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Article VI.—ECHINODERMS FROM LOWER CALIFORNIA, WITH DESCRIPTIONS OF NEW SPECIES: SUPPLEMENTARY REPORT[1]

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When the collection of echinoderms made by the 'Albatross' Expedition to Lower California in the spring of 1911 was sent to me about ten years ago, by some mistake a considerable amount of material was not shipped. This was discovered and sent to me in the late fall of 1921 and, as it contains species not in the original lot, it seems desirable to publish this supplementary report.[2]

This second collection contains 462 specimens of 58 species, and no fewer than ten of these species were not represented in the first collection. Moreover, two of the ten additional species are new to science, though unfortunately each is represented by only a single broken specimen. The entire collection of echinoderms made by the 'Albatross' on her Lower California cruise, therefore, consisted of 2343 specimens of 117 species, of which nine were undescribed. There were 41 kinds of sea-stars, 34 of brittle-stars, 21 of echini and 20 holothurians, and a single specimen, in the supplementary collection, represents the comatulids or feather-stars. The presence of this comatulid, which is of an undescribed species, is perhaps the most interesting feature of the additional material.

More than a third of this second collection is from shore stations, of which San Francisquito Bay is easily the most important, 98 specimens of 10 species coming from there, two of these not being in the first collection. It is interesting to note that the remarkable new brittle-star, described beyond, was taken at Station 5694, which was noted in my first report as being the station where the most species were taken. Here, at a depth of 640 fms., no fewer than 19 species were collected. The new comatulid is from Station 5692, which is off Point San Tomas, west coast of Lower California, a region noted in my earlier report for the large number of species found there.

I desire to express here my thanks to Mr. Roy W. Miner, of The American Museum of Natural History, for courtesies in connection with the preparation of the present report.

[1]Scientific Results of the Expedition to the Gulf of California in charge of Dr. C. H. Townsend, by the U. S. Fisheries Steamship 'Albatross' in 1911; Commander G. H. Burrage, U. S. N., Commanding. XII. Published by permission of the U. S. Commissioner of Fisheries.

[2]The present report is supplementary to 'Echinoderms from Lower California, with descriptions of new species.' By Hubert Lyman Clark, 1913, Bull. Amer. Mus. Nat. Hist., XXXII, pp. 185–236, Pls. XLIV–XLVI.

CRINOIDEA

Trichometra europacifica, new species

Centro-dorsal relatively large, conical, covered by the cirrus sockets, which are arranged in about three horizontal series, no vertical series or radial groups being indicated.

Cirri about 20 in number, 4 or 5 mm. long, with 15 or 16 segments. The cirri at the apex of the centro-dorsal are noticeably smaller than those in the outer or marginal series. Basal segment almost discoidal, its length not one-half its thickness; second segment not quite so long as wide; third, distinctly longer than its distal diameter, which is greater than the proximal; fourth segment the longest of all, twice as long as the distal diameter, which is much greater than the proximal; the segment is nearly cylindrical where its diameter is least, proximal to the middle; the distal margin is flaring, especially on the dorsal side, where it projects considerably. Fifth segment very similar to fourth, but sixth and seventh are shorter and stouter. Succeeding segments each a trifle shorter and smaller than its predecessor, and the least diameter is at the proximal margin more and more clearly. But even the fifteenth and sixteenth segments are longer than their distal diameter. Sixteenth segment with a conspicuous opposing spine which is not quite so long as the diameter of the segment. Terminal claw moderately slender, slightly curved, about equal to the last segment in length.

Radials almost bowl-shaped, the width nearly three times the length in the median line, which is somewhat less than the lateral margins, as the distal margin is distinctly concave. The first costals are similar to the radials but are lower, the width being fully three times the length. Costal axillaries rhombic, about as long as broad, the margins slightly concave, the angles blunt and rounded; the anterior margins are swollen, flaring and a little roughened. Surface of all the I Br series otherwise quite smooth. Costals and axillaries scarcely in contact, but first brachials externally appressed; hence there is a distinct pit-like depression between the I Br series of adjoining radii.

Ten arms, all broken distally so the length can only be estimated; probably about 25 mm. long. First brachial short, its outer edge about twice as long as inner, its distal margin only a little concave and not at all flaring, and nearly smooth; second brachial irregularly pentagonal, about as long as thick; third and fourth brachials, united by syzygy, together longer than the second and therefore distinctly longer than broad; following brachials about as long as broad, except syzygial pairs, which distally probably occur at intervals of two bifascial articulations. Beyond the third brachial, the distal margin of each pinnule-bearing segment projects as a spiny knob, characteristic of the genus, but these knobs are not conspicuous and are best seen in a perfectly profile view of a dried arm; when thus viewed the dorsal median line of each brachial is distinctly concave.

