

Prof. Alex^r. Agassiz
with the Author's kind regards.

REPORT

ON

A COLLECTION OF ECHINODERMATA

FROM THE

SOUTH-WEST COAST OF IRELAND,

DREDGED IN 1888 BY A COMMITTEE APPOINTED
BY THE ROYAL IRISH ACADEMY.

(PLATES XXV. to XXIX.)

BY

W. PERCY SLADEN, F.L.S., F.G.S.,
Secretary of the Linnean Society.

A PAPER

Read before the ROYAL IRISH ACADEMY, June 23, 1890;

and

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LIII.

CORRIGENDA.

The Editor requests that the following Corrigenda will be made:—

Page 688, line 10, for 5, read 33.

„ 699, line 4, for *bellis* (Linck), Lyman, read *aculeata*
(O. F. Muller), Gray.

„ 703, lines 4 and 8 from below, for *bellis*, read *aculeata*.

For these mistakes the Editor is responsible.

June 6, 1891.

... locality, for it is not a little remarkable that so large a number of species of Echinoderms should have been taken from the comparatively limited number of eight stations. The majority (24 species) were dredged from depths of 345 and 750 fathoms, and are consequently important additions to our lists of the Fauna of the British Area.

I.—CRINOIDEA.

1. *Antedon rosacea* (Linck).

Locality—Long Island Sound. Depth 4 fathoms.

II.—ASTEROIDEA.

1. *Plutonaster bifrons* (Wyv. Thoms.), Sladen.

Locality—Lat. 51° 1' N.; Long. 11° 50' W. Depth 750 fathoms.

2. *Pontaster limbatus*, Sladen.

Locality—About 56 miles off Dursey Head. Depth 345 fathoms.

LIII.

REPORT ON A COLLECTION OF ECHINODERMATA FROM THE SOUTH-WEST COAST OF IRELAND, DREDGED IN 1888 BY A COMMITTEE APPOINTED BY THE ROYAL IRISH ACADEMY. BY W. PERCY SLADEN, F.L.S., F.G.S., Secretary of the Linnean Society. (Plates XXV. to XXIX.)

[Read JUNE 23, 1890.]

THE REV. W. S. GREEN kindly asked me to report upon the collection of Echinodermata obtained during the dredging cruise of 1888. The Committee were fortunate in obtaining an interesting series of forms. Forty species are enumerated in the following lists, viz. :—Crinoidea, 1 ; Asteroidea, 17 ; Ophiuroidea, 6 ; Echinoidea, 10 ; Holothuroidea, 6. Four of the species of Asterids and one of the Echinids are new. Several of the other forms are either rare or extend our knowledge of their geographical and bathymetrical distribution. The novelties consist of a new species of Hymenaster, a new species of Pteraster, two new species of Pentagonaster, and one new species of Porocidaris. The collection as a whole furnishes striking evidence of the richness of the locality, for it is not a little remarkable that so large a number of species of Echinoderms should have been taken from the comparatively limited number of eight stations. The majority (24 species) were dredged from depths of 345 and 750 fathoms, and are consequently important additions to our lists of the Fauna of the British Area.

I.—CRINOIDEA.

1. *Antedon rosacea* (Linck).

Locality—Long Island Sound. Depth 4 fathoms.

II.—ASTEROIDEA.

1. *Plutonaster bifrons* (Wyv. Thoms.), Sladen.

Locality—Lat. $51^{\circ} 1' N.$; Long. $11^{\circ} 50' W.$ Depth 750 fathoms.

2. *Pontaster limbatus*, Sladen.

Locality—About 56 miles off Dursey Head. Depth 345 fathoms.

3. *Astropecten irregularis*, Linck.
Depth 345 fathoms.
Depth 24 fathoms.
Depth 50 fathoms.
4. *Psilaster Andromeda* (Müller & Troschel), Sladen.
? locality.
5. *Luidia ciliaris* (Philippi), Gray.
Depth 52 fathoms.
6. *Luidia Sarsii*, Düben & Koren.
Depth 5 fathoms.
7. *Pentagonaster balteatus*, n. sp. (Plate xxv., figs. 1-5.)
Rays five. $R = 22$ mm.; $r = 13$ mm.; $R = 1.69 r$. The
minor radius is thus in the proportion of 59 per cent.

General form flat and moderately thick. Marginal contour pentagonoid with lunate sides, having the radial angles slightly produced, and obtusely rounded at the extremity. Interbrachial arcs forming a wide, regularly sweeping curve. Margins rather thick and almost equally rounded actinally and abactinally. Abactinal area slightly inflated in the central and radial regions, and slightly depressed in the interradial areas near the margin. Actinal area subplane, with slight depressions in the interradial areas.

The abactinal area is covered with rather large hexagonal plates, those in the median radial line being larger than the others, excepting only the basal plates, and two or three adjacent plates in the interradial areas, which are subequal to the largest in the median radial series. All the plates diminish in size as they approach the margin. The abactinal plates do not quite reach the extremity of the ray in consequence of the junction of the penultimate and antepenultimate supero-marginal plates of the two sides of the ray in the median radial line. The surface of the plates is covered with large, low, uniform hemispherical granules, which are not crowded so as to actually touch, or at any rate modify the form of the separate granules. The tabulum is surrounded by a single series of similarly low granules, the outer edge of which is sharply cut in conformity with the contour of the hexagon, as if the latter had been "dressed" with a knife. The abactinal surface of the tabula in the radial regions is slightly convex. Occasional plates (but very few) bear a single small excavate pedicellaria, with two short spatulate jaws.

The supero-marginal plates, which are eight in number, counting from the median interradiial line to the extremity, form a broad and conspicuous border to the abactinal area, the breadth of which at the median interradiial line is about 3.75 mm.; and it diminishes very slightly towards the extremity of the rays. The plates near the interradiial line have their breadth fully twice their length. The length of the plates is equal up to the fifth and then diminishes, the breadth being greatly in excess throughout. The ultimate plate is very small and wedge-shaped, with the apex directed towards the median radial line. The surface of the plates, which is slightly convex in the transverse direction, is entirely covered with rather large, low, uniform, flatly hemispherical granules which, though closely placed, are not so crowded as to modify the form of the granules. The odd terminal plate, though very small, is larger than the ultimate supero-marginal plate; it is shield-shaped or subcordiform, with the apex adcentral, and thickened and turned abactinally towards the outer margin.

The infero-marginal plates, which are nine in number, counting from the median interradiial line to the extremity, correspond to the superior series for two or three plates on each side of the median interradiial line, but alternate with them along the outer part of the ray. The breadth is about twice the length at the median interradiial line, but diminishes gradually up to the antepenultimate plate, where the proportions are subequal. The infero-marginal plates are covered with granules similar to those on the superior series. I have not detected the presence of pedicellariæ on either series of marginal plates.

