaene alone is represented, in the other only the oxeas.

Genus POECILLASTRA Sollas (1888).

Poecillastra SOLLAS, 1888, p. 79.

Typically of plate-like form, the one surface bearing pores, the other small evenly dispersed oscula. No specialized pore or oscular areas. Triaenes, often rare, sometimes reduced to triods, occur at the surface in the usual position, with rhabdome radial; similar triaenes, or the calthrops form, are commonly present scattered in the interior. Small oxeas, microxeas of good size, are scattered throughout the sponge; in some species smaller ones, dermal microxeas, are concentrated in the ectosome. Genus extends over toward *Characella* and *Pachastrella*.

Poecillastra Sollas (1888, p. 79) is retained, with Topsent (Topsent 1902*b*, p. 10; Wilson 1904, p. 109), in spite of the fact that it is not sharply separable from *Characella* and *Pachastrella*. Several authors, Lendenfeld, Dendy, Lebwohl, would merge it in *Pachastrella*. But as numerous specific forms become known, what sponge genera are sharply separable?

POECILLASTRA CILIATA, new species.

Plate 37, fig. 3; plate 45, figs. 8, 9.

Station 5424, one specimen. Sponge body a lamella about 2 mm. thick, probably more or less vertical in nature, 60 mm. wide, and

45 mm. high. A broken edge in one region is interpreted as the lower. The remaining and larger part of the edge is rounded and uninjured, evidently free. The lamella is somewhat curved, and the curvature is irregular, but in the region of the free margin one surface is slightly convex, the other concave.

The two surfaces of the lamella are alike in that each is covered with abundant small apertures, often about 100 μ in diameter, but ranging from 60 to 250 μ, the differences in size perhaps being due in part to different degrees of closure. Typically there is one aperture in each mesh of the dichotriaenal reticulum. Each leads into a canal which penetrates the interior of the sponge. Doubtless one surface is the pore, the other the oscular surface, but anatomically they are not distinguishable.

Spicules.—(1) Dichotriaenes (pl. 45, fig. 9), alike on both surfaces, cladomes at the surface, rhabdomes radial. The clads overlap, forming a rather irregular reticulum. Protoclad 100 by 70 μ; deuteroclads 360 μ long, strong; rhabdome 450 by 75 μ, tapering, pointed. A few dichotriaenes occur in the interior, where they occupy no constant position with respect to the sponge surfaces.

(2) Large oxeas, slightly curved, commonly about 2 mm. by 70 μ; passing radially or obliquely through the sponge, the two ends projecting on opposite surfaces; also scattered tangentially and obliquely in interior, some of the internal spicules reaching 3.5 mm. by 80 μ.

(3) Long, slender oxeas, about 850 by 8 μ; spicules projecting, obliquely radial, especially round the rhabdome of the triaenes; inequiended, the outer slenderer end very thin and like a whiplash, often broken off. Alike on both surfaces.

(4) Small oxeas (pl. 45, fig. 8, *a*), classed as choanosomal microxeas, 160–220 by 6 μ, with slight centrotylote ringlike enlargement; very abundant in parenchyma. Spicules offering a transition to the dermal microxea can be found on searching, but they are very few.

(5) Dermal microxeas (pl. 45, fig. 8, *b*), 32–40 by 4 μ; spicule slightly centrotylote; the two halves very slightly bent upon one another, the spicule thus presenting an angular projection at the middle; lying tangentially in the dermal membrane of both surfaces, forming a thin but dense crust.

(6) Streptasters (pl. 45, fig. 8, *c*) of the metaster type, varying toward the amphiaster and plesiaster. Axis short and slightly curved, rays long and slender; rays commonly grouped near the ends of the axis, 3 to 6 at each end. The larger spicules approach the plesiaster type. In end view the spicules appear as oxyasters. Total length of spicule 16–30 μ. In the walls of canals and scattered in parenchyma.

Holotype.—Cat. No. 21290, U.S.N.M.

Genus CHARACELLA Sollas (1888).

Characella Sollas, 1888, p. 91.

Massive, sometimes vaselike, also incrusting. Triaenes localized at periphery of body, in the usual position with radial rhabdome. Microxeas present, sometimes differentiated into larger (choanosomal) and smaller (dermal) ones.

CHARACELLA ABBREVIATA, new species.

Plate 37, fig. 7; plate 45, figs. 7, 10.

D5513, one specimen.

Sponge massive, irregular; attached by under surface. Horizontal diameters 70 mm., 50 mm.; vertical diameter 40 mm. Upper surface feebly hirsute with oxeas projecting 1–3 mm.; latero-inferior surface smooth. Color, light brown.

Dermal membrane riddled with pores, about 100 μ in diameter, lying everywhere between the tangential rays of the supporting triaenes. Numerous small oscula, 0.5 mm. and less in diameter, scattered over the surface in general. On the upper surface is an efferent aperture 9 by 5 mm., crossed by a bar of ectosome, leading into a very shallow cloaca, the wall of which is studded with the mouths of canals, 2–3 mm. in diameter.

Spicules.—(1) Orthotriaene (pl. 45, fig. 10); abundant; clads long, tangential, overlapping, in more than one layer, and constituting an irregular reticulum which supports the dermal membrane; rhabdome short and radial, sometimes aborted and then appearing as a rounded tubercle; all rays smooth, strong, and pointed. Clads 300–800 μ long; characteristic size 600–700 by 50–60 μ. Rhabdome commonly 300–350 μ by 55–70 μ.

(2) Large oxea (pl. 45, fig. 10); characteristic size 2.4 mm. by 80–90 μ; smooth, equiended. Some radial and projecting; others scattered promiscuously in parenchyma.

(3) Choanosomal microxea (pl. 45, fig. 7, *a*); 150–300 by 5 μ; characteristic size 280 by 5 μ. Very abundant throughout the interior, especially abundant around canals.

(4) Dermal microxea (pl. 45, fig. 7, *b*); smooth, spindle-shaped, not centrotylote; 40–60 by 3 μ, commonly about 48 by 3 μ. Abundant in dermal membrane.

(5) Streptasters (pl. 45, fig. 7, *c*); of the amphiaster type. Axis short and slender, about 4 μ long; rays long, slender, tapering, 12–16 μ long; 3–4 rays at each end of the axis; total length of spicule commonly about 30 μ. Rarely a larger form, of the plesiaster type, occurs; total length 48 μ, with only 4 rays.

Holotype.—Cat. No. 21255, U.S.N.M.

The rhabdome of the triaene is, as said, not infrequently reduced in this species to a tubercle. This variation has been fixed, so to speak, in *Nethea*, in which genus the triaenes are not localized at the surface but are scattered through the sponge. (Topsent, 1902*b*, p. 11.)

Family STELLETTIDAE.

Stellettidae SOLLAS, 1888; LENDENFELD, 1903.

The tetraxon megascleres are triaenes, radially arranged. With euasters, some of which are slightly modified in certain species in the direction of streptasters, but without true streptasters or sterrasters. In addition, microrhabds or sanidasters occur in some species.

Dendy (1916) would include in the Stellettidae certain reduced or epipolasid genera, *Asteropus* Sollas and *Jaspis* Gray. I believe it is best, considering all the purposes for which our classification schemes are used, not to follow this practice but to retain the Epipolasidae as a hadromerine (astromonaxonellid) family, thus adhering to objective fact rather than to deductive reasoning. Of course, as everyone knows, it is not possible to do this always and at the same time to avoid practices that are artificial. A case in point is that of *Geodinella spherastrosa* (see p. 322), a species strictly without triaenes and yet one which is undoubtedly assignable to the Geodiidae, since it has all the other very characteristic marks of this family and since the monaxon megascleres are shown by certain vestiges, still recognizable, to be reduced triaenes.

Subfamily STELLETTINAE.

Stellettinae LENDENFELD, 1906, p. 253.

Without a special cloacal tube.

In addition to the genera represented in the collection (*Myriastra*, *Stelletta*, and *Ecionemia*) the subfamily includes the following:

Astrella Sollas (1888, p. 136). Merged in *Stelletta* by Lendenfeld 1903.

Anthastra Sollas (1888, p. 138). Merged in *Stelletta* by Lendenfeld 1903.

Dragmastra Sollas (1888, p. 187) emended, Dendy (1916, p. 237).

Aurora Sollas (1888, p. 187). See Dendy 1916, p. 242, for an important discussion of this genus. He would include certain species (of *Aurora*) strictly without triaenes but which he regards as reduced or "epipolasid" forms—namely, forms in which the monaxon megascleres more or less obviously represent triaenes in which the clads have degenerated. These species are : *Coppatias* (*Rhabdastrella*) *distinctus* Thiele (1900), *Diastra sterrastrosa* Row (1911), and *Aurora cribriporosa*, new species. I prefer to retain *Diastra* Row, and to merge *Rhabdastrella* Thiele in *Jaspis* (*Coppatias*). See Hadromerina.

Ancorina O. Schmidt (1862, p. 51). Sollas (1888, p. 182) includes here forms with a well-developed fibrous cortex, with euasters and sanidasters. Lendenfeld, 1903, enlarges the genus to include several others as subgenera. In 1906 (p. 253) Lendenfeld uses the genus in Sollas' sense plus *Stryphnus*, limiting it to forms with dichotriaenes. The genus is understood by me in Sollas' sense. The question as to the distinction between sanidasters and roughened microrhabds, and the separation of *Ecionemia* from *Ancorina*, is touched upon under *Ecionemia*.

Sanidastrella Topsent (1892 *c*, p. XVIII). To be retained? It would seem there is nothing in the spiculation to mark off the genus from *Ancorina*. The megascleres and sanidasters are essentially the same, and large oxyasters occur in *Ancorina*—as, for example, in *A. wageneri* O. Schmidt, merged in the type species, *A. cerebrum* O. Schmidt, by Lendenfeld, 1894, p. 29, the ray length here reaching 45 µ (Sollas, 1888, p. 189; Lendenfeld, 1894, p. 35).

Rhabdodragma Dendy (1916, p. 239). Distinct from *Ecionemia?*

Stryphnus Sollas (1888, p. 171). Lendenfeld, 1903, 1906, makes it a subgenus of *Ancorina*.

Algol Sollas (1888, p. 200). Subgenus of *Ancorina* in Lendenfeld, 1903; presumably also in Lendenfeld, 1906.

Penares Gray (1867, p. 542). Equivalent to *Papyrula* O. Schmidt, as used by Sollas, 1888, p. 198. Stellettids with small, smooth oxeas usually controtylote, which are densely aggregated in the ectosome. This small oxea, or "microxea" Authors, is a very different spicule from the micorhabd of *Ecionemia*, as is shown not only by its shape but by its much greater and very variable size. The length of the spicule ranges in the type species, *P. helleri* (O. Schmidt), from 20 to 175 µ, its thickness from 2 to 10 µ (Lendenfeld, 1903, p. 61). In *P. sollasi* Thiele (1900, p. 23), the spicule ranges in length from 26 to 90 µ; in *P. foliaformis* Wilson (1904, p. 114) from 60 to 160 µ; in *P. obtusa* Lendenfeld (1903, p. 263) from 100 to 150 µ; in *P. sclerobasa* Topsent (1904, p. 83), the length is 100 µ, thickness at the middle 12 µ.

Dercitus Gray. Position? See p. 277.

Calthropella Sollas. See p. 278.

Chelotropella Lendenfeld. See p. 278.

Appendix—*Papyrula* O. Schmidt (1868, p. 18. Sollas, 1888, p. 199. Lendenfeld, 1903, p. 69) may be provisionally retained for forms differing from *Penares* in the absence of euasters. Lendenfeld, 1906, p. 227, regards the small oxeas as derived from metasters and enrolls the genus in the Theneidae.

Genus MYRIASTRA Sollas (1888).

Myriastra SOLLAS, 1888, p. 112, plus *Pilochrota* SOLLAS, 1888, p. 120.

The ectosome is sometimes simple and collenchymatous, sometimes differentiated to form a fibrous cortex. Microscleres are euasters of one sort.

Lendenfeld (1903, 1906) merges *Myriastra* in *Stelletta* O. Schmidt. In this he is followed by Hentschel (1912). Dendy, on the other hand, retains (1905, 1916, 1916b) the genus, in which, doubtless with justice, he merges (1916) the forms which have an ectosome that is differentiated into a cortex and which have been grouped by many (Sollas, 1888; Wilson, 1902; Topsent, 1904; Dendy, 1905; Row, 1911; Stephens, 1912) under *Pilochrota* Sollas.

MYRIASTRA CLAVOSA (Ridley).

Plate 37, fig. 6.

Stelletta clavosa RIDLEY, 1884, p. 474.
Myriastra clavosa SOLLAS, 1888, p. 116.

Of this well-known species, a large number of specimens were taken, in different localities. All specimens spheroidal, with the horizontal diameter usually somewhat greater than the vertical; horizontal diameter ranging from 5 to 22 mm. The data as to color differences are, as is usual with collection material, scarcely more than suggestive. The color is sometimes whitish gray or light brown, sometimes reddish or pinkish brown, often greenish, sometimes greenish with patches of dull reddish purple. Some of the specimens are with embryos. In the great majority of the specimens there is a distinctly developed cloaca.

Station D5141. Eight specimens, 8–13 mm. in diameter, intergrading between classes "with cloaca" and "without cloaca." (See below.)

D5145. Nine specimens, 8–12 mm. diameter, with distinct cloaca. Seventeen specimens, 8–12 mm. in diameter, without distinct cloaca.

D5158. About seven dozen specimens, 11–20 mm. diameter, with distinct cloaca. A dozen specimens, 9–14 mm. in diameter, without distinct cloaca.

D5160. Twenty specimens, 13–22 mm. in diameter, with a cloaca. Two sponges have fused with one another, by the side.

D5174. Three specimens, about 10 mm. in diameter, with distinct cloaca.

D5205. Sixteen specimens, 5–10 mm. in diameter, with distinct cloaca except in some of the smallest.

D5218. Nine specimens, 18–21 mm. diameter, with a cloaca.

The species is a common one, occurring widely in East Indian waters (China Sea, Ternate, Amboina, Torres Straits, etc.) and in the neighboring part of the tropical Pacific (Lendenfeld, 1903, p. 48; 1906, p. 287; Hentschel, 1912, p. 310).

The shape is recorded as spheroidal, usually oblate (Ridley, 1884, p. 474; Sollas, 1888, p. 116; Topsent, 1897, p. 433; Lindgren, 1898, p. 331; Lendenfeld, 1903, p. 48; 1906, p. 287; Hentschel, 1912, p. 310), the diameter ranging from 5 to 14 mm. Only in the case of an isolated specimen, considered by Topsent (1897, p. 433) to belong to this species, is a different shape recorded. This specimen is a relatively large one, of compressed shape, 45 mm. high, 40 mm. wide, 10–20 mm. thick, exhibiting on its upper border two oscula 3–4 mm. wide. Details are not given, except that in the chiasters the rays are tylote or minutely tuberculate. In view of the general uniformity as to shape and size in the species, possibly this specimen would best be enrolled as a variety.

The recorded colors embrace yellowish, greenish white, a purplish tint, grayish brown, blackish brown, reddish white. It would seem that the natural color, if at all constant, includes green and purple tints.

In my specimens, as in the others found (see Sollas, 1888, p. 116), the pores are uniformly distributed in sievelike areas. The ectosomal trabeculae between these areas, which are often about 200 µ wide, contain the clads of the dichotriaenes, the surface appearing reticular. The stratum of small subdermal chambers into which the pores open directly, and which largely fill the ectosome (Sollas, 1888), is present. But I do not find that these chambers are divided by horizontal partitions into outer and inner portions (Sollas). From the chambers incurrent canals pass radially into the interior. But these, together with the radial skeletal bundles stop short of the central region, which thus lacks a radiate arrangement.

Variation in the cloaca. A small cloaca, opening by an osculum in the center of the upper surface, is a characteristic of the species. Sollas gives the most precise statements, but the cloaca described is exceptionally small. (See Lendenfeld, 1906, pl. 29, fig. 7.) He says (1888, p. 117) that the cloaca is in the shape of a short cylindrical tube about 1 mm. deep by 0.725 mm. wide, opening by an osculum surrounded by an oscular membrane. In the accounts of some other specimens it remains uncertain whether a distinct cloaca was present. In Dendy's specimens, for instance, from Ceylon, all small, 9 mm. or less in diameter, there is only "a single, slightly depressed vent" (1905, p. 72).

In the great majority of my specimens a distinct though small cloaca is present, opening by an osculum, surrounded by an oscular membrane, which occupies the center of the upper surface; numerous small efferent canals opening into the cloaca. The cloaca is rounded or conical in shape, commonly 2–4 mm. deep, 2–4 mm. wide, the osculum 1–2 mm. wide. The cloaca typically extends inward symmetrically toward the center of the sponge (pl. 37, fig. 6, right). But in some specimens it extends inward very obliquely (pl. 37, fig. 6, left).

In a small yet considerable minority of the specimens a distinct cloaca is not developed. Instead, the osculum, remaining apical as usual, is simply the aperture of a single small efferent canal. Or in place of cloaca and osculum there is only a most minute depression into which several small efferent canals open. Such specimens occur along with the common type in the same locality. Many of them are small, but some are of good size, 10–14 mm. diameter. There is intergradation between the two classes in the same locality. The facts indicate that with continued growth there is a strong tendency in the species to develop a cloaca, but that this tendency is inhibited, or possibly is germinally weak, in some individuals, which therefore reach a considerable size, 14 mm. in diameter or thereabouts, without developing a cloaca.

Table giving data for nine individuals concerning variation in the cloaca.

		Diameter of sponge.	Cloaca.	Diameter of osculum.
		Mm.		Mm.
Individuals with well developed cloaca.	Sponge 1	18	Rounded at bottom, 3 mm. deep, 3 mm. wide.	1
	Sponge 2	17	Funnel-shaped, 4 mm. deep, 2 mm. wide.	1
	Sponge 3	16	Funnel-shaped, 3 mm. deep, 2 mm. wide.	1¼
	Sponge 4	16	Rounded at bottom, 2 mm. deep, 3 mm. wide.	1½
Individuals with reduced cloaca	Sponge 5	19	2½ mm. deep, 1½ mm. wide	¾
	Sponge 6	13	1½ mm. deep, 1½ mm. wide, extending in somewhat obliquely.	½
	Sponge 7	11	1¼ mm. deep, 2 mm. wide	1
Individuals without a cloaca.	Sponge 8	13	Represented by a narrow efferent canal 2 mm. long, ½ mm. wide, extending in obliquely from the osculum.	½
	Sponge 9	11	Represented by a minute depression ¼ mm. deep, ⅓ mm. wide, into which 3 or 4 small efferent canals open.	⅓

The spicules, in respect to details of shape and dimensions, are not far from those recorded by Ridley, Sollas, etc., as may be seen from the following data.

1. Dichotriaenes. Cladomes of the larger lie in the dermal membrane. Rhabdome 2.7 mm. by 40–50 μ; protoclad 90–120 μ long; deuteroclads 200–220 μ long, reaching in some specimens 300 μ.

Lendenfeld (1906, p. 288) finds that internal to the subdermal spaces lies a second layer of dichotriaenes. This is so in my specimens. The facts further indicate that the dichotriaene begins deep in the choanosome as a protriaene, that it grows and differentiates as it passes toward the surface. The facts are as follows:

The dichotriaenes beneath the subdermal cavities are smaller than those of the outer layer. The difference especially concerns the deuteroclads, which are about 150 μ long. Internal to these are still other and smaller, obviously developing, dichotriaenes with deuteroclads, which vary in length, but which are all short and, indeed, in many cases minute. I give measurements of two spicules:

Rhabdome.	Protoclad.	Deuteroclads.
1300 by 18 μ.	90 μ long.	30 μ long.
1000 by 16 μ.	100 μ long.	5 μ long.

Internal to these, and still smaller, are protriaenes, which vary in size down to quite small spicules. The clads of the protriaenes represent, I believe, the protoclads of the later (dichotriaene) stage. I give the following measurements for the protriaenes:

Rhabdome.	Clads.	Rhabdome.	Clads.
1,000 by 14 μ	120 μ long.	500 by 7 μ	44 μ long.
800 by 14 μ	100 μ long.	450 by 7 μ	40 μ long.
900 by 14 μ	80 μ long.	320 by 10 μ	40 μ long.
600 by 14 μ	70 μ long.	300 by 7 μ	32 μ long.
600 by 14 μ	56 μ long.		

From the measurements given above it will be seen that there is a very complete transitional series, ranging from the small deep-lying protriaenes to the well-developed dichotriaenes. It is thus fairly certain that the former are only stages in the development of the latter.

2. Anatriaenes. Cladome about hemispherical. Rhabdome 2200 by 24 μ; clads 75–120 μ long, and stout. They accompany the dichotriaenes. Some of them pass out quite to the surface, their cladomes lying external to those of the dermal dichotriaenes. Quite small anatriaenes with very flat, shallow cladomes, lie intermingled with the developing dichotriaenes (see above). These doubtless are stages in development.

A detailed examination would probably show that the cladomes of the anatriaenes are well stamped with the "geographical mark"—that is, that in respect to this point, a quantitative one, the difference beween specimens from different localities is easily perceived. For instance, in a specimen from D5158 the cladomes were shallower than hemispherical, about umbrella-shaped, with clads 75 μ long.

While in a specimen from D5218 the cladomes were a little deeper than hemispherical, with clads 120 µ long.

3. Skeletal oxea, 2,000 by 24 µ and smaller. Together with the shafts of the triaenes in the radial skeletal bundles, and strewn irregularly in the central part of the sponge.

4. Cloacal oxea, small and slender; 250–340 by 5 µ. Tangentially strewn in cloacal wall; tangential in oscular membrane, radiating toward osculum. In Sollas' specimens these spicules were 9 µ thick, traversed the cloacal wall radially, projecting and making the cloacal wall hispid. In Lendenfeld's specimens (1906, p. 287) the spicules are closer to mine in thickness, 180–250 by 4–6 µ; probably radially arranged, since there is no statement to the contrary.

5. Chiasters, 8–12 µ in diameter, abundant at the surface and in choanosome. In general smaller at the surface than in interior. Rays long and slender, and distinctly tylote; rays 6–10 in number; as usual, the fewer the rays, the larger the spicule.

This agrees well with the records of Ridley (1884) and Sollas (1888). Lendenfeld (1906, p. 287), however, finds that in his specimens, when the chiasters are examined with an immersion objective, they turn out to be "acanthtylasters"—that is, the rays, 3–12 in number and cylindrical in shape, are armed at the end with a cluster of spines and may be minutely spined along their course; total diameter of spicule 6–16 µ, the size inversely as the number of rays. Sollas (1888, p. 119) had already found chiasters of this type in a specimen which he described as *M. toxodonta*, and which Topsent (1897, p. 433) merged in *M. clavosa.* Topsent's synonymy has been generally accepted. Lendenfeld assumes that the chiasters in the species are always "acanthtylasters," and hence that the variability, which is to be inferred from the records, is really due to the fact that the spicules have usually not been examined with a high objective. This conclusion, to be sure, remains to be tested.

My own observations confirm Lendenfeld in the essential matter. In two specimens (from D5158) examined for this point, the enlargement, in which a ray terminates, was found not to be a ball but an expansion subdivided into minute spines. This terminal expansion seemed to be flattened, and the number of spines about 5; the expansion, when seen endwise, looking something like a little star. The rays of the chiaster itself are approximately cylindrical, taper a little toward the end, and are in general without spines along their course but now and then show one.

MYRIASTRA SIEMENSI (Keller).

Stelletta siemensi KELLER, 1891, p. 341.—LENDENFELD, 1903, p. 36.

Station D5478, one specimen attached below to a *Eusponigia irregularis.*

The sponge is irregularly spheroidal with a greatest diameter of 65 mm., and is thus somewhat larger than any of Keller's specimens. The aperture of the apical cloaca is 12 mm. wide; cloaca and apertures of efferent canals as in Keller's specimens (pl. 19, figs. 50, 51), color much the same, also consistency.

Sections radial to surface show the features illustrated in Keller's figure 56 (pl. 20); except that the actual surface is well preserved in the *Albatross* specimen. Thus distal to the cladomes of the orthotriaenes is a thin layer of ectosome. The fibrous layer occupies the rest of the ectosome and is about 600 μ thick. The pores, chonal canals, subcortical crypts, and radial canals are all as in Keller's figure, except that the actual pores are small. Flagellated chambers of same size as in Keller's types.

The megascleres have the same arrangement as in Keller's types (pl. 20, fig. 56) and are of about the same size. The anatriaenes differ in having a deeper cladome. The details are as follows:

In the orthotriaenes, the rhabdome is 1 to 2.2 mm. long, 40–80 μ thick below cladome; clads 135 to 210 μ long, 35 to 70 μ thick at base. Orthotriaenes are abundant. Surface preparations show the clads meeting or overlapping and thus surrounding angular or rounded areas, often about 175 μ in diameter, in which the pores may be seen.

In the anatriaenes, the rhabdome is 2 to 2.5 mm. long, 20–35 μ thick below cladome; cladome deep or fairly deep, clads strong and 120 μ long.

The larger oxeas measure about 1.5 mm. by 20–24 μ.

In Keller's types the asters are "very small and delicate" oxyasters with 7–9 rays and about 10 μ in diameter. Similar asters occur in some abundance in both ectosome and choanosome of the *Albatross* sponge. Tangential sections show that they are quite abundant at the extreme surface, where they range in total diameter 8–12 μ. In the interior the total diameter ranges 8–16 μ. There is "no centrum," the rays are very slender and even under an immersion objective show no distinct terminal enlargement, although at such a magnification they appear slightly roughened.

Keller finds microspheres, about 5 μ in diameter, very abundant in spots in the choanosome. Colorless spherules up to this size occur also in the *Albatross* sponge in ectosome and choanosome, sometimes scattered but often in dense groups. Appearances suggest that there is perhaps some relation between such groups and the spheruliferous cells mentioned below.

Keller's sponges all contained peculiar masses of a problematical nature. These formed a single and nearly continuous layer in the outer part of the cortex (p. 342, pl. 20, figs. 56, 57), were spheroidal or ovoidal in shape, about 100 μ in diameter, and of a dark-brown color (yellowish in the figure given). Each mass is said to be a heap of most minute spheres ("winziger Kugeln") which are held together by a cement substance, and round each mass is a follicular epithelium. Keller thinks it likely that the masses (or only the cement substance?) are made up of spongin.

A conspicuous feature of a radial section through the *Albatross* sponge is a layer of bodies having about the same distribution and general appearance as the above. My material is doubtless better preserved than Keller's, and I find the masses to be groups or nests of spheruliferous cells ("cellules spheruleuses" of Topsent). The data are as follows: As seen in radial sections the masses are arranged in a single layer outside the fibrous stratum of the cortex, between it and the actual surface. The layer is interrupted by the radial megascleres and cortical canals; otherwise it is almost continuous. The masses, 100–160 μ in diameter, have, except near the surface, a sharp boundary. The lower and major part of each mass is more or less spheroidal in shape and is outlined by a thin but fairly conspicuous layer which is not a special cellular follicle but only a condensation of the surrounding mesenchyme. The masses are yellow in color.

Each of these problematical masses is a densely or loosely packed group of spheruliferous cells. The cells are 8 μ in diameter, and when stained with haematoxylin show a central nucleus. The cell body is entirely filled with minute spherules about 1 μ in diameter and yellow in color. A few spheruliferous cells of this kind may also be found scattered in the ectosome. Close to the surface of the sponge at the level of the triaene cladomes the nests of spheruliferous cells meet and fuse with one another in irregular fashion. This is best seen in tangential sections. Distal to the cladomes there is a very thin layer of the minute yellow spherules themselves. In this situation the spherules are no longer aggregated in cell groups. They must have broken out of the cells which produced them. They are best seen in thin tangential sections of the surface, where they appear, in places at any rate, as a single and continuous layer, on which are scattered the minute asters. The function of this superficial layer of spherules can only be guessed at.

It may be noted that a closely crowded superficial layer of granular cells has been recorded in other Stellettidae—as, for example, in *Stelletta crassiclada* (Lendenfeld, 1906, p. 281).

Genus STELLETTA O. Schmidt (1862).

Stelletta O. SCHMIDT, 1862, p. 46.

With or without a fibrous cortex. Microscleres are euasters of two kinds, one forming a dermal layer from which the other, the larger, is excluded.

Sollas (1888, p. 150) restricts the genus to forms with a fibrous cortex and well differentiated chones. Lendenfeld (1903, p. 33) enlarges the genus, merging in it numerous genera recognized by Sollas. Dendy (1905, p. 77) extends the genus in Sollas' sense to include forms with and without a fibrous cortex, the genus remaining characterized by the microscleres, euasters of two kinds. Lendenfeld (1906, pp. 252–53, 264) uses the genus to include forms in which the microscleres are euasters, one or two kinds, with, in some species, trichodragmas (orthodragmas of Sollas, dragmas of Lendenfeld); the genus thus including not only *Stelletta* in Dendy's sense (as used here) but *Myriastra* Sollas (plus *Pilochrota* Sollas, *Astrella* Sollas, *Anthastra* Sollas, *Dragmastra* Sollas, and *Aurora* Sollas.

STELLETTA RADICIFERA, new species.

Plate 37, fig. 2; plate 45, figs. 3, 11, 13.

D5179, one specimen.

More or less pear-shaped, the small end representing the upper end of the sponge. Height 25 mm., thickness at the middle 18 mm. Upper half of body smooth; lower half coarsely hirsute with downwardly projecting spicules, many protruding several millimeters and doubtless serving as roots. Color, brown.

A minute osculum, point-like in size, present at the apex of sponge. The pores are closed but the distribution of the dermal oxyasters indicates that they are scattered everywhere in the spaces bounded by the cladomes of triaenes, and have a diameter in the neighborhood of 40 µ. Probably in a certain physiological phase definitely outlined pore-areas appear.

The ectosome is about 140 µ thick, largely occupied by small subdermal cavities which are roofed over by a very thin dermal membrane. The ectosome is not histologically differentiated into a "cortex." But the deepest layer, which forms the floor of the subdermal cavities, is noticeable as a thin, fairly compact, brownish stratum, somewhat fibrous in the sense of being made up of horizontally elongated cells. Below this stratum is a zone of comparatively large rounded cavities, and similar spaces are abundant throughout the interior, there being a high ratio of cavity to solid tissue. Sponge tissue is delicate.

Closely set radial spicular bundles pass from an excentric point of the interior, much nearer the upper than the lower pole, to all points of the surface. There is no "nucleus" (the "nucleus" of the literature appears to be a spheroidal kernel containing practically no sponge tissue, made up of the inner ends of the radial skeletal elements which here come together and form a compact mass).

Spicules.—(1) Dichotriaenes (pl. 45, fig. 11). The chief radial spicule; cladomes at the surface supporting the dermal membrane, overlapping so as to enclose polygonal areas; other cladomes deeper in the ectosome. Rhabdome 3.4–5 mm. by 44 μ; protoclad 80 μ long; deuteroclads 100–190 μ long. The intermingled smaller spicules with very short deuteroclads are doubtless young forms, and indicate that the protoclad reaches its full length although not its thickness while the deuteroclads are very small.

Among the projecting spicules of lower half of body are some dichotriaenes.

(2) Anatriaenes (pl. 45, fig. 13). Present but not abundant in the radial bundles. Cladomes in ectosome and peripheral choanosome. Cladome rather shallow, apex rather sharp. Rhabdome may be as long as 8 mm.; 10 μ thick. Clads 40–60 μ long. Similar anatriaenes occur among the projecting spicules of the lower body, probably abundantly, but the ends are more often broken off. The clads are sometimes reduced, spicule becoming an anamonaene; clad up to 70 μ long, rhabdome 8–16 μ thick.

(3) Protriaenes (pl. 45, fig. 13). A few present in the radial bundles, cladome in the ectosome. Rhabdome long, 8 μ thick; clads 60–100 μ long. Similar protriaenes, with rhabdome 4.5 mm. by 8 μ, and clads 20–60 μ long are abundant among the projecting spicules of the lower body. Stronger protriaenes also occur among these projecting spicules; rhabdome 40 μ thick at the thickest point, tapering somewhat toward outer as well as toward inner end; clads strong, 50–85 μ long, sometimes rounded at the apex instead of pointed, sometimes unequal in length.

(4) Oxea. Abundant in the radial bundles; 3.4–4.5 mm. by 35–50 μ. Also among the projecting spicules of the lower body, where the thickness may reach 70 μ.

(5) Dermal oxyaster (pl. 45, fig. 3, *a*). Abundant, forming a crust. With small centrum and relatively long tapering rays. Total diameter, 8 μ.

(6) Oxyasters of interior. (*a*) Ectosomal oxyasters (pl. 45, fig. 3, *b*, *c*) abundant, 8–20 μ diameter, varying from a type without obvious centrum and 6–7 rays to a type with conspicuous centrum and more numerous rays. The centrum is most conspicuous and the rays most numerous in the largest spicules, but these are scanty. The spicules commonly range 12–16 μ in diameter, have a perceptible centrum and a number of rays greater than in the choanosomal type. (*b*) Choanosomal oxyasters (pl. 45, fig. 3, *d*) scantily present. About 16 μ diameter, with a few (6–7) long slender rays; without centrum. The asters of all the types intergrade.

Holotype.—Cat. No. 21301, U.S.N.M.

The *Albatross* species, as will have been seen, has the following complex of megascleres: Oxeas, dichotriaenes, anatriaenes, protriaenes. The only recorded species of the genus, *sens. str.*, having the same complex are certain Japanese forms. The probability is that all the forms with this complex are very closely related. The Japanese forms alluded to are *S. orientalis* Thiele (1898, p. 14), the surface of which is covered with a furze consisting largely of protriaenes; *S. validissima* Thiele (1898, p. 13), with protriaenes having clads 200 μ long, with dermal strongylasters, and with choanosomal oxyasters having many rays.

STELLETTA RADICIFERA, var. ROBUSTA, new variety.

An imperfect specimen from the same station (D5179) as the above possibly belongs in the same species. Preparations of the two are, however, easily distinguishable, and it would therefore be arbitrary to combine them, although the differences may be found to fall within the range of individual variation.

This sponge which I provisionally designate a new variety differs from the type in the following points:

(1) The dichotriaenes are larger. The rhabdome is 5–6 mm. by 70–85 μ; protoclad 100–120 by 60 μ; deuteroclads 210–260 μ long.

(2) The anatriaenes are larger. The rhabdome is 6–10 mm. by 32 μ, clads 70–100 μ long.

(3) The oxeas seem to reach a greater common average of size. At any rate spicules 5 mm. by 50 μ were easily found.

(4) The dermal oxyasters are somewhat smaller, 6–8 μ in diameter.

(5) Among the ectosomal asters, the large type, 20 μ in diameter, with conspicuous centrum and many rays, is much more abundant. The centrum is typically about one-fourth the total diameter, sometimes reaching one-third the total diameter.

(6) The thin, brown, semifibrous layer in the deepest part of the ectosome is not present.

The specimen, as said, is imperfect. It is hemispherical and probably represents the upper part of a subspheroidal sponge, the lower half of which has been torn away. Horizontal diameter 25 mm.. No oscula discoverable. Surface smooth and entirely covered by a thin layer of débris which obscures the pores. Color, very light brown.

Genus ECIONEMIA Bowerbank (1864).

Ecionemia Bowerbank, 1864, p. 173.—Sollas, 1888, p. 195 plus *Psammastra* Sollas, 1888, p. 174.

The ectosome may or may not be sufficiently fibrous to constitute a cortex. The larger triaenes supporting the dermal surface are usually plagiotriaenes (sometimes orthotriaenes or dichotriaenes). The microscleres include microrhabds which typically are minute roughened strongyles forming a dermal layer. The euasters are typically chiasters, rays tylote (tylaster) or not; the rays sometimes spinous, especially at the end (acanthtylaster); or, again, the rays stoutly strongylate (strongylaster); oxyasters and small spherasters with oxeate or strongylate rays may also occur.

Sollas (1888, p. 195) restricts the genus to forms in which the ectosome does not form a fibrous "cortex." Dendy (1905, pp. 80–81) gives sufficient reason for including both kinds of forms, those in which the ectosome is not, or possibly is not, fibrous and those in which it is more or less fibrous. This entails merging *Psammastra* Sollas, covering species with a cortex (Sollas 1888, p. 200), in *Ecionemia.*

Dendy (1916, p. 241) would exclude forms with trichodragmas, assigning these to his new genus *Rhabdodragma* (1916, p. 239).

Lendenfeld (1903, p. 61) makes *Ecionemia* a subgenus of *Ancorina*, but extends the conception to include forms listed by Sollas under several other genera.

Lendenfeld (1906, p. 253) restores *Ecionemia* as a genus. He would exclude forms with dichotriaenes, reserving *Ancorina* for the reception of these. He would also exclude forms in which the euasters are oxyasters, using *Sanidastrella* for these. Dendy (1905, p. 81) on the contrary includes forms with dichotriaenes and forms with oxyasters (1916, p. 242), a usage which seems to me necessary. This being so, what remains to distinguish *Ecionemia* from *Ancorina?* (1) The few recorded species of *Ancorina* have a well developed fibrous cortex. This is less strongly developed or possibly absent in the *Ecionemia* species. But this is not much of a reason for separating the two groups. (2) The separation of the two genera nominally rests on the distinction drawn between the sanidaster of *Ancorina* and the roughened microrhabd of *Ecionemia.* Lendenfeld has consistently refused to recognize this distinction. And others, as Dendy (1916, p. 239), think "the so-called sanidaster merges into the microrhabd type of spicule." This would seem to be the case. The sanidasters of the type species of Ancorina, *A. cerebrum* O. Schmidt, are described by Lendenfeld (1894, p. 35) as 5–8 μ long with numerous blunt spines, and such a spicule is certainly not far from the microstrongyles of *Ecionemia.* Probably then *Ecionemia* should even now be merged in *Ancorina.*

ECIONEMIA CRIBROSA Thiele.

Ecionemia cribrosa THIELE, 1900, p. 31.

Thiele's species is from Ternate. With it I identify a specimen from Station D5179. Lendenfeld (1903, p. 65) merges this species in another of Thiele's species, *E. agglutinans*, also from the Moluccas, but there is some difference in the records of the two forms. *E. cribrosa* falls in the group of *Ecionemia* species in which small, radial, ectosomal oxeas are present.

The *Albatross* sponge is more or less spheroidal, about 15 mm. in diameter, attached to the inside of a *Crepidula* shell. The color is dark brown at the surface, lighter below the ectosome. There are two small oscula about ¼ mm. in diameter on the upper surface near the equator.

Thiele says (1900, p. 31) in three of his specimens the pores are in closely set, commonly oval, areas, the intervening trabeculae forming a network. A fourth specimen, tentatively assigned to a variety, *micropora*, had inconspicuous, much smaller, pore areas.

Over a part of the surface of the *Albatross* specimen similar pore areas are visible to the eye as closely set small whitish patches separated by the brown ectosome. Such areas are about 300 μ or less in diameter, angular in shape, sometimes rosette-shaped—namely, with rounded lobes; about 6–7 pores in an area, pores about 20 μ in diameter. The intervening trabeculae of ectosome may be as wide as, or narrower than, the areas. Where such areas are most distinct the pores are for the most part closed. Elsewhere on the surface of this specimen the pores are fully open and "pore areas" do not exist. Instead the entire dermal membrane is uniformly riddled with pores. Through it ectosomal trabeculae separating the subdermal spaces can be vaguely seen. Transitions between these two states occur and it is clear that they represent different physiological phases. That is, where the sponge is expanded and the pores all open there are no areas. As the sponge loses water and the pores close, "pore areas" appear. Doubtless the events are about as follows: Above the larger spaces in the ectosome, what are denominated the subdermal chambers, the pores are slow in closing. In the regions between such spaces the pores close first of all and the pigment cells quickly invade the dermal membrane from the deeper strata of the ectosome. This brings on the appearance of brown trabeculae separating the "areas."

A further inspection of the surface of this sponge shows that as the pores continue to close quite small areas including only two or three pores may be left, well separated by brown ectosome. Doubtless the specimen for which Thiele suggests the name, var. *micropora*, was in this phase when preserved. It seems probable that after complete and prolonged closure of the pores the whole surface of the sponge might become uniformly brown. It can not be said that the "pore areas" make a specific mark, for they may or may not be there. What is possibly specific, however, is a general and subtle complex of anatomy and habit which results in the appearance of pore areas in a certain physiological phase.

As in Thiele's specimens, the ectosome is about 300 μ thick and contains an abundance of spheruliferous pigment cells. These extend into the choanosome along the radial skeletal bundles. The inner zone of the ectosome is densely fibrous and 40–60 μ thick; in it the pigment cells are only scantily present and distinctly flattened. Above the fibrous layer the ectosome contains abundant small rounded subdermal spaces, into which the pores open directly, piercing the dermal membrane. The subdermal spaces connect at the level of the fibrous layer with larger spaces, the subcortical crypts. These are more conspicuous than the subdermal spaces. The arrangement constitutes a variant of that shown in Sollas' diagram (fig. 7, *A*, p. xxiv, 1888). The choanosome contains some canals of relatively good size, but in general is compact.

The radial skeletal bundles are closely set, expand at the surface, converge internally, but by no means reach the center of the sponge.

The spicules closely approximate in shape and measurements those of Thiele's specimens, as will be seen from the following:

1. Skeletal oxea, reaching 2.5 mm. by 60 μ; in radial bundles, also scattered.

2. Plagiotriaenes, in radial bundles. Rhabdome 1.5–2 mm. by 60 μ. Clads in general lie at the surface; strong, 120–175 μ long. Younger ones, as usual, with cladomes deeper in the ectosome or in the outer part of the choanosome. Thiele (1900, p. 32) designates this spicule an orthotriaene; length of clad about 250 μ. But his figure shows that it is assignable to the category of plagiotriaenes, where Lendenfeld (1903) puts it.

3. Anatriaenes, in radial bundles; abundant. Rhabdome 3 mm. by 24 μ. Cladome deep, clads 80–120 μ long, strong. Cladomes generally in ectosome, close to the surface.

4. Protriaene. Rhabdome 15 μ thick, clads 40 μ long. Only one found protruding from the surface; the sponge was well searched over for this form of spicule. The protriaene may possibly be only an occasional variant of the characteristic triaene. Or, as Thiele suggests, it may possibly be a fairly constant element in the spiculation of the genus, though usually broken off and overlooked.

5. Ectosomal oxea, 250 by 3 μ. Radial to the surface, in ectosome. Abundant, but the individual spicules spaced well apart from one another. The spicule is equiended, this feature constituting a minute point of difference from Thiele's specimens.

6. Microstrongyles. Straight, a little thicker in middle than at ends, minutely roughened; 10–12 μ long by 2–3 μ. Crowded at, and close to, the surface, forming a dermal crust. Scantily present deeper in the ectosome and in choanosome.

7. Chiaster, mostly about 8 μ diameter, with very small centrum, and 6–9 long slender rays, not obviously tylote. Scantily present in ectosome and choanosome. Larger ones, 12 μ in diameter, with distinctly tylote rays, are occasionally found in choanosome.

The form evidently can not be separated from Thiele's species.

Subfamily TETHYOPSINAE.

Tethyopsinae Lendenfeld, 1906, p. 253.

With a special cloacal tube.

In addition to *Tethyopsis*, the subfamily includes the following genera: *Tribrachion* Weltner (1882, p. 50) (=*Tribrachium*, Sollas 1888, p. 153). (See also Lendenfeld, 1903, p. 67; Lendenfeld, 1906, p. 253). *Disyringa* Sollas (1888, p. 161). (See Lendenfeld, 1906, p. 290.)

Genus TETHYOPSIS Stewart (1870).

Tethyopsis Stewart, 1870, p. 281.

The cloacal tube contains several excurrent canals. Without sanidasters. One of the euaster forms may be slightly modified in the direction of a streptaster. Trichodragmas may occur.

TETHYOPSIS DUBIA, new species.

Plate 37, fig. 4; plate 45, figs. 12, 14, 15.

One specimen from D5163.

Sponge spheroidal, 15 mm. in diameter, attached to a shell on one side and much incrusted with shelly débris. The cloacal tube protrudes about 5 mm. It is 5 mm. wide at its base, slightly narrower at the free end. It contains four equal longitudinal canals, each about 1.5 mm. in diameter, all freely open at the upper end (in the actual specimen). The walls of the canals are very thin. They are plainly distinguishable from one another in cross section of the tube and are marked off from one another on the surface of the tube by slight longitudinal furrows. Thus the entire cloacal tube presents the appearance of being a fusion of four subsidiary tubes.

Pores are abundantly scattered over the surface of the body, which is somewhat uneven owing to the fact that the dermal membrane is elevated on the points of the cladi of the triaenes. The ectosome forms a very distinct translucent layer about 600 μ thick, which includes large subdermal spaces. The ectosome is fibrous in its outermost portion, and again where it borders upon the choanosome it includes a fibrous stratum, about 175 μ thick.

The radial megascleres, chiefly plagiotriaenes, proceed from the center to all points of the surface. They are so abundant as not to form distinct bundles. The system of radial triaenes is continued into the walls of the subsidiary cloacal tubes, but the spicules are here modified into orthomonaenes and orthodiaenes, the rhabdomes lying longitudinally, the cladi extending circularly, in the tube wall.

Spicules.—(1) Plagiotriaenes (pl. 45, fig. 14), small; clads 175–300 μ long, strong; rhabdome 3.3–4 mm. long, about 90 μ thick. The clads lie at the surface, supporting the dermal membrane, also in the deeper layer of ectosome below the subdermal cavities. Younger forms, of course, occur, the clads of some of them lying in the outermost part of the choanosome.

(2) Oxeas; equiended, smooth, tapering gradually toward each end; intermingled with the triaenes of the body and cloacal tube; 3.7–4.7 mm. long by 50–70 μ wide.

(3) Orthodiaenes and orthomonaenes, chief megascleres in the walls of cloacal tube. The characteristic spicule (pl. 45, fig. 15*b*) is a diaene that is nearly a monaene; rhabdome 3.7–4.4 mm. long, 35–50 μ thick; developed clad long, reaching 1,750 μ in length, about 35 μ thick, frequently somewhat sinuous; vestigial clad very short, often more or less curved or bent. The vestigial clad reaches a considerable development in some spicules, remaining shorter, however, than the other clad. In some of the diaenes (pl. 45, fig. 15*a*) in the basal region of the cloacal tube the long clad is dichotomous, the secondary clads usually unequal in length.

These modified triaenes of the tube walls are closely and elegantly combined, forming a firm skeleton, the rhabdome playing the part of a longitudinal element, the clads that of circular elements.

(4) Strongylasters (pl. 45, fig. 12, *a–d*), not strictly euasters, but representing a step from the euaster toward the streptaster type. Densely abundant in the dermal membrane of the body and cloacal tube, forming a crust; also abundant in the ectosome, and extending into outer part of choanosome. The presence of an axis in (all of?) these spicules taken in connection with the fact that the genus is obviously related to the Stellettidae rather than to the Theneidae, suggests (*a*) that a series of changes may convert a euaster into a true streptaster and (*b*) that this series of changes may be begun independently in different though related sponges.

The spicule is variable. In the common type (fig. 12*a*) there is a short curved axis bearing about 10 rays which are strongylate and larger terminally; total length of spicule 10 μ. Forms differing from the above in having fewer rays, 4–5, also occur (fig. 12 *b*, *c*). The spicule frequently appears as a euaster (fig. 12*d*), but this appearance in many cases (always?) is probably due to the spicule being seen in end view.

(5) Oxyaster (pl. 45, fig. 12*e*). Present in both ectosome and choanosome. Total diameter 14–20 μ; centrum of considerable size; rays long and pointed; often about 9 rays round equator when the spicule is seen more or less in optical section.

(6) Trichodragmas, about 20 by 12 μ; common in ectosome. The dragma, or bundle, is cylindrical; the component rhaphides very fine.

Holotype.—Cat. No. 21302, U.S.N.M.

A related species, *T. columnifer* Stewart is recorded from the Philippines (Sollas, 1888, p. 190). In this species the somal triaenes are orthotriaenes, and the cloacal triaenes are orthotriaenes with one clad much elongated. There is an ectosomal spheraster, minute. with actines reduced to tubercles; a choanosomal chiaster; also orthodragmas (trichodragmas).

The fragments (cloacal tubes), described by Lendenfeld (1906, p. 297) under *T. radiella* Marshall, present in the matter of the skeleton some close resemblance to *T. dubia.* There is a dermal crust of strongylasters, but these spicules appear to be true euasters. The chief megascleres of the tube are orthodiaenes (1906, pl. 27, figs. 1, 2, 4) of the same type as in the *Albatross* sponge. The two species differ greatly in respect to the canalar anatomy of the cloacal tube. It is only the tube of *T. radiella* that is known.

Family GEODIIDAE.

Geodiadae Gray, 1867.
Geodinidae O. Schmidt, 1870.
Geodiidae Sollas, 1888.—Lendenfeld, 1903.
Geodidae Lendenfeld, 1906, p. 305.
Geodidae plus *Erylidae* Lendenfeld, 1910; 1910*b*, p. 267.—Dendy, 1916, pp. 254, 256.

The characteristic microsclere is a sterraster which forms a dense cortical layer. The afferent cortical spaces nearly always, perhaps always, have the character of distinctly differentiated chone canals, which are sometimes uniporal, sometimes cribriporal. Similar efferent chone canals are common, but in their place there are not infrequently present efferent canals of the ordinary tetraxonid type which open by oscula of good size. In a few species the clads of the tetraxon megascleres have degenerated, the triaene thus becoming actually or nearly a tylostyle or style (*Geodinella*). Except in *Geodinella* the tetraxon megascleres are confined to the superficial part of the sponge where they are radially arranged.

Sollas's (1888) subfamilies Erylina (including *Erylus*, *Caminus*, and *Pachymatisma*) and Geodina (including the remaining genera) were discarded by Lendenfeld, 1903, 1906, who divided the family directly into genera. This seems the better practice.

In addition to the genera represented in the collection (*Erylus*, *Geodia*, *Sidonops*, *Geodinella*) the family includes the following:

Pachymatisma Bowerbank (1864, p. 171).

With afferent chone canals the roofs of which are cribriporal. Oscula few, sometimes the apertures of small cloacae; or abundant and scattered; or minute and very numerous. The megasclere-complex includes orthotriaenes and rhabds, but lacks anatriaenes and protriaenes. The sterrasters are spheroidal or ellipsoidal. The other microscleres are microstrongyles which form a dermal layer, and euasters which do not occur at the surface.

Lendenfeld (1903, p. 90 would include in this genus the little known *Stelletta intermedia* O. Schmidt, assigned with a query by

Sollas (1888, p. 241) to *Erylus*. *S. intermedia* has (dermal ?) granulated microxeas 75 μ long.

Caminus O. Schmidt (1862, p. 48).—Sollas (1888, p. 214).—Part Lendenfeld (1903, p. 92).

With afferent chone canals, the roofs of which are cribriporal, and ordinary oscula of good size. The magasclere-complex includes orthotriaenes and rhabds, but lacks anatriaenes and protriaenes. The sterrasters are spheroidal or ellipsoidal, somewhat flattened in some species. The other microscleres are spherules which form a dermal layer, and in some species euasters which do not appear at the surface.

As Topsent (1911, p. 3) remarks, Lendenfeld in his Tetraxonia (1903, p. 92) destroys the homogeneity of *Caminus* by altering the diagnosis so as to include *Geodia megastrella* Carter, in which the dermal (somal in Sollas' terminology) microsclere is a euaster and not a spherule.

In 1910 (p. 221) Lendenfeld gives a definition of *Caminus* in which he says "the dermal microscleres are asters." But this is equivalent to wiping out the useful distinction between asters and spherules, a distinction which is actual even if we admit that spherules are phylogenetically derived from asters.

Isops Sollas (1880, p. 396).—Sollas (1888, p. 236).—Lendenfeld (1903, p. 93).

Skeleton as in *Geodia*, and in habitus and arrangement of orifices not distinguishable from *Geodia*. Incurrent and excurrent cortical canals, both, uniporal chone canals.

In the case of many of the older species enrolled here (Sollas, 1880, Lendenfeld, 1903), it must be understood that the assignment to *Isops* is somewhat provisional, depending on the assumption that the apertures scattered over the surface are the openings of chone canals.

Since Lendenfeld's *Tetraxonia*, species have been described by Topsent (1906 *b*, p. 13); Lendenfeld (1906, pp. 315, 317, 319); Hentschel (1909, p. 365), *I. membranacea*, referred to *Aurora* by Dendy (1916, p. 243).

Caminella Lendenfeld (1894, p. 62).—Lendenfeld (1903, p. 89). In skeleton similar to *Geodia*. With incurrent uniporal chone canals. Instead of excurrent chone canals, there are efferent canals and oscula of the ordinary tetraxonid type.

The genus embodies a definite idea, departing from *Isops* in the character of its excurrent canals.

In Lendenfeld's later definition of the genus (1903) he restricts his statement, as in the case of the other genera of this family, to the excurrent and incurrent orifices, without mentioning the chone canals, whereas the presence or absence of the latter, and the variety of detailed differentiation which they undergo, constitute, as I take it, the really basic features.

Genus ERYLUS Gray (1867).

Erylus Gray, 1867, p. 549.

The afferent orifices are uniporal apertures into chone canals; efferent orifices also the uniporal openings of chone canals, or in other cases larger oscula. The megasclere-complex includes orthotriaenes and rhabds; anatriaenes and protriaenes absent. The sterraster is more or less flattened, often so flattened as to be a thin plate. Microrhabds (here spicules of good size, reaching a length of 70 μ), typically centrotylote, form a dermal layer. Euasters also occur, but not at the surface.

In some species the sterraster passes through an aspidaster stage, a thin plate in which the first formed rays are completely soldered together, thus giving the spicule for the time being smooth surfaces and a smooth margin. The short rays which beset the adult spicule develop secondarily upon the aspidaster stage.

The sequence of changes made in Sollas's definition (1888, p. 209) is as follows:

In none of the recorded species, unless *Stelletta intermedia* O. Schmidt be accepted as an *Erylus* (Sollas, 1888, p. 241), is the sterraster spherical, and Lendenfeld (1903, p. 85) emends by describing the sterraster as "flattened, more or less disklike."

Lendenfeld (1906, p. 305) adds that the sterrasters develop from thin plates ("aus scheibenförmigen Anlagen"). Lendenfeld at the time does not rest this idea on direct observation of ontogenetic stages, but on an examination of the adult sterraster. In *E. polyaster* he finds (p. 306) that the sterraster, which is only moderately flattened, is concentrically stratified, the innermost part appearing as a flattened plate which shows a radial structure, the surrounding layers showing no signs of a radial structure. Lendenfeld regards the inner, central, platelike mass as representing a young stage in the development of the spicule (see also pp. 309–310). This account, which is superseded by Lendenfeld's later one, of the sterraster seems to imply that the spicule develops in a radically different way from that presented in Sollas's scheme (1888, p. lxiv), in which sterrasters in general are derived from spherasterlike stages through growth and continued fusion, from the center outward, of the rays.

Lendenfeld (1910*b*, p. 294) finds that the oscula are sometimes no larger than the afferent apertures, and emends the definition accordingly, saying the genus has "uniporal efferents or larger oscula."

Lendenfeld (1910, p. 17; 1910*b*, p. 267) concludes as a result of his discovery of actual ontogenetic stages that the sterraster of *Erylus* is distinguished not only by its flattened shape but by passing through a stage with perfectly smooth surfaces, which does not occur in the development of the sterraster of *Geodia* and its allies. He therefore separates *Erylus*, designating its sterraster as an aspidaster, from the other Geodiidae, creating for the genus a new family, the Erylidae. The remaining genera are left, "for the present at least, in the Geodidae."

Dendy (1916, p. 256) accepts Lendenfeld's conception of the genus and the family Erylidae. This does not seem to me advisable, for the following reasons:

Erylus is (has been) characterized primarily by its complex of adult spicules. Accepting this idea of the genus, we find that of the 25 species there are only eight (four in Lendenfeld, 1910*b*, two in Dendy, 1916, together with *E. formosus* and *cylindrigerus*, see Sollas 1888 (pp. 213, 240)), in which the sterraster is known to pass through an aspidaster stage. It is by no means safe to assume that the others pass through this stage, for in the species described in this report, *E. cornutus*, they do not.. On the contrary, in this species they develop in the usual way described for sterrasters (Sollas, 1888, p. LXIV). Hence if we follow logically Lendenfeld's proposition we disrupt *Erylus*—namely the group of species, characterized primarily by a certain spicule-complex, and must assign some species, as *E. cornutus*, to another genus and indeed family. I take it, no one would wish to do this. Without minimizing in the least the interest and value of Lendenfeld's new facts, it does not seem to me that they are of such a kind as should influence the definition of genera or families.

Retaining *Erylus* in the older sense, we have to regard, with Sollas, the sterrasters as variable not only in facial outline but in thickness: in some species, very thin; in other species, comparatively thick. When the sterraster is very thin, its mode of growth leads through an aspidaster stage; but such spicules are not radically different from other sterrasters, and detailed study will probably result in the discovery of intermediate modes of development.

This interpretation of the aspidaster as representing only an extreme in a graduated series of morphogenetic methods, leading up from that practiced in *Geodia*, receives support from the recorded details. Thus Sollas (1888, p. 213) who regards the narrow, elongated, flattened, sterraster of *E. formosus* as only a modification of the spherical type, describes for this species a developmental stage made up of a center and trichite-like rays, already of unequal length in different regions (pl. 28, fig. 30), such that the shape of the spicule is thereby determined. This stage which is clearly only a modification of the corresponding one, with equal rays, in the formation of a spherical sterraster, is followed just before the completion of the spicule by a smooth stage (pl. 28, fig. 12), on which "the small spines which granulate the surface" of the adult subsequently appear.

These commence at the extremities and their formation progresses toward the center of each face. A central area on one face, corresponding to the depressed hilum of the more ordinary type of sterraster, remains devoid of spines. The detailed relation of the small spines, developing upon the smooth (aspidaster) stage, to the original rays which determine the general shape of the spicule, has not been worked out by Sollas or his successors. Possibly there is no direct relation, but it is also possible that the small spines are primarily serrations of the original rays.

Again in *E. discophorus* Sollas (1888, p. 238) describes the sterrasters as disciform bodies in which the actines form radiating ridges on the flat faces; the faces being granulated. In *E. cylindrigerus* Sollas (1888, p. 240) says "the young forms of the sterraster present themselves as excessively thin, smooth disks, composed of trichital actines, radiating in a single plane."

Lendenfeld (1910*b*, p. 283) described in detail the aspidasters of *E. sollasii.* They are disciform plates longer than wide; on one face, a smooth, very shallow depression corresponding to the hilum of the *Geodia* sterraster; on both faces and at the margin, short rays like those of the sterraster. The center of the aspidaster is granular, and from it numerous radial lines extend toward the margin. The youngest aspidasters observed (p. 285) were small "oval disks" composed of numerous rays, radiating predominantly (exclusively?) in the horizontal plane from a granular centrum; rays at first isolated, but becoming united basally as they grow in length and thickness. The fusion of rays, owing to their increase in thickness, finally becomes complete, the spicule acquiring a smooth margin and smooth faces. "Their smoothness in this stage constitutes the chief difference between them and the sterrasters of *Geodia*." "Later small, spine-like protuberances make their appearance on the surface of the smooth young aspidaster. These develop into the protruding rays" of the adult spicule. (See also pp. 272, 306–307.)

ERYLUS CORNUTUS, new species.

Plate 37, fig. 8; plate 45, figs. 5, 16; plate 46, figs. 1, 2.

A large fragment, from station D5275, 80 by 70 by 60 mm., no doubt belonging to a cup-like form with a shallow cloacal cavity. One surface of the fragment is concave and bears apertures, oscula, ½ to 1 mm. in diameter, 3–5 mm. apart. This probably represents the cloacal wall. The remaining natural surface of the specimen, I take it, represents the outer surface of the sponge. In its lower region this surface presents no visible apertures. In its upper region it presents small apertures ½ mm. and less in diameter, scattered sparsely. These are doubtless the pores.

Surface glabrous. Cortical layer whitish brown in color, interior darker. Interior shows many canals, the larger 5–8 mm. in diameter and abundant small ones 1–1½ mm. diameter.

The cortex is about 1 mm. thick, occupied almost exclusively by the sterrasters. The ectochrote is represented only by a very thin dermal membrane, and the innermost, fibrous, layer of the cortex is also quite thin.

The chones are relatively simple structures in this species. The uniporal incurrent chone-canals (pl. 45, fig. 16, *i. ch. c.*) are wide, straight, subcylindrical tubes that pass radially through the whole cortex, each opening below into a larger subcortical canal (*s. c.*). The aperture into the latter is much narrower than the chone-canal in general and is guarded by a fibrous sphincter (*sph.*). Above, the chone-canal is closed in by an area of sterraster-free dermal membrane, full of microrhabds, perforated by the pore (*p.*). A representative incurrent chone gives the following measurements: Pore, 350 μ in diameter; rim of sterraster-free dermal membrane surrounding the pore, 85–180 μ wide; diameter of chone-canal, 850 μ; diameter of aperture into subcortical canal, 525 μ.

The oscula are the apertures of uniporal excurrent chone-canals, essentially similar to the incurrent canals although somewhat wider. The sphincter at the inner end of the excurrent chone, guarding the aperture into the subcortical canal, is possibly narrower on the average than in the case of the incurrent chone. A representative excurrent chone gives the following measurements: Osculum, 1 mm. in diameter; rim of sterraster-free membrane surrounding it, 100 μ wide; diameter of chone-canal, 1,450 μ; diameter of aperture connecting with subcortical canal, 1,150 μ. The sphincter of this chone is therefore 150 μ wide.

There are some slender skeletal tracts, composed of monaxon megascleres, in the interior. Some of these are continuous with the radial bundles of the periphery of the sponge. The radial bundles, each consisting of a triaene with numerous monaxon megascleres, pass to the cortex which they do not enter. They are abundant, often 600–1,200 μ apart, as seen in sections.

Spicules.—1. Orthotriaene (pl. 46, fig. 1). Rhabdome, straight or nearly so, in a radial bundle. Cladome tangential, just beneath the cortex. The clads may be nearly straight, but are usually somewhat curved or bent like a horn, often conspicuously so; the end of a curved clad always pointing inward. One of the clads is occasionally dichotomous. Rhabdome and clads not far from the same size, ½ mm. long, 50 μ thick at the base. The rhabdome is sometimes a little longer than the clad, and the clads of a spicule may differ somewhat in length.

2. Strongyle. Stout, smooth, slightly curved; diminishing slightly in size toward the ends; 700–1,750 μ long, 30–40 μ thick. Most abundant spicule in the skeletal bundles.

3. Oxea. Smooth, 500–1,200 μ long, 12–25 μ thick. Common in the skeletal bundles.

4. Sterraster (pl. 46, fig. 2), Ellipsoidal; distinctly but not greatly flattened; 220 μ long, 175 μ wide, 112 μ thick. The individual rays of the adult spicule are small. In surface views (end views of rays) they appear as minute polygons, with 3 to 5 sharp angles, 2–3 μ in diameter; as a rule so closely set that the intervening spaces appear as lines which form a network; some of the rays farther apart.

The sterrasters in this sponge are thick as compared with those of most *Erylus* species, but in some specimens of *E. lendenfeldi* Sollas (see Lendenfeld, 1903, p. 85; Dendy, 1916, p. 257, says they are "much flattened"), *E. topsenti* Lendenfeld (Lendenfeld, 1903, p. 87), and in *E. polyaster* Lendenfeld (1906, p. 306), the ratio of thickness to the other dimensions is about the same as in *E. cornutus*.

There seems to be no essential difference in the structure or development of the sterraster between this species of *Erylus* and a *Geodia*. All stages in the development of the spicule are abundant in the interior. They are all spheraster-like—that is, consist of a center with rays, the rays gradually fusing as they elongate. No very flat rays and no smooth stage (aspidaster) are to be seen. Stages 30, 50, 70, 80, 100, 120, 140, 200 μ in diameter were measured. They all conform to Sollas' scheme of the development of the sterraster (1888 p. lxiv).

5. Microrhabd (pl. 45, fig. 5, *a*). Straight, or sometimes a little curved, usually centrotylote, but very slightly so; diminishing in thickness toward the ends, which are rounded; 25–50 μ long, about 6 μ thick. Abundant in the dermal membrane; present but rather scanty in the walls of the chone-canals.

6. Strongylaster (pl. 45, fig. 5, *b*). Rays stout, short, and truncated; ends as a rule rounded, instead of being squarely truncated, frequently notched in an irregular way. Total diameter 20–28 μ, number of rays 5–7. Abundant throughout choanosome, especially in the canal walls.

Holotype.—Cat. No. 21262, U.S.N.M.

Genus GEODIA Lamarck (1815), emend. Lendenfeld (1894).

Geodia LAMARCK, part plus *Cydonium* FLEMMING, SOLLAS 1888.

Geodia LAMARCK, emend. LENDENFELD, 1894, p. 46.—LENDENFELD, 1903, p. 104.—Part DENDY, 1916, p. 254.

Both afferent and efferent cortical canal spaces are typically independent chone-canals, the roofs of which are cribriporal. Frequently those portions of the chone-canals, both afferent and efferent, which lie in the extra-sterrastral layer of the ectosome (ectochrote) are so expanded as to have the character of ordinary subdermal spaces which largely fill the ectochrote. In addition to orthotriaenes (or dichotriaenes) and rhabds, the megasclere-complex frequently includes anatriaenes and protriaenes. The sterraster is spheroidal or ellipsoidal, in some species somewhat flattened. The dermal microsclere is a euaster. Other forms of euaster occur in the interior.

Cydonium Flemming is by general consent merged in *Geodia* (Lendenfeld, 1894; Topsent, 1904, p. 68; Dendy, 1905, p. 84; Thiele, 1905). Sollas in his definition of *Cydonium* (1888, p. 218) says the oscula are sometimes the uniporal openings of excurrent chones. But the species records scarcely bear out this statement, since in *Geodia* (*Cydonium*) *mülleri*, the only form cited by Sollas as possibly having uniporal efferent chones, Lendenfeld finds (1894, 1903) the oscula are cribriporal. Whatever species exist with uniporal efferents would be referable to *Sidonops*, while the *Cydonium* forms with cribriporal efferent chones are not distinguishable from *Geodia*.

In some species of *Geodia* the incurrent and excurrent orifices are not distinguishable. In other species the former are somewhat larger. The excurrent orifices are typically grouped in one or more restricted areas, the incurrent orifices covering the rest of the surface. In caliculate forms the chief excurrent area is the surface of the cloaca, but depressed areas on the outer surface may also be excurrent (*G. mülleri*). In some species the two classes of orifices are on opposite surfaces of the noncaliculate body (*G. exigua* Thiele).

The form is massive; or more or less caliculate; sometimes lobose; sometimes a thick, massive incrustation. In some of the caliculate forms, massive young stages are known (*G. mülleri*). Lendenfeld (1894, p. 91) has shown that the caliculate forms can not be separated from the noncaliculate, and hence that Sollas's definition (1888, p. 244) must be altered.

In some species (*G. stellata* Lendenfeld, *G. robusta* Lendenfeld, 1906) the system of subdermal spaces which largely fill the ectochrote is divided into unit systems, each unit system representing the outer (ectochrotal) horizontally expanded and branched portion of a chone-canal. Every unit system is covered over by a special pore area (incurrent or excurrent), and connects at its center with one of the straight tubular endochonal canals which pass radially through the sterrastral and innermost layers of the cortex. In other species (*G. philippinensis*) the system of subdermal spaces is perhaps not divisible into unit systems, since the dermal membrane is uniformly perforated instead of being divided into discrete pore areas and intervening aporous tracts; moreover the subdermal spaces appear to be so interconnected as to form a single, continuous system, connecting at intervals with the endochonal canals.

In some species there are deviations from the type, in the matter of the ectochrotal canal system, which tend toward a secondary acquisition of larger efferent canals and simple oscula. In *G. megastrella* (see Topsent, 1911*b*) for instance, there is a cloaca into which open numerous efferent canals, varying in diameter, each roofed over by a fenestrated membrane. Some of these canals in the neighborhood of the cloacal wall fuse, the common space (larger efferent canal) so formed being roofed over by a large fenestrated area of the cloacal lining. It is not recorded whether excurrent tubular endochonal canals are present in this species. The sterrastral layer, Topsent finds, is practically absent from the cloacal wall. A second step in the same direction, complementary of the above, is made by *G. perarmata* in which Dendy (1905) finds that the cribriform membrane lining the cloaca includes here and there larger openings "where the pores have apparently become confluent and thus formed small vents."

The species such as *Geodia barretti* Bowerbank (Sollas, 1888, p. 250), with uniporal excurrent chones, are referable to *Sidonops* (Lendenfeld, 1903, p. 101). Some later species with simple sphinctrate oscula, *G. micropunctata* Row (1911, p. 296) for instance, are likewise referable to *Sidonops*. In the case of a number of older species assigned to *Geodia* in Sollas' monograph the records leave it in doubt whether excurrent chones exist. The oscula in such forms are described as simple or the implication is that they are simple, and it is quite possible that the efferent canals are of the ordinary type common in tetraxonida. Several of these species have been referred t *Sidonops* by Lendenfeld (1903), and, unless a special genus is made for them, this seems to me the best procedure.

Dendy has recently discussed the limits of *Geodia*. He has doubts (1916, p. 254) as to the value of the character and arrangement of the incurrent and excurrent orifices for the discrimination of Geodid genera, a set of points on which Sollas and later writers have laid stress. He therefore uses *Geodia* in a wider sense than is customary, his definition of the genus, relating only to the skeleton, covering *Geodia* (plus *Cydonium*) *sens. str.*, *Isops* Sollas, *Sidonops* Sollas, and *Caminella* Lendenfeld.

The common practice is, it seems to me, still the better one. Probably the genera intergrade, but the extreme types are well marked, and many sponge genera intergrade with respect to any one of the several points that go to make up our conception of a genus. As to the biological value of such differences in the canal system, who knows? Perhaps they are quite as hereditary as many skeletal features. At any rate, even if the genera so based are artificial, they are to-day useful categories.

Since Lendenfeld's *Tetraxonia* (1903), species assigned to *Geodia* have been described by Topsent, 1904 (p. 70); Dendy, 1905 (p. 85); Lendenfeld, 1906 (pp. 328, 333); Hentschel, 1909 (p. 366); Lendenfeld, 1910 (pp. 55, 79, 96, 113, 151, 155, 161, 170, 175, 181, 188); Row, 1911 (p. 296); Hentschel, 1912 (p. 314); Lebwohl, 1914 (pp. 42, 49, 57); Stephens, 1915 (pp. 431, 432); Dendy, 1916 (p. 254).

GEODIA PHILIPPINENSIS, new species.

Plate 37, fig. 9; plate 46, figs. 3, 4, 5.

Station? Locality label missing. A very large vase-shaped sponge, 540 mm. high; mouth of vase 450 by 400 mm.; wall at the top 20 mm. thick, growing thicker below. The vase narrows toward the base, having the shape of a truncated, inverted cone; the base itself somewhat expanded, having a diameter of 300 mm.

The outer surface bears conspicuous radial tufts of spicules, about 10 mm. apart. Such tufts are 5 mm. and more in height, 2–3 mm. in diameter at the base, tapering toward the free end. Over a large part of the surface they are broken or worn off. Very many of the spicules composing the tufts are broken at their outer ends; the unbroken spicules are protriaenes with clads 50–70 μ long and anatriaenes with clads 50–70 μ long.. There is some indication that the outer surface, which now is in general smooth, is naturally covered with a continuous but rather thin furze of similar protriaenes and anatriaenes. At any rate, this surface shows such spicules, projecting 3–4 mm., in some spots which have apparently been protected from wear.

The basal surface, surface of attachment, is not quite flat, but is made somewhat uneven by elevations and depressions. It, too, shows in spots a sparse furze of projecting protriaenes and anatriaenes, like that just mentioned. The cloacal surface is smooth, that is, shows no projecting spicules.

Color of the surface is whitish gray, varying to a light brown. Color of choanosome a chocolate brown.

The cortex is slightly under 2 mm. in thickness, the extra-sterrastral layer (ectochrote) about 0.5 mm. thick, but this layer has in places been rubbed off.

The dermal membrane and cortical canal system of the two faces of the sponge, outer and cloacal, are alike. Doubtless the outer is the afferent (pore) face; the cloacal, the efferent or oscular face.

The dermal membrane, on both surfaces of the sponge, is a finely fenestrated membrane in which "pore areas," in the usual sense, are nonexistent—that is, the whole membrane is uniformly porous, and is not divided up into perforated areas and intervening aporous tracts. When it sinks down, as in a dried sponge, on the underlying ectosomal trabeculae, the effect of "pore areas" is produced, that is the ectosomal trabeculae now constitute low and apparently aporous ridges between which lie depressed areas that are obviously porous. But examination of surface preparations shows that there are pores (presumably afferent on one surface, efferent on the other) everywhere, both over the ridges and in the depressed areas. These pores are about 40 μ in diameter, separated only by narrow bands full of asters. They pierce the thin dermal membrane, opening into the subdermal spaces which fill the ectochrote.

The subdermal spaces open below into cylindrical endochonal canals which pass radially through the sterrastral layer. These canals are about 200 μ in diameter, and 1.5–2 mm. apart.

The subdermal spaces doubtless represent the expanded and ramified outer (ectochrotal) parts of independent cribriporal chone-canals, such as occur in some species. It is a question, in this species, whether these spaces are all continuous with one another, thus constituting a single system, or whether the whole set of spaces is divided, as in some forms described by Lendenfeld (1906, *G. stellata*, etc.), into unit systems, each unit system representing the outer part of a single chonal canal, which still connects at its center with the inner (endochonal) part of the same canal. (See under *Geodia.*)

The fact that the dermal membrane is everywhere perforated by closely set pores speaks against the idea that the subdermal cavities are grouped in unit systems, for if pores are everywhere, so must be subdermal spaces. The subdermal spaces within the limits of an ectosomal trabecula (see above) are doubtless very small.

The shape and arrangement of the subdermal cavities can best be directly studied in sections vertical to the surface, and in views of the under surface of the ectochrote, when the latter is cut free from the rest of the cortex. In sections they appear as rounded spaces. In the flat preparations of the ectochrote they appear as irregularly polygonal spaces, 175–500 μ in diameter, separated by thin partitions 50–100 μ thick. In the partitions here and there lie the radial skeletal bundles which as seen in this way are commonly 100–350 μ apart. There is no evidence of the grouping of the subdermal cavities in unit systems. Nevertheless the specimen is a dried one (although the drying was carefully carried out) and this detail of anatomy can not therefore be definitely decided.

The interior of the sponge wall is filled with very abundant large (somal) oxeas, scattered in all directions, often in tracts. In the peripheral region of the choanosome this diffuse skeleton gives place to radially arranged megascleres grouped, though often vaguely, in bundles. Here the somal oxea is again the most abundant spicule, but there are also numerous dichotriaenes and some anatriaenes, the cladomes of the triaene forms lying just below the cortex. Other dichotriaenes, accompanied by anatriaenes and a few protriaenes, along with an occasional large oxea, pass radially through the sterrastral layer of the cortex, constituting the very distinct radial bundles of the cortex, which are of course best seen in the ectochrote. A typical radial bundle in this region includes one or a few dichotriaenes, the cladomes of which support the dermal membrane, accompanied by a good many anatriaenes, and rather rarely by a protriaene or two. Occasionally a large oxea forms the axis of a bundle, instead of a dichotriaene. The radial bundles of the ectochrote are 100–350 μ apart. The skeleton of the cortex and peripheral choanosome is the same on the two surfaces of the sponge.

Spicules.—1. Dichotriaene (pl. 46, figs. 3, 5). Rhabdome 3–4 mm. long, 70 μ thick near cladome; protoclad 100 μ long; deuteroclads 150 μ long; measurements are for the superficial or dermal spicules. The cladomes of some spread out paratangentially just below the sterrastral layer; these are somewhat smaller than the superficial ones. The cladomes of others lie in and support the dermal membrane, dividing it up into imperfectly separated areas, which lack uniformity. The rhabdome of a superficial dichotriaene lies of course in an ectosomal partition (trabecula), and a clad may lie within the limits of a partition. Most of the clads extend out however into the thin sheets of membrane between the partitions. Even here sometimes pores can be seen directly over a clad, indicating that between the clad and the surface there are minute cavities.

2. Somal oxea, 3 mm. long, 50 μ thick; smooth, tapering, usually slightly curved; occasionally taking the shape of a style (strongyloxea).

3. Anatriaenes of the radial bundles (pl. 46, fig. 3). Rhabdome 3 mm. long, 16 μ thick below cladome, clads 70–80 μ long.

4. Protriaenes of the radial bundles (pl. 46, fig. 3). Rhabdome 2–3.5 mm. long, 8–24 μ thick; clads 40–90 μ long. The cladome sometimes has four rays, these of unequal length. The large protriaenes sometimes seen in the interior are probably stages in the development of the dichotriaene.

5. Ectosomal oxea (pl. 46, fig. 3), 370–500 by 6–8 μ. Smooth, evenly tapering; straight or slightly curved. Perforating, and slightly projecting from, the dermal membrane radially or obliquely, or tangential in it; singly or in loose sheaves; abundant. Abundant also in the peripheral choanosome.

6. Sterraster (pl. 46, fig. 3). A flattened ellipsoid; face 124 by 104 μ; thickness 80 μ. Sterrastral layer of cortex about 1.2–1.5 mm. thick. Abundant sterrasters scattered through choanosome.

In the adult sterraster, the outer ends of the rays are stellate—viz. polygonal and very distinctly produced at the angles into sharp little processes (spines of Sollas); the outer ends about 4 μ in greatest diameter and closely set. Hilum, a depression, as usual showing no rays. Young stages of the sterraster are plentiful in the choanosome. They show that the ontogenetic development of the spicule takes place in the usual way (Sollas, 1888, p. LXIV).

7. Dermal oxyaster (pl. 46, fig. 4, *a*); total diameter 4–6 μ. With a perceptible centrum; number of rays rather small, about five seen in optical section. Very abundant in the dermal membrane of both surfaces. Abundant also in the ectochrote and through the choanosome.

8. Choanosomal oxyaster (pl. 46, fig. 4, *b*). Total diameter, 24–36 μ. Rays long, strong, tapering, more or less distinctly, though minutely, spinose at the end. The spicule is sometimes classifiable as an acanthtylaster of Lendenfeld, but again the rays are really pointed at the end. Total number of rays 6 or 7 to about 20, 5–10 visible when the equator of spicule is focussed. Centrum absent in spicules with smallest number of rays; distinctly developed in spicules with largest number of rays. Size of the spicule is, as usual, inversely as the number of rays. Abundant in the choanosome.

Holotype.—Cat. No. 21320, U.S.N.M.

GEODIA SPARSA, new species.

Plate 37, fig. 5; plate 46, figs. 7, 8.

A fragmentary specimen, from station D5593, chiefly consisting of two subcylindrical branches, largely fused together, but projecting at the top as free and somewhat flattened lobes rounded terminally. Total height 70 mm., greatest width 40 mm., diameter of the branches from 15 to 25 mm.

Color of surface and cortex, pale reddish; that of choanosome a light yellowish brown. The cortex is 1.5–2 mm. thick, and is occupied almost entirely by the sterrastral layer. The choanosome is excavated by numerous canals, 2–3 mm. in diameter, extending more or less lengthwise through the branches.

The surface is now, in general, glabrous. But in protected places there are spicules that project 1–3 mm. These, in such places, are abundant, yet not abundant enough to constitute a spicule-fur.

The dermal membrane with its crust of minute oxyasters is intact, but there are no apertures visible to the eye. The only apertures are minute pores, about 16 μ in diameter, scattered over the general surface; not anatomically distinguishable into afferent and efferent, although some are doubtless of the one kind, some of the other.

Doubtless most of the apertures are closed, but there is a sufficient number of open ones to show with some certainty the specific arrangement. The following data bear upon the specific arrangement.

The surface shows irregular, meandering, interconnected tracts, immediately below which sterrasters are absent (pl. 46, fig. 8). It is in such tracts, which quite lack definite boundaries, that the open pores are found. These are either well apart, in which case doubtless most of them are simply closed; or they are close together, separated by about the width, or by less than the width, of a pore. The latter condition perhaps shows the natural state of the surface, when the sponge is expanded and the pores are all open. At any rate, the open pores and groups of open pores are scattered in such a wide and general way as to indicate that possibly the dermal membrane is uniformly perforated (or rather perforable) with pores, that is, that there are no well defined pore areas and aporous tracts.

