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OF FISH AND FISHERIES FOR 1883.]

RESULTS
OF THE
EXPLORATIONS MADE BY THE STEAMER
ALBATROSS

OFF THE NORTHERN COAST OF THE UNITED STATES

IN

1883.

BY

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XVI.—RESULTS OF THE EXPLORATIONS MADE BY THE STEAMER “ALBATROSS,” OFF THE NORTHERN COAST OF THE UNITED STATES, IN 1883.

By A. E. VERRILL.

During the summer of 1883, the new United States Fish Commission steamer “Albatross,” Lient. Z. L. Tanner, commander, continued the work of dredging in the region of the Gulf Stream, along our coast, from off Cape Hatteras to Nova Scotia.* She is, in construction, well adapted to do deep-sea work, and fully equipped with improved apparatus, and therefore was able to carry the dredgings much farther out to sea than the “Fish Hawk” had been able to in previous years. The stations most distant from the coast were more than a third of the way to the Bermudas. The greatest depth successfully dredged was in 2,949 fathoms, at station 2099, N. latitude $37^{\circ} 12' 20''$, W. longitude $69^{\circ} 39'$, August 2. Besides this, there were four successful hauls in 2,033 to 2,369 fathoms, and twenty-seven between 1,000 and 2,000 fathoms. Between 500 and 1,000 fathoms there were nineteen hauls, and in less than 500 fathoms, sixty-three, making a total of one hundred and sixteen stations. At nearly all the localities, except on the rocky bottoms off Nova Scotia, a large beam-trawl was used, and in most cases large quantities of specimens were obtained, even at great depths. The bottom temperatures between 1,000 and 2,000 fathoms were usually between 37° F. and 39° F., and rarely 40° .

The minimum temperatures at the bottom, in this region, are between

* It is but just to say that the unusual thoroughness and remarkable success of these explorations of the Gulf Stream region have been due to the great skill and untiring zeal and energy of Captain Tanner, who has personally superintended all our deep-sea dredging operations during the past five years. It is proper to add that his efforts have been well supported by the other officers associated with him.

The naturalists associated with the writer in this work in 1883 were: Prof. S. I. Smith, Mr. Sanderson Smith, Prof. L. A. Lee, Mr. Richard Rathbun, Mr. J. H. Emerton (also as artist), Mr. B. F. Koons, Prof. Edwin Linton, Mr. H. L. Bruner, Mr. J. E. Benedict (naturalist attached to the steamer), Mr. R. S. Tarr, W. E. Safford, ensign U. S. N., and others, more or less. Mr. Peter Parker, Mr. John A. Ryder, Dr. Theodore Gill, and R. H. Miner, ensign U. S. N., worked on the fishes. The parties who went out dredging on the the steamer varied from time to time. Usually only three or four naturalists, besides Mr. Benedict, could be properly accommodated on board. I took no part in this portion of the work, in 1883, not going out on the steamer at all.

36° and 37° F., even below 2,000 fathoms. But temperatures, practically identical, have often been taken in about 1,000 fathoms, or even less. Therefore the minimum temperatures may be considered as practically reached at 1,000 fathoms, off our coast. Below that, there is very little change. Accordingly, many of the special deep-sea species range from 1,000 fathoms or less to below 2,000 fathoms, in this region. Serial temperatures were also taken at various localities.

CHARACTER OF THE DEEP-SEA DEPOSITS.

Some very interesting and important discoveries were made in regard to the nature of the materials composing the sea bottom under the Gulf Stream at great depths. These observations are of great interest from a geological point of view, as they illustrate the kinds of sedimentary rocks that may be formed far from land and in deep water, and some of them are contrary to the experience of other expeditions and not in accordance with the generally accepted theories of the nature of the deposits so far from land. The bottom between 600 and 2,000 fathoms, in other regions, has generally been found to consist mainly of "globigerina ooze," or, as in some parts of the West Indian seas, of a mixture of globigerina and pteropod ooze. Off our northern coasts, however, although there is a more or less impure globigerina ooze, in such depths, at most localities beneath the Gulf Stream, this is by no means always the case. The "globigerina ooze" usually has the consistency of fine, sticky mud, commonly of a gray, dull olive-green or bluish color. When washed through a very fine sieve a variable, but often large, proportion remains on the sieve, composed chiefly of the shells of *Globigerina* and other foraminifera, of many kinds, but mostly minute species, which live at or near the surface of the sea and fall to the bottom when dead or disabled. With these are many larger forms, both of calcareous and sand-covered species, which live at the bottom. In many places there are large quantities of the brown, sandy, rod-like and triradiate species (*Rhabdammina*), in which the rays become about half an inch long. These are mingled with small shells, annelid tubes, fragments of echinoderms, otoliths of small fishes, &c., together with a variable proportion of true beach sand. The globigerina ooze, as found off our coast, even from below 1,000 fathoms, is always mixed with some fine siliceous and granitic sand, in which grains of quartz, feldspar, and mica can easily be distinguished under the microscope; in shallow water (100 to 400 fathoms) the sand is coarser, with the grains easily visible to the naked eye, but of the same nature, and frequently contains much clay-mud. In several instances the bottom between 500 and 1,200 fathoms has been found to consist of tough and compact clay, so thoroughly hardened that large angular masses, sometimes weighing more than 50 pounds, have been brought up in the trawl, and have not been washed away appreciably, notwithstanding the rapidity with which they have been drawn up through about two miles of water. In fact, these masses of

hard clay resemble large angular blocks of stone, but when cut with a knife they have a consistency somewhat like hard castile soap, and in sections are mottled with lighter and darker tints of dull green, olive, and bluish gray. When dried they develop cracks and break up into angular fragments. This material is genuine clay, mixed with more or less sand, showing under the microscope grains of quartz and feldspar with some scales of mica. More or less of the shells of *Globigerina* and other foraminifera are contained in the clay, but they make up a very small percentage of the material.*

LIST OF STATIONS OCCUPIED BY THE "ALBATROSS" IN 1883.

The following abbreviations are used to indicate the character of the bottom. They are the same as those used by the United States Coast Survey with a few additions desirable for greater precision:

Materials.	Colors.	Other qualities.
B. for barnacles.	bk. for black.	brk. for broken.
C. for clay.	bn. for brown.	cal. for calcareous.
Cna. for concretions.	bu. for blue.	cra. for coarse.
Cr. for corals.	db. for drab.	dia. for diatomaceous.
F. for foraminifera.	dk. for dark.	fine. for fine.
G. for gravel.	gn. for green.	fer. for ferruginous.
M. for mud.	gy. for gray.	gib. for globigerina.
O. for ooze.	lt. for light.	hrl. for hard.
P. for pebbles.	ol. for olive.	lpy. for lumpy.
R. for rocks.	rd. for red.	rky. for rocky.
s. for sand.	sl. for slate.	sft. for soft.
sh. for shells.	wh. for white.	shy. for shelly.
spg. for sponges.	yl. for yellow.	sml. for small.
st. for stones.		spa. for specks.
		sty. for stinky.

In the following list the character of the bottom is not always given as in the original record, for in some cases colors or other qualities have been omitted, when unimportant, for the sake of condensation. In other cases additions or alterations have been made based on the materials actually brought up in the dredge or trawl, often in large quantities:

Station.	Locality.		Fathoms.	Bottom.	Temp., F.		Hour.	Date.
	N. lat.	W. long.			Bot- tom.	Sur- face.		
OFF CHESAPEAKE BAY.								
	° ' "	° ' "			°	°		
2001	37 46 30	74 00 00	499	gn. M.	.....	.....	.....	Mar. 23
2002	37 20 42	74 17 26	641	gn. M.	.....	1 48	.....	Mar. 23
2003	37 16 30	74 20 36	640	.....	.....	1 50	.....	Mar. 23
2004	37 19 45	74 26 00	98	gn. M. sh.	.....	1 51	.....	Mar. 23
2005	37 18 11	74 27 36	78	M. s. sh.	.....	1 50	.....	Mar. 23
2006	37 19 11	74 26 06	492	M. fine s.	.....	1 50	.....	Mar. 23
OFF CAPE HATTERAS.								
2007	35 17 00	75 13 00	15	fine s.	1 68	1 56	8.00 a. m.	Apr. 27
2008	35 09 40	75 04 36	88	M. fine s.	1 74	1 72	10.15 a. m.	Apr. 27

* This kind of material was encountered in much larger quantities during the past season (1884) than in 1883. See American Journal of Science for November, 1884.

Station.	Locality.		Fathoms.	Bottom.	Temp., F.		Hour.	Date.
	N. lat.	W. long.			Bot- tom.	Sur- face.		
OFF CAPE HATTERAS— continued.								
	° ' "	° ' "			°	°		
2009	35 29 35	74 46 45	531	-----	-----	1 09	8.45 a. m.	Apr. 28
2010	35 30 00	74 44 45	890	-----	-----	1 01	10.40 a. m.	Apr. 28
2011	36 38 30	74 40 10	51	s. brk. sh.	-----	1 48	9.00 a. m.	Apr. 30
2012	36 41 15	74 39 50	66	-----	-----	1 52	10.15 a. m.	Apr. 30
2018	36 45 30	74 25 30	888	gn. M.	-----	1 48	1 05 p. m.	Apr. 30
2014	36 41 05	74 28 58	373	s. brk. sh.	-----	1 47	6.35 a. m.	May 1
OFF CHESAPEAKE BAY.								
2015	37 31 00	74 53 30	19	fne. s. sh.	-----	-----	8.39 a. m.	May 5
2016	37 31 00	74 52 36	19	fne. s. sh.	45	45	9.06 a. m.	May 5
2017	37 30 48	74 51 29	18	fne. s. sh.	46	45	9.50 a. m.	May 5
2018	37 12 22	74 20 04	788	bu. M.	39	54	12.07 p. m.	May 7
2019	37 15 52	74 23 52	600	bu. M.	89	52	4.13 p. m.	May 7
2020	37 37 50	74 15 30	143	fne. s. M.	-----	54	5.30 a. m.	May 21
2021	37 36 00	74 16 00	179	M. s.	45	54	7.00 a. m.	May 21
2022	37 32 00	74 13 20	487	M. s.	40	52	10.00 a. m.	May 21
2023	37 48 00	74 01 30	377	M. fne. s.	-----	56	3.15 p. m.	May 21
OFF MARTHA'S VINEYARD.								
2024	40 02 10	70 27 00	221	dk. gn. M.	40	49	5.51 a. m.	May 25
2025	40 02 05	70 27 00	239	M. fne. s.	40	49	7.20 a. m.	May 25
2026	40 04 00	70 28 50	131	gn. M. s.	48	49	9.00 a. m.	May 25
2027	39 58 25	70 37 00	198	bu. M. s.	43	52	12.21 p. m.	May 25
2028	39 57 50	70 32 00	204	bu. M.	41	52	2.05 p. m.	May 25
2029	39 42 00	70 47 00	1,168	gn. M.	38	53	5.13 p. m.	May 25
2030	39 29 45	71 43 00	588	bu. M.	-----	49	6.20 a. m.	May 26
2031	39 29 00	72 19 55	74	M. wh. s.	49	50	1.05 p. m.	May 26
2032	39 29 00	72 19 40	73	M. s. brk. sh.	47	50	2.10 p. m.	May 26
2033	39 32 30	72 18 35	879	gn. M.	41	49	5.00 p. m.	May 26
2034	39 27 10	69 56 20	1,346	glb. o.	38	72	8.55 a. m.	July 17
2035	39 26 12	70 02 37	1,362	glb. o.	-----	71	2.50 p. m.	July 17
2036	38 52 40	69 24 40	1,735	glb. o.	38	76	4.30 a. m.	July 18
2037	38 53 00	69 23 30	1,781	glb. o.	38	76	1.22 p. m.	July 18
2038	38 30 30	69 08 25	2,033	glb. o.	-----	76	2.32 p. m.	July 23
2039	38 19 26	68 20 20	2,369	glb. o.	-----	81	noon.	July 23
2040	38 35 13	68 16 00	2,226	glb. o.	-----	76	4.20 a. m.	July 29
2041	39 22 50	68 25 00	1,608	glb. o.	38	72	3.50 a. m.	July 30
2042	39 33 00	68 26 45	1,555	glb. o.	38	71	10.32 a. m.	July 30
2043	39 49 00	68 28 30	1,467	glb. o.	38	72	5.07 p. m.	July 30
2044	40 00 30	68 37 20	1,067	glb. o.	39	72	5.25 a. m.	July 31
2045	40 04 20	68 43 50	378	M. fne. s.	40	72	10.00 a. m.	July 31
2046	40 02 49	68 49 00	407	bu. M.	40	72	noon.	July 31
2047	40 02 30	68 49 40	389	bu. M.	-----	72	2.15 p. m.	July 31
2048	40 02 00	68 50 30	547	s. G. M.	-----	72	3.56 p. m.	July 31
2049	39 43 40	69 20 00	1,025	bu. glb. M.	39	71	3.35 a. m.	Aug. 1
2050	39 43 50	69 21 20	1,050	glb. o.	-----	72	9.15 a. m.	Aug. 1
2051	39 41 00	69 20 20	1,106	glb. o.	39	72	2.34 p. m.	Aug. 1
2052	38 40 05	69 21 25	1,098	glb. o.	-----	73	6.16 p. m.	Aug. 1
OFF GEORGE'S BANK.								
2053	42 02 00	68 27 00	105	bu. M.	-----	61	5.00 a. m.	Aug. 29
2054	42 03 30	68 28 00	105	bu. M.	-----	64	6.20 a. m.	Aug. 29
2055	42 32 00	68 17 00	99	M. cra. G.	-----	60	9.24 a. m.	Aug. 30
2056	42 01 30	68 01 00	97	fne. s. G.	-----	57	3.23 p. m.	Aug. 30
2057	42 01 00	68 00 30	86	s. s. brk. sh.	-----	57	4.26 p. m.	Aug. 30
2058	41 57 30	67 58 00	35	gy. s.	50	58	6.39 p. m.	Aug. 30
2059	42 05 00	68 46 15	41	bu. M. s.	-----	55	5.00 a. m.	Aug. 31
2060	42 10 00	68 46 15	123	s. s. brk. sh.	-----	55	7.10 a. m.	Aug. 31
2061	42 10 00	68 47 45	115	bu. M. s.	40	54	8.00 a. m.	Aug. 31
2062	42 17 00	68 37 15	150	s. G. B.	42	61	10.47 a. m.	Aug. 31
2063	42 23 00	68 23 00	141	s. cra. G. B.	46	57	1.26 p. m.	Aug. 31
2064	42 25 40	68 08 35	122	cra. s. G. B.	-----	56	4.32 p. m.	Aug. 31
OFF CAPE SABLE.								
2065	42 27 00	65 00 45	80	s. G. B.	44	55	7.00 p. m.	Aug. 31
2066	42 19 40	65 49 30	65	st. G. B.	43	54	5.00 a. m.	Sept. 1
2067	42 15 25	65 48 49	122	s. G. B.	46	56	7.05 a. m.	Sept. 1
2068	42 08 00	65 48 40	181	s. fne. G.	42	56	10.30 a. m.	Sept. 1
2069	41 54 50	65 48 35	101	s. st. G. Cr.	42	56	1.34 p. m.	Sept. 1
2070	41 55 30	65 47 10	113	P. coral	43	57	2.58 p. m.	Sept. 1
2071	41 56 20	65 48 40	113	P. coral	-----	57	4.10 p. m.	Sept. 1

Station.	Locality.		Fathoms.	Bottom.	Temp., F.		Hour.	Date.
	N. lat.	W. long.			Bot- tom.	Sur- face.		
OFF CAPE SABLE—con- tinued.								
	° ' "	° ' "			°	°		
2072	41 58 00	65 35 00	858	gy. M.	39	56	6.15 a. m.	Sept. 2
2073	41 54 15	65 39 00	586	gy. s.	40	58	10.41 a. m.	Sept. 2
2074	41 43 00	65 21 50	1,809	fine glb. M.	40	60	6.42 a. m.	Sept. 3
2075	41 40 30	65 35 00	855	fine glb. M.	39	58	3.41 p. m.	Sept. 3
2076	41 13 00	66 00 50	906	bu. glb. M.	-----	60	3.20 a. m.	Sept. 4
2077	41 09 40	66 02 00	1,255	bu. glb. M.	39	63	8.00 a. m.	Sept. 4
2078	41 12 50	66 12 20	499	gy. M. s.	40	66	1.40 p. m.	Sept. 4
2079	41 13 00	66 19 50	75	wh. s.	45	67	4.15 p. m.	Sept. 4
2080	41 13 00	66 21 50	55	gy. s.	48	67	5.10 p. m.	Sept. 4
2081	41 10 20	66 30 20	50	wh. s. P. B.	46	56	6.50 p. m.	Sept. 4
2082	41 09 50	66 31 50	49	ora. s. B.	48	55	7.40 p. m.	Sept. 4
2083	40 26 40	67 05 15	950	gy. M.	40	72	4.30 a. m.	Sept. 5
2084	40 16 50	67 05 15	1,280	bu. M. s.	40	78	9.09 a. m.	Sept. 5
OFF MAETHA'S VINEYARD.								
2085	40 05 00	70 24 45	70	bu. M.	50	68	6.56 a. m.	Sept. 20
2086	40 05 05	70 35 00	69	M. s.	52	67	9.20 a. m.	Sept. 20
2087	40 06 50	70 34 15	65	M. wh. s.	50	67	10.30 a. m.	Sept. 20
2088	39 59 15	70 36 30	143	yl. s.	48	68	12.40 p. m.	Sept. 20
2089	39 58 50	70 39 40	168	gy. s.	45	69	3.13 p. m.	Sept. 20
2090	39 59 40	70 41 10	140	s. brk. sh.	48	68	4.40 p. m.	Sept. 20
2091	40 01 50	70 59 00	117	gn. M.	49	69	5.30 a. m.	Sept. 21
2092	39 58 35	71 00 30	197	gn. M.	45	67	7.50 a. m.	Sept. 21
2093	39 42 50	71 01 20	1,000	F. s. M.	36	69	1.12 p. m.	Sept. 21
2094	39 44 30	71 04 00	1,022	F. s. M.	38	68	5.07 p. m.	Sept. 21
2095	39 29 00	70 58 40	1,342	glb. O.	-----	69	9.02 a. m.	Sept. 20
2096	39 22 20	70 52 20	1,451	glb. O.	37	69	2.07 p. m.	Sept. 20
OFF CHESAPEAKE BAY.								
2097	37 56 20	70 57 30	1,917	glb. O.	-----	72	5.30 a. m.	Oct. 1
2098	37 40 30	70 37 30	2,221	glb. O.	-----	72	1.08 p. m.	Oct. 1
2099	37 12 20	69 39 00	2,949	glb. O.	-----	82	5.30 a. m.	Oct. 2
2100	39 23 00	68 34 30	1,628	glb. O.	37	69	11.05 a. m.	Oct. 3
2101	39 18 30	68 24 00	1,686	glb. O.	37	67	4.31 p. m.	Oct. 3
OFF DELAWARE BAY.								
2102	38 44 00	72 26 00	1,209	glb. O.	39	62	-----	Nov. 5
2103	38 47 20	72 37 00	1,091	glb. O.	39	62	-----	Nov. 5
2104	38 48 00	72 40 30	991	bu. glb. M.	41	63	-----	Nov. 5
OFF CHESAPEAKE BAY.								
2105	37 50 00	73 03 50	1,395	glb. O.	41	63	-----	Nov. 6
2106	37 41 20	73 03 20	1,497	glb. O.	42	63	-----	Nov. 6
OFF CAPE HATTERAS.								
2107	35 19 30	75 15 20	16	fine s. sh.	-----	76	-----	Nov. 9
2108	35 16 00	75 02 30	48	M. cra. s.	65	78	-----	Nov. 9
2109	35 14 20	74 59 10	142	bu. M.	50	76	-----	Nov. 9
2110	35 12 10	74 57 15	516	bu. M.	40	75	-----	Nov. 9
2111	35 09 50	74 57 40	938	gn. M.	-----	76	-----	Nov. 9
2112	35 20 50	75 18 00	15	s. bk. sp.	73	70	-----	Nov. 10
2113	35 20 30	75 19 00	15	s. M.	72	70	-----	Nov. 10
2114	35 20 00	75 20 00	14	s. M.	72	70	-----	Nov. 10
2115	35 49 30	74 34 45	843	M. fine. s.	39	78	-----	Nov. 11
2116	35 45 23	74 31 25	888	M. fine. s.	39	77	-----	Nov. 11

In many instances we have also dredged pebbles and small, rounded bowlders of granite and other crystalline rocks from beneath the Gulf Stream in deep water. These, I suppose, have been carried to that region by shore-ice floating off in great quantities from our northern coasts in winter and spring, and melting where the warm Gulf Stream water is encountered. The coarser sands and gravel are probably carried there in the same way, but the fine sand, in part at least, probably

floats out to this region after drying on the beaches during ebb tide, by reason of the adherent air and repellant action toward the water. The clay mud, with much of the fine sand, is probably carried out from the shallower water as suspended sediment. But some of the clay may result from the local decomposition of feldspathic rocks and sand at the bottom of the sea.

FAUNA OF THE DEEP WATER.

The deepest localities were all rich in animal life of many kinds.* A considerable number of interesting fishes were obtained, many of them new to our fauna. Some of these are new genera and species of great interest.

Very interesting additions to our collections were made in nearly every class of marine invertebrates, including many undescribed species and genera, some of which are of great morphological importance, while many of the described species were previously known only from distant regions on the European side of the Atlantic, in the Arctic or Antarctic regions, off the coast of South America, in the West Indies, or even in the Indian or Pacific Oceans. Thus our knowledge of the distribution of the deep-sea forms, both geographically and in depth, has been greatly increased. Some of these deep-sea species were first described as fossils from the European tertiaries. Moreover, a considerable number of our shallow-water species have been found to have a much greater range in depth than was anticipated, many of them going down below 500 fathoms, while some even go below 1,000 fathoms.

On the first trip of the "Albatross" from Wood's Holl, which was made July 16 to 19, four successful hauls were made with a large trawl, in 1,346 to 1,735 fathoms, on the 17th and 18th of July, two each day, besides the soundings and temperature determinations, including series of temperatures at various distances from the surface. On this trip about one hundred and five species of Invertebrates were obtained, not including the Foraminifera and other minute forms. There were among them fourteen species of Anthozoa; two of Hydroids; twenty-two of Echinoderms; thirty-eight of Mollusca; fifteen of Crustacea; one of Pycnogonida; ten of Annelida; one of Bryozoa; two of Sponges.

ANTHOZOA.

The Anthozoa were abundant, both in individuals and species, in most of the dredgings. From below 1,000 fathoms there were numer-

*An account of the Crustacea was published in the July number of the American Journal of Science by Prof. S. I. Smith, who has also published a detailed account of that group, with figures, in the Fish Commission Annual Report, part x. The writer has published a detailed paper on the Mollusca, with five plates, in the Trans. Conn. Acad., vol. vi, and also a brief general account of the work of the season in the American Journal of Science, vol. 23, p. 213, with descriptions of new species of Echinoderms and Anthozoa. Some of the new fishes have been described by Messrs. Gill and Ryder.

ous species, many of them of great interest. About forty species were taken; altogether, belonging to all the principal groups. Several were undescribed, while others are new additions to our fauna, though previously obtained elsewhere by the "Blake" or "Challenger." It was also a source of satisfaction to us that we rediscovered, in larger numbers, the few remaining species that the "Blake" and "Challenger" had discovered off our coast, but which the Fish Commission had not previously dredged.

The Pennatulacea were among those of greatest interest, and of these several fine species occurred, among which were two large and handsome species of the rare and curious genus *Umbellula*. In this genus there is at the summit of the tall, slender stem a close cluster of large, flower-like, deep red, orange-red, or purplish-red polyps, each with eight long, pinnate tentacles. The flexible stem is often 2 feet or more in length, and terminates at the base in a long, hollow, muscular bulb, which serves as an anchor when inserted into the mud. The first known species of this genus was brought up on a sounding line from deep water, off the coast of Greenland, early in the last century, and one of the two specimens was described by Ellis, and the other by Mylius with rude but characteristic figures. These specimens seem to have been lost. From that time it remained unknown until within a few years, and was often a source of doubt and perplexity to the systematists. The modern deep-sea explorations, and especially those of the "Challenger," have brought to light several additional species, and proved that the genus inhabits all the oceans in deep water. But no specimens of the genus had been taken on the North American coast before last year, though a small one had been dredged in the West Indies by the "Blake." One of our species appears to be *U. Guntheri* K lliker (fig. 3), first dredged on the other side of the Atlantic by the "Challenger;" the second and more common was apparently new (*U. Bairdii* V., fig. 2). It differs from the former in having longer and perfectly smooth polyps, with lanceolate clusters of zooids running up between them. It is 2 feet high, with the polyp-bodies over an inch in length. Both occurred in 1,731 to 2,033 fathoms, and sometimes together. The handsome, small, dark red *Pennatula aculeata* (fig. 7) has been taken many times, both by the "Albatross" and "Fish Hawk," and often in great numbers, as many as 100 to 200, and in one case 494 specimens in a single haul. Like most of the Pennatulacea it is brilliantly phosphorescent. It ranges from 100 to 1,255 fathoms, but is most abundant between 150 and 300 fathoms. A much larger and finer species (*P. borealis*, fig. 8), usually considered rare, but frequently brought in by our halibut fishermen from the northern banks, was dredged several times in 192 to 1,255 fathoms. It grows to the height of 18 inches or more, and is often 4 or 5 inches broad across the pinnæ. Its color is usually bright orange-red, varying to brownish red and to light orange. A large, handsome and very remarkable new species for which it is necessary to constitute a

new genus, if not also a new family, was taken once, in 1883, in 843 fathoms, but two better specimens were taken, in 1884, in 991 and 1,073 fathoms. This I have named *Benthoptilum sertum* (fig. 4). It has the general form of a large *Pennatula*, with short, thick, fleshy, oblique pinnae, from which spring several rows of numerous large and very long, soft, fleshy polyps, without calicles and without spicula, each group forming a boquet-like cluster of flower-like polyps, which in life are blood-red.

The singular club-shaped genus, *Kophobelemnon*, was represented by two species. One of these, which was undescribed (*K. tenue* V., fig. 5), is long, slender, and smooth, with a number of large polyps. It was taken in 499 to 2,369 fathoms, and in considerable numbers in some localities. The other and smaller rough species (*K. scabrum* V.) was previously known from a single specimen taken by the "Blake" in 1880. It occurred in 788 fathoms, but was taken more abundantly in 1884. A handsome new species, from 6 inches to a foot high, and slender, with many spiculate flower-like polyps in a row along each side on the upper half, was dredged in many localities by the "Albatross" in 1,467 to 2,369 fathoms. It belongs to the genus *Scleroptilum* (*S. elegans* V., fig. 6). This genus was previously known only from a related species taken off Japan by the "Challenger." Many of our specimens had a new species of Ophiuran (*Hemicuryale tenuispina* V., fig. 55) clinging closely to them, with its long, slender arms, which are provided with rough-tipped spines, closely coiled around the coral, which, like its commensal, is bright orange in color.

This Ophiuran is similar in habits to the *Astrophytons*, but, unlike most of the latter, the arms do not branch. All of this family habitually live clinging to Alcyonaria of various kinds, and generally agree in a most remarkable manner in color, and frequently, also, in the rough ornamentation of the surface, with the branches of the gorgonians to which they cling. This indicates a protective adaptation, both of color, form, and ornamentation, running through a large group, and inhabiting all the oceans, both in shallow and deep water. Two simple-armed species of this group, with similar habits, were also taken by us, one of which (*Astronyx Loveni*) lives clinging to several slender Pennatulacea, including *Distichoptilum gracile* V., *Anthoptilum grandiflorum* V., and *A. Murrayi* K. Another (*Astrochele Lymani* V., fig. 53) lives in large numbers on the bushy gorgonian coral, *Acanella Normani* V., with which it agrees in its orange or salmon-color. The two species of *Anthoptilum* referred to grow in long, stout, wand-like forms, with numerous large, naked, flower-like polyps in oblique rows. *A. grandiflorum* is much the larger, growing over 2 feet high and an inch in diameter, with many hundreds of polyps. It was dredged in 302 to 1,106 fathoms, but was first described by me in 1879 from many large specimens brought in by the Gloucester halibut fishermen from off Nova Scotia, on the deep-water banks. It was afterward described by Kölliker under a new name (*A. Thomsoni*) from specimens dredged by the "Chal-

lenger" off Buenos Ayres. *A. Murrayi* K. was first taken by the "Challenger" off Nova Scotia. The "Albatross" dredged it in 640 to 1,362 fathoms. Other tall, wand-like species are *Funiculina armata* V., which is very slender, and *Balticina Finmarchica*, fig. 11. The latter frequently grows to the length of a yard and is about an inch in diameter. Many of the specimens have the round, stony axis stripped bare at the end, and sometimes in other places, for a longer or shorter distance, by accidental injuries. Nearly always these naked places are occupied by a peculiar species of Actinian (*Actinauge nexilis* V., fig. 22), which starts like ordinary young Actinians, with a flat base, but the sides of the base spread out thin and wrap around the axis of the coral till they meet on opposite sides, when they coalesce by a firm suture, inclosing the coral in a sort of tube or sheath, and when several of them start near together their bases mutually coalesce where they come in contact, thus forming a continuous covering over the dead coral. This Actinian grows to a rather large size, and the weight of a cluster, often of five or six, and in one case nine, at the top of the tall, slender axis causes it to bend over, so that they are pendulous on the nodding summit of the coral. By certain writers this denuded condition of the axis of this species has been supposed to be normal, or at least constant, but I have seen numerous specimens that are perfect to the tip. Several other deep-sea Actinians from this region have the same habit of growth, inclosing the denuded axis of various species of Gorgonians. One of the most abundant of these is *Sagartia Acanella* V., fig. 25, which thus incloses denuded portions of the bush-coral, *Acanella Normani*. It has the same orange or salmon color as the coral on which it lives.

The Gorgonacea or "bush corals," are well represented, at great depths, by several handsome species, some of them 2 or 3 feet high, and nearly all belonging to genera that are peculiar to the deep sea, for which they are specially adapted by a peculiar modification of the base, which divides into a number of divergent, root-like branches, sometimes becoming much divided and slender, but more commonly flat and irregular. These penetrate, like roots, into the soft mud and thus give a secure anchorage on bottoms where no solid foundation could be had for species that adhere only to solid objects by a flat expansion of the base, as in nearly all shallow-water species. The root-like base is characteristic of the genera *Acanella*, *Lepidisis*, *Dasygorgia* and *Lepidogorgia* found in our region, and of many others found elsewhere in deep-sea dredging. Most of these corals are orange, orange-red, or salmon-color in life, some of them varying to red or to orange-brown. One of the most elegant of these, dredged in 1,346 to 1,362 fathoms, is *Dasygorgia Agassizii* V., first discovered by the "Blake." It is a plumose, much branched coral, with the terminal twigs very slender, while the main branches are spirally arranged. Its axis is slender, calcareous, and iridescent, and its root-like base is divided into short, flat, irregular branches. Its polyps are prominent, relatively large, rather far apart,

and obliquely seated on the branches. It belongs to the family *Ohryso-gorgiidae*, recently established by the writer for this and several other related deep-sea genera, nearly all having a brilliantly iridescent axis, and most of them with spiral branches.

We also dredged, in 858 to 1,735 fathoms, another allied new species, representing a new genus in this family. I have called it *Lepidogorgia gracilis*. It grows in the form of a very slender, tall, round, unbranched stem, about 3 feet high. The axis is iridescent, and the root is divided into many divergent branches, which are stony, white, round, and much branched, and when detached look like branching corals of a very different nature. The polyps are large, prominent, obliquely seated, secund and far apart along the stem, which is covered with a thin layer of small oblong scales. *Lepidisis caryophyllia* V. is also a coral that grows in the shape of a tall simple stem, a yard or more high, but its axis is divided into joints, the longer ones white, calcareous, and hollow, alternating with brown, short, horny ones. Its polyp-calicles are spinose and very long and clavate, and when the tentacles are, as usually seen, rolled up in a ball at the end, they resemble cloves in shape, a character to which the name refers. It was often taken in 1,098 to 1,735 fathoms, and its dead, stony joints must be abundant on the bottom, for they afford attachment for many other creatures of various kinds. The smaller and much branched, bush-like, orange-brown coral, *Acanella Normani* V., is the most common of all the corals. It has been dredged in a great many localities, both by the "Fish Hawk" and "Albatross," in 225 to 1,300 fathoms, often in great numbers, several hundreds sometimes coming up in a single haul. It grows about a foot high, and is often nearly as broad as high, its branches growing out three or four together, in close whorls, from the horny joints. It is decidedly phosphorescent. Many other creatures, such as Actiniæ, hydroids, barnacles, worms, and Ophiurans of several species are frequently attached to it, so that in this way it is a valuable aid to us in bringing up these abyssal creatures. One peculiar Ophiuran, *Astrochele Lymani* V., occurs in great numbers on this coral, which is its regular home. It twines its long slender arms, which bear numerous clusters of small hooks, closely around the branches of the coral, and it cannot be easily removed without breaking the arms. A dozen or more frequently occur on a single coral, and are often accompanied by *Ophiaeantha millespina* and other species having similar habits.

The *Acanthogorgia armata* V. is a large and much branched gorgonian with a horny axis, and long, clavate, spinose calicles. Some fine living specimens were taken in 407 and 640 fathoms. When living it was pale orange, or salmon-color, but it quickly turns either dark brown or black in alcohol or when dried. On the outside of Brown's Bank, off Southern Nova Scotia, at several stations, the "Albatross" dredged, in 101 to 131 fathoms, a number of good specimens of the great bush-coral, *Prim-*

noa lepadifera, thus accurately fixing one of its localities. It is often brought in by the Gloucester fishermen.

Among the Alcyonacea there were a few interesting forms. One of these, *Anthomastus grandiflorus* V. (fig. 12), grows somewhat in the form of a mushroom, with a broad, rounded top and a stout stem, which may either be attached to stones by a flat base, or penetrating the mud it may branch and divide into many curious little bulb-like expansions to form an anchorage. When full grown, it becomes large and hemispherical, often 4 to 5 inches broad, with a short, broad stem, while a number of very large, flower-like polyps are scattered over the top. Smaller specimens have but few of the large polyps, which are often an inch and a half across the tentacles, but there are many minute zooids on the surface between the polyps. Its color is dark red, or purplish red. It has been dredged in considerable numbers by the "Fish Hawk" in 410 to 458 fathoms, and by the "Albatross" in 858 to 1,395 fathoms. It was also obtained previously, of large size, by the Gloucester fishermen, from the outer banks off Nova Scotia. More recently, it has been redescribed from the Norwegian coast under the name of *Sarcophyton purpureum* Kor. & Dan.

There were also two large species allied to *Alcyonium*. One of the latter (fig. 13), common in 1,290 to 1,608 fathoms, almost always starts on a joint of *Lepidisis caryophyllia*, but its thin expanding base, after surrounding the coral, descends deeply into the mud, in a hollow, bulb-like form, firmly inclosing a ball of mud for an anchorage, a habit similar to that of several of the large Actinians.

There are several species of cup-corals living in deep water off our northern coast. Several of these are large and handsome species. The largest and most common, which we have also taken in considerable numbers every year on the "Fish Hawk," in 164 to 787 fathoms, is *Flabellum Goodei* V (fig. 14). It has a strongly compressed form, often with flat sides, and is very fragile. Large specimens are often 3 or 4 inches across the longest diameter. The animal is orange, with the lips and tentacles purplish red or brown. A second species of *Flabellum* (*F. angulatum* Moseley, fig. 15) was taken last season. It is a beautiful species, with a broad, cup-shaped calicle, somewhat hexagonal in outline. It was dredged several times this year, in 906 to 1,467 fathoms, and was originally discovered by the "Challenger," off Nova Scotia. The third species is a handsome coral (*Caryophyllia communis*, fig. 16) of which a number of fine, large, living specimens were dredged in 1,098 to 1,106 fathoms. It is narrow, cup-shaped at summit, but terminates in a rather acute base, which is turned to one side more or less decidedly. It was originally described as a fossil from the Italian tertiary formation. Another very fragile cup-coral, interesting on account of its remarkable habit of restoring itself, after being broken, by budding out from every fragment, so that most of the specimens have a larger or smaller frag-

ment of the dead parent coral adhering to its base, is *Dasmosmilia Lymani* (fig. 17). It was taken in 57 to 1,091 fathoms.

The Actinians are represented in deep water by several very large species, some of them handsomely colored. Several hundreds often come up in a single haul of the trawl, making a bushel or more in bulk. As most of these secrete from their surfaces a large amount of slimy mucus, their presence in such numbers is often a nuisance, as the slime obscures and injures rarer and more delicate things. An orange or pale red species, *Bolocera Tuediæ*, living mostly in 150 to 640 fathoms, is among the most common and most slimy. It has a smooth body, often 3 or 4 inches in diameter, with numerous very large light orange-red tentacles, 2 or 3 inches long and about as large as a man's fingers. These tentacles cannot be retracted and are very easily detached, and then resemble peculiar worms, for they retain the power of motion for some hours. They also have powerful stinging organs, or "nettling threads," which are able to poison the human hand severely, especially between the fingers, when the skin is softened by prolonged handling of the wet specimens, so that for those persons who are sensitive to such poisons they render the handling of the contents of the dredge rather unpleasant.

A very singular, large, soft, pinkish Lernean crustacean (*Antheacheres Dübenii* Sars, fig. 167-8) lives parasitically in the stomach of this Actinian, with which it agrees in color. It is not uncommon. A large, bright orange, scaly annelid, over 2 inches long (*Polynoë aurantiaca* V.), lives as a commensal among the tentacles.

Another common red or orange Actinian, taken in 55 to 616 fathoms, but most abundant in 150 to 400 fathoms, is *Actinauge nodosa* (fig. 20), which grows quite as large as the preceding, but has very numerous and smaller, retractile, red or orange-brown tentacles; vertical rows of tubercles cover the firm body, while just below the tentacles there is a broad zone which, like the tentacles, secretes an abundance of mucus, which is highly phosphorescent, so that when irritated the upper end of the body is illuminated, looking something like a large torch in the dark. In the deep-sea mud it has a bulbous base, but in less depths it attaches itself by a flat base to stones and shells, or clasps its base around worm-tubes and branches of corals.

Another very large and much handsomer species of this genus, with the same phosphorescent character and similar habits, is *Actinauge longicornis* V. (fig. 21), which has been taken many times in 100 to 325 fathoms. It often becomes 3 or 4 inches broad across the body, and 5 or 6 high, while the long, slender, tapered, pale pink tentacles, banded with purple, may be 3 or 4 inches long, and when fully expanded they may fill a space 10 or 12 inches in diameter, or the size of an ordinary water bucket. The body is white or pink, and has a somewhat parchment-like appearance. It bears rows of small warts. A still larger and very common species, in 60 to 640 fathoms,

is *Actinostola callosa* V. (fig. 24), which often becomes 5 or 6 inches across the body, and is usually somewhat higher than broad. It has a large number of short, thick tentacles, usually deep orange in color, while the body is lighter, varying to salmon or pale flesh-color, and has a smooth leathery texture and warty surface. This and the two preceding, when living on the deep-water muddy bottoms, have the habit of firmly inclosing a large ball of mud, often 2 or 3 inches in diameter, in the base. This is done by the basal disk first spreading out and then descending into the mud, when its edges contract so as to produce a hollow bulb, often with only a small central opening below. This bulb serves as an anchorage in the mud, but it is probable that all these species, at first, when very young, adhere to bits of corals, worm-tubes, shells, or some other solid substance, by a flat base, as usual with Actinians in shallow water, and that the base gradually becomes bulbous when it grows beyond its small support, for we often find young specimens thus attached, and have observed the bulb in all stages of formation. In some cases one half the base would be flat, and adherent to a shell, while the other half would have the bulbous form, inclosing mud. Moreover, when these same species inhabit hard bottoms, covered with shells and stones, as often happens, large specimens occur broadly attached by their flat bases, so that this must be regarded as a special adaptation suited to the peculiar conditions of muddy bottoms, but not yet become a permanent character of the genera, nor even of the species, so far as we have been able to discover.

Within the hollow bulbs, mixed with the mud, or next to the base itself, we usually find a number of chitinous pelicles, which have been secreted by the basal disk and cast off from time to time. This is not confined to either of the several genera that have bulbous bases, but is common to all. It indicates that the same ball of mud, or portions of it, at least, must be retained for a long period, or perhaps through life, for it is probable that individuals thus anchored in the mud do not move about at all, but ever afterwards remain fixed. Indeed, I have good evidence that some large individuals of *A. nodosa* attached to stones and shells remain fixed in the same place for years, without any disposition to creep about, and perhaps they may lose this power, more or less, as they grow old, though they certainly have it while young, as do most shallow-water species. The formation of the basal bulb in these Actinians, and in the *Alcyonium* above mentioned, throws much light on the probable origin of the specialized muscular basal bulb of the Pennatulacea.

A remarkable new genus (*Gondul mirabilis*) has been recently described by Koren and Danielssen,* which is attached by an adherent base, as in *Alcyonium*, but has the polyps arranged on bilateral oblique ridges, as in many Pennatulacea, and with four axial tubes,

* Bergen's Museum, Nye Alcyonider, Gorgonider og Pennatulider til Norges Fauna, p. 19, pl. 10, 1883.

much as in the latter, while the spicula also resembles those of this group. This may represent a primitive type from which the Pennatulacea have been derived. It is only necessary to suppose that the attached base of such a form may have become bulbous and more specialized, on account of the exigencies of muddy bottoms, as in the case of our Alcyonium and Actinians, when it would become a true member of the Pennatulacea. It might, of course, be urged that it is a degraded form, derived from the Pennatulacea, but this is not probable. At any rate, it is evident that the Pennatulacea, as a group, are adapted specially for life on the soft muddy bottoms of the deep sea, and probably were originally developed there from simpler attached forms of shallow-water origin.

The bulbous bases of the large Actinians are often useful to us in dredging, because they may inclose various small shells, &c., with the mud, and some of our new discoveries have been obtained only from this source. They are also very useful to us as bringing up the most perfect samples of the mud of the bottom, with precisely the same composition that it had when undisturbed, for the bulb is often so nearly closed that none of the mud can wash out, while the contents of the dredge and trawl and of the sounding cup are more or less washed on the way up, and the finer parts may be largely lost.

Another very large and handsome species of Actinian, first discovered in 1880, but one which does not descend to great depths, inhabiting only the warm zone, in 60 to 115 fathoms, is *Urticina perdis* V. (fig. 19). When in full expansion, it is often over a foot across, with its very numerous long, slender, translucent tentacles spread out in every direction. The body is smooth and curiously mottled with shades of lighter and darker brownish, yellow, and pale flesh-color, something like the feathers of a partridge, to which the name alludes. It is one of the few deep-water species that thrives well in confinement. We have kept large individuals in aquaria all summer, without special care. It is very active, constantly changing in form, and very voracious. The temperature of the water in which it naturally lives is similar to that of the harbor at Wood's Holl in summer, while most of the other species, coming from greater depths, live in and require much colder water than can be provided without special means of cooling.

We often keep deep-sea species, of different groups, alive for a few hours or days by keeping them in water cooled down in the ice-box on the steamer, in cases where it is desirable to bring them ashore with their natural colors and appearance for descriptions and figures. But in most cases they never recover from the injury received by being drawn up through the warm upper stratum of Gulf Stream water, which is usually above 70 degrees, and although they sometimes remain alive for a day or two, they seldom show any activity, and usually die within a few hours. The Crustacea are nearly always quite dead when brought on deck, for, excepting the hermit-crabs, they are injured by the rough

treatment and crushing that they receive in the trawl, as well as by the heat of the upper waters. The same is true of the more delicate species in all of the groups. But the Mollusca having strong shells; some of the Echinoderms; and all the large, tough-skinned Actinians seem to be injured or killed by the heat alone. It is probable, therefore, that but few of the more delicate deep-sea animals will ever be seen alive by man, and still fewer in a healthy living condition.

HYDROIDA.

The Hydroids are few in species, and not numerous individually in the deeper dredgings. But at moderate depths, especially near George's and Brown's Banks, a considerable number of northern and mostly well known European species were obtained. Several interesting species also occurred, some of them frequently, in 100 to 300 fathoms, off the southern coast of New England. Some of these are undescribed. The most abundant is a species of *Tubularia* with coarse, yellow stems (*T. indivisa*?). A new species of *Cladocarpus* (*C. flexilis* V., fig. 29), with tall, slender, pinnate, yellowish stalks is also very common. A large and rather coarse hydroid, *Calicella plicatilis*, fig. 30, is also rather common.

ECHINODERMATA.

The Echinoderms were among the most abundant and interesting of the deep-sea animals. About one hundred species were dredged by the "Albatross," many of which are new to our coast, though previously dredged on the European side, or in the Caribbean Sea and still more distant regions. Others are undescribed forms. Among the Holothurians, besides several species of *Trochostoma* and allied forms, there were two gigantic species, belonging to a peculiar deep-sea family of which many species were brought to light by the "Challenger" expedition. These occurred in large numbers at several stations, mostly between 1,000 and 1,500 fathoms, in some cases more than a barrelful of one of them coming up in a single haul. The largest and most singular one was a new species of *Benthoodytes* (*B. gigantea* V., figs. 31, *a*, *b*), a very large, massive species, flat below and convex above, sometimes 18 inches long and 5 or 6 broad, having a gelatinous, translucent appearance, but with a firm cartilaginous texture when fresh. The cartilage-like walls of the body are very thick, often an inch or more, and the visceral cavity is very small in proportion. Owing to the dense and impervious, cartilage-like tissues, this species is very difficult to preserve in alcohol,* the interior decaying before the fluid can penetrate the tissues, even when the visceral cavity is cut open. This has been dredged in 924 to 2,033 fathoms.

* During the season of 1884 this and other large gelatinous species (Cephalopoda, &c.) were preserved in much better condition by the use of ice-cold alcohol, kept in tanks in the ice-room ready for immediate use.

From its peculiar appearance the sailors on the "Albatross" called this species "boxing gloves."

The second was also a new form, *Euphronides cornuta* V. (figs. 32-33a), related to *E. depressa* of the "Challenger" expedition. It has a large, conical, median posterior elevation, double at the summit, and two pairs of large, elevated, teat-like anterior tubercles. To the latter character the name refers. In form it is not unlike *B. gigantea*, but it is smaller, narrower, less massive, and has a much thinner, reddish brown, or purplish brown, spiculose integument, without the cartilaginous character of the latter. To this the sailors gave the name of "overshoes," which it somewhat resembles in form and color. It has been taken in 855 to 1,735 fathoms.

A large, brown, undescribed species of *Synapta* (*S. brychia* V.), with large anchors, was discovered in 938 fathoms. This genus has generally been considered as entirely confined to shallow water.

Of Echini, we obtained two of the curious species having flexible shells (*Phormosoma placenta* and *P. uranus*). The former was taken in many localities and in considerable numbers. *P. uranus* has often occurred in 568 to 1,080 fathoms. Some of the specimens are 8 to 9 inches in diameter, and of a rich purplish color, an unusual color for deep-sea animals. *P. placenta* ranged from 458 to 1,230 fathoms. Other interesting species, not previously dredged by us, and characteristic of the greater depths, were *Pourtalesia Jeffreysii*, in 843 to 1,555 fathoms; *Aërope rostrata*, in 1,395 to 1,608 fathoms; *Aceste bellidifera*, in 1,395 to 1,467 fathoms; *Urechinus Naresianus*, in 1,309 fathoms; *Salenia varispina*, in 547 fathoms.

The *Echinus Norvegicus* was taken in large numbers in 1,043 to 1,255 fathoms, while *Brissopsis lyrifera* and *Schizaster fragilis* were very frequently dredged this season, the former in 938 to 1,555 fathoms, the latter in 100 to 239 fathoms.

The star-fishes were very numerous in the deep dredgings and are represented by many interesting species. One of the most abundant star-fishes was a fine, new, orange-red species of *Zoroaster*, of large size, with slender spinose arms (*Z. Diomedæ* V.). About two hundred specimens of this occurred at station 2035. It was taken at many stations, in 1,000 to 1,600 fathoms. The most common genus, as usual in very deep water, was *Archaster*, of which numerous species occurred. Many of these are very large and handsome forms, and are generally buff, salmon, orange, or orange-red in color. Several are unlike those species from less than 500 fathoms, taken by the "Fish Hawk." A large, new, orange-colored *Archaster*, with a very large madreporic plate (*A. grandis* V.) occurred in great numbers at several stations, in very deep water, often associated with *Zoroaster Diomedæ* and *Benthopecten spinosus*. It has a small or moderate-sized, flat disk, closely covered with fine paxillæ, with long, rather flat, tapering arms, having two rows of small marginal spines on each side. In several instances I have taken from the

stomach of this star-fish specimens of sea-urchins (*Brissopsis lyrifera* and *Acoste bellidifera*) 1 to 2 inches in diameter, but partially crushed.*

A smaller and very distinct new species of this genus (*Archaster sepius* V.), from 368 to 858 fathoms, has two regular, divergent rows of marginal spines all around, while the rather swollen marginal plates are covered with small, sharp spinules, and similar spinules cover the lower side. The adambulacral plates project strongly into the grooves and bear very convex groups of slender, tapering spines. The disk is rather small and the tapering arms moderately elongated.

