REPORT ON THE HOLOTHURIANS, COLLECTED BY THE HARVARD-HAVANA EXPEDITIONS 1938 AND 1939, WITH A REVISION OF THE MOLPADONIA OF THE ATLANTIC OCEAN*

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Very little dredging has been undertaken in the West Indian seas since the days of Alexander Agassiz and our knowledge about the deepwater holothurians rests almost completely on the material secured by the "Blake" and "Albatross". A few hauls were made by the "Fish Hawk" in the waters around Porto Rico in 1898 and in later years the Vanderbilt and Bingham expeditions have supplemented our knowledge about certain deep water invertebrates and their distribution.

The "Atlantis" cruises during the spring of 1938 and 1939, in the waters around Cuba, partly in the classical collecting grounds of the "Blake", have yielded an enormous amount of material of fishes and invertebrates and among the latter also a large number of holothurians.

As it was to be expected not many species are new. The group itself is small and the majority of the forms from deeper water are widespread and have therefore previously been described from other parts of the Atlantic Ocean. Three species are new (one was, however, previously listed under a wrong name, by Théel and later erroneously described as the juvenile stage of another species by Deichmann in 1930); three species are reported for the first time from the western part of the Atlantic Ocean while other records represent the first in which the species have been taken in numbers. Most valuable is the collection of Molpadonia and since that group was rather briefly

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treated in 1930 (the existing material in the U S. N M. having been exhaustively treated by H. L. Clark in 1908), the Atlantic forms of that order have now been revised and the recent literature critically discussed.

Besides the material from the Harvard-Havana expeditions, a few species are included which were secured by same of the "Atlantis" cruises from off New England, Georges Bank, etc. Also a few species from other sources (in the M. C. Z.) have been included to complete the account.

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Chiridota abyssorum v. Marenzeller.
**Chiridota ferruginea* (Verril).

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* Species marked with an asterisk were not secured by the Harvard-Havana cruises. In brackets are placed families genera and species which have been only briefly discussed.

ORDER I — ASPIDOCHIROTA

FAMILY SYNALLACTIDAE

Genus SYNALLACTES Ludwig

SYNALLACTES CRUCIFERA Perrier
(Plate 31, figs. 5-6)

Synallactes crucifera Perrier, 1898, p. 1,665; 1901, p. 339, pl. 12, figs. 5-6, pl. 17, figs. 21-35. Deichmann, 1930, p. 106 (*passim*).

Diagnosis. — Small form (6-8 cm.); mouth ventrally placed; anus subdorsal. Ventral side with cylindrical tube feet in two lateral bands and in a scattered band along the midventral ambulacrum. Dorsal side with conical papillae in several longitudinal rows, those nearest the midline usually with whip-like tips.

Spicules cross-shaped bodies (0.077-0126 mm.) with external spire often spinous, occasionally with a terminal slit-like perforation but otherwise solid; arms of cross with one or two perforations in the ends. Feet with large end plate and branching or perforated rods, straight or curved; papillae with an irregular mass of curved rods but apparently no end plate. Color in alcohol white.

Type. — Paris.

Type locality. — Off Morocco, 2,212 meters depth.

Distribution. — Known from the type locality and now reported from off Cuba.

Depth. — From between 1,200-1,300 fathoms.

Specimens examined. — The following material from the "Atlantis" cruises.

Station 2973 21° 09′ N., 85° 04′ W., 1,280 fathoms. 1 fragment.

Remarks. — The fragment measures about 6 cm. in length and consists mostly of strips of skin; the inner organs are completely lacking. The spicules agree well with those described and figured by Perrier.

Genus BATHYPLOTES Oestergren

BATHYPLOTES POURTALESI (Théel)
(Plate 31, figs. 3-4)

Stichopus pourtalesi Théel, 1886 a, p. 4.

Bathyplotes pourtalesi Deichmann, 1930, p. 102, pl. 9, figs. 3-7, (list of references).

Diagnosis. — Large form (20 cm.); a typical *Bathyplotes* but with vaulted dorsal side with large papillae and on the ventrum numerous large "fungiform" papillae.

Spicules tables with cross-shaped disk with slender arms with few perforation in the ends and a tapering spire composed of four rods, usually smooth, and with few cross-beams. Color in alcohol white.

Type. — M. C. Z.

Type locality. — Off St. Kitts, B. W. I.

Distribution. — Widespread in the West Indian seas, also reported from the eastern Atlantic (as *B. bipartius* Hérouard).

Depth. — 202-838 fathoms.

Specimens examined. — The following material from the "Atlantis" cruises.

Station 3366	20° 46′ N., 74° 59′ W., 625 fathoms.	2	fragments.
„ 3370	20° 47′ N., 75° 11′ W., 450 „	2	„

Bathyplotes bigelowi spec. nov.

(Plate 31, figs 1-2)

Diagnosis. — Large form (up to 25 cm.) with strongly flattened body and a continuous lateral brim of papillae interrupted only at the posterior end. Mouth ventral with 20 tentacles surrounded by a strong sphincter; anus terminal or subventral. Ventral side with cylindrical tube feet scattered without order, most numerous on the posterior part of the ventrum; a varying number of small "fungiform" papillae are present, forming two longitudinal rows. Dorsal side with two median rows of papillae, often completely retracted, and besides a few smaller papillae irregularly distributed. Skin rough to the touch on account of the large number of spicules.

Spicules a crowded layer of large tables with delicate lace-like disks with four large central holes and several smaller marginal holes; spire tall with four rods, several cross-beams and spines on the sides. Ventral tube feet with small end plate and curved supporting rods. Dorsal papillae lacking end plate. Color in alcohol white or grey, in some individuals finely dotted with brownish pigment.

Type. — M. C. Z.

Type locality. — Near Bahía de Cochinos, Sta. Clara province (Station 2323).

Distribution. — The waters around Cuba.

Depth. — From 220-320 fathoms.

Specimens examined. — The type and the following specimens, all from the "Atlantis" cruises around Cuba.

Station					Fathoms	
2963E	22° 07′	N.,	81° 08′	W.,	220-235	Fragments
2987	23° 22′	N.,	79° 53′	W.,	280-300	1 good, several fragments
2323	22° 00′	N.,	81° 09′ 30″	W.,	290-320	Type
3432	23° 05′	N.,	79° 29′	W.,	250	1 poorly preserved
3434	23° 10′	N.,	79° 35′	W.,	260	1 good, several fragments
3436	23° 05′	N.,	79° 28′	W.,	255	Fragments
3483	23° 12′ 30″	N.,	81° 22′	W.,	300	„

Remarks. — The type measures 22 cm. in length; one of the other, less perfect specimen reaches however, a length of 25 cm. The species resembles somewhat the type species, *B. natans* (Sars), which also occurs in the West Indians seas. It is, however, more flattened with a narrow body cavity and a wide marginal brim which is interrupted at the hind end; furthermore the anus is terminal or subventral, often placed in an indistinct furrow The inner anatomy is typical; the calcareous ring is low with broad radials which are deeply incised posteriorly. Traces of tentacle ampullae are present as indistinct lobes. A single ventral Polian vesicle is present in the type and a delicate stone canal, embedded in the dorsal mesentery, its head being attached to the dorsal wall of the body cavity. The mud-filled intestine runs straigth backward, almost reaching the cloaca, bends forward for a short distance and then runs backward; the third mesentery attaches to the right ventral interambulacrum. The respiratory trees have short lateral branches; the musclebands are thick, fleshy, the dorsal ones are much wider than the ventral ones. Most of the bodywall is covered by the musclebands except a narrow band on the sides. The musclebands appear superficially to be divided but actual examinations shows they are merely furrowed. The gonads form two clusters of dichotomously divided tubes, attached closely behind the ring canal and opening dorsally near the attachment for the stone canal. In the type, collected March 4, the tubes were filled by large eggs.

The species differ from both *B. natans* (Sars) and *B. pourtalesi* (Théel) in its terminal or subventral anus and its crowded layer of spicules which consist of tables with a completed lace-like disk. Its greatest affinities seems to lie with *Bathyherpystikes punctatus* Sluiter from the East Indies. (1901, p. 37, pl. 7, figs. 12-13) The latter genus differs so slightly from *Bathyplotes* that is seems natural to withdraw it as a synonym. Whether the present species is identical with Sluiter's species cannot be decided without careful comparison

of the types. The spicules figured by Sluiter are at least distinctly different from those observed in *B. bigelowi.*

AMPHIGYMNAS BAHAMENSIS Deichmann

(Plate 32, figs. 1-10)

Amphigymnas bahamensis Deichmann, 1930, p. 107, pl. 9, fig. 9; pl. 10, figs. 1-6.

Diagnosis. — Large form (30 cm.); body elongate, synallactid-like, with four rows of large dorsal papillae, a lateral row of still larger papillae and an midventral double row of small tube feet. Tentacles 20, mouth ventrally placed, anteriorly overhung by the dorsal papillae; anus terminal. Skin thin, parchmentlike or more thick and gelatinous, according to the degree of contraction; rough to the touch. Inner anatomy similar to that of *Synallactes,* but the longitudinal musclebands are undivided.

Spicules large tables with well developed disk, mostly with four large central holes and a varying number of smaller marginal holes. Spire mostly four-pillared and of varying height often partly reduced. Besides a number of smooth perforated plates is presout with holes of approximately uniform size. Feet with or without an end plate and with numerous supporting rods, often with dentate edge, and smaller tables with 3-4 short pillars in the spire. In the dorsal papillae tables of varying size and curved supporting rods but apparently no end plate. Color in alcohol white.

Type. — U. S. N. M.

Type locality. — Between Bahamas and Cape Fear, 262 fathoms.

Distribution. —Known from the waters around Florida and Cuba, possibly more widespread.

Depth. — Between 240-320 fathoms.

Specimens examined. — The following material from the "Atlantis" cruises.

Station 3324 22° 08′ N., 81° 09′ 30″ W., 320 fathoms. 1 large specimen.

Remarks. — The single specimens measures about 30 cm. in length but is strongly contorted; it is about twice as large as the types.

The spicules differ considerably from those observed in the two types. There are fewer of the simple plates with holes of approximately uniform size while large tables with four central holes and stout four-pillared spire are numerous. Also the ventral feet were discovered to possess an end plate but these may merely have been missed in the types. It is possible that the perforated plates represent a juvenile character which gradually disappears (the types

were immature), while the larger tables gradually become dominating. Aside from these differences the specimen seems to agree well with the types when the difference in size is considered.

Pseudostichopus Théel

Pseudostichopus occultatus v Marenzeller

Pseudostichopus occultatus v. Marenzeller, 1893, p. 15, pl. 4, fig. 9. Deichmann, 1930, p. 89.

Nec *Pseudostichopus occultatus* Hérouard, 1902, p. 14, pl. 2, figs. 4-11 (i. e. *P. marenzelleri* Hérouard, 1923, p. 25).

Diagnosis. — Small form (4-6 cm.), body normally covered by a coat of *Creseis* shells, etc. Tube feet larger along the sides, smaller in the interambulacra. A few perforated plates may be present near the anus; tentacles with curved rods; gonads with cross-shaped bodies, often with a central thickening.

Type. — Possibly in Vienna.

Type locality. — Eastern Mediterranean Sea.

Distribution. — Common in the Mediterranean Sea, also reported from the eastern coast of Spain. In the western part of the Atlantic reported from the waters around Cuba.

Depth. — In the eastern Atlantic taken from 363-2,180 meter. In the western Atlantic taken at 232 and 1,450 meters depth.

Specimens examined. — One individual from the "Atlantis" cruises.

Station 3344 21° 08′ N., 79° 56′ 30″ W., 690-700 fathoms. 1 specimen.

Remarks. — The members of the genus *Pseudostichopus* are most unsatisfactorily known and it is possible that some of the seven species recorded from the Atlantic Ocean may be united under one nome. The "Atlantis" specimen is completely covered by *Creseis*-shells. It is somewhat larger than a specimen previously collected near Cuba and also larger than the Mediterranean type specimen; these individuals measured respectively 2 and 4 cm.

Zygothuria Perrier

Zygothuria lactea (Théel)

Holothuria lactea Théel, 1886, p. 183.

Zygothuria lactea Deichmann, 1930, p. 198, pl. 8, figs. 8-9.

Zygothuria sp. Deichmann, 1930, p. 199, pl. 8, fig. 7.

Diagnosis. — Large form (6-15 cm. or more); body resembling a flattened sack; mouth ventral with about 20 tentacles, anus terminal;

tube feet few, large restricted to a ventro-lateral row on each side. Calcareous ring low; stonecanal attached to the dorsal integument; two Polian vesicles; intestine short; musclebands undivided; respiratory trees free with short lateral lobes; gonads attached closely behind the vascular ring as one tuft of divided tubes of varying size, the anterior tubes being smaller and less developed.

Spicules fragile tables, usually with six large holes in the disk and tall spire with three pillars and three diverging arms, mostly smooth; in some cases the spire ends in one central spine. Feet apparently without an end plate but with a few supporting rods; tentacles with smooth, curved or straight rods.

MESOTHURIA Ludwig, 1894

MESOTHURIA GARGANTUA Deichmann

Holothuria verrilli Théel (partim), 1886 a, p. 6.
Mesothuria gargantua Deichmann, 1930, p. 95, pl. 7, fig. 1.

Diagnosis. — Large form (20 cm.), robust, with thick skin; stout cylindrical feet, scattered over the entire surface except on the anterior part of the ventrum, dorsally slightly smaller. Inner anatomy typical of the genus; sexes separate.

Spicules mostly huge tables with irregular disk with numerous holes and a four-pillared spire with few to many blunt teeth on the top. Feet with a vestige of an end plate or none at all; tables of almost the same size as in the skin. Color in alcohol ivory white.

Type. — M. C. Z.

Type locality. — Off Barbados, 720 meter.

Distribution. — West Indian seas.

Depth. — From 325-500 fathoms.

Specimens examined. — One large individual from the "Atlantis" cruises.

Station 3459 23° 21′ N., 80° 36′ W., 500 fathoms.

Remarks. — The single large individual agrees completely with the type and other specimens previously reported from the West Indian seas.

MESOTHURIA MAROCCANA Perrier

Mesothuria maroccana Perrier, 1902, p. 312, pl. 16, figs. 32-35. Deichmann, 1930, p. 97 (list of synonyms).

Diagnosis. — Small form (4-8 cm.), with feet of unequal size, largest along the flanks, small but vell developed on the dorsum and

totally lacking on the ventrum. Inner anatomy typical of the genus; sexes separate.

Spicules regular tables, mostly with six holes; margin smooth or undulated; spire composed of three rods and ending in three diverging arms with few teeth. Feet with end plate and small tables of the same type as those in the skin, sometimes deformed. Color greyish brown with dark purplish tentacles.

Type. — Paris.

Type locality. — Off Morocco, 2,105 meter.

Distribution. — Eastern Atlantic, also widespread in the West Indian seas.

Depth. — Between 500-1,350 fathoms depth.

Specimens examined. — The following material from the "Atlantis" cruises.

Station	3366	20° 46′ N., 74° 59′ W., 625 fathoms.	1	specimen
„	3459	23° 21′ N., 80° 36′ W., 500 „	1	„

Remarks. — The single individual measures about 8 cm. in length. The species cannot be mistaken for any other form with its characteristic greyish brown color, purplish tentacles and completely smooth ventrum. The disk of the tables have frequently a more undulated outline than figured by Deichmann in 1930; similar tables were observed by Perrier.

MESOTHURIA VERRILLI (Théel)

Holothuria verrilli Théel, 1886 a, p. 6 (partim).
Mesothuria verrilli Deichmann, 1930, p. 93, pl. 6, figs. 1-8.
Nec *Mesothuria verrilli* Deichmann, 1926, p. 22, pl. 1, fig. 2 (juv. *Holothuria* sp.).

Diagnosis. — Large form (30 cm. or more) with delicate tube feet, almost thread-like, sacttered over the entire surface except the anterior part of the ventrum, often retracted. Inner anatomy typical of the genus; sexes separate.

Spicules, tables with regular to irregular disk and four-pillared spire, usually ending in four teeth or four bunches of few teeth. Feet with end plate and smaller tables, usually deformed. Color in alcohol, dirty brownish white.

Type. — M. C. Z.

Type locality.—Widespread in the West Indies, also known from the Eastern Atlantic, including the Mediterranean.

Depth. — From 382-1,000 fathoms.

Specimens examined. — The following material from the "Atlantis" cruises.

Station 3359 20° 38′ N., 74° 32′ W., 1,000 fathoms. 2 specimens, poorly preserved

Remarks. — The two specimen are externally so distorted that they can hardly be identified but the spicules resemble closely those of the type. The tables are much more delicate than those of *M. gargantua* and the ends of the pillars diverge, instead of being united by a wreath of spines as in *M intestinalis,* the only other species with four-pillared tables of similar size, from the West Indian seas.

Type. — British Museum.

Type locality. — Off New Zealand.

Distribution. — Widespread in the Pacific and Atlantic Oceans. Common off the coast of New England and in the West Indian Seas.

Depth. — From about 400-1,000 fathoms.

Specimens examined. — The following material from the "Atlantis" cruises and from other trips off the eastern coast of the United States.

Station 3359	20° 38′ N.,	74° 32′ W.,	1,000	fathoms.	2	specimens
„ 3993	23° 93′ N.,	80° 44′ W.,	580	„	1	„
"Atlantis" August 4, 1938,	38° 59′ N.,	72° 20′ W.,	980	„	1	„
„ „ „	38° 58′ N.,	72° 19′ W.,	1,040	„	2	„
„ „ „	39° 00′ N.,	72° 19′ W.,	1,050	„	2	„

Remarks. — The specimens intergrade to such an extent that it seems natural to withdraw the form which Deichmann in 1930 designated as *Zygothuria* sp., because it deviated slightly from the specimens hitherto described.

STICHOPODIDAE

STICHOPUS Brandt

STICHOPUS REGALIS (Cuvier)

(Plate 33, figs. 1-8)

Holothuria regalis Cuvier, 1817, p. 22, M. Sars, 1857, p. 152, pl. 2, figs. 78-81.
Stichopus regalis Lampert, 1885, p. 101 (complete list of references) Mortensen, 1927, p. 391, text figs. 232-233. Nobre, 1931, p. 145, pl. 13, fig. 4, text fig. 65, no. 2.

Diagnosis. — Large form (up to 36 cm.), with flat ventral side and vaulted dorsal side and a lateral margin of papillae; ventral side with numerous cylindrical feet, indistinctly arranged in three

bands; dorsal side with papillae. Mouth ventral with 20 tentacles; anus terminal; flanks thickened.

Calcareous ring low, radials with three anterior lobes and porteriorly deeply incised; Polian vesicle single; stonecanal with oblong head, attached in the mesentery Gonads two tufts of tubes, attached near the vascular ring.

Spicules form a crowded layer of large tables with rounded disk with up to 50 holes, spire stout, tapering, composed of four pillars with several cross beams and lateral teeth. Feet with end plate and numerous rods with serrate edge of the serrations closed so they form rows of holes. Dorsal appendages with a group of small perforated plates instead of an end plate and with similar rods.

Type. — Possibly in Paris.

Type locality. — Mediterranean Sea.

Distribution. — Common in the Mediterranean Sea and in the Biscayan Bay, also taken off the Canaries and as far north as off the western coast of Ireland. It is now, for the first time, reported from the West Indian Seas.