Vertical sections show that the sterraster-free areas just referred to (fig. 2) are largely occupied by subdermal cavities of some size. The thin dermal membrane roofing over these is pierced by the pores, which thus open directly into the cavities. Such a region of subdermal cavities connects below with endochones. Laterally such a region fades away into a thin ectochrote, which over the bulk of the sterrastral layer consists, in the actual specimen, of only the thin aster bearing, dermal membrane.

Endochonal canals of the usual type, narrow radial canals about 250 μ in diameter, perforate the sterrastral layer. The contracted inner ends of the chones form dense, subconical, little masses projecting into the subcortical spaces; scattered over the inner face of the cortex, 1–2 mm. apart. The contracted inner ends of the chones are to be seen in vertical sections and in ordinary flat preparations; their distribution over the inner face of the cortex can also very conveniently be studied in dried pieces from which the choanosome has been picked away.

The megascleres have the usual arrangement. There are oxeas abundantly scattered through the choanosome. In the periphery of the choanosome are numerous radial bundles, some of the megascleres of which enter and even pass through the cortex. The cladomes of the plagiotriaenes, for instance, are characteristically in the ectochrote.

Spicules.—1. Oxea, 2.5–3.5 mm. long, 44–48 μ thick, with many smaller sizes; in the radial bundles and scattered in the choanosome. A long, slender type, 20 μ thick and less, occurs among the spicules which conspicuously project from the surface.

2. Plagiotriaene (pl. 46, figs. 7*a*, 8). Rhabdome long, 50 μ thick near cladome; clads 175 μ by 50 μ. Smaller ones with clads down

to 125 μ long occur. The inclination of the clads away from the orthotriaene state is not great in this spicule.

The plagiotriaenes occur in the radial bundles. They are not at all abundant although their presence is constant. The cladome is at the surface of the sponge or sometimes within the sterrastral layer. In flat preparations the cladomes appear rather scantily strewn over the surface.

Quite small ones, with rhabdome only 20 μ thick and cladi 40–70 μ long, occur scantily in the choanosome, the cladomes lying in the subcortical zone. These are doubtless young stages.

3. Anatriaene. Rhabdome long, 8–15 μ thick above; clads 25–50 μ long; cladome rather shallow. Projecting radially from the surface. A large proportion of the spicules that project conspicuously (several millimeters) beyond the surface are anatriaenes. What are doubtless young stages occur scantily in two positions: (*a*) cladome in the subcortical zone; rhabdome 4 μ thick, clads 7–14 μ long; (*b*) cladome among the projecting ectosomal oxeas; rhabdome 2 μ thick above, clads only 4 μ long.

4. Protriaene. Rhabdome long, 15–20 μ thick above, clads 50–70 μ long. The rhabdome is occasionally prolonged beyond the insertion of the clads, the spicule becoming, in Lendenfeld's terminology, a promesotriaene (pl. 46, fig. 7*b*). The protriaenes occur scantily among the spicules projecting beyond the surface.

5. Ectosomal and subcortical oxeas; 210 by 4–7 μ; piercing and projecting more or less radially from the dermal membrane; here abundant, the spicules disposed singly or in loose sheaves. The same spicule occurs sparsely in the subcortical zone, usually in a radial position.

6. Sterraster. Slightly flattened, thickness about five-sevenths greatest diameter; in face view varying from nearly circular to elliptical; dimensions as seen in face view, 144 by 136 μ (approximately circular) to 193 by 155 μ (elliptical). The circular shape, in face view, may possibly be reached, but a number of measurements showed a discrepancy between the two horizontal axes. In face view the shape is sometimes slightly oval instead of elliptical.

The layer of sterrasters occupies nearly the whole thickness of the cortex, 1.5–2 mm. thick. The spicules are also scattered, together with young stages, through the choanosome. The development is of the usual type.

7. Dermal oxyaster; 4 μ in diameter; with relatively large centrum and short conical rays. Very abundant in dermal membrane.

8. Oxyaster of subcortical zone; also lining the lower part of endochonal canal. Total diameter 24–40 μ. Centrum distinctly developed. Rays long, tapering, spinose at extreme end, the end of the

spine sometimes appearing as an enlargement. Rays are numerous, often about 10 seen at one focus.

9. Oxyaster of choanosome: abundant, with no, or only a very small, centrum; total diameter 32–40 μ, ray length 12–16 μ; number of rays commonly 9–12. Rays relatively long, spinose at extreme end; the outstanding spines together with the apex of the ray making a small terminal crown, about as in Lendenfeld's acanthtylaster (Lendenfeld, 1906, p. 289). The terminal crown is more evident in the larger spicules but is perhaps always present.

The above is the dominant and characteristic aster of the choanosome, but other asters occur here ranging over to the form with large centrum and numerous rays. Smaller oxyasters of all sizes, down to spicules with a diameter of 4 μ, also occur in the choanosome. These have relatively long, sharp rays, and are probably stages in the development of the larger spicules.

Holotype.—Cat. No. 21267, U.S.N.M.

GEODIA JAPONICA (Sollas), var. SPHERULIFERA, new variety.

Plate 38, fig. 1.

Cydonium japonica Sollas, 1888 p. 256.

Geodia japonica (Sollas) Thiele, 1898, p. 7.—Lendenfeld, 1903, p. 111; 1910, pp. 72, 235.

A specimen sufficiently close to *G. japonica* to be best listed as a new variety was taken at station D5355. The body is a circular cake-shaped mass with convex upper surface bearing in its center a large shallow depression or cloaca. Horizontal diameter 100–110 mm., vertical thickness 40–60 mm.; cloaca 35 by 25 mm. wide, and about 15 mm. deep. Sponge firm, even hard, compact. Color, whitish brown.

Surface in general now glabrous, although there are in places megascleres projecting a few millimeters. The whole surface is covered with a dermal membrane, uniformly perforated with closely set pores; where this has been rubbed off, the chone canals open on the surface (artefact). The chone canals are distributed throughout the whole cortex and are alike everywhere; each expands above into a saucer-shaped subdermal cavity (chone vestibule). Very generally over the surface the roofs of such cavities are depressed, perhaps a contraction effect, while between them the trabeculae of sponge tissue, covered likewise by the porous dermal membrane, form low ridges. Thus a reticular appearance visible to the eye is produced, in which the depressed areas are a fraction of a millimeter in diameter and the intervening trabeculae have about same width. In flat surface preparations the chone vestibules give a star-shaped appearance, as in Lendenfeld's figure of *G. stellata* (1906, p. 37, fig. 1), owing to the small subdermal spaces which surround and open into the central space. Adjacent chone vestibules are interconnected by these small spaces, which lie in the trabecular regions.

The chief radial megasclere is the orthotriaene; rhabdome 2.5–3.5 mm. long, greatest thickness 70 μ; clads 200–260 μ long, basal thickness 50 μ.

Oxeas measuring 2 mm. by 35 μ, together with smaller ones, are common in the radial bundles and very numerous in the interior where they cross in all directions. The radial cortical oxeas are closely set, project a short distance, and measure 200–300 by 6 μ. Among the large projecting megascleres are some fusiform oxeas 2.8 mm. by 100 μ; these are probably foreign.

Anatriaenes are fairly abundant among the radial spicules, cladome rather deep in the mature spicule, clads 50–100 μ long and strong, rhabdome 5–7 mm. long and 15–30 μ thick. These spicules occur also among the megascleres which project beyond the surface.

Protriaenes with clads 70–100 μ long, occasionally up to 150 μ long with rhabdome several millimeters long and 18–30 μ thick, occur among the projecting megascleres. Promesotriaenes, in general similar to the protriaenes, also occur here; the mesoclad of same length as the other clads or somewhat longer, reaching 210 μ in length.

Sterrastral crust 900–1000 μ thick. Innermost layer of cortex fibrous. Sterrasters are flattened spheroids almost circular in full face view, 80–85 μ in horizontal diameter, 70 μ thick.

Minute strongylasters, 4–6 μ in diameter, form a dermal crust and are common in ectosome and interior. Centrum about one third the total diameter, with 7–8 rays that taper toward the end.

Cortical spherasters, 24–32 μ in diameter, especially abundant in the extra-sterrastral layer of the cortex, also elsewhere in the ectosome and in interior. Rays very numerous, exceedingly short, larger at the base, truncated and rounded terminally.

Polyactinal oxyspherasters, 16–20 μ in diameter, occur in the deeper ectosome and in interior. Centrum about one third the total diameter; rays numerous, tapering.

The oxyasters of the choanosome have 6–7 long tapering, minutely spinulate rays, blunt terminally; centrum absent, rays 20–32 μ long, total diameter of spicule 44–60 μ.

Holotype.—Cat. No. 21266, U.S.N.M.

Geodia japonica has been hitherto described only from Japan. The type reaches a large size, 0.5 meter in diameter (Thiele), is usually vasiform or saucer-shaped but may be massive; outer surface chacteristically lobose. Where the canals open directly on the surface (Lendenfeld, 1910, p. 72), the dermal membrane has doubtless been rubbed off.

Protriaenes and pro-mesotriaenes are listed by Lendenfeld, not by Sollas and Thiele; probably rubbed off in the latter specimens. The anatriaenes vary in details of shape (cf. figs. of Thiele and Lendenfeld); an outward curvature of the clads is pronounced in Lendenfeld's specimen. Minute dermal anatriaenes, some reduced, are inconstant in the species; present in Lendenfeld's specimen (Lendenfeld, 1910, p. 73).

There is some inconstancy (variation) in the type with respect to the microscleres. Thus the oxyspherasters listed by Sollas and Lendenfeld are not recorded by Thiele. The choanosomal oxyaster varies a good deal in size; total diameter in Sollas's type 21–36 μ (Lendenfeld, 1910, p. 77); somewhat smaller in Thiele's specimens; in Lendenfeld's specimen along with reduction of rays to 3–4 the total diameter rises to 46 μ. The minute strongylaster has a tendency to be irregular (Thiele, Lendenfeld).

The variety which I make is especially characterized by the presence of the cortical spherasters, which are not recorded for the type. The choanosomal oxyasters are larger than in the type. In the minute strongylasters the rays are fewer than in the type and relatively longer, the centrum correspondingly smaller.

Genus SIDONOPS Sollas (1889).

Sidonops Sollas, 1889, p. 277.—Lendenfeld, 1903, p. 99.
Synops Vosmaer plus *Geodia* Lamarck part, Sollas, 1888, pp. 227, 244.

In skeleton, habitus, and arrangement of orifices, not differing from *Geodia.* With incurrent cribriporal chones not different from those of *Geodia.* With excurrent uniporal chones, or with ordinary efferent canals that open by simple oscula.

For the group of forms with incurrent cribriporal and excurrent uniporal chones, Sollas in 1888 (p. 227) used *Synops* Vosmaer. But the pores of *Synops* are simple instead of cribriporal. Sollas therefore (1889) renamed his group of forms, *Sidonops. Synops* Vosmaer is regarded as synonymous with, and is merged in, the earlier *Isops* Sollas.

Lendenfeld, 1903, includes under *Sidonops* a number of species, listed by Sollas and other authors under *Geodia*, in which the species records leave it uncertain whether excurrent chone-canals are present. The oscula in these species (*Geodia flemingii*, *tuberculosa*, *reticulata*, *aerolata*, *media*) are said to be simple, scattered, or grouped. It is possible that some of them are the apertures of excurrent chones, or on the other hand only the openings of efferent canals of the ordinary tetraxonid type. I have explicitly indicated, in the genus definition, the existence of this group of species. If excurrent chones are really absent in this group, it might well be made into a new genus, bearing the same relation to *Sidonops* as *Caminella* does to *Isops*. Possibly some of the more recent species fall in this group. In *S. oxyastra* Lendenfeld (1910, p. 40) for instance, Lendenfeld's figure (pl. 7, fig. 2) suggests that perhaps the uniporal excurrent canals are not chone-canals.

The typical chones, incurrent and excurrent, are beautifully illustrated in *S. bicolor* Lendenfeld (1910, p. 48, pl. 9, figs. 15, 16). In some other species, *S. oxyastra* Lendenfeld (1910, p. 41), *S. angulata* Lendenfeld (1910, p. 26), the afferent cortical canals are differentiated into well-marked subdermal spaces and endochonal canals as in *Geodia stellata* Lendenfeld, etc.

Since Lendenfeld's Tetraxonia (1903) species of *Sidonops* have been described by Lendenfeld, 1910 (pp. 18, 24, 40, 46); Hentschel, 1912 (p. 315); Stephens, 1915*b* (p. 18).

SIDONOPS MICROSPINOSA, new species.

Plate 38, fig. 2; plate 46, figs. 6, 9, 10; plate 47, figs. 1, 2, 3, 8.

A specimen from Station D5593. Sponge vase-shaped, tapering below to an attached base; cavity of the vase occupies the whole of the upper surface and is very shallow. Sponge 90 mm. high, 75 mm. wide above, 45 mm. wide at the base; cloacal cavity about 15 mm. deep.

Sponge is brown, dense, and heavy; the cortex somewhat lighter in color than the interior. All canals are small. Both outer and cloacal surfaces are smooth, without projecting spicules; outer surface somewhat uneven.

The outer surface of the sponge is closely dotted with pore areas (pl. 46, figs. 6, 9; pl. 47, fig. 1), 180–360 μ in diameter and about 0.25 mm. apart. These areas which are rounded and plainly visible to the eye, are cortical areas without sterrasters but with abundant dermal spherasters. A pore area may include as many as six pores, but very often the number is only two or three, and frequently the area has only a single pore. The open pores measure up to 70 μ in diameter. Many, however, are much smaller, doubtless nearly closed, and in many areas the pores are completely closed. From the pores of an area pore canals (pl. 46, fig. 9, *p. c.*), in general oblique, pass into a radial afferent chone canal (*r. a. c.*). The inner end of the chone (*ch. e.*) projects into a subcortical crypt (*s. c.*). Round the open pores the spherasters are densely grouped, and they also line the pore canals. When the pore or pore canal is closed, its position is marked by a dense group or a streak, respectively, of spherasters. The radial chone-canal is lined with oxyasters.

The small number of pores in many areas and the fact that some areas have but one pore, make it clear that this sponge closely approaches *Isops.* The same condition has been noted by Sollas for *S. nitida* (Sollas, 1888, p. 231).

The surface of the cloacal cavity is covered with oscular areas, each including a single osculum (pl. 46, fig. 10; pl. 47, figs. 2, 3). An oscular area, like a pore area, is a cortical region without sterrasters but with abundant dermal spherasters. The areas are rounded or irregular, 350 μ to 1 mm. in longest diameter. Each area is the depressed center of a low circular elevation of the general cortex, the periosculur elevation (pl. 46, fig. 10, *p. o. e.*). The periosculur elevations are conspicuous to the eye, 1.5–2 mm. in diameter, with some smaller ones, and 1–2 mm. apart. The open oscula reach 200 μ in diameter, but even these are doubtless partially closed. Many oscula are completely closed. The osculum is the aperture of a radial efferent chone-canal (*r. e. c.*), the inner end of the chone, (*ch. e.*), projecting into a subcortical cavity (crypt), (*s. c.*). The open osculum is surrounded by a dense aggregation of dermal spherasters and these line the uppermost part of the chone-canal. When the osculum and canal are closed, the spherasters mark the site (pl. 46. fig. 10, *o*). The main part of the efferent chone-canal is lined with oxyasters. The similarity of the oscular area as a whole to a uniporal pore area is obvious. The difference is that the oscular area is larger and is surrounded by the periosculur elevation.

The skeleton includes closely set radial skeletal bundles made up of orthotriaenes and oxeas. Throughout the interior of the sponge there are abundant oxeas, scattered irregularly, separately and in tracts.

Spicules.—1. Oxea. A stouter form 1250 by 30 μ, and a slenderer form 1000 by 14 μ, are both common in the radial bundles and interior. Smaller sizes of the two types are abundant and the types of course intergrade. The spicule is smooth, the points not very sharp.

2. Orthotriaene. Rhabdome about 1 mm. long, 35–40 μ thick, tapering to a rounded point. Clads commonly about 220 μ long, 24–28 μ thick at the base. But forms with shorter stouter clads, about 170 by 35 μ, occur. Young stages plentiful.

3. Sterraster, a somewhat flattened ellipsoid, 56 by 48 by 40 μ. The sterraster crust is 230–280 μ thick. Stages in development of the spicule freely scattered through the interior. They show that the development takes place in the usual way (Sollas, 1888, p. LXIV).

4. Spheraster (pl. 47, fig. 8, *a*), 6–8 μ in diameter. Rays numerous but reduced to very low prickles, the centrum making up most of the spicule. The rays are so short that with low powers the spicule appears as a sphere. Abundant in dermal membrane; extending down into the pore and oscular canals, partly (fully half-

way) through the sterrastral layer. Scattered scantily through choanosome.

5. Oxyaster. (*a*) Small form (pl. 47, fig. 8, *b*) about 8 µ total diameter. Centrum well developed. Rays slender, fairly numerous; ray length about one-third diameter of the whole spicule. Common in ectosome and choanosome; lining cortical canals, except in the uppermost part of canal. (*b*) Larger form (pl. 47, fig. 8, *c*), 16–28 µ total diameter. Rays frequently about 12 in number, long and slender, in the larger spicules roughened. Centrum small. Common in choanosome. The two types intergrade, as indeed do the spherasters and the small oxyasters.

Holotype.—Cat. No. 21295, U.S.N.M.

Genus GEODINELLA Lendenfeld (1903).

Geodinella LENDENFELD, 1903, p. 117; 1910, p. 205.

With reduced triaenes arranged radially in the periphery of the sponge and occurring also in the interior. Clads of triaenes reduced to two or one or none, the spicule appearing as diaene, monaene, or style (tylostyle); even when present the clads are degenerate in size, often very degenerate.

The genus was established for *Geodia? cylindrica* Thiele (1898) from Sagami Bay, Japan. Lendenfeld in his first definition (1903, p. 117) described it as a genus in which the triaenes lie in the interior, arranged in longitudinal bundles constituting an axial skeleton; with spheroidal or ellipsoidal sterrasters; and in which the dermal microsclere is an elongated euaster, somewhat streptaster-like. With the discovery of a second species, Lendenfeld found it necessary to emphasize points other than those which he had first picked out. His second diagnosis reads: "Without regular triaenes. The tetraxon megascleres are monaene or diaene teloclads with reduced clads, and occur not only in the superficial part of the sponge but also in the interior."

GEODINELLA SPHERASTROSA, new species.

Plate 38, fig. 3; plate 47, figs. 4, 5, 6, 7.

A fragmentary specimen from station D5312, apparently about one-half of a sponge that was more or less spheroidal or thick cushion-shaped, with a horizontal diameter of about 37 mm. What I interpret as the upper and the latero-inferior surfaces have different curvatures and are separated by a margin which is rounded and vague (pl. 38, fig. 3, right). The upper surface (pl. 38, fig. 3, left) bears low rounded oscular elevations, 2.5 mm. in diameter, each pierced with a central, very small, osculum; the largest of the oscula 0.5 mm. in diameter; interval between neighboring oscular elevations

1–3 mm. The latero-inferior surface bears no oscular elevations. It is the pore surface and is marked by intercommunicating shallow depressions, 2–3 mm. apart and about 1 mm. wide, which divide it up into irregular and only very slightly prominent areas.

The cortex is whitish, the interior darker, gray-brown and compact. The cortex is about 1.8 mm. thick and is occupied almost entirely by the sterrastral layer. The ectochrote over the bulk of the sterrastral layer, except in fact in the sterraster-free areas, is represented only by a very thin dermal membrane.

The pores lie in small and irregular sterraster-free areas abundantly scattered over the latero-inferior surface of the sponge (pl. 47, fig. 6, *p. a.*). The smaller areas measure about 200 μ in diameter; the larger ones are several times that size. The areas are vaguely defined and by no means always sharply separated; the appearances are as if the sterrasters had been shifted about a good deal after the closure of the pores. Sometimes only one pore occupies an area; larger areas include several pores. The pores are mostly closed. There are some open ones, however, and these are about 100 μ in diameter.

The cortex of the latero-inferior surface is traversed by radial afferent chone-canals about 200 μ in diameter, each surrounded by some collenchyma. Into the outer end of each there open a few smaller oblique canals leading from the surface of the sponge. It is into these doubtless that the pores open, and the actual connection could be made out in a few cases. The afferent chone-canals are 2–3 mm. apart and end below, each, in a small endochone. The endochones are contracted, appearing as conical masses of densely fibrous tissue, with the included canal closed. They are much smaller than the corresponding structures of the efferent system (pl. 47, fig. 7). The apex of the chone projects into a subcortical canal.

My data make it clear that the sponge is to be classed among those with cribriporal afferents.

The oscula are the uniporal apertures of radial efferent chone-canals (pl. 47, fig. 7, *ef. c. c.*) The chone-canal from the surface of the sponge to the lower limit of the sterrastral layer is open, although somewhat constricted at several levels; the diameter varying from 200 to 400 μ. Round it is some finely fibrous collenchyma that is evidently contractile. At the lower level of the sterrastral layer, the chonal canal passes in the usual way into its very narrow innermost part, which occupies the axis of the endochone. This part of the canal is closed but is marked out by a streak of asters. The endochone has the usual character, being a conical densely fibrous mass, the apex (*ch. e.*) of which projects into a subcortical canal.

The megasclere skeleton has the arrangement that is usual in the family—that is, the peripheral choanosome is occupied by numerous radially placed megascleres and by bundles of the same, and there are megascleres abundantly scattered, some in tracts, through the interior. Some of the peripheral radial bundles are prolonged for a considerable distance into the interior, but there is no central, or axial, skeletal aggregation comparable to that occurring in *Geodinelle cylindrica* Thiele. An axial aggregation of megascleres (reduced triaenes and rhabds), but a very loose one, occurs also in the other recorded species of the genus, *G. robusta* (Lendenfeld, 1910, p. 208).

The reduced triaene is a constant and abundant constituent of the peripheral radial skeleton, also of the tracts and scattered skeleton of the interior. The dominant megasclere of the interior is the large oxea; and this spicule is abundant also in the peripheral radial skeleton.

Spicules.—1. Reduced triaene, represented by a monaene with degenerate clad or by a subtylostyle or style (pl. 47, fig. 4); about 2 mm. long, 40–44 µ thick.

The distal (cladal) end of the spicule is generally enlarged, but only slightly so, sometimes not at all enlarged (fig. 4*h*). In general there are no signs of clads, not even a branching of the axial canal at the distal end (fig. 4*g*). Nevertheless spicules not infrequently occur in which an extremely vestigial clad is present, monaene condition (figs. 4 *a*, *b*, *c*, *d*, *e*, *f*). The clad may be only a rounded protuberance on one side of the head, or a pointed and more definite protuberance. The axial canal of the clad is not straight, and looks as if made up of a row of dots, which probably means that the canal has not a uniform diameter. The proximal end of the reduced triaene is pointed.

In the peripheral part of the sponge the reduced triaenes lie in the usual position occupied by triaenes in this family. The spicule as a whole (rhabdome) is radial, and the distal end is commonly just below the sterrastral layer, sometimes in the layer.

2. Oxea, 2.4–3 mm. by 48 µ; in peripheral radial skeleton and in interior.

3. A long slender oxea, about 12 µ thick; not quite straight; occurring in some abundance in the radial skeleton, often in sheaves; along with the stouter megascleres or separately from them; sometimes, perhaps always, passing entirely through the cortex and projecting beyond the surface.

4. Sterraster, ellipsoidal and somewhat flattened; 200 µ long, 164 µ wide, 130 µ thick. Ends of rays small, stellate, leaving the usual reticulum of lines between them. Sterrastral layer about 1800 µ thick; the spicules together with developmental stages also scattered in the choanosome. Developmental stages plentiful, showing that the spicule develops in the usual way.

5. Dermal spheraster (pl. 47, fig. 5, *a*), 8 μ in diameter; abundant on pore and oscular surfaces, and extending for a short distance into the cortical canals. Centrum large, somewhat irregular; rays short, tapering to points that are not sharp; ray length considerably less than diameter of centrum; number of rays rather numerous often about 7–8 when seen at equatorial focus.

6. Strongylaster of cortical canals (pl. 47, fig. 5, b); lining the cortical canals and in the surrounding collenchyma. Centrum is smaller, rays longer and more numerous than in the dermal spheraster. With an immersion objective, rays are seen to be roughened, viz. most minutely spinose, terminally. Total diameter of spicule 12–14 μ; ray length equal to or somewhat greater than diameter of centrum.

7. Oxyaster (pl. 47, fig. 5, *c*), 30–32 μ in diameter; abundant throughout choanosome. Centrum small, 4 μ or less in diameter, or none; rays long, slender, tapering; rays few in number, 7–10. With an immersion it may be seen that the rays are roughened in the outer half, the roughnesses increasing in size towards the end of the ray, which is therefore often not strictly pointed. The spicule makes an approach to the acanthtylaster of Lendenfeld, but only a very slight approach.

Holotype.—Cat. No. 21268, U.S.N.M.

This species is certainly very close to *Geodinella robusta* Lendenfeld from the Pacific coast of North America (1910 p. 205), and possibly should be, and with the study of more specimens may be, best described as a variety of that sponge. In Lendenfeld's species, based on four specimens assigned to three varieties, the cortical efferent canals are uniporal, the cortical afferent canals probably cribriporal. The canal system, as in the *Albatross* specimen, is thus not different from that of *Sidonops.* Most of the reduced triaenes are monaenes, but diaenes occur in one variety; in one variety the clad of the monaene has a considerable length. Besides these and oxeas, strongyles and tylotes occur. Styles or subtylostyles also occur. Lendenfeld does not recognize these latter as reduced triaenes, but my data establish this origin for *G. spherastrosa* and make it probable for his species as well. As to the microscleres the choanosomal asters are oxyasters scarcely differing from those of the *Albatross* sponge. The dermal microscleres are, however, strongylasters, instead of spherasters with tapering pointed rays. The strongylaster of *G. robusta* is obviously the same spicule that occurs in the cortical canals of the *Albatross* form. The tangible points of difference between the two forms are, then, the character of the dermal aster and the greater degree of degeneration of the triaene in *G. spherastrosa.*

Suborder HADROMERINA.

Hadromerina TOPSENT, 1898 plus.

Sponge body generally compact and massive, approaching a definite shape, sometimes lamellate; also incrusting. Megascleres all monaxonid, often radially or somewhat radially arranged. In a few forms (Chondrosidae) the megascleres have been lost. Skeleton rarely fibrous, not distinctly reticulate, and usually without spongin. Microscleres, if present, are asters of some form, including under this term astrose spicules which develop from monaxon primordia with which chelae are associated in a few species. Probably derived for the most part from the Astrophora through loss of the tetractinellid megascleres but possibly polyphyletic.

Thiele (1898) and Dendy (1905, p. 106) pointed out that Topsent's sections, Aciculida and Clavulida, could not be retained since the characteristic megasclere in some of the Aciculida was in reality monactinal and not diactinal. In *Donatia*, for example, and in *Tuberella*, the so-called strongyloxea does not differ from a style. The sections are therefore abandoned and the group is divided at once into families.

For definitions and synonymy of the genera, in general, Topsent, 1898, is of the first importance. For the earlier history of many genera Vosmaer, 1887, is indispensable. Dendy, 1921*b*, lays emphasis on the distinction between true asters (euasters) and "pseudasters" (microscleres which develop from monaxon primordia) and transfers several families (Spirastrellidae, Clionidae, Suberitidae, Polymastidae) to the immediate neighborhood of the Desmacidonidae, which he would regard as the parent family. (See Spirastrellidae). He further restricts the group by deleting the Epipolasidae, referring these genera largely to the Stellettidae (1916, pp. 225, 235; 1916*b*, p. 93).

I have not been able to consult the original and so do not attempt to distribute *Kowalewskyella* and *Protosuberites*, new genera by Svarchevskii. (See Zoological Record for 1905.)

Family EPIPOLASIDAE.

Epipolasidae SOLLAS, 1888.
Coppatiidae TOPSENT, 1898, p. 108 plus *Streptasteridae* TOPSENT, 1898, p. 109.

With oxeate magascleres and typically with astrose microscleres, but the latter may be lost (*Spongosorites*, *Topsentia*). The asters may be all euasters or euasters associated with sanidasters (*Asteropus*) or all streptasters (inclusive of sanidasters), with which microrhabds or trichodragmas may be associated.

Dendy (1905, p. 107) combined Topsent's two families, and has been followed by Hentschel (1909, 1912) and Stephens (1915*b*).

More recently (1916, 1916*b*) Dendy would merge these forms, which are generally recognized as reduced Astrophora, in the Stellettidae, possibly some of them in the Pachastrellidae (Theneidae of this report). In this, I prefer not to follow him.

In addition to the genera represented in the collection, *Asteropus*, *Jaspis* (plus *Coppatias*), and *Spongosorites*, the family includes the following: *Amphius* Sollas, 1888, *Cryptotethya* Dendy, 1905, *Diastra* Row, 1911 (merged by Dendy, 1916, in *Aurora*), *Topsentia* Berg, 1899 (for *Anisoxya* Topsent, see Topsent, 1900, p. 2), *Trachycladus* Carter, 1879, *Raphidistia* Carter, 1878, *Spiroxya* Topsent, 1896 (emended 1900), *Holoxea* Topsent, 1892, *Melophlus* Thiele, 1899. Topsent, 1919, moves *Hemiasterella* Carter (syn. *Epallax* Sollas, 1888, *Kalastrella* Kirkpatrick, 1903), transferring it to the Axinellidae alongside of *Adreus* Gray and *Vibulinus* Gray (see Astraxinellidae); Dendy (1921*b*, p. 144) places the genus in the Spirastrellidae.

Rhabdastrella Thiele (1903, p. 934) is merged in *Jaspis*. By Dendy, 1916, this genus is merged in *Aurora*.

Magog Sollas (1888) has been deleted. (See Dendy, 1916.)

Drypleres Sollas (1888) is merged in *Jaspis*. (See discussion in Lindgren, 1898; Topsent, 1898; Thiele, 1900, p. 58).

Astropeplus Sollas (1888) is merged in *Jaspis*. (See Topsent, 1898; Dendy, 1916.)

Genus ASTEROPUS Sollas (1888).

Asteropus Sollas, 1888, p. 205.

With diactinal magascleres (oxeas). Microscleres include both euasters (oxyasters) and sanidasters.

ASTEROPUS SIMPLEX (Carter).

Plate 38, fig. 4.

Stellettinopsis simplex Carter, 1879, p. 349.
Asteropus simplex Sollas, 1888, p. 205.

A specimen from Station D5179.

The skeleton would not differentiate this sponge from the type, but in form of body it differs from specimens hitherto collected. It may then be designated forma *pyriformis*.

Asteropus simplex (syn. *A. haeckeli* Dendy), the only species of the genus, has been recorded from Australia and Ceylon (see Sollas, 1888; Dendy, 1905; Hentschel, 1909); from the Indian Ocean (Dendy, 1916); from Okhamadal in Kattiawar (Dendy, 1916*b*). Carter also records the species from Haiti. (See Dendy, 1905, p. 110; 1916, p. 252.) The shape as hitherto recorded is massive, sometimes attached; or amorphous, or incrusting.

The *Albatross* specimen is of an elongate pear shape, tapering below to a conical base, which was perhaps rooted in the sand. There is no surface of attachment. The upper end of the sponge has been cut away, the actual upper end of the specimen showing four canals, each about 1.5 mm. in diameter, close together and descending vertically into the sponge. The specimen is 50 mm. high, with a greatest width of 18 mm.; width of exposed upper surface 10 mm.

Color, light brown, darker at the lower end. The ectosomal layer, 1.5 to 2 mm. thick, is colorless.

Surface finely hirsute with projecting spicules, some of them protruding 1–2 mm. The upper part of the sponge, more than half the whole body, is completely covered with an incrusting *Gellius* about 2 mm. thick. Dendy's specimen from the Indian Ocean (1916, p. 251) was similarly incrusted with a *Gelliodes*, and Hentschel (1909, p. 370) records that some of his specimens from the southwest coast of Australia were covered with an incrusting *Hymedesmia.*

The following data on the skeletal arrangement may be given. The choanosome is thickly filled with the megascleres which are both scattered and in loose tracts, the latter predominantly longitudinal. The ectosomal layer contains fewer megascleres than the choanosome. Some cross it in tracts running more or less radially to the surface. There are also abundant tangential megascleres just below and supporting the dermal membrane. These average a smaller size than the spicules of the interior. The small oxeas, about 160 μ long, of the incrusting *Gellius* have penetrated in abundance the dermal membrane of the *Asteropus*, lying both on and in it.

Spicules.—1. Oxea 2,500–3,100 by 85–100 μ, with many smaller sizes down to spicules about 700 μ long.

Sollas (1888) puts the size at 1,320 by 28 μ. Dendy records for one specimen (1905) a maximum size of 1,900 by 65 μ; for another (1916) 2,100 by 65 μ; for another (1916*b*) 1,700 by 70 μ. Hentschel (1909) records a maximum of 2,525 by 72 μ.

2. Oxyaster, abundant in the choanosome; a few in the ectosome. Total diameter 40–70 μ; no centrum; rays commonly 5–7 in number; rays slender and tapering, roughened, but barely so, in the distal portion. The spicule sometimes, especially in canal walls, may closely imitate the small pentacts of the hexactinellida.

The size and distribution of this spicule are subject to considerable variation in the species. Thus in Hentschel's specimens (1909) the diameter ranges from 17 to 48 μ, and the spicule is much more abundant in some than in other specimens. In Dendy's specimens the diameter varies from 30 to 50 μ; the spicule "scarce and easily overlooked" in one specimen (1905); spicule local in distribution, so as to be easily overlooked, in another (1916*b*).

3. Sanidaster. Abundant in dermal membrane and in walls of some of the ectosomal canals; present scantily here and there in the

choanosome. Total length 12–20 µ, commonly about 16 µ. Spicule varies in details of shape.

Holotype.—Cat. No. 21252, U.S.N.M.

Dendy has raised the question (1916*b*, p. 99) whether this widely distributed species is indeed really a species or only a collection of forms which happen to agree in spiculation, because in different localities related sponges (possibly species of *Ancorina*) have undergone a similar reduction of skeleton. The same reflection is appropriate to many others of our literature species. A first essential to the answer is a detailed, intimate, knowledge of the structure and development as observed in different localities. A part of the value of systematic zoology, as it seems to me, is to indicate critical cases which are well worth such intensive study.

Genus JASPIS Gray (1867).

Jaspis Gray, 1867, p. 526, plus *Coppatias* Sollas, 1888, p. 206, plus *Dorypleres* Sollas, 1888, p. 426, plus *Rhabdastrella* Thiele, 1903, p. 934.

With diactinal (oxeate) megascleres. Microscleres are euasters. The body may be lamellate or cyathiform, or a cake-shaped mass, or massive and variously shaped, or incrusting. The oscula are small, numerous, and scattered; the pores and oscula in some forms on opposite faces. The megascleres are intercrossed in all directions without order (*Jaspis*, *Dorypleres*), or arranged partly in radiating fibers, partly scattered (*Coppatias*). In some species the megascleres of the ectosome are smaller than those of the choanosome, and are sometimes designated microxeas. They lie in a predominantly tangential direction and may constitute a well marked ectosomal skeleton. The microscleres are especially abundant at the surface.

Topsent (1898, p. 107) pointed out that *Dorypleres* Sollas could not be distinguished from *Coppatias* Sollas.

Lindgren (1898, p. 357) and Thiele (1900, p. 58) would retain *Jaspis* Gray (syn. *Dorypleres* Sollas) for forms in which the megascleres are scattered without order and *Coppatias* Sollas for those in which they are combined, partially at least, in tracts. Topsent (1904, p. 128) would also follow this practice. But the distinction made between these two groups of species is scarcely practicable, and of the two names Dendy (1916, p. 252) shows that the rules of nomenclature demand *Jaspis* for the combined group of forms.

Thiele (1903, p. 934) handles the generic idea, suggesting subdivision of the genus. Nomenclature demands, he thinks, that *Coppatias* be merged in *Jaspis*. The species without small oxeas and with radial tracts of oxeas should be combined in a new genus *Rhabdas-*

trella. *Dorypleres* might be revived for other species without small oxeas and in which the megascleres are scattered without order. *Jaspis* would be retained for species with small oxeas.

Kirkpatrick (1903, p. 239) includes a species, *J*. (*Coppatias*) *vaculifer* in which the microscleres are not euasters but microstrongyles. These are usually centrotylote and form a compact dermal layer. Kirkpatrick regards them as modified euasters. While this is probably so, the inclusion of the species disturbs further the homogeneity of *Jaspis*, and it would seem better to make it the type of a new genus.

JASPIS SERPENTINA, new species.

Plate 38, fig. 6; plate 47, fig. 11.

A specimen from station D5414.

Sponge essentially lamellate, but rising from an attached base so as to form a shallow more or less circular but irregular cup. Surface, especially that of the cup-cavity, uneven with depressions and thickenings, some of the depressions extending quite through the sponge. The inner surface of the cup is the oscular, the outer surface the pore face of the sponge. Cup 85–100 mm. wide; lamella 7–15 mm. thick. Sponge compact and firm. Color whitish gray.

Plan of the afferent system: Pores, 30–40 μ in diameter, are distributed in small, closely set areas over the outer face of the sponge. The areas are rounded or irregular, and include, often, 3–6 pores or sometimes twice that number. From the pore areas afferent canals pass into the interior. These connect sometimes with tangentially extending spaces lying not far below the surface, but there is no extensive development of subdermal spaces.

Plan of the efferent system: Main canals, about 0.5 mm. in diameter, pass more or less radially and at considerable intervals, from the interior towards the inner surface of the cup-like body. They connect with a peripheral system of spaces, lying about 200 μ below this (the oscular) surface, and large enough to be seen with the eye. From these, short oscular canals, sometimes only the direct prolongations of main efferent canals, proceed to the surface. The oscula are minute, 100–500 μ in diameter, and are scattered abundantly over the inner surface of the cup.

The ectosome of both surfaces is lighter in color than the interior, and something over 0.5 mm. thick. The difference in respect to the canal system between the ectosomal regions of the two surfaces (pore and oscular) of the sponge is easily seen in gross sections.

Spicules.—1. Small oxeas (pl. 47, fig. 11, *b*), sharp-pointed, evenly tapering, very slightly curved; commonly ranging from 60 by 3 to 350 by 8 μ, but reaching a length of 500 μ. The ectosome on both surfaces of the sponge is thickly packed with these spicules, which are arranged tangentially, obliquely, and radially. The spicule is also very abundant in the choanosome.

2. Large twisted rhabds (pl. 47, fig. 11, *a*), sometimes with oxeate, sometimes with strongylate ends; about 2 mm. long, and 40 μ thick at the middle. From the middle the spicule tapers gradually toward both ends, which, as said, are in some spicules sharp, in others rounded. The choanosome is filled with these spicules, so twisted and intertwined as to form a very coherent mass. An abnormal form of the spicule occasionally occurs, in which the axis is branched, bifid or trifid, at one end.

3. Chiasters (pl. 47, fig. 11, *c*), 6–8 μ in diameter, with no (enlarged) centrum and about 7–8 rays; rays cylindrical and minutely spinose distally (acanthtylasters of Lendenfeld). Spicule abundant on both surfaces and throughout the sponge.

4. Oxyasters (47, fig. 11, *d*, *d'*), commonly 20–20 μ in diameter, with no (enlarged) centrum and about 7 strong, sharp rays. They number of rays may be reduced to 5, 4, or even 3 (triad condition). As usual, the forms with fewer rays are the larger, the total diameter sometimes reaching 50 μ with a ray length of 24 μ. Small spicules ranging down to the size of the chiaster occur, doubtless young stages. The oxyasters are abundant throughout the sponge.

The difference between ectosomal and choanosomal skeleton is more conspicuous in this than in other species. The shape of the choanosomal megasclere is also distinctive.

Holotype.—Cat. No. 21270, U. S. N. M.

Genus SPONGOSORITES Topsent (1896).

Spongosorites Topsent 1896, p. 117, 1898, p. 108, and Dendy 1905, p. 182, plus *Acanthoxifer* Dendy 1905, p. 156, plus *Anacanthaea* Row 1911, p. 329.

Form various, sometimes lamellate, in which case the oscula may be on one face, pores on the other. Choanosomal skeleton made up of oxeas, thickly and irregularly strewn. Ectosomal skeleton dense, composed of oxeas usually smaller than the choanosomal spicules, and variously grouped, sometimes in radial brushes, sometimes tangential and forming a smooth crust. Without astrose microscleres, but sometimes with trichodragmas.

SPONGOSORITES SULUENSIS, new species.

Plate 38, fig. 8; plate 48, fig. 3.

Two fragmentary specimens, 6 mm. thick, the larger 80 mm. by 55 mm. in area, both with rounded natural margin, from station D5168.

Dermal membrane of pore surface uniformly perforated with small closely set pores. The main afferent canals extend in radially from this surface, and are imperfectly seen through the dermal membrane causing the appearance of "pore areas." The canals are less than 1 mm. in diameter and 1–2 mm. apart (pl. 48, fig. 3).

The oscula vary in diameter from 2 mm. to less than 1 mm., and are very abundant, commonly about 3 mm. apart. Two or three, occasionally more, oscula may open into a common shallow surface depression, or they may open singly. Round each osculum there is a narrow depressed marginal zone which is perforated by small apertures resembling pores. Where the oscula open into a common depression, the whole floor of this between and around the oscula is porous. The main efferent canals opening at the oscula are radial to the surface and something less than 1 mm. in diameter (pl. 48, fig. 3).

The sponge is comparatively dense and compact, whitish brown in color.

The skeleton of the interior is made up of oxeas of very different sizes, many of them large; thickly and irregularly strewn. Vague tracts of spicules are here and there distinguishable, extending from the interior toward the surface. There is a very little spongin uniting the spicules, best seen in teased preparations on spicules that have been torn apart.

The ectosomal skeleton at each surface of the sponge is distinct, although it shades off into the choanosomal skeleton. At the pore surface are well defined radiating brushes of oxeas, thickly and uniformly distributed, and projecting slightly beyond the surface. The skeleton of this surface also includes multispicular tangential tracts of oxeas, lying between the pores, but these are obscured by the radiating brushes which are about 400 μ long.

The ectosomal skeleton of the oscular surface in general is composed of tangentially placed oxeas. These form a dense, smooth dermal crust about 100 μ thick. The porous areas round the oscula, on the contrary, have the same kind of skeleton as the pore surface of the sponge.

Spicules.—1. Choanosomal oxeas, 140 by 7 to 1,350 by 32 μ, the larger sizes abundant. The spicule is smooth, slightly curved, and tapers gradually from the middle to the points, which are sharp.

2. Ectosomal oxeas similar to those of choanosome, but smaller, ranging from 140 by 7 to 450 by 16 μ. The oxea is not infrequently represented by a style.

3. Trichodragmas, in the choanosome; not very abundant. The exceedingly fine hair-like spicules may occur singly but usually in bundles, about 100 by 2–8 μ, including from 2 or 3 to a considerable number of spicules. The spicules of a bundle are often loose and divergent at the ends. The trichodragmas are frequently curved, sometimes spirally, round two or three of the larger megascleres, as if holding them together. They are best seen in teased preparations.

Holotype.—Cat. No. 21297, U.S.N.M.

The *Albatross* sponge plainly lies in the neighborhood of *Jaspis* (plus *Coppatias*) in the Epipolasidae as a form without astrose microscleres. Closely related sponges without microscleres are the species described by Topsent (1896) and Dendy (1905) under *Spongosorites.* In *Spongosorites*, as emended by Dendy (1905, p. 182), the choanosomal skeleton is composed of oxeas scattered thickly in all directions, the ectosomal skeleton is especially dense and is composed of similar but smaller, tangentially placed, oxeas. Dendy (1905 and 1921*b*), would transfer this genus to the Axinellidae, but I see no good reason for doing so.

Acanthoxifer Dendy (1905, p. 156) is, I take it, also a related sponge. In this genus the main skeleton is a confused reticulation of, chiefly smooth, oxeas; cortical skeleton made up of radial brushes of, chiefly spined, oxeas; microscleres, trichodragmas. *Anacanthaea* Row (1911, p. 329) is a similar form in which none of the oxeas are spined. These two genera are placed by Dendy (1905) and Row (1911) in the subfamily Heteroxyinae Dendy (referred now, Dendy 1921, p. 25, to the Desmacidonidae) created by Dendy for *Acanthoxifer* and for *Heteroxya* Topsent, which he would remove from the Donatiidae. But their place, as well as that of *Spongosorites*, including the *Albatross* species, seems rather to be in the neighborhood of *Jaspis.*

The several genera are certainly close together. In respect to the ectosomal skeleton, the *Albatross* sponge resembles on its oscular face (spicules tangential) *Spongosorites sensu* Dendy, on its pore face (spicules in radial brushes) *Acanthoxifer* and *Anacanthaea.* In the choanosomal skeleton all the forms are essentially alike. It does not seem possible therefore to retain these genera as separate groups. *Spongosorites* may easily be sufficiently enlarged to include the other forms, and the definition of this genus, employed above, represents an attempt to do this. Dendy (1921*b*, pp. 124–126) discusses the genus and describes a new species from the Indian Ocean.

Family DONATIIDAE.

Tethyidae AUTHORS.
Donatiidae BAER, 1906.

Massive, discoidal, or incrusting forms. The megascleres are radially arranged rhabds: styles (=strongyloxeas, sometimes fusiform) or oxeas. Ectosome often but not always differentiated to form a fibrous cortex, frequently furnished with radiating microrhabds. The microscleres exclusive of microrhabds, which are not always present, are euasters, sometimes of two sorts. But microscleres may be entirely absent (*Tuberella*, *Trachya*, *Heteroxya*).

In addition to the genera represented in the collection, *Donatia* and *Tuberella*, the family includes: *Tethyorrhaphis* Lendenfeld (1888), *Xenospongia* Gray (1858), *Trachya* Carter (1870), *Heteroxya* Topsent (1898), and *Halicometes* Topsent (1898). (See Topsent 1920*d*, p. 33.)

For forms with streptasters an *appendix* to the family may be created. *Scolopes* Sollas (1888), with amphiasters instead of euasters, would be classed here. Topsent (1898, p. 108) pointed out that it was nearly related to the Donatiidae.

Topsent (1898) assigns *Xenospongia*, somewhat doubtfully to be sure, to the Spirastrellidae. Dendy (1905) after original study of a good specimen refers it to the Donatiidae.

Dendy (1916, p. 259) is inclined to think that if "epipolasid" forms, such as certain species which he refers to *Aurora* (see *Aurora* under Stellettidae), are admitted into the Stellettidae, then possibly the whole family of Donatiidae should be merged in the Stellettidae. He nevertheless retains the family, although he would limit it, possibly excluding the oxeate forms: *Trachya* and *Heteroxya.*

Thiele's suggestion (1903, p. 965) that the name *Donatia* should be used for *Tethya* Authors and *Tethya* for *Craniella* Authors has been followed by many, Lendenfeld (1903) adopting *Tethya* in the latter sense and Baer (1906) introducing the name Donatiidae for Tethyidae Authors. Dendy (1916 p. 260) reviews the matter and thinks the wisest course would be to abandon the generic name of *Tethya* altogether, since Lamarck included very diverse sponges under this name without indicating any one as the type species. Topsent has recently (1920*b*) made out a good case in equity for the practice that was common before 1903—namely the use of *Tethya* for hadromerine sponges such as *Alcyonium aurantium* Pallas (= *A. lyncurium* Linnaeus)—and it seems to me regrettable that any change was ever made in this custom. Still *Tethya* in such a sense appears to have no valid claim in strict law while *Donatia* has.

Topsent, who (1920*b*) has recently gone through the older literature on this matter, is convinced that *Tethya* can not be used for a sigmatophorous sponge, since *T.* (*Alcyonium*) *cranium* O. F. Müller, included by Lamarck under *Tethya*, is not such a sponge, Johnston (1842, p. 83) being in error when he picked this name for his own sponge which plainly is a sigmatophorous form. For this (sigmatophorous) type Topsent advocates *Craniella* Schmidt (1870), thus upholding the practice of Sollas as against that of Gray, Carter (see Sollas, 1888, p. cxxii), Thiele, and Lendenfeld. Sollas' practice in this matter, adhered to by Topsent (1904, 1920*b*), Dendy (1905), and Kirkpatrick (1908) should, I think, be followed.

Genus DONATIA Nardo (1833).

Donatia Nardo, 1833, p. 522.—Thiele, 1903, p. 965.
Tethya Authors.—Lendenfeld, 1896, p. 16 (older synonymy in detail).

Sponge usually of more or less spheroidal form, but sometimes a flattened crust. Ectosome distinctly differentiated from the choanosome, constituting a cortex which is more or less fibrous and which lacks special microrhabds. Megascleres are rhabds, usually fusiform styles or subtylostyles. Microscleres are spherasters together with smaller euasters of one or two sorts.

DONATIA INGALLI (Bowerbank), var. SEYCHELLENSIS (E. P. Wright).

Plate 47, figs. 9, 10.

Tethea ingalli Bowerbank, 1872, p. 119.
Alemo seychellensis Wright, 1881, p. 13.

The species as here conceived (see below) covers *D. ingalli* (Bowerbank), *D. maza* (Selenka), *D. seychellensis* (Wright), and *D. japonica* Sollas.

A specimen of the variety was taken at station D5181. Sponge is spheroidal, 25 mm. in diameter, considerably incrusted with shelly débris opposite the oscular process.

Over most of the surface the conules are conspicuous conical projections very generally produced into slender gemmiferous processes. The pores form irregular areas between the conules. There is a single osculum at the end of an oscular process, the latter 8 mm. long and 2 mm. wide.

The ectosome is colorless and in general about 2 mm. thick, thinner in the depressed areas and thicker in the conular regions. It is fibrous in its deeper stratum (pl. 47, fig. 9, *f. s*). Its outer stratum is much interrupted with subdermal spaces and pore canals. The choanosome is greenish in color.

There are the usual strong radial bundles (pl. 47, fig. 9) extending from the center, expanding and subdividing in the cortex into narrow brushes which support the dermal membrane. The styles making up the radial bundles taper toward both ends and measure 1,600–2,000 by 28–32 μ.

The styles of the surface brushes range from small ones, 500 by 8–10 μ, up to the larger spicules just mentioned.

In the outer half of the choanosome, between the radial bundles, there are abundant styles more or less radially arranged, those in the immediate neighborhood of the radial bundles inclined obliquely to the latter. The spicules commonly range from 500 by 12 μ to 1,000 by 18 μ, with some larger ones 1,800 by 32 μ.

The central ends of the radial skeletal bundles are bound together by small styles, about 400 by 12 μ, forming a dense aggregation or "nucleus."

The spherasters (pl. 47, fig. 10, *a*) are of the usual type with large centrum and conical rays; total diameter of the spicule about 60 µ. They are abundant in the ectosome, especially just below the level of the subdermal cavities. A few smaller ones occur in the outermost stratum of the choanosome.

The chiasters, tylasters of some writers, acanthtylasters of Lendenfeld (pl. 47, fig. 10, *b*), are about 12 µ in diameter with small centrum and about seven rays which are enlarged and spinose at the end; rays appear simply tylote when seen at magnifications of 400–600. The spicules are crowded at the surface forming a dermal crust; also abundant in the ectosome in general; also abundant in the walls of canals in the choanosome.

Chiasters with terminally spinose rays have long been known to occur in several species. Lindgren (1898, p. 358) refers to this fact. In *D.* (*Stelletta*) *nux* Selenka, the larger ectosomal chiasters are of this kind (Thiele, 1900, p. 61). In *D. lyncurium* Authors such spicules sometimes occur (Topsent, 1900, p. 295). In *D. magna* Kirkpatrick (1903, p. 240) they are characteristic: also in the several varieties of *D. japonica* described by Hentschel (1909, p. 372). Topsent in his recent essay on *Donatia* (1918) shows rays of this character in all the species figured. Doubtless in some of the older descriptions the spinelets have simply been overlooked.

The choanosomal oxyasters (pl. 47, fig. 10, *c*) are common throughout the choanosome, although less abundant than the chiaster. Total diameter of spicule 30–40 µ; rays about 6–7 in number, spicule often hex-radiate; centrum very small, rays long and tapering, straight or curved. The rays sometimes bear a few, one to three, lateral spines, and are not infrequently bifid. Spicules transitional to the chiaster now and then occur; intermediate in size; the rays comparatively stout and bearing at the apex several short spinelets.

The data given above make it plain that the *Albatross* sponge belongs to the type known as *D. seychellensis.*

The difficulty in distinguishing species in *Donatia* has been pointed out more than once. Sollas (1888) recognized *D. lyncurium* (Linnaeus), *D. ingalli* (Bowerbank), *D. maza* (Selenka), *D. seychellensis* (Wright), *D. multifida* Carter, and recorded several other insufficiently described and uncertain species.

The species which Sollas recognized are distinguishable types, whatever their genetic relationship may be and regardless of the fact that various kinds of intermediate forms exist. Their differential characteristics may be stated as follows:

In *D. seychellensis* there are spherasters, chiasters (doubtless characteristically acanthtylasters), and larger choanosomal oxyasters. Cortex with extensive intracortical cavities, and only fibrous in its deeper stratum.

D. ingalli differs from *D. seychellensis* in not having extensive intracortical cavities, but, instead, long narrow canals of uniform diameter each leading from a single pore and passing completely through the cortex. The cortex is fibrous throughout.

D. japonica differs from *D. seychellensis* in the absence of the choanosomal oxyaster. Hentschel (1912, p. 317) finds intermediates. Topsent (1918, p. 599) thinks perhaps Hentschel had representatives of several species before him. But it seems probable now that we shall find, if we look for them, individuals that are intermediate in respect to any one of the differential characters that separate related forms in this and many sponge genera.

D. maza differs from *D. seychellensis* in the form of the choanosomal aster. It is what is often called a strongylaster and distinctly smaller than the oxyaster of *D. seychellensis.* The rays are roughened rather than distinctly spined whereas in *D. seychellensis* they are characteristically spined; rays only rarely dichotomous whereas they are characteristically so in *D. seychellensis.* The spicule of the *Albatross* form (see above) may be said to vary toward the *D. maza* type.

In *D. lyncurium* the cortex is variable, sometimes of the *D. ingalli*, sometimes of the *D. seychellensis* type. Smaller euasters, Topsent, 1918 (p. 568), variable in details of shape but of about same size, the ectosomal not differing from the choanosomal; centrum small; rays 9–15, feebly spinose along their length or only terminally so, the terminal spines frequently producing an enlargement (acanthtylaster type); rays cylindrical or tapering, varying towards the oxyaster type, which apparently is reached or nearly reached (Topsent, 1918, fig. 18, p. 568), although Topsent says "they do not differentiate into pure oxyasters"; diameter of entire spicule 13–20 μ.

In *D. multifida* Carter spicules are essentially like those of *D. seychellensis*, but the body is "membraniform, lacinulate, expanded, flat or erect, fan or vase shaped, proliferous" (Sollas, 1888, p. 441).

Since Sollas' monograph a very considerable number of forms have been described, one effect of which has been to make the distinctions between the species recognized by Sollas less sharp. Besides Sollas, Lindgren, Thiele, Hentschel, Dendy, and recently Topsent (1918) have critically discussed these distinctions and deepened our knowledge of the genus.

Lindgren (1898, p. 358) rearranged and combined the recorded species, reducing the number to three: *D. lyncurium* Authors, with spherasters, and oxyasters 12–20 μ in diameter; *D. ingalli* Bowerbank, with spherasters, tylote chiasters 6–16 μ in diameter, and oxyasters 20–52 μ in diameter; and *D. japonica* Sollas, with spherasters, and tylote chiasters 8–16 μ in diameter. Of these he regarded *D. lyncurium* as the simplest and probably the oldest form. From it he derived *D. ingalli* and from the latter *D. japonica.* This grouping of Lindgren's is open to the criticism (Thiele, 1900, Dendy, 1905, 1916, Hentschel, 1909, 1912) of being artificial, in that the characters of the smaller euasters are exclusively used for the distinguishing of species, although other points of difference between recorded forms are known and again there are recorded forms which, in respect to the astrose characters, are intermediates, falling not in but between Lindgren's species.

Thiele (1900, p. 61) points out that for the secure foundation of the species it is essential to learn how constant within a species is the structure of the cortex.

Dendy in 1905 (p. 113) was inclined to use the well known, widely spread, and manifestly variable form, *D. lyncurium* Authors (Mediterranean, Atlantic, and Arctic Oceans) as a world-wide species, and recorded Ceylon forms under it as varieties. Later (1916, p. 260) he refers these eastern forms to *D. japonica*, *D. ingalli*, and *D. seychellensis*, adding a new species, *D. stella-grandis*, distinguished especially by the very large size of the spherasters.

Hentschel, 1909, would disregard the difference in cortical anatomy recorded for *D. seychellensis* and for *D. ingalli*, merging the former in the latter. Topsent (1897, 1906, 1918) practices this treatment. In 1912 (p. 316) Hentschel decides for a use of the designation *D. ingalli* as covering a group of forms, " species, subspecies, tropi," which it is not at present possible to characterize differentially. Such conclusions state, implicitly at least, a task of systematic zoology that begins to be imperative—namely, the critical study of certain widely spread and variable species, with the purpose of marking out the lines and magnitudes of the variation that affects, in different quarters of the world, the several " characters," setting down also the environmental conditions that are associated with particular character combinations—all, as solid and wide bases for rational experimentation.

Topsent in his comprehensive and very helpful review (1918) of the various forms (34 species and about 10 varieties) classed under *Donatia*, proposes to merge many of them. I am here only concerned with a few of the changes proposed. With regard to others I have formed no opinion. Topsent would unite a number of Sollas's types, *D. ingalli*, *D. maza*, *D. seychellensis*, *D. multifida*, along with several species more recently described, all under the name of *D. diploderma* (Schmidt). In the matter of the name chosen, it seems to me that Schmidt's description of *Tethya diploderma* (1870, p. 52) is too incomplete to enable one to refer, with certainty, specimens of *Donatia* to this species. Schmidt to be sure states (1880, p. 78, footnote) that Selenka's *T. maza* (redescribed, from authentic specimens, by Sollas, 1888) is identical with his

T. diploderma, but there is nothing to show that this statement is more than a conjecture.

If the species enumerated above are to be merged, as I think should be done with perhaps the exception of *D. multifida*, so peculiar in its shape of body, it would be more justifiable to use for the group the name of the oldest recognizable form—namely, that of *D. ingalli* (Bowerbank, 1872), as Hentschel, 1912 (see above) has done. Hentschel in his text (p. 317), although not in his definition, would also include *D. japonica* Sollas, a species which Topsent (1918) holds to be distinct. In regard to the latter three of this set of forms, *D. ingalli*, *maza*, *seychellensis*, and *japonica*, Sollas long ago (1888, p. 428) stated that he was "inclined to regard them as varietal modifications of a single species."

I may be allowed a word or two as to what I understand by this expression "varietal modification" or variety (compare what is said on the separation of genera and subgenera, farther on under *Tetilla*.)

Certainly the phenomena of variation in sponges are coming closer to our eyes as many, myself among the number (1904, 1919, 1919 *b*), have pointed out in recent years. The various diagnostic features which have been picked out as characterizing natural races all vary and vary, apparently, independently of one another, so that many kinds of combinations come into existence. Moreover they do not vary as definite, relatively unalterable, features (unit characters of the older Mendelian terminology) which are present or absent, as in the typical Mendelian crossings, but any one "character" varies quantitatively so as to produce a series only the extremes of which contrast sharply. Hence as the number of combinations known to us increases—in other words, as the number of carefully studied individuals from various regions, intergrading more or less and in very complex fashion, increases—it becomes more and more difficult to apply our customary method of classification, which is essentially a splitting method. Any attempt to cleave the whole of one of these assemblages into subgroups (subspecies, varieties, etc.) is arbitrary. It can only lead to erroneous conceptions. Nevertheless within a group of related natural objects, such as an assemblage of *Donatia* individuals, we see certain distinct types to which numbers of individuals conform, but we also see numerous individuals which conform to none of these and which in respect to one character are intermediate between certain two types while in respect to another character they may be intermediate between two other types. If now we are to express objective fact in our classifications, we have to recognize by name certain somewhat heterogeneous groups (*Donatia* species) and the types within these (varieties), understanding by the latter not subdivisions into which the whole of the group is split. In classifying individual organisms it will thus often happen that the group (species) is the only category we can use, but in other cases the individuals conform to well-marked types and may therefore be referred to varieties. This is the practice which F. E. Schulze years ago marked out as the proper one (1879, pp. 11–12) when dealing with exuberant variability, and, I believe, it is understood by many to be the correct procedure. Nevertheless in systematic manuals of to-day we frequently find a widely ranging and variable species represented as *separable* into subgroups, usually designated subspecies, the implication being not that one is a relatively heterogeneous remainder but that all are equivalent groups stamped with about the same degree of homogeneity.

With regard to a fundamental difference in meaning between terms, such as subspecies and variety, for intraspecific groups, all systematists must confess that our knowledge of variation in sponges (and organisms in general) is yet too fragmentary for us to apply, widely and consistently, in the work of classification the ideally different categories for which such terms are sometimes meant to stand. The increased use in recent years of "subspecies" has been marked, especially for geographical races, and this has perhaps tended to crystallize the erroneous idea that a species is a congeries of equivalent smaller groups, into some one of which any particular individual must go.

Nor are we as yet able to use, except here and there, in systematics the various kinds of intraspecific groups with which experimental genetics begins to make us acquainted. As to the genetic values and correlations of the differential characters that stamp varietal types we are largely in the dark. This is true, for instance, of the differences in cortical anatomy which mark off *D. ingalli*, *sens str.*, from *D. seychellensis*, as it is true of the absence of a particular microsclere (as in *D. japonica*). Topsent (1918) tends to disregard the features of cortical anatomy. But, as far as I know, there are no recorded data which indicate that they are less constant than spicular features.

Genus TUBERELLA Keller (1880).

Tuberella Keller, 1880, p. 276.

Without a fibrous cortex and without microscleres. Chief megascleres are large fusiform styles arranged in distinct spiculo-fibers that course toward the surface, or which are so abundant that an arrangement in fibers is scarcely perceptible. Small slender styles radiately arranged occur in the ectosome.

TUBERELLA CILIATA, new species.

Plate 39, fig. 1.

A specimen from station D5641.

Sponge massive, amorphous, partially breaking up into rounded lobes. Surface very minutely and thickly conulose, and finely hirsute with spicules that project in general about 1 mm. There is some indication that small oscula, now closed, are scattered sparsely over the surface. Pores closed, but arrangement of subdermal cavities indicates that they are scattered. Color whitish brown.

There is a translucent, gelatinous-looking ectosome about one-half millimeter thick, not fibrous but collenchymatous. The collenchyma extends down into the choanosome, accompanying the larger canals which connect the interior with the ectosomal spaces.

The ectosomal cavities include (1) shallow, interconnecting subdermal spaces about 50 μ deep, immediately below the thin surface membrane, which is only about 4 μ thick; and (2) a system of inner spaces lying close to the choanosome, and from which relatively large canals pass into the interior. The inner ectosomal spaces are commonly about 175 μ deep; they interconnect and are much more conspicuous than the true subdermal spaces. Just beneath the latter the ectosomal cells are elongated parallel to the floor of the space, but there is no distinctly differentiated fibrous stratum.

The body is well filled with very numerous styles, 1,400–2,000 by 20–36 μ; straight, or slightly curved or bent; tapering toward the small, rounded, basal end as well as toward the pointed apex; in the peripheral region curving radially to the surface, the superficial ones projecting in the conuli, a few in each conulus. The spicules are so abundant that there seems at first sight to be no arrangement into fibers, but in a carefully macerated slice in which the spicules remain in position, a very imperfect arrangement into spiculo-fibers can be made out. The fibers, or tracts, are dense, without spongin, close together, and imperfectly separated. They all trend toward the surface.

Very slender ectosomal styles, 1,100–1,300 by 4 μ, about cylindrical in shape, sometimes slightly curved, are abundant. In the ectosome they are radially arranged and grouped indistinctly in bundles, the outer spicules of a bundle projecting from one of the minute conuli. But these tufts of projecting spicules are not far from being continuous with one another.

Holotype.—Cat. No. 21319, U.S.N.M.

This is evidently a quite different form from *T. aaptos* (O. Schmidt), hitherto the only generally recognized species of the genus. In *T. aaptos* (Topsent, 1900, p. 285) the larger megascleres form distinct, well-separated spiculo-fibers which radiate from centers, and the ectosomal styles are much shorter and stouter than in the Philippine species, forming moreover fairly distinct diverging brushes. *T. aaptos* has been recorded from the Mediterranean and Gulf of Mexico (see Topsent, 1900), from Porto Rico (Wilson, 1902, p. 388), southwest Australia (Hentschel, 1909, p. 377), Aru Islands (Hentschel, 1912, p. 319), Okhamandal in Kattiawar (Dendy, 1916*b*, p. 101).

Family SPIRASTRELLIDAE.

Spirastrellidae Ridley and Dendy, 1886, 1887.

Megascleres usually styles or tylostyles, sometimes diactinal. Asters of various forms (euasters, spirasters, sanidasters, discasters) occur, often forming a dermal crust.

The genera are *Timea* Gray, 1867 (=*Hymedesmia* Bowerbank, Authors), *Spirastrella* Schmidt, 1868, *Latrunculia* du Bocage, 1869, *Sceptrintus* Topsent, 1898, *Placospongia* Gray, 1867, *Negombo* Dendy, 1905, *Anthosigmella* Topsent, 1918, and *Diplastrella* Topsent, 1918. *Xenospongia* Gray, placed in this family by Topsent, is removed to the Donatiidae. Dendy, 1921*b* (p. 131), has recently added to the family *Barbozia*, *Didiscus*, and *Sigmosceptrella*, new genera, and also *Sceptrella* O. Schmidt, *Podospongia* du Bocage, *Trachycladus* Carter (see Epipolasidae), and *Axos* Gray (see Vosmaer, 1887, p. 243).

The spiraster of the Spirastrellidae has generally been regarded as a modification of the "true aster" (euaster). But Vosmaer (1909) concluded that this spicule is not an aster but a spiral monaxon with spines, since the latter contain no axial canals as do the actines of a true aster. Dendy (1916*b*, p. 96; 1921*b*, p. 129*ff*) in pursuance of Vosmaer's argument and as a result of the discovery of some fundamentally interesting forms, transfers the Spirastrellidae and along with them the Clionidae, Suberitidae, and Polymastidae to the neighborhood of the Desmacidonidae which he would regard as the parent family. This is a change of great importance, one which demands time for a consideration of all the facts involved. Topsent in a paper published in 1922 goes so far in this direction as to transfer *Latrunculia* and the very similar forms *Podospongia* and *Sigmosceptrella* to the Poeciloscleridae (nearly equivalent to Desmacidonidae), grouping them in a new subfamily, Latrunculiinae. He regards the position of Dendy's other new genera, *Didiscus* and *Barbozia*, as doubtful. Whatever resemblance there is between the special microscleres of the latter two and the former three genera may, he thinks, be attributed to convergent evolution. The remaining Spirastrellidae he would apparently retain as a family in the usual position (as here).

There is not perfect agreement among writers as to the nomenclature of the genera. Thiele, 1903 (p. 955) has ruled that

Hymedesmia Bowerbank in Topsent's sense (1898, 1900) should be designated *Timea* Gray; also that the designation *Hymedesmia* Bowerbank should be used for the ectyonine group of species for which Topsent (1892) proposed the name *Leptosia*, since this group included *Hymedesmia zetlandica* Bowerbank, the type of *Hymedesmia*. Lundbeck (1910, p. 41), Stephens (1912, p. 58; 1915*b*, p. 22) and Hentschel (1912, p. 322) accept Thiele's changes, as do I. *Hymedesmia* in Topsent's sense of 1898 has, however, the sanction of Topsent's later papers and of Dendy, 1905. Dendy 1921*b* (p. 142) now accepts Thiele's changes.

The systematic position of *Placospongia* is discussed by Vosmaer and Vernhout (1902, p. 16). These authors call to mind that Keller (1891) demonstrated that the so-called sterrasters of this genus develop from spirasters, and that he therefor transferred the genus from the neighborhood of the Geodiidae in the *Astrophora* to the Spirastrellidae. Keller's move has been generally followed (Vosmaer, Lendenfeld, Thiele, Dendy).

Genus SPIRASTRELLA O. Schmidt (1868).

Spirastrella SCHMIDT, 1868, p. 17.

Sponge incrusting, cushion-shaped, massive, or vasiform; in the latter case the two surfaces may be structurally different, the outer incurrent, the cloacal excurrent. Surface of cushion-shaped or massive sponges may bear digitate or less regularly shaped processes, some or all of which bear terminal oscula. Megascleres, tylostyles or styles or intergrades, or a mixture of the two forms. Microscleres usually present, and abundant, in the form of spirasters; frequently forming a dermal crust; sometimes exceedingly scarce or even wanting.

SPIRASTRELLA VAGABUNDA Ridley.

Spirastrella vagabunda RIDLEY, 1884, p. 468.

Station D5142, three pieces. These have been sliced off from what were evidently large sponges, or perhaps one sponge; the largest slice measures 200 by 120 mm., with a thickness of 40 mm. The elevations on the surface of the sponge are in one piece digitate processes, 20–30 mm. high; in another piece the larger processes are irregular nodules; in the third piece the processes are conical and only about 10 mm. high. The processes contain prolongations of the large canals of the interior, often a single axial canal of good size in a process. Typically, doubtless, this opens by a terminal osculum, but in the actual specimen open oscula are found only on a few processes. The surface of the sponge is glabrous and actually aporous; the pores, like most of the oscula, have doubtless closed. There are numerous large canals in the interior, 3–10 mm. in diameter; some sand is found here and there in the choanosome. Color of sponge brown, the cortex whitish.

The choanosomal skeleton is a feltwork of megascleres aggregated, in part, into dense but vaguely defined spiculo-fibers, between which are abundant spicules; the fibers, or tracts, cross and fuse in irregular fashion; the skeleton as a whole is close (dense); a little spongin here and there cements the spicules together. The megascleres are styles, the head sometimes slightly tylote, 600–700 by 16–20 µ.

The ectosome is occupied by a conspicuous and compact layer, varying in thickness from 0.7 to 3 mm., of megascleres crossing in all directions. The megascleres are like those of the choanosome. This dense "cortex" is traversed by narrow tubular canals, more or less radial to the surface; those in the piece examined were a fraction of a millimeter wide and 2–4 mm. apart.

At the surface are small, radially placed styles (sometimes subtylote), imperfectly arranged bouquet-fashion, the points projecting; these spicules, in places at any rate, are abundant enough to form a continuous stratum; they measure 250–450 by 6–10 µ.

There is the usual dermal crust of spirasters. These are 10–12 µ long; axis long and curved, probably always spirally, the microscopic image showing two or sometimes only one curve; rays numerous, short, stout, blunt, distributed as usual along the length of the axis.

Under *S. vagabunda* Ridley, 1884 (p. 468), described sponges from Torres Straits, Trincomalee, and Ceylon, which were massive, "tending to grow up into large nodular elevations, which may bear one or more vents." The interior is made cavernous by wide canals. There is a strong "cortex," about 0.8 mm. thick, formed by intercrossing megascleres. The megascleres are tylostyles 600 by 20 µ, or (in var. *trincomaliensis*) scarcely tylote at all and about 13 µ thick; spirasters delicate and long, 32 µ long, with fairly numerous short and rather blunt spines. The largest specimen measured 225 mm. by 130 mm., with a thickness of 60 mm. Ridley calls attention to the characteristic and relatively constant external appearance of the species.

Dendy, 1905 (p. 122), extends the idea of the species by describing several varieties from Ceylon. In one variety (*trincomaliensis*), the surface elevations are digitate processes about 23 mm. long, excavated by the exhalent canals, which are "extremely narrow" (sponge was perhaps greatly contracted). The megascleres form some, at any rate, surface brushes. Megascleres are tylostyles and styles about 620 by 9 µ; spirasters 12 µ long, with blunt rays (blunt in all spicules?). In another variety (p. 124) the spirasters may reach a length of 48 µ. Dendy merges several species.

Topsent, 1893, describes a variety from the Gulf of Tadjoura, and (1918) suggests some fusion of species.

Thiele, 1900 (p. 70), assigns sponges from Ternate to this species, into which he would merge *S. inconstans* Dendy (Ceylon).

Dendy, 1916*b* (p. 132), has recently reported the species, var. *tubulodigitata*, from Okhamandal, and 1921*b* (p. 139) (type and varieties) from the Indian Ocean.

Vosmaer, 1911 (p. 14), merges in this species *S. digitata* Hentschel, from Southwest Australia. In *S. digitata* (Hentschel, 1909, p. 385), the sponge body is massive with processes that are digitate, clavate, lobular, or irregularly nodular ("knölliger Gestalt"). Megascleres are subtylostyles varying toward the tylostyle and toward the style, 225–700 by 8–12 µ; there are two classes, large and small, but with intergrades. Spirasters are 12–16 µ long with stout irregular outgrowths which only rarely are spinous in shape. A cortex is not mentioned, nor is the arrangement of the small megascleres stated. The sponges are evidently close to the *Albatross* specimens.

Vosmaer (1911) goes far in combining *Spirastrella* species. He merges (p. 15) *S. vagabunda*, based on the study of Indo-Australian sponges, in *S. angulata* Bowerbank, from Madeira, and this species along with many others he combines under *S. purpurea* (Lamarck).

Topsent, 1906*b* (p. 2), has redescribed the type specimens of *S. purpurea*. The species is probably vasiform, one face (outer) bearing radial tuberosities, the other (inner) without tuberosities and with very numerous punctiform oscula about 1 mm. apart. There is a "cortex" about 0.55 mm. thick; at the surface, a crust of spirasters and radial tylostyles, the points of which just project. Megascleres, tylostyles 330–350 by 10–12 µ. Spirasters vary in size and details of shape; the common large size, 22 µ long.

Topsent, 1918, criticises Vosmaer's fusion of species as too extensive. Hentschel, 1912 (p. 324), and Stephens, 1915 (p. 434), however, make use of *S. purpurea* in the extended sense of Vosmaer, Hentschel recording under this name sponges from the Aru Islands, while Stephens' sponges came from the South Atlantic. I incline to believe with Topsent, 1918, that Vosmaer's species idea is too comprehensive. In particular it seems to be that in the case of the species here recorded (*S. vagabunda*), and in the case of many others, some classificatory importance should be assigned to habits of growth which, under suitable conditions, lead to the assumption of more or less definite external characteristics. Such growth habits are perhaps quite as hereditary as the small details of spicular shape and size.

With respect to the small radially placed megascleres at the surface of the *Albatross* specimens, it must be supposed either that they are of variable occurrence in the species (which would rob *S. vagabunda* of one of its characters and in so far weaken the particular species idea), or that they have been generally overlooked.

Genus PLACOSPONGIA Gray (1867).

Placospongia Gray, 1867, p. 127.—Vosmaer and Vernhout, 1902, p. 16.

Sponge incrusting or branching. There is a cortex composed chiefly of thickly packed sterrospires (pseudo-sterrasters); within this a layer of soft parenchyma; and within this, in the branching type, a solid axis of sterrospires. Surface conspicuously divided into polygonal areas by narrow grooves, destitute of sterrospires, which contain canal apertures. Spicules include parenchymal tylostyles in radiating bundles, smaller cortical tylostyles (varying to styles) projecting in the dermal grooves, sterrospires, spherasters (sometimes rare or absent), dermal spherules or in other species dermal microspires (=microstrongyles or small spirasters or spirulae of Authors). Parenchymal spirasters of good size occur in some species.

PLACOSPONGIA MELOBESIOIDES Gray.

Placospongia melobesioides Gray, 1867, p. 127.

Station D5174, a specimen representing a branch, 60 mm. long, diameter 8–14 mm., color pinkish buff. Station D5108, several fragments, among them one consisting of a vertical branch, 33 mm. high with diameter 8–12 mm., arising from an incrusting portion; all dark red brown.

The following spicular measurements are taken from the specimen collected at D5174. Parenchymal (choanosomal) tylostyles, 600–900 by 12 μ; Hentschel, 1912 (p. 323), gives for the species the range in length as 821–1250 μ. Cortical tylostyles, varying to styles, 190–320 by 10–16 μ, the spicules thus relatively stout; range in length for the species (Hentschel, 1912) 197–509 μ. Sterrospires 60–64 μ long; range for the species 67–78 μ. Spherasters, abundant especially at the surface, 16–18 μ in diameter; range for species as recorded by Hentschel 12–17 μ. Dermal spherules, in the usual abundance, about 1.5 μ in diameter; Hentschel gives range as 1.2–3 μ.

The species has been repeatedly taken in the Malay archipelago and Indian Ocean, and possibly in Florida waters (Sollas, 1888, p. 272). Since the monograph of Vosmaer and Vernhout, it has been recorded by Dendy (1905, p. 126) for Ceylon, and by Hentschel (1912, p. 323) for the Aru Islands. The other well known species of the genus, *P. carinata* (Bowerbank) has been recorded since Vosmaer and Vernhout's memoir, by Dendy 1916*b* (p. 132), 1921*b*. (p. 144); and by Hentschel, 1912 (p. 324).

Family POLYMASTIDAE.

Polymastidae Vosmaer, 1887, p. 328.

Ectosome histologically differentiated into a cortex that is usually distinctly fibrous. A cortical skeleton is also differentiated. The characteristic megascleres are monactinal, tylostyles or styles, and the skeleton is radiate. Ordinarily without microscleres.

In addition to *Trichostemma* (see below), the genera are *Polymastia* Bowerbank, 1864 (syn. *Rinalda, Weberella*), *Spinularia* Gray, 1868 (syn. *Rhaphidorus* Topsent, see Stephens, 1915*b*, p. 31), *Proteleia* Ridley and Dendy, 1886 (placed by Lendenfeld, 1906, p. 175, in an appendix to the Sigmatophora as a genus in which one of the megasclere forms still retains a trace of its original tetraxonid character), *Tylexocladus* Topsent, 1898, *Sphaerotylus* Topsent, 1898, *Quasillina* Norman, 1869, *Ridleia* Dendy, 1888, *Tentorium* Vosmaer, 1882, *Atergia* Stephens, 1915*b* (p. 32).

Dendy, 1916*b*, and 1921*b*, continues as formerly to combine the Polymastidae with the Suberitidae, under the latter name. But the family (Polymastidae) is in general use (Topsent, 1904, 1917; Wilson, 1904; Kirkpatrick, 1908; Hentschel, 1914; Stephens, 1912, 1915, 1915*b*).

Genus TRICHOSTEMMA Sars (1872).

Trichostemma Sars, 1872, p. 62.—Ridley and Dendy, 1887, p. 216.

Free living sponges of a symmetrical form which approaches the hemispherical; with a marginal fringe of long radiating spicules. Oscula, one or more, on only one face of the body at the ends of short tubes or papillae. There is a thick ectosome so well filled with spicules as to form a relatively dense cortex, which entirely surrounds a much less dense choanosome. Megascleres, tylostyles varying sometimes toward the style. No microscleres.

TRICHOSTEMMA STRATICULATUM, new species.

Plate 38, fig. 7; plate 48, fig. 1.

Ten specimens from station D5428.

Shape of body varying from that of a plano-convex lens to a conical shape. The approximately flat face is the oscular. The marginal fringe projects toward this face. The convex surface is smooth and clean and in one specimen bears a slender projecting process (pl. 48, fig. 1). The oscular face is covered with fine sandy débris. It bears a number, 6–8, of small rounded papillae about 0.5 mm. in height. These are scattered, although in several specimens one papilla is close to the center of the face. The papillae are probably all oscular. At any rate this was found to be the case with several (five) actually sectioned. Pores?

Color of the clean upper surface whitish, the marginal region in most specimens marked off, as a somewhat translucent ring, from a central more opaque region which indicates the extent of the choanosome. Diameter of the body varies from 9 to 20 mm. In a representative lens-shaped specimen, the body diameter is 15 mm., thickness at the center 6 mm. In one of the conical specimens, the diameter is 11 mm., the central thickness 8 mm. The marginal fringe is 6–9 mm. wide.

Probably the body can change its shape to a limited extent. At any rate, the fringe is inclined much more sharply toward the oscular face in some specimens than in others, and the marginal region of the sponge body in some specimens inclines distinctly in that direction.

As to the natural position of the sponge, Ridley and Dendy, 1887 (p. 218), infer that the oscular face is always the upper, and that therefore in one of their two species the fringe spicules project upward, in the other species downward. Vosmaer (1885, pl. 1) represents his sponges as resting on a substratum by means of the spicular fringe, but with the oscula on the upper surface. It is not impossible, however, that in sponges so resting the oscular face may be directed downwards (the position of the animal would then be rather loosely analogous to that of bottom-living medusae such as certain Rhizostomes), in which case my figure (pl. 48, fig. 1) should be turned. In *Halicnemia patera*, Bowerbank (1866, p. 96) regards the oscular face as the under one. In the physiologically somewhat parallel case of the Crinorhiza sponges, Ridley and Dendy think the radiating marginal processes project downward, thus serving to hold up the sponge on a muddy bottom. But Topsent (1902) argues that, at any rate in some Crinorhiza forms, these processes project upward.