A large and handsome new *Archaster* (*A. robustus* V.), remarkable for its long, high, squarish arms and smoothish appearance, was taken at several localities, in 938 to 1,467 fathoms. Its marginal plates are closely covered with small scale-like spinules, but bear no marginal spines. The disk is small and the arms long. It is sometimes over a foot in diameter. Another new and very elegant species of this genus (*A. formosus* V.) was taken sparingly at several stations, in 1,467 to 1,608 fathoms. This species has a rather broad, flat, pentagonal disk, with large, distinct, hexagonal paxillæ, while the arms rapidly narrow and have only one or two rows of paxillæ distally. Their tips are slender and terminate in a thickened apical plate. There are no marginal spines.

A very interesting new form, taken in many localities, is related to *Archaster* and *Astropecten*, closely resembling some of the spinose species of these genera in general appearance. It represented a new genus (*Benthopecten spinosus* V.). The flat dorsal surface is closely covered with tessellated, angular plates, having single, definite, small pores for solitary branchial papulæ between them, while there are no true paxillæ, the small spinules arising singly, or two or three together, directly from the plates. The marginal plates, above and below, bear single large, sharp spines, the five largest ones occupying the central interbranchial plates, on the upper margin. The disk is of moderate or rather small size, but the arms are long and tapered. It occurred in 855 to 1,917 fathoms, in 1883, but is most abundant in 1,260 to 1,500 fathoms.

Among the most interesting of all the star-fishes were two species of the remarkable genus *Brisinga*. One of these (*B. elegans* V.), taken in many localities in 1883 and 1884, in 906 to 2,021 fathoms, sometimes in large numbers, has often been obtained and preserved nearly entire. It is a handsome species with very long, slender, finely-tapered arms, usually eleven or twelve in number, but varying from nine to thirteen.

* In one case I also found in its stomach a fresh specimen of the common surface barnacle (*Lepas anatifera*), which is often found in large numbers attached to floating timber, &c., in the Gulf Stream. This *Lepas* unquestionably sank to the bottom and was swallowed by the star-fish (living at the depth of 1,395 fathoms) before decomposition had begun. This illustrates well the dependence of the deep-sea life on the surface fauna.

The small disk and the basal, slightly swollen portion of the arms are covered with small sharp spinules, arranged in small clusters or standing singly, but not forming definite transverse groups on the basal part of the arms. The marginal spines are long and very slender, and mostly stand in a single row. The other (*B. costata* V.) is a coarser species, which usually comes up broken into numerous fragments, by spontaneous division. In this species the spinules and pedicellariæ form large and prominent transverse ridges or ribs on the swollen basal part of the arms, as well as on the distal portion. It resembles the *B. coronata* Sars, in general appearance. It was taken during the last two seasons in 991 to 2,021 fathoms.

The curious little pentagonal star-fish, described by Wyville Thomson (Voyage of the "Challenger," p. 378, Figs. 97, 98), as *Porcellanaster cœruleus* (figs. 40, 41), was taken in considerable numbers at many localities, in 1883 and 1884, in 816 to 1,917 fathoms. Its cœrulean color is due only to the bluish mud, with which its large stomach is usually filled, showing through the translucent integument. The real color is buff or pale salmon.

Among the large and showy forms of star-fishes is a new species of *Solaster* (*S. abyssicola* V.), which is bright red or orange in color, and often becomes over a foot in diameter. It has a broad disk and usually eight or nine arms. It has rather small rounded clusters of spinules on moderately elevated paxillæ, both above and beneath. The spinulation is coarser and the paxillæ larger, more elevated, and less crowded than in *S. endeca*, of the shallow waters.

The Ophiurans were abundantly represented by many species, some of which were previously undescribed and others unknown from this region. Several of them are of large size and conspicuous. Among these one of the largest and most abundant was *Ophiomusium Lymani*, of which many hundreds or even thousands were often taken in a single haul in 900 to 1,100 fathoms. It has occurred at many localities in 238 to 2,033 fathoms. Another almost equally large species of the same genus (*O. armigerum* Lym.) also occurred abundantly at several stations in 1,731 to 2,369 fathoms. A handsome species, remarkable for its large and distinct, symmetrically arranged dorsal scales (*Ophioglypha bullata*), has been taken in considerable numbers in 1,608 to 2,574 fathoms. A smaller flattened species (*O. lepida* Lym.) occurred in vast numbers at several stations, both in 1883 and 1884. It seems to be very abundant at about 1,500 fathoms, and is widely diffused in 428 to 2,574 fathoms. Our perfect specimens generally, if not always, have small, slender spinules scattered over the disk, which was not the case with the original types described by Lyman. The spinules are easily rubbed off. A large species of *Ophiochiton* (*O. grandis* V.) was taken in 888 fathoms. This genus had not been taken before in this part of the Atlantic. Numerous species of *Ophiacantha*, which is a very common and characteristic deep-water genus, were taken, among which were several that

were undescribed and others not before known from this region. The species of simple-armed *Astrophytonidæ*, taken by the "Albatross," have been referred to on previous pages [pp. 8, 10]. They are often found clinging to the Pennatulacea and Gorgonians, in large numbers, in company with the various species of *Ophiacantha*.

The very common species, *Antedon dentata*, was the only crinoid obtained, with the exception of fragments and young of *Rhizocrinus* (fig. 57). Of the former we also took a few young specimens, in the attached or stemmed condition (fig. 58).

A fine species of stalked crinoid belonging to the genus, *Benthoocrinus*, was dredged in 1884, in 2,021 fathoms, off Chesapeake Bay.

CRUSTACEA.

The Crustacea were very numerous and included many new forms of great interest. According to the report of Prof. S. I. Smith* there were fifty-seven species of deep-water Decapod Crustacea, besides fifteen shallow-water ones. Of these he has described nineteen as new. At the single haul in 2,949 fathoms six species were taken, while thirteen occurred below 2,000 fathoms, and twenty-nine below 1,000 fathoms.

The twenty-nine species taken below 1,000 fathoms include twenty-one Caridea, or true shrimp, two Eryontidæ, three Galatheidæ, one Paguroid, one Lithodes, and one Brachyuran belonging to the Dorippidæ.

"It is interesting to compare these results with the lists of the fauna of the North Atlantic below 1,000 fathoms, given by the Rev. Dr. Norman in the presidential address to the Tyneside Naturalists' Field Club, published last year. In Dr. Norman's lists only twelve species of Decapoda are recorded, none of them from as great a depth as 2,000 fathoms, and of these twelve species seven were known only from the 'Blake' dredgings of 1880."

In the course of subsequent studies Professor Smith has added a few more species to the list.

The deep-sea crustacea are neither degraded in structure nor small in size. Among them are representatives of all the higher groups, while many of the species are remarkable for their great size. A true crab (*Geryon quinquedens* Smith, fig. 156), common in 105 to 816 fathoms, is one of the largest crabs known, for the massive body is often 5 inches long and 6 broad. It is dark red in color. The great spiny spider-crab (*Lithodes Agassizii* Smith, fig. 151), first described from the "Blake" collection, but also taken in 1882 and 1883 by the Fish Commission, measures over 3 feet across the outspread legs, while the body is 7 inches long and 6 broad, and covered with long, sharp spines. It ranges from 410 to 1,255 fathoms. Several of the shrimp are nearly a foot long, not including the antennæ, which, like the legs, are often remarkable for their great length and slenderness.

* Report of the United States Commissioner of Fish and Fisheries, Part X, for 1882 (published 1884), p. 45, and American Journal of Science, vol. 28, p. 53, July, 1884.

The following, according to Professor Smith, are some of the more interesting forms: "A new genus of Brachyura, allied to *Ethusa*, 1,496 to 1,735 fathoms; an Anomuran belonging to A Milne-Edwards' new genus *Galacantha* [= *Munidopsis* Whiteaves], 1,479 fathoms; two species of *Pentacheles* (fig. 152, a genus of Eryontidæ allied to *Willemasia*), between 843 and 1,917 fathoms; a stout Palæmonid (*Notostomus*, fig. 160), 6 inches long and intense dark crimson in color, 1,309 to 1,555 fathoms; a gigantic *Pasiphaë* (fig. 158), 8½ inches long, 1,342 fathoms; three species of a remarkable new genus allied to *Pasiphaë*, and also to *Hymenodora*, and some other genera of Palæmonidæ, which shows that *Pasiphaë* is closely allied to the Palæmonidæ; a large Penæid, a foot in length, referred to the little-known genus *Aristeus* (fig. 159); and a large *Sergestes*, 3 inches in length."

"A striking characteristic of the deep-sea crustacea is their red or reddish color. A few species are apparently nearly colorless, but the great majority are some shade of red or orange, and I have seen no evidence of any other bright color. A few species from between 100 and 300 fathoms are conspicuously marked with scarlet or vermilion, but such bright markings were not noticed in any species from below 1,000 fathoms. Below this depth orange-red of varying intensity is apparently the most common color, although in several species, very notably in the *Notostomus* already referred to, the color was an exceedingly intense dark crimson."

I have in former articles repeatedly called attention to the prevalence of salmon, orange, and scarlet colors among the deep-sea animals of various groups, and have insisted that these are protective colors in consequence of the peculiar nature of the light transmitted to them through a vast thickness of sea-water. This view necessarily implies that a certain amount of sunlight is thus transmitted. The existence of well-developed eyes in the deep-sea fishes, cephalopods, crustacea, &c., may well be regarded as positive evidence of the existence of a certain amount of light even at the greatest depths explored. According to Prof. S. I. Smith there were sixteen species of decapod and schizopod crustacea taken by the "Albatross" at depths below 2,000 fathoms, eight of them ranging downward to 2,949 fathoms, and all these species had normal faceted eyes. Nine of them had dark-colored eyes, similar to allied shallow-water species, and not much smaller; four had small black or dark eyes; one had light-colored eyes larger than usual in the shallow-water species of the same genus; and nine had small light-colored eyes.

Professor Smith has also called attention to the remarkably large size and small number of the eggs of many of these deep-sea crustacea, their eggs being often ten, fifteen, and sometimes even more than three hundred times larger than those of allied shallow-water species.

"The large size of the eggs is a marked feature in many of the deep-water Decapoda. The eggs of *Eupagurus politus* from 59 to 500 fathoms, are more than eight times the volume of those of the closely allied and

larger *B. bernhardus* from shallow water, and in *Sabinea princeps*, from 400 to 900 fathoms, they are more than fifteen times as large as in *S. septemcarinata*, from 25 to 150 fathoms. The most remarkable cases are among the deep-water genera. *Galacantha rostrata* and *G. Bairdii*, from between 1,000 and 1,500 fathoms, have eggs 3^{mm} in diameter in alcoholic specimens, while in the vastly larger lobster they are less than 2^{mm}. The largest crustacean eggs known to me are those of *Parapasiphaë sulcatifrons* (fig. 162), a slender shrimp less than 3 inches long, taken between 1,000 and 3,000 fathoms. Alcoholic specimens of these eggs are fully 4 by 5^{mm} in shorter and longer diameter, fully ten times the volume of the eggs of *Pasiphaë tarda* from 100 to 200 fathoms, more than three hundred and fifty times the volume of those of a much larger shallow-water *Palamon*, and each one more than a hundredth of the volume of the largest individual of the species. From the peculiar environment of deep-water species it seems probable that many of them pass through an abbreviated metamorphosis within the egg, like many fresh-water and terrestrial species, and these large eggs are apparently adapted to producing young of large size, in an advanced stage of development, and specially fitted to live under conditions similar to those environing the adults."

"Among the Schizopoda there are two large species of *Gnathophausia*, one over 4 inches in length, and a *Lophogaster*, all from below 2,000 fathoms. One of the most interesting Schizopods is a small *Thysanoessa* (a genus of Euphausiidae) from 398 to 1,067 fathoms, of which one female was found carrying eggs. The eggs are carried in an elongated and flattened mass beneath the cephalothorax, are apparently held together by some glutinous secretion, and are attached principally to the third pair of pereopods (antepenultimate cephalothoracic appendages)."

One of the Schizopoda of frequent occurrence is *Thysanopoda Norvegica*, taken at the surface, and also apparently from 150 to 239 fathoms, in the trawl-wings.

"The Amphipoda from deep water are comparatively few in number, and have not yet been carefully examined, but among them is one specimen of the gigantic *Eurythenes gryllus* Boeck (*Lysianassa Magellanica* Milne-Edwards), probably the largest of all known Amphipoda. This specimen, which is over 4½ inches long, and very stout in proportion, was taken in 1,917 fathoms, north latitude 37° 56' 20", west longitude 70° 57' 30". The few previously known specimens came from Cape Horn, Greenland, and Finmark, and have apparently all been taken from the stomachs of fishes. This species and its occurrence in the extreme Arctic and Antarctic seas, has been much discussed, and is the subject of a long memoir by Lilljeborg, but the apparently anomalous distribution is explained by its discovery in deep water off our middle Atlantic coast."

Other Amphipods are *Themisto bispinosa*, apparently from 373 to 1,348 fathoms, in trawl-wings; and *Epimeria loricata*, in 168 to 239 fathoms.

The Cumacea and Isopoda are each represented by several species,

but these groups have not yet been fully examined. Among the Isopods, one of the largest and most common is *Sysconus infelix* Harger (fig. 164), which is orange in color. Another singular species is *Astacilla granulata* Harger (fig. 165).

The Copepoda and Ostracoda are very abundant, both in the lots obtained in the trawl-wings and in the surface collections. Very many fine species were noticed, but they have not yet been reported upon by Mr. Rathbun, who has charge of these groups. He has studied a number of interesting and novel forms of Lerneans found parasitic on several of the deep-sea fishes. A representative of this group (*Antheocheres Dubonii* Sars, figs. 166, 167), which lives in the stomach of the large sea-anemone (*Bolocera Tuedia*) has been referred to on a previous page [p. 12].

The Cirripeds were represented in deep water by several species of *Scalpellum* and allied genera, most of them of small size; one of these (*S. Strömii*) occurs frequently on the deep-sea gorgonian corals. Two or three species of this group live upon the large crab, *Geryon quinquedens*, some of them on the exterior and some in the gill-cavity. A large species of *Scalpellum*, allied to *S. regius* W. Thomson, was taken several times in deep water on Brown's Bank, off Nova Scotia; and large clusters of *Balanus Hameri* were dredged on the shallower parts of that bank.

PYCNOGONIDA.

The Pycnogonida were well represented by two or three very large species of *Colossendeis* and other genera, in 900 to 1,500 fathoms. Some of the largest of these (*C. colossea* Wilson, fig. 169) measured nearly 2 feet across the outstretched legs. Nine of them were taken at one haul in 1,106 fathoms. It is orange-colored in life.

ANNELIDA.

The Annelida are well represented at all depths, but yet they appear to be relatively much less numerous below 500 fathoms than in shallower water. In 100 to 300 fathoms they are usually abundant. The most conspicuous species, as well as one of the most abundant, is *Hyalinocia artifex* V. (figs. 177-179a), which inhabits and drags about a large, quill-like, free tube, often 8 to 10 inches long, open at both ends, and so translucent as to show the large iridescent annelid within it. This is frequently taken in very large numbers, several thousands coming up in a single haul, in 150 to 640 fathoms. Two species of Actinians (*Sagartia abyssicola* and the young of *Actinauge nodosa*) are very often attached to these tubes, and also various hydroids and sponges.

There are also two or three large species of *Leodice* (*L. polybranchia* V., fig. 180, *L. vivida*, &c.), which inhabit irregular, rough, parchment-like tubes, very common in 100 to 300 fathoms. *Nothria conchophila*

V., which constructs flat, free tubes, about 2 inches long, out of broken bivalves, often occurs in vast numbers in the warm zone.

A large and conspicuous, smooth, orange-red scaly annelid (*Polynoi aurantiaca* V., fig. 173), lives as a commensal among the tentacles of *Bolocera Tuedia*; and another species of this group (*P. Acanella* V., fig. 172, a-c), is very abundant among the branches of *Acanella Normani*. It has a dark purple proboscis and finely spinulose scales. Numerous small species of many genera have been taken at great depths.

Several other interesting deep-sea annelids are illustrated on the plates (figs. 172-190).

GEPHYREA.

Several large and remarkable species of Gephyrea have been taken in deep water, but they are not yet determined. Among them there is a large strongly sulcated species (fig. 192), taken in 707 to 1,060 fathoms, which is often 3 to 5 inches long and nearly an inch in diameter, in alcohol. Another equally large species, from 858 to 1,168 fathoms, is covered with large warts or verrucæ. Both of these appear to be species of *Phascolosoma*. There is a large *Priapulid* (fig. 191, a) from 1,000 fathoms, and a small one from 1,060 fathoms. A large *Thalassema* occurred in 1,600 fathoms.

NEMERTEANS.

The nemertean worms are not common in deep water, and but few species have been taken in our deep-water dredgings. The largest and most interesting one is a bright orange species, which grows to the length of 10 feet or more, and is about a third of an inch in diameter. It occurred in 192 fathoms, and is identical with *Macronemertes gigantea* Verrill, originally from the Gulf of Maine. *Cerebratulus luridus* V. (fig. 195) occurred in 64 to 192 fathoms.

MOLLUSCA.

The Mollusca were very numerous and proved to be of even greater interest than those previously taken by the "Fish Hawk." The number of species of Mollusca added to the fauna of this region by the "Albatross" in 1883 was more than 150, of which over 80 were undescribed.*

Four new forms of Cephalopods were taken, including two new genera. One of these, from 2,949 fathoms, is an Octopod (*Eledonella pygmaea* V.), allied to *Eledone*, but peculiar in having the suckers singularly enlarged and altered in form on the hectocotylized arm (fig. 64). Another, from 1,731 fathoms, is a small squid (*Leptoteuthis diaphana* V., fig. 62), remarkable for its slenderness and transparency and for its

* Most of these new species are described by the writer in the Transactions of the Connecticut Academy, vol. vi, 1884, with figures.

very elongated head. The others are species of *Octopus*, from 142 and 1,290 fathoms.

Of Gastropods many new forms occurred. One of the most remarkable is a large shell, from 1,395 to 2,594 fathoms, the living ones only from below 2,000 fathoms, constituting a new genus (*Benthodolium abyssorum* V., fig. 84, a, b), allied to *Dolium*, but having an operculum, and in form somewhat resembling *Buccinum*. Its animal and dentition are, however, like *Dolium*. There was also a thin and delicate *Buccinum* (*B. abyssorum* V., fig. 80) of good size, the live ones ranging from 906 to 1,309 fathoms. Several interesting new forms of *Sipho* occurred. These are mostly small species, but some of them are of good size, as *S. profundicola* V. (fig. 81), living in 1,525 to 2,574 fathoms.

The curious and very beautifully sculptured shells belonging to the genus *Seguensia* were among the most interesting forms. Two species were taken living. One of these is *S. formosa* Jeffreys (fig. 88), the other is a closely related new species, *S. eritima* V. (fig. 89). They both occurred several times in 1,290 to 2,033 fathoms. The possession of these species, with the animal preserved in alcohol, enabled me to study the dentition, and thus ascertain the zoological affinities of the genus. It proves to belong to the Tænioglossa, somewhere near *Aporrhais* and *Fossarus*, but evidently represents a new family (*Seguensidae* V.). It has no relationship whatever with Trochidæ, where it had been put by Boog-Watson and by Dall, nor with *Solaridæ*, where it was located by Jeffreys and others. The resemblance to these widely diverse groups is confined entirely to the shell, which is, however, very peculiar.

The Toxoglossa, as usual in deep water, were relatively very numerous, and included several handsomely sculptured new species belonging to *Pleurotomella* and allied genera. The largest of these is *P. Bairdii* (fig. 68), which is the largest member of this group known off our coast. It occurred living in 1,537 to 2,021 fathoms. Another remarkable and elegant species is *P. Catherinæ* (fig. 76, a), from 843 to 2,033 fathoms. *P. Benedicti* (fig. 70, a), from 1,290 fathoms; *P. Emertoni* (fig. 74), from 1,917 fathoms; and *P. Bruneri* (fig. 75), from 1,608 to 2,033 fathoms, are also handsome shells, with the elegant and delicate sculpture and translucency characteristic of many deep-sea shells.

The Chitons or Polyplacophora are very scarce in deep water, perhaps owing to the small number of suitable objects to which they can adhere, for even the small limpets are generally found in worm-tubes, empty skate's eggs, or other similar places. Only five species of Chiton have been taken below 60 fathoms by us, and most of these also live in shallow water and do not go very deep. One was a very interesting new species (*Euplacophora Atlantica* V., figs. 102, 102a) belonging to a group not known before from the Atlantic. It is remarkable for the very broad anterior girdle.

The Rhipidoglossa are well represented in deep water by several handsome species belonging to the Trochidæ, such as *Calliostoma Bairdii*

V. & S. (fig. 96), *Margarita regalis* V. & S. (fig. 97), *M. lamellosa* V. & S. (fig. 98), and by several small species of *Cyclostrema*. A more peculiar group includes curious small limpet-shaped shells, not distantly allied to *Fissurella*, but imperforate at tip. Of these we now know 10 species from our deep dredgings. These belong to the genera *Addisonia*, 1 species; *Cocculina*, 6 species; *Lepetolla*, 1 species; *Propilidium*, 2 species.

The Tectibranchs are relatively abundant in deep water, one of the shell-less species, *Koonsia obesa* V. (fig. 107), grows to a very large size, some examples being 4 to 5 inches long and 3 broad. A large and handsome new *Scaphander* (*S. nobilis* V., fig. 106) was taken alive in 1,058 to 1,309 fathoms.

The Scaphopods are much more numerous in deep than in shallow water, and are abundantly represented by several species of *Dentalium*, *Siphodentalium*, and *Cadulus* (fig. 126). *D. solidum*, from 843 to 1,309 fathoms, grows to the length of 3½ inches. *Cadulus grandis* V. and another allied new species (*C. princeps* V.) are remarkably large representatives of this genus. The former lives in 816 to 1,537 fathoms, the latter in 1,525 to 1,594 fathoms.

Of Heteropoda, eight species were taken, including at least six species of *Atlanta* (figs. 110, 111). Part of these were only dredged as dead shells, but others were taken alive at the surface. Two transparent species of *Pirola* (fig. 112) and *Piroloides* were common at the surface, associated with *Sagitta*, which it somewhat resembles in shape. All these species, except one, and most of the twenty-three Pteropods have long been known from the more tropical parts of the Atlantic, but not from so far north.

The Bivalves or Lamellibranchs are relatively less abundant than in shallow water, and are less peculiar; but they include numerous species of the Anatinidæ and Corbulidæ (especially the genus *Næra*), the Nuculidæ, including the genera *Nucula*, *Leda*, *Yoldia*, *Glomus*, *Malletia*, &c.; and the Arcidæ, including *Arca* and *Limopsis*. The Lucinidæ are also well represented by several species of *Cryptodon* (or *Azinus*) and other genera. Among the most peculiar forms are *Pholadomya arata* (figs. 133, 134), *Mytilimeria fœruosa* (fig. 132), *Verticordia cœlata* (fig. 131, a), and *Poromya sublevis* (fig. 128). Several species of *Pecten* and *Amusium* also occur, most of them with delicate, translucent, and elegantly sculptured shells (figs. 141, 142).

Of the Brachiopoda we took two deep-sea species, both new to our coast, but known on the European side. These are *Waldheimia cranium*, in 1,362 fathoms, and *Discina Atlantica*, in 1,251 to 1,467 fathoms.*

The accompanying tables will give an idea of the number and bathymetrical distribution of the different groups of Mollusca.

The writer's published list† of the Mollusca taken in 1880 to 1883 by

*An additional species was obtained in 1884: *Atrætia gnæmon*, in 1,525 to 1,594 fathoms.

†Transactions Connecticut Academy, vol. vi, p. 263, 1884.

the "Fish Hawk" and "Albatross," off our northern coast, exclusive of those dredged only in shallow water, included 380 species and 21 named varieties. But of these, at least 42 are pelagic species, taken either alive at the surface or dead at the bottom, viz: Cephalopoda, 2; Tænioglossa, 1; Ptenoglossa, 1; Nudibranchiata, 4 (2 live also in shallow water); Heteropoda, 8; Pteropoda, 24; Lamellibranchiata, 3 (2 live also in shallow water). Possibly a few other species, now considered as deep-water forms, may be pelagic, for it is difficult to tell at what depths free-swimming species of Cephalopods are taken, unless they occur in the stomachs of the deep-sea fishes. Many small Gastropods, &c., living habitually on floating *Fucus* and *Sargassum*, are caught with these sea-weeds in the trawl, on its way up or down, and mingling with the shells from the bottom may give rise to errors of this kind. Thus some of the species of *Rissoa*, *Cingula*, *Oithna*, &c., may not really live at the depths recorded, but at the surface. There were also a considerable number of minute, undetermined species not included in the list. During the season of 1884 about 40 species, of which about 25 were undescribed, were added to this list. These are largely from the deepest dredgings.

Of the 343 species* and 20 named varieties in my published list of 1883, regarded as living at the bottom, 89 are also shallow-water forms, living habitually in less than 60 fathoms, in this region. A considerable number, considered as deep-water species on this part of the coast, occur in shallow water north of Cape Cod, and some of them may eventually be found to occur in the cold belt off Martha's Vineyard in 25 to 60 fathoms. Of the shallow-water species, 63 occur also between 200 and 500 fathoms, and 18 below 1,000 fathoms. Some of these have a remarkable great range geographically, as well as in depth. Of the 273 species and varieties regarded as belonging to the deep-water fauna in this region, 143 have occurred in the comparatively warm zone, between 60 and 200 fathoms. A considerable number of these have been taken only in the more southern dredgings, off Chesapeake Bay and Cape Hatteras, and some of them only in depths not much exceeding 100 fathoms, where the Gulf Stream has the greatest effect. In this zone occur species belonging to southern genera, such as *Dolium Bairdii* (fig. 83), *Marginella borealis* (fig. 79), *Solarium boreale* (figs. 95, 95a), *Avicula hirundo*, &c.

The number that occupy the zone between 200 and 500 fathoms is 128, while 118 inhabit the depths between 500 and 1,000 fathoms, and 96 have been taken between 1,000 and 2,000 fathoms. Although but five of our dredgings have been in more than 2,000 fathoms,† we are able to

* More recent studies of the 1883 shells have added several species to the list, mostly from the deeper localities. They are included in the accompanying list.

† During the season of 1884 other series of dredgings were made in the same region in depths below 2,000 fathoms. From these a large number of additional species of Mollusca and other groups were obtained.

enumerate 34 species from between 2,000 and 3,000 fathoms, which is a much greater number than had previously been recorded from such depths in the North Atlantic.

The species and varieties already described as new from the 1883 collections are 76, as follows: Cephalopoda, 4; Gastropoda, 58; Solenocochna, 4; Lamellibranchiata, 10. The total number of species of Mollusca added to the fauna of this region by the Fish Commission dredgings since 1880 is over 275.

The different groups of Mollusca differ greatly in the relative proportion of deep and shallow water species, as shown by the following tables. Thus the deep-water Cephalopods are 23, against 4 shallow-water and surface species. The Gastropods exclusively deep water are 166, against 38 of shallow-water origin. The shallow-water Lamellibranchs, however, seem to have a much greater tendency to range into deep water, for of these there are but 68 deep-water species and varieties, associated with 46 shallow-water ones.

TUNICATA.

On the upper part of the Gulf Stream slope, at the depths of about 65 to 125 fathoms, in localities where the bottom is of compact sand and gravel, it is often well covered with various sponges, hydroids (*Tubularia*, *Cladocarpus*, &c.), and large, rough groups of a coarsely wrinkled ascidian, which appears to be identical with *Cynthia partita* Stimpson. This species occurs abundantly in shallow water on stones, piles, &c., from North Carolina to Vineyard Sound, often forming, in such situations, large, irregular clusters. A few other species, not yet studied, also occur, though less commonly, on the hard bottoms in 100 to 125 fathoms. At the northern stations, off Nova Scotia, where the bottom is often stony, many of the well-known northern forms occur, such as *Boltenia Bolteni*, *Ascidia complanata*, *Cynthia pyriformis*, &c. In the deeper waters, where the bottom is usually of soft mud and sand, or ooze, ascidians are not very common, though several undetermined species of *Molgula* and allied forms have been taken. One species of *Molgula*, which was taken in 1,608 fathoms, is about an inch in diameter, soft, flattened, and covered with a thick coat of foraminifera.

The most interesting ascidian taken by us is a new species of the curious, long-stemmed genus, *Culeolus*, first discovered by the "Challenger." It is peculiar to deep water, and a species very closely allied to our own was dredged by the "Challenger" off the coast of Japan. I have named our species *Culeolus Tanneri* (figs. 144, 145, a. b.),* in honor of our accomplished commander.

* *Culeolus Tanneri* Verrill, sp. nov. Stem long, slender, somewhat decreasing in size from the base to the summit. Body irregularly pear-shaped, the lower end tapering to a conical form, where it joins the stem, while the stem itself can be seen extending upward about 15 to 20^{mm} along the dorsal margin, where it forms, for that distance, a rounded midrib terminating in a prominence in one specimen and at a de-

Several fine species of *Salpa*, some of them of great size, often occurred in abundance in our trawl, but they belong to the surface fauna, and will be mentioned more particularly under that head.

BRYOZOA.

The Bryozoa collected have not yet been carefully studied. They are usually not abundant in deep water, owing mainly to the absence of favorable objects for attachment. Whenever we have met with bowlders or hard concretions in deep water we have generally found a number of species of Bryozoa adhering to them. On the hard, spongy bottoms, in 65 to 125 fathoms, several species commonly occur, mixed with the hydroids and sponges, or adhering to ascidians, shells, pebbles, &c. One of the most interesting of these is a slender species of *Salicornaria*.

On the stony bottoms off Nova Scotia, in about 100 fathoms, large numbers of well-known northern species were taken. On stones and hard concretions, taken at station 1124, in 640 fathoms, there are several species, among which are *Cellularia scabra*, *Discopora ovalis*, and a *Tubulipora*. The two latter also occurred on stones from 234 fathoms, with *Membranipora Flemingii* and other species. The curiously branched form, *Kinetoskias* (or *Bugulopsis*) *flexilis* V., occurred in 194 fathoms.

SPONGES.

The sponges obtained in this region have not yet been studied. Those from deep water are not very numerous, but some of them are of great interest. One large handsome, vase-like, vitreous sponge, resembling *Holtentia*, was taken at station 2067, in 122 fathoms, off Nova Scotia. A thin, felt-like species, belonging to the same group, occurred in 640 to 780 fathoms. A large, coarse-fibered, felt-like *Phakellia*, growing in semicircular or funnel-shaped fronds, was taken in 640 fathoms, together

pression in another. The dorsal margin is nearly straight, but swells out a little in the middle, and is subcarinate, with a row of small scattered papillæ along the ridge. The distal end is large, rounded, swollen, and bordered on each side by a distinct keel, which is covered with several crowded rows of prominent, rough, though soft papillæ, which merge into a large, triangular patch of similar but larger papillæ, situated on the dorsal side near the distal end, where the dorsal carina meets the lateral ones; the papillæ in this cluster are large, stout, tapering to a point, and covered on all sides with minute, conical spinules. The lateral rows of papillæ extend back to about the middle of the body on the ventral side, where they meet, thus inclosing a large ovate area, near the middle of which the large cloacal-opening is situated. This opening is bilabiate, each lip bordered with one or two rows of elongated, rough papillæ, like those of the lateral carinæ. The oral opening is very large, in expansion nearly round, the proximal side sometimes bending inward, leaving a sinus on either side of it; the margin is thickened and revolute, bordered by a row of small tapering papillæ. The whole surface of the test is covered by minute, granule-like or conical elevations, which are rather close over the dorsal parts, less numerous beneath. Color dull yellowish gray, the stem dark brown.

Length of the stem of one specimen, 155^{mm}; its diameter near the base, 2^{mm}; length of body, 70^{mm}; greatest diameter, 40^{mm}; diameter of mouth, 8^{mm}. Station 2041, in 1,608 fathoms, 1883.

with a slender pinnate species of *Cladorhiza* (*C. abyssicola* Sars ?). The large, stout, clavate, species (*C. grandis* V., fig. 1), occurred occasionally. It is not uncommon in 100 to 200 fathoms off Nova Scotia. The curious slender-stemmed *Stylocordyla longissima* G. O. Sars, was dredged on muddy bottoms several times in 407 to 1,423 fathoms. *Dorvillia echinata* Verrill, which forms large, harsh, spiculose balls, attached to the mud by long root-spicules, occurred in one instance.

On the hard bottoms in 65 to 125 fathoms several irregularly lobed and branched species, belonging to *Chalina*, *Isodictya*, *Halichondria*, &c., occurred in great abundance. With these there were large numbers of hard, rigid, sparingly branched and rather strong stems of an unknown sponge, composed of long closely-united siliceous spicules.

FAUNA OF THE NORTHERN WATERS.

One trip, stations 2053 to 2084, was made to the northern waters, during which a number of hauls were made, both in shallow and deep water, on and near Brown's Bank, off Cape Sable, Nova Scotia, and off the southern slope of George's Bank, August 29 to September 5. On the southern border of Brown's Bank a rough, hard bottom, covered with stones and large barnacles, was found in 108 to 113 fathoms (stations 2069 to 2071), on which the great bush-coral (*Primnoa lepadifera*) appeared to be abundant, and several good specimens of it were obtained by the use of tangles and grapples, but the bottom was too rough for the trawl. Various other well-known northern and Arctic species, most of them already discovered in the same region by our former explorations, were obtained from the cold-water localities, many of which were in moderate depths. Great clusters of the large barnacle (*Balanus Hameri*) were dredged in abundance in 80 to 120 fathoms on Brown's Bank. It was usually associated on these rough, stony bottoms with *Balanus porcatus*. Among the more prominent of the northern Echinoderms taken in these northern waters were *Solaster endeca*, *Crossaster papposus*, *Lophaster furcifer* (fig. 49, a), *Ophiacantha spectabilis*, and several new species of *Ophiacantha* enumerated in the general list.

One interesting Arctic shell was added to the American fauna on this occasion. This is a limpet-like species (*Piliscus commodus* Midd.) previously known from the extreme northern coasts of Europe and Asia, from Iceland, and from Alaska. It was dredged in the same region as the *Primnoa*, in 150 fathoms, and lives clinging closely to the rocks. Doubtless other additions to our northern fauna will be found among these northern dredgings when they shall have been carefully studied.

On the hard bottoms, covered with barnacles, &c., in about 100 fathoms, off Nova Scotia, several northern species of sponges were obtained, mostly of *Halichondria*, *Chalina*, and allied genera. Among these were *Chalina oculata*, *Polymastia robusta*, &c.

The fauna in the deep-water localities dredged on the same trip (stations 2072 to 2078, 2083, 2084) did not differ essentially from that found at corresponding depths off Martha's Vineyard.

LIST OF ANTHOZOA* DREDGED BY THE "ALBATROSS" IN 1883.

ALCYONARIA.

- Pennatula aculeata* Kor. & Dan. Figs. 7, *a*, *b*.
B. range, 97 to 1,255 fathoms, 1883. Abundant locally.
- Pennatula aculeata*, var. *rosea* Kor. & Dan.
B. range, 157 to 410 fathoms (197 fathoms, 1883). Rare.
- Pennatula (Ptilella) borealis* Sars. Figs. 8, *8a*.
B. range, 192 to 1,255 fathoms (204 to 1,255 fathoms, 1883). More common off Nova Scotia.
- Benthoptilum sertum* Verrill. Fig. 4.
B. range, 843 to 1,073 fathoms (843 fathoms, station 2115, off Cape Hatteras, 1883). Rare.
- Balticina Finmarchica* (Sars) Gray. Figs. 11, *11a*.
B. range, 164 to 858 fathoms (197 to 858 fathoms, 1883). Not rare; common off Nova Scotia.
- Anthoptilum grandiflorum* Verrill. 1879. Fig. 9.
B. range, 302 to 1,731 fathoms (1,098 to 1,731 fathoms, 1883). Scarce and local; common off Nova Scotia.
- Anthoptilum Murrayi* Kölliker.
B. range, 640 to 1,362 fathoms (843 to 1,362 fathoms, 1883). Common locally.
- Funiculina armata* Verrill. 1879.
B. range, 252 to 1,362 fathoms (1,050 to 1,362 fathoms, 1883). Not uncommon.
- Kophobelemnon tenue* Verrill. 1884. Fig. 5, *a*.
B. range, 1,362 to 2,369 fathoms, 1883. Not common; local.
- Kophobelemnon scabrum* Verrill. 1883.
B. range, 499 to 788 fathoms, 1883. Not common; abundant locally in 1884.
- Umbellula Bairdii* Verrill. 1884. Fig. 2.
B. range, 1,731 to 2,033 fathoms, 1883. Not common; local.
- Umbellula Guntheri* Kölliker. Fig. 3.
B. range, 1,731 to 2,033 fathoms, 1883. Not common; local.

* The following paper on the "Blake expedition" Anthozoa contains descriptions and figures of many of the deep-sea species by the writer:

Report on the Anthozoa, and on some additional species dredged by the "Blake" in 1877-79, and by the U. S. Fish Commission steamer "Fish Hawk" in 1880-82. From the Bulletin of the Museum of Comparative Zoölogy, vol. xi, No. 1, July, 1883.

Many species are also described by the writer in "Brief Contributions to Zoölogy from the Museum of Yale College" in the American Journal of Science, 1878 to 1884; and others in the Proc. U. S. National Museum, vol. ii, pp. 165-205, 1879.

Protoptilum aberrans K lliker.

B. range, 861 to 1,290 fathoms (1,098 to 1,290 fathoms, 1883). Rare.

Distichoptilum gracile Verrill. 1882.

B. range, 780 to 1,050 fathoms (1,050 fathoms, 1,883). Rare.

Scleroptilum gracile Verrill. 1884. Fig. 6.

B. range, 1,467 to 2,369 fathoms, 1883. Abundant locally.

Renilla reniformis Cuv.

B. range, shore to 15 fathoms, off Cape Hatteras, 1883.

Acanella Normani Verrill. 1878.

B. range, 105 to 1,731 fathoms, 1883. Very common and abundant.

Lepidisis caryophyllia Verrill. 1883.

B. range, 1,098 to 1,735 fathoms, 1883. Common.

Keratoisis ornata Verrill. 1878.

B. range, 150 to 300 fathoms off Nova Scotia; 858 fathoms, 1883, off Cape Sable; dead joints. Northern; not rare off Nova Scotia.

Lepidogorgia gracilis Verrill. 1884. Fig. 10.

B. range, 858 to 1,735 fathoms, 1883. Locally abundant.

Dasygorgia Agassizii Verrill. 1883.

B. range, 1,346 fathoms, 1883. Rare and local.

Paramuricea borealis Verrill. 1878.

B. range, 101 to 855 fathoms, 1883. Not rare; common northward.

Acanthogorgia armata Verrill. 1878.

B. range, 407 to 640 fathoms (407 fathoms, 1883). More common off Nova Scotia, in 150 to 300 fathoms.

Primnoa reseda (Pallas) Verrill.

B. range, 101 to 131 fathoms, 1883. Northern; not taken south of Brown's Bank, Nova Scotia.

Anthomastus grandiflorus Verrill. 1878. Fig. 12.

B. range, 75 to 1,395 fathoms, 1883. Local; common off Nova Scotia.

Gersemia longiflora Verrill. 1883.

B. range, 858 to 1,917 fathoms, 1883. Locally abundant.

Eunephthya L tkeni (Marenz.) Verrill.

B. range, 858 to 1,497 fathoms, 1883. Not common; chiefly northern.

Alcyonium multiflorum Verrill. 1879.

B. range, 130 to 300 fathoms, off Nova Scotia (131 to 239 fathoms, 1883). Common off Nova Scotia.

Alcyonium carneum L. Agassiz.

B. range, 8 to 55 fathoms (13 fathoms, 1883). Abundant locally in 15 to 30 fathoms.

Cornulariella modesta Verrill. 1874.

B. range, 80 to 150 fathoms (80 fathoms, 1883, off Cape Sable). Entirely northern.

ACTINARIA.

- Adamsia sociabilis* Verrill. 1882. Fig. 26.
B. range, 79 to 410 fathoms (98 fathoms, 1883). Abundant locally.
- Sagartia abyssicola* (Kor. & Dan.) Verrill. Fig. 177.
B. range, 69 to 640 fathoms (131 to 487 fathoms, 1883). Abundant.
- Sagartia Acanella* Verrill. 1883. Fig. 25.
B. range, 252 to 1,608 fathoms (407 to 1,608 fathoms, 1883). Abundant on Acanella.
- Sagartia spongicola* Verrill. 1883.
B. range, 79 to 317 fathoms (81 to 179 fathoms, 1883). Abundant on spongy bottom.
- Synanthus mirabilis* Verrill. 1879.
B. range, 150 to 333 fathoms. Common off Nova Scotia.
- Urticina crassicornis* Ehr.
B. range, 16 to 141 fathoms (49 to 141 fathoms, 1883, George's and Brown's Banks). Abundant northward in shallow water.
- Urticina perdx* Verrill. 1882. Fig. 19, a.
B. range, 62 to 192 fathoms (62 fathoms, 1883). Common locally.
- Actinauge longicornis* Verrill. 1882. Fig. 21.
B. range, 100 to 325 fathoms (142 to 197 fathoms, 1883). Not uncommon.
- Actinauge nexilis* Verrill. 1883. Figs. 22, 22a.
B. range, 168 to 245 fathoms (197 fathoms, 1883). Common.
- Actinauge nodosa* (Fabr.) Verrill. Fig. 20.
B. range, 86 to 1,098 fathoms (122 to 1,098 fathoms, 1883). Abundant and generally diffused.
- Actinauge consors* Verrill. 1882. Fig. 161.
B. range, 164 to 458 fathoms. Local; not common.
- Actinostola callosa* Verrill. 1882. Fig. 24.
B. range, 55 to 640 fathoms (99 to 239 fathoms, 1883). Common.
- Actinernus nobilis* Verrill. 1879. Figs. 23, 23a.
B. range, 1,068 to 1,582 fathoms, 1883. Rare; common off Nova Scotia in 200 to 300 fathoms.
- Bolocera Tuedia* Gosse.
B. range, 37 to 1,106 fathoms (65 to 1,106 fathoms, 1883). Generally distributed and abundant.
- Cerianthus borealis* Verrill. 1873.
B. range, 60 to 264 fathoms (99 fathoms, 1883). Not uncommon; but adults are rarely dredged.
- Epizoanthus Americanus* Verrill. 1864.
B. range, 26 to 547 fathoms (35 to 547 fathoms, 1883). Generally diffused and very abundant.

Epizoanthus Americanus Verrill (encrusting variety).

B. range, 49 to 906 fathoms, 1883. Abundant.

Epizoanthus paguriphilus Verrill. 1882. Fig. 28.

B. range, 252 to 640 fathoms (499 fathoms, 1883). Abundant locally.

This large species, in all cases observed, has formed the carcinoëcia of *Parapagurus pilosimanus*. The surface is smooth and glaucous, dark bluish gray in alcohol, and often partly covered with fine mud.

Epizoanthus abyssorum Verrill. 1885. Fig. 27.

B. range, 1,555 to 2,033 fathoms, 1883. Common.

This species generally forms the carcinoëcia of *Parapagurus pilosimanus*, but sometimes consists of two or three large obconic polyps arising from a grain of sand. In the former case there are four to six divergent marginal polyps, usually with an odd one above and beneath. The polyps are large, usually clavate in contraction, with twenty-four convergent ridges at the summit. The surface is closely covered with small foraminifera, mixed with some sand grains. Color grayish white, purple or orange tinted at summit. Length of largest polyps, in contraction, 10 to 13^{mm}; diameter, 9 to 11^{mm}.

MADREPORARIA.

Flabellum Goddei Verrill. 1878. Fig. 14.

B. range, 75 to 888 fathoms, 1883. Common.

Flabellum angulatum Moseley. Fig. 15.

B. range, 906 to 1,467 fathoms, 1883. Not common; local.

Caryophyllia communis (Seguenza) Moseley. Fig. 16.

B. range, 1,022 to 1,106 fathoms, 1883. Not common; local.

Paracyathus granulosus Verrill. 1885.

B. range, 1,091 fathoms, 1883. Not common.

Dasmosmilia Lymani Pourt. 1871. Fig. 17.

B. range, 65 to 179 fathoms, 1883. Common locally.

Oculina implicata Verrill. 1864.

B. range, 14 fathoms, off Cape Hatteras, 1883.

SPECIES PREVIOUSLY DREDGED BY THE "FISH HAWK" 1880 TO 1882, BUT NOT OBTAINED IN 1883.

Pennatula aculeata, var. *alba* Verrill. 1883.

B. range, 216 fathoms, 1882. Very rare.

Virgularia Ljungmani Köll. † (young.)

B. range, 487 fathoms, 1880. Rare.

Anthothela grandiflora (Sars) Verrill.

B. range, 255 fathoms, station 1031, 1881. Local; common off Nova Scotia.

Actinernus saginatus Verrill. 1882.

B. range, 458 fathoms, station 1029, 1881. Rare.

Bolocera multicornis Verrill. 1882.

B. range, 33 to 90 fathoms, 1879, 1881. Local, northward, off Cape Cod.

Edwardsia farinacea Verrill. 1866.

B. range, 146 fathoms, station 1038, 1881. Not common; frequent in shoal water northward.

Bathyactis symmetrica (Pourt.) Moseley.

B. range, 225 to 252 fathoms, 1880. In 32 to 2,900 fathoms, "Challenger" expedition.

ADDITIONAL DEEP-SEA SPECIES DREDGED BY THE "ALBATROSS" IN
1884.

Stylatula, sp.

Station 2171, in 444 fathoms. Rare.

Stenogorgia casta Verrill. 1883.

Station 2220, in 1,054 fathoms; "Blake" expedition, 337 fathoms, off Georgia.

Phellia, sp.

B. range, 991 to 2,516 fathoms.

Desmophyllum cristagalli Edw. & Haime.

B. range, 1,054 to 1,060 fathoms. Rare.

Lophohelia prolifera Edw. & Haime.

B. range, 100 to 300 fathoms, off Nova Scotia; 1,060 fathoms, dead, 1884. Rare.

PARTIAL LIST OF DEEP-WATER HYDROIDA.

The following list includes only the more conspicuous and common forms. Many others have been taken, but the collection has not yet been carefully examined:

Monocaulus glacialis (Sars) Allman.

Corymorpha pendula Agassiz.

Occasionally taken on muddy bottoms in 30 to 182 fathoms.

Eudendrium, sp.

Not uncommon.

Dicoryne flexuosa Sars.

Not rare on stones and shells in 20 to 80 fathoms.

Tubularia indivisa L. (†)

Abundant in 65 to 158 fathoms, on hard bottoms of sand and gravel, among sponges.

Tubularia (†) sp.

Simple, cornucopia-shaped, yellow stems. B. range, 1,525 to 1,731 fathoms, on Gorgonians.

Hydractinia echinata Johnst.

Common from low water to 60 fathoms.

Nemertesia antennina Lx.

Not uncommon in 90 to 125 fathoms.

Cladocarpus flexilis Verrill, sp. nov. Fig. 29.

Common in 65 to 130 fathoms, on hard bottoms, with sponges.

Plumularia gracillima G. O. Sars.

Not rare in 70 to 125 fathoms.

Thuiaria, sp.

Not common.

Sertularia cupressina Linné.

Common in less than 100 fathoms.

Calicella plicatilis (Sars) Hincks. Fig. 30.

Common in 100 to 351 fathoms.

Cuspidella grandis Hincks.

Not common.

Opalorhiza parvula Allm.

Not common.

Halecium Beanii ? Johnst.

Not rare.

Halecium filicula Allm.

Not common.

Halecium sessile Norm.

Rather rare.

Lafoëa dumosa Sars.

Common at moderate depths.

Clytia Johnstoni Hincks.

Common at moderate depths and at the surface.

Campanularia, sp.

Not common.

Campanularia, sp.

A very slender form. Station 2037, in 1,731 fathoms.

Obelia dichotoma ? Hincks.

Not common.

Obelia longicyatha ? Allm.

Not uncommon on worm-tubes, &c., in 100 to 200 fathoms.

*LIST OF ECHINODERMATA DREDGED BY THE "ALBATROSS" IN 1883.**

In this list a few northern species are included that were taken in comparatively shallow water, on George's Bank and Brown's Bank, off Cape Sable, Nova Scotia, and are not yet known from the deep water farther south.

HOLOTHURIOIDEA.

Benthodytes gigantea Verrill. 1884. Figs. 31, 31a, 31b.

B. range, 938 to 2,033 fathoms, 1883. Locally very abundant.

Euphronides cornuta Verrill. 1884. Figs. 32, 33, 33a.

