

No. 1. — *Reports on the Results of Dredging, under the Supervision of ALEXANDER AGASSIZ, in the Gulf of Mexico (1877-78), in the Caribbean Sea (1879-80), and along the Eastern Coast of the United States during the Summer of 1880, by the U. S. Coast Survey Steamer "Blake," LIEUT.-COMMANDER C. D. SIGSBEE, U. S. N., and COMMANDER J. R. BARTLETT, U. S. N., Commanding.*

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XXX.

Report on the Holothurioidea, by HJALMAR THÉEL. With one Plate.

THE following list not only enumerates the deep-sea Holothurians which were dredged during the Blake expeditions, but contains also several other shallow-water forms brought home from different localities of America, principally by the Hassler Expedition, and now in the Museum of Comparative Zoölogy of Cambridge. Referring to my report on the Challenger Holothurioidea, to which this list properly may be considered as an Appendix, I have nothing of importance to add with regard to general conclusions.

Deima Blakei, n. sp.

Figures 1, 2.

Three of the specimens present the greatest similarity with *Deima validum*, while the remaining forms differ in a marked manner, having a certain degree of variability and asymmetry in the number of pedicels and processes. The three first-mentioned forms have eleven pedicels on each side of the ventral surface, the posterior pair being very minute and placed behind the anus, which is completely ventral in position. Immediately in front of the anus a pair of minute pedicels run out from the odd ambulacrum, which is almost naked or possesses one or two rudimentary almost inconspicuous appendages. Along each side of the body, above the pedicels, a row of six large conical processes is situated; the dorsal surface bears, in addition, five or six pairs of such processes.

The other specimens, on the contrary, are not of such evident symmetry, the number of processes and pedicels being more variable, and the processes being much more flexible, almost like those in *Oncirophanta mutabilis*.

With regard to the deposits, all the specimens resemble the last-mentioned species, to which they also bear a strong resemblance regarding the shape of the genital tubes. According to the shape of the deposits, *Deima Blakei* has a much thinner and more flexible integument than *Deima validum*. Considering the obvious agreement with both *Deima* and *Oncirophanta*, I think the Blake specimens properly may be regarded as transitional forms combining these two genera. In external appearance, in the arrangement of the pedicels and processes, in the shape of the tentacles, etc., they closely remind one of the genus *Deima*.

Habitat. St. Vincent; depth, 573 fathoms; six specimens. Lat. 17° 28' 30" N., Lon. 77° 30' W. (1880); depth, 610 fathoms; one specimen.

Orphnurgus asper, THÉEL.

Habitat. Guadeloupe; depth, 583 fathoms. A single specimen.

Euphronides depressa, var. minor, n.

All the specimens are greatly deformed. The largest attains only 150 mm. in length. The azygos dorsal appendage is, as a rule, small.

Habitat. Lat. 39° 38' 20" N., Lon. 70° 56' W.; depth, 1241 fathoms; numerous very badly macerated specimens. Lat. 24° 33' N., Lon. 84° 23' W.; depth 1920 fathoms; several specimens. Lat. 41° 24' 45" N., Lon. 65° 35' 30" W. (1880); depth 1242 fathoms; one specimen.

(?) Benthodytes typica, THÉEL.

All the specimens are badly macerated and deformed, and in such a state of preservation as to render a closer examination impossible. As a rule, all the Psychropotidæ change very considerably when preserved in alcohol, and, in order to understand their organization and external appearance, it is quite necessary to see them living.

Habitat. Martinique; depth 1030 fathoms; numerous specimens. Lat. 24° 33' N., Lon. 84° 23' W.; depth 1920 fathoms; numerous specimens. Lat. 24° 30' N., Lon. 88° 58' W.; depth 1568 fathoms; several specimens. Lat. 19° 7' N., Long. 74° 52' W.; depth 1200 fathoms; two specimens.

Benthodytes assimilis, n. sp.

The species presents the greatest similarity with *Benthodytes sanguinolenta*, and differs from it only in some minute features, which possibly may

prove not to be of specific value. But considering the differences which really exist with regard to the outer appearance, and taking into consideration, that the deposits were dissolved in the types brought home by the Challenger expedition, I propose to refer it, for the present at least, to a new species.

The Blake specimen differs from *Benthodytes sanguinolenta* in being devoid of the transverse ventral row of papillæ situated immediately behind the crown of tentacles; the position of the anus is more ventral, and it carries only a very few slender dorsal processes, which seem to be confined to the two ambulacra alone. The madreporic canal appears to open exteriorly (?). The integument is rather rough from numerous larger and smaller deposits, which consist of four curved arms and a smooth central spine directed outwardly; each of the four arms generally bears a large process directed outwardly and a few smaller ones. In the ventral perisome, the deposits are more irregularly formed, and have the shape of unbranched rods and three- or four-armed bodies. Thus the deposits of this species closely resemble those of *Euphronides depressa*.

Habitat. Bequia; depth 1591 fathoms. One specimen, 220 mm. long and 53 mm. broad.

Benthodytes sp. (?).

The very defective state of the specimens at my disposal renders a detailed examination impossible. They seem to bear the closest resemblance to *Benthodytes abyssicola*. There appear to be fifteen tentacles. The dorsal ambulacral appendages are few and minute. The deposits present themselves as scattered, very large and robust four-armed spicules with a long spinous central spine, the extremity of which is usually split into two or three spinous tops, giving to the surface of the skin a remarkable roughness. The central spines are almost visible to the naked eye.

Habitat. Bequia; depth 1507 fathoms; three very incomplete specimens.

Pælopatides Agassizii, n. sp.

