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SIX NEW STARFISHES FROM THE GULF OF CALIFORNIA AND ADJACENT WATERS.*

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The zoögeographic region which extends from Peru northward to and including the Gulf of California and the southern portion of the Pacific coast of the peninsula of Lower California is very remarkable not only on account of the relatively large number of peculiar genera which occur therein, but also because of the curious relationships which the endemic species show to others in southeastern Australia, the Hawaiian Islands, the Mediterranean, and the Caribbean Sea, in addition to their relationships with types occurring in Oceania and in the Malayan region.

A considerable amount of work has been done here, both by shore collectors and, in deep water, by the "Albatross"; yet it is clear that there is still a great amount to be accomplished, for many types which should occur here are as yet unknown, while others have not been seen since they were first recorded, some of them more than half a century ago.

Of the six species herein described *Sideriaster canaliculatus* is related, more or less closely, to *S. grandis*, known from a single specimen from the Gulf of Mexico; *Saraster insignis* is related to other types in the eastern north Pacific; *Anthenea mexicana* is related, though not very closely, to other species of the genus in Australia, India and China; *Narcissia gracilis* is related to two Atlantic forms, one of which occurs in the Gulf of Mexico; *Echinaster parvispinus* is related to other species of the genus in the Malayan region; while *Cyllaster seminuda* finds its nearest counterpart in the Hawaiian Islands.

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These new species will be figured and further discussed in a paper dealing with the fauna of the region based upon the recently determined material in the U. S. National Museum, where figures of such rare forms as *Acanthaster ellisi* (Gray) and *Leiaster teres* Verrill, which the Museum also possesses from the Gulf of California, will also be included.

FAMILY ASTROPECTINIDÆ GRAY.

Sideriaster canaliculata new species.

Five arms; R=64 mm.; r=19 mm.; R:r=3.4:1; width of ray at base (measured from the interradial line) 22 mm.; superomarginals 45.

General form stellate; disk medium sized; rays tapering evenly to a blunt extremity.

Gonads confined to the interradial portion of the disk, not extending out along the rays.

There are well developed superambulacral plates.

The paxillæ are closely placed, though not crowded, and are remarkably uniform in size, those adjacent to the superomarginals being only slightly smaller than those in the radial line of the arms, and the latter similarly only slightly larger than those in the center of the disk.

A large paxilla from the radial region at the base of the arms has a rather low thick stalk supporting a crown consisting of from six to ten (most commonly seven, rarely more than eight) stout blunt radiating spines, with frequently one or two (rarely more) additional much smaller and shorter spines between them, and from one to four (most commonly one or two) short stout round-tipped spines, resembling the radiating spines but shorter, at the summit. The radiating spines are about as long as the column of the paxilla is high.

The large prominent exposed madreporite is situated exactly midway between the center of the disk and the interbrachial margin. It is circular, 3.5 mm. in diameter, and bears numerous more or less complete septa extending from the periphery a greater or lesser distance toward the center. It presents a most striking similarity to a coral polyp.

Papule, regularly six about each plate, occur uninterruptedly across the arms.

The superomarginals are short and broad; in the interbrachial arc they are wedge-shaped, about half as long at the actinal as at the abactinal end, 5 mm. wide and 1 mm. long at the well rounded abactinal border; they are evenly curved, the arc of the curvature making an angle of about 60° with the plane of the disk; gradually they become more oblong and increase in length to the fifth and following, which have parallel sides and are noticeably larger than those in the interbrachial arc; on the arms they become more recumbent, lying mostly on the abactinal surface, though still with a uniform curve from the actinal to the abactinal border.

The superomarginals bear on their outer surface usually three (some-

times two or four) alternating rows of short stubby well spaced truncated spines which increase slightly in diameter from the base to the broad nearly flat tip, and are about as high as, or slightly higher than, their basal diameter; in the interbrachial arc there are about twelve of these spines to a row, and on the outer part of the arms eight or nine; those in the median row are slightly larger than those in the lateral rows. The channels between the superomarginals are filled with very numerous short very slender spinelets which are almost or quite concealed from view by the outermost rows of spines on their outer surface.