The adambulacral plates are rather broader than long. Their armature consists of a marginal series of six, rather short, obtusely pointed or rounded spinelets, which are flattened transversely, and with a tendency to become prismatic; the adoral spinelet being much shorter than the others, and placed further back on the plate. The marginal series is followed by a second regular series of three short, robust, prismatic, pointed papilliform spinelets; and the outer part of the plate is occupied by three series of three uniform papilliform granules. These granules are usually regularly placed as above described, but occasionally a little irregularity occurs. They are intermediate in size between the very short papilliform spinelets of the second series, which are little more than elongated granules, and the true granules of the actinal intermediate plates. Near the outer extremity of the furrow one of the papilliform spinelets of the second series becomes very large and robust. I have found no pedicellariæ on the adambulacral plates.

The mouth-plates are elongate and triangular, but not conspicuous. Their armature consists of a marginal series of nine or ten short, equal spinelets, similar to those in the furrow series on the adambulacral plates, but with a tendency to become more distinctly prismatic as they proceed inward; a series of six to eight large, low, coarse and distinctly prismatic granules, forming a longitudinal series on the actinal surface of the plate parallel to the suture which unites the two mouth-plates of an angle; and an intermediate series between these two series of about three similar prismatic granules.

The actinal interradial areas are paved with rather large sub-rhomboid intermediate plates, arranged in series parallel to the ambulacral furrows. The surface of the plates is covered with rather large, low, uniform, distinctly-spaced, hemispherical granules, which are arranged in straight series along the margins of the plates, but show no definite order within this boundary.

The anal orifice is sub-central, and on the right posterior side of a plate larger than those in the immediate neighbourhood.

The madreporiform body, which is small and polygonal in outline, is situated at about one-third of the distance between the centre and the margin. The surface is marked with rather coarse irregular convolutions. On its adcentral side is a single large basal plate, larger than the madreporite itself; and a similar large basal plate is present in each of the other interradial areas in a corresponding position, and larger than any of the other abactinal plates.

Colour in alcohol, a bleached yellowish white.

Locality.—Lat. $51^{\circ} 1' N.$; Long. $11^{\circ} 50' W.$ Depth 750 fathoms.

Remarks.—This species has more distinctly lunate sides, and more obtusely-rounded radial angles than *Pentagonaster granularis*, Retz., sp., to which at first sight it presents some resemblance. It is at once distinguished, however, by the great width of the marginal plates, which are much broader than long, by the complete granulation of the marginal plates, by the armature of the adambulacral plates, which has more spines in the furrow series, and a greater number of series on the actinal surface of the plate. Pedicellariæ are also more numerous and more distinctly entrenched.

8. *Pentagonaster concinnus*, n. sp. (Plate xxvi., figs. 1-5.)

Rays five. $R = 22$ mm.; $r = 12$ mm.; $R = 1.83 r$. The minor radius is thus in the proportion of 54.5 per cent.

General form flat, and rather thin. Marginal contour a deeply

lunate pentagonoid or stellato-pentagonal, with the radial angles produced, and tapering to an acute extremity; interbrachial arcs regularly rounded, the curve being that of a part of a circle. Margins rather thin, bevelled abactinally, more abruptly rounded actinally. Abactinal area capable of slight inflation. Actinal area plane.

The abactinal area is covered with small subcircular plates, closely placed, only the three medio-radial series of plates being separated by papulæ. The abactinal plates do not extend to the tip of the ray, the three supero-marginal plates preceding the ultimate, uniting with the corresponding plates on the other side of the ray in the median radial line. The margin of the tabulum is surrounded by a series of small, rather broad granules, moderately spaced, and the surface of the tabulum is covered with a small, uniform, well spaced, hyaline granulation. I have not detected the presence of pedicellariæ upon any of these plates.

The supero-marginal plates, which are eight in number, counting from the median interradial line to the extremity, form a well-defined border to the abactinal area, of uniform breadth throughout. The plates near the interradial line have their length rather greater than their breadth, but these proportions gradually become equalized, when the fourth or fifth plate from the median interradial line is reached; and the antipenultimate and penultimate plates have the breadth slightly greater than the length. The ultimate plate is small and wedge-shaped, with the apex directed towards the median radial line. The abactinal surface of the supero-marginal plates is slightly convex, which causes each plate to be distinctly defined. A few small uniform hemispherical granules are present on the lateral wall of the plate, which rub off with the slightest touch. Whether the whole surface of the plate was during life covered with similar granules I am unable to say, but I am inclined to think that such was not the case. A few large, isolated, irregularly placed pits are present on the surface of the plate, more numerous near the junction of the abactinal and lateral areas. A series of small granules surrounds the margin of the plate. The odd terminal plate is conical and larger than the ultimate supero-marginal plates; it bears at the apex a robust, obtuse, short, papilliform spine.

The infero-marginal plates are eight in number, counting from the median interradial line to the extremity. The three plates on each side of the median interradial line have the length subequal to the breadth, but in all the succeeding plates the length is greater than

the breadth. The ultimate plate is small and corresponds with the ultimate supero-marginal plate. The infero-marginal plates bear precisely similar granules to those on the superior series, their presence now being similarly confined to the lateral area, and the single series surrounding the margin. On the naked portion of the actinal surface of the plate large isolated pits occur, and occasionally a granule is present therein. I have detected no pedicellariæ on either series of marginal plates.

The adambulacral plates are slightly longer than broad, and their armature consists of three regular series; the first or furrow series being true spinelets, whilst the second and third, which are on the actinal surface of the plate, are only granules. In the furrow series are five or six short obtuse cylindrical spinelets which are directed over the furrow, the adoral spinelet of the series being often placed further back on the plate than the others, and it is sometimes also much smaller. The second and third series consist of a longitudinal row of four or five granules, the outer series being similar to the granules on the actinal intermediate plates, and the second series only slightly more elongate or papilliform. I have found no pedicellariæ on the adambulacral plates, in fact nowhere on this example at all.

The mouth-plates are small, but fairly conspicuous. Their armature consists of a marginal series on each plate of eight spinelets similar to the marginal or furrow series on the adambulacral plates, the innermost spinelet being rather larger than the others, and subprismatic. On the actinal surface of the plate is a longitudinal series of eight granules parallel to the suture which unites the two mouth-plates of an angle; a series of four granules parallel to the margin adjacent to the adambulacral plates; and an intermediate series, also of four granules, traversing the surface of the plate between these two series. The granules in each of these series become slightly more papilliform as they approach the free margin.

The actinal interradial areas are paved with small, normally rhomboid but occasionally polygonal, intermediate plates. They are arranged in series parallel to the ambulacral furrow. The plates of the series adjacent to the adambulacral plates are slightly larger than the others, and this series, which is the longest, does not extend beyond the third infero-marginal plate, counting from the median interradial line. The surface of the plates is covered with small, low, uniform granules, which are well spaced, and exhibit no arrangement excepting the series which marks out the margin.

The anal orifice is slightly excentric, and is surrounded by

several rather larger plates than those in the central region generally.