On bisecting the sponge it is seen (pl. 48, fig. 1) that the ectosome is colorless and so thick that the loose brown choanosome (*ch*) occupies only about one-third of the central thickness of the sponge. The oscular canals (*o. c.*) are simple tubular canals, 350–500 μ wide, leading from the choanosome, through the cortex, each to an osculum. Each canal is immediately surrounded by ascending radial skeletal bundles.

The spicules are fusiform tylostyles that vary in size in the different regions of the body. The head is small but usually well developed, although the spicule not infrequently becomes a subtylostyle.

The cortex of the upper (oscular) face, in respect to its skeleton, is distinctly stratified (pl. 48, fig. 1). (*a*) The superficial stratum, about 600 μ thick, is composed of closely set short tylostyles, about 500 by 12 μ, radially placed and projecting slightly at the surface.

The spicules are in dense conical bouquets, which, however, intermingle close to their apices and form a continuous furze. (*b*) The middle stratum, (*u. c. m.*) is only the space between the superficial and the inner stratum. It includes some scattered tylostyles, 300 by 8 μ to 600 by 16 μ. (*c*) The inner stratum is somewhat thicker than the superficial one, and is not so compact. It is composed of tylostyles radiating obliquely in all directions from points near the choanosomal border. A vague grouping in brushes is perceptible in some spots. A common size of spicule is about 600 by 16 μ. The spicules as a class are certainly thicker and probably somewhat longer than those of the superficial stratum.

The cortex of the lower (convex) face is also made up of three strata. (*a*) The superficial stratum is not very compact. It is composed of obliquely radial tylostyles, not in brushes, many projecting slightly. The prevailing trend is from the center toward the margin of the sponge, but there is no great regularity of arrangement. The spicules range from 300 by 8 μ to 600 by 16 μ. (*b*) The middle stratum, (*l. c. m.*) is dense. It is composed of long spicules, compactly grouped; these are tangential, becoming radial at the margin. The stratum is thickest in the center of the sponge, and peripherally is continued into the marginal fringe. The spicules within the limits of the body range from about 1,600 by 17 μ to 4 mm. by 24 μ. The spicules of the fringe (*fr. s.*) range up to 10 mm. by 24 μ. (*c*) The inner stratum is much like the superficial one. The tylostyles, often about 600 by 16 μ, radiate obliquely from the choanosomal margin toward the surface, in general trending toward the fringe border of the sponge.

The occasional slender process borne by the convex face of the sponge includes thickly packed tylostyles arranged lengthwise in the process.

The choanosome contains some, but not many, scattered tylostyles, ranging from 300 by 12 μ to 900 by 16 μ. It is, further, crossed by the ascending radial skeletal bundles (pl. 48, fig. 1. *a. r. b.*). These bundles pass from the central part of the lower cortex to and through the upper cortex. Some, perhaps all, surround oscular canals. The bundles are made up of compactly grouped tylostyles, 1–2 mm. in length and about 20 μ thick, placed lengthwise in the bundle. The bundles expand above, the spicules of the expanded end projecting on the upper surface of the sponge somewhat farther than the surrounding cortical spicules. Thus each osculum is surrounded by a special, although vaguely outlined, fringe of spicules.

Holotype.—Cat. No. 21306, U.S.N.M.

In *T. hemisphericum* Sars from the Arctic Ocean there are several quite long oscular tubes borne on the convex face of the sponge

(Vosmaer, 1885, pl. 1). Doubtless the shape of the individual animal is subject to some change, but it seems improbable that the same (oscular) face could at one time be nearly flat and at another strongly convex. In some other points, however, the Philippine specimen agrees with *T. hemisphericum.* Thus the oscular face in the latter is covered with a furze of short tylostyles, and there are radial ascending skeletal bundles passing from the center of the lower cortex to the upper cortex (Vosmaer, 1885, pl. 2, figs. 17, 18). In Topsent's (1913 *b*, p. 20) specimens (from 72° 37′ north, 20° 0′ east) of this species the general anatomy is as in the *Albatross* specimens. But in the latter the stratification of the peripheral body appears to be much more conspicuous and indeed different in details from that of the Atlantic species.

T. sarsii Ridley and Dendy (1887, p. 218), which the Philippine sponge resembles in general shape, as do some specimens of *T. hemispericum* (see Vosmaer, 1885, pl. 1), has one comparatively long oscular tube about in the center of the flat face. Round it are a number of "small round, translucent patches," the nature of which is doubtful (Ridley and Dendy, 1887). In the figure given, pl. 43, they look much like the oscular papillae of my form. The cortical skeleton of both surfaces is considerably simpler than in the Philippine species (Ridley and Dendy, 1887, p. 217, fig. 8); the choanosomal spicules form radiating groups; and ascending radial bundles are apparently absent. Thus there are differences, although minute ones. *T. sarsii* occurs in Australian waters, off the Azores, and in the Indian Ocean (Dendy, 1921 *b*, p. 151).

Another species of the genus is *T. irregularis* Ridley and Dendy (1887, p. 220), from off Valparaiso. *Radiella sol* Schmidt (1870, p. 48), from near Cuba is regarded by Hansen (see Ridley and Dendy, 1887, p. 217) and Topsent (1898) as synonymous with *T. hemisphericum.* It has, however, only one oscular protuberance in the center of the upper face, and the fringe spicules project upward (Schmidt, 1870, pl. 4, fig. 6). *Halicnemia patera* Bowerbank (see Ridley and Dendy, 1887, p. 218) is probably yet another species, although Ridley and Dendy think that, in spite of the similarity of external form, this sponge does not belong in *Trichostemma.* The peculiar spicules, however (Bowerbank, 1864, pl. 10, figs. 228–233), on which Ridley and Dendy lay stress seem to be only modified tylostyles, in which case they can scarcely be thought of as a reason for excluding this species from the genus. Topsent (1913*b*, p. 21) has recently described a new and beautiful species, *T. grimaldii,* from the North Atlantic.

Family SUBERITIDAE.

Suberitidinae part O. SCHMIDT, 1870, p. 46.
Suberitidae part VOSMAER, 1887, p. 330.—Part RIDLEY and DENDY, 1887, p. 197.—Plus *Mesapidae* TOPSENT, 1898, pp. 103, 104.

Without a differentiated cortex. Skeleton either not radiate or radiate only in a partial way. Megascleres tylostyles or styles. Microscleres absent or represented in some forms by rhabds (centrotylote microstrongyles, or spinose rhabds that are tylostyles or variants of such).

In addition to *Rhizaxinella* (see below) the genera are *Suberites* Nardo, 1833, *Ficulina* Gray, 1868, *Laxosuberites* Topsent, 1896, *Terpios* Duchassaing and Michelotti, 1864 (see Dendy 1921*b*, p. 148), *Pseudosuberites* Topsent, 1896 (syn. *Suberanthus* Lendenfeld), *Prosuberites* Topsent, 1893, *Axosuberites* Topsent, 1893, *Mesapos* Gray, 1867, and *Tethyspira* Topsent, 1890. For the latter two genera Topsent erected (1898) a special family, Mesapidae, retained in 1900 (p. 252) and 1904 (p. 19). Topsent in 1919 removes *Semisuberites* Carter, 1877 (syn. *Cribrochalina* O. Schmidt in the sense of Vosmaer 1882, 1885; syn. *Plectodendron* Lendenfeld), transferring it to the Desmacidonidae.

Thiele (1898, 1905) discusses the genus *Suberites.* He thinks Topsent's genera *Pseudosuberites*, *Laxosuberites*, and *Prosuberites* should have the value of subgenera. *Terpios* and *Ficulina* should also, he thinks, be classed as subgenera; a new subgenus, *Suberella*, should be made for *Suberites heros* O. Schmidt, and *Suberites* sens. str. be reserved for forms like *S. domuncula* (Olivi).

Dendy, 1905, (p. 130), uses *Suberites* in a comprehensive sense, although he partly indorses Topsent's splitting of the genus into *Pseudosuberites*, etc.

Genus RHIZAXINELLA Keller (1880).

Rhizaxinella KELLER, 1880, p. 272.—TOPSENT, 1898, p. 104.

Pedunculate forms, the peduncle sometimes branched, each branch ending above in a body. Body spherical, ovoid, or cylindrical, with an osculum near the summit; stalk attached to substratum by a plate-like expansion or a set of roots. Megascleres are tylostyles or styles; among them, in several species, sinuously curved forms. Spicules of the body more or less radiately arranged. Peduncle includes, or in the adult state of some species consists of, a dense bundle of longitudinally arranged spicules.

The genus shades over into *Suberites.* (See Thiele's discussion, 1898.) There is an interesting resemblance, especially of certain species, to *Stylocordyla* (see Hentschel, 1909), which differs from *Rhazaxinella* apparently only in the oxeate character of its megascleres. (See Ridley and Dendy, 1887, p. 222).

RHIZAXINELLA NUDA, new species.

Plate 38, fig. 5.

A specimen from station D5512.

The body is club-shaped, about 55 mm. long, 21 mm. thick, rounded above, tapering below, and continued into a hard, bare stem. The latter is irregularly cylindrical, 60 mm. long, 4–6 mm. thick, and ends below in a thin plate-like expansion. A small osculum nearly closed is eccentrically placed on the upper end of the body.

Color very light brown; stem darker. Sponge firm and compact.

Surface of body without eminences, covered with a fine furze of projecting spicules. Stem is continued into body as an axial bundle of spicules, about 3 mm. thick. This ascends two-thirds of the way through the body breaking up at its upper end into indistinctly marked radial tracts, which project upwards and outwards.

The skeleton of the parenchyma of the body consists of large smooth fusiform tylostyles, more or less radially arranged and reaching the surface; not grouped in well-marked bundles; mostly about 2 mm. by 50–60 μ. The degree of tapering from the middle toward the ends of the spicule is considerable; the point is sharp; head small but well marked.

The skeleton of the body includes also a dense ectosomal crust of similar but smaller tylostyles, 600–1,200 by 14–30 μ, which project about 0.5 mm. from the surface. The ectosomal spicules are arranged in conical tufts, the spicules of a tuft diverging. The tufts (bouquets) are however closely set and overlap, so that at and beyond the surface the crust is continuous and not broken up into groups of spicules.

Stem of sponge is stony without a covering of parenchyma and without the ectosomal crust. It is made up of a dense mass of longitudinally arranged and interwoven tylostyles. Some of these are like those of the body parenchyma. Many however are slenderer, nearly cylindrical, and with rounded apex, often becoming tylotes (tylote strongyles). These are slightly curved in an irregularly sinuous fashion; 1,500–3,200 by 28–44 μ. Transitions between the two types occur.

The axial bundle of spicules in the interior of the body includes both the slender sinuous tylostyles or tylotes and the stouter straight fusiform tylostyles. The latter reach a greater length, 3 mm., here than in the parenchyma and are commonly rounded at the apex. The sinuous megascleres are relatively less abundant in this axial bundle of the body than in the stem proper.

Probably in younger stages of this species the parenchyma of the body extends down over the axial skeleton of the stem. But this in the actual specimen is, as said, quite bare, the parenchyma of the body gradually thinning away, from above downwards, to a sharp edge which encircles its upper end.

Holotype.—No. 21294, U.S.N.M.

The remaining families of the suborder, defined and in some measure discussed below, are not represented among the forms studied.

Family CLIONIDAE.

Clionidae TOPSENT, 1887.
Clioniadae GRAY, VOSMAER, 1887.

Hadromerina that bore into and excavate molluscan shells and other calcareous bodies.

The genera are *Cliona* Grant, 1826, *Dotona* Carter, 1880, *Thoosa* Hancock, 1849, *Alectona* Carter, 1879, *Dyscliona* Kirkpatrick, 1900 (see Topsent, 1907, p. xx), *Clionopsis* Thiele, 1905 (see Topsent, 1908), *Poterion* Schlegel, 1858 (see Vosmaer, 1908; George and Wilson, 1919), *Cliothosa* Topsent, 1905 (see Topsent 1920, p. 89), *Heterocliona* Verrill, 1907.

Family STYLOCORDYLIDAE.

Stylocordylidae TOPSENT, 1898.

Pedunculate forms. Skeleton radiate in the body, longitudinal in the stalk. Megascleres diactinal. Microscleres microrhabds or spherasters, or absent.

The genera are *Stylocordyla* W. Thomson, 1873, *Cometella* O. Schmidt, 1870, *Oxycordyla* Topsent, 1904. (For *Halicometes* Topsent see Donatiidae; also see Topsent, 1920*d*, p. 33.)

Family CHONDROSIDAE.

Chondrosidae F. E. SCHULZE, 1877.

With a fibrous cortex. Flagellated chambers small and with special canaliculi (dipodal type). Megascleres have been lost. Microscleres in some forms have been lost.

The genera are *Chondrilla* Schmidt, 1862 (with euasters, which may be of more than one kind), *Chondrosia* Nardo, 1833 (with no spicules). *Thymosia* Topsent, 1895, with horny fibers, is here classed among the *Keratosa* (see *Psammaplysilla kelleri*). Topsent, 1918, p. 603, would add to the family *Chondrillastra*, new genus.

Topsent places the family in his *Carnosa*. In Delage and Hérouard's text and in Minchin's text essentially the same classification is adopted.

Thiele, 1900 (pp. 64–65), pointed out the similarities of the Chondrosidae to *Donatia* (*Tethya* at that time). He regards the family as derived through reduction from *Donatia*-like forms and puts it in the Clavulida (=Hadromerina part). Dendy, 1905 (pp. 107, 130), follows Thiele in ranging the family under the Hadromerina (Astromonaxonellida Dendy) as forms, not primitively simple like the Myxospongida, but in which the megascleres have been lost and in some species the microscleres also.

Hentschel 1909, 1912, likewise places the Chondrosidae along with the Donatiidae. Like Dendy, in the latter's more recent papers, he does not separate the groups Astrophora and Hadromerina (Astromonaxonellida).

Dendy, 1916 (p. 267), would include in the family only *Chondrilla* and *Chondrosia.* He derives the family and the Donatiidae from the Stellettidae, ranging it as one of the astrotetraxonid families which, as said, he does not separate into tetractinellid and monaxonid groups.

Family ASTRAXINELLIDAE.

Astraxinellidae Dendy, 1905.

Dendy, 1905 (p. 107), suggested that certain forms such as *Vibulinus* Gray, 1867, which owing to habitus and the anatomy of the skeleton in general have been referred to the Axinellidae, should be grouped owing to the possession of astrose microscleres in a new family, the Astraxinellidae, of the Hadromerina (Astromonaxonellida). Stephens (1912, p. 59; 1915*b*, p. 28) has followed this suggestion.

In this family fall also *Adreus* Gray, 1867, and *Hemiastrella* Carter, 1879. Topsent, 1919, reviews the latter genus, merging in it not only *Epallax* Sollas, 1888 but *Kalastrella* Kirkpatrick, 1903. Topsent would place it in the Axinellidae alongside of *Adreus* and *Vibulinus.* Hallman (1912, p. 132) adds to the Astraxinellidae his new genus *Paracordyla.* Dendy (1921*b*, p. 107) in his most recent memoir would abandon the family on the ground that the astrose microscleres may be regarded as degenerate acanthostyles, and the genera possessing them may thus be gathered under the Ectyoninae.

(Family Spirasigmidae. A new family has been suggested by Hallman, 1912 (p. 131, footnote), under this name for certain described forms: *Trachygellius* (*Trachya*) *globosa* Carter, *Spirasigma*, new genus for *Gellius aculeatus* Whitelegge, and possibly *Trachycladus* Carter usually classed in the Epipolasidae.)

Suborder SIGMATOPHORA.

Sigmatophora SOLLAS, 1888.

With tetraxonid megascleres; microscleres when present are sigmas; without desmas.

Family SAMIDAE

Samidae SOLLAS, 1887.

In addition to the Tetillidae the suborder includes Family Samidae, Sollas, 1887, 1888, represented by *Samus* Gray, 1867, in which the characteristic megascleres are amphitriaenes (Sollas, 1888, p. cxxvi).

Lendenfeld has, 1906, deleted his family Tethyopsillidae. Hernandez, 1914 (p. 21), proposes a new family, Ectyonillidae, for *Ectyonilla*, new genus, *Cantabrina*, new genus, and other (described) genera.

Family TETILLIDAE.

Tetillidae SOLLAS, 1886, 1888.—Plus *Tethyopsillidae* part, LENDENFELD, 1903.
Tethydae LENDENFELD, 1906.

The characteristic megascleres are protriaenes, which may be very slender, arranged radially. The skeleton in general is usually strongly radiate.

The family includes the following genera: *Tetilla*, *Craniella*, (*Tethya*), *Paratetilla*, *Amphitethya*, *Cinachyra*, *Fangophilina*.

Genus TETILLA O. Schmidt (1868).

Tetilla O. SCHMIDT, 1868, p. 40 plus *Chrotella* SOLLAS, 1888, p. cxxv.
Tetilla O. SCHMIDT plus *Cinachyra* SOLLAS part plus *Tethyopsilla* LENDENFELD part, LENDENFELD, 1903, pp. 16, 26, 30.
Tethya LAMARCK part plus *Cinachyra* SOLLAS part, LENDENFELD, 1906, pp. 69, 138.

Typically the ectosome is not a distinct layer but shades off into the choanosome; pores and oscula scattered, not located in special depressions. In some species, however, the ectosome is to some extent histologically differentiated and partially assumes the character of a fibrous cortex, thus constituting an approach to *Craniella*. And in some species there are special depressions (probably efferent as well as afferent) on the smooth floor of which are numerous small apertures (subgenus *Cinachyrella*). There is no cortical skeleton of radial megascleres. The microscleres have been lost in some species.

Lendenfeld, 1906, merges *Tetilla* in *Craniella* (*Tethya*) and hence changes the family name to Tethydae. As has been elsewhere said

(George and Wilson, 1919), it seems best to retain both genera. The family name (Tetillidae) remains unchanged.

"*Tetilla*, the simplest and therefore presumably the ancestral genus of the family, has been gradually enlarged in the practice of recent writers by the incorporation in it of atypical species that depart in one direction or another from the central group of typical forms to which Sollas' definition (1888) is applicable" (George and Wilson, 1919). Thus species that have differentiated in the direction of *Craniella*, in that they have the beginnings of a fibrous cortex, are here included (*T. longipilis* Topsent, 1904, p. 97; *T. anomala* Dendy, 1905, p. 91; *T. borodensis* Dendy, 1916*b*, p. 105). Other species are classed here that have differentiated toward *Cinachyra* in that there are superficial poriferous depressions, the floor of which exhibits pore-like apertures, the inhalent or exhalent nature of which is not quite certain (see Kirkpatrick, 1905, Dendy, 1905), but these species lack the fibrous cortex and cortical skeleton of *Cinachyra*. I propose to group them under the subgenus *Cinachyrella*.

Tetilla and its relatives offer excellent illustrations of the fact that sponge genera become more and more difficult to distinguish as the number of known species increases. While this is perfectly well known, a few words on the matter may not be amiss. (See Wilson, 1919, 1919*b*.)

Each genus is of course only a group that has been gradually built up round a type embodying a certain combination of well-marked features or "characters." In the cases of *Tetilla*, *Craniella*, and *Cinachyra*, the main "characters," grouped in pairs (Mendel-wise), the members of which contrast, are as follows:

1. A nonfibrous cortex (*a*) or a fibrous cortex (*A*).
2. Radiating cortical oxeas not present (*b*) or present (*B*).
3. Pores scattered (*c*) or grouped in poriferous depressions (*C*).

Of these characters *Tetilla* typically embodies *a*, *b*, and *c*; *Craniella*, *A*, *B*, and *c*; *Cinachyra*, *A*, *B*, and *C*.

Comparison of many species shows that the characters vary, more properly have varied during the evolution of the present races, independently of one another and hence the number of combinations actually found increases with the number of species known. In the case of the above genera there are more combinations than there are genera recognized, and this is of course often the case in systematics. Thus in the group of species congregated under *Tetilla* we find not only the typical combination but others as well: *A*, *b*, and *c*; *a*, *b*, and *C*.

In such a state of affairs we can either combine genera until we get groups so heterogeneous as to be useless to biology, or we can go on splitting up genera on the plan that each genus shall represent only a particular combination. Thus, on this idea, it would be logical to divide the species now grouped under *Tetilla* into three genera.

But another difficulty faces us here in that the extremes of a character, the sharply contrasting conditions that constitute the members (allelomorphs) of a pair, are so often connected by intergrades. Thus in *Tetilla* between nonfibrous cortex and fibrous cortex there are intergrades. And it may confidently be said that the more intensive grows the study of a group of species, the more of these intergrading series come to be known. Hence it may be expected that the characters above designated as *b* and *B* will, like *a* and *A*, be found to intergrade, and *c* and *C* likewise, if indeed the recorded data do not already justify that conclusion.

In view of the common existence of intergrades between the contrasting members of a pair of generic characters (*a* and *A*, for example), it becomes in the end impossible to split sponges, organisms in general probably, into genera, each of which shall represent a particular combination of characters.

What practice remains then for the classifier who knows that without systematics biological data in general can not be recorded with any certainty that they will be found again, and who therefore must classify, but who does not wish to set up a system of categories which can be precisely defined only because they are artificial and into which, while some organisms go nicely, others can be brought only after a character is pared down in thought, or extended in thought? One way out, and, as I have indicated above, the way into which we have fallen in the case of *Tetilla*, is to recognize larger heterogeneous genera (*Tetilla*, for example) and other smaller, more homogeneous ones. I can not see at present any better way. It is certainly a preferable method—that is, one that enables biologists to find the recorded data more successfully—than that of building up genera, all of which overlap extensively.

Similar considerations apply to subgenera. Where a genus, *Tetilla* for instance, becomes very large and heterogeneous, some grouping of species becomes necessary. And yet because of the intergrading of characters a sharp division of the whole into subgeneric groups is probably only temporarily possible. Forms will, for instance, doubtless be found with pore areas of such a kind as to constitute these forms intermediates between the subgenus proposed below, *Cinachyrella*, and species the whole dermal membrane of which is a sieve membrane (as in *Tetilla ciliata*, for example). I would propose to leave such intermediates in the body of the genus, which thereby still remains heterogeneous.

Subgenera used in this sense are not really groups into which (all) the species of a genus are *divided*, but rather groups which are sufficiently homogeneous to be set off from a still heterogeneous remainder. The advantage in this treatment, if there is one, and it seems to me there is, lies in the result that the assignment of a particular form to a group becomes less dubious than where the attempt is made to divide the whole genus into subgenera, each of which is supposed to be definitely marked by a particular character or combination of characters. If the character or combination is distinctly developed, a subgenus in the sense proposed here is ready to receive the form. If such features are absent, or are not well marked, the form goes in the body of the genus. This remains heterogeneous, and yet it may be greatly reduced in extent by the institution of the several homogeneous subgroups. Such a treatment will, I believe, in the end make it easier both to place and find particular species.

In the body of the genus, as here understood, will fall the species enumerated under *Tetilla* by Lendenfeld, 1903 plus *T.* (*Tethyopsilla*) *stewartii* Lendenfeld, 1888 (p. 45), and the following species not included in, or published later than, his synopsis:

T. (*Chrotella*) *minuta* (Wilson), 1902, page 383.
T. longipilis Topsent, 1904, page 97.
T. (*Chrotella*) *amphiacantha* (Topsent), 1904, page 96.
T. poculifera Dendy, 1905, page 90.
T. (*Tethyopsilla*) *metaclada* Lendenfeld, 1906, page 135.
T. (*Tethya*) *sansibarica* Lendenfeld, 1906, page 89.
T. (*Tethya*) *vestita* Lendenfeld, 1906, page 95.
T. (*Tethya*) *gladius* Lendenfeld, 1906, page 97.
T. (*Tethya*) *hebes* Lendenfeld, 1906, page 98.
T. (*Chrotella*) *ibis* (Row), 1911, p. 311.
T. (*Tethya*) *serica* (Lebwohl), 1914, page 13.
T. dactyloidea, var. *lingua* Dendy, 1916*b*, page 104.
T. pilula Dendy, 1916*b*, page 104.
T. barodensis Dendy, 1916*b*, page 105.
T. furcifer Dendy, 1921*b*, page 9.

Three of the species included in this report fall here: *T. dactyloidea* (Carter), *T. ciliata*, and *T. spinosa.*

For the species falling under *Cinachyrella* see below under that heading.

TETILLA DACTYLOIDEA (Carter).

Tethya dactyloidea CARTER, 1869, p. 15.
Tetilla dactyloidea SOLLAS, 1888, p. 44.

About five dozen specimens taken at "Tacloban Anchorage, about ship; hand dredge."

Since Lendenfeld's Tetraxonia, 1903, where (p. 18) the references are given, the species has been recorded by Dendy, 1916*b* (p. 102, pl. 2, figs. 10 *a–c*), for the coast of Kattiawar (Arabian Sea). A variety living in fresh water has been described by Annandale, 1915.

In the *Albatross* specimens the sponge body is, as usual, elongate and subcylindrical, with a terminal osculum leading from a cloaca, on the wall of which are the apertures of numerous small efferent canals. There is the usual extensive root tuft at the lower end by which the sponge is fastened in the mud.

The *Albatross* specimens very generally are somewhat clavate, enlarged and rounded above, smaller below. A typical specimen is 45 mm. long, exclusive of root tuft; 12 mm. thick above, 6 mm. thick about middle of body, with a cloaca 6 mm. deep. Some small, doubtless young, ones, 12 mm. long by 2.5 mm. thick, were taken. The dense sponge parenchyma contains abundant embryos. The color is light brown, verging on lead gray, but there is reason for believing that the natural color in this species is purple red or yellow (Carter 1887). In my specimens, as in Dendy's (1916*b*), conspicuous bundles of spicules pass obliquely downward and outward from a point just below the floor of the cloaca. At this point the beginnings of the bundles are aggregated, forming a little mass ("skeletal nucleus") that is sometimes conspicuous. These bundles reach the lower end and adjoining region, from which they enter into the root tuft or project freely from the surface.

From the ectosome in general well-marked radial bundles of megascleres are prolonged into the interior. Between these are numerous scattered megascleres. The ectosomal megascleres themselves are arranged in close-set divergent (conical) brushes, each brush including some large oxeas and many very slender protriaenes, most of which project only a short distance, but some far beyond the surface. The ectosomal brushes as seen in surface preparations are sometimes distinct and separate from one another, sometimes continuous with one another.

The spicule measurements, as determined for a few of these specimens, increase, but not greatly, the range of recorded sizes.

1. Oxea, tapering gradually from middle to the sharp points, 1,500–2,000 by 14–16 μ, in the ectosomal and internal bundles. In Lendenfeld's Tetraxonia (1903) 60 μ is given as the thickness of the oxea—obviously a misprint. (See Sollas 1888, p. 44.)

Smaller oxeas of same type, 450–900 by 6–8 μ, scattered everywhere.

2. Ectosomal protriaenes, very slender. Rhabdome 2 μ thick, probably 2–3 mm. long (difficult to isolate whole); clads, making an acute angle with one another, even thinner than rhabdome, hair-like and about 50 μ long.

Stouter protriaenes project here and there from the lower surface. Rhabdome 6–7 μ thick, several mm. long. Clads 3 μ thick at the base, tapering to the point; varying in length but reaching 120 μ; making an acute angle with one another.

3. Anatriaenes. Rhabdome 4–6 μ thick, several mm. long; clads 44–48 μ long; making up the root tufts; abundant also in down-

wardly projecting bundles of the parenchyma, the cladomes situated at or near the surface.

4. Sigmas, fairly stout, 8–10 μ long. Abundant at the surface, present also in the interior. In Dendy's specimens the microscleres were found to be not very abundant.

TETILLA CILIATA, new species.

Plate 39, fig. 2

Station D5431, two specimens. The measurements given below refer to the larger one.

Sponge ovoidal, 35 mm. high, 25 mm. thick. A terminal osculum 4 mm. in diameter leads into a cloaca about 5 mm. deep, into which open a number of efferent canals about 1 mm. wide. There is an oscular fringe 3 mm. high. Sponge is hispid with delicate spicules, projecting about 1 mm. beyond the surface. Over the lower end numerous bundles of spicules protrude which unite to form a root-tuft. This holds together a ball-like mass of débris 12 mm. in diameter.

Color light gray to whitish. Sponge moderately compact and firm. If sponge is expanded (pores and canals wide open), as in one specimen, this surface appears coarsely porous, owing to the subdermal spaces and peripheral canals being seen through the dermal membrane.

Ectosome thin, not fibrous nor distinctly marked off from the choanosome; with small subdermal cavities between the radiating skeletal bundles. Dermal membrane, the usual very thin sheet riddled everywhere with pores.

Skeleton.—Strong radial bundles run from the interior toward the surface, passing in the ectosomal region into divergent brushes. The radial bundles are made up of large oxeas and the rhabdomes of protriaenes. The ectosomal brushes include small oxeas which just reach the dermal membrane, and numerous protriaenes most of which protrude. Oxeas of all sizes are scattered irregularly and thickly throughout the sponge. The oscular fringe includes large oxeas, with smaller sizes, and many protriaenes. The root bundles, in the neighborhood of the sponge body, include large oxeas and small protriaenes, the bulk of the root tuft being made up of very long anatriaenes.

Spicules.—1. Oxea. (*a*) The common type is smooth, equiended, tapering gradually toward each end, 4 mm.—0.5 mm. by 40–7 μ. The largest oxeas occur in the root bundles. In the oscular fringe they reach a length of 3.5 mm. In the body the common large size is about 3 mm. by 30–35 μ. Very many small oxeas occur, ranging from 700 by 12 μ to 450 by 7 μ. (*b*) The oxeas of the ectosomal brushes are, for the most part, distinctly inequiended, about 1 mm. by 8 μ, the thicker end the outer. (*c*) A very few long slender spinulate oxeas, about like those of *T. spinosa*, occur in the oscular fringe and protrude over the general surface.

2. Protriaene. (*a*). The common and conspicuous form protruding over the general surface has a rhabdome 1.5–0.9 mm. by 6–7 μ, clads 80–40 by 3–4 μ; rhabdome as usual tapering from near the cladome to a very fine end; clads straight, often somewhat unequal in length in the same spicule. (*b*). Slenderer forms occurring with the foregoing, having longer and outwardly curving clads. Rhabdome about 2 mm. by 3–6 μ; clads reaching 140 μ in length. (*c*) Hair-like forms occur in abundance along with (*a*) and (*b*); rhabdome about 1 μ thick; clads outcurving, 20–40 μ long. The specific name calls attention to the presence and the location of these spicules which doubtless are young forms, in the sense that they constitute the stock from which class (*b*) is recruited. (*d*). Protriaenes of the root bundles have a long rhabdome of the usual shape, reaching 7 mm. by 14 μ, and long straight clads, 100–180 μ in length. (*e*). Protriaenes of the oscular fringe are chiefly strong spicules with straight clads; rhabdome 6.7–3.5 mm. by 10–20 μ, clads 160–100 by 5–8 μ. Inner part of the fringe includes many smaller protriaenes, in which the clads are only 25–35 μ long.

3. Anatriaene, occurring in the root tuft and in the radial bundles of the lower end of the body. Rhabdome of usual shape, over 8 mm. in length, 8–10 μ thick; clads about 40 μ long.

4. A single plagiotriaene, resembling those figured by Dendy for *T. poculifera* (1905, p. 90), was observed.

5. Sigmas, 10–20 μ long, abundant throughout the interior and at the dermal and gastral (cloacal) surfaces. In the interior the spicules measure 10–16 μ. In the ectosome small sizes are abundant, but larger ones, 16–20 μ, are also common. In the gastral membrane, the spicules measure 10–12 μ.

Holotype.—Cat. No. 21312, U.S.N.M.

The species is close to *T. poculifera* Dendy (1905, p. 90). The most essential difference is the absence of a small oxea (microxea), about 230 μ long, which constitutes a conspicuous element of the skeleton in *T. poculifera*.

There are suggestive resemblances to *T. spinosa* of this report.

TETILLA SPINOSA, new species

Plate 39, fig. 3.

Station D5146, one specimen.

Sponge obconical with the truncated base somewhat convex, 60 mm. high, 35 mm. thick. A single osculum, 2.5 mm. in diameter, at the upper pointed end, leads into a small cloaca about 4 mm. deep, on the floor of which several (five) efferent canals open. Upper and lateral surface smooth, and set off rather sharply from the base which bears small protuberances and is covered with root bundles. The root bundles penetrate and hold a mass of shelly débris and foraminifera, about as large as the sponge body. Color, a light yellowish brown. Sponge firm and compact. Ectosome collenchymatous with small subdermal cavities. Pores scattered over surface between the protruding ectosomal brushes of spicules. Parenchyma with abundant embryos.

The skeleton consists of—

1. Closely set conical ectosomal brushes, about 700 μ deep, protruding only slightly at the surface.

2. Radial bundles of large megascleres.

3. Scattered parenchymal oxeas of many sizes.

4. Long bundles of slender megascleres which descend from the interior of the sponge to the basal surface or beyond it, in the latter case forming the root bundles.

Spicules.—1. Smooth parenchymal oxea, of many sizes up to 3.8 mm. by 40 μ; the two ends not noticeably dissimilar; scattered everywhere, the larger nearer the center of the sponge.

2. Large, smooth oxea, 1.5–2 mm. by 28–40 μ; inequiended, the thicker end being the outer; in radial bundles.

3. Ectosomal oxea, 400–650 by 2–6 μ; smooth; inequiended, thicker end the outer; in the ectosomal brushes.

4. Spinose oxea, 3 mm. by 6–8 μ; inequiended, thicker end the outer. The spines project inwards, are fairly strong in the larger spicules, feeble in some of the slenderer. In the radial bundles and moderately abundant, although distributed without any apparent regularity.

5. Slender ectosomal protriaenes. Rhabdome 500 by 2 μ; clads still slenderer, 12–16 μ long. The most abundant spicule in the ectosomal brushes.

6. Larger protriaenes. Rhabdome 3 mm. by 7–10 μ; clads 30–100 μ long. In radial bundles.

7. Anatriaenes, forming the root bundles and the bundles which descend from the interior to the basal surface of the sponge. Rhabdome very long, certainly 1 cm.; 12 μ thick near cladome, tapering quickly to 4 μ, thickening again gradually to 8 μ, and finally tapering gradually toward the point. Clads 60–76 μ long.

8. Sigmas. Commonly 8–12 μ long, but reaching 16 or even 20 μ in length. Abundant at the surface and in interior.

The species is especially characterized by the spinose oxeas, in less degree by the slenderness of the small protriaenes.

Holotype.—Cat. No. 21303, U.S.N.M.

(TETILLA) CINACHYRELLA, new subgenus.

Cynachyra part LENDENFELD, 1903, p. 26.

Species of *Tetilla* in which there are poriferous pits (smooth and sphinctrate depressions, the wall of which is a sieve-membrane) but which lack the cortex characteristic of *Cinachyra.*

Tetilla hirsuta Dendy (1889, p. 75; 1905, p. 89) and perhaps some of the other species enumerated under *Cinachyra* by Lendenfeld, 1903, fall here. It may be noted that *Tetilla* (*Cinachyra*) *malaccensis* Igerna B. J. Sollas, 1902 (p. 219), from the Malay Peninsula, was not included in Lendenfeld's list. The following species published since Lendenfeld, 1903, also fall here:

Tetilla limicola Dendy, 1905, p. 93.

Tetilla (*Cinachyra*) *anomala* Dendy, 1905, p. 91; 1921*b*, p. 20.

Tetilla (*Cinachyra*) *isis* Lendenfeld, 1906, p. 143; Dendy, 1921*b*, p. 16.

Tetilla (*Cinachyra*) *hamata* Lendenfeld, 1906, p. 145.

Tetilla (*Cinachyra*) *alba-tridens* Lendenfeld, 1906, p. 149.

Tetilla (*Cinachyra*) *alba-bidens* Lendenfeld, 1906, p. 151.

Tetilla (*Cinachyra*) *alba-obtusa* Lendenfeld, 1906, p. 154.

Tetilla (*Cinachyra*) *vertex* Lendenfeld, 1907, p. 310.

Tetilla (*Cinachyra*) *vertex*, var. *monticularis* Kirkpatrick, 1908, p. 11.

Tetilla cinachyroides Hentschel, 1911, p. 281.

Tetilla (*Cinachyra*) *phacoides* Hentschel, 1911, p. 285.

Tetilla (*Tethya*) *clavigera* Hentschel, 1912, p. 327.

Tetilla (*Cinachyra*) *mertoni* Hentschel, 1912, p. 332.

Tetilla (*Cinachyra*) *nuda* Hentschel, 1912, p. 333.

Tetilla (*Cinachyra*) *vaccinata* Dendy, 1921*b*, p. 14.

Tetilla (*Cinachyra*) *providentiae* Dendy, 1921*b*, p. 18.

The species included in this report which fall under *Cinachyrella* are, in addition to *Tetilla hirsuta* Dendy and *T. clavigera* (Hentschel), *T. crustata*, together with var. *patellae-spinosae* and the forms *aperta* and *hispida*, *T. paterifera.*

TETILLA (CINACHYRELLA) HIRSUTA Dendy.

Tetilla hirsuta DENDY, 1889, p. 75; 1905, p. 89; 1916*b*, p. 104.
Cinachyra hirsuta (Dendy) LENDENFELD, 1903, p. 28.

Malchochin Harbor, Linapacan Island, one specimen. There are some differences in spicule measurements (see below), but the *Albatross* sponge fits well in Dendy's species, agreeing with the type (Dendy, 1889, p. 75) not only in possessing poriferous pits, but also in regard to the structure of the ectosome, the general shape, color, and size of the body, the hirsute nature of the surface, and the presence of a central "nucleus" from which the skeletal bundles radiate.

The specimen is roughly hemispherical and was probably attached by the under surface, which is smooth and shows distinctly the radiating skeletal bundles. Horizontal diameter about 30 mm. The projecting spicules of the upper and lateral surfaces have caught a quantity of dirt.

Small massive buds are present in considerable number at the surface, impaled on the long spicules. Doubtless in correlation with this condition the surface is made uneven by numerous small eminences.

The poriferous pits are all small, a typical one measuring 1.6 mm. in diameter, 1.1 mm. in depth. They are abundantly scattered over the upper and lateral surfaces, but owing to the dirt and projecting spicules are inconspicuous. Some of the pits are narrow and cleft-like, a shape which I take to be due to contraction. The membrane lining the pits is smooth, and perforated with closely set pores. Dendy regards some of the pits as afferent, others as efferent, and this seems probable. Still I find a few simple apertures, 1–2 mm. in diameter, scattered over the upper surface that seem to be oscula.

The radiating skeletal bundles are made up of large oxeas together with protriaenes and anatriaenes. The spicules projecting at the surface are oxeas with intermingled protriaenes.

The oxeas range down from 4 mm. by 50 μ, thus agreeing well with the type.

The protriaenes of the general surface have a rhabdome 4–6 mm. long, 14 μ thick near the cladome, then tapering to a hair-like thickness; clads 70–150 by 5–7 μ thick at the base. The spicules are only fairly abundant, some projecting while the cladomes of others lie in the ectosome. The protriaenes of the type are smaller, but it may be that *entire* spicules were not measured. One suspects, perhaps without warrant, that this was the case both for protriaenes and anatriaenes, the rhabdomes of which are given as 460 μ or less in length.

Dendy does not describe the protriaenes of the poriferous pits, to which I therefore give a few words. A pit is bounded all around by radial skeletal bundles which include many protriaenes. These lie chiefly on the side next the pit. Some pass out radially with the oxeas, but many bend away from the bundle inclining themselves in an obliquely radial direction toward the pit, the wall of which thus becomes covered with the projecting cladomes of these spicules. Such protriaenes are much smaller than those of the general surface, the rhabdome varying down to a thickness of only 4 μ, the clads to a length of 30 μ.

The anatriaenes lie in the radial bundles, the cladomes in the ectosome at different levels but not far apart. The more internal spicules are evidently the younger, having shorter rays and more expanded cladomes. The anatriaenes are fairly abundant. The rhabdome is several millimeters long, in a particular case 2.8 mm.; about 5 μ thick near the cladome, then becoming hair-like; clads 55–80 μ long.

The sigmas in the type have a length of 22 μ. They are smaller, only 10–12 μ long, in the *Albatross* specimen. They are abundant in the dermal membrane and in the interior, especially in the canal walls.

Spheres were found in only one of Dendy's specimens (Dendy, 1905, p. 90). They are present in the *Albatross* specimen; scantily scattered in the choanosome; more common in the ectosome, but here only abundant in the walls of some of the narrow canals. They are spheroidal or slightly irregular, 2–8 μ in diameter; sometimes packed closely together in little groups of 2–4, occasionally looking as if they were fusing.

Owing to the smaller size of some of the spicules, especially the sigmas and until the measurements are better known for more specimens from different localities, the *Albatross* sponge might be provisionally held apart from the type as a variety.

T. hirsuta has been recorded from the Gulf of Manaar (Ceylon) and the west coast of British India (Okhamandal in Kattiawar). Two closely related forms are *T.* (*Cinachyra*) *voeltzkowi* Lendenfeld, from Zanzibar (Lendenfeld, 1897), and *T. cinachyroides* Hentschel, from southwest Australia (Hentschel, 1911, p. 281). The latter has a small variety of oxea which marks it off. The former seems to differ from Dendy's species only in spicule measurements, and should probably be merged into it.

TETILLA (CINACHYRELLA) CLAVIGERA (Hentschel)

Plate 39, fig. 4

Tethya clavigera Hentschel, 1912, p. 327.

Station D5169, one specimen.

Hentschel had two fragments from the Aru Islands. These he interpreted as belonging to a massive, spheroidal or hemispheroidal sponge. This inference is confirmed by the *Albatross* specimen which is subspheroidal, 70-80 mm. in diameter, with no base or obvious surface of attachment.

The vestibular spaces or poriferous pits are scattered abundantly and yet not thickly over the whole surface. They have the same shape as in the type specimen, each being a radially elongated ellipsoidal sac opening to the exterior by a narrower canal. They are larger than in Hentschel's specimen, a typical pit measuring 11 mm. in depth, with a bottom width of 5 mm. and a circular aperture 2 mm. in diameter. Some of the apertures are surrounded by short, rather vague, fringes of projecting spicules. Probably where the fringes do not occur, they have been rubbed off. In each pit that was opened, a small commensal ophiuroid was found. The wall of the pit is smooth. It doubtless is studded with pores in the expanded state of the sponge, but in the actual specimen is aporous. Nevertheless in spots what seemed to be traces of closed pores were visible. As in the type specimen, small protriaenes were seen in places to project obliquely over the wall of the pit.

As in the type no oscula, apart from the poriferous pits, were to be seen. The pits are probably therefore in part efferent, in part afferent.

The specimen agrees with Hentschel's in being incrusted with shelly débris, etc.; in the dense character of the ectosome, which, however, does not include a fibrous stratum; in the arrangement of the megascleres, ectosomal brushes of smaller spicules being absent. The distinctness of the radial skeletal bundles is lessened somewhat by the presence of radial megascleres scattered between them. The sponge is heavy and very compact, all the canals being small. The ectosome measured about 500 μ in thickness and no subdermal cavities could be seen.

The *Albatross* specimen is much larger than that from which Hentschel's pieces came, and may be looked on as an older specimen. It comes from a different locality. One would expect to find, then, spicule measurements different from Hentschel's, and in fact the spicules are considerably larger.

Oxeas, in general equiended, tapering, 2.5 mm. by 16 μ to 6 mm. by 50 μ; the chief radial spicule and chief spicule in fringe of poriferous pit. Small equiended oxeas, commonly 180–200 by 3–4 μ, are scattered in some abundance through the parenchyma. They perhaps represent young stages.

Protriaenes are almost absent over the general surface of the sponge. The very few seen had short, stout clads 36–40 μ long, rhabdome long and 16–30 μ thick near cladome. Protriaenes are common in the fringes of the pits. Here they have a long, tapering rhabdome, reaching several millimeters in length, about 16 μ thick near cladome; clads 50–70 by 12 μ. Smaller, slenderer protriaenes project obliquely from the lateral walls of the pits, in places. The protriaenes in the type specimen are very slender.

Anatriaenes are common, along with the radial oxeas. The cladomes of many lie in the ectosome, but there are also many that project beyond the surface of the sponge about 1–2 mm. The rhabdome is 12 μ thick near the cladome, then tapering to a hair-like thickness, about 7 mm. long, often somewhat sinuous where wrapped round the large oxeas. Clads in a typical spicule measure 56 by 12 μ. The anatriaenes in the type specimen are very slender.

Anatriaenes with completely degenerate clads, the spicule ending distally in a knob, occur less frequently than in Hentschel's specimen. Intermediates between these and the regular anatriaene also occur. In some of them only one or two clads are completely degenerate. In others one or two clads are simply shorter than the normal. In the related *Tethya coactifera* Lendenfeld (1906, p. 75) the triaenes exhibit similar variations to those of this species.

The sigmas are abundant, simple contort, 14–16 µ long (7–11 µ in the type specimen).

TETILLA (CINACHYRELLA) CRUSTATA, new species.

Plate 39, fig. 5; plate 48, fig. 5.

Station D5152, 10 specimens; station D5134, 1 specimen; station D5179, 1 specimen; station D5478, 4 specimens; station D5337, 1 specimen.

Body massive, somewhat flattened, often greatly flattened, from above downward, with rounded or polygonal equatorial outline; sometimes nearly spheroidal; pyriform in youth, with the small end up. Vertical thickness of body ranges from slightly less than to one-half the greatest horizontal diameter, which in these specimens measures 40 to 75 mm. Under surface generally torn and then showing the radiating skeletal bundles. Perfect specimens show that even in the subspheroidal individuals this surface is generally flattended; nevertheless in one such specimen it is more convex than the upper surface. It bears root spicules which in one of the adults (70 mm. in horizontal diameter), doubtless representing the normal condition, are abundant over the marginal region of this surface. These spicules together with the entangled sand are matted together into a mass 10 to 20 mm. thick. In the other specimens the root spicules are inconspicuous, doubtless having been broken off.

The surface in general often appears smooth, or nearly so, to the eye, but in other places or specimens is covered with a thin incrustation of sand. Examination shows that the megascleres of the radial bundles normally project a short distance, about a millimeter or less. The radial bundles are so abundant in many places that their projecting spicules form a practically continuous covering, which of course catches sand. In other places there are pretty large intervals between the radial bundles, and, although in the intervals there are some medium-sized and small projecting oxeas, over such parts of the surface whatever fur there is, is scanty even in the natural unrubbed state. Smoothness of the surface in general is of course largely due to the fact that the projecting spicules have been rubbed off. Several of the specimens are infested with small brown actinians, which project from the surface.

On the upper surface, and especially round the upper part of the lateral surface, or round the margin of the very flattened specimens, are the apertures of poriferous pits. The apertures are 2–5 mm. in diameter, each surrounded by a fringe of projecting spicules, which is sometimes thick and close and 3 mm. in length; fringe often more or less worn down. The pits have no constant arrangement, although there is sometimes a central one; this is apical in a pyriform young specimen 40 mm. in diameter. They usually number 8–12 on a sponge. The pits are smooth walled and of the same elongated ellipsoidal shape as in *T. clavigera.* The radial depth is 10–20 mm., bottom width 7–9 mm. The wall in some is uniformly perforated with thickly set minute pores leading into canals that abut against the wall. But in the case of other pits apertures easily visible to the eye, 1 mm. or thereabout in diameter, occur scattered over the general poriferous surface. And in some cases the whole or a large part of the pit wall is covered with apertures visible to the eye, ranging down from 0.5 mm. in diameter to small pores. No other apertures than those of the pits are found on the surface of the sponge, and it would seem therefore that some of the pits must be afferent, others efferent.

The pits contain a great deal of shelly débris, and usually commensal ophiuroids. Projecting obliquely from the wall are small (trichodal) protriaenes; rhabdome about 2 µ thick, clads 12–20 µ long.

The ectosome does not include a distinct fibrous stratum, although in its deeper part are numerous fiber cells disposed tangentially in isolated tracts. Its outer part is occupied by a dense crust, 350–600 µ thick, of tangentially disposed oxeas (pl. 48, fig. 5, *a–b*). In the young specimen referred to above this crust is only 150–250 µ thick. Brownish granular cells are scattered in the dermal layer and through the choanosome. The sponge is firm; often rather porous owing to the number of small canals, 1–2 mm. in diameter. Some specimens are more compact. Color brown, often dark.

Strong skeletal bundles extend radially from the center of the sponge to the surface, there expanding in the usual way. There are no radial ectosomal brushes of smaller megascleres. The radial bundles include abundant oxeas, protriaene forms, and some anatriaenes. Fringes of the poriferous pits include oxeas, protriaenes, and prodiaenes. The root spicules include protriaenes and very many anatriaenes.

Spicules (pl. 48, fig. 5).—1. Oxeas. Large equiended spicules, 7–9 mm. by 60–90 µ, along with smaller ones, are abundant in the radial bundles, sometimes projecting. In the specimen from station 5134 the radial oxeas of the under surface reach a length of 11 mm. Similar oxeas, ranging from 1 mm. by 20 µ to less than half that size, are scattered abundantly through the choanosome. The tangential ectosomal oxeas are like those of the choanosome.

2. Protriaenes. (*a*) Protriaenes, prodiaenes, and promonaenes occur abundantly in the radial bundles, the promonaenes and prodiaenes being especially conspicuous and characteristic. The rhabdome in these spicules is about 4 mm. by 16–24 μ; clads with a basal thickness about equal to that of rhabdome. The single clad of the monaene, whch in some specimens (station 5478) may be irregularly curved in and out, is 200–350 μ long; on the under surface (station 5134) it may reach 500 μ in length; very rarely it is dichotomous (station 5478). In the diaenes the clads are 120–250 μ long; very rarely the clads may spread out almost at right angles to the rhabdome. In the protriaenes the clads are in general shorter and slenderer than in the prodiaenes, but the range in size is about the same. Any or all of these protriaenes forms may project a short distance beyond the surface of the sponge.

(*b*) Protriaenes of a stouter type project from the radial bundles in some abundance over the general surface and occur among the root spicules; rhabdome long and 20–35 μ thick; clads shorter and relatively stouter than in type *a*, 50–100 μ long; one clad sometimes aborted.

(*c*) Protriaenes of the fringes round the apertures of the poriferous pits have a long rhabdome, 9–10 mm. long, 16–24 μ thick, with clads 100–175 μ long. Smaller ones also occur. From the adjacent part of the lateral wall of the pit quantities of very small trichodal protriaenes project obliquely upward.

3. Anatriaenes. (*a*) In the anatriaenes of the radial bundles in general the rhabdome is 5–10 mm. long, 8–12 μ thick, then becoming hair-like; clads 20–50 μ long. These spicules are not abundant in the preparations made from some specimens (station 5152) but are more abundant in those made from others (stations 5134 and 5179). Many project beyond the surface.

(*b*) Anatriaenes of the under surface reach a larger size than those of the upper and lateral surfaces and are also more abundant, many projecting. They form the chief element in the root bundles. The rhabdome measures about 10 mm. by 20 μ, clads 40–90 μ long.

4. Sigmas. In the ectosome and adjoining zone of the choanosome, the sigmas, which are very abundant, measure commonly 28–36 μ in length, the spiral being long and open and generally showing two convexities; smaller ones are intermingled. The spicule is frequently so bent in the middle (see *Chrotella macellata* Sollas) as to have something of the appearance of a toxa. In the choanosome in general the sigmas are shorter, about 16 μ long, and of the typical simple contort shape.

Holotype.—Cat. No. 21316, U.S.N.M.

The considerable number of the specimens included in the collection makes it possible to eliminate from the species-idea minor features due to accident or such as are strictly local. The characteristic features are, then, the ectosomal crust of tangentially disposed oxeas, the large promonaenes and somewhat smaller prodiaenes of the radial bundles, the projecting protriaenes (including diaenes) with short, strong clads, the difference in size and shape of the ectosomal and choanosomal sigmas. Including the *forms* described below there is very considerable diversity within the species not only in the matter of shape, but as respects the hirsuteness of the surface and the termination of the efferent canals. But the skeletal peculiarities are essentially the same throughout the series of specimens, and it seems necessary to group all of the latter together as one species.

The specimens from the different localities vary as to size of the megascleres. For instance in the specimen from 5179 all of the megascleres average a larger size than in those from 5152.

The species is related to *T. (Cinachyra) isis* Lendenfeld (Lendenfeld 1906, p. 143) from the northwest coast of Australia. It is also certainly very close to *T. (Chrotella) macellata* (Sollas) from the Philippines. No mention is made, however, in the case of the latter species of the ectosomal crust of oxeas. The "cloacae" opening by "oscula" in Sollas' species seem to correspond to the poriferous pits of *T. crustata.*

TETILLA (CINACHYRELLA) CRUSTATA forma HISPIDA, new form.

At station D5442 was taken the largest of all the specimens of this species. The sponge has a horizontal diameter of 115 mm. with a vertical diameter of 75 mm., and is subspheroidal with a large flattened base, approaching the hemispheroidal shape.

Over the latero-superior surface are a few smooth areas, evidently worn smooth, but the surface in general is covered with a continuous fur of spicules projecting 2–3 mm., formed by protruding elements of the radial bundles. This conspicuous fur makes the peculiarity of the *form.* It is useless to speculate as to its genetic value. Perhaps any individual of the species growing up under similar conditions would acquire it.

The flattened basal surface, smooth in the center (worn perhaps), is elsewhere thickly covered with spicules projecting outward and downward 5–8 mm.

The poriferous pits are numerous and of the usual type, some 20 mm. deep. Most are on the latero-superior surface, a few on extreme upper surface. Many are closed, and in such cases the spicules of the marginal fringe have come together, forming a papilla, 3–4 mm. high, which conceals the aperture. No other apertures or specialized areas (see var. *patellae-spinosae*) are present. The sponge is infested with the small brown actinian, so commonly present in this species. The ectosomal anatomy and skeletal arrangement are as in the type.

Spicules.—1. The oxeas are as in the type.

2. (*a*). The large promonaenes of the radial bundles are perhaps a trifle smaller than in the type. The clads measured were 180–300 μ long, sometimes irregularly wrinkled or bent, sometimes curved into a hook-shape, sometimes with two bold curves like the horns of certain cattle.

The prodiaenes of the radial bundles are likewise somewhat smaller than in the type. The clads measured were 90–180 μ long, sometimes unequal in length; often irregularly wrinkled or bent, sometimes symmetrically so—that is, both clads bent alike.

(*b*). The projecting protriaenes of the radial bundles are like those of the type, perhaps in the average slenderer, the rhabdome 6–8 mm. long and about 24 μ thick, the clads 50–100 μ long. These are the chief elements of the surface fur.

(*c*). The protriaenes of the fringes of the poriferous pits are essentially as in the type. The rhabdome may be as thick as 28 μ, the clads as long as 250 μ.

The anatriaenes and sigmas are as in the type.

Four other specimens smaller than the above were taken at the same station. They range in shape from subspheroidal to hemispheroidal or are even more flattened. They all have the flattened basal surface so common in this species. They are all hirsute in places, but have evidently been more or less rubbed.

Holotype.—Cat. No. 21308, U.S.N.M.

TETILLA (CINACHYRELLA) CRUSTATA forma APERTA, new form.

Station D5593, one specimen.

The essential point of difference from the type lies in the presence of unmistakable oscular canals which are easily distinguishable from the poriferous pits. Whether this is a structural and fixed point of difference between races, or whether it is a feature of physiological anatomy (as, I think, it may turn out to be), one, that is, which varies with the physiological state of the individual, it is not possible to say. It is quite conceivable that in one and the same poriferous pit the lining membrane may at certain times be perforated uniformly with many minute apertures, at other times with fewer but larger ones, and that at still other times the apertures may coalesce until all trace of a perforated lining membrane disappears, the efferent canals then opening directly into the pit. This would now be called a cloaca, or if one of the efferent canals happened to be much larger than the others, it would appear simply as the prolongation of such a canal.

The form comes from a different locality from those where the type was taken, and with the difference in canal anatomy are associated other differences. But these, especially the spicule measurements, are only such as generally characterize colonies of individuals belonging to the same species but living at some distance from one another. They constitute the now well recognized "geographical mark".

Sponge is irregularly spheroidal, 75 mm. in diameter. Upper and latero-superior surfaces bear numerous, 11, apertures, 2–5 mm. in diameter. Several of the larger are oscula. The others, 2–3 mm. wide, are the openings of the poriferous pits. Both are surrounded by spicular fringes, although these in many cases have been nearly rubbed off. The general surface is undoubtedly covered in nature with a scanty furze of spicules projecting about 1 mm., but these have been rubbed off over a large part of the surface, leaving the dermal membrane smooth. The lower surface is covered with projecting bundles of root spicules, which combine to form a tangled mass that covers the base of the sponge to a thickness of a few millimeters but does not form an elongated root tuft. Sponge, dark brown, both internally and at the surface.

Some of the oscula are the apertures of large efferent canals, which may be as wide as 8 mm., and which penetrate far into the sponge. The lining membrane of the canal for some millimeters internal to the osculum appears porous, although most of the pores are closed. In other cases the osculum leads into a comparatively shallow cavity, on the floor of which open several, 4–5, efferent canals, 1.5–2 mm. in diameter.

The poriferous pits are smaller than in the specimens of the type, a typical one measuring 8 mm. deep, 4 mm. wide, with an aperture 2–3 mm. wide. The lining membrane is abundantly perforated by small apertures, although these are not numerous enough to make the membrane sieve-like. Most apertures are 20–30 μ in diameter, but they intergrade with numerous larger ones about 85 μ in diameter. The dermal membrane at the surface of the sponge shows no pores.

The skeletal arrangement immediately surrounding the oscular canals and the poriferous pits is the same. It consists of numerous radial skeletal bundles which support the lateral wall of canal or pit and project at the surface, forming a marginal fringe round the aperture. This consists chiefly of protriaenes. Internal to the aperture are the usual very delicate protriaenes projecting obliquely from the lateral wall.

The large oxeas of the radial bundles are smaller than in the type specimens. Moreover, they exhibit two well-marked patterns (*modes* round which very many of the spicules may be grouped), a slenderer and a stouter, which, however, intergrade. The one type measures about 5 mm. by 50 μ, the other 3 mm. by 100 μ.

The common large promonaenes, prodiaenes, and the protriaenes of the radial bundles do not differ from those of the type.

The stout form of protriaene with cladome projecting beyond the surface is present as in the type. A few were observed in which one and even two clads were completely degenerate.

The protriaenes of the marginal fringes possibly average a larger size than in the type, clads of the larger ones observed ranging from 180 to 280 μ in length.

In this form, as said, root bundles are abundant. Long, stout protriaenes with short clads are common in them. The rhabdome is over 11 mm. long, about 36 μ thick above, clads 50–70 μ long, 20 μ thick at the base.

The anatriaenes of the radial bundles are like those of the type. They are common in this specimen. The anatriaenes of the root bundles are like those present on the under surface of the type.

The sigmas of the ectosome and interior show the same contrast as in the type. The former are 28–44 μ long, the latter 16–20 μ long.

Holotype.—Cat. No. 21318, U.S.N.M.

TETILLA (CINCHYRELLA) CRUSTATA, var. PATELLAE-SPINOSAE, new variety.

Plate 39, fig. 7.

Station D5335, 23 specimens.

The shape is remarkably uniform. The sponges are subspheroidal with a noticeably flattened basal surface; diameter in most of them 70–85 mm., but ranging down to 40 mm. The general surface is smooth or nearly so, but examination shows that, as in the type, the spicules of the radial bundles naturally project. Over the lowermost part of the lateral surface just above the base, projecting spicules are present in abundance in some of the specimens (doubtless rubbed off in others); they protrude downward and outward a few millimeters. Over the basal surface, in all but one specimen, the projecting (root) spicules have been for the most part rubbed off. But in this one specimen the whole basal surface is covered with a mat of root spicules, which holds a quantity of sand; the mat is now only a few millimeters thick, doubtless compressed artificially. Density and color as in the type.

The poriferous pits are numerous and resemble those of the type; depth in two representative pits, 13 mm. and 20 mm. As in specimens of the type which are high enough to have a considerable area of lateral surface, the pits occur especially on the laterosuperior surface, much more rarely on the extreme upper part of the body. The lining membrane of the pit is smooth and finely porous, in upper part of pit showing the usual trichodal protriaenes. Apertures of pits in general round, sometimes becoming slit-like in closing; those widest open measure 6 mm. in diameter. Fringes as in type, but very often worn down.

What distinguishes these specimens at a glance from the type is the presence of more or less circular, depressed, shallow, spinous areas (doubtless oscular) on the upper surface of the body. Of these there are often three or four in a specimen, but I have counted as many as five and as few as two or, in the smallest specimen, only one. The diameter of the areas ranges in general from 10 to 20 mm., the depth from 1 to 3 mm. Both the margin and general surface of the area are typically thickly covered with spicules that project about 2 mm; these have been more or less rubbed off in many areas. The covering spicules of the area catch and hold sand in some quantity. The surface of an area shows either no apertures at all or a number of quite small ones, a fraction of a millimeter in diameter. These are doubtless oscula; where they appear to be absent, they no doubt are simply closed. No other oscula occur in the sponge. The small oscula of this variety evidently correspond to those described by Kirkpatrick (1905) for *Cinachyra barbata*, although their distribution is different. If the inferences generally drawn from anatomy are correct, it would seem that in this species we have two classes of oscula, the small ones of this variety and the large ones of forma *aperta*. One may hazard the guess that there are both afferent and efferent poriferous pits, the detailed features of which vary with the physiological state, and small oscula as well.

The ectosomal anatomy is as in the type. The skeletal arrangement is as in the type. As in the type, the specimens are commonly infested with a small brown actinian.

Spicules.—1. The oxeas of radial bundles, ectosome, and choanosome are as in the type.

2. (*a*). The promonaenes of the radial bundles are as in the type; rhabdome commonly about 28 µ thick; clad commonly 200–250 µ long. The prodiaenes and protriaenes of the radial bundles do not differ from those of the type.

(*b*). Protriaenes and prodiaenes with short and comparatively stout clads, 35–85 µ long, project from the radial bundles over the general and basal surface as in the type.

(*c*). Protriaenes of the fringes of the poriferous pits, thickly crowded and resembling those of the type; rhabdome 8–10 mm. long, clads 70–150 µ long. The prodiaene is commoner than the triaene form.

(*d*). Protriaenes and prodiaenes of the fringes and general surface of the oscular areas, thickly crowded and like those guarding the poriferous pits.

3. Anatriaenes of radial bundles like those of type; some projecting from general surface. Anatriaenes of under surface like those of type.

4. Sigmas of ectosome and interior show the same contrast in size and shape as in the type. Those of the ectosome measure 20–32 µ in length, those of the interior 16–20 µ.

Holotype.—Cat. No. 21310, U.S.N.M.

TETILLA (CINACHYRELLA) PATERIFERA, new species.

Plate 39, figs. 6, 8; plate 48, fig. 4.

Station D5169, three specimens.

Sponge massive, somewhat elongated vertically, larger and rounded above, narrower below where the body is probably naturally buried in the sand. The largest specimen is 95 mm. high with a greatest diameter of 60 mm., the others not far from these dimensions. A single osculum, terminal in two, lateral in one specimen, leads from a cloaca. In one specimen the osculum is 4 mm. wide, the cloaca 6 mm. deep, 5 mm. wide. In a second specimen the dimensions are about the same. But in one specimen the osculum (terminal) is 12 mm. wide, the cloaca 25 mm. deep, with a width of 12 mm. The oscula are without fringes. The surface of the cloaca shows the apertures of a few small efferent canals.

The poriferous pits are very numerous, distributed over the whole surface except the base, or only over the upper and lateral surfaces. They are shallow, obviously sphinctrate, having a sharp margin when they are contracted (pl. 39, fig. 6), a vague and rounded margin when not contracted (pl. 39, fig. 8). The largest measures 8–10 mm. in diameter, with a depth of 2–3 mm. They range down to small ones about 1 mm. wide. In two of the specimens the pits do not exceed 4–5 mm. in diameter. There is no fringe. The floor is smooth and so perforated with pores as to be sieve-like. As bearing on the ontogenetic and evolutionary origin of the pits, it is interesting to note that over the lower lateral surface there are pits that are scarcely depressed and other similar smooth pore areas that are not depressed at all. Microscopic preparations show that between the poriferous pits there are also some scattered pores.

The surface in general between the poriferous pits is glabrous, very feebly and minutely conulose. But over the lower lateral surface are areas that are hirsute or produced into long downwardly projecting slender root processes which include bundles of root spicules. Such areas are more or less covered with shelly débris.

The narrowed basal part of the sponge may be simple, the whole sponge pear-like; or the base may be somewhat irregular showing a tendency to become lobate. There is no root-tuft, but the base is covered with projecting root-processes which hold shelly débris.

The color is light brown in two specimens, darker in the third. The choanosome is dense. The ectosome is likewise dense, somewhat fibrous in its superficial stratum and without radiate cortical oxeas.

Strong skeletal bundles curve out radially from the center of the sponge to the surface. In the peripheral region, the bundles are not very sharply separated one from the other. Over the general surface the superficial spicules project slightly in groups that are quite small, with much dermal membrane between them that shows no megascleres. The radial skeletal bundles are present and alike, both within the limits of the poriferous pits and between the pits. There are no special ectosomal brushes of smaller spicules in which the radial bundles terminate. The extreme basal part of the sponge contains abundant, in fact consists chiefly of, strong, vertically descending spicule bundles that fray out at the lower end.

Over the surface in general the radial bundles are made up chiefly of oxeas with intermingled protriaenes. Root bundles of the base and lower lateral surface include also many anatriaenes.

Spicules.—1. Oxea. Smooth, equiended, tapering gradually to sharp points. In the radial bundles they measure 2.5–4 mm. by 35–50 μ, with smaller, slenderer ones. In the root bundles they reach a larger size, 4.5 mm. by 65 μ.

Small oxeas, about 250 by 2 μ, scattered through the choanosome, are fairly abundant in two specimens, and almost absent in the third. Probably a detailed examination would show that the different regions of one and the same individual differ a good deal in respect to this point.

2. Protriaene. Common but not very abundant in the radial bundles and the root bundles, less common in one than in the other two specimens. Spicules in the radial bundles have a rhabdome 3–4 mm. long, 8–12 μ thick above; clads 24–60 μ long, 5–7 μ thick at the base. In two specimens, spicules with shorter, stouter clads (34–40 μ long, 6–7 μ thick) predominate. In the third specimen, spicules with slenderer clads (40–60 μ long, 5–6 μ thick) predominate. In this specimen prodiaene and promonaene forms were noted.

In the root bundles stouter protriaenes occur along with the ordinary forms; rhabdome 16–22 μ thick, clads 24–28 μ long and quite thick. Some protriaenes also occur here, of ordinary size, but with clads so degenerate as to form mere protuberances.

3. Anatriaene. Absent in the radial bundles of the general body, common in the root bundles of the lower body and base. Spicules characterized by a very flat cladome. In a typical spicule (pl. 48, fig. 4, *a*) rhabdome is several millimeters long, 12 μ thick above; clads short, stout, almost at right angles to the rhabdome, about 24 μ long, 12 μ thick at the base. Slenderer but similar spicules also occur, down to those with rhabdome 5–6 μ thick and clads 8–12 μ long. The anatriaenes show a considerable tendency to vary. Thus spicules with three short rounded clads, which may be only 4 μ long, occur (pl. 48, fig. 4, *b*). Monaenes, larger than the common anatriaenes, occur; rhabdome 16 μ thick, clad 20 μ long and 16 μ thick (fig. 4, *c*). All the clads may be so degenerate that the spicule is virtually tylote at this end (fig. 4, *d*). Rarely the rhabdome is prolonged beyond the degenerate clads (fig. 4, *e*).

4. Sigmas. Abundant in the dermal membrane of the poriferous pits and between them, and in the cloacal wall; also abundant throughout the interior of the sponge, 12–16 μ long, of the usual shape.

Holotype.—Cat. No. 21314, U.S.N.M.

The species is close to *Tetilla* (*Cinachyra*) *mertoni*, Hentschel (1912, p. 332), from the Kei Islands, a form with larger pits that reach a diameter of 3 cm. In *T. mertoni* there are several cloacae, apparently very similar to the pits; the anatriaenes, while they have a flat cladome, are of a slender type and the spicules are apparently not confined to the root bundles. The protriaenes are slenderer, with larger clads, than in *T. paterifera;* they are also said to be less abundant than the anatriaenes. The sigmas in Hentschel's species have truncated or slightly dilated ends. The Philippine species also resembles, especially in external appearance, *Tetilla* (*Cinachyra*) *vaccinata* from the Indian Ocean, Dendy 1921*b* (p. 14). There are however skeletal differences and also differences concerning the oscula.

Genus CRANIELLA O. Schmidt (1870).

Craniella O. SCHMIDT, 1870, p. 66.—SOLLAS, 1888, p. 30.—TOPSENT, 1920*b*, p. 7.
Tethya LENDENFELD, 1903, p. 23.—LAMARCK part, LENDENFELD, 1906, p. 69.

The ectosome is differentiated into an inner fibrous layer, traversed more or less radially by cortical oxeas, and an outer collenchymatous layer excavated by subdermal cavities. Pores scattered over surface of sponge. Oscula distinguishable from pores and usually few in number. The microscleres have been lost in some species.

As to the propriety of the name *Craniella*, instead of *Tethya*, see *Donatia*. Lendenfeld, 1906, merges *Tetilla* (plus *Chrotella*) and *Craniella* (*Tethya*) because of the existence of forms intermediate in respect to certain features. I follow the common practice and maintain both genera (for some discussion of this matter, see George and Wilson, 1919, and previously under *Tetilla*). In the following list Lendenfeld's practice must be borne in mind.

Since Lendenfeld's Tierreich synopsis (1903) there have been described—

C. elegans Dendy, 1905, p. 95, Ceylon.

Tethya coactifera Lendenfeld, 1906, Kerguelen.

Tethya stylifera Lendenfeld, 1906, Kerguelen.

Tethya crassispicula Lendenfeld, 1906, Kerguelen.

Tethya armata Baer, 1906, Zanzibar.

Tethya sagitta Lendenfeld, 1907, p. 307, Antarctic.

C. disigma Topsent, 1904, p. 100, Azores.

C. sagitta Lendenfeld, var. *microsigma* Kirkpatrick, 1908, p. 1, Antarctic.

C. sagitta Lendenfeld, var. *pachyrrhabdus* Kirkpatrick, 1908, p. 4.

A few species assigned by Sollas and others to *Craniella* (*Tethya*) are inscribed by Lendenfeld, 1903, under *Tethyopsilla*.

CRANIELLA SIMILLIMA (Bowerbank).

Plate 40, fig. 1.

Tethea simillima part BOWERBANK, 1873, p. 15.

Craniella simillima (BOWERBANK), SOLLAS 1888, p. 30.

Tethyopsilla zetlandica (CARTER) part, LENDENFELD, 1903, p. 31.

Station D5151, one specimen; D5164, one specimen; D5141, one specimen.

Sollas, 1888, discusses Bowerbank's description and type, and redefines the species as subspheroidal with terminal osculum and conulose surface; the conules absent over the base, here replaced by a general pilosity. Without microscleres. Sollas' specimens came from the Australian coast, the Philippines, and the vicinity of the Aru Islands. The largest measured 29 by 27 mm.

Lendenfeld, 1903 (p. 31), combines the species along with two others of Sollas' under *Tethyopsilla zetlandica* (Carter), a form from the neighborhood of the Shetland Islands, differing from the common Atlantic *Craniella cranium* in a negative character, the absence of sigmas. Hentschel (1911, p. 287; 1912, p. 331) accepts *T. zetlandica* in Lendenfeld's extended sense, and so designates two sponges, one from the Australian coast, one from the Aru Islands.

It seems to me desirable, for the present at least, to retain *C. simillima* as an Indo-Pacific form, in which the general surface is markedly conulose, while the base is pilose. Hentschel's sponges just referred to, one of which measures 5 cm. in diameter, would perhaps fall under *C. simillima*. In one, at any rate, the surface is distinctly conulose. For the other this character is not given.

In regard to the absence of sigmas, the feature on which Lendenfeld's Tethyopsillidae (1903, p. 29, deleted by Lendenfeld, 1906) and *Tethyopsilla* Lendenfeld (1903, p. 30) chiefly rest, it may be said that Sollas, 1888 (p. 55), looks on this character as a good specific difference. Topsent, 1904 (p. 99), would not assign to the feature even this value, and accordingly regards the specimens designated *Craniella zetlandica* (Carter) by Sollas as not separable from *Craniella cranium* (see Lendenfeld, 1906, p. 121). In the classification adopted in this report, *Tethyopsilla* Lendenfeld is not accepted, but the absence of sigmas is looked on as a specific difference, one that distinguishes for instance *C. simillima* from the Ceylon sponges designated *Craniella elegans* by Dendy (1905, p. 95).

The *Albatross* specimens of *C. simillima* are larger than have been recorded. One is ellipsoidal, 65 mm. high, 45 mm. wide. Another is spheroidal, 53 mm. in diameter. In the former there is a single terminal small osculum, in the latter four small oscula near the upper pole. The conules are sharp, 1–2 mm. high, frequently connected by ridges and often about 2 mm. apart. Papillae of the basal surface, very small, closely set elevations, appearing rounded to the eye. Sponge is heavy and compact, reddish-brown at the surface, lighter colored inside. One specimen is full of large bluish embryos, about 1,400 μ in diameter, in which the radial skeletal bundles have already formed.

The dermal membrane between the conules is riddled with pores which extend up on the conules. From these, short cylindrical pore canals, 20–60 μ in diameter, pass into the subdermal spaces of the outer ectosomal layer. The outer layer of the ectosome is commonly 200–500 μ thick between the conules, thicker than this where the conules are close together; nonfibrous, brownish, but without coarsely granular conspicuous cells. The inner or cortical layer of the ectosome is 1,200–1,800 μ thick, without pigment, fibrous, and is filled with the radial cortical spicules which often protrude into the outer estosomal layer and even reach the surface. In the extreme basal region of the sponge the whole ectosome is thicken than elsewhere.

The radial skeletal bundles coming from the center of the sponge pass in the usual way into and project from the conules, some of the spicules projecting several millimeters beyond the surface. The protruding spicules include protriaenes, anatriaenes, and some large oxeas, the bundles themselves being made up of these three classes of spicules.

The radial oxeas reach a size of 4 mm. by 50 μ.

The cortical oxeas measure 1,200–1,400 by 32–50 μ. Sollas says they are fusiform. I find them slightly inequiended, the inner end as usual being the finer one.

Protriaenes have a rhabdome about 5 mm. long, 12–18 µ thick above, then tapering to a hair-like thickness; clads 60–80 µ long, strong; cladomes projecting, or occasionally within the conulus but near the surface.

Anatriaenes have a rhabdome which may reach a length of 10 mm., 8–15 µ thick above, then hair-like; clads 40–60 µ long. These spicules very abundant in the bundle; some cladomes projecting, but most in the ectosome, those of younger spicules in the outer part of choanosome.

The specimen from D5141 is very different from the other two. From the similarity in skeleton I conclude that it is probably a young form of the same species. It is pyriform, 19 mm. high, with a faintly papillose surface, the papillae supported by the radial bundles. The upper rounded end appears to the eye to be without projecting spicules, the lower half showing such spicules, which however only protrude a short distance and do not form a root tuft.

Brown granular cells are abundant in the ectosome, and the specimen differs from the preceding also in the following skeletal measurements:

The cortical zone of the ectosome is only 700 µ thick in the upper part of the sponge, 1,100 µ thick below. The larger radial oxeas are only about 2 mm. by 24 µ. The cortical oxeas are about 700 by 20 µ.

The protriaenes are small; the rhabdome only 8–12 µ thick, the clads 40–60 µ long. These spicules barely project or do not project in the upper half of the sponge. They are more abundant and they project freely in the lower half.

The anatriaenes are also smaller than in the other two specimens, although they have the same shape and show the same abundance and arrangement. The rhabdome is about 7 µ thick above, the clads 40 µ long.

Genus PARATETILLA Dendy (1905).

Paratetilla Dendy, 1905, p. 97.

With a special layer of modified triaenes in the ectosome or at the junction between ectosome and choanosome. The triaenes may depart from the ortho- or plagiotriaene type only in having a very short rhabdome; or they may depart in various ways, becoming irregular and lacking uniformity in one and the same sponge. Some species with, some without, special poriferous depressions.

PARATETILLA ARCIFERA, new species.

Plate 40, fig. 2; plate 48, fig. 6.

Station D5400, one specimen.

Sponge subglobular, both upper and lower surfaces flattened. Horizontal diameter about 30 mm. Shelly incrustations conceal a considerable part of the surface, and on one side the body has been torn badly.

In the equatorial zone are deep poriferous pits, with smooth lining membrane and without marginal fringes. The lining membrane shows small closely set pore areas separated by narrow trabeculae. The cavities underlying the membrane are no larger than the subdermal cavities of the general surface, a fact which tends to indicate that the pits are afferent. In the specimen there are two perfect pits and parts of two others. The largest has an equatorial width of 14 mm., the others about half that.

A small, very eccentrically placed osculum, about 1 mm. in diameter, in a depressed smooth area, is present on the upper surface. Perhaps other oscula were present in the torn region.

The ectosome is not distinctly fibrous. There is a fairly extensive system of subdermal cavities, from which narrow canals pass into the interior, and into which small pore canals pass everywhere from the dermal surface. The abundance of sigmas in the walls aids in tracing the pore canals.

The under surface was doubtless attached in places and was torn loose from its substratum. Nevertheless the dermal membrane over a large part of it is uninjured. This surface is very different from the rest, which is much incrusted with sand grains, etc., and is hispid with the projecting spicules of the radial skeletal bundles. The under surface, on the contrary, has a smooth, clean, thin dermal membrane showing small pore-areas separated from one another by a net-work of narrow trabeculae. It is quite similar to the membrane lining the poriferous pits.

The skeletal bundles pass radially outwards to all parts of the sponge from about the center of the lower surface, the lowermost bundles lying lengthwise at this surface in plain view. Doubtless the detailed character of the lower surface varies in accordance with the local conditions affecting the individual.

Spicules (pl. 48, fig. 6).—1. Oxea, equiended, 3.5 mm. by 50 μ, with smaller sizes. The chief spicule of the radial bundles, the more superficial ones projecting from the surface.

2. Oxea, small and slender, about 360 by 2–3 μ; scattered, not very abundantly, between the skeletal bundles.

3. Orthotriaene with short rhabdome; the characteristic ectosomal spicule; abundant. Typically the rhabdome is radial to the surface, the clads tangential; the spicules forming one to about three layers. In a typical spicule the rhabdome measures 120 μ, the clads 370 μ in length; larger and smaller sizes occur; rhabdome in general about one-third the length of a clad. Rhabdome straight, tapering to a point, or more cylindrical. Clads with the usual bowlike curvature; those of a spicule generally alike.

A few reduced orthotriaenes occur. Clads and rhabdome all about equal in size, 60–100 μ long, all straight and cylindrical.

4. Anatriaene. Abundant in the radial bundles. Cladomes for the most part grouped near the surface, some farther out almost at the surface; a few projecting. Rhabdome 3–4 mm. long, 6 μ thick near cladome, then becoming hair-like. Cladome rather shallow, clads 40–48 μ long.

5. Protriaene. Present over the general surface in the radial bundles, but few in number; some with cladomes below the surface, some with cladomes projecting. Rhabdome 3.5–4 mm. long, 8–12 μ thick near the cladome, somewhat thicker below, and then tapering to a hair-like thickness in the usual way. Clads 50–70 μ long.

Bundles of the under surface include a considerable number of protriaenes, larger than those of the rest of the body and for the most part projecting. Rhabdome reaching 14 μ in thickness, clads 120 μ in length.

6. Sigmas, about 16 μ long, of the usual shape. Abundant in the dermal membrane, including the general and lower surfaces and the lining of the poriferous pits. Very abundant in the canal walls, but absent or only scantily present in the tissue between the canals.

Holotype.—Cat. No. 21278, U.S.N.M.

Dendy, 1905 (p. 97), established this genus for a new form, *P. cineriformis*, from Ceylon, in which the modified triaenes are irregular, and an old form, *P.* (*Tethya*) *merguiensis* (Carter), in which Sollas (1888, p. 16, *Tetilla merguiensis*) had shown that these spicules were only orthotriaenes with short rhabdome.

