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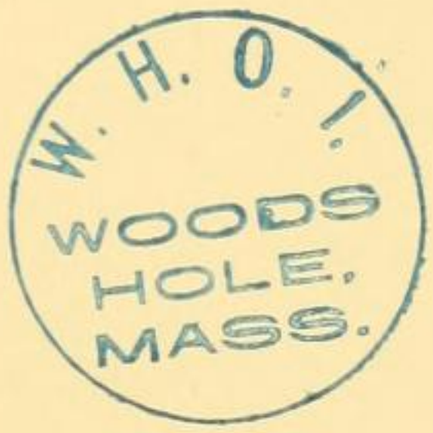
ECHINOIDEA AND OPHIUROIDEA

By

TH. MORTENSEN



CONTENTS

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By Th. Mortensen

(Plates I–IX; text-figs. 1–53)

INTRODUCTION

THIS report deals with the Echinoids and Ophiurids collected by the 'Discovery', the 'Discovery II' and the 'William Scoresby' in the years 1925–35, mainly in the sub-Antarctic and Antarctic seas, from the Magellanic region to South Georgia, the Palmer Archipelago, the South Sandwich Islands, and off Marion Island. Some few hauls made off Gough Island, Tristan da Cunha, Ascension, South Africa, Angola, Annobon in the Gulf of Guinea, and in Cook Strait, New Zealand, have added a not inconsiderable number of species.

It has been thought preferable in the systematic account to deal with all this material together—not to arrange it according to localities.

Although our knowledge of the Echinoid and Ophiurid fauna of the sub-Antarctic and Antarctic seas is rather extensive, particularly owing to Koehler's divers reports on the collections made by the 'Belgica', the 'Scotia', the 'Pourquoi-Pas?', the Swedish Antarctic Expedition and the Australasian Antarctic Expedition, quite a considerable number of new forms are contained in the Discovery collections, a fact tending to indicate that we are still far from having a complete record of all the species occurring in the sub-Antarctic and Antarctic regions, not to mention the distribution and biology of these forms. But this much we do know, that the sub-Antarctic–Antarctic Echinoderm fauna is exceedingly rich, far exceeding that of the Arctic–sub-Arctic region.

The Discovery collection has afforded me a much desired opportunity of clearing up various little known forms, particularly the Ophiurids from South Georgia described by Studer; also some of those described by Koehler needed revision—not to speak of those described by Jeffrey Bell—a revision which has led to a not inconsiderable reduction in the number of species hitherto recorded from these regions. I beg to express here my great indebtedness to the authorities of the British Museum, London, to Professor Dr W. Arndt of the Berlin Museum, and to Professor Dr Sixten Bock of the Stockholm Museum, Dr E. Leloup of the Bruxelles Museum, and Dr A. Panning of the Hamburg Museum, for lending me type material of various old, insufficiently known forms, thus enabling me to give additional information about them and to supply new illustrations of them, where it was thought desirable.

The Echinoid collection does not contain any large number of species, thirty-one in all (including two varieties), and only three of these, *Notechinus marionis*, *Abatus curvidens* and *Amphipneustes similis*, are new to science.

Twenty-two of these Echinoids are from the Antarctic–sub-Antarctic region. At the same time the species hitherto recorded from the Antarctic region are reduced by one, the *Amphipneustes Mortenseni* of Koehler being shown to be identical with *A. Lorioli*, Koehler, representing only the female sex of the latter species, which was based on a male specimen. No results of more general interest are to be derived from this Echinoid material, the only fact worth special mention being the occurrence of a *Centrostephanus*, probably *C. longispinus* (Phil.), in the Gulf of Guinea, of a *Plagiobrissus*, probably *P. Costae* (Gasco), from off French Congo, and of an *Echinocardium*, probably *E. connectens*, Mortensen, from the Cape Verde Islands, these genera having till now not been recorded from the West African coast.

The Ophiuroid collection contains a considerably larger number of species, viz. 102 species in all (including eight varieties). Of these the following thirty species and varieties are new to science.

Astrochlamys sol, n.sp. (Clarence Island).
Ophioscolex nutrix, n.sp. (South Georgia—Falkland Islands).
O. marionis, n.sp. (Marion Island).
Ophiacantha vivipara, var. *pentactis*, n.var. (Palmer Archipelago).
O. densispina, n.sp. (Falkland Islands).
O. angolensis, var. *inermis*, n.var. (French Congo).
Ophiomitrella falklandica, n.sp. (Falkland Islands—South Shetlands).
Ophiactis seminuda, n.sp. (Tristan da Cunha).
Amphiura grandisquama, var. *guineensis*, n.var. (Gulf of Guinea).
A. microplax, n.sp. (South Georgia).
A. microplax, var. *disjuncta*, n.var. (South Shetlands—South Sandwich Islands).
A. monorima, n.sp. (South Georgia).
A. da Cunhae, n.sp. (Tristan da Cunha).
Amphiodia ascia, n.sp. (Angola).
Amphioplus aciculatus, n.sp. (French Congo).
A. acutus, n.sp. (Palmer Archipelago).
Ophionephthys magellanica, n.sp. (Magellanic Region).
Ophionereis sexradia, n.sp. (Gulf of Guinea).
O. novae-zelandiae, n.sp. (Cook Strait).
Ophiozonella megaloplax, n.sp. (Cook Strait).
O. falklandica, n.sp. (Magellanic Region).
Ophiurolepis brevirima, n.sp. (South Shetlands, Clarence Island).
O. turgida, n.sp. (Magellanic Region).
Homalophiura inornata, var. *tuberosa*, n.var. (South Shetlands).
Ophiura serrata, n.sp. (South Shetlands).
O. flexibilis, var. *crassa*, n.var. (Clarence Island).
Amphiophiura gibbosa, n.sp. (South Shetlands).
Ophiocten bisquamatum, n.sp. (South Georgia).
O. amitinum, var. *simulans*, n.var. (South Africa).
Ophiomusium constrictum, n.sp. (Magellanic Region).

None of the new species represent new generic types; but a new genus, *Ophiolebella*, is established for the *Ophiolebes biscutifer* of G. A. Smith, which does not properly belong to the genus *Ophiolebes*.

To the very rich Ophiurid fauna of the Antarctic and sub-Antarctic seas are thus added no less than sixteen new species and four new varieties. On the other hand the number of Antarctic–sub-Antarctic species of Ophiurids previously recorded is considerably reduced owing to the fact that several of them were found by the present researches to be only synonyms of other species. This holds good of the following species.

Ophiodiplax disjuncta, Koehler, is identical with *Ophiacantha antarctica*, Koehler, from the 'Belgica' (non *Ophiacantha antarctica* (Lyman)), and must henceforth be named *O. disjuncta* (Koehler).

Ophiochondrus falklandica, Koehler, is identical with *O. stelliger*, Lyman.

Amphiura Mortenseni, Koehler, *A. alternans*, Koehler, and *A. Eugeniae*, var. *gracilis*, Hertz, are identical with *A. Belgicae*, Koehler. Very probably also *A. Joubini*, Koehler, is identical with *A. polita*, Koehler (cf. p. 279).

Ophioceramis antarctica, Studer, is identical with *Amphiodia affinis* (Studer).

Amphipholis patagonica, Ljungman, is identical with *A. squamata* (Delle Chiaje).

Ophioperla Ludwigi, Koehler, is identical with *Ophiura Koehleri*, Bell, and must henceforth be named *Ophioperla Koehleri* (Bell).

Ophiozona inermis, Bell, and *Ophioglypha resistens*, Koehler, are identical with *O. Martensi*, Studer, the species having to be named *Ophiurolepis Martensi* (Studer).

Ophiomastus rotundus, G. A. Smith, is identical with *Ophiura meridionalis* (Lyman).

Ophiosteira echinulata, Koehler, is identical with *O. antarctica*, Bell.

Further, the West African *Ophiostigma africanum*, Lyman, is identical with the West Indian *O. abnorme* (Lyman).

In regard to the zoogeography of the Antarctic and sub-Antarctic regions the Ophiurid collection of the 'Discovery' does not materially change our conceptions, as set forth in detail by Koehler (1912) in his report on the Echinoderms of the 'Pourquoi-Pas?', by Ekman (1925) in his report on the Holothurians of the Swedish Antarctic Expedition, and by the present author in his reports on the Echinoids of the German South Polar and the Swedish Antarctic Expeditions. (I may also recall the zoogeographical chapters in A. H. Clark's report on the Crinoids and M. Hertz' report on the Ophiurids of the German South Polar Expedition.) I do not think it desirable or profitable, therefore, to enter again here on a discussion of the zoogeography of the Antarctic and sub-Antarctic regions. Extensive researches in the vast, almost unknown area of the Antarctic to the south of the Pacific Ocean would make a renewed discussion of the zoogeographic problems of the Antarctic region profitable—but such researches are still only a desideratum, as are also more extensive investigations of the bottom fauna of the Antarctic deep sea.

Of considerable zoogeographical interest are the facts of the occurrence of the South African *Amphiura incana* in the Gulf of Guinea and of the North Atlantic *A. Chiajei* as far south as Angola, facts which tend to show that extensive investigations along the west coast of tropical Africa would bring results of very great zoogeographical interest. This is another great desideratum.

As a fact of morphological interest may be mentioned the coalescing above the arm of the two bursae at each radius in *Ophiacantha densispina*, a feature previously known only in *Ophiomitrella corynephora*, H. L. Clark (cf. my Echinoderms of South Africa, p. 332). That the spicules in the bursal wall of this same species of *Ophiacantha* form inner thorns proceeding into the body cavity is a unique feature; but, of course, this has more the value of a curiosity. Another interesting fact is the existence of only a single genital slit in each interradius in *Amphiura monorima* (cf. p. 274).

Much more interest, however, attaches to the discovery that a very great proportion of the Antarctic Ophiurids are viviparous. Till now only six of these Ophiurids were known to be viviparous, viz. *Ophiomyxa vivipara*, *Ophiacantha vivipara*, *O. imago*, *Amphiura magellanica*, *Amphipholis squamata* (*patagonica*) and *Ophionotus hexactis*. I have found no less than twenty-five more of the Antarctic Ophiurids to be likewise viviparous, namely:

Astrochlamys bruneus
Ophioscolex nutrix
O. marionis
Ophiacantha densispina
Ophiomitrella ingrata
O. falklandica
Ophiochondrus stelliger
Amphiura angularis protecta
A. microplax
A. monorima
A. Lymani
A. deficiens
A. Belgicae
Amphiura Eugeniae
Amphiodia affinis
Ophiolebella biscutifera
Ophioceres incipiens
Ophiozonella falklandica
Ophiomages cristatus
Ophiosteira antarctica
Ophiurolepis Martensi
Ophiura meridionalis
O. Rouchi
Amphiophiura Rowetti
A. gibbosa

We thus know now at least thirty-one Ophiurids of the Antarctic and sub-Antarctic regions to be viviparous. Of the other Ophiurids from this region the following twenty-five species are not viviparous:

Gorgonocephalus chilensis
Astrotoma Agassizii
Ophiacantha disjuncta
O. antarctica
Ophiactis asperula
Amphiura angularis
A. microplax disjuncta
A. dilatata Gaussi
A. Joubini
A. princeps
Amphioplus acutus
A. peregrinator
Ophiogona Döderleini
Ophioperla Koehleri
Ophionotus victoriae
Ophiosteira Senouqui
Ophiuroglypha Lymani
Ophiurolepis carinata
O. gelida
O. brevirima
O. Wallini
O. partita
Homalophiura inornata
H. inornata tuberosa
Ophiocten amitinum

The rest of the species are unknown in regard to their sexual character, or the material examined has been insufficient for giving definite information. But it may be regarded as an established fact already that *about* 50 *per cent of the Ophiurids of the Antarctic–*

sub-Antarctic region are viviparous, a perfectly astonishingly high percentage in comparison with other regions, where only very few species are viviparous. Foremost comes here the New Zealand region with six viviparous species out of a total number of forty-one species, thus *ca.* 15 per cent, all other regions having a still smaller number of viviparous forms. Particularly the difference between the Arctic–sub-Arctic and the Antarctic–sub-Antarctic region in regard to the number of viviparous forms is very striking; but this has been repeatedly emphasized, so I shall not go into details here.

I may here mention a statement in literature which would seem to show that the Korean seas are remarkably rich in viviparous Ophiurids. Duncan in his paper *On some Ophiuroidea from the Korean Seas* (Journ. Linn. Soc. Zool., XIV, 1878, p. 464) says about *Ophionereis dubia*, var. *sinensis*, Dunc., that "it has a marsupium, and doubtless, as was commonly the case in these Korean seas, it was viviparous". During a visit to the British Museum in July 1935 I took the opportunity of re-examining all these supposed viviparous Ophiurids from the Korean seas and was able to ascertain that—as I expected—it is all a mistake. The *Ophionereis* happened to be preserved (dried) in such a contracted state that one of its bursae is widely open, looking indeed like a kind of marsupium. But it is only an empty bursa, and there is not the slightest sign that this or any other of Duncan's Ophiurids is viviparous. At the time Duncan wrote this paper the anatomy of the Ophiurids was still very imperfectly known. Not until Ludwig, in this same year, 1878, published his famous paper *Beiträge zur Anatomie der Ophiuren* (Zeitschr. wiss. Zool., XXXI) did we get a real understanding of the bursae of Ophiurids and their relation to the gonads. It was thus quite natural for Duncan to take the widely open bursa of his *Ophionereis* for a marsupium; and seeing the bursal slits also in his other Ophiurids, he naturally concluded that they all were viviparous. But he did not open any of them to ascertain whether there were really young ones within these supposed "marsupia", and did not think either of looking at other Ophiurids, or he would have concluded that they were all brood-protecting, or else have discovered his mistake. Thus we need no longer concern ourselves with these mysterious viviparous Ophiurids of the Korean seas.

In my paper *Biological observations on Ophiurids* (Papers from Dr Mortensen's Pacific Exped., LXIII, Vid. Medd. Dansk Naturh. Foren., 93, 1933) I gave a revised list of all known viviparous Ophiurids, amounting to thirty-two. As *Amphipholis patagonica*, and also *A. japonica* and *sobrina*, are there reckoned as distinct species, whereas in reality they are probably all indistinguishable from *A. squamata*, the actual number of viviparous Ophiurids known up to 1933 was only twenty-nine species. The discovery of no less than twenty-five new viviparous Ophiurids, as stated in the present report, makes it desirable to revise the whole matter again, particularly with regard to the question of the hermaphroditism of the viviparous Ophiurids.

The Ophiurids till now known to be viviparous are:

1. *Astrochlamys bruneus*, Koehler. Sexes separate.
2. *Ophiomyxa vivipara*, Studer. Sexes separate.
3. *O. brevirima*, H. L. Clark. Sexes separate.

4. *Ophioscolex nutrix*, Mortensen. Facultative hermaphrodite.
5. *O. marionis*, Mortensen. Hermaphrodite.
6. *Ophiacantha imago*, Lyman. Sexes separate.
7. *O. marsupialis*, Lyman. Sexual character unknown.
8. *O. vivipara*, Ljungman. Protandric hermaphrodite, or parthenogenetic(?).
9. *O. anomala*, G. O. Sars. Hermaphrodite.
10. *O. densispina*, Mortensen. Sexes separate.
11. *Ophiomitrella clavigera*, Mortensen. Protandric hermaphrodite.
12. *O. corynephora*, H. L. Clark. Protandric hermaphrodite.
13. *O. hamata*, Mortensen. Protandric hermaphrodite.
14. *O. ingrata*, Koehler. Protandric hermaphrodite.
15. *O. falklandica*, Mortensen. Protandric hermaphrodite.
16. *Ophiochondrus stelliger*, Lyman. Hermaphrodite.
17. *Amphiura magellanica*, Ljungman. Hermaphrodite.
18. *A. capensis*, Ljungman. Hermaphrodite.
19. *A. constricta*, Lyman. Hermaphrodite.
20. *A. borealis* (G. O. Sars). Protandric hermaphrodite.
21. *A. Stimpsoni*, Lütken. Hermaphrodite.
22. *A. annulifera*, Mortensen. Hermaphrodite.
23. *A. Stepanovii*, Tscherniawsky. Protandric hermaphrodite.
24. *A. iris*, Lyman. Sexual character unknown.
25. *A. angularis protecta*, Hertz. Hermaphrodite.
26. *A. microplax*, Mortensen. Parthenogenetic (?).
27. *A. monorima*, Mortensen. Hermaphrodite.
28. *A. Lymani*, Studer. Sexes separate.
29. *A. deficiens*, Koehler. Sexual character unknown.
30. *A. Belgicae*, Koehler. Hermaphrodite.
31. *A. Eugeniae*, Ljungman. Parthenogenetic (?).
32. *Amphiodia affinis* (Studer). Hermaphrodite.
33. *Amphipholis squamata* (D. Ch.). Hermaphrodite (including *A. japonica*, *sobrina*, and *patagonica*).
34. *A. misera*, Koehler. Hermaphrodite.
35. *Ophionereis vivipara*, Mortensen. Hermaphrodite.
36. *Cryptopelta aster* (Lyman). Hermaphrodite.
37. *C. granulifera*, H. L. Clark. Hermaphrodite.
38. *Pectinura cylindrica* (Hutton). Hermaphrodite.
39. *P. gracilis*, Mortensen. Hermaphrodite.
40. *Ophioconis vivipara*, Mortensen. Sexual character unknown.
41. *Ophiotjalfa vivipara*, Mortensen. Sexual character unknown.
42. *Ophiolebella biscutifera* (G. A. Smith). Hermaphrodite.
43. *Ophioceres incipiens*, Koehler. Protandric hermaphrodite.
44. *Ophiozonella falklandica*, Mortensen. Sexes separate.
45. *Ophiomages cristatus*, Koehler. Sexual character unknown.
46. *Ophiosteira antarctica*, Bell. Hermaphrodite.
47. *Ophiurolepis Martensi* (Studer). Sexes separate.
48. *Ophiura meridionalis* (Lyman). Hermaphrodite.
49. *O. Rouchi* (Koehler). Sexes separate.
50. *Amphiophiura Rowetti*, G. A. Smith. Hermaphrodite.
51. *A. gibbosa*, Mortensen. Sexual character unknown.
52. *Stegophiura nodosa* (Lütken). Hermaphrodite.
53. *S. vivipara*, Matsumoto. Hermaphrodite.
54. *Ophionotus hexactis* (E. A. Smith). Hermaphrodite.

Omitting the seven species the sexual character of which is unknown, we find thus that nine species of viviparous Ophiurids have separate sexes. Two or three appear to be parthenogenetic, and thirty-six species are hermaphrodites, one of them, *Ophioscolex nutrix*, a facultative hermaphrodite, some specimens having separate sexes.

The overwhelming majority of the viviparous Ophiurids thus are hermaphrodites. Since not a single non-viviparous Ophiurid is known to be hermaphrodite, there must be some connection between viviparity and hermaphroditism. One might suggest the reason for the hermaphroditism of the viviparous forms to be to facilitate fertilization; but the fact that several of these species are protandric hermaphrodites and others apparently parthenogenetic rather tells against such a suggestion. The fact that the species with separate sexes are mainly found among the more primitive forms, *Ophiomyxa*, *Ophiacantha*, may indicate that hermaphroditism represents a condition acquired by the more specialized forms; but since there are also forms with separate sexes among the morphologically highest types, e.g. *Ophiozonella* and *Ophiurolepis*, this reasoning loses its weight. Indeed, the whole matter seems inexplicable from the facts at present available.

Ophioceres incipiens is a rather intricate case. It seems fairly certain that it starts as a male, changing then to female, returning again to the male condition and finally to a pure female condition.

The very interesting fact that a sort of copulation takes place in the viviparous *Astrochlamys bruneus* might also represent an effort to facilitate fertilization; but the three other Ophiurids in which a similar copulation takes place, *Ophiodaphne materna*, Koehler, *Ophiosphaera insignis*, Brock, and *Amphilycus androphorus*, Mortensen, are not viviparous (cf. my paper quoted above, *Biological observations on Ophiurids*, pp. 178–88), so the above suggestion does not apply equally to all four cases of copulation.

It appears that there is a tendency towards an intra-ovarial development in the viviparous Antarctic Ophiurids. The only case hitherto known was *Ophionotus hexactis*; I have now found it to occur likewise in *Amphiura microplax* and *monorima*, and almost certainly also in *A. Lymani* and *Belgicae*, *Ophiomages cristatus*, and *Amphiophiura Rowetti*. The most remarkable of these cases is that of *Ophionotus hexactis*, in which the embryos even pass through a stage as a sort of "pelagic" larva within the ovary (cf. my *Studies of the development and larval forms of Echinoderms*, 1921, p. 179, pl. xxxii).

I cannot suggest any reasonable explanation of this tendency to give up using the bursae as a marsupium and to let the embryos develop within the ovaries themselves. It would seem that fertilization must be less easily practicable within the ovaries than within the bursae. On the whole, there are a number of perplexing questions in connection with this matter: why should there be such a high percentage of viviparous forms in the Antarctic–sub-Antarctic region, when in the Arctic–sub-Arctic region, with corresponding low temperatures, there are relatively much fewer viviparous forms; why that pronounced tendency to hermaphroditism among the viviparous forms, and why the tendency to intra-ovarial development? Perhaps the study of other animal groups in the same region may lead to the solution of these problems.

Mention may here be made of the curious fact discovered in *Ophiomitrella falklandica* that the older young ones within the bursae may feed upon their younger brothers and sisters. This recalls what was found in the viviparous Comatulid *Isometra vivipara*, Mortensen, where the young Pentacrinoids, attached to the cirri of the mother, catch and devour their brother and sister larvae on their passage from the marsupium in the pinnulae, where they are hatched, to the cirri, where they are to attach themselves (cf. my Report on the Crinoidea of the Swedish South Polar Expedition, 1918, p. 15).

One cannot help wondering how the young ones, which in several species reach a very considerable size within the mother, can get out through the genital slits, as for instance in *Ophiolebella biscutifera*, where the young reach the size of 2 mm. in diameter of disk and the genital slits are only 0·5 mm. long. It is astonishing how these young specimens, in spite of their rigid and apparently inflexible skeletons, can assume the most irregular shapes without even the most delicate of their plates being crushed when pressed together in the bursae, and still assume a normal radiate form when they are born. One must marvel also how the mother specimen can get food absorbed, when its stomach is squeezed by the large young ones, or even reduced to a network among the young ones, as in *Ophiochondrus stelliger* (cf. p. 260).

A good many of the Antarctic Ophiurans were found to be infested with parasites, mainly Crustaceans. The ectoparasitic Copepod *Cancerillopsis* was found on several specimens of *Ophiacantha disjuncta*. The curious entoparasitic Copepod *Ophioika* (or something related to it) was found in *Ophiacantha vivipara*, *O. disjuncta*, *Ophiomitrella falklandica*, *Ophiura meridionalis*, and *Ophiurolepis partita*. The Cirripedian *Ascothorax* was found in *Amphiura Belgicae* and *A. microplax*. In *A. Belgicae* likewise a curious sac-shaped, shell-less Gastropod was found, containing a number of embryos with shells (Fig. 19, p. 282). In *A. microplax disjuncta* a Nematode was found coiled up in the male gonads, and in *Ophiochondrus stelliger* a parasitic organism, probably referable to the peculiar problematic *Nidrosia*, which I described from the gonads of *Ophiura Sarsi* (Ingolf Ophiuroids, p. 74). Finally I may mention that I found some specimens of *Ophiacantha rosea* in the British Museum infested with *Myzostoma*, mainly at and within the bursae.

Several of the Ophiurids were taken in considerable numbers by the expedition and must play an important part in the ecology of the Antarctic and sub-Antarctic seas; but by far the most numerous of them is *Ophiocten amitinum*, young specimens of which were taken in several places off the Falkland Islands in incredible numbers, by hundreds of thousands, if not by millions! That they must form an important source of food for other animals is evident, as also that they must be competitors for food, being in both ways a factor of no small importance in the economy of these seas.

ECHINOIDEA

Family CIDARIDAE

Ctenocidaris speciosa, Mortensen

(Plate I, figs. 2–12)

Ctenocidaris speciosa, Mortensen, 1910. Swedish South Polar Exped. Echinoidea, VI, 4, p. 4, pls. i, ii; iii, figs. 1–2; iv, figs. 1–3; xiii.
C. speciosa, H. L. Clark, 1925. Cat. Recent Sea-Urchins Brit. Mus., p. 36.
C. speciosa, Mortensen, 1928. Monogr. Echinoidea. I, Cidaridae, p. 122.

St. 27.[1] 15. iii. 26. West Cumberland Bay, South Georgia, 110 m. Some young specimens, infested with *Echinophyces mirabilis*, Mortensen.

St. 39. 15. iii. 26. East Cumberland Bay, South Georgia, 179–235 m. 1 specimen.

St. 42. 1. iv. 26. Off mouth of Cumberland Bay, South Georgia, 120–204 m. Several specimens, some of them very young; partly infested with *Echinophyces*.

St. 123. 15. xii. 26. Off mouth of Cumberland Bay, South Georgia, 230–250 m. 5 specimens, 3 of them infested with *Echinophyces*. Also 4 very young specimens, just liberated from the marsupium.

St. 140. 23. xii. 26. Stromness Harbour to Larsen Point, South Georgia, 122–136 m. 3 small specimens, infested with *Echinophyces*. Also some very young specimens.

St. 142. 30. xii. 26. East Cumberland Bay, South Georgia, 88–273 m. 1 specimen.

St. 144. 5. i. 27. Off mouth of Stromness Harbour, South Georgia, 155–178 m. 3 specimens.

St. 148. 9. i. 27. Off Cape Saunders, South Georgia, 132–148 m. 6 specimens.

St. 160. 7. ii. 27. Near Shag Rocks, South Georgia, 177 m. 1 large, fine specimen and some small ones.

St. 170. 23. ii. 27. Off Cape Bowles, Clarence Island, 61° 25′ S, 53° 46′ W, 342 m. 1 specimen.

St. 190. 24. iii. 27. Bismarck Strait, Palmer Archipelago, 64° 56′ S, 65° 35′ W, 308–315 m. 6 specimens.

St. 600. 17. i. 31. 67° 09′ S, 69° 27′ W, off Adelaide Island, 487–512 m. 1 damaged specimen: identification not quite certain.

St. WS 33. 21. xii. 26. 54° 59′ S, 35° 24′ W, 135 m. 2 specimens.

St. WS 42. 7. i. 27. 54° 41′ S, 35° 47′ W, 175 m. 2 specimens.

St. MS 71. 9. iii. 27. East Cumberland Bay, South Georgia, 110–60 m. 5 specimens.

This species evidently is quite common off South Georgia and the Shag Rocks, whence the type specimens were brought home by the Swedish South Polar Expedition. As with the original specimens, some of those taken by the Discovery Expedition have the primary spines much overgrown with the slimy colonies of the Bryozoan *Alcyonidium* (Plate I, fig. 5), other specimens having them covered by great numbers of a small white, viviparous bivalve Mollusc (*Limopsis* sp.) (Plate I, figs. 2, 4). Adult specimens with the primary spines clean, not occupied by these commensals, are only rarely found.

A considerable percentage of the smaller specimens are of a quite peculiar appearance. The primary spines are more distinctly thorny and more slender than normal, and

[1] Further data concerning the stations where specimens were taken, including the nature of the bottom, the gear used and the temperature and salinity of the water, will be found in the Station Lists issued in this series of Reports. Particulars of Sts. 1–700 and Sts. WS 1–575 have already been published, and other lists dealing with later stations will appear in due course.

particularly the oral primaries are quite different from those of the normal form, not coarsely serrate as in the latter, but finely thorny like the other primaries and much more slender and fragile than in the typical form. On the whole such specimens look so different from the typical *Ctenocidaris speciosa* that it would seem almost incredible that they could belong to the same species (compare Plate I, figs. 2, 8, 9 with Plate I, figs. 3–5). Nevertheless, they actually do so. Their different appearance is due to the fact that they are infested with the peculiar parasitic organism *Echinophyces mirabilis*, which I described from *Rhynchocidaris triplopora*, Mortensen, in my Report on the Echinoidea of the German South Polar Expedition (1909, pp. 12–17, pl. xii). This parasite, the nature of which is quite problematic (perhaps a Phycomycete), lives in the primary spines (recognizable by some small tubes protruding through the spinules of the spine) and has the extraordinary effect of *causing the genital openings of the host to be removed from their usual place in the apical system to the edge of the peristome*; a new genital duct is formed, leading to the pore at the peristome. It looks, indeed, as if this were a sensible action, with the view of securing the transport of the eggs into the marsupium on the sunken peristome where the embryos are hatched.

In the original material of *Ctenocidaris speciosa* I found a couple of specimens infested with this same parasite; also in these specimens the genital openings were removed from the apical system, not, however, as far as the peristome, but to the middle of the interambulacra. The specimens in the present collection infested with the parasite give some important additional information. In this material also some of the infested specimens have the genital openings in the middle of the interambulacra (Plate I, fig. 11), but others have them at the peristomial edge, a little outside, or at the very edge or below the edge (Plate I, figs. 10, 12). And I find that *the specimens with the genital openings at the peristome are females, while those with the openings at the ambitus are males.* (One of the original specimens with the openings at the ambitus was also found to be a male; *op. cit.*, p. 11.)

Apart from this removal of the genital openings from the apical system the parasite has no castrating effect. The infested specimens are breeding fully, and there is not the slightest indication that the embryos are abnormal, though it may well be that the embryos are liable to be infested with the parasite through infection from the mother. I have found both eggs and nearly fully formed young ones in one and the same marsupium, not, however, in many different stages of development but so that the embryos were clearly of two sets, the eggs being thus evidently shed at different intervals, a limited number (scarcely ever more than *ca.* 10) at a time.

As none of the infested specimens exceed *ca.* 30 mm. h.d.[1] (whereas the normal specimens reach a size of at least *ca.* 50 mm. h.d.), it seems beyond doubt that the parasite interferes with the growth and dwarfs the specimens. At the same time they attain sexual ripeness at a much smaller size than the normal specimens. While in the latter the genital openings do not begin to appear until at a size of *ca.* 25 mm. h.d. (they are just about to appear in the specimen shown in Plate I, fig. 6), infested speci-

[1] Horizontal diameter.

mens may already have genital openings at a size of *ca.* 12 mm. h.d. The test may be much more flattened in the parasitized than in the normal specimens. Further, it is a natural consequence of the smaller size of the primary spines that the primary tubercles and their areoles are on the whole conspicuously smaller than in the normal specimens, and while in the latter they are, in the larger specimens, confluent to a considerable extent, they are in the parasitized specimens less confluent, sometimes even conspicuously apart. The median interambulacral space is also, of course, correspondingly more developed than in normal specimens (compare Plate I, fig. 7 with fig. 6). Further, the pedicellariae may afford a curious difference in being invested with a much thicker skin than in normal specimens (cf. Swedish South Polar Exped. Echinoidea, p. 10); this, however, is not a constant feature.

I may recall here the fact that *Ctenocidaris Perrieri*, Koehler, is also liable to attack by the parasite *Echinophyces* (cf. Monogr. Echinoidea. I, Cidaridae, p. 124).

The specimens from Sts. 170 and WS 42 differ from the typical form in having the oral primaries more spade-shaped, without coarse serrations (compare Plate I, figs. 3 and 5). As, however, they do not differ in their other characters from the typical form, and as also specimens intermediate in this regard occur, there is no reason for distinguishing these specimens as a separate variety, still less as a separate species.

In the original description of this species (*op. cit.*, p. 7) it was suggested that it might prove to be brood-protecting. In the material at hand there are, as a matter of fact, some specimens which carry embryos on the peristome—but only among the parasitized specimens; not one of the several normal adults is carrying young ones. Does it mean, perhaps, that only the parasitized specimens are brood-protecting, the normal ones not? This question cannot be answered from the material at hand. In the quite young, normal specimens, *ca.* 3 mm. diameter of test, the primary spines are of a distinctly embryonal character, rather strongly thorny (cf. Swedish South Polar Exped. Echinoidea, pl. xiii, fig. 6), very different from the largest of the embryos found in the marsupium of parasitized specimens; also the youngest free parasitized specimens have their primary spines much less thorny, and in addition their secondary spines differ from those of the normal ones in being coarser.

Ctenocidaris Perrieri, Koehler

Ctenocidaris Perrieri, Koehler, 1912. II[e] Expéd. Antarct. Française. Echinodermes, p. 150, pls. xii, figs. 4–8; xiii, figs. 2–8; xiv, figs. 9–14; xv, figs. 1–10.
C. Perrieri, H. L. Clark, 1925. Cat. Recent Sea-Urchins Brit. Mus., p. 35.
C. Perrieri, Mortensen, 1928. Monogr. Echinoidea. I, Cidaridae, p. 123, pl. lxix, fig. 23.
St. 181. 12. iii. 27. Schollaert Channel, Palmer Archipelago (64° 20′ S, 63° 01′ W, 160–335 m.). 4 adult specimens and 1 very young specimen.

None of these specimens carry embryos on their peristome, and there is thus still no proof of the suggestion set forth in my Cidarid Monograph (*op. cit.*, p. 124) that this species may be brood-protecting like *C. speciosa*. All the specimens are normal, not infested with *Echinophyces*.

The single very young specimen is too young (4 mm. h.d.) to be identified with certainty; it might equally well be referred to *C. speciosa*. But as it was found together with the adult *C. Perrieri*, whereas *C. speciosa* was not found at this station, there is the probability that it is *C. Perrieri*.

Ctenocidaris Geliberti (Koehler)

(Plate IX, fig. 8)

Eurocidaris Geliberti, Koehler, 1912. II[e] Expéd. Antarct. Française. Echinodermes, p. 146, pl. xiv, figs. 1–8.

E. Geliberti, Koehler, 1926. Austral. Antarct. Exped. Echinod. Echinoidea, p. 22, pls. 102, fig. 8; 119, fig. 3.

Ctenocidaris Geliberti, Mortensen, 1928. Monogr. Echinoidea. I, Cidaridae, p. 126, pl. lxxvii, fig. 9.

St. 599. 17. i. 31. 67° 08′ S, 69° 06′ W, 203 m. 1 specimen.

This is a young specimen, still without a trace of the genital openings, although of a fairly large size, 20 mm. h.d. This indicates that this species grows to a considerable size. The type, and only specimen hitherto known, is 30 mm. h.d.

As in the type specimen one of the oculars is insert. It is Oc. IV, as seems to be the case also in the type; this then may not improbably be a specific character. In the type specimen no large globiferous pedicellariae were found; Koehler even says (*op. cit.*, 1926) that they do not exist in this species. The present specimen shows this to be a mistake, a couple of large globiferous pedicellariae being found on its apical system. The valves (Plate IX, fig. 8) are long and slender, much as in *C. spinosa* (Koehler) (cf. Monogr. Echinoidea. I, Cidaridae, p. 125).

The young developing upper primary spines are greenish. The denuded test is white.

The locality of this specimen is close to that of the type specimen (Baie Marguerite); also the depth is the same.

Austrocidaris canaliculata (A. Agassiz)

(Plate I, fig. 1)

Austrocidaris canaliculata, Mortensen, 1910. Swedish South Polar Exped. Echinoidea, p. 11, pls. iii, figs. 6–8; iv, figs. 4–11; xiv, figs. 1–2, 6–11, 16–18.

A. canaliculata, H. L. Clark, 1925. Cat. Recent Sea-Urchins Brit. Mus., p. 27.

A. canaliculata, Mortensen, 1928. Monogr. Echinoidea. I, Cidaridae, p. 141, pls. xvi, figs. 14–15; lxxvii, fig. 18.

St. 51. 4. v. 26. Off Eddystone Rock, East Falkland Islands, 105–115 m. 2 specimens.

St. WS 81. 19. iii. 27. 8 miles N 11° W of North Island, West Falkland Islands, 81–82 m. Several specimens.

St. WS 82. 21. iii. 27. 54° 06′ S, 57° 46′ W, 140–144 m. 2 specimens.

St. WS 84. 24. iii. 27. $7\frac{1}{2}$ miles S 9° W of Sea Lion Island, East Falkland Islands, 74–75 m. 9 specimens (young).

St. WS 85. 25. iii. 27. 8 miles S 66° E of Lively Island, East Falkland Islands, 79 m. Several specimens.

St. WS 86. 3. iv. 27. 53° 53′ S, 60° 34′ W, 147–151 m. 1 small specimen.
St. WS 88. 6. iv. 27. 54° 00′ S, 64° 57′ W, 118 m. 2 specimens.
St. WS 90. 7. iv. 27. 13 miles N 83° E of Cape Virgins Light, Argentina, 52° 18′ S, 68° 00′ W, 82 m. 1 specimen.
St. WS 91. 8. iv. 27. 52° 53′ S, 64° 37′ W, 191–205 m. 1 specimen.
St. WS 92. 8. iv. 27. 51° 58′ S, 65° 01′ W, 143–145 m. 2 specimens.
St. WS 93. 9. iv. 27. 7 miles S 80° W of Beaver Island, West Falkland Islands, 130–133 m. 2 young specimens.
St. WS 98. 18. iv. 27. 49° 54′ S, 60° 35′ W, 171–173 m. 2 specimens.
St. WS 576. 17. iv. 31. 51° 35′ S, 57° 50′ W, 34–24 m. 5 specimens.
St. WS 755. 21. ix. 31. 51° 39′ S, 57° 39′ W, 75 m. 5 specimens.
St. WS 816. 14. i. 32. 52° 10′ S, 64° 56′ W, 150 m. 3 specimens.
St. WS 818. 17. i. 32. 52° 31′ S, 63° 25′ W, 272–278 m. 3 specimens.
St. WS 823. 19. i. 32. 52° 14′ S, 60° 01′ W, 80–95 m. 1 specimen.
St. WS 824. 19. i. 32. 52° 29′ S, 58° 27′ W, 146–137 m. 2 specimens.
St. WS 825. 19. i. 32. 50° 50′ S, 57° 13′ W, 135–144 m. 3 specimens.
St. WS 837. 3. ii. 32. 52° 49′ S, 66° 28′ W, 98–102 m. Several (young) specimens.
St. WS 847. 9. ii. 32. 50° 16′ S, 67° 57′ W, 51–56 m. 1 specimen.

From St. WS 85 there is a very fine specimen carrying a great number of embryos on the apical system. As a photographic figure of a specimen of this species carrying young ones has never been given, the drawing published by Wyville Thomson (Journ. Linn. Soc. Zool., XIII, 1876, p. 65; The Atlantic, II, p. 224) being the only figure hitherto in existence, I take the opportunity of giving here a photographic figure of the present specimen. It has one of its primary spines covered by a colony of an Ascidian, another by a sponge, while a third carries a thick lump of a Bryozoan, and others carry small *Spirorbis* tubes. The upper primaries are pointing straight upwards, not bent so as to cover the apical system; the young ones are held together in a large mass between these upright spines; apparently they do not use their tube feet for attaching themselves to the spines of the mother.

Eucidaris tribuloides (Lamk.)

(Plate I, figs. 13–15)

Eucidaris tribuloides, Mortensen, 1928. Monogr. Echinoidea. I, Cidaridae, p. 400.

St. 1. 16. xi. 25. Clarence Bay, Ascension Island, 16–27 m. 12 specimens.
St. 283. 14. viii. 27. Off Annobon, Gulf of Guinea, 18–30 m. 15 specimens.

These specimens again raise the question whether the form of *Eucidaris* from Ascension, which was designated by Koehler as *Cidaris minor*, should be regarded as a separate variety of *Eucidaris tribuloides*, or even as a separate species, or simply united with the typical *E. tribuloides*. In my Monograph of the Cidaridae (pp. 405–6) I came to the conclusion that there is no reason to distinguish it even as a variety.

The specimens in hand from Ascension are all very alike in regard to the markedly verticillate primary spines and the brown-banded secondaries. On comparing them with specimens of corresponding sizes from the West Indies it is evident that, besides the much more verticillate character of the primary spines, the Ascension form has in general a conspicuously larger peristome (cf. Plate I, figs. 13 and 15); the apical system

also is slightly larger. Further, there is a very conspicuous difference in the colour of the secondary spines: a uniform yellowish or whitish with scarcely any indication of a darker band in the West Indian form, brownish or with a very conspicuous brownish band in the Ascension form. On the other hand, the young specimens from Annobon, Gulf of Guinea, are much more like the Ascension form, the secondary spines being almost as dark and the primary spines almost as distinctly verticillate as in the latter. Also the dark band on the secondary spines may be rather distinct in the Annobon specimens, and the dimensions of apical system and peristome are likewise rather alike. It therefore seems to follow that the Ascension form is identical with the West African form, viz. the var. *africana* of *E. tribuloides*. But as long as we do not know any large specimens of either the typical *tribuloides* or the variety from Ascension (the largest of the specimens in hand is 17 mm. h.d.), there is always the possibility that the Ascension form does not grow to such a large size as the typical form and the var. *africana*, and if so the Ascension form evidently should be regarded as a distinct variety. For the present the question cannot be definitely settled.

In regard to the pedicellariae, it may be pointed out that the large globiferous ones are like those of the typical West Indian *tribuloides*. No tridentate pedicellariae are found on any of the specimens examined.

Measurements are given here of some of the specimens from Ascension and, for the sake of comparison, of specimens from the West Indies and from Annobon of corresponding sizes; of the latter, unfortunately, only quite young specimens are available.

h.d. mm.	v.d. mm.	Apical system mm.	Peristome mm.	Number of		Longest spines mm.
				I.A.	A. pro I.A.	
Eucidaris tribuloides from Ascension						
17·2	9	8·5 (49·4 % h.d.)	10 (53 % h.d.)	6	7–8	11
15	8	7 (46·6 ,,)	8 (53·3 ,,)	6–7	7–8	14
12·5	7	6 (48 ,,)	8 (64 ,,)	6	7	7
11·5	6·5	6 (50·2 ,,)	7 (60·9 ,,)	5	7–8	9
11	6	5·5 (50 ,,)	6·5 (59 ,,)	5	7–8	8
8	4	4 (50 ,,)	4·5 (56·2 ,,)	4–5	5–6	8
Eucidaris tribuloides, West Indies, typical form						
18	7·5	7 (39 ,,)	7 (39 ,,)	6	8–9	20
17	9	7 (41·2 ,,)	8 (47 ,,)	6	7–8	17
13	7	6 (46·1 ,,)	6·5 (50 ,,)	6	7–8	19
10	5	4·5 (45 ,,)	5 (50 ,,)	5–6	6–8	9
Eucidaris tribuloides, var. *africana* from Annobon						
11	5	5·5 (50 ,,)	6 (54·5 ,,)	5	6–7	8
8	4	4 (50 ,,)	4 (50 ,,)	4–5	5–6	9

Family ARBACIIDAE

Arbacia Dufresnii (Blainville)

Arbacia Dufresnii, P. de Loriol, 1904. Notes pour servir à l'Étude des Echinodermes, 2 Sér., II, p. 8, pl. ii, figs. 2–5.
A. Dufresnii, Agassiz and H. L. Clark, 1908. Hawaiian Echini. The Salenidae, Arbaciadae, etc., p. 69, pl. 47, figs. 1–11.
A. Dufresnii, Mortensen, 1910. Swedish South Polar Exped. Echinoidea, p. 25, pls. v, figs. 4–12; xv, figs. 2–3, 6, 8–10, 13.
A. Dufresnii, H. L. Clark, 1925. Cat. Recent Sea-Urchins Brit. Mus., p. 69.
A. Dufresnii, Mortensen, 1935. Monogr. Echinoidea. II, p. 579.

St. 1321. 16. iii. 34. Cockburn Channel, Tierra del Fuego, 66 m. 4 specimens and 4 dead tests.
St. WS 71. 23. ii. 27. 6 miles N 60° E of Pembroke Light, East Falkland Islands, 80–82 m. 1 specimen.
St. WS 81. 19. iii. 27. 8 miles N 11° W of North Island, West Falkland Islands, 81–82 m. 3 specimens.
St. WS 83. 24. iii. 27. 14 miles S 64° W of George Island, East Falkland Islands, 129–137 m. 8 specimens.
St. WS 85. 25. iii. 27. 8 miles S 66° E of Lively Island, East Falkland Islands, 79 m. 2 specimens.
St. WS 583. 2. v. 31. 53° 39′ S, 70° 54′ W, 14–78 m. 1 specimen.
St. WS 755. 21. ix. 31. 51° 39′ S, 57° 39′ W, 75 m. 2 specimens.

H. L. Clark (*op. cit.*, 1925) has called attention to the remarkable fact that this species has never been recorded from the Falkland Islands. Upon zoogeographical grounds it was rather inexplicable that it should not occur there, the Falkland Islands being so integral a part of the Magellanic region, where this species otherwise is widely distributed. It extends up to the La Plata River on the east coast and to 42° S on the west coast (Puerto Montt), and also as far south as the Antarctic Coast (Booth Wandel Island, cf. below), its range in depth being from the littoral region down to *ca.* 300 m. It is thus very satisfactory that the species has now been found to occur also off the Falkland Islands.

The species might well be expected to occur also off South Georgia; but as it has never been recorded from there, and as it is not represented in any of the numerous dredgings off South Georgia by the 'Discovery' it would seem to be a fact that it does not occur there. This induces one to think that there must be something wrong with the single specimen from the Antarctic coast (Booth Wandel Island) brought home by the Expédition Charcot (cf. Koehler, 1906, Stellérides, Ophiures et Echinides. Expéd. Antarct. Française, 1903–1905, p. 29). As a misidentification is hardly thinkable, I cannot help suggesting that there must be a mistake with the label, the specimen having in reality been obtained from some South American locality. If the species really occurs on the Antarctic coast, it is strange that the Discovery as well as all the other Antarctic expeditions failed to find it to the south of South America.

In view of Bernard's statement (*Echinides recueillis par l'Expédition du Cap Horn*, Bull. Mus. d'hist. nat. Paris, 1895) that this species is brood-protecting, rearing its young on the buccal membrane, it is important to notice that there is no indication that any of the specimens at hand carry the young ones on the peristome. Moreover, I think

it quite beyond doubt that Bernard's observation rests on a misinterpretation, viz. that the young specimen (of 6 mm. h.d.) which he found on the peristome of one of his specimens had come there accidentally, probably during capture or preservation. The fact that the eggs of *A. Dufresnii* are very small, 0·1 mm., and extremely numerous is entirely incompatible with a brood-protecting habit and indicates that this species has pelagic larvae, as is the case with the other species of *Arbacia*. Studer's observation (*Gazelle-Echinoidea*, Monatsber. Akad. Berlin, 1880, p. 868) that the eggs when shed remained attached to the test, is no doubt due to the unnatural conditions under which the observation was made. In any Echinoid with pelagic larvae the same thing may be observed; ripe specimens on being removed from the water are very often induced to shed their eggs and then the eggs will remain in thick clusters on the test, among the spines, whereas when shed under natural conditions the eggs are gradually dispersed in the water. I have found such thick layers of eggs in preserved specimens of many species of sea-urchins known to have pelagic larvae; and not only the eggs, even the sperm may be found similarly lying in thick layers on the test. Both cases are found among the specimens of *A. Dufresnii* in this collection. It may be added that these eggs —as was to be expected—are found to be unfertilized, or at least cleavage has not yet begun. We may thus certainly dismiss, as without any foundation whatever, the idea that *A. Dufresnii* is a brood-protecting species (cf. Mortensen, Swedish South Polar Exped. Echinoidea, p. 32).

Family DIADEMATIDAE

Diadema antillarum, var. ascensionis, Mortensen

Diadema ascensionis, Mortensen, 1909. Deutsche Südpolar-Exped. Echinoiden, p. 55, Taf. vii, fig. 10; xvi, figs. 1, 4, 8, 16–17, 21–23.

D. antillarum, var. *ascensionis*, Mortensen, 1933. *Echinoderms of St Helena* (*other than Crinoids*). Papers from Dr Th. Mortensen's Pacific Exped., 1914–16, LXVI (Vid. Medd. Dansk Naturh. Foren., 93), p. 465.

For other literary references see my paper of 1933, *loc. cit.*

St. 1. 16. xi. 25. Clarence Bay, Ascension, 16–27 m. 7 specimens.

As set forth in my paper on the Echinoderms of St Helena, the shape of the tridentate pedicellariae is so characteristic and constant that it is not justifiable to identify this mid-Atlantic *Diadema* simply as *D. antillarum*. Whether we regard it as a variety of the latter, or as a separate species, is of small importance.

The specimens all have the spines banded with white and brownish, and are, indeed, very delicate and beautiful objects. Concerning the blue lines (which appear white in the preserved specimens) it may be pointed out that there are two parallel lines in each interambulacrum, not one bifurcating line, as stated in my paper on the St Helena Echinoderms; the two lines issue separately from the apical ring, though apparently not directly connected with the latter.

Centrostephanus sp. (young)

St. 283. 14. vii. 27. Annobon, Gulf of Guinea, 18–30 m. 5 specimens.

These specimens are probably the young of *C. longispinus* (Philippi); but they are too young to be identified with certainty as belonging to this species, the young stages of which are unknown. They are of sizes 4–8 mm. h.d.; no genital pores are formed as yet. The spines are banded, brownish and white.

Family TEMNOPLEURIDAE

Genocidaris maculata, A. Agassiz

Temnocidaris maculata, A. Agassiz, 1872. Revision of the Echini, p. 286, pl. viii, figs. 1–18.
Genocidaris maculata, Mortensen, 1903. Danish 'Ingolf' Exped. Echinoidea, 1, p. 84, pls. vii, figs. 24, 30; viii, fig. 7.
G. maculata, Döderlein, 1906. Deutsche Tiefsee-Exped. Echinoiden, p. 198, Taf. xxv, fig. 2; xxxv, fig. 13; xlvi, fig. 4.
G. maculata, H. L. Clark, 1925. Cat. Recent Sea-Urchins Brit. Mus., p. 76.

St. 279. 10. viii. 27. Off Cape Lopez, French Congo, 58–67 m. 1 specimen.

The specimen is a young one, only 4 mm. h.d., with as yet no genital pores. But I see no reason to doubt that it is really this species which has already been recorded from off the Congo by Döderlein (*op. cit.*).

Family ECHINIDAE

Sterechinus Agassizii, Mortensen

(Plate II, figs. 11–16)

Sterechinus Agassizii, Mortensen, 1910. Swedish South Polar Exped. Echinoidea, p. 42, pls. vi, figs. 9–12; vii, fig. 3; xvi, figs. 1, 7–8, 13, 15, 18.
Echinus margaritaceus, H. L. Clark, 1912. Hawaiian Echini. Pedinidae . . . Echinometridae, p. 262.
E. diadema, H. L. Clark, 1925. Cat. Recent Sea-Urchins Brit. Mus., p. 113.

For references to literature prior to 1910 I may refer to my work on the Echinoids of the Swedish South Polar Expedition, *loc. cit.*

St. 27. 15. iii. 26. West Cumberland Bay, South Georgia, 110 m. 2 specimens.
St. 39. 25. iii. 26. East Cumberland Bay, South Georgia, 179–235 m. 7 specimens.
St. 42. 1. iv. 26. Off mouth of Cumberland Bay, South Georgia, 120–204 m. 2 specimens (young).
St. 146. 8. i. 27. 53° 48′ S, 35° 37′ W, South Georgia, 728 m. Several specimens.
St. 157. 20. i. 27. 53° 51′ S, 36° 11′ W, South Georgia, 970 m. 4 specimens.
St. 158. 21. i. 27. 53° 48′ S, 35° 57′ W, South Georgia, 401–411 m. 16 specimens.
St. 160. 7. ii. 27. Near Shag Rocks, South Georgia, 177 mm. 8 specimens.
St. WS 27. 19. xii. 26. 53° 55′ S, 38° 01′ W, South Georgia, 107 m. 5 specimens.
St. WS 86. 3. iv. 27. 53° 53′ S, 60° 34′ W, South Georgia, 151–147 m. 5 specimens.
St. WS 91. 8. iv. 27. 52° 53′ S, 64° 37′ W, South Georgia, 191–205 m. 1 specimen.
St. WS 93. 9. iv. 27. 7 miles S 80° W off Beaver Island, West Falkland Islands, 133 m. 4 specimens (young).
St. WS 97. 18. iv. 27. 49° 00′ S, 61° 58′ W, 146 m. 1 specimen.

St. WS 99. 19. iv. 27. 49° 42′ S, 59° 14′ W, 251–225 m. 2 specimens.
St. WS 109. 26. iv. 27. 50° 18′ S, 58° 28′ W, 145 m. 3 specimens.
St. WS 211. 29. v. 28. 50° 17′ S, 60° 06′ W, 161–174 m. 2 specimens.
St. WS 228. 30. vi. 28. 50° 50′ S, 56° 58′ W, 229–236 m. 1 specimen.
St. WS 246. 19. vii. 28. 52° 25′ S, 61° 00′ W, 267–208 m. 1 specimen.
St. WS 248. 20. vii. 28. 52° 40′ S, 58° 30′ W, 210–242 m. 12 specimens.
St. WS 795. 18. xii. 31. 46° 14′ S, 60° 24′ W, 157–161 m. 1 specimen.
St. WS 840. 6. ii. 32. 53° 52′ S, 61° 49′ W, 368–463 m. 1 specimen.
St. MS 71. 9. iii. 26. East Cumberland Bay, South Georgia, 110–160 m. 1 specimen.

The specimens from St. 39 might almost equally well be identified as *S. antarcticus* (cf. below).

The specimen from St. WS 91 measures no less than 81 mm. h.d., and thus by far exceeds the largest size hitherto recorded for this species, viz. 60 mm. It is of the typical shape, low-conical (Plate II, figs. 14–16); even at this large size the oculars are all exsert. As might be expected, the secondary tubercles of the oral side are particularly well developed; but the fact that the areoles of the consecutive plates are widely separated is unusual, they being otherwise as a rule confluent. On the other hand, the areoles of the primary and the larger secondary tubercles of the same plates may be confluent near the ambitus. That this is merely an individual peculiarity, not indicating a local type, appears from the fact that other specimens from the same region (e.g. St. WS 109) have the areoles confluent.

Plate II, figs. 12, 13 give a good representation of the characteristic appearance of this species when preserved with its dense, bristling coat of delicate secondary spines intact. Unfortunately these spines, as well as the primary ones, are exceedingly brittle so that the merest touch will break them.

Sterechinus antarcticus, Koehler

Sterechinus antarcticus, Koehler, 1902. Result. Voyage 'Belgica'. Echinides et Ophiures, p. 8, pls. ii, figs. 9–10; iii, figs. 1–8, viii, figs. 55–56.

S. antarcticus, Mortensen, 1909. Deutsche Südpolar-Exped. Echinoiden, p. 75, Taf. viii, figs. 2, 4, 14–15; ix, figs. 1, 3–5, 14; xvii, figs. 1, 7, 10, 16, 19–21, 26, 30.

St. 170. 23. ii. 27. Clarence Island, 342 m. 4 specimens.
St. 175. 2. iii. 27. Bransfield Strait, South Shetlands, 200 m. 1 specimen (young).
St. 177. 5. iii. 27. 27 miles SW of Deception Island, South Shetlands, 1080 m. 1 specimen (fragments).
St. 180. 11. iii. 27. Schollaert Channel, Palmer Archipelago, 160–330 m. 2 specimens.
St. 181. 12. iii. 27. Schollaert Channel, Palmer Archipelago, 160–335 m. 3 specimens.
St. 182. 14. iii. 27. Schollaert Channel, Palmer Archipelago, 278–500 m. 1 specimen.
St. 599. 17. i. 31. 67° 08′ S, 69° 06′ W, 203 m. 1 specimen (young).
St. WS 167. 1. iii. 28. 53° 31′ S, 39° 22′ W, 460 m. 1 specimen.

The distinction between *S. antarcticus* and *S. Agassizii* is not sharp; as a matter of fact the specimens from St. 181 may perhaps rather be referable to *S. Agassizii*, while, on the other hand, the specimens from St. 39 mentioned above under *S. Agassizii* might equally well be referred to *S. antarcticus*. The consequence is that *S. antarcticus* can hardly be maintained as a separate species, but only as a variety, and not even a very

distinct variety. The reason why I do not follow H. L. Clark (Hawaiian Echini, Pedinidae. . . Echinometridae, p. 262; Cat. Recent Sea-Urchins Brit. Mus., p. 113) in regarding *antarcticus* as a simple synonym of *S. diadema* (Studer)—with which latter also *S. Agassizii* and *Neumayeri* are united as simple synonyms—is because the typical *antarcticus* is a very characteristic form and apparently mainly confined to the Antarctic, whereas both *diadema* and *Agassizii* are mainly sub-Antarctic. That *antarcticus* and *Agassizii* meet off South America, the former extending as far north as South Shetlands, perhaps South Georgia, the latter as far south as South Georgia, the two forms thus meeting there, is a natural consequence of the geography of this region. Very probably the two forms also interbreed here, this adding to the difficulty of distinguishing them clearly in all cases. If they did occur together over their whole area, I should not hesitate to regard them as only one very variable species; but so far as at present known each of them has its own area of distribution. Therefore I do not think it correct simply to regard them all as one single species, as does Clark. That *diadema*, *Agassizii* (formerly "*margaritaceus*") and *antarcticus* are very closely related and evidently only local specializations of one single, original species I quite agree. As for *S. neumayeri* I do not think it so closely connected with the other three forms, but quite a distinct species, though it also evidently interbreeds with *antarcticus* (or *Agassizii*), which makes some specimens, very probably hybrids, difficult to refer with certainty to one or other form.

Sterechinus Neumayeri (Meissner)

(Plate II, figs. 1–4)

Sterechinus Neumayeri, Mortensen, 1909. Deutsche Südpolar-Exped. Echinoiden, p. 64, Taf. vii, fig. 7; viii, fig. 6; ix, figs. 2, 6–7, 9, 11–13, 15; xvii, figs. 2–6, 8, 12–14, 17–18, 22–23, 27, 29.

S. Neumayeri, Mortensen, 1910. Swedish South Polar Exped. Echinoidea, p. 42, pls. vi, figs. 7–8; vii, figs. 1–2, 4.

S. Neumayeri, Koehler, 1912. II^{e} Expéd. Antarct. Française. Echinodermes, p. 160, pl. xiii, fig. 1.

For other literary references see the work of 1909, *loc. cit.*

St. 141. 29. xii. 26. East Cumberland Bay, South Georgia, 17–27 m. 1 specimen.

St. 163. 17. ii. 27. Paul Harbour, Signy Island, South Orkneys, 18–27 m. 16 specimens.

St. 164. 18. ii. 27. Normanna Strait, Coronation Island, South Orkneys, 24–36 m. Several specimens.

St. 173. 28. ii. 27. Port Foster, Deception Island, South Shetlands, 5–60 m. Several specimens.

St. 371. 14. iii. 30. 1 mile E of Montagu Island, South Sandwich Islands, 99–61 m. 1 specimen.

St. 1489. 17. i. 35. Port Lockroy, Wiencke Island, Palmer Archipelago. On the beach, at low tide. 1 specimen.

St. MS 71. 5. iii. 26. East Cumberland Bay, South Georgia, 110–60 m. 2 specimens.

St. MS 73. (No information.) South Georgia. 3 specimens.

St. MS 74. 17. iii. 26. East Cumberland Bay, South Georgia, 22–40 m. 2 specimens.

The specimens from St. MS 71 are unusually lightly coloured and have a rather close resemblance to *S. Agassizii*; quite probably they are hybrids between these two species.

The specimens from St. 173 have unusually long primary spines, thus looking rather different from the normal form (Plate II, figs. 1–3). There are, however, no other differences, and as other specimens are rather intermediate in regard to the length of the spines, I do not think it desirable to designate these specimens by a separate name, not even as a "forma".

Notechinus magellanicus (Philippi)

Notechinus magellanicus, Döderlein, 1906. Deutsche Tiefsee-Exped. Echinoiden, p. 227, Taf. xxvii, fig. 9; xxviii, figs. 3–4; xxxv, fig. 15; xlvii, fig. 5.

N. magellanicus, Mortensen, 1910. Swedish South Polar Exped. Echinoidea, p. 36, pl. xvi, figs. 3, 6, 9–12, 19.

N. magellanicus, Bernasconi, 1925. Result. Primera Exped. a Tierra del Fuego. Equinodermos, p. 10, Lam. ii, figs. 1–3.

Pseudechinus magellanicus, H. L. Clark, 1925. Cat. Recent Sea-Urchins Brit. Mus., p. 118.

St. 48. 3. v. 26. 8·3 miles N 53° E of Port William, Falkland Islands, 105–115 m. Several specimens.

St. 51. 4. v. 26. Off Eddystone Rock, East Falkland Islands, 105–115 m. 3 specimens.

St. 52. 5. v. 26. Port William, East Falkland Islands, 17 m. 1 specimen.

St. 229. 4. v. 27. 53° 40′ S, 61° 10′ W, 46–0 m. 3 specimens.

St. 388. 16. iv. 30. 56° 19′ S, 67° 10′ W, 121 m. 11 specimens.

St. 652. 14. iii. 31. 54° 04′ S, 61° 40′ W, Burdwood Bank, 171–169 m. 1 specimen.

St. 724. 16. xi. 31. Fortescue Bay, Magellan Strait, 0–5 m. 5 specimens.

St. WS 71. 23. ii. 27. 6 miles N 60° E of Cape Pembroke, East Falkland Islands, 82–80 m. Several specimens.

St. WS 73. 6. iii. 27. 51° 01′ S, 58° 54′ W, 121–130 m. Several specimens.

St. WS 77. 12. iii. 27. 51° 01′ S, 66° 31′ W, 110–113 m. Several specimens.

St. WS 79. 13. iii. 27. 51° 01′ S, 64° 59′ W, 132–131 m. 1 specimen.

St. WS 80. 14. iii. 27. 50° 57′ S, 63° 37′ W, 152–156 m. 6 specimens, and 5 dead tests.

St. WS 81. 19. iii. 27. 8 miles N 11° W of North Island, West Falkland Islands, 81–82 m. 2 specimens.

St. WS 82. 21. iii. 27. 54° 06′ S, 57° 46′ W, 140–144 m. 4 specimens.

St. WS 84. 24. iii. 27. 7·5 miles S 9° W of Sea Lion Island, East Falkland Islands, 75–74 m. 10 specimens.

St. WS 85. 25. iii. 27. 8 miles S 66° E of Lively Islands, East Falkland Islands, 74–75 m. 5 specimens.

St. 88. 6. iv. 27. 54° S, 64° 57′ W, 118 m. 2 specimens.

St. WS 93. 9. iv. 27. 7 miles S 80° W of Beaver Island, West Falkland Islands, 133–130 m. 1 specimen.

St. WS 94. 16. iv. 27. 50° S, 64° 57′ W, 110–126 m. 5 specimens.

St. WS 95. 17. iv. 27. 48° 58′ S, 64° 45′ W, 109–108 m. 1 specimen.

St. WS 210. 29. v. 28. 50° 17′ S, 60° 06′ W, 161 m. 2 specimens.

St. WS 211. 29. v. 28. Same position as WS 210. 161–174 m. 3 specimens.

St. WS 212. 30. v. 28. 49° 22′ S, 60° 10′ W, 242–249 m. 8 specimens.

St. WS 216. 1. vi. 28. 47° 37′ S, 60° 50′ W, 219–133 m. 14 specimens.

St. WS 218. 2. vi. 28. 45° 45′ S, 59° 35′ W, 311–247 m. 1 specimen.

St. WS 219. 3. vi. 28. 47° 06′ S, 62° 12′ W, 116–114 m. 1 specimen.

St. WS 225. 9. vi. 28. 50° 20′ S, 62° 30′ W, 162–161 m. 6 specimens (young).

St. WS 228. 30. vi. 28. 50° 50′ S, 56° 58′ W, 229–236 m. 1 specimen.

St. WS 229. 1. vii. 28. 50° 35′ S, 57° 20′ W, 210–271 m. 7 specimens.

St. WS 236. 6. vii. 28. 46° 50′ S, 60° 40′ W, 272–300 m. 1 specimen.
St. WS 237. 7. vii. 28. 46° 00′ S, 60° 05′ W, 150–256 m. 15 specimens.
St. WS 239. 15. vii. 28. 51° 10′ S, 62° 10′ W, 196–193 m. 1 specimen.
St. WS 243. 17. vii. 28. 51° 06′ S, 64° 30′ W, 144–141 m. Several specimens.
St. WS 244. 18. vii. 28. 52° 00′ S, 62° 40′ W, 253–247 m. Several specimens.
St. WS 248. 20. vii. 28. 52° 40′ S, 58° 30′ W, 210–242 m. 1 specimen.
St. WS 576. 17. iv. 31. 51° 35′ S, 57° 50′ W, 34–24 m. 1 specimen.
St. WS 583. 2. v. 31. 53° 39′ S, 70° 54′ W, 14–78 m. 1 specimen.
St. WS 755. 21. ix. 31. 51° 39′ S, 57° 39′ W, 75 m. Several specimens.
St. WS 764. 17. x. 31. 44° 38′ S, 61° 58′ W, 106–110 m. Several specimens.
St. WS 782. 4. xii. 31. 50° 28′ S, 58° 30′ W, 141–146 m. 4 specimens.
St. WS 795. 18. xii. 31. 46° 14′ S, 60° 24′ W, 157–161 m. 2 specimens.
St. WS 799. 21. xii. 31. 48° 04′ S, 62° 48′ W, 141–137 m. 1 specimen.
St. WS 801. 22. xii. 31. 48° 26′ S, 61° 28′ W, 165 m. 3 specimens.
St. WS 804. 6. i. 32. 50° 23′ S, 62° 49′ W, 150–143 m. 8 specimens.
St. WS 825. 28. i. 32. 50° 50′ S, 57° 15′ W, 135–144 m. 3 specimens.
St. WS 829. 31. i. 32. 50° 51′ S, 63° 13′ W, 155 m. 1 specimen.

The question whether *Notechinus* should be regarded simply as a synonym of *Pseudechinus*, as is the opinion of Clark (*op. cit.*, 1925), or whether it should be retained as a genus distinct from *Pseudechinus*, I intend to discuss in Part III of my Monograph of the Echinoidea. For the present, at least, I prefer to regard it as a separate genus, in accordance with the opinion of Döderlein.

Notechinus marionis, n.sp.

(Plate II, figs. 5–10; Plate IX, figs. 1–4)

St. 1562. 7. iv. 35. 46° 53′ S, 37° 55′ E, 97–104 m. Several specimens.
St. 1563. 7. iv. 35. 46° 48′ S, 37° 49′ E, 101–106 m. Several specimens.
St. 1564. 7. iv. 35. 46° 36′ S, 38° 02′ E, 108–113 m. 12 specimens.

These stations are all off Marion Island.

h.d. mm.	v.d. mm.	Apical system* mm.	Peristome mm.	Number of	
				A.	I.A.
25	12·2	7·5 (30 % h.d.)	9 (36 % h.d.)	20–21	13–14
24	12	7 (29·1 ,,)	9 (37·5 ,,)	20–21	13–14
22	10·5	6·8 (30·9 ,,)	8·5 (38·6 ,,)	20–21	12
21·5	11	6 (28 ,,)	8 (37·2 ,,)	19–20	12–13
19	9·5	6·5 (34·2 ,,)	7 (37 ,,)	18–19	11–12
16	8·5	4·5 (28·1 ,,)	6 (37·5 ,,)	17	11–12
15·5	7·5	5 (32·3 ,,)	6 (38·7 ,,)	16–17	11–12
13	7	4·5 (34·7 ,,)	5 (38·5 ,,)	15–16	10
12	6	3·5 (29·1 ,,)	5 (41·7 ,,)	15	11

* Measured along the longest axis, Oc. I, Gen. 3.

Largest specimens 27 mm. in diameter of test. The test is low, hemispherical, the circumference circular or rounded pentagonal; it is only slightly sunken towards the peristome.

Primary ambulacral tubercles distinctly smaller than the interambulacral primaries; they are confluent till well above the ambitus. In the largest specimens the secondaries along the median line are slightly enlarged so as to indicate median series. Primary interambulacral tubercles confluent up to the ambitus. In the largest specimens the secondaries are somewhat enlarged at the ambitus, forming fairly conspicuous secondary series, sometimes also outside the primary series, but these outer tubercles are somewhat smaller than those inside the primary series. Rarely there may be two enlarged secondary tubercles inside the primary one, these three then forming together an oblique, upward-turning series on each plate at the ambitus (Plate II, fig. 10). There is no naked median space in either ambulacra or interambulacra.

The apical system is fairly large, *ca.* 30 per cent of the horizontal diameter of the disk. Oc. I is insert, as usual in *Notechinus*, but often Oc. II and V, or even also Oc. IV, are insert. There is a rather broad naked outer margin on the apical plates. The periproct is rather large, the plates very characteristically thin and flat, and perfectly smooth. The

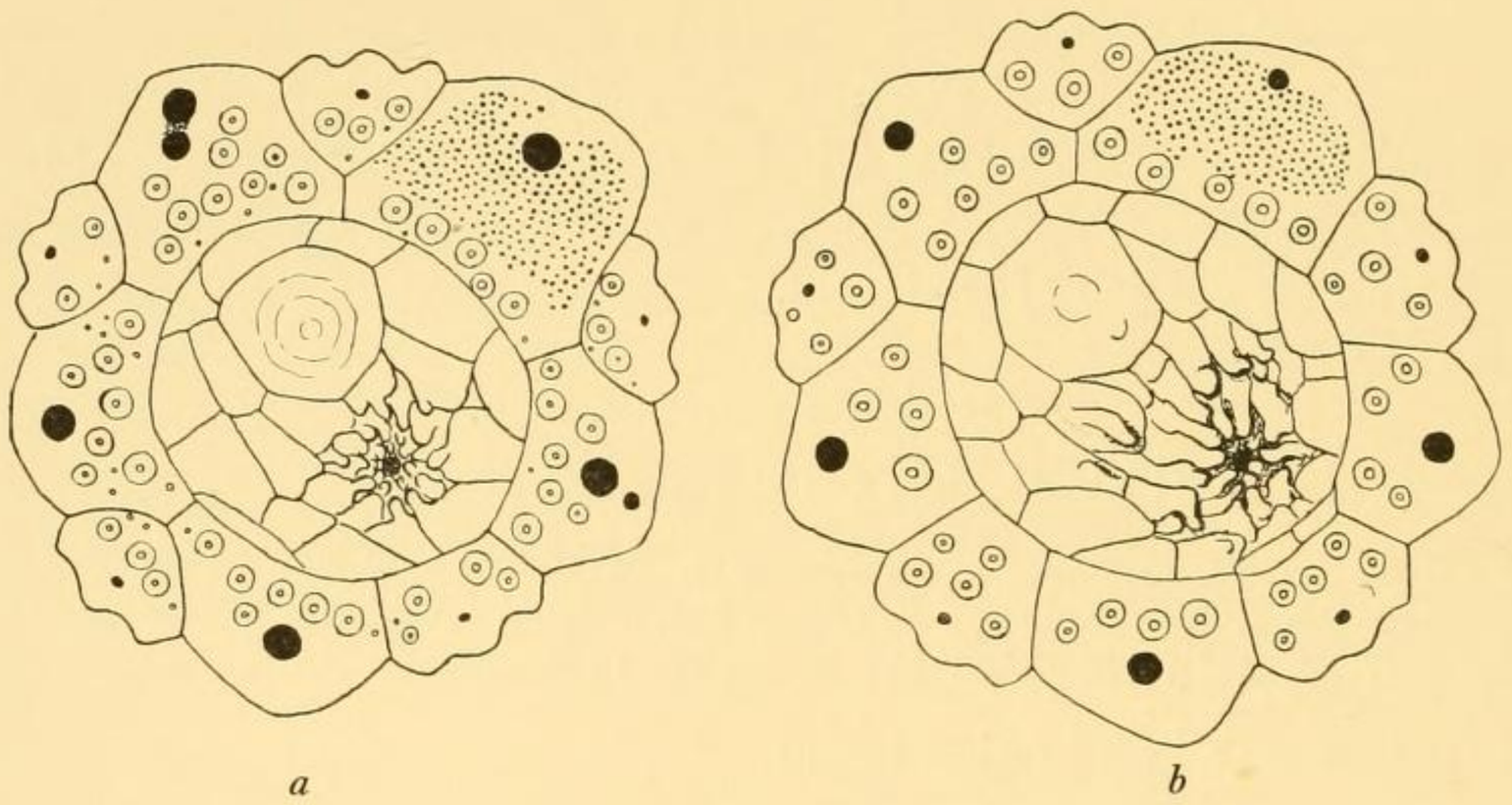

Fig. 1. Apical system of *Notechinus marionis*, n.sp., ×9.

suranal plate is, except in the small specimens, from a size of *ca.* 14 mm. h.d., usually separated from the edge of the periproct by a series of small plates (Fig. 1 *a*, *b*). It usually shows some concentric striations. The small plates round the anal opening are raised into small papillae. The peristome, as typical of the genus, is wholly devoid of plates outside or inside the buccal plates; some few, very slender bihamate spicules are found in the distal part.

Spines rather slender, not exceeding a length of *ca.* 10 mm., even in the largest specimens; those around the peristome slightly curved. Secondary spines slender, but, as typical of the genus, not pointed. Pedicellariae as typical of the genus. The large globiferous pedicellariae may have up to three teeth along either side of the blade; but equally often there are only one or two. The small globiferous pedicellariae with one tooth on either side (Plate IX, figs. 2, 3). Both sorts of globiferous pedicellariae on the whole rather numerous. Tridentate pedicellariae exceedingly scarce, often totally lacking. They

are small, of the usual form, as are also the ophicephalous and triphyllous pedicellariae. Only very few bihamate spicules in the intestinal walls, but the walls of the (coalesced) gonads are studded with large bihamate spicules. Colour of the spines whitish. The denuded test white with a faint greenish or brownish tint on the aboral side. The periproct white, rarely with a tinge of greenish on the suranal plate.

Particularly by the character of its periproct and by its colour this species is very well distinguished from the two other species of *Notechinus* hitherto known, *N. magellanicus* (Philippi) and *novae-zealandiae*, Mortensen. Also the number of interambulacral plates is smaller. It might have been expected that these specimens from off Marion Island would prove to be identical with the variety *novae-amsterdamiae* described by Döderlein (Deutsche Tiefsee-Exped. Echinoiden, p. 229) from New Amsterdam, and Döderlein (*op. cit.*) expressed the opinion that the specimens from off Marion Island and Prince Edward Island taken by the 'Challenger' and identified by Agassiz as *Echinus magellanicus* (Challenger Echinoids, p. 116) would belong to the var. *novae-amsterdamiae*. Without having seen these specimens I venture to say that they will most probably belong to the present species, *Notechinus marionis*. The fact that H. L. Clark (Cat. Recent Sea-Urchins Brit. Mus., p. 118) states their colour to be "very light" is in favour of this suggestion, but re-examination of the specimens is necessary for definitely settling this question.

Loxechinus albus (Molina)

Loxechinus albus, Mortensen, 1910. Swedish South Polar Exped. Echinoidea, p. 52, pls. vi, figs. 1–6; viii; xvi, figs. 2, 4–5, 14, 16–17.
L. albus, H. L. Clark, 1925. Cat. Recent Sea-Urchins Brit. Mus., p. 134.
L. albus, Bernasconi, 1925. Result. Primera Exped. a Tierra del Fuego. Equinodermos, I, p. 7, Lam. i, figs. 4–6.

St. 982. 18. x. 32. Sholl Bay, Cockburn Channel, Magellan Strait. Littoral. 1 specimen.

Parechinus angulosus (Leske)

Parechinus angulosus, Mortensen, 1903. Danish 'Ingolf' Exped. Echinoidea, I, p. 108.
Protocentrotus angulosus, Döderlein, 1906. Deutsche Tiefsee-Exped. Echinoiden, p. 204, Taf. xxvii, figs. 6–8; xxxv, fig. 16; xlvii, fig. 6.
Parechinus angulosus, H. L. Clark, 1925. Cat. Recent Sea-Urchins Brit. Mus., p. 117.

1926. Saldanha Bay. Beach collection. 6 specimens.
8. ix. 26. Simons Town, Cape Peninsula, 0–2 m. 1 specimen.
St. 90. 11. vii. 26. Simons Town. Cape Peninsula, 1–2 m. 7 specimens.

I must join Clark in regarding the species *angulosus* as the type of the genus *Parechinus*, Döderlein's genus *Protocentrotus* thus becoming a synonym of *Parechinus*.

Family ECHINOMETRIDAE

Echinometra lucunter (Linn.)

Echinometra lucunter, Mortensen, 1933. *Echinoderms of St Helena* (*other than Crinoids*). Papers from Dr Th. Mortensen's Pacific Exped., 1914–16, LXVI (Vid. Medd. Dansk Naturh. Foren., 93), p. 468.

For other literary references, see the paper quoted.

St. 2. 17. xi. 25. Clarence Bay, Ascension. Littoral. 4 specimens.
St. 271. 29. xi. 27. Elephant Bay, Angola. Littoral. 2 specimens.

As for the identification of these specimens as *E. lucunter* I may refer to the remarks given in my St Helena Echinoderms, *loc. cit.* I expect that a thorough revision of the Echinometras will give the result that these mid-Atlantic and West African specimens are not simply identical with the West Indian *E. lucunter*. But this is not the place for such revision; I hope to give it in Part III of my Monograph of the Echinoidea.

Family HEMIASTERIDAE

Abatus cavernosus (Philippi)

(Plate III, figs. 11, 12)

Abatus cavernosus, Mortensen, 1910. Swedish South Polar Exped. Echinoidea, p. 70, pls. ix; x, figs. 2, 4, 6–8, 10–13; xvii, fig. 9; xviii, figs. 3–4; xix, figs. 28–30, 32–33, 35–39, 41–43, 45–46, 50–51.

A. cavernosus, H. L. Clark, 1917. Hawaiian Echini. Echinoneidae...Spatangidae, p. 175.

A. cavernosus, H. L. Clark, 1925. Cat. Recent Sea-Urchins Brit. Mus., p. 205.

A. cavernosus, Bernasconi, 1925. Result. Primera Exped. a Tierra del Fuego. Equinodermos. i. Echinoidea, p. 12, Lam. ii, figs. 4–6.

A. cavernosus, Koehler, 1926. Austral. Antarct. Exped. Echinod. Echinoidea, VIII, iii, p. 53, pl. cix, figs. 1–4, 6–8.

A. cavernosus, Grieg, 1929. *Echinodermata from the Palmer Archipelago, South Shetlands, South Georgia and Bouvet Islands*, Sci. Results Norwegian Antarct. Exped. 1927–8 and 1928–9, II, p. 12.

A. cavernosus, Grieg, 1929. *Some Echinoderms from the South Shetlands*. Bergens Mus. Årbok, 1929, III, p. 8.

A. cavernosus, Tortonese, 1933. *Gli Echinodermi del Museo di Torino*. I. *Echinoidi*. Boll. Mus. Zool. Torino, XLIII, p. 160, Tav. xi, fig. 48.

A. cavernosus, Tortonese, 1934. *Asterie ed Echini della Patagonia e della Tierra del Fuoco*. Boll. Mus. Zool. Torino, XLIV, p. 12.

The literature prior to 1910 has been dealt with in my work on the Echinoids of the Swedish South Polar Expedition, where a revision of the *Abatus* species and related forms was given, clearing up so far as possible the confusion till then reigning in this group of Spatangoids. As for the older literature reference may be made to this revision, only the literary references to works after 1910 being given here. The statement of Grieg that *A. cavernosus* occurs at Kerguelen is evidently a mistake that has crept in from the old literature.

St. 27. 15. iii. 26. West Cumberland Bay, South Georgia, 110 m. 1 young specimen.
St. 28. 16. iii. 26. West Cumberland Bay, South Georgia, 168 m. 3 specimens.
St. 30. 16. iii. 26. West Cumberland Bay, South Georgia, 251 m. Several specimens.

St. 39. 25. iii. 26. East Cumberland Bay, South Georgia, 179–235 m. Several specimens.
St. 42. 1. iv. 26. Off Cumberland Bay, South Georgia, 120–204 m. 5 specimens.
St. 45. 6. iv. 26. East of Jason Island, South Georgia, 238–270 m. 8 specimens.
St. 140. 23. xii. 26. Stromness Harbour to Larsen Point, South Georgia, 122–136 m. 8 young specimens.
St. 142. 30. xii. 26. East Cumberland Bay, South Georgia, 88–273 m. Several specimens.
St. 146. 8. i. 27. 53° 48′ S, 36° 02′ W, South Georgia, 728 m. 1 young specimen(?).
St. 148. 9. i. 27. Off Cape Saunders, South Georgia, 132–148 m. 2 very young specimens.
St. 167. 20. ii. 27. Off Signy Island, South Orkney Islands, 244–344 m. 1 medium-sized, 1 large, 9 small specimens.
St. 182. 14. iii. 27. Schollaert Channel, Palmer Archipelago, 278–500 m. 2 very young specimens.
St. WS 32. 21. xii. 26. Mouth of Drygalski Fjord, South Georgia, 91–225 m. 1 specimen.
St. WS 62. 19. i. 27. Wilson Harbour, South Georgia, 26–83 m. Several specimens.
St. MS 15. 17. ii. 25. East Cumberland Bay, South Georgia, 109 m. 9 specimens.
St. MS 68. 2. iii. 26. East Cumberland Bay, South Georgia, 220–247 m. Several specimens.
St. MS 69. 5. iii. 26. East Cumberland Bay, South Georgia, 146 m. 1 specimen.

Attention should be called to the rather extraordinary variation which occurs in this species (as in *Amphipneustes Lorioli*) in regard to the size of the marsupia; they may, indeed, be twice as large in one specimen as in another. Also in the males the depth of the petals varies very considerably, and they are sometimes so deep that one would rather think them to be female marsupia. The small size of the genital pores shows, however, that they are actually males (as I have also verified by an examination of the gonads).

The extraordinary development of the marsupia in the female is best realized by inspection of the interior side of the test. Plate III, figs. 11, 12 represent the inside of the test of a female and a male.

