

Tracts 1535.

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CAMBRIDGE PALAEONTOLOGY.

By HARRY SEELEY.

IV. *Some new Upper Greensand Echinoderms.*

Hemiaster M' Coyii.

Outline oblong, oval, slightly flattened at the anterior extremity, longer than wide; height two-thirds of the length. The most elevated part is a little behind the apex, the widest part a little anterior to the middle. The transverse section is oval. Upper side slightly convex, sloping down towards the anterior end. Under side slightly convex; the part anterior to the mouth depressed. Anal side nearly vertically truncated; anterior end round. Ambulacra straight, unequal, very slightly impressed. The odd ambulacrum is formed of straight zones, each composed of about a dozen pairs of round pores, which are placed obliquely and rather wide apart; the pores are close together. The anterior ambulacra consist of a similar number of pores, which are smaller and closer together. The posterior ambulacra are very short, the zones consisting of about four pairs of pores. Mouth transversely oval, bordered by a little groove, and placed in the anterior third of the shell. Anus oval. The fasciole is wide and 7-sided; it is angular posteriorly, with a short side anteriorly; the posterior and shorter pair of lateral sides is parallel; the granules of which it is formed are very dense, and only just visible to the naked eye. The shell is very thin, and covered with comparatively large tubercles.

This well-marked Urechin is so distinct as not to admit of comparison with any form with which I am acquainted. Its nearest relative is a more globular form which occurs with it.

Rare. Coll. University; J. Carter, Esq.

Salenia (? *Hyposalenia*) *Woodwardi*.

Round, greatly depressed. Ambulaeral areas narrow and straight, furnished with two rows of rather small tubereles, which are placed close together and occupy the whole of the space between the pores. The poriferous zones are slightly sinuous, wide, united above and below, and consist of nearly twenty pairs of pores; the pairs are wide apart and oblique. The lower part of each plate is a little impressed, so that the upper part projects below the pair of pores of the plate above. Plates nearly quadrate. Interambulaeral areas about three times the width of the ambulaeral, furnished with two rows of large tubereles of three in a row, of which the top or middle one is largest. The boss is greatly elevated, hemispherical, and erenulated on the top. The areolæ are surrounded, except towards the poriferous zones on which they abut, by a closely-placed row of secondary tubereles. The small interspaces between the double zigzag rows which these form are granulated. The mouth is very slightly pentagonal. The apical disk appears to have been but slightly elevated; its marginal plates scarcely projected above those of the test. The ocular plates have a rather deep spoon-shaped hollow on each side of the ambulaeral area. The other plates are not sufficiently preserved for description, but appear to have been ornamented.

Lat. $\frac{5}{16}$ inch, alt. $\frac{2}{16}$ inch; oral opening nearly $\frac{3}{16}$ inch; apical opening nearly $\frac{4}{16}$.

This remarkable little Urehin is so distinct as not to admit of comparison with any known form.

Rare. Coll. Univ. Mus.; Ashwell.

Hyposalenia may be regarded as a section of *Peltastes*, and *Peltastes* and *Goniophorus* as subgenera of *Salenia*.

Goniophorus lunatus, Ag., var. *minutus*.

A minute inflated Urehin with an elevated disk. Base flattened and slightly concave. Apical disk a regular pentagon, broad; its margin considerably elevated: it is divided into six pits, of which the central one is the anus; it is square. The pit immediately in front is also square; all the rest are pentagonal. Each of the five pits is margined by a strong elevated ridge: the three anterior are transversely divided by a septum rather less elevated than the marginal eordon. The genital openings are in the middle of the sides of the pentagon, at the point where the ridges meet. The madreporic tuberele is visible, and occupies the right half of the right anterior pentagon. The ambulaera are narrow and furnished

with two rows of tubercles, which occupy the whole space, except towards the base, where a few others are introduced. From them descend short transverse ridges, forming pits, in which the pores are placed. The pairs of pores are in single file throughout. The interambulacra are furnished with two rows of tubercles of four each; the uppermost of the left row is very large. The bosses are hemispherical and crenulated. The scrobiculæ are surrounded by a row of granules. The peristome is rather pentagonal.

Lat. $\frac{8}{48}$ inch, alt. $\frac{6}{48}$ inch; oral opening $\frac{3}{48}$ inch; apical disk $\frac{7}{48}$ inch.

This form is easily distinguished by the characters of the apical disk, the narrower ambulacral areas, larger interambulacral tubercles, small size, &c.

It is one of the many unique treasures contained in the cabinet of my friend Mr. Carter.