B. range, 855 to 1,735 fathoms, 1883. Locally abundant.

Lophothuria Fabricii Verrill. Figs. 34, a, young.

B. range, 16 to 1,168 fathoms (75 to 858 fathoms, 1883, George's Bank and off Nova Scotia). Scarce and small, except northward.

Lophothuria squamata (Müll.) Verrill (†)

B. range, 80 fathoms, 1883, off Nova Scotia. Rare.

Psolus phantapus (Fabr.) Oken.

B. range, 86 fathoms, 1883, near George's Bank. Northern.

Pentacta frondosa Jæger.

B. range, 20 to 141 fathoms (86 to 141 fathoms, 1883, near George's Bank) Not common south of Cape Cod; abundant from Maine northward.

Pentacta minuta (Fabr.) Verrill.

B. range, 60 to 101 fathoms, 1883, off Nova Scotia. Common from Maine northward in shallow water.

Thyone scabra Verrill. 1873.

B. range, 51 to 640 fathoms (105 to 547 fathoms, 1883). Common.

Trochostoma turgida Verrill, = *Molpadia turgida* Verrill. 1879.

B. range, 45 to 858 fathoms, 1883. Not uncommon.

Trochostoma Ayresii Verrill. 1885.

B. range, 1,467 to 2,033 fathoms, 1883. Not uncommon.

Trochostoma abyssicola Verrill. 1885.

B. range, 1,200 to 2,000 fathoms. Not uncommon.

Echinostoma abyssicola Verrill, sp. nov. 1885.

B. range, 2,033 fathoms, 1883. More frequent in 1884.

A small, white, fusiform species, 15 to 20^{mm} long, entirely covered with large, strong plates, each of which bears a conical spinule.

*Many of the Echinoderms of this region have been described by the writer in "Brief Contributions to Zoology" in the American Journal of Science, 1878 to 1885. See also Proc. U. S. Nat. Mus., vol. ii, 1879.

A general catalogue of the Echinoderms dredged from 1880 to 1882 is contained in Part x, of this report, p. 658, 1884.

Synapta brychia Verrill, sp. nov.

B. range, 938 fathoms, station 2111, off Cape Hatteras, 1883.

A large species, with a strong, thick, opaque purplish brown skin, as preserved in alcohol. The strong longitudinal muscles are lighter colored. The skin contains rather large, scattered, ovate plates, easily visible to the naked eye. They are perforated by numerous (seventy to eighty or more) small rounded openings, and have a central eminence, composed of several slender processes. Each plate bears a large anchor, its length equal to that of the plate. The shaft of the anchor is round and smooth, narrowed next the expanded end, which is surmounted by several rough or lacerate denticles; the flukes are long, sharp, smooth, strongly recurved, more than a third as long as the shaft. Many of the anchors project from the skin, and are large enough to be visible to the naked eye. Length, in alcohol, 160^{mm}; diameter, 10^{mm}.

ECHINOIDEA.

Pourtalesia Jeffreyii W. Thomson.

B. range, 843 to 1,555 fathoms, 1883. Not uncommon.

Aërope rostrata W. Thomson.

B. range, 1,395 to 1,608 fathoms, 1883. Local and not common.

Aceste bellidifera W. Thomson.

B. range, 1,395 to 1,497 fathoms, 1883. Not common.

Schizaster fragilis (Düben & Koren) L. Agassiz.

B. range, 37½ to 321 fathoms (99 to 239 fathoms, 1883). Common; locally abundant.

Schizaster Orbygnianus A. Ag.

Schizaster canaliferus, variety, Verrill, this report for 1882, part x, p. 658.

B. range, 65 to 179 fathoms (117 to 179 fathoms, 1883). Not uncommon; local.

Brissoopsis lyrifera (Forbes) L. Agassiz.

B. range, 65 to 1,555 fathoms (938 to 1,555 fathoms, 1883). Common.

Urechinus Naresianus A. Ag.

B. range, 1,309 fathoms, 1883. Local; gregarious.

Echinarachnius parma Gray.

B. range, 6 to 888 fathoms (35 to 888 fathoms, 1883). Common; often very abundant in shoal water.

Phormosoma placenta W. Thomson.

B. range, 458 to 1,309 fathoms (499 to 1,309 fathoms, 1883). Common.

Phormosoma uranus W. Thomson.

B. range, 843 to 938 fathoms, 1883; 568 to 1,080 fathoms, 1884. Not common; local and gregarious.

Echinus gracilis A. Agassiz.

B. range, 73 to 202 fathoms (73 fathoms, 1883). Not uncommon; local.

Echinus Norvegicus Dübén & Koren.

B. range, 888 to 1,497 fathoms, 1883. Common; often extremely abundant.

Echinus elegans Dübén & Koren (†).

B. range, 858 to 888 fathoms, 1883.

Strongylocentrotus Drübachiensis A. Ag.

B. range, 1 to 640 fathoms (35 to 141 fathoms, 1883, George's Bank and Brown's Bank). Common as far south as off Chesapeake Bay at moderate depths.

Salenia varispina A. Agassiz.

B. range, 547 fathoms, 1883. One specimen only.

Arbacia punctulata Gray.

B. range, shore to 20 fathoms (19 fathoms, 1883). Common in shallow water from Vineyard Sound southward.

ASTERIOIDEA.

Asterias Forbesii Desor.

B. range, shore to 20 fathoms (19 fathoms, 1883). Abundant from Massachusetts Bay southward.

Asterias vulgaris St. = *A. rubens* L. (†)

B. range, shore to 208 fathoms (41 to 86 fathoms, 1883, George's Bank and Brown's Bank). Abundant from off Long Island northward, in moderate depths. Ranges as far south as off Cape Hatteras.

Asterias Tanneri Verrill. 1880. Fig. 42, a.

B. range, 69 to 373 fathoms (78 to 373 fathoms, 1883). Common.

Asterias briareus Verrill. 1882.

B. range, 31 to 373 fathoms (78 to 373 fathoms, 1883). Rare.

Leptasterias compta (Stimp.) Verrill.

B. range, 18 to 150 fathoms (38 to 150 fathoms, 1883). Common and widely diffused; often very abundant in moderate depths.

Stephanasterias albula (Stimp.) Verrill.

Stichaster albulus Verrill, formerly.

B. range, 64 to 192 fathoms (69 to 117 fathoms, 1883). Common and widely diffused; locally abundant. Ranges from the Arctic Ocean and Northern Europe to Cape Hatteras.

Zoroaster Diomedææ Verrill. 1884.

B. range, 98 to 1,555 fathoms, 1883. Common; sometimes abundant locally.

Brisinga elegans Verrill. 1884.

B. range, 906 to 1,395 fathoms, 1883. Local; not uncommon; gregarious.

Brisinga costata Verrill. 1884.

B. range, 888 to 1,255 fathoms, 1883. Not common.

One of the larger examples, from station 2116, but not the largest, measured 37 inches in diameter; disk, 2.75 inches; greatest breadth of arms, .75; length of longest spines, .62 of an inch.

Cribrella sanguinolenta (Müller) Lütken.

B. range, shore to 194 fathoms (69 to 122 fathoms, 1883). Common as far south as Cape Hatteras at moderate depths; abundant northward.

Solaster abyssicola Verrill. 1885.

Solaster Earllii Verrill, this Report for 1882, p. 659 (not of 1879).

B. range, 843 to 1,537 fathoms (843 to 1,395 fathoms, 1883). Not uncommon.

A large species, often a foot in diameter, somewhat resembling *S. Earllii*, but with very different spinulation on the actinal side. Rays usually eight or nine, varying to seven and ten. Abactinal side covered with rather small, not very close, rounded paxillæ, bearing small and short spinules. The brauchial papulæ are large and numerous, thickly scattered on the disk and base of arms. Marginal plates prominent, bearing a transverse, oblong group of small rough spinules in two or three rows. Interbrachial ventral areas of moderate size, covered with rounded paxillæ similar to those of the back, but arranged in regular rows, and bearing a divergent group of five to eight small rough spinules. The adambulacral plates bear an outer transverse row of five to seven, rather short, moderately thick spines, united at base and covered by a thick skin; and an inner group of three or four nearly equal and rather short spines, united together by a web for about half their length. Color, while living, uniform orange or deep red. Greater radius of a medium sized example, 113^{mm}; lesser radius, 40^{mm}.

Solaster endeca Forbes.

B. range, shore to 150 fathoms, north of Cape Cod (122 fathoms, 1883, George's Bank). Common northward from Cape Cod in moderate depths.

Crossaster papposus M. and Tr.

B. range, shore to 150 fathoms, north of Cape Cod (49 to 75 fathoms, 1883, George's and Brown's Banks). Northern; common from the Bay of Fundy northward, in shallow water.

Lophaster furcifer (Dub. & Kor.) Verrill = *Solaster furcifer* auth. Figs. 49, 49a.

B. range, 234 to 640 fathoms (150 fathoms, 1883, George's Bank). Rare; chiefly northern; it occurs in moderate depths in the Gulf of Maine and off the Nova Scotia coast.

Pteraster militaris M. & Tr. Fig. 35.

B. range, 10 to 150 fathoms, north of Cape Cod (101 to 130 fathoms, in 1883, off Nova Scotia). Common on the coast of Maine and northward, in shallow water.

Diplopteraster multipes (Sars) Verrill. Fig. 43.

B. range, 124 to 640 fathoms (197 to 239 fathoms, 1883). Common and widely diffused as far south as off Cape Hatteras.

Hymenaster modestus Verrill. 1885.

B. range, 1,098 to 1,451 fathoms, 1883. Rare.

Porania grandis Verrill. 1879. Figs. 44, 44a, 45, 45a.

B. range, 66 to 373 fathoms, 1883. Not uncommon.

Poraniomorpha spinulosa Verrill.

Porania spinulosa Verrill, Proc. Nat. Mus., 1879, p. 202.

B. range, 86 to 640 fathoms (122 to 250 fathoms, 1883). Not uncommon.

Astrogonium granulare M. & Tr. Figs. 48, 48a.

B. range, 122 to 640 fathoms (122 fathoms, 1883, George's Bank). Rare south of Cape Cod; more common off Nova Scotia and northward.

Hippasteria phrygiana Gray=*H. plana* auth. Fig. 47, variety.

B. range, 30 to 150 fathoms, north of Cape Cod (50 to 150 fathoms, 1883, George's and Brown's Banks). Northern; common off Cape Cod, in the Gulf of Maine, off Nova Scotia, and northward.

Odontaster hispidus Verrill. 1880.

B. range, 56 to 487 fathoms (65 to 239 fathoms, 1883). Common; locally abundant.

Astropecten articulatus Say.

B. range, shore to 25 fathoms, south of Cape Hatteras (15 to 20 fathoms, 1883).

Archaster arcticus M. Sars.

B. range, 113 to 547 fathoms, 1883. Frequent, but only in small numbers.

Archaster Americanus Verrill. 1880.

B. range, 45 to 225 fathoms (65 to 197 fathoms, 1883). Common, widely diffused, and often very abundant.

Archaster Floræ Verrill. 1879. Fig. 36.

B. range, 86 to 410 fathoms (197 to 239 fathoms, 1883). Common, and widely diffused; locally abundant.

Archaster robustus Verrill. 1884.

B. range, 938 to 1,467 fathoms, 1883. Not rare in the deeper dredgings.

Archaster grandis Verrill. 1884.

B. range, 1,106 to 2,033 fathoms, 1883. Common; very abundant locally.

Archaster Agassizii Verrill. 1880.

B. range, 182 to 1,342 fathoms (499 to 1,342 fathoms, 1883). Common and widely diffused; locally sometimes very abundant.

Archaster Parelii Düben & Koren. Fig. 37.

B. range, 225 to 1,608 fathoms (547 to 1,608 fathoms, 1883). Not rare, but always in small numbers.

Archaster formosus Verrill. 1884.

B. range, 1,467 to 1,608 fathoms, 1883. Not common.

Archaster tenuispinus Düben & Koren. Fig. 38.

B. range, 368 to 1,731 fathoms (888 to 1,731 fathoms, 1883). Common; often abundant locally.

Archaster sepius Verrill. 1885.

B. range, 368 to 858 fathoms (858 fathoms, 1883). Rare.

Benthopecten spinosus Verrill. 1884.

B. range, 855 to 1,917 fathoms, 1883. Common; locally abundant.

Luidia elegans Perrier. 1876 (Verrill, 1880). Figs. 39, a.

B. range, 53 to 192 fathoms (65 to 70 fathoms, 1883). Common; sometimes abundant locally.

Luidia clathrata (Say).

B. range, shore to 25 fathoms, south of Cape Hatteras (15 to 19 fathoms, 1883). Southern; common in shallow water.

Porcellanaster caeruleus W. Thomson. Figs. 40, 41.

B. range, 906 to 1,917 fathoms, 1883. Frequent; sometimes abundant.

OPHIUROIDEA.

Ophioglypha Sarsii (Lützk.) Lyman.

B. range, 30 to 1,608 fathoms (65 to 1,608 fathoms, 1883). Common, widely diffused; large and often very abundant at moderate depths in the course of the Arctic current, off Martha's Vineyard.

Ophioglypha signata Verrill. 1882.

B. range, 65 to 640 fathoms, 1883. Common in moderate depths.

Ophioglypha confragosa Lyman. 1878.

B. range, 238 to 2,033 fathoms (2,033 fathoms, 1883). Not common.

Ophioglypha bullata W. Thomson.

B. range, 1,608 to 2,221 fathoms, 1883. Not rare; local.

In respect to the large rounded scales of the disk, our larger specimens agree closely with the description of *O. convexa*, to which I at first referred them. Other characters agree better with *O. bullata*.

Ophioglypha lepida Lyman. 1878. Var. *spinulosa* Verrill. 1884.

B. range, 888 to 1,497 fathoms, 1883. Extremely abundant in several localities.

The disk is flat and thin; the scales thin, unequal, rather irregular in size, with curved margins; and there are small sharp spinules scattered over the disk. The arms are slender, and there is a single, longer, upper spine rather widely separated from the two lower and much smaller ones, close to the tentacle-scales.

Ophioglypha Ljungmani Lyman. 1878 (†).

B. range, 843 to 1,467 fathoms. Common.

This species is very closely allied to the preceding, and, like it, usually has, when perfect, a few small spines scattered on the disk; but the disk is much thicker, and the arms higher at base. The mouth-shields are larger and longer, emarginate laterally; disk scales coarser; the jaws more acute; mouth-papillæ, four or five, short, flat rounded, except the inner one.

Ophiomusium Lymani W. Thomson.

B. range, 238 to 2,033 fathoms (640 to 2,033 fathoms, 1883). Abundant and large in many localities.

Ophiomusium armigerum Lyman. 1878.

B. range, 1,731 to 2,369 fathoms, 1883. Abundant locally.

Ophiochiton grandis Verrill. 1884.

B. range, 388 fathoms, 1883. Rare.

Ophiomitra spinea Verrill. 1885.

B. range, 2,038 fathoms, station 2,035, 1883. Two specimens.

A large species resembling *O. valida*. Arms five, long and stout; disk five-lobed, indented between the arms; radial shields moderately large, irregularly ovate, with a small notch in the broad outer end; their inner ends are separated by a wedge of small scales, but the outer ends are in contact, or nearly so; disk-scales rather small, unequal, bearing small, low, conical spinules or granules; a few granules on the outer end of radial shields and bases of the arms. Arm-spines, eight or nine at base of arms, long, slender, acute, sharply thorny, arising from prominent side plates; the middle spines are the largest and roughest; the rows do not meet above at base of arms. Mouth-shields rhombic, with incurved lateral margins; the inner angle acute, the outer one obtuse or rounded; side mouth-shields thickened, crescent-shaped; tentacle-scale rather large, those at base of arm wide, flat, and obtuse; farther out lanceolate and rather acute. Mouth-papillæ numerous, unequal, rather irregular and crowded at the outer mouth-angles, where they form two or more rows; in the largest example there are eighteen to twenty, or more, in each angle; in the smaller one about twelve; they are mostly rather slender, spiniform, or papilliform, the outermost one wider and more flattened. The larger specimen has the disk 14^{mm} in diameter; the smaller one, 11^{mm}.

Ophiacantha bidentata (Retz.) Ljung.; Lyman (*pars*) "Challenger" Ophiuroidea.

Ophiacantha spinulosa (M. and Tr.) Lyman, Illus. Catalogue Mus. Comp. Zoology.

B. range, 40 to 351 fathoms (101 to 351 fathoms, 1883). Common northward, in moderate depths, from Massachusetts Bay to Greenland.

The form here intended is the same as that described and figured by

Lyman, Lütken, Duncan and Sladen, and others as *O. spinulosa*, from northern waters. Lyman's deep-water specimens, some of which I have examined, belong in part at least, to the following species.

Ophiacantha fraterna Verrill, sp. nov.

B. range, 908 to 1,608 fathoms. Common.

Disk rounded, rather swollen, with ten slightly raised radial ridges made by the radial shields, which have the outer ends small, a little prominent and naked. The surface of the disk is covered with very small, short, obtuse, rough spinules, terminated by several minute sharp thorns; usually mixed with these there are many small, rather rough conical granules, of about the same size. Arm-spines at base of arms about eight, longest on the second and third joints beyond the disk, but the rows are not closely approximated dorsally. The upper spines are long, very slender, acute, and but slightly roughened; the middle ones are a little thorny; the lower ones comparatively short. Tentacle-scale flattened, small, tapered, subacute. Ventral arm-plates narrow, about as long as broad, strongly convex on the outer margin, and with a distinct angle on the inner. Mouth-shields small, transversely cross-shaped, with a small outer lobe extending a little on the interbrachial spaces, and with a small, very obtuse angle on the inner margin, the side lobes much larger and more prominent. Side mouth-shields rather wide, somewhat crescent-shaped, strongly curved. Mouth-papillæ about three on each side, besides a larger one below the teeth; they are rather long, spiniform, and acute, the outer one not differing from the rest. Color in alcohol dull brownish yellow, usually with darker brown blotches on the arms and disk. Diameter of disk, usually 9 to 12^{mm}.

This species has hitherto been confounded with *O. bidentata*, which it resembles. It differs in the smaller size and different character of its disk-spinules, in the rougher spines, smaller and more acute tentacle-scales, and in the sharp, spiniform, outer mouth-papillæ. The mouth-shields have an outer lobe extending somewhat on the interbrachial spaces, though less so than in *O. millespina* and several other species.

Ophiacantha varispina Verrill, sp. nov.

B. range, 101 fathoms, off Nova Scotia.

Disk slightly five-lobed, covered on the central part with small, elongated, tapered, acute, rough spines, which are gradually replaced toward the margins by shorter and stouter, very rough, obtuse stumps, surmounted by a group of sharp, rough spinules; radial shields slightly exposed at the prominent outer end. Arms slender; the spines about eight, somewhat rough, glassy; the upper ones long, slender, acute, the rows nearly meeting on the second joint beyond disk; the lower ones are shorter and very slender; tentacle-scale flat, subspatulate, broadly rounded at the end. Ventral arm-plates near base of arms not much broader than long, rather pentagonal, the outer edge curved, or

subtruncate in the middle, the inner edge nearly straight or slightly angulated centrally. Mouth-shields strongly four-lobed, the inner angle acute, with concave sides, the lateral lobes prominent, subacute, the outer lobe smaller, obtuse, extending somewhat on the interbrachial area; side mouth-shields wide, not very long, somewhat crescent-shaped, the outer margin convexly arched to fit the concave sides of the mouth-shield. Mouth-papillæ mostly flat and broad, lanceolate or obtuse, three or four on each side besides the infradental; a slender, smaller one often stands out of line, back of the outermost, which is flatter and more obtuse than the others. Color yellowish brown, with darker blotches on disk and arms. Diameter of disk, 9^{mm}; length of arms, 35^{mm}. Station 2069, in 101 fathoms, off Nova Scotia. Peculiar in the mixture of sharp spines and obtuse thorny stumps on the disk. General appearance much as in *O. bidentata*.

Ophiacantha granulifera Verrill. 1885.

B. range, 101 to 200 fathoms, off Nova Scotia.

Disk five-lobed, covered with small rounded and conical, slightly rough granules; radial shields form ten rather prominent ridges, naked only at the rounded and prominent outer end; interbrachial spaces beneath scaly, with few granules. Arms rather broad. Arm-spines eight to nine at base of arms, the rows not approximating dorsally; the upper ones are long, very slender, acute, slightly roughened; the middle ones are stouter and distinctly thorny; the lower ones much shorter; tentacle-scale small, lanceolate, subacute, except on the two first joints, where they are obtuse and flattened, and sometimes two together; side arm-plates broadly united ventrally; ventral arm-plates unusually broad and short, especially on the second to seventh joints, where they are transversely oblong, the outer margin nearly straight or slightly emarginate, the inner edge with a slight median angle; farther out they become longer, narrower, and somewhat trapezoidal. Mouth-shields small, somewhat cruciform, with a small outer lobe, an obtuse inner angle, and with acute lateral lobes. Side mouth-shields larger, broad, strongly curved, thickened, and minutely granulose. Mouth-papillæ all spiniform, three or four on each side, besides a larger one below the teeth. Color light brownish yellow, with darker blotches on the arms. Diameter of disk, 9^{mm} to 11^{mm}. Easily distinguished by the short, wide, ventral arm-plates and the small, close, granules on the disk.

Ophiacantha enopla Verrill. 1885.

B. range, 351 to 640 fathoms, 1882, 1883.

Easily distinguished by having numerous mouth-papillæ, the outer ones forming a crowded group at the end of the mouth-angles. The disk is covered with small obtuse or rounded granule-like stumps, slightly spinulated at the end. The arm-spines are long and slender, glassy, seven or eight near the base of the arms, forming a nearly continuous band on the dorsal side. Color in life, orange.

Ophiacantha abyssicola G. O. Sars.

B. range, 1,000 to 1,608 fathoms, 1883. Not uncommon. Very closely allied to the next, and perhaps identical.

Ophiacantha millespina Verrill. 1879.

B. range, 100 to 1,917 fathoms, 1883. Abundant and widely diffused.

Ophiacantha aculeata Verrill. 1885.

B. range, 1,346 to 1,395 fathoms, 1883.

A large species, with five unusually long, gradually tapering arms. Disk rounded and swollen, throughout evenly covered with small, slender, elongated spinules, having rough sides and terminated by four to six slender, rough, divergent points. These disk-spinules are less crowded, smaller, longer, and more slender than in *O. bidentata*. End of radial shields not exposed. Arm-spines very long, slender, nearly smooth, eight or nine at base of arms, those next to the edge of disk decidedly longer and forming an almost continuous band above. Tentacle-scales rather wide, but with acute tips at base of arms, rapidly becoming smaller and acute-lanceolate farther out. Mouth-shields rather small, rounded externally, and not extending much on the inter-brachial spaces, obtuse-angled on the inner side. Jaws broader and more obtuse than in most species. Mouth-papillæ rather slender, usually three or four on each side of a jaw, besides the median one; the outer one is largest, broad and flat at base, rapidly narrowed toward the acute end; the next two are more slender, spiniform, and acute; sometimes an additional smaller one stands out of line, behind those in the regular row. Color, light orange or buff. Diameter of disk of a large example, 17^{mm}; length of arms, 110^{mm}. Stations 2034 and 2105, in 1,346 to 1,395 fathoms, on *Brisinga elegans* V.

Ophiacantha anomala G. O. Sars.

B. range, 101 to 131 fathoms, off Nova Scotia, 1883. Not common; chiefly northern.

This species is easily recognized by having regularly six arms. The disk is covered with rather large and coarse stump-like spinules, rough at the obtuse or rounded summit.

Ophiacantha spectabilis G. O. Sars.

B. range, 131 fathoms, off Nova Scotia, 1883. One specimen only.

This species has smoothish, tapering, acute spines on the disk. The mouth-papillæ are slender, tapering, and acute.

Ophiacantha crassidens Verrill, Amer. Journ. Sci., February, 1885.

B. range, station 2115, in 843 fathoms, off Cape Hatteras.

This large species is easily distinguished by its disk, covered with small, conical, acute spines, and by the remarkably large, rough, and thick mouth-papillæ, which are crowded. The arm-spines are rather short and blunt. The color is dark brown in alcohol. .

Ophiacantha gracilis Verrill, sp. nov.

B. range, 220 to 858 fathoms, mostly off Nova Scotia, on Gorgonians.

A small, delicate species, with long, slender, attenuated arms. Disk round and full, covered with relatively large, easily visible scales, each of which bears a rather large and high columnar spinule, a little enlarged at the summit and terminated by five or six or more, slender, sharp, divergent points. Arm-spines along most of the length of the arm, four or five, short for the genus, being about half as long as an arm-joint; the small upper one is tapered; the lower ones are stouter, rough, blunt, and hooked at the end; the lowest is largest and most hooked; on the two joints next to the disk the five spines are much longer, very slender, tapered, acute; the two upper ones twice as long as an arm-joint. Tentacle-scale, small, spiniform; mouth-papillæ few, about three on each side of a jaw, besides a larger, odd, terminal one; the lateral ones are small, spiniform; the two outer ones stand a little back from the slit, like tentacle-papillæ; mouth-shields small, narrow, rounded without; acute, angular within; side shields, large, angular; ventral arm plates widely separated, elongated, rounded on the outer edge; the inner end with an angular median point. Diameter of disk, 3.5^{mm}; length of arms, about .22^{mm}. Probably young, but very unlike the young of any of our other species.

Ophioteles Acanellæ Verrill, Amer. Journ. Sci., February, 1885.

B. range, 91 to 122 fathoms, off Nova Scotia.

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Disk rounded, smaller, covered above and below with rather large globular or capitate stumps, minutely spinulose at the end. Arms short. Arm-spines at base of arms, six or seven, short, obtuse, rough, with small spinules; the four lower are shorter and stouter than the upper ones, with a blunt or clavate, rough, thorny tip; the upper ones are more cylindrical, but mostly blunt, shorter than the breadth of the arm-joint; the lower groups of three or four spines extend nearly to the mouth-angles. Mouth-papillæ, three or four on each side, small, nearly equal, rounded, obtuse. Diameter of disk, 6^{mm}. Station 2071, on *Paramuricea borealis*, in 113 to 122 fathoms, off Nova Scotia.

Ophiopholis aculeata Gray.

B. range, shore to 1,000 fathoms (18 to 1,000 fathoms, 1883). Very common and widely diffused as far south as off Cape Hatteras.

Amphiura Otteri Ljungmann (?); Lyman.

B. range, 182 to 1,608 fathoms (487 to 1,608 fathoms, 1883). Not uncommon.

In this species the disk is covered with small scales, above and below; the radial shields are elongated, wedge-shaped, with a narrow group of scales between their divergent and tapered inner ends. The arms are very long and rather slender, flattened, usually with about six spines toward the base, but in large specimens there may be as many as eight; they are moderately long, tapered, and, except the upper

ones, mostly a little bent toward the end, with the tip slightly hooked. Two flat, blunt tentacle-scales, which are very small and indistinct in young specimens; a pair of stout mouth-papillæ at the end of each jaw, and one smaller spiniform one on each side, a little farther back; a stout, erect, spiniform tentacle-papilla at the outer end of the mouth-slit on each side.

Amphiura fragilis Verrill, sp. nov.

B. range, 239 to 1,467 fathoms.

Disk, five-lobed, covered above with small, delicate scales, naked beneath; radial shields, pear-seed-shaped, slightly divergent, the inner ends separated by a narrow row of scales. Arms long and slender; Arm-spines, four or five near the disk, usually four along the middle and three toward the tip of the arms; they are subequal in length, the upper one a little longer and more enlarged toward the base, the tips obtuse and minutely roughened or spinulose on one side. Tentacle-scale absent or rudimentary. Mouth-shields small, rounded; side mouth-shields rather broad. Mouth-papillæ, four to each angle; a pair of large, stout, blunt ones stand at the end of the jaw, and a much smaller, spiniform, acute one a little farther back on each side; there is also an acute, spiniform, erect papilla outside of the mouth-tentacle, opposite the outer angle of the mouth-slits, as in *A. Otteri*. Ventral arm-plates, subquadrate, longer than broad, with the outer angles rounded and the inner ones truncated; farther out they become shorter and somewhat five-sided, with the outer margin rounded and the inner corners so much truncated as to form a median angle. Diameter of disk of an ordinary specimen, 5^{mm}; length of arms, about 30^{mm}. Resembles the young of *A. Otteri*, but differs in lacking tentacle-scales and in having the disk naked below, and in the arm-spines, which are not curved.

Amphiura macilenta Verrill. 1882.

B. range, 53 to 115 fathoms (70 fathoms, 1883). Very abundant locally, in moderate depths, as far south as off Cape Hatteras.

Amphiura Goësi (Ljung.) Lym.

B. range, 14 fathoms, station 2114, off Cape Hatteras.

Amphiura tenuispina (Ljung.) Lyman. Fig. 55.

B. range, 115 to 487 fathoms (407 fathoms, 1883). Not uncommon.

Amphilepis Norvegica (Ljung.) Lym.

B. range, 547 to 1,608 fathoms, 1882, 1883. Common and large.

Ophiocnida olivacea Lyman. 1869.

B. range, 63 to 192 fathoms (131 fathoms, 1883). Sometimes abundant locally.

Ophioscolex glacialis Müller & Troschel.

B. range, 101 to 1,000 fathoms, 1883. Common.

Ophioscolex quadrispinus Verrill. 1884. Figs. 56, 56a, 56b.

B. range, 101 to 234 fathoms (101 fathoms, off Nova Scotia, 1883).
Rare.

Disk swollen; arms five, long, attenuated distally. The disk and base of arms are covered with a thick soft skin, with close wrinkles or small rounded verrucæ above, becoming concentric and radial wrinkles beneath, but beyond the basal part of the arms becoming smoother and thinner, concealing the feebly developed arm-plates. Arm-spines four, or alternately three and four, near base of arms (three in young examples), nearly equal, rather stout, tapered; lower ones blunt; upper, acute in part, scarcely as long as the breadth of the arm. Tentacle-scale small, tapering, acute; teeth, six to eight or more, rather slender, acute, often in pairs; mouth-papillæ, small, slender, acute, unequal, eight to ten on a side of each angle, besides two or three larger ones outside of the second mouth-tentacle and one within the slit at the first mouth-tentacle; the outer papillæ in large specimens are crowded so as to form two or more rows. Large examples have the disk 14^{mm} in diameter; length of arms, 70^{mm}. Stations 1121 and 2069; also Gulf of Maine, station 38, in 112 fathoms, 1878.

Hemieuryale tenuispina Verrill. 1885.

Astronyx? tenuispina Verrill, Amer. Journ. Sci., vol. 28, p. 219, 1884.

B. range, 1,362 to 2,033 fathoms, 1883. Locally abundant on *Scleroptilum gracile* V.

The disk is covered with thin roundish scales, visible when dried, without granules; radial shields prominent distally; arms with small scales above, and larger prominent ones along the sides; spines three, the upper longest; tentacle-scales small, spiniform; mouth-shield small, rhombic; mouth-papillæ several, small, in a regular row.

Astrochele Lymani Verrill. 1878. Fig. 53.

B. range, 264 to 1,608 fathoms; 407 to 1,608 fathoms, 1883. Abundant on *Acanella*.

Astronyx Loveni Müller and Troschel. Figs. 54, 54a, b.

B. range, 787 to 1,362 fathoms (843 to 1,362 fathoms, 1883). Common on Pennatulacea.

Gorgonocephalus Lamarckii Lyman.

Astrophyton Lamarckii M. & Tr., Syst. Ast., 1842.

B. range, 150 to 300 fathoms (194 fathoms, 1882; 239 fathoms, 1883).
Common off Nova Scotia on Alcyonaria.

CRINOIDEA.

Antedon dentata (Say) Verrill. Fig. 58, young.

B. range, 69 to 640 fathoms (69 to 487 fathoms, 1883). Common; sometimes abundant locally.

LIST OF ECHINODERMATA DREDGED BY THE "FISH HAWK", 1880 TO 1882,
NOT OBTAINED BY THE "ALBATROSS" IN 1883.

Toxodora ferruginea Verrill. 1882.

B. range, 100 to 155 fathoms, 1880, 1881. Locally common.

Spatangus purpureus Leske.

B. range, 89 to 158 fathoms, 1881, 1882. Not common.

Echinocyamus pusillus (Müller) Gray.

B. range, 146 fathoms, 1881. One specimen only.

Echinus Wallisi A. Agassiz.

B. range, 156 to 640 fathoms, 1880, 1881, 1882. Not common.

Temnechinus maculatus A. Agassiz.

B. range, 115 fathoms, 1880. One specimen only.

Dorocidaris papillata A. Agassiz (variety).

B. range, 104 to 158 fathoms, 1881, 1882. Locally common.

Hemipedinia Cubensis A. Agassiz.

B. range, 194 fathoms, 1882. One specimen.

Poraniomorpha borealis Verrill. Figs. 46, 46a.

Asterina borealis Verrill, Amer. Journ. Sci., vol. xvi, p. 213, 1878.

B. range, 192 to 225 fathoms, 1880. Rare; northern.

Archaster Bairdii Verrill. 1882.

B. range, 351 to 396 fathoms, 1881. Rare.

Ctenodiscus crispatus Dübén & Koren.

B. range, 182 to 321 fathoms, 1880, 1881, 1882. Local; abundant north of Cape Cod.

Ophioglypha (Ophiopleura) aurantiaca Verrill. 1882.

B. range, 86 to 317 fathoms, 1880, 1881, 1882. Rare.

Rhizocrinus Lofotensis Sars. Fig. 57, young.

B. range, 640 fathoms, 1882. Station 2226 in 2,021 fathoms, 1884.

ADDITIONAL DEEP-WATER ECHINODERMATA DREDGED BY THE
"ALBATROSS" IN 1884.

Ankeroderma limicola Verrill. 1885.

Station 2171, in 444 fathoms, off Chesapeake Bay.

Aspidodiadema Antillarum A. Agassiz.

Station 2210, in 991 fathoms. Rare. West Indian.

Zoroaster fulgens W. Thomson.

Station 2206, in 1,043 fathoms. One example. European.

Pteraster pulvillus Sars.

Station 2226, off Chesapeake Bay, in 2,021 fathoms, 1884. Gulf of Maine and off Nova Scotia. Rare.

Astroporpa annulata Lüttk. and Örsted.

Off Cape Hatteras, stations 2267 to 2269, and 2301, in 48 to 68 fathoms, on *Titanideum suberosum* V. West Indian.

Bathycrinus, sp., near *B. gracilis* W. Thomson.

B. range, 2,021 fathoms, station 2226. One specimen.

LIST OF DECAPOD CRUSTACEA TAKEN BY THE "ALBATROSS" IN 1883.

The following list has been compiled from the papers published by Prof. S. I. Smith.* The Cumacea, Amphipoda, Isopoda, and lower groups, obtained in 1883, are not here included, for they have not yet been reported upon, though a few are mentioned on a previous page.

BRACHYURA.

Anamathia Agassizii Smith. 1885.

Amathia Agassizii Smith, 1882.

B. range, 142 to 333 fathoms (142 to 197 fathoms, 1883).

Hyas coarctatus Leach.

B. range, 35 to 906 fathoms, 1883. Chiefly northern.

Collodes robustus Smith. 1883.

B. range, 56 to 373 fathoms (78 to 373 fathoms, 1883).

* The following papers by Professor Smith are the principal ones relating to the deep-water Crustacea of this region :

Preliminary Notice of the Crustacea dredged in 64 to 325 fathoms, off the south coast of New England by the United States Fish Commission in 1880. From the Proceedings of the National Museum, Washington, vol. iii, for 1880, January, 1881.

Preliminary Report on the Brachyura and Anomura dredged in deep water off the south coast of New England by the United States Fish Commission in 1880, 1881, and 1882. From the same, vol. vi, p. 1, June, 1883.

Report on the Crustacea. Part I. Decapoda ["Blake" expedition]. From the Bulletin Mus. Comp. Zoology, x, 1882.

Report on the Decapod Crustacea of the "Albatross" dredgings off the east coast of the United States in 1883. Extracted from the annual report of the Commissioner of Fish and Fisheries for 1882. Published 1884.

Crustacea of the "Albatross" dredgings in 1883. From the American Journal of Science, vol. xxviii, July, 1884.

On some new or little known Decapod Crustaceans from recent Fish Commission dredgings, off the east coast of the United States. From the Proceedings of the National Museum, vii, p. 493, 1885.

The following papers contain descriptions of the deep-water Isopoda :

Report on the Isopoda ["Blake" expedition]. From the Bulletin of the Museum of Comparative Zoology, vol. xi, No. 4, September, 1883. By Oscar Harger.

Report on the Marine Isopoda of New England and adjacent waters. This report, part vi, for 1878, p. 297. By Oscar Harger.

The following paper, relating to the "Blake" Crustacea, contains descriptions of species also dredged by the United States Fish Commission :

Études préliminaires sur les Crustacés. From the Bulletin of the Museum of Comparative Zoology, vol. viii, No. 1, December, 1880. By A. Milne-Edwards.

Euprognatha rastellifera Stimpson.

B. range 44 to 229 fathoms (66 to 98 fathoms, 1883). Very abundant locally, 1880, 1881.

Cancer irroratus Say.

B. range, shore to 314 fathoms (18 to 86 fathoms, 1883). Extends to the region south of Cape Hatteras in moderate depth.

Cancer borealis Stimpson.

B. range, shore to 435 fathoms (18 to 373 fathoms, 1883). Found as far south as Cape Hatteras, off the coast.

Geryon quinquedens Smith. 1879. Fig. 156.

B. range, 105 to 740 fathoms (105 to 588 fathoms, 1883); 263 to 740 fathoms, "Blake" expedition.

Achelous Gibbesii Stimpson.

B. range, 16 fathoms, 1883; off Cape Hatteras.

Persephone punctata (Brown) Stimpson.

B. range, 14 fathoms, 1883; off Cape Hatteras.

Ethusina abyssicola Smith. 1884.

B. range, 1,497 to 1,735 fathoms, 1883.

ANOMURA.

Latreillia elegans Roux.

B. range, 70 to 134 fathoms (70 fathoms, 1883).

Homola barbata (Fabricius) White.

B. range, 56 to 373 fathoms (143 to 373 fathoms, 1883).

Porcellana Sayana (Leach) White.

B. range, 48 fathoms, 1883; off Cape Hatteras.

Lithodes maia Leach.

B. range, 141 to 291 fathoms (141 fathoms, 1883; off Nova Scotia).

Lithodes Agassizii Smith. 1882. Figs. 151, 151a, 151b.

B. range, 410 to 1,255 fathoms (843 to 1,255 fathoms, 1883).

Eupagurus bernhardus (Linné) Brandt.

B. range, 5 to 86 fathoms, 1883.

Eupagurus politus Smith. 1882.

B. range, 31 to 640 fathoms, 1883.

Eupagurus pubescens (Kröyer) Brandt.

B. range, 26 to 86 fathoms (31 to 86 fathoms, 1883).

Eupagurus Kröyeri Stimpson.

B. range, 35 to 640 fathoms (35 to 239 fathoms, 1883).

Eupagurus longicarpus (Say) Stimpson.

B. range, shore to 20 fathoms (19 fathoms, 1883).

Eupagurus pollicaris (Say) Stimpson.

B. range, 1 to 20 fathoms (18 to 19 fathoms, 1883).

Catapagurus Sharreri A. M. Edwards. Fig. 26.

Hemipagurus socialis Smith. 1881.

B. range, 51 to 264 fathoms (78 to 140 fathoms, 1883).

Parapagurus pilosimanus Smith. 1879. Fig. 28.

B. range, 250 to 2,221 fathoms (1,731 to 2,221 fathoms, 1883).

Sympagurus pictus Smith. 1883. Fig. 161.

B. range, 164 to 264 fathoms (168 fathoms, 1883).

Munida Caribæa Smith. 1882. (Stimpson ?) Fig. 153.

B. range, 56 to 264 fathoms (69 to 131 fathoms, 1883). Very abundant locally in 1880, 1881.

Munidopsis rostrata Smith. 1885.

Galacantha rostrata A. M.-Edwards.

B. range, 1,098 to 1,342 fathoms, 1883; 1,241 to 1,394 fathoms, "Blake" expedition.

Munidopsis Bairdii Smith. 1885.

Galacantha Bairdii Smith. 1884.

B. range, 1,497 fathoms, 1883.

Munidopsis curvirostra Whiteaves.

B. range, 75 to 1,290 fathoms. 1883.

MACRURA.

Pentacheles sculptus Smith. 1880. Fig. 152.

B. range, 464 to 843 fathoms (843 fathoms, 1883).

Pentacheles nanus Smith. 1884.

B. range, 843 to 1,917 fathoms, 1883.

Pentacheles debilis Smith. 1884.

B. range, 1,290 to 1,309 fathoms, 1883.

Ceraphilus Agassizii Smith. 1882. Fig. 155.

B. range, 499 to 959 fathoms, 1883; 263 to 603 fathoms, "Blake" expedition.

Orangon vulgaris Fabricius.

B. range, shore to 20 fathoms (18 to 19 fathoms, 1883).

Pontophilus Norvegicus M. Sars.

B. range, 105 to 524 fathoms (105 to 239 fathoms, 1883).

Pontophilus brevirostris Smith. 1881.

B. range, 51 to 233 fathoms (65 to 98 fathoms, 1883).

Pontophilus abyssii Smith. 1884.

B. range, 1,917 to 2,221 fathoms, 1883.

Sabinea princeps Smith. 1882. Fig. 157.

B. range, 372 to 888 fathoms (640 to 888 fathoms, 1883).

Sabinea Sarsii Smith. 1879.

B. range, 122 to 150 fathoms, 1883; off Nova Scotia.

Glyphocrangon sculptus Smith. 1884. Fig. 154.

Rhachocaris sculpta Smith, "Blake" expedition, Crust., p. 49, pl. 5, fig. 3, pl. 6, fig. 3-3d, 1882.

B. range, 1,098 to 1,395 fathoms, 1883.

Hippolyte Liljeborgii Danielssen.

B. range, 75 to 524 fathoms (75 to 150 fathoms, 1883).

Hippolyte pusiola Kröyer.

B. range, 49 fathoms, 1883; off Nova Scotia.

Hippolyte polaris Ross.

B. range, 122 fathoms, 1883; off Nova Scotia.

Hippolyte Grænlandica (Fabricius) Miers.

B. range, 35 fathoms, 1883; George's Bank.

Bythocaris gracilis Smith. 1885.

B. range, 888 to 1,043 fathoms, 1883, 1884.

Pandalus Montagui Leach.

B. range, 113 fathoms, 1883; off Nova Scotia.

Pandalus propinquus G. O. Sars.

B. range, 122 to 524 fathoms (122 to 239 fathoms, 1883).

Pandalus borealis Kröyer.

B. range, 105 fathoms, 1883; off George's Bank.

Pandalus leptocerus Smith. 1881.

B. range, 10 to 430 fathoms (18 to 197 fathoms, 1883).

Nematocarcinus ensiferus Smith. 1884.

Eumiersia ensifera Smith, "Blake" expedition, Crust., p. 77, pl. 13, figs. 1-9, 1882.

B. range, 588 to 2,033 fathoms, 1883.

Ephyrina Benedicti Smith. 1885.

B. range, 959 fathoms, 1883.

Acanthephyra Agassizii Smith. 1882.

Miersia Agassizii Smith, 1882.

B. range, 105 to 2,949 fathoms, 1883.

Acanthephyra eximea Smith. 1884.

B. range, 938 fathoms, 1883; off Cape Hatteras.

Acanthephyra brevirostris Smith. 1885.

B. range, 1,395 to 2,949 fathoms, 1883.

Notostomus robustus Smith. 1884. Fig. 160.

B. range, 1,309 to 1,555 fathoms, 1883.

Meningodora mollis Smith. 1882.

B. range, 1,106 fathoms, 1883; 1,632 fathoms, "Blake" expedition.

Hymenodora glacialis G. O. Sars.

B. range, 861 to 2,949 fathoms, 1883, 1884.

Pasiphaë princeps Smith. 1884. Fig. 158.

B. range, 1,342 fathoms, 1883.

- Parapasiphaë sulcatifrons* Smith. 1884. Fig. 162.
B. range, 516 to 2,949 fathoms, 1883.
- Parapasiphaë cristata* Smith. 1884.
B. range, 1,628 fathoms, 1883.
- Parapasiphaë compta* Smith. 1884.
B. range, 2,369 fathoms, 1883.
- Benthæcetes Bartletti* Smith. 1882.
Benthescymus Bartletti Smith, "Blake" expedition, Crust., p. 82, pl. 14, figs. 1-7, 1882.
B. range, 588 to 858 fathoms, 1883.
- Benthescymus ? carinatus* Smith. 1884.
B. range, 1,022 fathoms, 1883.
- Benthescymus ?*, sp. indet.
B. range, 1,555 fathoms, 1883.
- Amalopenæus elegans* Smith. 1882.
B. range, 372 to 2,369 fathoms (640 to 2,369 fathoms, 1883); 457 to 1,632 fathoms, "Blake" expedition.
- Amalopenæus valens* Smith. 1884.
B. range, 640 fathoms, 1883.
- Aristeus ? tridens* Smith. 1884. Fig. 159.
B. range, 843 to 2,221 fathoms, 1883.
- Hepomadus tener* Smith. 1884.
B. range, 2,949 fathoms, 1883.
- Hymenopenæus microps* Smith. 1884.
B. range, 906 to 1,731 fathoms, 1883.
- Sergestes arcticus* Krøyer.
B. range, 139 to 1,025 fathoms (221 to 1,025 fathoms, 1883).
- Sergestes robustus* Smith. 1881.
B. range, 372 to 1,632 fathoms (640 to 641 fathoms, 1883); 1,632 fathoms, "Blake" expedition.
- Sergestes mollis* Smith. 1882.
B. range, 373 to 2,949 fathoms, 1883; 1,632 fathoms, "Blake" expedition.

SCHIZOPODA.

- Gnathophausia*, sp.
B. range, 858 to 2,033 fathoms, 1883.
- Gnathophausia*, sp.
B. range, 959 to 2,949 fathoms, 1883.
- Thysanoessa*, sp.
B. range, 398 to 1,067 fathoms.
- Lophogaster*, sp.
B. range, 1,022 to 2,949 fathoms, 1883.

Thysanopoda Norvegica Kröyer.

B. range, 35 to 252 fathoms (f); found in trawl-wings from various depths; 150 to 239 fathoms, 1883. Common at the surface, northward.

Boreomysis tridens G. O. Sars.

B. range, 351 to 500 fathoms, 1880, 1882, 1883. Common in the trawl-wings.

LIST OF ADDITIONAL DEEP-WATER CRUSTACEA DREDGED BY THE
"FISH HAWK" AND "BLAKE," 1880-'82.

The following species, previously dredged in this region, have not yet been recorded as taken in 1883, but many of the Amphipods and Iso-pods, as well as additional species, are known to be among the collections of 1883, not yet carefully examined.

BRACHYURA.

Anamathia Tanneri Smith. 1885.

Anathia Tanneri Smith, Proc. Nat. Mus., vi, p. 3, 1883.

B. range, 130 to 146 fathoms, 1881.

Lispognathus furcatus A. M.-Edwards.

B. range, 317 to 225 fathoms, 1881, 1882.

Lambrus Verrillii Smith. 1881.

B. range, 65 to 134 fathoms, 1880, 1881.

Bathynectes longispina Stimpson.

B. range, 85 to 225 fathoms, 1881, 1882.

Acanthocarpus Alexandri Stimpson.

B. range, 50 to 200 fathoms, 1880, 1881. Common in 1880.

Myropsis quinquespinosa Stimpson.

B. range, 79 fathoms, 1881. One specimen.

Cymopolia gracilis Smith. 1883.

B. range, 142 fathoms, 1880. One specimen.

Ethusa microphthalma Smith. 1881.

B. range, 67 to 156 fathoms, 1880, 1881.

ANOMURA.

Lyreidus Bairdii Smith. 1881.

B. range, 100 to 120 fathoms, 1880. Two specimens.

Porcellana Sigsbeiana A. M.-Edwards.

B. range, 134 fathoms, 1881. One specimen.

Cutapagurus gracilis Smith. 1882.

Hemipagurus gracilis Smith, Proc. Nat. Mus., iii, p. 426, 1881.

B. range, 53 to 155 fathoms. Common in 1880 and 1881.

Munida valida Smith. 1883.

B. range, 245 to 640 fathoms, 1882. Two specimens.

Eumunida picta Smith. 1883.

B. range, 115 to 158 fathoms, 1881, 1882.

Anoplionotus politus Smith. 1883.

B. range, 79 to 134 fathoms, 1880, 1881.

MACRURA.

Arctus depressus Smith. 1881.

B. range, 86 fathoms, 1880. Rare.

Nephropsis aculeatus Smith. 1881.

B. range, 100 to 126 fathoms, 1880. Rare.

Axius armatus Smith. 1881.

B. range, 100 to 142 fathoms, 1880. Rare.

Hippolyte Phippsii Kröyer.