Pinnules all broken and defective, but enough segments are left to show that all were very slender and distally filiform. In the first pinnule the basal joint is about as long as wide, the second is longer, the third still longer and the fourth is fully twice as long as thick. The distal segments on all the pinnules are extremely slender at middle, but conspicuously swollen at the joints. Genital glands are present on some of the basal pinnules.

Color very pale brown dorsally, the cirri nearly white; oral surface dark brown.

TYPE.—Cat. No. —, U. S. Nat. Mus., from Station 5692.

Station 5692. Off Pt. San Tomas, west coast of Lower California, 1076 fms. Bottom temp. 37.1°.

One specimen.

Owing to the locality and the fact that there was only a single small broken specimen, I was inclined to list this comatulid as *Thaumatometra parvula* (Hartlaub), in spite of the obviously different cirri, but Mr. Austin H. Clark suggested to me that the arms were evidently the arms of a *Trichometra* and the combination of characters shown by the cirri, pinnules, and arms clearly indicated an undescribed species. Oddly enough, the species most closely resembling this new one from the eastern Pacific is the little *Trichometra minutissima* A. H. Clark, from off the Brazilian coast in 818 fms. But the Atlantic species has a very different centro-dorsal, far more numerous cirri, much rougher costals and somewhat more slender pinnules. For convenience in comparing the two species, I have modeled my description of *europacifica* after the pattern of the original description of *minutissima* (1908, Proc. U. S. Nat. Mus., XXXIV, p. 233).

ASTEROIDEA

Astropecten erinaceus Gray

Astropecten erinaceus GRAY, 1840, Mag. Nat. Hist., (new series), VI, p. 182.

The present specimens are large, R=80 and 125 mm., and are conspicuously spiny. The color is the usual yellow-brown of dry sea-stars. In the larger specimen, r and br each=28 mm. and hence R= 4.5 r.

Conception Bay, east coast of Lower California.

Two specimens.

Thrissacanthias penicillatus (Fisher)

Persephonaster penicillatus FISHER, 1905, Bull. U. S. Bur. Fish., XXIV, p. 297.
Thrissacanthias penicillatus FISHER, 1910, Ann. Mag. Nat. Hist., (8) V, p. 171.

These specimens are large adults, ranging from R=100 mm. to R=225 mm., and call for no special comment. They are merely additional specimens from four stations previously recorded, namely Stations 5694, 5697, 5698, and 5699.

Thirteen specimens.

Pectinaster agassizii (Ludwig)

Cheiraster agassizii LUDWIG, 1905, Mem. Mus. Comp. Zoöl., XXXII, p. 1.
Pectinaster agassizii LUDWIG, 1910, Sitz. K. Preuss. Akad. Wiss., XXIII, p. 449.

These specimens range in length of R from 15 to 55 mm. They are in part from Stations 5689 and 5692, whence they were previously

recorded, but there are 18 specimens from Station 5696. Off San Luis Obispo County, California, 440 fms. Bottom temp., 39.9°.

Forty-four specimens.

Nearchaster aciculosus (Fisher)

Acantharchaster aciculosus FISHER, 1910, Zool. Anz., XXV, p. 550.
Nearchaster aciculosus FISHER, 1911, Ann. Mag. Nat. Hist., (8) VII, p. 92.

These are simply five additional adult specimens from Station 5694. The length of R ranges from 90 to 150 mm.

Pseudarchaster pusillus Fisher

Pseudarchaster pusillus FISHER, 1905, Bull. U. S. Bur. Fish., XXIV, p. 304.

This is merely additional material from Station 5675. There are 18 specimens with R = 28 to 33 mm.

Ceramaster leptoceramus (Fisher)

Tosia leptocerama FISHER, 1905, Bull. U. S. Bur. Fish., XXIV, p. 306.
Ceramaster leptoceramus FISHER, 1911, Bull. U. S. Nat. Mus., No. 76, p. 210.

There are two additional specimens from Station 5675 with R = 35 to 40 mm. They seem to me more like *japonicus* than *leptoceramus*, except for the presence of abactinal radial secondary plates.

Oreaster occidentalis Verrill

Oreaster occidentalis VERRILL, 1867, Trans. Connecticut Acad. Sci., I, p. 278.

The present large series shows great diversity in the number, distribution, and acuteness of the abactinal spines and the tubercles. The five radial spines near margin of disk are usually, but not always, conspicuous. A perfectly preserved specimen, which seems to have retained the living form very well, has R = 80 mm., r = 35 mm., br = 25 mm. and vertical diameter of disk = 45 mm. Hence R = 2.3r, 3br, and only 1.3 v.d. None of the specimens give any clue as to the color in life. The largest specimens have R = 105 mm.

