



**An illustrated catalogue of type specimens of the bathyal brittlestar genera  
*Ophiomusium* Lyman and *Ophiosphalma* H. L. Clark  
(Echinodermata: Ophiuroidea)**

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## Abstract

Type specimens of 61 species of the bathyal ophiurid genera *Ophiomusium* Lyman and *Ophiosphalma* H.L. Clark are illustrated and their main features outlined, to form a partial catalogue for current and future workers. Thirty-nine species of *Ophiomusium* and 22 of *Ophiosphalma* are recognised, based largely on the number of exposed tentacle pores on the basal ventral arm plates. Most of the *Ophiosphalma* listed here are new combinations from their original genus, *Ophiomusium*. *Ophiomusium sculptum* Verrill is a junior subjective synonym of *O. acuferum* Lyman, and *Ophiosphalma fimbriatum* (Koehler) is a junior subjective synonym of *O. glabrum* (Lütken & Mortensen). The subspecies *Ophiomusium fimbriatum atlanticum* Hertz and *Ophiomusium facunda muta* Hertz are elevated to full species. Because of their bathyal habitat (<4000 m), representatives of these genera are relatively rare in collections, and it will require fresh material of a range of sizes, for morphological comparison and for DNA analysis, to reliably confirm their taxonomic validity and clarify their relationships.

**Key words:** Morphology, taxonomy, world-wide bathyal ophiuroids

## Introduction

The genera *Ophiomusium* Lyman, 1869 and *Ophiosphalma* H.L. Clark 1941 occur in all the world's oceans between 200–4000 m, and are very similar in appearance. Both genera have smooth or low tubercular disc plates, stiff arms with short arm spines, and exposed tentacle pores on only the first two, three or four ventral arm plates. Since H. L. Clark's erection of *Ophiosphalma* in 1941, a number of *Ophiomusium* species have been transferred to it. The differences between species are often slight and age-related, and this has given rise to confused identification, and numerous synonyms.

In 1980–81 I examined many specimens of *Ophiomusium* and the few *Ophiosphalma* recognised then, during a tour through the natural history museums of India, Europe, Britain, the USA and Australia (see Acknowledgments). Type specimens were examined where possible and were illustrated using a camera lucida. My initial plan was to try to unravel the relationships between species on morphological grounds, but this proved difficult due to the reduced number and variability of diagnostic features, particularly those that change with age.

Also, early descriptions and illustrations are scattered in a wide variety of 18th and early 19th century journals, often hard to locate.

I have now assembled here the notes and illustrations of the type specimens I examined in the hope that they will act as a partial catalogue and a source of data for current and future workers. A number of long-lost type specimens are noted, and some synonyms are created and suggested in this catalogue. Thirtynine species of

*Ophiomusium* and 22 species of *Ophiosphalma* are recognised here. Some type specimens could not be located in the major repositories, and lectotypes have been erected, where appropriate. Some species may require new material to confirm their validity and clarify their relationships.

*Ophiomusium* was erected by Theodore Lyman in 1869 from specimens obtained by HMS *Challenger* in the West Indies (Barbados). Lyman went on to describe many species in a series of papers between 1869 and 1882. In the 20th century, the main contributors to the large number of species of *Ophiomusium* were Koehler, A. H. and H. L. Clark, and Mortensen (see References).

Hendler (1998), using SEM, discovered minute tentacle pores associated with the lowest arm spine on all arm segments of *Ophiomusium lymani* Wyville-Thomson, and *Ophiosphalma jolliensis* (McClendon), thus indicating that all species of those two genera probably have tentacle pores throughout the arms. However, because the minute pores are not obvious to the eye or through normal binocular microscopes, I propose that the term “exposed tentacle pores” be used for the pores which are very evident on the sutures of the first few lateral and ventral arm segments, on which Clark (1941) based his division of *Ophiomusium* into two genera. The varying occurrence of these exposed pores in different species are useful systematic indicators, as they have been used by numerous past and present students of the group. Likewise, the number of ventral arm plates may also be a useful character, as Schöner (1967) and Turner (1999) have shown that in *Ophiomusium* the number of plates is fixed at a certain point in ontogeny and does not increase with further growth. Another character which became obvious during the present study of type material was that in *Ophiosphalma* the radial shields are separated, even in young specimens, or in the case of one species (*O. monoplax* H. L. Clark) in contact only at mid-point in adult specimens. In *Ophiomusium*, many species have fully contiguous radial shields in adults.

Fell (1960) introduced an additional character to separate *Ophiosphalma* from *Ophiomusium*: oral papillae being either fused or separated around the jaw. He also restricted the tentacle pore character to *Ophiomusium* s.str. Having studied 61 type specimens of these two genera, I have concluded that the oral papillae fusion character is too variable. I have therefore concentrated on the number of pairs of exposed tentacle pores, which separate the two genera into 39 *Ophiomusium* and 22 *Ophiosphalma*. Clark (1941) referred to the importance and consistency of this character, and that it had become evident that the division of *Ophiomusium* into two genera was quite justified. I am aware of current investigations into the status of *Ophiosphalma* and its relationships to other genera using DNA (Sabine Stöhr, *pers.comm.* August 2015), and await the results with interest.

Three species, *Ophiomusium fallax* Koehler, 1904, *O. incertum* Koehler, 1930, and *O. kimblae* Baker, 1979, have no exposed tentacle pores even in young specimens, and only one or two ventral arm plates, and may eventually be removed from *Ophiomusium*.

Species and generic changes made in this publication are based on examination of type specimens. Unless otherwise indicated, all illustrations in this catalogue are of the primary type specimens, and scales equal 1mm.

### Synonymies:

*Ophiomusium sculptum* Verrill 1899 synonymised with *O. acuferum* Lyman 1875, *Ophiosphalma fimbriatum* (Koehler, 1922) synonymised with *O. glabrum* (Lütken & Mortensen, 1899).

**New Combinations** (*Ophiosphalma* replaces *Ophiomusium* where appropriate)

*Ophiomusium mutum* (Hertz, 1927), *Ophiosphalma archaster* (Wyville-Thomson, 1878), *Ophiosphalma armatum* (Koehler, 1922), *Ophiosphalma atlanticum* (Hertz, 1927), *Ophiosphalma breve* (H. L. Clark, 1939), *Ophiosphalma corticosum* (Lyman, 1878), *Ophiosphalma diomedea* (Lütken & Mortensen, 1899), *Ophiosphalma elli* (A. H. Clark, 1949), *Ophiosphalma familiare* (Koehler, 1897), *Ophiosphalma glabrum* (Lütken & Mortensen, 1899), *Ophiosphalma impotens* (Koehler, 1922), *Ophiosphalma jolliense* (McClendon, 1909), *Ophiosphalma laqueatum* (Lyman, 1878), *Ophiosphalma monoplax* (H. L. Clark, 1915), *Ophiosphalma nitidum* (H. L. Clark, 1939), *Ophiosphalma properum* (Koehler, 1904), *Ophiosphalma regulare* (A. H. Clark, 1936), *Ophiosphalma spinigerum* (Mortensen, 1933), *Ophiosphalma spinulosum* (Koehler, 1922), *Ophiosphalma variabile* (Lütken & Mortensen, 1899)

**Abbreviations:** AM: Australian Museum, Sydney; BMNH: British Museum of Natural History, London; NMNH or USNM: National Museum of Natural History, Smithsonian Institution, Washington; NMNZ: Museum of New Zealand, Wellington; MCZ: Museum of Comparative Zoology, Harvard University, Boston; RMNH: Naturalis, Leiden, collections formerly the ZMA - Zoological Museum, University of Amsterdam; SAM: South Australian

Museum, Adelaide; ZMUC: Zoological Museum, University of Copenhagen; ZSI: Zoological Survey of India, Calcutta; d.d.: diameter of disc.

## Species examined

### *Ophiomusium* Lyman 1869

*Ophiomusium* Lyman, 1869: 322 [type species *Ophiomusium eburneum* Lyman, 1869 by monotypy]

*Ophiomusa* Hertz, 1927: 102 [type species *Ophiomusium lymani* Wyville-Thompson, 1873 by monotypy; synonymized by H. L. Clark, 1941].

**Generic description:** Disc diameter up to 30 mm, arms three times d.d. Dorsal disc plates usually large, often porcellaneous, with either smooth, finely granular, or low conical stumps. Plates closely soldered. Radial shields mostly adjoined in adults. Ventral disc plates usually smooth, and large. Oral shield dominant. Oral papillae fused or separated. Genital slits adjacent to 1st, 2nd, or 3rd ventral arm plates, often sinuous, and with lateral papillae. Arms moniliform, with large lateral plates meeting above and below, bearing 1–13 arm spines.

Spines usually short, ventral-most longest, sometimes bifurcate. Dorsal and ventral arm plates may only be present on basal arm segments; if present further on arm, they become progressively very small. Tentacle pores present on all ventral arm segments, but only readily observable as exposed pores on the first two arm segments. Usually a scale on each pore.

### *Ophiomusium acuferum* Lyman, 1875.

Figures 1 a, b, c,

*Ophiomusium acuferum* Lyman, 1875; Borges & Campos, 2011. *Ophiomusium sculptum* Verrill, 1899

**Holotype** MCZ 427, off Barbados, 177–219m.

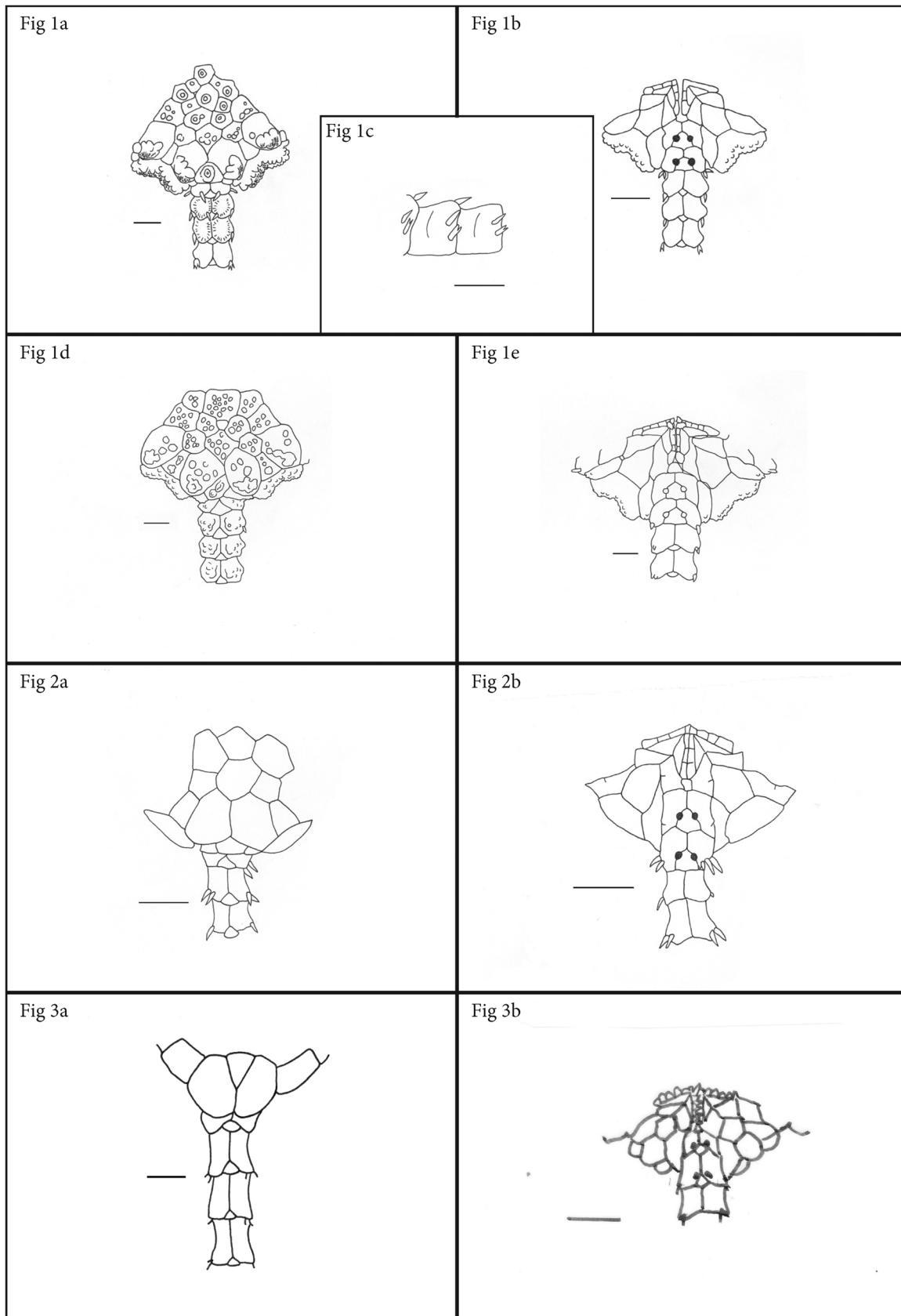
Other material examined: 3 specimens BMNH 92-2-22-16-18, Barbados, 133 m; 4 specimens USNM 21289, Mayaguez Harbour, Puerto Rico, 97–120 fms (as *O. sculptum*); 9 specimens, USNM E513, E514, E4375, E4539, E4540, E4538, University of Iowa Barbados-Antigua Expedition Stations 4, 7, 15, 28, 44–49. The Yale Peabody Museum in Boston was searched for the types of *O. sculptum*, but none were located. Dr Marc Eleaume, Paris Museum has recently informed me that a syntype of this species is in their collection: MNHN 10284, ex-*Albatross* expedition.

