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Some fossil Clypeastrids (Echinoidea) from Brimstone Hill (St. Kitts) and Sugar Loaf (St. Eustatius), Lesser Antilles ¹⁾

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In March 1958 Dr. J. H. WESTERMANN and Mr. H. KIEL collected some fossil Echinids on the islands of St. Kitts and St. Eustatius.

The fossils of St. Kitts were found in a yellow limestone (sample nr. 42), situated on the west flank of Brimstone Hill, belonging to a series of peculiar-looking upturned sedimentary beds, occurring around a volcanic plug (MARTIN-KAYE, 1959). According to C. T. TRECHMANN (1932) the fauna of these beds is put down as Pliocene, possibly late Pliocene.

The Sugar Loaf fossils were found in a coquina (sample nr. 31), the stratigraphic position of which was described by MOLENGRAAFF 1886, 1931: stratum nr. 1. The Sugar Loaf strata are tilted beds of largely sedimentary origin.

Radiocarbon datings of corals of the Brimstone Hill and Sugar Loaf limestones have timed these strata as late Pleistocene (WESTERMANN & KIEL).

The collection contains:

Clypeaster rosaceus (LINNAEUS, 1758) St. Kitts
Clypeaster subdepressus ? (GRAY, 1825) St. Kitts
Paraster eustatii sp. nov. St. Eustatius

The specimens are kept in the collections of the Geological Institute of the University of Amsterdam.

The author is greatly indebted to Dr. J. H. WESTERMANN for putting the interesting material at his disposal and for subsequent most kind information and generous help.

¹⁾ Received March 6, 1961.

Clypeaster rosaceus (LINNAEUS, 1758)

Echinus rosaceus LINNAEUS, 1758, p. 665.

Clypeaster rosaceus MORTENSEN, 1948, p. 40; COOKE, 1942, p. 11.

Clypeaster dalli CLARK and TWITCHELL, 1915, p. 218, Pls. 99. 2a—b; 100, 1a—b;
JACKSON, 1922, p. 33, Pl. 4. 1; MORTENSEN, 1948, p. 44.

4 specimens and some fragments from St. Kitts (Brimstone Hill).

We cannot find essential differences between these fossils and the recent form: the double wall of the test, the lamellae in the inner part of the test, the shape of the petals and of the test, all characters of the recent form, are also found in the specimens at hand. They very closely resemble MORTENSEN's figure (1948, Monograph IV₂, Pl. I, Fig. 2).

COOKE (1942, p. 11) mentions the species as a fossil from the Pliocene Caloosahatchee Marl (Florida and Dominican Republic). He is certainly right in considering *C. dalli* a synonym of *C. rosaceus*. JACKSON (1922, p. 33) mentions the species as a fossil from the Miocene of Puerto Rico, Cuba (COTTEAU, 1897: Calcareous concretions, Bellamar, no geological horizon given), Anguilla (LAMBERT, 1915, in a calcareous tuff, evidently Pliocene).

Two fragments from the Geological Museum in Delft (Collection G. A. F. MOLENGRAAFF, St. Eustatius, KB nr. 4336 DD; locality not indicated but is thought to be Sugar Loaf) probably also belong to this species.

Clypeaster subdepressus ? (GRAY, 1825)

Echinanthus subdepressus GRAY, 1825, p. 427.

Clypeaster subdepressus COOKE, 1942, p. 11, Pl. IV, 5.

Clypeaster subdepressus MORTENSEN, 1948, p. 112.

? *Clypeaster meridanensis* MICHELIN, 1850; 1861, p. 136, Pl. XIV, Fig. 1a—f; JACKSON, 1922, p. 44; MORTENSEN, 1948, p. 26.

A number of fragments from St. Kitts (Brimstone Hill).

These fragments presumably belong to one specimen, though they are insufficient for a reconstruction of the test. They were found in the same locality as the preceding species, viz. in yellow limestone, west flank of Brimstone Hill, St. Kitts.

The flat and sharp border and the concave surface towards the petals show that the fragments certainly do not belong to *Clypeaster rosaceus* (L.). Comparing them with the species described by MORTENSEN (1948, in his Monograph IV₂, p. 112), it seems probable that these fragments with their flat and sharp border belong to *Clypeaster subdepressus* (GRAY). Comparing them with the West-Indian fossils mentioned in JACKSON (1922), they might belong to *Clypeaster meridanensis* MICHELIN (1861, p. 136, Pl. 14, Fig. 1 a-f). It seems not easy to distinguish *C. meridanensis* and *C. subdepressus*.

