Papers from Dr. Th. Mortensen's Pacific Expedition 1914—16.

LXV.[1])

Echinoderms of South Africa.

(Asteroidea and Ophiuroidea).

By

Th. Mortensen.

(With Plates VIII—XIX.)

In H. L. Clark's most important paper "The Echinoderm Fauna of South Africa" (Annals of S. African Museum XIII. 1923) the first adequate report on the South African Echinoderm fauna is given, from which we get an idea of what a rich and peculiar fauna this is.

Since then two more papers on S. African Echinoderms, based on material collected by the Fisheries Survey of S. Africa have been published by H. L. Clark, viz. on the Echinoidea and the Asteroidea (Fisheries and Marine Biological Survey. Report No. 4. I and VII. 1925—26), in which a considerable number of additions to the South African Echinoderm Fauna are given. The rest of the Echinoderms collected by the Fisheries Survey of South Africa after those reported on in Clark's first paper have not been dealt with.

A few more additions to the S. African Echinoderm fauna are given in my paper "On some Echinoderms from S. Africa" (Ann. Mag. Nat. Hist. 9. Ser. XVI. 1925) based on material sent me from the Durban Museum, viz. *Dactylosaster cylindricus* Gray, *Anthosticte Pacei* Mrtsn.,

[1]) It is with the special permission of the Board of Directors of the Rask-Oersted Fund that this report on S. African Echinoderms, as also the following report on the Echinoderms of St. Helena, are included in the series of "Papers from Dr. Th. Mortensen's Pacific Expedition". I beg to express my sincere thanks for this favour — a favour the more important, as the publication of these rather voluminous reports might otherwise have met with some difficulties.

Th. Mortensen.

Anthenoides Marley Mrtsn., *Hacelia superba*, var. *capensis* Mrtsn., *Astroschema capense* Mrtsn., and *Ophiactis savignyi* (Müll. & Troschel).

In a paper by Koehler "Sur quelques Ophiures des côtes de l'Angola et du Cap." (Göteborgs K. Vet. & Vitterh. Samh. Handlingar. XXV. 1923) is recorded *Ophiacantha Barracoutæ* n. sp., which is, however, identical with Clark's *Ophiacantha nerthepsila*.

M. Hertz in her memoir "Die Ophiuriden d. deutschen Südpolar-Expedition 1901—1903" (1926) records from S. Africa *Ophiactis africana*, var. *capensis* n. subsp., which is, however, identical with the common S. African *Ophiactis plana*, and in her memoir "Die Ophiuriden d. Deutschen Tiefsee-Expedition. I." 1927 *Ophiachasma nitida* n. sp. *Gymnophiura novembris* n. sp., and *Ophiura carnea* Ltk.; the latter is, however, identical with *Dictenophiura anoidea* H. L. Clark, not with the North Atlantic *Ophiura carnea*.

In my Monograph of the Echinoidea I. 1929 I recorded the existence in S. African Seas of a *Goniocidaris* sp., and in my paper "New Contributions to the knowledge of the Cidarids" (Mem. Ac. R. Sci. Copenhague. 9 Ser. IV. 1932) I added to the S. African fauna: *Histocidaris elegans* (A. Ag.), *Sterocidaris squamosa* Mrtsn., *Sterocidaris excavata* n. sp.; *Acanthocidaris maculicollis* (de Meijere), *Kionocidaris striata* n. g. n. sp., with the variety *teretispina* n. var.

During a visit to S. Africa in 1929 I had some opportunities of making investigations in S. African Seas, particularly through the Government and the Director of the Fisheries Survey of S. Africa, Dr. C. v. Bonde, placing the survey steamer "Pickle" at my disposal for some time; first off Durban, in August. It was arranged that I should have the vessel at disposal for marine investigations for some three weeks, immediately after the ending of the meeting of the British Association, which took place in S. Africa (Cape Town, Johannesburg) that year. Through an unfortunate accident it happened, however, that the screw of the "Pickle" was damaged, when the ship on its way up from Cape Town was some miles from Durban. The necessary reparation of the screw took about two weeks. This, combined with unsettled weather conditions, had the result that I could actually dispose of the ship for trawlings and dredgings only 6 days. Nevertheless, the outcome was of very considerable importance, and quite a number of species new to science, or new to the S. African fauna were found (particularly of Ophiurans); but one cannot help deploring the said

unfortunate accident, in view of the incomparable richer outcome which would most certainly have been the result, if the ship had actually been at my disposal for two weeks more in the wonderfully rich sea off the Natal Coast.

Later on, on my return to S. Africa after a visit to Mauritius I could use the "Pickle" for 5 days for explorations off Cape Peninsula, with very fine results. I also got permission from the firm Irwin & Johnson to accompany their trawler "John C. Meikle" on a trip to the Agulhas Bank from 8th to 15th December, which gave a good deal of interesting Echinoderms. After my return to Denmark I had further the great pleasure of receiving an important sending of Echinoderms from off East London from Captain G. Pace of the trawler "Disa"; also Mr. Bell Marley, Director of the Natal Fisheries, Durban, sent me some fine Echinoderms.

A fact of the highest importance for me was that Dr. C. van Bonde placed at my disposal the whole of the Echinoderm material accumulated in the Laboratory of the Fisheries Survey, containing all the material collected by Dr. F. Gilchrist, which had not been sent to H. L. Clark for being reported on. This gave me an opportunity of studying quite a number of species not taken by myself during my own investigations in the S. African seas.

All this material thus being at my disposal has resulted in quite a material increase of our knowledge of the Echinoderm fauna of the South African seas. Already through Clark's researches we had got a good idea of the unusual interest that attaches to this fauna. The present researches contribute very materially to strengthening this interest, showing that the South African Echinoderm Fauna is one of the richest and most characteristic of the world.

It is my very agreable duty here to express my great indebtedness to the South African Government, and to the director of the Fisheries Survey of South Africa, Dr. C. van Bonde, for the most important assistance thus rendered me. Likewise my best thanks are due to the firm Irwin & Johnson and to the officers of the ships "Pickle" and "John C. Meikle", as also to Captain G. Pace of the "Disa". Further I beg to express my cordial thanks for all assistance rendered me, to the Danish Consuls, Mr. Jeppe in Cape Town and Mr. Andersson in Durban, to the authorities of the South African Museum, Cape Town, Dr. L. Gill, Dr. K. H. Barnard, and Dr. Law-

rence, to the director of the Durban Museum, Dr. E. C. Chubb and to Mr. Bell Marley, and, last not least, to my friends Mrs. and Mr. Lindstrøm, Rondebosch, and Mrs. and Mr. Eigil Christiansen, Durban, who all through their kindness and ever ready assistance have contributed very materially to increasing my scientific results and to make my visit to South Africa an unforgettable experience.

I beg to express also my cordial thanks to the authorities of various Museums for sending me specimens for comparison with my S. African Echinoderms, viz. Prof. W. Arndt of the Berlin Museum, Dr. K. H. Barnard of the South African Museum, Cape Town, Prof. Sixten Bock of the Stockholm Museum, Dr. H. Engel of the Amsterdam Museum, Prof. L. Jägerskjöld of the Gothenburg Museum, Prof. L. Joubin of the Paris Museum, Dr. C. C. A. Monro of the British Museum, London, and Dr. A. C. Stephen of the Edinburg Museum. Particularly it was of material importance that most of the species mentioned in Bell's Reports on S. African Echinoderms were sent me for reexamination so that the remarkable "identifications" of this author could be corrected.

In this report I intend to deal only with the Asteroids and Ophiurids of the S. African seas. The Holothurians will be dealt with by Mr. S. Heding and the Crinoids by Professor Torsten Gislén. The Echinoids, exclusive of the Cidarids, which were reported on in my paper "New Contributions to the knowledge of the Cidarids" will be included in my "Monograph of the Echinoidea".

I think it practical to give first a tabellaric view of all the Asteroidea and Ophiuroidea now known to occur in South African Seas, viz. from Natal to Lüderitz Bay. In the first column are given the species hitherto recorded, by Clark, and in the works quoted above which have been published after Clark's report. From this list are, of course, excluded those species included in Clark's report which are, or were by that time, not known from further South than Mozambique and thus do, or did by that time, not properly belong to the S. African fauna.

In second column is given a corrected list of all the species now actually known to occur in S. African Seas.

In the list of the previously recorded species are added letters indicating, who is responsible for the record, viz. B. — F. Jeffr Bell; D. — Döderlein; H. — Hertz; Lj. — Ljungman; Me. — Meissner; M. — Mortensen. For those species, where no letter is added, Clark

is responsible. The species not examined by Clark or by the present author are marked with an asterisc. Some few of the species not thus marked are not reported on in the special part of this paper; of such species I have had an opportunity of seeing specimens identified by Clark, but no new material has been available of them.

List of Asteroidea and Ophiuroidea of S. African Seas, from Natal to Lüderitzbay.

Previously recorded species.	Revised list of species.
Asteroidea.	**Asteroidea.**
Porcellanaster coeruleus W. Th.	*Porcellanaster coeruleus W. Th.
Pectinaster Filholi Perrier	*Pectinaster Filholi Perrier
Luidiaster hirsutus Studer	Luidiaster hirsutus Studer
Plutonaster intermedius (Perrier)	Plutonaster intermedius (Perrier)
— proteus H. L. Clark	— proteus H. L. Clark
Dipsacaster Sladeni Alcock	Dipsacaster Sladeni Alcock
Leptychaster kerguelensis E.A.Smith (B)	— —
	Persephonaster Roulei, var. euryplax n. var.
Bathybiaster robustus Verrill	Bathybiaster robustus Verrill
Psilaster acuminatus Sladen	Psilaster acuminatus Sladen
Astropecten polyacanthus M. & Tr.	Astropecten polyacanthus M. & Tr.
— granulatus M. & Tr.	— granulatus M. & Tr.
— anacanthus H. L. Clark	— anacanthus H. L. Clark
— leptus H. L. Clark	— leptus H. L. Clark
— irregularis pontoporæus Sladen	— irregularis pontoporæus Sladen
	— Hemprichii M. & Tr.
	— antares Döderlein
	— exilis n. sp.
Luidia africana Sladen	Luidia africana Sladen
— Savignyi Audouin	* — Savignyi Audouin
	? — maculata M. & Tr.
Pseudarchaster tesselatus Sladen	Pseudarchaster tesselatus Sladen
— brachyactis H.L.Clark	— brachyactis H.L.Clark
Mediaster capensis H. L. Clark	Mediaster capensis H. L. Clark
	— — durbanensis n. var.
Ceramaster chondriscus H. L. Clark	Ceramaster chondriscus H. L. Clark
— trispinosus H. L. Clark	* — trispinosus H. L. Clark
— patagonicus euryplax H.L. Clark	* — patagonicus euryplax H.L. Clark
Calliaster baccatus Sladen	Calliaster baccatus Sladen
— acanthodes H. L. Clark	— acanthodes H. L. Clark
Tosia tuberculata Gray	Tosia tuberculata Gray

Cladaster macrobrachius H. L. Clark	Cladaster macrobrachius H. L. Clark
Sphæriodiscus Bourgeti Perrier	Sphæriodiscus Bourgeti Perrier
Hippasteria phrygiana (Parelius)	Hippasteria phrygiana capensis n. var.
— strongylactis H. L. Clark	— strongylactis H. L. Clark
Anthosticte Pacei Mrtsn. (M)	Anthosticte Pacei Mrtsn.
Anthenoides Marleyi Mrtsn. (M)	Anthenoides Marleyi Mrtsn.
Odontaster australis H. L. Clark	Odontaster australis H. L. Clark
Oreaster mamillatus Audouin	*Oreaster mamillatus Audouin
	Tylaster meridionalis n. sp.
Chondraster elattosis H. L. Clark	*Chondraster elattosis H. L. Clark
Austrofromia Schultzei Döderlein (D)	Austrofromia Schultzei Döderlein
Dactylosaster cylindricus Gray (M)	Dactylosaster cylindricus Gray
Hacelia superba capensis Mrtsn. (M)	Hacelia superba capensis Mrtsn.
Cycethra sp.(?)	*Cycethra sp.(?)
Asterina granifera (Gray)	Asterina granifera (Gray)
— — sporacantha H. L. Clark	— — sporacantha H. L. Clark
— exigua (Lamk.)	— (Patiriella) exigua (Lamk.)
— dyscrita H. L. Clark	— — —
* — calcarata (Gray) (K)	— — —
— lüderitziana Döderlein (D)	* — lüderitziana Döderlein
— gracilispina H. L. Clark	— gracilispina H. L. Clark
* — coccinea (Gray)	Not S. African
*Parasterina bellula Sladen	Parasterina bellula Sladen
*Asterina penicillaris (Lamk.) (Me)	— —
	— formosa n. sp.
	Disasterina leptalacantha africana n. var.
Anseropoda novemradiata (Bell)	Anseropoda novemradiata (Bell)
— habracantha H. L. Clark	— habracantha H. L. Clark
	— grandis n. sp.
Echinaster reticulatus H. L. Clark	Echinaster reticulatus H. L. Clark
Henricia ornata (Perrier)	— ornatus Perrier
— —	Henricia abyssalis Perrier
Poraniopsis capensis H. L. Clark	Poraniopsis capensis H. L. Clark
Cryaster brachyactis H. L. Clark	Cryaster brachyactis H. L. Clark
Culcita veneris Perrier (B)	— —
Crossaster penicillatus Sladen	Crossaster penicillatus Sladen
Lophaster quadrispinus H. L. Clark	Lophaster quadrispinus H. L. Clark
Pteraster capensis Gray	Pteraster capensis Gray
— affinis E. A. Smith	* — affinis E. A. Smith
	— fornicatus n. sp.
	— flabellifer n. sp.
Diplopteraster multipes (M. Sars)	Diplopteraster multipes (M. Sars)
Hymenaster lamprus H. L. Clark	Hymenaster lamprus H. L. Clark
— gennæus H. L. Clark	— gennæus H. L. Clark
— latebrosus Sladen	* — latebrosus Sladen

Hymenaster membranaceus Sladen	*Hymenaster membranaceus Sladen
Stichaster felipes Sladen	Cosmasterias felipes (Sladen)
Marthasterias glacialis (Linn.)	Marthasterias glacialis rarispina (Perrier)
— rarispina (Perrier)	— — —
— africana (M. & Tr.)	— — africana (M. & Tr.)
*Asterias capensis Perrier (B)	Sclerasterias capensis (Perrier)
Eustolasterias stenactis H. L. Clark	— stenactis (H. L. Clark)
	— eustyla (Sladen)
Coscinasterias calamaria (Gray) (B)	*Coscinasterias calamaria (Gray)
Perissasterias polyacantha H. L. Clark	Perissasterias polyacantha H. L. Clark
— obtusispina H. L. Clark	* — obtusispina H. L. Clark
— heptactis H. L. Clark	* — heptactis H. L. Clark
	— sp.
Coronaster volsellatus (Sladen)	Coronaster volsellatus (Sladen)
Brisinga cricophora Sladen	Brisinga cricophora Sladen
Stegnobrisinga splendens H. L. Clark	*Stegnobrisinga splendens H. C. Clark
Ophiuroidea.	Ophiuroidea.
Asteronyx Loveni Müll. & Troschel	Asteronyx Loveni Müll. & Troschel
	Astroceras spinigera n. sp.
	Asterostegus tuberculatus n. g., n.sp. not S. African.
Ophiuropsis Lymani Studer	
Astroschema capensis Mrtsn. (M)	Astroschema capensis Mrtsn.
Astrothamnus papillatus H. L. Clark	Astrothorax papillata (H. L. Clark)
Gorgonocephalus chilensis (Philippi)	Gorgonocephalus pectinatus n. sp.
Astrocladus euryale (Retzius)	Astrocladus euryale (Retzius)
	— hirtus n. sp.
	— africanus n. sp.
	Astroconus capensis n. sp.
Ophiomyxa vivipara Studer	Ophiomyxa vivipara Studer
	— bengalensis Koehler
	— tenuispina n. sp.
Ophioscolex dentatus Lyman	Ophioscolex dentatus Lyman
	— — var. spiniger n. var.
	— inermis n. sp.
Ophiacantha nerthepsila H. L. Clark	Ophiacantha nerthepsila H. L. Clark
	— scutigera n. sp.
	— baccata n. sp.
	— striolata n. sp.
	— (Ophiotreta) durbanensis n. sp.
Ophiomitrella corynephora H. L. Clark	Ophiomitrella corynephora H. L. Clark
	— hamata n. sp.
	Ophioplinthaca sexradia n. sp.
Ophiothamnus remotus Lyman	Ophiothamnus remotus Lyman

	Ophiothamnus remotus var. cordatus n. var.
Ophiothrix aristulata Lyman	Ophiothrix aristulata Lyman
— fragilis (Abildgård)	— fragilis (Abildgård)
— triglochis Müll. & Troschel	— triglochis Müll. & Troschel
— roseo-coerulans Grube (B)	— —
— longipeda (Lamarck)	* — longipeda (Lamk.)
— capensis Lütken	Ophiogymna capensis (Lütken)
	— fulgens (Koehler)
Ophiocnemis marmorata (Lamarck)	?Occurrence at S. Africa doubtful.
Ophiopsammium nudum H. L. Clark	*Ophiopsammium nudum H. L. Clark
Ophiothela dividua v. Martens	Ophiothela dividua v. Martens
Ophiactis carnea Ljungman	Ophiactis carnea Ljungman
— plana Lyman	— plana Lyman
— africana, var. capensis (H.)	— — —
— abyssicola (M. Sars)	— abyssicola (M. Sars)
	— nidarosiensis Mrtsn.
Amphiura dilatata Lyman	Amphiura dilatata Lyman
— capensis Ljungman	— capensis Ljungman
— angularis Lyman	— angularis Lyman
— incana Lyman	— incana Lyman
— candida Ljungman	Not recognizable; species delenda.
	Amphiura uncinata Koehler
	— grandisquama, var. natalensis n. var.
	— linearis n. sp.
	— adjecta n. sp.
	— compressa n. sp.
Amphipholis squamata Delle Chiaje	Amphipholis squamata (Delle Chiaje)
— minor (Döderlein)	— — —
	— strata n. sp.
	— similis n. sp.
Amphioplus gibbosus (Ljungman)	Amphioplus(?) gibbosus (Ljungm.)
— integer (Ljungman)	— integer (Ljungm.)
	— falcatus n. sp.
	— pectinatus n. sp.
	— furcatus n. sp.
	Amphilepis scutata n. sp.
Ophionereis dubia (Müll. & Troschel)	Ophionereis dubia (Müll. & Troschel)
— porrecta Lyman	— porrecta Lyman
Ophiochiton australis H. L. Clark	— australis (H. L. Clark)
	Ophiocoma valenciæ Müll. & Troschel
Cryptopelta aster (Lyman)	Cryptopelta aster (Lyman)
Ophiarachnella capensis (Bell)	Ophiarachnella capensis (Bell)
	Ophiopezella decorata n. sp.
Ophioderma leonis Döderlein	Ophioderma leonis Döderlein

*Ophioderma Wahlbergi Müll. & Troschel	*Ophioderma wahlbergi Müll. & Troschel
	Ophiolepis cincta Müll. & Troschel.
Ophiura costata (Lyman)	Ophiura costata (Lyman)
— irrorata (Lyman)	— irrorata (Lyman)
— flagellata (Lyman)	— flagellata (Lyman)
— trimeni Bell	— trimeni Bell
	— (Ophiuroglypha) tumida n. sp.
Dictenophiura anoidea H. L. Clark	Dictenophiura anoidea H. L. Clark.
Ophiocten amitinum Lyman	Ophiocten amitinum Lyman
	— — var. microplax n. var.
— pacificum Ltk. & Mrtsn.	— latens Koehler.
Ophiomusium Lymani Wyv. Thomson	Ophiomusium Lymani Wyv. Thomson
Ophiomisidium flabellum (Lyman)	*Ophiomisidium flabellum (Lyman)
Astrophiura cavellæ Koehler	Astrophiura permira Sladen
Ophiernus vallincola Lyman	Ophiernus vallincola Lyman

The present report serves greatly to emphasize the zoogeographical relations of the South African Echinoderm fauna as set forth by Clark (Op. cit. 1923. p. 224—227). The percentage numbers of the components of that fauna are, of course, somewhat modified, but not so much as to alter the general results, and I do not therefore think it necessary, or even desirable to give any details here, where only the Asteroids and Ophiurids are dealt with. It may only be stated briefly that out of the total number of Asteroids now actually known from S. African Seas, viz. 85, no less than 58 are known from nowhere else in the world, and of the Ophiuroids 56 of a total number of 82.

I would point out the extraordinary number of new forms, particularly Ophiurids, found off Durban. This result of the few dredgings done there gives definite promise of a rich harvest, when once extensive trawlings and dredgings are undertaken in the deeper waters off the Natal coast. It is to be expected that most of the Deep-sea fauna of the Indian Ocean will be found there — and probably much farther South. This will be one of the most interesting problems to investigate: how far South the Indian Ocean species go, and how far North the Cape region species go. I would expect the region off Algoa Bay to be, if I may so say, the critical area, where most of these species have respectively their southern and northern limit.

Very noteworthy are the facts that there are scarcely any species common to the S. African and the Magellanic region (*Ophiomyxa vivipara*, *Ophiactis plana*, and *Diplopteraster multipes*, the two latter of

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Species	Depth in meters	Cape Province	Algoa Bay	Natal	Mosambique	Indian Ocean	Malay Archipelago	Australia	S.W. Africa	Atlantic	West Indian	Magellanic Region	Kerguelen	Other localities
Porcellanaster coeruleus W. Th.	1475—2700	×	..	..	..	..	..	..	..	×	..	..	..	..
Pectinaster Filholi Perrier	1180—2460	×	..	..	..	..	..	..	..	×	..	..	..	..
Luidiaster hirsutus Studer	235—440	×	..	..	..	..	..	..	..	..	..	..	×	..
Persephonaster Roulei, var. euryplax Mrtsn.....	405	..	..	×	..	..	..	..	..	..	..	..	..	..
Plutonaster intermedius Perrier.....	560—1720	×	..	..	..	..	..	..	×	..	×	..	..	..
— proteus H. L. Clark	1360—1800	×	..	..	..	..	..	..	..	..	..	..	..	..
Dipsacaster Sladeni Alcock	165—650	×	..	..	..	×	..	..	..	..	..	..	..	..
Bathybiaster robustus Verrill	1360—2630	×	..	..	..	..	..	..	..	×	..	..	..	(Off N. America)
Psilaster acuminatus Sladen	35—1710	×	..	..	..	..	..	×	..	..	..	..	..	N. Zealand
Astropecten polyacanthus M. Tr.	0—90	..	..	×	×	×	×	×	..	..	..	..	..	N. Zealand
— irregularis, pontoporæus Sladen	10—180	×	×	..	..	..	..	..	..	..	..	..	..	..
— granulatus M. Tr.	10—55 (?360)	×	..	×	..	..	×	×	..	..	..	..	..	..
— Hemprichii M. Tr.....	Littoral (?)	..	..	×	×	..	..	..	..	..	..	..	..	Red Sea
— antares Döderlein	9—63	×	..	..	×	..	..	..	..	..	..	..	..	..
— leptus H. L. Clark.....	205—370	..	..	×	..	..	..	..	..	..	..	..	..	..
— exilis Mrtsn.....	?	..	..	× (?)	..	..	..	..	..	..	..	..	..	..
— anacanthus H. L. Clark ..	122—277	..	..	×	..	..	..	..	..	..	..	..	..	..
Luidia africana Sladen	54—320	×	×	..	..	..	..	..	..	..	..	..	..	..
— maculata M. Tr.	0—640	..	..	×	×	×	×	×	..	..	..	..	..	Japan
— Savignyi Audouin.....	18—45	..	..	×	..	×	×	..	..	..	..	..	..	Red Sea
Pseudarchaster tesselatus Sladen	150—450	×	..	..	..	..	..	..	..	..	..	..	..	..
— brachyactis H. L. Clark	360—720	×	..	..	..	..	..	..	×	..	..	..	..	..
Mediaster capensis H. L. Clark.....	38—167	×	..	..	..	..	..	..	..	..	..	..	..	..

— trispinosus H. L. Clark....	414	×	..	..	..	..	..	..	..	..	..	..	..	..	
— patagonicus, euryplax H. L. Clark	153—322	×	..	..	..	..	..	..	..	..	..	..	..	..	
Calliaster baccatus Sladen	9—140	×	×	..	..	..	..	..	..	..	..	..	..	..	
— acanthodes H. L. Clark.....	115—405	×	×	×	..	..	..	..	..	..	..	..	..	..	
Tosia tuberculata Gray.....	80—540	×	×	×	..	..	..	..	..	..	..	..	..	..	
Cladaster macrobrachius H. L. Clark..	385—900	×	..	..	..	..	..	..	..	..	..	..	..	..	
Hippasteria phrygiana, capensis Mrtsn.	306—966	×	..	..	..	..	..	..	..	..	..	..	..	..	
— strongylactis H.L.Clark ..	315—966	×	..	..	..	..	..	..	..	..	..	..	..	..	
Anthosticte Pacei Mrtsn.	? (ca. 250)	..	..	× (?)	..	..	..	..	..	..	..	..	..	..	
Anthenoides Marleyi Mrtsn.....	250—270	..	..	×	..	..	..	..	..	..	..	..	..	..	
Sphæriodiscus Bourgeti Perrier.....	410—760	..	..	×	..	..	..	..	..	×	..	..	..	(Cape Verde)	
Odontaster australis H. L. Clark.....	240—315	×	..	..	..	..	..	..	..	..	..	..	..	..	
Oreaster mamillatus Audouin	Littoral	×	..	..	×	..	..	..	..	..	..	..	..	Red Sea	
Tylaster meridionalis Mrtsn.	194	×	..	..	..	..	..	..	..	..	..	..	..	..	
Chondraster elattosis H. L. Clark.....	966—1008	×	..	..	..	..	..	..	..	..	..	..	..	..	
Poraniopsis capensis H. L. Clark.....	288—414	×	..	..	..	..	..	..	..	..	..	..	..	..	
Austrofromia Schultzei Döderlein.....	14—16	×	×	..	..	..	..	..	..	..	..	..	..	..	
Dactylosaster cylindricus Gray.....	Littoral	..	..	×	×	×	..	..	..	..	..	..	..	Hawaiian Isl.	
Hacelia superba, capensis Mrtsn.....	?	..	..	(?) ×	..	..	..	..	..	..	..	..	..	..	
Cycethra sp.	77	..	×	..	..	..	..	..	..	..	..	..	..	..	
Parasterina bellula (Sladen).....	0—54	×	..	..	..	..	..	..	..	..	..	..	..	..	
— formosa Mrtsn.....	54	×	..	..	..	..	..	..	..	..	..	..	..	..	
Asterina granifera (Gray)	0—40	×	..	..	..	..	..	..	..	..	..	..	..	..	
— — , sporacantha H. L. Clark.....	0—80	×	..	..	..	..	..	..	..	..	..	..	..	..	
— (Patiriella) exigua (Lamk.)...	Littoral	×	×	×	×	×	×	×	×	..	..	..	..	St. Helena	
— lüderitziana Döderlein.....	Littoral	..	..	..	..	..	..	..	×	..	..	..	..	..	
— gracilispina H. L. Clark.....	25—40	×	..	..	..	..	..	..	..	..	..	..	..	..	
— leptalacantha, africana Mrtsn.	Littoral	..	×	..	..	..	..	..	..	..	..	..	..	..	

Species	Depth in meters	Cape Province	Algoa Bay	Natal	Mosambique	Indian Ocean	Malay Archipelago	Australia	S.W. Africa	Atlantic	West Indian	Magellanic Region	Kerguelen	Other localities
Anseropoda novemradiata (Bell)	60—300	×	..	×	..	..	..	..	..	..	..	..	..	..
— habracantha H. L. Clark	120—150	..	×	×	..	..	..	..	..	..	..	..	..	..
— grandis Mrtsn	310	..	..	..	..	..	..	..	×	..	..	..	..	..
Henricia abyssalis (Perrier)	210—1635	×	..	..	..	..	..	..	..	×	..	..	..	..
Echinaster ornatus Perrier	0—35	×	..	..	..	..	..	..	..	..	..	..	..	..
— reticulatus H. L. Clark	30—288	×	..	..	..	..	..	..	..	..	..	..	..	..
Cryaster brachyactis H. L. Clark	40—100	×	×	..	..	..	..	..	..	..	..	..	..	..
Crossaster penicillatus Sladen	70—805	×	×	..	..	..	..	..	..	..	..	..	..	..
Lophaster quadrispinus H. L. Clark	350—520	×	×	×	..	..	..	..	..	..	..	..	..	..
Pteraster capensis Gray	35—365	×	×	..	..	..	..	..	..	..	..	..	..	..
— affinis E. A. Smith	50—415 (?)	× (?)	..	..	..	..	..	..	..	..	..	..	×	..
— fornicatus Mrtsn.	322	×	..	..	..	..	..	..	..	..	..	..	..	..
— flabellifer Mrtsn	360	..	..	..	..	..	..	..	×	..	..	..	..	..
Diplopteraster multipes (M. Sars)	100—1170	×	..	..	..	..	..	..	..	..	..	×	..	N. Atlantic, N. Pacific
Hymenaster latebrosus Sladen	ca. 1450—3500	×	..	..	..	..	..	..	..	..	..	..	..	Antarctic, Deep-sea
— membranaceus Sladen	ca. 1450—2025	×	..	..	..	..	..	..	..	×	..	..	..	..
— lamprus H. L. Clark	ca. 1450	×	..	..	..	..	..	..	..	..	..	..	..	..
— gennæus H. L. Clark	ca. 1350—1450	×	..	..	..	..	..	..	..	..	..	..	..	..
Cosmasterias felipes (Sladen)	153—367	×	..	..	..	..	..	..	..	..	..	..	..	..
— capensis (Perrier)	Littoral (?)	× (?)	..	..	..	..	..	..	..	..	..	..	..	..
Marthasterias glacialis, rarispina (Perrier)	ca. 15—115	×	×	..	..	..	..	..	..	..	..	..	..	..
— — africana M. Tr.	Littoral	×	..	..	..	..	..	..	..	..	..	..	..	..
[illegible]	[illegible]													Tristan

— sp.	90	..	..	×	..	..	..	..	..	..	..	..	..	..	..
Perissasterias polyacantha H. L. Clark	165—305	×	..	..	..	..	..	..	..	..	..	..	..	..	..
— sp.	?	× (?)	..	..	..	..	..	..	..	..	..	..	..	..	..
— obtusispina H. L. Clark	385	×	..	..	..	..	..	..	..	..	..	..	..	..	..
— heptactis H. L. Clark	378	×	..	..	..	..	..	..	..	..	..	..	..	..	..
Coscinasterias calamaria (Gray)	0—ca. 40	..	..	×	..	×	..	×	..	..	..	..	..	..	N. Zealand
Coronaster volsellatus (Sladen)	170—405	×	..	×	..	..	×	..	..	..	..	..	..	..	..
Brisinga cricophora Sladen	410—700	×	..	..	..	..	..	..	..	..	×	..	..	..	..
Stegnobrisinga splendens H. L. Clark	846	..	..	×	..	..	..	..	..	..	..	..	..	..	..
Asteronyx Loveni M. Tr.	ca. 100—1800	×	..	..	..	×	×	×	..	×	×	..	..	..	Pacific
Astroceras spinigerum Mrtsn.	405	..	..	×	..	..	..	..	..	..	..	..	..	..	..
Asterostegus tuberculatus Mrtsn.	376	..	..	×	..	..	..	..	..	..	..	..	..	..	..
Astroschema capensis Mrtsn.	?	..	..	×	..	..	..	..	..	..	..	..	..	..	..
Astrothorax papillata (H. L. Clark)	43—558	×	×	×	..	..	..	..	..	..	..	..	..	..	..
Gorgonocephalus pectinatus Mrtsn.	350—540	×	×	..	..	..	..	..	..	..	..	..	..	..	..
Astrocladus euryale (Retzius)	15—90	×	×	..	..	..	..	..	..	..	..	..	..	..	..
— hirtus Mrtsn.	?	...	..	× (?)	..	..	..	..	..	..	..	..	..	..	..
— africanus Mrtsn.	?	?	..	..	..	..	..	..	..	..	..	..	..	..	..
Astroconus capensis Mrtsn.	415	..	..	×	..	..	..	..	..	..	..	..	..	..	..
Ophiomyxa vivipara Studer	0—360	×	..	..	..	..	..	..	..	..	..	×	..	..	..
— bengalensis Koehler	250—550	..	..	×	..	×	×	..	..	..	..	..	..	..	..
— tenuispina Mrtsn.	?	..	..	?	..	..	..	..	..	..	..	..	..	..	..
Ophioscolex (Ophiolycus) dentatus Lyman	160—405	×	..	..	..	..	..	..	..	..	..	..	..	..	..
Ophioscolex (Ophiolycus) dentatus, spiniger Mrtsn.	405	..	..	×	..	..	..	..	..	..	..	..	..	..	..
Ophioscolex inermis Mrtsn.	405	..	..	×	..	..	..	..	..	..	..	..	..	..	
Ophiacantha nerthepsila H. L. Clark	30—90	×	..	..	..	..	..	..	..	..	..	..	..	..	..
— scutigera Mrtsn.	160—215	..	..	×	..	..	..	..	..	..	..	..	..	..	..
— baccata Mrtsn.	228—284	..	..	×	..	..	..	..	..	..	..	..	..	..	..

Species	Depth in meters	Cape Province	Algoa Bay	Natal	Mosambique	Indian Ocean	Malay Archipelago	Australia	S.W. Africa	Atlantic	West Indian	Magellanic Region	Kerguelen	Other localities
Ophiacantha striolata Mrtsn.....	405	..	..	×	..	..	..	..	..	..	..	..	..	..
— (Ophiotreta) durbanensis Mrtsn.....	405	..	..	×	..	..	..	..	..	..	..	..	..	..
Ophiomitrella corynephora H. L. Clark	288—415	×	..	..	..	..	..	..	..	..	..	..	..	..
— hamata Mrtsn.	405	..	..	×	..	..	..	..	..	..	..	..	..	..
Ophioplinthaca sexradia Mrtsn.....	43	×	..	..	..	..	..	..	..	..	..	..	..	..
Ophiothamnus remotus Lyman.....	90—415	×	..	×	..	..	..	..	..	..	..	..	..	..
— — cordatus Mrtsn.	405	..	..	×	..	..	..	..	..	..	..	..	..	..
Ophiothrix aristulata Lyman	70—530	×	..	..	..	..	×	×	..	..	..	..	..	..
— fragilis (Abildgård)	0—475 (1245)	×	..	..	..	..	..	..	..	×	..	..	..	Mediterranean
— triglochis M. Tr.....	0—215	×	×	×	..	..	..	..	..	..	..	..	..	..
— longipeda (Lamk.).....	0—658	..	..	×	×	×	×	×	..	..	..	..	..	..
Ophiogymna capensis (Lütken).....	?	..	..	× (?)	..	..	..	..	..	..	..	..	..	..
— fulgens (Koehler)	25—925	..	..	×	..	..	×	..	..	..	..	..	..	..
Ophiopsammium nudum H. L. Clark..	65	..	..	×	..	..	..	..	..	..	..	..	..	..
Ophiothela dividua v. Martens	?	..	×	..	..	..	..	..	..	..	..	..	..	..
— Danæ Verrill.....	12—215	..	..	×	..	..	×	..	..	..	..	..	..	Fiji
Ophiactis carnea Ljungman.....	0—215	×	×	×	..	..	..	..	..	..	..	..	..	..
— plana Lyman.....	70—405	×	..	×	..	..	(×)	..	..	..	..	×	..	Cosmopolitan(?)
— abyssicola (M. Sars)	125—4000	×	..	..	..	..	..	..	..	×	..	..	..	..
— nidarosiensis Mrtsn.....	200—560	× (?)	..	..	..	..	..	..	..	×	..	..	..	..
Amphiura atlantica, dilatata Lyman..	150—265	×	..	..	..	..	..	..	..	..	..	..	..	..
— capensis Ljungman.....	Littoral	×	..	..	..	..	..	..	×	..	..	..	..	..
— angularis Lyman.....	55—270	×	..	..	..	..	..	..	..	..	..	..	×	..
— incana Lyman	15—55	×	×											

— grandisquama natalensis Mrtsn.	405	..	..	×	..	..	..	..	..	..	..	..	..	..	..
— linearis Mrtsn.	90—160	..	..	×	..	..	..	..	..	..	..	..	..	..	..
— adjecta Mrtsn.	63	..	..	×	..	..	..	..	..	..	..	..	..	..	..
— compressa Mrtsn.	54	×	..	..	..	..	..	..	..	..	..	..	..	..	..
— albella Mrtsn.	405	..	..	×	..	..	..	..	..	..	..	..	..	..	..
Amphipholis squamata (D. Ch.)	0—740	×	..	×	..	×	×	×	×	×	×	..	..	..	Cosmopolitan
— strata Mrtsn.	54	×	..	..	..	..	..	..	..	..	..	..	..	..	..
— similis Mrtsn.	63	..	..	×	..	..	..	..	..	..	..	..	..	..	..
Amphioplus gibbosus (Ljungm.)	?	..	..	×	..	..	..	..	..	..	..	..	..	..	..
— integer (Ljungm.)	15—63	×	..	×	..	..	..	..	..	..	..	..	..	..	..
— falcatus Mrtsn.	405	..	..	×	..	..	..	..	..	..	..	..	..	..	..
— pectinatus Mrtsn.	405	..	..	×	..	..	..	..	..	..	..	..	..	..	..
— furcatus Mrtsn.	45	..	..	×	..	..	..	..	..	..	..	..	..	..	..
Amphilepis scutata Mrtsn.	405	..	..	×	..	..	..	..	..	..	..	..	..	..	..
Ophionereis dubia (M. Tr.)	13—230	..	×	×	×	×	×	×	..	..	..	..	..	..	Japan
— porrecta Lyman	ca. 10—160	..	×	×	..	×	×	×	..	..	..	..	..	..	Hawaiian Isl. Riu-Riu
— australis (H. L. Clark)	84—160	..	..	×	..	..	..	..	..	..	..	..	..	..	..
Ophiocoma Valenciæ M. Tr.	Littoral	..	..	×	×	×	..	..	..	..	..	..	..	..	Red Sea
Cryptopelta aster (Lyman)	77—415	×	..	..	..	..	..	..	..	..	..	..	..	..	..
Ophiarachnella capensis (Bell)	0—90	×	..	..	..	..	..	..	..	..	..	..	..	..	..
Ophiopezella decorata Mrtsn.	Littoral	..	..	×	..	..	..	..	..	..	..	..	..	..	..
Ophioderma leonis Döderlein	0—18	×	..	..	..	..	..	..	×	..	..	..	..	..	..
— wahlbergi M. Tr.	Littoral	..	..	(?) ×	..	..	..	..	..	..	..	..	..	..	? Red Sea
Ophiolepis cincta M. Tr.	0—35	..	..	×	..	×	×	×	..	..	..	..	..	..	Society Isl.
Ophiura costata (Lyman)	45—1620	×	..	..	..	..	..	..	..	..	..	..	..	..	..
— irrorata (Lyman)	600—4315	×	..	..	..	..	×	..	..	×	..	..	..	..	Cosmopolitan
— flagellata (Lyman)	96—2330	×	..	..	..	×	×	..	..	×	..	..	..	..	N. Pacific
— trimeni Bell	160—1620	×	..	..	..	..	..	..	..	..	..	..	..	..	..
— (Ophiuroglypha) tumida Mrtsn.	120—405	..	..	×	..	..	..	..	..	..	..	..	..	..	..

Species	Depth in meters	Cape Province	Algoa Bay	Natal	Mosambique	Indian Ocean	Malay Archipelago	Australia	S.W. Africa	Atlantic	West Indian	Magellanic Region	Kerguelen	Other localities
Dictenophiura anoidea H. L. Clark....	40—100	×	..	..	..	..	..	..	×	..	..	..	..	..
Ophiocten amitinum Lyman.....	50—3510	..	×	..	..	..	..	..	..	..	..	×	×	Antarctic, Deep-sea
— — microplax Mrtsn.	Littoral	..	×	..	..	..	..	..	..	..	..	..	..	..
— latens Koehler.....	2140—4700	×	..	..	..	..	..	..	..	×	..	..	..	..
Gymnophiura novembris Hertz.....	564	×	..	..	..	..	..	..	..	..	..	..	..	Pacific
Ophiomusium Lymani W. Th.....	130—3435	×	..	..	..	..	..	..	..	×	..	..	..	..
Ophiomisidium pulchellum (Lyman) ..	180—270	×	..	..	..	..	..	..	..	..	..	..	..	Madagascar
Astrophiura permira Sladen.....	180—318	×	..	..	..	..	..	..	..	× (?)	..	..	..	Antarctic, Deep-sea
Ophiernus vallincola Lyman	825—2475	×	..	..	..	..	×	..	..	..	..	..	..	..

which are of almost cosmopolitan distribution), or to S. Africa and Kerguelen — *Luidiaster hirsutus*, *Pteraster affinis*, *Amphiura incana*, and *Ophiocten amitinum* being the only ones — and I cannot help wondering whether the only specimen of *Pteraster affinis* recorded from S. Africa is correctly identified [1]).

A fact of considerable zoogeographical interest is the find of a *Tylaster* species in S. African waters, very closely related to the only other species of that genus known, the rare *Tylaster Willei* Kor. & Dan. of the arctic Atlantic Deep-sea N. of Iceland.

As Clark gives only the rather meagre percentage numbers of the species endemic to S. Africa or common to S. Africa and other regions I think the above list, giving the actual distribution of each species, to be of some practical value.

[1]) Cf. Additional Note, p. 397.

As facts of more general interest resulting from these investigations I would mention the viviparity of *Pteraster capensis*, *Cryptopelta aster*, and *Ophiomitrella hamata*, the two latter, together with the likewise viviparous *Ophiomitrella corynephora* being also hermaphroditic. A very interesting anatomical fact is made known for the two said *Ophiomitrella* species: *O. corynephora* has the bursæ at each arm coalesced above the arm, there being thus in this species 5 large bursæ, each with two openings; this is carried to an extreme in *O. hamata*, all the bursæ being there coalesced into one single, circular space, lying below the stomach and, of course, with the 10 usual openings. On the other hand, in *Ophiothamnus remotus* there are no bursæ at all.

Asteroidea.

I. Family ***Benthopectinidæ.***

Luidiaster hirsutus Studer.

Th. Studer. 1884. Asteriden u. Euryaliden d. "Gazelle". Abh. Ak. Berlin v. J. 1884. p. 47. Taf. IV. 7. a—d.
H. L. Clark. 1923. Echinod. Fauna S. Africa, p. 241.
— 1926. Echinod. S. Africa. Fish. & Mar. Biol. Surv. II. Asteroidea, p. 2.

Off Cape Peninsula, 34°5′ S. 18°1′ E. 118 fathoms. 4 specimens. 17. XII. 1929.
Off Cape Peninsula, 34°21′ S. 17°57′ E. 178 fathoms, 1 specimen. 18. XII. 1929.
These specimens dredged onboard the "Pickle".
There are further some specimens from:
31°14′ S. 16°30′ E. 171 fms. 7 specimens
31°02′ S. 15°42′ E. 245 - 10 —
30°43′ S. 16°38′ E. 126 - 1 —

The colour of the live specimens was a faint reddish pink, which has kept fairly well in some of the dried specimens.

The difference between the present species and *Pectinaster Filholi* Perr. given by Clark (Op. cit. 1923) in the key, viz. that the latter has only one large spine on the ventral side of the adambulacrals, whereas *Luidiaster hirsutus* has three large spines there, does not at all hold good. I find now one, now two, now three such large spines in *Luidiaster* (viz. specimens with the papularium V-shaped) — these specimens being otherwise so perfectly alike that there can be no question but that they all are really one and the same species. — Not

having seen specimens of *Pectinaster Filholi*, I shall not try to indicate the characters, by which the two forms may be distinguished.

II. Family ***Astropectinidæ.***

Astropecten irregularis, var. *pontoporæus* Sladen.

Astropecten pontoporæus Sladen 1883. J. Linn. Soc. XVII. p. 259.
— *capensis* Studer 1884. "Gazelle" Ast. p. 44.
— *pontoporæus* Sladen 1889. Challenger Ast. p. 210 Pl. XXXV. 1—2; XXXVIII 10—12.
— *irregularis*, var. *pontoporæus* Döderlein 1917. "Siboga" Ast. I. Astropecten. p. 75. Taf. I. 5; VII. 9—10.
— *pontoporæus* H. L. Clark. 1923. Ech. Fauna S. Africa p. 249.
— *irregularis*, var. *pontoporæus* H. L. Clark 1926. Echinoderms S. Africa. Fish & Mar. Biol. Surv. II. Seastars (Asteroidea) p. 6.

A number of specimens I took onboard the trawler "John C. Meikle" on the Agulhas Bank, 35—42 fathoms, off Cape Barracouta, in December 1929. Also some specimens were taken in False Bay, at depths of 15—30 fathoms, onboard the "Pickle", December 1929. Further, I have in 1930 received a number of specimens from off East London from Captain Pace.

I quite agree with Döderlein and Clark that this South African *Astropecten* can only be regarded as a subspecies of the N. Atlantic *A. irregularis*, and I may add that also the colour is the same as in *irregularis*, a light reddish-violet, particularly in the distal part of the arms, which may sometimes keep fairly well also in dried specimens.

As in *irregularis* the spine on the superomarginals may be totally wanting, corresponding to the var. *pentacanthus*.

Astropecten Hemprichii Müll. & Troschel.

Astropecten Hemprichii Müller & Troschel. 1842. Syst. d. Asteriden p. 71.
— — Döderlein 1917. "Siboga"-Ast. I. Astropecten. p. 139. Taf. VI. 1—2; Taf. XIII. 1—1 b.
— — H. L. Clark 1923. Echinod. Fauna S. Afr. p. 250.

One specimen of this species was sent me in 1931 by Mr. Bell Marley, Durban. Unfortunately there was no information about the locality from where it came. But as other specimens sent at the same time were from Durban, it is rather sure that also this species came

from there, so that this species would now actually belong to the fauna of S. Africa, viz. the Natal coast, where so many other tropical forms have their southern limit.

Astropecten anacanthus H. L. Clark.

Pl. VIII. Figs. 7—8.

Astropecten anacanthus H. L. Clark 1926. Ech. S. Afr. Fish & Mar. Biol. Surv. II. Sea-stars (Asteroidea) p. 4. Pl. I. 1—2.

Off Durban, 68 fathoms. 29. VIII. 1929. 6 specimens, dredged onboard the "Pickle".

Off Durban, 120 fathoms. 22. VIII. 1929. 1 specimen, dredged onboard the "Pickle".

The figures of this species given in Clark's paper being not very satisfactory, I give here new figures of the species.

The coloration is quite characteristic, brownish in the centre of the disk and the interradii, and a band of the same brownish colour across the arms about at the middle or nearer the distal end. — The largest specimen in hand has a size of R = 35 mm.

Astropecten antares Döderlein.

Pl. VIII. Figs. 3—6.

L. Döderlein. 1926. Über Asteriden a. d. Museum von Stockholm. Kgl. Svenska Vetensk. Akad. Handlingar. 3. Ser. II. p. 6. Taf. I. 4; IV. 3, 3. a.

One large fine specimen (R = 51 mm) I took onboard the Trawler "John C. Meikle" on the Agulhas Bank (4 miles S. of Cape Barracouta) 35 fathoms. 13. XII. 1929. Further there are some smaller specimens (R ca. 25 mm) from 31°23′ S. 29°55′ E. 13 fathoms.

These specimens are quite conform with the description of the type given by Döderlein. I would only remark that the number of the ventro-lateral plates is not very constant; most of the specimens have two to each side, but they may be reduced to only one or, on the other hand, there may be three of them. The median series of paxillæ of the arms in some of the specimens have, as described by Döderlein, a small central spine, forming a distinct longitudinal series particularly in the distal part of the arm, but this is no constant feature. — The large specimen (dried) has preserved traces of a reddish colour on the superomarginals.

The only specimen hitherto known of this species came from Mozam-

bique. Probably then it is a warm-water species having a southward extension, its southern limit being at the Agulhas Bank, as may be concluded from the fact that it has not been found in the Cape region in spite of much dredging and trawling there, and that only a single specimen was found on the Agulhas Bank, where *Astropecten pontoporæus* was found in great numbers.

I beg to thank my friend Professor Döderlein for kindly identifying this species for me.

Astropecten leptus H. L. Clark.

Pl. IX. Figs. 3—4.

H. L. Clark. 1926. Echinoderms S. Afr. Fish. and Mar. Biol. Surv. II. Sea-stars (Asteroidea), p. 6. Pl. I. 3—4.

A couple of specimens (cotypes) of this species having been left me by the Fisheries Survey, I take the opportunity of giving new figures of it; the figures given in Clark's paper are so very poor that hardly any details can be made out on them, and it is therefore necessary to have better figures of the species. I hope, the figures here given will prove more satisfactory.

I have nothing to add to the careful description of the species given by Clark.

Astropecten exilis n. sp.

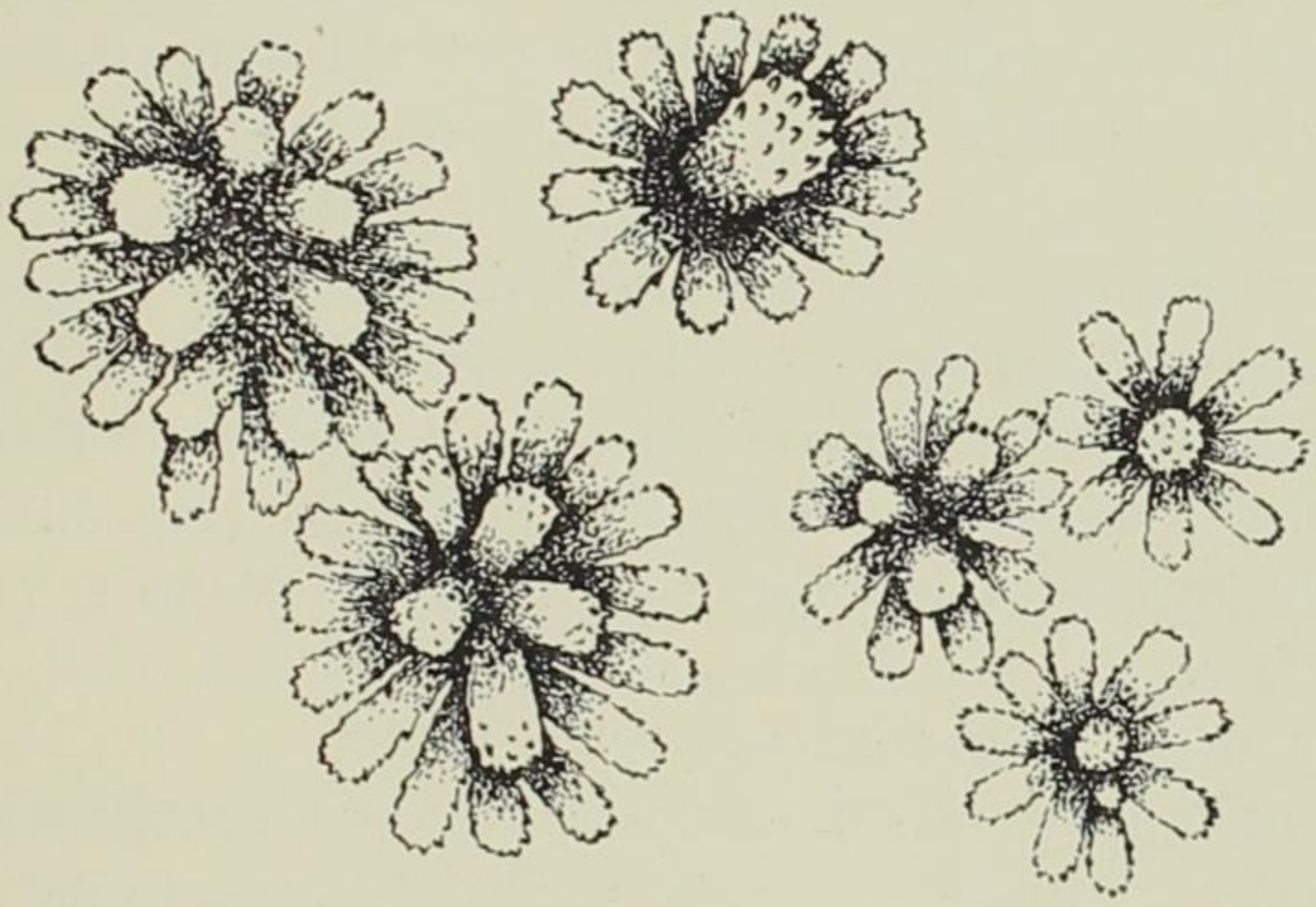
Pl. VIII. Figs. 1—2.

1 specimen of unknown locality, but probably from off the Natal Coast or off Portuguese East Africa.

R = 70 mm, r = 8. — Arms very slender, tapering very gradually towards the point. Disk slightly elevated in the centre. Paxillæ of disk with ca. 16 slender, but rather coarsely serrate, peripheral spinelets and 4—6 more club-shaped central spinelets. In the interradii there is mostly one, very conspicuous, club-shaped central spinelet. The papillæ of the arms are only very indistinctly arranged in transverse series; in the distal half of the arms the paxillæ are distinctly smaller than in the basal half and on the disk, and have only ca. 8—10 peripheral, 1—3 central spinelets (Figs. 1. a, b.). No pedicellariæ.

Supero-marginals very high, particularly in the interradii, forming ca. $^3/_4$ of the vertical side of the arm. In the distal part of arms they become gradually lower, and also encroach somewhat on the dorsal

side of the arm; they are here about equally long and broad, whereas in the basal part they are much broader than long. They are covered with a low granulation, slightly larger in the upper part, but there



a. b.

Fig. 1. Paxillæ of *Astropecten exilis* n. sp. a. From the disk, in the radii; b. from the distal part of arm. × 30.

are no spines on any of the supero-marginals. The granules are partly more in the shape of short somewhat pointed spinelets and directed distalwards. Infero-marginals do not extend laterally beyond the supero-marginals. There is one conspicuous flattened lateral spine, and below

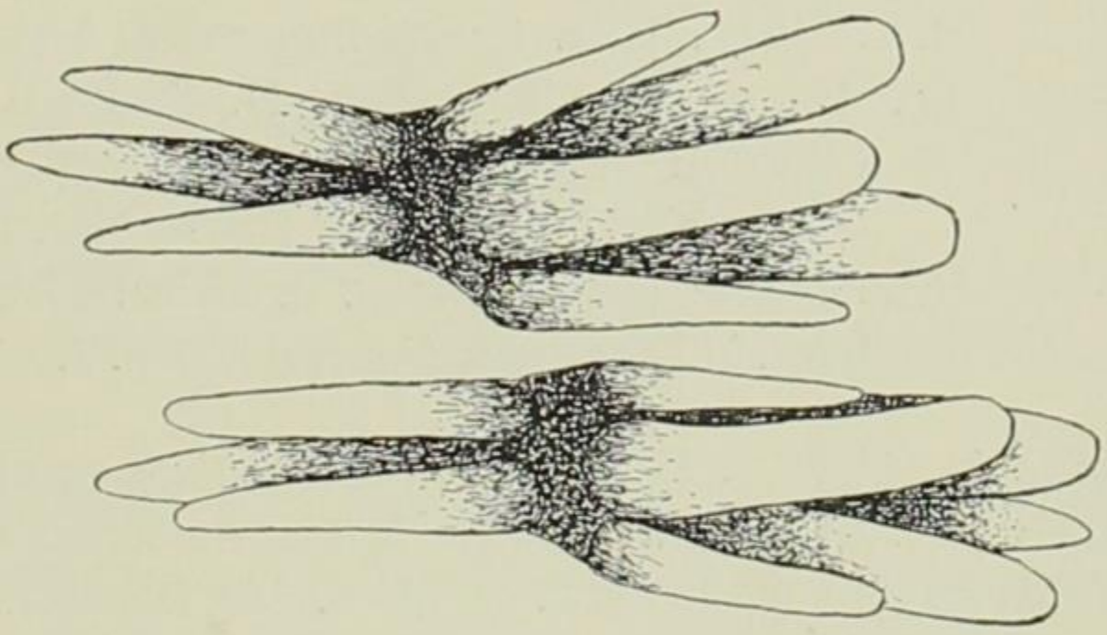


Fig. 2. Two adambulacrals of *Astropecten exilis* n. sp. × 30.

that, at the distal edge of the plate, there is usually a second such spine, scarcely half the length of the first one. The infero-marginals covered with short, flattened, lanceolate spinelets, a median series of

which may be somewhat larger in the proximal plates — apparently not in the distal plates; but on account of the poor preservation, most of the infero-marginals having lost their covering of spinelets nearly completely, this cannot be ascertained definitely. There are 3 fairly well developed ventrolateral plates to each side, apparently without pedicellariæ. Adambulacrals with three furrow spines, the median one slightly compressed. Outside the furrow spines a longitudinal series of 3, the middle one distinctly enlarged; distally to them again usually 2 similar, enlarged spines. — It is, however, only few of the adambulacrals that have the spines intact; but it would seem that it is the typical arrangement here described and figured (Fig. 2). The jaws apparently have a double row of ca. 10 rather coarse spines on the outer surface.

Colour of the dried specimen white.

This species seems to be nearest related to *Astropectus eremicus* Fisher from the Philipine Seas, from which it seems to differ only in rather unimportant details e. g. in the paxillæ. But then *eremicus* is black ("sepia"), the present specimen white; this would seem to show definitely that they are two distinct species.

Psilaster acuminatus Sladen.

Psilaster acuminatus Sladen. 1889. "Challenger" Ast. p. 225, Pl. 40. 1—2; 42. 7—8.
— — H. L. Clark. 1916. "Endeavour" Ech. p. 32.
— — H. L. Clark. 1923. Echinod. Fauna S. Africa p. 248.
— — Th. Mortensen. 1925. Ech. N. Zealand- & Auckland-Campbell Isl. III—V. p. 274. (Papers Dr. Th. M. Pacif. Exp. XXIX; Vid. Medd. Dansk Nat. Foren. Bd. 79).
— — H. L. Clark. 1926. Echinod. S. Africa. Fish. & Mar. Biol. Surv. II. Sea-stars (Asteroidea) p. 3.

Off Cape Peninsula (34°21′ S. 17°57′ E. 178 fathoms); 2 specimens, dredged onboard the "Pickle", 18. XII. 1929. There are further numerous specimens from the S. African Fisheries Survey, 30°30′ S. 15°55′ E. 143 fathoms, and one from 31°03′ S. 15°42′ E. 245 fathoms.

The latter specimen is interesting in having the marginal plates rather bare. That this is, however, not a character of specific value is quite evident, this specimen differing in no other respects from the other specimens with the marginal plates totally covered by papillæ.

Moreover there is a good deal of variation in the density of the covering of the marginal plates, several specimens having some few of the supero-marginals partly naked, though not to such an extent as in the specimen mentioned.

The colour in life is a light pink as in *Pstlaster andromeda*.

Dipsacaster Sladeni Alcock.

Dipsacaster Sladeni Alcock. 1893. Natural History Notes from H. M. "Investigator". Ser II. 7. An account of the collection of Deep-sea Asteroidea. Ann. Mag. Nat. Hist. 6 Ser. XI. p. 87. Pl. V. 3—4.

— — H. L. Clark. 1923. Echinoderm Fauna S. Africa p. 264.

— — H. L. Clark. 1926. Ech. S. Africa. Fish. & Mar. Biol. Survey. II. Sea-stars (Asteroidea) p. 3.

Leptoptychaster kerguelensis F. Jeffr. Bell. 1905. Marine Investigat. S. Africa. III. Echinod. II. p. 242. (non: *Leptoptychaster kerguelensis* E. A. Smith.)

This large, splendid species is one of the commonest of Sea-stars in deep-water off Cape Peninsula. It occurred in numbers in all the hauls I made there; I think it superfluous to give the exact localities, the depths were 93—178 fathoms, thus extending the known bathymetrical limits somewhat upwards.

A number of specimens were also received from Captain Pace from off East London.

The colour in life is a beautiful red.

The specimens recorded by Bell (Op. cit.) under the name of *Leptoptychaster kerguelensis* is a *Dipsacaster Sladeni*, as I can ascertain, a specimen having been sent me for examination from the British Museum. This specimen has a large Spatangoid (probably a *Brissopsis*) in its stomach.

I may call attention to the fact that Otto le Roi has found the interesting Cirripedian parasite *Dendrogaster* in this sea-star (*Dendrogaster arborescens* und *Dendrogaster Ludwigi*, zwei entoparasitische Ascothoraciden. Zeitschr. f. wiss. Zoologie, Bd. 86. 1907). Also in one of the specimens in hand this parasite is found, even two parasites in the same specimen; it is a very interesting fact that the gonads of the sea-star are very small and undeveloped, an indication of the parasite having at least some castrating effect on its host.

Persephonaster Roulei, var. *euryplax* n. var.

Pl. IX. Figs. 1—2.

Off Durban, 29°56′ S. 31°19′30″ E. 225 fathoms. 26. VIII. 1929. 1 specimen dredged onboard the "Pickle". R. = 120 mm; r. = 25 mm.

This specimen in general corresponds very well with the description of *Persephonaster Roulei* given by Koehler, 1910, in his report on the "Investigator" Asteroidea I. p. 19. viz. with the second of Koehler's specimens, in which the spines of the supero-marginals were almost completely reduced.

In the absence of photographic figures of this latter specimen it is not quite easy to form a definite opinion of it, but for the present, until new and richer material comes to hand, we must accept Koehler's statement, that it is identical with the type of *P. Roulei*, differing only in the reduction of the spines of the supero-marginal plates, and it does, indeed, seem quite probable that Koehler is right in maintaining this reduction to be of no specific value, the species *Roulei* offering variations in regard to the armature of the supero-marginal plates corresponding to what obtains in *Astropecten irregularis*.

As for the specimen in hand it may perhaps rather represent a separate species. It appears to differ from *P. Roulei* in the supero-marginals being broader than in that species. Koehler describes these plates as being a little broader than long, in the present specimen they are twice as broad as long; also their number is a little smaller, ca. 40, than in *P. Roulei*, 47—48, by a corresponding arm length. Further, the paxillæ would seem to be more numerous in *P. Roulei*, ca. 20 to a half transverse series at the base of the arms, than in the present specimen, ca. 10—12 to each half transverse series. In the other characters, particularly the armature of the infero-marginals and adambulacrals there seems to be no difference.

I think then the best course, for the present, will be to designate the specimen from off Durban as a variety of *Persephonaster Roulei* Koehler. The exact locality of the latter is unknown, we know only that it is in the Indian Ocean.

III. Fam. ***Luidiidæ.***

Luidia maculata Müller & Troschel.

Müller & Troschel. 1842. System d. Asteriden, p. 77.
Koehler. 1910. Astéries et Ophiures des îles Aru et Kei. Abhandl. Senckenb. Naturf. Ges. XXXIII. p. 267, Pl. XV. 1—2; XVI. 8—9; XVII. 8.

Döderlein. 1920. Die Gattung Luidia. "Siboga" Exped. XLVI. b. p. 241, 262.
H. L. Clark. 1923. Echinod. Fauna S. Africa, p. 252.

2 specimens, almost certainly from off the Tugela river, 18 fathoms, received from the Fisheries Survey of S. Africa. There is thus hardly any doubt that this species is really to be included in the S. African fauna.

Luida africana Sladen.

Sladen. 1889. "Challenger" Ast. p. 256. Pl. XLIV. 1—2.
Bell. 1905. Marine Invest. S. Africa. III Echinod. II. Ast. p. 245.
Döderlein. 1920. Die Gattung Luidia. "Siboga" Exped. XLVI. b. p. 245, 288.
Clark. 1923. Echinoderm Fauna S. Africa. p. 252.
— 1926. Echinod. S. Afr. Fish. & Mar. Biol. Survey. II. Sea-stars, p. 8. (*Luindia*! sic).

False Bay, 30 fathoms. 20. XII. 1929. 1 large, 2 small specimens.
Cape Point in N. 83° E. 18 miles. 20. XII. 29. 2 specimens.
34°17′ S. 17°58′ E. 160 fathoms. 18. XII. 29. 6 large specimens.
34°21′ S. 17°57′ E. 178 fathoms. 18. XII. 29. 1 large specimen.

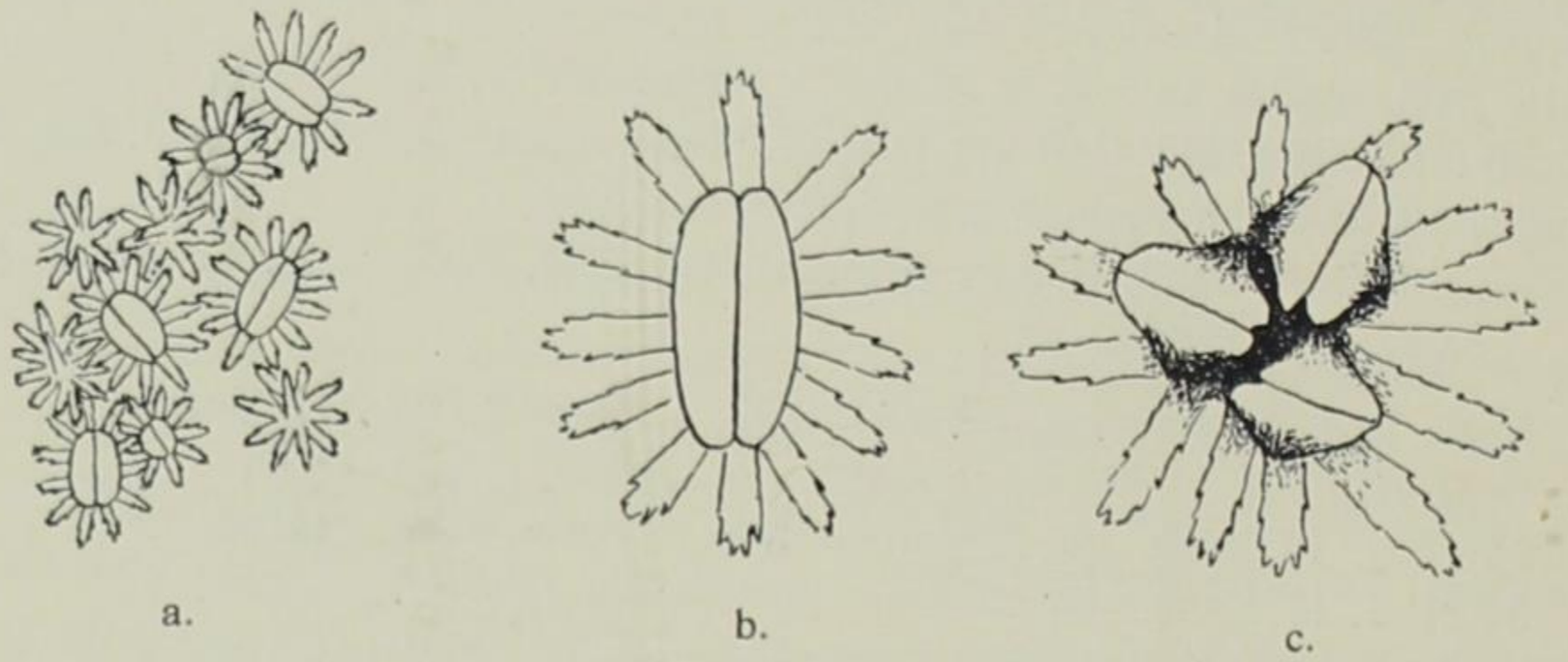
These specimens all dredged onboard the "Pickle". Further, I took 2 specimens onboard the trawler "John C. Meikle" 4 miles S. of Cape Barracouta, 13. XII. 29. Finally I have a specimen from off East London, sent me by Captain Pace, VIII. 1930.

Clark (Op. cit. 1926) expresses doubt whether *L. africana* can be maintained as distinct from *L. Sarsi* of the North Atlantic. I do not think there can be any doubt but that the two are quite distinct, although in most regards they are so much alike that it is hard to find quite reliable differences. But the pedicellariæ offer a striking difference. While in *L. Sarsi* pedecellariæ are never found on the dorsal paxillæ, they are usually found in *L. africana*, in larger specimens at least, sometimes in very great numbers, so as to give a peculiar aspect to the dorsal side — as if it were full of something like *Globigerina*-shells. These pedicellariæ are usually broad, spoon-shaped, but may also be narrow, round bodies, very much like a *Globigerina* in shape (Fig. 3). The pedicellariæ on the ventro-lateral plates are also broad, spoon-shaped, very different from those of *L. Sarsi* (Fig. 4). Sometimes there may be two, or even three pedicellariæ on some of the paxillæ. — The dark longitudinal median stripe on the arms is no constant character — at least I do not observe it in some of my larger, dried specimens.

About the specimens from off Durban I shall not express any opinion, having only a single arm from there (39 fathoms); like the

specimen mentioned by Clark it has a distinct central spinelet on the paxillæ, and the pedicellariæ on the ventro-lateral plates are quite different from those of *L. africana*. I think therefore, it is another species, but which species, I must leave undecided.

The specimens from off Morocco which I referred (Echinodermes du Maroc et de Mauritanie. Bull. Soc. Sc. nat. Maroc. V. 1925.) to *L. africana* are not really that species, and most probably the same



a. b. c.

Fig. 3.

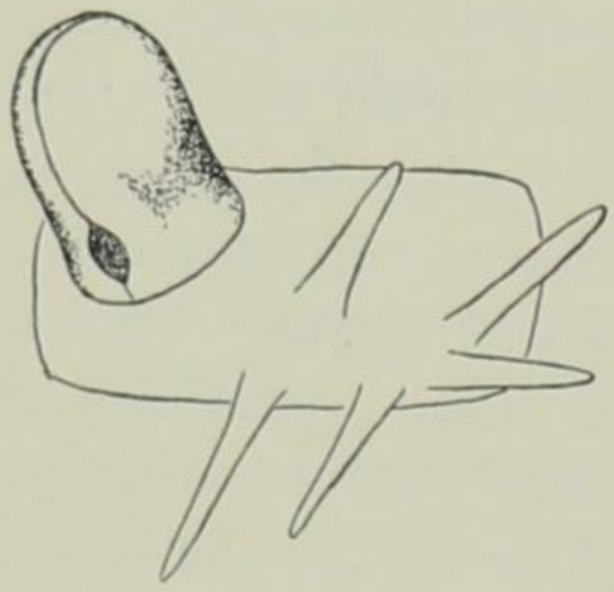


Fig. 4.

Fig. 3. Paxillæ, with pedicellariæ, of *Luidia africana* Sladen. a. Group of paxillæ from disk. × 12. b. Paxilla with pedicellaria. × 30. c. Paxilla with three pedicellariæ. × 30.

Fig. 4. Ventro-lateral plate, with pedicellaria, of *Luidia africana* Sladen. × 20.

is the case with those from various localities off N.W. Africa identified as *L. africana* by Sladen (Chall. Ast.) and Koehler (Echinod. Mission Gruvel. Ann. Inst. Océanogr. II. 5. p. 2.). I shall not enter here on the question to which species these N.W. African specimens really belong, but only state that there is no proof — and no probability either — that *Luidia africana* occurs off N.W. Africa.

IV. Family ***Goniasteridæ.***

Pseudarchaster tesselatus Sladen.

Pseudarchaster tesselatus Sladen. 1889. "Challenger" Asteroidea, p. 112, Pl. XVII. 3—4; XVIII. 9—10.

Pseudarchaster tesselatus H. L. Clark. 1923. Echinod. Fauna S. Africa, p. 253.
— — H. L. Clark. 1926. Ech. S. Afr. Fish. & Mar. Biol. Surv. II. Sea-stars (Asteroidea), p. 9.

Several specimens dredged onboard the "Pickle" viz.:
Off Cape Point, 93 fathoms, 20. XII. 1929. 12 specimens.
Off Cape Peninsula, 34°6′ S. 18°2′ E. 118 fathoms, 23. XII. 1929. 6 specimens.
Off Cape Peninsula, 34°21′ S. 17°57′ E. 178 fathoms, 18. XII. 1929. 1 specimen.
Besides these specimens I got a considerable number of specimens from the Fisheries Survey of S. Africa:
30°43′ S. 16°46′ E. 118 fathoms. Several specimens.
30°30′ S. 16°25′ E. 115 fathoms. Several specimens.
10 miles W. of Hout Bay, 89 fathoms. 19. XII. 1917. 3 specimens.

It is evident from the records here given that this species is very common in deep water off Cape Peninsula. Several of them, particularly those from 30°30′ S. 16°25′ E., are rather large, R. up to nearly 100 mm; the largest of all is the specimen dredged in 178 fathoms, 18. XII. 1929, its R. = 105 mm.

The colour in life is a uniform red.

Two specimens have 6 arms, and one has one arm bifid at the point.

In some specimens the spines of the infero-marginals are erect, not appressed, as is usually the case. This gives these specimens a rather different appearance — but is decidedly only due to preservation, there being no other differences between such specimens and those with the spines appressed.

A character which has apparently not been noticed by the previous authors is this that the spinelets on the ventral interadial plates are usually conspicuously club-shaped, their basal part being slender, almost forming like a stalk. This may be particularly distinct on the larger of these spinelets.

Mediaster capensis H. L. Clark.

Pl. VIII. Fig. 10.

H. L. Clark. 1923. Echinod. Fauna S. Africa, p. 256; pl. XVI. 1—2.

Cape Point in N. 83° E. 18 miles. 93 fathoms. 2 specimens dredged onboard the "Pickle", 20. XII. 1929.

These specimens are perfectly conform with the description and figures given by H. L. Clark.

Colour in life red.

Mediaster capensis var. *durbanensis* n. var.

Pl. VIII. Fig. 9.

Off Durban, 225 fathoms. 1 specimen, dredged onboard the "Pickle" 26. VIII. 1929.

This specimen (R. = 40 mm, r. = 18 mm) agrees in general very closely with the typical *M. capensis*, only in regard to the marginal plates there is a very noteworthy difference. These are, on the whole, not nearly so well marked off from the disc as in the typical form, and particularly the infero-marginals are much broader than in the latter and encroaching more on the ventral interradius. This difference is so conspicuous (Pl. IX. Fig. 9, to compare with Pl. IX. Fig. 10) that it does not seem justifiable simply to regard these two forms as identical. On the other hand, with only one specimen available of the deviating form, it is, of course, impossible to decide whether we have here a separate species, or a variety, or perhaps only an individual aberration of *M. capensis*. The fact that the typical form has till now been found only off Cape Peninsula rather indicates that the form from off the Natal Coast may be a distinct species. For the present I shall prefer to designate it only as a variety of *M. capensis*.

If a distinct species one may expect it to be distributed over the Indian Ocean. Koehler ("Investigator" Asteroidea I. p. 78. Pl. X. 4) has recorded *Mediaster ornatus* Fisher from the Arabian Sea, 492 fathoms. One would beforehand expect that the specimen from off Durban might be identical with this species from the Arabian Sea. If, however, Koehler's figure be correctly drawn, such identity is out of the question; the marginal plates are represented as narrow as in *M. ornatus* (and *M. capensis*), not broad like those of the Durban-specimen.

Ceramaster chondriscus H. L. Clark.

H. L. Clark. 1923. Echinod. Fauna S. Africa, p. 258. Pl. XIV. 5—6.

Off Cape Peninsula, 34°17′ S. 17°58′ E. 160 fathoms, 18. XII. 1929. 3 specimens.
Off Cape Peninsula, 34°21′ S. 17°57′ E. 178 fathoms, 18. XII. 1929. 4 specimens.
Dredged onboard the "Pickle".

These specimens agree very well with the description and figures given by Clark, so that I cannot have any doubt about the identification.

Without entering on a more detailed discussion of the S. African *Ceramaster*-species I would merely point out that, judging from some

specimens in hand of *Ceramaster patagonicus* var. *euryplax* H. L. Clark, identified by Clark himself, it seems that the main characters given by Clark as distinguishing this latter from *C. chondriscus* are not very reliable. The length and breadth of the supero-marginals is subject to considerable variation, and the distal subambulacral spines are usually as conspicuously enlarged as in the var. *euryplax* — and in the latter they are not always enlarged (cf. H. L. Clark. Echinod. S. Afr. Fish. & Mar. Biol. Surv. II. Sea-stars, p. 10). Also the pedicellariæ may be as numerous in the var. *euryplax* as in *C. chondriscus*. I think it, therefore, very doubtful, whether *Ceramaster patagonicus* var. *euryplax* can really be maintained as separate from *Ceramaster chondriscus*.

Tosia tuberculata (Gray).

Pl. X. Figs. 5—7.

Astrogonium tuberculatum Gray. 1866. Synopsis of the species of Starfish in the British Museum. p. 10. Pl. I. 2.

Pentagonaster granulatus Bell. 1905. Mar. Investig. S. Africa. III. Asteroidea, p. 246.

Tosia tuberculata H. L. Clark. 1923. Echinod. Fauna S. Africa p. 266. Pl. IX. 1—2.

— — H. L. Clark. 1926. Echinod. S. Afr. Fish. & Mar. Biol. Surv. II. Sea-stars (Asteroidea), p. 11.

A considerable number of specimens were dredged onboard the "Pickle" in December 1929 off Cape Peninsula, at depths of 94—178 fathoms, this species being, together with *Dipsacaster Sladeni*, very common in this area. Several specimens were further sent me from East London by Capt. Pace (depth unknown).

The largest specimen in hand has a size of R. = 95 mm. In these larger specimens the tubercles of the dorsal side may be very closeset; they have the shape of low warts, most of them with one or more pedicellariæ sitting in deep pits (Pl. X. Fig. 7).

Whereas all the specimens from off the Cape Peninsula have slender, pointed arms, the distal marginals not increasing in size, some of the specimens from off East London have the distal 5—6 marginals very conspicuously enlarged, the end of the arm being correspondingly thicker (Pl. X. Fig. 6). The 3—4 distalmost supero-marginals are contiguous in the dorsal midline.

On comparing these thick-armed specimens with the slender-armed form from off Cape Peninsula, one would very naturally think

them to be two different species — however, also the slender armed form is represented among the specimens from off East London, and there are all transitions between the two forms so that it is impossible to draw a limit between them. We have thus here a case parallel to that of *Calliaster acanthodes* and of the New Zealand species *Pentagonaster pulchellus* Gray, in which latter particularly the size of the distal marginal plates varies to an extraordinary degree (cf. my paper "Echinoderms of New Zealand and the Auckland-Campbell Islands. III—V. Asteroidea, Holothurioidea and Crinoidea". Papers from Dr. Th. M. Pacif. Expedition XXIX. Vid. Medd. Dansk Nat. Foren. Bd. 79. 1925, p. 281—285. Pl. XII. 6—10).

In view of the fact that the type of *Tosia tuberculata* is stated to come from Port Natal it is of interest that by my dredgings and trawlings off Durban in August 1929 I did not secure any specimens of *Tosia* ; that it does occur off the Natal coast is evident, however, from the fact that I have received from the Durban Museum 3 specimens taken 18 miles East off the Tugela River, by Capt. Pace. Two of these specimens are of the thick-armed form, the third more intermediate. — The colour of the live specimens is a beautiful red.

Calliaster baccatus Sladen.

Sladen. 1889 "Challenger" Asteroidea, p 280, Pl. 56. 1—4.
Bell. 1905. Mar. Invest. S. Africa. III. Echinoderma. II. Asteroidea. p. 247.
H. L. Clark. 1923. Echinod. Fauna S. Africa, p. 264.

One small specimen of this species I dredged onboard the "Pickle" in False Bay, 27 fathoms, 19. XII. 1929. Some specimens were later on received from Capt. Pace from off East London.

Some of the specimens in hand show a rather conspicuous coloration of the disk, a mottling of brownish-olive and a light greenish-olive. It would seem then that this is the colour in life. The marginal plates are a uniform greenish-olive.

Calliaster acanthodes H. L. Clark.

Pl. X. Figs. 1—2.

H. L. Clark. 1923. Echinod. Fauna. S. Africa, p. 264. Pl. XII. 3—4.
— 1926. Echinod. S. Africa. Fish. & Mar. Biol. Surv. II. Sea-stars (Asteroidea). p. 11.

5 young specimens (R. = 21—25 mm) dredged onboard the "Pickle" off Durban, 225 fathoms (26. VIII. 1929).

Further, I have received some larger specimens from Capt. Pace, collected onboard the trawler "Disa" off East London.

In the young specimens the dorsal side is nearly naked, spines being developed as yet only on the plates in the middle of the disk, and mainly in the carinal series. The 3—4 distal supero-marginals are contiguous in the midline. The characters of the marginal plates and of the oral side are already those typical of the species.

These specimens have kept a light mauve colour — but I have made no notice of their colour in life, so it cannot be said definitely that this is their real colour.

As mentioned by Clark (Op. cit. 1926) the distal marginal plates may sometimes be considerably swollen. Such specimens look strikingly different from those with not swollen marginals. (Figs. 1—2. Pl. X). This is a parallel to what obtains in *Tosia tuberculata*.

Anthenoides Marleyi Mrtsn.

Th. Mortensen. 1925. On some Echinoderms from S. Africa. Ann. Mag. Nat. Hist. 9 Ser. XVI. p. 149. Pl. VIII. 1—2.

In the laboratory of the S. African Fisheries Survey I found 3 specimens of this species from 29°34′ S. 31°49′ E. 150 fathoms, and 1 specimen from 29°43′ S. 37°31′ E. 140 fathoms, thus from off the Natal coast.

The former specimens are of a uniform brownish red colour. The largest specimen has R. = 85 mm, thus very nearly the size of the type specimen, the others are slightly smaller, that from 140 fathoms only R. = 50 mm.

These specimens on the whole agree very closely with the type, only a few minor features call for some remarks. None of the tubercles on the distal supero-marginals are bilobed, as was the case in the type, and only rarely they are flattened and shield-shaped. The infero-marginals have usually 6—7 spines in the interradii (2—3 in the type) and the ventro-lateral plates mostly have 2—3 tubercles in the middle (1 in the type). These small differences, of course, are only individual variations.

Hippasteria phrygiana, var. *capensis* n. var.

Pl. XI. Fig. 1.

H. L. Clark (Echinoderm Fauna of S. Africa, p. 270) felt uncertain whether the S. African *Hippasteria* represents a separate species or is simply identical with the North Atlantic *Hippasteria phrygiana*

(Parelius), and it is only provisionally that he designates the South African form as *H. phrygiana*. In his report of 1926 (p. 13) he seems to have come to the definite result that the S. African form cannot be separated from the N. Atlantic species, stating his largest specimen to be "a very typical *phrygiana*", and that "compared with specimens from the North Atlantic, the resemblance is notable and the differences insignificant".

I cannot quite agree with Clark herein. On a comparison of my S. African specimens (2 fine, large specimens, taken by the trawler "John C. Meickle", Table Mountain in N.W. 46 miles, 195 fathoms, 4.II.1930, and a large specimen, identified by H. L. Clark, presented to me by the Fisheries Survey of S. Africa) with specimens from N. European seas, I find a very conspicuous difference in the size of the pedicellariæ on the oral side, these being much smaller in the S. African than in the N. European form, — as appears from the two figures, Pl. XI. Figs. 1—2. This is not a difference due to age; the specimen of the variety figured (Fig. 1) is much larger than that of the N. European form (Fig. 2). Other fully reliable differences may not exist, but the said difference in the size of the pedicellariæ of the ventral (not the dorsal) side is so conspicuous and apparently constant, that it seems to me not justifiable to regard the S. African form simply as identical with the N. European, typical form of *Hippasteria phrygiana*. The right course will be, in my opinion, to regard the S. African form as a variety of the North Atlantic *H. phrygiana*. Whether it is, perhaps, identical with the S. American *Hippasteria hyadesi* (Perrier) is impossible to say at present, our knowledge of this latter form being altogether too insufficient.

V. Family ***Odontasteridæ.***

Odontaster australis H. L. Clark.

Pl. X. Figs. 3—4.

H. L. Clark. 1926. Echinod. S. Africa. Fish. & Mar. Biol. Survey II. Sea-stars, p. 16. Pl. I. 5—6.

Off Cape Peninsula, 34°17′ S. 17°58′ E. 160 fathoms, 1 specimen.
Off Cape Peninsula, 34°24′ S. 18°16′ E. 133 fathoms, 1 specimen.
Both were dredged onboard the "Pickle", 18. XII. 1929.

These two specimens are a good deal larger than the type, viz. R. = 65 mm, r. = 24 mm; R. = 60 mm, r. = 21 mm. They are con-

siderably more long-armed than the type, which is much more pentagonal; however, one of the arms in the smaller specimen is only 47 mm — and it does not seem to have been broken and regenerated. Corresponding to the greater length of the arms the number of the marginal plates is larger than in the type (ca. 25 to each side of arm in the largest specimen). The madreporite is distinctly nearer to the centre of disk than to the supero-marginal (in the type apparently situated about midway). The spinelets of the paxillæ and of the ventro-lateral plates are more numerous than in the type.

These differences from the type are rather conspicuous so that it might well seem doubtful whether they could belong to the same species as the specimen described and figured by Clark. But then the two specimens in hand again differ conspicuously among themselves. One (the smaller) has numerous pedicellariæ (Fig. 5), particularly on the supero-marginals, on the inner ventro-lateral plates, and also here and there on the dorsal paxillæ, the other has none; in the former the unpaired median supero-marginal is about rectangular, in the other it has the same shape as in the type, narrowed at its lower end.

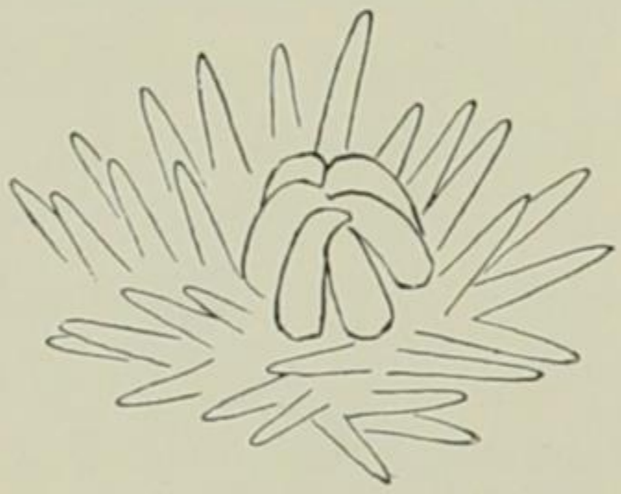


Fig. 5. Pedicellaria from inner ventro-lateral plate of *Odontaster australis* H. L. Clark. × 12.

Most probably these differences are all nothing but individual variations — but much more material is necessary for settling the question definitely. For the present we have the choice between regarding the three specimens known as representing three different species or as belonging all to one and the same rather variable species. The latter course seems the only reasonable.

The smaller specimen has still (in dried condition) preserved a uniform yellowish-red colour.

VI. Family *Linckiidæ.*

Austrofromia Schultzei (Döderlein).

Pl. XIII. Figs. 8—10.

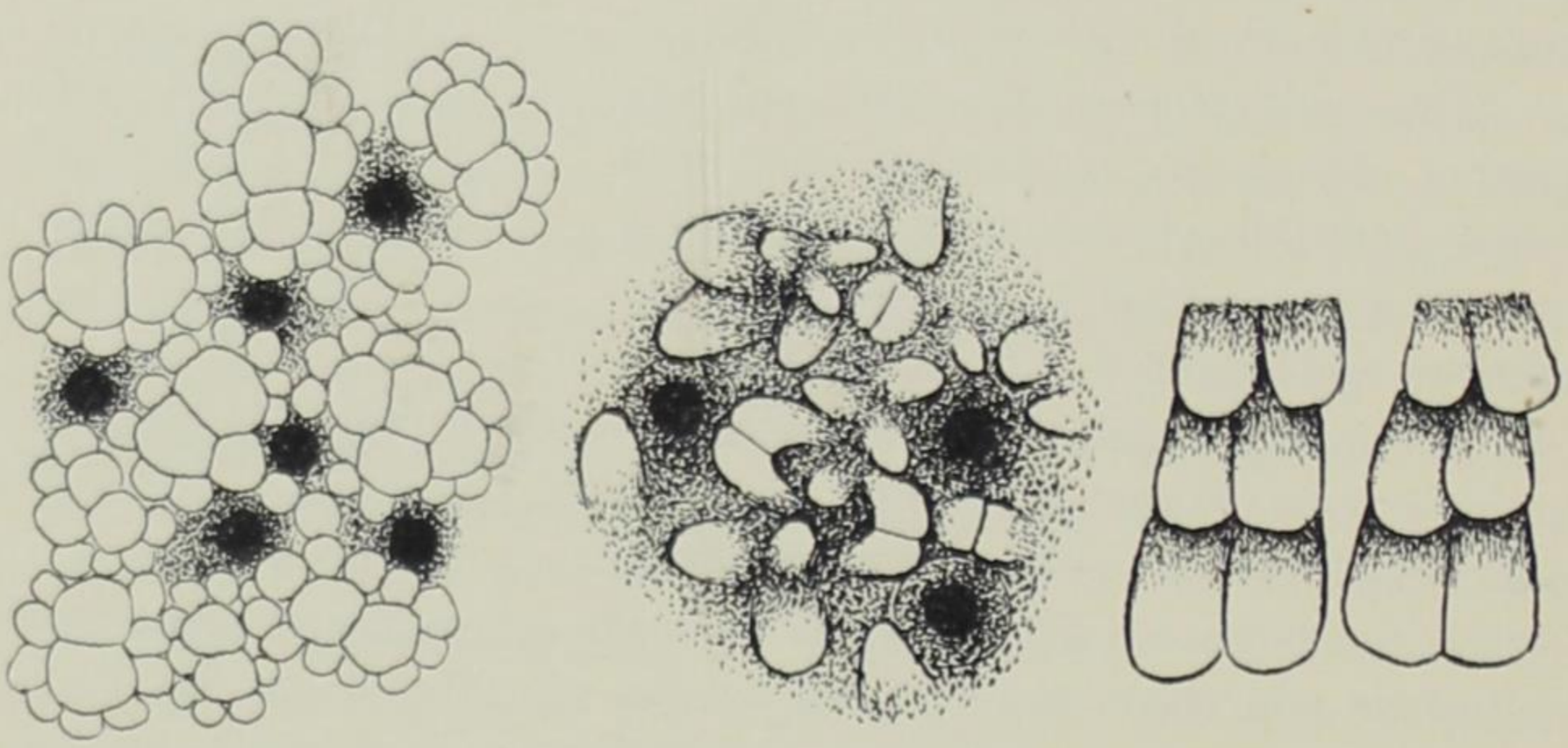
Fromia Schultzei Döderlein. 1910. Asteroidea, Ophiuroidea und Echinoidea, in Schultze. Ergebn. Forschungsreise Südafrika. IV. Jen. Denkschr. XVI. p. 249. Taf. IV. 3—3. b.

Austrofromia Schultzei H. L. Clark. 1923. Echinod. Fauna S. Africa, p. 276.

One specimen dredged onboard the "Pickle", 19. XII. 1929, in Gordon Bay 8—9 fathoms.

Further I have received 2 specimens from off East London, from Capt. Pace, VIII. 1930.

These specimens correspond very well with the description and figures given by Döderlein. I would only mention the characteristic arrangement of the granules on the dorsal side, as shown in fig. 6. a. This is not seen clearly in Döderlein's figures and not mentioned



a. b. c.

Fig. 6. *Austrofromia Schultzei* (Döderlein). a. Granules of dorsal plates; b. spines from the oral side, partly forming pedicellariæ; c. spines of two adambulacral plates. All × 12.

either in his description. It appears that the plates (groups of granules) of the dorsal surface were somewhat larger in the type than in the present specimens; but this is, evidently, subject to some variation, since they are decidedly smaller in my specimens from off East London than in the one from Gordon Bay. On the oral side the granules, or spines, are sometimes placed two and two together so as to form a kind of pedicellaria (Fig. 6. b.).

The dried specimens are of a reddish-brown colour, which probably nearly corresponds with the colour in life, but I have omitted to notice particularly the colour in life of the specimen, I took in Gordon Bay.

VII. Family *Asteropidæ*.[1])

Cryaster brachyactis H. L. Clark.

Pl. XII. Fig. 14.

Culcita veneris Bell. 1905. Mar. Invest. S. Africa III. Echinoderma II p. 248.
(non: *Culcita veneris* Perrier.)
Cryaster brachyactis H. L. Clark. 1923. Echinod. Fauna S. Africa, p. 293.
Pl. XI. 1—2.

The specimen recorded by Bell (Op. cit.) as *Culcita veneris* has been sent me for examination from the British Museum. I find it to be identical with Clark's *Cryaster brachyactis*. On the other hand, it must be agreed that it bears a rather considerable resemblance to Perrier's *Culcita veneris* from St. Paul, so that Bell's referring his specimen to that species is not so meaningless, as the name "*Culcita*" would seem to imply. The fact is that the "*Culcita veneris*" is no *Culcita* at all, as Perrier himself has also hinted at in his description of the species (Les Stellérides de l'île St. Paul. Arch. de Zool. expér. & génér. VIII. 1879. p. 48); it belongs probably to the family *Asteropidæ* or perhaps to the *Cryasteridæ*. That the South African species is not identical with the *C. veneris* is evident from the fact that its ventral interradii are quite smooth, whereas in the St. Paul species they are covered with fine spines.

Tylaster meridionalis n. sp.

Pl. XII. Figs. 11—13.

30°44′ S. 15°43′ E. 108 fathoms, 3 specimens.

The type specimen is almost pentagonal, R. = 28 mm, the other specimens have the arms fairly well set off, R. = 25 mm, r. = 20 mm. The type has the disk very high, cushion-like, in one of the other specimens the disk is more flattened, but it seems that this is due to preservation. The end of the arms somewhat upturned. The dorsal side is rather slimy, with the scattered small spinelets just visible. The madreporite is a flat, round, white disk, 2 mm in diameter, situated

[1]) Koehler has made the genus *Cryaster* the type of a separate family including also his genus *Magdalenaster*. I do not think this family sufficiently well founded. *Cryaster* is so closely related to the *Asteropidæ*, that there seems no good reason for separating it from the said family (— judging at least from the S. African *Cryaster brachyactis* —), and *Magdalenaster* is nothing but a very large *Henricia sanguinolenta*.

about midway between the margin and the centre of the disk. Its white colour makes it very conspicuous against the flesh-coloured dorsal skin. Anal opening rather distinct, surrounded by some whitish granules. — When cleared in xylol the dorsal skin is seen to contain only some few very minute irregular calcareous deposits, which do not form a real skeleton and are in no connection with the spinelets of the skin.

Along the edge of the disk there is a rather conspicuous fringe of short spines, 3—4 to each marginal plate; in the type there is a second series of 4—5 spines inside the marginal fringe; in one of the specimens this inner series is absent, and here also the marginal fringe is little developed. In this latter specimen, which has been dried, there is seen to be 3—4 irregular transverse series of plates in the oral interradii; in the not dried specimens, these plates cannot be distinguished, but an irregular radial striation is seen.

Adambulacral armature somewhat irregular, but as a rule there is one furrow spine and one outer spine to each adambulacral spine, forming two conspicuous longitudinal series; sometimes there are two furrow spines to a plate, sometimes one or other spine is bifid. Mouth plates flat, with 3—4 marginal spines to each side and one somewhat larger superoral spine to each half of jaw.

It is of very considerable interest thus to find the genus *Tylaster*, hitherto known only in one single, very rare species, *Tylaster Willei* Dan. Kor.[1]) from the deep Polar Sea to the North of Iceland, represented also in S. African Seas. The S. African species differs from the northern species in the adambulacral spines being arranged mainly in two series (in 3 series in *Tylaster Willei*). It would also seem that in *T. Willei* there are no superoral spines on the jaws. Otherwise the two species are obviously very much alike and, no doubt, very closely related.

[1]) A subgenus *Tylaster* was etablished by W. K. Spencer for some Jurassic Goniasterids related to *Calliderma*. (The evolution of the Cretaceous Asteroidea, Philos. Transact. Vol. 204. p. 99. 1913). This name being preoccupied for the recent Asteroid named (1884) *Tylaster Willei* by Danielssen & Koren, the name of the fossil form was altered into *Tylasteria* (through a printers error made into *Tylasterie*) by Dom Aurelien Vallette, in his "Note sur une nouvelle espéce d'Astropecten du Bathonien du Tremblay (Nièvre)" Bull. Soc. Géol. de France 4. Sér. XXIX. 1929. p. 418. Note.

VIII. Family *Asterinidæ.*

Anseropoda (Palmipes) habracantha H. L. Clark.

H. L. Clark. 1923. Echinod. Fauna S. Africa, p. 287. Pl. XVII. 4—5.

Off Durban, 68 fathoms, 1 specimen, dredged onboard the "Pickle" 29. VIII. 1929.

This specimen which is a small one, R. = 15 mm, corresponds very closely with the description given by Clark, excepting only that the second of the spines on the ventral surface of the adambulacral plates is not much longer than the others, and not curved, as is stated to be the case — "as a rule" — in the type specimen. Also the marginal spines of the oral plates, or jaws, amount to 10, against 6—8 in the type.

In view of the otherwise complete agreement with the type these two differences most probably mean only individual variations. But as long as we know only two specimens of the species, it is of course impossible to say anything more about that.

The fact that both the specimens known are so small (the type R. = 16 mm) may perhaps indicate that this species does not reach any large size.

The specimen has preserved traces of a pinkish colour.

Anseropoda (Palmipes) grandis n. sp.

Pl. XII. Figs. 1—2.

31°14′ S. 16°27′ E. 173 fathoms, 1 specimen.

The specimen is very badly broken, and only the disk and one arm and a fragment of another are preserved. But these fragments show that the specimen must have been a very large one, R. = ca. 130 mm. Arms 5.

In the centre of the disk the plates are irregularly arranged, but along the radii they form regular series: a carinal series and 4 lateral series, the three outer of which carry papulæ, there being thus 3 series of papulæ to each side of the radial midline, continuing for about $^2/_3$ of the armlength; the inner of these series continues a little farther outwards. The papulæ are small, equal sized, surrounded by a circle of 6—7 erect, pointed spines, scarcely 1 mm long.

These groups of papular spines give the median part of the rays and the centre of the disk a rough appearance contrasting rather

strongly with the very smooth interradii. The carinal plates may have a similar group of spinelets placed on a small elevation; in the distal part of the one nearly complete arm they form a fairly conspicuous median line. Besides the papular spines the plates may carry one or some few isolated spinelets of the same size and shape. The interradial plates each carry one or 2—3 fine spinelets at their proximal edge, the plates otherwise remaining entirely smooth. The ventral interradial plates carry each a bundle of 3—4 somewhat longer spines, ca. 15 mm long, arranged in a transverse line, and webbed in their basal part; besides, there is a number of much smaller spinelets, scattered over the plates. The adambulacral plates carry a bundle of 8—9 equally long, slender, partly webbed furrow spines, and on their outer surface an oblique series of 3—4 webbed spines, outside which there may again be one or two similar spines (Fig. 7). The jaws carry 7—8 somewhat stronger marginal spines and on their outer surface a group of 3—4 spines.

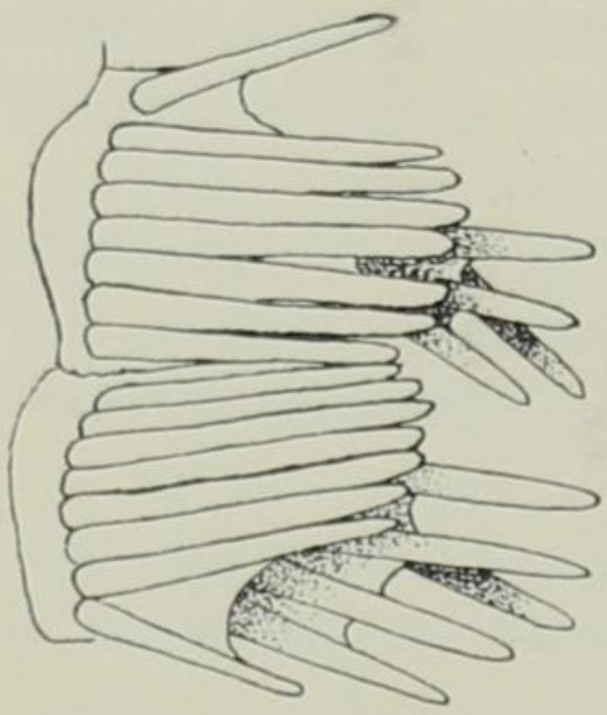


Fig. 7. Two adambulacral plates of *Anseropoda* (*Palmipes*) *grandis* n. sp. × 12.

The dried specimen has a slight, uniform pinkish tint on both dorsal and ventral side. It appears to be very fragile; the smaller arm-fragment has the distal half regenerated. — Complete adult specimens must form very striking and magnificent objects.

This species appears to be related to *Palmipes ludovici* Koehler from off the Maldive Islands ("Investigator" Asteroidea I. p. 100, Pl. X. 1) from which it differs, however, very markedly, particularly in the character of the papulæ and the armature of the dorsal plates. It does not seem to be nearly related to any other of the 5-armed *Palmipes*-species.

In the laboratory of the S. African Fisheries Survey I found a small fragment of an arm labelled by Clark: "*Anseropoda* sp., apparently not *novemradiata*"; it undoubtly belongs to the present species.

Asterina (*Patiriella*) *exigua* (Lamarck).

Pl. XII. Figs. 4—8.

Asterias exigua Lamarck. 1816. Animaux sans vertèbres III. p. 554.
Asterina — Perrier. 1875. Revision des Stellérides du Mus. d'hist. nat. Paris. (Sep. copy). p. 302.

Asterina calcarata Koehler. 1908. "Scotia" Echinod. p. 296. (non: *Ast. calcarata* (Val.)).
— *exigua* Koehler 1910. "Investigator" Asteroidea II. p. 129. Pl. IX. 6—7.
Patiriella — Verrill. 1913. Rev. Gen. Starfishes Subfam. Asterininæ. Amer. J. Sc. 4 Ser. XXXV. p. 484.
— — W. K. Fisher. 1919. Starfishes Philippine Seas. Bull. U. S. Nat. Mus. 100. 3. p. 416. Pl. 109. 3—4.
Asterina — H. L. Clark. 1923. Echinoderm Fauna S. Africa. p. 285.
— *dyscrita* — Ibidem. p. 284. Pl. XVI. 5—6.
Patiriella exigua — 1928. Sea-Lilies, Sea-stars. S. Australian Museum. Rec. S. Australian Mus. III. p. 392.
— — Döderlein. 1928. Seesterne d. deutschen Südpolar-Exped., p. 296.

Numerous specimens collected on the rocky shores of Cape Peninsula (St. James, Sea Point, Cape of Good Hope) I. 1932. Further, I collected several specimens on the rocky shores at Humewood, near Port Elizabeth (12. VII. 1929), and off Durban (the "Bluff", VIII. 1929). Most of the specimens are small, R. = ca. 5—10 mm, but some few are considerably larger, one from St. James and one from Port Elizabeth as large as R. = 20 mm. A couple of 6-armed and 4-armed specimens are also found in the rich material at hand.

This species appears to be strictly littoral; it may be found under stones at the shore, but it is particularly common in rock pools between high and low tide, where the water remains still-standing, when the tide is low, the temperature of the water then often rising very considerably, which does not seem to be detrimental to this beautiful little seastar. Flat rock surfaces in such pools, covered with a vegetation of calcareous algæ (*Melobesia*, *Lithothamnion*) and other low algal growth, with few centimeters of water over, are its favorite resorts. Its colour marvellously resembles that of the bottom, a mottled reddish-greenish of various shades, so that it requires much attention to discover it. Over and over again I have had to admire, how perfect a concealment their colour affords them on such flats, though directly exposed to the strongest light.

Their food evidently consists of all the minor animal organisms found on the rocks or the algæ (not rarely one may find them on such larger algæ as may grow in these rock pools, particularly Florideans, clinging round the stems and branches of the algæ). Observing the specimens immediately on their being removed from the rock, one finds them to have the stomach expanded so as to cover almost their whole under surface; in this way then they directly suck off the rock

surface below them. When removed they rapidly retract the stomach.

When thus creeping around, their circumference is almost circular, the interradial edges being distinctly convex. On preservation they usually change their outline considerably, the interradii becoming more or less distinctly concave. By throwing them into formaline immediately on their being picked off the rock I succeeded in preserving some few of them in their natural shape (Pl. XII. Figs. 5, 7), but even so most of them contracted more or less and folded in their interradial edges.

I may recall here the observation mentioned in my "Studies of the Development and Larval forms of Echinoderms" (1921, p. 188), that *Asterina exigua* has direct development, like *Asterina gibbosa*, its eggs being deposited on the rock surface; also its genital pores are on the ventral surface, as in *Ast. gibbosa* (Pl. XII. Fig. 6).

Fisher (Op. cit.) and Clark (Op. cit. 1928) have called attention to the bare area in the interradii just outside the jaws as very characteristic of this species. It certainly is — but it is found likewise e. g. in *Asterina calcarata*, and, on the other hand, it is not constantly found in *Ast. exigua*. On the whole, there is much variation in the characters of this species, particularly in regard to the spinulation of the ventral side. More usually the interradial plates nearest the jaws are devoid of spines, as is also the series of plates nearest the adambulacral plates; in such specimens the proximal interradial plates are usually more or less reduced in size, and separated by broad interspaces of naked skin, which on dried specimens become very conspicuous through being darker than the plates (Pl. XII. Figs. 6—8). But in several specimens there is no such naked space, and spines are found on all the interradial plates, also those nearest the adambulacrals. All intermediates are found between these two extremes. Also in regard to the spines on the distal interradial plates there is much variation, there being sometimes only one spine to each plate, almost to the margin of the disk, sometimes two spines to each plate, now only on two—three plates near the margin, now on 5—6 plates in the median series. Likewise the size and shape of the outer adambulacral spine varies very much, being now simply blunt, now distinctly widened and flattened, truncate, sometimes even slightly bifid at the end. These variations show definitely that Clark's *Asterina dyscrita* cannot be distinguished from *Ast. exigua*, not even as a separate variety.

Koehler in his report on the Echinoderms of the "Scotia" (p. 296) records *Asterina calcarata* (Val.) from False Bay and Saldanha Bay, stating to have compared the S. African specimens with specimens of *calcarata* from the Chilenian coast and found them completely identical. "L'*A. calcarata* peut donc remonter plus haut vers le Nord qu'on ne le croyait." Seeing that he does not mention the commonest S. African *Asterina*, *A. exigua*, and in view of the fact that nobody else has found *Ast. calcarata* in S. African waters, I could not help thinking, that these specimens identified by Koehler as *A. calcarata* might in reality be *A. exigua*.

On my application Dr. A. C. Stephen of the R. Scottish Museum, Edinburgh, kindly sent me some of Koehler's specimens of *A. calcarata* from False Bay. My suspicion proved fully justified — they are not *calcarata*, but, as was to be expected, the common *Ast. exigua*. That the other specimens thus identified by Koehler are likewise *A. exigua*, there is, of course, no reason to doubt. The occurrence of the S. American *Asterina calcarata* at S. Africa thus has been proved to rest on a misidentification.

It may be mentioned here, that *Asterina exigua*, so widely distributed all over the Indo-Pacific region, has been found by me also at St. Helena (cf. my forthcoming report on the Echinoderms of St. Helena).

Asterina gracilispina H. L. Clark.

H. L. Clark. 1923. Echinod. Fauna S. Africa, p. 286. Pl. XVI. 3—4.

In the collection of the S. African Museum there is a specimen from False Bay, 14 fms. R. = 10 mm, which I refer, though with considerable doubt, to this species. In general shape it is exactly like the type, as figured by Clark, Op. cit. But there are some rather noteworthy differences. The spinelets of the dorsal plates are not sharp, might rather be designated as blunt, and they are disposed round the edge of the plates, leaving a median space bare. The madreporite is distinct. The spinelets on the ventro-lateral plates I would not designate as "delicate" either, they are rather stout, and I do not find more than 3 of them on the outer, mostly only two on the inner of these plates.

The species *gracilispina* was described from two specimens only, and accordingly nothing is known about the extent of its variations;

but we may well assume, that, like e. g. *A. exigua*, it will prove to be subject to rather considerable variation, so that the present specimen will come within its limits. For the present I think it to be the only reasonable course to refer this specimen to *A. gracilispina*, with due reservation, because of the coarser character of the spinelets of its dorsal and ventral sides.

Asterina granifera (Gray).

Patiria granifera Gray 1847. Descr. New Gen. & Species of Asteriadæ. P. Z. S. p. 82.
Asterina — Perrier. 1876. Rev. Stellérides du Mus. Paris. p. 319. (Sep. copy).
— — H. L. Clark. 1923. Echinod. Fauna S. Afr. p. 281. Pl. XVII. 1—2.

Sea-Point, Cape Peninsula; rocky coast, at low tide, 29. XI. 1929. 2 specimens.

Gordon Bay, 8—9 fathoms. 19. XII. 1929. 1 young specimen.

The latter should perhaps rather be referred to *Parasterina bellula*, of which some larger specimens were taken at the same locality. The matter is of slight importance, since, as stated below, there is much probability that *Parasterina bellula* and *Asterina granifera* are in reality identical, in spite of the fact that one is referred to the genus *Parasterina*, the other to the genus *Asterina*. The value of these genera is, namely, also questionable — or perhaps rather the referring of *granifera* to the genus *Asterina* is questionable.

Asterina coccinea (Gray).

Pl. XIII. Fig. 4.

Patiria coccinea Gray. 1841. Synopsis of the genera and species of the class *Hypostoma* (*Asterias* Linnæus). Ann. Mag. Nat. Hist. VI. p. 290.
Asteriscus coccineus Müller & Troschel. 1842. System d'Asteriden, p. 43.
Patiria coccinea Gray. 1847. Proc. Zool. Soc. p. 82.
— — — 1866. Synopsis of the species of Starfish, p. 17.
Asterina — Perrier. 1875. Revision des Stellérides du Museum Paris, p. 314.
— — Clark. 1923. Echinod. Fauna S. Africa, p. 283.
Non: *Asterina coccinea* Bell. 1905. Mar. Invest. S. Africa, III. Asteroidea, p. 248. (= *Parasterina bellula* (Sladen) and *Asterina* (*Patiriella*) *exigua*).

Through the kind help of Dr. Monro I have received two photos of one of Gray's types[1]), one of which is reproduced here in Pl. XIII. Fig. 4, so that we have now, at length, an illustration showing what this species really looks like. It is rather mysterious that such a large striking form has never been refound — the *Asterina coccinea* of Bell, the only author after Gray to record it from S. Africa, being something different, as I find on examining two of his specimens, sent me from the British Museum. One specimen labelled st. 176 (? the one numbered 10004 in Bell's report) is *Asterina exigua*, var. *dyscrita* H. L. Clark, another from Mossel Bay, is *Parasterina bellula* (Sladen). It is rather extraordinary, that Bell could think these two specimens to be one and the same species. (A third specimen listed by Bell as *Ast. coccinea* I have not seen — but judging from the two other specimens it is rather safe to say that it will not be a genuine *coccinea* either).

As it seems impossible that such a large, evidently littoral seastar could have passed unnoticed, I cannot help suggesting that the labelling of the old specimens on which Gray's description is based, is erroneous and that they did not really come from the Cape of Good Hope — and I would even venture to suggest that they came from the Pacific, i. e. that they are identical with *Asterina miniata* (Brandt). From the photos their identity cannot be seen definitely, but there is nothing decidedly against it and the red colour of *coccinea* might fit fairly well with *A. miniata*. Only the direct comparison of the type specimens of *coccinea* with specimens of *A. miniata* (or *pectinifera*) can solve the question. But that *Asterina coccinea* does not properly belong to the S. African fauna, I feel rather sure. (— See Additional Note, p. 397).

Asterina penicillaris (Lamk.).

Pl. XIII. Figs. 5—7.

According to a kind information from Professor Joubin the type of Lamarck's *Asterias penicillaris* does not exist any more (— and probably was lost long ago, since Perrier does not mention this species in his "Revision"). The specimen described by Müller & Troschel

[1]) Dr. Monro informs me that there are only 3 specimens of the *Patiria coccinea* in the British Museum, whereas *Perrier* (Op. cit.) says that there are "plusieurs individus". It may also be noticed that the description given by Perrier does not seem to fit well with the photos, which might perhaps indicate that different species were confounded by Gray under the name *coccinea*.

in their "System der Asteriden", p. 42, under the name of *Asteriscus penicillaris*, then alone can give us information of the species *penicillaris*.

Through the kindness of Professor W. Arndt I have had these specimens, collected in the Red Sea by Hemprich & Ehrenberg, sent for examination, together with three specimens from the Cape identified by Meissner as *Asterina penicillaris*.

First, as regards the Cape specimens of Meissner it is quite clear that they are identical with *Parasterina bellula* (Sladen). As for the specimens of Müller & Troschel (Pl. XIII, figs. 5—7) it is evident that they are likewise very closely related to *Parasterina bellula*, and were it not for the description of the colour given by Müller & Troschel I would really think them identical. But this description "oben mit blaülichen Grunde und rothbraunen Stacheln, unten blau" does not at all fit with the red colour of the Cape species. If this description be correct, the identity of the Red Sea specimens with those of the Cape is out of the question. But is that description correct? Müller & Troschel state the description of the colour to be taken from drawings (from life evidently) by Lesueur — but their specimens were collected by Hemprich & Ehrenberg, and there is no evidence at all that Lesueur was there together with them. There is then no proof at all that Lesueur's drawing was of the same species as those described by Müller & Troschel as *Asteriscus penicillaris*.

Only through renewed researches on living material of the Red Sea Asterinas can we get a solution of the question. If the specimens of the Red Sea are really coloured as described by Müller & Troschel, they will represent a distinct species, which may then well keep the name *penicillaris*, Müller & Troschel's specimen being then regarded as the neotype of *A. penicillaris*. If they turn out to be not thus coloured, but red as the Cape specimens, they will be identical with the latter and must then be named *Parasterina bellula* (Sladen), since there is no guarantee at all that Müller & Troschel were right in identifying this form with Lamarck's *A. penicillaris*, and this latter will then be a *species delenda*.

The great number of *Asterina* species, no less than eleven, enumerated in Clark's Echinoderm Fauna of S. Africa thus becomes considerably reduced through this critical examination.

First two species, *A. coronata* and *Burtonii* are to be eliminated as not S. African, being not known S. of Mozambique. One, *A. calcarata*, is an erroneous identification of *A. exigua;* the same holds good of *Asterina penicillaris*, which is *Parasterina bellula*. Another species, *A. coccinea*, is probably the Pacific *Ast. miniata*, and certainly not S. African. Finally, *A. dyscrita* is not valid, not to be distinguished from *A. exigua*.

There are thus left only *Ast. granifera*, with the var. *sporacantha*, *Ast. exigua*, *gracilispina* and *lüderitziana* as truly S. African species of *Asterina* — and moreover it is rather probable that *Ast. granifera*, with the variety *sporacantha*, are not distinguishable from *Parasterina bellula*. As a compensation for this reduction there are in the present report added two new characteristic Asterinids to the S. African fauna, viz. *Parasterina formosa* and *Disasterina leptalacantha*, var. *africana*, besides the new *Palmipes* (or *Anseropoda*) *grandis*, so that the S. African region is still very rich in Asterinids.

Disasterina leptalacantha, var. *africana* n. var.

Pl. XII. Fig. 3.

1 specimen found, together with *Asterina exigua*, in a rock pool off Humewood, Port Elizabeth, 12. VII. 1929. Further, there is a specimen in the S. African Museum from off Tugela river, Natal, 200 fathoms.

These specimens agree very closely with the *Asterina leptalacantha* from Queensland, described by H. L. Clark, 1916, in his "Report on the Sea-Lilies, Star-fishes, Brittle-Stars and Sea-Urchins obtained by the F. I. S. "Endeavour" on the coast of Queensland . . . and Western Australia" (Biol. Results Fishing Experiments F. I. S. "Endeavour" IV. 1. p. 57. Pl. XVIII. 3—4), so closely, indeed, that it is quite probable, they are not even distinguishable as a separate variety. If I do establish a new variety for the S. African specimens, it is mainly for zoogeographical reasons, the type species being known only from Queensland. If once discovered in intermediate localities, and when a more extensive material becomes available, it is quite probable, that the characters by which the variety is distinguished come within the individual variations of the species, corresponding to what obtains in *Asterina exigua*.

These characters are: the ventro-lateral plates are all of them provided with a spine, whereas in the type the three most adoral plates of the

first series are perfectly bare. There are 7 marginal spines to each side of the jaws, whereas there are only 5 in the type. In regard to the dorsal side the two S. African specimens show some difference: the specimen from 200 fathoms is completely naked on the dorsal side, except the plates round the anus and the merest indication of spinelets on one of the plates adjoining the madreporite; in the specimen from Port Elizabeth there are, besides the spinelets on the plates round the anus and the madreporite (— which latter are as well developed as in the type —) also some spinelets on a few of the interradial plates, though less so than in the type. This character thus shows a perfect gradation, and is, evidently, of no value as distinguishing feature, but the two other characters mentioned above may perhaps hold good.

The specimen from Port Elizabeth, preserved in alcohol, affords the important information that both the dorsal and the ventral surface is covered by a rather thick, gelatinous skin. On the dorsal side of the arms the skin lies in transverse folds, corresponding to the transverse series of plates; on the ventral side all the spines are enclosed in a rather thick skin; the spine-series, with their skin-sheaths, form elevated walls, separated by deep furrows, the whole underside being thus distinctly radially striated. — Of the colour of the live specimen I can give no information.

It is of very considerable interest to have found this Asterinid, so characteristic through its naked dorsal side and the thick gelatinous skin covering the whole surface, represented in S. African Seas. Also the large bathymetrical distribution, from 0 to 200 fathoms is very noteworthy.

Parasterina bellula (Sladen).

Patiria bellula Sladen. 1889. "Challenger" Ast. p. 385. Pl. LXIII. 1—2; LXIV. 5—6.

Asterina coccinea. Bell. 1905. Marine Invest. S. Africa. Asteroidea p. 248 (non: *Patiria coccinea* Gray).

Patiria bellula Koehler. 1908. "Scotia" Echinod. p. 296.

Callopatiria bellula Verrill. 1913. Revision of the genera of Starfishes of the Subfamily Asterininæ. Amer. J. Sc. 4. Ser. XXXV. p. 480.

Parasterina — Clark. 1923. Echinod Fauna. S. Africa, p. 280.

Of this very fine species I collected 4 specimens on the rocks at St. James, Cape Peninsula. Further, I dredged 5 specimens in Gordon Bay, at a depth of 8—9 fathoms, 19. XII. 1929, and two in Buffals Bay, 30 fathoms, 20. XII. 1929, onboard the "Pickle".

The largest specimen has a size of R. = 60 mm. The colour of the live specimens is a very beautiful red, which has kept fairly well in specimens preserved in formaline and then dried.

One of the specimens from Buffals Bay might perhaps rather be identical with Clark's variety *sporacantha* of *Asterina granifera*. I am, indeed, very much inclined to think that this variety should rather be referred to *Parasterina bellula;* — on the whole, the limit between *Asterina granifera* and *Parasterina bellula* is by no means clear, as already pointed out by Clark (Op. cit. p. 280). It is indeed, very probable that it is all only one, rather variable species, which would then have to keep the species name *granifera* Gray.

A specimen from old times in the collection of the Copenhagen Museum is remarkable in the small, secondary plates of the dorsal skeleton being developed to so extraordinary a degree as almost to conceal the primary plates. It is otherwise a typical *bellula*, and as it is labelled "Cap" there is no reason for regarding it as anything but an individual variation of the species.

The specimen from Mossel Bay recorded by Bell as *Asterina coccinea* (Gray) has been sent me for examination. It is *Parasterina bellula*. Another of Bell's specimens of *A. coccinea* (St. 176. Cape of Good Hope), likewise sent me for examination, is *Asterina exigua*. Also the specimen of "*A. coccinea*" from the third locality in Bell's report is something else, since Dr. Monro informs me that it looks quite different from Gray's types.

Parasterina formosa n. sp.

Pl. XII. Figs. 9—10.

False Bay (Cape Point S. $2^1/_4$ miles), 30 fathoms. Sand. 1 specimen, dredged onboard the "Pickle", 19. XII. 1929.

R. = 22 mm, r. = 10 mm. The arms rather slender, elevated, scarcely narrowing towards the end, which is rounded. Disk covered with small plates, there being a circle of slightly larger plates round a small central area, in the middle of which is seen the anus and at the edge of which is seen the madreporite. The plates along the dorsal midline of the arms are of the same size as those of the disk, but only for about $^1/_3$ of the arm-length, then the plates increase conspicuously in size, and in the distal half they are much larger than those of the disk, very distinctly limited against each other. The spinelets of these

distal plates are arranged in a circle along the margin of each plate, leaving a conspicuous central space bare, except for 2—4 isolated spinelets. The bare space shows in the distalmost plates some small granular elevations of hyaline substance. On the smaller plates in the basal part of the arms and on the disk the spinelets form irregular groups, leaving no bare central space on the plates (for which there would be no room either); between these plates are seen very small spinelets, isolated or in groups of 2—4; evidently they are born on small secondary plates, which can, however, not be distinguished without cleaning away the skin. These small spinelets are not found between the large plates in the distal part of the arms. The papulæ are rather conspicuous, they continue almost to the end of arms. In the dorsal interradii the plates are small, like those of the disk. Marginal plates distinct, both series covered with spinelets like those of the dorsal side. The two first series of ventro-lateral plates continue almost to the end of the arm, the third series to about the middle of the arm; the fourth series is quite short. The ventro-lateral plates with a transverse series of (2) 3—5 spines each, except the plate just outside the jaw, which has only one spine; these spines are about twice the length of those of the dorsal side. Furrow spinelets 3—4, the middle one the longest; on the outer surface of the adambulacrals there is an oblique series of three similar spines. Jaws with 7 marginal spines to each side, the 4 outer ones small, the three proximal ones larger, the one at the apex the largest. On the outer surface each jaw-plate carries an arch of 3—4 spines, similar to the adambulacral spines. — Colour of the preserved (dried) specimen a light purplish of the skin between the plates of the dorsal side, which makes the plates stand out very distinctly.

I do not see any near relation between this very beautiful species and any other known Asterinid.

IX. Family *Echinasteridæ.*

Echinaster ornatus Perrier.

Pl. XIII. Figs. 1—3.

Echinaster ornatus Perrier. 1869. Rech. s. les Pédicellaires et Ambulacres des Astéries et des Oursins. Ann. Sc. Nat. 5. Sér. XII. p. 251. (Separate copy p. 59).

Cribrella ornata Perrier. 1875. Revision des Stellérides du Museum d'Hist. nat. Paris. Arch. Zool. Expér. IV. p. 376. (Separate p. 112).
— — Sladen. 1889. "Challenger" Ast. p. 543.
— — Koehler. 1908. "Scotia" Echinod. p. 293. Pl. XII. 105—106.
Henricia — Döderlein. 1910. Ast. Oph. & Ech. in Schultze. Forschungsreise in W. und Zentral Süd Africa. IV. 1. (Jen. Denkschr. XVI.) p. 252. Taf. IV. 2—2. a.
— — H. L. Clark. 1923. Echinod. Fauna S. Africa, p. 289.
Non: *Henricia ornata* H. L. Clark. 1926. Echinod. S. Afr. Fish & Mar. Biol. Surv. II. Sea-stars. p. 19. (= *Henricia abyssalis* (Perrier)).

Some specimens taken on the rocky shores at St. James, Cape Peninsula. Further some specimens dredged onboard the "Pickle" in False Bay, 8—15 fathoms. 19. XII. 1929.

It is perfectly evident that this species is not a *Henricia*, since it has no papulæ on the oral side. The question is only, whether it can remain in the genus *Echinaster*, in which it was originally placed by Perrier, or it should rather form a separate genus. It is the fact that there are numerous short, grain-like spinelets on the dorsal skeletal meshes, not isolated spines as in *Echinaster*, which makes the reference to that genus questionable. I find, however, that, whereas in all the specimens from the shore there are such numerous grain-like spinelets, in some of the specimens from False Bay the spinelets are arranged in single series along the skeletal meshes (Pl. XIII. fig. 3) — and also in *Echinaster sepositus*, the type of the genus, the spines may be arranged in rather dense series along the skeletal meshes. Thus there are all transitions from the typical *Echinaster*-arrangement to the closeset spinelets of the littoral specimens of *Ech. ornatus*, and since there are no other essential differences, there can be no doubt that the Cape species is a true *Echinaster*. It should be emphasized that the arrangement of the dorsal spinelets in single or multiple series is not dependant on age; my largest specimen has the spinelets in single series, and, on the other hand, I have quite young specimens in which they are already numerous and closeset.

The colour of the live specimens is a beautiful reddish-orange. The largest specimen in hand has R. = 60 mm.

The species has been most excellently figured from the oral side by Döderlein (Op. cit.), but it may not be superfluous to give some new figures here, particularly for showing the different aspect of those

with the closeset spinelets from those with the spinelets in single series (Pl. XIII. figs. 1 and 3) — and also for comparison with the real *Henricia* species.

One of the specimens from St. James has one of its arms quite short; it suggest autotomy, so commonly observed in another *Echinaster*-species, *Ech. luzonicus*. But whether it really is a case of autotomy can, of course, only be ascertained through direct observations.

That the specimens identified by Clark 1926 as *Henricia ornata* are not identical with the present species, I can say with certainty, having several of those specimens before me. They must be referred to *Henricia abyssalis* Perrier.

The specimens recorded by Bell (1905. Mar. Invest. S. Africa. III. p. 251) as *Henricia ornata* very probably are partly the true *ornata* (viz. the littoral specimens), partly *Henricia abyssalis* (Perrier) viz. the deep-water specimens. It is curious to see Clark (Op. cit.) praise the wisdom of Bell in referring all these specimens to *Henricia ornata*. It is very rare to have reason to praise Bell for wisdom in his identifications of Echinoderms — and the present case proves to be no exception to the rule. A bit of careful examination cannot leave the slightest doubt of two very distinct types being here confounded.

Döderlein (Op. cit.) regards *Cribrella simplex* Sladen (Chall. Ast. p. 547. Pl. 97. 5—6; 98. 9—10) as identical with *Ech. ornatus*. I do not think this correct; the statement that the spinelets of the dorsal side are at wide intervals apart, single isolated hemispherical or slightly conoid granules which are quite invisible without the aid of a magnifying glass (Op. cit.) does not fit with *Ech. ornata*. Otherwise I shall not enter more nearly on a discussion of this question.

Bell (Mar. Invest. S. Africa. III. Ast. p. 252) mentions two specimens of *Echinaster*, which he could not identify. These two specimens were sent me for examination from the British Museum; they are both of them quite typical *Echinaster ornåtus*.

Echinaster reticulatus H. L. Clark.

H. L. Clark. 1923. Echinod. Fauna S. Africa. p. 290. Pl. XV. 1—2.

To this species I refer a specimen which I dredged onboard the "Pickle" off Cape Peninsula, 34°17′ S. 17°58′ E. 160 fathoms. 18. XII. 1929.

Further, a specimen from 31°29′ S. 16°54′ E. 153 fathoms, is, evidently, the same species. This latter specimen has an extraordinary large, elevated, madreporite; it makes the impression of being pathological.

The distinction between *Echinaster reticulatus* and such forms of *Ech. ornatus* which have the spinelets of the dorsal side arranged in single series is not very clear. The existence of numerous papulæ on the oral side in *reticulatus* and their complete absence in *ornatus* would seem to make a sharp distinction, — but, as a matter of fact, they vary very considerably in number, being sometimes very few. — But the question of the specific value of the two forms cannot be solved through examination of some few poorly preserved specimens. Also the relation of *Ech. reticulatus* to *Henricia abyssalis* is not very clear — it seems rather to stand as intermediate between the typical *Echinaster ornatus* and the typical *Henricia abyssalis*.

Henricia abyssalis (Perrier).

Pl. XIII. Figs. 11—12.

Cribrella abyssalis Perrier. 1894. Échinodermes du "Travailleur" et du "Talisman". p. 144. Pl. XI. 1.

Henricia ornata Bell. 1905. Mar. Invest. S. Africa. III. Asteroidea, p. 250. (Pro parte).

— — H. L. Clark. 1926. Echinod. S. Africa. Fish. & Mar. Biol. Survey. II. Sea-stars (Asteroidea) p. 19. (Non: (*Henricia*) *Echinaster ornatus* Perrier.)

Off Cape Peninsula (34°5′ S. 18°2′ E.), 118 fathoms. 23. XII. 1929. 5 specimens.

Off Cape Peninsula (34°17′ S. 17°58′ E.), 160 fathoms. 18. XII. 1929. Several specimens.

Off Cape Peninsula (34°2′ S. 18°7′ E.), 94 fathoms. 17. XII. 1929. 4 specimens.

Off Durban, 225 fathoms. 26. VIII. 1928. 7 specimens.

These specimens all dredged onboard the "Pickle". Further, 46 miles N.W. of Table Mountain, 130—195 fathoms, 1 specimen, taken by the trawler "John C. Meikle".

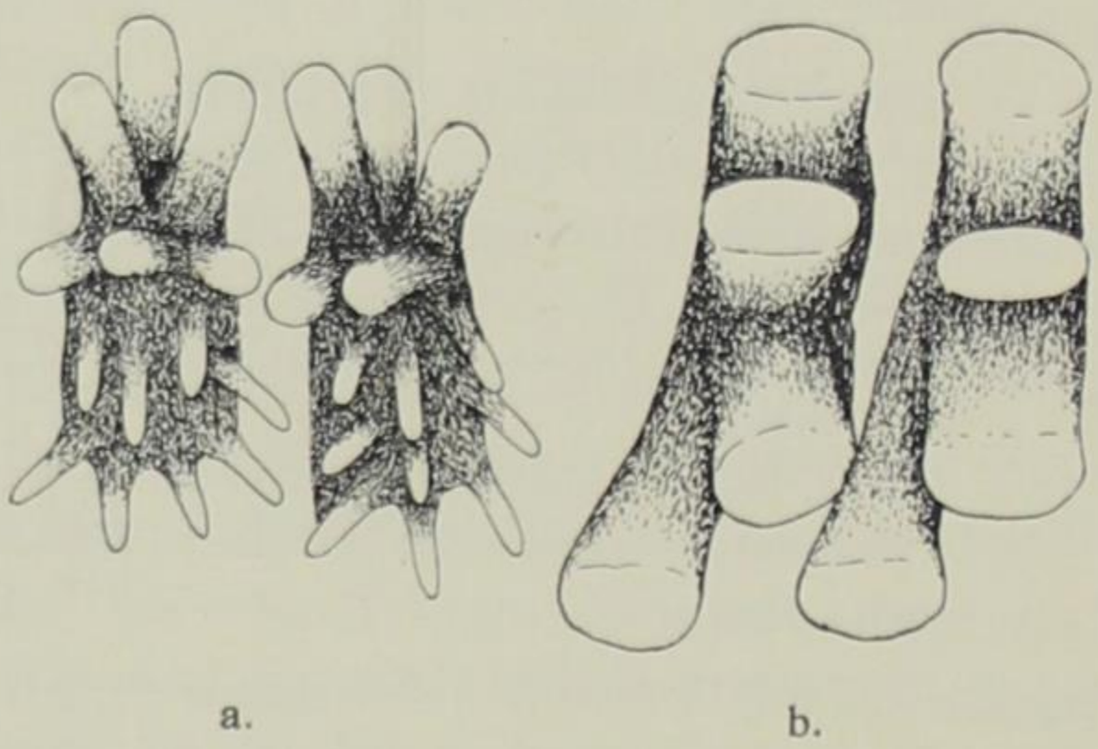
That these specimens have nothing with (*Henricia*) *Echinaster ornatus* to do is perfectly evident, as explained above. I think it rather certain that they are identical with Perrier's *Cribrella abyssalis*, at least I do not see, how they could be distinguished from that species, of which I have had sent a specimen from the Paris Museum for comparison.

As for the specimens from off Durban, I agree with Clark that they are probably identical with the specimens from off the Cape.

The largest specimens seen by me (R. = 70 mm) were taken by Dr. K. H. Barnard off Dassen Island, 140 fathoms.