Depth. — In the eastern Atlantic ranging from 5-400 meters (Mortensen).

Specimens examined. — The following material from the "Atlantis" cruises.

Station 3480 23° 10′ N., 81° 28′ W., 200 fathoms. 1 specimen

Remarks. — The diagnosis given above is based upon examination of the one individual (from Naples) which the M. C. Z. possesses, supplemented by information given by M. Sars (1857) and Mortensen (1927) The species appears to be one of these forms which is so well known that not detailed description ever has been compiled. The color, according to Mortensen is brownish, often with white spots on the dorsum; the underside is pale. Characteristic of both the Mediterranean specimen (which is much faded) and the "Atlantis" specimen is a number of small dark spots situated in the deeper layer of the integument.

The "Atlantis" specimen measures about 25 cm. in length but is so completely contorted that it possibly is abnormally stretched. It is impossible to trace the characteristic lateral brim of papillae although some obviously are present but the flanks are distinctly thickened. Dorsally as ventrally the appendages appear to be arranged as in the typical form. The inner anatomy which is fairly well preserved resembles that of the typical form from Naples. It is

apparently an older individual, the posterior prolongations on the calcareous ring are longer, the interradials stouter and the consistency of the ring more soft than in the Naples specimen. The stone canal has the same kind of oblong head and is attached in the same manner. The gonads form somewhat longer tubes but the shape and position agree with the conditions in the typical specimen.

The spicules have likewise been compared with those of the Naples specimen. They differ slightly in having a more irregular and undulating margin and the supporting rods are longer and more delicate. These differences may however be purely individual variations or due to difference in age or possibly the difference in the depth at which the animals have been taken. Comparison of a series of specimens taken at different depth may show that is the case. But with only one specimen available it seems unwise to segregate the eastern and western forms as separate species or varieties.

Stichopus badionotus Selenka

Stichopus badionotus Selenka, 1867, p. 316, pl. 18, fig. 26. Deichmann, 1930, p. 80, pl. 5, figs. 30-36.

For diagnosis, distribution, etc., see Deichmann, 1930, p. 80.

Specimens examined. — The following material from the "Atlantis" cruises. Matanzas Bay, Cuba, collected on the shore, March 20, 1938. 1 specimen.

Remarks. — The single individual measures about 20 cm. in length but is strongly contracted. The color is uniformly brown. The species represents one of the most common forms in the West Indies.

Holothria Linnaeus

Holothuria mexicana Ludwing

Holothuria mexicana Ludwig, 1875, p. 25. Deichmann, 1930, p. 74, pl. 5, figs. 15-20. Panning, 1934, p. 31, text fig. 24.

Diagnosis, etc. see Deischmann, 1939, and Panning, 1934.

Specimens examined. — Eight individuals of medium size (10-15 cm.) collected in Seguana Bay, Isle of Pine, Cuba, 1938.

Remarks. — The preserved specimens are all of the dark variety with brownish grayish dorsal side, greyish to yellowish ventral side and mostly dark pedicels. The spicules are typical of the species.

Holothuria lentiginosa v Marenzeller

(Plate 34, figs. 1-7)

Holothuria lentiginosa v. Marenzeller, 1893, p. 6, pl. i, fig. 1; pl. 2, fig. 1. Panning, 1934, p. 82, fig. 68. Hérouard, 1929, pp. 53, 63.

Diagnosis. — Large form (up to 46 cm. in living condition), cylindrical body, fourth ventral with 20 tentacles, anus terminal Ventral side with scattered tube feet, completely retractile; dorsal side with contractile papillae and smaller tube feet, more or less papilliform.

Spicules, an external layer of tables with disk of varying size, largest in the appendages and with stout tapering spire. An inner layer of narrow smooth buttons, often twisted or incomplete. Ventral feet with end plate and straight supporting rods with perforated ends and often a number of lateral holes; dorsal appendages without end plate but curved supporting rods. Color light brown, paler on the ventral side; tip of appendages darker, often with a paler area around the base of the papillae.

Type. — Monaco.

Type locality. — Off the Azores, 130 meter depth.

Distribution. — Eastern Atlantic and the West Indian Seas.

Depth. — In the Eastern Atlantic from 67 and 250-389 meters depth. In the Western Atlantic reported from 175 and 250 fathoms.

Specimens examined. — The following material from the "Atlantis" cruises.

Station 2961	22° 07′ N., 81° 08′ 30″ W.,	250-255 fathoms.	1 specimen
„ 3465	23° 09′ N., 81° 27′ W.,	175 „	1 „

Remarks. — The "Atlantis" specimens measure 13 and 18 cm. and are thus slightly larger than the type. (The record of 46 cm. is due to Hérouard who had occasion to examine a living specimen.) Externally the two individuals agree fairly well with v Marenzeller's colored figure of the type made from life. The lateral and dorsal papillae are, however, completely retracted as are also the majority of the tube feet. There are apparently also many more tube feet in the "Atlantis" specimens which seem to be older than the type.

v Marenzeller says little about the inner anatomy as most of the inner organs were lost. Dissection of the specimen from station 2,961 showed that the anatomy was not remarkable in any way. The calcareous ring is low, the stone canal has an oblong, soft, sack-like head which lies free to the right, and a single Polian vesicle is attached

to the ventral side of the vascular ring. The gonads form a bunch of slender tubes, dichotomously divided and attached near the oral end. A few eggs were lying in the tubes, indicating that spawning had recently taken (the specimen was collected in May)

The spicules resemble those figured by v Marenzeller except that many tables have a smooth instead of a dentate margin. The tables show the same diversity of size as noted by v. Marenzeller; the largest tables are found in the appendages.

H lentiginosa has been taken twice before in the Eastern Atlantic. It differs from all other species of the genus *Holothuria* known in that region and so far no species is known in the West Indies with which it may be confused. Bedford (1899, p. 145) noticed the similarity of the spicules with those of *H pardalis* and suggested that it represents a variety of that widespread shallow water species.

Holothuria occidentalis Ludwig

(Plate 34, figs. 8-13)

Holothuria occidentalis Ludwig, 1875, p. 28, fig. 35. Deichmann, 1930, p. 60, pl. 2, figs. 9-17 Panning, 1934, p. 78, fig. 63 (copy of Ludwig's figure)

Diagnosis. — Medium-sized form (up to 15 cm. long) with 20 small tentacles, mouth ventrally placed; anus terminal. Ventrally few tapering feet, dorsally and laterally conical papillae. Skin thin but firm, packed with spicules. Calcareous ring with short posterior protuberances on the radials; stonecanal attached in the mesentery; Polian vesicles in varying numbers, the smaller ones, if present, often in clusters.

The spicules consist of an external layer of small tables; disk with small holes and blunt marginal spines, upward bent; spire stout with few teeth, often partly resorbed, forming four tapering points. An inner layer of small deformed knobbed buttons, often holes completely oblitterated. Appendages apparently without an end plate but with numerous supporting rods, straight or curved, often with a number of holes along the widened middle ortion. Color light brown, paler on the ventrum; dorsal papillae almost white.

Type. — Hamburg.

Type locality. — West Indian Seas.

Distribution. — Known from off the Virgin Islands (Th. Mortensen) and off Cuba.

Depth. — From about 200 fathoms.

Specimens examined. — The following material from the "Atlantis" cruises.

Station 3389	22° 32′ N.,	78° 08′ W.,	220 fathoms.	2	specimens.
„ 3419	22° 45′ 30″ N.,	79° 00′ W.,	180 „	1	„
„ 3420	22° 05′ N.,	79° 29′ W.,	250 „	1	„

Remarks. — The two specimens from station 3,389 were opened. They differ from the previously examined specimen from the museum in Copenhagen from the Virgin Islands, 200 fathoms) merely in having only one Polian vesicle. The gonads are almost ripe in these individuals, collected at the end of March; one is a female, the other a male; both measure about 15 cm. in length.

The spicules agree well with those figured in 1930, from the specimen in Copenhagen.

I have little doubt that Ludwig's two species are synonymous and that the present material represents his *H. occidentalis.* Strictly speaking the name *H. sulcata* should have been chosen since it appears before *occidentalis* but the description of the latter seemed to fit the specimen which was examined and it was first afterwards that it was realized that *H sulcata* possibly could be identical with *H. occidentalis.*

Panning uses Ludwig's figures in his revision of the genus *Holothuria* but places the two species *occidentalis* and *sulcata* in two widely separated groups. Re-examination of Ludwig's types is therefore imperative to decide whether the two species are identical or not.

ORDER II — ELASIPODA

DEIMATIDAE

Deima Théel

Deima blakei Théel

Deima blakei Théel, 1886 a, p. 1, figs. 1-2. Deichmann, 1930, p. 115, pl. 10, figs. 7-11, pl. 11, figs. 1-3; 1936, p. 9.

Diagnosis. — Large form (up to 15 cm.), with flattened ventral side and vaulted back; mouth and anus ventrally placed; tentacles about 20 in number. Ventral side with a lateral row on each side of normally 11 tube feet, decreasing in size toward the posterior end; in front of the anus a few abortive tube feet are usually present. Dorsal side with normally 6 large conical papillae along the sides and 3-7 large conical papillae along the dorsal ambulacra.

Spicules large plates composed of a single layer; the perforations in the center are the largest; a few spines may be present and, in young individuals, a low central protuberance composed of a reticulum. Feet with elongate rods or plates; end plate apparently lacking. Color in alcohol white; in life brilliant red.

Type. — M. C. Z.

Type locality. — Off St. Vincent, 573 fathoms.

Distribution. — In the West Indian Seas known from the type locality, south of Jamaica, near the Bahamas and around Cuba. In the Eastern Atlantic previously reported from near the Azores.

Depth. — From 573-1,519 fathoms.

Specimens examined. — Several individuals from the "Atlantis" cruises.

Station	3358	20° 40′ N., 74° 32′ W.,	975 fathoms.	1 specimen, small, infested with endoparasitic gasteropod
„	3366	20° 46′ N., 74° 59′ W.,	625 „	5 specimens, 4 large, 1 small
„	3369	20° 49′ N., 75° 98′ W.,	600 „	2 specimens, large

Remarks. — The abundance of material shows the same variability of the number of the dorsal papillae and number of lateral feet as indicated by Théel. Most noteworthy was to find that in the youngest individual the large perforated plates often had a low reticulated knob near the center while the plates in the larger individuals had merely a few scattered spines on the outer side.

The small individual was furthermore interesting in that it was infested with one of the rare endoparasitic gasteropods. The parasite was attached to the ventral side of the body cavity and to the intestine.

Orphnurgus Théel

Orphnurgus asper Théel

Orphnurgus asper Théel, 1882, p. 82, pl. 15; pl. 34, figs. 15-16; pl. 38, fig. 10; pl. 41, fig. 3, pl. 44, fig. 3; 1886 a, p. 2. Deichmann, 1930, p. 117, pl. 11, figs. 4-8.

Diagnosis, etc. See Deichmann, 1939, p. 117

Specimens examined. — Several from the "Atlantis" cruises.

Station	3365	20° 49′ N., 74° 59′ W.,	600 fathoms.	2 specimens.
„	3366	20° 46′ N., 74° 59′ W.,	625 „	7 „

Remarks. — The material measures from 7 to 19 cm. in length. The characteristic short, strongly spinous rods makes it easy to recognize the species. It is apparently quite common in deeper water in the West Indian Seas.

Station	3367	20° 46′ N., 70° 02′ W.,	640 fathoms.	6 specimens.
„	3369	20° 49′ N., 75° 08′ W.,	600 „	1 „

PSYCHROPOTIDAE

BENTHODYTES Théel

BENTHODYTES TYPICA Théel

(Plate 35, figs. 1-2)

Benthodytes typica Théel, 1882, p. 103. Deichmann, 1930, p. 123.

Diagnosis. — Small form (10-15 cm. long), with a broad lateral brim of alongated tube feet; mouth ventral with 20 tentacles; anus terminal; venirum with a double row of tube feet along the midventral ambulacrum; dorsum with a few papillae.

Spicules simple pointed rods, slightly curved, often with a central swelling; ends slightly spinous. Color intensive reddish or purplish.

Type. — British Museum.

Type locality. — Off Gibraltar

Distribution. — Wide spread in the Eastern and Western Atlantic.

Depth. — From 1,400-3,514 meter

Specimens examined. — About 20 individuals or fragments, all poorly preserved from the "Atlantis" cruises.

					Fathoms		
Station	2966	22° 47′ N.,	80° 24′ W.,		2,125.	5 small	specimens
„	2967	19° 47′ N.,	75° 06′ W.,		1,530.	5 „	„
„	2967A	19° 47′ N.,	75° 06′ W.,		1,580-1,800.	2 „	„
„	2967B	19° 45′ 30″ N.,	74° 57′ 30″ W.,		1,330-1,650.	5 „	„
„	2976	21° 19′ N.,	76° 05′ W.,		1,450.	3 „	„
„	3344	21° 38′ N.,	80° 12′ W.,		1,440.	5 „	„
„	3355	19° 30′ N.,	75° 00′ W.,		1,070-1,950.	10 „	„

BENTHODYTES LINGUA Perrier

(Plate 35, figs. 3-4)

Benthodytes lingua Perrier, 1898, p. 902; 1901, p. 466, pl. 12, figs. 1-2, pl. 21, figs. 1-9. Deichmann, 1930, p. 124.

Benthodytes sp. Théel, 1886 a, p. 3.

Diagnosis. — Large form (25-30 cm.), with narrow marginal brim of papillae; mouth ventrally placed, with 15 tentacles; anus terminal. Ventral side with a double row of tube feet along the midline; dorsal side with few papillae, often inconspicuous.

Spicules huge crosses with inward curved arms and an outer central projection, often divided into two or three arms; surface of spicules rough, spinous. Tentacles with simple spinous rods. Color varying shades of red or purplish.

Type. — Paris.

Type locality. — Off Morocco.

Distribution. — Reported once from the Eastern Atlantic; apparently common in the western part.

Depth. — From 860-2,200 meter.

Specimens examined. — A few individuals, all poorly preserved from the "Atlantis" cruises.

Station 2969	19° 47′ N., 75° 54′ W.,	1,145-1,075	fathoms.	1 specimen
„ 3359	20° 38′ N., 74° 32′ W.,	1,000	„	2 „

Remarks. — The species was originally listed by Théel as *Benthodytes* sp. from the West Indies. Its spicules are so characteristic that it cannot be confused with any other species. The crosses measure more than 1 mm. in diameter and may easily be observed with the unaided eye.

Euphronides Théel

Euphronides violacea Perrier

Euphronides violacea Perrier, 1896, p. 102, 1901, p. 438, pl. 20, fig. 14. Deichmann, 1930, p. 128.
Euphronides deressa var. *minor* (partim) Théel, 1886 a, p. 2.
Euphronides assimilis Théel, 1886, p. 3.

Diagnosis. — Large form (up to 20 cm.); resembles the northern form *E cornuta* Verrill but has only four pairs of dorsal papillae. Outer and inner features typical of the genus.

Spicules, dorsally large crosses with arms inward bent and a central smooth conical projection surrounded by four shorter spines; ventrally, smaller crosses, often almost flat, slightly spinous or smooth rarely with a trace of an external central projection. Color reddish or purplish.

Type. — Paris.

Type locality. — Off Morocco.

Distribution. — Eastern and Western Tropical Atlantic.

Depth. — From 1,180-4,060 meter.

Specimens examined. — The following material from the "Atlantis" cruises.

Station 3355	19° 50′ N., 75° 00′ W.,	1,070-1,950 fathoms.	1 specimen
„ 3379	21° 49′ N., 76° 43′ W.,	910 „	1 „

Remarks. — The species is closely related to the northern form, *E cornuta* Verril, described from off the eastern coast of the United States. It differs in the lower number of dorsal appendages (which in this case could not be ascertained) and the more simple crosses in the skin of the ventral side. Further investigations may reveal that the characters listed are inconstant and that the two forms intergrade. In that case Verril's old name has the priority

Euphronides kernervei (Hérouard)

(Plate 35, figs. 9-12)

Psychorpotes kerhervei Hérouard, 1902, p. 27, pl. 4, figs. 1-9; 1923, p. 104, pl. 3, figs. 4-5.

Benthodytes kerhervei Deichmann, 1930, p. 125.

Diagnosis. — Small form (6-8 cm.), with insignificant unpaired dorsal appendage; lateral feet small, united into a narrow brim; midventral ambulacrum with a doube row of tube feet; mouth ventral with about 16 tentacles; anus ventrally placed. (The arrangement of the dorcal paired papillae is completely unknown.)

Spicules strongly spinous crosses, occasionally with a larger external central spine and smaller basal spines, often bifid.

Type. — Monaco.

Type locality. — Between the Azores and Portugal.

Distribution. — Known from the Eastern and Western Tropical Atlantic.

Depth. — From 3,825-5,505 meter.

Specimens examined. — The following material from the "Atlantis" cruises.

Station 2966 20° 46′ N., 74° 59′ W., 625 fathoms. 1 specimen, poorly preserved

Remarks. — The specimen measures about 8 cm. in length; the color is deep purplish. It is exceedingly poorly preserved but resembles a slightly smaller specimen taken near St. Croix, Virgin Islands and described by Deichmann in 1930. Some of the spicules in the present specimen were found to approach those of the *Eupro-*

nides-type and the species has therefore provisionally been switched over to that genus. It is distinctly different from all other Psychropodidae known from the West Indies.

ORDER III — DENDROCHIROTA

The majority of this order of plankton feeders are shallow water forms, and only few members of this comparatively modern group have descended into deeper water The "Atlantis" cruises to Cuba secured only one species, previously reported from that region. From the eastern coast of the United States two deep water species were secured by the Atlantis summer cruises.

CUCUMARIIDAE

Sphaerothuria Ludwig, 1894

Ypsilothuria E. Perrier, 1886.(*)
Nec *Ypsilothuria* Hérouard, 1923, p. 118 (i. e. *Echinocucumis*).

Diagnosis. — Small dendrochirotes with globose, rigid body, few cm. in diameter and with mouth and anus placed on shorter or longer protuberances. Tentacles almost or completely unbranched, of unequal size and in one species reduced in number (?) Feet delicate, cylindrical, few in number, in five more or less incomplete rows.

Skin covered by huge plates, visible with the naked eye; plates composed of more than one layer except in very young individuals; holes in plates small. The majority of the plates carry a stout pillar or spine, more or less centrally placed. Some of the plates along the ambulacra are perforated for the passage of the tube feet. Deep water forms.

Type species. — *Sphaerothuria bitentaculata* Ludwig.

Remarks. — The genus *Ypsilothuria* Perrier is undoubtedly a synonym of Ludwig's genus although Perrier's description is not very detailed. The chief differences between the two genera is supposed to be the lower number of tentacles in *Sphaerothuria* but that may possibly be a variable character. It seems more important that both

(*) The name *Sphaerothuria* is retained although it is a complete synonym of *Ypsilothuria*, published by E. Perrier in 1886, attached to the two species *attenuata* and *talismani* with figures, but no diagnosis was given and the descriptions are not sufficiently detailed to make identification positive as Ludwig pointed out (1894, p. 155). R. Perrier (1902) placed *Sphaerothuria* as a synonym of *Ypsilothuria* at the same time as he describes the latter as a new genus and also designates *attenuata* and *talismani* as new species. Neither the genus nor the two species are recognized as such in the Zoological Record for 1886 although Perrier's book is listed and all the new species and genera, dsecribed by Theél and others, are given.

genera have plates of complex structure and tube feet which pass out through a pore in the scales. In the related genus *Echinocucumis* Sars which also occurs in the Atlantic Ocean (and sometimes has been mistaken for *Sphaerothuria*), the plates have large holes and are always simple, composed of only one layer, and the tube feet pass out trough an indentation in the margin of the scale. Also the spire is almost invariably eccentrically placed.