The line of union between the superomarginals and the inferomarginals is slightly sunken.

The inferomarginals correspond to the superomarginals, which in general they resemble; but in addition to the armature as described for the latter they possess on the outer border of the actinal surface, or more or less below the middle of the plate, a broad extremely flattened truncated spatulate spine from 1 mm. to 1.5 mm. in length, about half as broad as long or even shorter, increasing more or less in length from the base to the tip, with more or less convex sides. In the interbrachial arc there may be two or even three of these spines to a single inferomarginal; beyond the proximal third of the arm they become smaller, at the middle of the arm being but little larger than the short spines covering the outer surface of the plate, soon after disappearing altogether.

The actinal intermediate areas are moderate in size; the plates are arranged in regular series running from the inferomarginals to the corresponding adambulacrals; an unpaired line of plates runs from the mouth plates about half way to the marginals. A single series of actinal intermediate plates extends to the twentieth inferomarginal, a second to the twelfth, and a third to the seventh. These actinal intermediate plates are narrow, with deep channels between the rows which are filled with small slender spinules similar to, but fewer and coarser than, the spines filling the channels between the marginals. Each plate bears on its actinal surface usually from four to eight short truncated spines, similar to those on the marginals but more spaced, and of various sizes instead of uniform, or nearly uniform, size. All of the plates bordering the adambulacral and mouth plates, and a few of the others, bear pedicellariæ, usually with three or four jaws.

The adambulacral plates bear on their sharply angular furrow margin three broad and strongly flattened spines. The innermost of these, situated at the apex of the angle, is slightly recurved, and is flattened transversely to the furrow; the spines on either side of this are straight, slightly less broad, and the axis of their flattening is parallel with the edge of the plate so that they make an angle of 30° with the axis of flattening of the median spine, or of 60° with each other. Behind these is a row of two or three similar flattened spines, the axis of the flattening being parallel with the furrow; but one or both of the outer of these may turn more or less so as to form supplementary furrow spines, and the central one may become enlarged, especially toward the end of the ray. Beyond these is a row of two similar, but smaller spines. The grooves

between the plates are filled with slender spines resembling those in the grooves between the marginals.

The mouth plates are narrow; the furrow margin is short, with apparently five flattened spines which decrease in length outwardly and resemble those of the furrow series on the adambulacrals, but are more slender; the margin adjoining the adambulacrals bears five or six much shorter spines of diminishing length; just within these there are five or six longer and stouter spines, also of diminishing length. The sutural edge bears three or four long spines corresponding to and resembling those on the distal furrow margin, abruptly changing to a series of much smaller spines before the maximum width of the plate is reached. The edge bordering the adambulacrals bears very numerous short fine spines like those bordering the adambulacrals.

Color in alcohol, brownish yellow.

Type.—Cat. No. 36,951, U. S. N. M., from "Albatross" Station 2998, Gulf of California, in 40 fathoms.

FAMILY BENTHOPECTINIDÆ VERRILL.

Saraster new genus.

Genotype.—*Saraster insignis*, new species.

The characters of this genus are given in the description of the type species following.

Saraster insignis new species.

Five arms; R=100 mm.; r=10 mm. (actinally) to 12 mm. (abactinally); R:r=8.3 to 10:1; width of ray at base (between odd interradial marginals) 15 mm.; superomarginals 46.

General form stellate; rays broad at the base, tapering rather rapidly in the first quarter, much less rapidly from that point onward; odd interradial marginals are present in both series in all interradial.

The gonads reach the fifth or sixth superomarginal.

The pedicels have well developed, though small, sucking disks.

The interbranchial septum is very small, membranous.

The dorsal muscle bands are not attached to a proximal ambulacral ossicle.

There are no pedicellariæ.