This species, though rather variable as other *Henricia*-species, is well characterized by the regularity of the series of ventral interradial plates, two of which continue nearly to the end of the arm, parallel to the adambulacral plates. Also the armature of the adambulacral plates (Fig. 8. a.), particularly the small, delicate spines occupying the outer part of the plates, is conspicuously different from that of the true (*Henricia*) *Echinaster ornatus* (Fig. 8. b.) with which this species was hitherto confounded.

In the figure of the oral side of this species given by Perrier (Op. cit. Pl. XI. 1. a.) the jaws are represented as being uniformly



a. b.

Fig. 8. Adambulacral spines of *Henricia abyssalis* (Perrier) (a), and of *Echinaster ornatus* Perrier (b). × 20.

covered by closeset short spines; in the Cape specimens it is evident that there is a double, irregular series of spines on the outer surface of the jaws — and exactly the same arrangement I find in the cotype of *abyssalis*. There is thus no difference herein between the Cape-specimens and the typical *abyssalis*, the said figure being not quite correct in this detail.

I fail to see, how the *Cribella caudani* Koehler (Echinodermes du "Caudan", p. 46. figs. 16—17) can be distinguished from *abyssalis;* most probably the two are identical.

It is scarcely to be doubted that *Henricia abyssalis* will prove to be distributed all over the Southern Atlantic Deep-sea, so that its occurrence off S. Africa does not mean its distribution to be discontinuous.

X. Family *Pterasteridæ.*

Hymenaster lamprus H. L. Clark.

Pl. XIV. Figs. 8—9.

H. L. Clark. 1923. Echinod. Fauna S. Africa, p. 301. Pl. XI. 3—4.

Some specimens from the "Pieter Faure" collections, P. F. 17074. Cape Point N. 58° E. 49 miles, 900 fms, and P. F. 17114 B. Cape Point N. 70° E. 40 miles, 800 fms. Green mud.

The largest of these specimens has a size of R. = 110 mm.

I can have no doubt that these specimens must be referred to the species *H. lamprus* H. L. Clark, in spite of the fact that the oral spines are not two, as found by Clark in the type specimen, but 3, sometimes even 4, besides the strong spine at the apex. Also the ventro-lateral spines are somewhat longer than indicated by Clark. It should also be pointed out that here and there we may find 3 spines on an adambulacral plate.

Clark says that it may not be impossible that this is only the young *H. giganteus* Sladen, though he thinks this highly improbable. Undoubtedly it is nearly related to *H. giganteus*, but particularly the quite different arrangement of the spiracles seems to me to prove that the two species are quite distinct. The great size of the specimens in hand also tend to indicate the specific distinctness of *H. lamprus*.

I think it not superfluous to give here a couple of new figures of the species, after dried specimens, in which particularly the ventro-lateral spines come out very distinctly.

Two of the specimens have a large, deep scar in some of the interradii, near the centre of the disk. It lies at hand to suggest that this may be due to young ones of rather large size having left the dorsal cavity here, much as we know it from *Pteraster obscurus*, and as it is shown here to be the case also in *Pteraster capensis*. I have, however, been unable to find any young ones in any of the specimens, so it can merely be a suggestion that this species may be brood-protecting like the said *Pteraster* species.

Pteraster capensis Gray.

Pl. XIV. Figs. 1—3.

Pteraster capensis Gray. 1847. Proc. Zool. Soc. p. 83.
— — Perrier. 1875. Révis. des Stellérides du Mus. d'hist. nat. Paris. p. 382. (Separate).
Retaster — Bell. 1905. Echinod. S. Africa. II. Asteroidea. p. 250.

Pteraster capensis H. L. Clark. 1923. Echinod. Fauna S. Africa. p. 298.
— — — 1926. Echinod. S. Afr. Fish. & Mar. Biol. Surv. II. Sea-stars. p. 21.

Off Cape Peninsula 34°17′ S. 17°58′ E. 160 fathoms. 18. XII. 1929. 9 specimens.

Off Cape Peninsula 34°5′ S. 17°59′ E. 146 fathoms. 23. XII. 1929. 1 specimen.

Off Cape Peninsula 34°21′ S. 17°57′ E. 178 fathoms. 18. XII. 1929. 1 specimen.

These specimens dredged onboard the "Pickle".

Further, some specimens from East London were sent me by Capt. Pace.

The specimen from 178 fathoms is very interesting in showing two large young ones about to leave the brood cavity of the mother specimen (Pl. XIV. Fig. 1), just as we know it from *Pteraster obscurus*. Some other specimens, which I opened, did not show either eggs or young ones in the marsupium.

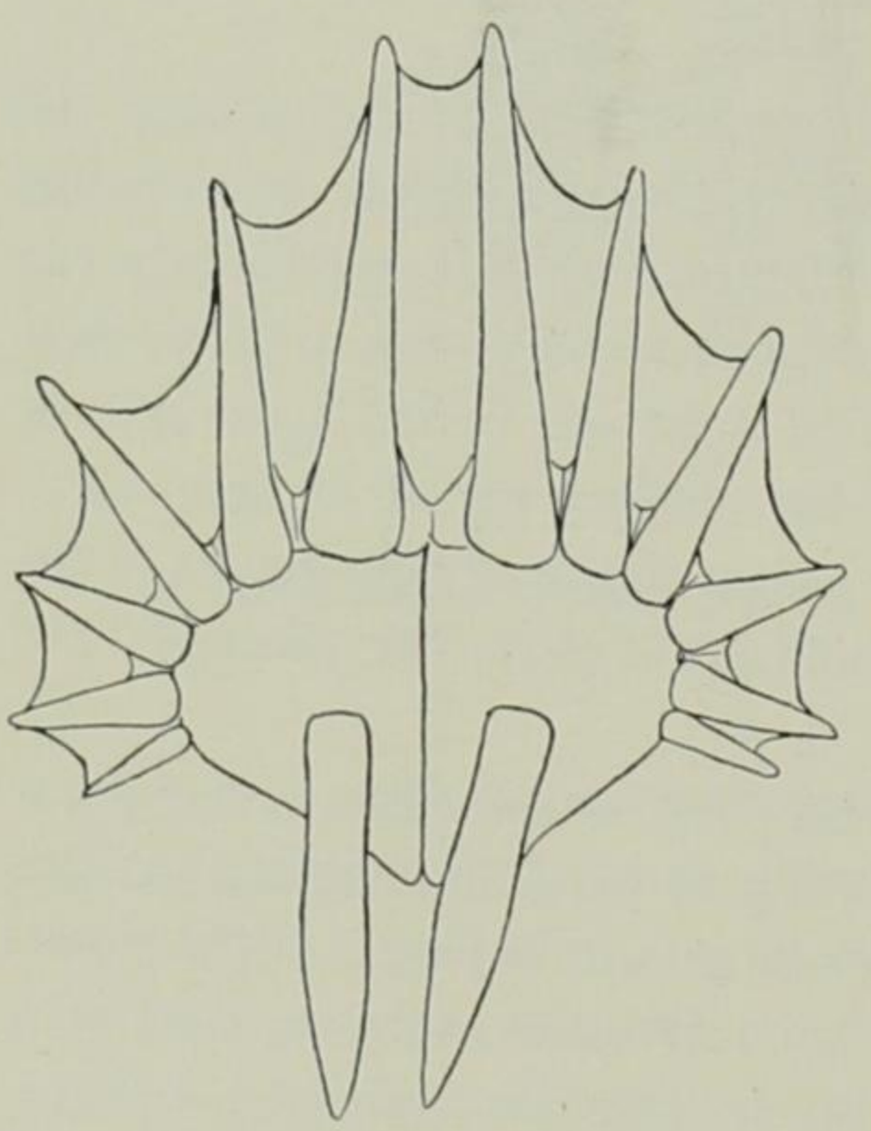


Fig. 9. Jaw of *Pteraster capensis* Gray. ×6.

One of the specimens from off East London has one of the arms bifurcating (Pl. XIV. Fig. 3).

The characters given by Clark as distinguishing this species from *Pteraster affinis* and *Retaster cribrosus*, viz.: the arm length, the number of the spiracles, and the number of the adambulacral and oral spines, do not hold good. There is so considerable variation in these characters, that it seems impossible to distinguish the species by means thereof. Thus, e. g. a specimen in hand, identified correctly by Clark as *Pteraster capensis*, has 5 oral spines but only 4 spines on most of the adambulacral plates. But there is another much better character, viz. the webbing of the oral spines. In *Pt. capensis* the oral marginal spines are all united by a common membrane (Fig. 9), (as already mentioned by Perrier, Op. cit.). In *Pt. affinis* the web does not continue across the point of the jaw, the spines to each side forming

a separate web; this is well shown by E. A. Smith in his Pl. XVI. Fig. 5, though not mentioned in the description of the species (Philos. Transact. 1879, p. 275). Finally, in *Retaster cribrosus* the web does not continue across the point of jaw, but passes on to the spine on the outer side of the jaw, as also mentioned and figured by v. Martens (Über ostasiatische Echinodermen. Arch. f. Naturgesch. 1867, p. 109. Taf. III. 2. c.).

Also the spine of the outer surface of the jaws appears to offer a good specific character; in *Pt. capensis* its distal, hyaline part is simply cylindrical, gradually tapering to a point[1]), whereas in *Pt. affinis* it is tricarinate. In *Retaster cribrosus* these spines are simply cylindrical, scarcely hyaline in the distal part; (there is a specimen of this species from Zanzibar in the collection of the Copenhagen Museum).

Another character distinguishing *Pt. capensis* from *affinis* is the fin-membrane along the ventral side of the arms. In *capensis* it is very narrow; as this it not seen in the figure of the oral side, given by Clark (Pl. IX., 4), I give here a new figure from a specimen in alcohol (Pl. XIV. Fig. 2); in the dried specimens it does not come out so distinctly.

Pteraster flabellifer n. sp.

Pl. XIV. Figs. 6—7.

31°03′ S. 15°51′ E. 200 fathoms, 1 specimen.

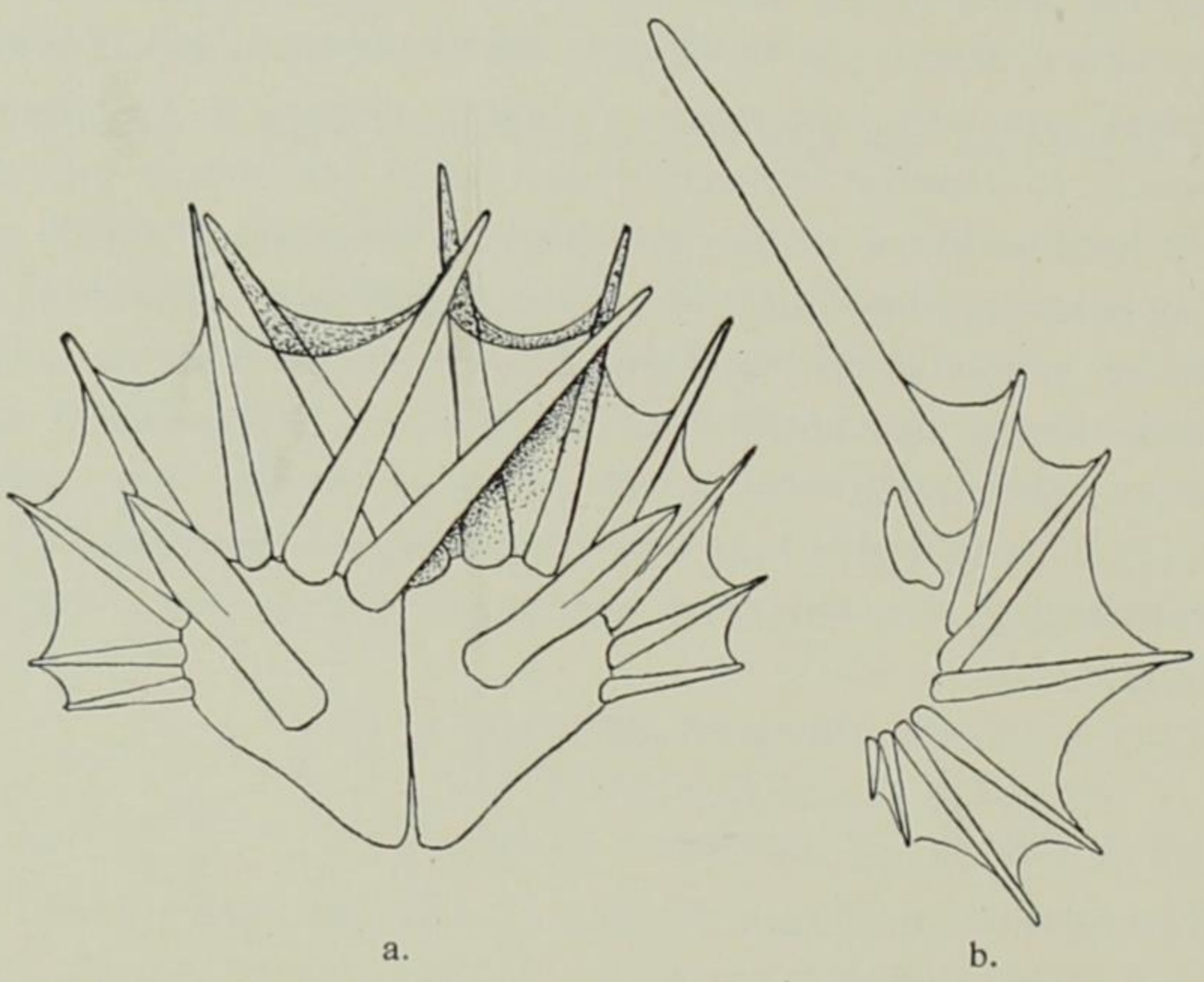
Arms 6; R. = ca. 30 mm, r. = ca. 16 mm; the arms are thus rather long and fairly slender.

The jaws are low, but with the distal end prominent. 7 slender oral spines to each side, increasing gradually in length and strength from the outer to the inner, united on each side by a web which leaves the distal part of the spines free. At the apex of the jaw the two webs cross over a little, but are not united (Fig. 10. a.). The superoral spines are sharply tricarinate. — Adambulacral spines 6—7, arranged in curved series, the concavity outwards; the spines nearest the furrow much the smallest (Fig. 10. b.). Ventro-lateral spines of moderate length, the fin-membrane partly distinct from above. Paxillæ of dorsal side with 5—6 rather long, slender spines; no strong central spine. Dorsal membrane without calcareous deposits. Spiracles apparently few, scattered, apparently of varying size.

[1]) Gray (Op. cit.) states this spine to be absent; perhaps it was lost in the type specimen — but it is well developed in the species.

Colour of the dried specimen white.

That this species is quite distinct from any other known species seems evident — but it is, of course, impossible from the single specimen to judge about the constancy of all the characters described. Indeed, I think they are not constant. I have namely two other, smaller specimens, with only 5 arms, one from 31°00′ S. 16°17′ E. 156 fathoms, the other from off Durban, 225 fathoms (dredged onboard the "Pickle",



a. b.

Fig. 10. *Pteraster flabellifer* n. sp. a. Jaw; b. Adambulacral and ventro-lateral spines. × 9.

26. VIII. 1929) which I am inclined to think identical with the 6-armed specimen; the oral and adambulacral armature is the same, only the oral webs do not cross over at the apex of the jaw.

Only a much larger material can give the definite solution to the problem, whether we have here two distinct species, one 6-armed, the other 5-armed, or only one species with a varying number of arms.

Pteraster fornicatus n. sp.

Pl. XIV. Figs. 4—5.

S.W. of Cape St. Martin, 179 fathoms. 1. IV. 1920. 2 specimens.

Type specimen R. = 8 mm, r. = 6 mm; the second, smaller specimen has R. = 6.5 mm, r. = 5 mm. Shape almost pentagonal, the

arms being very short and with the end turned upwards. Disk rather high, cushion-like.

Jaws low, but with the posterior end raised. Oral spines 6 (5) to each side, free, not united by a web, very slender, except the first; superoral spine rather short, but stout, strongly tricarinate (Fig. 11). Adambulacral spines 5, in a curved series (the concavity outwards), the innermost much the smallest. Ventro-lateral spines of moderate length, the fin-membrane not discernible from above.

Paxillæ of dorsal side with 5—6 slender spines. No reticulation of dorsal membrane, which is very delicate, without spicules. Spiracles scattered singly all over the dorsal side.

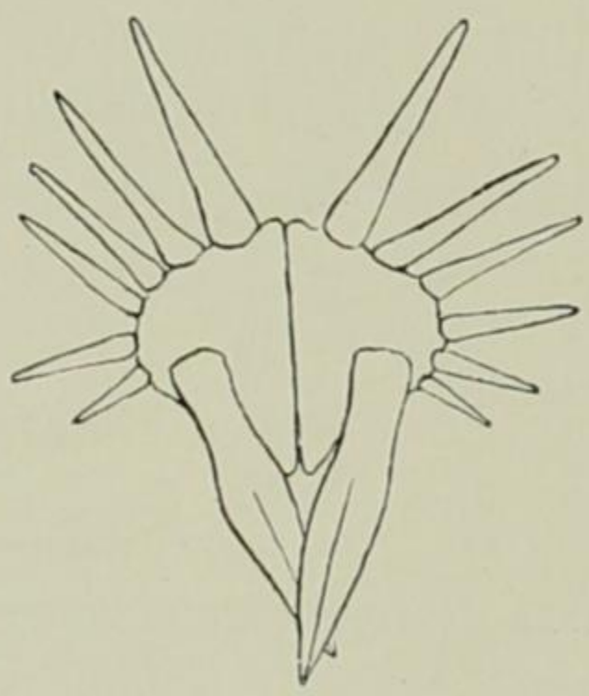


Fig. 11. Jaw of *Pteraster fornicatus* n. sp. × 12.

These are the two specimens from St. 34, which H. L. Clark, 1926 (p. 21—22) records under the name of *Pteraster capensis*, stating that they are "too small to make their identity certain". I cannot at all agree with Clark herein. Although they are very probably only young specimens, the character of the jaws — the not webbed oral spines and the strongly tricarinate superoral spines — shows very clearly that they have nothing with *Pt. capensis* to do. The species to which they are the nearest related is, evidently, the Japanese species *Pt. obesus* H. L. Clark, which differs from the S. African species mainly in the greater number of spines (8—10) in the dorsal paxillæ and in the two proximal oral spines being flat and square-cut at the end. I think then, there can be no doubt that we have here a distinct species, easily recognizable by the characters here described, even though it should ultimately prove to grow to a much larger size than the specimens in hand.

Diplopteraster multipes (M. Sars).

Pteraster multipes M. Sars. 1877. Fauna littoralis Norvegiæ. III. p. 65. Pl. VIII. 1—17.

Diplopteraster multipes W. K. Fisher. 1911. Ast. North Pacific. Bull. U. S. Nat. Mus. 76. p. 371. Pl. 107. 1—2.

— — H. L. Clark. 1923. Echinod. Fauna. S. Africa. p. 300.

— — — 1926. Echinod. S. Afr. Fish. & Mar. Biol. Surv. II. Sea-stars. p. 22.

Off Cape Peninsula, 34°17′ S. 17°58′ E. 160 fathoms. 18. XII. 1929. 2 specimens.

Off Cape Peninsula, 34°21′ S. 17°57′ E. 178 fathoms. 18. XII. 1929. 7 specimens.

Dredged onboard the "Pickle".

The two large specimens from the latter locality were of a dark red colour when alive, the other, smaller, specimens were of a light red or pink colour.

In the paper of 1926 Clark suggests that the S. African form may ultimately prove to be different from the N. Atlantic-N. Pacific form. The comparison which I have undertaken between S. African and N. Atlantic specimens has led me to the result that they cannot be distinguished — as was also the result reached by Clark in 1923.

XI. Family ***Solasteridæ.***

Lophaster quadrispinus H. L. Clark.

H. L. Clark. 1923. Echinod. Fauna S. Africa. p. 295. Pl. XVIII. 1—2.
— 1926. Echinod. S. Afr. Fish. & Mar. Biol. Surv. II. Sea-stars. p. 21.

Off Durban, 225 fathoms, 12 young specimens, dredged onboard the "Pickle" 26. VIII. 1929.

I have further received a specimen from off East London, sent me by Captain Pace.

To Clark's description I would only add that there may be as many as 12 slender spines along the edge of the oral plates, and that the adambulacral plates often have 5—6 furrow spines instead of 4.

Crossaster penicillatus Sladen.

Crossaster penicillatus Sladen. 1889. "Challenger" Asteroidea, p. 446. Pl. LXX. 5; LXXII. 9—10.
Solaster — Bell. 1905. Marine Invest. S. Africa. III. Ast. p. 249.
Crossaster — Koehler. 1909. "Scotia" Echinoderms. p. 224.
— — Clark. 1923. Echinod. Fauna S. Africa. p. 295.
— — — 1926. Echinod. S. Afr. Fish. & Mar. Biol. Surv. II. Ast. p. 21.

Off Cape Peninsula, 34°2′ S. 18°7′ E. 94 fathoms, 17. XII. 1929. 2 specimens.
Off Cape Peninsula, 34°5′ S. 18°2′ E. 118 fathoms, 23. XII. 1929. 1 specimen.
These specimens dredged onboard the "Pickle". Further, I found in the

collection in the laboratory of the Fisheries Survey some specimens from 33°43′ S. 16°38′ E. 126 fathoms.

Two specimens were sent me by Capt. Pace from off East London.

The colour in life appears to be a uniform red, judging from the preserved specimens. I have, however, not made any notes about their colour after the living specimens.

XII. Family *Asteriidæ*.

Marthasterias glacialis, var. *rarispina* Perrier.

Pl. XVI. Figs. 2—3.

Asterias rarispina Perrier. 1875. Revis. Stellérides Mus. Paris. p. 62.
Marthasterias rarispina Clark. 1923. Echinod. Fauna S. Africa. p. 305.
Asterias glacialis Bell. 1905. Mar. Invest. S. Afr. Ast. p. 252.

Agulhas Bank, 4 miles S. of Cape Barracouta, 35 fathoms, sandy mud. 6 specimens, taken onboard the trawler "John C. Meikle".

False Bay, 11—30 fathoms. 10 specimens; Gordon Bay, 8—9 fathoms. 1 specimen. 19. XII. 1929, dredged onboard the "Pickle".

Further, there are some specimens from off Sea Point, 45 fathoms, from the Fisheries Survey. Finally, 6 specimens from Capt. Pace from off East London.

The largest specimens in hand have R. = 110 mm; it would appear then, that this variety does not attain more than about half the size of the typical, N. Atlantic *Marthasterias glacialis*.

The difference between specimens with only the three main series of dorsal spines and the variety *africana*, with many irregularly arranged spines, is very striking (Pl. XVI. Figs. 1—2). But transitional forms are found (Pl. XVI. Fig. 3) so that neither of the two forms can rank higher than as — not very distinct — varieties.

The colour of the live specimens is a light reddish or pinkish, much as the typical *Marthast. glacialis*.

On some of the specimens I find a number of Caprellids attached on the dorsal side. This would appear to be a similar symbiosis as that known of *Asterias rubens* and the Caprellid *Podalirius typicus*.

Marthasterias glacialis, var. *africana* (Müll. & Troschel).

Pl. XVI. Fig. 1.

Asteracanthion africanus Müller & Troschel. 1842. System d. Asteriden, p. 15.
Marthasterias africana Clark. 1923. Echinod. Fauna. S. Afr. p. 306.

St. James, Cape Peninsula. 3 specimens, taken on the rocky shore, Jan. 1930.

These specimens agree very well with Müller & Troschel's description, and, as they come from the type locality, it may be regarded as beyond doubt that we have here the true *Ast. africana*. Though I have never met with similar specimens in deeper water, it is evident that there are all transitions between this form and the typical *rarispina*. It would seem that the variety *africana* is strictly littoral, whereas the var. *rarispina* does not occur directly on the coast.

Cosmasterias felipes (Sladen).

Pl. XV. Figs. 1—4.

Stichaster felipes Sladen. 1889. "Challenger" Asteroidea. p. 433. Pl. 101. 1—2; 103. 7—8.
— — H. L. Clark. 1923. Echinod. Fauna S. Africa, p. 304.
— — — 1926. Echinod. S. Afr. Fish. & Mar. Biol. Surv. II. Ast. p. 22.
Cosmasterias capensis W. K. Fisher. 1930. Ast. N. Pacific. III. (Bull. U. S. Nat. Mus. 76.) p. 228. (Non: *Asterias capensis* Perrier.)

Off Cape Peninsula, 34°24′ S. 18°16′ E. 133 fathoms, 18. XII. 1929. 12 specimens.

Off Cape Peninsula, 34°17′ S. 17°58′ E. 160 fathoms, 18. XII. 1929. 3 specimens.

Off Cape Peninsula, 34°21′ S. 17°57′ E. 178 fathoms, 18. XII. 1929. 2 specimens.

Off Cape Peninsula, 34°2′ S. 18°7′ E. 94 fathoms. 17. XII. 1929. 8 specimens.

Cape Point N. 83° E., 18 miles. 93 fathoms, 20. XII. 1929. 12 specimens.

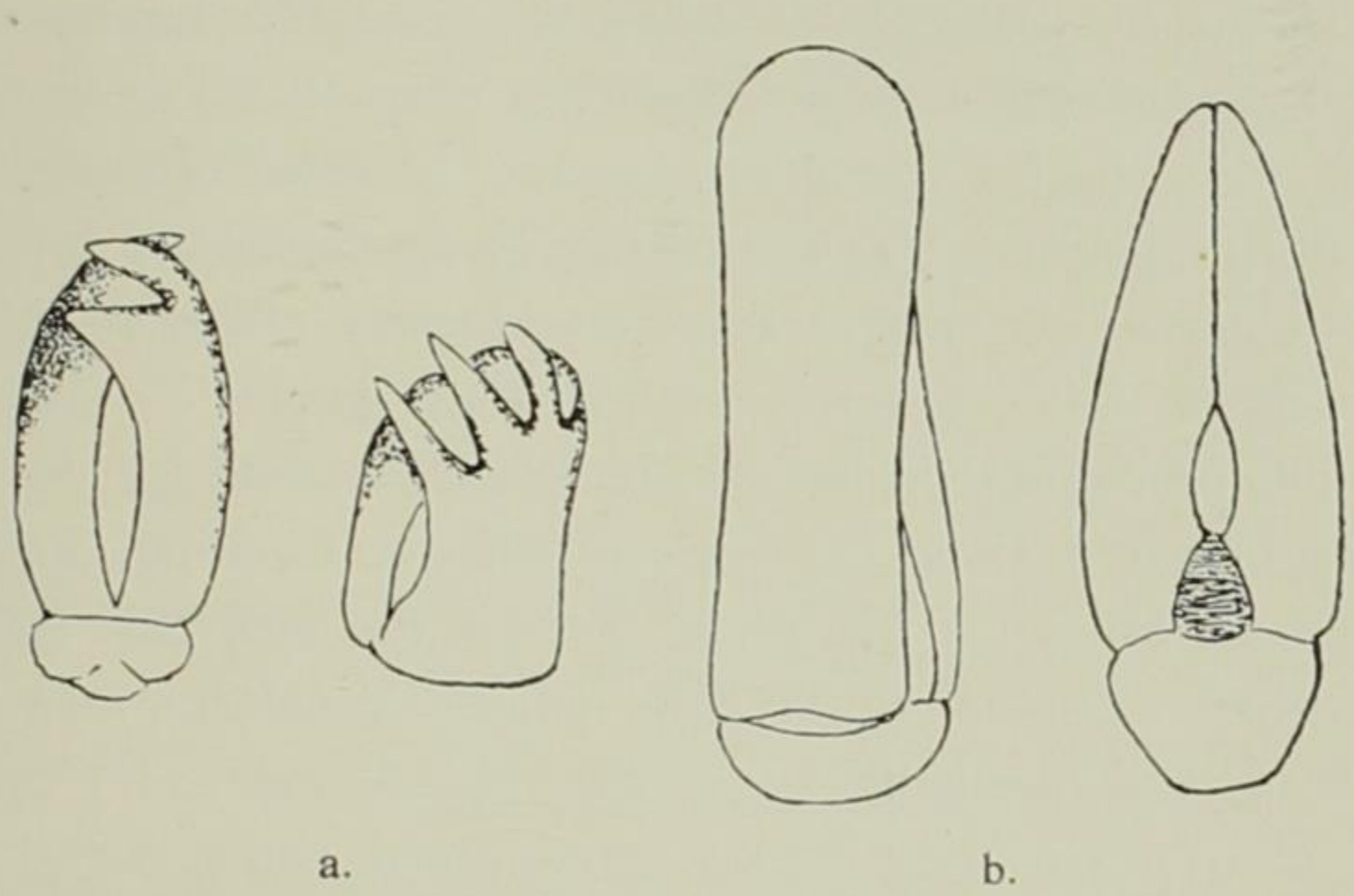
These specimens dredged onboard the "Pickle".

There are further some specimens from the Fisheries Survey, labelled only with some numbers, the meaning of which could not be traced.

The colour of the live specimens was a dull reddish.

Fisher (Notes on Asteroidea IV. Ann. Mag. Nat. Hist. 9 Ser. XVIII. 1926, p. 198) suggests that *Asterias capensis* Perrier is only the young stage of *Stichaster felipes*, which latter name should then be discarded for the name *capensis* Perrier — and in his work of 1930 (Op. cit.) he has definitely changed the name *felipes* into *capensis*. Having had one of the specimens of *Asterias capensis* from the British Museum (labelled 1847, Dr. A. Smith, and thus evidently one of the specimens examined by Perrier and accordingly a cotype) for examination and comparison with my specimens of *Cosmast. felipes*, I must decidedly protest against the idea that the two could be identical. It is true, I have no specimens

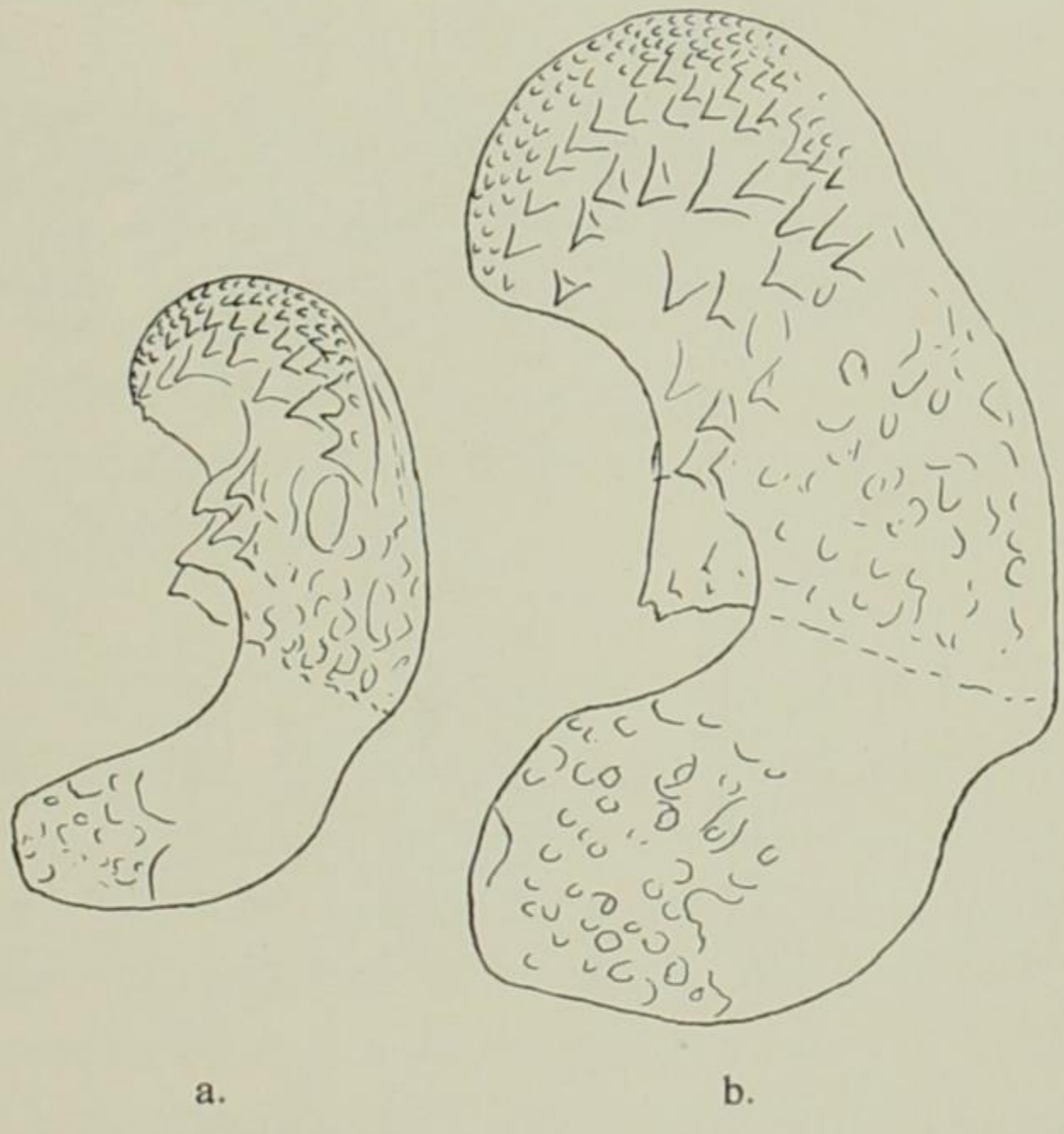
of *felipes* quite as small as *capensis*, the youngest *felipes* having R. = 27 mm, *capensis* R. = 14 mm. But — as appears from the



a. b.

Fig. 12. Straight pedicellariæ of *Cosmasterias felipes* (Sladen) (a), and of *Sclerasterias eustyla* (Sladen) (b.). × 30.

(slightly magnified) photos of these two specimens, Pl. XV. Figs. 3—4, they are so very unlike — *capensis* very much more robust than *felipes* — that alone from their general appearance it is evident, they could



a. b.

Fig. 13. Valves of crossed pedicellariæ of *Cosmasterias capensis* (Perrier) (a), and of *Cosmasterias felipes* (Sladen) (b.). × 235.

not be identical. Then the disk-plates are much more distinct in *felipes* than in *capensis*, and the spines are much more slender in *felipes*. Fisher thinks the *capensis* specimens too young for having as yet developed the large unguiculate pedicellariæ (Fig. 12. a.) so characteristic of *felipes*; but in the youngest specimen in hand of the latter they are already numerous. Also the crossed pedicellariæ are much larger, ca. twice the size, in *felipes* than in *capensis* (Figs. 13. a—b.).

Then *capensis* is evidently a selfdividing species — the specimen in hand has four madreporites — and is usually 6-armed. None of the specimens of *felipes* show any trace of being selfdividing, and not one of them has 6 arms. On the whole, I think the idea that species normally 6-armed and selfdividing as young transform into 5-armed, non-dividing adult, a mistake — for Asteroids as well as for Ophiuroids.

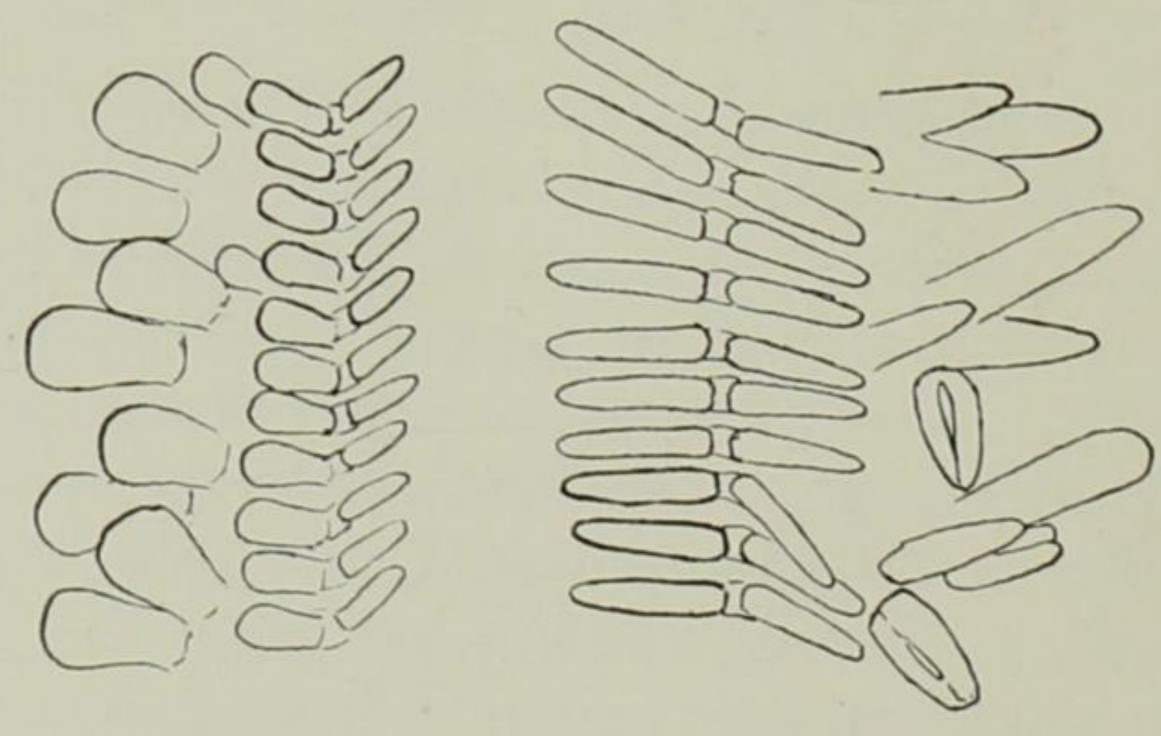
The information and figures now given show definitely that *capensis* and *felipes* are two quite distinct species.

Cosmasterias capensis (Perrier).

Pl. XV. Figs. 11—12.

Asterias capensis Perrier. 1875. Revis. Stellérides. Mus. Paris. p. 73.
— — Clark. 1923. Echinod. Fauna. S. Africa. p. 307.
Cosmasterias capensis Fisher. 1926. Notes on Asteroidea. IV. Ann. Mag. Nat. Hist. 9 Ser. XVIII. p. 198.

Referring to the remarks given above under *Cosmast. felipes* I shall here confine myself to giving figures of the specimen lent me from the British Museum. Attention should be called to the club-shape of the



a. b.

Fig. 14. Adambulacral spines of *Cosmasterias capensis* (Perrier) (a), and of *Cosmasterias felipes* (Sladen) (specimen R. = 35 mm) (b.). × 6.

spines outside the adambulacral spines, so very different from that of *Cosmast. felipes* (figs. 14. a—b.).

The specimen of *Ast. capensis* mentioned by Bell (1905) Mar. Invest. S. Afr. III. Ast. p. 252) could not be found, I am informed by Dr. Monro. There is then no certainty at all that it was a true *capensis*, and there is no possibility either of any reasonable guess as to what it was.

Sclerasterias stenactis (H. L. Clark).

Pl. XV. Figs. 5—6.

Eustolasterias stenactis H. L. Clark. 1926. Echinod. S. Afr. Fish. & Mar. Biol. Survey II. Ast. p. 23. Pl. 4.

Sclerasterias — W. K. Fisher. 1928. Asteroidea of the North Pacific. II. Bull. U. S. Nat. Mus. 76. p. 107.

Off Durban, 225 fathoms, 4 young specimens, dredged onboard the "Pickle", 26. VIII. 1929. The largest has R. = 35 mm.

The figures given here differ rather conspicuously from those given by Clark. Nevertheless, I can have no doubt that the identification as *E. stenactis* is correct, both because they agree fully with Clark's description, and also because they agree no less completely with a young specimen in hand identified by Clark himself. Also the locality is the same.

The specimens, dried from formaline, are of a reddish-brown colour, which, evidently, is much like the colour in life.

Fisher (Op. cit. p. 108) regards *stenactis* as a subspecies only of his *Sclerasterias euplecta* from the Hawaiian Islands. He has, however, not seen any specimen of *stenactis*, and as I have no specimen of the typical *Scl. euplecta* I think it preferable for the present to maintain *stenactis* as a separate species.

Sclerasterias sp.

From off Durban, 50 fathoms, there is a single small specimen (R. = 5 mm) of a 6-armed, self-dividing Asterid (dredged onboard the "Pickle" 27. VIII. 1929), which I cannot hesitate in referring to the genus *Sclerasterias*, but I do not think it advisable to try to identify the species on the base of a single young specimen. It should only be stated that it is certainly different from *Sclerasterias stenactis* (H. L. Clark) and likewise that it has nothing with *Cosmasterias capensis* to do.

Sclerasterias eustyla (Sladen).

Pl. XV. Figs. 7—8.

Asterias (Stolasterias) eustyla Sladen. 1889. "Challenger" Ast. p. 587. Pl. 106. 5—8.

Sclerasterias — Fisher. 1928. Asteroidea N. Pacific. II. p. 107.

30°44′ S. 15°43′ E. 108 fathoms, 1 specimen (from the Fisheries Survey).

This specimen, which has all the arms broken off the disk, agrees so well with the description and figures of the species *eustyla* given by Sladen that I cannot hesitate in identifying it with that species. The apparent differences seen on comparing the figures here given with those of Sladen are evidently due to the present specimen being dried, whereas the specimen figured by Sladen was in alcohol. This fact also easily explains, why Sladen does not mention the straight pedicellariæ, which, although quite conspicuous on the dried specimen, may easily be concealed by the richly developed papulæ. These pedicellariæ, ca. 1.2 mm long, are not unguiculate, but have the end of the valves simple, rounded, rather duck-bill shaped (Fig. 12. b; p. 275).

As Sladen states specially to have been unable to find any "forficiform" pedicellariæ on the oral side of the single specimen examined by him, it should be mentioned that in the present specimen they occur in fair numbers on the oral side.

It may be observed that the plates of the very small disk are almost completely naked.

The species was hitherto known only from off Tristan da Cunha, 100—150 fathoms. There is nothing surprising then in finding it to occur in S. African waters.

Perissasterias polyacantha H. L. Clark.

H. L. Clark. 1923. Echinod. Fauna S. Africa. p. 307. Pl. XVIII. 3.
— 1926. Echinod. S. Afr. Fish. & Mar. Biol. Surv. II. Ast. p. 29. Pl. 6.

Off Cape Peninsula, 34°17′ S. 17°58′ E. 160 fathoms, 18. XII. 1929. 1 specimen.

Cape Point N. 83° E. 18 miles. 93 fathoms. 20. XII. 1929. 1 specimen.
These specimens were dredged onboard the "Pickle".

The species is an exceedingly brittle one, the arms dropping off from the disk almost by merely touching it.

The colour in life is a dull reddish.

Perissasterias sp. (young).

Pl. XV. Figs. 9—10.

From an unknown S. African locality (the label has only the number 1480) there is a young 5-armed specimen which may not improbably represent a new species of the genus *Perissasterias;* as, however, young specimens of the species *polyacantha* H. L. Clark and *obtusispina* H. L. Clark are unknown, we have no means of deciding whether it be the young of one of these, or it represents a new species. The specimen is in very poor condition, and all the arms broken from the disk. R. = ca. 40 mm. There are only three spines on the adambulacral plates, only in the basal part some of them have 4 spines, without attached pedicellariæ. No ventro-lateral plates (as in the distal part of arms in larger specimens of *polyacantha*). Infero-marginals with two rather large, distinctly flattened spines. Supero-marginal and dorsal spines few, small, pointed; pedicellariæ scattered, not in wreaths.

As there are known already three species of this genus, so characteristic of S. African Seas, it would not be altogether too surprising to find still a fourth species there; but so long as we know only large specimens of the three other species, it is quite impossible to say whether the characters observable in this young specimen are of specific value or they are only characters of youth.

Ophiuroidea.

Family ***Gorgonocephalidæ.***

Astrothorax papillata (H. L. Clark).

Astrothamnus papillatus H. L. Clark. 1923. Echinoderm Fauna of S. Africa. p. 316. Pl. XX. Figs. 5—6.

There is no doubt that this species belongs, not to the genus *Astrothamnus* Matsumoto, to which it was referred by Clark, but to the genus *Astrothorax* of Döderlein, characterised by its hook-belts consisting of larger, isolated plates carrying numerous not regularly arranged hooks, and by its hooks having only one secondary tooth (in *Astrothamnus* there are 4—6 secondary teeth on the hooks).

To the careful description given by Clark a few remarks may be added, as also figures of the hooks and spines (Fig. 15. a—f.). The

hook-belts become very broad on account of the series of granules of the "interannuli" nearest the hook-bearing plates being rather large and as high as these latter, thus apparently forming part of the hook-belts, whereas the one or two middle series of the interannuli are much smaller and low, the result being that the broad hook-belts are separated by narrow, sunken rings, as partly well seen in Pl. XX. 5 of Clark's paper. On the sides of the arms the interannuli are reduced to only one series of plates, the lowermost one of them, between each two

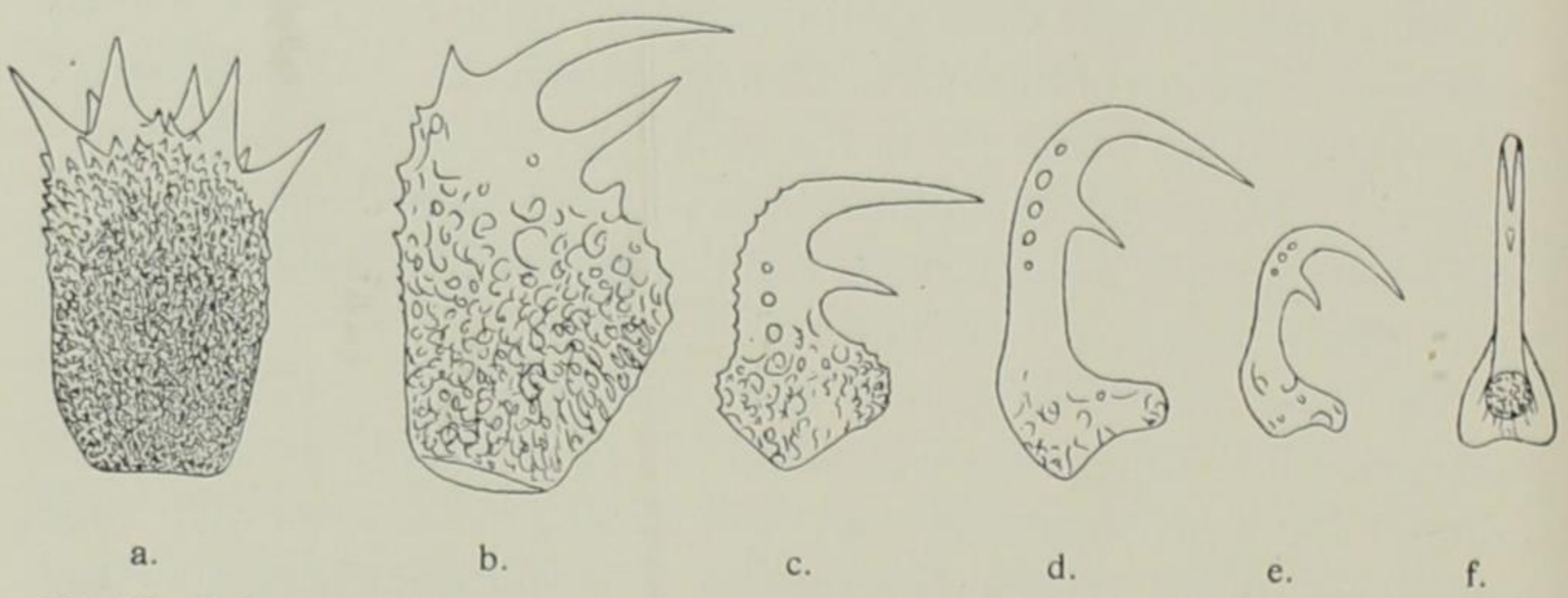


Fig. 15. Spines and hooks of *Astrothorax papillata* (H. L. Clark). Shows the gradual transformation from the normal armspine (a) to the hook-shaped spines from distal part of arm (b, c). Hooks from the belts of the dorsal side of arm (d, e); hook seen in front view (f.). a. × 50; b—f. × 120.

spine-bundles, being usually quite a conspicuous, rounded, smooth plate.

The arm-spines are stated by Clark to be, beyond the proximal-most segments, 4, or usually 5, very rarely 6. I find in a specimen of 20 mm diameter of disk even 7 arm spines. In preserved specimens the arm-spines are generally turned towards the base of the arms. They terminate in a varying number of hyaline thorns (Fig. 15. a.).

The said specimen of 20 mm diameter of disk has no less than 4 madreporites. Generally there is, however, only one madreporite.

I have specimens from the following localities:

Off Durban, 123 fathoms, 1 specimen.
Off Durban, 209 fathoms, 1 specimen.
30°3′ S. 31°3′ E., 112 fathoms, 2 specimens.
33°17′ S. 27°35′ E., 24 fathoms, 5 specimens.

Gorgonocephalus pectinatus n. sp.

Pl. XVIII. Figs. 1—2.

Gorgonocephalus Pourtalesi Bell. 1905. Marine Invest. S. Africa. III. Ophiuroidea, p. 259.

— *chilensis* H. L. Clark. 1923. Echinoderm Fauna of S. Africa. p. 318.

Non: *Gorgonocephalus chilensis* (Philippi).

Description of type specimen. Diameter of disk ca. 30 mm. Dorsal side of disk almost perfectly naked, only here and there a single, small granule. The radial ribs very prominent, narrow, widely apart at the arm-base, convergent towards the centre of the disk, which is distinctly sunken. The radial ribs are of nearly the same width throughout; they carry a number of small, but rather conspicuous tubercles, arranged without any regular order; where intact (in the centre of the disk) they terminate in some small thorns. The marginal belt of plates (which is very distinct) carries some tubercles of the same size as the radial ribs. The ventral interradii are closely covered with small, uniform granules. Such granules are found also along the abradial edge of the genital slits; these latter are short, reaching from about the 5th to the 9th—10th arm-segment.

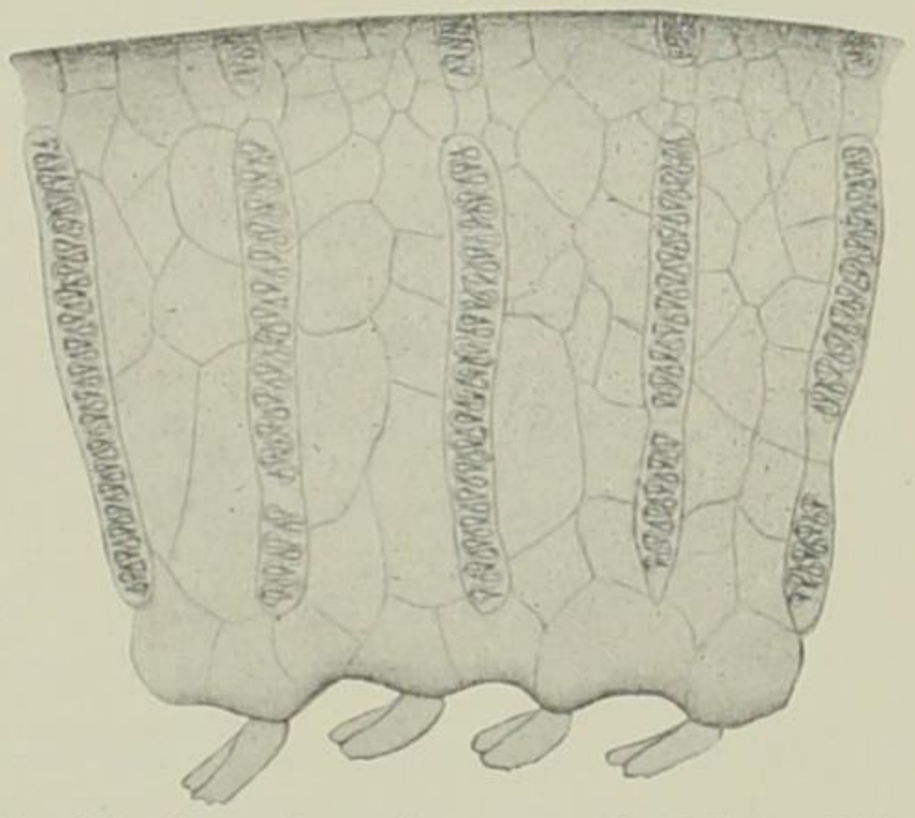


Fig. 16. Part of arm (segments 3—6 from disk) of *Gorgonocephalus pectinatus* n. sp. Side view. Showing the plating and the hook-belts. × 8. (The limitation of the plates in the lower part scarcely as distinct as here represented.)

The mouth-frame perfectly smooth, excepting a few granules at the edge of the interradii. Also the ventral side of the arms smooth, only with a few, scattered, small granules in the proximal part. Mouth papillæ rather slender, in a not very dense cluster at the apex of the jaws. Madreporite of moderate size, slightly protruding into the interradius. Arm-spines present from the second pore-pair, 2 at the first 4—5 pore-pairs, then three on some segments, then two or three, quite irregularly alternating, now three, now two being the predominant number. The spines terminate with some small thorns.

The first forking is just outside the disk. There are 8 segments unto the first forking, 10—11 between the 1st and 2nd; from the 2nd forking the branches become of unequal length; on the main arm the shorter branch has 10—11, the longer ca. 30—33 segments. Beyond the third forking there is somewhat less difference in the length of the branches.

The dorsal side of the arms smooth, covered with fairly large, irregular, smooth plates, interrupted by the rather conspicuous belts of hooks (Fig. 16). The hook-belts are interrupted in the dorsal midline

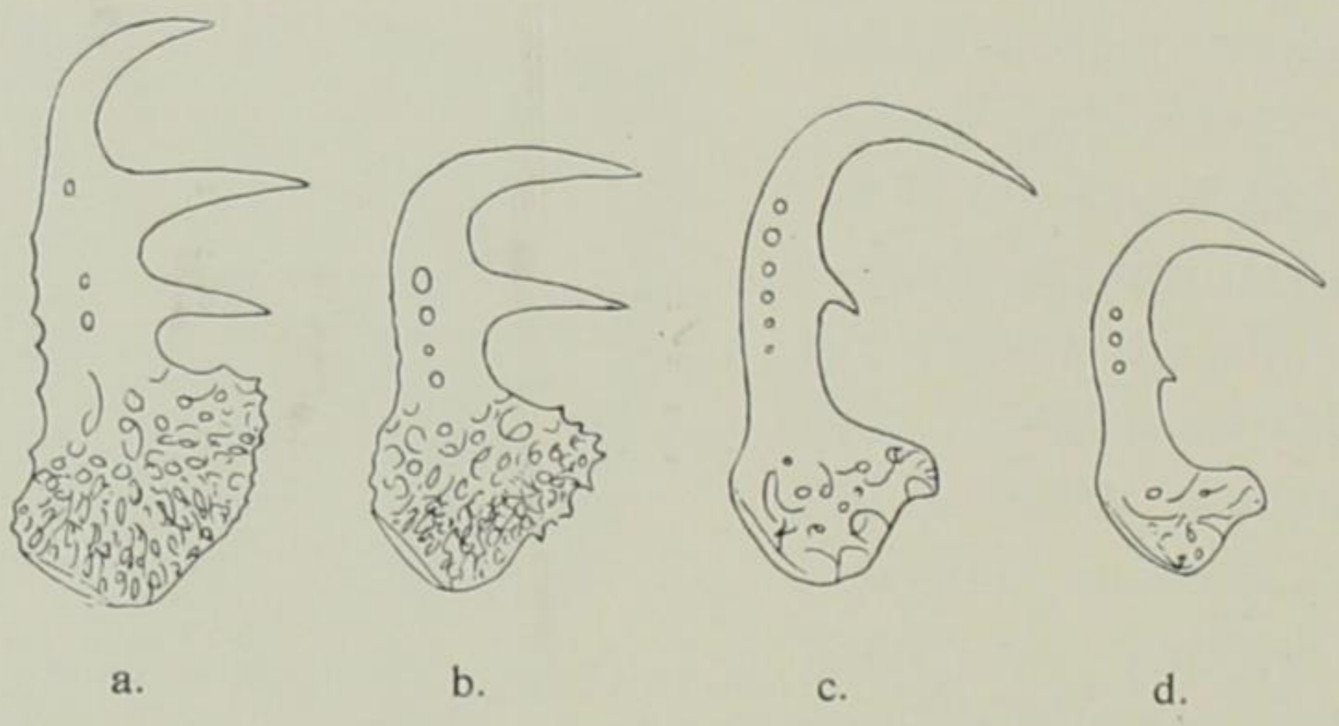


Fig. 17. Hooks of *Gorgonocephalus pectinatus* n. sp. a—b. Transformed armspines from distal part of arms; c—d. Hooks from dorsal side of arms. × 120.

on the proximal 4—6 segments, and also broken up into 2—3 pieces on the sides of the arm; but they are complete from about the 2nd forking. The hooks (Figs. 17. c, d.) are of the typical form, with one secondary tooth, which is, however, unusually small.

The colour of the dried specimen creamy-white; the naked parts of the disk a light brownish, with some small darker spots.

From the examination of a number of specimens received from the S. African Museum it appears that, as might be expected, there is a good deal of variation in this species, as in other *Gorgonocephalus*-species. It is mainly in the character of the disk that there is a conspicuous variation. In some specimens the interradial spaces carry more numerous tubercles, sometimes they are even almost as closely covered as are the radial shields. Also the character of the tubercles varies, they being sometimes thicker, more conical, sometimes longer and more slender, spine-like. A young specimen, 11 mm diameter of disk,

has relatively the strongest tubercles; still, I do not think it doubtful that it really belongs to this species. The tubercles of the interradial spaces are of the same character as those on the radial ribs. The number of arm-joints between the forkings is subject to much variation; but on the whole there is a conspicuous difference in the length of the two branches of each forking after the second or the third forking. In some specimens the hook-belts are not distinct in the proximal part of the arms — partly evidently because of bad preservation.

The largest specimen is ca. 55 mm diameter of disk.

The type specimen, which was taken off East London, S. Africa (Buffalo River N.N.E. 17 miles, 195 fms.), was received from the S. African Museum under the name of *Gorgonocephalus chilensis*. Finding it to be quite distinct from *G. chilensis*, I was naturally led to suggest that the specimens from S. African seas mentioned in literature might rather be *G. pectinatus*, not *G. chilensis*. I therefore applied to the British Museum and to the S. African Museum with the request to have their S. African specimens of *G. chilensis* sent for reexamination. From the British Museum I received the specimen mentioned by Bell (Op. cit. 1905) as *Gorgonocephalus Pourtalesi* Lyman (= *Gorg. chilensis* (Philippi)) — it is *Gorgonocephalus pectinatus*, not *G. chilensis*. From the S. African Museum I received a number of specimens among which 4 labelled in Clark's hand *Gorgonocephalus chilensis* (Cape Point N.E. by E. $^3/_4$ E., 28 miles, 300 fathoms). They are all of them *G. pectinatus*, not *G. chilensis*. Thus, — although I have not seen the 2 specimens mentioned by Clark (loc. cit.) from the locality Vasco da Gama Peak, N. 71° E., 15 miles, 230 fms. — it may safely be stated that *Gorgonocephalus chilensis* is not known from S. African Seas, what has been recorded as this species being the quite distinct species *Gorgonoc. pectinatus*. From a zoogeographical point of view this result is very satisfactory, serving to emphasize the fact that, at least as regards the Echinoderms, there is no nearer relation between the S. African and the S. American marine faunas.

Gorgonoc. pectinatus is very easily distinguished from *G. chilensis* by the character of the arms — distinctly plated and nearly or completely without granules, and with the arm combs very distinct already from the base or, more rarely, from the 2nd forking in *G. pectinatus*, closely granular from the base, and the hooks not beginning till about

the 4th forking and forming conspicuous belts only on the terminal branchlets in *G. chilensis*[1]).

The localities from which I have seen specimens are:

Cape Point N.E. by E. $^3/_4$ E. 28 miles, 300 fathoms.
Lions Head, Cape Peninsula, S.E. $^1/_4$ E. 50 miles, 230 fathoms.
Cape Point, N.E. $^3/_4$ E. 29 miles, 470 fathoms.
Buffalo River, East London, N.N.E. 17 miles, 195 fathoms.

The type specimen is from the last locality.

The nearest relations of *G. pectinatus* must be sought among those species which have distinct hook-belts already in the proximal part of the arms, viz. *G. dolichodactylus* Döderl., *G. sundanus* Döderl., and *G. moluccanus* Döderl. The first of these stands apart on account of its hooks having no secondary tooth. The S. African species may be the nearest related to *G. moluccanus*, but differs from it in various characters, e. g. the much larger size of the genital slits in the latter species. So long as we do not know the range of variation of *G. sundanus* and *moluccanus* (Döderlein had only 1 specimen of each, and he suggests that possibly the two are only variations of a single species. Op. cit. 1927, p. 26—27) it is not easy to state more definitely the differences between the S. African and the Moluccan species. But that they must be regarded as representing distinct species can hardly be questionable — particularly so long as they are known only from so widely distant localities, one from the S. African, the other(s) from the Moluccan Sea.

Clark (loc. cit.) suggests that *G. chilensis* (i. e. *G. pectinatus*) "is viviparous and the young remain with the mother until well grown", because he has found the larger individuals carrying on their backs much younger ones, which are "clinging very tightly, some of the

[1]) From the descriptions and figures of *G. chilensis* found in previous literature it does not appear clearly, how it is with the hook-belts in the proximal part of the arms. In Bell's description of *Astrophyton Lymani* (Account of the collections of the "Alert" in the Strait of Magellan and on the coast of Patagonia. P. Z. S. 1881. p. 99) which is generally recognised to be identical with *G. chilensis*, it is stated that the dorsal side of the arms is closely granulated; this character alone shows that the S. African form with the plated, non-granulated arms must be a different species. A specimen of the true *G. chilensis* in hand (from off the coast of Argentina, 38°15′ S. 54°20′ W.), agreeing perfectly with Bell's rather unusually careful description of "*Astrophyton Lymani*", shows the hooks to begin only at about the 4th forking.

ultimate arm divisions entering into the genital slits of the carrier". Alone the fact that there are innumerable small gonads, as in other *Gorgonocephalus*-species, proves sufficiently that it cannot be viviparous. That the young ones may be found on the back of the adult has nothing with viviparity or brood-protection to do, as will be evident from my observations on *Gorgonoc. caput-medusæ*, in which young ones are often found on the back of the adult in spite of the fact that the eggs are shed free in the sea (cf. my paper "Observations on some Echinoderms from the Trondhjem Fjord. K. Norske Vidensk. Selsk. Skr. 1923. 3, p. 13—16). It simply means that the young ones happen — which must be quite easy where many specimens live together — to attach themselves to an adult, in the same way as they may happen to find a Gorgonian or the like to attach themselves to. In this way it happens that also in Ophiurids like *Ophiothrix fragilis* or *Ophiopholis aculeata*, which are known with certainty to have pelagic larvæ, the young ones may be found on the back or the arms of the adult.

That the young *Gorgonocephalus* even assumes a kind of parasitic habit, eating of the skin of the adult to which it has attached itself, as is rather convincingly shown by Fedotov (Über eigenartigen Parasitismus bei Stachelhäutern. Z. f. Morph. u. Oekol. d. Tiere. 22. 1931), is an additional proof that this occurrence of the young specimens on the back of the adults has nothing with protection of the brood or with viviparity to do.

Astroconus capensis n. sp.

Pl. XVIII. Figs. 3—4.

One specimen from 29°51′ S. 31°28′ E. 230 fathoms (Fisheries Survey). Diameter of disk ca. 30 mm.

Disk rather flat. The radial ribs are narrow, conspicuously raised, widely apart distally, converging towards the centre, which is deeply sunken. Along the ribs are placed, without any order, several conical tubercles of moderate size, terminating (when intact) in a number of small thorns. Along the interradial edges of the disk are some smaller conical tubercles, likewise ending in some small thorns. The disk otherwise closely covered with minute, smooth plates, which produce a very finely granular appearance. The ventral interradii are rather closely tuberculate, the tubercles being small, but distinct. At the edges of the genital slits, particularly the adradial edge, they assume the

shape of small, slender spines. In the distal part of the interradii are found scattered some tubercles intermediate in size between those on the edge of the disk and those of the general covering of the ventral interradii.

The mouth frame and the ventral side of the arms covered with a dense mosaic of small irregularly polygonal, flat plates. On the jaws, which are somewhat elevated, these plates are smaller and have more the character of granules; along the interradial edges of the mouth frame, on the other hand, they partly assume the character of tubercles like those of the interradii. The mouth papillæ are rather long and stout, particularly those on the apex of the jaw; they form a continuous series all round the edge of the mouth slits. The madreporite is very inconspicuous, situated at the edge of the mouth frame, encroaching a little upon the interradius. The genital slits are ca. 5 mm long, equalling about four arm segments in length.

The underside of the arms is flat, without any grooves, but there may be an indication of a transverse furrow between the segments from the first forking onwards. The first forking is at the edge of the disk, at the 8th segment; from the 2nd forking the branches are very unequally developed, there being a main stem with alternating side branches; there are 8—9 segments between 1. and 2. forking, 12—13 between the following forkings on the main branches, ca. 7—8 on the side branches. In the distal branches there may be up to ca. 20 segments between the forkings, but this is quite inconstant. The arm-spines begin at the 2nd pair of pores. There are at first only 2 (sometimes only 1) of them; from about the first forking there are 3 (rarely 4) of them, and on the distal branches again only 2. On the proximal part of the arms the spines are simply pointed, farther out they terminate in 2—3 hyaline thorns, and in the distal part of the arms, of course, they gradually assume the shape of hooks (Fig. 18. a, b.). They are much shorter than an arm-joint, the inner one is the longest.

The dorsal side of the arms covered with a mosaic of very small plates which may along the upper surface partly assume the character of small tubercles; on the whole the dorsal surface of the arms is very smooth. There is a rather conspicuous median furrow, and also between the segments there are somewhat sunken transverse furrows, the arms having thus a slightly annulated appearance. The hooks begin at about the 3rd forking and form complete belts from about the 4th forking.

The hooks are of the typical form, with only 1 secondary tooth (Fig. 18. c—d.).

Ventral plates do not exist, as seen on removing the general covering by means of hypochlorite of sodium. No distinct belt of the hook-bearing plates is observable on removing the superficial covering, such as is found in *Astrocladus euryale*.

Colour of the preserved, dried specimen pure white.

After this report on the S. African Ophiurids had been completed I received from the Hamburg Museum a specimen of an Euryalid from

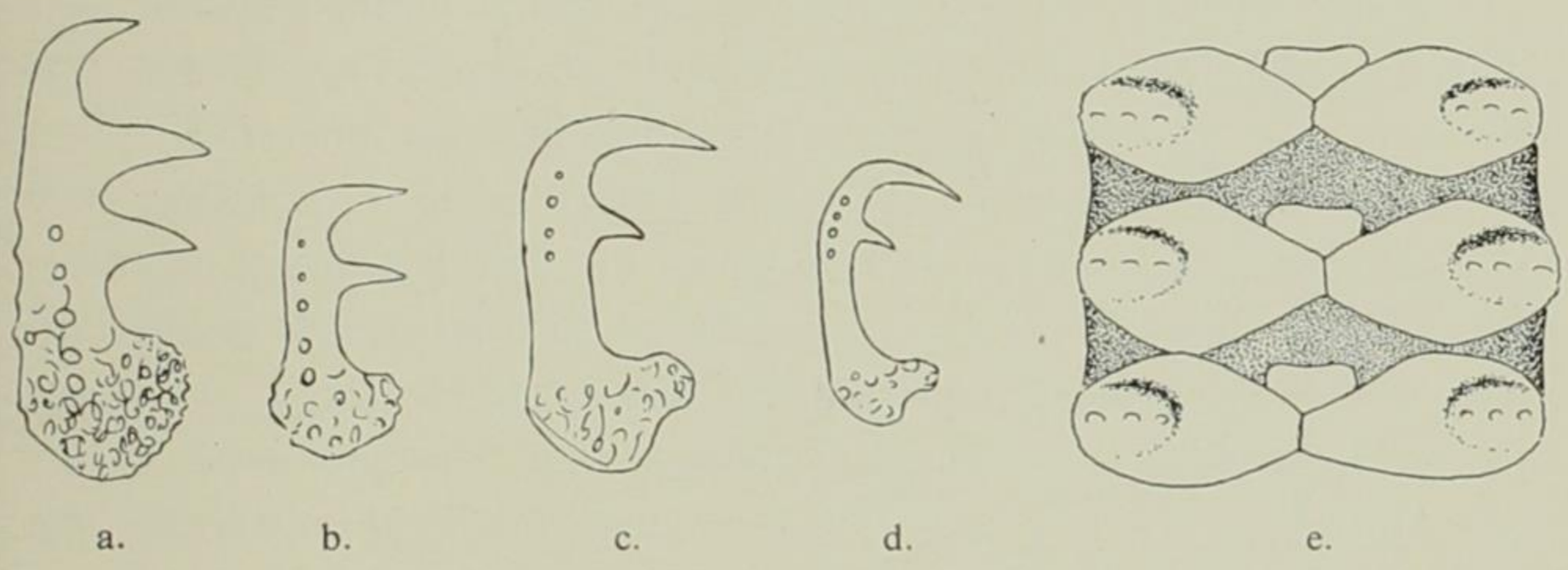


Fig. 18. Hooks of *Astroconus capensis* n. sp. a—b. Transformed armspines from distal part of arm; c—d. Hooks from dorsal side of arm. e. Ventral side of arm of *Astroconus australis* (Verrill); three armjoints, cleaned so as to show the small ventral plates and the large lateral plates, each with an evelated part to which the armspines are attached. a—d. × 135; e. × 9.

the Natal coast (between Natal and Mossel Bay, Bell Marley, 1927) which proves to belong to *Astroconus capensis*. It is about the same size as the type specimen, with which it agrees very well. It is only to be remarked that the distal edge of the mouthframe is more distincly spiny than that of the type, and that there is a small but fairly distinct pit or depression at the base of each arm in the midline, just outside the mouth slit. The colour of this specimen is a light brownish.

It may perhaps be open to discussion whether the present species rightly belongs in the genus *Astroconus*. At least it differs rather conspicuously from the two other species of this genus hitherto known, *A. australis* (Verrill), the genotype, and *A. annulatus* Koehler, in the much smaller size of the tubercles of the radial ribs. In *A.annulatus* the disk is very high, but in this regard *capensis* is more like *A. australis*.

According to Döderlein (Op. cit. 1911, p. 36) the genus *Astroconus* agrees with *Gorgonocephalus* in all essential points, thus also in the

very important character: the existence of a marginal series of larger interradial plates. On p. 69 Döderlein says about this marginal belt of plates that its existence is difficult to ascertain on account of the hard skin, "doch glaube ich ihn bei *Astroconus* annehmen zu dürfen" (cf. also p. 71, under *Astroconus australis*). This belt of marginal plates, however, does not exist in any of the three species, as I have been able to ascertain definitely by applying hypochlorite of sodium. Another character of *Astroconus* is, according to Döderlein (Op. cit. 1911, p. 36), the existence of simple ventral arm-plates, in contradistinction to *Gorgonocephalus* which has the ventral plates divided into smaller plates. In *A. capensis* there are absolutely no ventral arm-plates. But the ventral plates of *A. australis* are quite rudimentary (Fig. 18. e.) and may be entirely absent in the finer branches; in *A. annulatus* they are likewise quite small and rudimentary. The step from these rudimentary plates in the two said species to their total disappearance in *A. capensis* is so small that it would hardly necessitate creating a new genus for the latter for this reason, and there are no other characters which could be regarded as of generic value. Thus I think it the only reasonable course simply to refer this S. African species to the genus *Astroconus* (otherwise known only from the Australian Seas), though it must be acknowledged that it has no very close relation to the two other known species. It is out of the question to refer the S. African species to any other of the genera of Gorgonocephalids.

Astrocladus hirtus n. sp.

Pl. XIX. Figs. 1—3.

Three specimens from off the coast of Natal (or perhaps from off Portuguese E. Africa; locality uncertain).

Diameter of disk of the largest specimen ca. 20 mm, of the smallest ca. 14 mm.

The very conspicuous radial ribs are closely covered with slender, almost spine-like papillæ, ca. 0.1—0.2 mm long, terminating in a varying number of short thorns. The interradii and the space between the radial ribs more sparsely covered with similar, but somewhat coarser papillæ rising from a very finely granular general covering. Some of the papillæ between the radial ribs may be rather conspicuously larger than the rest of them. The whole dorsal surface has a somewhat shaggy appearance. The radial ribs are subject to some irregularity. Normally they are nearly parallel, slightly attenuating

towards the centre of the disk, which they nearly reach. In the largest specimen one pair of the radial ribs is reduced to merely the distal end, in the smallest specimen one of the ribs is shortened, as if the inner end had been cut off.

The mouth frame, the jaws, and the ventral side of the arms very smooth, only on a closer inspection seen to be covered with a very dense mosaic of very small plates, scarcely of granular character. The ventral interradii with a similar, only still finer, general covering, but towards the edge of the disk with some scattered, short, slender spines.

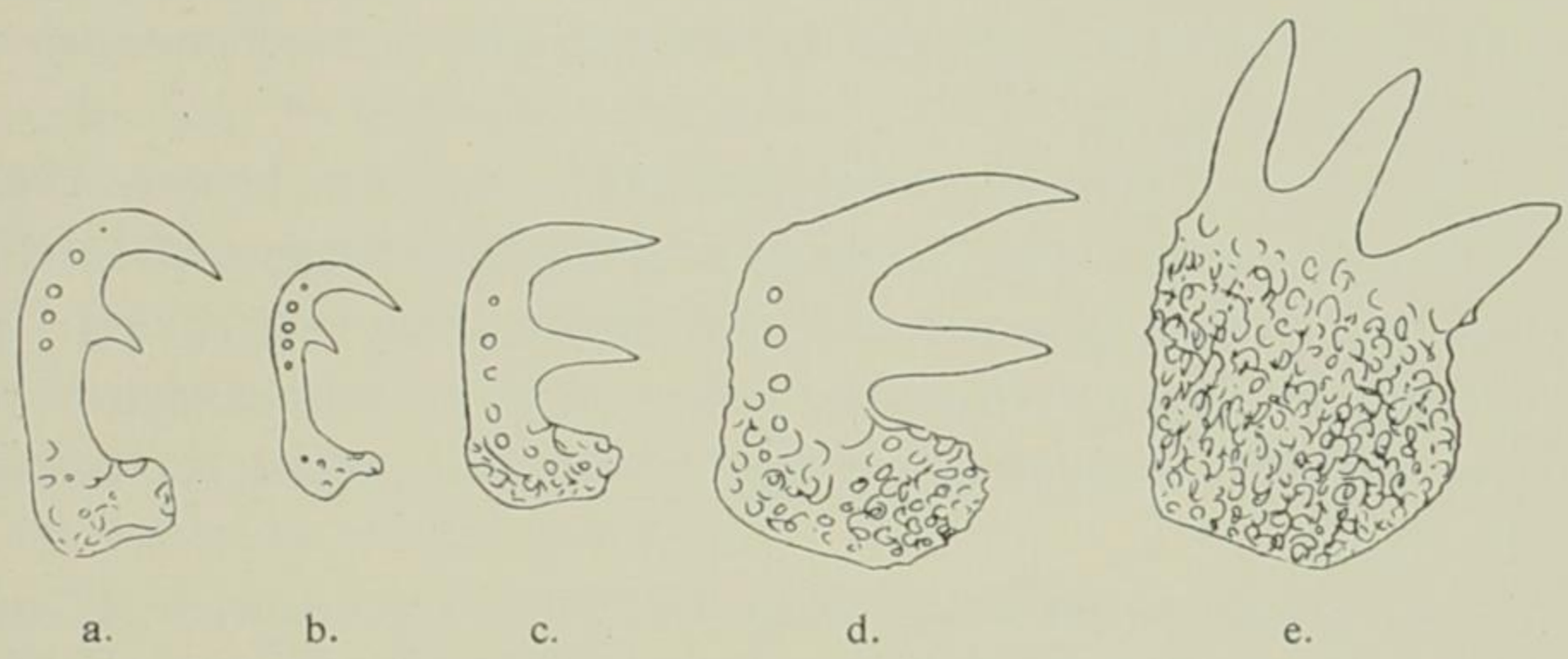


Fig. 19. Hooks of *Astrocladus hirtus* n. sp. a—b. From dorsal side of arm; c—d. transformed armspines from distal part of arm; e. normal armspine. × 135.

The mouth papillæ rather short and coarse, in a dense cluster at the apex of the jaw, continuing along the sides of the jaw, but not forming a continuous fringe across the outer end of the mouth slits, which are not coalesced to any noticeable degree. The madreporite projects to some degree into the soft interradius; there are two madreporites in the largest specimen, one in the others. The genital slits are rather unusually narrow, ca. 2—3 mm long, situated at the edge of the disk, off the first branching.

The first branching of the arms is entirely within the disk. The distances between the branchings very short; there are 5 segments until the first branching, as a rule only 4 segments between the following branchings, rarely as many as 6, or as few as 3. There are no distinct grooves on the underside of the arm in the basal part. The arm-spines begin at about the 3rd forking; at first there are only 2—3, farther out 4—5. They are very short, terminating in one or more hyaline thorns (Fig. 19. e.).

The dorsal surface of the arms closely covered by papillæ of the same general character as those of the radial ribs, only much smaller. No larger papillæ or tubercles are found on the arms, but a number of small, flat, naked plates produce a more or less uneven appearance of the covering of the arms. These plates evidently represent the hook-bearing plates, but there are no hooks on them; no larger plates are found at the ventral edge of the arms. Scattered hooks are found from about the 5th forking, entire belts from about the 6th forking. On the distal branchlets the hook-belts are rather prominent and, together with the arm-spines, make these branchlets look rather coarse. The hooks are of the form typical of *Astrocladus*, with one secondary tooth (Fig. 19. a—b.).

The colour of the preserved specimens a uniform creamy-white.

This species appears to be related to *Astrocladus tonganus* Döderlein which has a similar disk-covering (cf. Döderlein 1911, p. 77); but it differs very markedly from the latter species in various characters, the small number of segments between the branchings being particularly noteworthy.

To *Astrocladus hirtus* I refer a couple of young specimens, 8—4.5 mm diameter of disk from off Zululand (Durnford Point N.E. by E. 9 miles, 13 fms.) sent me from the S. African Museum. That the armspines begin before the first forking in the smallest, and before the 2nd forking in the larger of them is only what should be expected, and other differences of importance from the above description I do not find.

Astrocladus hirtus, var. *reticulatus* n. var.

Pl. XVIII. Figs. 5—6.

One specimen from off Tugela River, 14 fms. (British Museum). Diameter of disk 23 mm.

This specimen differs in various respects from the typical *A. hirtus*. The radial shields are not so close together as those of the type, and the spinous covering less conspicuous, as is also that of the arms. As in the type there are some coarser papillæ rising from a finely granular general covering, but these papillæ are arranged in irregular lines, forming a rather distinct reticulation. The mouth papillæ are more blunt and less distinct than those of the type; finally the arm-spines begin at the 2nd forking, in the type only at the 3rd.

Particularly the last mentioned character forbids simply to identify

this specimen as *A. hirtus*, the more so as this specimen is larger in diameter of disk than any of the specimens of *A. hirtus*. Possibly a richer material will show this specimen to belong within the limits of variation of *A. hirtus*, but with the scanty material now at hand I think it the safest course to regard it as a variety of *A. hirtus*.

Astrocladus africanus n. sp.

Pl. XVII. Figs. 1—2.

Diameter of disk 58 mm. Dorsal side of disk with a number of moderately sized conical tubercles, placed, without any regularity whatever, mainly on and between the radial ribs and at the centre of the disk, the interradii being almost entirely devoid of these tubercles. The general covering of the disk is very smooth, but is seen on the dried specimen to consist of a mosaic of very small, flat plates, not of granular character; they are slightly larger, and also a little conically raised on the radial ribs — which are very conspicuous. The ventral interradii are set with rather numerous short spines, much finer than the tubercles of the dorsal side.

The mouth frame and the underside of the arms are covered by a mosaic of small, flat, irregular plates, continuing also over the jaws which are rather thick and elevated. On the interradial part of the mouth frame are found a few scattered spines like those of the interradii; also on the jaws a few such spines may occur. The mouth papillæ form an irregular cluster on the apex of the jaw and continue as an uninterrupted fringe all round the mouth slits, which are to some degree coalesced, as those of *A. euryale*. The madreporite is close to the edge of the mouth frame, scarcely protruding into the interradius. The genital slits are ca. 10 mm long. A curious feature is the existence of a short, ca. 2 mm long, rather deep, radiating furrow in each interradius, except the one with the madreporite, beginning just outside the mouth frame. Whether this is a constant feature cannot, of course, be ascertained after the single specimen in hand.

Some very indistinct grooves are found on the ventral side of the arms in the basal part. The first branching lies wholly within the disk. The distances between the branchings are very short, the number of segments between the branchings is in the proximal part of the arms 7—8. The arm-spines begin at the first branching, but may exceptionally be found already at the 2—3 last pores before this branching.

There are in the proximal part of the arms generally only 2, farther out generally three spines; they are short, slightly curved, ending in a single thorn; farther out they gradually assume the shape of hooks, with 3—1 teeth, and serrate along the convex side (Figs. 20. e—f.). The dorsal surface of the arms is covered by a dense, uniform mosaic of very small, smooth, almost flat plates, without any larger tubercles among them. There is a fairly distinct, sunken, dorsal midline, and also the spaces between the segments are somewhat sunken, the arms thus getting a rather distinct annulated appearance. In places a couple



Fig. 20. Hooks and spines of *Astrocladus africanus* n. sp. a—c. Hooks from dorsal side of arm; d—f. transformed armspines. × 160.

of somewhat larger oval plates are found in the sunken rings near the dorsal midline, but this is subject to great irregularity. They represent the hook-bearing plates, but there are no hooks on them in the specimen at hand. Also at the ventral edge of the arms a round plate, smaller and less conspicuous than the oval plates on the dorsal side, may occur, but still more irregularly. The hooks begin at about the 4th branching, but very few and scattered. Complete belts are found only on the finer branches. The hooks are of the typical form, with one secondary tooth (Figs. 20. b, c.), exceptionally there may be two secondary teeth (Fig. 20. a.).

As in *Astrocladus euryale* there is, in the more distal part of the arms a more or less complete belt of hook-bearing plates partly concealed under the general covering of granules. There are no traces of ventral plates.

The single specimen in hand is, unfortunately, without locality. But there is no doubt that it has come from somewhere in the South

African Seas. It was found in the collections of the Fisheries Survey of S. Africa.

This species would seem to have its nearest relation in *Astrocladus coniferus* Döderlein from the East Asiatic Seas. It is, however, quite distinct from that species, and very easily distinguished from it by the general covering of the disk which consists in *A. coniferus* of small sharply pointed granules, in the present species of quite flat, smooth granules. To none of the other *Astrocladus* species hitherto known has it any nearer relation.

Astrocladus euryale (Retzius).

Pl. XVIII. Fig. 7.

Gorgonocephalus verrucosus Lyman. 1882. Chall. Oph. p. 262. Pl. XLVIII.
— — Bell. 1905. Marine Invest. S. Afr. III. Ophiuroidea, p. 260.
Astrocladus euryale Döderlein. 1910. Asteroidea, Oph., Echin. in Schultze: Zool. u. Anthropol. Ergebn. im Westl. u Zentral Süd-Afrika. IV. Jena'er Denkschr. XVI. p. 256.
— — Döderlein. 1911. Japan. u. a. Euryalæ, p. 106.
— — H. L. Clark. 1923. Echinod. Fauna S. Afr. p. 319.
Non: *Gorgonocephalus verrucosus* Bell. 1909. Report on the Echinoderms (other than Holothurians) coll. by Stanley Gardiner in the Western Parts of the Indian Ocean. Trans. Linn. Soc. 2. Ser. Zool. XIII. p. 19. (= *Astroglymma Robillardi*, var. *spinosum* Mrtsn.).

This species I found in great numbers in Walker's Bay at a depth of ca. 50 meters, sandy bottom, in a haul with the big trawl of the trawler "John C. Meikle". All the specimens were of about the same large size, ca. 50—60 mm diameter of disk. It was further taken at the following localities:

False Bay, 40 m; Agulhas Bank, Cape Infanta N.E. by N. 15 miles, 90 meters; sand.

Gordon Bay (False Bay), 15—17 m.

A couple of specimens were also sent me by Capt. Pace, from off East London.

Although a very common species, represented in most collections, a few descriptive remarks may not be out of place.

Ventral arm-plates are not at all developed. The lateral plates are, as seen when the outer covering of granules has been removed (on treating with hypochlorite of sodium), very short and small, scarcely

reaching the edge of the arm. On the distal branches a belt of small plates continues across the dorsal side of the arm, lying on the vertebræ (Fig. 21); these plates carry the hooks. On the thicker parts of the arms these plates are absent or rudimentary, in correspondance with the fact that hooks are also absent here. The hooks have the usual shape, with one secondary tooth. In the distal part of the arm-branches the arm-spines (or tentacle scales) gradually assume the shape of hooks, only somewhat larger and coarser than the hooks of the dorsal side of the arms (Fig. 22).

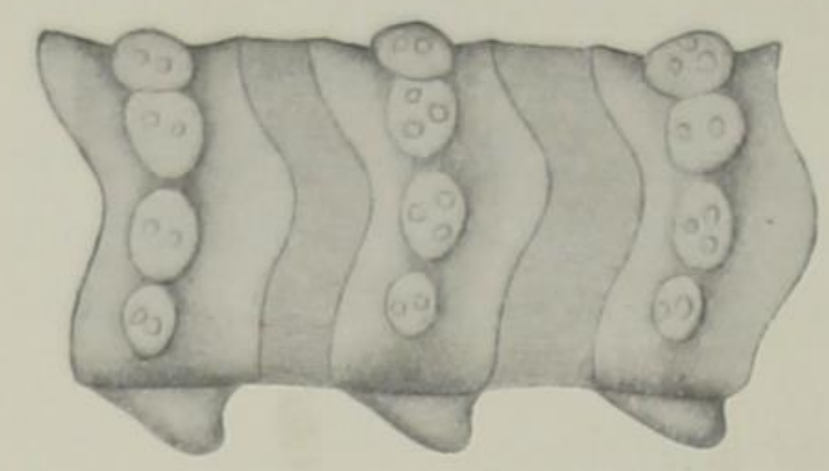


Fig. 21. Three armjoints from distal part of arm of *Astrocladus euryale* (Retzius), side view. The covering granules removed, in order to show the belt of small plates lying on each vertebra. × 12.

The tubefeet, which are sheathed as usual in the Gorgonocephalids, are very faintly developed; only the mouth tubefeet are well developed, with the sheath full of small calcareous plates. The mouth is remarkably small, due to the fact that the distal part of the mouth-angles is covered over through the skin of each two neighbouring jaws uniting for a distance of a couple of millimetres (Pl. XVIII. Fig. 7). The gonads are extremely numerous, small, apparently without any regular arrangement. The eggs are very small, ca. 0.1 mm, which fact may indicate that it has a pelagic larval stage.

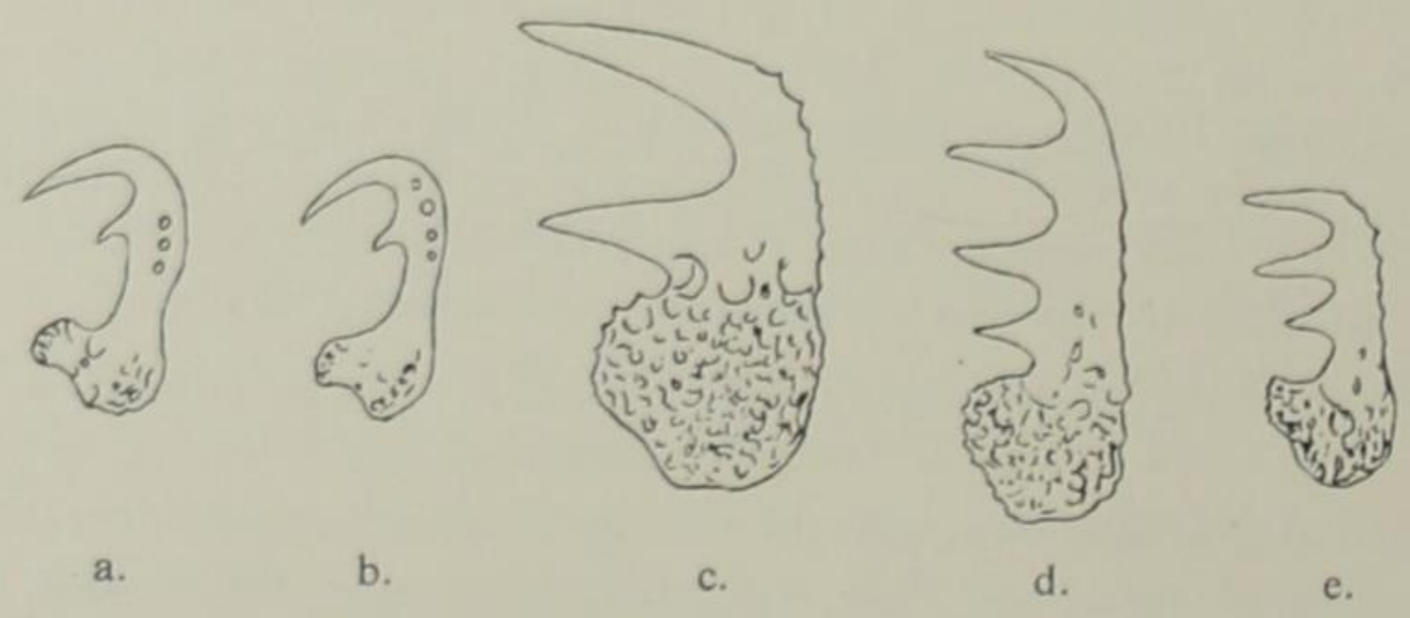


Fig. 22. Hooks and armspines of *Astrocladus euryale* (Retzius). a—b. Hooks of dorsal side of arm; c—e. transformation of armspines in distal part of arms. × 120.

A number of specimens were opened, in the hope of finding parasites (*Protomyzostomum*) in them, but nothing was found. The smallest specimens were ca. 20 mm diameter of disk. It is rather important to notice that these young specimens, about the identification of which

there cannot be the slightest doubt, have the arm spines (or tentacle papillæ) well developed also on the proximal part of the arm, before the first forking, even from the 2nd foot-pore.

In some material sent me from the S. African Museum there are two very young specimens, of 5.5 and 6 mm diameter of disk, which I think must be *A. euryale* (one from off Cape Peninsula, Vasco da Gama N. W. $^3/_4$ N. 41 fms., the other from S.E. of East London, 32 fms.). Here the large tubercles have scarcely begun to form on the disk; in the smaller of them there is still a trace of naked radial shields.

As pointed out by Clark, it appears that the distribution of *A. euryale* is very restricted, and that it is one of the eminently characteristic S. African forms. There are, however, two statements found in literature of its occurrence outside S. African waters. Bell (Op. cit.) records it from Providence Island (N. of Madagascar), and Stiasny & Groenewegen (Verzeichniss d. Ophiuriden Sammlung d. Naturhist. Reichsmuseum Leiden. Zool. Mededeelingen 's Rijks Mus. Nat. Hist. Leiden. XII. 1929, p. 178) record it from Jobi, New Guinea, and from the Moluccas.

The two specimens from Providence Isl. referred by Bell to *Gorg. verrucosus* = *Astrocladus euryale*, have been lent me for reexamination from the British Museum. As I expected beforehand, Bell's identification is erroneous. The two specimens very clearly belong to the genus *Astroglymma*, characterised by having 5 madreporites, and the hooks provided with a secondary tooth. Of course, Bell could not then know of the genera created later on by Döderlein for the various groups within the Gorgonocephalids; but to refer them to so easily recognisable and relatively well known a species as "*Gorg. verrucosus*" is certainly unpardonable; the merest glance at the specimens shows the large tubercles of "*G. verrucosus*" to be absent and that there is no likeness at all between the two forms, beyond the fact that they are both Gorgonocephalids. Of the two specimens the smaller, 10 mm diameter of disk, is indistinguishable from specimens of *Astroglymma Robillardi* (de Loriol) of a corresponding size; the larger, 20 mm diameter of disk, differs from *A. Robillardi* in having branched spines on the disk. It is described in my "Studies of Indo-Pacific Euryalids" (Vid. Medd. Dansk Naturh. Foren. Bd. 96, 1932, p. 38) as var. *spinosum* of *A. Robillardi*.

As for the specimens from New Guinea and the Moluccas recorded

by Stiasny & Groenewegen, I am informed by Dr. Stiasny that the labelling is unreliable, so there is in their records no proof at all for the occurrence of *A. euryale* outside the S. African Seas. *Astrocladus euryale* accordingly is known only from the S. African Seas, from off Cape Peninsula to off East London, and from depths of 15—90 meters.

Family *Trichasteridæ.*

Astroceras spinigerum n. sp.

Pl. XVIII. Figs. 8—9.

Diameter of disk 7 mm; arms rather short, scarcely more than ca. 5 times the diameter of disk, but none of them complete. Radial shields narrow, rib-like, each with a very conspicuous series of 3—4 thick, cylindrical, smooth spines, the outermost the largest, the innermost the smallest. The disk otherwise naked. As a continuation of the spines of the radial shields there is a double series of quite similar spines along the dorsal side of the arms, one pair to each joint. On the proximal 4—5 joints they are as large as the outermost ones on the radial shields, then gradually they become reduced in size, until on the last joints where they are found, the 15—17th, they are only quite small tubercles. The proximal 4—5 joints are widened for accommodating the gonads, and in this part there are distinct "bars", which carry the spines.

The mouth papillæ are represented by few, small, round warts, which become somewhat larger and more numerous deeper down on the sides of the jaws. The infradental papilla rather unusually slender for an *Astroceras*, but the teeth are broad and strong as usual in this genus. The adoral shields are short and square, the buccal shields so rudimentary as not to be distinctly observable. The lateral arm plates are broad, joining in the ventral midline till far out on the arms, at least in the proximal half length of the arms, the vertebræ having in accordance herewith the ventral furrow open. In the distal part of the arms the vertebræ have the ventral furrow closed over as typical of the Trichasterids (cf. Th. Mortensen. Studies of Indo-Pacific Euryalids. Vid. Medd. Dansk Naturhist. Foren. Bd. 96, 1932, p. 3). The ventral arm plates beyond the second are small, somewhat irregular in outline, but fairly distinct. The two first ones are rather large, the second may be divided into two (Fig. 23. a.). The two arm-spines,

beginning normally at the second pore-pair, are short, cylindrical, with the end thorny; the inner one not longer than the outer one, even in the middle of the arm. In the distal part of the arms they are transformed into hooks of the shape usual in Trichasterids (Fig. 23. b.). Colour a uniform greyish-brown.

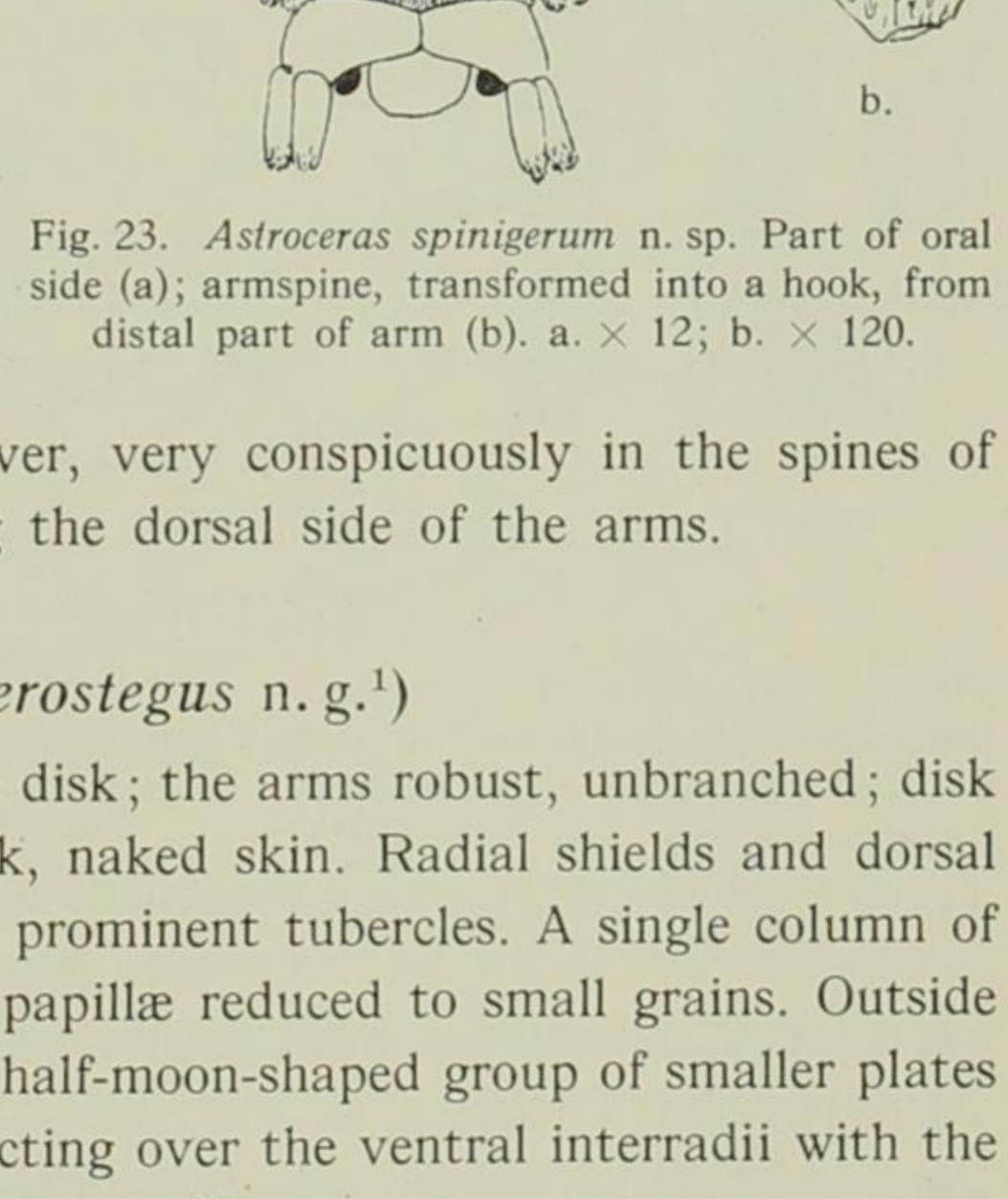


Fig. 23. *Astroceras spinigerum* n. sp. Part of oral side (a); armspine, transformed into a hook, from distal part of arm (b). a. × 12; b. × 120.

The single specimen of this species I took on board the "Pickle" off Durban (29°48′ S. 31°18′ E.) at a depth of 225 fathoms, on a sandy bottom with sponges. 22. VIII. 1929.

Through the character of the lateral arm plates joining in the ventral midline this species is related to *Astroceras compar* Koehler, from which it differs, however, very conspicuously in the spines of the radial shields and along the dorsal side of the arms.

Asterostegus n. g.[1])

A Trichasterid with large disk; the arms robust, unbranched; disk and arms covered with thick, naked skin. Radial shields and dorsal side of arms with numerous prominent tubercles. A single column of rather strong teeth; mouth papillæ reduced to small grains. Outside the adoral shields there is a half-moon-shaped group of smaller plates forming a kind of roof projecting over the ventral interradii with the deep-lying, nearly vertical genital slits.

Genotype: *Astrostegus tuberculatus* n. sp.

This genus stands nearest to *Astroceras*, particularly *Astroceras compar*, but differs markedly from it in the unique character of interradial plates forming a projection like a roof over the proximal part

[1]) τὸ στέγος — the roof.

of the interradius. Also the numerous large tubercles on the dorsal side of the arms is a very unusual character probably of generic value.

Asterostegus tuberculatus n. sp.

Pl. XIX. Figs. 4—5.

One specimen in rather poor condition, taken off Durban, 209 fathoms (Fisheries Survey).

Diameter of disk 23 mm, arms probably ca. 15 times the length of the disk diameter; they are all incomplete and rather much coiled up so that their exact length cannot be ascertained.

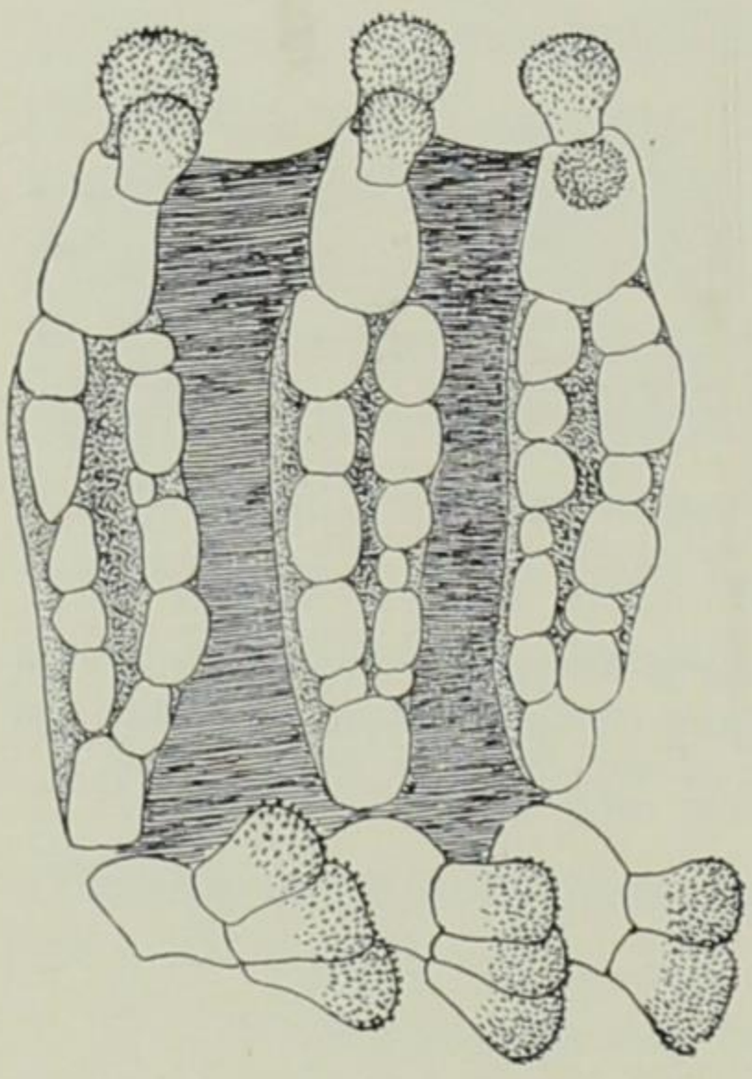


Fig. 24. Part of arm of *Asterostegus tuberculatus* n. sp., in side view, cleaned in order to show the series of small plates continuing from the lateral plates to the "bars". × 8.

The disk is not reenteringly curved at the interradial edges. The radial shields form (in the dried specimen) slightly raised ribs, well separated from each other; they carry each an irregular series of round tubercles, in the distal part forming an irregular group of 3—5. There is an irregular plate near the centre of the disk, indicating that there is likely to be a rosette of distinct primary plates in the young specimens. The skin between the radial shields and in the interradii entirely naked, but along the interradial edges of the disk are seen some few small tubercles.

The arms are very robust, ca. 6 mm broad at the base, distinctly higher than broad (ca. 8 mm high) and distinctly compressed, the sides being vertical. Along the dorsal side each segment normally carries, on each side, two conspicuous tubercles like those of the radial shields, attached to the upper end of short, but distinct "bars"; thus there are four series of tubercles along the dorsal side of the arms, more or less regularly, there being sometimes three tubercles to a bar instead of two, more rarely only one. The tubercles continue to about the middle of the arm, becoming gradually smaller, reduced to quite small granules; these latter also totally disappear in

the distal part of the arm, which is thus quite naked. In the proximal part of the arms the sides are apparently quite naked, but through the skin is seen a more or less distinct rugosity. On dissolving the skin it is seen that there is on each vertebra a double series of small, low plates continuing up till where the "bar" originates (Fig. 24). The gonads, as

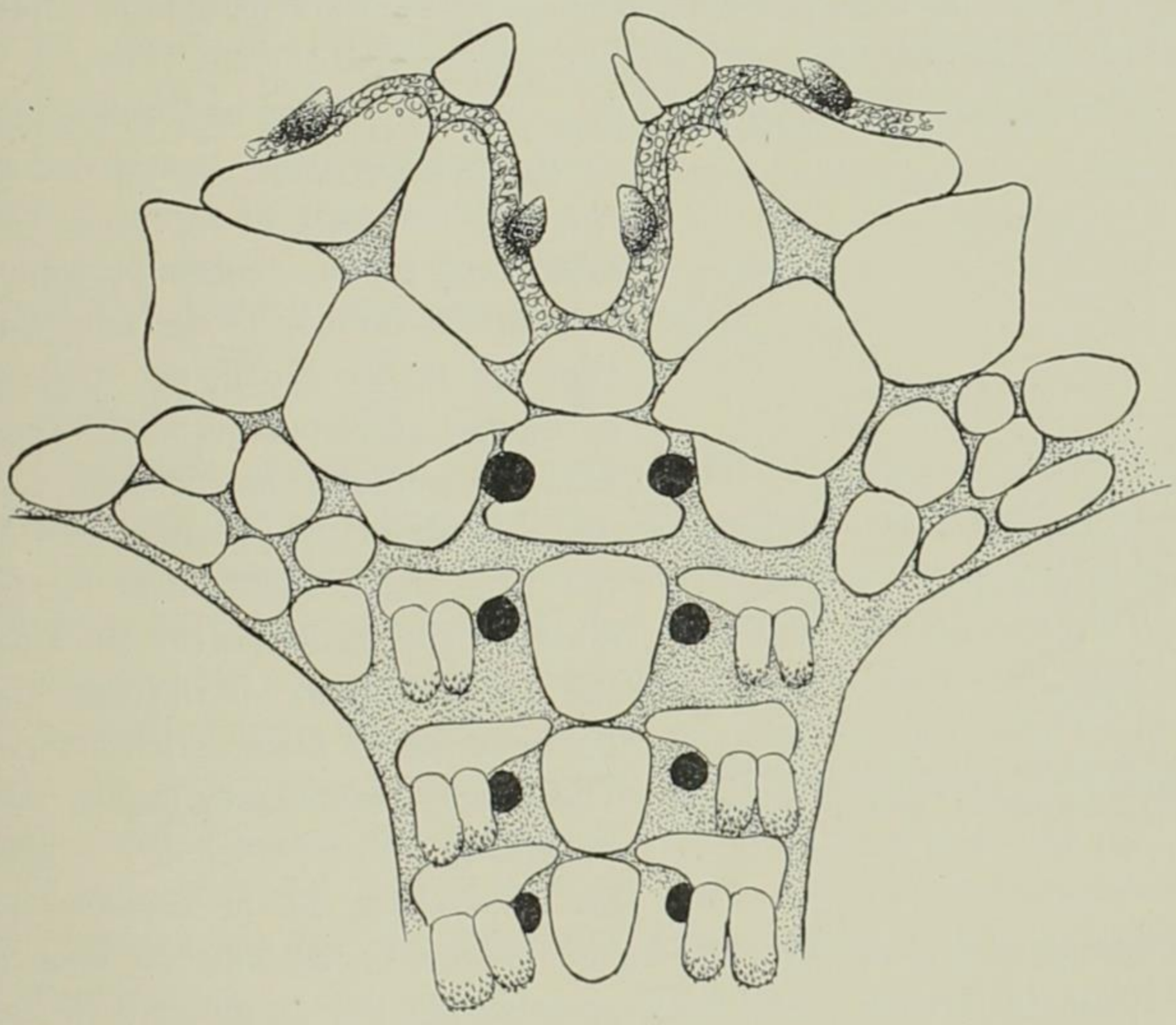


Fig. 25. Part of oral side of *Asterostegus tuberculatus* n. sp. Cleaned, in order to show the plates distinctly. × 6.5.

usual in the unbranched Trichasterids, are only one pair to each arm, passing out along the dorsal side of the arm in the cavity supported by the bars. But they are here passing much farther out on the arm than usual, even to about the 25th joint. The gonads are thus of an extraordinary length, but — in the present, male specimen, at least — rather thin, the dorsal cavity being not very wide.

On the mouth frame and along the oral side of the arms are found some few, scattered grains, just visible through the thick skin (when dried). The jaws are short, carrying a single vertical series of not very conspicuous, well spaced teeth, and a number of very fine granules on the sides, but no true mouth papillæ. The buccal tubefeet placed

on the middle of the jaw side, nearer the upper edge, not at the corners of the mouth slits as is otherwise the usual position. The adoral plates square, rather thick. Outside the adoral plates is found a number of 4—5 rounded plates, arranged in a semi-circle, joining the edge of the mouth frame, and outside these again 2—3 similar plates, all these plates together forming like a roof over the inner part of the ventral interradius, the genital slits also being for a great part covered thereby (Fig. 25).

The ventral arm plates are rather unusually large and well developed, elongate oval, contiguous in the proximal part of the arm. The lateral arm plates accordingly do not join in the midline of the arm, but they are rather broad, not reduced to narrow spine-bearing shafts (Fig. 25). In accordance herewith the vertebræ in about the proximal half of the arms have the ventral furrow open; in the distal part of the arms the ventral furrow of the vertebræ is closed as in other Trichasterids. The lateral plates carry usually two short, thick spines, which have almost the same shape as the tubercles on the dorsal side of the arm, the end being more or less widened, swollen or distinctly flattened, and finely spinous (Fig. 24). In places there are three or even four arm-spines. They remain short and of equal length till about the middle of the arm, also the lateral plates remaining low. Then rather suddenly the spines are transformed into hooks, of the typical Trichasterid shape (Fig. 26), and at the same time the lateral plates are transformed into the usual narrow shafts, at the end of which the two hooks are attached. The hooks are rather unusually large, but gradually become smaller in the distal part of the arm.

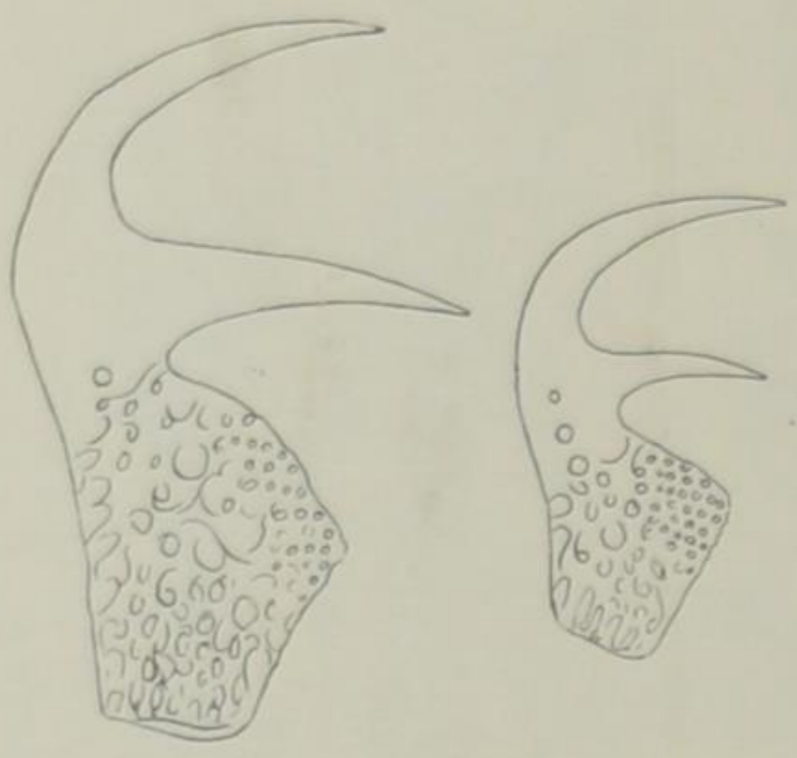


Fig. 26. Hooks (transformed armspines) from distal part of arms of *Asterostegus tuberculatus* n. sp. × 80.

The colour of the single, dried specimen is a uniform brownish.

Family *Asteronychidæ.*

Asteronyx Loveni Müller & Troschel.

Asteronyx Loveni Müller & Troschel. 1842. System d. Asteriden, p. 119. Taf. X. 3—5.

Asteronyx Loveni Koehler. 1904. "Siboga" Oph. I. p. 167.
— — H. L. Clark. 1911. North Pacif. Ophiurans, p. 285.
— — Döderlein. 1911. Japan. u. a. Euryalae, p. 115.
— — Th. Mortensen. 1912. Über Asteronyx Loveni. Z. wiss. Zool. 101.
— — H. L. Clark. 1916. "Endeavour" Echinoderms, p. 78.
— — Matsumoto. 1917. Monogr. Jap. Oph. p. 33.
— — Koehler. 1922. Oph. Philippine Seas ("Albatross"), p. 34.
— — H. L. Clark. 1923. Echinod. Fauna S. Afr. p. 314.
— — Döderlein. 1927. Indopacif. Euryalae. p. 59. Taf. 7. 7—8.
— — Koehler. 1930. Oph. des Mers d'Australie et de l'Arch. Malais, p. 23.

Some specimens got from the Fisheries Survey, viz.

33°37′ S.	16°55′ E.	1000 fathoms.	1 specimen.
31°21′ S.	16°17′ E.	246 —	4 —
31°17′ S.	16°11′ E.	254 —	3 —

The larger specimens are ca. 35—40 mm diameter of disk. None of the arms are complete, but the longest must have been at least ca. 350 mm, probably more. (Matsumoto gives the arm length of a specimen 42 mm in diameter of disk as 500—590 mm).

Some of the larger specimens were opened in order to see, whether they would contain the parasitic Copepod, *Chordeumium obesum* (Jungersen)[1]) rather commonly found in the specimens from the Danish Seas. I did, however, not succeed in finding any.

I quite agree with H. L. Clark that the S. African specimens cannot be distinguished from the typical *A. Loveni*, which is a truly cosmopolitan species.

Family ***Ophiomyxidæ.***

Ophiomyxa vivipara Studer.

Ophiomyxa vivipara Studer. 1876. Über Echinod. a. d. antarkt. Meere. Monatsber. Akad. Berlin. p. 462.
Ophioscolex Coppingeri Bell. 1881. Echinod. of the Strait of Magelhan and the Coast of Patagonia. P. Z. S. 1881. p. 98. Pl. VIII. 6.

[1]) H. F. E. Jungersen. Chordeuma obesum, a new parasitic Copepod endoparasitic in Asteronyx Loveni. Rep. Brit. Ass. 1912. Mindeskrift for Japetus Steenstrup. I. No. XVI. 1914. — The name *Chordeuma* being preoccupied it was altered into *Chordeumium* by K. Stephensen in his description of *Arthrochordeumium appendiculosum*, a new endoparasitic Copepod in the Ophiurid *Astrocharis gracilis* Mrtsn. (Th. Mortensen & K. Stephensen. On a gall-producing parasitic Copepod infesting an Ophiurid. Papers from Dr. Th. Mortensen's Pacific Expedition 1914—16. II. Vid. Medd. Dansk Naturh. Foren. Bd. 69. 1918, p. 268).

Ophiomyxa vivipara Studer. 1883. Übersicht über die Ophiuriden d. "Gazelle". Abhandl. Akad. Berlin v. Jahr. 1882. p. 29. Taf. III. 15.
— — H. Ludwig. 1898. Ophiuren d. Sammlung Plate. Zool. Jahrb. Suppl. 4. p. 768.
— — Ludwig. 1899. Jugendformen v. Ophiuren. Sitz. ber. Akad. Berlin 1899. p. 26.
— — Koehler. 1908. Asteroidea, Ophiuroidea, and Echinoidea of the Scottish Nat. Antarctic Exped. "Scotia". Zool. Vol. V. p. 278.
— — H. L. Clark. 1915. Cat. Rec. Oph. p. 170. Pl. 2. 1—2.
— — — 1923. Echinod. Fauna S. Afr. p. 313.
— — Th. Mortensen. 1924. Echinod. New Zealand & Auckland-Campbell Islands. II. Ophiuroidea. p. 114.

Some specimens got from the Fisheries Survey, viz.
34°17′ S. 17°58′ E. 160 fathoms. 4 specimens.
34°21′ S. 17°57′ E. 178 — 3 —
33°02′ S. 16°53′ E. 200 — 2 —

The suggestion by Clark (Op. cit.) and by myself (Op. cit.) that the S. African specimens are not really the same species as the *Ophiomyxa vivipara* of the Patagonian seas still remains unproved for want of sufficient material of the latter form. As seen from the figures I gave in the work quoted, there is scarcely any appreciable difference between these two forms in the shape of the plates. It may also be stated that there is no reliable difference in the shape of the radial shields (as seen from the interior) in both forms; they may vary very considerably in shape even in the different radii of the same specimen. The only difference I can find, which would seem to hold good, is that in the S. African form there is only one spine at the proximal 5—6 pores, whereas in the Magellanic form there are two spines already at the third or fourth pore-pair. And even if this be a constant difference, it would seem a rather insufficient reason for regarding them as two separate species. At most, I think, we could then regard the S. African form as a variety of *Ophiomyxa vivipara*.

A very interesting observation was made on one of the S. African specimens in regard to the double anchors. These were found in fair numbers both in the dorsal skin, in the bursal wall and in the gonads; but in the stomach wall particularly they were exceedingly numerous and arranged vertically in the epithelium itself (Fig. 27), like a kind of pallisade work. In another specimen I found them arranged in the same way, but much less numerous, and in a third specimen there

were only very few double anchors in the stomach wall. The anchors differ from those of *Ophiomyxa australis* figured p. 112, fig. 5. 2, in my paper of 1924, in having a small thickening in the middle of the bar (Fig. 28. d.).

Quite young specimens with only 2—5 arm-joints, found in the bursæ, are interesting in showing a number of small, somewhat rudimentary spines on the dorsal side (fig. 28. a—c.). In larger young ones as well as in the adult there is no trace of spines. The young ones grow to a very considerable size before leaving the bursa of the mother, up to 5 mm diameter of disk, and an arm length of 15—20 mm, with up to ca. 30 segments. There is usually 1—3 young ones in each bursa. I have found them of two different sizes in the same specimen, the smaller ones ca. 2 mm diameter of disk, with 2—4 arm joints, the larger ones ca. 5 mm diameter of disk and ca. 25—30 arm joints. The larger ones may be exceedingly much folded up.



Fig. 27. Section of stomachal wall of *Ophiomyxa vivipara* Studer, containing numerous double anchors. × 110.

Ludwig (Op. cit. p. 274) states that in the young ones is seen "an der medianen Seite eines jeden Tentakelpores an den unteren Gliedern der jungen Arme die Anlage einer zarten, relativ langen Tentakelschuppe, die beim alten Thiere gänzlich in Wegfall kommt

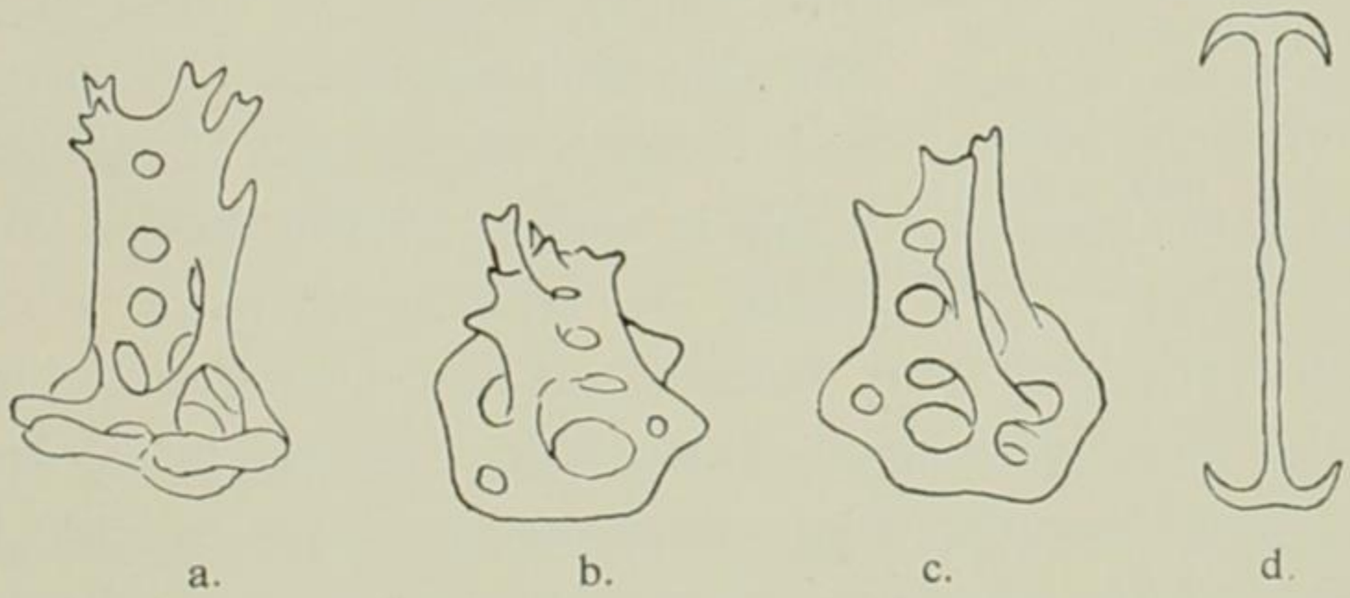
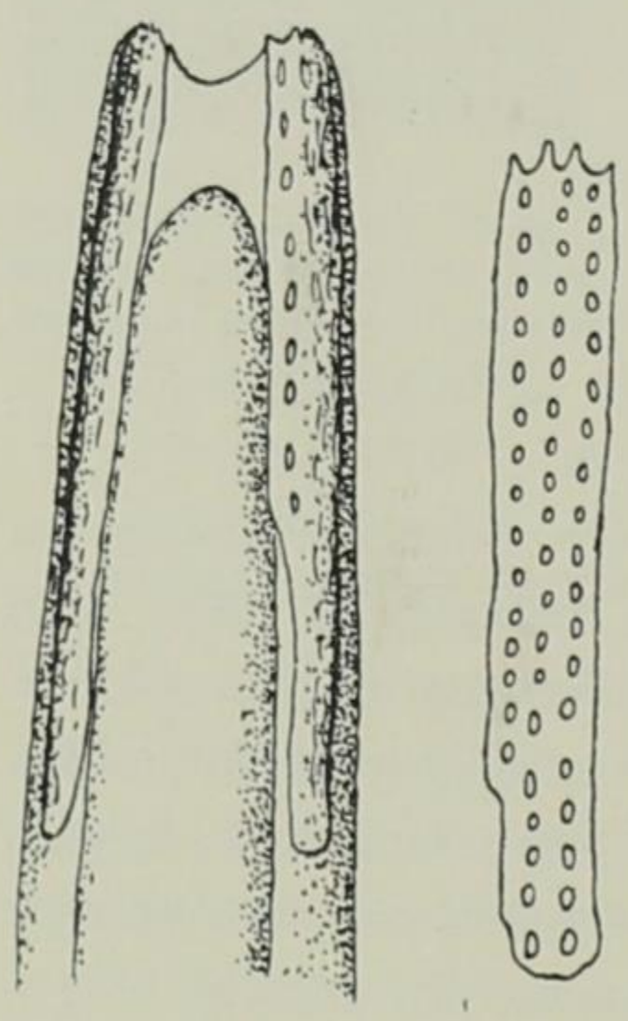


Fig. 28. *Ophiomyxa vivipara* Studer. a—c. Spines of young ones from the bursæ; d. double anchor. × 225.

oder nur noch als Rudiment vorhanden ist". Finding no traces of tentacle scales in the young ones of the S. African specimens, I thought that we might perhaps have herein an important difference between the two forms, the young ones of the S. American form having a tentacle scale, the S. African form having no such scale. On a closer examination of some young ones of the S. American form I found a

trace of a tentacle scale only at one pore in one specimen, but a rather broad one, evidently something different from what Ludwig observed. In fact, I have little doubt that what Ludwig saw was not the tentacle scale, but the slender, calcareous plates lying in the end of the sheath surrounding the tubefeet in *Ophiomyxa* (Fig. 29; description and figures of this structure in *Ophiomyxa serpentaria* are given in my report on the "Ingolf" Ophiuroidea, p. 13). Thus there is no difference herein between the S. African and the S. American form. It may further be pointed out that also in the S. American form spines are found on the disk, in the smaller of the young ones, only, it would appear, in a rather smaller number than those of the S. African form.



a. b.

Fig. 29. *Ophiomyxa vivipara* Studer. Point of tubefoot, showing sheath with the two calcareous plates (a); an isolated calcareous plate from sheath (b). × 220.

The double anchors are found in good numbers already in the youngest stage present, lying below the plates, probably in the stomach wall. The glassy plates are not yet found in the smallest specimens, only fenestrated plates as in other Ophiurids, but in those of ca. 5 mm diameter of disk they are present, together with the normal fenestrated plates. These latter are partly in evident transformation into glassy plates, the holes being more or less completely filled out; but it is likewise evident that glassy plates are forming also directly as small glassy disks, without holes. No doubt the main part of the exceedingly numerous glassy plates filling the skin of the disk of the adult have originated in this way, directly, not through the transformation of originally fenestrated plates.

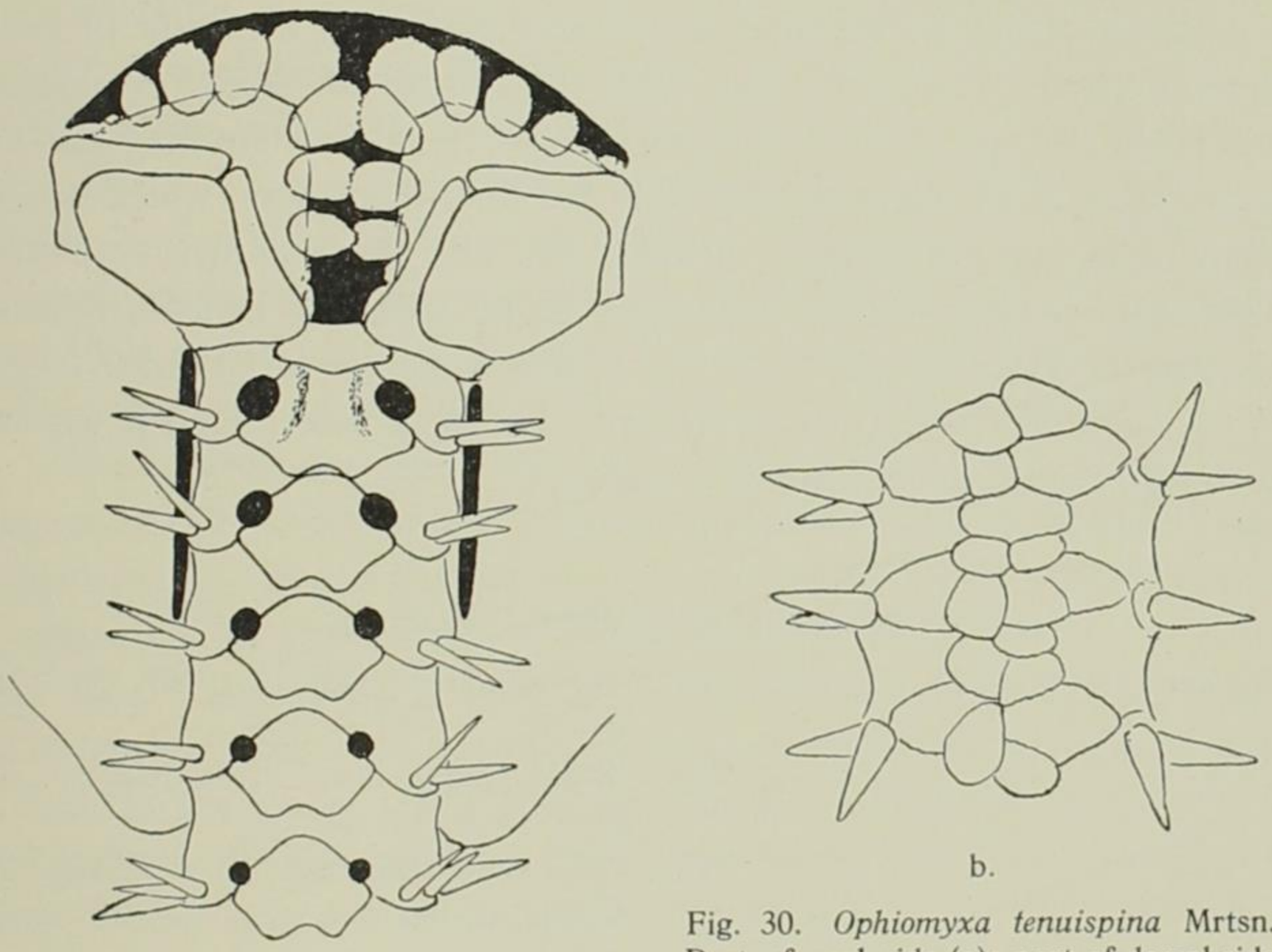
Ophiomyxa tenuispina n. sp.

Pl. XIX. Fig. 27.

One specimen from the "Pieter Faure" collection; P. F. 13476. Sandy Point N.$^1/_4$E. 10 miles, 95 fms., rock. (ca. 50 miles N. of East London). Ca. 12 mm diameter of disk, arms broken.

Mouth papillæ with indistinctly serrated margin, 3 to each side of jaw. Buccal shield rather broad, distinctly broader than long, with

rounded edges; adoral shields narrow, just meeting in the median line. First ventral arm plate small, rhomboidal; the following ones about as broad as long, with an outer notch and the outer corners produced (Fig. 30. a.). They are distinctly separated from each other. Dorsal plates distinct, a group of ca. 4 irregular plates in the midline and a larger plate to each side, reaching to the lateral plate (Fig. 30. b.). The spines are rather unusually slender, particularly on the proximal



a. b.

Fig. 30. *Ophiomyxa tenuispina* Mrtsn. Part of oral side (a); part of dorsal side of arm (b). × 9.

part of the arms, and the lowermost one is both the most slender and the longest, about the length of an arm joint. There are 2 spines on the joints within the disk; the free joints have almost regularly 4 spines, the uppermost of which is the strongest; some few joints here and there have only 3 spines; they are very erect. Marginal plates distinct. The genital slits reach to about the 3rd joint.

As usual in *Ophiomyxa* a rather thick skin covers the whole animal, so that the exact shape of the plates can only be seen after the skin has been dissolved.

The colour of the dried specimen is a uniform creamish-white.

The specimen is a male; there is then no possibility for ascertaining

whether the species is viviparous or not, the two known viviparous species of *Ophiomyxa*, *O. vivipara*, and *O. brevirima* having separate sexes.

This species is very clearly distinct from *Ophiomyxa vivipara*, particularly the shape of the ventral and dorsal armplates leaving not the slightest doubt of their being two separate species. It would seem that this new species is the most nearly related to the New Zealand species *Ophiomyxa brevirima* H. L. Clark, with which it agrees in the shape of the ventral and dorsal arm plates; as a matter of fact, the only noteworthy difference is in the armspines, which are longer and more slender in the S. African species. Possibly there may also be found to be some slight difference in the double anchors, which would seem to be somewhat more slender, and also more numerous in the S. African species. If it be ultimately found that also *O. tenuispina* is viviparous, then I should think it to represent only a variety of *O. brevirima*. But until its eventual viviparity has been ascertained it will be better to regard it as a distinct species.

Ophiomyxa bengalensis Koehler.

Ophiomyxa bengalensis Koehler. 1899. "Investigator" Oph. I. p. 69. Pl. XII. 91—92.
— — — 1922. Oph. Philipp. Seas. "Albatross" p. 17. Pl. 5. 5—6; 92. 1.
— — — 1930. Oph. Mers d'Australie et de l'Archipel Malais. p. 48.

Some specimens got from the Fisheries Survey, viz.
29°43′ S. 32°21 E. 140 fathoms. 3 large specimens.
Off Durban, 305 fathoms. 1 large specimen, in rather poor condition.