The commensal bivalve Mollusc occurring on this species has been described by Grieg (Echinoderms from the Palmer Archipelago, p. 14) under the name of *Montacuta Christenseni*. In my work of 1910, p. 73, I stated that, according to information given me by Mr H. Lynge, it should belong to the genus *Lepton*.[1] This apparent discrepancy is due to the fact that *two different sorts* of bivalves are found commensally on this Spatangoid. By far the commoner is the *Lepton*, with perfectly smooth valves. The *Montacuta* with radiating ribs, as described by Grieg, I have found only on the specimen from St. 142. I have not found both the commensals together on the same specimens of the sea-urchin. The *Lepton* in particular often occurs in great numbers, almost filling up the petals, and the apical system is often completely covered by them. The tests of the *Lepton* are so exceedingly thin as to leave no trace when the specimens are dried. That this is not due to the preserving fluid having been acid is evident from the fact that the finest details of the valves of the pedicellariae are intact.

Very young specimens of this Echinoid, when found isolated, are not identifiable with complete certainty; this applies, for example, to the specimens from Sts. 140 and 148

[1] Bernasconi (*op. cit.*, p. 16) also records such bivalves, and these were identified by Professor Duello Jurado as belonging to the genus *Lepton*.

and perhaps also to the young specimens from St. 167. On the whole it is scarcely possible to distinguish with certainty between *Abatus cavernosus* and *A. Philippii* in the young stages; but when, as is often the case, only *A. cavernosus* is represented among the adults from some station, the young ones occurring with them may no doubt be regarded as belonging to this species also.

The specimen from St. 146, a young one 14 mm. in length, has the rostrate pedicellariae remarkably diversified; its identification as *A. cavernosus* I must regard as quite uncertain, though its globiferous pedicellariae are of the *cavernosus* type. It has two subanal tube feet developed. The great depth, 728 m., is also unusual for *cavernosus*. It is possible that it is really a new species of *Abatus*, but to base a new species of the difficult genus *Abatus* on a single young specimen I would think unreasonable.

Abatus cavernosus, var. bidens, Mortensen

(Plate III, fig. 10; Plate IX, figs. 9–11)

Abatus cavernosus, var. *bidens*, Mortensen, 1910. Swedish South Polar Exped. Echinoidea, p. 73, pl. xix, figs. 32, 35, 39, 42.

St. 39. 25. iii. 26. East Cumberland Bay, South Georgia, 179–235 m. 2 specimens.
St. MS 15. 17. ii. 25. East Cumberland Bay, South Georgia, 110 m. 1 specimen.

The information about *A. elongatus* (Koehler) given below, p. 227, shows that the present form has nothing to do with that species, as might be suggested. Perhaps it would be more correct to regard this form as a separate species.

Abatus curvidens, n.sp.

(Plate III, fig. 9; Plate IX, figs. 17–20)

St. 181. 12. iii. 27. Schollaert Channel, Palmer Archipelago, 160–335 m. 1 specimen.
St. 182. 14. iii. 27. Schollaert Channel, Palmer Archipelago, 278–500 m. 1 specimen.

Length mm.	Breadth mm.	Height mm.
42	37	24
36	34	23

The larger specimen, which is the holotype, is a male, in a very good state of preservation; the smaller specimen is a female, somewhat broken.

Test low, but somewhat hemispherical, the apex being slightly anterior; it is distinctly broader in the anterior part, with a notch at the frontal ambulacrum, which is only slightly sunken. The posterior petals are about two-thirds the length of the anterior ones. Both of them are transformed into marsupia in the female. The peripetalous fasciole is on the very edge of the test anteriorly; some little distance behind the anterior petals it bends sharply inwards; the posterior part of the fasciole, across the posterior interambulacrum, is nearly straight. The posterior edge of the test slopes slightly downwards. The labrum, which is rounded, extends backwards to opposite the middle of the second adjoining ambulacral plates. The peristome not much sunken. Four well-developed subanal tube feet.

The globiferous pedicellariae are very numerous in the type specimen along all the ambulacra inside the fasciole; a good number also occur on the posterior interam-

bulacrum, behind the fasciole. They are very conspicuous on account of their dark colour, the general colour of the specimen being a light brownish. In the smaller specimen they are not nearly so numerous and are much less conspicuous, due to the specimen having been dried. The valves (Plate IX, figs. 19, 20) are small, elegantly curved (the species name *curvidens* refers to this feature), terminating in two or three long slender teeth; the number of the teeth appears to be more generally two, but it is by no means rare to find three of them. Often there is an irregular hump on the dorsal side of the valves. The rostrate pedicellariae are small; the valves are curved at the end, which is somewhat constricted, and have only two to four short teeth, sometimes none at all (Plate IX, fig. 18). Along the sides of the valves there are usually some rather coarse serrations. The tridentate pedicellariae, which do not reach any large size, only *ca.* 0·5 mm. length of head, have broad simply leaf-shaped valves (Plate IX, fig. 17). There are no two-valved pedicellariae. The triphyllous pedicellariae are just like small tridentate ones.

It is quite evident that this form cannot be referred to any of the rather numerous species of the genus *Abatus* hitherto known. One of these species was insufficiently known, viz. *A. elongatus* (Koehler), the description and figures of this species given by Koehler in his record of the Echinoderms of the Scotia Expedition (Trans. Roy. Soc. Edinb., XLVI, 1908, p. 618, pl. xvi, figs. 145–58) being not all that could be desired. Thus nothing is said about the important character whether subanal tube feet are present or not. As one of the co-types has very kindly been sent me for re-examination from the Edinburgh Museum, I take the opportunity of supplying here some information of this species; from this it appears that *A. elongatus* is a distinct species, not identical with *A. Agassizii*, as I formerly suggested (Swedish South Polar Exped. Echinoidea, p. 86). The specimen is unfortunately badly broken and the exact number of the subanal tube feet cannot be stated, but there are at least three of them. The labrum ends opposite the second adjoining ambulacral plate. The figures of the pedicellariae given by Koehler are rather crude, so I have taken the opportunity of giving some new figures of them (Plate IX, figs. 12–16). It was particularly Koehler's fig. 155, said to represent a rostrate pedicellaria, that I found strange and remarkably different from the rostrate pedicellariae of other species of *Abatus*. They proved to be tridentate pedicellariae of the characteristic restricted form often occurring with two valves (here only three-valved samples were found) (Plate IX, fig. 16). The rostrate pedicellariae are of quite another shape (Plate IX, fig. 14) and were overlooked by Koehler. The characters of the pedicellariae show beyond doubt that the present species is entirely different from Koehler's "*Hemiaster*" *elongatus*.[1]

Of the other species of *Abatus* with bidentate globiferous pedicellariae, *A. bidens*, Mortensen, *A. Shackletoni*, Koehler, *A. Agassizii* (Pfeffer), and *A. ingens*, Koehler, the

[1] The species name *elongatus* was changed by Thiéry into *Koehleri*, because a (fossil) *Hemiaster elongatus* had already been described. Since, however, Koehler's species does not belong to *Hemiaster*, but to the genus *Abatus*, there is no need to change the specific name. In this I quite agree with Koehler (Austral. Antarct. Exped. Echinod. Echinoidea, p. 55).

three latter differ in the absence of subanal tube feet (besides other characters). As for *A. bidens* (which as stated above, p. 226, is perhaps better regarded as a separate species than as a variety of *A. cavernosus*) it differs markedly in the form of the pedicellariae, as seen from the figures given here for comparison (Plate IX, figs. 9–11).

Abatus Philippii, Lovén

Abatus Philippii, Lovén, 1871. *Om Echinoideernas byggnad.* Öfvers. Vet. Akad. Förh., VIII, p. 6.
A. Philippii, Mortensen, 1910. Swedish South Polar Exped. Echinoidea, p. 83, pls. xi, figs. 6, 9–13; xix, fig. 47.
A. Philippii, H. L. Clark, 1917. Hawaiian Echini. Echinoneidae...Spatangidae, p. 175.
For other literary references see my work on the Echinoidea of the Swedish South Polar Expedition, *loc. cit.*

St. 181. 12. iii. 27. Schollaert Channel, Palmer Archipelago, 160–335 m. 1 specimen and fragment (dorsal side) of another. Both are males; still, I do not think the identification as *A. Philippii* doubtful.

The validity of *A. Philippii* as a distinct species is somewhat uncertain. Clark (*op. cit.*, 1917) suggests that it may be based only on specimens of *A. cavernosus* in which the posterior petals have not yet been transformed into marsupia. The material at my disposal does not support Clark's suggestion that the marsupia of the female do not develop contemporaneously, but that the anterior ones develop first and the posterior ones later. Thus in a couple of specimens of 30–32 mm. length I find all the marsupia equally developed, though not very deep as yet, the specimens being not yet mature, as is evident from an examination of the gonads. On the other hand, the fact that *A. Philippii* appears to be on the whole of rare occurrence tends to support Clark's suggestion. It may also be possible that the forms with only the anterior petals transformed into marsupia may represent aberrant specimens of *cavernosus*. However this may be, I think it desirable for the present to designate these specimens with only the anterior petals transformed into marsupia under the name *A. Philippii*, whether it be a "forma", an "aberratio", a variety, or a true species.

Abatus Agassizii (Pfeffer)

Abatus Agassizii, Mortensen, 1910. Swedish South Polar Exped. Echinoidea, p. 86, pls. x, figs. 1, 3, 5, 9, 14; xix, fig. 4.
A. Agassizii, H. L. Clark, 1917. Hawaiian Echini. Echinoneidae...Spatangidae, p.176.
? *A. Agassizii*, H. L. Clark, 1925. Cat. Recent Sea-Urchins Brit Mus., p. 204.

St. 55. 16. v. 26. Entrance to Port Stanley, East Falkland Islands, 10–16 m. 1 young specimen.
St. 388. 16. iv. 30. 56° 19′ S, 67° 10′ W, 121 m. 1 specimen.
St. WS 25. 17. xii. 26. Undine Harbour, South Georgia, 18–27 m. 2 young specimens.
22. x. 34. Weir Creek, Falkland Islands, 3·5 m. 3 young specimens.

Although these specimens are quite young, 5–18 mm. long, I have no doubt that the identification is correct. The absence or feeble development of the subanal tube feet affords a marked difference, particularly from *A. cavernosus*, in which these tube feet are already well developed in specimens which have just left the marsupium. As for the

specimens from Heard Island and the Ross Sea referred by Clark (*op. cit.*, 1925) to *A. Agassizii* I think it questionable whether they are actually *A. Agassizii*, and Clark expressed himself with some reservation on this point.

Globiferous pedicellariae were not found in any of these specimens, this type of pedicellaria being thus still unknown in *A. Agassizii*.

This species was hitherto known with certainty only from South Georgia; the finding of it at the Falkland Islands by the 'Discovery' is thus of considerable interest.

Schizaster (Tripylaster) Philippii (Gray)

Tripylus Philippii, Gray, 1855. Cat. Recent Echinida Brit. Mus. I, Irregularia, p. 59, pl. v, fig. 1.

Schizaster Philippii, A. Agassiz, 1872. Revision of the Echini, p. 612, pl. xxvi, figs. 40, 41.

S. (*Tripylaster*) *Philippii*, Mortensen, 1907. Danish 'Ingolf' Exped. Echinoidea, II, pp. 122, 123.

S. (*Tripylaster*) *Philippii*, Mortensen, 1910. Swedish South Polar Exped. Echinoidea, p. 90, pls. xii, figs. 8, 10–11; xix, figs. 5, 7, 15–16, 21, 31, 48–49.

Tripylaster Philippii, H. L. Clark, 1917. Hawaiian Echini. Echinoneidae...Spatangidae, p. 177.

For other literary references see my work of 1910, *loc. cit.*

St. 51. 4. v. 26. Off Eddystone Rock, East Falkland Islands, 105–115 m. 1 dead test.

St. WS 83. 24. iii. 27. 14 miles S 64° W of George Island, East Falkland Islands, 137 m. 1 specimen.

St. WS 785. 6. xii. 31. 49° 25′ S, 62° 37′ W, 150 m. 1 specimen.

The specimen from St. WS 83 is of medium size, 60 mm. long, 52 mm. broad. That from St. 51, which is an old, dead test, partly covered with worm tubes, is 77 mm. long, 72 mm. broad, thus distinctly broader than the younger specimen. I see, however, no reason to doubt their identity, such variation in shape being of common occurrence in most species. In the specimen from St. WS 83 I find the pedicellariae of the typical shapes, as described in my work on the Echinoidea of the Swedish South Polar Expedition. The specimen from St. WS 785 is almost totally denuded, only a couple of small tridentate pedicellariae being left. But it is evidently a typical *T. Philippii*.

Amphipneustes Koehleri, Mortensen

Amphipneustes Koehleri, Mortensen, 1910. Swedish South Polar Exped. Echinoidea, p. 94, pls. xi, figs. 2–5, 7, 8, 15, 18; xvii, figs. 10–11; xviii, figs. 1–2; xix, figs. 3–4, 8–9, 13–14, 19–20, 23–25, 27.

A. Koehleri, H. L. Clark, 1917. Hawaiian Echini. Echinoneidae...Spatangidae, p. 163.

A. Koehleri, H. L. Clark, 1925. Cat. Recent Sea-Urchins Brit. Mus., p. 198.

St. 27. 15. iii. 26. West Cumberland Bay, South Georgia, 110 m. Several specimens.

St. 42. 1. iv. 26. West Cumberland Bay, South Georgia, 120–204 m. 5 specimens.

St. 126. 19. xii. 26. 53° 58′ 30″ S, 37° 08′ W, 100(–0) m. 1 specimen.

St. 140. 23. xii. 26. Stromness Harbour to Larsen Point, South Georgia, 122–136 m. Several specimens.

St. 144. 5. i. 27. Off mouth of Stromness Harbour, South Georgia, 155–177 m. 1 specimen.

St. 148. 9. i. 27. Off Cape Saunders, South Georgia, 132–148 m. 4 specimens.

St. 160. 7. ii. 27. Near Shag Rocks, South Georgia, 177 m. 2 specimens.

St. 474. 12. xi. 30. 1 mile W of Shag Rocks, South Georgia, 199 m. Several specimens.

St. WS 33. 21. xii. 26. 54° 59′ S, 35° 24′ W, 130 m. 4 specimens.

None of the present specimens exceed a length of 33 mm. As none of the other specimens known exceed a length of 38 mm. (the type specimen) it is evident that this is about the maximum size of this species, which is, accordingly, noticeably smaller than the other species of the genus *Amphipneustes*.

In my description of this species (*op. cit.*, 1910) I was unable to decide whether young specimens have a fasciole. The large material now at hand, containing specimens of all stages, allows this question to be settled. As was to be expected there is not the slightest trace of a fasciole at any stage of development and growth.

In the type specimen (*op. cit.*, p. 96, pl. xi, fig. 18) the labrum was found to reach as far backwards as the middle of the second ambulacral plate. This is a rather unusual condition. Generally it reaches only to the middle of the first ambulacral plate; but it is sometimes more elongate, so as to reach to the middle of the second ambulacral plate. This has nothing to do with age; the elongate condition of the labrum may be found in quite young specimens and, on the other hand, the short labrum in adult specimens. Sometimes the labrum ends opposite the middle of the first ambulacral plate on one side, of the second on the other side; in such a case the first ambulacral plate on the one side is conspicuously produced posteriorly.

The genital pores appear at a size of about 12–15 mm. length.

It would appear that the embryos leave the marsupium at a somewhat earlier stage than in *A. Lorioli* or *similis*.

Amphipneustes Lorioli, Koehler

(Plate III, figs. 5–8; Plate IV, fig. 8; Plate IX, fig. 27)

Amphipneustes Lorioli, Koehler, 1901. Result. Voyage 'Belgica'. Echinides et Ophiures, p. 12, pls. ii, fig. 12; v, fig. 37; vi, figs. 42, 43.

A. Lorioli, Mortensen, 1910. Swedish South Polar Exped. Echinoidea, p. 91, pls. xi, figs. 17, 19; xix, figs. 1–2, 6, 10–12, 17, 22, 26.

A. Mortenseni, Koehler, 1912. II^{e} Expéd. Antarct. Française. Echinodermes, p. 176, pl. xv, figs. 11–17; xvi, figs. 1–5.

A. Lorioli, H. L. Clark, 1917. Hawaiian Echini. Echinoneidae...Spatangidae, p. 163.

A. Lorioli, H. L. Clark, 1925. Cat. Recent Sea-Urchins Brit. Mus., p. 198.

St. 181. 12. iii. 27. Schollaert Channel, Palmer Archipelago, 160–335 m. 4 specimens.
St. 182. 14. iii. 27. Schollaert Channel, Palmer Archipelago, 278–500 m. 4 specimens.
St. 600. 17. i. 31. 67° 09′ S, 69° 27′ W, off Adelaide Island, 487–512 m. 1 specimen.

Three of the specimens are females. As shown in Plate III, figs. 5, 6 and Plate IV, fig. 8, there is a conspicuous variation in the development of the petals; also the general shape of the large specimen (Plate III, fig. 6) is somewhat different from that of the other specimens, it being distinctly higher than the other specimens, and somewhat more flattened on top.

It is a curious fact that the marsupia of two of the specimens are quite empty; the third contains only very few embryos and eggs, three stages of development being represented. The largest embryos, which are 3 mm. long and just ready to leave the marsupium, do not show any trace of a fasciole. Pedicellariae have not yet been

formed; I have found only what appears to be the first rudiment of a globiferous pedicellaria.

One of the specimens has the madreporite separated from the right anterior genital plate, as was the case in the type specimen; in all the other specimens there is no line separating the madreporite from the right anterior genital. All the specimens have three genital pores, the existence of four genital pores in the type specimen being evidently an anomaly.

Globiferous pedicellariae, which were hitherto only very imperfectly known in this species, are found well developed. They are of a highly characteristic structure, the valves terminating in a number of quite short teeth (Plate IX, fig. 27), a type not known from any other species of the *Amphipneustes-Abatus* group. As for the other pedicellariae I may refer to the description and figures given in my report on the Echinoids of the Swedish South Polar Expedition.

I must regard it as almost certain that the *A. Mortenseni*, Koehler, is not to be maintained as a species separate from *A. Lorioli*. The former being known only from a female specimen, the latter from a couple of male specimens, it was of course not easy to point out exactly by which characters the two species differed from each other; but Koehler thinks the pedicellariae show sufficient differences to prove that the two forms represent different species. It is remarkable that Koehler could have reached this conclusion. Only tridentate and rostrate pedicellariae were known at that time, and they are absolutely identical. In the shape and structure of test the two "species" are exactly alike, apart from the difference due to the different sexes. There only remains the question of the globiferous pedicellariae. In my report on the Echinoids of the Swedish South Polar Expedition (pp. 93–4) I mention having found in *A. Lorioli* one, very poorly preserved, globiferous pedicellaria that seemed to be of the same structure as the globiferous pedicellariae of *A. Koehleri*: that is to say with the valves terminating in two long teeth and thus conspicuously different from those here figured. But it is stated that "the valves have in addition to the two large teeth in the point one or two shorter teeth". This might indicate that they are actually different from those of the present specimens. If so, the present specimens are not identical with *A. Lorioli*, but should be referred to *A. Mortenseni*, since it is a fact that the globiferous pedicellariae in these forms afford excellent specific characters. But until it is definitely proved that in the forms described respectively as *A. Lorioli* and *A. Mortenseni* we have two different types of globiferous pedicellariae, I must believe that both belong to one species, the name of which must be the older, viz. *A. Lorioli*. I may add that I have had an opportunity of examining the type of *A. Mortenseni* in the Paris Museum; unfortunately not a single globiferous pedicellaria is left on it.

Amphipneustes similis, n.sp.

(Plate IV, figs. 1–7; Plate IX, figs. 21–26)

St. 170. 23. ii. 27. Off Cape Bowles, Clarence Island, 342 m. 1 specimen.
St. 180. 11. iii. 27. Schollaert Channel, Palmer Archipelago, 160–330 m. 2 specimens.
St. 182. 14. iii. 27. Schollaert Channel, Palmer Archipelago, 278–500 m. 3 specimens.

The outline of the test is almost regularly oval; the height varies rather considerably, as seen from the measurements. Particularly the specimen from St. 170 (no. 5 in the table below) is unusually low. The apical system is central, but the greatest height is behind the apical system, the posterior interambulacrum rising as a more or less prominent keel. The periproct is situated on the slightly truncated posterior end, scarcely visible from below. The labrum is rather prominent, the peristomial part of the test rather conspicuously sunken; the plastron is quite flat.

	Length mm.	Height mm.	Width mm.	Length of petals mm.		
				Antero-lateral	Postero-lateral	
1	72	40	63	28	26	♂ ♀ Holotypes
2	72	44	62	28	25	
3	65	34	57	22	21	♀ ♂ Cotypes
4	61	31	53	24	23	
5	54	25	47	14	14	

The petals of the male are rather distinctly sunken, the postero-lateral ones more so than the antero-lateral ones. The frontal ambulacrum distinctly petaloid and almost as much sunken as the antero-lateral petals. In the female the paired petals are transformed into deep marsupia, the width of which varies very conspicuously, as seen in Plate IV, figs. 2, 5.

The interambulacra are more or less raised, the posterior one, as stated, forming a keel, which may be quite sharp or more rounded. The sternum is narrow, gently widening towards the posterior end. The madreporite is small. There are usually three genital openings, but the specimen from St. 170 and one of those from St. 182, both females, have only two. In the former specimen the right anterior marsupium is undeveloped (Plate IV, fig. 3); this specimen accordingly is somewhat abnormal.

The spines form a uniform, not very dense covering, among which the numerous, black globiferous pedicellariae in well-preserved specimens stand out very conspicuously on the aboral side.

The valves of the globiferous pedicellariae terminate in five long, slender teeth, as in *Parapneustes* (Plate IX, figs. 22, 23). The rostrate and tridentate pedicellariae also are of the same type as in *Parapneustes*, but there is some variation in the shape of the rostrate form (Plate IX, fig. 26).

The colour is a light brownish.

The young ones in the same marsupia are in all stages, from the egg to the fully formed young (14 mm.) ready to leave the marsupium.

In the female holotype the frontal ambulacrum is somewhat abnormally bent (Plate IV, fig. 2).

This is a very perplexing species. It agrees almost completely in every respect with *Parapneustes reductus*, Koehler—but there is no trace of fascioles, whereas the fascioles,

according to Koehler, are particularly well developed in *P. reductus*, better so than in the species *P. cordatus*. The fact that the fascioles in Koehler's figure of *P. reductus* in side view (*op. cit.*, pl. xvi, 14) seem to have been retouched on the photo, whereas figs. 12 and 13 of the same plate, showing the same specimen from above and in end view, do not show any trace of fascioles, might lead one to suggest that some mistake has crept into the representation of the species. Having had an opportunity of re-examining the type specimen in the Paris Museum I can, however, testify to the correctness of Koehler's description and figures. The fasciole has been marked with a black line on the specimen, not on the photo; but it is quite distinctly seen on the specimen.

It might, of course, be suggested that fascioles were originally present in the Discovery specimens, but have been reduced in the course of development. If so, one would expect a fasciole to be developed in the young ones ready to leave the marsupium. There is, however, no trace of a fasciole in the young specimens from the marsupium in the present species. These specimens, it may be added, have the globiferous pedicellariae typically developed.

The present species forms a most remarkable parallel to *P. reductus*; but the character of the fascioles, entirely absent in one and distinctly developed—though very thin—in the other, shows definitely that the two forms belong to two distinct genera.

Parapneustes cordatus, Koehler

(Plate III, figs. 1–4)

Parapneustes cordatus, Koehler, 1912. II[e] Expéd. Antarct. Française. Echinodermes, p. 165, pl. xvi, figs. 15–27.

P. cordatus, H. L. Clark, 1917. Hawaiian Echini. Echinoneidae...Spatangidae, p. 173.

St. 181. 12. iii. 27. Schollaert Channel, Palmer Archipelago, 160–335 m. 2 specimens.
St. 182. 14. iii. 27. Schollaert Channel, Palmer Archipelago, 278–500 m. 4 specimens.

Only a single, apparently male, specimen of this species was taken by the 'Pourquoi-Pas?'. Koehler's very careful description of this specimen could thus, of course, not be all that was to be desired and in particular the question whether this species is brood-protecting like most other Antarctic Spatangoids had to be left undecided. It is therefore most satisfactory that the 'Discovery' has secured some specimens in fair preservation, which give not only the solution of the question whether the species is brood-protecting, but also other very important information.

The specimens, which are all adult, 49–56 mm. in length, agree perfectly with the type specimen in regard to their general shape, only the restriction of the posterior part of the test is sometimes less pronounced. Also in the pedicellariae (particularly those remarkable globiferous pedicellariae with the valves terminating in five long and slender teeth) these specimens agree perfectly with the type. But in regard to the fascioles they differ conspicuously from the type specimen. Whereas this latter had only the peripetalous fasciole developed, the present specimens also have a latero-subanal fasciole. As a rule the peripetalous fasciole is fairly distinct, but it may be more or less reduced, sometimes more on one side than on the other; the latero-subanal fasciole is generally

distinct on the side of the test; the subanal part is sometimes quite reduced, sometimes very distinct. There is thus much variation in the development of the fascioles.

Both male and female specimens are found in this material, and, as was to be expected, the females have the paired petals transformed into deep marsupia, this species being thus also brood-protecting. The embryos contained in the same marsupium are in all stages of development, from newly laid eggs to fully formed young ones ready to leave the marsupium. The breeding thus appears to go on continuously, i.e. so long as the breeding season lasts; but of its duration we know nothing.

The young ones ready to leave the marsupium are already distinctly elongate, 3 mm. long, and have the peripetalous fasciole quite clearly developed. Pedicellariae have not yet appeared, but the first sphaeridia have been formed.

A specimen of 8 mm. length is characteristically elongate (6 mm. broad), almost rectangular. The circumlateral fasciole is well developed, but the transverse fasciole has only just begun to appear (cf. the development of the fascioles in the young *Abatus cavernosus*, as described in my report on the Echinoidea of the Swedish South Polar Expedition, pp. 75–83). The periproct is in this specimen still close to the apical system. Genital pores have, of course, not yet appeared. A couple of globiferous pedicellariae found on the aboral side, and a rostrate pedicellaria found on the posterior end of the test, make the identification of this specimen as a young *Parapneustes cordatus* quite certain.

One specimen, a male, is remarkable in having four genital pores, the madreporite also having a genital pore. The labrum is generally more pointed and narrow than shown in Koehler's pl. xvi, fig. 26; but both forms may occur, as shown in Plate III, figs. 3, 4, and it is not a sexual difference, as I find both the broad and the narrow form to occur in male specimens.

Family SPATANGIDAE

Echinocardium connectens, Mortensen

(Plate IV, figs. 9–10)

Echinocardium connectens, Mortensen, 1933. *The Echinoderms of St Helena* (*other than Crinoids*). Papers from Dr Th. Mortensen's Pacific Exped. 1914–16, LXVI (Vid. Medd. Dansk Naturh. Foren., 93), p. 469.

St. 299. 4. ix. 27. Tarrafal, San Antonio, Cape Verde Islands, 7–11 m. 1 specimen.

This specimen is, at any rate, very closely related to the St Helena species, *E. connectens*, with which it agrees in the character of the frontal ambulacrum, the absence of larger spines (tubercles) above the ambitus, and in the character of the triphyllous pedicellariae. Unfortunately only triphyllous pedicellariae are found and these even are exceedingly scarce.

On account of the very scarce and insufficient material hitherto known of *E. connectens*, and with only a single specimen in hand of the present form, I do not like to state definitely that it is really identical with the species from St Helena, but I have little doubt about their identity. The specimen is 20 mm. long, 20 mm. broad and 14 mm.

high, the greatest height being behind the apical system. The frontal end is nearly vertical, the frontal ambulacrum only slightly sunken. The labrum reaches the second adjoining ambulacral plates; two tube feet are found within the subanal fasciole. There is a rather conspicuous fasciole along each side of the periproct.

Since no *Echinocardium* has hitherto been recorded from the West African coast (south of Morocco) the discovery of this specimen is of considerable interest. It is most desirable that further material of the species should be obtained in order that its identity may be definitely settled. As it is a shallow-water species which no doubt lives buried in sand or mud, it should not be difficult to collect it in sufficient numbers.

Plagiobrissus sp. (young)

St. 279. 10. viii. 27. Off Cape Lopez, French Congo, 58–67 m. 1 specimen.

This young specimen, which is only 5 mm. long, seems almost certainly to belong to the genus *Plagiobrissus*, and quite probably it is *Plagiobrissus Costae* (Gasco). But it is too young to be definitely identified.

From St. 933, 17. viii. 32, 260 m., there is a very young specimen of a Spatangoid which is quite unidentifiable; the whole oral side is lacking, so that it is not even possible to see whether it is an amphisternous or a meridosternous form.

Family URECHINIDAE

Plexechinus Nordenskjöldi, Mortensen

(Plate IX, figs. 5–7)

Plexechinus Nordenskjöldi, Mortensen, 1910. Swedish South Polar Exped. Echinoidea, p. 61, pls. xvii, figs. 1–8; xviii, figs. 5–12.

P. Nordenskjöldi, H. L. Clark, 1917. Hawaiian Echini. Echinoneidae...Spatangidae, p. 120.

St. 27. 15. iii. 26. West Cumberland Bay, South Georgia, 110 m. 1 specimen.
St. 140. 23. xii. 26. Stromness Harbour to Larsen Point, South Georgia, 122–136 m. 4 specimens.
St. 144. 5. i. 27. Off mouth of Stromness Harbour, South Georgia, 155–178 m. 2 specimens.
St. 148. 9. i. 27. Off Cape Saunders, South Georgia, 132–148 m. 1 specimen.

These specimens in general agree very well with the type, as described in my work of 1910; but the oral side can scarcely be said to be "somewhat deepened" in front of the peristome—there is hardly any depression at all to be observed here. Also it can hardly be said that the mouth opening is "almost vertical"; it can at most be said to be distinctly oblique. The largest of the specimens is 19 mm. long, thus a good deal larger than the type.

In regard to the pedicellariae it is remarkable that ophicephalous pedicellariae are lacking in all the present specimens; on the other hand, the tridentate pedicellariae are better developed, reaching a somewhat larger size than in the type (Plate IX, figs. 5–7).

In some of the specimens a number of specimens of a *Loxosoma* are found attached to the spines, mainly on the aboral side.

This very interesting little Echinoid is still known only from the vicinity of South Georgia.

OPHIUROIDEA

Family GORGONOCEPHALIDAE

Astrotoma Agassizii, Lyman

(Plate V, figs. 1, 2; Plate VI, figs. 1, 2)

Astrotoma Agassizii, Lyman, 1875. *Ophiuridae and Astrophytidae. Hassler Exped.* Ill. Cat. Mus. Comp. Zool., VIII, p. 24, pl. iv, figs. 52–56.

A. Agassizii, Koehler, 1908. Scott. Nat. Antarct. Exped. Astéries, Ophiures et Echinides, p. 614, pl. xiii, fig. 120.

A. Agassizii, Döderlein, 1911. Japanische und andere Euryalae, p. 100.

A. Agassizii, Koehler, 1922. Austral. Antarct. Exped. Echinod. Ophiuroidea, p. 9, pl. lxxvi, figs. 1–11.

A. Agassizii, Koehler, 1923. Swedish Antarct. Exped. Astéries et Ophiures, p. 102.

A. Agassizii, Fedotov, 1927. *Morphologische Studien an Euryalae.* Zeitschr. Morphol. Ökol. Tiere, IX, pp. 381–4.

A. Agassizii, Döderlein, 1927. Indopacifische Euryalae, p. 87.

A. Agassizii, Döderlein, 1930. Deutsche Tiefsee-Exped. Ophiuriden. II, Euryalae, p. 372, Taf. i, figs. 1, 1 *a*.

St. 39. 25. iii. 1926. East Cumberland Bay, South Georgia, 179–235 m. 2 large specimens.

St. 42. 1. iv. 26. Off mouth of Cumberland Bay, South Georgia, 120–204 m. 4 large specimens, 2 small ones.

St. 140. 23. xii. 26. Stromness Harbour to Larsen Point, South Georgia, 122–136 m. 8 specimens, large and small.

St. 144. 5. i. 27. Off mouth of Stromness Harbour, South Georgia, 155–178 m. 5 specimens.

St. 148. 9. i. 27. Off Cape Saunders, South Georgia, 132–148 m. 2 specimens.

St. 152. 17. i. 27. 53° 51′ S, 36° 18′ W, South Georgia, 245 m. 5 specimens.

St. 159. 21. i. 27. 53° 52′ S, 36° 08′ W, South Georgia, 160 m. 1 specimen.

St. 160. 7. ii. 27. Near Shag Rocks, South Georgia, 177 m. 15 specimens.

St. 345. 8. ii. 30. 55° 20′ S, 34° 47′ W, 200–100 m. 1 specimen.

St. 600. 17. i. 31. 67° 09′ S, 69° 27′ W, 501–527 m. 8 specimens.

St. 652. 14. iii. 31. Burdwood Bank, 171–169 m. 1 specimen.

St. WS 83. 24. iii. 27. 14 miles S 64° W of George Island, East Falkland Islands, 137–129 m. 1 specimen.

St. WS 84. 24. iii. 27. 7·5 miles S 9° W of Sea Lion Island, East Falkland Islands, 75–74 m. 1 specimen.

St. WS 85. 25. iii. 27. 8 miles S 66° E of Lively Island, East Falkland Islands, 79 m. 15 specimens (young).

St. WS 93. 9. iv. 27. 7 miles S 80° W of Beaver Island, West Falkland Islands, 133–130 m. 3 specimens.

St. WS 108. 25. iv. 27. 48° 31′ S, 63° 34′ W, 118–120 m. 1 specimen.

St. WS 243. 17. vii. 28. 51° 06′ S, 64° 30′ W, 144–141 m. 1 specimen.

St. WS 246. 19. vii. 28. 52° 25′ S, 61° 00′ W, 267–208 m. 3 specimens.

St. WS 248. 20. vii. 28. 52° 40′ S, 58° 30′ W, 210–242 m. 10 specimens.

St. WS 818. 17. i. 32. 52° 34′ S, 63° 13′ W, 278–284 m. 6 specimens.

St. WS 819. 17. i. 32. 52° 42′ S, 62° 39′ W, 312–329 m. 1 specimen.

St. WS 820. 18. i. 32. 52° 53′ S, 61° 51′ W, 351–367 m. 2 specimens.

St. WS 824. 19. i. 32. 52° 29′ S, 58° 27′ W, 146–137 m. 15 specimens.

St. WS 825. 28. i. 32. 50° 50′ S, 57° 15′ W, 135–144 m. 5 specimens.

St. WS 840. 6. ii. 32. 53° 52′ S, 61° 49′ W, 368–463 m. 2 specimens.

St. WS 871. 1. iv. 32. 53° 16′ S, 64° 12′ W, 336–341 m. 4 specimens.

The very rich material of *A. Agassizii* collected by the ships of the Discovery Committee gives us a much better idea of what a splendid form this Gorgonocephalid is than could be gathered from the specimens hitherto known. The largest of these, collected by the Australasian Antarctic Expedition (cf. Koehler, *op. cit.*, 1922), did not surpass a diameter of disk of 36 mm.—in the present material the largest specimen measures 60 mm. in diameter of disk, others measuring some 45–55 mm. in diameter. In these large specimens the radial ribs are generally very conspicuous, though dependent to some degree on the preservation, specimens with the disk somewhat swollen having them much less conspicuous than those with the disk flattened. The latter case particularly holds good of the largest specimen (Plate V, fig. 2), which, indeed, gives much the impression of being senescent. The arms in these large specimens are very powerful, some 11 mm. wide, 13 mm. high, and have a very snake-like appearance. About the length of the arms in these large specimens it is not possible to give any definite statements, because the arms are very much coiled up and in most cases broken. But in a specimen 22 mm. in diameter of disk with the arms uncoiled I find the arm length to be no less than *ca.* 400 mm. This does not necessarily imply that in the larger specimens the arms are correspondingly longer, for in a specimen of *ca.* 25 mm. diameter the arms do not much exceed 300 mm. in length. (Koehler states that the arms of his specimen of 36 mm. diameter of disk were more than 320 mm. in length; evidently they were broken, so that it is unknown by how much they exceeded that length.) It would appear that there is considerable variation in the length of the arms, though not in the arms of the same specimen, such as is characteristic of *Asteronyx*.

In specimens with the disk flattened there is generally a sharp edge along the interradii, recalling the belt of marginal plates of *Gorgonocephalus*. There are, however, no conspicuous marginal plates; on removing the grain-covering one finds the scales here not much larger than the scales underlying the granules of the disk; it is mainly the folding of the skin that produces this sharp edge.

The primary plates of the disk are usually distinct in the young specimens, as represented by Koehler (*op. cit.*, 1908, pl. xiii, fig. 120); but herein there is a good deal of individual variation.

I have opened a couple of specimens in order to see what they feed on. Remnants of Crustaceans, Copepods and what was probably a Hyperiid were found and in one specimen there was a rather large lump of jelly of uncertain origin. It appears that the species feeds on plankton organisms, which it most probably catches with the slender distal part of its arms. The eggs are small and numerous, indicating perhaps a free-swimming larval stage.

Astrochlamys bruneus, Koehler

(Plate VII, fig. 8)

Astrochlamys bruneus, Koehler, 1912. II[e] Expéd. Antarct. Française. Echinodermes, p. 143, pl. xi, figs. 3, 4, 6, 7, 14, 15.

A. bruneus, Koehler, 1923. Swedish Antarct. Exped. Astéries et Ophiures, p. 103.

A. bruneus, Döderlein, 1930. Deutsche Tiefsee-Exped. Ophiuriden. II, Euryalae, p. 373, Taf. i, figs. 3–5 (p. 356, fig. 1 *e*; p. 363, fig. 14 *l*, *m*).

St. 39. 25. iii. 26. West Cumberland Bay, South Georgia, 179–235 m. 4 specimens.
St. 123. 15. xii. 26. Off mouth of Cumberland Bay, South Georgia, 230–250 m. 2 specimens.
St. 140. 23. xii. 26. Stromness Harbour to Larsen Point, South Georgia, 122–136 m. 3 specimens.
St. 144. 5. i. 27. Off mouth of Stromness Harbour, South Georgia, 155–178 m. 4 specimens.
St. 148. 9. i. 27. Off Cape Saunders, South Georgia, 132–148 m. 1 specimen.
St. 170. 23. ii. 27. Off Cape Bowles, Clarence Island, 342 m. 1 specimen.

Most of the larger specimens of this species are carrying a smaller one on their back (Plate VII, fig. 8), a fact naturally leading to the suggestion that this is a sort of copulation, the larger specimen being the female, the smaller the male. And so it actually is, as proved by the examination of the gonads of these specimens. It was possible also to demonstrate that the species is viviparous. The two first specimens opened had their bursae entirely empty; the third had them packed with eggs, which seemed, however, to be only just fertilized. But the fourth specimen opened settled the question, for it had the bursae filled with embryos, all in the same stage of development. The embryos

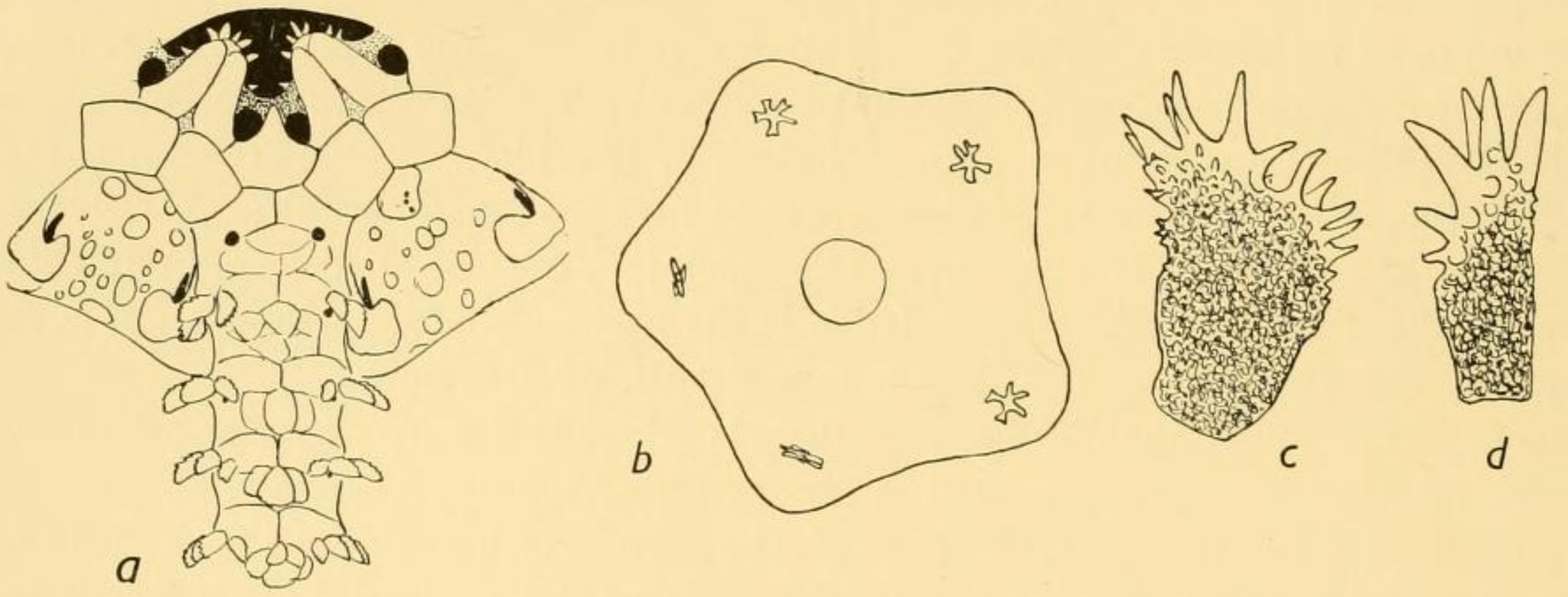

Fig. 2 *a–c*. *Astrochlamys bruneus*, Koehler. *a*, Part of oral side, ×8. *b*, Embryo, showing the five terminal plates, and in the centre the mouth, ×80. *c*, Arm spine, ×45.

Fig. 2 *d*. Arm spine of *Astrochlamys sol*, n.sp., ×45.

were small and star-shaped, with an indication of a mouth invagination and the first indication of the skeleton, viz. the terminal plate; but as yet there was no trace of the ambulacral skeleton or of any other plates (Fig. 2 *b*). There were some 200 embryos in each bursa, which means that they cannot reach any large size before they leave the mother—in conformity with the small size of the genital slits. The eggs are shed (into the bursae) all at a time, and this appears to be likewise the case with the sperms, none of the males being found to contain ripe sperms in their gonads. This is again in conformity with the fact that some of the larger specimens carry no male on their back, so that copulation is not going on constantly, as is the case in *Amphilycus androphorus*, Mortensen, and, to a less degree apparently in *Ophiosphaera insignis*, Brock, and *Ophiodaphne materna*, Koehler (cf. Mortensen, *Biological observations on Ophiurids*. Papers from Dr Th. Mortensen's Pacific Exped., LXIII (Vid. Medd. Dansk Naturh. Foren., 93), 1933, pp. 178–88). In these three Ophiurids the male is carried over the mouth of

the female. *Astrochlamys bruneus* is the first Ophiurid known to carry the male on the back, as it is also the first viviparous Gorgonocephalid made known.

The largest specimen at hand measures 20 mm. in diameter of disk, the arms being *ca.* 100 mm. long. I give here a sketch of the oral side of this species (fig. 2 *a*) in order to show the shape of the plates, which is not seen distinctly in either Koehler's or Döderlein's figures. Koehler states that the two first pairs of pores are without papillae, and his pl. xi, fig. 6 (*op. cit.*, 1912) shows it distinctly. Döderlein (*op. cit.*) states that only the first pore pair is without papillae, and this is clearly indicated in his figure (Taf. i, fig. 4). The apparent contradiction is due to the fact that the first pair of pores in Koehler's figure are the outer mouth pores. But these are covered over by a thick skin which closes up the distal half of the mouth slits. Only when this skin is dissolved do these pores become distinct. An indication of this skin covering the mouth slit is seen on the right side, the upper arm, in Döderlein's Taf. i, fig. 4.

Astrochlamys sol, n.sp.

(Plate VII, fig. 9)

St. 170. 23. ii. 27. Off Cape Bowles, Clarence Island, 342 m. 1 specimen, attached to a coral-like Bryozoan.

Diameter of disk *ca.* 13 mm., length of arms *ca.* 50 mm. Arms 10.

In its general characters this species closely resembles *A. bruneus*. Mouth papillae not distinct, being covered by the thick skin that invests the whole animal. First pair of arm pores apparently rudimentary. As in *A. bruneus* there are one or two spines (papillae) at the second pore pair, three at the third pair, and thereafter four spines. These latter are slightly different from those of *A. bruneus*, having fewer thorns (Figs. 2 *c–d*). The hooks are alike in both; the hook belts are interrupted in the dorsal median line in the proximal part of the arms. In regard to the plates of the oral region it appears that the buccal plates are somewhat better developed than in *A. bruneus*. Ventral plates of arms irregularly divided as in *bruneus*.

Not thinking it desirable to remove the specimen from the Bryozoan to which it clings, or to spoil it too much by cleaning off the skin, I cannot give any detailed figures. But the species is so markedly different from the five-armed *A. bruneus* by reason of its numerous arms that the characters here given should suffice for recognizing it with certainty.

Astrohamma tuberculatum (Koehler)

Astrothamnus tuberculatus, Koehler, 1923. Swedish Antarct. Exped. Astéries et Ophiures., p. 133, figs. 1 *a–f*.

Astrotoma tuberculatum, Döderlein, 1927. Indopacifische Euryalae, p. 21.

Astrohamma tuberculatum, Döderlein, 1930. Deutsche Tiefsee-Exped. Ophiuriden. II, Euryalae, p. 372, Taf. i, fig. 2 (p. 363, fig. 14 *n*).

St. 190. 24. iii. 1927. Bismarck Strait, Palmer Archipelago. 315 m. 2 specimens.

These specimens are 15–16 mm. in diameter of disk, thus somewhat larger than those hitherto recorded (8–10·5 mm.). They conform perfectly to the descriptions given by Koehler and Döderlein and do not call for further remarks.

Gorgonocephalus chilensis (Philippi)

Gorgonocephalus chilensis, Döderlein, 1911. Japanische und andere Euryalae, pp. 30, 105, Taf. v, fig. 5; viii, figs. 1, 1 *a*.

G. chilensis, H. L. Clark, 1915. Cat. Recent Ophiurans, p. 185.

G. chilensis, Koehler, 1923. Swedish Antarct. Exped. Astéries et Ophiures, p. 101, pl. xiv, fig. 1.

G. chilensis, Döderlein, 1927. Indopacifische Euryalae, pp. 30, 92.

G. chilensis, Zirpolo, 1932. *Sul* Gorgonocephalus chilensis, *Lyman*. Ann. Mus. Zool. Univ. Napoli, VI, 7, pp. 1–16.

Non: Gorgonocephalus chilensis, H. L. Clark, 1923. Echinoderm Fauna South Africa, p. 318 (=*Gorgonocephalus pectinatus*, Mortensen).

For the older literature I may refer to Döderlein's work of 1911 (*loc. cit.*).

St. 51. 4. v. 26. Off Eddystone Rock, East Falkland Islands, 105–115 m. 1 large specimen.

St. 158. 21. i. 27. 53° 48′ S, 35° 57′ W, South Georgia, 401–411 m. 2 specimens, one large, *ca.* 70 mm. diameter of disk, one small, 20 mm. diameter.

St. 160. 7. ii. 27. Off Shag Rocks, South Georgia, 177 m. 1 young specimen, 9 mm. diameter of disk.

St. 181. 12. iii. 27. Schollaert Channel, Palmer Archipelago, 160–335 m. 3 specimens.

St. 576. 17. iv. 31. Falkland Islands, 34–24 m. 2 large specimens.

St. WS 72. 5. iii. 27. 51° 07′ S, 57° 34′ W, Falkland Islands, 79 m. 1 specimen, *ca.* 65 mm. diameter of disk.

St. WS 73. 6. iii. 27. 51° 01′ S, 58° 54′ W, Falkland Islands, 121 m. 2 specimens.

St. WS 76. 11. iii. 27. 51° 00′ S, 62° 02′ W, Falkland Islands, 207–205 m. 3 specimens.

St. WS 80. 14. iii. 27. 50° 57′ S, 63° 37′ W, Falkland Islands, 152–156 m. 2 specimens, young, 8 and 15 mm. diameter of disk.

St. WS 829. 31. i. 32. 50° 51′ S, 63° 13′ W, Falkland Islands, 155 m. 4 specimens.

This species was not hitherto known to occur as far south as South Georgia and the Palmer Archipelago. The larger of the specimens from South Georgia has almost naked radial ribs, but does not otherwise differ from typical *G. chilensis*; in the smaller specimen, on the other hand, the radial ribs are rather unusually strongly spiny. On the whole, there is much variation in the development of "stumps" on the disk. In the young specimens of *G. chilensis* the disk is densely covered by a uniform granulation, which is, again, remarkably coarse in the specimen from the Shag Rocks Bank. On the largest of the specimens from St. WS 829 a couple of young ones, 3 mm. in diameter of disk, were found attached. Already at this size the disk is covered by rounded granules, none of the primary plates remaining distinct.

In the young specimens the hooks are already present at the base of the arms, but only on the sides, not forming complete belts till beyond the second forking, and in the adult specimens still farther out.

The larger specimen from St. 158 is stated in a note to be thus coloured: "Disk whitish, arms salmon-pink, deepest at tips."

Two specimens were opened in order to see whether they might be infested with *Protomyzostoma*; nothing of the kind was found. The eggs are small and the gonads exceedingly numerous, much as in *Gorgonocephalus eucnemis*, etc.; the presence of young ones on one of the specimens is thus, as in other species, a casual attachment of the

young on an adult—not necessarily its parent—and not a case of viviparity or brood-protection.

That the specimens from South Africa referred to *G. chilensis* have nothing to do with this South American species, but represent a distinct species, *G. pectinatus*, Mortensen, I showed in my paper on the Echinoderms of South Africa (Papers from Dr Th. Mortensen's Pacific Exped., LXV (Vid. Medd. Dansk Naturh. Foren., 93), 1933, p. 283).

As for the specimens from Kerguelen and New Zealand, likewise referred to *G. chilensis*, I must reserve opinion until the examination of new and sufficient material allows a definite judgment. The zoogeography of other sub-Antarctic Echinoderms is not in favour of these specimens being identical with the South American *G. chilensis*.

Family TRICHASTERIDAE

Astroceras elegans (Bell)

Astroschema elegans, Bell, 1917. Brit. Antarct. ('Terra Nova') Exped. Echinoderma, p. 7.
Astroceras elegans, Mortensen, 1924. *Echinoderms of New Zealand and the Auckland-Campbell Islands.* II, *Ophiuroidea.* Papers from Dr Th. Mortensen's Pacific Exped., XX (Vid. Medd. Dansk Naturh. Foren., 77), p. 107, pl. iv, fig. 3.
A. elegans, Mortensen, 1933. *Studies of Indo-Pacific Euryalids.* Vid. Medd. Dansk Naturh. Foren., 96, p. 53.

St. 934. 17. viii. 32. 34° 11′ S, 172° 10′ E, north of New Zealand, 92–98 m. 2 specimens.

These specimens differ from those hitherto known in the arms being of a uniform light brown colour (apart from the white tubercles), not an annulated appearance due to alternating rings of white and brown skin. I do not think this colour difference to be any serious objection to referring them to the species characteristic of the area off the north end of New Zealand, *A. elegans*.

Family OPHIOMYXIDAE

Ophiomyxa vivipara, Studer

Ophiomyxa vivipara, Studer, 1876. *Über Echinod. a. d. antarkt. Meere.* Monatsber. Akad. Berlin, p. 462.
Ophioscolex Coppingeri, Bell, 1881. *Echinod. Straits of Magellan and coast of Patagonia.* Proc. Zool. Soc. Lond., 1881, p. 98, pl. viii, fig. 6.
Ophiomyxa vivipara, Ludwig, 1898. *Ophiuren d. Sammlung Plate.* Zool. Jahrb., Suppl. IV, p. 768.
O. vivipara, H. L. Clark, 1915. Cat. Recent Ophiurans, p. 170, pl. 2, figs. 1–2.
O. vivipara, Mortensen, 1920. *On Hermaphroditism in viviparous Ophiurids.* Acta Zoologica, I, p. 10.
O. vivipara, H. L. Clark, 1923. *Echinoderm Fauna of South Africa.* Ann. S. African Mus., XIII, p. 313.
O. vivipara, Mortensen, 1933. *Echinoderms of South Africa.* Papers from Dr Th. Mortensen's Pacific Exped., LXV (Vid. Medd. Dansk Naturh. Foren., 93), p. 301.

St. 6. 1. ii. 25. Tristan da Cunha, 80–140 m. 1 specimen.
St. 388. 16. iv. 30. 56° 19′ S, 67° 10′ W, 121 m. 1 specimen.
St. WS 73. 6. iii. 27. 51° 01′ S, 58° 54′ W, Falkland Islands, 121–130 m. 2 specimens.
St. WS 80. 14. iii. 27. 50° 57′ S, 63° 37′ W, Falkland Islands, 152–156 m. 1 specimen.
St. WS 81. 19. iii. 27. 8 miles N 11° W of North Islands, West Falkland Islands, 81–82 m. 10 specimens.
St. WS 84. 24. iii. 27. 7·5 miles S 9° W of Sea Lion Island, East Falkland Islands, 75–74 m. 8 specimens.
St. WS 85. 25. iii. 27. 8 miles S 66° E of Lively Island, East Falkland Islands, 79 m. 2 specimens.
St. WS 88. 3. iv. 27. 54° 00′ S, 64° 57′ W, 118 m. 2 specimens.
St. WS 93. 9. iv. 27. 7 miles S 80° W of Beaver Island, West Falkland Islands, 133–130 m. 4 specimens.
St. WS 243. 17. vii. 28. 52° 00′ S, 64° 30′ W, West Falkland Islands, 144–141 m. 3 specimens.
St. WS 776. 3. xi. 31. 46° 18′ S, 65° 02′ W, 107–99 m. 1 specimen.
St. WS 804. 6. i. 32. 50° 21′ S, 62° 53′ W, 143–150 m. 1 specimen.
St. WS 823. 19. i. 32. 52° 14′ S, 60° 01′ W, 80–95 m. 1 specimen.
St. WS 824. 19. i. 32. 52° 29′ S, 58° 27′ W, 146–137 m. 10 specimens.
St. WS 825. 19. i. 32. 50° 50′ S, 57° 15′ W, 135–144 m. 1 specimen.
St. WS 848. 10. ii. 32. 50° 37′ S, 66° 24′ W, 115–117 m. 1 specimen.

In my paper on the South African Echinoderms (*op. cit.*, 1933, p. 302) I remarked that the only difference I could find between the South African and the South American form of this species was that in the South African form there is only one spine at the proximal five or six pore pairs, whereas in the Magellanic form there are two spines already at the third or fourth pore pair. The specimens in the present collection all have two spines from the third or fourth pore pair, which seems to indicate that this difference is reliable, so that it may be possible to distinguish the South African form as a separate variety, var. **capensis**, n.var.

The specimen from off Tristan da Cunha, a locality from which the species had not hitherto been recorded, agrees with the typical South American form in regard to the numbers of spines at the proximal pore pairs.

Ludwig (*op. cit.*) proved that *Ophioscolex Coppingeri* of Bell was identical with *Ophiomyxa vivipara*. Having seen the type-specimen of Bell's species in the British Museum, I can confirm the result reached by Ludwig.

Ophiomyxa brevirima, H. L. Clark

Ophiomyxa brevirima, H. L. Clark, 1915. Cat. Recent Ophiurans, p. 169, pl. i, figs. 3–4.
O. brevirima, Mortensen, 1924. *Echinoderms of New Zealand and the Auckland-Campbell Islands.* II, *Ophiuroidea.* Papers from Dr Th. Mortensen's Pacific Exped., xx (Vid. Medd. Dansk Naturh. Foren., 77), p. 110.

St. 941. 20. viii. 32. 40° 51′ S, 174° 48′ E, Cook Strait, 128 m. 4 specimens.

Referring to the observation recorded in my paper on the New Zealand Ophiurids (p. 113) that two types of breeding occur among the specimens identified as *O. brevirima*, viz. one having the bursae filled up with a great number of small embryos, the other having only one young in each bursa (a difference tending to indicate that the two types in reality represent two distinct species), it should be mentioned that the present

specimens belong to the type with numerous small embryos in the bursae. The specimens, which are not very well preserved, show an indication of dark bands on the arms; otherwise they are white.

Ophioscolex (Ophiolycus) nutrix, n.sp.

(Plate VII, fig. 6.)

St. 159. 21. i. 27. 53° 52′ S, 36° 08′ W, South Georgia, 160 m. 2 specimens.
St. 160. 7. ii. 27. 53° 43′ S, 40° 57′ W, near Shag Rocks, South Georgia, 177 m. 1 specimen.
St. WS 42. 7. i. 27. 54° 42′ S, 36° 47′ W, South Georgia, 198 m. 2 specimens.
St. WS 86. 3. iv. 27. 53° 53′ S, 60° 34′ W, Falkland Islands, 151–147 m. 1 specimen.
St. WS 225. 9. iv. 28. 50° 20′ S, 62° 30′ W, Falkland Islands, 162 m. 1 specimen.
St. WS 228. 30. vi. 28. 50° 50′ S, 56° 58′ W, Falkland Islands, 229–236 m. 4 specimens.
St. WS 824. 19. i. 32. 52° 29′ S, 58° 27′ W, Falkland Islands, 146–137 m. 2 specimens.
St. WS 839. 5. ii. 32. 53° 30′ S, 63° 29′ W, Falkland Islands, 403–434 m. 1 specimen.

Diameter of disk up to *ca.* 10 mm., length of arms about three to four times the diameter of disk. Both aboral and oral sides of disk with a varying number of small spines, protruding through the thick investing skin; in the specimen figured in Plate VII, fig. 6, they are exceptionally numerous. Radial shields small, but fairly distinct, oval, widely separated—but in some specimens no trace of radial shields is seen.

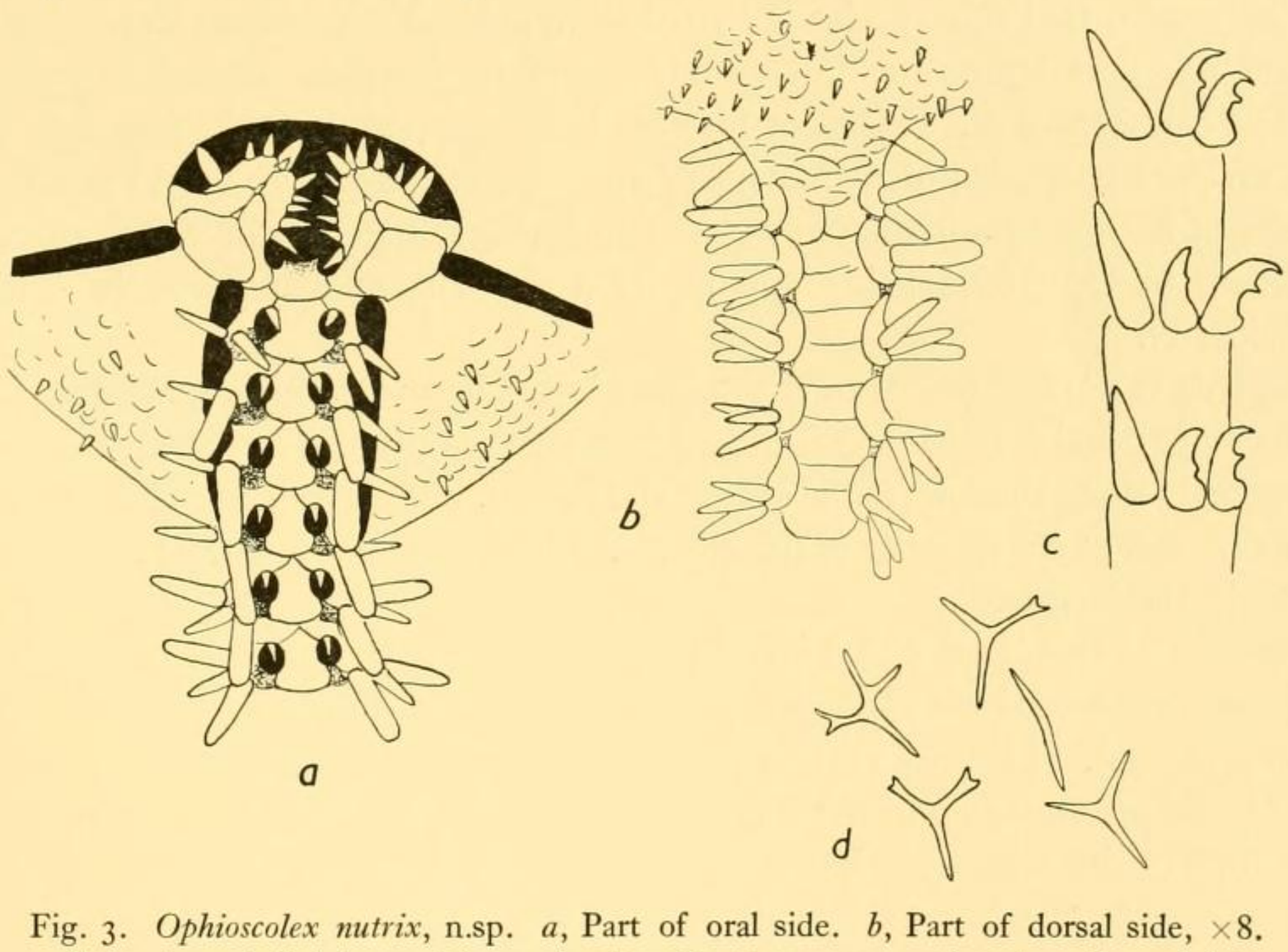

Fig. 3. *Ophioscolex nutrix*, n.sp. *a*, Part of oral side. *b*, Part of dorsal side, ×8. *c*, Side view of distal arm joints, showing the two upper spines transformed into hooks, ×30. *d*, Spicules from stomach wall, ×45.

Mouth papillae rather irregular and varying in number; generally the distalmost one or two are somewhat enlarged. Buccal shields conspicuously broader than long, with an obtuse angle within and a straight outer edge. Adoral shields joining within. Ventral plates contiguous in the proximal part of arm, separated beyond the disk; the distal

edge is gently convex. The pores have a well-developed tentacle scale (Fig. 3 *a*). Dorsal arm plates in the basal part of arms fairly regularly divided into two parts (Fig. 3 *b*). Arm spines two on the joints within the disk; beyond the disk there are three spines. In the proximal part of the arms the lowermost and the uppermost spine enlarged, somewhat flattened and sometimes a little curved. In the distal part the two uppermost spines transformed into hooks (Fig. 3 *c*). The scales of the disk as usual with a glassy, concentrically striated margin. Rather large mainly three-radiate spicules in the stomach wall (Fig. 3 *d*). About the colour in life there is no information; the preserved specimens are white.

It is evident that this species is nearly related to the South African *O. dentatus*, Lyman, and it might, indeed, seem questionable whether the small differences to be observed (cf. fig. 3 with the figures of *O. dentatus* given in my paper on the South African Echinoderms, pp. 310–11, figs. 32–4) are really of sufficient value for specific distinction. Of this there cannot, however, be the slightest doubt, for I find that the South American form is *viviparous* and—partly—*hermaphrodite*, whereas *O. dentatus*, as well as the closely related *O. purpureus*, are not viviparous and have separate sexes. Thus it is certain that the South American form is a quite distinct species, the more interesting as this is the first viviparous species of the genus *Ophioscolex* to be known.

The statement that this species is "partly" hermaphrodite means that some specimens are not hermaphrodite, but purely males or females. Thus the species is a *facultative hermaphrodite*. This is of interest in connection with the fact that the two known viviparous species of *Ophiomyxa* have separate sexes. It would seem to be a beginning of hermaphroditism that we are witnessing in this primitive Ophiurid, hermaphroditism in Ophiurids being apparently a specialization acquired in connection with viviparity.

As regards the arrangement of the gonads in the hermaphrodite specimens it seems to be the more usual condition that the male gonads are situated at the adradial side, the female gonads along the interradial side of the bursae, but there is no regularity either in the arrangement or the number of the gonads. I have found only one or two young ones at a time in the bursae.

No species of *Ophioscolex* was known till now from the Antarctic or sub-Antarctic region, the "*Ophioscolex Coppingeri*" of Bell being nothing but *Ophiomyxa vivipara* (cf. above, p. 242). It is thus a rather surprising fact that no less than two species of the genus, *Ophioscolex nutrix* and the following species, *O. marionis*, have been discovered by the ships of the Discovery Committee in the sub-Antarctic region.

Ophioscolex marionis, n.sp.

St. 1563. 7. iv. 35. 46° 48′ S, 37° 49′ E, off Marion Island, 113–99 m. 1 specimen.

Diameter of disk 5·5 mm. Arms all broken close to the disk; they are 1·5 mm. broad, somewhat flattened. Disk covered by thick skin, through which some scattered short spines protrude all over the dorsal side, a single one also here and there on the ventral interradii. Apparently no radial shields. The buccal shields are small, rounded tri-

angular, adoral shields rather broad, not joining within; they separate broadly the buccal shield from the first lateral plate. Mouth papillae small, feebly developed. Ventral arm plates distinctly longer than broad, with convex distal edge, joining broadly at least as far out on the arms as they are preserved. Dorsal arm plates very feebly developed, as usual, but covering the whole broad dorsal side between the small lateral plates; they are not divided in two by a transverse line. Arm spines four, short, robust, the lowermost and uppermost ones slightly longer than the two middle ones. One tentacle scale. Colour in alcohol brownish.

The species is clearly *viviparous*; not that I have actually found embryos within it, but the eggs are large, *ca.* 0·2–0·3 mm. and yolky, seven to ten eggs in each gonad; and then it is *hermaphrodite*, there being one male gonad at the adradial side and one or two female gonads at the interradial side of the bursa. As not a single case is known

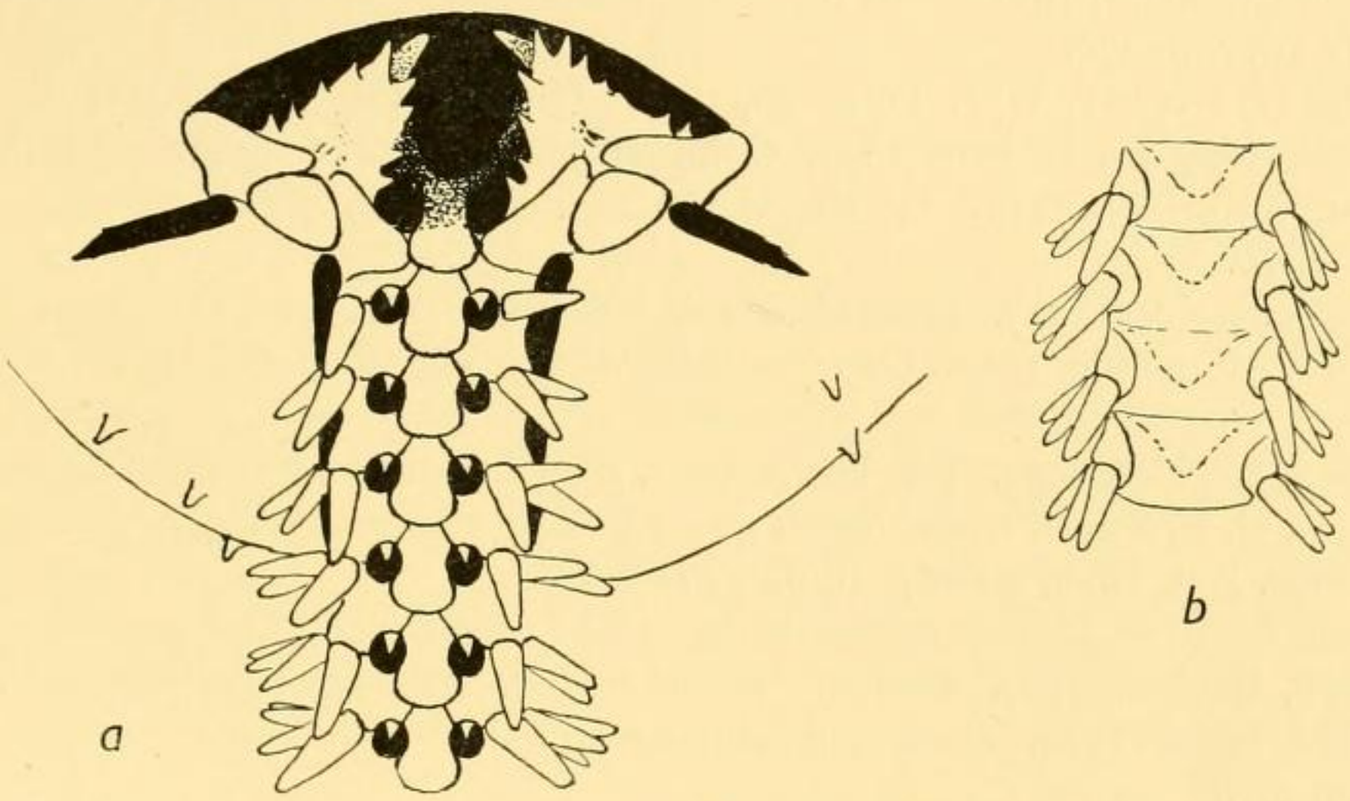

Fig. 4. *Ophioscolex marionis*, n.sp. *a*, Part of oral side. *b*, Part of dorsal side of arm. The dotted arch-lines represent the outline of the vertebrae seen through the exceedingly thin dorsal plates. ×15.

of a non-viviparous Ophiurid being hermaphrodite, we may, I think, safely conclude that this species must be viviparous, as the character of the female gonads also indicates.

It may be added that no spicules are found in the stomach wall, such as occur in *O. nutrix*.

That this species is not very closely related to the other Antarctic species of *Ophioscolex*, *O. nutrix*, is evident enough; a comparison of the figures will show the differences in the shape of the buccal shield, ventral and dorsal arm plates, and the mouth papillae, to which may be added the difference in the number of arm spines, one having three, the other four spines, which makes an important difference within this genus. It would appear that the present species is the nearest related to *O. quadrispinus*, Verrill, from off Nova Scotia; this species is, however, scarcely sufficiently well known to allow the differences between the two species to be indicated; but it seems that *O. quadrispinus* has no spines on the disk.

It is very regrettable that the arms of the single specimen of *O. marionis* are all broken, so that it cannot be seen whether the upper spines are transformed into hooks in the distal part of the arms, as they are in *O. dentatus-purpureus* and *O. nutrix*, a character which has an important bearing on the question of the validity of the subgenus or genus *Ophiolycus* (cf. my paper on the Echinoderms of South Africa, p. 315). If these spines are not transformed into hooks in *O. marionis* this species will form a connecting link between *Ophiolycus* and the typical *Ophioscolex*.

Family OPHIACANTHIDAE

Ophiacantha vivipara, Ljungman

(Plate VII, fig. 2)

Ophiacantha vivipara, Ljungman, 1870. *On tvänne nya arter Ophiurider*. Öfvers. Vet. Akad. Handl., 1870, p. 470.

Ophiocoma (?) *vivipara*, Wyv. Thomson, 1877. The Atlantic, II, pp. 241–4, fig. 50.

Ophiacantha vivipara, Ludwig, 1899. Ophiuroideen Hamburger Magalh. Sammelreise, p. 13.

O. vivipara, Koehler, 1912. II^{e} Expéd. Antarct. Française. Echinodermes, p. 138, pl. xi, figs. 1–2, 10.

O. vivipara, Koehler, 1917. *Echinodermes de Kerguelen.* Ann. Inst. Oceanogr., VII, 8, p. 71.

O. vivipara, Mortensen, 1920. *On Hermaphroditism in viviparous Ophiurids*. Acta Zoologica, I, p. 10.

O. vivipara, Koehler, 1923. Swedish Antarct. Exped. Astéries et Ophiures, p. 105.

O. vivipara, G. A. Smith, 1923. *Report on the Echinoderms coll. during the voyage of the 'Quest'*. Ann. Mag. Nat. Hist., 9 Ser., XII, p. 368.

O. vivipara heptactis, Hertz. 1926. Deutsche Südpolar-Exped. Ophiuroiden, p. 36.

O. vivipara, Koehler, 1927. Austral. Antarct. Exped. Echinod. Ophiuroidea, p. 12.

O. vivipara, Grieg, 1929. *Some Echinoderms from the South Shetlands*. Bergens Mus. Årbok, 1929, 3, p. 7.

For references to the older literature I may refer to Ludwig, *op. cit.*

St. 27. 15. iii. 26. West Cumberland Bay, South Georgia, 110 m. Several specimens.
St. 39. 25. iii. 26. East Cumberland Bay, South Georgia, 179–235 m. 4 specimens.
St. 42. 1. iv. 26. Off mouth of Cumberland Bay, South Georgia, 120–204 m. Several specimens.
St. 123. 15. xii. 26. Off mouth of Cumberland Bay, South Georgia, 230–250 m. 2 specimens.
St. 140. 23. xii. 26. Stromness Harbour to Larsen Point, South Georgia, 122–136 m. *ca.* 15 young specimens.
St. 144. 5. i. 27. Off mouth of Stromness Harbour, South Georgia, 155–178 m. 4 specimens.
St. 148. 9. i. 27. Off Cape Saunders, South Georgia, 132–148 m. 1 young specimen.
St. 156. 20. i. 27. 53° 51′ S, 36° 21′ W, South Georgia, 200–236 m. 2 specimens.
St. 159. 21. i. 27. 53° 52′ S, 38° 08′ W, South Georgia, 160 m. 1 specimen.
St. 160. 7. ii. 27. Near Shag Rocks, South Georgia. 177 m. 5 specimens.
St. 170. 23. ii. 27. Off Cape Bowles, Clarence Island, 342 m. 10 specimens.
St. 175. 2. iii. 27. Bransfield Strait, South Shetlands, 200 m. 2 specimens.
St. 190. 24. iii. 27. Bismarck Strait, Palmer Archipelago, 93–130 m. 3 specimens.
St. 474. 12. xi. 30. Off Shag Rocks, South Georgia, 199 m. 12 specimens.
St. 599. 17. i. 31. 67° 08′ S, 69° 06′ W, 203 m. 1 specimen.
St. 652. 14. iii. 31. Burdwood Bank. 171–169 m. 1 specimen.
St. 1562. 7. iv. 35. 46° 53′ S, 37° 55′ E, off Marion Island, 90–97 m. 4 specimens.
St. 1563. 7. iv. 35. 46° 48′ S, 37° 39′ E, off Marion Island, 113–99 m. 6 specimens.

St. 1564. 7. iv. 35. 46° 36′ S, 38° 02′ E, off Marion Island, 108–113 m. Several specimens.
St. WS 27. 19. xii. 26. 53° 55′ S, 38° 01′ W, South Georgia, 106 m. 10 specimens.
St. WS 33. 21. xii. 26. 54° 59′ S, 35° 24′ W, South Georgia, 130 m. *ca.* 20 specimens.
St. WS 42. 7. i. 27. 54° 42′ S, 36° 47′ W, South Georgia, 198 m. 2 specimens.
St. WS 73. 6. iii. 27. 51° 01′ S, 58° 54′ W, Falkland Islands, 121 m. 3 specimens.
St. WS 80. 14. iii. 27. 50° 57′ S, 63° 37′ W, Falkland Islands, 152–156 m. 2 specimens.
St. WS 81. 19. iii. 27. 8 miles N 11° W of North Island, West Falkland Islands, 81–82 m. 5 specimens.
St. WS 84. 24. iii. 27. $7\frac{1}{2}$ miles S 9° W of Sea Lion Island, East Falkland Islands, 75–74 m. Several specimens.
St. WS 85. 25. iii. 27. 8 miles S 66° E of Lively Island, East Falkland Islands, 79 m. 15 specimens.
St. WS 88. 6. iv. 27. 54° 00′ S, 64° 57′ W, 118 m. 8 specimens.
St. WS 91. 8. iv. 27. 52° 54′ S, 64° 37′ W, 191–205 m. 1 specimen.
St. WS 92. 8. iv. 27. 51° 58′ S, 65° 01′ W, 145–143 m. Several specimens.
St. WS 93. 9. iv. 27. 7 miles 80° W of Beaver Island, West Falkland Islands, 133–130 m. 5 specimens.
St. WS 233. 5. vii. 28. 49° 25′ S, 59° 45′ W, 185–175 m. 5 specimens.
St. WS 234. 5. vii. 28. 48° 52′ S, 60° 25′ W, 195–207 m. Several specimens.
St. WS 248. 20. vii. 28. 52° 40′ S, 58° 30′ W, Falkland Islands, 210–242 m. Several specimens.
St. WS 750. 19. ix. 31. 52° 12′ S, 67° 19′ W, 95 m. 2 specimens.
St. WS 755. 21. ix. 31. 51° 39′ S, 57° 39′ W, 77 m. 8 specimens.
St. WS 773. 31. x. 31. 47° 28′ S, 60° 51′ W, 291–296 m. 1 specimen.
St. WS 800. 22. xii. 31. 48° 16′ S, 62° 10′ W, 139–137 m. 5 specimens.
St. WS 804. 6. i. 32. 50° 21′ S, 62° 53′ W, 143–150 m. 7 specimens.
St. WS 815. 13. i. 32. 51° 52′ S, 65° 44′ W, 132–162 m. 1 specimen.
St. WS 816. 14. i. 32. 52° 10′ S, 64° 56′ W, 150 m. 2 specimens.
St. WS 817. 14. i. 32. 52° 23′ S, 64° 19′ W, 191–202 m. 14 specimens.
St. WS 824. 19. i. 32. 52° 29′ S, 58° 27′ W, 146–137 m. Several specimens.
St. WS 825. 29. i. 32. 50° 50′ S, 57° 15′ W, 135–144 m. *ca.* 15 specimens.
St. WS 840. 6. ii. 32. 53° 52′ S, 61° 49′ W, 368–463 m. 15 specimens.
St. WS 869. 31. iii. 32. 52° 15′ S, 64° 14′ W, 187 (–0) m. Several specimens.
St. MS 14. 17. ii. 25. East Cumberland Bay, South Georgia, 109–180 m. 6 specimens.
St. MS 71. 9. iii. 25. East Cumberland Bay, South Georgia, 110–60 m. Several specimens.

In my paper, *On Hermaphroditism in viviparous Ophiurids*, I have stated (p. 10) that this species appears to be a protandric hermaphrodite, the old and poorly preserved material then at my disposal making this statement, however, somewhat uncertain. On a renewed examination of the rich material now at hand I find that it is not protandric.

Specimens of 5–6 mm. diameter already show gonads of distinctly female character. I think that in one case I have discerned a male gonad in a specimen of 6 mm. diameter of disk, together with distinct female gonads. But otherwise I have found only female gonads in all the numerous specimens of various sizes, from 5 to 18 mm. diameter of disk. (Among the specimens of var. *pentactis* male specimens are quite common.) This is quite a perplexing case; one is, indeed, tempted to suggest that the species is usually parthenogenetic. I have re-examined some preparations on which the statements in my paper of 1920 about the hermaphroditism of this species are (partly) based, and find that there is, at least, one clearly hermaphrodite gonad from a specimen of 9·5 mm. dia-

meter, whereas the gonads of a specimen of 8·5 mm. diameter appear to be all female. A gonad from a specimen of 14 mm. diameter is purely male. The indications thus are that this species is a proterogynic hermaphrodite.

It may be mentioned that there is only one young one, more rarely two, at a time in the bursae, and rarely in more than two to three bursae at a time, in conformity with the fact that rarely more than three to four young ones are found attached to the females.

In some cases I found gonads only along the adradial side of the bursae.

Some of the specimens from South Georgia are infested by a parasitic organism, probably referable to the Copepod genus *Ophioika*, described by K. Stephensen from an *Ophiacantha* from the Bali Sea (*Some new Copepods, parasites of Ophiurids and Echinids*. Papers from Dr Th. Mortensen's Pacific Exped., LXIV (Vid. Medd. Dansk Naturh. Foren., 93), 1933, p. 205). The parasite does not castrate its host; I have found young ones in the bursae in a specimen infested with the parasite. A couple of specimens from Sts. 170 and 190 are infested by an ectoparasitic Copepod of the genus *Cancerillopsis* (?), attached on the dorsal side of the arms, close to the disk.

M. Hertz (*op. cit.*, 1926) has established a variety *heptactis* for the Kerguelen specimens, founded on the fact that an 8-rayed specimen is carrying a 7-rayed young one, all the specimens on the whole being 7-rayed with the exception of only two 8-rayed specimens. The 7-rayed condition thus appears to be hereditary in the Kerguelen form, which is taken to necessitate a separate subspecies for this form. Evidently, however, Dr Hertz has forgotten that Studer (*Über Echinodermen aus dem antarktischen Meere, ges. a. d. Reise S.M.S. 'Gazelle'*. Monatsber. Akad. Berlin, 1876, p. 460) had already established a variety *kerguelensis* for the Kerguelen form; if this form then deserves to rank as a subspecies (which I rather doubt), its name must be *kerguelensis*, the name *heptactis* of Hertz falling directly into synonymy therewith.

As for the specimens in the present collection 6-rayed and 7-rayed specimens are about equally common. One may find 6-rayed young ones on 7-rayed specimens (whereas the inverse case, 7-rayed young ones on 6-rayed specimens was not observed). Here the number of the arms is decidedly of no classificatory value whatever. As for the 5-rayed specimens, cf. below under the var. *pentactis*.

Ophiacantha vivipara, var. pentactis, n.var.

(Plate VII, figs. 3, 4)

St. 170. 23. ii. 27. Off Cape Bowles, Clarence Island, 342 m. 3 specimens.
St. 187. 18. iii. 27. Neumayr Channel, Palmer Archipelago, 259–354 m. 5 specimens.
St. 190. 24. iii. 27. Bismarck Strait, Palmer Archipelago, 93–130 m. 3 specimens.
St. 599. 17. i. 31. 67° 08′ S, 69° 06′ W, 203 m. 1 specimen.