**Main Features:** In the holotype, the periphery of marginal disc plates is raised and knobbly. All other disc plates have one or more tubercles, those adjacent to the marginal plates with a group of 3–4 tubercles concentrated at their distal corners. Those inside this ring (primaries) have one or two central tubercles. First dorsal arm plate raised and knobbly and separates the radial shields. Dorsal sides of the lateral arm plates are also knobbly. Small dorsal arm plates lie in a median longitudinal depression. Interradial marginal plates large, V-shaped, protuberant, and knobbly. Otherwise, the surface of all plates is smooth (micro-reticulate).

Ventral surface smooth, 2 pairs of exposed tentacle pores, 1 circular scale. Closely adjoining oral papillae. Sinuous genital slits run to the distal end of the first lateral arm plate. Oral shield, 2 genital plates, and a large interradiial plate only in the ventral interradiial area.

Ventral arm plates throughout, but very small distally. 3 small arm spines. On basal arm segments a longer spine is present on the dorsal side of each lateral arm plate, each side of the median groove. Lower down on the arm near the ventral margin, are two small spines the lowermost of which has a bifurcate tip and hollow core.

This species is conspecific with *O. sculptum* Verrill 1899 as identified in the USNM collections, including one specimen identified by Verrill himself, and others identified by H. L. Clark. These specimens compare well with Verrill's original description and figures, except for the first ventral arm plates shown in his Figure 2, Plate II, which are unlike any *Ophiomusium* in that they are extremely small (25% of arm width) and the exposed tentacle pores are located in the middle of the ventral faces of the lateral arm plates. Also, Verrill did not mention in his description of the type the presence of dorsal arm spines, which are present in the specimens he identified in the USNM. Verrill's type specimen could not be located in the YPM.



**FIGURE 1.** *Ophiomusium acuferum* MCZ 427: a, b, dorsal and ventral disc sectors; c, basal arm segments; d, e *Ophiomusium sculptum* USNM 21289: dorsal sector.

**FIGURE 2.** *Ophiomusium alecto* USNM E0005197: a, b, dorsal and ventral disc sectors.

**FIGURE 3.** *Ophiomusium altum* RMNH V.Ech.O 2045 : a, b dorsal and ventral disc sectors.

***Ophiomusium alecto* A. H. Clark, 1936.**

Figures 2 a, b

**Holotype** USNM E0005197, north of Puerto Rico, 183–549 m, RV *Caroline*, Johnson-Smithsonian Deep Sea Expedition March 1933.

**Main Features:** Disc diameter 4 mm, disc circular. Arms 8 mm. Dorsal surface dominated by primary plates and radial shields. A large interradial plate present. First 5 dorsal arm plates swollen, remainder low and hardly visible. 3–4 arm spines, lower and middle ones longest.

Two ventral arm plates, 2 pairs of exposed tentacle pores, genital slits long and raised at edges, sinuous.

***Ophiomusium altum* Koehler, 1904.**

Figure 3 a, b

*Ophiomusium altum* Koehler, 1904; H. L. Clark, 1939.

**Syntypes** (3) RMNH V.Ech.O.2045, *Siboga* Station 76, Makassar Straits, Indonesia, 2029 m. Other material examined: 1 specimen BMNH 1948-5-26-16-364, Gulf of Aden, John Murray Expedition Station 26, 2312 m., 2 specimens BMNH 1948-5-26-365, Zanzibar, John Murray Expedition station 118, 1789 m.

**Main Features:** Disc 5 mm diameter, inflated, highest point is the rosette plates and the central plate has a central prominence. There are 2 pairs of exposed tentacle pores with one scale on each. Arms are thin with long joints, carrying 4 small and closely set arm spines. A second, smaller specimen is with the holotype, but is not labelled as a type specimen.

***Ophiomusium anisacanthum* H. L. Clark, 1928.**

Figures 4 a, b

*Ophiomusium anisacanthum* H. L. Clark, 1928; Baker and Devaney 1981.

**Holotype** SAM K254 (previously E 480), Spencer or St Vincent Gulfs, South Australia, <55m. This is an unusually shallow occurrence for *Ophiomusium* and may be an error.

**Main Features:** Disc with large, finely granular plates dorsally and ventrally. Radial shields pear-shaped and separated by two plates. Interradial areas consist of three large plates, including a wide marginal plate. Ventral interradial areas have six large plates including distinctive oral shields pointed proximally and straight distally. Oral papillae separated.

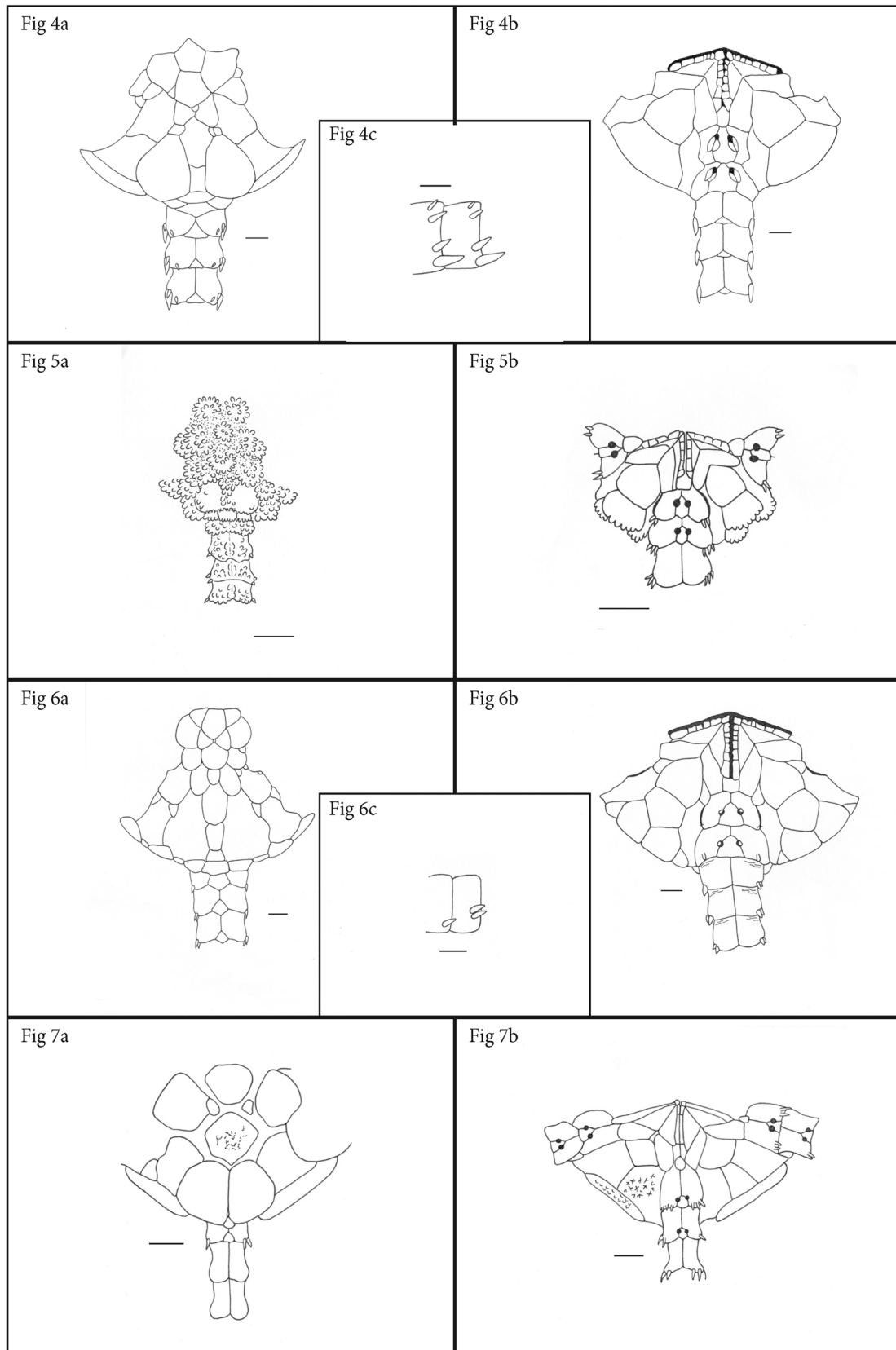
Lateral arm plates large, bearing four arm spines on the basal segments. The lowermost pair of spines are separated from the uppermost, and the lowermost spine is the longest. Beyond the 7th or 8th segments, only the lower pair are present. The first two ventral arm plates are large and each has a pair of tentacle pores bearing two scales. Succeeding ventral arm plates are small, triangular and reach only to the 8th segment. Dorsal arm plates triangular and present only basally.

***Ophiomusium asperum* Koehler, 1930.**

Figures 5 a, b

**Holotype** ZMUC OPH-498, Pacific Expedition Station 7, north Banda Sea, Indonesia, 196 m.

**Main Features:** The disc of this species has distally swollen plates bearing small conical stumps on their distal edges. The lateral arm plates are also swollen distally with similar cones or raised portions. The ventral surface of the disc is without tubercles apart from those on the distal edge of the plate adjoining the oral shield. Otherwise, all disc plates are strongly granular. There are 2 pairs of exposed tentacle pores, each with a single scale which does not cover the entire pore. There are only 2 ventral arm plates on each arm. The oral papillae are not separated.



**FIGURE 4.** *Ophiomusium anisacanthum* SAM K254: a,b, dorsal and ventral disc sectors; c, basal arm segments.

**FIGURE 5.** *Ophiomusium asperum* ZMUC OPH-498: a, b, dorsal and ventral disc sectors.

**FIGURE 6.** *Ophiomusium australe* SAM K256: a, b, dorsal and ventral disc sectors; c, basal arm segments

**FIGURE 7.** *Ophiomusium canaliculatum* USNM E00035: a, b, dorsal and ventral disc sectors.

***Ophiomusium australe* H. L. Clark, 1928.**

Figures 6 a, b

*Ophiomusium australe* H. L. Clark, 1928; Baker, 1979; O'Hara, 1990. *Ophiomusium aporum* H. L. Clark, 1928; Baker, 1979.

**Holotype** SAM K256, Spencer or St Vincent Gulfs, South Australia, depth unknown.

**Main Features:** This species was originally described by Clark as a variety (now = subspecies) of *O. simplex* Lyman 1878. However, in 1979 I examined the type and concluded that *australe* was a valid species, and synonymized *O. aporum* with it (Baker 1979). The disc plates are smooth and overlapping, and the radial shields are separated by 3 plates decreasing in size towards the arm. At the interradial margin of the disc are two overlapping tumid plates. The oral shields, post-oral plate and the two tumid marginal plates make up the ventral surface. There are two exposed tentacle pores, each with a scale. The genital slits are short—one lateral plate long. There are two triangular ventral arm plates and gradually diminishing dorsal plates on each arm. The lateral arm plates carry 2 small spines.