San Francisquito Bay, east coast of Lower California. Carman Island, east coast of Lower California.

Thirty-two specimens.

Amphiaster insignis Verrill

Amphiaster insignis VERRILL, 1868, Trans. Connecticut Acad. Sci., I, p. 373.

There is a single small specimen, with R = only 30 mm., from Conception Bay, east coast of Lower California.

Phataria unifascialis (Gray)

Linckia (*Phataria*) *unifascialis* GRAY, 1840, Mag. Nat. Hist., (new series), VI, p. 285.

Phataria unifascialis, SLADEN, 1889, 'Rep. Voy. 'Challenger,' Zoöl.,' XXX, p. 786.

These dried specimens from two additional localities have R = 55 to 80 mm.

Espiritu Santo Island, east coast of Lower California.

San Francisquito Bay, east coast of Lower California.

Twelve specimens.

Pharia pyramidata (Gray)

Ophidiaster (*Pharia*) *pyramidatus* GRAY, 1840, Mag. Nat. Hist., (new series), VI, p. 284.

Pharia pyramidata SLADEN, 1889, 'Rep. Voy. 'Challenger,' Zoöl.,' XXX, p. 784.

This well-known and characteristic "West coast" species was not represented in the first collection, but now there are some small specimens at hand, with R = 67 to 74 mm.

San Francisquito Bay, east coast of Lower California.

Three specimens.

Solaster borealis (Fisher)

Crossaster borealis FISHER, 1906, Proc. Washington Acad. Sci., VIII, p. 134.

Solaster borealis FISHER, 1911, Bull. U. S. Nat. Mus., No. 76, p. 320.

There is an additional specimen from Station 5694, with 11 rays, R = 30 mm., and another from Station 5696, with 11 rays, R = 50 mm.

Heterozonias alternatus (Fisher)

Crossaster alternatus FISHER, 1906, Proc. Washington Acad. Sci., VIII, p. 131.

Heterozonias alternatus FISHER, 1910, Ann. Mag. Nat. Hist., (8) V, p. 172.

Considerable additional material of this species is at hand from Stations 5694, 5697, and 5698. They show a good range in size, as R = 23 to 110 mm. One specimen has eleven rays; all the others ten.

Fourteen specimens.

Lophaster furcilliger Fisher

Lophaster furcilliger FISHER, 1905, Bull. U. S. Bur. Fish., XXIV, p. 312.

There are ten more specimens of this sea-star from Station 5694, with R ranging from 27 to 60 mm.

Peribolaster biserialis Fisher

Peribolaster biserialis FISHER, 1905, Bull. U. S. Bur. Fish., XXIV, p. 313.

There is another specimen from Station 5696, and it is the largest of those taken, as R = 20 mm.

Hymenaster perissonotus Fisher

Hymenaster perissonotus FISHER, 1910, Ann. Mag. Nat. Hist., (8) V, p. 170.

Two specimens from Station 5691 are much larger than those of the first collection, as R = about 60 mm.

Zoroaster evermanni Fisher

Zoroaster evermanni FISHER, 1905, Bull. U. S. Bur. Fish., XXIV, p. 317.

There are three specimens from Station 5699 with R = 135 to 152 mm. One has the big pedicellariæ characteristic of Fisher's subspecies *mordax*, but these are lacking in the other two. It is worth noting that the locality is on the border line, both geographically and bathymetrically, of the range of the subspecies.

Zoroaster ophiurus Fisher

Zoroaster ophiurus FISHER, 1905, Bull. U. S. Bur. Fish., XXIV, p. 315.

There are three additional specimens of this species from Station 5689, with R = 125 to 140 mm.

Myxoderma platyacanthum (H. L. Clark)

Zoroaster platyacanthus H. L. CLARK, 1913, Bull. American Mus. Nat. Hist., XXXII, p. 199.

Myxoderma platyacanthum FISHER, 1919, Ann. Mag. Nat. Hist., (9) III, p. 393.

There are three additional specimens in the present collection, with R = 60 to 70 mm. They bear the label "D 5695. Mar. 15, 1911." This is clearly a mistake as the station number and date do not correspond. It is evident that these specimens are from the type locality, Station 5675, where collecting was done on March 15.

Fisher's further investigations into the anatomy of the Zoroasteridæ have established the generic rank of *Myxoderma* and have shown that the present species belongs in the genus.

Myxoderma sacculatum (Fisher)

Zoroaster (*Myxoderma*) *sacculatus* FISHER, 1905, Bull. U. S. Bur. Fish., XXIV, p. 316.

Myxoderma sacculatum FISHER, 1919, Ann. Mag. Nat. Hist., (9) III, p. 392.

This species is not recorded as in the first collection. There are five specimens from Station 5694, having R = 180 to 185 mm.