B. range, 73 fathoms, near George's Bank, "Blake" expedition. Not uncommon northward in shallow water.

Caridion Gordoni Goës.

B. range, 143 fathoms, "Blake" expedition. Northern.

Bythocaris nana Smith, 1885.

B. range, 65 to 142 fathoms, 1880; 178 fathoms, "Blake" expedition, 1880.

Pandalus tenuipes Smith. 1881.

B. range, 100 to 252 fathoms, 1880.

Penæus politus Smith. 1881.

B. range, 142 fathoms, 1880. One specimen.

SCHIZOPODA.

Pseudomma roseum G. O. Sars.

B. range, 500 fathoms, 1880.

Lophogaster, sp.

B. range, 155 fathoms, 1880.

CUMACEA.

Diastylis quadrispinosus G. O. Sars.

B. range, 100 to 142 fathoms, 1880. Additional species have also been taken.

STOMATOPODA.

Lysiosquilla armata Smith. 1881.

B. range, 65 to 120 fathoms, 1880, 1882.

AMPHIPODA.

The following list is very incomplete. Many additional species have been taken which have not yet been reported upon :

Stegocephalus ampulla Bell.

B. range, 168 to 264 fathoms, 1880, 1881, 1882.

Epimeria loricata G. O. Sars.

B. range, 90 to 640 fathoms, 1880, 1881, 1882.

Haploops setosa Boeck.

B. range, 252 fathoms, 1880.

Ptilocheirus pinguis Stimpson.

B. range, 45 to 86 fathoms, 1880, 1881.

Erichthonius difformis M.-Edw.

B. range, 192 fathoms, 1880, 1881.

Unciola irrorata Say.

B. range, 1 to 192 fathoms, 1880, 1881, 1882, 1883.

Themisto bispinosa Boeck.

B. range, 44 to 110 fathoms. Perhaps also from the surface.

Neohela phasma Smith. 1881.

B. range, 349 to 374 fathoms, 1880, 1882.

Caprella, sp.

B. range, 843 to 1,080 fathoms, 1883, 1884.

ISOPODA.

The following list is very incomplete, for the Isopods collected since 1881 have been but little examined.

Many of the following were also taken in 1883. Several species described by Mr. Harger from the "Blake" expedition, dredged south of Cape Hatteras, are not included in this list.

Janira alta (Stimp.) Harger.

B. range, 65 to 487 fathoms, 1880, 1882.

Munnopsis typica Sars.

B. range, 125 to 142 fathoms, 1880, 1881.

Astacilla granulata (Sars) Harger. Fig. 166.

B. range, 291 to 640 fathoms, 1882.

Cirolana polita Harger.

B. range, 89 to 321 fathoms, 1880, 1882.

Cirolana impressa Harger. 1883. Fig. 165.

B. range, 100 to 321 fathoms, 1880, 1881.

Æga psora (L.) Kröyer.

B. range, 306 to 640 fathoms, 1880, 1882.

Rocinela Americana (Sch. & Mein.)

B. range, 85 to 157 fathoms, 1880, 1882; 257 fathoms, "Blake" expedition.

Rocinela, sp.

B. range, 129 fathoms, "Blake" expedition.

Systemus infelix Harger. Fig. 164.

B. range, 182 to 640 fathoms, 1880, 1881, 1882.

Phryxus abdominalis Köyer.

B. range, 97 to 351 fathoms, on *Pandalus leptocerus*.

Anthura, sp.

B. range, 349 fathoms, 1882.

Gnathia cerina (Stimp.) Harger.

B. range, 65 to 487 fathoms, 1880.

Tanais, sp.

B. range, station 1146, 1881.

LIST OF DEEP-WATER PYCNOGONIDA.

The following list includes the Pycnogonids that have been recorded from the region under discussion, obtained by the "Blake"* and "Fish Hawk." It is very incomplete, for those collected in 1881, 1882, and 1883 have not been fully studied, although many interesting species were obtained. Several of the following species recorded as having been obtained in 1883 and 1884 were identified by Prof. S. I. Smith. Others, not here recorded, are known to have been taken in 1883.

Pycnogonum littorale Ström.

B. range, 73 to 810 fathoms. Common northward from low-water mark to 100 fathoms.

Colossendeis angusta Sars.

B. range, 810 to 1,242 fathoms, "Blake."

Colossendeis colossea Wilson. Fig. 169.

B. range, 500 to 1,500 fathoms; 499 to 1,106 fathoms, 1883; 924 to 1,230 fathoms, 1884.

Colossendeis macerrima Wilson. Fig. 170.

B. range, 317 to 1,073 fathoms; 922 fathoms, "Blake" expedition; 317 fathoms, 1882; 1,073 fathoms, 1884.

Colossendeis gracilis Hoeck.

B. range, 924 to 1,600 fathoms, 1884. (Identified by S. I. Smith.)

Scæorhynchus armatus Wilson. Figs. 171, 171a.

B. range, 1,242 fathoms, "Blake" expedition; 1,073 fathoms, 1884.

* For the "Blake" collection, see report on the Pycnogonida, by E. B. Wilson, Bulletin Mus. Comp. Zoology, viii, No. 12, five plates, 1881.

Pallenopsis longirostris Wilson.

B. range, 500 fathoms, 1880

Nymphon grossipes (L.) Fabr.

B. range, 150 to 524 fathoms. Common northward in 12 to 110 fathoms.

Nymphon Strömii Kröyer.

B. range, 234 to 780 fathoms; 260 to 524 fathoms, "Blake;" 234 to 780 fathoms, 1882.

Nymphon pallenoides Sars.

B. range, 922 fathoms, "Blake" expedition.

LIST OF DEEP-SEA AND SURFACE MOLLUSCA COLLECTED BY THE
"ALBATROSS" IN 1883.

In the following list the shallow-water Mollusca dredged off Nova Scotia and Cape Hatteras are not included,* but the pelagic species belonging to the Pteropoda and Heteropoda, &c., are introduced, partly as a matter of convenience and partly because their dead shells are constantly dredged up from the bottom at all depths.

In addition to the following list of Mollusca, a large number of species were dredged in the same region by the "Fish Hawk" in 1880 to 1882, which are here omitted. They have been already enumerated by Miss K. J. Bush, in her list of the Mollusca of the "Fish Hawk" dredgings (this report, vol. xi, p. 701) and in my Second Catalogue of Mollusca. About forty species not contained in either of the lists were dredged in the same region by the "Albatross" in 1884. Of these about twenty-five were undescribed.

The nomenclature of this list is, with the exception of a few necessary changes, essentially the same as that used in my "Second Catalogue of Mollusca," in the Transactions of the Connecticut Academy, vol. vi, 1884, where the synonymy is briefly given. The references in the following list are to that paper and the preceding one, in volume v of the Transactions. A large part of the new forms were described and figured in those two papers.†

* For the Hatteras shells, see special list by Miss K. J. Bush, p. 77.

† Catalogue of Marine Mollusca added to the Fauna of New England during the past ten years, from the Transactions of the Connecticut Academy, vol. v., Part II, 1882. Five plates.

Second Catalogue of Mollusca, recently added to the Fauna of the New England coast and the adjacent parts of the Atlantic, consisting mostly of deep-sea species, with notes on others previously recorded. From the Transactions of the Connecticut Academy, vol. vi, Part I, 1884. Five plates.

Third Catalogue of Mollusca. From the same, vol. vi, Part II, 1886. Three plates. Descriptions and lists of many of these Mollusca are also contained in the following papers, by the writer:

Notice of recent additions to the marine Invertebrata of the northeastern coast of
H. Mis. 67—36

As it is always important, in giving the bathymetrical distribution of shells to distinguish between those taken alive and those of which only dead shells are obtained (which may have been carried by fishes, crabs, and various other agencies far from their true habitats), an asterisk (*) is added to designate living specimens, while a dagger (†) indicates dead shells. When no sign is added, it is to be understood that the specimens were living. The "Bathymetrical range" here refers only to the range as actually observed in this region by the United States Fish Commission, unless otherwise stated.

The geographical distribution is indicated, in a general way, by the abbreviations following the range in depth, but I have not attempted to make it complete in this respect. Owing to the uncertainty as to the alleged identity of the species recorded from other regions with our own, and to the incompleteness of the published lists of species collected by the various other recent dredging expeditions, the knowledge of the foreign distribution of many of these species is still very imperfect, and is sure to be largely increased within a few years, so that any facts of this kind that can now be given will have, at best, only a temporary value. The abbreviations are as follows: N., = northern, indicates that the species ranges northward along the American coast, beyond New England waters; S., = southern, southward beyond Cape Hatteras; Arc, = Arctic; Eu., = European; Med., = Mediterranean; Af., = West African; P., = North Pacific; As., = North Asia; Ob., = Caribbean Sea and West Indies; Oc., = Oceanic or pelagic.

America, with descriptions of new genera and species and critical remarks on others. Proceedings of the United States National Museum, vol. iii, December, 1880, and January, 1881.

Part II, Mollusca, with notes on Annelida, Echinodermata, &c., collected by the United States Fish Commission [pp. 356-405], December, 1880, and January, 1881.

Part III, Catalogue of Mollusca, recently added to the Fauna of Southern New England [pp. 405-406], by A. E. Verrill.

Part IV, in vol. v [pp. 315 to 343], 1882, Additions to the deep-water Mollusca, taken off Martha's Vineyard, in 1880 and 1881.

The Cephalopods of the northeastern coast of America. Part II, The smaller Cephalopoda, including the "Squids" and Octopi, with other allied forms. Trans. Conn. Acad., v [pp. 259-424, pls. 26-56], June, 1880, to October, 1881.

Report on the Cephalopods [of the "Blake" expedition, 1880], and on some additional species dredged by the United States Fish Commission steamer "Fish Hawk," during the season of 1880. Bulletin Mus. Comp. Zool., vol. viii [pp. 99-116, 8 plates], March, 1881.

Supplement report on the "Blake" Cephalopods, vol. xi, pp. 105-115, plates i, ii, iii, 1883.

Report on the Cephalopods of the northeastern coast of America. This report, Part VII, for 1879 [244 pages, 46 plates], 1882.

See also Brief Contributions to Zoology, Nos. 40 to 56, in American Journal of Science, 1877 to 1884.

CEPHALOPODA.

- Lestoteuthis Fabricii* (Licht.) Verrill. Trans. Conn. Acad., v, 291, 390,
pl. 45, f. 1-2*d*; pl. 46, f. 1-1*f*; pl. 55, f. 1-1*d*.
Bathymetrical range, 255 to 906 fathoms. N., Arc., P.
- Ommastrephes illecebrosus* (Les.) V. v, 268, pls. 28, 29, 37, 38, 39.
B. range, 0 to 1,022 f.; beaks 1,091 to 1,917 f. N.
- Sthenoteuthis Bartramii* V. v, 288.
Surface.* Southern. Oc.
- Mastigoteuthis Agassizii* V. v, 297, pl. 48; pl. 49, f. 2, 3-3*g*; vi, 243.
B. range, 640 to 1,050 f.
- Cheiroteuthis lacertosa* V. v, 299, 408, pl. 47, f. 1-1*b*; pl. 56, f. 1-1*f*; vi, 243.
B. range, 435 to 2,221 f. (2,949, arms). N.
- Leptoteuthis diaphana* V. vi, 141, pl. 32, f. 1. Fig. 62.
B. range, 1,731 f.
- Brachioleuthis Beanii* V. v, 406, pl. 55, f. 3-3*b*; pl. 56, f. 2-2*a*; vi, 245.
B. range, 183 to 843 f.
- Calliteuthis reversa* V. v, 295, pl. 46, f. 1-1*b*; vi, 243.
B. range, 365 to 2,369 f.
- Desmoteuthis hyperborea* (Steenst.) V. v, 302, pl. 27, f. 1-2; pl. 39, f. 1.
B. range, 641 f., off Chesapeake Bay. N., Arc.
- Desmoteuthis tenera* V. v, 412, pl. 55, f. 2-2*d*; pl. 56, f. 3; vi, 245.
B. range, 396 to 1,346 f.
- Rossia sublevis* V. v, 354, 419, pl. 30, f. 2; pl. 31, f. 3; pl. 46, f. 4; pl. 47,
f. 2-4.
B. range, 115 to 640 f. N.
- Heteroteuthis tenera* V. v, 357, 419, pl. 46, f. 2-2*d*, 3-3*b*; pl. 47, f. 5-5*b*.
B. range, 18 to 301 f., eggs 317 f.
- Argonauta argo* Linné. v, 364, 420; vi, 247, pl. 28, f. 1-1*b*. Figs. 63,
63*a*, 63*b*.
B. range, shells, 64 to 1,917 f.; living at surface. Oc., Ob., S., Med.
- Alloposus mollis* V. v, 366, 420, pl. 50, f. 1-2*a*; pl. 51, f. 4; vi, 247.
B. range, 238 to 1,346 f.; frag. 1,735 f.
- Octopus Bairdii* V. v, 368, 421, pl. 33, f. 1, 1*a*; pl. 34, f. 5, 6; pl. 36, f.
10; pl. 38, f. 8; pl. 49, f. 4, 4*a*; pl. 51, f. 1, 1*a*.
B. range, 85 to 843 f.; 28 to 300 f. N. of Oape Cod. N., Eur.
- Octopus piscatorum* V. v, 377, pl. 36, f. 1, 2; vi, 248.
B. range, 1,362 f. Northern.
- Octopus Carolinensis* V. vi, 235.
B. range, 142 f., off Cape Hatteras.
- Octopus gracilis* V. vi, 236.
B. range, 1290 f.

Eledone verrucosa V. v, 380, pls. 52, 53; vi, 248.

B. range, 787 to 1,255 f.

Eledonella pygmaea V. vi, 145, pl. 32, f. 2. Fig. 64.

B. range, 2,949 f., off Chesapeake Bay.

Staurotenthis syrtensis V. (?) v, 382, pl. 32, f. 1-5; vi, 249.

B. range, 1,346 f., station 2034, off Nova Scotia. N.

GASTROPODA.

TOXOGLOSSA.

Admete Couthouyi Jay (= *A. viridula* Gld.)

B. range, 155 to 1,255 f. N., Arc., Eu.

Pleurotoma Dalli V. and S. v, 451, pl. 57, f. 1-1a. Figs. 66, 66a.

B. range, 94 to 142 f.*; 146 f. †

Pleurotomella Agassizii V. and S. v, 454, pl. 57, f. 3, 3a. Fig. 67.

B. range, 39 to 1,309 f.*; 1,608 f. †

Pleurotomella Bairdii V. and S. vi, 147, pl. 31, f. 1. Fig. 68.

B. range, 1,608 to 1,731 f.*; 2,221 f. †

Pleurotomella Benedicti V. and S. vi, 148, pl. 31, f. 2, 2a. Fig. 70.

B. range, 1,290 f.

Pleurotomella Sandersoni V. vi, 149, pl. 31, f. 3, 3a. Fig. 71.

B. range, 1,290 to 2,033 f.

Pleurotomella Saffordi V. and S. vi, 151, pl. 31, f. 4, 4a. Fig. 72.

B. range, 843 to 1,608 f.

Pleurotomella bandella Dall = *P. Diomedæ* V. vi, 152, 250, pl. 31, f. 5-5a. Fig. 73.

B. range, 1,290 to 2,033 f. Cb.

Pleurotomella Emertoni V. and S. vi, 154, pl. 31, f. 6. Fig. 74.

B. range, 1,917 f. † Off Chesapeake Bay. Cb.

Pleurotomella Bruneri V. and S. vi, 155, pl. 31, f. 7, 7a. Fig. 75.

B. range, 1,608 f.*; 2,033 f. †

Pleurotomella Catharinae V. and S. vi, 155, pl. 31, f. 9, 9a. Figs. 76, 76a.

B. range, 843 to 2,033 f.

Gymnobela engonia V. vi, 157.

B. range, 906 to 1,451 f. †; 1,608 f.*

Gymnobela curta V. vi, 158, pl. 31, f. 10.

B. range, 843 to 1,290 f.*; 1,467 to 1,917 f. †

Gymnobela curta, var. *subangulata* V. vi, 159.

B. range, 197 to 2,033 f. †; 1,290 to 1,451 f.*

Gymnobela brevis Verrill. 1885.

B. range, 1,290 to 1,608 f.

- Gymnobela hebes* V. v, 459, pl. 57, f. 7.
B. range, 252 to 906 f.*; 1,290 to 2,033 f.†
- Bela ovalis* Friele=*Bela pygmaea* V. v, 460, pl. 57, f. 8.
B. range, 312 to 906 f.*; 1,091 f.† N., Eu., Arc.
- Bela tenuicostata* Sars.
B. range, 843 to 1,290 f. Eu.
- Bela cancellata* (Mighels) Stimpson. v, 475, pl. 43, f. 10, 11; pl. 57, f. 13.
B. range, 126 to 547 f.† N., Arc., Eu.
- Bela subvitrea* V. vi, 160.
B. range, 843 f. Off Cape Hatteras.
- Bela subturgida* V. vi, 161.
B. range, 843 f. Off Cape Hatteras.
- Bela Rathbuni* V. vi, 236.
B. range, 1,395 f.† Off Cape Hatteras.
- Spirotropis ephamilla* V. vi, 162.
B. range, 1,917 f.†; 2,221 f.* (Off Chesapeake Bay.
- Typhlomangilia Tanneri* V. and S. vi, 163, pl. 31, f. 8. Fig. 78.
B. range, 1,290 f.
- Taranis Mörchii* (Malm) Jeffreys. v. 486, pl. 57, f. 18.
B. range, 365 f.†; 368 to 858 f.* N., Arc., Eu., Ob.
- Taranis Mörchii*, var. *tornatus* V. vi, 251.
B. range, 1,255 f. Off Nova Scotia.
- Taranis pulchella* V. v, 487, pl. 57, f. 17; vi, pl. 29, f. 8. Fig. 77.
B. range, 349 to 487 f.
- Aemete inflata* Friele=*Trichotropis inflata* Friele. vi. 178.
B. range, 1,290 f. Arc.

RACHIGLOSSA.

- Marginella borealis* V. vi, 165, pl. 29, f. 4. Fig. 79.
B. range, 64 to 100 f.†; 66½ to 81 f.*
- Volutella lachrimula* Gld. vi, 166.
B. range, 142 f.*; 516 f.† Off Cape Hatteras. S.
- Buccinum undatum* Linné. v, pl. 58, f. 10.
B. range, 6 to 123 f.*; 142½ to 843 f.† N., Arc., Eu.
- Buccinum cyanum* Brug. v, 492, pl. 43, f. 5; pl. 58, f. 11.
B. range, 101 to 150 f., off Cape Cod. N., Arc., Eu.
- Buccinum abyssorum* V. and S. vi, 167, pl. 31, f. 11-11b. Figs. 80, a.
B. range, 49 f.†; 906 to 1,309 f.*
- Sipho Stimpsonii* Mörch. v, 499, pl. 57, f. 24.
B. range, 16 to 300 f. N.
- Sipho Stimpsonii*, var. *liratulus* V. v, 500.
B. range, 18 f.†; 55 to 319 f.* N.

Sipho pubescens V. v, 501, pl. 43, f. 6; pl. 57, f. 25.

B. range, 18 to 179 f.†; 192 to 640 f.* N.

Sipho pygmaeus (Gld.) V. v, 501, pl. 57, f. 21.

B. range, 12 to 640 f. N.

Sipho parvus V. and S. v, 504, pl. 57, f. 20-20b.

B. range, 193 to 906 f.

Sipho obesus V. vi, 168.

B. range, 843 f. Off Cape Hatteras.

Sipho profundicola V. and S. vi, 170, pl. 31, f. 13. Fig. 81.

B. range, 1,497 to 1,917 f.†; 2,033 f.*

Sipho profundicola, var. *dispar* V. vi, 171.

B. range, 1,555 f.

Sipho glyptus V. v, 505, pl. 57, f. 22; pl. 58, f. 1, 1a. Fig. 82.

B. range, 193 to 547 f.

Sipho caelatus V. v, 506, pl. 57, f. 19, 19a.

B. range, 75 to 616 f.†; 302 to 516 f.*

Sipho caelatus, var. *hebes* V. vi, 172.

B. range, 640 to 1,255 f.

Sipho (*Mohnia*) *caelatulus* V. vi, 172.

B. range, 516 to 547 f.†; 906 to 1,290 f.*

Sipho (*Mohnia*) *simplex* V. vi, 174.

B. range, 99½ f.†; 843 f.*

Sipho (?) *hispidulus* V. vi, 239.

B. range, 2,033 f.* Off Delaware Bay.

Neptunea despecta (Linné) Ad., var. *tornata* (Gld.).

B. range, 69 to 100 f.† off George's Bank. N., Arc., Eu.

Neptunea decemcostata (Say) H. and A. Ad.

B. range, 6 to 322 f.†; 41 to 86 f.* N.

Trophon clavatus Sars. (?) vi, 176.

B. range, 843 to 2,033 f. Eu. (?)

Urosalpinx Carolinensis V. vi, 237.

B. range, 142 to 516 f.†; 938 f.* Off Cape Hatteras.

Urosalpinx macra V. vi, 239.

B. range, 142 f.†

Anachis Halicæti (Jeff.). v, 513, pl. 43, f. 7; vi, 252.

B. range, 79 f.†; 115 to 640 f.* N., Arc., Eu.

Astyris diaphana V. v, 513, pl. 58, f. 2.

B. range, 64 f.†; 100 to 487 f.*

Astyris pura V. v, 515.

B. range, 71 f.†; 100 to 1,255 f.*

TÆNIOGLOSSA.

Dolium Bairdii V. and S. v, 515; vi, 253, pl. 29, f. 2-2b. Figs. 83, 83a.

B. range, 89 to 234 f.†; 98 to 202 f.*

Benthodolium abyssorum V. and S. vi, 177, pl. 31, f. 12-12b. Figs. 84, 84a.

B. range, 1,395 f.†; 2,221 f.* Off Chesapeake Bay.

Natica clausa Brod. and Sowerby.

B. range, 13 to 1,255 f.†; 238 to 843 f.* N., Arc., Eu.

Lunatia heros (Say) H. and A. Adams.

B. range, 0 to 238 f. N., S.

Lunatia Grönlandica (Möll.) Ad.

B. range, 12 to 65 f.†; 75 to 1,290 f.* N., Arc., Eu.

Lamellaria pellucida, var. *Gouldii* V. v, 518, pl. 58, f. 3.

B. range, 44 to 1,497 f.

Piliscus commodus (Midd.) vi, 191.

B. range, 150 f., off Nova Scotia. Arc., Eu., P.

Capulus Hungaricus (Linné). v, 519; vi, pl. 29, f. 6.

B. range, 71* to 458 f. Eu.

Crucibulum striatum (Say) H. and A. Adams.

B. range, 3 to 65 f.*; 100 f.† N.

Crepidula plana Say.

B. range, 0 to 55 f.*; 155 to 487 f.† N., S.

Velutina lævigata (L.) Gld.

B. range, 15 to 86 f.*; 100 to 130 f.† N., Arc., Eu.

Torellia fimbriata V. and S. v, 520, pl. 57, f. 27, 27a. Fig. 85.

B. range, 142 to 321 f.

Torellia vestita Jeff. v, 521, pl. 42, f. 5.

B. range, 4 to 86 f.†; 146 to 317 f.* N., Eu.

Litiopa bombyx Rang. v, 523.

Surface.* S., O.

Cingula Jan-Mayeni (Friele) V. v, 524, pl. 42, f. 8. Fig. 86.

B. range, 238 to 1,290 f. N., Arc.

Cingula brychia V. vi, 179, pl. 32, f. 9.

B. range, 349 to 1,290 f.

Cingula syngenes V. vi, 180, pl. 32, f. 11.

B. range, 142 f.† Off Cape Hatteras.

Cingula leptalea V. vi, 182, pl. 32, f. 10.

B. range, 858 f. Off Nova Scotia.

Cingula apicina V. vi, 183, pl. 32, f. 8.

B. range, 1,608 f.

Cingula Sandersoni V. vi, 241.

B. range, 142 f.† Off Cape Hatteras.

Oithna tenella, var. *costulata* Jeff. vi, 184.

B. range, 2,033 f. Off Delaware Bay. Eu., Med., Azores.

Oithna cingulata V. vi, 184, pl. 32, f. 7.

B. range, 906 to 1,290 f.†; 1,467 f.*

Oithna (?) *olivacea* V. vi, 185, pl. 29, f. 5.

B. range, 193 to 1,290 f.†

Fossarus elegans V. and S. v. 522, pl. 57, f. 28. Fig. 87.

B. range, 100 to 142 f.†

Seguenzia formosa Jeff. vi, 186, pl. 31, f. 14¹-14b. Figs. 88, 88a.

B. range, 1,290 to 2,033 f. Eu.

Seguenzia formosa, var. *nitida* V. vi, 188.

B. range, 2,033 f. Off Delaware Bay.

Seguenzia eritima V. vi, 189, pl. 31, f. 15. Fig. 89.

B. range, 1,290 to 2,033 f.

Oerithiella Whiteavesii V. v, 522, pl. 42, f. 7.

B. range, 238 to 843 f. N.

Aporrhais occidentalis Beck.

B. range, 34 to 1,000 f.†; 115 to 349 f.* N.

PTENOGLOSSA.

Scalaria Dalliana V. and S. v, 527, pl. 57, f. 33. Fig. 91.

B. range. 85 f.†; 115 to 193 f.*

Scalaria Andrewsii V. v, 526, pl. 57, f. 35. Fig. 94.

• B. range, 100 f.†; 547 f.*

Acirca gracilis V. v, 528, pl. 57, f. 31.

B. range, 349 to 843 f.†; 487 to 547 f.*

Aclis Walleri J. v. 528, pl. 57, f. 36.

B. range, 349 f.†; 365 to 938 f.* Eu.

Ianthina fragilis Desh.

Surface.† S., O.

RHIPHIDOGLOSSA.

Rotella cryptospira V. vi, 241.

B. range, 142 f.† Off Cape Hatteras.

Ethalia multistriata V. vi, 242.

B. range, 142 f.† Off Cape Hatteras.

Leptothyra induta Watson. vi, 197.

B. range, 142 f.† Off Cape Hatteras.

Calliostoma occidentale (Mighels).

B. range, 207 f.†; 365 to 640 f.* N., Arc., Eu.

Calliostoma Bairdii V. and S. v, 530, pl. 57, f. 26. Fig. 96.

B. range, 56 to 640 f.†; 64 to 192 f.* Cb.

Margarita regalis V. and S. v, 530, pl. 57, f. 37; vi, 254, pl. 29, f. 14.
Fig. 97.

B. range, 64 to 173 f.†; 193 to 1,555 f.*

Machæroplax obscura (Couth.) Friele.

B. range, 12½ to 487 f. N., Arc., Eu.

Cyclostrema Dalli V. v, 532, pl. 57, f. 39; vi, pl. 29, f. 15. Fig. 99.

B. range, 487 to 858 f.

Cyclostrema Dalli, var. *ornatum* V. vi, 255, pl. 32, f. 17.

B. range, 843 f.

Cyclostrema cingulatum V. vi, 198, pl. 32, f. 14.

B. range. 547 f.†

Cyclostrema, sp. (= *C. affine* V. vi, 199, pl. 32, f. 15, non Jeffreys).

B. range, 365 to 858 f.†; 843 f.*

Cyclostrema diaphanum V. vi. 199, pl. 32, f. 16.

B. range, 1,290 f.*; 2,033 f.†

Tharsis, sp. vi, 201.

B. range, 843 f.† Off Cape Hatteras.

Fissurella Tanneri V. vi, 255, pl. 29, f. 13, 13a.

B. range, 104 f.*; 142 f.† Southern.

Puncturella noachina (L.) Lowe.

B. range, 16 f.†; 34 to 640 f.* N., Arc., Eu.

Puncturella (*Fissurisepta*) *erimeta* V. vi, 204, pl. 32, f. 19, 19a.

B. range, 1,451 f.

Propilidium elegans V. vi, 205.

B. range, 1,395 f. Off Chesapeake Bay.

Addisonia paradoxa Dall. v, 533; vi, 256, pl. 29, f. 10, 11-11b. Figs. 100, 100a.

B. range. 66 to 202 f.†; 71 to 156 f.* (? Eu., Med.)‡

Ooculina leptalea V. vi, 202, pl. 32, f. 20-20b. Fig. 101.

B. range, 1,395 to 2,033 f. Southern.

Ooculina spinigera Jeff. vi, 203.

B. range, 335 to 843 f. Eu.

Ooculina conica V. vi, 204.

B. range, 499 f. Off Nova Scotia.

Lepetella tubicola V. and S. v, 534, pl. 58, f. 29-29a.

B. range, 142 to 547 f.†; 134 to 396 f.* Eu.

POLYPLACOPHORA.

Hanleyia mendicaria (Migh.) Carp. v, 534.

B. range, 49 to 317 f. N. Arc., Eu., Med.

‡ By Mr. Jeffreys this species is identified with *A. eocentros* Jeff. = *Gadista eocentros* Tib., of the Mediterranean. (Proc. Z. Soc. London, 1882, p. 673.)

Trachydermon albus (Linné.) Carp.

B. range, 99 f., off Nova Scotia. Arc., Eu.

Trachydermon exaratus (Sars). vi, 208, pl. 30, f. 2-2b.

B. range, 101 to 194 f. Eu.

Leptochiton alveolus (Sars) Lovén. v, 534.

B. range, 99 to 640 f. N., Eu.

Placophora (Euplacophora) *Atlantica* V. and S. vi, 206, pl. 30, f. 1, 1b.
Figs. 102, 102a.

B. range, 122 to 640 f.

GYMNOGLOSSA.

Stilifer Stimpsoni V. v, 535, f. 2.

B. range, 6 to 1,255 f. N.

Stilifer curtus V. v, 535.

B. range, 410 to 1,255 f.

Eulima stenostoma Jeff. v, 536; vi, 254.

B. range, 843 to 1,451 f.*; 1,467 f.† N., Eu.

Turbonilla Rathbuni V. and S. v, 536, pl. 58, f. 15. Fig. 104.

B. range, 64 to 1,395 f.†; 100 to 365 f.*

Turbonilla Bushiana V. v, 537, pl. 58, f. 16.

B. range, 365 to 1,290 f.*; 1,451 to 1,467 f.†

Eulimella lucida V. vi, 192, pl. 32, f. 3, 3a.

B. range, 2,033 f.

Eulimella chariessa V. vi, 193, pl. 32, f. 4-4b.

B. range, 2,033 f.

Eulimella nitida V. vi, 194, pl. 32, f. 5.

B. range, 2,033 f.†

Eulimella (or *Monestho*) *lissa* V. vi, 195, pl. 32, f. 6.

B. range, 142 f. Off Cape Hatteras.

Odostomia tornata V. vi, 196.

B. range, 142 f.† Off Cape Hatteras.

Odostomia disparilis V. vi, 196.

B. range, 142 f.† Off Cape Hatteras.

TECTIBRANCHIATA.

Actæon nitidus V. v, 540, pl. 58, f. 21.

B. range, 238 to 843 f.*; 1,451 f.†

Actæon melampoides Dall. vi, 210.

B. range, 843 f.† Off Cape Hatteras. Ob.

Ringioura nitida V. v, 540.

B. range, 100 to 547 f.†; 120 to 487 f.* Ob.

Scaphander nobilis V. vi, 209, pl. 32, f. 18-18d. Fig. 106.

B. range, 906 f.†; 1,091 to 1,309 f.*

Scaphander puncto-striatus (Migh.) Ad.

B. range, 46 to 1,255 f.*; 1,362 to 1,467 f.† N., Arc., Eu.

Philine quadrata (Wood) Forb. and Han.

B. range, 20 to 266, f.†; 312 to 480 f.* N., Arc., Eu.

Amphisphyræ globosa Lovén. v, 543.

B. range, 115 to 155 f.†; 319 to 843 f.* N., Eu.

Diaphana gemma V. v, 543, pl. 58, f. 22.

B. range, 100 to 2,033 f.

Diaphana nitidula (Lov.) v, 543.

B. range, 155 to 906 f. Eu.

Cylichna alba (Brown) Lovén.

B. range, 12 to 1,091 f.*; 1,290 f.† N., Arc., Eu.

Cylichna (?) Dalli V. v, 542; vi, pl. 29, f. 15.

B. range, 452 to 906 f.†; 938 to 1,290 f.*

Cylichna occulta (Migh.) Ad.

B. range, 100 to 1,467 f.*; 1,608 f.† N., Arc., Eu.

Pleurobranchæa tarda V. v, 546, pl. 58, f. 26. Fig. 105.

B. range, 28 to 640 f.

Koonia obesa V. v, 545; vi, pl. 28 f. 7. Fig. 107.

B. range, 192 to 312 f.

NUDIBRANCHIATA.

Soyllæa Edwardsii V. v, 550, pl. 43, f. 10. Fig. 109.

Surface.* Wood's Holl; off Cape Hatteras. Oc.

HETEROPODA.

Atlanta Peronii Les. v, 529; vi, pl. 28, f. 4, 4a. Figs. 110, 110a.

B. range, 15½ to 1,608 f.† Oc.

Atlanta Gaudichaudii Eyd. and Soul. vi, 211. Fig. 111.

Surface.* Oc.

Atlanta rosea Soul. vi, 211.

B. range, 843 to 2,369 f.†; surface.* Oc.

Atlanta Lamanonii Eyd. and Soul. vi, 211.

B. range, 1,731 f.† Oc.

Atlanta pulchella V. vi, 211.

Surface.* Oc.

Atlanta inclinata Soul. vi, 211.

B. range, 516 to 843 f.†; surface.* Oc.

Pirolloidea Lesueurii Eyd. and Soul.

Surface.* Station 2194.

Pirola Keraudrenii Eyd. & Soul. Fig. 112.

Surface.* Stations 2038 and 2039.

PTEROPODA.

- Cymbulia calceolus* V. v, 553, pl. 58, f. 33. Fig. 120.
B. range, 18 to 1,467 f.†; surface.* Oc.
- Cavolina tridentata* (Gmelin) Gray. v, 554, f. 6, 7.
B. range, 45 to 2,033 f.†; surface.* Oc.
- Cavolina uncinata* (D'Orb.) Gray. v, 554. Fig. 116.
B. range, 64 to 1,608 f.†; surface.* Oc.
- Cavolina longirostris* (Les.) v, 555.
B. range, 64 to 2,033 f.†; surface.* Oc.
- Cavolina gibbosa* (Rang). vi, 213.
B. range, 193 to 1,451 f.† Oc.
- Cavolina quadridentata* (Lesueur). vi, 212.
B. range, 142 to 1,467 f.† Oc.
- Cavolina angulata* (Soul). vi, 213.
Surface.* Oc.
- Cavolina inflexa* (Les.) Gray. v, 555.
B. range, 487 to 1,467 f.† Oc.
- Pleuropus Hargerii* V. v, 555; vi, pl. 28, f. 3. Fig. 114.
Surface.* Oc.
- Diacria trispinosa* Gray. Fig. 115.
B. range, 64 to 1,451 f.†; surface.* Oc.
- Olio pyramidata* Linné. v, 555.
B. range, 64 to 2,033 f.† Oc.
- Balantium recurvum* Children. v, 556
B. range, 64 to 1,917 f.† Oc.
- Triptera columnella* (Rang). v, 557; vi, 214. Fig. 117.
B. range, 142 to 1,608 f.† Oc., S.
- Styliola virgula* (Rang). vi, 213.
Surface.* Oc., S.
- Styliola virgula*, var. *corniformis* (D'Orb.). vi, 214.
Surface.* Oc., S.
- Styliola subulata* (Quoy and Gaimard). vi, 213.
B. range, 15½ to 1,467 f.†; surface.* Oc., S.
- Styliola recta* Blainv. v, 556. Fig. 118.
Surface.* Oc., S.
- Spirialis retroversus* (Flem.), var. *MacAndrei* Forbes. v, 557.
B. range, 499 to 1,731 f.†; Surface.* Oc., Eu., Med.
- Spirialis Gouldii* St. (? *S. balea* Möll., var.).
B. range, 858 to 1,735 f.† Oc., N., Eu.
- Spirialis bulimoides* Soul. vi, 215.
Surface.* Oc., S.

Spirialis trochiformis Soul. vi, 214.

Surface.* Oc., S.

Clione papilionacea Pallas. Fig. 122.

Surface.* Oc., N., Arc., Eu.

Clione longicaudata Soul. vi, 215.

Surface.* Oc.

Trichocyclops Dumercilii (Oken) Esch. vi, 215.

Surface.* Oc.

SOLENOOONCHA.

Dentalium solidum V. vi, 215.

B. range, 843 to 1,309 f.

Dentalium striolatum Stimp.

B. range, 25 to 115 f.†; 146 to 1,255 f.* N., Eu.

Dentalium occidentale Stimp. v, pl. 42, f. 16-18. Figs. 123, 124, 125, a.

B. range, 26 to 115 f.†; 146 to 1,255 f.* N., Eu.

Dentalium occidentale, var. *sulcatum* V. vi, 217.

B. range, 75 to 1,255 f.*

Dentalium, sp. g. vi, 217.

B. range, 1,731 to 2,033 f. Southern.

Dentalium, sp. h. vi, 217.

B. range, 843 f.†; 2,033 f.* Southern.

Siphodentalium vitreum M. Sars. v, 557, pl. 42, f. 19.

B. range, 100 f.†; 349 to 1,290 f.* N., Arc., Eu.

Siphodentalium teres Jeff. vi, 218.

B. range, 843 f.†; 858 to 1,290 f.* Eu.

Siphonentalis affinis (Sars). v, 558, pl. 42, f. 20, a, b.

B. range, 349 to 365 f.†; 499 to 1,731 f.* N., Eu., Azores.

Oadulus Pandionis V. and S. v, 558, pl. 53, f. 30, 30a. Fig. 126, a.

B. range, 85 to 487 f.*; 516 f.† (? Eu., Med., Af.).

Oadulus Watsoni Dall. vi, 219.

B. range, 197 to 938 f.†; 547 to 843 f.* Ob.

Oadulus grandis V. vi, 219.

B. range, 843 to 1,290 f.†; 906 to 1,098 f.*

Oadulus spectabilis Verrill. 1885.

B. range, 1,467 f.†

Oadulus Jeffreysii ? (Monteros). v, 559; vi, 257.

B. range, 115 f.*; 516 to 843 f.† Eu., Azores.

Oadulus subfusiformis Jeff.

B. range, 100 to 115 f. Eu., Med.

Oadulus cylindratus Jeff. vi, 220.

B. range, 1,608 f. Eu.

LAMELLIBRANCHIATA.

Teredo megotara Hanley. Fig. 127, animal.

B. range, 55 f.†; 100 to 1,467 f.*; surface* in wood. S., O., Eu.

Xylophaga dorsalis (Turt.) F. and Han. v, 559, pl. 44, f. 9.

B. range, 32 to 2,033 f. N., Eu., Med.

Ensatella Americana (Gld.) V.

B. range, 0 to 28 f.*; 64 to 89 f.† N., S.

Saxicava Norvegica (Speng.) Woodw.

B. range, 20 to 506 f.†; 300 f.* N., Arc., Eu., P.

Cyrtodaria siliqua (Speng.) Woodw.

B. range, 28 to 258 f.† N., Arc.

Poromya sublevis V. vi, 221, pl. 32, f. 21. Fig. 128.

B. range, 1,917 f.† Off Chesapeake Bay.

Neara obesa Lovén. v, 563, pl. 44, f. 10, c.

B. range, 192 to 1,290 f.; 20 to 150 f. N. of Cape Cod. N., Arc., Eu., Azores.

Neara glacialis G. O. Sars. v, 562, pl. 44, f. 10, a, b.

B. range, 64 to 547 f. N., Arc., Eu.

Neara rostrata (Speng.) Lovén. v, 562, pl. 58, f. 39.

B. range, 65 to 487 f.†; 85 to 155 f.* N., Eu., Med., Af., Azores, Ch., Patagonia.

Neara lamellosa M. Sars. v, 561; vi, pl. 30, f. 3.

B. range, 319 to 547 f. Eu., Med., Af.

Neara gigantea V. vi, 223.

B. range, 1,917 f.† Off Chesapeake Bay.

Neara undata V. vi, 223.

B. range, 2,221 f.† Off Chesapeake Bay.

Neara, sp.

B. range, 142 f. Off Cape Hatteras.

Periploma papyracea (Say) Con.

B. range, 7 to 1,255 f. N.

Cochlodesma Leanum Couth.

B. range, 2 to 20 f.*; 65 f.† S.

Thracia Conradi Couth.

B. range, 4 to 193 f.†; 34 f.* N.

Thracia nitida V. vi, 221, pl. 32, f. 22. Fig. 130.

B. range, 1,917 f. Off Chesapeake Bay.

Pecchiolia abyssicola Sars. v. 565.

B. range, 192 to 487 f.*; 516 to 1,290 f.† N., Arc., Eu.

Pecchiolia gemma V. v, 565; vi, 258, pl. 30, f. 7, 8.

B. range, 75 to 1,290 f.†; 499 to 906 f.*

Mytilimeria flexuosa V. and S. v, 567, pl. 58, f. 38; vi, 258. Figs. 132, a, b.

B. range, 75 to 319 f.†; 349 f.*

Ceronia arctata (Con.) Ad.

B. range, 0 to 183 f.†; 0 to 2 f.* N.

Abra longicallis (Scacchi). vi, 224.

B. range, 1,467 f.† Eu., Med., Canaries, Af., Azores, Ob.

Macoma sabulosa (Speng.) Mörch.

B. range, 30 to 208 f.†; 29 to 1,255 f.* N., Arc., Eu., P., As.

Cyprina Islandica (Linné) Lam.

B. range, 8 to 128 f.*; 130 to 349 f.† N., Arc., Eu.

Astarte castanea Say.

B. range, 0 to 100 f.*; 142 to 435 f.† N., S.

Astarte undata Gld.

B. range, 8 to 480 f. N.

Astarte crenata Gray.

B. range, 34 to 640 f. N., Arc., Eu., As.

Venericardia granulata (Say)=*borealis* Con. v, 572; vi, 258.

B. range, 8 to 435 f.†; 9 to 192 f.* N.

Loripes lens V. and S. v, 569; vi, 259.

B. range, 5 to 192 f.†; 120 f.* N.

Lucina flosa Stimp.

B. range, 4 to 349 f.†; 20 to 30 f.* N.

Cryptodon subovatus (J.) V. v, 570.

B. range, 480 f.†; 499 f.* Eu., Af.

Cryptodon Gouldii (Phil.) Stimp.

B. range, 6 to 1,467 f. N., Eu.

Cryptodon obesus V. v, 569.

B. range, 12 to 100 f.†; 115 to 1,290 f.* N.

Cryptodon grandis V. 1885.

B. range, 938 f.†, 1883; 965* and 1,582 fathoms†, 1884.

Cryptodon ferruginosus (Forbes). v, 570.

B. range, 100 to 1,467 f. N. Arc., Eu., Med.

Cryptodon tortuosus (Jeff.). vi, 226.

B. range, 499 to 1,290 f. Eu.

Azinopsis, sp. nov.

B. range, 1,451 f.

Diplodonta turgida V. and S. v, 569, pl. 58, f. 42; vi, pl. 30, f. 10, 11.

Figs. 135, 136.

B. range, 65 to 98 f.†

Montacuta tumidula Jeff. vi, 225.

B. range, 843 to 1,091 f. Southern. Eu.

Kelliella, sp. nov.

B. range, 2,033 f.

Yoldia thraciformis (Storer) Stimp. Figs. 137, 138, animal.

B. range, 29 to 182 f.†; 192 to 906 f.* N.

Yoldia sapotilla (Gld.) Stimp. Fig. 139, animal.

B. range, 4 f.†; 12 to 321 f.* N., Arc.

Yoldia expansa Jeff.

B. range, 365 f.*; 1,451 to 1,467 f.† Eu.

Yoldia luoida Lovén. v, pl. 44, f. 1.

B. range, 29 to 1,608 f.†; 115 to 1,290 f.* N., Arc., Eu., Med.

Yoldia frigida Torell. v, 573, pl. 44, f. 2.

B. range, 157 to 1,255 f. N., Arc., Eu., Med., As.

Yoldia Jeffreysi (Hidalgo). vi, 229.

B. range, 349 f.*; 499 to 1,290 f.† Eu., Med., Af., Azores, Ob.

Yoldia subequilatera (Jeff.). vi, 229.

B. range, 499 to 1,731 f. Eu., Arc.

Yoldia sericea Jeffreys, var. *striolata* J. vi, 226.

B. range, 516 to 1,731 f. Eu.

Yoldia Messanensis (Seguenza), var. vi, 227.

B. range, 1,451 to 2,033 f.†; 1,467 f.* Eu., Med., Azores, Ob.

Leda Bushiana V. vi, 229.

B. range, 516 f. Off Cape Hatteras.

Leda tenuisulcata (Couth.) Stimp.

B. range, 25 to 120 f.†; 640 f.* N.

Phaseolus ovatus ? (Jeff. MSS.). vi, 230.

B. range, 1,290 f. († Eu.)

Malletia obtusa (M. Sars) Mörch. vi, 226.

B. range, 516 f.†; 788 to 1,608 f.* Eu., Med.

Glomus nitens Jeff. vi, 231.

B. range, 1,608 f.† Eu.

Nucula delphinodonta Mighels.

B. range, 10 to 1,290 f. N., Arc., Eu.

Nucula proxima Say.

B. range, 3 to 302 f.*; 310 to 516 f.† S.

Nucula tenuis (Mont.) Turton.

B. range, 75 to 266 f.†; 302 to 1,255 f.* N., Arc., Eu., Med., Ob., P., As.

Nucula cancellata Jeff. vi, 231.

B. range, 858 f.†; 906 to 2,033 f.* Eu., Azores.

Nucula granulosa Verrill. vi, p. 280.

B. range, 487 to 858 f.*

- Arca pectunculoides* Sc. v, 573, pl. 44, f. 6.
B. range, 79 to 640 f. N., Eu., Med., Cb.
- Arca pectunculoides*, var. *septentrionalis* Sars. v, 573.
B. range, 79 to 640 f. N., Arc.
- Limopsis minuta* (Phil.) v, 576.
B. range, 64 to 115 f.†; 120 to 2,221 f.* N., Arc., Eu., Med., Af., Azores.
- Limopsis cristata* Jeff. v, 577; vi, 231.
B. range, 549 f.† Eu., Med.
- Limopsis plana* Verrill, 1885.
B. range, 197 to 2,221 f.
- Limopsis tenella* Jeff. vi, 232.
B. range, 1,731 to 2,033 f. Eu.
- Mytilus edulis* Linné.
B. range, 0 to 57 f.*; 1,608 f.† (perhaps from surface *Fuci*). Oc., S., N., Arc., Eu., Med., P., Antarctic.
- Modiola modiolus* (Linné) Turton.
B. range, 0 to 115 f.*; 202 f.† N., Arc., Eu., P., As.
- Modiolaria discors* (Linné) Lovén.
B. range, 15 to 90 f. N., Arc., Eu., Med., P., As.
- Idas argenteus* Jeff. v, 579; vi, pl. 30, f. 16, 16a.
B. range, 335 to 2,033 f.* in wood. Surface† (in wood). Eu.
- Dacrydium vitreum* (Möll.) Torell. v, 579, pl. 44, f. 8, 8a.
B. range, 300 f.†; 312 to 1,555 f.* N., Arc., Eu., Med., Af., Azores.
- Pecten Clintonius* Say. vi, 261.
B. range, 8 to 349 f.†; 13 to 146 f.* N.
- Pecten Islandicus* Müller.
B. range, 33 to 122 f.*; 124 to 194 f.† N., Arc., Eu., P., As.
- Pecten glyptus* V. v. 580.
B. range, 69 to 156 f.†
- Pecten vitreus* (Gmel.) Wood. v, 580, pl. 42, f. 21.
B. range, 57 to 64 f.†; 100 to 787 f.* N., Arc., Eu., Med., Af.
- Pecten pustulosus* V. v, 581, pl. 42, f. 22, 22a; vi, 261. Figs. 142, a.
B. range, 99 to 321 f.*; 365 to 547 f.† N., Eu.†
- Pecten leptaleus* V. vi, 232.
B. range, 142 f. Off Cape Hatteras.
- Pecten fragilis* Jeff. vi, 232.
B. range, 843 f. Off Cape Hatteras. Arc., Eu., Azores.
- Limæa subovata* (Jeff.) Monteros. v, 580.
B. range, 100 to 1,362 f.†; 252 to 1,290 f.* Eu., Arc., Med., Azores.
- Avicula hirundo*, var. *nitida* V. v, 582, pl. 58, f. 43.
B. range, 64 to 192 f. Oc.
H. His. 67—37

Avicula squamulosa? Lam. vi, 233.

Surface. S., Oc.

Anomia aculeata Müll.

B. range, 4 to 640 f. N., Arc., Eu.

BRACHIOPODA.

Terebratulina septentrionalis (Couth.)

B. range, 16 to 396 f. N., Arc., Eu., Af.

Waldheimia cranium (Müller) Davidson. vi, 234.

