

SMITHSONIAN MISCELLANEOUS COLLECTIONS

VOLUME 98, NUMBER 11

ECHINODERMS (OTHER THAN HOLOTHURIANS)
COLLECTED ON THE PRESIDENTIAL
CRUISE OF 1938

(WITH FIVE PLATES)

BY

AUSTIN H. CLARK

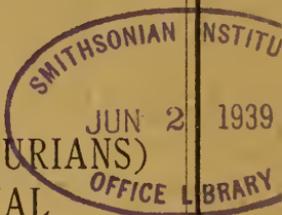
Curator, Division of Echinoderms,
U. S. National Museum



(PUBLICATION 3536)

CITY OF WASHINGTON
PUBLISHED BY THE SMITHSONIAN INSTITUTION

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During the cruise of the U.S.S. *Houston* with President Roosevelt on board in the summer of 1938 Dr. Waldo L. Schmitt, who participated in the expedition as Naturalist, obtained specimens of 23 species of echinoderms other than holothurians. Although small, this collection is remarkable in including three new species, as well as representatives of several very rare species.

From Clipperton Island come numerous specimens of a curious small ophiuran that appears to be identical with one described from Mer in the Murray Islands, Torres Strait, by Dr. Hubert Lyman Clark in 1915 under the name of *Ophiocoma parva*. In 1921 Dr. Clark compared *Ophiocoma parva* with the 6-armed young of the West Indian *O. pumila*, which it very closely resembles. He said it seems probable that *O. parva* is the young of a larger 5-armed species.

The discovery of *O. parva* on Clipperton Island, where, as in Torres Strait, no species related to *O. pumila* is known to occur, led to an examination of the relationships between *O. parva*, and a related species from the Galápagos Islands, with *O. pumila*.

It was found that these species are closely related to the 6-armed individuals assumed to be the young of *O. pumila*. But these 6-armed individuals show such marked differences from 5-armed *O. pumila* of approximately the same size that they certainly cannot represent the same species.

I have, therefore, segregated *Ophiocoma parva*, the related species from the Galápagos Islands, and the related species from the West Indies hitherto assumed to be the 6-armed young of *O. pumila*, in the new genus *Ophiocomella*, a genus closely allied to, though apparently quite distinct from, *Ophiocoma*.

The species recorded in the following pages are listed below; the four herein described as new are given in small capitals.

<i>Ophiomyxa flaccida</i>	<i>Ophioderma appressa</i>
<i>Amphiodia violacea</i>	<i>Echinaster parvispinus</i>
<i>Amphipholis squamata</i>	<i>Heliaster cumingii</i>
<i>Ophiactis simplex</i>	<i>Sclerasterias</i> , sp.
<i>Ophiactis savignyi</i>	<i>Euclidaris thouarsii</i>
<i>Ophiothrix ørstedii</i>	HESPEROCIDARIS HOUSTONIANA
<i>Ophiothrix galapagensis</i>	<i>Lytechinus scmituberculatus</i>
<i>Ophiocoma scolopendrina</i>	<i>Caenocentrotus gibbosus</i>
<i>Ophiocomella parva</i>	<i>Echinometra lucunter</i>
OPHIOCOMELLA CARIBBAEA	<i>Echinometra insularis</i>
OPHIOCOMELLA SCHMITTI	<i>Encope perspectiva</i>
OPHIONEREIS ROOSEVELTI	<i>Encope micropora</i>

Of the new species three are from the Galápagos Islands; the fourth, *Ophiocomella caribbaea*, heretofore regarded as the 6-armed young of *Ophiocoma pumila*, is from the West Indies.

Dr. Hubert Lyman Clark has been so kind as to give me his opinion on the status of *Hesperocidaris houstoniana* and the three species of *Ophiocomella*, and Prof. Walter K. Fisher was so good as to examine the specimen listed as *Sclerasterias*, sp.

OPHIUROIDEA

OPHIOMYXA FLACCIDA (Say)

Locality.—Old Providence Island, 120 miles east of the Mosquito Coast (lat. 13° 21' N., long. 81° 22' W.); shore; reef and tide-pool collecting; August 1, 1938. Two specimens (U.S.N.M. no. E.5612).

AMPHIODIA VIOLACEA (Lütken)

Locality.—Cocos Island: Chatham Bay; from a bottom sample; August 3, 1938. One specimen (U.S.N.M. no. E.5626).

AMPHIPHOLIS SQUAMATA (Delle Chiaje)

Locality.—Lower California: Cedros Island; about one-quarter of the way from the shore to the anchorage; from a bottom sample in 24-25 fathoms (44-46 m.); July 17, 1938. One specimen (U.S.N.M. no. E.5629).

OPHIACTIS SIMPLEX (LeConte)

Locality.—Lower California: Magdalena Bay; 10-15 fathoms (18-27 m.); July 18, 1938. One specimen (U.S.N.M. no. E.5628).

OPHIACTIS SAVIGNYI (Müller and Troschel)

Localities.—Clipperton Island; shore collecting on rocks south of landing place; July 21, 1938. Five specimens, all with 6 arms, taken with *Ophiocomella parva* (U.S.N.M. no. E.5631).

Galápagos Islands: Sullivan Bay, James Island; shore and tide-pool collecting; July 24, 1938. One specimen with 6 arms (U.S.N.M. no. E.5627).

Galápagos Islands: Narborough Island; shore collecting; July 25, 1938. One specimen with 6 arms, taken with *Ophiocomella schmitti* (U.S.N.M. no. E.5641).

OPHIOTHRIX ÖRSTEDII Lütken

Locality.—Old Providence Island, 120 miles east of the Mosquito Coast (lat. $13^{\circ}21' N.$, long. $81^{\circ}22' W.$); shore; reef and tide-pool collecting; August 1, 1938. Three specimens (U.S.N.M. no. E.5615).

OPHIOTHRIX GALAPAGENSIS Lütken and Mortensen

Plate 1, figs. 5, 6

Localities.—Galápagos Islands: Sullivan Bay, James Island; shore and tide-pool collecting; July 24, 1938. Ten specimens (U.S.N.M. nos. E.5613, E.5614, E.5630).

Galápagos Islands: Elizabeth Bay, Albemarle Island; south end of the black beach north of the mangroves north of the two "red" islands; July 26, 1938. Nine specimens (U.S.N.M. no. E.5642).

Notes.—In the specimens from James Island the disk is from 2.3 to 11.2 mm. in diameter, and the arms are from about 7 to about 55 mm. long.

In the specimen with the disk 2.3 mm. in diameter the central portion of the disk is occupied by a large circular central plate that is bare except for 5 stumps ending in 3 long divergent points interradially placed near the periphery. The exposed portion of the radials is relatively smaller than in larger examples, the radial shields extending only about half way from the periphery of the disk to the center, and each radial shield bears 5-8 stumps with triradiate ends resembling those borne on the small plates covering the remainder of the disk. At the base of the arm there are 6 arm spines, the number soon falling to 5 and later to 4; on the third and following arm combs the lowest spine is in the form of a hook, these hooked spines becoming very large in the outer portion of the arms.