The madreporiform body, which is small and suboval in form, is situated nearer the centre by about its own diameter than midway between that point and the margin. Its surface is marked with rather coarse irregularly convoluted striations. On its adcentral side is a single large basal plate larger than the madreporite itself, and a similar large basal plate is present in each of the other interradial areas, in a corresponding position, and larger than any of the other abactinal plates.

After the foregoing description was written, and the drawings to illustrate it had been made on stone, I found a larger example of the species at the bottom of a tin, which had unfortunately escaped my notice previously. This specimen measures $R = 54$ mm. ; $r = 31$ mm. There are eleven supero-marginal plates, counting from the median interradial line to the extremity, exclusive of the odd terminal plate. Four plates preceding the ultimate unite with the corresponding plates on the other side of the ray in the median radial line. A greater number of longitudinal series of abactinal plates in the radial areas are separated by papulæ; and small foraminate pedicellariæ are occasionally present on the abactinal plates. In the armature of the adambulacral plates there are usually six spinelets in the furrow series, followed by five and six in the second and third series, the second series being subpapilliform.

The actinal surface of the infero-marginal plates is covered with widely-spaced pits, upon which granules are borne. The widely-spaced granulation imparts a peculiar character to the ornamentation of these plates. The actinal intermediate plates are very large in relation to the size of the plates on the abactinal surface. In other respects this example accords with the description above given, excepting the slight modifications dependent on larger size.

Colour in alcohol, a bleached yellowish white, with a slight brownish shade.

Locality.—Lat. $51^{\circ} 1' N.$; Long. $11^{\circ} 50' W.$ Depth 750 fathoms.

Remarks.—This species is allied to *Pentagonaster granularis*, Retz., sp., but is distinguished by the more pointed rays, by the union of the supero-marginal plates in the median radial line at the extremity of the ray, by the ornamentation of the marginal plates, by the character of the abactinal plates, and by the armature of the adambulacral plates.

9. *Nymphaster protentus*, Sladen.

? Locality.

A single example measuring $R = 101$ mm., $r = 28$ mm. There are occasional small pedicellariæ on the marginal plates, but no spiniform granules whatever are present. The occasional presence of small spiniform granules on the marginal plates of large specimens of this species from the S.W. Coast of Ireland has been noted by Professor Jeffrey Bell¹ in examples dredged by the Rev. W. Spotswood Green, and by myself² in an example dredged by Mr. G. C. Bourne. Mr. Bourne³ has given expression to the opinion of Canon Norman, that *Nymphaster protentus* is, in its younger condition, indistinguishable from *Pentagonaster subspinosus* of the "Blake" expedition described by Perrier in 1884. Mr. Bourne⁴ has accordingly cited the specimens dredged by him under the name of *Nymphaster subspinosus*. The smallest examples of *Nymphaster protentus* which I have examined do not, however, support that view, and the character of the series of specimens in various stages of growth, which I have examined, appear to me to strengthen the opinion that the species are distinct.

10. *Zoroaster fulgens*, Wyville Thomson.

Locality—Lat. $51^{\circ} 1' N.$; Long. $11^{\circ} 50' W.$ Depth 750 fathoms.

11. *Stichaster roseus* (O. F. Muller), Sars.

Depths 50–52 fathoms.

12. *Neomorphaster eustichus*, Sladen.

Locality—Lat. $51^{\circ} 1' N.$; Long. $11^{\circ} 50' W.$ Depth 750 fathoms.

13. *Pteraster personatus*, n. sp. (Plate xxvii., figs. 1–5.)

Marginal contour substellate; interbrachial arcs well indented and somewhat angular; the minor radial proportion being about 35 per cent. $R = 70$ mm. (approximately); $r = 25$ mm.

Rays very broad at the base and tapering to a fine extremity, which is sharply recurved; general form depressed; abactinal surface convex over the disk, and bevelled gradually to the margin; lateral fringe not conspicuous, or perhaps only on the inner part of the interbrachial arc.

¹ "Ann. and Mag. Nat. Hist.," ser. 6, vol. iv., p. 435, 1889.

² "Journ. Marine Biol. Assoc." (N.S.), vol. i., p. 327, 1890.

³ *Ibid.*, p. 327.

⁴ *Ibid.*, pp. 307, 308.

The supradorsal membrane is rather thin and very fibrous, the fibres in the tissue being very fine, numerous, and closely interlacing. The paxillæ are numerous and closely placed, having crowns of three or four (or more) long, thin, needle-like spinelets, articulated on a long pedicle. In the central region of the disk more spinelets may be present. The spinelets have the appearance of being very protuberant, the membrane hanging closely for a considerable distance from the tip, which gives a very spinose character to the abactinal surface. No regularity in the arrangement of the paxillæ is superficially discernible. The membrane is semi-transparent, except when old and thick. The spiracula are small, irregular in position, and few in number. The oscular orifice, though moderately large, is inconspicuous; the spinelets of the valves are numerous, long, and much crowded.

The ambulacral furrows are broad, slightly petaloid, and taper towards the extremity. The tube-feet are very large, with a large, puffy, centrally-invaginated terminal disk. The armature of the adambulacral plates consists of a comb of five spinelets. The innermost spine is the smallest, measuring from 1.75 to 2 mm. in length, and is placed at the aboral end of the plate, and the outermost spine is the longest, being between 5 and 6 mm. long. The comb forms a regular semicircular curve, passing from the aboral end of the furrow margin of the plate to the outer margin of its actinal surface, the comb, which traverses the actinal surface of the plate, being curved round aborally at the margin of the furrow. All the spinelets are united by web, which is delicate, semi-transparent, and deeply indented between the spinelets; and it falls almost perpendicularly from the outermost spine of the comb, and does not extend far out upon the actino-lateral spines.

The segmental apertures are moderately large. The aperture-papilla is thick and rather jawbone-shaped, and is free on the aboral side only, forming a slightly angulated lip.

The mouth-plates are of moderate size, and, though rather short, are widely expanded laterally. The keel along the median line of junction is high and broad, and prominent aborally. Each plate bears an armature of five mouth-spines, which form a webbed comb situated entirely on the horizontal margin of the plates; the innermost spine is the longest, measuring between 5 and 6 mm. in length, the outermost two very small, the last being about 1.5 mm. in length. The series of spines on each plate are united by web, but the two combs of a mouth angle are separate and independent. No secondary or superficial spines are present on the actinal surface of the plates.

The first or most adoral transverse comb of the adambulacral plates of two neighbouring rays are closely approximated at their attachment to the actinal membrane behind the aboral peak of the mouth-plates, but they are not joined together.

The actino-lateral spines are long, rather delicate, and closely placed, and extend to the margin of the actinal surface. The spines are horizontal in their disposition, forming a flat actinal surface to the disk; and the fringe appears to extend very slightly beyond the margin. The longest spine, which measures 11 mm. or a little more, is the seventh or eighth, counting from the mouth-plates; and those on the outer part of the ray are very small.