***Ophiomusium canaliculatum* H. L. Clark, 1917.**

Figures 7 a, b

**Holotype** USNM E000035, *Albatross* 1909, station 4732 North Pacific 344m.

**Main Features:** Disc surface entirely rugose. Few disc plates, large radial shields and dorsal marginal plates. Oral shields diamond-shaped. Oral papillae not separated. Two exposed tentacle pores, no tentacle scales. The disc plates have sunken marginal bands of anastomosing crystals, which may be artefacts resulting from preservation.

***Ophiomusium constrictum* Mortensen, 1936.**

Figures 8 a, b

**Holotype** BMNH 12-30-1477, *Discovery* Expedition 1936. WS 871, southwest of Kerguelen Is, 336–341 m.

**Main Features:** Mortensen's description is mostly accurate, but he neglected to note the presence of small dorsal arm plates in the first 3 or 4 segments. There are 2 pairs of exposed tentacle pores, and genital slits run parallel to the first arm plate and are separated from it. The oral shield is very small, the arms are distinctly moniliform, and the disc plates are distinct and higher than the radial shields. The marginal disc plates protrude slightly.

***Ophiomusium eburneum* Lyman, 1869.**

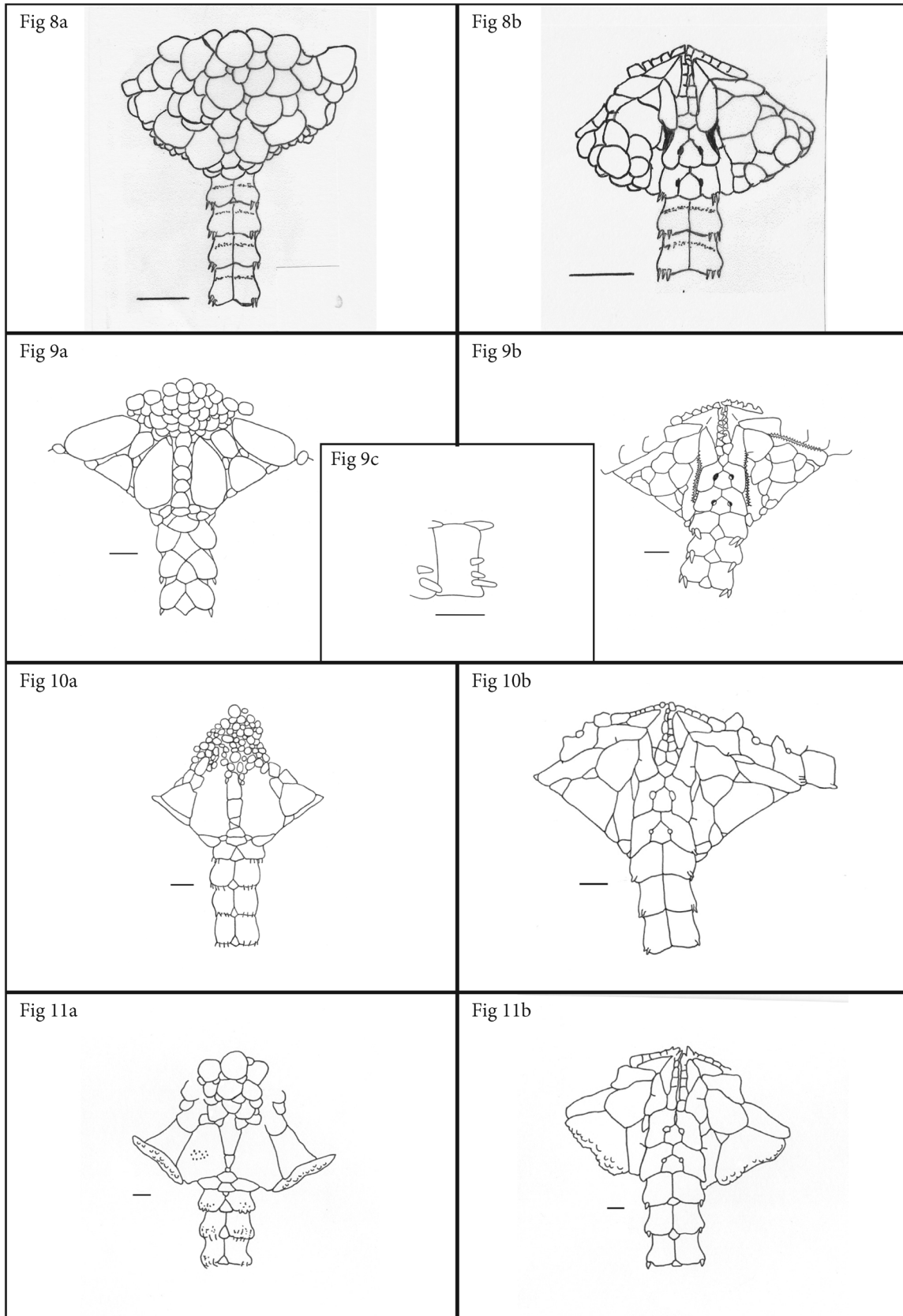
Figures 9 a, b, c

*Ophiomusium eburneum* Lyman, 1869; Borges & Amaral, 2007.

**Material examined:** 1 specimen, MCZ 443, *Blake* expedition, off Havana, 320m; 1 specimen BMNH 92-2-22-13, off Havana.

**Main Features:** Despite this being the type species for the genus, Lyman did not designate a numbered holotype. However, his very detailed description refers mainly to a specimen with a 9 mm diameter disc with 25 mm arms, taken off Sand Key, Florida, in 270–325 fathoms. In 1980 I could not locate this specimen in the MCZ collections. However since then, a labelled holotype from the type locality has been found (MCZ 444). Another specimen identified by Lyman from the *Blake* Expedition (MCZ 443) (Lyman 1878), was incorrectly referred to by Downey (1969) as the holotype. Figure 9 is MCZ443. This specimen has remarkable saw-tooth-edged jaws. The disc is covered by many small very finely tuberculate scales and large separated radial shields. There are lumpy plates around the arm bases, and the small oral shields are surrounded by many finely tuberculated scales. There are 2 pairs of exposed tentacle pores on the first 2 ventral arms plates, and 3 small, short arm spines in this specimen.





**FIGURE 8.** *Ophiomusium constrictum* BMNH 12-30-1477: a, b, dorsal and ventral sectors.

**FIGURE 9.** *Ophiomusium eburneum* MCZ 443, (not type): a, b, dorsal and ventral disc sectors; c, basal arm segments.

**FIGURE 10.** *Ophiomusium facetum* USNM 41370: a, b, dorsal and ventral disc sectors.

**FIGURE 11.** *Ophiomusium facundum* USNM 41364: a, b, dorsal and ventral disc sectors.

***Ophiomusium facetum* Koehler, 1922.**

Figures 10 a, b

*Ophiomusium facetum* Koehler, 1922; Guille, 1981

**Holotype** USNM 41370 Nogas Id, Sulu Sea, 1752m. Dr Marc Eleaume, Paris Museum, has recently informed me that 23 syntypes of this species are in their collection: NMNH 10300, ex-CREVETTIERE 1971.

**Main Features:** Disc with smooth plates and large separated radial shields. Many small scales centrally. Lateral arm plates long and high, smooth, with 6–7 small, evenly placed arm spines. Dorsal arm plates small throughout. 2 ventral arm plates, 2 pairs of exposed tentacle pores, each with a large scale. A large central interradial plate is present. A second specimen, but not a type, from the same locality (USNM E41368) has 1 or 2 rudimentary ventral arm plates distal to the main plates.

***Ophiomusium facundum* Koehler, 1922.**

Figures 11 a, b

*Ophiomusium facundum* Koehler, 1922; Liao & A. M. Clark, 1995.

**Lectotype** USNM 41360 *Albatross* Station 5373 (station misspelt by Koehler as 5378), Marindique Id, Philippines, 618m. Paralectotype, USNM 41364, *Albatross* Station 5538, between Negros and Siquijor Ids, Philippines, 468m. Both specimens were examined by Koehler. Dr Marc Eleaume, Paris Museum, has recently informed me that a syntype of this species is in their collection: NMNH 10385, ex-*Albatross* Expedition.

**Main Features:** The lectotype is large -18 mm d.d. Disc coarsely granulated, especially the large radial shields. 1 large interradial plate extends ventrally to abut with oral shield, which itself has a very wide distal section and a narrow proximal one. Dorsal and ventral arm plates throughout, dorsal midline sunken. Edges of lateral arm plate flared and granulated. 4–6 arm spines, lowermost 2 are close together, the others evenly and widely spaced. The 2nd lowest spine is fatter than the others. Two pairs of exposed tentacle pores. Genital slits reaching the distal corners of the first lateral arm plates.

The paralectotype USNM 41364 is figured (Fig. 11)

***Ophiomusium fallax* Koehler 1904.**

Figures 12a, b

*Ophiomusium fallax* Koehler, 1904; H. L. Clark, 1915.

**Synypes** (3), RMNH V.Ech.O. 6342, *Siboga* Station 156, NW of Palau Belau, S of Philippines, 469 m.

**Main Features:** Disc covered with similar-sized plates, radial shields only slightly larger. Dorsal midline of arms sunken, lateral arm plates bulbous, with small, low dorsal arm plates present. Koehler did not record the dorsal arm plates, but they are present all in 3 type specimens. No exposed tentacle pores or ventral arm plates.

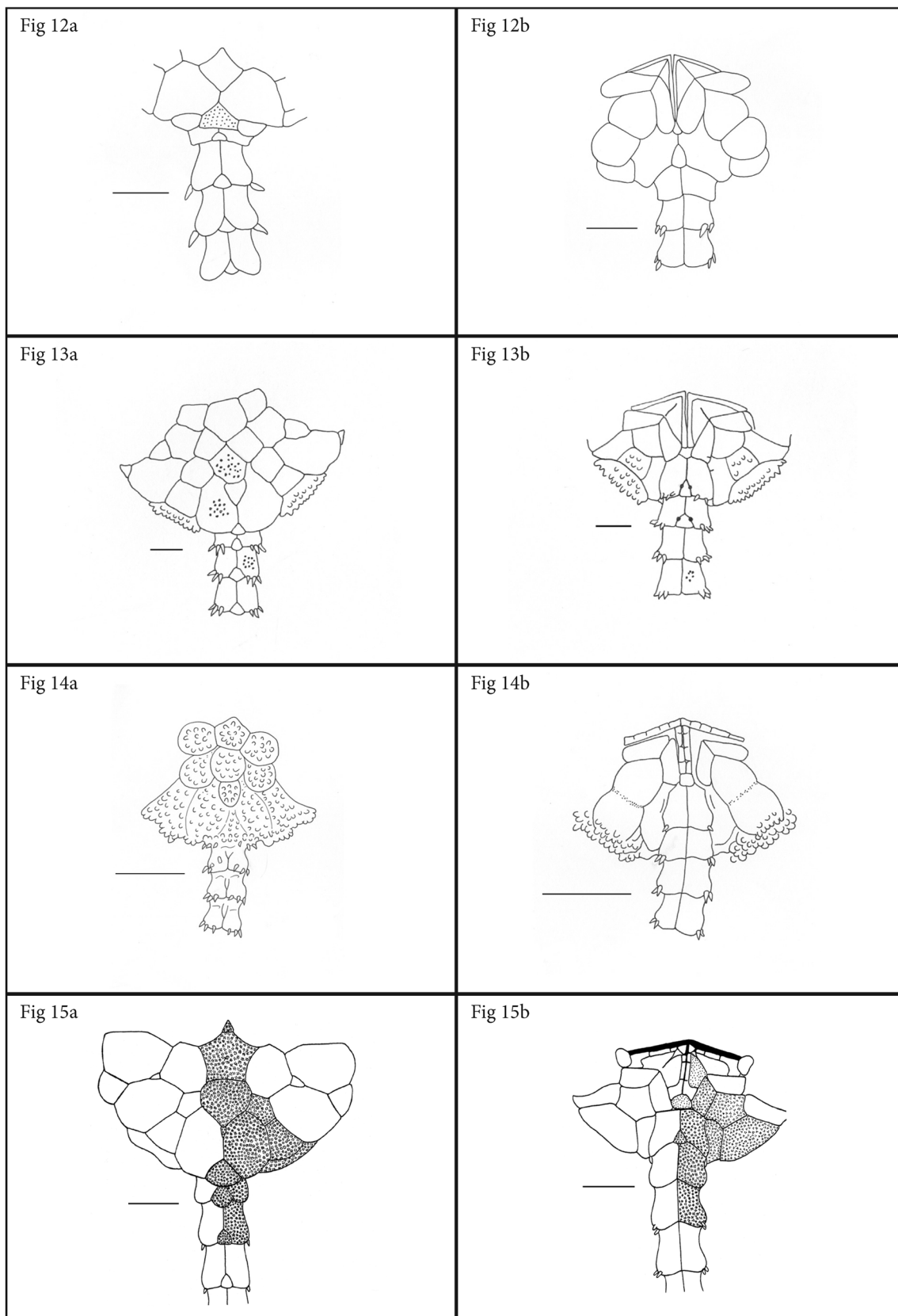
***Ophiomusium granosum* Lyman, 1878.**

Figures 13 a, b

*Ophiomusium granosum* Lyman, 1878; Litvinova, 1981.