Lindgren, 1898 (p. 328), had already merged *Tetilla merguiensis* in *Tetilla* (*Stelletta*) *bacca* (Selenka), in which the ectosomal megascleres are plagiotriaenes with reduced rhabdome; all four rays usually about equal and straight.

Thiele, 1900 (p. 39), followed Lindgren in this matter of synonymy, and further classed several of Kieschnick's names (1896, 1900) as synonyms of *T. bacca*—namely, *T. ternatensis*, *T. amboinensis*, *T. violacea*, and *T. rubra*, the first from Ternate, the others from Amboina.

Lendenfeld, 1903, adopted the synonymy of *T. bacca* upheld by Lindgren and Thiele, except that he separated from this species two of Kieschnick's forms, *T. amboinensis* and *T. rubra*, which he combined and transferred to *Cinachyra* (*C. amboinensis*). While *T. merguiensis* is perhaps a synonym of *T. bacca*, Lendenfeld is justified in retaining *T. amboinensis* Kieschnick as a distinct species, since it has poriferous pits (Kieschnick, 1900), and these are not definitely recorded for *T. bacca*, although Dendy, 1921*b* (p. 21), would interpret the apertures in Selenka's type (*Stelletta bacca*) as such. Lendenfeld's treatment, at the moment, seems to be the safer.

The *Albatross* sponge is evidently close to Kieschnick's species, which Hentschel has more recently (1912, p. 331, *Cinachyra amboinensis*) recorded from the Aru Islands. Hentschel calls the ectosomal spicules orthotriaenes, and says the rays vary in shape and length. Kieschnick's type was ovoidal, blue gray, with an apical osculum and small cloaca; root tuft at the lower end; poriferous pits; the ectosomal megascleres varying from regular "Vierstrahler" (calthrops) to "modifications of an ordinary triaene" (his figures are not decisive in this matter). The *Albatross* sponge differs too much from this in habitus, and especially in the character of the ectosomal triaenes, to be identified as the same species.

Under the genus we may then record, to date: *Paratetilla bacca* (Selenka), *P. amboinensis* (Kieschnick), *P. cineriformis* Dendy, *P. excentrica* Row (1911, p. 306), a form in which the ectosomal triaenes are very irregular, and the species here described. Dendy, it should be added, who has recently (1921*b*, pp. 21–25) studied a number of specimens from the Indian Ocean, would follow Thiele's practice and accept *P. bacca* as a comprehensive variable species to include all that Thiele (see above) put into it and also his own *P. cineriformis* and *P. eccentrica* Row. Within this species he retains one of Kieschnick's names as a variety, var. *violacea*, and establishes a new variety, *corrugata*, in which the very numerous poriferous pits (porocalices) tend to become confluent.

The sponge from Amboina designated by Topsent, 1897, p. 437, *Tetilla merguiensis*, since it has amphitriaenes, would appear to be a distinct species referable to *Amphitethya* Lendenfeld. This is certainly a more objective treatment than to interpret the amphitriaenes as abnormalities.

Likewise *Paratetilla aruensis* Hentschel, 1911 (p. 329), is referable to *Amphitethya*, although Dendy has recently (1921*b*, p. 21) expressed the opinion that it may be left in *Paratetilla*. Hentschel, it should be added, would merge the two genera, while Dendy thinks they may be kept separate.

The remaining genera of the family are not represented among the sponges studied. They are defined and discussed below.

Genus CINACHYRA Sollas (1886).

Cinachyra SOLLAS, 1886, p. 183; 1888, p. 23.—Part, LENDENFELD, 1903, p. 26.—Part, DENDY, 1921*b*, p. 11.

The ectosome is a fibrous cortex traversed by radial cortical oxeas. Poriferous depressions with sphinctrate mouths are present. In some species there are also simple oscula.

Sollas, 1888, regarded some of the poriferous depressions as afferent, others efferent. The facts as a whole confirm, I think, this interpretation. Nevertheless Kirkpatrick has (1905) found simple oscula, or oscular eminences, over the upper surface of *C. barbata* Sollas. Kirkpatrick reviews the species and thinks probably the records are deficient and the species all have simple oscula like *C. barbata.* It is difficult to believe that this is universal (see *Tetilla crustata* of this report), unless indeed, as I have suggested (under *Tetilla crustata*, var. *aperta*), one and the same poriferous depression may in a different physiological state of the individual come to appear as a simple cloaca or as the terminal part of a main efferent canal.

Some of the species enrolled by Lendenfeld, 1903, and Dendy, 1921*b*, under *Cinachyra* fall under *Tetilla* according to the classification followed in this report. Kirkpatrick (1905 p. 666) indeed judges from the records that in only one of these species, *C. barbata*, is there a fibrous cortex " with a dense palisade of oxeas."

Since the Tierreich synopsis (Lendenfeld, 1903) Lendenfeld (1906, 1907), Hentschel (1911, 1912), Kirkpatrick (1908), and Dendy (1921*b*) have recorded a number of new forms under *Cinachyra.* They all fall under *Tetilla* (*Cinachyrella*) as used in this report. Dendy, 1921*b*, discusses the differential features of the species which he groups under *Cinachyra* and gives a useful key.

Genus AMPHITETHYA Lendenfeld (1906).

Amphitethya LENDENFELD, 1906, p. 126.

With microscleres, without vestibular poriferous depressions, with amphiclads (amphi- triaenes, -diaenes, -monaenes).

Lendenfeld, 1906, under this head combines with a new species, *A. microsigma*, some old ones previously described under Tetilla.

Among these is *Tetilla* (*Tethya*) *stipitata* (Carter), in which the characteristic generic spicules, amphitriaenes, " very variable in form and size " and sometimes " reduced to simple triaenes," occur in the basal (stem) part of the sponge (Sollas, 1888), and which therefore fits well in the genus. In Lendenfeld's species, *A. microsigma*, amphitriaenes, connected by transitional forms with plagiotriaenes, occur and also only in the stalk.

Lendenfeld also lists here somewhat provisionally *Tetilla* (*Tethya*) *bacca* (Selenka). The synonymy of *T. bacca* is confused, as Dendy has said (1905). Lendenfeld, 1903, following Lindgren and Thiele, combined under this head several sponges, among them the sponge from Amboina described by Topsent (1897) as *Tetilla merguiensis.* This sponge has amphitriaenes and is accordingly referable to *Amphitethya.* In the other sponges combined by Lendenfeld under *T. bacca*, amphitriaenes are not recorded; these sponges are assignable to *Paratetilla.* It thus comes about that *T. bacca* is mentioned by Dendy, 1905, under *Paratetilla*, and by Lendenfeld under *Amphitethya.*

Hentschel, 1912, deletes *Amphitethya*, making it synonymous with *Paratetilla;* but, as far as the records enable one to judge, the two genera represent different character-combinations, and both should be retained. *Paratetilla aruensis* Hentschel, 1912 (p. 329), which has amphitriaenes, thus becomes *Amphitethya aruensis.*

Genus FANGOPHILINA O. Schmidt (1880).

Fangophilina O. SCHMIDT, 1879–80, p. 73.
Spongocardium KIRKPATRICK, 1902, p. 224.

With microscleres, with two unlike vestibular spaces or poriferous depressions, of which one belongs to the incurrent, and one to the excurrent system.

O. Schmidt's *Fangophilina submersa*, from the Caribbean, was tentatively placed by Sollas, 1888, along with *Cinachyra*. Lendenfeld, 1903, classed it with that genus. Kirkpatrick, 1905, and Lendenfeld, 1906, regard *Fangophilina* as a good genus, of which *Spongocardium* is a synonym. The genus includes in addition to *F. submersa* O. Schmidt, *F.* (*Spongocardium*) *gilchristi* Kirkpatrick, 1902 (p. 224), and *F. hirsuta* Lendenfeld, 1906 (p. 157).

* * * * * * *

Under *Tethyopsilla* (Lendenfeld, 1888), Lendenfeld (1903) groups along with his type, *T. stewartii*, a number of species assigned by Sollas and some others to *Tetilla* and *Craniella*. Dendy has suggested that the genus, characterized by the absence of microscleres, is an artificial (polyphyletic) one. It seems clear that microscleres are sometimes lost. The genus, in the classification followed in this report, is deleted and the species distributed. Hentschel (1911, 1912), however, uses it, as does Baer (1906).

Topsent (1913*b*, p. 14) would group certain of the species referred by Lendenfeld to *Tethyopsilla* under a new genus *Craniellopsis*. These are the species which resemble *Craniella* in possessing cortical oxeas. They are *C. infrequens* (Carter), *C. zetlandica* (Carter), and *C. lentiformis* (Thiele). To them Topsent adds *C. azorica*, new species, from the Azores. Some would doubtless prefer, with the writer, to set off these forms from *Craniella* as a subgenus, it being understood that such a subgenus, based on a single character, will include forms in which the character has been acquired by analogical variation and between which therefore the genetic relationship is not especially close.

Suborder HALICHONDRINA.

Halichondrina VOSMAER 1887; RIDLEY and DENDY, 1887; and AUTHORS.

Megascleres all monaxonid. Skeleton very commonly reticulate or fibrous, with a good deal of spongin. Microscleres, when present, either sigmas or derived forms such as chelas.

Family HAPLOSCLERIDAE.

Haplosceridae TOPSENT 1894*c*; and AUTHORS.

Haplosceridae minus *Hamacanthinae* and *Merliinae* DENDY, 1921*b*.

Microscleres often absent; when present never chelas. The megascleres are fundamentally diactinal. Where the skeleton is made up of distinct spiculo-fibers, these are typically non-plumose.

The family is taken in the sense of Topsent (1894*c*), except that the Phoriosponginae are excluded. The subfamilies recognized are the four (Gelliinae, Renierinae, Chalininae, Spongillinae) advocated by Topsent, 1904, and the Phloeodictyinae. The forms making up the subfamilies Tedaniinae, Desmacellinae, and Hamacanthinae were transferred by Topsent, 1894*c*, to the Desmacidonidae as forms which have lost the chelas. The general complexity of these sponges seems to justify this move which has been followed by Topsent in later papers, by Wilson, 1904, and Hentschel, 1912, for *Tylodesma* (*Biemma* Authors), by Hentschel, 1911, for *Desmacella*, by Kirkpatrick, 1908, Lundbeck, 1910, and Hentschel, 1911, 1912, for *Tedania*, and by Dendy, 1921*b*, for *Tedania* and the *Desmacellinae*. Dendy, 1905, added a new subfamily: Heteroxyinae, for *Acanthoxifer*, new genus, and *Heteroxya* Topsent, the latter referred by its author and in this report to the Donatiidae (Tethyidae Authors). Row (1911) contributed a new genus, *Anacanthaea*, to this subfamily which Dendy, 1921*b* (p. 25), now transfers to the Desmacidonidae. (See this report under Spongosorites.)

Dendy has (1916*b*) proposed to merge the Axinellidae in this family, but more recently would regard the bulk of the Axinellidae as reduced Desmacidonidae (1921*b*, p. 111). Lundbeck in his important memoir (1902) prefers not to use the family, but holds to the Homorrhaphidae and Heterorrhaphidae of Ridley and Dendy (1887).

Subfamily GELLIINAE.

Gelliinae RIDLEY and DENDY, 1887.

The megascleres are diactinal, oxeas, or strongyles; with microscleres in the shape of sigmas, toxas, rhaphides or trichodragmas or microxeas, separately or in various combinations.

The group (Gelliadae part, Gray, 1872) is taken in the sense of Ridley and Dendy (1887) and Dendy (1905). Lundbeck, 1902, and Topsent, 1904, include *Oceanapia*, assignable to the Phloeodictyinae. The group is thought by Dendy to include the most primitive sponges of the family, from which others (Renierinae, Chalininae, for example) without microscleres have been derived.

Genus GELLIUS Gray (1867).

Gellius Gray, 1867, p. 538.—Ridley and Dendy, 1887, p. 37.

Gelliinae in which the skeleton is typically a renieroid network without fibers. But spicule tracts may also be present, or indeed may replace the simple renieroid network. The latter in some species becomes very irregular and halichondrioid. Spongin is scanty. When spicule tracts are present, they are not sharply defined fibers as in Gelliodes.

Gellius, in which Gray (1867) gave the skeleton as "regularly netted," has been defined by Ridley and Dendy, 1887, Topsent, 1894*c*, and Lundbeck, 1902, as without distinct fibers or at any rate without long fibers. But compact spicule tracts, including a little spongin, which are not far from the fibers of many Gelliodes species, are found in *Gellius flagellifer* Ridley and Dendy (1887), *Gellius perforatus* Wilson (1904), and in some other forms.

The megascleres in the genus are characteristically oxeas, but there are species with strongyles (Lindgren, 1898). Lundbeck, 1902 (p. 71), sums up the combinations of microscleres occurring in the genus as follows: Sigmas; sigmas and toxas; sigmas and rhaphides separately or forming trichodragmas; rhaphides (trichodragmas); toxas. He would merge *Rhaphisia* Topsent (megascleres—oxeas; microscleres—rhaphides or trichodragmas, or trichodragmas and toxas). The number of species is growing so that some subdivision, even if artificial, based on the microscleres, would be useful.

The distinction between the group of species constituting *Gellius* and that constituting *Gelliodes* is vaguer than is sometimes assumed (Dendy thus, 1905, p. 137, defines *Gelliodes* as having fibers with abundant spongin), and a brief discussion of the latter genus may not be out of place here.

Gelliodes Ridley (1884, p. 426) may be defined: Gelliinae in which the skeleton includes, sometimes in addition to a finer network or a more scattered skeleton, *sharply defined fibers* forming a reticulum, which in some species is produced by the dendritic branching and anastomosing of longitudinal fibers. Spongin may be abundant, in which case the fiber is cored (Chalina-like) by the spicules, or scanty, in which case the fiber is a mere column of spicules (Petrosia- or Pachychalina-like) cemented together, but the column not covered, by spongin. Microscleres—sigmas, or sigmas with toxas.

Lundbeck, 1902 (p. 75), has materially helped in the progressive definition of Ridley's genus. In the type species (Ridley, 1884, p. 426) and in some other species, those described by Lundbeck (1902) and in *G. petrosioides* Dendy (1905, p. 138), for instance, spongin is very scanty, and yet the fiber has a distinctness which is absent from our concept of Gellius, toward which the genus shades over. Some rearrangement of the species of the two genera, to avoid overlapping is probably already desirable.

As Lundbeck, 1902 (p. 78), says, since sigmas and toxas occur together in the new species which he describes, Dendy's earlier suggestion, that it may prove necessary to merge *Toxochalina* (with toxas), might now be followed. But, as he intimates, it would be better to keep the two genera separate by stressing the regular, chalinid, arrangement of the skeletal fibers in *Toxochalina* in contrast to the more irregular arrangement which is on the whole characteristic of *Gelliodes.* And yet in some species (type species, for example, Ridley, 1884) of the latter, radial fibers and connectives are distinguishable. We here meet again the common phenomenon of the intergradation of a group of species with *several* other such groups, the explanation of which seems to be that the characters of the ancestral group have varied during the evolution of the existing species independently of one another, and thus numerous combinations of characters have resulted.

GELLIUS VARIUS (Bowerbank), var. FIBROSA, new variety.

Plate 40, fig. 3; plate 49, fig. 1.

Halichondria varia BOWERBANK, 1875, p. 292.
Gellius varius RIDLEY, 1884, p. 424.

Bowerbank's name of *Halichondria varia* (1875, p. 292) was given to several specimens from the Straits of Malacca, in which the body was in some cases a rough irregular mass and in others consisted of short cylindrical branches; with renieroid skeletal network, uni- or bi-spiculous; with unispiculous dermal network. Ridley (1884, p. 424) states that in this type the oxeas measure 220 by 16 μ, the sigmas 25 to 32 μ long.

With this species Ridley (1884) combined *Isodictya virgata* Bowerbank, also from Straits of Malacca (Bowerbank, 1875, p. 294). The sponge so named consisted of two branches, not exceeding 2 inches in height. The renieroid skeletal network shows well-pronounced multispiculous primary (namely, radial) lines. Ridley gives the oxeas as measuring 220 by 14 μ, the sigmas 25 μ long.

Ridley (1884) had two fragments from Port Darwin; of an erect, cylindrical habitus; dimensions not given. In these the oxeas measured 250 by 15 μ, the sigmas 19 μ long. Ridley and Dendy (1887, p. 38) had several fragments from the Philippines, all more or less cylindrical, the largest 80 mm. long by about 6 mm. in diameter. The pieces branch and the branches show a strong tendency to anastomose. The size and distribution of the oscula are as in the *Albatross* specimen. The oxeas measure 220 by 13–14.5 μ, sigmas about 40 μ long.

Two dried specimens of the *Albatross* collection are assignable to this species, one from station D5626, the other from Togian Bay, Togian Island, Gulf of Tomini, Celebes; also two alcoholic specimens from Togian Bay. They differ, however, from the records in a marked anatomical feature—namely, the possession of strong longitudinal spicule-tracts—and may on that account be referred to a variety, *fibrosa*, new variety. The sponges are much taller than those recorded, the oxeas considerably smaller, and the sigmas are at the lower limit of the range recorded, which is considerable.

Sponge body consists of a branching axis, which may be cylindrical, or distinctly flattened, the branches often meeting and fusing and terminating in pointed extremities. Where the sponge is more cylindrical the diameter is 5–7 mm. In one of the typical flattened regions the diameters are 20 mm. and 7 mm. Total height reaches 300–400 mm. Sponge firm but brittle; color of dried sponge, light gray or light yellowish brown; color of alcoholic specimens, reddish brown. The photograph, (pl. 40, fig. 3), shows a very flattened piece, a moderately flattened piece, and a terminal cylindrical branch, side by side, all from a dried specimen.

Pores are closely and uniformly distributed over the surface in the meshes of the dermal reticulum. Abundant small afferent canals, about 0.5 mm. in diameter, extend in radially from the surface and give the sponge a porous appearance. Oscula about 2 mm. in diameter are abundantly scattered over the surface, leading into well-marked depressions into which several efferent canals directly debouch.

The skeleton is made up of a renieroid reticulum and longitudinal polyspicular tracts, often compact enough to deserve the name of fibers, 20–100 μ in diameter. They consist of closely packed spicules in about 3 to 12 rows; they branch and anastomose obliquely so as to form a coarse and rather vague network with elongated meshes. The longitudinal tracts were conspicuous in all the sections made, but are considerably more abundant and closely set in some regions than in others. They are especially developed in, though by no means confined to, the axial part of the sponge. Thus in a typical region where the total diameter of the sponge is 7 mm., the longitudinal tracts occupy an axial portion about 4 mm. wide. Their distribution varies however in the same specimen (perhaps with the age of the region), and a considerable number may occur in the superficial part of the body. Indeed, in some sections in which they were rather sparsely present, the tracts were quite as abundant in the peripheral as in the axial part of the body.

The rest of the skeleton is in general made up of a renieroid reticulum, with 4 or 3 sided meshes, the side about the length of a spicule and formed by one or sometimes two spicules (pl. 49, fig. 1).

In this reticulum the spicules are so arranged as to form fibers or lines that are radial to the surface (*r. f.*) There is the usual variation, however, and in the dried specimen from Togian Bay, while the radial fibers are commonly 1–2 spicules thick, they are sometimes thicker, up to about 4 spicules. In the same specimen, the connectives between the radial fibers, while they commonly have the length of a single spicule (pl. 49,, fig. 1, *c*) may be twice as long; and, while as a rule only one or two spicules thick, they may range up to a thickness of 4 spicules. The dermal reticulum is merely the outermost part of the skeletal reticulum, the meshes 4 or 3 sided, the side formed usually by one spicule. In both skeletal and dermal reticulum, spongin is scanty, only conspicuous in the angles. In several parts of the Togian Bay specimens single spicules, or bunches of two, radiate outward from the nodes of the dermal reticulum.

The longitudinal tracts are connected with the finer reticulum. In transverse sections of the sponge they may be seen to meet the reticulum at points (nodes) where several spicules come together.

The oxeas, smooth, slightly curved, evenly tapering at both ends, measure 160–180 by 8–9 μ; sigmas 18–20 μ long, abundant in the interior and dermal membrane.

Holotype.—Cat. No. 21329, U.S.N.M.

GELLIUS ANGULATUS (Bowerbank), var. VASIFORMIS, new variety.

Plate 40, fig. 4.

Halichondria angulata Bowerbank 1866, p. 233; 1874, p. 101.
Gellius angulatus (Bowerbank) Ridley and Dendy, 1887, p. 44.—Topsent, 1892, p. 76; 1904, p. 231.—Lundbeck, 1902, p. 63.

This North Atlantic species is a massive, apparently small, sponge; main skeleton is a rather irregular renieroid reticulum, occasionally multispicular; dermal reticulum unispicular. Ridley and Dendy give the spicular dimensions as follows: oxea 290–340 by 9–10 μ; toxa 80 by 1 μ; sigma 19 by 1 μ. Topsent (1904) in some of the specimens from the Azores finds the oxeas unusually large, 530–550 by 9–13 μ; the sharply angulated toxas 73 μ long; sigmas 17 μ long.

Dendy (1905, p. 136) refers a small massive Ceylon sponge to a variety (*canaliculata*, new variety) of this species. Main skeleton a unispicular reticulum; dermal skeleton composed of scattered oxeas placed tangentially. Oxea about 250 by 8–10 μ; toxa, shorter and stouter than in the type, sharply angulated in the middle, up to 44 μ in length; sigma, simply contort, about 28 μ long. Surface of sponge shows ramifying canals just beneath dermal membrane, running to oscula of moderate size at one end of body.

A partially macerated specimen from station D5162 is referable to this species and because of its vasiform habitus may be given a varietal name.

The sponge is a thick-walled vase, tapering below to a small attached base. An axial cloaca, extending throughout the body, opens on the upper end by a large osculum. Total height 125 mm.; diameter 60 mm. Diameter of osculum 25 mm.; cloaca in its upper part as wide as the osculum, diminishing below. Sponge firm but slightly compressible; light brown in color.

The dermal membrane has macerated away. The outer surface shows abundant small apertures, mostly 1 mm. or less in diameter, leading into more or lesss radial canals of corresponding size. A large hole, 20 by 12 mm., on the side of the sponge, perforates the wall and leads into the cloaca—probably the result of an injury. A considerable part of the lining of the cloaca is uninjured. This is smooth and shows no apertures. Just beneath it are a good many canals, 3 mm. and over in diameter, which perhaps open into the upper part of cloaca where the lining has been lost. Sponge tissue in general dense; canals, except those just referred to and a few others, 1 mm. or less in diameter.

Skeleton a unispicular reticulum with a little spongin at the nodes; meshes triangular, squarish, or polygonal; side of mesh 70–190 μ long and therefore less than the length of a single spicule.

Spicules.—1. Oxea, smooth slightly curved, gradually pointed as in the type, not abruptly as in variety *canaliculata*, about 240 by 9 μ.

2. Sigma, slender, simply contort, 16–20 μ long; abundant. A few larger forms, up to 68 μ in length, were observed. It is uncertain if they belong to the sponge.

3. Toxa, fairly stout, sharply angulated in the middle; not at all common. Specimens measured 28, 32, 40, 52, 68 μ in length; the small forms, 28–32 μ, are the more abundant.

Holotype.—Cat. No. 21264, U.S.N.M.

Genus STRONGYLOPHORA Dendy (1905).

Strongylophora Dendy, 1905, p. 141.

Meglascleres are strongyles of various sizes together with, in some species, oxeas. Megascleres partly collected in spiculofibers and tracts, with but little spongin; these forming a reticulum. A dense cortical layer of the skeletal reticulum may be differentiated. Microscleres in the form of smooth microxeas, chiefly or exclusively found in the dermal membrane.

I have slightly altered Dendy's original diagnosis (1905, p. 141), to cover the facts presented by the species to be described.—Topsent's new genus, *Microxina* (1917, p. 72), is placed by its author close to *Strongylophora*.

STRONGYLOPHORA CORTICATA, new species.

Plate 40, fig. 7; plate 48, figs. 2, 7.

A dried specimen, taken at station D5593. Sponge body consists of a branching axis, cylindrical or more often flattened, the branches anastomosing so as to give rise to an irregular mass. Transverse diameters of sponge: In a cylindrical region, 25 mm.; in a somewhat flattened region, 45 and 30 mm.; in a very flattened, laminate, region, 100 and 30 mm. Total height of sponge 405 mm.; greatest width 200 mm. Sponge has a distinct rind about 1 mm. thick, much firmer than the interior, which in the dried specimen is loose and fragile.

Oscula 5 to 10 mm. in diameter scattered over surface, each leading into a depression into which numerous smaller canals open. A fine dermal skeletal reticulum extends over whole surface, excepting the oscula which are open. Fleshy part of dermal membrane macerated.

The firm part of the rind consists of a dense subdermal lamella about 0.5 mm. thick, made up of closely packed megascleres, and perforated by rounded apertures (= radial canals), 250–350 µ in diameter. The parts of the lamella between the apertures measure 175–250 µ in width. The lamella is doubtless to be looked on as a close reticulum of dense spiculo-fiber. Between the subdermal lamella and the superficial (dermal) skeletal reticulum is a space crossed by radial pillars made up of the large megascleres. Between the pillars lie subdermal chambers, for the most part 250–350 µ wide; pillars narrow as compared with the chambers, often about 85 µ wide at the middle. In places where the sponge body has been cut across, a second skeletal lamella like the subdermal one may be seen in the inner parenchyma; more or less parallel to the surface of sponge but joining the subdermal lamella at an angle.

Skeleton of interior, internal to the subdermal lamella, made up of an irregular reticulum and scattered megascleres. The reticulum is composed of dense spiculo-fibers, up to 200 µ thick, and less compact spicule-tracts, grading down to bands 1–2 spicules thick. Dermal skeletal reticulum in general polyspicular; meshes 100–200 µ in diameter; sides of meshes formed by loose tracts of a few megascleres or occasionally by single spicules. Abundant radial tufts of very small oxeas, microxeas, project outwards from the strands of the dermal reticulum, not only from the nodes but from the sides of the meshes.

Spicules.—1. The dominant spicule is a strongyle (pl. 48, fig. 2,*a*), 260–315 by 18–22 µ, smooth, slightly curved, with evenly rounded ends. Smaller sizes are common, grading down through all sizes to small and relatively very stout forms (pl. 48, fig. 7,*a*), as small as 30 by 9 µ. Small strongyles of a slender type (fig. 7,*b*), 30–40 by 3–5 µ, also occur.

2. Oxeas (pl. 48, fig. 2,*b*) smooth, slightly curved, with sharp points, 220 by 12 μ, with many smaller sizes grading down to the microxeas, are common. The form is sometimes (rarely) that of the style.

3. Microxeas (pl. 48, fig. 7,*c*), smooth, slightly bent in the middle (angulated), 30–32 by 2–3 μ, common, especially in the dermal membrane but also in the interior. Nearly straight forms (fig. 7,*e*) are also abundant. The stylote form (fig. 7,*d*) of this spicule also occurs. If we assign the spicule to the group of microscleres, it is only because of convenience of description. For it is connected with the larger oxeas by intermediate spicules of all sizes, which occur abundantly. For such intermediate oxeas the following measurements may be recorded: 180 by 10 μ, 160 by 10 μ. 124 by 7 μ, 100 by 7 μ, 80 by 5 μ, 60 by 4 μ, 40 by 4 μ.

4. A good many slender curved oxeas, 40–50 by 1–2 μ, are found in the interior, some of which might be described as toxas (fig. 7, *f*.) The curvature varies; some are bent considerably more than others. The characteristic double curvature of the toxa is occasionally acquired, but more often it is only approached, as in the spicules figured where the ends of the bow are nearly straight, not recurved.

The spiculo-fibers, skeletal tracts, and skeletal lamellae, are composed chiefly of the large strongyles, with other megascleres intermingled. The dermal reticulum is made up, in addition to the radial tufts of microxeas, of large and medium sized oxeas overlying large strongyles. Spongin, although scanty, is present in the spiculo-fibers and tracts, as is well seen in fragments treated with potash for a minute, just long enough to free the spicules of a fiber from one another and from the spongin.

Holotype.—Cat. No. 21331, U.S.N.M.

The genus *Strongylophora* was founded by Dendy (1905, p. 141) for a sponge, *S. durissima*, taken in the Ceylon seas. Dendy's sponge apparently has no rind, although toward the surface the skeletal reticulum becomes more regular. Thiele (1903, p. 938) has described a sponge from Ternate, to which he gives the name of *Petrosia strongylata.* The spicules are substantially like those of *S. durissima* and the *Albatross* species, and the sponge should be brought under Strongylophora.

Dendy (1905) rather doubtfully places his genus in the Gelliinae, where it may be left for the present. Nevertheless the structure of the rind in the species here described is close to that of *Coelosphaera* (comp. *C. toxifera* of this report). In both the characteristic portion is a dense fenestrated lamella about 0.5 mm. thick. This resemblance may, to be sure, be only a case of convergent evolution, but it is so striking that I was induced to look very carefully for chelas in the *Strongylophora* species, but could find none. In looking for the chelas, however, the toxa-like oxeas (*see previously*) were noticed, and search showed that there were a good many of them in the sponge. Thus a second point of resemblance, of the kind that might be expected to occur in a related species, exists. Resemblances are scattered however, for in *Phloeodictyon fistulosum* there is a feature which constitutes a point of resemblance between the Phloeodictyinae and *Strongylophora.* In *Phloeodictyon fistulosum* namely, as noted by Topsent (1904, p. 236), the dermal skeleton includes not only oxeas like those of the main skeleton (300–330 by 10–12 μ), but much smaller forms also (80–100 by 3–5 μ). Ridley (1884, p. 420) also refers to this fact.

Subfamily RENIERINAE.

Renierinae Ridley and Dendy, 1887.

Megascleres, oxeas, or strongyles varying occasionally to styles. Skeleton reticulate, or the spicules may be scattered without definite arrangement. Spongin absent or present in small amount; only exceptionally does it envelop the spicules. No microscleres.

The group (Renierinae part, O. Schmidt 1870) is taken in the sense of Ridley and Dendy (1887) and Dendy (1905). Lundbeck, 1902, Kirkpatrick, 1902, Thiele, 1903, and Topsent, 1904, include *Phloeodictyon*, assignable to the Phloedictyinae.

Genus HALICHONDRIA Fleming (1828).

Halichondria **Fleming, 1828, p. 520.—Vosmaer, 1887, p. 336.—Ridley and Dendy, 1887, p. 1.—Lundbeck, 1902, p. 16.**

Renierinae in which the spicules are irregularly scattered, not forming a permanently fixed reticulum, sometimes aggregated to form tracts; with very little or no spongin. Spicules: oxeas, rarely strongyles.

The place of this genus in the classification has commonly been looked on as an assured one. But Topsent has in recent years (1911) pointed out that the ciliated larva differs from that of the Renierinae and proposes a new classification in which *Halichondria* and *Reniera* are widely separated.

HALICHONDRIA PANICEA Johnston.

Halichondria panicea **Johnston, 1842, p. 114.—Ridley and Dendy, 1887, p. 2.**

To this species two specimens from station D5218 are referable. One is an amorphous mass 60 mm. in diameter with oscula that are not raised or only slightly raised above the surface. The other is elongated horizontally, branched at one end, 80 by 30 mm., with four oscula, all at the ends of short oscular lobes or prominences. A third specimen, broken, from station D5447, resembles the latter in respect to the oscula. Color, light yellowish brown.

The dermal membrane is the usual sieve membrane, perforated everywhere by closely set pores. It is, where perfect, well lifted up above the subjacent tissue, as if the sponges had been killed when thoroughly expanded. Beneath it narrow trabeculae of denser tissue are rather vaguely seen. If now the dermal membrane should sink down, in a sponge losing water, upon the trabeculae, the effect of a reticulum, formed by the trabeculae and embracing pore areas, would be produced. Bowerbank (1866, p. 230) refers to this appearance of the surface in dried specimens. Tangential, narrow subdermal canals are present in some abundance but they are not conspicuous. Doubtless with respect to them, also, the physiological state of the sponge (contracted or expanded) would materially alter the appearance of the surface.

The spicules of the interior are thickly strewn in all directions in the usual irregular way. Tracts, as distinct from the general mass of spicules, are not recognizable. In the ectosomal trabeculae between the subdermal chambers, the spicules have in general a radial or obliquely radial position and project. Such aggregations of spicules are however often too wide and not compact enough to be called tracts. The dermal membrane contains, in addition, abundant more or less tangential spicules. The oxea is the usual smooth, slightly curved form, tapering evenly to sharp points, 700–900 by 26–32 μ with smaller sizes. Now and then a style occurs.

The species, as generally conceived, is cosmopolitan, of no particular habitus, and without any very marked characteristics. The oxeas are always relatively long and slender; Ridley and Dendy (1887, p. 3) put the range in length at 200–1000 μ, Lundbeck (1902, p. 7) at 350–1000 μ. The spicules are especially large in the Indo-Pacific specimens (Topsent 1901, p. 10). The species has in recent years been recorded several times from this region by Dendy (1905, p. 146; 1916*b*, p. 112; 1921*b*, p. 37).

The spicules of the interior are characteristically strewn without order and thickly; those of the dermal membrane may be closely packed in all directions, some tangential, some radial and projecting, others oblique; but often the dermal spicules are so arranged as to form a rete with 3 to many sided meshes (Bowerbank, 1866, p. 229; Lundbeck, 1902, p. 17; Dendy, 1905, p. 146). Since the spicules are free to move, the difference in arrangement of the dermal spicules may possibly be correlated with the physiological state of the sponge. Sponges are included in the species, in which the spicules of the interior show a strong tendency to arrange themselves in coarse fibers and in which there is a well developed dermal reticulation of spicular fiber (Dendy 1916*b*, p. 113).

The simplicity of the skeleton makes it difficult to pick out what racial differences may exist in *Halichondria*, and perhaps *H. panicea*, as employed to-day, is a conglomerate, which will be analyzed as we learn more about the structural details of individuals in different parts of the world. This appears to be the attitude of Hentschel (1914, p. 135).

HALICHONDRIA VARIABILIS Lindgren.

Halichondria variabilis LINDGREN, 1898, p. 285.

Lindgren's species (1898, p. 285) was based on sponges from Cochin China and Java. The basal part of the body sends up fingerlike processes; spicules of interior partly strewn irregularly, partly combined in tracts; ectosomal tracts, 3–4 spicules thick, support small, sharp dermal conuli, projecting beyond the apices of the latter. Surface of sponge everywhere "granulated" by the conuli. Oxea, 720 by 16 µ, gradually pointed.

Hentschel (1912, p. 408) refers to this species a specimen from the Aru Islands, agreeing in habitus as well as in the other features with Lindgren's types. The oxeas are slender, 520–1160 µ long.

The spicules and their arrangement in the interior would scarcely mark off this species from *H. panicea*, but the small sharp dermal conules, supported by more or less radial ectosomal spicular tracts, do. This I conceive to be the distinguishing mark of the species along with spicules of the same type as in *H. panicea.* The irregularity in the curvature of the oxea to which Lindgren calls attention, and which Hentschel found was common in the larger spicules of his specimen, is slight as Lindgren's figure (1898, pl. 19, fig. 1) shows. The habitus too is probably only a local feature.

To this species may be referred a specimen from station D5414. The sponge is a bar-shaped, somewhat flattened, mass, rising from an enlarged base; total height 150 mm., width 25 to 40 mm. Oscula 4–5 mm. in diameter with some smaller ones, numerous; chiefly along one of the narrow sides of the bar, extending thence on to the base and the upper extremity. Large canals of about the diameter of the oscula are present in the interior of the sponge. The surface shows conspicuous, tangential, subdermal canals, 1–2 mm. wide, each with some surrounding collenchyma. These canals are about 5 mm. apart and combine with one another, forming more or less of a connected reticulum. Such canals occur in specimens of *H. panicea*, and Dendy calls attention to them in *H. reticulata Baer* (1916*b*, p. 113). They are especially developed in the *Albatross* specimen.

The small sharp conules, characteristic of the species, are about 1 mm. apart. In addition, the surface exhibits a feature, to which attention has not been called, and which may not be constant. It is conspicuous when the sponge is examined with a lens. From each conulus radiate a number of narrow ridges, all combining to form a fine dermal reticulum, composed of ridges or of trabeculae which are not elevated, between which lie thinner areas of dermal membrane riddled with pores. The ridges and trabeculae are denser and more fibrous than the rest of the dermal membrane; they are not supported by a skeletal reticulum. This reticulum is essentially the same as that found in many horny sponges, where the varying appearance of the surface in the same specimen indicates that the reticulum, which is conspicuous when the pores are open, may disappear when the pores have been closed for a considerable time. It offers a striking case of analogical resemblance between widely distant sponges.

As in the already described specimens, the spicules of the interior are both scattered irregularly and combined in loose tracts. The ectosomal tracts which extend into and support the conules, slightly projecting beyond the apices of the latter, may be radial or quite oblique. Save for these, the dermal membrane is almost free of spicules; it contains only a few scattered ones. Perhaps this is a variable feature, for Lindgren (1898, p. 285) says: "In the dermal membrane the spicules are quite without order."

The oxeas are slightly curved, taper gradually to sharp points and commonly measure 650–770 by 24–30 μ. A slight irregularity of curvature is present in some of the spicules (would it not be found, on searching, in other species?). A more definite, doubtless local, peculiarity is a feeble annulation exhibited by some of the spicules, which may or may not be in the middle.

It may be noted that some of the north Atlantic *Halichondrias* have also differentiated ectosomal spicular tracts which support the dermal membrane on their projecting ends. This resemblance of these species (*H. oblonga* and *H. tenuiderma*, Lundbeck, 1902, pp. 24, 26) to the East Indian form is probably only analogical—namely, due to the independent occurrence and fixation of the same variation in organisms having a common basic constitution.

Genus RENIERA Nardo (1847).

Reniera NARDO, 1847.—O. SCHMIDT, 1870, p. 39.—RIDLEY and DENDY, 1887, p. 14.

Skeleton typically a close and uniform reticulum, each side of the polygonal mesh formed by a single spicule. Spongin usually at the nodes of the reticulum. The side of the mesh may however be multispicular, and long multispicular tracts may develop.

RENIERA IMPLEXA Schmidt, var. BAERI, new variety.

Reniera implexa SCHMIDT, 1868, p. 27.—BAER, 1906, p. 13, pl. 1, fig.8; pl. 4, figs. 15–17.

One specimen, from a tide pool, San Pascual, Burias Island

Sponge consists of a clump of about 30 tubes, which arise from a common amorphous basal portion, itself attached to a clump of slender stony phloeodictyine fistulae, perhaps belonging to *Phloeodictyon cagayanense* (oxeas of fistulae measure about 230 by 12 μ). The *Reniera* tubes exhibit a great deal of lateral fusion; this is so extensive in places that the individuality of the tubes is here marked externally only by the cloacal apertures. Tubes range from small ones 25 mm. high and 12 mm. in diameter to larger ones 50 mm. high and 25 mm. in diameter. Tube wall is thick, diameter of cloaca about one-third to one-fourth total diameter. Terminal cloacal apertures relatively large, up to about 8 mm. in diameter. Common amorphous basal part of sponge reaches 25 mm. in height; greatest width of whole specimen 100 mm., greatest height 75 mm. Sponge somewhat compressible and elastic, but soft and easily torn. Color now a light dirty brown.

Subdermal cavities of medium size underlie the thin dermal membrane. From these, narrow afferent canals extend radially into the wall. Corresponding radial efferent canals open by unobstructed apertures directly into the cloaca; apertures of these canals close together, 1½ mm. in diameter to a fraction of a millimeter. Outer surface of sponge, where it is well preserved, is minutely conulose; conuli a small fraction of a millimeter high, about one millimeter apart but spaced irregularly, vaguely shaped and feeble. Sponge, taken in March, full of embryos.

Skeleton essentially a renieroid reticulum, meshes square or triangular, the side unispicular and about length of a spicule; transparent spongin at nodes of reticulum; oxea of the cylindrical type, 132 by 6 μ. In addition, the tube wall includes some inconspicuous polyspicular tracts which pursue in general a longitudinal course; these tracts are loose, about 2–6 rows wide. Dermal reticulum unispicular; meshes triangular, square, rectangular, or polygonal, like those of the inner skeleton or often corresponding to two or three of the latter; a few free, tangential, spicules also present in the dermal membrane.

Holotype.—Cat. No. 21293, U.S.N.M.

The *Albatross* sponge is evidently the same form as that described by Baer (1906), from the neighborhood of Cape Town. Baer's excellent photograph (pl. 1, fig. 8), although of a sponge somewhat smaller than mine, shows the habitus. The oxeas are of about the same size as in the *Albatross* sponge. Baer finds that the dermal membrane is perforated by uniformly distributed afferent apertures 1 mm. wide. Perhaps in his specimens the actual dermal membrane had been torn off, thus leaving uncovered the apertures of the radial afferent canals. Baer refers his sponge to *R. implexa*, but now that another specimen has been taken from a different locality in the east, the form may well be set apart from the type.

The type was based (Schmidt, 1868, p. 27) on Adriatic specimens. It was then recorded by Ridley and Dendy (1887, p. 15, pl. 1, fig. 4) and by Topsent (1904, p. 244) from the Azores, by Dendy (1905, p. 142) from Ceylon, and by Row (1911, p. 315) from the Red Sea. The North Atlantic and Mediterranean sponges of the species have a characteristic habitus (Ridley and Dendy, 1887, Topsent, 1904). The sponge tubes are elongated, slender (about 7–10 mm. wide in the *Challenger* specimen figured), and stipitate. Longitudinal polyspicular tracts probably always occur in addition to the renieroid reticulum. In Mediterranean specimens examined by Ridley and Dendy the oxeas measured 138 by 7 μ, in the North Atlantic specimens the recorded range is from 160 by 6 μ (Ridley and Dendy) to 200 by 7–8 μ (Topsent). In Dendy's specimens from Ceylon the tubes are only about 5 mm. in diameter, the multispicular fibers loose, feeble, and sparsely present; oxeas 136 μ by 4 μ. Row's Red Sea sponges resembled the Mediterranean forms.

Genus PETROSIA Vosmaer (1887).

Petrosia (*Schmidtia* Balsamo Crevelli) VOSMAER, 1887, p. 338.
Petrosia RIDLEY and DENDY, 1887, p. 9.—TOPSENT, 1894c, p. 4.—LUNDBECK, 1902, p. 54.—HENTSCHEL, 1912, p. 389 (some discussion of variation).

Renierinae in which the skeleton consists of a reticulum of stout polyspicular fibers or looser tracts, with very little or no spongin, and often of scattered spicules besides. Spicules, oxeas or strongyles, sometimes with intermediates. Consistency very hard, almost stony. Some species approaching *Pachychalina*.

PETROSIA TESTUDINARIA (Lamarck).

Plate 40, fig. 6.

Alcyonium testudinarium LAMARCK, 1815, p. 167.
Reniera testudinaria RIDLEY, 1884, p. 409.
Petrosia testudinaria (Lamarck) DENDY, 1889, p. 77.

Dendy, 1889 (p. 77), gives a detailed account of this species, based on the study of a specimen from the Gulf of Manaar. This cup-shaped sponge was 400 mm. high, 300 mm. wide at the base; cavity 180 mm. deep, its aperture 380 by 170 mm. Outer surface with prominent parallel ridges running vertically, ridges 40–50 mm. high and about 50 mm. apart. Texture of dry sponge, fragile and crumbling. Wide canals, at right angles to general surface, terminate on margins of ridges, there covered in by networks. Similar, covered, oscula occur in the wall of the cavity. Spicular network covering in the oscula similar to that which covers the general surface of the sponge, but coarser. Skeleton a coarse irregular network of stout fibers composed of a great number of spicules loosely and irregularly bound together. Spicules slightly curved, ranging from oxeate to strongylate, varying much in size especially in diameter, typical full-grown spicules 370 by 17.5 μ.

Ridley had earlier (1884, p. 409) studied two specimens of this species (*Alcyonium testudinarium*, Lamarck, 1815) from Queensland. He gives the dimensions of one, 6 inches high by 6 inches broad. Both specimens were crateriform and with ridges on the outer surface. Spicules, strongyles simply rounded at ends, sometimes tapering somewhat to the ends, along with some oxeas; average maximum size 320 by 16 μ. Ridley says his specimens agree with Lamarck's type.

Dendy (1905, p. 144) briefly describes and figures another specimen from the Gulf of Manaar. It is wider than high, about 170 mm. wide, 120 mm. high, and with the meridional ridges (ribs). Hentschel (1912, p. 403) records a small specimen, 80 mm. high, from the Aru Islands; spicules 358–470 μ long. Topsent (1920*d*, p. 8) describes specimens from Singapore; the spicules are oxeas reaching 415 by 26 μ.

The vertical ridges on the outer surface of the sponge appear to be a characteristic of the species, but Dendy would include forms in which they are replaced by very irregular outgrowths (Dendy, 1889, pl. 3, fig. 2, showing a specimen from the Mergui archipelago), and Hentschel in his definition of the species would also include such forms. I suggest that they may be referable to another species, *P. lignosa* (see below).

The *Albatross* collection includes a fine dried specimen from station D5147 (pl. 40, fig. 6), agreeing well with Dendy's description. (See previously.) The vase is wider than high, 300 by 270 mm., the crateriform cavity 130 mm. deep. The meridional ridges are about 20–30 mm. apart, some of them near the base of the sponge breaking up into irregular projections. Sponge is firm, but not nearly so heavy nor so woody as the *P. lignosa* of this report. Color, light brown to light gray on the surface, darker inside.

The canals terminating (beginning probably) on the margins of the ridges and those leading into the cavity of the cup are as Dendy describes.

I may add the following notes on the skeleton. The internal skeletal reticulum is in general coarse and irregular, with some scattered spicules. But owing to the anastomosis of fibers in one and the same plane, reticular lamellae about 0.2 mm. thick are differentiated. These lie about 1 mm. apart, roughly parallel to one another and to the two surfaces of the vase. The meshes of the lamellae are small and the texture is fine; characteristic meshes measure 80, 60, 40 μ in width. Between the lamellae the framework is coarser; the fibers often 140–175 μ thick, characteristic meshes measuring 1.0, 0.7, 0.5, 0.4 mm. in width.

The skeleton of the ectosomal region is finer and more regular than that of the interior, showing radial fibers and transverse connectives. There are some minor differences between the dermal skeleton of the exterior and that of the cloacal wall. Thus the meshes of the skeletal reticulum covering the outer surface are commonly 175–350 μ wide, while those of the reticulum lining the cavity measure about 175–260 μ in width. There are more projecting tips of radial fibers on the inner than on the outer surface (due to wearing?). The strands of the reticulum on both surfaces are mostly 3–5 spicules wide. There is for the most part one pore in each mesh of the reticulum.

The characteristic spicule is an intermediate, 385–400 by 20 μ, smooth, slightly curved, ends tapering but rounded off instead of pointed. Strongyles of same size, with ends evenly rounded off, also occur. Sharp-pointed oxeas occur among the spicules of smaller sizes.

PETROSIA TESTUDINARIA, var. FISTULOPHORA, new variety.

Plate 40, fig. 5; plate 41, figs. 1, 2; plate 48, fig. 8.

Three dried specimens from stations D5249, D5253, D5254, and alcoholic fragments from D5253 and D5254 constitute the material on which this variety is based. The essential difference from the type lies in the fact that the outer surface bears fistular processes instead of vertical ridges, but there are intergrading individuals.

The sponge from station D5254 (pl. 41, fig. 1) represents the extreme amount of divergence from the type. It is an oblate spheroidal mass about 300 mm. wide and 160 mm. high. It was attached by the whole under surface, which is somewhat convex and rough. The crateriform cavity, opening on the upper surface, is small, only 100 mm. wide and 60 mm. deep. Sponge is light brown, darker inside; firm, but in the dried state easily broken; considering its bulk, not heavy.

The outer surface bears very numerous radiating hollow projections, which may be designated as fistular processes. These are 15 mm. or less apart, somewhat flattened in the meridional plane and closed at the outer end by dermal membrane. A typical process measures 15 mm. in height, with cross diameters of 20 and 12 mm., the long cross diameter lying in a meridional plane of the sponge; wall of the process about 3 mm. thick. The cavity in each fistular process is a large afferent canal, which has the flattened shape of the process and extends deep into the sponge body, branching as it goes. The surface of the crateriform cavity is folded so as to give rise to maeandriform ridges about 5 mm. high and 2–3 mm. wide. Numerous and relatively large efferent canals, 5–6 mm. in diameter, lead into the crateriform cavity; their apertures covered by the dermal membrane of this cavity; the canals radiating as cylindrical tubes deep into the sponge body.

The skeletal framework includes reticular lamellae like those of the type (see previously), but coarser, the meshes measuring 175–350 μ in width; spiculo-fibers composing the lamellae about 150–175 μ thick along with thinner and looser spicule tracts. The lamellae are 1–2 mm. apart, in the superficial regions roughly parallel to the outer and inner surfaces of the sponge; in the interior they are, sometimes at least, arranged concentrically to the larger canals. The skeleton between the lamellae may be the usual coarse, irregular one, but in places there is found a system of straight pillar-like spiculo-fibers, about 150–200 μ thick and 0.5 to 2 mm. apart, which run from lamella to lamella, vertically to them; between the pillar-like fibers there is only a very scanty, irregular, reticulum.

The dermal skeletal reticulum of the outer surface is made up primarily of spiculo-fibers about 175 μ thick, between which stretch thinner looser spicule tracts, composed often of only two or three spicules; meshes 175–350 μ wide. Skeletal reticulum of the inner surface about the same, perhaps slightly coarser (in the *Albatross* specimen of the type, see above, it is somewhat finer. The relation is probably a point of individual variation).

The spicules (pl. 48, fig. 8, *a*) are sharp-pointed oxeas, 400–440 by 22 μ. They are thus somewhat larger, and differ in respect to the apices from the specimen of the type, described above. But the precise shape of the apex, as the other specimens of the variety show, is a matter of individual variation.

The specimen from station D5253 (pl. 40, fig. 5) represents about a fourth of a larger but similar sponge. In this sponge the diameter was about 400 mm., height 200 mm.; the crateriform cavity, as in the other specimens of the variety, relatively very small. The fistular processes and included canals are larger, especially in that cross diameter which represents a meridional plane of the sponge. The spicules (pl. 48, fig. 8*b*) agree with those of the first specimen, except that they are rounded at the apices, thus not differing from the characteristic spicule in the *Albatross* specimen of the type.

The specimen from station D5249 (pl. 41, fig. 2) is complete. It is the smallest of the three, the horizontal diameter being about 200 mm., the height 140 mm. The cavity is 90 mm. wide and 60 mm. deep. The sponge is intermediate in habitus between the type and the variety. The fistular processes are either represented by meridional ribs or are very flattened and arranged in meridional rows. The spicules measure 400 by 20 μ, and are, as in the preceding, round-pointed oxeas—that is, rounded off at the apex. Sharp-pointed smaller sizes of the spicule occur.

Holotype.—Cat. 21285, U.S.N.M.

The *Albatross* specimens of type and variety make a series that is very suggestive for the study of the origin and nature of variations. But how far the differences are phaenotypic and how far due to racial differences remains to be ascertained.

The laminated condition of the skeleton which I have described is something not peculiar to *P. testudinaria*, for Hentschel has described in two other forms, *P. truncata aruensis* and *P. nigricans irregularis* (1912, pp. 402, 405), a concentric arrangement which is somewhat similar. Perhaps such lamellae are to be looked on, in part, as Hentschel suggests, as representing growth rings, but it would seem that they constitute, at least in *P. testudinaria*, an established, constant feature of the skeletal arrangement.

The laminated structure of the skeleton in these species of *Petrosia* and in *Coelosphaera toxifera* of this report probably only constitutes a case of analogical resemblance. Petrosia is probably however a near relative of the *Phloeodictyinae* (see Lundbeck, 1902, p. 56; 1910 p. 28), and a form like *Petrosia testudinaria*, var. *fistulophora* constitutes, at least in the matter of morphological plan, an intermediate, showing how a vase-shaped *Petrosia* through continued increase in thickness of wall and decrease in size of the cavity, coupled with the localized outgrowth of surface projections, might pass into a massive, fistulate, phloeodictyine sponge.

PETROSIA LIGNOSA, new species.

Plate 41, fig. 3; plate 48, fig. 9.

Two dried specimens from stations D5147 and D5250. The specimen from D5147 (pl. 41, fig. 3) represents about one-third of a great conical vase with small truncated solid base (vase was sawn in two when collected). Total height of vase about 600 mm.; diameter of mouth of vase about the same; wall in general 50–75 mm. thick. The sponge from D5250 is a vase 400 mm. high; cross diameters of mouth 300 mm. and 500 mm.; thickness of wall 110 to 150 mm. In both, the outer surface is closely beset with large, gnarled protuberances disposed without any definite arrangement. Between many of these and also on them are abundant, small, mammillate (subconical or subcylindrical) projections, rounded apically, 5 to 15 mm. high with a width something less than the height. Inner surface of vase smooth. Canals, up to 5–6 mm. in diameter, extend in radially from both surfaces, their mouths covered over by dermal skeletal reticula.

The skeletal framework includes main fibers, about 225 μ thick, which ascend in the body wall, arching so as to radiate obliquely toward both outer and inner surface. Somewhat thinner connectives extend transversely between these, giving rise to a regular network with rectangular meshes, commonly about 1 mm. wide. In a longitudinal section of the sponge, the main fibers and connectives present a very ladder-like appearance. The fibers are independent, not associated together as parts of a reticular lamella, as in *P. testudinaria.* They consist of closely packed megascleres with a little spongin.

There is a dermal skeletal reticulum on both surfaces. Meshes in the neighborhood of 300 μ wide, commonly 4 or 5 sided, with the side formed by a tract of a few spicules or sometimes by a single spicule. The tips of the radial skeletal fibers project; and at least where the surface is well preserved, there are closely set small, radial bundles or tufts, 60–120 μ high, composed of the very small megascleres, which project from the tangential tracts of the dermal skeleton.

The megascleres range from very large ones through all sizes to very small ones. The total range observed was 420 by 20 μ to 32 by 6 μ. As in the other species with this skeletal peculiarity, the spicules fall more or less in two classes, large ones and very small ones. The common size for the large spicules is, in one specimen, about 300 by 16 μ, in the other 300 by 20 μ. For the small spicules the common size is about 40 by 6 μ to 80 by 10 μ. The spicules (pl. 48, fig. 9) are smooth, slightly curved, and range from oxea to strongyle; occasionally even a style (fig. 9, *d*) is formed. There are some differences between the individual sponges as to the prevailing shape of the spicules. Thus in the specimen from D5250 pointed oxeas are absent or nearly so, the characteristic megasclere being a strongyle in which the ends taper very slightly or not at all (fig. 9 *a*). In the other specimen the characteristic large spicule is an intermediate (fig. 9, *b*), with tapering ends which are not sharp but rounded at the apex. But sharp-pointed oxeas (fig. 9 *c*, *e*) also occur in abundance. The very small spicules (fig. 9, *f*) are in both specimens strongyles or intermediates. They occur everywhere along with the large spicules, but are especially abundant at the dermal surface, in the projecting ends of the radial skeletal fibers and forming the small radial tufts referred to above.

Holotype.—Cat. No. 21283, U.S.N.M.

PETROSIA LIGNOSA, var. PLANA, new variety.

Plate 41, figs. 4, 5.

Two dried vasiform sponges from Togian Bay, Togian Island, Gulf of Tomini, Celebes, clearly belong to the above species but differ conspicuously from the type in that the outer surface is smooth or only vaguely roughened, lacking the gnarled protuberances. Both specimens are roughly cylindrical, 300–340 mm. high, 95–130 mm. wide, diminishing somewhat above, the wall, 25–50 mm. thick, thinning away to an edge at the mouth of the vase. One of them expands below into a large solid base and the indication is (pl. 41, fig. 5) that a second vase arose from the base but was sawn off. The sponges are of the same heavy, woody character as the type; the color is the same, and the canals are essentially similar.

The fibers of the skeletal framework are like those of the type but somewhat thicker, ranging up to 350–400 μ in thickness. The framework is somewhat coarser than in the type, the meshes often 1 to 1.5 mm. wide. In neither specimen is the framework as regular as in the type, although in the superficial region everywhere fibers radial to the surface and connectives are distinguishable. The individual differences have some interest and may be noted. Thus in one of the two sponges (pl. 41, fig. 4), conspicuous long main fibers, such as are present in the type, were not observed, the skeleton consisting simply of a coarse irregular reticulum, with radial fibers and connectives differentiated at both surfaces. In the other specimen (pl. 41, fig. 5) the base in its outer part shows radial fibers with transverse connectives, giving large squarish meshes; internally the skeleton of the base is irregular. In the wall of the vase long ascending main fibers are present but their distribution is peculiar and different from that of the type. Instead of arching over toward both surfaces, they ascend just beneath the dermal membrane of the sponge cavity, and arch over to the outer surface, thus passing completely through the wall of the vase.

The dermal skeleton is as in the type, the meshes about 225 μ wide. The coarser fibers of the superficial internal skeleton show through the surface reticulum, and thus may seem at first sight to divide it into a system of areas, each of which appears subdivided by the strands of the dermal reticulum proper.

The spicules are similar to those of the type and are distributed in the same way, the very small ones forming small radially projecting tufts, closely set on the dermal reticulum. They do not reach as large a size as in the type, the large spicules measuring in one specimen (fig. 4) 240–280 μ by 14–16 μ, in the other (fig. 5) 240–280 by 13–14 μ. They range down to very small ones of about the same size as in the type. There are individual differences between the two sponges as to the shape of the spicule ends. In one specimen (fig. 4) the spicules, large and small, are almost all oxeas with sharp points. In the other (fig. 5) the prevailing type, both for large and small spicules, is the intermediate (oxea rounded at the apices); but typical strongyles are common and there are some sharp-pointed oxeas.

Holotype.—Cat. No. 21337, U.S.N.M.

This species adds one more to the list of Petrosias in which the spicules range from large to very small ones. Besides the Mediterranean *P. dura* (O. Schmidt) and the North Atlantic *P. crassa* (Carter), which is sometimes large and with crateriform cavity (Topsent, 1904, p. 241), *P. strongylata* Thiele (1903, p. 938) from Ternate, *P. truncata*, var. *aruensis* Hentschel (1912, p. 402) from the Aru Islands, *P. nigricans* Lindgren (1898, p. 287) from Java, and *P. nigricans*, var. *irregularis* Hentschel (1912, p. 405) from the Aru Islands, may be noted.

The differences offered in the skeletal framework by the three specimens of this species (type and variety) have some interest. They are, in all probability, individually acquired, not hereditary, differences. Assuming this, it becomes worth while to formulate the question whether some of the individual peculiarities are not adaptive responses (of growth and differentiation) to mechanical stresses and strains, such as those exerted by water currents and the weight of the whole body—as, for instance, in the case of bones, where there seems to be a very considerable power of adapting the arrangement of bone lamellae to the mechanical needs of the individual case? Experimentation on this point is doubtless feasible.

PETROSIA SIMILIS Ridley and Dendy, var. GRANULOSA, new variety.

Plate 41, fig. 7.

Petrosia similis Ridley and Dendy, 1887, p. 9.

Several elongated, subcylindrical, more or less flattened pieces from Station D5141. Three measure, each, about 100 mm. long; the fourth is shorter; transverse diameters in typical regions, 20 and 17 mm., 30 and 20 mm., 35 and 25 mm. The pieces widen terminally, where one is slightly lobate. Sponge heavy, firm and incompressible, but not stony; dark reddish brown, owing to the presence throughout the body of quantities of cells containing reddish brown granules.

Surface appears smooth to the eye; uniformly dense or showing the ends of very small canals, a fraction of a millimeter in diameter, distributed generally about 2 mm. apart. With a lens the surface, where uninjured, is seen to be distinctly, though minutely, conulose, radial skeletal fibers entering into and supporting the conuli. Pores closed. Oscula abundant, mostly about 3 mm. in diameter. They exhibit an imperfectly developed bilateral distribution, in that, although scattered ones occur, they tend to be confined to the opposite and narrower sides of the sponge, thus forming somewhat vaguely marked rows. Interior of sponge compact, canals small; ratio of soft tissue to skeleton fairly high.

Skeletal framework a reticulum of spiculo-fiber with a good many scattered spicules. Fibers fairly compact, frequently 80–120 μ thick, although thicker and slenderer ones occur; spicules cemented together by a small amount of spongin. Main fibers may be distinguished, although they are not conspicuously differentiated, which in the axial part of the sponge pursue a longitudinal course. These curve outward in the peripheral part of body, extending radially toward the surface, where they enter and support the little conuli. Meshes of skeletal reticulum 200–700 μ wide.

The dermal membrane includes, besides the projecting ends of the radial fibers, tangential spicules. These in places are scantily scattered, not forming a reticulum, but in other places are groupeo in slender tracts, one to a few spicules thick, which form a reticulum with meshes somewhat less in width than the length of a spicule.

Oxeas, of the usual type, cylindrical—namely, beginning to taper near the ends; slightly curved; 220–260 by 14 μ.

Holotype.—Cat. No. 21279, U.S.N.M.

The *Albatross* sponges are close to the type (Ridley and Dendy, 1887, p. 9), in elongated specimens of which the oscula tend to become arranged in a row. Distinguishing marks of the variety are the conulose surface, the partial development of a special dermal skeleton, the presence of so many granular cells, and the color. In the type the dermal membrane is supported by the projecting ends of the radial fibers, but lacks other special dermal skeleton; conuli are not recorded. The type is recorded from south of Cape of Good Hope, Kerguelen, between Kerguelen and Heard Island (Ridley and Dendy, 1887); Ceylon waters (Dendy, 1905, p. 145); Aru Islands (Hentschel, 1912, p. 406). Varieties have been recorded from between Strait of Magellan and the Falkland Islands (Ridley and Dendy, 1887); Amboina (Topsent, 1897, p. 476); Ceylon waters (Dendy, 1905); Aru Islands (Hentschel, 1912); off Galapagos Islands (Wilson, 1904, p. 121). Of the varieties, *compacta* is recorded for the Philippines by Ridley and Dendy and by Hentschel. This variety differs from the type and from the *Albatross* specimens in being stony hard and in the absence of tufts of spicules (ends of radial fibers) supporting the dermal membrane.

Hentschel (1912), is inclined to regard the species as an artificial congeries of forms, and it must be owned that the whole group, type plus varieties, is rather vaguely delimited.

In several *Petrosia* specimens the surface is described as "rough" or "granular." Perhaps a closer examination will show that in some of these the surface is minutely conulose, as in the variety here described.

PETROSIA CRUSTATA, new species.

Plate 41, fig. 6; plate 49, fig. 2.

Station D5414, one specimen. Sponge an amorphous mass, thin and incrusting below, that has grown round and is penetrated by a Gorgonia-like alcyonarian. Greatest diameter 60 mm. The sponge is surmounted by a *Discodermia emarginata* (the compact mass at the summit in pl. 41, fig. 6), and is infested with small barnacles, round each of which the sponge tissue forms an elevation open at the summit; the apertures, scattered over the surface, look at first sight like oscula.

Surface of sponge white, smooth, aporous (to eye and lens), and stony. Interior whitish with a tinge of yellow, firm but far from stony, friable; permeated by numerous canals visible to the eye, these varying in diameter from minute ones up to canals 2 mm. wide, but comparatively few are over 1 mm. wide; many canals conspicuously surrounded by collenchyma. The pores are closed, but gaps in the layer of dermal spicules indicate that they everywhere perforate the dermal membrane. Oscula few, scattered, about 3 mm. in diameter; raised slightly above the surface on short oscular tubes which are scarcely more than rims, 1–3 mm. high. The osculum leads into a canal of corresponding width, which not far from the surface receives several efferent canals.

There is a very irregular skeletal reticulum of compact spiculo fiber, with abundant free spicules scattered between the fibers. Spicules of the fibers packed closely and cemented together with a small amount of spongin. Fibers of the reticulum 50–200 μ thick; meshes have about the same range in width. This reticulum extends to the surface of the sponge, and to the lining walls of the largest canals, in which the abundant tangential spicules form a lining reticulum of spiculo-fiber with rounded meshes. All but the larger canals are, however, surrounded by tissue, collenchymatous in some cases, which lacks the skeletal reticulum and contains only scattered spicules. Since there are numerous canals, many of considerable size, numerous gaps in the skeletal reticulum are produced, occupied either by canals or by canals surrounded by sponge tissue lacking the reticulum. Such interruptions may be thought of simply as larger meshes in the reticulum as a whole; they are of all sizes up to the diameter of the large canals. These many interruptions of different sizes give to the skeleton the appearance of a very heterogeneous structure.

In the tissue surrounding the canals of considerable size, which, as said above, does not contain any part of the skeletal reticulum but only scattered spicules, it may be seen in thick sections that the spicules cross one another in all directions producing in places, when seen with a low objective, the effect of a vague, loose reticulum; but there is in such places no union between the spicules and no regularity of arrangement.

The arrangement of the fibers and meshes of the skeletal reticulum is quite irregular, although of course there are some fibers in the immediate neighborhood of the surface more or less radial to it, and the same is true of the walls of the largest canals.

The dermal membrane contains a thin crust-like layer, one to a few spicules thick, of tangential spicules, with some obliquely radial ones; this layer shading off into the skeletal reticulum. In it the spicules cross in all directions. While the skeletal reticulum reaches and supports the dermal membrane, and some of the fibers are radial to it, there are no fibers projecting from it.

The spicules (pl. 49, fig. 2) are smooth, cylindrical, slightly curved oxeas, 130–160 μ by 8–10 μ; rather abruptly pointed, inclining toward the tornote shape. A variant occurs having the shape of the strongyle; those seen were shorter than the characteristic spicule.

Holotype.—Cat. No. 21281, U.S.N.M.

The hard, smooth dermal layer, constituting a thin crust, and the variable texture of the internal skeleton caused by the presence of so many areas of all sizes into which the skeletal reticulum does not penetrate, are the most salient characteristics of this species.

Genus TRACHYOPSIS Dendy.

Trachyopsis DENDY, 1905, p. 147.

Renierinae in which the main skeleton is composed of a dense, irregular network of oxeas, while the surface is protected by similar spicules arranged in vertical brushes, which support the pore-bearing dermal membrane.

TRACHYOPSIS HALICHONDRIOIDES Dendy.

Trachyopsis halichondrioides DENDY, 1905, p. 147.

A specimen of this species from station D5218 is massive and elongated, about 60 by 30 mm. There are no indications of attachment, and the sponge may have been a "roller." The oscula are not obvious; doubtless closed. There is only a single elevation corresponding to the tubular oscular processes described by Dendy (1905, p. 147); this includes a canal, 2 mm. in diameter, extending inward from the apex of the elevation.

The very smooth surface and compact texture; the halichrondrioid arrangement of the skeleton, with vague tracts radial to the surface terminating in brushes of projecting oxeas; the shape of the oxea;

the color; all these are points of resemblance, which make it necessary to include the sponge in Dendy's species, which is based on a specimen from Ceylon waters.

There are, of course, minor quantitative differences from the type. The spicules, disregarding the smaller sizes, range from 400 by 12 μ to 520 by 20 μ; upper limit in the type is 640 by 32 μ. In the type the oxeas of the dermal brushes project very slightly, and the brushes themselves are said to be dense. In the *Albatross* specimen the spicules commonly project 70–140 μ. The brushes are closely set, although, as is best seen in surface preparations of the dermal membrane, there are intervals between them. The brushes themselves are, however, not dense, but rather loose bouquets of spicules, varying down to little groups of two or three and indeed to single spicules. The dermal membrane also includes abundant oxeas scattered tangentially in all directions.

Dendy thinks the spicules of the dermal brushes are perhaps more slender than the spicules in general. This does not seem, from the measurements I have made, to be the case in the *Albatross* specimen.

The species has also been taken in the Red Sea (Row, 1911, p. 321). In these specimens the spicules reached a length of 600 μ. The *Albatross* specimen is in size intermediate between the type and the largest of Row's specimens, which measured 100 by 55 mm.

Subfamily CHALININAE.

Chalineae O. SCHMIDT, 1868.
Chalininae RIDLEY and DENDY, 1887.

Skeleton typically and almost always a network of horny spiculofibers, characterized by considerable regularity of arrangement; the spongin usually completely enveloping the spicules, which may be present in numerous rows or in a few or only one axial row; or the fiber may contain only a few scattered spicules. In extreme cases the spicules are vestigial or even completely absent, such forms becoming *pseudoceratose* (Dendy, 1905). The group extends over toward *Reniera* in that it includes species in which the skeleton is a combination of a renierine reticulum and distinctly chalinine fibers.

The group, which dates back to Schmidt, 1868, is taken in the sense of Ridley and Dendy (1887), Dendy, 1890, and Dendy, 1905. Topsent, 1894*c*, and Thiele, 1903, include *Toxochalina*, assignable because of its microscleres to the Gelliinae. Lundbeck, 1902 (p. 56), includes some of the phloeodictyine species: *Rhizochalina oleracea* and *carotta* Schmidt. Some of the forms, species of *Chalinopsilla* for example, included in Lendenfeld's (1889) Eusponginae are probably to be referred here.

Dendy, 1905 (p. 147), thinks the group is perhaps polyphyletic, including sponges derived from several genera of Gelliinae and Renierinae through strong development of spongin accompanied in some cases by loss of microscleres.

Genus PACHYCHALINA O. Schmidt (1868).

Pachychalina O. Schmidt, 1868, p. 8.—Ridley and Dendy, 1887, p. 19.

Not tubular. Surface smooth or spinose. Skeleton composed of stout fibers containing numerous spicules arranged in several rows.

PACHYCHALINA FIBROSA Ridley and Dendy.

Pachychalina fibrosa Ridley and Dendy, 1887, p. 19.

Station D5136, two specimens possibly representing pieces of an elongated sponge which had broken off from the general body and had healed, for the surface is everywhere covered with dermal membrane and spines. Station D5141, an elongated branching specimen. These specimens are well represented by the two figures of the species given by Ridley and Dendy (1887, p. 21, pl. 4, figs. 3, 4) and even in size are close to the sponges there portrayed. The general shape of the body, size and spacing of the spines, large size of the oscular depressions showing on the bottom the mouths of the efferent canals, appearance of the skeletal reticulum through the dermal membrane, all constitute points of resemblance between the *Challenger* and *Albatross* sponges.

The fibers of the main skeleton are 70–175 μ thick, with slenderer ones, and are completely filled with spicules. Abundant spicules are scattered between the fibers.

In the dermal reticulum, the fibers are 8–22 μ thick, some unispicular, more polyspicular (2–3–4 rows), with abundant spongin; meshes rounded and about as wide as the length of a spicule or less. This is evidently the finer reticulation described by Ridley and Dendy. Below and distinct from it are the superficial tangential fibers of the main skeleton. Such is, I take it, the typical arrangement, although quite often the coarser fibers do not lie beneath but form an actual part of the dermal reticulum. They evidently constitute the "coarser reticulation" of Ridley and Dendy.

The spicules are oxeas of the more cylindrical type, ends sometimes rounded; 88–96 by 3–4 μ.

Ridley and Dendy's types were from the Atlantic, off Bahia and Bermuda; a specimen from the Philippines was referred by them (1887, p. 22) to an unnamed variety of the species. Lindgren, 1898 (p. 293), identified as this species specimens from Java and Cochin China, and by merging certain species added to the distribution localities Christmas Island and the Mergui Archipelago. Hentschel, 1912 (p. 400), records the species from the Aru Islands but remarks that it is not sharply delimited from *P. diffusa* (Ridley). Hentschel adds (p. 402) that any division of the intricately varying *Pachychalina* forms into species and varieties has but little permanent value, a conclusion for which much may be said to-day as in O. Schmidt's time.

PACHYCHALINA FIBROSA, var. GRACILIS, new variety.

Station D5136, two masses perhaps originally united, each composed of several long, slender, subcylindrical, branching shoots, some of which reach 300 mm. in length. Similar specimens were taken at D5145. The shoots fuse with one another in an irregular, accidental fashion. Surface covered with large and prominent spines. Diameter exclusive of spines commonly about 6 mm.; but the shoot may be distinctly flattened, diameters in a typical case 7 mm. and 4.5 mm. Spines variable in size, 2–5 mm. high, mostly 2–5 mm. apart. Oscula 2 mm. or somewhat less in diameter, in a single row along a shoot, usually 5–6 mm. apart. A reticulum of yellow fibers shows plainly through the dermal membrane; nodes of the reticulum distinct, meshes 3–5 sided and about 1 mm. wide. Sponge light brown; firm, flexible, but easily cracked in bending.

Main skeleton a reticulum of stout fibers consisting of spongin cored by multiserially arranged megascleres. The reticulum has considerable regularity in that radial fibers and connectives are distinguishable, the latter commonly transverse and the meshes more or less rectangular.

Radial fibers 120–175 μ thick, core of spicules one-third to one-fourth total thickness of fiber. Connectives very similar but in general slightly slenderer and with a somewhat thinner core of spicules in which the individual spicules are less densely packed. Meshes of the reticulum 500–900 μ wide.

Spicules between the fibers of main skeleton not scattered as in *P. fibrosa* but surrounded and united by spongin, thus forming fine secondary reticula which occupy the meshes of the main skeleton. Fibers of the secondary reticula only about 8–20 μ thick, unispicular or containing 2–3 rows of spicules, spongin relatively abundant; width of mesh commonly near the length of a spicule but also greater.

Dermal skeleton essentially a fine reticulum of very slender mostly unispicular fibers relatively rich in spongin; width of meshes, which are rounded, about the length of a spicule or less. This fine reticulum as a rule overlies and is distinct from the superficial (tangential) fibers of the main skeleton which show beneath it and at first sight appear to divide it into a system of large meshes. And indeed some of these thick fibers do lie strictly in the dermal skeleton, the fine dermal reticulum on both sides of such a fiber not extending over it but meeting and uniting with it.

The spicules are strongyles, very slightly curved, 70–80 by 3–4 μ.

Holotype.—Cat. No. 21276, U.S.N.M.

This variety is well represented by Hentschel's figure (1912, pl. 15, fig. 7) of *Pachychalina diffusa* (Ridley), var. *affinis* from the Aru Islands, but the main fibers in Hentschel's sponge are poor in spongin and the spicules (tornotes) measure 80–112 by 5–7 μ. In the type of this species, *P. diffusa*, the fibers have more spongin, but the spicules are about as thick as in Hentschel's variety. (See Ridley and Dendy 1887, p. 22.) In ranging the *Albatross* sponge under *P. fibrosa* rather than *P. diffusa*, I have laid the greater weight on the size of the spicules and the less on the amount of spongin in the fiber.

Genus SIPHONOCHALINA O. Schmidt (1868).

Siphonochalina O. Schmidt, 1868, p. 7.—Ridley and Dendy, 1887, p. 29.

Tubular Chalininae in which the outer surface of the tube is smooth or comparatively so—that is, without the spinous processes of Spinosella.

SIPHONOCHALINA FASCIGERA Hentschel.

Plate 42, fig. 2.

Siphonochalina fascigera Hentschel, 1921, p. 398.

Three dried specimens, one not labeled, the others from Tomahu Island (south of Boeroe or Bouro Island); large pieces of seven tubes, in alcohol, from Tomahu Island; two alcoholic specimens from Station D5136.

The finest specimen, dried, from Tomahu, consists of about 10 tubes arising from a common base. The tubes are larger and with thicker walls than in Hentschel's specimens (from the Kei Islands). The height of the tubes is 300–360 mm., diameter about 25 mm., wall about 3 mm. thick, thinning away to an edge round the large terminal aperture. Surface varies from smooth to conulose, the upper part of the tube smoother than the lower. The other dried specimens consist, each, of a few tubes united below; in these the outer surface is smooth.

The Tomahu Island alcoholic specimens, diameter of which reaches 30 mm., wall 2–3 mm. thick, show one case of branching, several cases of ordinary lateral fusion between tubes, and some interesting tendril-like structures. These are solid slender outgrowths, 1–2 mm. thick, reaching 30 mm. in length, which on two tubes have developed in large number especially round the cloacal edge but also from the neighboring lateral wall. Most of them taper from the base to the apex, which is free. But some extend from tube to tube, fastening the tubes together; in these the connection with each tube is expanded, the middle part slender. These tendril-like structures, it would seem from the anatomy, provide the sponge tubes with a specialized means of gaining support, in that they can establish connection between tubes which are some distance apart.

Abundant small canals extend in radially from both inner and outer surfaces of the sponge. The apertures on the inner surface, oscula, are about 0.5 mm. or less in diameter; not covered in by reticular membranes. On the outer surface, the canals (afferent) are covered in by the dermal reticulum.

The slender longitudinal fibers, 20–30 μ thick, are as Hentschel states, typically unispicular, although such fibers occur containing in places two or even three rows of spicules. The slender fibers combine to form bundles as in Hentschel's specimens; this feature is variable and is less marked in the specimens from station D5136 than in the others. The meshes of the unispicular renieroid network extending between the longitudinal fibers are 3, 4, or 5 sided, with spongin showing at the angles. The dermal reticulum is only the most superficial part of the general skeletal network. The oxeas measure commonly 80 by 4 μ, reaching 90 by 5 μ, and are therefore somewhat larger than in the type specimens.

Hentschel (1921) has called attention to the unique character of the skeleton in this form, and to the resemblance offered to certain species of Reniera. The long fibers are, however, of a distinctly chalinine type, and the habitus is that of *Siphonochalina.*

SIPHONOCHALINA CRASSIFIBRA Dendy.

Siphonochalina crassifibra Dendy, 1889, p. 82.

Several specimens, along shore, Tataan, Tawi-Tawi.

One specimen is a single tube as if independent, attenuated at extreme base. Four others are bunches of tubes which ascend from a common basal part, side by side; lateral fusions common; from 4 to 12 tubes in a bunch. The tubes are cylindrical with some tendency to form enlargements which may be roughly annular, but the surface is fairly even. The cloaca extends throughout the tube; generally with only one (apical and large) cloacal aperture, but in some tubes there are also smaller lateral apertures. Wall of tube relatively thick, one-third to one-quarter total diameter of tube. The tubes range in height from 30 to 120 mm., in diameter from 10 to 23 mm. Color in life, lilac. Sponge firm but somewhat compressible and elastic; tough.

Dermal membrane, where uninjured, is finely and uniformly porous; pores in the meshes of the dermal reticulum. The usual abundant small afferent canals are seen beneath the dermal membrane, giving the surface a vaguely porous appearance. Wall of cloaca covered with the closely set apertures of efferent canals; these apertures not closed in by membrane, 1.5 mm. to a fraction of 1 mm. in diameter. Sponges, taken in February, are full of embryos.

The main skeleton includes ascending primary fibers which curve outward toward the surface, branching as they go, thus becoming radial. Between these are stretched primary connectives, the arrangement producing large squarish or rectangular meshes visible to the eye about 300–600 μ wide. These meshes are subdivided into smaller ones, 100–200 μ wide, by reticula of finer secondary connectives. Primary fibers close to cloacal wall, about 120 μ thick, diminishing to a thickness of 100–50 μ as they approach outer surface, usually less than 50 μ thick at the surface. Except at the surface the spongin of the fibers is very abundant, the spicules chiefly but not absolutely confined to a loose core about one-third the thickness of the fiber. At the surface, while the fibers remain plurispicular, the spongin is comparatively scanty.

The primary connectives are like the main fibers, although in general somewhat slenderer, 70–100 μ thick. The secondary connectives are slenderer than the primary, grading down to a thickness of about 12 μ; spongin abundant, spicules forming a core one to a few rows wide.

Fibers of dermal skeletal reticulum for the most part very slender, 10–28 μ thick, ranging from unispicular to such as contain a few rows of spicules; spongin abundant. Thicker fibers may actually form a part of this reticulum but most of the thick fibers seen in surface view are subdermal. Perhaps the precise condition in any one spot is not constant during growth changes. Meshes of dermal reticulum mostly 175–350 μ wide, 4-sided or polygonal. From the fibers of the reticulum, not only at the nodes but between them, short tufts of spicules project radially outward. Some of these represent the ends of radial skeletal fibers, but others do not. They all project just beyond the dermal surface and include from 2–3 to a considerable number of spicules.

The spicule is a small slender oxea, 80 by 3 μ.

The habitus, regularity in arrangement of the main fibers and primary connectives, thickness of fibers, character of fiber, size of oxea, all show that the *Albatross* sponges can not be separated from *Siphonochalina crassifibra* described by Dendy (1889) from the Gulf of Manaar (Ceylon). There is only one point of difference. In Dendy's sponges there are only (numerous) scattered spicules between the primary connectives, whereas in the *Albatross* specimens such spicules are cemented together and form secondary reticula.

This difference in morphogenetic behavior may be looked on as a variable feature. In Dendy's type the main fibers are about 140 μ thick, connectives about 84 μ; oxea 84 by 3.5 μ; color, deep blue.