In the largest specimen there are 11 arm spines just beyond the disk, the number soon falling to 8, later to 7, and then to 6 or 5. On the arm combs beyond the sixth-eighth the lowest spine is in the form of a hook.

The largest specimens from Albemarle Island have the disk 15 mm. in diameter and the arms 80 mm. long. Some are entirely blackish. In others the arms are narrowly banded with white on about every fourth upper arm plate, and the disk, except for the extreme edge, may be light or even cream-white.

OPHIOCOMA SCOLOPENDRINA (Lamarck)

Locality.—Clipperton Island; shore collecting on rocks south of landing place; July 21, 1938. One specimen (U.S.N.M. no. E.5619).

Notes.—In this specimen the disk is about 20 mm. in diameter and the arms are about 105 mm. long. The color above is uniform blackish brown, below the same, each under arm plate with a low white triangle of which the long base coincides with the proximal edge of the plate and the apex reaches nearly half way to the distal edge. These white triangles gradually decrease in size and disappear after about a dozen under arm plates. The proximal lower arm spines are tipped and sometimes longitudinally striped with white, and the mouth papillae are broadly tipped with white. The madreporic plate has a large white oval spot of which the outer end touches the distal border.

OPHIOCOMELLA, n. gen.

Diagnosis.—A genus of Ophiocomidae in which the included species are of small size, with the disk up to 5 mm. in diameter; the arms are 6 or 7 in number, from 3.25 to 5 times as long as the diameter of the disk; the disk is finely plated, shows very small and widely separated radial shields, and bears numerous scattered stout spinules that are from two to three times as long as thick, or even longer; and the arm spines are 4, subequal, or the uppermost the longest and the lowest the shortest, becoming 3 at the arm tips.

Genotype.—*Ophiocomella caribbaea*, n. sp.

Included species.—*Ophiocomella parva* (H. L. Clark), *O. caribbaea*, n. sp., and *O. schmitti*, n. sp.

Range.—Known from Mer Island, Torres Strait, Clipperton Island, the Galápagos Islands, and the West Indies. Littoral.

Affinities.—The genus *Ophiocomella* appears to be closely related to that section of the genus *Ophiocoma* including *O. pumila* from the Caribbean Sea and tropical west Africa, *O. alexandri* from the west

coast of Central America, and *O. valenciae* from the east coast of Africa and the Mascarene Islands. It is distinguished from this group of species by the possession of 6 or 7 arms; the occurrence on the disk of short stout spinules with usually pointed ends instead of elongated granules; by the occurrence of 2 tentacle scales (when present) on the first tentacle pore only; by the shape of the oral shields; and by the close approximation, or contact, of the adoral shields. The arm spines in preserved specimens of the species of *Ophiocomella* almost invariably stand out approximately at right angles to the arm, as in *Ophiactis*.

KEY TO THE SPECIES IN THE GENUS OPHIOMELELLA

- a*¹. Spinules on upper surface of disk small and closely set, about 100 to each square millimeter (Torres Strait; Clipperton Island)..*parva* H. L. Clark.
*a*². Spinules on upper surface of disk coarser and more scattered, not more than 60 to each square millimeter
*b*¹. Spinules numerous, about 50-60 to each square millimeter, rather short and stout, mostly about twice as high as thick or rather lower, with usually rounded tips (West Indies).....*caribbaea*, n. sp.
*b*². Spinules relatively few, about 30-35 to each square millimeter, longer and more slender, mostly 3-4 times as long as thick with pointed ends (Galápagos Islands).....*schmitti*, n. sp.

OPHIOMELELLA PARVA (H. L. Clark)

Plate 1, figs. 1, 2

Locality.—Clipperton Island; taken in shore collecting on rocks south of the landing place; July 21, 1938. Forty-two specimens (U.S.N.M. nos. E.5639, E.5640).

Notes.—Of the 42 specimens collected, 39 have 6, and 3 have 7 arms. In the largest specimens the disk is 5 mm. in diameter and the arms are 17 mm. long.

In a number of specimens of different sizes the 3 arms on one side are from slightly to much smaller than the 3 arms on the other side, indicating that division takes place at various ages, and suggesting that it may occur more than once.

The radial shields are visible as small, narrow, elongate, widely separated plates, one on either side of the arm bases.

The first tentacle pore has usually a single tentacle scale, though in each individual one or more of these pores have 2 tentacle scales.

The adoral shields almost or quite meet beyond the inner end of the mouth shields.

The color in alcohol is white, the aboral side of the disk sometimes faintly tinged with green; the disk shows a brownish yellow patch at the base of each arm; and more or less coarse irregular mottlings of the same color; the arms are frequently and narrowly banded with brownish yellow, the bands occupying usually about 2 upper arm plates and being separated by usually 1 or 2 upper arm plates.

With these specimens of *Ophiocomella parva* were five specimens of *Ophiactis savignyi*.

Remarks.—Dr. Hubert Lyman Clark, to whom I sent one of these specimens of *Ophiocomella parva* for examination, writes that he is confident it is nothing but a young specimen of *Ophiocoma alexandri*. There is no evidence that *Ophiocoma alexandri* occurs at Clipperton Island and, indeed, such occurrence is quite unlikely, for *O. alexandri* has never been found in any locality inhabited by *O. scolopendrina*.

The National Museum possesses a young specimen of *Ophiocoma alexandri* with the disk about 2.3 mm. in diameter and the arms about 9 mm. long, and another with the disk 3.6 mm. in diameter and the arms about 15 mm. long, both collected by John Xantus at Cape San Lucas, Lower California (U.S.N.M. 1171). Both of these, which are considerably smaller than the largest specimens of *Ophiocomella parva*, have 5 arms, and they differ markedly from the specimens identified as that species.

In young *Ophiocoma alexandri* the granules on the disk are much coarser than they are in *Ophiocomella parva*, and are shorter with more swollen sides and more broadly rounded tips. Very small radial shields are visible, more or less concealed by one or more granules.

In young *Ophiocoma alexandri* the upper arm plates are more fan-shaped than in *Ophiocomella parva*—that is, they have straighter proximally convergent sides.

In *Ophiocoma alexandri* the arm spines are longer than in *Ophiocomella parva*, especially beyond the bases of the arms, and less rapidly tapering, and those on the proximal arm combs are less strongly flattened. The combs just beyond the disk in young *Ophiocoma alexandri* have usually 5 spines, those following 4, and those in the outer portion of the arms 3. In *Ophiocomella parva* the combs never have more than 4 arm spines.

The first two tentacle pores in young *Ophiocoma alexandri* have each 2 tentacle scales; in *Ophiocomella parva* the second and following pores have a single tentacle scale, and the first has usually a single scale, though sometimes 2.

The mouth shields in young *Ophiocoma alexandri* are broadly egg-shaped and about as long as the greatest (distal) width; in *Ophiocomella parva* they are rhombic with slightly rounded angles, and only half again as long as the greatest (median) width.

In young *Ophiocoma alexandri* the side mouth shields are widely separated from each other instead of being almost or quite in contact as in *Ophiocomella parva*.