One of the largest specimens has the following measurements: length 270 mm.; breadth 120 mm.; height varying between 5 and 10 mm. The body is thus very depressed, almost flat, and very broad; its anterior and posterior ends are obtusely rounded or truncated. The pedicels are only present on the odd ambulacrum, where they form a thin double row over three fourths of its length; the anterior fourth of the odd ambulacrum is naked. The thin wide brim, which surrounds the body and reaches a breadth of about 40 mm., is pierced by a number of canals which branch off from the two ventral lateral ambulacra, cross the brim, and run out in very minute papillæ situated in the margin of the brim. These papillæ form a simple row in

the margin of the brim round the body, and are scarcely visible to the naked eye. The dorsal papillæ are minute, few in number, and probably confined to the ambulacra alone. The mouth is ventral in position, and the anus dorsal. There are twenty (?) tentacles. The color is bluish violet.

The deposits are scattered, and consist of very regularly formed three-armed bodies, with smooth nearly straight arms forming equal angles with one another and having the ends slightly enlarged and pierced with one or several holes; a long central simple column directed outwardly runs out from the centre of the body and terminates in some minute spines. The calcareous ring is evidently absent or dissolved. Two Polian vesicles 50 mm. long are present. Each of the longitudinal muscular bands is divided into two. The respiratory trees are long and more developed. A bundle of long slender genital tubes is situated on each side of the dorsal mesentery.

Habitat. Lat. $39^{\circ} 43' N.$, Lon. $10^{\circ} 55' 25'' W.$ (1880); depth 1002 fathoms; two specimens. Lat. $38^{\circ} 16' 45'' N.$, Lon. $73^{\circ} 10' 30'' W.$ (1880); depth 1186 fathoms; one specimen. Lat. $39^{\circ} 38' 20'' N.$, Lon. $70^{\circ} 56' W.$ (1880); depth 1241 fathoms; two specimens.

Stichopus Pourtalesii, n. sp.

On account of the very defective state of the specimens, it is almost impossible to get an exact idea of their true shape. So far as I can observe, they resemble in all respects *Stichopus natans* of Sars, except that the ventral surface appears to have two kinds of pedicels: small ones, like those of *Stichopus natans*; and very wide, wart-like ones, which seem to be placed along the sides of the body. By means of these warts the animals adhere firmly to rocks and stones, so that it seems almost impossible to obtain a perfect example. The deposits resemble those of *Stichopus natans*, Sars, but possibly the spire bears longer, more numerous spines on the four vertical rods. Considering the very incomplete state of all the specimens, it is probable that other differences also exist between this species and that of Sars, but for the present I cannot find any other than the large remarkable wart-like feet which *Stichopus Pourtalesii* possesses.

Habitat. St. Kitts (1878-79); depth 208 fathoms; fragments of several specimens. Grenada (1878-79); depth 291 fathoms; fragmentary specimens. Guadeloupe (1878-79); depth 734 fathoms; fragments. (Barbados 1878-79); depth 209 fathoms; fragments. Lat. $18^{\circ} 20' 30'' N.$, Lon. $87^{\circ} 16' 40'' W.$ (Bartlett, 1880); depth 600 fathoms; one specimen.

Stichopus Johnsoni, n. sp.

In a contracted state, the animal attains a length of 150 mm. The color is yellowish brown. There are twenty tentacles of the same size and shape. The ventral pedicels are not crowded, and they do not seem to form any well-

marked longitudinal series. The dorsal papillæ are scattered, and of two kinds : partly situated on rather large conical warts, and partly running out directly from the surface of the skin. The papillæ situated on warts form a simple row along each side of the body, about six in each row, and are besides found scattered irregularly over the rest of the back, though they appear to belong principally to the ambulacra. Scattered among these warts, the small papillæ are visible. A single Polian vesicle, 20 mm. long, is present. A thin bundle of long, slender genital tubes is situated on each side of the dorsal mesentery.

The deposits consist of tables and buttons. The disks of the tables are rather large, with a smooth or uneven margin, and are, as a rule, pierced with numerous holes, which form several peripheric circles. The disks of the ventral tables are smaller, and provided with fewer holes, which often form only a simple peripheric circle. The spire is built up of four rods and one transverse beam, and terminates in several teeth; usually some teeth are placed also on the rods themselves and the transverse beam, so that a side view often presents two crowns of teeth. The upper quadrangular opening of the spire is often closed by a complete or incomplete cross. The buttons are smooth, elongate, often asymmetrical or incomplete, and they are always pierced with more than three pairs of holes; usually one side of the buttons is more developed than the other.

Habitat. Five miles south of Santa Barbara (Cal.); depth 22 fathoms; a single specimen.

(?) *Stichopus natans*, Sars.

Habitat. St. Kitts (1878-79); depth 208 fathoms; some very imperfect specimens.

(?) *Stichopus fuscus*, Ludwig.

The specimen seems to agree in all respects with the description of Ludwig, with the exception of the dorsal papillæ, which have not been satisfactorily mentioned by Ludwig. In the specimen from San Diego all the papillæ are placed on low, wide warts, which are scattered over the dorsal ambulacra as well as interambulacra, so that they do not present an arrangement in rows, except along each side of the body, where they form a simple row. The C-shaped deposits appear to be thinly distributed, and the tables are small and terminate in 20 to 23 teeth; the margin of the disk of the tables is smooth, and perforated with a complete or incomplete circle of peripheric holes. The short spire is composed of four rods and one transverse beam.

Habitat. San Diego, California (Hassler Exp.). One specimen, 170 mm. long.

Holothuria Verrilli, n. sp.

The following description applies to the specimen dredged at St. Vincent. The body is ovate. The tentacles, probably twenty, are drawn inside the body. The ambulacral appendages consist of small pedicels, scattered over the body; they are rather distant on the greater part of the ventral middle line, and more closely packed along the lateral ventral ambulacra, and especially on the posterior portion of the ventral surface. They are not arranged in rows. The integument is very rough from numerous crowded tables, which are of varying size, some being very solid and robust, others of a more delicate structure. The rounded or angular disks of the tables are always pierced with a large central hole, surrounded by a single or several crowns of peripheral holes. The spire is, as a rule, built up of four rods and one or two transverse beams, and terminates usually in four rather long teeth, each provided with spines of considerable size; the spire is rarely built up of more than four rods. The specimen is whitish. The interior structure does not present any differences from that usual in other species of this genus.