Dendy (1905, p. 155) proposes to regard *S. crassifibra* as a variety of *S.* (*Tubulodigitus*) *communis* (Carter), recorded by himself (1889, p. 81) and Carter (1881, p. 367) from the Gulf of Manaar, also by Ridley (1884, p. 401) from Port Jackson, Australia. For this form Ridley gives the primary fibers as only 35–42 μ thick; oxea 100 by 5 μ. Dendy more recently (1916*b*, p. 114) has recorded *S. crassifibra* from Okhamandal. In these (Okhamandal) sponges it may be noted that the primary fibers are only about 50 μ thick, a close approach to *S communis.* Dendy (1905) touches on the vagueness of the characters which differentiate *S. communis*, *crassifibra* and a number of other *Siphonochalinas.* Row (1911, p. 325) has recorded *S. communis* from the Red Sea.

Genus DACTYLOCHALINA Lendenfeld (1887).

Dactylochalina LENDENFELD, 1887, p. 810 plus *Chalinodendron* LENDENFELD, 1887, p. 819.

Sponges with solid digitate processes, the processes generally cylindrical and slender, often branching and anastomosing, sometimes very numerous. Fibers of skeletal reticulum polyspicular, generally slender. Meshes of reticulum remarkably large.

In Lendenfeld's classification (1887) of the Chalinine sponges, *Chalinodendron* is distinguished from *Dactylochalina* chiefly by the reticular appearance of the surface ("mit netzförmiger Oberflächen-Structur"). This would seem to be a secondary feature dependent on the large size of the skeletal meshes, and these in both genera are large, varying from 200 to 300 μ in width in *Chalinodendron*, from 130 to 400 μ in *Dactylochalina.*

The fibers are polyspicular and generally slender in both genera, but slenderer in *Dactylochalina*, in most species of which, but not invariably, there is no noteworthy difference in thickness between the main fibers and the connectives. In some of the *Chalinodendron* species (*C. exiguum* and *C. minimum*). however. the fibers (50 μ) are no thicker than in some of the *Dactylochalinas*, and in one species (*C. exiguum*) there is no noteworthy difference in thickness between main fibers and connectives.

The spicules are somewhat, or considerably, larger in *Chalinodendron* than in *Dactylochalina*, but in *C. ramosum* they are only 110 by 5 μ and in the *Albatross* form, described below, and which is obviously very close to *C. exiguum*, they are still smaller, 100 by 4 μ. Among the *Dactylochalina* species, we find spicules 100 by 3 μ, 90 by 2 μ, 67 by 4 μ, 60 by 2 μ.

In both genera the sponges are digitate, the processes generally but not invariably slenderer in Chalinodendron than in Dactylochalina.

Lendenfeld later (1888, p. 102) modifies his earlier definition of *Chalinodendron*, inserting the presence of conuli among the characters. But the conuli are small, indeed must be very small in the slenderer species.

It seems to be advisable to combine the genera. *Dactylochalina*, so understood, will even then probably run over into *Pachychalina*, but, as is well known, Chalinine sponges are so "plastic" that their division into genera is especially difficult.

DACTYLOCHALINA EXIGUA (Lendenfeld), var. SAMARENSIS, new variety.

Plate 42, fig. 1.

Chalinodendron exiguum LENDENFELD, 1887, p. 819.

Three specimens from a coral reef near Catbalogan, Samar.

Sponge consists of very many, long, slender, cylindrical, dichotomously branching and freely anastomosing processes, 2–3 mm. thick and reaching 150 mm. in length. These processes or "shoots" form a loose mass 100–150 mm. in diameter. When such a mass is disentangled it is found that anastomoses are so common as to give the sponge a somewhat retiform appearance. Whether the primary shoots which may be distinguished in such a mass were all originally derived from a single basal one, can not be told. It is at least possible that this is not the case but that branches of neighboring individuals fuse indiscriminately with one another as well as with their sister-branches.

Sponge is slightly hard to the touch, but both compressible and flexible, not rigid enough to stand erect in the air, but in nature perhaps upheld by the water and waving about in it. Color now, whitish-brown.

Surface smooth, presenting, very distinctly with a lens, a reticulated appearance, due to the large meshes of the dermal skeleton. Sponge partially macerated. Oscula and pores?

Skeletal reticulum composed of fibers 40–50 μ thick, with large meshes which very commonly are 300–500 μ, but which range from 175 to 600 μ in width. In the ectosomal region, while there are very many large meshes, small meshes are commoner than elsewhere. From the axial part of the sponge main fibers curve upwards and outwards, becoming radial near the surface, where they frequently project slightly. Between these there are transverse connectives. If the section be taken through the axis of a stem, the skeleton shows considerable regularity. All fibers, main and connectives, of about same thickness; contain many rows of spicules, which about fill the fiber; spongin moderately abundant. Free spicules are scattered between the fibers.

The dermal skeletal reticulum, which is only the outermost part of the general skeleton, is composed of tangential fibers like those of the interior and forming large polygonal meshes like those of the interior. The ends of the radial fibers, which project only slightly or not at all and which lie at or between the nodes of the reticulum, are observable in surface views.

The oxea is smooth, slightly curved, sharp pointed, 100 by 4 μ with smaller sizes.

Holotype.—Cat. No. 21258, U.S.N.M.

The sponge evidently differs but little from the type (Lendenfeld, 1887, p. 819; the author's reference to fig. 65, pl. 26, is probably a *lapsus*, since the figure does not correspond to the description), which is from the east coast of Australia, and the chief characters of which are given as follows: A bunch of branching processes, 3 mm. thick and 60 mm. long, showing some oscula 400 μ in diameter; meshes of skeletal reticulum 290 μ wide (probably the common mean is meant); fibers 50 μ thick, connectives not differing from main fibers in any noteworthy degree; *oxea, straight, 150 μ by 8 μ;* scattered spicules between the fibers.

Subfamily PHLOEODICTYINAE.

Phloeodictyina CARTER, 1882, p. 117.

Phloeodictyinae RIDLEY and DENDY, 1887, p. 31.—Part DENDY, 1905, p. 165.—DENDY, 1921*b*, p. 44.

Sponge body provided with fistular outgrowths. Characteristically the ectosomal skeleton is much denser than the choanosomal, constituting a sort of rind. Microscleres in shape of sigmas or toxas may be present.

Lundbeck, 1902 (p. 56), dissolves Carter's group and distributes the genera. (See George and Wilson, p. 153.) His example has been followed by Topsent and others. Dendy (1905) retains the group to include *Phloeodictyon*, *Oceanapia*, *Histoderma* (now *Coelosphaera*), *Sideroderma* (=*Siderodermella* Dendy 1921*b*), and *Amphiastrella*, which necessitates placing it in the Desmacidonidae. *Rhizochalina sens. str.* (Lundbeck 1902, p. 56), to cover *R. oleracea* O. Schmidt and *R. carotta* O. Schmidt (Schmidt, 1870, pp. 35–36), is referred by Lundbeck to the Chalininae because of the "solid spongin fibers filled with a large number of very small oxea." Dendy (1905) accepts this reference, while Topsent more recently (1920*d*, p. 2) would assign the genus to the Gelliinae. But the general anatomy of Schmidt's two species is such that they might logically be referred to the Phloeodictyinae. This is the opinion of Dendy in his latest memoir (1921*b*, p. 45).

Lundbeck, 1910 (pp. 28–29), again criticises the subfamily and believes the anatomical resemblances are features which have been independently acquired, thus interpreting them as instances of convergent evolution. Dendy in his recent memoir (1921*b*) admits this so far as to separate the non-cheliferous, haplosclerid, genera from *Coelosphaera* (=*Histoderma*) and its allies.

Genus PHLOEODICTYON Carter (1882).

Phloeodictyon CARTER, 1882, p. 122.—LUNDBECK, 1902, p. 56.
Rhizochalina part, RIDLEY, 1884, p. 419.—RIDLEY and DENDY, 1887, p. 32.—Part, TOPSENT, 1894*c*, p. 6.
Occanapia part, DENDY, 1894, p. 248.

Spongin usually present, but the skeleton is not a reticulum of distinctly chalinine spiculo-fiber, as in *Rhizochalina sens. str.* Megascleres, oxeas varying to strongyles. No microscleres.

PHLOEODICTYON PUTRIDOSUM (?Lamarck, species).

Rhizochalina putridosa (?Lamarck, species) RIDLEY and DENDY 1887, p. 33.

A fine large specimen from station D5355 is referable to this species. It is spheroidal, 115 mm. in diameter. As in the *Challenger* specimens the fistulae are numerous (about 40) and rise vertically upward from the upper and lateral surfaces, facts which sufficiently mark off the species from the more commonly recorded *P. fistulosum* (Bowerbank), the original types of which came, like those of *P. putridosum*, from Australian waters. In the *Challenger* specimens the lower surface is 'almost without trace of fistulae'; in the *Albatross* sponge it shows some small apertures, about 3 mm. in diameter, which possibly indicate the presence in the uninjured sponge of small root fistulae. In the *Challenger* specimens, 93–137 mm. in diameter, the fistulae, 6–12 mm. in diameter, were nearly all broken off close to the surface; unbroken ones short and closed terminally. The fistulae in the *Albatross* sponge are of about same width; some shorter ones perfect and terminally closed; most are broken off but several are 60–70 mm. long although broken terminally. In the *Challenger* specimens the megascleres are oxeas, hastately pointed, 195 by 13 μ: in the *Albatross* specimen they are similarly shaped oxeas, but smaller, 150–160 by 8 μ.

The *Challenger* specimens were much incrusted with foreign organisms. Likewise the surface of the *Albatross* specimen shows some serpulid tubes, polyzoa, and molluscan shells. But the chief incrustation is a calcareous (nullipore) alga (Corallinaceae). This organism forms a practically solid white calcareous layer, about 5 mm. thick, at the periphery of the entire sponge and is continued down as a thinner lining layer into some of the canals. Over most of the body it now constitutes the outer surface of the mass and from it the fistulae rise up. Only over the upper surface is the smooth outer layer of the sponge itself still preserved, underlaid by the calcareous layer within which, as within a rind, lies the sponge pulp. After treatment with acid, the calcareous layer is seen to be made up of the sponge skeletal reticulum and the branching, apparently cylindrical, body of the alga, which has everywhere grown between the fibers of the reticulum. The alga evidently infests the outer layer of the choanosome, just beneath the ectosome (dermal layer plus what Ridley and Dendy, 1887, call the bast layer). It converts this into a calcareous rind, outside of which remains the sponge ectosome which tends to break and peel off. The completeness of the calcareous rind coupled with the presence of the sponge pulp within it seems to demonstrate conclusively that some of the fistulae must be afferent and others efferent, for they provide the sole channels of connection between the sponge pulp and the surrounding water. Where the ectosome has been left, as on the upper surface of the sponge, it tends to rise up and form low blister-like swellings. The *Challenger* specimens seem to exhibit something of this appearance, in that the surface is said to be "very uneven and covered with numerous bladder-like, almost glabrous swellings."

The *Challenger* specimens and Lamarck's came from Australian waters. The fistulae taken by the *Challenger* in the Atlantic (off Bahia) and the specimen described by Topsent (1892, p. 74) from the Azores are very doubtfully referred by Ridley and Dendy and by Topsent respectively to this species.

PHLOEODICTYON CAGAYANENSE, new species.

Plate 42, fig. 3; plate 48, fig. 10.

One specimen from Station D5423 (off Cagayan Island in the Jolo Sea). Sponge massive, elongated, 60 mm. high, 40 mm. in transverse diameter, incrusted at lower pole with a leathery alcyonarian. There is a firmer cortex about 1 mm. thick, the outer layer of which is smooth and stony. Sponge tissue internal to the cortex, dense but fragile. Surface covered everywhere with very numerous fistular tubes, mostly 1–2 mm. in diameter, a few reaching a diameter of 3–4 mm. The tubes, which are mostly 4–5 mm. apart, are all broken off, the longest projecting only about 2 mm. Wall of the tubes stony, a prolongation of the cortex; thin, only a fraction of a millimeter thick; including a single undivided cavity, which is produced into the interior for some distance, as a more or less radial canal. Color of the sponge in general, light yellowish-brown; sections show that the dermal layer of the cortex is colorless and translucent.

Skeleton of interior, a loose and vague reticulum, in general unispicular, the side of a mesh equal to the length of a spicule. The spicules are united by a little spongin, easily demonstrated in sections mounted in water. In the deeper part of the cortical region, the reticular arrangement is more distinct, the sides of the meshes here being polyspicular and stout, often about 50 μ thick. In the dermal layer of the cortex the spicules are closely packed and parallel to the surface, forming a dermal crust 100–200 μ thick. Skeleton of the fistular wall, essentially a continuation of the cortical skeleton.

Spicules.—Oxea varying to the strongyle (pl. 48, fig. 10). The spicule is cylindrical, curved or somewhat bent, not always symmetrically, and about 200 by 10–14 μ. In the oxea the ends are often quite suddenly pointed but in this matter there is variation, spicules occurring with more tapering points.

The salient characters of the species are the stony surface and the very large number of fistulae.

Holotype.—Cat. No. 21289, U.S.N.M.

Family DESMACIDONIDAE.

Desmacidinae O. Schmidt, 1870, p. 52.
Desmacidonidae part, Vosmaer, 1887, p. 348.
Desmacidonidae plus *Heterorrhaphidae* part, Ridley and Dendy, 1887, pp. 31, 62.
Poeciloscleridae plus *Haploscleridae* part, Topsent, 1894, pp. 3, 6.
Desmacidonidae plus *Haploscleridae* part, Dendy, 1905, pp. 135, 158.
Desmacidonidae plus *Homorrhaphidae* part plus *Heterorrhaphidae* part, Lundbeck, 1902, 1905, 1910.

The characteristic microscleres are cheloids (chelas and modifications), but forms are included in which these spicules presumably have been lost during the course of evolution.

The subfamilies recognized are the Mycalinae, Phoriosponginae (see George and Wilson, 1919, p. 153), Ectyoninae, together with the Tedaniinae, Desmacellinae, Hamacanthinae, and Merliinae (see previously, under Haploscleridae). Topsent (1913*b*, p. 52; 1919) would add the Stylotellinae (Lendenfeld 1888) for *Stylotella*, *Stylinos* Topsent (restored), and *Semisuberites* Carter (type: *S. arctica* Carter covering *Cribrochalina variabilis* Vosmaer, *Cribrochalina sluiteri* Vosmaer, and perhaps other literature species. Topsent, 1919, p. 4), deleting *Stylaxia* Topsent, 1913.

The status of the subfamilies Tedaniinae, Desmacellinae, and Merliinae, which are not represented among the sponges studied, is as follows:

Subfamily TEDANIINAE.

Tedaniinae RIDLEY and DENDY, 1887, p. 50.

Forms in which the chelas have been lost. Megascleres of two forms, monactinal forming the main skeleton, and diactinal, tylote or tornote, forming the dermal skeleton. Microscleres generally present in the form of rhaphides. Genera distinguished by Ridley and Dendy: *Tedania* Gray 1867, *Trachytedania* Ridley, 1881.

Topsent distinguishes the rhaphides of these forms, as onychetes, from true rhaphides; they, the former, are described, (1913, p. 630) as inequiended and spinulose in a definite fashion. Topsent, 1912 (p. 3), separates species without microscleres under a new genus, *Kirkpatrickia.*

Ridley and Dendy placed the group in their family Heterorrhaphidae. Topsent, 1894*c*, transferred the genera to the Desmacidonidae. Lundbeck, 1902 (p. 1), likewise places the genera in the Desmacidonidae, referring them to subfamily Mycalinae. Hentschel, 1911 (p. 332, and 1912), disposes of them in the same way, except that he merges *Trachytedania* in *Tedania.* Dendy, 1921*b*, (p. 25), also incorporates these sponges in the Desmacidonidae.

Subfamily DESMACELLINAE.

Desmacellinae RIDLEY and DENDY, 1887, p. 58.

Ridley and Dendy defined the group: "Megasclera all monactinal, stylote or tylostylote. Microsclera sigmata or toxa or both," and assigned the sponges to the Heterorrhaphidae. Genera distinguished by Ridley and Dendy included only *Desmacella* Schmidt, 1870 (*Desmacodes* Schmidt, 1870, is a synonym).

Topsent, 1892 (p. 80), continues to use the subfamily, but adds *Biemma* Gray (1867), which is redefined as having tylostyles and sigmas, and a halichondrioid skeletal framework, whereas *Desmacella* Schmidt (1870, p. 83) is defined as having tylostyles or styles or a mixture of the two forms, with sigmas or toxas or with both together, or with trichodragmas, or with trichodragmas accompanied by either sigmas or toxas, and with a skeletal framework that is fibrous. Topsent recognizes four species of *Biemma* and six species of *Desmacella.* Topsent (1894*c*, p. 6) abandons the subfamilies and transfers the genera to the Esperellinae (Mycalinae).

Lundbeck, 1902, uses the subfamily, placed in the Heterorrhaphidae, to include *Biemma*, *Desmacella*, and *Hamacantha.* *Biemma* and *Desmacella* are used *sensu* Topsent, in that the former is conceived as having a skeletal framework which, if fibrous, is only inconspicuously so; while in *Desmacella* the framework includes well developed fibers.

Thiele, 1903, points out that the name *Desmacella* should be canceled and replaced by *Biemna* Gray, and for *Biemma sensu* Topsent and authors he proposes *Tylodesma.* Wilson, 1904, accepts these nomenclatural changes.

Dendy, 1905 (p. 155), retains the subfamily, placing it in the Haploscleridae, and does not follow Thiele in nomenclature; *Desmacella* is defined as having a *reticulate* skeletal framework. Henschel, 1911, follows Topsent, 1894*c*, in transferring the genera to the Desmacidonidae (Mycalinae); Desmacella is defined as having a reticular skeleton, *Biemma* as having a halichondrioid skeleton. Hentschel, 1912 (pp. 350–354), adopts Thiele's nomenclatural changes, using *Biemna* Gray in place of *Desmacella* authors and *Tylodesma* Thiele for *Biemma* authors. He continues to define the skeleton of *Tylodesma* as halichondrioid, but this distinction from *Biemna* is certainly vague, as is shown by the fact that he is forced to assign to the latter genus not only species with definitely defined fibers but others with only loose tracts of spicules. Topsent, 1913 (pp. 50, 51), accepts Thiele's nomenclatural changes, as do Hallman, 1916, and Stephens, 1921.

Since Thiele's nomenclatural changes have been so generally adopted the name of the subfamily should be changed to Biemninae.

Dendy, 1921*b* (p. 56), brings the case up again. He accepts Thiele's nomenclatural change in so far as it affects sponges like *Desmacidon peachii* Bowerbank, which are thereby renamed *Biemna* Gray (a brief review of the data is given in Wilson, 1904, p. 135), but is unwilling to accept *Tylodesma.* "If there is one thing clear in the whole muddle" he thinks "it surely is that *Tylodesma* is a pure synonym of *Desmacella.*" I can not agree with Dendy that *Desmacella* should be retained, for the following reasons:

Desmacella Schmidt, 1870 (p. 53, also pp. 3, 77), was set up to cover certain new species, two *Hamacanthas* (*johnsoni* and species) and *Desmacidon peachii* Bowerbank. It is therefore in part synonymous with *Hamacantha* Gray, as Vosmaer (1887) pointed out. Schmidt, 1880 (p. 82), withdrew the *Hamacanthas*, but the genus remained in part at least synonymous with *Biemna* Gray, of which *Desmacidon peachii* may fairly be taken, as is now generally done, as the type species. This only leaves Schmidt's new species, *pumilio* and *vagabunda* (Schmidt 1870), as a body for his genus.

None of the species which Schmidt lists is designated as the type and neither of the new species is described in sufficient detail to be recognizable. Lundbeck, 1902 (p. 99), in fact is in doubt whether they even belong in the genus (still called at the time of his writing *Desmacella*). Dendy, with justice, however, picks the first of the new species, *D. pumilio*, as the type, but there is nothing in the diagnosis of *D. pumilio* to distinguish it from *Biemna.* The second species, *D. vagabunda*, however, shows that Schmidt was using *Desmacella* to cover sponges with tylostyles arranged in loose tracts as well as those with tylostyles combined in definite fibers, like *Desmacidon peachii* Bowerbank, for which *Biemna* Gray had already been arranged although it had been lost sight of. *D. vagabunda* might then possibly, in spite of its inadequate description, have been selected by a subsequent author as the type of a genus, *Desmacella sens. str.*, marked off from *Biemna* by the halichondrioid character of its skeletal framework. This step, which was permissible (International Rules of Zoological Nomenclature, article 30, *g*, Proc. Ninth Congress, 1914), but which neither was nor is obligatory, was not taken. Instead the genus, sharply enough conceived by Topsent, 1892, but given a name (*Biemma*) which had to be withdrawn, was designated by Thiele *Tylodesma.* To bring in again the unfortunate term *Desmacella*, as Dendy proposes, and employ it at this late date for the genus in question would surely be an unwarranted step.

Tylodesma as a generic name should then stand, if the genus itself stands as a group distinct from *Biemna.* Dendy, 1921*b*, is evidently doubtful whether both genera should be retained. If *Tylodesma* (or, as he would call it, *Desmacella*) is retained, he thinks it can only be on the ground that it lacks the rhaphides (or trichodragmas), which he would make a differential feature of *Biemna.* But to exclude species from *Biemna* because they have no rhaphides would bring more trouble, in that we would run counter to established practice: See Topsent's definition of *Desmacella* (=*Biemna*), 1892 (p. 83); Topsent, 1904 (p. 225); Hentschel, 1912 (p. 353, *Biemna truncata* with no rhaphides), (p. 354, *Tylodesma microstrongyla* with rhaphides). Hallmann, 1916, 1917, also has interesting propositions for the subdivision of this group of species into genera. However, it seems to me that all the species would better be combined in one genus, *Biemna*, within which subgeneric types (see under *Tetilla* for instance) could doubtless be set up. We would thus have a genus of reasonable scope and identical with what Schmidt understood by *Desmacella* after he had excluded *Hamacantha* (1880). For a different set of propositions concerning the grouping of these species, see Hallmann 1916. Dendy, 1921*b*, it may be added, now places them in the Desmacidonidae.

Subfamily MERLIINAE

Merliinae KIRKPATRICK, 1911, p. 51.

Silicious sponges which have acquired a basal calcareous skeleton. The silicious sclerites include tylostyles and peculiar microscleres, clavidiscs, probably derived from diancistron-like or sigma-like spicules. Other microscleres, rhaphides, trichodragmas, toxas, and sigmas occur in the only known form, *Merlia normani*.

Kirkpatrick, 1911, and Dendy, 1921 (p. 51), regard this aberrant sponge as related to the Hamacanthinae, and since they place the latter in the Haplosceridae, the Merliinae are put there too. The relationship to *Hamacantha* seems to be the basic fact.

Subfamily MYCALINAE

Esperellinae RIDLEY and DENDY, 1887, p. 62.—DENDY, 1905, p. 159.
Esperellinae part plus *Dendoricinae* part, TOPSENT, 1894*c*, pp. 6, 9.
Mycalinae LUNDBECK, 1905, p. 7.—HENTSCHEL, 1911, p. 287.
Mycalinae plus *Myxillinae* part, TOPSENT, 1913, pp. 625, 632.

Skeletal fibers, or spicular tracts, without echinating spicules and not markedly areniferous.

Dendy, 1921*b* (p. 55), proposes to restore the names *Esperella* and *Aegagropila* for genera made to receive certain species which according to recent usage would fall under *Mycale*. In consequence he retains the name *Esperellinae* for the subfamily in place of *Mycalinae*. This is a change in a set of terms which seemed about to establish themselves definitely, and if it is desirable, as Dendy points out, to segregate species of *Mycale*, why not set them off as subgenera?

Genus MYCALE Gray (1868).

Esperella AUTHORS.
Mycale GRAY, 1868, p. 533.—THIELE, 1903, p. 949 (nomenclatural history here given).—LUNDBECK, 1905, p. 23.

Incrusting massive, and erect forms of various shapes, sometimes with considerable symmetry, occur; the form is rarely tubular. Megascleres combined in polyspicular fibers, usually with but little spongin, but the spiculo-fibers may be well cornified and firmly united in reticular fashion. Megascleres monactinal, stylote to tylostylote. The characteristic microscleres are palmate anisochelas; to these may be added sigmas, toxas, trichodragmas, and very small isochelas (possibly young forms of the anisochela), in different combinations.

MYCALE AEGAGROPILA (Johnston).

Halichondria aegagropila Johnston, 1842, p. 119.
Esperella aegagropila Vosmaer and Pekelharing, 1898, p. 19.

Occurring as a thin incrustation, 350–500 μ thick, on a dendritic alcyonarian taken at stations D5136 and D5145.

The megascleres as a rule form the usual, short, more or less vertical fibers running upward from the base and expanding at the surface in wide brushes. But where the sponge is very thin, the brushes alone stretch from base to surface. The tangential spicules of the dermal membrane are arranged in tracts, several spicules thick, forming a reticulum in which the side of a mesh is about equal in length to a spicule.

The megascleres are subtylostyles or styles, the two forms about equally abundant, 250–280 by 7 μ. The spicule tapers toward the base as well as toward the point, and is often not quite straight.

The anisochelas are 36–50 μ long. In the dermal membrane they frequently occur in rosettes. Young stages are abundant down to minute ones, 4 μ long.

The large toxas reach 160 μ in length and occur singly. Smaller sizes, especially a size about 50 μ long, are much more abundant. These occur singly but also often in bundles, constituting toxodragmas.

The characteristic sigmas are 70–90 μ long; smaller sizes abundant.

The incrustations from the two stations seem to differ slightly, as might be expected. At any rate in my preparations of material coming from station 5145 the very large toxas and the large sigmas are more abundant,, the anisochelas less abundant and smaller, than in preparations of material from station 5136.

Vosmaer and Pekelharing (1898, pp. 19–31) have shown that a number of forms should be combined under this specific name, although there is ground for objection to some of their mergings. The species may be defined as a widely spread one generally occurring as a thin incrustation, in which the characteristic combination of spicules is as given above and in which the skeletal arrangement is, in general, as given above. A full description with references to the literature is given in Vosmaer and Pekelharing's paper. Doubtless many geographical varieties, differing in details, are distinguishable. Perhaps the incrusting sponges which Hentschel describes (1911, p. 296) under *Mycale macilenta*, var. *australis*, from southwest Australia may be regarded as such. In these sponges the tangential dermal megascleres form a thick layer, and a second form of anisochela, 12–20 μ long, differing in some details of shape from the larger ones, is distinguishable. Stephens, 1912 (pp. 32–33), would also continue to distinguish *M. macilenta* from *M. aegagropila*, referring to the former species sponges in which the anisochelas fall in two groups, to the latter those in which the anisochelas are all of one type and scattered singly, not in rosettes. Vosmaer and Pekelharing have, however, laid stress on the variability of the anisochela in their species.

MYCALE EUPLECTELLIOIDES (Row), var. REGULARIS, new variety.

Esperella euplectellioides Row, 1911 (communicated, 1910), p. 333.

Station D5136, a colonial mass consisting of three tubes united laterally and below, outer surface of the tubes bearing numerous lobular projections which give evidence of a tendency to become tubular. Largest tube 200 mm. high, diameter of terminal aperture and middle of body 80 mm., smaller below; this is about the size of the type. Wall of tube thin, in general about 1 mm. thick, thicker in the immediate region of a spine. (See below.)

Station D5145, a colonial mass including three tubes similar to the above; these are fused, in places, laterally and basally. Height of tubes 150 mm., diameter of aperture and middle body in one, 60 mm., in the others, about 40 mm.

Dermal membrane of outer surface of a tube scarcely porous to the eye, but in reality perforated by the abundantly scattered small pores. Lining membrane of inner surface studded with very numerous small oscula, 1 mm. and less in diameter. The thin wall of the tube in some specimens is interrupted by a few rounded gaps, of varying size, several millimeters in diameter; these have smooth edges and are doubtless healed wounds. Sponge flesh whitish, skeletal fibers brown or yellow.

The reticulum of spiculo-fibers which supports the wall is very similar to that of the type, but instead of being irregular is regular in that longitudinal main fibers and connectives are distinguishable. Main fibers ascend, more or less parallel to one another, toward the rim of the vase; they are 3–5 mm. apart. Connectives simple or reticular, often 2–4 mm. apart. The entire reticulum is very coarse, sizes of meshes about as in type.

Outer surface of variety covered with sharp strong spines, commonly about 3 mm. long, which project more or less upward. The spines are oblique branches of the main fibers and have the same structure as the latter. In the type the outer surface is covered with the bare, branching, tree-like ends of the larger fibers. In both variety and type the inner surface of the sponge is comparatively smooth.

Main fibers of the reticulum 500–850 μ thick, connectives thinner. Fibers densely filled to the surface of the fiber with the longitudinally arranged megascleres. Nevertheless the spongin uniting the spicules and covering the whole bundle is sufficiently obvious in preparations. All fibers alike.

Just beneath the dermal membrane at both surfaces the megascleres are gathered into long slender tracts about 50 μ thick, very different in appearance from the fibers of the reticulum; they are of the characteristic *Mycale* kind, showing no or almost no spongin. These tracts are obliquely tangential in position, curving to the surface where they expand, forming loose brushes which also are almost tangential in position.

The megascleres are subtylostyles 300 by 6–7 μ, with many slenderer (probably younger) forms 3–4 μ thick; grouped in the fibers, tracts, and surface brushes, and scattered abundantly in the parenchyma. In the type the spicules are smaller, 157–210 by 3 μ.

The sigmas are 70–90 μ long, about 2 μ thick; abundant in parenchyma and at both surfaces. In the type they are 100 μ long.

The palmate anisochelae are 28–30 μ long, in rosettes and singly; common in parenchyma and at both surfaces. In the type they are 26 μ long, and do not occur in rosettes.

Holotype.—Cat. No. 21273, U.S.N.M.

The type is from the Sudanese Red Sea. The reticulum of fibers which supports the sponge wall is irregular, not divisible into primary and secondary fibers, and the outer surface is rougher than in the *Albatross* sponges.

Mycale fistulata Hentschel (1911, p. 292), from Shark's Bay, Southwest Australia, may be listed as another variety of this species. The tubes approach in size the smaller *Albatross* specimens. They fuse laterally. Thickness of wall not given, but evidently thin. Small oscula are distributed over the inner surface. The skeletal reticulum is regular and like that of the *Albatross* variety, but there are no spines, the surface of the sponge being smooth. The subtylostyles are closer in length to variety *regularis*, but in thickness to the type. The anisochelae are 24–26 μ long, the sigmas only 42–65 μ long.

Neither Row nor Hentschel mentions ectosomal tracts and brushes such as occur in the *Albatross* sponges. These structures have some interest as representing a remnant of the characteristic *Mycale* skeletal arrangement, from which the reticulum of well-cornified fibers departs so widely. A reticulum of this general kind, made up of cornified spiculo-fibers firmly combined, is not pecular to *M. euplectellioides.* It occurs in a few other species: *M. nuda* (Ridley and Dendy, 1887, p. 70) and *M. imperfecta* (Baer, 1906, p. 20).

Genus MYXILLA O. Schmidt sensu Lundbeck (1905).

Myxilla O. SCHMIDT, 1862, p. 71. Not *Myxilla* TOPSENT, 1892, p. 108, 1894*c*, p. 11, 1904, p. 168.—Emended LUNDBECK, 1905, p. 131.—KIRKPATRICK, 1908, p. 27.—TOPSENT, 1913, pp. 623, 625.—HENTSCHEL, 1914, p. 97.

Myxilla part, RIDLEY and DENDY, 1887, p. 128.—DENDY, 1895, p. 29; 1905, p. 168.

Dendoryx GRAY plus *Lissodendoryx* TOPSENT part, TOPSENT, 1892, p. 97; 1894*c*, p. 9; 1904, pp. 172, 173.

Habitus varying; incrusting, massive, lamellate, club-shaped forms all occur. Main skeleton a polyspicular reticulation of monactinal megascleres, sometimes very diffuse; fibers differentiated in some species. Skeletal spicules generally spinose styles, sometimes smooth. Special ectosomal megascleres present; these ordinarily diactinal and most often smooth but sometimes spinose. Microscleres isancoras, most often tridentate, to which sigmas may be added.

The generic synonomy is involved. *Myxilla*, as used by Ridley and Dendy, 1887, and Dendy, 1895, 1905, is placed in the Ectyoninae but is conceived as intermediate between the Mycalinae and Ectyoninae, including species both with and without echinating spicules. Dendy would regard the former as the primitive forms, the latter as derived forms in which the spined styles (tylostyles) have been retained although they have lost their original echinating arrangement and "have passed into the main skeleton" forming a reticulation with one another. A necessary corollary is to draw the further deduction that in some species the megascleres have lost their spines.

From this very comprehensive genus Topsent, 1892, 1894*c*, 1904, subtracts the species without echinating spicules (mycaline), leaving *Myxilla* as a distinctly ectyonine genus. For the mycaline species with spined megascleres he restores *Dendoryx* Gray and for those with smooth megascleres establishes Lissodendoryx.

It was pointed out by Dendy, 1895 (p. 29), and by Thiele, 1903 (p. 953), that *Dendoryx* as used by Topsent is not defensible from the nomenclatural standpoint, since the type species of *Myxilla*, *M. rosacea* (Lieberkühn), has no special echinating spicules and is a *Dendoryx* in the sense of Topsent. If, therefore, Topsent's subdivision of *Myxilla* is carried out, the name *Myxilla* must be used instead of *Dendoryx*, and some other generic name or names be found for the ectyonine species of *Myxilla* in the sense of Ridley and Dendy, and Dendy. Lundbeck 1905, followed by others (Kirkpatrick, Hentschel, Topsent), introduces the nomenclatural change of *Myxilla* for *Dendoryx*.

As to the ectyonine species of *Myxilla* in the sense of Ridley and Dendy, Topsent, 1913 (p. 623), refers some to *Stylostichon* Topsent, others in which the skeleton is reticulate to *Dendoryx* Gray emended, used in the sense of *Myxilla*, Topsent olim. According to this proposition, the names, *Myxilla* and *Dendoryx*, of Topsent's classification would simply be interchanged.

Lundbeck and Levinsen (Lundbeck 1905, pp. 2–7) find that ancoras and chelas are sharply separated—that is, there are no transitional forms. On this basis they would separate genera with ancoras from those with chelas. Lundbeck applies this principle, accepted by Kirkpatrick, Topsent, Hentschel, George and Wilson (1919), to the case of *Myxilla* (*Dendoryx* formerly) and *Lissodendoryx*. These two genera intergrade with respect to the character (spinulation or smoothness of megascleres) on which they were originally separated by Topsent. Lundbeck redefines them on the basis of the microscleres, assigning species with ancoras to *Myxilla*, species with chelas to *Lissodendoryx*.

Considering the very great resemblance between *Myxilla and Lissodendoryx tawiensis* of this paper, and other similar cases, I wish to say that it seems to me artificial to place such species in different genera. It would be preferable, to list the two sets of species as subgroups of *Myxilla*, frankly defining them as groups based on a single character and therefore probably artificial. Rather, however, than disturb at present this current tendency in classification, I make use of the two genera.

MYXILLA CRUCIFERA, new species.

Plate 42, fig. 5; plate 49, figs. 3, 4.

Station D5168, one specimen. Sponge a concavo-convex lamellate fragment, about 40 by 50 mm. and 5–8 mm. thick. The convex surface bears the oscula, 1–2 mm. in diameter and 2–4 mm. apart, from which the main efferent canals, about as wide as the oscula, extend radially inward. The concave surface is very irregular, presenting a cup-like depression; dermal membrane of this surface uniformly perforated by the closely set pores. Through this sieve-like membrane the main afferent canals, less than 1 mm. in diameter and about 1 mm. apart, may be seen extending radially inward, thus making the impression of pore areas separated by nonporous tracts. Color, light brown; sponge firm.

Main skeleton a polyspicular reticulum formed by smooth styles; meshes 3 or 4 sided; side of a mesh about equal to the length of a spicule; bundle forming the side frequently includes 6–8 spicules but the number ranges down to two or three. Spicules bound together at nodes of reticulum by a little spongin. Bundles of spicules forming the radial sides of the most superficial meshes very commonly project slightly. Sides of the meshes in the interior may be so aligned as to give rise to continuous, but inconspicuous, tracts; best developed of these are radial to the surfaces and help to bound the main canals.

The ectosomal megascleres, slender tornotes, are abundant; tangentially and radially arranged at both surfaces of the sponge, the radial spicules slightly protruding and for the most part in closely set divergent brushes. Round the oscula, the tornotes are especially abundant; they here form tangential sheaves.

Spicules.—1. Skeletal style (pl. 49, fig. 3, *a*), smoth, cylindrical, slightly curved near basal end, 270–300 by 18–21 µ.

2. Ectosomal tornote (fig. 3, *b*), smooth, straight, 165–200 by 6–7 µ.

3. Sigma (fig. 3, *c*), 50–70 µ long but ranging down to 10 µ long; the larger abundant in the interior, the smallest common in the dermal membrane as well as in the interior.

4. Ancora (pl. 49, fig. 4, *a*, b), 40 µ long ranging down to 10 µ long; abundant in dermal membrane of both surfaces, present but less abundant in the interior. The spicule is the usual tridentate isancora. There is just a suggestion of an angulation in the middle of the shaft (fig. 4, *a*); alae are longer than the teeth. In an apical view the spicule presents a neatly symmetrical, four-parted, crosslike figure, the shaft with the thin lateral expansion on each side (ala) just opposite the middle tooth and in this view looking not unlike a tooth, the lateral teeth opposite each other. (Compare such figures as 17*b*, pl. 21, Ridley and Dendy, 1887.)

This species is very close in its spiculation to *M. lacunosa* Lambe from the extreme eastern Pacific (west coast of Vancouver Island, Lambe, 1893, p. 70), a massive sponge with sigmas about 19 µ long. In its lamellate character and in respect to the classes of spicules presented, the species also resembles *M. hastata* Ridley and Dendy (1887, p. 134) from the Atlantic coast of South America, but the two are far apart in respect to the size of the megascleres and in some other points.

Genus LISSODENDORYX Topsent emended Lundbeck (1905).

Amphilectus part, AUTHORS.—Part, VOSMAER, 1887, p. 353.
Myxilla SCHMIDT part, DENDY, 1895, p. 29; 1905, p. 168.
Lissodendoryx TOPSENT 1892; 1894*c*, p. 9; 1901, p. 19.—LUNDBECK, 1905, p. 153.—GEORGE and WILSON, 1919, p. 150.

Skeletal framework reticular, including sometimes well-marked fibers, or dendritic; spongin present in variable amount. Skeletal megascleres generally smooth styles, but sometimes spined. Special ectosomal megascleres present; these generally, but not always, diactinal. Microscleres isochelas, never ancoras; these may be accompanied by sigmas, toxas, or trichodragmas.

Lundbeck's (1905) definition needs some slight alterations. Thus the ectosomal (dermal) megascleres are not always diactinal. They are monactinal for instance, at least as a rule, in the species described below, and in *L. tuberosa* Hentschel (1911, p. 327) and *L. styloderma* Hentschel (1914, p. 101). The monactinal form is perhaps, as Hentschel 1911 (p. 328) suggests, the ancestral one, the diactinal forms derived ones. The variations of the spicule in the species described below support this phylogeny. The isochelas are not always chelae arcuatae, but in some species, *L. tuberosa* Hentschel and the species described below, chelae palmatae. The chelas may be accompanied not only by sigmas, but by toxas or trichodragmas. (See Topsent's review of the genus, 1901, p. 19.)

LISSODENDORYX TAWIENSIS, new species.

Plate 42, fig. 4; plate 49, fig. 5.

A specimen from station D5163 (Sulu archipelago, Tawi Tawi group). Specimen broken but apparently including most of the sponge, which has the shape of a curved lamella, attached and thickened at the base and becoming here cup-like. The lamella is 3–4 mm. thick, thinning away toward the upper edge.

Concave face of lamella riddled with closely set pores about 50 μ in diameter. Through the dermal membrane the main afferent canals, extending more or less radially inward, may be seen. They are 1 mm. or less in diameter and about that distance apart. Outer, convex, face of sponge likewise riddled by closely set small apertures, but these are larger and less uniform than on the concave face, varying in diameter from 100 to 800 μ; they are doubtless the oscula. Efferent canals, 1 mm. and less in diameter, extend in radially from this surface, either opening by single oscula or roofed in by an extension of the dermal membrane perforated by several apertures. Embryos are present in the parenchyma, many of them full of short skeletal spicules.

Skeletal framework a rather loose polyspicular reticulum of spinose styles; meshes 3–4 sided, side of mesh about equal to length of a spicule. The spicules forming the side of a mesh number frequently 3 or 4, but the common variation is from 1 to 6; they form a loose bundle. The bundles forming the sides of the meshes are so arranged as to form some continuous tracts of considerable length. The skeletal framework breaks up at each surface into loose bunches of divergent spicules, which project slightly; such bunches are about a spicule's length apart. Spongin scantily present at the nodes of the skeletal reticulum.

The ectosomal megascleres are present at both surfaces, some tangential, others radial and slightly projecting. The radial spicules are not in brushes, but are scattered or in loose groups of a few; they lie along with the bunches of projecting skeletal spicules and between them. There is a difference, but only one of degree, between the two surfaces of the sponge. On the oscular surface, the ectosomal spicules are more abundant and they seem to average a greater length than on the pore surface.

The skeletal spicule (pl. 49, fig. 5, *a*) is a spinose style, slightly curved, 280–350 by 18–20 µ. The spines are mere prickles scattered along the shaft in some abundance, thickly set at the extreme basal end.

The ectosomal megascleres are variable, but always smooth and slender; 150–280 by 4–5 µ. The common type (pl. 49, fig. 5, *b*) is a tylostrongyle in which the basal end, which is the innermost in a radially placed spicule, is slightly tylote. Sometimes (rarely) both ends of the spicule are slightly tylote, but even then one end (the inner) is larger than the other. Sometimes, not often, neither end is thickened, the spicule being a strongyle. On the oscular surface of the sponge it not infrequently happens that the outer end is pointed, the spicule becoming a tylostyle. As said above, the spicules seem to average a larger size on the oscular surface than on the pore surface. On the former, the common range in length is 160–280 µ (15 spicules measured). On the latter, the common range in length is 150–200 µ (15 spicules measured).

The isochelas (pl. 49, fig. 5, *d*) are 14–20 µ long. They are abundant in the interior and in the dermal membrane of both surfaces. I have examined them with an immersion objective (Zeiss) in balsam and water. They are very transparent, but I find them to be chelae palmatae and not chelae arcuatae—that is, the axis is not greatly curved, nor is the ala separated below from the axis by a conspicuous notch, and the tooth is broad.

Toxas (pl. 49, fig. 5, *c*) are abundant close to the dermal membrane and in the interior. The spicule is much bent at the middle and the ends sharp; 150–350 µ long, 2–3 µ thick. Smaller sizes, young stages, are common.

Holotype.—Cat. No. 21272, U.S.N.M.

Genus COELOSPHAERA Wyville Thomson (1873).

Coelosphaera WYVILLE THOMSON, 1873, p. 484.—DENDY, 1921*b*, p. 102.

Histoderma CARTER, 1874, p. 220.—TOPSENT, 1894*c*, p. 10.—DENDY, 1905, p. 166.—Part, LUNDBECK, 1910, p. 7.

Body typically spheroidal and phloeodictyine in appearance, with a hard dermal layer made up of closely packed tangentially placed megascleres, and with fistular processes. Typically the megascleres are tylotes, fusiform or subfusiform, varying to strongyles of similar shape; ends occasionally unequal, spicule becoming actually monactinal. In one set of species however the megascleres are cylindrical oxeas varying to strongyles of similar shape. With microscleres in the form of isochelas, accompanied often by sigmas, less often by trichodragmas or toxas.

Dendy, 1921*b* (p. 102), points out that the genus was established in 1873 by Wyville Thomson and that Carter's name *Histoderma* is a synonym and must be retired in spite of its universal currency. Dendy is evidently right and *Coelosphaera* must be used instead of *Histoderma*, since Thomson's sponge, *C. tubifex*, is recognizably described (1873, pp. 484–486, fig. 83). The habitus of this sponge is phloeodictyine; there is a smooth rind; the megascleres are "pinheaded," the microscleres sigmas and isochelas. Dendy concludes, moreover, that Carter's type, *Histoderma appendiculatum*, is specifically identical with this species.

In separating *Coelosphaera* (*Histoderma*) from the haplosclerid phloeodictyine sponges Lundbeck (1910, p. 28) is influenced in part by the fact that the megascleres of such species as *C.* (*Histoderma*) *appendiculata* Carter are fundamentally different from those of *Phloeodictyon*, etc. The spicules of the latter genera are oxeas varying to strongyles, cylindrical and fundamentally diactinal. The magascleres of *C.* (*Histoderma*) *appendiculata* Carter on the contrary are fusiform or subfusiform tylotes, which only secondarily become strongylate; moreover, they show their desmacidine origin in an early ontogenetic stage which is monactinal (Lundbeck, 1910, p. 10). This is convincing. A complication is however effected by the occurrence of species like *C.* (*Histoderma*) *singaporensis* (Carter), *C.* (*Histoderma*) *vesiculata* Dendy, and *C. toxifera* of this report. In these species the megascleres are cylindrical oxeas or strongyles or intermediates, which do not differ from the haplosclerid type of diactinal spicule (Ridley, 1884, p. 421, Lindgren, 1898 p. 297, Dendy, 1905 p. 166). A curious feature, too, is that in them all the megascleres show such a remarkable variation in size, more especially in length. In these species, nothing in the adult spicule suggests a monactinal phylogenetic origin, and while the ontogeny has not been studied in detail, Ridley, 1884, interprets very slender oxeas as young stages in *C.* (*Histoderma*) *singaporensis* and Dendy, 1905, mentions for *C.* (*Histoderma*) *vesiculata* slender hair-like spicules, apparently diactinal, which are probably young stages of the adult sclerites. Thus these species are set off in respect to an important feature from the typical *Coelosphaeras*, and something might be said in favor of their union with the haplosclerid Phloeodictyinae, regarding the latter as forms in which the chelas have been lost. On the whole, however, it seems best not to separate them from the other *Coelosphaeras*, but to regard the cylindrical shape of the megasclere as the culmination of an evolutionary tendency which begins to show itself even in the typical species of the genus. In a revision of genera I suggest that these species be set off from the type as a subgenus.

Topsent, 1894*c* (p. 11), enumerated the species of the genus known at that time. Lundbeck, 1910 (pp. 25–26), has given a more recent list in which, however, some of the forms are referred by him to other genera. He includes *Sideroderma navicelligerum* Ridley and Dendy, for which Dendy, 1921*b* (p. 105), substitutes the new name *Siderodermella.* To Lundbeck's list may be added: *C.* (*Histoderma*) *verrucosa*, var. *fucoides* Topsent from Amboina (Topsent, 1897, p. 452), *C.* (*Histoderma*) *dichela* and var. *gracilis* Hentschel from the Aru Islands (Hentschel 1912, pp. 343, 345).

COELOSPHAERA TOXIFERA, new species.

Plate 42, fig. 7; plate 49, fig. 6.

One dried specimen from station D5640. Sponge massive, 100–130 mm. high with horizontal diameters of 160 and 300 mm. The body, which is covered with a firm rind, bears on its upper and lateral surfaces very numerous (about 75) tubular processes, 5–10 mm. in diameter. The ends of most of these fistulae are broken off but are present in the case of a few, which may be seen to taper somewhat to a rounded closed extremity. The complete fistulae are 30 mm. or less in length. One of them is terminally branched, dividing into three short processes.

What appear to be three cloacal apertures, 20–40 mm. in diameter, lie on the upper surface. These seem to be natural and lead, each, into a depression into which open several canals. The whole under surface is much incrusted; it was evidently attached and is without appendages.

The skeletal framework is made up of strong spiculo-fibers, often 0.5 mm. thick, consisting of closely packed megascleres; spongin almost absent. In the body the spiculo-fibers are combined to form reticular laminae about 0.5 mm. thick, the apertures in which are 0.5 mm. or thereabouts in diameter, while the spiculo-fibers between the apertures are somewhat less than the diameter of the latter. Such reticular laminae are disposed more or less parallel to the surface of the sponge, 1–3 mm. apart. Between them extend trabeculae of spiculo-fiber, forming a coarse, irregular reticulum.

The dermal membrane of the body is very thin, shows no pores, and is filled with closely packed megascleres of all sizes, arranged tangentially. The underlying hard rind is formed by the most superficial of the skeletal reticular laminae; the apertures in this are smaller than in the laminae of the interior.

The fistular processes are hollow. The wall is about 1 mm. thick and consists of a thin dermal membrane, overlying a fairly coarse reticulum of spiculo-fiber. The dermal membrane includes a single layer of tangentially placed megascleres, not closely packed as in the dermal membrane of the body but forming an irregular network, in general unispicular; the 3 or 4 sided meshes about half a spicule length in width; typically each mesh containing a pore.

Spicules.—1. Strongyles (pl. 49, fig. 6, *a*, *b*), cylindrical, smooth, slightly curved, with a typical size of about 360 by 16 µ. From this size the spicules grade down to very small ones, 36 by 10 µ; the smaller sizes are abundant, the intermediate sizes scanty.

2. Palmate isochelas (pl. 49, fig. 6, *c*), 20 µ long, in the interior and in the dermal membrane of the fistular processes.

3. Toxas (pl. 49, fig. 6, *d*), 60–80 µ long, abundant in the membranes of the interior; the degree of curvature varies somewhat, and the curvature is sometimes asymmetrical.

Holotype.—Cat. No. 21340, U.S.N.M.

Subfamily HAMACANTHINAE.

Hamacanthinae Ridley and Dendy, 1887, p. 59.
Hamacantha Gray, Topsent 1894*c*, p. 7.

Desmacidonidae in which chelas as such are not present; characterized by the presence of peculiar microscleres, diancistra.

Genus HAMACANTHA Gray (1867).

Vomerula part, O. Schmidt, 1880, p. 82.
Hamacantha Gray, 1867, p. 538.—Part Vosmaer, 1885, p. 28; 1887, p. 352.—Topsent, 1894*c*, p. 7.—Lundbeck, 1902, p. 9.—Topsent, 1904, pp. 215–224.
Hamacantha Gray plus *Vomerula* Schmidt, Ridley and Dendy, 1887, p. 59.

Habitus varying; massive, erect, incrusting, and papillate forms occur. Skeletal framework consists of polyspicular fibers or tracts, together with scattered spicules, crossing in irregular fashion to form more or less of a network; spongin absent or present in small amount. Megascleres: generally styles, but sometimes oxeas or a mixture of the two; or styles, tylostyles, and strongyles; in some species megascleres of ectosome, exotyles, differ from those of general skeleton, having the shape of strongyles or tylostrongyles with roughened outer end. Microscleres: diancistra; in some species, two or even three forms of diancistron, differing greatly in size, may occur; in addition, toxas, sigmas, trichodragmas or bundles of stouter microxeas may also occur.

Ridley and Dendy, 1887, redefined *Hamacantha* Gray and *Vomerula* Schmidt, making the distinction to lie in the shape of the megascleres, oxeate in the former, stylote in the latter. Topsent, 1894*c* (p. 7), combined the two genera on the ground that the megascleres vary within the same species. Vosmaer (1887) had previously used *Hamacantha* in this extended sense, reserving *Vomerula* Schmidt for forms like *V. tibicen* O. Schmidt (1880, p. 83) possessing diancistra and chelas (Vosmaer lists, as an example, *V. tenda* O. Schmidt, evidently a slip, since the definition shows he had in mind Schmidt's second species, *V. tibicen.* Topsent has recently, 1920*d*, (p. 9) redescribed *V. tenda.*) But since no one has rediscovered forms with diancistra and chelas, Ridley and Dendy's criticism (1887, p. lxvi) of *Vomerula tibicen* Schmidt has been followed, and the species, and with it, *Vomerula* in the sense of Vosmaer 1887, deleted. *Hamacantha* in the present sense remains as the sole genus of the subfamily.

Lundbeck, 1902 (p. 108), enumerates the known species, to which Topsent especially (1904) has added a number of others from the region of the Azores. *Hamacantha* is a genus of sufficient complexity to be set apart from simpler forms such as the Gelliinae, Renierinae, etc., along with which Ridley and Dendy, 1887, classed it. Topsent, 1894*c*, accordingly transferred it to his Poecilоscleridae (Desmacidonidae authors). Some others, however, Kirkpatrick, 1911, and Dendy, 1921*b* (p. 25), would retain the genus (or subfamily) in the Haploscleridae.

HAMACANTHA ESPERIOIDES (Ridley and Dendy), var. MINDANAENSIS, new variety.

Vomerula esperioides Ridley and Dendy, 1887, p. 60.
Hamacantha esperioides Kirkpatrick, 1903, p. 253.

One specimen from station D5504 (off the island of Mindanao).

Ridley and Dendy's species was based on a number of large, erect sponges from the South Atlantic (Agulhas Bank and off Rio de la Plata). Surface conulose; dermal membrane reticular to the eye. Main skeleton a coarse reticulum of thick stout spiculo-fiber; dermal skeleton in general a reticulation of spiculo-fiber. Megascleres: styles, smooth, slightly curved, tapering at both ends, 700 by 19 μ. Microscleres: large diancistra 177 μ long and sigmas 38 μ long. A small type of diancistron, regarded as perhaps a young form, of about same length as the sigma is also recorded. *H. esperioides* has also been taken southeast of Cape Colony (Kirkpatrick, 1903, p. 253.)

Lundbeck has shown, 1902 (pp. 101–102), that three classes of diancistra coexist in the same individual in *H. bowerbanki*, differing greatly in size though only slightly in shape (1902 p. 18). Topsent, 1904, likewise finds very small and medium sized diancistra along with the large ones in several species. Lundbeck has, moreover, examined, 1902 (p. 103), *H. esperioides* and finds that the small diancistra recorded by Ridley and Dendy cannot be young forms, but represent a distinct class of spicule.

I refer the *Albatross* specimen to a variety, instead of to the type, because of its difference in form, smaller size of styles, smaller size of sigmas, and absence of the very small diancistra.

The *Albatross* sponge is an amorphous mass 13 by 8 cm., incrusting and surrounding a broken mollusk shell; thickness of sponge 25 mm. and less. Surface is not conulose, but as in the type is conspicuously reticular to the eye, except over the large ectosomal spaces; there are several such, the largest 9 mm. in diameter, roofed in by the nonreticular translucent dermal membrane; some of these open by oscula, 3–5 mm. in diameter; it is uncertain whether they are all efferent. The resemblance in surface appearance to the type (see Ridley and Dendy) is thus close.

The sponge is whitish brown, compressible and easily broken; greatly excavated by canals of considerable size. In general the choanosome reaches the dermal membrane in the shape of narrow trabeculae, between which lie the small subdermal chambers. The trabeculae divide up the dermal membrane into polygonal areas, and thus give to the surface the reticular appearance perceptible to the eye. The dermal membrane is uniformly pierced by closely set pores, 90–180 μ in diameter, although the reticular appearance of the surface suggests the existence of "pore-areas" separated by aporous tracts. In the nonreticular areas of dermal membrane roofing in the larger ectosomal spaces pores occur, as well as elsewhere.

The internal skeletal framework consists of abundant compact spiculo-fibers, looser tracts, and scattered spicules, all crossing in every direction without order. Spicule tracts that are radial to the surface are distinguishable in the superficial part of the sponge. The fibers reach a thickness of 160 μ. Spongin not perceptible; if present at all, there can only be a very little of it. The dermal skeleton in general is an irregular reticulum quite as in Ridley and Dendy's figure, 1887 (pl. 17, fig. 12). Over the larger ectosomal spaces where the dermal membrane is not reticular to the eye, the spicule tracts are either more confusedly arranged or else broken up into scattered spicules.

The styles agree with those of the type except that they are smaller, 470–500 by 12 μ. The large diancistra are like those of the type and of about same size; they commonly have a length of

160–180 μ, smaller ones down to a length of 100 μ occurring sparsely. The very small diancistra of the type could not be found. The sigmas are only 16–18 μ long. The diancistra and sigmas occur abundantly in the dermal membrane and in the interior. No rosettes were observed, the diancistra apparently always occurring singly.

Holotype.—Cat. No. 21269, U.S.N.M.

Subfamily ECTYONINAE

Ectyoninae RIDLEY and DENDY, 1887, p. 128.—TOPSENT, 1894*c*, p. 11.—LUNDBECK, 1905, pp. 1–2.

Desmacidonidae in which the spiculo-fibers of the skeleton are echinated by monactinal, usually spined, spicules. In incrusting forms the corresponding spicules project vertically from the basal skeletal plate.

Genus CLATHRIA O. Schmidt (1862).

Clathria SCHMIDT, 1862, p. 57.—DENDY, 1895, p. 31.—HENTSCHEL, 1911, p. 368.

Clathria SCHMIDT plus *Rhaphidophlus* EHLERS, RIDLEY and DENDY, 1887, pp. 146, 151.

Clathria SCHMIDT plus *Rhaphidophlus* EHLERS, TOPSENT, 1894*c*, pp. 14, 15.

Generally erect sponges. Main skeleton a reticulation of spiculo-fiber usually with much spongin; the fibers include skeletal styles or subtylostyles, generally smooth but in some species more or less spinose, especially at the basal end; fibers echinated by spined styli (acanthostyles). In the ectosome and elsewhere there are usually free stylote megascleres, often slenderer and shorter than the skeletal styles; these may form a radial dermal crust (*Rhaphidophlus*). Microscleres, small palmate isochelas and toxas (or rhaphides), together or separately; microscleres sometimes absent.

Hentschel, 1911, and Hallman, 1912 (p. 205), would include forms in which the echinating spicules are smooth. The toxa, as is known (see Wilson, 1902, p. 398), may vary in the same specimen from the typical shape to that of the rhaphid, both toxas and rhaphides sometimes forming loose bundles. Hentschel has recently (1912, p. 359) drawn attention to this fact.

CLATHRIA FRONDIFERA (Bowerbank), var. SETO-TUBULOSA, new variety.

Halichondria frondifera BOWERBANK, 1875, p. 288.

Clathria frondifera RIDLEY, 1884, pp. 448, 612.—RIDLEY and DENDY, 1887, p. 149.

Station D5136, one specimen. Station D5141, several fragments and two larger specimens.

Primarily in this sponge there are irregularly lamellate branches, bearing ridges and terminating above in free processes which project obliquely upward and are digitate or spinous in shape, up to about 5 mm. long and 1.5–2 mm. in diameter. Branches 1.5–2 mm. thick; thin or often membranous between the ridges. The mode of growth is obviously such that the free processes become confluent, then constituting ridges of a lamellate branch.

It is, however, only in places, chiefly in terminal (younger) parts of the sponge, that independent branches exist. Elsewhere the branches have for the most part fused edgewise to form a tubular structure, 10–25 mm. in diameter, which itself exhibits irregular branching. The inner surface of the tubes is smooth or nearly so, while the outer bears the above-mentioned processes and ridges, the latter in some specimens assuming a very meandriform aspect. The wall of the tube retains the thickness of the original branches and, like the latter, shows many membranous areas (fenestrae). The cavities in the several parts of the tubular structure are by no means all confluent. Some are, but many cavities are isolated as a result of their mode of formation. The cavities open to the exterior above and sometimes below and laterally.

One specimen shows that after the tubular structure has been attained the formation of conspicuous digitate or spinous processes and independent lamellate branches may be practically suppressed, the tubes growing in direct and simple fashion. That is, the whole sponge is in this case tubular, the inner surface smooth, the outer adorned with many meandering ridges and low processes, the wall fenestrated with many membranous areas.

The more or less tubular sponge may grow predominantly in one direction, or in several directions, the largest specimens measuring 110–120 mm. in greatest length. The attachments indicate that the habit is in general repent. The sponge is somewhat compressible but firm; color in alcohol, a very light brown. The membranous fenestrae show better after drying.

Pores in the meshes of the dermal reticulum. Doubtless very small scattered apertures are the oscula.

The skeletal reticulum of spiculo-fibers is close with rounded or elongated meshes. Main fibers longitudinal, 80–120 μ thick, the included styles forming a core surrounded by abundant spongin; the included styles belong both to the stout and slender skeletal forms. These fibers are less than the length of a skeletal style apart. Connectives like main fibers but in general slenderer with fewer rows of spicules.

Spicules.—1. Skeletal styles. (*a*) Stout form, smooth, slightly curved, 180 by 10 μ to 250 by 12 μ. (*b*) Slender form of about same length but only 6 μ or thereabouts in thickness.

2. Acanthostyles, 50–75 μ long. Head and shaft spinose, but usually a region next the head is bare or less spinose than the rest of shaft.

3. Long slender dermal styles, 200–250 by about 6 μ, are scattered tangentially in the dermal membrane. Very commonly the head is perceptibly spinose at a magnification of 600; in other spicules the spinulation is absent or not perceptible at this magnification.

4. Small dermal styles, 80–100 by 4–5 μ, the head slightly tylote and minutely spinose; radially projecting, abundant. These and the underlying tracts of longer tangential dermal styles make a dermal reticulum with meshes 100–120 μ wide.

5. Isochelae 10–12 μ long, at surface and in interior; abundant. No toxas were found. The horny fiber sometimes splits off slender shreds which at first glance look like toxas.

Holotype.—Cat. No. 21256, U.S.N.M.

The *Albatross* sponge, along with several others, is certainly close to *C. frondifera* (Bowerbank) from East Indian and Australian waters. Ridley, 1884 (p. 449), doubtless refers to the tendency in this species to become tubular when he says that the branches anastomose freely "forming a number of deep angular cells, open above and below and more or less at the sides also, owing to the fenestrae left between the branches." The type has toxas and lacks the small radial dermal styles. The distribution to date is given in detail in Ridley and Dendy 1887 (p. 149).

Topsent 1892*b* (p. 3), records the species for the Red Sea. Lindgren 1898 (p. 309), records it for the Sea of Java. Dendy (1905) (p. 170), records the species for Ceylon and merges in it *C. corallitincta* Dendy (1889), also from Ceylon. He adds that "the slender styli or tylostyli may form a fairly distinct dermal skeleton, in which they are either irregularly scattered or arranged in more or less definite radiating brushes. The bases of these spicules are sometimes minutely spined." Dendy somewhat later, 1916*b* (p. 128), while inclining to regard *C. frondifera* as "a very variable and widely distributed species," again sets up *C. corallitincta* as a separate species, but still later 1921*b* (p. 65), adds: "I am not at all sure that the distinction between this species and *Clathria procera* (Ridley) can be maintained, and both may be merely varieties of *C. frondifera*." Dendy, 1916 (p. 128), mentions the presence of large pseudoscula on prominent parts of his *C. corallitincta* which would thus seem to share in the tube-forming habit.

Hentschel, 1912 (p. 360), records the species from the Aru Islands, and notes that his specimens are in places tubular. He distinguishes from the type two new varieties, one of which, variety *dichela*, has small subtylostyles of about the same size as spicule (4) in the *Albatross* sponge, but it has also toxas and two classes of isochelas. Hentschel gives the types as having "Keine Rinde," but in one of his varieties (*major*) he finds that "eine dünne Rinde aus ungeordneten Nadeln ist vorhanden." Doubtless the armature of dermal spicules varies a good deal within the species.

Thiele, 1903 (p. 958), has studied a specimen which is certainly very close to, probable identical with, the *Albatross* form. Thiele's sponge, from Ternate, he remarks is very similar to *C. frondifera* (Bowerbank). He refers it to *Rhaphidophlus filifer*, variety *spinifera* Lindgren (1898), but erects Lindgren's variety into a species. This identification would seem to be questionable, since Thiele's sponge includes in its dermal "crust" a small style not mentioned by Lindgren. The spiculation of Thiele's sponge (1903, fig. 23) is very close, except in the presence of toxas, to that of the *Albatross* variety, and in its habitus it resembles the growing parts of the latter in which independent branches are distinguishable.

The data indicate that in *C. frondifera* we are dealing, as Dendy has suggested, with a widely distributed and variable species. Among the variable structures we must include the dermal skeleton, which may be present in a highly developed state (var. *setotubulosa*) or only as a fairly distinct structure lacking characteristic spicules (Dendy's specimens of the type, 1905, p. 170, see previously), or it may be so inconspicuous (absent?) as to have escaped mention. If this series of forms is correctly interpreted as a group of varieties, *Rhaphidophlus* Ehlers in the usual sense (to which the variety here described, considered by itself, would be referable) can not be maintained. And, indeed, since Dendy, 1895 (p. 31), it has been generally, although not always, merged in *Clathria*. Recently Hallmann, 1912 (p. 175), would restore the genus, using it, however, in a special sense to include only species in which the projecting dermal styles are *of a special kind*, namely, derivatives of the echinating styles and typically shorter than the latter. I suspect that this definition is too precise to be of use in practice. Topsent (1920*d*, p. 17) is willing to restore the genus practically in its old sense.

CLATHRIA FASCICULATA, new species.

Plate 42, fig. 6; plate 49, figs. 7, 8.

One dried specimen from Togian Bay, Togian Island, Gulf of Tomini, Celebes.

The sponge is of fruticose appearance, branching and expanding from the attached base upward; the branches, commonly about 15 µ thick, anastomose freely with one another. Height of the whole mass 230 mm., greatest width 170 mm. Color, grayish red.

The surface is covered with closely set conuli, singly or in ridges, between which there is smooth membrane. Oscula 4 mm. and less in diameter, scattered over the sponge. Pores closed. Subdermal cavities underly the smooth parts of dermal membrane.

Skeletal framework consists of ascending main fibers which are compound (fascicled) and an intervening large-meshed irregular network of simple fibers. The main fibers are 300–500 μ thick and about 1–2 mm. apart. Each is made up of several compact elementary fibers, or funiculi, 50–100 μ thick, which lie close together, less than a spicule's length apart; the funiculi fuse with one another here and there, and are moreover connected together, sometimes by scattered spicules but more generally by small spicular bundles that are placed well apart from one another. The branches of the main fibers diverge in obliquely radial directions and pass singly into the conuli, where the funiculi are more intimately fused than elsewhere. The fibers consist of closely packed smooth styles and a little spongin; spongin not showing, or barely showing, on the outside of the funiculi. They are echinated with acanthostyles, but in many places very sparsely, perhaps owing to imperfect preservation.

The reticulum which stretches between the main fibers, is made up of simple fibers 50–85 μ thick. The meshes vary in size and shape, characteristic ones measuring 175 by 175 μ, 200 by 350 μ, 300 by 350 μ, 250 by 500 μ. The fibers are made up of closely packed smooth styles and some spongin; there is little or no spongin on the outside of the fiber, except at the nodes and round the bases of the acanthostyles. The echinating acanthostyles are fairly common in some regions, sparsely scattered in others; the differences may be due to the preservation.

Spicules.—1. Skeletal style (pl. 49, fig. 7), smooth, slightly curved, 200–280 by 8–12 μ; closely packed in skeletal fibers.

2. Dermal style (pl. 49, fig. 8, *a*, *b*), smooth, nearly straight; a great many about 100–120 by 3 μ, but they run up to 200–300 by 5–6 μ. Abundant in the dermal membrane, where they occupy, in general, a tangential position; over the conuli, they project radially, forming a furze, and elsewhere they may project in diverging tufts (bouquets), although not densely enough to form a furze.

3. Acanthostyle (pl. 49, fig. 7), 70–80 by 6 μ; head spinose and slightly enlarged; part of shaft near head usually less spinose than the distal half.

4. Isochela (pl. 49, fig. 8, *c*), palmate, small, 14–16 μ long, fairly abundant in the dermal membrane and in the membranes of the interior.

5. Rhaphides, as long as 200 μ but variable in length, although always long and slender; slightly bent or curved in irregular fashion;

usually separate, but sometimes in groups as trichodragmas; rarely occurring in the shape of the toxa.

Holotype.—Cat. No. 21326, U.S.N.M.

In some other species of *Clathria*, the skeletal framework has differentiated in the same general direction as in *C. fasciculata.* Thus Hentschel (1911, p. 364) describes a form (not named) in which the skeleton is made up of spicular bundles which ascend like pillars and between which is suspended, so to speak, a network of delicate horny fibers. And in *C. elegantula* (Ridley and Dendy, 1887, p. 149; Hentschel 1911, p. 372) there are ascending columns between which stretches a reticulum of fibers. But in these forms the columns and pillars are not fascicled.

Family AXINELLIDAE.

Axinellidae Ridley and Dendy, 1887, p. 166.

Sponge body ordinarily more or less upright, of a branching, lamellate, or cup-like habitus. But massive and even incrusting forms occur, the latter perhaps representing a developmental phase. Skeleton typically consists of ascending bundles of spiculo-fibers, from which arise subsidiary fibers which radiate to the surface. Skeletal fibers without spined echinating spicules and typically plumose. The characteristic megascleres are monactinal. In addition to these, diactinal megascleres may also occur and in some genera are the only form. Microscleres in the shape of microxeas (to include the acanthoxeas of some forms), trichodragmas, or sigmas occur in a few genera; cheloid microscleres do not occur.

Following Dendy (1905, p. 182), certain sponges with axinellid characters but with asters (*Vibulinus*, for example) have been generally transferred to the Astraxinellidae (in the *Hadromerina*), although Dendy himself now gives up this group. Topsent (1894*c*, p. 2, 1897; *b*, p. 249) had already transferred *Raspailia* to the Ectyoninae, a move that has been uniformly followed, *Syringella* being looked on as a subgenus of *Raspailia.* Even with these exclusions, Dendy, 1905 (p. 182), regards the family as ill-defined and probably polyphyletic. More recently, 1916*b*, he would delete the family, including the genera in the Haplosceridae. Still later, 1921*b*, he would retain the group as a subfamily in the Desmacidonidae. Doubtless there are good phylogenetic arguments underlying these proposed changes, but when one considers how little we know of the ontogeny and the heredity-variation phenomena of sponges, it must be confessed that the value of any considerable change in a generally accepted scheme of classification is at present problematical.

Over 30 genera have been enrolled in this family, but with respect to several there is little reason why they should be put here. With the exclusion of these, a good group is left centering round such forms as *Axinella, Phakellia*, *Acanthella*, and *Auletta*, which seem to be related, through *Raspailia* and *Axinella*-like species with a few acanthostyles (*Axinella acanthifera* George and Wilson, for instance, which I now think would best be transferred to *Raspailia*), to the Ectyoninae (Dendy's original position, see George and Wilson, 1919, p. 161). Hallmann, 1916, 1917, and Dendy, 1921*b* have recently discussed a number of the genera and their classification.

Genus AXINYSSA Lendenfeld (1897).

Axinyssa LENDENFELD, 1897, p. 116.

Axinellidae with conuli; skeletal spicules, oxeas. No microscleres. Lendenfeld's diagnosis, 1897, reads " massive axinellidae," but the species described below has a large apical cloacal cavity. Other species of the genus have been described or recorded by Kirkpatrick, 1903 (pp. 245, 246), and by Topsent, 1906 (p. 7).

Thiele, 1903 (p. 934), thinks it advisable to confine the axinellidae with oxeas (amphioxeas) to the following three genera: *Dactylella* Thiele, *Axinyssa* Lendenfeld, *Phycopsis* Carter. This rule, if rigidly followed out, would necessitate the removal from *Axinella*, and possibly other genera, of certain species that have been placed there. A distinction should probably be made between equiended and inequiended oxeas. The latter form is close to the style, and species with it might well be left in *Axinella*.

AXINYSSA ACULEATA, new species.

Plate 42, fig. 8; plate 49, fig. 9.

Two specimens, one (dried) from station 5254, the other from station 5641. The illustrations were made from the former specimen, which happened to be studied first.

Both specimens massive, attached below, with a large apical cloacal cavity, which is coextensive or nearly so with upper surface of sponge. In the dried specimen the horizontal diameter of the whole sponge is 140 mm., height 120 mm.; cloacal cavity 70–100 mm. wide and about 60 mm. deep. The other specimen is something over half as large, with a cloacal cavity that is relatively somewhat wider. Sponge firm but not hard. Color, brown.

Both surfaces, outer and cloacal, covered with minute, sharp spine-like conuli, which in general are connected with fine ridges; conuli

0.5 to something over 1 mm. high, 0.5 to 1 mm. apart. The outer surface of sponge is roughened by numerous elevations, which in the alcoholic specimen are irregular in shape, but in the dried specimen are short subcylindrical lobes projecting upward and outward; such lobes are mostly 10–15 mm. high and about 5 mm. in diameter, grading away into slight irregular protuberances. Surface of cloaca lacks the elevations which make the outer surface so uneven.

A few pores are distinguishable in the alcoholic specimen; doubtless most are closed; the open pores are scattered over both surfaces, where they perforate the thin dermal membrane and lead directly into the subdermal cavities which are of moderate size. Oscula 1 to 4 mm. in diameter are scattered over both surfaces; they are larger and more abundant in the dried specimen than in the other.

Skeletal framework consists of ascending spicular tracts interwoven so as to form a loose irregular reticulum which nearly fills the whole sponge body, breaking up close to each surface into short obliquely radial tracts which enter and support the conuli and connecting ridges. The spicules of a radial tract separate so that a conulus contains a very few spicules, usually only two or three and sometimes only one (pl. 49, fig. 9). Spongin very scanty and the tracts of the main skeleton thus not well defined; these tracts 150–250 μ thick and crowded, the meshes between them often 300–400 μ wide, longer than wide. Between the tracts of the main reticulum lie scattered spicules, which close to the surface may assume a tangential position, thus extending between the radial tracts where the latter enter the conuli. The short radial tracts of this species may be taken to represent the radial fibers of axinellids in which the skeleton is distinctly differentiated into an axial part and a peripheral part.

Spicules.—Oxea (pl. 49, fig. 9), equiended, cylindrical, smooth, slightly curved, sharp pointed; 1000–1500 by 30–40 μ. Slender, young forms of course occur. A very few styles occur, intermingled with the oxea, but no more than might be expected to occur through variation in any sponge with diactinal megascleres. Another variation occurs, rarely, in both specimens; in this type the oxea is not evenly curved, but is sharply, although not much, bent at some point which is usually not the middle, the spicule hence asymmetrical. A third variation, which may be looked on as an intensification of the last occasionally occurs in one (the dried) specimen; the oxea of this type is curved at several points, thus becoming serpentine; such spicules were found in the interior, perhaps serving as binders; they correspond to smaller sizes of the typical spicule, a characteristic one measuring 500 by 10 μ.

Foreign spicules (small raphid-like oxeas, sigmas, and sigma-like oxeas) occur in the alcoholic specimen at the surface in spots. They are in such places abundant enough to be deceptive, making the impression of being intrinsic elements of the skeleton.

Holotype.—Cat. No. 21341, U.S.N.M.

Suborder LITHISTIDA

Lithistida O. SCHMIDT, 1870, p. 21.

The characteristic megascleres are desmas, generally united into a coherent framework.

The current internal classification of the *Lithistida* which we owe to Sollas (1888) and which with minor changes is employed in Lendenfield's synopsis (1903) is open to some criticism, as Dendy, 1905 (pp. 99, 102), and Hentschel (1912, pp. 305–06) have pointed out. It remains, however, very usable, although if the subdivisions *Hoplophora* and *Anoplia* continue to be employed the *Anoplia* must be extended to include forms with microscleres (see below. *Taprobane*).

Family THEONELLIDAE.

Tetracladidae SOLLAS, 1888, p. 284.
Theonellidae LENDENFELD, 1903, p. 126.

With special ectosomal megascleres, having the character of trienes (phyllotriaenes, discotriaenes, dicho- or trichotriaenes). The desma is tetracrepid or rarely tricrepid. With microscleres.

Lendenfeld, 1903, changes the name (Zittel's) of the family as used by Sollas; adds *Sulcastrella* O. Schmidt, in which the desma is apparently tricrepid; and merges the following genera: *Neosiphonia* Sollas into *Jereopsis* O. Schmidt, *Rimella* O. Schmidt into *Racodiscula* Zittel, *Collinella* O. Schmidt into *Discodermia* Bocage.

The following forms not included in, or described later than, Lendenfeld's synopsis (1903) fall in this family: *Theonella levior* Lendenfeld (1906, p. 344), *T. lacerata* Lendenfeld (1906, p. 347), *T. annulata* Lendenfeld (1906, p. 350), *T. discifera* (1906, p. 351), *T. pulchrifolia* Dendy (1921*b*, p. 5); *Discodermia natalensis* Kirkpatrick (1902*b*, p. 172), *D. emarginata* Dendy (1905, p. 99), *D. ramifera* Topsent (1904, p. 57), *D. tuberosa* Dendy (1921*b*, p. 6); *Racodiscula clava* (Schmidt) (Topsent, 1904, p. 58).

Genus THEONELLA Gray (1868).

Theonella GRAY, 1868*b*. p. 438.—SOLLAS, 1888, p. 284.—THIELE, 1900, p. 50.—LENDENFELD, 1903, p. 126; 1906, p. 344.

With tetracrepid desmas; with phyllotriaene ectosomal spicules, clads simple or dichotomous or more complexly branched, these spicules grading over in some species to the dichotriaene form; with microrhabds that are usually strongylate but sometimes oxeate.

Thiele, 1900, discusses Sollas' definition of the genus, and would not limit it to cup or vase shaped forms, nor to those with the pores in sieves, but would leave only the skeletal characters as diagnostic. Lendenfeld 1903 adopts this change.

Lendenfeld, 1906 (pp. 343–44), makes a change in the customary distinction between *Theonella* and *Discodermia*, owing to his discovery of a form (*T. discifera*, 1906, p. 351), in which characters hitherto regarded as differentials—namely, phyllo- or discotriaenes—intergrade. This is a good case of the familiar phenomenon that genera which seem to be natural are found, as the number of known species increases, to intergrade with respect to one or more of the differential characters (Wilson, 1919, 1919*b*). The possession of microxeas, larger than the microscleres (strongylate) proper, would still continue, in Lendenfeld's scheme, to set off *Discodermia* from *Theonella*. But these two classes of spicules intergrade in some species, as for instance, *Discodermia ramifera* Topsent (1904, p. 58), where they form but a single class, the range in length being 20–45 μ. The same holds for *Discodermia emarginata*, var. *lamellaris* of this report. In most of the recorded species of *Discodermia* the difference in size between the microrhabds and the microxeas is not very great, the former ranging about 10–20 μ, the latter up to 50 μ, in length. In a few species, however, the categories are quite distinct, as in *D. panoplia* Sollas, where the microxeas have a length of 70–100 μ, the microrhabds a length of only 10–15 μ.

THEONELLA SWINHOEI Gray.

Theonella swinhoei Gray, 1868*b*, p. 565.—Sollas, 1888, p. 284.—Lendenfeld, 1903, p. 126.

Four specimens, two from station D5218, one from D5593, and one from D5252, cannot be separated from one another nor from Gray's species. They show however that the species idea must be somewhat modified. Thus the ridges and projecting lobes which are conspicuous on the surface of some specimens (Sollas, 1888, Lendenfeld, 1903) may be absent in others. The vasiform habit with single cylindrical cloaca extending nearly through the entire sponge, again, is not constant. For the cloaca may extend only through the upper half of the sponge, or instead of being vasiform the sponge may be massive, the upper surface bearing several oscula, each leading into a cloacal canal which extends through one-quarter to one-third the total height of the sponge. The pores are not strictly in groups (sieves, Sollas), but the whole dermal membrane is uniformly porous. The system of larger subdermal cavities which may be joined "together to form irregular sinuous canals, having a somewhat stellate arrangement," which are "seen as dark spaces through the skin" (Sollas, 1888), is not constant. The species remains characterized especially by the skeletal elements, in particular by the phyllotriaenes. These spicules are arranged in several layers in the ectosome; the rhabdome is short; the clads long and narrow with irregular outline, very variable in the same specimen, and indeed in the same spicule, sometimes simple, sometimes irregularly bifurcate or even trifurcate—that is, with secondary branches that divide.

One of the specimens from D5218 is about cylindrical, tapering toward the upper end, passing below into an expanded amorphous basal part; 65 mm. high, 35 mm. in transverse diameter. An osculum, 6 mm. in diameter, at the upper end passes into a cylindrical cloaca which extends down nearly to the base of the sponge. The second specimen, 80 mm. high with transverse diameter of 50 mm., from this locality is very similar. The base of this specimen has been torn off. The osculum measures 10 mm., the cloaca 15 mm., in cross diameter. Color of these sponges, a light brown.

The sponge from D5593 is 90 mm. in height, with a transverse diameter of 50 mm. in the upper half, widening below; vase-like; osculum 15 mm. in diameter; cloaca 18 mm. in diameter, tapering below, 45 mm. deep. The apertures of the very numerous canals opening into it are not all open, some being closed in with sieve-membranes.