C. subdepressus was mentioned as a fossil with slightly different odd petal and thicker margin by COOKE (1942, p. 11) from the Pliocene, Waccamaraw formation of the Eastern United States; but MORTENSEN (1948, in his Monograph IV₂, p. 115) doubts the identity with the recent

species ("the fossil specimens differing rather markedly from the recent ones").

C. meridanensis came from "Terr. tert., envir. de Mérida (Yucatan)" and from "Miocene, Guadeloupe". Our fragments are insufficient to decide this case, but it seems reasonable to refer them with doubt to *C. meridanensis* though a comparison with the recent *C. subdepressus* does not permit to find any difference.

A fragment from St. Eustatius in the collections of the Delft Geological Museum (Collection G. A. F. MOLENGRAAFF, KB nr. 4336 DD; locality not indicated, but is thought to be Sugar Loaf) probably also belongs to this species.

***Paraster eustatii* sp. nov.**

Upper side of one specimen, St. Eustatius, Sugar Loaf (Fig. 1—4).

This fragment shows the petals, the whole peripetalous fasciole (see figure) and the beginning of the latero-anal fascioles, starting from the peripetalous fasciole between the anterior and posterior paired petals. The petals are distinctly deepened, not over much, however. The length of the anterolateral petals is 7 mm. They contain 18 respectively 20 pore pairs in the anterior row, 18 in posterior row. The posterolateral petals are much shorter, 3.7 mm. They contain 12 pore pairs in the anterior, 11 pore pairs in the posterior row. The frontal ambulacrum is rather deepened on the aboral side, less deep, but distinct near the margin. It contains 15-16 pore pairs inside the fasciole. They are placed obliquely (see figures), the lines connecting the two pores of a pair join anteriorly in the direction of the frontal slit.

There are four genital pores, the posterior ones are the largest. The apex is ethmolytic.

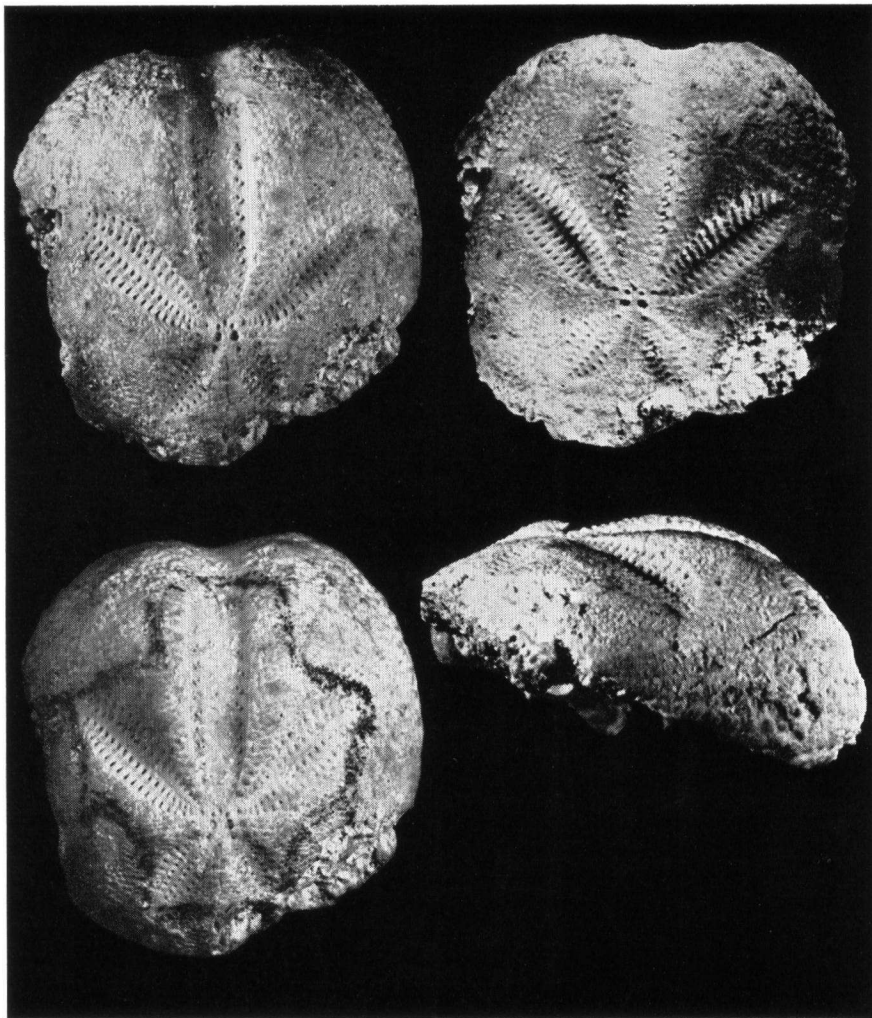
The peripetalous fasciole has been rendered distinct (Fig. 3) with black pencil. It shows strong incurvatures. Especially the curve between the frontal ambulacra, A III and A II and A III and A IV, seems to distinguish the animal from the other species. The latero-anal fasciole is distinct, especially on the left side.