The abactinal plates are strongly stellate, large and small intermingled, the large with a low tabulum. Each abactinal plate bears usually one, on the disk sometimes two, rarely three, long rough spines which have numerous longitudinal serrate ridges; in the center of the disk the spines may reach 5 mm. in length; along the mid-line of the arms they remain of the same length until the end of the basal quarter, though they become more slender; beyond this point, and along the sides of the arms, they are shorter and more slender, but the transition from the longer to the shorter spines is always very gradual. If there is more than one spine to a plate, they are usually of very different sizes. The plates of the disk

and arm bases commonly have from three to six very small spines of different sizes about the bases of the larger.

The papulae are large, abundant, and conspicuous, occurring all over the abactinal surface to within 20 mm. of the tips of the arms; they are slightly smaller in the mid-radial line of the arms and in the center of the disk than elsewhere.

The madreporite is oval, measuring 4 mm. by 3 mm., the longer diameter radial; the surface is elevated, high, evenly convex, covered with numerous fine irregular ridges; its center is one-third of the distance between the odd interradial superomarginal and the center of the disk.

The odd interradial superomarginal is six sided; the abactinal and the two adjacent sides are of about the same length; the former is slightly concave, and the two latter are produced into a slight spine at the lower angles; the proximal border, adjoining the odd interradial inferomarginal, is about as long as the opposite side, straight, or slightly convex; the two lower lateral sides are about twice as long as the others, slightly concave. The abactinal surface of the plate within the outer face is produced into a rounded tubercle, not especially conspicuous, which bears on its outer side (not on its summit) a rough spine only slightly larger than the large spines of the disk, directed outward and more or less downward.

The superomarginals are low and long, mostly about twice as long as broad; the first is irregularly polygonal or quadrate, about as long as broad; the following are irregularly rhombic with the distal and proximal angles truncated; the suture between the adjacent superomarginals slants strongly inward, the abactinal end being more distal than the actinal. Each superomarginal bears in its upper two-thirds, springing from a common elevation, two slender spines, one directly above the other; the uppermost is the longer, resembling the long spines of the center of the disk but somewhat more slender; the lower is shorter and more slender; in the outer half of the arms the latter disappears. The common elevated base bearing these spines carries a few spinules.

The odd inferomarginal is elongated dorso-ventrally; the actinal third lies on the actinal surface, while the abactinal two-thirds stands almost vertically, forming with the corresponding superomarginal the side wall of the interbrachial arc. Viewed laterally the odd interradial inferomarginal appears six-sided; the actinal side, forming the border between the actinal and abactinal surfaces, is about twice as long as the other sides, which are all of equal length; that part of the plate which lies on the actinal surface is approximately semicircular, with two slight tubercles midway between the midradial point and the point of union with the adjacent inferomarginals. The plate bears a vertical median column of three slender spines of which the uppermost, situated in the center of the lateral surface, is 3 mm. long; the next, situated on the lateral surface just at the actinolateral border, is of about the same size; the third, situated just beyond the center of the actinal surface, is much smaller.

At first the inferomarginals are slightly displaced distally, but after the proximal fourth of the arm they correspond to the superomarginals; in the proximal fourth of the arm they resemble the superomarginals in

size and shape, but distally they are somewhat smaller. The upper border of the inferomarginals imbricates slightly over the lower border of the corresponding superomarginals. Each inferomarginal bears two spines, which are similar to those borne by the superomarginals.

The actinal intermediate plates are two (rarely three) in number, rounded, suspended in perisome just beyond the two tubercles on the inner border of the odd interradial marginals, or just distal to the outer angles of the mouth plates.

The adambulacral plates are slightly longer than broad; their distal and proximal borders are parallel, oblique, slanting adorally toward the furrow; the furrow border forms a prominent angle with a rounded apex and concave sides. The first adambulacral plate is separated from the odd interradial inferomarginal by the actinal intermediate plate; the second adjoins the first inferomarginal; the third lies across the suture between the first and second inferomarginals; from this point onward the adambulacrals, slightly more numerous than the inferomarginals, sometimes correspond, sometimes alternate, with them. The armature consists of two, rarely three, small slender spines situated side by side at the apex of the angle on the extreme inner edge well within the furrow; behind these, on the inner edge of the plate as viewed actinally, a much larger spine, resembling those on the inferomarginals, though very slightly smaller and less stout.