In his work on the Echinoderms of the II^{e} Expédition Antarctique Française ('Pourquoi–Pas?') Koehler has figured (pl. xi, 1) a large five-armed specimen under the name of *O. vivipara*; he regards this five-armed form as simply identical with the normally 6–7-rayed *O. vivipara*. Particularly he emphasizes the fact that there are all

possible transitions between the forms with the disk covered by a uniform granulation and those with numerous spines on the disk. Although these 5-armed specimens generally have more numerous spines on the disk besides the granules, there is thus no reason for distinguishing them from the typical 6–7-armed *O. vivipara*; and also in the other characters they agree, on the whole, with the typical *vivipara*. Still the matter is not quite so simple.

It is undeniable that these 5-armed specimens in general have a much more robust appearance than *vivipara* (cf. Plate VII, figs. 2–4); also the arms are longer and more robust. This can hardly be due simply to the fact that they have fewer arms than the typical form. Then it is a very noticeable fact that this large 5-rayed form is not met with among the specimens from the neighbourhood of the Falkland Islands, but only very far south, from the Palmer Archipelago to the Graham Land region. (Koehler's 5-rayed specimens are also all from this southern region.) If it were simply an individual variation of the 6–7-rayed *vivipara*, it would be hard to understand why such forms should not occur equally commonly also in the Falkland region (the single 5-rayed specimen I have seen from there is only a very young one). The typical *vivipara* also occurs in the more southern region, together with the 5-rayed form; but whereas the 5-rayed form is of common occurrence in the south, it apparently does not occur farther north. Further, there are among these large 5-rayed specimens several males, whereas no male specimens were observed among the typical 6–7-rayed specimens. None of the female specimens of the 5-rayed form have young ones in the bursae, so it is quite possible that this form is not viviparous—at least there is no proof that it is viviparous.

Thus, in my opinion, it is not justifiable simply to identify these specimens with the typical 6–7-rayed *O. vivipara*. If it is really *non-viviparous*, it must represent a separate species, but so long as we do not know this for certain, and in view of its resemblance with *vivipara* in general structure, I think it the safest course for the present to designate it as a variety of *O. vivipara*.

From *O. rosea*, with which there is much general resemblance, it is distinguished particularly by the outer mouth papillae being simple, not forming a cluster at the outer mouth tube foot. From *O. densispina* it differs in having both granules and spines on the disk, and in the arm spines being more smooth and not joining in the dorsal median line. Also the shape of the mouth shields is somewhat different (Figs. 5–6).

Ophiacantha densispina, n.sp.

(Plate VII, fig. 1)

St. WS 99. 19. iv. 27. 49° 42′ S, 59° 14′ W, Falkland Islands, 251–255 m. 1 specimen.
St. WS 248. 20. vii. 28. 52° 40′ S, 58° 30′ W, Falkland Islands, 210–242 m. 1 specimen.
St. WS 825. 29. i. 32. 50° 50′ S, 57° 15′ W, Falkland Islands, 135–144 m. 2 specimens.
St. WS 840. 6. ii. 32. 53° 52′ S, 61° 49′ W, Falkland Islands, 368–463 m. 3 specimens.

The type specimen (from St. WS 248) is a large, coarse specimen, 16 mm. in diameter of disk. The arms are all broken, but judging from their size they must have been at least about five to six times the diameter of the disk; they are somewhat flattened,

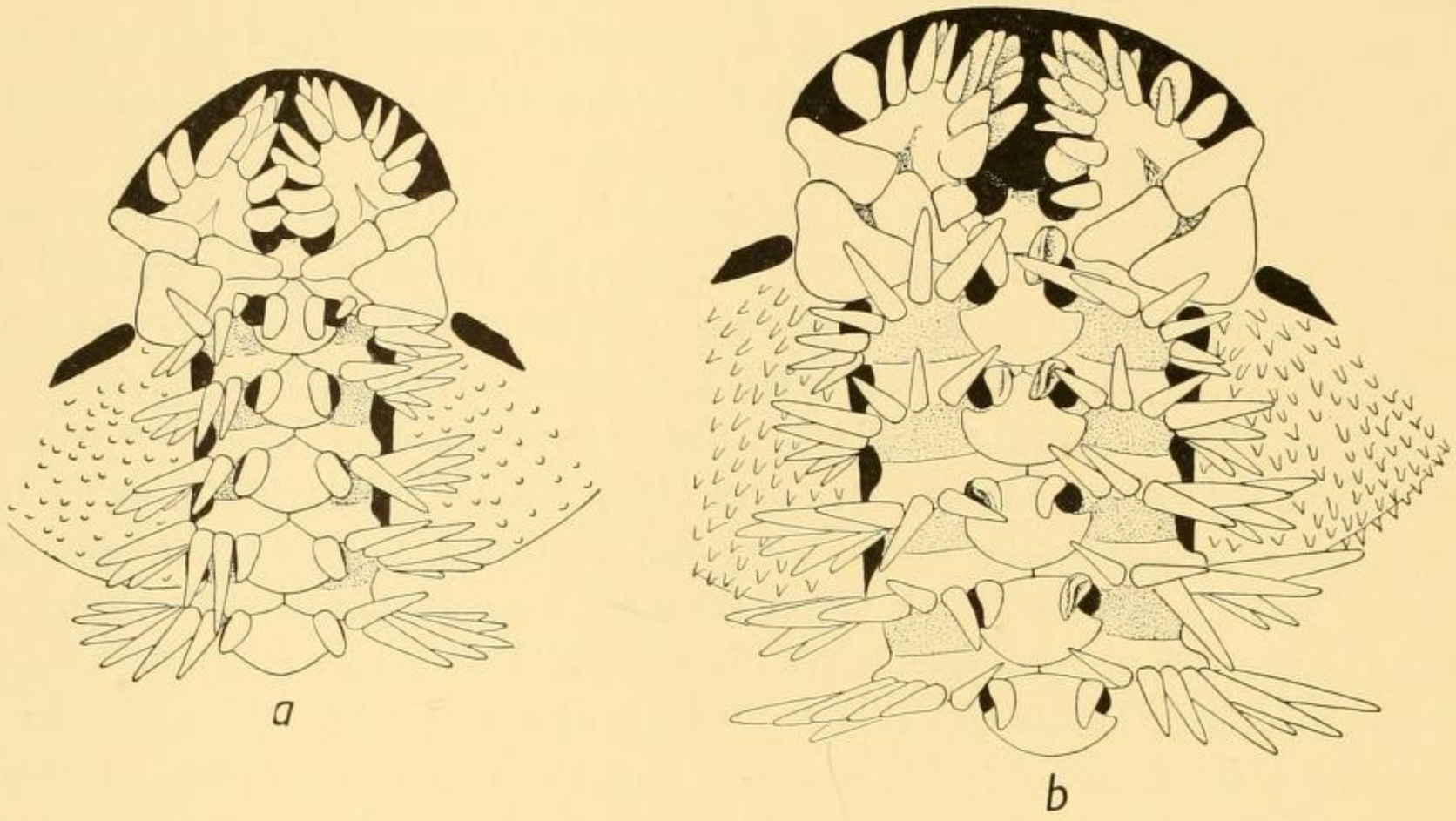

Fig. 5. Part of oral side of *Ophiacantha vivipara*, Ljungman (*a*), and of *O. vivipara*, var. *pentactis*, n.var. (*b*). ×6.

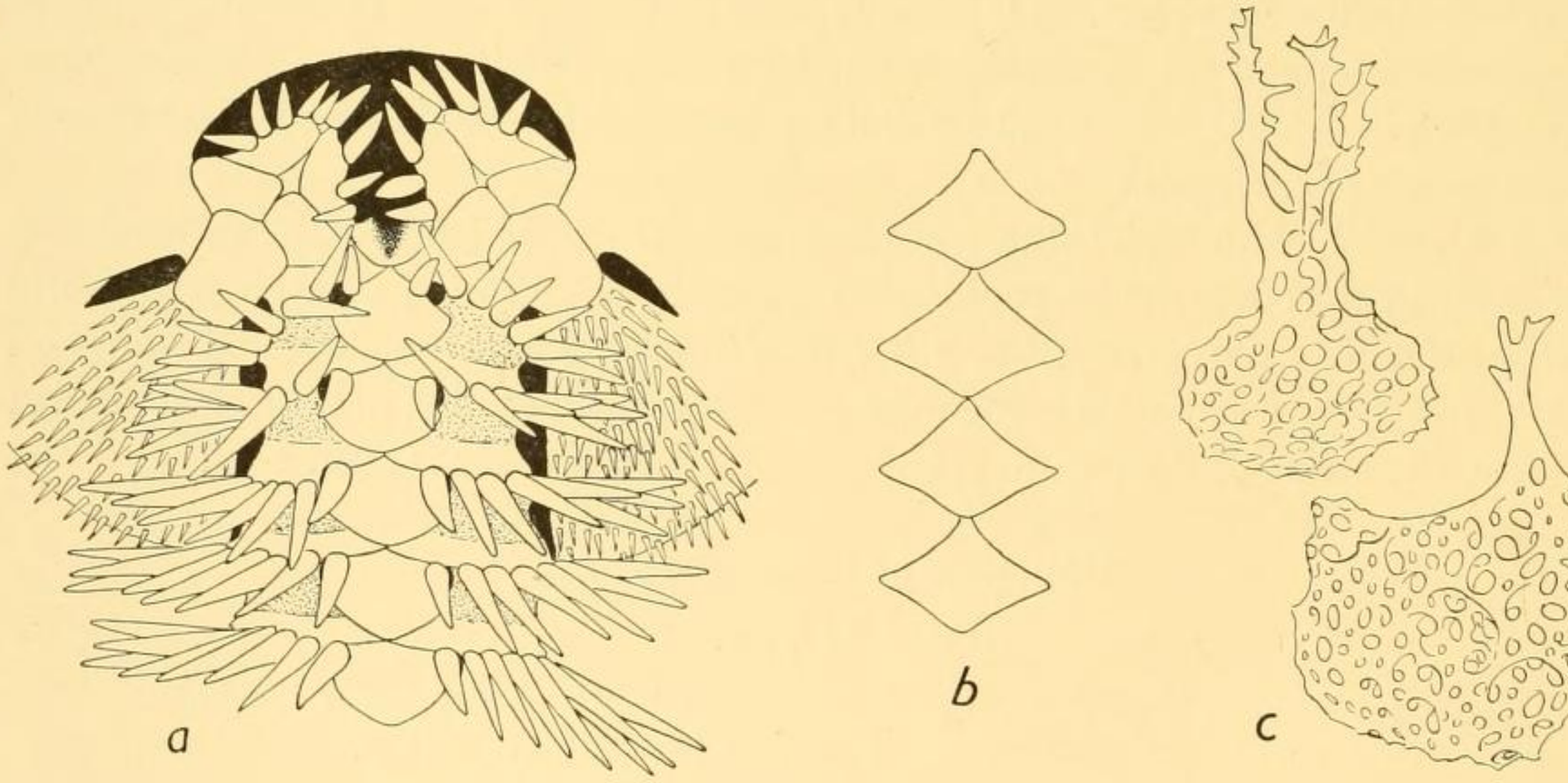

Fig. 6. *Ophiacantha densispina*, n.sp. *a*, Part of oral side, ×6. *b*, Dorsal arm plates, ×8. *c*, Spicules from bursal wall, with prolongations forming spines protruding into the body cavity. ×135.

3·5 mm. broad at the base. The other specimens are smaller and very poorly preserved.

The disk is covered, both on the dorsal and ventral side, by a rather dense coat of coarse spines, 1–1·5 mm. long; they are smooth, simply pointed in the type specimen, in other specimens more blunt. At most the distalmost part of the radial shields is naked, but there may be a rather distinct naked line proceeding inwards in continuation of the radial shields.

There are three to four rather long, slender mouth papillae on each side of the jaw, the outermost not, or only slightly, enlarged, and there are no extra papillae on the distal part of the jaws. The infradental papilla is not at all enlarged, rather smaller than the other papillae, but there are in the type specimen a few small extra papillae placed irregularly at the apex of the jaw. The buccal shields are of a very characteristic shape, almost rectangular, only slightly broader within than without; the adoral plates are small, almost square, sometimes with a more or less conspicuous outward prolongation which separates the buccal shield from the first lateral plate. The ventral plates, which are almost contiguous, have an almost straight proximal edge, the distal edge being convex; they are usually somewhat thickened and elevated in the distal part. A single large, leaf-shaped, more or less pointed tentacle scale. The dorsal plates are almost rhombical, almost contiguous proximally. Arm spines eleven to twelve in the proximal part of the arm, joining in the dorsal median line so as almost to conceal the dorsal plates. They are cylindrical, pointed, rather thorny in the basal part; they increase very gradually in length upwards, the uppermost ones being as long as five to six arm joints. One of the specimens from St. WS 840 is of a dark brown colour, the other specimens whitish, evidently bleached.

This species is *viviparous, but appears to have separate sexes*. The larger specimens (excepting the type and the specimen from St. WS 99, which are dried and could not be examined as to their sexual character) are males; only a small one, 5 mm. in diameter, from St. WS 825, is a female with young ones in the bursae (I found one large and one very small young one in the same bursa).

An interesting anatomical feature is found in this species, viz. that the two bursae at each arm have coalesced above the dorsal side of the arm. They are heavily plated, some of the plates prolonged into irregular spines, turning into the body cavity—to my knowledge a unique feature (Fig. 6 *c*).

There is undeniably much resemblance between this species and *Ophiacantha rosea*, Lyman, taken by the 'Challenger', also off Patagonia (St. 308). It is, however, beyond doubt that they are not identical, the main differences being found in the covering of the disk (small, short stumps of *O. rosea*) and in the mouth papillae, *O. rosea* having a cluster of distal papillae. Further, the bursae are not coalesced in *O. rosea*, as I can state, having examined a cotype of that species. It appears that *O. rosea* is not viviparous.

On examining the specimens of *O. rosea* in the British Museum I found that one from 'Challenger' St. 308 and two specimens from Tom Bay, Patagonia, are infested with *Myzostoma*, particularly at the bursal slits, one being even wholly within the bursa.

Ophiacantha disjuncta (Koehler)

Ophiacantha antarctica, Koehler, 1901. Result. Voyage 'Belgica'. Echinides et Ophiures, p. 34, pl. iv, figs. 23–25. *Non: Ophiacantha antarctica* (Lyman).

Ophiodiplax disjuncta, Koehler, 1911. Brit. Antarct. Exped., 1907–9. Astéries, Ophiures et Echinides, p. 48, pls. vi, figs. 9–11; vii, fig. 13.

Ophiacantha antarctica, Koehler, 1912. II^{e} Expéd. Antarct. Française. Echinodermes, p. 137.

Ophiodiplax disjuncta, Koehler, 1912. *Ibid.*, p. 142.

O. disjuncta, Koehler, 1922. Austral. Antarct. Exped. Echinod. Ophiuroidea, p. 15, pl. lxxviii, figs. 4–5, 9–12.

O. disjuncta, Koehler, 1923. Swedish Antarct. Exped. Astéries et Ophiures, p. 105.

O. disjuncta, G. A. Smith, 1923. *Report on the Echinoderms coll. during the voyage of the 'Quest'.* Ann. Mag. Nat. Hist., 9 Ser., xii, p. 369.

O. disjuncta, Mortensen, 1925. *On a small collection of Echinoderms from the Antarctic Sea.* Arkiv för Zoologi, xvii A, No. 31, p. 2.

Ophiacantha disjuncta, Hertz, 1926. Deutsche Südpolar-Exped. Ophiuroiden, p. 38, Taf. vii, fig. 5.

O. antarctica, Grieg, 1929. *Some Echinoderms from the S. Shetlands.* Bergens Mus. Årbok, 1929, p. 8.

St. 20. 4. iii. 26. 14·6 miles N 41° E of Cape Saunders, South Georgia, 200 m. 1 specimen.

St. 27. 15. iii. 26. West Cumberland Bay, South Georgia, 110 m. 12 specimens.

St. 39. 25. iii. 26. East Cumberland Bay, South Georgia, 179–235 m. 3 specimens.

St. 42. 1. iv. 26. Off mouth of Cumberland Bay, South Georgia, 120–204 m. Several specimens.

St. 123. 15. xii. 26. Off mouth of Cumberland Bay, South Georgia, 230–250 m. 5 specimens.

St. 140. 23. xii. 26. Stromness Harbour to Larsen Point, South Georgia, 122–136 m. 2 specimens.

St. 144. 5. i. 27. Off mouth of Stromness Harbour, South Georgia, 155–178 m. Several specimens.

St. 148. 9. i. 27. Off Cape Saunders, South Georgia, 132–148 m. 1 specimen.

St. 152. 17. i. 27. 53° 51′ S, 36° 18′ W, South Georgia, 245 m. 2 specimens.

St. 156. 20. i. 27. 53° 51′ S, 36° 21′ W, South Georgia, 200–236 m. 1 specimen.

St. 159. 21. i. 27. 53° 52′ S, 36° 08′ W, South Georgia, 160 m. 2 specimens.

St. 160. 7. ii. 27. Near Shag Rocks, South Georgia, 177 m. 1 specimen.

St. 170. 23. ii. 27. Off Cape Bowles, Clarence Island, 342 m. Several specimens.

St. 175. 2. iii. 27. Bransfield Strait, South Shetlands, 200 m. Several specimens.

St. 177. 5. iii. 27. 27 miles SW of Deception Island, South Shetlands, 1080 m. 1 specimen.

St. 180. 11. iii. 27. Schollaert Channel, Palmer Archipelago, 160 m. 1 specimen.

St. 181. 12. iii. 27. Schollaert Channel, Palmer Archipelago, 160–335 m. 5 specimens.

St. 182. 14. iii. 27. Schollaert Channel, Palmer Archipelago, 278–500 m. 1 specimen.

St 187. 18. iii. 27. Neumayr Channel, Palmer Archipelago, 259–354 m. 15 specimens.

St. 190. 24. iii. 27. Bismarck Strait, Palmer Archipelago, 90–130 m. and 315 m. Several specimens from both depths.

St. 195. 30. iii. 27. Admiralty Bay, King George Island, South Shetlands, 391 m. 15 specimens.

St. 363. 26. ii. 30. Off Zavodovski Island, South Sandwich Islands, 329–278 m. 8 specimens (1 6-rayed).

St. 599. 17. i. 31. 67° 08′ S, 69° 06′ W, 203 m. 10 specimens.

St. 600. 17. i. 31. 67° 09′ S, 69° 27′ W, 501–527 m. 4 specimens.

St. WS 42. 7. i. 27. 54° 42′ S, 36° 44′ W, South Georgia, 198 m. 12 specimens.

Some of the specimens are infested by the ectoparasitic Copepod *Cancerillopsis*, one of them (St. 599) by the entoparasite *Ophioika*.

There cannot be the slightest doubt that Koehler's *Ophiodiplax disjuncta* is identical with the species described by him in 1901 under the name *Ophiacantha antarctica*. From the descriptions and figures this is indeed quite evident; it is true the division of the dorsal arm plates was not observed by Koehler in his *O. antarctica*, but in a co-type sent me from the Brussels Museum I find them very well developed. No further discussion on the question of the identity of the two "species" is needed. It is curious that Koehler, in recording both *O. antarctica* and *Ophiodiplax disjuncta* in his work of 1912 did not notice their similarity.

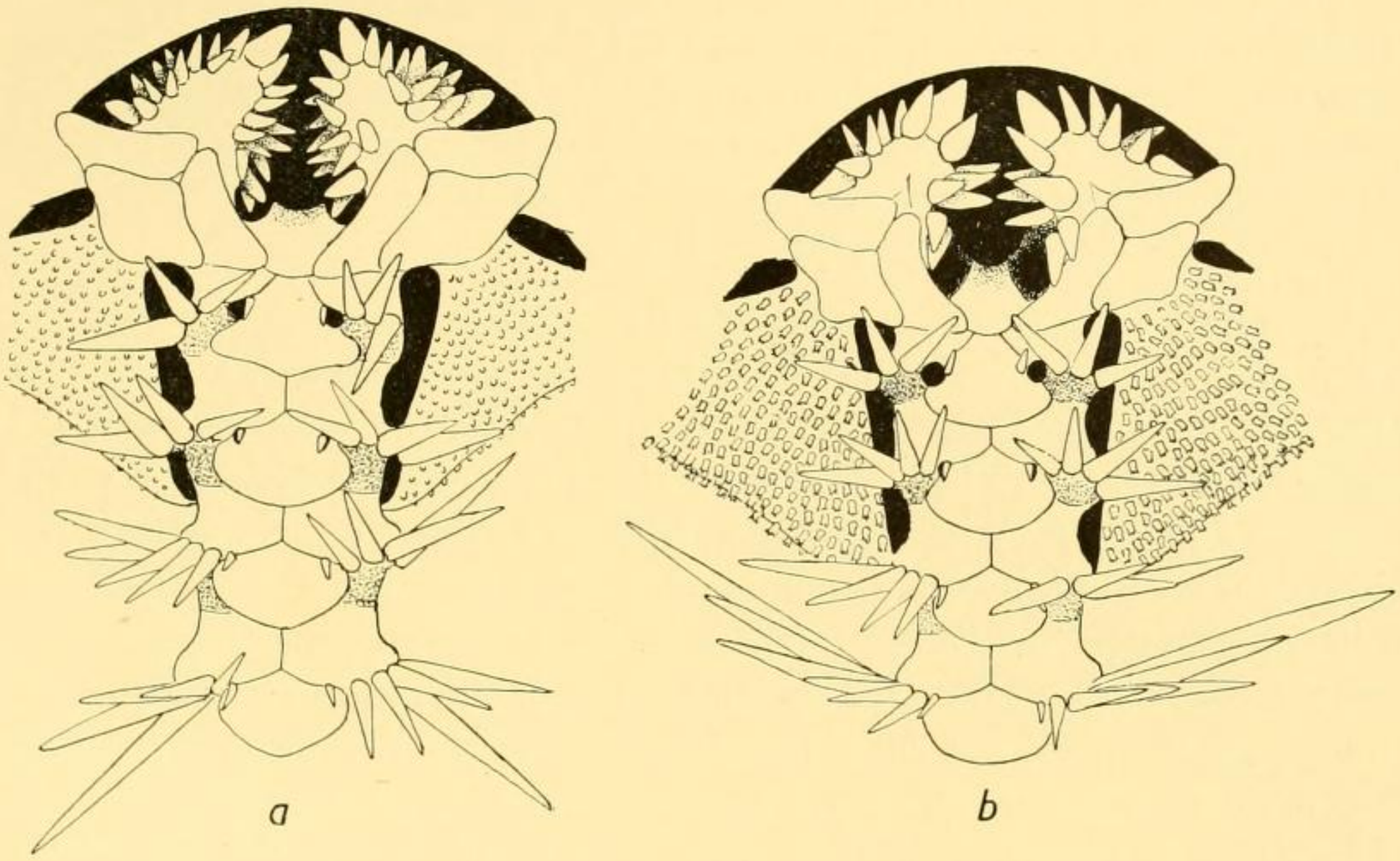

Fig. 7. *Ophiacantha disjuncta* (Koehler). Part of oral side of two specimens, showing variation in the development of the mouth papillae. ×12.

The name *antarctica*, though the older of the two, cannot be used for the species, as there already is the *Ophiacantha antarctica* (Lyman) originally referred by Lyman to *Ophioconis*, but quite evidently an *Ophiacantha*; thus the name *disjuncta* has to be used for this species.

As for the genus *Ophiodiplax*, Hertz has rejected it and included the species in the genus *Ophiacantha*, and I quite agree that the characters of the divided dorsal plates and the more or less conspicuous continuation of disk spinules on to the dorsal side of arms do not afford sufficient basis for making the species the type of a separate genus. There is, however, another character which might be of generic value—the multiplication of the mouth papillae. In some specimens there are a great number of papillae, placed mainly below the normal ones inside the mouth slits (Fig. 7 *a*); more generally there are only a few of these supernumerary papillae (Fig. 7 *b*), sometimes only one, very rarely none. As pointed out by Koehler in his description of *O. antarctica* this recalls Verrill's

genus *Ophiectodia*, and if we were to recognize that genus, *Ophiodiplax* would be a synonym of it. But I do not think that genus sufficiently well founded.

One of the specimens from St. 363 is 6-rayed, but otherwise conforms with the typical *disjuncta*. This species is *not* viviparous; but the eggs are very large, so that there is hardly the possibility that the larva *Ophiopluteus irregularis*, Mortensen, can actually belong to it, as suggested in my report on the Echinoderm larvae of the German South Polar Expedition, p. 96.

Ophiacantha antarctica (Lyman)

Ophioconis antarctica, Lyman, 1882. 'Challenger' Oph., p. 107, pl. xxiii, figs. 1–3.
Ophiacantha polaris, Koehler, 1901. Result. Voyage 'Belgica'. Echinides et Ophiures, p. 32, pl. iii, figs. 19–21.
O. polaris, Koehler, 1912. II^{e} Expéd. Antarct. Française. Echinodermes, p. 137.
Ophioconis antarctica, Hertz, 1926. Deutsche Südpolar-Exped. Ophiuroiden, p. 40.
Non: Ophiacantha antarctica, Koehler, 1901. Result. Voyage 'Belgica'. Echinides et Ophiures, p. 34, pl. iv, figs. 23–25 (= *Ophiacantha disjuncta* (Koehler)).

St. 170. 23. ii. 27. Off Cape Bowles, Clarence Island, 342 m. 2 specimens.
St. 172. 5. iii. 27. Off Deception Island, South Shetlands, 525 m. 1 specimen.
St. 181. 12. iii. 27. Schollaert Channel, Palmer Archipelago, 160–335 m. 2 specimens.
St. 186. 16. iii. 27. Fournier Bay, Anvers Island, Palmer Archipelago, 295 m. 1 specimen.
St. 363. 26. ii. 30. South Sandwich Islands, 329–278 m. 10 specimens.

Whereas I quite agree with Dr Hertz that Koehler's *Ophiacantha polaris* is indistinguishable from Lyman's *Ophioconis antarctica*, I cannot agree with her in retaining it in the genus *Ophioconis*. Without entering here on a discussion of Matsumoto's subdivision of the genus *Ophioconis* I would merely point out the peculiar character of the teeth in the genotype, *O. Forbesi* (Heller): broad, rounded, with a clear enamel-like border; this is so different from the shape of the teeth in *O. antarctica*: narrow, pointed like mouth papillae, and not enamel-like, that the two species cannot reasonably be referred to the same genus. *O. antarctica* is clearly an *Ophiacantha*, of the group designated by Verrill as *Ophiolimna*. Whether the latter should be maintained as a separate genus or as a subgenus of *Ophiacantha* is rather a matter of taste.

This species has separate sexes and appears not to be viviparous. But the eggs are large and yolky, which would seem to indicate that it has direct development, without a pelagic larval stage. In my report on 'Die Echinodermenlarven der Deutschen Süd-Polar Expedition', 1913, p. 96, I have suggested that the larva *Ophiopluteus irregularis* described there (p. 94, Taf. xiii, fig. 2; xiv, fig. 3; xv, figs. 1–3) may belong to *Ophiacantha antarctica*. This is, however, not the present species *O. antarctica* (Lyman), but the *O. antarctica* of Koehler, which must henceforth be named *O. disjuncta* (Koehler). The question whether the said larva may really belong to this latter species is discussed above.

The fact that several of the specimens in hand have the skin of the disk more or less lacerated (dissolved) indicates a peculiar histological character of the skin which exists in several Ophiurids, particularly among the Ophiomyxids, causing the skin to dissolve when the specimen is left out of the water for a few moments. This is evidently the case also in *O. Bairdi*, Lyman, the genotype of the subdivision *Ophiolimna*, to which *Ophiacantha antarctica* belongs.

Ophiacantha angolensis var. inermis, n.var.

St. 279. 10. viii. 27. Off Cape Lopez, French Congo, 58–67 m. 3 specimens.

These small Ophiacanthas (2–4 mm. diameter of disk) so strikingly recall *O. angolensis*, described by Koehler in his paper *Sur quelques Ophiures des côtes de l'Angola et du Cap* (Göteborgs K. Vetensk. Vitterh. Samh. Handl., xxv, 5, p. 4, pl. i, figs. 4–5), that one is much tempted to regard them as identical. There are, however, some differences which forbid such a course. In the typical *angolensis* the small stumps covering the disk terminate usually in three distinct, diverging spinules; in the present specimens these stumps terminate in a simple point. The arm spines are distinctly thorny in the proximal part of the arms in the typical *angolensis*, smooth in the present specimens; further the buccal shields have in general a more distinct outer lobe in these specimens than is the case in the typical *angolensis*. Otherwise the resemblance is complete: the shape of the dorsal and ventral arm plates, the strongly moniliform and much convoluted arms, the number of arm spines (5–4), the small tentacle scale, the three simple mouth papillae, the brownish colour. Also the locality and depth (*O. angolensis* was taken off Port Alexander, Angola, 73 m.) being much the same, the probability is that the differences pointed out are only individual variations. However, since the three present specimens are all alike, I think it preferable to designate them as a variety of *angolensis*. If, when more material comes to hand, it is found that the characters pointed out here are subject to variation so as not to be reliable for distinguishing between the typical form and the variety, the latter may be withdrawn.

The director of the Gothenburg Museum, my friend Professor L. A. Jägerskjöld has very kindly lent me the type specimen of *Ophiacantha angolensis*, so that I have been able to compare it with the three specimens in the present collection.

Ophiacantha (Ophiotreta) sp.

Ophiacantha Valenciennesi, Koehler, 1908. Scott. Nat. Antarct. Exped. Astéries, Ophiures et Echinides, p. 608.

St. 399. 18. v. 30. Gough Island, 102–141 m. Some young specimens.

These specimens, no doubt, are identical with those from the same locality referred by Koehler (*op. cit.*) to *O. Valenciennesi*, Lyman. They are all very young, 2–3 mm. diameter of disk, only one of them being as large as 6 mm. diameter of disk. Referring to the discussion of the Atlantic forms designated as *O. Valenciennesi* given in my work on the Ophiuridae of the "Ingolf" Expedition (1933, pp. 34–7), I find it impossible to identify these young specimens with certainty as *O. Valenciennesi* (as I had to leave unidentified a similar young specimen from St Helena (Echinoderms of St Helena, 1933, p. 440). The proximal spines are not widened or bifid at the point, as usual in the adults of *O. Valenciennesi*. The colour is a brownish mottled, the arms banded with white and brownish.

A larger material, particularly of adult specimens, will be necessary for settling the question of the identity of this South Atlantic form of *Ophiotreta*.

Ophiomitrella ingrata, Koehler

Ophiomitrella ingrata, Koehler, 1908. Scott. Nat. Antarct. Exped. Astéries, Ophiures et Echinides, p. 613, pl. xiv, figs. 126–127.

St. 399. 18. v. 30. Off Gough Island, 102–141 m. Several specimens.

Ophiomitrella falklandica, n.sp.

(Plate VII, fig. 5)

Ophioripa ingrata, Koehler, 1923. Swedish Antarct. Exped. Astéries et Ophiures, p. 106, pl. xiv, figs. 4–6.

St. 175. 2. iii. 27. Bransfield Strait, South Shetlands, 200 m. 2 specimens.
St. 652. 14. iii. 31. Burdwood Bank, 169–171 m. 5 specimens.
St. WS 83. 24. iii. 27. 14 miles S 64° W of George Island, East Falkland Islands, 137–129 m. 1 specimen.
St. WS 85. 25. iii. 27. 8 miles S 66° E of Lively Island, East Falkland Islands, 79 m. 3 specimens.
St. WS 228. 30. vi. 28. 50° 50′ S, 56° 58′ W, Falkland Islands, 229–236 m. 1 specimen.
St. WS 246. 19. vii. 28. 52° 25′ S, 61° 00′ W, Falkland Islands, 267–208 m. 3 specimens.
St. WS 248. 20. vii. 28. 52° 40′ S, 58° 30′ W, Falkland Islands, 210–242 m. 5 specimens.
St. WS 773. 31. x. 31. 47° 28′ S, 60° 51′ W, 291–296 m. 4 specimens.
St. WS 804. 6. i. 32. 50° 21′ S, 62° 53′ W, Falkland Islands, 143–150 m. 1 specimen.
St. WS 824. 19. i. 32. 52° 29′ S, 58° 27′ W, Falkland Islands, 146–137 m. 4 specimens.
St. WS 825. 29. i. 32. 50° 50′ S, 57° 15′ W, Falkland Islands, 135–144 m. 4 specimens.
St. WS 829. 31. i. 32. 50° 51′ S, 63° 13′ W, Falkland Islands, 155 m. 4 specimens.
St. WS 840. 6. ii. 32. 53° 52′ S, 61° 49′ W, Falkland Islands, 368–463 m. 5 specimens.
St. WS 871. 1. iv. 32. 53° 16′ S, 64° 12′ W, Falkland Islands, 336–341 m. 1 specimen.

The specimens from off the Falkland Islands and from the Burdwood Bank are regarded by Koehler (*op. cit.*) as identical with the species from Gough Island, originally described by Koehler as *Ophiomitrella ingrata*, but in his work on the Asterids and Ophiurids of the Swedish Antarctic Expedition (*loc. cit.*) transferred to the genus *Ophioripa*; but in my opinion they decidedly represent a different species. As appears from the figures given here of the two species (Figs. 8 *a–d*), the species from the Falkland region differs from *O. ingrata*, in addition to its much larger size (up to 9 mm. diameter of disk, *O. ingrata* not surpassing a diameter of 5 mm.), in being in general much coarser. This is seen clearly even in young specimens, as shown in the figures which are drawn from specimens of 3·5 mm. diameter of both species; in the larger specimens this difference is much more conspicuous. It is in the arm spines, the grains of the disk, and the mouth papillae that this difference is to be found, as seen from the figures; in both, however, they are finely thorny and rough. In the ventral and dorsal arm plates there is no distinct difference, but the radial shields afford a good and apparently constant difference, being widely separated in *falklandica* and contiguous in *ingrata*. The difference in the shape of the buccal shields shown in the figures is less reliable. It may be added that the granules of the disk in *falklandica* are often more elongate and quite club-shaped, recalling, indeed, the condition found in *Ophioripa conferta*, Koehler. As a matter of fact *O. falklandica* very much recalls *Ophioripa conferta* from off Maria Island, Tas-

mania, described by Koehler in his report on the Ophiuroids of the Australasian Antarctic Expedition (p. 19, pl. lxxxv, figs. 9–13), and I would not be altogether too

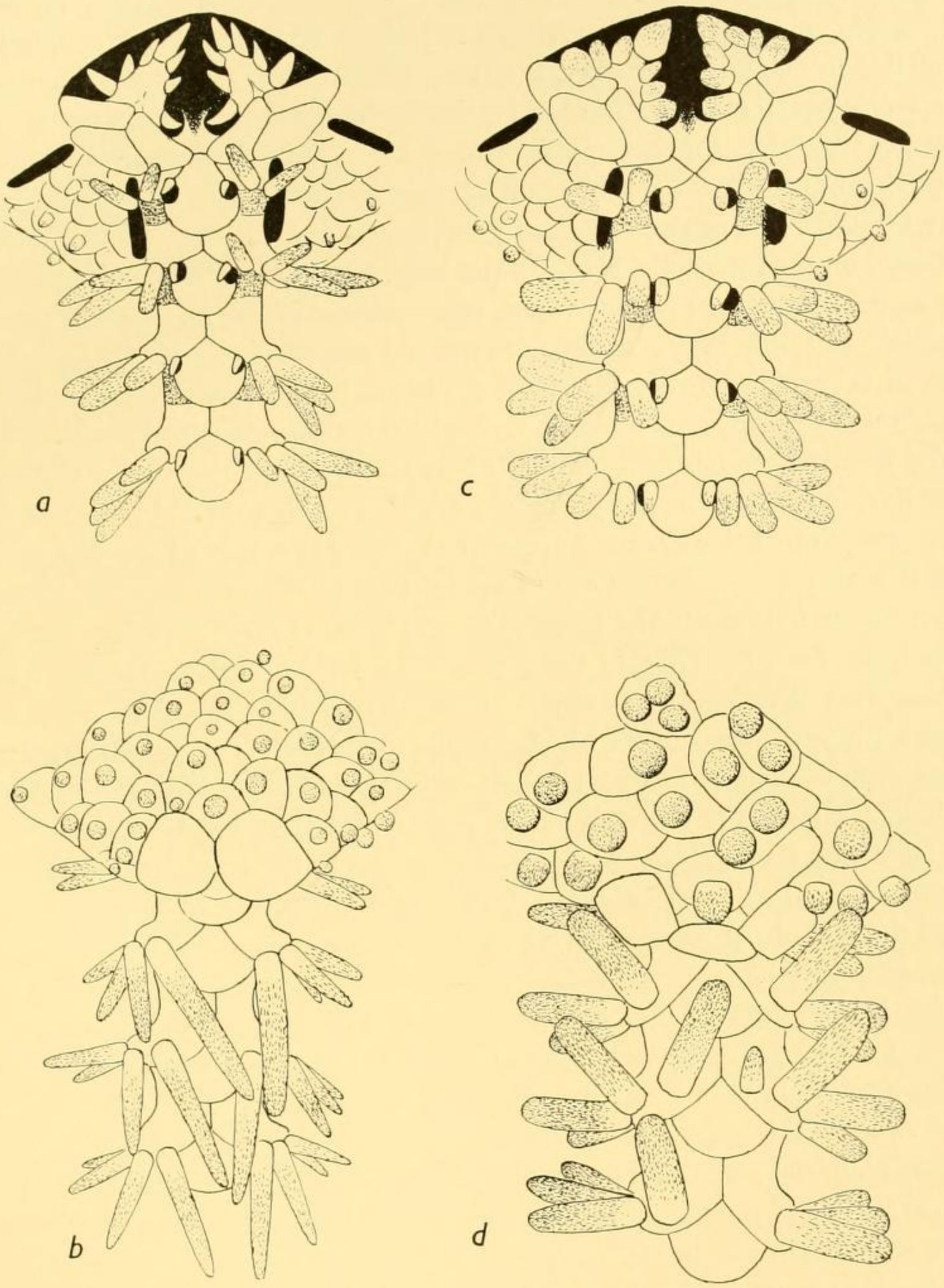

Fig. 8 *a*, *b*. *Ophiomitrella ingrata*, Koehler. Part of oral side (*a*) and dorsal side (*b*).
Fig. 8 *c*, *d*. *Ophiomitrella falklandica*, n.sp. Part of oral side (*c*) and dorsal side (*d*). ×22·5.

surprised if it were ultimately to be found that the two are identical. But for the present I do not venture to state definitely that the South American specimens, from depths of 79–463 m. (Koehler even records a specimen from 40 m.), are identical with the deep-sea species *O. conferta*, known only from off Tasmania from a depth of 2340 m.

Both O. ingrata and O. falklandica are viviparous. In my Echinoderms of South Africa (Vid. Medd. Dansk Naturh. Foren. XCIII, 1933, p. 333) I have stated, in discussing the viviparous South African species *Ophiomitrella corynephora*, H. L. Clark, that *O. ingrata* appears not to be viviparous, judging from the scarce material at that time available to me. This, however, is not so. *O. ingrata is viviparous*. There appears to be only one young at a time in each bursa, reaching a very large size so as to fill up the bursa completely. Further, *O. ingrata* is a *protandric hermaphrodite*, the young specimens being mainly males, the adult specimens females. In a specimen of 4 mm. diameter I found a very large testis distally on the adradial side of the bursae and a small female gonad on the interradial side. In the largest specimens there may still be traces of male sexual products in gonads which otherwise contain eggs.

O. falklandica is also viviparous and in general a protandric hermaphrodite. As I have found an adult specimen (7 mm. diameter of disk) to be purely male, it would seem that some specimens perhaps remain males throughout life—or perhaps become pure males again after having been hermaphrodites. There are two to five young ones at a time, of the same size, in each bursa, the young ones, which reach a considerable size with up to twelve arm joints, being jammed together in the most extraordinary way so that one wonders how they manage to get out of the bursae. In one specimen, which had only one to two young ones left in the bursae, the next batch of embryos were already found, squeezed in between the arms of the young ones, and of so irregular shape that it is astonishing that they could develop into regular brittle-stars. One of the young ones had a young embryo in its mouth, evidently in the act of devouring it—rather a peculiar case, analogous to that of the Comatulid, *Isometra vivipara*, in which the Pentacrinoids, attached to the cirri of the mother, catch and devour their sister and brother larvae, on their passage from the marsupium in the pinnulae down to the cirri (cf. Mortensen, 1918, The Crinoidea of the Swedish Antarctic Expedition, VI, 8, p. 15).

One of the specimens from St. WS 773 contains the remarkable parasitic Copepod *Ophioika*, Stephensen.

Koehler has transferred the species *ingrata*, including *falklandica*, from *Ophiomitrella* to his new genus *Ophioripa*, established in his work on the Ophiurans of the Philippine Seas (Bull. U.S. Nat. Mus., No. 100, 1922, p. 117), this genus differing from *Ophiomitrella* "in the large dorsal plates of the disk, which are provided with a transparent border, in the very small under arm plates, and in the wide separation along the median dorsal line of the arm of the columns of arm spines". I think this genus rather poorly characterized, and in any case, I do not see any sufficient reason for removing the species *ingrata*, or *falklandica*, from the genus *Ophiomitrella*. I would particularly emphasize that there is no transparent border on the dorsal plates of the disk, a feature which Koehler emphasizes as characteristic of the genus *Ophioripa*.

As stated in my Echinoderms of South Africa (*loc. cit.*) the bursae are separate in *ingrata*, and the same holds good of *falklandica*, in contradistinction to the South African *O. corynephora*. The bursae, when containing the large young ones, fill up the disk to such a degree that there is hardly room for the stomach, so that it would seem to

be difficult for the mother animal to get sufficient nourishment, a situation apparently the more precarious since it appears that breeding goes on constantly, when once started.

One of the specimens from St. 175, a young one of only 2·2 mm. diameter of disk, differs from the other specimens in the stumps of the disk being long and slender, recalling, as a matter of fact, the *Ophiacantha paramedea* of Hertz (Deutsche Südpolar Exped. Ophiuroiden, p. 39, Taf. vii, fig. 6; viii, figs. 1–2). However, a comparison with young ones of *O. falklandica* taken out of the bursae leaves no doubt that this specimen is only a newly born *O. falklandica*, the spines of the disk being equally long and slender in the still unborn young ones. By this I do not mean to say that *Ophiacantha paramedea* is only a young *Ophiomitrella falklandica*. The fact that the specimens of the *O. paramedea* were 4–5 mm. in diameter of disk, shows that they cannot be identical with *O. falklandica*, for specimens of the latter of this size have the same general appearance as the adult. This, however, is not the place to discuss the species *Ophiacantha paramedea*.

Ophiochondrus stelliger, Lyman

Ophiochondrus stelliger, Lyman, 1882. Sci. Results H.M.S. 'Challenger'. Ophiuroidea, p. 247, pl. xxi, figs. 13–15.

O. falklandicus, Koehler, 1923. Swedish Antarct. Exped. Astéries et Ophiures, p. 103, pl. xiv, figs. 2–3.

St. WS 228. 30. vi. 28. 50° 50′ S, 56° 58′ W, off Falkland Islands, 229–236 m. 3 specimens.
St. WS 824. 19. i. 32. 52° 29′ S, 58° 27′ W, off Falkland Islands, 146–137 m. 2 specimens.
St. WS 871. 1. iv. 32. 53° 16′ S, 64° 12′ W, off Falkland Islands, 336–341 m. 1 specimen.

There is no doubt but that these specimens are identical with Koehler's *O. falklandicus*; but it is equally certain that this latter is again identical with Lyman's *O. stelliger*. That they were closely related was observed by Koehler, who, however, thought them to differ, *O. falklandicus* having only three arm spines, of about equal length, whereas *O. stelliger* has four, the upper one much the longest. Further, the buccal shields were supposed to be different, Lyman's pl. xxi, fig. 13, showing the shape of the buccal shield much broader than that of *falklandicus*, as seen in pl. xiv, fig. 3, of Koehler's work. Another difference of much more importance escaped the attention of Koehler, viz. that the genital slits in *O. stelliger* are shown in Lyman's figure to be long, reaching to the very edge of the disk, whereas in Koehler's species they are only half that length.

Finding, however, that in the present specimens there are on the proximal joints actually four arm-spines, the upper one distinctly the longest, I strongly suspected the two other differences to be due to incorrect drawing. At my request Mr Dilwyn John very kindly sent me a camera sketch of the oral side of the type specimen, which shows the genital slits to be short as in *falklandicus* and the buccal shields of exactly the same shape as in *falklandicus*. Thus the identity of *O. falklandicus* with *O. stelliger* is definitely proved.

From a zoogeographical point of view this identity is also acceptable, the type locality, off La Plata (1080 m.), being essentially within the same region as the Falkland Islands; the species is known from only these two localities.

O. stelliger is viviparous and hermaphrodite. There are two to three gonads on the interradial, one on the adradial side of each bursal slit; it is the single gonads which are hermaphrodite, containing both sperms and eggs at the same time.

Only a single egg develops at a time, and apparently only one at a time in each interradius. The young ones reach a large size and may be discerned quite distinctly through the thin, rather transparent skin of the dorsal side of the disk. This is something quite unusual; it is due to the fact that the stomach does not, as is usual, spread over the whole dorsal side, by its dark colour concealing the underlying embryos, but is compressed between the young ones, squeezed into narrow strands, forming a kind of reticulation between the young ones.

In one gonad I observed something recalling the curious parasitic organism *Nidrosia ophiurae*, which I have described from *Ophiura Sarsi* (Danish 'Ingolf' Exped. Ophiuroidea, p. 74). I cannot, however, state definitely that it is the same.

Family OPHIOCOMIDAE

Ophiocoma Bollonsi, Farquhar

Ophiocoma Bollonsi, Farquhar, 1908. *Description of a new Ophiurid.* Trans. N. Zealand Inst., XL, p. 108.

O. Bollonsi, H. L. Clark, 1921. *The Echinoderm Fauna of Torres Strait.* Publ. Carnegie Inst., 214, p. 132.

O. Bollonsi, Mortensen, 1924. *Echinoderms of New Zealand and the Auckland-Campbell Islands.* II. *Ophiuroidea.* Papers from Dr Th. Mortensen's Pacific Exped., XX (Vid. Medd. Dansk Naturh. Foren., 77), p. 120.

St. 941. 20. viii. 31. 40° 53′ S, 174° 47′ E, Cook Strait, New Zealand, 128 m. 1 specimen.

Although the spines of this specimen can scarcely be said to be canaliculate, there is no doubt that it belongs to *O. Bollonsi*, Farquhar. Some of the spines are club-shaped, on account of some kind of parasitic organism, as mentioned in my paper of 1924 (p. 122).

Each dorsal arm plate has a narrow, white transverse band, the ground colour being brownish. This gives the arms a finely banded appearance.

Ophiopsila guineensis, Koehler

Ophiopsila guineensis, Koehler, 1914. Meeresfauna Westafrikas. Echinoderma, p. 203, pl. viii, figs. 1–4, 7–8.

St. 283. 13. viii. 27. Off Annobon, Gulf of Guinea, 18–30 m. 2 specimens.

To Koehler's description of this species I would only add that the ventral interradii are naked proximally, and that the disk, which is preserved in one of the specimens, is whitish with black, not reddish brown spots, as was the case in the types. Otherwise these specimens are in good agreement with Koehler's description.

Ophiopsila platyspina, Koehler

Ophiopsila platyspina, Koehler, 1914. Meeresfauna Westafrikas. Echinoderma, p. 206, pl. viii, figs. 10–11.

St. 283. 13. viii. 27. Off Annobon, Gulf of Guinea, 18–30 m. 6 specimens and some broken arms.

Although Koehler's description is based on only a single, poorly preserved specimen there is scarcely anything to be added. I would say that his statement that the dorsal arm plates are covered with "gros granules très apparents" is a little exaggerated, as it requires considerable magnification—some 25–30 times—to see them clearly, and with such magnification the same thing can be seen in many other Ophiurids (also in *Ophiopsila guineensis*, though not quite as conspicuous as in *O. platyspina*), owing to the microscopic structure of the plates.

The colour of the disk is rather variable; one specimen shows a fine reticulation of blackish and whitish, the others have some large irregular, blackish spots, surrounded by whitish, on a reddish brown ground. The colour of the arms—reddish brown, with a narrow band of blackish or dark grayish on about every fourth or fifth joint—is very characteristic and makes even fragments of arms easily recognizable.

Family OPHIOTHRICHIDAE

Ophiothrix triglochis, Müller and Troschel

Ophiothrix triglochis, Müller and Troschel, 1842. System d. Asteriden, p. 114.
O. triglochis, Koehler, 1904. *Ophiures nouveaux ou peu connues*. Mém. Soc. Zool. France, 1904, p. 81.
O. triglochis, H. L. Clark, 1923. *Echinoderm Fauna of South Africa*. Ann. S. African Mus., XIII, p. 337.
O. triglochis, Mortensen, 1933. *Echinoderms of South Africa*. Papers from Dr Th. Mortensen's Pacific Exped., XX (Vid. Medd. Dansk Naturh. Foren., 77), p. 337.

Other literary references are given in my paper of 1933, *loc. cit.*

St. 90. 10. vii. 26. Simonstown, False Bay, South Africa, 10 m. 8 specimens.
St. 91. 8. ix. 26. Off Roman Rock, False Bay, South Africa, 35 m. 2 specimens.

Ophiothrix fragilis (Abildgård)

Ophiothrix fragilis, H. L. Clark, 1923. *Echinoderm Fauna of South Africa*. Ann. S. African Mus., XIII, p. 337.
O. fragilis, Mortensen, 1933. Danish 'Ingolf' Exped. Ophiuroidea, IV, 8, p. 45, pl. i, figs. 1–7.
For further literary references see my work on the 'Ingolf' Ophiuroidea, *loc. cit.*

1926. Saldanha Bay. Littoral. 3 specimens.

Ophiothrix roseo-coerulans, Grube

Ophiothrix roseo-coerulans, Mortensen, 1933. *The Echinoderms of St Helena (other than Crinoids)*. Papers from Dr Th. Mortensen's Pacific Exped., 1914–16, LXVI (Vid. Medd. Dansk Naturh. Foren., 93), p. 440, pl. xxii, figs. 5–7.
For other literary references, see the paper quoted.

St. 1. 16. xi. 25. Clarence Bay, Ascension, 16–27 m. Several specimens.
St. 2. 17. xi. 25. Ascension. Littoral. 8 specimens.

The species was hitherto known only from St Helena, but its occurrence at Ascension was to be expected, so it is very satisfactory that it has now actually been found there.

Family OPHIACTIDAE

Ophiactis asperula (Philippi)

Ophiactis asperula, Ludwig, 1898. *Die Ophiuren der Sammlung Plate*. Zool. Jahrbücher, Suppl., pp. 752–5.
O. asperula, Ludwig, 1899. Ophiuroideen Hamburger Magalh. Sammelreise, p. 6.
O. asperula, H. L. Clark, 1915. Cat. Recent Ophiurans, p. 259, pl. x, figs. 11–12.
O. asperula, H. L. Clark, 1918. *Brittle-Stars, new and old*. Bull. Mus. Comp. Zool., LXII, pp. 300, 310.
O. asperula, Mortensen, 1920. *On Hermaphroditism in viviparous Ophiurids*. Acta Zoologica, I, p. 4.
O. asperula, Koehler, 1922. Austral. Antarct. Exped. Echinod. Ophiuroidea, p. 36, pl. lxxxi, figs. 8–9.
O. asperula, Koehler, 1923. Swedish Antarct. Exped. Astéries et Ophiures, p. 116.
For references to the older literature see Ludwig, *op. cit.*

St. 48. 3. v. 26. 8·3 miles N 51° E of Port William, Falkland Islands, 105–115 m. 5 specimens.
St. 51. 4. v. 26. Off Eddystone Rock, East Falkland Islands, 105–115 m. 18 specimens.
St. 52. 5. v. 26. Port William, East Falkland Islands, 17 m. 3 specimens.
St. 55. 16. v. 26. Entrance to Port Stanley, East Falkland Islands, 10–16 m. 3 specimens.
St. 56. 16. v. 26. Port William, East Falkland Islands, 10½–16 m. 4 specimens.
St. 57. 16. v. 26. Port William, East Falkland Islands, 15 m. Several specimens.
St. 388. 16. iv. 30. 56° 19′ S, 67° 10′ W, off Cape Horn, 121 m. 18 specimens.
St. 652. 14. iii. 31. Burdwood Bank, 171–169 m. Several specimens.
St. 724. 16. xi. 31. Fortescue Bay, Magellan Strait, 0–5 m. 15 specimens.
St. 1321. 16. iii. 34. Cockburn Channel, Tierra del Fuego, 66 m. Several specimens.
St. WS 73. 6. iii. 27. 51° 01′ S, 58° 54′ W, East Falkland Islands, 121 m. Several specimens.
St. WS 79. 13. iii. 27. 51° 01′ S, 64° 59′ W, 132–131 m. 2 specimens.
St. WS 80. 13. iii. 27. 50° 57′ S, 63° 37′ W, 152–156 m. Numerous specimens.
St. WS 81. 19. iii. 27. 8 miles N 11° W of North Island, West Falkland Islands, 81–82 m. 2 specimens.
St. WS 82. 21. iii. 27. 54° 06′ S, 57° 46′ W, Burdwood Bank, 140–144 m. 12 specimens.
St. WS 83. 24. iii. 27. 14 miles S 64° W of George's Islands, East Falkland Islands, 137–129 m. 3 specimens.
St. WS 84. 24. iii. 27. 7·5 miles S 9° W of Sea Lion Island, East Falkland Islands, 75–74 m. Numerous specimens.
St. WS 85. 25. iii. 27. 8 miles S 26° E of Lively Island, East Falkland Islands, 79 m. Numerous specimens.

St. WS 88. 6. iv. 27. 54° 00′ S, 64° 57′ W, 118 m. Several specimens.
St. WS 93. 9. iv. 27. 7 miles S 80° W of Beaver Island, East Falkland Islands, 133 m. 5 specimens.
St. WS 109. 26. iv. 27. 50° 19′ S, 58° 28′ W, 145 m. 1 specimen.
St. WS 210. 29. v. 28. 50° 17′ S, 60° 06′ W, 161 m. 2 specimens.
St. WS 221. 4. vi. 28. 48° 23′ S, 65° 10′ W, 76–91 m. 11 specimens.
St. WS 225. 9. iv. 28. 50° 20′ S, 62° 30′ W, 162–161 m. Several specimens.
St. WS 228. 30. vi. 28. 50° 50′ S, 56° 58′ W, 229–236 m. 4 specimens.
St. WS 231. 4. vii. 28. 50° 10′ S, 58° 42′ W, 167–159 m. 2 specimens.
St. WS 239. 15. vii. 28. 51° 10′ S, 62° 10′ W, 196–193 m. 3 specimens.
St. WS 243. 17. vii. 28. 51° 06′ S, 64° 30′ W, 144–141 m. 5 specimens.
St. WS 246. 19. vii. 28. 52° 25′ S, 61° 00′ W, 267–208 m. 4 specimens.
St. WS 247. 19. vii. 28. 52° 40′ S, 60° 05′ W, 172 m. 5 specimens.
St. WS 248. 20. vii. 28. 52° 40′ S, 58° 30′ W, 210–242 m. 15 specimens.
St. WS 249. 20. vii. 28. 52° 10′ S, 57° 30′ W, 166 m. 1 specimen.
St. WS 576. 17. iv. 31. 51° 35′ S, 57° 50′ W, 34–24 m. 2 specimens.
St. WS 583. 2. v. 31. 53° 39′ S, 70° 54′ W, 14–78 m. Numerous specimens.
St. WS 755. 21. ix. 31. 51° 39′ S, 57° 39′ W, 77 m. Numerous specimens.
St. WS 761. 13. x. 31. 44° 22′ S, 63° 02′ W, 97 (–0) m. 4 specimens.
St. WS 771. 29. x. 31. 42° 42′ S, 60° 31′ W, 90 m. 4 specimens.
St. WS 776. 3. xi. 31. 46° 18′ S, 65° 02′ W, 107–99 m. 7 specimens.
St. WS 781. 6. xi. 31. 50° 30′ S, 58° 50′ W, 148 m. 10 specimens.
St. WS 782. 4. xii. 31. 50° 28′ S, 58° 30′ W, 141–146 m. 5 specimens.
St. WS 785. 6. xii. 31. 49° 25′ S, 62° 37′ W, 150–146 m. 6 specimens.
St. WS 804. 6. i. 32. 50° 21′ S, 62° 53′ W, 143–150 m. 2 specimens.
St. WS 814. 13. i. 32. 51° 45′ S, 66° 40′ W, 111–118 m. Several specimens.
St. WS 823. 19. i. 32. 52° 14′ S, 60° 01′ W, 80–95 m. 1 specimen.
St. WS 824. 19. i. 32. 52° 29′ S, 58° 27′ W, 146–137 m. 18 specimens.
St. WS 825. 29. i. 32. 50° 50′ S, 57° 15′ W, 135–144 m. Several specimens.
St. WS 836. 3. ii. 32. 55° 05′ S, 67° 38′ W, 64 m. 2 specimens.
St. WS 837. 3. ii. 32. 52° 49′ S, 66° 28′ W, 98–102 m. 3 specimens.
St. WS 841. 6. ii. 32. 54° 12′ S, 60° 21′ W, 109–120 m. 11 specimens.
St. WS 848. 10. ii. 32. 50° 37′ S, 66° 24′ W, 115–117 m. 2 specimens.
St. WS 869. 31. iii. 32. 52° 15′ S, 64° 14′ W, 187 (–0) m. 1 specimen.
6. v. 31. Puerto Bueno. Sarmiento Channel, Magellan Strait, 13 m. 2 specimens.
7. v. 31. Ringdove Inlet. Wide Channel, Magellan Strait. 1 specimen.

The numerous specimens of this well-known species call for no special remarks, excepting two from St. WS 88, which are regenerating the disk that must have been torn away in some way or another. Further, a specimen from St. WS 85 has one arm quite rudimentary, not projecting beyond the disk, although the corresponding part of the mouth frame is normally developed.

The species very strikingly recalls the North Atlantic *O. Balli*, Thompson, but is somewhat more robust. Like the latter it may be found between the layers of the parchment-like tubes of *Chaetopterus*. It is also frequently found in sponges. It also very much resembles the North Atlantic *Ophiopholis aculeata*, which is, indeed, a close relation of *Ophiactis*.

That the species is not viviparous (or brood-protecting) as suggested by Ludwig (*Brutpflege bei Echinodermen*, Zool. Jahrb., Suppl. VII, 1904) I have shown in my paper

On Hermaphroditism in viviparous Ophiurids (1920, p. 4), the very numerous small eggs excluding the possibility of viviparity or brood-protection. The examination of the rich material in this collection confirms this statement. No doubt it has a typical *Ophiopluteus* larva, as has its near relation *Ophiactis Balli*.

Ophiactis Savignyi (Müller and Troschel)

Ophiactis Savignyi, Koehler, 1914. Meeresfauna Westafrikas. Echinoderma, p. 184, pls. vii, fig. 15; x, figs. 1–3.

O. Savignyi, Mortensen, 1933. *Echinoderms of South Africa.* Papers from Dr Th. Mortensen's Pacific Exped., LXV (Vid. Medd. Dansk Naturh. Foren., 93), p. 348, fig. 58 *b*.

O. Savignyi, Mortensen, 1933. *Echinoderms of St Helena* (*other than Crinoids*). Papers from Dr Th. Mortensen's Pacific Exped. 1914–16, LXVI (Vid. Medd. Dansk Naturh. Foren., 93), p. 442.

St. 1. 16. xi. 25. Clarence Bay, Ascension, 16–27 m. 5 specimens.
St. 283. 14. viii. 27. Annobon, 18–30 m. 4 specimens.

The species had not hitherto been found at Ascension; but its occurrence might well be inferred from the facts that it was found at St Helena (Mortensen, 1933) and at Annobon in the Gulf of Guinea; from the latter locality it was recorded by Koehler, 1914.

Ophiactis nidarosiensis, Mortensen

Ophiactis nidarosiensis, Mortensen, 1920. *Notes on some Scandinavian Echinoderms, with descriptions of two new Ophiurids.* Vid. Medd. Dansk Naturh. Foren., 72, p. 60.

O. nidarosiensis, Mortensen, 1927. Handbook Echinod. Brit. Isles, p. 200.

O. nidarosiensis, Mortensen, 1933. *Echinoderms of South Africa.* Papers from Dr Th. Mortensen's Pacific Exped., LXV (Vid. Medd. Dansk Naturh. Foren., 93), p. 346.

O. nidarosiensis, Mortensen, 1933. Danish 'Ingolf' Exped. Ophiuroidea, p. 51.

St. 399. 18. v. 30. Off Gough Island, 102–141 m. 2 specimens.

After the finding of this species in South African seas (*op. cit.*) there is nothing unexpected in finding it now in material dredged by the 'Discovery II' off Gough Island. The specimens agree perfectly with the type from the Trondhjemfjord.

Ophiactis seminuda, n.sp.

St. 6. 1. ii. 26. Off Tristan da Cunha, 80–140 m. 3 specimens.
St. 1187. 18. xi. 33. Off Tristan da Cunha, 117–106 m. 6 specimens (young).

Diameter of disk of largest specimen scarcely 3 mm.; arms about four to five times the diameter of disk. The largest specimen has five arms, the others have six arms and are self-dividing.

The disk is covered by medium-sized, rather thick scales, among which no primary plates can be made out. One of the specimens has a few pointed spines on the disk, the other specimens have no spines at all on the disk. The ventral interradii are naked in the proximal part. The mouth shields appear to be, typically, almost rhombic, but generally —as is so often the case in self-dividing species—they are more or less irregular in

shape. Adoral shields joining rather widely within. Two broad scale-like outer mouth papillae (exceptionally only one). The infradental papilla is distinctly pointed. Ventral plates a little longer than broad, with convex outer edge; they are rather broadly contiguous in the proximal part of the arms. Dorsal arm plates broadly contiguous in the proximal part of the arms, with convex distal edge; they are somewhat broader than long. Four, exceptionally five, arm spines, which are rather robust; the middle ones are more or less distinctly truncate, flattened, with the edges finely spinulose, the end being somewhat axe-shaped. One large, oval tentacle scale. Colour light greyish or white, the younger specimens with two to three well-defined brownish bands on the arms.

The unusual condition of the ventral interradii being naked in their proximal part forms a marked character of this species; it is, however, not easily ascertained in the

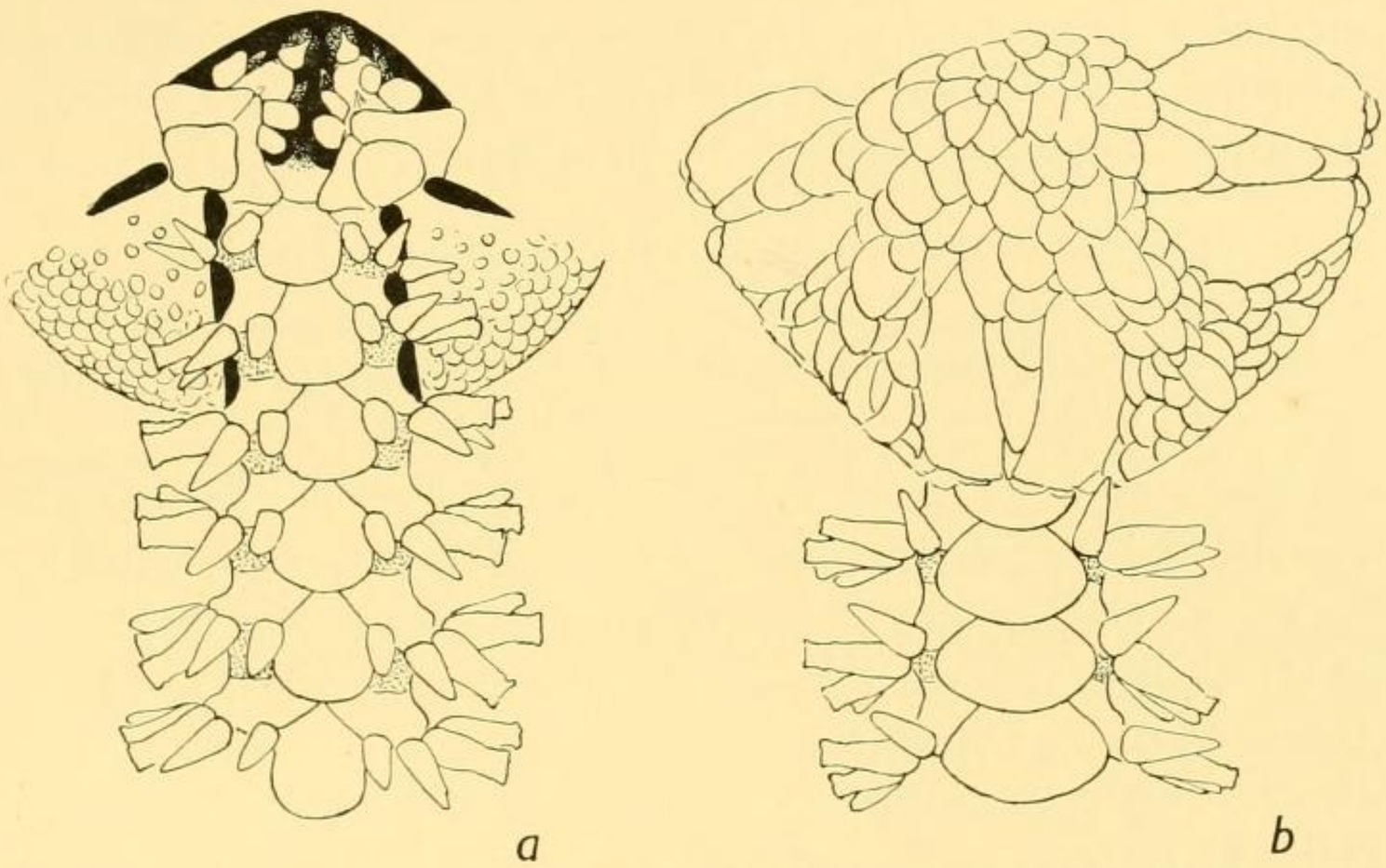

Fig. 9. *Ophiactis seminuda*, n.sp. Part of oral side (*a*) and dorsal side (*b*) ×24.

young specimens. The species does not seem very closely related to any other known species.

Two of the regenerating specimens are remarkable in having only two arms in regeneration, so that here would seem actually to be a case where a five-armed adult would be derived from a self-dividing, possibly originally six-armed specimen. But this is the only case I have ever seen among the very numerous self-dividing specimens of *Ophiactis* which I have examined. Another specimen has only one full-grown arm, one somewhat smaller, and three young, regenerating arms. Yet another specimen has two full-grown arms, one opposite the other, and two young regenerating arms on either side. On the whole there is evidently a good deal of irregularity in the propagation by autotomy in this species. At any rate, this single case of regenerating five-armed specimens cannot prove it to be the rule that six-armed self-dividing young specimens end as five-armed adults, as appears to be the opinion of H. L. Clark.

Ophiactis resiliens, Lyman

Ophiactis resiliens, Lyman, 1882. Sci. Results H.M.S. 'Challenger'. Ophiuroidea, p. 115, pl. xx, figs. 7–9.

O. nomentis, Farquhar, 1907. *Notes on New Zealand Echinoderms with description of a new species*. Trans. New Zealand Inst., xxxix, p. 125.

O. resiliens, Mortensen, 1924. *Echinoderms of New Zealand and the Auckland-Campbell Islands*. II, *Ophiuroidea*. Papers from Dr Th. Mortensen's Pacific Exped., xx (Vid. Medd. Dansk Naturh. Foren., 77), p. 124.

For other literary references see my paper of 1924, *loc. cit.*

St. 941. 20. viii. 32. Cook Strait, 128 m. 1 specimen.

This is a typical specimen of this fine species. It may be mentioned that the dorsal arm plates are partly broken up into smaller, irregular plates; this feature I have not observed in the specimens from New Zealand on which my statements in the work quoted were based, whereas it occurs not uncommonly in Australian specimens. Farquhar, however, has observed it in specimens of his *O. nomentis*, which, as I have shown in my paper quoted, is identical with *O. resiliens*.

Ophiactis profundi, var. Novae-Zelandiae, Mortensen

Ophiactis profundi, var. *Novae-Zelandiae*, Mortensen, 1924. *Echinoderms of New Zealand and the Auckland-Campbell Islands*. II, *Ophiuroidea*. Papers from Dr Th. Mortensen's Pacific Exped., xx (Vid. Medd. Dansk Naturh. Foren., 77), p. 128.

St. 941. 20. viii. 32. 40° 53′ S, 174° 47′ E, Cook Strait, New Zealand, 128 m. 5 specimens.

There is no doubt that these specimens are identical with the form which I described in my paper on the Ophiuroidea of New Zealand as a variety of *Ophiactis profundi*, Lütken and Mortensen. It is possible also that this *O. profundi* may be identical with the West Indian *O. plana*, Lyman.

Not having had the opportunity of comparing directly any West Indian specimen with the Pacific *O. profundi* or the var. *Novae-Zelandiae*, and as the West Indian form has never been sufficiently well figured (the photographic figures given by H. L. Clark in his Catalogue of the Recent Ophiurans, pl. x, figs. 1–2, do not show all the important details clearly), I shall refrain from taking a definite position on the question of the identity or distinctness of the Atlantic and the Pacific forms; I deem it therefore the best course to identify these specimens as—what they are sure to be—*O. profundi*, var. *Novae-Zelandiae*, leaving it to future researches to prove or disprove their identity with the West Indian *O. plana*.

Family AMPHIURIDAE

Amphiura magellanica, Ljungman

Amphiura magellanica, Koehler, 1923. Swedish Antarct. Exped. Astéries et Ophiures, p. 112.

A. magellanica, Mortensen, 1924. *Echinoderms of New Zealand and the Auckland-Campbell Islands*. II, *Ophiuroidea*. Papers from Dr Th. Mortensen's Pacific Exped., xx (Vid. Medd. Dansk Naturh. Foren., 77), p. 132.

For references to the older literature see the latter work, *loc. cit.*

St. 51. 4. v. 26. Off Eddystone Rock, East Falkland Islands, 105–115 m. Several specimens.
St. 399. 18. v. 30. Off Gough Island, 102–141 m. *ca.* 15 specimens.
St. 1321. 16. iii. 34. Cockburn Channel, Tierra del Fuego, 66 m. 13 specimens.
St. WS 84. 24. iii. 27. 7·5 miles S 9° W of Sea Lion Island, East Falkland Islands, 75–74 m. 1 specimen.
St. WS 388. 16. iv. 30. 56° 19′ S, 67° 10′ W, off Cape Horn, 121 m. 12 specimens.

It may be worth mentioning that one of the specimens from Gough Island has only four rays.

Amphiura spinipes, Mortensen

Amphiura spinipes, Mortensen, 1924. *Echinoderms of New Zealand and the Auckland-Campbell Islands.* II, *Ophiuroidea.* Papers from Dr Th. Mortensen's Pacific Exped., xx (Vid. Medd. Dansk Naturh. Foren., 77), p. 134.

St. 929. 16. viii. 32. 34° 31′ S, 172° 48′ E, New Zealand, 58–55 m. 3 specimens.
St. 934. 17. viii. 32. 34° 11′ S, 172° 10′ E, New Zealand, 98 m. 3 specimens.
St. 941. 20. viii. 32. 40° 51′ S, 178° 48′ E, New Zealand, 128 m. Numerous specimens.

These specimens agree perfectly with the type as described and figured in the paper quoted.

Amphiura angularis, Lyman

Amphiura angularis, Lyman, 1879. *Ophiuridae and Astrophytidae of H.M.S. 'Challenger'.* Bull. Mus. Comp. Zool., vi, p. 25, pl. xi, figs. 311–13.
A. angularis, Lyman, 1882. Sci. Results H.M.S. 'Challenger'. Ophiuroidea, p. 134, pl. xxix, figs. 1–3.
A. angularis, Koehler, 1917. *Echinodermes de Kerguelen.* Ann. Inst. Océanogr., vii, 8, p. 67, pl. viii, figs. 13–15.
A. angularis, H. L. Clark, 1923. *Echinoderm Fauna of South Africa.* Ann. S. African Mus., xiii, p. 327.
A. angularis, Mortensen, 1933. *Echinoderms of South Africa.* Papers from Dr Th. Mortensen's Pacific Exped., lxv (Vid. Medd. Dansk Naturh. Foren., 93), p. 354.

St. 1562. 7. iv. 35. 46° 52′ S, 37° 55′ E, off Marion Island, 97–104 m. 2 specimens.
St. 1563. 7. iv. 35. 46° 48′ S, 37° 49′ E, off Marion Island, 113–99 m. 5 specimens.
St. 1564. 7. iv. 35. 46° 36′ S, 38° 02′ E, off Marion Island, 108–113 m. 1 specimen.

As pointed out by Koehler (*op. cit.*) there is some discrepancy between the description and the figures of this species as given by Lyman. In the description it is stated that the ventral interradii are naked and they are thus represented in the figure (pl. xi, fig. 311) of the preliminary report (*op. cit.*, 1879); but pl. xxix, fig. 1 of the Challenger Ophiuroidea shows it wholly covered by scales, in contradiction with the text, which says "interbrachial space below only about one-third covered with minute scaling; the rest of the space is naked". Whether this is due simply to an error in the drawing, or perhaps to two different forms having been confused by Lyman under the name of *A. angularis*, can only be ascertained by a re-examination of the type material. But however this may be, there can be no doubt that it is the form with naked ventral interradii which must be regarded as the typical *A. angularis*. The present specimens all have naked ventral interradii and thus far there can be no doubt of their identity.

There are, however, some other discrepancies. The disk scales are stated by Lyman to be "coarse". I would rather describe the disk scales of the present specimens as very fine. But pl. xi, fig. 312 of the preliminary description shows the scales small and in good accordance with the present specimens. As for the buccal shields there is, as pointed out by Koehler, such great variation in their shape that no reliance can be placed upon them for specific distinction, and likewise in the shape and size of the radial shields there is great variation. Lyman describes and figures the first ventral arm plate as very small; I find it rather larger—a difference which is probably due to some little inaccuracy in the original drawings. On the whole I think it beyond doubt that the present specimens are the typical *A. angularis*, whereas the form described by Koehler (*op. cit.*, 1917) as *A. angularis*, with the ventral interradii wholly covered by scales, should probably rather be regarded as a separate variety of *angularis*. This would then also hold good of the specimens mentioned in my Echinoderms of South Africa (*loc. cit.*) which also have the ventral interradii wholly covered by scales.

It should be mentioned that there may also be a good deal of variation in regard to the tentacle scales. There are sometimes two scales here and there; in one case I even find two scales nearly throughout on two of the arms, the other arms having the normal single scale. In another specimen the tentacle scales are unusually small, and even absent in some places.

The species has separate sexes and is evidently not viviparous.

Amphiura angularis, Lyman, subsp. protecta, Hertz

Amphiura angularis, Lyman, subsp. *protecta*, Hertz, 1926. Deutsche Südpolar-Exped. Ophiuroiden, p. 32, Taf. ix, figs. 8–9.

St. 27. 15. iii. 26. West Cumberland Bay, South Georgia, 110 m. 2 specimens.
St. 42. 1. iv. 26. Off mouth of Cumberland Bay, South Georgia, 120–204 m. 1 specimen.
St. 140. 23. xii. 26. Stromness Harbour to Larsen Point, South Georgia, 122–136 m. 1 specimen.
St. 175. 2. iii. 27. Bransfield Strait, South Shetlands, 200 m. 5 specimens.
St. 177. 5. iii. 27. 27 miles SW of Deception Island, South Shetlands, 1080 m. 2 specimens.
St. 190. 24. iii. 27. Bismarck Strait, Palmer Archipelago, 93–130 m. 1 specimen.
St. WS 33. 21. xii. 26. 54° 59′ S, 35° 24′ W, South Georgia, 130 m. 2 specimens.

These specimens are in exact agreement with the description and figures given by Hertz (the latter unfortunately not being very clear). I quite agree with Dr Hertz that this form is closely related to *A. angularis*, Lyman, as also to *A. algida*, Koehler, which Hertz suggests might better be regarded as a subspecies of *A. angularis*.

I find this form to be *viviparous and hermaphrodite*. There appears to be only one gonad on each side of the genital slits, the one placed adradially being male, the one on the interradial side female. The gonads themselves are not hermaphrodite. There is one young at a time in a bursa, and I have found only one young at each ray.

The subspecies was hitherto known only from the Antarctic coast (the Gauss Station, 380 m.); its discovery in the region South Georgia—South Shetlands—Palmer Archipelago shows that it must be widely distributed in the Antarctic region.

Amphiura grandisquama, Lyman

Amphiura grandisquama, Lyman, 1869. *Prelim. Report on the Ophiuridae and Astrophytidae dredged in deep water between Cuba and the Florida Reef.* Bull. Mus. Comp. Zool., I, 10, p. 334.

A. longispina, Koehler, 1898. *Echinides et Ophiures de l'"Hirondelle'*. Camp. Sci. Monaco, XII, p. 52, pl. ix, figs. 45–6.

A. grandisquama, Mortensen, 1933. *Echinoderms of St Helena (other than Crinoids)*. Papers from Dr Th. Mortensen's Pacific Exped., 1914–16, LXVI (Vid. Medd. Dansk Naturh. Foren., 93), p. 451.

For other literary references see the last paper quoted.

St. 399. 18. v. 30. Off Gough Island, 102–141 m. 6 specimens.

The specimens are all quite small; but I do not think there can be any doubt that they belong to *A. grandisquama*.

Since the species was known from St Helena and from off the Natal coast, its occurrence at Gough Island was to be expected.

Amphiura grandisquama, var. guineensis, n.var.

Amphiura grandisquama, Koehler, 1914. Meeresfauna Westafrikas. Echinoderma, p. 190.

St. 283. 14. viii. 27. Off Annobon, Gulf of Guinea, 18–30 m. Several specimens in poor condition.

Koehler has identified directly as *A. grandisquama* some specimens from Île de Rolas, Gulf of Guinea, stating that "ils ne différaient en rien" from specimens from the West Indies or the Bay of Biscay. I find, however, that the present specimens differ from

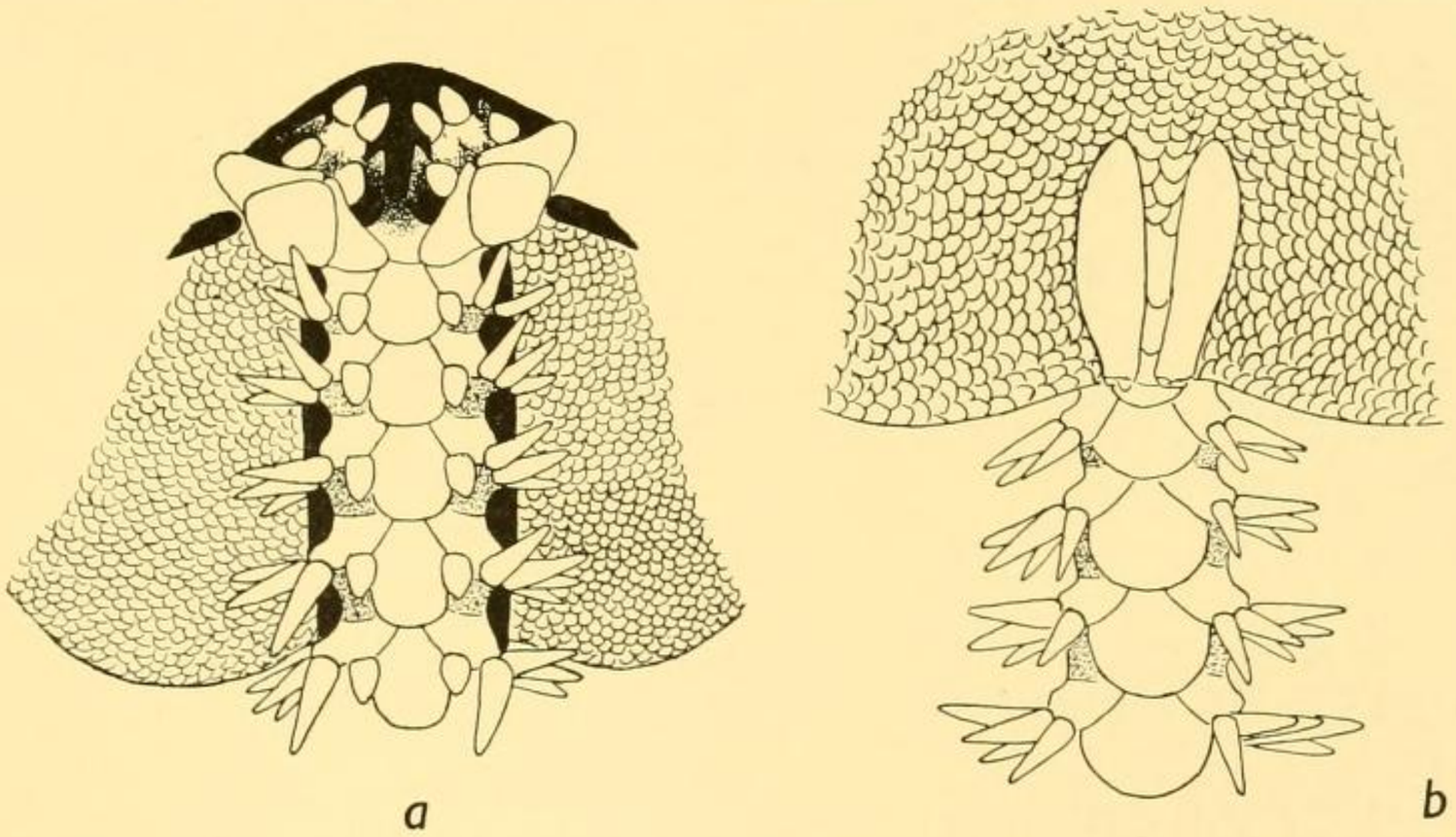

Fig. 10. *Amphiura grandisquama*, var. *guineensis*, n.var. Part of oral side (*a*) and dorsal side (*b*). ×24.

typical *A. grandisquama* in having much finer disk scales, in having often six arm spines on the proximal joints, and in the outer mouth papilla being in general more rounded, scale-like. Also the ventral arm plates are somewhat different from those of typical *grandisquama* (compare fig. 10 with fig. 19 of my Echinoderms of St Helena). Further, the interradii bulge conspicuously outwards between the arms. The spines show more or less distinct traces of brownish colour in their basal part.