In order to have a suggestion of the form of the test as seen from the side and hence of the height, I have given (Fig. 4) a side view of the shell. It seems to have been rather low.

It is no easy matter to identify the fragment with one of the species of *Paraster* that have been described. Even MORTENSEN 1951 (Monogr. V₂, p. 215 seq.) gives a summary that does not permit any satisfactory solution. The type species *Paraster gibberulus* seems to be a very variable species, including animals with a more deeply or less deeply incurved peripetalous fasciole (SAVIGNY, 1807 or 1826, Pl. VII Fig. 5; FOURTEAU, 1907, p. 192, Fig. 1; BRIGHTON, 1931, p. 330, Fig. 5, 6; CURRIE, 1938, Pl. VIII, Fig. 10) and with the pore pairs in the frontal ambulacrum oblique in one sense (the lines connecting the two pores of a pair joining anteriorly in the direction of the frontal slit) or in another (the lines connecting the two pores of a pair joining backwards in the direc-

tion of the apex). Compare the figures mentioned above, as also MORTENSEN 1951, Mon. V₂, Pl. XXII, Fig. 7. with MORTENSEN 1951, Mon. V₂, p. 220, Fig. 104b. This last figure was probably erroneously turned upside down. I suppose the front of the test to be situated towards the underside of the picture. Curiously, COTTEAU, 1875, in presenting his *Schizaster* (i.e. *Paraster*) *subcylindricus* on Pl. V, figures the pores in Fig. 15 in one sense and Fig. 17 in another. This might make one ask whether this is a variation that occurs within this species? It seems rather impossible.

Most probably KOEHLER, 1914, did not have any real *Paraster gibberulus*. Therefore, TORTONESE, 1932 and 1933, p. 160, described his *Paraster gibberulus* as a new species: *P. erythraeus*.



Paraster eustatii sp. nov.

FIGURES 1—4. *Paraster eustatii* sp. nov. 1. The fragment seen from above. 2. The fragment seen from above, to show the frontal notch. 3. The same as Fig. 1 but fasciole blackened. 4. The fragment seen from the left side.

Our specimen is quite closely related to the real *Paraster gibberulus* from the Red Sea, which was found as a recent species and also as a fossil in the Pleistocene of Egypt. It differs from the West-Indian *P. (Schizaster) subcylindricus* COTTEAU, 1875, p. 31, Pl. V, Fig. 14—17 (Ile St. Barthélémy, terrain éocène), JACKSON 1922, P. 78, Pl. 13, Fig. 10, Pl. 14, Fig. 1, 2, in having a slightly deeper frontal furrow at the ambitus, and a more deeper curving peripetalous fasciole. Compare my figures with COTTEAU and JACKSON, though JACKSON's Pl. 13, Fig. 10, looks, with the exception of the frontal notch, rather closely related to our specimen. *P. subcylindricus*, however, has been reported from the Eocene, hence from older layers.

P. sierrai ROIG, 1951, p. 63, Pl. 40, Fig. 1, is also from the Pleistocene (of Cuba) but the test is more rounded and the fasciole much less incurved between A II and A III and A IV.

Schizaster cubensis d'ORBIGNY, 1847, described for the first time distinctly by COTTEAU, 1880, p. 41, as *Hemiasster cubensis*, from the Pliocene of Cuba looks rather much like our specimen as seen from above, in the form of the fasciole and in the number and position of the ambulacral pores in A II, the frontal ambulacrum. It may differ as seen from the side and in COTTEAU's Pl. IV, Fig. 3, the four genital pores are all of the same size. COTTEAU says: "Pas de fasciole latéro-soucanal". It is impossible to identify this species with our fragment, but I want to emphasize their general resemblance.

Concluding, I cannot identify our fragment with any of the described species. The echinids of the genus *Schizaster* and, therefore, also of *Paraster*, seem to be in a period of luxurious variation and speciation. It is very difficult to taxonomize the recent species. The fossil ones, in their incompleteness and because it is not so very easy to get an idea of their variation within the species, give yet more difficulties.

For that reason it seems preferable to give the specimen a new name, *Paraster eustatii* sp. nov., which is distinguished from the related species by the arrangement of the pores in A II, the form of the peripetalous fasciole, the presence of a lateroanal fasciole, the four genital pores, the posterior ones being larger, the distinct but not very deep anterior slit and the rather low form as seen from the side.

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