Colour in alcohol, a dirty ashy grey, with a slightly purplish tinge on the actinal surface.

Locality.—Lat. $51^{\circ} 1' N.$, Long. $11^{\circ} 50' W.$ Depth 750 fathoms.

Remarks.—This species presents in a very striking manner the facies of a *Hymenaster*, and appears in many respects to hold an intermediate position between that genus and *Pteraster*. It may readily be distinguished from other forms by the disposition of the actino-lateral spines, by the character of the armature of the adambulacral plates, and by the absence of secondary or superficial spines on the actinal surface of the mouth-plates.

14. *Hymenaster giganteus*, n. sp. (Plate XXVIII., figs. 1-3.)

Marginal contour pentagonal, the indentation of the interbrachial arcs being slight, and more or less masked by an irregular and excrescent growth of the web. Rays slightly produced and recurved. The minor radius is in the proportion of from 64 to 68 per cent. $R = 160$ mm., $r = 102$ mm. These measurements are, however, only approximate, and are taken on the actinal surface, where there is much distortion and inflation. The general form of the example described is more or less distorted by inflation. On the abactinal surface the radial areas are well marked out, distinct from the fringe and inter-radial membrane, and have the appearance of being elevated above the general surface as viewed from above superficially. The lateral web is largely developed, thick, full, and in consequence somewhat irregular.

The supradorsal membrane, which is thick and opaque, is furnished with very numerous clearly-defined muscular fibres, which radiate from the tips of the spinelets and pass to those standing in close proximity around, the bands crossing at various angles, overlying and underlying one another, and forming a thick interlacing and irregularly reticulated

tissue. The spiracula, which are small, are moderately numerous, and usually isolated, that is to say, one only in a mesh. The paxillæ appear to have normally three spinelets, which are aggregated close together, so as to form a crown of small expansion. The paxillæ are widely and equidistantly spaced, and a more or less distinctly longitudinal arrangement may be observed. The tips of the spinelets protrude prominently, and the muscular fibres are not tightly stretched, but hang like slackened ropes round a tent-pole, the tips of the spinelets appearing in consequence like conical prickles upon the abactinal surface, those on the central half of the disk being especially long and prominent.

The oscular orifice is very large and conspicuous; the valves are formed of large robust spinelets, the longest measuring about 16 mm.; and all are united by a thick fleshy web, which gives a tubular character to the structure when the spinelets of the valves are erect.

The ambulacral furrows are very wide throughout, and are only slightly constricted until quite near the extremity. The armature of the adambulacral plates consists of two rather short, conical, tapering spinelets, about 3.5 mm. in length, and robust at the base, covered with membrane which forms a full, wide, terminal sacculus, extending for a distance greater than the length of the spine beyond the tip. Both spines are placed on the furrow margin of the plate, and radiate slightly apart. The aperture-papillæ are large, and have a wide and elongate sacculus, which gives them the appearance of an elongate, uniformly broad flap with obtusely-rounded extremities.

The mouth-plates are large and conspicuous; widely expanded laterally, the keel along the junction being high and abrupt and prominently produced aborally, and with a small abrupt peak adorally. Each plate bears a robust secondary or superficial spine on the side of the keel about one-third of the distance from the adoral to the aboral extremity of the plate, and a second similar spine stands near the adoral margin. The mouth-spines proper are three in number, short, robust, and conical, placed on the margin of the lateral flange of the plate.

The actino-lateral spines are long, robust, and widely-spaced, tending to meet the corresponding spines of the adjacent ray in the median interradial line, where there is much thickening and excrescent growth near the margin.

Colour in alcohol a dirty, yellowish, ashy-grey, with purplish traces on the actinal surface.

Mr. W. F. de V. Kane, who made a number of admirable drawings

on board ship during the cruise, which he has kindly sent for my inspection, informs me that the actinal surface of this starfish (of which he made a sketch) was of a deep blood-red colour before the specimen was placed in alcohol.

Locality.—Lat. $51^{\circ} 1' N.$, Long. $11^{\circ} 50' W.$ Depth 750 fathoms.

Remarks.—This species is unlike any of the other Atlantic forms described. It resembles *Hymenaster pellucidus*, Wyville Thomson, in the formula of the adambulacral armature, but is at once distinguished by its large size and coarse habit, as well as by the whole character of the abactinal surface. In the last-mentioned aspect *Hymenaster giganteus* is perhaps more nearly related to *Hymenaster glaucus*, Sladen, from South of Omae Saki, off Japan, than to any other species, but it is distinguished by the general form and habit, by the character of the supradorsal membrane, by the character of the adambulacral armature, and by the armature of the mouth-plates. *Hymenaster giganteus* is distinguished from *Hymenaster membranaceus*, Wyv. Thomson, by the difference of the supradorsal membrane, of the armature of the adambulacral plates and mouth plates.

15. *Cribrella oculata*, var. *abyssicola*, Norman.

Locality.—As last. Depth 750 fathoms.

16. *Asterias rubens*, Linné.

Locality.—Long Island Sound. Depth 4 fathoms.

17. *Brisinga coronata*, Sars.

Locality.—About 56 miles off Dursey Head. Depth 345 fathoms.

III.—OPHIUROIDEA.

1. *Ophioglypha lacertosa* (Linck), Lyman.

Locality.—Long Island Sound. Depth 4 and 5 fathoms.

2. *Ophioglypha albida* (Forbes), Lyman.

Depth 6 fathoms.

3. *Ophioglypha signata*, Verrill.

Locality.—About 56 miles off Dursey Head. Depth 345 fathoms.

A young example, which approaches very closely indeed in character to *Ophioglypha affinis* (Lütken), Lyman. The form of the mouth-shields in this specimen resembles that of *O. affinis* much more

closely than that of the figure given by Mr. W. E. Hoyle¹ of *O. signata*; and the uppermost arm-spine is not so long as described by Verrill, it being scarcely longer than the middle one.

4. *Ophiopholis bellis* (Linek), ~~Lyman~~ *aculeata* (O. F. Müller) Gray.
Depth 50 and 54 fathoms.
5. *Ophiothrix fragilis* (O. F. Müller), Müller & Troschel).
Depth 5 and 50 fathoms.
6. *Ophiobursa hystericis*, Lyman. (?)

Locality.—About 56 miles off Dursey Head. Depth 345 fathoms. Fragments of rays only, in bad state of preservation.

IV.—ECHINOIDEA.

1. *Dorocidaris papillata* (Leske), A. Agassiz.

Locality.—About 56 miles off Dursey Head. Depth 345 fathoms.

2. *Porocidaris gracilis*, n. sp. (Plate XXIX., figs. 1-5.)

Form circular, sub-globular, depressed, the height when measured from the summit of the convex apical system is nearly three-fourths of the breadth, or in the proportion of 72 per cent., the greatest diameter being 18 mm., and the height 13 mm. The test is depressed on the abactinal surface, moderately inflated at the ambitus, and gradually contracted below that line.