Hérouard (1923) claims that *Ypsilothuria* is a synonym of *Echinocucumis* while he upholds *Ephaerothuria* as a distinct genus. His conclusion is based upon the finding of a very young *"Echinocucumis"* (2-3 cm. long with 4-5 large ventral feet and less than 10 tentacles) in shallow water, north of Siberia. That specimen was found to have plates with small holes, as the deep water *Ypsilothuria*, while the fulgrown *Echinocucumis* has large holes, hence he holds that the holes increase in size this species, contrary to the normal procedure. But it seems very doubtful whether his *"Echinocucumis"* is correctly identified. The description suggests a young individual of *Cucumaria frondosa* (Gunnerus) of which adult individuals were taken in the same haul. If that is correct, the whole involved chain of proofs is reduced to nothing, and no grounds remain for referring *Ypsilothuria* to the synonymy of *Echinocucumis*.

Sphaerothuria talismani (Perrier)

Ypsilothuria talismani E. Perrier, 1886, p. 286, text fig. 204. R. Perrier, 1902, p. 318, pl. 12, figs. 9-10, text fig. 12.
Sphaerothuria talismani Deichmann, 1930, p. 154, pl. 19, fig. 3.

Diagnosis. — Small form (diameter of globular body up to 1 cm.); scales few with large spine, centrally placed; reticulum dense, rather fine and appears soon on the scales. Tentacles 10, of very unequal size, one on each side being much larger than the rest.

Spicules in tentacles curved rods, slightly spinous, with or without a few minute holes in the ends.

Type. — Paris.

Type locality.

Distribution. — In the Easterh Atlantis ranging from the coast of France to Cape Good Hope; in the western part reported from the Caribbean Sea and off the coast of New England.

Depth.

Specimens examined. — The following material from the "Atlantis" summer cruises.

July 26, 1939, Tow 6, 40° 05′ N., 68° 05′ 1,105-1,125 fathoms. 1 specimen

Remarks. — The single individual differs markedly from the specimens of *S. asperrima* in the lower number of spines and the finer reticulum on the scales. It agrees in all essentials with the specimens previously taken in the West Indian region (in the M. C. Z.)

Sphaerothuria asperrima Théel

Echinocucumis asperrima Théel, 1886 a, p. 10.
Echinocucumis typica Théel, 1886, p. 118 (*partim*). Nec *E. typica* Sars (*E. hispida* Barrett)
Sphaerothuria asperrima, Deichmann, 1930, p. 156, pl. 19, figs. 1-2.

Diagnosis. — Comparatively large form (diameter of the globose body up to 2 cm. in diameter); scales large, thick, with relatively small holes and secondary reticulum which appears comparatively late. Spire composed of several pillars, more or less fused. Tentacles ten, with plates perforated by small holes and undulated or scalloped edge.

Type. — M. C. Z.

Type locality. — Of Isles of Pines, Cuba, 158 fathoms.

Distribution. — Known from off Cuba, Florida and Barbados, possibly more widespread in the West Indies.

Specimens examined. — The following material from the "Atlantis" cruises.

Station	2960	22° 07′ N.,	81° 08′ 30″ W.,	270	fathoms.	1	specimen
„	2962	22° 07′ N.,	81° 08′ W.,	200-210	„	1	„
„	2962c	22° 07′ N.,	81° 08′ W.,	210	„	6	„
„	2982	22° 44′ 30″ N.,	78° 41′ W.,	150-180	„	1	„
„	3328	22° 08′ N.,	81° 10′ W.,	260-275	„	1	„
„	3330	22° 09′ 30″ N.,	81° 10′ 30″ W.,	280-263	„	1	„
„	3332	22° 09′ 30″ N.,	81° 11′ W.,	175-225	„	1	„
„	3374	22° 45′ N.,	75° 19′ W.,	300	„	1	„
„	3375	20° 45′ N.,	75° 20′ W.,	230	„	3	„
„	3376	20° 44′ 30″ N.,	75° 18′ W.,	285	„	1	„
„	3392	22° 35′ N.,	78° 18′ W.,	225	„	1	„
„	3475	23° 18′ N.,	80° 48′ W.,	400	„	1	„

Remarks. — The specimens agree well with the type. The spire is frequently almost completely fused into a solid rod, probably due to age but similar solid spires were observed also in the type, especially near the anterior and posterior ends.

The species occurs in as shallow water as *Echinocucumis hispida* (Barrett) but the latter is easily recognized on account of its simple

plates with large holes. From the closely related form, *S. talismani*, which normally seems to inhabit slightly deeper water, it is distinguished by its more numerous and more coarsely reticulated plates and the broad plates in the tentacles.

PSOLIDAE

Psolus Oken

Psolus pourtalesi Théel

Psolus pourtalesi Théel, 1886 a, p. 14, pl. 1, fig. 6. Deichmann, 1930, p. 188, pl. 20, figs. 5-7.

Diagnosis. — Small form (few cm. long), with numerous (about 20) imbricating smooth scales; no oral or anal operculum. Sole with marginal pedicels.

Spicules in sole thinly scattered plates varying from crosses to oval buttons with 3-5 holes, usually completely smooth; pedicels with end plate and heavy supporting rods and plates.

Type. — M. C. Z.

Type locality. — East of Nantucket (41° 24′ 45″ N., 65° 35′ 30″ W.), 1,242 fathoms.

Distribution. — As far as known only reported from the western part of the Atlantic Ocean.

Depth. — From 1,230-1,280 fathoms.

Specimens examined. — The following material from the "Atlantis" summer cruises.

1939, July 27	Tow 8	40° 01′ N.,	68° 06′ W.,	1,230 fathoms. 6 specimens
1939, July 27	Tow 9	39° 09′ N.,	68° 05′ W.,	1,280 „ 38 „

Remarks. — The specimens agree completely with the types in the M. C. Z.

ORDER IV — MOLPADONIA

Diagnosis. — Holothurians with barrel-shaped body, terminal mouth, surrounded by a well defined circle of fairly small tentacles, (sometimes claw-shaped); terminal anus, often placed on a longer or shorter "tail" Appendages usually totally lacking except for the minute anal papillae (one genus has a few whip-like papillae on the dorsum and a few degenerate appendages are stated to be present in certain other genera (?) Skin thin but tough, fibrous. Calcareous ring firmly built, often with short bifid prolongations on the radials; tentacles ampullae present or reduced. Stone canal opens

to the exterior in the dorsal midline or the head hangs free in the body cavity Respiratory trees present; musclebands simple or divided, no true retractors present; genital organs in two tufts of tubes, often opening on a shorter or longer papilla in the dorsal midline.

Spicules of various kind, as one or three pillared tables, plates, cross-cups or irregular bodies. Dark red or brown "phosphatic bodies" are present in many forms, often increasing in number with age while the spicules sometimes become reduced. A few forms seem to lack spicules entirely Anchors placed on a rosette of racquet-shaped plates, are present in some forms but disappear often with advancing age. Shallow water to deep sea forms.

Remarks. — The Molpadonia was, in 1908, regarded by H. L. Clark as a family of the order Actinopoda, now considered obsolete. The order is here divided into the families Gephyrothuriidae, Caudinidae, Molpadiidae and Eupyrgidae, essentially the same arrangement as that proposed by Heding in 1931. His orders Gephyrothurioidea and Molpadioidea are, however, rejected. Some of the forms in the Gephyrothurioidea are undoubtedly merely synallactids (hence the erroneous conception of connecting the Molpadonia with the Synallactidae) and the two remaining species, both belonging to the genus *Gephyrothuria,* differ so little from the Molpadioidea that there are no grounds for keeping them separate. The name Molpadioidea represents merely a synonym of the old name Molpadonia.

Three of the four families have representatives in the Western Atlantic, while the fourth is exclusively Arctic.

KEY TO THE FAMILIES ON THE ORDER MOLPADONIA

1. Tentacles with unpaired terminal digit and a few lateral digits or simple, in one case claw-shaped. 2

1. Tentacles with no unpaired terminal digit, usually one or two pairs of digits. 3

2. Tentacles simple; tentacle ampullae lacking; spicules comparatively large tables with numerous holes in the disk. Small forms few cm. long. Arctic.. . . [4. *Eupyrgidae* Semper 1868]

2. Tentacles with more than one digit, or claw-shaped; tentacle ampullae present (very small in some species); spicules derived from tables with solid or three-pillared spire; tail with

tables with round to oblong disk or fusiform rods. Spicules sometimes reduced with age or possibly totally lacking. Dark red egg-shaped 'phosphatic bodies'' often present; in some species anchors and racquet-shaped plates, frequently reduced with age. Mostly large forms. . . . . 3. *Molpadiidae* J. Müller 1850

3. Dorsal side with a few whip-like papillae; spicules lacking. . . . . 1. *Gephyrothuriidae* n. fam.

3. Dorsal side without whip-like papillae. Spicules large tables or plates, or cross-cups or irregular bodies. No phosphatic bodies but discoloration of the skin may occur in older individuals of some forms. . . . . 2. *Caudinidae* Heding 1931

REVISED LIST OF THE SPECIES OF MOLPADONIA KNOWN FROM THE ATLANTIC OCEAN, INCLUDING THE WEST INDIAN SEASS AND THE ARCTIC OCEAN

GEPHYROTHURIIDAE.

Gephyrothuria glauca H. L. Clark(*)

CAUDINIDAE.

Caudina arenata Gould.

Paracaudina obesacauda H. L. Clark.

Hedingia albicans (Théel) (syn. *Haplodactyla* Heding 1935, *nec* Grube 1840, nec Heding 1931).

MOLPADIIDAE.

Molpadia agassizi (Théel).

**Molpadia arctica* v. Marenzeller.

Molpadia barbouri spec. nov.

Molpadia blakei (Théel) (syn. *Paratrochostoma spiniferum* Heding, 1931, 1935).

**Molpadia borealis* (Sars).

Molpadia cubana spec. nov. (syn. *Trochostoma antarcticum* Théel (partim) 1886 a and *Molpadia oolitica* (partim) Deichmann, 1930).

**Molpadia maroccana* (Perrier) (i. e. *Paramolpadia diploa* and *capensis* Heding, 1931, 1935).

Molpadia musculus (Risso) (syn. *Eumolpadia asaphus* Heding, 1931, 1935).

Molpadia oolitica (Pourtalès) (syn. *Trochostoma turgidum* Verrill, 1885).

Molpadia parva (Théel).

EUPYRGIDAE.

Eupyrgus scaber Lütken.

(*) *G. europeensis* Hérouard is regarded as a synallactid while *Molpadiodemas caudum* Heding appears to be a synonym of *Pseudostichopus atlanticus* Perrier.

Remarks. — The 21 species listed by Heding in 1931, including some not mentioned in his paper and two new species, are here reduced to 15. All the species listed are discussed except three marked with an. Regarding these, see Deichmann, 1936, p. 460 and 1938, pp. 1-5. While the two first mentioned species are undoubtedly restricted to the Arctic Seas and the northern part of the Atlantic Ocean, the third may be expected to belong to the West Indian fauna.

1. Gephyrothuriidae fam. nov

Diagnosis. — Small or moderately large forms with terminal mouth surrounded by a circle of 15 tentacles with two pairs of lateral digits. Body barrel-shaped with a few pairs of whip-like papillae on the dorsal side and some abortive pedicels near the ends (?). Anus terminal, apparently never placed on a distinct tail as in most of the other Molpadonia. Calcareous ring simple, fairly tall with places firmly united; tentacle ampullae lacking; stone canal small, not attached to body-wall, possibly reduced in one species (?); musclebands undivided; gonads opening in the dorsal midline; genital papilla present or lacking.

Spicules seems to be totally lacking. Color greyish or white. Deep water forms.

Remarks. — The family includes one genus with two, possibly only one, species. A third species referred to this group is undoubtedly a young synallactid and the other genus recently created and included in the order Gephyrothuroidea Heding, viz., *Mopadiodemas* Heding with one species *M. acaudum* Heding, seems to be a synonym of *Pseudostichopus atlanticus* Perrier. (Compare Heding's detailed description and figures with Théel's equally careful description and figures of the closely related form *P mollis* Théel from the Pacific Ocean.)

Genus Gephyrothuria Koehler & Vaney

Syn. *Himastlephora* H. L. Clark, 1908.

Diagnosis. — As for the family.

Type species. — *G. alcocki* Koehler & Vaney.

Remarks. — The family contains only one genus with one or two species. The type came from the Indian Ocean, *G. glauca* (H. L. Clark) was described from the Western Atlantic while *G. europeensis*

Hérouard, from the Eastern Atlantic is undoubtedly a synallactid, probably a young *Pseudostichopus* as is also Heding's *Molpadiodemas acaudum* (See above)

The genus *Gephyrothuria* was established in 1902 by Koehler & Vaney who described a single species from the Indian Ocean. The two authors placed the species near to the Elasipoda but commented on the resemblance to the molpadids. In 1908 H. L. Clark described another species from the Atlantic Ocean but placed it in another, new genus, *Himasthlephora,* because his four individual apparently had a caudal appendage which was not present in *Gephyrothuria.*(*) He referred goth genera to the Molpadonia, or Molpadiidae as he then called the group.

In 1923 Hérouard described a small holothurian from the Eastern Atlantic and due to its lack of spicules and the presence of a few dorsal papillae, he referred it to *Gephyrothuria* and described it as a new species, *G. europeensis.* At the same time he relegated *Himasthlephora* to synonymy Superficially his description may fit a *Gephyrothuria* and Deichmann wrote in 1930 that apparently there was no differences between the two Atlantic species of that genus. But a more critical study of Hérouard's description and especially of his figures, reveals that the animal in question must be a yonug synallactid, probably a *Pseudostichopus.* This explains why Hérouard was so convinced that *Gephyrothuria* belonged near the synallactids and exhibited so many similarities with *Pseudostichopus.* Heding followed Hérouard and claimed (1931) that the Molpadonia had close affinities with the Synallactids. He had, however, no occasion to see either the type of *G. alcocki*(**) or of *C. glauca* but based obviously his studies on Hérouard's description of what is not a Molpadonia. At the same time Heding established a new genus,

(*) Actually Koehler & Vaney mentions an evaginated fragment of the intestine in their species.

(**) Heding's assuption (1935, p. 77) that *G. alcocki* has 20 tentacles instead of 15, is based on Koehler & Vaney's statement that the calcareous ring has three anterior points between the attachments for he longitudinal muscles on the radials. Heding feels that this would must correspond with 20 tentacles and refers furthermore to *Molpadiodemas acaudum* Heding which has 20 tentacles. But the latter is a synallactid and Koehler & Vaney may possibly have made an error in counting the anterior teeth. The figure and description suggest a typical molpadid and they state expressly that it has 15 tentacles, or Heding may have misinterpreted their description.

In this connection it may be mentioned that the number of tentacles in the Molpadonia is always easy to count, even when they are contracted. They are so few in number, so well spaced and arranged in a regular circle that one never encounters the difficulties in estimating the correct number that one does in many other groups.

Molpadiodemas with a single species, *M. acaudum* whichs eems to agree in every respect with *Pseudostichopus atlanticus* Perrier, also from the Atlantic Ocean.

Gephyrothuria glauca (H. L. Clark)

Himasthlephora glauca H. L. Clark, 1908, p. 40, 184, pl. 13, figs. 1-4. Heding, 1931, p. 276.
Gephyrothuria glauca Deichmann, 1930, p. 203.

Diagnosis. — As for the genus. Differ from the type species in minor detail such as the presence of a large genital papilla and the lack of a stone canal (?)(*)

Type. — U. S. N. M.; paratype in M. C. Z.

Specimens examined. — A paratype in the M. C. Z.

Remarks. — Aside from the "caudal appendage" which Clark himself was inclined to regard as an artefact (while Hérouard 1923 and Deichmann, 1930 both decided it was merely an evagination from the intestine) the species differs very little from the type species. More material may possibly prove that they are identical and in that case the name *G alcocki* will stand.

Hérouard's *G europeensis* was regarded as a syninym of *G. glauca* by Deichmann in 1930 but a more close study of his description with his repeated emphasiz laid on the similarities with *Pseudostichopus* makes it seem more probable that *G europeensis* belongs in that genus and possibly represents a young individual of the common form in the Atlantic *P atlanticus* Perrier. That explains why Héroaurd felt convinced that his *Gephyrothuria* is related to the synallactids, while Koehler & Vaney emphasize the similarities of *G. alcocki* with the Molpadonia, viz., the shape of the body, the terminal circule of 15 tentacles, etc.

2. Caudinidae Heding, 1931

Diagnosis. — Medium-sized to large forms, with barrel-shaped body, terminal mouth surrounded by a circle of small tentacles, with no terminal digit but 1-2 pairs of lateral digits. Anus terminal, placed on a shorter or longer caudal prolongation, which in some

(*) Clark was unable to find a stone canal in *G. glauca* but is material was quite old, collected in 1886, so the small amount of calcareous mass may ave dissolved.

Clark's figure of the calcareous ring is similar to the description given by Koehler & Vaney for *G. alcocki* and I think the two authors description of three points between the attachment of the longitudinal muscles indicaes the presence of 15 tentacles and not of 20 as Heding suggests (1935, p. 78). See above p. .

forms is practically absent. No appendages except the anal papillae. (In one form abortive pedicels are stated to be present (?) Calcareous ring firm, with or without short posterior prolongations; tentacle ampullae present; stone canal with head free in body cavity; longitudinal muscles divided; no true retractors present but the free edges of the anterior portion may simulate retractors; gonads as two tufts of tubules, the external opening in the dorsal midline behind the tentacles, sometimes on a distinct papilla.

Spicules large tables or perforated plates, small cross-cups or irregular bodies of variable form. In some forms the spicules are reduced with age, in others they seem almost to be lacking. No phosphatic bodies are present. Color white, grey, or with brownish spots.

Remarks. — The family comprises four genera. Heding (1931) took the initiative to divide the old genus *Caudina* into two, *Caudina* and *Paracaudina,* originally *Pseudocaudina* but changed the same year (1931), and this division was accepted by H. L. Clark (1935). Deichmann (1936) divided the genus *Caudina* into two, a genus comprising the shallow water forms, *Caudina,* and one comprising the deep-sea forms, *Hedingia.* Examination of the type material of *Acaudina* and *Aphelodactyla,* both of H. L. Clark, in the Zoological Museum in Amsterdam showed that these two genera were synonomous and as *Acaudina* precedes the other name, it must be the one accepted. *Acaudina demissa* (Sluiter) may possibly be found to be merely a very large individual of the common East Indian species, *A. molpadioides* (Semper). Contrary to the current belief, it was found that the latter had one pair of small digits, like *A. demissa.* A number of species of *Acaudina* have been described from the East Indies, in the course of time but Sluiter proved (1912) conclusively that the different forms were all identical. The latter paper undoubtedly escaped Heding's attention in 1931, as he lists all the species included in Clark's monograph. Two additional species were described by H. L. Clark (1938).