The mouth plates bear three long spines along the furrow which decrease rapidly in size outwardly; on the actinal surface of the plates, within the outermost of these, there is a single spine resembling the longest of the furrow series.

Color in alcohol dull gray, below white.

Type.—Cat. No. 36,895, U. S. N. M., from "Albatross" Station 2992, off Clarion Island, Lower California, in 460 fathoms.

FAMILY GONIASTERIDÆ FORBES.

SUBFAMILY ANTHENEINÆ FISHER.

Anthenea mexicana new species.

Five arms; R=54 mm.; r=24 mm.; R:r=2.25:1; superomarginals 13 or 14.

Form stellate, with the interbranchial arcs and the tips of the rays well rounded. At the ends the arms are abruptly upturned so that the tips stand vertically.

The outline of the dorsal plates, which are flat and not tumid, is more or less concealed. These plates bear distinct, usually cylindrical, tubercles, which are arranged in regular rows parallel to the mid-radial line of the arms. The most prominent of these tubercles are in two rows, one on either side of the mid-radial line, about 3 mm. apart at the widest point, which run from a point half way between the center of the disk and the arm base almost to the arm tip; the slightly sunken naked area between these rows (occupying the mid-radial line of the arm) decreases very slightly in width toward the arm tip. Beyond these rows on either

side is another parallel row of somewhat smaller tubercles which runs from a point on the side of the interradial furrow half way between the center of the disk and the margin of the superomarginals to the level of the fourth or fifth superomarginal, where it disappears; these lateral rows are about as far from the median rows as the latter are apart. Beyond these long lateral rows on either side is a short lateral row arising on the border of the interradial furrow about two-thirds of the distance from the center of the disk to the superomarginals, and running to the level of the distal border of the second superomarginal.

Shallow, rather broad, furrows extend from the apical region of the disk to near the superomarginals; these are more or less petaloid in shape, and are 4 mm. in maximum diameter, half way between the center of the disk and the superomarginals; these furrows are bordered with a more or less irregular and indistinct row of tubercles, and carry within the groove three pairs of large low tubercles.

Many of the abactinal plates carry pedicellariæ which, however, seem to be absent from the arms.

The madreporic body is small, about 2.5 mm. in diameter, with rather coarse striæ.

The superomarginals decrease regularly in width to the arm bases, then remaining of practically the same width to near the ends of the arms; they are slightly tumid, and their surface is covered with well spaced, rather high, tubercular granules; except for a few of the terminal, each bears a pedicellaria.

The inferomarginals correspond to the superomarginals, which they resemble in all ways except in being slightly wider, and in not decreasing perceptibly in width until near the tip of the arms; all of them bear pedicellariæ.

The actinal intermediate plates are numerous, and are arranged in rows between the marginals and the adambulacrals; they bear very numerous well spaced globular tubercles; toward the periphery of the actinal surface these tubercles become smaller, and merge into the tubercles covering the inferomarginals. Nearly all of the actinal intermediate plates bear the characteristic pedicellariæ; these are largest on the plates bordering the adambulacrals, where they occur in a diagonal position, their long axis coinciding with that of the series of plates of which the plates bearing them are a part; further from the ambulacral grooves the pedicellariæ become smaller and more irregular in orientation, though most of them have their long axis parallel to that of the series including the plate which bears them.