The variations with regard to the tables appear to be considerable. In two of the specimens from Dominica, the spire often, but not always, terminates in four smooth teeth; in others, for instance those from Barbados and Grenada, the top of the spire has a very irregular aspect, from numerous longer or shorter teeth, which are placed not only round the opening of the top itself, but also on a cross-like rod which covers this opening.

Habitat. St. Vincent (1878-79); depth 464 fathoms; one specimen 110 mm. long. Dominica (1878-79); depth 611 fathoms; one gigantic specimen, 230 mm. long. Dominica (1878-79); depth 982 fathoms; two specimens. Lat. 17° 30' N., Lon. 79° 14' W. (1880); depth 555 fathoms. Lat. 18° 20' 30" N., Lon. 87° 16' 40" W. (1880); depth 600 fathoms; two specimens, 230 mm. long. Barbados (1878-79); depth 399 fathoms; one specimen. Grenada (1878-79); depth 416 fathoms; one specimen. Grenada (1878-79); depth 955 fathoms; one specimen.

Holothuria Murrayi, THÉEL.

Habitat. Guadeloupe (1878-79); depth 769 fathoms; two specimens.

Holothuria lactea, THÉEL.

Habitat. Lat. 41° 33' 15" N., Lon. 65° 51' 25" W.; depth 810 fathoms; numerous specimens, which differ from those brought home by the "Challenger" only in the fact that the spire of the table often terminates in a simple long spine. Lat. 39° 43' N., Lon. 70° 55' 25" W. (1880); depth 1002 fathoms; numerous specimens. Lat. 38° 18' 40" N., Lon. 73° 18' 10" W. (1880); depth

922 fathoms; one typical specimen. Lat. $41^{\circ} 29' 45''$ N., Lon. $65^{\circ} 47' 10''$ W. (1880); depth 980 fathoms; one specimen. Lat. $18^{\circ} 20' 30''$ N., Lon. $87^{\circ} 16' 40''$ W. (1880); depth 600 fathoms; one specimen.

Holothuria arenicola, SEMPER.

Habitat. Charles Island, Gallapagos Archipelago (Hassler Exp., 1872). Five specimens.

Holothuria lubrica, SELENKA.

Habitat. Mazatlan. Two specimens, agreeing in all respects with the description of Selenka. The ventral cylindrical pedicels are slightly more crowded than the small dorsal, conical papillæ. The curved rods of the integument are strongly spinous, especially towards the extremities.

Holothuria impatiens, FORSKAAL.

Habitat. Charles Island and James Island, Gallapagos Archipelago (Hassler Exp.). Four specimens.

Holothuria imitans, LUDWIG.

One specimen is cylindrical, and measures 90 mm. in length and 12 to 14 mm. in breadth; the other two are more contracted, of an oval form, and have a length of 70 mm. and a breadth of 25 mm. The color is dark grayish or reddish brown on the back, and lighter on the ventral surface; the pedicels and papillæ are light. The anus is surrounded with five small groups of minute papillæ. In one of the specimens the ventral pedicels are distinctly arranged in four series, one along each side and two along the odd ambulacrum, each series containing about four pedicels in breadth. The dorsal papillæ are minute, smaller than the pedicels, and scattered without order. There are twenty tentacles.

The tables closely resemble those described by Ludwig, but he has drawn them with the upper part undermost, as I suggested in my report on the Challenger Holothurioidea. Thus, the tables are completely devoid of disks, and their spire carries at its outward end four double teeth. The rounded or truncate inward end of the spire also bears some spines. No other deposits are to be found in the body-wall itself, but the ambulacral appendages are supported by large, slightly flattened rods, which carry a series of prominences along each side; these prominences are often united with their ends, so that the rods themselves appear to have a series of holes along each side, just as is found in the rods of *Holothuria surinamensis*, Ludwig.

Habitat. Panama (Hassler Exp., 1872); three specimens.

Holothuria Marenzelleri, LUDWIG (var.?).

Although there exist some differences between our specimens and those described by Ludwig, still I refer them to the above species on account of the great similarity which I find to exist in several essential structural points. All the specimens are of a dark brown color, and the largest reaches a length of 110 mm. in a contracted state. There are twenty tentacles. The anus is round. Contrary to what seems to be the case in the type *Holothuria Marenzelleri*, the pedicels do not run out from warts, at least not the ventral ones; in some more contracted specimens, however, the dorsal pedicels give the impression of doing so. The dorsal pedicels do not seem to be true pedicels, but papillæ of a conical form, while the ventral whitish ones are longer, cylindrical, and provided with distinct light brown sucking disks. The ventral pedicels are possibly slightly more numerous than the dorsal papillæ. I have observed a low furrow along each side of the body, marking out the transition between the dorsal and ventral surfaces. The calcareous ring is of usual shape. Three larger and some smaller Polian vesicles are present. A single madreporic canal is to be found. The genital organ consists of a single bundle of slender, slightly branched tubes situated on the left side of the dorsal mesentery. The ampullæ of the dorsal and ventral appendages are distinctly visible on the inner surface of the skin.

The deposits consist of short rods, which, however, very seldom remain simple, but have the ends slightly dichotomously branched so that they have the aspect of an X; very often the branches of these deposits are united, the rods themselves thus becoming transformed into perforated plates or plate-like rods. A great part of the deposits also have the shape of small, very irregular, smooth plates, perforated with a few (two to ten) holes, and spinous in the uneven margin.

For my own part I must confess that most of those so-called species of *Holothuria* which are characterized by having calcareous rods or small plates in the skin resemble each other very closely, and that a revision of them is highly desirable. Thus, the specimens from the Galapagos Archipelago also bear a striking resemblance to *Holothuria lubrica*, Selenka.