Ambulacra straight and very narrow, the breadth being slightly less than one-fourth the breadth of the interambulacral area at the widest part. Poriferous zones only slightly sunken; pores very small, in simple pairs, conjugate; the pairs placed obliquely, the inner pores being the lowest; and there are five pairs of pores opposite one of the largest interambulacral plates. The interporiferous area has a breadth of exactly one-half the width of the whole ambulacral area, and is furnished with two rows of small mammillated miliary tubercles, that is to say, one tubercle to each plate, which occupies the whole space between the poriferous zone and the median suture, and no granules are present.

¹ "Proc. Roy. Soc. Edin.," vol. xii., pl. vii., fig. 6.

The interambulacral areas are rather more than four times the width of the ambulacra at their widest part, measuring 8.4 mm., the breadth of the ambulacra being 2 mm. There are two rows of seven and six primary tubercles respectively in each interambulacrum. The primary tubercles are of comparatively small elevation, perforate, and more or less distinctly crenulate on the abactinal side; those near the apex being strongly crenulate; and their mamelons are comparatively large, and almost hemispherical. The scrobicules are wide and transversely oval; the scrobicular ring is incomplete in consequence of confluence with the adjacent scrobicules actinally and abactinally. There are from six to eight small mammillated miliary tubercles on each side, with an occasional small irregularly placed miliary granule here and there, but no other tubercles or granules are present on the plate, and consequently no miliary zone. In a favourable light, traces of faint radiating channels may be detected traversing the scrobicular area on the actinal side of the largest plates. The peristome is subpentagonal, 7.25 mm. in diameter, being about two-fifths of the diameter of the test, or 40 per cent. The buccal membrane is covered with imbricating scales.

The apical system is large, measuring 8.5 mm. in diameter, or in the proportion of 47 per cent. of the diameter of the test. The genital plates are large and broadly shield-shaped. They are united by a rather broad contact, by which means all the ocular plates are shut out from entering the ring. The ocular plates are much smaller than the genital plates, and subpentagonal in shape, and their puncture is near the outer margin. I have not detected a puncture in any of the genital plates. There is, however, a well-defined round aperture amongst the periproctal plates, between the anal orifice, and one of the genital plates. The apical system as a whole is high and convex.

The primary radioles are long and slender, cylindrical and tapering slightly; the longest measures 48.5 mm. in length, and a little less than 2 mm. in diameter. They are finely striated longitudinally, the ridges being very slightly prominent, and marked with very faint and indistinct serrations. There is a short collar above the milled rim, 4 mm. in length, very finely and regularly striated, of a rich chocolate colour, in striking contrast to the ashy-white colour of the rest of the spine. The articulatory rim of the radioles above the ambitus is often strongly crenulate on one side in correspondence with the crenulated tubercle.

The colour of the test in alcohol is of a rich purplish-brown or chocolate colour.

Locality.—Lat. $51^{\circ} 1' N.$, Long. $11^{\circ} 50' W.$ Depth 750 fathoms.

Remarks.—Although this example is probably immature, I feel no hesitation in placing it in the genus *Porocidaris*; it is at once characterized by the strongly crenulated primary tubercles above the ambitus, and by the transversely oval, confluent scrobicules. It is distinguished from the previously described species by the narrow poriferous zones by the small number of the miliary or secondary tubercles on the ambulacral and interambulacral plates, and by the character of the primary radioles. Unfortunately, all the spines have been abraded from the actinal region of the test below the ambitus, and I am not able to say whether any of the peculiarly-toothed, flattened spinelets observed in other forms of *Porocidaris* were present in this species. None of the basal plates are punctured in this example, and I am unable to say, without dissection, whether the aperture amongst the periproctal plates between the anus and the ring of basal plates is in relation to the generative system. I am inclined to think it probable.

3. *Phormosoma placenta*, Wyville Thomson.

Locality.—As last. Depth 750 fathoms.

4. *Phormosoma uranus*, Wyville Thomson.

Locality.—As last. Depth 750 fathoms.

A single fine example which appears to me to accord closely with the figures given by Sir Wyville Thompson,¹ as well as with his remarks, and with those of Professor Alexander Agassiz,² upon the species. I have, however, never seen the type.

5. *Echinus microstoma*, Wyville Thomson.

Locality.—About 56 miles off Dursey Head. Depth 345 fathoms.

6. *Echinus norvegicus*, Düben & Koren.

Localities.—About 56 miles off Dursey Head. Depth 345 fathoms. Lat. $51^{\circ} 1' N.$, Long. $11^{\circ} 50' W.$ Depth 750 fathoms.

7. *Psammechinus miliaris* (Müller), Agassiz.

Depth 5 fathoms.

¹ "Voyage of the Challenger, the Atlantic," vol. i., pp. 146-149, figs. 33, 34.

² Zool. Chall. Exp., part ix., Report on Echinoidea, p. 103; Report on "Blake" Echini, Mem. Mus. Comp. Zool. Harvard, vol. x., pp. 35, 36.

8. *Spatangus purpureus*, O. F. Müller.
Depth 54 fathoms. ? locality.
9. *Spatangus Raschi*, Lovén.
Locality.—Off Dursey Head. Depth 345 fathoms.
10. *Brissopsis lyrifera* (Forbes), Agassiz.
Depth 5 fathoms.
Depth 54 fathoms.

V.—HOLOTHUROIDEA.

1. *Holothuria intestinalis*, Ascanius & Rathke.
Locality.—Lat. $51^{\circ} 1' N.$, Long. $11^{\circ} 50' W.$ Depth 750 fathoms.
2. *Holothuria tremula*, Gunner.
About 56 miles off Dursey Head. Depth 345 fathoms.
3. *Stichopus natans*, Sars.
Locality.—Lat. $51^{\circ} 1' N.$, Long. $11^{\circ} 50' W.$ Depth 750 fathoms.
4. *Cucumaria hyndmanni* (Thompson), Forbes.
Locality.—About 56 miles off Dursey Head. Depth 345 fathoms. A single young example, 14 mm. in length.
5. *Thyonidium pellucidum* (Fleming), Düben & Koren.
Depth 50 fathoms.
6. *Lætmogone violacea*, Théel.
Locality.—Lat. $51^{\circ} 1' N.$, Long. $11^{\circ} 50' W.$ Depth 750 fathoms.

LIST OF DREDGING STATIONS.

The following lists will show at a glance the association of the species at each of the stations (unfortunately the exact localities of several of these have been mislaid):—

1. Long Island Sound. Depth 4 fathoms.
Antedon rosacea. *Ophioglypha lacertosa.*
Asterias rubens.
2. Log 2. Depth 33 fathoms.
Luidia sarsii.