The adambulacral plates are apparently about as long as broad; the furrow border is slightly curved; they carry five or six (usually five) furrow spines, graduated in height from the small and short outer to the long and stout strongly flattened central, which increase in diameter and end in a rounded tip. These plates, especially near the mouth, may carry a small pedicellaria on the proximal (adoral) border. Within the series of furrow spines there is a series of three stout spines, the central much the largest, parallel to the furrow; beyond this, and spaced from

it, there is a series of three much smaller and shorter spines, not greatly larger than the granular spines of the actinal intermediate plates, from which they are separated by a narrow bare area.

The mouth plates have seven stout spines on the furrow border, which decrease very slightly in length; within the distal portion of the furrow border are two much stouter spines, and just within the apex another similar to these; along the inner margin of the plates is a row of five or six spines similar to these, but shorter.

Type.—Cat. No. 38,318, U. S. N. M., from the west coast of Mexico.

FAMILY LINCKIIDÆ PERRIER.

Narcissia gracilis new species.

Five arms; R=54 mm.; r=8.5 mm.; R:r=6.3:1; height to apex of abactinal region 7 mm.; width of arms at base 10 mm.

General form stellate, with long slender regularly tapering rays, up-turned at the tip; the body is low, the maximum height being less than the diameter of the arms at their base; the arm section at the base is low, rounded triangular.

The center of the abactinal surface is occupied by a mass of plates of different sizes in which the primary plates can usually be distinguished. From this central mass of plates there runs down the mid-line of each of the arms a prominent series of elongate polygonal plates bordered on either side by a row of much smaller plates beyond which is another row of larger plates, which are nearly as large as the plates in the mid-radial series. At the middle of the arm the series of small plates on either side of the carinal series disappears, and the carinal series merges with the large plates of the series beyond, the three series combining to form a broad dorsal band of irregularly arranged subequal polygonal plates.

In the proximal half of the arm many, or most, of the plates in the carinal row and in the rows of larger plates on either side of it bear pedicellariæ, but these are absent in the outer half of the arm.

Between the rows of large plates on either side of the carinal series in the proximal half of the arm and the dorsal band of large plates in the distal half of the arm, and the superomarginals, there are five rows of plates decreasing very slowly in size from above (abactinally) downward; of these rows the lowest reaches only to the third-fifth superomarginal, the second reaches to the fifth-eighth, and the third reaches the eighth-twelfth; the fourth and fifth, distally becoming more or less irregular, persist nearly to the tip of the arm. The last thirteen-fifteen superomarginals are in contact with the mid-dorsal band of large plates.

The madreporite is small, circular, 1.5 mm. in diameter, situated midway between the center of the dorsal surface and the interbrachial angle.

The anus is rather prominent, excentric, protected by short stout spines.

Single papulæ occur in the angles between all the abactinal plates, excepting between the plates in the broad dorsal band in the distal half of the arm, where they are rare. There are no actinal papulæ.

Pedicellariæ are only exceptionally present on the smaller abactinal plates.

Superomarginals and inferomarginals large and prominent, of equal size, rounded oblong, slightly longer than broad, in the distal quarter of the arm becoming squarish and at the tip slightly broader than long. The two series correspond except at the upturned arm tip. As far as the distal third or fourth of the arm each superomarginal, and several of the inferomarginals, bears a delicate pedicellaria with two long and very slender jaws ending in a palmate tip which lies in a slit-like groove on the surface of the plate.

Intermarginal papulæ occur in the proximal half or two-thirds of the arms.

Between the inferomarginals and the adambulacrals there are several rows of actinal intermediate plates; the first of these, adjoining the adambulacrals, is composed of plates which at first are not much inferior to the latter in size, though in the outer half of the arm their size slowly diminishes; this row extends to the fifth or sixth inferomarginal from the end of the ray; most of the plates in the middle half of the row bear pedicellariæ like those of the marginals; above this is a second row of slightly smaller plates which extends to the seventh inferomarginal; a third row of still smaller plates reaches to the fourth inferomarginal, while above this last are two additional rows, one of which reaches the third, the other the second, inferomarginal; except in the first row none of these plates bear pedicellariæ.