**Syntypes** (2) BMNH 82.12.23.418. *Challenger* Station 237, SE Sagami Bay, Japan. 3429 m. Syntype MCZ 451 Off Japan 1875 m.

**Main Features:** MCZ 451: 7 mm d.d. Disc coarsely granular, spikey at interradial margin. 5–7 sharp arm spines, midline of arms sunken dorsally and ventrally. Two pairs of exposed tentacle pores, no scale. Narrow ventral arm plates with some small tubercles. Naked oral shields, a tubercle covered plate between the oral shield and the larger interradial plate, which also has pointed tubercles. Genital slit small and alongside the proximal part of the first lateral arm plate. Dorsal arm plates also with tubercles.



**FIGURE 12.** *Ophiomusium fallax* RMNH V.Ech.O 6342: a, b, dorsal and ventral disc sectors.

**FIGURE 13.** *Ophiomusium granosum* MCZ 451: a,b, dorsal and ventral disc sectors.

**FIGURE 14.** *Ophiomusium incertum* ZMUC OPH-499: a, b, dorsal and ventral disc sectors.

**FIGURE 15.** *Ophiomusium kimblae* AM J10678: a, b, dorsal and ventral sectors.

***Ophiomusium incertum* Koehler, 1930.**

Figures 14 a, b

*Ophiomusium incertum* Koehler, 1930; Baker, 1979; Rowe & Gates, 1995.

*Ophiomusium aporum* H.L. Clark, 1928; Dartnall, 1980; Baker, 1979, p.30.

**Syntypes** ZMUC OPH-499 and MCZ 5916, Pacific Expedition Station 38, eastern Bass Strait, Australia, 180–290 m. A further syntype is in the ZMUC collection, from Station 95, Kei Is.

**Main Features:** This species is similar to *O. asperum* Koehler in that the disc plates have small conical stumps on most plates, arranged mainly on the distal part of each plate. The stumps are prominent on the edges of interradial plates. The ventral surface of the disc is smooth. The arms are different from *asperum* however, in that the 5–6 spines per segment are short and thick and are spaced evenly around the arm from dorsal to ventral on a noticeably swollen rim of the lateral arm plates. The oral papillae are fused, and the genital slits are small—less than half the length of the adjacent arm segment. No ventral arm plates or exposed tentacle pores.

*Ophiomusium aporum* H. L. Clark is a synonym of *O. incertum* (Baker, 1979). A further specimen of *incertum* was examined from the Kermadec Islands, and is a new record for the New Zealand region (NMNZ BS 581, 573–539 m).

***Ophiomusium kimblae* Baker, 1979.**

Figures 15 a, b

**Holotype** AM J10678, off Double Id Point, Queensland, 210–219 m.

**Main Features:** Finely rugose arm and disc plates. Radial shields hexagonal, contiguous for one third of their length, separated distally by a triangular tumid plate. Dorsal arm plates obvious for first 8 or 9 segments; thereafter, very small. Lateral arm plates long, meeting above and below, with 2 small spines situated low down. One ventral arm plate, no exposed tentacle pores. Ventral interradia occupied only by a large marginal plate, and oral shields.

Three oral papillae, proximal one pointed.

The holotype at 4.6 mm d.d. is the largest specimen of this species thus far discovered. Larger specimens may well show variation in the above features and closer relationships with other species, such as *O. anisacanthum* H. L. Clark.

***Ophiomusium leptobrachium* H. L. Clark, 1941.**

Figure 16 a, b, c

**Holotype** MCZ 6235, *Atlantis* Station 3363, off Puerto Cayo Moa, Cuba, 1518m.

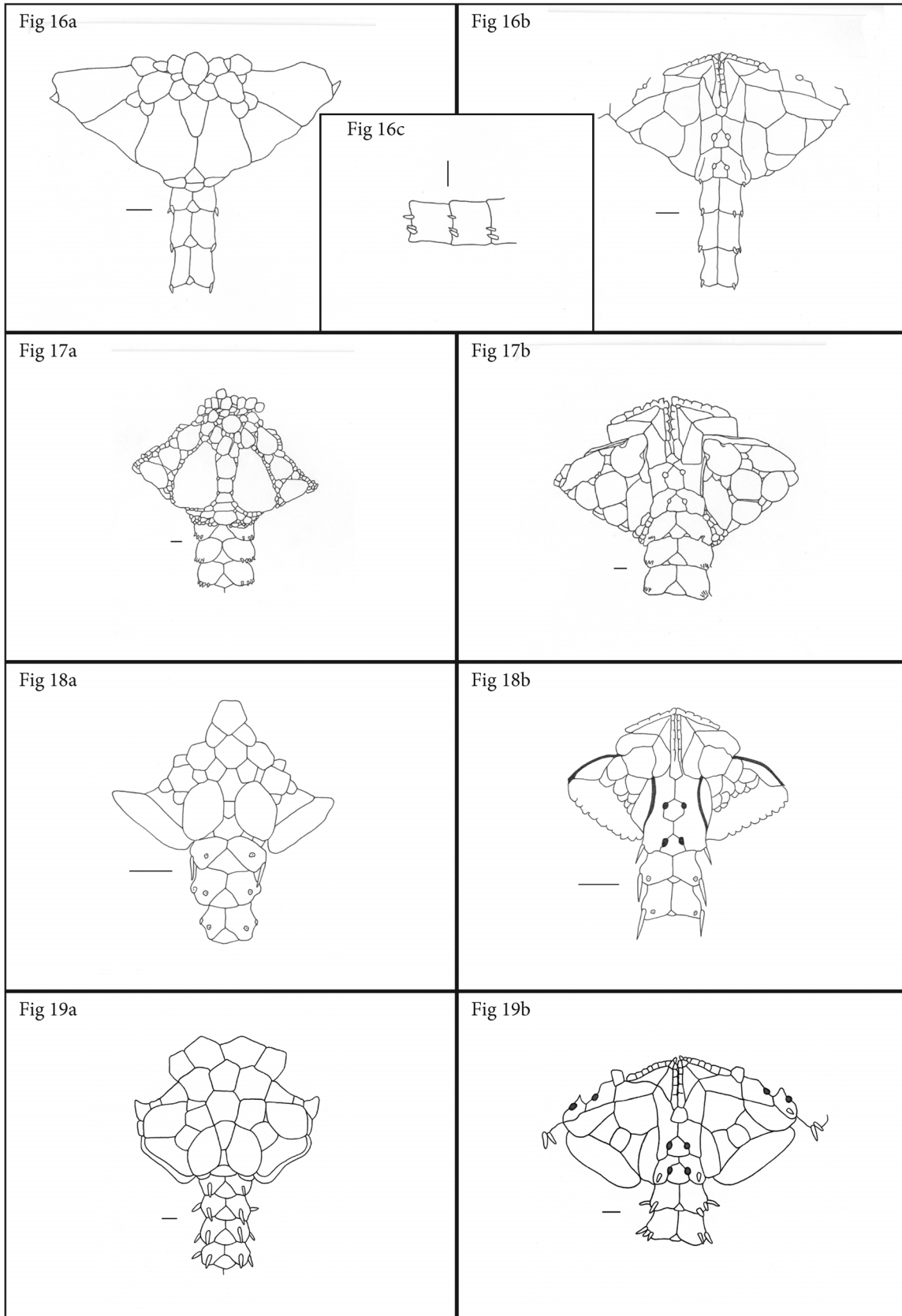
**Main Features:** Disc tumid, surface a fine meshwork, not granular. Large, triangular radial shields contiguous for half their length. Large interradial plate, longer than wide. Arms narrow, dorsal arm plates small. 2–3 small arm spines. Oral shields and 1 post-shield plate dominate the ventral interradius. Two pairs of exposed tentacle pores, each with a circular scale. Oral papillae separated. Only two ventral arm plates.

***Ophiomusium ligatum* Koehler, 1922.**

Figures 17 a, b

**Holotype** USNM E80, *Albatross* Station 5445, east coast of Luzon, Philippines 700m; 2 paratypes E81, Station 5650, Gulf of Boni, Celebes, 987m.

**Main Features:** Koehler's illustrated type is 22 mm d.d. with the longest arm 85 mm. Disc plates are small and circular, non-imbricating and slightly swollen. Three long plates in the interradia are surrounded by a bead-like belt of smaller plates. Large, coarsely rugose radial shields. A cluster of small plates at the dorsal base of each arm. Two pairs of exposed tentacle pores with scales.



**FIGURE 16.** *Ophiomusium leptobrachium* MCZ 6235: a,b, dorsal and ventral disc sectors; c, basal arm segments.

**FIGURE 17.** *Ophiomusium ligatum* USNM E80: a, b, dorsal and ventral disc sectors.

**FIGURE 18.** *Ophiomusium longispinum* ZMUC OPH-500: a, b, dorsal and ventral disc sectors.

**FIGURE 19.** *Ophiomusium luetkeni* BMNH 82.12.23.398: a, b, dorsal and ventral disc sectors.

***Ophiomusium longispinum* Koehler, 1930.**

Figure 18 a, b

**Syntypes** (2) ZMUC OPH-500, Pacific Expedition station 7, North Banda Sea, 196 m.

**Main Features:** Even-sized plates on disc apart from large interradials and oval radial shields. Interradial plates are ribbed. Arm spines almost a segment long, and present on dorsal surface of lateral arm plates. Two pairs of exposed tentacle pores each with a large scale. Shield-shaped oral shields, with many smaller plates between it and disc margin.

Ventral arm plates visible until the 6th arm segment.

***Ophiomusium lütkeni* Lyman, 1878.**

Figures 19 a, b

*Ophiomusium lütkeni* Lyman, 1878; H. L. Clark, 1939. *Ophiomusium impurum* Koehler 1904; Stöhr, 2011.

**Holotype** BMNH 82.12.23.398 Challenger station 192, Arafura Sea, 236 m. Syntype, MCZ 474 Challenger station 192, near Kei Ids, 235m.

There are also many specimens of this species collected by the John Murray Expedition at station 106: BMNH 1949.1.10.134-153, 183–194 m, and 9 specimens in the USNM (E0037252): Off Zanzibar, 240 m; 3 specimens, possible syntypes, NMRH, V.Ech.O. 2038, *Siboga* Station 65a, Flores Sea, Indonesia, 400 m; 3 specimens, possible syntypes, NMRH V.Ech.O. 2039, *Siboga* Station 253, N of Pulau Yamdena, Indonesia, 300 m. Dr Marc Eleaume, Paris Museum has recently informed me that a syntype of *O. impurum* in their collection: NMNH 10316, ex-*Siboga*.

**Main Features:** The type is 14 mm d.d. The lower edge of the interradial plates protrude further than other adjoining plates, and they have a roughened margin. The lateral arm plates have a very sharply angled spine-bearing central ridge, which give the arms a serrated appearance. No genital papillae. Two pairs of exposed tentacle pores.

The John Murray Expedition material (8–10 mm d.d.) has the same interradial plates as the type specimen but the plates bordering the oral shield are different, in that there are two plates obliquely overlapping, lying distal to the oral shield. On the dorsal surface of the arms the lateral plates project above the midline, leaving the dorsal arm plates in a depression. The radial shields are uniformly oval, unlike the angular shields in Lyman's figure.