Dr. Clark did not compare the specimen sent him with his specimens of *O. parva* from Torres Strait, and the description of that species is not sufficiently detailed to admit of accurate comparison. It is very likely that the specimens herein identified as *O. parva* in reality represent a different species; if this should prove to be the case I would suggest that that species be called *Ophiocomella clippertoni*.

OPHIOCOMELLA CARIBBAEA, n. sp.

Ophiocoma pumila (part) A. H. CLARK, Proc. U. S. Nat. Mus., vol. 86, No. 3056, p. 451 (station 28, U.S.N.M. no. 5559), pl. 54, fig. 3, Apr. 5, 1939 (the type specimen).

Description.—This species is very similar to *O. parva*. In the type specimen the disk is 4 mm. in diameter, and the 6 arms are about 13 mm. long. The 3 arms on one side are slightly larger than the 3 arms on the opposite side.

The plating on the aboral surface of the disk is somewhat coarser than is the case in *O. parva*, and the spinules are larger, less numerous, and more scattered. There are about 50-60 spinules to each square millimeter instead of about 100 as in *O. parva*. The spinules are mostly about twice as high as thick, or rather higher, swollen-conical with usually rounded tips, and are separated from each other by several times their basal diameter.

The first tentacle pore has 2 tentacle scales instead of only a single one as is usually the case in *O. parva*, but those following have only 1.

The mouth papillae, especially the outermost, are slightly narrower and less rounded than those of *O. parva*.

The adoral shields almost or quite meet beyond the inner end of the mouth shields.

The central portion of the interbrachial areas below, as in *O. parva*, bears a few widely scattered spiniform granules.

There are 4 arm spines until near the end of the arm, when the number falls to 3.

Locality.—Smithsonian-Hartford Expedition station 28; St. John, Virgin Islands; coral reef off Lagoon Point, on the west side of Coral Bay; W. L. Schmitt, April 6, 1937. One specimen (type, U.S.N.M. no. E.5559).

Notes.—This species has heretofore been considered the 6-armed young of *Ophiocoma pumila*, from which, however, it is quite distinct.

In a specimen of *Ophiocoma pumila* from Haiti with the disk 5 mm. in diameter and the 5 arms 28 mm. long, the arms are nearly six times as long as the diameter of the disk instead of only slightly more than three times as long as in *Ophiocomella caribbaea*.

The granulation of the disk is rather close, the granules, though somewhat irregularly placed, averaging about their own thickness apart. The granules show much diversity in size and shape, some being twice as thick as others. The smallest granules are approximately spherical; the largest, which are about half again as long as their greatest thickness, are conical with much swollen sides; most of them are intermediate between these two extremes, with more or less broadly rounded ends.

On the first 3 side arm plates beyond the disk there are 5 arm spines, of which the uppermost is the longest, and the lowest is the shortest. The number then falls to 4, and in the terminal portion of the arm to 3.

The first and sometimes also the second tentacle pore is provided with 2 tentacle scales.

The central portion of the interbrachial areas below is thickly covered with granules.

OPHIOCOMELLA SCHMITTI, n. sp.

Plate 1, figs. 3, 4

Description.—The disk is 3 mm. in diameter, and the arms are about 15 mm. long. This species differs from *O. parva* from Clipperton Island in having the elongate granules or stout spinelets on the disk longer, three times as long as thick or even longer, and much less numerous, about 30-35 to each square millimeter. The upper arm spines at the bases of the arms are more slender than those of *O. parva*, and less strongly flattened.

It differs from *O. caribbaea* in having the spinules on the disk longer, more sharply pointed, and more widely scattered.

Locality.—Galápagos Islands: Narborough Island; shore; W. L. Schmitt, July 25, 1938. One specimen (type, U.S.N.M. no. E.5638).

OPHIONEREIS ROOSEVELTI, n. sp.

Plate 2, figs. 7, 8

Characters.—The arms are black with well-separated small paired spots, and, distally, bands of white; the disk is brownish with numerous small whitish spots in the outer portion and fine parallel radiating whitish lines in the center; beneath, the arms are gray and the disk black; the arm spines are 4 on the first dozen arm combs beyond the edge of the disk, after which the uppermost is absent, so that there are only 3 from this point to the arm tip; the spines of the successive arm combs are aligned in regular rows along the arm.

Description.—In the larger of the two specimens, designated as the type, the disk is 19 mm. in diameter and the arms are 130 mm. long.

The entire aboral surface of the disk is covered with overlapping scales which are largest about the radial shields and in the radial areas, becoming much smaller in the center of the disk and in the interradial areas. Most of these scales are entirely concealed by a thick epidermis. Before the removal of the epidermis the only scales visible are the following: A row of about 15 conspicuous light-colored scales runs outward from the ends of the radial shields along the edge of the aboral surface of the disk for about one-third the distance across the interbrachial space. These scales, which imbricate toward the radial shields, become small and irregular toward the outer end of the row. In the angle between this row of scales and the radial shields, and extending downward for some distance behind the radial shields, there is a more or less obscured group of scales, with an indefinite border.

At the base of the arms, beyond the disk, the arm spines are 4 in number. All 4 spines are approximately of the same length. The 2 central spines are stout, slightly flattened, with abruptly truncated, broadly rounded ends, the lower spine of each pair slightly curved aborally. The uppermost spine is slightly more slender than the one just below it, and more strongly flattened. The lowest spine is markedly more slender and more tapering than the others. After the ninth to twelfth arm comb beyond the edge of the disk (usually the tenth or eleventh) the uppermost spine disappears, the combs from that point onward to the tip of the arm consisting of 3 spines of approximately the same length, of which the 2 uppermost are similar, stout and blunt, and the lowest is more slender and more tapering. In the outer portion of the arms the difference between the spines gradually disappears so that in the terminal portion the combs are composed of 3 similar rather slender tapering spines. The spines on successive combs are all at the same height so that the spines are aligned in regular rows along the arm, first in 4 rows, later in 3.

The disk is brownish, becoming dark in the center and in the inter-radial areas, with numerous small whitish spots, and in the central portion fine parallel radiating whitish lines. The arms above are slaty black with pairs of white spots, each the length of an upper arm plate in diameter, spaced somewhat unequally at intervals of 4-7 upper arm plates; in the outer half of the arms these spots fuse to form narrow bands which in width are equal to from 1 to 2 upper arm plates. The arm spines in the basal portion of the arms are tipped with white. Beneath, the arms are dark gray and the interradial areas black.

Note.—Another specimen from the same locality has the disk 11 mm. in diameter and the arms 75 mm. long.

Locality.—Galápagos Islands: Elizabeth Bay, Albemarle Island; south end of the black beach north of the mangroves north of the two "red" islands. Two specimens (cotypes, U.S.N.M. no. E.5618).

Note.—It gives me great pleasure to name this species for President Franklin D. Roosevelt, in grateful appreciation of his kindness and generosity in obtaining for the United States National Museum this unusually interesting collection of echinoderms.

Remarks.—Lütken and Mortensen (Mem. Mus. Comp. Zoöl., vol. 23, No. 2, p. 162, pl. 13, fig. 12, 1899) recorded and figured a single arm of a large species of *Ophionereis* from the Galápagos Islands (*Albatross* station 3405, 53 fathoms) with very broad upper arm plates and very small supplementary plates. These features appear to indicate, according to them, that the species represented by the arm is undescribed. Their figure shows that it cannot be referred to *O. roosevelti*; the upper arm plates are much broader and the supplementary plates are much smaller; the color, also, is wholly different.