With these characteristics it seems necessary to regard these specimens at least as a distinct variety of *A. grandisquama*. That the specimens from Île de Rolas will prove to belong to this same variety may well be suggested.

None of the specimens exceed a size of 5 mm. in diameter of disk, with an arm length of *ca.* 25 mm.

Amphiura microplax, n.sp.

St. 27. 15. iii. 26. West Cumberland Bay, South Georgia, 110 m. 3 specimens.
St. 144. 5. i. 27. Off mouth of Stromness Harbour, South Georgia, 155–178 m. 5 specimens.
St. WS 33. 21. xii. 26. 54° 59′ S, 35° 24′ W, South Georgia, 130 m. 1 specimen.
St. MS 68. 2. iii. 26. East Cumberland Bay, South Georgia, 247 m. 6 specimens.

Diameter of disk apparently not surpassing *ca.* 5 mm. Arms short, four to five times the diameter of disk. Outline of disk pentagonal, the edge of the interradii straight or only slightly notched.

Dorsal side of disk covered with moderate-sized scales, among which the six primary plates are usually distinct. The radial shields are short, narrow, separated only by a narrow wedge of scales. Ventral interradii covered with very small scales, which may leave the proximal part slightly bare or cover it completely. Buccal shields rather narrow, with an acute inner angle and a rounded outer lobe. Adoral shields triangular, narrowly or scarcely joining within. Outer mouth papilla conical, pointed; infradental papillae rather small, oval. First ventral plate of medium size, broadly contiguous with the second; the following ones more or less broadly contiguous. The ventral plates in general square, as broad as long, there being, however, some variation in their shape. Dorsal plates contiguous, with convex distal edge, in larger specimens almost biconvex,

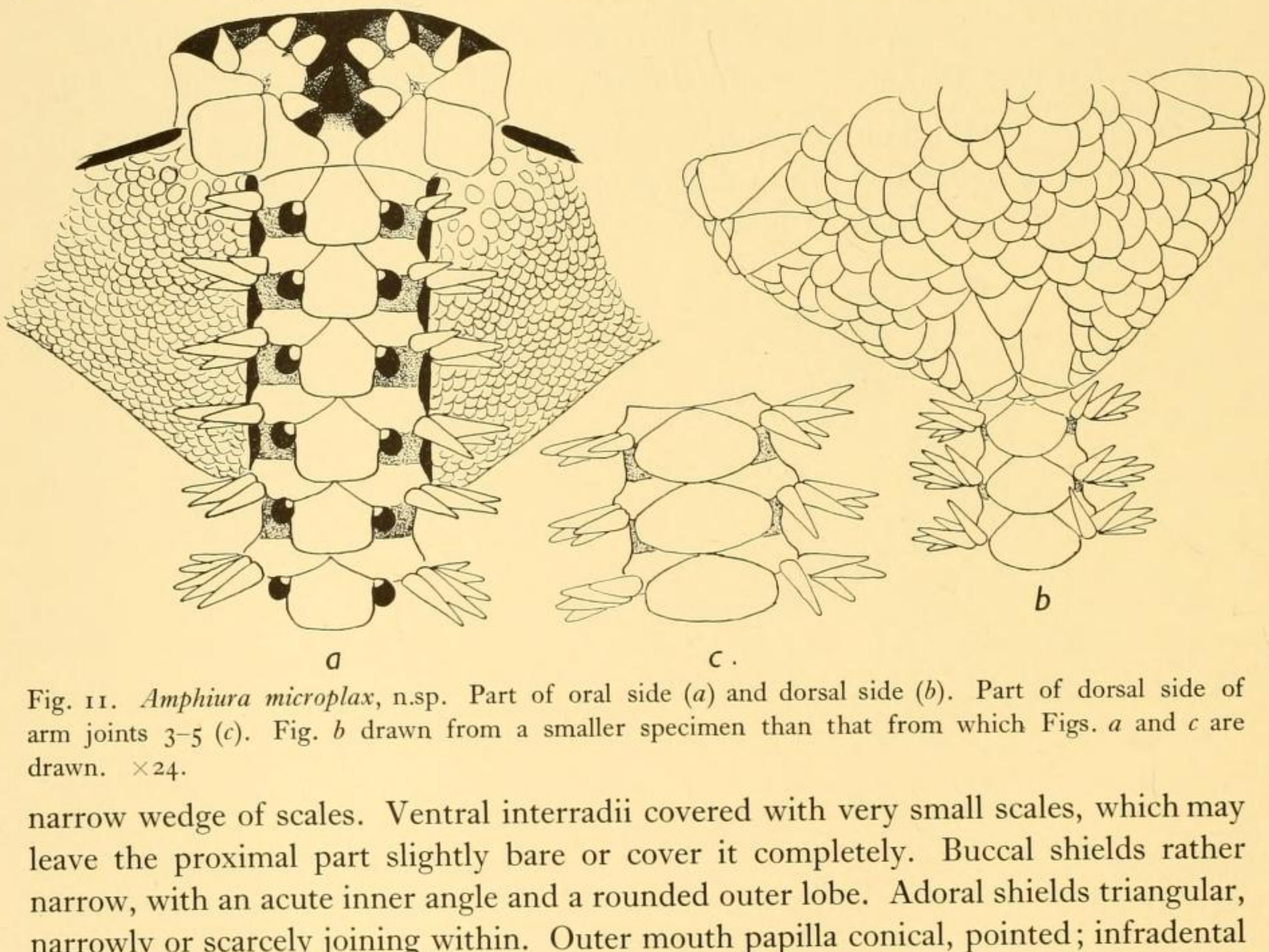

Fig. 11. *Amphiura microplax*, n.sp. Part of oral side (*a*) and dorsal side (*b*). Part of dorsal side of arm joints 3–5 (*c*). Fig. *b* drawn from a smaller specimen than that from which Figs. *a* and *c* are drawn. ×24.

distinctly broader than long. Arm spines five on the proximal joints, short, conical. Only one very small tentacle scale. Colour in alcohol whitish.

The specimens from St. MS 68 are stated to have been taken "from the roots of a giant sponge".

This species is viviparous. The development is intra-ovarial, as may be seen with certainty in adult specimens, where the bursa may be distinguished as an empty sac covering the large ovary which is filled with eggs and embryos. There is only one interradially placed gonad to each bursa; some ten eggs may develop at a time in the ovary. I have been unable to trace any male genital products in the gonads, these being purely female in all the specimens, even in young specimens of 2·5–3 mm. in diameter of disk. It thus appears that this species is parthenogenetic, for it is most improbable that there would not be a single male in the whole collection, if the species had separate sexes. But the material is too small to allow me to state definitely that such an extraordinary condition as parthenogenesis occurs normally in this species.

In one of the specimens from St. 27 the parasitic Cirripedian *Ascothorax* was found.

Amphiura microplax is very easily distinguished from the other Antarctic and sub-Antarctic Amphiuras with one tentacle scale: *A. magellanica*, *algida*, and *angularis protecta*. The very characteristic small tentacle scale forms a conspicuous difference from these species which all have a large, elongate tentacle scale. Among other Amphiuras it may perhaps find its nearest relative in *A. adjecta*, Mortensen (Echinoderms of South Africa, p. 355, fig. 62); possibly it is also related to *A. Mülleri*, Marktanner, from off St Paul (Marktanner-Turneretscher, *Beschreibung neuer Ophiuriden und Bemerkungen zu bekannten*. Ann. k. k. Naturhist. Hofmuseums, II, 1887, p. 300, Taf. xiii, figs. 25–6), but the figures of that species are altogether too unsatisfactory for a detailed comparison with other species.

Amphiura microplax, var. disjuncta, n.var.

St. 175. 2. iii. 27. Bransfield Strait, South Shetlands, 200 m. 1 specimen.

St. 363. 26. ii. 30. Off Zavodovski Island, South Sandwich Islands, 329–278 m. Several specimens.

St. 366. 6. iii. 30. 4 cables S of Cook Island, South Sandwich Islands, 155–322 m. 1 specimen.

These specimens bear so much general resemblance to *A. microplax* that one might be tempted to regard them as identical. They differ, however, from typical *microplax* in having separate sexes and, probably, in not being viviparous. In the adult male specimens the gonads are remarkably strongly developed and of a peculiar composite shape, recalling an ovary with a number of large eggs. I do not remember having ever seen an Ophiurid with such "composite" testes.

The eggs are rather large and yolky, not ripening all at a time, so that they must be shed from time to time as they become ripe.

Referring to the figures it will suffice to point out the points of difference from the typical *microplax*. The outer mouth papilla is smaller, more scale-like. The dorsal arm plates are usually not contiguous—but this is not a constant character; one may even

find in the same specimen one arm having the dorsal plates contiguous, and another with them non-contiguous. The radial shields are, on the whole, narrower and more elongate than in typical *microplax*, and the scaling of the disk less smooth. There are generally only four arm spines, also on the proximal joints, but sometimes there are five. Size and arm length is as in typical *microplax*.

The tentacle scale may be wanting on some joints, particularly in the distal part of the arms; in the young specimens they are generally lacking completely. Rarely there may be two scales at a single pore.

These structural differences are of only small importance, and, as stated above, were it only for these characters, there would scarcely be sufficient reason for keeping them

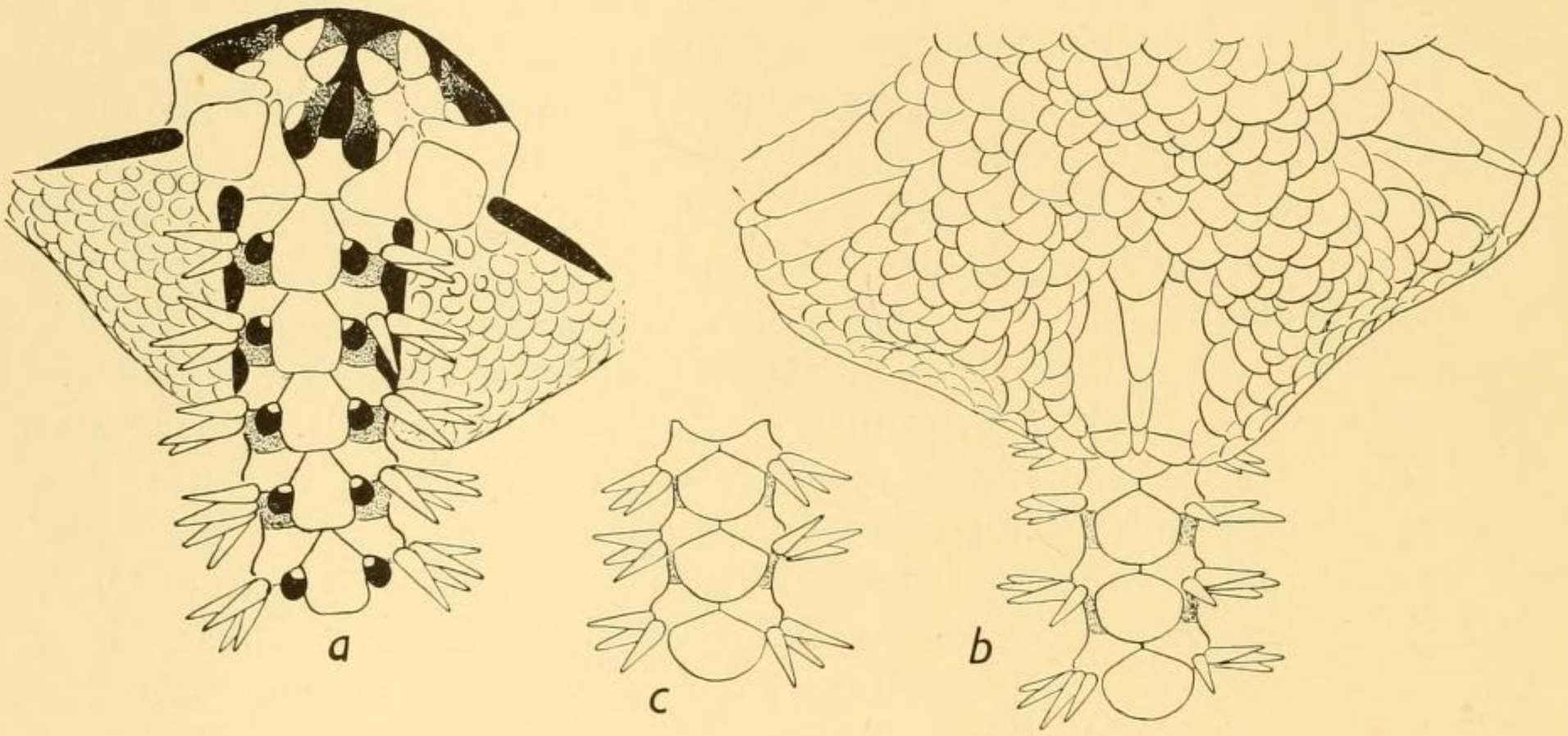

Fig. 12. *Amphiura microplax*, var. *disjuncta*, n.var. Part of oral side (*a*) and dorsal side (*b*). Dorsal side of arm joints from the middle of the arm (*c*). *a*, ×25; *b* and *c*, ×20. *b*, *c*, drawn from a larger specimen than that from which Fig. *a* was drawn.

separate from typical *microplax*. But the fact that the latter is viviparous and apparently parthenogenetic—no males having been found—whereas the present form has separate sexes—the males being particularly conspicuous—and is probably non-viviparous, necessitates keeping it as a distinct form, though very closely related to *A. microplax*. It seems to be the best course to designate it not as a separate species, but as a variety or subspecies of *microplax*.

Several of the gonads, particularly the large male gonads are found to be infested with a Nematode, lying coiled up within the gonad.

Amphiura monorima, n.sp.

St. 27. 15. iii. 26. West Cumberland Bay, South Georgia, 110 m. Several specimens.
St. 39. 25. iii. 26. East Cumberland Bay, South Georgia, 179–235 m. 1 specimen.
St. 42. 1. iv. 26. Off mouth of Cumberland Bay, South Georgia, 102–204 m. 4 specimens.
St. 123. 15. xii. 26. Off mouth of Cumberland Bay, South Georgia, 250 m. 3 specimens.
St. 140. 23. xii. 26. Stromness Harbour to Larsen Point, South Georgia, 122–136 m. 8 specimens.

St. 144. 5. i. 27. Off mouth of Stromness Harbour, South Georgia, 155–178 m. 12 specimens.
St. 148. 9. i. 27. Off Cape Saunders, South Georgia, 132–148 m. 1 specimen.
St. 149. 10. i. 27. Mouth of Cumberland Bay, South Georgia, 200–234 m. 2 specimens.
St. WS 27. 19. xii. 26. 53° 55′ S, 38° 01′ W, South Georgia, 107 m. 2 specimens.
St. WS 33. 21. xii. 26. 54° 59′ S, 35° 24′ W, South Georgia, 130 m. *ca.* 20 specimens.
St. MS 71. 9. iii. 26. East Cumberland Bay, South Georgia, 110–60 m. 2 specimens.

Diameter of disk apparently not surpassing *ca.* 5 mm.; arms short, not more than four to five times the diameter of disk. Circumference of disk round.

Dorsal side of disk with rather large, irregular scales, the largest at the centre; primary plates not distinct. Radial shields short, rather broad, widely diverging, sometimes contiguous distally. Ventral interradii wholly covered with rather large scales; the proximal part of the interradii in the adult usually more or less swollen (on account of

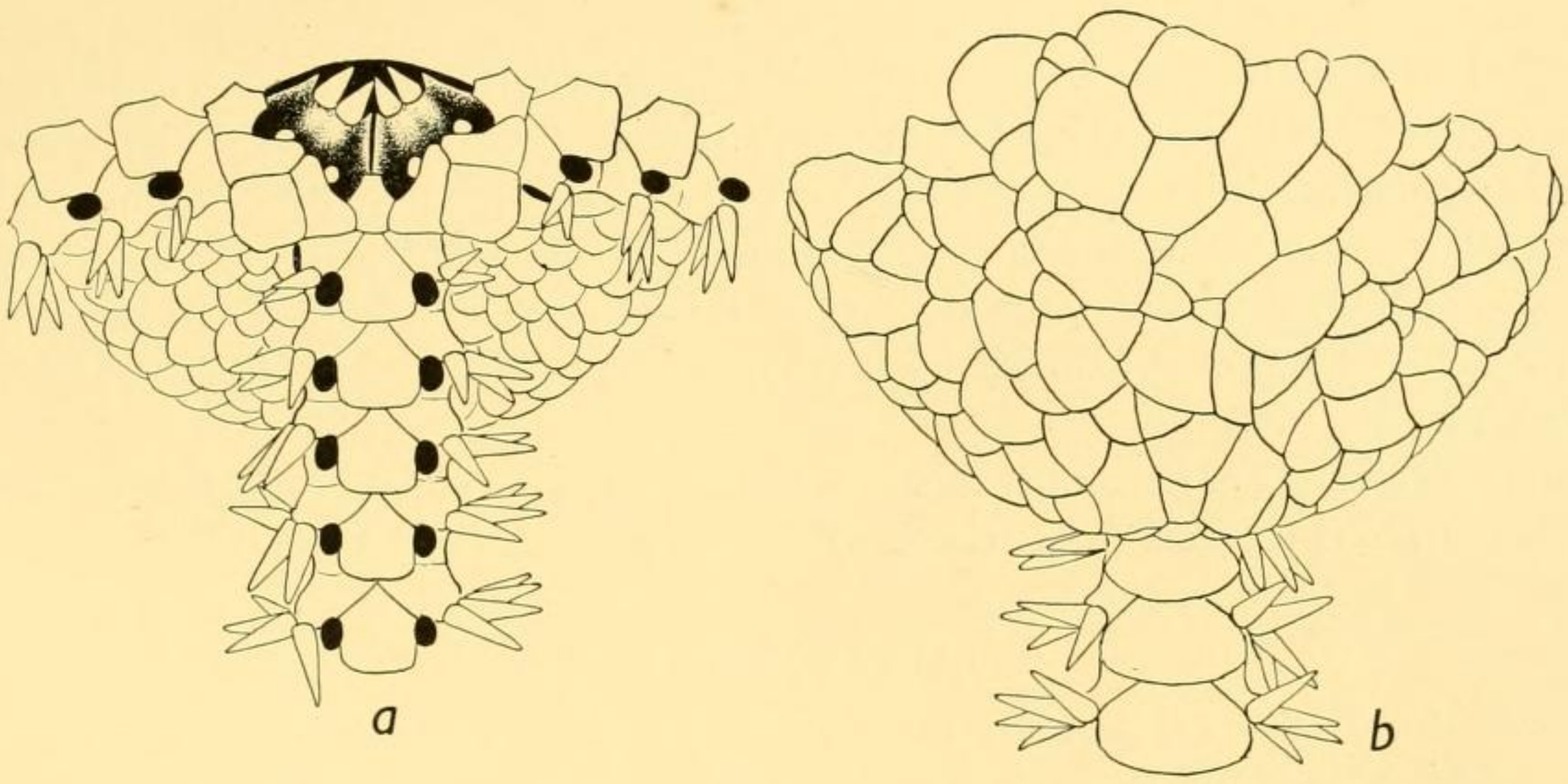

Fig. 13. *Amphiura monorima*, n.sp. Part of oral side (*a*) and dorsal side (*b*). ×20.

the sexual products). Buccal shields with a rather sharp inner angle and a broad truncated outer lobe. Adoral plates joining within, generally broadly so. Outer mouth papilla rounded, very small, sometimes totally wanting, infradental papillae rather pointed, well developed. The pore of the outer mouth tentacle continues inwards in a furrow, produced by the scale of the inner mouth tentacle being somewhat raised. As the jaws are somewhat sunken the part of the mouth frame proximally to the adoral shields is rather conspicuously sunken; round this sunken part the adoral shields, together with the buccal shields and the first ventral plate, form a somewhat raised pentagon, the corners of which are occupied by the buccal shields. The sides of the pentagon are slightly concave.

The first ventral plate is rather large, elongate hexagonal, contiguous with the second plate, which has a truncate inner end. The following ventral plates are merely in contact or slightly separated; they are about as long as broad, with a slightly convex outer edge. The dorsal plates are contiguous, having a truncate inner angle and a slightly convex

outer edge. Arm spines short, conical, four to five at the base of the arm. No tentacle scale. Colour in alcohol greyish white.

This species is viviparous. In the larger specimens I have only exceptionally found the embryos so far developed as to show the first rudiments of the skeleton; but in a smaller specimen I found fully developed young ones, ready to leave the mother. There appear to be generally only one or two embryos at a time in each interradius.

The gonads are hermaphrodite, and there is generally only one gonad in each interradius. There are no normal genital slits, but in specimens with ripe genital products a single, short and very narrow genital slit appears at the adoral end of the interradius, on one side, close to the buccal shield; sometimes there may be two genital slits in one of the interradii, viz. in cases where there are two gonads in the interradius, there is then one slit to each gonad. That the development must be intra-ovarial is clear, since there is no bursa.

The genital slit (the specific name *monorima* refers to the fact that there is usually only one slit in each interradius) is, of course, *not homologous with the normal genital or bursal slits of Ophiuroids*; it is a new formation, corresponding to the pore that develops opposite each ovary in *Ophiopus arcticus* (cf. Mortensen, *Über* Ophiopus arcticus, Zeitschr. wiss. Zool., LVI, 1893) and to the genital pore in *Amphilepis* (cf. Mortensen, Handbook of the Echinoderms of the British Isles, 1927, p. 222; Danish 'Ingolf' Exped., Ophiuroidea, 1933, p. 56).

In this character of its genital slits this species is unique among Amphiurids. In its other characters it seems to be related to *Amphiura tomentosa*, Lyman.

Amphiura Lymani, Studer

Amphiura Lymani, Studer, 1885. *Die Seesterne Süd-Georgiens, nach der Ausbeute d. deutschen Polarstation in* 1882–3. Jahrb. wiss. Anst. Hamburg, II, p. 163, Taf. II, fig. 10 *a–b*.
Amphiodia Lymani, H. L. Clark, 1915. Cat. Recent Ophiurans, p. 250.

St. 45. 6. iv. 26. 2·7 miles S 85° E of Jason Light, South Georgia, 270–238 m. 6 specimens.
St. 141. 29. xii. 26. East Cumberland Bay, South Georgia, 17–27 m. 7 specimens.
St. 145. 7. i. 27. Stromness Harbour, South Georgia, 26–35 m. 2 specimens.
St. WS 33. 21. xii. 26. 54° 59′ S, 35° 24′ W, South Georgia, 130 m. 6 specimens (young).
St. MS 71. 9. iii. 26. East Cumberland Bay, South Georgia, 110–60 m. 1 specimen.

It may seem somewhat bold to maintain that the above specimens, represented in Figs. 14 *a–c*, are identical with Studer's *Amphiura Lymani*, as figured by Studer (*op. cit.*). Judging from Studer's fig. 10 *b* this species would be an *Amphiodia*, to which genus Clark, thus far correctly, referred it. Nevertheless there is no doubt that these specimens are actually *Amphiura Lymani*. Through the kindness of Dr A. Panning of the Hamburg Museum, I have had the type material sent to me for examination. There are in all four specimens, two of which, almost completely destroyed by fungi, are evidently not *Amphiura Lymani*, but probably *Amphiodia affinis*. The two others are in fairly usable condition, the better of them being, however, again an *Amphiodia affinis*. Thus only the fourth specimen remains as the type of *Amphiura Lymani*, and although

in poor condition, it can be recognized as being the specimen described and figured by Studer under this name. The figure of the dorsal side, in particular, shows to some degree the actual character of the specimen (though his statement that the scales of the dorsal side are "feingekörnt" is a mistake, probably referring to the usual structure of these scales as seen under a fairly high magnification).

The representation of the mouth papillae in Studer's fig. 10 *b* is quite misleading. There are *not* three mouth papillae as shown there; it appears to be the mouth tentacle which Studer has mistaken for a papilla. Actually there are only two mouth papillae, as typical of *Amphiura* (Fig. 14 *a*, *b*), and accordingly the species is a true *Amphiura*. The shape of the ventral plates, etc. is very poorly shown in Studer's figure; they are as shown in Fig. 14 *a*, *b*.

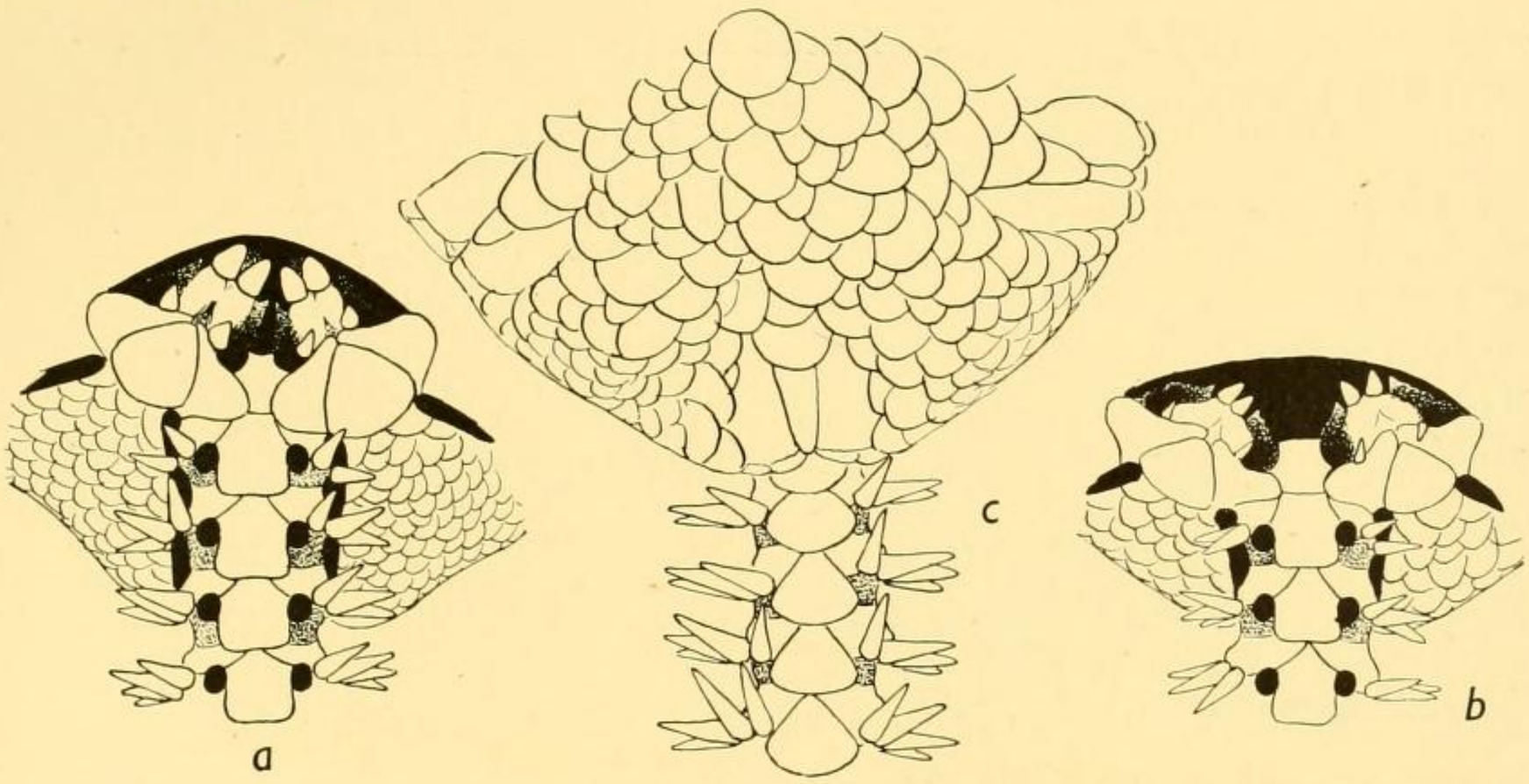

Fig. 14. *Amphiura Lymani*, Studer. Part of oral side of two different specimens (*a*, *b*); part of dorsal side (*c*). ×22·5.

This species recalls Lyman's *Amphiura tomentosa* from Kerguelen. I had, indeed, at first identified these specimens as *A. tomentosa*, it being impossible to realize from Studer's description and figures that they could be identical with his *A. Lymani*. Having now seen the type-specimen of *A. tomentosa* in the British Museum I may add here some information about this species. The ventral interradii are half naked; pl. xxix, fig. 10 of the Challenger Ophiuroidea, which shows the ventral interradii scale-covered, is thus erroneous (though fig. 11 shows the plates of the dorsal side of the disk correctly). Primary plates are not distinguishable. The buccal plates are rounded rhombic, not triangular as shown in pl. xxix, fig. 10; the outer mouth papilla is rather broad, but pointed, not scale-like as shown in the figure, which is on the whole poor and unreliable.

It may be suggested that the specimens from the South Orkneys ('Scotia') referred by Koehler (1908, Scott. Nat. Antarctic Exped., Astéries, Ophiures et Echinides, p. 607) to *A. tomentosa* are also in reality *A. Lymani*.

This species is viviparous, and it seems almost certain that the development is *intra-ovarial*. Further, it seems beyond doubt that this species has *separate sexes*; at least, I have found the various specimens opened to have either purely male or purely female gonads (there is only one gonad, more rarely two at the interradial side of the genital slit).

Some of the specimens from St. WS 33 look rather peculiar on account of their being preserved with the mouth widely open, the papilla of the inner mouth tentacle thus becoming very prominent; its edge may also be more or less distinctly serrate (Fig. 14*b*). As these specimens do not show other special characteristics I do not hesitate to refer them also to *A. Lymani*.

Amphiura deficiens, Koehler

Amphiura deficiens, Koehler, 1922. Austral. Antarct. Exped. Echinod. Ophiuroidea, p. 28, pl. lxxx, figs. 1–4.
A. tomentosa deficiens, Hertz, 1926. Deutsche Südpolar-Exped. Ophiuroiden, p. 31.

St. 160. 7. ii. 27. Near Shag Rocks, South Georgia, 177 m. 2 specimens.
St. 170. 23. ii. 27. Off Cape Bowles, Clarence Island, 342 m. 4 specimens.
St. 175. 2. iii. 27. Bransfield Strait, South Shetlands, 200 m. 5 specimens.
St. WS 33. 21. xii. 26. 54° 59′ S, 35° 24′ W, South Georgia, 130 m. 5 specimens.

These specimens are in good agreement with the description and figures given by Koehler. The figures are, however, not clear enough to show the details distinctly

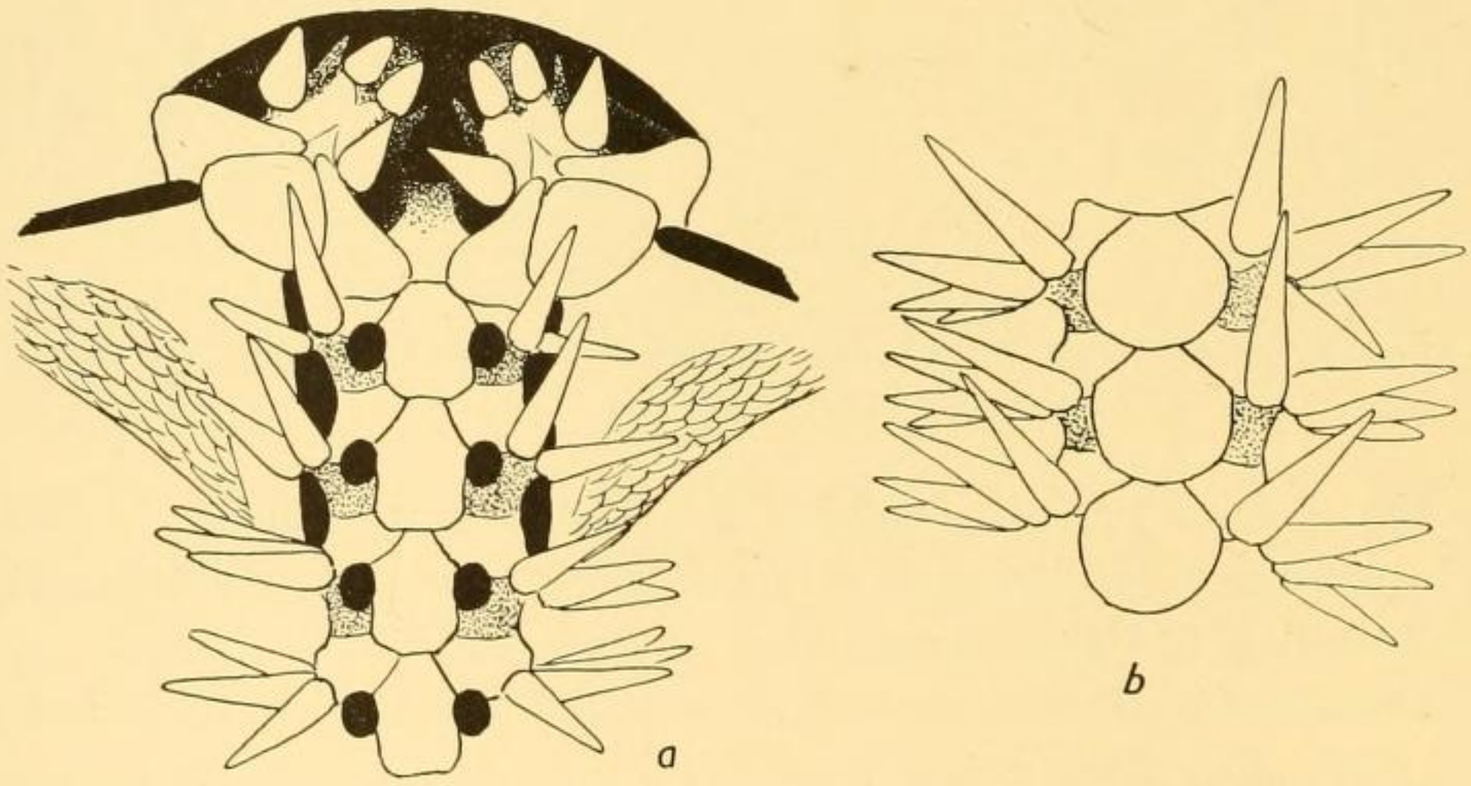

Fig. 15. *Amphiura deficiens*, Koehler. Part of oral side (*a*); dorsal side of arm, from the proximal part (*b*). ×25.

and I have thus thought it desirable to give a couple of drawings to show the shape of the plates more clearly.

It may be pointed out that most of the specimens have the proximal half of the ventral interradius naked, but in other specimens the scales continue almost to the edge of the buccal plates.

This species is *viviparous*; there is only one gonad at each bursal slit, placed on the interradial side. I regret to have forgotten to notice the character of the gonads, whether

hermaphrodite or female only, and the specimens having been dried, it is now too late to ascertain it.

No doubt the species is closely related to *A. tomentosa*, Lyman, as Koehler has noticed; but I think it preferable to retain it as a separate species, not to regard it merely as a subspecies of *tomentosa*, as does Hertz—the more so as our knowledge of the typical *tomentosa* is not very satisfactory.

Amphiura dilatata, subsp. Gaussi, Hertz

Amphiura dilatata, subsp. *Gaussi*, Hertz. 1926. Deutsche Südpolar-Exped. Ophiuroiden, p. 32, Taf. vi, figs. 5–6.

St. 27. 15. iii. 26. West Cumberland Bay, South Georgia, 110 m. 1 specimen.
St. 42. 1. iv. 26. Off mouth of Cumberland Bay, South Georgia, 120–204 m. 2 specimens.
St. 45. 6. iv. 26. 2·7 miles S 85° E of Jason Light, South Georgia, 238–270 m. 4 specimens.
St. 144. 5. i. 27. Off mouth of Stromness Harbour, South Georgia, 155–178 m. 4 specimens.
St. 148. 9. i. 27. Off Cape Saunders, South Georgia, 132–148 m. 1 specimen.
St. 152. 17. i. 27. 53° 51′ S, 36° 18′ W, South Georgia, 245 m. 1 specimen.
St. WS 33. 21. xii. 26. 54° 59′ S, 35° 24′ W, South Georgia, 130 m. 2 specimens.

These specimens in general agree very closely with Hertz' *A. dilatata*, subsp. *Gaussi*, of which I have had a pair of cotypes for comparison. It may be mentioned that small primary plates are sometimes distinct on the disk—the scales being on the whole scarcely as fine as in the type—and that the shape of the buccal shields varies to some degree, from rounded triangular, as shown in Hertz' text-fig. 10, p. 32, to more elongate, with a rounded outer lobe. The arm spines usually reach high up on the dorsal side, leaving—particularly in the proximal part of the arm—only a rather narrow median space free.

Probably these differences indicate that these specimens represent a local variety, but for the present there seems to be no reason for giving it a separate name. This subspecies, like the typical *dilatata*, Lyman (or rather *atlantica*, Ljungman), is *not* viviparous, and it has separate sexes. The gonads, when filled with ripe sexual products, are large and very distinctly seen through the thin, naked skin of the ventral interradii; often the skin has ruptured on preservation, the gonads protruding through the ruptures. The eggs are rather small and numerous, indicating that this species may not improbably have a pelagic larva of the *Ophiopluteus* type.

The specimen from St. 27 is regenerating the disk, which, as in other Amphiuras with naked ventral interradia (e.g. the North Atlantic *Amphiura filiformis*), is liable to be lost.

Amphiura Joubini, Koehler

? *Amphiura polita*, Koehler, 1901. Result. Voyage 'Belgica'. Echinides et Ophiures, p. 29, pl. vii, figs. 49–50; viii, fig. 51.

Amphiura Joubini, Koehler, 1912. II[e] Expéd. Antarct. Française. Echinodermes, p. 132, pl. xi, figs. 9, 13.

A. Joubini, Mortensen, 1925. *On a small collection of Echinoderms from the Antarctic Sea.* Arkiv för Zoologi, xvii, A, 31, p. 2.

A. Joubini, Grieg, 1929. *Some Echinoderms from the South Shetlands.* Bergens Mus. Årbok, 1929, 3, p. 7.

St. 175. 2. iii. 27. Bransfield Strait, South Shetlands, 200 m. 2 specimens.
St. 177. 5. iii. 27. 27 miles SW of Deception Island, South Shetlands, 1080 m. 1 specimen.
St. 180. 11. iii. 27. Schollaert Channel, Palmer Archipelago, 160 m. 15 specimens.
St. 181. 12. iii. 27. Schollaert Channel, Palmer Archipelago, 160–335 m. Several specimens.
St. 182. 14. iii. 27. Schollaert Channel, Palmer Archipelago, 278–500 m. Several specimens, partly very young.
St. 186. 16. iii. 27. Fournier Bay, Anvers Island, Palmer Archipelago, 295 m. 3 specimens.
St. 187. 18. iii. 27. Neumayr Channel, Palmer Archipelago, 259–354 m. 1 specimen.
St. 190. 24. iii. 27. Bismarck Strait, Palmer Archipelago, 315 m. 1 specimen.
St. 195. 30. iii. 27. Admiralty Bay, King George Island, Palmer Archipelago, 391 m. 4 specimens.

These specimens are, on the whole, in full agreement with the excellent description and figures given by Koehler (*op. cit.*). It may be pointed out that there are sometimes only five spines at the base of the arms, instead of the usual six or seven. A very noteworthy fact is that some of the spines on the part of the arms enclosed within the disk not infrequently terminate in two diverging, hyaline hooks (Fig. 17 *a*), instead of the

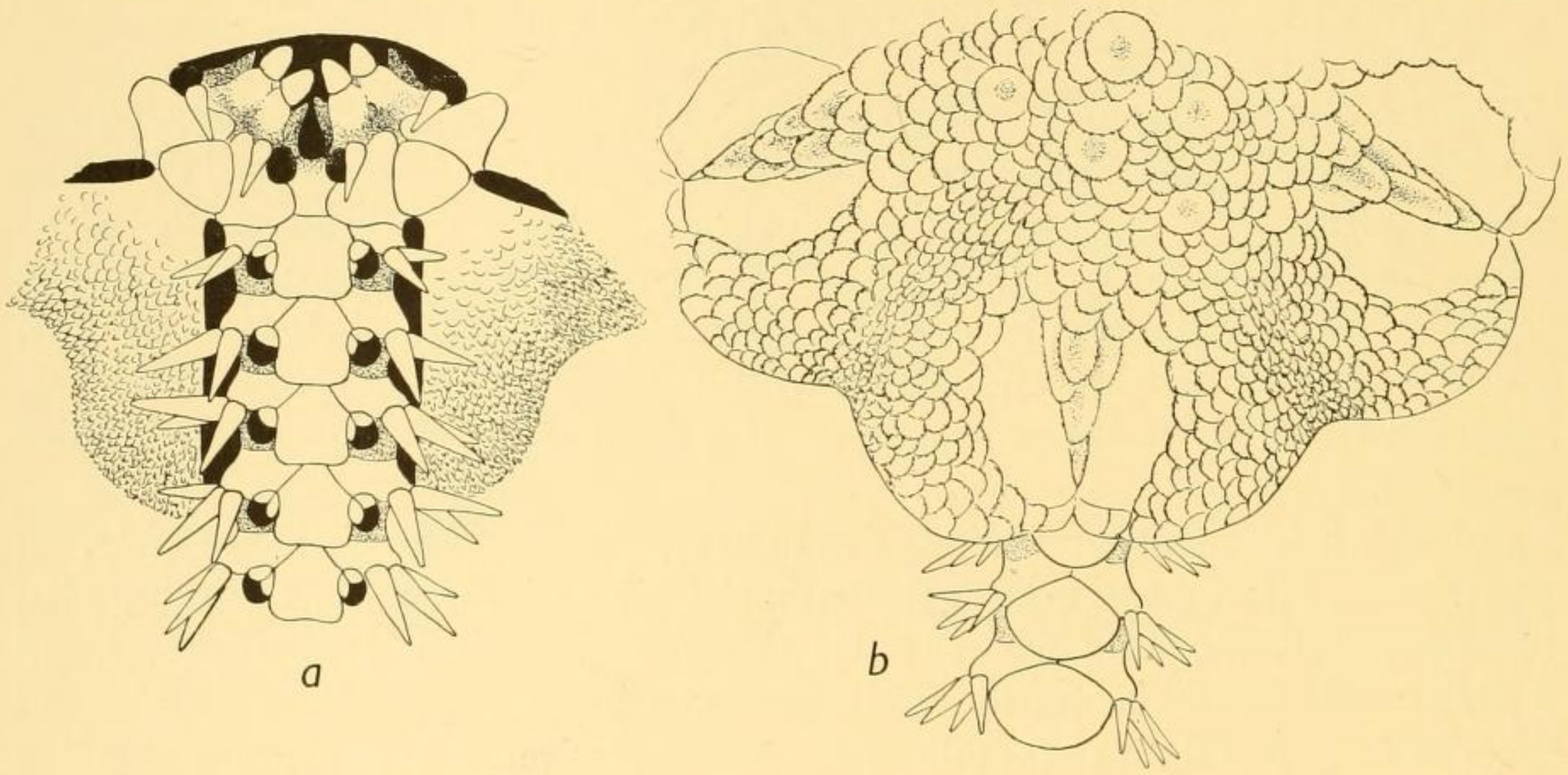

Fig. 16. *Amphiura Joubini*, Koehler, young. Part of oral side (*a*) and dorsal side (*b*). ×18.

usual single, inwardly pointing hook. This hook is not confined to the part of the arm enclosed within the disk, as Koehler states, but may continue almost to the middle of the arm, only it is much less conspicuous farther out on the arm, and is turned outwards. The spines are on the whole very smooth.

Young specimens have a very characteristic appearance, due to the fact that the edge of the disk-scales is somewhat thickened and very finely thorny, one might say ciliated (Fig. 16 *b*); also the primary plates are distinct, though small, whereas they are indiscernible in the adult. As these young specimens also have the main part of the ventral interradii naked and have generally only one tentacle scale, or even none at all, and only four spines, without distinct hooks, they differ so strikingly from the adult that one would be inclined to regard them as a separate species. There are, however, all possible transitions, according to size, from the young to the adult specimens, so that it is per-

fectly evident that they are all one and the same species: in particular the peculiar ciliated appearance of the scales affords an excellent character for identifying the younger specimens.

The buccal shields are rather variable in shape; in the younger specimens they are in general rounded triangular, whereas in the larger specimens they may be somewhat more elongate.

The species has separate sexes and is not viviparous.

I think it quite probable that *A. Joubini* is in reality identical with the *A. polita* described by Koehler in his work on the Echinoids and Ophiurids of the 'Belgica'. Having recently had an opportunity of examining one of Koehler's types in the Brussels Museum, I find that the character of the thorny spines (pl. vii, fig. 50) is not reliable, the spines being sometimes quite smooth. Further, the proximal spines are partly curved inwards, as is typical of *A. Joubini*. The tentacle scales are incorrectly represented in Koehler's pl. vii, fig. 49; they are as in *Joubini* (Fig. 16 *a*). Also the buccal shields are like those of *Joubini*, with straight outer edge. On the whole, I have hardly any doubt but that a direct comparison will show definitely that the two species are identical; the name *Joubini* will then have to give way to the name *polita*, as the older of the two.

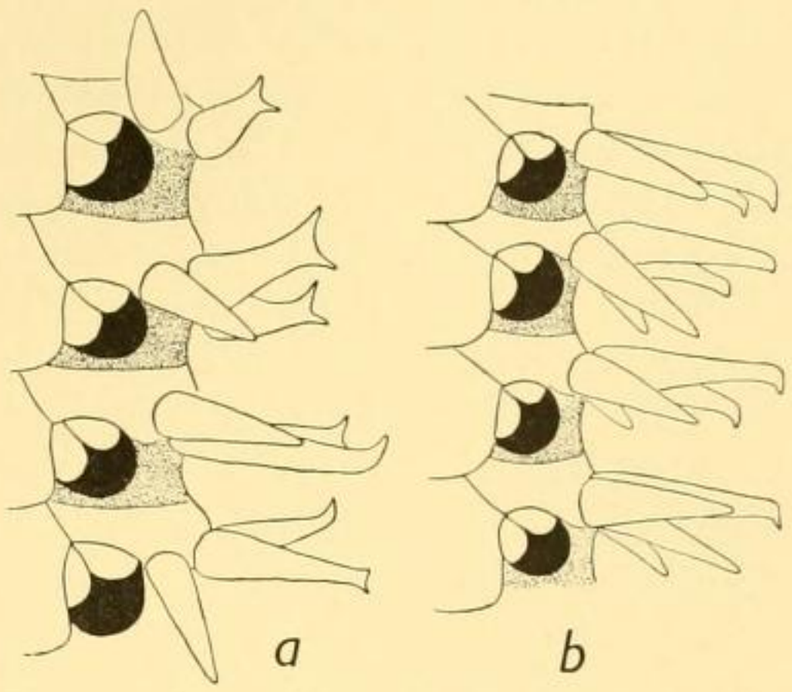

Fig. 17. Part of arm of *Amphiura Joubini*, Koehler, showing character of arm spines: *a*, joints 1–4; *b*, from middle of arm. ×15.

Amphiura Belgicae, Koehler

Amphiura Belgicae, Koehler, 1901. Result. Voyage 'Belgica'. Echinides et Ophiures, p. 27, pl. vii, figs. 46–8.

A. Mortenseni, Koehler, 1908. Scott. Nat. Antarct. Exped. Astéries, Ophiures et Echinides, p. 604, pl. xiv, figs. 121–2.

A. Mortenseni, Koehler, 1912. II[e] Expéd. Antarct. Française. Echinodermes, p. 134, pl. xii, fig. 2.

A. Mortenseni, Koehler, 1922. Austral. Antarct. Exped. Echinod. Ophiuroidea, p. 31, pl. lxxx, figs. 5–8.

A. Mortenseni, Koehler, 1923. Swedish Antarct. Exped. Astéries et Ophiures, p. 112.

A. alternans, Koehler, 1923. *Ibid.*, p. 107, pl. xv, figs. 1–4.

A. Eugeniae Mortenseni, Hertz, 1926. Deutsche Südpolar-Exped. Ophiuroiden, p. 29.

A. Eugeniae gracilis, Hertz, 1926. *Ibid.*, p. 30.

A. Mortenseni, Grieg, 1929. *Echinodermata from the Palmer Archipelago.* Sci. Res. Norwegian Antarct. Exped., 1927–9, II, p. 11.

A. Belgicae, Grieg, 1929. *Some Echinoderms from the South Shetlands.* Bergens Mus. Årbok, 1929, III, p. 6.

St. 27. 15. iii. 26. West Cumberland Bay, South Georgia, 110 m. Several specimens.
St. 39. 25. iii. 26. East Cumberland Bay, South Georgia, 179–235 m. 6 specimens.
St. 42. 1. iv. 26. Off mouth of Cumberland Bay, South Georgia, 120–240 m. 12 specimens.
St. 140. 23. xii. 26. Stromness Harbour to Larsen Point, South Georgia, 122–136 m. 5 specimens.

St. 144. 5. i. 27. Off mouth of Stromness Harbour, South Georgia, 155–178 m. 4 specimens.
St. 148. 9. i. 27. Off Cape Saunders, South Georgia, 132–148 m. 1 specimen.
St. 152. 17. i. 27. 53° 51′ S, 36° 18′ W, South Georgia, 245 m. 1 specimen.
St. 156. 20. i. 27. 53° 51′ S, 36° 21′ W, South Georgia, 200–236 m. 7 specimens.
St. 159. 21. i. 27. 53° 52′ S, 36° 08′ W, South Georgia, 160 m. 2 specimens.
St. 160. 7. ii. 27. Near Shag Rocks, South Georgia, 177 m. 3 specimens.
St. 167. 20. ii. 27. Off Signy Island, South Orkneys, 244–344 m. 4 specimens.
St. 170. 23. ii. 27. Off Cape Bowles, Clarence Island, 342 m. 7 specimens.
St. 175. 2. iii. 27. Bransfield Strait, South Shetlands, 200 m. 1 specimen.
St. 190. 24. iii. 27. Bismarck Strait, Palmer Archipelago, 93–130 m. 1 specimen.
St. 363. 26. ii. 30. 2·5 miles S 80° E of Zavodovski Island, South Sandwich Islands, 329–278 m. 1 specimen.
St. WS 27. 19. xii. 26. 53° 55′ S, 38° 01′ W, South Georgia, 107 m. 5 specimens.
St. WS 33. 21. xii. 26. 54° 59′ S, 35° 24′ W, South Georgia, 130 m. Several specimens.
St. WS 42. 7. i. 27. 54° 42′ S, 36° 47′ W, South Georgia, 198 m. 2 specimens.
St. WS 228. 30. vi. 28. 50° 50′ S, 56° 58′ W, Falkland Islands, 229–236 m. 1 specimen.
St. WS 244. 18. vii. 28. 52° 00′ S, 62° 40′ W, Falkland Islands, 253–247 m. 2 specimens.
St. WS 840. 6. ii. 32. 53° 52′ S, 61° 49′ W, 368–463 m. 3 specimens.
St. MS 14. 17. ii. 25. East Cumberland Bay, South Georgia, 190–110 m. 2 specimens.
St. MS 71. 9. iii. 26. East Cumberland Bay, South Georgia, 110–60 m. Several specimens.

It seems quite certain that Koehler's *A. Mortenseni* is identical with his *A. Belgicae*. In describing the former (*op. cit.*, 1908, pp. 604–5) he evidently forgot *A. Belgicae*, since he does not say a word of how they are to be distinguished from one another, only mentioning that *A. Mortenseni* cannot be confounded with *A. Eugeniae* and *A. Studeri*. In the descriptions of the two species no distinguishing characters are to be found, but the figures would seem to show them to be different. Thus the tentacle scales of *A. Mortenseni* are shown (pl. xiv, fig. 122) in a very curious position, at a right angle to one another; but that this is erroneous has been pointed out by Koehler himself (*op. cit.*, 1922, p. 31). As shown by the photographic figures given there, the tentacle scales are as in *A. Belgicae*. Some slight difference may be found in the shape of the buccal shields; but as shown in pl. 80, figs. 6–8 of Koehler's work of 1922, there is a considerable variation in their shape, so that no reliable distinguishing character can be deduced from them. There are no other differences. Comparison of a couple of co-types of *A. Belgicae*, received from the Brussels Museum, with the published figures of *A. Mortenseni* shows beyond any doubt that they are identical.

In addition the subspecies *gracilis* of *A. Eugeniae*, established by Hertz (Deutsche Südpolar-Exped., Ophiuroiden, p. 30), is in my opinion simply a synonym of *A. Belgicae*. Through the kindness of Professor W. Arndt, of the Berlin Museum, I have had a couple of specimens for examination and find them to agree completely with *A. Belgicae*. As for the character that it has only three arm spines, I find that an arm of a larger specimen lying together with these specimens has actually four spines, so this difference is not reliable.

Further, there can in my opinion be no doubt but that Koehler's *A. alternans* is also identical with *A. Belgicae*. Koehler (*op. cit.*, 1923) points out the great variation in the tentacle scales of *A. alternans*—from one scale almost regularly throughout the arm, to

none, likewise almost regularly throughout. He does not mention the occurrence of two tentacle scales here and there, alternating with one or none; but this is by no means of rare occurrence, and this latter case leads to that of typical *Belgicae* (*Mortenseni*): two scales regularly throughout the arm, excepting on some of the proximal joints. As a matter of fact, we have all transitions from the occurrence of two tentacle scales regularly throughout the arm to one or none, and as the specimens agree completely in all other characters, it is impossible to draw a line between them anywhere; consequently both *Mortenseni* and *alternans* become synonyms of *Belgicae*.

On the whole *A. Belgicae* is perplexing in showing such great variation in regard to the tentacle scales, for the number of these scales, two, one, or none, is otherwise of primary classificatory importance in the genus *Amphiura*. Not that this species is otherwise difficult to recognize. As a matter of fact, apart from the variation in the tentacle scales, its general appearance is quite characteristic: the long, stout, conical spines, almost constantly four in number, the large irregular scales in the centre of the disk, generally without recognizable primary plates, and the rather thick skin obscuring the plates of the mouth frame (this is also pointed out by Lyman as characteristic of *A. tomentosa*); further, the arrangement of the tentacle scales, when there are two of them, is characteristically different from such species as *A. Eugeniae*, as seen in Figs. 18 and 21. As for the young specimens identification is often difficult—but this holds of most Ophiuroids in their young stages.

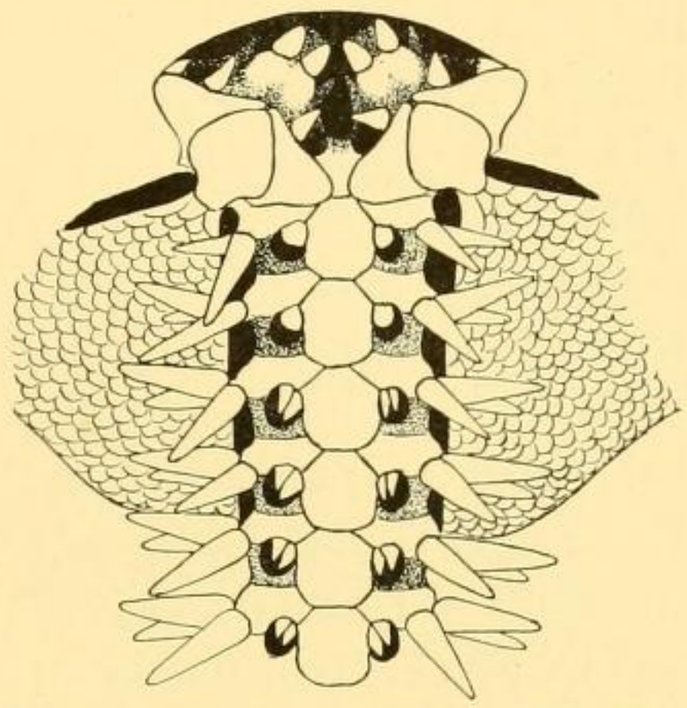

Fig. 18. *Amphiura Belgicae*, Koehler. Part of oral side. ×10.

The specimen from St. 190 is exceptional in having only three arm spines. One specimen from St. WS 27 is unusual in the spines (five) being somewhat flattened and even slightly widened at the point, not conical as is otherwise usual in this species. Both specimens being in all other characters typical, I can only regard them as individual variations of *A. Belgicae*.

Hertz regards *A. Mortenseni* (*Belgicae*) as only a variety of *Eugeniae*. I do not think this correct, as is evident from the description and figures of *A. Eugeniae* given below.

A. Belgicae is viviparous and hermaphrodite. Whether it is protandric I have been unable to settle definitely; it seems rather to be a more complicated case. Whereas in adult specimens it is easy enough to ascertain the hermaphrodite character of the gonads, both eggs and sperms being found within the same gonad (though sometimes only eggs are distinct), it seems as if the gonads in the younger specimens are of separate sexes. In one young specimen, 4 mm. in diameter of disk, I found very distinct male gonads, partly with ripe sperms, besides gonads with young eggs only. Young ones may be found in specimens of only *ca.* 6 mm. diameter of disk; it appears that they lie within the gonads, the development thus being intra-ovarial. The adult specimens also strongly convey this impression. In young specimens there are only one or two embryos in each

gonad, and only one or two gonads to each side of the arm. In adult specimens there are several more, up to about eight to ten eggs in each gonad (I have found no adult specimen with embryos, only with eggs). The eggs are large, rich in yolk; in the young embryonal stages there is a very distinct whitish animal pole and a large, yellowish-brown vegetative pole, which latter in the course of further development is enclosed by the dorsal skin of the embryo. Such embryos have a curious appearance, for the arms look like small, fat sausages, with the skeletal rudiments very small in comparison with the thickness of the arm. A careful study of the development of this species would clearly be remunerative; I have, however, neither the material nor the time to undertake such a study.

One of the specimens (St. WS 33) is infested by a *parasitic Gastropod*; it lies wholly within the body of the Ophiuran, a small opening in one of the ventral interradii showing the place through which the parasite entered. The body of the parasite is wholly sac-shaped, without any trace of its shell left, and it would, indeed, be impossible to tell what kind of animal it was, were it not that it is filled with young embryos with a well-developed, typical Gastropod shell (Fig. 19). These young snails no doubt leave the host by the hole through which the mother entered, and when outside must try to find a new specimen of the brittle-star into which they can penetrate. Probably this parasite belongs to, or is related to, one of the two other sac-shaped, shell-less Gastropods known, *Ctenosculum*, Heath (in *Brisinga*), or *Asterophilus*, Randall and Heath (in *Pedicellaster*).

Fig. 19. Embryo of parasitic Gastropod from *Amphiura Belgicae*. ×42.

Two other specimens are infested by the curious Cirripedian parasite, *Ascothorax*, which looks like a pea, but with a furrow from which protrude two pairs of short limbs. Indeed, it very much recalls an Ostracod. This parasite, like the above-mentioned Gastropod, lies wholly within the body of the brittle-star, but inside a rather heavily plated cyst, opening through a pore in the ventral interradius. (The Gastropod does not lie within a plated cyst.) Neither of the two parasites castrates its host.

The fact that only so very few specimens have been taken off the Falkland Islands (Sts. WS 228, WS 244, and WS 840) indicates that hereabout is the northern limit of the species, it being apparently very rare in this region. (About the identification of these specimens I have no doubt.)

Amphiura da Cunhae, n.sp.

St. 1187. 18. xi. 33. Off Inaccessible Island, Tristan da Cunha, 135–134 m. 8 specimens.

Diameter of disk of largest specimen 3 mm., arms *ca.* 15 mm. long, rather slender. Disk covered with rather coarse scales, among which the primary plates are distinct, particularly so in the younger specimens. The radial shields are short, one-third the length of the disk radius; they are separated by a single wedge of scales, in younger specimens contiguous distally. The ventral interradii are covered by somewhat smaller scales than those of the dorsal side of disk; proximally these scales are more scattered,

the inner part of the interradii being half naked, a feature specially distinct when the interradii are swollen on account of the ripe gonads. In dried specimens this half-naked condition may be less distinct because of the contraction.

Buccal shields spade-shaped, with a small but distinct outer lobe. Adradial shields broad, without or with an outer prolongation separating the buccal shield from the first lateral plate. Outer mouth papilla rather broad, rounded. Ventral plates of the usual form, with straight or slightly concave distal edge; the proximal ones contiguous. Dorsal arm plates rounded fan-shaped, slightly contiguous. Four rather coarse, smooth arm spines; two tentacle scales proximally; farther out, and in the younger specimens, only one or none. Colour of preserved specimens white.

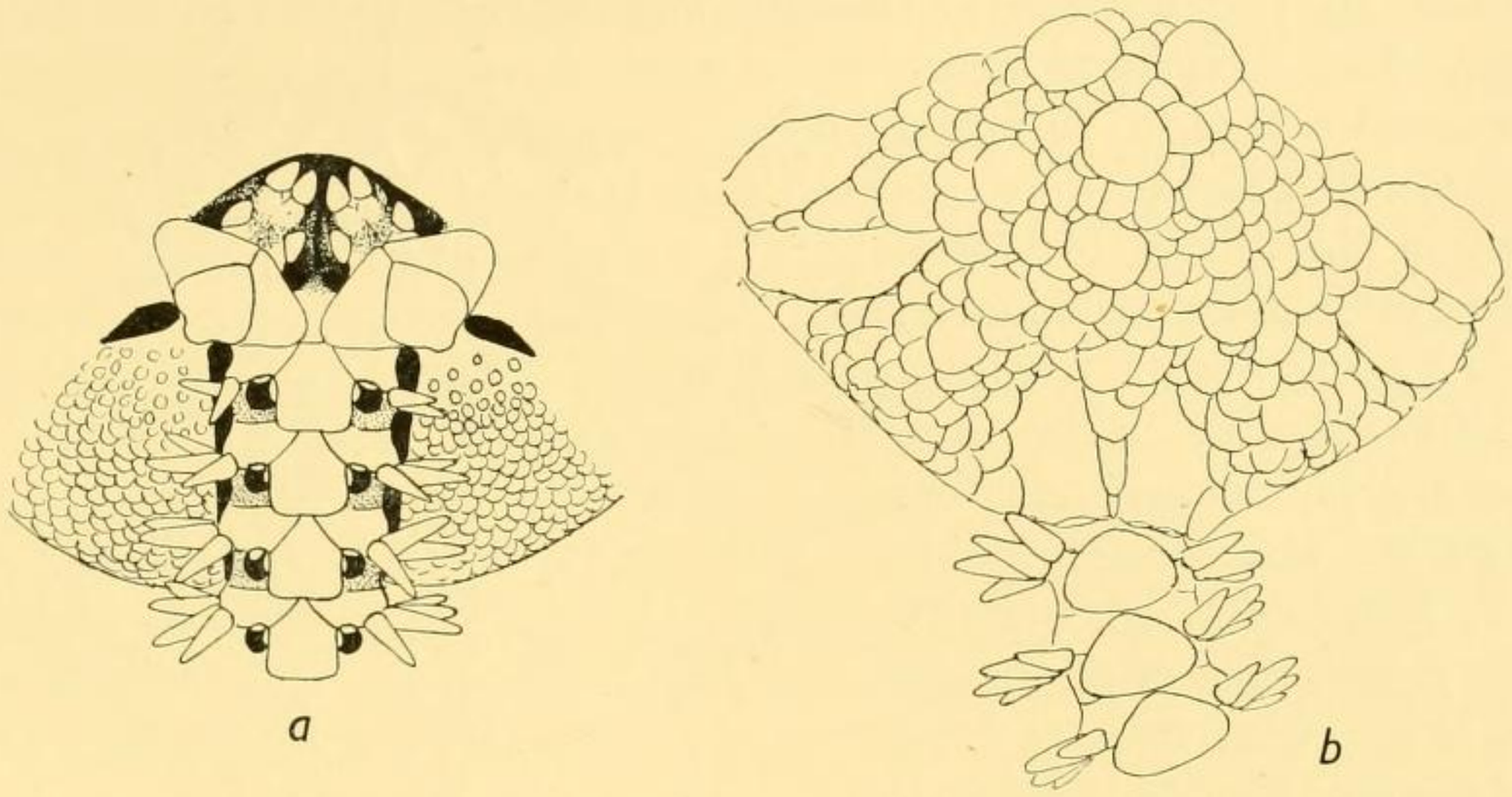

Fig. 20. *Amphiura da Cunhae*, n.sp. Part of oral side (*a*) and dorsal side (*b*). ×22·5.

The species has separate sexes, but the eggs are rather large, so it is not improbable that it will prove to be viviparous. There is only one female gonad at each bursa, placed interradially; two male gonads, likewise at the interradial side of the genital slit.

It seems evident that this species is closely related to the South African *A. albella*, Mortensen, from which it is distinguished mainly by the more scale-covered ventral interradii. Perhaps it should rather be designated only as a variety of the South African species. Because of the very scanty material as yet available of both (only two specimens of *A. albella* are known, from off Durban) I think it preferable to regard them, for the present at least, as two distinct species. The present species seems also to be nearly related to *A. Richardi*, Koehler; but *A. Richardi* is a much larger form, some 10 mm. in diameter of disk, whereas *A. da Cunhae* is full grown (at least fully mature) at a size of 3 mm. diameter.

Amphiura Eugeniae, Ljungman

Amphiura Eugeniae, Ljungman, 1867. *Ophiuroidea viventia huc usque congnita*. Ofvers. K. Vetenskaps-Akad. Förhandl., 1866, p. 318.
A. Eugeniae, Ludwig, 1899. Ophiuroideen Hamburger Magalh. Sammelreise, p. 8.
A. Eugeniae, H. L. Clark, 1915. Cat. Recent Ophiurans, p. 225, pl. iv, figs. 9, 10.

A. Eugeniae, Koehler, 1917. *Echinodermes de Kerguelen.* Ann. Inst. Océanogr., VII, 8, p. 63, pl. viii, figs. 1–9.
A. Eugeniae, Koehler, 1923. Swedish Antarct. Exped., Astéries et Ophiures, p. 110, pl. xiv, fig. 7.
A. Eugeniae, Hertz, 1926. Deutsche Südpolar-Exped. Ophiuroiden, p. 29.

Although this species is not represented in the material collected by the Discovery Committee, I may say some few words about it. The type of *A. Eugeniae* was never figured. Thinking it desirable to have that done, I applied to my friend Professor Sixten Bock of the Stockholm Museum, asking him to lend me the type specimen for this purpose, which he very kindly did. It is in rather poor condition, with all the arms broken off close to the disk; but the disk is sufficiently well preserved to afford a drawing of the oral side, which is given in Fig. 21.

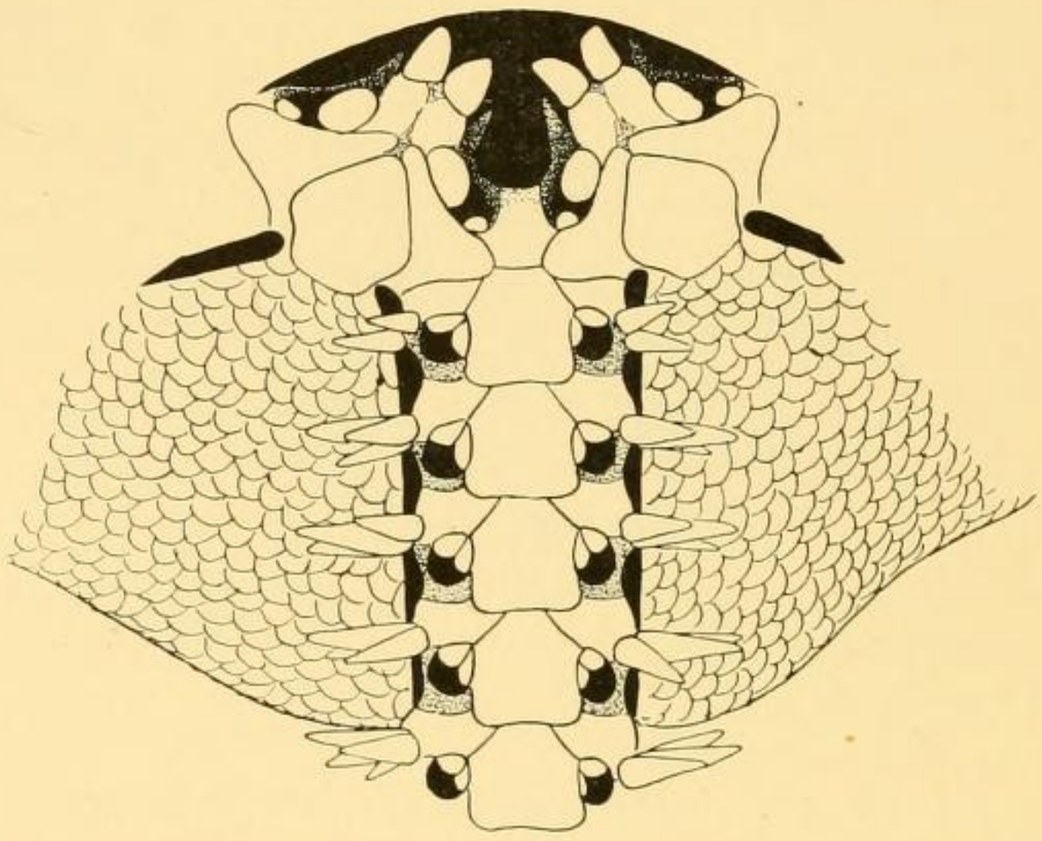

Fig. 21. Part of oral side of *Amphiura Eugeniae*, Ljungman. Type specimen. ×20.

The dorsal side of the disk very closely resembles that shown so excellently in pl. 4, fig. 9, of Clark's Catalogue of the Recent Ophiurans; there is thus no reason to give a special drawing of it. In the figure of the oral side of a specimen from the Swedish Antarctic Expedition given by Koehler (*op. cit.*, 1923, pl. xiv, fig. 7) the shape of the buccal shields is somewhat different from that of the type specimen (Fig. 21), the outer lobe being more distinct. As these specimens from the Swedish Antarctic Expedition (which Professor Sixten Bock has likewise sent me for examination) otherwise closely agree with the type, and as moreover they show some variation in the shape of the buccal shields—some even being exactly as in the type—no weight, of course, can be laid on this slight difference.

The examination of some of the specimens from the Swedish South Polar Expedition shows this species to be *viviparous*. I have found only female gonads, even in young specimens of only 5 mm. diameter of disk; the gonads here were very small, with only one quite young egg. It would seem then that this species is usually *parthenogenetic*.

The fact that the South American specimens all have a small papilla outside the large outer mouth papilla affords a conspicuous difference from the specimens from Kerguelen, which according to Koehler (Echinodermes de Kerguelen, p. 63, pl. viii, figs. 1–9) have constantly only one outer mouth papilla. In his work of 1923 (*op. cit.*, p. 111) Koehler has called attention to this difference and suggests that the Kerguelen form may represent a variety of *A. Eugeniae*, without, however, taking up a definite position on the question. There can, in my opinion, be no doubt that the Kerguelen

form at least represents a distinct variety, if not a distinct species (as is the opinion of H. L. Clark, in his Catalogue of Recent Ophiurans). It might even be maintained that they belong to two different genera, the Kerguelen form being a typical *Amphiura*, whereas *A. Eugeniae*, with two outer mouth papillae, should rather be referred to *Amphiodia*.

It is of importance to ascertain whether the Kerguelen form is viviparous like the typical *Eugeniae*; for if not, it is clearly a distinct species. For the present I prefer to regard it only as a variety of *Eugeniae*, which must then take the name *antarctica*, Studer, of which *Amphiura Studeri*, Lyman, becomes a synonym (cf. H. L. Clark, Cat. Recent Ophiurans, p. 223).

Hertz (Deutsche Südpolar Exped., Ophiuroiden, p. 29) regards *A. Mortenseni*, Koehler (=*A. Belgicae*, Koehler, cf. above, p. 280) as a subspecies only of *A. Eugeniae*. With this I cannot agree. As seen from a comparison of Fig. 21, *A. Eugeniae*, with Fig. 18, *A. Belgicae*, there is a conspicuous difference in the shape of the outer mouth papilla, of the ventral arm plates, and particularly of the tentacle scales, to which is added the important fact that in *A. Belgicae* the gonads are hermaphrodite, which they are not in *A. Eugeniae*. It thus seems quite evident that we have here two distinct species.

Hertz further established a variety *gracilis* of *Eugeniae* (*op. cit.*, p. 30). Through the kindness of Professor W. Arndt of the Berlin Museum I have had a couple of specimens of this variety for examination. I find them to be not at all of the *Eugeniae* type, but very clearly of the *Belgicae* type, as evinced by the shape of the outer mouth papillae, of the tentacle scales, and the large size of the spines. I think this variety is merely a synonym of *A. Belgicae* (cf. above, p. 280).

Amphiura princeps, Koehler

(Plate VII, fig. 10)

Amphiura princeps, Koehler, 1907. *Revision de la collection des Ophiures du Museum d'Hist. nat. Paris.* Bull. Sci. France Belgique, XLI, p. 303, pl. xii, figs. 28–9.

St. WS 89. 7. iv. 27. 9 miles N 21° E of Arenas Point Light, Tierra del Fuego, 23–21 m. 8 specimens.

St. WS 221. 4. vi. 28. 48° 23′ S, 65° 10′ W, 76–91 m. 1 specimen.

St. WS 776. 3. xi. 31. 46° 18′ S, 65° 02′ W, 107–99 m. 1 specimen.

St. WS 847. 9. ii. 32. 50° 16′ S, 67° 57′ W, 51–56 m. 1 specimen.

This species has hitherto only once been recorded, and it is thus very satisfactory that it has been taken by the 'William Scoresby'. The new localities do not markedly extend its geographical range; the species appears to be characteristic of the Magellanic region.

The figures given by Koehler being rather diagrammatic, I have thought it desirable to give some new figures. In reference to Koehler's description I would point out that the scales of the ventral interradii are rather thick, so as almost to give the impression of being granules. The great variation in the shape of the buccal shields is mentioned by Koehler; the heart-shape shown in Koehler's pl. xii, fig. 29, I have not observed, it is

evidently quite unusual; Fig. 22, *a*, *b*, show the more usual form. The second ventral plate is somewhat narrower than the following ones. These plates are slightly broader in the lower part, at the corners opposite the tentacle scales, than at the distal edge. The number of arm spines I find to be more generally six, sometimes only five.

The species has separate sexes, the male gonads being particularly richly developed; they look rather like ovaries filled with eggs, but microscopical examination shows at once their male character. The eggs are rather small and numerous, indicating that the species may have a typical *Ophiopluteus* larva.

There is a rather considerable resemblance between this species and *Amphiura Eugeniae*; but there can be no doubt that they are two quite distinct species. The absence

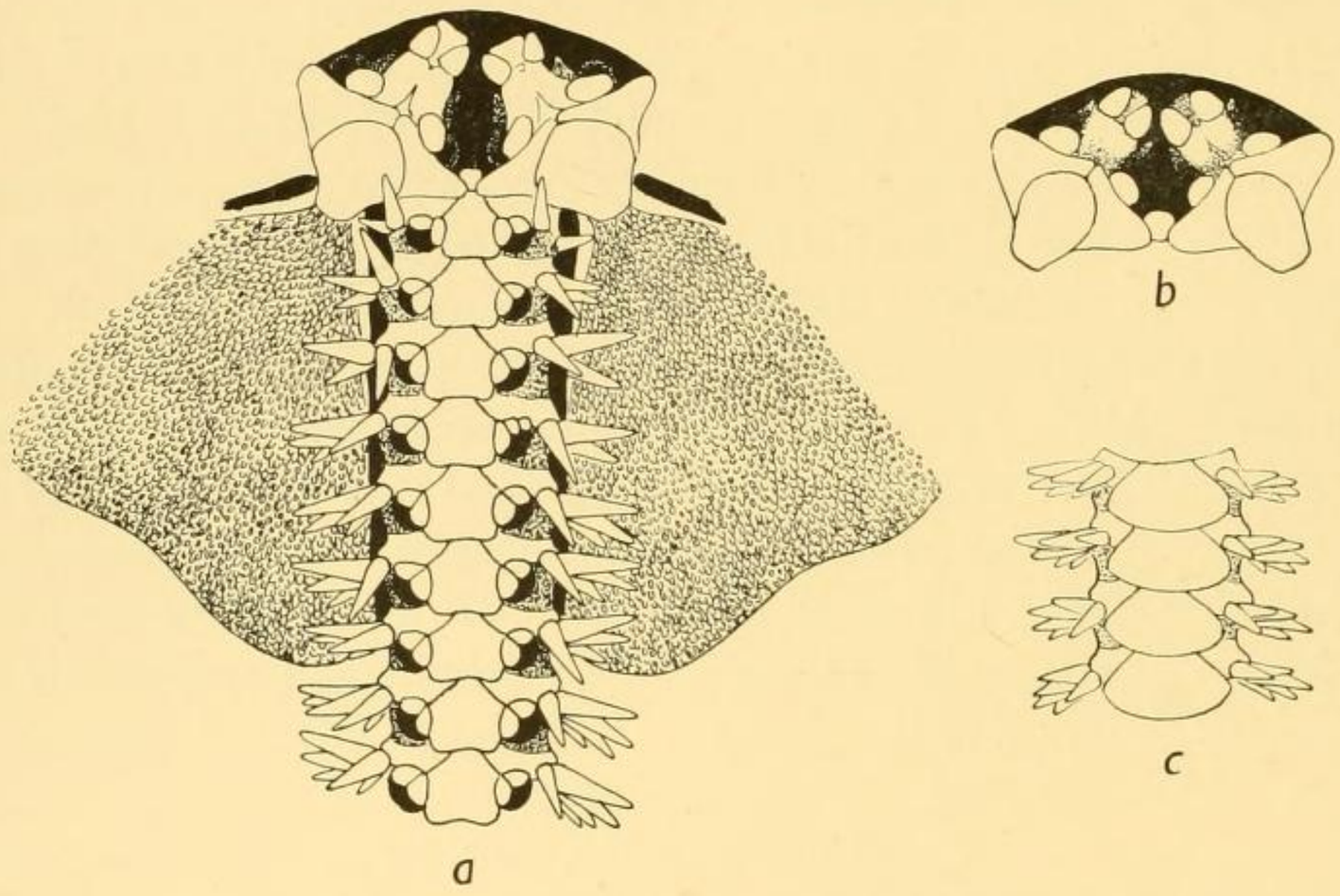

Fig. 22. *Amphiura princeps*, Koehler. Part of oral side (*a*). Mouthparts of another specimen (*b*). Part of arm, dorsal side, joints *ca.* 20–23 (*c*). ×12.

of the small outer mouth papilla, the very small inner ventral plate, and the generally larger number of arm spines in *A. princeps*, distinguish the two species very clearly, besides the fact that *A. Eugeniae* is viviparous and apparently parthenogenetic, whereas *A. princeps* is evidently not viviparous and has separate sexes, the males being of common occurrence.

Amphiura incana, Lyman

Amphiura incana, Lyman, 1882. Sci. Results H.M.S. 'Challenger'. Ophiuroidea, p. 128, pl. xxxiii, figs. 5–7.

A. incana, H. L. Clark, 1923. *Echinoderm Fauna of South Africa.* Ann. S. African Mus., XIII, p. 328.

A. incana, Hertz, 1926. Deutsche Südpolar-Exped. Ophiuroiden, p. 34, Taf. vii, fig. 1.

A. incana, Mortensen, 1933. *Echinoderms of South Africa.* Papers from Dr Th. Mortensen's Pacific Exped., LXV (Vid. Medd. Dansk Naturh. Foren., 93), p. 351.

St. 91. 23. ix. 26. False Bay, South Africa, 35 m. 6 specimens.

St. 283. 14. viii. 27. Annobon, Gulf of Guinea, 18–30 m. 12 specimens.

The finding of this species, hitherto known only from South African seas, in the Gulf of Guinea, is of considerable zoogeographical interest. The specimens from the Gulf of Guinea are quite typical, only somewhat smaller than the South African specimens, none of them exceeding 6 mm. diameter of disk.

Amphiura Chiajei, Forbes

Amphiura Chiajei, Lütken, 1858. Additamenta ad hist. Oph., I, p. 57, Tab. ii, fig. 12 *a*, *b*.
A. Chiajei, Ludwig, 1879. *Die Echinodermen d. Mittelmeeres*. Mitth. Zool. Stat. Neapel, I, p. 550.
A. Chiajei, Koehler, 1921. Faune de France. Echinodermes, p. 78.
A. Chiajei, Mortensen, 1927. Handbook Echinod. Brit. Isles, p. 212.

For the older literature cf. Ludwig, *op. cit.*

St. 274. 4. viii. 27. Off St Paul de Loanda, Angola, 64–65 m. 2 specimens.
St. 279. 10. viii. 27. Off Cape Lopez, French Congo, 58–67 m. 4 adult and several young specimens.

These are quite typical *A. Chiajei*. The species was not hitherto known farther south than the Moroccan coast; but the finding of these specimens off French Congo proves that it occurs probably all along the African Atlantic coasts, at least as far south as French Congo. It is only to be wondered at that it has not hitherto been found there.

The young specimens from St. 279, though not altogether showing the characters of the species clearly (only three arm spines), decidedly belong to this species; I have compared them with specimens of corresponding sizes from the Kattegat, where confusion with other species is excluded, and find them to be identical.

One cannot help being struck by the very great general resemblance between the present specimens and the *Amphiocnida semisquamata* described and figured by Koehler in Michaelsen's Meeresfauna Westafrikas. However, the scales of the present specimens are smooth and thus typical of *Amphiura Chiajei*, and do not end in a point as in *Amphiocnida semisquamata*—or rather *Acrocnida*, as it must be named according to Gislén's revision of these forms in his paper *On the generic types of the Ophiurid genus* Ophiocentrus *Ljungman* (Göteborgs K. Vetensk. Vitterhets-Samhälles Handlingar, IV, Ser. 30, 6, 1926). Further, there is no distinct median keel on the ventral plates as in *Amphiocnida semisquamata*, and the spines are more slender and pointed than in that species; it is thus out of the question that they could be identical. But it seems evident that the genus *Acrocnida* is very closely related to *Amphiura Chiajei*, perhaps derived from the latter, or at least from an *Amphiura* of that type.