On comparing the figures given here (Fig. 31) of this species with the figures of *O. bengalensis* given by Koehler in his Report on the "Investigator" Ophiurids, Pl. XII. 91—92, one would not think it possible that they could represent the same species. These figures of Koehler's are, however, anything but good, a recognition of which fact is also implied in Koehler's statement in the "Albatross" report that the photographic figures there given "show better than my figures published in 1896 and 1899 the habitus of this species". They certainly do, and a comparison of the specimens at hand with these latter figures leaves hardly any doubt of their identity. Further, I have some specimens

from the Kei Islands, identified by Koehler himself as *Ophiomyxa bengalensis*[1]), and they also quite agree with the S. African specimen.

Also the description given by Koehler needs various corrections, so I think it better to supply a new description based mainly on the specimens from S. Africa.

The mouth papillæ are rather pointed, not such broad scales as otherwise usual in *Ophiomyxa*, and they are only very finely serrate along their edges. There is, however, much variation in the shape of these papillæ, even from jaw to jaw in the same specimen. The buccal shields are almost semicircular, with a small outer lobe; there is no inner angle, as is stated in Koehler's description — probably it has been so in the type specimen; the specimen figured in the "Albatross" report shows the inner edge rounded as in the present specimens. The adoral plates may or may not have an outer lobe, separating the buccal shield from the first ventral plate; this varies within the same specimen as is also seen on Pl. 5. 5 of the "Albatross" Ophiuroidea.

The ventral arm plates have got a most extraordinary shape in the figure of the "Investigator" report, looking rather like a pair of small dumb bells — due to the fact that Koehler did not clean his specimen sufficiently, so that he saw only the two somewhat raised outer lobes. As seen from fig. 31. a (and also from Pl. 5. 5 of the "Albatross" Ophiuroidea) they are of quite usual Ophiomyxid shape, with a deep notch in the distal edge. The two first are contiguous, the following ones distinctly separated by the ventral plates which join in the mid-line. Dorsal arm plates are quite rudimentary or absent, represented only by some small, irregular plates lying on the dorsal side of the vertebræ in the proximal part of the arm (Fig. 31. b.), otherwise it is only the vertebræ which are seen through the skin. Three slender, finely serrate arm-spines about the length of an arm joint, the uppermost one usually somewhat thickened. The two-three first joints have as a rule only one spine, then one or two joints with two spines; from the fourth or fifth there are three. No tentacle scale.

The radial shields are fairly well developed. According to Koehler marginal plates are completely absent. This does not quite hold good. They are quite distinct across the arm base, connecting the radial

[1]) Not all the specimens mentioned in Koehler's work of 1930 as *O. bengalensis* are really this species. This need, however, not concern us here, as it has no bearing on the geographical distribution of the species.

shields; in the interradii they are rather rudimentary, but still they are there, forming the usual belt along the interradial margin, only less conspicuous than usual in *Ophiomyxa*.

The skin of the disk does not contain the usual glassy disks; instead I find it to contain numerous small, delicate c-shaped spicules (Fig. 31. c.), a feature not known from any other Ophiomyxid. On

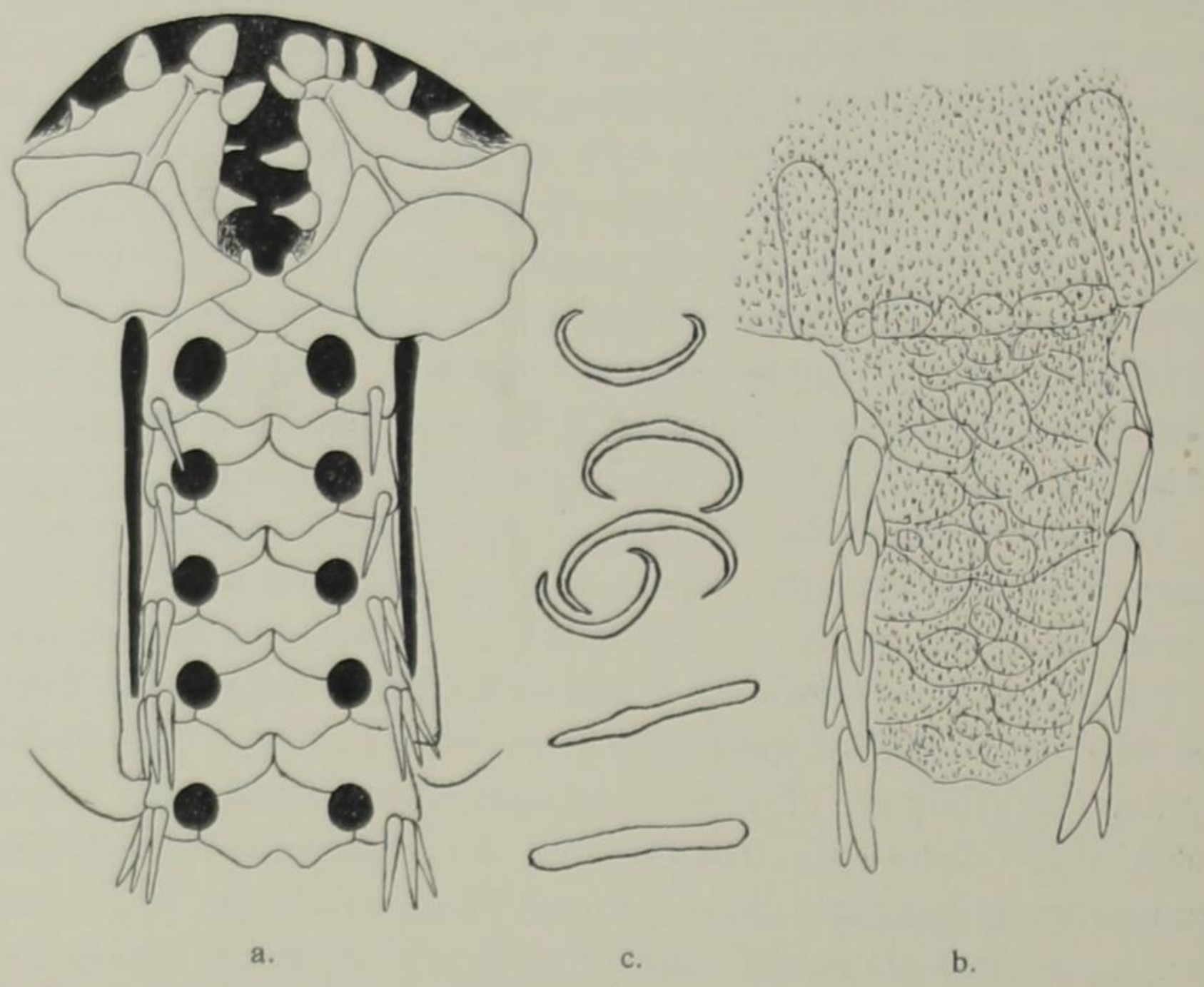


Fig. 31. *Ophiomyxa bengalensis* Koehler. Part of oral (a) and of dorsal side of disk and arm (b). Spicules from skin of disk (c-shaped) and from the stomach wall (rod-shaped) (c). a—b. × 6; c. × 340.

the other hand the double-anchors, otherwise so characteristic of *Ophiomyxa*, appear to be completely absent. In the stomach wall small simple rods (Fig. 31. c.) occur together with the c-shaped spicules.

A very characteristic feature of *O. bengalensis* is the presence of a number of small, irregular, white spots on disk and arms, as seen very well on Pl. 5. 6 of the "Albatross" Ophiuroidea. In the "Investigator" report Pl. XII. 91 they are represented very exaggeratedly as distinct, round granules. On a microscopical examination I find them to be quite irregular heaps of exceedingly minute calcareous grains.

The "Investigator" took this species at the Andaman Islands, its

occurrence in the S. African seas is then not so unexpected. It is otherwise known from the Philippines and the Kei Islands, so it will be sure to be distributed over the whole Indo-Malayan region. As to its bathymetrical distribution a curious mistake has crept into the "Albatross" report, p. 17. It is stated there that it was found at the Andamans in depths between 250 and 1073 fathoms (457—1962 meters); in the "Investigator" report it is given as 250 and 173 fathoms, so the 1073 is a rather serious lapsus! In reality the known bathymetrical distribution is: 250—550 m.

Ophioscolex (*Ophiolycus*)[1]) *dentatus* Lyman.

Ophioscolex dentatus Lyman. 1878. Oph. & Astroph. of the "Challenger". Bull. Mus. C. Zool. V. p. 157. Pl. VII. 184—186.
— — — 1882. "Challenger" Oph. p. 233. Pl. XXIV. 4—6.
— — Bell. 1905. Echinoderma. Marine Invest. S. African III. p. 259.
— — H. L. Clark. 1923. Echinod. Fauna S. Africa. p. 314.

Several specimens I dredged onboard the "Pickle", XII. 1929, viz.
34° 5′ S. 18° 1′ E. 118 fathoms. 10 specimens.
34°17′ S. 18° 5′ E. 160 — 8 —
34°21′ S. 17°57′ E. 178 — Several specimens.
34°23′ S. 18° 8′ E. 157 — 2 specimens.

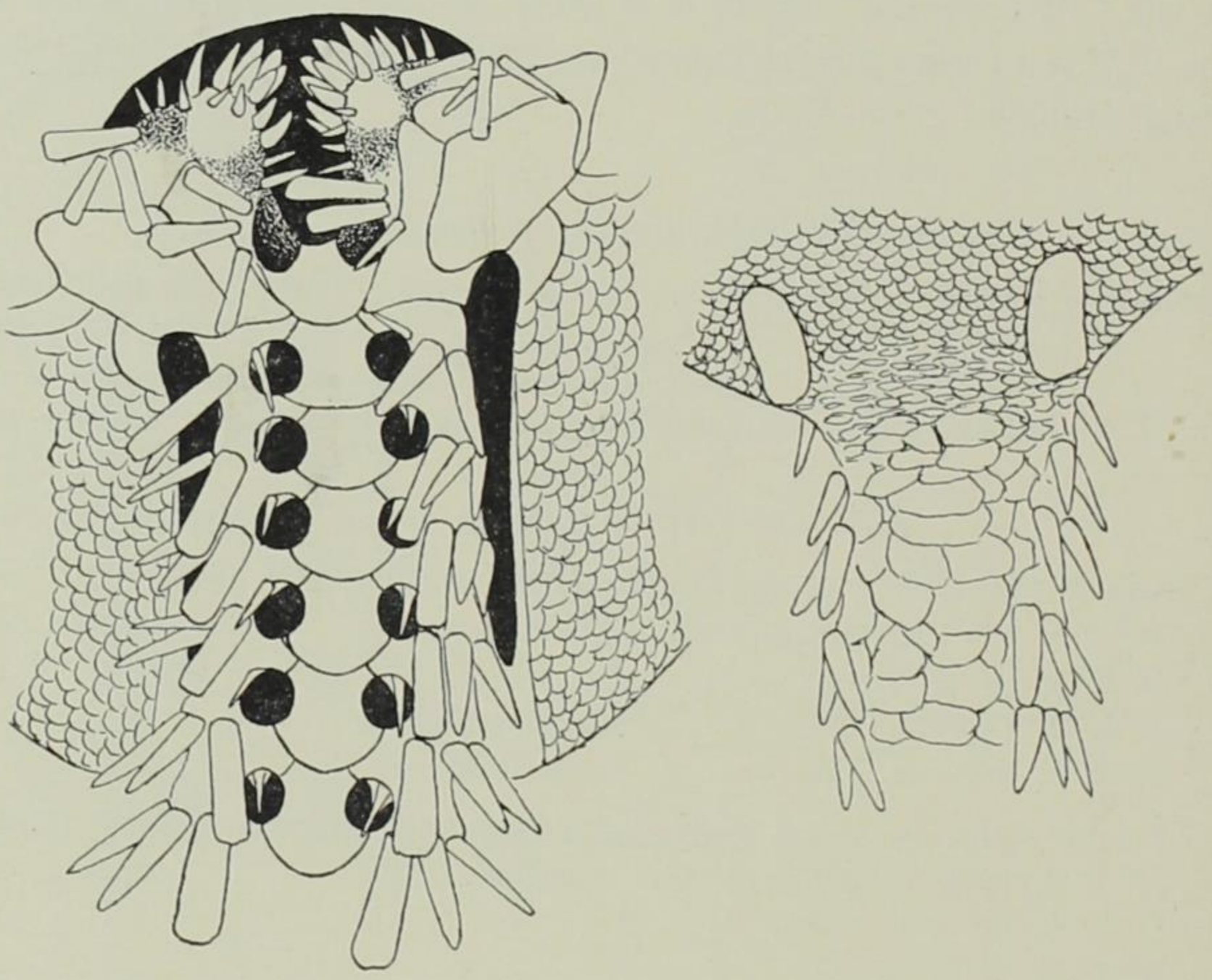
Further, some specimens were received from the Fisheries Survey, from:
33° 6′ S. 16°52′ E. 225 fathoms. 1 specimen.
31°29′ S. 17° 1′ E. 153 — 2 —
32°37′ S. 17°15′ E. 90 — 1 —
32° 2′ S. 16°53′ E. 200 — 1 —

H. L. Clark (Op. cit.) with full right observes that the figures of this species given by Lyman are not very satisfactory, without, however, supplying any new figures. I have then thought it desirable to give such figures here, drawn from dried specimens, showing the outline of the plates etc. distinctly, which Lyman's figures do not. Particularly the indications of the ventral arm plates in Lyman's figures are very misleading. As for the three outer mouth papillæ I would say that in one alcoholic specimen I find them very much as shown in Pl. XXIV. 4 of the Challenger Oph., as also the tentacle scales are in alcoholic specimens, on the whole, as shown in Lyman's figures, the enclosing skin being much broader than the enclosed

[1]) As for the name *Ophiolycus*, see p. 315.

calcareous scale. When dried the real shape of the scales, as well as of the mouth papillæ comes out clearly (Fig. 32).

The mouth papillæ form a whole cluster on the apex of jaws in adult specimens; on the sides follow 2—3 very slender papillæ, and then the 3 (more rarely 4) outer papillæ, which are very much longer, usually flattened and widened towards the point. Sometimes there is



a. b.

Fig. 32. *Ophioscolex* (*Ophiolycus*) *dentatus* Lyman. Part of oral (a) and dorsal side (b). × 8.

another long and slender papilla placed abradially to these papillæ, on the edge of the adoral plate. The jaws are raised into a conspicuous knob at the apex. The mouth shields are distinctly broader than long, with an obtuse inner angle; the adoral plates, which are meeting within, may have a broad outer lobe separating the mouth shield from the first lateral plate — or there may be no outer lobe at all — both cases to be found in one and the same specimen (Fig. 32. a.).

The ventral plates are, on the whole, — particularly in young specimens — somewhat longer than broad, contiguous, with a rounded, more or less prominent, outer edge; a good deal of variation, however, obtains in the shape of these plates, particularly in regard to their

distal edge (Figs. 32. a., 33. b.). The tentacle scale is slender, setaceous, about as long as the diameter of the pores, or a little more. The dorsal arm plates are more or less irregularly split up into a number of smaller plates; often they are only divided into two plates, especially in young specimens (Figs. 32. b., 33. a.).

The arm-spines are usually characteristic in the lowermost one being flattened and much broader than the others; it may even be much more so than those of the specimen represented in fig. 32. a., sometimes widening towards the end so as to be quite spatulate. There is, however, much variation in this regard also. In the distal part of the arm the two uppermost spines are transformed into hooks (Figs. 33. c.).

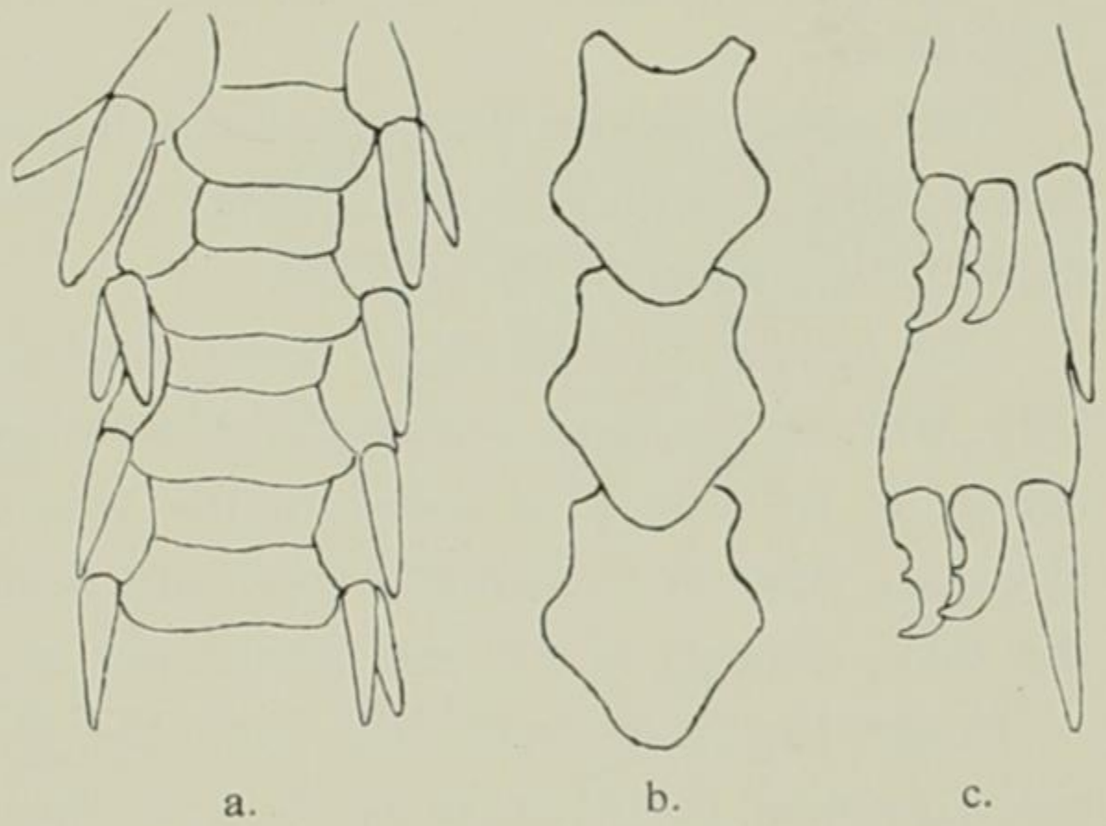


Fig. 33. *Ophioscolex* (*Ophiolycus*) *dentatus* Lyman. a. Part of arm of young specimen, dorsal side, showing division of dorsal plates; b. three ventral armplates; c. two armjoints from distal part of arm in side view, showing the two uppermost spines transformed into hooks. a—b. × 12. c. × 30.

When dried the disk is seen to be covered with minute, imbricating

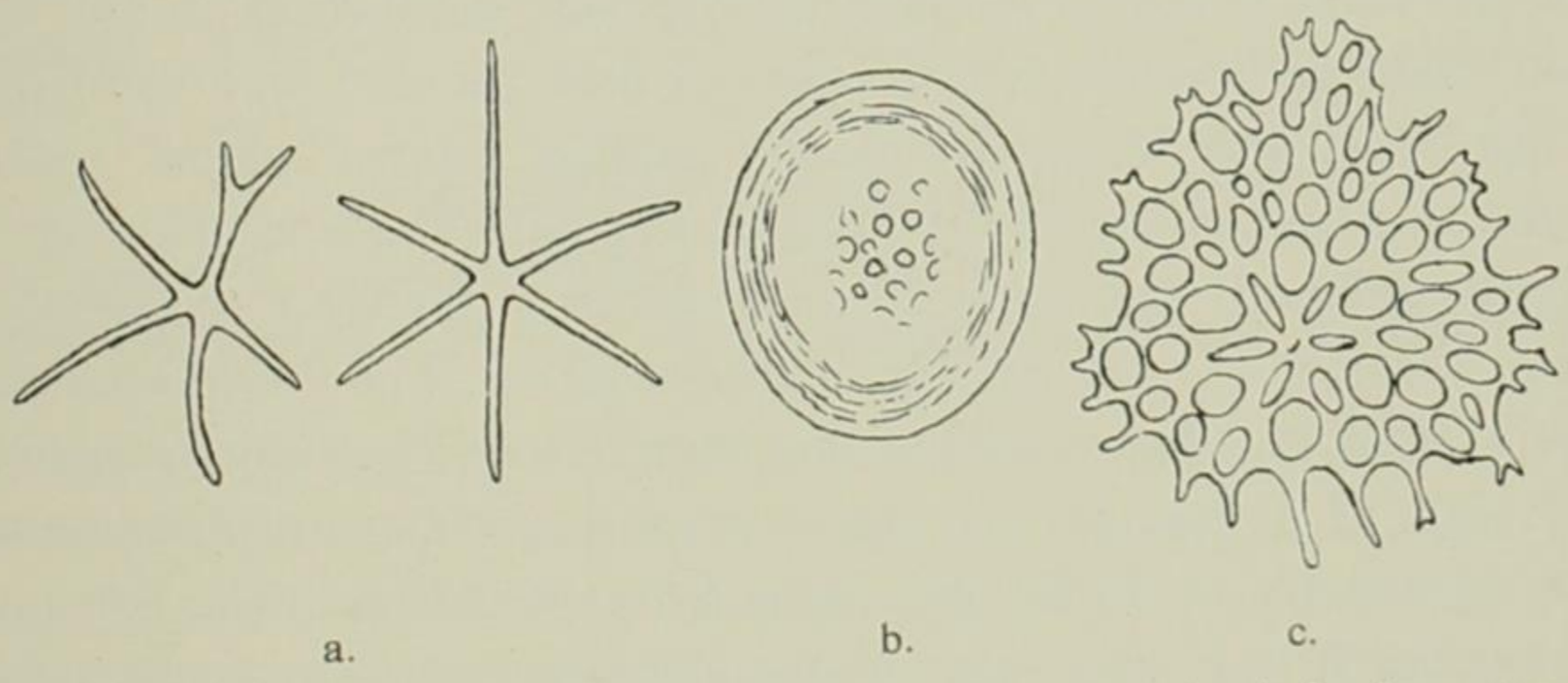


Fig. 34. *Ophioscolex* (*Ophiolycus*) *dentatus* Lyman. a. Star-shaped spicules from stomach wall; b. glassy plate from skin of disk; c. spicule from bursal wall. × 120.

scales of the usual *Ophioscolex*-type, clear, glassy plates with a few holes in the centre, and a more or less distinct concentric striation in the outer part (Fig. 34. b.). The radial shields are fairly distinct, narrow, elongate.

In the stomachal wall are found a number of beautifully star-shaped spicules (Fig. 34. a.) usually with 5—6 rays, but 3—4 rayed samples also occur; some of the rays may be a little branched. The spicules of the bursal wall have the more usual shape of fenestrated plates (Fig. 34. c.).

The colour of the live specimens is a beautiful dark red, on the dorsal side of both disk and arms. — The largest specimens have a diameter of disk of 15—16 mm.

This species is, evidently, closely related to *Ophioscolex purpureus* Düb. Kor. of the North Atlantic, of which it is the southern representative. It may even be questionable whether they are not in reality identical. Also in *O. dentatus* there are sometimes some few spines on the disk, though much less commonly so than in *purpureus*.

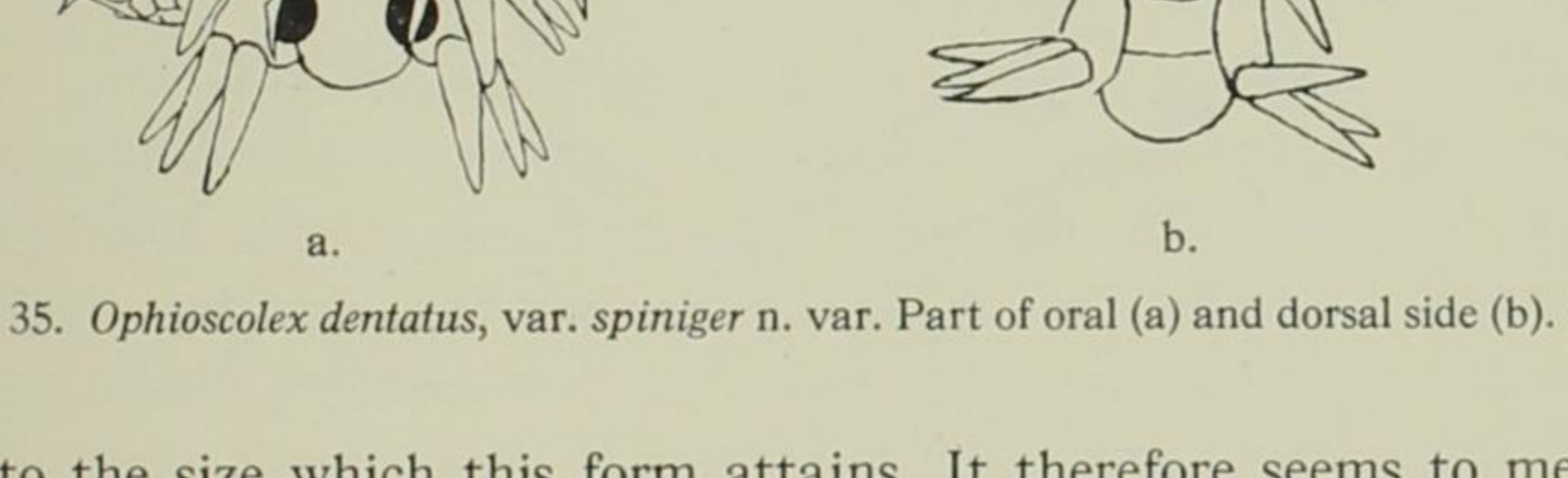
O. dentatus is known only from the S. African Seas. The known bathymetrical distribution is 90—225 fms.

Ophioscolex dentatus, var. *spiniger* n. var.

Off Durban, 29°56′ S. 31°19′30″ E. 225 fathoms. Sandy mud. 26. VIII. 1929. 3 specimens, dredged on board the "Pickle", the largest having a diameter of disk of 7 mm, an arm length of ca. 25 mm.

These specimens differ rather conspicuously from the typical *dentatus* in the disk being set with scattered small spines. As, however, a few spines may sometimes be found on the disk also of *O. dentatus*, this character is not so reliable for a specific distinction — and other good distinguishing characters I do not find. As seen on a comparison of figs. 35. a. and 32. a., the mouth papillæ, ventral plates, tentacle scales, arm spines are in the main alike; only the buccal shields are slightly different, but there is much variation in their shape in *dentatus*, so this is no very reliable character either. The dorsal arm plates would seem to offer a conspicuous difference (Fig. 35 b. to compare with figs. 32. b. and 33. a.); but in young specimens of *dentatus* they may be exactly as in the specimens from off Durban. The two upper arm spines in the distal part of the arms are transformed into hooks also in the specimens from off Durban. The absence of radial shields in fig. 35. b. is no reliable character either, as in another radius of the same specimen they are fairly distinct. On the whole, there is scarcely any other reliable character distinguishing the two forms than the spines of the disk.

The specimen of 7 mm diameter has the gonads strongly developed, which may mean that this form does not grow to nearly as large a size as the typical *dentatus;* if so, it should no doubt be regarded as a good species. But the scanty material at hand cannot give any certainty



a. b.

Fig. 35. *Ophioscolex dentatus*, var. *spiniger* n. var. Part of oral (a) and dorsal side (b). × 12.

as to the size which this form attains. It therefore seems to me the best course for the present to regard this form only as a variety of *Ophioscolex dentatus*.

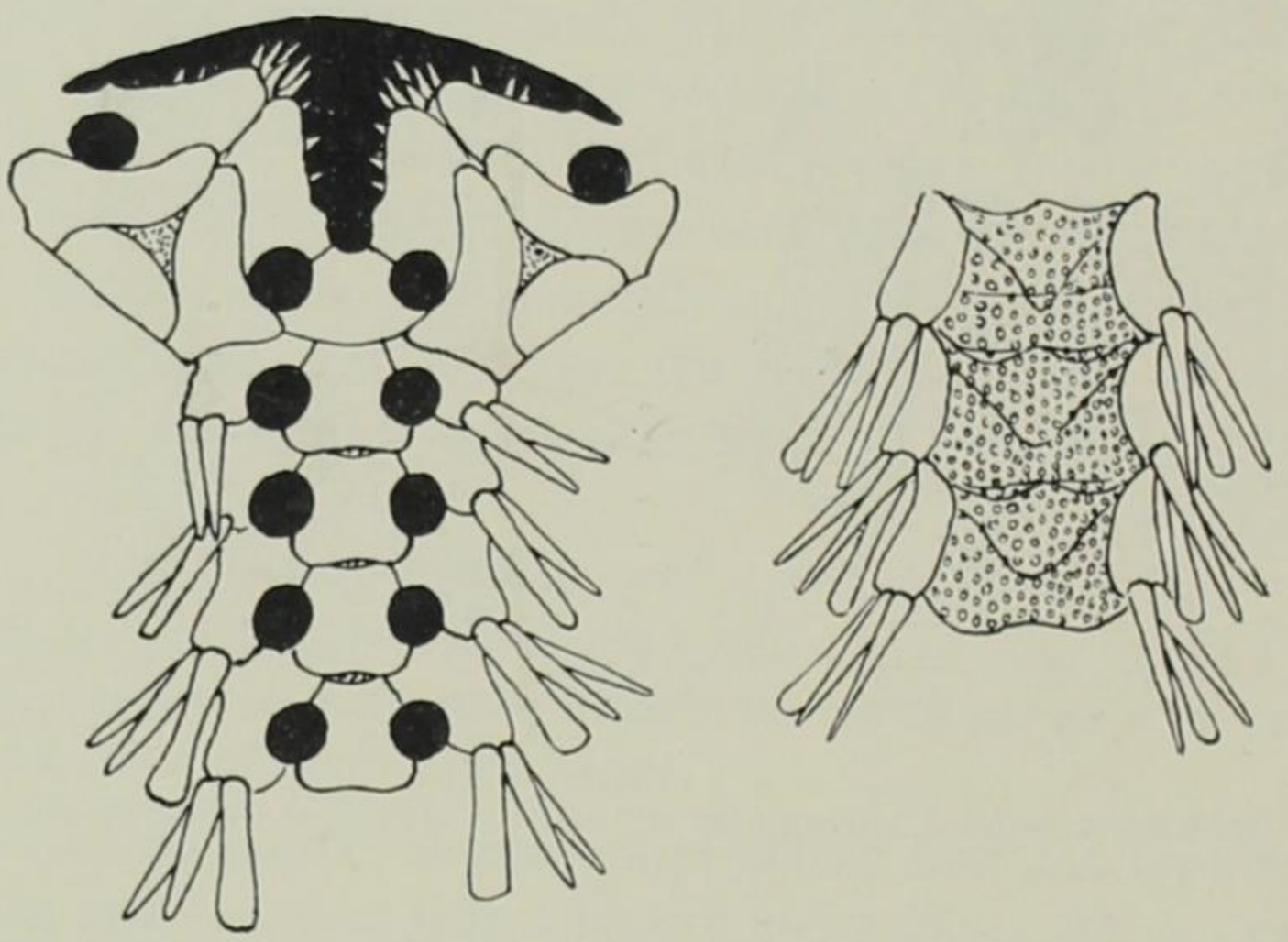
Ophioscolex inermis n. sp.

One specimen, dredged on board the "Pickle".
Off Durban, 29°56′ S. 31°19′30″ E. 225 fathoms. Sandy mud. 26. VIII. 1919.

The specimen is in poor condition, the disk lacking — dissolved as usually happens in *Ophioscolex*, when not preserved at once on coming out of the water. It is, however, seen by the traces of the skin left that the diameter of disk must have been ca. 8 mm. One arm is preserved almost complete; it is a little over 20 mm long and has probably been ca. 25 mm long when complete.

The mouth papillæ are few, small, and slender; on the apex there is a cluster of slightly longer papillæ, continuing a little downwards on the jaw, representing the "teeth", which must, however, be said

to be rather rudimentary. The second oral pores are distinctly outside the mouth edge. The buccal shields are very small, with rounded, semicircular inner edge and straight (or slightly concave) outer edge. The adoral plates are large, conspicuously prolonged adorally. The ventral arm plates are slightly longer than broad, with the distal edge a little concave (Fig. 36. a.). At a first glance one would rather say that dorsal plates are lacking; but as a matter of fact they are



a. b.

Fig. 36. *Ophioscolex inermis* n. sp. a. Part of oral side; b. dorsal side of three arm-joints, showing delicate dorsal plates, through which the vertebræ are seen. × 12.

there, only they are so delicate as to let the vertebræ shine through (Fig. 36. b.). They are very broad, contiguous, with a notch in the distal edge; in places it seems that they are divided by a transverse line into two parts. Three long and slender, somewhat glassy arm spines, the lowermost usually distinctly club-shaped. Upper arm spines not transformed into hooks in the distal part of the arms. No tentacle scales. — In the small rag of the dorsal skin preserved no glassy plates are found, only some scattered, small, delicate, fenestrated plates.

This species is evidently the most nearly related to *Ophioscolex glacialis*, from which it differs, however, markedly in the absence of the spine on the adoral plates, so characteristic of *O. glacialis*. According to Matsumoto (Monograph of Japanese Ophiuroidea. 1917.

Journ. Coll. Sci. Tokyo. XXXVIII. p. 8—9) *Ophioscolex* belongs to the group of the *Ophiomyxidæ* which have the second oral tentacle pore opening entirely within the oral slits, and the present species thus would seem not to be referable to the genus *Ophioscolex*. But in *O. glacialis*, the genotype of the genus *Ophioscolex* the second oral pore is in reality in the same position as in the present species, but on account of the sloping of the jaw, and of the presence of the spine on the adoral plate it has rather the appearance of the pore being inside the mouth slits, which it is in reality not, and the mouth papillæ do not pass outside this pore, as they do in *O. dentatus* (and *purpureus*). Thus there is herein no objection to referring the present species to the genus *Ophioscolex*. On the other hand, it also seems to fit perfectly with the genus *Ophiocynodus* of H. L. Clark (N. Pacif. Ophiurans, p. 274), with which it also agrees in the lowermost arm spine being club-shaped. But, as a matter of fact, I do not see how *Ophiocynodus* can be distinguished from *Ophioscolex* (also in *O. glacialis* the lowermost arm spine may be slightly club-shaped). I therefore think that *Ophiocynodus* should be regarded only as a synonym of *Ophioscolex*, which then falls in two distinct groups, one comprising the species *glacialis*, *corynetes*, and *inermis*, the other the species *purpureus* and *dentatus* (and probably also the other species having a tentacle scale), these latter having really the second oral pore inside the mouth slits, and also characterised by the two uppermost spines in the distal part of the arms being transformed into hooks. The latter group I think should rather be made a separate genus, or at least a subgenus, which I shall name ***Ophiolycus*** (*ὁ λύκος* — hook).

One more species of *Ophioscolex* without tentacle scale has been described, viz. *O. serratus* H. L. Clark (Echinoderms of Porto Rico, Bull. U. S. Fish Comm. 1901. II. p. 250, Pl. XIV. 14—17). This species differs very conspicuously from the other true *Ophioscolex* species through its strongly serrate, flattened spines, which resemble those of the genus *Ophiostyracium* H. L. Clark (N. Pacif. Ophiurans, p. 253). The character of the dorsal side of its arms, as well as the absence of spines on its disk, however, forbid simply referring it to that genus. So far as can be gathered from the description and figures given by Clark, it is a real *Ophioscolex*, but standing rather apart from the other true *Ophioscolex* species.

Family ***Ophiacanthidæ.***

Ophiacantha nerthepsila H. L. Clark.

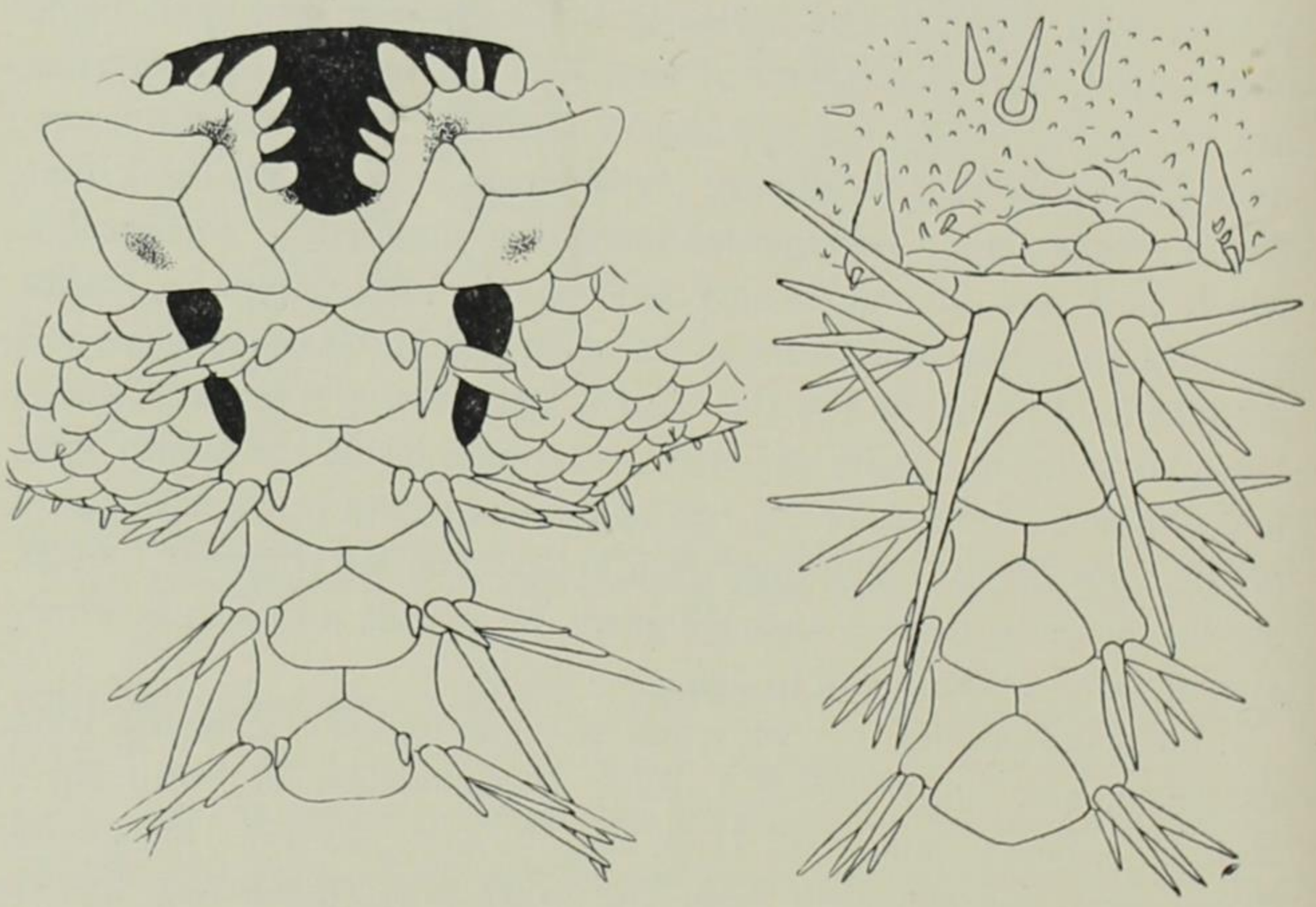
Ophiacantha nerthepsila H. L. Clark. 1923. Echinod. Fauna S. Africa, p. 319. Pl. XIX. 3—4.

— *Barracoutæ* Koehler. 1923. Sur quelques Ophiures des côtes de l'Angola et du Cap. Göteborg K. Vet. Vitterh. Samh. Handl. XXV. 5. p. 3. Figs. 1—3.

15 miles S.W. by W. of Cape Infanta, 48 fathoms. 14. XII. 1929. 7 specimens.

None of these specimens exceed a size of 4 mm diameter of disk, but they are adult, full of ripe sexual products.

Clark has drawn only the dorsal side of this species, and the photographic figure he gives of the oral side (Pl. XIX. 4) does not show



a. b.

Fig. 37. *Ophiacantha nerthepsila* H. L. Clark. Part of oral (a) and of dorsal side (b). × 20.

the details clearly. I have therefore thought it desirable to give a drawing of the oral side, as also of the dorsal side of an arm for showing the variation in the shape of the dorsal arm plates (Fig. 37).

The arm spines on the first free joint I find usually to join almost completely in the dorsal midline (Fig. 37. b.). The spines — or "spini-

form granules" — usually scattered among the granules of the disk may sometimes be totally lacking. The granules may continue till about midway in the ventral interradii. This is the case also in a cotype, which I have received from the S. African Museum. The buccal shields are more or less sunken in the middle.

There may be a large white spot in the centre of the disk.

It is rather remarkable that I found this species only in the above mentioned locality, whereas Clark has it from a good many localities, so that it would seem to be fairly common in the S. African seas.

There can be no doubt but that Koehler's *Ophiacantha barracoutæ* (from off Cape Barracouta, 40 fms.) is the same as Clark's *O. nerthepsila*. The question is only which of the two names has the priority. Both papers were published in May 1923. Koehler's paper was published on May 2nd, as I am informed by my friend Professor L. A. Jägerskjöld, Gothenbourg; the exact date of publication of Clark's paper it has, however, not been possible to ascertain. In view of this uncertainty I think it preferable to keep the name given by Clark, as his paper is much the more important and also much more easily accessible than Koehler's paper.

Ophiacantha scutigera n. sp.

Pl. XIX. Figs. 6—7.

Off Durban. 29°48′30″ S. 31°18′ E. 120 fathoms. 22. VIII. 1929. 6 specimens.
Off Durban. 30°2′30″ S. 31°3′ E. 90 fathoms. 27. VIII. 1929. 5 specimens.
Dredged onboard the "Pickle".

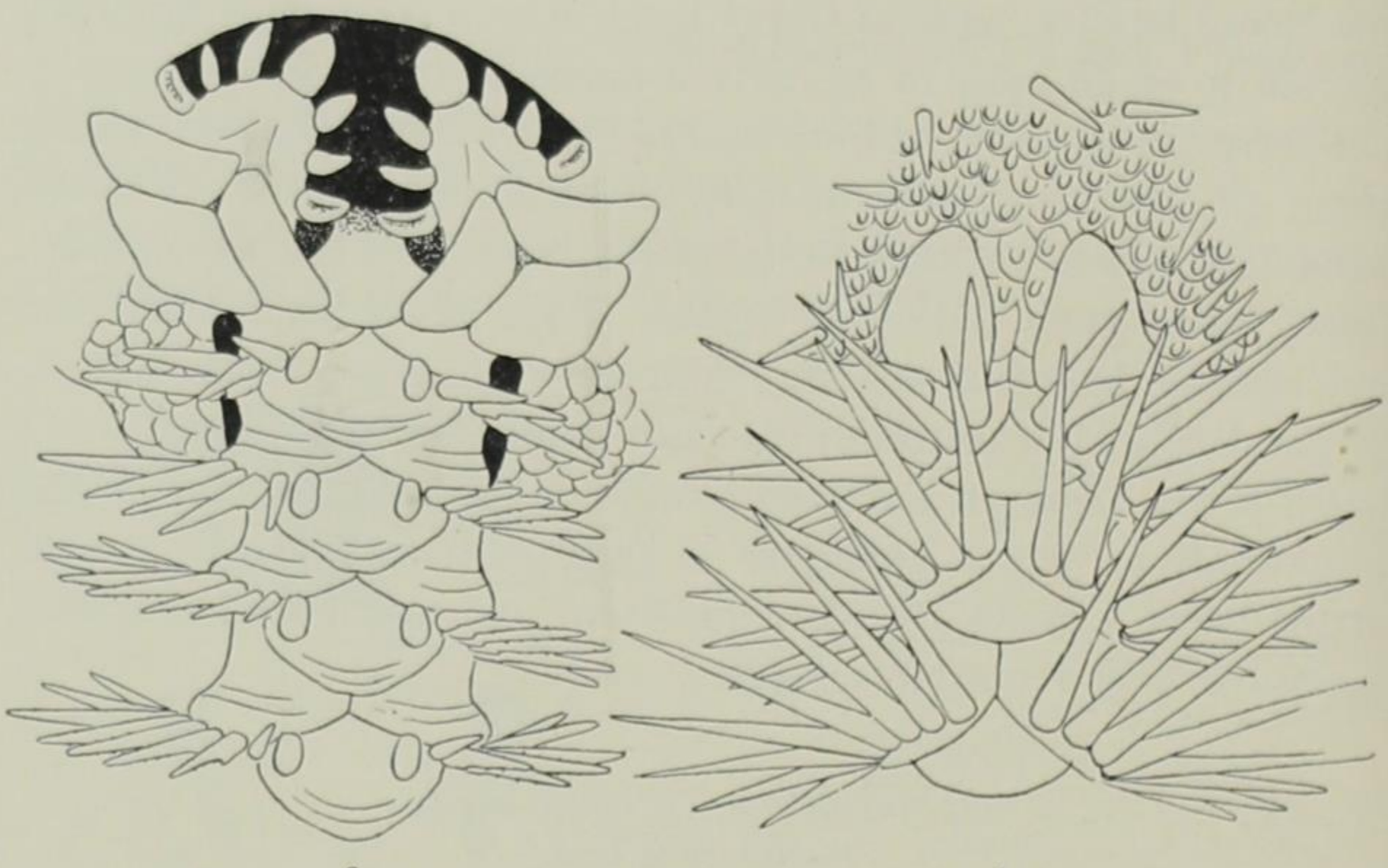
Diameter of disk 5 mm; length of arms ca. 30 mm.

Disk covered more or less densely with low, rounded, slightly rough stumps or grains, which may conceal the scales rather completely, except those between the radial shields; sometimes the scales are fairly distinctly discernible. Scattered among these stumps are found some slender, smooth, ca. 1 mm long spines in varying numbers; as a rule they occur more constantly in the centre of the disk and at the outer edge of the radial shields; these latter are about equally broad and long, and quite conspicuous, though rather small. They are separated by a varying number of scales. The scales of the ventral interradii are quite naked.

Mouth papillae three, exceptionally four to each side of jaw, the outer one slightly the largest, often rather distinctly concave on the

outer side. Buccal shields broader than long, with an obtuse inner angle and a not very pronounced outer lobe, or with the outer edge simply convex or even straight (Figs. 38. a.; 39. b.). There is thus rather much variation in the shape of the buccal shields. Adoral plates broad, meeting broadly within, but without any outer lobe, the buccal shield and first lateral plate thus in direct contact.

The first ventral plate rather large, hexagonal, the following ones



a. b.

Fig. 38. *Ophiacantha scutigera* n. sp. Part of oral (a) and dorsal side (b). × 15. The scales of the dorsal side somewhat too distinct in the figure.

with a very obtuse inner angle, the outer edge convex, with an indistinct median lobe. They are distinctly broader than long, slightly separated or just contiguous. The dorsal armplates are triangular, about twice as wide as long, with an acute inner angle and the outer edge more or less convex. They are widely separated (Figs. 38. b.; 39. c.). 10 arm-spines in the proximal part of arm, joining completely or nearly so in the dorsal midline (Fig. 39. a.). The upper ones are smooth, the lower ones somewhat serrate and particularly with a distinct prominence at the base, on the aboral side; they increase in length from below upwards, the uppermost being about the length of two arm joints. — One fairly large, rounded tentacle scale.

There is a quite marked concentric striation on the ventral and lateral armplates. The arms are not moniliform.

As a rule there are some conspicuous, small, dark spots round the radial shields and along the dorsal midline of the arms, standing out markedly against the grayish ground colour.

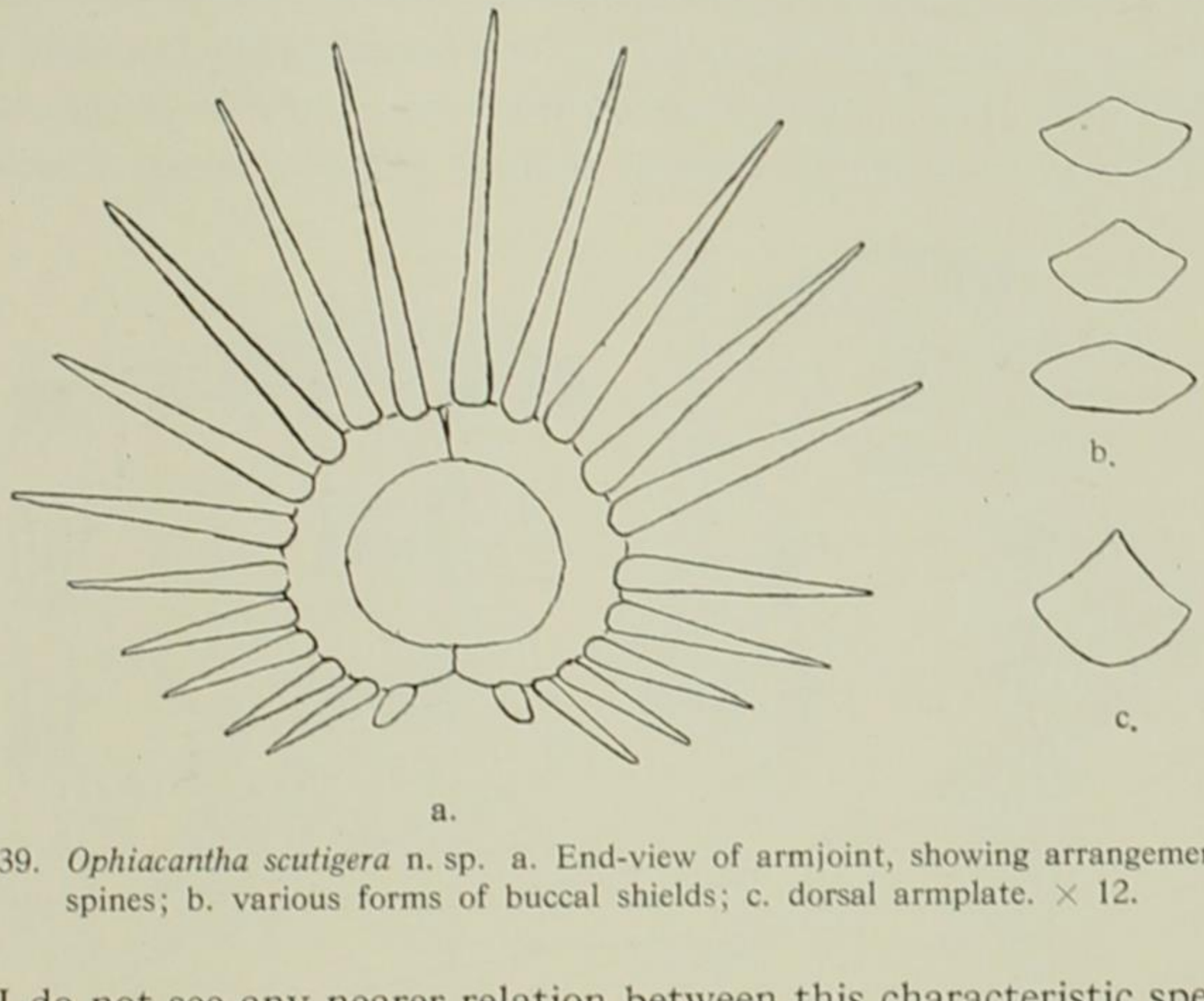


Fig. 39. *Ophiacantha scutigera* n. sp. a. End-view of armjoint, showing arrangement of spines; b. various forms of buccal shields; c. dorsal armplate. × 12.

I do not see any nearer relation between this characteristic species and any of the numerous species of *Ophiacantha* hitherto known.

Ophiacantha baccata n. sp.

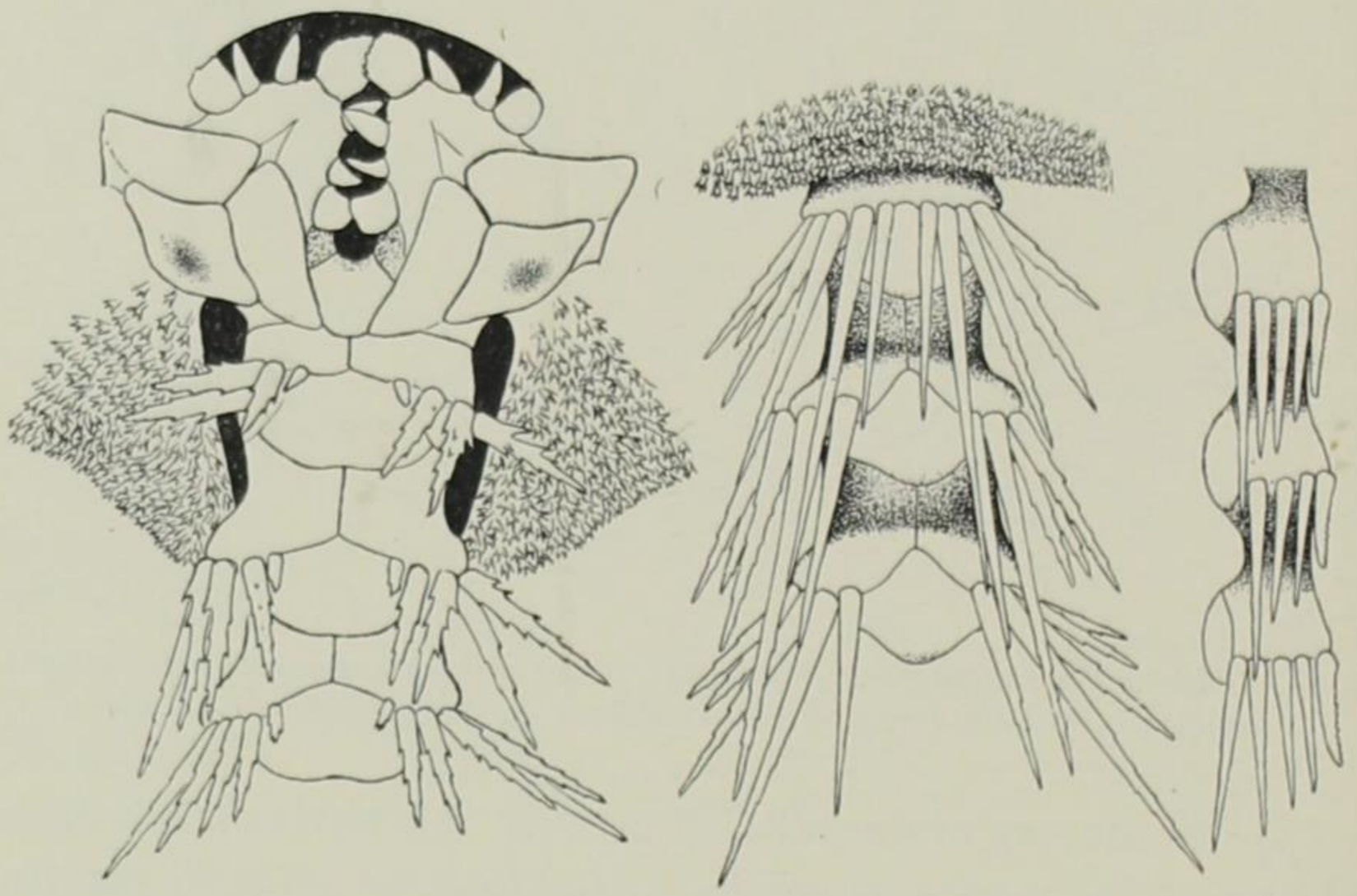
Pl. XIX. Fig. 8.

Off Durban, 29°59′ S. 31°7′30″ E., 127 fathoms. 3 specimens, dredged on-board the "Pickle", 27. VIII. 1929. Further, I have received from the Fisheries Survey several specimens in a poor state of preservation from 29°51′ S. 31°16′ E. 158 fathoms.

Diameter of disk 5 mm; length of arms ca. 30 mm. Disk closely covered with a uniform coat of delicate stumps terminating in three diverging, often bifurcating thorns (Fig. 41. a.). At most the distal end of the radial shields may be naked; but there is usually an indication of radial ribs. Ventral interradii also completely covered by the stumps, no scales being visible.

Three mouth papillæ to each side of jaw, the outermost one usually somewhat larger than the others; the fact that they are often placed on edge makes them appear somewhat more slender than they are

really; the infradental papilla distinctly the largest, somewhat indistinctly serrate. Buccal shields about twice as broad as long, inner sides concave, outer side convex, with an indistinct lobe; they have a rather distinct depression in the middle. Adoral shields very broad, with a narrow distal lobe separating the buccal shield from the first ventral plate; it is, however, set off from the main part of the adoral plate so as to appear like a small separate plate, which it is not, the



a. b. c.

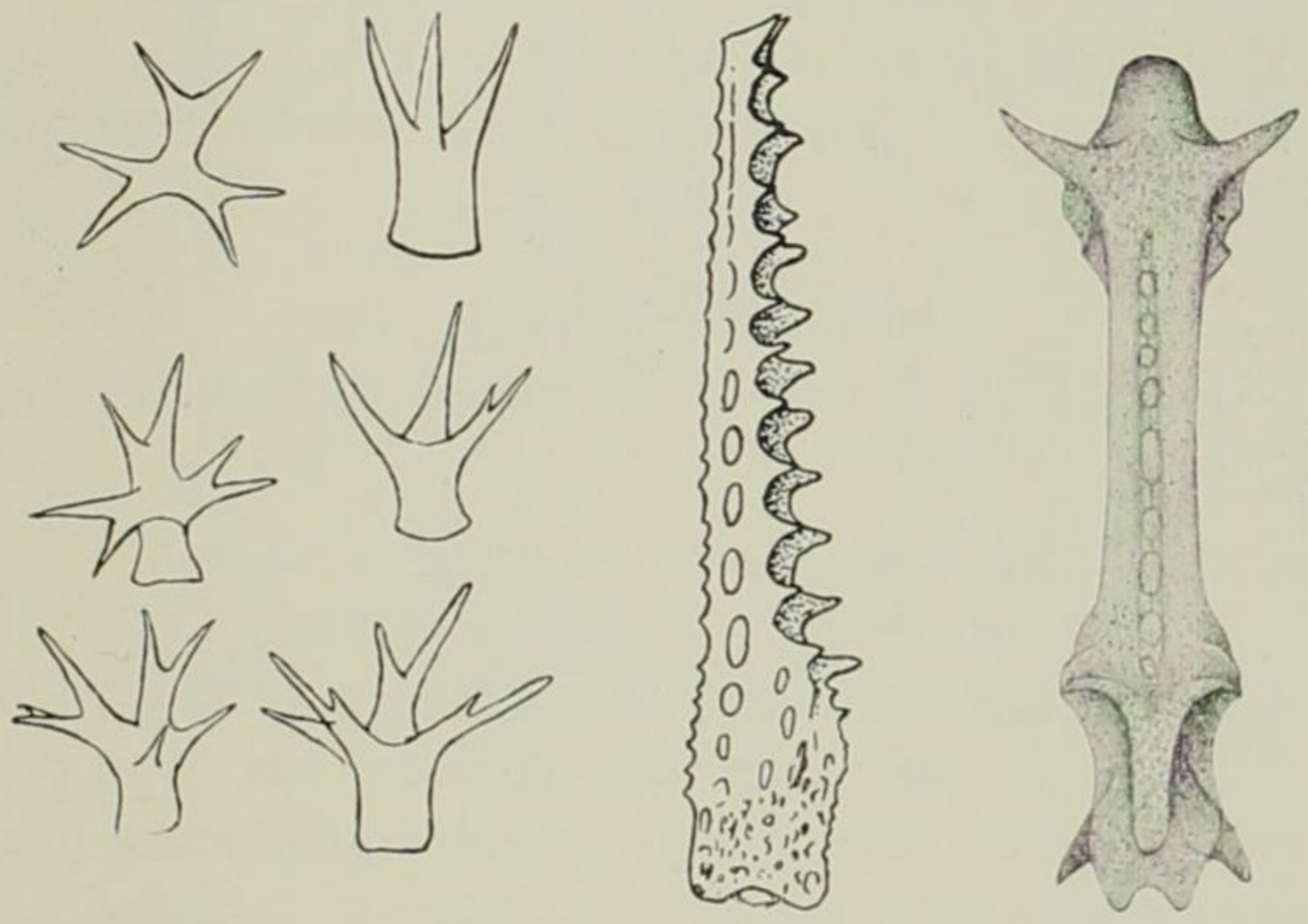
Fig. 40. *Ophiacantha baccata* n. sp. a. Part of oral side; b. part of disk and the dorsal side of the three proximal armjoints; c. three armjoints from distal part of arm, side view. × 15.

apparent dividing line being only the limit between the much thicker main part of the adoral plate and the somewhat sunken lobe (Fig. 40).

First ventral plate a little longer than broad, the following ones distinctly broader than long, particularly the second. They are widely separated; the inner angle is very obtuse, the outer edge slightly convex, with an indistinct notch in the middle. The dorsal arm plates are triangular, with the distal edge somewhat prominent. 6—7 spines at the base of arms, joining in the dorsal midline on the first free joint; they increase in length from the lowermost, which is scarcely as long as an arm joint, to the uppermost — or the second from above — which is about the length of two arm joints. The lower ones are strongly serrate, the serrations gradually diminishing upwards, the upper-

most spines being almost entirely smooth. A single small tentacle scale, which is somewhat serrate.

The arms are very strongly moniliform (Fig. 40. c.) (the species name *baccata* refers to this character); in the distal part of the arms this becomes still more pronounced through the fact that the constricted part of the joints consists of clear, transparent, calcareous substance almost without any reticulations, the long and slender,



a. b. c.

Fig. 41. *Ophiacantha baccata* n. sp. a. Stumps from the disk, seen from above and in side view; b. lowermost armspine from distal part of arm; c. vertebra from distal part of arm. a—b. × 125; c. × 95.

only partly coalesced vertebræ (Fig. 41. c.) being distinctly discernible through the transparent lateral plates. This structure makes the arms look very much like a string of beads. The arm spines in the distal part of the arms are only 5 or 4; they are almost smooth, except the lowermost one, which has a double series of serrations along its under side (Fig. 41. b.).

The colour is a light straw-colour, with numerous small dark spots scattered over the disk; sometimes it is only single stumps here and there which are thus darker coloured. There are often some indistinct brownish bands on the arms.

This species is related to *Ophiacantha pentagona* Koehler from which it is, however, easily distinguished particularly by its very strongly moniliform arms. Other species with similarly moniliform

arms are *O. pentacrinus* Lütken and *O. moniliformis* Ltk. & Mrtsn. Both of them differ markedly from *O. baccata* in the outer mouth papilla not being widened; also the shape of the mouth shields is quite different, as are the stumps of the disk, particularly in *moniliformis*. There is no question but that the S. African species *O. baccata* is quite distinct from these or any other *Ophiacantha*-species hitherto described.

It would appear that also *Ophiacantha angolensis* Koehler ("Sur quelques Ophiures des côtes de l'Angola et du Cap" 1933 p. 6. Figs. 4—5) is related to *O. baccata* and has strongly moniliform arms. But the fact that it has only 5 arm spines shows it to be different from the present species.

Ophiacantha striolata n. sp.

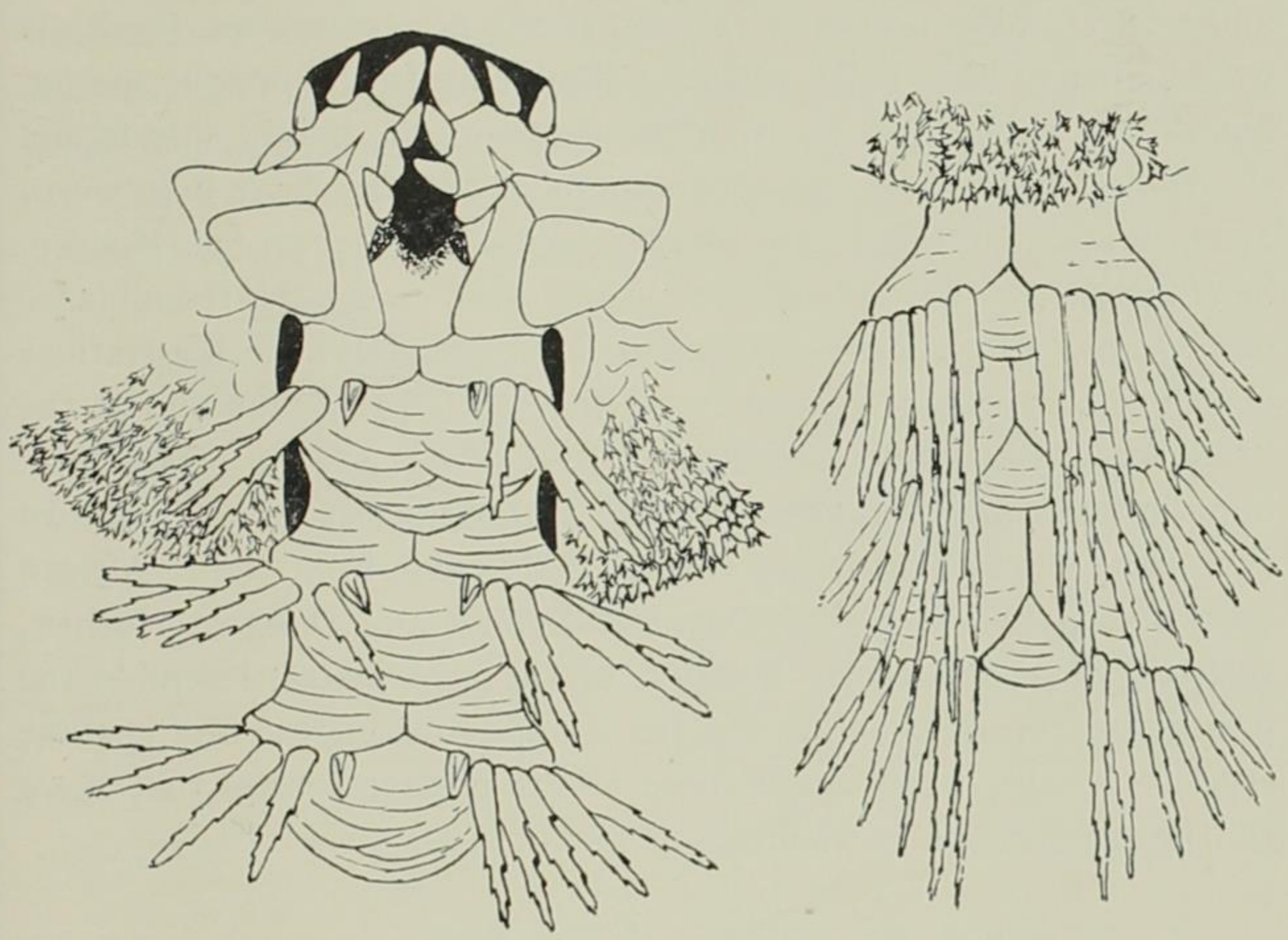
Off Durban, 29°56′ S. 31°19′30″ E. 225 fathoms. 26. VIII. 1929. 2 specimens, dredged onboard the "Pickle".

Diameter of disk 3 mm; length of arms ca. 12 mm.

Disk closely covered with stumps terminating in 3 divergent, rather coarsely serrated branches (Fig. 42; 43. a.). Only the distal end of the radial shields just discernible; no radial ribs. Also the ventral interradii covered by these stumps, except a small space just outside the buccal shields.

Mouth papillæ three to each side of jaw, of uniform size, conspicuously smaller than the infradental papilla. Buccal shield rounded triangular, with an indistinct lobe on the outer edge. Adoral plates rather narrow, joining within, and with a narrow outer lobe separating the first lateral plate from the buccal shield. First ventral plate rather narrow, longer than wide; following ventral plates distinctly broader than long, with a very obtuse inner angle and the outer edge conspicuously convex. They are all separated, but not very widely so (Fig. 42. a.). Dorsal armplates small, triangular, widely separated. Arm spines very slender, rather strongly thorny, in basal part of arms 8, joining in the dorsal midline or very nearly so; they increase in length upwards, the uppermost being about the length of two arm joints. The number of the spines gradually decreases, till in the distal part of the arms there are only 4; here they are nearly smooth, except the lowermost one, which is finely serrate along the lower edge (Fig. 43. b.). — One small tentacle scale, which is pointed and somewhat furrowed on its upper side.

Both ventral and lateral plates, and even the small dorsal arm plates, show a very conspicuous concentric striation, which makes these

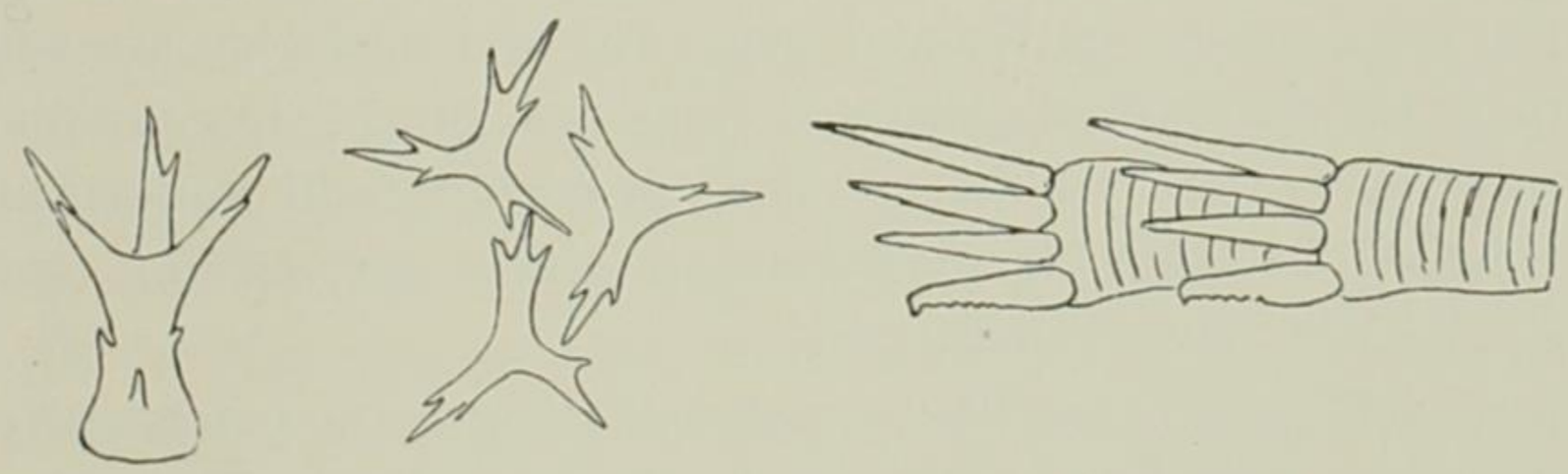


a. b.

Fig. 42. *Ophiacantha striolata* n. sp. Part of oral (a) and dorsal side (b). × 30.

plates look quite shining under the microscope. The arms are not moniliform.

The colour of the dried specimens is the usual light straw colour.



a. b.

Fig. 43. *Ophiacantha striolata* n. sp. a. Stumps from the disk, in side view and from above; b. two armjoints from distal part of arm, side view. a. × 125; b. × 30.

A similar concentric striation of the arm plates is found also in some other *Ophiacantha*-species, e. g. *O. Bairdi* Lyman, *O. graphica*

Koehler, *O. lineata* Koehler, *O. metallacta* H. L. Clark, and the here described species *O. scutigera* Mrtsn. Among these *O. Bairdi*, *metallacta*, and *scutigera* have no nearer relation to the present species. *O. lineata* would seem to have much general resemblance to the present species, but differs markedly from it in the shape of the buccal shields and the ventral arm plates; also the stumps of the disk have a crown of 5—6 thorns, not 3 as in the present species (cf. Camp. Sci. Monaco, 34. Pl. XXV. 6—8). Still greater would seem to be the resemblance of *O. graphica* to the present species. Unfortunately, the illustrations of this species given in Koehler's report on the Ophiurans of the "Albatross" Philippine Expedition (Pl. 18. 4—5) are very indistinct; but the fact that *O. graphica* has two tentacle scales on the first two pore pairs shows sufficiently that it is different from the S. African species. Also the species *O. longidens* Lyman and *O. legata* Koehler, with the same concentric striation of the arm plates, resemble the present species rather much, but the stumps covering the disk in these species are so different from those of the present species that there can be no question of their being identical.

Ophiacantha (*Ophiotreta*) *durbanensis* n. sp.

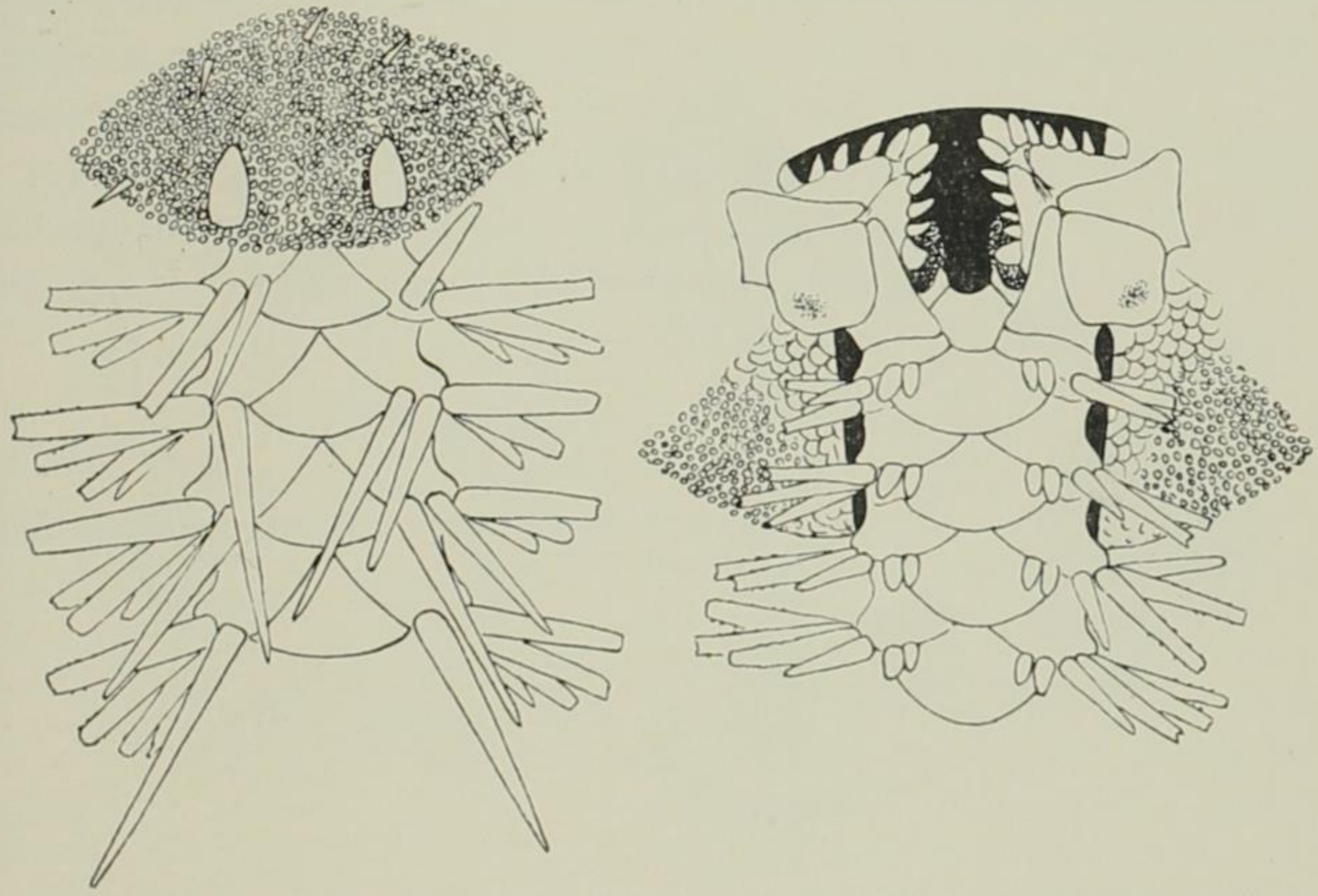
Pl. XIX. Figs. 13—15.

Off Durban, 29°56′ S. 31°19′30″ E., 225 fathoms, 2 specimens, dredged onboard the "Pickle", 26. VIII. 1929.

Diameter of disk 7 mm, length of arms ca. 45 mm (all broken). Disk very flat, covered by a uniform coat of small grains which conceal the scales completely. Scattered among these grains are a number of slender, erect spines, ca. 0.5 mm long. The radial shields are small but quite distinct, widely separated from each other; they are about twice as long as wide (Fig. 44. a.). The ventral interradii grain-covered (but without the spines) in the outer part, the — very small — scales being naked in the proximal part.

5—6 small mouth papillæ to each side of jaw, the outermost one somewhat enlarged. The infradental papilla is small, placed at a lower level than the mouth papillæ. Mouth shield spearhead-shaped, distinctly longer than broad, with a slight impression in the distal part. Adoral plates narrow, joining or not quite joining within, with a broad outer lobe, separating the buccal shield from the first lateral plate. First ventral arm plate broader than long; the following ones about twice

as broad as long, contiguous, with the outer edge convex (Fig. 44. b.). Dorsal arm plates triangular, with an acute inner angle and the outer side convex; they are merely contiguous. The grain covering of the disk continues a little over the basal part of the arm; there may be a couple of grains at the distal border of the first dorsal plate. 5 arm spines, the uppermost the longest, about as long as two arm joints; they are compressed, the lower ones distinctly truncate, slightly bifid and with



a. b.

Fig. 44. *Ophiacantha* (*Ophiotreta*) *durbanensis* n. sp. Part of dorsal (a) and oral side (b). × 10.

finely serrate edges. Tentacle scales two at each pore, the inner one slightly the smaller and gradually diminishing in size, to disappear completely in the distal part of the arm.

Colour of the disk a very faint mottling of white and light brownish (in the dried specimens); arms without special colour.

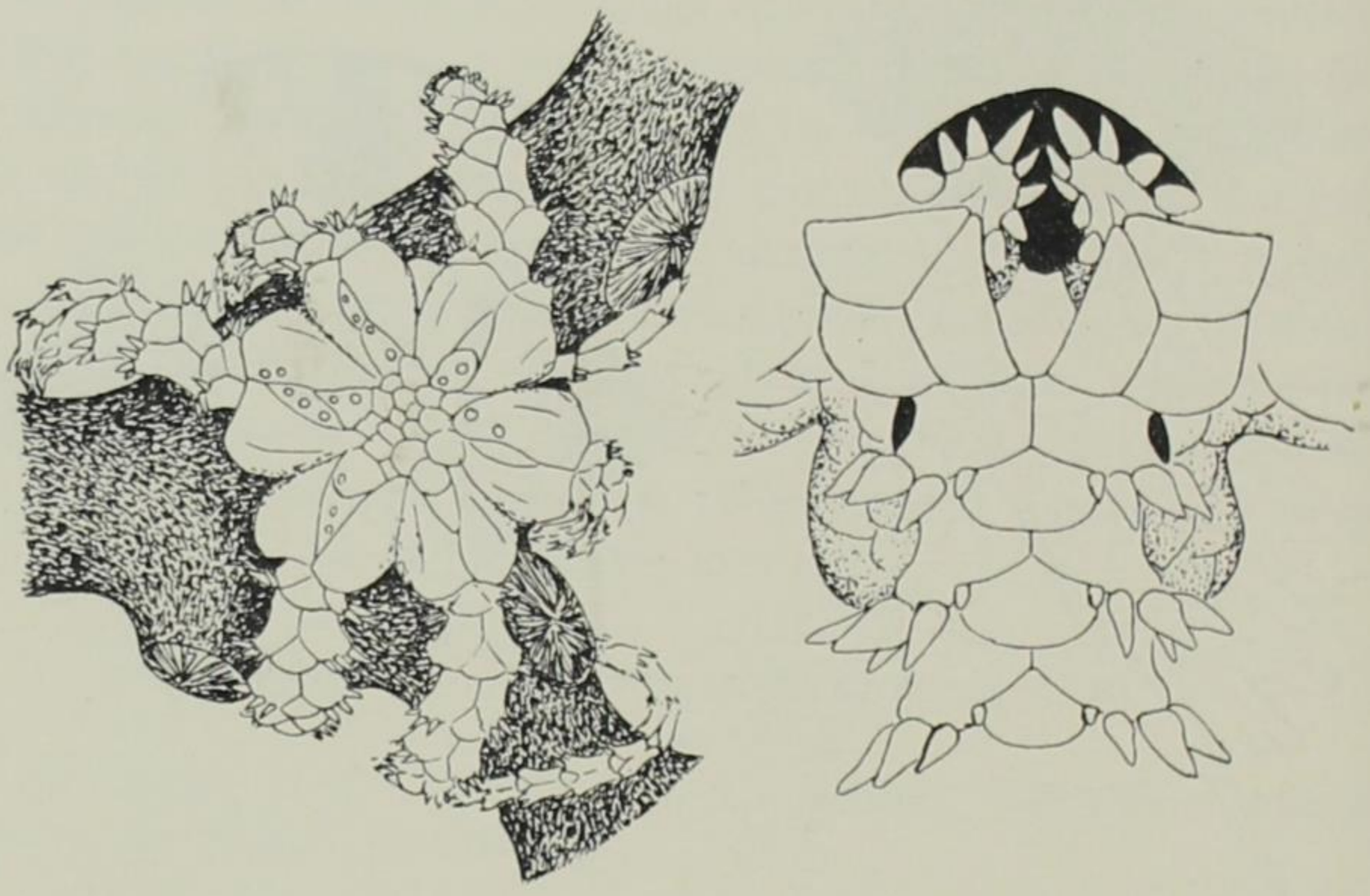
This species is related to *Ophiacantha* (*Ophiotreta*) *Valenciennesi* Lyman and *O. bisquamata* Matsumoto, both of which have likewise two tentacle scales in the main part of the arm, not only on one or two of the basal joints, and their arm spines likewise are truncate and slightly bifid at the point. The present species is, however, very distinctly characterized by its naked radial shields and the presence of spines among the granules on the disk.

Ophioplinthaca sexradia n. sp.

33°17′ S. 27°35′ E. 24 fathoms. 2 specimens, attached to a Gorgonian (Fisheries Survey).

Diameter of disk 2.5 mm. Arms wound round the coral, so that their length cannot be measured, but they are apparently ca. 4—5 times as long as the diameter of the disk. Arms six.

Disk occupied in the main by the radial shields, which are some-



a. b.

Fig. 45. *Ophioplinthaca sexradia* n. sp. a. Specimen attached to a Gorgonian; b. part of oral side of disk. a. × 10; b. × 25.

what elevated, contiguous in their distal part, diverging inwards, separated by an irregular wedge of scales, some of which carry 2—3 small granules. Also on the radial shields some granules may occur (Fig. 45. a.). There is a more or less distinct longitudinal furrow in each radial shield, nearer the abradial edge. The centre of the disk is somewhat sunken, occupied by a few irregular, polygonal plates. There is a deep interradial furrow; in one interradius of one of the specimens there is a distinct wedge of scales, the interradial edge here bulging out, whereas otherwise there is a deep marginal interradial incision as usual in *Ophioplinthaca*. The ventral interradii with fairly large, naked scales. Genital slits very short.

Mouth papillæ three or four to each side of jaw, the outer one a

little widened; the infradental papilla rather slender. Adoral plates very broad, without an outer lobe; buccal shield with an obtuse inner angle and a strongly convex outer edge. First ventral plate distinctly longer than broad; the second ventral plate widely separated from the first, broader than long, with an obtuse angle within and the outer edge convex; the following ones gradually assume a more triangular form, all distinctly separated from each other (Fig. 45. b.). Dorsal arm plates triangular, with convex outer edge, widely separated from each other. Arm spines 4, very short, thick and clumsy. One small tentacle scale. Colour of dried specimens straw colour.

This small form is the only 6-armed *Ophioplinthaca*-species made known till now, and is accordingly very easily distinguished. It has no distinct relation to any other known species.

Ophiothamnus remotus Lyman.

Pl. XIX. Figs. 9—11.

Ophiothamnus remotus Lyman. 1878. Oph. & Astroph. of the "Challenger". Bull. Mus. Comp. Zool. V. p. 149. Pl. VIII. 201—203.
— — — 1882. "Challenger" Oph. p. 212. Pl. XIV. 1—3.
— — Studer. 1883. Übersicht über die Ophiuriden, welche während der Reise S.M.S. Gazelle um die Erde 1874—76 gesammelt wurden. Abh. Ak. Berlin v. J. 1882. p. 24.
— — Bell. 1903. Echinoderma. III. Ophiuroidea. Marine Invest. S. Africa. III. p. 258.
— — H. L. Clark. 1923. Echinod. Fauna S. Africa, p. 324.

Several specimens were dredged onboard the "Pickle":
34° 2′ S. 18° 7′ E. 94 fathoms. 17. XII. 1929. 8 specimens.
34° 5′ S. 18° 1′ E. 118 — — 15 —
34°17′ S. 18°58′ E. 160 — 18. XII. 1929. Several specimens.
34°21′ S. 17°57′ E. 178 — — — —
34°24′ S. 18°16′ E. 133 — — 6 specimens.
34° 5′ S. 17°52′ E. 146 — 23. XII. 1929. 12 —
Off Durban, 30°2′ S. 31°3′ E. 90 fathoms. 1 specimen.

This species evidently is one of the commonest of the S. African Ophiurids, particularly off the Cape Peninsula at depths of ca. 100—200 fathoms. But it ranges as far North along the East coast as off the Natal coast (Tugela River). The present records do not extend its bathymetrical range beyond that given by Clark, 51—230 fathoms.

Studer (Op. cit.) gives the locality 34°13′6″ S. 18°0′7″ W. 117 fathoms. — This locality is in the middle of the Atlantic, W. of Tristan da Cunha, in the true deep-sea area. Looking at his list of the species, Op. cit. p. 30, we find that in the 18°0′7″ *W* is a printer's error for *O* — viz. off the Cape of Good Hope, the type locality of the species. An exactly similar case occurs under *Ophiuropsis Lymani*, in the same author's report on the Asteroids and Euryalids of the "Gazelle" (Abh. Akad. Berlin v. J. 1884, p. 55), where the locality is given as 11° E., instead of 112° E., which has caused Clark to include this species in the S. African fauna, whereas in reality the locality is off West Australia (cf. my "Studies of Indo-Pacific Euryalids", Vid. Medd. Dansk Naturh. Foren. Bd. 96. 1932—33 p. 73).

As pointed out by Clark there is a good deal of variation in regard to the spines on the disk, both in regard to their number and size. Therefore, although I have not seen any specimen corresponding to that mentioned by Clark as having 7 stout, abruptly pointed spinelets, 5 of which form a symmetrical quintet at the centre of the disk, and having in addition a number of minute widely scattered granules, I do not doubt that he is right in referring this specimen also to *O. remotus*, when, as he says, there are no other differences from the typical form.

Also in other respects there is some variation. Thus the mouth shields may differ a good deal in size, but their shape remains essentially the same, apart from some irregularities which may occur now and then. A much more conspicuous variation, however, occurs in regard to the shape of the disk, in that it may be deeply incised in the interradii, so as to recall the genus *Ophioplinthaca*, or it may be simply round or even bulging out in the interradii (Pl. XIX. Figs. 9—10). The difference between the extremes is so great that at a first glance one would think it improbable that they could belong to one and the same species. There are, however, all possible transitions between the extremes, and as there are no other differences to be found, it is beyond doubt that they are really all the same species. — Also as regards the number and relative size of the scales on the disk there is a very considerable variation. This, however, is no doubt due to the fact that it is apt to lose (or actively throw off?) its disk and regenerate it again. It would appear that specimens with numerous small disk-scales are such as have regenerated their disk. In these specimens also

the spines of the disk are in general smaller and less numerous than normally; they may even be totally absent. Such specimens recall the Japanese species *Ophiothamnus venustus* Matsumoto.

Looking on such thrown off disks one sees that there are no openings along the sides of the arms. The calcareous plating continues without any interruption across the dorsal side of the arms — apart from a small hole in the radial midline. *Ophiothamnus remotus* accordingly

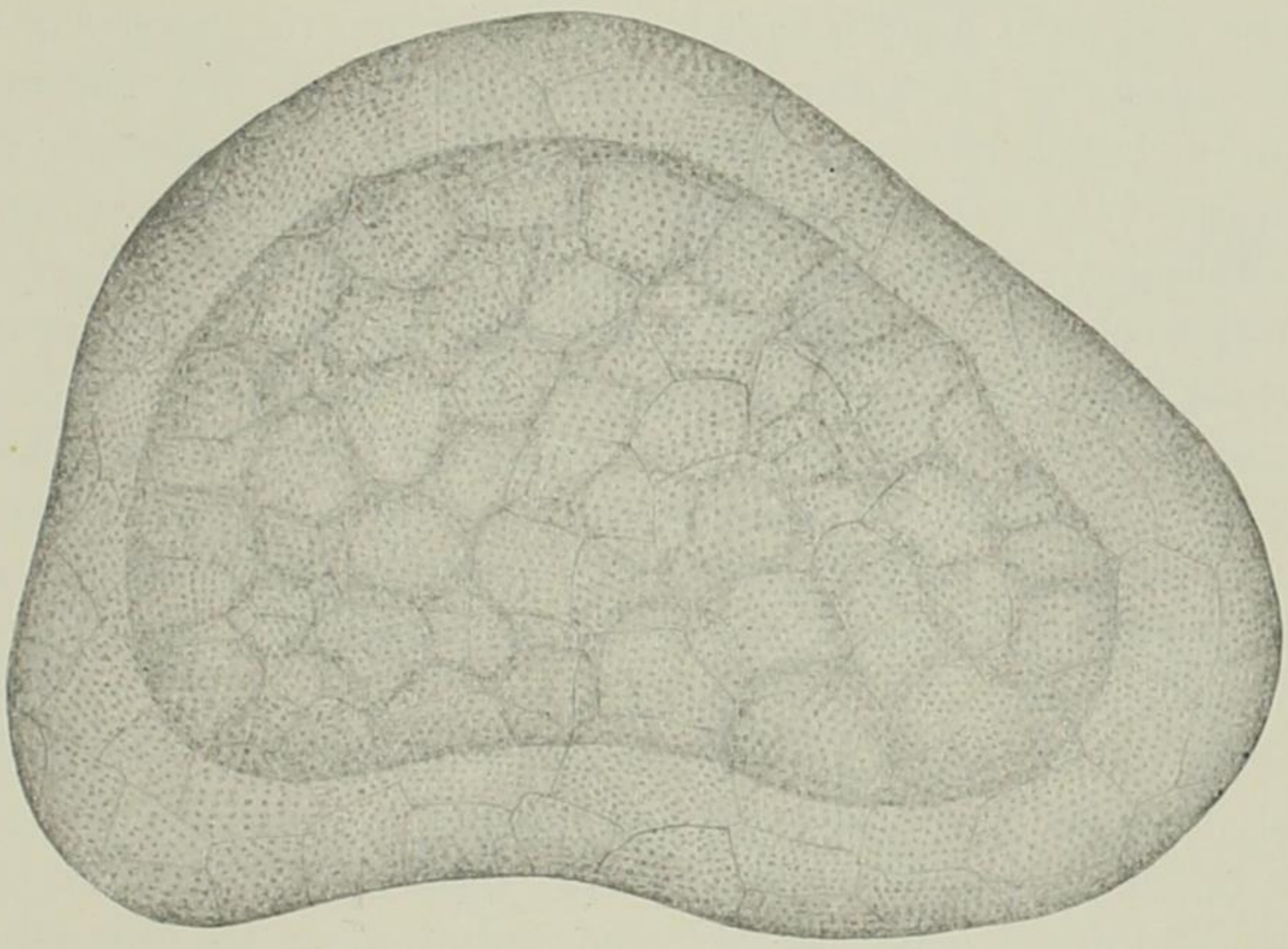


Fig. 46. Gonad of *Ophiothamnus remotus* Lyman. × 125.

has no bursæ. The genital plates also lack a genital scale. The complete specimens, with their disk preserved, show a narrow but distinct slit along the side of each arm, resembling a bursal slit; but it does not lead into any bursa, it is only the limitation of the disk against the arm, there being no coalescing between disk and arm except on top of the arm, which accounts for the fact that the disk is so easily lost.

There is only one rather large gonad to each side of the arm, lying within a spacious cavity, the wall of which is paved with angular calcareous plates (Fig. 46). This cavity resembles a bursa (Lyman's "ovarial bursæ"), but the fact that the gonad lies within it, and that there is no outer opening, proves that it cannot be a bursa. As the gonad lying within the cavity is surrounded by a fine membrane, it seems that

the outer membrane with the calcareous plates cannot be the homologue of the gonad membrane. What its true morphological value is, I do not know.

Exactly the same arrangement of the genital organs and the absence of bursæ was found by Lyman ("Challenger" Oph. p. 212, Pl. XLII. 1) in *Ophiothamnus vicarius* and by Matsumoto (Monogr. Japan. Ophiuridea, p. 129) in *O. venustus*. In my paper "Über Ophiopus arcticus (Ljungman), eine Ophiure mit rudimentären Bursae" (Zeitschr. f. wiss. Zool. LVI. 1893) I have tried to show that the "creases of the disk" along the arms represent true bursæ, against the opinion of Lyman. I shall have to modify that opinion in so far that the slits ("creases") can at most be regarded as rudimentary bursæ, being probably derived from the bursal structure typical of Ophiurids. (Also my statement Op. cit. p. 509, that the apparent polygonal plates seen over the gonads in Lyman's figure Pl. XLII. 1 must probably be the ripe eggs shining through the ovarian wall, not the calcareous plating of which Lyman speaks, must be corrected. Lyman's description is quite correct, only the figure is not very intelligible. On seeing the thing itself one can easily understand it. The figure here given may, I hope, be more clear).

How the sexual products are shed, in the absence of bursæ, is not clear. I suppose it will be in the same way as in *Ophiopus arcticus;* in this Ophiuran, likewise without bursæ, I have found that the eggs come out through pores formed in the ventral side of the disk, simply through resorption of the skin and the calcareous plates (cf. my paper "Über Ophiopus arcticus"). In the material at hand I have seen only one specimen with eggs protruding in one place in an interradius — but I am not sure that it is something normal, it might be due to some casual rupture.

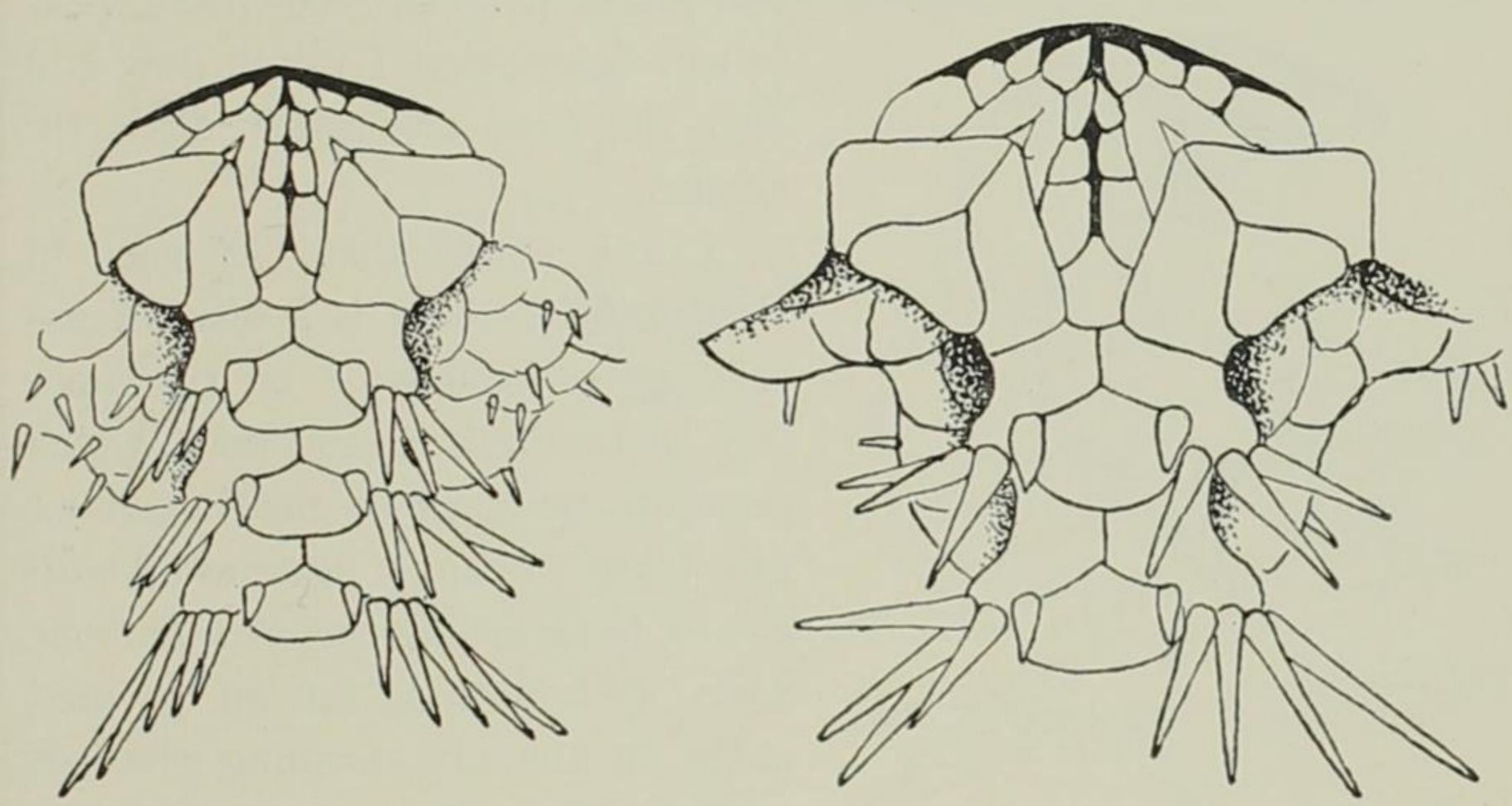
It would seem that in *Ophiocymbium cavernosum* Lyman the genital organs are arranged in a similar way as in *Ophiothamnus remotus*, judging from the description given by Lyman (Challenger Oph. p. 163).

Ophiothamnus remotus, var. *cordatus* n. var.

Off Durban, 29°56′ S. 31°19′30″ E. 225 fathoms. 4 specimens, dredged on-board the "Pickle", 26. VIII. 1929.

These specimens differ markedly from the typical *O. remotus* in the shape of the buccal shields, which are distinctly heart-shaped (Fig. 47. b,

to compare with Fig. 47. a. showing the typical *O. remotus*). This is the only appreciable difference I can find; the difference in the shape of the first (second) ventral plate seen in the two figures is not to be relied on; it may show a slight concavity in the outer edge also in the variety, and in the typical *O. remotus* the concavity is not always distinct, may vary from arm to arm even within the same specimen. It would appear that the arms are a little more slender and the joints



a. b.

Fig. 47. Part of oral side of *Ophiothamnus remotus* Lyman (a) and of the var. *cordatus* n. var. (b). a. × 12; b. × 30.

more constricted in the variety than in the typical form. But with the scanty material available, and the four specimens being of smaller size (ca. 2 mm diameter of disk, *O. remotus* up to 4—5 mm diameter of disk), it is not safe to ascertain that we have here a distinct species. The only reasonable course seems to me for the present to be this, to distinguish this form with the heart-shaped buccal shields as a — very distinct — variety of *O. remotus*. — It may be pointed out that also the typical *O. remotus* occurs off the Natal coast.

Ophiomitrella corynephora H. L. Clark.

Ophiomitrella corynephora H. L. Clark. 1923. Echinod. Fauna S. Africa, p. 322. Pl. XIX. 5—6.

34°17′ S. 17°58′ E. 160 fathoms. 3 specimens, dredged onboard the "Pickle". Further, several specimens, partly attached to Gorgonians, were received

from the Fisheries Survey; for most of them the locality cannot be made out any more. 1 specimen is from 39°2′ S. 16°53′ E. 200 fathoms.

The specimens agree very well with the description given by Clark. As he has given a detail figure of only the dorsal side of disk and arm, and the photographic figure of the oral side, Pl. XIX. 6, shows none of the details of the plates, I have thought it desirable to give here a figure of part of the oral side, showing the outlines of the plates (Fig. 48). To Clark's excellent description I would only add that the jaws are rather distinctly sunken.

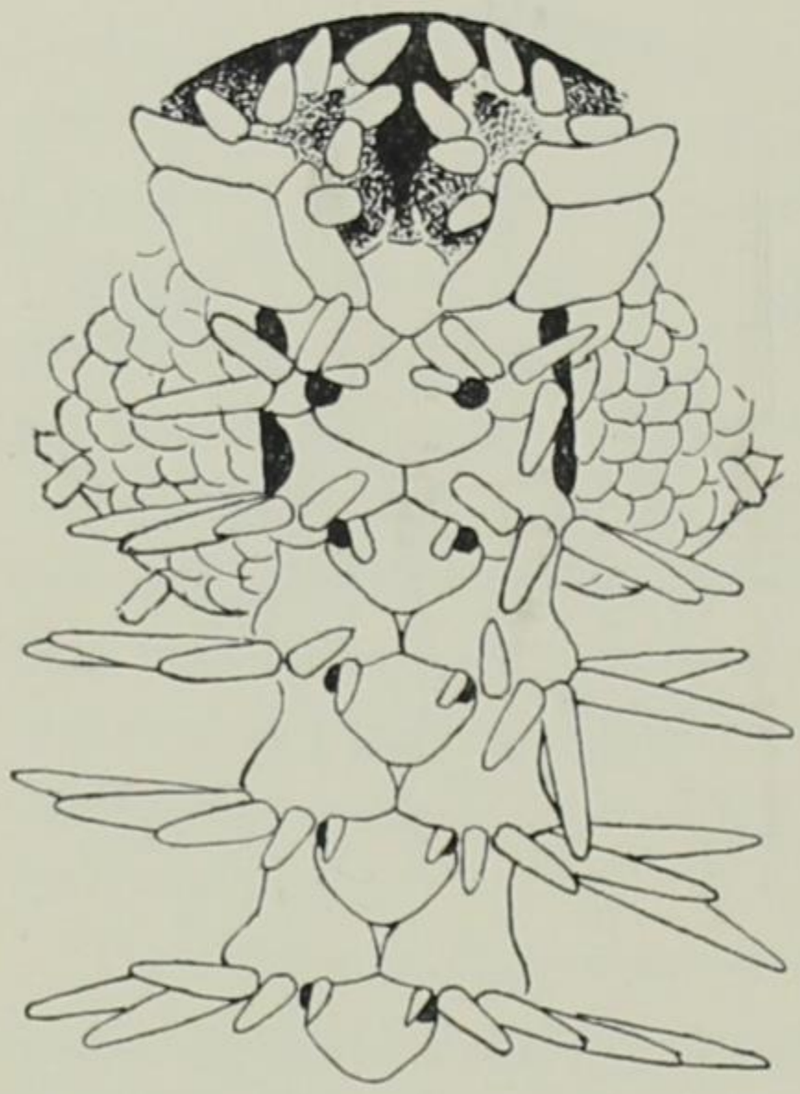


Fig. 48. Part of oral side of *Ophiomitrella corynephora* H. L. Clark. × 12.

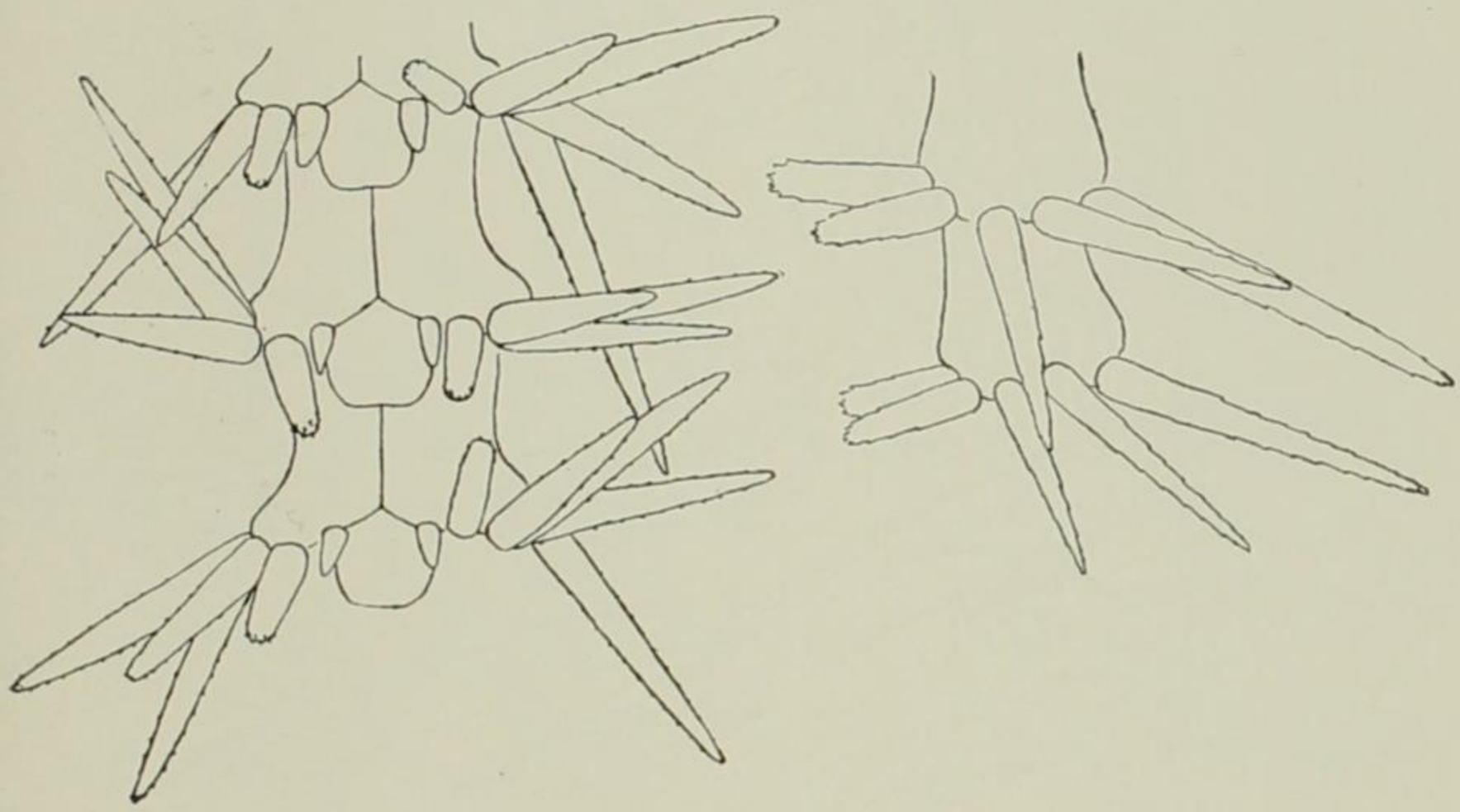
Clark states that "as usual in *Ophiomitrella* there is a distinct papilla or tentacle-scale on the inner side of the oral tentacle-pore, which seems to be borne on the first under arm-plate". I cannot agree at all with Clark in regarding this as a tentacle scale; it is nothing but an elevated ridge on the jaw forming the admedian edge of the pore (Fig. 48). For a comparison with *O. hamata* n. sp. are given figures to show the character of the spines (Figs. 49. a—b.).

The interesting observation was made by Clark that this species is viviparous. I can add that, like the other viviparous species of *Ophiomitrella*, *O. clavigera* (Ljungman), it is also hermaphroditic, and likewise a proterandric hermaphrodite. Further there is a very remarkable anatomical feature in *O. corynephora*, viz. that the two bursæ of each radius unite across the arm so as to form one large, common space. This is a feature otherwise quite unknown in Ophiurids outside the Euryalids.

As is the case with *Ophiomitrella clavigera* the present species may be infested with a peculiar parasitic Copepod — apparently the same as is found in *O. clavigera*, living in the gonads. The parasite does not completely castrate its host, as is neither the case in *O. clavigera;* it destroys only the gonad in which it is lodged. There is, however, also

another very peculiar parasitic Copepod which lives in galls in the dorsal side of the disk. The gall is lined — also in the interior — with skin containing calcareous plates like those of the dorsal skin; it remains open to the exterior through several small irregular pores. Both these parasites appear to be quite rare, contrary to what is the case with *Ophiomitrella clavigera*, of which generally the majority of the specimens are parasitized.

H. L. Clark points out the near relation between the S. African



a. b.

Fig. 49. Armjoints of *Ophiomitrella corynephora* H. L. Clark, from middle of arm. a. From the ventral side; b. in side view. × 20.

O. corynephora and the species from the Gough Island described by Koehler under the name of *Ophiomitrella ingrata*. To the differences between the two species mentioned by Clark I would add that, judging from a couple of paratypes of *O. ingrata*, which I received long ago from Dr. Bruce, *O. ingrata* is not viviparous and its bursæ are not united across the dorsal side of the arms.

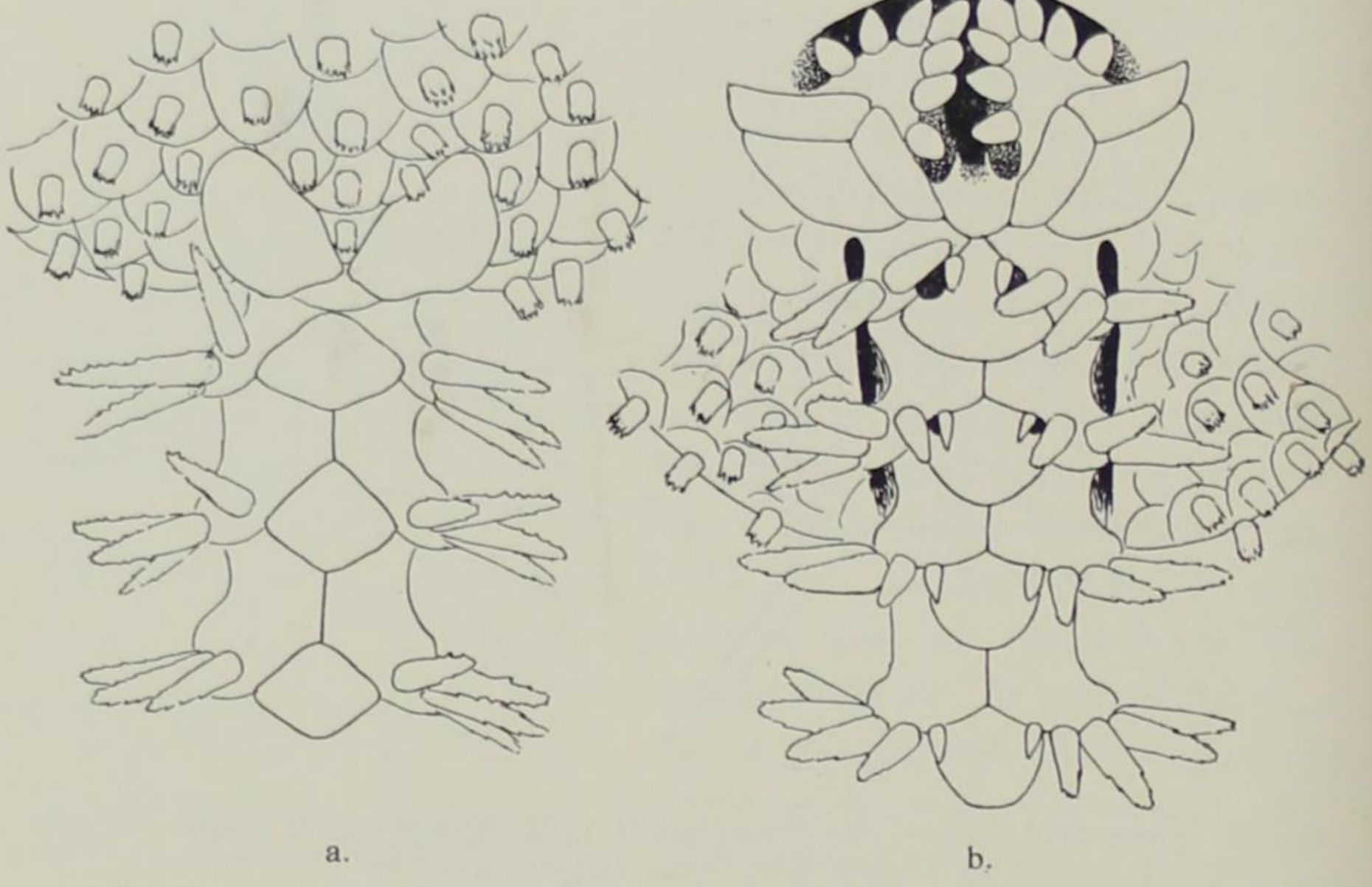
Ophiomitrella hamata n. sp.

Pl. XIX. Fig. 12.

Off Durban; 29°56′ S. 31°19′30″ E. 225 fathoms. 8 specimens on a Gorgonarian (*Thouarella* sp.).

Diameter of disk 4 mm, length of arms ca. 12 mm. Three thick mouth papillæ to each side of jaw. Buccal shields about twice as broad

as long, with inner edges slightly concave, outer edge convex. Adoral shields rather broad, joining within, not outwards prolonged between buccal shield and first lateral plate; jaws not sunken as in *O. corynephora*. The two first ventral plates narrowly contiguous, the following ones widely separated, about as long as broad, the outer edge strongly convex (Fig. 50. b.). One distinct, but rather small tentacle scale. Dorsal armplates diamond-shaped, widely separated. 4, exceptionally



a. b.

Fig. 50. *Ophiomitrella hamata* n. sp. Part of dorsal (a) and oral side (b). × 20.

on one or other of the basal joints 5, arm spines, scarcely as long as an arm joint, rather robust and coarsely and irregularly dentate, particularly along the adoral side (Figs. 51. a—b.). The arm joints are not much constricted. Radial shields distinct, rather broad, diverging, merely in touch at the distal end. Scales of disk rather coarse, each with a coarse stump, finely thorny in the end (Fig. 50. a.). — Colour in alcohol whitish.

In regard to the shape of the plates and the disk covering this species differs very little from *O. corynephora*, so little, indeed, that one might be inclined to think them identical; but the arm spines are so very conspicuously different from the smooth arm spines of

O. corynephora that they alone offer a sufficiently sharp distinction between the two species (Fig. 51 to compare with Fig. 49). Another difference is found in the jaws, which in the present species are flat, not sunken as those of *corynephora*.

Like *O. corynephora* this species is viviparous and a proterandric hermaphrodite. I found two rather large young ones of the same size in one of the specimens opened. As regards the bursæ it offers a very striking difference from *corynephora* in all the

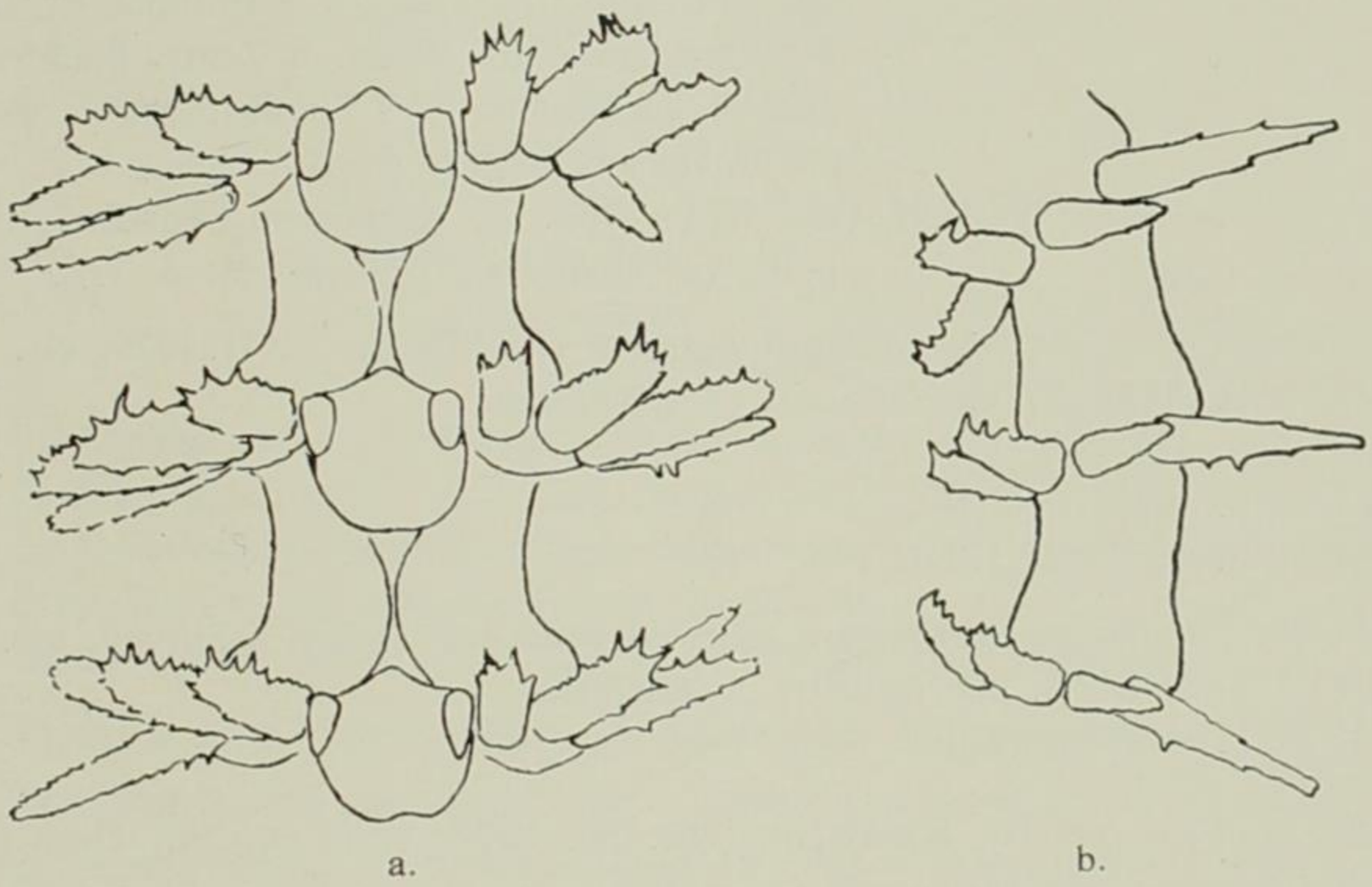


Fig. 51. Armjoints, from middle part of arm (joints 20—22) of *Ophiomitrella hamata* n. sp. a. From ventral side, b. in side view. × 30.

bursæ having coalesced so as to form one common circular space, a feature entirely unique in Ophiurids outside the Euryalids. It is a very remarkable fact that of the three viviparous species thus far known within the genus *Ophiomitrella*, one, *O. clavigera* (Ljungm.), has the bursæ separate as usual in Ophiurids, another, *O. corynephora*, has them united two and two, forming a common space across each arm, the third, *O. hamata*, has them all united into a common circular space, on the top of which lies the stomach, which is thus entirely devoid of interradial pouches.

The peculiar parasitic Copepod living in galls on the dorsal side of the disk, in connection with the outside through irregular pores, was found in this species, as in *O. corynephora*.

Family ***Ophiothrichidæ.***

Ophiothrix aristulata Lyman.

Ophiothrix aristulata Lyman. 1882. "Challenger" Oph. p. 223. Pl. XXI. 9—12.
— — Bell. 1905. Ech. S. Africa. III. Ophiuroidea. p. 258.
— — Koehler. 1922. Oph. "Albatross" Philippine Exp. p. 205. Pl. 35. 1—3; 97. 1. a—f.
— — Clark. 1923. Ech. Fauna S. Africa, p. 336.
Non: *Ophiothrix aristulata* Döderlein. 1910. Asteroidea, Ophiuroidea, Echinoidea, in L. Schultze. Zool. u. Anthropol. Ergebn. Forschungsreise im Westl. u Zentr. Südafrica. Jena'er Denkschr. XVI. p. 254. Pl. V. 4—5. (= *Ophiothrix fragilis* Abgd.).
Non: — — Hertz. 1926. Oph. d. deutschen Südpolar Exp. p. 35. (= *Ophiothrix triglochis* M. & Tr.).

Several specimens were dredged onboard the "Pickle", XII. 1929, viz.
34° 5′ S. 17°52′ E. 146 fathoms. 4 specimens.
34° 5′ S. 18° 1′ E. 118 — 6 —
34°17′ S. 17°58′ E. 160 — 8 —
34°21′ S. 17°57′ E. 178 — 15 —

Further, some specimens were received from the Fisheries Survey, viz.
31° 3′ S. 15°51′ E. 200 fathoms. 4 specimens.
34°37′ S. 18°29′ E. 139 — 2 —

As pointed out by Koehler (Op. cit. 1922) it is evident that the specimens from Lüderitzbay mentioned by Döderlein (Asteroidea, Ophiuroidea, Echinoidea, in L. Schultze. Zool. u. anthropol. Ergebn. Forschungsreise im westl. u. zentr. Südafrica. Jena'er Denkschriften. XVI. 1910, p. 254. Pl. V. 4—5) as *Ophiothrix aristulata* are not that species. Koehler thinks it to be *Ophiothrix fragilis* var. *pentaphyllum*. Professor Döderlein having kindly sent me one of his specimens I must join Koehler in the opinion that it is only a variety of *O. fragilis*. Whether really the var. *pentaphyllum* I would not like to say definitely, the varieties of *O. fragilis* being not too clearly distinguishable.

The specimens from off Simonstown mentioned by Hertz (Op. cit.) under the name of *Ophiothrix aristulata* are — as might be expected — not that species, but *O. triglochis*. I can state this definitely, Prof. Döderlein having kindly sent me one of these specimens for re-examination.

In the work quoted Koehler throws doubt on the validity of the

variety *investigatoris* of *O. aristulata*, which he described in his report on the "Investigator" Ophiuroids (p. 67, Pl. XI. 86—87). I can only join him herein. Another thing is that perhaps not all that has been recorded as *Ophiothrix aristulata* from various parts of the Indo-Pacific is really that species. But this does not concern us here, as there can be no doubt of the S. African specimens being the true *O. aristulata*, the type locality of the species being off the Cape Peninsula.

Ophiothrix triglochis Müller & Troschel.

Ophiothrix triglochis Müller & Troschel. 1842. Syst. d. Asteriden. p. 114.
— — Lütken. 1869. Add. Hist. Oph. III. p. 59.
— — Koehler. 1904. Oph. nouv. ou peu connues. Mém. Soc. Zool. Fr. 1904. p. 81.
— — Bell. 1905. Echinod. S. Africa. III. Oph. p. 259.
— — Clark. 1923. Ech. Fauna S. Africa, p. 337.

Off Durban, 35—120 fathoms. Several specimens.
Agulhas Bank, 4 miles S. of Cape Barracouta, 35 fathoms. Several specimens.
Agulhas Bank, 10 miles W. of Cape Barracouta, 40 fathoms. Several specimens.
False Bay, 8—30 fathoms. Several specimens.
Cape of Good Hope, under stones, at low tide. 2 specimens.

Though very closely allied to *Ophiothrix fragilis*, I think it correct to maintain it as a separate form — species or variety —. It is evident that, on the whole, in spite of a good deal of variability it has quite a distinct stamp of its own, so that one is generally not in doubt about the identification.

Young specimens are sometimes found clinging to the arms of the adult; as in *O. fragilis* this is not a case of protection of the brood, it being quite per chance that the young ones after their metamorphosis from the pelagic larva happen to settle down on adult specimens in places where these latter occur in good numbers. There is thus exceedingly little probability that the adult specimens are the parents of the young ones clinging to them.

The specimens from off Durban are, on the whole, much smaller than those from Agulhas Bank and False Bay, only two-three specimens out of more than a hundred being of about the same size as the full-sized ones from the more southern localities. This would seem to indicate that the species up here in the warmer regions off Natal does not in general reach the same size as in the colder waters farther South. Also it appears that it becomes sexually mature at a smaller

size — ca. 3 mm diameter of disk — in the warmer regions than it does farther South. But my evidence for this is not sufficient, the specimens from off Durban being taken in August, those from Agulhas Bank and False Bay in December. But the facts available do point towards this conclusion.

That the specimens from off Simonstown and Simons Bay mentioned by Hertz (Oph. d. Deutsch. Südpolar-Exped., p. 35) as *Ophiothrix aristulata* are in reality *O. triglochis*, was pointed out above, under *O. aristulata*.

Clark (Op. cit. p. 338) suggests that the specimens from False Bay identified by Bell as *Ophiothrix roseo-coerulans* are "better referred to *triglochis*"; evidently he has, however, not seen Bell's specimens. Dr. C. C. A. Monro having sent me one of Bell's specimens for examination I can state that it corresponds exactly to the form of *triglochis* mentioned by Clark (loc. cit.) as having long spinelets on the disk, so numerous as to replace most of the stumps, the radial shields remaining bare. This form of *O. triglochis* appears to be relatively rare, but is connected with the typical form, the disk of which is covered by short stumps only, by transitional forms so that it would appear it cannot claim the rank of a separate species. Perhaps it might deserve ranking as a separate variety of *triglochis;* I have, however, not material enough of this form, so I prefer not to take any definite position as to this question. That this spinous form is not identical with *O. fragilis* I quite agree with Clark.

Ophiothrix fragilis (Abildg.).

H. L. Clark. 1923. Echinod. Fauna S. Africa, p. 337.

I did not myself collect this species, but in the material from the S. African Fisheries Survey there are some specimens — in very poor state of preservation — from Dassen Island (on kelp), and some other localities which cannot now be made out with certainty.

Ophiogymna fulgens (Koehler).

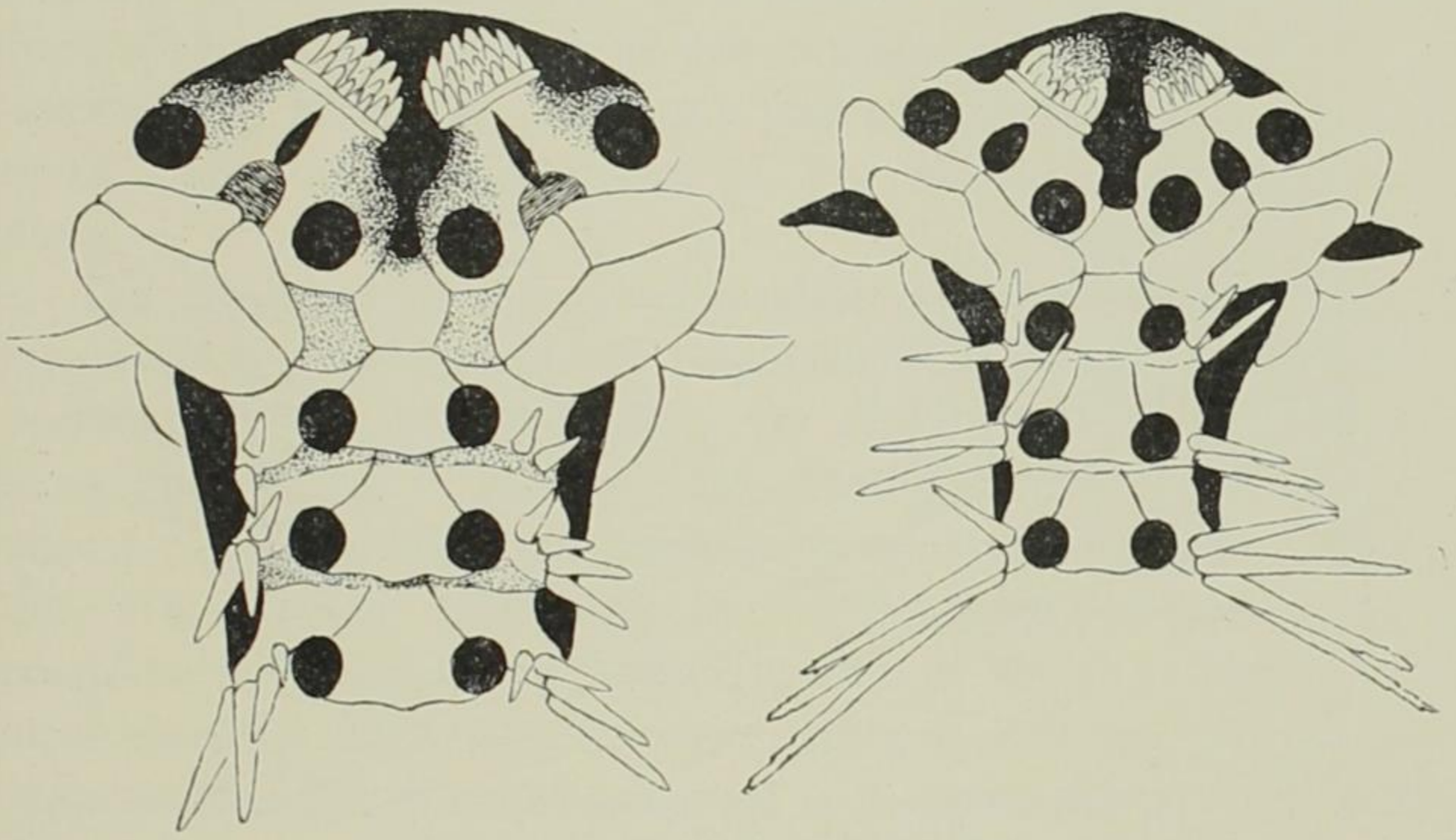
Pl. XIX. Fig. 25.

Ophiothrix fulgens Koehler. 1905. "Siboga" Oph. II. p. 107. Pl. X. 3—6.
Ophiogymna — — 1922. Ophiuroidea. "Albatross" Philippine Exped. Bull. U. S. Nat. Mus. 100. p. 288. Pl. 42. 1—8; 43. 9—10; 44. 8; 60. 6; 103. 8.

Ophiogymna fulgens Koehler. 1930. Oph. d'Australie & de l'Archipel Malais. p. 189.

Off Durban, 68 fathoms. 1 specimen, dredged onboard the "Pickle", 29. VIII. 1929.

This specimen, which is a rather large one, 12 mm diameter of disk, corresponds very well with the descriptions and figures of *O. fulgens* given by Koehler, the only noteworthy difference being that



a. b.

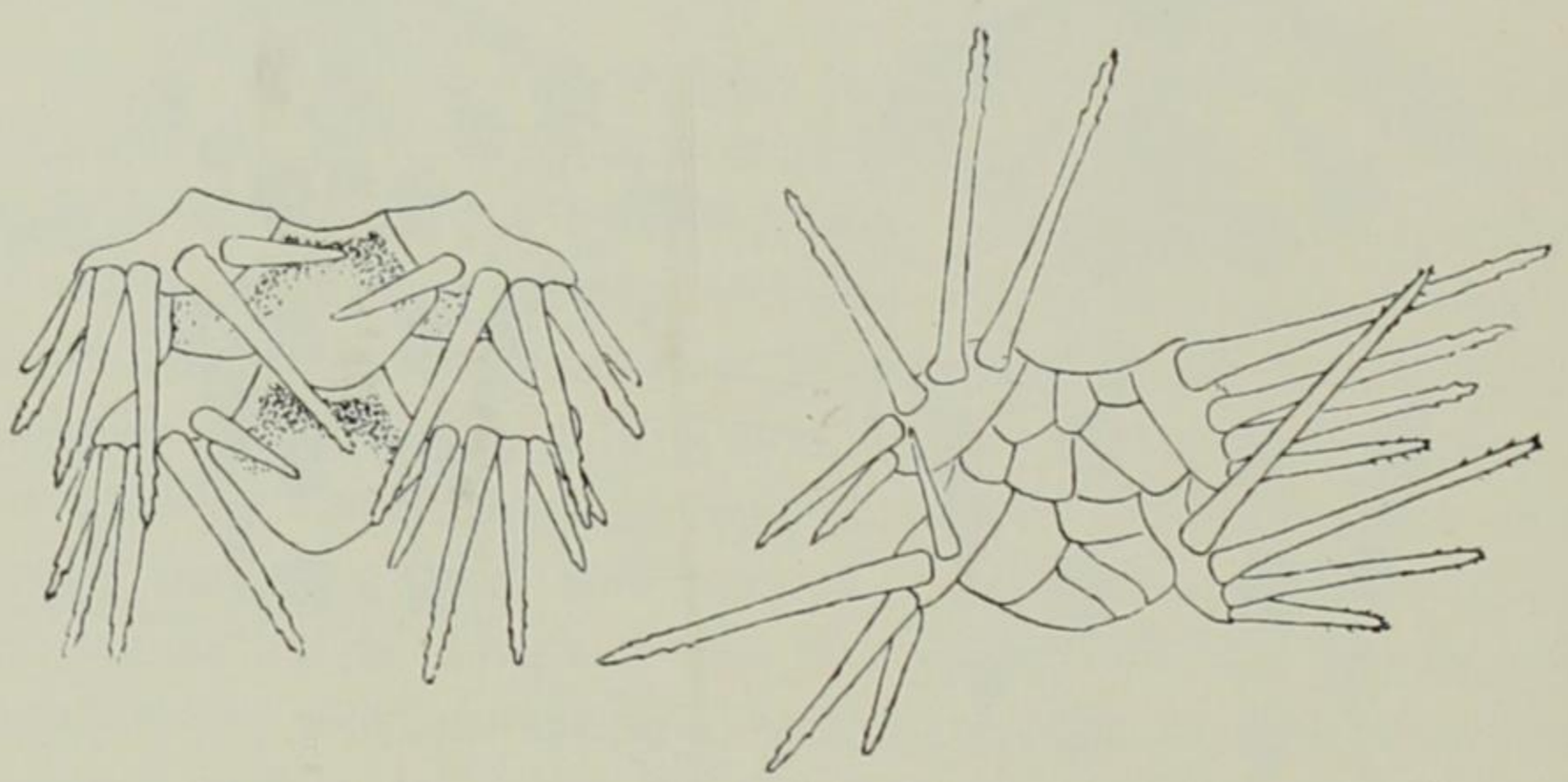
Fig. 52. Part of oral side of *Ophiogymna fulgens* (Koehler) (a) and of *Ophiogymna capensis* (Lütken) (b). × 10.

the opening in the jaw is much narrower than usual (Fig. 52. a.). It is wholly white, but also Koehler records such purely white specimens, the coloration being, on the whole, rather variable, as are also the other characters of the species. The dorsal armplates of the present specimen are undivided (Fig. 53. a.), only quite exceptionally one or other plate may be found which is slightly divided. They are somewhat excavated in the basal part.