KEY TO THE GENERA OF THE FAMILY CAUDINIDAE

1. Tentacles with one pair of digits. Spicules almost lacking. . . . . [4. *Acaudina* H. L. Clark]
1. Tentacles with two pairs of digits. . . . . 2.
2. Spicules as minute cross-cups. . . . . 2. *Paracaudina* Heding.
2. Spicules as larger tables or plates. . . . . 3.
3. Spicules comparatively small tables and knobbed buttons, reduced in one species. . . . . 1. *Caudina* Stimpson.
3. Spicules large tables or plates with numerous holes. Deep water forms. . . . . 3. *Hedingia* Deichmann.

Remarks. — The genus *Acaudina* is exclusively East Indian. The three other genera have each one representative in the Western Atlantic. Only one was secured by the "Atlantis" expeditions but all three species are briefly discussed here.

1. Caudina Stimpson, 1853

Diagnosis. — Molpadonia with 15 tentacles with two pairs of digits, the distal pair longer, but no terminal unpaired digit. Body barrel-shaped with a longer or shorter caudal portion. Calcareous ring with fairly short posterior prolongations on the radials. Tentable ampullae present; single Polian vesicle; stone canal with roundish head, not opening in the dorsal integument. Longitudinal muscle bands divided, no true retractors present although the free edges of the anterior portion may project as ridges into the body cavity and give the impression of retractors, especially in older individuals. Third loop of intestine held in position by "pseudomesenteries", powerful strands attached to the lateral walls. Respiratory trees well developed. Gonads forming two tufts of long tubes, several times divided and opening behind the crown of tentacles.

Spicule tables with usually four pillars in the low spire which ends in numerous teeth; disk with four central holes and eigth to ten marginal holes; edge often knobbed. Besides a varying number of knobbed buttons, usually with two larger and two smaller holes. Spicules almost completely reduced in one species.

Type species. — *Caudina arenata* (Gould) ,

Remarks. — The genus has been recently delimited to include only the type species from the coast of New England, a closely related form from the Japanese waters, *C. simile* Augustin, and *C. arenicola* (Stimpson) from the estuaries along the coast of Southern California and also taken from off Cedros Island, Lower California at 44 fathoms depth. The last mentioned species is usually described as lacking spicules almost completely and its position has therefore been somewhat doubtful. Oestergren (1907, p. 210, footnote), was the first to call attention to the presence of the pseudomesenteries in this species as well as in the related form, *C. arenata*, and explained their presence as caused by the burying habits of these two shallow water forms, while the deep water form, *C. arenata* var Théel (i. e. *Hedingia albicans* Théel), lacked these structures. Recently it has been discovered that *C. arenicola* possesses spicules which are very similar to those of the somewhat smaller type species *C. arenata* (See Deichmann, 1938, p. 112).

Caudina arenata (Gould)

Chiridota arenata Gould, 1841, p. 345. H. L. Clark, 1908, p. 174, pl. 10, figs. 1, 2, 11.
Caudina arenata Deichmann, 1930, p. 200, pl. 24, figs. 2-5. Heding, 1935.

Diagnosis. — As for the genus. Posterior end of the body distinctly tapering.

Spicule tables (diameter 0.09-0.14 mm.) and smaller knobbed buttons. Color of preserved specimens white. Shallow water form, usually taken at about 35 fathoms deph buried in the sand or mud.

Type. — Lost.

Type locality. — Coast of New England, washed up on the shore after storms.

Distribution. — Known only from the coast of New England, where it seems fairly common.

Depth. — From about 35 fathoms depth.

Specimens examined. — None from the "Atlantis" cruises.

Remarks. — Heding has recently studied this species and figured spicules from both old and young individuals which show the considerable changes which the spicules undergo. The so-called buttons are very likely merely imperfectly developed tables. The species may reach a length of 25 cm. most individuals measure about 10-15 cm. It is possible that very old individuals (which never have been available), may show the same degeneration of the spicules as that known from *C arenicola* (Stimpson) and also to some extent occurs in the related genus *Paracaudina* where the typical cross-cups gradually becomes substituted by irregular four-holed plates.

The species seems to occur at a rather inaccessible depth, that is, at about 35 fathoms. It is unfortunate that it apparently never occurs in shallow water like the Japanese form of *Paracaudina chilensis* for it would probably be an ideal animal for experimental wory An excellent description of its anatomy was given by Gerould in 1895.

2. Paracaudina Heding, 1931

Caudina auctores.
Pseudocaudina Heding, 1931 (preoccupied).

Diagnosis. — Medium sized to large; as *Caudina* but with small cross-cups or small plates with a few central holes; spicules sometimes degenerating more or less with advancing age. No phosphatic bodies

but a diffuse reddish or brownish pigment may be found in older individuals. Shallow water forms.

Type. — *Paracaudina chilensis* (J Müller)

Remarks. — The genus has a number of representatives in the Pacific Ocean and one in the West Indies.

Paracaudina obesacauda (H. L. Clark)

Caudina obesacauda H. L. Clark, 1908, p. 38, 1935, p. 176, pl. 9, figs. 1-5. Deichmann, 1930, p. 201, pl 201, pl. 24, figs. 6-8; 1938, p. 23.

Diagnosis. — As the type species *P chilensis* (J Müller) but the cross-cups are more bluntly rounded, almost identical with those of *P coriacea* (Hutton) from New Zealand.

Type. — M. C. Z.

Type locality. — Marco, Florida.

Distribution. — Known from the Gulf of Mexico, coast of Florida and Texas, possibly more widely distributed in the Gulf of Mexico.

Depth. — Shallow water

Specimens examined. — Several in the M. C. Z.

Remarks. — The question of the varieties of *P chilensis* has recently been discussed by Deichmann (1938), who found that *P. chilensis* ranges from Chile to the Japanese waters and recently has been found in the Bay or Monterey, California, and also off the west coast of Mexico and Guatemala and Costa Rica. The specimens from the last mentioned locality came from relatively deep water, 35-40 fathoms and the spicules were somewhat untypical while the Mexican and Guatemalan specimens from 7 and 10 meters depth had spicules which partly resembled the typical *chilensis* spicules, partly those of the New Zealand and the West Indian species. It seems as if the spicules have a tendency to develop blunt spines in the individuals from the northern and southern waters while the eastern and western forms tend to develop rounded disks, and both types are combined in the individuals from the western coast of Central America. To maintain *P obesacauda* as a separate species is mostly a practical way of indicating its geographical range.

3. Hedingia Deichmann, 1938

Hedingia Deichmann, 1938, p. 112.

Synonym. *Caudina auctores* (partim) *Trochostoma* auctores (partim). Nec *Trochostoma* Danielssen & Koren (i. e. *Molpadia* Cuvier)

Diagnosis. — Medium-sized caudinids, usually with long, narrow tail end. Skin thin, rigid, filled with large spicules. Inner anatomy

similar to that of *Caudina* but no lateral pseudo-mesenteries attached to the third loop of the intestine.(*)

Spicules, large tables with numerous holes in the disk and three-pillared spire or reduced to a cluster of spines or totally lacking; spicules often spinous. Deep water forms.

Type species. — *Hedingia albicans* (Théel).

Remarks. — A list of the four species referred to the genus is found in Deichmann, 1938, p. 112. Three of the species are known from the eastern and northern Pacific, while the type species is found in deep water in the Atlantic Ocean and also reported from near New Zealand.

Hedingia albicans (Théel)

Trochostoma albicans Théel, 1886.
Caudina arenata Gould var. *armata* Théel, 1886 a, p. 17 Nec *Caudina arenata* Gould.
Caudina albicans H. L. Clark, 1908, p. 37.
Trochostoma mediterranea Baldelli-Bartolini, p. 105.
Haplodactyla albicans Heding, 1935, p. 65, pl. 4, fig. 9, pl. 5, fig.
Hedingia albicans Deichmann 1938, p. 112.

Diagnosis. — As for the genus. Spicules large tables with numerous holes in the disk which often is triangular in outline; spire, three-pillared; disk and spire often spinous.

Type. — British Museum.

Type locality. — Off New England, 38° 34′ N., 72° 10′ W., 1,240 fathoms.

Distribution. — Eastern and Western Atlantic, Mediterranean. A variety, var. *glabra* Théel, known from off New Zealand.

Depth. — About 900-1,500 fathoms.

Specimens examined. — The following material from the "Atlantis" summer cruises during 1937, 1938 and 1939.

(*) Hedig finds strands attached to the third loop of the intestine beside the ventral mesentery. The material I have had occasion to examine was not very well preserved. About this structure which is so well marked in *Caudina* and *Paracaudina*. Oestergren (1907, p. 210, footnote) emphasizes how "Bei *Caudina arenata* (Gould) finden sich ähnliche wenn auch schwachere Pseudo-mesenterien (he is discussing *Caudina arenicola* Stimpson) bei der nachverwandten (artlich doch scheidenden) *C. armata* (Théel) (i. e. *Hedingia albicans* Théel) fehlen diese Bildungen jedoch was ihre geringe systematische Bedeutung beweist."

		Fathoms	
1937, August 10,	38° 31′ N., 73° 03′ W.,	975- 905	1 specimen
1938, August 3,	37° 43′ N., 73° 40′ W.,	1,105	1 fragment (tail end)
1938, August 4,	38° 58′ N., 72° 19′ W.,	1,040	1 specimen
1938, August 4,	38° 59′ N., 72° 20′ W.,	980	1 „
1939, July 24, Tow 4,	40° 05′ N., 67° 52′ W.,	1,325	1 „
1939, July 26, Tow 6,	40° 05′ N., 68° 05′ W.,	1,105-1,135	1 „
1939, July 26, Tow 7,	40° 06′ N., 68° 06′ W.,	1,160-1,100	1 „

Remarks. — The specimens agree well with Théel's description which was based on one individual from the same weters. The tables show a varying amount of spines. The species is most closely related to *H. ludwigi* Ohshima from Japanese waters.

3. MOLPADIIDAE

Diagnosis. — Typical Molpadonia with 10-15 small tentacles in a circles, claw-shaped or with terminal digit and a few small lateral digits. Calcareous ring with short posterior prolongations on the radials. Tentacle ampullae usually well developed (in one species almost lacking). Stone canal attached to integument behind the opening for the gonads in the dorsal midline. Other anatomical features typical.

Spicules tables, three-pillared or with spire fused into a single spine; in some forms the spire is reduced in most tables so they form large plates; sometimes fusiform rods are present. Tail with tables, often smaller, often with elongate disk, in some forms modified into long fusiform rods with or without a spire. Phosphatic bodies present ih some species, increasing in number with advancing age; in some cases the calcareous spicules are resorbed at the same time; in other forms phosphatic bodies seem to be totally lacking. Anchors and racquet-shaped plates are present in some forms, either during the early stages or throughout life; in others they seem to be totally lacking.

KEY TO THE GENERA NOW ACCEPTED

Tentacles fifteen in number, soft, with terminal and lateral digits. . . . . [*Ceraplectana* H. L. Clark]

Tentacles ten in number, hard, claw-shaped. . . . *Molpadia* Cuvier

Remarks. — The genus *Molapdia* has seven valid representatives in the western part of the Atlantic Ocean and five of these appear to be restricted to the American waters. An eighth species is known from the Eastern Atlantic and a ninth and tenth from the northern Atlantic and the Arctic Sea. (See list on p. 00). *Ceraplectana* with one species, is known from the Northern and Eastern Pacific only.

Ankyroderma and *Trochostoma,* both of Danielssen & Koren, represent in my opinion, merely juvenile and senescent stages of *Molpadia. Haplodactyla* Grube, 1840 and Heding, 1931 is a complete synonym of *Molpadia,* based on material of *M musculus* (Risso) while *Haplodactyla* Heding, 1935 is a synonym of that part of *Caudina* now called *Hedingia. Embolus* Selenka, 1867 was based on poor material of *Molpadia oolitica* (Pourtalès) and is simply a synonym of *Molpadia.*

Pseudomolpadia, Paratrochostoma and subgenus *Paramolpadia,* all of Heding, 1931, must likewise be withdrawn as synonyms of *Molpadia.* (See Deichmann, 1936)

KEY TO THE SPECIES MOLPADIA KNOWN FROM THE WESTERN PART OF THE ATLANTIC OCEAN

1. Spicules chiefly three-pillared tables with several cross beams (in one species normally reduced with advancing age, in another partly substituted by huge plates) Tail with tables of roundish or elongate outline but not typically fusiform in shape. 2
1. Spicules chiefly one-pillared tables without any trace of cross-beams, may partly become substituted by large plates in certain species. Tail with fusiform rods. 5
2. Phosphatic bodies seems to be totally lacking; tables large; besides also enormous perforated plates; tail with oblong tables. 3. *Molpadia barbouri* spec. nov.
2. Phosphatic bodies present. Tables not remarkably large; no perforated plates present . . 3
3. Tables mostly with irregular, disk with 3-12 holes, edge often incompletely closed; tail with irregular tables with tendency to develop an oblong disk. Spicules often almost completely lacking in larger individuals which may be nearly black from the numerous phosphatic bodies. . . . . 1. *Molpadia oolitica* (Pourtalès)
3. Tables fairly regular disk, with 3-6 holes; edge complete 4
4. Tail with smaller tables with rounded or oblong outline of the disk and numerous small holes; phosphatic bodies present but not excessively numerous. . . . 2. *Molpadia cubana* spec. nov.
4. Tail with oblong tables with few holes . 5. *Molpadia parva* (Théel)

5. Spicules mostly large plates; if spire is present it is one-pillared. Tail with large fusiform rods; no phosphatic bodies — 4. *Molpadia agassizi* (Théel)

5. Spicules small to moderately sized tables with 3-6 holes, in one species gradually substituted by large fusiform rods or rhombic plates . . . . . — 6

6. Spicules small tables with 3, rarely 6 holes; spire tapering or ending in hooks; no phosphatic bodies. Tentacle ampullae unusually short, almost lacking. . . . — 6. *Molpadia blakei* (Théel)

6. Spicules in body wall of varying size with 3-6 holes, often disk with marginal projections; in older individual the tables are replaced by fusiform rods or rhombic plates; phosphatic bodies numerous . . — 7 *Molpadia musculus* (Risso)

1. Molpadia oolitica (Pourtalès)

(Plate 36, figs. 1-3)

Chiridota oolitica Pourtalès, 1851, p. 13.

Molpadia oolitica Deichmann, 1936, p. 58, text figs. (List of the more important references.

Trochostoma turgida Verrill, 1879, p. 462, 1885, p. 539.

Molpadia turgida H. L. Clark, 1908, p. 104. Deichmann, 1930, p. 195, pl. 22, figs. 1-3, 14-180.

Diagnosis. — Large form (up to 15 cm. long); external and internal anatomy quite typical.

Spicules normally reduced with age, sometimes retained, often present only in the tail region. Spicules three-pillared tables with 3-12 holes, disk often irregular, with marginal projections or imperfectly closed holes. Tables in tail of similar size, often with two terminal projections. Phosphatic bodies numerous, especially in older individual which may almost black from them. Anchors and racquet-shaped plates apparently never present.

Type. — M. C. Z.

Type locality. — Massachusetts Bay, from stomach of cod.

Distribution. — Common off the coast of New England, not north of New Foundland. Reported from Charleston (*M. pauper* (Selenka) and off Florida (*M borealis* Pourtalès) but may not be a normal element of that region (wrong locality?)

Depth. — Between 50-400 fathoms.

Specimens examined. — The type and several older specimens in the M. C. Z. A large individual from (Atlantis, 1935) with its

spicules retained, and 34 small individuals from off Gloucester, 70 fms. (collected by J Miller, spring 1939) likewise with well developed spicules.

Remarks. — The discovery of numerous small individuals of *M. oolitica* within the area where it normally occurs is of interest. It has permitted comparison with the form from off Cuba, hitherto considered the young of *oolitica* but now accepted as a distinct species and it has definitely solved the mystery of Verrill's *M turgida* from the New England waters.

Verrill's species has long been suspected of being a synonym of *M. oolitica* but the almost total lack of spicules in most individuals of the latter made it almost impossible to make use of Verrill's definition. Furthermore a curious error appeared in H. L. Clark's account 1908, p. 158, namely the statement that *turgida* had 12-40 perforations in the disk of the tables and this error was repeated by Deichmann in 1930. An extract of Verrill's description indicates that *turgida* reaches a size of 12.5 cm. and the spicules contains tables with three inner holes and an external circle of smaller holes ten or more; edge often with irregular projections. Spine elongate, acute, consisting of three or four colums; numerous phosphatic bodies. In other words *turgida* represents individuals of *oolitica* in which the spicules are preserved. Verrill states the species occurs between 45-858 fathoms (1885); Deichmann has found the greatest depth for specimens of *oolitica* with exact locality to be about 400 fathoms. Possibly Verrill by mistake has included some records of *M musculus* (Risso) which occurs in deeper water off the coast of New England.

2. **Molpadia cubana** spec. nov.

(Plate 37, figs. 1-3)

Trochostoma antarcticum Théel, 1886 a, p. 16. Nec *T antarcticum* Théel, 1886.
Molpadia oolitica Deichmann, 1930, p. 195 (partim). Nec *M. oolitica* Pourtalès, 1857, p. 13.

Diagnosis. — Small form (up to 4 cm. long), with three-pillared tables with 3 larger and a varying number of smaller holes. Tail with much smaller tables with numerous holes, disk of tables round or oblong but without definite prolongations. Phosphatic bodies present, often in association with spicules; anchors and raquet-shaped plates never observed.

Type. — M. C. Z.
Type locality. — Off Havana, 175-210 fathoms.

Distributions. — Known only from the waters around Cuba.

Depth. — Normally between 150-285 fathoms. The depth of 1,440 fathoms (station 3,344) may be an error in labelling.

Specimens examined. — The types and the following individuals from the Atlantis cruises:

						Fathoms		
Station	2962D	22° 07′	N.,	81° 08′	W.,	175-210.	3	specimens. Types
„	2963A	22° 07′	N.,	81° 08′	W.,	155-190.	1	„
„	2963C	22° 07′	N.,	81° 08′	W.,	205.	1	„
„	2982D	22° 44′ 30″	N.,	73° 41′	W.,	150-180.	9	„
„	2982E	22° 45′	N.,	78° 46′	W.,	150-180.	10	„
„	3328	22° 08′	N.,	81° 10′	W.,	260-275.	2	„
„	3332	22° 09′ 30″	N.,	81° 11′	W.,	175-225.	2	„
„	3333	22° 13′	N.,	81° 11′	W.,	190-200.	5	„
„	3344	21° 38′	N.,	80° 12′	W.,	1,440.	1	„
„	3376	22° 44′ 30″	N.,	75° 18′	W.,	285.	1	„
„	3406	22° 42′	N.,	78° 38′	W.,	200.	1	„
„	3410	22° 47′	N.,	78° 41′	W.,	260.	1	„
„	3414	22° 30′ 30″	N.,	78° 52′	W.,	230.	10	„
„	3415	22° 51′ 30″	N.,	78° 35′ 30″	W.,	210.	1	„
„	3417	22° 50′	N.,	78° 56′	W.,	200.	2	„
„	3409	22° 44′	N.,	78° 41′	W.,	200.	1	„

Remarks. — The numerous individuals measure between 2-4 cm. in contracted condition; fully expanded they would probably measure around 5 cm. The color is white with more or less pronounced rusty tinge here and there in the places where the phosphactic bodies are numerous.