Ophiocentrus novae-zelandiae, Gislén

Ophiocnida pilosa, H. L. Clark, 1909. *Echinodermata. Sci. Results Trawling Exped. 'Thetis'*. Mem. Austral. Mus., IV, p. 541.
Amphiocnida pilosa, Mortensen, 1924. *Echinoderms of New Zealand and the Auckland-Campbell Islands*. II, *Ophiuroidea*. Papers from Dr Th. Mortensen's Pacific Exped., XX (Vid. Medd. Dansk Naturh. Foren., 77), p. 154.

Ophiocentrus novae-zelandiae, Gislén, 1926. *On the generic types of the Ophiurid genus* Ophiocentrus *Ljungman* (Amphiocnida *Verrill*). Göteborgs K. Vetensk. Vitterhets-Samhälles Handlingar, xxx, 6, p. 13.

St. 939. 17. viii. 32. 35° 49′ S, 173° 27′ E, Cook Strait, New Zealand, 98 m. 1 young specimen.

Whereas it is clear, as shown by Gislén (*op. cit.*), that the genus *Amphiocnida* of Verrill is identical with Ljungman's genus *Ophiocentrus*, it can hardly be regarded as definitely settled that the New Zealand form is really specifically different from the typical *pilosa*, from the Bass Strait; it is, accordingly, with due reservation that I am here following Gislén in regarding the New Zealand form as a separate species. Comparison with material from the type locality will be needed for deciding the question of the specific validity of the New Zealand form. I rather expect, judging from the great variability existing in the New Zealand form (cf. *op. cit.*, 1924), that they will prove to be all one species.

The present specimen (2 mm. diameter of disk) shows an interesting feature in having two slender spines on the distal edge of the buccal shields. If this proves to be a constant character, the present specimen would represent a species different from those from the Colville Channel described in my paper of 1924, in which no such spines were observed. But I have little doubt that this is merely an individual variation.

Amphiodia affinis (Studer)

Amphiura affinis, Studer, 1885. *Die Seesterne Süd-Georgiens*. Jahrbuch wiss. Anst. Hamburgs, II, p. 162, Taf. ii, fig. 9 *a*, *b*.
Ophioceramis antarctica, Studer, 1885. *Ibid.*, p. 160, Taf. ii, fig. 7 *a*, *b*.
Amphioplus affinis, Koehler, 1917. *Echinodermes de Kerguelen*, Ann. Inst. Océanogr., VII, 8, p. 69, pl. viii, figs. 10, 11.
A. affinis, Koehler, 1923. Swedish Antarct. Exped. Astéries et Ophiures, p. 115.
Amphiactis affinis, Hertz, 1926. Deutsche Südpolar-Exped. Ophiuroiden, p. 27, Taf. vi, fig. 3.

St. 45. 6. iv. 26. 2·7 miles S 85° E of Jason Light, South Georgia, 238–270 m. 1 specimen.
St. 141. 29. xii. 26. E. Cumberland Bay, South Georgia, 17–27 m. 7 specimens.
St. 179. 10. iii. 27. Melchior Island, Schollaert Channel, Palmer Archipelago, 4–10 m. 1 specimen.

To the very careful description of this species given by Koehler (*op. cit.*, 1917), one point of importance should be added, viz. that the genital slits are quite short, not reaching beyond the first arm joint (Fig. 23). I have been able to ascertain this also in the type specimens, Studer's original material having very kindly been lent me for re-examination from the Hamburg Museum. It appears that the tentacle scale is often lacking at the first pore pair.

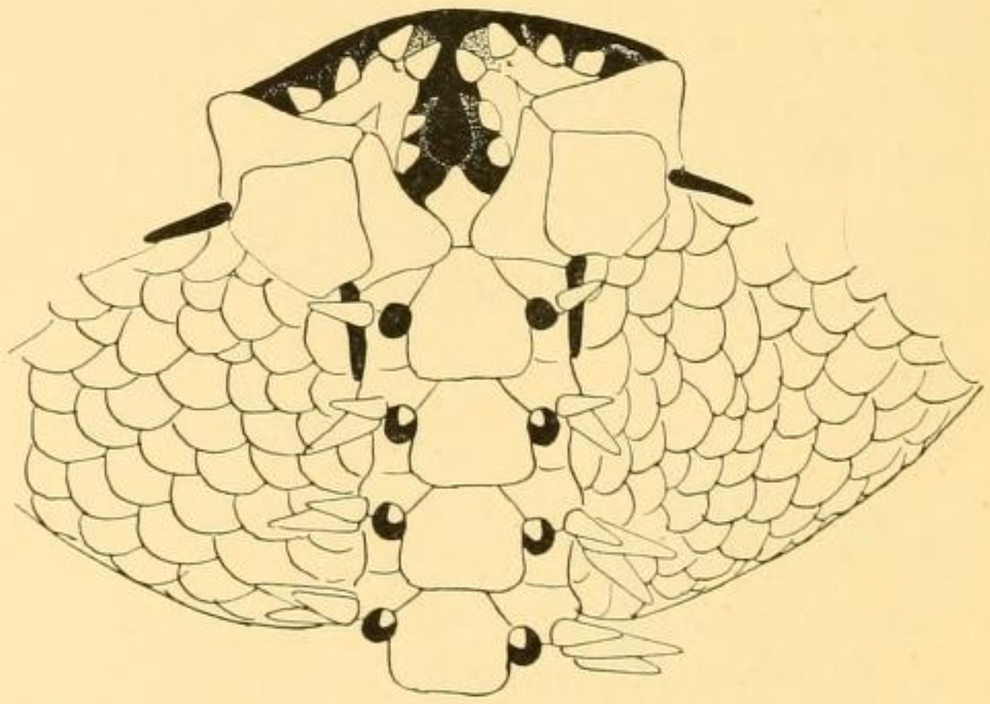

Fig. 23. *Amphiodia affinis* (Studer). Part of oral side. ×20.

It would seem more correct to refer this species to the genus *Amphiodia* than to *Amphioplus* as Koehler has done; as a matter of fact the mouth papillae are in accordance with the *Amphiodia* type (as defined by Matsumoto, Monogr. Japanese Ophiuroids, p. 166), not with the *Amphioplus* type (Fig. 23). To *Amphiactis*, to which genus it is referred by Hertz, it does not seem to me to have any near affinity.

This species is viviparous and hermaphrodite. The gonads themselves are not hermaphrodite, but either of pure female or of pure male character; they are found only at the interradial side of the genital slits (judging from the two specimens opened). It appears that the development is intra-ovarial. There are only one or two eggs (embryos) at a time in each ovary.

There cannot be the slightest doubt that Studer's *Ophioceramis antarctica* is identical with his *Amphiura affinis*. From an inspection of the very poor figures of the two "species" given by Studer (*op. cit.*) it is at once evident that they must be very closely allied, in spite of the fact that Studer referred them to two different genera and families. Suspecting an error here on the part of Studer I applied to my friend Dr A. Panning of the Hamburg Museum for the loan of the type of this *Ophioceramis antarctica*, which he very kindly sent me. My suspicion proved well founded. Not a single character can I find by which to distinguish it from *A. affinis*. The specimen is in rather poor condition, but it is still possible to make out the characters of the species, though the genital slits are not yet distinct (the specimen is a young one, 3 mm. diameter of disk). From the figure given by Studer (fig. 7 *a*) it would appear that the radial shields are quite indistinguishable, in contradistinction to *A. affinis*, the figure of which (fig. 9 *a*) shows the radial shields quite distinctly. But the former figure is incorrect, the radial shields are exactly of the same shape and size as in *A. affinis* of corresponding size. Further, the tentacle scales would seem to afford an important difference, *Ophioceramis antarctica* being stated to have two tentacle scales, "sehr kurz, flach", *A. affinis* to have only one small tentacle scale. In reality *Ophioceramis antarctica* has only one tentacle scale, exactly as in *A. affinis*, and both of Studer's figures, 7 *b* and 9 *b*, show it incorrectly; it is as drawn here in Fig. 23.

The identity of Studer's *Ophioceramis antarctica* and *Amphiura affinis* being thus a fact, the question is which name has to be used for the species. In Studer's paper *Ophioceramis antarctica* comes first; but in 1867 Ljungman described an *Ophiophragmus antarcticus*, which H. L. Clark (Cat. Recent Ophiurans, p. 249) has referred to the genus *Amphiodia*. The identity of Ljungman's *Ophiophragmus antarcticus* with *Amphiodia chilensis* (Müller and Troschel) does not make the species name *antarctica* available for the present species, unless the species *chilensis* is referred to the genus *Ophiophragmus*, which is, however, disputable. I think it therefore the safest course to let the present species keep the name *affinis*, which will be available no matter to which genus, *Amphiodia* or *Amphioplus*, the species is referred.

It is satisfactory that the confusion caused by this *Ophioceramis antarctica* has been cleared up, a species the more mysterious since the genus *Ophioceramis* is otherwise not known outside the tropical region.

I may take the opportunity of pointing out here that one more species has erroneously been referred to the genus *Ophioceramis*, viz. *O. albida* of Ljungman. This was originally described by Ljungman as an *Amphipholis*, but by Lyman transferred to *Ophioceramis*, which is accepted by H. L. Clark. There can in my opinion be no doubt that this species does not belong to any of these genera, but to the genus *Amphioplus*. The teeth in particular are very different from those of the typical *Ophioceramis*—few, simply tongue-shaped in *O. albida*, very numerous and excavated in *Ophioceramis*; also the dorsal arm-plates are quite different—simple in *O. albida*, more or less irregularly divided longitudinally in *Ophioceramis*.

Amphiodia acutispina, Koehler

Amphiodia acutispina, Koehler, 1914. Meeresfauna Westafrikas. Echinoderma, p. 195, pl. vii, figs. 11–14.

St. 279. 10. viii. 27. Off Cape Lopez, French Congo, 58–67 m. 1 specimen.

The single specimen, like those described by Koehler, has lost the disk and the greater part of the arms. But there can be no doubt of its identity with this characteristic species.

Amphiodia ascia,[1] n.sp.

(Plate VII, fig. 11)

St. 272. 30. vii. 27. Off Elephant Bay, Angola, 73–97 m. 2 specimens.

Diameter of disk 5 mm., arms apparently about six to seven times that length. Interradial edges of disk slightly concave.

Disk scales small, imbricating; there is no trace of primary plates, at most a small central plate discernible. Radial shields rather large, about as long as half the disk radius; they are separated in one of the specimens by only a single, narrow wedge of scales, in the other by several more scales. Ventral interradii almost totally naked, only with some few small, widely scattered scales. Buccal shields almost circular, only at the distal edge narrowing so as to form a broad, rounded lobe (Fig. 24 *a*); in the second specimen this outer lobe is a little more distinct. Adoral plates not quite joining within; they have a broad outer lobe, separating the first lateral plate from the buccal shield. Mouth papillae very characteristic: a very small, scale-like one outermost, and then a long, spine-like papilla. Infradental papillae, as well as the papilla of the first mouth tentacle, of the usual shape, but the jaws are unusually high. First ventral plate broad and square. Those following about as broad as long, broadly contiguous in the proximal part, the sides and the distal edge with a slight re-entrant curve; the proximal three to four plates have a rather distinct keel on each side. The dorsal arm-plates are about twice as broad as long, with a rounded inner angle and a convex distal edge. Arm spines six or seven, the lowermost slightly the longest, about the length of an arm-joint, the following gradually smaller, the uppermost one being the smallest.

[1] *Ascia* = a hatchet.

They are slender, pointed, except the second from below from a few joints outside the disk; this spine is broader than the others and terminates in two small hyaline hooks, the spine thus having the shape of a small hatchet. (The species name refers to this character.) No tentacle scale. The specimens (dried) show no trace of particular colour.

This very characteristic species does not seem nearly related to any other known species of the genus *Amphiodia* (or *Amphiura*—to which latter genus it might perhaps equally well be referred, just as well as *Amphiura Eugeniae*).

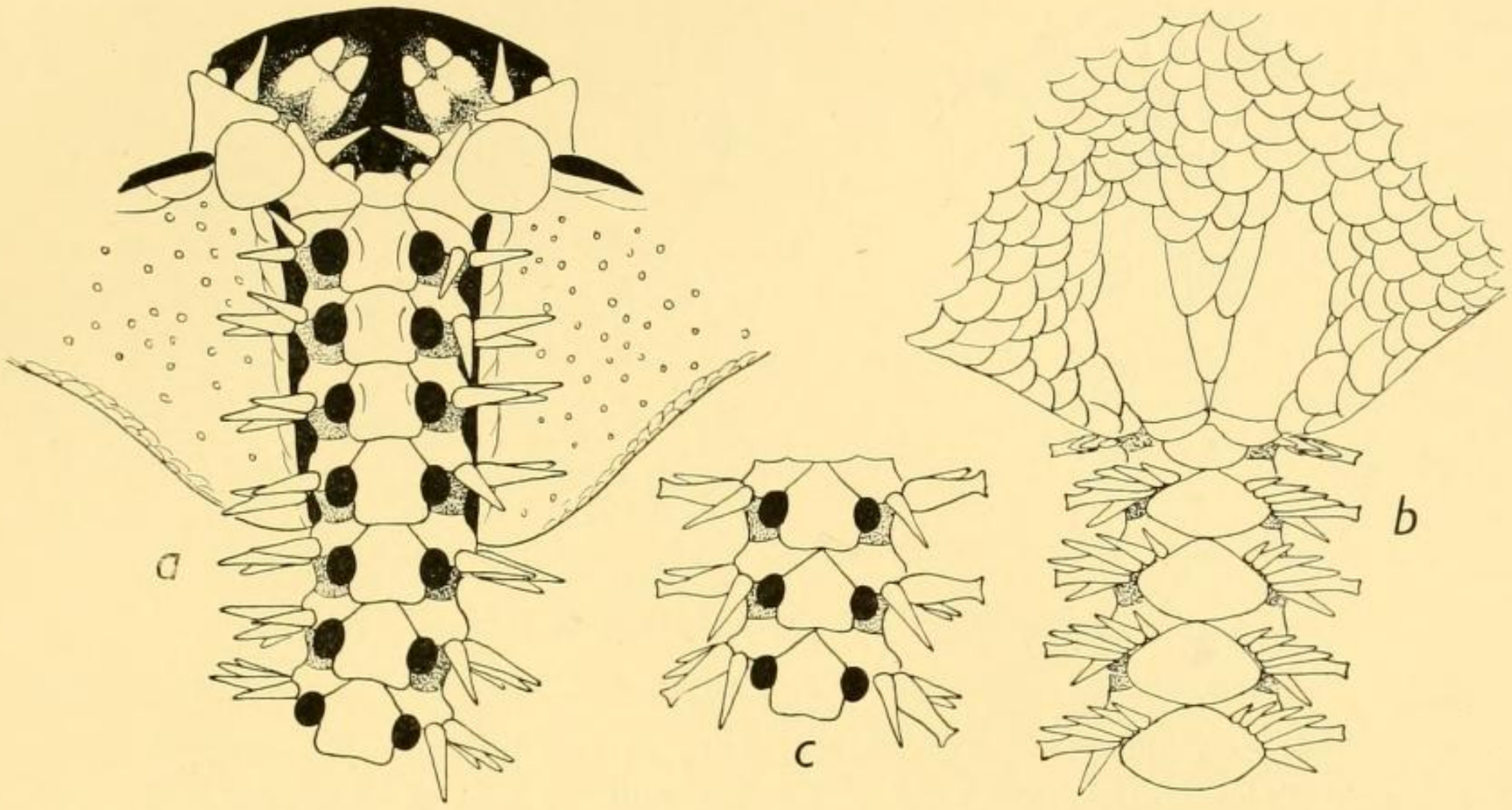

Fig. 24. *Amphiodia ascia*, n.sp. Part of oral side (*a*) and dorsal side (*b*). Arm joints from the middle of arm, oral side (*c*). ×20.

Ophionephthys magellanica, n.sp.

St. WS 742. 5. ix. 31. 38° 22′ S, 73° 41′ W, 35 m. 6 specimens.

These specimens having all lost the disk, no complete description of the species can be given. However, the shape of the mouthparts and the arm plates shows it to be decidedly different from any other species of *Ophionephthys* hitherto described, and since the genus *Ophionephthys* was not hitherto known to occur in the Magellanic region, I have deemed it desirable to name the species, in spite of the incompleteness of the description.

The arms are very long and slender, as usual in this genus; as they are all broken, nothing can be said of their actual length.

There are three rather small, scale-like, outer mouth papillae, much smaller than the infradental papillae. The buccal shields are spade-shaped, with a more or less conspicuous outer lobe; the adoral shields, which join within, have a rather sharp outer (adradial) angle. The hole in the jaws, characteristic of *Ophionephthys*, as well as of *Ophionema*, is sometimes indistinct (Fig. 25 *a*). Ventral arm plates usually distinctly longer than wide, with distal edge slightly concave. Dorsal arm plates fan-shaped,

conspicuously broader than long, narrowly contiguous. Five or four slender, pointed arm spines. Tentacle scales normally two, but irregularly developed, there being often only one scale. Some of the specimens have an indication of light brownish colour.

The lateral plates are rather broad and the peculiar feature that these plates appear double on the dorsal side of the arms, because the edge of the vertebra is seen below the lateral plate, as described by Eigil Nielsen (*Ophiurans from the Gulf of Panama, California, and the Strait of Georgia*. Papers from Dr Th. Mortensen's Pacific Expedition,

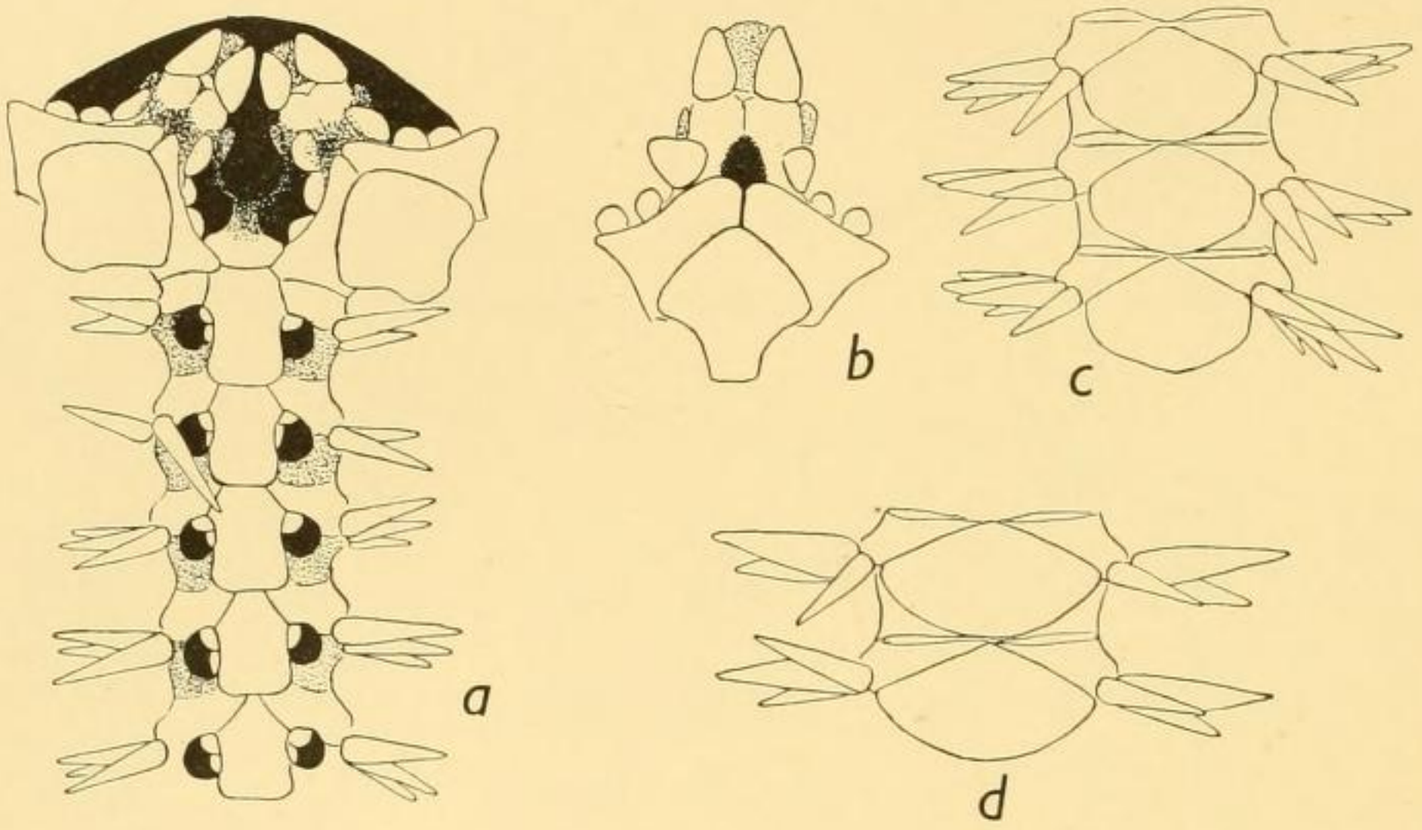

Fig. 25. *Ophionephthys magellanica*, n.sp. Part of oral side (*a*); mouthpart (jaw) of another specimen (*b*). Arm joints, dorsal side; joints 6–8 (*c*), and from middle of arm (*d*). ×20.

LIX, Vid. Medd. Dansk Naturh. Foren., 91, 1932, p. 265, figs. 7–8), is only just indicated here.

This species seems to be related to *Ophionephthys stewartensis*, Mortensen, from Stewart Island (Mortensen, Echinoderms of New Zealand and the Auckland-Campbell Islands. II, Ophiuroidea, p. 159), from which it is, however, very well distinguished by the shape of the buccal shields and the dorsal arm plates.

Amphipholis squamata (Delle Chiaje)

Amphipholis squamata, Ljungman, 1871. *Förteckning öfver uti Vestindien af Dr A. Goës samt under Korvetten Josefinas Expedition i Atlantiska Oceanen samlade Ophiurider*. Öfvers. K. Vetenskaps Akad. Förhandl. Stockholm, 1871, p. 633.

A. patagonica, Ljungman, 1871. *Ibid.*, p. 646.

Amphiura squamata, Koehler, 1908. Scott. Nat. Antarct. Exped. Astéries, Ophiures et Echinides, p. 607.

Amphipholis patagonica, Ludwig, 1898. *Die Ophiuren d. Sammlung Plate*. Zool. Jahrb., Suppl., p. 764.

A. patagonica, Koehler, 1923. Swedish Antarct. Exped. Astéries et Ophiures, p. 113, pl. xiv, figs. 11–12.

A. squamata, Bernasconi, 1926. *Una Ofiura vivipara de Necochea*. An. Mus. Nac. Hist. Nat. Buenos Aires, XXXIV, p. 146, Lam. i–iii.

A. squamata, Mortensen, 1933. Danish 'Ingolf' Exped. Ophiuroidea, p. 63.

St. 4. 30. i. 25. Off Tristan da Cunha, 40–46 m. 1 specimen.
St. 399. 18. v. 30. Off SW point of Gough Island, 102–141 m. 10 specimens.
St. 724. 16. x. 31. Fortescue Bay, Straits of Magellan, 0–5 m. 1 specimen.
St. 941. 20. iii. 32. 40° 53′ S, 174° 47′ E, Cook Strait, New Zealand, 128 m. 2 specimens.
St. 1187. 18. xi. 33. Off Tristan da Cunha, 117–106 m. Several specimens.
St. WS 762. 16. x. 31. 43° 50′ S, 65° 05′ W, 65–67 m. 1 specimen.

I do not see any possibility of distinguishing the *Amphipholis* from the Magellanic region from the cosmopolitan *A. squamata*. Studying the descriptions given of *A. patagonica* I cannot find any other differences pointed out than that the scales of the dorsal side of the disk are somewhat coarser in *A. patagonica*. But in this regard specimens of *A. squamata* vary rather considerably, so that it is impossible to base a specific distinction upon this character. A direct comparison of the fine specimen from the Magellan Strait (St. 724), the type locality of *A. patagonica*, with specimens of *A. squamata* from England or Iceland does not reveal any difference at all. Nobody would be able to distinguish specimens from the Magellanic region from *A. squamata*, if subjected to him for identification without knowing whence they came. The only reasonable course then is to give up a "species" which cannot be distinguished, and acknowledge it as identical with the cosmopolitan *A. squamata*.

Amphipholis nudipora, Koehler

Amphipholis nudipora, Koehler, 1914. Meeresfauna Westafrikas. Echinoderma, p. 193, pl. viii, figs. 15–16.

St. 279. 10. viii. 27. Off Cape Lopez, French Congo, 58–67 m. 3 specimens.

Like the specimens on which Koehler based his description of this species, the present specimens lack the disk, the character of which thus still remains unknown. But the characters of the mouth frame and the arms are quite sufficient for recognizing this very distinct species.

Ophiostigma abnorme (Lyman)

Ophiocnida abnormis, Lyman, 1878. *Ophiurans and Astrophytons. Rep. Dredging Operations of the U.S. Coast Survey Steamer 'Blake'*. Bull. Mus. Comp. Zool., v, 9, p. 227, pl. ii, figs. 37–9.
Ophiostigma africanum, Lyman, 1879. *Ophiuridae and Astrophytidae of H.M.S. 'Challenger'*. Bull. Mus. Comp. Zool., vi, 2, p. 41, pl. xiii, figs. 368–70.
Ophiocnida abnormis, Lyman, 1882. Sci. Results H.M.S. 'Challenger'. Ophiuroidea, p. 155.
Ophiostigma africanum, Lyman, 1882. *Ibid.*, p. 165, pl. xviii, figs. 17–19.
Amphipholis abnormis, Verrill, 1899. *North American Ophiuroidea*. Trans. Conn. Acad., x, p. 316.
Ophiostigma africanum, Koehler, 1909. Echinodermes. Camp. Sci. Monaco, xxxiv, p. 168.
Ophiocnida abnormis, Koehler, 1914. Meeresfauna Westafrikas. Echinoderma, p. 186.
Amphipholis abnormis, H. L. Clark, 1915. Cat. Recent Ophiurans, p. 240.
Ophiostigma africanum, H. L. Clark, 1915. *Ibid.*, p. 243.

St. 1. 16. xi. 25. Clarence Bay, Ascension, 16–27 m. 6 specimens.

I do not see any possibility of distinguishing Lyman's *Ophiostigma africanum* from his *Ophiocnida abnormis*. This may sound rather peculiar, since they are referred to two separate genera; but, as set forth by Verrill (*op. cit.*), the genus *Ophiocnida* as used by

Lyman is a very heterogeneous assemblage, and his *O. abnormis* does not agree with the typical *Ophiocnida*, which is characterized by having three equal-sized mouth papillae, as in *Amphiodia*. The mouth papillae of the species *abnormis* are exactly as in *Amphipholis*, the outer papilla being very broad and flat, and Verrill therefore transferred this species to the genus *Amphipholis*, in which he is followed by H. L. Clark. But exactly the same type of mouth papillae is found also in the genus *Ophiostigma* of Lütken. The question is then how to distinguish between *Amphipholis* and *Ophiostigma*. As a matter of fact, I do not find any other distinction mentioned between them than the existence of spines on the disk in the latter, these being absent in *Amphipholis*. This is a rather unimportant character, and we might thus far maintain *Amphipholis* and *Ophiostigma* to be identical. However, this would lead to the very deplorable result that *Ophiostigma* as the older name would have to supplant the very well known and now generally accepted name *Amphipholis*. I therefore think it necessary to maintain the name *Ophiostigma* for the group of species of the *Amphipholis* type with spines on the disk, just as *Ophiocnida* is kept for the species of the *Amphiodia* type with spines on the disk. Also the peculiar spine-like tentacle-scales appear to form a valuable generic character of *Ophiostigma*.

This species has separate sexes and is apparently not viviparous; I have not seen female gonads, the only two adult specimens, 2·5–3 mm. in diameter of disk, being males, the others not yet having the gonads developed.

The species was not hitherto known from Ascension, but being found in the West Indies and on the African coast, it was to be expected that it would occur there.

Amphioplus acutus, n.sp.

(Plate VIII, fig. 14)

St. 180. 11. iii. 27. Schollaert Channel, Palmer Archipelago, 160 m. 5 specimens.
St. 181. 12. iii. 27. Schollaert Channel, Palmer Archipelago, 160–335 m. Several specimens.
St. 182. 14. iii. 27. Schollaert Channel, Palmer Archipelago, 278–500 m. 4 specimens.
St. 190. 24. iii. 27. Bismarck Strait, Palmer Archipelago, 315 m. 1 specimen.

Diameter of disk up to 9 mm.; arms slender, about seven to eight times the diameter of disk. The outline of the disk is usually pentagonal, the interradial edges straight or at most gently concave.

The disk is covered by rather large, imbricating scales, among which the primary plates are not very distinctly seen. In the interradii the scaling of the underside generally continues some distance on the dorsal side, forming a rather well limited area because the scales here imbricate in the opposite direction to that of the scales of the dorsal side of the disk. The radial shields are narrow, straight, diverging, widely separated in their whole length; they are a little more than one-third the disk radius. The ventral interradii are covered throughout by small, more or less rounded scales, much finer than those of the dorsal side of the disk.

Buccal shields almost quadrangular, with inner and lateral angles almost right, but the distal angle rounded; the sides, particularly the inner ones, straight. The madreporite is usually conspicuous, with an irregular circle of very distinct pores, each on a

slight elevation, the more distinct as its colour is lighter than the general colour of the plate. Adoral plates not prolonged outwards so as to separate the first lateral plate from the buccal shield. The jaws are rather elongate. The mouth papillae are four (five) on each side; the outermost one is small, scale-like, the two following ones long and pointed, spine-like; the infradental papillae are small, sometimes somewhat irregular; also the papilla of the first mouth tentacle may be double.

The first ventral plate is small, with somewhat rounded distal edge; the following ventral plates slightly contiguous, somewhat broader than long, with lightly convex outer edge; the outer corners rather sharp. Dorsal arm plates broader than long, biconvex. Arm spines four, slender, conical, pointed, smooth. Tentacle scales typically two, but the one along the ventral plate often much smaller than the outer scale or totally lacking. Colour in alcohol dark grey.

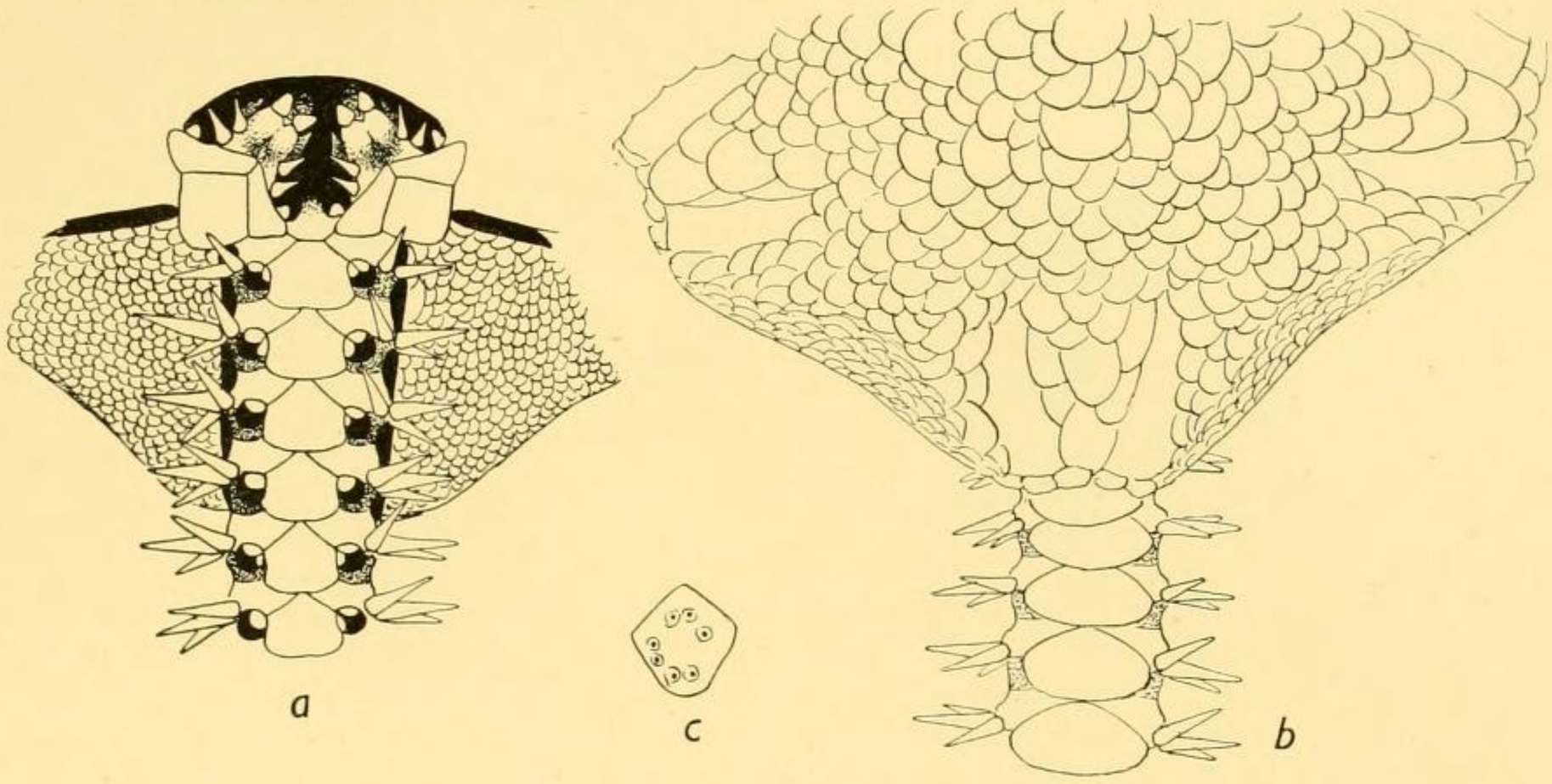

Fig. 26. *Amphioplus acutus*, n.sp. Part of oral side (*a*) and dorsal side (*b*). Madreporite (*c*). ×12.

One specimen, St. 181, has only four rays.

The species has separate sexes and is not viviparous.

In the elongate, pointed mouth papillae this species differs conspicuously from the other Antarctic species of *Amphioplus* (or *Amphiodia*). The same character is found in *Amphioplus gastracanthus* (Lütken and Mortensen) and *A. notacanthus* (Lütken and Mortensen) (Ophiuroidea of the Albatross Expedition, 1891, pl. xiii, figs. 4, 7); but these species are in other respects so different from the present species that there is hardly any close affinity between them. In *A. dispar* (Koehler) ('Investigator' Ophiuroidea, 1, pl. x, fig. 81) one of the distal mouth papillae is long and spiniform; but this species otherwise has no resemblance to the present species.

To this species I must refer also some young specimens, up to 2·5 mm. diameter of disk, from St. 182. They differ conspicuously from the typical adult *Amphioplus acutus* in having only a single (but slender, spiniform) outer mouth papilla, and in having only three arm spines (exceptionally a joint here and there may have four spines). Otherwise

they agree completely with *A. acutus*, and as I find specimens of 3 mm. diameter of disk with the mouth papillae typically developed as in the adults, but still with only three arm spines, I cannot have any doubt but that these young specimens are actually the young *Amphioplus acutus*; the spiniform outer mouth papilla is thus the first to develop, and the species is passing through an *Amphiura* stage. It may be added that I have ascertained that gonads have not yet appeared in these young specimens.

Amphioplus aciculatus, n.sp.

St. 279. 10. viii. 27. Off Cape Lopez, French Congo, 58–67 m. 2 specimens.

Diameter of disk 2 mm.; arms apparently about four to five times the diameter of disk.

Scales of the dorsal side of disk coarse, with their free edge slightly raised. There is a very conspicuous but somewhat irregular rosette of primary plates. The radial shields

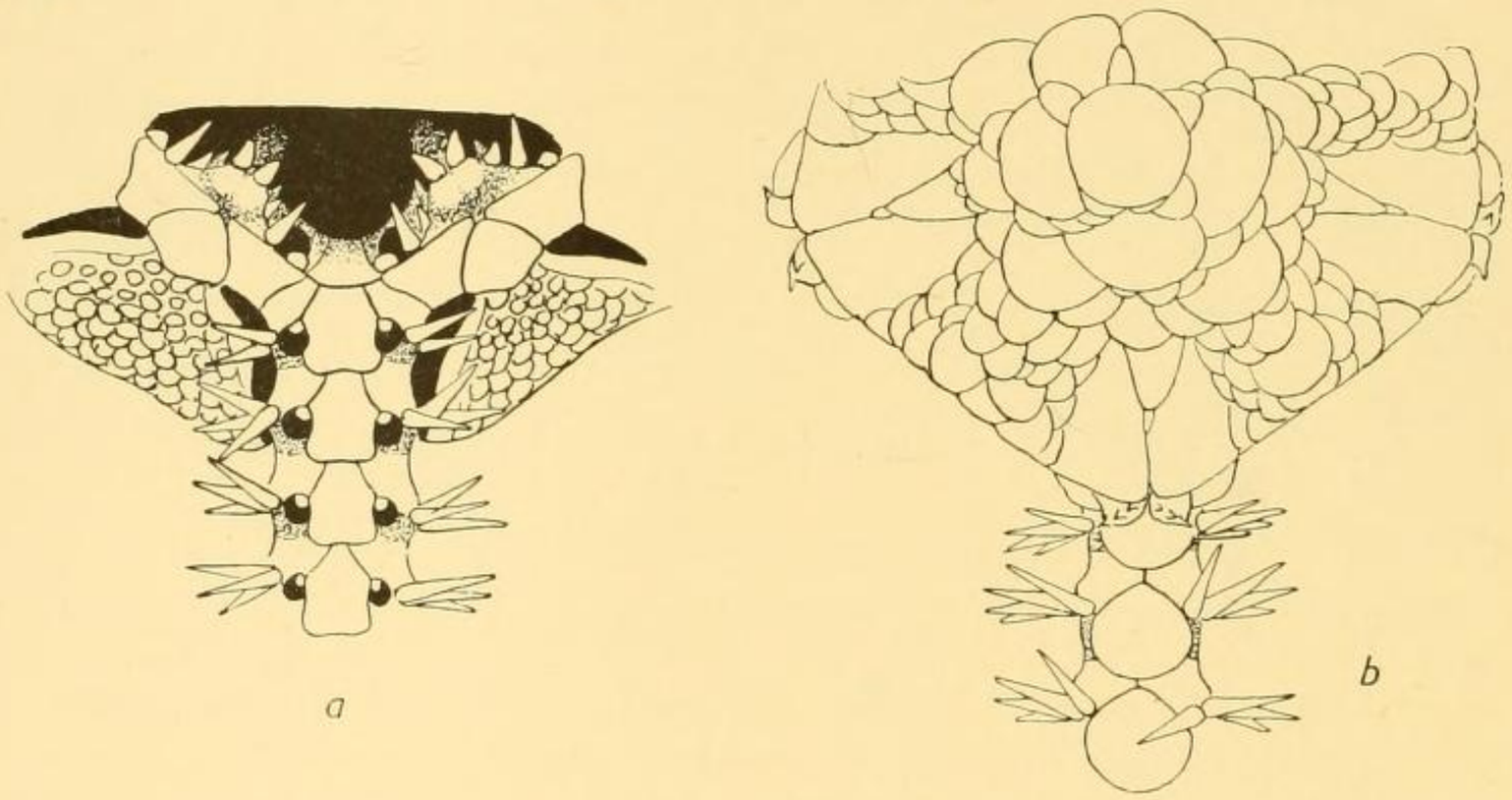

Fig. 27. *Amphioplus aciculatus*, n.sp. Part of oral side (*a*) and dorsal side (*b*). ×25.

are rather broad, about half the length of the disk radius, and contiguous in their distal half.

Outside the radial shields there is a rounded, knob-shaped plate which carries one to three small hyaline thorns. The ventral interradii are in one specimen somewhat sparsely covered with rounded scales, in the other almost naked. The buccal shields are rounded triangular, though with a small rounded outer lobe. The adoral plates are of rather unusual shape, with a straight inner side and a very broad outer lobe, widely separating the first lateral plate from the buccal shield. The outermost mouth papilla is small, scale-like, the second long, pointed, spine-like; the third is short, slightly pointed. The infradental papillae of moderate size, a little pointed. First ventral plate rather large, with convex distal edge. The following ventral plates distinctly longer than broad, contiguous, with sides and outer edge forming a slight re-entrant curve. Dorsal arm plates almost circular, not contiguous. Arm spines four, on the proximal joints, very slender and pointed. One small tentacle scale. No indication of particular colour.

Both specimens have the mouth very widely open. The disk is partly loosened from the arms and has contracted a little so as to become somewhat concave. The species appears to be liable to lose its disk.

This species appears to be the nearest related to the Japanese species *Amphiodia digitula* of H. L. Clark (North Pacific Ophiurans, p. 162, fig. 70; Matsumoto, Monograph of Japanese Ophiuroidea, p. 199, fig. 54) in which there is likewise a small spiny plate outside the radial shields. That the latter is referred to the genus *Amphiodia*, the present species to *Amphioplus*, is no serious objection to regarding them as related, the distinction between these genera not being sharp. As pointed out by Matsumoto the mouth papillae of *A. digitula* approach those of *Amphioplus*, and the present species might perhaps rather be referred to *Amphiodia*—it all depends on how strictly we limit those genera according to the number of the mouth papillae.

The character of the mouth papillae of the present species also recalls *Amphioplus acutus* (cf. Fig. 26 *a*, p. 295), but evidently there is no near relation between these two species.

Possibly the specimens in hand are only young ones; as they have been dried the condition of the genital organs cannot be ascertained.

Amphioplus peregrinator, Koehler

(Plate VII, figs. 12–15)

Amphioplus peregrinator, Koehler, 1912. II[e] Expéd. Antarct. Française. Echinodermes, p. 135, pl. xi, figs. 5, 11–12.

St. 175. 2. iii. 27. Bransfield Strait, South Shetlands, 200 m. 1 specimen.
St. 180. 11. iii. 27. Schollaert Channel, Palmer Archipelago, 160 m. 6 specimens.
St. 181. 12. iii. 27. Schollaert Channel, Palmer Archipelago, 160–335 m. 1 specimen.
St. 182. 14. iii. 27. Schollaert Channel, Palmer Archipelago, 278–500 m. 1 specimen.
St. 186. 16. iii. 27. Fournier Bay, Anvers Island, Palmer Archipelago, 295 m. 1 specimen.
St. 187. 18. iii. 27. Neumayr Channel, Palmer Archipelago, 259–354 m. 2 specimens.
St. 190. 24. iii. 27. Bismarck Strait, Palmer Archipelago, 98–130 m. 6 specimens.

There can be no doubt about the identity of these specimens with Koehler's *Amphioplus peregrinator*, described (*op. cit.*) from a single specimen collected by the 'Pourquoi-Pas?'. Some additional information may be gathered from these specimens, the largest of which reach a diameter of disk of *ca.* 11 mm. The incision in the interradial edges of the disk is not a constant character of the species; on the contrary, the disk, particularly in the larger specimens, often bulges out interradially, and may be considerably swollen. The proximal ventral plates are usually somewhat elevated. The arm spines are often four on the proximal joints in the larger specimens. The primary disk plates are usually very conspicuous, particularly in the young specimens.

The specimen from St. 182 shows distinct traces of colour; the ventral side of the arms and the adoral shields are a conspicuous orange, the same colour being also found on the radial shields and the primary plates of the disk. Also in dried specimens these plates may stand out lighter against the general dark grey colour of the disk. In the

specimen from St. 182 the dorsal side of the arms also shows a faint trace of orange colour.

The species has separate sexes, and is not viviparous.

The type specimen was taken at Port Lockroy, Palmer Archipelago, 70 m.; the species is thus as yet known only from the Palmer Archipelago and South Shetlands, 70–*ca.* 300 m.

From St. 182 there are a number of very young Ophiurids, which are not identifiable with certainty; but there are indications that they would have developed into Amphiurids, and not improbably *Amphiura peregrinator*. Unfortunately, the intermediate stages are lacking, so that certainty cannot be reached, and it seems, therefore, not desirable to give a description of these young specimens, the general appearance of which is not at all Amphiurid-like.

Family OPHIOCHITONIDAE

Ophionereis sexradia, n.sp.

St. 283. 14. viii. 27. Off Annobon, Gulf of Guinea, 18–30 m. 9 specimens.

Diameter of disk of largest specimen 6 mm.; arms six, about four times the diameter of the disk.

Scales of dorsal side of disk very small, but distinct, imbricating; they are slightly larger round the radial shields, which latter are small, about one-quarter the length of the disk radius, oval, separated by several rows of scales. No primary plates discernible. The ventral interradii look as if they were naked in the proximal half; in reality they are scale-covered throughout, as can be substantiated in dried specimens, but the skin is more or less conspicuously dark coloured in this proximal part, which conveys the impression that it is naked. Buccal shields spade-shaped, with a short, rounded distal lobe. Adoral plates narrow, but joining within. Usually four equal-sized mouth papillae on each side of jaw. Ventral arm plates somewhat longer than broad, contiguous, with convex distal edge and sides with a re-entrant curve. Dorsal arm plates broadly contiguous, somewhat longer than broad, with nearly straight distal edge. The supplementary plates of moderate size, but quite distinct. Three slender, equally long arm spines, slightly curved and flattened, of about the length of an arm joint. One large, oval tentacle scale. Colour in alcohol: the disk light greenish, with an elongate brownish spot at the base of each arm. Underside whitish, apart from the above mentioned dark proximal part of the interradii, this colour being evidently due to the stomach shining through the delicate body wall. Arms (and spines) whitish, or cream-coloured, with an irregular band of brownish on every fifth to sixth joint, the intervening part dotted with small brownish spots, in the main arranged in two longitudinal series.

Although in regard to the configuration of the plates and its general characters this species does not differ markedly from the other known species of the genus *Ophionereis*, it does so by having six arms, all the other species having five arms. Moreover, it appears

to practise self-division, three of the specimens in hand having the three arms in regeneration. This is not known to be the case in any other species of *Ophionereis*, as, indeed, self-division does not normally occur in five-armed Ophiurids. The fact that only three specimens out of nine show any trace of self-division indicates that this method of propagation is not constant, but evidently occurs only in a certain percentage of the specimens; still it is common enough to be regarded as a normal feature of the species.

In his memoir on the Echinoderms in Michaelsen's Meeresfauna Westafrikas Koehler does not record any species of *Ophionereis* from the African coast. Evidently he overlooked that Marktanner-Turneretscher (*Beschreibungen neuer Ophiuriden und Bemerkungen zu bekannten*. Ann. K. K. Naturhist. Hofmuseums, II, 1887, p. 301) has

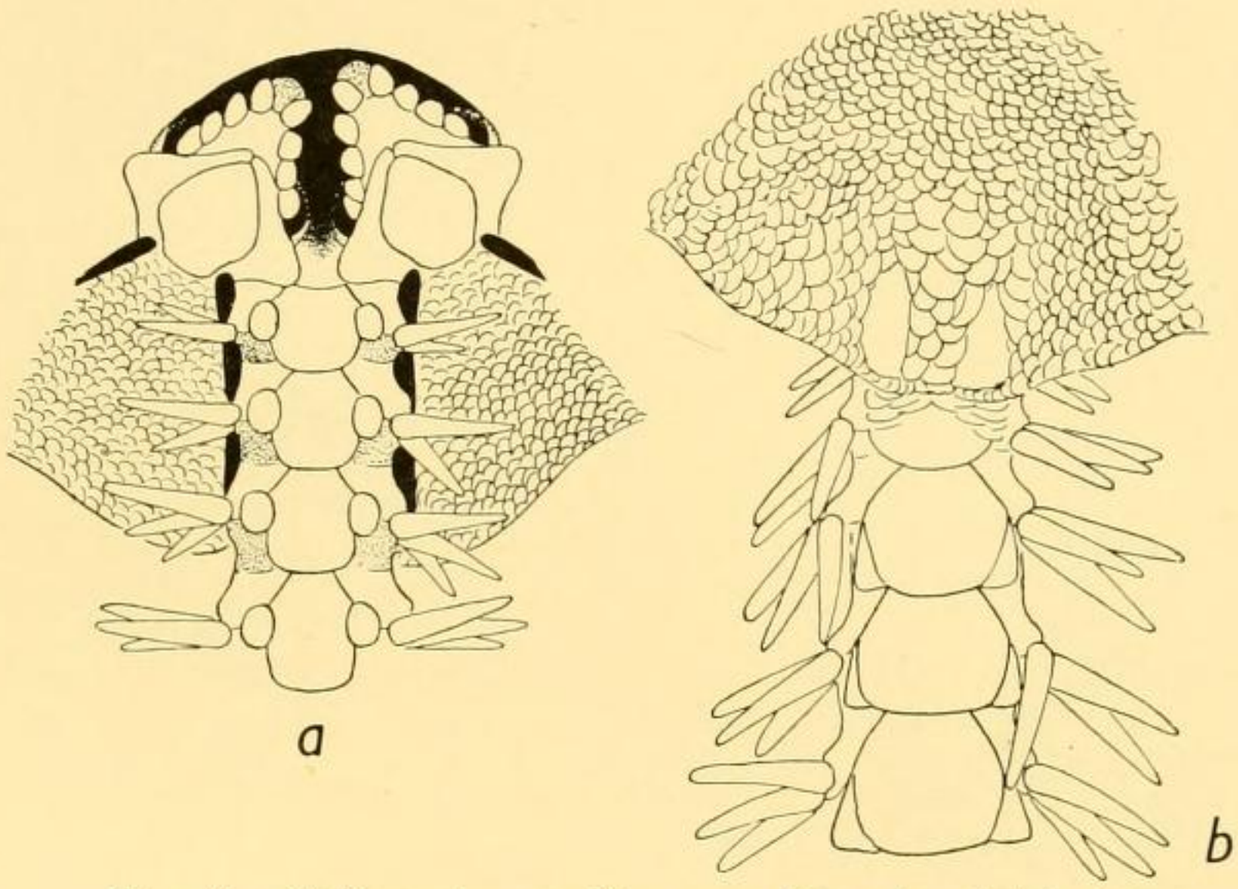

Fig. 28. *Ophionereis sexradia*, n.sp. Part of oral side (*a*) and dorsal side (*b*). ×20.

recorded a small specimen of *Ophionereis reticulata* from "Westafrika". It appears, however, that there must be some error in regard to this specimen. The locality given for it, 0° 7′ N, 23° 25′ W, is about in the middle of the Atlantic Ocean in very great depths. That an *Ophionereis reticulata* (or any other *Ophionereis*) should occur here may well be said to be out of the question, and the label of this specimen must evidently be wrong. If *Ophionereis reticulata* does actually occur off West Africa it is rather strange that it has not hitherto been met with there. At any rate, *Ophionereis sexradia* is the first species of *Ophionereis* that has been actually found to occur on the West African coast.

Ophionereis novae-zelandiae, n.sp.

St. 934. 17. viii. 32. 34° 11′ S, 172° 10′ E, Cook Strait, New Zealand, 98 m. 1 specimen.

Diameter of disk 4 mm.; arms *ca.* 30 mm. long, thus some seven to eight times the diameter of disk.

Scales of the dorsal side of disk rather coarse, uniform; the primary plates are small, but distinct, and form a fairly conspicuous rosette. The radial shields are small, oval,

scarcely one-third of the disk radius. The scales of the ventral interradii of the same size as those of the dorsal side of disk, rather thick. Buccal shields spade-shaped, with rounded corners and a small rounded outer lobe. Adoral plates narrow, joining within, with a conspicuous outer lobe separating the first lateral plate from the buccal shield. Mouth papillae as usual in *Ophionereis*. First ventral plate squarish, but broader distally. The following ventral plates broadly contiguous, about as broad as long, with convex outer edge and sides with a re-entrant curve. The outer corners not much produced. Dorsal arm plates rather squarish, with sides and distal edge almost straight.

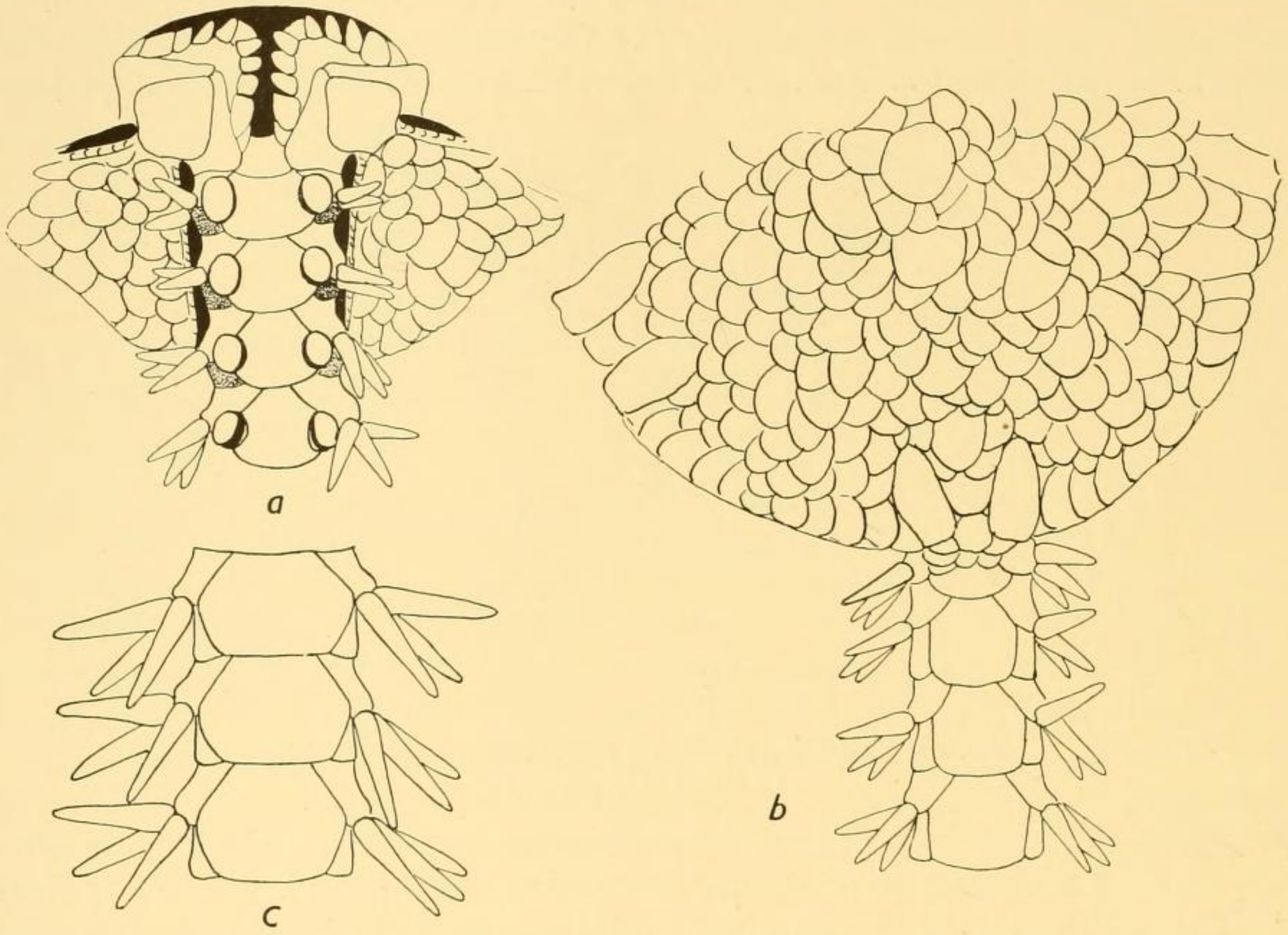

Fig. 29. *Ophionereis novae-zelandiae*, n.sp. Part of oral side (*a*) and dorsal side (*b*). ×22·5. Arm joints from middle of arm of a larger specimen; dorsal side (*c*). ×20.

The supplementary plate fairly large and distinct, almost rectangular in the proximal part of the arm. Three slender arm spines, about the length of an arm joint. One large, oval tentacle scale. Colour of dried specimen whitish, with a faint indication of brownish bands on the arms.

This species is about intermediate between *Ophionereis porrecta*, Lyman, and *O. australis* (H. L. Clark). From the former it differs notably in the shape of both dorsal and ventral arm plates. The arm spines also are longer and more slender than in *O. porrecta*, and the colour is lighter. From the South African *O. australis* it differs in the disk scales being smaller and more uniform; the shape of the dorsal plates and the supplementary plates is also rather different (cf. Mortensen, Echinoderms of South

Africa, fig. 77, p. 375). On the whole, in spite of the unfortunate fact that only a single specimen is at hand, and we thus do not know whether it is adult or only a young specimen, there can be no doubt that it is a distinct species, the genus *Ophionereis* being thus represented by two species in New Zealand seas. To the other New Zealand species, *Ophionereis fasciata* (Hutton), the present species is not closely related.

Family OPHIODERMATIDAE

Pectinura cylindrica (Hutton)

Pectinura cylindrica, Mortensen, 1924. *Echinoderms of New Zealand and the Auckland-Campbell Islands.* II, *Ophiuroidea.* Papers from Dr Th. Mortensen's Pacific Exped., xx (Vid. Medd. Dansk Naturh. Foren., 77), p. 172, figs. 35, 1–2.

P. cylindrica, Mortensen, 1925. *Ibid.*, III–V, p. 391.

For earlier literary references, see my paper of 1924, *loc. cit.*

St. 941. 20. iii. 32. 40° 53′ S, 174° 47′ E, Cook Strait, New Zealand, 128 m. Numerous specimens.

I may recall the fact that the species is viviparous and hermaphrodite (*op. cit.*, 1925).

Ophioderma longicauda, var. guineense, Greeff

Ophioderma guineense, Greeff, 1881. *Echinodermen beobachtet auf einer Reise nach der Guinea-Insel São Thomé.* Zool. Anzeiger, v, p. 156

O. longicauda, var. *guineense*, Koehler, 1914. Meeresfauna Westafrikas. Echinoderma, p. 173, pl. ix, figs. 1–3.

St. 283. 13. viii. 27. Off Annobon, Gulf of Guinea, 18–30 m. 4 specimens.

I quite agree with Koehler that this form from the Gulf of Guinea is not sufficiently different from the West Atlantic and Mediterranean *O. longicauda* to rank as a separate species. It may even be doubted whether it deserves the rank of a separate variety. But it is not the place here to enter on a detailed study of this question.

Family OPHIOLEPIDAE

Ophiozonella falklandica, n.sp.

St. WS 212. 30. v. 28. 49° 22′ S, 60° 10′ W, 242 m. *ca.* 10 adult specimens, and a great number of young ones.

St. WS 244. 18. vii. 28. 52° 00′ S, 62° 40′ W, 253 m. Several specimens.

St. WS 818. 17. i. 32. 52° 31′ S, 63° 25′ W, 272–278 m. 4 specimens.

St. WS 819. 17. i. 32. 52° 45′ S, 62° 27′ W, 329–242 m. 4 specimens.

St. WS 820. 18. i. 32. 52° 53′ S, 61° 51′ W, 351–367 m. 6 specimens.

St. WS 821. 18. i. 32. 52° 56′ S, 60° 55′ W, 461–468 m. 1 specimen.

St. WS 839. 5. ii. 32. 53° 30′ S, 63° 29′ W, 403–414 m. 1 specimen.

St. WS 871. 1. iv. 32. 53° 16′ S, 64° 12′ W, 336–341 m. 1 specimen.

Diameter of disk of largest specimen 10 mm.; arms rather robust, scarcely exceeding three times the diameter of disk.

Dorsal side of disk covered with coarse, but smooth scales, among which the primary plates are usually very conspicuous; in the younger specimens there are only some few

small plates in the corners between the primary plates, in larger specimens the primary plates are wholly separated by smaller plates. Generally there are two larger plates in the interradii. The radial shields are small, oval, widely separated by a series of two to three plates. The ventral interradii are covered by a varying number of plates, none of which are particularly conspicuous. The genital slits are narrow and short, not reaching beyond the end of the first lateral plate. The buccal shields are slightly irregular, with an acute inner angle; the inner sides concave, the outer edge convex; they may be distinctly longer than broad, or equally long and broad, there being thus a rather considerable variation in their shape. The adoral shields are short, broad distally, narrowing towards

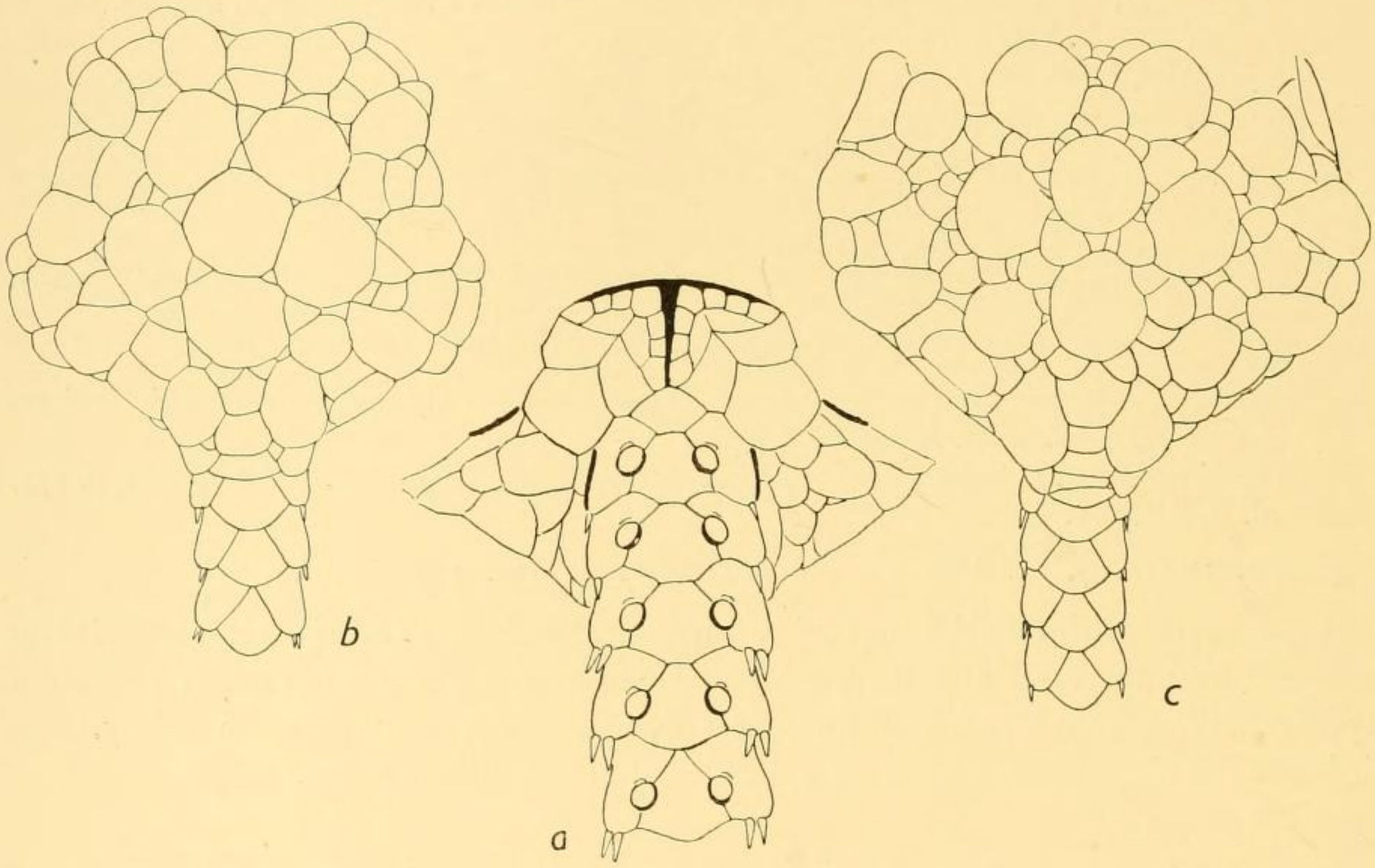

Fig. 30. *Ophiozonella falklandica*, n.sp. Part of oral side (*a*). ×12. Dorsal side of two different specimens (*b*, *c*). *b*, ×9; *c*, ×6.

the median line, where they join; sometimes, however, they are about equally broad in their whole length, almost square. There are three or four square mouth papillae; the teeth are broad, rounded.

First ventral plate broader than long, with rather sharp corners. The following ventral plates contiguous till some distance beyond the disk; their outer edge somewhat produced. Dorsal arm plates contiguous on the proximal three or four joints, with straight sides and strongly convex distal edge. Two short, conical arm spines, the lowermost the longer, not half the length of the arm joint. One large, oval tentacle scale. Colour of the preserved specimens whitish.

This species is viviparous, but *not* hermaphrodite. There is only one gonad at each bursa, placed interradially. Some of the larger specimens, 6–8 mm. diameter of disk,

were found to have the gonads purely female; one specimen of 5 mm. has the gonads of purely male character, in another specimen of the same size the gonads contain only young eggs. There is thus no sign that the species is a protandric hermaphrodite.

I have found two to three young ones in a bursa. They are rather robust, with only three short, thick arm joints, when ready to leave the mother. The ventral interradii are occupied almost wholly by the adoral shields, the buccal shield still lying on the dorsal side, which is otherwise covered only by the large primary plates. It is an interesting fact that the second mouth tentacle is here still lying wholly outside the mouth slits; the mouth papillae have not yet been formed (Fig. 31).

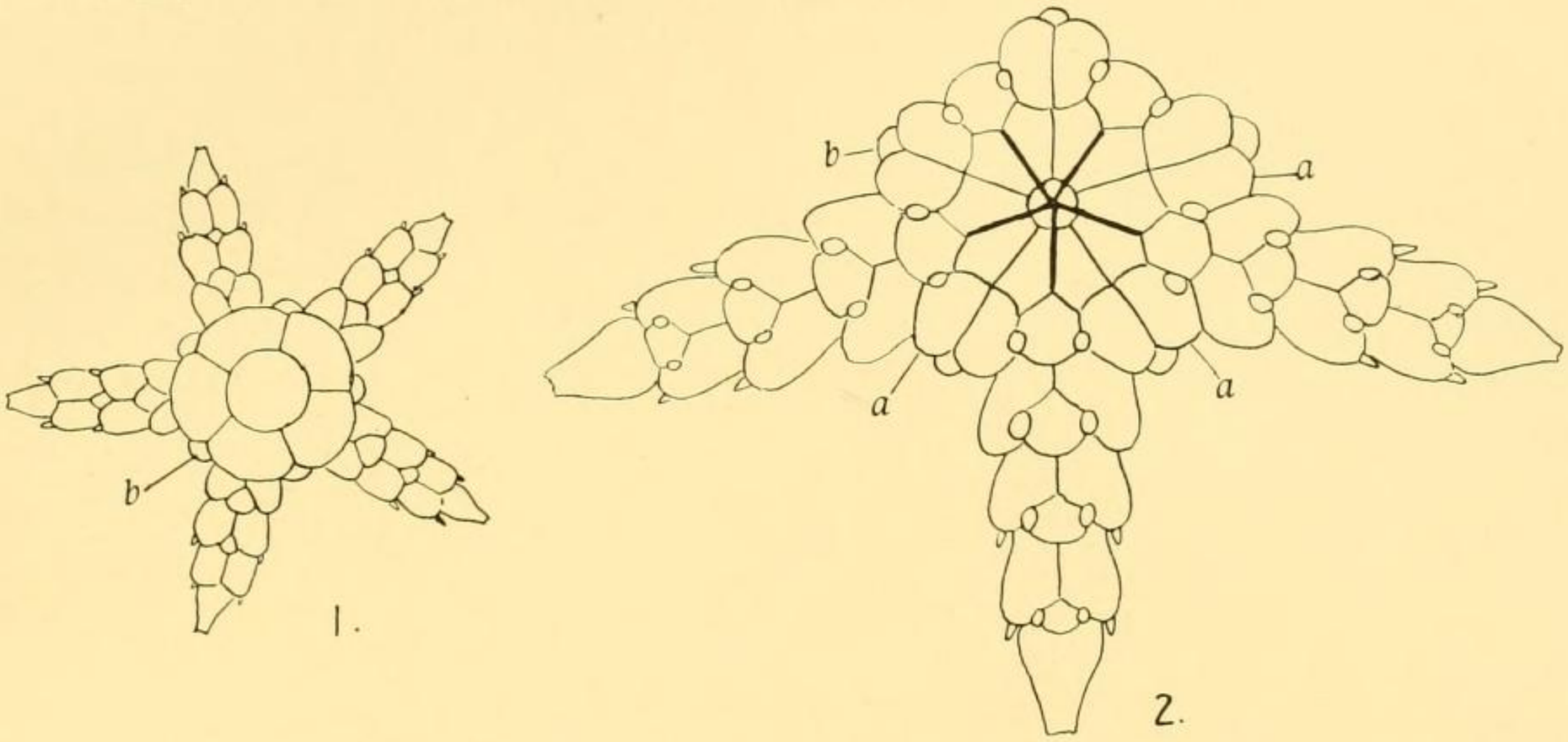

Fig. 31. *Ophiozonella falklandica*, n.sp. Young. 1, Dorsal side, ×15. 2, Oral side, ×30. *a*, Adoral plates. *b*, Buccal plate. Note that the tentacle scale at the first ventral plate has disappeared in the adult.

Ophiozonella alba (Lütken and Mortensen) ('Albatross' Ophiuroids, pl. vi, figs. 7–9) would seem to be the nearest relation of the present species, differing from it mainly in its longer arm spines, and in the arm joints being more constricted. Also the first ventral plate is characteristically different—much narrower than in *O. falklandica*.

Ophiozonella megaloplax, n.sp.

St. 939. 18. viii. 32. 35° 50′ S, 173° 28′ E, Cook Strait, New Zealand, 87 m. 1 specimen.

Diameter of disk 3 mm., arms *ca.* 7 mm. Dorsal side of disk covered with few large plates among which there is only an occasional small scale. No regular rosette of primary plates, the central plate can scarcely be made out. The radial shields are contiguous, only a single small scale wedged in between them proximally; a column of two broad scales in the interradii. The ventral interradii almost wholly covered by a single large plate joining the small, triangular buccal shield; beside this plate there are only the genital scales and a couple of plates distally. Adoral plates broadly joining within and with a conspicuous outer lobe separating the first lateral plate from the buccal shield. Four or five broad, square mouth papillae, the outermost one the largest. First ventral plate rhombic, merely in contact with the second; the following ventral plates

widely separated; their outer edge convex. The three proximal ones have their sides with re-entrant curves on account of the large, oval tentacle scale; from the fourth they are triangular, the tentacle scales being now smaller and placed at the lateral corners. The dorsal arm plates are triangular, widely separated. Only two short appressed arm spines. The genital slits show a slight proximal and distal widening; they end opposite the middle of the second lateral plate. The colour is a light greyish brown on the radial shields with the arms and the other disk plates whitish; also a couple of narrow whitish bands on the arms.

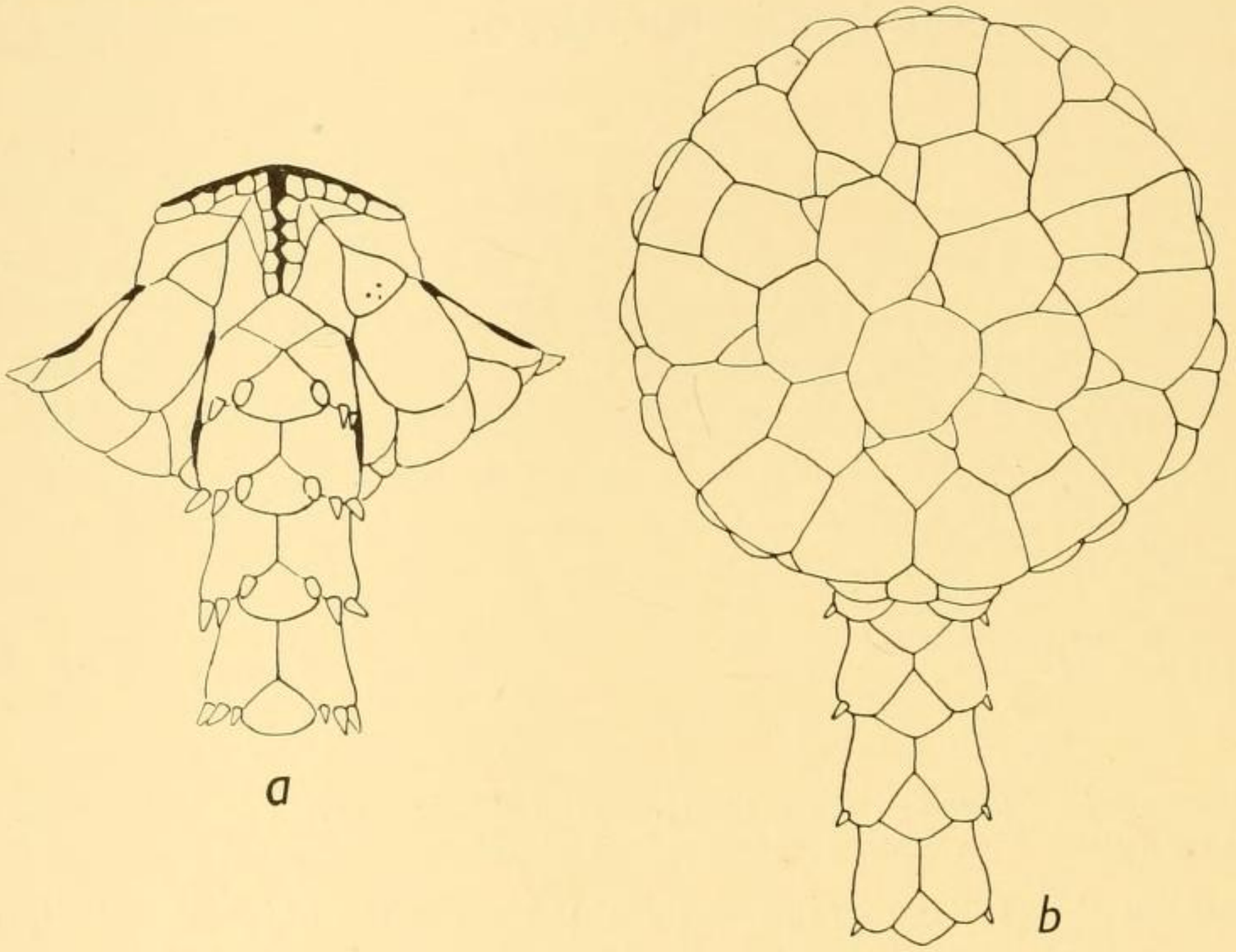

Fig. 32. *Ophiozonella megaloplax*, n.sp. Oral side (*a*) and dorsal side (*b*). *a*, ×22·5; *b*, ×20. The buccal plate with the three pores is the madreporite.

In particular, the covering of the ventral interradii distinguishes this species from all other known species of *Ophiozonella*, as also from *Ophiozonoida picta*, the only related species in New Zealand seas.

Ophiozonoida picta, H. L. Clark

Ophiozonoida picta, H. L. Clark, 1915. Cat. Recent Ophiurans, p. 340, pl. 18, figs. 3–4.
O. picta, Mortensen, 1924. *Echinoderms of New Zealand and the Auckland-Campbell Islands.* II, *Ophiuroidea*. Papers from Dr Th. Mortensen's Pacific Exped., xx (Vid. Medd. Dansk Naturh. Foren., 77), p. 168.

St. 934. 17. viii. 32. 34° 11′ S, 172° 11′ E, Cook Strait, New Zealand, 98 m. 4 specimens.

I have nothing to add to the descriptions of this beautiful little Ophiurid given in the two works quoted. One specimen was opened; it was found not to be viviparous.

Ophiolebella, n.g.

Disk covered with distinct, but irregular, not distinctly imbricating scales, among which the primary plates are not distinguishable. Generally some small granules are found on the plates or on the borders between the plates. Radial shields small, but distinct. Dorsal arm plates usually with a supplementary plate at the proximal edge. Mouth-papillae close-set, square. Teeth, no tooth papillae; there are only three teeth on each jaw. Pores of second mouth tentacles wholly within the mouth slits. Genital slits exceedingly short, scarcely 0·5 mm. long. Tentacle pores very small, covered by the small tentacle scales. Arm spines short, not much appressed. Arms often strongly inrolled.

Genotype: *Ophiolebes biscutifer*, G. A. Smith.

The reference of this characteristic species to the genus *Ophiolebes* I think quite unacceptable. In the shape of the mouth papillae in particular it is different from the typical *Ophiolebes* and this character seems to show conclusively that this little Ophiurid is no Ophiacanthid but an Ophiolepidid. The inrolling of the arms, of course, is unusual for an Ophiolepidid; but in *Ophioceres* also there is a tendency in this direction, and of its being an Ophiolepidid there can scarcely be any doubt. I think then that the present form belongs to the Ophiolepidae, but as a rather aberrant form, apparently not very closely related to any of the known genera, though in some degree recalling *Ophioceres*.

Ophiolebella biscutifera (G. A. Smith)

Ophiolebes biscutifer, G. A. Smith, 1923. *Report on the Echinoderms coll. during the voyage of the 'Quest'* (1921–2). Ann. Mag. Nat. Hist., 9 Ser., XII, p. 374.

St. 27. 15. iii. 26. West Cumberland Bay, South Georgia, 110 m. 9 specimens.
St. 39. 25. iii. 26. East Cumberland Bay, South Georgia, 179–235 m. 2 specimens.
St. 42. 1. iv. 26. Off mouth of Cumberland Bay, South Georgia, 102–104 m. Several specimens.
St. 123. 5. xii. 26. Off mouth of Cumberland Bay, South Georgia, 250 m. 2 specimens.
St. 140. 23. xii. 26. Stromness Harbour to Larsen Point, South Georgia, 122–136 m. Several specimens.
St. 144. 5. i. 27. Off mouth of Stromness Harbour, South Georgia, 178 m. 3 specimens.
St. 149. 10. i. 27. Mouth of East Cumberland Bay, South Georgia, 200–234 m. 3 specimens.
St. 152. 17. i. 27. 53° 51′ S, 36° 18′ W, South Georgia, 245 m. 6 specimens.
St. 156. 20. i. 27. 53° 51′ S, 36° 21′ W, South Georgia, 200–236 m. 5 specimens.
St. 159. 21. i. 27. 53° 48′ S, 36° 08′ W, South Georgia, 160 m. 3 specimens.
St. 160. 7. ii. 27. Off Shag Rocks, South Georgia, 177 m. Several specimens.
St. WS 840. 6. ii. 32. 53° 52′ S, 61° 49′ W, 368–463 m. 2 specimens (one 6-rayed).
St. MS 71. 9. iii. 26. East Cumberland Bay, South Georgia, 110–60 m. 1 specimen.

Referring to the description of this species given by G. A. Smith (*op. cit.*) I may confine myself to giving some additional remarks and some figures, Smith giving only a figure of the dorsal side.

The granules of the disk are exceedingly variable, as appears from the figures. Often there is a conspicuous group at the distal end of the radial shields, while other specimens show no granules at all, or only very few; but though the general appearance of such

naked specimens is very different from that of the grain-covered ones, there can be no doubt that they are only individual variations, the other characters being identical, and all intermediate stages being found. The supplementary dorsal plate may be very regularly developed, or it may be found only here and there (Fig. 33 *b*, *c*). The lateral plates may leave a space between them in the ventral midline, but the ventral plates remain just as widely separated as where the lateral plates join completely.

The genital slits vary somewhat in length, but they hardly exceed a length of 0·5 mm., and are often only half that length; there may be some granules at the slits. The adoral plates are excluded from the genital slits. The arm spines are three or four.