The specimen from D5252 is not vasiform, but massive; somewhat elongated vertically, larger above, smaller below near the basal surface by which sponge was attached; height 95 mm., horizontal diameter 80 mm. above, 50 mm. below. The somewhat flattened upper surface bears four oscula, 8–10 mm. in diameter, each leading into a cloacal canal of about the same width and 20–30 mm. deep.

In none of these specimens does the surface bear marked ridges or protuberances.

The pores are strictly not in groups, although they may appear so. The fact is that the dermal membrane, riddled everywhere with pores, rests immediately on narrow subdermal trabeculae about 60 mm. thick, which include the clads of the phyllotriaenes and which surround and inclose small subdermal chambers, 150–230 μ in diameter. Into each of these chambers a few, 1–5, pores open. Balsam preparations show that, as is so often the case in sponges, there are pores directly over the subdermal trabeculae as well as between them, the trabeculae only *appearing* to be solid.

The larger subdermal spaces, other than the small uniformly distributed ones just referred to, as seen through the dermal membrane, vary in appearance in the different specimens. In those from D5218 they are inconspicuous and rounded. In that from D5593 they are conspicuous, narrow, sinuous canals, about 1 mm. wide, and about 10 mm. apart, which anastomose to form a coarse network. In the specimen from D5252 these spaces for the most part are rounded and separate, but there are also narrow, subdermal, tangential channels as in the sponge from 5593. The various appearances, including that of Sollas' specimens (Sollas, 1888, p. 285), seem to be due to the degree in which conspicuous tangential canals are developed interconnecting the subdermal mouths of the canals which penetrate the interior.

In details of surface appearance, including the color, which is lighter, the specimens from D5252 and D5593 resemble one another more than they do those from D5218 and, as will be seen below, this is true also for the microstrongyles.

The skeletal measurements are close to or within those recorded by Lendenfeld for the species. In the desma the clads are 30–40 μ thick, 200–250 μ long if simple, but sometimes bifurcating. Zygosis terminal.

In the phyllotriaene the rhabdome, 80–130 μ long, 12–20 μ thick, tapers to a point, sometimes strongylate. Clads, if simple, 200–300 μ long, commonly 12–16 μ wide (width varies from 8 to 20 μ). In a selected characteristic bifurcate clad, primary branch (protoclad) was 70 μ long, secondary (deuteroclad) 200 μ long. In another the protoclad was 105 μ long, the deuteroclads 110 and 50 μ long. The spicules, as said, are very variable.

Skeletal rhabds, strongylate or very slightly tylote at the ends, 400–500 by 8 μ, in bundles, some of them radial to the surface, and scattered through the interior. Very abundant in the neighborhood of the osculum, beyond the limits of the desmas.

Microstrongyles in the specimens from D5218, 20–24 by 3 μ; in those from D5593 and D5252, smaller, only 12 by 2–3 μ; in all, curved or bent as usual, the surface roughened in a feebly spinose fashion. The range for the previously recorded specimens is 15–30 by 2–3.9 μ (Lendenfeld, 1903).

The species has been recorded from the neighborhood of Ternate, Celebes, Amboina, Manila, and Formosa.

THEONELLA SWINHOEI Gray, var. VERRUCOSA, new variety.

Plate 43, fig. 1; plate 49, fig. 10.

One (dried) specimen from D5356.

The sponge here recorded differs from the type in two features, precise enough for use in classification. The epactines of the desmas are not smooth as in the type, but verrucose with low conical tubercles; and the microstrongyles of the surface are smaller than those of the interior.

Body vasiform, subspheroidal, somewhat obconical, higher than wide (120 mm. high, 110 mm. across the upper surface). Base flattened. Surface with low irregular bosses. Cloaca extending through the body, its aperture on upper surface of sponge 35 mm. wide. Color varies from gray to brown.

The epactines of the desmas may be simple or bifurcated or may end in flattened extremities, as Sollas has pointed out (1888, p. 285). They are in general distinctly verrucose, sometimes strongly so, sometimes weakly so, and sometimes smooth. The low blunt conical tubercles, sometimes arranged in rings, cover the shaft, and are distinct from the complex tubercles developed in the region of zygosis. In general the zygosis is terminal, as described by Sollas, the skeletal reticulum showing nodal enlargements. But sometimes the tuberculate enlargement extends from the node along the whole side of a skeletal mesh. The union in such a case is no doubt lateral as described by Thiele (1900, p. 53), and as I have been able to observe myself in some instances. The epactines are thicker than in the type, their thickness ranging from 40 to 70 µ. The skeletal meshes vary from 130 by 80 µ to 250 by 250 µ.

The phyllotriaenes (pl. 49, fig. 10) are larger than in the type. The clads are bifurcate or, not rarely, trifurcate. Width of protoclad 24–40 µ, length of protoclad and deuteroclad together commonly about 350 µ. Rhabdome about 100 by 30–40 µ. The phyllotriaenes form a single layer, not several as in the type.

The skeletal strongyles, 500 by 7–8 µ, lie chiefly in small radial bundles between the subdermal cavities, along with the outermost radially directed beams of the skeletal framework.

The microstrongyles are abundant in the interior and in the dermal membrane. In the interior the spicules measure 10–22 by 2–3 µ, the larger sizes the common ones. The spicules are roughened in the usual way, and the larger ones commonly curved or bent in the middle. In the dermal membrane, with a few exceptions here and there, they measure only 10–12 by 2–3 µ, and are straight or nearly so.

Holotype.—Cat. No. 21342, U.S.N.M.

THEONELLA INVAGINATA, new species.

Plate 43, fig. 2; plate 49, figs. 11, 12, 13, 14, 15.

One specimen from station D5335.

Sponge vasiform, tapering below to the attached base; 35 mm. high, 20 mm. across at the upper end. A terminal osculum, 2 mm. wide, leads into a long narrow cloaca having a maximum width of

5 mm., which extends to the lower end of the sponge. The cloaca opens to the exterior not only at the terminal osculum, but by means of lateral diverticula at three other oscula as well. Two of these are near the upper end, one near the lower. All the oscula (pseudoscula, as they would more properly be called) are of about the same size. Sponge stony; pinkish-brown.

Pores in the rounded meshes of a skeletal reticulum that is formed by the overlapping clads of the ectosomal phyllotriaenes. Meshes of the reticulum 150–200 µ in diameter; two or three pores, sometimes only one pore, in each mesh.

The tetracrepid desma (pl. 49, figs. 11, 15) starts out as a triaene. The four primary clads, which become more or less branched, make bold curves, bounding different skeletal meshes. They become tuberculate at the ends where they enter into zygosis. The primary clads frequently but not always bifurcate, and the secondary branches again may send out short branches; all branches tuberculate at the ends, zygosis being terminal. Primary clads about 35 µ thick. Length of undivided clad 100–175 µ. In a bifurcated clad, primary branch 75–125 µ long, secondary branches 50–140 µ long.

The dermal phyllotriaenes (pl. 49, fig. 12) form a single layer. Rhabdome is about 150 by 20 µ, tapering to a point. Typically there are three narrow primary clads which branch irregularly, the spicules being, thus, not far removed from the dichotriaene type. There is considerable variation, however, as regards details. One of the primary clads may not branch, while the others do. Or a primary clad may simply widen out into an irregular termination instead of branching. The secondary clads often do not branch, or some branch and others do not. Occasionally there may apear to be four main clads, but this is probably due to bifurcation of one of the three primary clads close to the center. Length of clads variable; primary clads commonly 100–200 µ long, 35 µ wide; secondary clads commonly 75–150 µ long.

The membrane lining the cloaca includes phyllotriaenes, which may be designated gastral phyllotriaenes, arranged in a single layer with rhadomes vertical to the surface. They (pl. 49, figs. 13, 14) are of a different type from those of the dermal surface, varying toward the discotriaene form. Rhabdome 60–90 by 12–14 µ. The cladomes which overlap in an irregular way are greatly flattened and very thin. They vary from that of an ordinary phyllotriaene with dichotomous clads to an irregular platelike cladome in which clads are not distinguishable. Often three primary clads are present in the shape of stout wide lobes which expand terminally but are not subdivided. Or the unexpanded end of the lobelike clad may be subdivided by a shallow notch into two secondary lobes. Greatest diameter of cladome 180–450 μ.

Long slender smooth rhabds occur in the ectosome of the dermal and gastral surfaces. In the dermal ectosome they form radial bundles, and are also scattered singly. In the gastral ectosome they form both radial and tangential bundles. The spicules, which are difficult to isolate whole, reach a length of 420 μ and are 4–6 μ thick. They include strongyles with slightly tylote ends and styles which taper evenly to a point and are placed with the rounded end outermost.

Microrhabds form a crust at the dermal and gastral surfaces, and are abundant in the interior. They measure 8–12 μ in length, 2 μ thick; surface prickly; ends strongylate or oxeate.

Holotype.—Cat. No. 21304, U.S.N.M.

From the fact that in this sponge the cloacal membrane includes phyllotriaenes, it is probable that the cloaca is to be looked on as having a different morphological value—that is, as having arisen phylogenetically in a different way, and probably as produced ontogenetically in a different way, from the cloaca of other species of *Theonella*, such as *T. swinhoei.* In the latter species the lining membrane of the cloaca (or cloacae) is like that of the canals in general—namely, contains abundant microrhabds but no phyllotriaenes. The cloaca then in such species is probably to be looked on as merely an enlarged canal, or as a space produced by the fusion of canals during ontogenetic growth. In *T. invaginata*, on the contrary, the cloacal lining seems to represent an inturned part of the ectosome—that is, a part which has become virtually inturned through the continued upward growth of the margin of the young sponge.

Analogies to the species here described are presented by *T. discifera* Lendenfeld (1906, p. 351) from the west coast of Australia, and in a less degree by *T. lacerata* Lendenfeld (1906, p. 347) from near Sumatra. In the dermal phyllotriaenes of the latter species the clads are very wide and irregular, sometimes undivided, the cladome thus varying in the direction of the discotriaene (1906, pl. 44, figs. 1, 3). In the former species the dermal triaenes are a mixture of phyllotriaenes, discotriaenes, and intermediate forms (1906, pl. 43, figs. 8–12). The variation in these species toward the discotriaene form, it will be noticed, affects the triaenes of the surface in general, whereas in the *Albatross* species this tendency comes into activity only over the inner (probably in an earlier stage of growth, the upper) face of the sponge.

THEONELLA CYLINDRICA, new species.

Plate 44, fig. 4; plate 50, figs. 1, 2, 3.

One specimen from station D5593.

Sponge irregularly cylindrical, 80 mm. high, 9 to 13 mm. in transverse diameter, bearing several protuberances, and expanded below where it was probably attached. Sponge rigid; yellowish brown in color.

The dermal membrane exhibits the usual closely set, more or less rounded, pore areas separated by the dermal skeletal reticulum made up of overlapping clads of the phyllotriaenes. The pore areas are about 150–200 μ in diameter, each including 3–6 pores. Only a single osculum is to be seen, slightly less than 2 mm. in diameter, leading into a small cloacal canal; this is on the side of the sponge, upon one of the protuberances. Sponge interior contains only fine canals, 0.5 mm. and less in diameter. There are numerous small subdermal cavities.

The ectosomal phyllotriaenes (pl. 50, fig. 1, *a*, *b*) form a single layer. Rhabdome short, sharp pointed or rounded at the apex; usually a little irregular; about 100 by 22 μ. Clads variable and irregular; flattened and narrow; bifurcated or not; but typically some, though not all, the clads of a spicule are bifurcated; greatest length of an entire clad about 250 μ, width 28–30 μ. Clads closely interlaced to form a firm dermal skeletal reticulum.

The clads of the tetracrepid desmas (pl. 50, figs. 2, 3) are smooth except at the ends, where zygosis takes place. Here they break up into a few, short branches bearing irregular tubercles. Clads 140–175 μ long, about 35 μ thick.

The skeletal rhabds are long and slender, about 600 by 5 μ; strongylate at the outer end, strongylate or tapering to a point at the inner end; chiefly in bundles that are more or less radial to the surface, but there are some scattered spicules.

The microrhabds are very small, 8 by 3 μ; rounded at the ends and roughened with minute prickles; abundant in dermal membrane and interior.

Holotype.—Cat. No. 21305, U.S.N.M.

In respect to habitus, the sponge approaches closest to *Theonella conica* (Kieschnick). But in this species (Thiele, 1900, p. 50) the clads of the phyllotriaenes are not branched, and the skeletal framework is feeble, the desmas being easily isolated. Except for the habitus and the unusually small size of the microrhabds the sponge would not be separable from *T. swinhoei.*

Genus DISCODERMIA Bocage (1869).

Discodermia Bocage, 1869, p. 160.—Sollas, 1888, p. 292.—Thiele, 1900, p. 51.—Lendenfeld, 1903, p. 128.—Dendy, 1905, p. 99.—Lendenfeld, 1906, p. 353.

With tetracrepid desmas; ectosomal megascleres are discotriaenes; microscleres are strongylate microrhabds and larger microxeas, which in some species intergrade forming but one class of spicule.

Some reference to the facts underlying the separation of *Discodermia* from *Theonella* has already been made under *Theonella*. It is evident that the two genera can not be sharply separated, either on the score of the discotriaenes or on the possession of microxeas. Nevertheless, while the two groups of species intergrade, it seems advisable to retain, at least for the present, both genera.

DISCODERMIA EMARGINATA Dendy.

Discodermia emarginata Dendy, 1905, p. 99.

A single specimen from station D5414, agreeing closely with Dendy's type, from the Gulf of Manaar, in respect to habitus and skeleton.

The sponge is an amorphous mass about 40 mm. in diameter, showing low rounded protuberances. It is attached to another sponge, *Petrosia crustata.* The consistency is dense and stony. No oscula were discoverable with certainty. Doubtless they are small apertures, more or less closed, as in the specimen of var. *lamellaris* (see below), and so scattered as to escape observation. The pores 30–50 μ in diameter, are scattered over the surface, in the gaps in the dermal armor formed by the overlapping disk-like cladomes of the triaenes. They occur singly; or in groups of two or three, or sometimes in curving rows which include a number (up to about six) of pores. They open for the most part into small rounded subdermal spaces which are independent of one another, each connecting with the exterior by one or a few pores.

The desmas are similar both in adult and developmental stages to those described by Dendy.

The discotriaenes are like those of the type. Diameters of the cladome range commonly from 180 to 250 μ. The spines on the outer face are low and conical, disappearing near the margin of the disk. The rhabdome, 80–150 μ long by 20–30 μ thick, is pointed or rounded at the apex.

The long slender rhabds are common. They are sometimes, I think always, oxeate at both ends; 5 to 8 μ thick, and in the neighborhood of 1 mm. long. They occur in loose bundles, oblique or radial to the surface, in the peripheral part of the sponge and seem to be especially abundant at the apices of the rounded protuberances.

In Dendy's type no microxeas are mentioned. The microrhabds are described as "usually fusiform and strongylate, with very minutely roughened surface"; 16 µ long. In the *Albatross* specimen the microrhabds are similar, the ends strongylate to oxeate but never sharp; 12–18 µ long by 2–3 µ thick at the middle. They form a thin layer, one spicule thick, external to the triaene cladomes; are especially abundant round the pores, and common in the walls of the canals and throughout the interior.

Using Lendenfeld's definitions of Theonellid genera (1903), the sponge falls in *Kaliapsis.* But the spinose character of the outer face of the disk in the triaene, on which Lendenfeld lays emphasis, does not seem to be a sufficient reason for separating such species from *Discodermia.*

DISCODERMIA EMARGINATA Dendy, var. LAMELLARIS, new variety.

Plate 43, fig 5.

Under this heading I record two specimens from station D5482 of lamellate habitus, one face bearing the oscula, the other the pores, as in some other species of the genus (*D. discifurca* Sollas, *D. ornata* Sollas). The skeletal and other differences from the type are slight, and it is not improbable that the variety merely represents an older stage of growth, the type a younger one.

In the specimen illustrated the base is amorphous, from which the body rises in the shape of an irregular lamella about 5 mm. thick. This is curved, showing a concave and a convex surface. The concave surface bears the oscula which are just visible to the eye; the opposite surface bears the pores. The greatest diameter of the whole mass is 50 mm.

In the other specimen, the body rises from a flattened base as a curved lamella similar to the preceding. But several lamellate outgrowths seem here to have fused with one another in an irregular way, so as to surround and imperfectly roof in a space. Greatest diameter of the whole mass 65 mm.

The oscula are abundant, 250 µ to 1 mm. apart. Most are closed by the usual thin membranes, but the cylindrical oscular canals leading radially inward are conspicuous. The osculum, when fully open, probably has about the diameter of the oscular canal, which ranges from 80 to 195 µ, exceptionally reaching 250 µ.

The arrangement of pores is interesting. They are much more numerous than in the specimen assigned to the type, but of about the same size. They are closely set in rows, one pore wide. The rows of pores interconnect with one another and thus give rise to an irregular reticulum. In each mesh of the reticulum there is sometimes only one, more often a number (two to four), of the discotriaene cladomes.

In correlation with the increase in the number of pores, the subdermal cavities, which in the specimen assigned to the type had already begun to fuse in rows, here constitute tubular channels, about 250 μ wide, which extend parallel to and just beneath the surface membrane. Such channels have obviously been produced by the continued formation of small subdermal cavities and their fusion in rows. (They are best seen in thick tangential sections of the surface region, examined from the inner side.)

Again, the main afferent and efferent canals have acquired a certain regularity of arrangement in correlation with the lamellate shape and the differentiation of the two faces as oscular and poriferous. They are of about the same size and they both pass radially into the sponge interior from the respective faces.

As to the skeleton of these lamellate specimens, the long slender rhabds are especially abundant in the marginal region. Otherwise the only skeletal difference from the type concerns the microscleres. These are here less uniform, ranging commonly from 8 to 25 μ in length, 2 to 3 μ thick at the middle; not infrequently reaching a size of 40 by 4 μ. All the spicules are minutely roughened, thicker in the middle and tapering toward the ends; ends strongylate in the smaller spicules, oxeate in the larger but never sharp; in the larger spicules, the two halves commonly bent at a slight angle; the larger spicules sometimes distinctly centrotylote. While the presence in considerable numbers of the very small rhabds, often narrowly ellipsoidal in shape, catches the eye, all sizes and shapes of these spicules are intermingled and intergrade so that they can not be separated; the distribution is the same as in the specimen assigned to the type. Thus as in the case recorded by Topsent, *Discodermia ramifera* (Topsent 1904, p. 58), the microscleres here form a single category which includes both the *microrhabds* and the *microxeas* of the conventional generic diagnosis as given for instance by Sollas (1888) and Lendenfeld (1903, 1906).

Holotype.—Cat. No. 21260, U.S.N.M.

Genus JEREOPSIS O. Schmidt (1879).

Jereopsis O. SCHMIDT, 1879, p. 20.—LENDENFELD, 1903, p. 133.
Neosiphonia SOLLAS, 1888, pp. 299, 334.

The desma is tetracrepid; crepis, in some species at least, an amphitriaene. The ectosomal triaenes are dichotriaenes or trichotriaenes. With streptasters that vary from the spiraster to the amphiaster type.

JEREOPSIS FRUTICOSA, new species.

Plate 43, fig. 3; plate 50, figs. 4, 5, 6, 7, 9, 11, 12.

One specimen from station D5168.

Sponge body a fruticose mass consisting of branches which diverge from the small basal part, anastomosing here and there with one another. Whole mass 55 mm. high, 90 mm. in one horizontal axis, 50 mm. in the other. Branches fundamentally cylindrical, about 7 mm. in diameter; somewhat flattened and lobe-like, especially at the ends. Oscula, 1 mm. in diameter, at the ends, and in rows along the flattened upper side, of the branches; no oscula on under surface of sponge. Sponge hard, stony; brownish yellow.

Spicules.—1. Desma. The desma is built not on a calthrops nor a simple triaene but on an amphitriaene, as is shown by the folllowering facts. Small free amphitriaenes (pl. 50, fig. 4) about 160 μ long occur sparingly in the ectosome. In these the axial canal extends through the shaft, and to the tip of each clad. In the young desmas (pl. 50, fig. 5), which occur in the ectosome and which are free or only slightly connected with the skeletal framework, the amphitriaene character is still obvious. Comparison with the first stage (pl. 50, fig. 4) shows that the shaft has increased in thickness but not in length. The clads on the other hand have increased greatly in length, although the axial canal extends only into the basal part of the clad. In the adult desma (pl. 50, fig. 9) the axial canal system continues to reveal the original amphitriaene state—that is, it has not changed with the growth of the desma, the canals still extending into the bases of the primary clads. From the end, however, of each branch of the original axial canal system (a system of sharp, distinct lines) there may be traced, after boiling in nitric acid, a pale granular axial streak which extends throughout the branching clad. Comparison with the earlier stages shows that the shaft has continued to increase in thickness but has retained its original length. The clads vary greatly in different spicules and even on the same spicule. The original (primary) clad may remain undivided, or secondary clads may be formed on it, and even tertiary clads on the secondary. There seems to be a law of growth whereby no unbranched clad shall materially exceed the shaft in length. Zygosis is established through the development of abundant bulbous interlocking projections on the ends and sides of the *terminal* clads, whether these be primary, secondary, or tertiary (pl. 50, figs. 7, 12). In the adult desma the shaft is 50–60 μ thick; the meshes of the skeletal framework 90–210 μ in diameter. The peculiar desma of this species and the interpretation of the facts have been discussed in an earlier paper (Wilson 1920).

2. Dichotriaenes. The cladomes (pl. 50, fig. 11) lie in the dermal membrane; primary clad 30–35 by 17–21 μ, secondary clads 100-130 μ long. Rhabdome 105–125 by 14–21 μ, pointed at the end, sometimes bluntly. Spicules are common in which one or a few of the terminal clads are not of full size, sometimes slightly deformed. The trichotriaene variation, found in *Jereopsis superstes* (Sollas), was not observed.

3. Oxeas. Small oxeas, 100–180 by 4–5 μ, occur alongside the rhabdomes of the triaenes, projecting slightly from the surface. Larger oxeas, about 240 by 5 μ, occur in the ectosome apart from the triaenes, but radial to the surface, singly or in bundles of a few. These and the small forms are fairly abundant round the oscule.

A few large oxeas, possibly foreign, were observed; they measured 400–600 by 16–24 μ, with blunt ends.

4. Streptasters. The spicules of the interior are amphiasters (pl. 50, fig. 6, *a*) or amphiasters that approach the spiraster type (fig. 6, *b*). In the former, the total length of which is about 24 μ, there are about four long, slender rays at each end of the short slender axis. In the latter class of amphiaster the total length is about 20 μ, the axis is stouter, and the rays somewhat shorter, stouter, more numerous and more distributed along the axis.

The streptasters of the dermal membrane (pl. 50, fig. 6, *c*) are spirasters about 16 μ long. Rays shorter and blunter and more numerous than in the spicules of the interior, and scarcely or not at all grouped at the ends of the axis. All classes of streptaster are minutely roughened.

Holotype.—Cat. No. 21271, U.S.N.M.

Family COSCINOSPONGIIDAE.

Corallistidae SOLLAS, 1888, p. 301.
Coscinospongiidae LENDENFELD, 1903, p. 135.

With ectosomal triaenes which may be dichotriaenes, phyllotriaenes, or discotriaenes. Desma monocrepid and tuberculate.

Lendenfeld accepts the family in Sollas' sense but restores Coscinospongia Bowerbank, not recognized by Sollas, into which he merges two of the genera used by Sollas, *Corallistes* and *Heterophymia*, thus making it necessary to change the family name. By other mergings Lendenfeld still further reduces the number of genera employed by Sollas.

In this family there have been described since Lendenfeld's synopsis (1903) *Coscinospongia gracilis* Lendenfeld (1906, p. 354), *Macandrewia auris* Lendenfeld (1906, p. 358), *M. robusta* Topsent (1904, p. 61), *M. ramosa* Topsent (1904, p. 62).

Genus COSCINOSPONGIA Bowerbank (1869).

Coscinospongia Bowerbank, 1869, pp. 85, 99.—Lendenfeld, 1903, p. 135 (synonomy).

The dermal triaenes are dichotriaenes or derivatives of the same, regarded as mesotriaenes with distal ray but without rhabdome.

COSCINOSPONGIA THOMASI (Sollas).

Plate 50, fig. 10.

Corallistes thomasi Sollas, 1888, p. 307.
Coscinospongia thomasi (Sollas), Lendenfeld, 1903, p. 137.

Station D5513, two specimens: lamellate, ascending in the water, attached below, the free margin rounded. One measures 75 mm. wide, 60 mm. high, about 4 mm. thick. The other is somewhat smaller and broken. Color, light brown. Both sponges considerably larger than Sollas' specimen.

The sponges show there is no constant relation between convexity and concavity of surface and the distribution of pores and oscula. For in one specimen the pores are on the more convex side, oscula on the more concave, while the opposite is true of the other specimen. The pore areas are small circular depressions about 200 μ in diameter and 0.5 mm. apart. In the center of the area, in a few cases, a minute aperture, the pore, has remained open. The very similar oscular areas on the other side are somewhat larger, about 300 μ in diameter and 1–2 mm. apart. Again, in a few cases, a minute aperture, the osculum, has remained open in the center of the area.

The spicule measurements are close to those given by Sollas (1888).

The desma (pl. 50, fig. 10) shows the characteristic fungiform tubercles, some of the tubercles on the most peripheral desmas supporting the dermal membrane along with the cladomes of the triaenes. The length of a developed desma is 400–500 μ, thickness of middle body, epirhabd, 30–35 μ. There are several clads, reaching 175 μ in length, and the spicules present bold curves which help to bound different skeletal meshes. The tubercles are for the most part simple, or there are two or three closely juxtaposed tubercles on the same stalk, or the tubercle may be indented as if subdividing. Range in width of tubercle 24–50 μ.

In the dichotriaene, the rhabdome measures 210–280 by 28–35 μ; primary clad 28–35 μ long and about as wide; secondary clads 65–100 μ long, not always alike in same spicule, sometimes irregularly curved. Margins and upper surface of clads uneven, about as in Sollas' specimens.

Very slender rhabd spicules occur on the pore side of the sponge. They lie in the ectosome, radial to the surface and projecting beyond it; fairly abundant, but distributed singly at distinct intervals. The spicules are oxeas, 300–350 by 1–2 µ. They doubtless correspond to the orthotrichites observed by Sollas (1888, p. 307) in boiled out preparations.

The dermal crust formed by the microstrongyles is one layer deep. The spicules have the characteristic wavy (angularly serpentine) shape and measure 24–32 by 4–5 µ.

The streptasters are 20–24 µ long; axis short, slightly curved, sometimes appearing to be straight; the rays, tapering and sharp-pointed, commonly both on the axis and at the ends. The spicule varies, as in Sollas' specimen, from forms with shorter and more numerous rays to those with longer and fewer, frequently 5–8, rays. The amphiaster shape, with about 3 rays at each end, is sometimes assumed.

Family PLEROMIDAE.

Pleromidae Sollas, 1888, p. 312.
Pleromatidae Lendenfeld, 1903, p. 140.

With special ectosomal megascleres having the form of triaenes. Desma monocrepid and not tuberculate, sometimes of a simple rod-like character.

COSTIFER, new genus.

Desmas typically rodlike, without clads; loosely articulated together. Other megascleres are ectosomal plagiotriaenes, large oxeas radial to the surface, and small parenchymal oxeas. Microscleres, streptasters and microrhabds.

COSTIFER VASIFORMIS, new species.

Plate 43, fig. 6; plate 50, figs. 8, 13, 14; plate 51, fig. 1.

Station D5168, one specimen, dried.

A vase-shaped sponge 270 mm. high; transverse diameters of upper end, 280 mm. and 210 mm.; base flattened and about 150 mm. wide. The cloacal cavity extends throughout the sponge and is, no doubt accidentally, open below. Wall of vase 20–25 mm. thick in the upper part of sponge, thicker below. Sponge heavy, firm and incompressible, but scarcely stony. Color, light brown to light gray.

Outer surface of sponge much incrusted with foreign matter. Naturally it is covered with a crust of projecting plagiotriaenes. Closely set fine canals, 0.25–0.5 mm. in diameter, extend in from this surface, their apertures more or less covered by the layer of plagiotriaenes. The surface of the cloacal cavity shows closely set, rounded apertures, 1 mm. and less in diameter; these doubtless are small oscula.

Spicules.—1. Skeletal desma, monocrepid; commonly rodlike without clads and with two concave articular surfaces (pl. 50, fig. 13). Rod somewhat curved or bent; smooth or slightly roughened with a few vague elevations; ends tapering, or rounded and blunt, sometimes gnarled. Rarely desmas occur (pl. 50, fig. 8) in which the epirhabd has developed one or a few clads, the articular facets still remaining on the epirhabd. The desmas are loosely articulated together and fall apart during boiling. They are distributed uniformly throughout the parenchyma. Common length of desma, 2.0–2.5 mm., diameter 110–170 µ.

2. Large oxeas (pl. 50, fig. 14 *a*), 2–2.5 mm. long, about 70 µ thick; arranged more or less vertically to the dermal membrane at both surfaces.

3. Plagiotriaenes (pl. 50, fig. 14, *b*), abundant at both surfaces. Rhabdome about 850 µ long, 45 µ thick; clads 400 µ long. Numerous smaller sizes present. The spicules sometimes, rarely, assume partially or completely the dichotriaene character in that one or more rays fork.

At the outer surface the spicules form an exposed crust or armor outside the dermal membrane. In this extradermal crust the cladomes are paratangential to the surface of the sponge, the rhabdomes radial, the spicules forming several layers. The spicules evidently emerge from the sponge body at slight elevations of the actual dermal surface; from such elevations numerous spicules may be seen protruding, the rhabdomes diverging somewhat from one another. Plagiotriaenes quite like the extradermal ones lie also in the ectosome, the cladomes supporting the dermal membrane, the rhabdomes radial.

At the inner surface a thick extradermal crust of plagiotriaenes is not present, although a considerable number of spicules project through the dermal membrane, the cladomes becoming extradermal. Cladomes of other spicules are in the ectosome and support the dermal membrane, the rhabdomes radial.

4. Small oxeas (pl. 51, fig. 1, *a*), so-called microxeas, very abundant in the parenchyma; smooth and evenly tapering, 90–165 µ by 4 µ.

5. Microrhabds (pl. 51, fig. 1, *b*), in the form of microstrongyles about 20 by 5 µ, exceedingly abundant in the dermal membrane at both surfaces. Outline of spicule irregular, the irregularities sometimes sufficiently pronounced to deserve the name of protuberances.

6. Streptasters (pl. 51, fig. 1, *c*), with very short axis and rays that are often vaguely grouped at the two ends of the spicule; abundant in the parenchyma. Total length of spicule about 15 µ, ray length 5–7 µ.

Holotype.—Cat. No. 21343, U.S.N.M.

The nearest relative of this remarkable sponge seems to be the equally remarkable little form, *Pleroma turbinatum*, dredged by the *Challenger* off one of the Fiji Islands and described by Sollas (1888, p. 312) as the representative of a new family, the Pleromidae. The simple character of the desma, the shape of which often suggests a rib, is noteworthy in *Costifer*. The spicule resembles the rodlike young stage of monocrepid desmas in general, more especially in such a species as *Scleritoderma paccardi* O. Schmidt (1879, pp. 9, 28, pl. 2, fig. 3).

Family SCLERITODERMIDAE.

Scleritodermidae Sollas, 1888, p. 315.
Scleritodermatidae Lendenfeld, 1903, p. 141.

With special ectosomal megascleres having the character of rhabds (tylostyles, styles, tylostrongyles, strongyles). Desma is monocrepid. Microscleres when present are sigmas.

Lendenfeld (1903, p. 141) accepts Sollas' family comprising the two genera *Scleritoderma* O. Schmidt and *Aciculites* O. Schmidt. Sollas' designation of the rhabds as microstrongyles is properly abandoned but Lendenfeld's reference to them as amphistrongyles is not apt.

Assignable to the family and described since Lendenfeld's synopsis (1903) is *Aciculites orientalis* Dendy (1905, p. 101) from Ceylon. Regarding *Microscleroderma* Kirkpatrick and *Taprobane* Dendy, see appendix to Leiodermatiidae.

Genus ACICULITES O. Schmidt (1879).

Aciculites O. Schmidt, 1879, p. 29.—Lendenfeld, 1903, p. 143.—Dendy, 1905, p. 101.

Scleritodermidae without microscleres.

Dendy (1905, p. 101) would place the genus in the Leiodermatiidae.

ACICULITES CILIATA, new species.

Plate 43, fig. 7; plate 51, figs. 2, 3.

Station D5356, one specimen. The sponge is a thick walled stony cup more or less conical in shape but asymmetrical. Greatest horizontal diameter 53mm., height 35mm., wall about 10mm. thick. Latero-inferior surface separated from surface of cavity by a nearly flat margin, 10mm. wide, which faces upward and outward. Color of surface, brown; interior, lighter. In the marginal region of the cup numerous small canals, a fraction of a millimeter wide, lying just below and parallel to the dermal membrane, may be seen radiating toward the cavity of the cup. In the substance of the sponge small canals, about 0.5 mm. wide, are numerous. The ectosome of the sponge appears to be perfect over the marginal region but is only partially preserved over the outer surface and has disappeared from the surface of the cavity.

Desma monocrepid, more or less curved and branched and with abundant tubercles; greatest length commonly about 350 µ, thickness of middle body 30 µ. Some tubercles are simple, but the characteristic ones are compound, resembling irregular rosettes. The desmas are firmly united; skeletal meshes rounded and frequently about 100 µ wide. In the ectosome abundant developing desmas are present (pl. 51, fig. 2). The smallest observed were slightly irregular rods (fig. 2, *a*). These become branched through the development of outgrowths (fig. 2, *b*). The outgrowths (clads) become fairly long and the desma thus acquires several bold curves (pl. 51, fig. 2, *c;* pl. 51, fig. 3), which help to bound different skeletal meshes. But straighter, more elongated, forms also occur.

The special ectosomal megascleres in the marginal region of the sponge are tylostyles or styles, 385–540 by 8–10 µ, head end terminally spinulate, tapering gradually toward the point which is blunt, the spicule sometimes slightly curved. In the tylostyle form the head end is only slightly enlarged. Some of the spicules lie tangentially at the surface forming a thin crust, one layer deep. Others are radial to the surface, distributed singly but at short intervals; the spicules not projecting or scarcely projecting beyond the surface; outer end of the spicule is the basal, larger, end.

Over the outer surface of the sponge dermal megascleres, such as have just been described, are not found. In their stead are long and very slender oxeas, 350–700 by 2–3 µ; tapering gradually toward both ends, which are sharp; spicule often slightly curved. Some lie tangentially at the surface, but most are radial. The latter are not in bunches, but distributed singly at short intervals; they penetrate well into the interior and project for the most part 300–400 µ beyond the surface, looking something like long cilia. Dermal spicules of the inner surface of sponge unknown.

Holotype.—Cat. No. 21251, U.S.N.M.

The species is evidently close to *A. higginsia* O. Schmidt, from off Havana. In this sponge (Sollas, 1888, p. 347) the desma is tuberculate; the rhabd measures 271–355 by 10 µ and is a tylostrongyle, or tylostyle, or strongyle. The rhabds lie tangentially at the surface and form a single layer; are also at right angles to the surface, the tylote end outward and in contact with the dermal membrane. The genus includes, besides the two forms just mentioned, *A. orientalis* Dendy (1905, p. 101) from Ceylon.

Family LEIODERMATIIDAE.

Azoricidae Sollas, 1888, p. 319.
Leiodermatiidae Lendenfeld, 1903, p. 145.

Without special ectosomal megascleres and, except in a few forms, without microscleres. With monocrepid desmas and rhabds.

The family definition is slightly modified, in order to cover *Taprobane* Dendy and *Microscleroderma* Kirkpatrick, for which it seems desirable to create an *appendix*. Of the nine genera recognized by Sollas as belonging in this family Lendenfeld retains only two. Five of the genera including *Azorica* Carter are merged, along with *Petromica* Topsent, in *Leiodermatium* O. Schmidt, and the family name changed. Lendenfeld's synopsis is so convenient that I prefer to follow him in merging *Azorica* in *Leiodermatium*, although the pores and oscula in *Leiodermatium lynceus* (the type of Schmidt's genus: see discussion in Sollas 1888, p. 348) O. Schmidt (1870, p. 22) differ conspicuously from those of Azorica.

Lithobactrum Kirkpatrick (1902*b*, p. 175) falls in and is assigned by its author to this family. If we adopt Lendenfeld's rearrangement of the genera, the genus fits in *Gastrophanella* O. Schmidt. Since Lendenfeld's synopsis there have been reports concerning the following species: *Petromica grimaldii* Topsent, 1904 (p. 64); *P. massalis*, new species, Dendy, 1905 (p. 104), 1921*b* (p. 8); *Leiodermatium pfeifferae* (Carter), Topsent, 1904 (p. 63); *L. deciduum* (O. Schmidt), Lendenfeld 1906 (p. 363); *L. crassiusculum* (Sollas), Hentschel 1912 (p. 307); *Microscleroderma hirsutum*, new genus, new species, Kirkpatrick, 1902*b* (p. 173); *Taprobane herdmani*, new species. Dendy, 1905 (p. 102), 1921*b* (p. 7).

Genus LEIODERMATIUM O. Schmidt (1870, 1879).

Leiodermatium part, O. Schmidt, 1870, p. 22.—As defined by exclusion, O. Schmidt, 1879, p. 28.—Part, Lendenfeld, 1903, p. 145.
Azorica Carter plus *Leiodermatium* O. Schmidt, Sollas, 1888, pp. 319, 352.

Lamellate or vasiform sponges with pores on one face and oscula on the other. The rhabd megascleres are styles or oxeas. Without microscleres.

Possibly one of the species, *L. chonelleides* (Döderlein), assigned to Azorica by Sollas, does not conform to the definition just given. (See Lendenfeld, 1903, p. 147.)

LEIODERMATIUM PFEIFFERAE (Carter).

Plate 43, figs. 4, 8; plate 51, figs. 4, 5, 6, 7.

Azorica pfeifferae Carter, Sollas 1888, p. 319.—Topsent, 1904, p. 63.
Leiodermatium pfeifferae (Carter), Lendenfeld, 1903, p. 148.

Sollas (1888, p. 320) suggests that the *Challenger* specimen from Amboina may represent a piece of a vasiform sponge. A specimen (pl. 43, fig. 4), taken at station D5629, confirms his suspicion that the species may be vasiform as well as plate-like. It is a stony conical cup, 50 mm. high and 70 mm. across the mouth. The wall is smooth and ½ to 2½ mm. thick. The cup is broken open at the base. The apertures of the (presumably) efferent canals, scattered over the inner face, are about 150 μ in diameter; those of the afferent canals, on the outer surface, of about same size.

The desmas are firmly united. The rounded fenestrae perforating the skeleton are smaller, and the skeleton is denser, in the superficial region than in the interior, where the fenestrae measure 70–175 μ in diameter. What may be called a typical desma has a total length of about 340 μ; thickness of epirhabd 35 μ. But the desma varies a good deal both in size and shape. (See Sollas, 1888, p. 323.) The epirhabd may be nearly straight or very curved. The clads, few in number, project at about right angles to the adjoining part of the epirhabd, and may be short or comparatively long. The articular surfaces are at the ends of the clads and epirhabd. They are concave and frequently much expanded (pl. 51, fig. 7, where the concave face of the articular process (*a. p.*) is applied to the other desma) but the articulation is sometimes only one of apposition (pl. 51, fig. 5.) Perhaps the latter condition indicates an earlier stage of zygosis.

The spinose tubercles on the desma vary in shape and frequency. They may be simple spines, or bifurcated and thus bidentate (pl. 51, figs. 4, 7). Very frequently the bifurcation, more strictly speaking the formation of new outgrowths simulating division, is continued (pl. 51, fig. 7), and we eventually get the characteristic tubercles of the species, which consist of an irregular rosette of 3 to 6 or 7 spines surrounding a convex area (pl. 51, figs. 4, 6). The spinose tubercles occur on epirhabd and clads, often abundantly, yet many desmas are comparatively smooth. At the surface of the sponge, the tubercles are small and simple, thickly crowded, often blunt, terminating as described by Sollas (1888, p. 320) at about the same level and thus giving support to the dermal membrane. The rosette-like tubercles described above are identical with those figured by Topsent (1904, pl. 8, fig. 7).

The oxeas which project in small bundles over both surfaces are 350–420 μ long and about 6 μ thick. They are thus smaller than in the Amboina specimen described by Sollas, in which they measured 750 by 8 μ. The oxeas measured by Topsent (1904, p. 64) in a specimen from the Azores reached a length of 700 μ with a thickness of only 1.5 to 3 μ.

The species has been recorded for widely separated parts of the Atlantic, and for the Banda Sea. (See Lendenfeld, 1903.)

A second dried specimen (pl. 43, fig. 8), precise locality unknown, is of the lamellate type. The skeleton shows a radial striation, absent in the other and which is not mentioned in the literature of the species. It is in all probability correlated with the arrangement of the larger canals, neither feature being fixed (hereditary). In order to call attention to this, physiological, peculiarity, the sponge may be designated forma *striata*.

The lamella is 130 mm. wide, 75–90 mm. high, 1.5 mm. thick; one face slightly concave, the other slightly convex. Concave surface vaguely undulating, the undulations parallel to the free edge. On each surface there are thickly crowded minute apertures, about 150 μ in diameter. The oxeas are smaller than in the other specimen, measuring only 240–300 by 3–4 μ.

The skeleton shows on the surface, especially after boiling for a few minutes in nitric acid, fine lines that radiate from the base of the lamella toward the free margin. This radiate arrangement which is visible to the eye exists throughout the interior, as may be seen in tangential sections. The appearance is directly caused by the fact that along lines which are roughly radial, the desmas lie much closer together and are united in a more complex fashion than in the intervening areas. Except in this feature there seem to be no differences from the skeletal framework of the other specimen.

Holotype.—Cat. No. 21321, U.S.N.M.

Appendix to Leiodermatiidae.—Forms with sigmas.

Microscleroderma Kirkpatrick (1902*b*, p. 173) and *Taprobane* Dendy (1905, p. 102) may conveniently be listed here. *Microscleroderma* is assigned by its author to the Scleritodermidae, although it lacks the ectosomal rhabds of this family. Kirkpatrick would overcome the difficulty by interpreting the rhabds in question as modified and large sigmas. But the rhabds of the Scleritodermidae can scarcely be claimed as microscleres, since they measure 80 to 540 μ in length, and it seems very doubtful whether there is any real resemblance to sigmas. The size, radiate arrangement, and tylote outer end of the spicules in species of *Aciculites* suggest, on the contrary, the thought that they may even be degenerate triaenes. Perhaps observations on the variation of the rhabds, including monstrous forms, might throw light on their phylogeny.

Taprobane, as Dendy (1905) has pointed out, would fall in the Leiodermatiidae (indeed in Leiodermatium) were it not for the presence of sigmas and, on the other hand, might be regarded as a Scleritodermid without special ectosomal spicules, and thus there is no place for it in Sollas' classification. The general evidence that microscleres are easily lost is strong to-day, and for that reason I list the genus in an appendix to the Leiodermatiidae, as above. If Sollas' suborder Anoplia continues in use (as in Lendenfeld, 1903), the definition should read " usually without microscleres " instead of " without microscleres."

Taprobane should probably be merged, in the next revision of the group, into *Microscleroderma*. In respect to the vasiform body, skeletal framework, desma, oxeas, there is agreement. The appearance of the microscleres in *Microscleroderma* is peculiar (Kirkpatrick, 1902*b*, pl. 4, fig. 1*e*), but the text makes it evident that they are sigmas. The only differences seem to be that the sigmas are ectosomal in *Microscleroderma* and scattered through the body in *Taprobane*, and that the apertures of the afferent canals in *Microscleroderma* are perhaps not uniporal.

Genus TAPROBANE Dendy (1905).

Taprobane Dendy, 1905, p. 102.

Lamellate or vasiform sponges without special ectosomal megascleres; with minute uniporal apertures on both faces; with monocrepid tuberculate desmas, long slender oxeas, and sigmas.

TAPROBANE HERDMANI Dendy.

Plate 44, fig. 5

Taprobane herdmani Dendy, 1905, p. 103.

A dried specimen taken at station D5135 is referable to this species. Like Dendy's type it is vasiform, but growth has taken place in such a way that instead of one there is a complex of vases of different sizes arising from a common basal plate; the separate vases more or less fused. The smallest vase has almost the dimensions of Dendy's type, being 65 mm. high and 70 mm. across the top. The largest vase is 190 mm. high and 170 mm. across the top. The whole mass is about 200 mm. wide, greatest height 190 mm. The wall is about 10 mm. thick, somewhat thinner than in the type. The sponge like the type is dense and stony. Color, whitish. The surface is more even than in the type, and there are no barnacle galls.

Both surfaces, where not rubbed, are shaggy with projecting bundles of long oxeas. Dendy finds the afferent and efferent uniporal areas, on opposite surfaces, alike and 0.3 mm. in diameter. The efferent areas, covering the inner face, in the *Albatross* specimen are of about this size and closely set; the rims prominent, doubtless owing to the dried condition of sponge. The afferent areas, on the outer surface, are similar but slightly smaller.

The desmas agree with the type, the epirhabd in the adult spicule being curved, with a few clads on the convex side. When isolated with hydrofluoric acid, they give the measurements recorded by Dendy. The skeletal beams are richly tuberculate, the tubercles for the most part rounded and simple, but sometimes pointed and sometimes bifid. They may approach the rosette type (found in *Leiodermatium pfeifferae*, for instance), in that on and around a simple rounded tubercle, simple or bifid pointed processes are formed, as is indicated in one of Dendy's figures (pl. 4, fig. 2*c*). Developing desmas are abundant beneath the dermal membrane.

A point not mentioned in the description of the type is the radiate arrangement of the fenestrae (alveoli) of the skeletal framework. This is very marked in sections of the cleaned skeleton even to the unaided eye, the fenestrae appearing as rounded or squarish spaces, often about 200 μ in diameter, arranged in rows that are radial to the margin of the vase mouth and obliquely radial to the two surfaces. The intervening skeletal beams are mostly 100–200 μ thick.

In the type the oxeas are said to form "loose wisps or brushes, running at right angles to the surface, beyond which their ends project," disappearing more or less completely from the deeper parts of the sponge. The largest complete spicule measured reached only 1.88 mm. by 8 μ. The *Albatross* specimen seems to present a difference in this matter, for the oxeas are in compact and closely set bundles, often as thick as 100 μ, although sometimes much thinner. The bundles project, where the surface has not been rubbed, about 5 mm. The appearance is very much as in *Microscleroderma hirsutum* Kirkpatrick (Kirkpatrick, 1902, pl. 4, fig. 1*b*). The constituent oxeas vary greatly in size but reach a length of 10 mm. with a thickness of 40 μ.

The sigmas are 6–8 μ long, as compared with 10 μ for the type; otherwise there is agreement.

The type is from the Gulf of Manaar. Dendy (1921*b*, p. 7) has recently described specimens from the Indian Ocean.

* * * * * * *

Representatives of five of the nine recognized families are described above. The remaining four families, listed and in part discussed below, are not represented among the sponges studied.

Family NEOPELTIDAE.

Neopeltidae Sollas, 1888, p. 344.—Lendenfeld, 1903, p. 140.

Family SIPHONIDIIDAE.

Siphonidiidae Lendenfeld, 1903, p. 140.
Cladopeltidae Sollas, 1888, p. 317.

In this family (Siphonidiidae) since Lendenfeld's synopsis there have been recorded the following species: *Siphonidium ramosum* (O. Schmidt), Topsent, 1904, p. 63; *Plakidium* (new genus) *acutum*, new species, Lendenfeld, 1906, p. 360.

Family VETULINIDAE.

Vetulinidae LENDENFELD, 1903, p. 149.
Anomocladidae SOLLAS, 1888, p. 354.

Family DESMANTHIDAE.

Desmanthidae TOPSENT, 1893*b*, pp. XXXVI–XXXVII; 1894*b*, p. 311; 1898*b*, p. 231.—KIRKPATRICK, 1902*b*, p 176.—LENDENFELD, 1903, p. 144.

Lendenfeld (1903, p. 144) restricts the family to forms with tetracrepid desmas. But Kirkpatrick (1902*b*) uses it in the wider sense of Topsent, 1898*b*, to include those with monocrepid desmas as well. While this runs counter to the principle (Zittel's) followed in Sollas' system, according to which genera with tetracrepid desmas (Theonellidae) are separated from those with monocrepid desmas (Corallistidae, now Coscinospongiidae), it is in strict logic admissible since it sometimes happens that along with monocrepid desmas some tetracrepid ones may occur in the same individual even (O. Schmidt, 1879, p. 24; Sollas, 1888, p. 342; Topsent, 1904, p. 60). In the known instances of this combined occurrence of the two types, the aberrant (tetracrepid) desma includes a crepis, three rays of which are short and one long, and which is regarded as a degenerate tetraxon spicule. The family (Coscinospongiidae) in which these instances occur is defined as having a monocrepid desma. The occasional occurrence of imperfect tetracrepid desmas may be regarded as reversional. The case of the Desmanthidae is somewhat different, since here a form, *Monanthus*, with monocrepid desmas is combined with another, *Desmanthus*, having tetracrepid desmas (modified triaenes).

In addition to the single species given by Lendenfeld (1903) the list now includes *Desmanthus topsenti* (Hentschel, 1912, p. 307) and, using the family in the wide sense, *Monanthus* (new genus) *plumosus* (Kirkpatrick, 1902*b*).

Thiele (1899*b*) has suggested, but without sufficient reason, that *Desmanthus* is really a monaxonid sponge, and Kirkpatrick (1902*b*) touches on the same question with respect to *Monanthus.*

Thiele's suggestion (1899*b*) that *Monocrepidium* (new genus) *vermiculatum* (Topsent 1898*b*, p. 229), originally assigned to this family by Topsent, is a monaxonid sponge, allied to *Bubaris*, has been accepted by Topsent (1904, p. 148). In their external form and in the way they interlock, the megascleres of *Monocrepidium* present some analogies to the simple rodlike desmas of *Costifer vasiformis* of this report.

LITHISTIDA INCERTAE SEDIS.

BRACHIASTER, new genus.

BRACHIASTER SIMPLEX, new species.

Plate 51, figs. 8, 9.

A macerated lithistid was taken at station D5162, the desmas of which are of such a novel and interesting character that it is desirable to name the sponge, although, owing to the loss of the microscleres, it can not be placed in the classification.

Sponge lamellate, approaching a triangular shape, about 70 mm. wide, 8 mm. thick. The entire free edge is rounded and appears to be natural. One surface, slightly convex, is heavily incrusted with sand. The opposite surface is slightly concave and is cleaner. Sponge stony and yet in some slight degree flexible.

Only the desmas remain. They are tetracrepid and form a coherent skeleton, but on boiling in caustic potash or nitric acid a good many, in more or less perfect condition, separate out. In hydrofluoric acid, of course, they separate out completely. The young forms, which have not yet entered into articulation, are comparatively abundant.

The young forms are simple dichotriaenes (pl. 51, fig. 9*a*), or dichomesotriaenes (fig. 9*b*), or more complicated spicules (fig. 9*c*) in which the primary clads may bear three branches instead of two, the secondary clads again branching dichotomously or trichotomously, and in which one or both of the axial rays branch in similar fashion.

The adult desmas are obviously dichotriaenes or dichomesotriaenes in which the secondary clads and axial rays break up each into two or three terminal branches (pl. 51, fig. 8). The facets for articulation (*a. s.*) with other desmas are terminal or lateral on the branches or in the angles between branches. Some irregular variants of the type occur.

Holotype.—Cat. No. 21254. U.S.N.M.

The following macerated and unidentifiable lithistids were taken:

At station D 5172, a shallow cup-like sponge 70 mm. in diameter. Desma monocrepid.

At station D 5218, two specimens evidently of same species, the larger 80 mm. high. Sponge excavated by an axial cloaca of considerable size. Outer surface of skeleton labyrinthine, divided into trabeculae and lobes about 2–4 mm. wide by somewhat narrower meandering channels and spaces. Desma monocrepid with rosette-like tubercles resembling those of *Leiodermatium pfeifferae.*

At station D 5593, a vasiform sponge 60 mm. high, cloaca 30 mm. deep. Desma tetracrepid.

* * * * * * *

Hentschel (1912, p. 306) has described a new form, *Lophacanthus rhabdophorus*, which he points out does not fit in any of the families as these at present are defined. Pending some better arrangement, an appendix to the Theonellidae might be created for it to include forms without microscleres. The triaene concept of the family, already extensive, would have to be further enlarged to include mesolophotriaenes with degenerate rhabdome.

Order KERATOSA.

Ceraospongiae O. Schmidt, 1862, p. 19.
Keratosa Hyatt, 1875, p. 399.—Polejaeff, 1884, p. 38.
Ceratosa Ridley, 1884, p. 378.
Ceratina Vosmaer, 1887, p. 362.
Monoceratina part plus *Hexaceratina* part, Lendenfeld, 1889.
Euceratosa Dendy, 1905, p. 200.

Skeleton made up of horny fibers. Without proper spicules. Absence of spicules primitive and not due to evolution by loss. Sand grains and other foreign mineral particles often aid in forming the skeleton. and in exceptional cases constitute its chief part.

The families included are the Darwinellidae (Aplysillidae of some authors, Darwinellidae plus Aplysillidae of Lendenfeld, 1889), Pleraplysillidae Topsent (see George and Wilson, 1919, p. 166), Spongelidae, and Spongidae.

The group of true horny sponges, without proper spicules, was early recognized and embodied in the systems of Grant (1826, 1861) and Nardo (1833). Bowerbank's Keratosa (1864, p. 155), on the other hand, was made to include some sponges with proper spicules. The same is true of the Keratospongia of Gray (1867). Carter (1875) recognized the true horny sponges, but split them in two groups, Ceratina and Psammonemata, distinguished chiefly by quantitative differences in the foreign contents of the fibers.

Lendenfeld's monograph (1889) remains as the all-important handbook for practical work on the horny sponges. But his Hexaceratina, it would seem, should be deleted, and *Darwinella*, *Aplysilla*, *Ianthella*, *Dendrilla*, *Haddonella* (Igerna Sollas, 1903) combined with *Megalopastas* Dendy in the Darwinellidae (in the matter of the terminology of this family see George and Wilson, 1919, p. 164), as advocated by Dendy. Lendenfeld's Monoceratina is distinctly stated to be a polyphyletic group, and is therefore made to include forms with spicules and forms in which the spicules have obviously been lost, all conceived as transitional types from different stocks of the Halichondrina (Chalininae and various Desmacidonidae). Dendy (1905) made an important advance by clearing away these types, the similarity of which to the Keratosa he looks on as the result of convergent evolution, designating them as pseudoceratose forms. A monophyletic group (Euceratosa) is thus left, the basal family of which in Dendy's scheme is the Darwinellidae.

The genera included by Lendenfeld in the Monoceratina but which, from the point of view just stated, should be excluded as pseudoceratose sponges, are *Aulena* (assignable as Lendenfeld remarks, 1889, p. 90, to the Desmacidonidae—the other Aulenidae are probably distributable among the remaining Keratose families), *Chalinopsilla* (assignable to the Chalininae, see Lendenfeld, p. 121), *Phoriospongia* and *Sigmatella* (assignable to the Desmacidonidae—see George and Wilson, 1919, p. 153, where the subfamily Phoriosponginae is retained in an emended sense). Lendenfeld's subfamilies under the Spongidae continue to be useful in practical work

Family DARWINELLIDAE

Darwinellidae MEREJKOWSKY, 1878, p. 44.—VOSMAER, 1887, p. 366.—TOPSENT, 1905, p. clxxiii.—GEORGE and WILSON, 1919, p. 163.
Darwinellidae plus *Aplysillidae* LENDENFELD, 1889, p. 672.
Aplysillidae DENDY, 1905, p. 203; 1916*b*, p. 95.—ROW, 1911, p. 359.—HENTSCHEL, 1912, p. 429.

Keratosa with eurypylous and large flagellated chambers; with a skeleton composed of separate horny fibers that ascend from the base of the sponge and are simple or branched, or the skeleton may be reticulate; "spicules" of spongin may also occur; the spongin fibers contain a medulla or pith and lack foreign mineral particles.

Genus IANTHELLA Gray (1869).

Ianthella GRAY, 1869, p. 49.—POLEJAEFF, 1884, p. 22.—LENDENFELD, 1889, p. 683.

Large, lamellar or cup-shaped sponges, pedunculate below; lamella or wall thin as compared with area of sponge surface; surface conulose. Skeleton a coarse and regular reticulum, made up of large main fibers which radiate from the peduncle to the margin of the lamella, and connectives extending at right angles to the former. Main fibers fascicular and, sometimes, at any rate, bandlike, the bands set edgewise to the surfaces of the sponge; connectives simple, slightly fascicular, or resembling the main fibers in being very fascicular and bandlike. From the reticulum small simple fibers, originating at or between the nodes of the reticulum, pass vertically to both surfaces where they end in the conuli; these fibers sometimes branching in dendritic fashion. All (primary) skeletal fibers alike; hollow, the axial cavity surrounded by a noncellular pith, which in turn is surrounded by the spongin of the fiber; the latter containing abundant, regularly disposed cells or cavities in which cells once were, such cells presumably spongoblasts, once superficial but becoming engulfed during the growth in thickness of the fiber.

IANTHELLA FLABELLIFORMIS (Pallas).

Spongia flabelliformis Pallas, 1766, p. 380.
Ianthella flabelliformis Polejaeff, 1884, p. 37.—Ridley, 1884, pp. 392, 601.—Lendenfeld, 1888, p. 23 (older synonymy given in detail); 1889, p. 696.—Hentschel, 1912, p. 434.

Station 5145, one large dried specimen. Sponge a lamella 600 mm. high and about as wide, narrowing to a thick, short, stalk-like base; lamella in general about 4 mm. thick, at the very base fully 20 mm. thick. In the region of the stalk one surface is somewhat convex and one somewhat concave, this difference disappearing a short distance above the stalk. A difference between the two surfaces with respect to oscula, pores, and perhaps conuli, has been recorded for this species (Lendenfeld, 1889, p. 696; Hentschel, 1912, p. 434). But in the *Albatross* specimen oscula 2 mm. and less in diameter are, at any rate, abundant on both surfaces, and the conuli of the two surfaces are alike; pores indistinguishable. Color of specimen, black, but the natural color is known to be a bright yellow, which quickly changes on exposure to the air to a dark violet blue. The species may reach a height of 1,000 mm. (Lendenfeld, 1888, p. 23).

The radial fascicular fibers in the lower part of the sponge have the character of more or less cylindrical bundles, but throughout the body in general they form thin reticular lamellae, placed edgewise to the sponge surfaces and about 3 mm. apart; these are the bands mentioned by Lendenfeld. The connectives have the character of simple or slightly fascicular fibers, and the system of square or rectangular meshes formed by them with the radial bands is quite regular, closely resembling the photograph of *I. basta* given by Lendenfeld (1889, pl. 47). But, as recorded by Lendenfeld (1888, p. 24), the connectives in *I. flabelliformis* may form bands like those formed, doubtless through continual branching and anastomosis, by the radial fibers.

The specimen considering its area is thin for the species, and the conuli, distributed at intervals of about 3 mm. along the edges of the radial bands, are very low. They are not over 1 mm. high, and for the most part simple, occasionally divided close to the apex into two or three points. Correspondingly the supporting fibers of the conuli are simpler than has been recorded for some individuals, where they have been found to be dendritic (Lendenfeld, 1888; Hentschel, 1912). These fibers are in the *Albatross* specimen simple, slender, conical processes, sometimes divided near the apex, extending out from the edges of the radial skeletal bands. They bear no relation to the intersection points made by radial fibers and connectives, although in some other specimens (see Lendenfeld) they originate from such points.

Lendenfeld (1889, p. 683) recounts that this species has been known since 1713, when it was first described by Petiver under the name *Rete phillippense*. It has been recorded from the Philippines, Indian Ocean, Australian coast, Torres Straits, and the Aru Islands.

IANTHELLA BASTA (Pallas).

Spongia basta Pallas, 1766, p. 309.

Ianthella basta Lendenfeld, 1889, p. 695 (older synonymy given in detail).—Topsent, 1920*c*, p. 316.

Station D5139, pieces of fronds ("bands" of Lendenfeld) and one perfect frond 350 mm. long, 100–120 mm. wide, 2–3 mm. thick exclusive of conuli. Edge of this frond terminally and in part along both sides is the natural sharp edge of the sponge.

Main fibers about 3 mm. apart, in general vertical but curving more or less radially to the edge of the frond. Connectives transverse in usual way and mostly 2–3 mm. apart. Conuli sharp, distributed along edges of main fibers on both sides of sponge, 1 mm. or less high and 2–3 mm. apart. On one face the dermal membrane is riddled with pores which make the impression of being in areas, 120–180 μ in diameter, separated by narrow trabeculae. On the other face are minute oscula a fraction of a millimeter in diameter, typically in a single row between every two main fibers, and 1.5–3 mm. apart. Color in alcohol, reddish, shading off in places toward yellow.

The species has been recorded from the Indian Ocean and Australian seas (Lendenfeld, 1889; Topsent, 1920*c*).

Family SPONGELIDAE.

Spongelidae Poléjaeff, 1884, p. 23.—Vosmaer, 1887, p. 362.—Part Lendenfeld, 1889, p. 590.—Dendy, 1905, p. 207.—George and Wilson, 1919, p. 164.

Spongelidae Authors plus *Pleraplysillidae* part Topsent, 1905, p. clxxxiv.

Keratosa with eurypylous and large flagellated chambers, with a skeleton composed of separate horny fibers that ascend from the base of the sponge and are simple or branched, or the skeleton is more commonly reticulate. Horny fibers without pith, generally containing abundant foreign mineral particles. Skeleton may be reduced, then consisting of foreign particles usually held together by a little spongin, but the latter may be absent.

Genus SPONGELIA Nardo (1834).

Spongelia NARDO, 1834, p. 714.—O. SCHMIDT, 1862, p. 28.—F. E. SCHULZE, 1879, pp. 153–154.—LENDENFELD, 1899, pp. 641–649.

Skeleton distinctly fibrous, always including main fibers, these containing abundant mineral inclusions. Main fibers generally united by connectives but they may be separate and distinct dendritic structures. Connectives generally slenderer than main fibers, with or without mineral inclusions; but in some species with reticular skeleton main fibers and connectives are so much alike as to be scarcely distinguishable. Surface of sponge almost always conulated.

SPONGELIA FRAGILIS (Montagu), var. FASCICULATA new variety.

Plate 44, fig. 1.

Spongia fragilis MONTAGU, 1818, p. 114.
Dysidea fragilis JOHNSTON, 1842, pp. 187, 251.
Spongelia pallescens F. E. SCHULZE, 1879*b*, p. 138.

Two good-sized pieces from Togian Bay, Togian Island, Celebes. One specimen somewhat lamellate below, passing above into a solid cylindrical process 25–30 mm. in diameter that has been cut off; total height, 120 mm. The other is a solid cylindrical branch, tapering to the apex, 25–30 mm. in diameter and 170 mm. long. Quite possibly both pieces belonged to same sponge. The sponge then may be said to be ramose. Numerous oscula, mostly about 3 mm. in diameter, are scattered over one side of the lamellate portion and, what is of some interest, along one side of each cylindrical process. Consistency firm. Surface very dark brown, almost black, interior light in color.

Conuli about 3 mm. apart and 1 mm. high, not sharp but truncated apically; surface conspicuously depressed between the conuli. There is the usual dermal reticulum formed by narrow fibrous bands radiating from the apices of the conuli. Pores actually closed, but it may be seen that they occupy the meshes of this reticulum and measure 50–85 µ or thereabouts in diameter. The dermal membrane is smooth, without sand. Parenchyma fairly dense, but besides the main oscular canals there are numerous small canals, ⅓ mm. to 1 mm. in diameter, which extend in more or less radially from the surface. There are no subdermal cavities of large size. The flagellated chambers measure 60 by 50 µ to 70 by 60 µ. The parenchyma contains large numbers of sperm balls (sponges were taken in November).

Radial main fibers terminate in the conuli (pl. 44, fig. 1, from a section vertical to the surface). Between these, connectives are richly developed. The radial main fibers are about 2 mm. apart in the peripheral sponge body; fascicular and generally 300–500 μ thick; composed of a close reticulum of slender individual fibers, the latter 50–85 μ thick and completely filled with foreign particles, chiefly sand.

Connectives mostly 70–85 μ thick; thicker ones are sometimes formed by the lengthwise fusion of slender fibers; connectives in general completely filled with foreign particles, chiefly sand, but not infrequently considerable spongin shows round the sand core. The connectives extending between two adjacent radial fibers establish coarse reticula, meshes mostly 300 μ to 1 mm. wide, but the range is from less than 300 μ to 2.5 mm.; the very large meshes lie between connectives which are simple, that is, unbranched or only slightly branched. When this skeletal arrangement is cut transversely, as in sections parallel to the surface of the sponge, it exhibits a comparatively uniform meshwork, the meshes mostly 1–2 mm. wide.

There is no proper dermal skeletal reticulum, but just below the dermal surface the most peripheral of the connectives form a tangential network which may be designated a subdermal reticulum. This is perforated by rounded spaces, for the radial canals, 1–2 mm. in diameter. Such spaces are commonly about 2 mm. apart, the intervening reticulum showing meshes which grade down from 1 mm. to about 150 μ in diameter.

Holotype.—Cat. No. 21299, U.S.N.M.

F. E. Schulze in his classical essay on *Spongelia* (1879*b*) recognizes (p. 127) the impossibility of separating the group of Adriatic forms into sharply distinct species. Intermediates occur between all subdivisions, and holding this in mind all the Adriatic *Spongelias* (*avara*, *pallescens*, *elegans*, *spinifera*) might be regarded as varieties of one species.

Under the name of *S. pallescens* O. Schmidt, Schultze (1879*b*, p. 138) combined with that sponge several others of Schmidt's (1862, 1864) *Spongelias*. In the species so conceived Schulze finds (p. 141) the form, consistency, and color variable. The conuli are fairly uniform, 1–3 mm. high and 1–3 mm. apart. Radial main fibers and connectives are readily distinguishable. The main fibers, 1.5–2 mm. apart in the body of the sponge, terminate in the conuli, and are thickly filled with foreign particles, chiefly sand grains. No mention is made of any tendency in the main fibers to become fascicled. The connectives are cylindrical and considerably thinner than the main fibers, sometimes completely filled with foreign particles, sometimes practically without such, the two extremes connected by intermediates. The connectives vary also as regards richness of development; sometimes sparsely and regularly developed, the resulting net work coarse and ladder-like, with meshes that are often about 2 mm. wide (1879*b*, pl. 7, fig. 6); or again so richly developed as to form a network as close as in *Euspongia officinalis;* intermediates connect these extremes.

Schulze's account makes it plain that *Spongelia pallescens* can not be *split up* into distinct subgroups. The different forms to which he gives the names of subspecies and variety are, as he says (p. 149), only types within the species and not subdivisions. These types he regards (but here he is, one suspects, only in part on solid ground) as forms which owe their differential peculiarities to the local environment. With this understanding, Schulze makes two subspecies, *fragilis* and *elastica.* In *fragilis* not only the main fibers but the connectives, which are usually sparsely developed, contain abundant foreign bodies. Within this subspecies the body may be incrusting, or growing up into branches, the branches in some specimens tubular, in others solid. Such types (*formae* in our current terminology) he distinguishes as varieties *incrustans*, *tubulosa*, and *ramosa.* In the other subspecies, *S. pallescens elastica*, the connectives for the most part are without foreign particles and form well-developed reticula. In this subspecies the body may be massive (var. *massa*) or more or less branched, the branches generally solid (var. *lobosa.*) A tendency is noted for differential color characteristics to be associated with the structural subspecific characters.

Lendenfeld (1889) separated Schulze's two subspecies as distinct species, *S. fragilis* and *S. elastica*, but the facts stated above would seem to show that the separation is artificial and that the single species should be maintained in Schulze's sense. Schmidt's name of *pallescens* (1862) employed by Schulze must, however, give place to *fragilis*, since Lendenfeld has shown (1889, p. 642) by direct comparison that *Dysidea fragilis* (Montagu, 1818) Johnston, 1842, is identical with Schulze's subspecies *fragilis.* The name of the species, conceived in Schulze's sense, thus becomes *S. fragilis* (Montagu). I suggest that *elastica* be set off as a variety. The Philippine sponge may be set off as another variety, *fasciculata*, distinguished by the fascicular character of the main fibers. It approaches the type in that the connectives contain foreign particles, *elastica* in that they are richly developed. Doubtless with continued study other combinations—as, for instance, fascicled main fibers with sparsely or richly developed connectives free from foreign particles—will be discovered. As numerous combinations of characters come to be known within a group ("species") which can not actually be split into subdivisions owing to the occurrence of intermediates, it comes to be a question as to what method of notation we shall employ in the designation of individuals. Perhaps we shall have to limit ourselves to the erection of a certain number of standard combinations (varieties or subspecies) and designate nonconforming individuals as *near* certain of these standard forms.

With regard to the fascicled character of the main fibers in *Spongelia* it may be called to mind that Hyatt (1877, p. 545) states that in the specimens which he refers to *Dysidea fragilis* Johnston the primary fibers are often compound. Schulze (1879 *b*, p. 124) refers to this fact, and further on (p. 151) in the same memoir describes fascicular main fibers in *S. elegans* Nardo. In *S. fragilis*, var. *implexa*, from Australian waters, Lendenfeld (1889, p. 666) says "exceptionally a fascicular structure is indicated in the areniferous main fibers, 0.17–0.2 mm. thick." Wilson records (1902, p. 410) that in the Porto Rican sponge referred to *S. pallescens fragilis*, var. *ramosa*, the main fibers are somewhat fascicular.

Since Lendenfeld's monograph (1889), where the distribution is given, the species has been taken several times. Topsent lists it for the Azores (1892) and again for Amboina (1897). Dendy (1905) refers Ceylon sponges to it, splitting the species after Lendenfeld into *S. fragilis* and *S. elastica*. Hentschel (1921) lists two varieties from the Aru Islands. Stephens (1912, 1917) records the species from the Irish coast. Dendy (1916 *b*) records it from Okhamandal and questions (p. 139) the desirability of separating *S. elastica* from *S. fragilis*. It would seem that the species name is used by all these authors in the limited sense of Lendenfeld's monograph.

Family SPONGIDAE.

Spongidae Lendenfeld, 1889, p. 121.

Sponges with small flagellated chambers, 20 to 50 μ wide, and a skeleton, generally in the shape of a reticulum, composed of solid, or pithed, horny fibers. In exceptional cases the whole fiber may consist of pith-substance.

Subfamily Eusponginae.

Eusponginae Lendenfeld, 1889, p. 123.

Skeletal reticulum close-meshed, the fibers solid, containing only a narrow medullary streak instead of a conspicuous pith as in the Aplysininae. Main and connective fibers generally distinguishable; all fibers simple, none fascicular. Main fibers usually with foreign bodies, which are, however, in general small, not distending the fiber.

Genus PHYLLOSPONGIA Ehlers (1870).

Phyllospongia EHLERS, 1870, p. 30.—LENDENFELD, 1889, p. 154.
Phyllospongia plus *Carteriospongia*, HYATT, 1877, pp. 540, 543.

Thin lamellate Eusponginae, often cup-shaped; frequently with a sand cortex.

The genus has been defined or species recorded by Keller, 1889–91, Lendenfeld, 1897, Topsent, 1897, Thiele, 1899, Dendy, 1905, Topsent, 1906, and Row, 1911.

PHYLLOSPONGIA FOLIASCENS (Pallas).

Spongia foliascens PALLAS, 1766, p. 395.
Phyllospongia foliascens LENDENFELD, 1889, p. 196 (older synonymy in detail).

Four specimens, all dried; three from the Sulu Archipelago, fourth (label lost) probably from same region.

There may be some disagreement as to the specific identity of all the various forms grouped together by Lendenfeld (1889, p. 196) under *P. foliascens*, and it is well to state that the *Albatross* specimens are of the type designated *Halispongia ventriculoides* by Bowerbank (1874 *b*, pl. 47, fig. 2) and *Carteriospongia radiata* by Polejaeff (1884, pl. 4, fig. 5). Lendenfeld's figure (1889, pl. 24, fig. 6) represents a specimen of this type.

The largest specimen taken along shore of Simulac Island, Tataan Pass, is a conical vase 200 mm. high, 250 mm. across the mouth; wall, halfway between base and margin, 4 mm. thick. Oscula, 0.5 to 1 mm. in diameter, are abundant on the inner face, absent on the outer face, of the vase. The reticulate appearance of the two surfaces departs slightly from Lendenfeld's description (1889, p. 197), in that the polygonal dermal areas, which are marked off from one another by narrow furrows, are distinctly larger and narrower on the outer than on the inner (oscular) surface. These dermal areas, it may be added, are produced by clusters of closely set radial skeletal fibers, which are absent along the furrows. As in the specimens examined by Lendenfeld, there are no horny fibers in the dermal membrane, only a "sand-cortex" made up chiefly of sand grains with intermingled fragments of spicules. Lendenfeld's description of the skeleton (p. 198) applies on the whole satisfactorily to this specimen.

A second specimen from same locality as the first is flabellate, 130 mm. high and considerably wider, divided above into lobes. The surfaces are intact, and it may be seen that the oscula, about 1 mm. in diameter, are confined to one side of the lamella, on which they are abundant. The dermal areas are, as in the first specimen, larger and narrower on the outer (nonoscular) surface; or they are simply smaller.

A third specimen, a shallow vase 50 mm. high, 70 mm. wide, was taken along the shore in the vicinity of Ramblon. The dermal areas, of course, vary, but there is the same general difference between the two surfaces as noted for the first specimen.

The fourth specimen, locality unknown, is flabellate, 75 mm. high, 130 mm. wide. In the upper part there is the same difference between the two surfaces, in respect to the dermal areas, as in the first specimen. In the lower part of the body, the nonoscular (outer) surface is minutely tuberculate, owing to the subdivision of the clusters of radial fibers which support the dermal areas in the typical surface pattern.

Lendenfeld (1889, p. 199) gives the distribution in detail, recording numerous localities in the Indian Ocean, including the Philippines, Tropical Pacific, and Australian Seas. Since his monograph, the species has been taken several times. Keller (1889–91) and Topsent (1906) record it for the Red Sea. Topsent, however, expresses some doubt as to the specific identity of the forms grouped together by Lendenfeld, and notes that the particular form studied by him is that recorded by Hyatt (1877, p. 541) as *Carteriospongia otahitica.* Topsent also records the species from Amboina (1897, p. 483), and Lendenfeld (1897, p. 124) from Zanzibar. Topsent (1920*c*, p. 317) has recently added *Spongia penicillata* Esper to the list of synonyms of this species.

PHYLLOSPONGIA ALIENA, new species.

Plate 51, fig. 10; plate 52, figs. 1, 3, 5.

Station D5174, one specimen (alcoholic). Sponge, a vase 120 mm. high and about as wide across the mouth; wall of vase 8 mm. thick. Outer surface smooth, without oscula. Inner surface appears granular to the eye, with numerous oscula 1 mm. to 1.5 mm. in diameter. Color, whitish.

Outer surface occupied by rounded pore areas about 100 μ in diameter, without skeleton, separated by narrow trabeculae, 30–40 μ thick, full of sponge spicules and sand grains, and forming a reticulum. No horny fibers in the dermal membrane of this or the inner surface.

Inner surface likewise exhibits a dermal skeletal reticulum, the trabeculae of which are made up of spicules and sand grains. But this is interrupted by very numerous aggregations of sand and spicules, to which is due the granular appearance of this surface. Perhaps this appearance of both surfaces, as respects detail, varies with the closure or opening of the pores. Flagellated chambers 30–40 μ in diameter.

The spicules and sand grains at outer and inner surface constitute a "sand cortex" about 700 μ thick (pl. 51, fig. 10, *s. c.*). Fibrous skeleton includes a reticulum in the middle layer of the sponge wall, slender radial fibers (*r. f.*) diverging from this on both sides, and very peculiar connectives.

Skeletal reticulum in the middle layer of the wall is scanty, its fibers charged with sand grains and spicules, and not much, if any, thicker than the radial fibers. The radial fibers are slender, 85 μ and less in thickness, laden with sand grains and sponge spicules; regularly arranged, projecting outward and upward, and about 400 μ apart; frequently uniting in pairs to form a fiber of the mesial reticulum.

The connectives are long, slender, smooth, cylindrical fibers, of very uniform thickness, 24 to 28 μ thick; without inclusions. They are very abundant in all parts of the sponge, intertwining and crossing one another and the main skeletal fibers (pl. 51, fig. 10; pl. 52, fig. 1). They run in all directions, but very many extend parallel to the surfaces of the sponge and thus cross the radial fibers; of these again, very many extend lengthwise (vertically in the upright sponge). The fibers branch dichotomously now and then, but only very rarely. They are united with one another not by the anastomosis of branches, but chiefly by short transverse bars of spongin (pl. 52, fig. 1, *sy*), to which the term synapticula (borrowed from the Hexactinellida) may be applied. The synapticula, which only very rarely contain inclusions (spicules), are abundant, and thus the fibers are combined together in reticular fashion.

These fibers are very long, but how long I do not know. Perhaps they connect, as branches, lower down in the sponge with the system of main fibers. Where they cross one another or cross the main (including radial) fibers, the crossing fibers are commonly cemented together by little masses of spongin (pl. 52, fig. 3, *sp.*). Here and there, but only rarely, a connective is united to a radial fiber in the way that is usual in horny sponges. This is true of fiber *a* (pl. 52, fig. 1), the connective appearing to arise as a lateral branch from the radial fiber. Occasionally the end of a connective is found constituting a spongin expansion on the side of another, as in the case of fiber *a* (pl. 52, fig. 5). Summarizing, it may be said that in this species the connectives are represented by long, independent fibers, which are united with the main fibers and with one another almost exclusively by short bars of spongin (synapticula) or by little masses of spongin.

The connectives show a very narrow medullary streak; this is more conspicuous near the end of the fiber than elsewhere (pl. 52, fig. 5). The substance is stratified, as may be seen in side view of the fibers, near the end (pl. 52, fig. 5), or in cross sections of the fibers. The fibers have a very definite sharp contour, as if the outermost layer were smooth and hard, making a kind of cuticle. The spongin, which serves as cement, has itself a sharp contour, but this is not as "cuticular" in appearance as the surface layer of the fibers, although the difference is one of degree. At the free end of the fiber (pl. 52, fig. 5) the outer layer is no more cuticular in appearance than is the case with the spongin cementing the fibers together. The substance of the fiber has the color and appearance of spongin, appearing distinctly yellow when a sufficient thickness of material is looked at.

When the sponge is macerated for some time in cold caustic potash, some of the connectives remain unbroken, the substance appearing translucent and homogeneous: the medulla is made more distinct and often looks granular; it may be locally widened and very conspicuous (artifact). More often the connectives are split, more or less, into shreds and tatters by the potash; the substance may at first sight seem to be fibrous, but this appearance is due to the splitting and to the laminated structure of the substance. The sharp contrast between outer layer and inner substance disappears in such macerations, the pieces of a split fiber all looking alike, firm and yellow, presenting the same appearance as the synapticula of spongin. There thus can be no doubt that the connectives are made up of spongin.

After boiling in weak caustic potash (5 per cent) for a minute or two, some of the connectives are changed in a significant way. The medulla is made more distinct and is shown to widen out a little at the end of the fiber; the surface layer is wrinkled, indicating that the inner substance is softer than it; at fractured ends the inner substance may protrude in unbroken condition for some little distance beyond the outer "cuticular" layer. In fibers broken across in this way, the fractured surfaces of the inner substance stain easily with haematoxylin, whereas with the same stain and time the unbroken fiber stains scarce at all. All these appearances indicate that while the fiber is made up of spongin the outermost layer is especially hard and dense.

After being just brought to a boil in strong (50 per cent) nitric acid, the distinction between surface layer and inner substance of the connectives disappears, and the whole fiber tends to split up as in cold caustic potash, the outer layers sometimes peeling off from an inner core. Boiling for a couple of minutes in this strong acid indicates that the fibers are less resistant than the synapticula: the former, in my preparations, had been very largely dissolved, while plenty of synapticula remained.

These connectives are much like many of the connectives of *Euspongia officinalis*, but the almost complete absence of the branching and anastomosing habit gives them a strikingly independent appearance, and the way in which they are secondarily united by synapticula and amorphous little masses of spongin is very peculiar. They seem at bottom to be ordinary spongin fibers and quite different things from Hircinia filaments, a resemblance to which may possibly be suggested by the mere verbal description.