B. range, 1,362 f.† Arc., Eu., P.

Discina Atlantica King. vi, 233.

B. range, 1,251 to 1,467 f.† Eu., Arc., Med., Australia.

FAUNA OF THE SHALLOW WATER NEAR CAPE HATTERAS.

The first and the last trips of the season were made to the waters off Chesapeake Bay and Cape Hatteras. In that region, besides some interesting hauls that were made in deep water, a few were made in shallow water, during the stormy weather encountered on the last trip. These were near the coast, in 15 to 145 fathoms (stations 2107 to 2109, 2112 to 2114). They proved to be of great interest, for scarcely anything had been previously known respecting the fauna inhabiting the outside waters, in moderate depths, off our Southern Atlantic coasts north of Florida, most of the inshore collecting in that region having been carried on in the harbors and sheltered sounds, while the dredgings by the "Blake" and "Fish Hawk" were mostly in deep water far from the shore.

From these few shallow-water dredgings made by the "Albatross" a large number of interesting additions to the known Mollusca of the Atlantic coast have been obtained. Many of these are West Indian species, not known before from north of Cuba, while a considerable number are undescribed. Among the interesting discoveries was a handsome living *Conus* of good size, from 48 fathoms. It resembles the *Conus Delessertii* Recluz. The general character of the Mollusca is decidedly more tropical, or rather "warm-temperate," than that of the shore fauna of the adjacent coast. But with the southern forms, such as species of *Conus*, *Oliva*, *Olivella*, *Marginella*, *Cancellaria*, *Semicassis*, *Solarium*, &c., there are also many northern species, common on the New England coast, but hitherto not known to live so far south. It appears very strange to see West Indian and northern or even Arctic species mingled together in the same haul of the dredge. The mildness and unusual uniformity of temperature during the whole year, due to the greatly diminished volume, or absence of the arctic current, over

the inshore plateau, and to the effect of the Gulf Stream in winter, are doubtless the causes of this peculiar assemblage.

These shallow-water shells, which are mostly of small size, have been studied with care by Miss K. J. Bush, who has identified many of the known species and described several of the new ones. I am greatly indebted to her for the accompanying list of the species already determined, but the study of these shells is not yet completed, and this list must, therefore, be regarded only as a partial one.†

The representatives of other groups were of less importance than the shells, but several interesting southern species of Echinoderms and Anthozoa were taken, of which the bathymetrical range is little known. Among these were specimens of the branched coral, *Oculina implicata* V., and the leaf-like *Renilla reniformis* Cuv. The southern shallow-water star-fishes, *Luidia clathrata* Say and *Astropecten articulatus* Say, also occurred in these localities, in 14 to 25 fathoms. During the more extended explorations in the same region in 1884, *Ophiothrix angulata* and *Amphiura elegans* (= *tenuis* Ayres) occurred in 16 fathoms, while the curious West Indian *Astroporpa annulata* occurred several times, of large size, clinging to the Gorgonian, *Titanidæum suberosum* V., in 48 to 68 fathoms.

LIST OF THE SHALLOW-WATER MOLLUSCA DREDGED OFF CAPE HATTERAS BY THE "ALBATROSS" IN 1883.

By Miss K. J. Bush.

The following list is not intended as a complete list of the shells of this region, but is nearly complete for the work of 1883. Many additional species were dredged in the same region, in the autumn of 1884. The bathymetrical range refers only to the collection of 1883. Most of the common species also occur in very shallow water in the harbor of Beaufort, N. C., or even at low-water mark. An asterisk (*) indicates specimens living; a dagger (†), dead shells only.

CEPHALOPODA.

Sthenoteuthis Bartramii (Lesueur) Verrill.
Surface.*

GASTROPODA.

TOXOGLOSSA.

Conus Delessertii (†) Recluz.
B. range, 48 fathoms.*

† Another and more extensive series of dredgings in shallow water in the same region was made by the "Albatross" in 1884, by which a much larger collection was obtained, including, besides many additional Mollusca, a great variety of interesting Crustacea, among which there are many species not before known from the Atlantic coast of the United States. The additions to the Brachyura are especially interesting and numerous. Many are Floridian and West Indian species.

Mangilia rubella Kurtz and Stimpson.

B. range, 14 fathoms; † 15 fathoms.*

Mangilia cerina (Stimp.) Verrill.

B. range, 14 to 15 fathoms.†

Mangilia ephamilla Bush, sp. nov.

B. range, 14 to 15 fathoms; † 48 fathoms.*

Shell of moderate size, rather stout, with a regularly tapered, acute spire, consisting of about five sharply angulated whorls below the nucleus. Suture marked by a distinctly raised, rounded, undulating spiral thread. Nucleus small, prominent, semi-transparent, glassy, composed of about two and a half turns, with a small, rather prominent apical whorl, which, with the second, is very smooth; the third is crossed by delicate, curved, transverse riblets, which are rendered somewhat nodulous by the intersection of a single, faint, revolving, median thread: the others have about nine broad, prominent, acute, straight, longitudinal ribs extending from suture to suture, and separated by deep, concave interspaces about equal in width to the ribs. The whole surface is covered with distinctly raised, rounded cinguli and microscopic threads, which are roughened by the intersection of the fine lines of growth, and, under the microscope, have the appearance of being covered with minute grains of sand. The cingulus at the center, defining the shoulder of the whorls, is the most conspicuous; above this there are about five finer ones, and below, on the whorls of the spire, two or three, the number increasing to ten or twelve on the body-whorl. The aperture is a little less than half the length of the shell, narrow, oblong, broadest at its posterior third, pinched up anteriorly into a straight, slightly elongated canal. Outer lip thin (broken); inner lip inconspicuous. No operculum.

Color in alcohol deep yellow, with white ribs and canal.

Length of largest specimen, 6.5^{mm}; breadth, 3^{mm}; length of aperture, 3^{mm}; its breadth, .5^{mm}.

One living specimen (No. 35,404) was taken at station 2,108; also, young dead specimens at stations 2,112 (No. 35,884), and at 2,114 (No. 35,515).

This species is closely allied to *M. cerina*, but differs in having a stouter form, more angularly shouldered whorls, and especially in having very prominent, straight ribs extending from suture to suture.

Mangilia melanitica Dall, var. *oxia* Bush.

B. range, 14 to 15 fathoms.*

Shell small, slender, fusiform, lustrous, transparent, glassy, with a tall, regularly tapered, acute spire; whorls eight, slightly convex, angulated, carinated, with the suture defined by a distinct, smooth, rounded thread; nucleus large, acute, consisting of three and a half rapidly tapering coils, with a small, very prominent, decidedly upturned apical

whorl, smooth, with the exception of a distinct median keel on the two lower whorls. Sculpture consists of about seventeen very thin, slightly raised, strongly recurved riblets extending from suture to suture, rendered nodulous by the intersection of a rather broad, smooth, rounded median carina. The greatest curvature of the transverse riblets is above the carina on the wide, slightly concave subsutural band, which is crossed also by the lines of growth, and in some specimens by numerous microscopic revolving striæ. On the body-whorl, from the posterior end of the aperture to the end of the canal, there are about twelve rather fine, smooth, rounded cinguli; the first, situated just above the suture and a little wider and more prominent than the others, is rendered nodulous by the crossing of the transverse riblets, at which they abruptly end, and is separated from the second by a rather wide, smooth space, crossed only by the microscopic lines of growth; the space between the others decreases so that, on the canal, they are rather close together. On some of the specimens, there is an additional cingulus midway between the carina and the first cingulus; and three or four of the transverse riblets, and sometimes all of them, on the dorsal surface, extend as nearly straight lines to the base of the canal. The aperture, in immature specimens, is rather broad-ovate, with a thin, slightly curved outer lip, having a very shallow, wide posterior sinus, and the columella has a slight sigmoid curvature, most decided at its posterior third, while in more mature specimens the aperture is very narrow-oblong, with a very much thickened outer lip, forming a conspicuous white varix with a thin brown edge bending in and partly closing the aperture, and with a deep, narrow, oblique sinus considerably below the suture. Some specimens have about four smooth, raised, rounded, revolving threads on the interior of the aperture, which form, by their abrupt terminations, conspicuous nodules within the margin of the outer lip. The outer lip also increases posteriorly and joins the inner lip a little below the suture, thus considerably shortening the aperture. Columella nearly straight, with a row of from four to six very minute white crenulations just within the thin free edge of the inner lip; canal very short, narrow at its base, but suddenly widened by the abrupt outward turning of the lip.

Color of fresh specimens, when dry, amber, with lighter tinted carina, and red-brown edged aperture; some specimens are also irregularly spotted with red-brown.

Length of a medium-sized mature specimen, 5^{mm}; its breadth, 2^{mm}; length of aperture, 1.75^{mm}; its breadth, .5^{mm}. A specimen without the thickened lip has an aperture 2^{mm} long and nearly 1^{mm} broad.

Found in large numbers, both living and dead.

Mr. W. H. Dall considers this shell identical with a species from Florida to which he has given the name, *melanitica* (MSS.), but admits a varietal difference.

Mangilia oxytata Bush, sp. nov.

B. range, 48 fathoms.†

At station 2,108, a single dead specimen (No. 35,395), somewhat resembling the preceding, was taken.

It consists of about eight whorls; those of the spire strongly angulated just below the middle, and ornamented with about nine rather prominent, straight, transverse ribs, commencing at the periphery and extending to the suture; these, with their wide, concave interspaces, are crossed by three rather strong, nearly smooth, rounded, equally distant carinæ, the third defining the suture. Smooth, oblong nodules are formed by the intersection of these with the ribs, those on the periphery being the most conspicuous, as the first carina is slightly wider than the other two. The subsutural band is wide, slightly concave, crossed by delicate, excurved, raised lines or riblets extending from the suture to the median carina, and by three or four fine, slightly raised, equally distant, revolving threads. The nucleus is large, semi-transparent, shining, composed of four and a half turns, with a small, exceedingly prominent, decidedly upturned, apical whorl, which, with the two following, is smooth and glassy; the next two have a fine, smooth median carina. On the body-whorl the ribs continue to the base of the siphon, and are crossed by small, nearly smooth, rounded, equally distant cinguli, which commence a little below the third principal carina and continue to the end of the canal. The entire surface is covered with very minute microscopic granules. Aperture narrow-ovate, pinched up anteriorly into a short, rather narrow, straight canal. Outer lip very much thickened, with a conspicuous varix and a thick, smooth, rounded, very irregularly curved, light brown edge, and a deep, narrow sinus considerably below the suture, at the angle of the shoulder; inner lip inconspicuous; columella slightly curved.

Color yellowish white, tinged with brown just below the suture, and on the anterior part of the body-whorl.

Length, 5^{mm}; breadth, 2.5^{mm}; length of aperture; 2^{mm}; its breadth, 1^{mm}.

This species, although closely resembling the preceding, is sufficiently characterized in having a much stouter form, more acute apex, more angularly shouldered whorls, fewer and more prominent ribs, more numerous cinguli, and especially in having its entire surface microscopically granulated.

Mangilia ? glypta Bush, sp. nov.

B. range, 48 fathoms.†

Shell small, semi-transparent, fusiform, with about five slightly convex whorls below the nucleus, which consists of three and a half smooth, transparent, white, glassy, regularly increasing turns. The apical whorl is small, not very prominent, somewhat oblique. The sculpture consists of about ten rather indistinct, narrow, longitudinal ribs, and broad,

rounded, very conspicuous cinguli, which, in crossing the ribs, form prominent, smooth, white, oblong beads or nodules; there are three rows of these on the whorls of the spire, and five or six on the body-whorl, the second and third below the suture being more prominent and farther apart than the others. Cinguli without nodules continue to the end of the canal, the transverse ribs disappearing at its base. Aperture a little more than one-third the length of the shell, narrow-ovate, pinched up anteriorly into a very narrow, short canal; outer lip thickened, forming a slight varix, with a thin, white edge and a shallow sinus, close to the suture, with one or two minute white crenulations just within its posterior edge; there are also about five similar but much larger crenulations on the inner margin of the lip, extending from the sinus to the base of the canal. Inner lip continuous with the outer, with a free, thin, white edge, having four or five minute white crenulations just within its inner margin. Canal short, narrow, bent slightly backward at its anterior end, with a decided, but shallow, notch.

Color of dead specimens, in alcohol, light brown; when dry, dirty white. One fresh specimen has a light brown, lamellose epidermis. It may belong to *Pisania*.

Length of a specimen with imperfect nucleus, 5^{mm}; its breadth, 2.5^{mm}; length of aperture, 2.5^{mm}; its breadth, 1^{mm}.

Three imperfect specimens, (No. 35,363) were taken at station 2,108.

Acus dislocatus (Say).

B. range, 14 to 15 fathoms.†

Acus concavus (Say).

B. range, 14 to 15 fathoms.†

Acus protextus (Conrad) Dall.

B. range, 48 fathoms.†

Cancellaria reticulata (Linné).

B. range, 14 fathoms.†

RACHIGLOSSA.

Oliva literata Lamarck.

B. range, 14 to 15 fathoms.*

Olivella mutica (Say).

B. range, 14 to 15 fathoms;* 48 fathoms.†

Fulgur carica Conrad.

Nassa consensa Ravenel.

B. range, 14 to 48 fathoms.†

Tritia trivittata (Say) H. & A. Adams.

B. range, 14 to 15 fathoms.†

Eupleura caudata (Say) H. & A. Adams.

B. range, 15 fathoms.†

Anachis avara (Say) Perkins.

B. range, 14 fathoms;† 48 fathoms.*

calaria multistriata Say.

B. range, 14 to 15 fathoms.†

calaria angulata Say.

B. range, 14 to 15 fathoms.†

olarium granulatum Lamarck.

B. range, 48 fathoms.*

RHIPHIDOGLOSSA.

Rissurella alternata Say.

B. range, 14 fathoms.†

GYMNOGLOSSA.

Obeliscus crenulatus Holmes.

B. range, 15 fathoms; † 48 fathoms.*

Eulima oleacea Kurtz and Stimpson.

B. range, 15 fathoms.†

Niso ægleës Bush, sp. nov.

B. range, 14 to 15 fathoms.*

Shell of moderate size, regularly tapered, conical, thin, semi-transparent, smooth, shining, consisting of about twelve closely coiled, flattened whorls, with the suture indistinct, defined by a thread of dark, chestnut-brown, above and below which there is an indefinite band of yellowish-white, gradually shading, towards the center of the whorls into light yellow or brown, sometimes mingled with purple. The nucleus is small, consisting of about three regularly coiled whorls of a light purple or amethystine color. Base prominent, angulated, with a moderately large and deep umbilicus, margined by a dark chestnut-brown thread. Aperture nearly quadrangular, the angles being formed at the termination of the dark threads, defining the base and the umbilical region, somewhat produced at the anterior angle, forming an indistinct notch. Outer lip thin, with a dark chestnut-brown edge; inner lip regularly curved, slightly reflected over the umbilicus, with a somewhat thickened, dark chestnut-brown edge; just back of this there runs across the base, from within the umbilicus to the sutural thread, a thread or streak of the same dark chestnut-brown color, and throughout the entire length of the shell, with the exception of the nucleus, similarly colored streaks occur, crossing the whorls at irregular intervals. In specimens somewhat eroded, fine but distinct lines of growth cross the whorls at pretty regular intervals, and even in fresh specimens indications of them are occasionally seen. Operculum horny, very thin, light yellow.

Length of the largest specimen, 7.5^{mm}; its breadth, 3.5^{mm}; length of aperture, 2.5^{mm}; its breadth, 2^{mm}.

A few living and several dead specimens were taken.

Odostomia cancellata (D'Orbigny).

B. range, 14 to 15 fathoms.†

TECTIBRANCHIATA.

Philine Sagra (D'Orbigny).

B. range, 15 fathoms.†

Cylichna biplicata (Lea).

B. range, 14 to 15 fathoms.*

Volvula, sp. nov.

B. range, 14 to 15 fathoms.*

Bulla Candeï D'Orbigny.

B. range, 15 fathoms.†

Utriculus canaliculatus (Say) Stimpson.

Pleurophyllidia Cuvieri Meckel.

B. range, 15 fathoms.*

HETEROPODA.

Atlanta Peronii Lesueur.

B. range, 15 to 843 fathoms.†

Atlanta inclinata Souleyet.

B. range, 15 to 843 fathoms.†

PTEROPODA.

Cavolina uncinata (D'Orbigny) Gray.

B. range, 48 to 843 fathoms.†

Cavolina longirostris Lesueur.

B. range, 14 to 938 fathoms.†

Cavolina quadridentata (Lesueur).

B. range, 15 to 192 fathoms.†

Diacria trispinosa Gray.

B. range, 15 to 843 fathoms.†

Olio pyramidata Linné.

B. range, 48 to 938 fathoms.†

Styliola virgula (Rang).

B. range, 15 fathoms.†

Styliola subulata (Quoy and Gaimard).

B. range, 15 to 843 fathoms.†

Styliola recta Blainville.

B. range, 15 fathoms.†

SOLENOCONCHA.

Dentalium leptum Bush, sp. nov.

B. range, 14 to 15 fathoms.†

Shell of moderate size, very slender, slightly curved posteriorly, rather thin, delicate, with a very smooth and glossy surface, destitute of sculpture, except at the posterior end, which is covered with numerous,

crowded, very fine, raised, longitudinal lines visible only under the lens. Anterior aperture round with a sharp, thin edge; posterior aperture somewhat thickened, very small, round, slightly oblique, with a deep, narrow, dorsal notch. Color delicate salmon, or yellow, gradually shading into white toward the anterior end. Several dead specimens.

Length, 31.5^{mm}; diameter of anterior aperture, 2^{mm}; posterior aperture, about .5^{mm}.

Cadulus Carolinensis Bush, sp. nov.

B. range, 14 fathoms; † 15 to 48 fathoms.*

Shell of medium size, semi-transparent, very glossy, white, circular throughout its entire length. Greatest diameter at about the anterior third, diminishing slightly to the round, very oblique, anterior aperture, and backward to the posterior end, at first very gradually and farther back very rapidly. Curvature well marked in some specimens, very slight in others, nearly uniform dorsally; but ventrally, most decided in the posterior third. Posterior aperture very small, round, a little oblique, with four small, distinct notches, two on each side. A few living, and many dead specimens.

Length, 9.5^{mm}; greatest diameter, about 2^{mm}; diameter of anterior aperture, 1^{mm}; posterior aperture, .4^{mm}.

LAMELLIBRANCHIATA.

Ensatella Americana (Gould) Verrill.

B. range, 15 fathoms.†

Corbula disparilis D'Orbigny.

B. range, 14 to 15 fathoms.†

Corbula Swiftiana C. B. Adams.

B. range, 14 to 15 fathoms; † 48 fathoms.*

Neera costata Bush, sp. nov.

B. range, 48 fathoms.*

Shell moderately thick, compressed, triangular-ovate, with a contracted and somewhat elongated rostrum, and with three or four very prominent, curved, distant, radiating ribs on the convex part of the valves, and with a few smaller and closer ones anteriorly. Umbos high, smooth; beaks somewhat curved backward. The dorsal margin, from the beaks to the end of the rostrum, is strongly and regularly concave, the rostrum being a little upturned or straight at the tip; anteriorly, the dorsal margin is convex, and falls off abruptly to the obtusely rounded anterior end. The ventral margin is broadly rounded and projects outward in an acute angle at the projection of each of the principal ribs; the intervals between these angles are usually concave, and beyond the hindermost rib the outline recedes in a concave curve to the origin of the rostrum, which is rapidly narrowed to near the tip. Of the three principal radiating ribs, the middle one runs from the beak nearly to

the middle of the ventral margin, curving a little backward; the hindermost terminates about midway between the former and the end of the rostrum, curving strongly backward; the most anterior one ends about midway between the middle one and the anterior end of the shell; midway between this and the middle one, there is a smaller secondary rib. These three primary ribs are strongly elevated, not very broad, with the summit rather thin, finely notched by the concentric lines of growth; the most posterior rib is the largest and highest, and projects most at the margin. Between these ribs the spaces are wide and strongly concave, marked by numerous and regular lines of growth. On the anterior end of the shell there are two or three smaller radiating ribs, which are separated by intervals about equal to their own breadth, and give the margin a slightly crenulated appearance. The rostrum is narrow, strongly compressed, with both the dorsal and ventral outline concave. Two small ridges run from the beak to the tip of the rostrum, separated by a very narrow, flattened area. The right valve has two well-marked lateral teeth, the posterior one considerably longer and larger than the anterior; between these there is a small, ovate cartilage-pit. The inner surface of the valves shows deeply indented grooves corresponding to the primary external ribs. Color, opaque white. Epidermis indistinct.

Length of the largest specimen, 6^{mm}; height, 4^{mm}; thickness, 4^{mm}.

Four living and one dead specimens (No. 35,362) were found at station 2,108.

This species bears considerable resemblance to *N. ornatissima* D'Orb., but the ribs are less numerous, more curved, and the primary ones are much larger and more widely separated, and the shell is less convex. There is no other similar species known from the Atlantic coast.

Clidiophora trilineata (Say) Carpenter.

B. range, 14 to 15 fathoms.†

Pandora, sp.

B. range, 14 to 48 fathoms.†

Spisula solidissima (Dillwyn) Gray.

B. range, 14 to 15 fathoms.†

Macha strigillata (Linné), var. (†)

B. range, 15 fathoms.†

Tellina alternata Say.

B. range, 15 fathoms.†

Tellina lintea Conrad.

B. range, 14 to 15 fathoms.†

Tellina iris Say.

B. range, 15 fathoms.*

Angulus tener (Say) Adams.

B. range, 14 to 15 fathoms; * 48 fathoms.†

Strigilla flexuosa (Say).

B. range, 15 fathoms.†

Abra equalis Say.

B. range, 14 fathoms;* 15 to 48 fathoms.†

Mulinia lateralis (Say) Gray.

B. range, 14 to 15 fathoms.†

Venus mercenaria Linné.

B. range, 14 to 15 fathoms.†

Dosinia discus Reeve.

B. range, 14 to 15 fathoms.†

Dosinia obovata (Conrad).

B. range, 14 to 15 fathoms.†

Chione trapezoidalis? (Kurtz).

B. range, 14 to 15 fathoms.†

Chione alveata (Conrad).

B. range, 15 to 48 fathoms.†

Callista convexa (Say) H. & A. Adams.

B. range, 15 to 48 fathoms.†

Callista gigantea Chemnitz.

B. range, 15 fathoms.†

Callista maculata (Linné).

B. range, 15 fathoms.† (Young.)

Venericardia tridentata Say.

B. range, 15 fathoms.†

Cardium magnum Born.

B. range, 14 to 15 fathoms.†

Cardium pinnulatum Conrad.

B. range, 15 to 48 fathoms.†

Chama congregata Conrad.

B. range, 14 fathoms.†

Lucina flosa Stimpson.

B. range, 48 fathoms.†

Lucina orenulata Conrad.

B. range, 14 to 15 fathoms;† 48 fathoms.*

Lucina nassula Conrad.

B. range, 14 to 15 fathoms.†

Cyclas dentata (Wood).

B. range, 14 to 15 fathoms.†

Cryptodon obesus Verrill.

B. range, 15 to 48 fathoms.†

Diplodonta punctata Say.

B. range, 14 fathoms.†

Montacuta bidentata (Montagu).

B. range, 48 fathoms.*

Leda unca Gould.

B. range, 14 to 48 fathoms.†

Nucula proxima Say.

B. range, 14 to 15 fathoms; † 48 fathoms.*

Scapharca transversa (Say) H. & A. Adams.

B. range, 14 to 15 fathoms.†

Argina pexata (Say) Gray.

B. range, 14 to 15 fathoms.†

Pinna seminuda Lamareck.

B. range, 14 to 48 fathoms.†

Pecten dislocatus Say.

B. range, 14 to 15 fathoms; † 48 fathoms.*

Anomia glabra Verrill.

B. range, 15 fathoms.†

Ostrea equestris Say.

B. range, 14 fathoms.†

FAUNA OF THE SURFACE WATER OF THE GULF STREAM.

Collections of the invertebrate surface fauna were made at many localities during this and previous seasons in the waters of the Gulf Stream, both by means of hand-nets and towing nets, while porpoises (*Delphinus delphis*), sharks, and fishes of various kinds have been taken by the use of harpoons and hooks. By the use of muslin nets, known as "trawl-wings," attached to the ends of the trawl frame, so as to be somewhat above the bottom, many pelagic species have been obtained which have not occurred in the surface nets. It is impossible, however, in many cases to know whether such species actually live at or near the bottom, at the surface, or in intermediate depths, for they are liable to enter these nets at any time during the descent or ascent of the trawl, as well as during the time that it is on the bottom. The trawl-wings have, however, furnished a large number of species, of various groups, which we have never taken in any other way, and it is probable that many of these live swimming free, either near the bottom or at various depths intermediate between the surface and bottom, where the temperature may best suit them. In the surface nets a great many eggs and young of fishes of various kinds are usually taken, the young fishes varying in size from those just hatched up to 2 or 3 inches in length.

Copepod crustacea are usually the most abundant forms of small surface animals, occurring in great quantities and of many genera and species. Various species of the genus *Calanus* are the most common.

Several species of the genus *Saphirina* were taken, some of them very brilliant in colors; also many small shrimp belonging to the *Macrura* and *Schizopoda*, and various species of *Amphipoda* and *Isopoda*.

The *Isopods* are usually found clinging to floating sea-weeds (*Sargassum* and *Fucus*) or other floating objects, but are capable of swimming about free. The most common species is *Idotea robusta*, which is a particularly oceanic species, remarkable for its metallic luster and bluish color. The commonest *Amphipods* are *Themisto bispinosa*, which often occur in vast numbers, both at the surface and in the trawl-wings, and *Calliopius laeviusculus*, which is very common and often abundant at the surface. There are also several species of *Hyperia* and allied genera that live parasitic on jelly-fishes.

The most interesting and beautiful *Amphipod* is a species of *Phrovinia* (fig. 163). It is almost transparent and colorless, with the exception of the black eyes. It is about an inch long and lives in a transparent, gelatinous, tubular case or dwelling, which is open at both ends, and usually about an inch in length and nearly as much in diameter. By forcing a current of water through this tube it swims about with considerable rapidity. Clusters of pinkish young ones are often seen attached to the inside of the case. The curious structures or cases inhabited by this species are not all alike, some being smooth and others longitudinally ribbed or keeled, the ribs having serrated edges. The ribbed cases are evidently made from the posterior half of the test of a large *Salpa*, common in the same waters, and having the same serrated ribs. Perhaps the smooth ones are made from other species of *Salpa* and *Doliolum*. Among the surface crustacea are delicate species of the curious genus *Lucifer* (*L. typus*?). Among the common small shrimp are *Latreutes ensiferus*, which is very abundant, and *Leander tenuicornis*, of somewhat larger size. The *Schizopod* shrimp, *Nyctiphanes Norvegica*,* is often taken in the trawl-wings with several other related species. Sometimes it is very abundant at the surface, especially northward.

Two species of free-swimming oceanic crabs (*Nautilograpsus minutus* and *Neptunus Sayi*) are of common occurrence, usually clinging to the clusters of floating sea-weeds, which they imitate in colors, but swimming rapidly away when disturbed. The young of various crabs in the zoëa and megalops stages are taken in the surface nets, as well as the curious larval forms of *Palinurus*, *Squilla*, and allied genera.

Several oceanic barnacles, especially *Lepas pectinata* and *L. fascicularis*, occur attached to floating drift-wood and other objects, and in one case a small barnacle of this group occurred attached to a living siphonophorous jelly-fish (*Porpita*). Several oceanic annelida were taken, while larval forms of annelids are not uncommon. Among the latter was a very large larva, probably of *Chaetopterus*, but much larger than that of the shore species. The larval forms of *Echinoderms* are not uncommon.

* Prof. G. O. Sars refers this species to a new genus (*Nyctiphanes*) recently established by him. It is the *Thysanopoda Norvegica* Krüyer

The oceanic mollusca are numerous in the Gulf Stream, even as far north as our explorations extended, though doubtless far less abundant than farther south. More than twenty-five species of Pteropods occur living in the region explored, and many of them were taken in the surface nets, though other species were caught only in the trawlings, which they probably entered, in most cases, when the trawl was at or near the surface. Most of these Pteropods are very delicate and beautiful forms, with glassy or amber-like transparent shells of various shapes. Those taken in 1883 are all enumerated in the general list of mollusca (p. 70).

At least a dozen species of the curious Heteropods have also been taken by us in the same region. The most abundant of these are the flat, spiral, glassy, and broadly-keeled shells of several species of *Atlanta* (figs. 110, 111). Two transparent naked species, belonging to *Firois* (fig. 112) and *Firoloides* are not uncommon, and *Carinaria*, with its glassy, slipper-like shell, is sometimes taken. Several species of naked mollusks (Nudibranchiata) also occur in the same region. One of the largest and most frequent of these is the *Scyllæa Edwardsii* V. (fig. 109), which clings to the floating fucus and sargassum, and imitates in a marvelous manner the colors, forms, and ornamentation of these sea-weeds. Another large and interesting species (*Fiona nobilis*) has been found several times among the brown and yellow stems of barnacles (*Lepas*) attached to floating timber. It deposits its eggs in inverted cup-shaped, or funnel-shaped, clusters, attached by a little pedicel at the small end. A very curious and beautiful free-swimming species (*Glaucus marginatus*, figs. 113, a, b) was taken in 1884. It is bright blue and silver in life.

Some of the species of Cephalopods are taken alive at the surface, but most of them are difficult to capture. One living specimen of the paper-nantilus (*Argonauta argo*, figs. 63, a, b) was caught in 1882 in a hand-net by Dr. Kite, on the "Fish Hawk." The most abundant Gulf Stream species is *Sthenoteuthis Bartramii*, known as the "flying squid," because it sometimes shoots out of the water with such force as to fall upon the decks of vessels. Very large specimens of this were caught off Cape Hatteras at the surface, and during the last season (1884) they were taken in large numbers and of large size off Martha's Vineyard by jigging them with hooks after attracting them to the side of the steamer by an electric light lowered to the surface of the water. It was not previously known north of Cape Hatteras. A small squid, furnished with sharp claws on its long arms (*Onychia agilis* V.), was also taken at the surface last summer. Many dead and more or less mutilated examples of the great, gelatinous, Octopus-like *Alloposus mollis* V. were several times observed floating at the surface, and sometimes also large specimens of a curious squid (*Calliteuthis reversa* V.). Both of these are probably true deep-sea species, which only rise to the surface when dead or disabled.

The various pieces of drift timber found floating in the Gulf Stream have always been found filled with the burrows of a large species of *Teredo* (*T. megotara*, fig. 127), which seems to be the only common species in that region.

Among the most abundant forms of pelagic life are several species of *Salpa*. One of these is the common species of the New England coast (*Salpa Caboti*, figs. 147, a), which grows to be only about an inch long, in the solitary form, but it often occurs in vast quantities, completely filling the sea, so that surface nets are quickly filled and clogged up with it. In this there are delicate reticulations of clear blue lines on the edges of the mantle, gills, and other internal organs, and the nucleus is usually deeply tinged with blue.

A much larger species, which is also very abundant on most trips, often grows in the solitary form to the length of 3 to 4 inches or more, with a diameter of 1 to 1.25 inches, while the chained individuals are sometimes even longer, with each end running out into a long, tapering, acute tip, while both ends are abruptly terminated in the solitary individuals. The body has eight longitudinal angles or keels, serrated along their edges. The chains often become several feet long, but easily break up when disturbed. This species (figs. 148-150) is related to *S. maxima* Forskal, but is apparently distinct. It is, however, probably identical with *S. clostra*, M. Edwards, of the Mediterranean, well figured in the illustrated edition of Cuvier (Plate 121, figs. 2-2d).

In this the whole body is nearly colorless, except the nucleus, which is dull orange or orange-brown, but whitish on the sides. On many occasions a bushel or more of this species has been caught in the trawl, evidently from near the surface. In the summer of 1884, this species was taken in Vineyard Sound and Buzzard's Bay, August 25 to September 5, in considerable numbers, but not so large as those found in the Gulf Stream. This must be an unusual occurrence, however. A special collection of this species was made in 1882, by hardening in chromic acid, to be used by Professor Brooks for making sections in studying its anatomy and embryology, and were found by him very satisfactory.

Another very interesting species (*S. pinnata*), previously known from the Mediterranean, was taken in 1883, off Cape Hatteras. In this species the chained individuals are united together in such a way as to form circular or wreath-like groups. Species of *Doliolum* (fig. 146) and of *Appendicularia* were also taken, but have not been studied with care.

Large specimens of *Pyrosoma* have also been taken on several occasions. Some of these were 15 to 18 inches long, and nearly 2 inches in diameter at the larger end, tapering gradually to the small end.

The floating masses of sea-weeds (*Sargassum* and *Fucus*) are nearly always covered with various species of Hydroids and Bryozoa. Among the latter is an encrusting species which covers the fronds and bladders with a delicate calcareous network, and when the *Sargassum* is dried

the bladders often shrink away and leave the encrusting Bryozoa in the form of very elegant hollow balls. Among the Hydroids the most abundant are *Obelia geniculata* and several small species of *Aglaophenia*.

The jelly fishes are very abundant and very interesting in the Gulf Stream water. Among the most common and conspicuous is the "Portuguese man-of-war" (*Physalia arethusa*), remarkable for its curious form and habits, as well as for its brilliant blue and crimson colors and its virulent stinging powers. Related to this, and not less beautiful, is the *Porpita Linnaeana*, which has a very beautiful, circular, radiated, pinkish floating disk, bordered with bright blue, while the delicate zooids hanging from its lower surface form an elegant blue and green fringe around it. This has been taken several times, but the best lot was obtained at station 2039. Specimens of the allied form (*Verella nutica*), which is beautifully varied with blue, green, and pink, and has a thin oblong disk, with an oblique, diagonal crest or sail, were taken, but they were not full grown. Several other species of Siphonophores were obtained, among which were *Gleba hippopus* and a species of *Cuboides*. Of the medusæ, *Pelagia cyanella*, *Stomolophus meleagris*, *Periphylla hyacinthina*, *Trachynema digitale*, *Calyropsis typa* Fewkes, and a large species of *Zygodactyla* were among the most prominent.

A large and conspicuous medusa, with distant, stout, and rather stiff-looking tentacles, and broad, deep marginal lobes, was taken in several localities. (Stations 2034, 2037, 2039, 2040, 2045, 2079, 2104.) It grows to be over 6 inches in diameter, and the stomach and genital organs have a deep purplish brown color when recently placed in alcohol, but its color in life was not noted. Mr. Fewkes considers this a new species of the rare genus, *Atolla* (*A. Verrillii*). The specimens of *Stomolophus meleagris* were large and handsome. According to the observations of Mr. William Nye, jr., on the "Albatross," the disk in this species contracted, when first taken, 102 times per minute. It was taken near stations 2085 and 2088.

Among the most abundant and characteristic of the forms of pelagic life are the curious, transparent-finned worms belonging to the genus *Sagitta* (figs. 196, a). These have a well-marked head with two eyes, and with broad groups of sharp, curved spines on each side of the head, while there is a well-developed caudal fin, like that of a fish in form, and other fins on the sides of the body. They swim through the water with great rapidity and are so transparent that they are not easily seen. They are usually taken in large numbers in our surface nets, of all sizes, from a small fraction of an inch up to 2 or 3 inches in length. Probably there are several species among them. They are equally abundant in the trawl-wings from all depths, and among those that have been taken only in the trawl-wings there is one large species, nearly 3 inches long, which is deep salmon or orange in color, while the surface species are colorless.

A very different but equally transparent worm (*Tomopteris*) is also frequently taken. In this genus there are bilobed swimming-feet along

each side, with a pair of long curved appendages on the sides of the head. Some singular forms of Turbellarian worms have also been taken, one of which is about 2 inches long, and flat, with a pair of long lateral appendages extending back from the head. Its color in life was orange.

The Protozoa are also well represented by various species of Radiolaria and Foraminifera. Among the latter are several small species of *Globigerina* and allied genera that are nearly always taken in the surface nets, and the shells of these are also among the most abundant of those that constitute the "Globigerina ooze" of the bottom.

It is certain that all this vast assemblage of surface-life must be constantly dying and sinking to the bottom, thus furnishing food for the numerous inhabitants of the deep sea, directly or indirectly. Although these soft-bodied creatures would quickly decay in water so warm as the surface of the Gulf Stream, it is necessary to remember that at the depth of less than 150 fathoms the temperature falls to about 40° F., so that decomposition would go on very slowly after they had fallen to that depth. However, it is probable that such creatures begin to sink into the cold depths as soon as they are injured or weakened in any way, and thus they would reach the cold zone before life is extinct. In fact it may be that the cold itself in most cases is the actual or immediate cause of the death of those weakened or partially disabled creatures that are unable to keep their places at the surface. As a matter of fact, I have taken from the stomachs of bottom-dwelling creatures, like Actiniae and star-fishes, various surface animals, including *Salpa* and *Lepas*, which showed no signs of decomposition. Yet it is estimated that it would take several days for such things to sink to the bottom in 2,000 fathoms.

Hitherto we have not met with small forms of plant life in the Gulf Stream in any abundance. The microscopic plant life seems to be much less abundant there than near the coast. In fact, the small amount of such organisms hitherto observed seems to indicate that the vast numbers of the small forms of animal life cannot depend mainly upon plants for their primary food-supply, and renders it more than probable that many of the Protozoa, at least, are capable of deriving their food directly from inorganic matter to a large extent, if not entirely. It is not necessary to believe that this power is restricted to the vegetable kingdom, but this question needs farther investigation.

PRÉLIMINARY LIST OF ACALEPHÆ COLLECTED BY THE "ALBATROSS"
IN 1883 IN THE REGION OF THE GULF STREAM.

By J. W. FEWKES.

The following list includes nearly all the species obtained in 1883, with the exception of various minute hydroid gonophores, which have not yet been studied, and a few species too imperfectly preserved for

identification. A few species obtained in 1884 are also included in the list.*

Atolla Verrillii Fewkes, sp. nov.

The genus *Atolla* was described by Hæckel in his report on the deep-sea medusæ of the "Challenger," from the Antarctic Ocean, between the Kerguelen Islands and Melbourne, and from St. Mathias Bay, Patagonia.

Our species was collected in the following localities:

Station.	Locality—				Depth.		
	N. lat.		W. long.				
	o	'	"	o	'	"	Fathoms.
2024	39	27	10	69	56	20		1,246
2037	38	53	30	69	23	30	1,781
2039	38	19	26	68	20	20	2,369
2040	38	35	13	68	16	00	2,226
2042	39	33	00	68	26	45	1,555
2044	40	00	50	68	37	29	1,067
2045	40	04	20	68	43	50	373
2094	39	44	30	71	04	00	1,022

The genus is represented by eight specimens, three of which are over 45^{mm} in diameter. The "Challenger" collected five specimens. Our species is very closely related to the Antarctic one, *A. Wyvillii* Hæck. The depth recorded for *A. Wyvillii* is 1,950 and 2,040 fathoms. Our species ranges from 373 to 2,369 fathoms. My largest specimen, a little over 45^{mm} in diameter, although smaller than Hæckel's largest (66^{mm}) has twenty eight tentacles, marginal sense-bodies, and marginal lobes before bifurcation, while his has but twenty-two.

Nauphantopsis Diomedæ, gen. et sp. nov.

A new genus, *Nauphantopsis*, one of the most important collected by the "Albatross," resembles *Nauphanta* in the sculpturing of the exumbrella, but while the latter has sixteen marginal lappets, *Nauphantopsis* has thirty-two; *Nauphantopsis* has thirty-two deep furrows across the corona; *Nauphanta* has sixteen deep and sixteen shallow coronal incisions; *Nauphantopsis* has twenty-four tentacles and eight sense-bodies, which are very imperfect. *Nauphanta* has eight tentacles and eight sense-bodies. Three tentacles are therefore side by side on the rim of the former, alternating with the sense-bodies. The single specimen was found at station 2033, in latitude 38° 30' 30" N. and longitude 69° 08' 25" W., in a depth of 2,033 fathoms.

This genus is morphologically one of the most valuable of the collection, and, like *Nauphanta*, probably belongs to the deep-sea fauna. It connects the family of Collaspidæ, of which *Atolla* is one of two mem-

* In most cases it is impossible to say whether the novel forms of medusæ taken in the trawl and trawl-wings are inhabitants of the bottom waters or the surface, or of intermediate depths. Eventually those that belong to the surface-fauna will doubtless be taken in the surface-nets, but this will require much more extensive collecting of the surface animals than has yet been attempted.

bers, with the Periphyllidæ. Its coronal furrow and sculpturing of the exumbrella recalls the former family, and the arrangement of the tentacles in threes and other features, the latter. Hæckel rightly says of *Nauphanta* that, like *Atolla*, "it is a true deep-sea form of high phylogenetic antiquity." The allied *Nauphantopsis* supports Hæckel's interpretation of the relationship of the Peromedusæ and the Collaspidæ. *Ephyroides rotaformis* Fewkes, gen. et sp. nov.

A new genus, *Ephyroides*, has rounded elevations, from sixteen to thirty-two in number, on the exumbrel side of the corona of the bell. It is a member of the Ephyridæ of Hæckel, and occurs at the following stations:

Station.	Locality—		Depth.
	N. lat.	W. long.	
2042	39 33 00	68 26 45	Fathoms. 1,555
2044	40 00 30	68 37 20	1,097
2051	39 41 00	69 20 20	1,106
2047	40 02 30	68 49 40	389

Periphylla hyacinthina Steenstrup.

The Periphyllidæ are represented by a fine suite of specimens of the medusa, *Periphylla hyacinthina* Steenstrup, and another species which may turn out to be a new genus closely allied to the latter. From these medusæ, of which there are fifteen specimens, I shall be able to study at length the development of the genus *Periphylla*, of which at present nothing is known.

Halicreas minimum Fewkes.

In 1880-'81 the "Albatross" collected a strange medusa, to which was given (Bull. Mus. Comp. Zool., vol. ix, No. 8) the name *Halicreas minimum* Fewkes. In the present collection this genus is represented by several specimens. The genus is a marked one, by the possession of eight prominences on the margin of the umbrella, from which radial ribs extend toward the center of the disk. These radial prominences bear two or more rows of small rounded tubercles. The velum is similar to that of *Solmaris*, *Ouinina* and certain Narcomedusæ. It has eight rounded knobs on the subumbral surface of the disk, as in the young *Zygodactyla Grænelandica*. The specimens of this genus in the collection will enable me to make out a good anatomy of this extraordinary medusa. They come from the following stations:

Station.	Locality—		Depth.
	N. lat.	W. long.	
2084	39 27 10	69 56 20	Fathoms. 1,346
2086	38 52 40	69 24 40	1,735
2039	38 19 26	68 20 20	2,369
2041	39 22 50	68 25 00	1,606
2042	39 33 00	68 26 45	1,555
2216	39 47 00	70 30 30	968

Halicreas is the type of a new family of medusæ, the Halicreasidæ, which stands intermediate between the Narcomedusæ and the Acraspeda.

Among the smaller medusæ there are many Campanellidæ.

Solmaris incisa, sp. nov.

A giant *Solmaris* (50–60^{mm} in diameter) of a new species (*S. incisa*) is represented by three specimens from the following stations:

Station.	Locality—		Depth.
	N. lat.	W. long.	
2094	39 44 30	71 04 00	Fathoms. 1, 023
2104	38 48 00	72 40 30	591

This species has thirty-two radial pits or furrows on the subumbrel side of the disk. These indentations are confined to the corona.

HYDROIDA.

The hydroid gonophores are very numerous, and there are species of *Zygodactyla*, sp. nov., and *Mesonema*, *Staurophora laciniata* Ag., *Turris episcopalis* Fewkes, several Oceanidæ, and one or two minute genera which have not been satisfactorily examined.

The collection also contains specimens of *Porpita Linneæana* Less., *Verella mutica* Bosc, and *Rataria* (young *Verella*?). There is a single *Agalma nectocalyx*, a large *Gleba*, and fragments of Agalmidæ. *Cuboides* and *Sphenoides* were found for the first time in the Gulf Stream.

The indications are that there are several genera and species of Rhizophysidæ in the Gulf Stream. The collection contains fragments of three or four undetermined species, besides two species which could be identified. There is also a new genus of Rhizophysidæ in the collection. A new species of *Rhizophysa* is allied to *R. inermis* of Studer. In this species there are no tentacles, and the polypites and sexual organs arise in clusters at intervals on the axis, as in *Apolemia*. The float of another unknown *Rhizophysa* is 15^{mm} in shorter, 30^{mm} in longer diameter, in alcohol. This is the largest *Rhizophysa* float ever recorded. A short section of the stem of this giant still remains with the float, but the remainder, with its appendages, is broken and lost, so that identification is impossible.

Pterophysa grandis, gen. et sp. nov.

A magnificent new genus of Rhizophysidæ, which will be described under the name *Pterophysa*, is one of the most important additions made by the "Albatross" to our Medusan fauna. This genus has two lateral muscular wings on the polypites and no tentacles. The sides of the polypites are specialized into grasping organs, which, in conjunction with the lateral folds, convert these organs into suckers, by which

the animal clings to a foreign body. This specialization may also serve for the capture of prey, since *Pterophysa* has no tentacles for that purpose. The genus was found clinging to the "dredge rope" at station 2227. Collected in 1884.

Angelopsis globosa, gen. et sp. nov.

Lesson, in his "Histoire des Zoophytes Acalephes," figures and describes an interesting medusa, discovered by Rang, to which he gave the name *Angela*. This genus lies between *Physalia* and other Physophores, and, filling that gap, is of greatest interest. Unfortunately, since the original description by Lesson, *Angela* has never been rediscovered. The collection of the "Albatross" contains a Physophore closely allied to *Angela*, to which the name *Angelopsis* seems appropriate. There are two specimens of *Angelopsis* from station 2105, in latitude $37^{\circ} 50' 00''$, N., longitude $73^{\circ} 03' 50''$ W., in a depth of 1,395 fathoms. *Angelopsis* is intermediate in structure between *Rhizophysa* and *Physalia*, and in my judgment shows that Dr. Chun is right in separating these genera from the other Physophores with which they have so little in common.

Pelagia cyanella Per. et Less., *Stomolophus meleagris* Ag., *Aurelia flavidula* Per. et Les., and an unknown Aurelian are found in the collection. There are two specimens of the latter, which is probably a new genus.

In this brief enumeration I have simply made mention or touched upon the salient features of my new genera, without entering upon the many morphological considerations which such unusual forms suggest. I have not enumerated the new species of hydroid gonophores, since at this stage of my research it would be impossible for me to rightly estimate, in the case of most of them, whether their characters are generic or specific. From the nature of the case these small, almost microscopic, medusæ require a longer time for identification. The whole collection confirms a fact which every student of marine zoology who has collected in the Gulf Stream has long known, that these waters teem with a medusan life, of which only a small fraction has yet been described.

The following list contains the majority of the Medusæ sent to me. Several doubtful species are omitted. The majority of the latter are hydroid gonophores of small size and doubtful affinities.

ACRASPEDA.

Atolla Verrillii, sp. nov.

Aurelia flavidula Per. et Less.

Ephyroides rotaformis, gen. et sp. nov.

Nauphantopsis Diomedææ, gen. et sp. nov.

Periphylla hyacinthina Steenstrup.

Periphylla, sp. nov., forsitan gen. nov.

Stomolophus meleagris Ag.

Aurelia, incertæ sedis.

TRACHYMEDUSÆ.

Campanella, sp. nov.
Halicreas minimum Fewkes.
Solmaris incisa, sp. nov.

SIPHONOPHORA.

Physalia Arothusa Til. Common.
Rhizophysa uvaria, sp. nov.
Rhizophysa, sp. ?
Pterophysa grandis, gen. et sp. nov.
Angelopsis globosa, gen. et sp. nov.
Agalma, sp. ?
Cuboides, sp. ?
Sphenooides, sp. ?
Gleba hippopus Forsk.

DISCOIDEA.

Porpita Linnæana Less.
Rataria (*Velella young* ?).
Velella mutica Bosc.

HYDROIDA.

Mesonema, sp. nov.
Zygodactyla, sp. nov. Common.
Zygodactyla, sp. nov.
Turris episcopalis Fewkes.
Staurophora laciniata Ag.
Oceanidæ, incertæ sedis.

LIST OF ADDITIONAL GULF STREAM ACALEPHS COLLECTED IN 1880 AND 1881.

The following species were recorded by Mr. Fewkes in his former paper :*

CTENOPHORA.

Beroë, sp.
 Station 920, 1881.

DISCOPHORA.

Periphylla hyacinthina Steenstrup.
 Stations 936, 952, 954, 995, 1881.

SIPHONOPHORA.

Apolemia, sp.
 Off Block Island, 1880.

* On the Acalephæ of the east coast of New England; II Acalephæ collected by the United States Fish Commission during the summer of 1880 and 1881. (Bulletin Museum Comp. Zool., vol. ix, p. 300, 1880.)

Agalma elegans Fewkes.