A single specimen has been found in which the following characters may be generic:—

Poles opposite. Apical opening moderate [cordate]. Oral opening entire, circular. Tubercles imperforate, crenulated. The ambulacral areas are half the width of the interambulacra. In them large tubercles are developed on one row of plates, and small tubercles on the other; in the interambulacral areas are two primary rows. Pores bigeminal. The poriferous zones are wide, and much impressed above.

Should the characters presumed to be generic prove constant, the name *Caseolus* might perhaps be used to indicate them.

[? *Cyphosoma*] *impressa*.

Pentagonal, greatly depressed, flattened above, concave below. Oral opening deeply sunk, circular. Apical aperture heart-shaped, extending into the odd interambulacrum. Ambulacra narrow, furnished with one row of about seven tubercles, which are as large as those of the interambulacra. On the other series of plates is a row of small granules, about three or four to each large plate: near the apex two or three small tubercles are developed. The poriferous zones are impressed on the upper part. The pores are placed in a straight line between elevated transverse ridges. There are two primary rows, and two secondary rows between these. In the interambulacra are two rows of tubercles of seven or eight each. Areolæ large, radiated, scarcely impressed, nearly circular, and margined by a row of granules, which separates them

one from another. On the upper part of the test, the suture between the interambulacral rows of plates is impressed.

Lat. $\frac{1\frac{1}{6}}$ inch; oral apert. $\frac{4}{16}$ inch; apical apert. $\frac{4}{16}$ by $\frac{3}{16}$ inch.

Coll. University Museum.

I cannot conceal from myself a suspicion that some of the characters here described are a monstrous development. Nothing, however, is wanting in the anatomy of the test, nor is anything unnatural superadded. The only really abnormal character is the unsymmetrical ambulacral ornament arising from the coalescence and development of granules into large tubercles. If this character is not generic, it can only be an individual variation: if it should prove to be the latter, the genus would have characters probably indicating its place to be among the *Saleniadæ*.

Diadema fungoideum.

Test circular; inflated on the lower part, obliquely depressed above, thus appearing rather subconical. Base rounded, on its inner part concave; oral aperture deeply sunk and larger than the apical disk. Ambulacral spaces two-thirds the width of the interambulacra; furnished with two rows of tubercles, which are very large round the circumference and become less elevated and rapidly smaller above, and regularly smaller below: those of the circumference and base are of the same size as the corresponding interambulacral tubercles; those of the upper surface much smaller. Each row consists of about eight. Round the circumference the rows are separated by a single zigzag line of granules. On the upper part the pairs of pores are close together, but in the middle they become wider apart, and are separated by a granule, which renders their detection difficult. The space between them and the tubercles is granulated. The interambulacral tubercles are very large and close together, in two straight rows of eleven each; on the upper part they are but slightly smaller than at the circumference; separated by wide spaces, which are occupied by two somewhat irregular rows of granules. On the outside of the tubercles round the bend of the base are two or three very small accessory tubercles. Each pair of pores is enclosed in a little, oblique, elevated, oval ring. On the base the interambulacral areas are noticeably inflated.

Lat. $\frac{1\frac{3}{2}}$ inch, alt. $\frac{8}{32}$ inch; apical disk $\frac{4}{32}$ inch.

This very distinct and remarkable little species is most nearly related to *D. Carteri* (Woodw.), from which it is distinguished by its subconical shape, absence of secondary tubercles, difference in size and number of primary tubercles and granulations, &c.

Very rare. Coll. University.

Diadema intertuberculatum.

Circular, tumid, flattened and slightly concave below, somewhat flattened above. The ambulacral and interambulacral areas have each two distinct rows of tubercles, of about eleven each; the tubercles are large and wide apart. Areolæ large, circular, and margined by cirelets of granules; in the interambulacral area the borders just coalesce in the longitudinal direction. In the ambulacral area the tubercles are rather smaller, above much smaller, and the areolæ separated from each other by a granulated space. The rows of tubercles are very close together, so that the areolæ touch obliquely, and on the lower part of the shell are separated by a zigzag line of granules. The interambulacral rows are wide apart, and bordered externally on the base with short rows of about six secondary tubercles. Also, on the basal part, between the primary rows, are two rows of secondary tubercles, each formed of about five or six. On the upper part there is generally a row of granules between those margining the areolæ. Shell thin.

Width $\frac{1}{8}$ inch, height $\frac{7}{16}$ inch; width of mouth $\frac{4}{16}$ inch.