OPHIODERMA APPRESSA (Say)

Locality.—Old Providence Island, 120 miles east of the Mosquito Coast (lat. $13^{\circ}21'$ N., long. $81^{\circ}22'$ W.); shore; reef and tide-pool collecting; August 1, 1938. Three specimens (U.S.N.M. no. E5607).

ASTEROIDEA

ECHINASTER PARVISPINUS A. H. Clark

Locality.—Lower California: Magdalena Bay, inside the northern point of the entrance to bay, between Belcher Point and the anchorage; 10-15 fathoms (18-27 m.); sandy and weedy bottom; July 18, 1938. Three specimens (U.S.N.M. no. E.5610).

Note.—In these three specimens $r = 33$ mm.

HELIASTER CUMINGII (Gray)

Plate 3, fig. 9

Locality.—Galápagos Islands: Elizabeth Bay, Albemarle Island; south end of the black beach north of the mangroves north of the two "red" islands. July 26, 1938. One specimen (U.S.N.M. no. E.5611).

Notes.—In this specimen there are 21 arms; $R = 30$ mm., $r = 16$ mm. The spines on the abactinal surface are rather widely scattered and are strongly capitate. They are single except in the midline of the free portion of each ray where there are five groups, the innermost of 2 spines and the distal three of usually 3, sometimes 2, rarely 4.

The rays are of various lengths, showing that the animal is undergoing active ray reduplication. In addition to the perfectly formed arms of various sizes, there are 4 arm buds all situated in interradial openings having the appearance of rents in the aboral epidermal covering, the inner edge of which in all cases is 10 mm. from the center of the disk, or 6 mm. within the bases of the free rays.

These arm buds arise far below the aboral epidermal covering, apparently between the upper portions of the proximal marginal plates of 2 adjacent rays, and grow upward. The tip is provided with a terminal row of 4 and a subterminal row of 5 short stout spines armed with stout low conical spinelets. The furrow spines are well developed. When the growing arm bud reaches the epidermal covering the latter is ruptured, and the edge of the rent draws away from the arm bud leaving a conspicuous opening.

The arm bud now grows outward and slightly downward, parallel with the aboral surfaces of the adjacent rays, the tip, however, remaining turned up at right angles to the rapidly extending newer growth which, becoming deeper and developing a dark epidermal covering with the usual capitate spines, rapidly repairs the inner portion of the rent, at the same time extending it toward the interbrachial border; on reaching the interbrachial border the arm bud grows outward into an arm of the typical form.

The tube feet in the arm buds, as in the fully developed arms, are in 2 rows which are slightly zigzag, alternate tube feet being nearer and farther from the midline of the groove.

The largest of the arm buds, which reaches to within 4 mm. of the interbrachial angle, beyond the end of which the rent extends entirely through the animal from the aboral to the oral side, is visible on the oral surface, were it separates 2 of the arms for about half the distance from their bases to the interbrachial angle. It appears as a small

replica of the bases of the adjacent arms, with small furrow spines and small tube feet, set considerably below the general surface.

The arm buds are situated as follows, clockwise from the madreporite; the 2 larger in interradial 2 and 14, the 2 very small ones in interradial 11 and 19.

SCLERASTERIAS, sp.

Locality.—Galápagos Islands: Tagus Cove, Albemarle Island; from the anchor chain in 50 fathoms (91 m.) of water; July 26, 1938. One specimen (U.S.N.M. no. E.5643).

Notes.—The specimen at hand is small and young; $R=8.5$ mm., $r=2$ mm.; there are 6 arms, 5 of full size and the sixth in the form of a well developed bud; there are 12-13 inferomarginal and 43 adambulacral plates.

Prof. Walter K. Fisher was so very kind as to examine this specimen for me.

ECHINOIDEA

EUCIDARIS THOUARSII (Agassiz and Desor)

Localities.—Galápagos Islands: Sullivan Bay, James Island; July 24, 1938. Two specimens (U.S.N.M. nos. E.5632, E.5633).

Galápagos Islands: Elizabeth Bay, Albemarle Island; July 26, 1938. One specimen (U.S.N.M. no. E.5634).

Galápagos Islands: Post Office Bay, Charles Island; July 27, 1938. Seven specimens (U.S.N.M. no. E.5637).

Notes.—One of the specimens from James Island (E.5632) is the largest recorded for this species. The horizontal diameter is 76 mm., the height is 57 mm., and the longest spines are 68 mm. long.

HESPEROCIDARIS HOUSTONIANA, n. sp.

Plate 4, figs. 10, 11; plate 5, figs. 12-14

Characters.—The interporiferous zone of the ambulacra is elevated and is completely covered by the 2 marginal rows of large and the 2 inner rows of small tubercles; the primary spines are about one-third again as long as the horizontal diameter of the test and are slightly tapering, slightly flattened, abruptly truncated distally, and carry 13 or 14 rows of granules which are low and evenly rounded on the oral side, but rise into conical prominences on the aboral side. The new species is most closely related to *H. panamensis* (A. Agassiz) from which, however, it appears to be quite distinct.

Description.—The test is 17 mm. in horizontal diameter, and 8 mm. in height; the apical system and the peristome are both 8 mm. in diameter; the primary spines are 22 mm. long.

The test is circular, much flattened, twice as broad as high, with strongly curved sides; the apical system is flat; about the peristome the border of the test is slightly incurved; the apical system and the peristome are of the same size, their diameter being one-half that of the test.

The ambulacra at the ambitus are 2.5 mm. broad, and the interambulacra are 8 mm. broad, the width of the ambulacra being 31 percent of that of the interambulacra. Above the ambitus the ambulacra are slightly sinuate.

The interporiferous zone of the ambulacra is elevated slightly above the surface of the poriferous zones on either side, which slope upward toward it. At the ambitus the interporiferous zone is 1.2 mm. in width and the adjacent poriferous zones are 0.6 mm., the interporiferous zone being about twice the width of the adjacent poriferous zones.

In the interporiferous zone the marginal series of tubercles are very regular. The tubercles in these series are large, their diameter being markedly greater than that of the adjacent pores, and they are separated from each other by about their own diameter. Between the 2 rows of marginal tubercles are 2 rows of smaller tubercles. The tubercles in these 2 inner rows are about as large as a pore. They are situated in the lower angles of the plates, and their outer side is tangent to the midambulacral articular lines between the plates so that the interporiferous zone shows no naked median area. The tubercles of these 2 rows alternate with each other, and also with the large tubercles of the marginal rows.