The adambulacral plates are oblong, at first about twice as broad as long, decreasing slightly in length distally, and increasing again terminally; the plates in this series are separated from each other by prominent grooves. The furrow spines are four, becoming three in the distal half of the arm; they are triangular in cross section, the sharpest apex of the triangle being directed toward the center of the furrow border of the plate which bears them; the most proximal is the stoutest, and the two median are the most slender.

Beyond the furrow series there are three rows each composed of three short truncated spines which are triangular or polygonal in section; the innermost row, bordering the furrow spines, is somewhat curved, and is placed somewhat obliquely so that the distal end is nearer the furrow than the proximal; the spines of the outermost row are scarcely distinguishable from the granular investment of the body surface.

The mouth plates are triangular; each bears from seven to nine stout prismatic spines on the ambulacral border; on the common actinal surface of each pair there are from eight to ten stout prismatic spines which decrease in size outwardly.

The whole body is covered with closely packed fine hemispherical or polygonal granules which entirely conceal the outlines of the underlying plates; the only breaks in this granular covering are the papular pores and the narrow elongate grooves in which lie the pedicellariæ.

The color in alcohol is light yellowish, or dark brown.

Type.—Cat. No. 38,317, U. S. N. M., from "Albatross" Station 2829, off Lower California, in 31 fathoms.

FAMILY ECHINASTERIDÆ VERRILL.

Echinaster parvispinus new species.

Five arms; R=53 mm.; r=10 mm.; R:r=5.3:1.

The arms are robust, evenly tapering.

The abactinal plates are thick and heavy, but relatively small, arranged in three regular rows along the dorsal (abactinal) surface of the arms, with three additional irregular rows between the outermost of the dorsal rows and the superomarginals. The three dorsal rows of plates, which are about 2 mm. apart, form three rather prominent narrow and irregular ridges, and bear numerous short conical or cylindrical, sometimes capitate, jointed spines, usually two or three to a plate, which rarely reach 1 mm. in height, in an irregular zigzag series; in the carinal row there are about forty-five of these spines from the base to the tip of the arm.

The plates of the lateral rows are somewhat less regular in disposition, and are less elevated. The spines which they bear are more slender than the spines of the three median series, though not much smaller; this, combined with the lesser elevation of the plates, serves to make the lateral plates and spines noticeably less conspicuous than the median. The plates in these lateral rows are more numerous than those in the median, there being four in the former to three in the latter. In the lateral rows there is only one spine to a plate.

The center of the abactinal area bears scattered spines which are similar to those of the three median rows on the arms.

The madreporite is oval, about 2 mm. in the greater diameter, bearing short peripheral spines.

Papulae are very abundant, in alcoholic specimens often appearing to form broad continuous lines which extend the whole length of the arms between the rows of spines. Single intermarginal papulae may occur, especially toward the ends of the arms.

The superomarginals, which form a continuous band all along the arm, are irregular in shape, longer than broad; their spines, one to a plate, form a regular line all along the arm, and are similar in character to the spines on the plates above.

The inferomarginals proximally bear two (rarely three) spines similar to those of the superomarginals in a transverse series, these becoming reduced to one in the outer half of the arms.

In the actinal interradial areas only the spines of the inferomarginal series occur; these are commonly much reduced in size, and sometimes obsolete.

On the adambulacral plates the furrow series consists of three spines; the first of these is very small, recurved, situated on the inner face of the plate near the bottom of the groove; the next is nearly or quite twice as long, slender, situated half way up on the inner face, and the third is much stouter than the two preceding, situated on the inner border of the plate. Behind this third spine is another much smaller spine on the actinal surface of the plate.

Color in alcohol usually dark purplish or reddish brown, sometimes light pink.

Type.—Cat. No. 36,893, U. S. N. M., from "Albatross" Station 3021, Gulf of California, 14 fathoms.

Cyllaster new genus.

Genotype.—*Cyllaster seminuda*, new species.

The disk is very small.