Gulf Stream, 1880.

Haliphyta magnifica Fewkes.

Station 953, 1881.

Diphyes, sp.

Gulf Stream, 1880.

HYDROIDA.

Trachynema digitale A. Ag.

Stations 985, 1026, 1881.

Calycopsis typa Fewkes.

Station 870, 1880; and stations 924, 945, 952, 1881.

Chromatnema rubrum Fewkes.

Stations 936, 954, 1881.

Halicreas minimum Fewkes.

Stations 954, 1029, 1881.

EXPLANATION OF PLATES.

Unless otherwise stated, the figures on all the plates were made by Mr. J. H. Emerton.

PLATE I.

- FIG. 1. *Umbellula Bairdii* V. Side view of the polype and upper part of the stem, natural size; 1a, lower end of the stem and bulb of the same.
- FIG. 2. The same. Ventral view, showing the tentacles in partial retraction.
- FIG. 3. *Umbellula Guntheri* K. Ventral view of the polype and upper part of the stem, natural size.
- FIG. 3a. The same. Dorsal view.
- FIG. 3b. The same. Lower end of the stem and bulb.

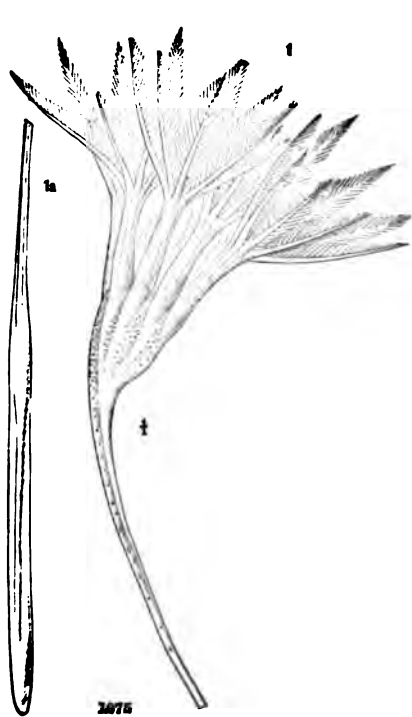


PLATE II.

- FIG. 4. *Benthoptilum sertum* V. Ventral view of a part of the rachis, showing one of the middle clusters of polyps entire and the base of the opposite cluster, natural size.
- FIG. 10. *Lepidogorgia gracilis* V. Side view of a portion of the stem, showing two of the polyps, enlarged four diameters.
- FIG. 10 a. The same. Showing the base of the denuded stem and a part of the branched roots, natural size. The terminal branchlets of the roots have been broken off from this specimen.
- FIG. 12. *Anthomastus grandiflorus* V. Side view of a small specimen, showing the expanded polyps and the branched or lobulated roots, characteristic of specimens taken on muddy bottoms, natural size.
- FIG. 13. *Gersomia longiflora* V. Side view of a rather small specimen, with the base attached to a joint of *Lepidisis caryophyllia*, and forming a bulbous expansion filled with mud below it, enlarged one and one-half diameters.

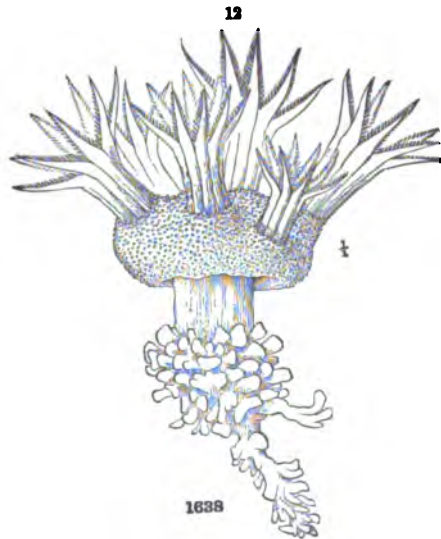
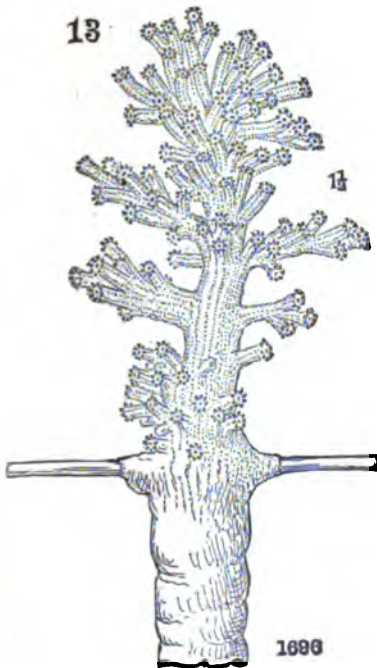
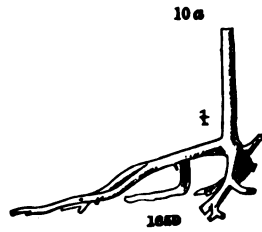
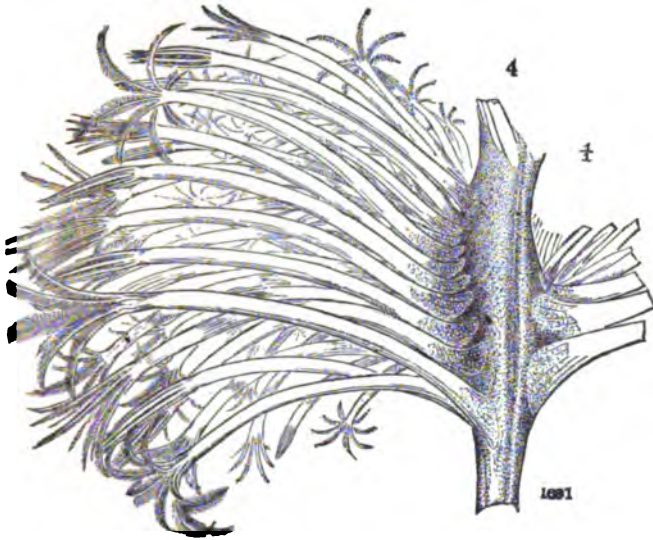


PLATE III.

- FIG. 5. *Kophobolemon tenue* V. Ventral view, natural size.
- FIG. 5 a. The same. Dorsal view.
- FIG. 6. *Scleropilum gracile* V. Dorsal view of a small specimen, enlarged one and one-half diameters.
- FIG. 7. *Pennatula aculeata*. Ventral view of a medium sized specimen, natural size; a, dorsal view of a young specimen, drawn from life, showing the expanded polyps, one-half natural size; b, front view of one of the polyps of the same, much enlarged.
- FIG. 11. *Baltioina Finmarchlos*. Side view of a small specimen, imperfect at the summit, one-half natural size.
- FIG. 11 a. The same. Side view of a portion from the middle part of the rachis, somewhat enlarged.
- FIG. 11 b. The same. One of the calicles and expanded polyps (a), enlarged nine diameters.
- FIG. 201. *Lepidisis caryophyllia* V. Portion of the middle part of the stem bearing three polyps, enlarged four diameters; c, a group of the external scale-like spicula of the coenenchyma, enlarged sixty diameters.

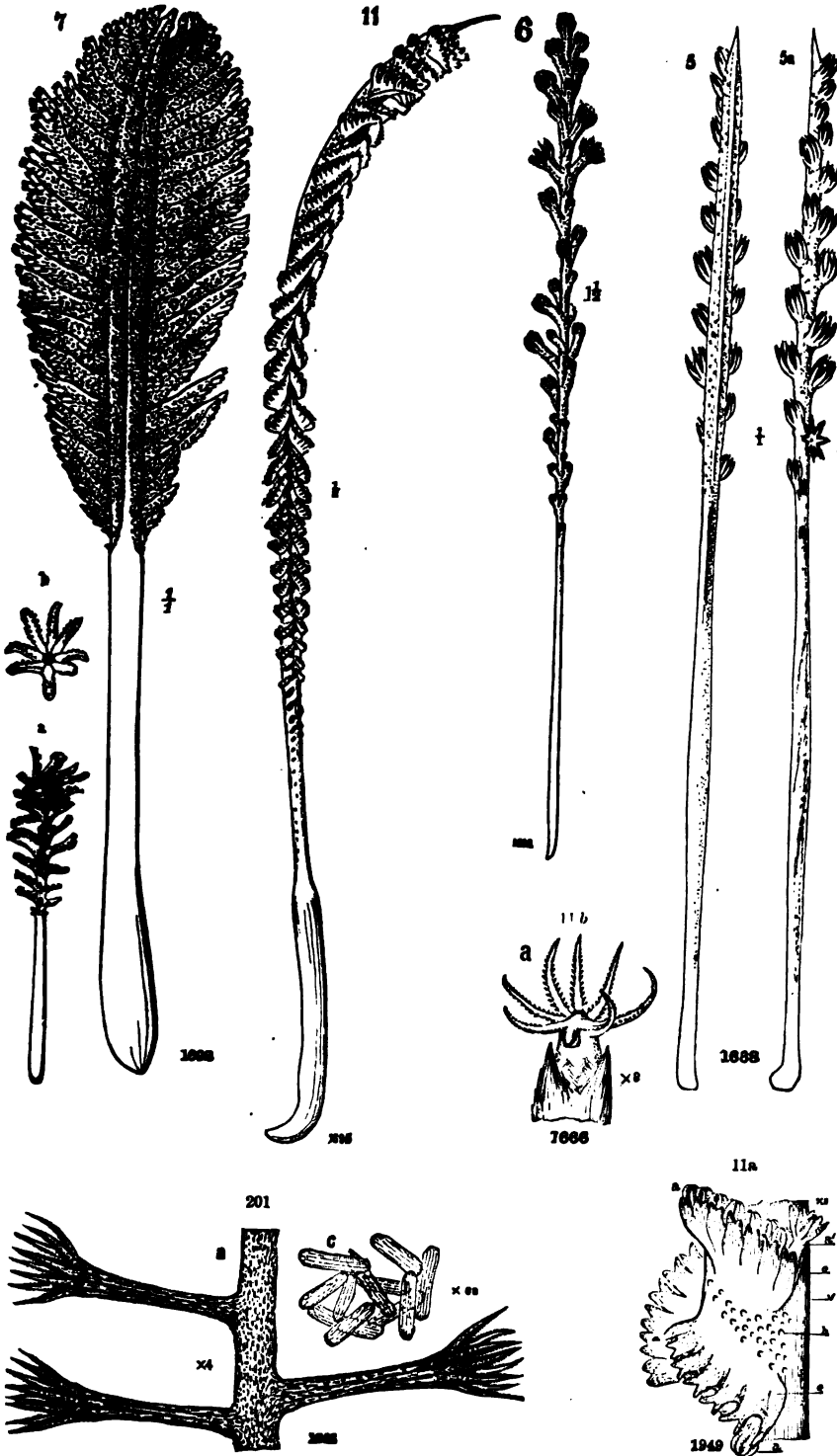


PLATE IV.

FIG. 8. *Pennatula (Ptilolla) borealis*. Side view of a rather small specimen, one-half natural size.

FIG. 8a. The same. Side view of a part of the rachis and pinnae, enlarged two diameters; *a*, the pinnae with full-sized sexual polyps; *a'*, rudimentary pinnae at the base of the rachis; *b*, the lateral groups of the rudimentary or asexual zooids; *b'*, clusters of similar zooids on the basal part of the pinnae; *b''*, the larger asexual zooids along the ventral surface of the rachis; *c*, the naked area at the base of the pinnae; *c'*, *c''*, the naked surfaces on the upper and lower surfaces of the pinnae near the base; *e*, the naked longitudinal area on the ventral side of the rachis; *P*, the basal bulb; *P'*, the enlarged swelling at the upper end of the bulb.

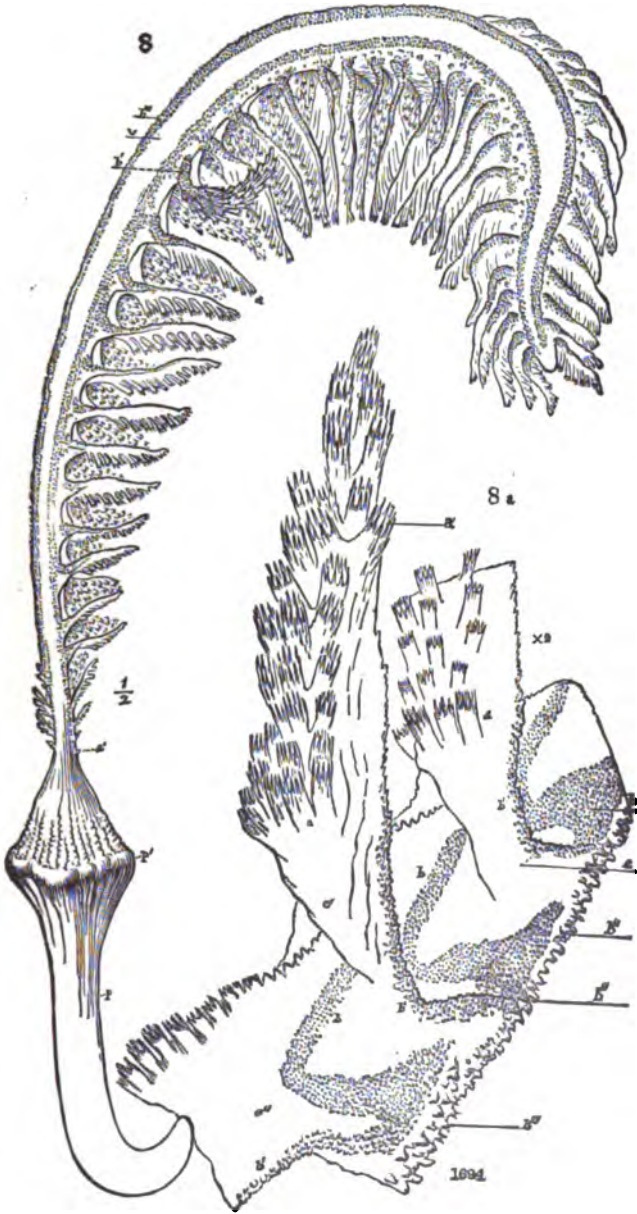


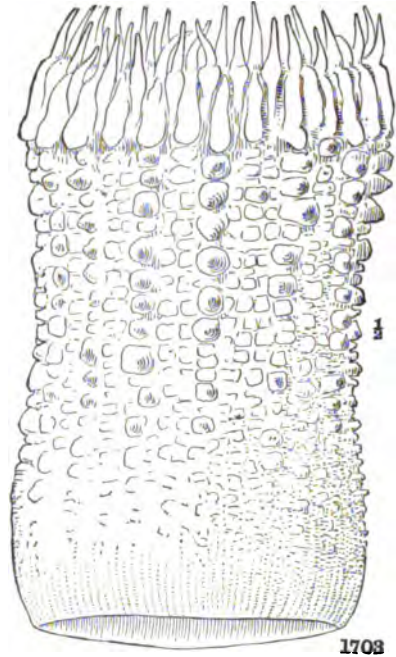
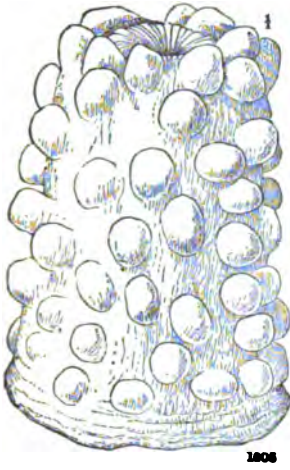
PLATE V.

- FIG. 14. *Flabellum Goodii* V. Top view of a medium-sized specimen, showing the animal in partial contraction, enlarged one and one-half diameters. From a specimen recently preserved in alcohol.
- FIG. 15. *Flabellum angulatum*. Side view, enlarged one and one-half diameters.
- FIG. 16. *Caryophyllia communis*. Side view, enlarged one and one-half diameters.
- FIG. 17. *Dasmosmilia Lymani*, one and one-half natural size. Side view of a specimen from which about one-fourth had been broken away by a longitudinal fracture, after which the calicle had been perfectly restored.
- FIG. 20. *Actinauge nodosa*. Side view of a specimen in partial expansion, with a bulbous base inclosing mud, one-half natural size.
- FIG. 20 a. *Actinauge nodosa*, variety *tuberculosa*. Side view of a contracted specimen, natural size.

Figs. 15, 16, 17, were drawn by Mr. J. H. Blake, and the others by Mr. J. H. Eberton.

20 a

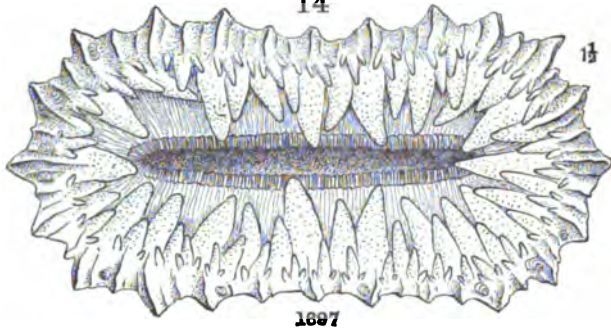
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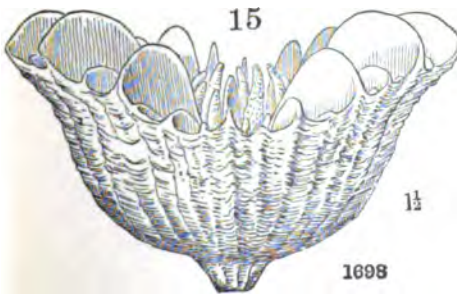
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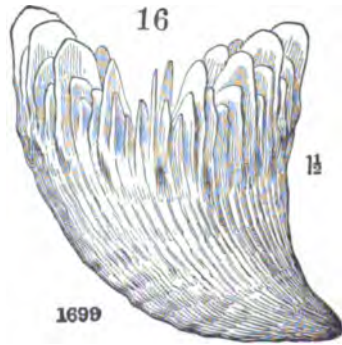


PLATE VI.

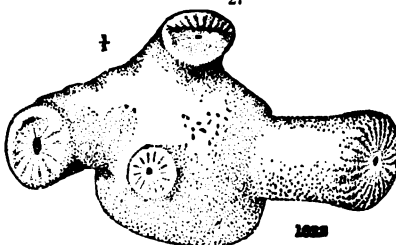
- FIG. 19.** *Urticina perditæ* V. Side view of a living specimen in partial expansion, one-half natural size; *a*, the same, top view of the mouth and a segment of the disk, showing the arrangement of the tentacles, natural size.
- FIG. 19 b.** The same. Side view of a large, living specimen in full expansion, with the border of the disk broadly extended and thrown into undulations or frills and with the mouth protruded at the summit of a cone, less than one-half natural size.
- FIG. 27.** *Epizoanthus abyssorum* V. Dorsal view of a group forming the carcinoecium of *Parapagurus pilosissimus*, natural size.
- FIG. 27 a.** The same. Side view of a small cluster arising from a grain of sand, natural size.

27 a



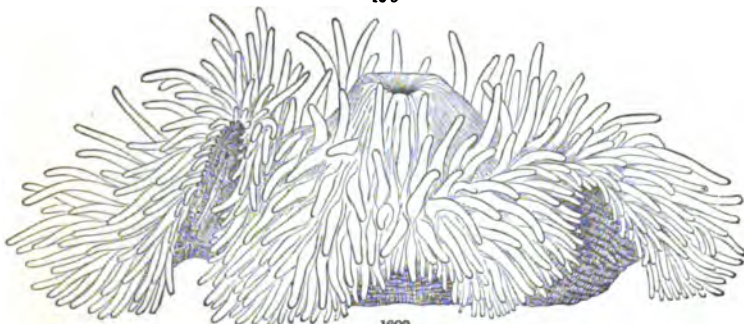
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27 i



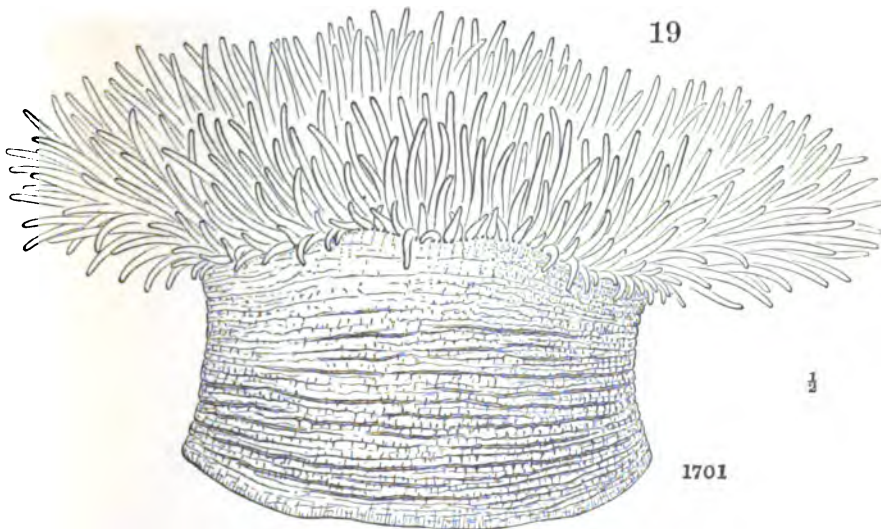
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19 b



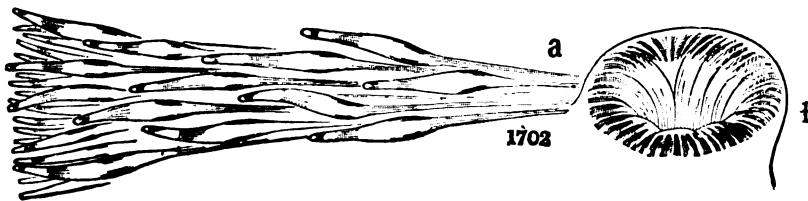
1699

19



1701

a



1702

PLATE VII.

- FIG. 21. *Actinauge longicornis* V. Side view of a medium-sized living specimen in partial expansion, about one-half natural size. The dotted line shows the form and extent of the cavity containing mud in the bulbous base.
- FIG. 22. *Actinauge nezilis* V. Top view of a partially expanded specimen attached to the summit of the denuded axis of *Ballicina Fismarohica*, somewhat enlarged.
- FIG. 22 a. The same. A group of four individuals attached in the same way and completely covering the axis by the clasping bases, natural size; a, side view of the terminal individual closely contracted; b and c, two smaller individuals less contracted; d, basal view of a similar individual showing the suture of the clasping base.
- FIG. 23. *Actinernus nobilis* V. View of the expanded disk and tentacles, two-thirds natural size.
- FIG. 23 a. Side view of a smaller and more contracted specimen, two-thirds natural size.
- FIG. 200. *Sagartia spongicola* V. Top view of a small specimen clasping a stem of *Tubularia*, natural size.

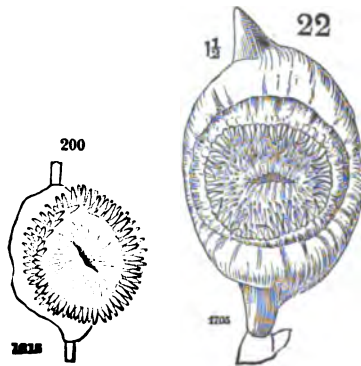
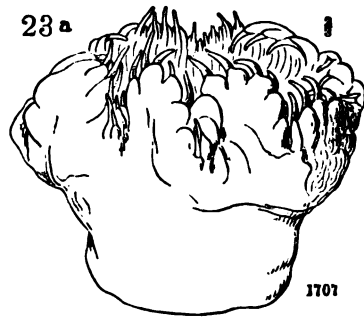
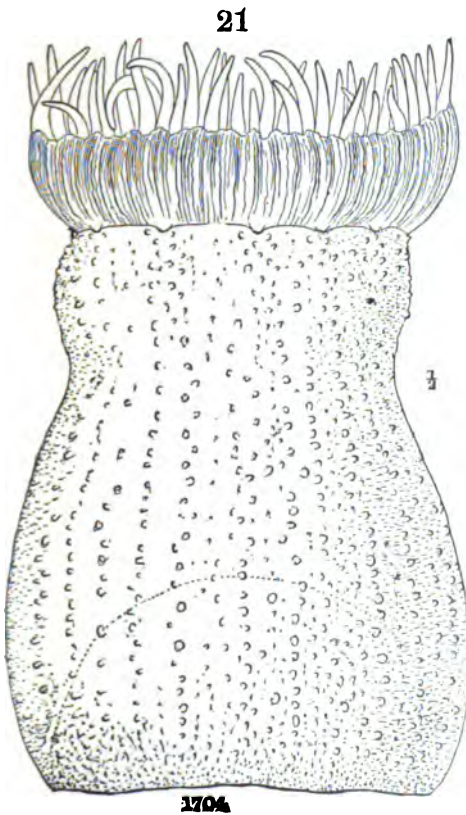
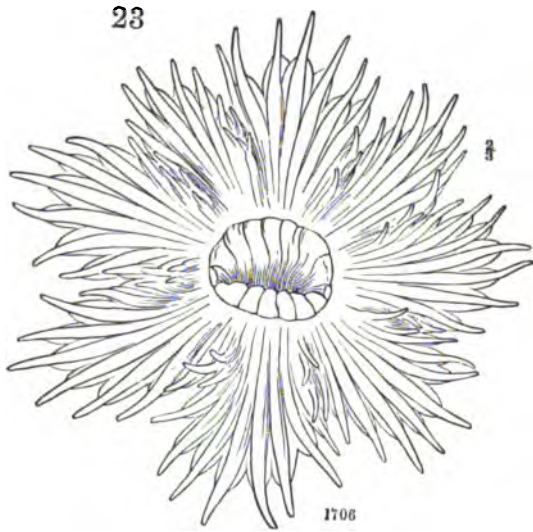
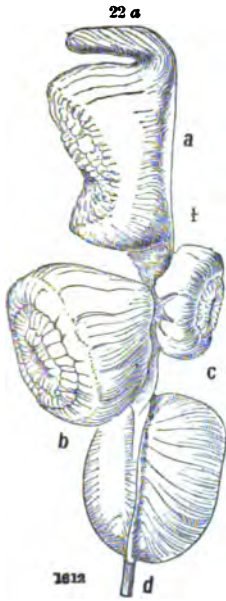
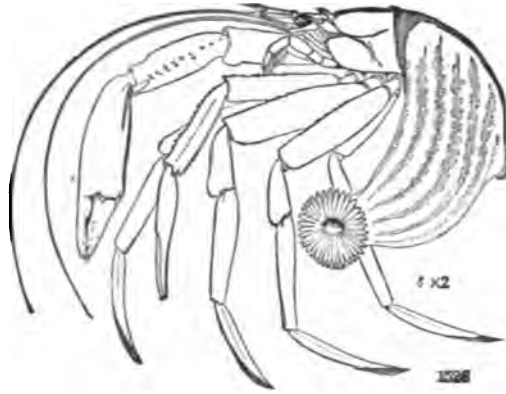


PLATE VIII.

FIG. 26. *Adamsia scotabille* V., forming the carcinoecium of *Catapagurus Sherreri*, side view of the male, enlarged two diameters.

FIG. 28. *Episoanthus paguriphilus* V., forming the carcinoecium of *Parapagurus pilosimanus* Smith, about three-fifths natural size. From an alcoholic specimen in which some of the polyps were partially expanded.

26



27

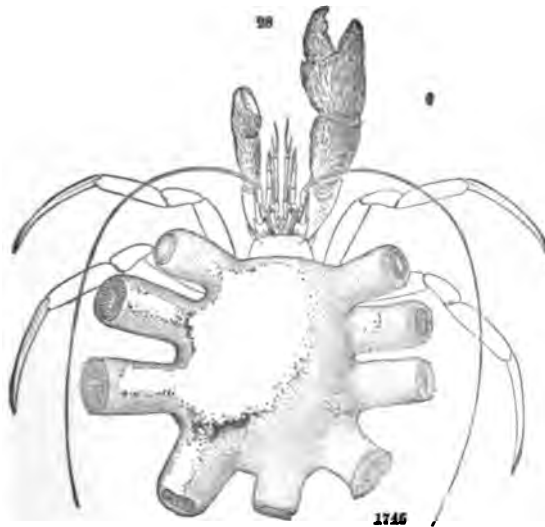


PLATE IX.

- FIG. 9. *Anthoptilum grandiflorum* V. Dorsal view of four clusters of polyps from the middle portion of the rachis and of the groups of rudimentary zooids between their bases, natural size. On the lower part of the figure some of the polyps have been cut off to show their arrangement. Drawn from an alcoholic specimen.
- FIG. 9a. The same. Side view, natural size.
- FIG. 29. *Cladocarpus flexilis* V. Side view of a portion of a branch showing the form of the calicles and nematophores, enlarged twenty diameters.
- FIG. 30. *Callicella plicatilis*. View of a branch, enlarged twenty diameters.
- FIG. 199. *Dasygorgia Agassizii* V. Part of the stem and one branch of the type specimen from the "Blake" Expedition.

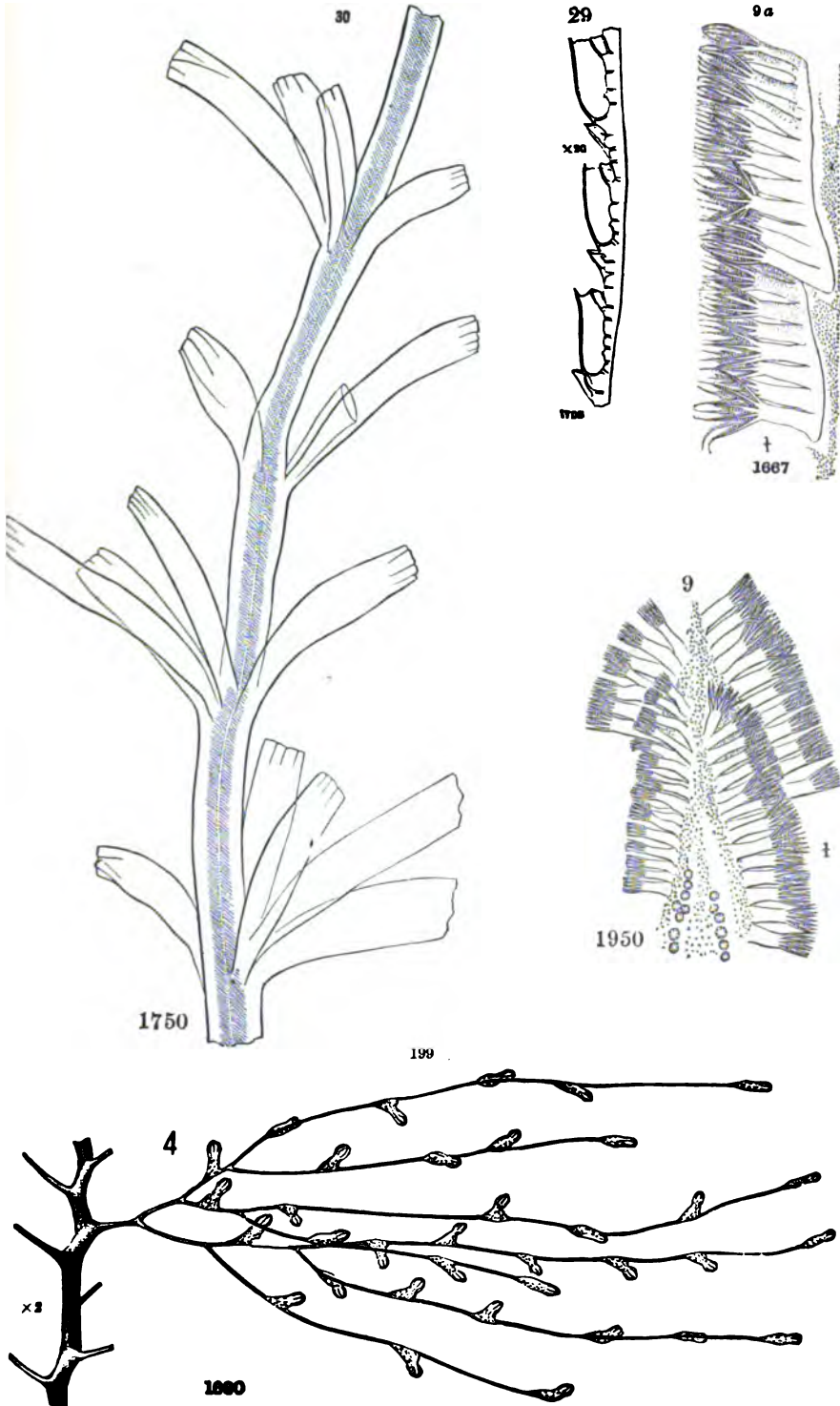


PLATE X.

- FIG. 31. *Benthodytes gigantos* V. Dorsal view of a rather small specimen, one-half natural size. From a specimen kept a short time in alcohol.
- FIG. 32. *Euphrontides cornuta* V. Side view of a small-sized specimen, two-thirds natural size. Copied from a sketch made from a living specimen by Mr. A. Baldwin.
- FIG. 34. *Lophothuria Fabricii* V. Upper and under surfaces, natural size.

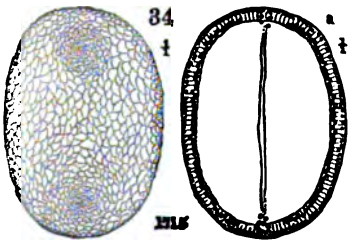
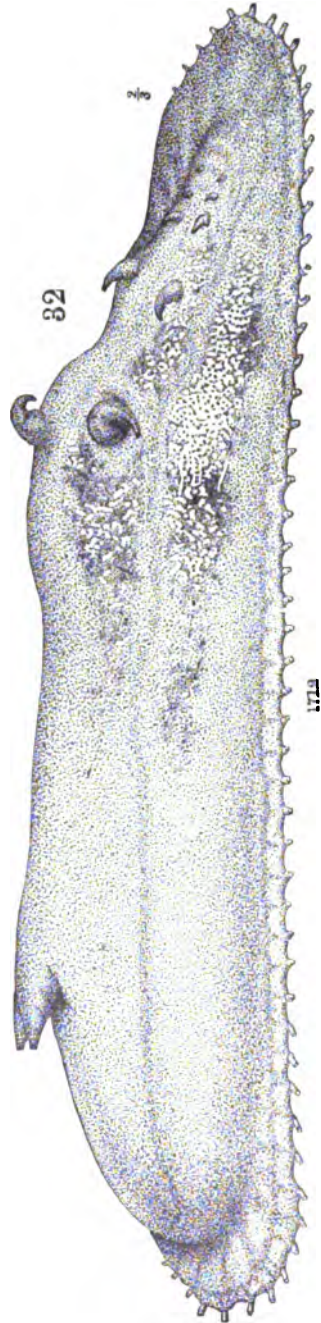
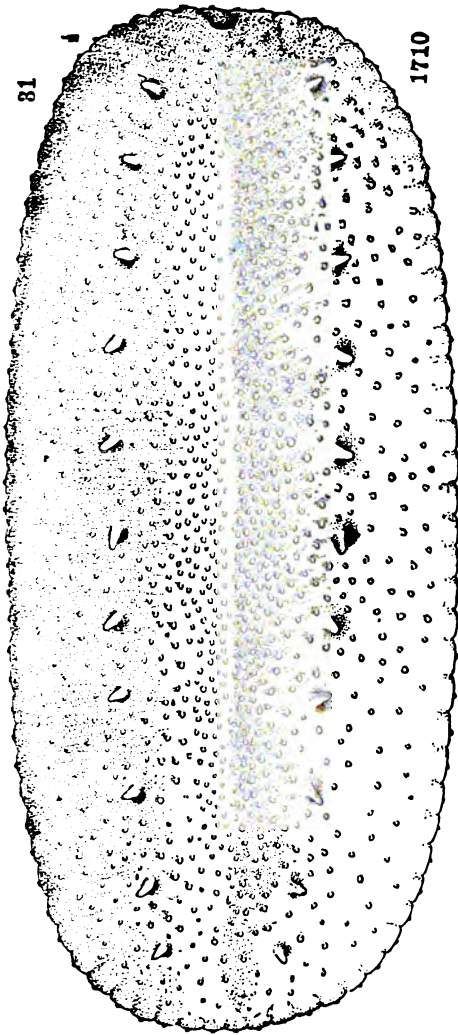


PLATE XI.

FIG. 31 a. *Benthodytes gigantea* V. View of the under surface of a small specimen, one-half natural size. From a specimen kept a short time in alcohol.

FIG. 31 b. The same. Ventral surface of the anterior part of a similar specimen having the tentacles more expanded, natural size.

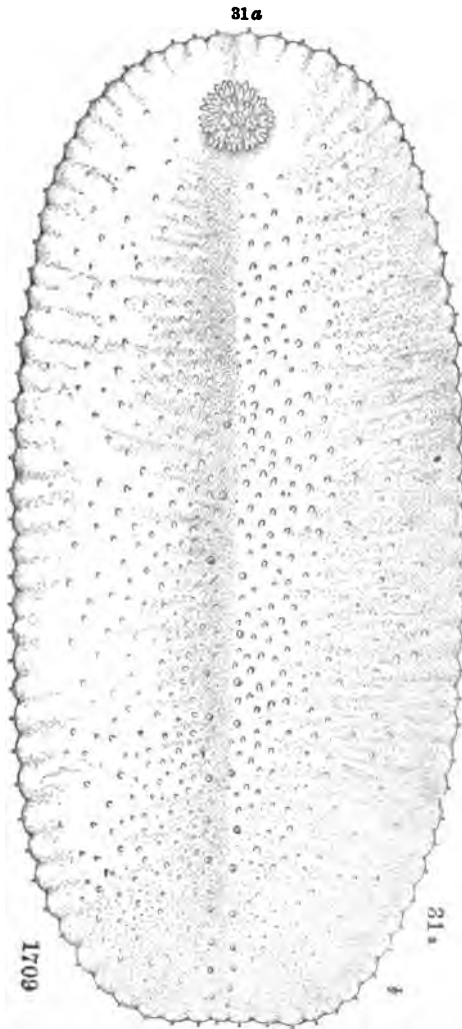
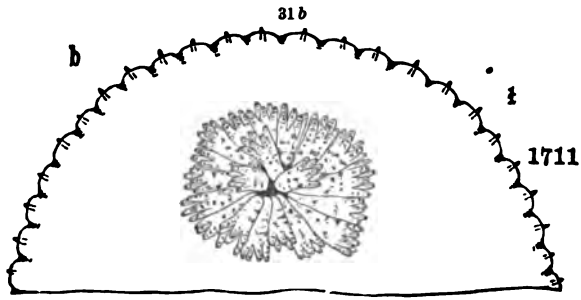


PLATE XII.

- FIG. 33. *Euphronides cornuta* V. Upper surface of a specimen preserved a short time in alcohol, two-thirds natural size.
- FIG. 33a. The same. Lower surface of the same specimen, two-thirds natural size.

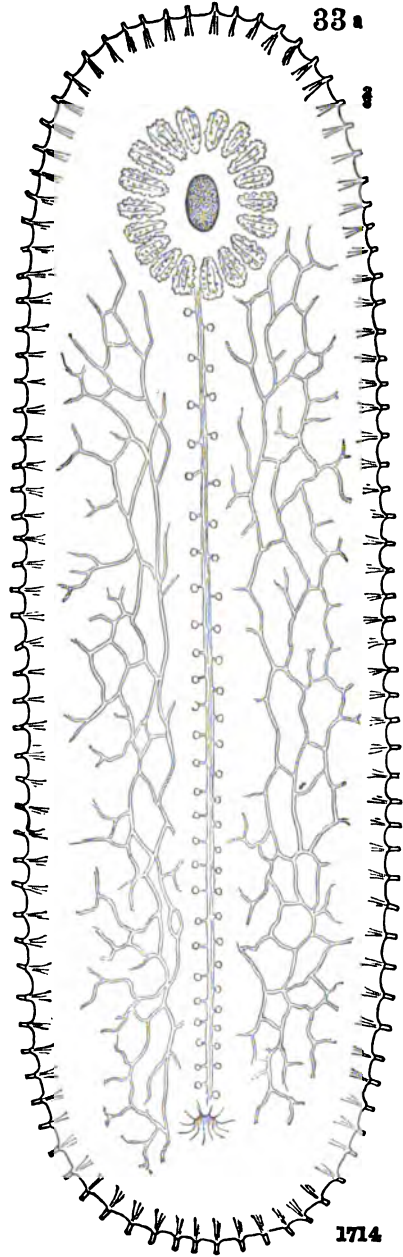
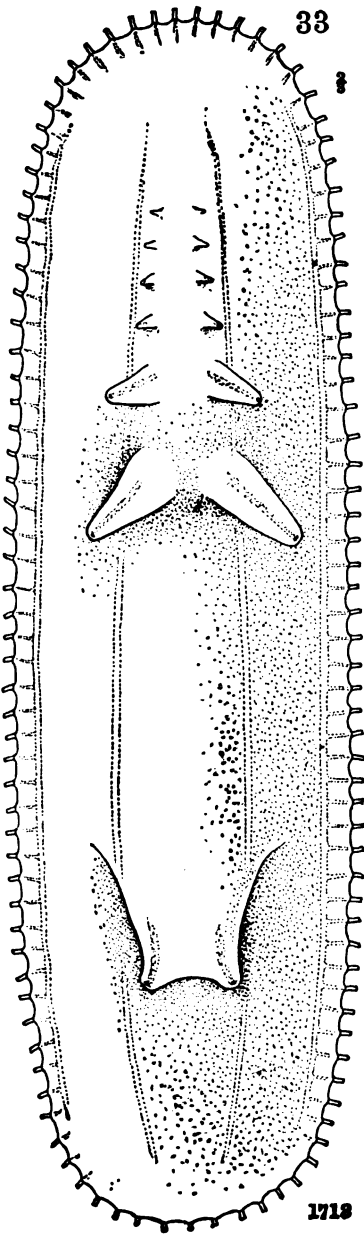
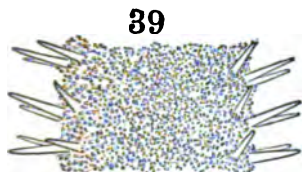
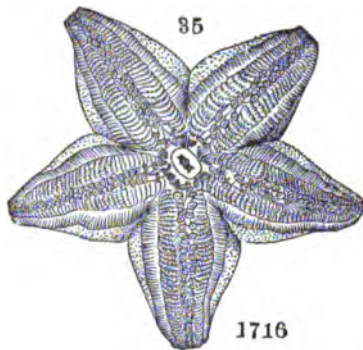
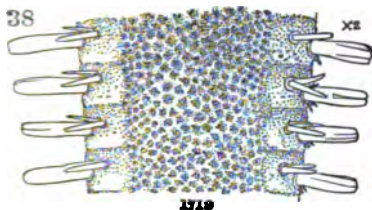
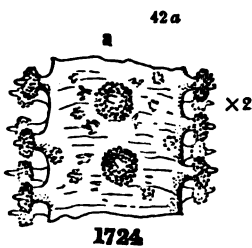
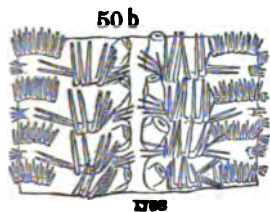
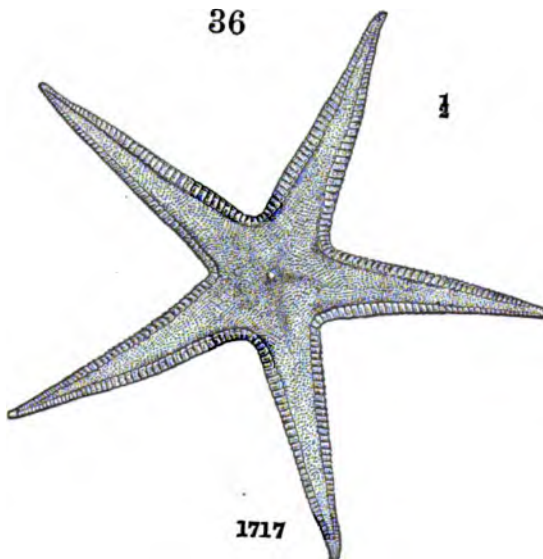
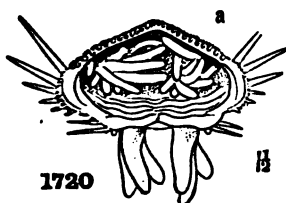


PLATE XIII.

- FIG. 35. *Pteraster militaris*. Lower surface, somewhat reduced. After M. Sara.
- FIG. 36. *Archaster Floris* V. One-half natural size. Copied from a photograph.
- FIG. 37. *Archaster Parelli*. Lower surface, nearly natural size. Copied from a photograph.
- FIG. 38. *Archaster tenuispinus*. Upper surface of the middle portion of an arm, enlarged two diameters.
- FIG. 39. *Luidia elegans*. Upper surface of the middle portion of an arm, enlarged one and one-half diameters; a, the same, transverse section from an alcoholic specimen.
- FIG. 42. *Asterias Tunneri* V. Dorsal view of one of the arms of a living specimen, three-fourths natural size.
- FIG. 42a. The same. Middle portion of an arm, enlarged two diameters.
- FIG. 50b. *Solaster Earlii*. Lower surface of the middle portion of an arm, somewhat enlarged. (See Plate XIX.)



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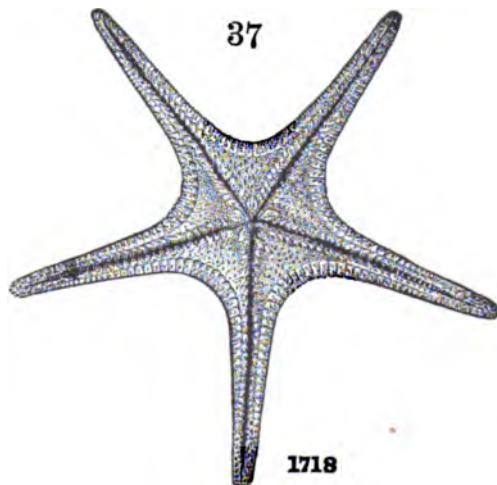


PLATE XIV.

FIG. 40. *Porcellanaster oerulesus*. Upper surface, enlarged two diameters.

FIG. 41. The same. Actinal surface.

FIG. 43. *Diplopteraster multipes*. Actinal surface, two-thirds natural size.

(Figs. 40 and 41 were drawn by J. H. Blake; Fig. 43, by J. H. Emerton.)

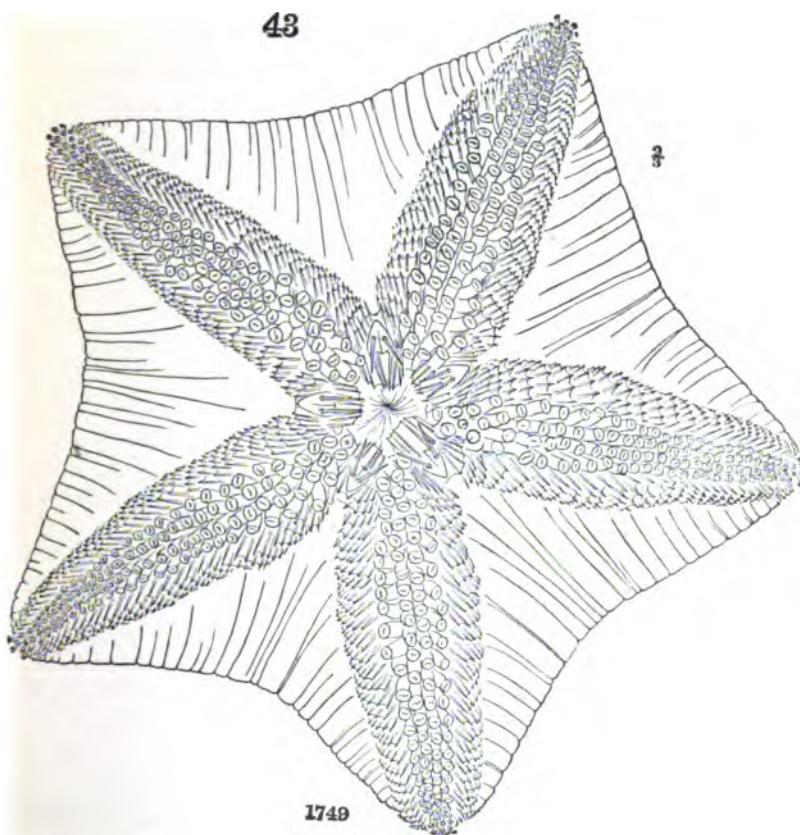
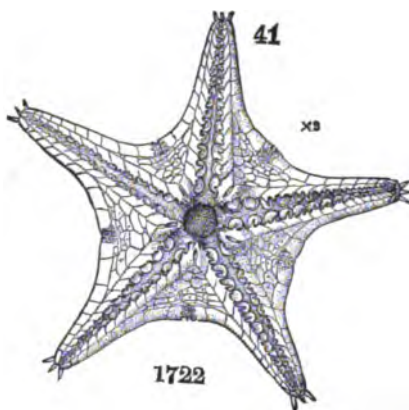
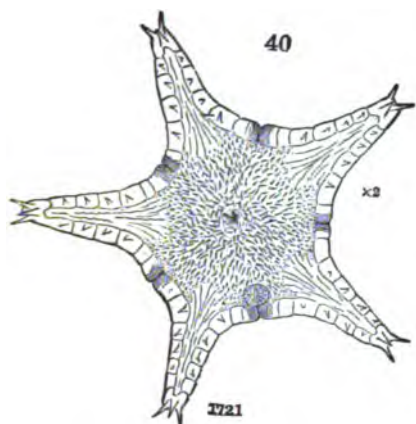


PLATE XV.