Habitat. Charles Island and James Island, Galapagos Archipelago (Hassler Exp., 1872). Numerous large and small specimens.

Cucumaria californica, SEMPER.

A detailed examination of the specimens shows several differences from the type, but considering that Semper's specimen only attained half the size of the specimens at my disposal, and that they are dredged at the same locality, I must suppose that they represent the same species.

The body is ovate, and possesses ten nearly equal tentacles. The large pedicels form a double row along each ambulacrum; the interambulacra are

naked. The color is darker or lighter violet or brown; the pedicels are yellowish and the tentacles blackish. Probably the animal is dark in living state. The calcareous ring is devoid of posterior prolongations, and in a low state of development. The deposits consist of numerous thick, roundish, oval or elongate, irregular perforated plates, which, contrary to the figure drawn by Semper, often present uneven surfaces from the presence of low elevations or knobs. However, the plates not unfrequently seem to be quite smooth. The number of perforations is variable. The pedicels are supported by elongate simple or three-armed perforated spicules or rod-like plates, and possess a very fragmentary terminal plate. In one of the specimens the exterior layer of the perisome contains small, scattered, irregularly formed perforated spicules, which are either simple or irregularly three- or four-armed. These spicules, which are of much finer construction than the underlying plates, are probably dissolved in the remaining specimens. The specimen from Magdalena Bay appears to possess anal teeth (?).

Habitat. Mazatlan; three specimens. Magdalena Bay; one specimen.

Cucumaria dubiosa, SEMPER (var.?).

The specimens agree in all respects with the type described by Semper, except that no interradial pedicels are to be distinguished. Considering, however, the very striking similarity in every other respect, I can only refer them to the species of Semper. There is no doubt that *Cucumaria miniata* also bears the greatest resemblance to this species; a revision of all such forms which are characterized by possessing the same kind of deposits is highly desirable.

Habitat. Eden Harbor in the Strait of Magellan (Hassler Exp.); several specimens. Mayne Harbor in the Strait of Magellan (Hassler Exp.); one specimen. Lat. 37° 42' S., Lon. 56° 20' W. (Hassler Exp.); depth 44 fathoms; two specimens.

Echinocucumis typica, Sars.

Figure 3.

Some of the specimens, especially those brought home from Barbados and St. Kitts, are remarkable in having an almost completely spherical body with a highly reduced bivium, so that the oral and anal apertures closely approach each other. The specimens obtained at Barbados reach 15 mm. in diameter, and their whole appearance reminds one most strikingly of an Ascidian; the trivium is enormously developed; the mouth and anus are each situated in a small conical prominence on the upper part of the sphere. Otherwise they seem to resemble the Norwegian *Echinocucumis typica* in almost every detail. However, in the West Indian forms the pedicels seem, as a rule, to be smaller

and more scattered on the ambulacra, excepting towards the mouth and anus, where they appear to be much more crowded; two of the tentacles are very long, resembling in their retracted state long slender tubular sacs strengthened with crowded transverse calcareous spicules, and they appear to be almost unbranched. The close-lying plates render the body-wall very hard, rough, and brittle, and closely resemble those in the type described by Sars.

With regard to the shape of the body, the specimens from Barbados form a transition between the *Dendrochirota* and *Rhopalodiniæ*.

Habitat. Grenada (1878-79); depth 576 fathoms; one typical specimen. Off Morro Light (1878-79); depth 250-400 fathoms; one typical specimen. St. Vincent (1878-79); depth 464 fathoms; one specimen. St. Kitts (1878-79); depth 270 fathoms; four specimens. Lat. 24° 8' N., Lon. 82° 51' W. (1877-78); depth 339 fathoms; eight specimens. Barbados (1878-79); depth 209 fathoms; two specimens.

Echinocucumis asperrima, n. sp.

The body, like that of *Echinocucumis typica*, is curved; the ventral surface is considerably more developed and more convex than the dorsal. The body tapers strongly both towards the anterior and posterior extremity; the caudal portion is long, narrow, and tail-like. In the largest specimen, the body itself measures about 25 mm. in length and 17 mm. in thickness; the retracted anterior portion of the animal is 10 mm. long, and the tail 18 mm., so that the whole length becomes about 53 mm. When fully extended the length is probably considerably greater. The anus seems to be fringed by cylindrical papillæ and teeth (?). The hard, brittle glassy integument is filled up with large reticulate scales, which are visible to the naked eye, each scale being provided with a long, more or less eccentric spine, which gives to the skin an almost spinous aspect. A closer examination reveals that each scale is irregularly oval or elongate, and composed of several superposed layers of calcareous network; the spine, or rather spire, which is situated more or less near the margin of the scales, presents traces of having been composed of a network like that in *Echinocucumis typica*, but the perforations have disappeared, and the whole forms a more or less irregular cone; at the base of the spine some perforations are often found.

So far as I can see, the tentacles are like those of *Echinocucumis typica*. The calcareous ring is very minute and devoid of posterior prolongations. A single madreporic canal and one Polian vesicle are present.

The pedicels are very minute, so that it is difficult to detect them among the large spines of the deposits. They appear to be more scantily distributed than in *Echinocucumis typica*, but belong evidently to the ambulacra alone; towards the extremities of the body, the pedicels are more easily distinguished. They are supported by curved transverse rods.

Habitat. Lat. 17° 55' N., Lon. 76° 41' 20' W. (1878-79); depth 150

fathoms; one specimen. Lat. $22^{\circ} 9' 30''$ N., Lon. $82^{\circ} 23'$ W. (1877-78); depth 158 fathoms; one specimen. Frederikstad (1878-79); depth 180 fathoms; one specimen.

Thyone scabra, VERRILL.