It is, of course, possible that the species *fulgens* is taken in a too wide sense, and that the white specimens do not really belong to it, in which case the S. African form would also have to be removed from the species *fulgens*. This question, however, can only be decided through the study of a much richer material. It would particularly be important to see whether the S. African specimens are all white

or they show the same colour variations as the *O. fulgens* of the Malay Archipelago; likewise it would be important to see whether the opening in the jaw is always such a narrow slit as in the present specimen; if so, that would evidently be an important character speaking against the identity of the S. African and the Indo-Malayan form. For the present, however, with only a single specimen available, I must regard it as identical with the Indo-Malayan *O. fulgens*.

The specimen carried a *Myzostoma* at one of its genital slits —



a. b.

Fig. 53. Two armjoints, dorsal side, of *Ophiogymna fulgens* (Koehler) (a) and of *Ophiogymna capensis* (Lütken) (b). × 10.

a very interesting fact, since this is the first case recorded of an Ophiothrichid infested with *Myzostoma*.

Ophiogymna fulgens has hitherto been recorded only from the Indo-Malay region; its occurrence off Durban indicates it to be distributed also over the Indian Ocean.

Ophiogymna capensis (Ltk.).

Pl. XIX. Fig. 26.

Ophiothrix capensis Lütken. 1869. Add. hist. Oph. III. p. 59, 100.
— — H. L. Clark. 1923. Echinod. Fauna S. Afr. p. 340.

No new material of this species has come to hand. The following remarks are based on Lütken's two original specimens, which were bought from Salmin, labelled Cap, without more detailed information of locality and depth at which they were taken. — It is perfectly evident that this species is not an *Ophiothrix*, but an *Ophiogymna*, as

might already be concluded from the description given by Lütken, the covering of the dorsal and ventral arm plates by a thick skin, and the absence of a tentacle scale being features characteristic of the genus *Ophiogymna*, not of *Ophiothrix*.

Lütken's statement of the buccal shields being coalesced with the adoral plates and the genital scales is due to the skin covering making the outlines of these plates indistinct; on removing the skin by means of cautiously applying hypochlorite of sodium one sees the outlines of the plates distinctly, as well as those of the ventral plates, as shown in fig. 52. b. The dorsal arm plates are broken up into several small, irregular fragments (Fig. 53. b.). There are no stumps on them.

The coloration of these two specimens is very characteristic: a conspicuous, dark (apparently originally black, now brownish) line beginning in the midline between the radial shields and continuing along the midline of the 4—6 proximal arm joints, ending there abruptly. Then a dark transverse band on the dorsal side of every 3rd—6th arm joint continuing out on the spines. The band may be complete or limited to the sides. The skin of the dorsal side of the arms otherwise finely dotted; one of the specimens has also the skin of the ventral side of the arms dotted, only much more finely than the dorsal side.

I would think it quite possible that *Ophiogymna pulchella* (Koehler) is in reality identical with *O. capensis*. The dark, dorsal midline of that species may be confined to a few of the proximal joints as in *capensis* — or it may be continuous along the dorsal side of the arm, or again it may be confined to the disk, from the centre to midway between the radial shields; the latter case is found in one of the two specimens from the Amboina Bay mentioned by Koehler in his report on the Ophiuroids of Australia and the Malay Archipelago (1930, p. 190). In this specimen the skin of the arms is conspicuously dotted and banded, somewhat more strongly than in *capensis*. In the other specimen, the one with the continuous, dark, dorsal midline, the dots are only slightly developed, and there are no transverse bands. Any distinct, reliable characters by which the species *capensis* and *pulchella* may be distinguished I do not see. If ultimately found to be identical, the species — which must then keep the name *capensis* — will no doubt be found distributed also over the Indian Ocean.

Ophiothela Danæ Verrill.

Ophiothela Danæ Verrill. 1869. New and imperfectly known Echinoderms and Corals. Proc. Boston Soc. Nat. Hist. XII. p. 391.
— — Döderlein. 1896. Bericht über die von Prof. Semon bei Amboina u. Thursday Isl. ges. Ophiuroidea. Semon's Forschungsreisen, Bd. V. Jena Denkschr. VIII. p. 297. Taf. XVII. 25. a—b.
— — — 1898. Über einige epizoisch lebende Ophiuroidea. Ibid. p. 486. Taf. XXXVII. 3—3. c.
— — Matsumoto. 1917. Monogr. Japan. Oph. p. 230.
— — Koehler. 1922. Oph. Philippine Seas. Bull. U. S. Nat. Mus. 100. 5. p. 297. Pl. 59. 1—3; 103. 1.

Off Durban, 29°47′ S. 31°12′ E. 35 fathoms. 22. VIII. 1929. Several specimens.
Off Durban, 29°48′ S. 31°18′ E. 120 fathoms. 22. VIII. 1929. Several specimens.
Dredged onboard the „Pickle".

I do not see any possibility of distinguishing these specimens from the common, over the whole Indo-Pacific distributed *Ophiothela Danæ*. None of them show the dark-blue lines on disk and arms so characteristic of *Ophiothela dividua* v. Martens.

Thanks to the kindness of Professor W. Arndt of the Berlin Zoological Museum I have had the opportunity of seeing the type specimens of the latter species. In view of the very great variability of *O. Danæ* I think it very difficult to point out any character by which *O. dividua* can be distinguished from it with certainty, beyond the coloration. But that does seem to afford a good distinguishing character — at least I have never seen any similarly coloured specimen among the very numerous specimens of *Ophiothela* which I have collected in various parts of the Indo-Pacific.

Ophiothela Danæ was not hitherto known from off the African East Coast. Probably its southern limit is here off the Natal Coast.

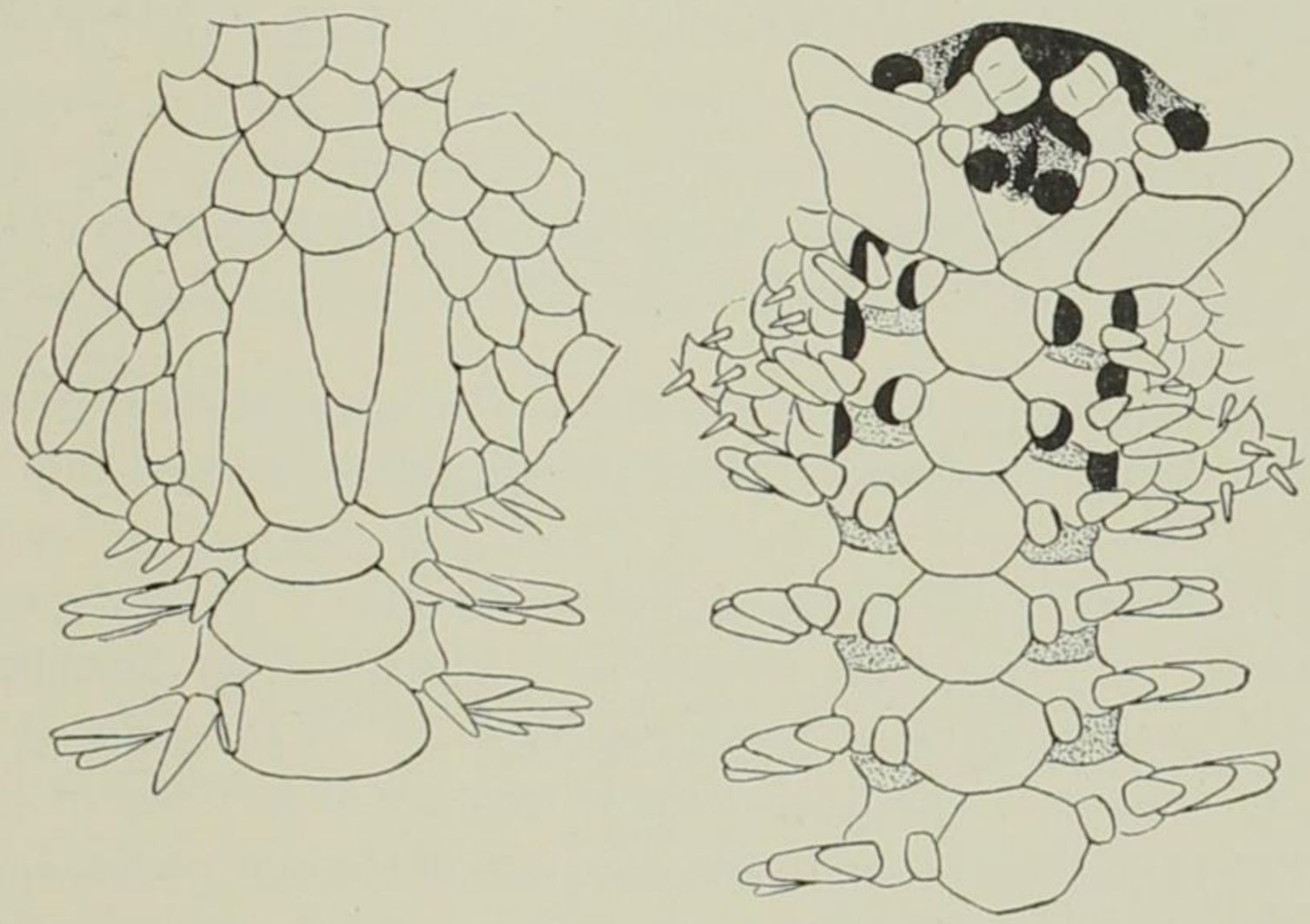
Family ***Ophiactidæ.***

Ophiactis carnea Ljungmann.

Ophiactis carnea Ljungman. 1867. Oph. viv. huc usque cogn. p. 324.
— — H. L. Clark. 1918. Brittle-Stars, new and old. Bull. Mus. C. Zool. LXII. p. 309.
— — — 1923. Echinod. Fauna S. Africa; p. 332. Pl. XX. 3—4.
— *africana, capensis* Hertz. 1926. Oph. Deutsch. Südpolar-Exp p. 29.

Off Durban; 35 fathoms. Several specimens. 22. VIII. 1929.
Off Durban; 120 fathoms. 1 specimen. 22. VIII. 1929.
4 miles S. of Cape Barracouta, 35 fathoms. 15 specimens. 13. XII. 1929.
Gordon Bay (False Bay), 8—9 fathoms. Several specimens. 19. XII. 1929.
False Bay, 15—17 fathoms. Several specimens. 19. XII. 1929.
Dredged onboard the „Pickle" (except those from off Cape Barracouta).

The species varies a good deal in colour. Whereas Clark states to have had only one specimen of olive-green colour, I find that most of the specimens from False Bay and Gordon Bay are of an olive-green



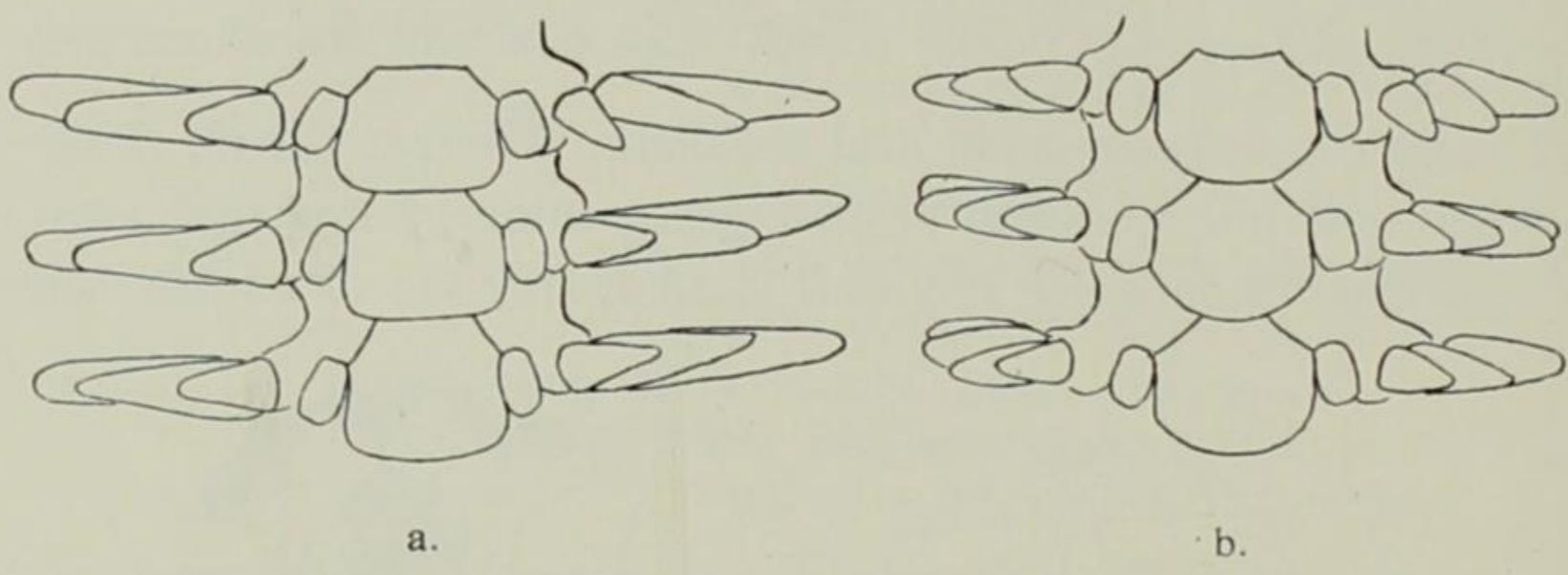
a. b.

Fig. 54. *Ophiactis carnea* Ljungman. Part of dorsal (a) and oral side (b). × 20.

ground colour, more or less variegated, the arms usually with darker bands. The specimens from off Durban are, on the whole, of a more reddish hue so that the name "carnea" fits quite well to them.

Such reddish specimens also occur among the specimens from False Bay and Gordon Bay, but they are much rarer than the olive-green specimens. The more light coloured specimens do not in any other way differ from the dark coloured ones, so that, although they look rather different, it is impossible to distinguish them by any other characters, and there can be no doubt that they are all one and the same species. The variations that may be found in the shape of the dorsal and ventral plates (Figs. 55—56) do not correspond with the colour-variations.

It is a marked feature of this species that, as a rule, the infradental papilla is not at all developed. Sometimes a small irregular papilla or scale is found in its place, but it is not easy to say whether it is a

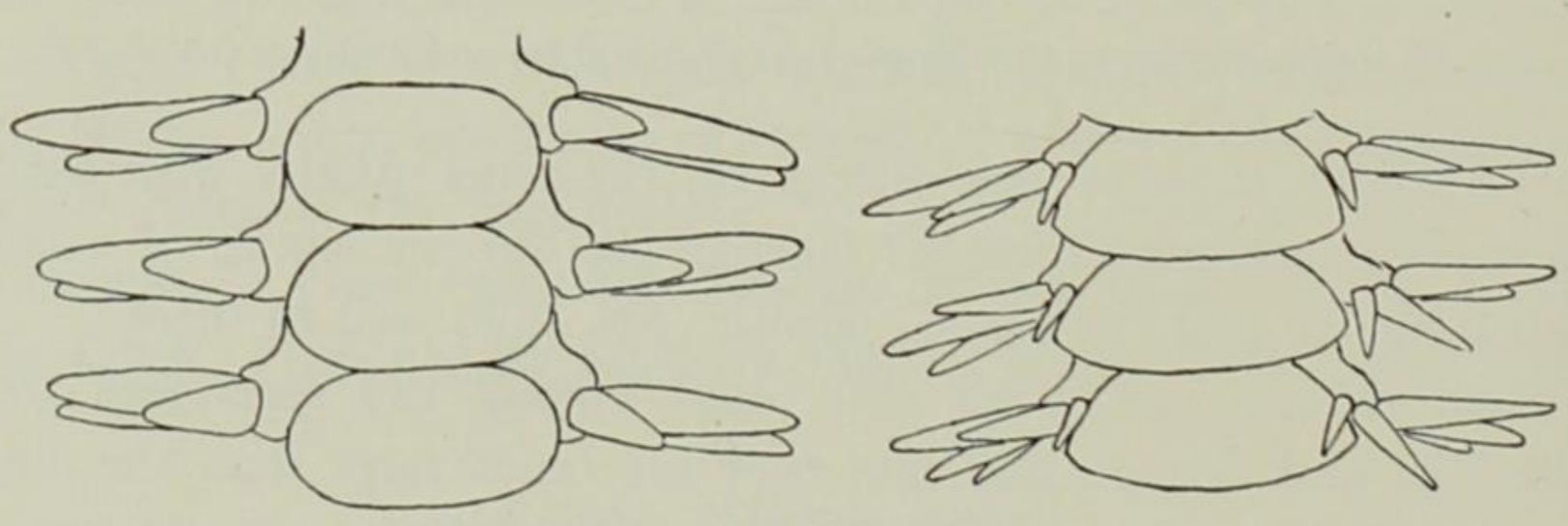


a. b.

Fig. 55. *Ophiactis carnea* Ljungman. Armjoints, ventral side, of specimens from False Bay (a) and from off Durban (b). × 20.

deform mouth papilla or a deform tooth. The upper tooth is generally large and well developed, often by radiating striæ divided into three parts (cf. fig. 54. b.).

In the report on the Ophiuroids of the German S. Polar Expedition Dr. Hertz (Op. cit. p. 29) records an *Ophiactis* from Simonstown, which she designates as a subspecies, *capensis*, of *Ophiactis africana* Koehler, a species hitherto known only from the West Coast of Africa, from Senegal to Angola. No figures are given of this subspecies *capensis*, and from the short descriptive note one can hardly gather anything



a. b.

Fig. 56. *Ophiactis carnea* Ljungman. Armjoints, dorsal side, of specimen from False Bay (a) and from off Durban (b). × 20.

else but that it is characteristic by one of the buccal plates being considerably larger than the others. Evidently Dr. Hertz has not understood that this larger buccal plate is the madreporite. Also in *Ophiactis*

carnea the madreporite is distinctly larger than the other buccal plates — and there can scarcely be any doubt that this "subspecies *capensis*" is nothing but *Ophiactis carnea*, the common species of False Bay, and the only *Ophiactis*-species known to occur there.

On the other hand, Dr. Hertz is quite right in finding these specimens to resemble closely Koehler's *Ophiactis africana*, the two speces *O. carnea* and *O. africana* being decidedly very nearly related. H. L. Clark in his revision of the genus *Ophiactis* (Op. cit. 1918) gives (in the key, p. 300) as difference between them that the disk-scaling is fine, 11—15 series in each interbrachial area, in *O. carnea*, coarser, 6—9 series in each interbrachial area, in *O. africana*. I rather think Clark has here accidentally interchanged the two names. At least I find *O. africana* to have, on the whole, much finer and more uniform, rounded scales than *O. carnea*. Also the radial shields are smaller in *O. africana*.

Ophiactis plana Lyman.

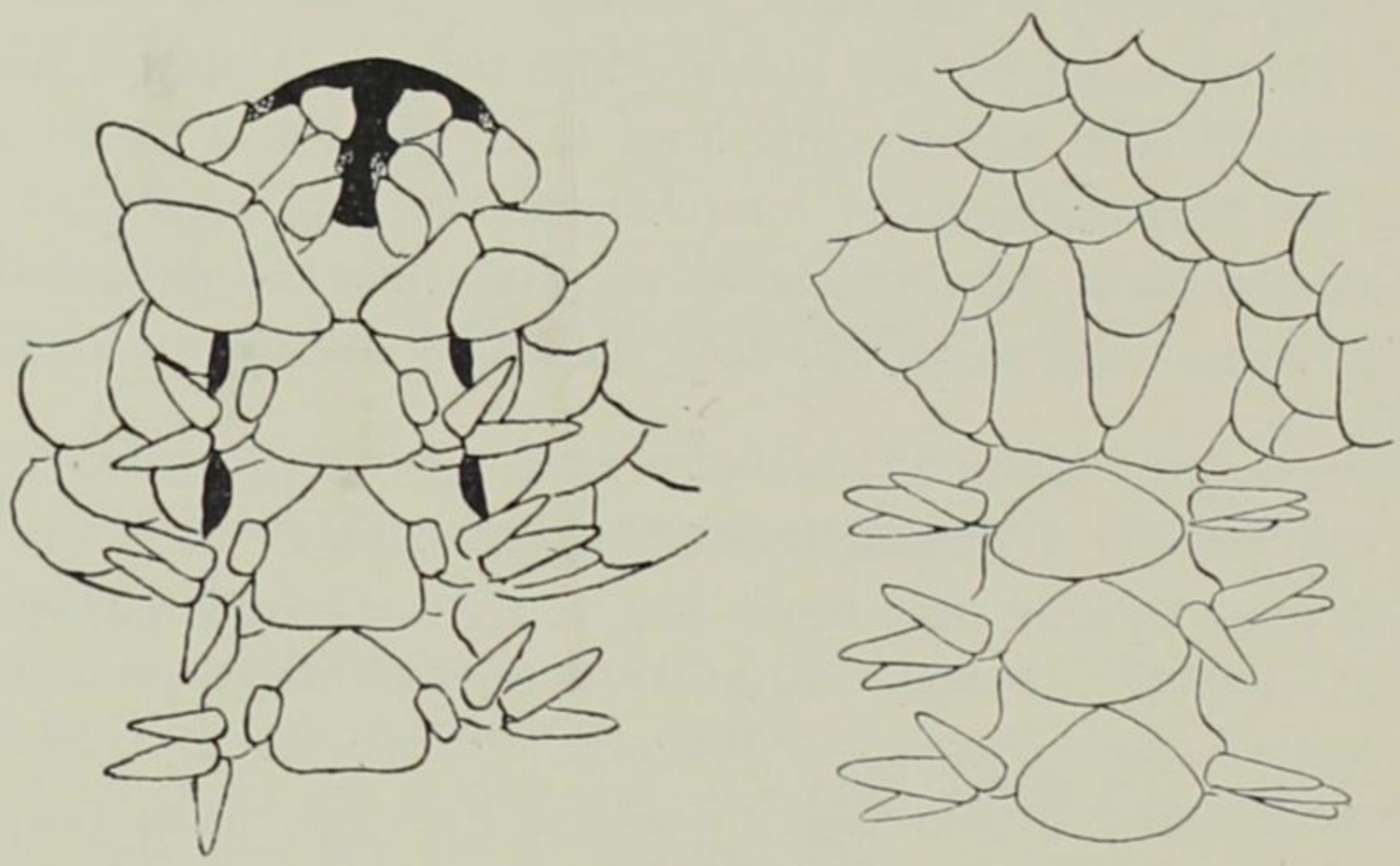
Ophiactis plana Lyman. 1869. Prelim. Rep. on the Oph. and Astroph. dredged in deep water between Cuba and the Florida Reef. Bull. Mus. C. Zool. I. 10. p. 330.
— — H. L. Clark. 1915. Cat. Rec. Oph. p. 264. Pl. 10. 1—2.
— — — 1918. Brittle-Stars, old and new. Bull. Mus. C. Zool. LXII. p. 301.
— — — 1923. Echinod. Fauna S. Africa, p. 333.

Several specimens dredged onboard the "Pickle", viz.

Off Durban,	29°56′ S.	31°19′ E.	225	fathoms.	26. VIII. 1929.	1 specimen.
—	29°54′ S.	31°22′ E.	39	—	—	1 —
—	30° 2′ S.	31° 2′ E.	90	—	27. VIII. 1929.	2 —
—	29°54′ S.	31°10′ E.	68	—	29. VIII. 1929.	1 —
—	34° 5′ S.	18° 2′ E.	118	—	23. XII. 1929.	6 —

The identification of these specimens with the West Indian *Ophiactis plana* Lyman rests on the authority of H. L. Clark, who has had the opportunity of comparing the S. African specimens with the type of Lyman's species. Of this latter Clark gave in his Catalogue of the Recent Ophiurans a couple of photographic figures, in which, unfortunately, not all the necessary details are to be made out. I do, however, not doubt that he was right in this identification, and I am also inclined to think he is right in regarding *Ophiactis profundi* Ltk. & Mrtsn. as identical with *O. plana*, whereas, on the other hand,

I must decidedly object to his regarding the 5-armed, not self-dividing *O. flexuosa* Lym. as identical with the 6-armed, self-dividing *O. plana*. Whether the *Ophiactis parva*, which I described in my report on the Suez-Canal Echinoderms (Trans. Zool. Soc. 1926. p. 123) is identical with *O. plana*, (a possibility already hinted at there) I do not venture to say; much more material is needed for deciding the question. I would only point out that the difference in the shape of the buccal shields seen on a comparison of the figure of *O. parva* (Op. cit.) with



a. b.

Fig. 57. *Ophiactis plana* Lyman. Part of oral (a) and dorsal side (b). × 22.

that given here of *O. plana* (Fig. 57) is not a reliable character, as particularly the shape of the buccal shields is subject to great variation in species which propagate by autotomy. On the whole, it does seem that *O. plana* is a cosmopolitan species, like *Ophiactis Savignyi*.

Ophiactis nidarosiensis Mrtsn.

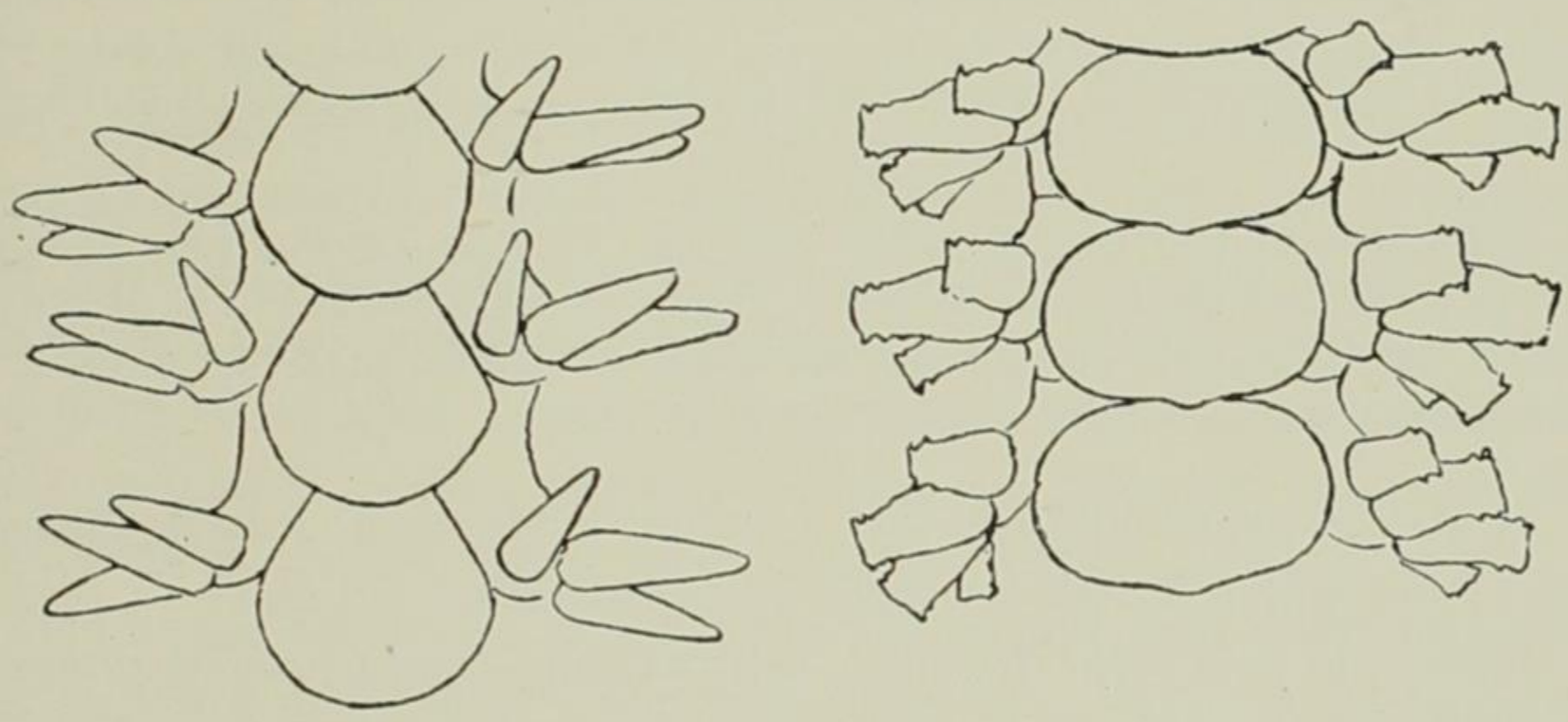
Ophiactis nidarosiensis Th. Mortensen. 1920. Notes on some Scandinavian Echinoderms, with descriptions of two new Ophiurids. Vid. Medd. Dansk Naturh. Forening. Bd. 72. p. 60.

— — — 1927. Handbook Ech. Brit. Isles, p. 200.

In the material received from Fisheries Survey there are two specimens of this species, unfortunately without locality. But it would then seem beyond doubt that this North Atlantic species occurs also

in S. African Seas; it would then also seem beyond doubt that it must be distributed all over the Eastern Atlantic.

From the two other 6-armed, self-dividing *Ophiactis*-species found



a. b.

Fig. 58. Armjoints, dorsal side, of *Ophiactis nidarosiensis* Mrtsn. (a) and *Ophiactis Savignyi* (Müll. & Troschel) (b). × 30.

in S. African Seas, *O. plana* and *O. Savignyi*, it is distinguished at a glance by the quite different shape of the dorsal arm plates (cf. figs. 57—58).

Ophiactis abyssicola (M. Sars).

Amphiura abyssicola M. Sars. 1861. Norges Echinod. p. 18. Pl. II. 7—12.
Ophiactis — Ljungman. 1867. Oph. viv. huc usque cogn. p. 324.
— *poa* Lyman. 1882. Challenger Oph. p. 119. Pl. XX. 13—15.
— *corallicola* Koehler. 1896. Echinod. du "Caudan". p. 75. Pl. III. 30.
— *abyssicola* H. L. Clark. 1918. Brittle-Stars, old and new. Bull. Mus. C. Zool. LXII. p. 304.
— — — 1923. Echinod. Fauna S. Afr. p. 334.
— — Th. Mortensen. 1927. Handbook Ech. Brit. Isles, p. 202.

I did not collect this species myself, but there are some fine specimens in the material from the Fisheries Survey. Unfortunately the locality cannot be made out, but it is certain that they are from S. Africa.

Whereas I quite agree with Clark in regarding Lyman's *Ophiactis poa*, from off Tristan d'Acunha, as identical with *O. abyssicola*, I do not think it justifiable to regard also *O. cuspidata* Lyman, from off the Kermadec Islands as the same species. Till now *O. abyssicola* is otherwise unknown from the Indo-Pacific.

Ophiactis Savignyi (Müll. & Troschel).

Ophiolepis Savignyi Müller & Troschel. 1842. System d. Asteriden, p. 95.
Ophiactis — Ljungman. 1867. Oph. viventia huc usque cogn. p. 323.
— *Reinhardtii* Lütken. 1859. Add. hist. Oph. II. p. 161. Tab. III. 7. a—b.
— *Savignyi* H. L. Clark. 1918. Brittle-Stars, new and old. Bull. Mus. C. Zool. LXII. p. 305.

Specimens of this species, which was not hitherto known from S. Africa, were sent me from the Durban Museum. They were collected by Mr. D. R. Boyce at Park Rennie, Natal. I also dredged one specimen off Durban (29°47′ S. 31°12′ E., 35 fathoms), onboard the "Pickle" (22. VIII. 1929).

It may be mentioned also that I found the species at Inhaca, Delagoa Bay, from where it had not been recorded either till now.

From the two other 6-armed, self-dividing *Ophiactis*-species occurring in S. African seas *O. Savignyi* is easily distinguished, from *O. plana* by having spines on the disk, from *O. nidarosiensis* by its broad dorsal arm plates, with a more or less conspicuous median lobe (Fig. 58. b.).

Family ***Amphiuridæ.***

Amphiura capensis Ljungman.

Amphiura capensis Ljungman. 1867. Oph. viv. huc usque cogn. p. 320.
— — Lyman. 1882. Challenger Oph. p. 129. Pl. XVIII. 14—16.
— — Koehler. 1908. Ast., Oph., Ech. Scottish Nat. Antarct. Exp. p. 298.
— — Döderlein. 1910. Ast., Oph., Ech. L. Schultze. Forschungsreise Südafrika. p. 253. Taf. V. 2—2. b.
— — Koehler. 1914. Echinod. Meeresfauna W. Afrikas. p. 190. (pro parte; the specimens from Lüderitzbay only).
— — Diakonov. 1914. Über Viviparität u. Wachstumserscheinungen by *Amphiura capensis* Ljungman. Zool. Jahrb. Syst. Bd. 36. p. 291. Taf. 8.
— — Mortensen. 1920. On Hermaphroditism in viviparous Ophiurids. Acta Zool. I. p. 12.
— — Clark. 1923. Echinod. Fauna S. Africa. p. 327.

Several specimens were collected by the author on the shores of Cape Peninsula; particularly at Sea Point, (29. XI. 1929 and 20. XI. 1930) but also at the Cape of Good Hope (5. I. 1930).

They are found under stones, often so close together that one can take some 4—5 specimens at a time with the hand. They do not go

deep down in the ground, lying almost directly under the stones, much as is the case with *Amphipholis squamata*. When touched they coil up their arms so as to cover the disk entirely — one cannot help thinking of somebody covering his head with his arms. They vary very much in colour; some are very dark, with nearly black arms, others are lighter coloured, with the arms yellowish with dark spots arranged in indistinct bands, others again have the arms a uniform light yellowish. Specimens preserved in alcohol usually have lost all colour, but some specimens still show traces of the original colour, as a faint violet tinge along the ventral side of the arms and in the distal part of the arms; sometimes there are traces of bands on the arms. Not rarely the spines have remained darker coloured.

One of the specimens had a whole Gastropod shell in its stomach. This does not mean to say that this Amphiurid feeds on Gastropods; probably it eats anything eatable that is not too big to be swallowed. But this is for direct observations on living specimens.

The discovery that this species is viviparous is due to Diakonov (Op. cit.); that it is also a hermaphrodite I made known in my paper of 1920 "On Hermaphroditism in viviparous Ophiurids". Diakonov expresses the opinion that the young ones normally leave the mother through a rupture in the disk, not normally through the bursal slits. As stated in my paper quoted, I think that the ruptures observed by Diakonov are accidental, and that the young ones normally get out through the genital slits, as in other viviparous Ophiurids. Fedotov, in his paper "Über eigenartigen Parasitismus bei Stachelhäutern" (Zeitschr. f. Morph. u. Ökologie d. Tiere. Bd. 22. 1931, p. 414) referring to the observations of Diakonov, states as an established fact that the young ones of this species leave the mother specimen through a rupture of the disk, overlooking the reservation taken by Diakonov, as well as the view expressed by me, that the ruptures observed by Diakonov are accidental. The rather numerous specimens in hand serve to strengthen my view; there are some of them with ruptures of the skin, but it is perfectly evident that these ruptures are accidental, without any relation to the young ones, being found in various places, now at the adoral edge of the ventral interradius, now on the dorsal side, now at the edge or close to one of the bursal slits — and not at all on the interradii with the largest young ones, ready to be born. Likewise I have found no specimens with scars that could be due to

ruptures caused by the young ones having made a rupture in the skin for getting out that way. On the other hand, I find only one specimen with a young one with one of its arms protruding through the bursal slit. Also in some cases the young ones are so large and have widened the skin of the mother to such a degree that it seems rather difficult to understand, how they could get out through the bursal slit. — The whole question can only be settled through direct observations on living specimens; it may be hoped that some S. African biologist will take up the matter. With the very easy access to living material it should be easy enough to make the necessary investigations.

The species is known to occur along the S. African coasts from Port Natal to Lüderitzbay. It is also recorded by Koehler (Op. cit. 1908) from Ascension and (Op. cit. 1914) from Angola and Senegal. Through the kindness of Dr. A. Panning of the Hamburg Museum I have been able to reexamine the specimens from Angola and Senegal identified by Koehler as *Amphiura capensis*. Those from Senegal are *Ophiactis africana*, differing from the typical *O. africana* only in having no spines on the disk; possibly they may prove to be a separate variety of that species, but I rather think them to be individual variations. That Koehler could mistake them for *Amphiura capensis* is due to the fact that there is really a considerable, superficial resemblance between these two forms; but a glance at the mouth structure shows that they have nothing with one another to do. His specimens from Lüderitzbay are *Amph. capensis*, sure enough, but the one from Angola which I have seen is an *Amphipholis*.

The specimen from Ascension referred by Koehler to *Amph. capensis* I have likewise had the opportunity of reexamining, Dr. A. C. Stephen of the R. Scottish Museum, Edinburgh, having kindly lent it to me for reexamination. There is no doubt that the identification is correct — it is really *Amph. capensis* (the specimen also contains a young one in one of its interradii). This isolated occurrence (the species does not occur at St. Helena — at least I have not been able to find it there during my researches there in February-March 1930) of the species at Ascension is so remarkable that I cannot help suggesting, it must be due to some casual interchange of labels. Until the species is found anew at Ascension I must remain sceptical as to the occurrence of this eminently South African species in that isolated tropical locality.

Amphiura incana Lyman.

Amphiura incana Lyman. 1882. "Challenger" Oph. p. 128. Pl. XXXIII. 5—7.
— — Clark. 1923. Ech. Fauna S. Africa, p. 328.
— — Hertz. 1926. Oph. Deutsche Südpolar-Exp. p. 34. Taf. VII. 1.
Non: *Amphiura incana* Bell. 1905. Ophiuroidea. Marine Invest. S. Africa. III. p. 258. (= *Amphioplus furcatus* n. sp. cf. below p. 370).

False Bay, 8—30 fathoms. 15 specimens. XII. 1929.
Off Durban 30°4′ S. 31°00′ E. 50 fathoms. 27. VIII. 1929. 6 specimens.
Dredged onboard the "Pickle".

On comparing the figure given by Hertz (Op. cit.) with the corresponding figure in the "Challenger" Oph., one cannot but wonder that the same species could vary to such extent in regard to the shape of the mouth shields. Nevertheless it does so. The figures here given (Fig. 60. c.) show some various forms, giving the transition from the narrow, angular form in Lyman's figure to the nearly circular form in Hertz's figure. It would seem that the rounded shape, as in the lowermost of these figures, is the more common. Very often there is a central depression in the mouth shields, but this is no constant feature. That the specimens from off Durban are really *incana* cannot be doubted. Thus it might also be possible that Bell's specimens from off the Tugela river were correctly identified. This is, however, not the case; they are the species described below as *Amphioplus furcatus*, as I must state after having had Bell's specimens for examination.

Amphiura atlantica, var. *dilatata* Lyman.

Amphiura dilatata Lyman. 1882. "Challenger" Oph. p. 135. Pl. XXIX. 4—6.
— — Clark. 1923. Echinod. Fauna S. Africa. p. 326.

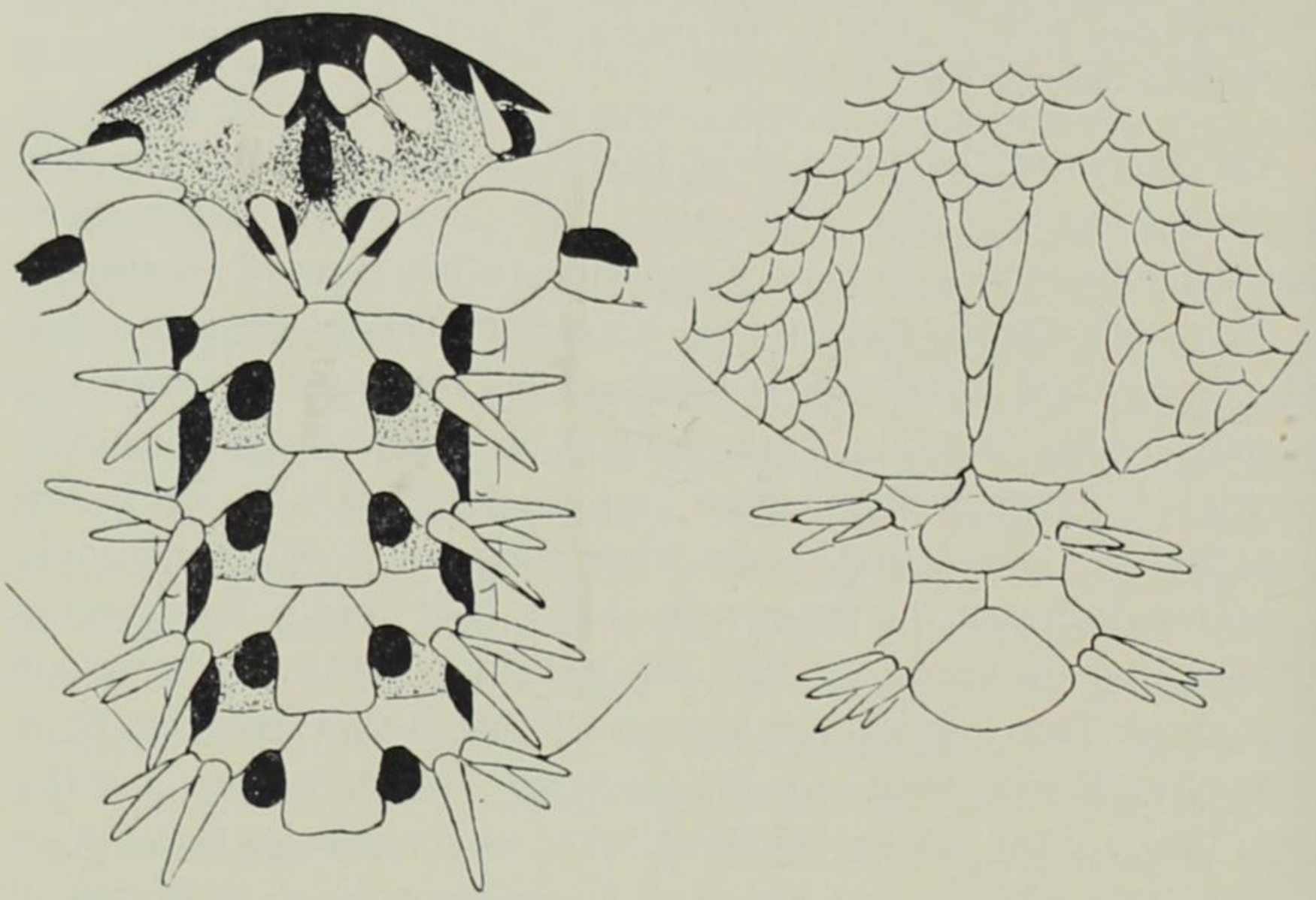
Several specimens dredged onboard the "Pickle", viz.

34°24′ S.	18°16′ E.	133 fathoms.	18. XII. 1929.	1 specimen.
34° 5′ S.	18° 2′ E.	118 —	23. XII. 1929.	5 —
34° 5′ S.	17°52′ E.	146 —	—	3 —

Some of the younger specimens have only 3 arm spines, the species having typically 5 arm spines. Also the radial shields are contiguous in the distal part, whereas they are wholly separated in the typical form. These differences, however, apparently are due only to age, and I do not think, there can be any doubt but that these specimens really belong to *A. dilatata*, the more so as they come from the type locality, off Cape Peninsula.

In a specimen at hand, identified by H. L. Clark, there are distinct traces of a single, small tentacle scale in the greater part of the arm.

Dr. Hertz (Oph. d. deutschen Südpolar Exp. p. 32) in describing an antarctic variety *gaussi* of *A. dilatata*, comments on the fact that Lyman's figure of the oral side of *A. dilatata* does not show the tentacle scale of the inner tentacle pore, and remarks that if that



a. b.

Fig. 59. *Amphiura atlantica*, var. *dilatata* Lyman. Part of oral (a) and dorsal side (b). × 25.

scale be really absent in *dilatata* the antarctic form must be regarded as a separate species. It is then of importance to state that this inner tentacle scale is even unusually well developed in *dilatata*, Lyman's figure being deficient in this respect. The corresponding figure in the preliminary report of the "Challenger" Oph. Pl. XI. 14 (Bull. Mus. Comp. Zool. VI. 1879) also shows this papilla.

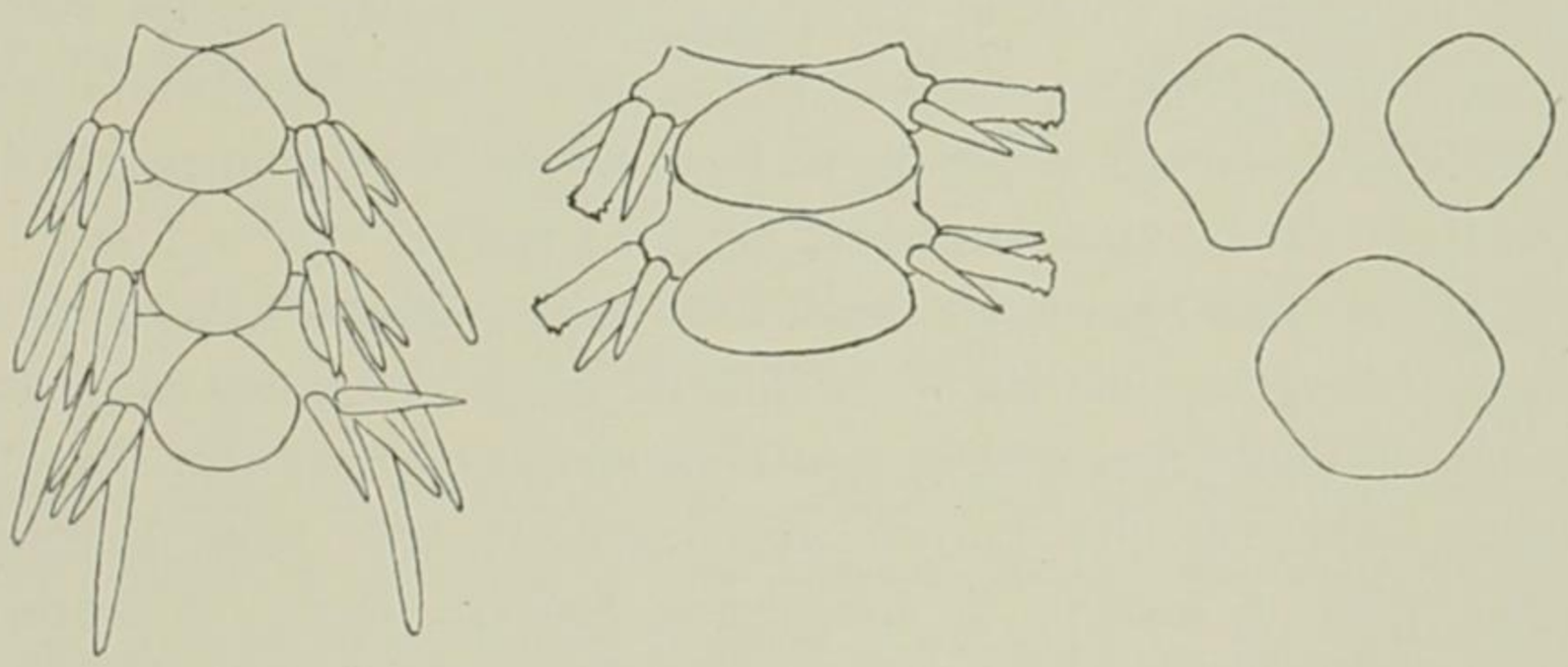
H. L. Clark (Op. cit.) suggests that *Amph. dilatata* may be identical with *Amph. atlantica* Ljungman, known from St. Helena. Koehler (Revision de quelques Ophiures de Ljungman. Arkiv. f. Zoologi. Bd. 19. a. 1926, p. 4) in redescribing the type-specimen of *A. atlantica*, thinks that the two species are not identical. Having now a fairly rich material of *Amph. atlantica* from St. Helena at disposal I must

join the opinion of Clark. It was pointed out by Koehler as an important character of *A. atlantica* that the second spine from below is somewhat axe-shaped widened, much as in *Amph. filiformis*. The same character I find, however, also in *dilatata* (Fig. 60. b.). On comparing the figures of *dilatata* given here (Fig. 59) with those of *A. atlantica* given in my report on the St. Helena Echinoderms it will be seen that the resemblance is almost complete. At most, I can regard *dilatata* as a variety of *atlantica*, mainly on account of its outer mouth papillæ being somewhat more slender than those of the typical *atlantica*.

Amphiura grandisquama, var. *natalensis* n. var.

Off Durban 29°56′ S. 31°19′ E., 225 fathoms. 4 specimens, dredged onboard the "Pickle", 26. VIII. 1929.

These specimens, which are all small and rather poorly preserved, are indistinguishable from the atlantic specimens of *Amphiura grandisquama* Lyman, except by the character of the dorsal arm plates, which are narrower and more rounded than those of the typical *A. grandisquama* (Fig. 60. a.; figures of the typical *A. grandisquama* are given in my report of the St. Helena Echinoderms). We may then for the present, at least, keep these specimens from off the Natal coast as a separate variety.



a. b. c.

Fig. 60. a. Armjoints, dorsal side, of *Amphiura grandisquama*, var. *natalensis* n. var.; b. same of *Amphiura atlantica*, var. *dilatata* Lyman. c. Buccal shields of *Amphiura incana* Lyman; the differences in size due to the differences in size of the specimens from which these buccal shields were drawn. × 20.

As Koehler (Oph. Albatross Philippine Exped. 1922. p. 159) has recorded *A. grandisquama* from the Philippine Seas, there is nothing

surprising in finding it also in the S. African Seas — it must rather be expected to occur all over the Indian Ocean. That it has not been found off the Cape and the Agulhas Bank, where now quite a good deal of investigations have been made, might indicate that the distribution of *A. grandisquama* from the West Indies to the Philippine Seas is not now continuous.

Amphiura angularis Lyman.

Amphiura angularis Lyman. 1882. "Challenger" Oph. p. 134. Pl. XXIX. 1—3.
— — Koehler. 1917. Echinodermes de Kerguelen. Ann. Inst. Océanogr. VII. Fasc. VIII. p. 67. Pl. VIII. 13—15.
— — Clark. 1923. Echinod. Fauna S. Africa. p. 327.

Cape Point in S. 22. W. 2 miles. 30 fathoms. 20. XII. 1929. 1 specimen.
Cape Point in S. 2 miles. 30 fathoms. 19. XII. 1929. 1 specimen.
These specimens dredged onboard the "Pickle".

These two small specimens are perfectly conform with the figures and the description given by Koehler (Op. cit.). The species was not hitherto known from so small a depth, only from 150—190 fathoms. But there is no record of the depth from which the specimens dredged by Rallier du Baty (Koehler. Op. cit.) came.

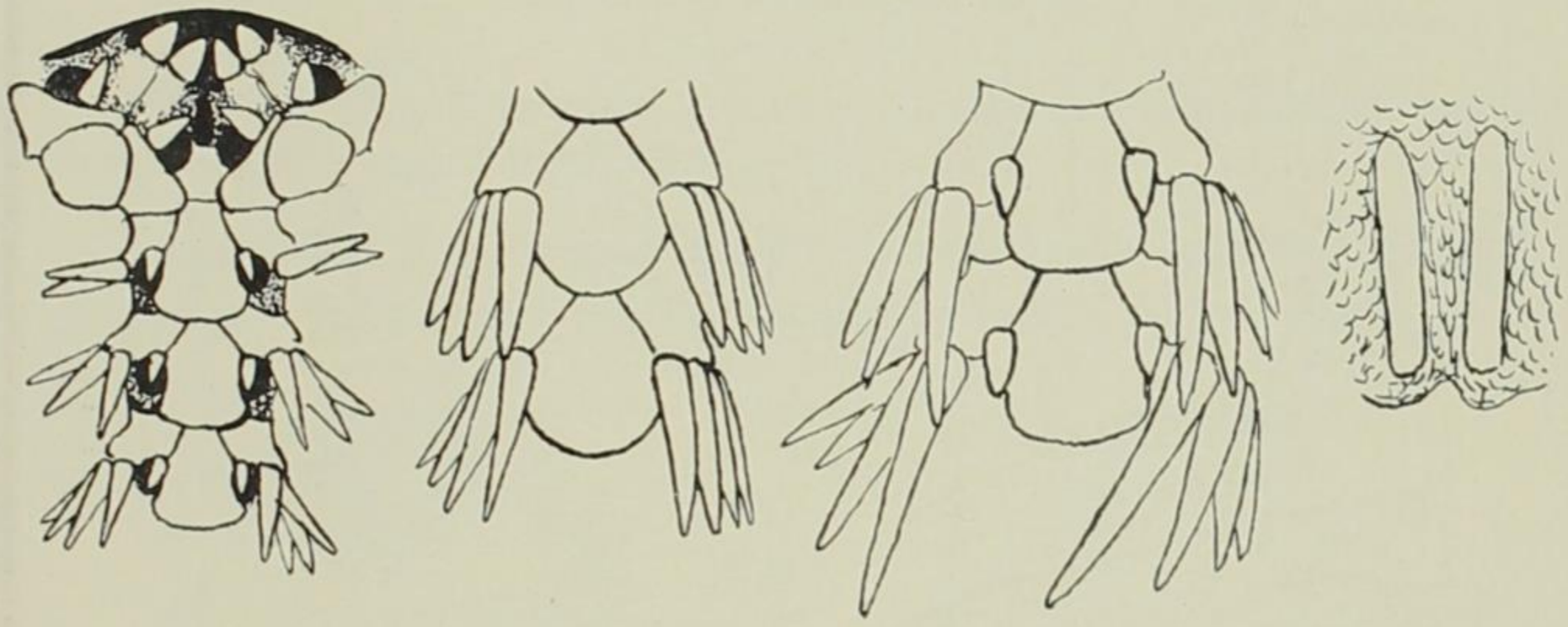
That the specimens from the West Indies ("Blake") and from the Atlantic, (the Josephine Bank, "Princesse Alice") recorded as *A. angularis* are not really that species, was pointed out by Koehler (Op. cit.). *A. angularis* is till now known with certainty only from Kerguelen and S. Africa. A variety or subspecies, *protecta*, from the Antarctic was described by M. Hertz in her report on the Ophiuroids of the German South Polar Expedition (p. 32).

Amphiura linearis n. sp.

Off Durban, 30°2′ S. 31°3′ E. 90 fathoms. 1 specimen.
Off Durban, 30°4′ S. 31°0′ E. 50 fathoms. 1 specimen.
These specimens dredged onboard the "Pickle".

Both these specimens, dredged onboard the "Pickle" 27. VIII. 1929, are in very poor condition; one is ca. 2 mm in diameter of disk, arms ca. 10 mm; the other ca. 3.5 mm diameter of disk, arms broken. The infradental papillæ are rather thick; on account of the jaws being very low, sunken, these papillæ form a conspicuous circle of small beads round the mouth-opening. Outer mouth papilla rather broad, but

pointed. Buccal plates rounded triangular, about equally broad and long; they are not very distinct in the larger specimen, but apparently of the same shape as in the small specimen (Fig. 61. a.). Ventral arm plates somewhat elongate, rather broadly contiguous; dorsal arm plates distinctly longer than broad, with outer edge convex; they are narrowly in contact. Arm spines 5 in the smaller, 6 in the larger specimen, flattened and appressed in the larger, not in the smaller specimen; the lowermost one is somewhat longer than the others. 1 leaf-shaped



a. b. c. d.

Fig. 61. *Amphiura linearis* n. sp. a. Part of oral side; b. armjoints, dorsal side; c. same, ventral side; d. radial shields. × 30.

tentacle scale of moderate size. Disk, both dorsally and ventrally, with a uniform covering of small scales. Radial shields very narrow, linear, parallel (Fig. 61. d.), a little more than $^1/_3$ the disk radius.

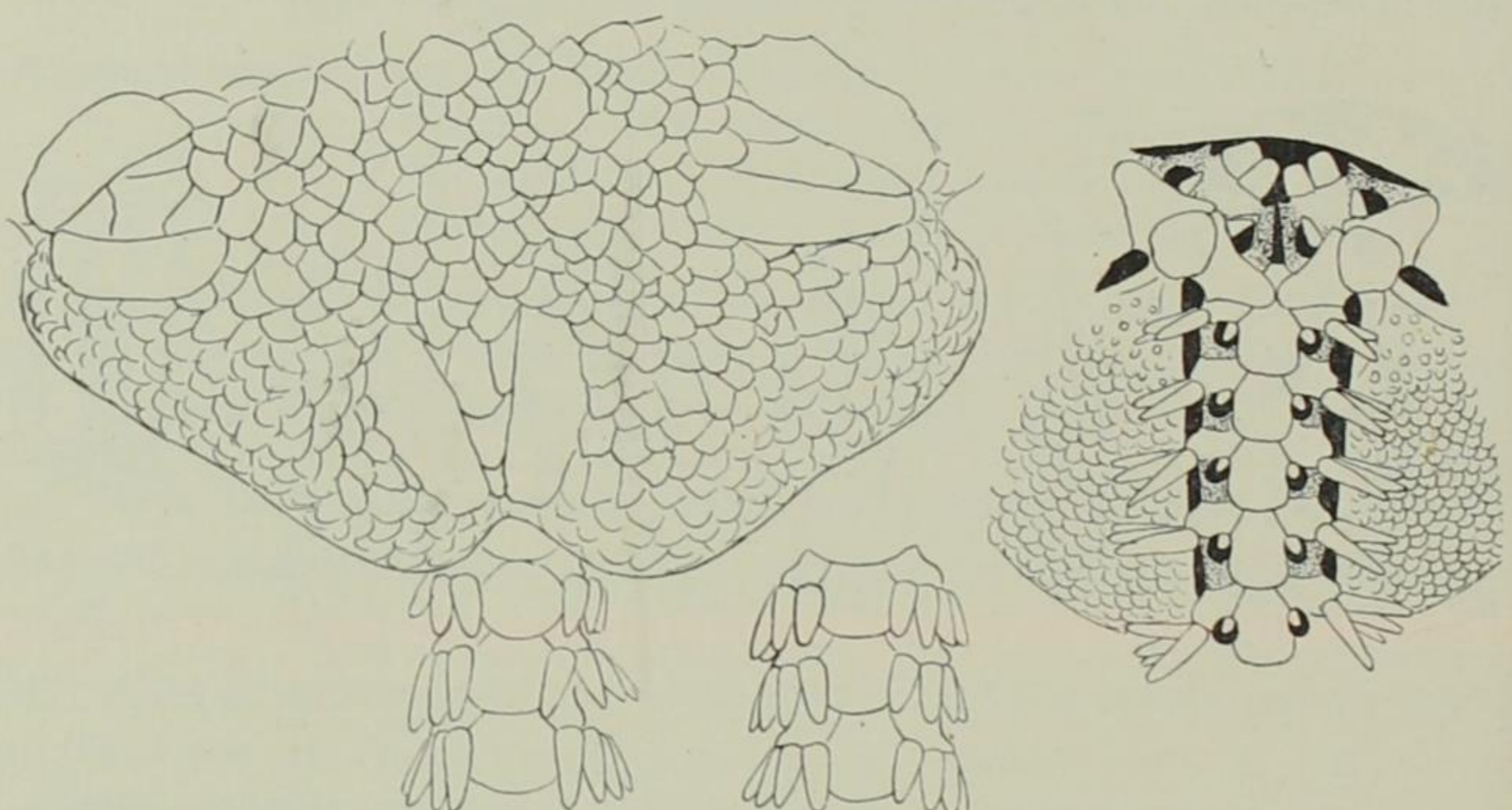
This species is particularly characterized by its narrow, linear radial shields, by which it is easily distinguished from all other species hitherto known.

Amphiura adjecta n. sp.

Off Durban, 29°47′ S. 31°12′ E. 35 fathoms. 5 specimens, dredged onboard the "Pickle", 22. VIII. 1929.

Diameter of disk up to 4 mm, length of arms ca. 5 times the diameter of disk. Infradental papillæ square, not particularly prominent; outer mouth papillæ short, spiniform, not pointed. Jaws low, short. Mouth shields rounded triangular, longer than wide. Ventral arm plates longer than wide, broadly contiguous, with convex outer edge. The fact that the first ventral plate is separated from the second (Fig. 62. b.),

rather unusual in *Amphiura*, does not afford any character of special value, as it is not constant, not even in all radii of the same specimen. Dorsal arm plates about as wide as long, apparentiy narrower because of the arm spines, which are flattened and appressed, leaving thus only a relatively narrow median belt free (Fig. 62. c.). The number of the arm spines is 6—5; the lowermost may be slightly the longest; no terminal widening, at most a very faint indication of lateral serrations



a. c. b.

Fig. 62. *Amphiura adjecta* n. sp. Part of dorsal (a) and oral side (b). Armjoints, dorsal side, showing the appressed spines (c). × 20.

at the end. 1 rather small tentacle scale. Dorsal side of disk (Fig. 62. a.) with rather coarse scales, among which the primary plates may be quite distinct; radial shields diverging inwards, rather broad, about $^1/_3$ of the disk radius. Ventral interradii covered with smaller scales which become more or less scarce adorally. No particular colour.

Similarly appressed, flattened spines are found in *Amphiura rapida* Koehler (cf. Pl. XVI. 11 of Koehler's memoir "Ophiures recueillis par le Dr. Th. M. dans les mers d'Australie et dans l'Archipel Malais" 1930 — not mentioned in the text which states (Op. cit. p. 100) incorrectly that the spines are cylindrical). There is, however, no nearer relation between these two species, *A. rapida* having 2 tentacle-scales, an important character within the genus *Amphiura*. Also the species *Amphiura latispina* Koehler and *Amph. kinbergiensis* Koehler (Bull. U. S. Nat. Museum 84. 1914. Pl. 5. 1—2 and Pl. 4. 6) have similar

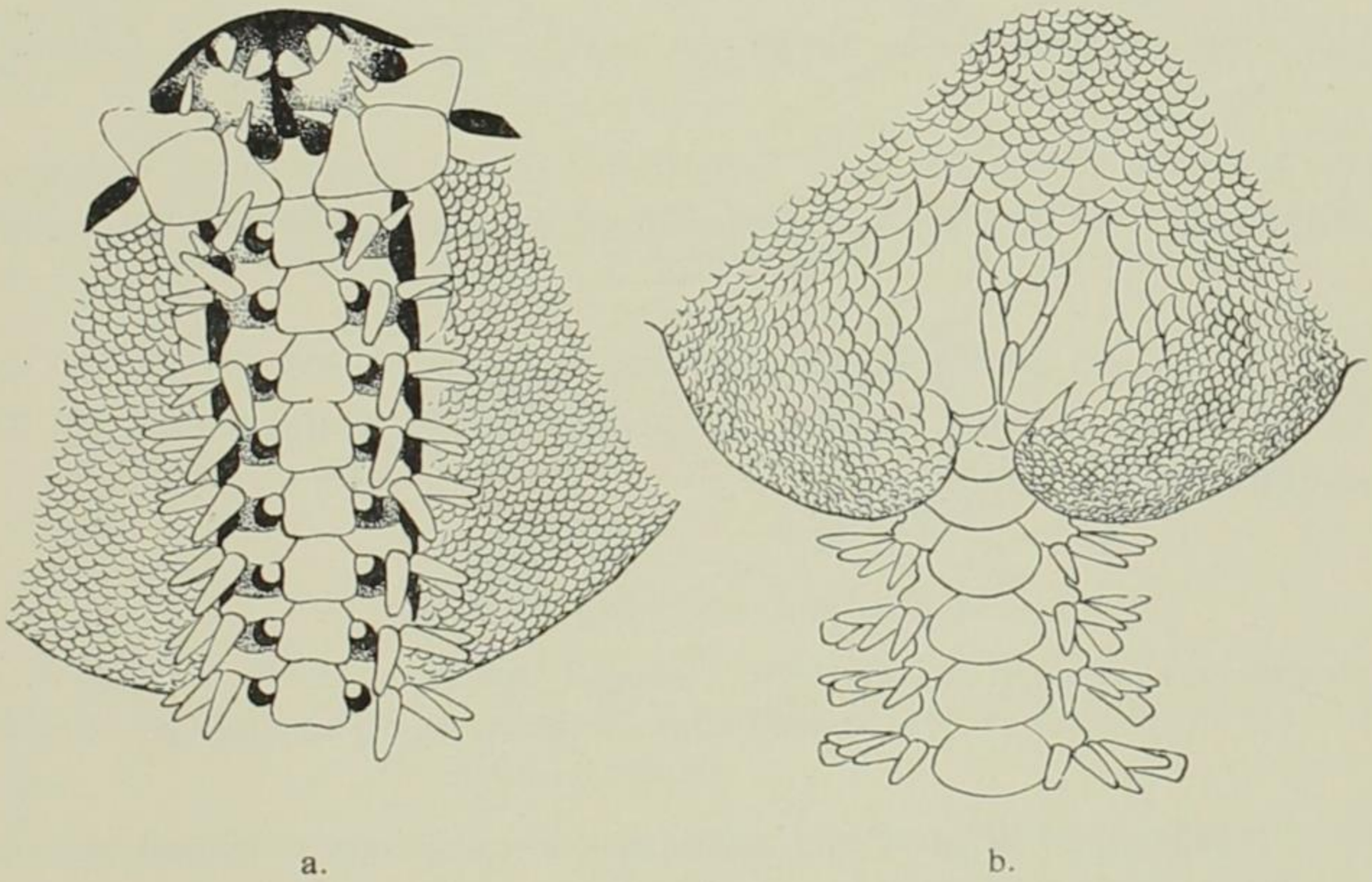
flattened, appressed spines, but they likewise differ conspicuously from the present species in having 2 tentacle scales. The relation of *A. adjecta* is rather with *Amph. angularis* Lyman and *A. algida* Koehler; but both of these differ from it in the arm spines being not flattened nor appressed; also the number of the spines is smaller, 4—3, against 6—5 in the present species. There can thus be no doubt that we have here a distinct new species of the great genus *Amphiura*.

Amphiura compressa n. sp.

Pl. XIX. Fig. 16—17.

False Bay (Cape Point in S., $2^1/_4$ miles), 30 fathoms; sandy bottom. 1 specimen, dredged onboard the "Pickle", 19. XII. 1929.

Diameter of disk 11 mm, length of arms ca. 7 times the diameter of disk. — Infradental papillæ almost vertically placed, ending in a

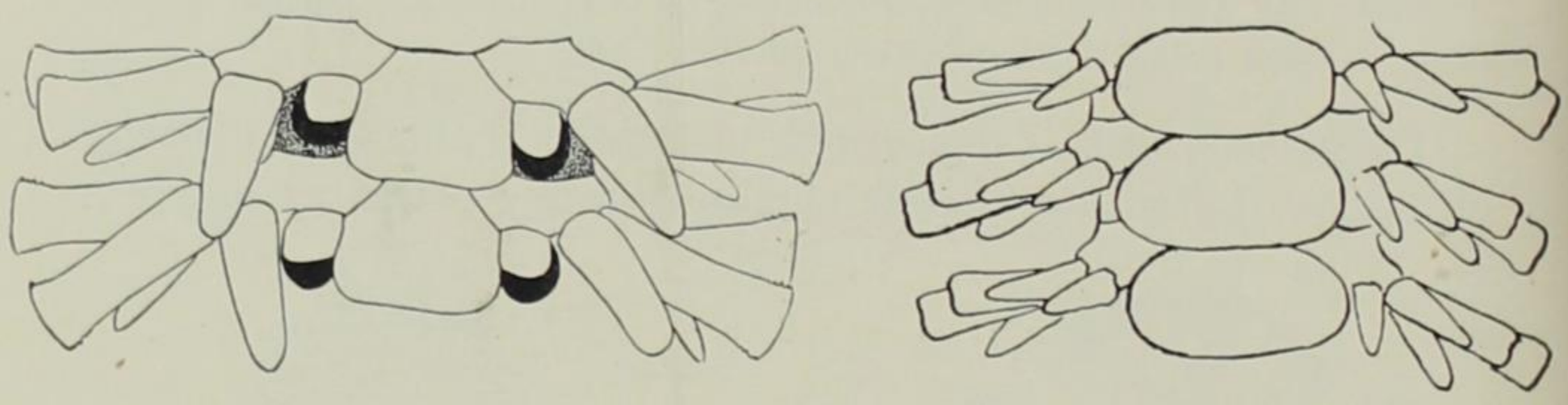


a. b.

Fig. 63. *Amphiura compressa* n. sp. Part of oral (a) and dorsal side (b). × 8.

point upwards; outer mouth papilla spiniform, rather coarse, not pointed. Buccal plates slightly longer than broad with a rounded apex and a small outer lobe. Ventral arm plates about as broad as long, broadly contiguous, with the outer edge somewhat concave (Fig. 63. a.). Dorsal arm plates transverse-elliptical, about twice as broad as long, broadly contiguous. Arm spines 6, erect, of about equal

length. From just outside the disk the second to fourth spine from below distinctly compressed and somewhat axe-shaped widened at the point, but with only very indistinct lateral serrations (Fig. 64). One tentacle-scale of moderate size. The arms on the whole rather robust. — Disk conspicuously lobed, with a deep notch above each arm and a somewhat less marked notch in each interradius. Radial shields about $^1/_3$ the disk radius, diverging broadly inwards. Disk covered, above and below, with very fine scales, among which the primary plates are scarcely distinguishable; around the radial shields the scales are somewhat coarser (Fig. 63. b.). No particular colour.



a. b.

Fig. 64. *Amphiura compressa* n. sp. Armjoints, ventral (a) and dorsal side (b); a. from proximal; b. from more distal part of arm. a. × 15, b. × 20.

The species does not bear distinct relations to any of the species of *Amphiura* hitherto known; it is particularly characterized by its compressed arm spines.

Amphiura uncinata Koehler.

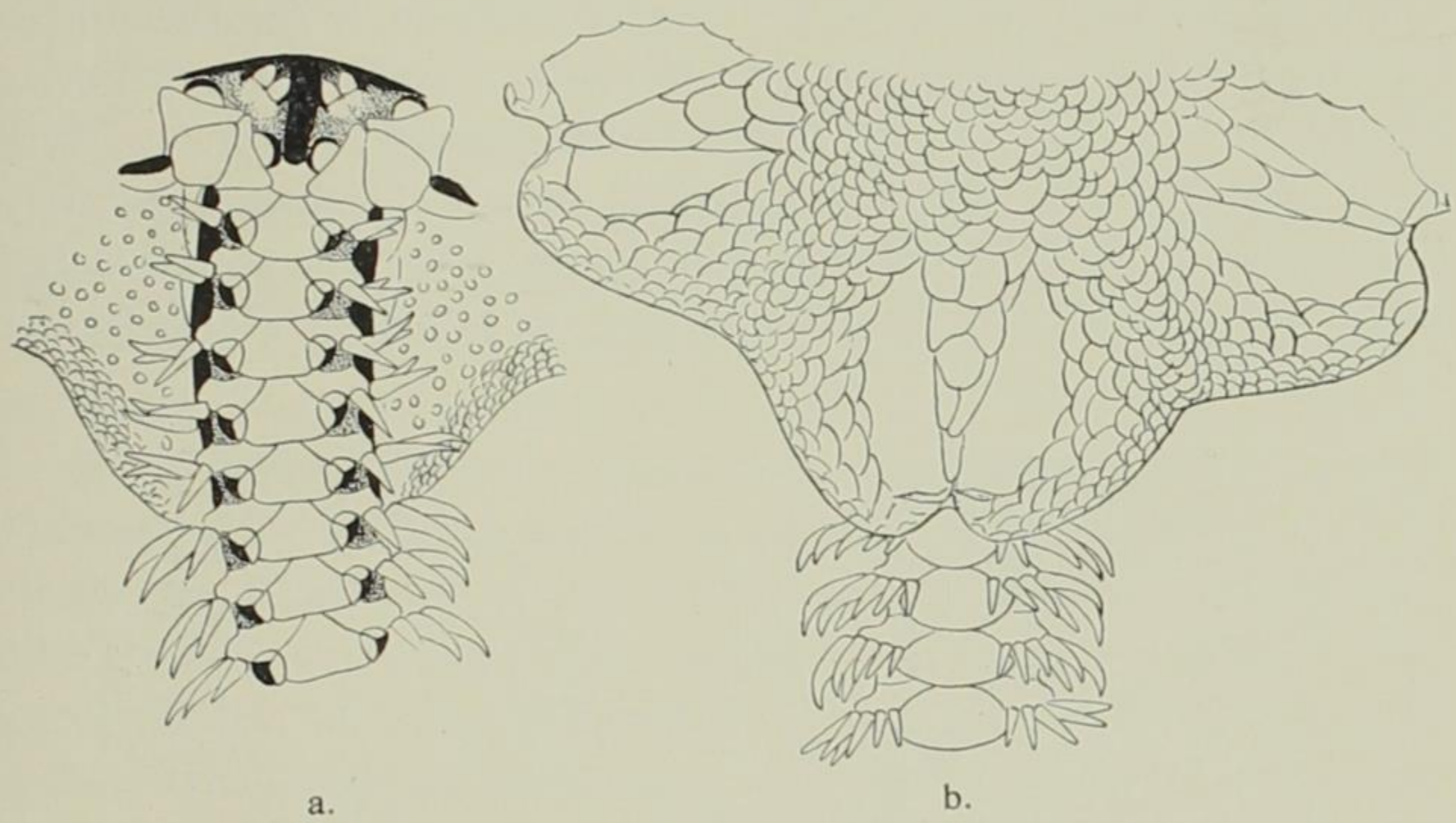
Amphiura uncinata Koehler. 1904. "Siboga" Oph. I. p. 76. Pl. XIV. 3—4.
— — — 1922. Oph. "Albatross" Philippine Exp. p. 160. Pl. 65. 6—8; 96. 4.

Off Durban, 29°56′ S. 31°19′ E. 225 fathoms. 10 specimens, dredged onboard the "Pickle", 26. VIII. 1929.

I do not see any character by which these specimens could be distinguished from the *A. uncinata* of the Malay Archipelago. This leads to the suggestion that the species will be found to occur in suitable localities all over the Indian Ocean, its southern limit being probably about here off the Natal coast.

The figures here given (Fig. 65—66) show some differences from those given by Koehler in the "Siboga" Oph., but it is evidently due

to these latter figures being somewhat diagrammatic. Thus the peculiar shape of the buccal shield shown there is hardly correct; in the photo-



a. b.

Fig. 65. *Amphiura uncinata* Koehler. Part of oral (a) and dorsal side (b). × 8.

graphic figure given in the "Albatross" Oph. the shape of the buccal shields is in accordance with that observed in the S. African specimens.

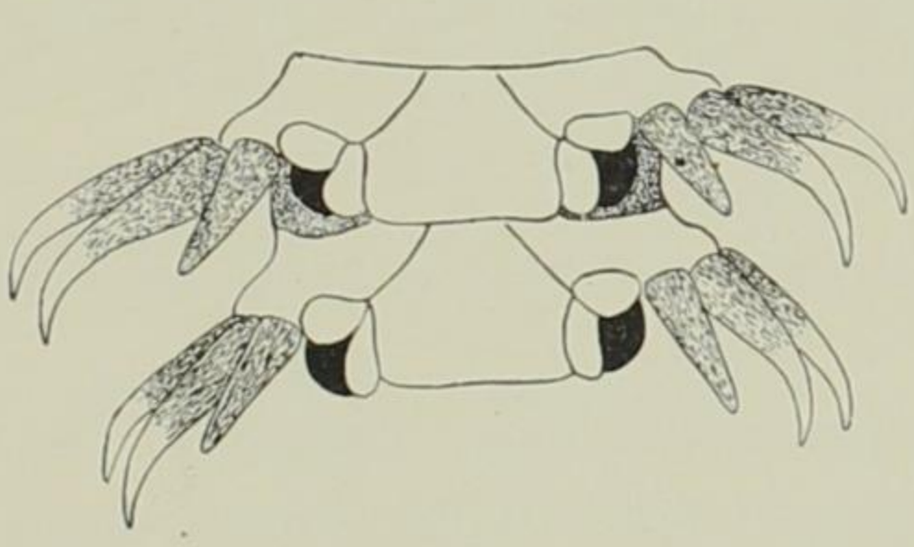


Fig. 66. Arm joints, ventral side, of *Amphiura uncinata* Koehler. × 15.

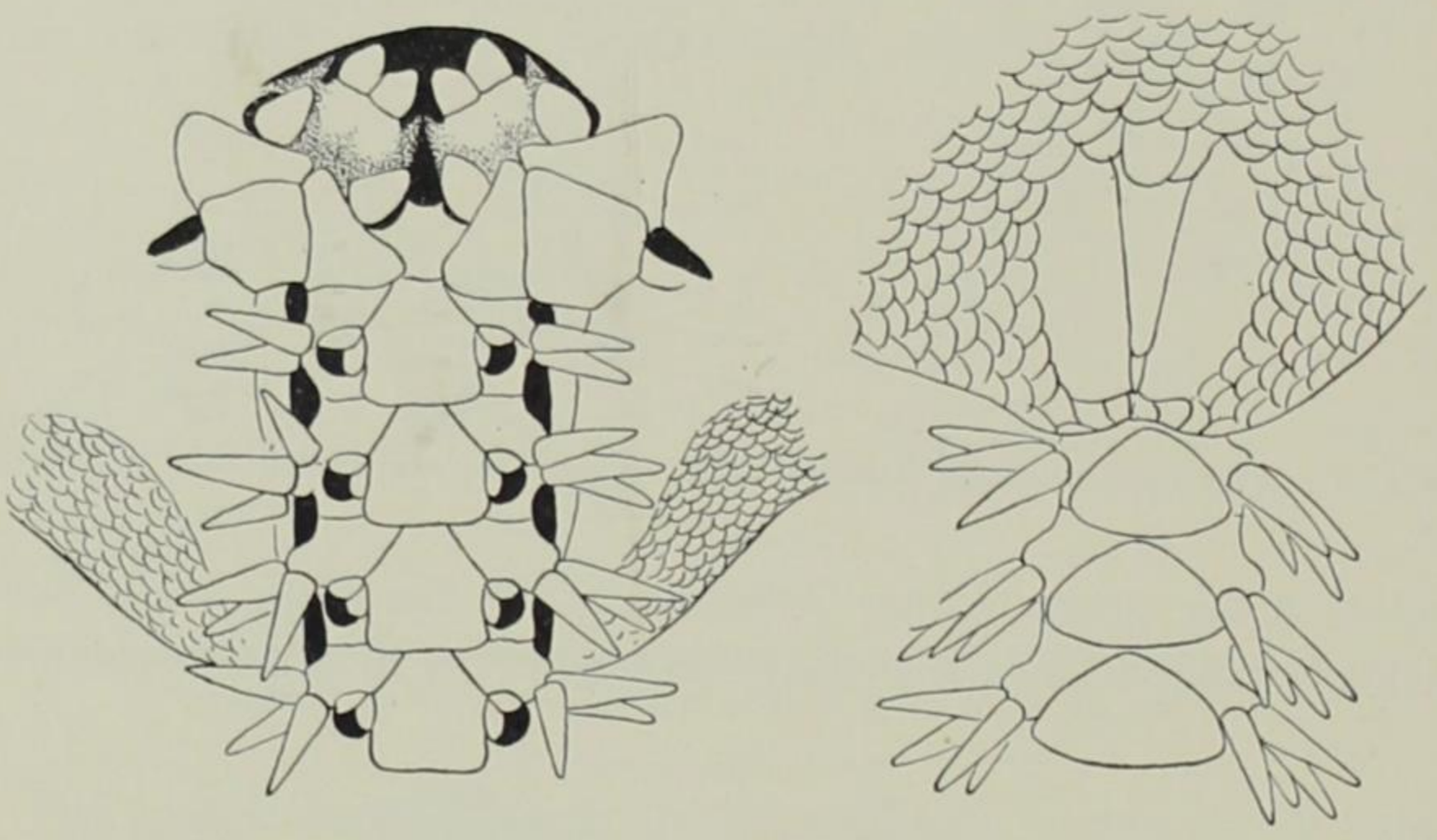
A couple of young specimens show the hyaline hook of the basal spines only just beginning to appear.

Amphiura albella n. sp.

Off Durban, 29°56′ S. 31°19′ E., 225 fathoms. 2 specimens, dredged onboard the "Pickle", 26. VIII. 1929.

Diameter of disk of the larger specimen (the type) 5 mm, length of arms ca. 6 times the diameter of the disk. — Infradental papillæ

flat, not prominent; outer mouth papilla rather broad, leaf-shaped, rounded. Buccal shields in the type specimen somewhat varying in shape, as appears from fig. 67. a.; the typical shape is like that to the right in the figure, or slightly less elongate. Adoral plates distinctly joining within. Ventral arm plates rather broadly contiguous, with outer edge straight. Dorsal arm plates broad, fan-shaped, scarcely contiguous. 4—3 conical, smooth arm spines. 2 tentacle scales. Dorsal side of disk covered with rather fine scales, the primary plates indistinct



a. b.

Fig. 67. *Amphiura albella* n. sp. Part of oral (a) and dorsal side (b). × 18.

in the larger specimen, but fairly distinct in the smaller specimen (of 3.5 mm diameter of disk). Radial shields ca. $^1/_3$ the disk radius, not contiguous, diverging inwards (Fig. 67. b.). Ventral interradii naked, except in the distal part. Colour whitish.

This species is evidently very nearly related to the Atlantic *Amphiura Richardi* Koehler. Judging by the figures given by Koehler (Camp. Sci. Monaco. XXXIV. Pl. XXVII. 1—2) there is a number of small differences — e. g. in the shape of the outer mouth papilla, the buccal and adoral plates; the radial shields are more widely separated in *Richardi*, the ventral arm plates much more narrowly contiguous. However, none of these characters are of great importance, and if it should ultimately be found that *A. Richardi* occurs also off S. Africa, I think the specimens from off Durban should be united with it; for

the present, with *A. Richardi* not known South of the Azores and Portugal, I think it necessary to regard the specimens from off Durban as representing a separate species.

(*Amphiura candida* Ljungman).

The description of this species given by Ljungman (Oph. viv. huc usque cogn. p. 318) is insufficient for recognizing the species — particularly as he does not say anything about the arm spines, their number and shape. The type specimen still exists, but is in so bad condition, all the calcareous substance having been completely dissolved, that nothing can be gathered from it as regards the specific characters of the species. It is therefore quite hopeless to try to identify the species among the S. African Ophiurids, and we must simply drop this "*Amphiura candida*" as a not recognizable species. The specimen described by Koehler (Ophiures nouvelles ou peu connues. Mém. Soc. Zool. Fr. 1904, p. 66) as *Amphiura candida* comes from Japan, and, in spite of the fact that it was identified by Marktanner-Turneretscher as *Amph. candida*, there is not the slightest proof that this identification was correct; on the contrary, there is every probability that this is quite a different species, as also suggested by Clark (Echinod. Fauna of S. Africa, p. 328). It is therefore not justifiable to make this specimen the neotype of *A. candida*, as does Koehler. *Amphiura candida* Ljungman is a *species delenda*.

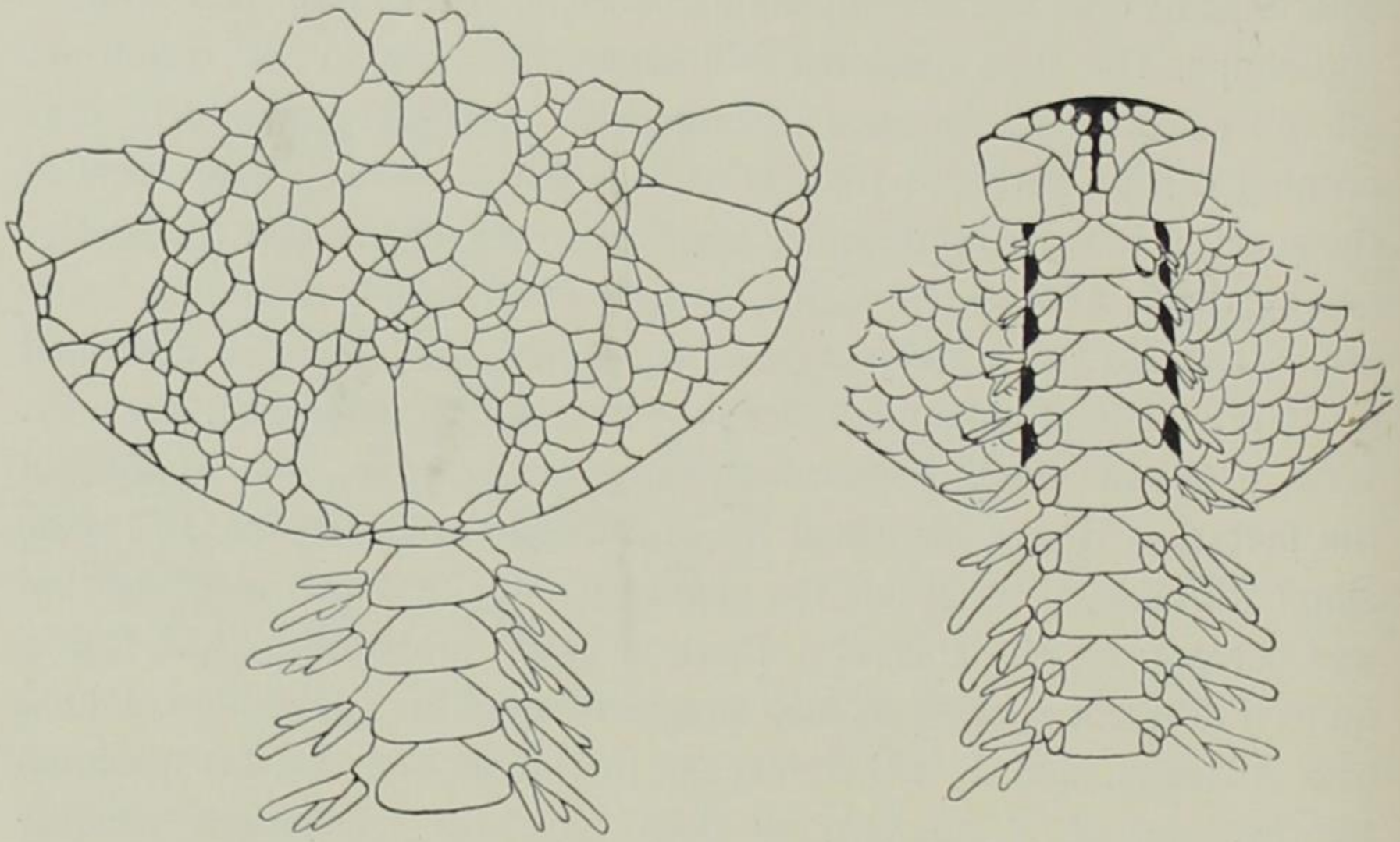
Amphipholis strata n. sp.

Pl. XIX. Fig. 20.

Cape Point in South, 2 miles; 30 fathoms; sand. 4 specimens. Dredged onboard the "Pickle", 19. XII. 1929.

Diameter of disk 8 mm, arms ca. 24 mm, thus only 3 times the diameter of the disk. — Mouth papillæ rather thick, of the typical *Amphipholis*-shape. Exceptionally (on one jaw-side in one specimen) the second papilla is double, there being thus on this side 4 mouth papillæ. Adoral plates rather broad, joining within, not continuing out between buccal plate and first lateral plate. Buccal plate with an acute angle within and a short, rounded distal lobe. It has a rather indistinct median impression. First ventral arm plate very small, forming like a continuation of the mouth papillæ. The ventral arm plates distinctly broader than long, with a straight outer edge and a

truncated angle within, the plates being narrowly contiguous. Dorsal arm plates broad, fan-shaped, truncated within, they being rather broadly contiguous. Lateral arm plates little prominent, carrying 3 arm spines, the middle one the longest, about as long as an arm segment, and slightly club-shaped. The spines on the arm joints enclosed in the disk are short, gradually increasing in size until just outside the disk, where they are the longest (Fig. 68. b.). After some 5—6



a. b.

Fig. 68. *Amphipholis strata* n. sp. Part of dorsal (a) and oral side (b). × 8.

joints the spines again decrease in size. This gives the arms a rather characteristic appearance. Two large tentacle scales, covering the foot-pore completely. Dorsal side of disk covered with a pavement of rather large, smooth, polygonal plates, among which the primary plates remain distinct, usually forming a regular rosette; the primary plates are separated by a varying number of small plates. (In the type specimen there is some irregularity in the rosette). Radial shields contiguous, broad, rounded (Fig. 68. a.). Ventral interradii covered by rather coarse, imbricated scales. Colour of the preserved specimens white.

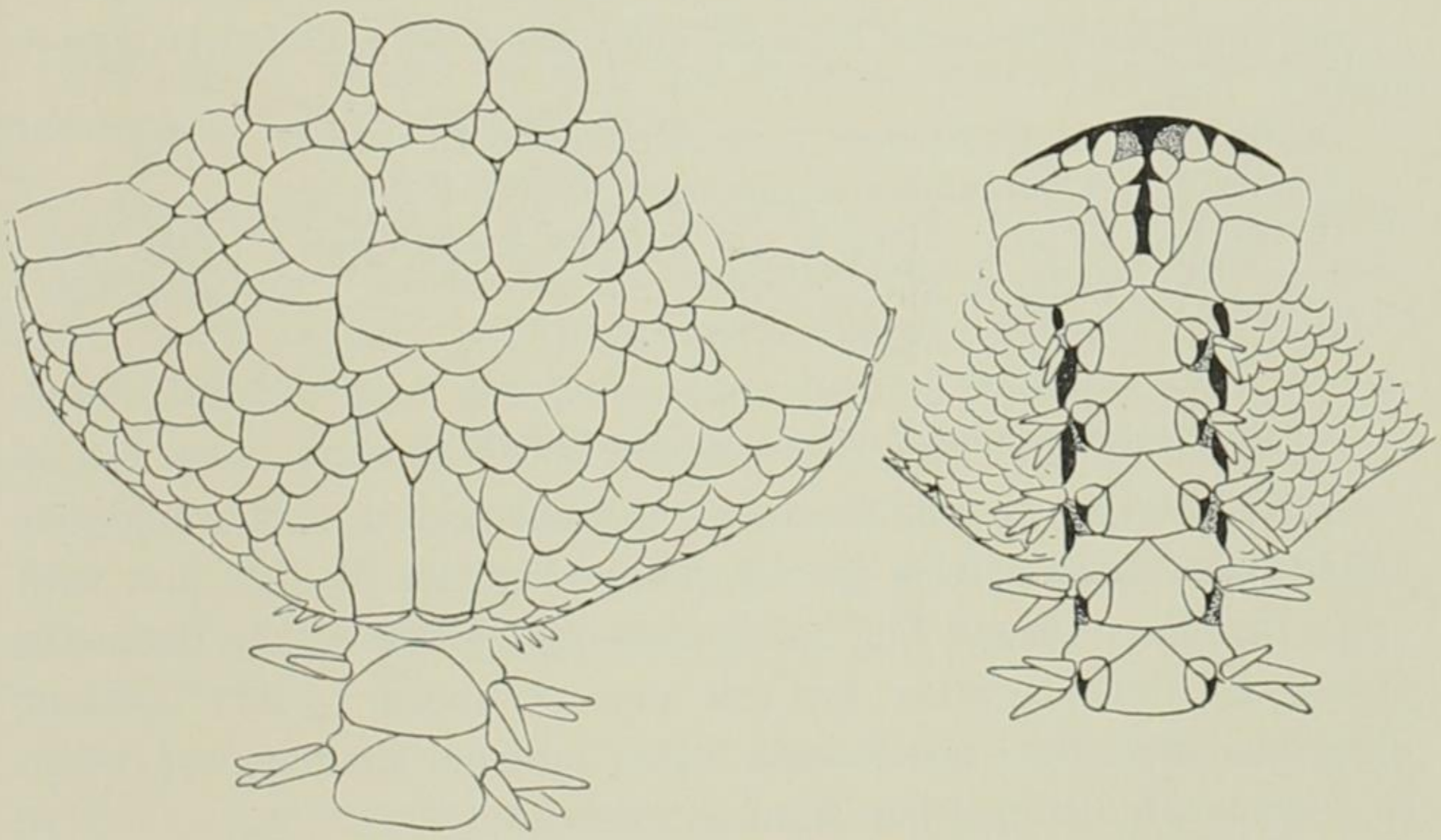
This notable species recalls to some degree, by its disk-covering, *Amphiodia grisea* Ljungman (cf. Koehler. Revision de quelques Ophiures de Ljungman, Ark. f. Zoologi. Bd. 19. A. 2. 1926. Pl. III. 7), but in its other characters it differs so markedly from this West Ameri-

can species that their identity is quite out of the question. Also *Amphioplus integer* (Ljungman) has some resemblance with the present species (cf. Koehler. Ophiures nouvelles ou peu connues. Mém. Soc. Zool. France. 1904. p. 65, figs. 16—17) but, apart from the fact that it has four mouth papillæ and thus belongs to another genus, there are so many differences that an identity is out of the question. The species to which the present species seems the nearest related is *Amphipholis* (or *Amphiodia*) *violacea* (Lütken) (cf. Eigil Nielsen. Ophiurans from the Gulf of Panama, California and the Strait of Georgia. Papers from Dr. Th. Mortensen's Pacific Exped. LIX. Vid. Medd. Dansk Naturh. Foren. Bd. 91. 1932; p. 269); but, in spite of the general resemblance, there are so many differences, e. g. in the shape of the dorsal arm plates, the mouth shields, the arm spines, that an identity is out of the question — as also the locality of *A. violacea* (Gulf of Panama) must beforehand make an identity with the S. African species very improbable.

Amphipholis similis n. sp.

Off Durban, 29°47′ S. 31°12′ E., 35 fathoms. Sand, shells. 1 specimen, dredged onboard the "Pickle", 22. VIII. 1929.

Diameter of disk 3 mm, arms ca. 5 times the diameter of disk, rather robust. Mouth papillæ as typical of *Amphipholis;* buccal shields



a. b.

Fig. 69. *Amphipholis similis* n. sp. Part of dorsal (a) and oral side (b). × 20.

about equally broad and long, rounded-rhomboidal. Adoral plates joining rather broadly within, not prolonged outwards between buccal shield and first lateral plate. Ventral arm plates about equally broad and long, with a scarcely truncated inner angle, the plates being only very narrowly contiguous, and the outer edge straight or slightly convex (Fig. 69. b.). Dorsal arm plates broad, fan-shaped, barely in contact. Three rather thick, simply pointed, arm spines. 2 rather large tentacle scales. Dorsal side of disk with rather coarse, imbricate scales, among which the primaries are very distinct, narrowly separated by some smaller scales. Radial shields contiguous, rather narrow, about $^1/_3$ the disk radius (Fig. 69. a.). Ventral interradii with scales about as coarse as those of the dorsal side. No special colour in the preserved specimens.

This species has much general resemblance with *Amph. strata*, but differs very distinctly from it in the character of the arm spines and the shape of the mouth shield. Also the radial shields are distinctly narrower than those of *A. strata*. Like this latter species it seems to be the most nearly related to *Amph. violacea* Lütken.

Amphipholis squamata (D. Ch.).

Amphipholis squamata H. L. Clark. 1923. Echinod. Fauna S. Africa, p. 330.
— *minor* M. Hertz. 1926. Oph. Deutsch. Südpolar Exp. p. 35.

Sea Point, Cape Peninsula; the coast, under stones. 20. I. 1930. Several specimens.

Off Simonstown, 16 fathoms. 2 specimens, 19. XII. 1929.
Gordon Bay, 8—9 fathoms. 1 specimen, 19. XII. 1929.
Off Durban, 29°56′ S. 31°19′ E. 225 fathoms. 8 specimens, 26. VIII. 1929.
— 29°59′ S. 31° 7′ E. 127 — 1 — 27. VIII. 1929.
— 30° 4′ S. 31°00′ E. 50 — 1 — —
— 29°54′ S. 31°10′ E. 68 — 2 — 29. VIII. 1929.
All these specimens dredged onboard the "Pickle".

The specimens from off Durban, 225 fathoms, are partly somewhat larger than usual for this species, 5 mm diameter of disk, and with arms ca. 25 mm long. The dorsal arm plates are rather distinctly separated from each other, but this does not appear to be a constant difference. And I do not see any other tangible character by which they could be distinguished from *A. squamata*.

Two of the specimens from off Durban are infested with an ectoparasitic Copepod of the genus *Cancerilla*. In one of them the parasite

is attached as usual on the oral side, in the other the parasite has attached itself on the dorsal side at the base of the arm, producing some anomaly in the disk in the corresponding radius.

This parasite has been described, under the name of *Cancerilla durbanensis*, by Mr. K. Stephensen in his paper "Some new Copepods, parasites of Ophiurids and Echinids" (Papers from Dr. Th. M. Pacific Expedition, 1914—16. LXIV. Vid. Medd. Dansk Naturh. Forening. Bd. 93. 1933. p. 198).

H. L. Clark has already suggested that the *Amphipholis minor* (Döderlein) may not be really distinguishable from *A. squamata*. I think it quite safe to assert that it is identical with *A. squamata*. The specimens mentioned by M. Hertz (Op. cit.) as *A. minor* I have had sent from the Berlin Museum. I do not see any possibility of distinguishing them from *A. squamata*. Hertz's suggestion that *A. minor* may have developed twice independently from *A. squamata* (since she has it also from St. Paul) is quite superfluous. *A. squamata* is found almost everywhere in the world, evidently having an excellent means of transportation in the roots of littoral algæ.

The littoral specimens from Sea-Point are partly very dark coloured, some of them almost black.

Amphioplus falcatus n. sp.

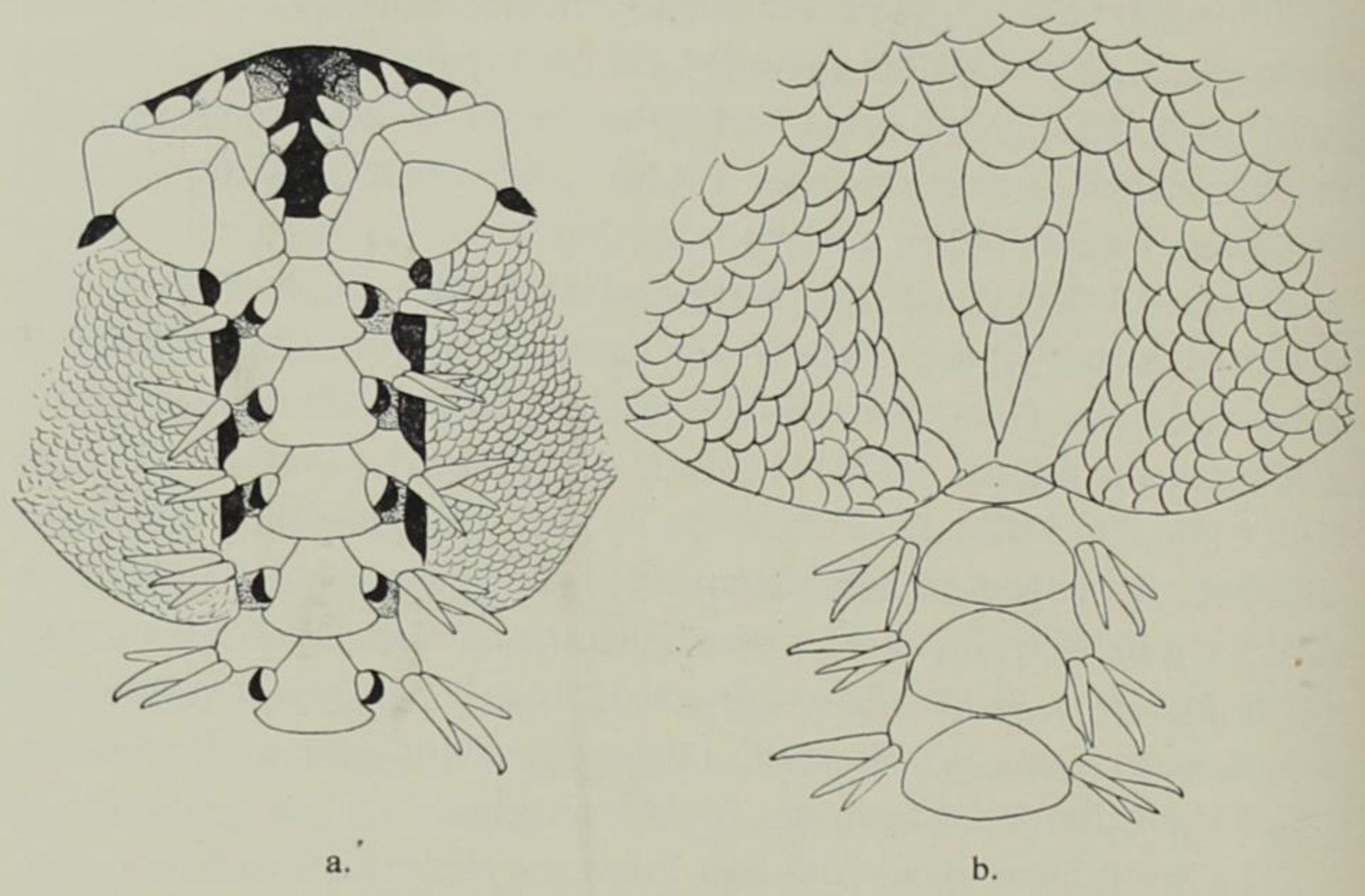
Pl. XIX. Figs. 18—19.

Off Durban, 29°56′ S. 31°19′ E. 225 fathoms. Several specimens, dredged onboard the "Pickle", 26. VIII. 1929.

Diameter of disk 7 mm, length of arms ca. 10 times the diameter of the disk. — Second mouth papilla placed at a somewhat lower level than the others, so that it may perhaps be questionable whether it should be reckoned as a true mouth papilla. The third papilla is the largest, broad, scale-like. Mouth shields triangular, with rounded angles; they vary rather considerably in shape, as appears from the figures 70. a. and 71. Adoral plates meeting broadly within, usually continuing in a broad lobe distally, separating the first ventral plate from the buccal shield.

Ventral plates somewhat longer than broad, rather broadly contiguous; outer edge slightly convex, outer corners somewhat produced. Dorsal arm plates distinctly broader than long, with outer edge slightly convex, the inner edges forming almost a half-circle. They are scarcely

in contact. Lateral plates not very prominent, carrying three spines, the middle one of which is the longest, ending in a small hook. One rather large, somewhat triangular, tentacle scale. Dorsal side of disk



a. b.

Fig. 70. *Amphioplus falcatus* n. sp. Part of oral (a) and dorsal side (b). × 15.

with moderately coarse, imbricated scales, among which the primary plates are scarcely distinguishable. Radial shields narrow, curved, broadly diverging inwards, separated by three rows of scales; (their curved, falcate shape comes out better in the photo, Pl. XIX. Fig. 19, than in the drawing Fig. 70. b.); they remain in contact distally.

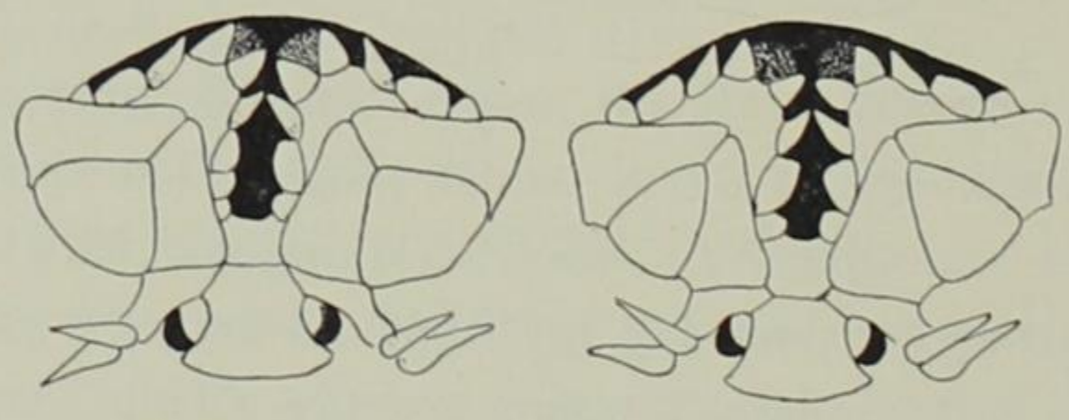


Fig. 71. *Amphioplus falcatus* n. sp. Part of oral frame of different specimens, to show variation in shape of buccal and adoral plates. × 15.

Ventral interradii covered with much finer scales than those of the dorsal side. The disk is rather conspicuously incised above the base of the arms. Most of the specimens have lost their disk. Colour of disk (in the preserved specimens) a light bluish-gray; the arms whitish,

somewhat shining on the dorsal side, sometimes with indication of a faint reddish-brown colour on the under side.

This species, so characteristic by its curved, falcate, radial shields and the hooked median spine, does not seem more nearly related to any other hitherto known species.

Amphioplus pectinatus n. sp.

Off Durban, 29°56′ S. 31°49′ E. 225 fathoms. 2 specimens dredged onboard the "Pickle", 26. VIII. 1929.

Diameter of disk 5 mm, arms slender, broken, but apparently rather long. Mouth papillæ 5 to each jaw side, the 4th distinctly the

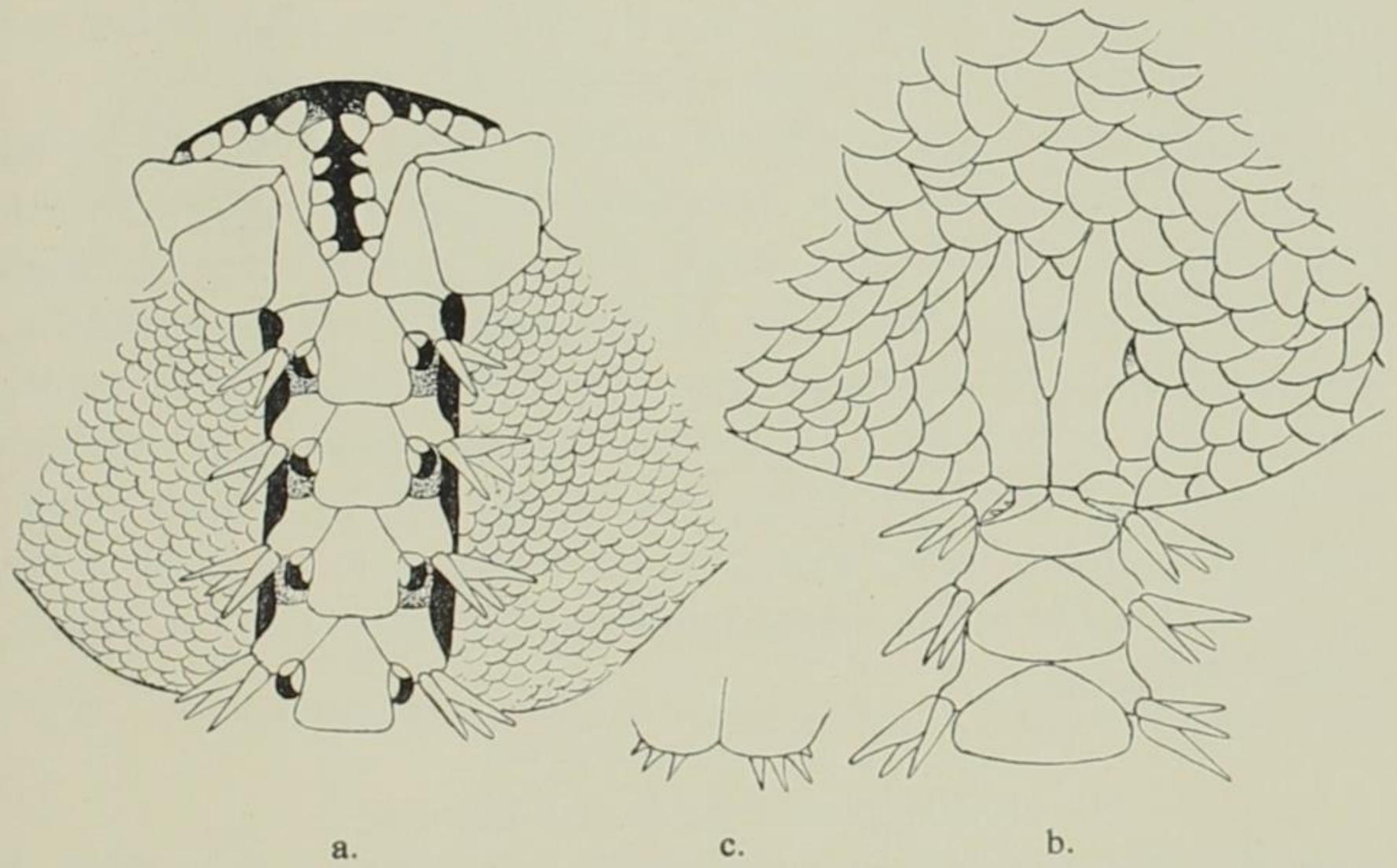


Fig. 72. *Amphioplus pectinatus* n. sp. Part of oral (a) and dorsal side (b). Distal end of radial shields, with the hyaline thorns (c). a—b. × 20; c. × 35.

broadest. Buccal shields slightly longer than broad, with a short outer lobe; inner angle rounded, the sides slightly concave. Adoral plates joining within; an outer process separates the first lateral plate from the buccal shield. Ventral plates somewhat longer than broad, with a truncate inner angle, the plates being rather broadly contiguous; the distal edge straight, outer corners rounded. Dorsal arm plates broad, fan-shaped, scarcely contiguous. 3 simply pointed arm spines, the middle one somewhat enlarged proximally. 2 small tentacle scales. Dorsal side of disk covered with rather coarse scales, among which the primary

plates are not distinguishable. Radial shields rather slender, $^1/_3$ the length of the disk radius, contiguous in the distal part, diverging in the proximal half, separated by a wedge of scales. At the distal end of each radial shield is a scale produced into one or more (3—5) hyaline thorns (Fig. 72. b. c.). Ventral interradii covered with scales very much finer than those of the dorsal side. Colour of the dried specimens whitish, but the scales of the dorsal side of disk present a peculiar aspect in their centre being dark, the edges white, due evidently to their central part being quite thin, the edge somewhat thickened.

The second specimen differs in the scales of the dorsal side of the disk being finer and in the radial shields being somewhat shorter. Also the comb at the distal end of the radial shields is less developed, though still distinct. There being no other differences, I cannot hesitate in referring this specimen to the same species as the type.

The only species hitherto known with a similar comb at the distal end of the radial shields is *Amphiodia digitula* H. L. Clark (North Pacific Oph. p. 162, Fig. 70), which differs otherwise markedly from the present species (in the mouth papillæ, buccal shield, radial shields, arm spines). It would appear that the present species is in reality more nearly related to the Japanese species *Amphioplus rhadinobrachius* H. L. Clark (North Pac. Oph. p. 167, Fig. 74), which differs, however, — besides in the absence of the combs — in the shape of the buccal shields and in the mouth papillæ; an identity with the present species is excluded.

Amphioplus integer (Ljungman).

Amphipholis integra Ljungman. 1867. Oph. viv. huc usque cogn. p. 313.
Amphiura — Koehler. 1904. Oph. nouv. ou peu connues. p. 65.
Amphioplus integer Clark. 1923. Echinod. Fauna S. Afr. p. 330.

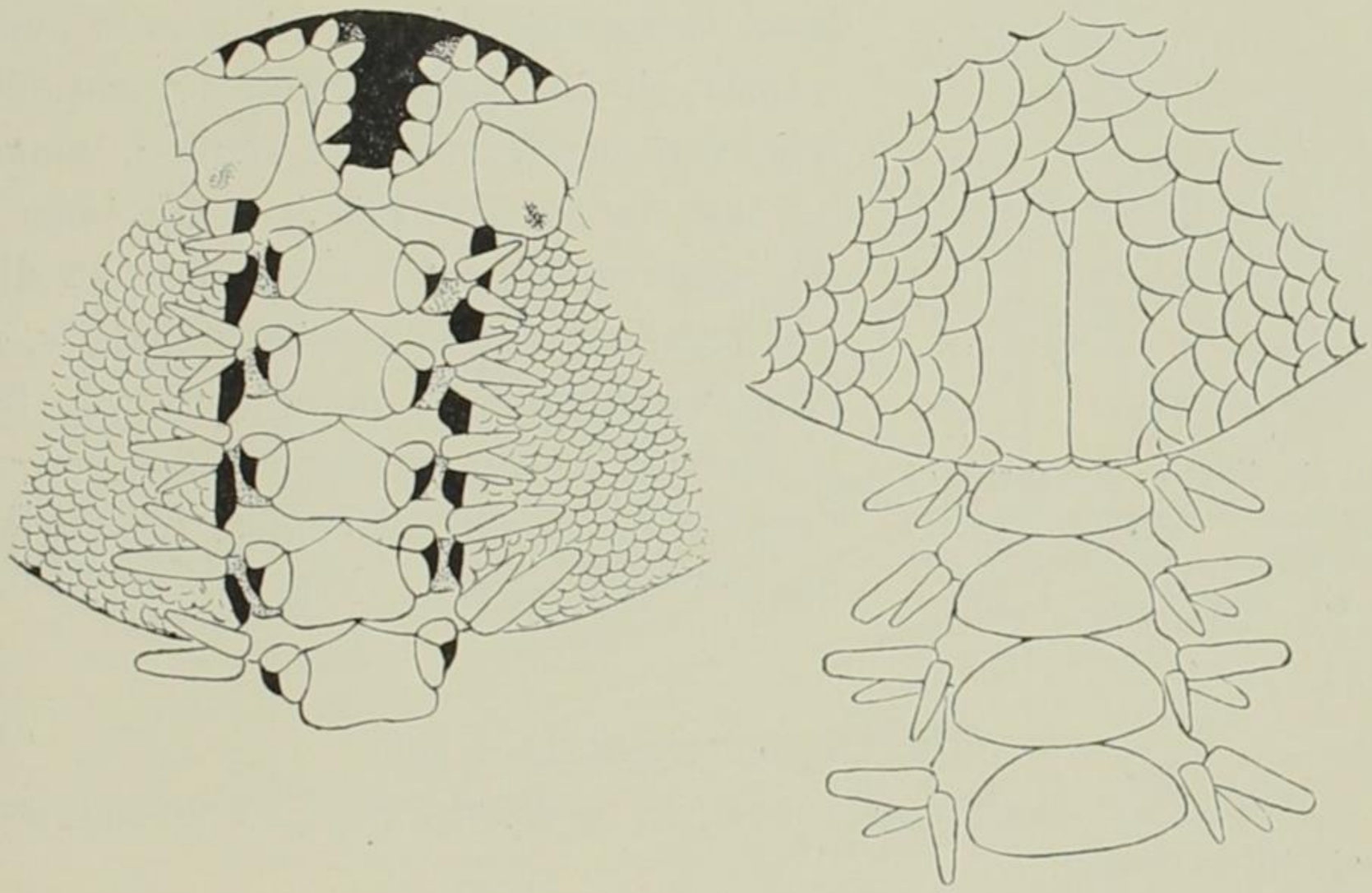
Off Durban, 29°47′ S. 31°12′ E. 35 fathoms. 1 specimen, dredged onboard the "Pickle", 22. VIII. 1929.

Gordon Bay (False Bay), 8—9 fathoms. 1 specimen, dredged onboard the "Pickle", 19. XII. 1929.

The specimen from Gordon Bay answers completely the description given by Koehler (Op. cit.), excepting one point: the dorsal arm spine is not club-shaped — which was also the fact with the specimens referred by Clark to this species. I quite agree with Clark that this sole character, not mentioned in the original description by Ljungman,

does not justify distinguishing these specimens as a different species besides *A. integer*.

The specimen from off Durban differs rather more from Koehler's description (Figs. 73. a—b.). The radial shields are somewhat longer and narrower, and the arm spines are shorter and thicker; here the middle one may be slightly spatulate, recalling to some degree the upper spine in Koehler's figure 16.



a. b.

Fig. 73. *Amphioplus integer* (Ljungman). Specimen from off Durban. Part of oral (a) and dorsal side (b) × 20.

Here again, I think the differences too small for separating this specimen from *A. integer* — the more so as it comes from near the type locality. Probably it will be found, when a much richer material comes to hand, that the differences pointed out do come within the limits of variation of the species *Amphioplus integer*. On the other hand, it seems clear that the specimen from Durban has much resemblance with *Amphioplus gibbosus* (Ljungman), and it is quite possible that it should rather be referred to that species; particularly the arm spines recall that species (cf. the description given by Koehler. Revis. de quelques Ophiures de Ljungman, p. 21, Pl. IV. 5—6) — but then the type specimen has a distinct rosette of primary plates, which the

present specimen has not. — Much more material is needed for clearing up fully the species *Amphioplus integer* and *gibbosus*, their variation and interrelation — possibly their identity.

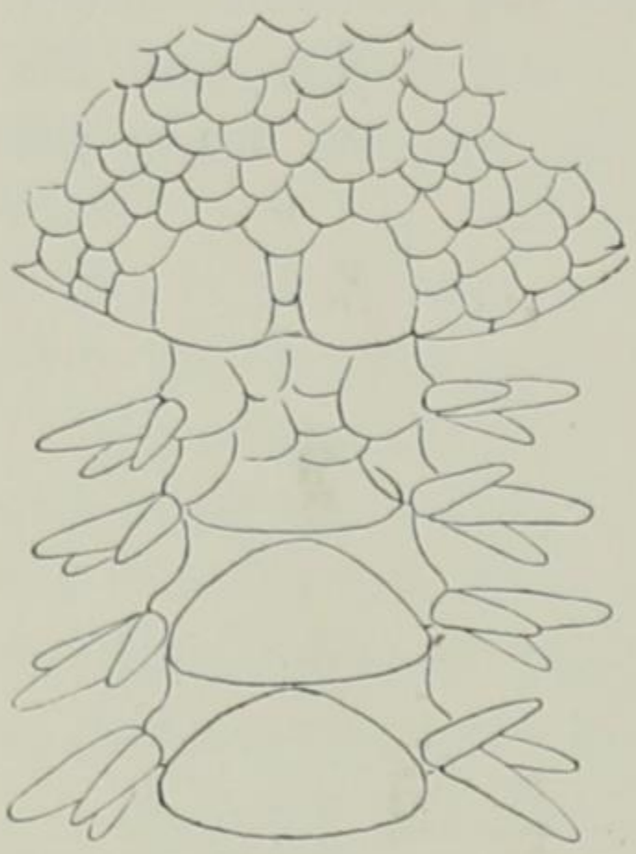


Fig. 74. Part of dorsal side of specimen of *Amphioplus integer* (Ljungman), probably abnormally regenerated. × 20.

From the same locality off Durban there is a specimen with a remarkably small disk and with quite small radial shields (Fig. 74); some irregular plates are found on the dorsal side of the arm at the base. Otherwise this specimen is in every respect similar to the above mentioned specimen of *A. integer*. I think it almost beyond doubt that this is a specimen of the same species which has lost its disk and regenerated it somewhat anomally. At least, we must have more specimens like it, before we can accept it as a normal form; if so, it will, of course, represent a distinct species.

Amphioplus furcatus n. sp.

Off the South Head, Tugela River, N. by W. $4^3/_4$ miles; 25 fathoms, black mud, 10 specimens.

This is the species recorded by Bell (Marine Investigations in S. Africa III. 1905. The Echinoderma. III. Ophiuroidea. p. 258) under the name of *Amphiura incana*, with the remark, though, that he was "not very confident of this determination". An extraordinary idea to identify this species as *Amph. incana*, a species with which it has no resemblance at all, beyond the fact that both are Amphiurids.

Diameter of disk 5 mm; arms very slender, ca. 8 times the length of the disk diameter. Mouth papillæ four to each jaw side, the third slightly the largest. Buccal shields nearly twice as long as broad, with a rounded, outer lobe; inner angle rounded; sides nearly straight. Adoral plates may or may not continue out between the buccal shield and the first lateral plate; both conditions may be met with in the same specimen (Fig. 75. a.). Ventral arm plates slightly broader than long, scarcely in contract, the inner angle being barely truncated. Distal edge straight or slightly concave. Dorsal arm plates broad,

fan-shaped, hardly in contact. Armspines 3, slender, simply pointed, the middle one the longest. Two large tentacle scales, particularly the one along the ventral plate very large. Disk with a uniform covering of small scales, among which the primary plates are not distinguishable. Radial shields about $^1/_3$ the disk radius, joining in their whole length. Edge of the disk sharp, with a bordering of small, branching, hyaline thorns (Fig. 75. c.); they are not easily observable except in side view.

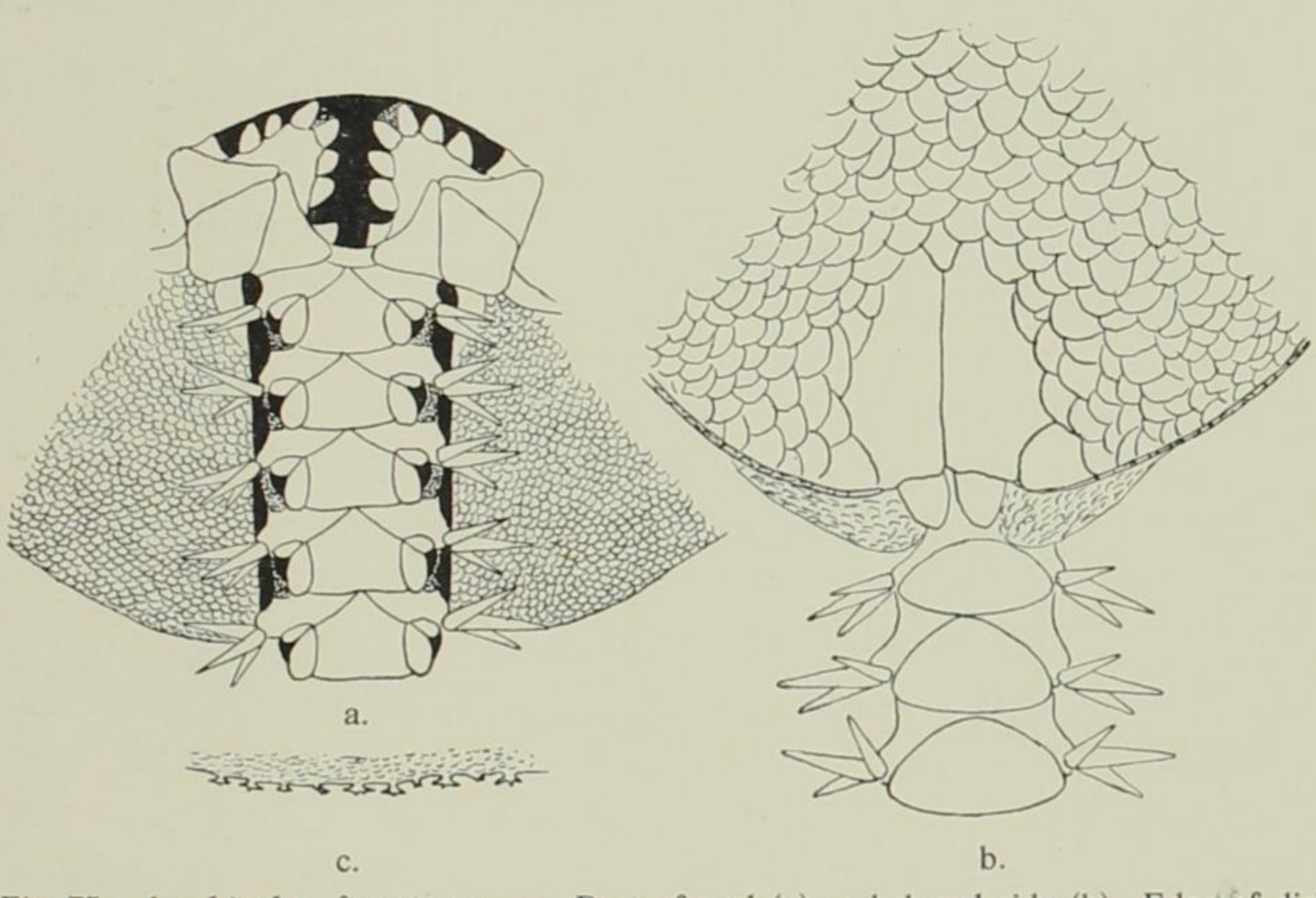


Fig. 75. *Amphioplus furcatus* n. sp. Part of oral (a) and dorsal side (b). Edge of disk with the small branching thorns (c). a—b. × 18; c. × 30.

Ventral interradii covered with exceedingly fine scales. The disk is very easily lost. No special colour.

It is interesting to find an Amphiurid with this sort of marginal fringe, known hitherto only in species from the West Coast of N. America and from Amboina, represented also in S. African waters. Eigil Nielsen (Oph. from the Gulf of Panama, California and the Strait of Georgia, p. 276) has proposed to unite these species with the branching thorns at the edge of the disk into a separate subgenus or genus *Amphispina*. This is certainly very natural — but the fact that the present species has 4 mouth papillæ, thus belonging to the *Amphioplus*-group, whereas the three other species have 3 mouth papillæ, and belong to the *Amphiodia*-group seems to indicate that this character has arisen separately within both these groups. It would therefore not be correct

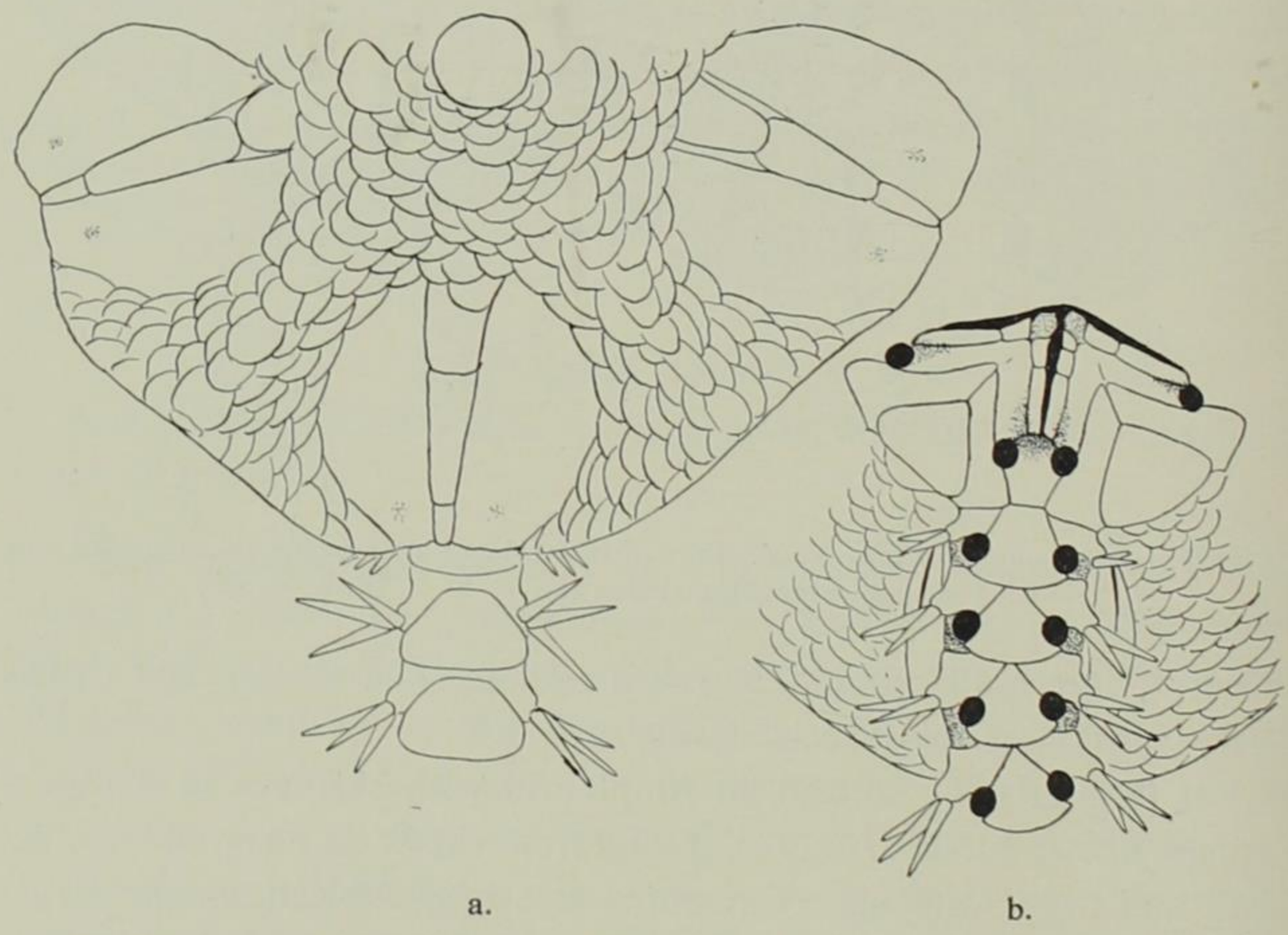
to unite the present species within the same subgenus as the three other species. I think it better to leave it for the present in the genus *Amphioplus*. That these branching spines are much smaller in the present species than in the others is also a noticeable fact.

Family ***Amphilepidæ***.

Amphilepis scutata n. sp.

Off Durban, 29°56′ S. 31°19′ E. 225 fathoms. 1 specimen, dredged onboard the "Pickle", 26. VIII. 1929.

Diameter of disk 5 mm, length of arms 45 mm. Mouth papillæ two to each side of jaw, the outer one by far the broadest; on one jaw



a. b.

Fig. 76. *Amphilepis scutata* n. sp. Part of dorsal (a) and oral side (b). × 15.

side the inner papilla is divided into two. Buccal shield rounded-triangular; adoral plates joining broadly wihtin. First ventral arm plate distinctly longer than broad, the proximal part of it sloping rather abruptly down towards the mouth slit. The proximal ventral plates contiguous, but already from the fifth they are separated; their outer edge is slightly convex (Fig. 76. b.). Dorsal arm plates not con-

tiguous, with a nearly straight distal edge and a much narrower, but similarly straight proximal edge. Arm spines three, slender, pointed, the median one slightly the longest. No tentacle scale. Dorsal side of disk with rather coarse, imbricated scales, among which the central plate is very conspicuous, the other primary plates rather indistinct. Radial shields large, of about semilunar shape, narrowly separated throughout by a single series of elongated scales. Each pair of radial shields form together an almost circular figure, resembling very much a shield, the more so as they are slightly elevated in the middle. An inconspicuous depression is found on each radial shield near the outer edge (Fig. 76. a.). The ventral interradii covered with imbricated scales of about the same size as those of the dorsal side. Genital scales narrow, the slit between them being found off first to second armjoint. Colour whitish.