Heliaster kubiniji Xantus

Heliaster kubiniji XANTUS, 1860, Proc. Acad. Nat. Sci. Philadelphia, p. 568.

In the present series of very poorly preserved specimens, there is great range in size, as R = 13 to 100 mm. The number of rays ranges

from 15 to 24, but all the large specimens have 23. There is one with 15 rays, one with 17, one with 19, one with 20, five with 21, five with 22, eight with 23, and one with 24.

Espiritu Santo.

San Francisquito Bay, east coast of Lower California.

Twenty-four specimens.

Asterias forreri De Loriol

Asterias forreri De Loriol, 1887, Rec. Zool. Suisse, IV, p. 401.

There is a very poorly preserved sea-star in the present collection with R = 95 mm. from San Francisquito Bay, which is evidently identical with the sea-stars from the same place which are recorded in the first report as *Asterias forreri*. As Fisher's revision of the Pacific coast Asteriidæ is not yet published, I let the name stand as in the former report, to prevent any possible confusion later on.

OPHIUROIDEA

Since the publication of the first report, the classification of the ophiurans has undergone quite a revolution and the sequence of the species is almost reversed. To facilitate comparison and prevent confusion, it seems best to follow the sequence of species that was used in the earlier report. Fortunately, no changes of nomenclature are necessitated by the activity of recent years in ophiuran taxonomy.

Ophiura leptoctenia H. L. Clark

Ophiura leptoctenia H. L. Clark, 1911, Bull. U. S. Nat. Mus., No. 75, p. 51.

An additional specimen, 6 mm. across the disk, from Station 5694 calls for no comment.

Ophiura superba (Lütken and Mortensen)

Ophioglypha superba Lütken and Mortensen, 1899, Mem. Mus. Comp. Zoöl., XXIII, p. 116.

Ophiura superba Meissner, 1901, Bronn's 'Thierreich,' II, pt. 3, p. 925.

There are six additional specimens, 14 to 28 mm. across the disk, from Station 5694. In one fairly perfect specimen, 18 mm. across the disk, the arms are 90 mm. long.

Ophiocten pacificum Lütken and Mortensen

Ophiocten pacificum Lütken and Mortensen, 1899, Mem. Mus. Comp. Zoöl., XXIII, p. 131.

Two badly damaged specimens, one from Station 5689 and one from 5694, are scarcely worth recording.

Ophiernus polyporus Lütken and Mortensen

Ophiernus polyporus LÜTKEN AND MORTENSEN, 1899, Mem. Mus. Comp. Zoöl., XXIII, p. 109.

An additional specimen, 13 mm. across the disk, from Station 5682 throws no light on the question of the validity of this species.

Ophiomusium glabrum Lütken and Mortensen

Ophiomusium glabrum LÜTKEN AND MORTENSEN, 1899, Mem. Mus. Comp. Zoöl., XXIII, p. 132.

There are five additional specimens from Station 5689. They are about 30 mm. across the disk and the arms are about 165 mm. long.

Ophiomusium jolliense McClendon

Ophiomusium jolliense MCCLENDON, 1909, Univ. of California Publ., Zoöl., VI, No. 3, p. 36.

There is a typical example of this species, 7 mm. across the disk, in the present collection, but it was not represented in the material reported on previously.

Station 5682. Off Cape St. Lucas, Lower California, 491 fms. Bottom Temp. 40.8°.

One specimen.

Ophiomusium lymani Wyville Thomson

Ophiomusium lymani WYVILLE THOMSON, 1873, 'The Depths of the Sea,' p. 172.

One of the 18 additional specimens now at hand from Station 5689 is larger than any in the earlier collection, measuring 32 mm. across the disk, while the others are from 13 mm. up.

Amphiura diomedeæ Lütken and Mortensen

Amphiura diomedeæ LÜTKEN AND MORTENSEN, 1899, Mem. Mus. Comp. Zoöl., XXIII, p. 151.

An additional, well-preserved specimen from Station 5694 has the disk 15 mm. across and the arms about 180 mm. long.

Amphipholis squamata (Delle Chiaje)

Asterias squamata DELLE CHIAJE, 1828, 'Mém. Anim. s. Vert.,' III, p. 74, Napoli.

Amphipholis squamata VERRILL, 1899, Trans. Connecticut Acad. Sci., X, p. 312.

A tiny brittle-star with disk about 2 mm. across is evidently an *Amphipholis* but shows no characters by which it can be distinguished from the ubiquitous species of Europe and eastern North America. Of course, were it full grown, it might show distinctive characters, but, as it

is, no other course seems right than to refer it to the cosmopolitan *squamata*. There was no representative of the genus in the earlier collection. The present specimen bears the label—"Middle of east side of Cerros Island, March 12, 1911." This island is off the western coast of Lower California.

