

PROCEEDINGS
OF THE
BIOLOGICAL SOCIETY OF WASHINGTON

THREE NEW STARFISH AND ONE NEW BRITTLE-STAR
FROM CHILE.

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While working off the coast of Chile from the ninth to the twelfth of February, 1888, the "Albatross" brought to light three new starfish and a new ophiuran, the descriptions of which follow.

FAMILY ASTROPECTINIDÆ Gray.

Plutonaster sirius, new species.

Five arms; $R=33$ mm.; $r=11$ mm.; $R:r=3:1$; superomarginals 24 to 26.

The cœca extend to the fourth superomarginal.

The gonads are not developed.

The ampullæ are conical with the base (the actinal end) hemispherical; the pedicel is attached near the base. They may thus be described as single, with a slight actinal swelling.

The abactinal skeleton is composed of irregular rounded plates.

The abactinal surface is covered with closely set, though not crowded, paxillæ; these are very uniform in size, but are smaller on the center of the disk and on the outer part of the arms than elsewhere. At the sides of the arms and around the interbrachial arc they are arranged in transverse rows; in the center of the disk and in a band down the center of each arm their arrangement is irregular. The paxillæ have a low tabulate base, rarely so high as broad at the convex summit, bearing in the larger from twelve to sixteen spinelets which are longer than the height of the tabulate base, of which the peripheral make a slight angle with the vertical axis.

The surface of the large compound madreporite is concealed by five or six much enlarged paxillæ, most of which are situated around its border.

The papulæ, which are small and regularly arranged about the bases

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of the paxillæ, are absent from the center of the disk and from the median portion of the arms.

The first superomarginals are slightly wedge-shaped, twice as broad as the abactinal length; the second are more oblong, twice as broad as long; the following gradually decrease in height so that those beyond the seventh are only very slightly broader than long. In abactinal view the width of the superomarginals remains uniform until the outer third of the arm, whence it slowly decreases to the tip. In one specimen the decrease in width begins at the base of the arm, while in the smallest it begins at the center of the interbrachial arc. On the arms the superomarginals are always less than half as broad as the paxillar area between them.

The superomarginals are evenly convex dorso-ventrally, with the outer surface nearly flat; they are covered with short, truncated, round-tipped spinelets which are not crowded; these become smaller toward the abactinal margin, longer and more slender along the lateral borders, and still more slender in the fasciolar grooves.

The inferomarginals correspond with the superomarginals; they are laterally of the same height and are similar to them. Actinally they form a border of about the same width and relative proportions. Their armature is similar, but they bear on the actinolateral border a stout conical spine which is small and short on the first, slightly longer on the second, and longest on the third or fourth, where it reaches 1.25 mm. in length, thence remaining uniform for some distance and slowly decreasing in length toward the end of the arm.

The actinal intermediate plates are arranged in regular rows between the inferomarginals and the adambulacrals, the rows corresponding to the latter but not to the former. The individual plates imbricate more or less over those preceding. The rows extend as far as the fifth, or proximal part of the sixth, inferomarginal, there being in this distance nine columns, the first of five or six plates, the second of four or five, the third of three or four, the fourth of three, the fifth of two or three, the sixth and seventh usually of two, and the remainder of one. The plates are elevated in the center and bear, on the largest, from fifteen to seventeen short round-tipped spinelets. Each of these groups of spinelets is separated from those on the plates in the adjacent columns by conspicuous bare channels, and from those of the plates in the same series by similar, but much narrower, channels.

The adambulacral plates are at first rhombic; on the arms they become oblong, about twice as long as broad, flattened on the side adjoining the inferomarginals, projecting into the ambulacral furrow in a rounded angle. On the earlier plates the angle in the furrow margin is not central, but situated near the adoral border; it gradually moves distally, becoming almost central in the plates in the outer half of the arm. The armature consists of six long subequal slender furrow spines; on the earlier plates the second of these from the adoral end lies at the apex of the angle; later the third occupies this position, and on the arms the third and fourth; beyond these there are two rows of four well spaced

shorter spines; rarely there is an enlarged spine on the distal portion of the actinal surface of the plate.