- FIG. 44. *Porania grandis* V. Actinal surface, two-thirds natural size.
FIG. 45. The same. Actinal surface of a young specimen, natural size.
FIG. 45a. The same specimen. Abactinal surface.

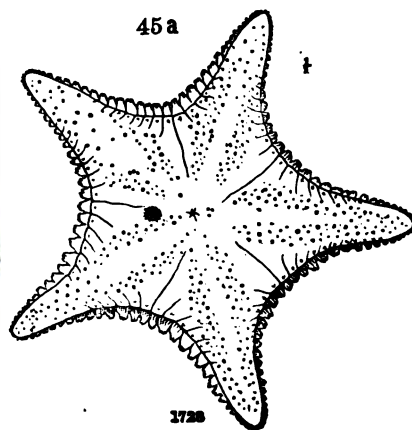
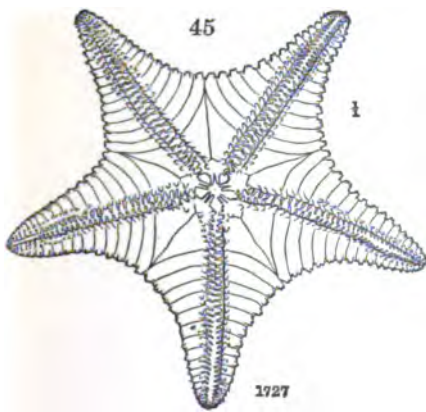
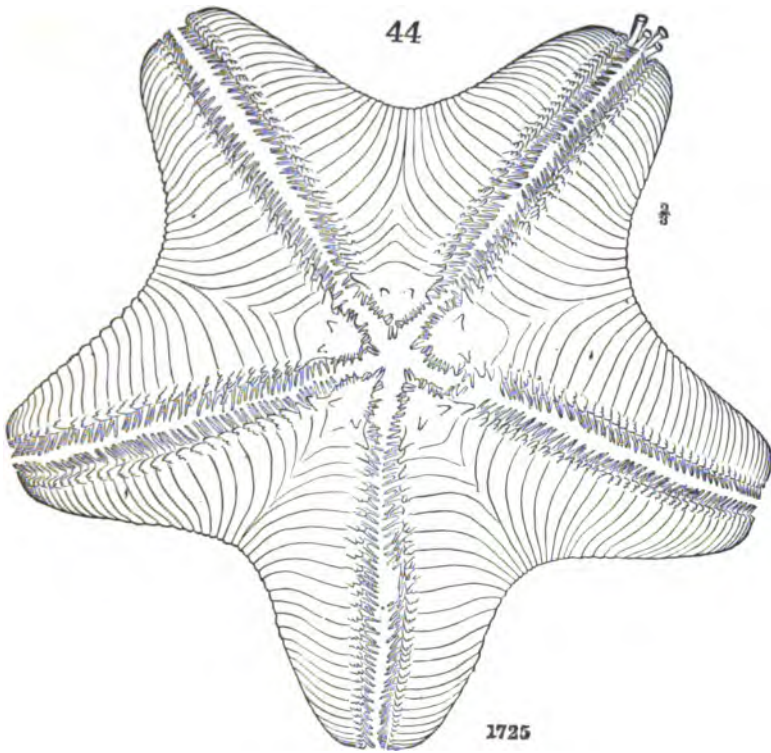


PLATE XVI.

FIG. 44 a. *Perania grandis* V. Actinal surface, two-thirds natural size. From the same specimen as Fig. 44, which was alive but not in full vigor when drawn.

FIG. 49. *Lophaster furcifer*. Abactinal surface of a small specimen, natural size.

FIG. 49 a. The same specimen. Actinal surface.

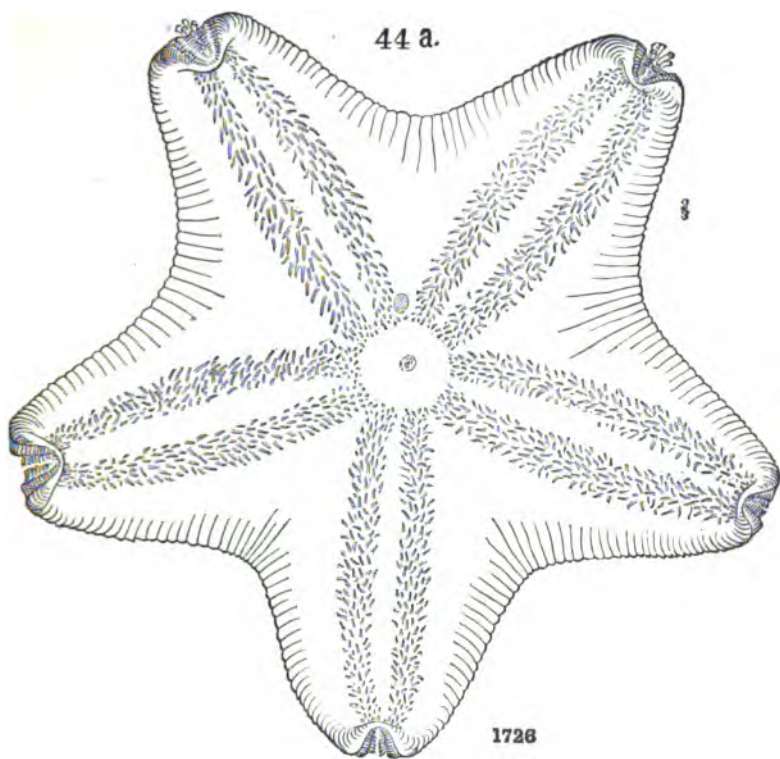


PLATE XVII.

FIG. 47. *Hippasteria phrygiana*. Actinal surface of a specimen having an unusual number and variety of pedicellariæ, one-half natural size. Copied from a photograph of a dry specimen.

FIG. 52. *Bristanga Americana* V. Side view of the basal portion of one of the arms, natural size; a, dorsal surface of the middle portion of an arm, natural size; b, the same, ventral surface. From one of the arms of the type specimen, preserved in alcohol, from the fishing banks off Nova Scotia.

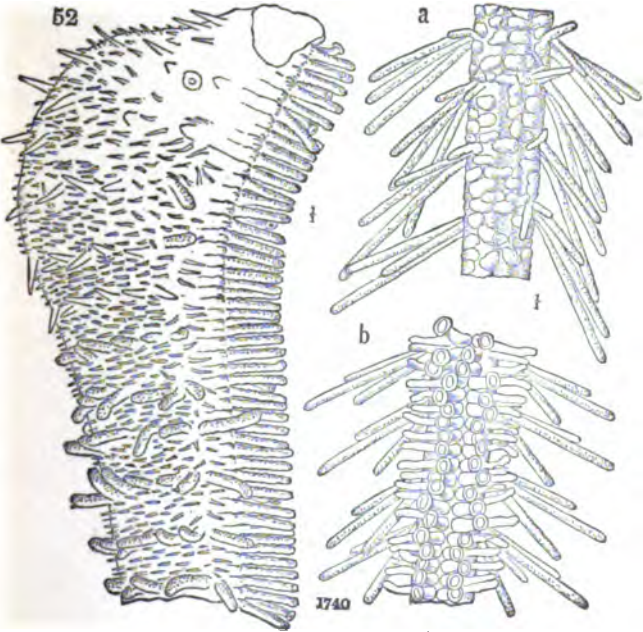
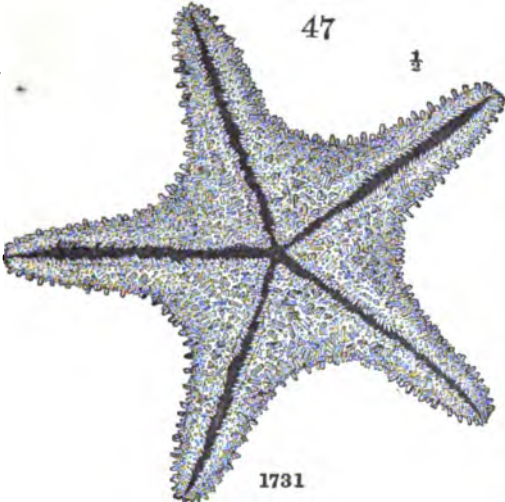


PLATE XVIII.

- FIG. 46. *Asterina borealis*. Actinal surface of the type specimen, enlarged two diameters.
- FIG. 46*a*. The same specimen. Abactinal surface.
- FIG. 48. *Astrogonium granulare*. Abactinal surface of a small specimen, enlarged one and one-half diameters.
- FIG. 48*a*. The same. Actinal surface, two-thirds natural size. Copied from photographs of dry specimens.
- FIG. 51. *Tremaster mirabilis*. Profile view of one of the type specimens from the fishing banks off Nova Scotia, three-fourths natural size.

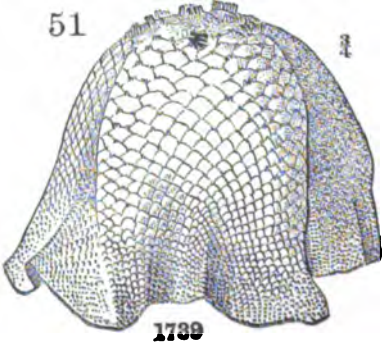
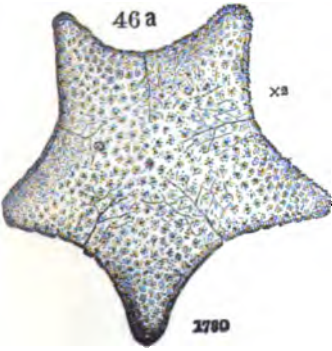
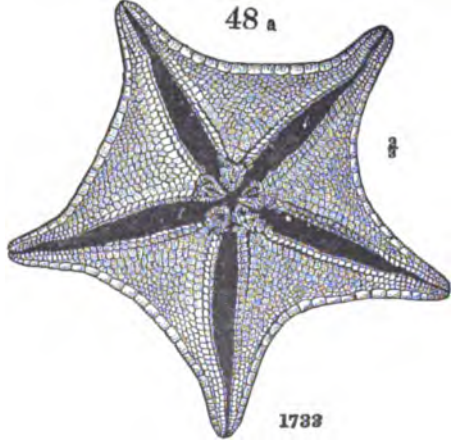
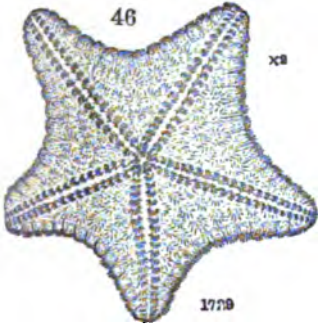
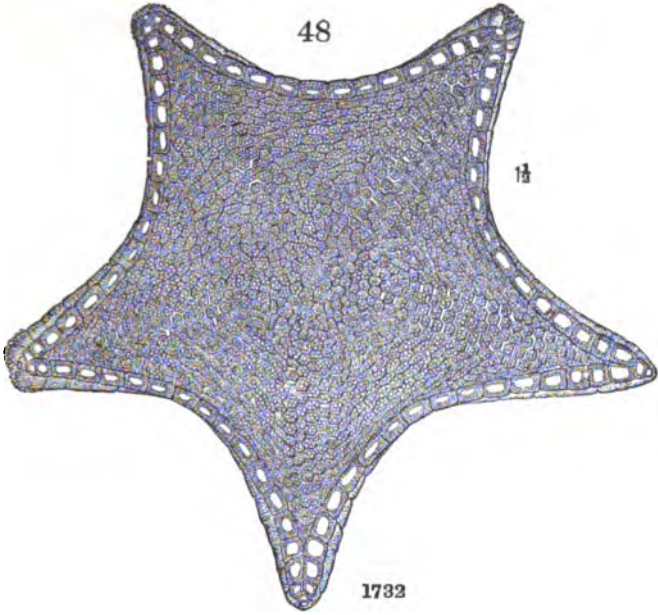


PLATE XIX.

FIG. 50. *Solaster Earlii* V. Abactinal surface of one of the type specimens from the fishing banks off Nova Scotia, one-half natural size.

FIG. 50 a. The same specimen. Actinal surface.

Both figures were copied from photographs of a dried specimen.

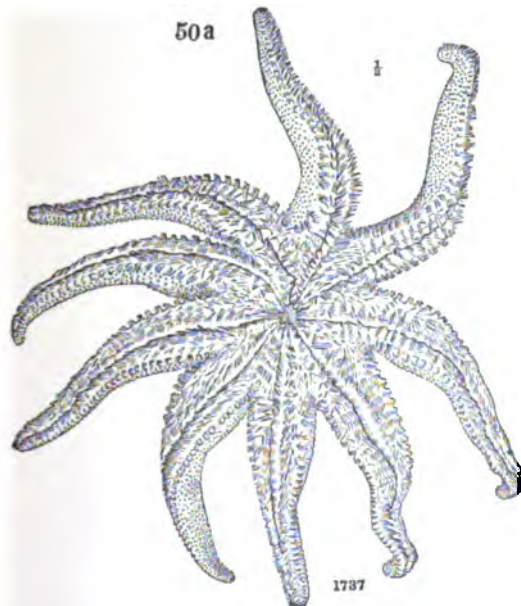
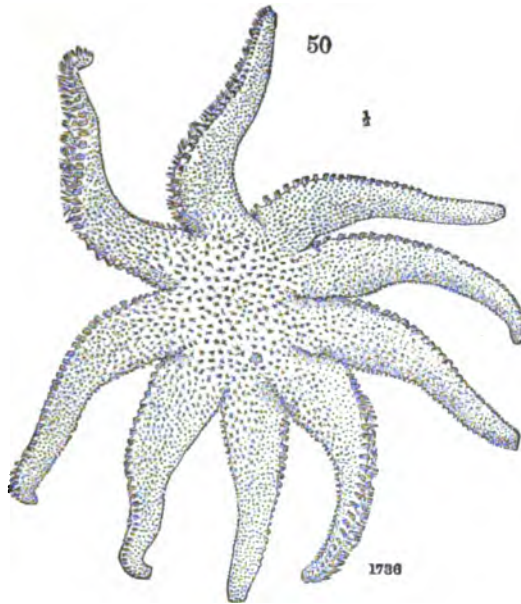


PLATE XX.

- FIG. 53. *Astrochele Lymani* V. Abactinal surface of the type specimen, which is not full-grown, attached to a branch of *Acanella*, enlarged three diameters.
- FIG. 54. *Astronyx Loveni*. Part of the actinal surface of a small specimen, enlarged four diameters; *a*, portion from the distal part of one of the arms, ventral side.
- FIG. 54*b*. One of the lateral rows of hooks and tentacles from the basal part of an arm, enlarged twenty-four diameters; *c*, two of the hooks from the distal portion of an arm.
- FIG. 55. *Amphiura tenuispina*. Abactinal surface of a small specimen, enlarged about four diameters. From a camera lucida drawing by the author.
- FIG. 56. *Ophioscolex quadrispinus* V. Actinal surface of a portion of the disk and arms, enlarged four diameters.
- FIG. 56*a*. The same. Portion of an arm from near the base. Ventral surface, enlarged eight diameters; *b*, the same, side view, showing the basal joints, which sometimes have five spines.

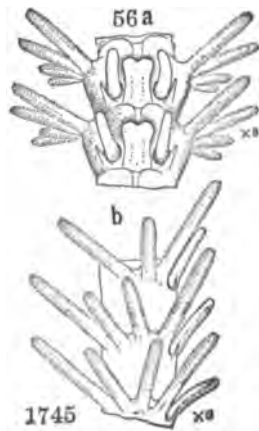
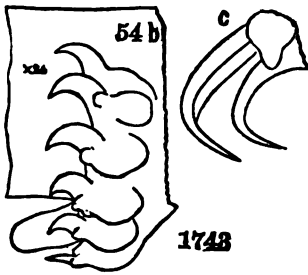
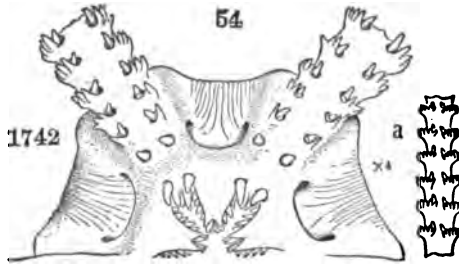
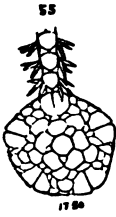


PLATE XXI.

FIG. 57. *Rhizocrinus Lofotensis*. A young and somewhat imperfect specimen from 640 fathoms, enlarged eight diameters. The base of the stem and the tips of the arms are broken off.

FIG. 58. *Astædon dentata*, young. In the attached or pentacrinus stage, enlarged about eight diameters.

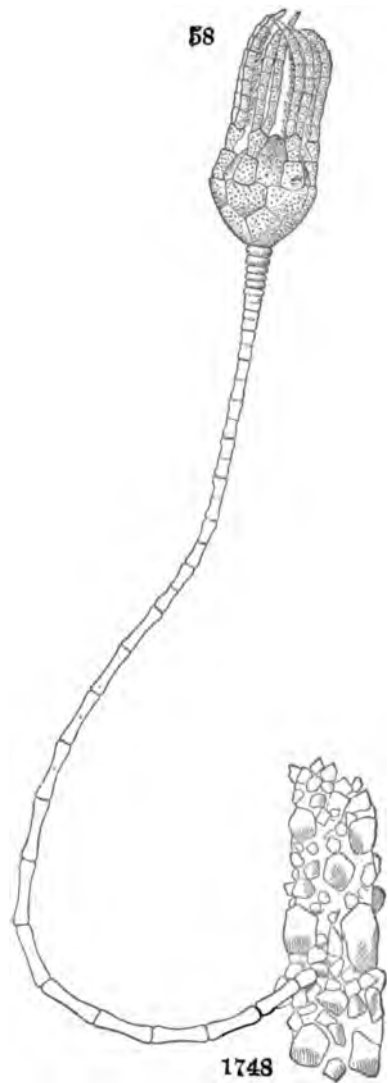
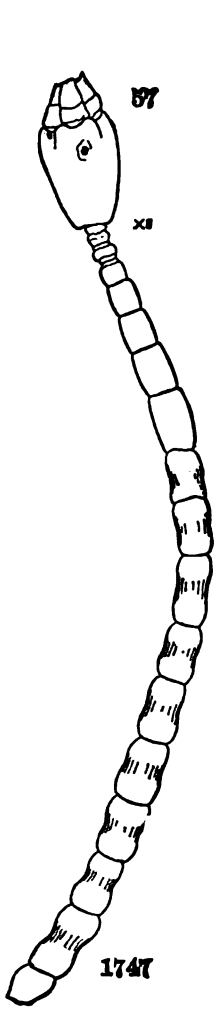


PLATE XXII.

- FIG. 60. *Abralia megalops* V. Ventral surface, enlarged one and one-half diameters.
From a specimen which differed from the type in having raised verrucae scattered on the lower surface.
- FIG. 61. The same. One of the lateral arms, more enlarged.
- FIG. 62. *Leptoteuthis diaphana* V. Dorsal view of the type specimen, enlarged one and one-half diameters.
- FIG. 64. *Eledonella pygmaea* V. One of the lateral arms of the type specimen, enlarged.
- FIG. 65. *Octopus pictus* V. Dorsal view of the type specimen, enlarged four diameters.

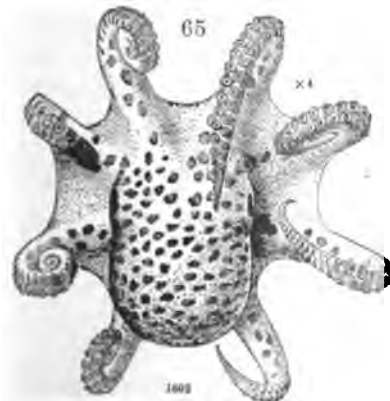
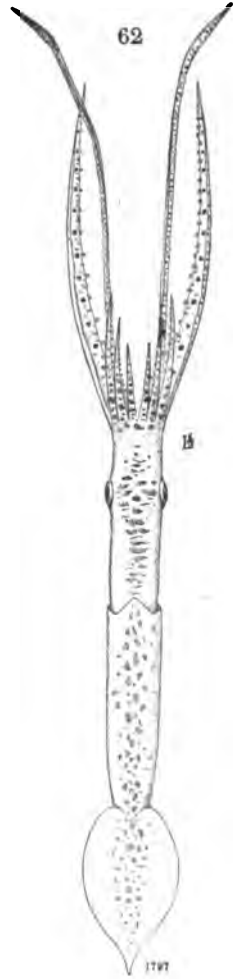
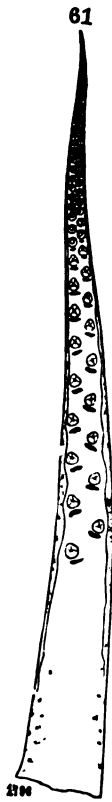


PLATE XXIII.

FIG. 63. *Argonauta argo*. Side view of the animal, natural size. From a young specimen taken off Long Island, at the surface.

FIG. 63 a. The same specimen. Front view of the shell, natural size.

FIG. 63 b. The same specimen. Side view, natural size.

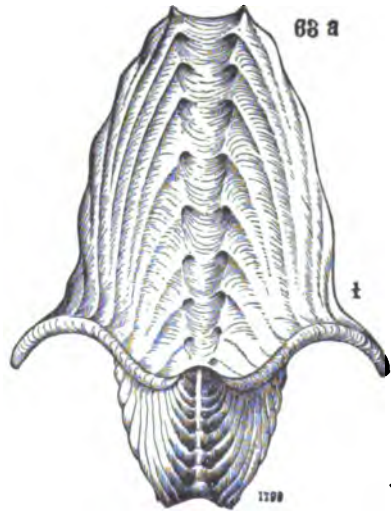
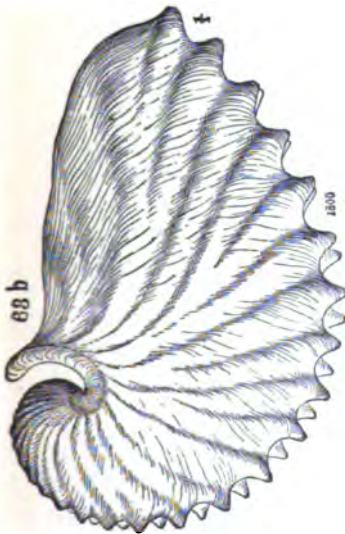
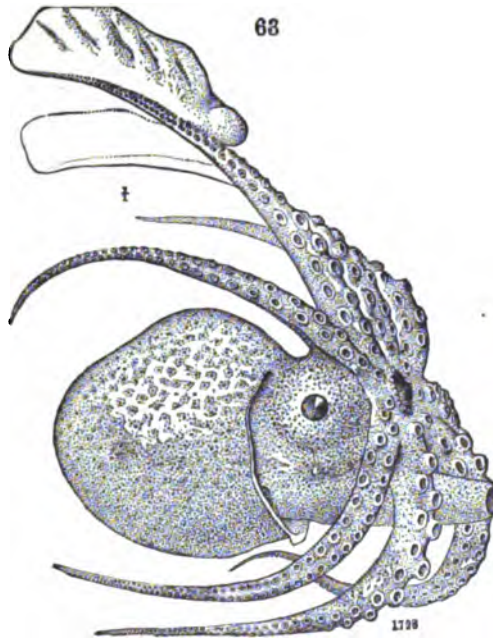


PLATE XXIV.

- FIG. 66. *Pleurotoma Dall*, enlarged two diameters.
FIG. 66 a. The same. Side view of the anterior whorls, enlarged two diameters.
FIG. 67. *Pleurotomella Agassizii* V., enlarged two diameters.
FIG. 68. *Pleurotomella Bairdii* V. Female, enlarged one and one-half diameters.
FIG. 69. *Pleurotomella Pandionis* V., enlarged one and one-half diameters.
FIG. 70. *Pleurotomella Benedicti* V. & S., enlarged three diameters.
FIG. 70 a. The same. To show nuclear whorls, enlarged twenty-two diameters.
FIG. 71. *Pleurotomella Sandersoni* V., enlarged six diameters.
FIG. 71 a. The same. To show nuclear whorls, enlarged twenty-two diameters.
FIG. 72. *Pleurotomella Saffordi* V. & S., enlarged four diameters.
FIG. 73. *Pleurotomella bandella*, enlarged four diameters.
FIG. 74. *Pleurotomella Emertoni* V. & S., enlarged three diameters.
Fig. 68 was drawn by Ensign W. E. Safford, U. S. N. The others, by J. H. Emerton.

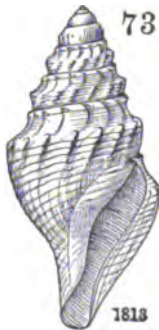
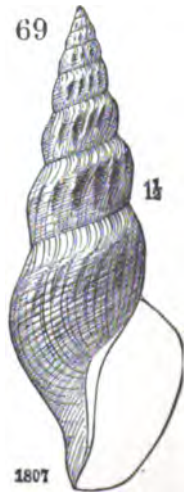
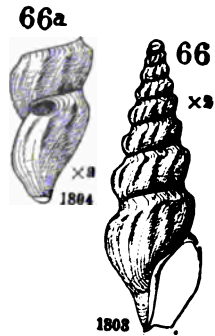
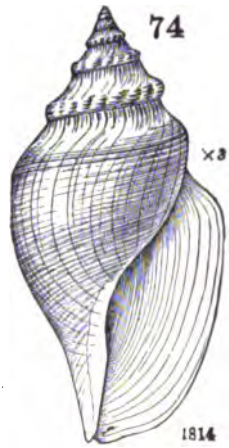
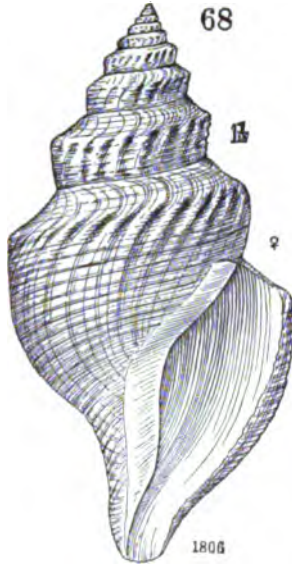
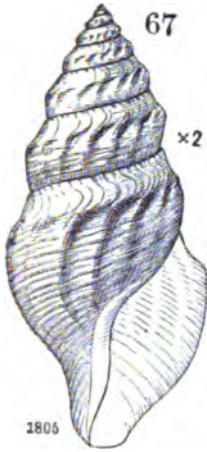


PLATE XXV.

- FIG. 75. *Pleurotomella Brusari* V. & S., enlarged six diameters.
FIG. 76. *Pleurotomella Catherina* V. & S., enlarged four diameters.
FIG. 76 a. The same. To show nuclear whorls, enlarged twenty-two diameters.
FIG. 77. *Taranis pulchella*, enlarged eight diameters.
FIG. 78. *Typhlomangilia Tanneri* V. & S., enlarged three diameters.
FIG. 79. *Marginella borealis* V., enlarged two diameters.
FIG. 80. *Buccinum abyssorum* V., enlarged one and one-half diameters; a, the operculum.
FIG. 81. *Sipho profundicola* V. & S., enlarged one and one-half diameters.
FIG. 82. *Sipho glyptus* V., enlarged two diameters.
FIG. 86. *Ctagula Jan Mayeni*, enlarged eight diameters.
FIG. 90. *Scalaria Granlandica*. Dorsal view of the animal with the proboscis extended, and the two anterior whorls, enlarged about four diameters.
FIG. 91. *Scalaria Dalliana* V. & S., enlarged six diameters.
FIG. 92. *Scalaria Pourtalesii* V. & S. Female, enlarged three diameters.
FIG. 93. *Scalaria Lecana* V. Front view of an imperfect specimen, enlarged six diameters.
FIG. 94. *Scalaria Andrewsii* V., enlarged eight diameters.

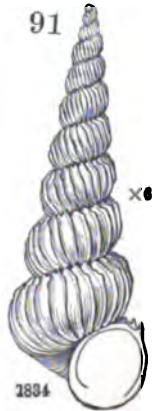
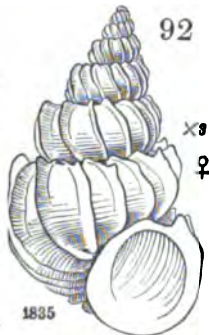
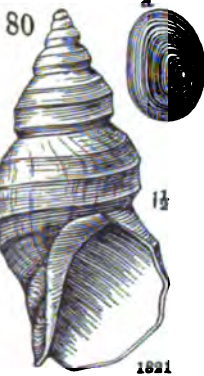
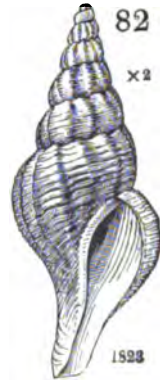
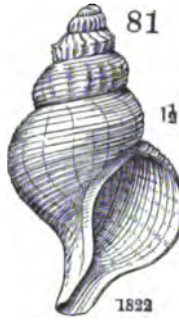
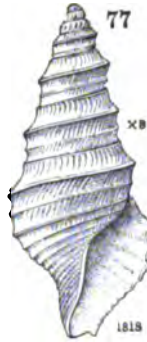
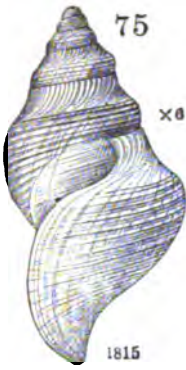


PLATE XXVI.

- FIG. 83. *Dolium Bairdii* V. & S. Male, enlarged one and one-half diameters.
FIG. 83 a. The same. Animal of the male, two-thirds natural size.
FIG. 84. *Benthodolium abyssorum* V. & S., enlarged one and one-half diameters; a,
operculum of the same specimen.
FIG. 84 b. The same. Part of the odontophore, enlarged one hundred diameters.
FIG. 85. *Tyrellia Ambriata* V. & S. Male, enlarged two diameters.
FIG. 87. *Fossarus elegans* V. & S., enlarged eight diameters.
FIG. 88. *Seguensia formosa*, enlarged ten diameters.
FIG. 88 a. Operculum of the same.
FIG. 89. *Seguensia eritima* V., enlarged ten diameters.

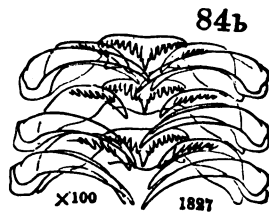
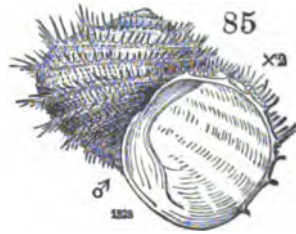
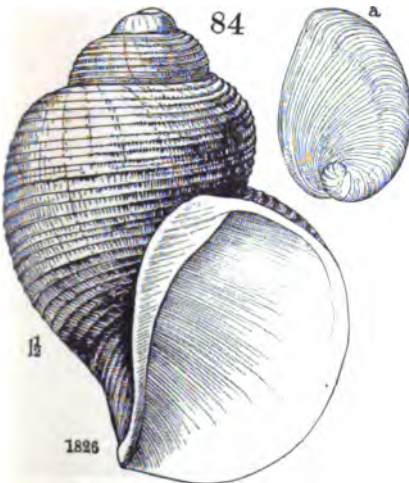
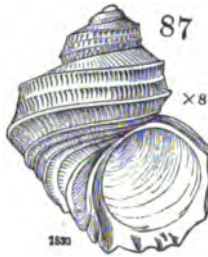
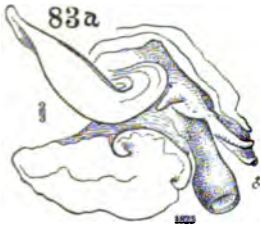
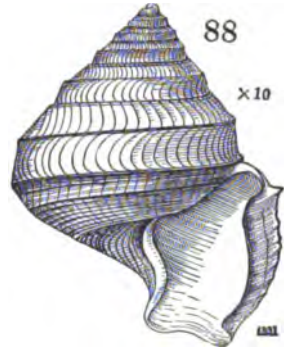
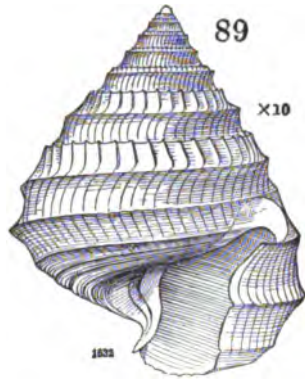
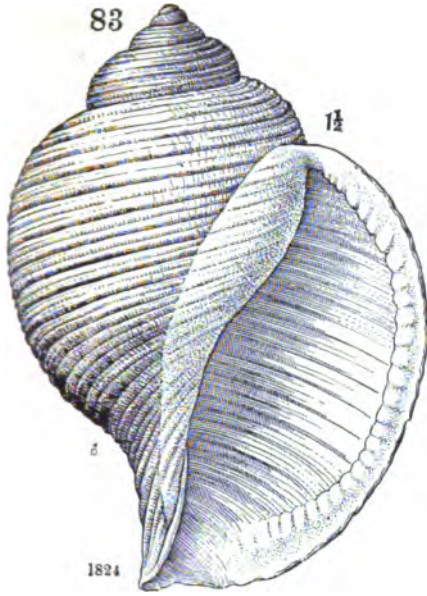


PLATE XXVII.

- FIG. 95. *Solarium boreale*, enlarged three diameters.
- FIG. 95 a. The same. Upper surface of a young specimen, enlarged six diameters.
- FIG. 96. *Calliostoma Bairdii* V. & S. Dorsal view of the living animal and shell, enlarged one and one-half diameters.
- FIG. 97. *Margarita regalis* V. & S., enlarged three diameters.
- FIG. 98. *Margarita lamellosa* V. & S., enlarged eight diameters.
- FIG. 99. *Cyclostrema Dalli* V., enlarged ten diameters.
- FIG. 100. *Addisonia paradoxa*. Female. Ventral view of the animal and shell in alcohol, enlarged three diameters.
- FIG. 100 a. The same. Side view of the shell, enlarged about two diameters.
- FIG. 101. *Cocculina leptalea* V. Side view, much enlarged.
- FIG. 102. *Placophora Atlantica*. Dorsal view, enlarged one and one-half diameters.
- FIG. 102 a. The same specimen. Ventral view.
- FIG. 103. *Amicula Emersonii*. Ventral view, two-thirds natural size; a, the posterior end, more enlarged.
- FIG. 104. *Turbonilla Bathursti* V. & S., enlarged four diameters.

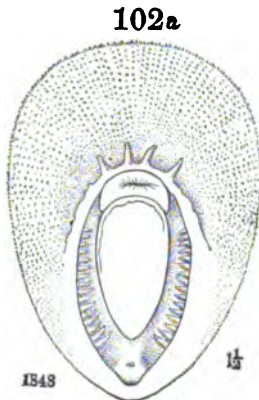
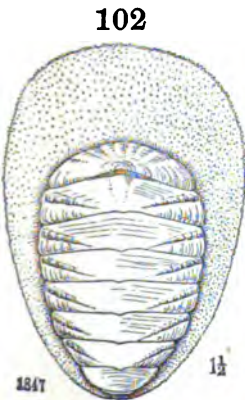
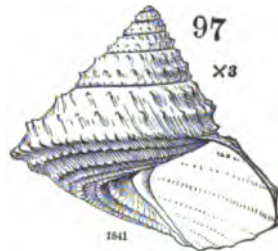
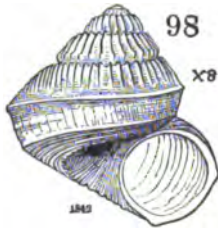
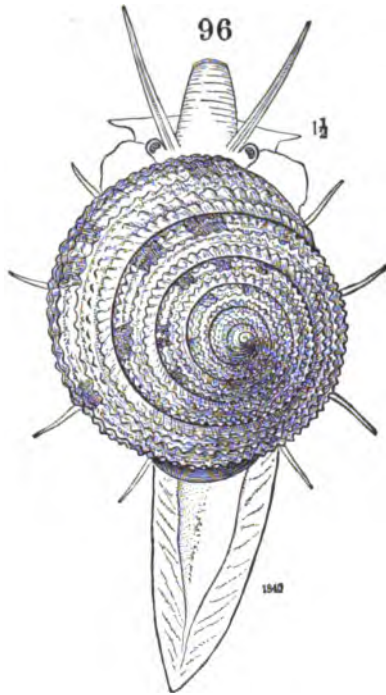
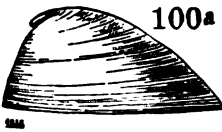
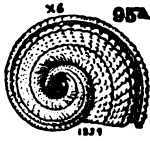
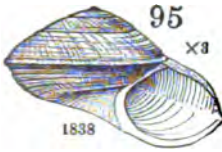


PLATE XXVIII.

- FIG. 105. *Pleurobranchæa tarda* V. Dorsal view of a specimen in alcohol, two-thirds natural size.
- FIG. 106. *Scaphander nobilis* V., natural size.
- FIG. 107. *Koonsia obesa* V. Dorsal view of a specimen preserved a short time in alcohol, in which the dorsal part of the body is much contracted, two-thirds natural size.
- FIG. 108. *Issa ramosa* V. & Em. Dorsal view of a living specimen, enlarged three diameters.
- FIG. 108 a. The same. Part of the odontophore, much enlarged.
- FIG. 109. *Seyllæa Edwardii* V. Side view of a living specimen, two-thirds natural size.
- FIG. 113. *Glaucus margaritaceus*. Ventral view of a nearly mature specimen, considerably enlarged.
- FIG. 113 a. The same. Dorsal view of a younger specimen, much enlarged; b, view of a still smaller specimen.
- FIG. 123. *Dentalium occidentale*, enlarged four diameters.
- FIG. 124. The same. A small specimen of a more curved variety, enlarged two diameters.
- FIG. 125. The same. View of a young specimen with more numerous sulcations, enlarged four diameters; a, transverse section of the same.
- FIG. 126. *Cadulus Pandionis* V. & S., enlarged about three diameters; a, front view of the anterior end to show the aperture.
- Fig. 109 was drawn from life by Ensign W. E. Safford, U. S. N.
- Figs. 113 and 113 a were copied from sketches made at sea by Mr. A. Baldwin.

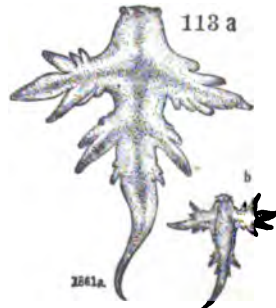
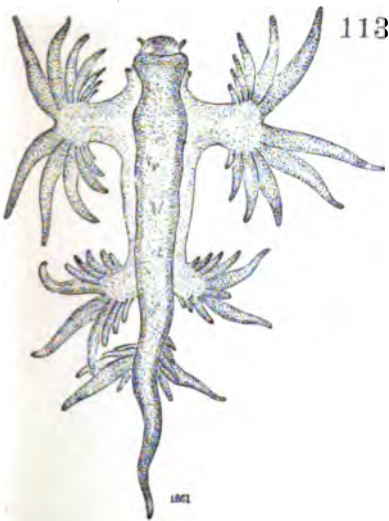
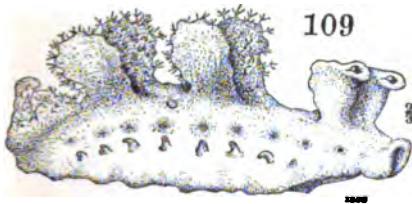
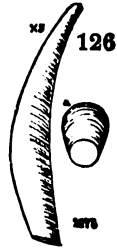
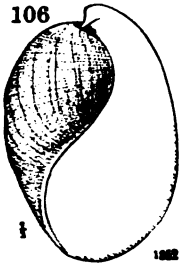
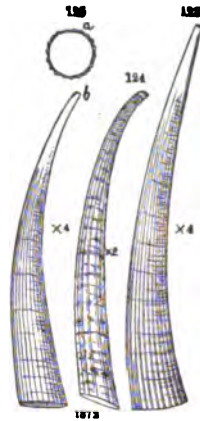
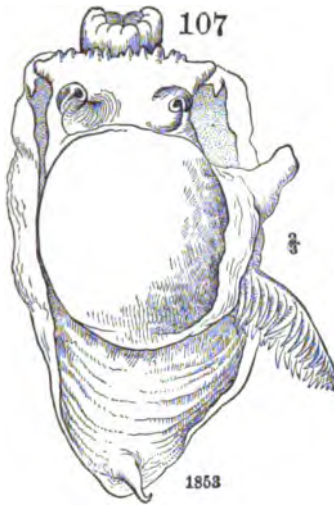


PLATE XXIX.

- FIG. 110. *Atlanta Peronii*. Side view of a somewhat broken specimen, enlarged eight diameters.
- FIG. 110 a. The same specimen. Front view.
- FIG. 111. *Atlanta Gandiaudii*. Side view, much enlarged.
- FIG. 112. *Trocha Keraudrenii*. Side view of a specimen preserved a short time in alcohol, enlarged four diameters.
- FIG. 114. *Pleuropus Hargerii* V. Side view of one of the type specimens, preserved in alcohol.
- FIG. 115. *Diacria trispinosa*. Expanded animal and shell, enlarged about two diameters.
- FIG. 116. *Cavolina uncinata*. Expanded animal and shell, enlarged about two diameters.
- FIG. 117. *Triptera columnella*. Expanded animal and shell, much enlarged.
- FIG. 118. *Styliola recta*. Shell, much enlarged.
- FIG. 119. *Styliola striata*. Expanded animal and shell, much enlarged.
- FIG. 120. *Cymbulia calceolus*. Front view of a specimen a short time in alcohol, two-thirds natural size.
- FIG. 121. *Spongiobranchia australis*. Ventral view of the living animal, much enlarged.
- FIG. 122. *Clione papilionacea*. Dorsal view of the living animal, enlarged two diameters.
- Figs. 114, 118, and 122 were drawn by the author; 110, 112, and 120 by J. H. Emerton; 115, 116, 117, 119, and 121 were copied from Eydoux and Souleyet by Eusign W. E. Safford; Fig. 121 is a camera lucida drawing by Mr. Safford.

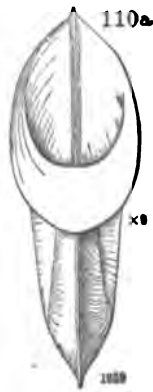
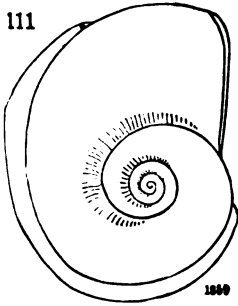
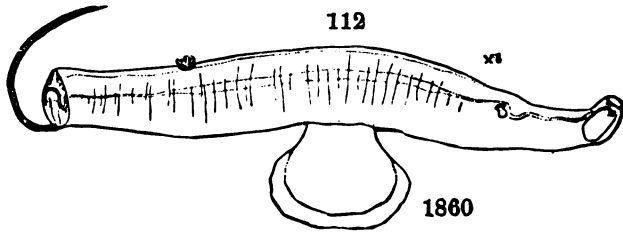
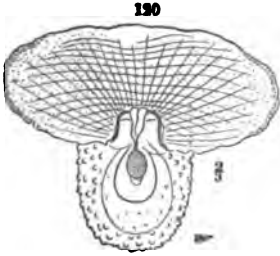
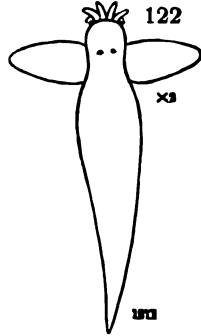
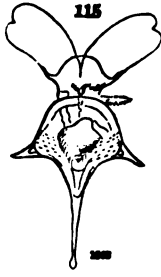
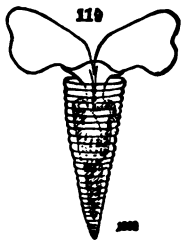
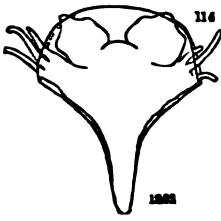


PLATE XXX.

- FIG. 127. *Teredo negotara*. Side view of the animal in expansion, one-half natural size.
- FIG. 128. *Poromya sublevis* V. Inner surface of right valve, enlarged three diameters.
- FIG. 129. *Noera multicostrata* V. & S., enlarged three diameters.
- FIG. 130. *Thracia nitida* V. Type specimen, enlarged one and one-half diameters.
- FIG. 131. *Verticordia ovalata* V. Type specimen, enlarged ten diameters; *a*, interior of the right valve; *b*, exterior of the same valve.
- FIG. 132. *Mytilimeria flexuosa* V. & S. Type specimen, enlarged one and one-half diameters.
- FIG. 133. *Pholadomya arata* V. & S. Portion of right valve of two specimens to show variations in the hinge, enlarged two diameters; *a*, form with more thickened hinge margin; *b*, shorter and more triangular form with thinner hinge margin.
- FIG. 134. The same. Type specimen. Exterior of the right valve, enlarged one and one-half diameters.
- FIG. 135. *Diplodonta turgida* V. & S. Interior view of right valve, enlarged one and one-half diameters.

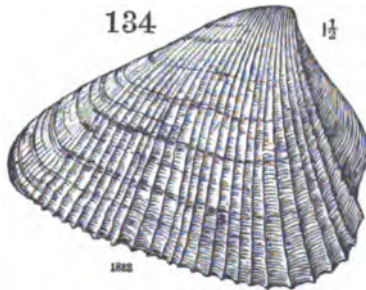
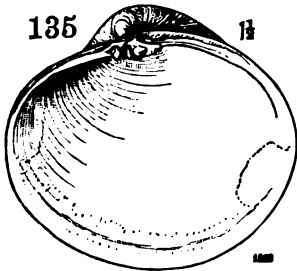
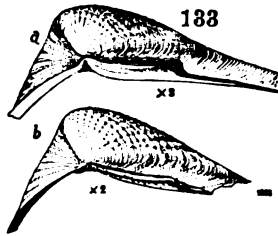
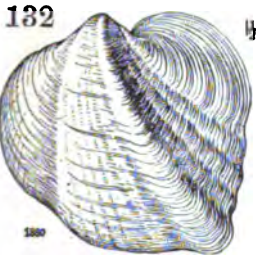
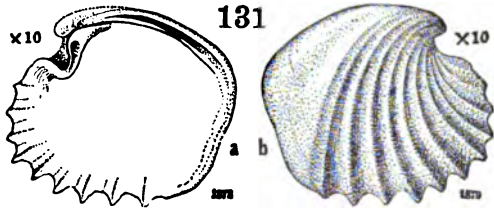
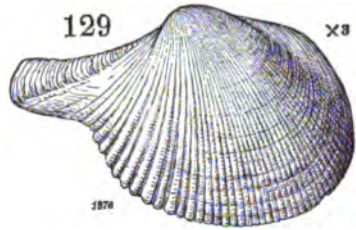


PLATE XXXI.

- FIG. 136. *Diplodonta turgida* V. & S. Interior view of left valve of another specimen, enlarged one and one-half diameters.
- FIG. 137. *Yoldia thraoiformis*. Side view of the shell and living animal in expansion, two-thirds natural size.
- FIG. 138. The same. Ventral view of the shell and living animal, two-thirds natural size.
- FIG. 139. *Yoldia sapotilla*. Side view of the shell and living animal in full expansion, one and one-half times natural size.
- FIG. 140. *Leda acuta*. Interior of left valve, enlarged four diameters.
- FIG. 141. *Pecten vitreus*, natural size.
- FIG. 142. *Pecten pustulosus* V. One of the type specimens, enlarged two diameters; *a*, lower valve; *b*, upper valve of the same specimen.
- FIG. 144. *Culeolus Tanneri* V. Side view of one of the type specimens, natural size; *a*, front view of the same specimen.
- FIG. 145. The same. Side view of another type specimen, natural size; *b*, posterior view of the same specimen.
- Figs. 144 and 145 were drawn from specimens preserved a short time in alcohol.