The length of the larger specimen in the retracted state is about 90 mm. The anus possesses fine calcareous teeth. The pedicels are cylindrical, slender, rigid, and present in great number; they attain a length of about 2 mm. The calcareous ring closely resembles that in *Thyone fusus*. A single Polian vesicle and one madreporic canal are present. The calcareous tables of the perisome remind us slightly of those in the above-mentioned species, but the disks are much more irregular, and pierced with a greater number of holes (sometimes as many as twenty) of nearly equal size. The species undoubtedly bears a striking resemblance to *Thyone fusus*, but differs in having a strongly curved body, and in that the posterior portion of the body is long and tapering; the tables are also different.

Habitat. Lat. $40^{\circ} 1'$ N., Lon. $70^{\circ} 58'$ W. (1880); depth 129 fathoms; several specimens. Lat. $38^{\circ} 21' 50''$ N., Lon. $73^{\circ} 32'$ W. (1880); depth 197 fathoms; one specimen.

Thyone spectabilis, LUDWIG.

Habitat. Patagonia (Hassler Exp.); numerous specimens. Off Bermeja Head, Lat. $41^{\circ} 17'$ S., Lon. 63° W.; depth 17 fathoms; several specimens.

Thyone Hassleri, n. sp.

The body in a contracted state is nearly cylindrical, slightly more tapering towards the posterior extremity, and measures about 120 mm. in length. The color is brownish, except the ends of the pedicels, which are whitish. The two ventral tentacles are much smaller than the remaining eight. The body-wall is rather thin, but hard in consequence of the close-lying deposits. In the three specimens at my disposal, the ambulacra are marked by a low, longitudinal furrow. The pedicels, which seem to be slightly larger and more closely placed on the ventral surface, and very sparsely scattered in the anterior portion of the body, are present on the ambulacra as well as the interambulacra; but they are possibly absent on a very narrow space along each interambulacrum. The deposits are very closely crowded, and consist principally of two kinds: small, rounded, discoidal, highly transparent bodies in several layers; and minute, scattered, perforated cups. The discoidal bodies, which are larger in the interior layer, resemble at first sight agglomerations of drops of oil; generally, they are not perforated, though they not unfrequently have one, two, or four holes. Those in the inner layer of the perisome are usually without

holes. The cups are often irregular and not very well developed, occurring in several stages of growth. A complete cup is built up of a cruciform rod with the curved arms united by a rim provided with several knobs. Sometimes the cups almost form spheres.

At the posterior end of the body, the skin is filled up with irregular large plates, perforated with numerous holes; these plates are partly simple, partly composed of several superposed layers, so that each plate has the aspect of a thick irregular network. The posterior end of the body also feels very rough and hard to the touch. The anus is devoid of teeth.

The pedicels have a small, more or less reduced terminal plate, but are devoid of true supporting rods. The strong retractors are attached slightly in front of the middle of the body. A single Polian vesicle and one madreporic canal are present. Each genital bundle is very well developed, and consists of numerous unbranched slender tubes. The calcareous ring is composed of ten simple pieces, devoid of posterior prolongations.

This species certainly bears a strong resemblance to *Thyone* (*Thyonidium*?) *lechleri*, Lampert, but differs mainly in the shape of the deposits and the calcareous ring.

Habitat. Sandy Point, Strait of Magellan (Hassler Exp.); three specimens.

Thyonidium molle, SELENKA.

The tentacles vary greatly in number and size. The radial pieces of the calcareous ring are slightly prolonged and bifurcate posteriorly.

Habitat. Payta, Peru (Hassler Exp.). Several specimens.

Psolus operculatus, POURTALÈS.

Figure 4.

In addition to the description of Pourtalès, the following may be mentioned. As a rule the odd ambulacrum is naked, except at the anterior and posterior extremities where a few pedicels are to be found; but in two specimens one or more pedicels are also placed at about the middle of that ambulacrum. The sole is strengthened by numerous close-lying deposits of a more or less marked symmetrical shape; they consist of solid oval or roundish slightly concave plates or cups, which usually are perforated with four holes, and have the margin more or less deeply undulated from low outwardly directed knobs. In addition to the symmetrical cups, others are present more or less developed and pierced with a varying number of holes.

The largest complete specimen in the collection measures 37 mm. in length, 24 mm. in breadth, and about 11 mm. in height. The smallest has only a length of 15 mm. In all the specimens I have seen, the mouth has five large triangular scales, which, however, do not cover the opening completely, but

leave a central space free; in consequence of the scales being obtusely rounded at their free angle, the naked central space of the mouth has an almost stellate shape; and in each angle of this space, which alternates with the free obtuse ends of the scales, a tooth-shaped free pointed end of an underlying scale becomes visible. These "teeth" are easily distinguishable in the smallest, as well as largest specimens. The anus is surrounded by small overlapping scales in such a manner that no true valves become visible. The scales are covered with minute rounded granules. The number of scales between the mouth and anus varies; in the largest specimen they are about ten. In all specimens the pedicels form a double row round the sole, those in the exterior row piercing the margin of the body.

One of the largest specimens from Barbados has the following measurements: length 38 mm., breadth 32 mm., and height 25 mm. Consequently, it is not depressed, but almost hemispheric, and is covered with numerous grains placed upon the scales on the dorsal surface. These grains resemble very complicated tables, and consist of a concave perforated disk supporting an irregular elongate network with numerous small teeth in the free end. In addition to the grains, the exterior layer of the dorsal integument contains small, concave perforated cups, which carry numerous obtuse spines in the rim. I have not been able to observe such cups in the other specimens at my disposal, but they probably have been destroyed, together with the exterior layer of the integument. The sole of the above-mentioned large individual bears deposits which are often larger and more irregular than is the case in the typical specimen.

Among the small typical specimens obtained at Sand Key, three are remarkable in having anal and oral valves arranged just as in *Psolus tuberculosus*, and in possessing only about three scales between the oral and anal valves. It seems very probable that these specimens belong to another species.

Habitat. Sand Key; depth 110 to 150 fathoms; numerous typical specimens. Barbados (1878-79); depth 82 to 103 fathoms; three small specimens, about 15 mm. long, and one larger specimen, 38 mm. long and 32 mm. broad.