Ophiacantha normani Lyman

Ophiacantha normani LYMAN, 1879, Bull. Mus. Comp. Zoöl., VI, p. 58.

There are 51 additional specimens of this common brittle-star from Station 5694. They range from 9 to 17 mm. across the disk.

Ophiacantha parasema[1], new species

Disk about 22 mm. in diameter and 8 to 10 mm. thick; arms all broken near base, 4 to 5 mm. wide, the longest basal piece little more than 10 mm. long. Disk covered with a rather thick soft skin, the surface of which bears numerous crowded, more or less circular, minute plates, each of which carried a single, very acute, slightly rough spine. These spines are relatively thick at the base and taper to the sharp point; they are considerably longer than the diameter of the plate and hence the disk appears to be crowded with them. The longest are about a millimeter in length. Radial shields completely concealed and apparently wanting, but when the inner surface of the disk is examined, they can be detected as thin, flat plates, about 3 mm. long and half as wide, lying side by side, nearly parallel but scarcely in contact.

Upper arm plates quadrilateral, overlapping, with distal margin strongly convex and lateral margins converging proximally. The basal plate has a slightly convex proximal region and the lateral margins are a little concave. It is about as long as wide, but all the succeeding plates are much wider than long. There are, however, only half a dozen upper arm plates on the longest arm fragment present and it is hard to say how much of their shortness and overlapping is due to the highly contracted condition of the arms. For the three fragments that are still attached to the disk are pulled back dorsally so strongly that the upper surface rests against the disk, much as occurs in the usual specimens of *Ophiotholia*, and, when forcibly laid down horizontally, their upper surfaces are markedly concave from the evident contraction of dorsal muscles. Side arm plates moderately large, the spine-bearing ridges prominent, not meeting above, but apparently meeting narrowly below between the under arm-plates. It is possible however that in a relaxed arm, lying horizontally, the distal margin of the under arm-plates would overlie and conceal the side arm plates in the median line. Each side arm plate bears 6 or 7 arm-spines, of which the uppermost is probably the longest, or the next to the uppermost perhaps, and the lowest shortest; as all are broken, neither their actual nor relative lengths can be determined. They are glassy, acicular, longitudinally ridged and somewhat rough, but not thorny; the longest was evidently longer than the arm segment and apparently equalled two segments at least. Under arm plates small, depressed at center so that they are distinctly concave, quadrilateral, with rounded corners and concave lateral margins. They are not in contact in the present condition of the arms.

[1] παράσημος = spurious, in reference to its not being a typical member of the genus.

Tentacles long and basally large, scarcely contracted at all. Tentacle pores large, guarded by three tentacle-scales which were apparently somewhat spiniform, but as all are broken at the tip their actual form is uncertain.

Interbrachial spaces below covered with thin, soft skin, with a few spine-bearing scales like those of the dorsal surface; these are most numerous, naturally, near the disk margin and are wanting near the mouth. Genital slits conspicuous, especially orally, margined by well-developed genital plates and at the oral end by the adoral plates and side arm plates. Oral shields conspicuous, nearly three times as wide as long, except the madreporite in which the length almost equals the width; the proximal margin has a distinct sharp median angle, but the narrow lateral angles are rounded. Adoral plates L-shaped, the tip of each branch expanded, especially the shorter; they meet broadly in front of oral shield, but abut on the first under arm plate at the other end. Oral plates rather large and a little swollen. Teeth in a vertical series of about 4, bluntly pointed, about twice as long as wide. Oral papillæ 4 on each side, the smallest ones distalmost, the largest at apex of jaw; the largest are as long as the teeth but not quite so wide. Besides the oral papillæ, the sides of the jaw are armed with conspicuous oral tentacle-scales; the first oral pore is guarded by two large ones, as big as the smaller oral papillæ but of course above them (apparently below, when the mouth-parts are being examined); the outer pore is guarded by three similar spiniform scales which are nearly at the same level and in line with the oral papillæ. Color pale gray.

TYPE.—Cat. No. —, U. S. Nat. Mus., from Station 5694.

Station 5694. Southwest of Santa Cruz Island, California, 640 fathoms.

One specimen.

The actual relationships of this brittle-star are dubious, owing to the defective condition of the specimen. The swollen disk and dorsally contracted arms, with the apparent absence of radial shields, remind one of *Ophiotholia*, but the mouth-parts are quite like many species of *Ophiacantha*. If the distal part of the arms were present, we should be better able to decide whether the relationship to *Ophiotholia* is at all close. Under existing conditions, it seems better to put the species in *Ophiacantha*, although it is obvious that it is not closely related to any species of that genus. The whole family of the Ophiacanthidæ needs revision with a careful comparison of internal skeletal plates which have hitherto been largely ignored. When this revision is made there will no doubt be a considerable increase in the number of genera which should be recognized.