The rays are slender ($R=6r$ to $8.3r$), usually subcylindrical, very flexible, usually arising somewhat abruptly from the disk; that is, there is usually a more or less straight, though short, interbranchial border.

The abactinal skeleton is more or less open, or aborted.

The papulæ are isolated, very large and conspicuous.

The marginal plates are more or less imperfectly developed and irregular, or absent altogether.

The adambulacral plates have from two to six sabre-shaped spines on the furrow face; the actinal surface is densely packed with from twenty to forty spines or spinules, all long, or one or two rows bordering the furrow long, the remainder short.

This genus is very closely related to *Henricia*; it includes, in addition to the type, *Cyllaster polyacantha* (Fisher), *C. clarki* (Fisher), and *C. pauperrima* (Fisher), all of which were originally described as *Henricia*.

Cyllaster seminuda new species.

Five arms; R =about 50 mm.; $r=6$ mm.; $R:r=8.3:1$.

The arms are very long, slender, approximately cylindrical, and very flexible; there are no marginals in either series.

The abactinal skeleton is very greatly reduced. A continuous line of very narrow elongate plates runs along the mid-dorsal line from the base of the arms to the tip; it does not extend onto the disk. Between this median line and the region normally occupied by marginals is a widely open, exceedingly irregular, meshwork of narrower and smaller plates; within the spaces between the narrow lines forming this meshwork are numerous granules. Exteriorly the plates and the granules bear numerous fine spines, those on the granules being usually one or two in number, though sometimes more, according to their size, those on the plates being irregularly distributed, on the mid-dorsal line showing a tendency to grouping. The skeleton becomes somewhat more dense at the arm tips. The disk and arm bases carry a few small detached plates and numerous spiniferous granules.

The interradial areas of the disk actinally have an irregular median column of very narrow plates which resembles the line of plates running down the midline of the arms, and numerous relatively large widely spaced granules, which become suddenly smaller and more numerous toward the abactinal surface.

Between the adambulacrals and the outer (actinal) border of the dorsal meshwork, covering the region normally occupied by the marginals, is a band occupied solely by very numerous minute spiniferous granules.

The madreporite is large, oval, with a few coarse irregular striæ situ-

ated on the border of the disk as viewed abactinally; it bears a few small spinelets about its border.

The papulae are very large, abundant, and conspicuous, covering the dorsal surface of the disk and arms, and the lateral surfaces of the latter; on the sides of the arms they are arranged in regular diagonal lines; in the midradial region of the arms and on the disk their arrangement is irregular.

There are no traces of any plates between the adambulacrals and the actinal border of the dorsal meshwork.

The adambulacral plates at first are about twice as broad as long, becoming about as long as broad after the proximal third of the arm; each of these plates is separated from its neighbors by a distinct interval or suture.

The adambulacral plates bear within the furrow three long and very slender spines situated one above the other; on the furrow margin there are usually three longer and stouter spines, forming a furrow comb; these may be arranged with the central one in advance, or they may (more rarely) stand in a diagonal line with the outermost nearest the center of the furrow; the innermost spine on the furrow margin (whether the first or the second) is directly over the slender furrow spine. The typical arrangement seems to be, middle one in advance, proximal one slightly behind it, distal one considerably behind it. The middle one, which is larger than the others, is more or less sabre-shaped. The actinal surface of the plate is studded with small spinelets which are irregular in position.

The mouth plates are large and, owing to the absence of actinal intermediate, or other except adambulacral, plates, very conspicuous. The mouth spines are five in number, resembling the spines on the border of the adambulacrals. On the outermost angle, deep in the furrow, are two more spines, much smaller and more slender, of which the proximal is opposite the fifth of the furrow series, and the distal, which is slightly smaller, is situated slightly beyond. The inner half of the mouth plates is covered with small spinules, but the distal half is naked.

Color in alcohol brownish white.

Type.—Cat. No. 38,316, U. S. N. M., from "Albatross" Station 2993, off the Revillagigedo Islands, Lower California, in 364 fathoms.