Psolus tuberculosus, n. sp.

Figure 5.

As is seen from the figures, the exterior appearance of this species is very characteristic. The specimens dredged at Sand Key are the largest, and may be considered as types. They measure 30 mm. in length, 16 mm. in breadth, and 14 mm. in height. When the animals are fully extended, these measurements become slightly different. The mouth is closed by five large triangular valves, which form together a very regular pentagonal shield; the anus is also closed by five small valves, which have the free angle rounded, and which form together a small, more rounded pentagon, or anal shield. The dorsal surface is very hard and rough from large scales, which appear to be placed side by side

and to overlap very little; the marginal plates are, as usual, of minute size. The scales bear numerous rounded granules, and, in addition, a very large central process or tubercle of conical form with rounded top. The valves and the marginal plates appear to be devoid of such tubercles. The largest tubercles attain a length of nearly 3 mm., and are placed one in each angle of the oval pentagonal shield. The anal pentagon has a rather prominent tubercle at each angle. The ventral sole is surrounded by a double row of pedicels, those in the exterior row perforating the margin of the body. Anteriorly, where the body is more contracted, the inner row appears to be double, but this evidently depends upon the contraction. The sole is strengthened by crowded large irregular plates of various size, perforated by numerous holes (the largest plates have as many as fifty holes or more) and provided with numerous rounded knobs; the ends of the knobs are sometimes united, thus constituting an irregular network on the exterior surface of the plates themselves. All the remaining forms are comparatively small, the smallest only 7 mm. long; as a rule, all the small specimens I have seen have more numerous and densely crowded tubercles, which generally resemble rather long spines, while the small rounded granules, on the contrary, are not so abundant, or may be even absent.

Habitat. Off Sand Key (1877-78); depth 50 fathoms; one slightly contracted specimen. Barbados (1878-79), depth 103 fathoms, two small, contracted specimens; depth 84 to 125 fathoms, one small specimen; depth 73 fathoms, three small specimens; depth 94 fathoms, two minute specimens 7 mm. long. Barbados (Hassler Exp.), depth 100 fathoms; several small specimens. Dominica (1878-79), depth 118 fathoms; one specimen, 15 mm. long. Lat. 25° 33' N., Lon. 84° 21' W. (1877-78); depth 101 fathoms; one specimen, 15 mm. long, 13 mm. broad, 8 mm. high. (?) Lat. 23° 52' N., Lon. 88° 5' W.; depth 95 fathoms; two specimens which possibly do not belong to this species.

Psolus Pourtalesi, n. sp. (?)

Figure 6.

All the specimens, which are of about the same size (30 mm. long, 20 mm. broad, and 6 mm. high at the mouth), are remarkable in being very depressed and flattened. With regard to the arrangement of the scales, and their size, they evidently resemble *Psolus incertus* of Théel and *Psolus peronii* of Bell, but they differ from these two species in several respects, especially in the shape of the body. As will be understood from the figures, *Psolus Pourtalesi* has numerous small, almost smooth scales, and is totally devoid of any oral and anal valves. The pedicels form a double row round the sole, those in the exterior row perforating the margin of the body. The odd ambulacrum is naked, or possesses a few pedicels in its anterior and posterior parts. The sole is strengthened with thinly scattered cruciform bodies, the arms of which often

are dichotomously branched and united with one another, so as to give origin to small, smooth perforated plates. There is no doubt that *Psolus Pourtalesi* is nearly allied to *Psolus squamatus*.

Habitat. Lat. 41° 24' 45" N., Lon. 65° 35' 30" W. (1880); depth 1242 fathoms; ten specimens.

Psolus braziliensis, n. sp.

Figure 7.

The body is like that in *Psolus phantapus*. The length, including the extended mouth, is 32 mm. The color is whitish. Two ventral tentacles are always much smaller than the eight remaining. The ventral rectangular sole carries three series of pedicels, the two lateral composed of about four rows, the middle of only two. Anteriorly and posteriorly the series run together. The exterior row of each lateral series is placed in the margin of the body. The dorsal body-wall is rather soft and covered with scales, which overlap very little. The mouth is not closed by valves, but by a series of elongate triangular scales with a very acute free angle; the anus is closed by similar smaller and more irregular scales. Outside of the scales, the dorsal perisome contains minute conical cup-like tables, and large, elongate conical table-like deposits made up of a more or less irregular network with the free end spinous. The sole is strengthened by small, scattered, smooth plates with an uneven margin and perforated by four or more holes.

Scattered among the dorsal deposits small, highly reduced "pedicels" are found, which are strengthened by a small but very well marked perforated terminal plate, and by well-developed irregular plates. There is no doubt that these are true pedicels, and thus it is a very interesting fact, that some species of *Psolus* have retained the dorsal pedicels, though in a very rudimentary state. The scales seem to present some larger pores, through which the pedicels communicate with the ambulacral system (?).

Habitat. Porto Seguro; two specimens.

Psolus, sp. (?).

The body, which has a length of 12 mm., is very flattened and covered with scales on the dorsal surface; these decrease considerably in size towards the oral and anal openings, which consequently are completely devoid of valves. The general appearance of the body closely resembles that of *Psolus Pourtalesi*. The pedicels form a double row round the sole, the exterior row being placed in the margin of the body. The odd ambulacrum is naked. The sole is strengthened with small plates of a more or less symmetrical appearance; the most symmetrical are oval, with four holes, and twelve knobs or rounded prominences arranged in the margin; in addition, the surface itself of the

plates bears a few knobs. The plates themselves are, however, rarely so symmetrical; they mostly have more or fewer holes and knobs.

The most characteristic feature of this animal is that each dorsal scale bears one or several slender flexible cylindrical appendages, which are supported by a peculiar calcareous skeleton, composed of small crowded perforated plates or cups. Unfortunately, the material is too scanty to allow any detailed examination, or to decide whether these appendages have any communication with the water-vascular system.