Ophiocoma æthiops Lütken

Ophiocoma æthiops LÜTKEN, 1859, 'Add. ad Hist.,' pt. 2, p. 145.

A very small brittle-star bearing every indication of being an *Ophiocoma*, and certainly not *O. alexandri*, is referred to this Panamic species. The disk is less than 2 mm. across, prettily variegated, as are

the arms, with yellow-brown and cream-color. Accompanying this specimen is a slip on which is written: "Lower California on oyster shells. No locality label." Only a single specimen of *æthiops* was in the original collection and that was from Angel de la Guardia Island in the Gulf of California.

Ophiocoma alexandri Lyman

Ophiocoma alexandri LYMAN, 1860, Proc. Boston Soc. Nat. Hist., VII, p. 256.

A young specimen of this species, 4 mm. across the disk and yellow-brown in color, is very finely preserved, but, like the young *æthiops*, it is accompanied by a slip reading "Lower California. No locality label. On oyster shells."

Ophiothrix spiculata Le Conte

Ophiothrix spiculata LE CONTE, 1851, Proc. Acad. Nat. Sci. Philadelphia, V, p. 318.

There are 30 very badly preserved small specimens of this common Panamic brittle-star with the disk 2 to 7 mm. across. They bear a label "D 5695" but this locality is obviously wrong, as the depth at Station 5695 was 534 fms. and *spiculata* is essentially a littoral species. It has been recorded from depths near the 100 fms. line, but that is extreme. The label with the specimens bears the date April 26, 1911 and the specimens themselves indicate that they were taken in very shallow water.

Astroschema sublæve Lütken and Mortensen

Astroschema sublæve LÜTKEN AND MORTENSEN, 1899, Mem. Mus. Comp. Zoöl., XXIII, p. 187.

There are two more specimens from Station 5695, one an adult with disk 13 mm. across and arms fully 200 mm. long, but only 3 mm. in diameter; the other very young, with disk smooth, only 2 mm. across and arms so tightly coiled on the gorgonian, on which both it and the adult are borne, that they cannot be measured.

Asteronyx excavata Lütken and Mortensen

Asteronyx excavata LÜTKEN AND MORTENSEN, 1899, Mem. Mus. Comp. Zoöl., XXIII, p. 185.

There is a single additional specimen, 22 mm. across the disk, on a gorgonian from Station 5688.

ECHINOIDEA

Eucidaris thouarsii (Agassiz and Desor)

Cidaris thouarsii AGASSIZ AND DESOR, 1846, Ann. Sci. Nat., VI, p. 326.
Eucidaris thouarsii DÖDERLEIN, 1887, 'Jap. Seeigel,' p. 42.

There are some good representatives of this species in the present collection and they show no little diversity in form. For example, one 42 mm. in diameter is 24 mm. high, v.d. thus equal to less than .60 h.d., while another specimen 58 mm. in diameter is 41 mm. high, v.d. equaling more than .70 h.d. In the best-preserved specimens the spines are nearly or quite equal to the diameter of the test. In one specimen there are 7 or 8 coronal plates in a series, while in another there are 9 or 10, a very large number for *thouarsii*. The specimens from Espiritu Santo bear a label reading "Enemies of pearl oyster at propagating plant." It seems highly improbable that this can be a fact, though it may be the impression of the pearl-shell growers. It would be interesting to know in just what way the sea-urchin is supposed to injure the pearl shells.

Espiritu Santo.

San Francisquito Bay, east coast of Lower California.

Six specimens.

Centrostephanus coronatus (Verrill)

Echinodiadema coronata Verrill, 1867, Trans. Connecticut Acad., I, p. 294.

Centrostephanus coronatus A. Agassiz, 1872, Illust. Cat. Mus. Comp. Zoöl., VII, p. 97.

There are five unusually large specimens at hand, 45 to 50 mm. h.d.: thus twice as big as the largest in the earlier collection. The coloration too indicates maturity, for the banded spines of the young are no longer in evidence. Although all of the primaries have the tips broken off, they are long enough to show the absence of bands; they are deep claret distally but browner basally.

San Francisquito Bay, east coast of Lower California.

Astropyga pulvinata (Lamarck)

Cidarites pulvinata Lamarck, 1816, 'Anim. s. Vert.,' III, p. 59.

Astropyga pulvinata Agassiz and Desor, 1846, Ann. Sci. Nat., VI, p. 345.