In the interambulacra the areoles are low, and their edges are not raised. Those at the ambitus are slightly oval transversely, and those below become progressively more and more strongly oval. The areoles at the ambitus measure 3.6 by 3 mm. The 2 or 3 areoles nearest the peristome are confluent, the 2 uppermost are separated by 2 rows of tubercles, and the second and third from the apical system are separated by 2 rows of reduced tubercles, or are in some cases confluent; the areoles at the ambitus are separated from those above and below by usually a single row of tubercles. The boss is rather low with a small mamelon having a small perforation, which shows no trace of crenulation. The edge of the platform of the areoles below the ambitus is smooth; at the ambitus it bears from 20 to 25 tubercles, though the row may be more or less deficient. Around each

areole there is a row of scrobicular tubercles, interrupted below on the areoles at the ambitus, and both above and below on those below the ambitus. In the midline of the interambulacra below, but not above, the ambitus there is a somewhat irregular row of smaller tubercles between the scrobicular tubercles surrounding adjacent areoles so that the midline of the interambulacra is completely filled with tubercles.

The diameter of the apical system is one-half that of the test at the ambitus. The oculars are all rather widely exsert. The genital pores are small, and are situated about one-third of the distance from the outer apex to the inner edge of the genital plates. The genital plates are 2.8 mm. wide at the base and 2.4 mm. long in the midline. The oculars bear 7-9 tubercles, the genitals 14-18; each of the small plates in the periproctal area bears a single tubercle, some of the larger peripheral ones sometimes having 2 or even 3. As the tubercles on the genital and ocular plates are rather widely separated, the dense mass of secondary spines on the periproctal plates is separated from the row of closely placed spines along the outer borders of the oculars and genitals by a conspicuous, almost completely naked, band about 1.5 mm. wide.

The peristome is almost flat. There are 10-11 plates in each ambulacral series, and 4 in the interambulacral series.

The primary spines are about one-third again as long as the horizontal diameter of the test. They are fairly slender, slightly flattened, and taper gradually to an abruptly truncated, though not expanded, tip. The shaft is closely set with granules arranged in 13 or 14 longitudinal lines which just at the tip of the spine become ridges. The granules in each line alternate with those in the lines on either side. On the oral side of the spine these granules are low, elongated in the direction of the longitudinal axis of the spine, and have evenly convex and highly polished surfaces. On the aboral side the granules rise into cones directed distally, the apex of the cones being almost or quite above the distal edge of the base. The granules and cones are rather well separated from each other, and the space between them is occupied by a sort of loose spongy felting of rather coarse glassy anastomosing hairs. The neck of the spines is usually, though not always, distinct. It is from one-half to quite as long as the collar, shows only slight indications of the granules, and is highly polished, lacking the felted covering. The collar is somewhat more than 1 mm. in length, cylindrical, and very finely striate, the striations being narrow, high, and well separated, with a finely serrate crest. In occasional spines, somewhat more tapering than the others, the features of the collar

are continued to the tip; there is no felted covering, and the granules are indicated only by slight elevations over which the fine striations run uninterruptedly. The milled ring is low and not conspicuous; it is of the same color as the collar.

The topmost primary spine in each interambulacrum is rudimentary, consisting of a broadly truncated cone about as high as broad at the base with strongly convergent sides and the edges of the base broadly rounded. The surface is somewhat spongy, with very numerous and very fine striations. There are 5 of these rudimentary spines about the apical system.

The oral primaries are about 4.5 mm. long with a very long collar occupying about their proximal half, beyond which they are smooth and more or less polished. The second is transitional to the ambital spines.

The secondary spines are slender and flattened. The scrobicular spines are 3 mm. long, strongly flattened, broadly truncate or with the distal end more or less convex, and have parallel sides that in the proximal quarter converge to the base.

The marginal ambulacral spines are 2.5 mm. long, resembling the scrobicular spines but much narrower. The miliary spines are small, delicate, and sharply pointed.

The pedicellariae resemble those of related species. Small globiferous pedicellariae are numerous and conspicuous, large globiferous and tridentate rather uncommon.

The color is bright brownish red, the tips of the scrobicular and ambulacral marginal spines sometimes showing a purplish tinge. The primary spines are light at the base, becoming darker in the outer two-thirds, where they may be obscurely banded or blotched with lighter. When dry, the spongy covering gives them a frosted appearance between the granules. The collar is brownish red, somewhat lighter than the adjacent scrobicular spines, and the neck is of the same color. The oral primaries have whitish tips.

The test is dull creamy white, with the peristome and the interporiferous areas of the ambulacra tinged with dull yellowish. The apical system is pale brownish red, fading to whitish on the border of each plate. The plates surrounding the apical system are faintly tinged with greenish.

Locality.—Galápagos Islands: Tagus Cove, Albemarle Island; from the anchor chain in 50 fathoms (91 m.) of water; July 26, 1938. Six specimens (type, U.S.N.M. no. E.5604; the other five specimens under U.S.N.M. nos. E.5605 and E.5606).

Comparisons.—This new species is allied to *H. panamensis* from which it differs most noticeably in the characters of the interporiferous zone of the ambulacra, which is slightly elevated with larger tubercles than those seen in *H. panamensis* and no naked median line, and in the primary spines, which are tapering and have 13-14 longitudinal series of granules instead of being cylindrical with about 16-18 series of granules as in *H. panamensis*.

My friend Dr. Hubert Lyman Clark, of the Museum of Comparative Zoölogy at Harvard, to whom I submitted two specimens for comparison with *H. panamensis*, writes that he regards these as young specimens of *panamensis*, although he notes that there is some diversity in the slenderness and form of the primary spines. He does not mention the differences in the interporiferous zone of the ambulacra.

LYTECHINUS SEMITUBERCULATUS (L. Agassiz and Desor)

Localities.—Galápagos Islands: Elizabeth Bay, Albemarle Island; south end of the black beach north of the mangroves north of the two "red" islands; July 26, 1938. Two specimens (U.S.N.M. no. E.5617).

Galápagos Islands: South Seymour Island; north end of the plateau land section of the island; July 29, 1938. Five dead tests (U.S.N.M. no. E.5616).

Note.—The larger of the two specimens from Albemarle Island has a horizontal diameter of 28 mm.

CAENOCENTROTUS GIBBOSUS (L. Agassiz and Desor)

Locality.—Galápagos Islands: Elizabeth Bay, Albemarle Island; south end of the black beach north of the mangroves north of the two "red" islands; July 26, 1938. Two specimens (U.S.N.M. nos. E.5608, E.5609).

Notes.—One of the specimens is 45 mm. in horizontal diameter and olive green in color. The other is 20 mm. in diameter; the test is bright green with the poriferous areas abactinally light buff; the spines are dark brown becoming olive toward the base.

ECHINOMETRA LUCUNTER (Linné)

Locality.—Old Providence Island, 120 miles east of the Mosquito Coast (lat. 13°21' N., long. 81°22' W.); shore; reef and tide-pool collecting; August 1, 1938. Four specimens (U.S.N.M. nos. E.5622, E.5636).

Note.—The largest of the four specimens measures 52 by 43 mm.

ECHINOMETRA INSULARIS H. L. Clark

Locality.—Galápagos Islands: Post Office Bay, Charles Island; July 27, 1938. One specimen (U.S.N.M. no. E.5621).

Notes.—This specimen measures 44 by 39 mm.; the longest primary spines are 35 mm. long. There are 6 pore pairs above the ambitus and 5 below. The test is white, more or less tinged with purple aborally; the spines vary from deep purple to black.