The Flores Sea specimens are 4, 7 & 8 mm d.d. They have large interradial plates with hollowed, outwardly oblique marginal surfaces. Radial shields diamond-shaped, disc centre is sunken, with a few symmetrically arranged plates. Distal ends of radial shields slightly swollen. Arms distinctly moniliform. Spine ridges quite angular. Two pairs of exposed tentacle pores. First two ventral arm plates large, remainder small, wider than long but present to the end of the arm.

The Pulau Yamdena specimens have the large interradial plates and the saw-tooth like arms which characterise this species. There is also one from this station which has a bifurcate arm. The largest specimen is 10 mm d.d.

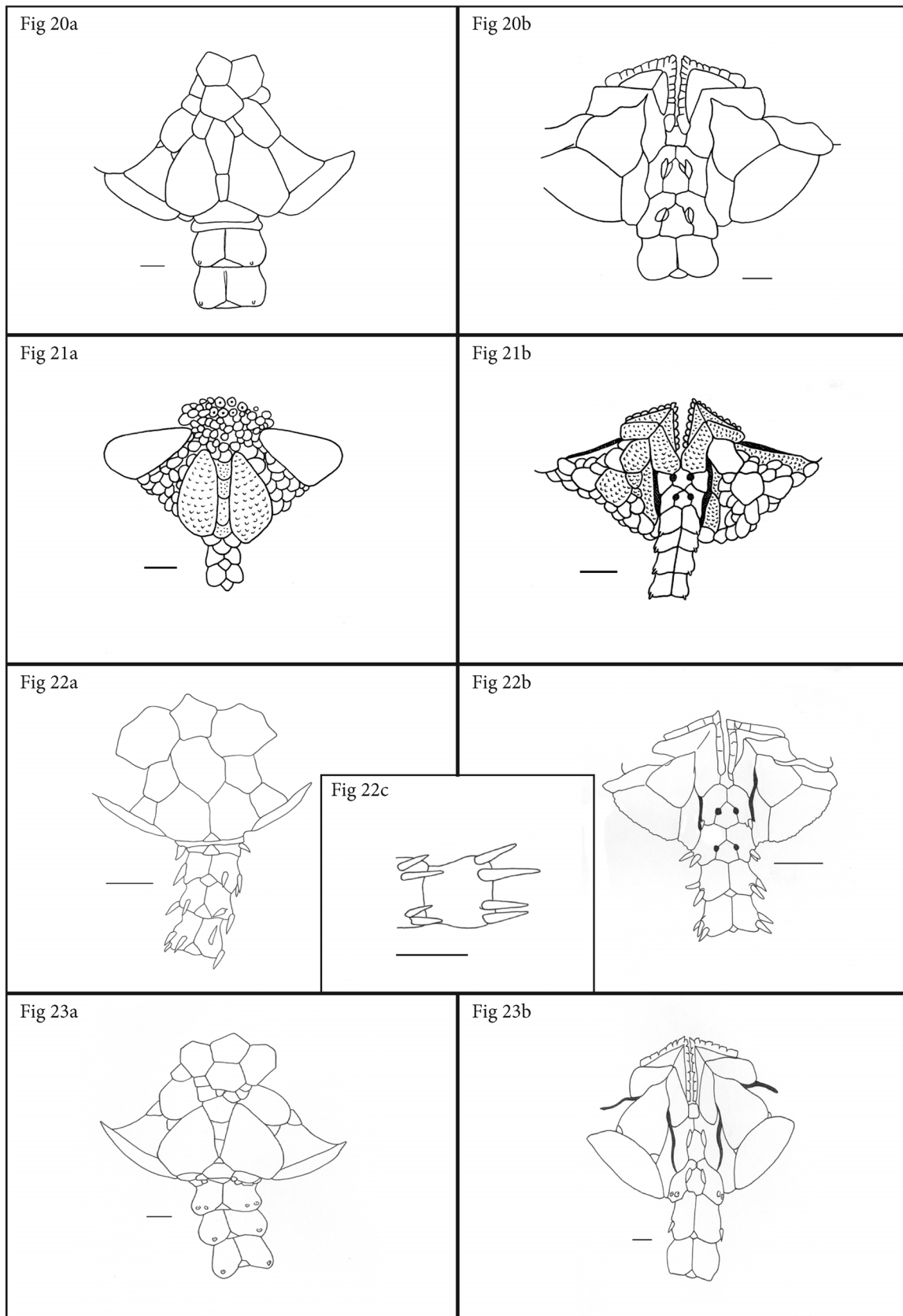
***Ophiomusium lunare* Lyman, 1878.**

Figures 20 a, b

*Ophiomusium lunare* Lyman 1878; Guille & Vadon, 1986.

**Holotype** BMNH 82.12.23.399 Challenger Station 219, Admiralty Is, 274 m.

**Main Features:** The disc is covered with smooth plates and larger, separated radial shields. There are large interradial plates with two longer than wide plates between it and the central rosette. Dorsal arm plates small, triangular, wider than long. Lateral arm plates slightly tumid, with 3–4 small arm spines (note: the arm spines are absent from about halfway up the arms in the holotype). Two large ventral arm plates excavated each side for two pairs of exposed tentacle pores, each with an elongated scale. Distal ventral arm plates very small. Large, proximally pointed oral shields adjoining the interradial plate.



**FIGURE 20.** *Ophiomusium lunare* BMNH 82.12.23.399: a, b, dorsal and ventral disc sectors.

**FIGURE 21.** *Ophiomusium lymani* BMNH 90.2.19.9.10: a, b, dorsal and ventral disc sectors.

**FIGURE 22.** *Ophiomusium microporum* MCZ 6236: a, b, dorsal and ventral disc sectors; c, basal arm segments.

**FIGURE 23.** *Ophiomusium mirandum* MUC OPH-501: a, b, dorsal and ventral disc sectors.

***Ophiomusium lymani* Wyville-Thomson, 1873.**

Figures 21 a, b

*Ophiomusium lymani* Wyville-Thomson, 1873; Martynov & Litvinova, 2008. *Ophiomusa lymani* Hertz, 1927, H. L. Clark, 1939.

*Ophiomusidium lymani* (A. M. Clark & Courtman-Stock), 1976.

**Lectotype** BMNH 90.2.19.9.10, *Porcupine* Expedition off the west coast of Ireland. Surprisingly for such a well-known and widely distributed species, a holotype is not identified in the BMNH collections. One specimen BMNH 90.2.19.9.10, 28 mm d.d. longest arm 78 mm, from the *Porcupine* sample, is here selected the lectotype. A second specimen in the same lot has all its arms broken, but is here selected as a paralectotype. There are many other specimens in the BMNH collected from all oceans depths between 1033 and 3338 m. 4 specimens from the Western Australian Bight, 1080–1100 m were examined in the AM (J10018).

**Main Features:** Disc plates covered with fine skin, granular. Small primaries with central prominence. Radial shields long and pear-shaped, separated by 4–5 plates. Multiple interradial plates extending to ventral surface of disc. Oral shields pear-shaped, with a 5-sided plate of similar size attached distally. The lectotype has 2 pairs of exposed tentacle pores on the only two ventral arm plates. One tentacle pore scale. 6 to 8 short arm spines adpressed to arm (note: some specimens have up to 13 arm spines). Lateral arm plates surround arm.

***Ophiomusium microporum* H. L. Clark, 1941.**

Figures 22 a, b, c

**Holotype** MCZ 6236, *Atlantis* station 3384, Old Bahama Channel, Cuba, 530m

**Main Features:** Disc tumid with a few large scales. Radial shields are wide and separated only proximally. They slope up markedly towards the disc centre. Large marginal interradial plate, notched along edge. Oral shield and interradial plate dominate ventral interradius.

Genital slits extend to the end of the first ventral arm plate. Two pairs of exposed tentacle pores, one scale. Six ventral arm plates, the first two of which are large. Four long arm spines basally, upper 2 separated from lower 2. Underside of arm flat. Arms finely tuberculate.

***Ophiomusium mirandum* Koehler, 1930.**

Figures 23 a, b

**Holotype** ZMUC OPH-501, Kei Expedition Station 59, eastern Banda Sea, 388 m.

**Main Features:** Thick disc with large radial shields occupying two thirds of the disc radius, shields completely separated by 5 plates. Large pear-shaped oral shields and large interradial plates. Very short but wide triangular dorsal arm plates throughout arm. Four small arm spines, 2 low, 2 high basally. Two elongate pairs of exposed tentacle pores, each with one long scale on the aboral side and a rim-like scale on the opposite side. Ventral arm plates present to the end of the arms.

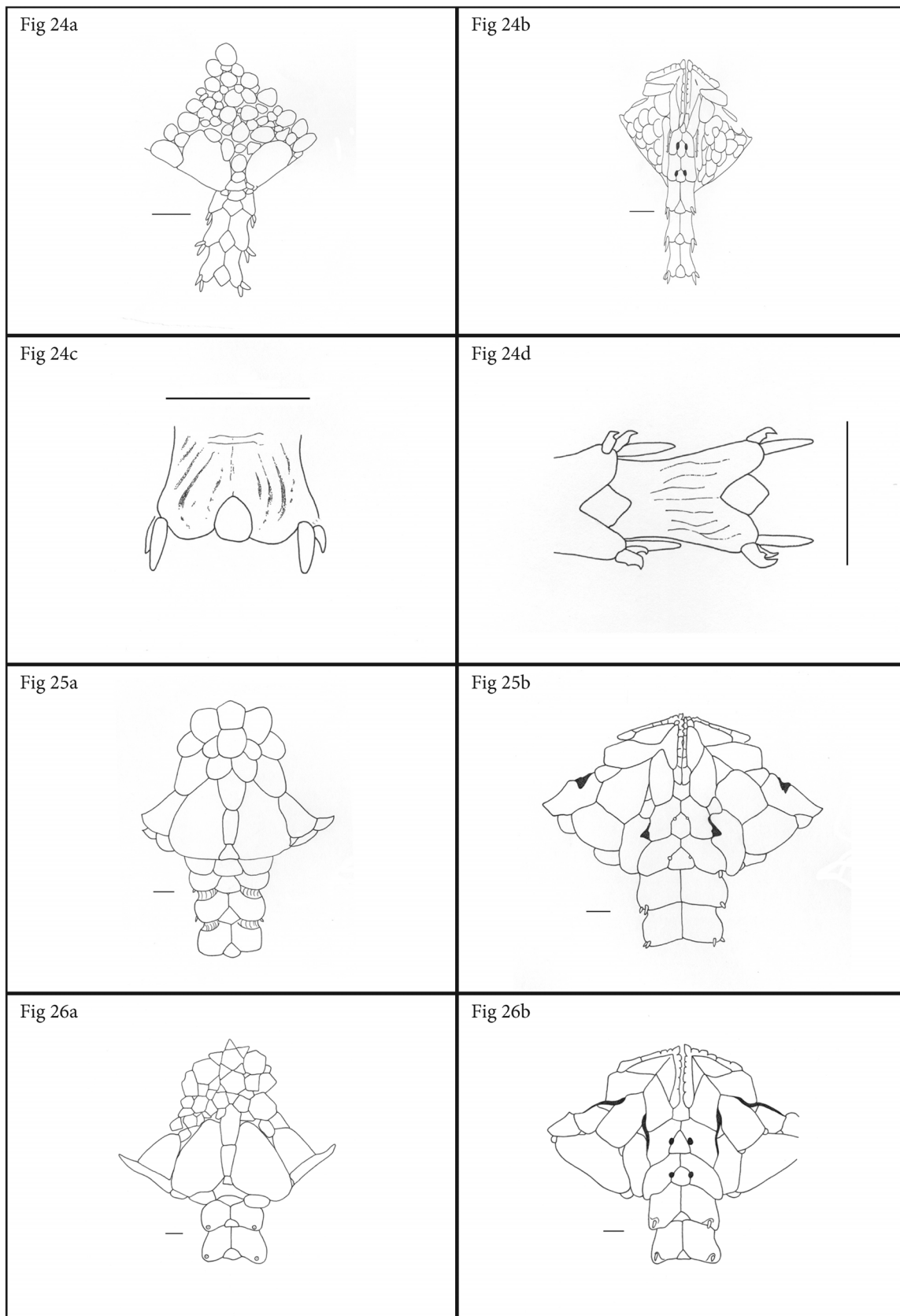
***Ophiomusium moniliforme* H. L. Clark, 1941.**

Figures 24 a, b, c, d

**Holotype** MCZ 6237, *Atlantis* station 2953, Bahia de Corrientes, Cuba, 1125m.

**Main Features:** Disc tumid with many small scales. Radial shields small, widely separated. Glabrous surface. Long arm joints, surface of arm plates contour-ridged, distal arm segments elongated. Diamond-shaped dorsal arm plates throughout. Two then 3 arm spines, uppermost pair transformed into hooklets, lowermost longest—equalling one arm segment. Small oral shields and many interradial plates. Short genital slits originating away from oral shield and just one arm segment long. Oral papillae not separated. Two pairs of exposed tentacle pores, each with 1 scale. 9–10 ventral arm plates.