Habitat. Lat. 25° 35' N., Lon. 84° 21' W. (1877-78); depth 101 fathoms; one very defective specimen.

Trochostoma Blakei, n. sp.

Figure 8.

The body is ovate, the anterior extremity truncated and the posterior suddenly tapering into a narrow tail or caudal portion. There are fifteen (?) tentacles. The anus is devoid of anal teeth (?). The color is whitish or grayish. The length of the body itself is about 68 mm., and that of the tail 7 mm. The tail is doubtless longer when fully extended. The integument is thin, almost transparent, but rough from numerous close-lying tables, which have a peculiar shape. They consist of a small disk, which as a rule is pierced with three comparatively large holes and has a more or less marked trilobate rim. The disk supports a very long simple and slender column, which at the base appears as composed of three rods. The end of the column is usually divided into three obtuse slightly curved teeth, or it is slightly enlarged and surrounded by a circlet of small hooks directed downward. The disks of the tables rarely have more than three holes; but when that is the case, three of the holes are always larger. In the tail, the tables have an elongate fusiform disk, which has about four holes in the enlarged centre and carries a spire made up of three rods and terminating in several spines. No other deposits are to be observed. The species is nearly related to Marenzeller's *Trochostoma arcticum*.

Habitat. Grenada (1878-79); depth 955 fathoms; one specimen.

Trochostoma antarcticum, THÉEL.

The specimens agree most fully with the Challenger specimens. The deposits consist only of tables, characterized by their long spire, which as a rule is composed of three parallel rods united by numerous transverse beams; the ends of the three rods are bipartite or tripartite. No true wine-colored deposits are visible, but several of the tables themselves have begun to change in color, so that they in some places present a yellowish brown aspect; immediately in the neighborhood of these yellowish portions of the tables, some

small colored grains are visible, but these grains are never found except in connection with such deformed tables. In *Ankyroderma Marenzelleri*, Théel, the deposits also seem to undergo similar changes in color. I am much inclined to think that the presence or absence of wine-colored bodies cannot be accepted as specific characters.

Habitat. Lat. 24° 8' N., Lon. 82° 51' W. (1877-78); depth 339 fathoms; three specimens.

***Trochostoma arcticum*, MARENZELLER, var. *parva*, n.**

This form evidently bears the greatest resemblance to *Trochostoma arcticum*, but some minor differences exist, in consequence of which I propose to consider it as a variety. The fifteen tentacles have only a single short branch on each side. The body-wall is very thin, but rough from the scattered tables. The tail of the animal is destroyed, but the remaining portion of the body measures about 60 mm. The color is yellowish gray. The calcareous ring possesses five bipartite posterior prolongations. The scattered tables have an irregular disk, which is pierced with a varying number of large holes (usually few in number) and provided with prolongations or processes running out from the circumference of the disk. The disk supports a spire, which is irregularly spinous especially towards the free end, and composed of three rods, which are transversely united at several points.

I have examined two other specimens dredged at the same station, the largest of which attains a length of only 30 mm. Among the usual tables I have found some minute ones resembling those of *Trochostoma antarcticum*. Théel. This variety probably combines the extremes living in the arctic and antarctic seas.

Habitat. Grenada (1878-79); depth 416 fathoms; one specimen.

***Trochostoma arcticum*, MARENZELLER, var. *cœruleum*, n.**

This variety is distinguished from the northern form only by the abundance of pigment in the skin, which gives to the animal a bluish-violet color. Possibly also the disks of the tables are larger and more regularly formed. The tentacles have only a single pair of short branches near the top.

Habitat. Grenada (1878-79); depth 553 fathoms; one specimen, about 80 mm. long.

***Caudina arenata*, GOULD, var. *armata*, n.**

So far as I can observe, the specimens agree in all respects with those described by Selenka, Semper, and Marenzeller, except in the shape of the deposits. The body itself of the largest specimen measures about 50 mm. in length, and the narrow caudal portion is 35 mm. long. The fifteen tentacles

have each two pairs of minute branches or digits. The calcareous ring has five bipartite prolongations.

The very crowded deposits consist of irregularly formed tables, which deviate from those described by Semper, etc. in having much larger disks and a spire made up of only three rods, in consequence of which I propose to refer the Blake specimens to a variety. In general, the disks of the tables are large, smooth, of an irregular shape with uneven margin, and pierced with numerous holes. They often have an irregular triangular or quadrangular form, with twenty or more holes. The spire is composed of three irregularly spinous rods, united by a few (two or three ?) transverse beams. So far as I can understand from the descriptions hitherto made, the spire in the typical specimens should be composed of four rods.

Habitat. Lat. 35° 44' 40" N., Lon. 74° 40' 20" W. (1880); depth 898 fathoms; three specimens. Lat. 41° 24' 45" N., Lon. 65° 35' 30" W. (1880); depth 1242 fathoms; two specimens.

***Ankyroderma affine*, DANIELSSEN & KOREN (var.).**

In the specimen dredged at St. Vincent, a few light wine-colored bodies are present. On the contrary, I have not been able to detect a single one of those colorless bodies which have been figured and described by Danielssen and Koren (compare Figs. 26 and 27 in their report), and I must confess that these bodies appear to me to be nothing else than artificial products owing to preservation in alcohol.

Among the "tables" I have observed a few very scattered, minute perforated plates supporting a very long spine, which carries at the top a crown of hooks, like those found by me in *Trochostoma antarcticum*. The anchors always have a discoidal, perforated base. Contrary to what is observed in *Ankyroderma Jeffreysii* (var.), I never found the fusiform bodies except at the extremities of the body.

Habitat. St. Vincent (1878-79); depth 464 fathoms; one specimen, 35 mm. long. Dominica (1878-79); depth 391 fathoms; one specimen.