ENCOPE PERSPECTIVA L. Agassiz

Locality.—Lower California: off Punta Gorda, Cape San Lucas; off rocky shore to west, and San Jose del Cabo Bay; 6-10 fathoms (11-18 m.); July 19, 1938. One specimen (U.S.N.M. no. E.5635).

Note.—The specimen is 95 mm. long.

ENCOPE MICROPORA L. Agassiz

Locality.—Lower California: off Punta Gorda, Cape San Lucas; off rocky shore to west, and San Jose del Cabo Bay; 6-10 fathoms (11-18 m.); July 19, 1938. Sixteen specimens (U.S.N.M. no. E.5620).

Note.—The specimens vary from 10 to 66 mm. in length.

EXPLANATION OF PLATES

PLATE 1

- FIG. 1. *Ophiocomella parva*, a 7-armed specimen from Clipperton Island, aboral view (U.S.N.M. no. E.5639). $\times 3$.
- FIG. 2. *Ophiocomella parva*, another 7-armed specimen from Clipperton Island, oral view (U.S.N.M. no. E.5639). $\times 3$.
- FIG. 3. *Ophiocomella schmitti*, n. sp., the type specimen from Narborough Island, Galápagos, aboral view (U.S.N.M. no. E.5638). $\times 3$.
- FIG. 4. *Ophiocomella schmitti*, n. sp., the type specimen from Narborough Island, Galápagos, oral view (U.S.N.M. no. E.5638). $\times 3$.
- FIGS. 5, 6. *Ophiothrix galapagensis*, two specimens from James Island, Galápagos, aboral view, showing variation in the spinulation of the disk (U.S.N.M. nos. E.5613 [fig. 6] and E.5614 [fig. 5]). $\times 2$.

PLATE 2

- FIG. 7. *Ophionereis roosevelti*, n. sp., the cotypes from Albemarle Island, Galápagos, aboral view (U.S.N.M. no. E.5618). $\times 2$.
- FIG. 8. *Ophionereis roosevelti*, n. sp., the cotypes from Albemarle Island, Galápagos, oral view (U.S.N.M. no. E.5618). $\times 2$.

PLATE 3

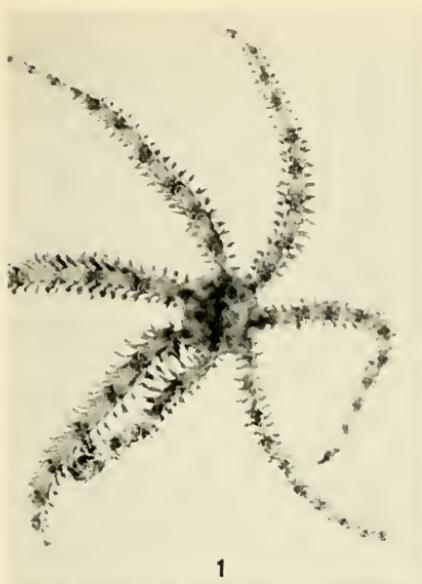
- FIG. 9. *Heliaster cumingi*, a young individual from Albemarle Island, Galápagos; the pointers indicate the four arm buds (U.S.N.M. no. E.5611). $\times 3$.

PLATE 4.

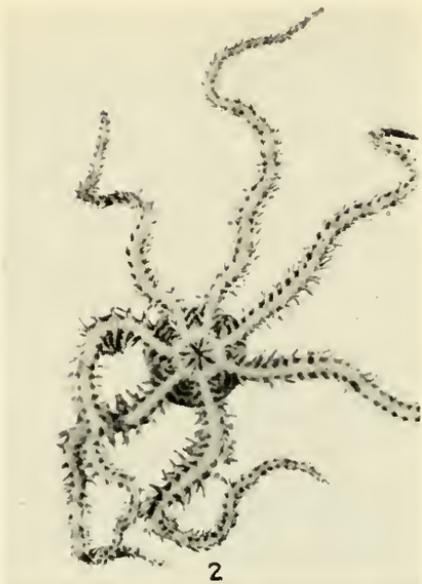
- FIG. 10. *Hesperocidaris houstoniana*, n. sp., from Albemarle Island, Galápagos, oral view (U.S.N.M. no. E.5605). $\times 2$.
- FIG. 11. *Hesperocidaris houstoniana*, n. sp., from Albemarle Island, Galápagos, aboral view (U.S.N.M. no. E.5605). $\times 2$.

PLATE 5

- FIG. 12. *Hesperocidaris houstoniana*, n. sp., the type specimen from Albemarle Island, Galápagos, aboral view (U.S.N.M. no. E.5604). $\times 2$.
- FIG. 13. *Hesperocidaris houstoniana*, n. sp., the type specimen from Albemarle Island, Galápagos, lateral view (U.S.N.M. no. E.5604). $\times 2$.
- FIG. 14. *Hesperocidaris houstoniana*, n. sp., the type specimen from Albemarle Island, Galápagos, oral view (U.S.N.M. no. E.5604). $\times 2$.



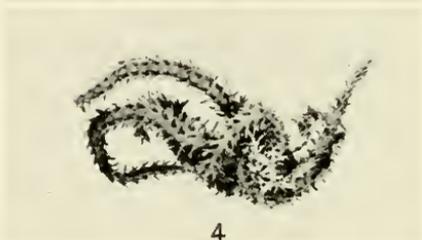
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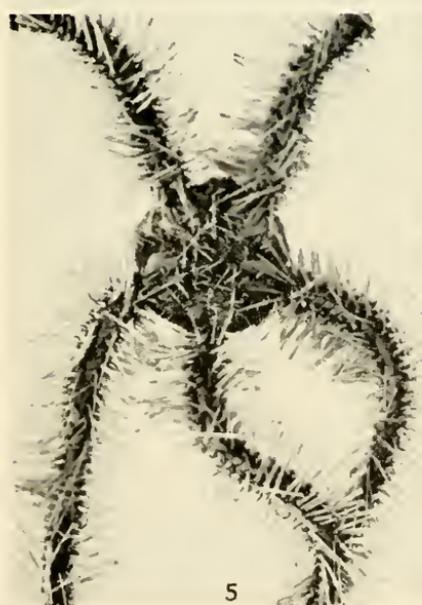
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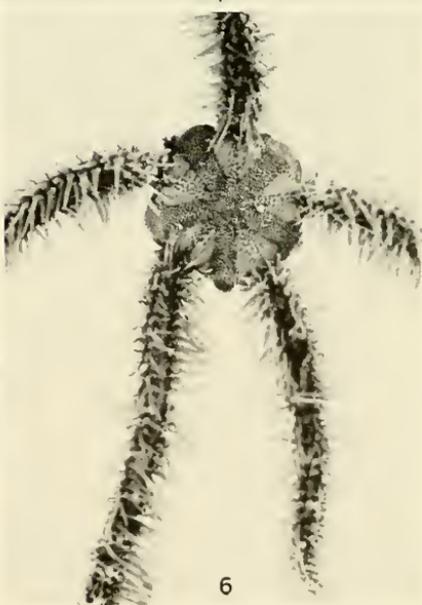
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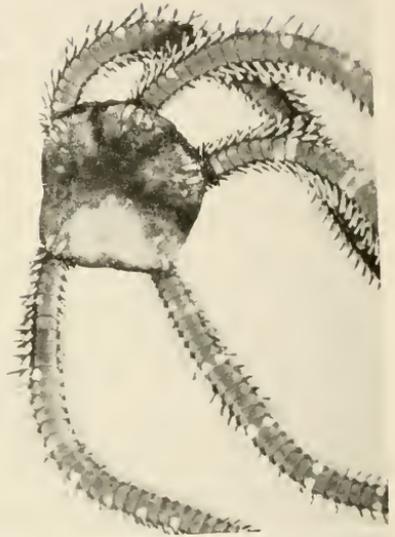
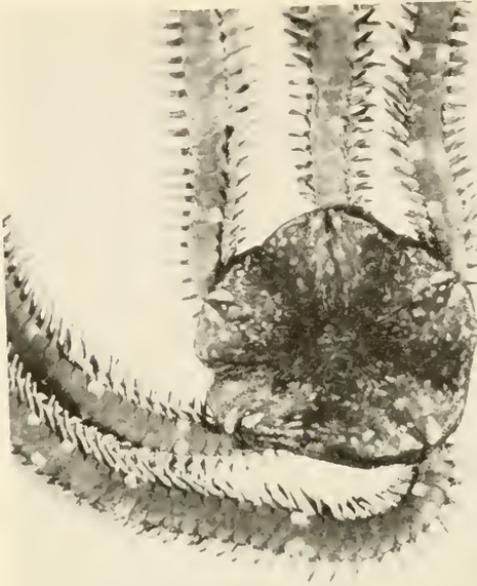