The inner anatomy is not remarkable in any ways except that the animals apparently are sexually ripe and the individuals collected therefore may represent the fulgrown stage of this species. The gonads in the Atlantis specimens, collected in the early spring, are partly collapsed tubes with swollen bead-like portions as if the sex-products necently had been shed.

M. cubana was in 1930 regarded as the juvenile stage of *M. oolitica* Pourtalès, the common form from off the coasts of New England and also supposedly recorded from the coast of Florida. The three small specimens from the Blake Expedition (identified as *antarctica* by Théel) were considered to represent the only juvenile stages of *M. oolitica* known in any collection. Fortunately a large number of small individuals of *M. oolitica* of about the same size (3-4 cm.) were dredged by Mr. J. Miller from Gloucester, 70 fms. and direct

comparison between the northern and southern form became therefore possible. The result was that the southern form was found to deserve to be considered as a separate species.

M cubana differs from *oolitica* in the more trim and firmly built tables with rounded edges, and the much smaller tables in the tail which show no tendency to develop prolongations. Also it is, as far as our present knowledge goes, a much smaller species. From Théel's *M. antarctica* from off the coast of Chile it differs in the presence of phosphatic bodies and in apparently the general shape of the spicules. Direct comparison of the two species would, however, be highly desivable.

3. **Molpadia barbouri** spec. nov

(Plate 39, figs. 1-6)

Diagnosis. — Medium-sized form (6-8 cm. long); skin rigid filled with numerous large spicules and rough to the touch on account of the large spires of the tables. Inner anatomy typical; calcareous ring with long posterior radial prolongations, slightly bifid; tentacle ampullae short, barely reaching the posterior margin of the calcareous ring; stonecanal long with a small rounded head attached in the dorsal mesentery next to the genital duct; a single ventral Polian vesicle is present; gonads as two tufts of short tubes; respiratory trees slender with short lateral lobes; musclebands divided.

Spicules large tables with large disk, mostly with four large central holes and a varying number of marginal holes; spire tall, with 3-4 pillars and a varying number of cross beams and spines. Also large plates, probably derived from tables. Tail with tables with oblong disk, approaching fusiform rods; spire often small or lacking. Phosphatic bodies as well as anchors and racquet-shaped bodies seem to be totally lacking (only fairly large individuals have been examined) Color in alcohol pure white.

Type. — M. C. Z.

Type locality.

Distribution. — The waters around Cuba.

Depth. — From 370-605 fathoms.

Specimens examined. — The following material from the "Atlantis" cruises.

			Fathoms		
Station 2994	23° 24′ N.,	80° 44′ W.,	580.	3 specimens	
„ 2995	23° 24′ N.,	81° 00′ W.,	370-605.	6 „	
„ 3313	22° 12′ 30″ N.,	85° 06′ W.,	550.	5 „	(including the type).

Remarks. — The 12 specimens measure between 3 cm. and 8 cm.; the smallest are unusually contracted so they actually represent much larger individuals. The species is striking with its white color and rigid, finely spinulose skin whith no trace of phosphatic bodies. It represents undoubtedly the counterpart to *Molpadia agassizi* Théel among the forms which have tables built up of 3-4 pillars while the latter typifies a deep water form of the group which has a spire composed of a single rod. It cannot be mistakern for any other species in the Atlantic Ocean.

4. Molpadia agassizi (Théel)

(Plate 39, Nos. 7, 8)

Ankyroderma agassizi Théel, 1886 a, p. 19.
Molpadia agassizi, H. L. Clark, 1908, p. 169. Deichmann, 1930, p. 197, pl. 23, figs. 1-3.

Diagnosis. — Medium sized forms (6-7 cm.), with thin, rigid integument, filled with large perforated plates and a few tables with solid spire. Tail with fusiform rods. No trace of phosphatic bodies but anchors and racquet-shaped plates are numerous in the types.

Type. — M. C. Z.

Type locality. — Off Bequia, from 2,712 meters depth.

Distribution. — West Indies.

Specimens examined. — The type and another individual from the "Blake" expedition but lacking locality

Remarks. — The glassy integument and the lack of phosphactic bodies gives this species a certain resemblance to *M. barbouri* and the spicules are therefore here figured side by side to emphasize the differences.

5. Molpadia parva (Théel)

(Plate 38, Nos. 4-6; text figures 9, Nos. 1-3)

Trochostoma arcticum var. *parva* Théel, 1886 a, p. 17.
Trochostoma arcticum var. *cocrulum* Théel, 1886 a, p. 17.
Molpadia parva H. L. Clark, 1908, p. 108. Deichmann, 1930, p. 196, pl. 22, figures 10-13.

Diagnosis. — Medium-sized form (up to 7 cm.); spicules medium-sized tables with three large central holes and normally three or more smaller marginal holes. Spire tall with three pillars and several cross-beams. Similar tables but with more or less oblong disk are present in the tail. Phosphatic bodies lacking or rare. Anchors and racquet-shaped plates discovered in one individual.

Types. — M. C. Z.

Type locality. — Off Grenada, 416 fathoms (var. *parva*) and 583 fathoms (var. *coerulum*)

Distribution. — Known from the typelocalities and south of Cuba. According to H. L. Clark also taken off Nantucket "Albatross" stations 2,144 and 2,106 (U. S. N. M.).

Depth. — From 416 to about 1,300 fathoms.

Specimens examined. — Théel's two types and the following material from the "Atlantis" cruises.

Station 3345 21° 08′ N., 79° 56′ 30″ W., 690-700 fathoms. 1 specimen

Remarks. — The "Atlantis" specimen resembles the type of var. *parva*. The spicules are of the same shape and the skin contains the diffuse pigment which also characterizes the type. A few red phosphactic bodies were discovered in the skin of the type specimen. More interesting was, however the discovery that a few anchor's and racquet-shaped plates were present in the "Atlantis" specimen.

As the spicules of neither var. *parvum* nor var. *coerulum* were figured by Théel in 1886 they are now figured. The tables of var. *coerulum* are somewhat more complex but until more material is available it seems natural to regard to two forms as identical.

6. Molpadia blakei (Théel)

(Plate 38, Nos. 6-8)

Trochostoma blakei Théel, 1886 a, p. 16, pl. 1, fig. 8. Perrier, 1902, p. 525, pl. 22, figs. 3-6.
Molpadia blakei, H. L. Clark, 1908, p. 163. Deichmann, 1930, p. 196, pl. 22.
Trochostoma blakei var. *excentrica* Hérouard, 1923, p. 136, pl. 9, figs. 3-9.
Trochostoma angulatus Hérouard, 1923, p. 136, pl. 3, fig. 6, pl. 8, fig. 3.
Trochostoma grossularia Hérouard, 1923, p. 137, pl. 9, figs. 13-16, 21-32.
Paratrochostoma spiniferum Heding, 1935, p. 72, pl. 4, figs. 13-14, pl. 5, figures 20-21.

Diagnosis. — Medium-sized form (6 cm.); tentacle ampullae unusually short almost lacking.

Spicules in body wall minute tables with three large holes in the disk and a solid spire tapering into a point or ending in a few hook; base of spire often divided into three pillars. Tail with fusiform rods or tables with a low spire ending in a few hooks. No phosphatic bodies, anchors or racquet shaped plates.

Type. — M. C. Z.

Type locality. — Off Grenada, 945 fathoms depth.

Distribution. — West Indies, off Nova Scotia (*T angulatum* Hérouard) and Eastern Atlantic (*T grossularia* var *excentrica* Hérouard) Recently reported from the waters south and west of Greenland (i. e. *Paratrochostoma spiniferum* Heding)

Depth. — From about 1,000 to 1,500 fathoms.

Specimens examined. — The type in the M. C. Z. and some individuals in the U S. N. M.

Remarks. — An excellent description has been given by Heding who finally points out that *Parathochostoma spiniferum* possibly is identical with *M. blakei* or its varieties. The excentric position of the tail which Hérouard noticed in his variety *excentrica* is, however, not a stable character as it may occur in some individuals of any species of *Molpadia* an not in others, taken in the same haul. The shape of the calcareous ring falls likewise within the range of variation which is considerable the genus *Molpadia.* The most significant character which Heding indicates, namely the lack of free tentacle ampullae is the only one which possibly justifies a new genus although not transference of the genus to the *Eupyrgidae.* Actually the tentacle ampullae are merely unusually short and may in some specimens appear to be totally lacking while they are perfectly distinct in other individuals. The undivided musclebands which Heding claims are present in his small specimens of *P spiniferum* are not characteristic of Théel's type which has very wide bands, distinctly divided, as in the other members of the genus *Molpadia.* It seems there fore more correct to withdraw the genus *Paratrochostoma* as a synonym of *Molpadia* and modify the diagnosis of the latter to read "tentacle ampullae present but in some forms notably short".

7 Molpadia musculus (Risso)

(Plate 40, Nos. 1-15)

Molpadia musculus H. L. Clark, 1908, p. 165, pl. 23, figs. 4-7 (complete list of references). Deichmann, 1930, p. 198, pl. 22, figs. 4-9, pl. 23, figs. 4-7

Ankyroderma loricata Perrier, 1901, p. 535, pl. 22, figs. 23-28. Hérouard, 1923, p. 133.

Eumolpadia asaphes Heding, 1931, p. ; 1935, p. 42, pl. 5, figs. 9-10, pl. 7, fig. 2, pl. 8, fig. 3, text fig. 9.

Diagnosis. — Large form (up to 16 cm.).

Spicules tables with solid spire, 3-6 holes in the disk, often marginal projections and, with advancing age, fusiform plates or rods, broad or narrow, with a varying number of holes, often an abortive spire. Tail with fusiform rods with 3-4 central holes, sometimes a

minute spire. Phosphatic bodies present in varying number; anchors and racquets present in most individual but may be completely reduced.

Type. — Undoubtedly lost.

Type locality. — Mediterranean Sea, probably in less tan 200 fathoms depth.

Distribution. — Circumtropical, and reaching more northern and southern localities in certain places (North Atlantic (*M. asaphes* Heding) Kerguelen (*M. violacea* Studer, Théel) Also off New Zealand, off Chile, etc.

The following material from the "Atlantis" cruises.

Station 2962	22° 07′ N.,	81° 08′	W.,	200-210	fathoms.	2	specimens
„ 2962D	22° 07′ N.,	81° 08′	W.,	175-210	„	1	„
„ 2963C	22° 07′ N.,	81° 08′	W.,	205	„	6	„
„ 3328	22° 08′ N.,	81° 10′	W.,	260-275	„	10	„
„ 3345	21° 08′ N.,	79° 56′ 30″	W.,	690-700	„	1	„
„ 3374	20° 45′ N.,	75° 19′	W.,	300	„	1	„
„ 3387	22° 33′ N.,	78° 10′	W.,	245	„	1	„
1938, Aug. 3	37° 43′ N.,	73° 40′	W.,	1,105	„	1	„

Remarks. — The majority of the specimens from the Western Atlantic agree well with the typical form, described from the Mediterranean, and cannot either be separated from specimens from the Eastern Pacific. The fusiform spicules in the bodywall (lacking in young individuals) show two extremes, the *loricata*-type, with broad rhombiform plates, and the *violacea*-type, with narrow needle-like rods, usually with the central holes placed in a depression.

A series ranging from 1-6 cm. has been examined. In the smallest individuals only delicate tables are present; later heavier tables appear, often with marginal projections and finally typical fusiform plates or rods, or a mixture of both, become dominating.

Anchors and racquets are numerous in smaller individuals but become gradually more scarce and seem sometime to be totally lacking. Phosphatic bodies are present in varying numbers; most of the Atlantis specimens are slightly freckled or show rusty-red patches, other individuals are dark red in color

The largest specimen from the northern waters measures 8 cm. in length and has narrow fusiform rods, numerous phosphatic bodies and lacks apparently totally anchors and racquets. It agrees therefore with Heding's *asaphes* based on a much smaller individual from the northern Atlantic or Studer's *violacea*, known from Kerguelen and

off the coast of Chile. There are, however, specimens in the M. C. Z. with exactly the same type of spicules, from the West Indian Seas and off the coast of Chile, and in these anchors and racquet are present, just as I have seen typical specimens of *M musculus* with few or no anchors and racquets. I an therefore convinced that *asaphes* and *violacea* merely represent variations of *M musculus* and not distinct species.

Eupyrgidae Semper, 1868

Eupyrgidae Semper, 1868, p. 24. Heding, 1931, p. 281; 1935, p. 68.

Diagnosis. — Small forms with 15 tentacles, apparently simple finger-shaped. Calcareous ring low without posterior prolongations; tentacle ampullae reduced; muscleband undivided; stonecanal attached to dorsal integument and opening to the exterior in front of the genital opening.

Spicules huge tables with numerous holes in the disk and three-pillared spire. Arct and subarctic forms.

Remarks. — The family comprises one genus, *Eupyrgus* Lütken, 1857 The other genus referred to the family, *Paratrochostoma* Heding, with one species *P spiniferum* Heding, is a synonym of *Molpadia* and the type species is identical with *M blakei* (Théel) Except for the unusually short tentacle ampullae it differs little from the typical members of the genus *Molpadia* and the stone canal opens behind the genital opening as in that genus, not in front of it as in *Eupyrgus*. The musclebands are divided while Heding claims they are undivided in his very small specimens of *P. spiniferum*. It is, however, often difficult to ascertain whether the bands are divided or simple in such small individuals, especially if they are strongly contracted.

Eupyrgus Lütken, 1857

Diagnosis. — As for the family

Type species. — *Eupyrgus scaber* Lütken.

Remarks. — The type species occurs widespread in the Arctic Seas, usually in comparatively shallow water. A related form, *E. pacificus* has been described by Oestergren from the Northern Pacific Ocean. An excellent anatomical description has recently been given of the type species by Heding, 1935, p. 69, pl. 4, figs. 10-11, pl. 8, fig. 11.]

ORDER V — APODA BRANDT

The "Atlantis" cruises around Cuba in the spring of 1938 and 1939 secured only one species, viz., the common large shore form, *Euapta lappa* (Müller) From more northern water were secured two deep water forms which are discussed below and furthermore is included a discussion of Verrill's *Toxodora ferruginea* which now is referred to the genus *Chiridota*.

For information about the West Indian apodous holothurians the reader is referred to Clark's and Deichmann's papers from 1908 and 1930 and various publications by Heding which have appeared since 1928.

FAMILY SYNAPTIDAE

Genus EUAPTA Oestergren

For diagnosis, etc., see Clark, 1908, pp. 70-73 and Deichmann, 1930, p. 205.

Synapta lappa J Müller, 1850, p. 134. Théel, 1886, p. 10, pl. 1, fig. 7
Euapta lappa H. L. Clark, 1908, p. 73, pl. 4, figs. 23-25. Deichmann, 1930, p. 205; 1936, p. 9.
Nec *Euapta lappa* Boone, 1928, p. 14, i. e. *E. godeffroyi* (Semper).

Specimens examined. — Several fragments from the following shore-locality of the "Atlantis" cruises.

Station 3347 April 9 20° 03′ N., 77° 55′ W., 13 fathoms. Fragments

Remarks. — The species occurs widespread in the West Indies. It has once been reported from Bermuda (H. L. Clark, 1907), overlooked by Deichmann (1930), but seems not to be a typical element of the islands fauna. According to Théel (1886) it is also known from Teneriffa.

A closely related form occurs in the Indo Pacific, ranging from Mauritius to the western coast of Mexico. In the latter locality it was described as *E. lappa* by Boone (1933) but later referred to *E. godeffroyi* (Semper) by Deichmann (1936). The two species differ in minor characters. Frequent malformation of the anchors and the presence of a webbing between the basal part of the tentacles are characteristic features of the Indo Pacific species. Comparison of a large number of well preserved specimens may possibly reveal

that the two species cannot be kept separate, in that case the name *E. lappa* must be retained as it is 18 years older than Semper's name.

Protankyra Oestergren, 1898

For diagnosis, etc., see Clark, 1908, p. 103.

Protankyra brychia (Verrill)
(Plate 41, Nos. 1-3)

Synapta brychia Verrill, 1885, p. 339.

Protankyra brychia Oestergren, 1898, p. 116. H. L. Clark, 1908, pp. 25, 103, pl. 4, figs. 12-14. Deichmann, 1930, p. 209. Ludwig (†) & Heding, 1935, p. 149 (passim).

Synapta sp. Théel, 1886 a, p. 20.

Diagnosis. — Medium-sized form (up to 10 cm. long, almost 1 cm. in diameter); tentacles unknown; Polian vesicles 2 in number (?) (or more).

Spicules anchors with smooth to serrate flukes and branched handle and deep scoop-shaped anchor-plates with numerous holes with smooth or spinous edges; handle variously developed often as an irregular mass of branches. Miliary grains present along the ambulacra in the muscles. Color grayish with a purplish tinge.

Type. — U. S. N. M.

Type locality. — Off Cape Hatteras, 938 fathoms (headless fragments).

Distribution. — From the West Indies to off New York.

Depth. — From 938 to 1,105 fathoms.

Specimens examined. — The types in U. S. N. M.; a fragment from off Florida; Théel's fragment of *Synapta* sp. from off New Jersey, and some fragments from off New York (37° 43′ N, 73° 30′ W., 1,105 fms., "Atlantis", W E. Schevill coll).

Remarks. — From the western part of the Atlantic Ocean two species have been reported, viz., *P. brychia* (Verrill) and *P. abyssicola* (Théel), the latter being originally described from the Eastern Atlantic. Heding has recently (Ludwig (†) and Heding, 1935) tried to outline the differences between the two Atlantic species. Nothing is, however, known about the arrangement of the ciliated funnels in Verrill's species, and Clark's statement that the species possesses two Polian vesicles may be erroneous since the type specimens which he examined lacked the oral end. The spicules of the types show considerable variation in size and intergrade with those of *P. abyssicola*. The anchors have, as usual, sometimes smooth, sometimes errate

flukes and the anchor-plates are oval to round with larger or smaller holes with smooth or dentate margin. They resemble Heding's figures, *P abyssicola* from the Eastern Atlantic.(*) The latter species has 5-7 Polian vesicles and scattered ciliated funnels. I am convinced that Verrill's species includes also *P abyssicola* (Théel) Ludwig's species *P pacifica* (originally described as a variety of the Atlantic form) has, according to Heding, up to 10 Polian vesicles and ciliated funnels in longitudinal series—characters of rather dubious value—and more strongly spinulated anchor-plates. The anchors may, however, have smooth or serrate flukes according to their age, as Clark has pointed out in 1920. On acount of the definite difference in the spicules it seems corret to maintain *P pacifica* as a distinct form. Apparently there is a tendency among the deep water forms to develop spines in the Pacific Ocean, as examplified by *Hedingia albicans* (Théel) and *Staurocucumis abyssorum* (Ludwig)(**) which have strongly spinous spicules in the Eastern Pacific Ocean while the representatives in the Atlantic Ocean have almost smooth spicules.

CHIRIDOTIDAE

Chiridota Eschscholtz 1829

Chiridota abyssicola v. Marenzeller, 1893, p. 19, p. 1, fig. 5, pl. 2, fig. 7 H. L. Clark, 1908, p. 119 (passim).
?Achiridota ingolfi Heding, 1935, p. 17
?Paradota ingolfi Ludwig(†) and Heding, 1935, p. 150.

Diagnosis. — Medium-sized form (known to reach a length of 10 cm) with 12 tentacles with up to 15 digits (1 terminal and up to 7 on each side) Stone canal short, polian vesicles numerous (12-20)

Spicules in few wheel-papillae, possibly reduced in some individuals. Wheels with six spokes (diameter 0.08-0.1 mm.)