***Ankyroderma Jeffreysii*, DANIELSSEN & KOREN (var.).**

Some of the specimens have a marked violet color from more or less crowded wine-colored bodies, while others are almost colorless and devoid of such bodies. The anchors have a discoidal perforated base, just as I have found in *Ankyroderma Danielsseni*, which possibly may prove to be only a variety of *Ankyroderma Jeffreysii*.

Habitat. Lat. 41° 33' 15" N., Lon. 65° 51' 25" W. (1880); depth 810 fathoms; two specimens. Lat. 34° 39' 40" N., Lon. 75° 14' 40" W. (1880); depth 603 fathoms; one specimen. Lat. 38° 20' 8" N., Lon. 73° 23' 20" W.

(1880); depth 740 fathoms; one specimen. Lat. 33° 35' 20" N., Lon. 76° (1880); depth 647 fathoms; one specimen. Grenada (1878-79); depth 553 fathoms; two specimens.

Ankyroderma Agassizii, n. sp.

What especially distinguish this form from all hitherto known ones are the deposits, which form several superposed layers, so that the thin body-wall becomes rough and brittle. In the interior a continuous layer of large, smooth, irregularly rounded plates is to be found; these plates overlap each other by the edges, have a smooth but uneven margin, and are perforated with numerous holes, as many as sixty or seventy; the central are larger than the peripheral ones. Outside of these true plates we find other deposits, which, however, are not closely packed, but much scattered; they resemble the tables which are found in other forms of *Ankyroderma*, and consist of a rather large, irregular disk, perforated with a varying number of large holes and carrying a simple central spine. Here and there much smaller delicate tables may be found, which have a trilobate disk pierced with only three holes and resemble those found in *Trochostoma Blakei*. Scattered among these tables are situated the stellate bodies characteristic of the genus. They consist of three to six long spoonlike rods, arranged with the enlarged perforated end towards a common centre; the enlarged, slightly concave end is pierced with numerous holes, twenty-five to thirty or more. The anchors which are connected with these stellate bodies have the usual shape, their base being discoidal and perforated, and their symmetrical flukes slightly serrated.

The caudal portion of the body is strengthened by a thick layer of transverse fusiform rods, with the enlarged centre pierced by a few holes.

Otherwise, the body has the shape characteristic of the *Molpodids*.

The body itself is nearly cylindrical, about 60 mm. long, wider posteriorly, and decreasing slightly towards the anterior truncated end; at the posterior extremity it suddenly tapers into a narrow tail, which has a length of about 20 mm., so that the whole animal attains a length of about 80 mm. The tentacles are drawn within the body, their true shape and number being unknown. The color is light grayish inclining to violet. The radial pieces of the small calcareous ring bear a bifurcate posterior prolongation.

Another specimen was obtained at a depth of 1058 fathoms (from an unknown locality), which doubtless belongs to the same species. It has 15 minute tentacles and some small anal papillæ.

Habitat. Bequia (1878-79); depth 1507 fathoms; one specimen.

Synapta, sp. (?)

Habitat. Woman Key. One defective specimen, which probably is nearly related to Semper's *Synapta reticulata*.

Synapta, sp. (?).

From the defective state, a close examination is impossible. The handle of the symmetric anchors is dentate and the flukes serrated. The anchor-plates are rather large, rounded or oval, perforated with numerous holes, and at the slightly narrower truncate end, where the anchors are attached, resemble an irregular network. The margin of the plates is uneven from the presence of processes or spines, and spines are also present on the surface of the plates at the margin of the holes. Possibly the species is identical with *Synapta abyssicola*, Théel.

Habitat. Lat. 39° 25' 30'' N., Lon. 70° 58' 40'' W., depth 1394 fathoms; one incomplete specimen.

Chirodota rotifera POURTALÈS.

The largest specimen, which measures about 75 mm. in length, has fifteen digits in each of the twelve tentacles (Ludwig only counted twelve digits). The wheel papillæ are principally placed on the interambulacra, but a few also occur on the ambulacra, and they are less numerous on the ventral surface than on the three dorsal interambulacra.

Habitat. Porto Seguro (Thayer Exp.); several specimens.

Chirodota contorta LUDWIG.

Habitat. Port Gallant, Patagonia; numerous specimens.

LIST OF HOLOTHURIDS IN SUCH AN IMPERFECT CONDITION THAT THEIR
EXAMINATION IS NOT POSSIBLE.

- HAB. Guadeloupe, depth 769 fathoms; one specimen.
 “ “ depth 734 fathoms; fragments.
 “ “ depth 878 fathoms; two fragments of an Aspidochirote.
 “ “ depth 734 fathoms; a Molpodid.
 “ Dominica, depth 824 fathoms; fragments.
 “ “ depth 982 fathoms; fragments.
 “ Martinique, depth 1030 fathoms; fragments.
 “ St. Vincent, depth 573 fathoms; one defective specimen, related to
Holothura Verrilli.
 “ Bequia, depth 1591 fathoms; one specimen.
 “ “ depth 1507 fathoms; fragments, probably of a Psychropotide.
 “ Ham's Bluff, depth 2376 fathoms; fragments of a Psychropotide.
 “ Grenada, depth 553 fathoms; fragments.
 “ Montserrat, depth 303 fathoms; fragmentary specimens.
 “ Off Havana, depth 100 fathoms; fragments probably of an Echinocucumis.
 “ St. Lucia, depth 116 fathoms; fragments of an Echinocucumis.
 “ Lat. 40° 1' N., Lon. 70° 58' W. (1880); depth 129 fathoms; an incomplete Chirodota.
 “ Lat. 24° 1' N., Lon. 88° 58' W. (1877-78); depth 1568 fathoms; fragments.
 “ Lat. 16° 42' N., Lon. 83° 1' W. (1878-79); depth 961 fathoms; fragments.
 “ Lat. 18° 51' N., Lon. 83° 7' W. (1880); depth 903 fathoms; fragments.