The mouth plates have twelve short spines along the median border which decrease slowly in length distally; on the furrow margin there are four or five long spines continuing into a similar series of from five to seven more slender spines similar to those on the adambulacrals, one or two of which stand on the edge bordering the first adambulacral; the most proximal of these arises between the most distal spine of the furrow series and the furrow. A few additional spines similar to those in the central rows occur on the free surface of the plates.

The color in alcohol is grayish white.

Type.—Cat. No. 36,949, U. S. N. M., from "Albatross" Station 2788, off the coast of Chile, in 1050 fathoms.

FAMILY LUIDIIDÆ Verrill.

Luidia porteri, new species.

Five arms; $R=98$ mm.; $r=11$ mm.; $R:r=8.9:1$; width of arms at base 12 mm.; superomarginal paxillæ 70.

Arms long and unusually narrow, slowly and regularly tapering from the base to the tip; upper surface flat, not especially depressed, the first row of paxillæ beyond the superomarginals defining the border of the dorsal surface.

The paxillæ are exceedingly delicate, with a short central spinule and several long and very slender radial spinules; they are everywhere in contact with their neighbors through the long radial spinules.

The superomarginal paxillæ correspond to the inferomarginals; they are more or less oval in shape, mostly about twice as long as wide, and carry about twenty long radial spinules, some of which are almost hair-like, and from five to ten somewhat shorter spinules on the summit; at the base of the arm they bear from one to five (usually from one to three) pedicellariæ of different sizes, but after the middle of the arm pedicellariæ become very rare.

Within the superomarginal paxillæ is a row of much smaller paxillæ, five of which correspond to three superomarginals; these have about ten long radial spinules and from three to five shorter central ones, and are approximately circular in outline. Within this row the paxillæ decrease almost imperceptibly in size and in regularity of arrangement to the mid-line of the ray, where they have most commonly eight slender radial spinules, and a single short median spinule.

Occasional paxillæ in the center of the disk and in the central portion of the ray bear prominent granuliform pedicellariæ, but these are not very abundant, and are almost entirely absent from the distal half of the arms.

In the actinal half of the interbrachial arc and on the adjacent arm bases pedicellariæ are extraordinarily abundant, occurring on all the paxillæ, sometimes as many as five on one paxilla.

The superomarginals are narrow, their ridges being about as wide as the deep channels between them; the armature differs on alternate plates, as follows: (1) just beneath the superomarginal paxilla there is a long prominent spine 5 mm. in length, directed outward and obliquely upward; just below the ambitus there is a slightly smaller spine, directed outward and slightly downward; half way between this and the actinal border of the plate there is a much smaller, though similar, spine; (2) slightly above the ambitus there is a long spine directed outward and very slightly upward; slightly below the ambitus there is a similar, usually very slightly smaller, spine, directed outward and slightly downward; otherwise the plate is as in the preceding type. At the base of the arm each inferomarginal bears on its actinal surface from one to five (usually two or three) pedicellariæ, which vary all the way from granuliform to forcipiform, but these soon disappear; there are a few scattered spinules on the outer surface, and the sides are abundantly supplied with capilliform spinelets. The two inferomarginals in the center of the interbrachial arc bear numerous short spines and spinules, or several conspicuous pedicellariæ and spinules.

The alternation of two and three long spines on the inferomarginals, and especially the occurrence of long spines just below the superomarginal paxillæ only on alternate plates, is a striking feature of the species.

The actinal intermediate plates are narrow, with a knife-like crest which bears a large and prominent pedicellaria of the forcipiform type with usually one or two fine spinules near it.

The adambulacral plates bear just within the furrow a sabre-shaped flattened spine; just beyond this there is a much longer and stouter spine, curved at the base; just behind this, so close to it as to arise almost from a common base, there is a shorter straight spine. These spines are situated slightly beyond the median line of the plate, and proximal (adoral) to them are usually from one to four slender spinules situated toward the outer edge of the plate.

The mouth plates have a long stout spine at the inner angle which stands at the head of a series of seven spines arranged along the median suture; these decrease gradually in length for the first four; the remainder are much smaller; on each pair of mouth plates, below and more or less to one side of one of the spines of the central pair there is a large forcipiform pedicellaria; on the side opposite to that on which this pedicellaria occurs there are two spines of rapidly decreasing length; these spines, with the median, stand almost in a straight line across the inner end of the pair of mouth plates; at right angles to them, along the sides of the individual plates, is a series of three slender spines, and along the side bordering the first adambulacral many capillary spinelets.