(*) Miliary grains occur, according to Heding, in the longitudinal muscles of *P abyssicola* (they were not mentioned by Théel) and Ludwig found them likewise in *pacifica*. H. L. Clark observed that there was miliary grains along the radii in the types of *brychia* and used that character to distinguish the latter from *abyssicola* and *pacifica* but, by an error, he states (p. 103) that *brychia* lacks accessory grains. He figures, nowever, the grains (pl. 4, fig. 14) and they agree completely with Hedings figures. As they are present in all three "species" they are of no value as a distinguishing character.

(**) In case of *S. abyssorum* the corresponding Atlantic form has been considered a distinct species, *S. ingolfi* (Deichmann). See Mortensen, 1927

Type. — Monaco.

Type locality. — Off the Azores.

Distribution. —Eastern and Western Atlantic.

Depth.

Specimens examined. — A fragment from one of the "Atlantis" cruises off New York (with *P brychia* (Verrill)), Aug. 4, 1938, 38° 58′ N., 72° 19′ W., 1,040 fathoms.

Remarks. — The records of a species of *Chiridota*, closely allied to *C. laevis* (Fabricius) but from deep water, has always been viewed with suspicion. As the "Atlantis" operated solely in deeper water in August 1938, and the *Chiridota* furthermore was in a vial which contained *Protankyra brychia* it seems proved beyond doubt that the specimen actually came from deeper water

From v Marenzeller's description may be quoted that the type of *C. abyssicola* measured 10 cm. in length and had 12 tentacles with 12-15 digits; the gonads on the right side of the mesentery were considerably larger than those on the left side. The wheel-papillae were few, only 4 in number each contained about 20 wheels with six spokes and ranging in size from 0.08-0.1 mm. in diameter. No other spicules were described but probably it did not occur to v Marenzeller to examine the tentacles and the skin immediately behind these. Very likely they would have been found to contain rods of similar type as those present in the tentacles of *C. leavis.*

The "Atlantis" fragment represents a hind-end with a few wheels, sufficient to establish the generic position of the animal and nothing seems to speak against referring it to v Marenzeller's species.

As the wheel-papillae are few in this species and as it is known that the wheels often become completely reduced in certain deep water forms of *Chiridota* known from the Pacific Ocean, it seems quite probable that *Paradota abyssicola* Heding, from deeper water in the Eastern Atlantic, may represent a specimen of *C. abyssicola* v. Marenzeller in which the wheels have disappeared. Heding's specimens were smaller; the tentacles were 12 in number(*) and had only 7-9 digits; the stone canal had a cylindrical head about 12 Polian vesicles were present. Spicules were lacking except for a few rods in the tentacles and in the skin behind these. Heding's individuals came from 1,750 and 2,258 meters depth, while v Marenzeller's specimen came from 2,870 m. and the "Atlantis" specimen was taken at 1,105 fathoms depth.

(*) By mistake the number is given as 15 in the diagnosis.

CHIRIDOTA FERRUGINEA (Verrill)

(Plate 41, figs. 4-7)

Toxodora ferruginea Verrill, 1882, p. 220. H. L. Clark, 1908, p. 126. Deichmann, 1930, p. 213. Ludwig (†) and Heding, 1935, p. 150 (passim).

Diagnosis. — Medium-sized form (less than 10 cm.); tentacles 12, with numerous digits; skin translucent, filled with minute reddish pigment spots.

Spicules numerous curved rods and sometimes a few six-spoked wheels, probably normally in wheel-heaps.

Type. — Possibly in U S. N. M.

Type locality. — Eastern coast of the United States (Albatross sta. 870).

Distribution. — Known from the type locality and vicinity.

Depth. — From 71-155 fathoms.

Specimens examined. — Two head-less fragments in the M. C. Z., part of Verrill's material.

Remarks. — The material of *Toxodora ferruginea* Verrill in the M. C. Z. was re-examined in connection with the study of the deep water *Chiridota* discussed above. It was then discovered that in this species which supposedly lacked these structures, a few wheels actually were lying in the skin. As the absence of wheels was the sole reason for maintaining the genus *Toxodora* the latter must therefore be withdrawn, as a synonym of *Chiridota.*

Chiridota ferruginea is undoubtedly closely related to *C. albatrossi* Edwards from the western coast of North America. The latter species has likewise scattered rods in the skin and shows tendency to loose its wheels; it is also found in deeper water

Heding's suggestion that *Paradota* possibly is a synonym of *Toxodora* cannot be upheld except so far as *Paradota* possibly also may be discovered to possess wheels and thus likewise becomes a synonym of *Chiridota.*

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LIST OF STATIONS WHERE HOLOTHURIANS WERE SECURED

2960 22° 07′ N., 81° 08′ 30″ W., 270 fathoms. Near Bahia de Cochinos, Santa Clara, Cuba. February 18, 1938.
Sphaerothuria asperrima (Théel).

2961 22° 07′ N., 81° 08′ 30″ W., 250-255 fathoms. Near Bahia de Cochinos, Santa Clara, Cuba. February 23, 1938.
Holothuria lentiginosa v. Marenzeller.

2962 22° 07′ N., 81° 08′ W., 200-210 fathoms. Near Bahia de Cochinos, Santa Clara, Cuba. February 24, 1938.
Sphaerothuria asperrima (Théel).
Molpadia musculus (Risso).

2962C 22° 07′ N., 81° 08′ W., 210 fathoms. February 24, 1938. Near Bahia de Cochinos, Santa Clara, Cuba. February 24, 1938.
Sphaerothuria asperrima (Théel).

2962D 22° 07′ N., 81° 08′ W., 175-210 fathoms. February 24, 1938. Near Bahia de Cochinos, Santa Clara, Cuba.
Molpadia cubana n. sp.
Molpadia musculus (Risso).

2963A 22° 07′ N., 81° 08′ W., 155-190 fathoms. Near Bahia de Cochinos, Santa Clara, Cuba. February 25, 1938.
Molpadia cubana n. sp.

2963c 22° 07′ N., 81° 08′ W., 205 fms. Near Bahia de Cochinos, Santa Clara, Cuba. February 25, 1938.
Molpadia cubana n. sp.
Molpadia musculus (Risso)

2963e 22° 07′ N., 81° 08′ W., 220-235 fathoms. Near Bahia de Cochinos, Santa Clara, Cuba. February 25, 1938.
Bathyplotes bigelowi n. sp.

2966 20° 47′ N., 80° 24′ W., 2,125 fathoms. South of Santa Clara Province, Cuba. February 26, 1938.
Benthodytes typica Théel.
Euphronides kerhervei (Hérouard).

2967 19° 47′ N., 75° 06′ W., 1,530 fathoms. Off Bahia de Guantanamo, Oriente, Cuba. March 4, 1938.
Benthodytes typica Théel.

2967a 19° 47′ N., 75° 06′ W., 1,580-1,800 fathoms. Off Bahia de Guantanamo, Oriente, Cuba. March 4, 1938.
Benthodytes typica Théel.

2967b 19° 45′ 30″ N., 74° 57′ 30″ W., 1,330-1,650 fathoms. SE of Bahia de Guantanamo, Oriente, Cuba. March 4, 1938.
Benthodytes typica Théel.

2969 19° 47′ N., 75° 54′ W., 1,145-1,075 fathoms. EE of Bahia de Guantanamo, Oriente, Cuba. March 5, 1938.
Benthodytes lingua Perrier.

2973 21° 09′ N., 75° 04′ 30″ W., 1,245-1,335 fathoms. N. of Oriente, Cuba. March 5, 1938.
Synallactes crucifera Perrier.

2976 21° 19′ N., 76° 05′ W., 1,450 fathoms. N of Gibara, Oriente, Cuba. March 8, 1938.
Benthodytes typica Théel.

2982d 22° 44′ 30″ N., 78° 41′ W., 150-180 fathoms. Old Bahamas Channel due N of Punta Caldera, Camagüey, Cuba. March 11, 1938.
Sphaerothuria asperrima (Théel)
Molpadia cubana n. sp.

2982e 22° 45′ N., 78° 46′ W., 150-180 fathoms. Old Bahamas Channel due N of Punta Alegre, Camagüey, Cuba. March 11, 1938.
Molpadia cubana n. sp.

2987 23° 22′ N., 79° 53′ W., 280-300 fathoms. Nicholas channel, S. of Cay Sol Bank, Cuba. March 13, 1938.
Bathyplotes bigelowi n. sp.

2993 23° 24′ N., 80° 44′ W., 580 fathoms. N of Bahia de Santa Clara, Santa Clara, Cuba. March 15, 1938.
Zygothuria lactea (Théel).

2994 23° 24′ N., 80° 50′ W., 565-585 fathoms. N. of Bahia de Sta. Clara, Santa Clara, Cuba. March 15, 1938.
Molpadia barbouri n. sp.

2995 23° 24′ N., 81° 00′ 30″ W., 370-605 fathoms. Off Bahia Cardenas, Matanzas, Cuba. March 16, 1938.
Molpadia barbouri n. sp.

3313 22° 12′ 30″ N., 85° 06′ W., 550 fathoms. Off Cape San Antonio, Pinar del Río, Cuba.
Molpadia barbouri n. sp.

3323 22° 00′ N., 81° 09′ 30″ W., 290-320 fathoms. Near Bahia Cochinous, Santa Clara, Cuba. April 4, 1939.
Bathyplotes bigelowi n. sp. TYPE.

3324 22° 08′ N., 81° 09′ 30″ W., 320 fathoms. Near Bahia Cochinos, Santa Clara, Cuba. April 4, 1939.
Amphigymnas bahamensis Deichmann.

3328 22° 08′ N., 81° 10′ W., 260-275 fathoms. Off Bahia Cochinos, Sta. Clara, Cuba. April 5, 1939.
Bathyplotes bigelowi n. sp.
Sphaerothuria asperrima (Théel)
Molpadia cubana n. sp.
Molpadia musculus (Risso)

3330 22° 09′ 30″ N., 81° 10′ 30″ W., 280-263 fathoms. Near Bahia Cochinos, Santa Clara, Cuba. April 5, 1939.
Sphaerothuria asperrima (Théel).

3332 22° 09′ 30″ N., 81° 11′ W., 175-225 fathoms. Near Bahia Cochinos, Sta. Clara, Cuba. April 5, 1939.
Sphaerothuria asperrima (Théel).
Molpadia cubana n. sp.

3333 22° 13′ N., 81° 11′ W., 190-200 fathoms. Near Bahia Cochinos, Santa Clara, Cuba. April 6, 1939.
Molpadia cubana n. sp.

3344 21° 38′ N., 80° 12′ W., 1,440 fathoms. Off Cienfuegos, Sta. Clara, Cuba. April 8, 1939.
Benthodytes typica Théel.
Pseudostichopus occultatus v. Marenzeller.
Molpadia cubana n. sp.

3345 21° 08′ N., 79° 56′ 30″ W., 690-700 fathoms. Off Banco Paz, Santa Clara, Cuba. April 8, 1939.
Molpadia musculus (Risso).
Molpadia parva (Théel).

3347 20° 03′ N., 77° 55′ W., 13 fathoms. Off Cabo Cruz, Oriente, Cuba. April 9, 1939.
Euapta lappa (J Müller)

3355 19° 50′ N., 75° 00′ W., 1,070-1,950 fathoms. Near Guantanamo Bay, Cuba.
Euphronides violacea Perrier.

3358 20° 40′ N., 74° 32′ W., 975 fathoms. Between Cuba and Clarion Bank. April 18, 1939.
Deima blakei Théel (with a parasitic gasteropod)

3359 20° 38′ N., 74° 32′ W., 1,000 fathoms. Off Baracoa, Oriente, Cuba. April 18, 1939.
Benthodytes typica Théel.
Benthodytes lingua Perrier.
Zygothuria lactea (Théel).
Mesothuria verrilli (Théel).

3362 20° 48′ N., 74° 30′ W., 1,020 fathoms. Off Baracoa, Oriente, Cuba. April 18-19, 1939.
Mesothuria maroccana Perrier.

3365 20° 46′ N., 74° 59′ W., 600 fathoms. Off Punta Cabanas, Oriente, Cuba.
Orphnurgus asper Théel.

3366 20° 46′ N., 74° 59′ W., 625 fathoms. Off Punta Cabanas, Oriente, Cuba. April 19, 1939.
Deima blakei Théel.
Orphnurgus asper Théel.
Bathyplotes pourtalesi (Théel).

3367 20° 46′ N., 75° 02′ W., 640 fathoms. April 19, 1939.
Orphnurgus asper Théel.

3369 20° 49′ N., 75° 98′ W., 600 fathoms. Off Punta Cabanas, Oriente, Cuba. April 20, 1939.
Deima blakei Théel.
Orphnurgus asper Théel.

3370 20° 47′ N., 75° 11′ W., 450 fathoms. Off Puerto Tanamo, Oriente, Cuba. April 20, 1939.
Bathyplotes pourtalesi (Théel).

3374 20° 45′ N., 75° 09′ W., 300 fathoms. Off Puerto Tanamo, Oriente, Cuba. April 20, 1939.
Sphaerothuria asperrima (Théel).
Molpadia musculus (Risso).

3375 20° 45′ N., 75° 20′ W., 230 fathoms. Off Puerto Tanamo, Oriente, Cuba. April 20, 1939.
Holothuria occidentalis Ludwig.
Sphaerothuria asperrima (Théel).

3376 20° 44′ 30″ N., 75° 18′ W., 285 fathoms. Off Puerto Tanamo, Oriente, Cuba. April 20, 1939.
Sphaerothuria asperrima (Théel).
Molpadia cubana n. sp.

3379 21° 49′ N., 76° 43′ W., 910 fathoms. Off Puerto Manati, Oriente, Cuba. April 25, 1939.
Euphronides violacea Perrier.

3387 22° 33′ N., 78° 10′ W., 245 fathoms. Off Cayo Romano, Camagüey, Cuba. April 27, 1939.
Molpadia musculus (Risso).

3389 22° 32′ N., 78° 08′ W., 220 fathoms. Off Cayo Romano Camagüey, Cuba. April 27, 1939.
Holothuria occidentalis Ludwig.

3406 22° 42′ N., 78° 38′ W., 200 fathoms. Off Cayo Caco, Camagüey, Cuba. April 29, 1939.
Molpadia cubana n. sp.

3409 22° 44′ N., 78° 41′ W., 200 fathoms. Off Punta Alegre, Camagüey, Cuba. April 29, 1939.
Molpadia cubana n. sp.

3410 22° 47′ N., 78° 41′ W., 260 fathoms. Off Punta Alegre, Camagüey, Cuba. April 29, 1939.
Molpadia cubana n. sp.

3414 22° 30′ 30″ N., 78° 52′ W., 230 fathoms. Off Punta Alegre, Camagüey, Cuba. April 29, 1939.
Molpadia cubana n. sp.

3415 22° 51′ 30″ N., 78° 35′ 30″ W., 210 fathoms. Off Punta Alegre, Camagüey, Cuba. April 29, 1939.
Molpadia cubana n. sp.

3417 22° 50′ N., 78° 56′ W., 200 fathoms. Off Punta Alegre, Camagüey, Cuba. April 30, 1939.
Molpadia cubana n. sp.

3419 22° 46′ 30″ N., 79° 00′ W., 180 fathoms. Off Punta Alegre, Camagüey, Cuba. April 30, 1939.
Holothuria occidentalis Ludwig.

3420 22° 49′ N., 79° 04′ W., 190 fathoms. Off Punta Alegre, Camagüey, Cuba. April 30, 1939.
Holothuria occidentalis Ludwig.

3432 23° 05′ N., 79° 29′ W., 250 fathoms. Off Caibarien, Santa Clara, Cuba. May 1, 1939.
Bathyplotes bigelowi n. sp.

3434 23° 10′ N., 79° 35′ W., 260 fathoms. Off Caibarien, Santa Clara, Cuba. May 1, 1939.
Bathyplotes bigelowi n. sp.

3436 23° 05′ N., 79° 28′ W., 255 fathoms. Off Caibarien, Santa Clara, Cuba. May 2, 1939.
Bathyplotes bigelowi n. sp.

3459 23° 21′ N., 80° 36′ W., 500 fathoms. May 5, 1939.
Mesothuria gargantua Deichmann.
Mesothuria maroccana Deichmann.

3465 23° 09′ N., 81° 27′ W., 175 fms. Off Matanzas, Matanzas, Cuba. May 4, 1939.
Holothuria lentiginosa v. Marenzeller.

3475 23° 18′ N., 80° 48′ W., 400 fathoms. Off Matanzas, Matanzas, Cuba. May 10, 1939.

3480 23° 10′ N., 81° 28′ W., 200 fathoms. Off Matanzas, Matanzas, Cuba. May 11, 1939.
Stichopus regalis (Cuvier).

3483 23° 12′ N., 81° 23′ W., 285 fathoms. Off Matanzas, Matanzas, Cuba. May 11, 1939.
Bathyplotes bigelowi n. s.

3484 23° 12′ 30″ N., 81° 22′ W., 300 fathoms. Off Matanzas, Matanzas, Cuba. May 11, 1939.
Bathyplotes bigelowi n. sp.

Other "Atlantis" stations from the northern waters, from which Holothurians were secured

1937, August 10, 38° 31′ N., 73° 03′ W., 975-905 fathoms.
Hedingia albicans (Théel).

1938, August 3, 37° 43′ N., 73° 40′ W., 1,105 fathoms.
Molpadia musmulus (Risso).
Hedingia albicans (Théel.)

1938, August 4, 38° 58′ N., 72° 19′ W., 1,040 fathoms.
Chiridota abyssicola v. Marenzeller.
Hedingia albicans (Théel)

1938, August 4, 38° 59′ N., 72° 20′ W., 980 fathoms.
Hedingia albicans (Théel).

1938, August 4, 39° 00′ N., 72° 19′ W., 1,050 fathoms.
Zygothuria lactea (Théel)

1939, July 26, Tow 6. 40° 05′ N., 68° 05′ W
1,105-1,135 fathoms.
Zygothuria lactea (Théel)
Sphaerothuria talismani (Perrier).
Hedingia albicans (Théel).

1939, July 24, Tow 4. 40° 05′ N., 67° 52′ W.
1,325 fathoms.
Hedingia albicans (Théel)

1939, July 26, Tow 7. 40° 06′ N., 68° 06′ W.
1,160-1,100 fathoms.
Protankyra brychia (Verrill).
Hedingia albicans (Théel).