This interesting sea-urchin was not represented in the former collection, but there is a fine series at hand now, ranging from 15 to 95 mm. in diameter. Unfortunately, they are not in the best of condition, the small ones in particular being more or less damaged. On the larger specimens the spines are mostly missing or broken. The most interesting feature of these Astropygas is the coloration. All specimens of *pulvinata* which I have seen hitherto have had a dull greenish ground color, in marked contrast to the deep red of *A. radiata*. The present specimens however show that the ground color in *pulvinata* is deep, purplish red at and above the ambitus and that the greenish color of dry museum mate-

rial is due to the peeling off and loss of the red epidermis, which appears to flake off and disappear very easily. A very constant feature of the coloration of *pulvinata*, conspicuous in all but one of the present series, is a yellowish triangular spot in each interradius just above the ambitus. This is usually visible even in the greenish specimens and is very noticeable in the red ones. Apparently this spot is pale yellow, or possibly even white, in life.

San Francisquito Bay, east coast of Lower California.

Fifteen specimens.

Arbacia incisa (A. Agassiz)

Echinocidaris incisa A. Agassiz, 1863, Bull. Mus. Comp. Zoöl., I, p. 20.

Arbacia incisa H. L. Clark, 1913, Bull. American Mus. Nat. Hist., XXXII, p. 220.

There is a fine series of this species in the present collection, for the most part in good condition. They range from 10 to 38 mm. in diameter. The relative length of the primary spines shows some diversity; in the individual with the test 38 mm. h.d., the spines are 39 mm. long, but in one having h.d. 16 mm. the spines are 23 mm. long. Half a dozen of the specimens lack a locality label but the others are from San Francisquito Bay, east coast of Lower California.

Twenty specimens.

Clypeaster speciosus Verrill

Clypeaster speciosus Verrill, 1870, American Journ. Sci., (2) XLIX, p. 95.

This fine clypeastroid was not represented in the first collection, but beautifully preserved specimens are now at hand, 76 mm. long, 66 mm. wide and 18 mm. high. They have the lower side very flat and the color is a deep, dull purple.

San Esteban Island, Gulf of California.

Two specimens.

Encope californica Verrill

Encope californica Verrill, 1871, Trans. Connecticut Acad. Sci., I, p. 586.

This remarkable clypeastroid was also wanting in the earlier collection, although two other species of *Encope* were represented. The three species are easily distinguished from each other and show no tendency to intergrade or hybridize. It is possible that they do not occur together at any given place, but that each species has its own particular habitat. The 'Albatross' collections indicate that *californica* and *grandis* occur at the same locality and that *grandis* and *micropora* are

both found at Tiburon Island, but that of course does not prove that they are actually living together at the same spot.

The specimens of *californica* in the present lot show interesting diversity in the proportions of length and breadth. A typical specimen is 93 mm. long and 93 mm. wide, but three others are 95 by 93, 104 by 101 and 116 by 110. As a rule, the length is slightly greater than the width, but occasionally the width is greater; thus one specimen 109 mm. long is 112 mm. wide. The color of the dry specimens is brown, with a marked violet tinge around the lunules and along the margin.

Conception Bay, east coast of Lower California.

Twenty-one specimens.

Encope grandis Agassiz

Encope grandis Agassiz, 1841, 'Monogr. Echin., Scutelles,' II, p. 75.

There are additional specimens of this extraordinary creature at hand from new localities. The length exceeds the width, the measurements being 98 by 93 mm. and 100 by 98.

Conception Bay, east coast of Lower California.

San Francisquito Bay, east coast of Lower California.

Two specimens.

Urechinus loveni (A. Agassiz)

Cystechinus loveni A. Agassiz, 1898, Bull. Mus. Comp. Zoöl., XXXII, p. 79.

Urechinus loveni Mortensen, 1907, 'Dan. Ingolf.-Exp., IV, Echinoidea,' pt. 2, p. 50.

There are two additional specimens of this odd and fragile sea-urchin from Station 5684. One is 78 mm. long, 57 mm. wide and 35 mm. high, while the other is 75 by 44 mm.

Schizaster townsendi A. Agassiz

Schizaster townsendi A. Agassiz, 1898, Bull. Mus. Comp. Zoöl., XXXII, p. 82.

Additional material from Station 5697 consists of eight more or less complete specimens, 40 to 50 mm. long, and fragments of others.

Brissopsis pacifica (A. Agassiz)

Toxobrissus pacificus A. Agassiz, 1898, Bull. Mus. Comp. Zoöl., XXXII, p. 83.

Brissopsis (Toxobrissus) pacifica Mortensen, 1907, 'Dan. Ingolf.-Exp., IV, Echinoidea,' pt. 2, p. 44.

There are 42 additional specimens, 10 to 30 mm. long, and many fragments, from Station 5675.