3. Log 67. About 56 miles off Dursey Head. Depth 345 fathoms.

<i>Pontaster limbatus.</i>	<i>Echinus microstoma.</i>
<i>Astropecten irregularis.</i>	<i>Echinus norvegicus.</i>
<i>Brisinga coronata.</i>	<i>Spatangus raschi.</i>
<i>Ophioglypha signata.</i>	<i>Holothuria tremula.</i>
<i>Ophiobursa hystericis</i> (?).	<i>Cucumaria hyndmanni.</i>
<i>Dorocidaris papillata.</i>	

4. Log 69. Lat. 51° 1' N., Long. 11° 50' W. Depth 750 fathoms.

<i>Plutonaster bifrons.</i>	<i>Porocidaris gracilis.</i>
<i>Pentagonaster balteatus.</i>	<i>Phormosoma placenta.</i>
<i>Pentagonaster concinnus.</i>	<i>Phormosoma uranus.</i>
<i>Zoroaster fulgens.</i>	<i>Echinus norvegicus.</i>
<i>Neomorphaster eustichus.</i>	<i>Holothuria intestinalis.</i>
<i>Pteraster personatus.</i>	<i>Stichopus natans.</i>
<i>Hymenaster giganteus.</i>	<i>Lætmogone violacea.</i>
<i>Cribrella oculata</i> , var. <i>abyssicola.</i>	

5. Log 70. Depth 5 fathoms.

<i>Ophioglypha lacertosa.</i>	<i>Psammechinus miliaris.</i>
<i>Ophioglypha albida.</i>	<i>Brissopsis lyrifera.</i>
<i>Ophiothrix fragilis.</i>	

6. Log 71. Depth 24 fathoms.

Astropecten irregularis.

7. Log 72. Depth 54 fathoms.

<i>Astropecten irregularis.</i>	<i>Spatangus purpureus.</i>
<i>Stichaster roseus.</i>	<i>Brissopsis lyrifera.</i>
<i>Ophiopholis bellis</i> bellis <i>aculeata.</i>	

8. Log 73. Depth 50 fathoms.

<i>Luidia ciliaris.</i>	<i>Ophiothrix fragilis.</i>
<i>Stichaster roseus.</i>	<i>Thyonidium pellucidum.</i>
<i>Ophiopholis bellis</i> bellis <i>aculeata.</i>	

9. Localities not recorded.

<i>Psilaster andromeda.</i>	<i>Spatangus purpureus.</i>
<i>Nymphaster protentus.</i>	

DESCRIPTION OF THE PLATES.

PLATE XXV.

- Fig. 1. *Pentagonaster balteatus*, Sladen. Abactinal aspect; natural size.
2. Abactinal aspect of a ray; magnified 3 diameters.
 3. Actinal aspect of a ray; magnified 3 diameters.
 4. A portion of the abactinal surface; magnified 15 diameters.
 5. Adambulacral plates and adjacent portion of the actinal surface; magnified 27 diameters.

PLATE XXVI.

- Fig. 1. *Pentagonaster concinnus*, Sladen. Abactinal aspect; natural size.
2. Abactinal aspect of a ray; magnified 3 diameters.
 3. Actinal aspect of a ray; magnified 3 diameters.
 4. A portion of the abactinal surface; magnified 25 diameters.
 5. Adambulacral plates and adjacent portion of the actinal surface; magnified 18 diameters.

PLATE XXVII.

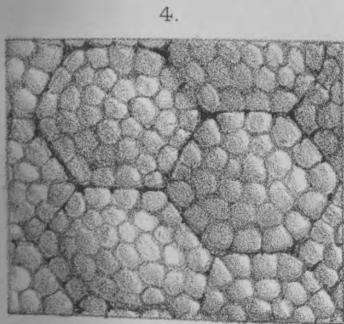
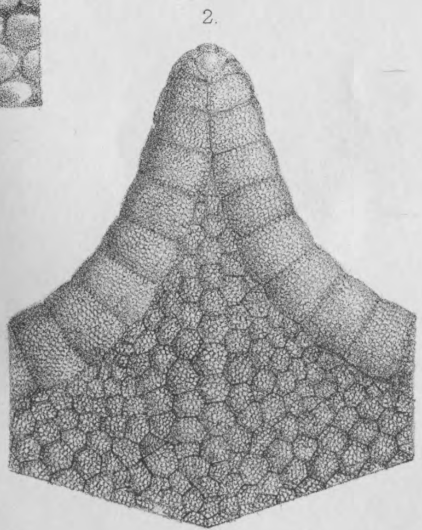
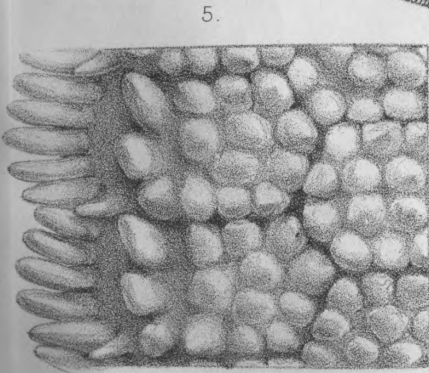
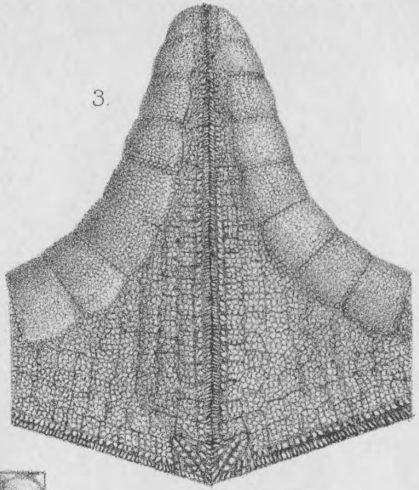
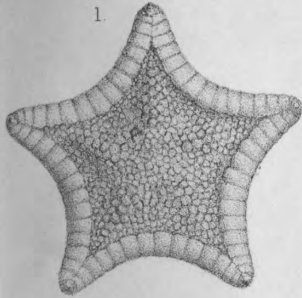
- Fig. 1. *Pteraster personatus*, Sladen. Abactinal aspect, natural size.
2. Actinal aspect; natural size.
 3. A portion of the supradorsal membrane; magnified 6 diameters.
 4. Adambulacral plates and adjacent portion of the actinal surface; magnified 7 diameters.
 5. Mouth-plates; magnified 5 diameters.

PLATE XXVIII.

- Fig. 1. *Hymenaster giganteus*, Sladen. Abactinal aspect; natural size.
2. A portion of the supradorsal membrane; magnified 5 diameters.
 3. Adambulacral plates and adjacent portion of the actinal surface; magnified 4 diameters.

PLATE XXIX.