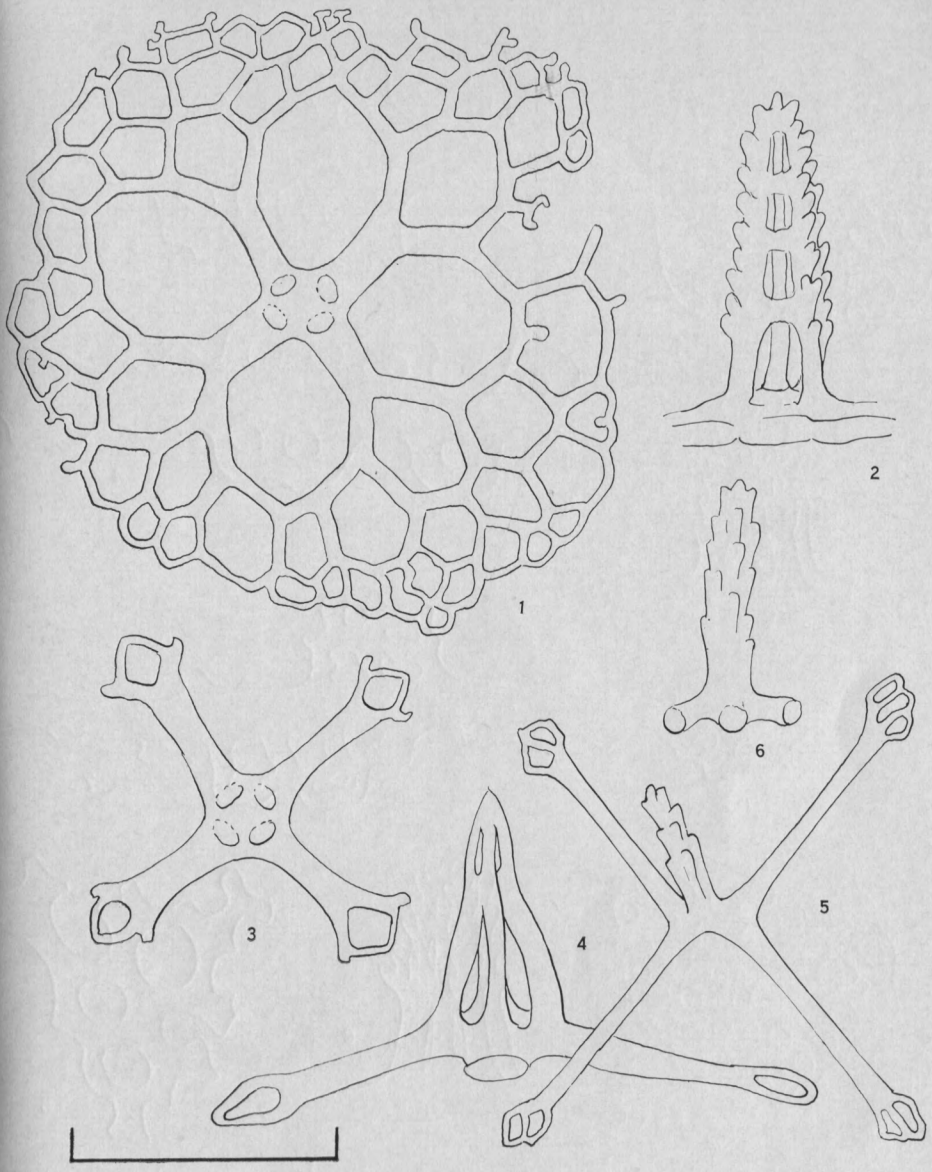
1939, July 27, Tow 8. 40° 01′ N., 68° 06′ W.
1,230 fathoms.
Psolus pourtalesi (Théel).

1939, July 27, Tow 9. 39° 09′ N., 68° 05′ W.
1,280 fathoms.
Psolus pourtalesi (Théel).

Other localities from which holothurians in the M. C. Z. are specially discussed

1939, May 30. Off Gloucester, about 70 fathoms. J. Miller coll.
Molpadia oolitica (Pourtalès).

18 , S. of Marthas Vineyard Station "Blake"
Chiridota ferruginea (Verrill).

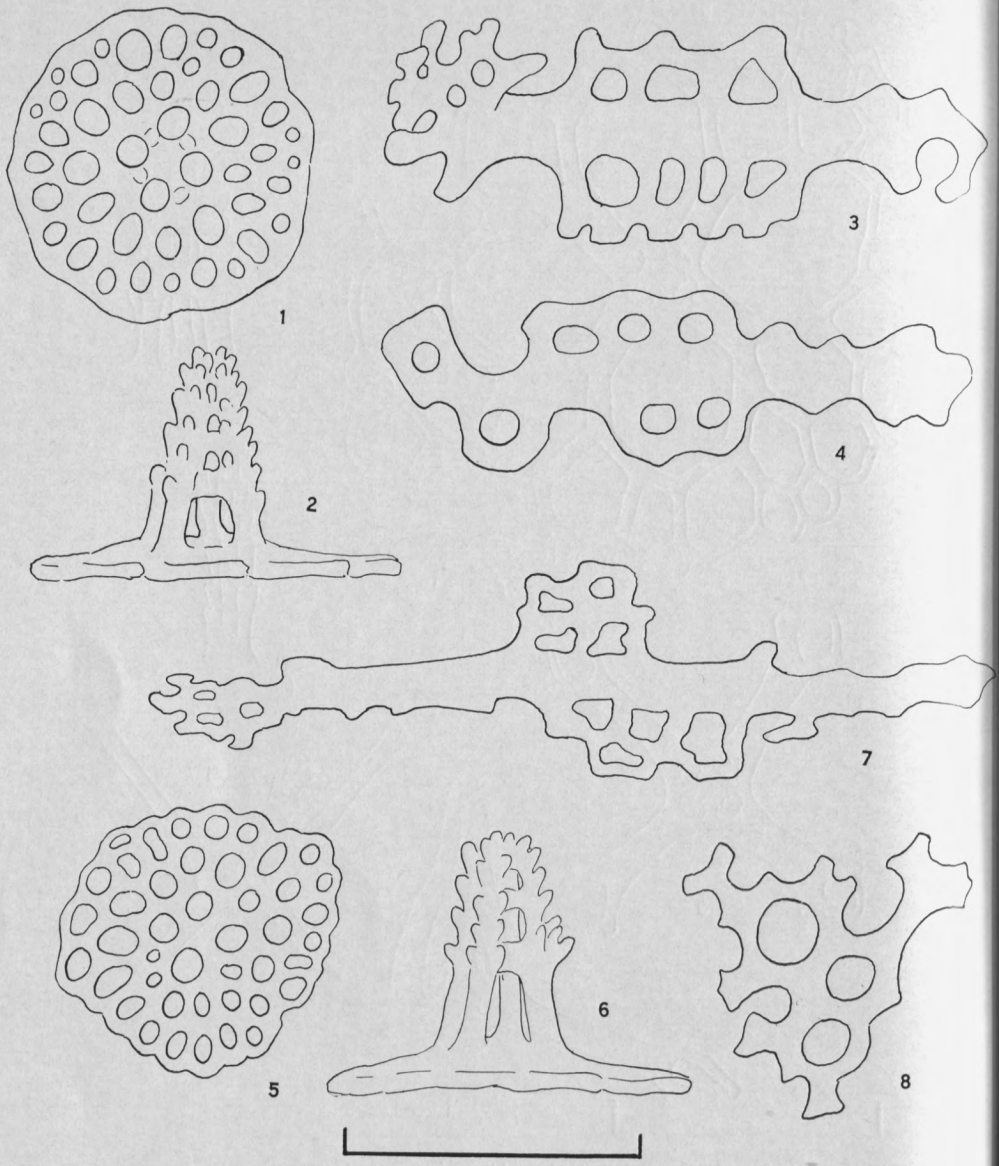


Bathyplotes bigelowi spec. nov.

1 2. Table, disk and lateral view of spire.
Bathyplotes pourtalesii (Théel)

3 4. Table with cross-shaped disk, disk and lateral view.
Synallactes crucifera Perrier

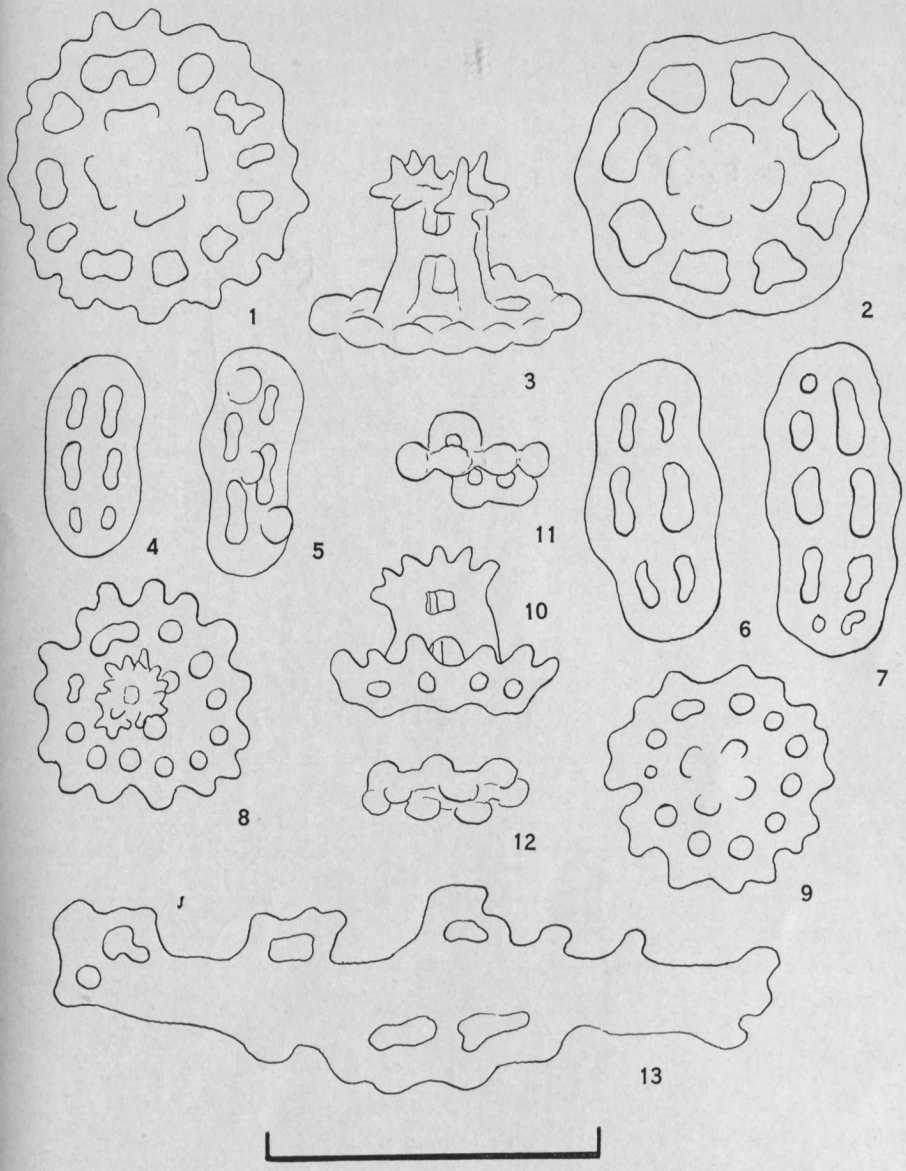
5 - 6. Cross-shaped deposit and central projection.



Stichopus regalis (Cuvier)

1 4. Spicules from a specimen from the Mediterranean Sea; 1 2, tables;; 3 4, supporting rods from tube feet.

5 8. Spicules from a specimen from the West Indian Seas; 5 - 6, tables; 7 supporting rod; 8, reticulated plate from dorsal papilla.

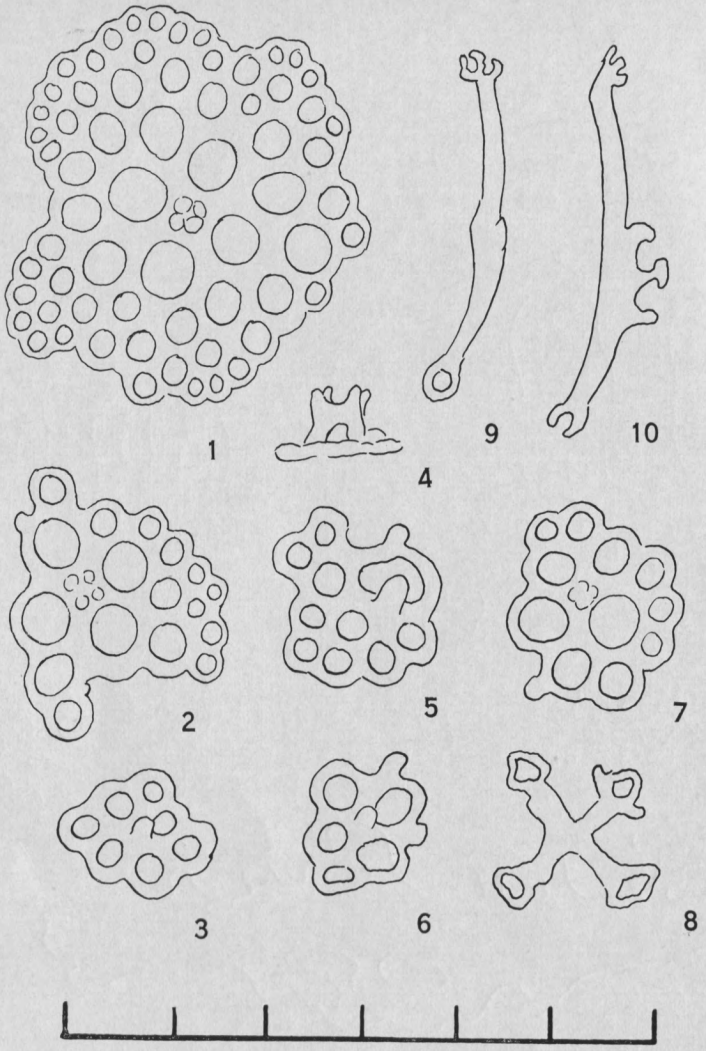


Holothuria lentiginosa v. Marenzeller

1 7 Spicules from a specimen collected in the West Indian Seas.
1 3. Tables; 4 7 buttons.

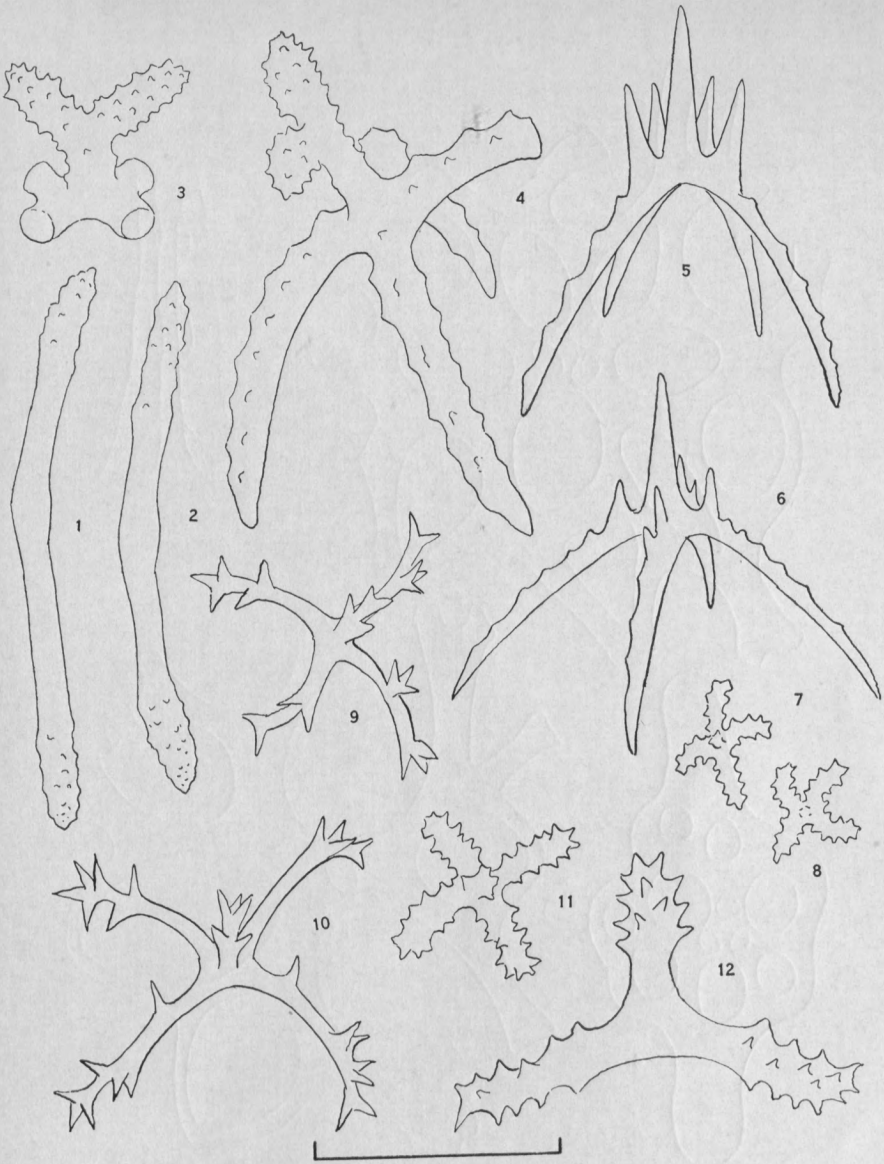
Holothuria occidentalis Ludwig

8 10. Tables; 11 12, knobbed buttons; 13, supporting rod from tube foot.



Amphigymnas bahamensis Deichmann

1. Large table from integument; 2–8, smaller tables or plates from appendages; 9–10, supporting rods from tube feet.



Bentrodytes typica Théel

1 2. Spinous rods from the integument.

Benthodytes lingua Perrier

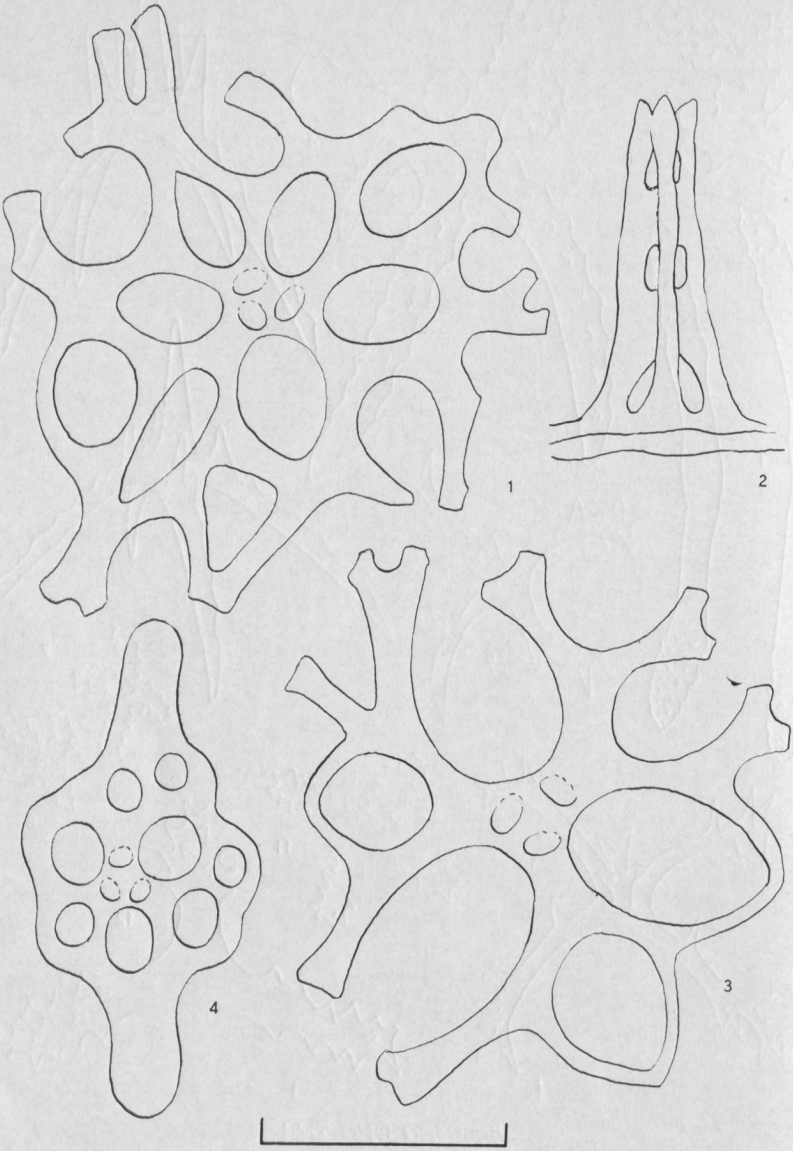
3 4. Large crosses with bifurcate outer projections (arms partly cut off)

Euphornides violacea Perrier

5 6. Large crosses from the dorsal side; 7 8 small spinous crosses from the ventral side.