This species differs from *D. Carteri* in the presence of secondary tubercles between the interambulacral primary rows, in the more inflated form, smaller mouth, greater space between the tubercles, &c.

Rare. Cambridge and Ashwell. Coll. University.

Diadema (?Tetragramma) scriptum.

Depressed, very slightly pentagonal, inflated. Pores close together and in double series above, wide apart below. Ambulacral areas half the width of the interambulacra, furnished with two rows of about twenty or twenty-two tubercles, which are as large as those of the interambulacra, except on the upper part, where they become smaller and closer together: the rows are close together. As in *D. divergens*, the tubercles are semi-radiate. On the lower part of the shell the areolæ are confluent, above they scarcely exist. Round the circumference the intermediate space is granulated; the granules partly surround the areolæ, and are for the most part in two rows. Interambulacral tubercles in two primary rows of sixteen or seventeen; each is flanked externally by a row of nine or ten secondary tubercles, of the same size as the primaries. Outside of each of these are two tertiary rows, of about twice the number. Areolæ on the lower part confluent; above circular, and commonly margined with a circle of granules, but for which the upper part of the space between the primary rows, which is concave, would be naked. Round the circumference,

and below, the interspace is closely and irregularly granulated. Shell round the mouth inflected. Apical opening pentangular; width 6 lines.

Lat. $1\frac{1}{2}$ inch, alt. $\frac{5}{8}$ inch.

Most nearly related to *D. Malbosii* (Desor), but differs in the small size of the mouth, in having the rows of tertiary tubercles, in the greater number (especially of ambulacral) tubercles, &c.

Diadema (subg. *Pseudodiadema*) *inversum*.

Circular, depressed, flattened above, concave below. Apical opening pentangular. The greatest inflation is above the middle of the shell. Mouth very deeply sunk. Ambulacral tubercles arranged in two rows of about seventeen each, nearly as large as the interambulacrals, except on the upper surface, where they become much smaller, and are scarcely elevated: the rows are separated on the lower part of the shell by a single zigzag row of granules,—round the circumference by two rows; the space above naked. The areolæ are large circles, which are confluent; they are indistinctly radiated. On the outer side of the bosses, on the lower half of the shell, descend three wide deep grooves, each to a pair of pores, the inner one of which they almost obscure, thus giving the tubercles a remarkable semiradiated appearance. The zones are straight, and the pores in single file throughout. Except on the upper part, each pair of pores appears to be surrounded by a little ring, which is divided by the septum being also elevated. Interambulacral tubercles in two primary rows of about sixteen each; they are each flanked externally by a secondary row of about nine; outside of these, on each side, is a tertiary row of two or three times the number. The tubercles are radiated, and on the upper part of the shell surrounded by a row of granules; from the areolæ enlarging, these become, at the circumference, a double row of granules. The upper parts of the intermediate spaces are naked and rather hollow.

Lat. $1\frac{1}{4}$ inch, alt. $\frac{9}{16}$ inch; apical apert. $\frac{7}{16}$ inch; oral apert. $\frac{5}{16}$ inch.

Most nearly related to *D. Barretti* (Woodw.). It differs, however, in having the tertiary tubercles, two or three of which are placed on each plate, in the greater number of tubercles, the different inflation, small mouth, and in having but half as many rows of granules.

Rare. Coll. University.

From the oral opening being mostly filled with phosphate of lime, not more than fifteen tubercles in a row will commonly be visible.

Cidaris gradata.

Greatly inflated, flattened below, with the peristome circular; elevated above, with the periprocte pentagonal. Ambulacral areas nearly one-third of the width of the interambulacra, sinuous, and divided into two parts by a deep mesial groove; furnished with four rows of rather large granules, which are not arranged in straight transverse lines. Poriferous zones deeply impressed on the base, furnished with a close row of granules, which are rather smaller than those of the intermediate spaces; they divide the pairs of pores. The ambulacra are narrow at the apex, so that the inner rows of granules are suppressed; they become a little narrower towards the mouth. Interambulacral area with two rows of rather convex plates, of three and four each. The tubercles are small on the base, and progressively increase in size, so that the scrobiculæ of the uppermost of the 'three-series' occupies half the width of the area. The uppermost plate of the 'four-series' is small and granulated, or has only a rudimentary tubercle. The areolæ are circular, moderately impressed, placed below the middle of the plates; margined by two rows of large granules of about thirteen each, an inner row forming the margin of the pit, and an outer row between these, which does not reach to the margin; thus both rows appear to form one irregular circle. The bosses are truncated cones, which are proportionally elevated inversely to their size. The tubercles are large depressed spheres. Miliary granulation coarse, on the upper part very large, so that a line of not more than twelve would be sufficient to reach across the widest part of the largest plate.