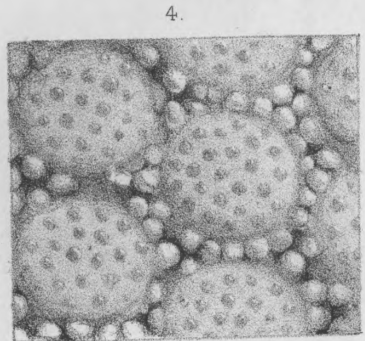
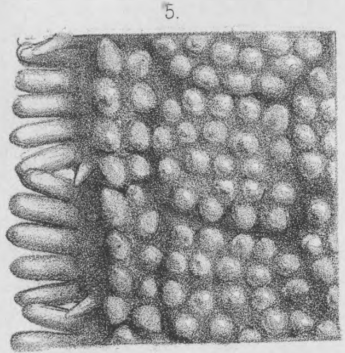
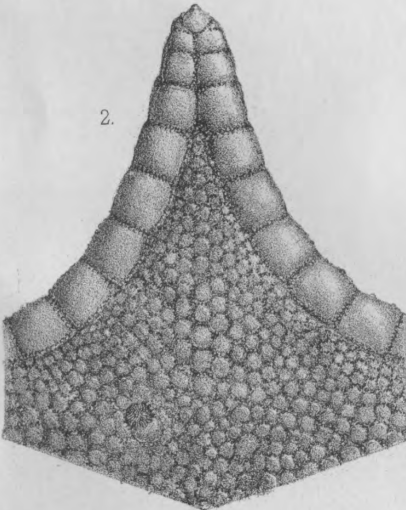
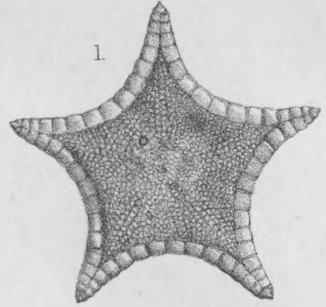
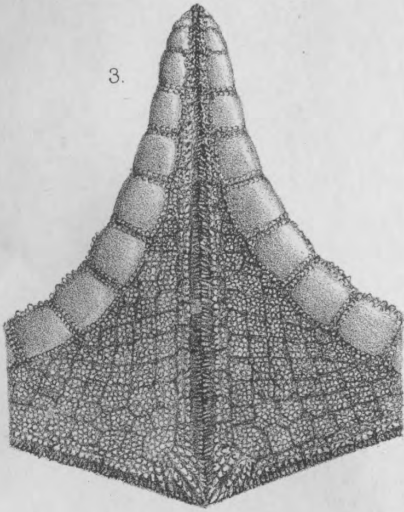
- Fig. 1. *Porocidaris gracilis*, Sladen. Profile view; natural size.
2. Actinal aspect; natural size.
 3. A portion of the test near the ambitus; magnified 5 diameters.
 4. A portion of a primary radiole; magnified 12 diameters.
 5. Apical system; magnified 3 diameters.



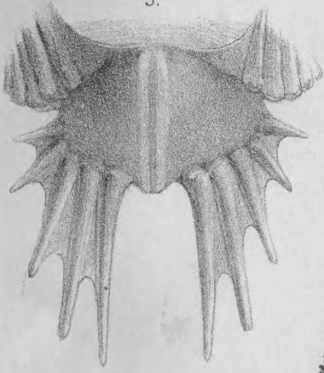
F.H. Michael del et lith.

West, Newman, imp.

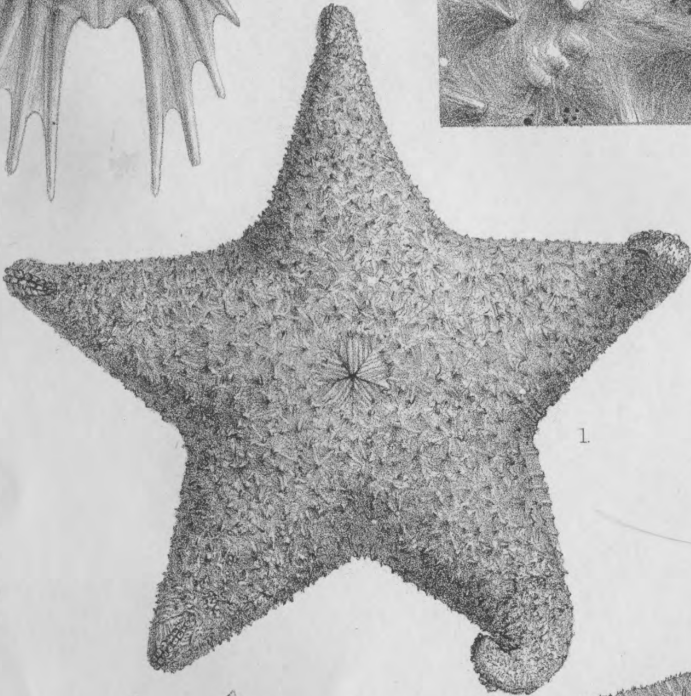
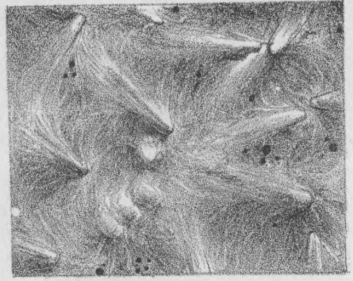
PENTAGONASTER BALTEATUS, *Sladen.*



5.

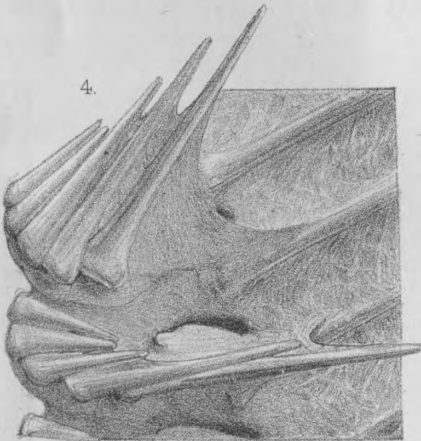


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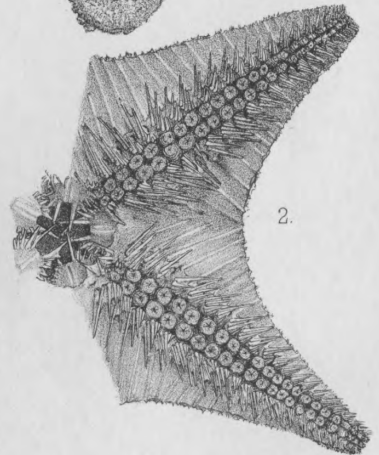