This species, the first Amphilepid discovered in S. African Seas, is evidently the nearest related to *Amphilepis mobilis* Koehler from the Malay Archipelago, in which the radial shields are somewhat similar. It differs from that species in the complete absence of the characteristic, broad border of small scales (cf. Koehler. "Siboga" Oph. I. p. 94. Pl. XX. 6—7). Also the genital scales are different; they are broad and more distally placed in *A. mobilis*, much as in *A. norvegica*. (This feature is not mentioned by Koehler; but I have, through the kindness of Dr. H. Engel of the Amsterdam Museum, had the specimens of *A. mobilis* sent to me, so that I could compare them directly with the present species).

Family ***Ophiochitonidæ.***

Ophionereis porrecta Lyman.

Ophionereis porrecta Lyman. 1865. Oph. & Astroph. Ill. Cat. Mus. Comp. Zool. I. p. 147.
— — H. L. Clark. 1921. Echinod. of Torres Strait. p. 117. Pl. XII. 6; XXX. 2—3.
— — — 1923. Echinod. Fauna S. Africa, p. 344.

Off Durban, 30°2′ S. 31°3′ E. 90 fathoms. 2 young specimens, dredged on-board the "Pickle". 27. VIII. 1929.

The question was raised by H. L. Clark (Op. cit. 1923), whether the S. African specimens are really identical with the Indo-Malayan

Ophionereis porrecta, or they should rather be distinguished as a separate subspecies or species. The scanty material in hand (one specimen from off East London was sent me for identification from the Hamburg Museum) does not give sufficient opportunity for taking a definite position in regard to this question. My impression is, however, that they are not identical, so it is with all reservation that for the present I follow Clark in naming it *O. porrecta*.

Ophionereis dubia (Müller & Troschel).

Ophiolepis dubia Müller & Troschel. 1842. Syst. d. Asteriden, p. 94. Savigny. Description de l'Egypte. Echinodermes. Pl. I. 3.
Ophionereis — Lyman. 1865. Oph. & Astroph. Bull. Mus. C. Zool. I. p. 149.
— — H. L. Clark. 1923. Echinod. Fauna S. Africa.

Off Durban, 30°2′ S. 31°3′ E. 90 fathoms. 1 small specimen, dredged onboard the "Pickle" 27. VIII. 1929.

Ophionereis australis (H. L. Clark).

Ophiochiton australis H. L. Clark. Echinod. Fauna S. Africa, p. 345. Pl. XX. 1—2.

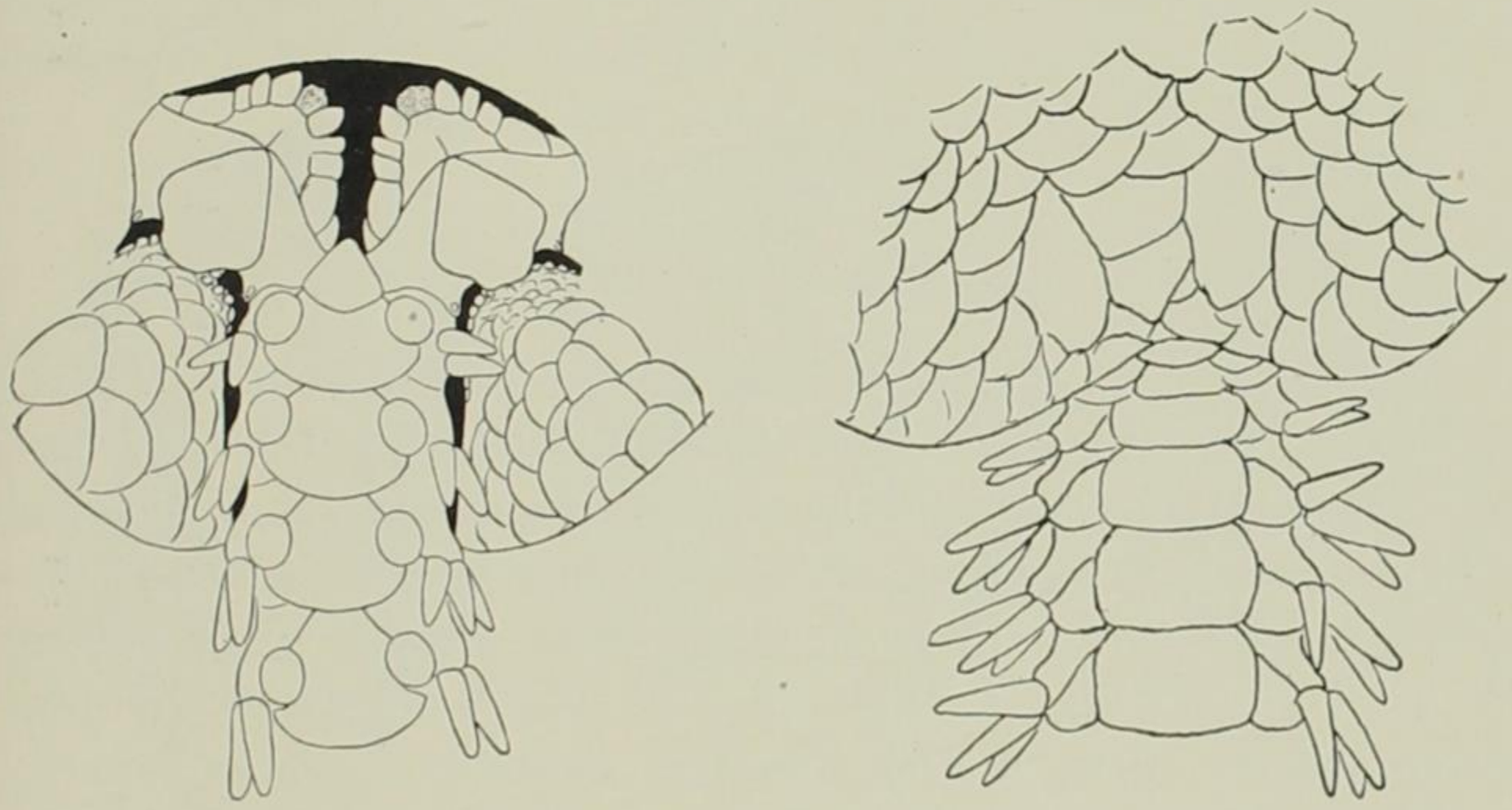
Off Durban, 30°4′ S. 31°00′ E. 50 fathoms; gravelly bottom, with masses of agglutinated worm tubes. 9 specimens.
Off Durban, 30°2′ S. 31°3′ E. 90 fathoms; 2 specimens.
Off Durban, 29°54′ S. 31°10′ E. 68 fathoms; 2 specimens. All these specimens dredged onboard the "Pickle", 27—29. VIII. 1929. Further, 4 specimens from 30°3′ S. 31°3′ E. 112 fathoms, were received from the Fisheries Survey.

The largest specimen has a diameter of disk of 11 mm. A specimen of scarcely 9 mm diameter of disk has the arms 80 mm long.

I have nothing to add to the careful description given by Clark, only I think it desirable to give figures (Fig. 77. a—b.) to show the details, the photographic figure given by Clark being rather unclear, the outlines of the various plates not showing very distinctly.

Clark refers this species to the genus *Ophiochiton* because of the (supposed) complete absence of supplementary dorsal arm plates; in the figure he gives of the dorsal side of an arm, he shows, however, very distinctly these supplementary plates on the second and the third joints. It is rather funny that he could overlook them in spite of having drawn them himself. As a matter of fact, these supplementary plates are present on several of the proximal armjoints; in the largest

specimen I find them present until about the middle of the arm, but growing gradually smaller and more or less concealed by the arm spines. In young specimens, 5—6 mm diameter of disk they are discernible only on the proximal 5—6 arm joints. On the whole, these supplementary plates are very inconspicuous; but they are there, sure enough, and accordingly this species is an *Ophionereis*, not an



a. b.

Fig. 77. *Ophionereis australis* (H. L. Clark). Part of oral (a) and dorsal side (b). × 12.

Ophiochiton. As well noticed by Clark it has a considerable resemblance to *Ophionereis porrecta*, but it is easily distinguished from that species by its much smaller supplementary dorsal arm plates.

Family ***Ophiocomidæ.***

Ophiocoma valenciæ Müller & Troschel.

Ophiocoma valenciæ Müller & Troschel. 1842. Syst. d. Asteriden, p. 102.
— — H. L. Clark. 1915. Cat. Rec. Oph. Pl. 16. 7—8.
— — — 1921. Echinod. Torres Strait, p. 131.
— — — 1923. Echinod. Fauna S. Africa, p. 349.

One specimen of this species I collected in the rock pools at the Bluff, Durban, in August 1929. Another specimen from the same locality was sent me by Mr. Bell Marley in 1931.

The species was not hitherto known S. of Mozambique, and it is thus only now that it can be justly included in the S. African fauna.

Family ***Ophiodermatidæ.***

Cryptopelta aster (Lyman).

Pl. XIX. Fig. 21.

Ophiopeza aster Lyman. 1882. Challenger Oph. p. 12. Pl. XXI. 16—18.
Cryptopelta — H. L. Clark. 1909. Notes on some Australian and Indo-Pacific Echinoderms. Bull. Mus. C. Zool. LII. p. 131.
— — — 1923. Echinoderm Fauna S. Africa, p. 350.

34°5′ S. 18° 1′ E. 118 fathoms, 17. XII. 1929. 4 specimens.
34°21′ S. 17°57′ E. 178 — 18. XII. 1929, 1 —
34° 5′ S. 17°52′ E. 146 — 23. XII. 1929, 1 —
All these specimens dredged onboard the "Pickle".

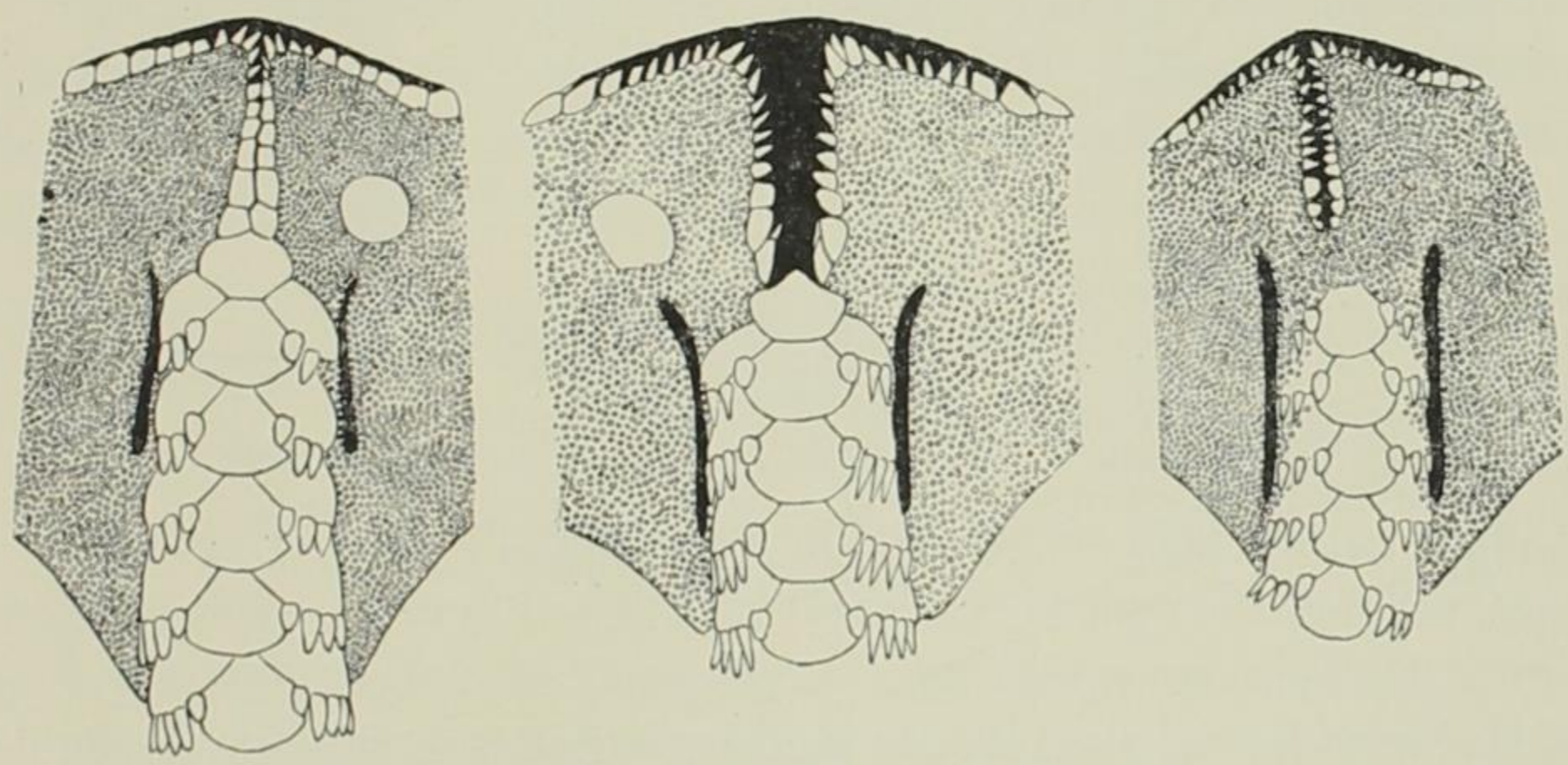
Clark (Op. cit. 1923) suggests that the specimens from the Malay Archipelago referred by Koehler ("Siboga" Oph. II. p. 13) to "*Ophiopeza*" *aster* may not be really the same species as the true *Cryptopelta aster* from off Cape Peninsula. In his "Ophiures rec. par le Dr. Th. M. dans les Mers d'Australie et dans l'Archipel Malais" (Papers from Dr. Th. M. Pacific Exped. 1914—16. LIV. Vid. Medd. Dansk Naturh. Foren. Bd. 89. 1930, p. 276) Koehler establishes a new variety, *longobrachialis* for the specimens from the Malay Archipelago. Having now had an opportunity of directly comparing both forms (which neither Clark nor Koehler has had), I can definitely state that they are distinct species.

The only difference thought by Koehler to exist between the South African *Cr. aster* and the Indo-Malayan var. *longobrachialis* is in the relative length of the arms. The specimens from the "Siboga", recorded under the name of *Ophiopeza aster* (Siboga Oph. II. p. 13), are 8—12 mm diameter of disk, with an arm length of 50 mm. In the S. African specimens the arms are ca. 38—40 mm long in specimens of 10—12 mm diameter of disk, 40—50 mm in specimens of 15 mm in diameter. Thus there is really some little difference in the arm length, but not so much that it can be said to be a very distinct character. But there are other characters which put the specific difference of the two forms beyond question.

The mouth papillæ are distinctly coarser and thicker in *aster* than in *longo-brachialis*; the first ventral plate is covered by grains in *longo-brachialis*, but not in *aster* (or any of the other species) (Fig. 78). The dorsal side of the arms is rounded and arched in *Cr. aster*, flat

in *longo-brachialis*, and also the shape and width are different in the two species (cf. Fig. 79—80).

The characters here pointed out leave no doubt of the Indo-Malayan form being a distinct species, which thus gets the name *longobrachialis* Koehler. Another question is this, whether all the specimens from the Indo-Malayan Archipelago reported by Koehler under the name of *aster* or var. *longo-brachialis* really belong to the same species. I do not think so. I have examined the specimens from

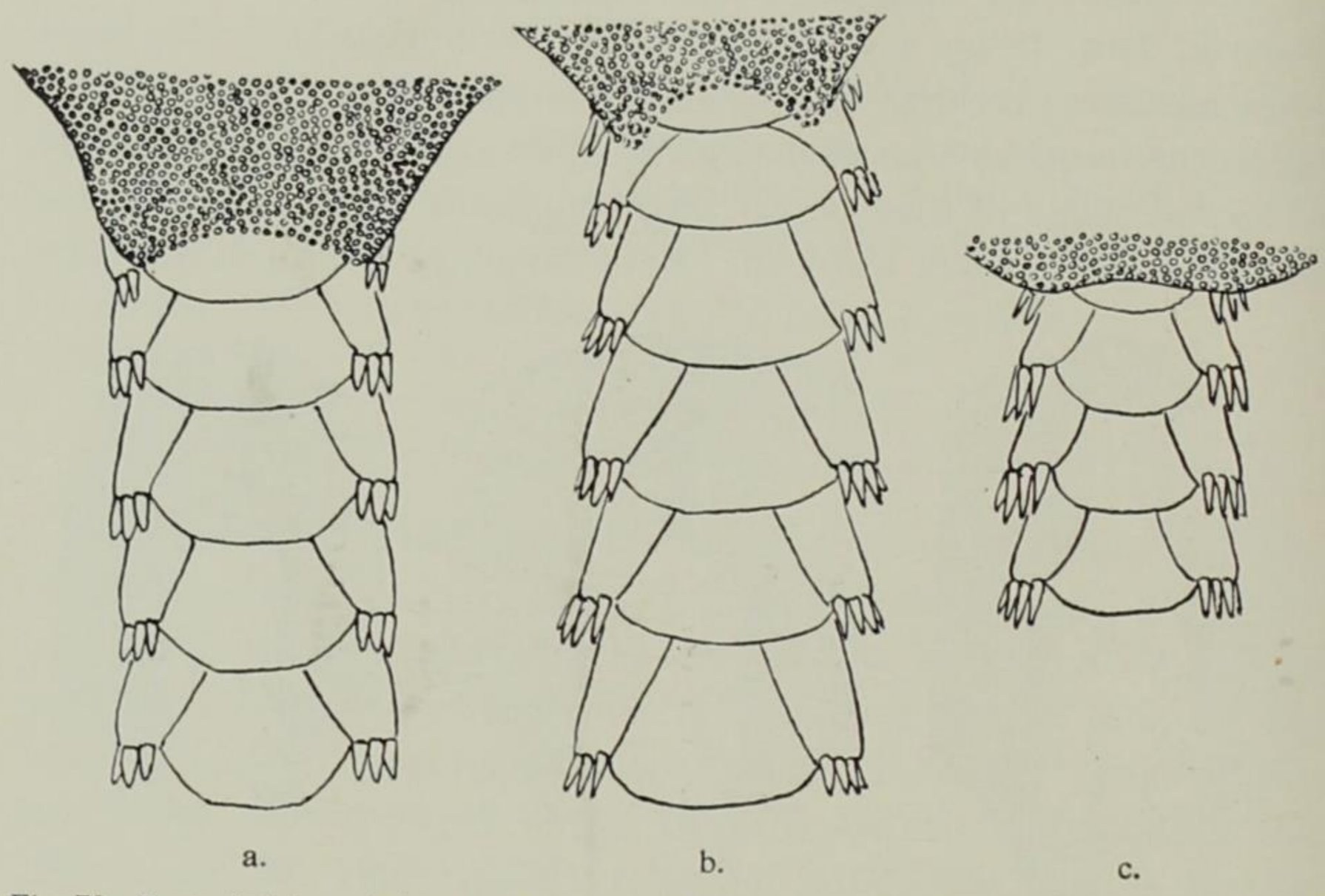


a. b. c.

Fig. 78. Part of oral side of *Cryptopelta aster* (Lyman) (a), *Cr. keiensis* n. sp. (b), and *Cr. longobrachialis* Koehler (c). × 7.

the "Siboga", which Dr. Engel has very kindly sent me. The specimens from Stat. 40 and 99 are typical *Cr. longobrachialis*. The specimen from St. 282 differs in not having the first ventral plate covered by grains, though otherwise agreeing well with *longobrachialis*. Whether this specimen represents perhaps another species I do not venture to say; much more material is needed for deciding whether we have here only an individual aberration or a separate species (or variety). Of the specimens mentioned by Koehler in his work of 1930 the two specimens from off Jolo are typical *Cr. longobrachialis* and must be regarded as the types of that species; but the specimen from the Kei Islands, Stat. 53, is decidedly another, distinct species, differing from *Cr. longobranchialis* not only in the first ventral plate being uncovered, but also in other characters. Thus the dorsal arm plates are separated in at least the distal $^1/_3$ of the arms, only in about the distal $^1/_5$ or even less in *longobrachialis* and *aster*. Also the colour is quite different:

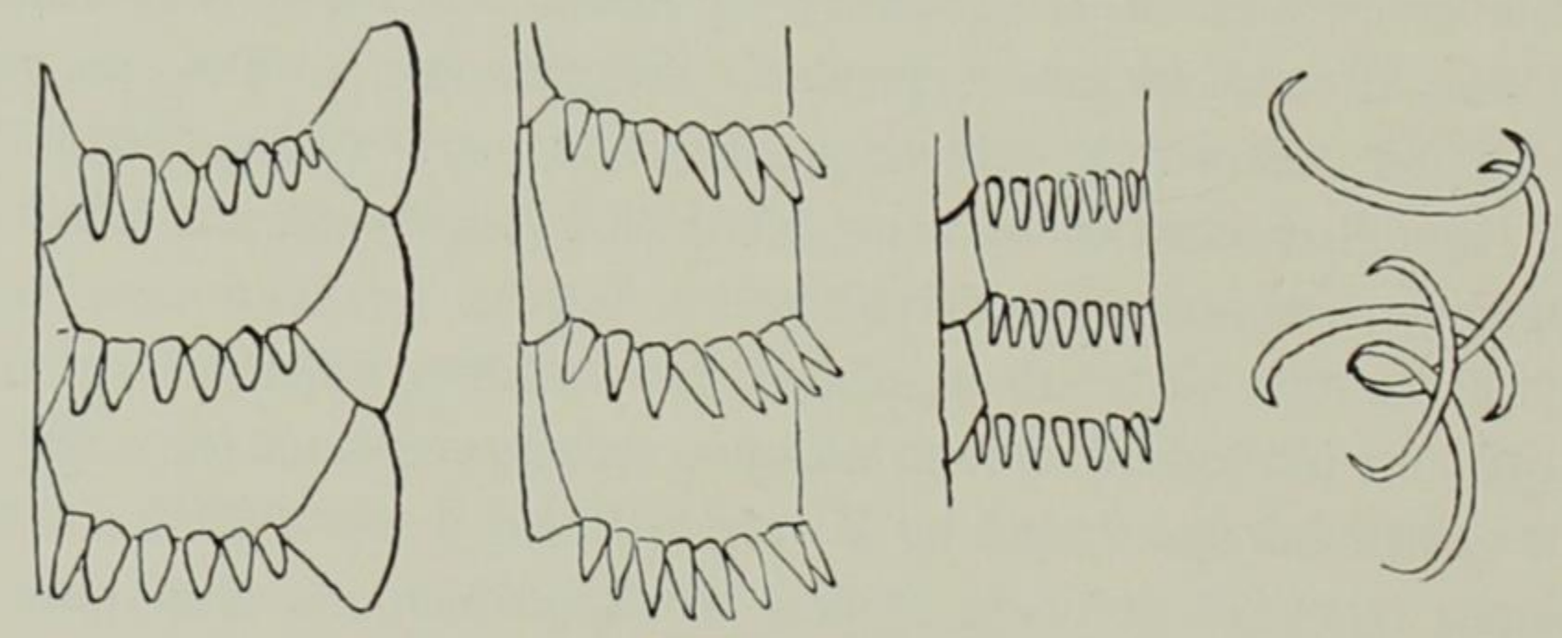
numerous very small, pink spots on the disk along the ventral interradii and indistinct pink bands on the arms, whereas *longobrachialis*



a. b. c.

Fig. 79. Part of disk and dorsal side of arm of *Cryptopelta aster* (Lyman) (a), *Cr. keiensis* n. sp. (b), and *Cr. longobrachialis* Koehler (c). × 12.

is of a uniform brownish-yellow on the disk and with indistinct olive bands on the arms (*Cr. aster* is simply white on the disk and has, in



a. b. c. d.

Fig. 80. Part of arm, side view, of *Cryptopelta aster* (Lyman) (a), *Cr. keiensis* n. sp. (b), and *Cr. longobrachialis* Koehler (c). Spicules from stomach wall of *Cryptopelta aster* (Lyman) (d). a—c. × 12; d. × 125.

live specimens, a tint of yellow in the distal part of the arms; in the preserved specimens also the arms are simply white).

The said specimen from the Kei Islands thus evidently represents a third species, which I shall designate ***Cryptopelta keiensis*** n. sp. (Figs. 78—80). One very important character of *Cryptopelta aster* I can add, viz. that it is viviparous and hermaphroditic. This is also the case with another species, viz. *Cryptopelta granulifera* H. L. Clark (from Mauritius), but not with *Cr. longobrachialis*. With regard to *Cr. keiensis* I must leave it undecided whether it is viviparous or not, the single specimen known having been dried.

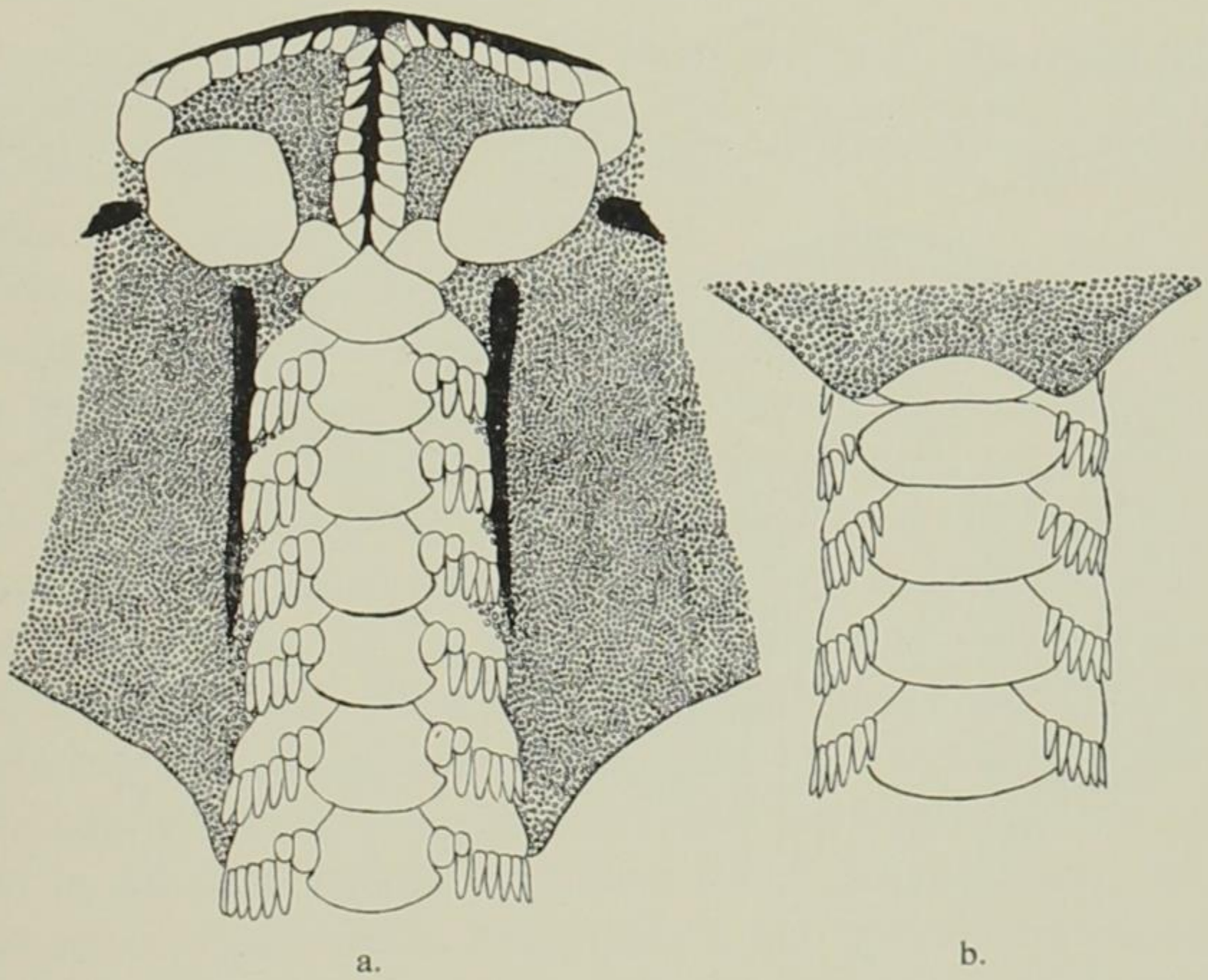
An interesting character of the genus *Cryptopelta* is the presence in the stomach wall of innumerable C-shaped (bihamate) spicules (Fig. 80. d.). It should also be pointed out that generally the madreporite remains naked.

Ophiopezella decorata n. sp.

Pl. XIX. Fig. 24.

Durban, under stones at the pier, 10. VII. 1929, 1 specimen.

Diameter of disk 14 mm, arms up to 40 mm long, rather stout. Mouth papillæ 8, exceptionally 9, to each side of jaw, the penultimate the largest. Buccal shields distinctly broader than long, rounded, with an obtuse, rounded point within; adoral shields covered, except a small



a. b.

Fig. 81. *Ophiopezella decorata* n. sp. Part of oral (a) and dorsal side (b). × 8.

part at the distal end, occupying the space between first ventral arm plate and the buccal shield. The first ventral plate with a peak within, broader than long. The following ventral plates about as broad as long, broadly contiguous, with a convex distal edge (Fig. 81. a.). Dorsal arm plates distinctly broader than long, broadly contiguous, the distal edge nearly straight (Fig. 81. b.). Dorsal side of arms flat. Two tentacle scales, the outer one the smaller, covering the base of the first spine. Number of arm spines at base of arm 11—12; they are not quite half as long as the arm joint, the two lowermost ones slightly the longest. Disk with a uniform covering, above and below, of very small granules. Marginal plates not very conspicuous. Colour of disk (of dried specimen) a uniform grayish, the arms with 4—5 conspicuous brownish-olive bands, not continuing on to the ventral side of the arms.

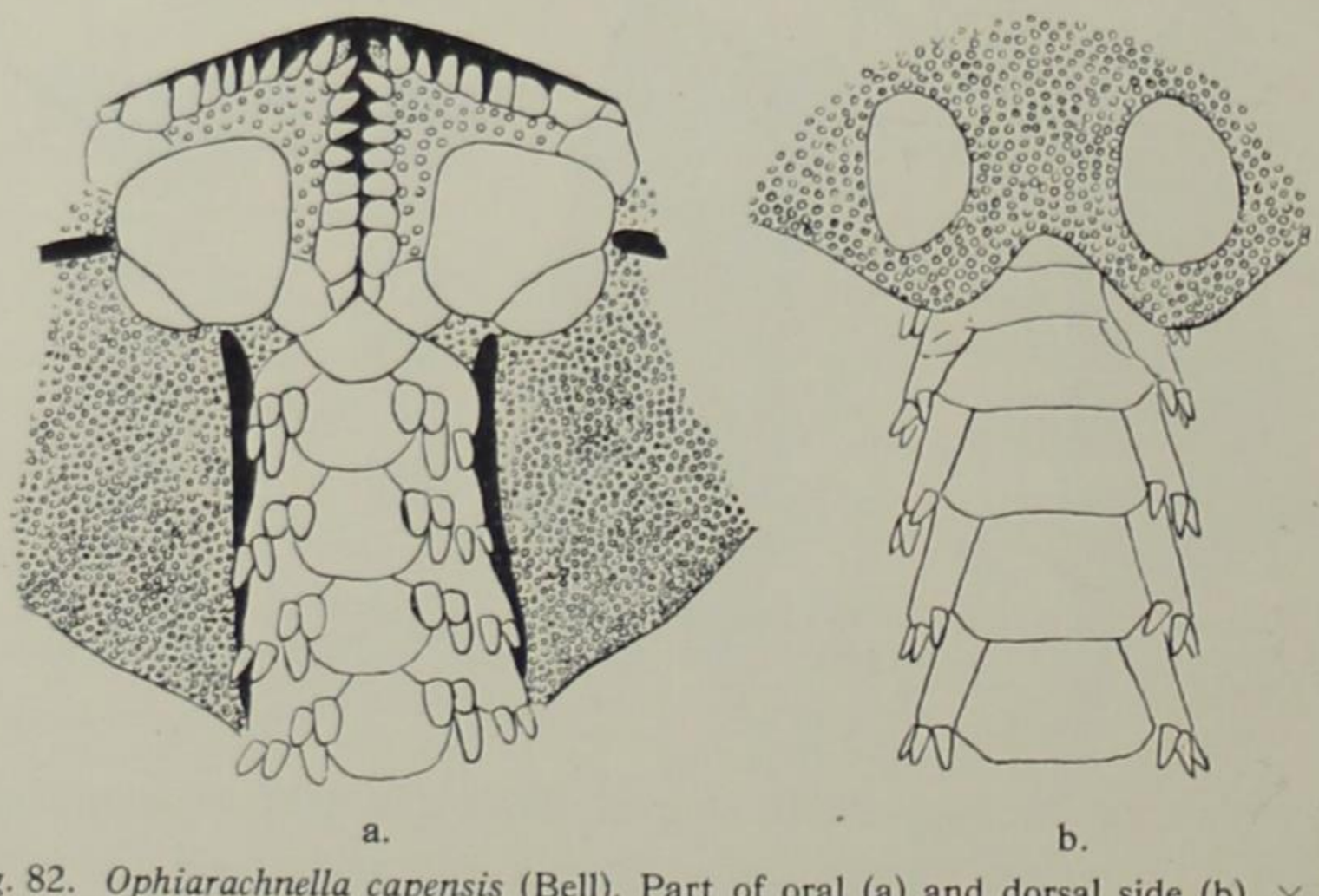
From the two other known species of the genus *Ophiopezella*, *O. spinosa* and *dubiosa*, the present species is very easily distinguished by several characters e. g. the shape of its buccal shields, dorsal arm plates, as well as by the striking coloration.

Ophiarachnella capensis (Bell).

Pectinura capensis F. Jeffr. Bell. 1888. Descriptions of four new species of Ophiurids. Proc. Zool. Soc. London. p. 282. Pl. XVI. 3—4.

Ophiarachnella capensis H. L. Clark. 1923. Echinod. Fauna S. Africa, p. 351.

Cape of Good Hope, under stones at low tide. 1 specimen, 5. I. 1930.



a. b.

Fig. 82. *Ophiarachnella capensis* (Bell). Part of oral (a) and dorsal side (b). × 10.

The figures given by Bell not being too exact in the details, I have thought it desirable to give some new figures of the species (Fig. 82. a—b.). Particularly the different shape of the mouth shields is noticeable. The grains on the jaws are somewhat larger and more spaced than those on the disk. The spines are conical, excepting the first, which is slightly the longest. The present specimen (9 mm diameter of disk) has 5 arm spines. One of the buccal shields, viz. the madreporite, is without supplementary plate, as Clark found it to be the case in one of his specimens. The coloured bands of the arms are distinct, and there is an irregular dark spot in the centre of the disk.

Ophioderma leonis Döderlein.

Ophiura tongana Lyman. 1882. "Challenger" Oph. p. 9. (non: *Ophioderma tongana* Lütken).

Ophioderma leonis Döderlein. 1910. Ast. Oph. & Ech. in Schultze. Zool. u. Anthrop. Ergebn. Forschungsreise W. u. Zentr. Süd-Afrika. IV. 1. (Jen. Denkschr. XVI.) p. 252. Taf. V. 1, 1. a.

— — H. L. Clark. 1923. Echinod. Fauna S. Africa, p. 351.

Gordon Bay, 8—9 fathoms. 2 specimens, dredged onboard the "Pickle", 19. XII. 1929.

In one of the specimens (20 mm diameter of disk) the radial shields are totally covered by grains, in the other (24 mm diam. of disk) one radial shield remains naked, and a mere trace of its neighbour can be seen.

Both Döderlein and Clark (Op. cit.) suggest that the "*Ophiura tongana*" recorded by Lyman (Op. cit.) from Simons Bay, 10—20 fms., is in reality *Ophioderma leonis*, not Lütken's *Ophioderma tongana*. I can now ascertain definitely that this suggestion is correct. Dr. Monro has very kindly examined the single specimen from the "Challenger", preserved in the British Museum, and has sent me a drawing of one of its jaws (Fig. 83). It has the adoral plates naked, as in *O. leonis*, whereas in *tonganum* the adoral plates are, according to Lütken's description, completely covered by granules. Further, the narrow, white, double lines occurring on every 4—5 joints in *tonganum* are not found in the "Challenger" specimen, but it has indistinct, whitish bands, as in typical *leonis*. Thus, there is not the slightest reason for doubt as to the identity of this "Challenger" specimen with *Ophio-*

derma leonis, the only *Ophioderma*-species known with certainty to occur in the S. African seas — the actual locality of *Ophioderma Wahlbergi* Müller & Troschel being still problematic (cf. Clark. Op. cit. p. 353).

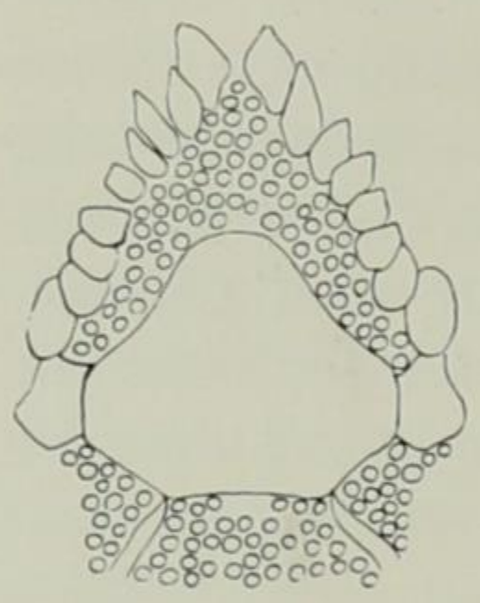


Fig. 83. Jaw of Lyman's "*Ophiura tongana*" from Simon's Bay. Drawing by Dr. Monro. (Enlargement not stated.)

As regards *Ophioderma tonganum* Lütken I otherwise must give the rather sad information that the type specimen appears to have been lost. It is, according to the kind information of Dr. A. Panning, not found in the Hamburg Museum, where the collections of the Museum Godeffroy are preserved, and it is not in the Copenhagen Museum either, where the other types of the Ophiurids described by Lütken are preserved. But the two characters mentioned above: the complete covering of the adoral shields and the white, double lines on the arms, should be sufficient for recognizing the species, when it is ever met with again.

Family ***Ophiolepidæ.***

Ophiolepis cincta Müll. & Troschel.

Ophiolepis cincta Müller & Troschel. 1842. System d. Asteriden, p. 90
— — Lütken. 1859. Add. hist. Oph. II. p. 101. Tab. II. 6. a—b.
— — De Loriol. 1894. Cat. Rais. Echinod. Île Maurice. III. Oph. & Astroph. p. 9. (Here complete list of literature).
— — Koehler. 1905. Siboga Oph. II. p. 16.
— — H. L. Clark. 1921. Echinod. Torres Strait, p. 143.

One specimen was taken under stones, at low water, on the pier of Durban, 10. VII. 1929. Another fine specimen I took under old coral blocks at Inhaca, Delagoa Bay.

The species was not hitherto known South of Zanzibar.

Ophiolepis Garretti Lyman 1865 (Oph. & Astroph. Ill. Cat. Mus. C. Zool. I. p. 61, Pl. II. 4) is generally regarded as a synonym only of *O. cincta*. H. L. Clark (Op. cit. 1921) states: "Lyman has given a very good colored figure of the adult under the name *Ophiolepis garretti*. The young are much less handsomely colored." The specimen of *O. Garretti* is 9 mm in diameter, thus hardly to be designated as the adult of *O. cincta*, which grows to a much larger size, at least 15 mm diameter of disk. Then Lyman states *O. Garretti* to be distinguished

from *O. cincta* "by shorter mouth shields and much longer arms. The best distinguishing mark, however, is the microscopic appearance of granulation which the upper arm plates have, while in *O. cincta* they are smooth and glossy". — To these differences must be added that of the colour. *O. Garretti* is red, with yellow bands on the arms. *O. cincta* is grayish, mottled with whitish on the disk, and with bands of the same whitish colour on the arms. Both small and large specimens are similarly coloured, and I have seen no specimens with the slightest indication of a reddish colour.

I think it therefore very unlikely that *O. Garretti* could be identical with *O. cincta*. Whether all the specimens from the Malay Archipelago referred by Koehler to *O. cincta* are really identical with the typical form (Red Sea, East Africa) is another question which might well deserve a closer investigation; I have, however, no time to enter on such investigation now.

Ophiura flagellata (Lyman).

Ophioglypha flagellata Lyman. 1882. "Challenger" Oph. p. 42. Pl. IV. 16—18.
Gymnophiura coerulescens Lütken & Mortensen. 1899. "Albatross" Oph. p. 114. Pl. VII. 5—7.
Ophioglypha flagellata Koehler. 1899. "Investigator" Oph. I. p. 18.
— — — 1904. "Siboga" Oph. I. p. 56.
— — — 1906. Oph. "Travailleur" & "Talisman". p. 261.
Ophiura — H. L. Clark. 1911. North Pac. Oph. p. 60.
— — Matsumoto. 1917. Monogr. Jap. Oph. p. 273.
— — Koehler. 1922. Oph. "Albatross". Philippine Exp. p. 375. Pl. 85. 1, 6—7; 86. 1—4, 10.
— — H. L. Clark. 1923. Echinod. Fauna S. Africa, p. 359.

This almost cosmopolitan species was not taken in any of my own trawlings or dredgings in S. African seas; but there are specimens in the material handed over to me by the Fisheries Survey, viz.

33°37′ S. 16°55′ E. 1000 fathoms. 2 specimens.
33°28′ S. 16°40′ E. 1000 — 15 —

These specimens are all in poor condition (dried), hardly anything of the arms being left. All of them have the disk scales very well developed, with a distinct central plate; there is nothing recalling the condition of "*Gymnophiura coerulescens*". The same was the case with the specimens examined by Clark (Op. cit. 1923). I therefore must say that I do not feel quite convinced of regarding these specimens as

identical with the Pacific *Oph. flagellata* (*Gymnoph. coerulescens*), the more so as also the arm spines are shorter, not exceeding the length of the arm joint, and there are also some other small differences (e.g. the genital papillæ). But for a final decision it would be necessary to have a much larger material and also specimens from the Atlantic and the Indian Ocean for comparison with the specimens from the Pacific, which are not available to me. I shall then for the present follow Clark in referring also the S. African specimens to *C. flagellata*, stating, however, expressly that I do not feel convinced of the correctness of this identification.

Ophiura trimeni Bell.

Ophiura trimeni F. Jeffr. Bell. 1905. Echinoderma. III. Ophiuroidea. Marine Invest. S. Africa. III. p. 257. Pl. I. 3—4.
— — H. L. Clark. 1923. Echinod. Fauna. S. Africa, p. 360.

Several specimens dredged onboard the "Pickle":
34°17′ S. 17°58′ E. 160 fathoms. 18. XII. 1929. Several specimens.
34°21′ S. 17°57′ E. 178 — — 9 specimens.
34° 5′ S. 17°52′ E. 146 — 23. XII. 1929. 12 —
Further, some specimens were received from the Fisheries Survey, viz. from.
32°37 S. 17°15′ E. 90 fathoms. Several specimens.
33° 2′ S. 16°53′ E. 200 — 10 specimens.

As said by Clark the description of this species by Bell is rather inadequate. I would particularly point out that his statement "no arm comb" is incorrect; the arm combs are there, only not very strongly developed and not passing high up on the dorsal side, so that they are more easily seen in side view. The species being very fragile, the papillæ are often lost, but when only tolerably well preserved the combs are distinct enough. As this is a character of rather considerable importance, it was necessary to have the statement of the absence of the arm combs corrected.

The figures given by Bell being in several respects incorrect — too many mouth papillæ, proximal ventral plates too short, passage from the larger proximal pore pairs to the smaller ones on the following joints much too abrupt, the shape of dorsal arm plates not correctly shown etc. — I have thought it desirable to give new figures of the species (Fig. 84). Further, an important character appears to have been overlooked by both Bell and Clark, viz. the existence of small spines on the disk. This character recalls *Ophiura Ljungmani* (Lyman) —

and it is perfectly evident that these two species are closely related. That they are, however, perfectly distinct is equally evident; as distinguishing characters I may mention the shorter arm spines in *Ljungmani* (scarcely as long as an arm joint in *Ljungmani*, about as long as two joints in *trimeni*), the better developed arm comb in *Ljungmani* and

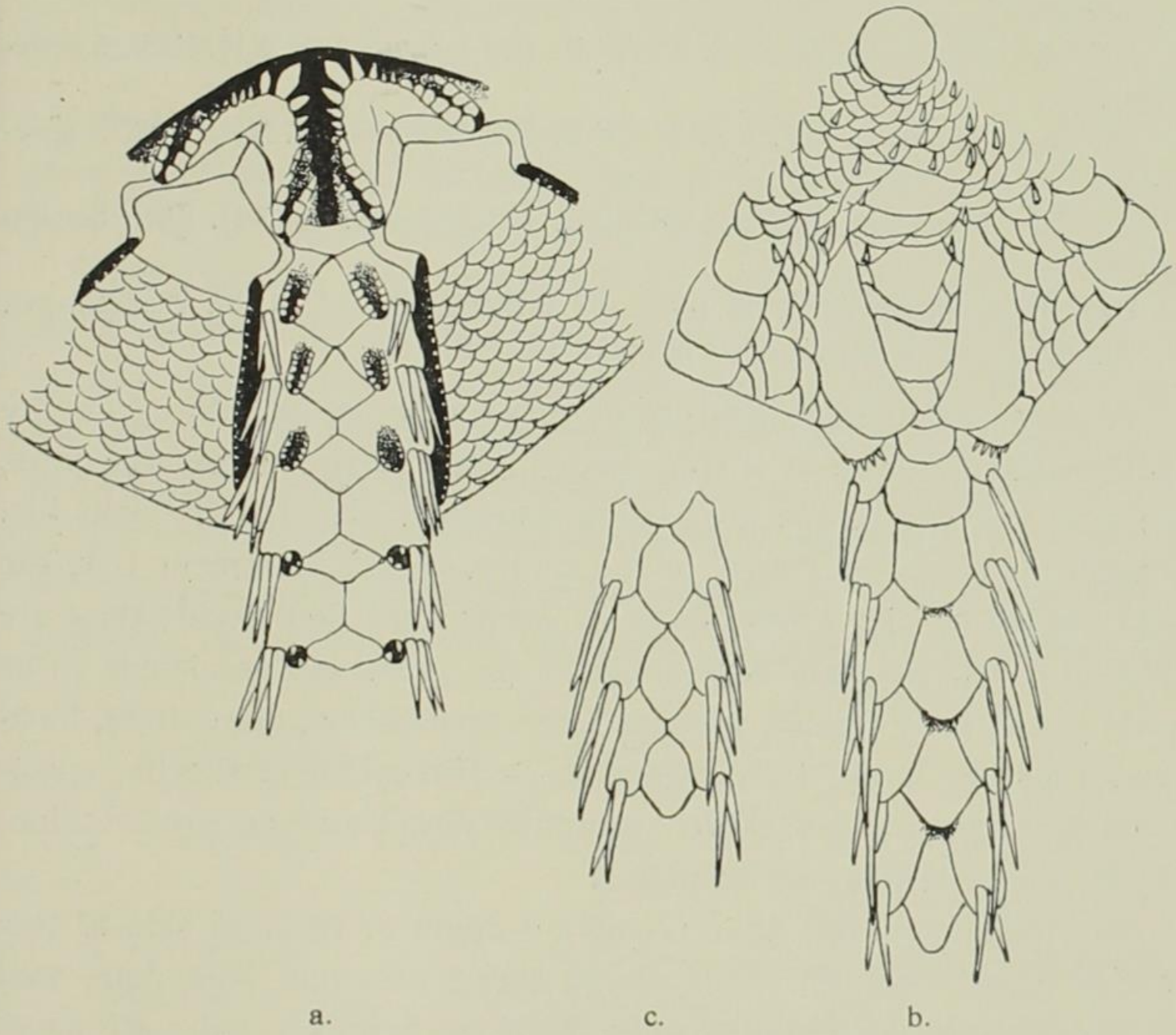


Fig. 84. *Ophiura trimeni* Bell. Part of oral (a) and dorsal side (b). Armjoints, dorsal side from distal part of arm (c). × 8.

the somewhat different shape of the dorsal arm plates. Also the spines on the disk are much shorter in *trimeni* than in *Ljungmani*.

A couple of specimens of *O. trimeni* have still preserved a reddish colour on the dorsal side of the arms and, somewhat fainter, on the disk. — It appears not to surpass a size of ca. 10 mm diameter of disk.

Ophiura (*Ophiuroglypha*) *costata* (Lyman).

Ophioglypha costata Lyman. 1882. "Challenger" Oph. p. 50. Pl. V 1—3.
Ophiozona capensis Bell. 1905. Echinoderma. III. Ophiuroidea. Marine Invest. S. Afr. III. p. 256. Pl. I. 1—2.

Ophiura costata. H. L. Clark. 1923. Echinod. Fauna S. Africa, p. 357.
Ophiuroglypha capensis M. Hertz. 1927. Ophiuroidea d. deutschen Tiefsee-Exped. p. 90. Taf. VII. (II) 10.

Off Cape Peninsula, 34°2′ S. 18°7′ E. 94 fathoms. 17. XII. 1929. Several specimens.

Off Cape Peninsula, 34°5′ S. 18°1′ E. 118 fathoms. 17. XII. 1929. Several specimens.

Off Cape Peninsula, 34°17′ S. 17°58′ E. 160 fathoms. 18. XII. 1929. 5 specimens.

Off Cape Peninsula, 34°21′ S. 17°57′ E. 178 fathoms. 18. XII. 1929. 5 specimens.

Off Cape Peninsula, 34°24′ S. 18°16′ E. 133 fathoms. 18. XII. 1929. Several specimens.

Cape Point in N. 83° E. 18 miles. 93 fathoms. 20. XII. 1929. 7 specimens.
All these specimens dredged onboard the "Pickle".

A very characteristic feature of this species is, as pointed out by Hertz, the presence of a ring-shaped, deep furrow across the jaws, the proximal end of the jaws being somewhat elevated; it looks like a small plate, raised a little in the centre. Bell's statement that the podia appear to be absent does, of course, not hold good; they are only as a rule strongly contracted in the preserved specimens so as to be not directly visible, without some preparation. Sometimes, however, they are found fully extended. — The colour of the live specimens is a light reddish, which generally disappears on preservation, in alcohol as well as in formaline.

In view of the fact that Lyman's figure of the oral side of this species (Chall. Oph. Pl. V. 1) shows the 4 proximal pore pairs well developed, whereas normally only the three first pore pairs are developed, it is of interest to state that sometimes 4 pore pairs may be developed on one or other arm, though apparently never on all of the arms. — Among the very numerous specimens examined only one is 4-rayed. Not rarely a small supplementary plate is found at the inner angle of the mouth shield.

It would seem that the reduction of the pores, combined with the transformation of the middle spine into a small upturned hook, may justify the genus (or subgenus) *Ophiuroglypha* established by Hertz for the group of species showing this combination of characters.

The species is evidently very common in deep water off the Cape, and it is one of the species characteristic of S. African seas, being not known from elsewhere.

Ophiura (*Ophiuroglypha*) *tumida* n. sp.

Pl. XIX. Figs. 22—23.

Off Durban, 29°59′ S. 31° 7′ E. 127 fathoms. Several specimens.
— 29°54′ S. 31°10′ E. 68 — — —
— 29°56′ S. 31°19′ E. 225 — 1 specimens.

These specimens dredged onboard the "Pickle", 27. VIII. 1929.

Further, I got some specimens from the Fisheries Survey: 29°51′ S. 31°16′ E. 158 fathoms.

Most of the specimens are small, but a good deal of them, mainly from the depth of 127 fathoms, reach a size of up to 15 mm diameter and have all appearances of being full grown.

The species is very closely related to *O. costata*. On the oral side the only difference to be noted is that of the central plate-like depression being much less pronounced than in *costata*. The aspect of the dorsal side is rather conspicuously different from that of *costata* in the larger plates being distinctly swollen, particularly the radial shields and the interradial marginal plate, these plates being all quite flat in *costata*. Also the outline of the arms, in side view, is conspicuously different, the dorsal plates being distinctly tumid in *tumida*, quite

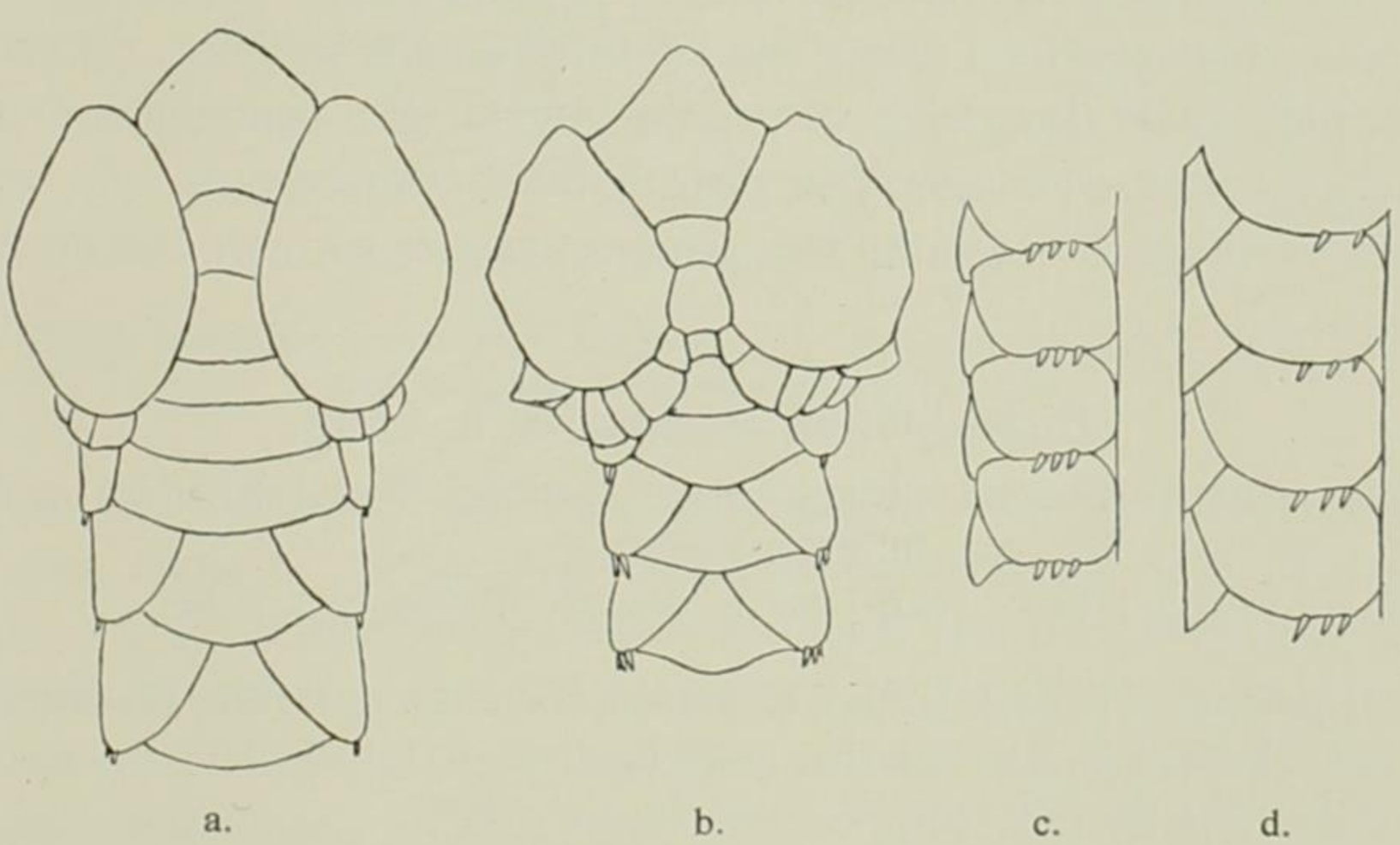


Fig. 85. Part of dorsal side of *Ophiura costata* (Lyman) (a) and *Oph. tumida* n. sp. (b); part of arm, side view, of *Oph. tumida* (c) and of *Oph. costata* (d). × 12.

flat in *costata* (Figs. 85. c—d.). Finally, there is a conspicuous difference in the combs at the base of arms, they being much farther apart in *costata* than in *tumida* (Figs. 85. a—b.). By means of this character also the younger specimens, in which the tumidity of the radial shields

and marginal plates is much less outspoken, may be distinguished fairly easily from the young *O. costata*. — The latter also grows to a considerably larger size than *O. tumida*, up to ca. 25 mm in diameter.

The specimens from the Fisheries Survey are all small, and their marginal plates scarcely so much swollen as those of the typical form. Still I cannot doubt that they do belong to this same species. Also, the combs at the arm bases are as those of the typical form.

Ophiura (*Ophiuroglypha*) *irrorata* (Lyman).

Ophioglypha irrorata Lyman. 1882. "Challenger" Oph. p. 47. Pl. V. 7—9.
Ophiura — H. L. Clark. 1923. Echinod. Fauna S. Africa, p. 358.
Ophiuroglypha irrotata (sic!). M. Hertz. 1927. Oph. Deutsch. Tiefsee-Exp. p. 86.
Ophiura (*Ophiuroglypha*) *irrorata*. Th. Mortensen. 1923. "Ingolf" Oph. p. 86.

This species did not occur in any of my own dredgings and trawlings in S. African seas, but there are some specimens in the material left me by the Fisheries Survey, from 33°37′ S. 16°55′ E. 1000 fathoms and 33°28′ S. 16°40′ E. 1000 fathoms (1 small specimen).

The fact that the well developed podia are not confined to the three or four proximal joints, but continue a good way out, till about the 10th joint, decreasing very gradually in size, contribute to the effacing of the otherwise rather clear limits of *Ophiuroglypha* and cause me to hesitate in accepting this group of species as more than a subgenus.

Dictenophiura anoidea H. L. Clark.

Dictenophiura anoidea H. L. Clark. 1923. Echinod. Fauna S. Africa. p. 361. Pl. XIX. 1—2.
Ophiura carnea. Hertz. 1927. Oph. d. deutsch. Tiefsee-Exp. p. 69.

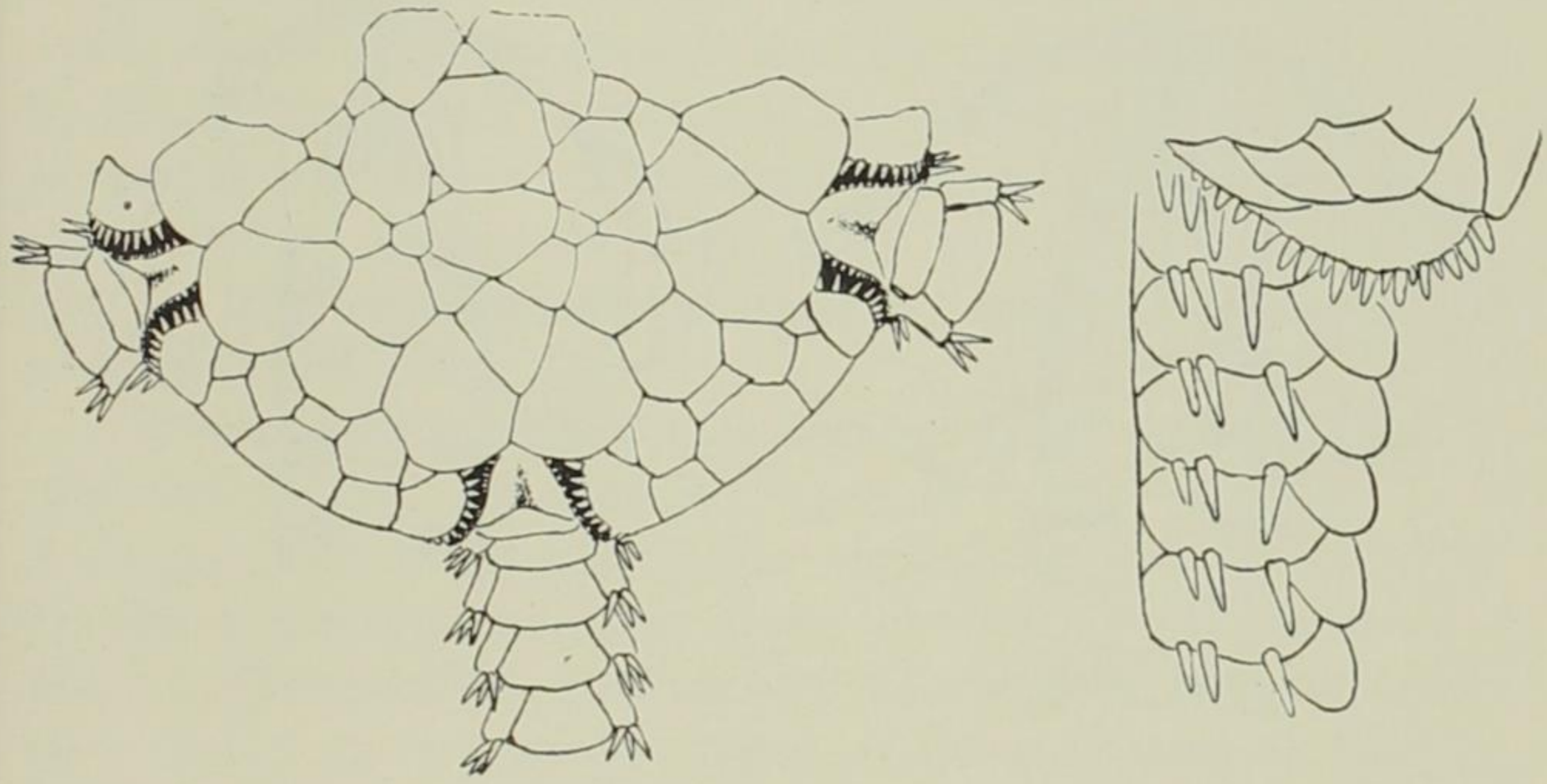
Cape Point in South $2^1/_4$ miles. 30 fathoms; sand. 19. XII. 1929. 12 specimens.
34°5′ S. 18°2′ E. 118 fathoms; black sand. 23. XII. 1929. 1 specimen.
Chapmans Bay, 28 fathoms; sand. 20. XII. 1929.

There are further in the material left me by the Fisheries Survey some specimens from Nieca River mouth N.W.×N$^1/_4$W. 7 miles, 43 fms.; s. sh. coral P. F. 13313 (near East London).

The specimen from Chapman's Bay is 10 mm in diameter of disk, thus considerably larger than the largest specimen seen by Clark (6.5 mm diam.).

As the photographic figures of this species given by Clark do not show any structural details distinguishably, I give here some drawings of it (Fig. 86, 87. a.).

H. L. Clark has well remarked that this species is very closely related to the European *Oph. carnea*, the genotype of the genus *Dictenophiura*, but he thinks it to be perfectly distinguishable from the latter particularly by the upper arm plates of *anoidea* being perfectly flat, in *carnea* swollen. The figure given here of the side view of an arm of the specimen of 10 mm diameter shows, however, the dorsal arm plates



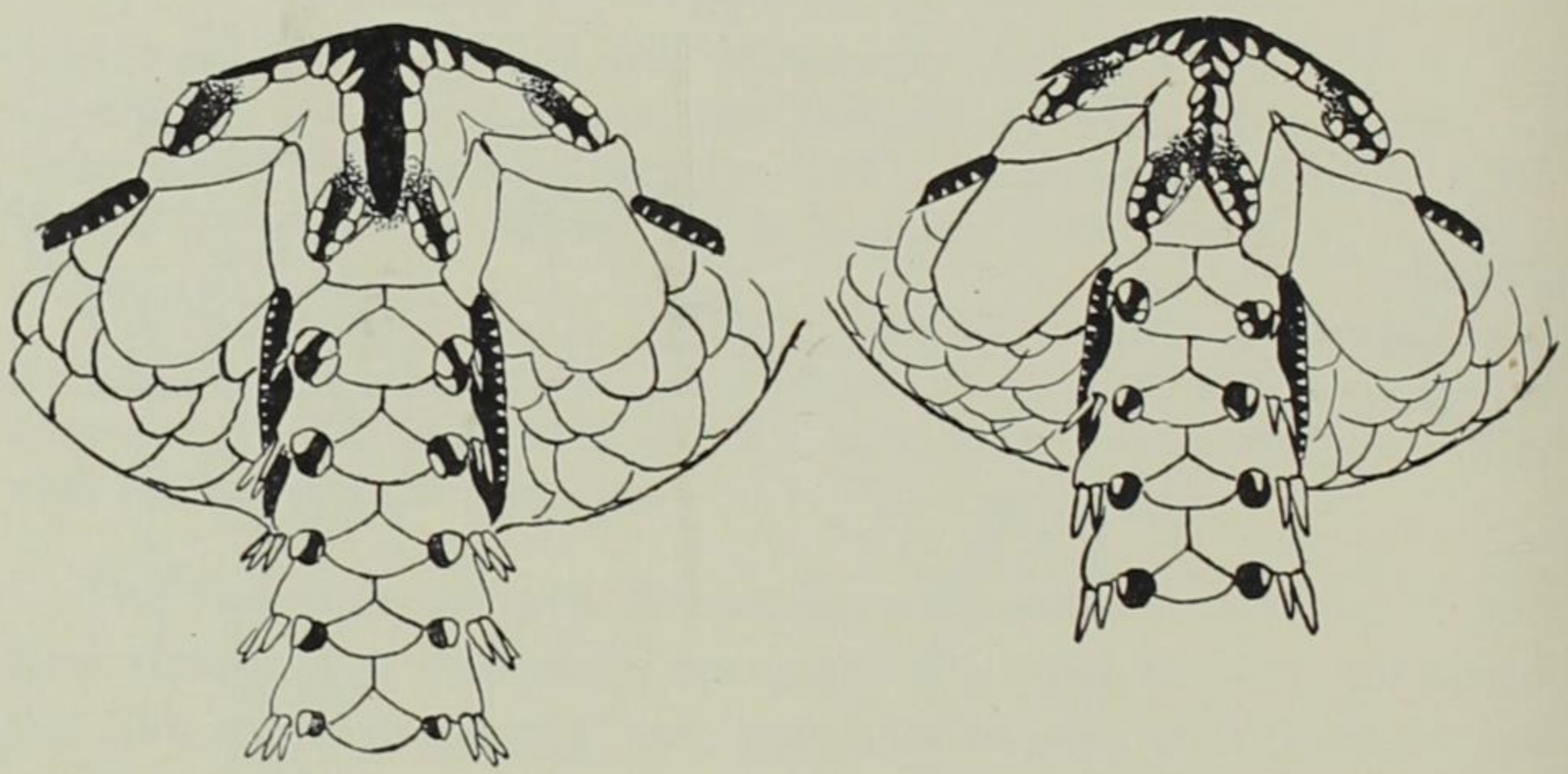
a. b.

Fig. 86. *Dictenophiura anoidea* H. L. Clark. Part of dorsal side (a); basal part of arm and armcomb, side view. (b). a. × 10; b. × 20.

of the adult *anoidea* to be very distinctly swollen, by no means less so than those of *carnea*. This character, accordingly, does not hold good. Further, Clark states the ventral arm plates to be smaller and less conspicuous in *anoidea* than those of *carnea*. I wonder how he came to this statement. The case is exactly the inverse; in *carnea* the ventral plates are distinctly smaller, and they are thick, elevated, whereas in *anoidea* they are flat. This is, I think, the most conspicuous difference between the two species. The disk plates of *carnea* are also a little smaller and more numerous (by no means "much more numerous" as says Clark) and the arm spines a little shorter (not "about twice" as short) than those of *anoidea*. That the two are good, distinct species can scarcely be doubted. That the specimen from the Agulhas Bank

recorded by Hertz (Op. cit.) as *Ophiura carnea* is not really this species but *Dictenophiura anoidea* can hardly be doubtful.

Another very closely related species is the *Ophiura Skoogi* of Koehler from Angola. (Sur quelques Ophiures des côtes de l'Angola et du Cap. Medd. Göteborgs Mus. Zool. Avdeln. 18. 1923. p. 11. figs. 10—11), which is, as Koehler has well recognized also a *Dictenophiura*. It differs from *anoidea* by its distinctly longer buccal shields (Fig. 87. b.) and also by the primary disk plates being wholly surrounded by small plates, which they are not in *anoidea* (or in *carnea* either). — The Indo-



a. b.

Fig. 87. Part of oral side of *Dictenophiura anoidea* H. L. Clark (a), and of *Dictenoph. Skoogi* Koehler (b). × 12.

Malayan species *stellata* is sharply distinguished from the three other species, particularly by its large marginal, interradial plate, and I cannot at all agree with Clark that *anoidea* should be intermediate between *carnea* and *stellata*.

Ophiocten amitinum Lyman.

Ophiocten amitinum Lyman. 1882. "Challenger" Oph. p. 79. Pl. IX. 7—9.
— — Studer. 1883. Oph. d. "Gazelle", p. 16. Taf. II. 8. a—f.
— — Ludwig. 1899. Oph. d. Hamburger Magalhaensische Sammelreise, p. 4.
— — H. L. Clark. 1923. Echinod. Fauna S. Africa, p. 363.
— — Koehler. 1923. Ast. & Oph. Swedish Antarctic Exped. p. 122.

Some specimens dredged onboard the "Pickle":
False Bay, 30 fathoms. 20. XII. 1929. 4 specimens.
34°5′ S. 18°2′ E. 118 fathoms. 23. XII. 1929. 2 specimens.

It is on the authority of H. L. Clark that I refer these specimens to *Ophiocten amitinum*. They are identical with some specimens from S. African seas identified by Clark (left me by the S. African Museum). As Clark has directly compared these specimens with specimens from the "Challenger" there ought to be no doubt of the correctness of this identification. Still, I will not omit pointing out some small differences from the figures given by Lyman.

The buccal shields are represented by Lyman as broader than long, and also stated so in the description; in the S. African form they are rather longer than broad. That the papillæ on the basal arm joints are less developed than those of the typical form is mentioned by Clark, but he does not say that there is a rather distinct incision in the disk above the arm base, recalling rather much *Ophiura affinis*. On the whole, this species recalls rather much *Ophiura affinis* and, with the latter, tends to efface the limit between the genera *Ophiocten* and *Ophiura*.

The species *Ophiocten africanum* described by Koehler from Angola (Sur quelques Oph. des côtes de l'Angola et du Cap; p. 15, figs. 6—7) is another such intermediate form. Having had an opportunity of examining the type specimen, kindly lent me by my friend, Professor L. Jägerskjöld, Director of the Gothenburg Museum, I may state that it is very closely related to the Mediterranean *Ophiura Grubei* Heller, and should, in my opinion, rather be referred to the genus *Ophiura* than to *Ophiocten*.

The specimens in hand of *Oph. amitinum* have partly rather distinct, dark bands on their arms.

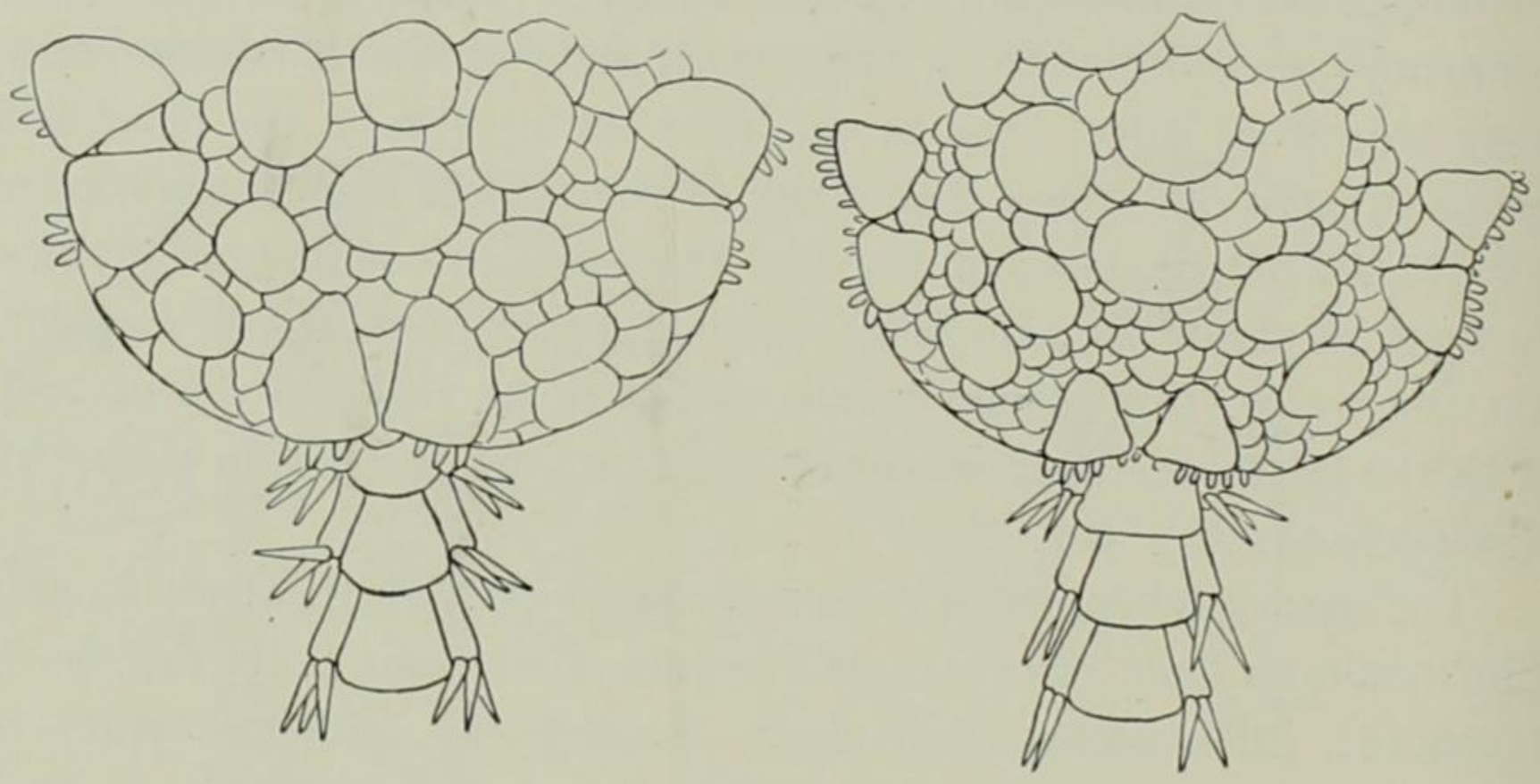
Ophiocten amitinum, var. *microplax* n. var.

Under stones in rock-pools at Humewood, near Port Elizabeth. 12. VII. 1929. 8 specimens.

The specimens are all small, the largest 2.5 mm diameter of disk.

In general they have great likeness to *Ophiocten amitinum*, the only distinct, and apparently constant, difference being in the size of the radial shields. These are in the present form very small, scarcely half the size of those of the typical *O. amitinum* of a corresponding size (Fig. 88. a—b.). It would seem that also the buccal shields are a little longer in the present form than in *amitinum* — but this is no very distinct or quite constant difference.

The rather unusual habitat for an *Ophiocten*, none of the other species having been found in the purely littoral region, makes one expect it to represent a separate species. In view of its great general resemblance with *O. amitinum* I shall, however, prefer to designate this littoral form only as a variety of that species, leaving it to future researches to settle the question of its specific validity. — None of the specimens were sexually mature, so it may be expected that it will



a. b.

Fig. 88. Part of dorsal side of *Ophiocten amitinum* Lyman (a) and of *Oph. amitinum*, var. *microplax* (b) n. var. × 18.

reach a larger size than that of the present specimens. The colour of the preserved (dried) specimens is a pure white.

Ophiocten latens Koehler.

Ophiocten latens Koehler. 1906. Oph. du "Travailleur" & du "Talisman", p. 267. Pl. XVIII. 11—12.
— — Th. Mortensen. 1927. Handbook Echinod. Brit. Isles, p. 246.
— — — 1933. "Ingolf" Oph. p. 98.
— *pacificum*. H. L. Clark. 1923. Echinod. Fauna S. Africa, p. 364. (non: *Ophiocten pacificum* Ltk. & Mrtsn.).

This species was not taken in any of my own dredgings or trawlings in S. African seas, but there are 3 specimens from 33°50′ S. 17°59′ E. 1190 fathoms, in the material left me by the Fisheries Survey.

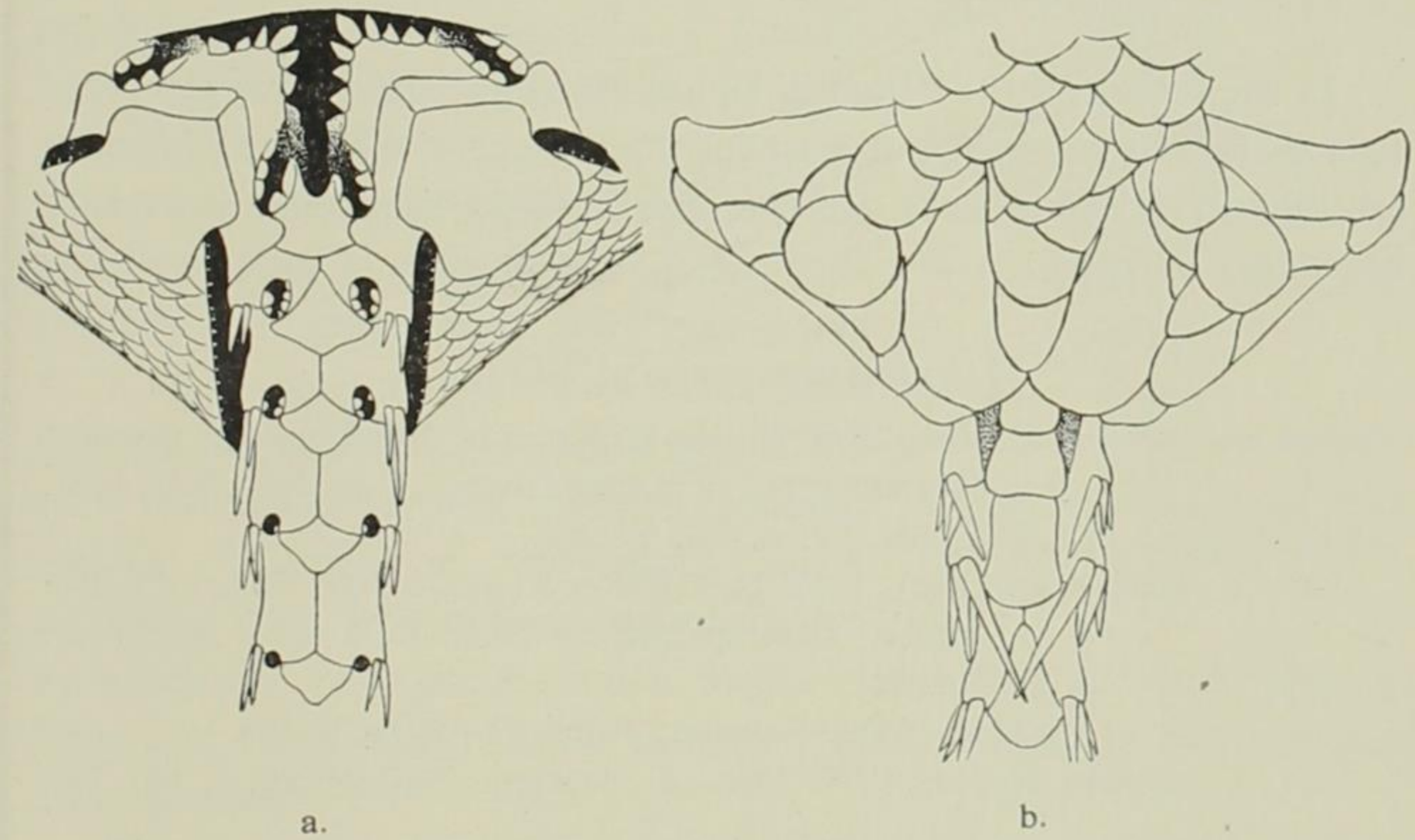
These specimens are quite conform with those recorded in my report of the Ophiuroidea of the Ingolf Expedition under the name of *Ophiocten latens* Koehler. As I have set forth there (p. 98, Figs. 51. a, b.)

I do not think it safe to regard *O. latens* and *O. pacificum* as identical, the difference in the shape of the mouth shields, the arm combs, and the ventral arm plates being characters apparently important enough for regarding them as different species. In these regards my S. African specimens agree completely with the Atlantic species *O. latens*, not with the species of the Pacific. Although I have not examined the S. African specimens identified by Clark as *O. pacificum*, it will scarcely be too rash to suppose that they also belong to the Atlantic type.

Gymnophiura novembris Hertz.

Gymnophiura novembris M. Hertz. Oph. d. deutsch. Tiefsee-Exp. p. 72. Taf. VI (I). 9—10.

No specimens of this species were collected by myself or by the S. African Fisheries Survey, the species having till now been found only by the German Deepsea Expedition off the Agulhas Bank (35°9′ S.



a. b.

Fig. 89. *Gymnophiura novembris* Hertz. Part of oral (a) and dorsal side (b). × 15.

18°32′ E.) at a depth of 564 meters. Having a cotype at disposal (left me by the Berlin Museum) I think it desirable to give a couple of figures of it (Fig. 89), as the photographic figures given by Hertz do not show the details at all distinctly; particularly the figure of the oral side is very indistinct.

As for referring this species to the genus *Gymnophiura* I do not

feel quite convinced of the correctness of so doing — but I have not sufficient material for entering on a discussion of this question. I would only point out the great general resemblance between this species and *Ophiura trimeni* Bell, as will appear on a comparison of the figures 89 and 84.

Ophiomusium Lymani Wyv. Thomson.

Ophiomusium Lymani Wyv. Thomson. 1873. Depths of the Sea, p. 172.
— — Clark. 1923. Echinod. Fauna S. Africa, p. 364.
— — Mortensen. 1927. Handbook Ech. Brit. Isles, p. 253.
Ophiomusa — Hertz. 1927. Oph. Deutsche Tiefsee. Exp. p. 103.
Ophiomusium — Mortensen. 1933. "Ingolf" Oph. p. 100.

No specimens were taken in my own dredgings and trawlings in S. African seas, but there are specimens in the material of the S. African Fisheries left me by the Fisheries Survey, viz.

33°37′ S. 16°55′ E. 1000 fathoms. 2 specimens.
33°28′ S. 16°40′ E. 1000 — 4 —

In the report on the "Ingolf" Ophiuroidea (p. 102) I have given my reasons for not accepting, at least for the present, the genus *Ophiomusa* established by Dr. Hertz for the species of *Ophiomusium* with only two pairs of pores.

Astrophiura permira Sladen.

Astrophiura permira Sladen. 1879. On the structure of Astrophiura, a new and aberrant genus of Echinodermata. Ann. Mag. Nat. Hist. 5. Ser. IV. p. 401. Pl. XX.
— *Cavellæ* Koehler. 1915. Description d'une nouvelle espèce d'Astrophiura, l'Astrophiura Cavellæ. Bull. Inst. Océanogr. No. 311.
— — Clark. 1923. Echinod. Fauna S. Africa, p. 354.
— *permira* Hertz. 1927. Oph. d. deutsch. Tiefsee-Exp. p. 83. Taf. VII (II). 4—5.

There are 4 specimens in the material of the Fisheries Survey, left me by Dr. C. van Bonde. They are, unfortunately, labelled only by a number, the meaning of which cannot be made out.

Clark has expressed grave doubts as to the specific value of the *Astrophiura Cavellæ* described by Koehler, and Hertz simply calls the same specimens upon which Koehler's species was based *Astr. permira*, without even entering on a discussion of the question of the

validity of Koehler's species. I can only join Hertz in regarding *A. cavellæ* as identical with *A. permira*.

Koehler points out as differences between *permira* and *Cavellæ* the arrangement of the dorsal plates, the presence of buccal shields in *Cavellæ*, they being absent in *permira*, and the absence of arm spines beyond the first free joint in *Cavellæ*, their presence in *permira*. That the two first of these characters are invalid was shown by Clark; as regards the arm spines the material at hand proves that no difference exists here either, spines occurring at least until the 6th free arm joint in the South African form (Fig. 90); very probably they continue to the end of the arm. Thus there is not a single reliable difference between *permira* and the S. African form, and there can be no doubt any longer of Koehler's species *A. Cavellæ* being simply a synonym of *Astrophiura permira* Sladen.

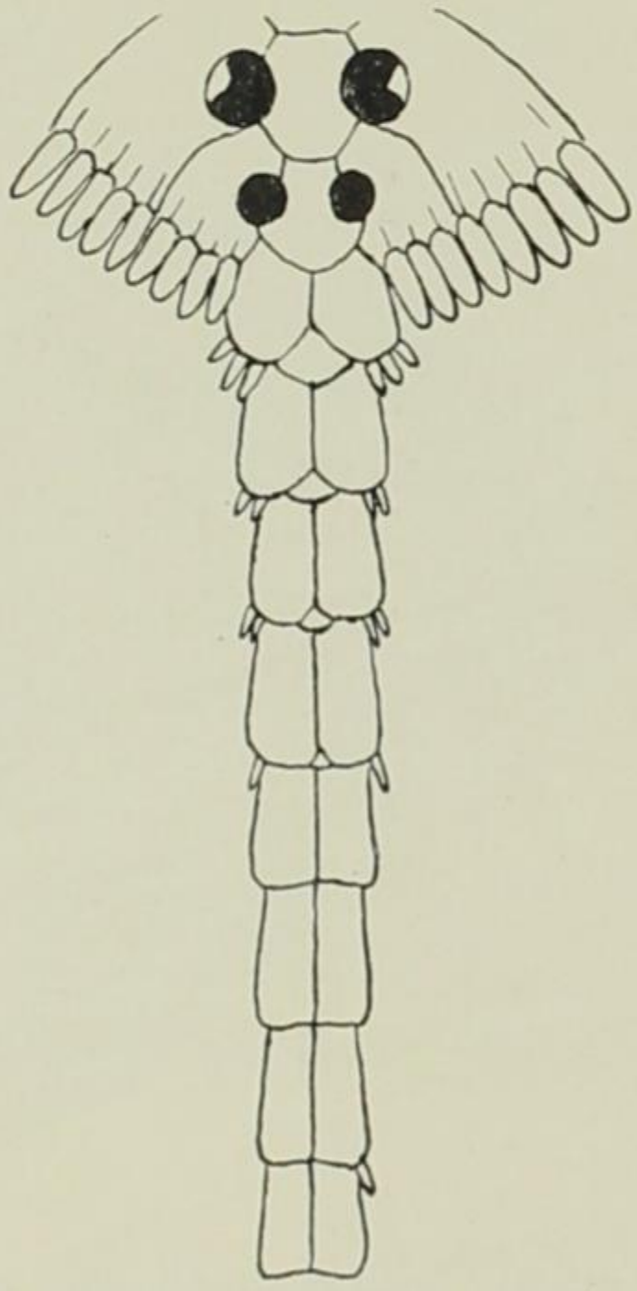


Fig. 90. Part of disk and arm, ventral side, of *Astrophiura permira* Sladen. × 12.

In one of the specimens an arm piece of 7 free joints is preserved (Fig. 90); it is evident that there must have been some 4—5 joints more in the intact arm. Thus there is no difference in the length of the arms between *A. permira* and the Japanese species *A. kawamurai* Matsumoto. As a matter of fact, I do not see any character by which the Japanese form can be distinguished from the S. African form, and I can hardly doubt that they really belong to one and the same species.

Koehler (Op. cit. p. 9) mentions having observed the genital organs as a pair of small, dark, slightly branching glands. I give here a figure to show these organs (Fig. 91). As eggs cannot be discerned it is probable that the species is a male. No genital openings are observable in any of the specimens in hand. That pores for the shedding of the genital products are formed by resorption of the plates of the skin, as it takes place in *Ophiopus arcticus*, cannot be doubted, since genital slits are absent. — I fully agree with Matsumoto in seeing in the

10 large plates round the mouth the jaw-plates and in the elongated, narrow plate along the first arm joint the adoral plate, not the genital scale, as it was interpreted by Sladen.

The strong development of the tubefeet on the arm joints enclosed in the disk, together with the whole shape of the disk, makes it eminently

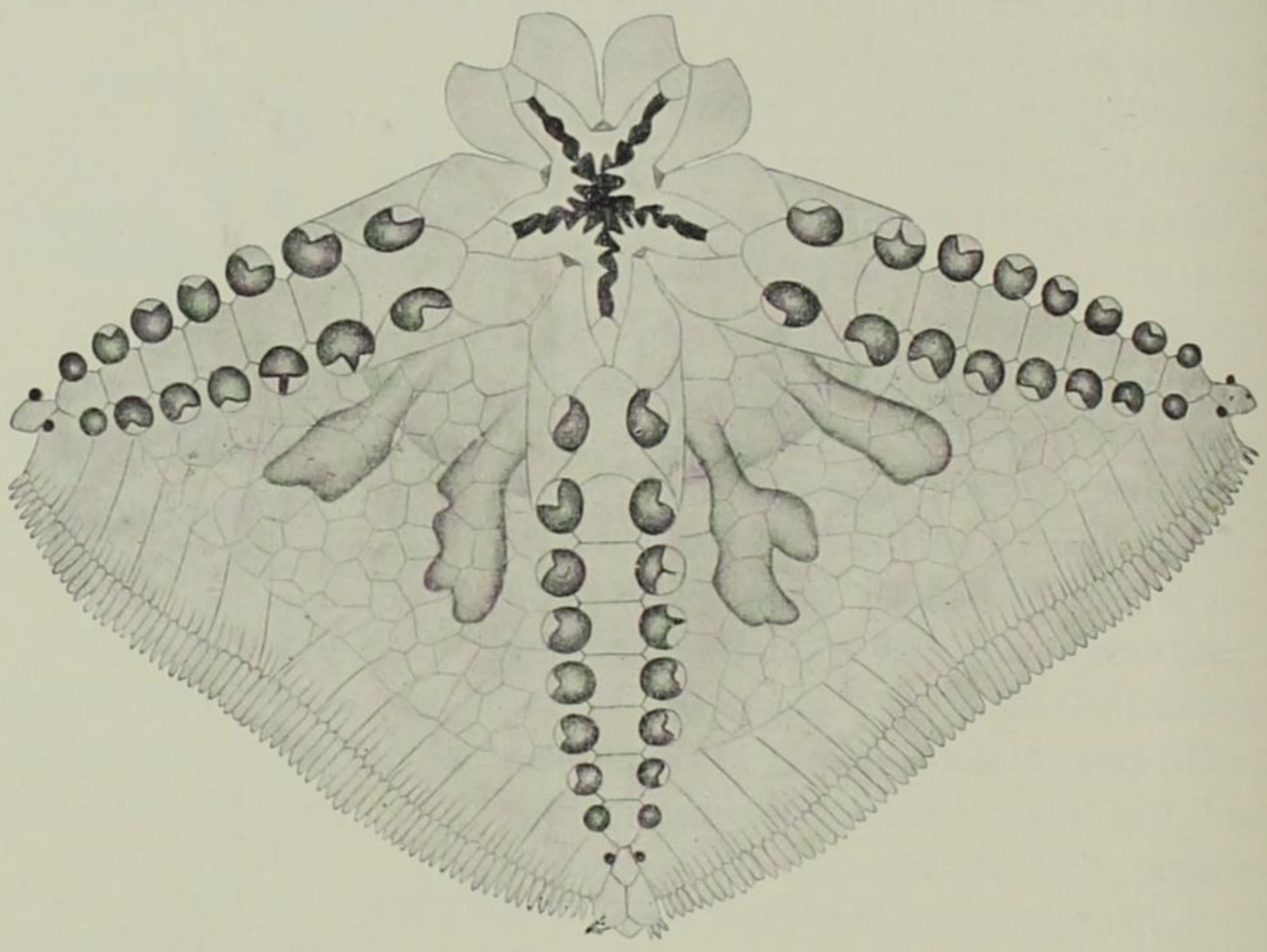


Fig. 91. *Astrophiura permira* Sladen. Part of oral side, showing genital organs. × 10.

fit for acting as a large sucking disk, and there can hardly be any doubt that the species lives attached on stones or other hard objects much as a *Patella*, as Matsumoto also found it to be the case with the Japanese species, *A. kawamurai*, and as I found it to be the case with the closely related *Ophiophycis gracilis* Mrtsn. from St. Helena.

Additional Note.

Asterina coccinea (Gray) (ad. p. 256—57). During a recent visit to the British Museum I had the opportunity of seeing the type material of this species. All 3 specimens are in a very poor condition, nothing to be seen of the ambulacral or buccal armature. It is therefore impossible to identify them with full certainty; but judging from

the characters of the dorsal side it seems rather certain that they are identical with the Californian species *Asterina miniata* (Brandt). As Brandt's name is the older (1835) the *Patiria coccinea* of Gray (1841) becomes a synonym of *Asterina miniata*.

Pteraster affinis E. A. Smith (ad. p. 230). The specimen referred to this species by H. L. Clark, 1923 (Echinod. Fauna S. Africa, p. 300), has been sent me for examination by Dr. K. H. Barnard. I find it to differ remarkably from *Pt. affinis* in the character of the superoral spine, which terminates in a cylindrical peg, whereas this spine is stated to be tricarinate in *Pt. affinis*. However, examining the original specimens of *affinis* in the British Museum I find a good deal of variation to obtain in the character of the superoral spine; it cannot really be said to be typically tricarinate — even in the type specimen it is not very distinctly tricarinate; more generally it is cylindrical, somewhat irregular. I think it not at all improbable that the specimen from off Cape Peninsula is really identical with the Kerguelen form, as stated by Clark.

After this paper was nearly ready from the press, I received Dr. Arthur A. Livingstone's paper "Some genera and species of the Asterinidæ" (Rec. Australian Mus. XIX. 1. 1933). It being too late for including references to it, I must content myself with calling attention here to this important paper.

Explanation of the Plates.

Plate VIII.

Figs. 1—2. *Astropecten exilis* n. sp. Aboral (1) and oral side (2).
- 3—4. — *antares* Döderlein. Large specimen, aboral (3) and oral side (4).
- 5—6. — — Döderlein. Small specimen, aboral (5) and oral side (6).
- 7—8. — *anacanthus* H. L. Clark. Aboral (7) and oral side (8).
- 9—10. *Mediaster capensis* H. L. Clark. The typical form (10) and Var. *durbanensis* n. var. (9). Oral side.

All figures natural size.

Plate IX.

Figs. 1—2. *Persephonaster Roulei*, var. *euryplax* n. var. Oral (1) and aboral side (2).
- 3—4. *Astropecten leptus* H. L. Clark. Oral (3) and aboral side (4).

All figures natural size.

Plate X.

Figs. 1—2. *Calliaster acanthodes* H. L. Clark. Aboral side. Showing difference in the size of the distal superomarginals.
- 3—4. *Odontaster australis* H. L. Clark. Aboral side.
- 5—7. *Tosia tuberculata* Gray. Aboral side. 5—6. Two young specimens, showing difference in the size of the distal supero-marginals. 7. Part of very large specimen, with closeset tubercles, carrying pedicellariæ.

All figures natural size.

Plate XI.

Fig. 1. *Hippasteria phrygiana*, var. *capensis* n. var. Oral side.
- 2. — — (Parelius). Specimen from the Skagerrack. Oral side.

Natural size.

Plate XII.

Figs. 1—2. *Anseropoda* (*Palmipes*) *grandis* n. sp. Disk and one arm; oral (1) and aboral side (2).
- 3. *Disasterina leptalacantha*, var. *africana* n. var. Oral side.
- 4—8. *Asterina* (*Patiriella*) *exigua* (Lamarck). Very large specimen, oral side (4). Large specimen, aboral side, showing rounded outline (5). Six-armed specimen, oral side, showing genital pores (6). Smaller specimens, oral side, showing the naked space at the oral end of interradii (7—8). In specimen 7 the normal convex outline of the interradii partly preserved.
- 9—10. *Parasterina formosa* n. sp. Aboral (9) and oral side (10).
- 11—13. *Tylaster meridionalis* n. sp. Oral (11) and aboral side (12). Dried specimen in side view (13).
- 14. *Cryaster brachyactis* H. L. Clark. Oral side. (The "*Culcita veneris*" of Bell; cf. p. 249).

All figures natural size.

Plate XIII.

Figs. 1—2. *Echinaster ornatus* Perrier. Aboral (1) and oral side (2).
- 3. — — — Specimen with the spinelets arranged in simple series. Aboral side.
- 4. *Patiria coccinea* Gray. Type specimen; aboral side.

Plate XV.

Figs. 1—4. *Cosmasterias felipes* (Sladen). Aboral (1 and 3) and oral side (2 and 4).
- 5—6. *Sclerasterias stenactis* (H. L. Clark). Aboral (5) and oral side (6).
- 7—8. — *eustyla* (Sladen). Arms, from the oral side (7) and in side view (8).
- 9—10. *Perissasterias* sp. Arms, from the oral (9) and aboral side (10).
- 11—12. *Cosmasterias capensis* (Perrier). Type specimen. Aboral (11) and oral side (12).

Natural size, except figs. 3—4 which are slightly magnified.

Plate XVI.

Fig. 1. *Marthasterias glacialis*, var. *africana* (Müll. & Troschel). Aboral side.
- 2—3. — — — *rarispina* (Perrier). Aboral side.

All figures natural size.

Plate XVII.

Figs. 1—2. *Astrocladus africanus* n. sp. Type specimen. Aboral (1) and oral side (2).

Natural size.

Plate XVIII.

Figs. 1—2. *Gorgonocephalus pectinatus* n. sp. Type specimen. Aboral (1) and oral side (2).
- 3—4. *Astroconus capensis* n. sp. Type specimen. Oral (3) and aboral side (4).
- 5—6. *Astrocladus hirtus*, var. *reticulatus* n. var. Type specimen. Oral (5) and aboral side (6).
- 7. — *euryale* (Retzius). Oral side of disk; two of the mouth slits denuded in order to show (in the other three slits) that the distal part of the mouth slits is covered over by the skin (best seen in the right side of the figure).
- 8—9. *Astroceras spinigerum* n. sp. Type specimen. Aboral (8) and oral side (9).

All figures natural size.

Plate XIX.

Figs. 1—3. *Astrocladus hirtus* n. sp. Aboral (1—2) and oral side (3).
- 4—5. *Asterostegus tuberculatus* n. sp. Type specimen. Oral (4) and aboral side (5).
- 6—7. *Ophiacantha scutigera* n. sp. Oral (6) and aboral side (7).
- 8. — *baccata* n. sp. Aboral side.

Figs. 5—7. *Asterina penicillaris;* specimens from the Red Sea, thus identified by Müller & Troschel.
- 8—10. *Austrofromia Schultzei* Döderlein. Specimens from East London. Oral (8) and aboral side (9). Arm in side view (10).
- 11—12. *Henricia abyssalis* (Perrier). Aboral (11) and oral side (12).

All figures natural size.

Plate XIV.

Figs. 1—3. *Pteraster capensis* Gray. Specimen with two young ones about to leave the brood chamber; indistinctly seen in upper right interradius (1). Specimen from the oral side, showing the narrow fin-membrane (2). Specimen with bifurcating arm; oral side (3).
- 4—5. — *fornicatus* n. sp. Type-specimens; aboral (4) and oral side (5).
- 6—7. — *flabellifer* n. sp. Type specimen; aboral (6) and oral side (7).
- 8—9. *Hymenaster lamprus* H. L. Clark. Aboral (8) and oral side (9).

All figures natural size.

Figs. 9—11. *Ophiothamnus remotus* Lyman. Aboral (9—10) and oral side (11).
- 12. *Ophiomitrella hamata* n. sp. Aboral side.
- 13—15. *Ophiacantha* (*Ophiotreta*) *durbanensis* n. sp. Aboral (13, 15) and oral side (14).
- 16—17. *Amphiura compressa* n. sp. Type specimen. Oral (16) and aboral side (17).
- 18—19. *Amphioplus falcatus* n. sp. Oral (18) and aboral side (19).
- 20. *Amphipholis strata* n. sp. Aboral side.
- 21. *Cryptopelta aster* (Lyman). Specimen opened so as to show the bursæ filled out by young ones.
- 22—23. *Ophiura* (*Ophiuroglypha*) *tumida* n. sp. Oral (22) and aboral side (23).
- 24. *Ophiopezella decorata* n. sp. Type specimen. Aboral side.
- 25. *Ophiogymna fulgens* (Koehler). Aboral side.
- 26. — *capensis* (Lütken). Type specimen. Aboral side.
- 27. *Ophiomyxa tenuispina* n. sp. Type specimen. Oral side.

All figures natural size.

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Papers from Dr. Th. Mortensen's Pacific Expedition
1914—16.

LXVI.

The Echinoderms of St. Helena.
(Other than Crinoids).[1]

By

Th. Mortensen.

With Plates XX—XXII.

For many years, almost ever since I began studying Natural History, I have been interested in the question of the origin of the marine fauna of St. Helena, my interest being particularly roused when, in the early nineties, I read Wallace's "Island Life". In this fascinating book the origin of the land fauna and flora of St. Helena is explained, the various ways and means of transport pointed out, through which the components of the land fauna and flora may have reached that little island, so isolated in mid-ocean, and there flourished — until it was for the greater part destroyed through "civilized" mans agency.

It is only the land fauna and flora that is dealt with by Wallace, the marine fauna and flora being left entirely out of consideration, and very naturally so, because altogether too little was known of the marine fauna and flora for being at all usable for a discussion of its origin. But it is clear that quite similar, and no less interesting, problems as those connected with the land fauna and flora must be connected with the origin of the marine fauna and flora of such an isolated island,

[1]) This report on the Echinoderm Fauna of St. Helena, is, together with the following paper, by Professor T. Gislén, dealing with the Crinoids of St. Helena, included in the series "Papers from Dr. Th. Mortensen's Pacific Expedition" with the special permission of the Board of Directors of the Rask-Oersted Fund.

which has evidently never been in much nearer connection with the continents than it is now.

For many years my interest in the marine fauna of St. Helena was, however, mainly platonic, no thorough investigations of that fauna having been undertaken, and the little that was known being altogether too insufficient for speculation about the origin of this fauna. But then prospects of myself being able to make such investigations at St. Helena offered themselves when, through the liberal grants of the Rask-Oersted Fund and the Carlsberg Fund, I could undertake an expedition to Java—Mauritius—South Africa in 1929—1930. Being in S. Africa it was natural enough to take the homeward trip by the normal monthly mail passing St. Helena and use the time from one mail to the next for making marine investigations there. It came even so fortunate for me that the next mail was somewhat delayed so that I could spend a little more than 5 weeks at St. Helena, from January 26th to March 6th, 1930. By another very fortunate circumstance it happened that the "Dana" on her famous circumnavigation arrived at Cape Town early in February that year and took the homeward course via St. Helena. Through the kindness of the leader of the "Dana Expedition" the late, lamented Professor Johs. Schmidt, the "Dana" was then placed at my disposal for dredgings and trawlings round St. Helena for 3 days — and by the small distances, the island being only 47 □ miles (123 km²), much work might be accomplished in three days with a steamer well fitted out for that kind of work.

It did, however, not come out quite as easily as I had fancied. For work in the shallower water on the coastal plateau surrounding the island I could use a fair-sized motor-boat hired from Mr. Solomon, the Danish Consul in Jamestown. Accordingly I wanted to use the "Dana" for work in deep water on the steep ledge of the coastal plateau and in the deep-sea just outside the ledge. But this proved to offer unexpected difficulties. The bottom of the edge of the plateau was exceedingly irregular, must, indeed, have much the appearance of the coast of the island itself, with steep rocks and deep ravines in close succession. We might set the trawl at a depth of 1100 meters, then after having moved about the ship's length there would be 500 meters, immediately after again 1800 meters, and so on. No wonder that the trawl would at once get hold in the bottom and come up completely torn; that it did come up at all is more to be wondered at.

I thought then, it might be more profitable to work in much deeper water, where clean mud bottom was to be expected. The trawl was set in 2400 meters — and was immediately caught in the bottom. It

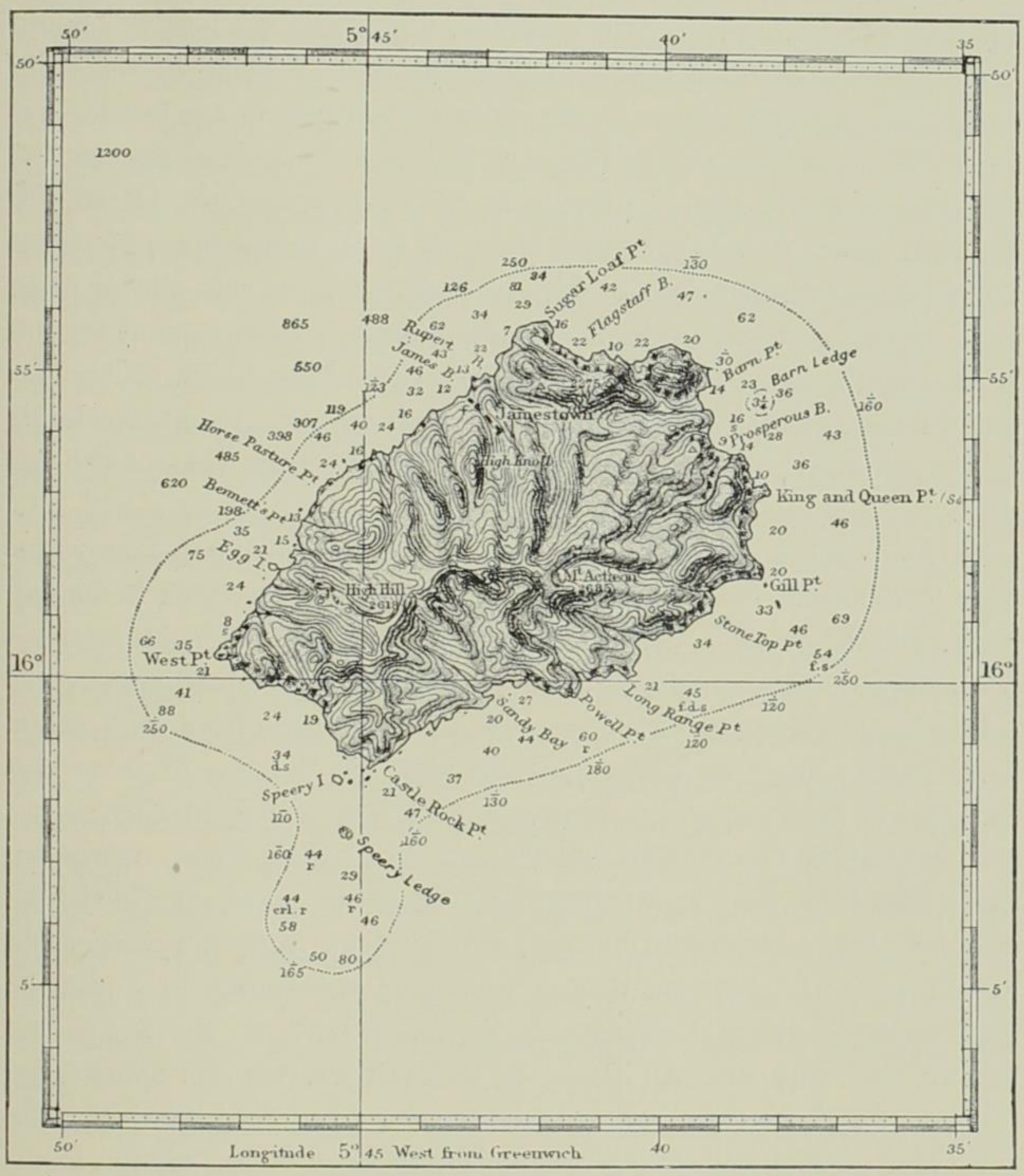


Fig. 1. Map of St. Helena.

gave great trouble to get it up, — the depth was now 2780 meters — but we got it at length, not too much torn and with some few very interesting specimens, not the least interesting being some pieces of volcanic rock, from the very foundation stone of the island. It was then deemed preferable, in spite of all, to work on the slope itself,

and we did succeed in getting some successful hauls, which gave very fine results, so that we have now an idea of the sort of fauna that lives on the steep ledge round the island.

The main work was, however, that accomplished, by means of the said motor-boat, on the coastal plateau. Conditions are here in general very good for dredging and trawling, the bottom being in the main clean. The operations were in the main carried out on the lee-side, off the N.W. coast, but also in Flagstaff Bay and Prosperous Bay on the North side and in Manatee Bay[1]), at the S.W. end of the Island. Off the S. E. coast I could not work with my small motor boat, distances from Jamestown being too great, and there being no safe anchor place here on the windward side. But some dredgings undertaken here on-board the "Dana" gave nothing but what had been found off the lee-side of the island, so there is every reason to expect that the fauna of the windward side does not differ essentially from that of the lee-side.

Over great areas, particularly in Flagstaff Bay and Prosperous Bay, the bottom is a fine black sand with only a very poor fauna and flora. On the lee side the bottom is more varied. Off Sugarloaf areas with clay bottom are found; off Jamestown wide areas are covered with the big, irregular lumps of the sponge *Chondrosia plebeia* O. Schmidt; other areas are covered with big mussels of the genus *Arca*[2]), on most of which grow some corkscrew-shaped *Cirripathes*. Off Egg Island the bottom was covered with small stones overgrown with *Lithothamnion;* in Manatee Bay again the trawl got filled with a fernlike branched Anthipathid, which must form a rather dense covering of the bottom. I was greatly disappointed in finding no Ophiurids on these Anthipathids, as on the whole, the fauna was rather poor and uniform there, as everywhere. On the sponges off Jamestown *Ophiothrix roseo-coerulans* was fairly common, likewise *Eucidaris clavata*, the young ones generally more or less hidden in the cavities of the sponge. On the bottom with *Arca-Cirripathes* the other

[1]) The name Manatee Bay is not found on the chart, fig. 1. It is the middle part of the S.W. end of the island.

[2]) According to the kind information from my friend Dr. N. Odhner of the Stockholm Museum this is *Arca Bouvieri* Fischer, known otherwise from W. Africa. It was described by E. A. Smith as a separate species, *Arca St. Helenæ*, but Dr. Odhner thinks it identical with the said W. African species.

Cidarid, *Tretocidaris spinosa*, was rather common. On the stony bottom off Egg Island *Pseudoboletia* occurs in patches in great numbers. Otherwise only scattered individuals of the various Echinoderm species were taken in the dredgings or trawlings.

Near the coast *Diadema* occurs in flocks, as is usual for Diademas. On the black rocks are found in great numbers the black *Echinometra lucunter*, together with the remarkable large, black Actinian, *Phymactis Sanctæ Helenæ* (Lesson). Whereas the Actinian is attached directly to the rock surface, exposed to the surf, the Echinometras sit in holes in the rocks and are thus protected against being washed away by the surf. Whether the holes are natural or bored by the sea-urchin I shall not try to decide — but I think rather they are natural holes in the rock. In the more protected rock pools *Asterina exigua* is common. On the rocks off the pier at Jamestown are found the black Comatulid *Tropiometra carinata* and the black *Holothuria farcimen*, none of them very numerous. Among all these black specimens the red *Ophidiaster ophidianus*, now and then seen near the low water line, makes a very striking show.

On the whole, the Echinoderm fauna, as the marine fauna in general, is poor, nothing like what would be found on a coral island in the Indo-Pacific or in the West Indies. Also corals are very poorly represented for a tropical island; there are no reef-building corals, only some dwarfed stone-corals are found here and there in the rock pools. In deeper water in the outer part of the coastal plateau the beautiful pink *Sclerohelia* occurs, but in isolated colonies, whereas on the steep slope a kind of Lophohelian coral forms submarine reefs much like the Lophohelias in the Trondheimfjord. On these corals I found the interesting new, small, brood-protecting Ophiurid *Ophiophycis gracilis*.

The first record of an Echinoderm from St. Helena is, so far as I have been able to find, that of G. C. Wallich, who, in his curious "Note on the discovery of an extremely minute Vertebrate lower jaw in mud dredged at St. Helena" (Ann. Mag. Nat. Hist. 3 Ser. X. 1862, p. (304) 440), states to have collected *Echinus lividus* there. That this in reality means *Echinometra lucunter*, the common black sea-urchin found everywhere on the rocks at low water mark, cannot be question-

able, the more so since *Paracentrotus lividus* does not occur at St. Helena. — That the object which Wallich thought to be the lower jaw of a tiny vertebrate animal is a valve of a small globiferous pedicellaria of *Eucidaris clavata* Mrtsn. I have demonstrated in my note "Über den angeblichen Kieselschwamm Microcordyla Asteriæ Zirpolo. Ein Beitrag zur Geschichte der Pedicellarien" (Zoolog. Anzeiger. 97. 1932, p. 201). Thus, in this curious way, Wallich was the first to give evidence of the existence of this species at St. Helena. — It was on his way home from India, that he had an opportunity of making a single dredging off Jamestown, on the N. W. Coast of St. Helena, and thus was enabled to give this first little contribution to the knowledge of the Echinoderm fauna of St. Helena.

In April 1853 the Swedish fregate "Eugenia" called at St. Helena on returning from her circumnavigation (1851—53), and the medical officer and zoologist I. G. M. Kinberg made some marine collections there, including some Echinoderms. Unfortunately these Echinoderms were never dealt with, excepting alone a brittle-star which was described by Ljungman as *Amphiura atlantica* n. sp. in his paper "Ophiuroidea viventia huc usque cognita" (Öfvers. K. Svenska Vet. Akad. Förhandl. 1866. p. 321). Through the kindness of my friend Professor Sixten Bock, director of the department of Invertebrates of the Stockholm Museum, the rest of the Echinoderms collected by Kinberg at St. Helena were sent me for examination. They proved to be:

Echinometra lucunter (Linn.)
Moiraster magnificus (Bell)
Linckia formosa Mrtsn.
Asterina exigua (Lamk.)
Coscinasterias tenuispina (Lamk.).

All of these species would have been new to the St. Helena fauna, if a report on them had then been published. Now it can only be stated that all these species were actually first found there by the "Eugenia" Expedition, though first described or recorded from there much later, from the researches by Melliss, the "Scotia", Cunningham and the present author.

The next contribution is that of A. E. Grube, who in his note "Über einige seltnere oder neue Ophiuriden" (Jahresber. d. Schlesischen

Gesellsch. f. Vaterländ. Cultur. 45. 1868. p. 45) describes the new species *Ophiothrix roseo-coerulans* after some specimens from St. Helena, found in the Museum of Breslau; there is no history given of these specimens, which were bought from the naturalist dealer Salmin. But that they did really come from St. Helena is proven by my own researches there, which show this species to be quite common and, indeed, the only Ophiuran at all common at St. Helena.

The first general account of the Echinoderms of St. Helena is that given by J. C. Melliss in his fine book "St. Helena. A physical, historical, and topographical description of the island; including its Geology, Fauna, Flora, and Meteorology" 1875, p. 219—220. He there records the following Echinoderms as known to him to occur at the island:

Cidaris metularia Lamk. It is said that "there are two varieties of this species found at St. Helena". This, evidently means the two species of Cidarids common at St. Helena: *Eucidaris clavata* Mrtsn. and *Tretocidaris spinosa* Mrtsn.

Echinometra acufera Blainville, "the common thin-spined, black Sea-Egg, which abounds on the rocky coast all along the sea-shore just below high-water mark. This creature bores a hole in the solid basaltic rock sufficiently deep to protect itself". — He further mentions "a third, a very fine-spined Sea-urchin, the fragments of which I have picked up occasionally on the wind-ward sea-coast, but I never obtained a complete specimen". Whether this has been a *Diadema* or a *Pseudoboletia* is impossible to say.

Asterina minuta? "A small greenish Star-fish, found aboundantly sticking closely to the rocks around the sea-coast about high-water mark." This is the *Asterina exigua* (Lamk.).

Echinaster sp.? "A bright orange-coloured Sea-star. This brilliant creature may often be seen lying at the sea bottom near the shore, at the depth of a fathom or two". This is *Ophidiaster ophidianus* (Lamk.), which I found at the same depth off the pier of Jamestown.

Comatula sp.? "This very pretty, purple, feathery creature, not unlike the head of a miniature palm-tree, is occasionally taken from the pools of sea-water on the West rocks, and other parts of the coast." This is *Tropiometra carinata* (Lamk.).

Melliss further says: "There are several species of sand-stars, some of them very large and taken from deep water. I sent a collection

of them to the British Museum with the fishes, but as yet they have not been examined."

One of these sea-stars was the one described under the name of *Archaster magnificus* by F. Jeffr. Bell. 1881 (Description of a new species of the genus *Archaster* from St. Helena. Ann. Mag. Nat. Hist. 5 Ser. VIII. p. 440). It is now named *Moriaster magnificus* (Bell). The others of these sea-stars thus sent home by Melliss have apparently never been reported on. Thus in the "Challenger" Asteroidea the only sea-star recorded from St. Helena is *Moiraster magnificus*.

In 1903, in my "Ingolf" Echinoidea I, p. 17, I described the new Cidarid *Tretocidaris spinosa* after a specimen from St. Helena in the collection of the British Museum, probably one of the Echinoderms sent home by Melliss.

In 1908 R. Koehler in his report on the "Ophiures et Echinides de l'Expédition Antarctique nationale Ecossaise" (Trans. R. Soc. Edinburgh. XLVI) mentions the following Echinoderms dredged at St. Helena by the "Scotia" on its homeward voyage: *Linckia Bouvieri* Perrier and *Cidaris tribuloides* Lamarck. These are the *Linckia formosa* n. sp. described in the present paper and *Eucidaris clavata* Mrtsn. described in my Monograph of the Echinoidea, I, p. 408.

In 1909 Professor J. T. Cunningham spent five weeks at St. Helena making fisheries investigations. By his trawlings a small number of Echinoderms were obtained, a list of which he gives in a paper "On the marine Fishes and Invertebrates of St. Helena" in Proc. Zool. Soc. 1910, p. 124—125. It contains only the following species, identified by F. Jeffr. Bell: *Cidaris tribuloides*, *Tripneustes ventricosus*, *Echinometra subangularis*, *Linckia* sp. and *Antedon carinata*. The *Cidaris tribuloides* is, of course, *Eucidaris clavata*, the *Linckia*, if correctly identified to genus ("too young for specific determination" according to Bell) must, no doubt be *Linckia formosa*. The only species new to St. Helena in this list is *Tripneustes esculentus*. But I feel rather sure that this must be an erroneous identification or that the locality is wrong.

By my own researches off St. Helena I was very intent on finding this latter species there — but not a single specimen, or even a fragment of a dead test was found, whereas I often found fragments of dead tests besides numerous living specimens of *Pseudoboletia atlantica*. If *Tripneustes esculentus* did really occur at St. Helena, I do not think

I could have missed it. Also, there is no mention of a specimen from St. Helena in H. L. Clark's Catalogue of the recent Echinids (p. 124). One might suggest that it was a misidentification of *Pseudoboletia atlantica*, but of this species Clark mentions (p. 131) only one specimen from St. Helena and that is labelled as taken by Alexander, not by Cunningham. There is thus some mystery about this species; moreover Cunningham states to be not sure of the exact locality where he obtained it. Seeing that Clark records *Tripneustes esculentus* from Ascension, one might suggest that the said specimen came from there, not from St. Helena. In any case we cannot accept this species without reservation as belonging to the St. Helena Echinoderms, till new reliable proof of its occurrence there is given.

In H. L. Clark's Catalogue of the recent sea-urchins in the collection of the British Museum (1925) the following species are recorded from St. Helena: *Tretocidaris spinosa* Mrtsn., *Eucidaris tribuloides* (Lamk.), *Diadema antillarum* (Phil.), *Parechinus angulosus* (Leske), *Echinometra lucunter* (Linn.), and *Brissus brissus* (Leske). Of these *Parechinus angulosus* is the most remarkable. The fact that I did not find a single specimen of this species at St. Helena makes me doubt very much the correctness of this statement. If it did really occur there, it would be sure to occur in numbers in the rock pools, as is the case at the S. African coasts, but not one was seen.

H. L. Clark is not sure of the identification, but of this there can scarcely be any doubt. Dr. C. C. A. Monro has very kindly sent me some of these specimens, and I think the identification correct. Dr. Monro informs me that these specimens, as also the specimen of *Brissus brissus* were collected by Lieutenant Turton of the R. British Navy and presented to the Museum in 1887. Now, one cannot help wondering that here comes a young lieutenant and finds at a glance two notable Echinoids on the shores of St. Helena, which neither Melliss, Cunningham nor myself have been able to find — and for my own part I venture to say, that if *Parechinus angulosus* did really occur there, I could hardly have missed it — coming, as I did, from S. Africa, where I had collected any numbers of this species, and thus knew its habitat perfectly well. As for the *Brissus*, I am informed that it is a dried test with some spines on it. This would seem to indicate that it was found on the beach — but it would be rather impossible to find such tests lying on the little bits of sandy

beach that are found at St. Helena. I have never found anything there, and feel convinced that any such specimen that happened to be washed ashore there would be sure to be crushed by the violent surf reigning there. I cannot help, therefore, thinking that these specimens did not really come from St. Helena, and at least until new, reliable records of the occurrence of these species at St. Helena are at hand, I cannot without reservation accept them as belonging to the St. Helena fauna.

I shall now give a list of the St. Helena Echinoderms. In the left column are given the species hitherto recorded, under various names; in the right column the revised list, according to my own researches.

In the list of the previously recorded species I have added letters indicating on whom the record rests, viz.: B. = Bell; C. = Cunningham; Cl. = H. Lym. Clark; Gr. = Grube; K. = Koehler; Lj. = Ljungman; Me = Melliss; Mo. = Mortensen; W. = Wallich.

List of Echinoderms of St. Helena.

Species hitherto recorded.	Revised list of species.
Asteroidea	Asteroidea
	Astropecten sanctæ Helenæ n. sp.
	— variegatus n. sp.
Archaster magnificus Bell (B)	Moiraster magnificus (Bell)
	Luidia aciculata n. sp.
	Hacelia superba H. L. Clark
Echinaster sp.? (Me)	Ophidiaster ophidianus (Lamk.)
	Narcissia trigonaria, var. Helenæ n. var.
Linckia Bouvieri Perrier (K)	Linckia formosa n. sp.
	Chætaster longipes (Retzius)
Asterina minuta(?) (Me)	Asterina exigua (Lamk.)
	Coscinasterias tenuispina (Lamk.)
Ophiuroidea	Ophiuroidea
	Ophioscolex dentatus Lyman
	Ophiacantha prolata n. sp.
	— nitens n. sp.
	— trivialis n. sp.
	(— Helenæ n. sp.)
	Ophiotreta sp.
Ophiothrix roseo-coerulans Grube (Gr.)	Ophiothrix roseo-coerulans Grube
	Ophiactis abyssicola (M. Sars)
	— Savignyi (Müll. & Trochel)

	Ophiactis Lymani Ljungman
Amphiura atlantica Ljungman (Lj.)	Amphiura atlantica Ljungman
	— grandisquama Lyman
	Amphipholis squamata (D. Ch.)
	Ophiopyren atlanticum n. sp.
	Ophiura Ljungmani (Lyman)
	Ophiophycis gracilis n. sp.
	(Ophiomusium spinigerum n. sp.)
Echinoidea	Echinoidea
Cidaris metularia Lamk. (Me)	Eucidaris clavata Mrtsn.
— tribuloides Lamk. (K, C)	— — —
Tretocidaris spinosa Mrtsn. (Mo)	Tretocidaris spinosa Mrtsn.
	Cidaris cidaris, var. meridionalis Mrtsn.
Diadema antillarum Phil. (Cl)	Diadema antillarum, var. ascensionis Mrtsn.
Pseudoboletia atlantica H. L. Clark (Cl)	Pseudoboletia atlantica H. L. Clark.
Tripneustes ventricosus (Lamk.) (C)	? Not St. Helena
	Echinus atlanticus Mrtsn.
Parechinus angulosus (Leske) (Cl)	? Not St. Helena
Echinus lividus Lamk. (W)	Echinometra lucunter (Linn.)
Echinometra acufera Blv. (Me)	— — —
— subangularis (Leske) (C)	— — —
	Echinocardium connectens n. sp.
	Plagiobrissus costæ (Gasco)
Brissus brissus (Leske) (Cl)	? Not St. Helena
Holothurioidea	Holothurioidea
	Euapta (?) lappa (Müller)
	Holothuria farcimen Selenka
Crinoidea	Crinoidea (identified by Gislén)
Comatula sp. (Me)	Tropiometra carinata (Lamk.)
Antedon carinata (Lamk.) (C)	— — —
	Crinometra transversa Gislén
	(Monachocrinus incrassatus Gislén.)

Excluding the deep-sea species *Ophiacantha Helenæ*, *Ophiomusium spinigerum*, and *Monachocrinus incrassatus*, which do, of course, not strictly belong to the St. Helenan fauna, we know thus at present in all only 39 species of Echinoderms from St. Helena, 12 of which had formerly been recorded, under various names, from the island. Of these 39 species 13 are known only from deeper water on the steep edge of the

coastal plateau surrounding the island; from the coast and the coastal plateau are known in all only 26 species, a very poor fauna, indeed, for a tropical island. And, whereas it is highly probable that still a fair number of species may be found in greater depths on the steep edge of the coastal plateau, it is not very likely that many more species — if any — will be found on the coastal plateau itself or on the coasts of the island.

A very extraordinary fact, very striking for anybody who has undertaken marine investigations in various part of the world, is the total absence of species of the genus *Ophiura*, or any other Ophiolepid. On the whole, the Ophiurids form a very inconspicuous element of the St. Helena fauna, though three species: *Ophiothrix roseo-coerulans*, *Amphiura atlantica* and *Ophiactis Lymani* are not uncommon; the *Ophiothrix* is the only one generally found in the dredgings — particularly on the big sponge *Chondrosia plebeia*, so very common in places off Jamestown.

The greatest interest that connects with the St. Helena fauna is its geographical relations. It must be regarded as an established fact that St. Helena originated as an isolated volcano, rising from the bottom of the deep-sea in the middle of the Atlantic Ocean, and that it was never in much nearer connection with either Africa or S. America than it is now. It is true, H. v. Ihering, in his "Geschichte d. Atlantischen Oceans" 1927 (p. 13) finds in the statement that the Manatee occurred at St. Helena in pleistocene times proof that the island was formerly much larger and in much nearer connection with Africa or S. America than now, since it would be impossible for a Manatee to cross the Ocean by the enormous distances now separating St. Helena from Africa (1140 miles) and S. America (1800 miles). However, as I think to have shown definitely in my paper "On the Manatee of St. Helena" (Vid. Medd. Dansk Naturhist. Foren. Bd. 97. 1933), it is a mistake that the Manatee has been found pleistocene in St. Helena, and as for the records of the Manatee living at St. Helena in the 17th—19th century they rest on a misapplication of the name Manatee to — probably — a sea-lion. Thus the "Manatee" of St. Helena does not prove that the island was ever larger than it is now. A glance at the sea-chart will at once convince us that the steep edge of the coastal plateau represents the utmost limit to which the island can ever have extended.

By the geographical isolation of the island ever from the time of its origin, it is clear that the fauna (and flora) now inhabiting its littoral

region (as well as its land fauna and flora) must have reached it by transport across the ocean separating it from the nearest continents (or from the nearest islands, e. g. Ascension). This means, for the Echinoderm fauna, that the species now occurring there must have been transported across the sea as pelagic larvæ, or on floating algæ or the like — unless they have so great a bathymetrical distribution, that they occur also in the deep-sea and thus may have risen from there to the coastal plateau. This is probably the case with most of the species living in deep water on the edge of the coastal plateau. As for the species found on the coast or on the coastal plateau, not one of them is known to have such great bathymetrical distribution that it could have come to St. Helena via the deep-sea. Only *Chætaster longipes* is known to extend to a depth of 1140 m, but even this would not help it to cross the great depths of ca. 2500 meters separating St. Helena from Ascension (where this species likewise occurs), or Ascension from the nearest point on the African Coast, Cape Palmas (ca. 4000—5000 meters).

It is evident that such transport across the ocean must be comparatively rare events, and this accounts for two striking features in the St. Helena fauna (and flora): its relative poverty and the comparatively large number of endemic forms. These latter must be supposed to have come to the island in the earliest time of its existence and thus have had time enough to transform into new species or even genera (e. g. *Moiraster*).

The species not endemic of St. Helena must be supposed to have arrived later on, so that there has not been time enough for them to transform into new types — or it may be that there has been a more constant influx of larvæ (or adults) from outside, so that they could maintain their typical form unaltered.

The exact age of the island is uncertain, because of the absence of fossiliferous deposits. Wallace ("Island Life"), from the general character of the land fauna and flora of St. Helena, concludes that it must date back at least to the Miocene, perhaps earlier[1]). The character of the Echinoderm fauna would seem to fit well with that estimation of the age of St. Helena.

We may now give an analysis of the Echinoderm fauna of the coast and the coastal plateau of St. Helena.

[1]) Cf. also Daly. Geology of St. Helena. Proc. Amer. Acad. Arts & Sc. LXII. 1927.

Astropecten Sanctæ Helenæ . . .	Endemic.
— *variegatus*	Endemic.
Moiraster magnificus	Known also from Ascension; related to the Indo-Pacific genus *Anthosticte*.
Luidia aciculata	Endemic.
Hacelia superba	West Indian.
Ophidiaster ophidianus	N. E. Atlantic, Mediterranean.
Narcissia trigonaria, var.	
Helenæ	Endemic, closely related to and evidently originating from the Brazilian *N. trigonaria*.
Linckia formosa	Endemic. Closely related to the N. E. Atlantic-African *L. Bouvieri*.
Chætaster longipes	N. E. Atlantic—Mediterranean.
Asterina exigua	S. African, Indo-Pacific.
Coscinasterias tenuispina	N. E. Atlantic, Bermudas, Brazil.
Ophiothrix roseo-coerulans	Endemic. Closely related to the E. Atlantic-S. African *O. fragilis*.
Ophiactis Savignyi	Cosmopolitan, in the warmer areas.
Ophiactis Lymani	West Indian.
Amphiura atlantica	Endemic. Closely related to the S. African *Amph. dilatata*.
Amphipholis squamata	Cosmopolitan.
Eucidaris clavata	Endemic. Closely related to, and evidently originating from the West Indian-African *E. tribuloides*.
Tretocidaris spinosa	Known also from Ascension; related to the West-Indian *Tr. Bartletti*.
Diadema antillarum, var.	
ascensionis	Known also from Ascension. Closely related to and evidently originating from the West-Indian-African *D. antillarum*.
Pseudoboletia atlantica	Known also from Ascension. Related to the Indo-Pacific *Pseudoboletia maculata*.
Echinometra lucunter	West-Indian—African.
Echinocardium connectens	Endemic.

Plagiobrissus Costæ..... N. E. Atlantic—Mediterranean.
Euapta lappa..... West-Indian.
Holothuria farcimen..... Azores.
Antedon carinata..... West-Indian—East African.

Of the 26 littoral-sublittoral Echinoderms of St. Helena no less than 9 are endemic and 4 known only from St. Helena and Ascension, thus exactly 50 $^0/_0$, a fact bearing incontestable testimony of the very long time these small islands in the mid-Atlantic must have existed, as also of their total isolation during the whole time they have existed.

Four of these species viz. *Astropecten Sanctæ Helenæ*, *A. variegatus*, *Luidia aciculata*, and *Echinocardium connectens* are of unknown origin. For the rest of the species, endemic or not, we can, trace their origin with a fair degree of certainty. There are three distinct sources: The North East Atlantic—Mediterranean, the West Indies—Brazil and South Africa—the Indo-Pacific.

Fom the N.E. Atlantic—Mediterranean region have come: *Ophidiaster ophidianus*, *Chætaster longipes*, *Plagiobrissus Costæ* and *Holothuria farcimen;* further, in all probability, also *Linckia formosa* and *Coscinasterias tenuispina* must originate from this region, directly (*Coscinast. tenuispina*) or indirectly, having developed from some ancestral form coming from this region, viz. *Linckia formosa* (from *L. Bouvieri*).

From the West-Indian-Brazilian region have come: *Hacelia superba*, *Narcissia trigonaria Helenæ*, *Ophiactis Lymani*, *Euapta lappa*, — directly (*Hacelia superba*, *Ophiactis Lymani* and *Euapta lappa*) or indirectly, having developed from an ancestor coming from there, viz. *Narcissia trigonaria Helenæ* (from the Brazilian typical *N. trigonaria*). Possibly also *Tretocidaris spinosa* may have originated from the West Indian *Tr. Bartletti*. As for *Diadema antillarum ascensionis*, *Eucidaris clavata*, and *Echinometra lucunter* it is impossible to decide whether they came from the West Indian or from the East Atlantic—African region, these species, or, for the two first named, the species from which they have derived, being common in both these regions. That *Ophiactis Savignyi* also came from the West Indies is rather certain, whereas it is, of course, impossible to say definitely from where the cosmopolitan *Amphipholis squamata* came.