This species is viviparous and hermaphrodite, but not a protandric hermaphrodite. Even at a size of 3 mm. diameter the gonads are hermaphrodite. In such young specimens

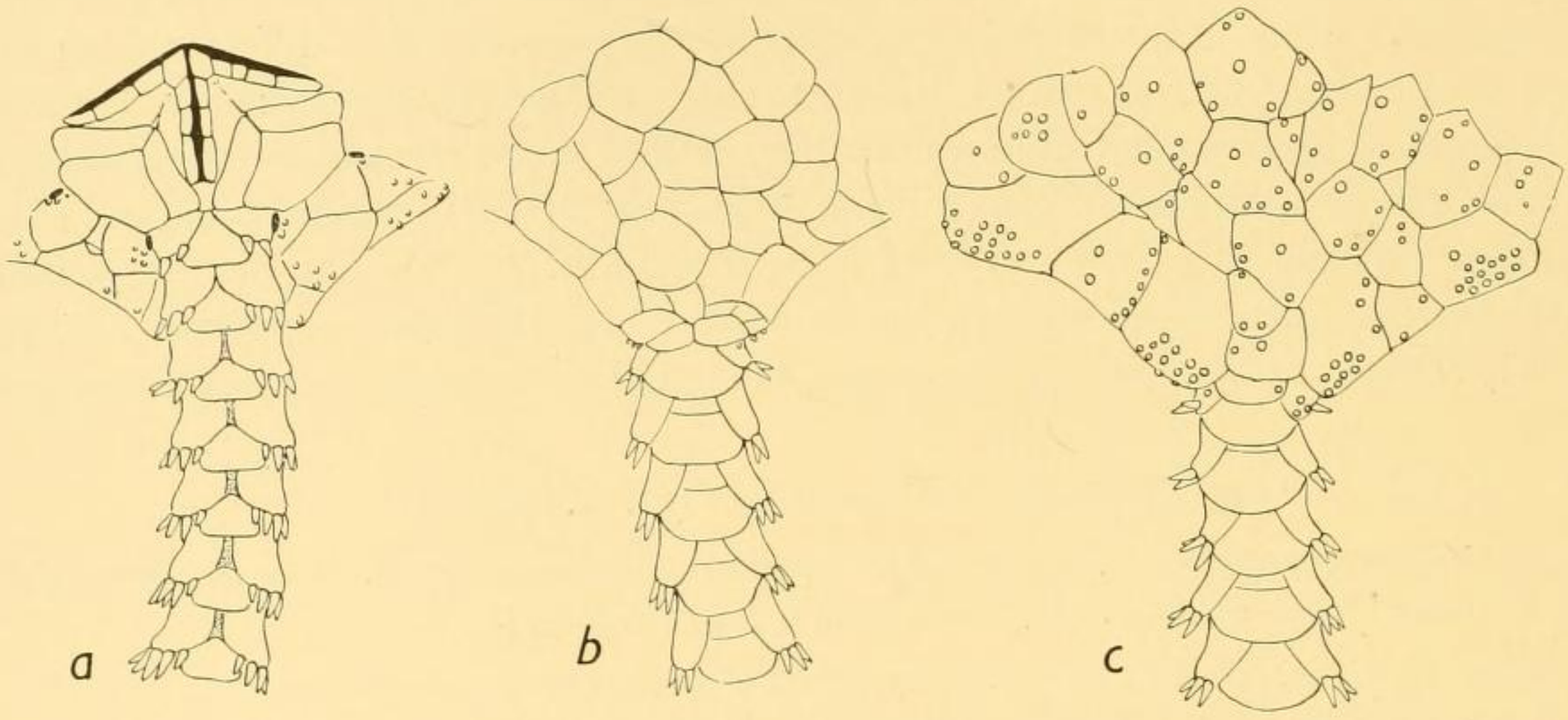

Fig. 33. *Ophiolebella biscutifera* (G. A. Smith). Part of oral side (*a*) and dorsal side (*b–c*) of two different specimens, one without, the other with granules. ×10.

there is only one gonad in each bursa, placed at the interradial side. At a size of 4 mm. diameter also an adradial gonad is present; this latter gonad would seem to be male at first, the young eggs appearing therein a little later than the sperm cells. At a diameter of 7 mm. there are two gonads at the interradial, one at the adradial side of the bursa, all of them containing both male and female genital products. At this size young ones are found in the bursae; I have found no more than three young ones in a specimen, but of an extraordinary size, up to 2 mm. in diameter of disk. It is difficult to imagine how such large young ones can get out through the minute genital slits, only 0·5 mm. long. What a squeezing they must undergo, in spite of their rather large, compact scaling. It would seem difficult enough for an arm alone of the young one to come out through the small slit—but such a large disk, and five radiating arms! It always makes one wonder, seeing the young ones in the bursae of viviparous Ophiurids so jammed together and distorted, how they can get clear of each other and assume normal radiate form. But the present case certainly seems to represent the climax of birth-difficulties

to the young ones—not to the mother, who must necessarily be entirely inactive, at most widening the genital slit as much as its small size allows.

One of the specimens 5·5 mm. in diameter from St. WS 840 has six arms. It looks rather different from the typical five-armed form. The buccal shields are much narrower, almost oval; the genital slits are somewhat longer, with a series of papillae along the edge. There is no supplementary plate to the dorsal arm plates. I think this specimen only an individual variation; the different shape of the buccal shields is, evidently, in the main due to the narrower space caused by the six rays. The other specimen from this same locality is rather intermediate between the six-rayed specimen and the common form in regard to the shape of the buccal shields.

Ophioceres incipiens, Koehler

(Plate VII, fig. 7.)

Ophioceres incipiens, Koehler, 1922. Austral. Antarct. Exped. Echinod. Ophiuroidea, p. 48, pl. lxxxiv, figs. 1–6, 13–14.
O. incipiens, Koehler, 1923. Swedish South Polar Exped. Astéries et Ophiures, p. 121.
O. incipiens, G. A. Smith, 1923. *Report on the Echinoderms coll. during the voyage of the 'Quest'* (1921–2). Ann. Mag. Nat. Hist., 9 Ser., xii, p. 370.
O. incipiens, Hertz, 1926. Deutsche Südpolar-Exped. Ophiuroiden, p. 25.

St. 27. 15. iii. 26. West Cumberland Bay, South Georgia, 110 m. 10 specimens.
St. 39. 25. iii. 26. East Cumberland Bay, South Georgia, 179–235 m. 1 specimen.
St. 42. 1. iv. 26. Off mouth of Cumberland Bay, South Georgia, 120–204 m. 10 specimens.
St. 140. 23. xii. 26. Stromness Harbour to Larsen Point, South Georgia, 122–136 m. 2 specimens.
St. 144. 5. i. 27. Off mouth of Stromness Harbour, South Georgia, 155–178 m. 8 specimens.
St. 152. 17. i. 27. 53° 51′ S, 36° 18′ W, South Georgia, 245 m. 6 specimens.
St. 156. 20. i. 27. 53° 51′ S, 36° 21′ W, South Georgia, 200–236 m. 8 specimens.
St. 159. 20. i. 27. 53° 48′ S, 36° 08′ W, South Georgia, 160 m. 4 specimens.
St. 160. 7. ii. 27. Off Shag Rocks, South Georgia, 177 m. 10 specimens.
St. 170. 23. ii. 27. Off Cape Bowles, Clarence Island, 342 m. Several specimens.
St. 175. 2. iii. 27. Bransfield Strait, South Shetlands, 200 m. 6 specimens.
St. 474. 12. xi. 30. 1 mile W of Shag Rocks, South Georgia, 199 m. 5 specimens.
St. MS 71. 9. iii. 26. East Cumberland Bay, South Georgia, 110–60 m. 1 specimen.

The specimen from St. 27 shows a very curious anomaly, two of the jaws being rudimentary (Plate VII, fig. 7).

It is a very interesting fact that often there is only one genital slit in some of the interradii.

This species is viviparous and hermaphrodite. In young specimens of *ca.* 5 mm. diameter of disk the gonads are male, but containing also quite young eggs. In specimens of *ca.* 7 mm. diameter I have found large young ones, one or two in each bursa (or gonad; cf. below). The young ones are rather large, 1·5 mm. in diameter of disk, and with five to six joints in the arms. As the genital slits are scarcely 1 mm. long, the young ones must change their shape considerably in order to get out, though the difficulties are not quite of the same order of magnitude as in *Ophiolebella biscutifera*.

After the birth of these young ones the parent specimen again turns mainly male, specimens of *ca.* 8–9 mm. diameter having the gonads full of sperms (or spermatogonia),

but with a new batch of young eggs. In the largest specimens, *ca.* 10 mm. diameter, I have found no young ones, but the ovaries filled with a number of large eggs (fifteen to twenty in each ovary). There may be one or two gonads at each side of the bursa; particularly when there is only one gonad at each side, these are greatly developed, looking like small, thick sausages, and filling up the disk almost completely. The bursae are seen distinctly, compressed between the gonads and empty, and it is certain that the eggs are lying in the gonads, not in the bursae. This seems to indicate that the development in this species is intra-ovarial (in the younger specimens it could not be ascertained whether the young ones are lying in the bursae or in the ovaries); in any case it is inexplicable how all these eggs could possibly get into the bursae. But, as it would seem, it is no less inexplicable how all these numerous eggs (or embryos) find room within the disk of the parent specimen, if they are going to develop to the same size as the young ones found in the specimens of *ca.* 7 mm. In these largest specimens the gonads appear to be purely female.

The species is thus not to be characterized as simply a protandric hermaphrodite; it is at first mainly male, then a breeding female, then again mainly male, and finally purely female.

Ophiolepis paucispina (Say)

Ophiolepis paucispina, Lütken, 1859. Additamenta ad hist. Oph., II, p. 204, Tab. ii, fig. 2.
O. paucispina, Koehler, 1914. Meeresfauna Westafrikas. Echinoderma, p. 177, pl. ix, fig. 14.

St. 283. 14. viii. 27. Off Annobon, Gulf of Guinea, 18–30 m. 1 specimen.

Attention should be called to the fact that this specimen has sometimes two, sometimes three arm spines, two being the normal number of spines in this species. Perhaps this is a character proper to the African specimens, which, if so, might be regarded as a variety of the typical West Indian form.

Ophiogona Döderleini (Koehler)

Ophioglypha Döderleini, Koehler, 1901. Result. Voyage 'Belgica'. Echinides et Ophiures, p. 19, pl. v, figs. 34–6.
O. Döderleini, Koehler, 1907. *Revision de la collection des Ophiures du Mus. d'Hist. Nat. Paris.* Bull. Sci. France Belgique, XLI, p. 293.
Ophiomaria Döderleini, A. H. Clark, 1916. Ophiomaria, *a new genus of Ophiurans from Southern South America and the adjacent portion of the Antarctic Continent.* Journ. Washington Acad. Sci., VI, p. 385.
O. Döderleini, Koehler, 1923. Swedish Antarct. Exped. Astéries et Ophiures, p. 126.

St. 177. 5. iii. 27. 27 miles SW of Deception Island, South Shetlands, 1080 m. 6 specimens.
St. 196. 3. iv. 27. Bransfield Strait, South Shetlands, 720 m. 1 specimen.

To the description of this species given by Koehler I may add a few remarks. Koehler states that the distal edge of the buccal plates is convex, and it is so represented in his fig. 35. I find it to be straight, or even slightly concave, as shown in Fig. 34 *a*. Further I find the shape of the dorsal and ventral plates somewhat different from that shown in Koehler's figures, so I have thought it desirable to give new figures thereof. The number of rudimentary dorsal plates at the base of arms, between the radial shields,

is very inconstant, sometimes four or five as shown by Koehler, sometimes only one or two, and examples of both may be found in one and the same specimen in different radii. The granules of the disk may continue between the first dorsal plates. In the larger specimens there may be as many as seven to eight arm spines. The species has separate sexes and appears not to be viviparous.

This species bears a very close resemblance to *Ophiogona laevigata* from Kerguelen, described by Studer (*Übersicht über die Ophiuriden S.M.S. 'Gazelle'*. Abh. Akad.

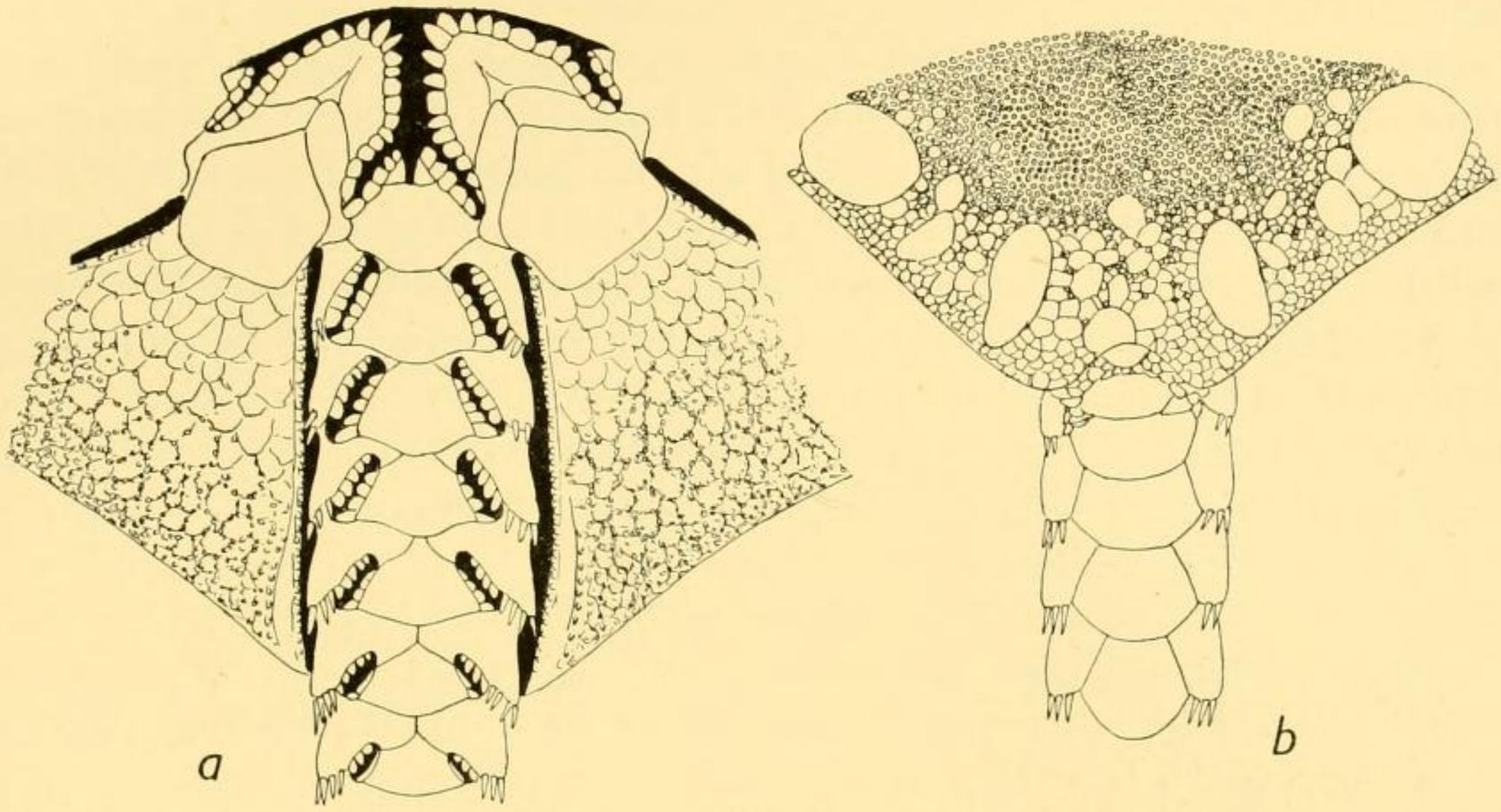

Fig. 34. *Ophiogona Döderleini* (Koehler). Part of oral side (*a*) and dorsal side (*b*). ×10.

Berlin, 1882, p. 6, Taf. 1, figs. 2 *a–c*). From the description and figures given by Studer I cannot gather any other difference than that in *O. laevigata* the radial shields are covered by granules, these being naked in the present species, and as this may quite probably be a difference due to age, the type of *O. laevigata* being no less than 40 mm. in diameter of disk (thus twice the size of the largest known specimens of *O. Döderleini*), this character alone does not justify us in regarding them as two distinct species. On application for the loan of the type material of *O. laevigata*, Professor W. Arndt of the Berlin Museum very kindly sent me a large specimen, 33 mm. in diameter, for comparison with my specimens. The only difference I can find is in the papillae of the first tentacle pore. As shown in Fig. 35 the papillae on the adradial side of the pore join in the radial mid-line, being all of them attached to the ventral plate itself; in *O. Döderleini* the adradial papillae of the first tentacle pore do not join in the radial mid-line, the two or three inner ones being attached to a small supplementary plate (Fig. 34 *a*). (Sometimes

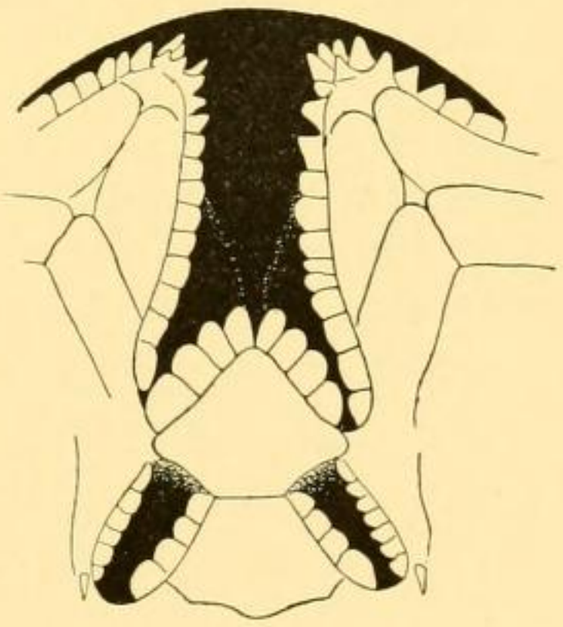

Fig. 35. *Ophiogona laevigata*, Studer. Part of mouth; showing the arrangement of the papillae along the first ventral plate. From cotype. ×6.

this supplementary plate is replaced by a small adradially-directed papilla.) Whether this is a constant difference it is, of course, impossible to ascertain from the single, very large specimen of *O. laevigata* (all the present specimens of *O. Döderleini* have it as described); but in any case I deem it better for the present to retain the name *Döderleini*. When new material of the Kerguelen form has been collected, it can be ascertained whether this difference holds good; if it does not, the name *Döderleini* will become a synonym of *laevigata*. (The specimen of *O. laevigata* examined has apparently lost the granules of the disk.)

The removal of this species from the genus *Ophiomaria*, to which it was referred by Austin H. Clark as accepted by Koehler, to *Ophiogona*, leads to the question whether Clark's genus *Ophiomaria* is not identical with the genus *Ophiogona*. I believe so; at least I do not find in the diagnosis of the genus *Ophiomaria* a single character that distinguishes it from *Ophiogona*. The reason why I hesitate to declare *Ophiomaria* a synonym of *Ophiogona*, is because the genotype of *Ophiomaria*, *O. tenella*, A. H. Clark, has never been figured. Perhaps it may be found to differ so much from *Ophiogona laevigata* and *Döderleini* in some point or other (though from the description that does not appear) that it may deserve to rank as the type of a separate genus.

Ophioperla Koehleri (Bell)

Ophiura Koehleri, Bell, 1908. National Antarct. Exped. Echinoderma, p. 11.
Ophioperla Ludwigi, Koehler, 1912. Ophioperla Ludwigi, *nov. gen.*, *nov. sp.* Zeitschr. wiss. Zool., CI, p. 259, Taf. xiii.
O. Ludwigi, Koehler, 1912. II[e] Expéd. Antarct. Française. Echinodermes, p. 126, pl. x, figs. 1, 5–7.
O. Ludwigi, Koehler, 1922. Austral. Antarct. Exped. Echinod. Ophiuroidea, p. 51.
O. Ludwigi, Koehler, 1923. Swedish Antarct. Exped. Astéries et Ophiures, p. 127.

St. 42. 1. iv. 26. Off mouth of Cumberland Bay, South Georgia, 120–204 m. 10 specimens.
St. 45. 6. iv. 26. 2·7 miles S 85° E of Jason Light, South Georgia, 238–270 m. 3 specimens.
St. 140. 23. xii. 26. Stromness Harbour to Larsen Point, South Georgia, 122–136 m. 1 specimen.
St. 144. 5. i. 27. Off mouth of Stromness Harbour, South Georgia, 155–178 m. 4 specimens.
St. 170. 23. ii. 27. Off Cape Bowles, Clarence Island, 342 m. 2 specimens.
St. 175. 2. iii. 27. Bransfield Strait, South Shetlands, 200 m. 1 specimen.
St. 177. 5. iii. 27. 27 miles SW of Deception Island, South Shetlands, 1080 m. 1 specimen.
St. 196. 3. iv. 27. Bransfield Strait, South Shetlands, 720 m. 2 specimens.
St. 474. 12. xi. 30. 1 mile W of Shag Rock, South Georgia, 199 m. 10 specimens.

To the very careful description given by Koehler (*op. cit.*, 1912) I would only add that the radial shields sometimes remain naked to some extent, so as to appear as small, widely separated, oval plates.

One of the specimens from St. 42 is stated to have had the upper side of disk and arms bright pink in life, the under side white. In alcohol all trace of colour is lost.

In young specimens, 3–4 mm. in diameter of disk, the scales of the dorsal side of the disk are almost completely naked, a granule having only begun to appear here and there. There is a distinct central plate, but the other primary plates are scarcely discernible; the scales of the disk are imbricating. The radial shields are short and broad, widely

divergent, scarcely joining distally. The arm spines are slender, pointed, not yet broad and flattened as in the adult. There are already four tentacle scales—or rather papillae—at the proximal pore pairs.

This species is not viviparous; it has separate sexes, there being in both sexes a series of gonads along both the adradial and the interradial side of the bursal slit. The eggs are very small, a fact which indicates that the species may have a typical *Ophiopluteus* larva.

It was quite a surprise to me, when seeing the type specimen of Bell's *Ophiura Koehleri*, which was sent me for examination from the British Museum, to find that it was identical with Koehler's *Ophioperla Ludwigi*. From the very poor description given by Bell nobody could imagine what the species would be like, and the fact that Bell did not give any figures of it, together with the erroneous statements that the disk is covered by smooth skin (it is a dense covering of very fine granules), and that the lower arm spines are deeply imbedded in the skin, could only be misleading and bewildering. Thus it came about that the species dedicated by Bell to Koehler was dedicated again unawares by Koehler to Ludwig. As for Bell expressing his regret that he had not "something better to offer to the honour of the distinguished French naturalist who has done so much for our knowledge of Ophiuroids", there was in reality only reason to regret the bad description he gave; the species is good and interesting enough, and must henceforth bear Koehler's name instead of that of Ludwig. Fortunately, this necessary change of name does not do much harm scientifically, the species having only very few times been mentioned in literature.

Ophionotus victoriae, Bell

Ophionotus victoriae, Bell, 1902. Rep. Nat. Hist. Collections 'Southern Cross'. Echinoderma, p. 219, pl. xxviii.
O. victoriae, Koehler, 1912. II^{e} Expéd. Antarct. Française. Echinodermes, p. 114, pls. x, figs. 2–4, 12–13; xi, fig. 8.
O. victoriae, Koehler, 1922. Austral. Antarct. Exped. Echinod. Ophiuroidea, p. 51.
O. victoriae, Koehler, 1923. Swedish Antarct. Exped. Astéries et Ophiures, p. 124.
O. victoriae, Hertz, 1926. Deutsche Südpolar-Exped. Ophiuroiden, p. 16.
O. victoriae, Hertz, 1927. Deutsche Tiefsee-Exped. Ophiuroiden, p. 67.
O. victoriae, Grieg, 1929. *Echinodermata from the Palmer Archipelago.* Sci. Results Norwegian Antarct. Exped., 1927–29, II, 9.

St. 173. 28. ii. 27. Port Foster, Deception Island, South Shetlands, 5–60 m. 11 specimens.
St. 175. 2. iii. 27. Bransfield Strait, South Shetlands, 200 m. 1 specimen.
St. 180. 11. iii. 27. Schollaert Channel, Palmer Archipelago, 160–330 m. 10 specimens.
St. 195. 30. iii. 27. Admiralty Bay, King George Island, South Shetlands, 391 m. 14 specimens.
St. 366. 6. iii. 30. 4 cables S of Cook Island, South Sandwich Islands, 155–322 m. 7 specimens.
St. 371. 14. iii. 30. 1 mile E of Montagu Island, South Sandwich Islands, 99–161 m. 3 specimens.
St. 456. 18. x. 30. 1 mile E of Bouvet Island, 40–45 m. Several specimens.
St. 458. 19. x. 30. 7 miles S 50° W of Cape Circumcision, Bouvet Island, 357–377 m. 10 specimens.

There are further a number of specimens from Deception Island, South Shetlands, 25–30 fathoms, without exact dates.

Koehler (*op. cit.*, 1912) has suggested that this species is oviparous, in contradistinction to the viviparous *O. hexactis*. I can confirm this suggestion; also it has separate sexes, as is usual in non-viviparous Ophiurids. The eggs are small and numerous. It is thus very probable that it has a typical *Ophiopluteus* larva—the more probable since the viviparous *O. hexactis* passes through a rudimentary larval stage within the ovary.

Hertz (*op. cit.*, 1927) states that the two species *O. hexactis* and *victoriae* "scheinen sich gegenseitig auszuschliessen bzw. zu vertreten". It is true that the areas of distribution of the two species appear on the whole markedly distinct, the former being in the main confined to the Kerguelen and the South Georgia regions, the latter mainly to the Antarctic region and the sea round Bouvet Island. But that they do not quite exclude one another appears from the fact that *O. victoriae* is recorded by Grieg (*op. cit.*) from South Georgia, where *O. hexactis* abounds. But it seems that in regard to these two species the same condition prevails as between *Ophiura Sarsi*, Lütken, and *Ophiopleura borealis*, Koren and Danielssen, in the Arctic seas (cf. Mortensen, 1932, *Echinoderms of the Godthåb Expedition*. Medd. om Grønland, 79, 2, p. 30), viz. that these species do not like each other's company and thus in general exclude one another.

Grieg's observations (*op. cit.*) on the year classes shown by this species may be well founded (in contradistinction to his finding year classes in *Ophiopleura borealis* and other deep-sea Echinoderms; cf. my work on the 'Ingolf' Ophiuroidea, p. 95; Monograph of the Echinoidea, II, p. 110).

Ophionotus hexactis (E. A. Smith)

Ophioglypha hexactis, E. A. Smith, 1876. *Description of species of Asteridae and Ophiuridae from Kerguelen's Islands*. Ann. Mag. Nat. Hist., 4 Ser., XVII, p. 111.

Ophionotus hexactis, Koehler, 1912. II[e] Expéd. Antarct. Française. Echinodermes, pl. xii, figs. 1, 3.

Ophiura hexactis, H. L. Clark, 1915. Cat. Recent Ophiurans, p. 320, pl. 19, figs. 5–6.

Ophionotus hexactis, Koehler, 1917. *Echinodermes de Kerguelen*. Ann. Inst. Océanogr., VII, 8, p. 61, pl. v, fig. 15.

O. hexactis, Mortensen, 1920. *On hermaphroditism in viviparous Ophiurids*. Acta Zoologica, I, p. 16.

O. hexactis, Mortensen, 1921. Studies of the development and larval forms of Echinoderms, p. 179, pl. xxxii.

O. hexactis, Koehler, 1923. Swedish Antarct. Exped. Astéries et Ophiures, p. 125, pl. xiv, fig. 10.

O. hexactis, Hertz, 1926. Deutsche Südpolar-Exped. Ophiuroiden, p. 17.

O. hexactis, Hertz, 1927. Deutsche Tiefsee-Exped. Ophiuroiden, I, p. 68, Taf. vi, fig. 4.

O. hexactis, Tortonese, 1934. *Gli Echinodermi del Museo di Torino*. II, *Ofiuroidi*. Boll. Mus. Zool. Torino, XLIV, p. 43, Tav. vii, figs. 42–6.

For the older literature cf. Koehler's work of 1917, *loc. cit.*

St. 28. 16. iii. 26. West Cumberland Bay, South Georgia, 168 m. 3 specimens (fragments).
St. 39. 25. iii. 26. East Cumberland Bay, South Georgia, 179–235 m. 6 specimens.
St. 42. 1. iv. 26. Off mouth of Cumberland Bay, South Georgia, 120–204 m. 12 specimens.
St. 45. 6. iv. 26. 2·7 miles S 85° E of Jason Light, South Georgia, 238–270 m. 10 specimens.
St. 140. 23. xii. 26. Stromness Harbour to Larsen Point, South Georgia, 122–136 m. 10 specimens (young).

St. 142. 30. xii. 26. East Cumberland Bay, South Georgia, 88–273 m. 14 specimens.
St. 144. 5. i. 27. Off mouth of Stromness Harbour, South Georgia, 155–178 m. 5 specimens.
St. 149. 10. i. 27. Mouth of East Cumberland Bay, South Georgia, 200–234 m. 1 specimen.
St. 474. 12. xi. 30. 1 mile W of Shag Rocks, South Georgia, 199 m. 10 specimens.
St. 1562. 7. iv. 35. 46° 53′ S, 37° 55′ E, off Marion Island, 97–104 m. 1 specimen.
St. 1563. 7. iv. 35. 46° 48′ S, 37° 49′ E, off Marion Island, 113–99 m. 9 specimens.
St. WS 25. 17. xii. 26. Undine Harbour (North), South Georgia, 18–27 m. 4 specimens.
St. WS 27. 19. xii. 26. 53° 55′ S, 38° 01′ W, South Georgia, 107 m. 1 specimen.
St. WS 33. 21. xii. 26. 54° 59′ S, 35° 24′ W, South Georgia, 130 m. 7 specimens.
St. WS 56. 14. i. 27. Larsen Harbour, Drygalski Fjord, South Georgia, 2 m. (kelp roots). 1 specimen.
St. WS 62. 19. i. 27. Wilson Harbour, South Georgia, 15–45 m. Several specimens.
St. WS 177. 7. iii. 28. 54° 58′ S, 35° 00′ W, South Georgia, 97–0 m. 3 specimens.
St. MS 10. 14. ii. 25. East Cumberland Bay, South Georgia, 26–18 m. 10 specimens.
St. MS 14. 17. ii. 25. East Cumberland Bay, South Georgia, 109–180 m. 8 specimens.
St. MS 15. 17. ii. 25. East Cumberland Bay, South Georgia, 109 m. 20 specimens.
St. MS 32. 1. v. 25. East Cumberland Bay, South Georgia, 40 m. Several specimens.
St. MS 68. 2. iii. 26. East Cumberland Bay, South Georgia, 220–247 m. Several specimens.
St. MS 69. 5. iii. 26. East Cumberland Bay, South Georgia, 146 m. 4 specimens.
St. MS 71. 9. iii. 26. East Cumberland Bay, South Georgia, 110–60 m. 16 specimens.
St. MS 74. 17. iii. 26. East Cumberland Bay, South Georgia, 32–40 m. 1 specimen.

This species is now so well known and well figured, particularly by Koehler (*op. cit.*, 1912) and by Clark (*op. cit.*, 1915), that there is no reason to give further descriptive notes on it. The fact that a five-armed specimen (St. 45) contains only six-rayed young ones is worth mentioning.

I may recall my observations (*op. cit.*, 1920, 1921) proving the species to be hermaphrodite and to have intra-ovarial development, the young ones passing through a "pelagic" larval stage within the ovary.

One of the specimens from St. 1563 is remarkable in having no radial shields at the base of one of the arms. Apparently it is only a case of abnormal regeneration.

Ophiomages cristatus, Koehler

Ophiomages cristatus, Koehler, 1923. Swedish Antarct. Exped. Astéries et Ophiures, p. 118, pl. xv, figs. 7–10.

St. 164. 18. ii. 27. Normanna Strait, Coronation Island, South Orkneys, 24–36 m. 1 specimen.

This specimen has a diameter of disk of 14 mm. and an arm length of *ca.* 45 mm., and thus considerably exceeds in size the two previously known specimens. It is in perfect agreement with the description and figures given by Koehler. The label states that the colour in life was "bright peach red" (Ridgway scale, 500–Ra). In alcohol the colour has completely faded.

This species is *viviparous*. Finding that an arm of a young one protruded through one of the genital slits, I opened one of the interradii with the view to ascertaining whether it is also perhaps hermaphrodite. This, however, could not be made out without damaging the precious specimen, which I did not think desirable. The gonads at the inter-

radial side of the bursal slits proved to be female; quite possibly male gonads may be situated adradially to the genital slits, on the dorsal side of the arm (as is the case for example in *Ophionotus hexactis*), but this must be left undecided.

It appears very probable that the development is intra-ovarial, as in *Ophionotus hexactis*. The gonads contain a considerable number of small eggs, besides one or two of larger size. It is thus very probable that only these large eggs develop into embryos, the other eggs serving as food for the embryo, as is the case in *O. hexactis*. One of the gonads from the interradius which I opened is considerably swollen, there being a large empty space with no eggs on the wall, and the small eggs in the basal part of the gonad apparently somewhat reduced in size. Unfortunately the large egg (or embryo) within this gonad is in an exceedingly poor state of preservation; but I can scarcely have any doubt that we have here a case similar to that which occurs in *Ophionotus hexactis*.

It is worth mentioning that the young ones have no regular rosette of primary disk plates.

The genus *Ophiomages* is evidently closely related to *Ophiosteira*; indeed, I rather think it ought to be united with that genus, which would then comprise the two species: *antarctica*, Bell, and *cristatus* (Koehler). (As for *O. Senouqui*, cf. below, p. 315.)

Ophiosteira Senouqui, Koehler

? *Ophioglypha carinifera*, Koehler, 1901. Result. Voyage 'Belgica'. Echinides et Ophiures, p. 14, pl. i, figs. 3–5.

Ophiosteira Senouqui, Koehler, 1912. II^{e} Expéd. Antarct. Française. Echinodermes, p. 110, pl. x, figs. 8–11.

O. Senouqui, Koehler, 1922. Austral. Antarct. Exped. Echinod. Ophiuroidea, p. 46, pl. lxxxvii, figs. 1–5.

O. Senouqui, Hertz, 1926. Deutsche Südpolar-Exped. Ophiuroiden, p. 24, Taf. v, figs. 1–3, 7.

St. 170. 23. ii. 27. Off Cape Bowles, Clarence Island, 342 m. 2 specimens.
St. 175. 2. iii. 27. Bransfield Strait, South Shetlands, 200 m. 2 specimens.
St. 187. 18. iii. 27. Neumayr Channel, Palmer Archipelago, 259–354 m. 1 specimen.
St. 190. 24. iii. 27. Bismarck Strait, Palmer Archipelago, 93–130 m. 1 specimen.
St. 599. 17. i. 31. 67° 08′ S, 69° 06′ W, Graham Land, 203 m. 2 specimens.
St. WS 94. 16. iv. 27. 50° 00′ S, 64° 58′ W, 110–126 m. 1 specimen.
St. WS 97. 18. iv. 27. 49° 00′ S, 61° 58′ W, 145–146 m. 1 specimen.
St. WS 212. 30. v. 28. 49° 22′ S, 60° 10′ W, 242–249 m. 1 specimen.
St. WS 245. 18. vii. 28. 52° 36′ S, 63° 40′ W, 304–290 m. 3 specimens.
St. WS 871. 1. iv. 32. 53° 16′ S, 64° 12′ W, 336–341 m. 1 specimen.

It is evident that *Ophiosteira Senouqui* is at least very closely related to, if not identical with, the species described by Koehler in his report on the 'Belgica' Echinoderms under the name *Ophioglypha carinifera*, and I can only wonder that Koehler in describing *O. Senouqui* did not make any reference to *carinifera*. Judging from the description of *carinifera* the only difference from *Senouqui* is the existence of granules between the plates of the disk. Koehler's figures show these granules very distinctly, and having recently had an opportunity of seeing the type specimen in the Brussels Museum I can testify to the correctness of Koehler's figures in this regard. The description states that

the granules are "très fins", and that in the centre of the disk they even encroach upon the surface of the plates themselves, as also upon the surface of the radial shields. But this is exactly what is also found, to a varying degree, in *Senouqui*; on the ventral interradii these granules also occur, sometimes even on the edge of the buccal shields. It seems that the only difference between *carinifera* and *Senouqui* is that in the former the granules are somewhat larger—a character of very small value, even if constant. I expect, therefore, that it will ultimately be found that *O. Senouqui* is identical with *O. carinifera*, and the name *Senouqui* will then have to be dropped as a synonym of *carinifera*.

Hertz (*op. cit.*, 1926, p. 25, note) expresses the opinion that the genus *Ophiosteira* is untenable, and at the same time establishes a new genus *Ophiuroglypha*, the main characters of which are the reduction of the ambulacral pores and, particularly, the transformation of the second arm spine into a glassy, upturned hook. To this genus, besides the genotype, *O. Lymani* (Ljungman), she also refers *Ophiosteira Senouqui* and a number of other species which do not concern us here. Since there are within the species *Senouqui* all possible transitions between specimens with strongly elevated plates, as in typical *Ophiosteira*, and with perfectly flat plates, as in *O. Lymani*, it seems quite natural to regard *O. Senouqui* and *O. Lymani* as congeneric. But this does not do away with the genus *Ophiosteira*. The character of the arm spines seems to constitute a valid distinction between the two genera. In *Ophiosteira* there are a considerable number of arm spines (five to nine), none of which are transformed into a hook, while in *Ophiuroglypha* there are only three arm spines, the second of which is, in the distal part of the arms, transformed into an upturned glassy hook. Accordingly, on this basis *O. Senouqui* (*carinifera*) is not an *Ophiosteira*, but an *Ophiuroglypha*, as maintained by Hertz.

The matter, however, is not so simple. A. H. Clark, in his paper on Ophiomaria, *a new genus of Ophiurans from Southern America and the adjacent portion of the Antarctic Continent* (Journ. Wash. Acad. Sci., VI, 1916, p. 385), refers the species *carinifera* to his new genus *Ophiomaria*, with which Koehler agrees (Swedish Antarct. Exped., Astéries et Ophiures, p. 127). Is then Hertz' genus *Ophiuroglypha* identical with, and only a synonym of, Clark's genus *Ophiomaria*? And should the present species be named *Ophiomaria Senouqui* (or *carinifera*)? As yet nobody can tell. The genotype of *Ophiomaria* is *O. tenella*, A. H. Clark, from off the coast of Chile. Unfortunately Clark does not give any figures of this species, and in the description he gives no information on the character of the arm spines, whether any of them is transformed into a hook or not. It rather seems that Clark's *Ophiomaria* is identical with Studer's genus *Ophiogona* (cf. above, p. 310), and that Hertz' name *Ophiuroglypha* will be available for *O. Lymani* and *Senouqui-carinifera*; but for the present we cannot take that for granted.

In view of the uncertainty in regard to these various points, I prefer for the present to retain the name *Ophiosteira Senouqui* for the species in question; but I expect that its correct name will ultimately be found to be *Ophiuroglypha carinifera* (Koehler).

It remains to be seen whether the other species referred to *Ophiosteira—O. echinulata*, Koehler, *O. debitor*, Koehler, and *O. rotundata*, Koehler (Austral. Antarct. Exped.), and *O. Koehleri*, A. H. Clark, from off the coast of Ecuador (Proc. Biol. Soc. Wash. XXX,

1917, p. 173)—really belong to that genus or rather to *Ophiuroglypha*. Koehler does not mention the character of the spines; but it seems not improbable that the two species *debitor* and *rotundata*, with only three arm spines, will have the middle one transformed into a hook, and thus will belong to *Ophiuroglypha*, whereas *O. echinulata*, with eight to nine spines, is a true *Ophiosteira*—indeed, I think it identical with *O. antarctica*. Having had an opportunity of examining the material of *O. antarctica* in the British Museum, I find all possible transitions between specimens that have all the plates of the disk perfectly smooth and those that have all the plates provided with a strong spine, the character of *O. echinulata*. Sometimes only the central plate has such a spine, the other plates being wholly smooth; in other specimens the central plate is smooth, the other plates having each a strong spine. Also in regard to the development of the radial keel there are all transitions, from a low, rounded, sausage-like elevation to a high, sharp edge. Neither can I discover any difference in the shape of the buccal shields—in short, I cannot find a single character of any value distinguishing *echinulata* from *antarctica*, and must, accordingly, regard *echinulata* as synonymous with *antarctica*. Thus in all probability the latter remains the only species of the genus *Ophiosteira*—unless *Ophiomages cristatus*, Koehler, is also a true *Ophiosteira*, which I think quite probable.

Ophiosteira antarctica is viviparous and hermaphrodite. There are three to four male gonads along the adradial side of the bursal slit, and one to two female gonads along the interradial side. I have found two to five young ones in each bursa, all at very nearly the same stage of development.

The species *O. Senouqui* has separate sexes and is not viviparous. There are a number of gonads along both the adradial and the interradial side of the bursal slits. The eggs are small and very numerous, indicating the probable existence of a typical *Ophiopluteus* larva. The bursal walls are quite strong and contain a great number of fenestrated plates.

Ophiuroglypha Lymani (Ljungman)

(Plate VIII, fig. 3)

Ophioglypha Lymani, Ljungman, 1870. *Om tvänne nya arter Ophiurider*. Öfvers. K. Vetenskaps. Akad. Förhandl. Stockholm, 1870, p. 472.
O. Lymani, Ludwig, 1898. *Die Ophiuren d. Sammlung Plate*, Zool. Jahrb. Suppl., p. 751.
O. Lymani, Ludwig, 1899. Ophiuroideen Hamburger Magalh. Sammelreise, p. 5.
O. Lymani, Koehler, 1907. *Revision de la collection des Ophiures du Mus. d'Hist. nat. Paris.* Bull. Sci. France Belgique, XLI, p. 295, pl. x, figs. 11–12.
Ophiura Lymani, H. L. Clark, 1915. Cat. Recent Ophiurans, p. 322.
O. Lymani, Koehler, 1923. Swedish Antarct. Exped. Astéries et Ophiures, p. 126.
Ophiuroglypha Lymani, Hertz, 1926. Deutsche Südpolar-Exped. Ophiuroiden, p. 25, Taf. v, figs. 4–6, 8.
O. Lymani, Hertz, 1927. Deutsche Tiefsee-Exped. Ophiuroiden, p. 85.

St. 152. 17. i. 27. 53° 51′ S, 36° 18′ W, South Georgia, 245 m. 2 specimens.
St. 156. 20. i. 27. 53° 51′ S, 36° 21′ W, South Georgia, 200–236 m. Several large specimens.
St. 159. 21. i. 27. 53° 52′ S, 38° 08′ W, South Georgia, 160 m. 1 specimen.
St. 160. 7. ii. 27. Near Shag Rocks, South Georgia, 177 m. 1 specimen.
St. 474. 12. xi. 30. 1 mile W of Shag Rocks, South Georgia, 199 m. 1 specimen.

St. WS 81. 19. iii. 27. 8 miles N 11° W of North Island, West Falkland Islands, 81–82 m. 3 specimens.
St. WS 91. 8. iv. 27. 52° 54′ S, 64° 37′ W, 191–205 m. 4 specimens.
St. WS 92. 8. iv. 27. 51° 58′ S, 65° 01′ W, 143–145 m. 6 specimens.
St. WS 212. 30. v. 28. 49° 22′ S, 60° 10′ W, 242–249 m. 2 specimens.
St. WS 243. 17. vii. 28. 51° 06′ S, 64° 30′ W, 141–144 m. 1 specimen.
St. WS 806. 7. i. 32. 50° 03′ S, 64° 21′ W, 122–129 m. 1 specimen.
St. WS 815. 13. i. 32. 51° 52′ S, 65° 44′ W, 132–162 m. 5 specimens.
St. WS 819. 17. i. 32. 52° 42′ S, 62° 39′ W, 312–329 m. 2 specimens.
St. WS 840. 6. ii. 32. 53° 52′ S, 61° 49′ W, 368–463 m. 1 specimen.

One of the specimens from St. 156 was photographed before preservation (Plate VIII, fig. 3). The colour in life is stated to be "disk bright red above with all the plates white". A specimen preserved in formalin (St. WS 806) still shows very faint traces of the red colour; the specimens preserved in alcohol have lost all colour, except one from St. WS 816, which shows the red colour better than does the specimen in formalin.

Some of the specimens (St. WS 815) might equally well be identified as *Ophiosteira Senouqui*, there being in reality no sharp limit between these two forms, in spite of their being designated by two different generic names (cf. above, p. 315).

The character of the gonads, as was to be expected, is exactly as in *O. Senouqui*. Also the colour of the live specimens is the same in the two species, there being a note about one of the specimens from St. 152 stating: "disc bright red above, with all the plates white".

Ophiuroglypha tumida, Mortensen

Ophiura (*Ophiuroglypha*) *tumida*, Mortensen, 1933. *Echinoderms of South Africa.* Papers from Dr Th. Mortensen's Pacific Exped., LXV (Vid. Medd. Dansk Naturh. Foren., 93), p. 387, pl. xix, figs. 22–23.

St. 436. 20. ix. 30. Off Durban, 416 m. 4 specimens.

Although the plates of the dorsal side of the disk of these specimens are somewhat less tumid than in the typical form there can be no doubt that they belong to this species, the more so as they are from the type locality.

Ophiurolepis carinata (Studer)

Ophiolepis carinata, Studer, 1876. *Über Echinodermen a. d. antarkt. Meere.* Monatsber. Akad. Berlin, 1876, p. 460.
Ophioglypha carinata, Studer, 1883. *Übersicht über die Ophiuriden 'Gazelle'.* Abh. Akad. Berlin, 1882, p. 15, Taf. ii, fig. 7 *a–d.*
O. deshayesi, Lyman, 1882. Sci. Results H.M.S. 'Challenger'. Ophiuroidea, p. 72, pl. vii, figs. 13–15.
Ophiurolepis carinata, Matsumoto, 1917. Monogr. Japanese Ophiuroids, p. 282.

St. 363. 2·5 miles S 80° E of SE point of Zavodovski Island, South Sandwich Islands, 329–278 m. 1 specimen.

This is a large specimen, 21 mm. in diameter of disk; all arms broken off close to the disk. One of the interradii is partly lacking, apparently on account of a wound, which has, however, healed up again. Some Foraminifera are found attached to the disk plates.

This species has separate sexes. The gonads are numerous, arranged in a series along both the adradial and the interradial side of the genital slits; the eggs are small and very numerous. It may thus be concluded with a fair degree of certainty that the species is not viviparous, but probably has a typical *Ophiopluteus* larva.

The occurrence off the South Sandwich Islands of this species, which was hitherto known only from the Kerguelen region, shows that it must be widely distributed in the Antarctic seas.

Ophiurolepis gelida (Koehler)

Ophioglypha gelida, Koehler, 1901. Result. Voyage 'Belgica'. Echinides et Ophiures, p. 17, pl. i, figs. 6–8.

O. gelida, Koehler, 1912. II[e] Expéd. Antarct. Française. Echinodermes, p. 102, pl. ix, figs. 4–10, 13–15.

Homalophiura gelida, H. L. Clark, 1915. Cat. Recent Ophiurans, p. 326.

Ophiurolepis gelida, Koehler, 1922. Austral. Antarct. Exped. Echinod. Ophiuroidea, p. 79, pls. lxxxvi, figs. 11–15; lxxxix, figs. 1–14; xc, figs. 1–6.

O. gelida, Koehler, 1923. Swedish Antarct. Exped. Astéries et Ophiures, p. 130.

O. gelida, Mortensen, 1925. *On a small collection of Echinoderms from the Antarctic Sea.* Arkiv för Zoologi, xvii, A, 31, p. 2.

O. gelida, Hertz, 1926. Deutsche Südpolar-Exped. Ophiuroiden, p. 20.

O. gelida, Hertz, 1927. Deutsche Tiefsee-Exped. Ophiuroiden, p. 94.

St. 170. 23. ii. 27. Off Cape Bowles, Clarence Island, 342 m. 1 specimen.

St. 175. 2. iii. 27. Bransfield Strait, South Shetlands, 200 m. 11 specimens.

St. 180. 11. iii. 27. Schollaert Channel, Palmer Archipelago, 160 m. 1 specimen.

St. 187. 18. iii. 27. Neumayr Channel, Palmer Archipelago, 259–354 m. 2 specimens.

St. 190. 24. iii. 27. Bismarck Strait, Palmer Archipelago, 98–130 m. 12 specimens.

St. 363. 26. ii. 30. 2·5 miles S 80° E of SE point, Zavodovski Island, South Sandwich Islands, 329–278 m. 2 specimens.

St. 366. 6. iii. 30. 4 cables S of Cook Island, South Sandwich Islands, 155–322 m. 1 specimen (large).

St. 456. 18. x. 30. 1 mile E of Bouvet Island, 40–45 m. 5 specimens.

St. 599. 17. i. 31. 67° 08′ S, 69° 06′ W, 203 m. 4 specimens.

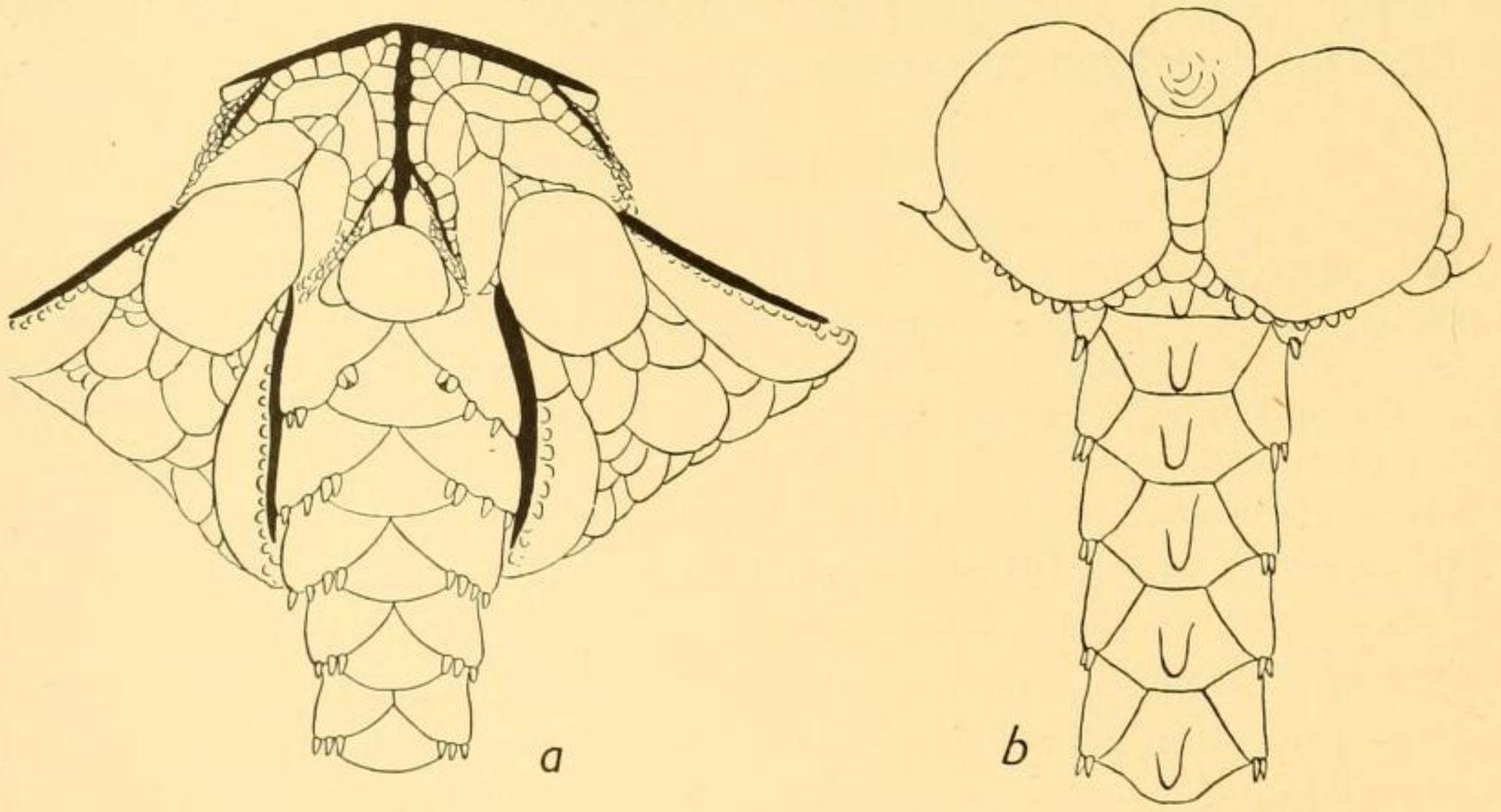

Fig. 36. *Ophiurolepis gelida* (Koehler). *a*, Part of oral side, ×6. *b*, Part of dorsal side, ×8.

As usual in this species the specimens are either covered with a sponge or with Foraminifera. To the specimens from Bouvet Island (St. 456) a number of a *Folliculina* are attached, both on the upper and under side of the disk and on the arms.

The species has separate sexes and is evidently not viviparous. There are two to four gonads on each side of the bursal slits; the eggs are rather numerous, of moderate size, *ca.* 0·3 mm. diameter, all ripening at the same time. The relatively large size of the eggs rather suggests direct development, not through a typical *Ophiopluteus* larva. This, of course, is a mere suggestion.

Ophiurolepis brevirima, n.sp.

(Plate VIII, figs. 8–13)

St. 170. 23. ii. 27. Off Cape Bowles, Clarence Island, 342 m. Several specimens.
St. 172. 26. ii. 27. Off Deception Island, South Shetlands, 525 m. 1 specimen.
St. 175. 2. iii. 27. Bransfield Strait, South Shetlands, 200 m. Several specimens.

Diameter of disk up to *ca.* 20 mm. Arms at most slightly exceeding four times the diameter of disk, but often scarcely as much as three times the diameter.

In larger specimens the disk is usually rather conspicuously elevated, rising from the edge at an angle of *ca.* 45°; but the middle part of the disk is flattened. The primary

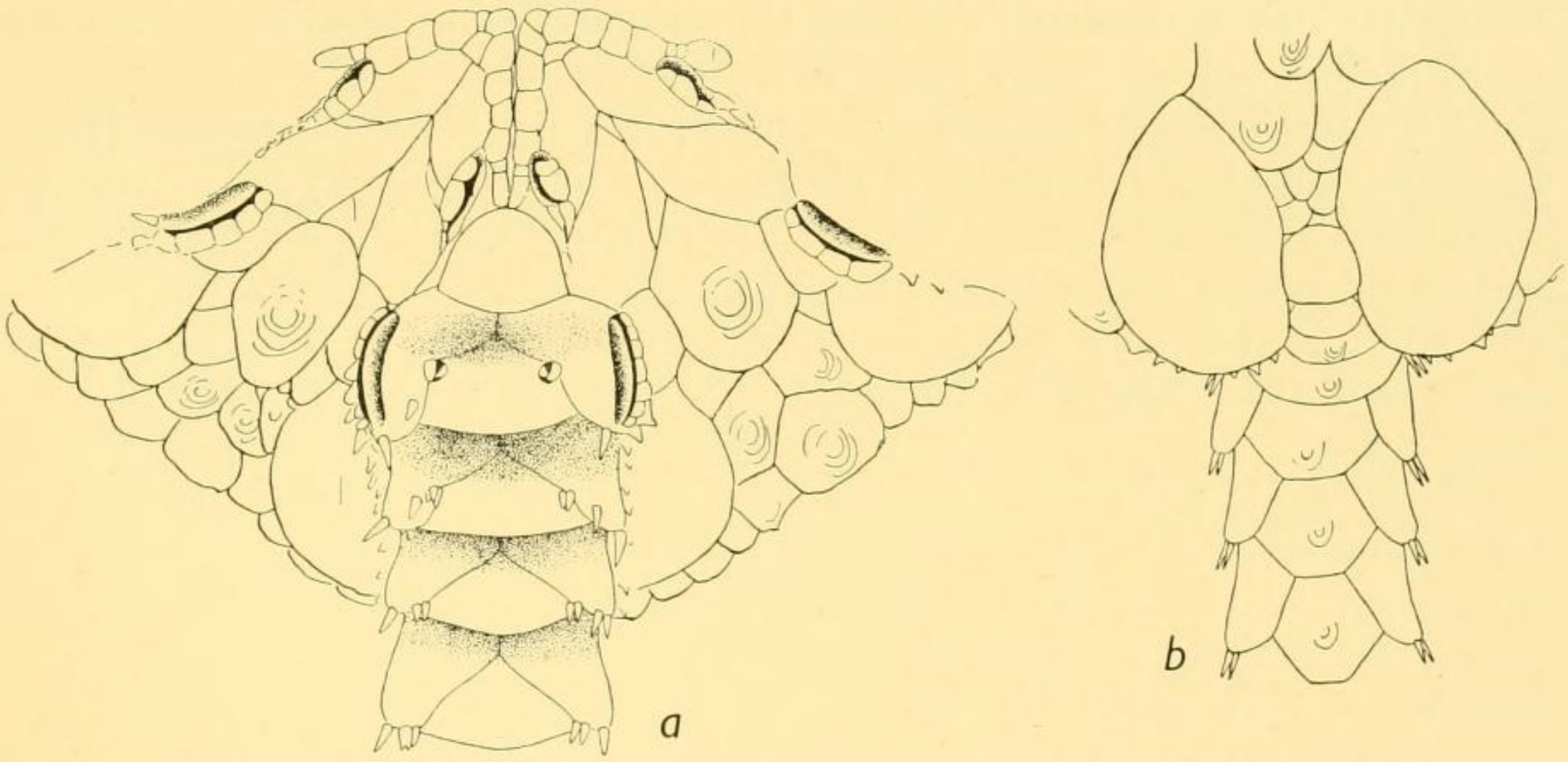

Fig. 37. *Ophiurolepis brevirima*, n.sp. Part of oral side (*a*) and dorsal side (*b*). ×6.

plates are not conspicuous, or even at all discernible, except in the young specimens, and even in these latter they are relatively small. All the plates of the dorsal side of the disk, excepting the radial shields, rise into a low knob surrounded by concentric rings. The radial shields are on the contrary smooth, and even usually somewhat sunken in the middle; they are oval, about half the length of the disk radius, separated by a column of plates, the innermost one of which is generally the most conspicuous. In the ventral interradii the most conspicuous plates are the genital scales, which leave only a rather narrow median space, occupied by some smaller scales, one in the median line being

usually somewhat more prominent. These ventral plates have no elevated knob, but usually show a fairly distinct concentric striation. The buccal plates are small, oval, more or less irregular, sometimes with the proximal part separated off as a distinct small plate. Adoral plates and jaws elongate, oval. Mouth papillae of the usual square shape. First ventral plate large, with a rounded inner edge and a nearly straight outer edge. It is distinctly separated from the second ventral plate; also all the following ventral plates are separated. They have a rather sharp angle proximally, the distal edge being lightly convex or a little produced in the middle. The proximal part of each joint on the ventral side in larger specimens sunken, the distal part correspondingly raised, giving a somewhat ladder-like appearance. The dorsal arm plates about hexagonal, contiguous, each plate rising into a rather sharp central knob, or there may be two or three serrations on the top. The arms on the whole conspicuously keeled, triangular in section. Usually two rather sharp, often somewhat outstanding arm spines, the lower one placed close to the two spine-like tentacle scales, the upper one a little distance above. The genital slits are very short, not extending beyond the end of the first lateral plate; the interradial side of the slit carries about four well-developed, square papillae, the adradial edge is raised into a sharp keel, without indication of papillae. In continuation of the genital slit there are a varying number of small spine-like granules which continue along the sides of the arms to the dorsal side along the distal edge of the radial shields, forming thus a rudimentary arm comb. Colour in alcohol whitish.

All the specimens are covered with a thick, irregular layer of a sponge, which, according to the kind information of Mr Burton, is the same species as that which so often covers *Ophiurolepis gelida*.[1] It often covers the Ophiuran completely, both dorsal and ventral side of both disk and arms, leaving only the mouth and the bursal slits uncovered.

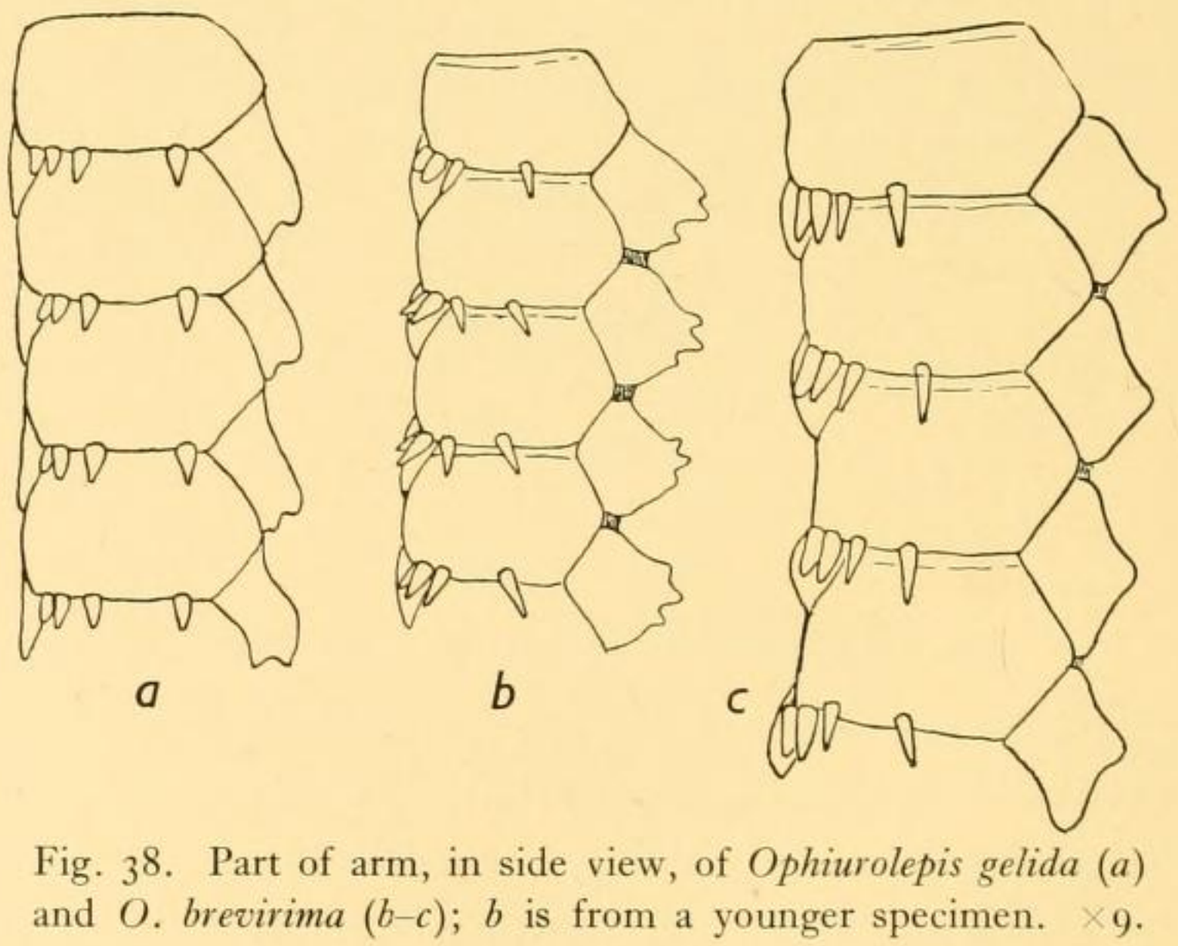

Fig. 38. Part of arm, in side view, of *Ophiurolepis gelida* (*a*) and *O. brevirima* (*b–c*); *b* is from a younger specimen. ×9.

Like *O. gelida* this species has separate sexes and is evidently not viviparous. The gonads are arranged in the same way as in *O. gelida*; the eggs are about the same size as in the latter, and also ripen all at the same time.

It is clear that this species is closely related to *O. gelida*, but is well distinguished from the latter, particularly by its peculiar short genital slits. The shape of the dorsal plates is also a little different; but more important is the fact that the ventral plates are separated

[1] This is generally stated to be *Iophon flabelli-digitatus*, Kirkpatrick. Mr Burton informs me that it is *Iophon radiatus*, Topsent.

in *brevirima*, even in the large specimens, whereas in *gelida* they are contiguous in the proximal part of the arms. Further, the buccal shields are on the whole smaller, and the genital scales larger than in *gelida*, in which latter also the ventral side of the arms is quite flat, not of such a ladder-like appearance as in the present species. The arrangement of the arm spines is also different, the upper spine being placed about at the middle of the lateral plate in *brevirima*, at the upper corner in *gelida*; the spines are a little longer in *brevirima* (Fig. 38 *a–c*). The two species thus must be regarded as quite distinct, but young specimens with the genital slits not yet typically developed are scarcely distinguishable.

O. gelida is thus no longer the only Ophiurid covered by sponge, as it was hitherto supposed to be; and it was even thought that the sponge covering was a sufficiently certain character for recognizing the species (cf. Koehler, Austral. Antarct. Exped., Echinod. Ophiuroidea, p. 81). Very probably the species *brevirima* has sometimes been misidentified as *O. gelida*. Thus when Hertz (Deutsche Südpolar Exped., Ophiuroiden, p. 20) states: "Ich meine sonst zu bemerken, dass stark bewachsene Individuen eine auffallende Höhenentwicklung einzelner Skelettelemente zeigen, z. B. eine Art Aufwülstung der Ränder der Genitalspalten", the suggestion may be made that such specimens were in reality *O. brevirima*.

Ophiurolepis Martensi (Studer)

Ophioglypha Martensi, Studer, 1885. *Die Seesterne Süd-Georgiens*. Jahrb. wiss. Anst. Hamburg, II, p. 161, Taf. ii, fig. 8 *a*, *b*.

Ophiozona inermis, Bell, 1902. Rep. Nat. Hist. Collections. 'Southern Cross'. Echinoderma, p. 217.

Ophioglypha resistens, Koehler, 1911. Brit. Antarct. Exped. 1907–9. Astéries, Ophiures et Echinides, p. 42, pl. vii, figs. 9–12.

Amphiophiura Martensi, H. L. Clark, 1915. Cat. Recent Ophiurans, p. 315.

A. resistens, H. L. Clark, 1915. Cat. Recent Ophiurans, p. 315.

Homalophiura inermis, H. L. Clark, 1915. Cat. Recent Ophiurans, p. 326, pl. xx, figs. 3–4.

Ophiurolepis resistens, Koehler, 1922. Austral. Antarct. Exped. Echinod. Ophiuroidea, p. 74, pls. lxxxvi, figs. 7–10, 18, 19; lxxxviii, figs. 8–10; xc, figs. 7–22.

O. resistens, Koehler, 1923. Swedish Antarct. Exped. Astéries et Ophiures, p. 130.

O. resistens, Hertz, 1926. Deutsche Südpolar-Exped. Ophiuroiden, p. 19.

O. resistens, Grieg, 1929. *Some Echinoderms from the South Shetlands*. Bergens Mus. Årbok, 1929, 3, p. 6.

O. resistens, Grieg, 1929. *Echinodermata from the Palmer Archipelago*. Sci. Results Norwegian Antarct. Exped., II, p. 8.

St. 27. 15. iii. 26. West Cumberland Bay, South Georgia, 110 m. Several specimens.

St. 39. 25. iii. 26. East Cumberland Bay, South Georgia, 179–235 m. 9 specimens.

St. 42. 1. iv. 26. Off mouth of Cumberland Bay, South Georgia, 120–204 m. 15 specimens.

St. 123. 15. xii. 26. Off mouth of Cumberland Bay, South Georgia, 230–250 m. Several specimens.

St. 140. 23. xii. 26. Stromness Harbour to Larsen Point, South Georgia, 122–136 m. Several specimens.

St. 141. 29. xii. 26. East Cumberland Bay, South Georgia, 17–27 m. 1 specimen.

St. 144. 5. i. 27. Off mouth of Stromness Harbour, South Georgia, 155–178 m. 11 specimens.

St. 148. 9. i. 27. Off Cape Saunders, South Georgia, 132–148 m. 3 specimens.
St. 149. 10. i. 27. Mouth of East Cumberland Bay, South Georgia, 200–234 m. 7 specimens.
St. 152. 17. i. 27. 53° 51′ S, 36° 18′ W, South Georgia, 245 m. 1 specimen.
St. 156. 20. i. 27. 53° 51′ S, 36° 21′ W, South Georgia, 200–236 m. 6 specimens.
St. 159. 21. i. 27. 53° 52′ S, 36° 08′ W, South Georgia, 160 m. 4 specimens.
St. 160. 7. ii. 27. Near Shag Rocks, South Georgia, 177 m. 8 specimens.
St. 474. 12. xi. 27. 1 mile W of Shag Rocks, South Georgia, 199 m. Several specimens.
St. 1562. 7. iv. 35. 46° 53′ S, 37° 55′ E, off Marion Island, 88–93 m. Several specimens.
St. 1563. 7. iv. 35. 46° 48′ S, 37° 49′ E, off Marion Island, 113–99 m. Several specimens.
St. 1564. 7. iv. 35. 46° 36′ S, 38° 02′ E, off Marion Island, 110–113 m. 7 specimens.
St. WS 25. 17. xii. 26. Undine Harbour (North), South Georgia, 18–27 m. 1 specimen.
St. WS 27. 19. xii. 26. 53° 55′ S, 38° 01′ W, South Georgia, 107 m. 2 specimens.
St. WS 33. 21. xii. 26. 54° 59′ S, 35° 24′ W, South Georgia, 130 m. 8 specimens.
St. WS 244. 18. vii. 28. 52° 00′ S, 62° 40′ W, Falkland Islands, 253 m. 3 specimens.
St. WS 818. 17. i. 32. 52° 31′ S, 63° 25′ W, 272–278 m. 2 specimens (young).
St. MS 63. 24. ii. 26. East Cumberland Bay, South Georgia, 23 m. 1 specimen.
St. MS 71. 9. iii. 26. East Cumberland Bay, South Georgia, 110–60 m. 12 specimens.

There cannot be the slightest doubt that the above specimens are actually identical with Studer's *O. Martensi*. The original specimens of the latter have been lent me from the Hamburg Museum and I have thus been able to compare them directly with the Discovery specimens; I find them to agree in every respect—a result which could not have been reached from a comparison with the very poor figures given by Studer. But it appears further that Koehler's *Ophioglypha resistens* is also identical with *O. Martensi*, as a comparison of the Discovery specimens with the excellent figures given by Koehler in his two works of 1911 and 1922 shows beyond doubt. (It is of interest in this connection that Koehler identified the specimens from South Georgia of the Swedish South Polar Expedition as *O. resistens*, *op. cit.*, 1923.) By this I do not mean to say that I feel convinced that all the specimens described by Koehler under the name of *O. resistens* are really *O. Martensi*. On the contrary, I feel rather inclined to think that e.g. the specimen figured in pl. vii, fig. 9 (*op. cit.*, 1911), with the pronounced elevation on the dorsal arm plates is in reality *O. gelida*; at least I have not found anything similar in any of the numerous specimens in the present collection. Also the fact that none of the present specimens exceed a size of *ca.* 10 mm. in diameter of disk, whereas Koehler's largest specimens were 12–14 mm., indicates the probability that different species have been mixed up with *O. resistens*. Unfortunately, the original specimens of *O. resistens* are not in the collection of the British Museum, so that I have been unable to make sure whether they all belong to the same species. But the figures 11–12, pl. vii (*op. cit.*, 1911) agree completely with *O. Martensi*, and thus even though there may be more than one species in the original lot of specimens, it is certain that the name *resistens* becomes a synonym of *Martensi*. We have here a natural explanation of the fact that the littoral species of South Georgia, *O. Martensi*, has never been recorded since it was first described; as a matter of fact, it is one of the commonest Ophiuroids of South Georgia. I think it further beyond doubt that Bell's *Ophiozona inermis*, from Cape Adare, Victoria Land ('Southern Cross') is identical with *O. Martensi*. From Bell's "descrip-

tion" nothing can be concluded, of course. But the excellent figures given by Clark (*op. cit.*, 1915), evidently from a co-type, agree perfectly with *O. Martensi*, so that it seems quite safe to conclude that they are identical. This also accounts for the fact that *O. inermis* has never again been recorded.

The specimens from St. WS 818 are very young and the identification not altogether certain; but those from St. WS 244 are adult and quite typical, so that the occurrence of the species as far north as the Falkland Islands is beyond doubt.

The species is viviparous, but apparently *not* hermaphrodite. I have found males only among the smaller specimens, 4–5 mm. diameter. In no case was there any indication

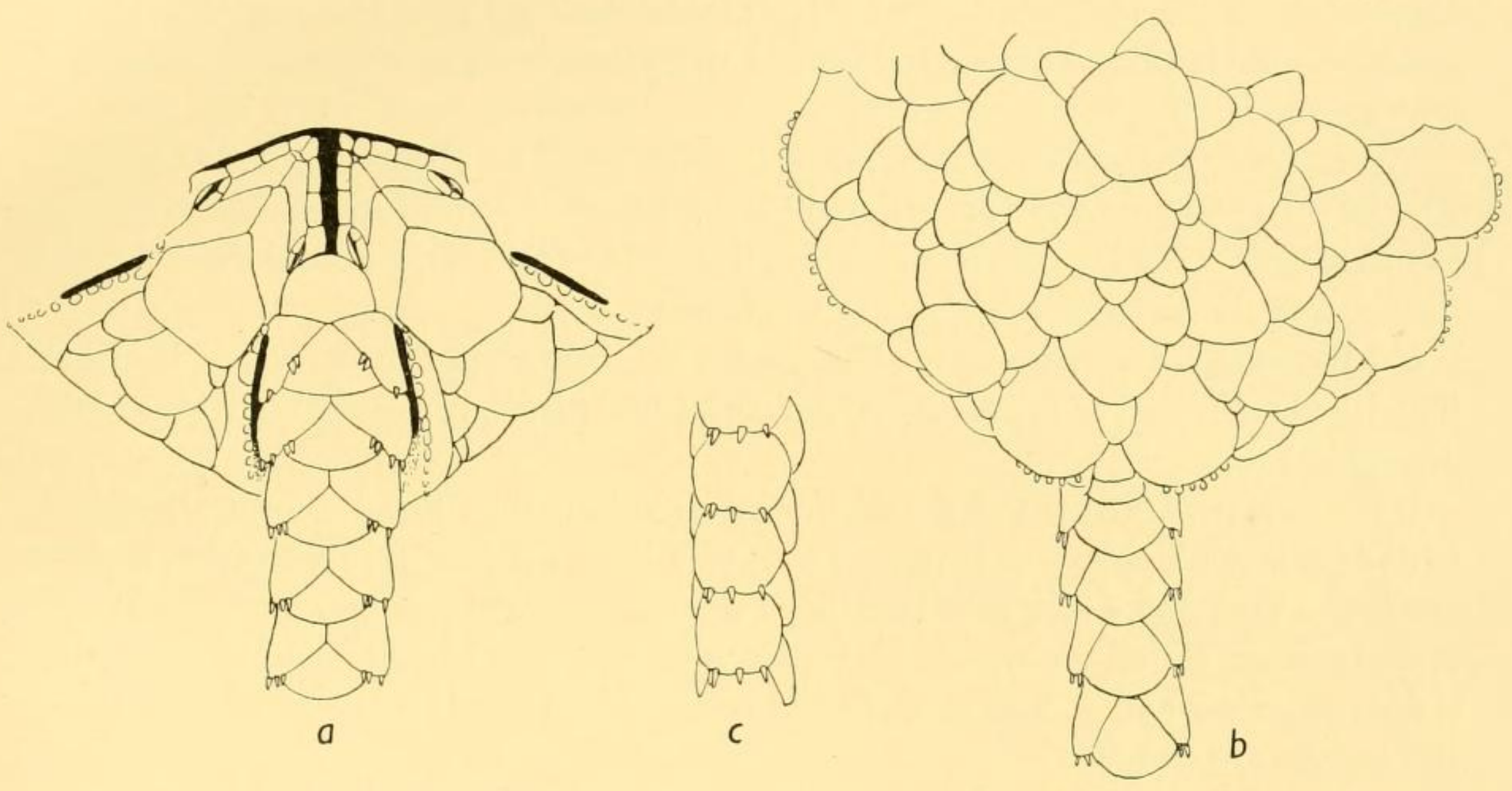

Fig. 39. *Ophiurolepis Martensi* (Studer). Part of oral side (*a*) and dorsal side (*b*). Part of arm in side view (*c*). ×12.

of young eggs developing within the testes, or of spermatozoa within the female gonads, so that the species evidently has separate sexes. There are usually two gonads at the interradial, one or two at the adradial side of the bursal slits. I have found five to six young ones, all in the same stage of development, in each bursa. In specimens containing large young ones the disk is quite swollen, almost hemispherical, as Koehler describes and figures it (*op. cit.*, 1922, p. 78, pl. lxxxviii *g*), though without suspecting the cause of it.

O. Martensi was not hitherto known from off Marion Island or from anywhere in the Kerguelen region.

In contradistinction to *O. gelida* this species is never covered with sponges, very rarely a single Foraminifer may be found to have attached itself upon it. Concentric rings, so characteristic of *O. gelida*, are never distinct on the disk plates.

Ophiurolepis Wallini, Mortensen

Ophiurolepis Wallini, Mortensen, 1925. *On a small collection of Echinoderms from the Antarctic Sea.* Arkiv för Zoologi, XVII, A 31, p. 3.

St. 160. 7. ii. 27. Near Shag Rocks, South Georgia, 177 m. 1 specimen.
St. 187. 18. iii. 27. Neumayr Channel, Palmer Archipelago, 259 m. 2 specimens.
St. 190. 24. iii. 27. Bismarck Strait, Palmer Archipelago, 130 m. 1 specimen.

To the original description of this species I would only add that the jaws are generally distinctly sunken in the middle, there being thus a circle of five rather conspicuous depressions round the mouth, just as in *Ophiurolepis partita*. None of the present specimens in hand have any of the ventral arm-plates divided, as was the case in the type specimen.

The species appears to have separate sexes and not to be viviparous, like *O. partita*. Two of the specimens were opened and both were found to be females. There are one or two gonads at the interradial, and one at the adradial side of the genital slit. The eggs are few and rather large, exactly as in *O. partita*.

On the whole, this species is closely related to *O. partita*, from which it is distinguished mainly by the character of the dorsal arm-plates, which are undivided in the present species.

It would appear further that Koehler's *Ophioglypha frigida* (Result. Voyage 'Belgica', Echinides et Ophiures, p. 16, pl. v, figs. 31–3) is also a close relation of the present species. I even had a suspicion that they might be identical; having, however, had an opportunity of seeing the type of *O. frigida* in the Brussels Museum and of comparing it with a specimen of *O. Wallini* that I had brought with me, I had to recognize that the two species are distinct.

Furthermore, it seems evident that the *Amphiophiura relegata*, described by Koehler in his report on the Ophiuroids of the Australasian Antarctic Expedition (p. 57, pl. lxxxviii, figs. 1–7) must also be nearly related to *O. Wallini* and *partita*. This sounds rather remarkable, since Koehler refers this species to quite a different genus, *Amphiophiura*. However, I think Koehler is mistaken in placing the species in this genus. Judging from his photographic figures—unfortunately very poor—it agrees very much more with *O. Wallini* and *partita*.[1] By this I do not mean to say that the species *relegata* should be transferred to the genus *Ophiurolepis*. As a matter of fact, I rather doubt whether all these species ought properly to be referred to the genus *Ophiurolepis*. I am strongly inclined to think that they ought to form a separate genus, differing from the typical *Ophiurolepis* in the much better developed ambulacral pores, and further characterized by the total absence of papillae at the base of the arms. I shall, however, refrain from establishing such a genus at present, as it could hardly be done properly without a complete revision of the large and difficult *Ophiurolepis-Homalophiura*

[1] After this report was sent to press I received from the Australian Museum, Sydney, a cotype of Koehler's *Amphiophiura relegata*. Comparison with the types of *Ophiurolepis Wallini* shows that these two species are, indeed, very closely related, though apparently distinct.

group, for which I have no time. I would emphasize, however, that the species mentioned are not better included in the genus *Homalophiura*, which is likewise characterized by its much reduced ambulacral pores—there being, indeed, some doubt whether *Homalophiura* can be maintained as a separate genus from *Ophiurolepis*.

Ophiurolepis partita (Koehler)

Ophioglypha partita, Koehler, 1908. Scott. Nat. Antarct. Exped. Astéries, Ophiures et Echinides, p. 595, pl. x, figs. 94–5.
Homalophiura partita, H. L. Clark, 1915. Cat. Recent Ophiurans, p. 327.

St. 180. 11. iii. 27. 1·7 miles W of N Point of Gand Island, Schollaert Channel, Palmer Archipelago, 160–330 m. 2 specimens.
St. 182. 14. iii. 27. Schollaert Channel, Palmer Archipelago, 278–500 m. 4 specimens.
St. 187. 18. iii. 27. Neumayr Channel, Palmer Archipelago, 259–354 m. 3 specimens.
St. 190. 24. iii. 27. Bismarck Strait, Palmer Archipelago, 130 m. 2 specimens.

The largest of the present specimens has a diameter of disk of 7 mm., whereas the type specimen from the 'Scotia', the only specimen hitherto found, was 10 mm. in

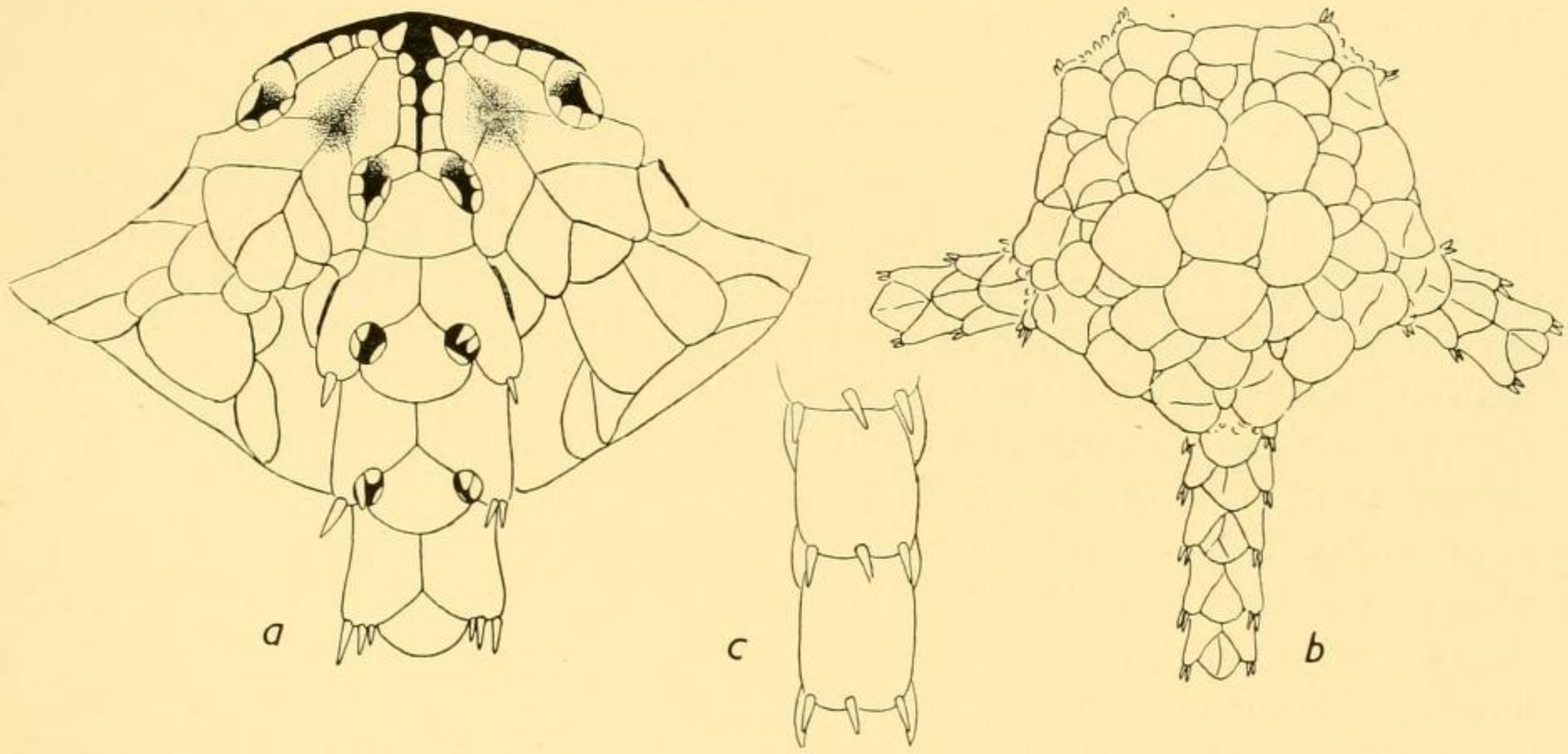

Fig. 40. *Ophiurolepis partita* (Koehler). Part of oral side (*a*). ×18. Dorsal side (*b*). ×9. Part of arm, side view (*c*). ×18.

diameter. This larger size may account for the conspicuous difference noted in the size of the primary disk plates, these being represented in Koehler's pl. x, fig. 94, as quite small, widely separated by a considerable number of small plates, whereas in the present specimens they are much larger, separated by only a few small plates, or even contiguous. The shape of the radial shields is also somewhat different from that shown in the figure quoted. They may be irregularly subdivided (Fig. 40 *b*). Koehler states that the plates of the disk are "très fortement granuleuses". This is rather exaggerated, conveying the impression that they are covered with separate granules, which they are not. It is only the usual calcareous substance of the plates which is rather coarse, giving the surface of the plates a more or less conspicuous granular appearance.