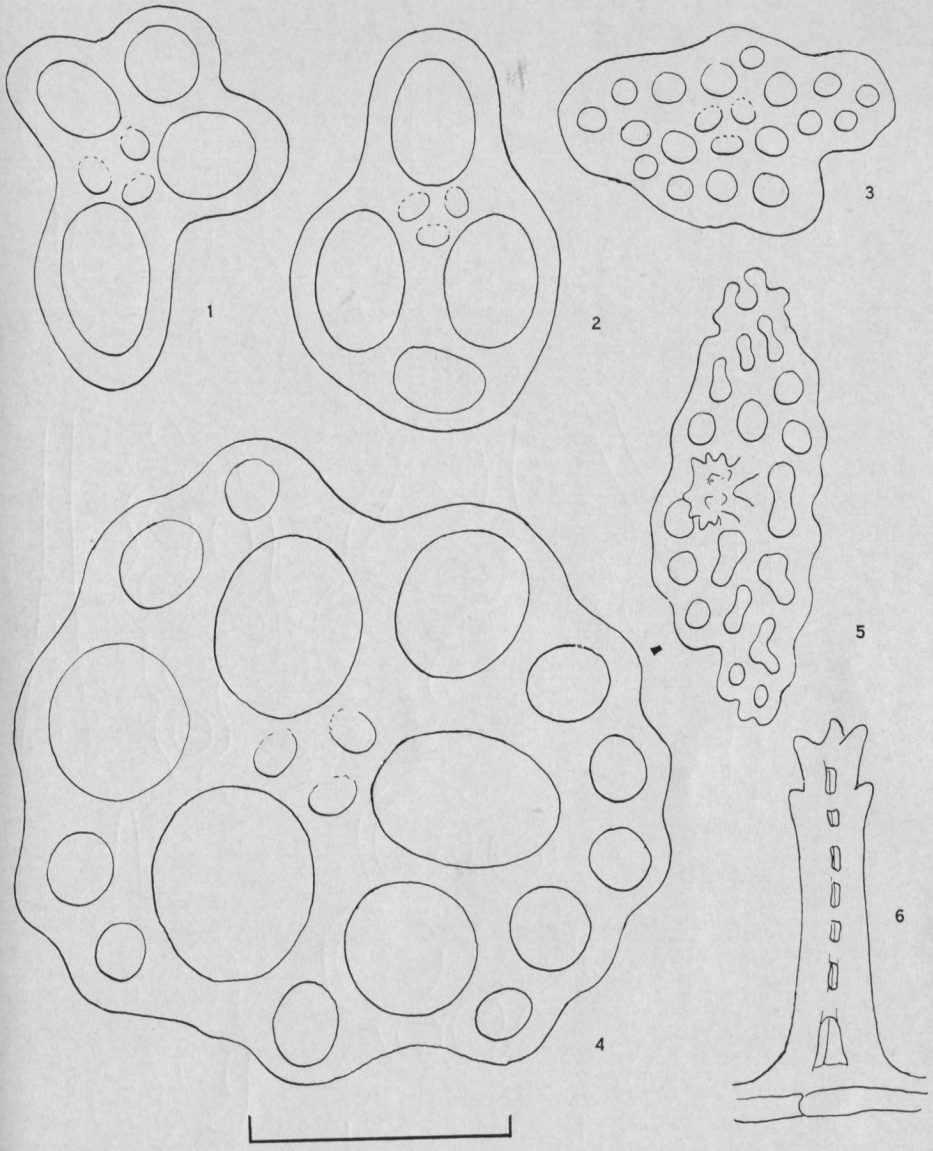
Euphornides kerhervei (Hérouard)

9 10. Large spinous crosses from the dorsal side. 11 12, smaller four and three armed deposits from the ventral side.



Molpadia oolitica (Pourtalès)

1 3. Large tables from integument; 4, elongate table from tail end. All from small individuals few cm. long from off Gloucester.

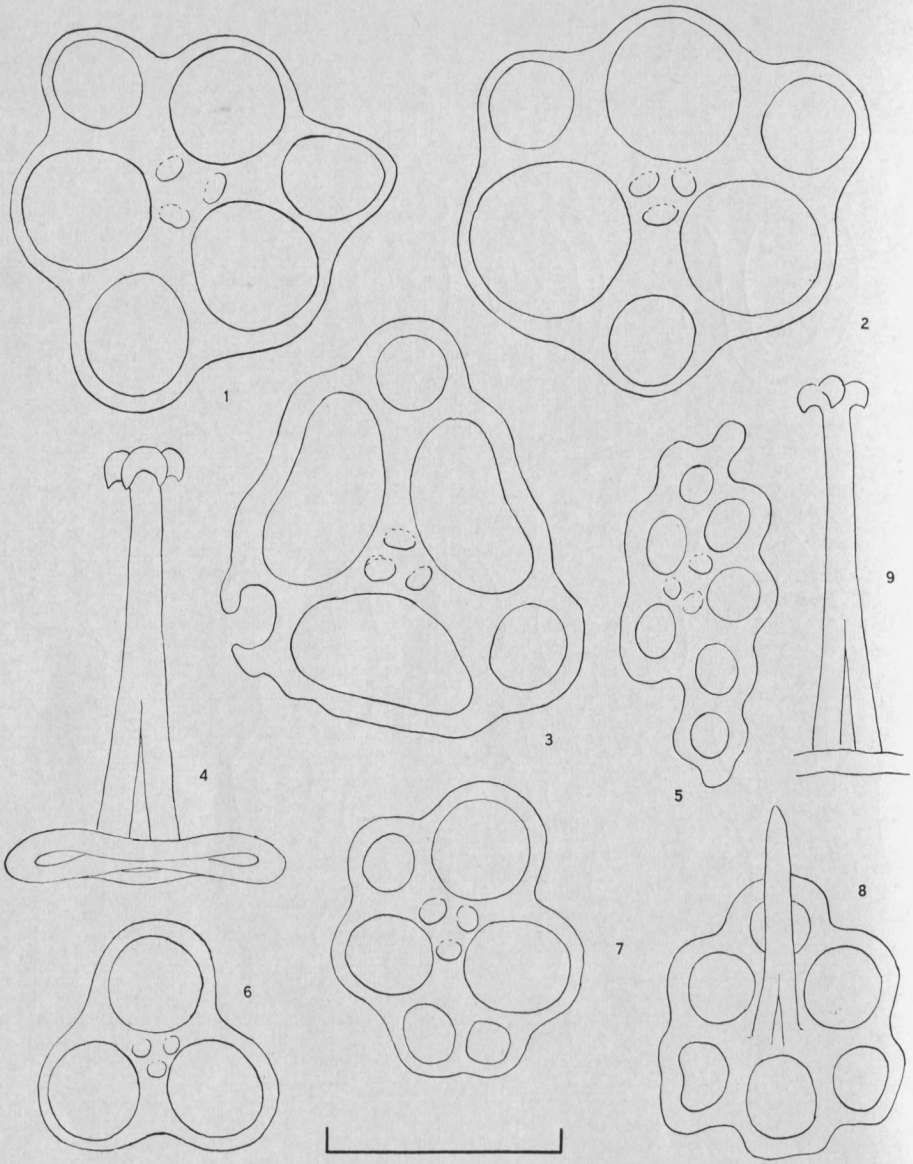


Molpadia cubana spec. nov.

1 2. Disk of tables from the integument; 3, disk of table from the tail end.

Molpadia parva (Théel)

4. Disk of table from Théel's type of var. *coerula*; 5, spire from same; 6, table from tail end from same.

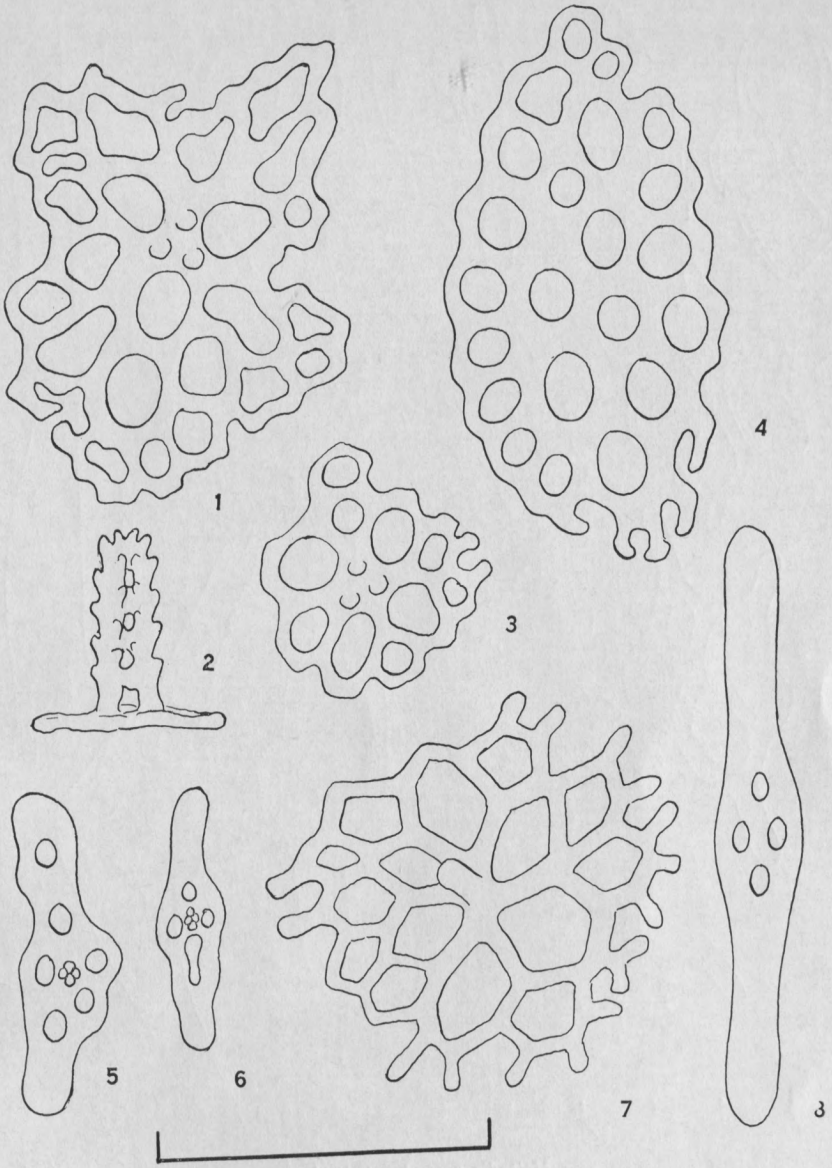


Molpadia parva (Théel)

1 3. Disk of tables from Théel's variety *parva*; 4, spire with hooks; 5, table from tail end.

Molpadia blakei (Théel)

6 8. Tables from Théel's type specimen; 9, spire with hooks from same.

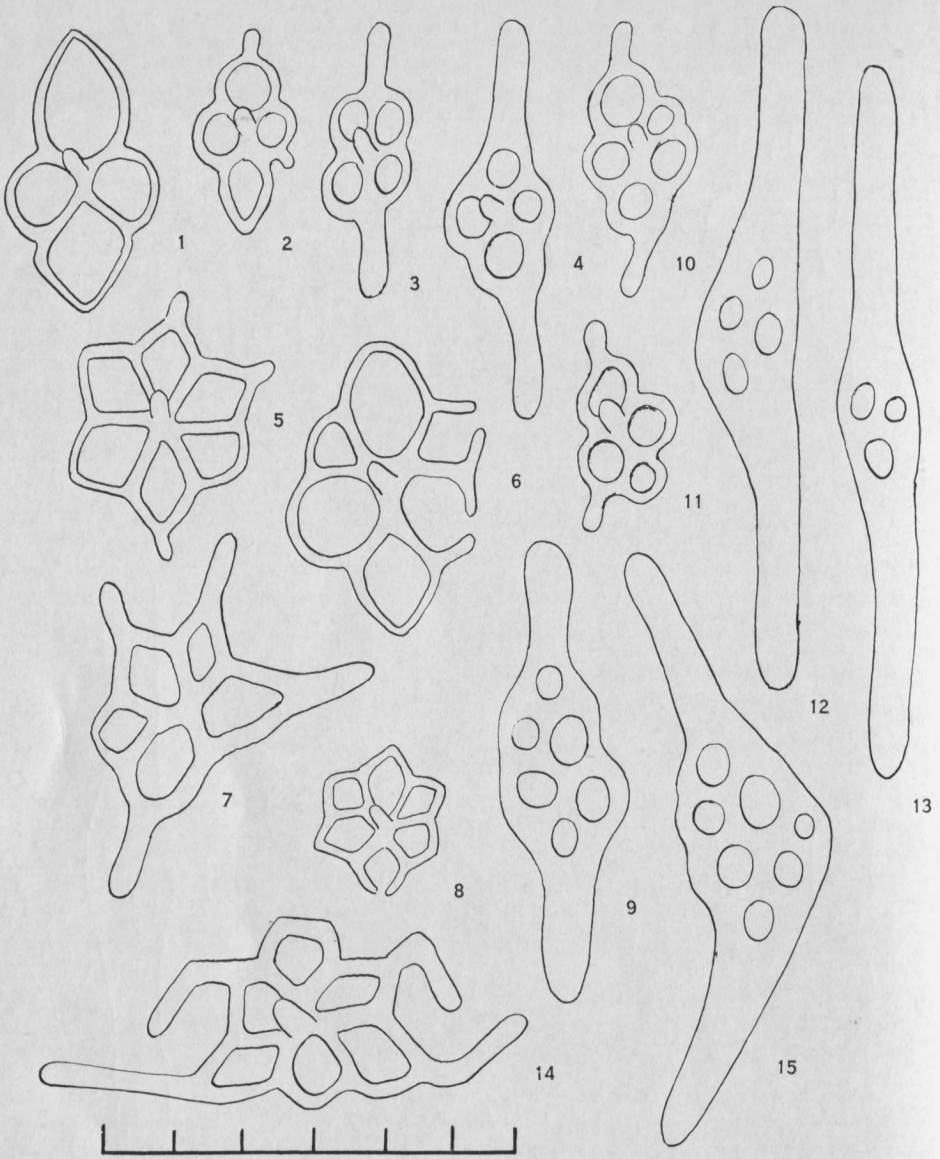


Molpadia barbouri spec. nov.

1 3. Tables, 4 plates with no trace of spire; 5 6, fusiform rods from tail end (from type).

Molpadia agassizi (Théel)

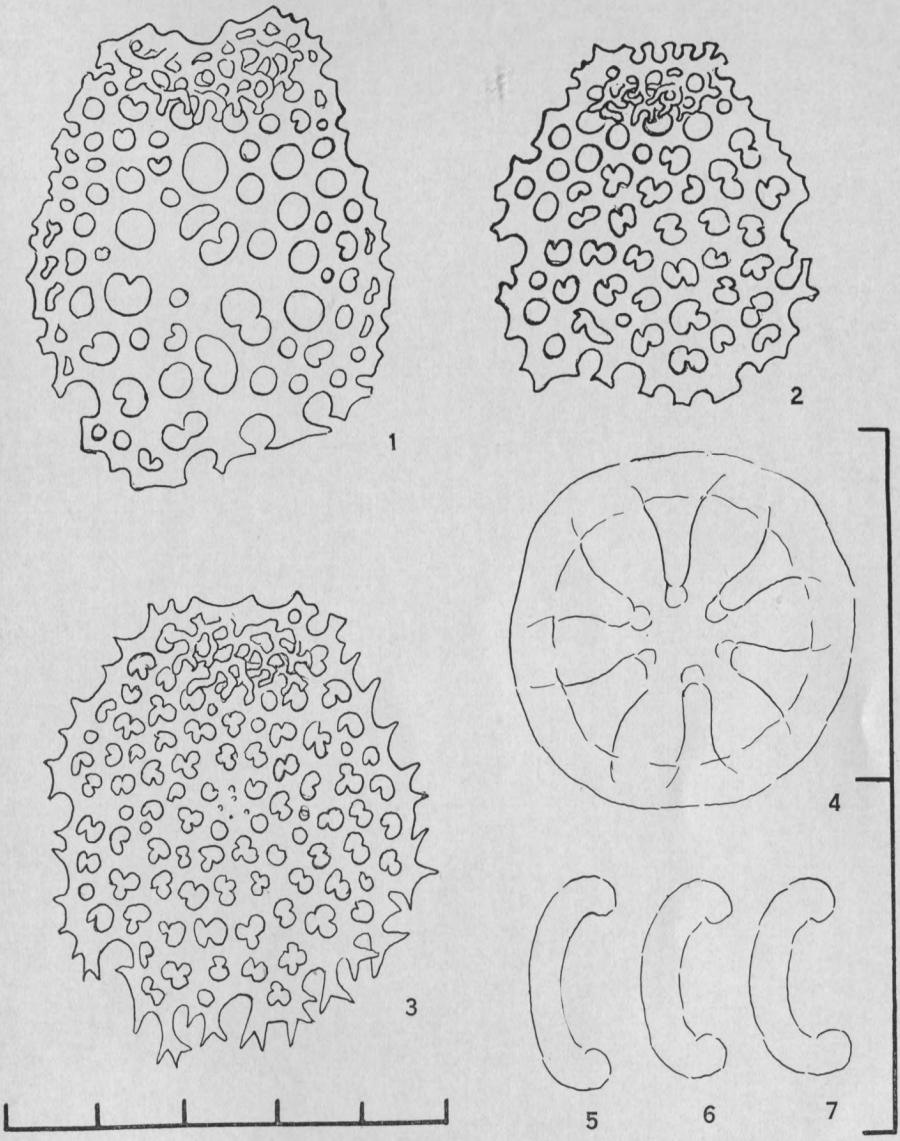
7 Small table; 8, fusiform rod from tail end (from type)



Molpadia musculus (Risso)

1 4. Tables and fusiform tables from specimen 1 cm. long; 5 9, tables and fusiform plates from specimen 2 cm. long; 10 13, tables and fusiform rods from specimen 6 cm. long (*violacea*-type). All from the West Indian Seas.

14 15. Table and fusiform plate from specimen from off the coast of New England (*loricata*-type, same as the two smaller specimens from the West Indies).



Protankyra brychia (Verrill)

1 2. Anchor-plates from specimens from off New Jersey (Théel's *P sp.*) and off Cedar Key Florida.

Protankyra pacifica Ludwig

3. Anchor-plate from specimen from off Lower California.

Chiridota ferruginea (Verrill)

4 7 Wheel and curved rods from a fragment from off Marthas Vineyard.