From South Africa and the Indo-Pacific region came *Moiraster magnificus*, *Asterina exigua*, *Amphiura atlantica* and *Pseudoboletia atlantica*, possibly also *Tropiometra carinata*. As the latter occurs both at East Africa and in the Brazilian-West Indian region it is impossible to state definitely from where it came; the fact that it does (apparently) not now occur in the Cape region, would tend to indicate that it came to St. Helena from Brazil — but as the species must, no doubt, formerly have occurred also in the Cape region, it is possible that it has come from there.

Moiraster magnificus is so closely related to the S. African *Anthosticte Pacei* Mrtsn., that it must, no doubt, have come from S. Africa, developed from a common ancestor of these two species. That they are referred to two different genera does not mean so much, since — in all probability — *Anthosticte* is not to be distinguished from *Moiraster*, but is simply a synonym of the latter. The N. E. Atlantic—Mediterranean *Tethyaster subinermis* is also related to *Moiraster*, but more distantly, so probability is for *Moiraster magnificus* having come from S. Africa.

From S. Africa has come also *Amphiura atlantica*, which is so closely related to the S. African *Amph. dilatata* that it is even very likely the two are identical.

Pseudoboletia atlantica has no relations in the Atlantic or the West Indies, whereas the genus is widely distributed in the Indo-Pacific. It must, evidently, have come from there — although the genus is not now represented in S. African seas. (The genus is not known as fossil.) In this case, as with *Tropiometra carinata*, it may be assumed that in a former warmer period, it did occur in S. African seas and by that time was transported to St. Helena—Ascension.

The only species now actually common to S. Africa and St. Helena is *Asterina exigua*. As this species has not pelagic larvæ, but direct development, like *Asterina gibbosa* (cf. Th. Mortensen. Studies of the development and larval forms of Echinoderms. 1921, p. 189) it is certain that it must have been transported directly to St. Helena — and there should be no difficulty for such transport. The huge Laminarian *Eclonia*, so very common at the S. African coasts is often carried by the current as far as St. Helena. I have found it cast ashore there, at Sandy Bay. That *Asterina exigua* must have been transported

to St. Helena on the roots of this alga is rather indisputable. Also the viviparous *Amphipholis squamata* may very well have come in this way to St. Helena — and it is likewise quite probable, that *Ophiothrix roseo-coerulans* came this way, derived from the S. African *Ophiothrix fragilis* or *Oph. triglochis*, though it is also quite possible that it came from the N.E. Atlantic *Oph. fragilis*.

It is rather curious that no more Echinoderms appear to have come from S. Africa, by this constant means of transport. One might expect that e. g. *Marthasterias glacialis rarispina* and *africana* might have been thus transported to St. Helena, but this does not appear to have happened. Likewise *Parechinus angulosus* would be liable to be transported in this way. I may recall in this connection that Koehler ("Scotia" Echinoderms p. 634) records *Amphiura capensis* as occurring at Ascension. I have had his (single) specimen for examination and must testify the correctness of the identification. But the fact that it does not occur at St. Helena (— I have collected great numbers of this species on the coast of Cape Peninsula and know its habits perfectly, there is thus no probability at all that I could have overlooked it at St. Helena, where I was specially on the look out for it —), and that it is otherwise known only from S. Africa (Koehler's records of its occurrence at the Senegal coast are due to misidentifications; cf. my report on the S. African Echinoderms) make it almost certain that this record of *Amph. capensis* from Ascension must be due to some confusion of the labels.

I venture to think that this discussion of the relations of the Echinoderm fauna of St. Helena has borne out my expectations, that it would prove of considerable interest for the study of the historical evolution of the fauna of the island. No doubt, there are other very isolated small islands which will offer problems of similar interest and importance in regard to the origin of their marine faunas (— I might name as examples the Bonin Islands, Easter Island, not to speak of the much larger Galapagos and Hawaiian Islands —). But St. Helena is rather unique by the fact that we can trace so distinctly how it received the components of its present littoral fauna of Echinoderms along three different ways. In this regard the Echinoderm fauna rather surpasses the land fauna, in so far as we cannot there so directly point out the sources of the various components, as it is possible for

several of the Echinoderms. Most probably a detailed study of the other marine Invertebrates would also give equally interesting and important results.

On the Wegener theory St. Helena has no direct bearing. It can only be said that, provided this theory be true, St. Helena must have come into existence after the continents of Africa and S. America had reached about their present distance from each other.

I. Asteroidea.

Astropecten Sanctæ Helenæ n. sp.

Pl. XX. Figs. 1—3.

Ruperts Bay, ca. 20 meters. 29. I. 1930. 1 specimen.
Off Sea-Cow Cove, ca. 30 meters. 13. II. 1930. 4 specimens.
Flagstaff Bay, ca. 60 meters. 24. II. 1930. 5 specimens.
Off Egg Island, ca. 40 meters. 5. III. 1930. Several specimens.

On the latter locality the bottom was covered with *Lithothamnion;* it would seem then that the species prefers this kind of bottom to the black sand-bottom of the other localities.

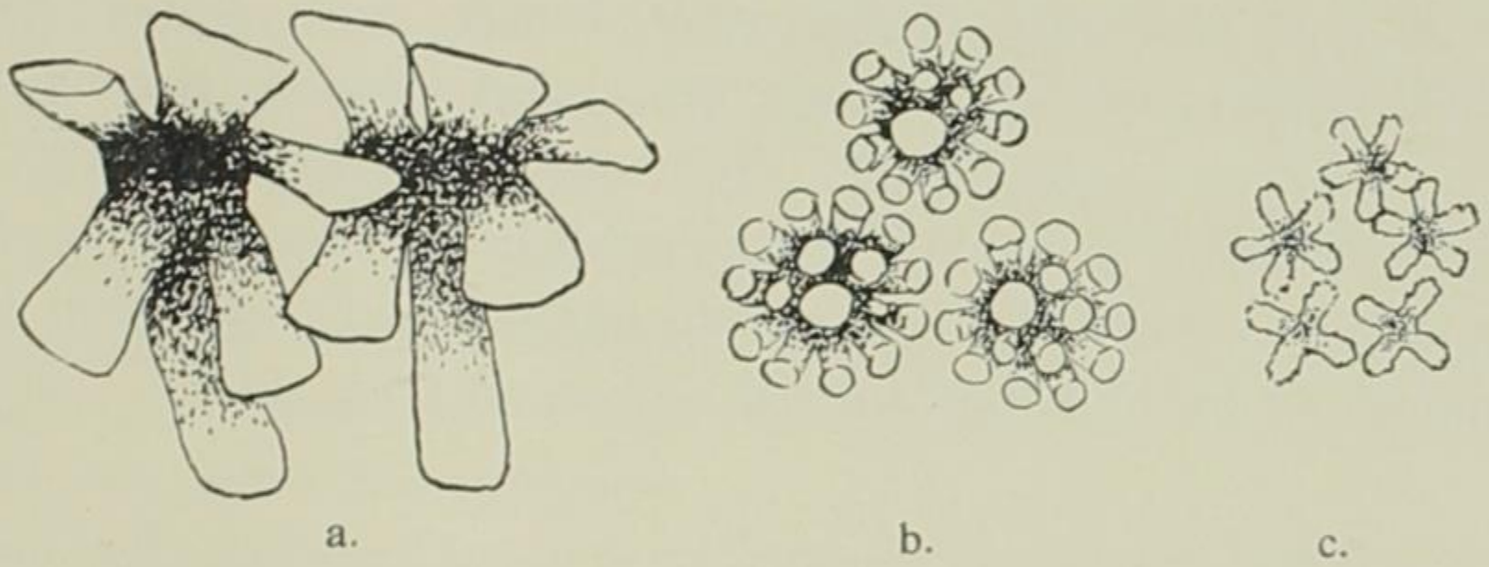
Largest specimen: R. = 53 mm, r. = 14 mm. Arms rather broad, gently tapering, the end somewhat rounded. The paxillar area broad, occupying ca. $^2/_3$ width of the arm in the basal part, but there may be a very considerable variation herein, due mainly to preservation[1]).

The paxillæ are arranged in more or less distinct transverse series along the sides of the arms. The paxillar spinelets are short, smooth, distinctly thickened at the end, assuming thus rather the aspect of granules (Fig. 2. b.), the central ones being the largest. Often there is only one spinelet, but the number varies from 1 to 5—6; peripheral spinelets ca. 10. In the center of the disk, which usually forms a small conical elevation, the paxillæ are, as usual, small, and very densely packed. The madreporite is small, naked, nearer the edge than the centre.

Supero-marginals 25—26 to each side of arm in adult specimens; in the distal part of the arm they are distinctly broader than long, but not much encroaching on the dorsal side of the arm. They are

[1]) By poor preservation a narrowing of the paxillar area will very easily occur; the paxillar area sinks and the marginals become more prominent, bending inwards, so that the paxillar area becomes much narrower than usual. On specimens lying a little while out of the water before being preserved such a narrowing of the paxillar area will very easily occur.

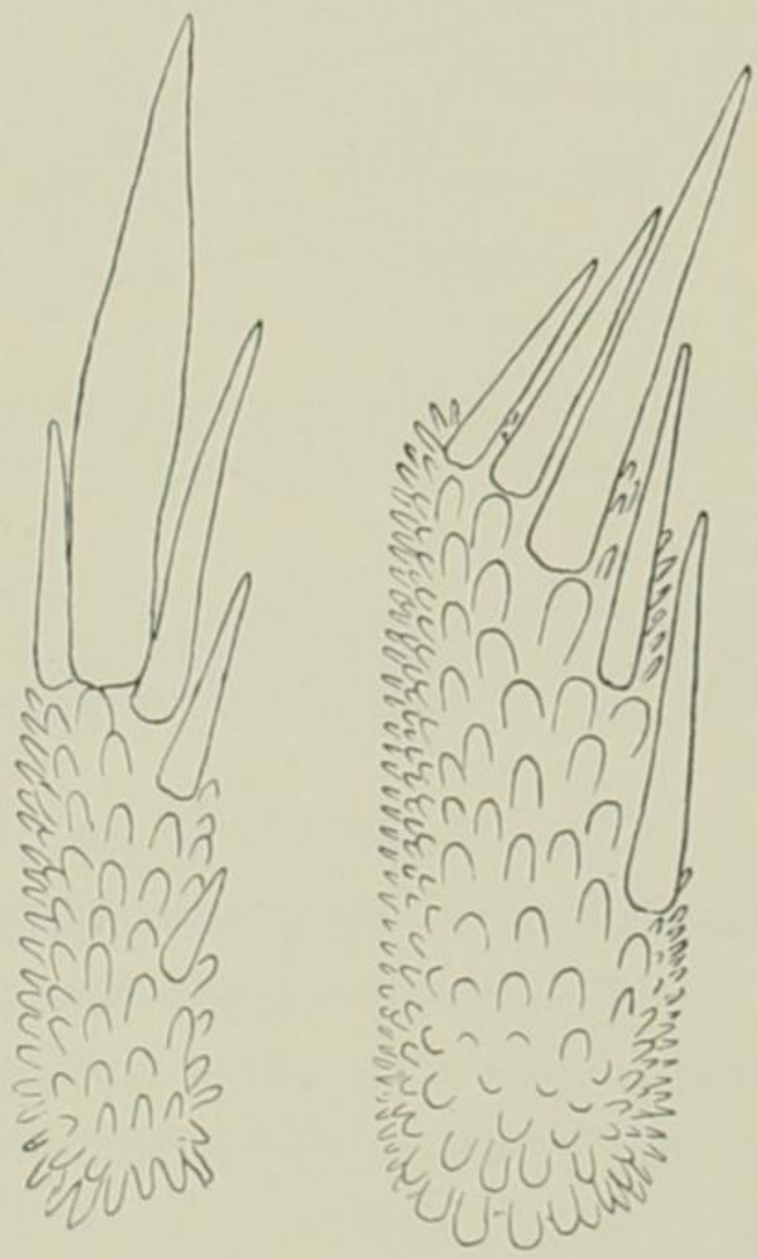
covered on the upper side with low, flattened granules; at the outer edge there is a low, obtuse spine; the vertical side is covered with



a. b. c.

Fig. 2. *Astropecten Sanctæ Helenæ* n. sp. Two adambulacral plates (a); paxillæ of adult (b) and young specimen (c). × 12.

small spinelets. Infero-marginals not extending outside the supero-marginals. There is one large terminal spine, flattened and pointed, and adorally to it a much smaller spine. Along the aboral edge there is a series of 3—5 pointed spines, gradually decreasing in size. The plates otherwise covered by low, flattened, somewhat scalelike spinelets (Fig. 3. a.). Ventro-lateral plates 3—4 to each side of arm, carrying simple spinelets. No pedicellariæ.



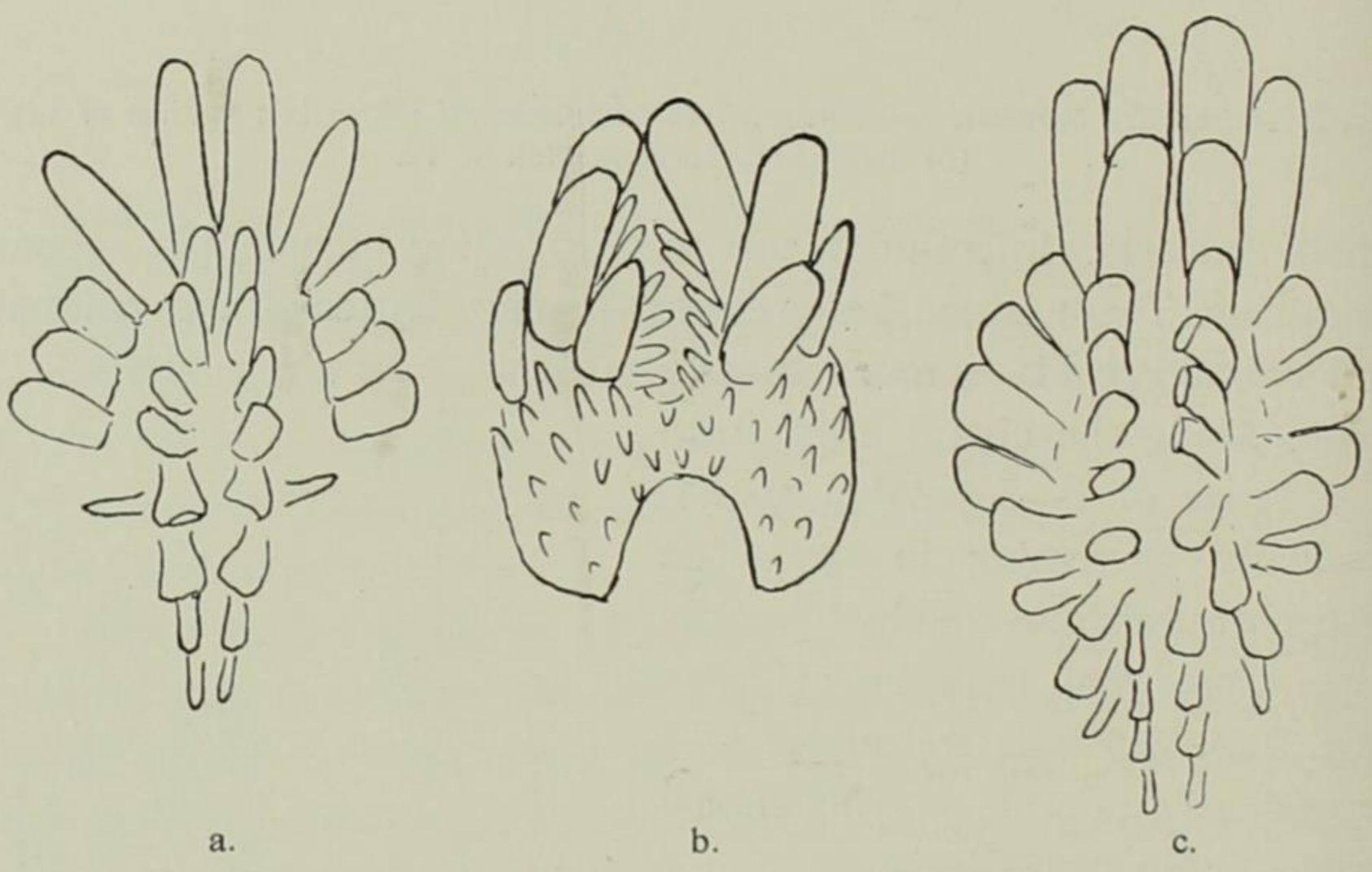
a. b.

Fig. 3. Infero-marginal plate of *Astropecten Sanctæ Helenæ* n. sp. (a) and of *A. variegatus* n. sp. (b). × 9.

Adambulacral plates with 3 furrow spines, the median one slightly the longer, cylindrical, the two lateral ones compressed at the point. Outside the furrow spines are three spines placed in somewhat oblique series; they are distinctly compressed, the median one distinctly the largest (Fig. 2. a.) some times they are excavated on the outer side. The jaws carry on the elevated median keel a double series of 8—10 short compressed spines, sometimes with one or two slender spinelets on the sides of the median keel. The jaws are somewhat truncate at the oral

end, carrying here four rather long, cylindrical spines; on the sides there are 3—4 much shorter, flattened spines (Fig. 4. a.).

The colour is a light pinkish-gray, usually with a more or less conspicuous dark band across the arms, and often with some small dark spots scattered on the disk. The end of the arms often with some pink colour. The oral side may be dark reddish-brown. — The specimens from black sand-bottom are as a rule darker than those from Lithothamnion-bottom, of a uniform red-brown, on both sides.



a. b. c.

Fig. 4. *Astropecten Sanctæ Helenæ* n. sp. Jaw (a); terminal plate of young specimen (b). *Astrop. variegatus* n. sp. Jaw (c). a. and c. × 12; b. × 30.

This species belongs to the *irregularis*-group, but is quite distinct from any of the species hitherto known.

In quite young specimens the paxillæ have only 4—5 peripheral spinelets and as yet no central one (Fig. 2. c.). In such specimens there are 3—4 large spines to each side of the terminal plate (Fig. 4. b.).

Astropecten variegatus n. sp.

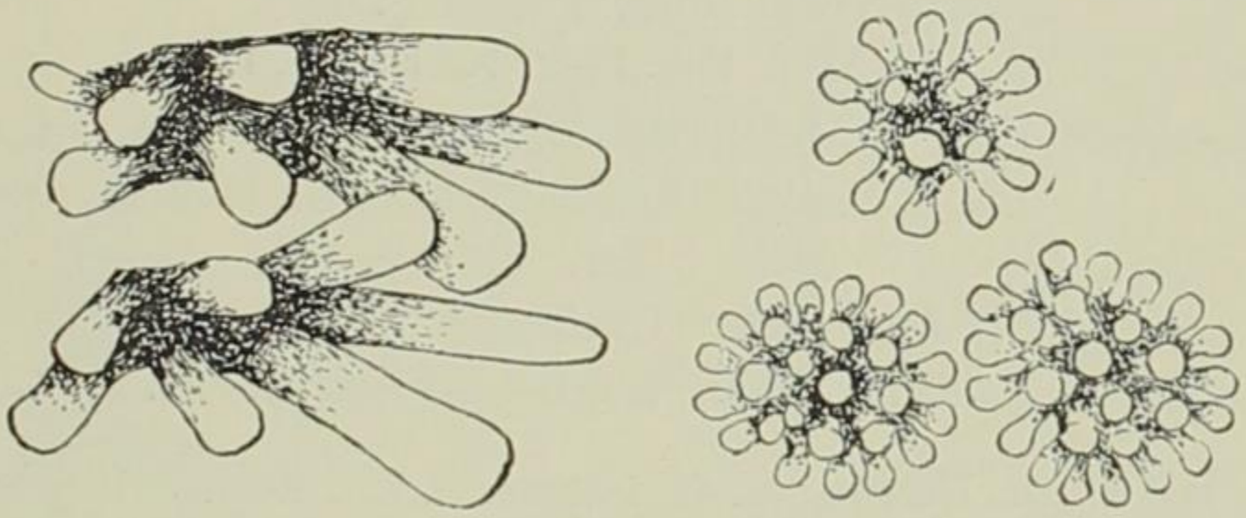
Pl. XXI. Figs. 3—6.

Ruperts Bay, ca. 20 meters. 29. I. 1930. 1 large and 1 small specimen.
Off Sugarloaf, ca. 40 meters. 14. II. 1930. 1 specimen.
Off Jamestown, ca. 50 meters. 3. II. 1930. 3 young specimens.

Largest specimen R. = 35, r. = 11. Arms rather broad at base, tapering, point not rounded. Paxillar area at base of arm about $^2/_3$

the width of the arm, the paxillæ not arranged in transverse rows, or at most so in the distal part of the arms. Disk flat, without any central, conical elevation. Paxillar spinelets short, smooth, capitate; in the proximal part of arm and on the disk the paxillæ are rather large with ca. 10 central and ca. 12—15 peripheral spinelets; usually some of the central ones are larger than the rest (Fig. 5. b.). At the sides along the supero-marginals the paxillæ are smaller and their spinelets fewer and more slender. In the central part of the disk the paxillæ are small and crowded.

Supero-marginals 15—16 to each side of arm in the largest specimen; they are distinctly broader than long, encroaching rather much on the



a. b.

Fig. 5. *Astropecten variegatus* n. sp. Two adambulacral plates (a); paxillæ, the upper one from an arm, the two below from the disk (b). × 12.

dorsal side of the arm. They are covered uniformly by low, capitate spines, almost of the appearance of granules. No indication of larger spines on the supero-marginals.

Infero-marginals with a conspicuous oblique series of 5—7 long, pointed, not flattened spines along distal and aboral edge, the 3rd being the largest (Fig. 3. b.); the plates otherwise covered with low, flattened, scale-like, not pointed spinelets. 3 ventro-lateral plates to each side, carrying slender spinelets. No pedicellariæ found anywhere.

Adambulacrals with three furrow spines, the median of which is slightly the longest, slender, cylindrical, the two lateral ones coarser, compressed; outside the furrow spines follow two longitudinal series of two spines each, none of which is enlarged and all distinctly smaller than the furrow spines (Fig. 5. a.). Rarely there may be a single spine outside the second series. The jaws with a double series of ca. 10 spines along the median keel; the innermost pair is considerably enlarged, those at the distal end smaller, more slender; also on the

sides of the median keel there are some spines, forming a secondary series which may have the appearance of continuing directly into the marginal series. There are to each side 3—4 short, flattened marginal spines and 2 larger, thicker at the proximal end (Fig. 4. c.).

The colour is a variegated dark-brown and cream-yellowish; there is a dark band across the middle of the arm, and the end of the arm is likewise dark. Also the jaws may be of the same dark colour.

This very characteristic species may be referred to Döderlein's *pectinatus*-group; but it does not seem very nearly related to any species hitherto known.

Moiraster magnificus (Bell).

Pl. XXI. Figs. 1—2; XXII. Fig. 1.

Archaster magnificus F. Jeffr. Bell. 1881. Description of a new species of the genus Archaster from St. Helena. Ann. Mag. Nat. Hist. 5 Ser. VIII. p. 440.

Moiraster — Sladen. 1889. "Challenger" Ast. p. 193.

— — Koehler. 1908. "Scotia" Echinod. p. 294. Pl. XII. 107—110.

Off Egg Island, St. Helena, ca. 40 meters. 3. III. 1930. 3 large specimens.

R. = 160—170.

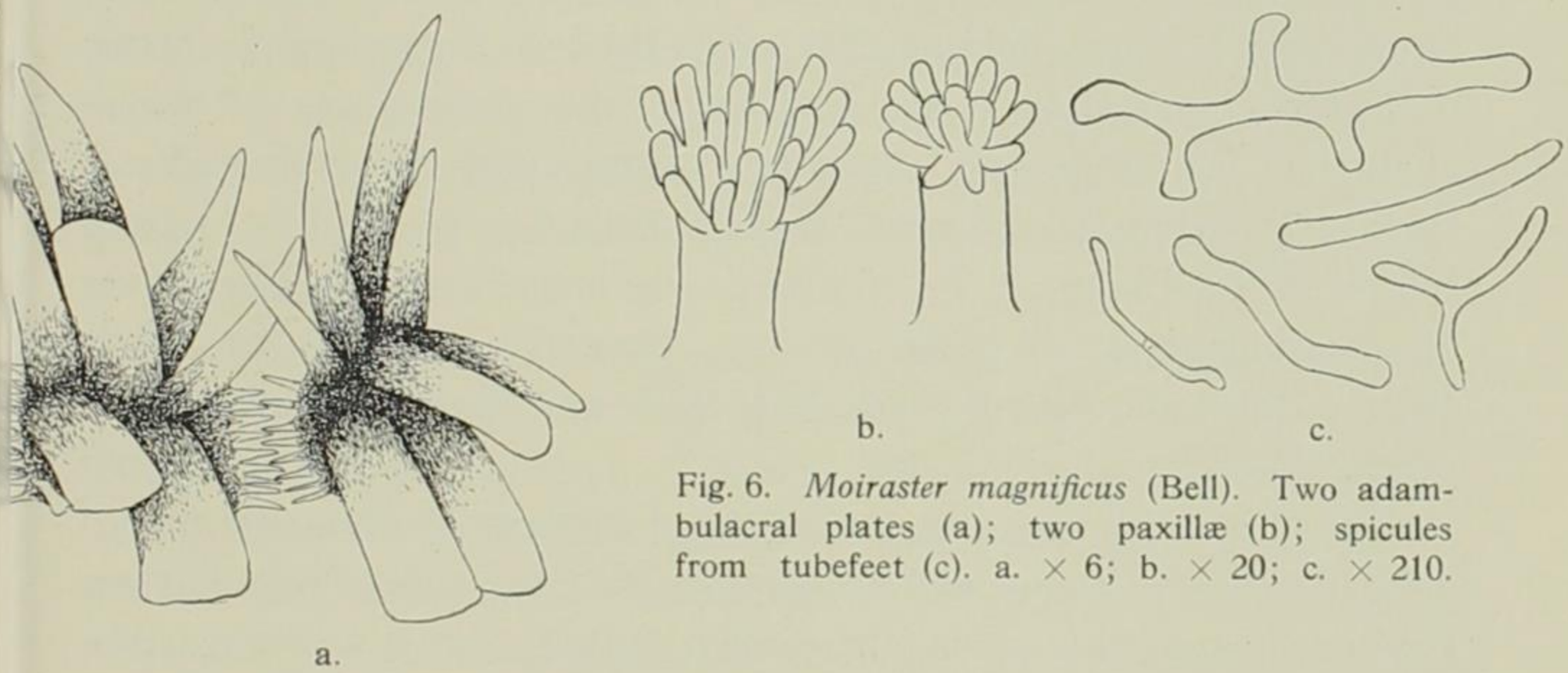
These specimens agree very well with the description given by Bell, so that there can be no doubt of the identification, the more so as they are from the type locality.

The photographic figures here given will show the general aspect of this large and fine sea-star better than Koehler's drawing (Op. cit.) of a medium sized specimen (from Ascension, 40 fathoms). Also some additions to the descriptions by Bell and Koehler are required; likewise some figures of details.

The paxillæ have a slender stalk; the spinelets are cylindrical, smooth, not distinctly capitate (Fig. 6. b.); that they are "closely appressed together, and not forming any kind of fringing crown" (Bell), is, partly at least, a consequence of poor preservation. Sometimes the central spinelets bend together so as to form a sort of pedicellaria.

The infero-marginal plates are separated by very deep furrows, the sides densely covered with fine spinelets; very deep fasciolar channels thus are formed, which continue between the radiating series of ventro-lateral plates (Pl. XXII. Fig. 1) and even between the adambulacral

plates, where, however, the furrows are shallower and the spinelets fewer. A median, incomplete, unpaired, radiating series of ventro-lateral plates is distinct, and even a shorter series to each side of it (Pl. XXII. Fig. 1). The typical arrangement of the adambulacral armature would seem to be three somewhat curved, compressed, pointed furrow spines, followed by a longitudinal series of 3, the middle one of which is the largest, flattened, and outside this another longitudinal series of 2 or 3 enlarged, flattened spines (Fig. 6. a.); but as a rule the arrangement is indistinct, and one might also say, there are 5 furrow spines followed by one enlarged spine etc. Along the edges



a. b. c.

Fig. 6. *Moiraster magnificus* (Bell). Two adambulacral plates (a); two paxillæ (b); spicules from tubefeet (c). a. × 6; b. × 20; c. × 210.

of the adambulacrals there are some small spinelets forming a continuation of the ventro-lateral fascioles. The jaws are large and thick, with numerous, not distinctly serially arranged spines on the outer surface. There are rather deep fasciolar channels between the jaws and the first adambulacral plates. None of the specimens are well enough preserved for showing clearly the number and character of the marginal spines of the jaws.

The colour of the live specimens was a uniform red. The gonads are serially arranged in the arms, continuing almost to the end. The tubefeet contain spicules as in *Tethyaster* and *Anthosticte* (Fig. 6. c.). The papulæ are distributed (singly) all over disk and arms. Although my specimens are dried it is clearly seen that the papulæ are somewhat branched or perhaps rather papillate.

The specimen represented in Pl. XXI. 2, the one collected by Kinberg (sent me from the Stockholm Museum, after this report

was ready), is interesting in showing the spines of the ventro-lateral plates much less developed than in the adult specimens, more like what obtains in the specimen figured by Koehler in his "Scotia" report (Op. cit. 1908).

A very young specimen (R. = 4 mm), taken together with the three large specimens, evidently is the young of this species, as appears from the fact that a second series of ventro-lateral plates has begun to develop; thus it cannot be referred to any other of the known Asteroids of St. Helena.

W. K. Fisher in his Report on the Asteroidea of the "Albatross" Philippine Expedition (Bull. U. S. Nat. Mus. 100. 3, 1930, p. 143) emphasizes the near relation that exists between the genera *Moiraster*, *Tethyaster*, *Sideriaster* and *Anthosticte*, the ascertaining of which characters are of generic importance being made the more difficult since only one species is known of each of the four genera (— a second species of *Anthosticte*, *A. Pacei* Mrtsn., was described in my paper "On some Echinoderms of S. Africa. Ann. Mag. Nat. Hist. 9 Ser. XVI. 1925, p. 147), and two of them, *Sideriaster* and *Moiraster* only incompletely known.

The knowledge now acquired of the characters of *Moiraster* makes it clear that the four genera are even much more closely related than Fisher thought them to be, so closely, indeed, that it seems scarcely possible to maintain all the four genera. *Tethyaster* is well characterised by its midradial row of enlarged paxillæ, the shallow marginal fascioles and the low paxillæ, so it may justly be maintained as a separate genus. (Fisher's statement, loc. cit., that its gonads do not extend to the end of the rays is a curious mistake, in flat contradiction to the careful description given by Ludwig in his "Seesterne d. Mittelmeeres"). As for *Anthosticte* it is seen now that the only character by which it differs from *Moiraster* is the absence of enlarged spines on the ventro-lateral plates. In regard to fascioles between the adambulacral plates there seems to be a very gradual passage from *Anthosticte* to *Moiraster* and *Sideriaster*. The latter, which is still imperfectly known, would likewise seem to differ from *Moiraster* only in lacking enlarged spines on the ventro-lateral plates. It is, of course, a matter of taste, hether this character, the presence or absence of enlarged spines on the ventro-lateral plates, affords sufficient reason for generic distinction. But it would appear that this is all the difference there is. Since

Moiraster is the oldest name of the three the question of the value of the three said genera does not concern the naming of the present species.

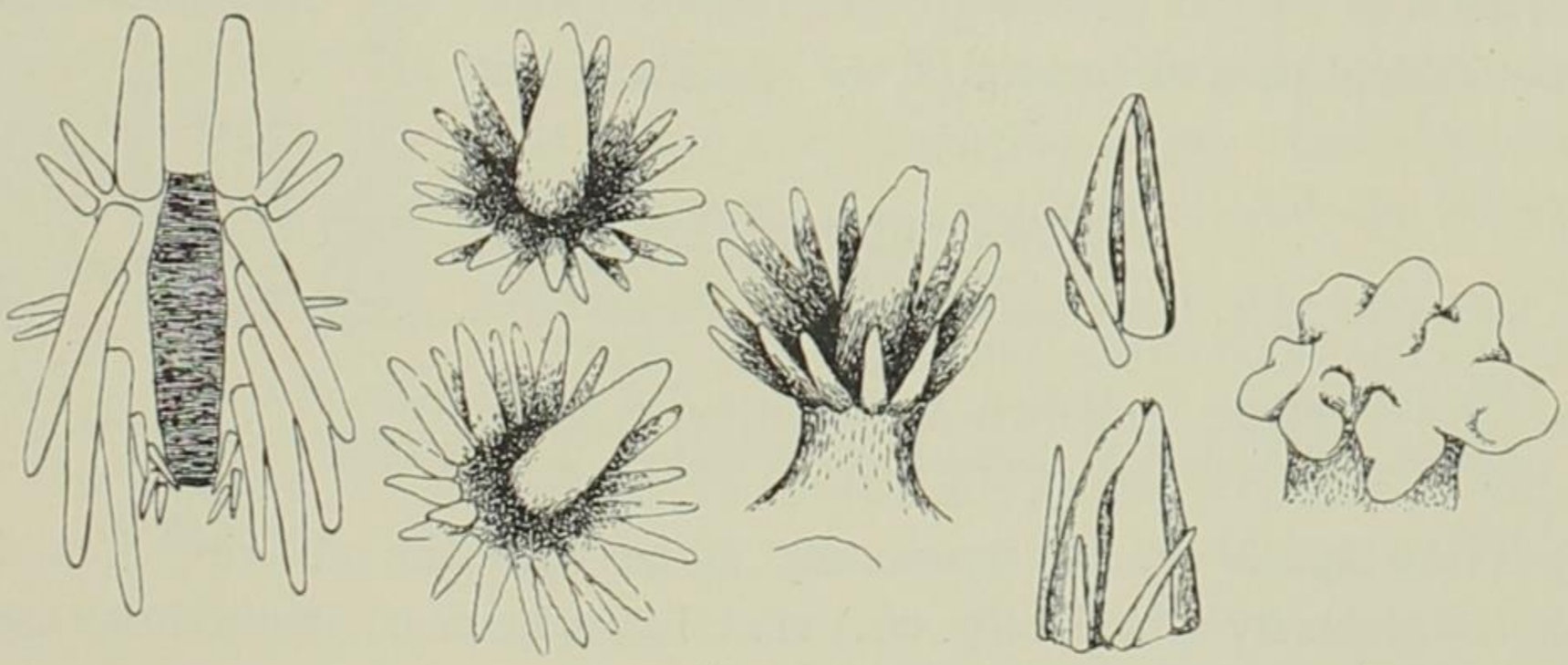
Luidia aciculata n. sp.

Pl. XX. Figs. 7—12.

Off Egg Isl., St. Helena, ca. 40 meters. 1 specimen.
Off Jamestown, ca. 50 meters. 1 specimen.
Off Lemon Valley, ca. 50 meters. Arm fragments.
Prosperous Bay, ca. 50 meters. 1 arm fragment.

5 Arms. Longest arm fragment ca. 130 mm. Arms slender, the largest piece 12 mm broad. Paxillæ all with a distinctly enlarged, pointed median spine (Fig. 7. b.), but it is still rather slender, nothing comparable to the thick spines found e. g. in *L. numidica* Koehler and in so many other *Luidia* species. Generally there is only one central spine, only on the supero-marginals there may be 2—4 such larger central spines.

The paxillæ of the lateral parts are arranged in distinct transverse series of 3 each, and very well spaced, the papular spaces (in dried specimens) being seen very distinctly between them. There are two transverse series corresponding to each supero-marginal. Along the midline paxillæ are much smaller and without any regular arrangement, but still so much spaced as to show clearly the papulæ, which are here much smaller than in the lateral parts of arm. On the disk the paxillæ stand quite close, the papulæ being indistinguishable. The madreporite is covered by a large paxilla. No pedicellariæ on the dorsal



a. b. c. d.

Fig. 7. *Luidia aciculata* n. sp. a. Jaw; b. paxillæ; c. pedicellariæ, from the 1. ventro-lateral plate (below), and from one of the ventro-lateral plates on the middle of the arm (above); d. papula. a. × 8; b—c. × 20; d. × 33.

paxillæ. The papulæ (Fig. 7. d.) are of the usual shape, low, lobed bushes.

Infero-marginals with 3, in the proximal part some of them with 4 large, erect, cylindrical, pointed spines, the uppermost the longest; the sides are densely covered with slender spinelets, forming a distinct, fairly deep fasciole; some few scattered similar, erect spinelets on the surface of the plates. No pedicellariæ are found on the infero-marginals. A single series of small ventro-lateral plates, continuing to the end of the arms, each carrying a bundle of 3—5 diverging, slender spinelets. The first unpaired ventro-lateral plate may carry a large, three-pronged pedicellaria (Fig. 7. c.); also on some of those farther out on the arm there may be a similar, but somewhat more slender pedicellaria. Adambulacrals with the usual three strong spines, the inner one sabre-shaped; also a single slender spinelet is found on some of the plates, but no pedicellariæ. The jaws (Fig. 7. a.) have four or five long, cylindrical spines to each side of the median suture (the first one at the apex of jaw) and 3—4 much smaller spines at the distal end. Near the proximal end are two moderately sized lateral spines, placed close together, sometimes joining like a pedicellaria, and at the distal end there are two slender spinelets close together, not forming a pedicellaria.

The colour is a uniform light brownish-gray. The large infero-marginal spines are brown at the base.

This species is quite distinct from any other Atlantic or West-Indian species, as also from the S. African *Luidia africana*. It must be referred to the *ciliaris*-group of Döderlein, but does not seem very closely related to any of the species of that group.

Hacelia superba H. L. Clark.

H. L. Clark. 1921. Echinoderm Fauna of Torres Strait, p. 87. Pl. 32.

Off Jamestown, St. Helena, ca. 40 meters. 6 specimens.
Off Lemon Valley, St. Helena, ca. 50 meters. 2 specimens.

These specimens so completely agree with the description and figures given by Clark (Op. cit.) that I can have no doubt but that they are really identical.

I have very little to add to Clark's description. The largest of the specimens in hand has R. = 100 mm, thus being somewhat larger

than the type. The colour of the live specimens was a light yellow, the papular areas dark orange.

An interesting feature is the existence of a dense ring of calcareous plates in the edge of the sucking disk of the tubefeet, seen as distinct whitish rings in the dried specimens. This was also observed by Ludwig in *Hacelia attenuata* (Ast. d. Mittelmeeres, p. 299) and may well be a character of generic value. Also in the tubefeet proper there are spicules, irregular rods, arranged mainly transversally (Fig. 8).

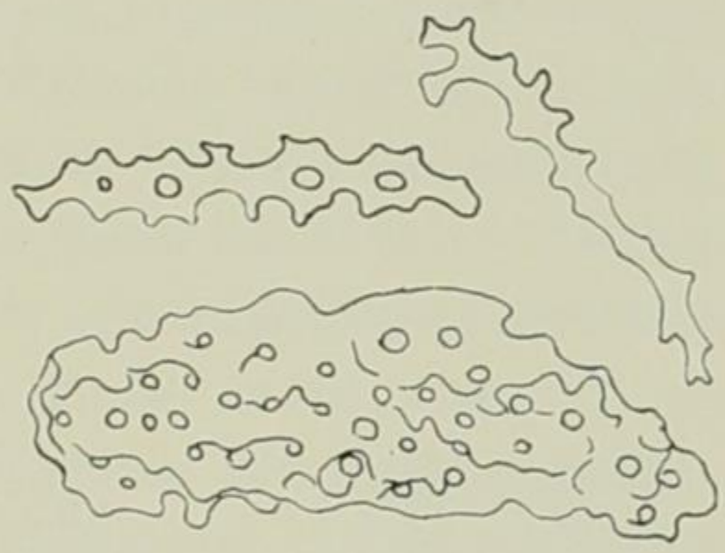


Fig. 8. Spicules from tubefoot of *Hacelia superba* H. L. Clark. × 235.

Clark states the terminal plate to be naked. In some of the specimens in hand it is provided with ca. 3—5 coarse warts, in others it is naked, but it has then much the appearance of the warts having been worn off. May not this be the case with the type specimen?

Here and there a single one of the dorsal plates at the end of arm may show a small naked spot. This is of interest in respect to the variety *africana* that I described in my paper "On some Echinoderms from S. Africa" (Ann. Mag. Nat. Hist. 9. Ser. XVI. 1925, p. 152), in which a number of the dorsal plates show such a naked space. Since in the present specimens there is only a single such naked plate, whereas in the S. African specimen up to 10 plates are thus naked, we have here a confirmation of my view that the S. African form is not identical with the West-Indian-St. Helena form.

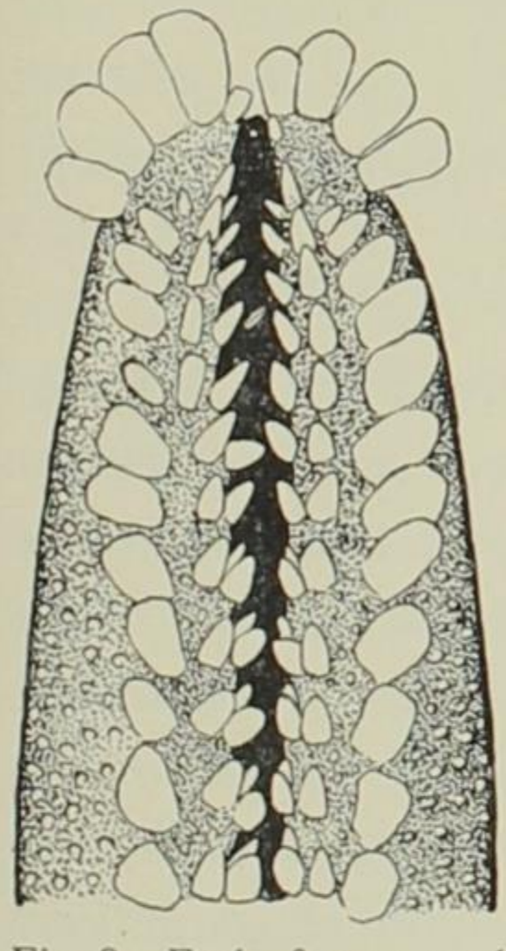


Fig. 9. End of arm, oral side, of young specimen of *Hacelia superba* H. L. Clark. × 23.

There is a single very small specimen (R. = 4 mm) from off Jamestown, which I cannot hesitate in identifying as the young of *Hacelia superba*. It offers some features of considerable interest (Fig. 9). At the point of the arm there are 4(3) large, broad, flat spines, forming like a fan; they are attached to the lower edge of the terminal plate and, no doubt, correspond to the warts found here in the adult. But then the specimen apparently differs very markedly

from the other Linckiids found off St. Helena in having a series of spines between the furrow spines and the usual outer series of spines; and this series is the first to appear, as seen clearly at the distal end of the ambulacral furrow in the figure. This series of spines is not found in any of the Linckiids of St. Helena in the adult stage. However, if we look at the distal end of the arms in *Hacelia superba*, we find there such a median series of spines between the furrow spines and the outer series — and this median series is even the most strongly developed of them. In *Ophidiaster* nothing of the kind is seen, and not in *Linckia* or *Narcissia* either, which also for other reasons cannot come into consideration in the parentage of this young specimen. There can thus be no doubt that we have here really a young stage of *Hacelia superba*. The plates are all completely covered with granules; the papulæ are single, one in each papular space.

Ophidiaster ophidianus (Lamk.).

Müller & Troschel. 1842. System d. Asteriden, p. 28.
Perrier. 1875. Revis. Stellérides Mus. Paris, p. 120.
Ludwig. 1897. Seesterne d. Mittelmeeres, p. 300. Taf. 3. 4—5; 8. 18—30.
H. L. Clark. 1921. Echinod. Fauna of Torres Strait, p. 79.
Koehler. 1921. Faune de France, Echinod., p. 38.
— 1924. Echinod. des Mers d'Europe. I. p. 163. Pl. VI. 7.

Off Jamestown, St. Helena, on rock-coast. II. 1930. 15 specimens.

This magnificent sea-star, mentioned already by Melliss, under the name of *Echinaster* sp. (cf. above p. 407), was not rarely seen on the rocks at Jamestown, sometimes just at the low water line, sometimes on the rock bottom off the pier, where it was taken by divers. Some specimens were uniformly red, others a mottled red and white or purple. The largest specimens have R. = ca. 100 mm.

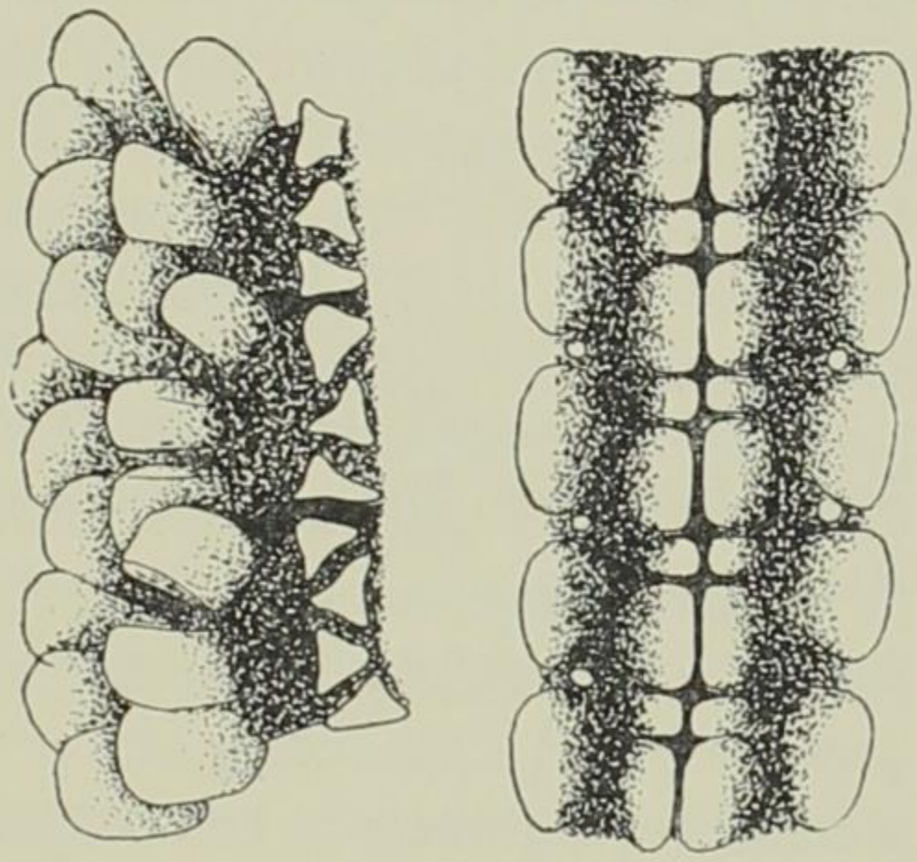
Without entering upon the question of the specific value of *Ophidiaster guildingii*, I would only emphasize that I have found, both here at St. Helena and at the Canaries, specimens of uniform red colour and such as were mottled with white or purple living together in the same locality, such specimens not being distinguishable by any other characters, so that no doubt can obtain as to their being all the same species, *Oph. ophidianus*. Thus, evidently, the mottled coloration is not a valid character by which to distinguish *Oph. guildingii* from *ophidianus*, as stated by Clark (Op. cit. 1921, p. 79).

Narcissia trigonaria, var. *Helenæ* n. var.

Pl. XX. Figs. 4—6.

Off Jamestown, ca. 40 meters. 26. I. 1930. 10 specimens.
Off Egg Island, ca. 40 meters. 6. III. 1930. 6 specimens.

These specimens bear so close a resemblance to *Narcissia trigonaria* Sladen, as described in the "Challenger" Asteroidea, p. 414, Pl. LXV. 5—8, that it is tempting to regard them as identical therewith; as *N. trigonaria* was taken off Bahia (depth unknown) there would be no zoogeographical objections to regarding the St. Helena specimens as identical with the Brazilian type. There are, however, some minor differences which make it preferable, at least for the present, to distinguish the St. Helena form as a separate variety, if not a separate species.



a. b.

Fig. 10. Three adambulacral plates of *Narcissia trigonaria* var. *Helenæ* n. var. (a); ambulacral furrow and five pairs of adambulacral plates of *Linckia formosa* n. sp. (b). × 12.

The arms of the typical form are stated to be "distinctly triangular in section, with a strongly marked median keel, in which there is a conspicuous break at the base of the ray, separating the keel of the ray from the elevated part of the disk". In the St. Helena specimens the arms are more rounded above, not distinctly triangular in section, and the passage from the arms to the disk is usually very gradual, without any distinct break. The median series of plates in the basal part of the arms is usually less conspicuous than those of the type and without tendency to becoming tubercular. The marginal plates can scarcely be said to be slightly convex, as they are stated to be in the type, and finally there would appear to be some difference in the adambulacral armature, there being only three spines in the median series on the outer surface of the adambulacral (Fig. 10. a.), whereas the type is stated to have 4 spines in this series (as also shown in Pl. LXV. Fig. 7); the furrow spines may be 3 or 4, and those of the outermost series 3 or 4, rarely 5, essentially as in the type.

If these differences prove constant, the St. Helena form rather represents a separate species; but as the type is known only from the single specimen taken by the "Challenger", we can have no idea, whether these differences are really constant, and it seems to me, therefore, the safest course for the present to regard the St. Helena form as a variety only of *N. trigonaria*, to which it is at any rate much more closely related than to *Narcissia canariensis*.

The ground-colour of the live specimens was orange or a reddish-orange, the plates on the dorsal side standing out whitish (or cream-yellow) against the ground-colour, producing a mottled aspect. The oral side is more whitish. Colour in life of the type species unknown.

The largest specimens have R. = 60 mm.

Linckia formosa n. sp.

Pl. XXII. Figs. 2—4.

Off Jamestown, St. Helena; ca. 50 meters. 15 specimens.
Off Egg Island, St. Helena; ca. 40 meters. 6 specimens.

Largest specimens R. = ca. 60 mm, r. = ca. 8 mm. Arms very slender, very slightly attenuating. Disk with a circle of 5—6 large primary plates surrounding one or more central plates. The original condition would seem to be one central and 5 radial plates, but there is much irregularity prevailing in the development of the disk plates; there may be several smaller plates in the central part, and the radial plates may be broken up into a number of smaller plates, hardly one of the original radials remaining intact. Along the median line of the arms there are several large plates, usually irregularly arranged, but sometimes arranged in fairly regular series, mainly in the proximal part of the arms; they are slightly elevated, but not tuberculate. Marginal plates small, but distinct, ca. 45 to each side of arm in the larger specimens. The dorsal side of arm rounded, the ventral side somewhat flattened. Papulæ few, usually 3—5 in each papular area. Ventrolateral plates only very indistinctly observable, on account of the dense granulation, but apparently there is only one series, continuing to about the middle of the arm. Adambulacral armature consisting of two furrow spines, the proximal one small, the distal one much larger, flattened. On the outer surface there is one slightly larger spine of the same shape as the distal furrow spine, and sometimes a very small spinelet, or granule alternating with the large spines (Fig. 10. b.). The

narrow space between the series of the furrow spines and the outer spines is entirely naked. The jaws are very small, their armature simply a continuation of the adambulacral armature. No pedicellariæ. The granules have the shape of low, somewhat pointed cones. In the distal part of arms sometimes one of the central granules of the marginal — mainly the inframarginal — plates may be enlarged so as to form a small, inconspicuous spine. Colour in life: the plates of the dorsal side a cream-yellow, the spaces between them reddish-orange.

It is clear that this species is nearly related to *Linckia Bouvieri* Perrier, but it differs strikingly from that species particularly in its colour, *L. Bouvieri* being a uniform bluish-violet. Also the arms are more slender and attenuate in the St. Helena species, the dorsal plates of the arms larger, more convex, and the number of papulæ distinctly smaller (3—5 in *L. formosa*, ca. 10 in *L. Bouvieri*). Not having any specimen of *L. Bouvieri* I sent a specimen of my St. Helena species to my friend, Prof. H. L. Clark, asking him to compare it with *L. Bouvieri*. He kindly informed me that the comparison fully justified my view of the St. Helena form representing a distinct species evidently related to *L. Bouvieri*, but differing from it in characters pointed out above.

No doubt it is this species which Koehler has recorded from St. Helena under the name of *Linckia Bouvieri* ("Scotia" Echinoderms, p. 296); as it was no doubt preserved in alcohol and thus had lost its characteristic coloration it would very naturally be regarded as a *Linckia Bouvieri*, the other distinguishing characters being little conspicuous.

Chætaster longipes (Retzius).

Asterias longipes Retzius. 1805. Diss. sistens spec. cogn. Asteriarum, p. 20.
Chætaster subulatus Müller & Troschel. 1842. Syst. d. Ast. p. 27.
— *longipes* Müller & Troschel. 1842. Syst. d. Ast. p. 127.
— — Perrier. 1875. Revis. Stellérides du Muséum, Paris. p. 329.
— — Ludwig. 1897. Seesterne d. Mittelmeeres, p. 134. Taf. I. 3—4; IX. 15—31.
— — Koehler. 1908. "Scotia" Echinod., p. 296.
— — Koehler. 1909. Res. Camp. Sci. Monaco. XXXIV. p. 88.

Off Jamestown, St. Helena, ca. 50 meters. II. 1930. 10 specimens.

The finding of this N. African-Mediterranean species as far South as St. Helena is of very considerable zoogeographical interest

— though not so very surprising, as it was taken by the "Scotia" at Ascension (Koehler, Op. cit. 1908.)

It is important that the statement of its occurrence also at Bermudas is erroneous, as shown by H. L. Clark in his paper on "The Echinoderms of the Challenger Bank, Bermuda". (Proc. Amer. Acad. Arts & Sci. LVII. 1922, p. 254), the specimen from there being *Chætaster nodosus* Perrier.

I may recall here that it has recently been found as far North as the S. Coast of Brittany (cf. R. Legendre. Deux Echinodermes nouveaux pour la Faune du Sud de la Bretagne. C. R. Sommaire d. Sciences. Soc. de Biogéographie. IX. No. 77. 1932.) This latter locality gives the northern, St. Helena the southern limit of this species, so eminently characteristic of the Eastern Atlantic.

The live specimens were of a uniform lemon-colour.

Asterina (*Patiriella*) *exigua* (Lamk.).

Th. Mortensen. 1933. Echinoderms of S. Africa. Asteroidea and Ophiuroidea. p. 252. Pl. XII. figs. 4—8.
For literary references see that paper.

This species was first recorded from St. Helena by Melliss (Op. cit. p. 219) under the name of *Asterina minuta*?

Numerous specimens collected in rock pools off Jamestown I. 1930; also 1 specimen taken in a rock pool at Prosperous Bay (17. II.1930) and a few specimens in Lot's Wife's Pond (2. III. 30).

These specimens are perfectly conform with those from S. Africa, and the species evidently must have been transported from there to St. Helena, most probably on the roots of the large algæ (*Eclonia*), which are also nowadays found driven ashore on St. Helena, whereas they do not grow there. Evidently the water is too warm for the alga, but, on the other hand, the *Asterina*, which occurs all over the tropical Indo-Pacific, will find the temperature very suitable. — It is a fact of great zoogeographical interest that we find thus this Indo-Pacific-South-African *Asterina* at St. Helena, but none of the Atlantic or West Indian species of the genus.

In the rock pools, where they were found, I noticed some bare, star-shaped spots on the rock surface, suggesting that they were spots that had been sucked clean by the sea-star. I was, however, unable to find anything like it directly under the sea-stars themselves, so it remains questionable whether the said suggestion be right.

Coscinasterias tenuispina (Lamk.).

Asteracanthion tenuispinus Müller & Troschel. 1842. Syst. d. Ast. p. 16.
— — Lütken. 1859. Bidrag til Kundskab om de ved Kysterne af Mellem- og Syd-Amerika levende Arter af Søstjerner. Vid. Medd. 1859. p. 71.
Asterias tenuispina Perrier. 1875. Revis. Stellérides Mus. Paris. p. 42.
— — Ludwig. 1897. Seesterne d. Mittelmeeres, p. 344. Taf. III. 8; XI. 18—19.
Coscinasterias tenuispina Koehler. 1921. Faune de France, Echinodermes, p. 26.
— — Koehler. 1924. Echinod. des Mers d'Europe. I. p. 103. Pl. I. 13.
Stolasterias — H. L. Clark. 1933. Handbook Littoral Ech. Porto Rico. p. 30.

Several specimens found on the rocks off Jamestown, St. Helena; also some specimens on the rocks at Prosperous Bay. One small specimen was taken by dredge in ca. 40 meters off Sugarloaf, 27. II. 1930.

The largest specimen, with 8 fully developed arms, has R. = ca. 60 mm. The St. Helena specimens are quite typical *tenuispina*, in every respect completely resembling specimens, which I collected in March 1930 at Las Palmas, Canary Islands.

The splitting up of the genus *Coscinasterias* into two subgenera — or genera — *Coscinasterias* s. str. and *Stolasterias* — seems to me rather unnecessary, at least I think it preferable here to keep the more familiar name *Coscinasterias* for this characteristic, mainly East-Atlantic species. Its occurrence in the West Indies needs confirmation; its occurrence at Bermudas (already recorded by Lütken in 1859 Op. cit.) may be due to accidental introduction from Europe, as suggested by Clark (Op. cit. 1933). After the species has now been found at St. Helena, its occurrence at the Cape Verdes and Brazil becomes only quite natural.

II. Ophiuroidea.

Ophioscolex dentatus Lyman.

Ophioscolex dentatus Lyman. 1882. "Challenger" Oph. p. 233. Pl. XXIV. 4—6.
— — H. L. Clark. 1923. Echinod. Fauna S. Africa, p. 314.

2 miles S. 49 E. of Long Range Point, St. Helena. 280—450 m. 24. II. 1930. 4 specimens, dredged onboard the "Dana".

The only reason for referring these specimens to *O. dentatus* rather than to *O. purpureus* Düb. Kor. lies in the fact that the latter till

now has not been recorded from farther South than the Bay of Biscay ("Talisman"). On the other hand, *O. dentatus* is otherwise known only from the S. African seas.

As I have explained in my report on the S. African Echinoderms, I do not think it really possible to keep *O. dentatus* distinct from *O. purpureus*, so it does not matter much whether we call these specimens from St. Helena *dentatus* or *purpureus*. The fact that they have all of them a few spines on the disk might rather point to the northern form, *purpureus*, in which spines are usually found on the disk, whereas in the S. African form, *dentatus*, such spines are only rarely found. — If by future researches it is found that *O. purpureus* occurs also in the region between the Bay of Biscay and St. Helena — as I expect it will, in accordance with the fact that so many other Echinoderms from the Mediterranean—East-Atlantic region do extend as far South as St. Helena, I should not hesitate in identifying the St. Helena *Ophioscolex* with the northern *O. purpureus* instead of with the S. African *dentatus*.

One of the specimens has only 4 arms.

Ophiacantha prolata n. sp.

2 miles E. of Bay Point, St. Helena; 480 m, bottom with old Lophohelias. 24. II. 1930. 10 specimens, dredged onboard the "Dana".

Diameter of disk of largest specimens 7 mm; arms ca. 4 times the diameter of the disk. Mouth papillæ 3 to each side of jaw, the outer one not widened. Mouth shields distinctly broader than long, with a rounded distal lobe, the lateral corners very sharp, usually slightly upwards curved. Usually they are somewhat depressed in the middle. Adoral plates joining broadly within; they have no outer lobe, the first lateral plate and the buccal shield being directly contiguous. First ventral arm-plate small, polygonal; the following ventral plates twice as broad as long, widely separated; the distal edge straight or very slightly concave. One small tentacle scale. Dorsal arm-plates triangular, with distal edge convex; inner angle somewhat rounded, lateral corners rather sharp. They are separated, but not widely. Arm-spines 8—9 on the basal joints, increasing in length upwards, the uppermost being as long as two joints; they may almost join in the dorsal midline on the first joint. They are very slender, rather

distinctly thorny, seen with some magnification. In the distal part of the arm the lowermost spine becomes rather strongly serrate along the adoral side (Fig. 11. c.). The arms are distinctly moniliform in the distal part. The disk is flat, without distinct radial ribs; it is wholly covered — also on the ventral side — by a very uniform coat of small low stumps, which are seen under a high magnification to terminate in usually three short thorns (Fig. 11. d.). — Colour (dry) a uniform light brownish.

At a first sight this species recalls *Ophiacantha abyssicola*, with which it agrees also in the shape of the ventral arm-plates; but it

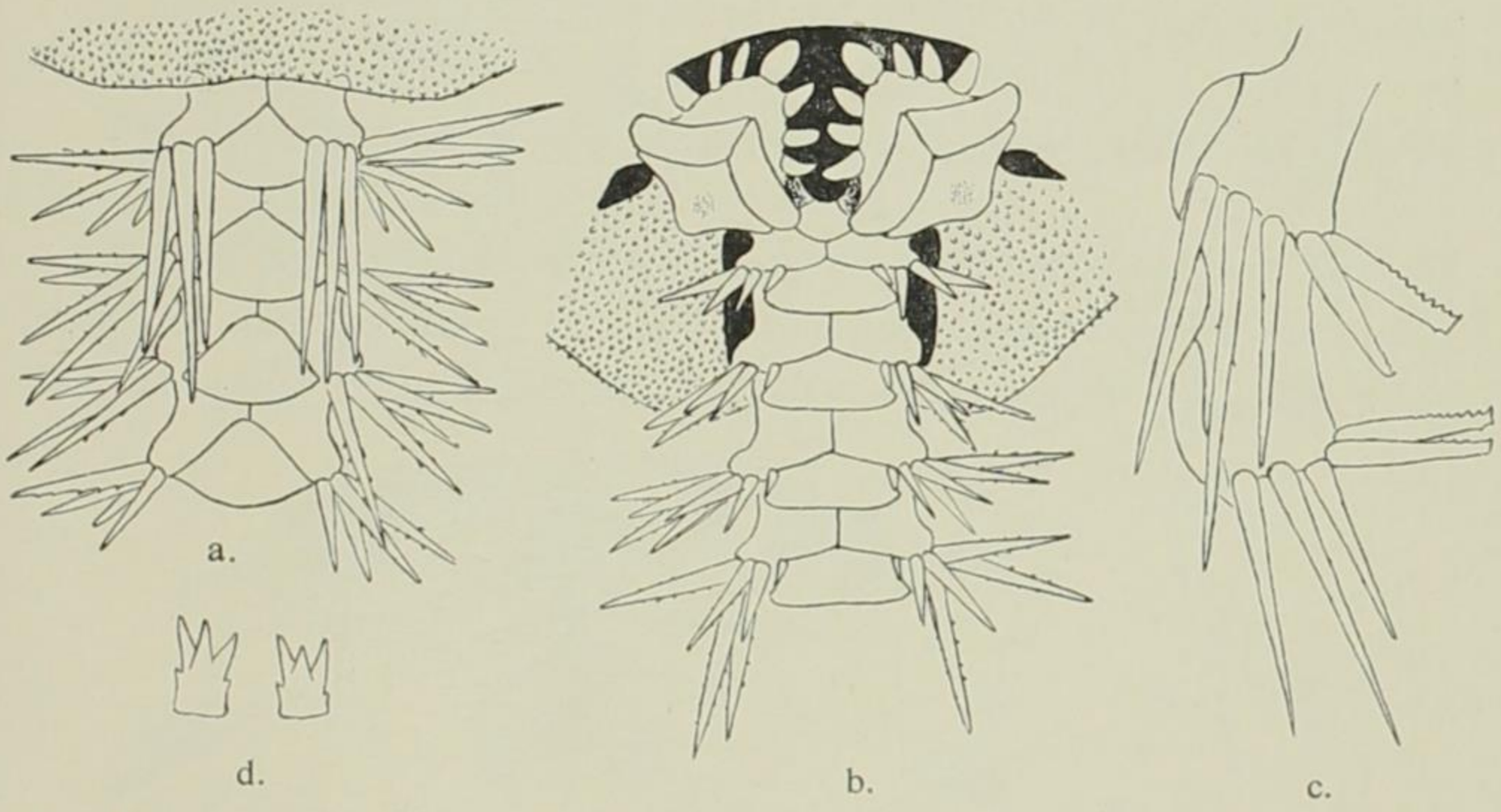


Fig. 11. *Ophiacantha prolata* n. sp. Part of dorsal (a) and oral side (b); two armjoints from distal part of arm, side view (c); stumps from the disk (d). a—b. × 9; c. × 22; d. × 90.

differs markedly from that species in the shape of the dorsal arm-plates, the buccal shields etc., so that an identity is absolutely excluded. Other species to which it bears some resemblance are: *Ophiacantha aculeata* Verr. and *Ophiacantha* (*Ophiomitrella*) *levis* Koehler; but, again, it differs from these species in several particulars, especially the characters of the stumps and the arm-spines, so that an identity is out of the question. It therefore seems beyond doubt that these St. Helena specimens represent a distinct, hitherto unknown species.

Ophiacantha nitens n. sp.

2 miles E. of Bay Point, St. Helena; 480 meters. Bottom with old Lophohelias. 24. II. 1930. 1 specimen, dredged onboard the "Dana".

Diameter of disk 2 mm; arms broken, probably ca. 4—5 times the diameter of the disk. Mouth papillæ small, 6 to each side of jaw. Buccal shields somewhat broader than long, with a small, rounded outer lobe and an obtuse angle within; lateral corners much rounded. Adoral plates narrow, joining proximally, with an outer lobe separating first lateral plate from buccal shield. First ventral arm plate rather large, oblong; the following all widely separated, the second broader than long, with outer edge convex, then gradually longer than broad. A

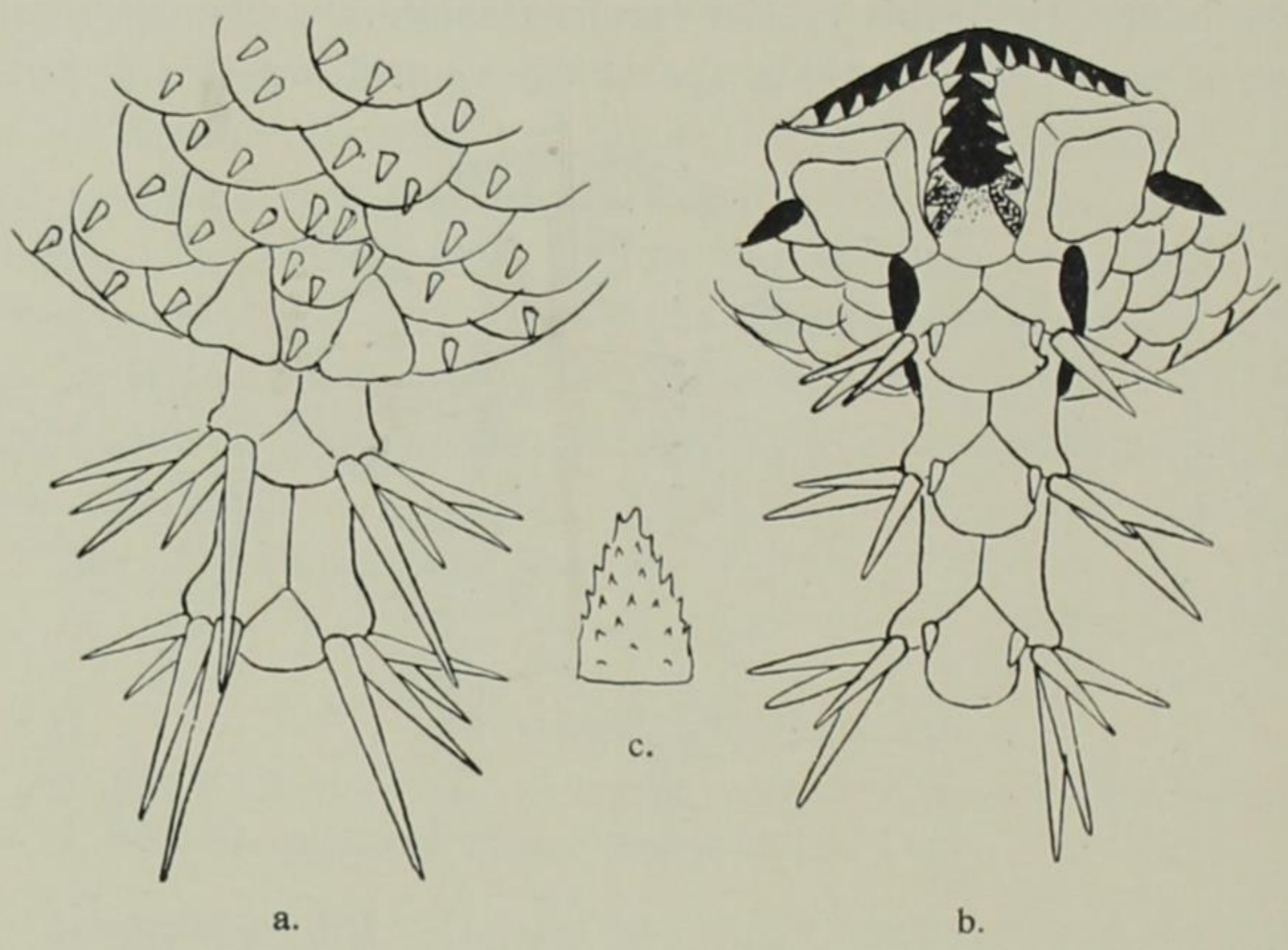


Fig. 12. *Ophiacantha nitens* n. sp. Dorsal (a) and oral side (b). Stump from the disk (c). a—b. × 30; c. × 125.

single, small tentacle scale. Dorsal arm plates small, triangular, with convex distal edge, widely separated. Arm spines four, simple, smooth, pointed, increasing in length from the lowermost to the uppermost, which latter is, in the proximal part of the arm, somewhat longer than an arm joint. The joints are not much swollen at their distal end, the arms not being distinctly moniliform. The disk is covered by large, somewhat shining scales with a metallic lustre. Each plate carries one or 2—3 short, but rather robust stumps, which — as seen by high magnification (Fig. 12. c.) — are finely rough. Radial shields small, but distinct, triangular, not joining distally. Scales of ventral interradii naked.

This species is related to *Oph. spinosella* Mrtsn., described in my

report on the "Ingolf" Oph. (p. 29). These two species, together with *Ophiacantha macrarthra* H. L. Clark (North Pacific Oph. p. 236, Fig. 112), would seem to form a special group within the vast genus *Ophiacantha*. Among themselves they differ very strikingly (which need not be specified here), so there can be no doubt of their specific validity. Each of these species is known from only a single specimen, of the same small size, 2 mm diameter of disk. This may perhaps indicate that, in spite of their small size, they are really adult.

Ophiacantha trivialis n. sp.

2 miles E. of Bay Point, St. Helena, 480 m. Bottom with old Lophohelias. 24. II. 1930. 1 specimen, dredged onboard the "Dana".

Diameter of disk 4 mm; arms broken, but apparently ca. 4 times the diameter of the disk.

Mouth papillæ three to each side of jaw, the outermost one not enlarged. Buccal shield distinctly broader than long, with a rather inconspicuous outer lobe. Adoral shields very broad, with an outer

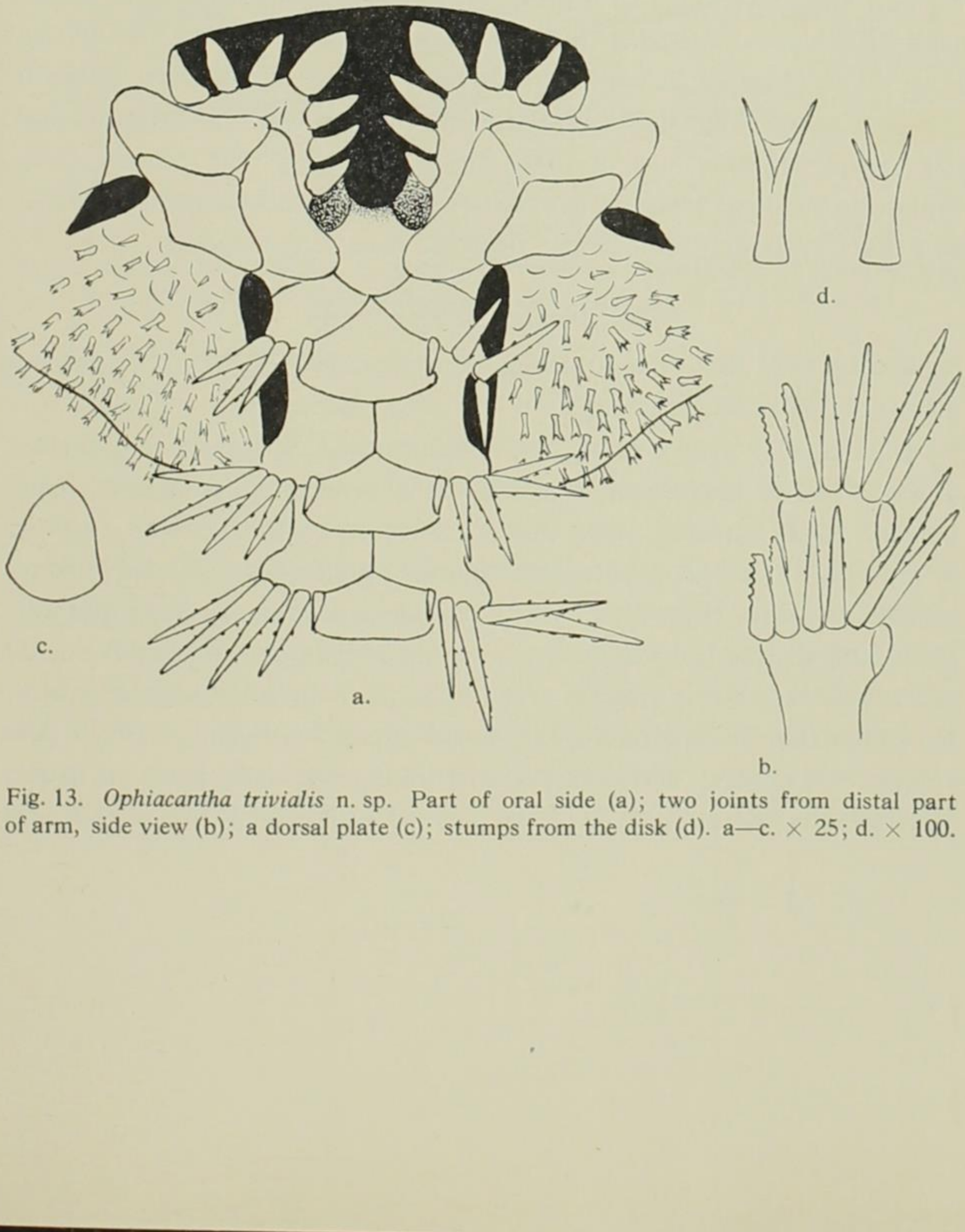


Fig. 13. *Ophiacantha trivialis* n. sp. Part of oral side (a); two joints from distal part of arm, side view (b); a dorsal plate (c); stumps from the disk (d). a—c. × 25; d. × 100.

lobe separating the first lateral arm plate from the buccal shield, this lobe being, however, apparently separated from the main part of the plate, because it lies at a somewhat lower level. First ventral plate large, longer than broad; the second barely in contact with the first, the following ones widely separated from each other, distinctly broader than long, with the distal border slightly concave. Dorsal arm plates somewhat cup-shaped (Fig. 13. c.), widely separated from each other. Arm spines 6—7 on the proximal joints, nearly joining in the dorsal midline. They increase in length upwards, the uppermost ones being about the length of two joints; they are slender, finely serrate. Farther out on the arm the lowermost spine, partly also the second from below, become conspicuously serrate on the under side (Fig. 13. b.). The arms are rather distinctly moniliform. The disk is covered by a close coat of stumps terminating in three, more rarely two, diverging thorns (Fig. 13. d.). Radial ribs not distinct. On the ventral interradii the stumps are less close set, and in the main terminating in two thorns, or even simply pointed. Colour (of dried specimen) white.

This species belongs to a group of species: *pentacrinus* Ltk. *pentagona* Koehler, *composita* Koehler, *angolensis* Koehler, *adiaphora* H. L. Clark, *baccata* Mrtsn., *vilis* Mrtsn., etc. — all of very uniform appearance, distinguished by characters of small general interest, and the varied combinations of these characters. That the present form cannot be identical with any previously described species seems evident, so I must, although reluctantly, describe it as a new species.

Ophiacantha Helenæ n. sp.

8 miles W. t. N. of the Sugarloaf, St. Helena, 2400—2780 m. 1 specimen, dredged onboard the "Dana", 23. II. 1930.

Diameter of disk 4 mm; length of arms ca. 3 times the diameter of disk, not to be measured exactly, the arms being too much convoluted. Disk covered, not very closely, by rather coarse stumps, terminating in a crown of some 6 thorns which may again have some smaller branches (Fig. 14. c., d.). The disk scales are rather large and seen fairly distinctly through the covering of stumps. The radial shields are small, but fairly distinct, separated by a broad wedge of scales. No radial ribs, the disk being, it would appear, uniformly convex (the specimen is slightly distorted). The stumps continue a little on to the ventral side, the main part of the ventral interradii being naked.

Mouth papillæ three to each side of jaw, slender and pointed, the outer one slightly enlarged. The infradental papilla conspicuously larger, elongate. Adoral shields very broad, with a broad outer lobe separating the buccal shield from the first lateral plate. Buccal shields more than twice as broad as long, with a very obtuse inner angle and the outer edge straight or with a very indistinct median lobe.

First ventral plate about equally long and broad, hexagonal; the following ventral plates very broad, occupying the whole width of the

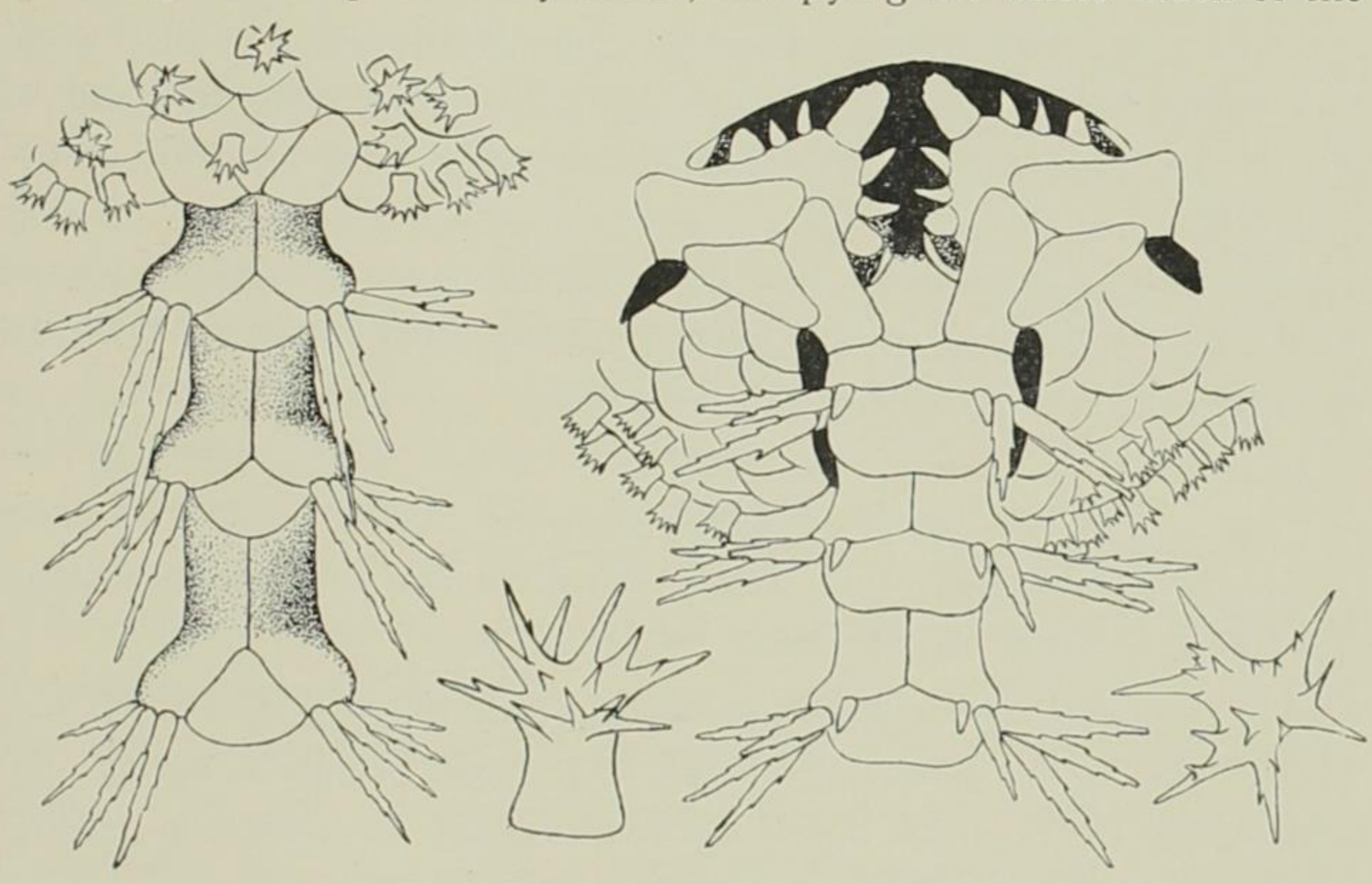


Fig. 14. *Ophiacantha Helenæ* n. sp. Part of dorsal (a) and ventral side (b). Stumps from the disk in side view (c) and seen from above (d). a—b. × 18; c—d. × 75.

arm; the inner angle is very obtuse, the two inner sides forming almost a straight line; the outer edge has a slight median concavity. The ventral plates all widely separated. Dorsal arm plates of the two basal joints triangular, with a well marked inner angle and the outer edge convex; from the third joint the inner angle becomes more obtuse. 5 spines on the basal joints, conspicuously serrate, the upper one the longest, about the length of an arm joint. One small, slender tentacle scale. Arms distinctly moniliform. Colour a simple light straw colour.

This species is related to *Ophiacantha aristata* Koehler, and perhaps still more so to *O.* (*Ophiomitrella*) *levis* (Koehler), which latter has the same characteristic shape of the ventral and dorsal arm plates (cf. Koehler. A contribution to the study of the Ophiurans of the

U. S. National Museum. Bull. U. S. Nat. Mus. 84. 1914. Pl. 10. 1—2). It differs, however, in the shape of the buccal and adoral plates, as also in having 9 arm spines. *O. aristata* differs from the present species in the shape of both the buccal and adoral plates as well as of the ventral and dorsal arm plates, besides in having 8 arm spines. The identity of the present species with any of the said species is thus out of the question. Another related species would seem to be *Ophiacantha cornuta* Lyman, from off the Kermadec Islands (Chall. Oph. Pl. XV. 3—5), which differs, however, both in the shape of the buccal and adoral plates and in having 8 arm spines, the lowermost one of which is curved and thickened, (this character is not shown in the figures!).

Evidently this species does not, strictly speaking, belong to the fauna of St. Helena. It will most probably be found to be widely distributed over the S. Atlantic deep-sea.

Ophiotreta sp.

2 miles E. of Bay Point, St. Helena, 480 m. Bottom with old Lophohelias. 24. II. 1930. 1 specimen, diameter of disk 4 mm.

As the *Ophiotreta* species are generally of fairly large size, it can scarcely be doubted that the present specimen is only a young one, and I deem it, therefore, better not to describe it (it cannot be referred with certainty to any of the known species).

Ophiothrix roseo-coerulans Grube.

Pl. XXII. Figs. 5—7.

Ophiothrix roseo-coerulans Grube. 1868. Über einige seltenere oder neue Ophiuriden. Jahresber. d. Schles. Ges. f. Vaterländ. Cultur. 45. p. 45[1]).

— — Koehler. 1904. Ophiures nouv. ou peu connues. Mém. Soc. Zool. France. 1904. p. 97.

Numerous specimens of this species — besides *Ophiactis Lymani* and *Amphiura atlantica* the only Ophiuroid at all common at St. Helena — were taken at various places on the coastal plateau off Jamestown, from off the Sugarloaf to off Egg Island, at depths of 20—30 fathoms,

[1]) The reference to Grube's paper given by Koehler (Op. cit.) is erroneous in every respect, excepting alone the name of the author and the title of the periodical.

particularly on the large sponges, *Chondrosia plebeia* O. Schmidt, so very common there in some places. Also in Prosperous Bay a specimen was taken at a corresponding depth, but here, on a bottom of black sand, it was evidently much less common.

Specimens were also taken on the shore, under stones in rock pools, off Jamestown and, particularly, off Prosperous Bay. Also in "Lot's wife's pond" some specimens were taken.

The largest specimens found — from the rock pools off Prosperous Bay — have a diameter of disk of 9 mm; thus it is evident that this species does not reach any large size.

The colour .varies to a great extent — as seen already from the careful description given by Koehler — from a dark purple or almost black to a light pinkish, but the darker colours are the more predominant. The specimens are of a rather uniform character, particularly as regards the covering of the disk: long, slender spines, scattered among much shorter stumps; the radial shields small, naked, or with some scattered stumps, often arranged in a longitudinal line.

The suggestion by H. L. Clark (The Echinoderm Fauna of S. Africa, p. 338) that *O. roseo-coerulans* cannot be separated from the S. African *Ophiothrix triglochis* M. & Tr. is, in my opinion, entirely unacceptable. The rich material which I have collected of both these forms show them to be quite distinct — even though some few specimens of *O. triglochis* may have longer spines on the disk among the normal uniform covering of small stumps. On the other hand, I quite agree with Clark (Op. cit.) that the specimens from S. Africa recorded by Bell (1805. Marine Investigations in S. Africa. The Echinoderma III. Ophiuroidea, p. 258) as *O. roseo-coerulans* are not that species, but *O. triglochis*.

The species *Ophiothrix roseo-coerulans* is till now known only from St. Helena.

Ophiactis abyssicola (M. Sars).

Amphiura abyssicola M. Sars. 1861. Norges Echinod. p. 18. Pl. II. 7—12.
Ophiactis — Ljungman. 1867. Oph. viv. huc usque cogn. p. 324.
— *poa* Lyman. 1882. Challenger Oph. p. 119. Pl. XX. 13—15.
— *corallicola* Koehler. 1896. Echinod. du "Caudan", p. 75. Pl. III. 30.
— *abyssicola* H. L. Clark. 1918. Brittle-Stars, new and old. Bull. Mus. C. Zool. LXII. p. 304.
— — H. L. Clark. 1923. Echinod. Fauna S. Africa. p. 334.
— — Th. Mortensen. 1927. Handbook Ech. Brit. Isles. p. 202.

3 miles N.E. by E. of the Sugarloaf. 6 specimens, dredged onboard the "Dana", 22. II. 1930. From what depth they came it is impossible to say, the ground being exceedingly uneven, the depth varying within very short distances from 1200 to 425 meters.

The finding of this common North-Atlantic species at St. Helena is only what should be expected, since it has been found off Tristan d'Acunha (the *Ophiactis poa* of the "Challenger") and off S. Africa (H. L. Clark, op. cit. 1923).

Ophiactis Savignyi (Müll. & Troschel).

Ophiolepis Savignyi Müller & Troschel. 1842. System d. Asteriden. p. 95.
Ophiactis Reinhardtii Lütken. 1859. Add. hist. Oph. II. p. 161. Tab. III. 7. a—b.
— *Savignyi* Ljungman. 1867. Oph. viv. huc usque cogn. p. 323.
— — H. L. Clark. 1918. Brittle-Stars, new and old. Bull. Mus. Comp. Zool. LXII. p. 305.
— — H. L. Clark. 1933. Handbook littoral Echinod. Porto Rico, p. 59.

James Bay, ca. 20 fathoms; 29. I. 1930. 2 specimens.
Prosperous Bay, 25 fathoms; 22. II. 1930. 1 specimen.

The occurrence of this cosmopolitan species at St. Helena is, of course, not at all surprising. It is only surprising that only 3 specimens were found in all, the species being otherwise usually found in great numbers, where it does occur. Perhaps this means that life conditions are not very favourable for it in the St. Helena waters. It is worth noticing that, whereas the species is otherwise often found in great numbers in sponges, I did not find it in the sponge so very common off St. Helena, *Chondrosia plebeia* O. Schmidt; perhaps this sponge has not the right flavour.

Ophiactis Lymani Ljungman.

Ophiactis Lymani Ljungman. 1871. Förteckning öfver uti Vestindien af Dr. A. Goës, samt under Korvetten Josefinas Expedition i Atlantiska Oceanen samlade Ophiurider. Öfvers. K. Vet. Akad. Förhandl. 1871. No. 6. p. 629.
(?) — — Koehler. 1909. Echinodermes. "Princesse Alice". Camp. Sci. Monaco. Fasc. XXXIV. p. 172. Pl. XXVIII. 9—10.
— — Koehler. 1926. Revision de quelques Ophiures de Ljungman, appartenant au Musée d'hist. nat. Stockholm. Arkiv f. Zoologi. Bd. 19. A. p. 24. Pl. V. 1—2.

Non: *Ophiactis lymani* H. L. Clark. 1918. Brittle-Stars, old and new. Bull. Mus. C. Zool. LXII. p. 303. Pl. IV. 5—6. (= *Ophiactis algicola* H. L. Clark. 1933).

Several specimens were taken at the following localities:
James Bay, ca. 20 fathoms. 29. I. 1930. 10 specimens.
Off Lemon Valley, ca. 20 fathoms. 4. II. 1930. 1 specimen.
Off Lemon Valley, ca. 60 fathoms, on a colony of *Sclerohelia*. 17. II. 1930. 3 specimens.
Off Sugarloaf, 25 fathoms. 22. II. 1930. 1 specimen.
Prosperous Bay, 5 fathoms. 17. II. 1930. 1 specimen.
Prosperous Bay, 25 fathoms. 22. II. 1930. 16 specimens.
Flagstaff Bay, 60 fathoms. 24. II. 1930. 1 specimen.

They were generally found on a bottom with shells and sponges; those from Prosperous Bay on a bottom of black sand.

There can be no doubt but that these specimens should be referred to the West Indian *Ophiactis Lymani*. Already from the detailed description given by Ljungman and the photographic figures given by Koehler (Op. cit. 1926) this seemed fairly evident. But in order to attain full certainty I asked my friend, Professor Sixten Bock of the Riksmuseum, Stockholm, to lend me the type specimen, which he very kindly did. The direct comparison of the St. Helena specimens with the type confirmed the view of their identity. Only in one respect I notice a small difference, viz. in the shape of the ventral plates; these have in the type the distal edge rather distinctly concave, whereas in the St. Helena specimens the distal edge is slightly convex; (cf. Figs. 15 b. and 16 d—e.). Perhaps the St. Helena specimens therefore ought rather to be regarded as a separate variety, var. *Helenæ* — but for stating so definitely we must first know, whether the said character of the ventral plates is constant in the West Indian specimens. In the St. Helena specimens the shape of the ventral plates is always as in Figs. 15. b. and 16. e.

Although the figures of the type specimen given by Koehler (Op. cit. 1926) are fairly good, they do not give all the details distinctly; I have therefore thought it desirable to give some drawings for showing the shape of the plates more clearly (Fig. 15). Attention should be called to the spines of the disk, which are characteristic in terminating in a distinct hyaline point (Fig. 15. d.); as a rule they are not present in young specimens. In the type these spines are very few and poorly preserved, but they seem to be of the same character as those of the

St. Helena specimens. Towards the end of the arms the lowermost arm spine assumes the shape of a hook (Fig. 15. c.). In the type specimen this character cannot be made out distinctly, the preservation not being sufficiently good for showing these delicate structures. The characteristic shape of the mouth shields is to be observed only in the fully developed part, not in the regenerating part. The colour is usually brownish-red, spotted with whitish; sometimes, however, it is more greenish; in these latter specimens the dusky spot on the arm spines

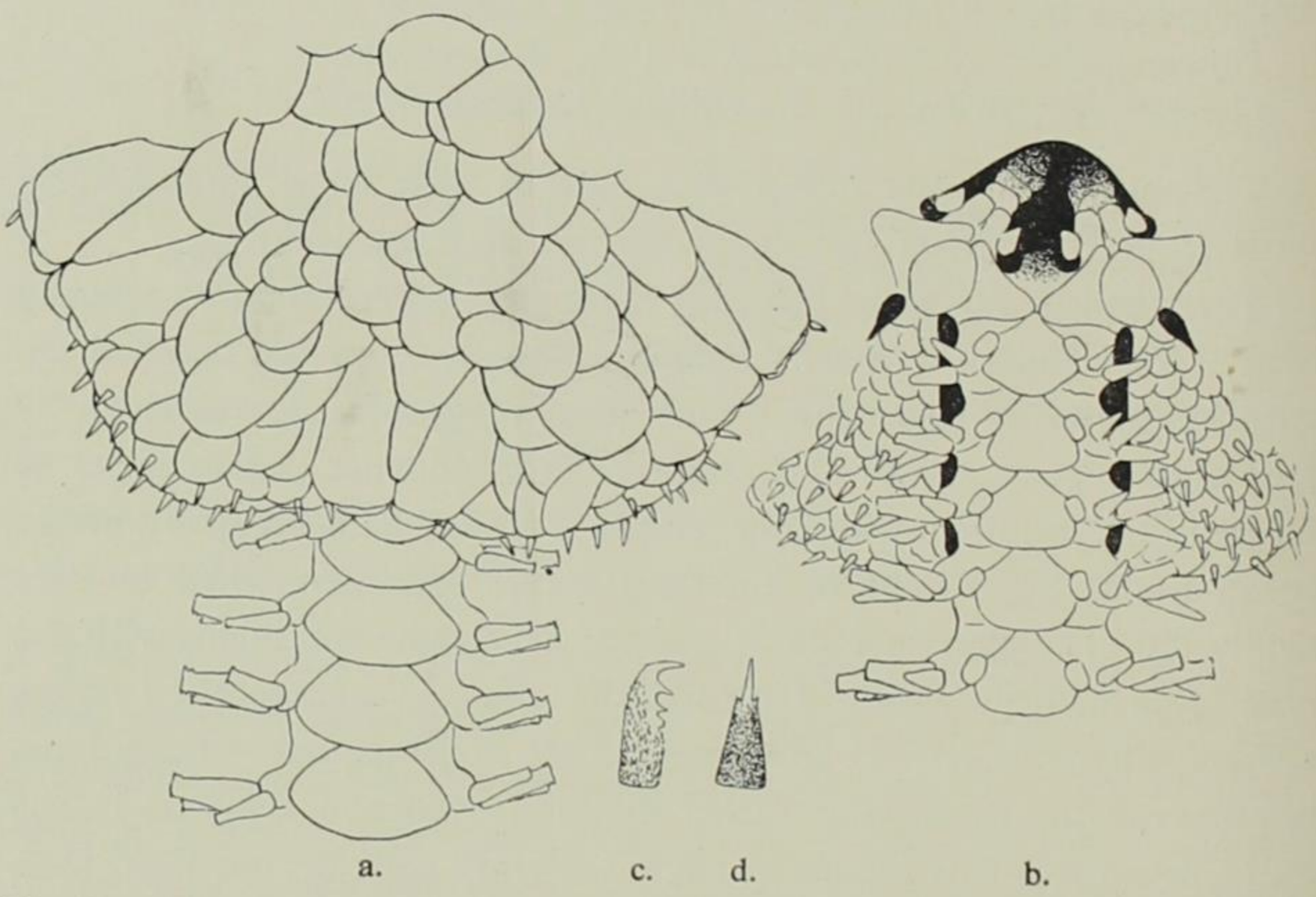


Fig. 15. *Ophiactis Lymani* Ljungman; specimen from St. Helena. Part of dorsal (a) and oral side (b). Hookshaped spine from distal part of arm (c); spine from the disk (d). a—b. × 18; c—d. × 75.

is particularly distinct. The largest specimens have a diameter of disk of 5 mm; one specimen has 7 arms.

Koehler, in his paper of 1926, refers to the description and figures of *O. Lymani*, which he gave in 1909 (Op. cit.) after a couple of specimens taken by the "Princesse Alice" off the Cape Verde Islands. He adds: "Je n'ai rien à ajouter à ma description à laquelle le lecteur pourra se reporter." On comparing the figures of the type specimen with those of the specimens from Cape Verde, one can only wonder that Koehler did not find anything to say about it. These latter figures are so different from those of the type that — if the drawings of the Cape Verde specimens be only tolerably correct — they certainly cannot

be identical — as already suggested by Clark (Op. cit. 1918). Not that I think it of much importance that Koehler represents these specimens as having two oral papillæ, since it seems rather certain that the innermost one of these papillæ does not represent a true mouth papilla, but the one belonging to the innermost foot pore. But the ventral and dorsal arm plates, and particularly the buccal plates, are so different from those of the type that it seems hardly possible that it could be due to poor drawing alone.

Otherwise the occurrence of *O. Lymani* at the Cape Verde Islands would fit very nicely with its occurrence at St. Helena.

The specimens recorded by Clark, Op. cit. 1918, as *Ophiactis Lymani* are distinguished as a new species, *Ophiactis algicola*, in his "Handbook of the littoral Echinoderms of Porto Rico . . ." 1933, p. 56.

The species *Ophiactis Lymani* is very closely related to *Ophiactis Mülleri* Lütken. This statement may seem rather strange, since H. L. Clark in his revision of the genus *Ophiactis* (Op. cit. 1918) places *O. Mülleri* among the species with two mouth papillæ, whereas *O. Lymani* has only one mouth papilla, a difference which is of primary importance within the genus *Ophiactis*. But the fact is that Clark is wholly mistaken about the species *Ophiactis Mülleri* of Lütken, it would seem, because he did not think it worth the while to ascertain which is the real *Ophiactis Mülleri* — as he says (Op. cit. p. 306): "It is quite possible that the names in use for the West Indian species of *Ophiactis*, *O. mülleri*, and *O. savignyi*, are not only not the first names applied to the respective forms, but are not now used as Lütken originally used them. Nothing whatever would be gained, however, by an attempted readjustment."

It is rather extraordinary to have such a declaration from H. L. Clark, who otherwise does not refrain from changing old, familiar, universally used names into names of totally unrecognizable species from old works, regardless of any damage and confusion thereby caused, as exemplified by his changing *Ophiura texturata* Lamarck into *Ophiura ophiura* (Linn.), or *Ophiocomina nigra* (Abildgård) into *Ophiacantha sphærulata* (Pennant) (that he also transfers the latter species to the genus *Ophiacantha* is another highly questionable matter, which does, however, not concern us in this connection).

I quite agree with Clark that nothing at all would be gained by digging up some old, totally forgotten name which might perhaps refer

to *O. Savignyi;* if such be found I would strongly advocate that the name *Savignyi* be made a nomen conservandum. But with regard to Lütken's *Ophiactis Mülleri* it is quite a different matter. Lütken is the founder of the modern study of Ophiuroids, and there is no excuse for disregarding his species, particularly of the West Indian Ophiuroids, of which Lütken made so profound and excellent a study. It is regrettable, of course, that Lütken did not give any illustrations of his *Ophiactis Mülleri*, but his description of it is so detailed and careful that there is no trouble in recognizing the species therefrom. And even if the Danish language may offer some difficulty, there is no excuse for giving *Ophiactis Mülleri* 2 mouth papillæ, when Lütken expressly says, both in the tabular view (Add. hist. Oph. II. p. 126) and in the description (p. 127) that it has only 1 mouth papilla, or to make it a 5-armed species when Lütken expressly says that it has, as a rule, 6 arms (the 6 being even a fat type). Also the number of the arm spines is different, Lütken stating that there are 4, at most 5 at the base of the arm, whereas there are 6—8 in the species that Clark calls *O. Mülleri.*

It appears that the confusion in regard to *Ophiactis Mülleri* arose from Ljungman taking the extraordinary step of regarding his species *quinqueradia* only as a variety of *O. Mülleri*[1]). Whereas Lyman in his "Ophiuridæ and Astrophytidæ (Ill. Catalogue Mus. Comp. Zool. I. 1865, p. 109) has a perfectly correct description of *O. Mülleri*, he places it in the "Challenger" Ophiuroidea (p. 113) in his "first type", viz. among the species whose mouth papillæ (are supposed to) increase in number with age — because, in accordance with Ljungman, he regards *quinqueradia* as the adult of *Mülleri.* Thus he comes to the statement that *O. Mülleri* has, as adult, 3—4 mouth papillæ to each side of jaw. Koehler (Revision de la collection des Ophiures du Mus. d'hist. nat. Paris. Bull. Sci. France & Belgique. XLI. 1907, p. 311) points out that Lyman was in error here, as Lütken in his original description states that there is only one mouth papilla. "C'est ce chiffre qui est exact." — (Whether the specimens, represented by Koehler in his report on the Echinoderms in Michaelsen's Meeres-

[1]) It is a curious fact that also Lütken himself has felt uncertain whether this 5-armed species might perhaps be the adult of *O. Mülleri;* three specimens of *O. quinqueradii* (in very poor condition, but still with all the characters perfectly distinguishable) are labelled by Lütken "n. sp.? an *O. Mülleri* ad(ult)."

fauna Westafrikas, 1914. Pl. VII. 9—10 as *Ophiactis Mülleri* are really that species, I do not feel sure; the very small, wholly separated radial shields make a rather conspicuous difference from typical *O. Mülleri*). Another reason for Clark's error in regard to *Ophiactis Mülleri* is very probably the fact that in general he appears to think species which are self-dividing and 6-armed to have only 5 arms in the adult stage (e. g. *Astroceras pergamenum* Lyman), an opinion for which there is no real support. It is true that we find among the adults of *Ophiactis Savignyi*, a typical self-dividing species, both 6-armed and 5-armed specimens. But it is highly probable that these 5-armed specimens are such as have never practised self-division. 5-armed specimens, with all arms equally developed, are likewise found among the young specimens. For proving that the adult 5-armed specimens have developed from young 6-armed, self-dividing specimens, it must be required that 5-armed specimens are found sometimes with half the disk and 2 or 3 arms in regeneration. I have never seen such specimens and, until such specimens are found, I do not believe that 5-armed specimens ever developed from originally 6-armed ones.

The 5-armed species figured by Clark in his Catalogue of Recent Ophiurans, Pl. XI. 5—6 as *Ophiactis Mülleri* has accordingly nothing at all with the latter species to do; it is the one described by Ljungman as *Ophiactis Mülleri*, var. *quinqueradia*, and thus must be designated *Ophiactis quinqueradia* Ljungman, to which come as synonyms the names *O. dispar* Verrill and *O. longibrachia* H. L. Clark. Whether the *Ophiactis Ljungmani* of Marktanner-Turneretscher also is identical with *quinqueradia*, as appears to be the opinion of Clark, or with *O. Savignyi*, as thinks Koehler (Op. cit. 1914. p. 185) I shall not try to decide. On the other hand, the species described by H. L. Clark (Op. cit. 1918, p. 307. Pl. 4. 3—4) under the name *Ophiactis cyanosticta* is identical with the true *Ophiactis Mülleri* of Lütken, and Clark's name thus becomes a synonym of the latter. I would particularly point out that the colour of the type specimens of *O. Mülleri* is — as correctly described by Lütken — exactly like that of *O. cyanosticta*, a variegated dull bluish-green and whitish, with dark markings on the arms, as seen in Clark's figures. (There is often a dark dorsal midline, which widens into a band on some of the plates).

There is one character which must be mentioned specially, viz. the scale-covering of the disk. Clark emphasizes that there are about

five series of scales in the interradial areas at the narrowest point. I find in the type-specimens usually only three series of scales here, one larger scale in the middle and a smaller one to each side. But there is a good deal of variation, even within the various interradii in the same individual, so I do not think any stress can be laid on this single character, the more so as it seems that in the specimen figured

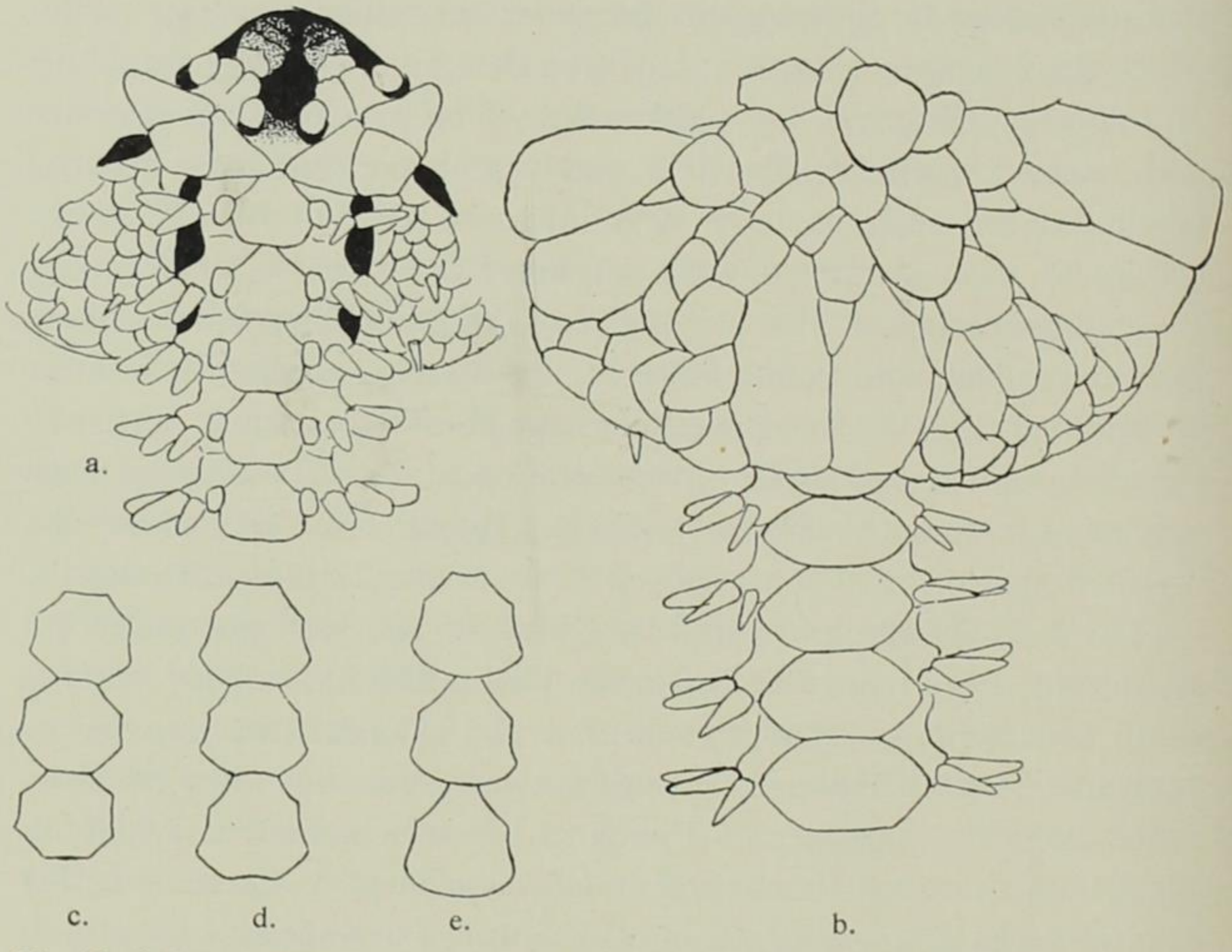


Fig. 16. *Ophiactis Mülleri* Lütken. Part of oral (a) and dorsal side (b) of type specimen. Three arm plates from about the middle of arm of *O. Mülleri*, type specimen, (c), of *O. Lymani*, type specimen (d), and of the St. Helena form of *O. Lymani* (e). All × 25.

by Clark, the holotype of *O. cyanosticta*, there are likewise only three series of scales at the narrowest point of the interradii.

It should be added that the arm spines are, as in *O. Lymani*, flattened and with small thorns at the distal end, recalling to some degree the axe-shaped spines of *Amphiura filiformis* etc.; in the distal end of the arms the lowermost spine becomes hook-shaped as in *O. Lymani*. Also the spines of the disk terminate in a hyaline point as those of that species. On the whole, as already stated, the two species *O. Lymani* and *Mülleri* are closely related, but easily distinguished by their very different coloration, *O. Lymani* never having those dark blue spots

so characteristic of *O. Mülleri*. Also the mouth shields are different in shape (cf. Figs. 15. b. and 16. a.), and likewise the ventral arm plates are somewhat different, particularly when — as is often the case in *O. Mülleri* — they become almost regularly hexagonal, as in Fig. 16. c. In *O. Mülleri* they are generally somewhat sunken in the middle, the distal border thus looking somewhat swollen (as also seen to some degree in Clark's figure of *O. cyanosticta*). In *O. Lymani* they are quite flat.

I take the opportunity here of giving some figures (Fig. 16) to show the structural details of *Ophiactis Mülleri*, drawn from the type-specimen. I think it superfluous to enter on a detailed comparison of this species with *O. quinqueradia*, the distinctness of the two species being quite evident from the foregoing remarks; but it may be just as well to mention that, besides in the above mentioned characters, they differ in the shape of the buccal shields, the dorsal and ventral arm plates, the radial shields, the disk covering, the colour, the size, the arm length — in short they are as different as species within the same genus could well be imagined to be. Of course, Clark did not regard them as identical either, he only misplaces the name *Mülleri* to apply to the species *quinqueradia*, giving the true *Mülleri* the new name *cyanosticta*. This he does likewise in his recently published "Handbook of the littoral Echinoderms of Porto Rico and the Virgin Islands" p. 57—58 — but it does not become more correct thereby.

Amphiura atlantica Ljungman.

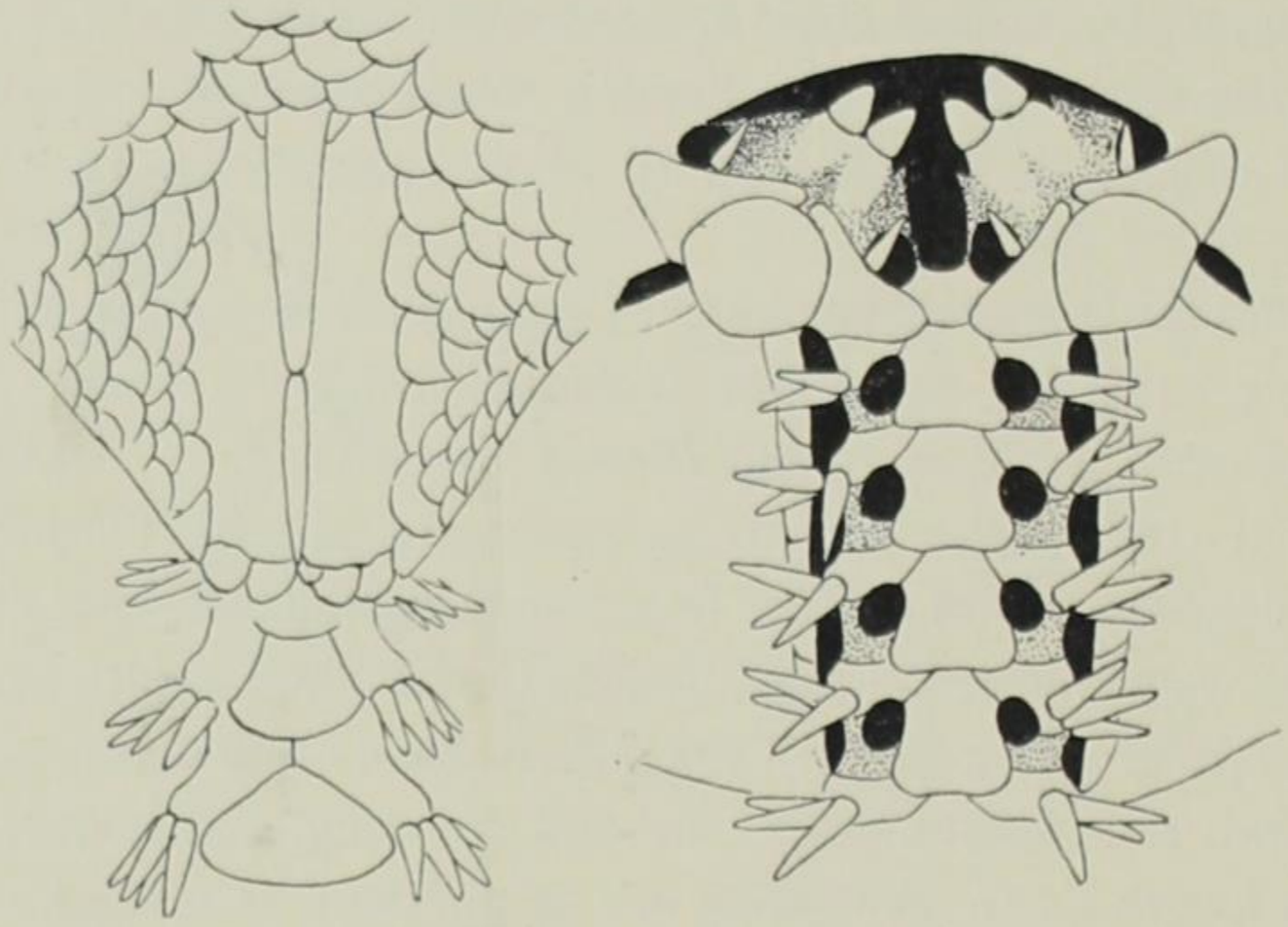
Amphiura atlantica Ljungman. 1867. Oph. viv. huc usque cogn. p. 321.
— — Koehler. 1926. Revision de quelques Ophiures de Ljungman. Arkiv f. Zool. Bd. 19. A. 2. p. 4.

Off Sugarloaf, 20—30 fathoms. 17 specimens. 27. II. 1930.
Flagstaff Bay, 35 fathoms. 2 specimens. 24. II. 1930.
Off King & Queen's Point, 40 fathoms. 1 specimen. 24. II. 1930.
Off Sea Cow Cove, ca. 15 fathoms, 1 specimen. 11. II. 1930.
7 miles E. of Bay Point, 480 m. (Old Lophohelias), 3 specimens. 24. II. 1930.

The species was hitherto known only from the specimen described by Ljungman, redescribed and figured by Koehler. It is therefore very satisfactory that new material has now come to hand, and I have thought it desirable to give some figures of it, the figures given

by Koehler not being all that could be desired — particularly the figure of the oral side.

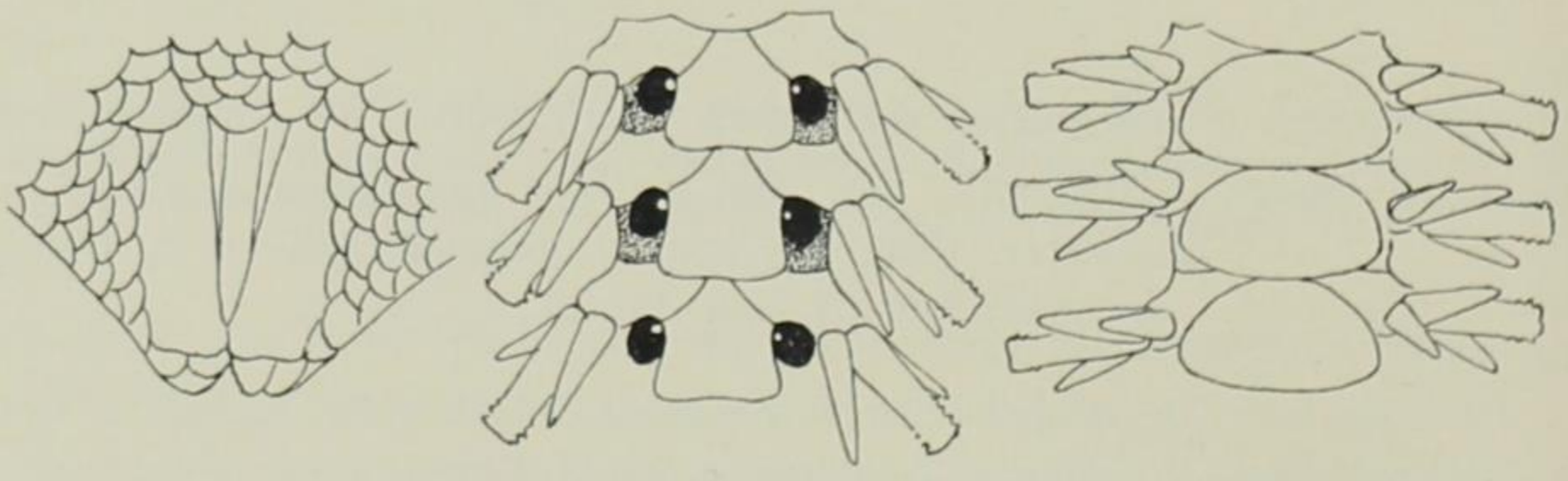
There is some variation in regard to the shape of the radial shields, as appears from Figs. 17 a. and 18. a.; also as regards the scale-covering



a. b.

Fig. 17. *Amphiura atlantica* Ljungman. Dorsal (a) and oral side (b). × 18.

of the disk there is some variation, the primary plates being sometimes quite distinct, sometimes scarcely distinguishable. The number of the arm-spines varies from 4—6. A very small, rudimentary tentacle scale is usually present (Fig. 18. b.), though not in the proximal part of the arm.



a. b. c.

Fig. 18. *Amphiura atlantica* Ljungman. Part of dorsal side of disk (a); three armjoints from middle of arm, showing the rudimentary tentacle scales (b); same, dorsal side (c). × 18.

There can be no doubt but that the South African *Amphiura dilatata* Lyman is so very closely related to *A. atlantica* as to be hardly distinguishable from it, even as a variety only. The characters pointed out by Koehler as justifying to keep the two forms as separate species,

viz. the scales of the disk, the radial shields, and the number of arm spines, vary so much that they cannot be used as distinguishing characters; the same holds good of the shape of the disk (more or less excavated in the interradii). Rudimentary tentacle scales are present also in *A. dilatata*, and the second spine from below is widened in the same way as in *atlantica*.

The only noticeable difference that I can find is that the outer mouth papilla is generally longer and more slender in *dilatata*.

Amphiura grandisquama Lyman.

Amphiura grandisquama Lyman. 1869. Prelim. Report Oph. & Astroph. dredged in deep water between Cuba and the Florida Reef. Bull. Mus. C. Zool. I. 10. p. 334.
— — Lyman. 1875. Oph. & Astroph. Zool. Res. of the Hassler Exped. Ill. Cat. Mus. C. Zool. VIII. Pl. V. 65.
— *longispina* Koehler. 1898. Ech. & Oph. de l'Hirondelle. Camp. Sci. Monaco. Fasc. XII. p. 52, Pl. IX. 45—46.
— *grandisquama* Verrill. 1899. Oph. of the Bahama Exped. Bull. Lab. Nat. Hist. Mus. Iowa. V. 1. p. 26.
— — Koehler. 1907. Rev. de la Coll. des Oph. du Mus d'hist. nat. Paris. Bull. Sci. France & Belgique XLI. p. 301.
— — Koehler. 1909. Echinod. "Princesse Alice". Camp. Sci. Monaco. Fasc. XXXIV. p. 177.
— — Koehler. 1914. Echinod. Meeresfauna W. Afrikas. p. 190.
— — Koehler. 1922. Oph. Albatross Philippine Exped. p. 159. Pl. 66. 6—8.
— — Mortensen. 1927. Handbook Ech. Brit. Isles. p. 209, 211.

3 miles N. by E. of Sugarloaf, 1200—425 m. 22. II. 1930. 1 specimen.
2 miles S. 49 E. of Long Range Point, 280—450 m. 24. II. 1930. 2 specimens.
2 miles E. of Bay Point; 480 m. (Old Lophohelias). 24. II. 1930. 5 specimens.
Dredged onboard the "Dana".

These specimens agree very well with the descriptions of *A. grandisquama;* only the tentacle scales are larger than those of two West Indian specimens at hand, and than shown in Koehler's Pl. XI. 46 (1898); but as there is a considerable difference in the size of the tentacle scale even in the specimens from St. Helena (Figs. 19. b. and d.), this is no sufficient reason for separating them from *grandisquama*. Also the shape of the mouth shields varies rather considerably. One of

the specimens has in two places two outer mouth papillæ, evidently a splitting up of the normally single, large outer papilla. The papilla of the first mouth-tubefoot is unusually strongly developed.

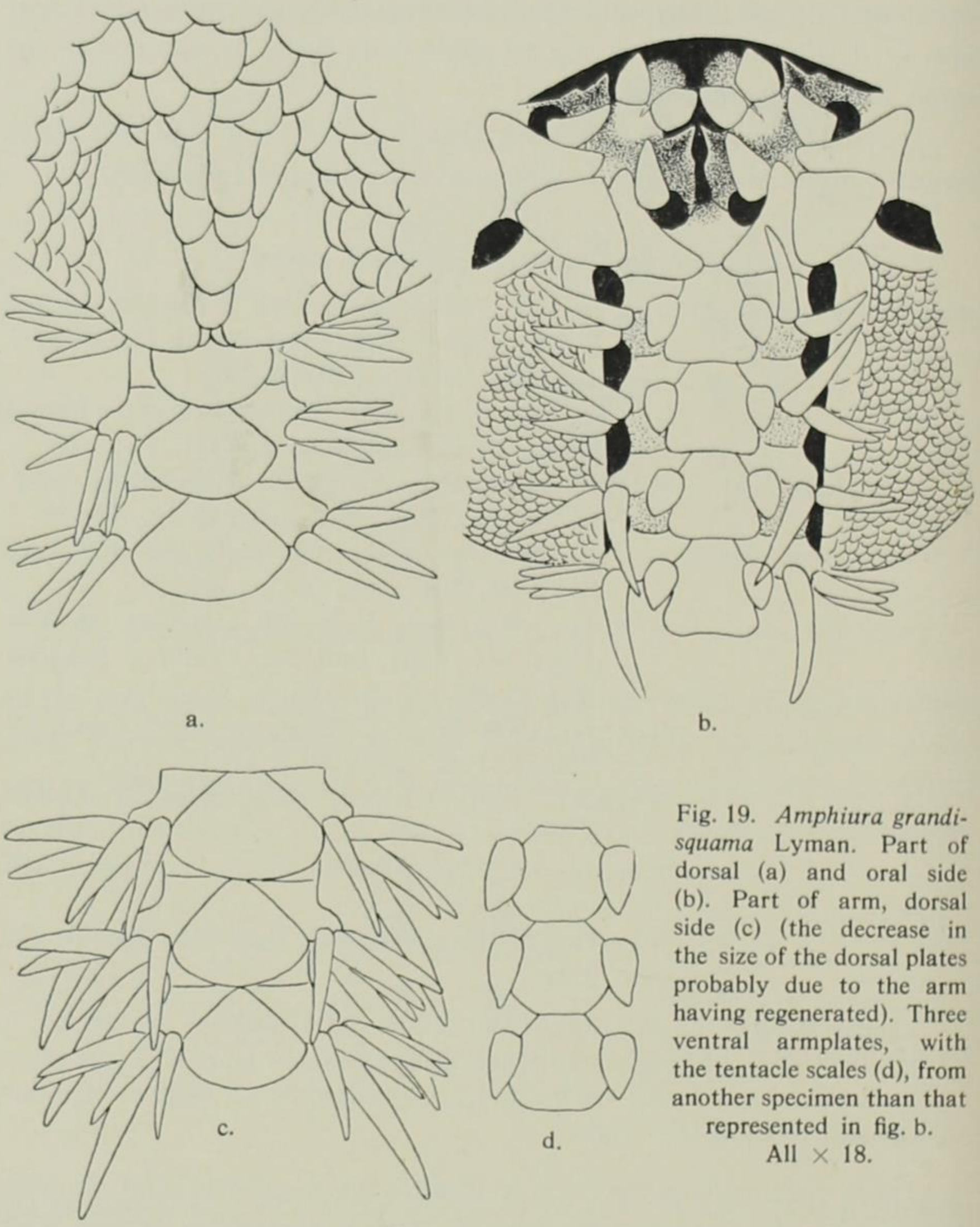


Fig. 19. *Amphiura grandisquama* Lyman. Part of dorsal (a) and oral side (b). Part of arm, dorsal side (c) (the decrease in the size of the dorsal plates probably due to the arm having regenerated). Three ventral armplates, with the tentacle scales (d), from another specimen than that represented in fig. b. All × 18.

The species being known already from the Bay of Biscay and the Gulf of Guinea, besides from the West Indian Seas, and from the Moluccan Sea, and off Durban, it is not so very surprising to find it now to occur also at St. Helena.

The figures given by Koehler (— Lyman never gave figures of

it, except the very unsatisfactory one of the mouth parts, op. cit. 1875. —) being not quite satisfactory as regards the outlines of the plates, I deem it desirable to give here some new figures of this species (Fig. 19).

The exact depth at which these specimens were taken being unknown, because of the irregularity of the bottom just outside the coastal plateau of St. Helena, the bathymetrical distribution of the species is not increased by the findings of it at St. Helena.

Amphipholis squamata (D. Ch.).

(For literary references, see my Report on the Ophiuroidea of the Danish "Ingolf" Expedition. 1933. p. 63.)

Prosperous Bay, 25 fathoms; black sand. 22. II. 1930. 1 specimen.

There is nothing surprising in the finding of this cosmopolitan Amphiurid at St. Helena. Although being viviparous and thus incapable of dispersal as pelagic larva, it has an excellent means of transportation in the large littoral algae, in the "roots" of which it is often found. In this way its occurrence in another very isolated place, viz. St. Paul (cf. M. Hertz. 1926. Ophiuroidea d. Deutschen Südpolar Exp. p. 35 — under the name of *Amphipholis minor* (Döderlein)) is evidently also to be explained.

The facts that it was not found on the shores under stones at low water[1]) and that only the said single specimen was taken in all the numerous dredge-hauls made, indicates that it does not thrive very well in the waters of St. Helena.

H. L. Clark, in his "Handbook of the littoral Echinoderms of Porto Rico and the other W. Indian Islands" 1933, p. 50, states that very young specimens may have 6 arms and show evidence of autotomy". This sounds rather extraordinary to me; I have examined hundreds and hundreds of this species from very many localities all over the world, but I do not remember ever having seen a six-armed young or adult specimen, and certainly I never found the slightest sign of autotomy. Are those 6-armed specimens of Clark really *Amphipholis squamata*?

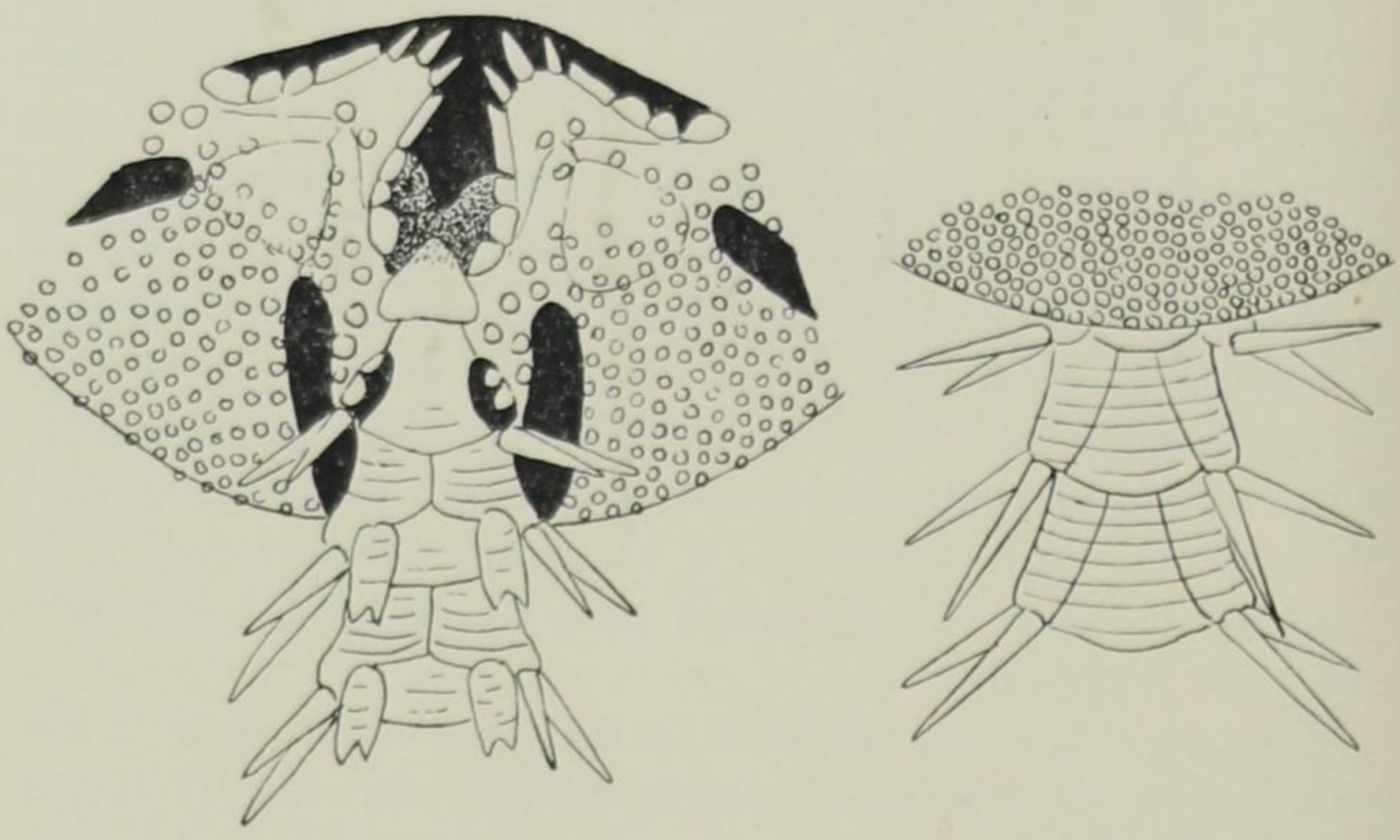
[1]) I find in my notebook special mention of the fact that no specimens of *Amph. squamata* could be found under the stones in places, where it would be likely to occur; the possibility of its having been overlooked is therefore excluded.

Ophiopyren atlanticum n. sp.

2 miles E. of Bay Point, 480 m. Bottom with dead Lophohelias. 24. II. 1930. 2 specimens.

Dredged onboard the "Dana".

Diameter of disk of the largest specimen 2.5 mm, length of arms ca. 12 mm. Disk wholly covered with granules, even the jaws partly covered, the buccal shields and adoral plates just discernible. Mouth papillæ 5 to each side of jaw; the innermost one elongate, slender, like the infradental one, the second broad and low, the three following



a. b.

Fig. 20. *Ophiopyren atlanticum* n. sp. Part of oral (a) and dorsal side (b). × 30.

ones narrower, more rounded. Buccal shields rounded-triangular. First ventral arm plate broad, triangular; the second broadly contiguous with the first, much longer than broad; the following ones are widely separated, broader than long, with straight outer edge and a very obtuse angle within. Tentacle scales at the first pore pair two small ones on the abradial edge of the pore. From the second pore pair onwards there is one large, leaf-shaped tentacle scale, almost twice as long as the ventral plate, and distinctly bifid at the point. Dorsal arm plates narrow, longer than broad, contiguous, rather distinctly keeled. The lateral plates with very conspicuous concentric lines, continuing also across the dorsal plates, the whole dorsal surface of the arms thus getting a peculiar lustrous appearance. On the ventral

side of the arms it is only the lateral plates that are thus distinctly striped, the ventral plates and the tentacle scales showing a less distinct transverse striation. Arm spines two, about the length of an arm joint; the uppermost is slightly the longer. Genital slits wide. The granules are finely spiny, of a honey-combed appearance as seen under high power in the microscope. — Colour white.

This species recalls to some degree *Ophiopyren bispinosum* Koehler from the Indian Ocean, and also *Ophiopyren striatum* Mrtsn. from the Arctic Sea, described in my Report on the "Ingolf" Ophiuroidea; but it differs very markedly from both, and indeed from all the species of *Ophiopyren* hitherto made known, in the character of the ventral plates.