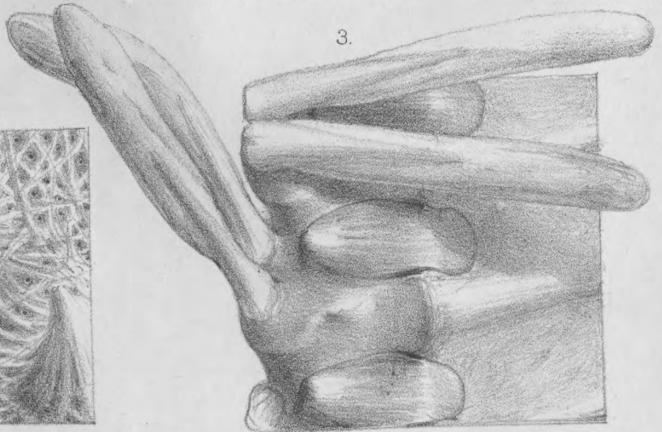
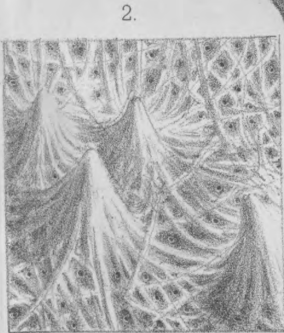
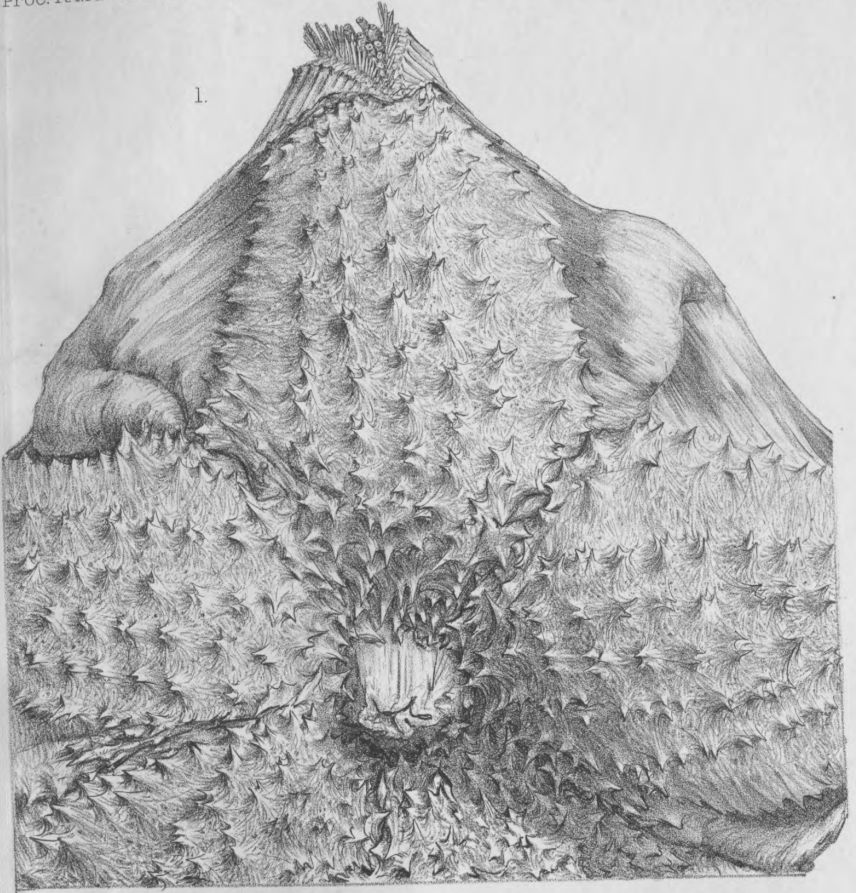
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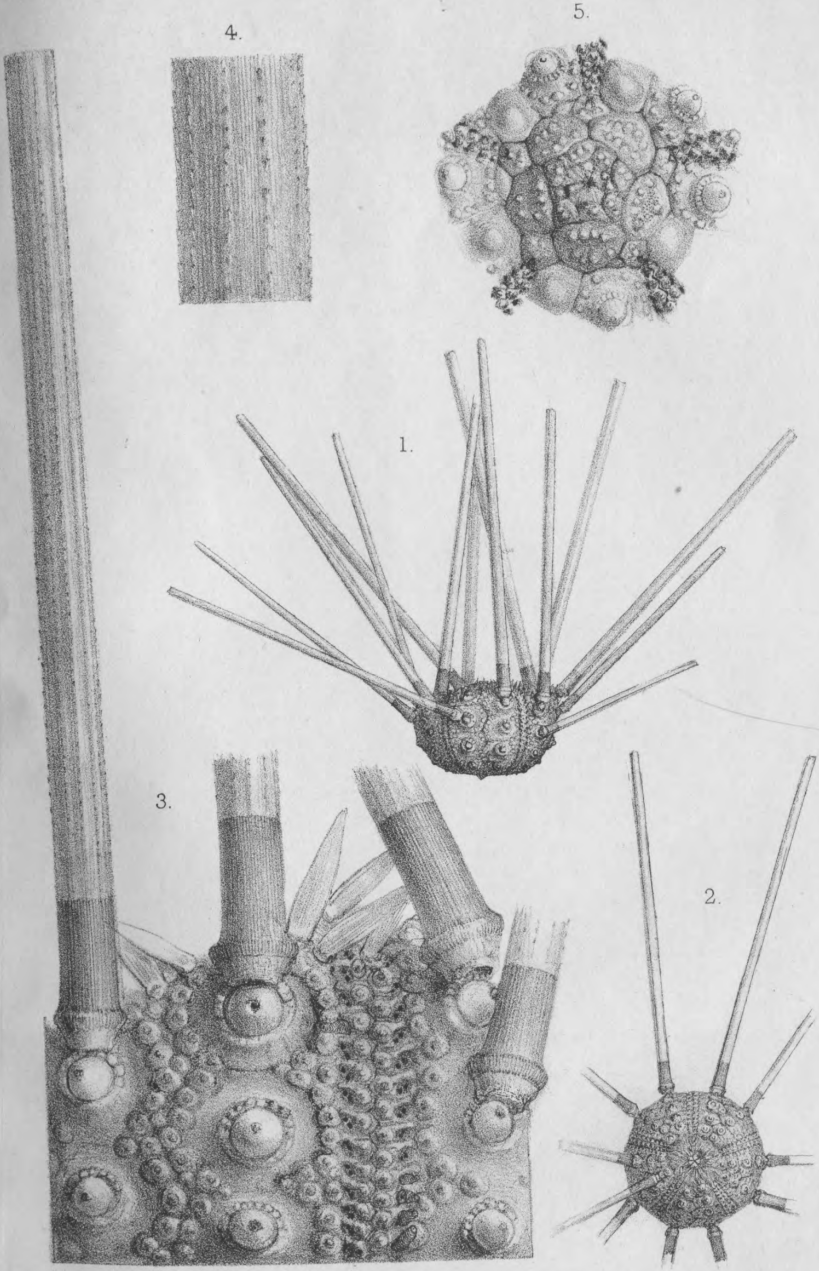




F.H. Michael del. et lith.

West, Newman, imp.

HYMENASTER GIGANTEUS, *Sladen.*



F.H.Michael del. et lith.

West, Newman, imp.

POROCIDARIS GRACILIS, Sladen.