I find that slender cylindrical connectives with a narrow medullary streak, in general quite similar to the connectives of *P. aliena*, occur here and there as constituents of the skeletal network in my preparations of *P. foliascens*, and are in places united by spongin synapticula quite as in *P. aliena*. Further, they are distinguishable in many parts of the skeletal network of this species (*foliascens*) as axial cores round which stratified spongin has been deposited. In fact, I suspect that the skeletal reticulum of *P. foliascens* is built up very largely on a primary foundation of cylindrical connectives like those of *P. aliena*.

Holotype.—Cat. No. 21288, U.S.N.M.

Genus **EUSPONGIA** Bronn (1859).

Euspongia BRONN, 1859.—LENDENFELD, 1889, pp. 222–223 (synonymy in detail).

Skeletal network pretty evenly developed throughout the often massive, but also vasiform, lobose, digitately branched, or lamellate body; all fibers, slender; meshes very small, not or scarcely perceptible to the eye. Main fibers simple, terminating, as a rule, singly in the conuli, but the main fiber may break up into two or three branches all of which terminate in one conulus; main fibers with inclusions; connecting fibers uniformly cylindrical, without inclusions, branching and continually anastomosing.

EUSPONGIA OFFICINALIS (Linnaeus).

Spongia officinalis LINNAEUS, 1735.

Euspongia officinalis LENDENFELD, 1889, p. 262 (synonymy in detail).

The collection includes 15 cut pieces all taken on same day, August 26, at Hinitungan, and representing a number of sponges, all massive and 80–180 mm. in diameter. They are all alike. The conuli are sharp, about 1 mm. high and 1.5–2 mm. apart, commonly connected by ridges, the intervening areas depressed in the usual way. The radial skeletal fibers frequently protrude at the conuli, singly or two or three in one conulus. A number of oscula, 4–9 mm. in diameter, on upper part of sponge. Surface blackish, lighter in lower part of sponge; interior yellowish brown to reddish. Several of the sponges with eggs.

In them all the conuli are higher, the ridges more prominent, and the depressed areas deeper in certain regions than is common. Such regions doubtless represent areas in which contraction had proceded quite far.

Main fibers of a region nearly parallel to one another, vertical to surface, 40–50 µ thick, well filled with spicule fragments but containing no, or almost no, sand grains. Fibers in the peripheral part of sponge are 900–1,800 µ apart. As a rule the fiber terminates singly in a conulus, but it may branch at very acute angles, the two or three branches terminating together in a single conulus. Connectives are of uniform thickness, about 20 µ thick, and contain no foreign inclusions; characteristic meshes 90, 180, 270 µ in diameter.

In addition to the above, three small specimens of massive shape, 50–60 mm. in diameter, were taken along the shore of Busin harbor, Burias Island. Conuli less than 1 mm. high, and less than 1 mm. apart. Oscula 2–4 mm. in diameter, many sphinctrate. Main fibers in peripheral part of sponge, 700–1,200 µ apart. In the remaining features mentioned above, these sponges agree with the larger ones and are therefore to be regarded as young (see below) forms of the same race.

Some of the recognized varieties (Lendenfeld, 1889) of *Euspongia officinalis* are well marked, although perhaps certain of them are only habitus forms. Others are vaguely delimited by quantitative differences which are too slight to be relied upon with any great certainty in the practical work of classification. It would probably be a good provisional step in the handling of collections, which do not permit the rich detailed comparisons between many individuals (young and old, in various kinds of habitat, and in different physiological states) that come with a residence in the working-field of a laboratory, to reduce the number of varieties, recognizing by name only such as depart conspicuously from a type which itself is conceived, in accordance with the facts, as not uniform but heterogeneous in respect to detail.

Thus I find that, as far as recorded data allow one to form a judgment, the Philippine sponges above described can not be separated from Dendy's variety *ceylonensis* from the Gulf of Manaar (Dendy, 1905, p. 211) nor, on the other hand, from the Porto Rico specimens which I referred (1902, p. 402) to var. *rotunda* in the sense of Lendenfeld (1889, p. 269), under which name Lendenfeld combined numerous West Indian and Florida forms that had been distinguished especially by Hyatt. From these the Mediterranean variety *adriatica* is not very distant, although possibly specimens of *adriatica* might be picked out from the others by the larger average size of the meshes and thickness of the connectives and by the fact that the foreign bodies in the main fibers are chiefly sand grains.

In listing the small specimens from Burias Island (see above) as young forms, I would add that they may be young in respect to time, or possibly only in respect to growth stage regardless of actual time age. I have in mind such cases as that of *Microcioma prolifera* Verrill (see George and Wilson, 1919), in which species we find thin incrusting forms and erect ramose forms together with intermediates, all breeding. The abundance of the incrusting type in Beaufort (N. C.) harbor, coupled with the comparative scarcity of the ramose forms, makes it probable that the sponge very often stops its growth, owing to environmental conditions, in the incrusting stage. Incrusting *Microcionas* may therefore, on this hypothesis, sometimes be quite as old in time as many a ramose specimen.

EUSPONGIA IRREGULARIS Lendenfeld, var. SURIGANENSIS, new variety.

Euspongia irregularis LENDENFELD, 1889, p. 245.

Station D5478 (vicinity of Surigao Strait), one specimen with an attached *Myriastra siemensi.* Sponge an amorphous, thin, flattened mass sending off subcylindrical branches which, in part, fuse with one another, thus producing a very irregular body. Dimensions of whole sponge 150 by 60 by 50 mm. Branches 5–10 mm. in diameter, length of longest free branch 50 mm. Oscula 3 mm. in diameter scattered over upper and lateral surfaces; all elevated more or less, the elevation in a few cases low, in most cases forming a tubular projection (cloacal tube) 8–13 mm. high by 3–4 mm. in diameter. Wall of cloacal tube very thin, inclosing a single cavity into base of which open several efferent canals. Osculum at apex of the tube is open in a number of cases; in others closed, but otherwise such tubes are like the open ones. In all about 20 such tubes are present. Surface of sponge in general with conuli 2–3 mm. apart and 1 mm. or less in height. Conuli over much of the surface interconnected by the usual sharp ridges with depressed areas between; distinctness of ridges doubtless varies with the contraction state. There are numerous smooth aconulous areas, several of them extensive: all apparently on sheltered parts of the surface. Sponge not as uniformly dense as *E. officinalis.* Color, lead gray, variable.

Dermal membrane is smooth, without sand, but containing plenty of spicule fragments; underlaid by subdermal cavities visible to eye. There is the usual dermal reticulum of fibrous bands with pores in the meshes, the larger interconular bands containing a good many spicules arranged lengthwise and looking almost like skeletal fibers. Flagellated chambers 40–44 by 30–36 µ.

Main fibers terminating singly in the conuli, mostly 42–56 µ thick, expanding here and there to as much as 77 µ thick; 2–3 mm. apart at surface, closer together in interior; containing no sand, only spicule fragments; these filling the fiber in the conuli, but less abundant in interior of sponge. Connectives and skeletal net show the irregularities (as compared with *E. officinalis*) characteristic of the species. Connectives in general 28 μ thick, but smaller ones also abundant, varying down to 10 μ thick; distribution of latter varies a good deal, however, for in some parts of a section all of the fibers are of about one thickness, 28 μ. The finer connectives are pretty well marked off from the larger, extending between the latter and subdividing the spaces embraced by them. These spaces vary from polygonal meshes as definitely bounded as in *E. officinalis* to elongated spaces which often are indefinitely bounded at one end. Typical meshes embraced by the larger fibers have the following dimensions: 700 by 250 μ, 420 by 245 μ, 350 by 280 μ, 350 by 350 μ, 280 by 210 μ, 210 by 77 μ. The smaller meshes produced by the finer connectives range down to 70 μ wide.

Holotype.—Cat. No. 21263, U. S. N. M.

In the possession of slender, cylindrical cloacal tubes (fistulae) the *Albatross* sponge agrees with *E. irregularis*, var. *fistulosa*, from the Bahamas (Lendenfeld, 1889, p. 249), but these are massive more or less spherical sponges, which in other respects also are not especially close to the *Albatross* form. In its branching habit, also in the possession of aconulous areas and small oscula, the latter resembles var. *jacksoniana* from Australian waters (Lendenfeld, 1889, p. 254). But in var. *jacksoniana* there are no cloacal tubes, and the main fibers are 100 μ thick with a dense axial column of large sand grains. Another branching *Euspongia* is *E. tenuiramosa* from Ceylon (Dendy, 1905, p. 213), but without other special resemblances to var. *suriganensis*. It is plain that a practically infinite number of combinations of characters is possible, and may in fact now exist, in these sponges, owing to the independent variability of features. The new varietal name is given to the form simply that the combination which it represents may not be lost sight of.

Lendenfeld (1889) gives the distribution of the species. Topsent (1897, p. 484) has since recorded it for Amboina, and Hentschel (1912, p. 435) for the Aru Islands.

Subfamily APLYSININAE.

Aplysininae LENDENFELD, 1889, p. 335 plus *Psammaplysillidae* KELLER, 1889, p. 358.

Skeletal fibers contain a conspicuous axial pith or, more rarely, are composed entirely of pith substance.

Genus PSAMMAPLYSILLA Keller (1889).

Psammaplysilla KELLER, 1889, p. 358, pl. 22, figs. 23–27.

Fibers consisting of a minutely reticulate pith substance, which is sometimes imperfectly surrounded by a very thin development of spongin. Fibers not cylindrical and smooth but irregular in outline, aggregated and anastomosing to form skeletal tracts, which may be compact enough to deserve the name of compound fibers; between such tracts, extensive askeletal areas.

PSAMMAPLYSILLA KELLERI, new species.

Plate 44, fig. 3.

Togian Bay, Togian Island, Celebes, two specimens. Sponge a branching species; several long, slender branches rise from a common basal part, the branches fusing here and there at points of contact. Branches up to 160 mm. long, somewhat flattened, tranverse diameter 5–12 mm.; covered with conuli a few millimeters apart, these interconnected by sharp ridges which pursue in general a longitudinal course. Surface in these specimens smooth and without apertures visible to the eye. Sponge firm and compact but flexible; of a reddish-purple color.

Very small pores are scattered thickly over the surface; from them fine pore canals lead through the ectosome. Sections show here and there small canals, which yet are somewhat larger than the average pore canal, perforating the ectosome and opening on the surface; one such measured 20–25 μ in width; possibly these are oscular canals.

There is a thin surface cuticle and a fibrous layer in the deeper part of the ectosome. The mesenchyme is abundant, with many small cells containing pigment. The flagellated chambers are small but vary a good deal in size in the actual specimens, probably in part owing to contraction. They are ellipsoidal and measure 40 by 30 μ, 40 by 20 μ, 36 by 28 μ, and in some places only 24 by 14 μ. When cut crosswise they appear circular. Conspicuous ducts leading to and from them are absent.

Skeletal fibers predominantly located in the more axial part of body and largely longitudinal, branching and combining to form a skeleton which is most irregular in its distribution; in places it is closely reticular but extensive areas are quite without a skeleton. Some of the fibers extend outward and terminate in the conuli. Such conular fibers diminish in thickness as they reach the surface, and close to the surface may be only 30–40 μ thick although frequently larger; somewhat further in, a characteristic conular fiber measures 80–90 μ in thickness. Individual fibers of the inner skeleton are for the most part 120–350 μ thick.

The (individual) fibers are very irregular in shape, the same fiber varying markedly in diameter even within a short length. They are abundantly covered with bulbous enlargements or, in places, with more elongated outgrowths. The whole fiber presents the appearance of a body which grows by budding.

The structure of the fibers, apart from their shape and arrangement, is remarkable. They are either entirely, or almost entirely, composed of a minute reticulum, the meshes of which are about 4 μ in diameter, the strands very fine and yellowish in color. Whatever surface layer a fiber has is, in many cases, only a part of the general reticulum which forms the body of the fiber, not differing from it. But in other cases the general reticulum is strengthened at the surface of the fiber by thicker bands, having the appearance of spongin, which run lengthwise but anastomose and form a superficial coarse reticulum. Such a surface structure appears to be only a differentiation of the general reticulum and not something apart from it. The fibers exhibit (pl. 44, fig 3) a coarse and conspicuous concentric stratification. Sometimes bits of spicules and often small spheroidal groups of deeply pigmented cells occur in the interior of a fiber, several of the latter often close together. The latter inclusions are prehaps connected with the origin of the fiber, which possibly could be worked out on this material. The fibers, as might be inferred from their structure, are not hard enough, in spite of their size, to offer any great resistance to sectioning.

Holotype.—Cat. No. 21291, U.S.N.M.

Keller's *Psammaplysilla arabica* (1889) is a common species in the Red Sea. Incrusting, cake-shaped, and more or less conical or massive specimens occur. Sponge is firm and leathery; when dried, stony hard; covered with large conuli; oscula scattered. Skeleton consists of distinct compound fibers which ascend from the base of sponge, each soon breaking up into a reticulum of individual fibers. The individual fibers are irregular and lobulated in outline (Keller, 1889, pl. 22, fig 27) and usually contain abundant sand grains. They are concentrically stratified in a coarse and conspicuous fashion and consist entirely of a finely reticulate material that is similar to the medulla of the *Aplysilla* or *Aplysina* fiber. Pigment cells are abundant in the mesenchyme, especially near the surface. The living sponge is of a bright leather color at surface, yellow inside; in alcohol, black violet. Character of flagellated chambers unknown. The sponge has also been recorded by Topsent, 1892*b*, for the Red Sea.

Keller made this interesting sponge the type of a new genus and family (Psammaplysillidae) which he derived from the Aplysillidae. His material did not, however, permit of the study of the flagellated chambers, and as Dendy (1905, p. 244) has pointed out the relationship is probably with *Aplysina* and not, as Keller thought, with *Aplysilla*. I assume, until the sponge is studied again, that this is the case. If it should turn out that the canal system is really of the *Aplysilla* type, the striking resemblance between the fibers of the *Albatross* sponge and Keller's type would have to be looked on as a case of analogical resemblance. We should have to conclude, in other words, that both in *Aplysilla* and *Aplysina* certain offshoots had developed the morphogenetic habit of not secreting a firm spongin layer on the outside of the fibers. In case all this, which seems very unlikely, should turn out to be so, the *Albatross* sponge should be received into a new genus close to *Aplysina*. The character of the fibers is so peculiar as to deserve generic value, although the sponge is obviously related to *Aplysina* and *Dendrospongia*.

Schulze, 1878 (p. 401), first pointed out that the medulla of the *Aplysina* fiber is finely reticular in structure. He notes also (p. 399) that in young fibers the spongin wall may be only one-thirtieth to one-tenth total diameter of the fiber, although it increases not only in absolute but in relative thickness as the whole fiber grows thicker. In *Aplysilla* he finds (1878, p. 411) that the finer structure of the fibers is essentially as in *Aplysina*. Lendenfeld (1889, p. 398) says that the pith in the *Aplysina* fiber shows a reticulate structure. He records species (p. 416) in which the pith forms nine-tenth of the thickness of the fiber, the surrounding spongin forming only a very thin, although laminated, coating. In Porto Rican specimens of *Aplysina flagelliformis anomala* and *Dendrospongia crassa* I find that the pith is composed of a minutely reticulated substance. The pith of these fibers or the pith plus the very innermost spongin evidently corresponds to the whole fiber of *Psammaplysilla*.

Another sponge must be considered in this connection. This is *Aplysina purpurea*, first described by Carter, in 1880, from Ceylon, and later (1881*b*, p. 103) more fully described by him, the distribution being extended to Australia. Dendy (1889, p. 97; 1905, p. 224) has studied Ceylon (Gulf of Manaar) specimens of this species. The sponge is more or less conical or massive; conulated; may reach 195 mm. in height. The skeleton is composed of dense local aggregations of very irregular, branching and anastomosing horny fibers accumulated along certain tracts to form the so-called compound fibers, while large intervening areas remain free from fiber altogether. The fibers themselves have a very curious structure, consisting of a very thin outer layer (if any) and a very thick pith, the latter exhibiting a granular or often minutely reticulate appearance. They are free from foreign bodies (Dendy 1905). Dendy concludes that Keller's *Psammaplysilla arabica* is very closely related to, if not identical with, *A. purpurea*. Carter (1881*b*) says that in *A. purpurea* the ectosome (dermal sarcode) is fibrous below, with abundant pigment cells. The color in alcohol is black purple. What Carter terms horn cells (1881*b*, pl. 9, fig. 1,*e*) are doubtless, as he concludes, stages in the development of the fibers. Their irregular shape in transverse section constitutes a point of resemblance to *P. arabica* and *P. kelleri*. Altogether it would seem that *Aplysina purpurea* must be regarded as the type of the genus to which I would in any case refer the *Albatross* sponge.

Row (1911, p. 377) refers a Red Sea sponge to *A. purpurea*. Hentschel (1912, p. 437) has studied a specimen from the Aru Islands. The individual fibers give very irregular cross sections and are variable (same fiber) in thickness, although often 200–300 µ thick, pith occupying nine-tenths or more of total thickness; the compound fibers measuring up to 2 mm. thick.

The resemblance between the fibers of *Psammaplysilla* and *Druinella* Lendenfeld deserves noting. In *D. rotunda* Lendenfeld, from Australian waters, the fibers show in cross section the same irregular lobose shape and coarse stratification (Lendenfeld 1889, p. 425, pl. 34). In Thiele's *D. ramosa*, from Celebes, the fibers show the same shape (Thiele, 1899, p. 24, pl. 4). Finally, the resemblance may be noted that is offered by the fibers of *Thymosia* Topsent (*T. guernei* Topsent, coast of France, Topsent, 1895, p. 574, pl. 22, fig. 7). This sponge, originally referred by Topsent to the Chondrosidae, is surely a horny sponge, as Lendenfeld (Zoologisches Centralblatt, vol. 3, p. 393) has suggested. Lendenfeld refers it to *Druinella*.

Subfamily STELOSPONGINAE

Stelosponginae LENDENFELD, 1889, p. 468.

Spongidae in which main fibers and connectives are generally distinguishable in the skeletal reticulum. The main fibers may be simple, but are generally more or less fascicular. Between the fascicular fibers, or between the simple main fibers in species without fascicles, the skeletal meshes are much larger than in the Eusponginae.

Genus HIRCINIA Nardo (1834).

Hircinia NARDO, 1834, p. 714.—LENDENFELD, 1889, p. 526.—GEORGE and WILSON, 1919, p. 166.

Stelosponginae with filaments in the ground substance and in which the connectives are characteristically attached to the main fibers by diverging roots which extend along the main fiber in one plane.

HIRCINIA MUTANS, new species.

Plate 44, fig. 2; plate 52, figs. 2, 4, 6, 7.

One dried specimen. Locality uncertain; no label. Sponge a cavernous mass, 280 mm. long, 150 mm. wide, and 40–100 mm. thick, which evidently had been attached and in part incrusting over one of the large surfaces. The mass is excavated by large passages, which pass through the body and are 10–20 mm. in diameter on the exposed surface, much larger over the attached surface. Dermal membrane of the attached surface pale and smooth, with only a few feeble conuli scattered here and there. On the exposed surface the conuli are strongly but variously developed, and there is a tendency for the sponge to grow out in the shape of irregular lobular elevations, between which the dermal membrane is comparatively smooth.

The character of the exposed surface with respect to the conuli is, as said, variable. The indication is that it alters with growth, and that the above mentioned lobular elevations are regions of growth. On this assumption it becomes possible to understand and describe the surface appearance. I pick out a number of conditions which I believe represent stages in growth change.

The particular surface condition, which is probably most characteristic of the species, exhibits no lobes. Instead we find elevations 3–5 mm. high, marked with several, sometimes numerous, prickles. Such elevations may be called *compound conuli.* They are mostly 10–15 mm. apart, measuring from the center of one elevation to that of the next, and are connected by prominent ridges, which divide the sponge surface into large, smooth, depressed areas. The prickles on the compound conuli may be styled *simple conuli.* Similar ones are found here and there on the ridges connecting the compound conuli. The compound conulus begins as (1) a simple conulus. In proof of this we find on the ridges not only simple conuli but (2) somewhat larger, and yet similar, elevations divided at the summit into two, three, or a few prickles, all close together. As such elevations grow they move apart and become (3) the compound conuli of the characteristic surface condition. If now a compound conulus becomes a spot of active growth, it becomes (4) more or less flattened at the top, the simple conuli moving apart from one another, but remaining connected by ridges. The flat-topped compound conulus increases in size and becomes (5) a small projecting lobe bearing simple conuli about 2 mm. apart, all interconnected by ridges. Such lobes increase in size and the simple conuli shift farther apart, so that (6) a well developed lobular projection results, bearing simple, sharp conuli 1–2 mm. high, 4–5 mm. apart, interconnected by ridges. Such lobular projections, where they are well developed, are separated by depressed areas of smooth membrane, 10–15 mm. wide. Conditions (3) and (6) differ much in appearance.

A few large oscula, 10–15 mm. in diameter, are found at one end of the sponge. They lead into shallow depressions into which a number of canals debouch. The oscular depressions may, however, be absent, the several canals opening independently on the surface. The body is greatly excavated by canals, the larger of which are 4–5 mm. in diameter. The dermal membrane is filled with broken spicules and a few sand grains, constituting the usual "sand cortex." This is distinct but thin, in general 100 μ or less in thickness. In certain regions the mineral bodies are uniformly distributed through the membrane, which in such places shows no signs of the pores. But over the greater part of the surface they are aggregated to form a dense reticulum in the meshes of which there is only thin membrane quite lacking such bodies. Here and there perforating the membrane filling a mesh is found an open pore. The meshes of this cortical reticulum are about 140 μ in diameter, the intervening strands about 50 μ thick. The entire arrangement indicates that when the pores have been closed for some time the mineral bodies become uniformly distributed through the dermal membrane, but as the pores open these bodies are shifted and become concentrated between and around them. The cortical reticulum is visible to the eye.

The filaments are very abundant, about 5 μ thick, tapering to one-half that thickness at the ends, where the enlargements are spheroidal and 10–12 μ in diameter. They are unspotted. The sponge in the dried state is compressible. Color purple or purplish gray on upper surface, yellowish brown on attached surface.

Skeleton.—Main fibers and connectives are distinguishable in the peripheral part of the sponge, the main fibers terminating in the conuli. But in the interior the course of the main fibers becomes so irregular that the skeleton here is not distinctly divisible into such fibers and connectives. Doubtless the larger fibers of the interior, with fairly abundant foreign contents, represent the main fibers, but no order is distinguishable in their distribution.

The main fibers (*m. f.* in figs. 2, 4, 6, 7 of pl. 52) may be only slightly or distinctly "fascicular," in the characteristic *Hircinia*-fashion as contrasted with *Stelospongia*—that is, the "fascicular" state is here produced by the prolongation along the primitively simple main fiber of the roots of connectives, instead of by the binding together of several more or less parallel fibers into a compound fiber. (See George and Wilson, 1919, pp. 168, 171.) The originally simple, solid, main fiber is about 150 μ thick, containing abundant sand grains and spicule fragments. It may remain simple throughout the greater part of its extent, being fascicular (fenestrated would be a better word) only where the roots of connectives meet it (pl. 52, fig. 4); or the connective roots may spread along the fiber to such an extent that it becomes almost everywhere fenestrated (pl. 52, fig. 6); such fibers may attain a thickness of 300 μ, occasionally even 400 μ.

The connectives, however much they differ in detail, are characterized by the fact that they meet the main fibers by triangular expansions perforated by apertures, which represent the connective roots of some other species. I refer to these (pl. 52, figs. 2, 4, 6, 7) as fenestrated expansions. Occasionally a connective is found which meets a main fiber not by such an expansion but by a few distinct roots (fig. 4). Where the connectives are joined by cross bars, the latter (fig. 4) terminate in small fenestrated expansions. And where one connective joins another at an angle, the same kind of connection is made (fig. 4). The fibers then in general have this characteristic way of combining, instead of by roots. They are in general without, or with only very few, mineral inclusions.

The connectives however differ considerably in detail. The following types may be recognized: (*a*) They are simple, solid fibers without inclusions, 35–50 μ thick, passing from main fiber to main fiber and only sparsely interconnected (fig. 4). (*b*) Thicker connectives, apparently formed by the fusion, parallel-wise, of two or three of the thinner ones, occur, sometimes with a few inclusions (spicules) (fig. 7). (*c*) Union between simple fibers, either parallel-wise or by interconnecting bars, gives rise to fenestrated membranes, which may be quite small or plates of considerable size (figs. 2, 6, 7).

Skeleton in general is coarse and irregular, the meshes except within a fenestrated plate large, up to and over 1 mm., sometimes reaching 3 mm., in width. There are no special dermal fibers, although occasionally a connective is so far out that it happens to be included in the dermal membrane.

Holotype.—Cat. No. 21324, U.S.N.M.

Comparing this species with two of the best known *Hircinia* forms, *H. variabilis* F. E. Schulze and *H. foetida* (O. Schmidt), it may be said that the main fibers are more "fascicular" than in *H. variabilis* and the connectives more disposed to form reticular (fenestrated) membranes, but this tendency does not go so far as in *H. foetida*, where the connectives in general have this character.

HIRCINIA VARIABILIS F. E. Schulze.

Hircinia variabilis F. E. Schulze, 1879, p. 12.—Lendenfeld, 1889, p. 557.

Station D5477, one specimen having the shape of a narrow vertical plate which bears along its lateral edges cylindrical branches extending out at right angles to the plate. The branches evidently have terminal oscula, although the latter are now closed. The shape of the sponge is obviously a variant of the ramose type. Total height, 120 mm.

Conuli low and not sharp, 3–4 mm. apart. Surface marked with the usual reticulum of narrow bands, 50 μ wide and less. full of sand grains, etc., bounding rounded or angular pore areas. 85–200 μ in diameter, that are free or nearly free of foreign particles; bands of this kind radiating from each conulus. Color, silver gray.

Filaments abundant, 6 μ thick in middle region, tapering toward the pyriform terminations: unspotted.

Main fibers fascicular, in the *Hircinia* fashion, only where connectives meet them, simple elsewhere; 260–175 μ thick, filled with sand grains and sponge spicules, extending radially into the conuli, one fiber in axis of each conulus, the fiber tapering terminally; the thin dermal layer of foreign particles covering the tips of the fibers as well as the surface in general; all as in Schulze's description. Main fibers at surface of sponge 3–4 mm. apart, the interval decreasing further in.

The system of connectives varies a good deal. The component fibers may be simple and narrow, about 100 μ thick, or may combine and form flattened plates, about 300–350 μ wide in a radial direction, which are fenestrated by comparatively few and small gaps. Whatever the details be, the connectives establish between the main fibers a comparatively simple and coarse meshwork, the meshes of which are rounded and for the most part 900–350 μ in diameter. The meshes here and there are much larger, up to 3 mm. in diameter. In other places the network is closer and the meshes may run down to a diameter of 150 μ and smaller. In general, an individual connective which meets a main fiber does so by breaking up into a set of branches ("roots"), but sometimes the connection is by a fenestrated expansion of the connective or even by an unfenestrated expansion. The connectives include sand grains and spicule fragments, these more often forming only a slender core in the fiber; the foreign particles are sometimes more abundant, but even then less abundant than in the main fibers.

There are no connectives in the dermal membrane, but the most superficial connectives sometimes lie directly beneath the membrane. The detailed nature of the most superficial connectives of the reticulum is inconstant (the inconstancy perhaps associated with growth); they sometimes differ noticeably from the connectives in general in that they contain spicule fragments with almost no sand grains and the spongin is pale.

The skeleton, as will be seen from the above, conforms in general to Schulze's admirable description, but this in its bravity scarcely more than suggests the lines of variation.

As more specimens assignable to the species are examined, it becomes evident that the variations are so numerous and intricate that not much use, except locally, can be made in practical classification of the several (eight) varieties recognized by Lendenfeld, (1889).

The distribution of the species recorded by Lendenfeld is wide, including the Mediterranean, Indian Ocean, Pacific, American coast of North Atlantic, and Australian seas. Since Lendenfeld's monograph the species has been recorded for Amboina (Topsent, 1897, p. 482), Porto Rico (Wilson, 1902, p. 405), Azores (Topsent, 1904, p. 250), Chilean waters (Thiele, 1905, p. 484), Sudanese Red Sea (Row 1911, pp. 371, 372), Spanish waters (Hernandez, 1916 p. 39, 1918 p. 33, 1921 p. 2).

BIBLIOGRAPHY.

Annandale, N.

1915. Fauna of the Chilka Lake. Sponges. Memoirs, Indian Museum, vol. 5. Calcutta.

Baer, L.

1906. Silicispongien von Sansibar, Kapstadt und Papeete. Archiv für Naturgeschichte, Jahrgang 72, vol. 1. Berlin.

Bowerbank, J. S.

1864. Monograph of the British Spongiadae, vol. 1. Ray Society. London.

1866. Idem, vol. 2. Same reference.

1874. Idem, vol. 3. Same reference.

1882. Idem, vol. 4. Same reference.

1872. Contributions to a general history of the Spongiadae, parts 1–3. Proceedings, Zoological Society of London. London.

1873. Idem, parts 4–5. Same reference.

1874*b*. Idem, part 6. Same reference.

1875. Idem, part 7. Same reference.

1876. Idem, part 8. Same reference.

1873*b*. On a collection of sponges from Ceylon. Proceedings, Zoological Society of London.

Bronn, H. G.

1859. Klassen und Ordnungen des Thierreichs, vol. 1. Amorphozoa. Leipzig. (Cited from Lendenfeld, 1889, p. 13.)

Carter, H. J.

1869. Description of a Siliceous Sand-Sponge found on the South-east coast of Arabia. (*Tethya dactyloidea.*) Annals and Magazine of Natural History, ser. 4, vol. 3.

1874. Descriptions and figures of deep-sea sponges and their spicules from the Atlantic Ocean dredged up on board H. M. S. *Porcupine*, chiefly in 1869. Annals and Magazine of Natural History, ser. 4, vol. 14.

1879. Contributions to our Knowledge of the Spongida. Same reference, ser. 5, vol. 3.

1881. Supplementary report on specimens dredged up from the Gulf of Manaar. Same reference, ser. 5, vol. 7.

1881*b*. Contributions to our knowledge of the Spongida. Order II. Ceratina. Same reference, ser. 5, vol. 8.

1882. New sponges, observations on old ones, and a proposed new group. Same reference, ser. 5, vol. 10.

1887. Report on the marine sponges, chiefly from King Island in the Mergui Archipelago, etc. Journal, Linnean Society (Zoology), vol. 21.

Crozier, Blanche B.

1918. Bermudan species of Donatia (Tethya). Annals and Magazine of Natural History, ser. 9, vol. 1.

Delage, Y., and Hérouard, E.

1899. Traité de Zoologie Concrète. Vol. 2, pt. 1. Mesozoaires. Spongiaires. Paris.

DENDY, A.

1887. The sponge fauna of Madras. Annals and Magazine of Natural History, ser. 5, vol. 20.

1889. Report on a second collection of sponges from the Gulf of Manaar. Annals and Magazine of Natural History, ser. 6, vol. 3.

1890. Observations on the West Indian chalinine sponges, with descriptions of new species. Transactions, Zoological Society of London, vol. 12.

1894. Catalogue of noncalcareous sponges collected by J. Bracebridge Wilson, Esq., M. A., in the neighborhood of Port Phillip Heads, part 1. Proceedings, Royal Society Victoria, vol. 7. Melbourne.

1895. Idem, part 2. Same reference, vol. 8.

1896. Idem, part 3. Same reference, vol. 9.

1905. Report on the sponges collected by Professor Herdman at Ceylon in 1902. In: Herdman Rep. Pearl Oyster Fisheries, pt. 3. London.

1916. Report on the Homosclerophora and Astrotetraxonida collected by H. M. S. *Sealark* in the Indian Ocean. Transactions, Linnean Society of London. Ser. 2. Zoology, vol. 17, pt. 2.

1916*b*. Report on the noncalcareous sponges collected by Mr. James Hornell at Okhamandal in Kattiawar in 1905–6. Williams and Norgate, London.

1921. The tetraxonid sponge spicule—a study in evolution. Acta Zoologica (separate).

1921*b*. Report on the Sigmatotetraxonida collected by H. M. S. *Sealark* in the Indian Ocean. Transactions, Linnean Society of London, vol. 18, pt. 1.

EHLERS, E.

1870. Die Esperschen Spongien in den Zoologischen Sammlungen der k. Universitäts. Universitäts-Programm. Erlangen. (Cited from Lendenfeld, 1888, p. 25.)

GEORGE, W. C. and WILSON, H. V.

1919. Sponges of Beaufort (N. C.) harbor and vicinity. Bulletin, U. S. Bureau of Fisheries, vol. 36 for 1917–18. Washington.

GRANT, R. E.

1826. Observations and experiments on the structure and functions of the sponge. Edinburgh Philosophical Journal. Vol. 14. (Cited from Vosmaer, 1887, pp. 47, 51, 203 and Johnston, 1842, p. 51).

1861. Tabular view of the primary divisions of the animal kingdom. London. (Cited from Bowerbank, 1864, p. 154.)

GRAY, J. E.

1867. Notes on the Arrangement of Sponges with the description of some new Genera. Proceedings Zoological Society of London.

1868. Observations on Sponges and on their Arrangement and Nomenclature. Annals and Magazine of Natural History, vol. 1.

1868*b*. Note on *Theonella*, a new Genus of Coralloid Sponges from Formosa. Proceedings, Zoological Society of London.

1869. Note on *Ianthella*, a new Genus of Keratose Sponges. Same reference.

HALLMANN, E. F.

1912. Zoological results of the fishing experiments carried out by the F. I. S. *Endeavour*, 1909–10 (H. C. Dannevig, Commonwealth Director of Fisheries). Part 2. Report on the sponges obtained by the F. I. S. *Endeavour* on the coasts of New South Wales, Victoria, South Australia, Queensland, and Tasmania. Part 1. Sydney.

HALLMANN, E. F.—Continued.

1916. A Revision of the genera with microscleres included, or provisionally included, in the family Axinellidae; with descriptions of some Australian species. Parts I, II. Proceedings Linnaean Society of New South Wales. Vol. 41. Sydney, New South Wales.

1917. Idem, pt. 3. Same reference.

HENTSCHEL, E.

1909. Die Fauna Südwest-Australiens. Tetraxonida. Part 1. Fischer, Jena.

1911. Idem. Part 2. Fischer, Jena.

1911*b*. Ueber den Ursprung der Microsclere der Desmacidoniden. Zoologischer Anzeiger, vol. 38, p. 148.

1912. Kiesel-und Hornschwämme der Aru-und Kei-Inseln. Abhandlungen der Senckenbergischen naturforschenden Gesellschaft, vol. 34. Frankfurt.

1913. Ueber einen Fall von Orthogenese bei den Spongien. Zoologischer Anzeiger, vol. 42, p. 255.

1913*b*. Ueber die Anwendung der funktionalen Betrachtungsweise auf die biologische Systematik. Biologisches Centralblatt, vol. 33, p. 644.

1914. Monaxone Kieselschwämme und Hornschwämme der deutschen Südpolar Expedition 1901–1903. Reimer, Berlin.

1914*b*. Die Spiculationsmerkmale der monaxonen Kieselschwämme. Mitteilungen aus dem Naturhistorischen Museum, vol. 31. Hamburg.

HERNANDEZ, F. F.

1912. Notas sobre algunas esponjas de Santander. Dissertation for the doctorate in the Central University of Spain. Madrid.

1914. Esponjas del Cantábrico. Parte segunda. Trabajos del Museo Nacional de Ciencias Naturales. Serie Zoologica, Núm. 17. Madrid.

1916. Fauna del Mediterraneo occidental. Esponjas Españolas. Same reference, Núm. 27.

1918. Esponjas del Litoral de Asturias. Same reference. Núm. 36.

1919. Descripción de tres esponjas nuevas del litoral Español. Revista de la Real Academia de Ciencias Exactas, Fisicas y Naturales, de Madrid. vol. 16. Madrid.

1921. Esponjas recogidas en la campaña preliminar del "Giralda." Boletin de Pescas, 1921. Madrid.

HYATT, A.

1875. Revision of the North American Poriferae; with remarks upon foreign species. Part I. Memoirs, Boston Society of Natural History. Vol. 2. Boston.

1877. Idem., Part 2. Same reference.

JOHNSTON, G.

1842. A history of British sponges and lithophytes. W. H. Lizars, Edinburgh.

KELLER, O.

1880. Neue Coelenteraten aus dem Golf von Neapel. Archiv für mikroskopischen Anatomie, vol. 18.

1889–91. Spongien-fauna des rothen Meeres. I and II. Zeitschrift für wissenschaftliche Zoologie, vols. 48 and 52.

KIESCHNICK, O.

1900. Kieselschwämme von Amboina. Semon, Zoologische Forschungsreisen in Australien und dem Malayischen Archipel, vol. 5. Jena.

KIRKPATRICK, R.

1900. Description of sponges from Funafuti. Annals and Magazine of Natural History, ser. 7, vol. 6.

1902. Marine Investigations in South Africa (Department of Agriculture, Cape of Good Hope). Descriptions of South African sponges. Government Printers, Cape Town.

1902*b*. Idem. Descriptions of South African Sponges, pt. 2. Same reference.

1903. Idem. Descriptions of South African Sponges, pt. 3. Same reference.

1905. On the oscules of Cinachyra. Annals and Magazine of Natural History, ser. 7, vol. 16.

1908. National Antarctic Expedition. Natural History, vol. 4. Porifera Tetraxonida. British Museum. London.

1911. On Merlia normani, a sponge with a siliceous and calcareous skeleton. Quarterly Journal of Microscopical Science, vol. 56.

LAMBE, L. M.

1893. On some sponges from the Pacific coast of Canada and Behring Sea. Transactions, Royal Society of Canada, vol. 10, sec. 4. Ottawa.

LEBWOHL, F.

1914. Japanische Tetraxonida. Journal of the College of Science, Imperial University of Tokyo, vol. 35, articles 2 and 5. Tokyo.

LENDENFELD, R. VON.

1885. Die Verwandtschaftsverhältnisse der Myxospongien. Zoologischer Anzeiger, vol. 8.

1887. Die Chalinien des australischen Gebietes. Zoologische Jahrbücher, vol. 2. Jena.

1888. Descriptive catalogue of the sponges in the Australian Museum. Sydney. Publication of the Australian Museum.

1889. A monograph of the horny sponges. Trübner and Co., London. Published for the Royal Society.

1894. Die Tetractinelliden der Adria. Schriften der mathematisch-naturwissenschaftlichen Classe der Kaiserlichen Akademie der Wissenschaften, vol. 61. Wien.

1894*b*. Die Spongien der Adria. II. Die Hexaceratina. Zeitschrift für wissenschaftliche Zoologie, vol. 54.

1896. Die Clavulina der Adria. Abhandlungen der Kaiserlichen Leopoldinisch-Carolinischen Deutschen Akademie der Naturforscher, vol. 69. Halle.

1897. Spongien von Sansibar. Abhandlungen der senckenbergischen naturforschenden Gesellschaft, vol. 21. Frankfurt.

1903. Das Tierreich, 19 Lieferung. Tetraxonia. Friedländer und Sohn. Berlin.

1906. Wissenschaftliche Ergebnisse der deutschen Tief-see Expedition. vol. 11. Die Tetraxonia. Fischer, Jena.

1907. Deutsche Süd-polar Expedition 1901–1903, vol. 9. Zoologie, I. Tetraxonia. Berlin.

1910. Reports on the scientific results of the expedition to the eastern tropical Pacific, in charge of Alexander Agassiz, by the U. S. Fish Commission steamer *Albatross*, from October, 1904, to March, 1905. The Sponges. 1. The Geodidae. Memoirs, Museum of Comparative Zoölogy, vol. 41, No. 1. Cambridge, Mass.

1910*b*. Idem. The Sponges. 2. The Erylidae. Same reference, vol. 41. No. 2.

LINDGREN, N. G.

1898. Beitrag zur Kenntnis der Spongienfauna des malayischen Archipels und der chineschen Meere. Zoologische Jahrbücher, Abtheilung für Systematik, Geographie und Biologie der Thiere, vol. 11. Jena.

LUNDBECK, W.

1902. The Danish Ingolf-Expedition, vol. 6, pt. 1. Porifera (pt. 1). Published * * * by the direction of the Zoological Museum of the University. Copenhagen.

1905. Idem. Porifera (pt. 2). Same reference.

1910. Idem. Porifera (pt. 3). Same reference.

MEREJKOWSKI, C.

1878. Études sur les Éponges de la Mer Blanche. Mémoires de l'Académie Impériale des Sciences de St. Pétersbourg, VII^e serie, vol. 26. St. Pétersbourg.

MONTAGU, G.

1818. An Essay on Sponges, with descriptions of all the species that have been discovered on the coast of Great Britain,. Memoirs, Wernerian Society, vol. 2. Edinburgh. (Cited from Lendenfeld, 1889, p. 54.)

NARDO, G. D.

1833–34. Classification der Schwämme. Isis (Oken), 1833, p. 519; 1834, p. 714. (Cited from Vosmaer, 1887, pp. 11, 51, 202).

PALLAS, P. S.

1766. Elenchus Zoophytorum. (Cited from Lendenfeld, 1888, p. 23.)

POLEJAEFF, N.

1884. Report on the scientific results of the voyage of H. M. S. *Challenger* during the years 1873–76. Zoology, vol. 11, pt. 31. Report on the Keratosa. Edinburgh.

RIDLEY, S. O.

1884. Spongiida. In: Report on the Zoological collections made in the Indo-Pacific Ocean during the voyage of H. M. S. *Alert*, 1881–82. British Museum. London.

RIDLEY, S. O., and DENDY, A.

1887. Report on the Monaxonida collected by H. M. S. *Challenger*. In: Report on the scientific results of the voyage of H. M. S. *Challenger* during the years 1873–1876. Zoology, vol. 20, pt. 59. Edinburgh.

ROW, R. W. H.

1911. Reports on the marine biology of the Sudanese Red Sea, XIX. Report on the sponges collected by Mr. Cyril Crossland in 1904–5, Part 2. Noncalcarea. Journal, Linnean Society. Zoology, vol. 31. London.

SARS, G. O.

1872. On some remarkable forms of animal life from the great deeps of the Norwegian coast. Part 1. Partly from the posthumous papers of Michael Sars. University Program. Christiania. (Cited from Lendenfeld, 1889, p. 61.)

SCHMIDT, O.

1862. Die Spongien des adriatischen Meeres. Leipzig.

1864. Supplement der Spongien des adriatischen Meeres. Leipzig.

1866. Zweites Supplement der Spongien des adriatischen Meeres. Leipzig.

1868. Die Spongien der Küste von Algier. Leipzig.

1870. Grundzüge einer Spongienfauna des atlantischen Gebietes. Leipzig.

SCHMIDT, O.—Continued.

1879–1880. Die Spongien des Meerbusen von Mexico. I. II. Jena.

1885. Entstehung neuer Arten durch Verfall und Schwund älterer Merkmale. Zeitschrift für wissenschaftliche Zoologie, vol. 42. Leipzig

SCHULZE, F. E.

1877. Untersuchungen über den Bau und die Entwicklung der Spongien. Die Familie der Chondrosidae. Zeitschrift für wissenschaftliche Zoologie, vol. 29. Leipzig.

1878. Idem. Die Familie der Aplysinidae. Same reference, vol. 30.

1879. Idem. Die Gattung Hircinia Nardo und Oligoceras n. g. Same reference, vol. 33.

1879*b*. Idem. Die Gattung Spongelia. Same reference, vol. 32.

1880. Idem. Die Plakiniden. Same reference, vol. 34.

1887. Report on the Hexactinellida collected by H. M. S. *Challenger*. In Report on the scientific results of the voyage of H. M. S. *Challenger* during the years 1873–76. Zoology, vol. 21. Edinburgh.

SOLLAS, IGERNA.

1902. On the sponges collected during the "Skeat Expedition" to the Malay Peninsula, 1899–1900. Proceedings, Zoological Society of London. 1902, pt. 2.

1903. On Haddonella topsenti, gen. et sp. n., the structure and development of its pithed fibers. Annals and Magazine of Natural History. Ser. 7, vol. 12.

SOLLAS, W. J.

1880. The Sponge-fauna of Norway: a report on the Rev. A. M. Norman's Collection of Sponges from the Norwegian coast. Annals and Magazine of Natural History, ser. 5. vol. 5.

1888. Report on the Tetractinellida collected by H. M. S. *Challenger*. In: Report on the scientific results of the voyage of H. M. S. *Challenger* during the years 1873–1876. Zoology, vol. 25. Edinburgh.

1889. On the geodine genera Synops Vosm. and Sidonops. A correction. Proceedings, Royal Dublin Society, vol. 6, pt. 5.

STEPHENS, JANE.

1912. Clare Island Survey. Part 59. Marine Porifera. Proceedings, Royal Irish Academy, vol. 31. Dublin.

1915. Atlantic Sponges collected by the Scottish National Antarctic Expedition. Transactions, Royal Society of Edinburgh, vol. 50, pt. 2. Edinburgh.

1915*b*. Fisheries, Ireland, Scientific Investigations, 1914, IV. Sponges of the coasts of Ireland. I. London.

1917. Report on the sponges collected off the coast of Ireland by the dredging expeditions of the Royal Irish Academy and the Royal Dublin Society. Proceedings, Royal Irish Academy, vol. 34, sec. B. Dublin.

1921. Fisheries, Ireland, Scientific Investigations, 1920, II. Sponges of the coasts of Ireland. II. Dublin.

STEWART, C.

1870. On a new Sponge. *Tethyopsis columnifer*. Quarterly Journal of Microscopical Science, vol. 10.

THIELE, J.

1898. Studien über pazifische Spongien. Zoologica, Heft 24. Stuttgart.

1899. Idem, pt. 2. Same reference, Heft 24, pt. 2.

1899*b*. Ueber Crambe crambe (O. Schmidt). Archiv für Naturgeschichte. Jahrgang 65.

1900. Kieselschwämme von Ternate. I. Abhandlungen der Senckenbergischen naturforschenden Gesellschaft, vol. 25, Heft 1. Frankfurt.

1903. Idem. II. Same reference, vol. 25, Heft 4.

1905. Die Kiesel-und Hornschwämme der Sammlung Plate. Zoologische Jahrbücher, Supplement 6, vol. 3. Jena.

1921. Ueber das System der Demospongien. Zoologischer Anzeiger, vol. 53.

THOMPSON, (SIR) C. WYVILLE.

1873. The Depths of the sea. Macmillan and Co. New York and London.

TOPSENT, E.

1887. Contribution à l'étude des Clionides. Archives de Zoologie expérimentale et générale, ser. 2, vol. 5 *bis*. Paris.

1892. Résultats des campagnes scientifiques * * * par Albert I^{re}, Prince Souverain de Monaco. Fasc. II. Contribution à l'étude des spongiaires de l'Atlantique Nord. Monaco.

1892*b*. Éponges de la Mer Rouge. Mémoires de la Société Zoologique de France, vol. 5. Paris.

1892*c*. Diagnoses d'éponges nouvelles de la Méditerranée et plus particulièrement de Banyuls. Archives de Zoologie expérimentale et générale, ser. 2, vol. 10. Notes et revue.

1893. Note sur quelques éponges du Golfe de Tadjoura recueillies par M. le Dr. L. Faurot. Bulletin, Société Zoologique de France, vol. 18.

1893*b*. Nouvelle série de diagnoses d'éponges de Roscoff et de Banyuls. Archives de Zoologie expérimentale et générale, ser. 3, vol. 1. Notes et revue.

1894. Étude sur la faune des spongiaires du Pas-de-Calais suivie d'une application de la nomenclature actuelle à la monographie de Bowerbank. Revue biologique du Nord de la France, vol. 7.

1894*b*. Étude monographique des Spongiaires de France. I. Tetractinellida. Archives de Zoologie expérimentale et générale, ser. 3, vol. 2. Paris.

1894*c*. Une réforme dans la classification des Halichondrina. Mémoires, Société Zoologique de France, vol. 7. Paris.

1895. Étude monographique des Spongiaires de France. II. Carnosa. Archives de Zoologie expérimentale et générale, ser. 3, vol. 3. Paris.

1896. Matériaux pour servir à l'étude de la faune des Spongiaires de France. Mémoires, Société Zoologique de France, vol. 9. Paris.

1897. Spongiaires de la Baie d'Amboine. Voyage de MM. M. Bedot et C. Pictet dans l'archipel Malais. Revue suisse de zoologie, vol. 4. Genève.

1897*b*. Sur le genre Halicnemia Bowerbank. Mémoires, Société Zoologique de France, vol. 10.

1898. Introduction a l'étude monographique des monaxonides de France. Classification des Hadromerina. Archives de Zoologie expérimentale et générale, ser. 3, vol. 6. Paris.

TOPSENT, E.—Continued.

1898*b*. Éponges nouvelles des Açores (Première Série). Mémoires, Société Zoologique de France, vol. 11. Paris.

1900. Étude monographique des Spongiaires de France. III. Monaxonida (Hadromerina). Archives de Zoologie expérimentale et générale, ser. 3, vol. 8.

1901. Expedition Antarctique Belge. Résultats du voyage du S. Y. Belgica en 1897–1898–1899. Spongiaires. Anvers.

1901*b*. Éponges de la Calle. Archives de Zoologie expérimentale et générale, ser. 3, vol. 9. Paris.

1902. Sur l'orientation des Crinorhiza. Comptes rendus des séances de l'Academie des sciences. Paris.

1902*b*. Les Asterostreptidae. Bulletin, Société scientifique et médicale de l'Ouest, vol. 11, no. 2. Rennes.

1904. Résultats des campagnes scientifiques * * * par Albert I^{re}, Prince Souverain de Monaco. Fasc. 25. Spongiaires des Açores. Monaco.

1905. Étude sur les Dendroceratida. Archives de Zoologie expérimentale et générale, ser. 4, vol. 3. Notes et revue. Paris.

1906. Éponges recueillies par M. Ch. Gravier dans la Mer Rouge. Bulletin du Muséum d'histoire naturelle. 1906. No. 7. Paris.

1906*b*. Les Clavulides purpurines. Same reference, 1906, No. 7.

1907. Cliona purpurea Hck. n'est pas une Clionide. Archives de Zoologie expérimentale et générale, ser. 4, vol. 7. Notes et revue. Paris.

1908. Sur une variété de Clionopsis platei Thiele. Bulletin de l'Institut Océanographique, No. 120. Monaco.

1911. Sur les affinités des Halichondria et la classification des Halichondrines d'après leurs formes larvaires. Archives de Zoologie expérimentale et générale, ser. 5, vol. 7. Notes et revue. Paris.

1911*b*. Sur une magnifique Geodia megastrella Carter du Muséum de La Rochelle. Imprimerie E. Martin. La Rochelle.

1912. Sur une grande Tedania abyssale des Açores (Tedania phacellina, n. sp.). Bulletin de l'Institut Océanographique, No. 252. Monaco.

1913. Spongiaires de l'expédition antarctique nationale écossaise. Transactions, Royal Society of Edinburgh, vol. 49, pt. 3. Edinburgh.

1913*b*. Résultats des campagnes scientifiques * * * par Albert I^{re}, Prince Souverain de Monaco. Fasc. 45. Spongiaires provenant des campagnes scientifiques de la Princesse-Alice dans les Mers du Nord. Monaco.

1915. Spongiaires recuellies par la "Scotia" dans l'Antarctique (1903–1904). Supplement. Transactions, Royal Society of Edinburgh, vol. 51, pt. 1. Edinburgh.

1916. Diagnoses d'éponges recueillies dans l'Antarctique par le Pourquoi-Pas? Bulletin du Muséum d'histoire naturelle, 1916, No. 3. Paris.

1917. Deuxième expédition antarctique française (1908–1910) * * * Documents scientifiques. Spongiaires. Masson et Cie. Paris.

1918. Éponges de San Thomé. Essai sur les genres Spirastrella, Donatia et Chondrilla. Archives de Zoologie expérimentale et générale, vol. 57, fasc. 6. Paris.

1919. Notes sur les genres Semisuberites et Hemiasterella. Bulletin de l'Institut Océanographique. No. 359. Monaco.

1920. Caractères et affinités des Thoosa Hanc. et des Alectona Cart. Considerations sur leurs germes à armure. Bulletin, Société Zoologique de France, vol. 45. Paris.

TOPSENT, E.—Continued.

1920*b*. Tethya aurantium (Pallas) et les Tethya de Lamarck. Bulletin du Muséum d'histoire naturelle. 1920, No. 7. Paris.

1920*c*. Sur quelques éponges du cabinet de J. Hermann décrites et figurées par Esper en 1794. Bulletin, Société Zoologique de France, vol. 45. Paris.

1920*d*. Spongiaires du Musée zoologique de Strasbourg. Monaxonides. Bulletin de l'Institut Océanographique. No. 381.

1922. Les mégasclères polytylotes des Monaxonides et la parenté des Latrunculiines. Bulletin de l'Institut Océanographique. No. 415. Monaco.

VERRILL, A. E.

1907. The Bermuda Islands. Part V.—Characteristic Life of the Bermuda Coral Reefs. Porifera: Sponges. Transactions, Academy Arts and Sciences, New Haven, Conn., vol. 12, pp. 330–344.

VOSMAER, G. C. J.

1882. Report on the sponges dredged up in the Arctic Sea by the "Willem Barents" in the years 1878 and 1879. Niederl. Archiv für Zool. Suppl. I.

1885. The sponges of the "Willem Barents" expedition, 1880 and 1881. Bijdragen tot de dierkunde, Aflevering 12. Amsterdam.

1887. Bronn: Die Klassen und Ordnungen des Thier-Reichs, vol. 2. Spongien. Leipzig and Heidelberg.

1902. On the shape of some siliceous spicules of sponges. Proceedings, Koninklijke Akademie van Wetenschappen te Amsterdam, 1902. Amsterdam.

1908. Poterion a boring sponge. Same reference.

1909. On the spinispirae of *Spirastrella bistellata* (O. S.) Ldf. Same reference.

1911. Siboga-Expeditie. The Porifera of the Siboga Expedition, II. The genus Spirastrella. Brill, Leiden.

1912. On the distinction between the genera Axinella, Phakellia, Acanthella a. o. Zoologische Jahrbücher, Supplement 15, vol. 1. Jena.

1916. On the occurrence of desmas or desmoids in *Hymeniacidon sanguinea*. Proceedings, Koninklijke Akademie van Wetenschappen te Amsterdam. Amsterdam.

VOSMAER, G. C. J., and PEKELHARING, C. A.

1898. Observations on sponges. Verhandelingen der Koninklijke Akademie van Wetenschappen te Amsterdam (Tweede sectie), pt. 6. Amsterdam.

VOSMAER, G. C. J., and VERNHOUT, J. H.

1902. Siboga-Expeditie. The Porifera of the Siboga Expedition, I. The genus Placospongia. Brill, Leiden.

WELTNER, W.

1882. Beiträge zur Kenntniss der Spongien. Inaug.-Dissertation. Freiburg.

WILSON, H. V.

1902. The sponges collected in Porto Rico in 1899. Bulletin, U. S. Commission of Fish and Fisheries, vol. 20 for 1900, pt. 2. Washington.

1904. Reports on the exploration off the west coasts of Mexico, Central and South America, and off the Galapagos Islands * * * during 1891 * * *. The Sponges. Memoirs, Museum of Comparative Zoölogy, vol. 30. Cambridge, Mass.

WILSON, H. V.—Continued.

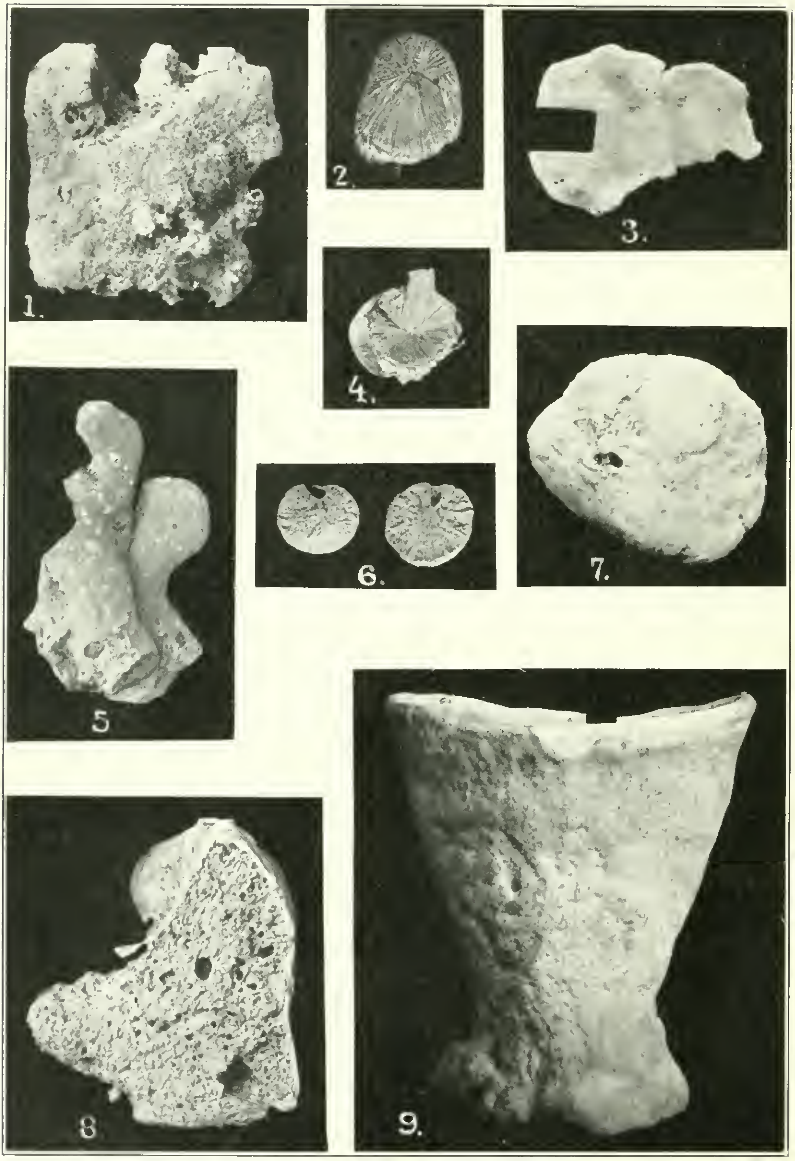
1919. In regard to species and sponges. The Scientific Monthly for 1919, p. 349.

1919*b*. On some generic distinctions in sponges. Journal, Elisha Mitchell Scientific Society, vol. 35, p. 15. Chapel Hill, N. C.

1920. A remarkable form of skeletal element in the lithistid sponges. (A case of analogical resemblance.) Same reference, vol. 36, p. 54.

WRIGHT, E. P.

1881. On a new genus and species of Sponge (*Alemo seychellensis*) with supposed heteromorphic zooids. Transactions, Royal Irish Academy, vol. 28.



SILICIOUS AND HORNY SPONGES FROM PHILIPPINE WATERS

FOR EXPLANATION OF PLATE SEE PAGE 607

EXPLANATION OF PLATES.

(Plates 37–44 from photographs; plates 45–52 from drawings. In reproduction the photographs have been reduced to about two-thirds the original size, the drawings have been reduced to about one-half the original size.)

Plate 37.

Fig. 1. *Sphinctrella bifacialis.* Upper surface of sponge showing cloacal depression into which oscula open. Two pieces have been cut out on far side of cloaca. On the near side the sponge is attached to a coralline mass. ×⅝.

2. *Stelletta radicifera.* Bisected sponge. ×1.

3. *Poecillastra ciliata.* Upper and lateral margins represent the free edge of the (lamellate) sponge. A piece has been excised. ×¾.

4. *Tethyopsis dubia.* Bisected sponge. ×1.

5. *Geodia sparsa.* Sponge from the side. ×⅝.

6. *Myriastra clavosa* (Ridley). Two bisected sponges. In the one to the right, the cloaca extends in radially; in the one to the left, it extends in obliquely. ×1.

7. *Characella abbreviata.* Upper surface showing cloaca, opening into which are seen two oscula. ×¾.

8. *Erylus cornutus.* Bisected sponge. Cloacal surface above; natural outer surface to the right; left half of sponge badly damaged. ×⅝.

9. *Geodia philippinensis.* Sponge from the side. ×1/7.

Plate 38.

Fig. 1. *Geodia japonica* (Sollas), var. *spherulifera.* From above, showing cloaca. ×⅔.

2. *Sidonops microspinosa.* Bisected sponge. ×½.

3. *Geodinella spherastrosa.* Left piece showing upper surface with oscular elevations; right piece showing latero-inferior surface passing above into upper surface. ×1.

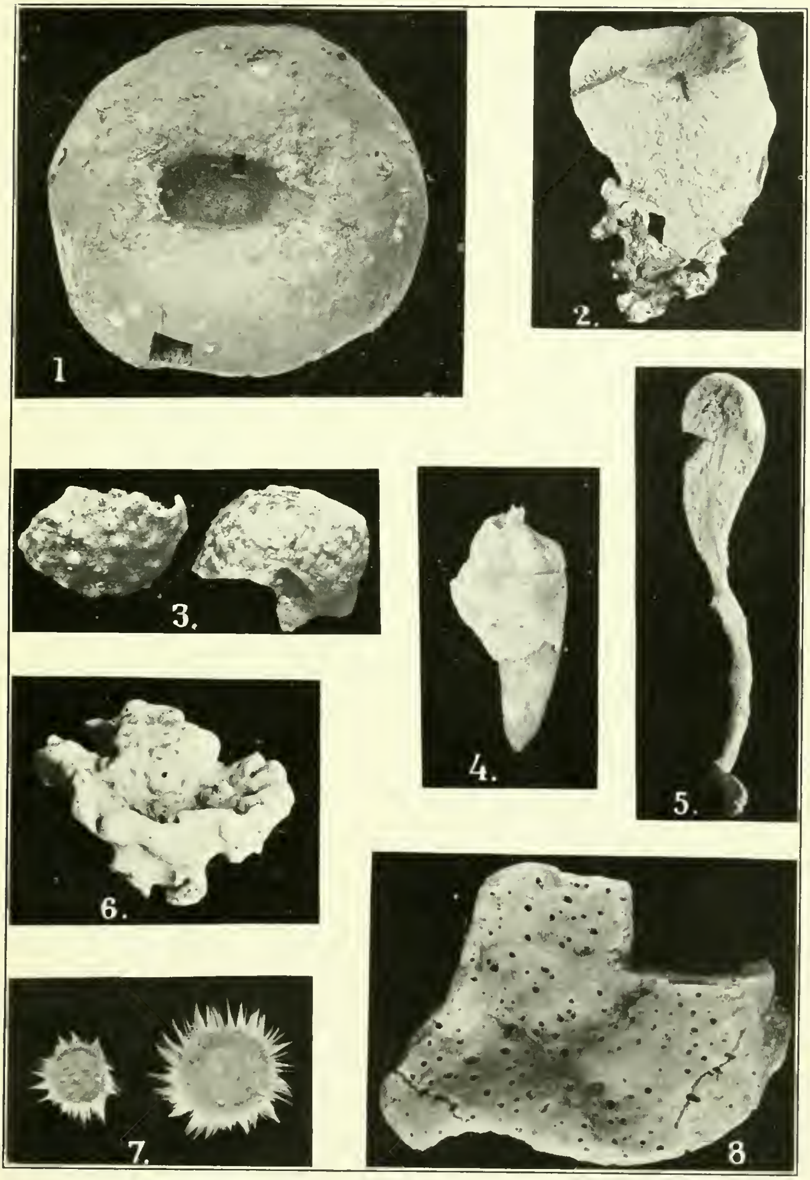
4. *Asteropus simplex* (Carter). From the side. The incrusting *Gellius* which covered the whole upper part of body has been partly cut away. ×1.

5. *Rhizaxinella nuda.* Bisected sponge, showing axial skeletal bundle. ×¾.

6. *Jaspis serpentina.* Obliquely from the side, showing upper cup-like cavity. ×½.

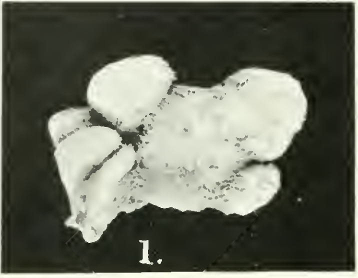
7. *Trichostemma straticulatum.* Oscular surfaces of two specimens. ×1.

8. *Spongosorites suluensis.* Oscular surface. ×1.



SILICIOUS AND HORNY SPONGES FROM PHILIPPINE WATERS

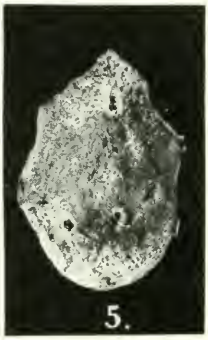
FOR EXPLANATION OF PLATE SEE PAGE 508


1.

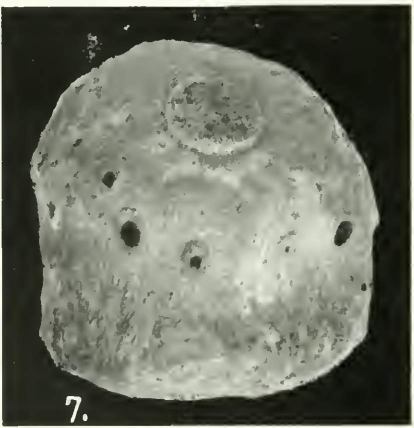

2.


3.


4.


5.


6.


7.


8.

Silicious and Horny Sponges from Philippine Waters

For explanation of plate see page 509

Plate 39.

Fig. 1. *Tuberella ciliata.* Latero-superior surface. ×$\frac{3}{4}$.

2. *Tetilla ciliata.* From the side. ×1.

3. *Tetilla spinosa.* From the side. ×$\frac{1}{2}$.

4. *Tetilla* (*Cinachyrella*) *clavigera* (Hentschel). ×$\frac{3}{4}$.

5. *Tetilla* (*Cinachyrella*) *crustata.* Upper surface; apertures of poriferous pits on this surface and at margin. ×$\frac{3}{4}$.

6. *Tetilla* (*Cinachyrella*) *paterifera.* From the side; apertures of pits more or less contracted and therefore with sharp margin. ×$\frac{3}{4}$.

7. *Tetilla* (*Cinachyrella*) *crustata*, var. *patellae-spinosae.* Obliquely from the side, showing a spinous (oscular) area and a number of poriferous pits. ×$\frac{3}{4}$.

8. *Tetilla* (*Cinachyrella*) *paterifera.* From the side; poriferous pits wide open. ×$\frac{3}{4}$.

PLATE 40.

FIG. 1. *Craniella simillima* (Bowerbank). From the side, showing conules above, papillae below. ×$\frac{3}{4}$.

2. *Paratetilla arcifera*. From the side, showing two poriferous pits; at the right, the body is covered with shelly incrusting material; some of the smooth under surface appears. ×1.

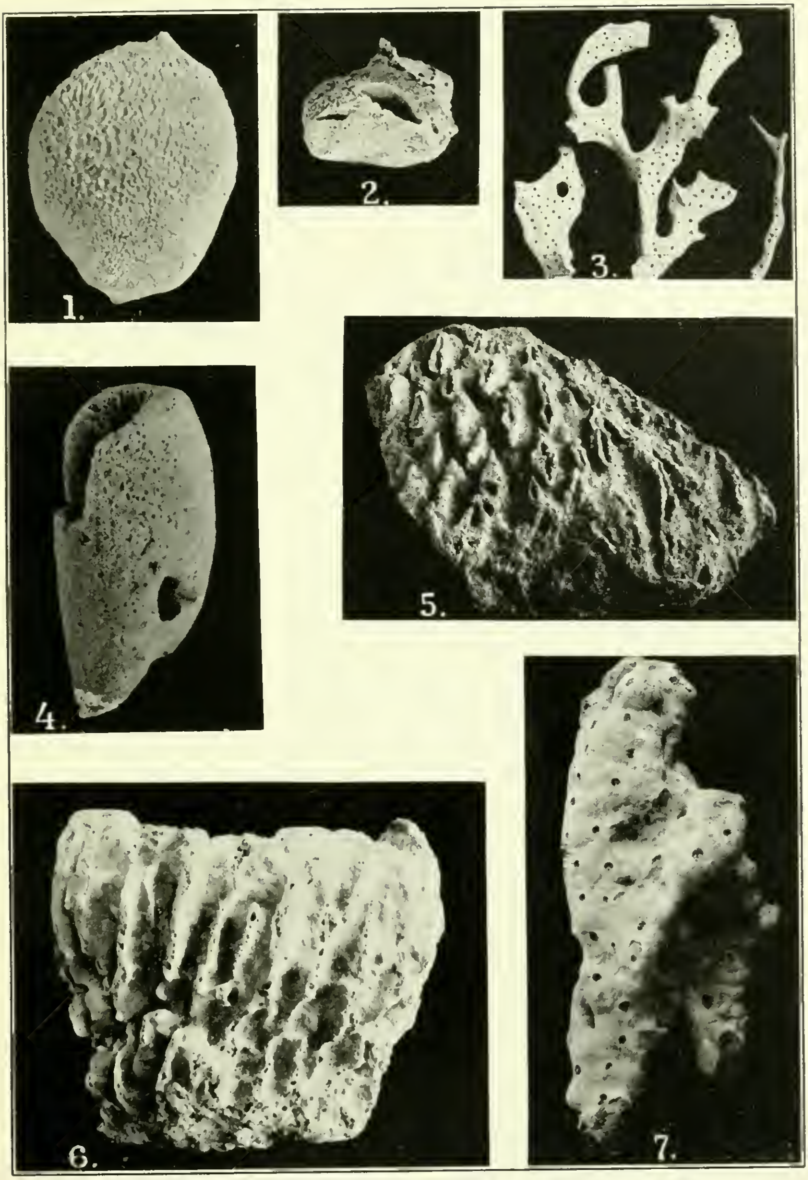
3. *Gellius varius*, var. *fibrosa*. Three pieces of the same specimen, showing very flattened, moderately flattened, and subcylindrical shapes; piece to the right is the end of a branch. ×$\frac{1}{3}$.

4. *Gellius angulatus*, var. *vasiformis*. From the side. ×$\frac{1}{2}$.

5. *Petrosia testudinaria*, var. *fistulophora*. Specimen from station 5253, from the side; specimen represents about a fourth of the whole sponge. ×$\frac{1}{4}$.

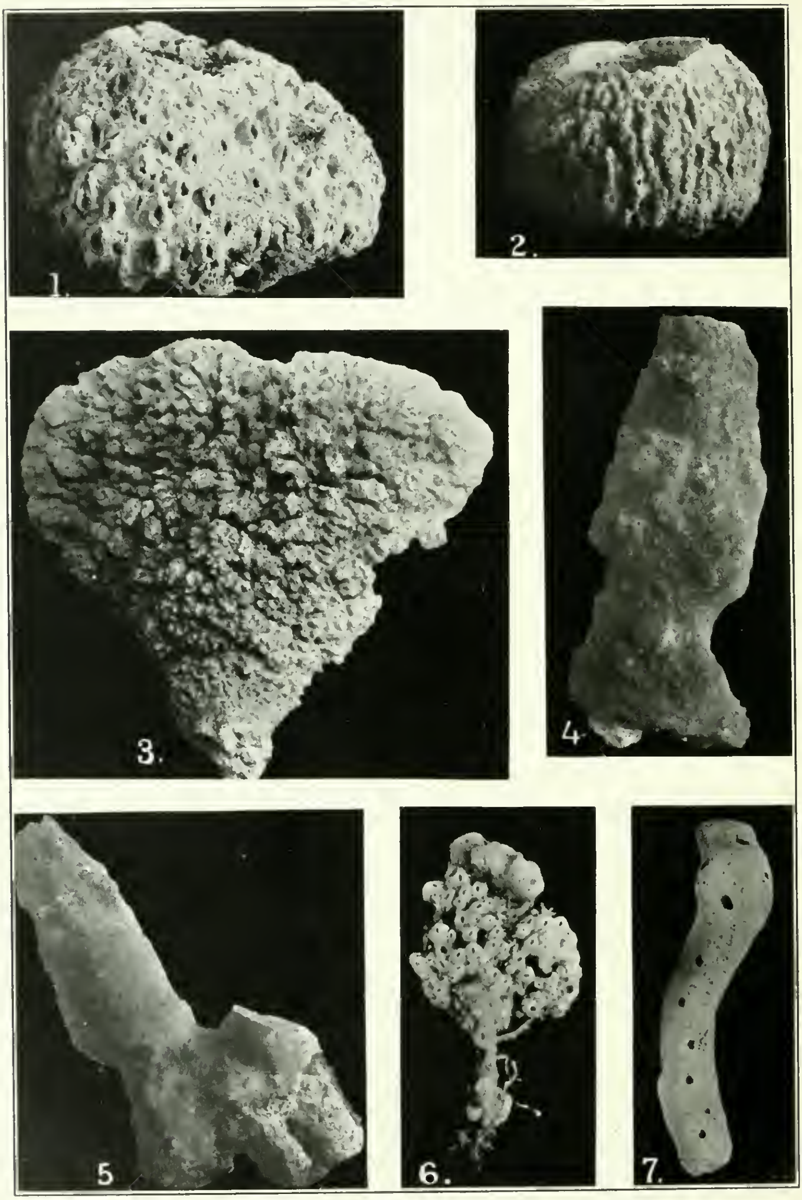
6. *Petrosia testudinaria*. From the side. ×$\frac{1}{4}$.

7. *Strongylophora corticata*. From the side. ×$\frac{1}{2}$



SILICIOUS AND HORNY SPONGES FROM PHILIPPINE WATERS

FOR EXPLANATION OF PLATE SEE PAGE 510



Silicious and Horny Sponges from Philippine Waters

For explanation of plate see page 511

PLATE 41.

FIG. 1. *Petrosia testudinaria*, var. *fistulophora*. Specimen, entire, from station 5254: from the side. $\times \frac{1}{4}$.

2. *Petrosia testudinaria*, var. *fistulophora*. Specimen, entire, from station 5249; from the side. $\times \frac{1}{4}$.

3. *Petrosia lignosa*. Side view of the vase-shaped sponge. $\times \frac{1}{7}$.

4. *Petrosia lignosa*, var. *plana*. From the side. $\times \frac{1}{4}$.

5. *Petrosia lignosa*, var. *plana*. From the side. $\times \frac{1}{4}$.

6. *Petrosia crustata* and *Discodermia emarginata* Dendy. The *Petrosia* covers a *Gorgonia*-like alcyonarian and everywhere shows the apertures of the little depressions which lodge barnacles. The *Discodermia* is the compact mass at the summit. $\times \frac{1}{2}$.

7. *Petrosia similis*, var. *granulosa*. Sponge seen from one of the narrower sides; oscula in a row. $\times \frac{1}{2}$.

PLATE 42.

FIG. 1. *Dactylochalina exigua*, var. *samarensis*. Part of a mass. The shoots composing it have been somewhat separated and spread out. ×⅔.

2. *Siphonochalina fascigera* Hentschel. Part of specimen from Tomahu Island; showing smooth and conulose types of surface. ×⅓.

3. *Phloeodictyon cagayanense*. From the side, with incrusting alcyonarian below. ×1.

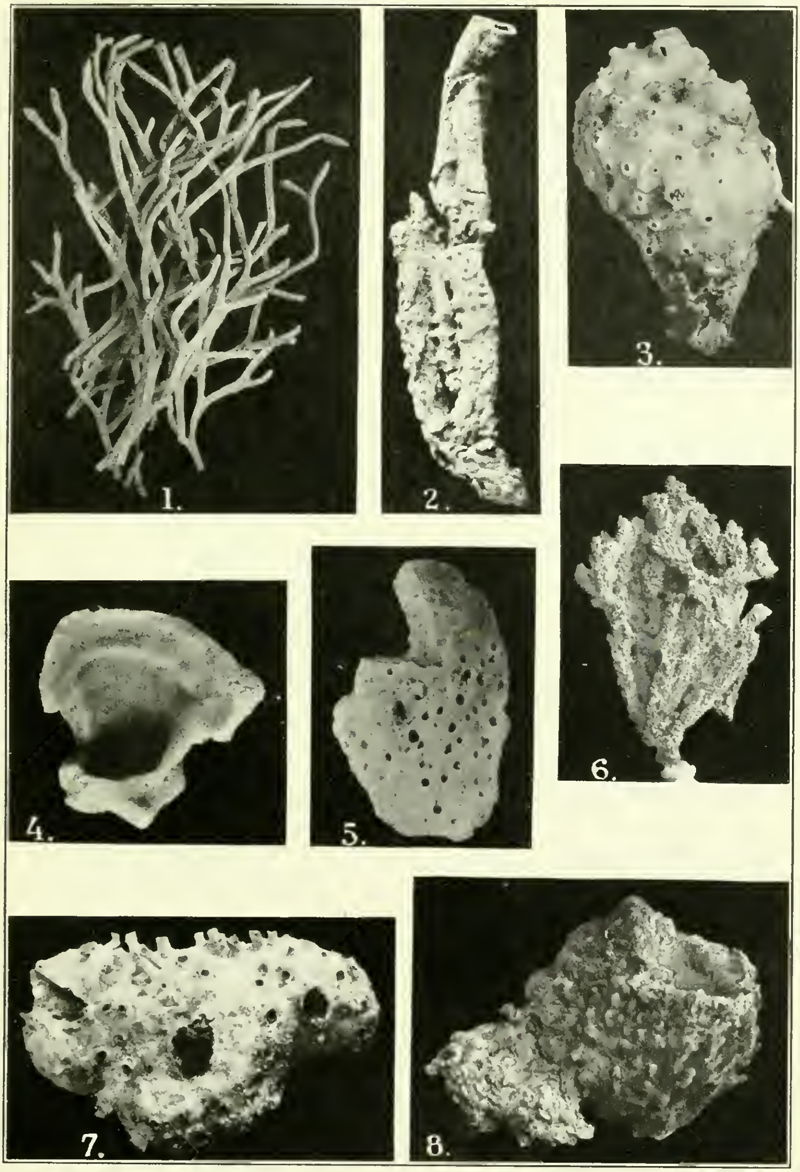
4. *Lissodendoryx tawiensis*. From the inner, concave, side. ×1.

5. *Myxilla crucifera*. From the oscular side. ×1.

6. *Clathria fasciculata*. From the side. ×¼.

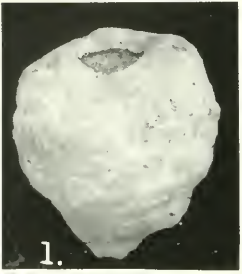
7. *Coelosphaera toxifera*. Obliquely from above. ×¼.

8. *Axinyssa aculeata*. Dried specimen from station 5254, from side. ×¼.

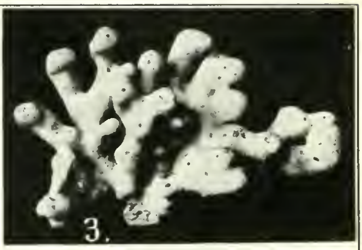


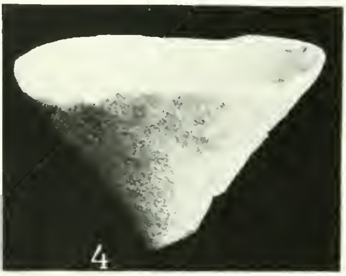
Silicious and Horny Sponges from Philippine Waters

For explanation of plate see page 512


1.

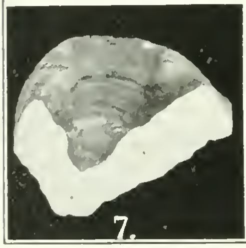

2.


3.


4


5.


6.


7.


8.

Silicious and Horny Sponges from Philippine Waters

For explanation of plate see page 513

PLATE 43.

FIG. 1. *Theonella swinhoei*, var. *verrucosa*. From the side. $\times \frac{1}{3}$.

2. *Theonella invaginata*. Sponge bisected, showing cloaca with apical aperture and two lateral diverticula which also open on the surface. $\times 1$.

3. *Jereopsis fruticosa*. Sponge mass from the side. $\times \frac{3}{4}$.

4. *Leiodermatium pfeifferae* (Carter). Vase-shaped specimen. $\times \frac{4}{5}$.

5. *Discodermia emarginata*, var. *lamellaris*. Showing the concave (oscular) face of the lamella which arises from an amorphous base. $\times 1$.

6. *Costifer vasiformis*. Vase-shaped sponge, from the side. $\times \frac{1}{4}$.

7. *Aciculites ciliata*. The cup-shaped sponge has been bisected. From the cut surface. $\times 1$.

8. *Leiodermatium pfefferae* (Carter). Lamellate specimen. $\times \frac{4}{5}$.

PLATE 44.