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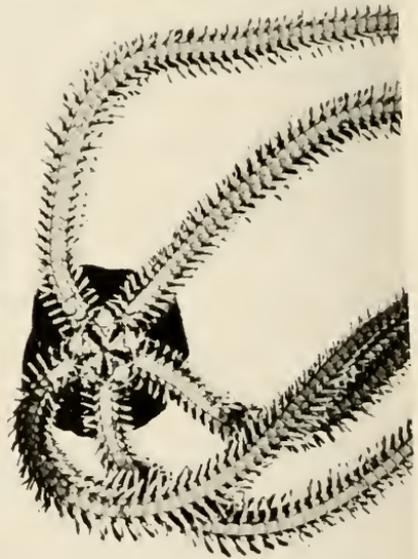
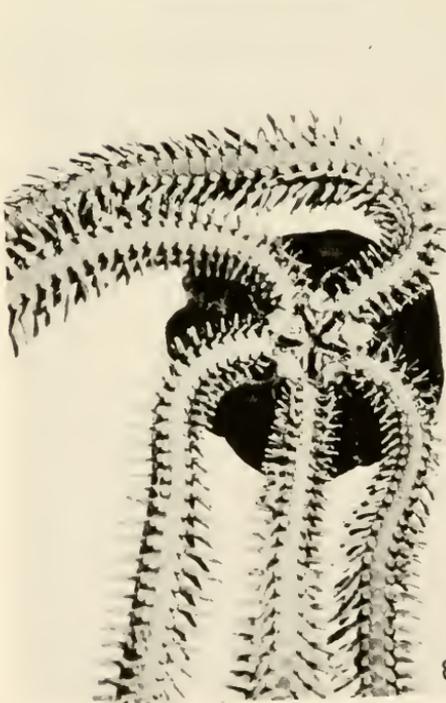


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OPHIOCOMELLA PARVA, *O. SCHMITTI*, N. SP., AND *OPHIOTHRIX GALAPAGENSIS*
(For explanation, see p. 17.)



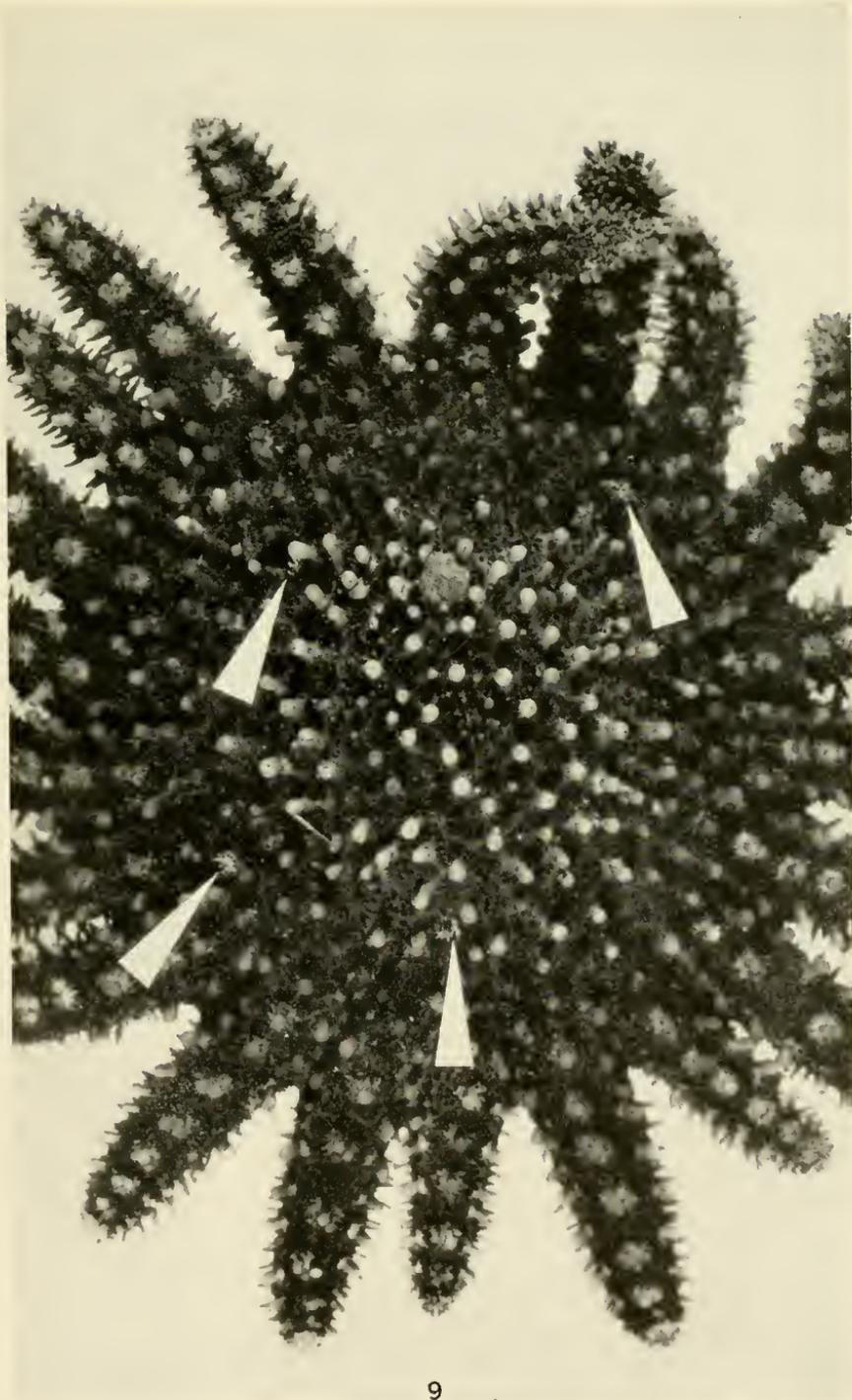
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OPHIONEREIS ROOSEVELTI, N. SP.