Ophiura Ljungmani (Lyman).

Ophioglypha Ljungmani Lyman. 1882. "Challenger" Oph. p. 44. Pl. IV. 8—10.
— *lepida* Lyman. Ibidem. p. 43, Pl. IV. 1—3.
— *Thouleti* Koehler. 1896. Ech. du "Caudan", p. 69. Pl. IV. 39—40.
Ophiura Ljungmani Mortensen. 1927. Handbook Ech. Brit. Isles, p. 240.
— — Mortensen. 1933. "Ingolf" Oph. p. 83.

3 miles N.E. by E. of the Sugarloaf, St. Helena, 1200—425 m. 3 specimens, dredged onboard the "Dana".

The occurrence of this species off St. Helena is only what might be expected, it being already known from off the coast of Brazil ("Challenger") and off S. Africa.

Ophiophycis gracilis n. sp.[1])

2 miles S. 49. E. of Long Range Point, 360—280 m. 24. II. 1930. 2 specimens.
2 miles E. of Bay Point. 480 m. 24. II. 1933. 10 specimens.
Dredged onboard the "Dana".

Diameter of disk in adult specimens scarcely exceeding 2 mm; arms about 3 mm long, very slender and delicate. Dorsal side of disk slightly elevated, oral side flat or slightly concave. There is a conspicuous rosette of primary plates, viz. a pentagonal central plate with slightly concave sides, and 5 rounded-polygonal radial plates. Distally to the radial plates, and in touch with these latter, follow the radial shields, which are contiguous in their whole length. In the interradii

[1]) The figure 21 was reproduced, much reduced, in the popular account of the "Dana" Expedition, 1932, p. 295, where also the name was first published.

there is a single elongate plate with straight sides and an angle at the inner end; its outer edge is slightly concave and joins a broader, almost elliptical marginal plate. At the base of each arm, outside the radial

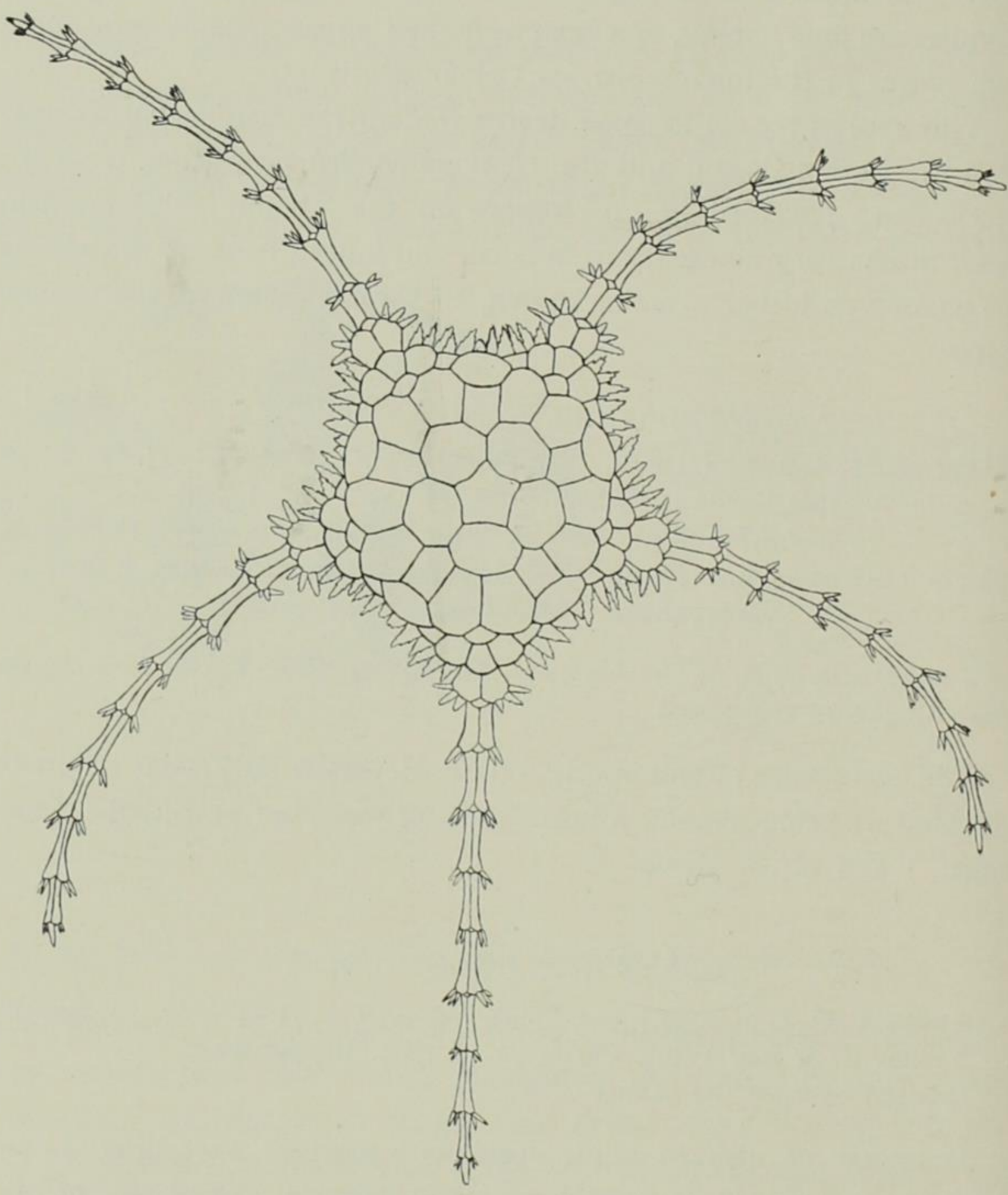
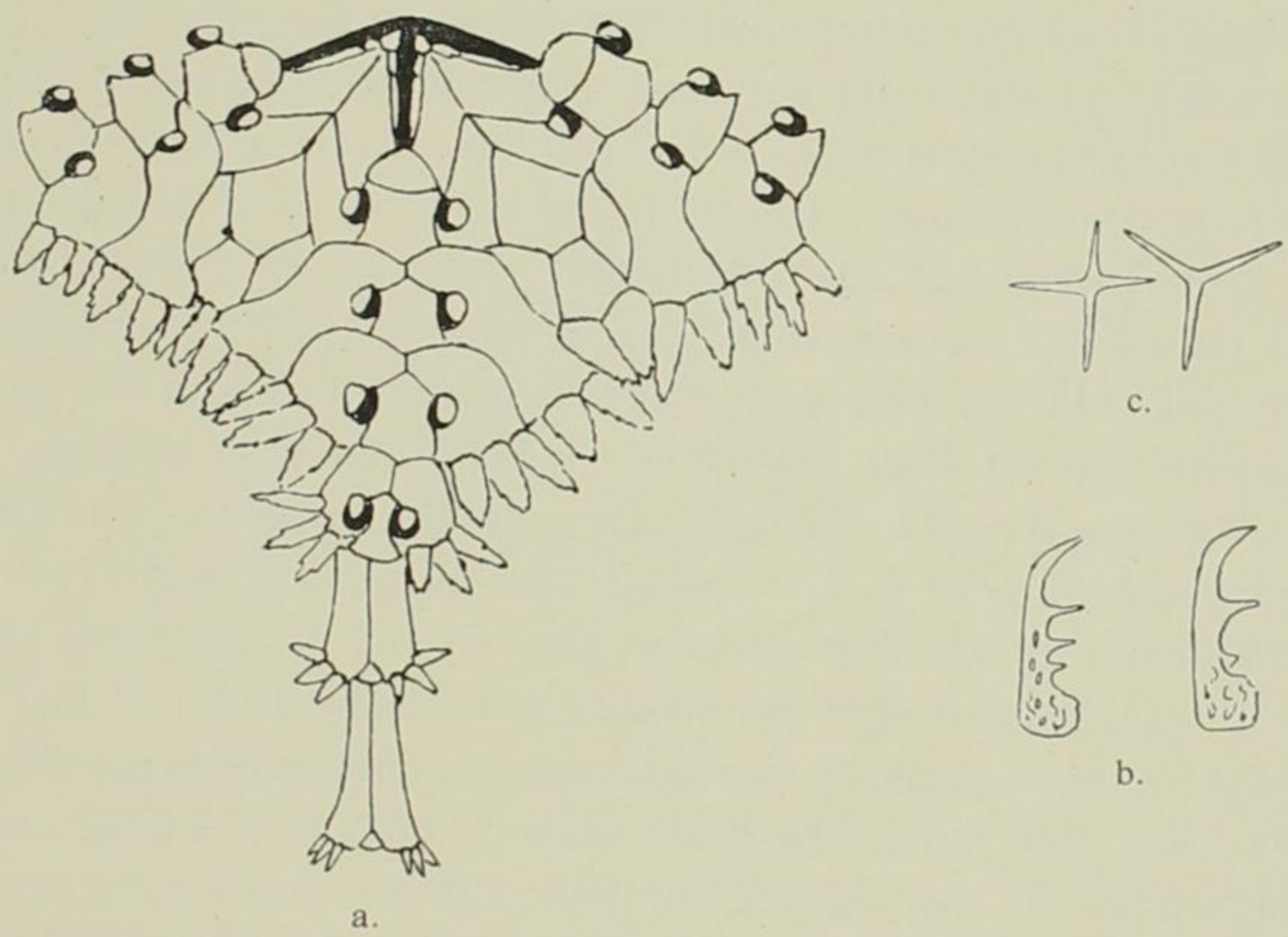


Fig. 21. *Ophiophycis gracilis* n. sp. Type specimen. Dorsal side. × 15.

shields, there are some smaller plates which partake in forming the border of the disk, but they are no true disk plates; they are the ends of the widened lateral plates of segments 1 and 2, in conformity with the fact that they carry spines. The two small plates in the radial line are, of course, the dorsal plates of the two first segments (Fig. 21).

The plates of the dorsal side all smooth, but the radial plates are slightly thickened in the middle.

The jaws carry a single broad papilla at the apex, and two or three narrow papillæ at the sides, the middle one much the largest; the mouth papillæ, on the whole, are very inconspicuous and to be made out distinctly only on specimens cleared in Canada balsam (Fig. 25). The adoral plates join broadly within; they are somewhat broader in their distal part that joins the first lateral plates. The mouth shield



a.

c.

b.

Fig. 22. *Ophiophycis gracilis* n. sp. Part of oral side (a); hook-shaped armspines from distal part of arm (b); spicules from stomachal wall (c). a. × 30; b—c. × 160.

is pentagonal or more rounded; distally to the mouth shield there is a single rather large plate reaching to the margin of the disk, and at each side, in the corner between the mouth shield and the marginal plate, is a smaller, somewhat elongate plate. The shape of all these plates is subject to some variation. There is no trace of bursal slits, unless the small space between the mouth shield and the first lateral plate (Fig. 25) should be regarded as the equivalent of the bursal slits; but as it is covered by skin, this would not seem likely. The ventral arm plates are all separated, except the two first; they are restricted in the middle because of the pores. From the fifth the ventral plates are reduced to very small, triangular plates, beyond the 6th they are so minute as to be observable only by rather strong magnification on

specimens cleared in Canada balsam. The lateral plates of the two first segments are much widened so as to reach the edge of the disk; the third pair is much less widened, and from the fourth joint they are long and slender, joining below and above so as to form a slender tube, slightly widened at the distal end, where the spines are carried. (As it was found very difficult to trace the exact limits of the plates on the oral side on the alcoholic or dried specimens, the figure of the oral side (Fig. 22) was drawn after a specimen cleared in Canada balsam).

The arm spines are two on the first, three on the following lateral plates, only on the distalmost joints there may be only two. Those of the two first segments are broad and flat, serrate along the edges; they form a conspicuous fringe all round the disk, which is made possible through the fact that the lateral plates are so elongate as to reach the edge of the disk, thus forming the greater part of the margin of the disk. In the middle of the interradius there are two spines apparently issuing from the median interradial marginal plate, not from the lateral plates. On the third joint the spines are also rather broad and flat, so as to form part of the marginal fringe. From the fourth joint they are much smaller, slender, and on the distal joints they gradually assume the character of small hooks (Figs. 22. b.). The dorsal arm plates are very small, triangular, disappearing on the last joints. Only four pairs of pores are distinct, each with a single, small tentacle scale. On the first free arm joint a pair of small pores may be observed in microscopical preparations; beyond this there is no trace of pores on the arms. The number of free arm joints in adult specimens is 7 to 9, the number varying in the arms of one and the same specimen.

The colour of the live specimens was a faint pinkish; the preserved specimens are whitish.

This very fine little Ophiurid I took (2 specimens) in a dredging with the "Dana" at St. Helena, 2 miles S. 49° E. of Long Range Point, at a depth of 360—280 meters; it was found attached to a stone. A few more specimens — one of them with four arms only — were found in another dredging the same day, 2 miles E. of Bay Point, 480 meters; these latter specimens were found in the washings of some old, dead "*Lophohelia*" branches, to which they had evidently been attached.

On removing the first specimen from the stone to which it was attached I was very surprised in discovering under its disk 8 young

embryos. This species thus protects its brood, covering it with its body, much as do several seastars. I have opened a couple of specimens and found only one gonad to each side of the arms, each gonad containing, in the female, one egg, ca. 0.15—0.2 mm in diameter, rich in yolk. The male gonads are slightly larger than the female gonads. As there are no bursal slits, the eggs must pass out through openings formed specially for that purpose, through resorption of the body wall with its calcareous plates, much as I have found it to occur in *Ophiopus arcticus* (cf. my paper "Über Ophiopus arcticus Ljungman, eine Ophiure mit rudimentären Bursen". Z. f. wiss. Zool. Bd. LVI

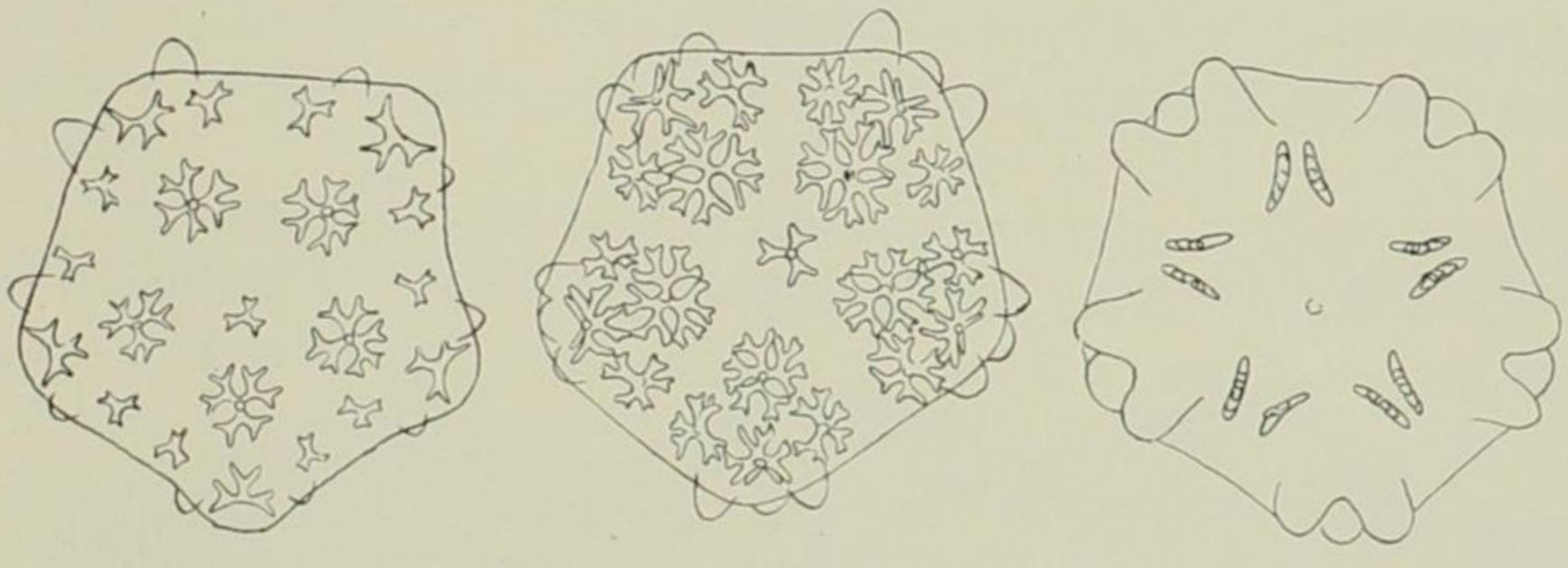


Fig. 23. Embryos of *Ophiophycis gracilis* n. sp. a—b. Dorsal side, showing two consecutive stages of development of the skeletal plates; c. oral side. × 105.

1893. p. 510). As no such openings are to be observed in the specimen found covering its young ones, this must mean that the openings through which the eggs pass out are already healed up again. Although thus protecting its young ones the species is not viviparous and not hermaphroditic.

In the anatomical preparations it was found that the stomachal wall contains a number of three- or four-radiate spicules (Fig. 22. c.).

The embryos were found to be in two slightly different stages of development, one showing the young skeletal plates a little further developed than the others (Fig. 23. a—c.). It appears that the first formed skeletal elements are the five radial plates and the terminal plates; next follow the radial shields and the central plate. In the more advanced stage the central plate is still the smallest. On the oral side only one pair of plates have made their appearance in the later stages, undoubtedly representing the jaws. The first pair of tentacles have

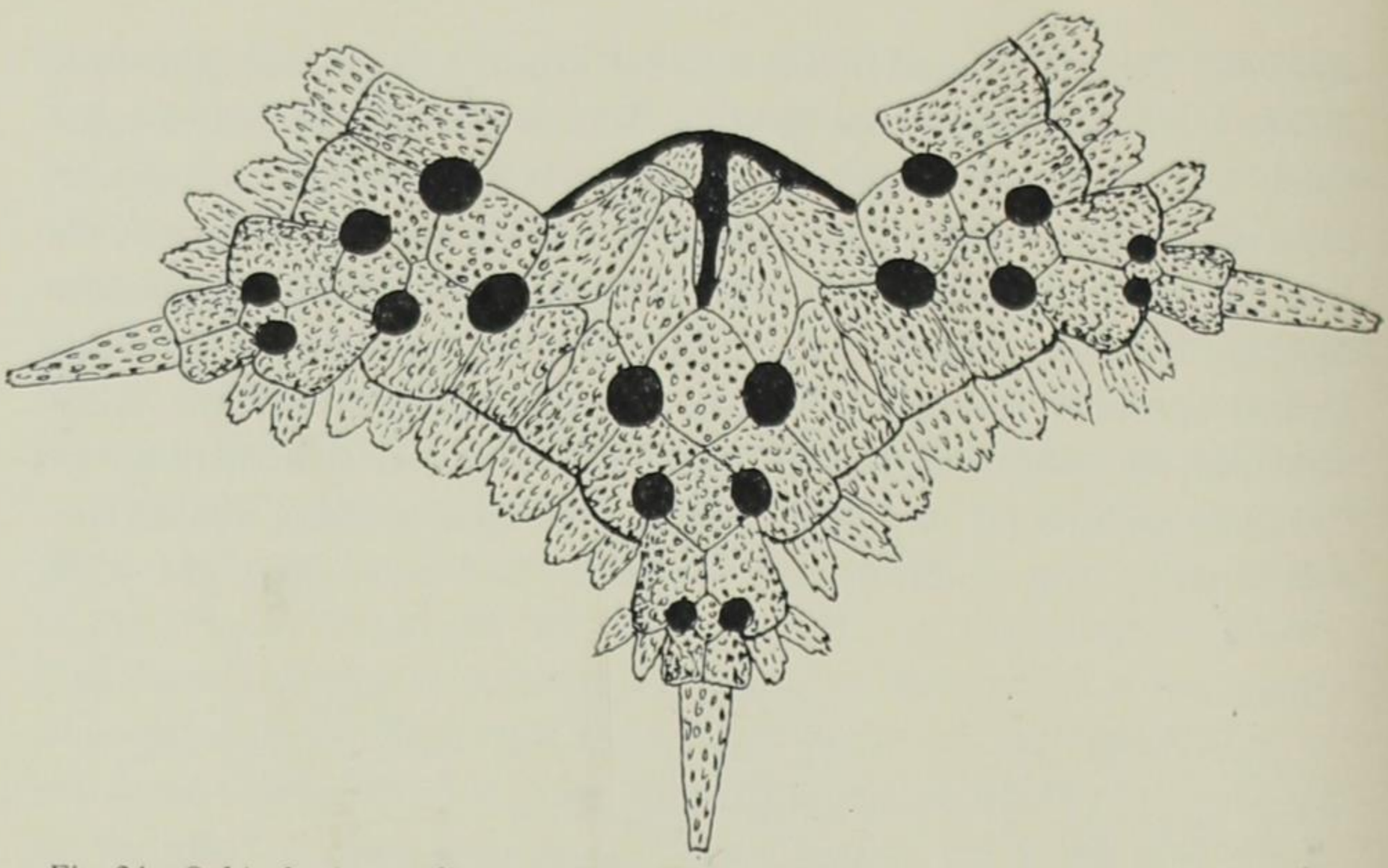


Fig. 24. *Ophiophycis gracilis* n. sp. Part of oral side of youngest free-living stage. × 65.

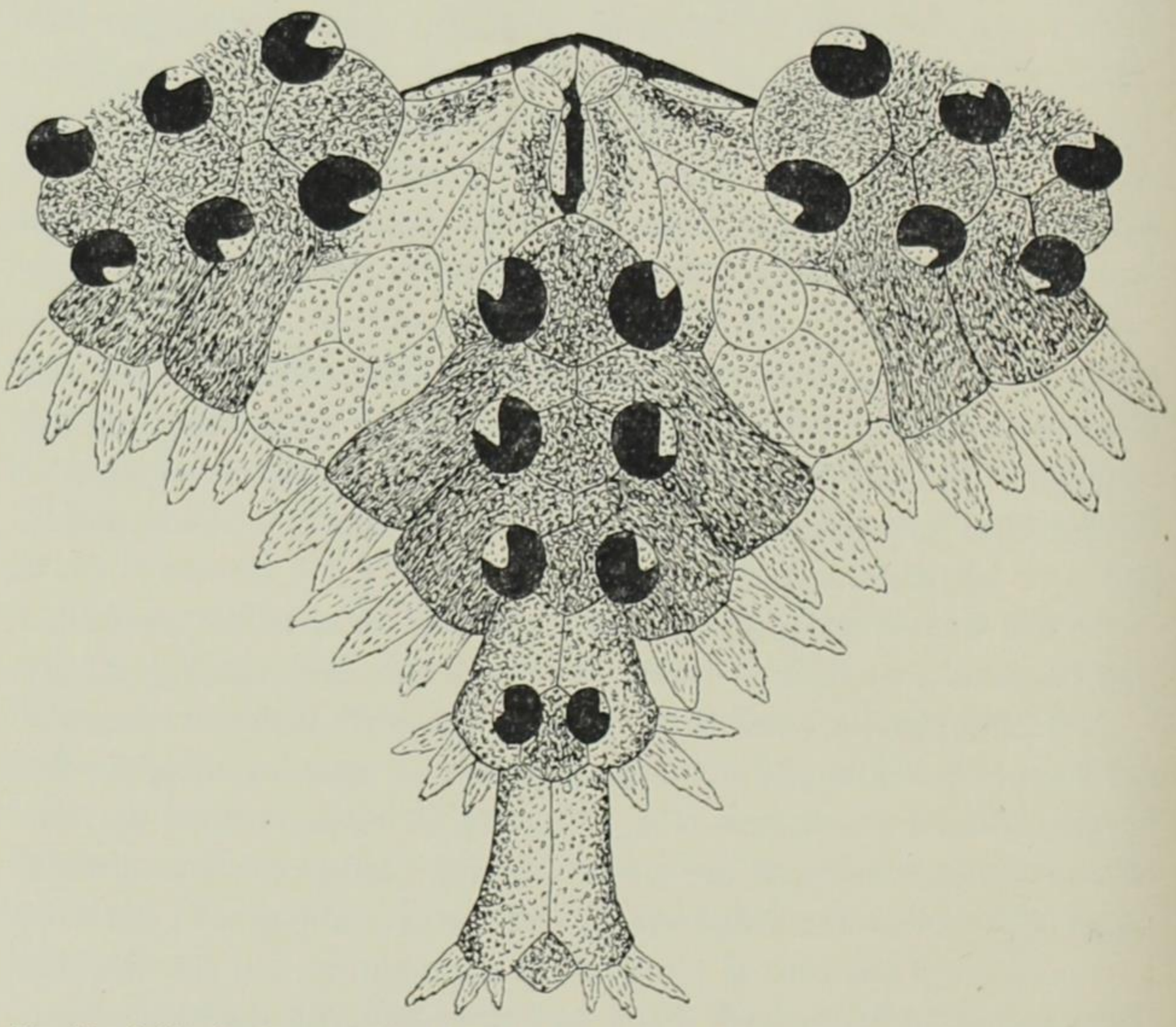


Fig. 25. *Ophiophysis gracilis* n. sp. Part of oral side of adult specimen, cleared in Canada balsam. × 55.

been formed; the terminal "feeler" is still quite short. The mouth opening has not yet been formed in the later of the two stages.

The youngest specimen found free-living (Fig. 24) has only three arm joints. It has as yet no mouth shields and no tentacle scales. But the main interest attaches to the fact that the adoral shields are widened like the lateral plates and reach the margin of the disk, carrying here one broad spine. In the course of growth the distal part of these plates is resorbed, so that they are widely removed from the margin (Fig. 25 to compare with Fig. 24). But the spines remain, now apparently issuing from the marginal plate; the development thus gives proof that these two spines in the middle of the interradial margin in reality belong to the adoral plates (which morphologically represent the lateral plates of the first segment).

This species has a fairly close resemblance to the *Ophiophycis mirabilis* Koehler, the genotype of *Ophiophycis* and the only species hitherto known. This latter species, which was taken (2 specimens) by the "Princesse Alice" off the Azores (38°26′ N. 26°30′45″ W., 1165 m), differs from the St. Helena species in various characters; it has 6 pairs of pores, against 4 in *O. gracilis*, and the 5 first lateral plates are widened, against only the 3 first in *O. gracilis*. The spines of the marginal fringe differ in shape from those of *O. gracilis* (cf. Pl. XXVI. 3—4 of Koehler's Report, Monaco, Fasc. XXXIV)[1]). The tentacle scales seem to be larger in *O. mirabilis*, and there are two of them at the first pore pair, only one in the St. Helena species; also, *O. mirabilis* appears to have more mouth papillæ, and its arms are not nearly as slender as are those of *O. gracilis*. Finally the species from the Azores is a good deal larger, ca. 5 mm diameter of disk, than the St. Helena species, which appears not to exceed 2 mm. While there are thus characters enough to prove the distinctness of the two species, there can be no doubt that both of them belong to the same genus, characterised particularly by the widening of the proximal lateral plates, their spines forming a fringe all round the disk.

[1]) Koehler figures these spines as an immediate prolongation of, not limited from, the lateral plates. This must be an error in the drawing; there can be no doubt that the spines will be limited against the lateral plates, as in *O. gracilis*.

Ophiomusium spinigerum n. sp.

8 miles W. by N. of Sugarloaf, St. Helena. 2400—2780 m. 1 specimen; dredged onboard the "Dana", 25. II. 1930.

Diameter of disk 15 mm; arms probably ca. 4—5 times the diameter of disk; the longest preserved is 48 mm long.

Mouth papillæ 6—7 (8) to each side of jaw, the outermost but one large and broad, the outermost one very small. Buccal shield longer

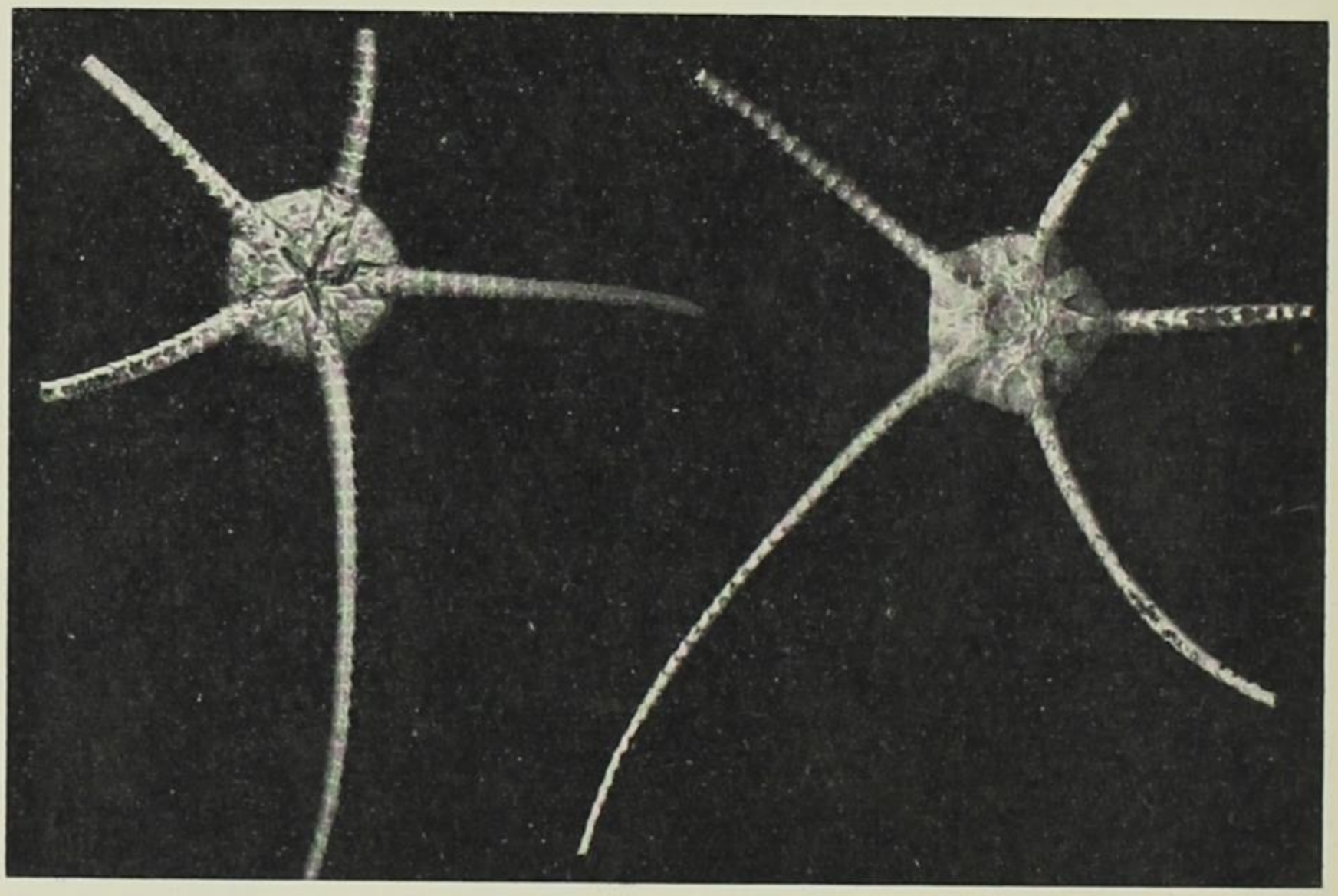


Fig. 26. *Ophiomusium spinigerum* n. sp. Type specimen, oral and aboral side. Natura size.

than broad; it has an acute angle within, the sides being more or less distinctly convex, till, about halfway, they get a distinct notch for the adoral end of the genital slit. The outer half of the buccal shield has straight sides and a slightly convex distal edge; this outer half of the shield is somewhat narrower than the inner half. Adoral shields very well developed, joining broadly within and having a broad outer lobe separating the first lateral plate widely from the buccal shield. First ventral plate very small, almost rectangular, but with a small angle within. The two following ventral plates narrowly contiguous, the fourth slightly separated from the third; the sides of the three first ventral plates are conspicuously notched by the pores. From the fifth

the ventral plates are widely separated, reduced to small triangular plates at the end of the joint; they continue to the end of the preserved part of the arms. Tentacle pores on the first 3 segments; they have 3—2 scales on the adradial side and 1 very broad scale on the abradial side, more exceptionally two, a small proximal and a large distal one. Genital slits do not reach the border of the disk, only to the end of the second arm joint; both margins are set with small papillæ (Fig. 27. a.). Dorsal arm plates rhombic, widely separated,

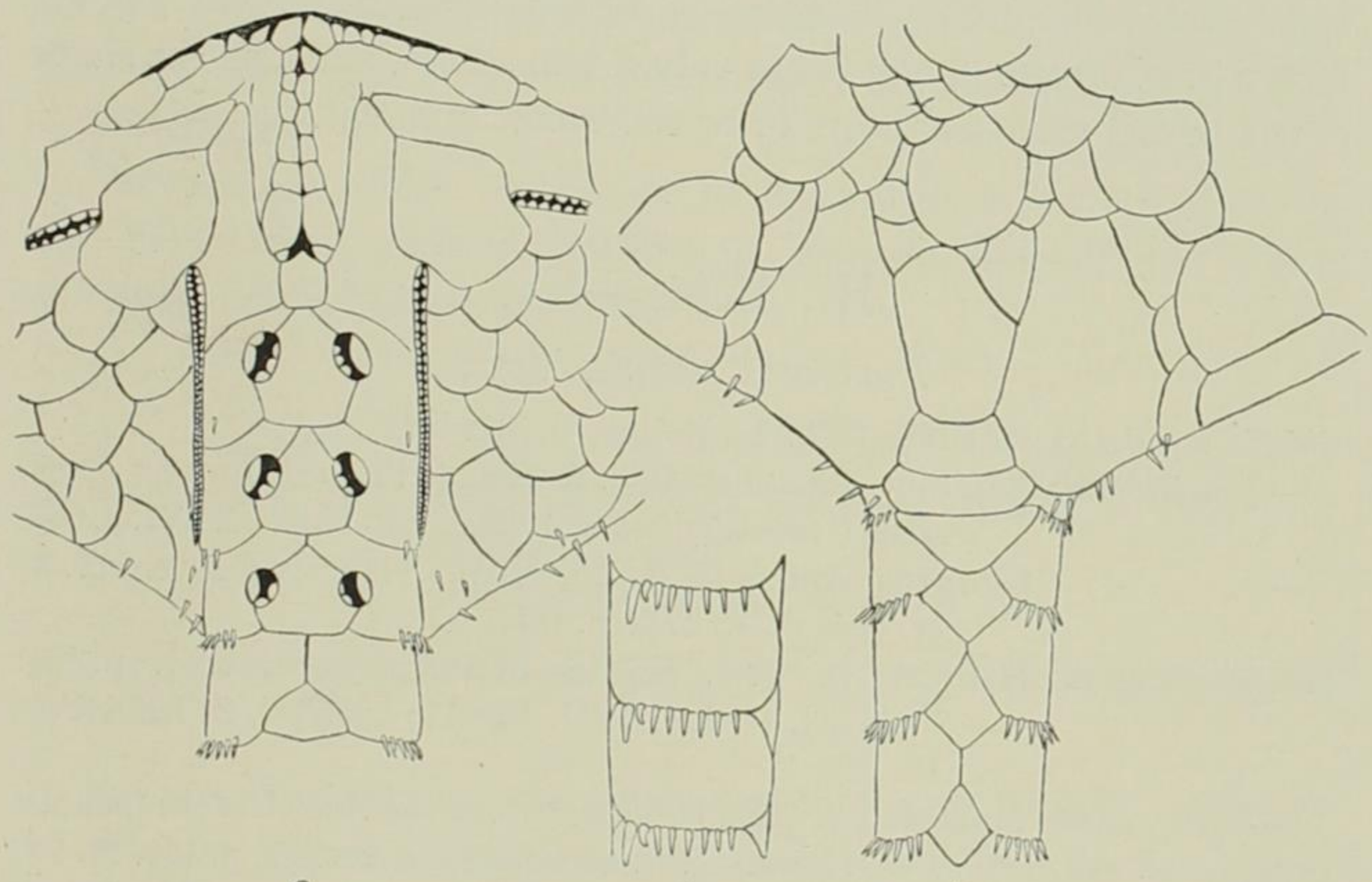


Fig. 27. *Ophiomusium spinigerum* n. sp. Part of oral (a) and dorsal side (b); three arm-joints, side view (c). × 6.

except the proximal ones, viz. two or three transformed ones in the notch between the radial shields, and the one of the first free arm joint, which has the inner angle truncate. Arm spines 8 on the proximal joints, somewhat outstanding, well developed; the lowermost one is slightly the longest, and the second from below is transformed into a small hook (Fig. 27. c.). Radial shields well separated; disk scales rather large, but not very distinctly limited. Primary plates not very distinct; two larger plates in the interradii, and one fairly large marginal plate, not distinctly seen from the ventral side; plates of ventral interradii well sized but irregularly arranged. The most striking character is the existence of some slender spines placed, without any order,

at the base of the arms and along the margin of the disk. — Colour (of dried specimen) white.

This species appears to be the nearest related to *Ophiomusium armatum* Koehler from the Philippine Seas (Oph. "Albatross" Philippine Exped. p. 389, Pl. 89. 8—10), which, according to the description, would seem to have also some scattered spines on the edge of the disk. Judging from the, unfortunately, very poorly reproduced photos, it seems to have also the second spine from below transformed into a spine. That they are not identical is certain; thus the genital slits are longer in *O. armatum*, and it has only 6 arm spines, and also the shape of the buccal shields appears to be somewhat different.

III. Echinoidea.

Eucidaris clavata Mrtsn.

Cidaris metularia Melliss. 1875. St. Helena, p. 219.
— *tribuloides* Koehler. 1908. Ast. Oph. & Ech. de l'Exped. Antarct. Ecossaise. ("Scotia"). Trans. R. Soc. Edinburgh. XLVI. p. 640.
— — Cunningham. 1910. On the Marine Fishes and Invertebr. of St. Helena. P. Z. S. p. 124.
Eucidaris clavata Mortensen. 1928. Monogr. of the Echinoidea. I. p. 408. Pl. XLII. 1—4; LXVII. 10—11; LXXIII. 2; LXXXVI. 15.
— — Mortensen. 1932. New Contrib. to the Knowl. of the Cidarids I—II. Mem. Ac. R. Copenhague. 9 Ser. IV. p. 169. Pl. IV. 3—5.

As mentioned in my paper of 1932 this species is quite common at depths of ca. 20—60 meters on the coastal plateau off Jamestown, particularly where the bottom is covered by the sponge *Chondrosia plebeia*. Also on the rocks about low water mark it is sometimes found.

This species, which is known only from St. Helena, is quite distinct from the West Indian *Eucidaris tribuloides*, but has evidently originated from the latter, the larvæ of which must have been transported across the ocean to St. Helena and there have developed into this new, characteristic form.

Tretocidaris spinosa Mrtsn.

Tretocidaris spinosa Th. Mortensen. 1903. "Ingolf" Echinoidea. I. p. 17, 28 Pl. X. 10, 11, 16.

Tretocidaris spinosa Koehler. 1908. Ast. Oph. & Ech. Exped. Antarct. Ecossaise ("Scotia"), p. 300. Pl. XVI. 163, 164.
— — H. L. Clark. 1925. Cat. Rec. Ech. Brit. Mus. p. 20.
— — Mortensen. 1928. Monogr. Echinoidea. I. p. 317, Pl. XXXIII. 1—3; XXXIV. 1—2; LXVII. 9; LXXI. 15; LXXXII. 32—36.
— — Mortensen. 1932. New Contrib. Knowl. Cidarids. p. 154. Pl. IV. 6—12; 15; XIII. 3.

Like *Eucidaris clavata* this species is quite common on the coastal plateau off Jamestown, but mainly at depths of 50—60 meters, and especially where the bottom is covered with *Arca Bouvieri*, overgrown by *Cirripathes*.

This species, which occurs also at Ascension, is nearly related to the West Indian *Tretocid. Bartletti* (A. Agassiz), from which it may not improbably have originated.

Cidaris cidaris, var. *meridionalis* Mrtsn.

Th. Mortensen. 1928. Monogr. Echinoidea. I. p. 298. Pl. XXXI. 8—10; LXVII. 5; LXXII. 20—21.
— 1932. New Contrib. Knowl. Cidarids, p. 154.

6 specimens dredged omboard the "Dana" 2 miles E. of Bay Point, 480 meters (24. II. 1930).

The colour of the live specimens was in general a light yellowish, the primary spines a faint pinkish; the small spines on the apical system with a small dark spot at the base. The point of the tubefeet dark brownish; also the genital openings dark.

These specimens thus are somewhat lighter coloured than in the types of the variety (from the Bay of Biscay). On the whole this variety is not very well marked.

Diadema antillarum, var. *ascensionis* Mrtsn.

Diadema ascensionis Th. Mortensen. 1909. Echinoidea d. deutschen Südpolar Exped.; p. 55. Taf. VII. 10; XVI. 1, 4, 8, 16—17, 21—23.
— *antillarum* Koehler. 1914. Beiträge z. Kenntnis d. Meeresfauna W. Afrikas. Echinoderma. I. p. 218. Pl. XI. 12, 13, 15; XV. 64—72.
— — H. L. Clark. 1925. Catalogue Recent Sea-Urchins. Brit. Mus. p. 42.

Diadema antillarum Mortensen. 1927. Echinides du "Travailleur" et du "Talisman". p. 25.

Several specimens were taken off the pier of Jamestown at a depth of 4—5 m; further, off Old Woman's Valley at the same depth. Off Egg Island, ca. 30 meters, 1 specimen. Also at Ascension I found some specimens in rock pools, during the half hour I was allowed to spend ashore there.

Evidently the species is quite common at St. Helena at least on the lee side of the island. It was found in various sizes, up to ca. 70 mm h. d.; the smallest ones were ca. 35 mm h. d. Quite young ones were not observed. The specimens found at Ascension were much smaller, the smallest 17 mm h. d.

The study of the rich material now at hand has convinced me that I was quite justified in regarding (Op. cit. 1909) the specimens from Ascension as distinct from the West Indian *Diadema antillarum*. The very characteristic shape of the tridentate pedicellariæ, as figured in my work quoted (1909, Taf. XVI. fig. 16), I find to be quite constant in the specimens from St. Helena (and Ascension); they occur in great numbers, scarcely surpassing a size of 0.8 mm length of head.

Whereas this character of the tridentate pedicellariæ at once distinguishes the St. Helena-Ascension form from the West Indian *Diadema antillarum*, I must agree that in the characters of the test the two forms are alike. Also the colour is essentially the same. In the St. Helena form I noticed the colour of the live specimens to be: a blue ring on the apical system, and a blue stripe downwards in the interambulacrum, bifurcating, one branch continuing downwards along each side of the interambulacrum; there is also a blue ring round the base of the primary spines. No distinct white spot in the naked upper part of the interambulacrum. The anal tubus (which is, of course, well developed) entirely black. In some specimens the blue stripes are so weak as almost totally to disappear. — This colour corresponds very well to that of *Diadema antillarum*, according to own observations on live specimens of the latter (in 1906).

Also the colour of the spines is as in *D. antillarum*, generally black, but sometimes a number of the spines are white. In the young specimens from Ascension the spines are conspicuously banded, black and white.

Whereas thus of the characters hitherto noted only that of the tridentate pedicellariæ holds good, there is one more character distinguishing the St. Helena form from *D. antillarum*, viz. that the spines

are in general decidedly thicker and more robust in the former than in the West Indian species.

In view of the fact that the tridentate pedicellariæ afford one of the main distinguishing characters within the genus *Diadema*, the very distinct difference in the shape of these pedicellariæ existing between those of the West Indian and the St. Helena-Ascension form forbids simply uniting this latter form with the West Indian *Diad. antillarum*. Whether we then regard it as a variety only of *D. antillarum* or as a distinct species does not matter, the main thing is that they are kept apart.

I will take the opportunity of stating here that I think the *Diadema* of the Canaries, Madeira, Cape Verde should likewise be distinguished as a separate variety of *D. antillarum*. It is not identical with the var. *ascensionis*, but rather nearer *D. antillarum*. However, I shall not at present enter on a discussion of this matter.

Echinus atlanticus Mrtsn.

Echinus atlanticus Th. Mortensen. 1903. Ingolf Echinoidea. I. p. 101. Pl. XVIII. 17; XIX. 37.
— — H. L. Clark. 1925. Cat. Rec. Ech. Br. Mus. p. 110.

2 miles 49 E. of Long Range Point, St. Helena. 520—375 meters. 1 large specimen, dredged onboard the "Dana", 24. II. 1930.

The species was hitherto known only from off Ascension; its occurrence at St. Helena is only what was to be expected, but, all the same, it is a matter of satisfaction to have thus actually found it there.

The specimen, which measures 64 mm h. d., is nearly white.

A full description of this species with figures, I expect to give in Part III of my Monograph of the Echinoidea.

Pseudoboletia atlantica H. L. Clark.

Pseudoboletia maculata Koehler. 1908. "Scotia" Echinoderms, p. 305. Pl. XV. 139—142; XVI. 165.
— *atlantica* H. L. Clark. 1925. Cat. Rec. Ech. Brit. Mus. p. 131.

Several specimens were dredged off Sea-Cow Cove, St. Helena, ca. 20 meters, on a bottom with small stones covered with *Lithothamnion*, in places also with loose *Furcellaria*-like algæ. On this locality they evidently occurred in great numbers, whereas the species was otherwise found only very rarely and mostly only fragments of dead tests.

It is a very peculiar fact that only large specimens were found, all ca. 80 mm h. d.

The colour varies rather much, from pure white, with the spines only very indistinctly banded, to greenish, with the spines very conspicuously banded. The naked test of a faintly greenish or pinkish tint, with more or less distinct darker spots arranged in concentric bands on the upper side.

The pedicellariæ are very numerous, particularly in the ambulacral and interambulacral median space on the upper side, and they are in the live specimens in a constantly waving movement, recalling a corn-field waving for a gentle breeze.

It covers itself with stones and algæ, quite as does *Tripneustes* and several other littoral Echinoids.

As I expect to deal more in details with this species, together with the other *Pseudoboletia*-species, in Part III of my Monograph of the Echinoidea, I shall here content myself with the above remarks, putting off also the photographic figures of the species till that work.

The species is known only from Ascension and St. Helena.

Echinometra lucunter (Linn.).

Echinometra subangularis A. Agassiz. 1872. Revis. of Ech. p. 283, Pl. X. a. 2—4.
— *acufera* Mellis. 1875. St. Helena, p. 219.
— *lucunter* Th. Mortensen. 1903. "Ingolf" Echinoidea I. p. 128.
— *subangularis* Koehler. 1908. "Scotia" Echinod. p. 304.
— — Cunningham. 1910. Mar. Fishes & Invertebr. of St. Helena. P. Z. S. p. 125.
— *lucunter* Koehler. 1914. Beitr. z. Kenntn. d. Meeresfauna W. Afrikas. Echinod. I. p. 249; Pl. XV. 83—84.
— — H. L. Clark. 1925. Cat. Rec. Ech. Br. Mus p. 143.

Common on the rocks all along the lee side of St. Helena, and probably also on the windward side, wherever the rocks afford irregularities among which they can maintain themselves. At least I have observed it at Prosperous Bay and Lots Wife's Pond. Also at Ascension I took some specimens.

Though I am naming it here, in accordance with Koehler and H. L. Clark, *Ech. lucunter*, I do not feel quite convinced that it is really simply identical with the West Indian species. It is, on the whole, less elongate than the typical *Ech. lucunter*, and there are also other minor differences — e. g. the peculiar fact that the colour is

constantly black, not now black, now brown, as in the West Indian form. But, as a thorough revision of the *Echinometra*-species is very much needed, I shall not at present take up a definite position towards the question, whether these mid-atlantic specimens perhaps rather represent a separate species or variety, like the mid-atlantic *Diadema*.

No doubt it is the present species which was mentioned by Wallich (Ann. Mag. Nat. Hist. 3. Ser. X. 1862. p. 441) under the name *Echinus lividus* as found at St. Helena. By a superficial examination it has, indeed, much resemblance with *Paracentrotus lividus*, which species does, however, not occur at St. Helena.

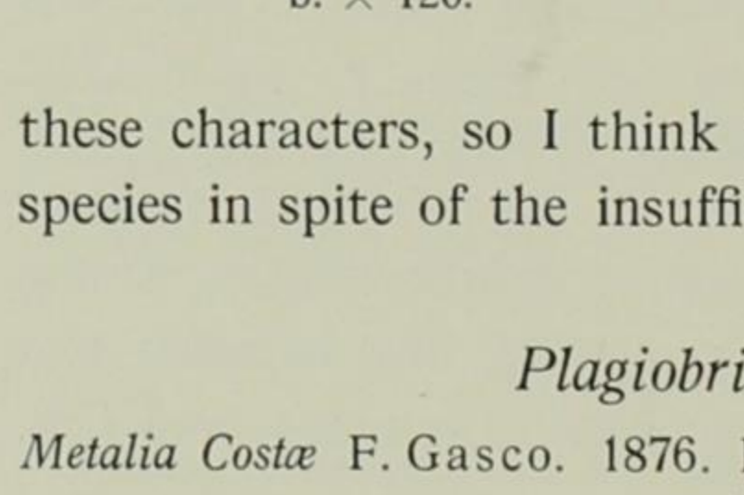
Echinocardium connectens n. sp.

Some fragments of a specimen of an *Echinocardium* were dredged (5. III. 1930) off Egg Island, St. Helena, at ca. 40 meters, on a bottom of small stones with *Lithothamnion*. Also off Lemon Valley, ca. 50 meters, some fragments of a dead test were taken.

Although the fragments are much too incomplete for allowing a full description of the species, they suffice for proving that we have here a very distinct new species of the genus *Echinocardium*, and a very interesting species too, forming a connecting link between two so rather distantly related species as *Ech. cordatum* (Pennant) and *Ech. pennatifidum* Norman.

The shape of the test must be rather like that of *pennatifidum*, the frontal ambulacrum being not sunken or, at most, very slightly so. (Length of the specimen ca. 40 mm). The pores within the fasciole are large, close set, very different from the tiny, distant pores of *pennatifidum;* they more recall those of *Ech. cordatum*, but they are placed in a single, regular series, not in an irregular double series as in the latter species. There appear to be no large spines above the ambitus. Characters of the labrum and the subanal fasciole cannot be made out. Of pedicellariæ only the triphyllous and a small tridentate form are found. The triphyllous pedicellariæ (Fig. 28. a.) are of the type found in *Ech. cordatum*, with a series of inner teeth on the blade, a structure hitherto known only in *Ech. cordatum*. The tridentate pedicellariæ (Fig. 28. b.) are not characteristic; that the large tridentate, as well as the globiferous pedicellariæ will offer good specific characters we may well infer — but, unfortunately, none of them are found on the fragments preserved. A peculiar feature is to be observed on

several of the triphyllous pedicellariæ, the neck and head being much swollen and dark brownish. On a microscopical examination they are found to be filled with very small yellowish or dark brown bodies — in all probability a parasitic plant-organism. The valves of these pedicellariæ are not dissolved or in any way abnormal in shape.



a. b.

Fig. 28. *Echinocardium connectens* n. sp. Valve of triphyllous (a) and tridentate pedicellaria (b). a. × 360; b. × 120.

It is very unfortunate that only such poor fragments have been found that none of the other characters of the species can be made out. But those characters which could be ascertained are sufficient to show that this is a quite distinct species, and I have no doubt that it will be quite possible to recognize the species from these characters, so I think it fully justifiable to establish this new species in spite of the insufficient material available.

Plagiobrissus Costæ (Gasco).

Metalia Costæ F. Gasco. 1876. Descrizione di alcuni "Echinodermi" nuove o per la prima volta trovati nel Mediterraneo. Rendic. Acc. Sci. Napoli. XV. 2. p. 4. fig. 1—2.

— — Th. Mortensen. 1913. Die Echiniden d. Mittelmeeres. Mitt. a. d. Zool. Stat. Neapel. XXI. p. 32. Taf. III. 1—6; V. 1—4, 6—10, 12—17, 19, 21, 24—27.

Plagiobrissus Costæ H. L. Clark. 1917. Hawaiian a. o. Pacific Echini. Echinoneidæ ... Spatangidæ. Mem. Mus. Comp. Zool. XLVI. p. 208.

— — Th. Mortensen. 1927. Echinides du "Travailleur" et du Talisman". Arch. Mus. Paris. 6. Sér. II. p. 32.

Some fragments of some dead and of one or two living specimens were dredged off Egg Island, St. Helena, at a depth of ca. 40 meters, on a bottom of coarse gravel and small stones with *Lithothamnion*.

I have succeeded in putting together some of the fragments so as to get almost the complete dorsal side of one large test, ca. 100 mm long. The resemblance with specimens from the type locality off Napoli is so complete that there can be no doubt of their identity. On the fragments of the live specimen(s) I have found only small tridentate,

ophicephalous and triphyllous pedicellariæ. The tridentate pedicellariæ are rather intermediate between the two forms figured in Fig. 25 and 27, Taf. V. of my paper of 1913.

The species being now known from the Mediterranean, from off the N.W. Coast af Africa, and from St. Helena, it is evident that it must be distributed all over the N. E. Atlantic, at least from Gibraltar to St. Helena, being one of the species characteristic of the area.

IV. Holothurioidea.

Euapta lappa (Müller)(?).

A fragment of a large Synaptid was dredged off Egg Island, St. Helena, on *Lithothamnion*-bottom, ca. 40 meters, (5. III. 1930). Unfortunately it is only a piece of the middle part of the body and thus it is impossible to identify the species with certainty, but according to Mr. S. Heding, who has kindly examined the fragment for me, it is an *Euapta*, and quite probably the common West Indian *E. lappa* (Müller), not *Euapta tobagoensis* Heding.

At any rate, it is an interesting fact that the existence at St. Helena of a large Synaptid has herewith been proved.

Holothuria farcimen Selenka.

Selenka. 1867. Beitr. z. Anatomie u. Syst. d. Holothurien. Z. wiss. Zool. Bd. XVII. p. 330, Taf. XVIII. 65.
Lampert. 1885. Die Seewalzen, p. 68.
Théel. 1885. "Challenger" Holoth. II. p. 220.
R. Perrier. 1902. Holothuries du "Travailleur" et du "Talisman", p. 417, Pl. XV. 15—27.

Some specimens taken on the rocks off the pier at Jamestown, II. 1930. Also in rock pools at Prosperous Bay and Lots Wife's Pond some few specimens were found. Finally, two specimens were dredged off Egg Island, St. Helena, on *Lithothamnion* bottom, ca. 40 meters, 5. III. 1930.

To the very careful description of this species given by R. Perrier (Op. cit.) I have only little to add.

The dorsal papillæ are stated to be placed on top of large, slightly prominent tubercles, which are almost contiguous. I find considerable variation to obtain in this respect in the St. Helena specimens. On

the dorsal side the papillæ mostly issue directly from the skin, towards the sides the tubercles may become gradually more distinct, and at the edge they may be quite conspicuous and almost contiguous; but in some specimens there is hardly a trace of such tubercles. Probably these differences are in the main due to preservation.

Perrier states the base of the tubercles to be whitish and the interspaces between the tubercles to be a lighter brown. This is not seen in the St. Helena specimens, which are all of a uniform brown colour, as described by Selenka, but some are of a distinctly lighter shade than others. There is thus some variation in regard to the colour.

As to the anatomy it should be remarked that I find, in the one

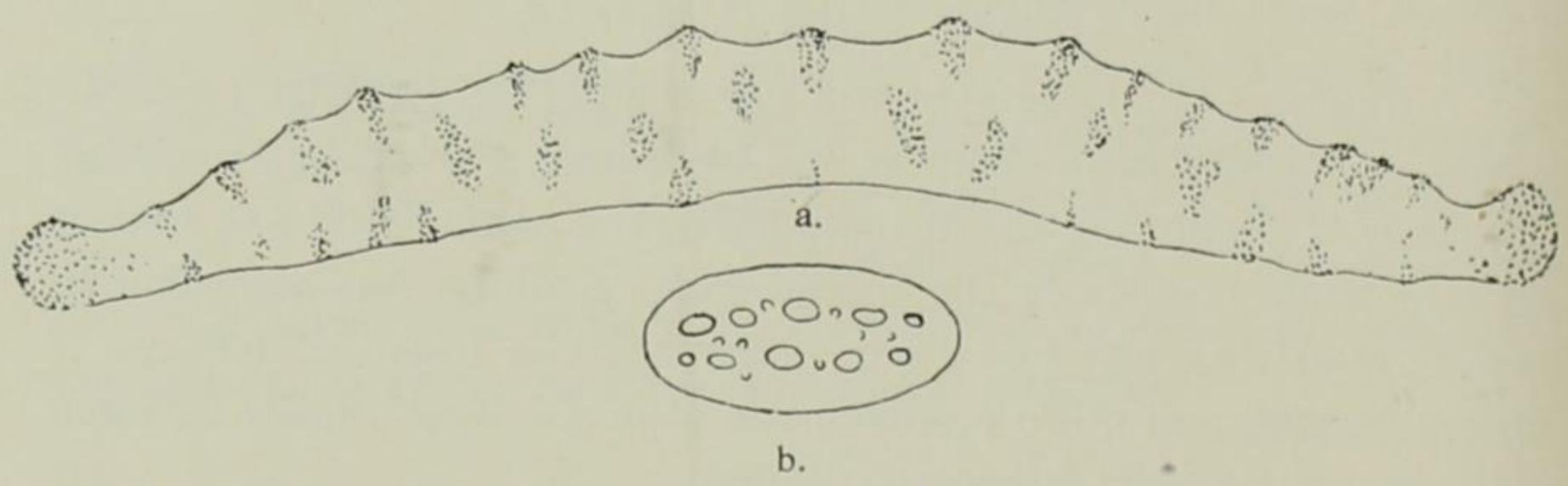


Fig. 29. *Holothuria farcimen* Selenka. Large, bow-shaped spicule from tentacles (a); button (b). × 165.

specimen opened, only one Polian vesicle, not two as found Perrier. The Cuvierian organs are small and thin, very numerous. I observed them to be discharged as short, ca. 1 cm long pieces, connected by very thin threads, so as to form a close net, like a spider's web, evidently a very active means of defence.

The calcareous deposits are, on the whole, very well figured by Perrier; I would only add that the buttons have not rarely some few irregularly scattered small knobs (Fig. 29. b.) and that the large bow-shaped spicules of the tentacles do not have quite the appearance seen in Pl. XV. Fig. 26 of Perrier's report; I find them as shown in Fig. 29. a.

The species was till now known only from the Azores.

Explanation of the Plates.

Plate XX.

Figs. 1—3. *Astropecten Sanctæ Helenæ* n. sp. Adult specimen, aboral (1) and oral side (2). Younger specimen, aboral side (3).

- 4—6. *Narcissia trigonaria*, var. *Helenæ* n. var. Adult specimen, oral (4) and aboral side (5). Young specimen, aboral side (6).

- 7—12. *Luidia aciculata* n. sp. Specimen with regenerating arms, aboral side (7); aboral (8) and oral side (9) of disk, arms broken. Parts of arms, aboral (10, 12) and oral side (11).

All figures natural size.

Plate XXI.

Figs. 1—2. *Moiraster magnificus* (Bell). Adult specimen, aboral side (1); young specimen, from the Stockholm Museum, oral side (2).

- 3—6. *Astropecten variegatus* n. sp. Adult specimen, oral (3) and aboral side (4); younger specimen, aboral (5) and oral side (6).

All figures natural size.

Plate XXII.

Fig. 1. *Moiraster magnificus* (Bell). Adult specimen, oral side.

- 2—4. *Linckia formosa* n. sp. Aboral side (2—3), oral side (4).
- 5—7. *Ophiothrix roseo-coerulans* Grube. Aboral side.

All figures natural size.

Separate copies ready from the press 24. X. 1933.

Papers from Dr. Th. Mortensen's Pacific Expedition 1914—16.

LXVII.

A small Collection of Crinoids from St. Helena.

By

Torsten Gislén.

With Plate XXIII.

Through the courtesy of my friend Dr. Th. Mortensen of Copenhagen I have been offered the opportunity of studying a small, but very interesting, series of Crinoids from St. Helena. My thanks are due to Dr. Mortensen, who did not only place the material at my disposal, but also in every way has facilitated my work by providing me with forms from different parts of the globe necessary for comparison.

It has been evidenced here that two forms of *Tropiometra* from E. America and Africa, earlier generally treated under two different names, must be regarded as belonging to the same species.

Moreover, the collection contains two new species. One has to be referred to *Crinometra*, a genus earlier regarded as endemic of the West Indies, but now, thanks to an inevitable redefinition of the genus, extending via St. Helena to Kermadec and Fiji. The second new species is a stalked crinoid of the genus *Monachocrinus* presenting characters of the BB which are unique among the *Bathycrinidæ*. In some respects it is the most primitive type of a Bathycrinid so far reported.

A stalked young, possibly of *Crinometra*, is also figured.

Tropiometra carinata (Lam.)
syn. *Tr. picta* (Gay).

Text-figs. 1—3.

From 1) James bay, St. Helena, 36 m., stone and shell. 29. I. 1930. 1 sp. (Sp. 1).
2) Jamestown, St. Helena, rocky coast. 1. II. 1930. 4 spp. (Spp. 2—5).
3) Jamestown, St. Helena, 36 m., sponges. 4. II. 1930. 3 spp. (Spp. 6—8).
4) Sea-cow cove, St. Helena, 27 m., stone, gravel. 11. II. 1930, 1 sp. (Sp. 9).
5) Prosperous Bay, St. Helena, rocky coast. 17. II. 1930. 9 spp. (Spp. 10—18).

Sp. 1. Dorsal cirrus-free area of Cd. 4.5 mm. C. ± XX 20—21; 15—17 mm. Stout arm-bases. Arm-tips broken. Colour purple.

Sp. 2. Dorsal cirrus-free area 3 mm. C. XXXVIII 24—27; 20—22 mm. Arms 80—90 mm, weakly carinated. P_2 25; 11 mm. Colour dark purple.

Sp. 3. Dorsal cirrus free area 6 mm. C. XXII 21—25; 20—22 mm. Arms ± 100 mm. Brr in the outer part of the arm with a small eminence distally. P_1 13; P_2 15; P_3 14; 8 mm. Colour purple blotched with yellowish.

Sp. 4. Dorsal cirrus-free area 7 mm. C. XXIX 25—27; ± 20 mm. Arms ± 80 mm. Stout arm-bases. Weak carination of arms. P_1 21; P_3 21; ± 10 mm.

Sp. 5. Dorsal cirrus-free area 3 mm. C. XIII 20—21; 14 mm. Arms 40 mm. Young specimen. Colour blotched purple and yellow.

Sp. 6. Dorsal cirrus-free area 6 mm. C. XLIII 21—26; 22—26 mm. Arms 170—180 mm. P_1 23; 13 mm; P_2 27; 13 mm; P_3 24; 13 mm; P_8 24; 11 mm. All proximal pinnules smooth and angular. Colour blotched as before, especially on the outer part of the arms.

Sp. 7. Dorsal cirrus-free area 5 mm. C. XXXVII 25—26; 20—21 mm. Arms 75 mm, purple.

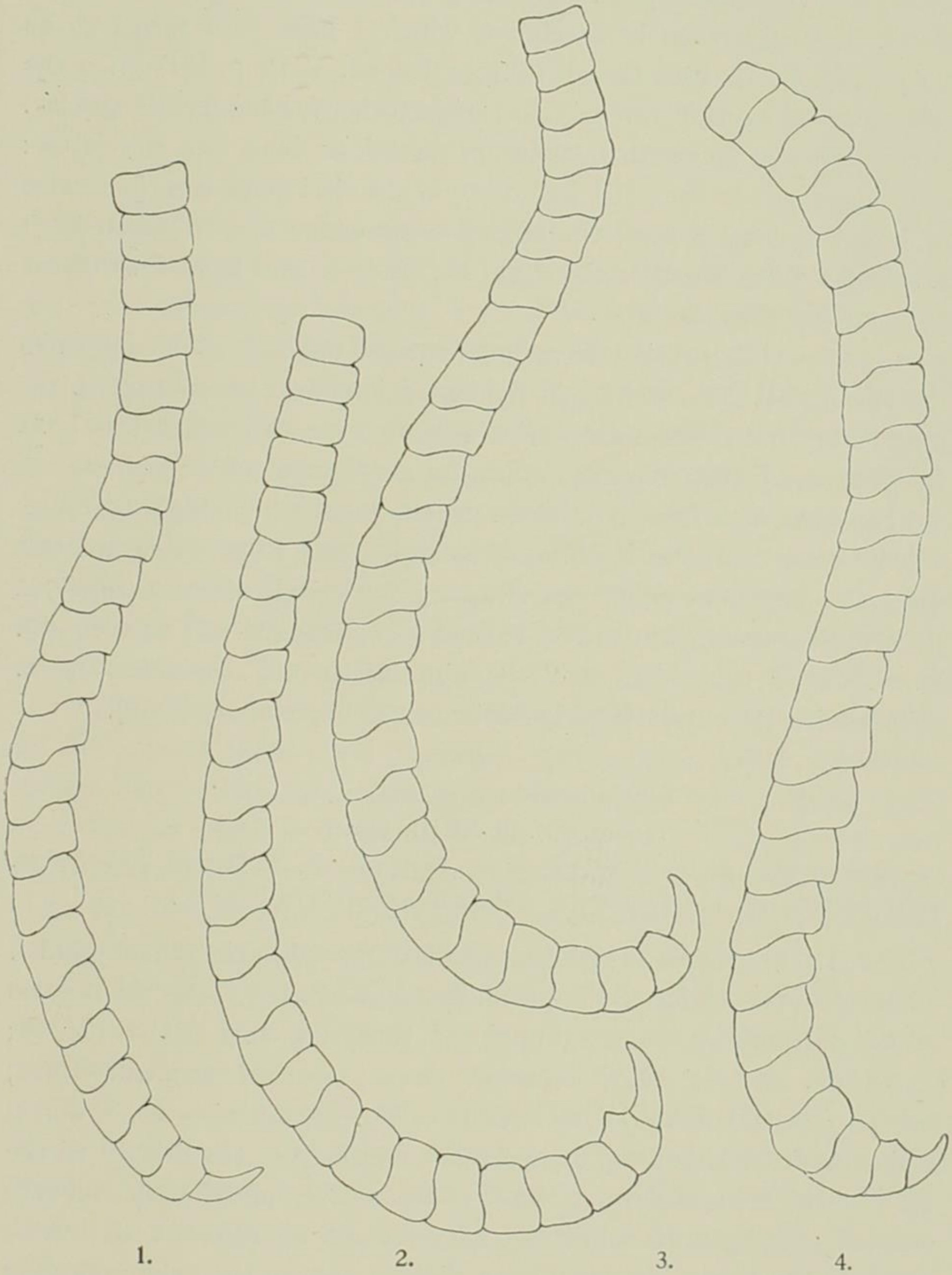
Sp. 8. Dorsal cirrus-free area 3 mm. C. XXXIII 26—28; 18—25 mm. Arms ± 80 mm purple.

Sp. 9. Dorsal cirrus free area 6 mm. C. XXIV 22—27; 18—22 mm. Arms rather much broken. Colour blotched in the outer part.

Spp. 10—18. Largest specimen: C. XXXI 28—29; ± 27 mm. Arms 140 mm. Smallest specimen: C. XXIV; 21. Arms about 70 mm. Brachials with a weak median carination and a small, often

yellow-coloured eminence on the distal part of each Br. This eminence in smaller specimens is often lacking.

Through the courtesy of Dr. Mortensen I have been able to compare these specimens with specimens from Tobago, West India,



1. 2. 3. 4.

Figs. 1—3. *Tropiometra carinata*, cirri. 1) From Tobago, 22 cirrals; 2) From St. Helena, 25 cirrals, 3) From Portuguese East Africa, 25 cirrals; 4) Cirrus of *Tr. encrinus*, 8/1.

Portuguese East Africa, and Zanzibar and examples of *T. encrinus* (determined by A. H. Clark).

A. H. Clark in 1911 (Proc. U. S. Nat. Mus. Vol. 40, p. 36) states "*Tropiometra encrinus*, while having the same number of cirrus-segments as *T. carinata* and *T. picta* has proportionally longer and stouter cirri". This difference in specimens which I have seen seems to be valid (Fig. 4). In 1918 Clark (Siboga Exped. 42 B, p. 131) gives the difference between *T. carinata* and *picta* to be, for the former species: cirrus-segments more than twice as broad as long, for the latter: cirrus-segments in the outer half or $^2/_3$ of the cirri much less than twice as broad as long. I refer the reader to drawings of cirri taken from specimens from West India, from St. Helena, and from Portuguese East Africa (Figs. 1—3).

I must confess that I have failed to get out any difference as to the proportion of the cirrals. As the carination of the arms in specimens from West India and East Africa seems to me to be identical I (as H. L. Clark) must regard *T. picta* as a synonym of *T. carinata*.

The specimens from St. Helena usually have a little higher number of cirri than examples from other localities, but I cannot regard this difference even as a varietal character. The cirrals are also usually a little more numerous in the St. Helena specimens (24—27 or even 29). A. H. Clark, however, mentions a specimen of *T. carinata* from S. Africa with 28 cirrals (Smiths. Misc. Coll. 61, No. 15, p. 39).

Crinometra transversa n. sp.

Text-fig. 5(?). Pl. XXIII. Figs. 1—4.

From 2 miles south, 49 east for Long Range Point, St. Helena, 280—360 M. Hard bottom. 24. II. 1930. 2 spp. Dredged onboard the "Dana".

Sp. 1. Cd a thick disk, rather much deepened in the dorsal middle. The free dorsal surface 3 mm, granulated and pitted. Interradial parts of Cd covered by stout and pointed tubercles. C. XXXVI 17—18; ± 23 mm, in XV—XX crowded rows. 1st—3rd segment short, 4th L = br, 5th L = $1^1/_2$ br, 6th L = $1^1/_3$ br, 8th L = br. A dorsal eminence from about the 8th segment which from the 9th up to the 12th cirral is transformed into a transverse, indistinctly bilobate crista. Opposing spine similarly transverse and sometimes with a weak notch in the crista. Terminal claw slightly shorter than the preceding segment which is L = $1^1/_3$ br.

Arms XXIV, 150 mm; partly broken. II Brr 2 (9 cases), 4 (3 + 4) (1 case). III Brr 2 (4 cases). Example of arm-division:

$$\text{I } 1\text{—}2 \begin{cases} \text{II } 1\text{—}2 \begin{cases} \text{Br } 1 \pm 2 \ldots \\ \text{III } 1\text{—}2 \begin{cases} \text{Br } 1 + 2 \ldots \\ \text{Br } 1 + 2 \ldots \end{cases} \end{cases} \\ \text{II } 1\text{—}2\ 3 + 4 \begin{cases} \text{III } 1\text{—}2 \begin{cases} \text{Br } 1 + 2 \ldots \\ \text{Br } 1 + 2 \ldots 16 + 17 \end{cases} \\ \text{Br } 1 \pm 2 \ldots 16 + 17 \end{cases} \end{cases}$$

In other ramifications there is often Br 1—2 3 + 4.

RR scarcely visible except in the interradial corners where there are some projecting tubercles. I Br 1 very short, covered by long tubercles which proximally and distally fuse to serrate flanges along the borders of the ossicle. I Ax with a high medio-dorsal tubercle and the flanged proximal and distal borders provided with 3 to 4 stout eminences on each side of the median line both proximally and distally. In this way the margin of the ossicle is bordered by a more or less distinct and everted denticulation. Moreover, there is a median dorsal tubercle or crest. Otherwise, however, the ossicle is smooth. A crest, well set off, also appears on II Brr 1—2 which have generally everted margins and sometimes also marginal tubercles. On Br 1 and 2 there is a medio-dorsal knob and in some rays also slightly everted margins. In Br 3 and 4 there may, moreover, appear some extra submedian knobs. The median tubercle is later transformed into a dorsal spine or carination which is developed in the distal part of the ossicle. This tubercle is traceable only on a short way of the arm. The distal margin of the Brr soon becomes a little overlapping and more or less denticulate. Though in rather close contact latero-basally the arm-bases are only slightly or not at all wall-sided. Second syzygy at about Br 16 to 20. Distal syzygies with an interval of 2—17, usually ± 10 oblique articulations.

P_1 27—28; ± 13 mm; P_2 24; 14 mm; P_4 19; 12 mm; P_5 13; ± 9 mm; P_8 15; 9 mm; P_{13} 15; 9 mm. Distal pinnules a little longer again. Proximal segments short, the distal ones L = $1^1/_3$ br (also in proximal pinnules). From P_5 or so the 3rd—5th segments are somewhat expanded.

Disk thrown off; closely granulated by small calcareous granules.

Colour yellowish except in some of the basal arm-parts where it is blackish (to Br 1 usually).

Sp. 2. Cd flattened dorsally, with free dorsal surface closely pitted. Rather high crests inter-radially. C. thrown off, ± XX cirrus-sockets arranged in X groups.

Arms XXI, 60 mm. II Br 4 (7 cases), 2 (3 cases), III Br 2 (1 case). Carination of arm-bases much less than in sp. 1, especially so on I Br 1 which is well visible. Its margins are a little everted, but the tubercles are rather insignificant.

I Ax with a well marked median crest and one or two submedian tubercles, the borders are a little everted. There is a high carina also on II Br 1—2. Following ossicles provided with rounded high median knobs. Proximal syzygies usually Br 1 + 2 after a II Br 4 axillary and Br 1 ± 2 3 + 4 after a II Br 2 axillary. P_{II} ± 20; ± 9 mm. P_{Dist} ± 10; 5 mm.

The arm-bases are dark-coloured. Yellowish regenerates from Br 1 or 3.

This new species as to the arm-sculpture resembles some of Hartlaub's *brevipinna* varieties: *decora*, *gracilis*, *tuberosa*, and A. H. Clark's *insculpta*. Still, the middle pinnules of the arms are proportionally longer than in most of the other Crinometras, the wall-sidedness of the basal arm-parts and the carination of proximal pinnules is not at all or only slightly developed. The medio-dorsal carina of the basal arm-parts is more sharply set off than in any of the forms described earlier. But above all, the transverse crest of the cirrals distinguish this species at once from all the other species of *Crinometra* so far described.

When in 1909 A. H. Clark established his genus *Crinometra* (Proc. Biol. Soc. Washington, Vol. 22, p. 22) he distinguished it from the related genus *Pachylometra* by the very long proximal pinnules, which should be very strongly carinate, and by the proportionately short middle and distal pinnules, "not quite half as long as P_1". The genital pinnules should be more abruptly expanded than in *Pachylometra*. Besides, there should appear in *Crinometra* overlapping brachials and usually tuberculation of the basal arm-parts. In 1918 (Siboga Exp. 42 B, p. 171) he considers the difference of length between proximal and middle pinnules (together with proximal carination of the former) to be the chief distinguishing characteristic between *Crinometra* and

the rest of the *Charitometridæ*. In fact, both the overlapping of the brachials, the expansion of the pinnules and the tuberculation of the basal arm-parts are so variable or vague characters within *Crinometra* that they certainly cannot be used for generic characterization. Now, it is the question if the characteristic: middle pinnules not quite half as long as P_1, could be used as distinguishing mark for *Crinometra*.

When studying Hartlaub's treatise upon the "varieties" of *Crinometra brevipinna* (1912 Mem. Mus. Comp. Zool. Vol. 27) we find the following statements. Var. *elegans* has P_1 10—12 mm, pinnules of the middle arm-parts 7 mm (p. 332), and concerning the var. *diadema* P_1 8 mm; pinnules of middle arm-parts (in spite of broken tips) 5 mm (p. 339). I have found the same proportion in a specimen of *Crinometra insculpta* borrowed from Copenhagen (determined by A. H. Clark): P_1 11.5 mm, shortest middle pinnules 7 mm (cf. also the specimens described above). On the other hand short middle pinnules, being half as long as the proximal ones, may occur in *Charitometridæ* which do not fall within *Crinometra* (cf. *Perissometra aranea*, *carinata*, *Monachometra mortenseni*, Gislén 1927, Vid. Medd. Dansk Naturh. Foren. Vol. 83, p. 33 ff.). It is clear that this characteristic cannot be used alone for distinguishing *Crinometra*. It might be asked whether it could be used together with other distinguishing marks. The carination of the proximal pinnules may be a rather good characteristic, but in some forms referred to this genus it is weakly developed and very insignificant (e. g. *granulifera* and specimens described above). The tuberculation in some forms is very characteristic and apparent, but in other forms lacking. Either, therefore, some forms with smooth arm-bases should be excluded from the genus (e. g. Clark's "*pulchra*" cf. Fig. 682, Monograph 2, 1921) or this characteristic should not be used as a generic distinguishing mark. As pointed out earlier the tuberculation of the arm-bases seems to me to have a low systematic importance only.

The high number of pinnulars in proximal pinnules (20—40) as compared with those of the middle ones (10—15) may be generically important, but similar conditions seem to occur also in some *Pachylometra* and *Perissometra*. However, the length of the middle pinnules does not seem to decrease in the last mentioned case. It is to be regretted in this connection, that our knowledge of proportion of proximal

pinnules is very scanty especially as regards the more recently described species.

As the comatulid described above, as well as some of the forms of *Crinometra* which are known earlier, cannot be separated as a group of species which can possibly be distinguished from other *Charitometridæ*, either the genus mentioned has to be given up or to be given an emended diagnosis. Facts seem to speak in favour of the latter solution. It may thus be possible to distinguish the genus in the following manner.

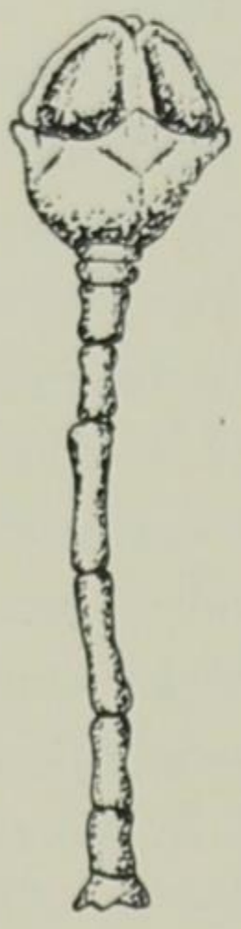


Fig. 5. Pentacrinoid, possibly of *Crinometra transversa*. 16/1.

Crinometra is a genus of the *Charitometridæ* where the Cd is a thick disk; C. are > XX 15—25, cirrus-sockets (in mature individuals) arranged in about 15 crowded columns. I Br 1 is very short, II Brr are 2 or 4, III Brr, when occurring, are 2, developed internally. Br 1 and 2 united by a syzygy at least after a II Br 4 or III Ax. P_1 or P_2 are the longest pinnules of the arm, with more than 20 segments. Pinnules then rapidly decreasing in length, the pinnules of the middle arm-part being about $^3/_4$ or $^1/_2$ of the proximal ones. Genital pinnules moderately expanded over a number of segments.

With this limitation also *Pachylometra inæqualis* must be included in the genus (cf. P. H. Carpenter 1888, text-fig. 5, p. 246 and Pl. 51) and perhaps *P. lævigata* too. *P. distincta*, in 1909 by A. H. Clark made the type of *Pachylometra*, in reality is a *Crossometra* (a genus created in 1916) as pointed out by me in 1928. (Ark. f. zoologi, Stockholm. Bd. 19 A, No. 32, p. 8). *Crossometra*, therefore, becomes a synonym of *Pachylometra*.

There is a small Pentacrinoid from 2 miles off Bay Point, St. Helena, 480 M. 24. II. 1930 (Dredged onboard the "Dana"); Fig. 5.

The calyx is chiefly composed of orals and basals. Small radials appear in the corners between the OO and BB. The orals have everted lateral borders. There are two short proximal stem-joints, the 2nd being wider than the stem. 3rd and 4th joints are apparently double, L = $1^1/_2$—2 br. 5th and 6th joints very long, L = 4—3 br. 7th joint much shorter, 8th L = $1^1/_3$ br; 9th joint a short disk attached to the substratum (dead "*Lophohelia*").

As no comatulid in the vicinity of St. Helena is known from this

depth except *Crinometra transversa* the young may be a larva of this form. The possibility of a species of the *Thalassometridæ* occurring here cannot, however, be denied.

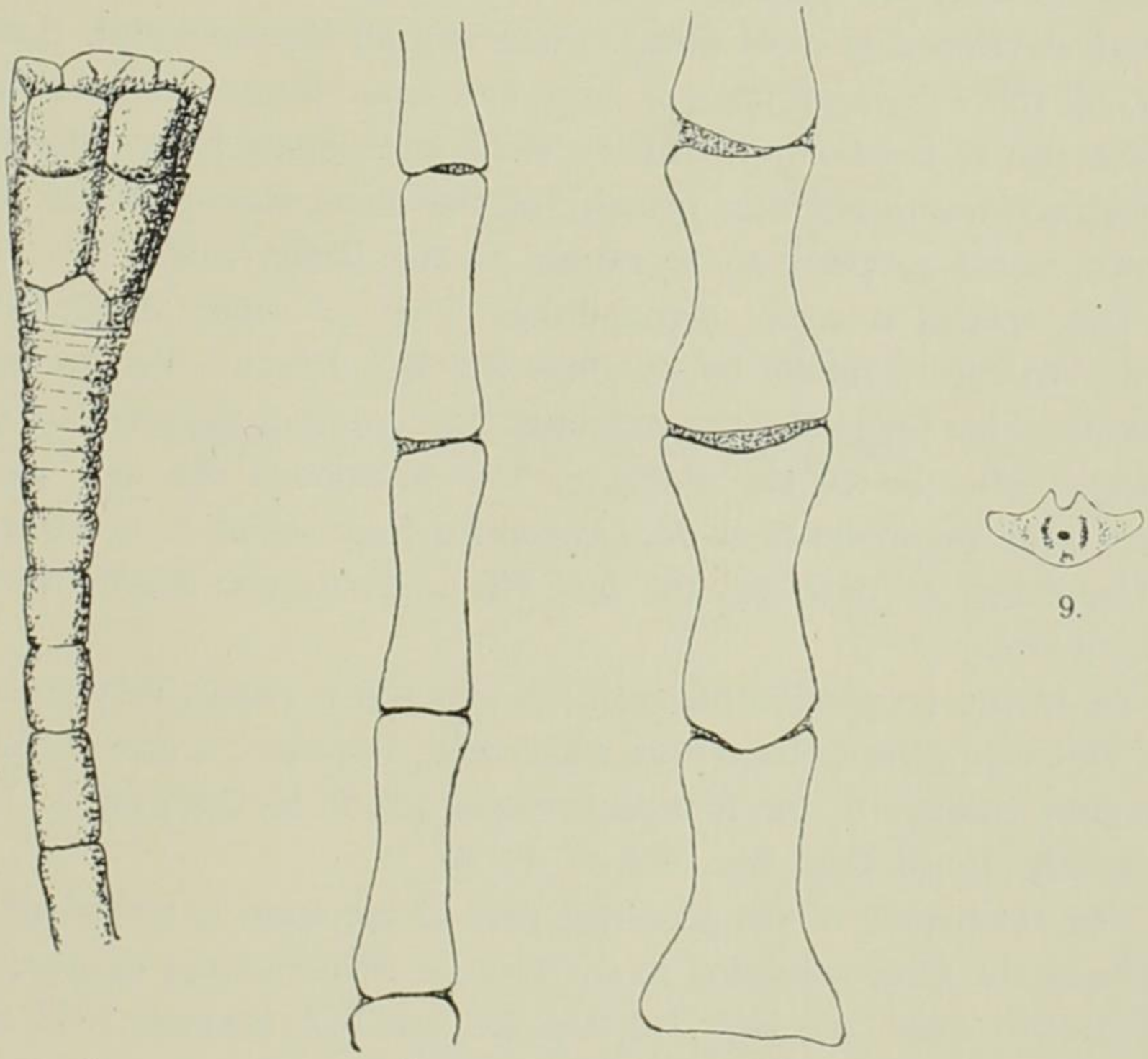
Monachocrinus incrassatus n. sp.

Text-figs. 6—9. Pl. XXIII, Figs. 5—7.

From 8 miles W to N of Sugarloaf, St. Helena. Hard bottom. 2400—2780 M. Dredged onboard the "Dana" 23. II. 1930, 1 sp.

BB pentagonal, separated by distinct sutures, median L about $^3/_4$ br (br 0.6 mm). RR twice as long, L = $1^1/_2$ br (h 1 mm). I Br 1 shorter again, L = $^2/_3$ br. Arms broken from here. Calyx evenly conical, br at proximal part of BB 0.8 mm, at distal part of RR 1.1 mm.

Stem 75 mm, broken at distal tip. There are 49 stem-joints in all. No radiculi on any segments. 8 proximal stem-joints very short, 9th L = $^1/_3$ br, 10th L = $^1/_2$ br, 11th L = br, 14th L = $1^1/_2$ br, 20th L



6. 7. 8.

9.

Figs. 6—9. *Monachocrinus incrassatus*. 6) Calyx and upper part of stem, 7) middle part, 8) distalmost segments of preserved part of stem, 11/1. 9) Distal articular facet of I Br 1, 17/1.

= 2 br. Longest stem-joints L = 3 br. The distalmost segments with knobby ends, L = $1^1/_2$—2 br of the swollen ends. The diameter of the stem under the BB is 0.8 mm. At the 10th segment 0.6 mm. Middle stem part 0.5 mm. Distally at the knobs 1 mm.

Colour: Calyx brownish, stem whitish.

As the new species lacks radiculi and is stated to have been taken on hard bottom the question may be raised if it might be a member of the *Phrynocrinidæ* which is anchored to hard bottom by a calcareous plate. In this family the genera *Phrynocrinus* and *Naumachocrinus* have very reduced BB, therefore the new species cannot be ranged among them. Still, the relative shortness of the BB and length of the RR distantly point towards the conditions found in *Naumachocrinus*. *Porphyrocrinus* shows much the same conditions as in those Monachocrini which have separate BB, but in *Porphyrocrinus* the upper part of the stem is not thickened and the distal stem-joints only very gradually reach the type of long slender knobby stem-joints which is so well developed in most *Bathycrinidæ* and all Monachocrini. Besides this, all the *Phrynocrinidæ* are large and stout forms, while the new species just as the *Bathycrinidæ* is a small and slender form. Therefore, *Monachocrinus incrassatus*, in spite of the distal stem-part not being known, seems properly to be ranged in the *Bathycrinidæ*.

This species is easily distinguished from all other Monachocrini (and even Bathycrinids) by its short free BB. Besides, the few short proximal stem-joints and the proximal thickening of the stem are very characteristic. As to the character last mentioned the new species bears some resemblance to *M. recuperatus* from which it is, however, distinguished at once by the low BB and the few short proximal stem-joints.

As to the proportion between BB and RR it recalls very strongly the Mesozoic genus *Mesocrinus* which had, however, a proximale and therefore belongs to the *Bourgueticrinidæ* (cf. P. H. Carpenter 1881, Quarterly Journ. Geol. Soc. Vol. 37, Pl. 6).

The thickening of the proximal part of the stem is remarkable as we have the same condition in the Triassic *Recoarocrinus recubariensis* (cf. Gislén, 1924 Zool. Bidr. Bd. 9, p. 201, and F. A. Bather 1897, Geol. Mag. Dec.4, Vol. 4, p. 118). This form differed from the recent Bathycrinids in a complete pinnulation of the proximal arm-parts, in thoroughly short stem-joints and, as far as we know, absence of radiculi and radices.

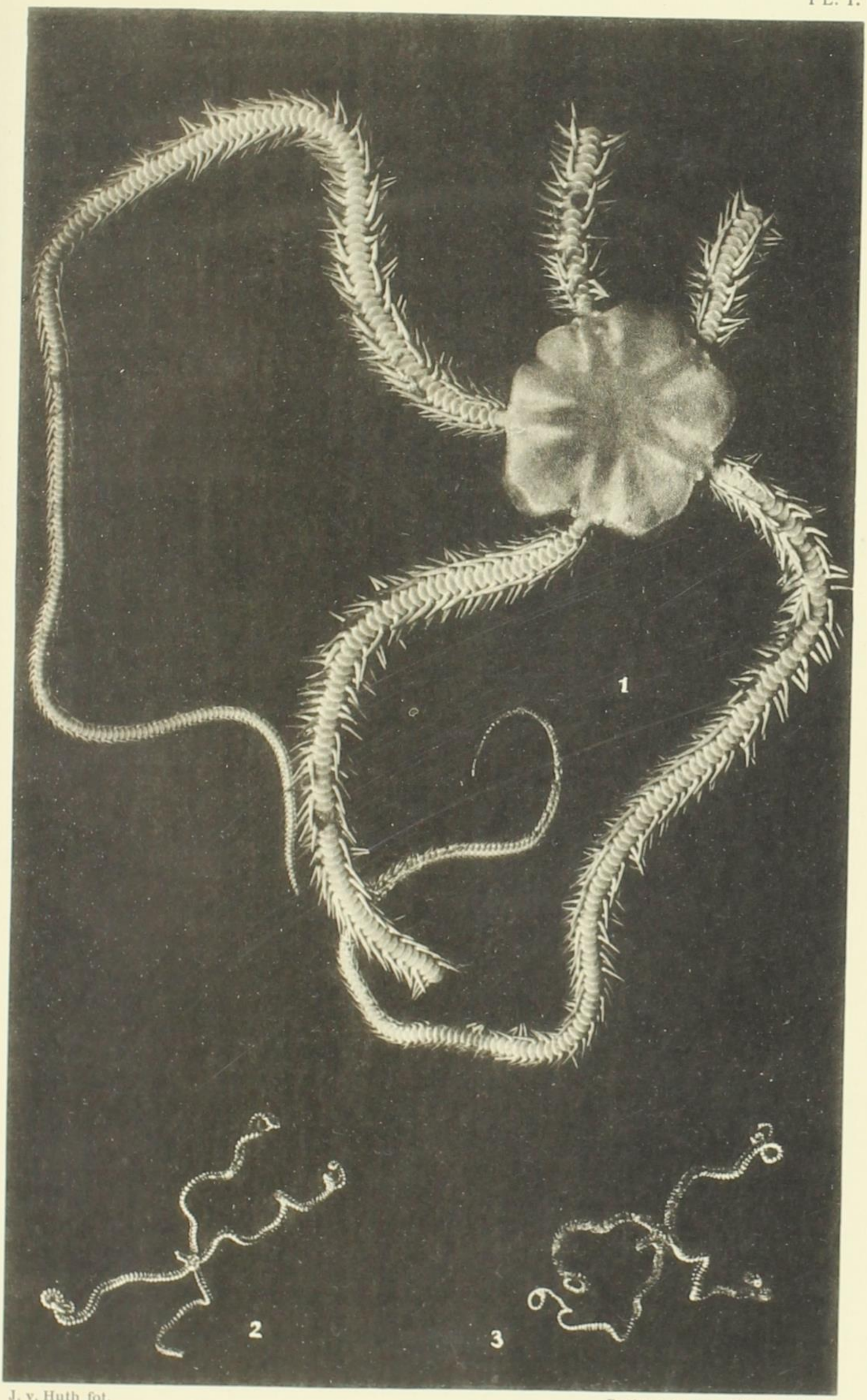
It may have been a starting point for the Apiocrinids which got the upper part of the stem excessively thickened. The little differentiated RR and BB in the new form described above, together with the swelling of the upper part of the stem shows it to be one of the most primitive of the recent Bathycrinids hitherto reported.

Explanation of Plate.

Plate XXIII.

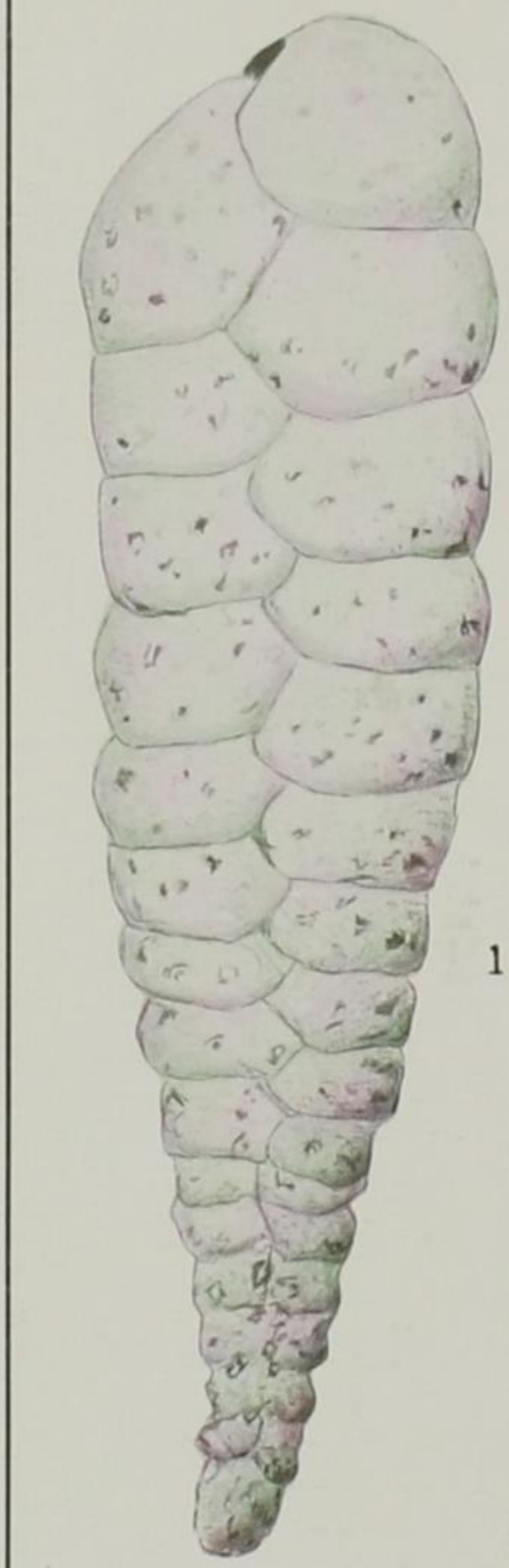
Fig. 1. *Crinometra transversa* n. sp. Type-specimen, $^3/_4$ natural size.
- 2. — — Cirrus. × 4.
- 3. — — P_1 × 4.
- 4. — — P_9 × 4.
- 5—7. *Monachocrinus incrassatus* n. sp. Type. Figs. 5, 6 × 4; 7 × 6.

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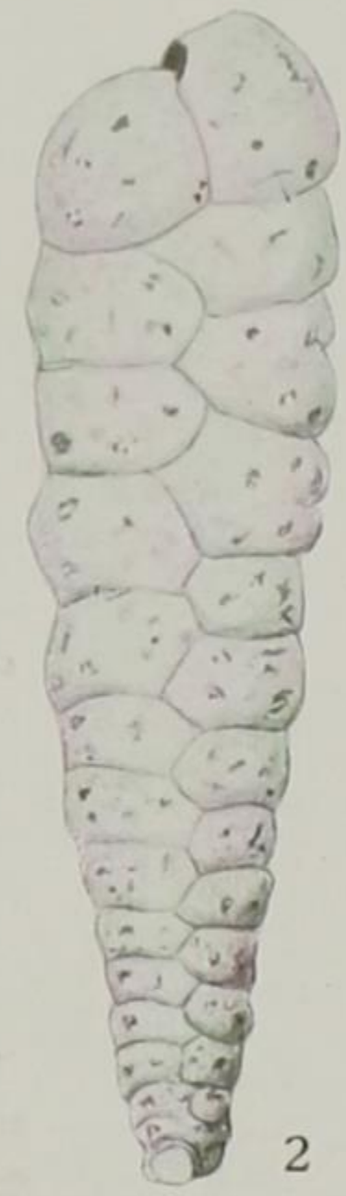


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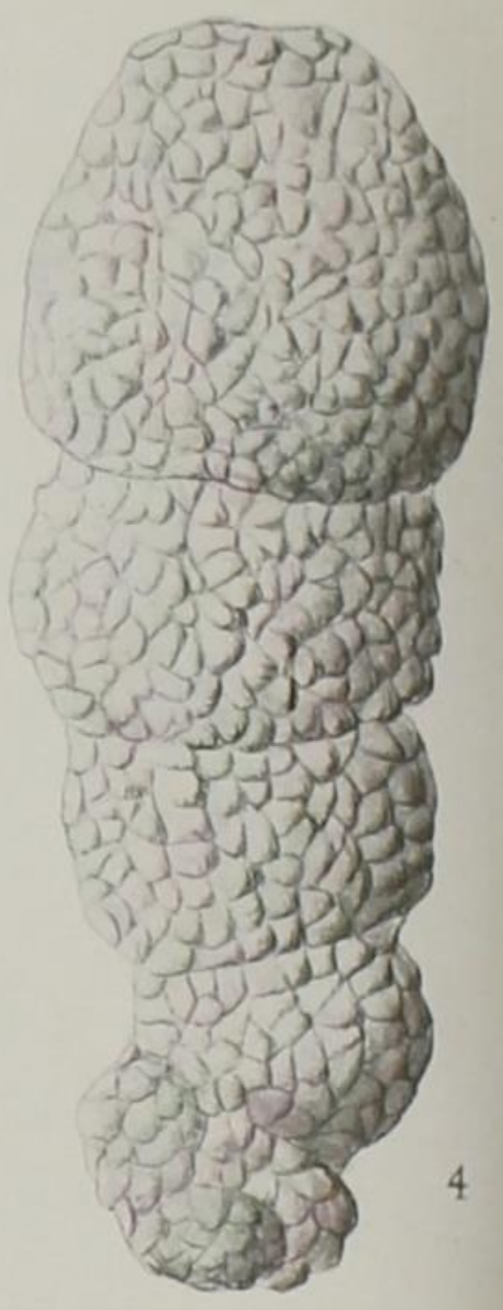
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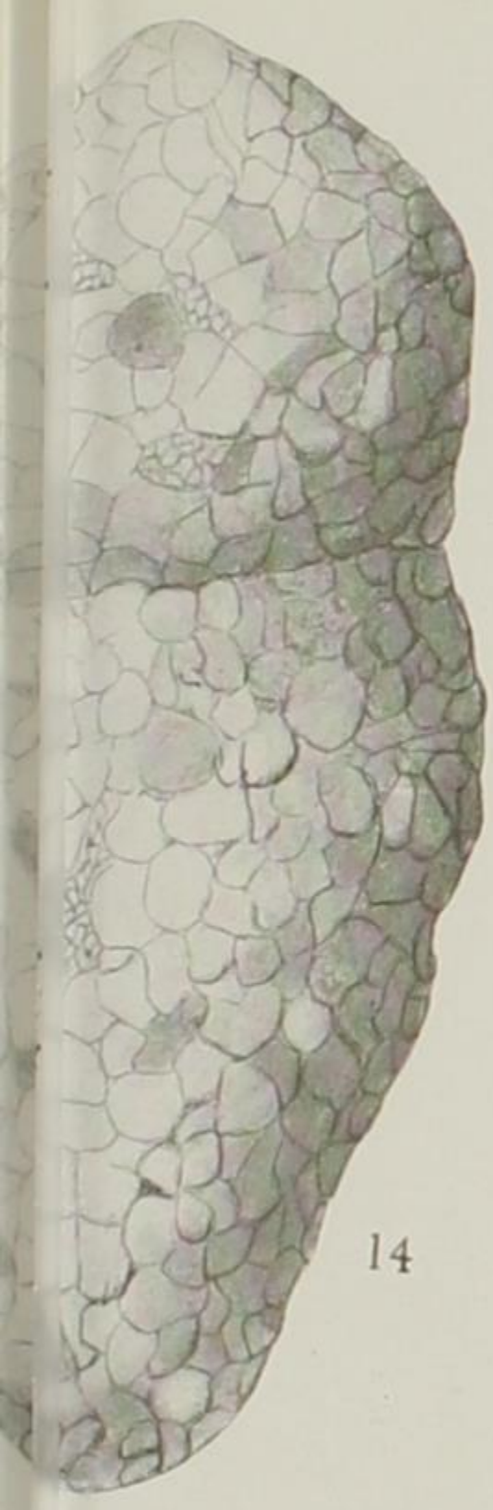


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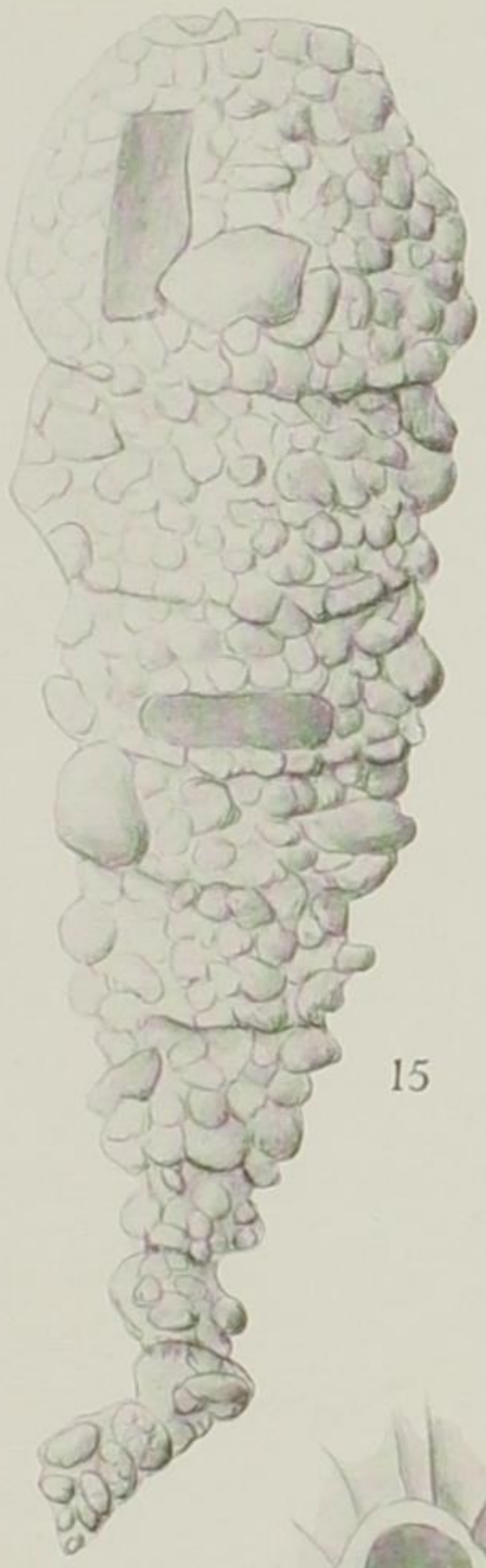


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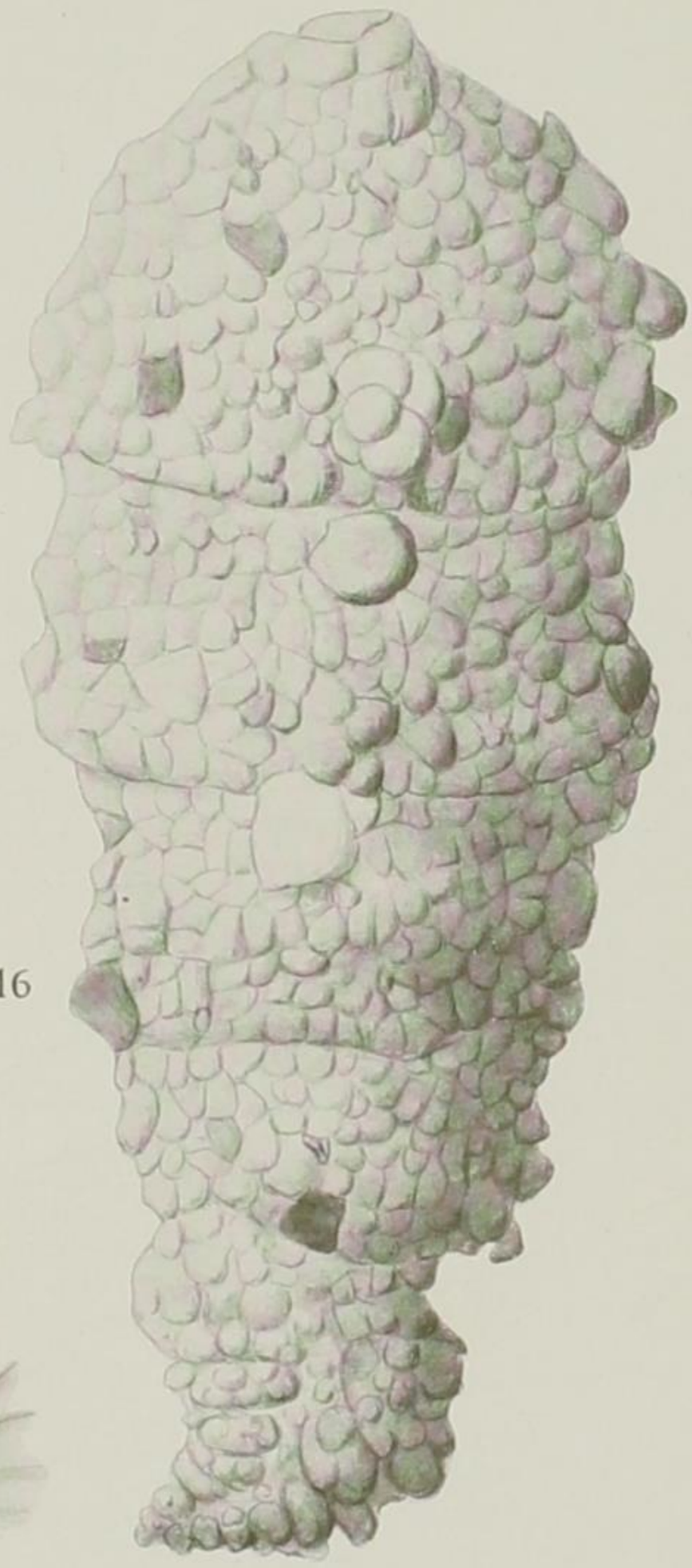
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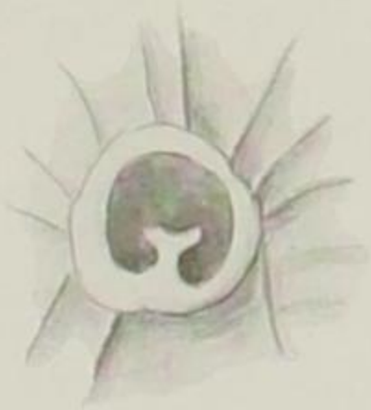
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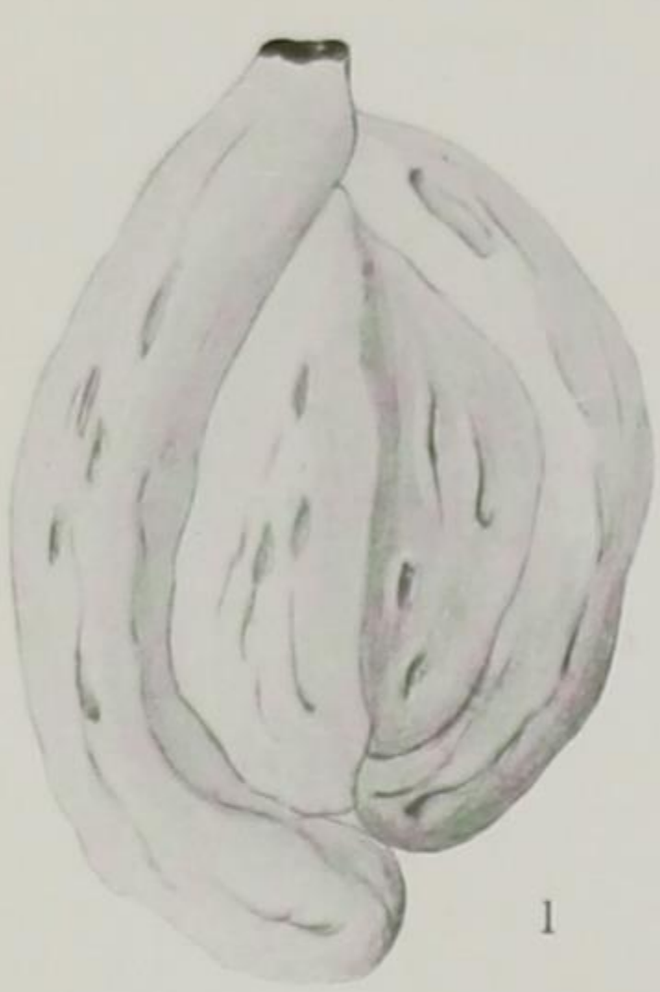
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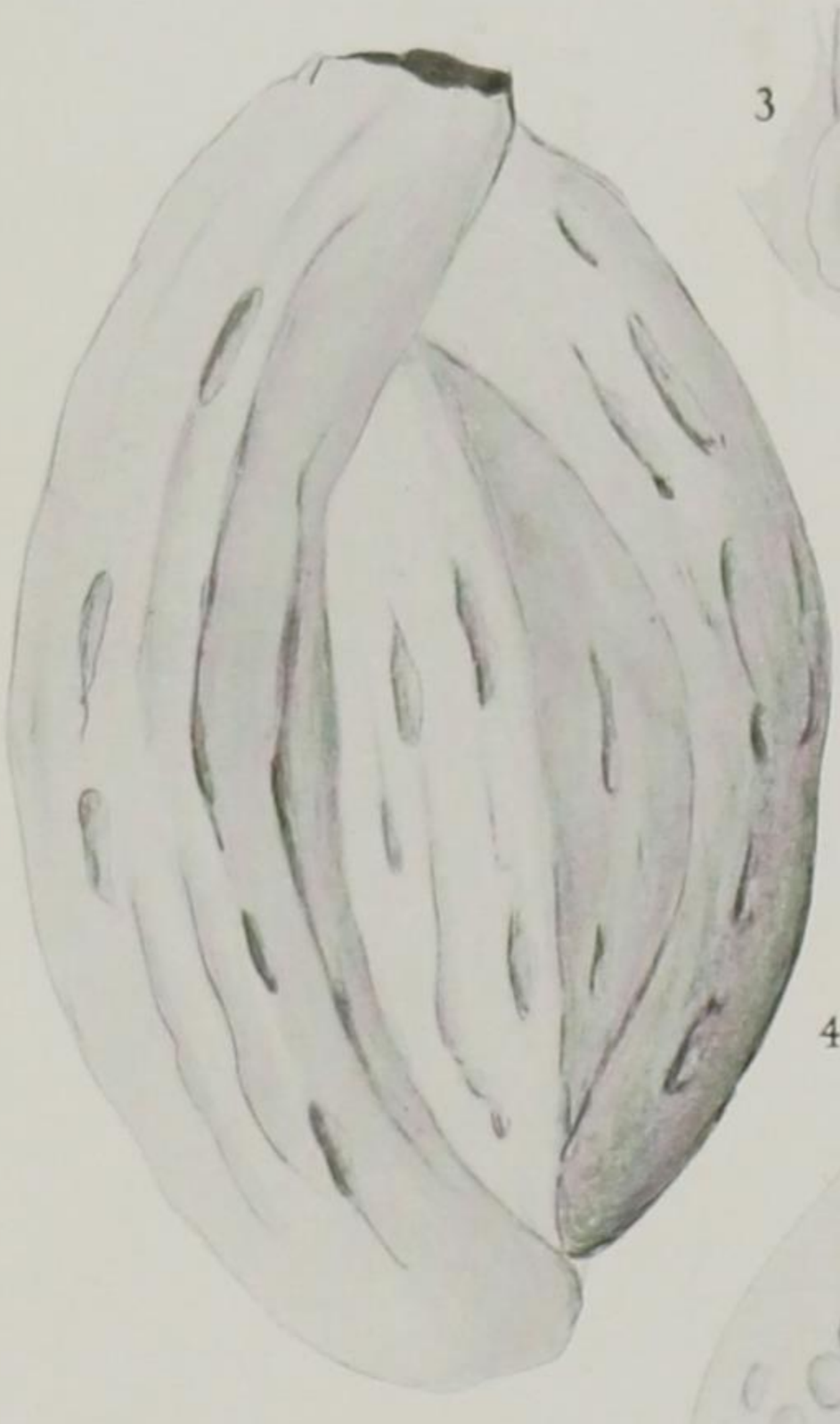
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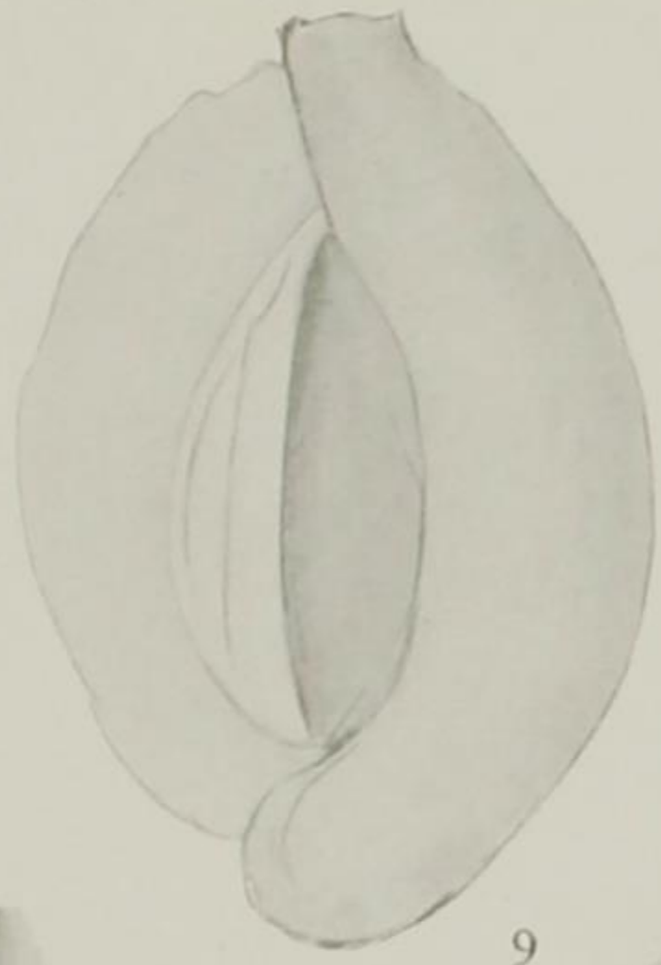
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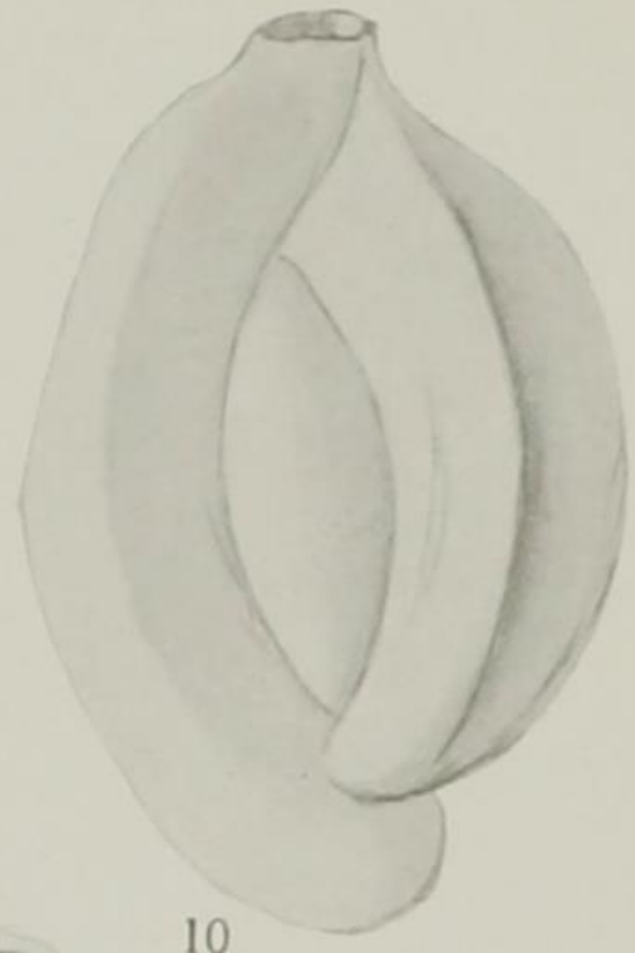
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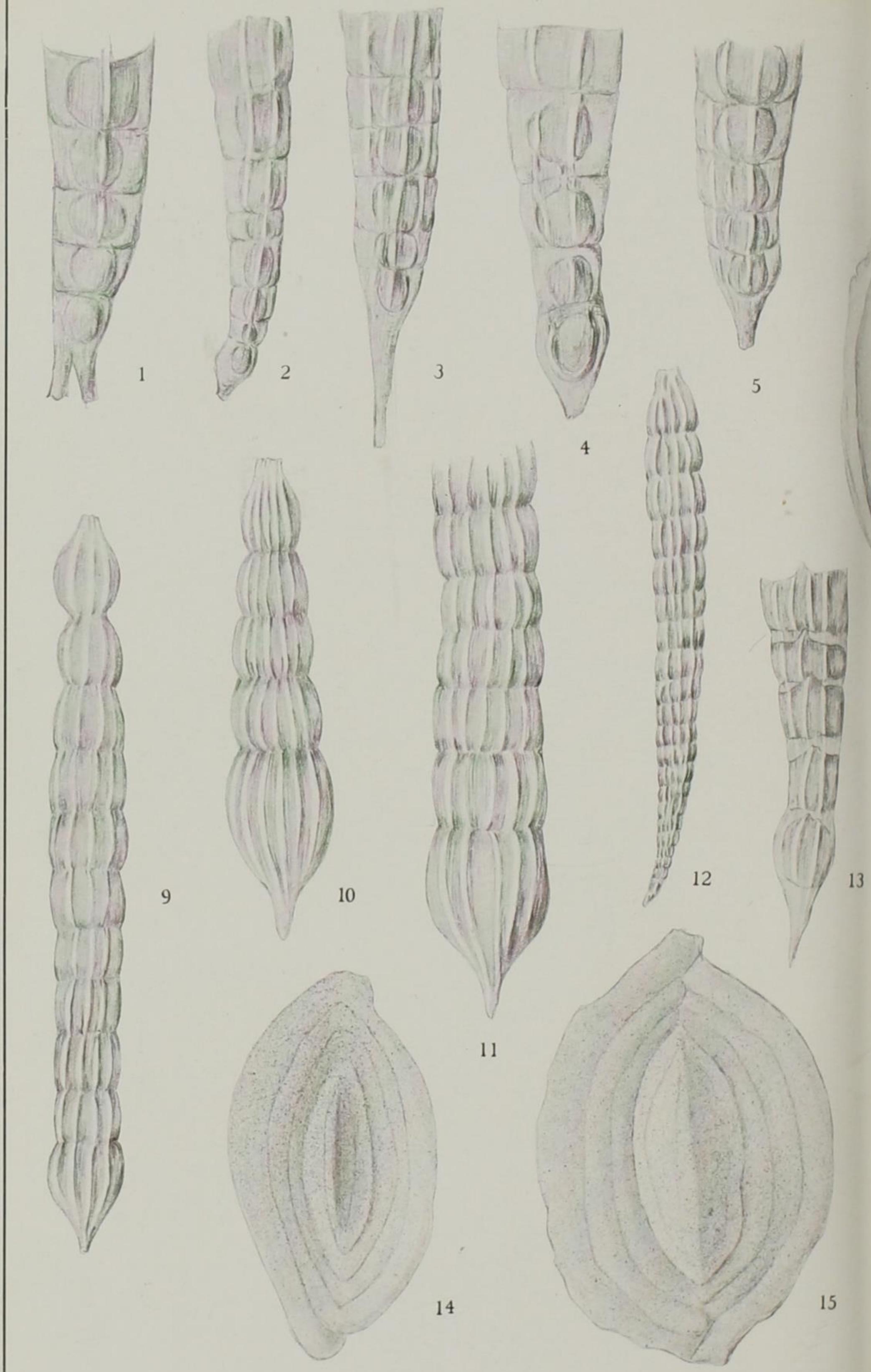


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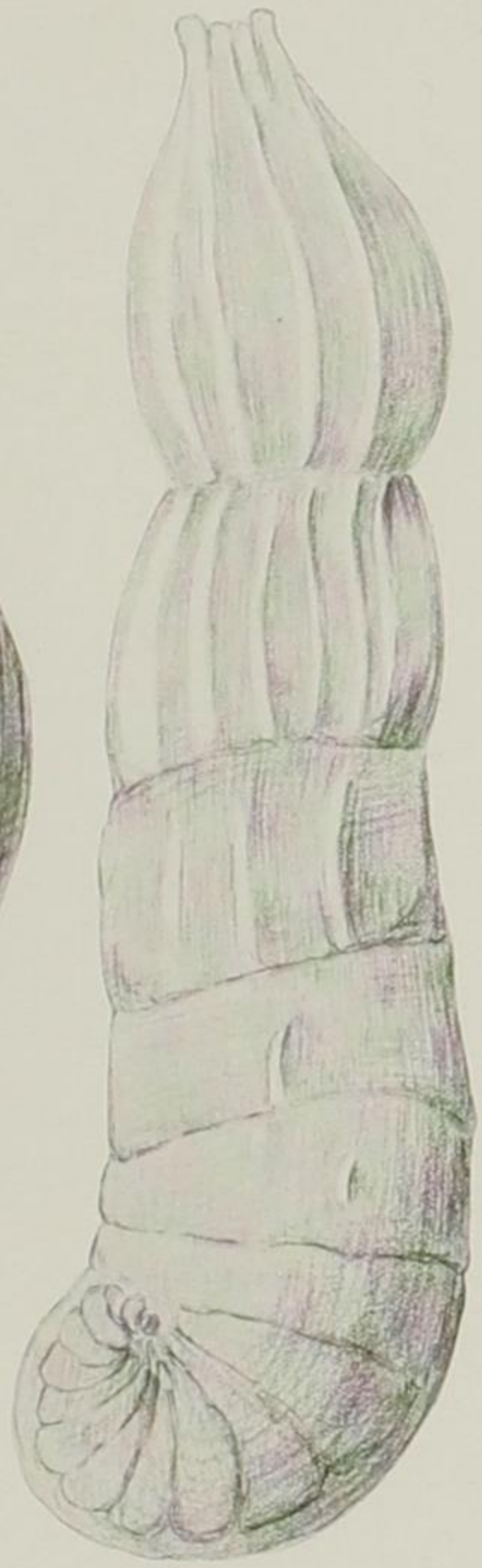