**FIGURE 24.** *Ophiomusium moniliforme* MCZ 6237: a, b, dorsal and ventral disc sectors; c, basal proximal arm segment; d, distal arm segments.

**FIGURE 25.** *Ophiomusium morio* USNM 40993: a, b, dorsal and ventral disc sectors.

**FIGURE 26.** *Ophiomusium mutum* ZMUC: a, b, dorsal and ventral disc sectors.

This species resembles *O. stellatum*, the only differences seem to be the length of the genital slits and the length of the lowermost arm spines distally.

***Ophiomusium morio* Koehler, 1922.**

Figures 25 a, b

**Holotype** USNM 40993 *Albatross* station 5392 Between Samar and Masbate, Philippines, 246m.

**Main Features:** Rigid skeleton and stiff arms. Moderately large, slightly tumid disc plates and radial shields. The shields separated from one another by 3 elongated plates. Three of the 5 oral shields split proximally. Unusual hoof-shaped genital slits. Dorsal arm plates throughout arm, only 2 ventral plates. Arm joints constricted. Two pairs of very small exposed tentacle pores, each with a single scale. Two small arm spines.

***Ophiomusium mutum* (Hertz) 1927.**

Figures 26 a, b

*Ophiomusium facunda* var *muta* Hertz 1927.

*Ophiomusium facundum mutum* Hertz, 1927. Stöhr, 2015.

**Syntypes** (2) ZMUC, Valdivia Station 254, off southern Somalia, 977m.

**Main Features:** The larger of the two type specimens of this species is 16 mm d.d. It has tiny arm spines, dominating lateral arm plates, and has narrower oral shields than *O. facundum*, and the ventral interradial plate is naked. These features separate it from that species.

The holotype of *O. mutum* is in the Berlin Museum. A recent enquiry to the ZMUC about the syntypes indicated that they cannot now be identified in the collection.

***Ophiomusium oligoplacum* H. L. Clark, 1915.**

Figures 27 a, b

**Holotype** MCZ 526, off Havana, 457–731m.

**Main Features:** Disc 5 mm d.d. with few plates, each raised above the sutures and finely tuberculate. Radial shields small, triangular and completely contiguous. Dorsal arm plates present throughout arm, 2 ventral arm plates each with a pair of exposed tentacle pores. Six small arm spines evenly spaced up to dorsal side. Thin skin on ventral surface, sutures wide. Genital slit obscure, but up to half the length of adjacent lateral arm plate. This species could be a young *O. rugosum* Koehler.

***Ophiomusium relictum* Koehler, 1904.**

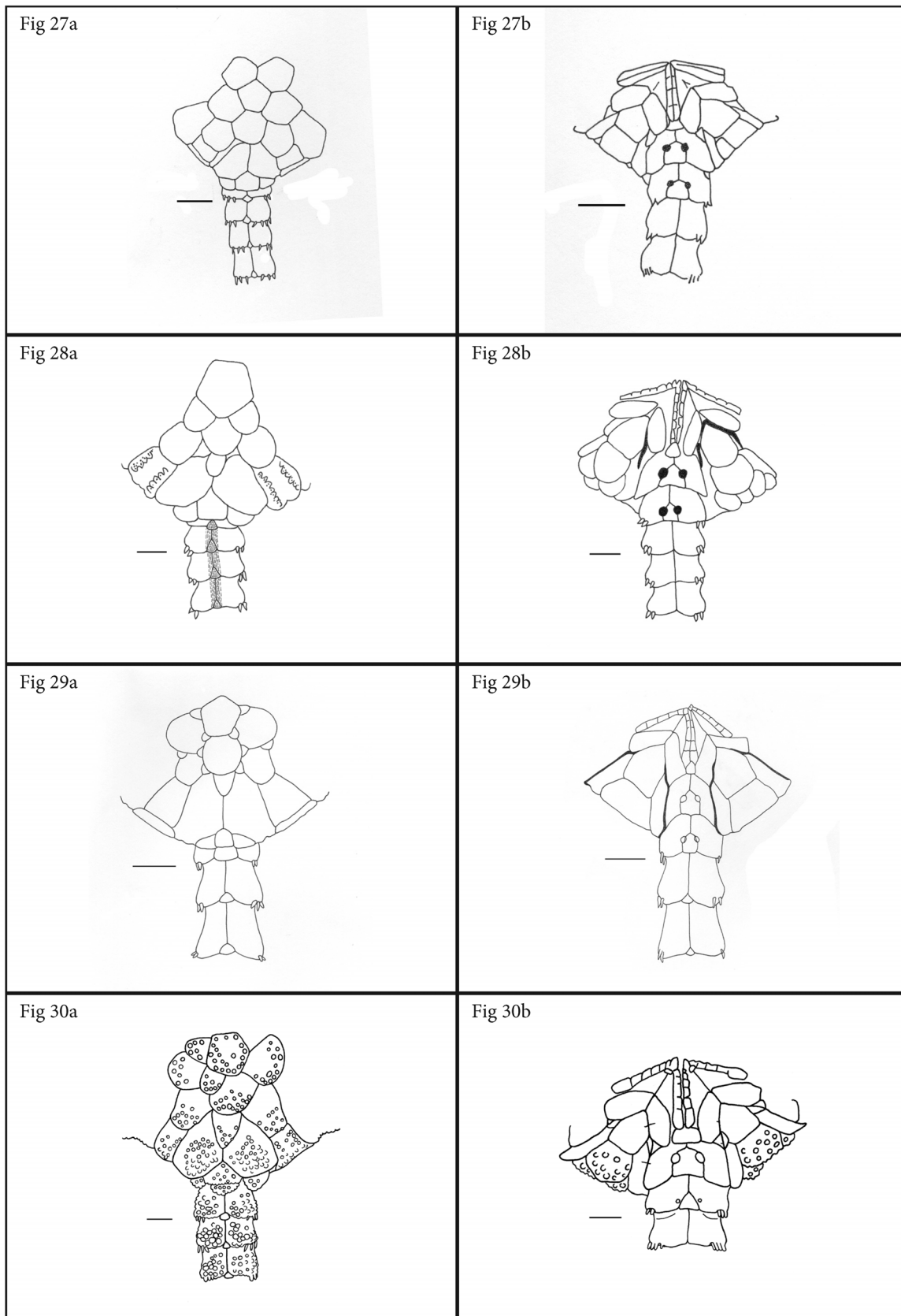
Figures 28 a, b

*Ophiomusium relictum* Koehler, 1904; Stöhr, 2011.

*Ophiomusa relictata* Hertz, 1927.

**Syntype** RMNH V.Ech. O. 2050.1 *Siboga* station 156, west of Waigeo, Halmhera Sea, 469 m and station 88, west of Palau, Makassar Strait, 1301m.

**Main Features:** Disc diameter <9 mm. Disc wrinkled, with large plates standing high from the surface. Large hexagonal central plate, radial shields small, divergent, separated proximally and distally, abutting only at about half length. Interradial plates roughened at edges. Lateral arm plates raised dorsally, with a groove in the dorsal midline. Dorsal plates small, longer than wide. Two ventral arm plates each with a pair of circular exposed tentacle pores. Four small arm spines. Genital slits small, extending between adoral shield and first lateral arm plate.



**FIGURE 27.** *Ophiomusium oligoplacum* MCZ 526: a, b, dorsal and ventral disc sectors.

**FIGURE 28.** *Ophiomusium relictum* RMNH V.Ech.O 2050: a, b, dorsal and ventral disc sectors.

**FIGURE 29.** *Ophiomusium rosaceum* USNM E5196: a, b, dorsal and ventral sectors.

**FIGURE 30.** *Ophiomusium rugosum* USNM 16378: a, b, dorsal and ventral disc sectors.

***Ophiomusium rosaceum* A. H. Clark, 1936.**

Figures 29 a, b

**Holotype** USNM E5196 *Caroline* station 101, Virgin Is, Puerto Rico, 548m.

**Main Features:** Disc 6 mm d.d. with few large plates partly separated by very small plates. Radial shields widely contiguous, one row of large scales interradially. Small dorsal arm plates throughout arm. Ventral interradius with oral shield and a large distal plate, plus 1 genital plate each side. Genital slits run from adoral shields to disc edge. Two pairs of exposed tentacle pores each with 1 scale. Extremely small ventral arm plates after the first two.

***Ophiomusium rugosum* Koehler, 1914.**

Figures 30 a, b

**Syntypes** (2) USNM 16378, *Albatross* station 2342 off Havana, Cuba, 367m..

**Main Features:** Disc with a few large imbricating plates. Adradial borders and area towards centre of plates tuberculate. Marginal plates more evenly tuberculate. Tubercles are actually enlarged granules. They are also present on the arms. Radial shields contiguous for approximately half their length. Dorsal arm plates very small, raised, and present throughout the arm. 7 evenly placed arm spines. The disc granules reach only to the post-oral plates ventrally, otherwise the ventral surfaces of the disc and arms are smooth. Few plates in the interradii. Genital slits run between oral shield and ½ length of first ventral arm plate. Two pairs of exposed tentacle pores, 1 scale on each, and the second pair of pores are smaller and are not on the border of the second ventral and lateral arm plates. Only the 2 ventral arm plates. Six Arm spines.

***Ophiomusium sanctum* Koehler, 1904.**

Figures 31 a, b

**Syntype** RMNH V. Ech. O. 2051 *Siboga* station 302, Savu Sea, southwest Timor, 212m.

**Main Features:** Disc with large pear-shaped radial shields, completely separated by two large and one small plate. The interradiial plates are moderate large, with two protruding plates either side ventrally. Large dorsal arm plates throughout arm. Herring bone-like arrangement of lateral arm plates. Oral shields pear-shaped, with two plates distally between the shield and interradiial plate. Genital slits half the length of the first lateral arm plate. Two pairs of exposed tentacle pores.

This species is much like *O. simplex* and *O. australe*.