Nearly $\frac{1}{2}$ inch high, more than $\frac{3}{4}$ inch wide; oral aperture $\frac{3}{8}$ inch, apical aperture $\frac{7}{16}$ inch.

Differs from *C. Heberti* (Desor) in wanting the character "scrobicules petits et serrés;" from *C. dissimilis* (Forbes) in the more elevated form, four rows of ambulacral granules, wide ambulacra, &c.

It is common, perhaps commoner than *C. Sedgwickii*, but in general only occurs in detached plates. A single beautifully perfect example is preserved in the cabinet of J. Carter, Esq.

Cidaris Sedgwickii.

Inflated, elevated [rather subconical?]. The ambulacral areas are narrow and sinuous. The poriferous zones much impressed, and rather narrower than half the intermediate tapering space; they have a row of granules down the middle, separating the two rows of pores: towards the apex the gra-

nules become less distinct. The pairs of pores are oblique, and are separated by an oblique elevated ridge: it is between these ridges that the granules are placed, which, by nearly uniting their extremities, give the zones a zigzag ornamentation. The space between the zones is occupied by two marginal rows of granules, between which there are, round the wider part, six much smaller rows of granules, of twice the number in a row: at the extremities these are reduced to two rows. The interambulacral areas are about five times the width of the spaces between them. The plates are high, and only four in each row. The scrobiculæ are large, circular, moderately deep, and above the base separated longitudinally by interspaces of equal width. Excepting the uppermost one, each is placed below the middle of the plate; they are surrounded by a prominent row of seventeen or eighteen granules, which are wide apart; each is placed on an elevated oval base. The bosses are very moderately elevated and compressed round the middle, so that in section the sides would be concave; a few of them are sometimes crenulated. The tubercles are large, rather depressed spheres, which are placed close on to the bosses. The perforation is small and circular. The miliary granules are extremely small and dense on the base; they gradually become larger above. Oral and apical openings both small.

Loc. Cambridge and Ashwell. Coll. University; J. Carter, Esq.

Spines occur not to be distinguished from those of

Cidaris clavigera.

Cidaris Bowerbankii.

Cidaris, n. sp. (figured in Dixon, Geol. Sussex, t. 24. fig. 25).

There are also spines of at least three or four unnamed species. One is a large, compressed, club-shaped spine, obliquely placed on a short neck; it is beautifully marked with longitudinal striæ, which are knotted into distant tubercles. Another is extremely compressed and ornamented with fine longitudinal ridges, which are granulated; its margins finely serrated. A third is cylindrical and irregularly granulated.

Besides these, there are spines nearly resembling those of *C. sceptrifera*, but much smaller and with fewer ridges. Spines occur nearly resembling those of *C. sulcata*, but more cylindrical and having the ridges unserrated. Another form of spine may belong to this species; it is slender, has fewer and more elevated ridges and a similar coronated summit.

I abstain from attaching names to these spines, as the prac-

tice of naming species from appendages which give no clue to the major part of the organism is a custom which loads the nomenclature with synonyms, and, from the extreme variability of spines in the same species, can only bring with it very questionable advantages.

The largeness of the object can furnish no reason for conferring on it a name; and we might with as much propriety give names to the spines of *Micraster* or *Galerites*: those names would, when the test was found, be just as much entitled to priority; in a natural-history point of view they would be no more objectionable. The only argument for naming the larger object is convenience. But the circumstance of the test not having been found is an evidence of the rarity of the species, and therefore of the little inconvenience which would result from its not having a name.

The names already given to spines can only be considered as provisional,—to be adopted if the first discovery of the test shall be made with them *in situ*, but to become synonyms if the test shall be separately named.

One specimen of *Diadema Bonei* from Warminster, measuring more than an inch over, with the apical opening broken, has twelve or thirteen ambulacral tubercles. The interambulacrals number twelve, and have secondary rows of nine. It thus only differs from the diagnosis of *D. Barretti* in having in the areas respectively half the number of rows of intervening granules. Another and perfect specimen appears to have but eight tubercles in the interambulaeral rows.

I have seen a single specimen of an internal cast of what was probably a large *Micraster*, nearly resembling *M. cor-anguinum*.

An elevated species of *Salenia* occurs.

One species of *Astrogonium* and

One species of *Pentacrinus*.