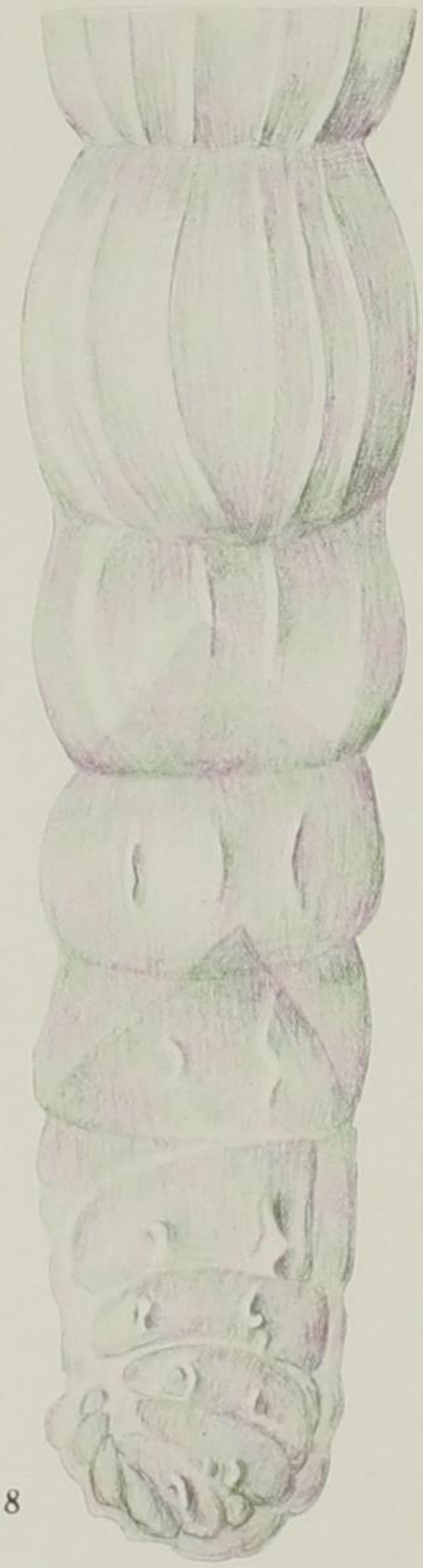
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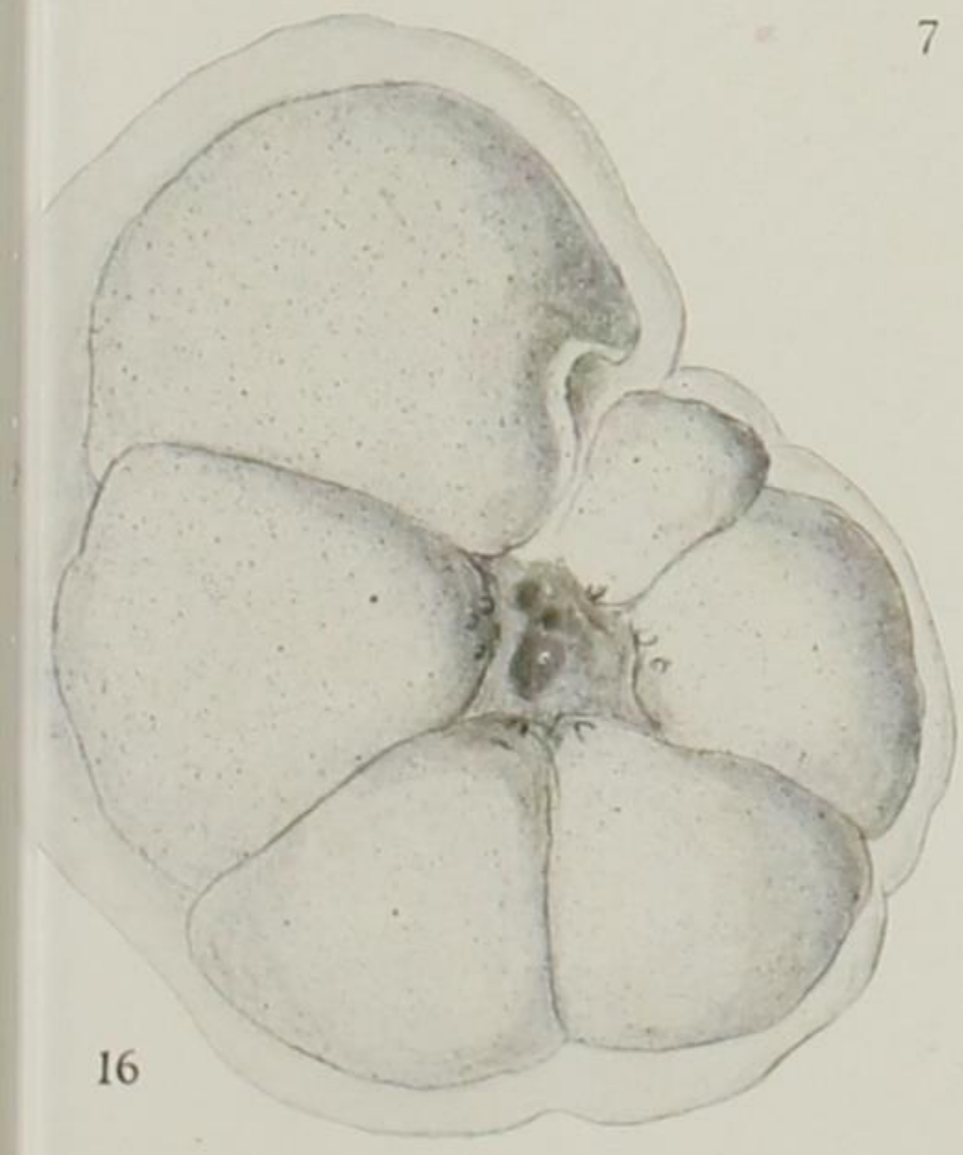
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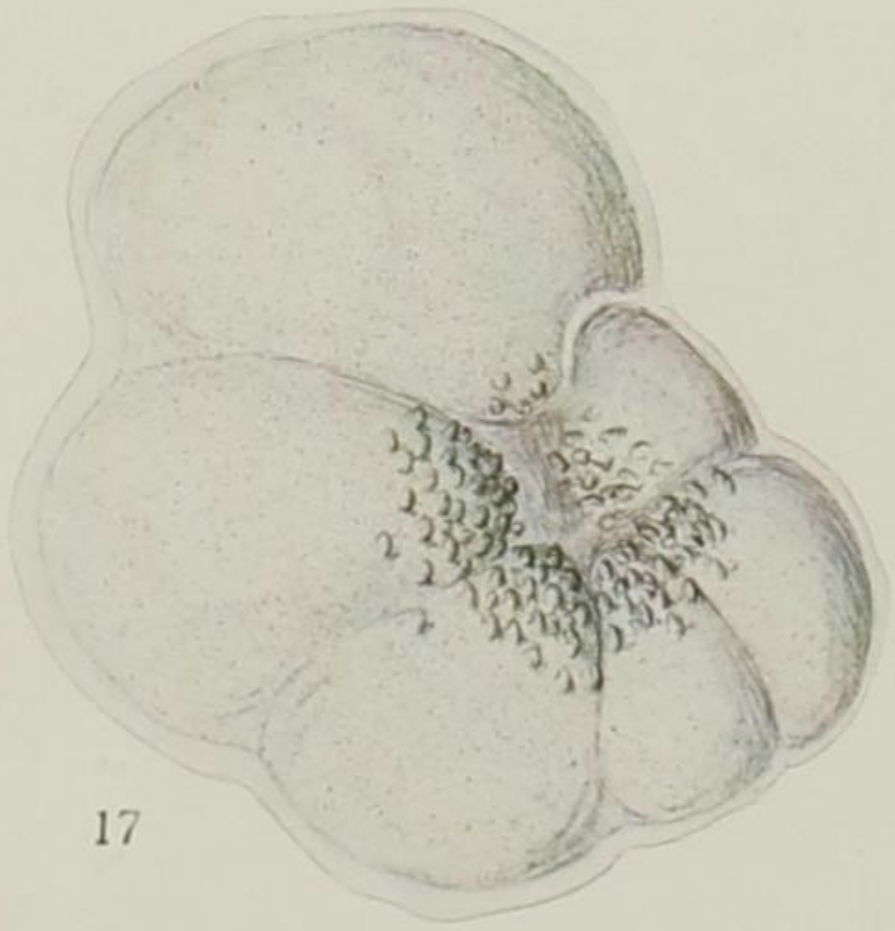
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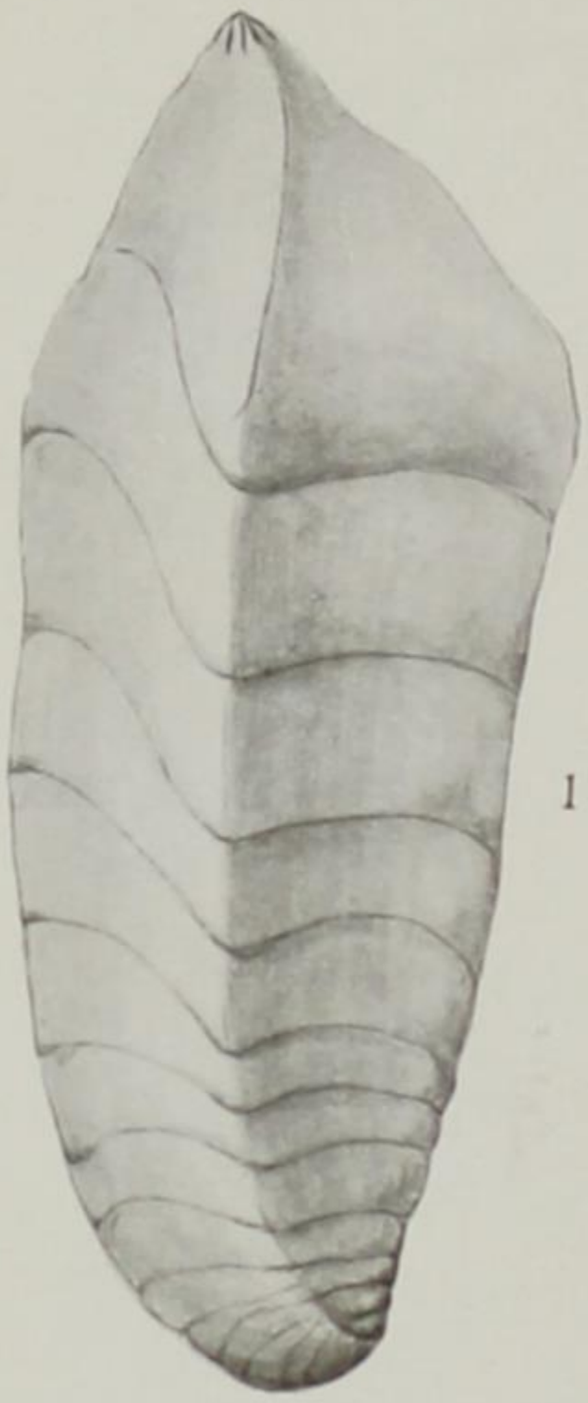
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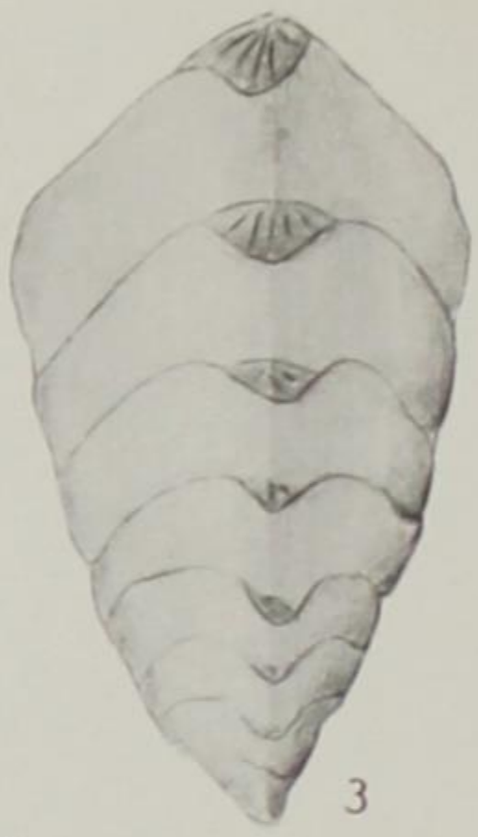
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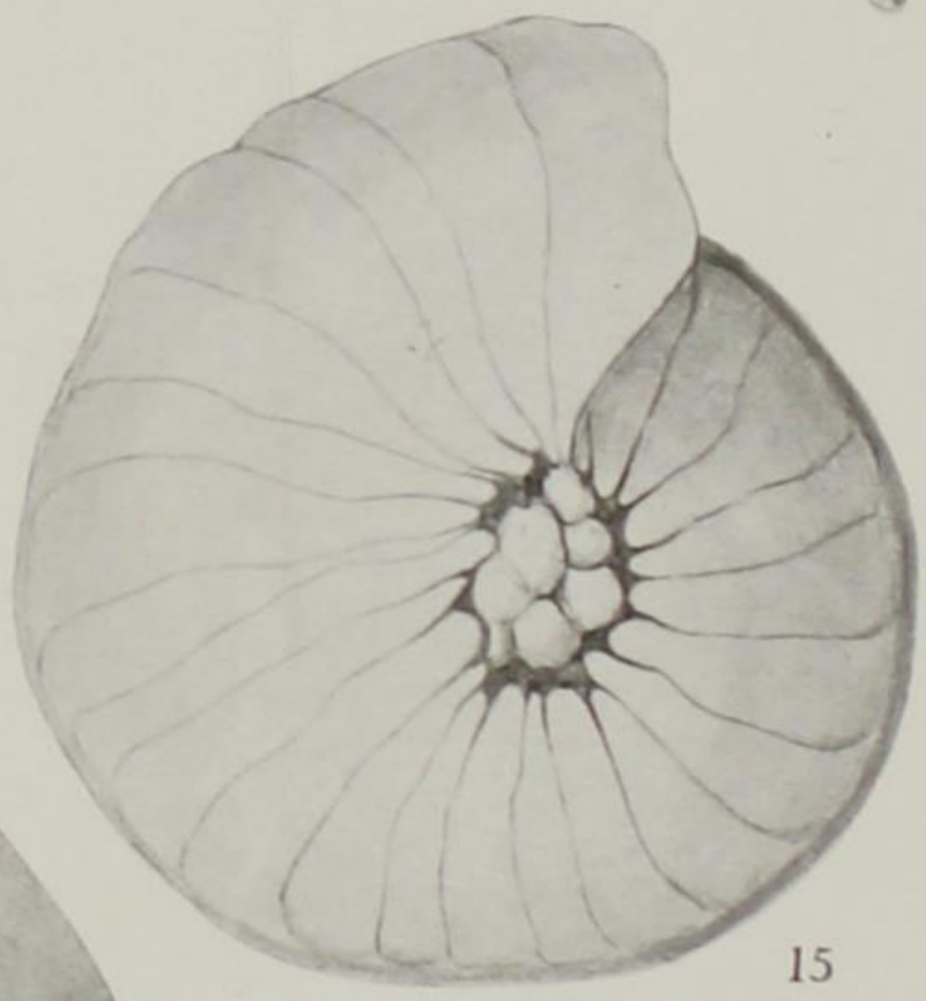
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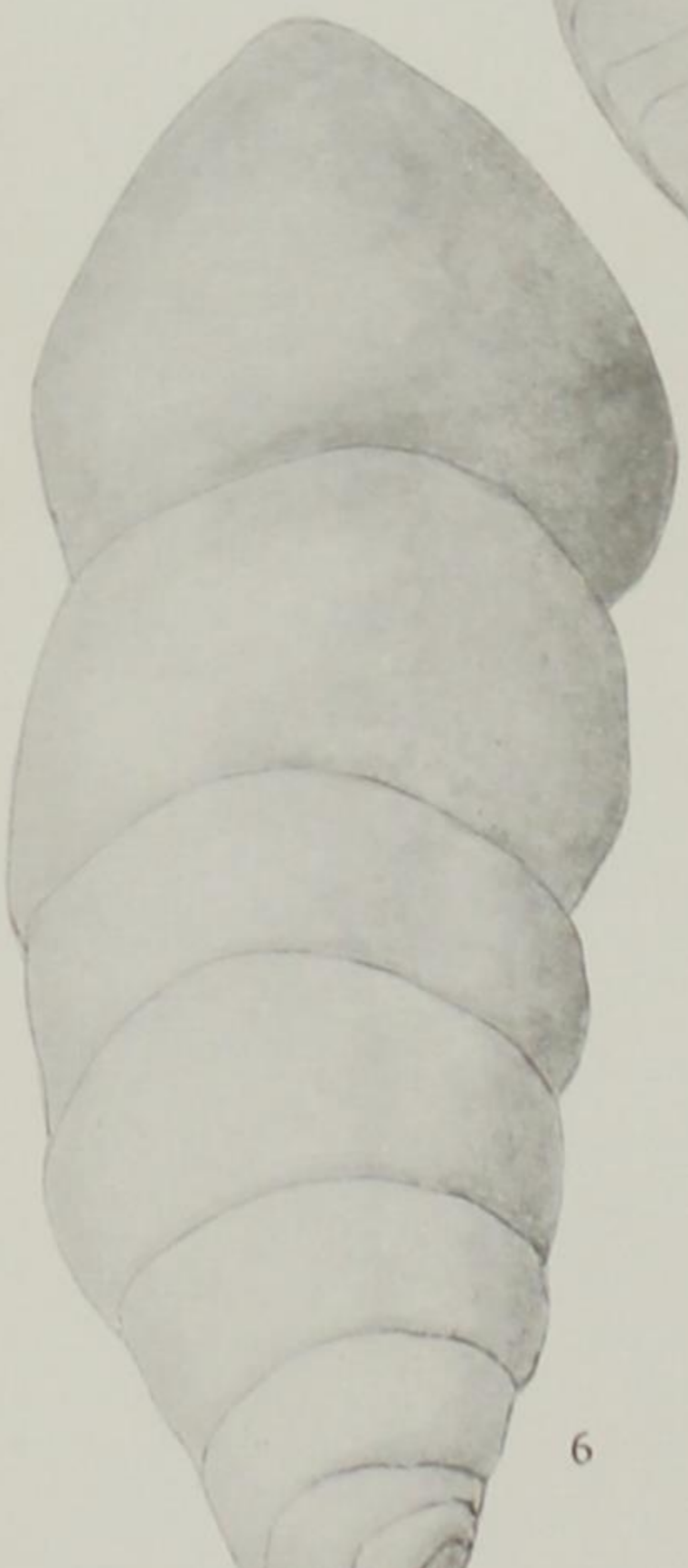
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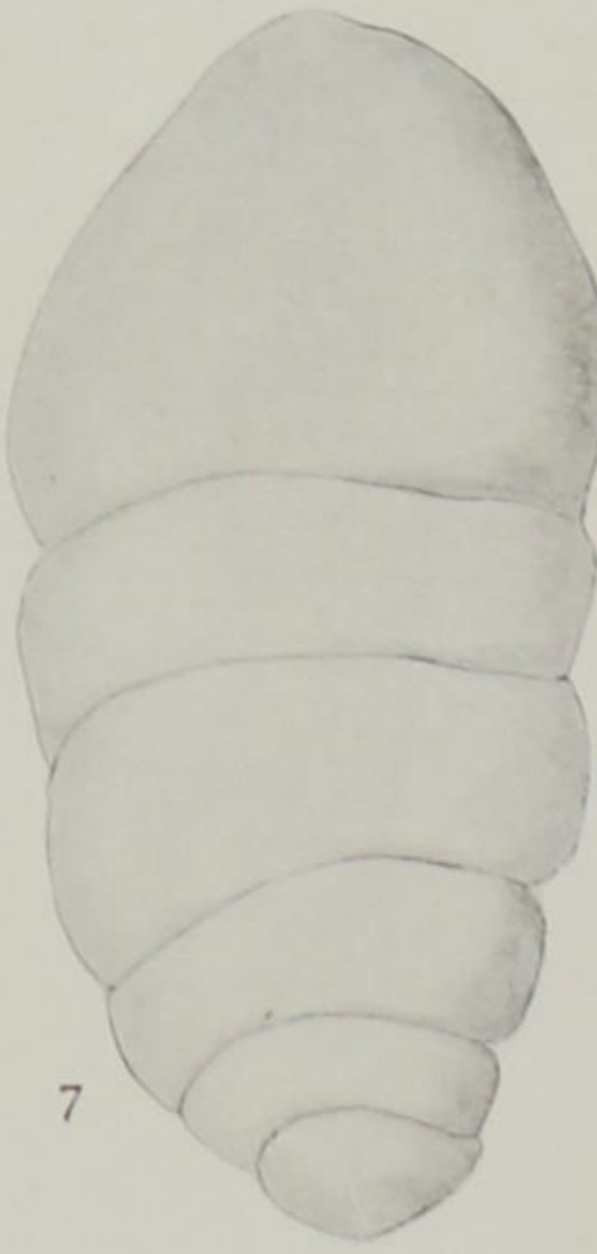
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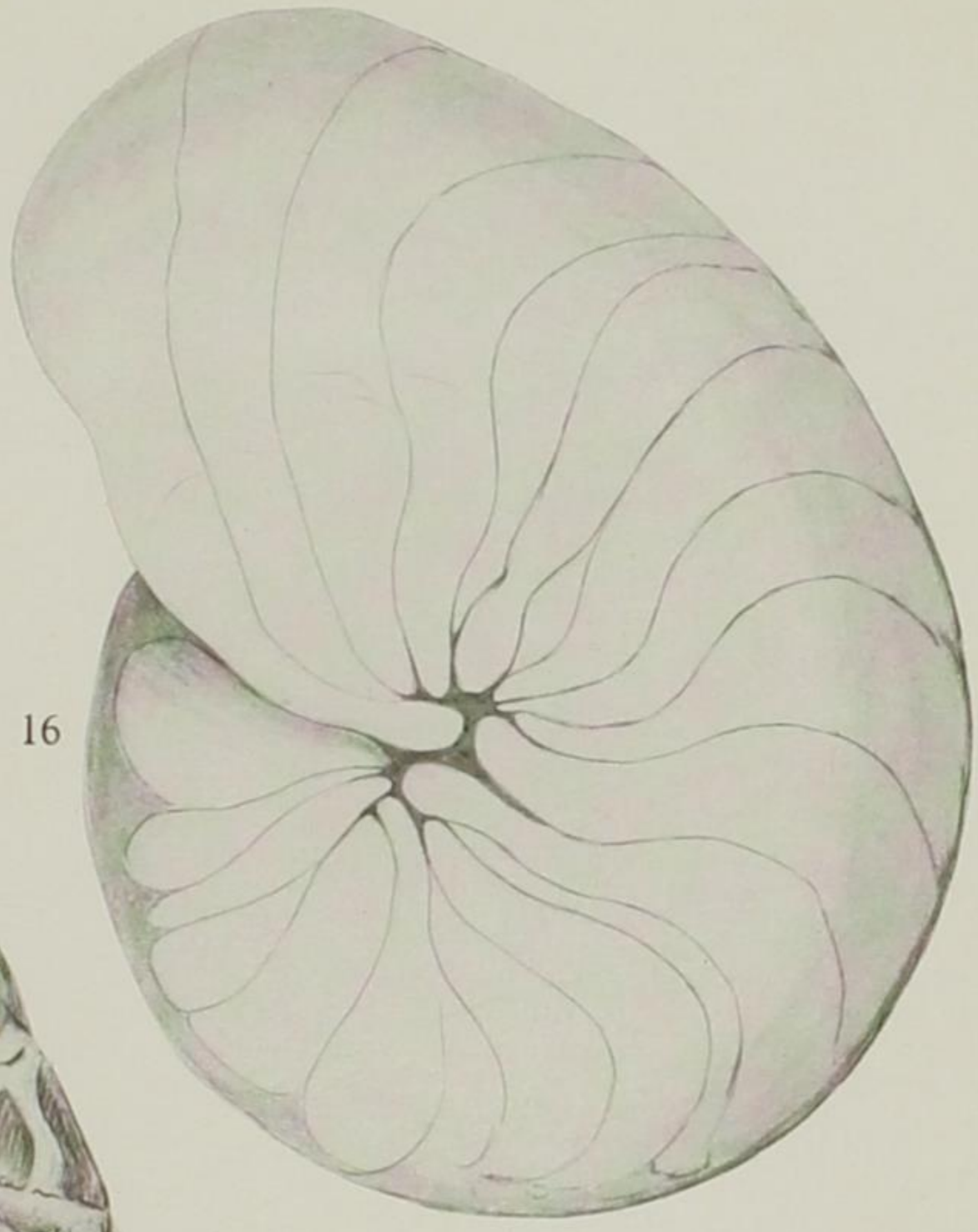
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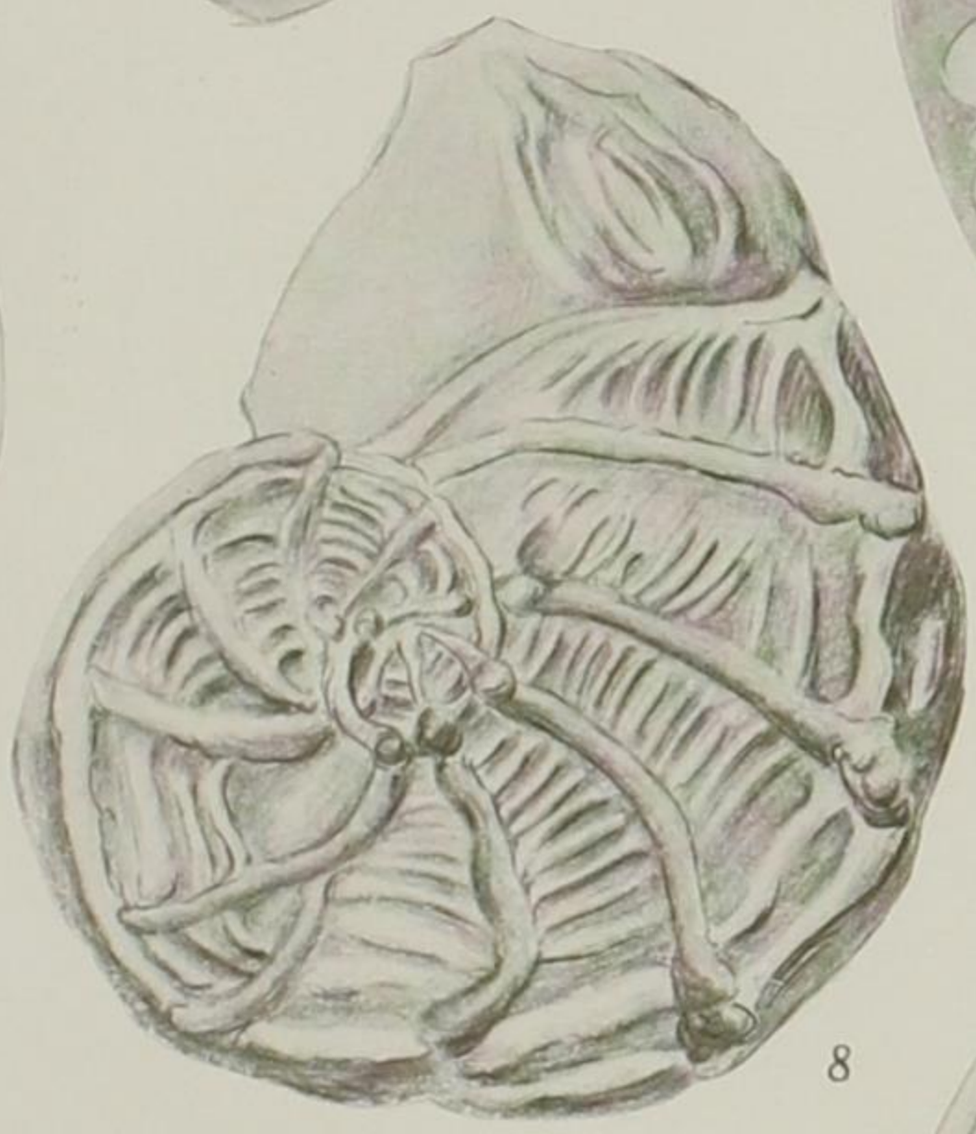
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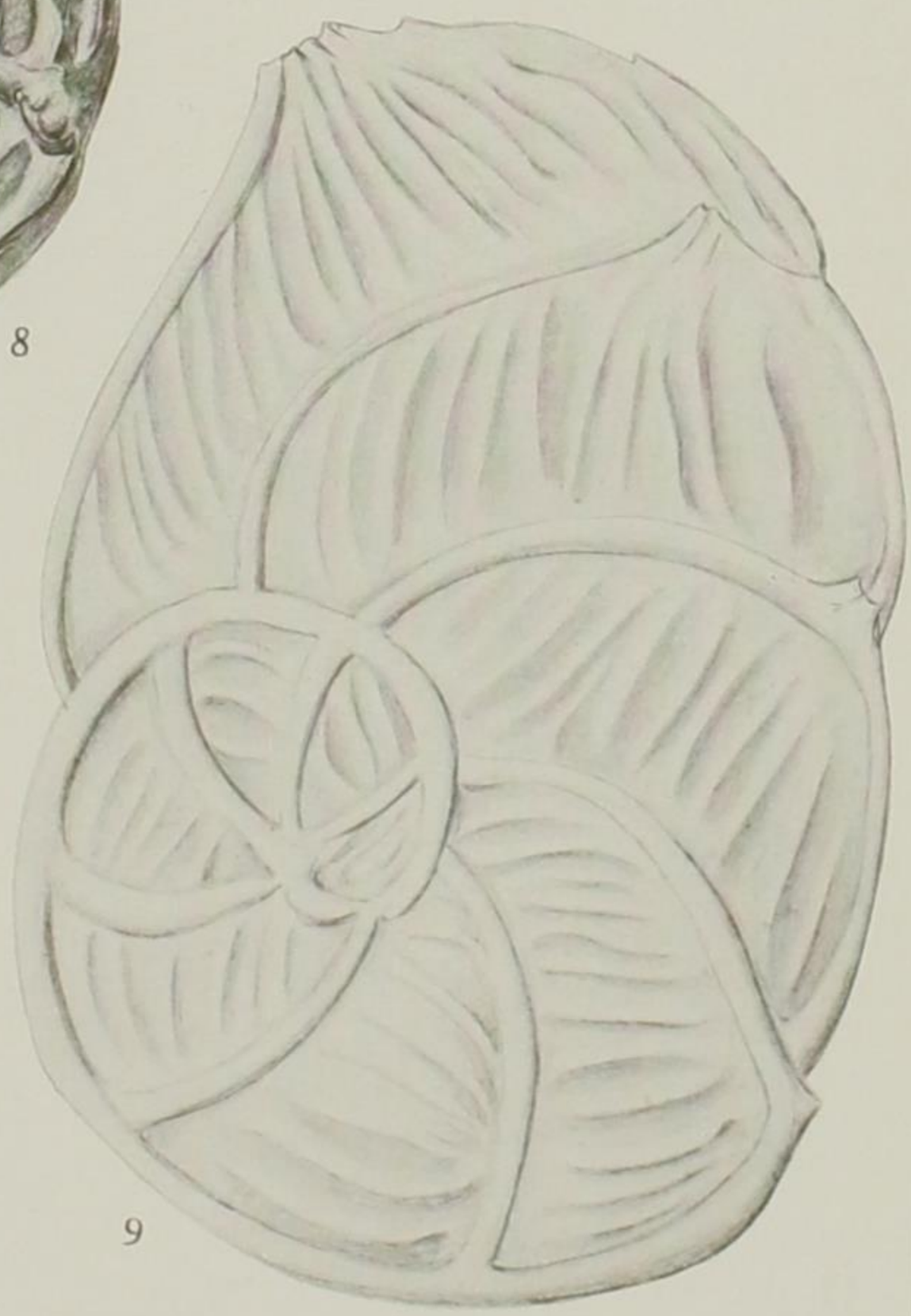


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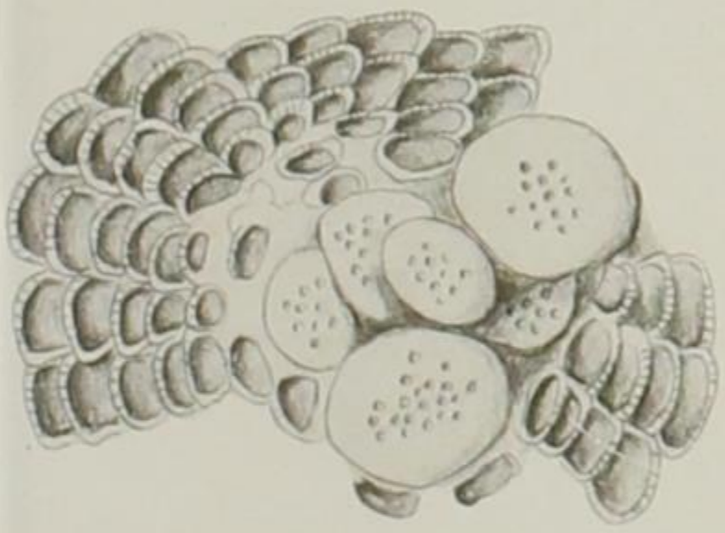


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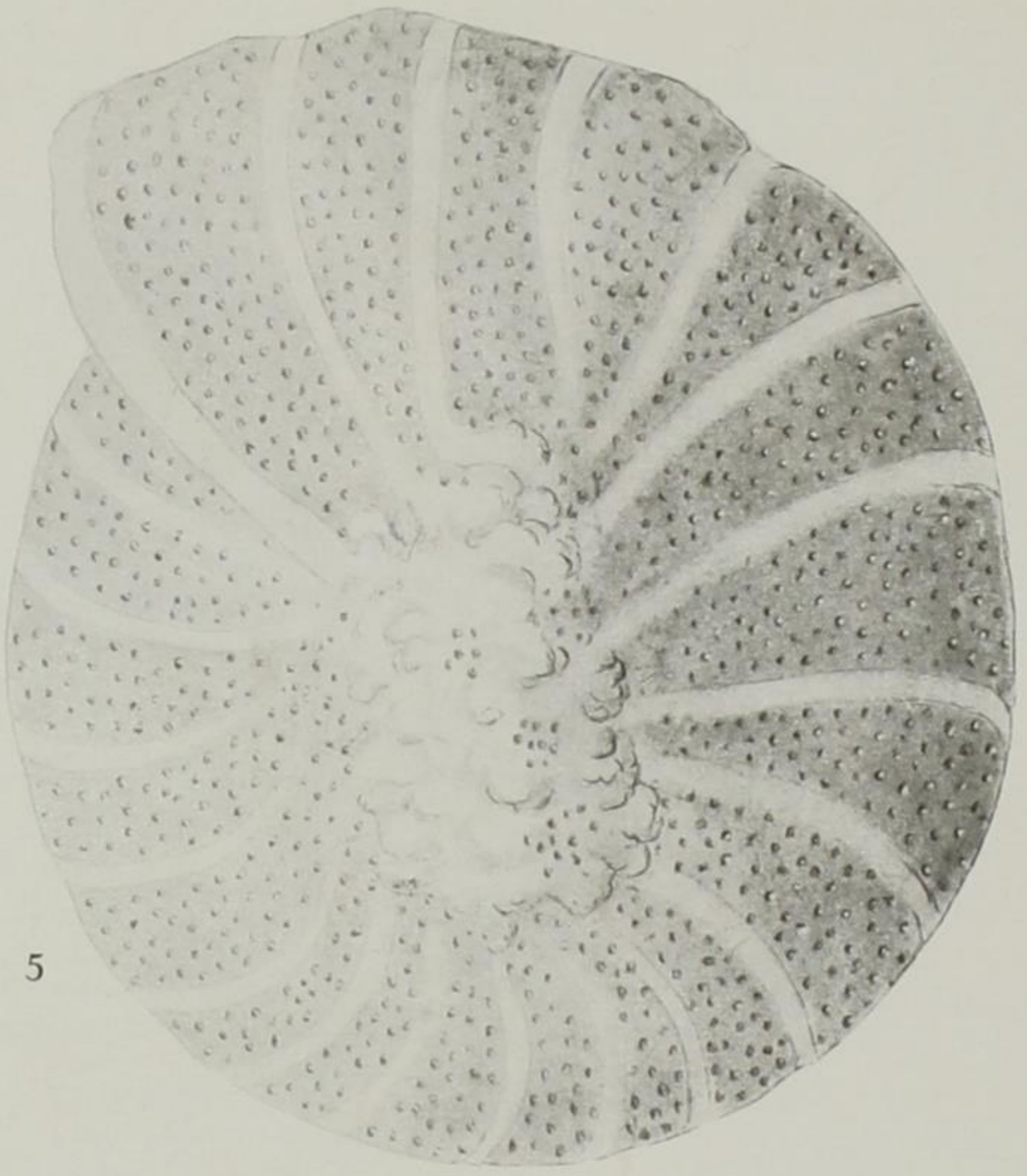


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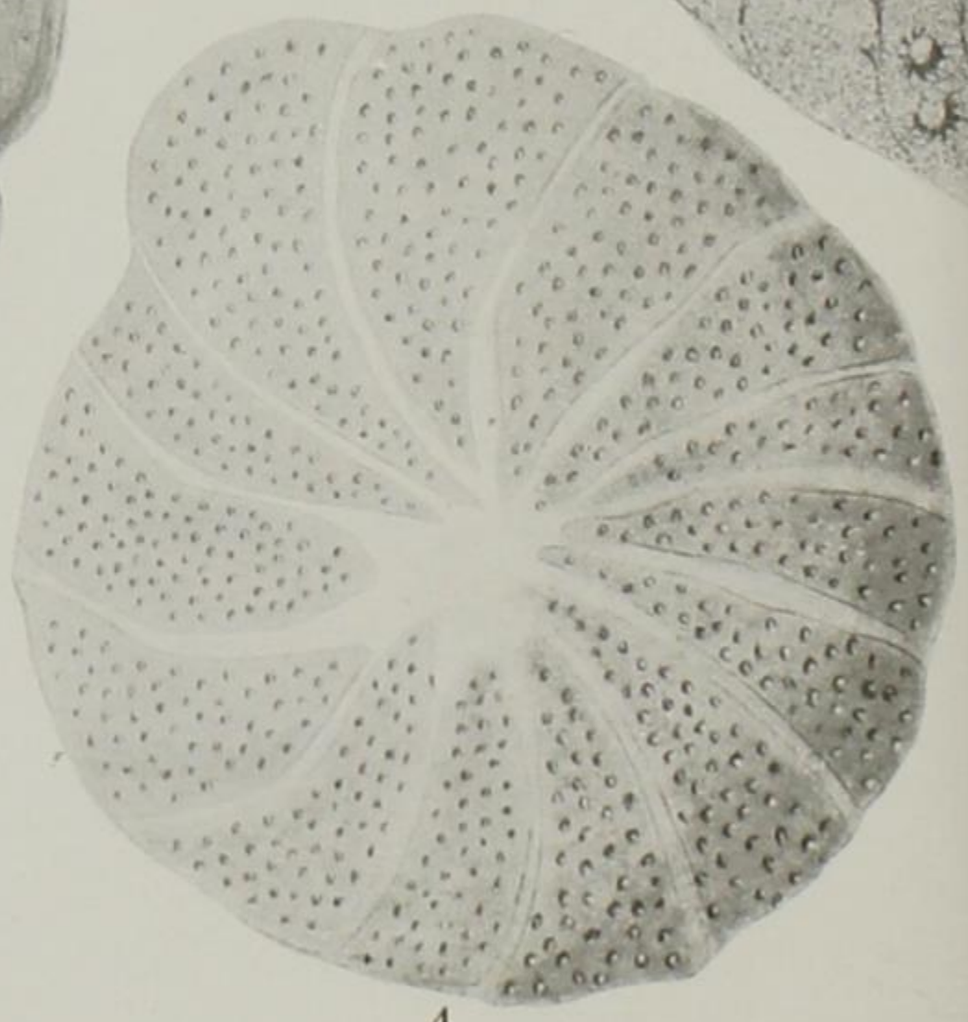


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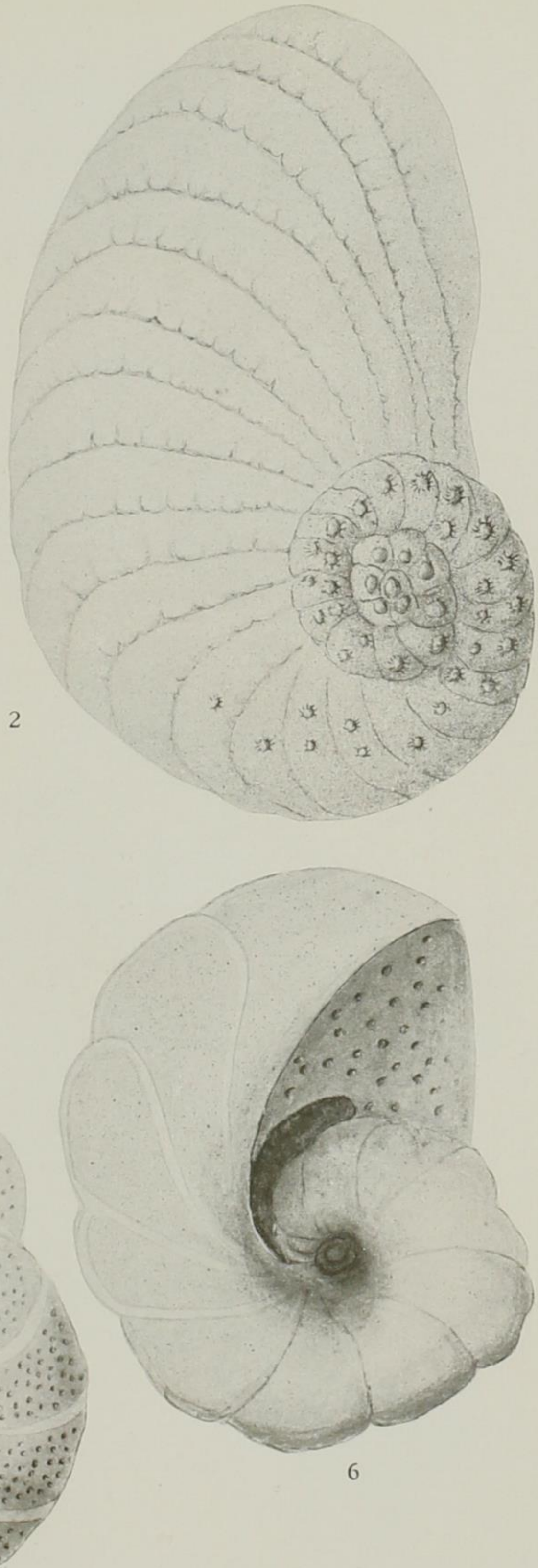


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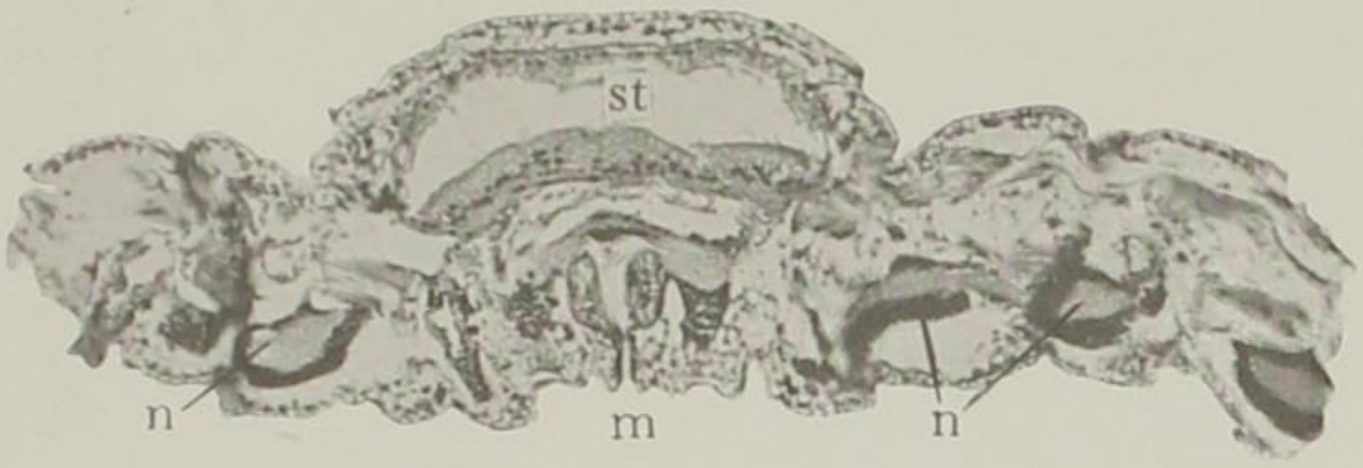


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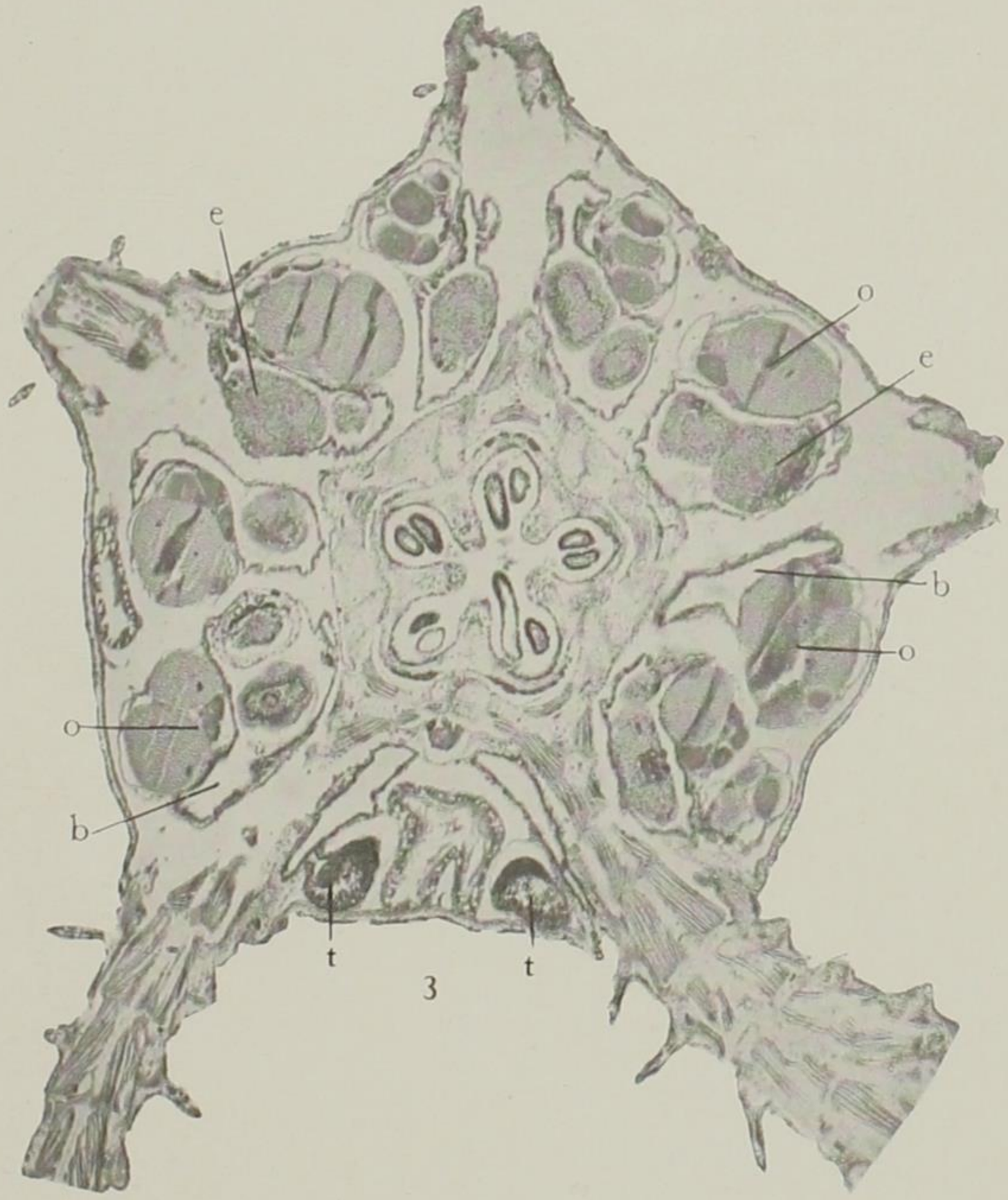
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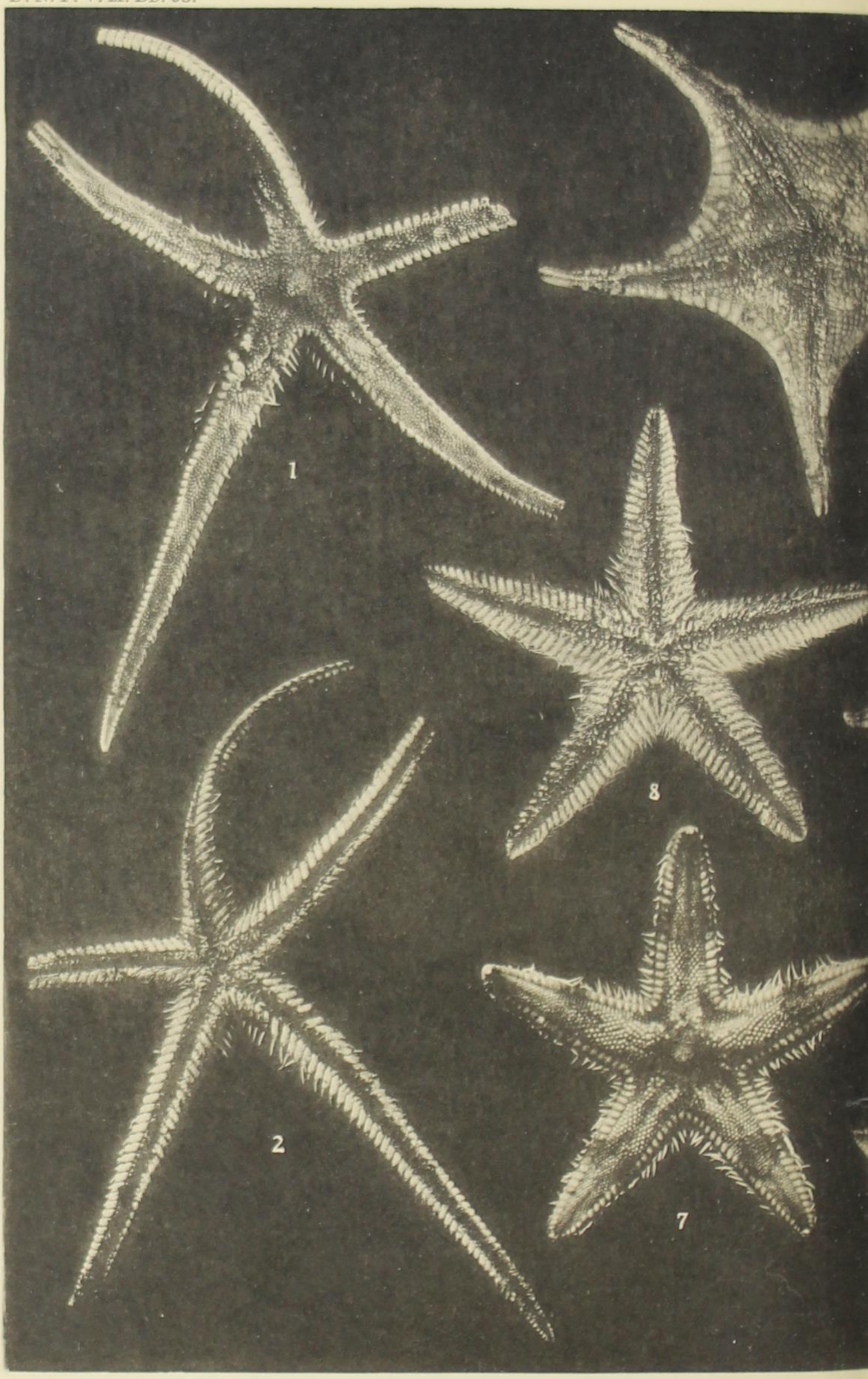


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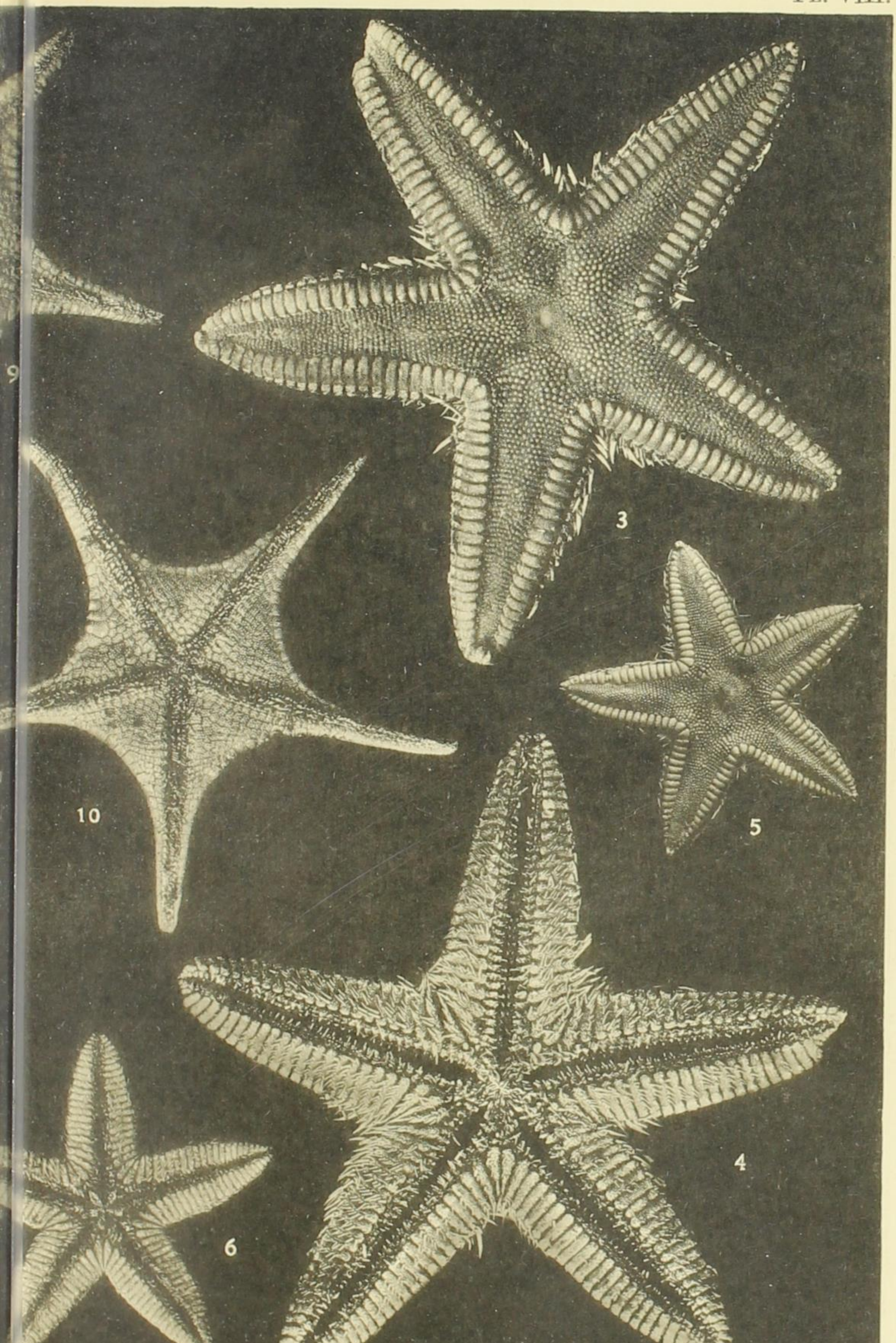


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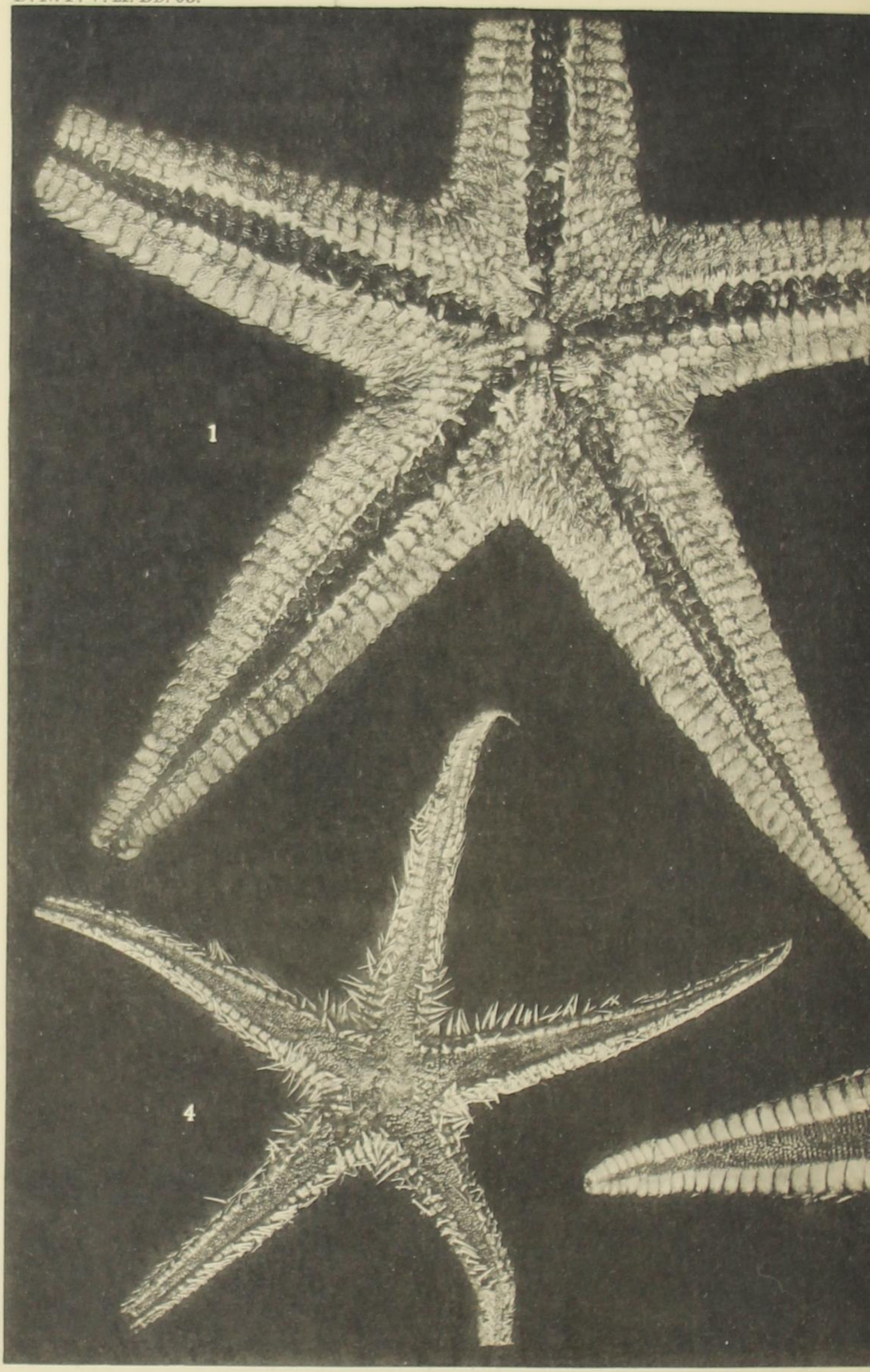
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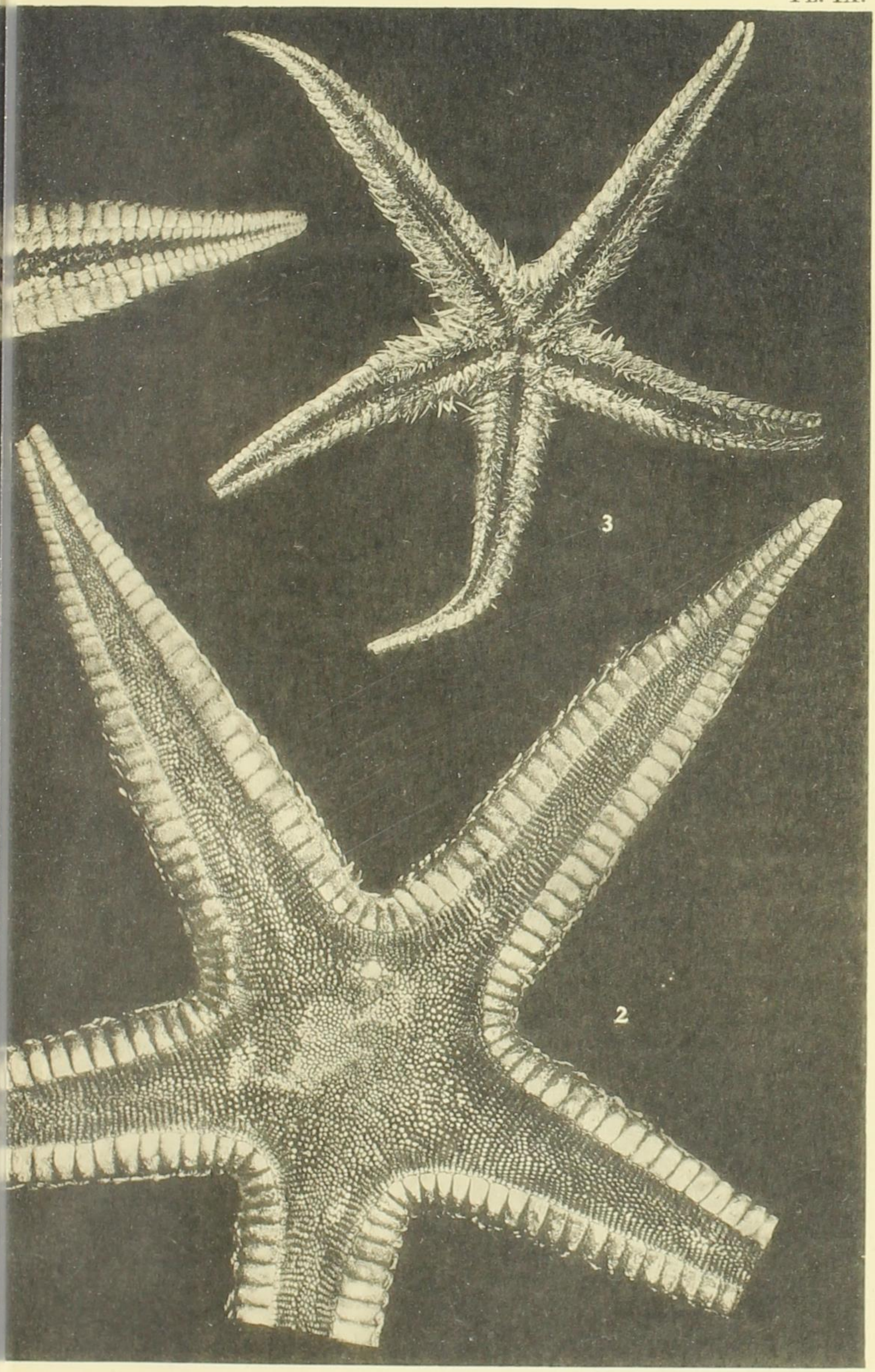
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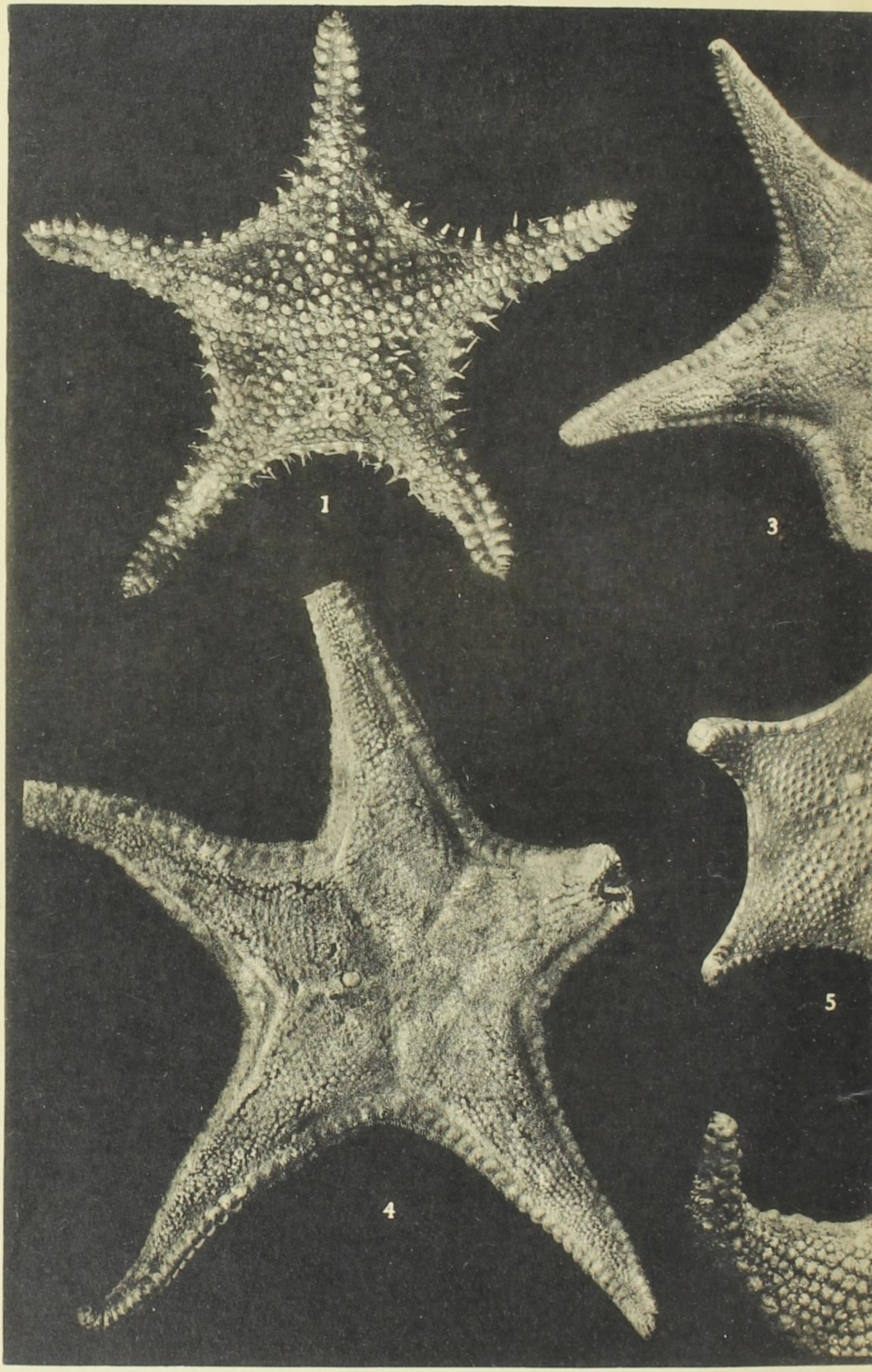
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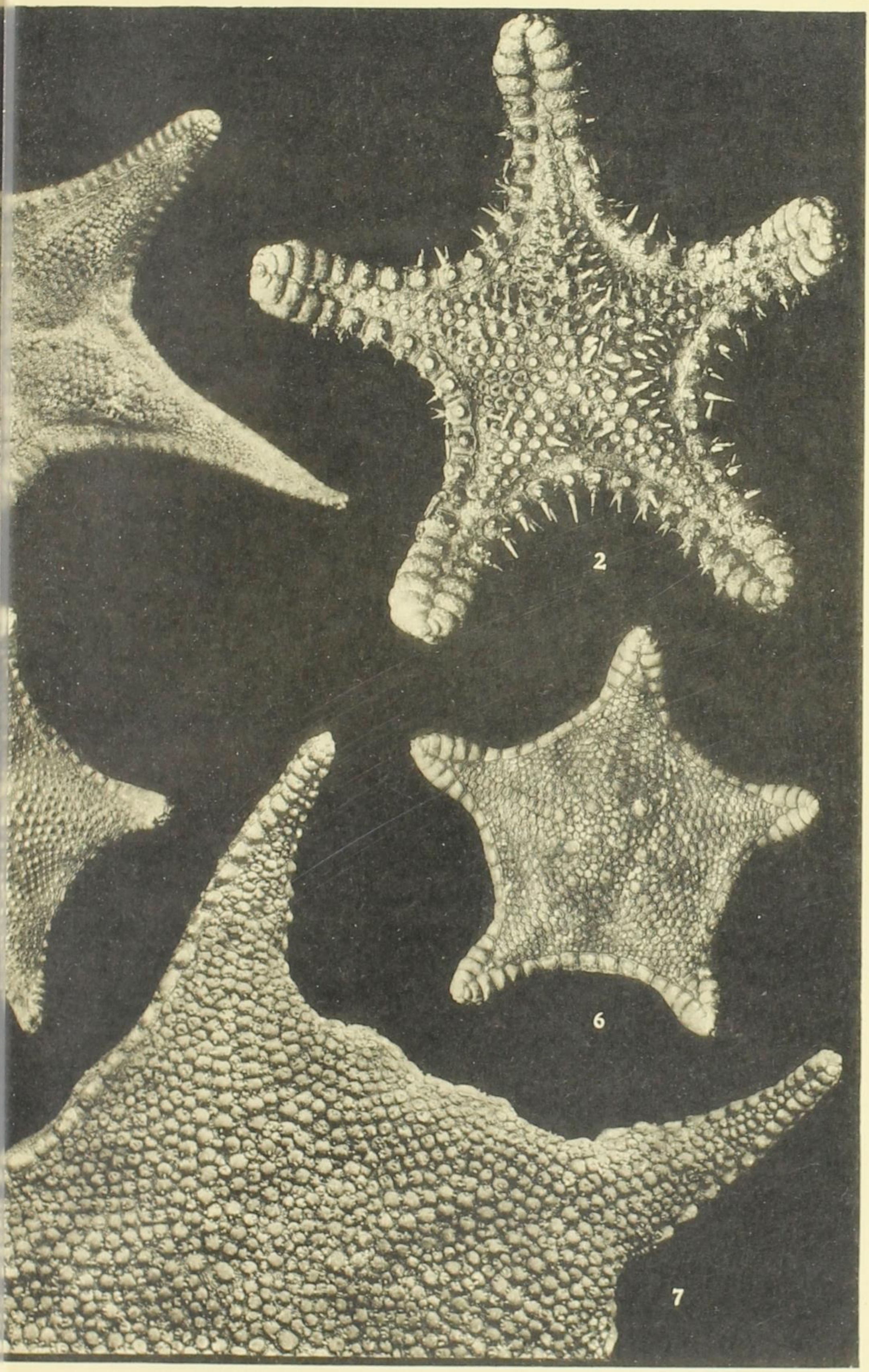
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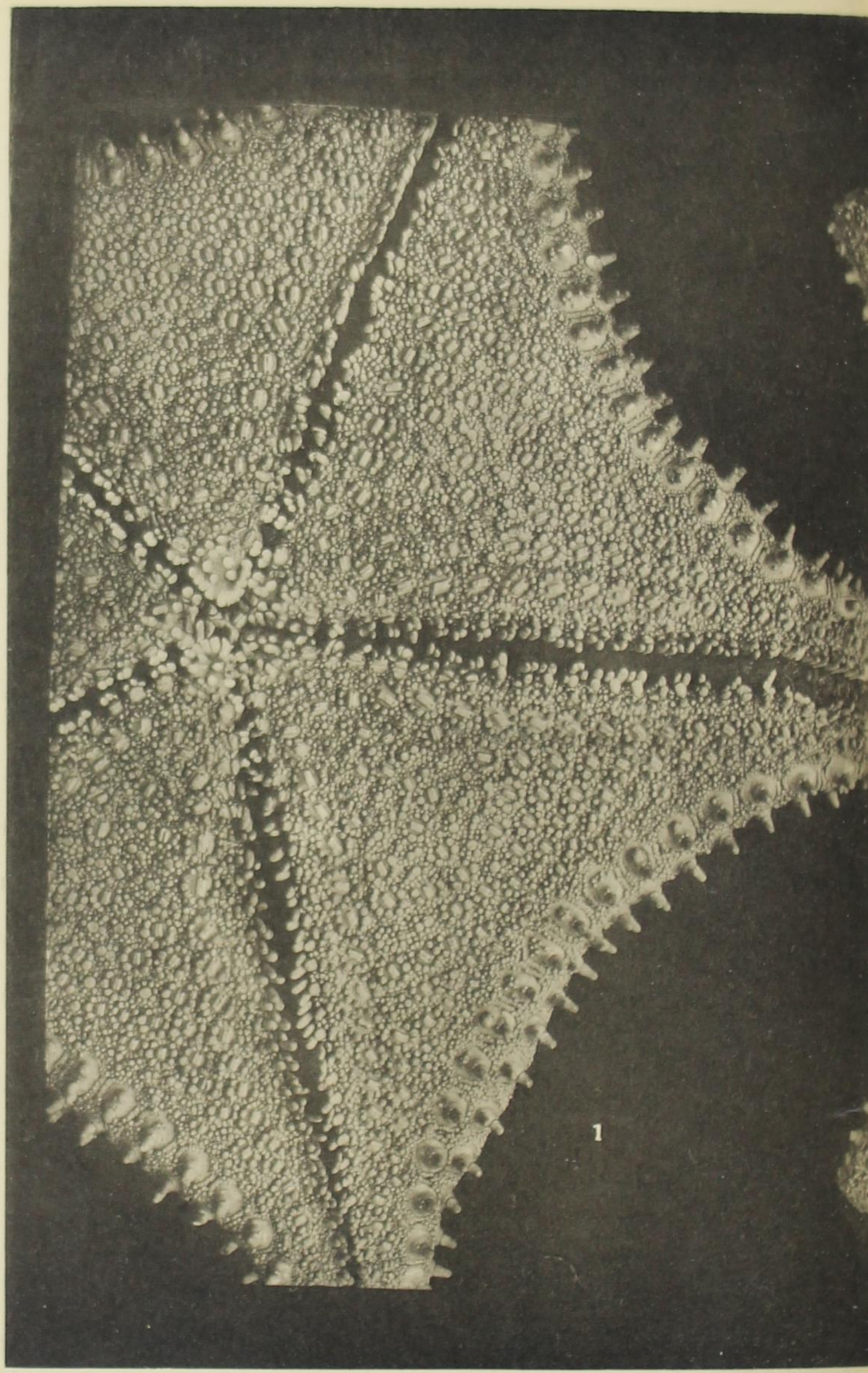
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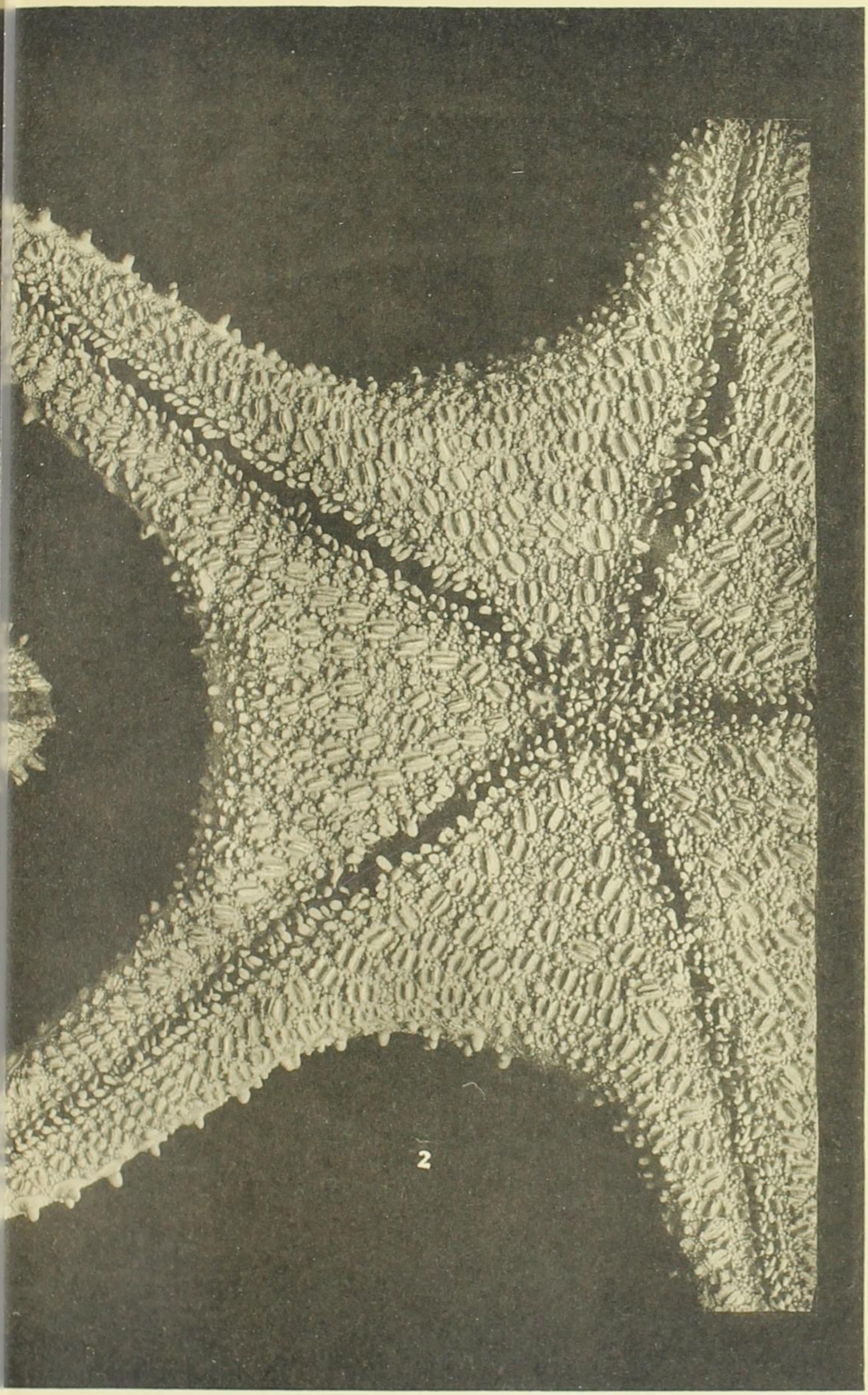
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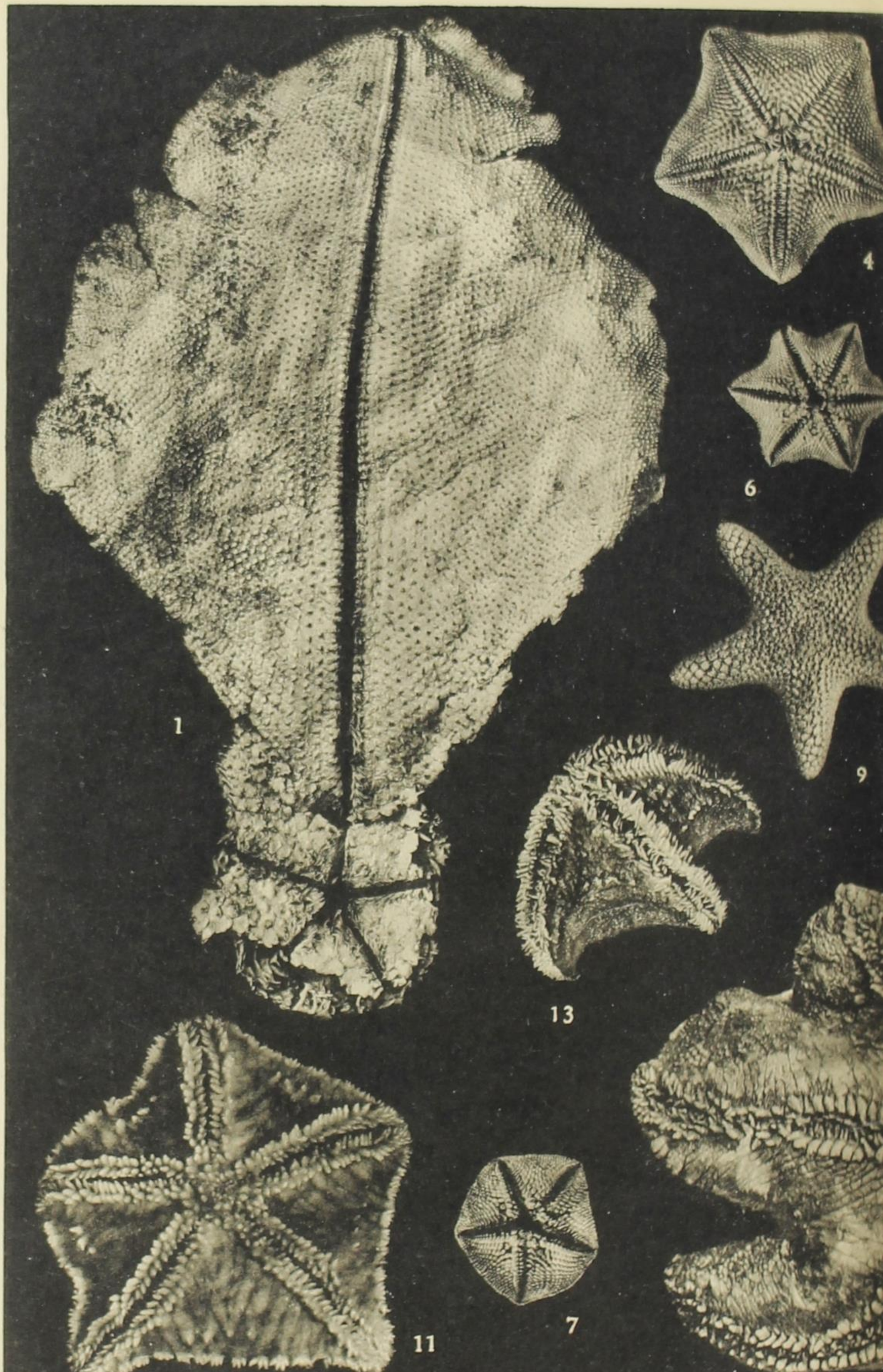
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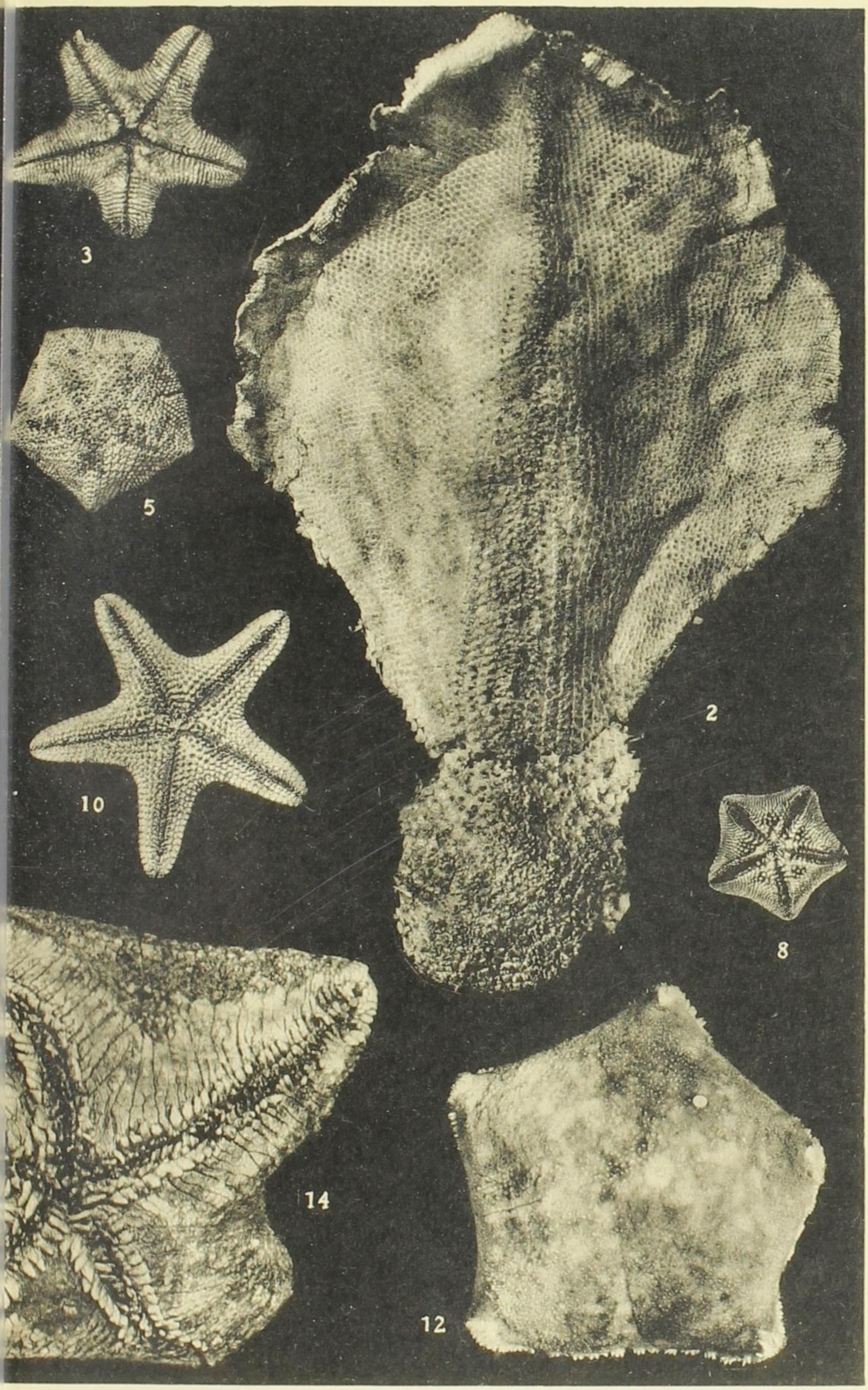
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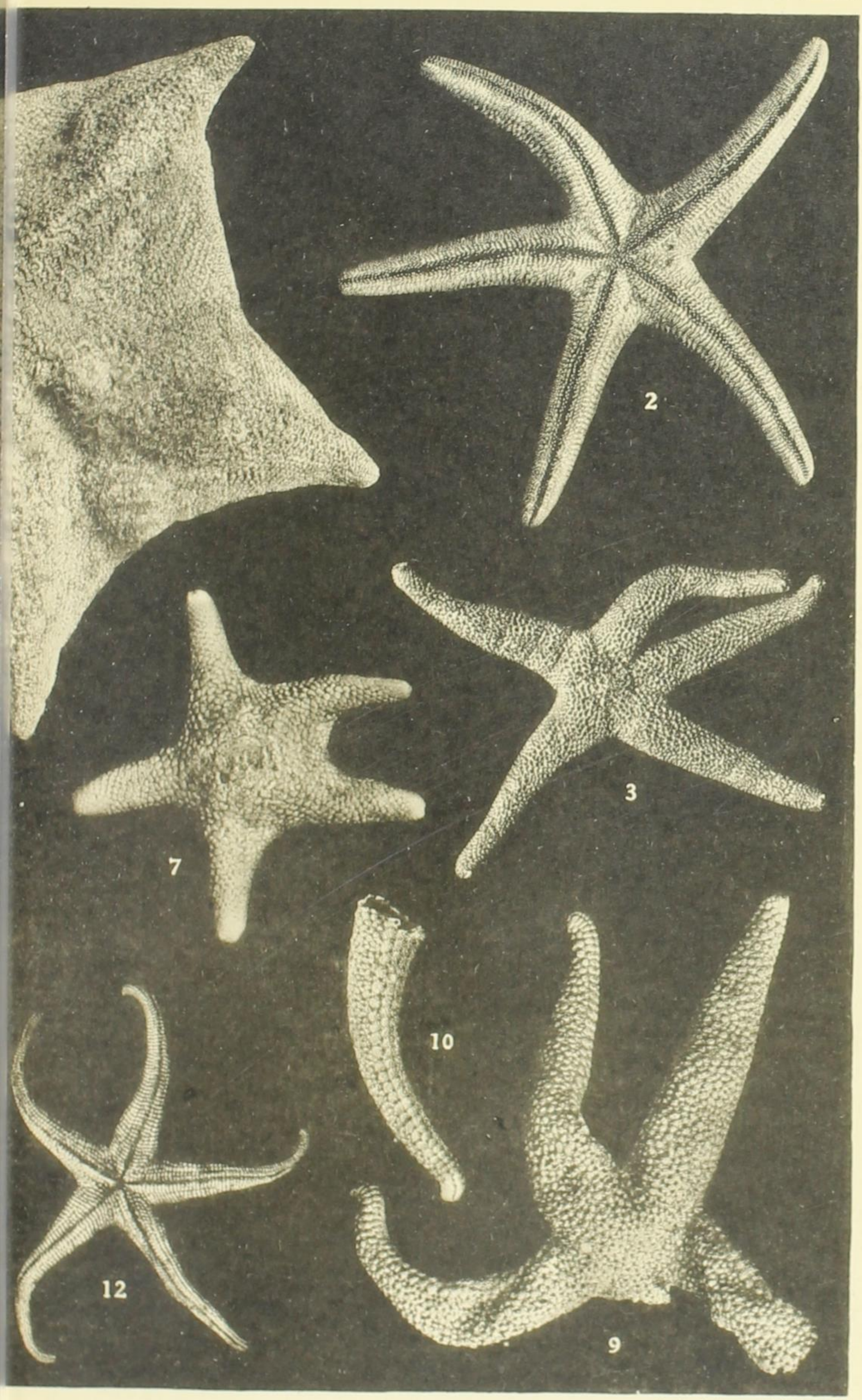
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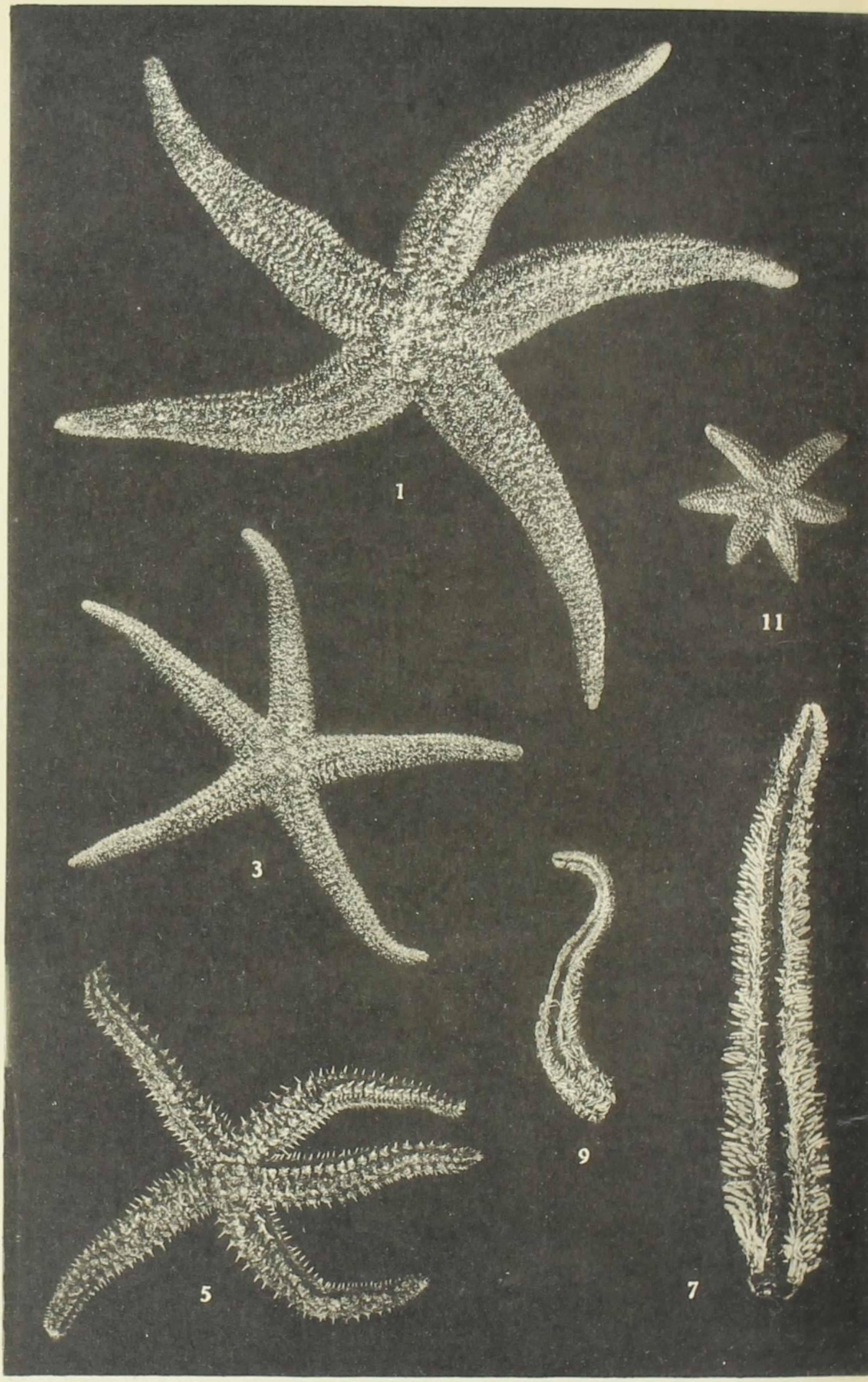
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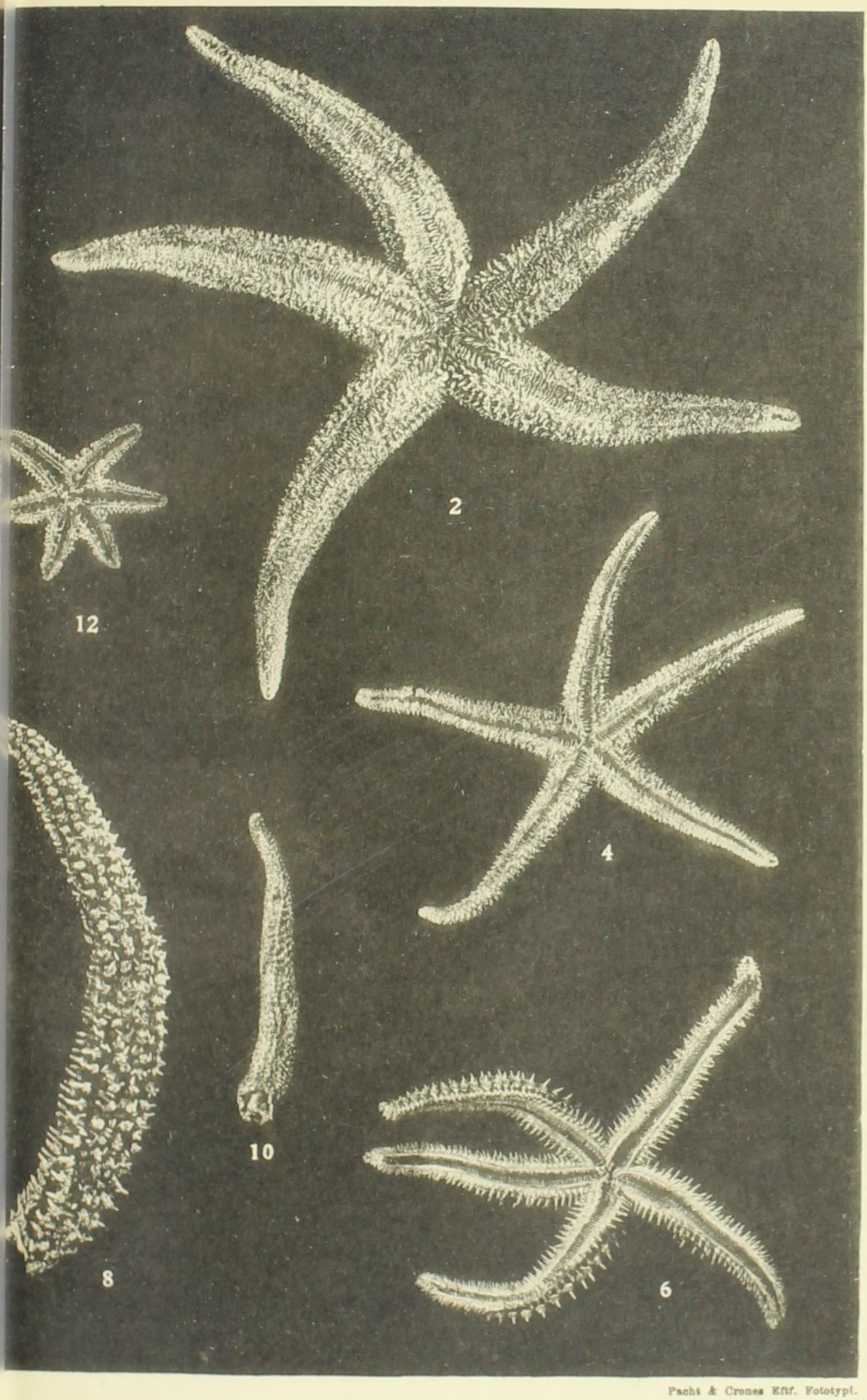
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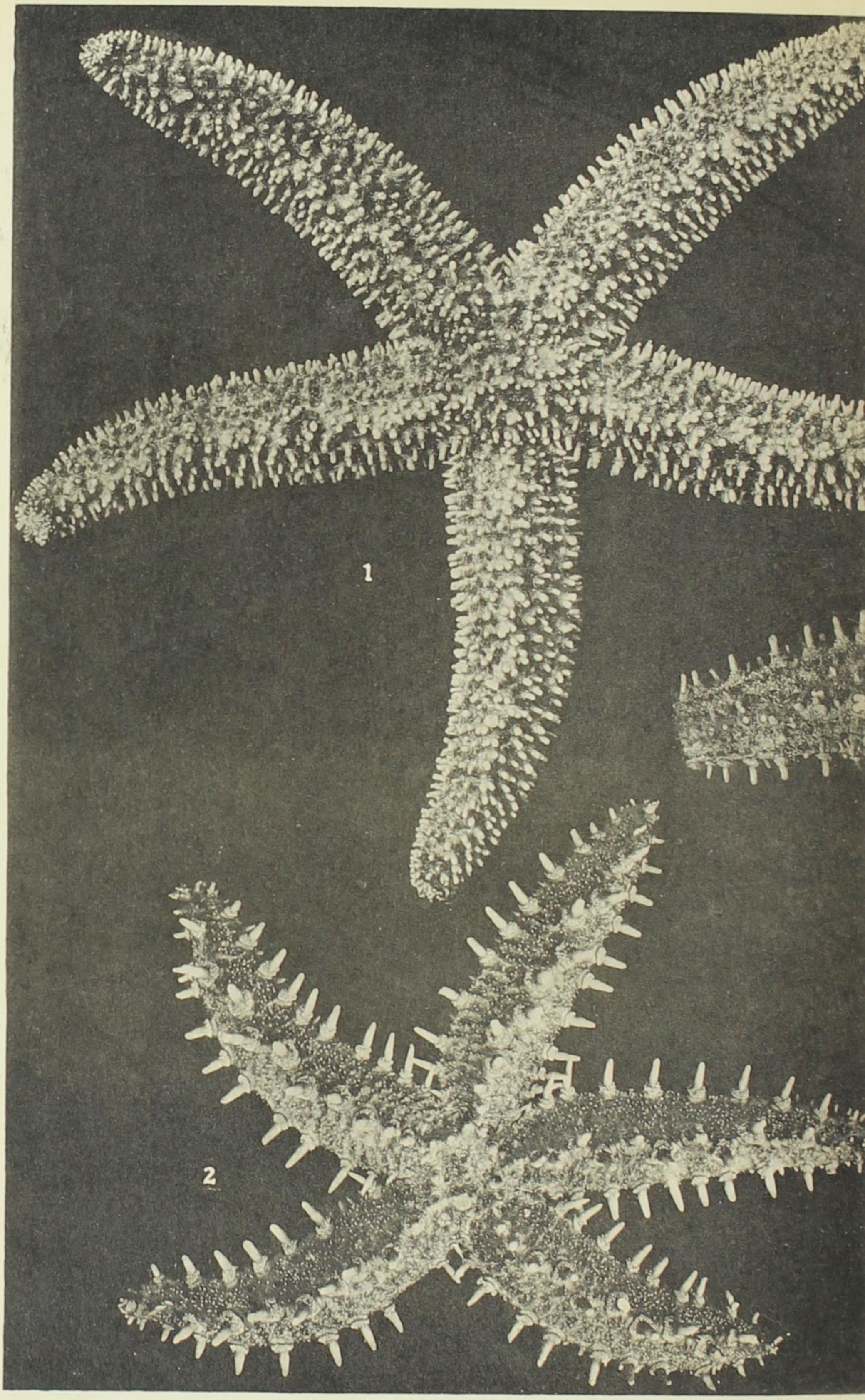
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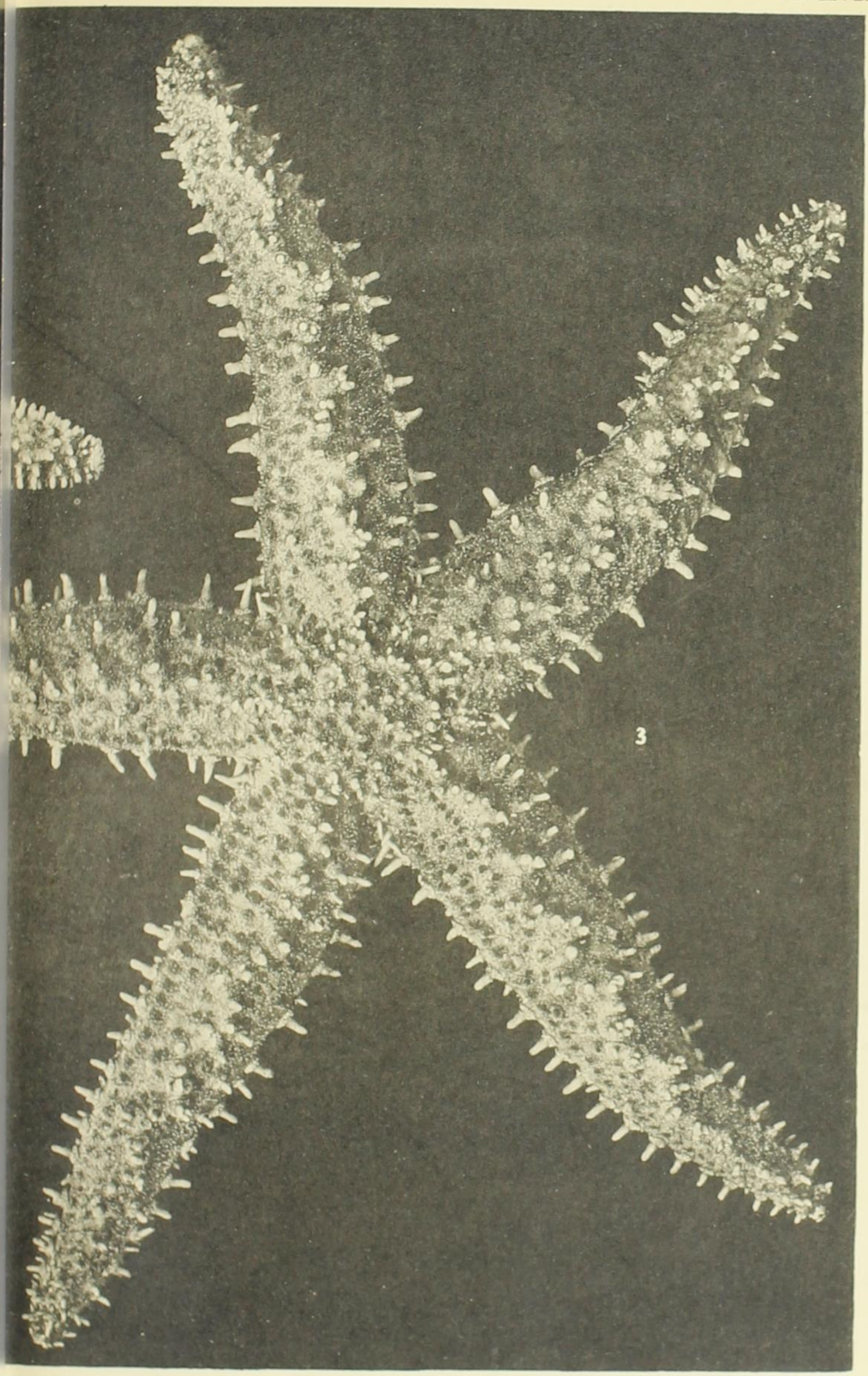
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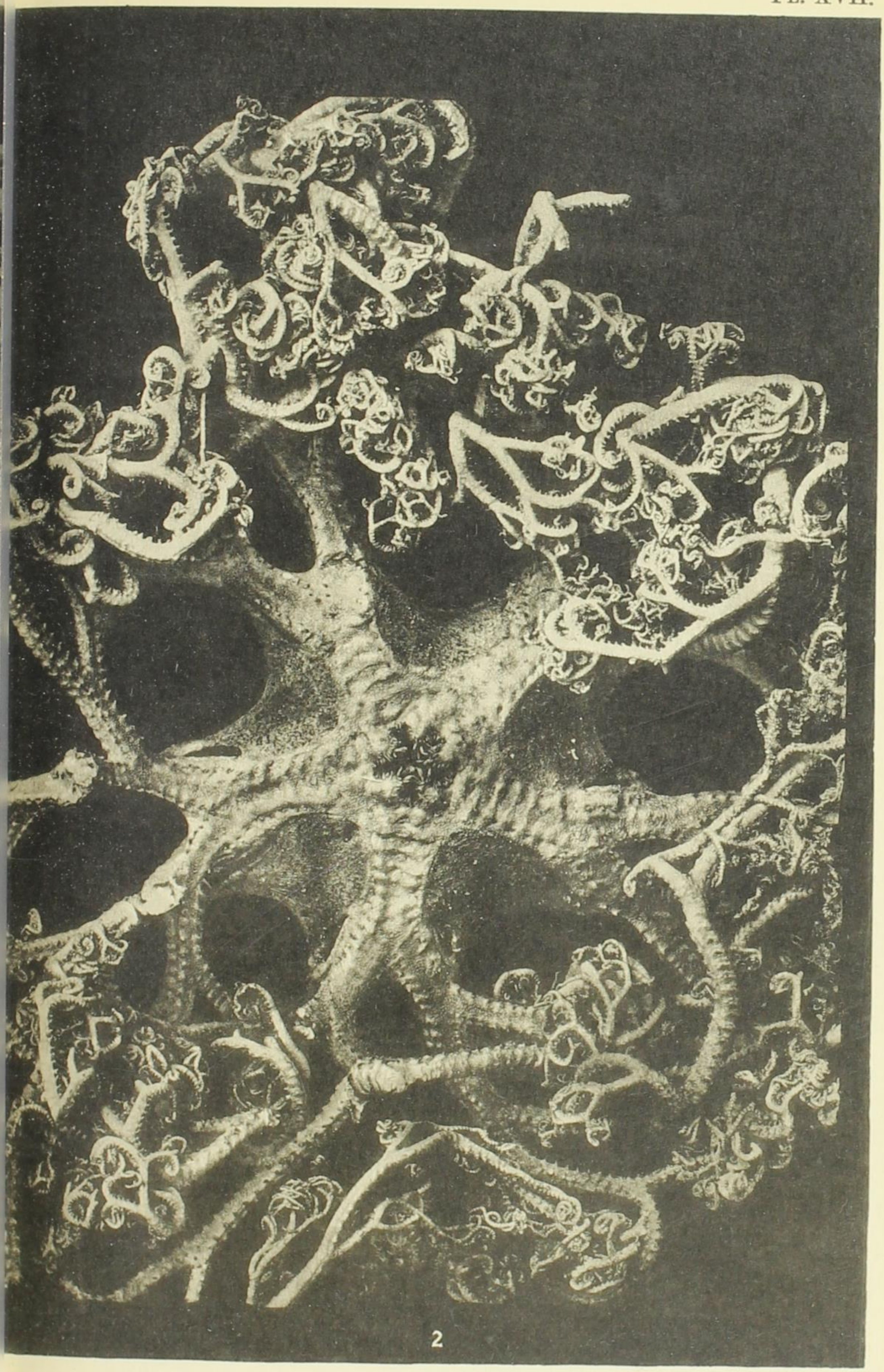
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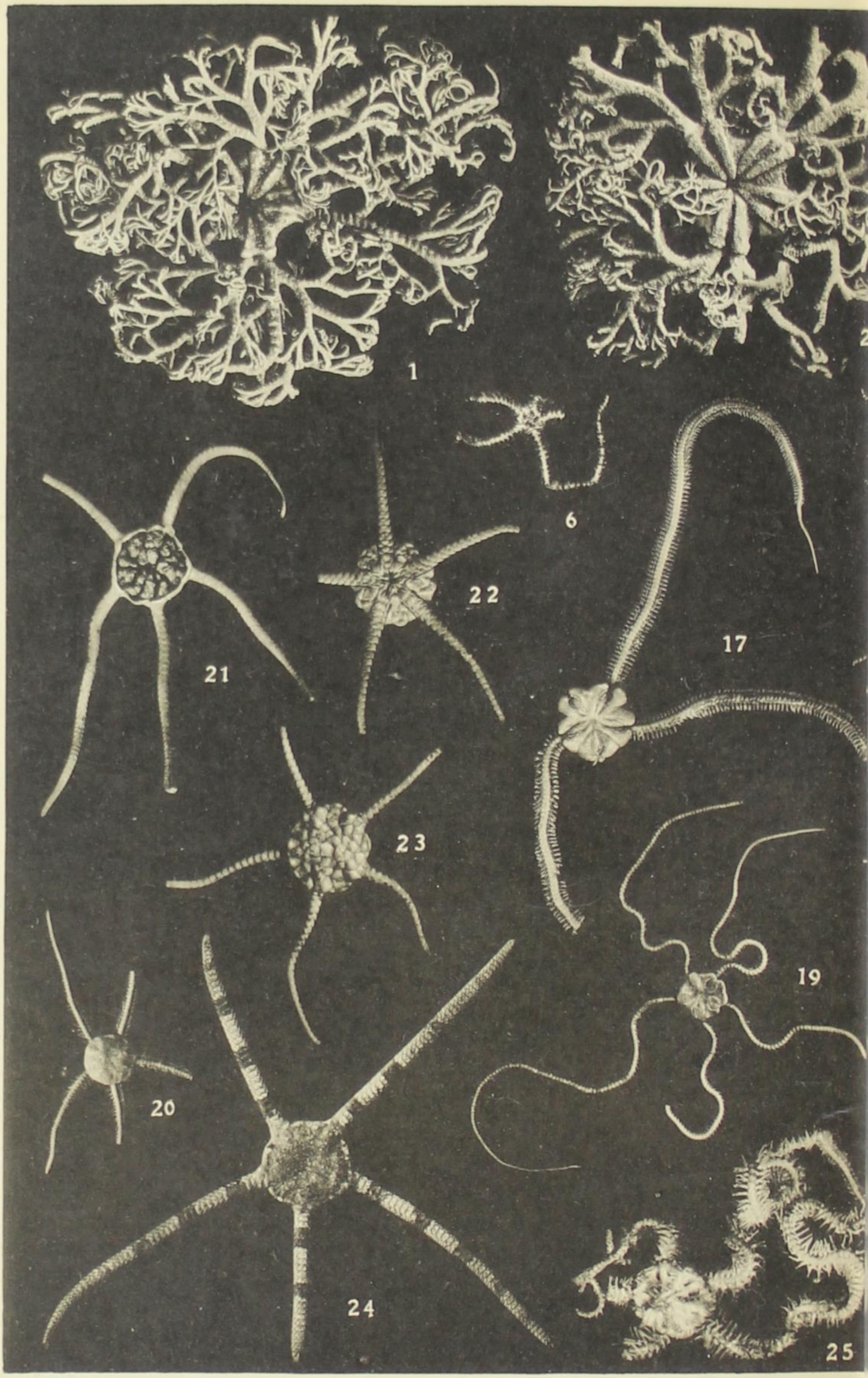


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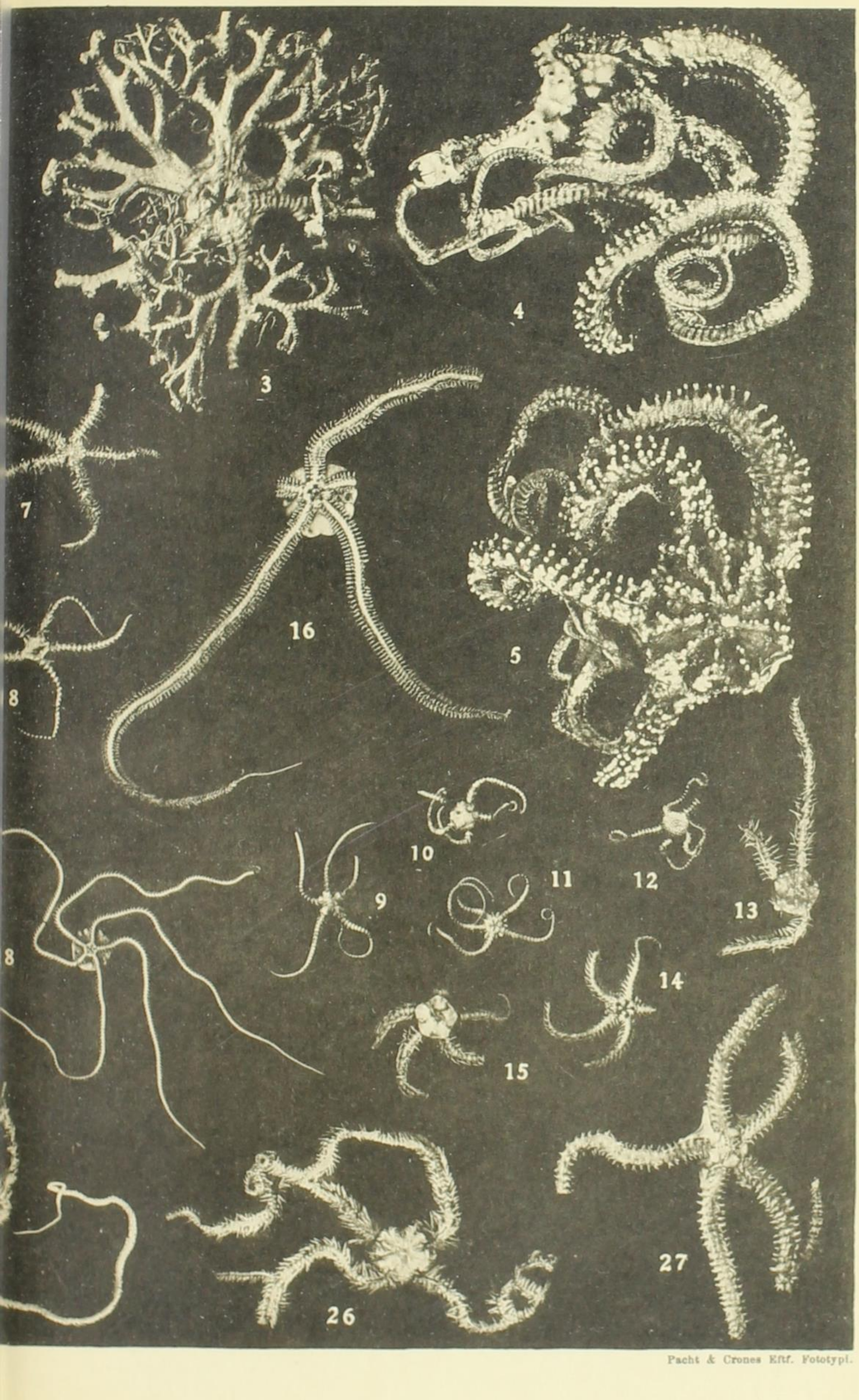


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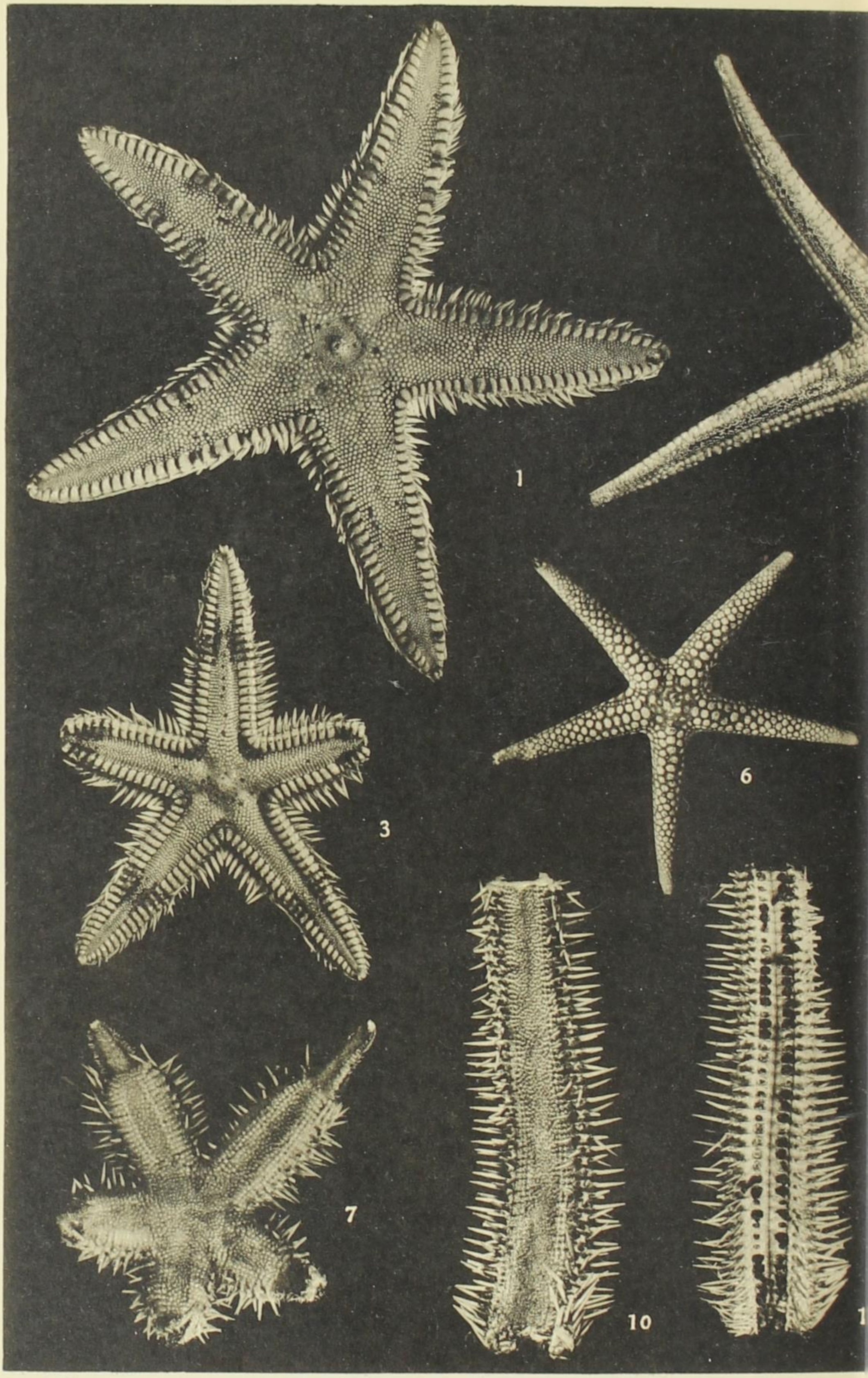
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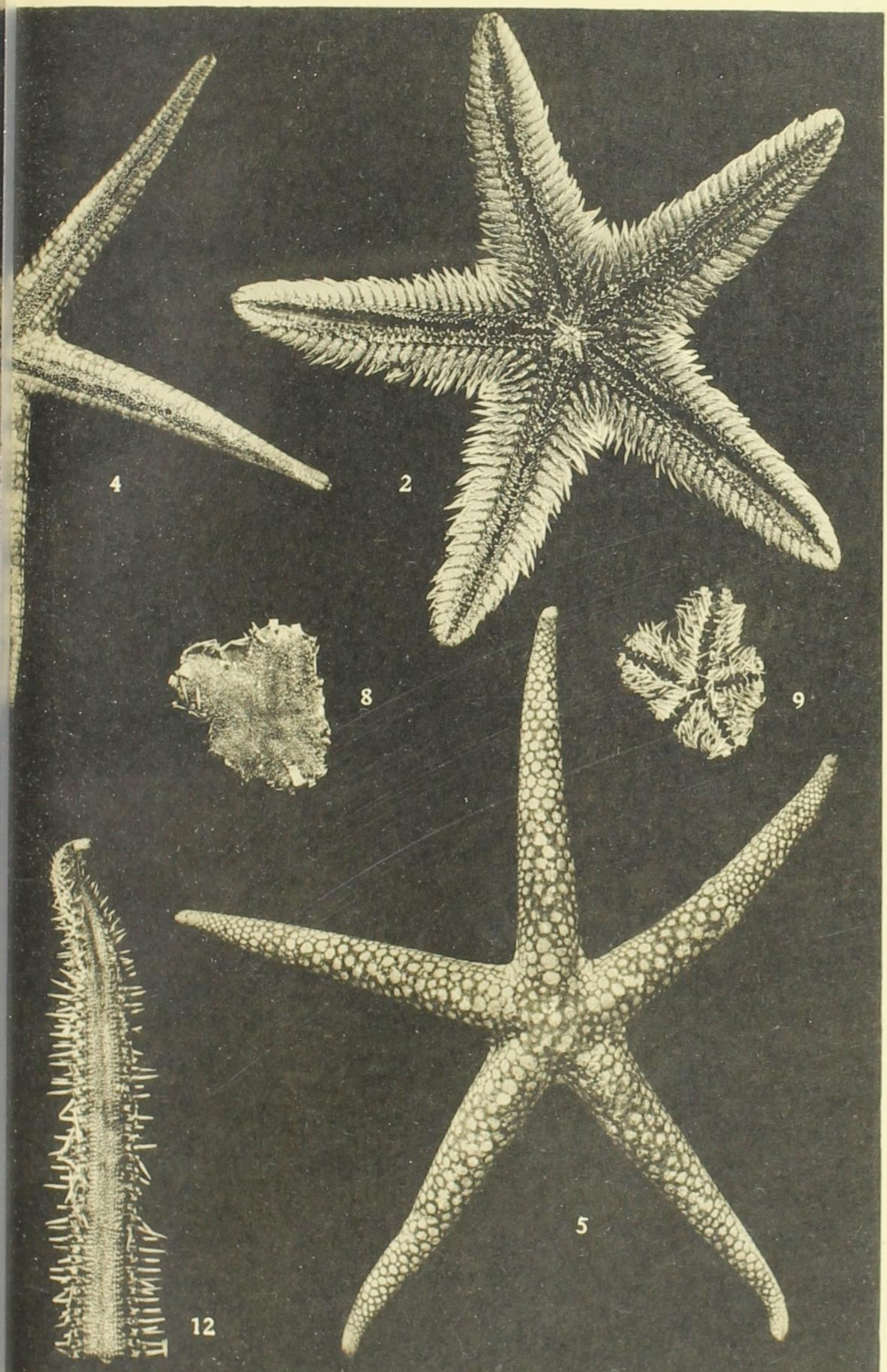
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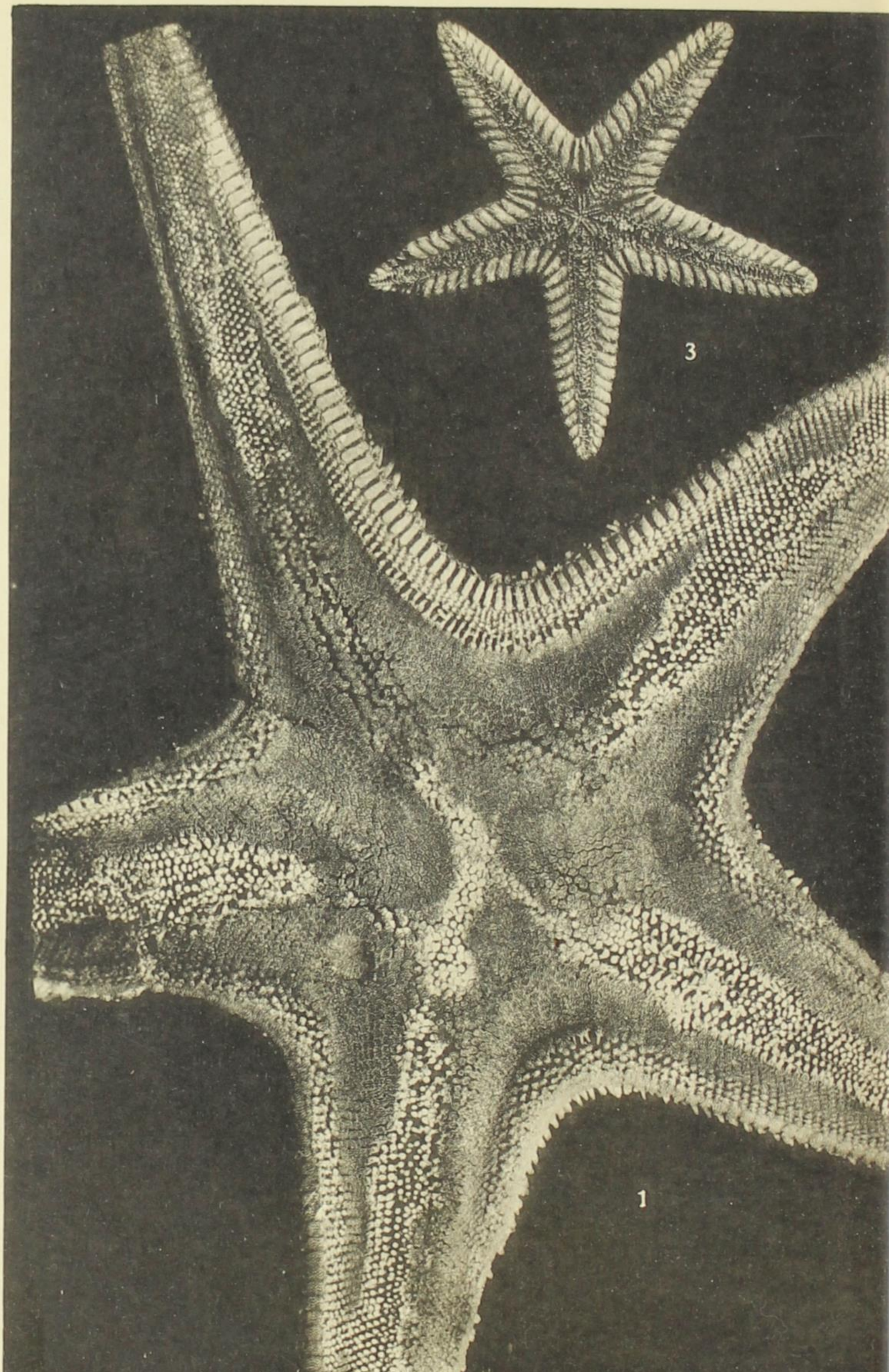
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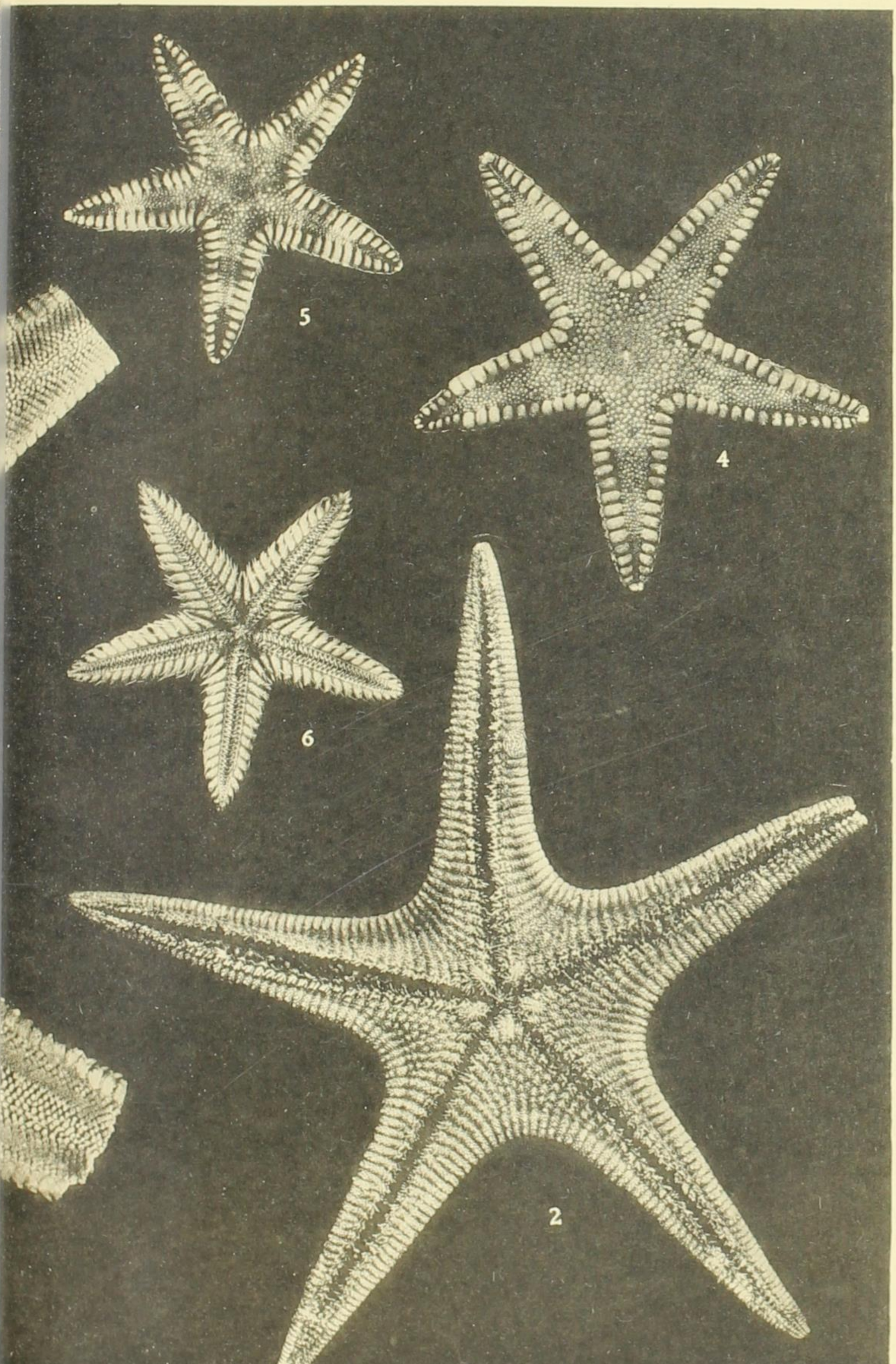
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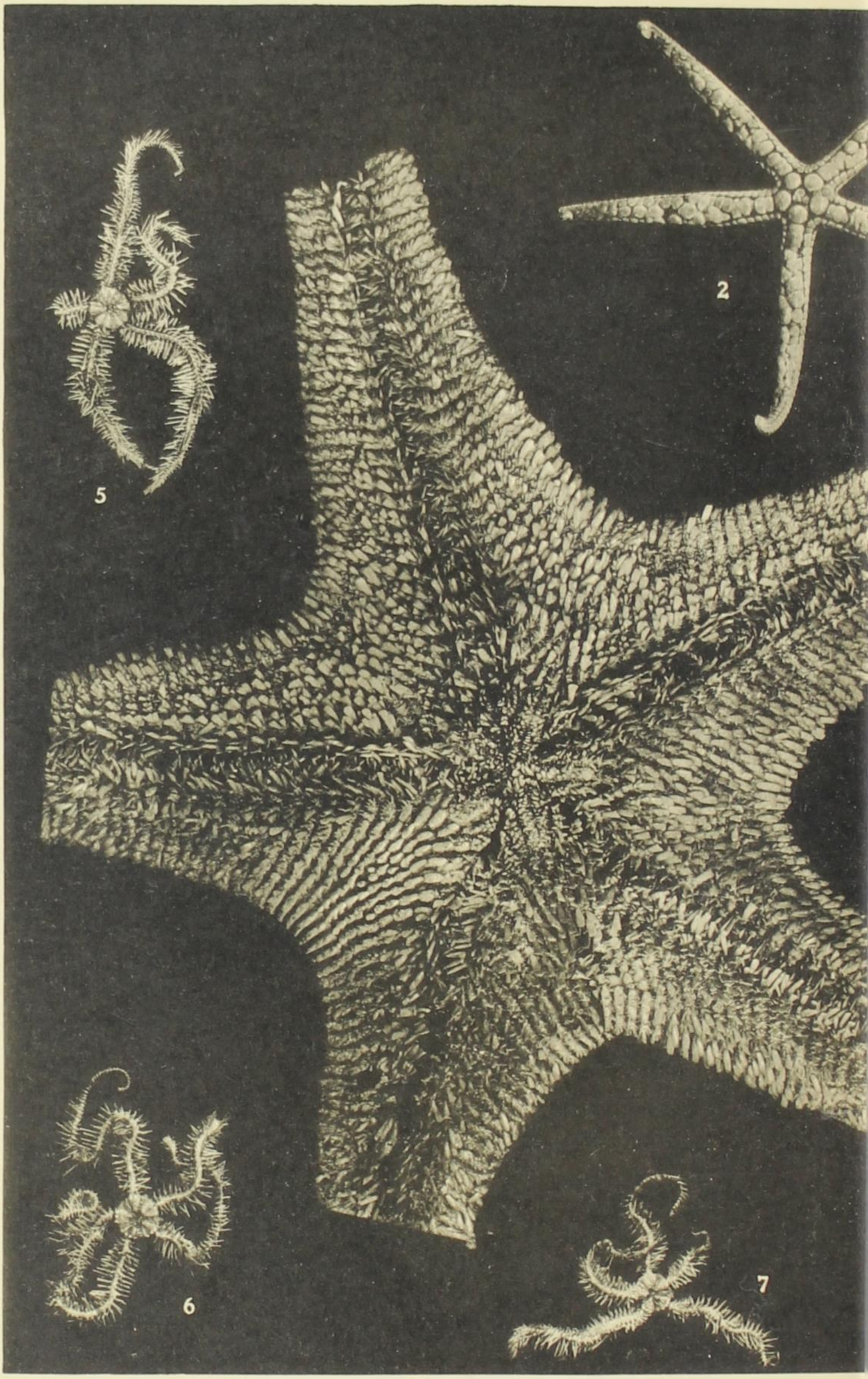
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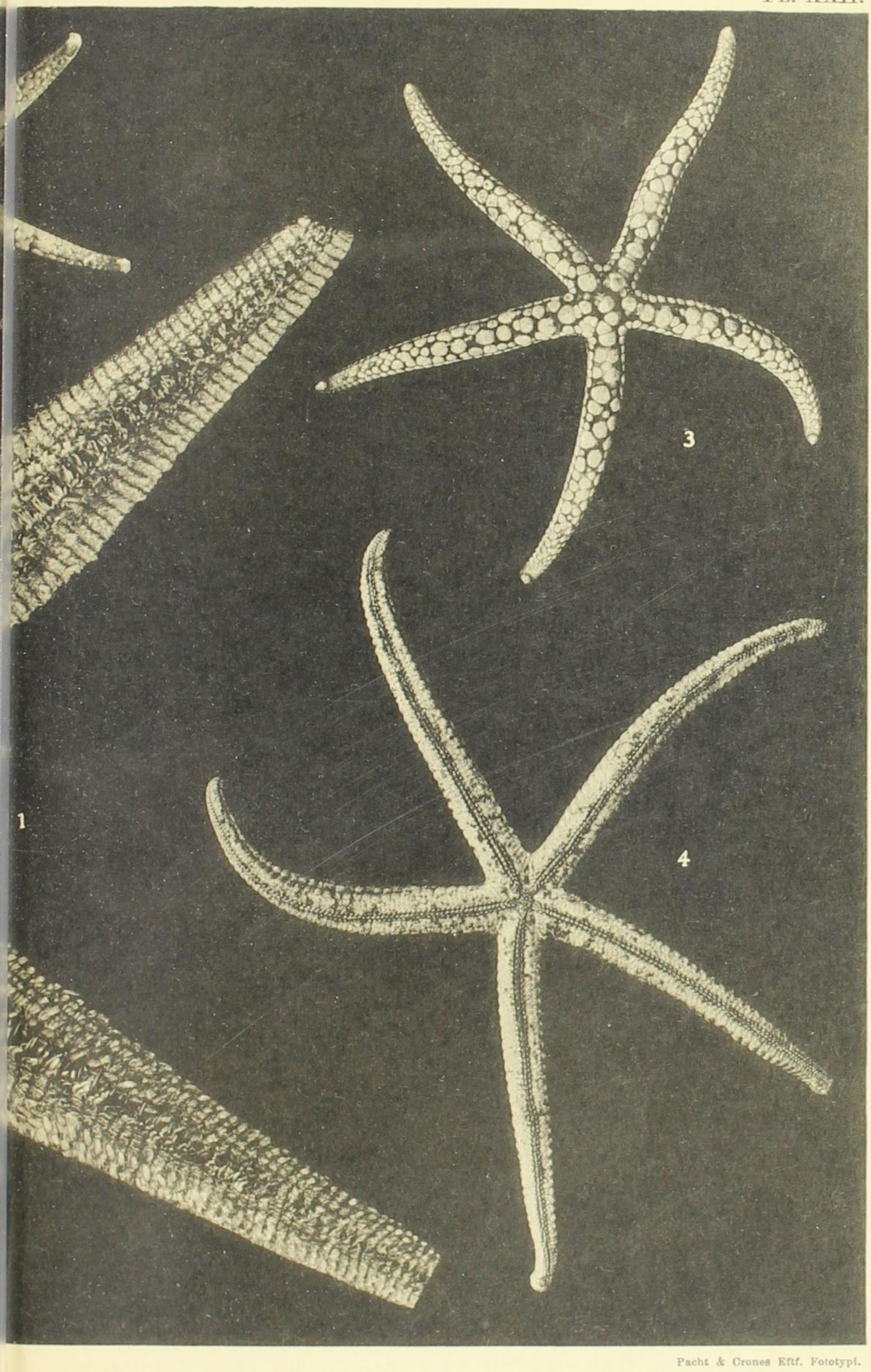
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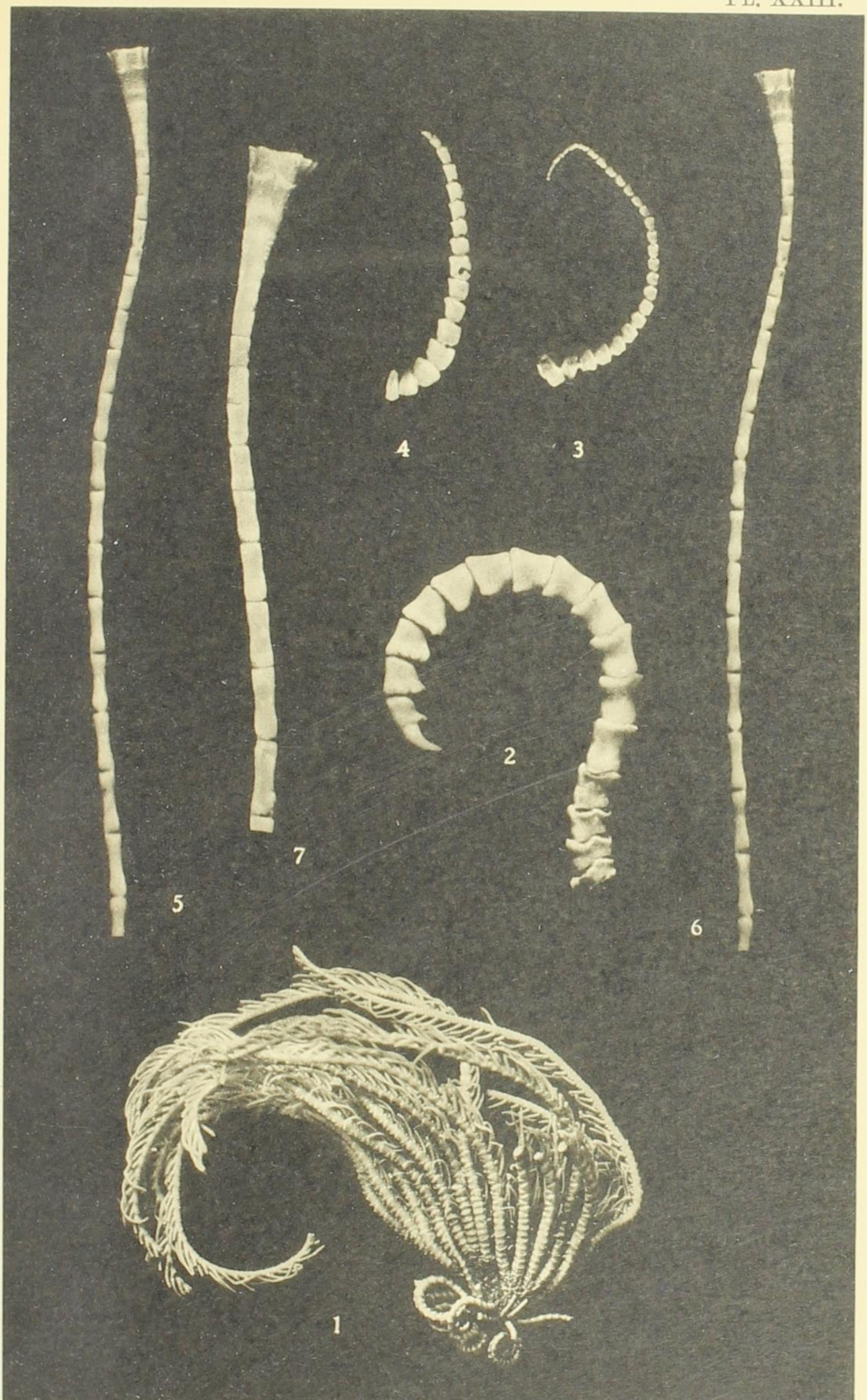
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