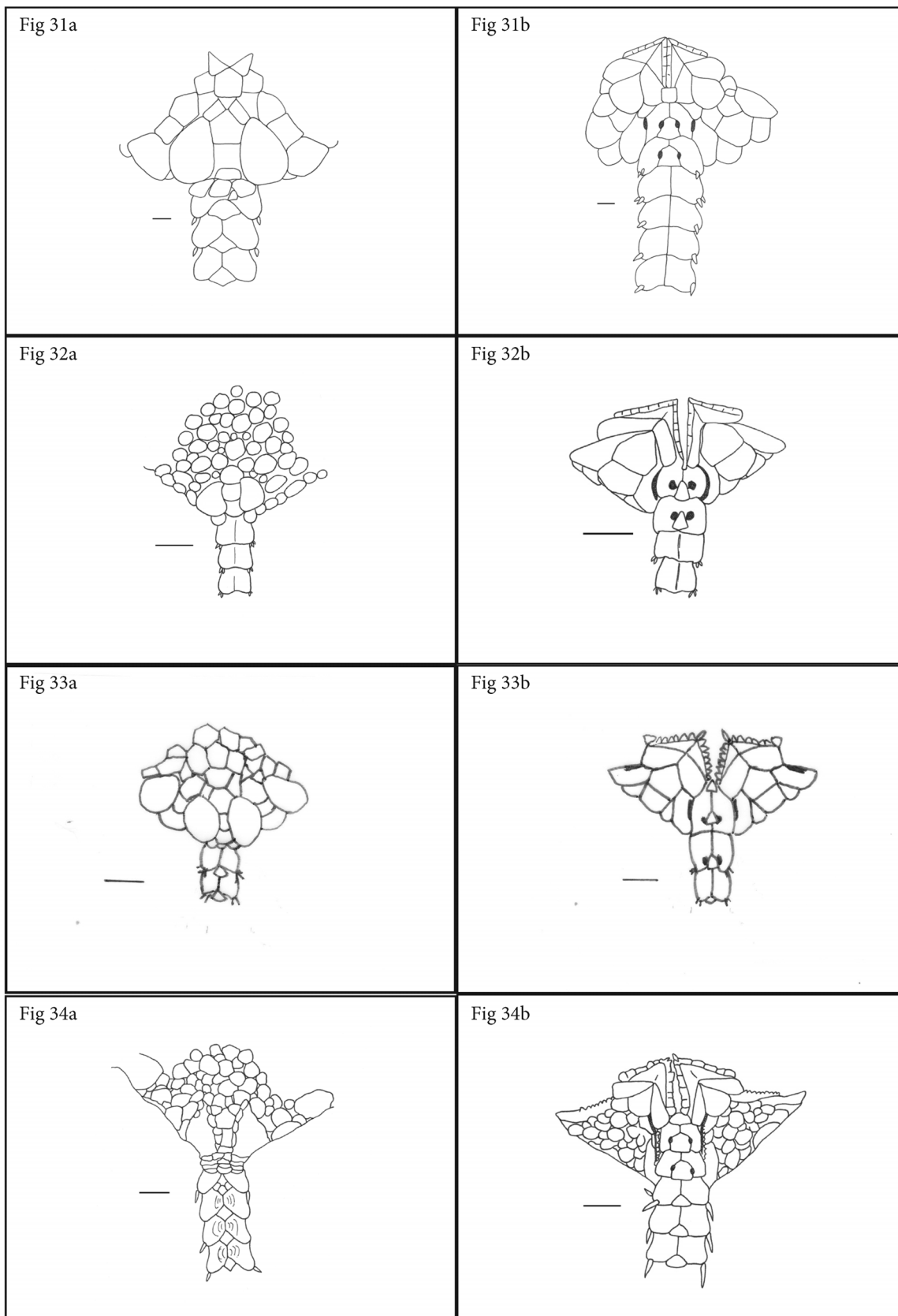
***Ophiomusium scalare* Lyman, 1878.**

Figures 32 a, b

*Ophiomusium scalare* Lyman, 1878; Stöhr, 2011.

**Holotype** BMNH 82.12.23.434, *Challenger* station 171, Kermadec Is, 1097m; 7 specimens ZSI 5110 off Port Blair, Andaman Is, 204m (identified by Koehler 1897).

**Main Features:** Disc of type 5 mm in diameter. Disc plates have thickened distal margins and those in the interradii protrude. Surface of disc and arm plates rough. Radial shields separated by two or three plates. Ventral surface resembles *O. simplex*, but the sutures are all accentuated. Two pairs of exposed tentacle pores, each with a scale. Two ventral arm plates, and small dorsal arm plates on proximal segments at least. Two, then three small arm spines.



**FIGURE 31.** *Ophiomusium sanctum* RMNH V.Ech.O 2051: a, b, dorsal and ventral disc sectors.

**FIGURE 32.** *Ophiomusium scalare* BMNH 82.12.23.434: a, b, dorsal and ventral disc sectors.

**FIGURE 33.** *Ophiomusium simplex* BMNH 82.11.23.443: a, b, dorsal and ventral sectors.

**FIGURE 34.** *Ophiomusium stellatum* MCZ 6477: a, b, dorsal and ventral disc sectors.

***Ophiomusium simplex* Lyman 1878.**

Figures 33 a, b

*Ophiomusium simplex* Lyman 1878; Sastry, 1987; Liao & A.M. Clark, 1995

**Holotype** BNMH 82.11.23.433 *Challenger* station Amboyne, 183 m; another specimen in the BMNH collection with the same registration number is labelled “type”. A series of non-type specimens from New Britain, BNMH 1898.8.8.83 are between 5 and 11 mm d.d.

**Main Features:** Holotype is 6 mm d.d. Large interradiial plate conspicuous from above, and 2 smaller, protuberant plates can be seen either side of it. Lyman’s figure has under-emphasised this feature. Ventral side of disc consists of oral shield and distal interradiial plate with two protuberant plates either side. There are two small arm spines low down on the lateral arm plates. Two pairs of exposed tentacle pores.

***Ophiomusium stellatum* Verrill, 1899.**

Figures 34 a, b

*Ophiomusium stellatum* Verrill, 1899; H.L. Clark, 1941.

**Neotype**, MCZ 6477, *Atlantis* station 3483, Gulf of Mexico, 521m.

Verrill’s type specimen could not be located either in the MCZ or the YPM collections. 4 specimens from the type locality identified by H. L. Clark are in the MCZ however, and I here designate one of these as a neotype.

**Main Features:** Disc with many imbricating scales both dorsally and ventrally. Small, widely separated radial shields. Arms noticeably flattened, depressed centrally between successive dorsal arm plates. Dorsal arm plates diamond-shaped, present throughout arm. Surfaces of arm plates finely rugose. Ventral plates throughout arm. Two long arm spines, lowermost longest and thickest, just short of one arm segment in length. Small oral shield. Genital slits run to half the length of the second lateral arm plates. Oral papillae not separated. Two pairs of exposed tentacle pores, each with 1 scale.

This species should be closely compared with *O. moniliforme* H. L. Clark.

***Ophiomusium testudo* Lyman 1875.**

Figures 35 a, b, c

*Ophiomusium testudo* Lyman 1875; H. L. Clark, 1941.

**Holotype** MCZ 485, *Hassler Expedition*, off Barbados, 182m.

**Main Features:** Few imbricating disc plates, finely granular. Radial shields separated by a triangular plate. Interradiial plate small. Dorsal arm plates throughout in median groove. Two ventral arm plates each with a pair of exposed tentacle pores, each with a scale. 3 small arm spines low down on lateral arm plates. Lateral arm plates finely granular. Ventral interradiial area consists of large bell-shaped oral shield and a similarly large distal plate, with two or three smaller plates at the disc margin.

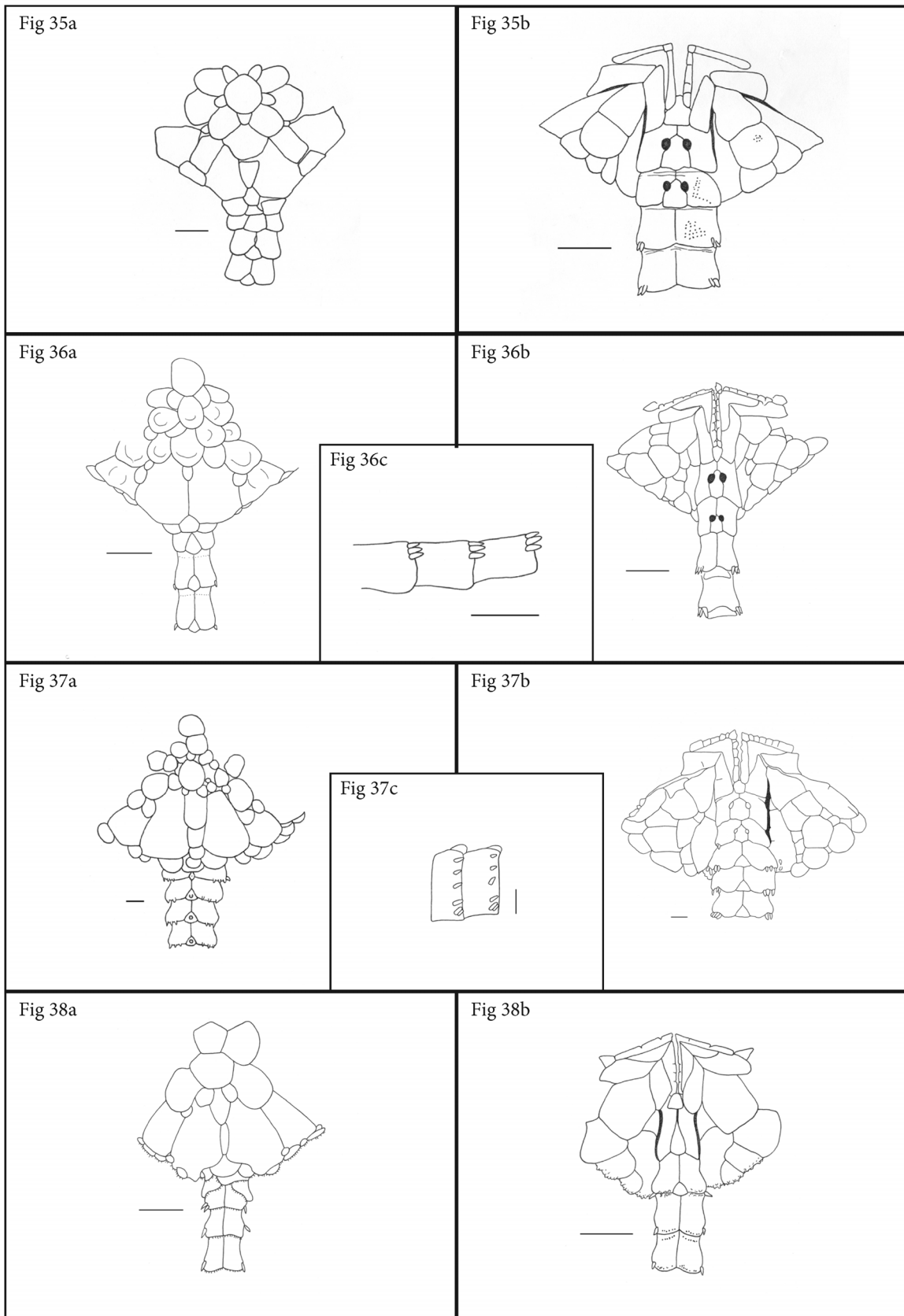
***Ophiomusium tripassalotum* H. L. Clark 1917.**

Figures 36 a, b, c

*Ophiomusium tripassalotum* Clark, 1917, 1941.

**Holotype** USNM E636, *Albatross* station 3690, Taumotu Archipelago, 1485 m.

**Main Features:** Disc tumid dorsally, flat ventrally. Plates smooth with higher distal margins and weak sutures. Radial shields large and separated only at the extreme distal and proximal ends. Dorsal and ventral arm plates throughout arm, dorsal plates thickened on radial side.



**FIGURE 35.** *Ophiomusium testudo* MCZ 485: a, b, dorsal and ventral disc sectors.

**FIGURE 36.** *Ophiomusium tripassalotum* USNM E636: a, b, dorsal and ventral disc sectors; c, basal arm segments.

**FIGURE 37.** *Ophiomusium trychnum* USNM E25646: a, b, dorsal and ventral disc sectors; c, basal arm segments.

**FIGURE 38.** *Ophiomusium ultima* ZMUC: a, b, dorsal and ventral disc sectors.

Three stout arm spines clumped low down on lateral arm plates. Two pairs of exposed tentacle pores with large oval scales.

***Ophiomusium trychnum* H. L. Clark 1911.**

Figures 37 a, b, c

*Ophiomusium trychnum* H. L. Clark, 1911; Irimura, 1982.

**Holotype** USNM E25646 *Albatross* station 5069 off Ose Saki, Suruga Gulf, Japan, 198–240m. 47 **paratypes** USNM, all from *Albatross* stations in 1906, off Japan.

**Main Features:** Heavy tumid disc, plates mostly raised and spherical. Large radial shields, totally separated. Dorsal and ventral arm plates throughout arm. Oral shields small, up to 10 plates between them and disc margin. Six arm spines, 3 grouped low. Two pairs of exposed tentacle pores. Genital slits run from adoral plate to end of second lateral arm plate.

***Ophiomusium ultima* Hertz 1927.**

Figures 38 a, b

*Ophiomusa ultima* Hertz, 1927; H. L. Clark, 1939.

**Syntypes** 3, ZMUC, *Valdivia* station 243, Menai Bay, Zanzibar, 400m; 4, BMNH 1948.5.26.437.8 John Murray Expedition station 105.

**Main Features:** Disc with large primary plates, and radial shields separated by a narrow plate, Interradial areas consist of a long narrow plate with smaller plates at the edge, which are “furry” with pointed granules. No dorsal arm plates, and only two ventral arm plates.