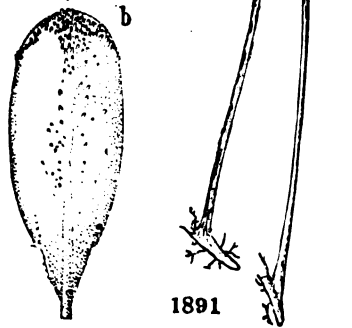
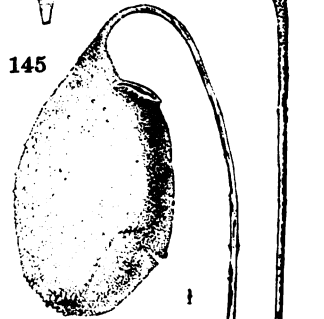
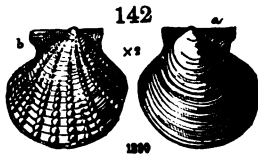
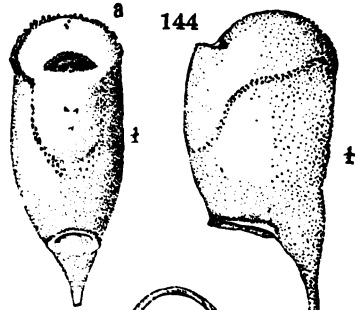
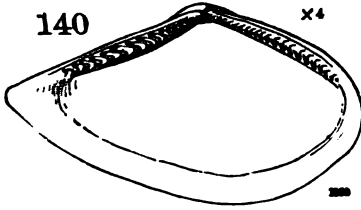
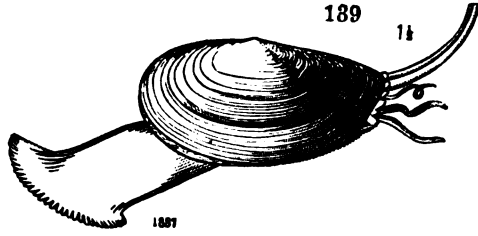
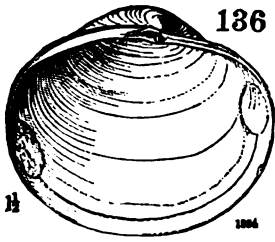


PLATE XXXII.

- Fig. 146. *Doliolum*, sp. View of a small living specimen taken in the Gulf Stream, much enlarged.
- FIG. 147. *Salpa Caboti*. Front view of a living specimen of the solitary form in which a chain is seen in process of development, enlarged three diameters; a, side view of the same specimen, which was taken in Vineyard Sound, August, 1884.
- FIG. 148. *Salpa clotha* M.-Edw. Dorsal view of a small individual of the solitary form in which a young chain is seen developing, enlarged three diameters.
- FIG. 149. The same. Side view of a somewhat smaller specimen, enlarged three diameters; a, dorsal view of another specimen, natural size.
- FIG. 150. The same species. One of the individuals from a chain not full grown, side view, natural size; a, the same specimen, front view.
- Figs. 147-150 were made by J. H. Blake from living specimens taken in Vineyard Sound, August, 1884. Fig. 146 was drawn by J. H. Emerton.

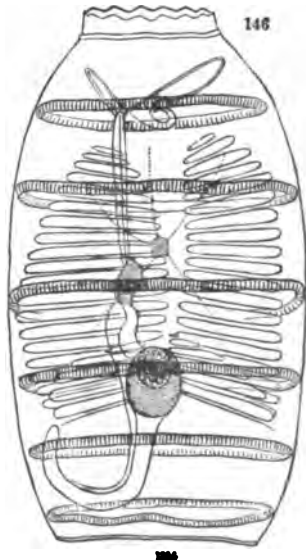
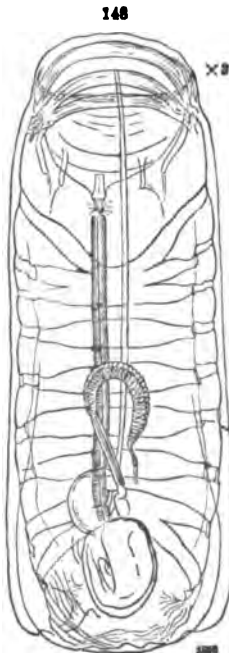
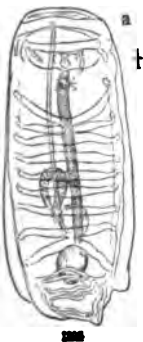
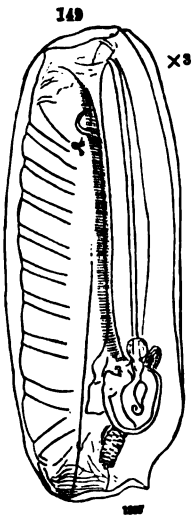
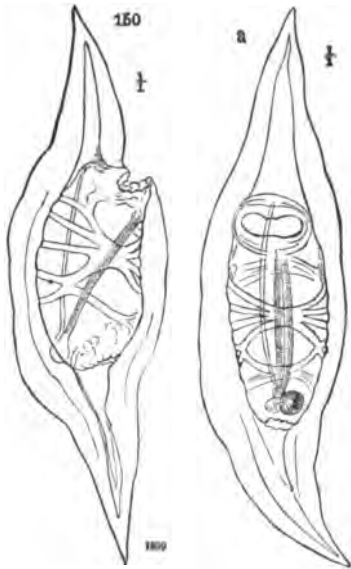
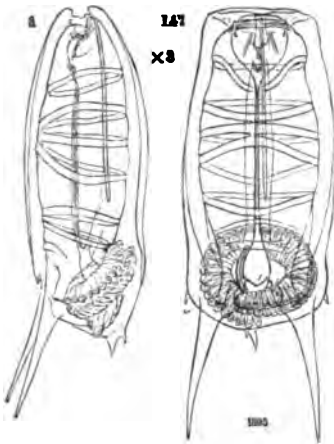


PLATE XXXIII.

FIG. 151. *Lithodes Agassisi* Smith. A small female, one-half natural size; a, dorsal view of a young specimen with long spines, enlarged two diameters; b, the same specimen, side view of the carapax.

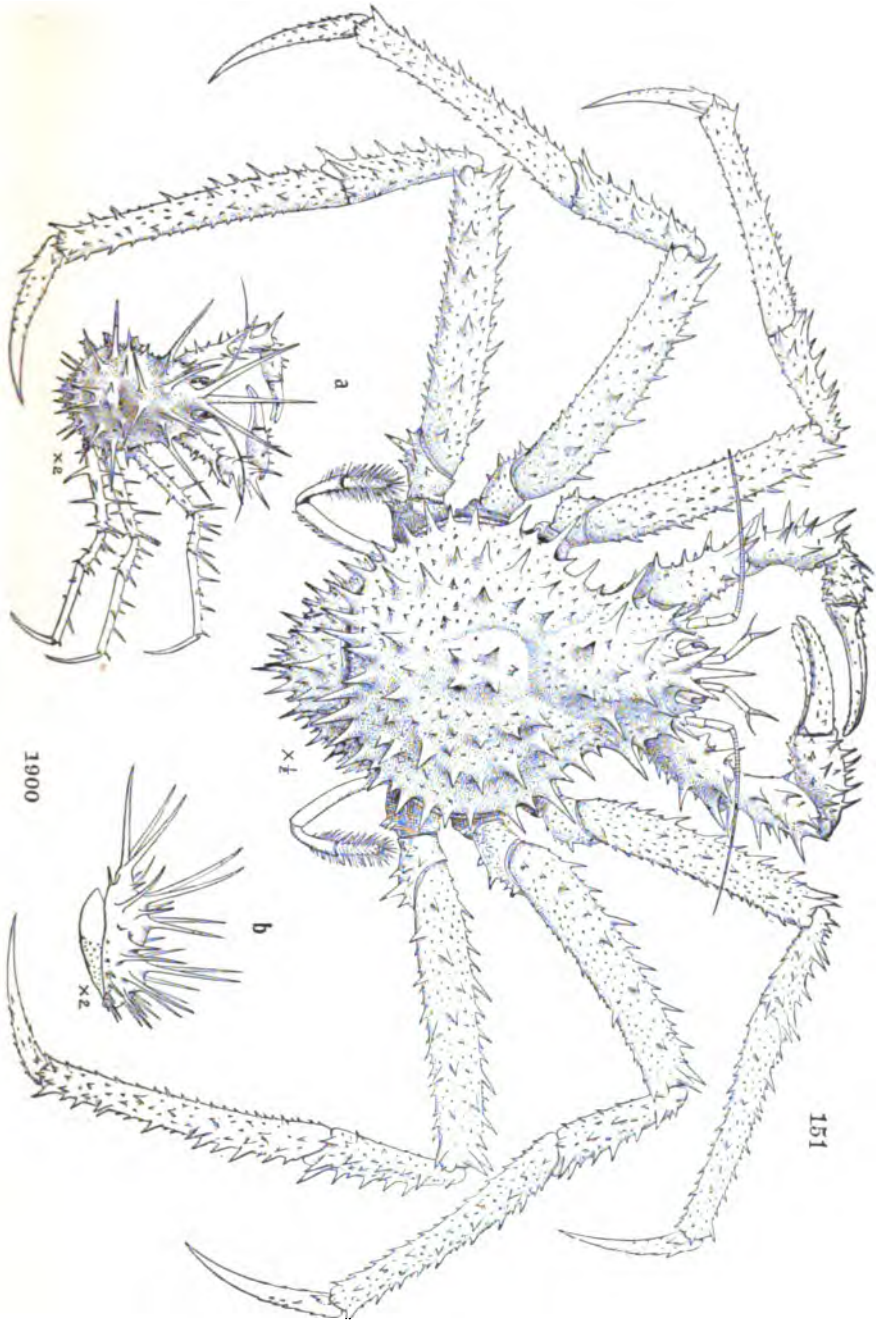


PLATE XXXIV.

FIG. 152. *Pentacholes sculptus* Smith. Female. Dorsal view, natural size.

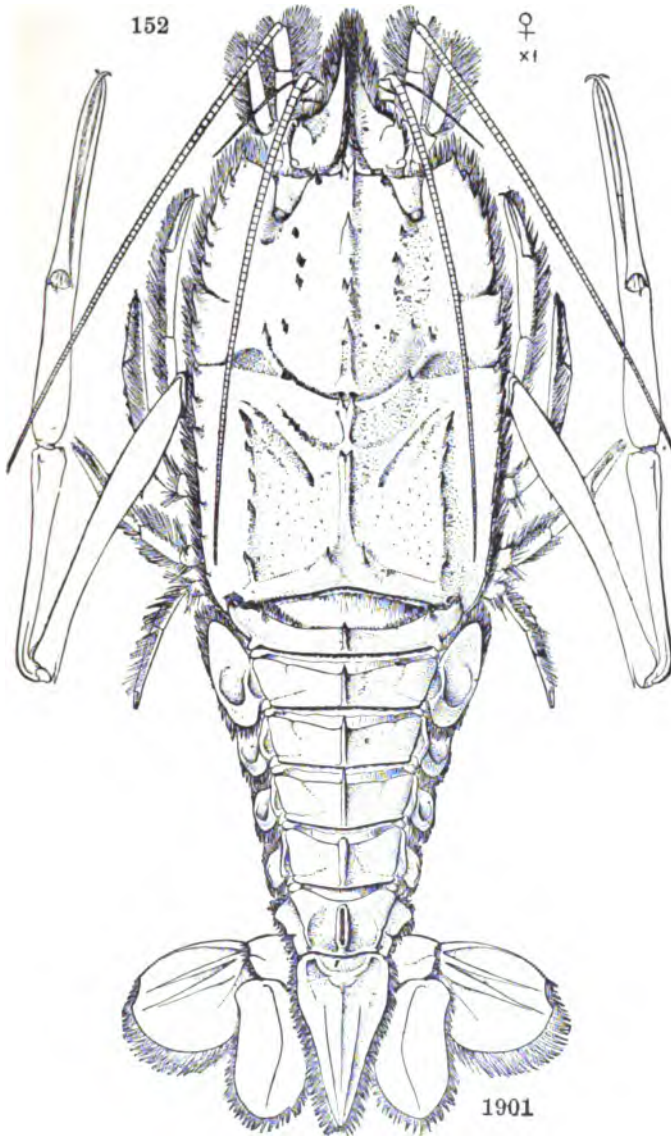


PLATE XXXV.

FIG. 153. *Munida Caribbea*? Male, natural size.

FIG. 154. *Glyptocrangon sculptus* Smith. Female, natural size.

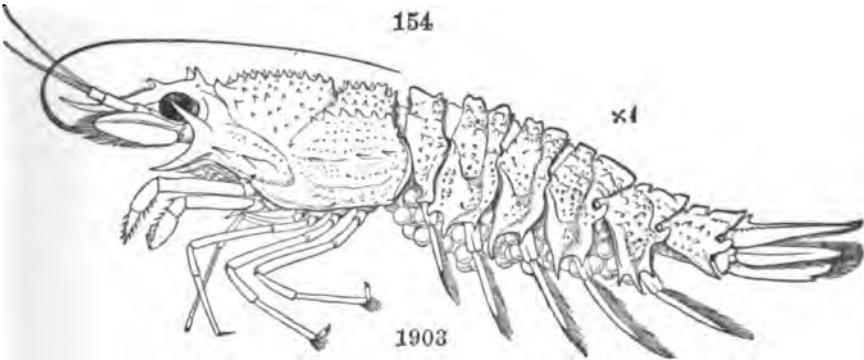
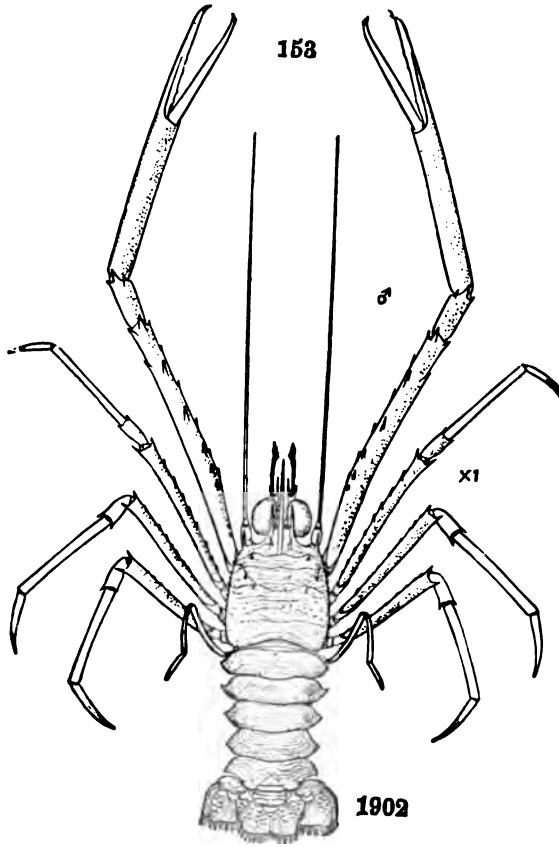


PLATE XXXVI.

- FIG. 155. *Ceraphilus Agassizii* Smith. Female, natural size.
- FIG. 157. *Sabinea princeps* Smith. Female with eggs, natural size.
- FIG. 163. *Phronima*, sp. In a transparent case formed from the test of a large *Salpa*. Female, with young attached to the inner surface of the case, somewhat enlarged.
- FIG. 164. *Sycenus infelix* Harger, enlarged one and one half diameters.
- FIG. 165. *Cirolana impressa* Harger, enlarged three diameters.
- FIG. 167. *Anthoacheres Dubeni*. Male, natural size; *a*, dorsal; *b*, ventral view.
- FIG. 168. The same. Female, natural size; *a*, ventral; *b*, lateral; *c*, dorsal view, with a detached egg case.

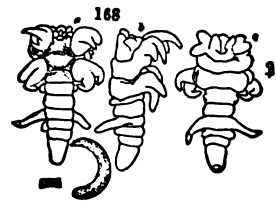
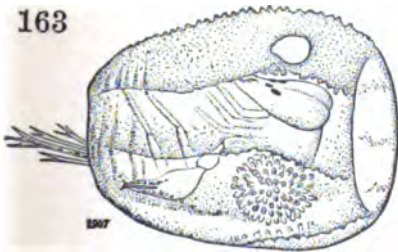
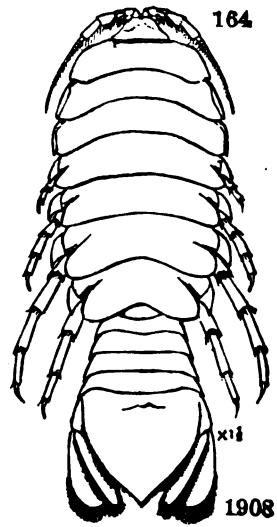
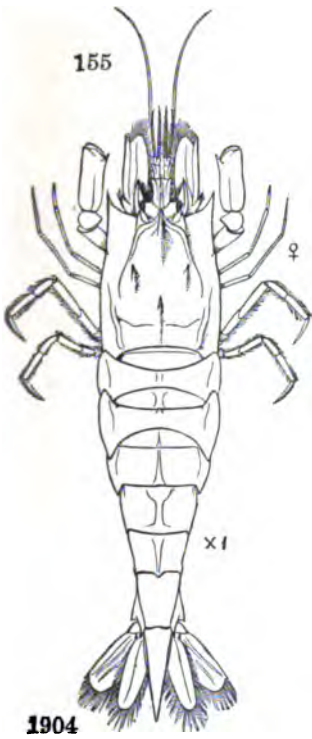
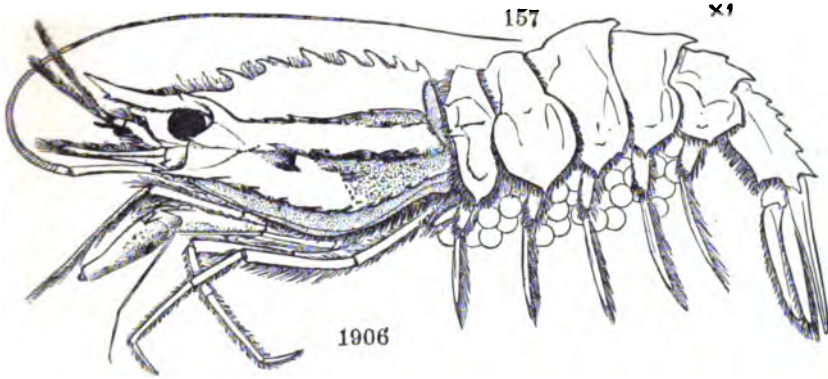


PLATE XXXVII.

FIG. 156. *Geryon quinquedens* Smith. A small male, two-thirds natural size.

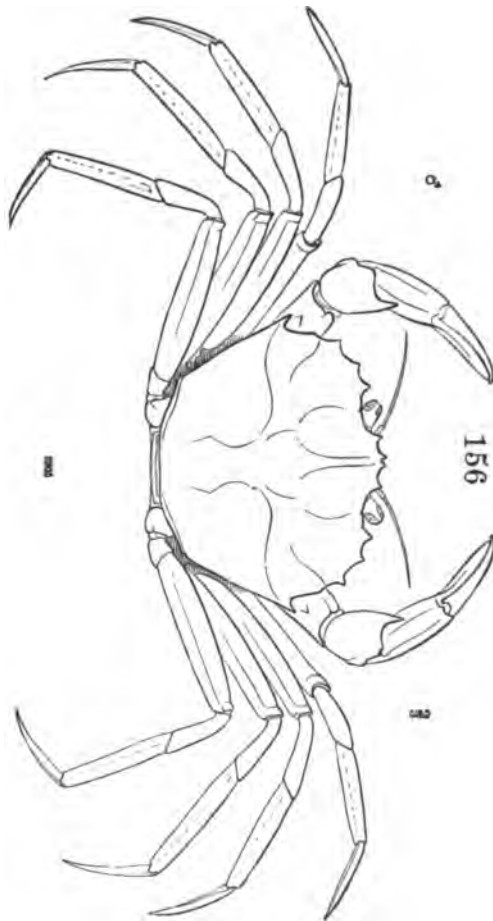


PLATE XXXVIII

FIG. 169. *Colossendeis collosea*, two-thirds natural size.

FIG. 170. *Colossendeis macerrima*, two-thirds natural size.

FIG. 171. *Scororhynchus armatus*. Dorsal view, two-thirds natural size; a, side view of body, natural size.

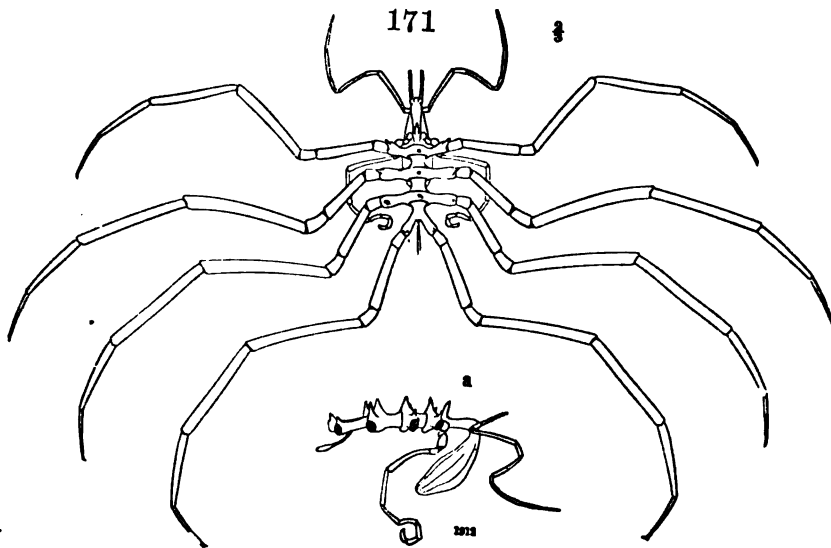
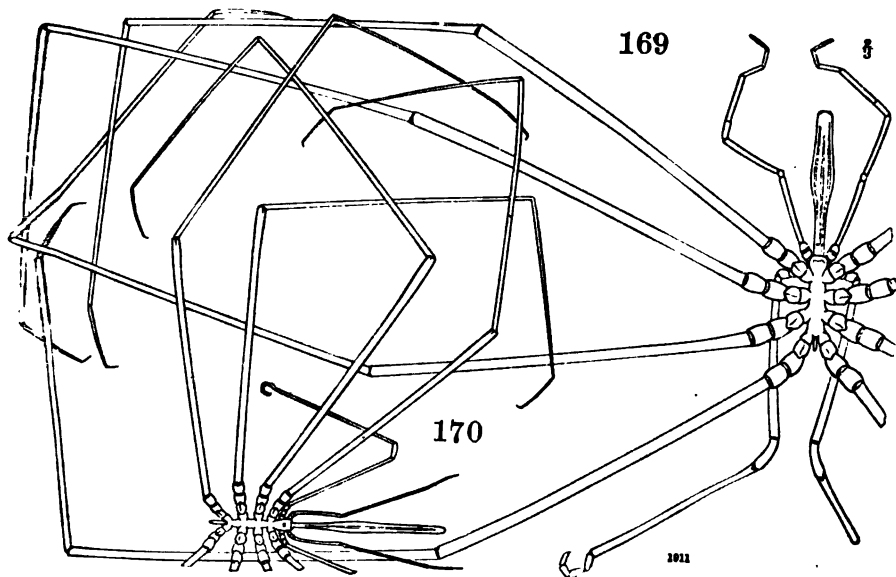


PLATE XXXIX.

- FIG. 172. *Polynoë Acanella* V. Dorsal view of the head and anterior segments, enlarged about four diameters.
- FIG. 172 a. The same. Part of a scale, enlarged eighty diameters.
- FIG. 172 b. The same. One of the parapodia, enlarged twenty diameters; *d*, the argel dorsal setæ; *id*, the slender dorsal setæ; *sv*, large upper setæ of the ventral fascicle; *iv*, smaller and more slender lower setæ of the ventral fascicle; *a*, tips of the dorsal setæ, enlarged eighty diameters; *b*, tip of one of the ventral setæ, enlarged eighty diameters.
- FIG. 172 c. The same. Portion of the spinulated part of one of the dorsal setæ to show the character of the spinules and longitudinal furrow, enlarged two hundred and fifty diameters.
- FIG. 176. *Latmatonice armata* V. Head and anterior segments. Dorsal view, enlarged six diameters. Three anterior scales have been removed to show the head; *a*, median antenna, *c*, *c'*, dorsal cirri of the first pair of parapodia; *p*, tentacular or ventral cirrus of the same parapodia; *vc*, ventral cirrus of the second parapodia; *dc*, dorsal cirrus of the third, and *dc'*, of the sixth parapodia; *ds*, slender dorsal setæ; *ds'*, stout dorsal setæ; *vs*, ventral setæ; *h*, head or cephalic lobe; *e*, papilla from which the anterior scale has been removed; *e''* and *e'''*, second and third pairs of scales.
- FIG. 176 a. The same. Setæ enlarged fifteen diameters; *d* and *d'*, the tips of the stout spine-like dorsal setæ; *ds*, a group of ventral setæ; *vc*, ventral cirrus.

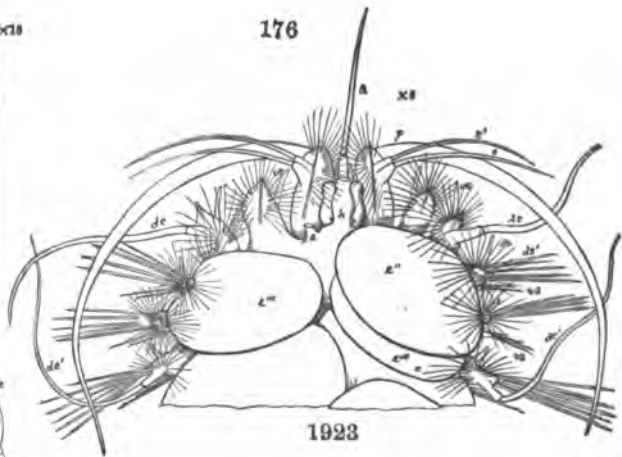
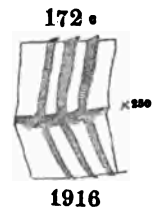
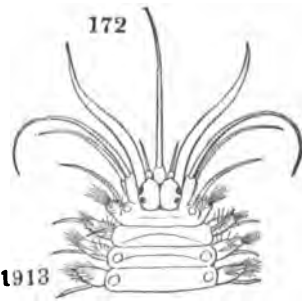
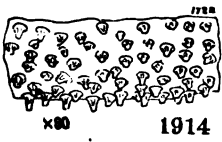
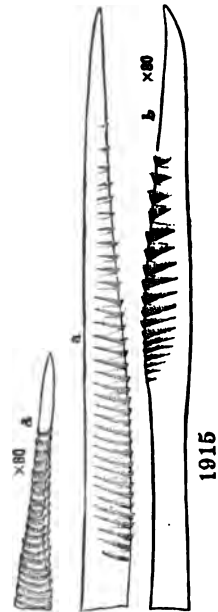
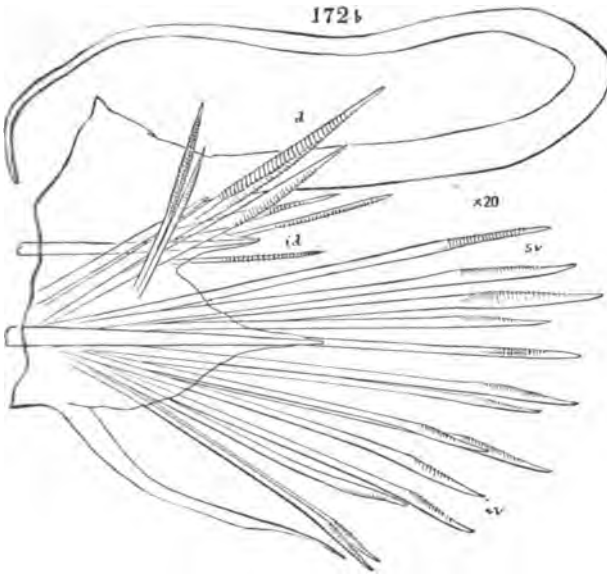
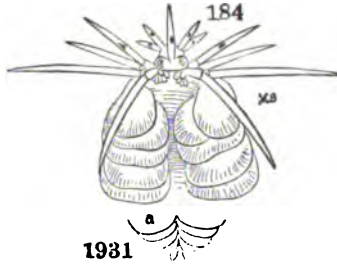
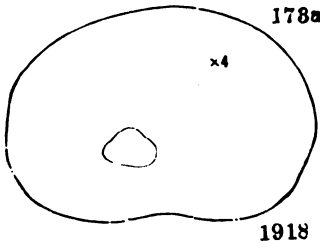
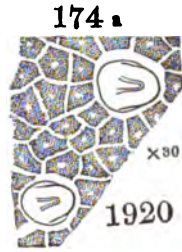
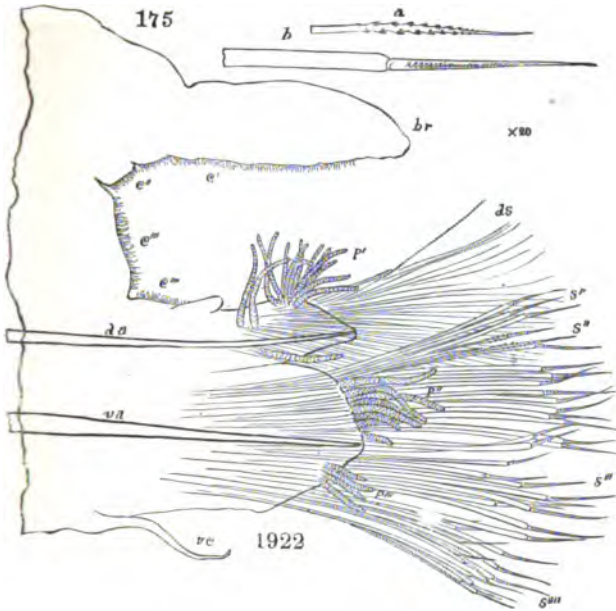


PLATE XL.

- FIG. 173. *Polynoe aurantiaca* V. One of the parapodia, enlarged fifteen diameters; *dc*, dorsal cirrus; *d*, small dorsal lobe, which is destitute of setæ; *v*, ventral lobe; *sv*, superior ventral setæ; *iv*, large inferior ventral setæ; *a*, one of the superior ventral setæ, enlarged eighty diameters.
- FIG. 173 a. The same. One of the scales, enlarged four diameters.
- FIG. 174. *Polynoe (Harmothoe) imbricata*. Dorsal view, enlarged two diameters.
- FIG. 174 a. The same. Part of a scale, enlarged thirty diameters.
- FIG. 174 b. The same. Setæ, enlarged forty diameters; *d*, one of the stout dorsal setæ; *v*, *v'*, ventral setæ.
- FIG. 175. *Leantra robusta* V. One of the parapodia, enlarged twenty diameters; *br*, branchial lobe of the dorsal side; *c*, *c'*, *c''*, line of cilia occupying the space between the branchial and setigerous lobes; *p'*, slender papillæ of the dorsal branch; *p''*, *p'''*, similar appendages of the ventral branch; *vc*, ventral cirrus; *da*, aciculum of the dorsal branch; *va*, aciculum of the ventral branch; *ds*, dorsal setæ; *s*, *s'*, *s''*, *s'''*, various forms of setæ of the ventral branch; *a*, tip of one of the slender simple setæ; *b*, tip of one of the compound ventral setæ, much more enlarged.
- FIG. 184. *Notophyllum Americanum* V. Head and anterior segments, enlarged eight diameters; *a*, posterior end of the same specimen.



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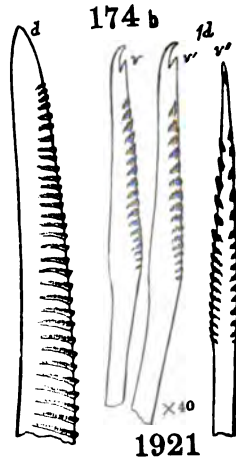
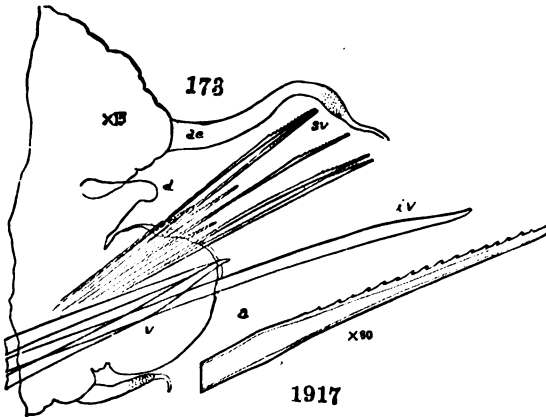


PLATE XLI.

- FIG. 178. *Hyalinaccio artifex* V. Head and anterior segments, enlarged about one and one-half diameters; *b*, the same, ventral view of the head and anterior segments of another specimen, enlarged about one and one-half diameters; *c*, the same, posterior segments and caudal cirri, enlarged five diameters.
- FIG. 178 *a*. The same. Ventral view of the head and anterior segments, enlarged three diameters.
- FIG. 179. The same. One of the anterior parapodia, enlarged thirty diameters; *b*, branchia; *c*, dorsal cirrus; *a*, one of the parapodia from a segment farther back, destitute of the branchia, enlarged thirty diameters; *c*, dorsal cirrus; *b*, one of the funnel-shaped setæ, enlarged seventy-five diameters; *e*, the same, enlarged three hundred and seventy-five diameters; *c*, a seta with bilobed tip, enlarged seventy-five diameters; *d*, spiniform seta, enlarged seventy-five diameters.
- FIG. 180. *Leodice polybranchia* V. One of the parapodia, enlarged twenty diameters; *a*, tip of one of the compound setæ, enlarged one hundred diameters; *b*, tip of one of the funnel-shaped setæ, enlarged two hundred diameters.
- FIG. 181. *Nothria conchyphila* V. Dorsal view of head and anterior segments, enlarged eight diameters.

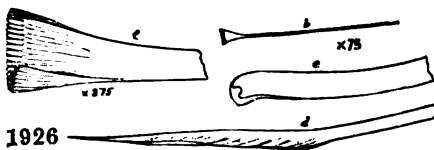
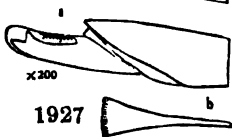
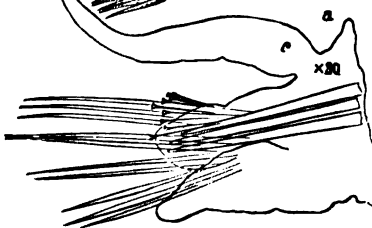
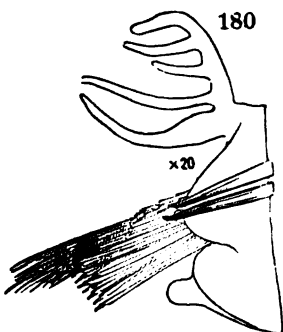
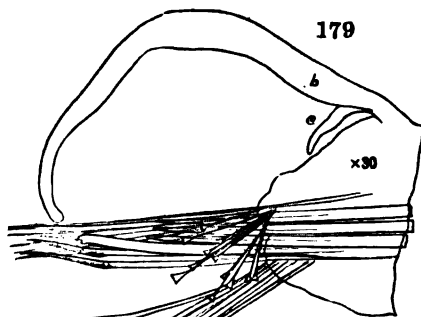
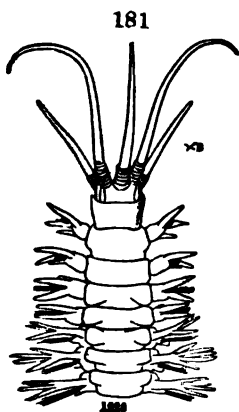
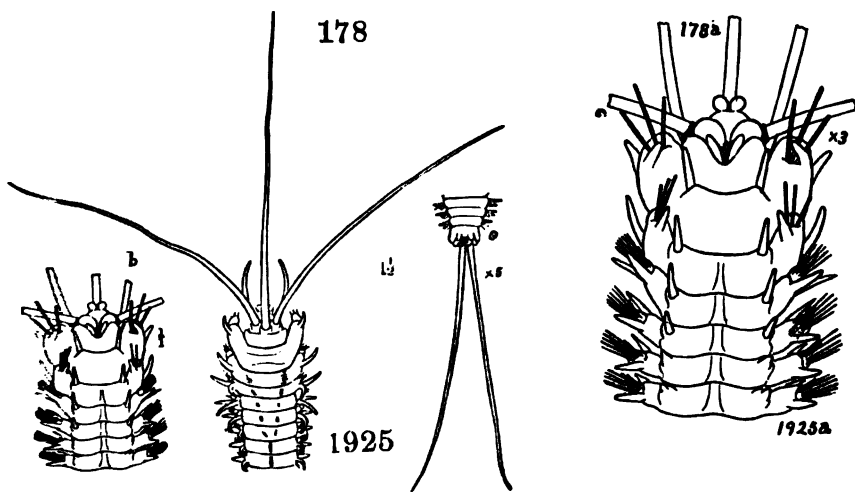


PLATE XLII.

- FIG. 182. *Amphinome Lepadis* V. Head and anterior segments, enlarged six diameters; *a*, posterior extremity of the same specimen; *b*, one of the branchiæ. This specimen was found among stems of *Lepas*, on floating timber, in the Gulf Stream.
- FIG. 183. *Syllis spongiphila* V. Dorsal view of the head and anterior segments, enlarged twenty-four diameters; *a*, one of the compound setæ, enlarged seven hundred and fifty diameters.
- FIG. 185. *Ophioglycera grandis* V. Head, enlarged four diameters.
- FIG. 185 *a*. The same. One of the parapodia from the anterior region; *b*, one of the parapodia from the middle region of the body. From a specimen taken at the surface in Newport Harbor.
- FIG. 188. *Sabella picta* V. Anterior segments and base of branchiæ, ventral view, enlarged four diameters; *c*, the same, posterior segments; *d*, one of the branchiæ.
- FIG. 188 *a*. The same. One of the hook-shaped setæ, enlarged one hundred diameters; *b*, one of the spatulate setæ, enlarged one hundred diameters.
- FIG. 189. *Vermilia serrula*. Dorsal view of the tube and expanded branchiæ; *o*, side view of operculum; *o*, operculum of another specimen, with adherent dirt.
- FIG. 190. *Maldane bioceps*. *a*, anterior portion, side view, enlarged four diameters; *b*, posterior portion, side view, enlarged two diameters.

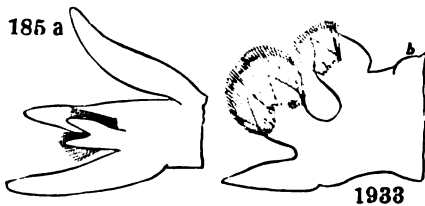
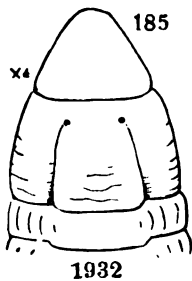
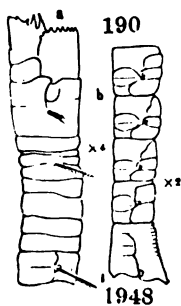
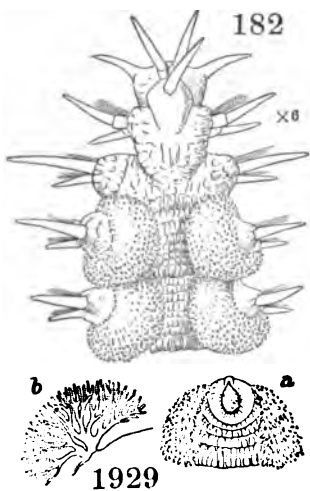
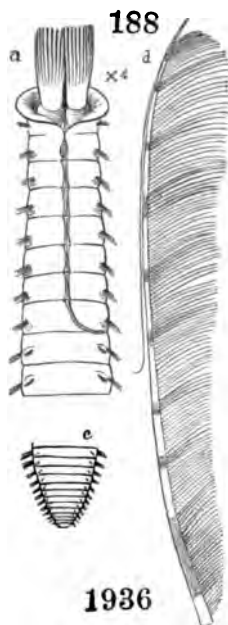
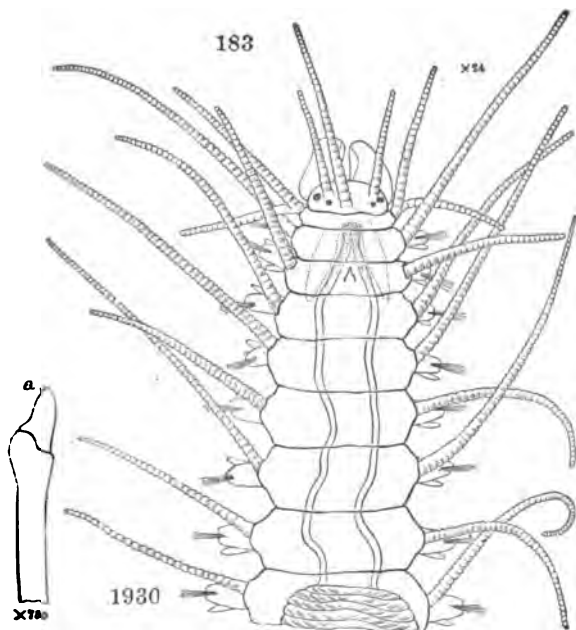


PLATE XLIII.

- FIG. 186. *Dipolydora concharum* V. Dorsal view of the head and anterior segments, enlarged sixteen diameters; a, caudal segments.
- FIG. 187. *Lepræa abyssicola* V. Side view, natural size.
- FIG. 187 a. The same. Side view of the head and anterior segments, enlarged three diameters; b, one of the uncini, enlarged three hundred diameters.
- FIG. 191. *Priapulid*, sp., natural size.
- FIG. 191 a. The same. Front view of the anterior end, enlarged two diameters.
- FIG. 192. *Phascolosoma*, sp., natural size; a, the same, ventral view of the anterior end; d, one of the openings of the segmental organs.
- FIG. 193. *Tristoma cornutum* V. Ventral view, enlarged four diameters. From a bill-fish. Type specimen, drawn from life.
- FIG. 194. *Tristoma lave* V. Ventral view, enlarged four diameters. From a bill-fish. Type specimen, drawn from life.
- FIG. 195. *Cerebratulus luridus* V. One-half natural size. Drawn from life.
- FIG. 196. *Sagitta gracilis* V. Dorsal view, enlarged four diameters.
- FIG. 196 a. The same. Dorsal view of the head, enlarged ten diameters. From a specimen taken at Wood's Holl, at the surface.

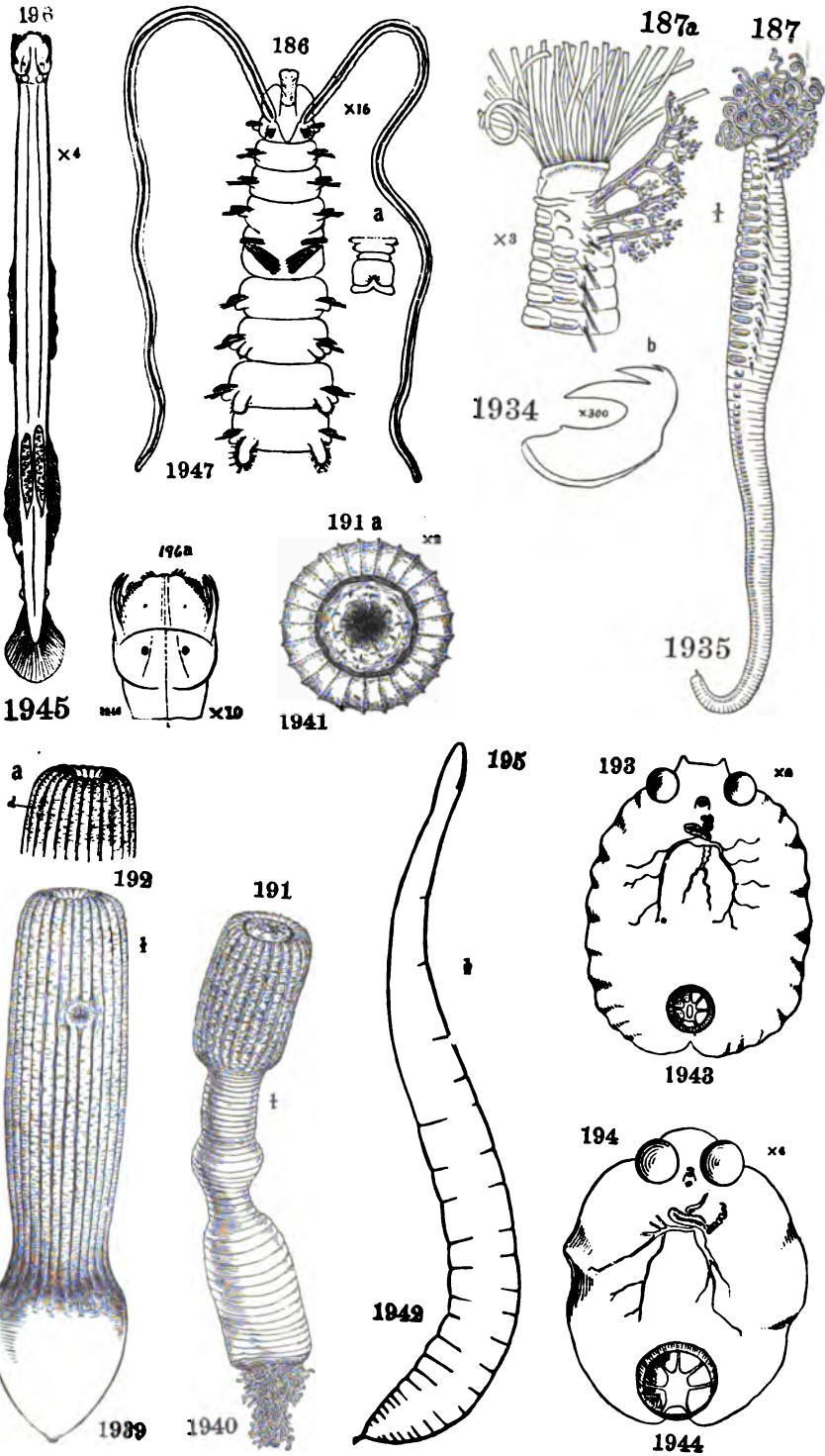
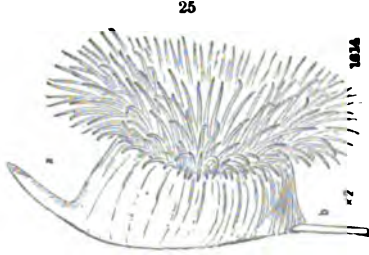
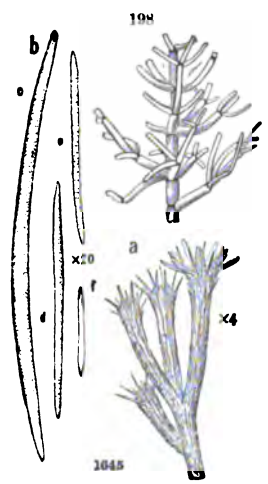
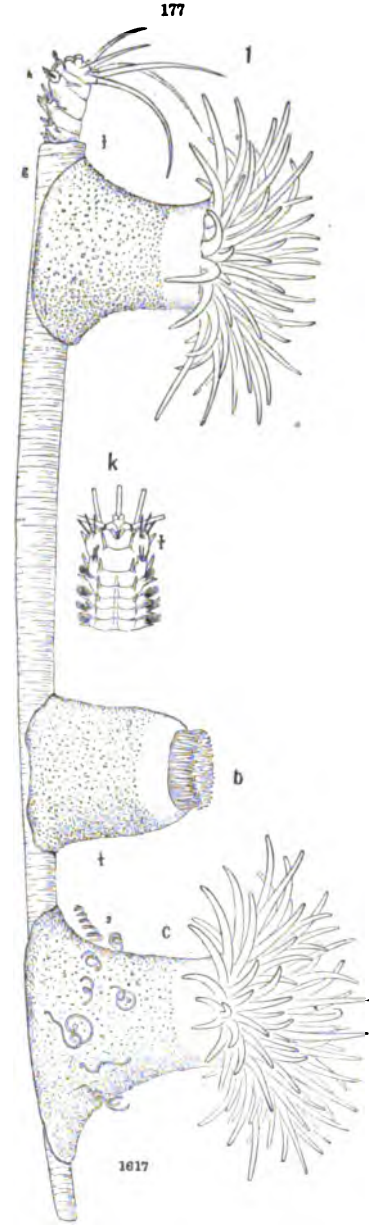


PLATE XLIV.

- FIG. 25. *Sagartia Acanella* V. Side view of a partially expanded specimen surrounding a branch of *Acanella Normani* by its clasping base; *a*, the prolongation of the base toward the tip of the branch; *b*, a smaller extension of the base in the opposite direction, enlarged two diameters.
- FIG. 177. *Sagartia abyssicola* V., on a tube of *Hyalinacciois artifex* V., somewhat less than natural size; *a*, an individual in full expansion; *b*, one partially contracted; *c*, one in expansion, showing the protruded scontia; *d*, the head and anterior part of the *Hyalinacciois* protruded from its tube, side view; *e*, ventral view of the same, with the antennæ cut off near their bases. Drawn from life.
- FIG. 197. *Cladorhiza grandis* V., two-thirds natural size.
- FIG. 198. *Acanella Normani*. Part of a branch with the axis denuded to show the arrangement of the branchlets in whorls, natural size; *a*, the same, a group of calicles from the tip of a branch with the tentacles partly expanded. Drawn from a living specimen; *e*, several forms of spiculæ, enlarged twenty diameters.



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