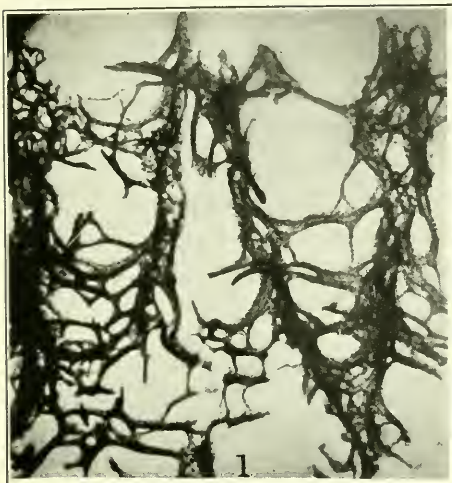
FIG. 1. *Spongelia fragilis* (Montagu), var. *fasciculata*. From a thick section vertical to surface of sponge, showing four main fibers and connectives. The conular terminations of the fibers appear in the preparation, which has been macerated in caustic potash. ×15.

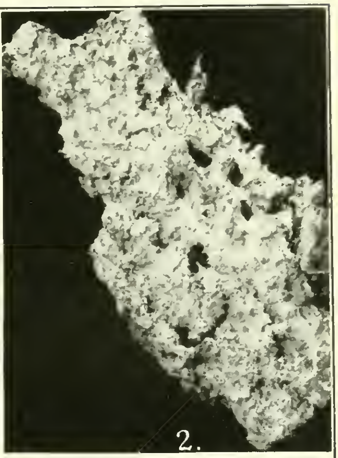
2. *Hircinia mutans*. From above. ×⅓.

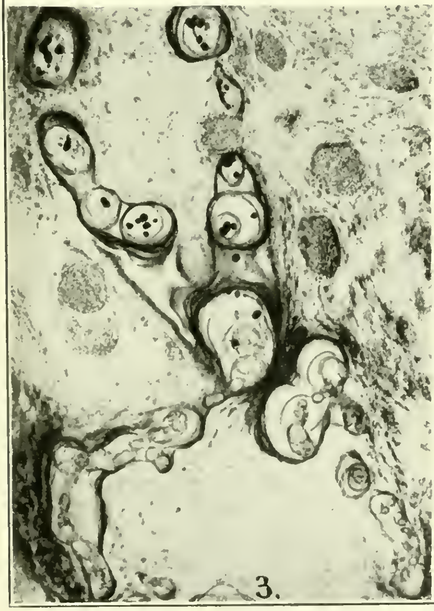
3. *Psammaplysilla kelleri*. From a transverse section (75 µ thick, Delafield's haematoxylin). Showing branching fibers with coarse concentric stratification and the included, small, opaque masses of pigmented cells. ×37.

4. *Theonella cylindrica*. From the side; the gap indicates where a piece was removed from the specimen. ×⅞.

5. *Taprobane herdmani* Dendy. Sponge, a complex of vases, seen from the side. ×⅓


1.


2.

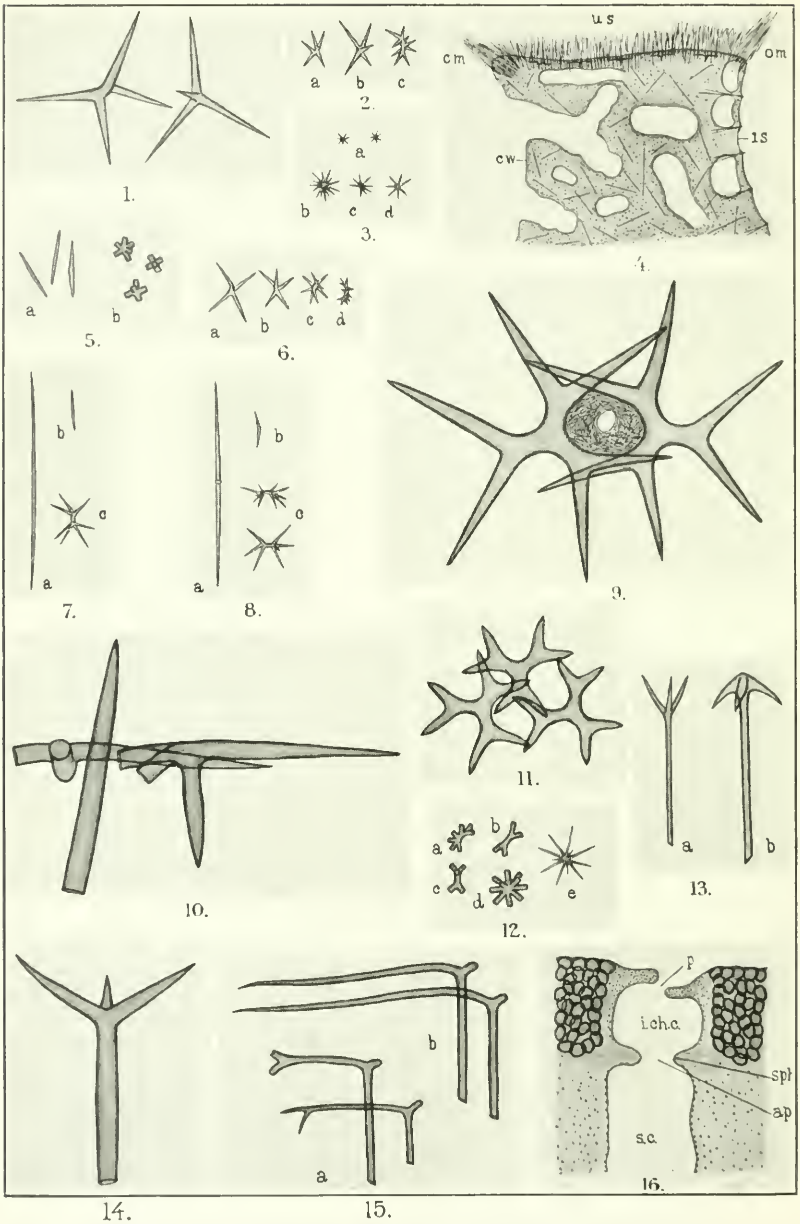

3.


4.


5.

SILICIOUS AND HORNY SPONGES FROM PHILIPPINE WATERS

FOR EXPLANATION OF PLATE SEE PAGE 514



Silicious and Horny Sponges from Philippine Waters

For explanation of plate see page 515

PLATE 45.

FIG. 1. *Thenea grayi* Sollas. Plesiasters. ×220.

2. *Thenea grayi* Sollas. *a*, *b*, metasters; *c*, spiraster. ×220.

3. *Stelletta radicifera*. *a*, dermal oxyasters; *b*, ectosomal oxyaster with large centrum; *c*, ectosomal oxyaster with smaller centrum and fewer rays; *d*, choanosomal oxyaster with no centrum. ×600.

4. *Sphinctrella bifacialis*. Part of a vertical section including upper surface, *u. s.*, lateral surface, *l. s.*, and cloacal wall, *c. w.*, of sponge The outer, *o. m.*, and cloacal, *c. m.*, margins of upper surface both bear long spicules; canals open on the cloacal surface. Somewhat diagrammatic. ×4.

5. *Erylus cornutus*. *a*, microrhabds; *b*, strongylasters. ×400.

6. *Sphinctrella bifacialis*. Streptasters. ×220.

7. *Characella abbreviata*. *a*, choanosomal microxea; *b*, dermal microxea; *c*, streptaster. *a*, *b*, ×240; *c*, ×600.

8. *Poecillastra ciliata*. *a*, choanosomal microxea; *b*, dermal microxea; *c*, streptasters. *a*, *b*, ×240; *c*, ×600.

9. *Poecillastra ciliata*. Skeletal arrangement of dermal surface. Cladomes of triaenes bound meshes; in each mesh a canal aperture; dermal microxeas are represented in the enclosed mesh. ×90.

10. *Characella abbreviata*. Skeletal arrangement; triaenes at the surface, and large projecting oxeas. From a section vertical to the surface. ×90.

11. *Stelletta radicifera*. Cladomes of dichotriaenes at surface of sponge. ×90.

12. *Tethyopsis dubia*. *a*, *b*, *c*, *d*, strongylasters of four types; *e*, oxyaster. ×1,000.

13. *Stelletta radicifera*. From a radial section; *a*, projecting protriaene; *b*, anatriaene of radial bundle. ×240.

14. *Tethyopsis dubia*. Plagiotriaene. ×90.

15. *Tethyopsis dubia*. Orthodiaenes. *a*, type in which the long clad is dichotomous; *b*, ordinary type. ×45.

16. *Erylus cornutus*. From a vertical section through cortex of outer surface showing pore, *p*, in the sterraster-free area of dermal membrane; incurrent chone-canal, *i. ch. c.*; sphincter, *sph*, limiting the aperture, *ap*, of chone canal into subcortical canal, *s. c.* ×25.

PLATE 46

FIG. 1. *Erylus cornutus.* *a*, *b*, orthodiaenes in side view, *c*, cladome seen from below. ×90.

2. *Erylus cornutus.* *a*, sterraster in edge view; *b*, same in face view. Rays shown only over a part of the surface of the sterraster in both figures. ×240.

3. *Geodia philippinensis.* From a vertical section showing a dichotriaene in the ectochrote accompanied by two anatriaenes and a protriaene; dermal membrane indicated by small asters; ectosomal oxeas radial to dermal membrane; outermost sterrasters shown. ×90.

4. *Geodia philippinensis.* *a*, dermal oxyasters; *b*, choanosomal oxyaster. ×600.

5. *Geodia philippinensis.* Cladomes of two dichotriaenes in natural position in the dermal membrane. ×90.

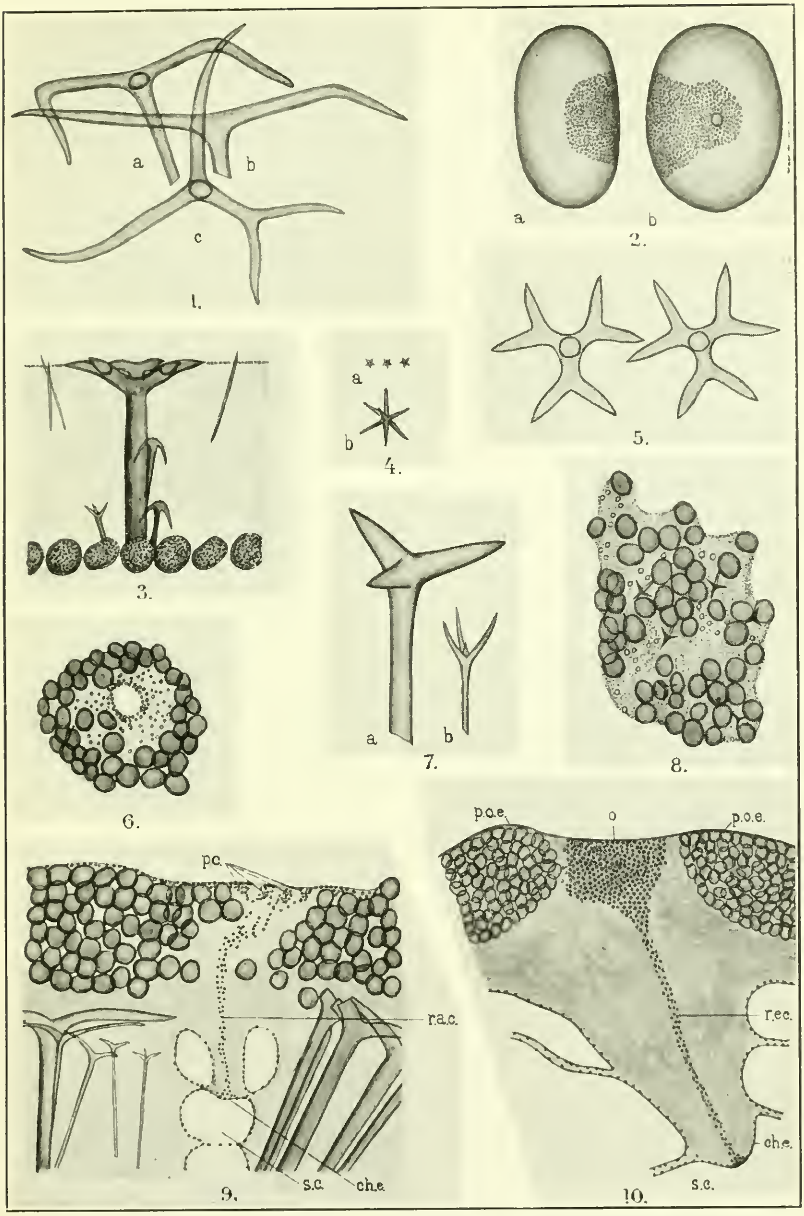
6. *Sidonops microspinosa.* Pore area with open pore. Spherasters crowded round edge of pore. ×140.

7. *Geodia sparsa.* *a*, plagiotriaene from the side. ×160; *b*, projecting protriaene with prolonged rhabdome. ×300.

8. *Geodia sparsa.* Part of dermal surface, showing distribution of plagiotriaenes; also sterraster-free tracts with open pores. ×45.

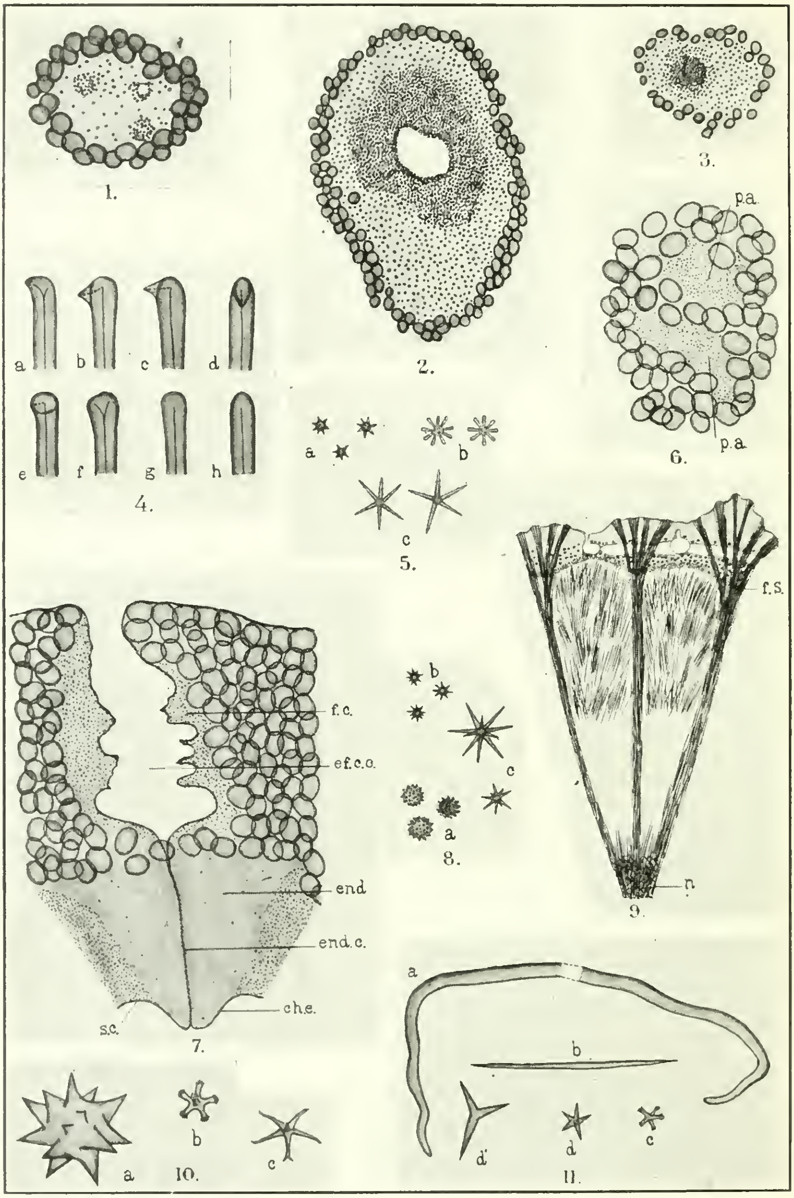
9. *Sidonops microspinosa.* Vertical section through a pore area and afferent chone canal. *p. c.*, oblique pore canals, probably four, marked by spherasters; *r. a. c.*, radial afferent chone canal marked by a streak of oxyasters; *ch. c.*, inner end of chone; *s. c.*, subcortical crypt. ×140.

10. *Sidonops microspinosa.* Vertical section through an oscular area. *p. o. e.*, periosculer elevation; *r. e. c.*, radial efferent chone canal, marked along most of its extent by a streak of oxyasters, but above by a dense accumulation of spherasters indicating the position of the osculum, *o*, which is actually closed; *ch. c.*, inner end of chone; *s. c.*, subcortical crypt. ×85.



Silicious and Horny Sponges from Philippine Waters

For explanation of plate see page 516



Silicious and Horny Sponges from Philippine Waters

For explanation of plate see page 517

PLATE 47

FIG. 1. *Sidonops microspinosa.* Pore area. One pore not completely closed. Two dense groups of spherasters indicate closed pores. ×140.

2. *Sidonops microspinosa.* Oscular area with an open osculum. Spherasters densely crowded round osculum. ×85.

3. *Sidonops microspinosa.* Oscular area with closed osculum. Position of latter indicated by an accumulation of spherasters. ×85.

4. *Geodinella spherastrosa.* Reduced triaenes. *a, b, c,* monaenes with comparatively sharp vestigial clad in side view; *d,* same with clad showing in face view; *e, f,* monaenes in which the vestigial clad is reduced to a slight rounded protuberance shown in side view; *g, h,* completely degenerate spicules in which there is no sign of a clad, the axial canal sending off no branch. ×175.

5. *Geodinella spherastrosa.* *a,* dermal spherasters; *b,* strongylasters from cortical canals; *c,* oxyasters from choanosome. ×600.

6. *Geodinella spherastrosa.* Surface, showing sterraster-free pore areas, *p. a.* ×45.

7. *Geodinella spherastrosa.* Vertical section through cortex. *ef. c. c.,* efferent chone canal opening above by an osculum; *end. c.,* closed canal of endochone marked by a streak of strongylasters; *ch. c.,* inner end of chone; *end.,* dense fibrous tissue of contracted endochone; *f. c.,* fibrous collenchyma round chone canal; *s. c.,* wall of subcortical canal. ×45.

8. *Sidonops microspinosa.* *a,* spherasters; *b,* oxyasters from cortical canal; *c,* larger oxyasters from choanosome. ×600.

9. *Donatia ingalli,* var. *seychellensis* (E. P. Wright). From a radial section. *f. s.,* fibrous stratum of ectosome; *n,* skeletal "nucleus." ×7½.

10. *Donatia ingalli,* var. *seychellensis* (E. P. Wright). *a,* spheraster ×600; *b,* chiaster (acanthtylaster) ×1,000; *c,* choanosomal oxyaster ×600.

11. *Jaspis serpentina.* *a,* skeletal twisted rhabd, only terminal parts shown, ×100; *b,* small oxea ×300; *c,* chiaster (acanthtylaster) ×1,000; *d, d′,* oxyasters ×500.

PLATE 48

FIG. 1. *Trichostemma straticulatum.* Median section. *a. r. b.*, ascending radial skeletal bundle; *ch*, choanosome; *fr. s.*, fringe spicules; *l. c. m.*, middle stratum of lower cortex; *o. c.*, oscular canal: *u. c. m.*, middle stratum of upper cortex. ×7½.

2. *Strongylophora corticata.* Skeletal spicules. *a*, strongyle; *b*, oxea ×225.

3. *Spongosorites suluensis.* Vertical section through the lamellate sponge. *n. e.*, natural edge; *o. s.*, oscular surface; *p. s.*, pore surface. ×7½.

4. *Tetilla (Cinachyrella) paterifera.* Anatriaene forms. *a*, common form seen in optical section; *b*, aberrant form with very short rounded clads; *c*, monaene form; *d*, tylostyle form; *e*, aberrant form with very short rounded clads and rhabdome produced beyond the cladome (anamesotriaene type). ×450.

5. *Tetilla (Cinachyrella) crustata.* From a section vertical to the surface. *a–b*, thickness of ectosomal layer of tangential oxeas. ×160.

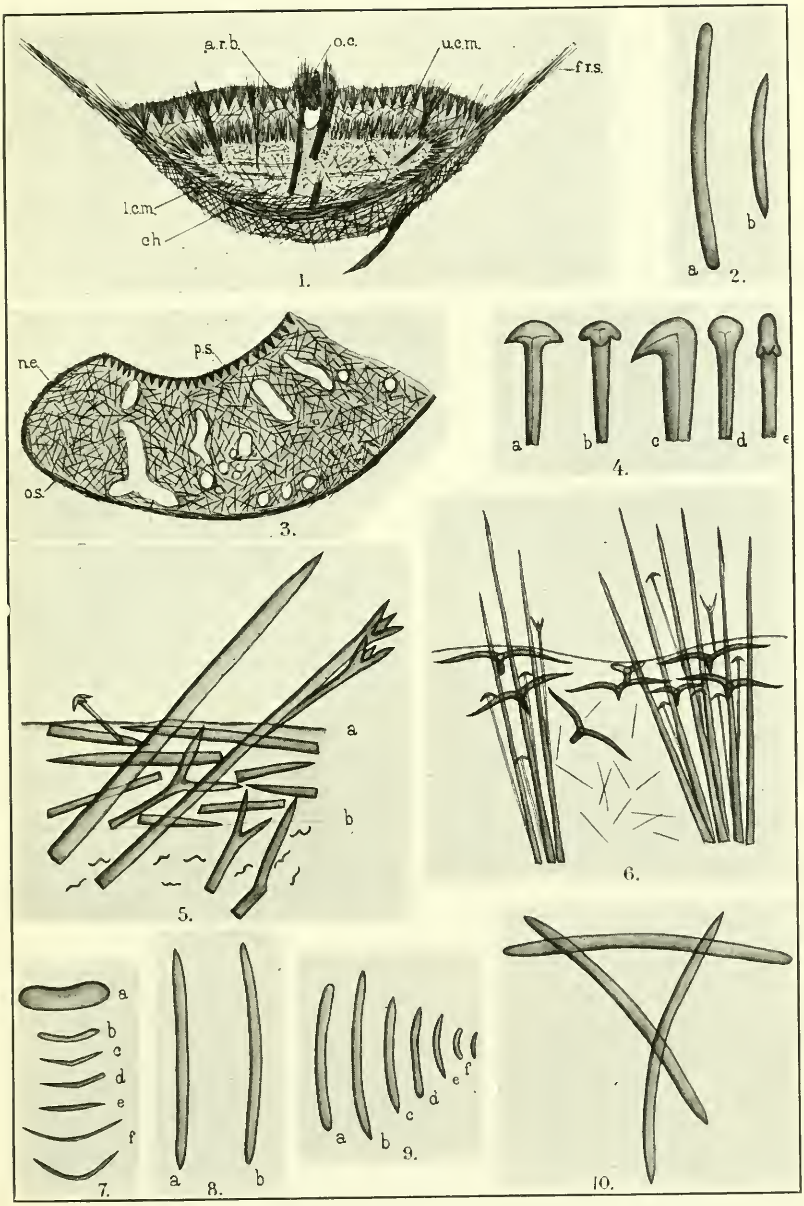
6. *Paratetilla arcifera.* From a radial section. ×45.

7. *Strongylophora corticata.* Spicules of microsclere size. *a*, small stout strongyle; *b*, small slender strongyle; *c*, characteristic angulated microxea; *d*, microstrongyle, a rare form; *e*, nearly straight microxea; *f*, very slender oxeas curved much like toxas but without the recurved ends of the latter. ×650.

8. *Petrosia testudinaria.* var. *fistulophora.* *a*, skeletal spicule, an oxea, of specimen from station 5254; *b*, skeletal spicule, an intermediate with tapering ends rounded at the extremity, of specimen from sta. 6253. ×150.

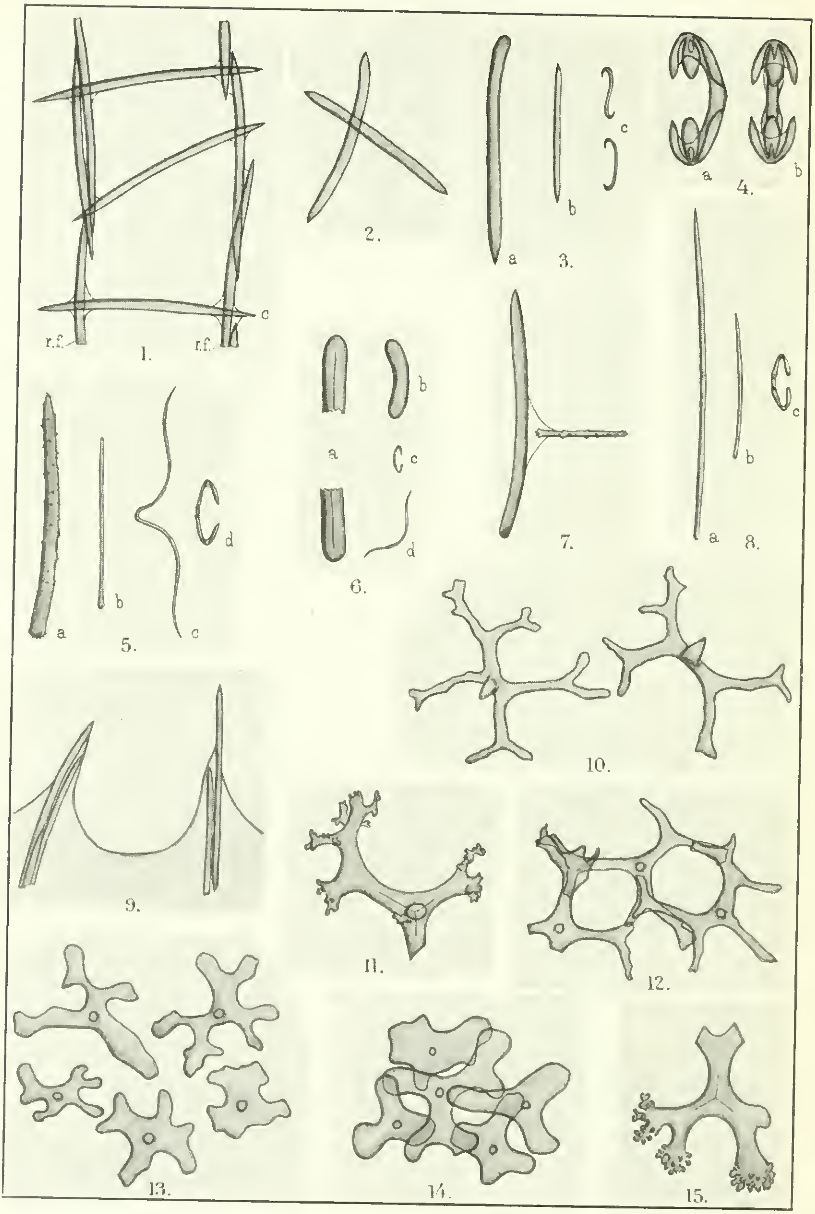
9. *Petrosia lignosa.* Spicules. *a*, strongyle with broadly rounded ends from specimen taken at station 5250. Other spicules from specimen taken at station 5147. *b*, intermediate (oxea with rounded ends); *c*, *e*, oxeas; *d*, style (a rare form); *f*, small strongyles. ×150.

10. *Phloeodictyon cagayanense.* Spicules: oxeas, one more abruptly pointed than the other, and strongyle. ×400.



Silicious and Horny Sponges from Philippine Waters

For explanation of plate see page 518



Silicious and Horny Sponges from Philippine Waters

For explanation of plate see page 519

Plate 49

Fig. 1. *Gellius varius*, var. *fibrosa*. From a vertical section, showing part of skeletal reticulum including two radial fibers, *r. f.*, with connectives, *c*. ×350.

2. *Petrosia crustata*. Spicules. ×375.

3. *Myxilla crucifera*. *a*, skeletal style; *b*, ectosomal tornote; *c*, sigmas in two positions. ×240.

4. *Myxilla crucifera*. Ancoras (tridentate isancoras). *a*, side view; *b*, ventral view. ×1100.

5. *Lissodendoryx tawiensis*. *a*, skeletal style; *b*, ectosomal tylostrongyle; *c*, toxa; *d*, isochela. *a, b, c*, ×240; *d* ×1,100.

6. *Coelosphaera toxifera*. *a*, the two ends of a typical strongyle; *b*, one of the very small strongyles; *c*, isochela; *d*, toxa. ×400.

7. *Clathria fasciculata*. Style of the skeletal fiber and echinating acanthostyle, basal end of the latter buried in the spongin of the fiber. ×400.

8. *Clathria fasciculata*. *a*, *b*, large and small dermal styles. ×400; *c*, isochela. ×1,100.

9. *Axinyssa aculeata*. From a vertical section, showing two dermal conuli with included spicules. ×60.

10. *Theonella swinhoei*, var. *verrucosa*. Phyllotriaenes seen from below. ×90.

11. *Theonella invaginata*. Nearly the whole of an isolated, not fully developed, desma. ×210.

12. *Theonella invaginata*. Dermal phyllotriaenes. ×100.

13. *Theonella invaginata*. Gastral phyllotriaenes of a less modified type than those of fig. 14. ×100.

14. *Theonella invaginata*. Gastral phyllotriaenes. ×100.

15. *Theonella invaginata*. Part of a fully developed desma. ×210.

Plate 50

Fig. 1. *Theonella cylindrica.* Phyllotriaenes. *a*, cladome from above; *b*, cladome from below. ×150.

2. *Theonella cylindrica.* Part of the desmal framework. ×230.

3. *Theonella cylindrica.* Young desma, from periphery of sponge; clads breaking up terminally into short branches which bear the irregular tubercles of zygosis. ×230.

4. *Jereopsis fruticosa.* Small free amphitriaenes from the ectosome. In one of the spicules drawn, the axial canal could not be distinctly traced at one end of the spicule. ×150.

5. *Jereopsis fruticosa.* Young desma with simple clads from ectosome, after treatment with hydrofluoric acid which has somewhat corroded the spicule. ×150.

6. *Jereopsis fruticosa.* Streptasters. *a*, amphiaster from interior; *b*, amphiaster from interior approaching the spiraster type; *c*, spiraster from dermal surface. ×620.

7. *Jereopsis fruticosa.* An uncorroded and nearly perfect desma detached from the skeleton in sectioning; a bit of an adjoining desma in zygosis is also shown. ×150.

8. *Costifer vasiformis.* Rare types of desma; main axis bearing a clad or a few clads; articular facets on epirhabd only. ×45.

9. *Jereopsis fruticosa.* Skeletal desmas isolated with hydrofluoric acid and therefore corroded. The two sets of clads at opposite ends of the shaft may be about equally developed, as in *a*. Or the clads at one end are much more extensively developed than at the other end, as in *b* and *c*. ×150.

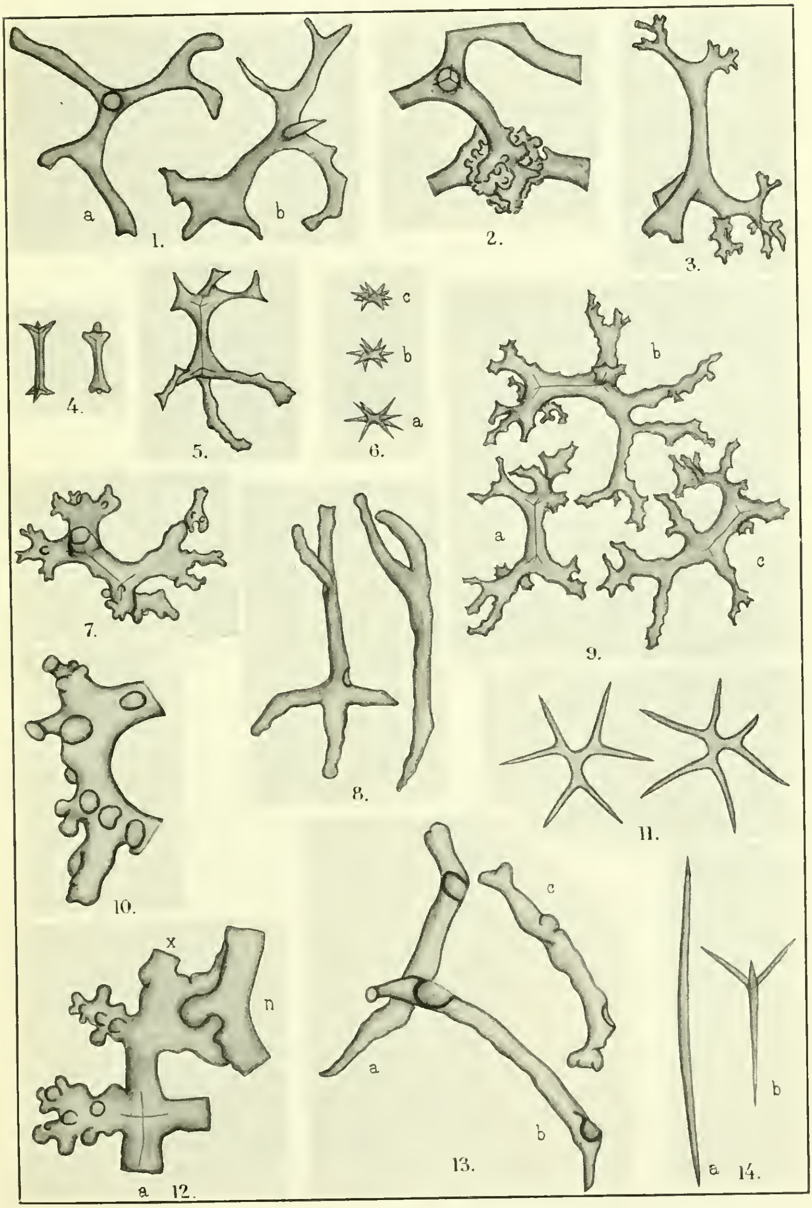
10. *Coscinospongia thomasi* (Sollas). Part of a developed desma. ×220.

11. *Jereopsis fruticosa.* Dichotriaenes. ×150.

12. *Jereopsis fruticosa.* One end of a fully developed uncorroded desma forming part of the skeletal framework. *a* is the shaft. Of the three primary branches into which it breaks at this end, only one is covered with the tubercles of zygosis. The middle primary branch divides into three secondaries. The middle secondary divides into two tertiaries, one of which, *x*, ascends to pass into a skeletal node at another level. *n*, a skeletal node as seen at a single focus; the entire node is much more complex, several desmas interlocking to form it. ×210.

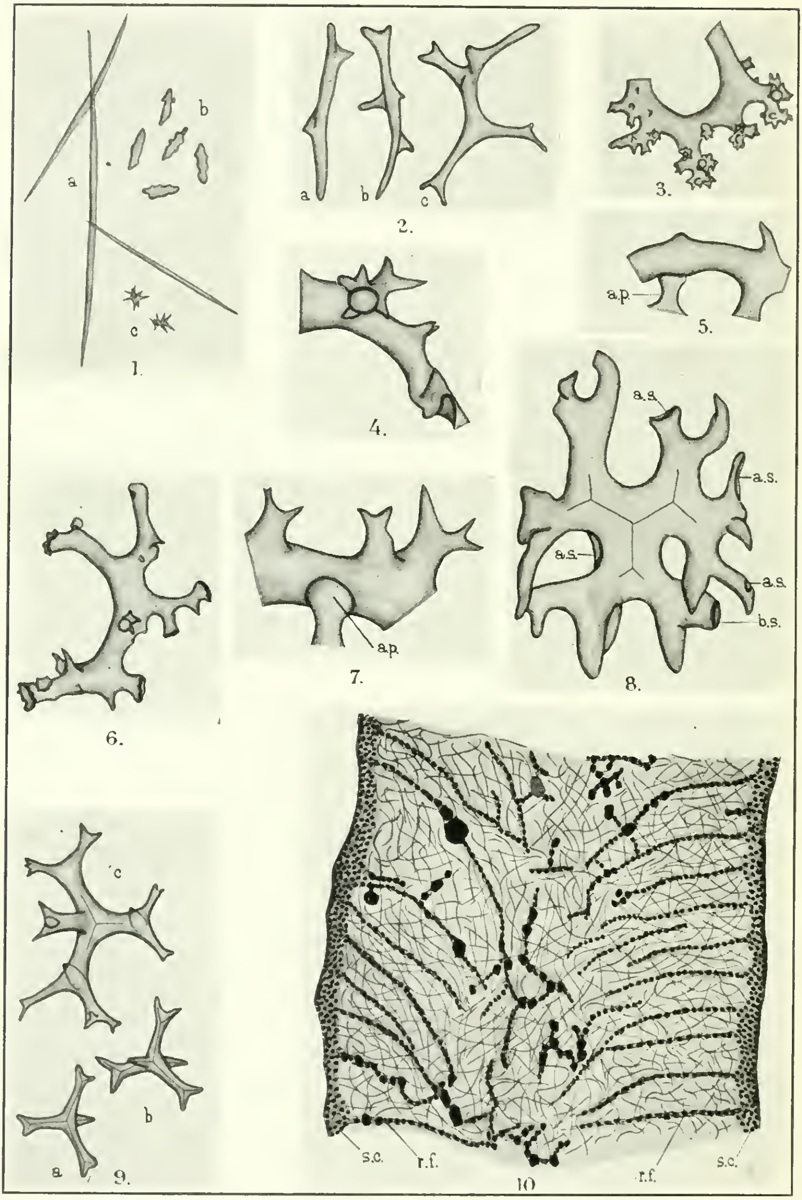
13. *Costifer vasiformis.* Common types of desma, rod-like and without clads. *a*, and *b*, still interlocking, each with two facets; *c*, with ends that are somewhat gnarled. ×45.

14. *Costifer vasiformis.* *a*, oxea; *b*, plagiotriaene. ×45.



Silicious and Horny Sponges from Philippine Waters

For explanation of plate see page 520



Silicious and Horny Sponges from Philippine Waters

For explanation of plate see page 521

PLATE 51

FIG. 1. *Costifer vasiformis.* *a*, microxeas; *b*, microstrongyles; *c*, streptasters. ×150.

2. *Aciculites ciliata.* Undeveloped desmas from just below dermal membrane of margin of the cup-shaped sponge. *a*, very young; *b*, somewhat older; *c*, still older form. ×220.

3. *Aciculites ciliata.* Part of adult desma, showing characteristic tubercles. ×220.

4. *Leiodermatium pfeifferae* (Carter). Part of a desma showing a rosette of three bidentate spinous tubercles, a single sharp bidentate tubercle, and a concave facet for zygosis. ×400.

5. *Leiodermatium pfeifferae* (Carter). Articulation of a simple kind. A clad, *a. p.*, of one desma is simply apposed to another desma. ×220.

6. *Leiodermatium pfeifferae* (Carter). An entire desma. ×220.

7. *Leiodermatium pfeifferae* (Carter). Part of desma bearing spinose tubercles embraced by an expanded articular process, *a. p.*, of another desma. ×400.

8. *Brachiaster simplex.* Cladome of adult desma (a dichotriaene); most of the secondary branches with tertiaries, one with quaternary branches. *a. s.*, articular surface; *b. s.*, broken surface. ×85.

9. *Brachiaster simplex.* Young desmas. *a*, simple dichotriaene form. *b*, simple dicho-mesotriaene form. *c*, mesotriaene in which two of the primary clads and the distal axial ray break up, each into three branches; rhabdome unbranched; nearly all secondary branches beginning to acquire tertiary branches. ×85.

10. *Phyllospongia aliena.* Part of a section through the lamellate sponge, vertical to the surface and radial to the free margin of the sponge; figure includes both surfaces. *r. f.*, radial fiber; *s. c.*, sand cortex. ×20.

Plate 52

Fig. 1. *Phyllospongia aliena.* From a vertical section, showing a radial fiber, *r. f.*, containing sand grains and foreign spicules, with connectives crossing it. One connective, *a*, starts from the radial fiber; others are all cemented to it by spongin; *sy*, a synapticulum. ×150.

2. *Hircinia mutans.* Two main fibers, *m. f.*, and connectives, latter ranging from simple fibers to fenestrated plates. Connectives not indicated along free edge of right fiber. ×45.

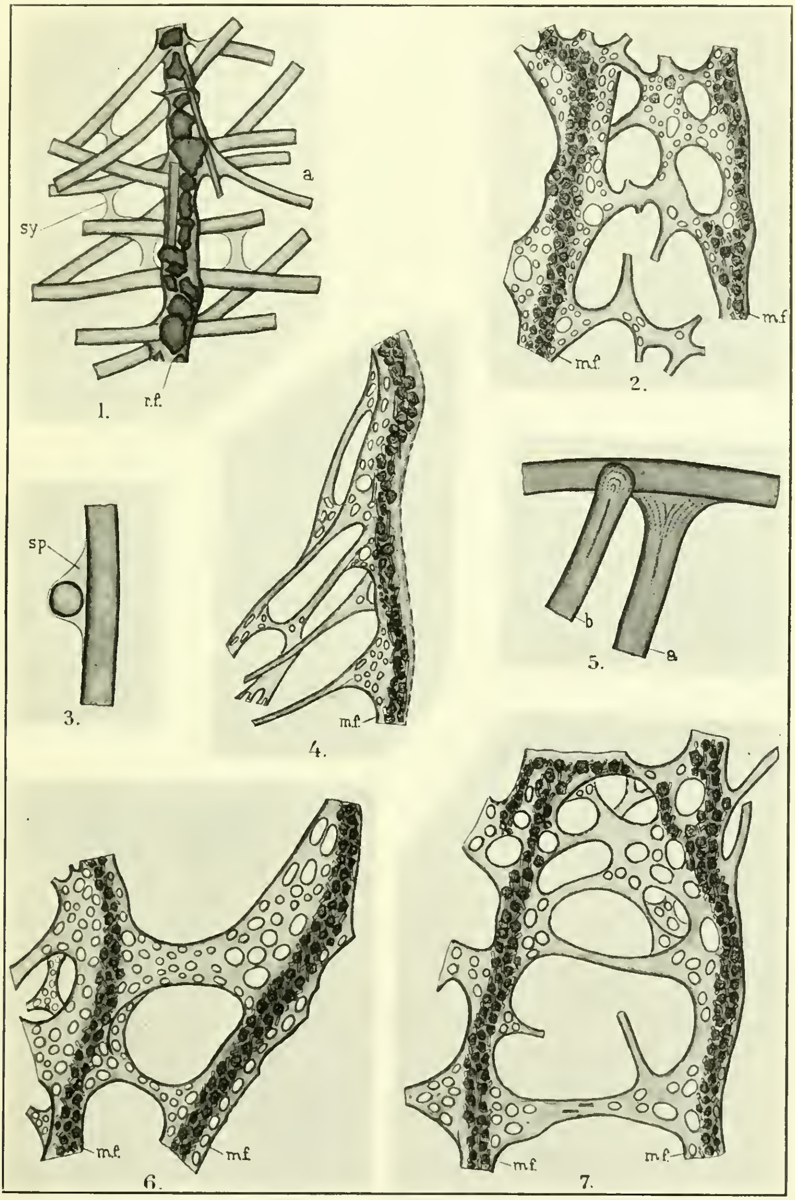
3. *Phyllospongia aliena.* Two connectives crossing one another cemented together by spongin, *sp.* ×300.

4. *Hircinia mutans.* A main fiber, *m. f.*, with connectives meeting it on one side. Origin of connectives on other side of fiber not shown. ×45.

5. *Phyllospongia aliena.* Connectives. One connective, *a*, ends in a spongin expansion on the side of another; in the expanded portion strata, parallel to the surface, are faintly distinguishable. The free end of another fiber, *b*, appears; its outer border is here no more cuticular in appearance than is the case with spongin which cements fibers together; terminal region faintly stratified. An axial medullary streak is distinguishable in both fibers, *a* and *b*, near the end. ×300.

6. *Hircinia mutans.* Two main fibers, *m. f.*, with connectives. One of the connectives is a fenestrated membrane of considerable width; the other is narrower. The roots (fenestrated expansions) of connectives have spread out extensively along the sides of the primitive (simple, solid) main fibers. Origin of connectives from far side of right fiber not shown. ×45.

7. *Hircinia mutans.* Two main fibers, *m. f.*, with connectives. Latter in part simple, meeting the main fibers in the usual way, in part (above) combined to form a fenestrated membrane. Connectives not indicated along free edge of right fiber. ×45.



Silicious and Horny Sponges from Philippine Waters

For explanation of plate see page 522

INDEX

Page
bbreviata, Characella 284
Acanthella 445
acanthifera, Raspailia (Axinella) 445
Acanthoxifer 331, 333, 386
Aciculida 326
Aciculites 463, 467
  ciliata 463
  higginsia 464
  orientalis 463, 464
aculeata, Axinyssa 445
aculeatus, Gellius 354
acutum, Plakidium 469
Adreus 354
adriatica, Euspongia officinalis 485
Aegagropila 425
aegagropila, Mycale (Halichondria, Esperella) 426, 427
affinis, Pachychalina diffusa 413
agglutinans, Ecionemia 297
alba-bidens, Tetilla (Cinachyra) 363
alba-obtusa, Tetilla (Cinachyra) 363
alba-tridens, Tetilla (Cinachyra) 363
Alcyonium aurantium 334
  cranium 334
  lyncurium 334
  testudinarium 334
Alectona 353
Alemo seychellensis 335
Algol 286
aliena, Phyllospongia 481, 484
amboinensis, Paratetilla 383
  Tetilla (Cinachyra) 382
amphiacantha, Tetilla (Chrotella) 358
Amphiastrella 418
Amphilectus 431
Amphitethya 355, 384, 385
  aruensis 383, 385
  merguiensis 383
  microsigma 384
  (Tetilla, Tethya) stipitata 384
Amphius 327
Anacanthaca 331, 335, 386
Ancorella 278
Ancorina 286, 297, 329
  cerebrum 286, 297
  wageneri 286
angulatus, Gellius (Halichondria) 390
Anisoxya 327
annulata, Theonella 447
anomala, Aplysina flagelliformis 490
  Tetilla (Cinachyra) 363
Anomocladidae 470
Anoplia 447, 468
Anthastra 285, 294
aperta, Tetilla crustata 363, 371
Aplysilla 472, 489, 490
Aplysillidae 472, 473, 489

Page
Aplysina 489, 490
  flagelliformis anomala 490
  purpurea 490, 491
Aplysininae 479, 487
appendiculatum, Coelosphaera (Histoderma) 434
arabica, Psammaplysilla 489, 490, 491
arcifera, Paratetilla 380
arctica, Semisuberites 421
armata, Tethya 378
aruensis, Amphitethya (Paratetilla) 383
  Petrosia truncata 403
Asteropus 285, 326, 327, 328
  haeckeli 327
  simplex 327
  simplex pyriformis 327
Asterostreptidae 277
Astraxinellidae 354, 444
Astrella 285, 294
Astromonaxonellida 276, 354
Astropeplus 327
Astrophora 273, 276, 277, 326, 327, 343, 354
Astrotetraxonida 276
Atergia 347
Aulena 473
Aulenidae 473
Auletta 445
auris, Macandrewia 459
Aurora 285, 294, 303, 327, 334
  cribriporosa 285
australis, Mycale macilenta 426
avara, Spongelia 477
Axinella 445
  acanthifera 445
Axinellidae 276, 327, 333, 354, 386, 444, 445
Axinyssa 445
  aculeata 445
Axos 342
Axosuberites 351
Azorica 465
  pfeifferae 465
azorica, Craniellopsis 385
Azoricidae 465
bacca, Paratetilla 363
  Tethya 384
  Tetilla (Stelletta) 382
baeri, Reniera implexa 398
Bajulus 275
barbata, Cinachyra 374
Barbozia 342
basta, Ianthella (Spongia) 474, 475
Biemma 386, 422, 423, 424
Biemna 423, 424
  truncata 424
Biemninae 423
bifacialis, Sphinctrella 280
bowerbanki, Hamacantha 438

Page
Brachiaster simplex 471
Bubaris 470
cagayanense, Phloeodictyon 420
Calcabrina 275
Calcarea 273
Calthropella 276, 278, 286
Calthropellidae 278
Caminella 303, 310, 320
Caminus 302
canaliculata, Gellius angulatus 390
Cantabrina 355
Carnosa 353
carotta, Rhizochalina 410, 418
Carteriospongia 480
    otahitica 481
    radiata 480
Ceraospongiae 472
Ceratina 472
Ceratosa 275, 277, 472
cerebrum, Ancorina 286, 297
ceylonensis, Euspongia officinalis 485
Chaelotropaena 277
Chalineae 410
Chalininae 386, 410, 473
Chalinodendron 416
    exiguum 416, 417
    minimum 416
    ramosum 416
Chalinopsilla 410, 473
Characella 277, 282, 284
    abbreviata 284
Chelotropella 278, 286
Chondrilla 353, 354
Chondrillastra 353
Chondrosia 353, 354
Chondrosidae 276, 326, 353, 354, 491
chonelloides, Leiodermatium 465
Chrotella 353, 377
    amphiacantha 358
    ibis 358
    macellata 369
    minuta 358
ciliata, Aciculites 463
    Poecillastra 282
    Tetilla 360
Cinachyra 355, 356, 363, 383, 384, 385
    alba-bidens 363
    alba-obtusa 363
    alba-tridens 363
    amboinensis 382
    anomala 363
    barbata 374, 384
    hamata 363
    isis 363, 370
    malaccensis 363
    mertoni 363, 377
    nuda 363
    phacoides 363
    providentiae 363
    vaccinata 363, 377
    vertex 363
    vertex monticularis 363
    voeltzkowi 365
Cinachyrella 355, 356, 357, 358, 363, 384
cinachyroides, Tetilla 363, 365
cineriformia, Paratetilla 382
Cladopeltidae 469

Page
Clathria 439, 442
    corallitincta 441
    elegantula 444
    fasciculata 442, 444
    (Halichondria) frondifera 439, 441, 442
        dichela 441
        major 442
        seto-tubulosa 439, 442
    procera 441
clava, Racodiscula 447
clavigera, Tetilla (Tethya) 363
clavosa, Myriastra (Stelletta) 287, 291
Clavulida 326, 354
Clavulina 276
Cliona 353
Clioniadae 353
Clionidae 326, 353
Clionopsis 353
Cliothosa 353
coactifera, Tethya 378
Coelosphaera 393, 418, 419, 433, 434, 435
    (Histoderma) appendiculata 434
    (Histoderma) dichela 435
    (Histoderma) dichela gracilis 435
    (Histoderma) singaporensis 434
    (Histoderma) verrucosa fucoides 435
    (Histoderma) vesiculata 434
    toxifera 403, 434, 435
    tubifex 434
Collinella 447
columnifer, Tethyopsis 301
Cometella 353
communis, Siphonochalina (Tubulodigitus) 416
compacta, Petrosia similis 407
conica, Theonella 454
Coppatias 285, 327, 329, 333
    distinctus 285
    vaculifer 330
Coppatiidae 326
Corallinaceae 419
Corallistes 459
    thomasi 460
Corallistidae 459, 470
corallitincta, Clathria 441
corrugata, Paratetilla bacca 383
corticata, Strongylophora 392
Corticella 276, 278
Corticidae 275
Corticium 275
Coscinospongia 459, 460
    gracilis 459
    thomasi 460
Coscinospongiidae 459, 470
Costifer 461, 463
    vasiformis 461, 470
Craniella 334, 355, 356, 377, 378
    cranium 378
    disigma 378
    elegans 378
    sagitta microsigma 378
    sagitta pachyrrhabdus 378
    simillima 378
Craniellopsis 385
    azorica 385
    infrequens 385
    lentiformis 385
    zetlandica 385

Page

- cranium, Craniella 378
- crassa, Dendrospongia 490
  - Petrosia 406
- crassiclada, Stelletta 293
- crassifibra, Siphonochalina 414, 415
- crassispicula, Tethya 378
- crassiusculum, Leiodermatium 465
- Crepidula 298
- cribriporosa, Aurora 285
- Cribrochalina 351
  - sluiteri 421
  - variabilis 421
- cribrosa, Ecionemia 297
- Crinorhiza 348
- crucifera, Myxilla 430
- crustata, Petrosia 407, 455
  - Tetilla 363
- Cryptotethya 327
- Cydonium 308, 309, 310
  - japonica 317
  - mülleri 309
- cylindrica, Theonella 454
- Dactylella 445
- Dactylochalina 416
  - exigua samarensis 417
- dactyloidea, Tetilla (Tethya) 358
- Darwinella 275, 472
- Darwinellidae 472, 473
- deciduum, Leiodermatium 465
- Demospongiae 275, 277
- Dendoricinae 425
- Dendoryx 429, 430
- Dendrilla 472
- Dendrospongia 490
  - crassa 490
- Dercitopsis 275
- Dercitus 277, 286
- Desmacella 386, 422, 423, 424
  - pumilio 423, 424
  - vagabunda 423, 424
- Desmacidinae 421
- Desmacidon peachii 423, 424
- Desmacidonidae 326, 386, 421, 422, 423, 424, 437, 444, 473
- Desmacodes 422
- Desmanthidae 470
- Desmanthus 470
  - topsenti 470
- Diastra 285, 327
  - sterrastrosa 285
- dichela, Coelosphaera (Histoderma) 435
  - Clathria frondifera 441
- Didiscus 342
- diffusa, Pachychalina 412
- Diplastrella 342
- discifera, Theonella 447, 448, 453
- discifurca, Discodermia 456
- Discodermia 447, 448, 455
  - discifurca 456
  - emarginata 408, 447, 455, 456
  - emarginata lamellaris 448, 455, 456
  - natalensis 447
  - ornata 456
  - panoplia 448
  - ramifera 447, 448, 457
  - tuberosa 447

Page

- disigma, Craniella 378
- distinctus, Coppatias 285
  - Rhabdastrella 285
- Disyringa 300
- domuncula, Suberites 351
- Donatia 274, 326, 334, 335, 336, 338, 339, 354, 377
  - diploderma 338
  - ingalli 335, 336, 337, 338, 339, 340
  - ingalli seychellensis 335
  - japonica 335, 336, 337, 338, 339, 340
  - lyncurium 336, 337, 338
  - magna 336
  - maza 335, 336, 337, 339
  - multifida 336, 337, 339
  - nux 336
  - seychellensis 335, 336, 337, 338, 339, 340
  - stella-grandis 338
- Donatiidae 333, 334, 353, 354, 386
- Dorypleres 327, 329, 330
- Dotona 353
- Dragmastra 285, 294
- Druinella 491
  - ramosa 491
  - rotunda 491
- dubia, Tethyopsis 302
- dura, Petrosia 406
- durissima, Strongylophora 393
- Dyscliona 353
- Dysidea fragilis 476, 478, 479
- Ecionemia 285, 286, 296, 297
  - agglutinans 297
  - cribrosa 297
  - cribrosa micropora 298
- Ectyonilla 355
- Ectyonillidae 355
- Ectyoninae 354, 421, 429, 439, 444, 445
- elegans, Craniella 378
  - Spongelia 477, 479
- elegantula, Clathria 444
- elastica, Spongelia 478, 479
  - Spongelia fragilis 478
  - Spongelia pallescens 478
- emarginata, Discodermia 408, 447, 455, 456
- Epallax 327, 354
- Epipolasidae 276, 285, 326, 333, 354
- Erylidae 302
- Erylina 302
- Erylus 302, 304, 305, 308
  - cornutus 305, 306, 308
  - cylindrigerus 305, 306
  - discophorus 306
  - formosus 305
  - lendenfeldi 308
  - polyaster 304, 308
  - sollasii 306
  - topsenti 308
- Esperella 425
- Esperellinae 422, 425
- esperioides, Hamacantha (Vomerula) 437, 438
- Euceratosa 472, 473
- euplectellioides, Mycale 427, 428
- Euspongia 484
  - irregularis 291, 486
  - irregularis fistulosa 487
  - irregularis jacksoniana 487
  - irregularis surigaanensis 486

Page

- Euspongia—Continued.
  - officinalis 478, 484, 485, 486, 487
  - officinalis adriatica 485
  - officinalis ceylonensis 485
  - officinalis rotunda 485
  - tenuiramosa 487
- Eusponginae 479, 491
- excentrica, Paratetilla 383
- exiguum, Chalinodendron 416
- Fangophilina 355, 385
  - (Spongocardium) gilchristi 385
  - hirsuta 385
  - submersa 385
- fasciculata, Clathria 442, 444
  - Spongelia fragilis 476
- fascigera, Siphonochalina 413
- fibrosa, Gellius varius 388
  - Pachychalina 411
- Ficulina 351
- fistulata, Mycale 428
- fistulophora, Petrosia testudinaria 401
- fistulosa, Euspongia irregularis 487
- fistulosum, Phloeodictyon 394, 419
- flabelliformis, Ianthella (Spongia) 474
- flagellifer, Gellius 387
- foetida, Hircinia 494
- foliaformis, Penares 286
- foliascens, Phyllospongia (Spongia) 480, 484
- fragilis, Spongelia (Spongia, Dysidea) 476, 478, 479
  - Spongelia pallescens 478
- frondifera, Clathria (Halichondria) 439, 441, 442
- fruticosa, Jereopsis 458
- fucoides, Coelosphaera (Histoderma) verrucosa 435
- furcifer, Tetilla 358
- Gastrophanella 465
- Gelliadae 386
- Gelliinae 386, 387, 437
- Gelliodes 328, 386
  - petrosioides 387
- Gellius 328, 386
  - aculeatus 354
  - (Halichondria) angulatus 390
  - (Halichondria) angulatus canaliculata 390
  - (Halichondria) angulatus vasiformis 390
  - (Halichondria) varius 388
  - (Halichondria) varius fibrosa 388
  - flagellifer 387
  - perforatus 387
- Geodia 302, 303, 306, 308, 309, 310, 312, 319
  - aerolata 319
  - barretti 310
  - cylindrica 322
  - exigua 309
  - flemingii 319
  - japonica 317, 318
  - japonica spherulifera 317
  - media 319
  - megastrella 303, 305, 310
  - micropunctata 310
  - mülleri 309
  - perarmata 310
  - philippinensis 309, 311
  - reticulata 319
  - robusta 309

Page

- Geodia—Continued.
  - sparsa 314
  - stellata 309, 312, 318, 320
  - tuberculosa 319
- Geodiadae 302
- Geodidae 302
- Geodiidae 277, 278, 302, 343
- Geodina 302
- Geodinella 302
  - cylindrica 324
  - robusta 324, 325
  - spherastrosa 285, 322, 325
- Geodinidae 302
- gilchristi, Fangophilina (Spongocardium) 385
- gladius, Tetilla (Tethya) 358
- globosa, Trachygellius (Trachya) 354
- gracilis, Coelosphaera (Histoderma) dichela 435
  - Coscinospongia 459
  - Pachychalina fibrosa 412
- granulosa, Petrosia similis 406
- grayi, Thenea 278, 280
- grimaldii, Petromica 465
  - Trichostemma 350
- guernei, Thymosia 491
- Haddonella 472
- Hadromerina 273, 276, 285, 326, 354, 444
- Halichondria oblonga 397
  - panicea 394, 396
  - reticulata 396
  - tenuiderma 397
  - variabilis 396
- Halichondrina 273, 276, 385, 394, 473
- halichondrioides, Trachyopsis 409
- Halicnemia patera 348, 350
- Halicometes 334, 353
- Halisarca 275
- Halispongia ventriculoides 480
- Hamacantha 422, 423, 424, 425, 436, 437
  - bowerbanki 438
  - (Vomerula) esperioides 437, 438
  - (Vomerula) esperioides mindanaensis 437
  - johnsoni 423
- Hamacanthinae 386, 421, 425, 436
- hamata, Tetilla (Cinachyra) 363
- Haploscleridae 386, 421, 423, 425, 437, 444
- hastata, Myxilla 431
- hebes, Tetilla (Tethya) 358
- helleri, Penares 286
- Hemiasterella 327, 354
- hemisphericum, Trichostemma 349, 350
- herdmani, Taprobane 465, 468
- heros, Suberites 351
- Heterocliona 353
- Heterophymia 459
- Heterorrhaphidae 386, 421, 422
- Heteroxya 333, 334, 386
- Heteroxyinae 386
- Hexaceratina 275, 472
- Hexactinellida 273, 275
- Hexadella 275
- higginsia, Aciculites 464
- Hircinia 491, 494, 495
  - foetida 494
  - mutans 491
  - variabilis 494
- hirsuta, Fangophilina 385

Page
hirsutum, Microscleroderma 465, 469
hispida, Tetilla crustata 363, 370
Histoderma 418, 419, 433, 434
    appendiculatum 434
Holoxea 327
Homorrhaphidae 386, 421
Homosclerophora 275
Hoplophora 447
Hymedesmia 328, 342, 343
    zetlandica 343
Ianthella 472, 473
    (Spongia) basta 474, 475
    (Spongia) flabelliformis 474
ibis, Tetilla (Chrotella) 358
imperfecta, Mycale 428
implexa, Reniera 398
    Spongelia fragilis 479
incrustans, Spongelia pallescens fragilis 478
infrequens, Craniellopsis 385
intermedia, Stelletta 302
invaginata, Theonella 451, 453
irregularis, Euspongia 291, 486
    Petrosia nigricans 403
    Trichostemma 350
isis, Cinachyra 363, 370
    Tetilla 370
Isodictya virgata 388
Isops 303, 319, 320, 321
    membranacea 303, 310
jacksoniana, Euspongia irregularis 487
Jaspis 285, 327, 329, 330, 333
    serpentina 330
    vaculifer 330
Jereopsis 447, 457
    fruticosa 458
    superstes 459
Kalastrella 327, 354
Kaliapsis 456
kelleri, Psammaplysilla 488, 491
Keratosa 276, 353, 472, 473
Keratospongia 472
Kirkpatrickia 422
Kowalewskyella 326
lacerata, Theonella 447, 453
lacunosa, Myxilla 431
lamellaris, Discodermia emarginata 448, 455, 456
Latrunculia 342
Laxosuberites 351
Leiodermatiidae 463, 465, 467
Leiodermatium 465, 467
    chonelloides 465
    crassiusculum 465
    deciduum 465
    lynceus 465
    pfeifferae 465, 471
        striata 467, 469
lentiformis, Craniellopsis 385
Leptosia 343
levior, Theonella 447
lignosa, Petrosia 400, 403
limicola, Tetilla 363
lingua, Tetilla dactyloidea 358
Lissodendoryx 429, 430, 431
    styloderma 432
    tawiensis 430, 432
    tuberosa 432

Page
Lithistida 273, 276, 447
Lithobactrum 465
lobosa, Spongelia pallescens elastica 478
longipilis, Tetilla 358
Lophacanthus rhabdophorus 472
lynceus, Leiodermatium 465
Macandrewia auris 459
    ramosa 459
    robusta 459
macellata, Tetilla (Chrotella) 370
macilenta, Mycale 427
Magog 327
major, Clathria frondifera 442
malaccensis, Tetilla (Cinachyra) 363
massa, Spongelia pallescens elastica 478
massalis, Petromica 465
Megalopastas 472
megastrella Geodia 303
Melophlus 327
merguiensis Amphitethya 383
    Paratetilla 382
    Tethya 382
    Tetilla 382
Merlia normani 425
Merliinae 386, 421, 425
mertoni, Tetilla (Cinachyra) 363, 377
Mesapidae 351
Mesapos 351
metaclada, Tetilla (Tethyopsilla) 358
Microciona prolifera 486
micropora, Ecionemia cribrosa 298
Microscleroderma 463, 465, 467, 468
    hirsutum 465, 469
Microsclerophora 275
microsigma, Amphitethya 384
    Craniella sagitta 378
microstrongyla, Tylodesma 424
Microxina 391
mindanaensis, Hamacantha (Vomerula) esperioides 437
minimum, Chaliuodendron 416
minuta, Tetilla (Chrotella) 358
Monanthus 470
    plumosus 470
Monaxonida 276
Monoceratina 472, 473
Monocrepidium vermiculatum 470
monticularis, Tetilla (Cinachyra) vertex 363
muricata, Thenea 280
mutans, Hircinia 491
Mycale 425, 428
    (Halichondria, Esperella) aegagropila 426, 427
    euplectellioides 427, 428
    euplectellioides regularis 427
    fistulata 428
    imperfecta 428
    macilenta 427
    macilenta australis 426
    nuda 428
Mycalinae 421, 422, 423, 425, 429
Myriastra 285, 287, 294
    clavosa 287, 291
    siemensi 291, 486
    toxodonta 291

Page

- Myxilla, 429, 430, 431
  - crucifera, 430
  - hastata, 431
  - lacunosa, 431
  - rosacea, 429
- Myxillinae, 425
- Myxospongiae, 275
- Myxospongida, 275, 354
- natalensis, Discodermia, 447
- navicelligerum, Sideroderma, 435
- Negombo, 342
- Neopeltidae, 469
- Neosiphonia, 447, 457
- Nethea, 277, 285
- nigricans, Petrosia, 406
- Noncalcarea, 275
- normani, Merlia, 425
- nuda, Mycale, 428
  - Tetilla (Cinachyra), 363
- Nullipore, 419
- oblonga, Halichondria, 397
- obtusa, Penares, 286
- Oceanapia, 386, 418, 419
- officinalis, Euspongia (Spongia), 478, 484, 485, 486, 487
- oleracea, Rhizochalina, 410, 418
- Oligosilicina, 276
- orientalis, Aciculites, 463, 464
  - Stelletta, 296
- ornata, Discodermia, 456
- Oscarella, 275
- Oscarellidae, 275
- otahitica, Carteriospongia, 481
- Oxycordyla, 353
- paccardi, Scleritoderma, 463
- Pachamphilla, 278
- Pachastrella, 277, 282
- Pachastrellidae, 275, 277, 278, 327
- Pachastrissa, 278
- Pachychalina, 411, 417
- Pachychalina diffusa, 411, 413
  - diffusa affinis, 413
  - fibrosa, 411
  - fibrosa gracilis, 412
- Pachymatisma, 302
- pachyrrhabdus, Craniella sagitta, 378
- pallescens, Spongelia, 476, 477, 478
- panicea, Halichondria, 394, 396
- panoplia, Discodermia, 448
- Papyrula, 286
- Paracordyla, 354
- Paratetilla, 355, 380, 384, 385
  - amboinensis, 383
  - arcifera, 380
  - aruensis, 383, 385
  - bacca, 383
  - bacca corrugata, 383
  - bacca violacea, 383
  - cineriformis, 382, 383
  - excentrica, 383
  - merguiensis, 382
- patellae-spinosae, Tetilla crustata, 363, 373
- patera, Halicnemia, 348, 350
- paterifera, Tetilla, 375

Page

- Penares, 286
  - foliaformis, 286
  - helleri, 286
  - obtusa, 286
  - sclerobasa, 286
  - sollasi, 286
- pendula, Thenea, 280
- penicillata, Spongia, 481
- perforatus, Gellius, 387
- Petromica, 465
  - grimaldii, 465
  - massalis, 465
- Petrosia, 399
  - crassa, 406
  - crustata, 407
  - dura, 406
  - lignosa, 400, 403
  - lignosa plana, 404
  - nigricans, 406
  - nigricans irregularis, 403, 406
  - similis, 406
  - similis compacta, 407
  - similis granulosa, 406
  - strongylata, 393, 406
  - testudinaria, 399, 403
  - testudinoria fistulophora, 401
  - truncata aruensis, 403, 406
- petrosioides, Gelliodes, 387
- pfeifferae, Leiodermatium, 465, 471
- phacoides, Tetilla (Cinachyra), 363
- Phloeodictyina, 418, 419
- Phloeodictyinae, 386, 418, 434
- Phloeodictyon, 394, 418, 434
  - cagayanense, 398, 420
  - fistulosum, 394, 419
  - putridosum, 419
- Phoriospongia, 473
- Phoriosponginae, 386, 421, 473
- Phycopsis, 445
- Phyllospongia, 480
  - aliena, 481, 484
  - (Spongia) foliascens, 480, 484
- Pilochrota, 287, 294
- pilula, Tetilla, 358
- Placospongia, 342, 343, 346
  - carinata, 346
  - melobesioides, 346
- Placospongidae, 276
- Plakidium acutum, 469
- Plakina, 275, 276
- Plakinastrella, 275
- Plakinidae, 275, 276
- Plakortis, 275
- plana, Petrosia lignosa, 404
- Plectodendron, 351
- Pleraplysillidae, 472, 475
- Pleroma turbinatum, 463
- Pleromatidae, 461
- Pleromidae, 461
- plumosus, Monanthus, 470
- poculifera, Tetilla, 358
- Podospongia, 342
- Poecillastra, 277, 282
  - ciliata, 282

Page
Poeciloscleridae 342, 421, 437
Polymastia 347
Polymastidae 326, 347
Poterion 353
procera, Clathria 441
prolifera, Microciona 486
Prosuberites 351
Proteleia 347
Protosuberites 326
providentiae, Tetilla (Cinachyra) 363
Psammaplysilla 487, 490, 491
    arabica 489, 490, 491
    kelleri 353, 488, 491
Psammaplysillidae 487, 489
Psammastra 296, 297
Psammonemata 472
Pseudoceratosa 473
Pseudosuberites 351
Pseudotetraxonina 276
pulchrifolia, Theonella 447
pumilio, Desmacella 423, 424
purpurea, Aplysina 490, 491
putridosum, Phloeodictyon (Rhizochalina) 419
Quasillina 347
Racodiscula 447
    clava 447
radiata, Carteriospongia 480
radicifera, Stelletta 294
Radiella sol 350
radiella, Tethyopsis 300
ramifera, Discodermia 447, 448, 457
ramosa, Druinella 491
    Macandrewia 459
    Spongelia pallescens fragilis 478
ramosum, Chalinodendron 416
    Siphonidium 469
Raspailia 444, 445
    (Axinella) acanthifera 445
regularis, Mycale euplectellioides 427
Reniera 394, 397
    implexa 398
    implexa baeri 398
Renierinae 386, 394, 437
Rete philippense 475
reticulata, Halichondria 396
Rhabdastrella 285, 327, 329
    distinctus 285
Rhabdodragma 286, 297
rhabdophorus, Lophacanthus 472
Rhacella 276
Rhaphidistia 327
Rhaphidophlus 439, 442
    filifer spinifera 442
Rhaphidorus 347
Rhaphisia 387
Rhizaxinella 351, 352
    nuda 352
Rhizochalina 419
    carotta 410, 418
    oleracea 410, 418
    putridosa 419
Ridleia 347
Rimella 447
Rinalda 347

Page
robusta, Macandrewia 459
    Stelletta radicifera 296
rosacea, Myxilla 429
rotunda, Druinella 491
    Euspongia officinalis 485
rubra, Tetilla 382
sagitta, Tethya 378
samarensis, Dactylochalina exiguum 417
Samidae 355
Samus 355
Sanidastrella 286, 297
sansibarica, Tetilla (Tethya) 358
sarsii, Trichostemma 350
Sceptrella 342
Sceptrintus 342
Schmidtia 399
Scleritoderma paccardi 463
Scleritodermatidae 463
Scleritodermidae 463, 467
sclerobasa, Penares 286
Scolopes 334
Scutastra 278
Semisuberites 351, 421
    arctica 421
serica, Tetilla (Tethya) 358
seto-tubulosa, Clathria (Halichondria) frondifera 439, 442
Sideroderma 418
    navicelligerum 435
Siderodermella 418, 435
Sidonops 302, 309, 310, 319, 320, 325
    angulata 320
    bicolor 320
    microspinosa 320
    nitida 321
    oxyastra 320
siemensi, Myriastra 291, 486
    Stelletta 291
Sigmatella 473
Sigmatomonaxonellida 276
Sigmatophora 273, 276, 347, 355
Sigmatotetraxonida 276
Sigmosceptrella 342
similis, Petrosia 406
simillima, Craniella 378
simplex, Brachiaster 471
singaporensis, Coelosphaera (Histoderma) 434
Siphonidiidae 469
Siphonidium ramosum 469
Siphonochalina 413
    (Tubulodigitus) communis 416
    crassifibra 414, 415, 416
    fascigera 413
sluiteri, Cribrochalina 421
sol, Radiella 350
sollasi, Penares 286
Sphaerotylus 347
spherastrosa, Geodinella 285, 322
Sphinctrella 277, 280
    bifacialis 280
spinifera, Rhaphidophlus filifer 442
    Spongelia 477
spinosa, Tetilla 358, 361
Spinosella 413

Page

- Spintharophora 276
- Spinularia 347
- Spirasigma 354
- Spirasigmidae 354
- Spirastrella 342, 343, 345
  - angulata 345
  - digitata 345
  - incrustans 345
  - purpurea 345
  - trincomaliensis 344
  - vagabunda 343, 344
  - vagabunda tubulo-digitata 345
- Spirastrellidae 326, 327, 334, 342, 343
- Spiroxya 327
- Spongelia 476, 479
  - avara 477
  - elastica 478, 479
  - elegans 477, 479
  - fragilis 478, 479
    - elastica 478
    - fasciculata 476
    - implexa 479
  - pallescens 476, 477, 478
    - elastica 478
    - elastica lobosa 478
    - elastica massa 478
    - fragilis 478
    - fragilis incrustans 478
    - fragilis ramosa 478, 479
    - fragilis tubulosa 478
  - spinifera 477
- Spongelidae 472, 475
- Spongia basta 475
  - flabelliformis 474
  - foliascens 480
  - fragilis 476
  - officinalis 484
  - penicillata 481
- Spongidae 472, 479
- Spongillinae 386
- Spongocardium 385
- Spongosorites 326, 327, 331, 333, 386
  - suluensis 331
- Stelletta 285, 287, 293, 294
  - bacca 382
  - clavosa 287
  - crassiclada 293
  - intermedia 302, 304
  - nux 336
  - orientalis 296
  - radicifera 294
  - radicifera robusta 296
  - validissima 296
- Stellettidae 277, 278, 285, 293, 326, 327, 334
- Stellettinae 285
- Stellettinopsis simplex 327
- Stelospongia 493
- Stelosponginae 491
- sterrastrosa, Diastra 285
- stewartii, Tethyopsilla 385
  - Tetilla 358
- stipitata, Amphitethya (Tetilla, Tethya) 384
- Stoeba 275, 277
- straticulatum, Trichostemma 347
- Streptasteridae 326

Page

- striata, Leiodermatium pfeifferae 467, 469
- strongylata, Petrosia 393, 406
- Strongylophora 391, 393
  - corticata 392
  - durissima 393
- Stryphnus 286
- Stylaxia 421
- stylifera, Tethya 378
- Stylinos 421
- Stylocordyla 352, 353
- styloderma, Lissodendoryx 432
- Stylostichon 429
- Stylotella 421
- Stylotellinae 421
- Suberanthus 351
- Suberella 351
- Suberites 351
  - domuncula 351
  - heros 351
- Suberitidae 326, 342, 347, 351
- Suberitidinae 351
- submersa, Fangophilina 385
- Sulcastrella 447
- sulcata, Thenea grayi 280
- superstes, Jereopsis 459
- suriganensis, Euspongia irregularis 486
- swinhoei, Theonella 448, 453, 454
- Synops 319
- Syringella 444
- Taprobane 447, 463, 465, 467, 468
  - herdmani 465, 468
- tawiensis, Lissodendoryx 430, 432
- Tedania 386, 422
- Tedaniinae 386, 421, 422
- tenda, Vomerula 437
- Tentorium 347
- tenuiderma, Halichondria 397
- tenuiramosa, Euspongia 487
- ternatensis, Tetilla 382
- Terpios 351
- testudinaria, Petrosia (Alcyonium, Reniera) 399
- Tethea ingalli 335
  - simillima 378
- Tethya 334, 335, 354, 355, 377, 378
  - armata 378
  - clavigera 363, 365
  - coactifera 367, 378
  - cranium 334
  - crassispicula 378
  - dactyloidea 358
  - diploderma 338, 339
  - gladius 358
  - hebes 358
  - merguiensis 382
- Tethya sagitta 378
  - sansibarica 358
  - serica 358
  - stylifera 378
- Tethydae 355
- Tethyidae 333, 334, 386
- Tethyopsilla 355, 358, 378, 379, 385
  - metaclada 358
  - stewartii 385
  - zetlandica 378
- Tethyopsillidae 355, 379

Page

- Tethyopsinae, 300
- Tethyopsis, 300
  - columnifer, 301
  - dubia, 300
  - radiella, 302
- Tethyorrhaphis, 334
- Tethyspira, 351
- Tetilla, 274, 339, 355, 356, 357, 358, 377, 384, 424
  - alba-bidens, 370
  - alba-obtusa, 370
  - alba-tridens, 370
  - amboinensis, 382
  - amphiacantha, 358
  - anomala, 356, 363
  - bacca, 382
  - borodensis, 356, 358
  - ciliata, 357, 358, 360
  - cinachyroides, 363, 365
  - clavigera, 363, 365
  - crustata, 363, 367
  - crustata aperta, 363, 371
  - crustata hispida, 363, 370
  - crustata patellae-spinosae, 363, 373
  - dactyloidea, 358
  - dactyloidea lingua, 358
  - furcifer, 358
  - gladius, 358
  - hamata, 370
  - hebes, 358
  - hirsuta, 363, 365
  - ibis, 358
  - isis, 363, 370
  - limicola, 363
  - longipilis, 356, 358
  - malaccensis, 363
  - merguiensis, 382
  - mertoni, 363, 377
  - metaclada, 358
  - minuta, 358
  - nuda, 363
  - paterifera, 375
  - phacoides, 363
  - pilula, 358
  - poculifera, 358, 361
  - providentiae, 363
  - rubra, 382
  - sansibarica, 358
  - serica, 358
  - spinosa, 358, 361
  - stewartii, 358
  - ternatensis, 382
  - vaccinata, 363, 377
  - vertex, 370
  - vertex monticularis, 363
  - vestita, 358
  - violacea, 382
  - voeltzkowi, 365
- Tetillidae, 355, 356
- Tetractinellida, 276
- Tetraxonida, 275, 277
- Thenea, 277, 278, 282
  - grayi, 278, 280
  - grayi grayi, 278
  - grayi sulcata, 280

Page

- Thenea—Continued.
  - muricata, 280
  - pendula, 280
- Theneidae, 275, 277, 286, 327
- Theonella, 447, 448, 453, 455
  - annulata, 447
  - conica, 454
  - cylindrica, 454
  - discifera, 447, 448, 453
  - invaginata, 451, 453
  - lacerata, 447, 453
  - levior, 447
  - pulchrifolia, 447
  - swinhoei, 448, 453, 454
  - swinhoei verrucosa, 450
- Theonellidae, 447, 470, 472
- thomasi, Coscinospongia (Corallistes), 460
- Thoosa, 353
- Thrombidae, 276
- Thrombus, 276
- Thymosia, 353, 491
  - guernei, 491
- tibicen, Vomerula, 437
- Timea, 342, 343
- topsenti, Desmanthus, 470
- Topsentia, 326, 327
- toxifera, Coelosphaera, 403, 434, 435
- Toxochalina, 388, 410
- toxodonta, Myriastra, 291
- Trachya, 333, 334
  - globosa, 354
- Trachycladus, 327, 342, 354
- Trachygellius globosa, 354
- Trachyopsis, 409
  - halichondrioides, 409
- Trachytedania, 422
- Triaxonia, 275
- Tribrachion, 300
- Tribrachium, 300
- Trichostemma, 347
  - grimaldii, 350
- Trichostemma hemisphericum, 349
  - irregularis, 350
  - sarsii, 350
  - straticulatum, 347
- Triptolemus, 277
- truncata, Biemna, 424
- Tuberella, 326, 333, 334, 340
  - aaptos, 341, 342
  - ciliata, 341
- tuberosa, Discodermia, 447
  - Lissodendoryx, 432
- Tubulodigitus, 416
- tubulosa, Spongelia pallescens fragilis, 478
- turbinatum, Pleroma, 463
- Tylexocladus, 347
- Tylodesma, 386, 423, 424
  - microstrongyla, 424
- vaccinata, Tetilla (Cinachyra), 363, 377
- vagabunda, Desmacella, 423, 424
- validissima, Stelletta, 296
- variabilis, Cribrochalina, 421
  - Halichondria, 396
  - Hircinia, 494

Page
varius, Gellius (Halichondria) 388
vasiformis, Costifer 461, 470
  Gellius angulatus 390
ventriculoides, Halispongia 480
vermiculatum, Monocrepidium 470
verrucosa, Theonella swinhoei 450
vertex, Tetilla (Cinachyra) 363
vesiculata, Coelosphaera (Histoderma) 434
vestita, Tetilla (Tethya) 358
Vetulinidae 470
Vibulinus 354, 444
violacea, Paratetilla bacca 383
  Tetilla 382

Page
virgatus, Isodictya 388
voeltzkowi, Tetilla 365
Vomerula 436, 437
  tenda 437
  tibicen 437
wageneri, Ancorina 286
Weberella 347
Xenospongia 334, 342
Yodomia 277
zetlandica, Craniellopsis 385
  Hymedesmia 343
  Tethyopsilla 378