A marked feature of this species, not mentioned by Koehler, is that the jaws are usually distinctly sunken in the middle, there being thus five conspicuous depressions round the mouth. The two specimens from St. 180 have the dorsal arm-plates undivided, and one of them has also the buccal shields entire. As they otherwise agree with the remaining specimens, particularly in regard to the tentacle pores, I have no doubt that they belong to the same species, *O. partita*.

The species has separate sexes, and would seem not to be viviparous. There are one to three gonads at each genital slit, placed interradially, and one or none adradially. The ovaries contain a small number, about three to six, large yolky eggs *ca.* 0·3 mm. in diameter. Three of the specimens contain a very remarkable, large, parasitic Crustacean, probably a Copepod (? *Ophioika*). It does not castrate its host. On the specimens from St. 182 are further found some small Gymnoblastic Hydroids, probably identical with the *Hydractinia vallini* described by Jäderholm (*Über einige antarktische u. subantarktische Hydroiden*. Arkiv för Zoologi, XVIII A, No. 14, 1926, p. 2) from *Ophiurolepis Wallini*.[1] The type specimen was taken in the neighbourhood of the South Orkneys, at a depth of 3195 m.

Ophiurolepis turgida, n.sp.

St. WS 871. 1. iv. 32. 53° 16′ S, 64° 12′ W, 336–341 m. 1 specimen.

Diameter of disk 10 mm., arms scarcely three times that length, rather robust. Disk flat, covered with moderately large, flat scales, among which the primary plates are only little prominent. Radial shields small, oval, scarcely one-third of the disk radius; they are narrowly separated distally, widely divergent proximally. Ventral interradii with a moderate number of rather thick plates; genital scales not very broad. Buccal shields rounded with a rather acute angle within, the point of which may be separated off as a separate small plate. Adoral plates narrow, slightly narrower than the jaws. Mouth papillae of the usual square shape. First ventral plate large, rounded proximally, with a low peak distally. The following two to three plates narrowly contiguous or nearly so; they are of the usual, nearly triangular form. Dorsal arm-plates rather broadly contiguous, with a low, wart-like prominence distally. Lateral plates somewhat swollen, carrying two small, rudimentary spines, one near the tentacle scales, the other nearer the upper edge, though some distance therefrom. Tentacle pores and scales rudimentary, as typical of *Ophiurolepis*. Genital slits very small and narrow, not proceeding beyond the first lateral plate; there are some few low, wart-like papillae along their interradial edge, these papillae continuing along the sides of the arms to the edge of the disk and along the outer edge of the radial shields. Colour of the single dried specimen white.

This species appears to be the nearest related to *O. anceps*, Koehler, which has also quite short genital slits. But the much thicker and more swollen plates of the disk and arms of *O. anceps* prove that they cannot be identical; the shape of the buccal shields and of the first ventral arm-plate is also quite different in the two species. From

[1] A related species, *Hydractinia* (*Stylactis*) *ingolfi*, found on *Homalophiura tessellata* (Verrill), was described by Dr Kramp in the report on the Hydroids of the Godthaab Expedition 1928, in Meddelelser om Grønland, 79, 1, 1932, p. 13: cf. Mortensen, 'Ingolf' Ophiuroids, p. 92, pl. iii, fig. 17.

Homalophiura inornata, with similar short genital slits, it differs in the plates being much thicker—there is even a slight indication of such thickenings as are so characteristic of *O. gelida*—besides other characters (cf. Fig. 42 *a*, *b*). (That the species *inornata* is referred to the genus *Homalophiura* while the present species is referred to the genus *Ophiurolepis* does not mean that they are essentially different, since the genus *Homalophiura* probably cannot be maintained as distinct from *Ophiurolepis*, see below, p. 329.)

On the whole, I think the only possible course is to regard the specimen described above as representing a separate species.

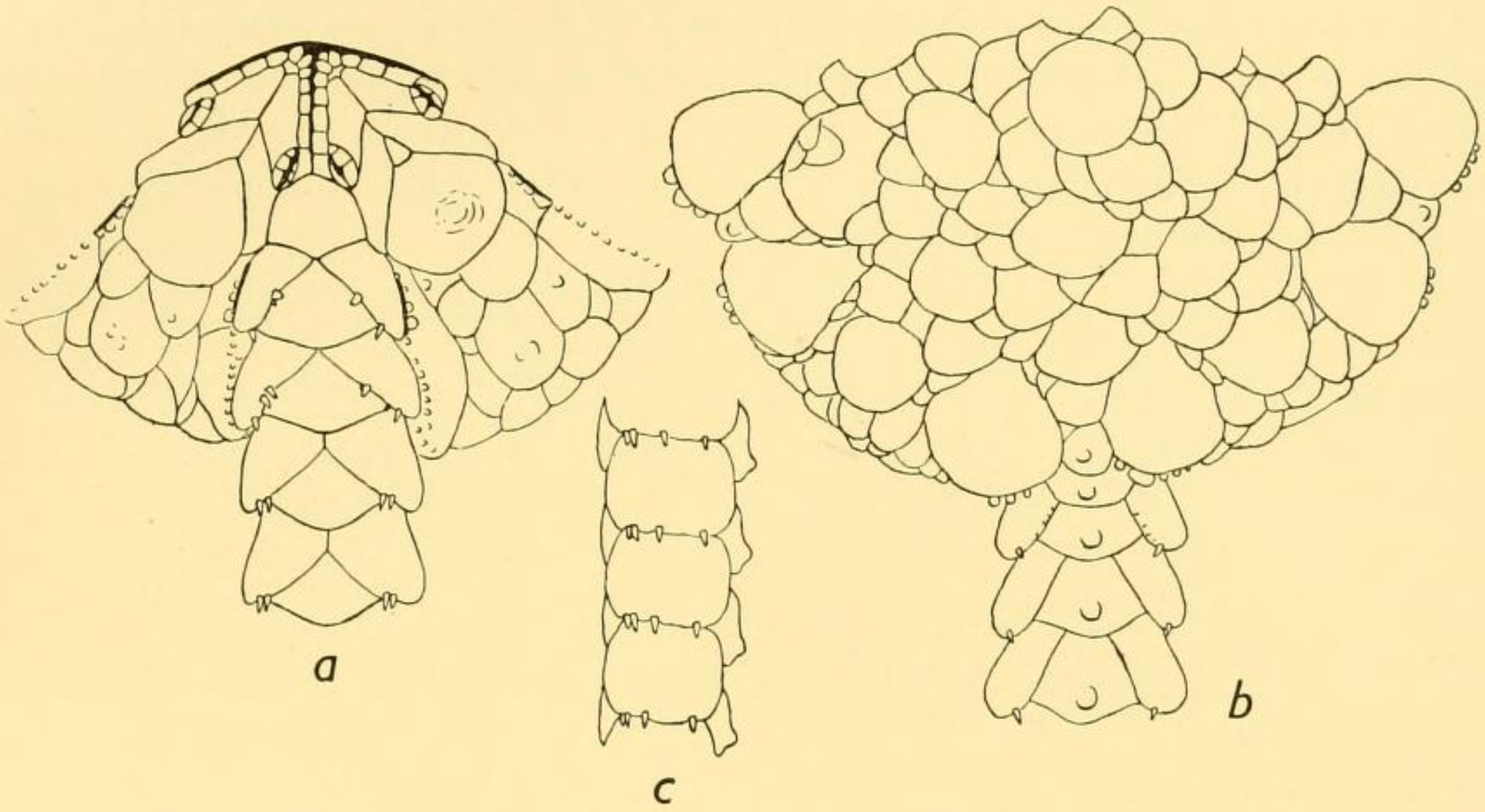

Fig. 41. *Ophiurolepis turgida*, n.sp. Part of oral side (*a*) and dorsal side (*b*). Part of arm in side view (*c*). ×8.

Homalophiura inornata (Lyman)

(Plate VIII, figs. 4–5)

Ophioglypha inornata, Lyman, 1882. Sci. Results H.M.S. 'Challenger'. Ophiuroidea, p. 73, pl. iii, figs. 10–12.

? *O. divisa*, Lütken and Mortensen, 1899. 'Albatross' Ophiuroids, p. 127, pls. iv, figs. 10–12; v, figs. 1–2.

O. inornata, Koehler, 1904. Siboga-Exped. Ophiuroidea, 1, p. 40.

O. inornata, Koehler, 1906. Ophiures du 'Travailleur' et du 'Talisman', p. 262.

Homalophiura inornata, H. L. Clark, 1915. Cat. Recent Ophiurans, p. 326.

H. inornata, Koehler, 1922. *Ophiurans of the Philippine Seas.* Bull. U.S. Nat. Mus., 100, 5, p. 387, pl. 82, fig. 9.

St. WS 212. 30. v. 28. 49° 22′ S, 60° 10′ W, 242–249 m. 3 specimens.
St. WS 236. 6. vii. 28. 46° 55′ S, 60° 40′ W, 272–300 m. 4 specimens.
St. WS 819. 17. i. 32. 52° 42′ S, 62° 39′ W, 312–329 m. 4 specimens.
St. WS 820. 18. i. 32. 52° 53′ S, 61° 51′ W, 351–367 m. 3 specimens.
St. WS 821. 18. i. 32. 52° 56′ S, 60° 55′ W, 461–468 m. Several specimens (in very poor condition).
St. WS 839. 5. ii. 32. 53° 30′ S, 63° 29′ W, 403–439 m. 1 specimen.

Nearly all the specimens from St. WS 821 have the buccal plates or the dorsal arm-plates, or both, irregularly divided. The specimens from the other stations have both buccal plates and dorsal arm-plates undivided. The great variation which exists on this point in the present species has been repeatedly emphasized by Koehler (*op. cit.*).

An important fact is to be noted in this species—or at least in the present specimens—viz. that the genital slits are quite short, not extending beyond the first lateral plate. But in continuation of the genital slit there are, in the larger specimens, a number of flat, irregularly arranged granules (recalling to some degree genital papillae) (Fig. 42*a*). This has an important bearing on the question of the identity of these specimens with Lyman's *Ophioglypha inornata* and with Lütken and Mortensen's *Ophioglypha divisa*. Both these species are represented as having long genital slits, continuing to the edge of

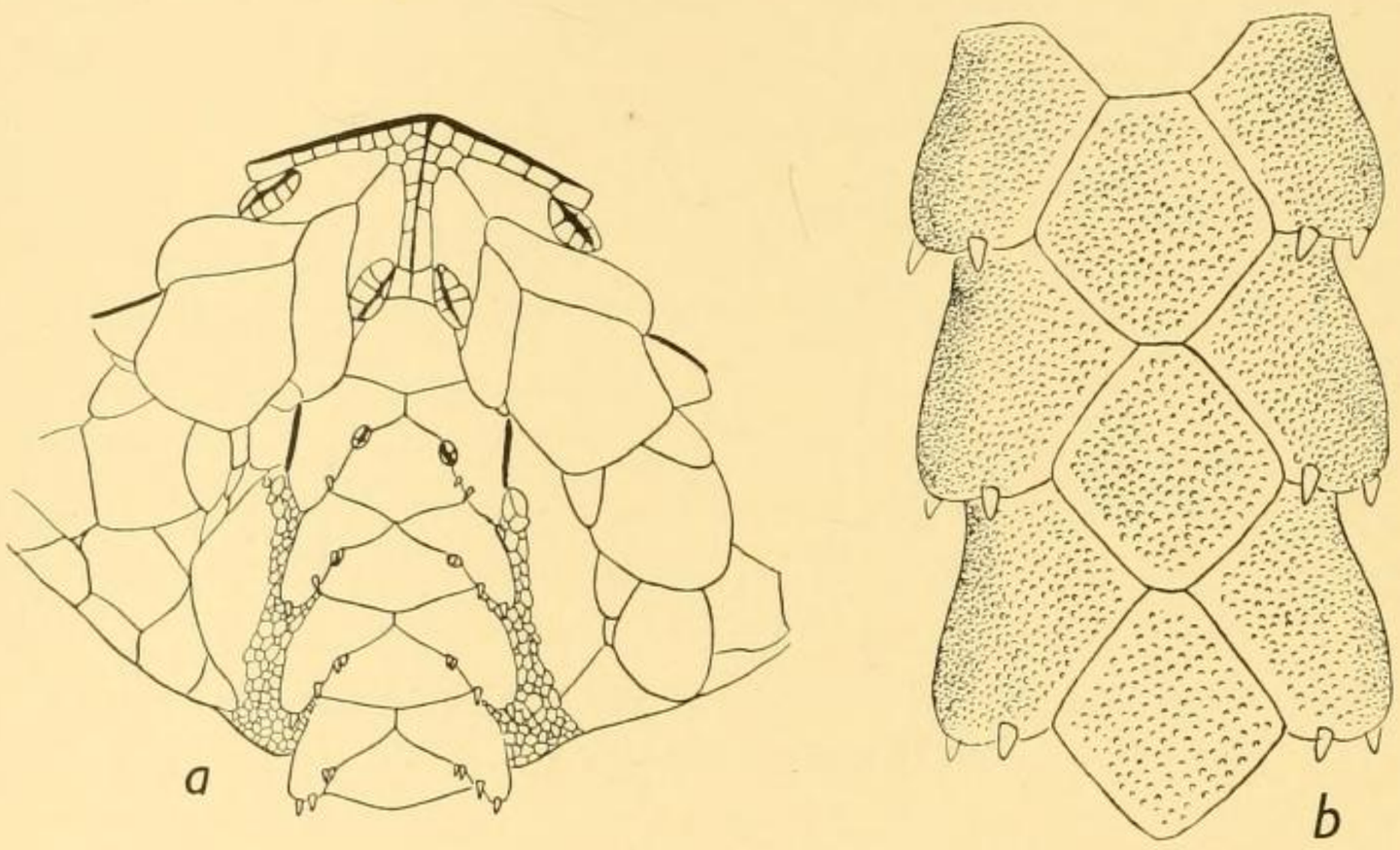

Fig. 42. *Homalophiura inornata* (Lyman). Part of oral side (*a*). ×6. Part of arm, dorsal side, of type specimen (*b*). ×20.

the disk. If that be correct, the present specimens are not identical with them, and must then represent a distinct species. Lately I had an opportunity of examining the type specimen of Lyman's *Ophioglypha inornata* in the British Museum. I find the genital slits to be quite short, not proceeding beyond the first lateral plate, but, as in the present specimens, there are some granules along the sides of the arms in continuation of the genital slits. Pl. III, fig. 10 of the Challenger Ophiuroidea is therefore erroneous in regard to the genital slits, and thus far the Antarctic specimens agree with Lyman's *inornata*. There is, however, one noteworthy difference. In the type of *inornata* the plates of the disk and arms have a peculiar coarsely granulated appearance (Fig. 42 *b*), whereas in the Antarctic specimens the plates are quite smooth. If this proves to be a constant difference between the Atlantic-Pacific specimens of *inornata* and those from the Antarctic seas, the latter should evidently form at least a separate variety.

As for *O. divisa*, Lütken and Mortensen, maintained by Koehler to be identical with *H. inornata*, I have no specimens of that species, so I cannot ascertain whether it has actually long genital slits as represented in pl. iv, fig. 10 and pl. v, fig. 1 of the Albatross Ophiuroidea. On applying to my friend Professor H. L. Clark, who has a couple of co-types of *O. divisa* in the Museum of Comparative Zoology, he kindly informs me that, having carefully compared these specimens with the figures quoted, he does "not think there is any reason to criticize these figures". Both specimens have the slits very tightly closed, so it is difficult to feel sure how long the slits are; but there is little doubt that they do go to the margin. After this I think it very doubtful whether *O. divisa* is really identical with *O. inornata*; at least, I cannot agree that such identity has as yet been proved.

H. inornata was not hitherto known from Antarctic seas; but with its (apparently) cosmopolitan distribution it is not surprising that it has now been found to occur, not only in the Magellanic region, but even so far south as the South Shetlands. The smallest depth from which it was hitherto known was 470 m.

The species has separate sexes and is not viviparous. There are numerous gonads along both sides of the bursae. The eggs are rather large and yolky, apparently not ripening all at a time. One of the specimens from St. 363 carries a number of specimens of a species of *Loxosoma*.

Hertz (Deutsche Südpolar-Exped., Ophiuroiden, p. 18) has pointed out the difficulty of distinguishing the genera *Homalophiura* and *Ophiurolepis* (and *Ophioplinthus*) and thinks that *Homalophiura* can scarcely be maintained. I rather think so too; however, this question cannot be settled without a very extensive study of all these forms, which would be out of place here; and as the species *inornata* is the genotype of *Homalophiura*, I shall retain that name for the present.

Homalophiura inornata, var. tuberosa, n.var.

St. 175. 2. iii. 27. Bransfield Strait, South Shetlands, 200 m. 1 specimen.
St. 363. 26. ii. 30. 2·5 miles S 80° E of SE Point of Zavodovski Island, South Shetlands, 329–278 m. 4 specimens.

These specimens on the whole agree very well with the above specimens of *H. inornata*, but they differ so markedly from them in the dorsal arm-plates that they must be designed as a separate variety. These plates are very small, separated and conspicuously thickened, so as to form the appearance of a series of small warts along the dorsal side of the arm. Also the plates of the disk are somewhat thicker than usual in the species.

Although this character of the dorsal arm-plates is rather a striking feature, I do not think it sufficient for a specific character, the more so as there is some variation in its development; the largest specimen from St. 363 has it so much less pronounced than the others that it may rather be designated simply as *inornata*; the one next in size is more intermediate. I shall therefore designate it only as a variety of *H. inornata*.

It may be mentioned that here and there a dorsal plate is seen to be irregularly divided; the buccal plates are also irregularly divided, as is so often the case in this species.

It may not be superfluous to state that the variety has separate sexes like the typical form; this is evident from the fact that the one specimen opened was found to be a ripe male.

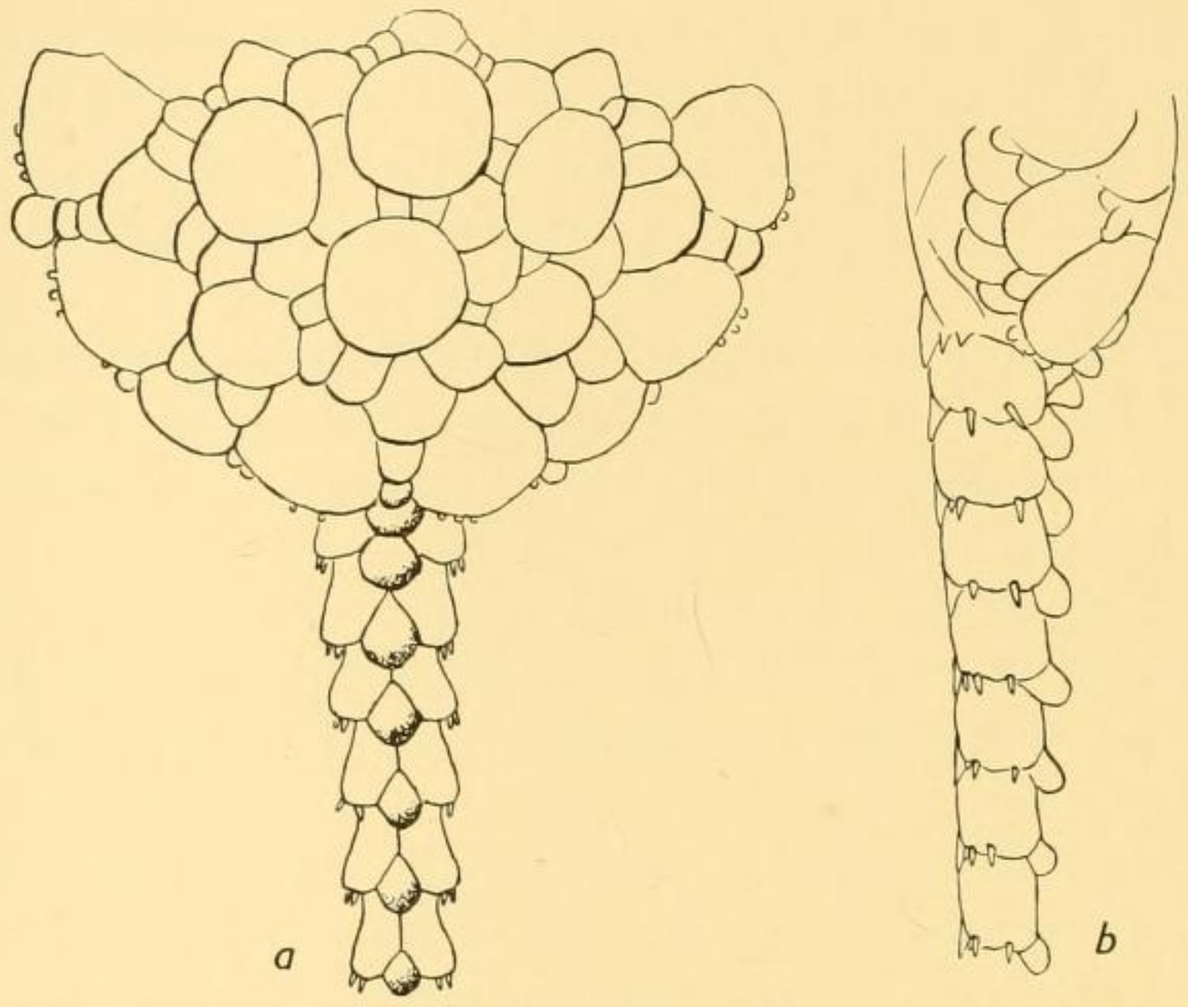

Fig. 43. *Homalophiura inornata*, var. *tuberosa*, n.var. Part of dorsal side (*a*); part of arm and disk, side view (*b*). ×10.

Ophiura meridionalis (Lyman)

Ophioglypha meridionalis, Lyman, 1879. *Ophiuridae and Astrophytidae of the 'Challenger'*. Part II. Bull. Mus. Comp. Zool., VI, p. 56, pl. xvi, figs. 447–9.

O. meridionalis, Lyman, 1882. Sci. Results H.M.S. 'Challenger'. Ophiuroidea, p. 40.

Ophiomastus rotundus, G. A. Smith, 1923. *Rep. Echinoderms of the 'Quest'*. Ann. Mag. Nat. Hist., 9 Ser., XII, 372.

St. 27. 15. iii. 26. West Cumberland Bay, South Georgia, 110 m. 8 specimens.

St. 39. 25. iii. 26. East Cumberland Bay, South Georgia, 179–235 m. 2 specimens.

St. 42. 1. iv. 26. Off mouth of Cumberland Bay, South Georgia, 120–204 m. 4 specimens.

St. 123. 15. xii. 26. Off mouth of Cumberland Bay, South Georgia, 230–250 m. Several specimens.

St. 126. 19. xii. 26. 53° 58′ S, 37° 08′ W, South Georgia, 100–0 m. 2 specimens.

St. 140. 23. xii. 26. Stromness Harbour to Larsen Point, South Georgia, 122–136 m. 10 specimens (young).

St. 144. 5. i. 27. Off mouth of Stromness Harbour, South Georgia, 155–178 m. 2 specimens.

St. 148. 9. i. 27. Off Cape Saunders, South Georgia, 132–148 m. 2 specimens.

St. 152. 17. i. 27. 53° 51′ S, 36° 18′ W, South Georgia, 245 m. 3 specimens.

St. 156. 20. i. 27. 53° 51′ S, 36° 21′ W, South Georgia, 200–236 m. 5 specimens.

St. 160. 7. ii. 27. Near Shag Rocks, South Georgia, 177 m. 7 specimens.

St. WS 33. 21. xii. 26. 54° 59′ S, 35° 24′ W, South Georgia, 130 m. 1 specimen.
St. WS 212. 30. v. 28. 49° 22′ S, 60° 10′ W, N of Falkland Islands, 242–249 m. 1 specimen.
St. MS 71. 9. iii. 26. East Cumberland Bay, South Georgia, 110–60 m. 7 specimens, and a number of very young specimens, the identification of which is uncertain.

There can be no doubt that these specimens are identical with the *Ophiomastus rotundus* of G. A. Smith, likewise from South Georgia, though differing in some minor points from Smith's description.

This identity was fully confirmed by the examination of one of Smith's original specimens, sent me for examination from the British Museum. Smith's statement that there are three arm spines up to the seventh joint, then four, must be due to some mis-

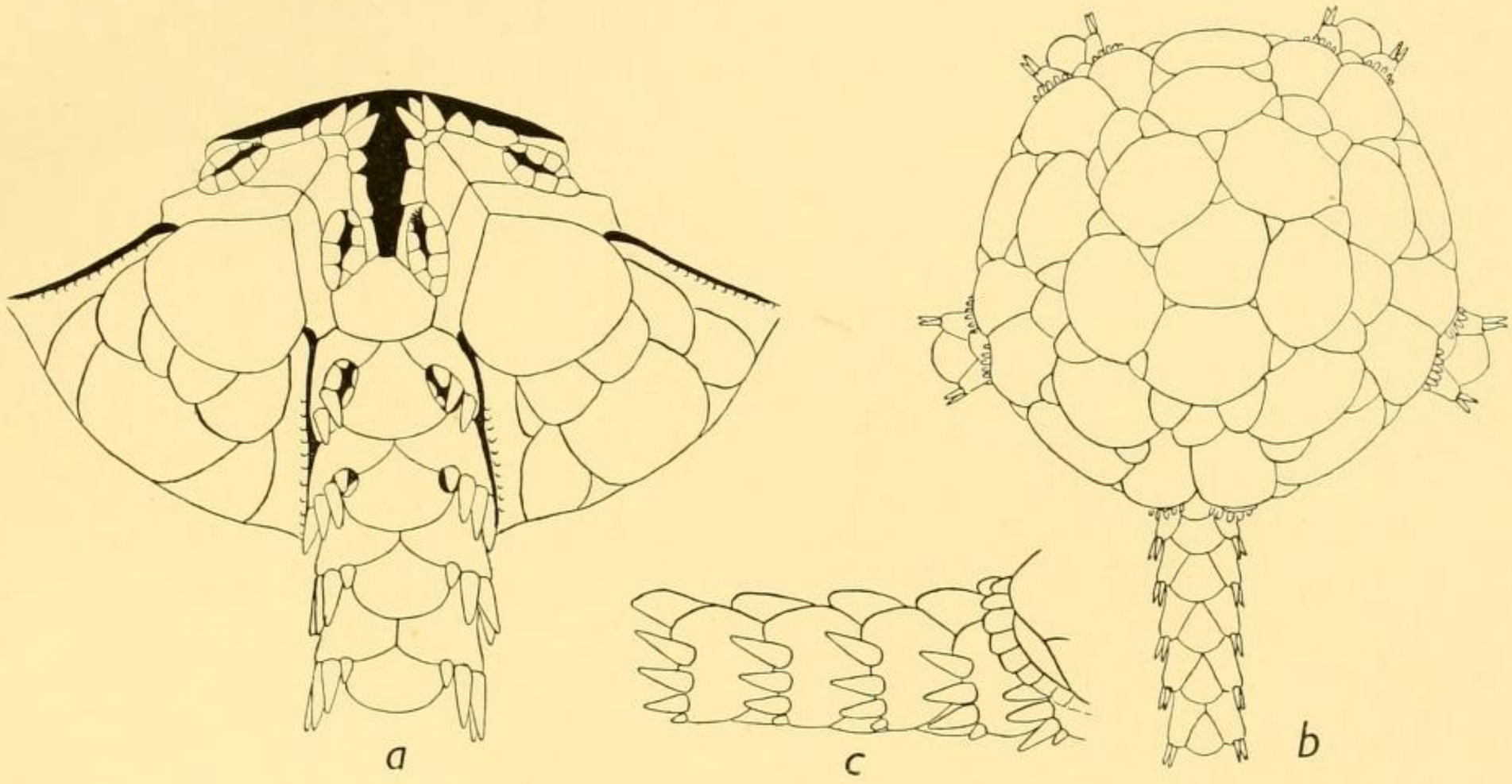

Fig. 44. *Ophiura meridionalis* (Lyman). Part of oral side (*a*), ×18; dorsal side (*b*), ×10. Proximal part of arm, side view (*c*). ×18.

take. My specimens, as well as the co-type sent me, have only three spines throughout; only quite exceptionally have I occasionally found four spines on a joint. It may be remarked that the upper spine is generally slightly the largest.

Not being able to see from extant descriptions and figures how this *Ophiomastus rotundus* could be distinguished from Lyman's *Ophioglypha meridionalis* from off La Plata, I applied to the British Museum for the loan of one of the original specimens of *O. meridionalis*, which was very kindly granted me. The result of the comparison of the two species is that there can be no doubt of their identity. As seen from Figs. 44, 45 there is some slight difference in the arrangement of the scales of the disk, the five primary radial plates being replaced by an irregular circle of eight plates in the type of *meridionalis*; this is, however, quite evidently an anomaly, and an exactly similar arrangement may be found in some of the specimens from South Georgia, though by far the majority of them have a regular circle of five primary radials. On the ventral side and on the arms no difference exists between *Ophiomastus rotundus* and *Ophiura*

meridionalis. Accordingly *Ophiomastus rotundus* is synonymous with *Ophiura meridionalis* (Lyman), which is thus distributed from off La Plata to South Georgia. The fact that there is only one specimen from off the Falkland Islands (St. WS 212) whereas there is a good number of specimens from various places off South Georgia, seems to indicate that the centre of distribution of the species is in the South Georgian area.

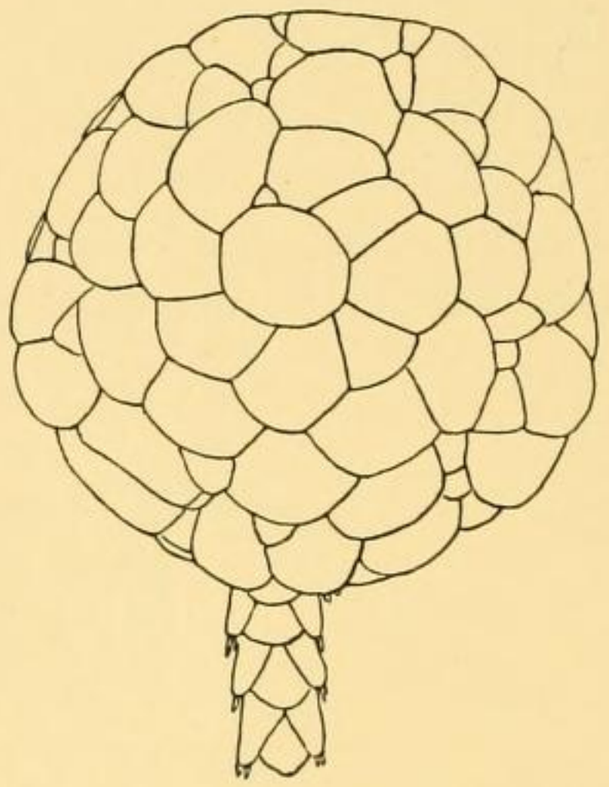

Fig. 45. *Ophiura meridionalis* (Lyman). Type specimen. Dorsal side. ×12·5.

I do not think this species can be referred to the genus *Ophiomastus*; the long genital slits and the existence of well developed arm combs are characters which do not conform with *Ophiomastus*, but with *Ophiura*, to which latter genus this species properly belongs. The tentacle scales are also markedly different from those of typical *Ophiomastus*.

None of the present specimens exceed a size of 6 mm. in diameter of disk, which thus appears to be the maximum size. *The species is viviparous and hermaphrodite*. The male gonads are found at the adradial side of the bursae and sometimes also at the interradial side, distally. The number of the gonads, male and female, varies to some extent, but generally there are only one or two of each at each bursa. The eggs are of the usual large size, *ca*. 0·3–0·4 mm., and there are only few of them; I have found only some six to eight embryos or eggs in each bursa. In no specimen were young ones found ready to leave the bursa, only such as had the skeleton in an incipient stage. Some of the specimens are infested by a curious Crustacean parasite, probably a Copepod (? *Ophioika*). It does not castrate its host.

It may be pointed out that there is some variation in regard to the tentacle scales of the second pore pair; generally there is only one tentacle scale here, as at the following pores, but not rarely there are two scales, at both sides of the pore. The specimen figured is unusual in having two scales at one pore, only one at the other. The disk is often conspicuously swollen, almost hemispherical, recalling to some degree that of *Ophiopyrgus*. The edge of the disk is usually rather sharp, marking the limit between the flat underside and the more or less elevated dorsal side.

Ophiura Rouchi (Koehler)

(Plate VIII, figs. 6, 7)

Ophioglypha Rouchi, Koehler, 1912. II[e] Expéd. Antarct. Française. Echinodermes, p. 107, pl. ix, figs. 11–12.

Ophiura Rouchi, Koehler, 1922. Austral. Antarct. Exped. Echinod. Ophiuroidea, p. 52, pl. lxxxv, figs. 1–2.

O. Rouchi, Hertz, 1926. Deutsche Südpolar-Exped. Ophiuroiden, p. 23.

St. 195. 30. iii. 27. Admiralty Bay, King George Island, South Shetlands, 391 m. 4 specimens.

To Koehler's excellent description of this species I have only to add that the uppermost arm spine is a little distant from the two others. The present specimens otherwise agree perfectly with Koehler's description and figures. The largest specimen is 7·5 mm. in diameter of disk, thus exceeding somewhat the largest size hitherto recorded, 6 mm. diameter of disk.

This species is viviparous but *not* hermaphrodite. Of two specimens opened one, 7 mm. in diameter, proved to be a female, with some ten young embryos in each bursa, all in the same stage of development, with the primary disk plates and the terminals recognizable; the other, 5 mm. in diameter, was a male. In both sexes two to three gonads were found at the interradial side, one to two at the adradial side of the bursa.

I quite agree with Koehler (*op. cit.*, 1922) that this species does not properly belong to the genus *Homalophiura*, to which it was referred by H. L. Clark (Cat. Recent Ophiurans, p. 327), but to the genus *Ophiura*, s.str.

Ophiura flexibilis, var. **crassa**, n.var.

St. 170. 23. ii. 27. Off Cape Bowles, Clarence Island, 342 m. 1 specimen.

This specimen in general corresponds with *O. flexibilis* (Koehler), but differs from it in the plates of the disk being smaller and more numerous than in the typical form; the

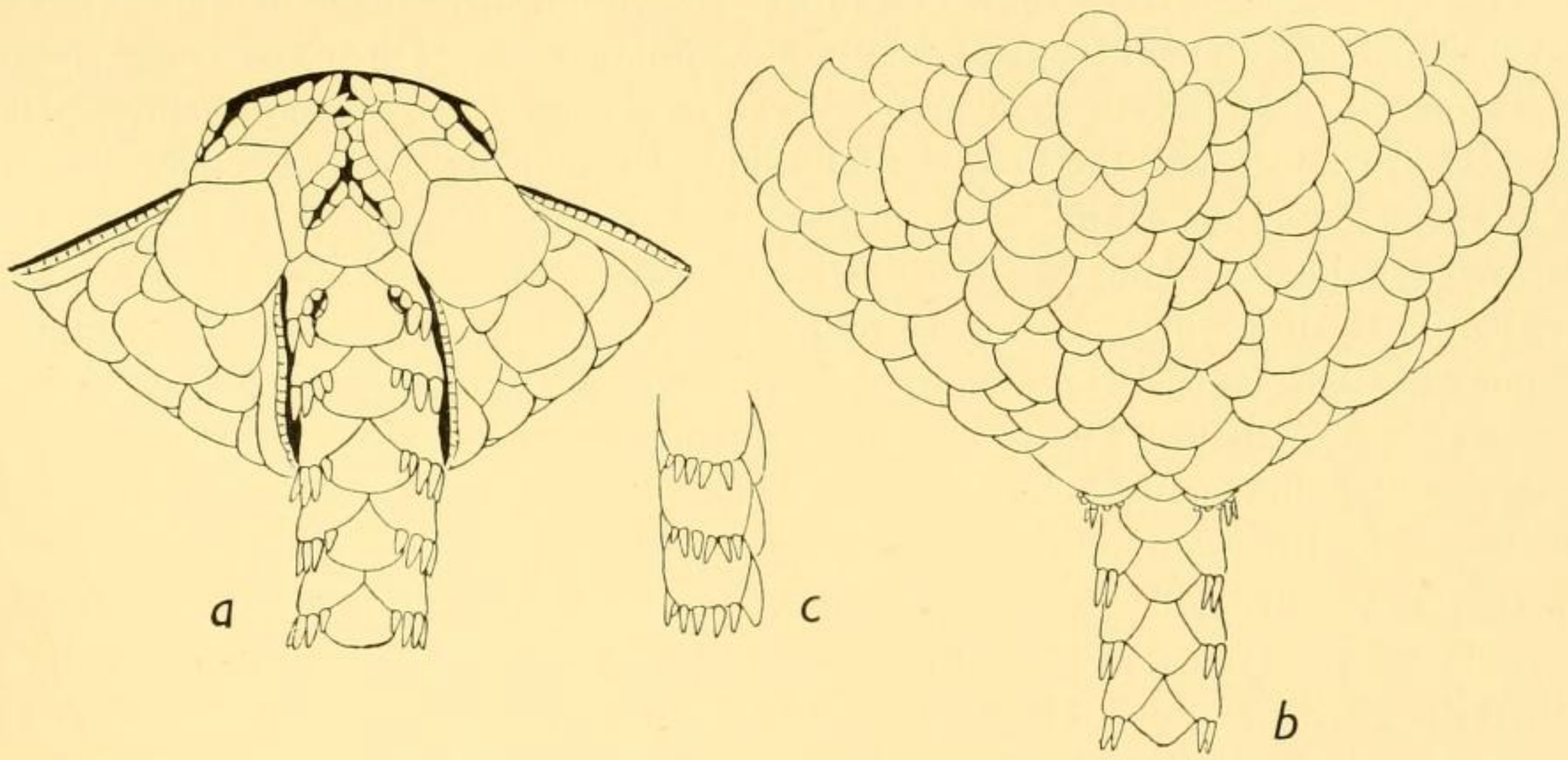

Fig. 46. *Ophiura flexibilis*, var. *crassa*, n.var. Part of oral side (*a*) and dorsal side (*b*); part of arm in side view (*c*).

ventral arm-plates are somewhat shorter and broader, and contiguous on the three proximal joints. The arms also are somewhat more robust than in the typical *flexibilis*. Quite exceptionally there may be five, instead of four, arm spines.

As the specimen is rather large, 8 mm. diameter of disk, it is quite possible that the differences pointed out are in the main due to age (I have no specimens of *flexibilis* of a corresponding size for comparison), and since the differences are rather unimportant, I do not think it desirable to make this single specimen the type of a separate species,

but prefer to designate it as a variety (it cannot be referred to any of the other known species of *Ophiura* from Antarctic seas).

Concerning the sexual character of the variety, as well as the typical *flexibilis*, I can only state that the eggs are of the usual large size, *ca.* 0·2–0·3 mm., and rich in yolk; but whether the species, or the variety, is viviparous or not cannot be decided from the scanty material at hand.

Ophiura serrata, n.sp.

St. 175. 2. iii. 27. Bransfield Strait, South Shetlands, 200 m. 4 specimens.
St. 195. 30. iii. 27. Admiralty Bay, King George Island, South Shetlands, 391 m. 1 specimen.

Diameter of disk 5·5 mm. Arms all broken, but apparently not more than about three times the disk diameter. They are triangular in section, the underside quite flat, the dorsal side keeled, but the keel is not sharp.

Dorsal side of disk rather flat, covered by large flat, imbricating scales, among which the primary plates are very conspicuous, forming in the younger specimens a very regular rosette. With age the primary plates evidently become separated by some smaller plates. Radial shields contiguous distally or nearly so. Ventral interradii with few, irregular plates, one in the middle, outside the buccal shield, somewhat larger than the others. Buccal shield rounded, with a small peak within. Adoral and oral plates of the usual shape. Mouth papillae three to four on each side of jaw, of the usual square shape. First ventral plate large, pentagonal, with convex outer edge. Second ventral plate scarcely in contact with the first, the following plates widely separated. Dorsal arm-plates rounded hexagonal in the proximal part of arm, gradually becoming longer and separated, pointed proximally and with the outer edge convex. The lateral plates, which are hardly at all swollen, carry three rudimentary, equal-sized and equidistant spines, at most the upper one slightly removed from the others. Only the two first pores well developed; from the third there are two small tentacle scales, from about the fifth only one. Genital slits well developed, reaching to the edge of the disk, with fairly well developed papillae along the genital scales; arm combs very little developed, at most two to three small papillae being visible from above. Colour of dried specimens whitish.

A conspicuous feature is found in the dorsal arm plates. They are separated by a rather deep furrow, which causes the dorsal outline of the arm as seen in profile to be a low serration, the plate itself being quite flat in outline (Fig. 47 *c*).

As regards the sexual characters of this species I can give no information beyond the fact that in one of the specimens, an interradius of which was opened, I found the gonads to contain only very few young, yolky eggs; it appeared that they would probably grow to the usual rather large size. Whether the species is viviparous cannot be ascertained from such poor evidence.

The specimen from St. 195 is somewhat larger, 7 mm. diameter of disk, and has some more small plates on the disk, the primary plates being wholly separated. The dorsal arm-plates are somewhat different in outline from those of the typical form (Fig. 47 *d*), and the lateral plates are rather distinctly swollen. Otherwise it agrees with the typical

form. From the sparse material at hand it is, of course, impossible to tell whether this represents a separate variety or is perhaps more typical of the species than the (younger) form here designated as the type. But, however this may be, the specimens from St. 175 are all alike, and it thus seemed more reasonable to select the largest of them as the type, instead of the single specimen from St. 195.

Though in no way a very marked form, I do not see that it can be referred to any known species of *Ophiura*.

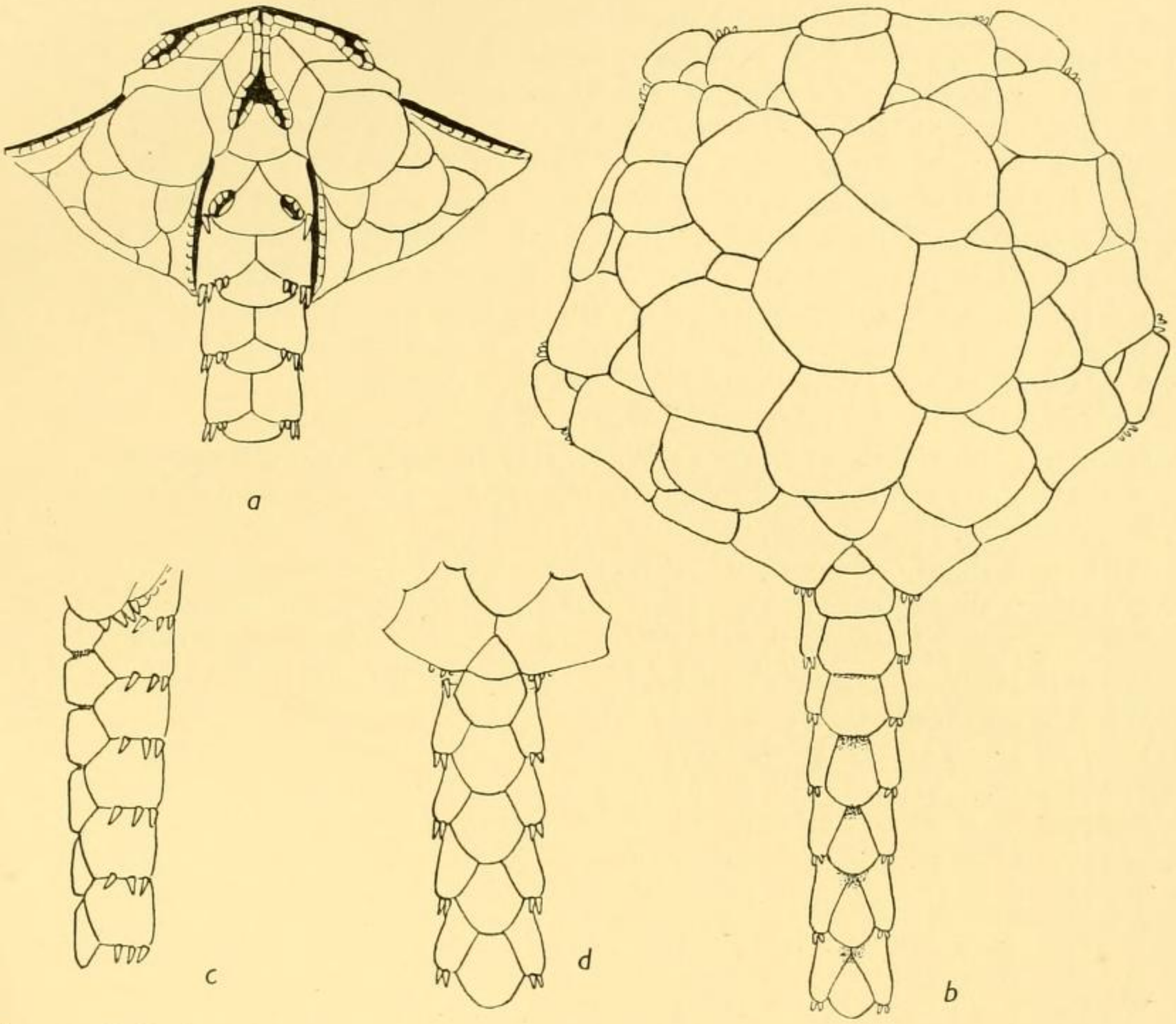

Fig. 47. *Ophiura serrata*, n.sp. Part of oral side (*a*); dorsal side (*b*). Part of arm, side view (*c*). Proximal part of arm, dorsal side, with radial shields, of specimen from St. 195 (*d*). All ×12·5.

Ophiocten amitinum, Lyman

(Plate VIII, fig. 2)

Ophiocten amitinum, Lyman, 1882. Sci. Results H.M.S. 'Challenger'. Ophiuroidea, p. 79, pl. ix, figs. 7–9.

O. amitinum, Studer, 1885. *Übersicht über die Ophiuriden der 'Gazelle'*. Abh. Akad. Berlin, 1882, p. 16, Taf. ii, fig. 8 *a–f*.

O. amitinum, Ludwig, 1899. Ophiuriden Hamburger Magalh. Sammelreise, p. 4.

O. amitinum, H. L. Clark, 1923. *Echinoderm Fauna of South Africa*. Ann. S. African Mus., XIII, p. 363. (Var. *simulans*, Mortensen.)

O. amitinum, Koehler, 1923. Swedish Antarct. Exped. Astéries et Ophiures, p. 122.

O. amitinum, Mortensen, 1933. *Echinoderms of South Africa.* Papers from Dr Th. Mortensen's Pacific Exped., LXV (Vid. Medd. Dansk Naturh. Foren., 93), p. 390. (Var. *simulans*, Mortensen.)

St. 91. 8. ix. 26. Off Roman Rock, False Bay, South Africa, 35 m. 1 specimen (type of var. *simulans*, n.var.).

St. 159. 21. i. 27. 53° 52′ S, 36° 08′ W, 160 m. 1 specimen.

St. 160. 7. ii. 27. Near Shag Rocks, South Georgia, 177 m. 12 specimens.

St. 474. 12. xi. 30. 1 mile W of Shag Rocks, South Georgia, 199 m. 10 specimens.

St. WS 93. 9. iv. 27. 7 miles S 80° W of Beaver Island, West Falkland Islands, 133 m. 2 specimens.

St. WS 99. 19. iv. 27. 49° 42′ S, 59° 14′ W, 251 m. 1 specimen.

St. WS 210. 29. v. 28. 50° 17′ S, 60° 06′ W, 161 m. Numerous young specimens.

St. WS 211. 29. v. 28. Same locality as St. WS 210. Numerous young specimens.

St. WS 212. 30. v. 28. 49° 22′ S, 60° 10′ W, 242 m. Numerous young specimens.

St. WS 213. 30. v. 28. Same locality as St. WS 212. Numerous young specimens.

St. WS 214. 31. v. 28. 48° 25′ S, 60° 40′ W, 208 m. Numerous young specimens.

St. WS 215. 31. v. 28. 47° 37′ S, 60° 50′ W, 219 m. Several young specimens.

St. WS 216. 1. vi. 28. Same locality as St. WS 215. Numerous young specimens.

St. WS 227. 12. vi. 28. 51° 08′ S, 56° 50′ W, 320 m. 5 specimens.

St. WS 229. 1. vii. 28. 50° 35′ S, 57° 20′ W, 210 m. Several specimens.

St. WS 231. 4. vii. 28. 50° 10′ S, 58° 42′ W, 167–159 m. Several young specimens.

St. WS 233. 5. vii. 28. 49° 25′ S, 59° 45′ W, 185–175 m. Numerous young specimens.

St. WS 234. 5. vii. 28. 48° 52′ S, 60° 25′ W, 195 m. Several young specimens.

St. WS 235. 6. vii. 28. 47° 56′ S, 61° 10′ W, 155 m. Several young specimens.

St. WS 236. 6. vii. 28. 46° 55′ S, 60° 40′ W, 272 m. Several young specimens.

St. WS 237. 7. vii. 28. 46° 00′ S, 60° 05′ W, 150 m. Numerous young specimens.

St. WS 244. 18. vii. 28. 52° 00′ S, 62° 40′ W, 253 m. Several young specimens.

St. WS 248. 20. vii. 28. 52° 40′ S, 58° 30′ W, 210–242 m. 1 specimen.

St. WS 748. 16. ix. 31. 53° 41′ S, 70° 55′ W, 300 m. 2 specimens.

St. WS 766. 18. x. 31. 44° 58′ S, 60° 05′ W, 545 m. 4 specimens, young.

St. WS 772. 30. x. 31. 45° 13′ S, 60° 00′ W, 162–309 m. 5 specimens, young.

St. WS 773. 31. x. 31. 47° 28′ S, 60° 51′ W, 291–296 m. Very numerous young specimens.

St. WS 781. 6. xi. 31. 50° 30′ S, 58° 50′ W, 148 m. 1 specimen.

St. WS 782. 4. xii. 31. 50° 28′ S, 58° 30′ W, 141–146 m. 8 specimens, in poor condition.

St. WS 783. 5. xii. 31. 50° 03′ S, 60° 10′ W, 155–159 m. Numerous young specimens.

St. WS 784. 5. xii. 31. 49° 48′ S, 61° 05′ W, 164–170 m. 7 specimens.

St. WS 818. 17. i. 32. 52° 31′ S, 63° 25′ W, 272–278 m. 2 specimens.

St. WS 819. 17. i. 32. 52° 42′ S, 62° 39′ W, 312–329 m. 1 specimen.

St. WS 824. 19. i. 32. 52° 29′ S, 58° 27′ W, 137–146 m. *ca.* 20 specimens, in poor condition.

The very numerous young specimens (by the hundred thousand) bear witness to the excellent food conditions that must exist in Falkland seas; it seems beyond doubt that this Ophiurid must be a factor of considerable importance in the ecology and economy of these seas.

Plate VIII, fig. 2, represents a photo of a live specimen; it is stated to have the "upper side of disc deep purplish brown, with white plates; arms deep brown above". Some few of the preserved specimens still show distinct traces of this coloration.

That this species is not viviparous has already been pointed out by Ludwig (*op. cit.*); I may add that it has, as was to be expected, separate sexes.

The specimen from St. 191, False Bay, South Africa, cannot simply be identified with the South American specimens of *Ophiocten amitinum*. It differs from the latter in the character of the arm comb, in the arms being more distinctly carinate, and in the colour, the arms being distinctly banded, with alternating white and dark, brownish bands. The more important difference is in the arm comb. In the South African form the comb continues downwards, along the genital slit, which it does not do in the South American form; further there is a distinct inner comb, whereas in the South American form there is no such distinct inner comb (Fig. 48 *a*, *b*).

In my Echinoderms of South Africa (*loc. cit.*) I pointed out the close resemblance between this South African form and the North Atlantic *Ophiura affinis*, Lütken. As a

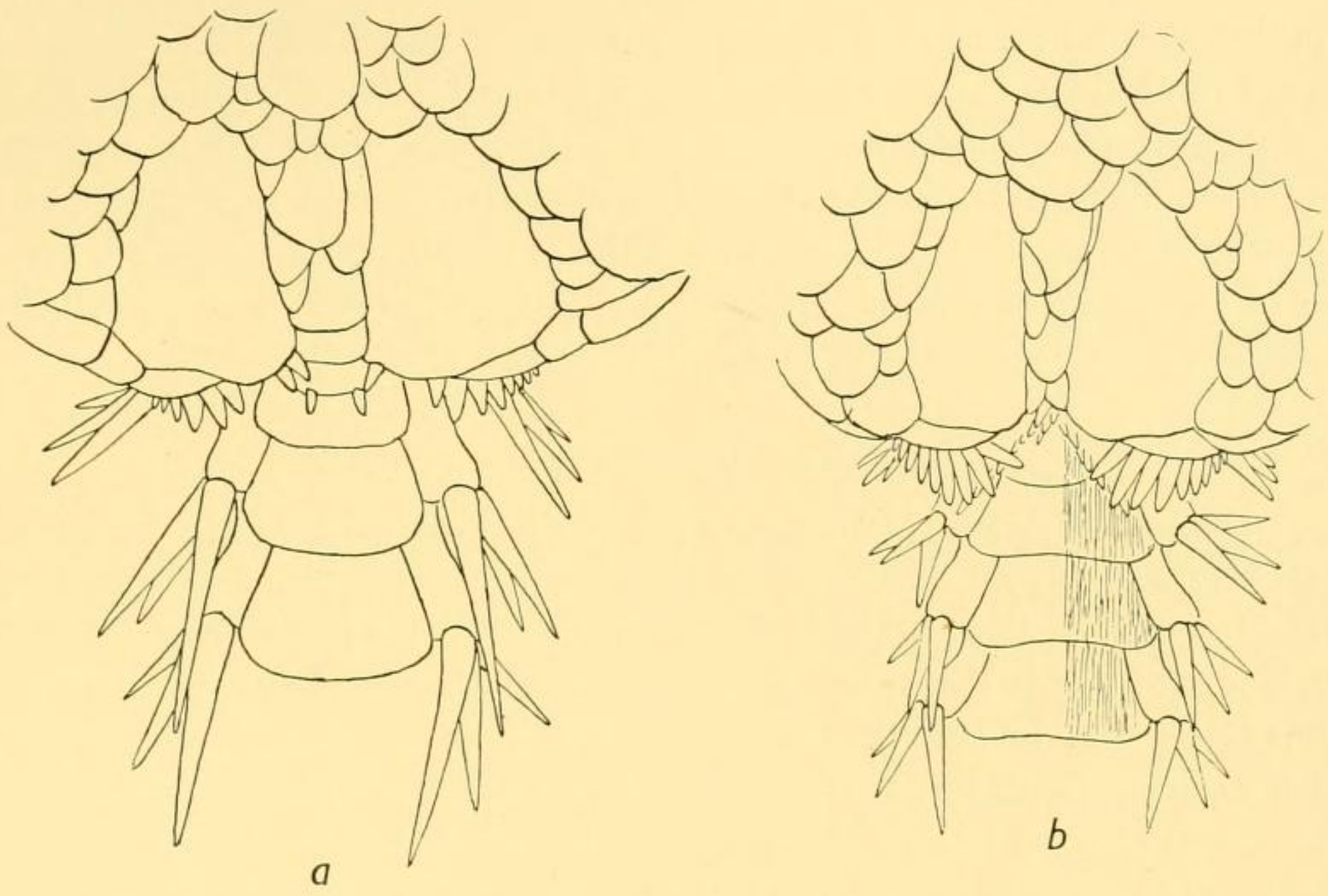

Fig. 48. Part of dorsal side of *Ophiocten amitinum*, Lyman (*a*) and of the var. *simulans*, n.var. (*b*). *a* is from a specimen 6 mm. in diameter of disk, *b* from a specimen 5·5 mm. in diameter. ×22·5.

matter of fact, I do not see how they can be distinguished, and I am very much tempted to regard the South African "*Ophiocten amitinum*" as identical with *Ophiura affinis*. I do not do so here for two reasons; first, because I have not seen any specimen of *Ophiocten amitinum* from the type locality, off Kerguelen—perhaps the Kerguelen specimens will prove to differ from those from South America and be more like the South African form; and then we do not know *O. affinis* from the West African Coast, unless the *Ophiocten africanum* of Koehler should prove to be identical with *affinis* (in my Echinoderms of South Africa, p. 391, I have expressed the opinion that it is more nearly related to the Mediterranean *O. Grubei*, Heller). In view of these uncertainties I think it preferable for the present to designate the South African form as a variety of *Ophiocten amitinum*, var. simulans, n.var.

Ophiocten dubium, Koehler

Ophiocten dubium, Koehler, 1901. Result. Voyage 'Belgica'. Echinides et Ophiures, p. 20, pl. vi, figs. 40–1.
O. dubium, Koehler, 1912. II^{e} Expéd. Antarct. Française. Echinodermes, p. 129.
O. dubium, subsp. *gaussense*, Hertz, 1926. Deutsche Südpolar-Exped. Ophiuroiden, p. 15, Taf. ii, figs. 4–5.

St. 170. 23. ii. 27. Off Cape Bowles, Clarence Island, 342 m. 1 specimen.
St. 190. 24. iii. 27. Bismarck Strait, Palmer Archipelago, 130 m. 2 specimens.

These are perfectly typical specimens of this remarkable *Ophiocten*. The specimen from St. 170 is adult, 9 mm. in diameter of disk. It is a ripe male, full of large testes; this shows the species to have separate sexes and to be, in all probability, non-viviparous. The specimens from St. 190 are young, 3–5 mm. in diameter of disk.

I do not think the subspecies *gaussense* of Hertz valid. The character on which it is based, eight arm spines, instead of nine to ten in the typical form, and somewhat longer than in the latter, is quite unimportant, and no doubt subject to a good deal of variation, as is usually the case in Ophiurids with numerous spines. Since only a very small number of specimens of this species have as yet been recorded, twelve in all, it seems unjustifiable to establish a separate subspecies on this character.

Ophiocten bisquamatum, n.sp.

St. 42. 1. iv. 26. Off mouth of Cumberland Bay, South Georgia, 120–204 m. 3 specimens.
St. 140. 23. xii. 26. Stromness Harbour to Larsen Point, South Georgia, 122–136 m. 1 specimen.
St. 152. 17. i. 27. 53° 51′ S, 36° 18′ W, South Georgia, 245 m. 1 specimen.

Diameter of disk of largest specimen 3·5 mm. Arms broken, but apparently not more than *ca.* 12–15 mm. in length. The disk is flattened, but the edge is rather high, rounded, not at all sharp as in most species of *Ophiocten*. There is usually a large, circular central plate which is somewhat eccentric (one of the specimens has no central plate). The disk is otherwise covered by rather large, imbricating plates, among which the primary plates are not distinct. Along the edges of the plates are found some very small, slightly elevated scales, like very low, nearly flat granules. The radial shields are distinctly broader than long, contiguous distally or wholly separated. The disk scales on the whole are exceedingly thin and delicate, looking dark (transparent) in the middle, whitish along the edges, where they imbricate. The ventral interradii show only some few small plates outside the large, squarish, rounded buccal shields. Mouth papillae four at each side of the jaw, the proximal ones pointed.

First ventral plate large, polygonal, with convex distal edge. The second ventral plate contiguous with the first, the third nearly contiguous with the second, the following ones widely separated. All the ventral plates with strongly convex distal edge. Dorsal arm-plates rectangular, with outer edge convex; they are distinctly longer than broad, and broadly contiguous. Three arm spines, the uppermost one the longest, only little longer than an arm joint in the proximal part of the arm. Tentacle scales at the first pore pair one at the adradial, three at the interradial side; the outer one of the three latter is elongate, spine-like, the others more leaf-shaped. The following pores have two, some-

times three, spine-like tentacle scales, continuing at least till the middle of the arm, the inner one then gradually becoming smaller and disappearing. The tentacle scales are very like the lower arm spines, and not much shorter, so that it is not easy to tell which are spines and which tentacle scales. The genital slits are wide, with the merest indication of papillae distally. Arm comb consisting only of three or four papillae at the distal edge of the radial shields. No papillae across the base of the arms or along the distal edge of the first dorsal arm plates. Colour of the dried specimens whitish.

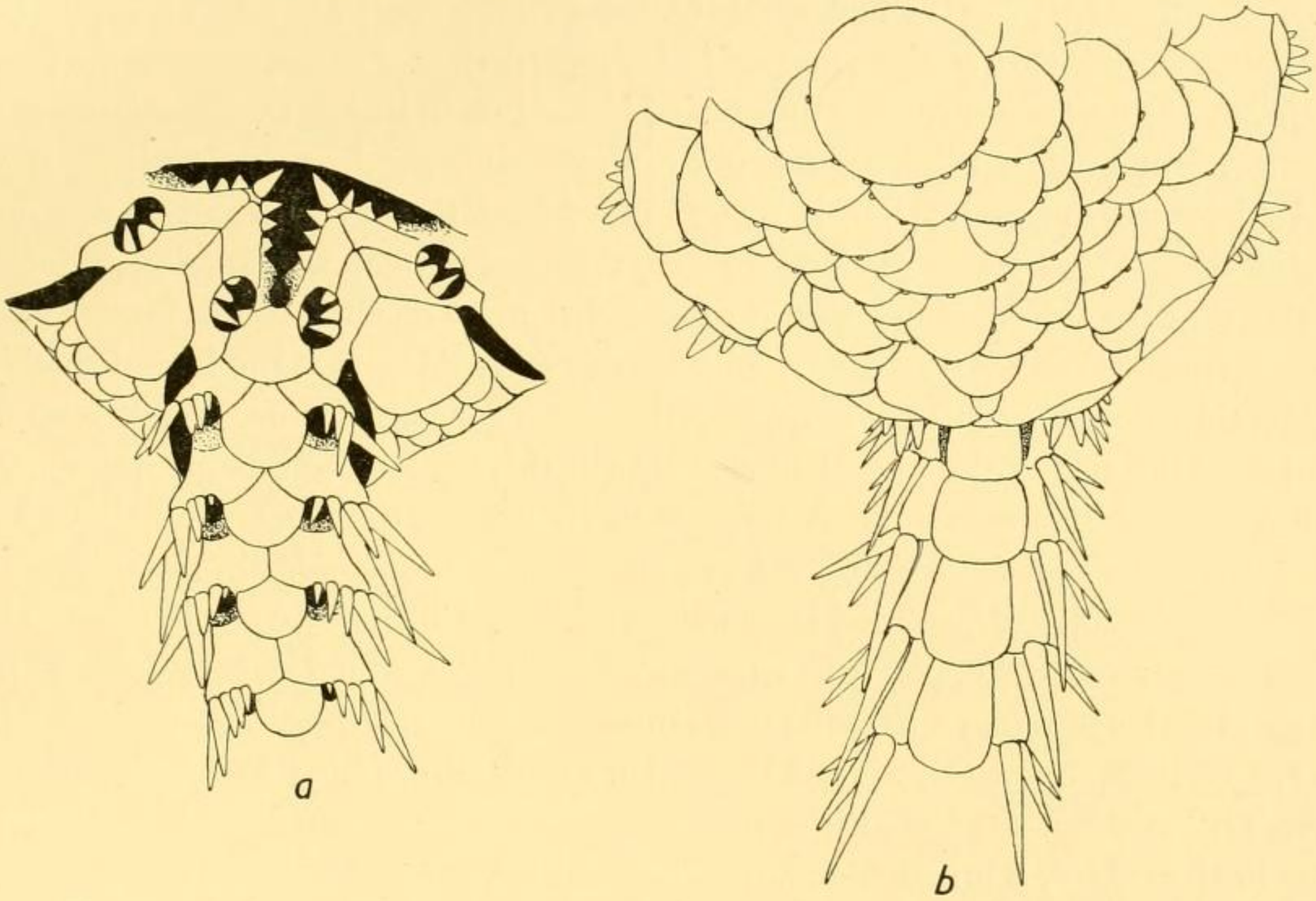

Fig. 49. *Ophiocten bisquamatum*, n.sp. Part of oral (*a*) and dorsal side (*b*). ×22·5.

This is an interesting species, recalling by its large, eccentric central plate *O. megaloplax*, Koehler, with which it also agrees in the shape of the dorsal arm-plates. The small granules of the disk recall *O. dubium*; but in the character of the tentacle scales it stands quite apart from the other known species of *Ophiocten*.

On the sexual characters I can give no information. On opening an interradius of the largest specimen I found no genital organs developed, which seems to indicate that none of the specimens are adult.

I may take the opportunity here of stating that *Ophiocten megaloplax* has separate sexes and is not viviparous.

Dictenophiura anoidea, H. L. Clark

Dictenophiura anoidea, H. L. Clark, 1923. *Echinoderm Fauna of South Africa*. Ann. S. African Mus., XIII, p. 361, pl. xix, figs. 1–2.

Ophiura carnea, Hertz, 1927. Deutsche Tiefsee-Exped. Ophiuroiden, p. 69 (*Non: Ophiura carnea*, M. Sars).

Dictenophiura anoidea, Mortensen, 1933. *Echinoderms of South Africa*. Papers from Dr Th. Mortensen's Pacific Exped., LXV (Vid. Medd. Dansk Naturh. Foren., 93), p. 388.

St. 91. 8. ix. 26. Off Roman Rock, False Bay, South Africa, 35 m. 3 specimens.

Dictenophiura Skoogi (Koehler)

Ophiura Skoogi, Koehler, 1923. *Sur quelques Ophiures des côtes de l'Angola et du Cap.* Göteborg. K. Vet. Vitterhets-Samhälles Handlingar, XXV, 5, p. 11, figs. 10–11.

Dictenophiura Skoogi, Mortensen, 1933. *Echinoderms of South Africa.* Papers from Dr Th. Mortensen's Pacific Exped., LXV (Vid. Medd. Dansk Naturh. Foren., 93), p. 390, fig. 87 *b*.

St. 279. 10. viii. 27. Off Cape Lopez, French Congo, 58–67 m. 15 specimens.

There can be no doubt that these specimens are identical with Koehler's *Ophiura Skoogi*. Another question is whether this *O. Skoogi* differs really so much from the North Atlantic *O. carnea* that it can reasonably be regarded as a separate species. Koehler (*op. cit.*, p. 14) points out quite a number of characters in which *O. Skoogi* differs from *O. carnea*. But I do not think a single one of them holds good, except, perhaps, that the radial shields are in general slightly larger in *O. Skoogi* than in *carnea*. The only noticeable difference I find is that the lateral plates are more swollen in *Skoogi* than in *carnea*, and also that the dorsal arm-plates are somewhat more swollen in the former. In my Echinoderms of South Africa I have given a figure showing that the buccal shields are considerably elongated in *O. Skoogi*, but this is no constant feature; there is so much variation in the size of the buccal shields that in this respect no reliable difference between *Skoogi* and *carnea* (and *anoidea*) can be found. In the work cited above I have further stated that *O. Skoogi* differs from both *carnea* and *anoidea* in the primary disk plates being "wholly surrounded by small plates", which they are not in the two other species. This is a mistake, partly in Koehler's description, which states that these plates are "separées les unes des autres par une rangée de petites plaques", partly in Koehler's fig. 11, which apparently shows the large plates each surrounded by a circle of smaller plates. They are not so; but all the plates, in the specimens preserved in alcohol, are darker in the centre, a broad edge appearing whitish. This produces the effect seen in Koehler's fig. 11. The same feature is also observable in both *carnea* and *anoidea*.

There thus remain, as the only characters distinguishing *O. Skoogi* from *carnea*, the more swollen dorsal and lateral arm-plates, and in addition the slightly larger radial shields, characters rather insufficient for specific distinction. I think that this form from the tropical coast of West Africa represents merely a variety of the North Atlantic *carnea*, which latter is recorded from as far south as the Cape Verde Islands. Before, however, the specific value of *O. Skoogi* is finally decided I think it desirable to have specimens from the north-west coast of Africa for comparison, and for this reason I shall for the present keep it as a separate species.

It may be added that this species (or variety) has separate sexes and is not viviparous, as holds good also of *O. carnea* and *anoidea*.

Amphiophiura Rowetti, G. A. Smith

Amphiophiura Rowetti, G. A. Smith, 1923. *Report on the Echinoderms coll. during the voyage of H.M.S. 'Quest'*. Ann. Mag. Nat. Hist., 9 Ser., XII, p. 370.

St. 20. 4. iii. 26. 14·6 miles N 41° E of Cape Saunders, South Georgia, 200 m. 1 specimen.
St. 27. 15. iii. 26. West Cumberland Bay, South Georgia, 110 m. 3 specimens.
St. 42. 1. iv. 26. Off mouth of Cumberland Bay, South Georgia, 120–204 m. 3 specimens.

St. 45. 6. iv. 26. 2·7 miles S 85° E of Jason Light, South Georgia, 238–270 m. 1 specimen.
St. 126. 19. xii. 26. 53° 58′ S, 37° 08′ W, South Georgia, 100 (–0) m. 1 specimen.
St. 140. 23. xii. 26. Stromness Harbour to Larsen Point, South Georgia, 122–136 m. 1 specimen (young).
St. 156. 20. i. 27. 53° 51′ S, 36° 21′ W, South Georgia, 200–236 m. 8 specimens (young).
St. 363. 26. ii. 30. 2·5 miles S 80° E of SE point of Zavodovski Island, South Sandwich Islands, 329–278 m. 1 specimen.
St. WS 33. 21. xii. 26. 54° 59′ S, 35° 24′ W, South Georgia, 130 m. 2 specimens.

Although G. A. Smith in describing this species omitted to give a figure of the oral side, I can have no doubt that the present specimens belong to that species, the more so as they come from the type locality, off South Georgia. One point alone would seem to be in contradiction to the description given by Smith, viz. the mouth shields, which are stated by Smith to be very large, occupying the whole of the interbrachial area on the

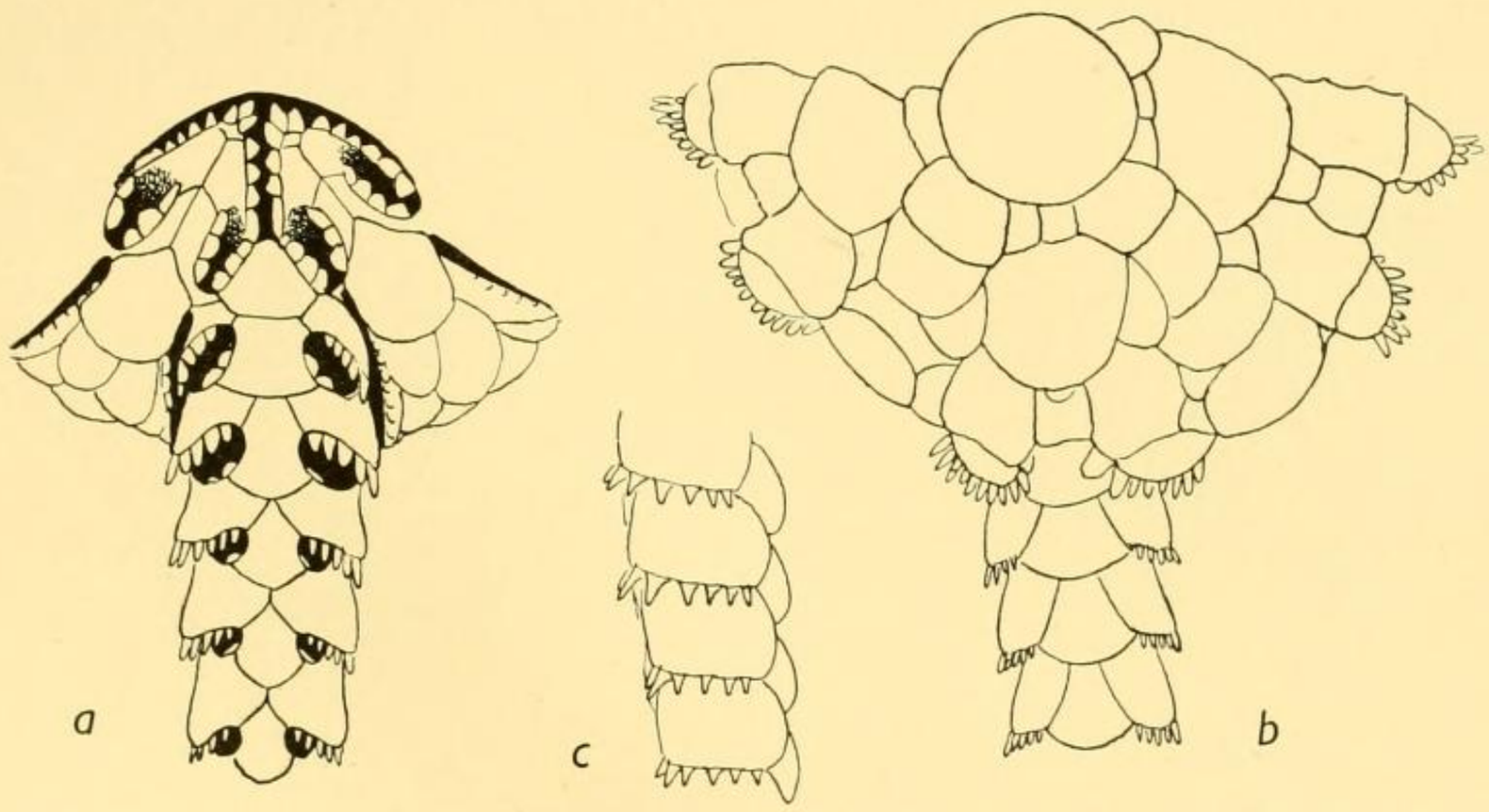

Fig. 50. *Amphiophiura Rowetti*, G. A. Smith. Part of oral side (*a*) and dorsal side (*b*); part of arm in side view (*c*). ×15.

ventral surface. The figure of the oral side given here is not in accordance with this statement; it shows the buccal shields rather small, occupying only the proximal half of the ventral interradius. There is, however, much variation in this respect, some of the other specimens having the buccal shields relatively larger, so as to cover more or less completely the whole ventral interradius; this depends to a great extent on the state of contraction of the interradius of the specimen (due to food content or the sexual state at the time of capture—and also, of course, to age, the younger specimens having these plates relatively larger). There is no possibility of distinguishing more than one species from the character of the mouth shields.

It may be mentioned that none of the spines in the distal part of the arms are transformed into hooks, such as are described by Hertz (Deutsche Tiefsee-Exped., Ophiuroiden, pp. 77–9) for *A. concava*, Hertz, and *A. trifolium*, Hertz.

The specimen from St. 363 (South Sandwich Islands) must, I think, likewise be referred to this species, in spite of the fact that the dorsal arm-plates are somewhat more

swollen than in the specimens from South Georgia. As, however, there is only one young specimen, 4 mm. in diameter of disk, from that station, I give this identification with some reserve.

This species is viviparous and hermaphrodite. There is one sausage-shaped testis at the adradial side of the bursa, sometimes also a second smaller one proximal to the large one. There is one female gonad at the interradial side of the bursa, with only one egg developing at a time, and it is almost certain that the development is intra-ovarial; the developing eggs are large, 0·5 mm. in diameter.

Amphiophiura gibbosa, n.sp.

St. 175. 2. iii. 27. Bransfield Strait, South Shetlands, 200 m. 3 specimens.

Diameter of disk of the largest specimen 6·5 mm., the arms rather stout, *ca.* 18 mm. in length, thus about three times the diameter of the disk. Disk covered by rather coarse

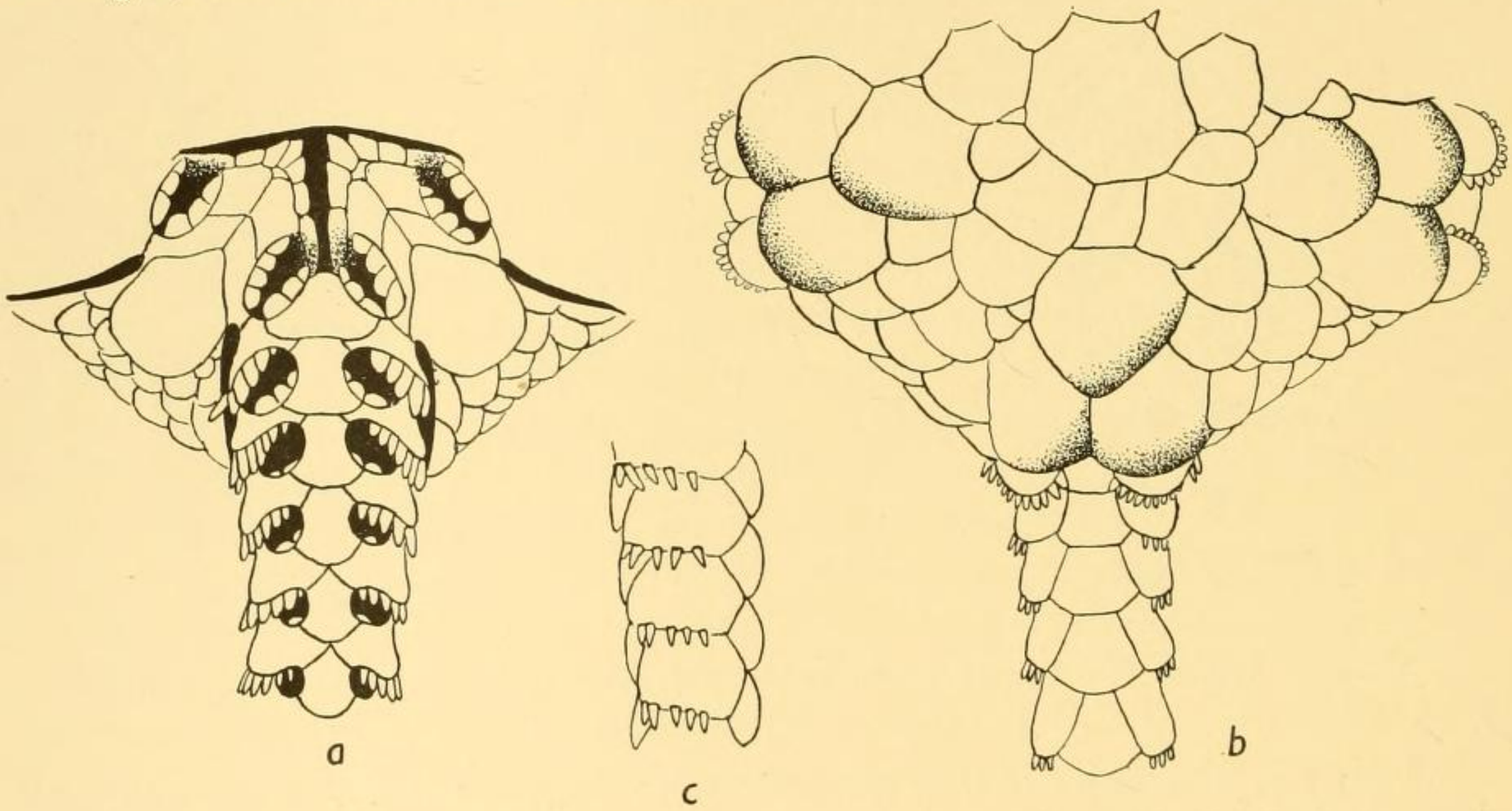

Fig. 51. *Amphiophiura gibbosa*, n.sp. Part of oral side (*a*) and dorsal side (*b*). Part of arm in side view (*c*). ×12.

scales, among which the polygonal central plate and five primary radial plates are conspicuous, particularly the latter, which form a wedge between the proximal ends of the radial shields.

These primary radial plates, together with the radial shields, are conspicuously elevated, and produce a somewhat gibbous appearance, recalling *Ophiosteira Senouqui*. The radial shields are contiguous in their distal half. In the younger specimens there is a single series of plates in the interradii, in the larger specimen several small plates have been added. No large plate on the edge of the interradii, also the ventral interradii are covered by small plates only, besides the buccal shields, which are fairly large, occupying about half of the interradius. In one case the proximal end of the buccal shield has been separated off as a small plate. Adoral and oral plates (jaws) of about equal size, in the

main flat, simple. Mouth papillae usually three to each side of jaw, of the common type. First ventral plate triangular, conspicuously broader than the following ones, which are of the shape usual in this genus; the three or four proximal ones are contiguous. Dorsal arm plates contiguous in the proximal part of the arms, not much swollen. Arm spines three or four in the proximal part of arms, short, equidistant, none of them transformed into hooks. Arm comb well developed, but the papillae are short, not longer than the arm spines. Papillae along the genital slits rudimentary; the slits reach to the edge of the disk. Tentacle pores large, with numerous scales or papillae, as usual in the genus. Colour of preserved specimens whitish.