The color, in alcohol, is yellowish white.

Type.—Cat. No. 36,947, U. S. N. M., from "Albatross" Station 2787, off the coast of Chile, in 61 fathoms.

I take great pleasure in naming this species for my friend Dr. Carlos Porter of Santiago de Chile.

FAMILY BENTHOPECTINIDÆ Verrill.

Pectinaster robustus, new species.

Five arms; $R=55$ mm. to the distal border of the twentieth superomarginal, beyond which point none of the arms are preserved; $r=15$ mm. General form stellate, with narrow pointed rays, very astropectinoid. The gonads do not extend into the arms. The pedicels have very small sucking disks; the ampullæ are double. There are no superambulacral plates.

The abactinal surface is covered with low paxillæ which are very slightly larger just within the arm bases than elsewhere; on the arms they become smaller and more widely spaced, and show a more or less regular arrangement in diagonal rows in the lateral portions. There are about twelve paxillæ across the arm at the third superomarginal, and about nine at the twentieth.

The typical paxillæ consist of a prominent central spinelet surrounded by from eight to ten shorter and more slender spinelets, usually between one-third and one-half of its length; some paxillæ have two central spinelets and more numerous lateral spinelets, while others lack the former. In the center of the disk a few of the paxillæ have the central spinelet much elongated, up to about 1 mm. in length, and a similar elongation of the central spinelet occurs on scattered paxillæ on the arms, becoming more frequent distally.

The papulæ are few, single, confined to a limited, but undifferentiated, area at the base of the rays.

The two interradial superomarginals are high, narrow, triangular, converging actinally; the second superomarginal is nearly twice as broad, approximately oblong, somewhat over twice as high as long; the third resembles the second, but is lower, twice as high as long; the following gradually decrease in height so that the sixth is about as high as long; the remainder are similar, becoming slightly longer than high at the broken end of the arm (the twentieth); the lower border of the superomarginals is strongly curved so that the seventh and following are almost semicircular in outline, slightly flattened where they adjoin the inferomarginals; the superomarginals are tumid, with deep grooves between them. The first superomarginal bears a vertical column of four or five spines of which the uppermost is about 1.5 mm. in length, and the following progressively shorter; the second superomarginal bears a column of three spines which are larger and stouter than those on the first; the third has one large spine, slightly smaller than the spines on the following superomarginals, and one or two very small spines below it; on the fourth and following there is a single large stout spine situated in the center of the semicircle formed by the lower border; this reaches a maximum size on the sixth, where it is about 4 mm. in length. The superomarginals are bordered, and their surface is covered, with long well spaced spinules which are longest along the lower border; usually two or three of these below and proximal to the large spine are especially elongated.

The interradial inferomarginals are considerably broader than the cor-

responding superomarginals, and the following inferomarginals are situated considerably beyond the corresponding superomarginals, though not enough so as regularly to alternate with them. In general the inferomarginals agree approximately in size and in shape to the corresponding superomarginals. They bear a large stout spine situated near the upper border, somewhat stouter than the spine on the superomarginals, and reaching 5 mm. in length; below this is another spine, about half as long and correspondingly less stout, and below this another, shorter and still more slender. The sides of the inferomarginals are armed with long scattered spinules a few of which occur also on the outer surface; one or more of these may be more or less enlarged. The interradi al inferomarginals bear a column of five or six approximately equal spines, resembling the longest spines in the similar corresponding superomarginal series; the first inferomarginal bears three spines of which the uppermost is the longest and the others decrease in length; the second and third are similar, but with progressively greater difference between the elongate uppermost and shorter lower spines. The lower borders of the inferomarginals in the interbrachial arc are prominent, raised above the surface of the actinal intermediate plates, and spineless.

Pectinate pedicellariæ occur between the interradi al pair of superomarginals, or between one of these and the adjacent superomarginal, in one case in both situations; there are no other pedicellariæ in the superomarginal series.

In three cases I found small pectinate pedicellariæ between the inferomarginals; one was between the two interradi al inferomarginals, one between one of these and a second inferomarginal, and the third between a third and fourth inferomarginal.