HOLOTHURIOIDEA

Molpadia musculus Risso

Molpadia musculus Risso, 1826, 'Hist. Nat. Princip. Product. Europe Mer.,' p. 293.

There is a single *Molpadia* from Station 5684, in fine condition, 80 mm. long by 25 mm. in diameter where largest, and with the caudal portion 13 mm. long. The color is pale gray and there are no phosphatic bodies. The calcareous particles seem to warrant referring it to this species, but it is certainly not a typical example.

Cucumaria abyssorum Théel

Cucumaria abyssorum Théel, 1886, 'Rep. Voy. 'Challenger,' Zool.,' XXXIX, p. 66.

There are two additional specimens from Station 5684 and five from 5691. They are well preserved and several show their ten tentacles. They are 50 to 95 mm. long and in the largest the genital papilla is conspicuous.

Psolus squamatus (O. F. Müller)

Holothuria squamata O. F. Müller, 1776, Proc. Zool. Dan., p. 232.

Psolus squamatus McAndrew and Barrett, 1857, Ann. Mag. Nat. Hist., (2) XX, p. 45.

There is another large *Psolus* at hand from Station 5695, measuring 80 mm. long by 55 mm. wide and 30 mm. high. It seems to me almost incredible that these specimens can really have been taken at a depth of 534 fms. and not show any differences to distinguish them from specimens taken in shallow water on the Norwegian coast. The species of *Psolus* are in need of critical revision and the Pacific coast material is not at present sufficient to make such a revision satisfactory.

Thyonepsolus nutriens H. L. Clark

Thyonepsolus nutriens H. L. Clark, 1901, Zool. Anz., XXIV, p. 168.

There is a small psolid at hand with only the unsatisfactory label "Gulf of California" to indicate whence it came. It is 12 mm. long by 6.5 mm. wide and about 4 mm. high. The calcareous deposits in the sole can be roughly grouped in three classes and are almost exactly like those of *Psolidium dorsipes* Ludwig. But the dorsal surface is quite unlike *Psolidium* and is exactly as described for *Thyonepsolus*, soft, thick, with no visible scales or plates, and very numerous pedicels not arranged in longitudinal series. The validity of *Thyonepsolus* has been questioned and some have relegated the genus to the synonymy of *Psolidium*, but

the examination of the present specimen confirms my belief that it is a recognizable, natural group. In one respect, however, this specimen from the Gulf of California is unlike those from Monterey, California, and that is in the deposits of the sole. It is probable, however, that my original description failed to recognize the diversity to be found in these desposits.

Benthodytes sanguinolenta Théel

Benthodytes sanguinolenta THÉEL, 1882, 'Rep. Voy. 'Challenger,' Zool.,' XIII, p. 104.

There are three fairly well preserved specimens of this deep sea holothurian, 125 to 175 mm. long, but they have with them no locality label. The 'Albatross' met with the species at four stations in depths exceeding one thousand fathoms.

Pseudostichopus mollis Théel

Pseudostichopus mollis THÉEL, 1886, 'Rep. Voy. 'Challenger,' Zool.,' XXXIX, p. 169.

There are three additional specimens from Station 5695. They are smooth, shiny white, and 110 to 150 mm. long.

Stichopus parvimensis H. L. Clark

Stichopus parvimensis H. L. CLARK, 1913, Bull. American Mus. Nat. Hist., XXXII, p. 234.

A young *Stichopus* only 40 mm. long seems to belong to this species. The dorsal papillæ have very dark tips.

Point San Bartolomé, west coast of Lower California. "Boat dredge."

Holothuria lubrica Selenka

Holothuria lubrica SELENKA, 1867, Zeitschr. f. w. Zool., XVII, p. 329.

The specimens listed in the earlier report bore no locality label, but of those now at hand only two lack such a label. The specimens run from 20 to 160 mm. in length, the last being a maximum for the species. It is interesting to note that the species occurs on both sides of Lower California as well as far up in the Gulf.

Angel de la Guardia Island, Gulf of California.

Pichilingue Bay, east coast of Lower California.

Santa Maria Bay, west coast of Lower California.

Eight specimens.

Holothuria monacaria (Lesson)

Holothuria (*Psolus* Oken) *monacaria* Lesson, 1830, 'Cent. Zool.,' p. 225.
Holothuria monacaria Jaeger, 1833, 'De Holoth.,' p. 24.

A small holothurian, 60 mm. long from Pichilingue Bay, east coast of Lower California, seems to represent this Indo-Pacific species, although it has not previously been recorded from the coast of America. A much smaller specimen, 15 mm. long, with no locality label other than "Lower California," is too young for certain identification, but may, for want of a better place, be referred to this species. I have little doubt however, that when the genus *Holothuria* is critically and carefully revised, the range of true *monacaria* will not include the western coast of America.