The species is *viviparous*. Probably it is also hermaphrodite, like *A. Rowetti*; but this I have been unable to ascertain definitely. Not thinking it desirable to spoil the type specimen, the only one preserved in alcohol, I have only opened one interradius from the ventral side, which showed merely the young embryos (with the skeleton just beginning to develop) lying as in *A. Rowetti*.

The character of the gibbous elevation of the primary radial plates and the radial shields distinguishes this species markedly from *A. Rowetti*, as well as from the other species of *Amphiophiura* known from the Antarctic seas or elsewhere. The species seems the nearest related to *A. Rowetti*, of which it may perhaps ultimately prove to be only a variety.

Ophiomastus conveniens, Koehler

Ophiomastus conveniens, Koehler, 1923. Swedish Antarct. Exped. Astéries et Ophiures, p. 122, pl. xv, figs. 5–6.

O. conveniens, Grieg, 1929. *Echinodermata from the Palmer Archipelago*, p. 10. Sci. Results Norwegian Antarct. Exped., II, p. 10.

St. 181. 12. iii. 27. Schollaert Channel, Palmer Archipelago, 160–335 m. 1 specimen.

The specimen is a young one, 3 mm. in diameter of disk. It is in full accordance with the description and figures given by Koehler, excepting the fact that the proximal arm joints have only three spines, not four, as had Koehler's specimen.

The genital slits have just begun to appear; they are very short, not exceeding one-third the length of the first lateral plate. Whether they will be longer in the adult does not appear from Koehler's description and figures, but the probability is that they remain quite short.

On Koehler's statement that the plates of the disk are covered with a very fine and regular granulation it may be remarked that it is the calcareous structure of the plates that is rather coarse, so as to produce a granular appearance; there are no separate granules.

No information on the sexual character of this species, whether viviparous or not, or hermaphrodite or not, can be gathered from the single young specimen examined. An interradius was opened, but showed nothing of the genital organs, which had evidently not yet developed.

Ophiomusium constrictum, n.sp.

St. WS 871. 1. iv. 32. 53° 16′ S, 64° 12′ W, 336–341 m. 2 specimens.

Diameter of disk 5 mm. Arms about three times that length, apparently not very stiff. Disk slightly elevated, covered with rather coarse scales, among which the primary plates are not very conspicuous. Radial shields separated by a wedge of scales, somewhat sunken below the level of the surrounding scales. The disk scales are flat, but of a rather coarse structure, as if finely granulated, this granular appearance being more distinct on the radial shields. There is only a single column of fairly large scales in the interradii. The ventral interradii covered with few, rather large, irregular scales. The buccal shields irregular, with the proximal point separated off as a distinct little plate.

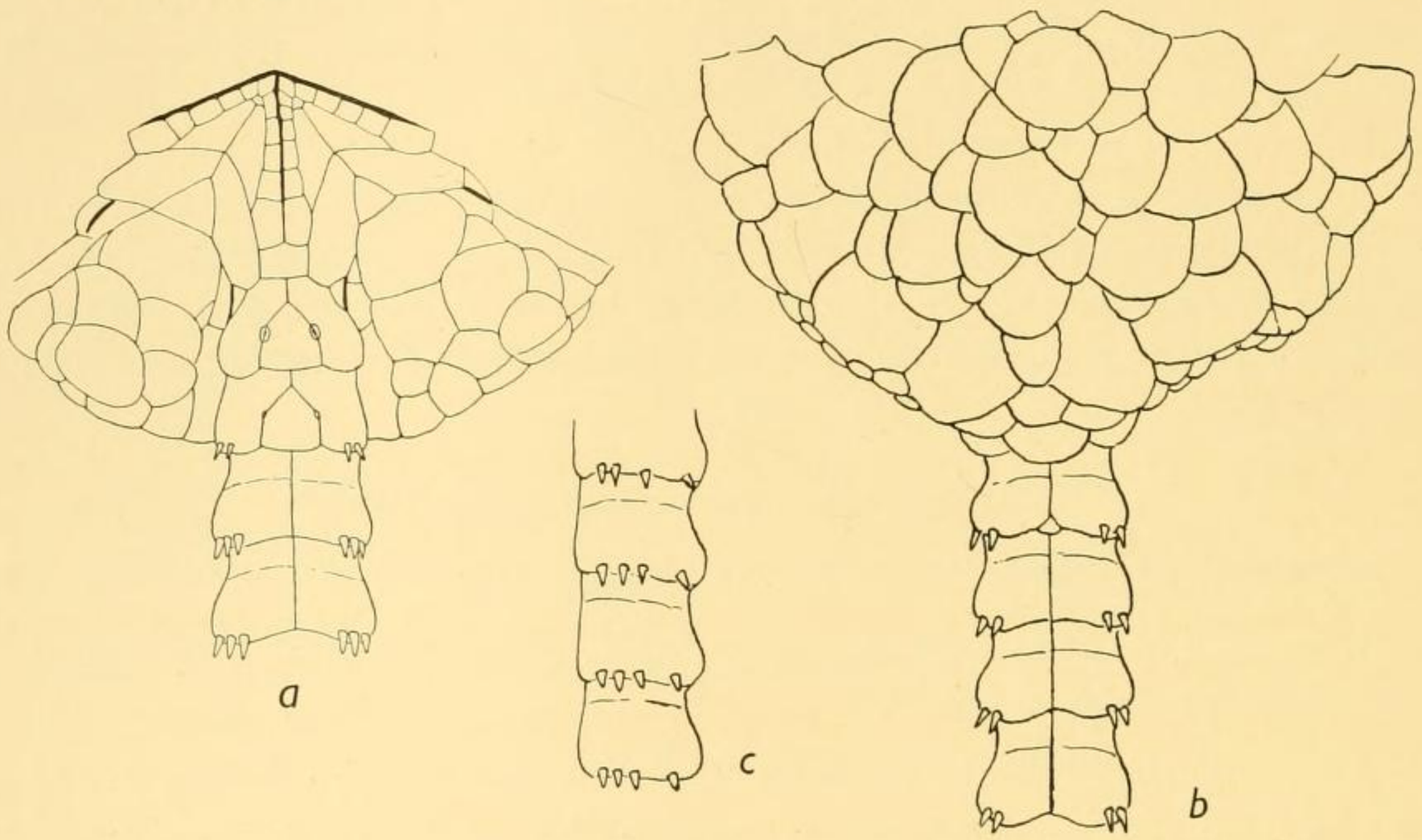

Fig. 52. *Ophiomusium constrictum*, n.sp. Part of oral side (*a*) and dorsal side (*b*); part of arm in side view (*c*). ×15.

Mouth parts of the usual type. First ventral plate small, rectangular, with the merest indication of a proximal angle. Only the two first ventral arm plates developed, and of the dorsal arm plates at most that of the first arm joint is present and then quite rudimentary. The lateral plates are strongly developed, swollen distally, constricted proximally; this constriction is limited from the swollen part by a rather distinct line and forms a kind of neck, the arms being thus rather distinctly moniliform. There are four rudimentary arm spines, the upper one placed a little apart from the others. Tentacle pores exceedingly poorly developed, only on the first joint are they at all distinct, totally lacking or merely discernible on the second joint. Genital slits very short and narrow, scarcely half the length of the first lateral plate. They are surrounded by some small irregular plates, the one to the adradial side being evidently the distal end of the adoral plate, those to the interradial side of the slit representing the proximal end of the genital scale. Colour of the dried specimens white, the radial shields slightly darker.

This species appears to be the nearest related to *Ophiomusium* (*Ophiomusa*) *ultima*, Hertz (Deutsche Tiefsee-Exped., Ophiuroiden, p. 106, Taf. ix, figs. 1–3), in which the arm joints also have a neck-like constriction. Unfortunately, Hertz' figures of this species are not clear, but the much longer arm joints alone show that this East African species (from off Zanzibar) is quite distinct from the present South American species.

Family OPHIOLEUCIDAE

Ophiopyren regularis, Koehler

(Plate VIII, fig. 1)

Ophiopyren regulare, Koehler, 1901. Result. Voyage 'Belgica'. Echinides et Ophiures, p. 26, pl. viii, figs. 52–4.

O. regularis, Koehler, 1922. Austral. Antarct. Exped. Echinod. Ophiuroidea, p. 36, pl. lxxxvi, figs. 1–2.

St. 159. 21. i. 27. 53° 52′ S, 36° 08′ W, South Georgia, 160 m. 1 specimen.

The single specimen of this species taken by the 'Discovery' has a diameter of disk of 8 mm., being thus the largest of the few (in all seven) specimens known. The arms are all broken close to the disk, excepting one, of which a piece 8 mm. in length is preserved.

A conspicuous feature not mentioned by Koehler is that the underside of the disk is a little concave, looking, indeed, like a large sucking disk. Evidently this means that the species lives attached to the surface of stones, corals and the like, such as is the case with *Ophiophycis gracilis*, Mortensen (Echinoderms of St Helena, p. 458), and *Astrophiura* (Mortensen, Echinoderms of South Africa, p. 396). The strong development of the tube feet is also in accordance with the suggestion that it lives thus attached.

The specimen having one of its interradii broken to pieces, I could examine the gonads. They proved to be purely male in character; thus it is certain that the species has separate sexes—which makes it probable, but does not necessarily imply, that it is not viviparous (cf. *Ophiozonella falklandica*).

As appears from the figure given here, the specimen differs in some degree from the description and figures given by Koehler. The buccal shields are slightly different, but more so are the ventral plates; in particular, I do not see these plates divided by a transverse line, as shown in Koehler's drawing (*op. cit.*, 1901, pl. viii, fig. 53). However, owing to the faint calcification of the plates in this species (and in the Ophioleucids in general) the outlines of the plates are difficult to make out. The tentacle scales also are rather differently represented in Koehler's and in my drawings; this would, however, seem to be due to some inaccuracy on Koehler's part, the photographic figure given in his work of 1922 agreeing much better with the figure given here than with his figure in the Belgica Ophiurids. The scales at the proximal pores may be rather difficult to distinguish; they are sometimes hardly more than a raised edge, which is particularly the case on the adradial side of the first pore pair. The spines are of unequal length, the upper much shorter than the lower one. The granules along the edge of the disk do not

form a regular border, as is shown by Koehler (also in the photographic figure). The dorsal side of the disk has evidently been almost completely covered by the granules, only the central plate and a small part of the radial shields remaining bare. Finally the dorsal arm-plates show a characteristic feature not observed by Koehler, the proximal four or five plates having a series of granules along their distal edge (Fig. 53 *b*). I have not observed transverse lines as shown in Koehler's fig. 52.

In spite of the differences here pointed out, I think the present specimen really identical with Koehler's *Ophiopyren regulare*. With the very scarce material available

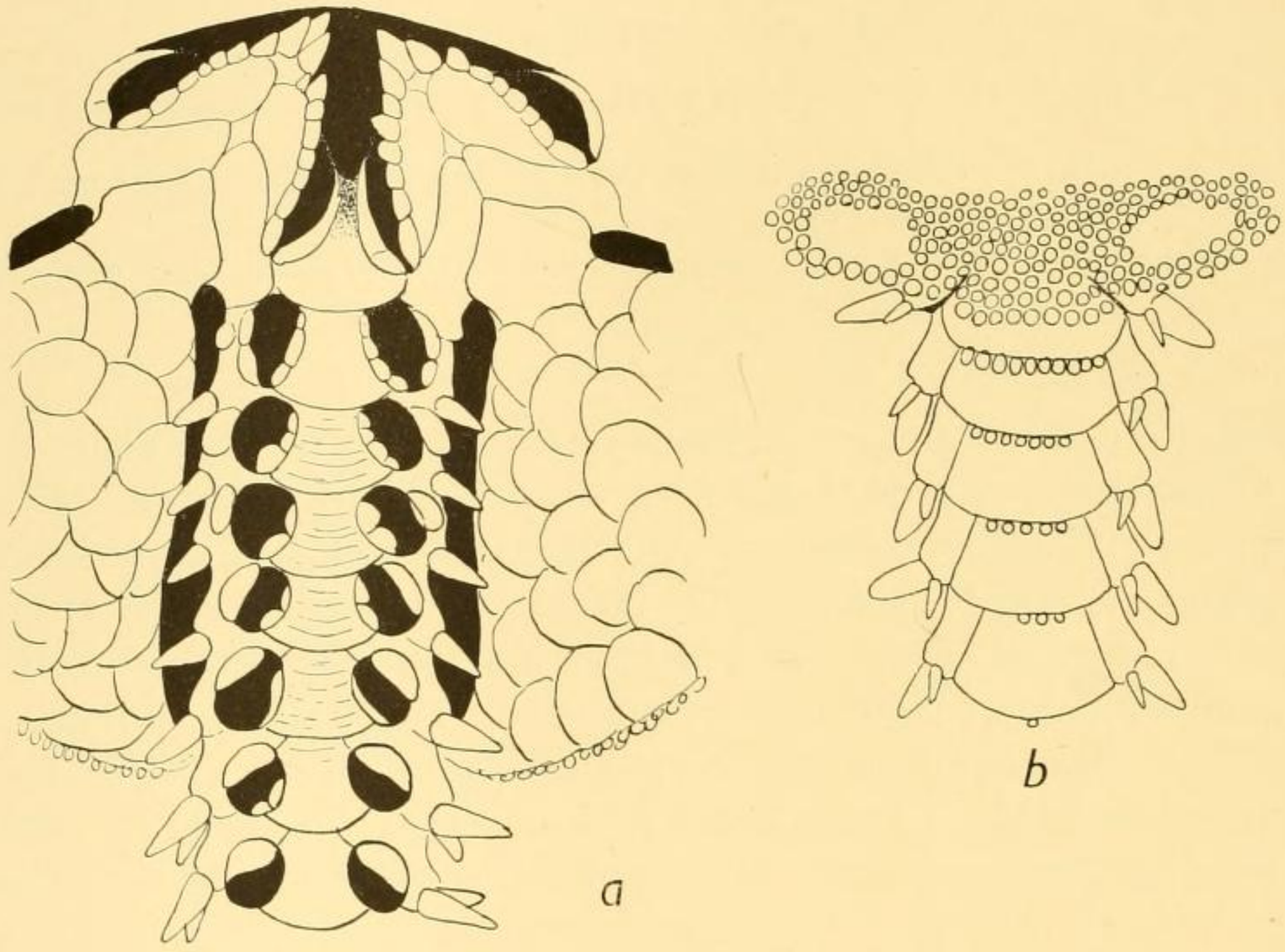

Fig. 53. *Ophiopyren regulare*, Koehler. Part of oral side (*a*) and dorsal side (*b*). ×20.

it would be unreasonable to lay much weight upon the various minor differences, which are due partly to inaccurate drawing, partly no doubt to individual differences, such as are known to occur to no small extent in these feebly calcified deep-sea forms. It would also be rather strange if two different species of these rare deep-sea forms should occur here in the same region.

Plate VIII, fig. 1, is a photograph of the living specimen. The colour is stated to have been "disc deep crimson red with a very large pale pentagonal patch in centre. Arms crimson red barred with cream colour." The preserved specimen does not show the slightest trace of this beautiful colour.

INDEX

Synonyms in italics

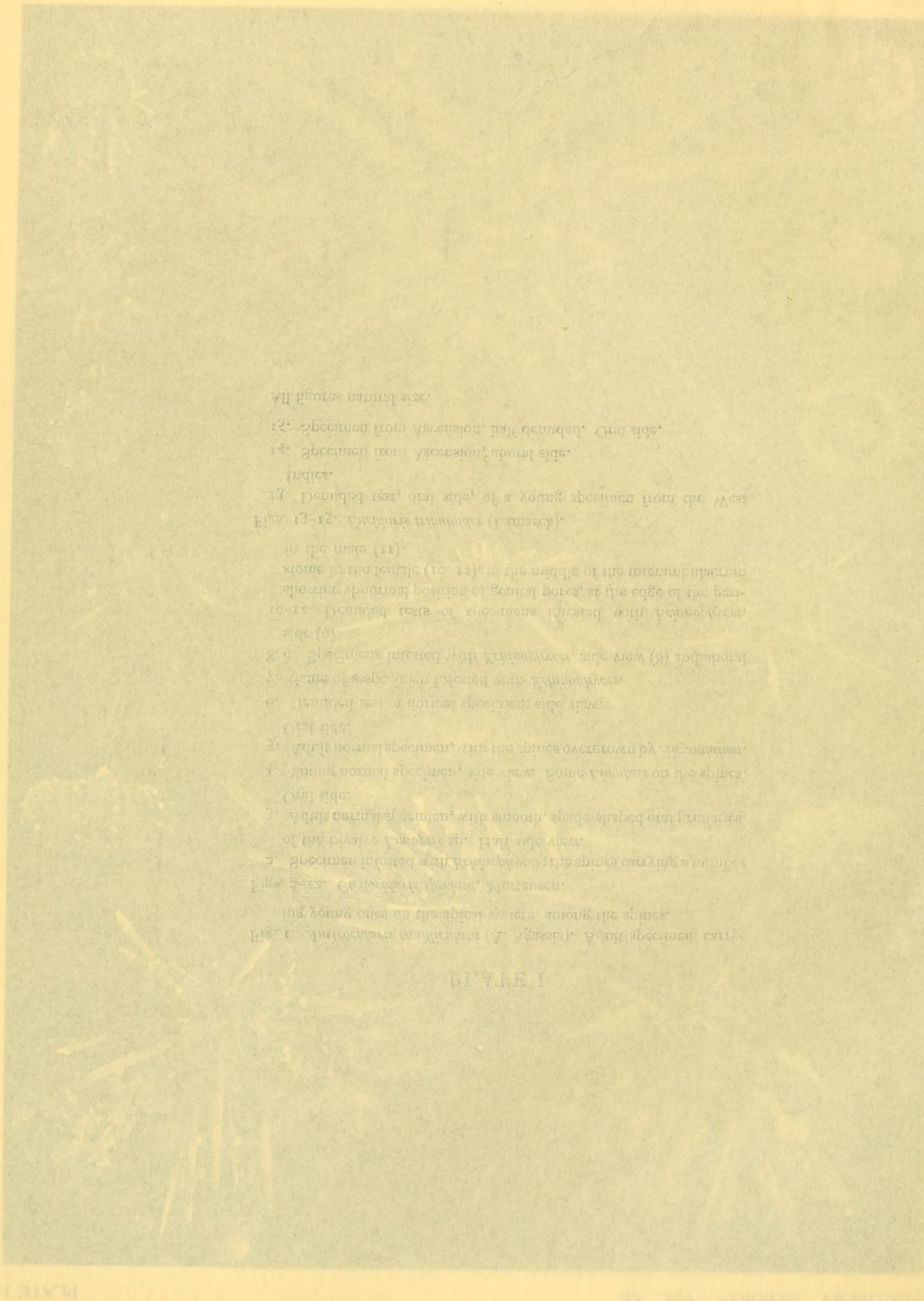

PLATE I

Fig. 1. *Austrocidaris canaliculata* (A. Agassiz). Adult specimen, carrying young ones on the apical system, among the spines.

Figs. 2–12. *Ctenocidaris speciosa*, Mortensen.

2. Specimen infested with *Echinophyces*; the spines carrying a number of the bivalve *Limopsis* sp. Half side view.
3. Adult normal specimen, with smooth, spade-shaped oral primaries. Oral side.
4. Young normal specimen, side view. Some *Limopsis* on the spines.
5. Adult normal specimen, with the spines overgrown by *Alcyonidium*. Oral side.
6. Denuded test of normal specimen, side view.
7. Same of a specimen infested with *Echinophyces*.
8, 9. Specimens infested with *Echinophyces*, side view (8) and aboral side (9).
10–12. Denuded tests of specimens infested with *Echinophyces*, showing abnormal position of genital pores, at the edge of the peristome in the female (10, 12), in the middle of the interambulacrum in the male (11).

Figs. 13–15. *Eucidaris tribuloides* (Lamarck).

13. Denuded test, oral side, of a young specimen from the West Indies.
14. Specimen from Ascension, aboral side.
15. Specimen from Ascension, half denuded. Oral side.

All figures natural size.

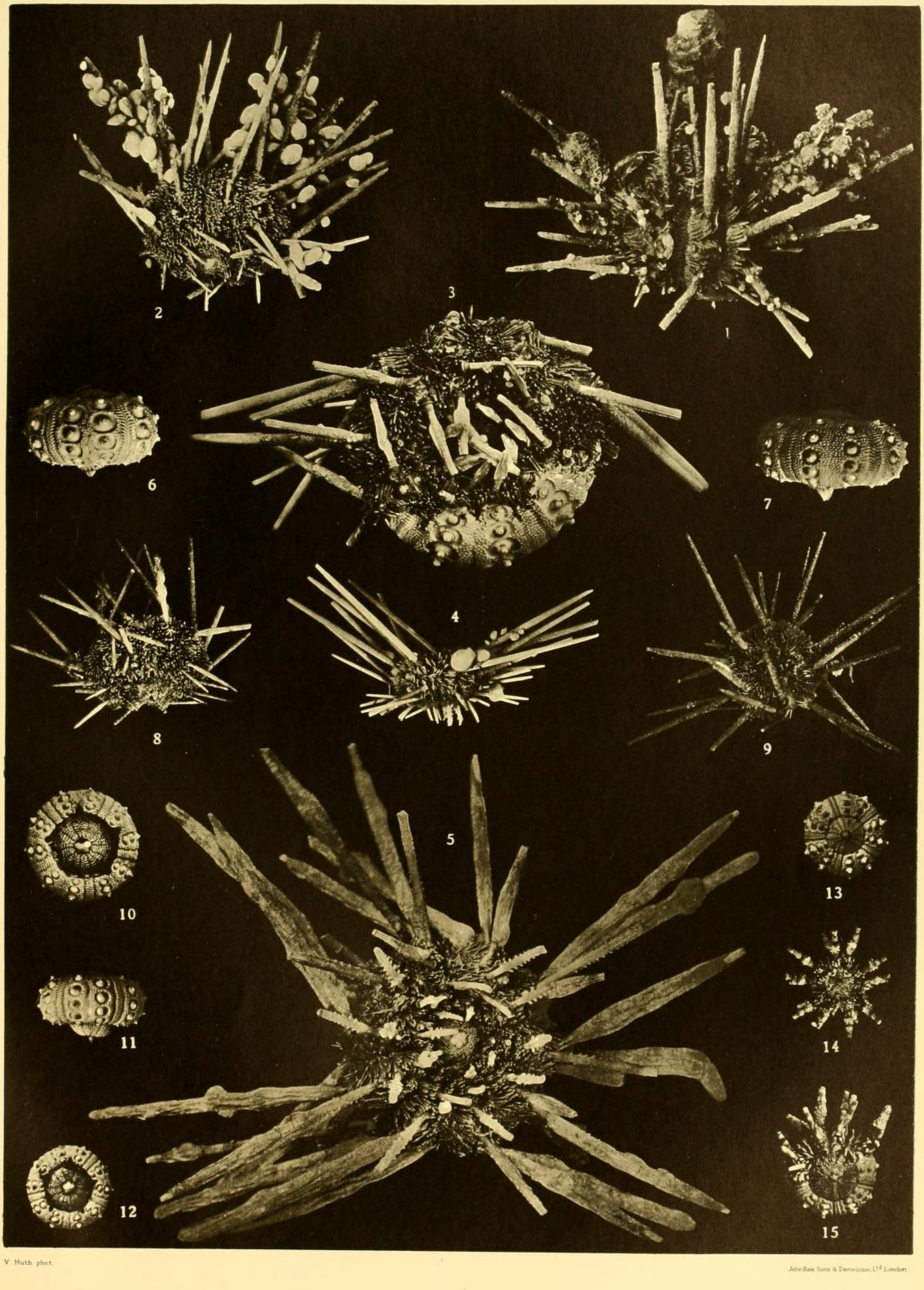

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PLATE II

Figs. 1–4. *Sterechinus Neumayeri* (Meissner).

1–3. Specimens of long-spined form, oral side (1, 3) and aboral side (2).

4. Large specimen, oral side.

Figs. 5–10. *Notechinus marionis*, n.sp.

5, 6. Adult specimens, oral side (5) and aboral side (6).

7–10. Denuded tests, aboral side (7), oral side (8); side view (9, 10).

Figs. 11–16. *Sterechinus Agassizii*, Mortensen.

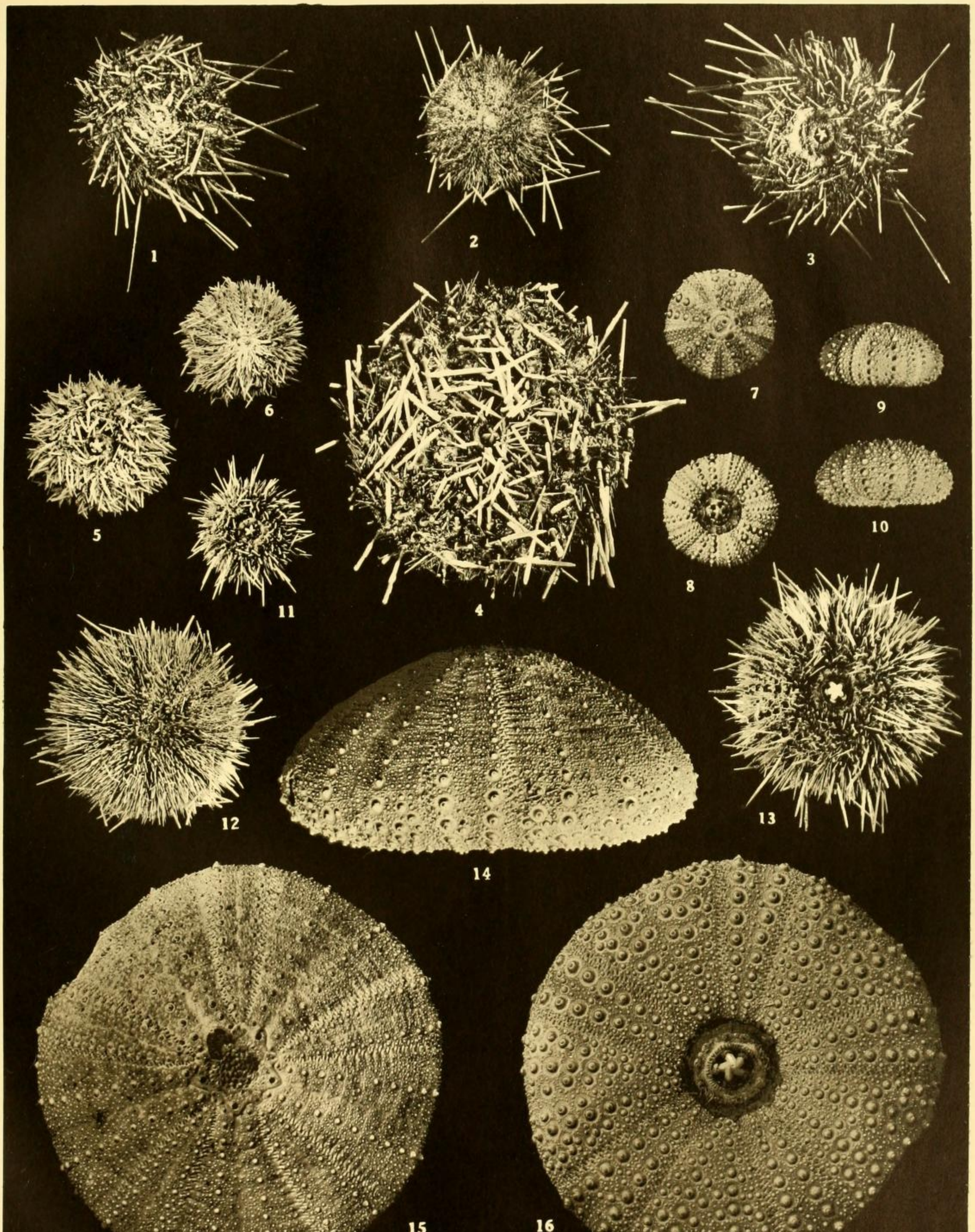
11. Young specimen, oral side.

12, 13. Well preserved specimens, showing the dense coat of very slender spines. Aboral side (12) and oral side (13).

14–16. Denuded test of very large specimen; side view (14), aboral side (15) and oral side (16).

All figures natural size.

N.B. Figure 5 has become blurred in the reproduction, the spines looking as if they were serrate. In reality they are quite smooth, as in Fig. 11.



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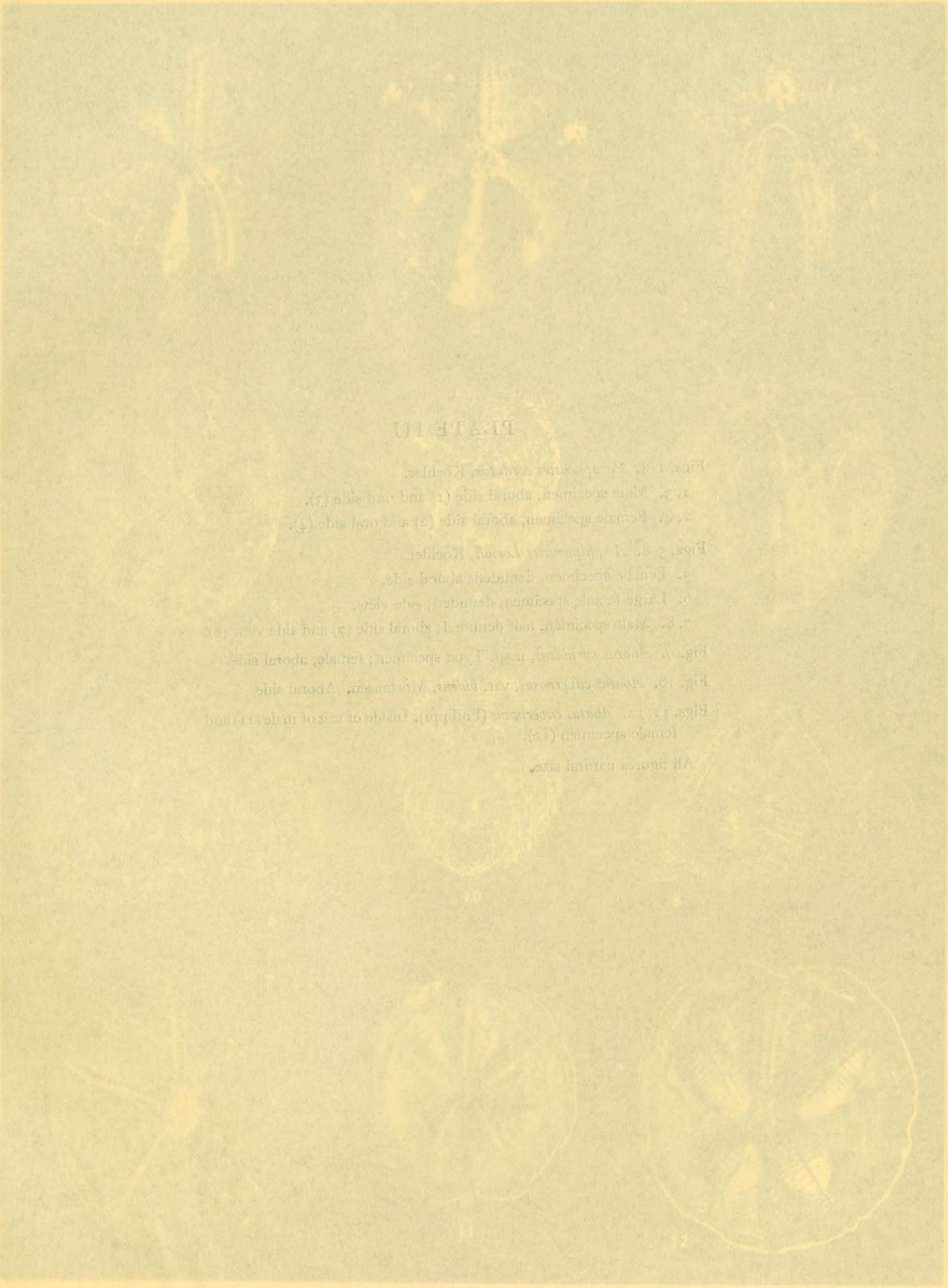


PLATE III

Figs. 1–4. *Parapneustes cordatus*, Koehler.

1, 3. Male specimen, aboral side (1) and oral side (3).

2, 4. Female specimen, aboral side (2) and oral side (4).

Figs. 5–8. *Amphipneustes Lorioli*, Koehler.

5. Female specimen, denuded; aboral side.

6. Large female specimen, denuded; side view.

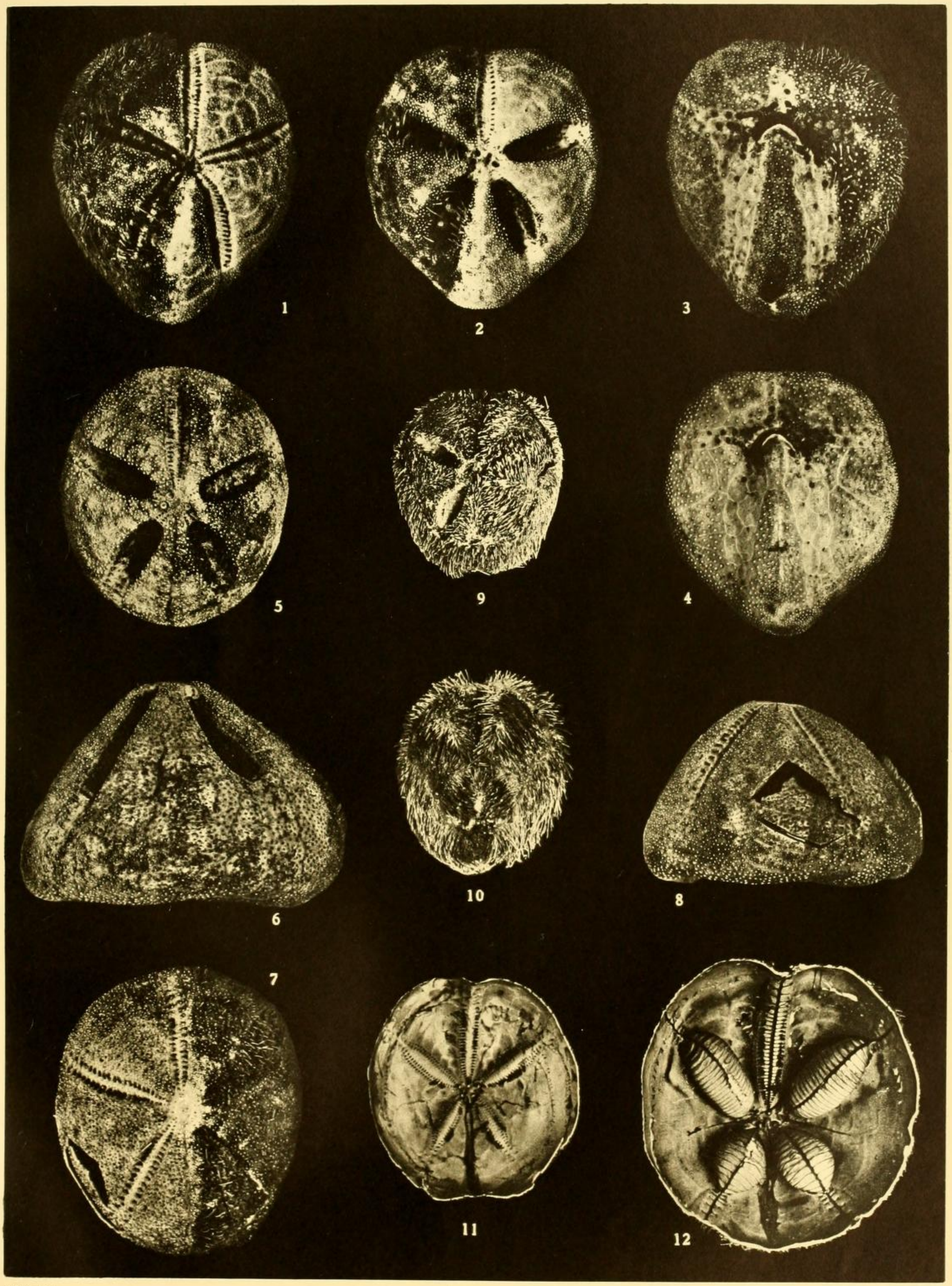
7, 8. Male specimen, half denuded; aboral side (7) and side view (8).

Fig. 9. *Abatus curvidens*, n.sp. Type specimen; female, aboral side.

Fig. 10. *Abatus cavernosus*, var. *bidens*, Mortensen. Aboral side.

Figs. 11, 12. *Abatus cavernosus* (Philippi). Inside of test of male (11) and female specimen (12).

All figures natural size.



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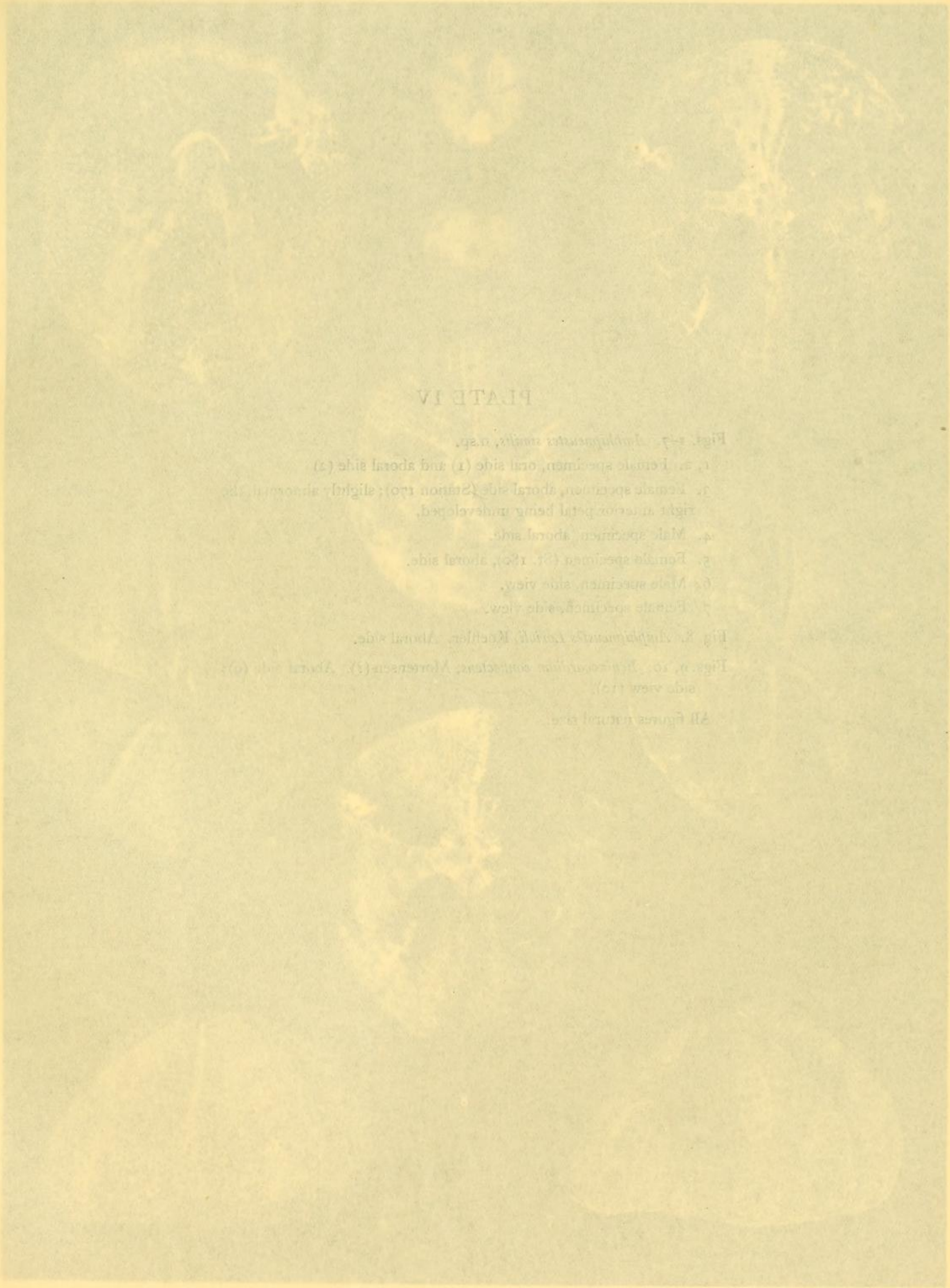


PLATE IV

Figs. 1–7. *Amphipneustes similis*, n.sp.

1, 2. Female specimen, oral side (1) and aboral side (2).

3. Female specimen, aboral side (Station 170); slightly abnormal, the right anterior petal being undeveloped.

4. Male specimen, aboral side.

5. Female specimen (St. 180), aboral side.

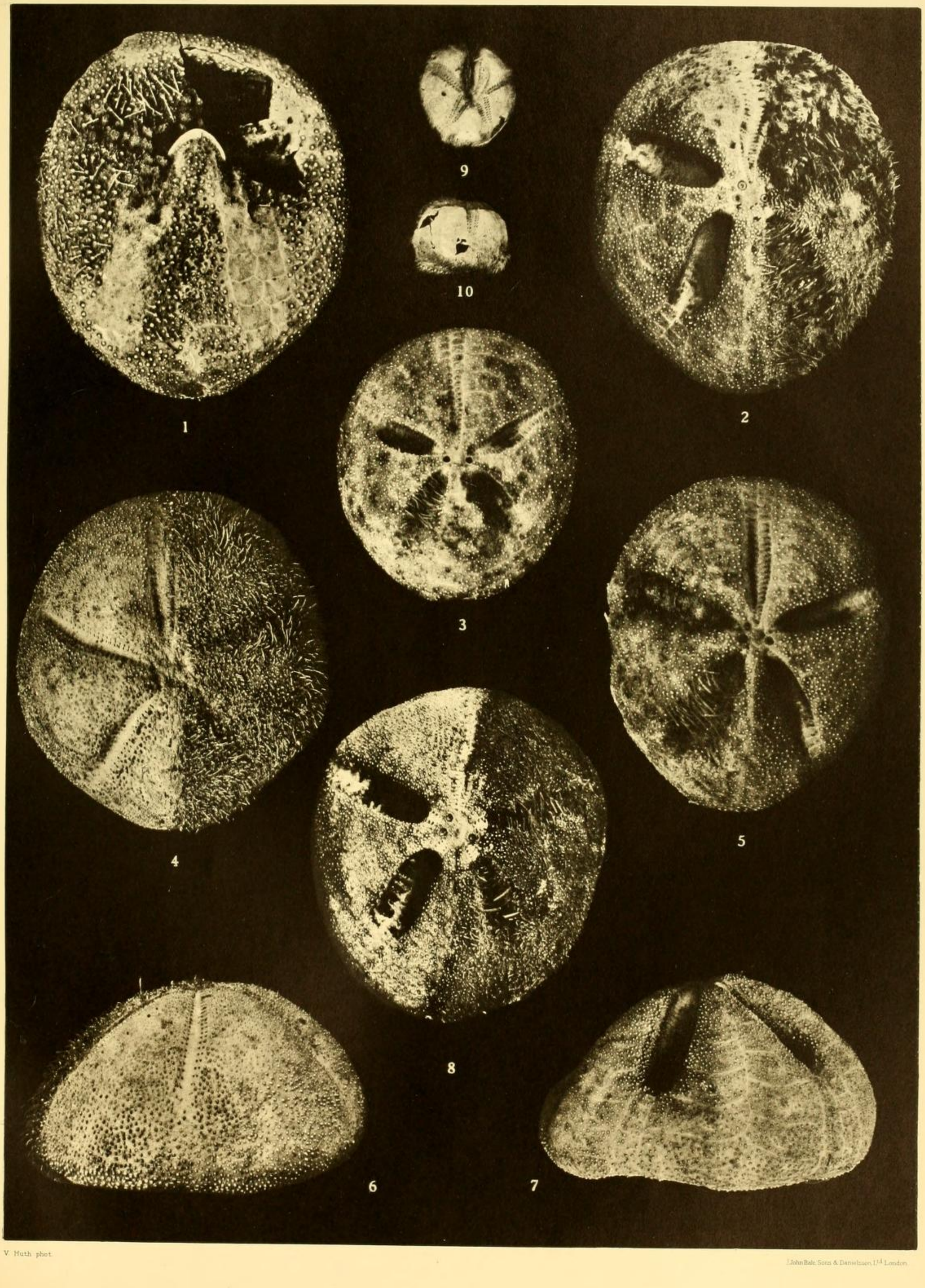
6. Male specimen, side view.

7. Female specimen, side view.

Fig. 8. *Amphipneustes Lorioli*, Koehler. Aboral side.

Figs. 9, 10. *Echinocardium connectens*, Mortensen (?). Aboral side (9); side view (10).

All figures natural size.



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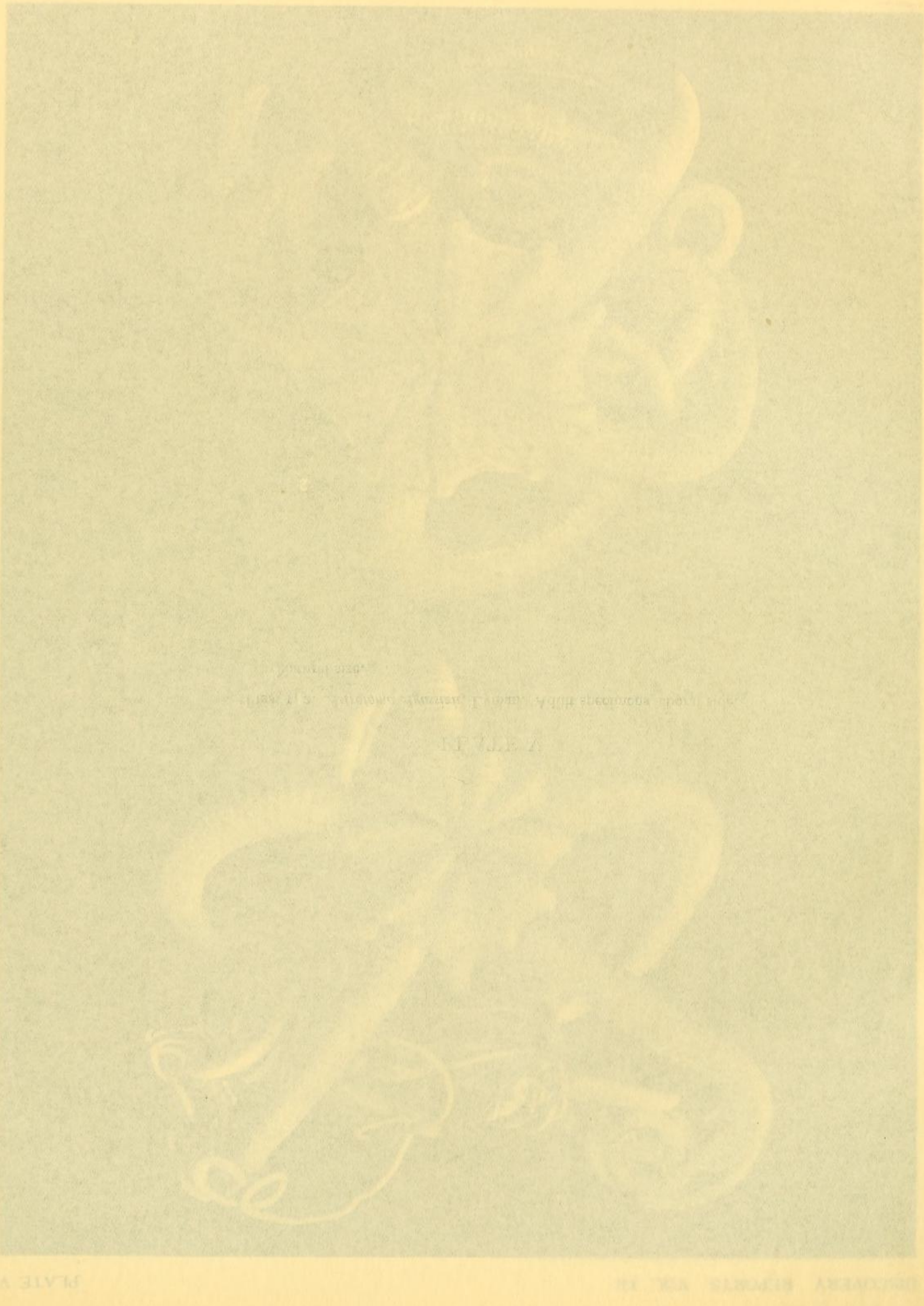
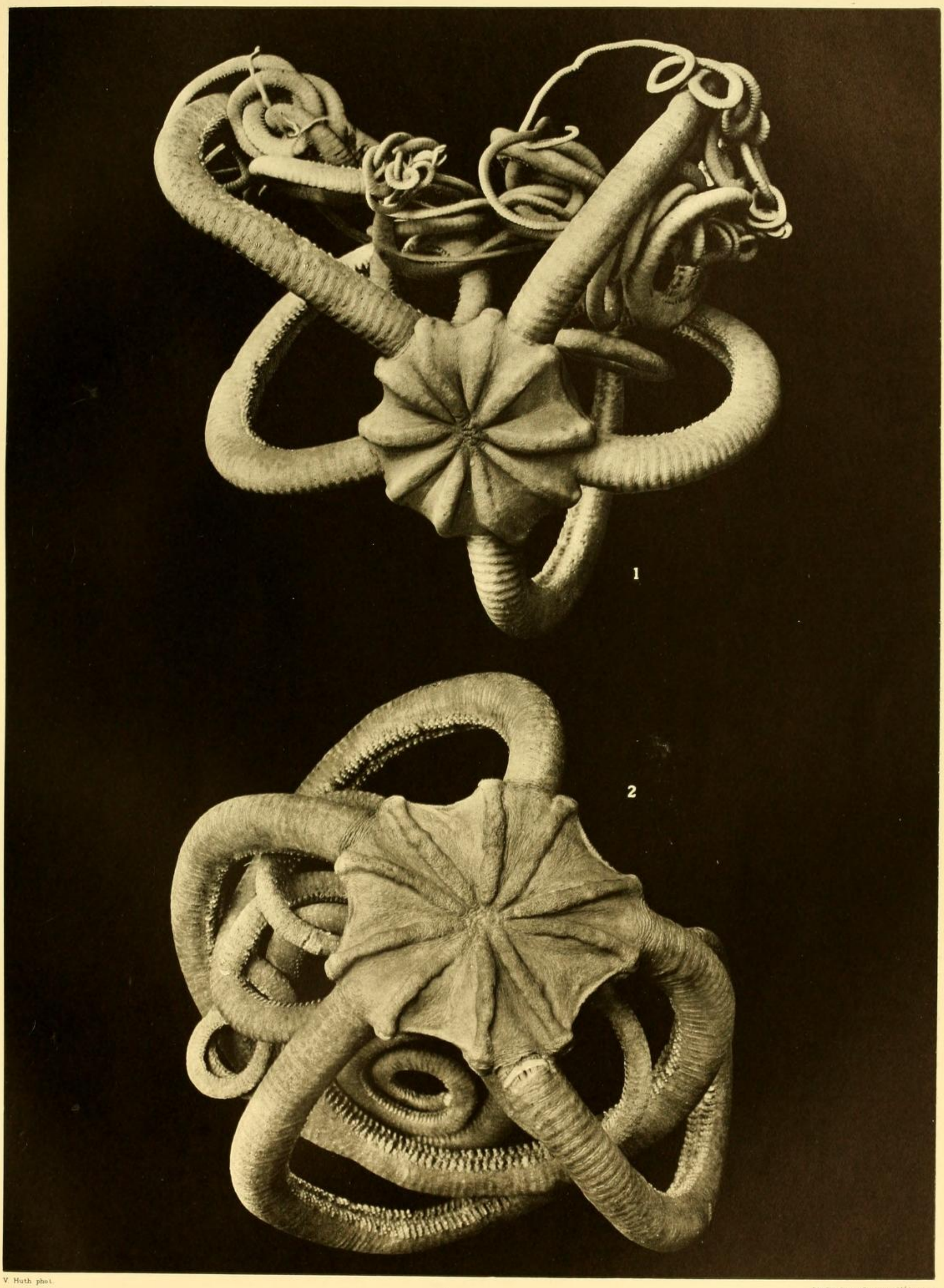


PLATE V

Figs. 1, 2. *Astrotoma Agassizii*, Lyman. Adult specimens, aboral side.

Natural size.



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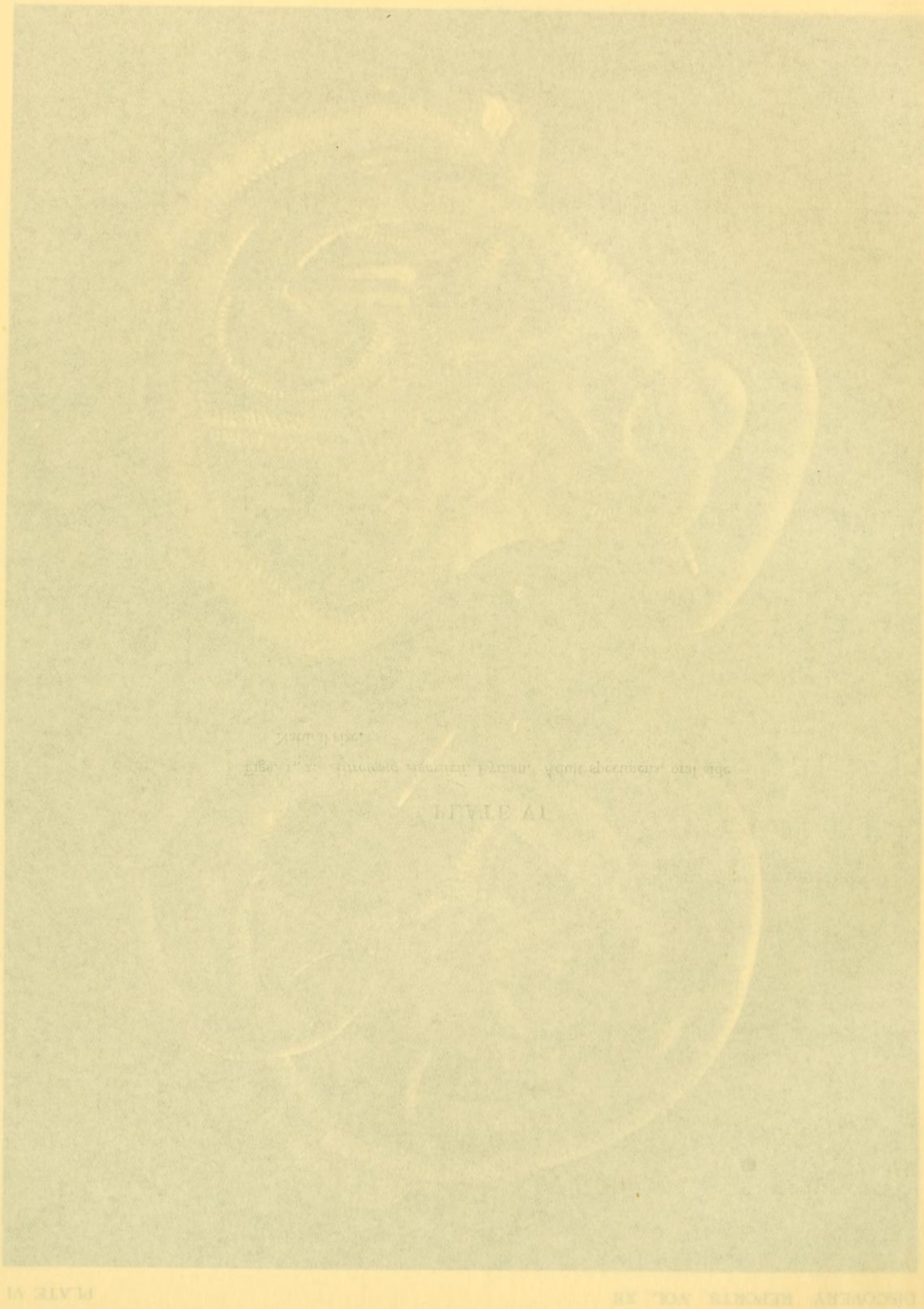

PLATE VI

Figs. 1, 2. *Astrotoma Agassizii*, Lyman. Adult specimens, oral side.

Natural size.

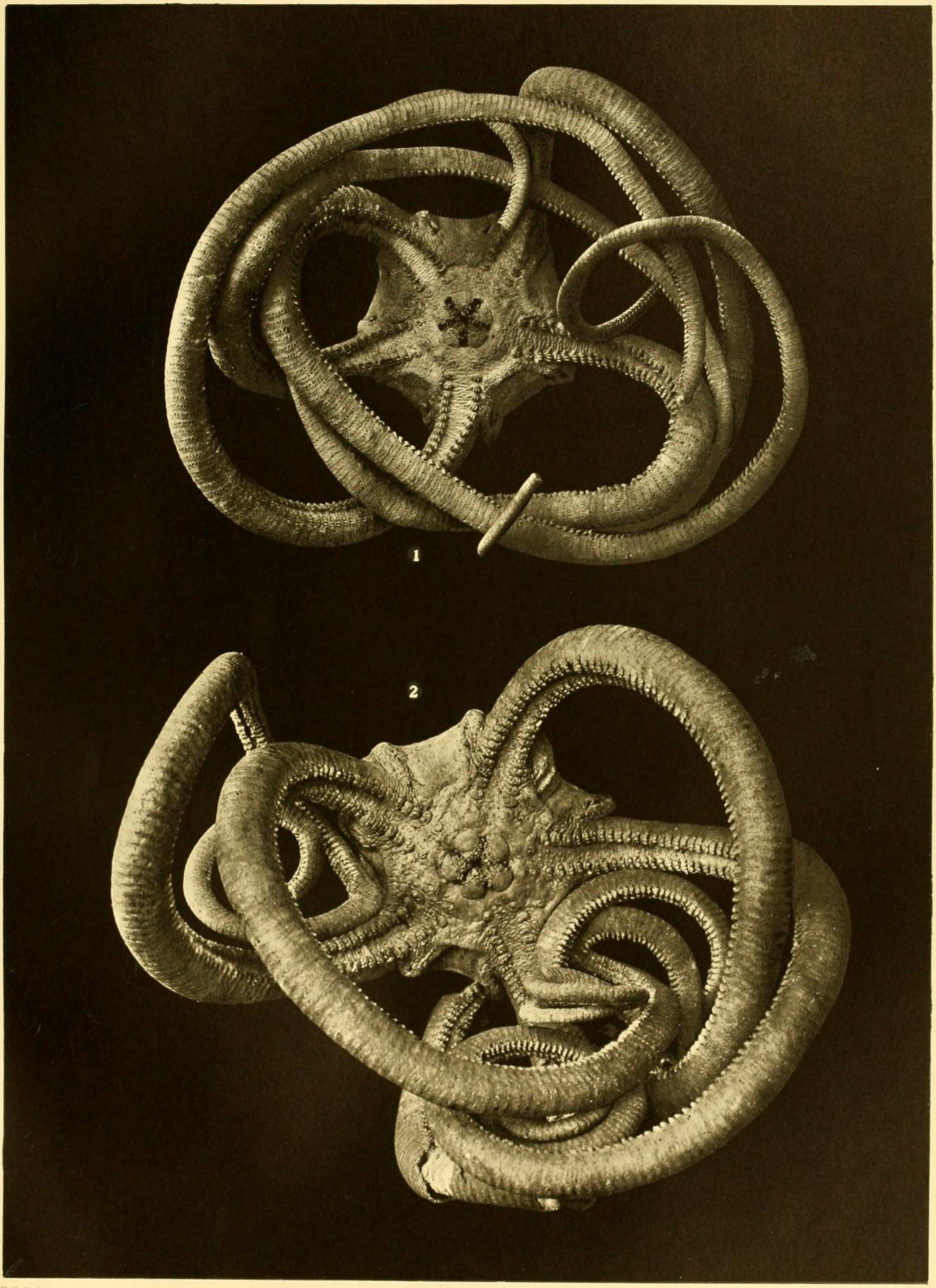

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PLATE VII

Fig. 1. *Ophiacantha densispina*, n.sp. Type specimen. Aboral side.

Fig. 2. *Ophiacantha* ***vivipara***, Ljungman. Specimen carrying young ones.

Figs. 3, 4. *Ophiacantha vivipara*, var. *pentactis*, n.var. Aboral side.

Fig. 5. *Ophiomitrella falklandica*, n.sp. Aboral side.

Fig. 6. *Ophioscolex* (*Ophiolycus*) ***nutrix***, n.sp. Aboral side.

Fig. 7. *Ophioceres incipiens*, Koehler. Abnormal specimen; oral side.

Fig. 8. *Astrochlamys bruneus*, Koehler. Specimens in copulation.

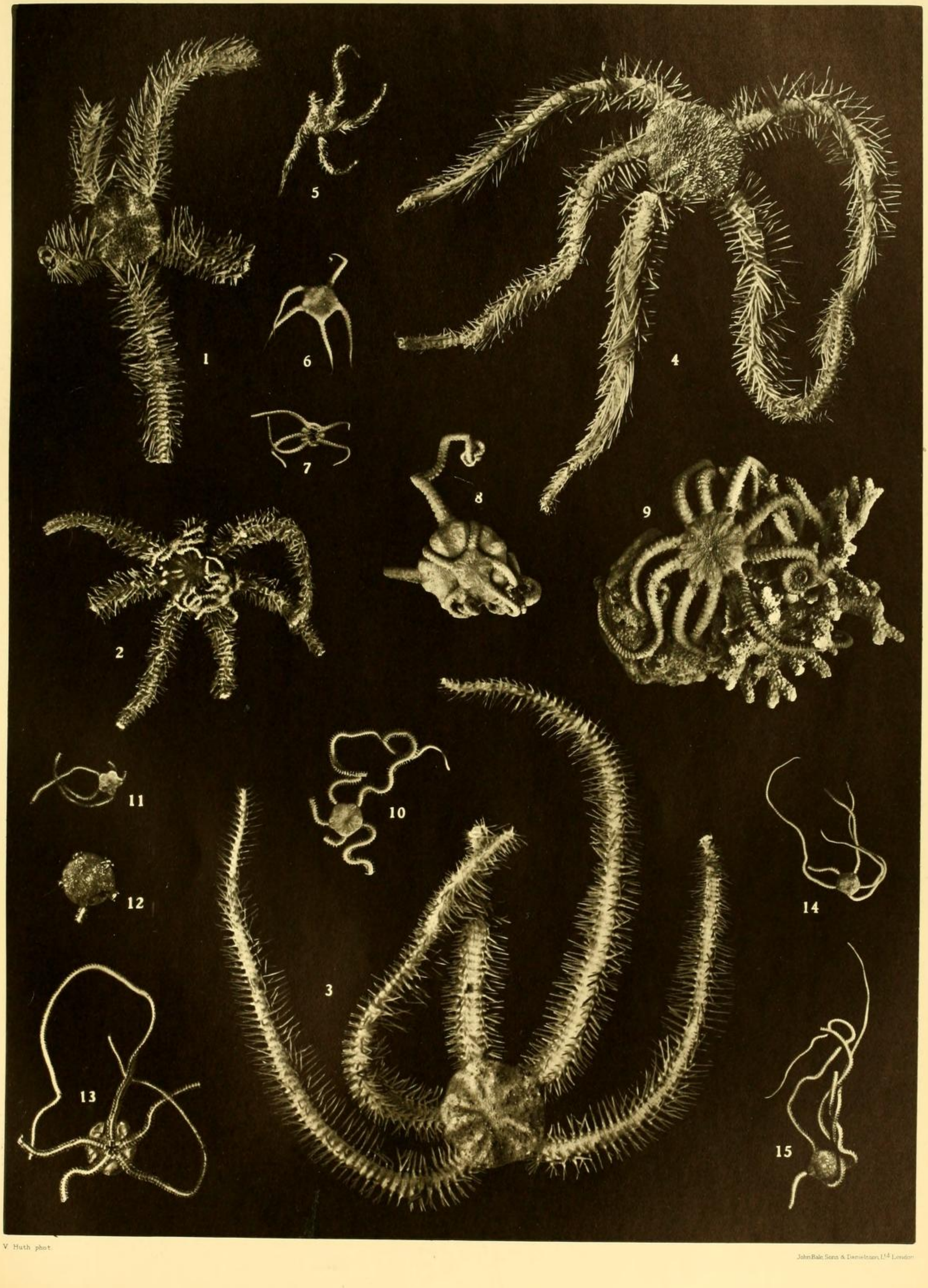
Fig. 9. *Astrochlamys sol*, n.sp. Type specimen. Aboral side. Attached to a colony of Bryozoans.

Fig. 10. *Amphiura princeps*, Koehler. Aboral side.

Fig. 11. *Amphiodia ascia*, n.sp. Aboral side.

Figs. 12–15. *Amphioplus peregrinator*, Koehler. Aboral side (12, 14, 15) and oral side (13).

All figures natural size.



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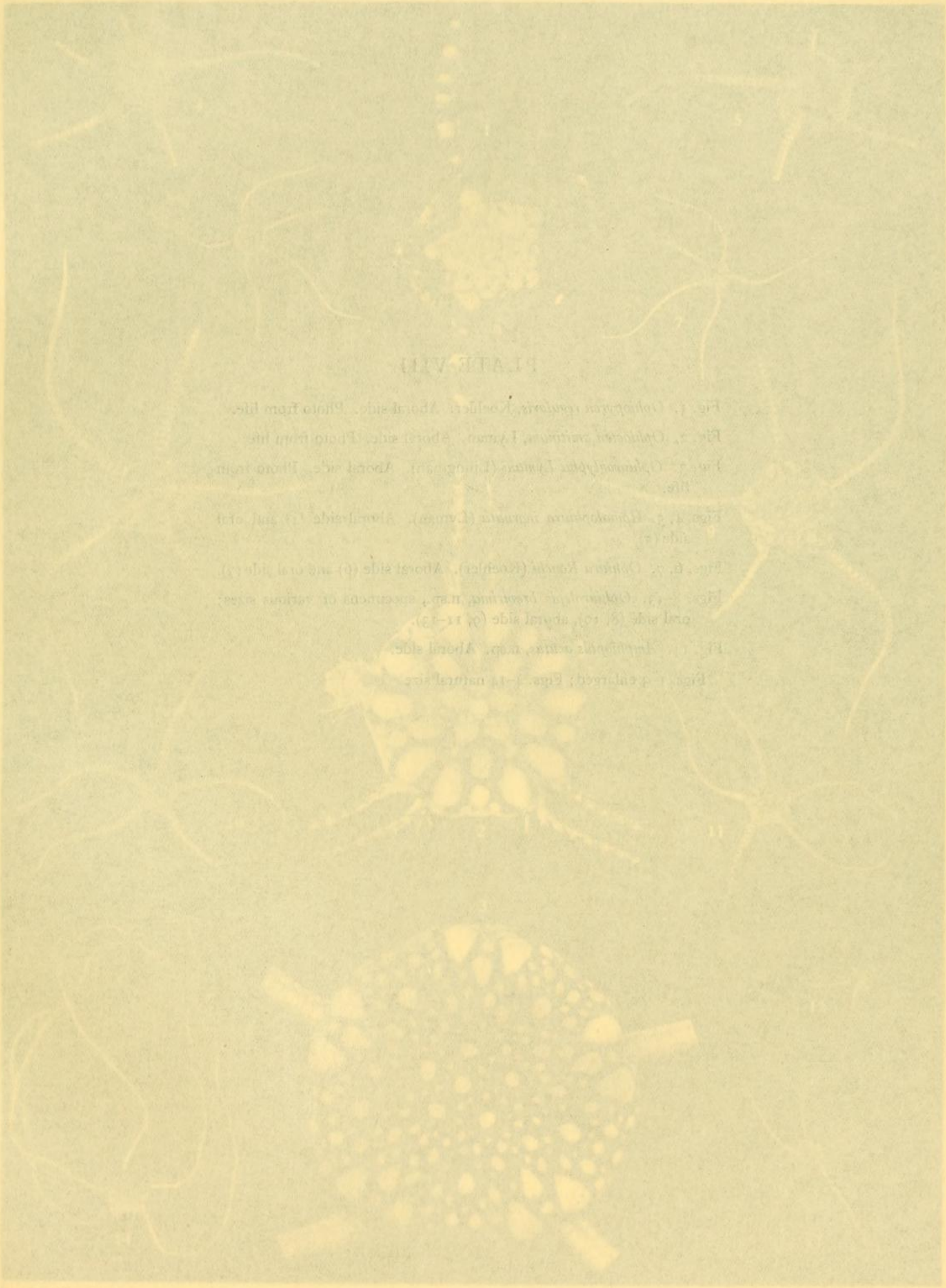


PLATE VIII

Fig. 1. *Ophiopyren regularis*, Koehler. Aboral side. Photo from life.

Fig. 2. *Ophiocten amitinum*, Lyman. Aboral side. Photo from life.

Fig. 3. *Ophiuroglypha Lymani* (Ljungman). Aboral side. Photo from life.

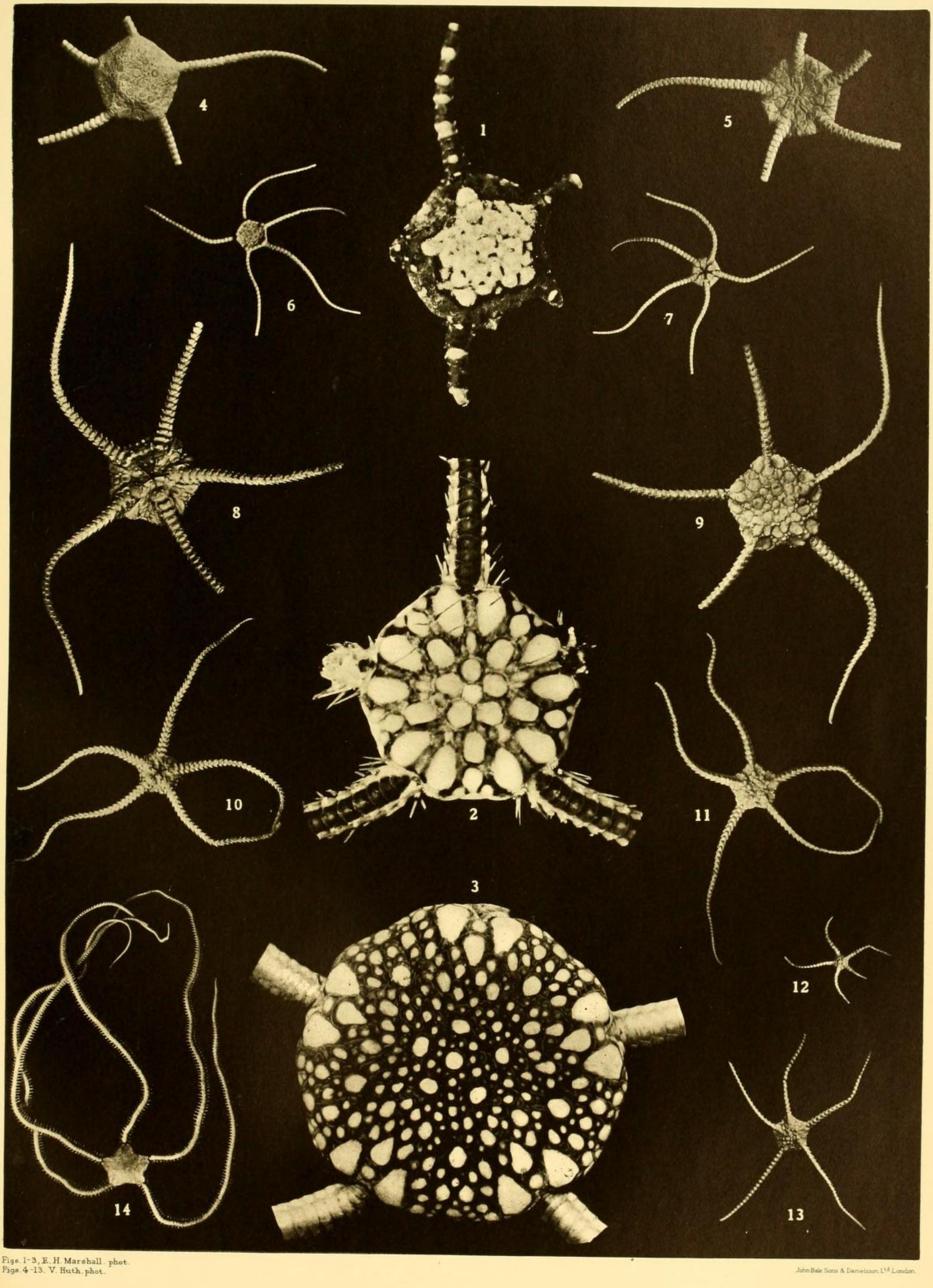
Figs. 4, 5. *Homalophiura inornata* (Lyman). Aboral side (4) and oral side (5).

Figs. 6, 7. *Ophiura Rouchi* (Koehler). Aboral side (6) and oral side (7).

Figs. 8–13. *Ophiurolepis brevirima*, n.sp., specimens of various sizes; oral side (8, 10), aboral side (9, 11–13).

Fig. 14. *Amphioplus acutus*, n.sp. Aboral side.

Figs. 1–3 enlarged; Figs. 4–14 natural size.



Figs. 1-3, E. H. Marshall. phot.
Figs. 4-13, V. Huth. phot.

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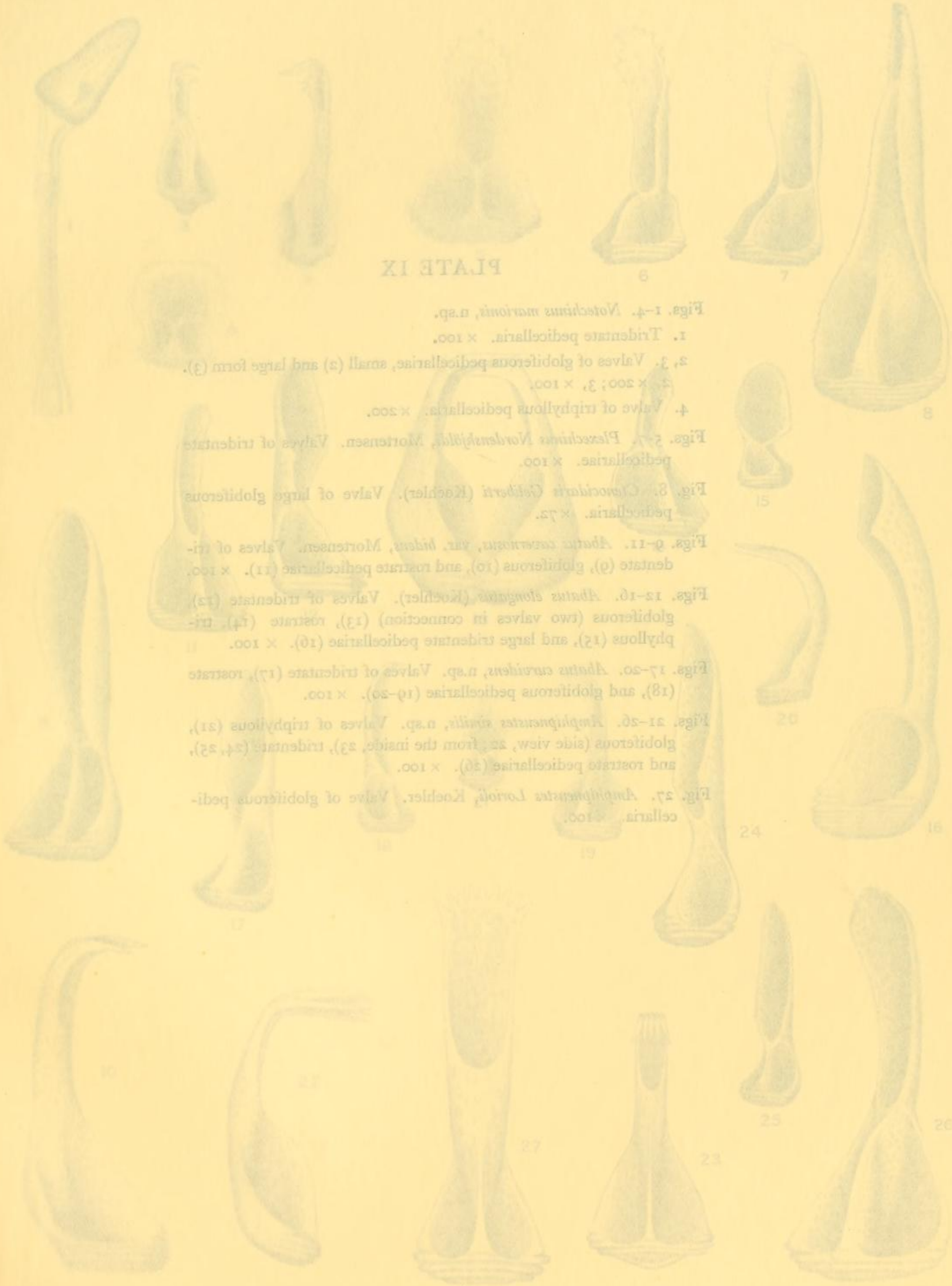


PLATE IX

Figs. 1–4. *Notechinus marionis*, n.sp.

1. Tridentate pedicellaria. × 100.

2, 3. Valves of globiferous pedicellariae, small (2) and large form (3). 2, × 200; 3, × 100.

4. Valve of triphyllous pedicellaria. × 200.

Figs. 5–7. *Plexechinus Nordenskjöldi*, Mortensen. Valves of tridentate pedicellariae. × 100.

Fig. 8. *Ctenocidaris Geliberti* (Koehler). Valve of large globiferous pedicellaria. × 72.

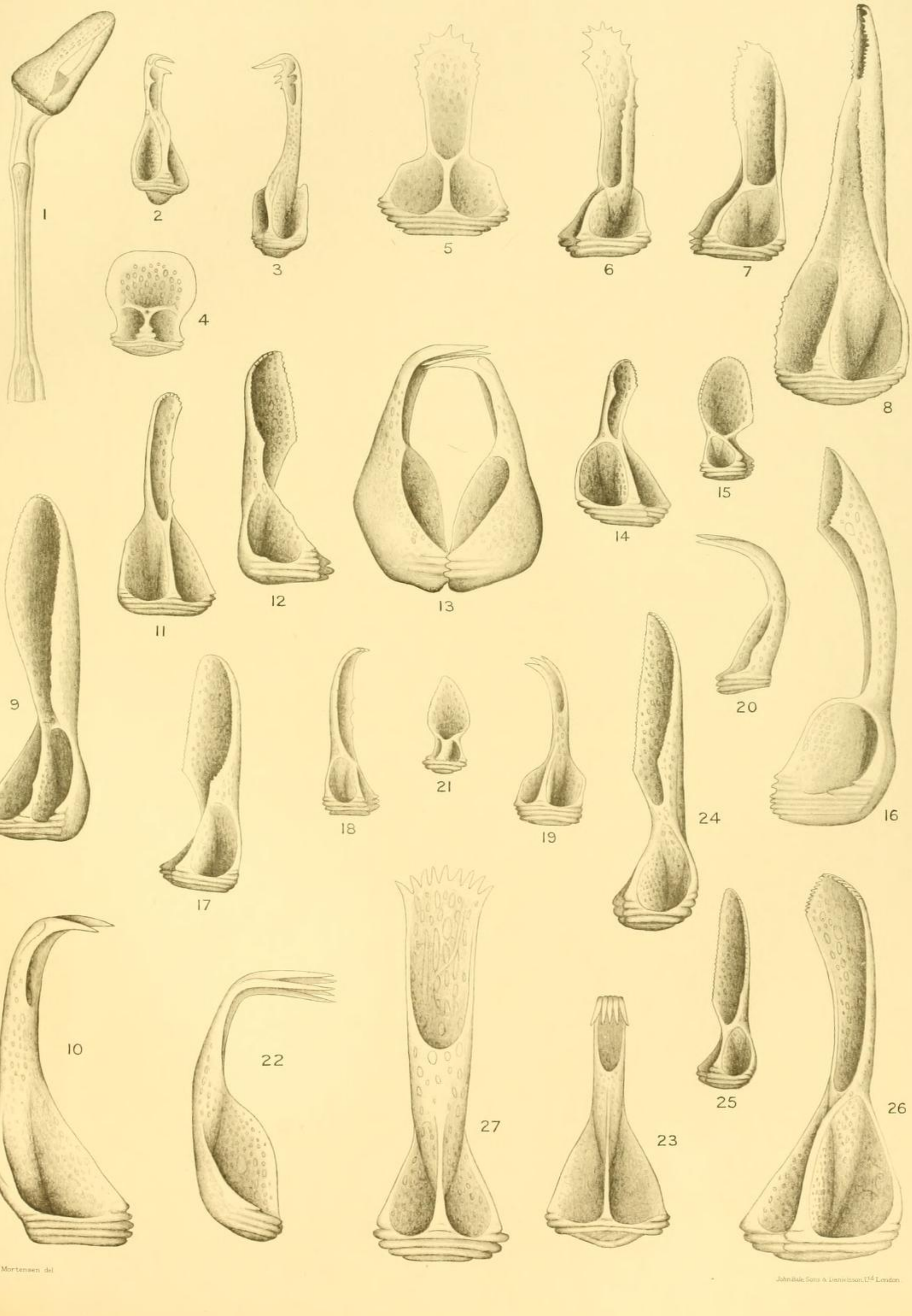
Figs. 9–11. *Abatus cavernosus*, var. *bidens*, Mortensen. Valves of tridentate (9), globiferous (10), and rostrate pedicellariae (11). × 100.

Figs. 12–16. *Abatus elongatus* (Koehler). Valves of tridentate (12), globiferous (two valves in connection) (13), rostrate (14), triphyllous (15), and large tridentate pedicellariae (16). × 100.

Figs. 17–20. *Abatus curvidens*, n.sp. Valves of tridentate (17), rostrate (18), and globiferous pedicellariae (19–20). × 100.

Figs. 21–26. *Amphipneustes similis*, n.sp. Valves of triphyllous (21), globiferous (side view, 22; from the inside, 23), tridentate (24, 25), and rostrate pedicellariae (26). × 100.

Fig. 27. *Amphipneustes Lorioli*, Koehler. Valve of globiferous pedicellaria. × 100.



Th. Mortensen del

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