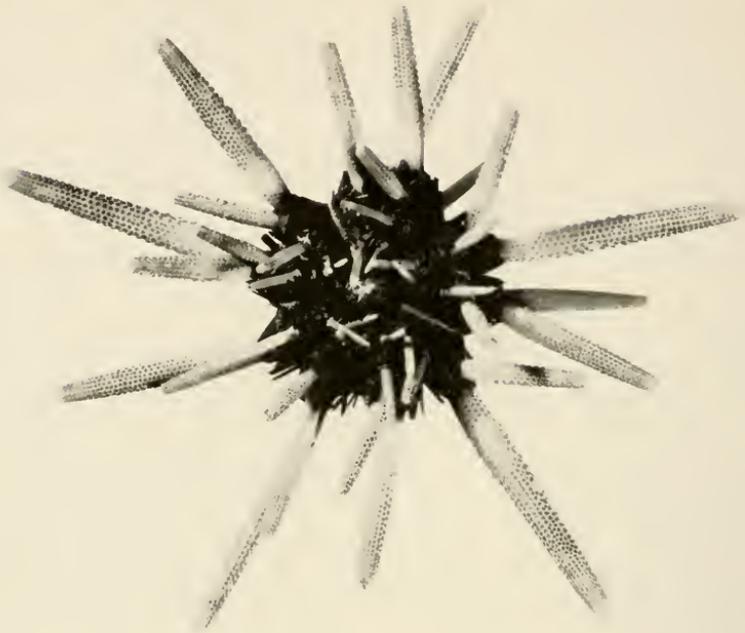
(For explanation, see p. 17.)



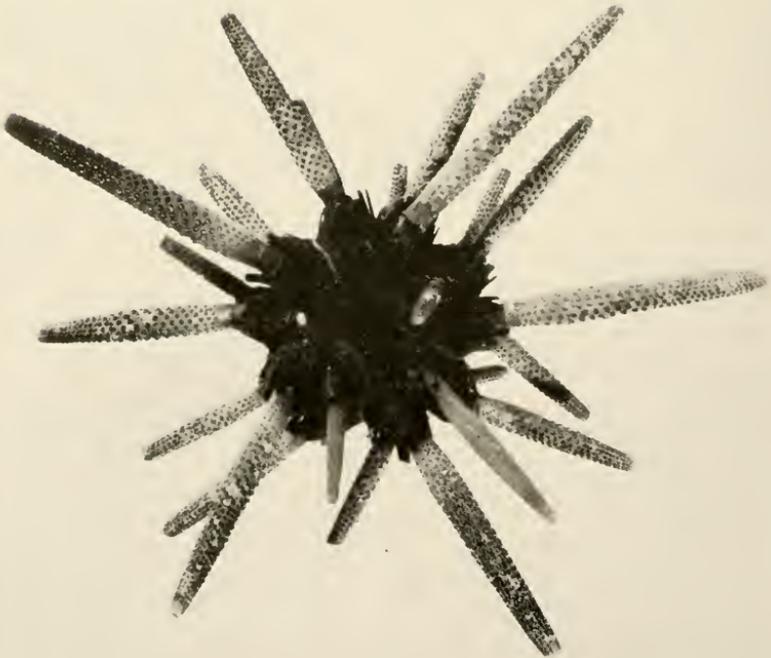
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HELIASTER CUMINGII

(For explanation, see p. 18.)

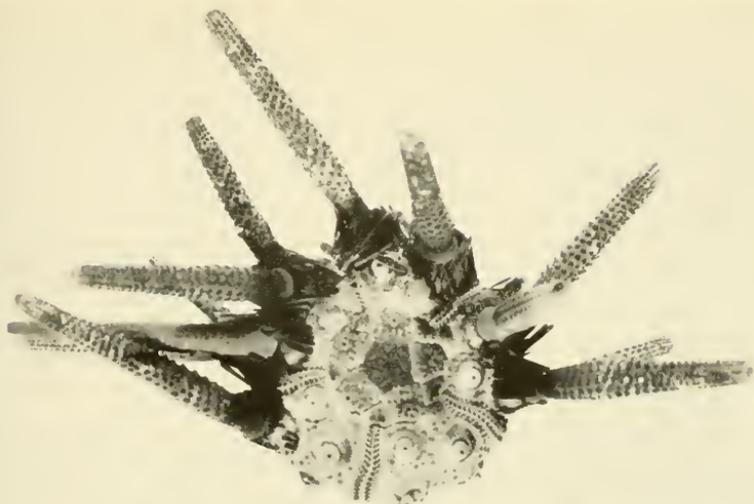


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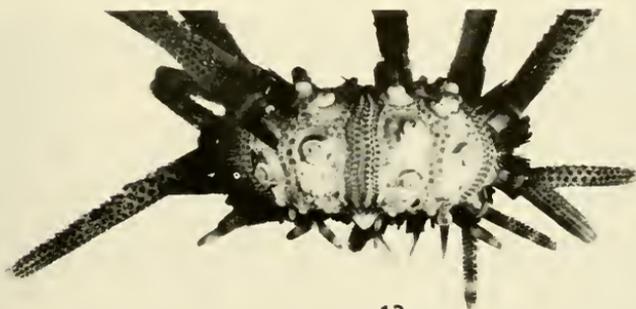


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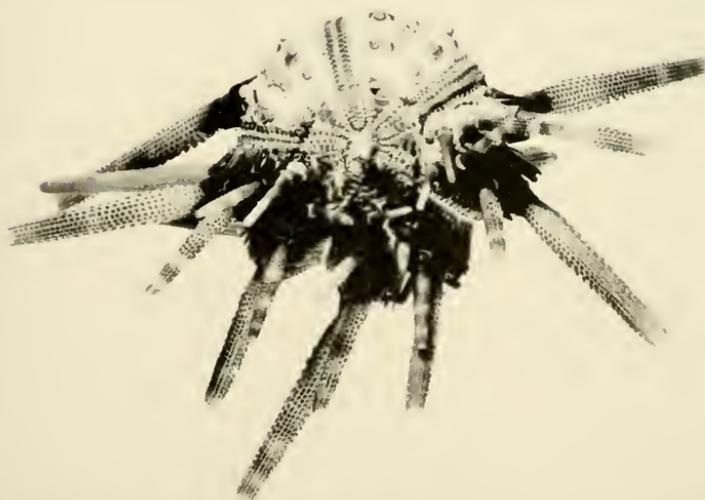
HESPEROCIDARIS HOUSTONIANA, N. SP.
(For explanation, see p. 18.)



12



13



14

HESPEROCIDARIS HOUSTONIANA, N. SP.

(For explanation, see p. 18.)