On the disk pectinate pedicellariæ may replace the central spine in the paxillæ, but these are relatively rare; more frequently pectinate pedicellariæ are formed by the modification of the borders of two adjacent paxillæ; this type occurs also on the arms.

The actinal intermediate area is covered with about thirty crowded plates which decrease rapidly in size from the adambulacrals to the marginals; these are armed with one, or in some of the larger two, long spines, and from one to six scattered elongate spinules. One or two pectinate pedicellariæ occur between these plates, in the angle near the mouth plates. There are from eight to ten actinal intermediate plates adjoining the adambulacrals; these correspond to seven adambulacrals, and the series ends at the proximal border of the fourth inferomarginal. Most of these plates have pectinate pedicellariæ between them.

The adambulacral plates are at first about as long as broad, the inner half projecting into the ambulacral groove in a right angle; further out on the arm they gradually become broader than long, and the projecting angle gradually becomes more acute. The armature consists of seven or eight long furrow spines, the two central the longest and stoutest; on the actinal surface there are two long stout spines, much longer than the furrow spines, resembling the lower spines on the inferomarginals, of which the inner is usually slightly stouter and longer than the outer;

there are three or four slender well spaced spines on the lateral borders, which resemble the outer furrow spines.

The mouth plates are short, with the inner half broadly rounded, and the surface tumid, bearing a few rather long spines; the furrow series consists of nine graduated spines of which the inner three are at right angles to, and the outer four or five parallel to, the median border.

The color in alcohol is dull yellow.

Type.—Cat. No. 36,945, U. S. N. M., from "Albatross" Station 2789, off the coast of Chile, in 1342 fathoms.

FAMILY OPHIOLEPIDIDÆ.

Ophiecten squamosum, sp. nov.

The disk is circular, thin, strongly overlapping the arm bases, 10.5 mm. in diameter; the arms at the base are 1.75 mm. across.

The radial shields are moderate in size, triangular to ovate, usually triangular with the outer angle broadly rounded, not much longer than the maximum (distal) breadth, which is about as great as the diameter of the arm base. The inner distal portion of the radial shields is slightly raised, and the inner distal angle is broadly rounded, sometimes slightly produced. The radial shields of each pair are separated interiorly by a squamous band with nearly parallel sides which in width is equal to about half the diameter of the arm bases.

The central portion of the disk is covered by six circular primary plates situated close together and separated by rather narrow lines of small rounded plates arranged in single rows; the remainder of the disk (excepting the radial shields) is covered by overlapping plates of very varied sizes, usually scattered larger plates separated by numerous smaller plates, though there is no regular arrangement. All of the plates of the disk are extremely thin.

The interbrachial areas below are covered with rather small rounded overlapping scales of approximately uniform size.

There are usually no papillæ of any sort about or on the arm bases; but occasionally from one to three small papillæ are found representing a rudimentary arm comb.

The oral shields are very low, pentagonal, nearly or quite twice as broad as long, with a very obtuse proximal angle, slightly converging lateral edges, and a straight distal edge.

The side mouth shields are very narrow, at the first arm tentacle pore almost entirely covered by the oral shield, the proximal lateral angles of which they surround.

The mouth papillæ are five in number; the innermost is triangular, sharp pointed; the next is of about the same length, but slightly longer and less pointed; the third is similar to the second, but slightly longer and less pointed; the fourth is longer than the third, with a nearly or quite straight outer edge; the fifth is as long as the three preceding, very narrow, with a straight distal edge.

The arm spines are three; the uppermost is slightly longer than an arm segment; the central is slightly shorter than an arm segment; the lowest on the proximal part of the arm is slightly shorter than the central, but on the outer portion of the arm is equal to it.

The tentacle scale is single, small, more or less pointed; just within it is a production of the border of the side arm plate which appears like a second low tentacle scale.

The under arm plates are small, low, triangular, with three straight sides and an obtuse distal angle.

Type.—Cat. No. 39,017, U. S. N. M., from "Albatross" Station 2789, off the coast of Chile, in 1342 fathoms.



Clark, Austin Hobart. 1917. "Three new starfish and one new brittle-star from Chile." *Proceedings of the Biological Society of Washington* 30, 151–158.

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