Lateral arm plates with fine pointed granules along their distal edges. Two small arm spines situated on a protruding ledge. No exposed tentacle pores. Oral papillae not well differentiated. Short genital slits, only ½ a lateral plate long. Large oral shields with one distal plate extending to the disc margin.

***Ophiomusium zela* A. H. Clark 1949.**

Figures 39 a, b

**Holotype** USNM E7129 and 2 paratypes E 7130, *Albatross* station 4018 vicinity of Kauai, Hawaii, 1469–1342 m.

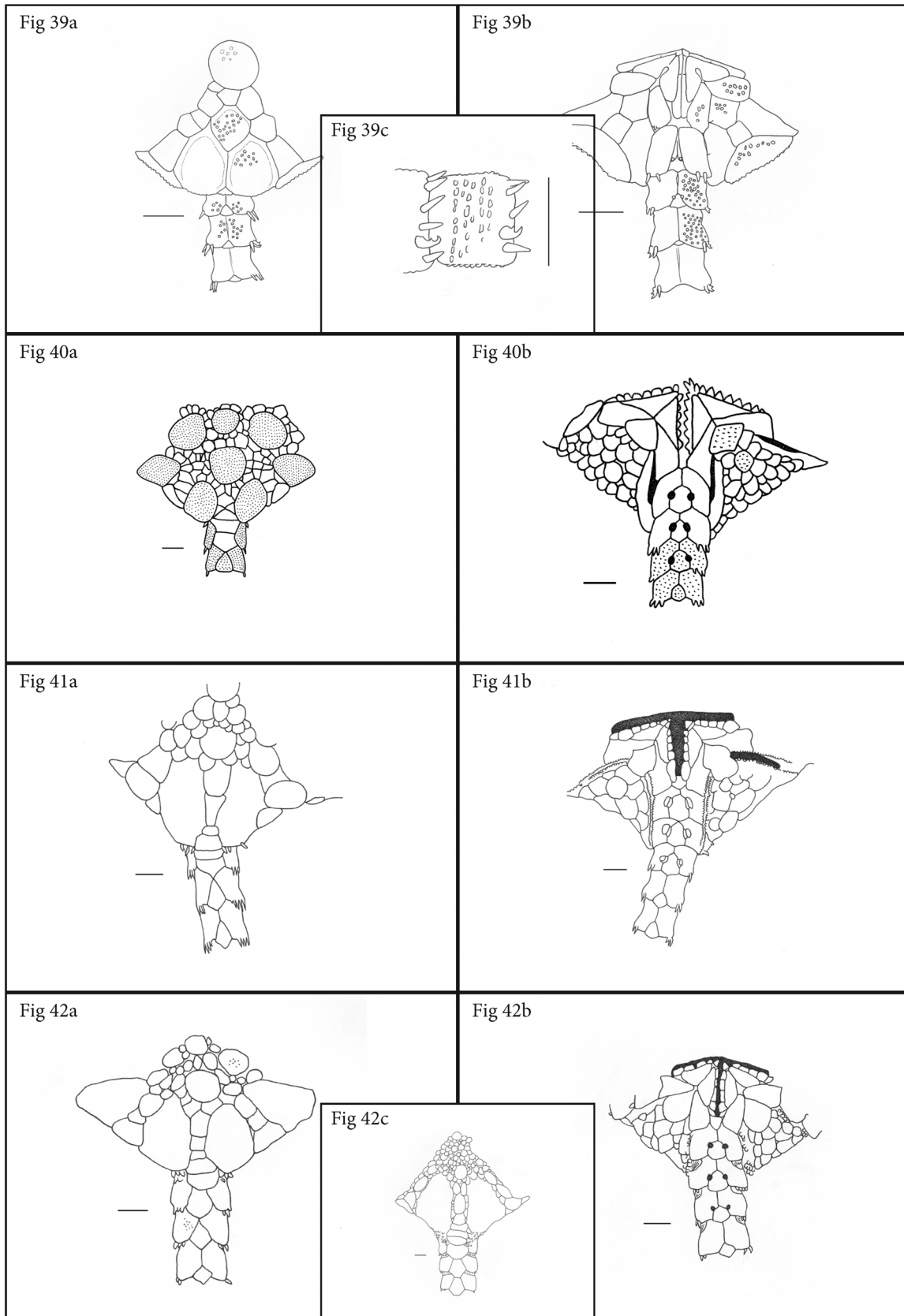
**Main Features:** Small circular disc with few plates, mainly primaries, all heavily granular. Granules have ball-like glassy heads. Areas between granules filled with skin. Radial shields contiguous. Small dorsal arm plates throughout arm. Six longish arm spines, 2 lowermost double hooked. Area between first lateral arm plates very narrow, containing first ventral arm plate. Two pairs of exposed tentacle pores, no scale. Diamond-shaped oral shields with one almost square plate between it and the wide interradianal plate. Oral papillae not separated.

***Ophiosphalma* H. L. Clark 1941**

*Ophiosphalma* H. L. Clark, 1941: 98–99 [type species *Ophiomusium planum* Lyman, 1878 (= *Ophiosphalma armigerum* (Lyman, 1878) [by original designation]).

**Generic description:** Disc up to 22 mm in diameter, arms up to 4 times d.d. Dorsal disc plates large, smooth, finely granulated or with small tubercles. Radial shields usually large, and fully separated except possibly in very young specimens. Ventral disc plates few, oral shields lemon-, droplet-, or dumbbell-shaped, large. Oral papillae fused or separated.





**FIGURE 39.** *Ophiomusium zela* USNM E7129: a, b, dorsal and ventral disc sectors.

**FIGURE 40.** *Ophiosphalma archaster* BMNH 82-12-23-364: a, b, dorsal and ventral disc sectors.

**FIGURE 41.** *Ophiosphalma armatum* USNM 0040923: a, b, dorsal and ventral disc sectors.

**FIGURE 42.** *Ophiosphalma armigerum* BMNH 82.2.23.177: a, b, dorsal and ventral disc sectors; c, *Ophiosphalma planum* MCZ 475: dorsal disc sector.

Exposed tentacle pores on lateral sutures of 3 or more ventral arm plates, often with multiple scales. Genital slits extend up to 4th arm segment, papilliform edges. Arms moniliform, lateral arm plates meeting above and below, ventral and dorsal arm plates throughout arms. 4–12 small arm spines, upper-most sometimes hooked.

The following species are assigned to *Ophiosphalma* on the basis of possessing 3 or more pairs of exposed tentacle pores, and fully separated radial shields in adults.

***Ophiosphalma archaster* (Wyville-Thomson, 1878), in Lyman, 1878.**

Figures 40 a, b

*Ophiomusium archaster* Wyville-Thomson 1878; H. L. Clark, 1915.

**Holotype** BMNH 82-12-23-364 HMS *Challenger* station 323 off Montevideo 3475 m.

**Main Features:** Disc 10 mm d.d., plates finely granular, 5 large round plates encircle a single primary. All are finely granular. Radial shields oval, similar size to ventral plates, and widely separated by 4–5 smaller plates. Oral papillae joined. Triangular oral shield with much smaller interradiial plates distad. Genital slits run to middle of first lateral arm plate. Three exposed tentacle pores. 4 small arm spines. A second non-type specimen, 23 mm d.d. is in the same jar and is completely covered with thick skin, its plates only just visible. This is possibly an artefact. The arms are hardly at all constricted between segments, as in the type. Three pairs of exposed tentacle pores.

***Ophiosphalma armatum* (Koehler, 1922).**

Figures 41 a, b

*Ophiomusium armatum* Koehler, 1922.

**Lectotype** USNM 0040923 *Albatross* Station 5428 eastern Palawan, 2021m. Dr Marc Eleaume, Paris Museum, has recently informed me that a syntype of this species is in their collection: NMNH 10384, ex-*Albatross* Expedition.

**Main Features:** Disc diameter 11 mm. Glabrous surface. Dorsal arm plates throughout length of arms, diamond-shaped. 6 subequal arm spines. 3 pairs of exposed tentacle pores, each with 2 tentacle scales. Long genital slits extending to disc edge, and bordered each side by bead-like papillae. Lemon-shaped oral shield, 6 oral papillae.

***Ophiosphalma armigerum* (Lyman, 1878).**

Figures 42 a, b, c

*Ophiomusium armigerum* Lyman, 1878; H. L. Clark, 1915.

*Ophiomusium planum* Lyman 1878; Madsen, 1951; Vadon & Guille, 1984; Paterson, 1985.

*Ophiosphalma armigerum* (Lyman 1878); H. L. Clark, 1941; Paterson, 1985.

**Snytype** BMNH 82.12.23.177, *Challenger* station 332; syntypes, MCZ 451 (2) off Japan 3429m; MCZ 441 (4) *Challenger* station 106, mid-Atlantic, 3383m; MCZ 475, Blake Expedition, Gulf of Mexico, 1820m (holotype of *Ophiomusium planum* Lyman).

**Main features:** Many small disc scales with protuberant primaries visible. In largest specimens (<17 mm d.d.) the primary disc plates are a different texture to other scales—they are similar to the radial shields and therefore stand out. Radial shields and interradiial areas separated by many small oval scales. Radial shields large. Genital slits slightly longer than the first arm segment, with bordering papillae. Oral papillae block-like, not pointed, and not separated. Oral shield varies from oval to lemon-shaped. Dorsal and ventral arm plates large and throughout the arms. Three, occasionally 4 pairs of exposed tentacle pores, with 2 or 3 scales on the first pores. 6-3 very small arm spines.

This species is similar to *O. elegans* Koehler, except that the shape of the oral shield differs, and oral papillae are not separated and free, as in *elegans*. *Ophiomusium planum* Lyman was synonymised with *O. armigerum* by Paterson (1985), and I concur with that decision.

A syntype of *Ophiosphalma armigerum* var *congoense* (Hertz, 1927) from Valdivia Station 63 (ZMUC) is 20 mm d.d., and differs from *armigerum* only in the dorsal surface of the disc being covered with many small scales, closely soldered, with scattered larger circular granular scales, which look similar to moon craters. There are 3–4 short arm spines, the 2nd to lowest being the longest. Until more material becomes available, *congoense* should remain as subspecies of *O. armigerum*. (Note: this specimen in the ZMUC was mislabelled *O. fimbriatum* var *atlanticum*).

***Ophiosphalma atlanticum* (Hertz, 1927).**

Figures 43 a, b

*Ophiomusium fimbriatum* var *atlanticum* Hertz, 1927.

**Syntype**, ZMUC, from Valdivia station 63, Gulf of Guinea, 2492 m.

**Main Features:** Hertz's variety *atlanticum* has dumbbell-shaped oral shields, no disc granules, and multi-scaled exposed tentacle pores on the first 3 segments. 7 arm spines. The genital slits extend to the distal end of the second arm segment. The syntype of *O. fimbriatum* var *atlanticum* I observed in the ZMUC is 19 mm d.d. I here elevate the variety to a separate species: *Ophiosphalma atlanticum* (Hertz).

***Ophiosphalma breve* (H. L. Clark, 1939).**

Figures 44 a, b

*Ophiomusium breve* H. L. Clark, 1939

**Holotype** BMNH 1948-5-26-415, John Murray Expedition 1933-34 station 105 off Zanzibar, 238-293 M., 1 paratype BMNH 1948-5-26-414 & 1 paratype MCZ 6094, station 105.

**Main Features:** The holotype differs from Clark's figure 58 in that it has 2 plates distal to the oral shield in 4 interradial, rather than 1. The marginal granules on the disc are distinct, and the surface is very granular. In the MCZ paratype, the arms are distinctly more granular than the disc. Three pairs of exposed tentacle pore, no scales.

***Ophiosphalma cancellatum* (Lyman, 1878).**

Figures 45 a, b

*Ophiomusium cancellatum* Lyman, 1878

*Ophiomusium cancellatum* Lyman, 1878; H. L. Clark, 1939.

*Ophiosphalma cancellatum* (Lyman 1878); Guille & Vadon, 1986.

**Holotype** BMNH 82-12-23-204, *Challenger* station 236, South of Sagami Bay. Japan, 1417 m. Additional material: John Murray Expedition, 4 specimens, 1207–1463 m, Zanzibar area; 1 specimen, *Challenger* station 33 off Bermuda, 796 m.

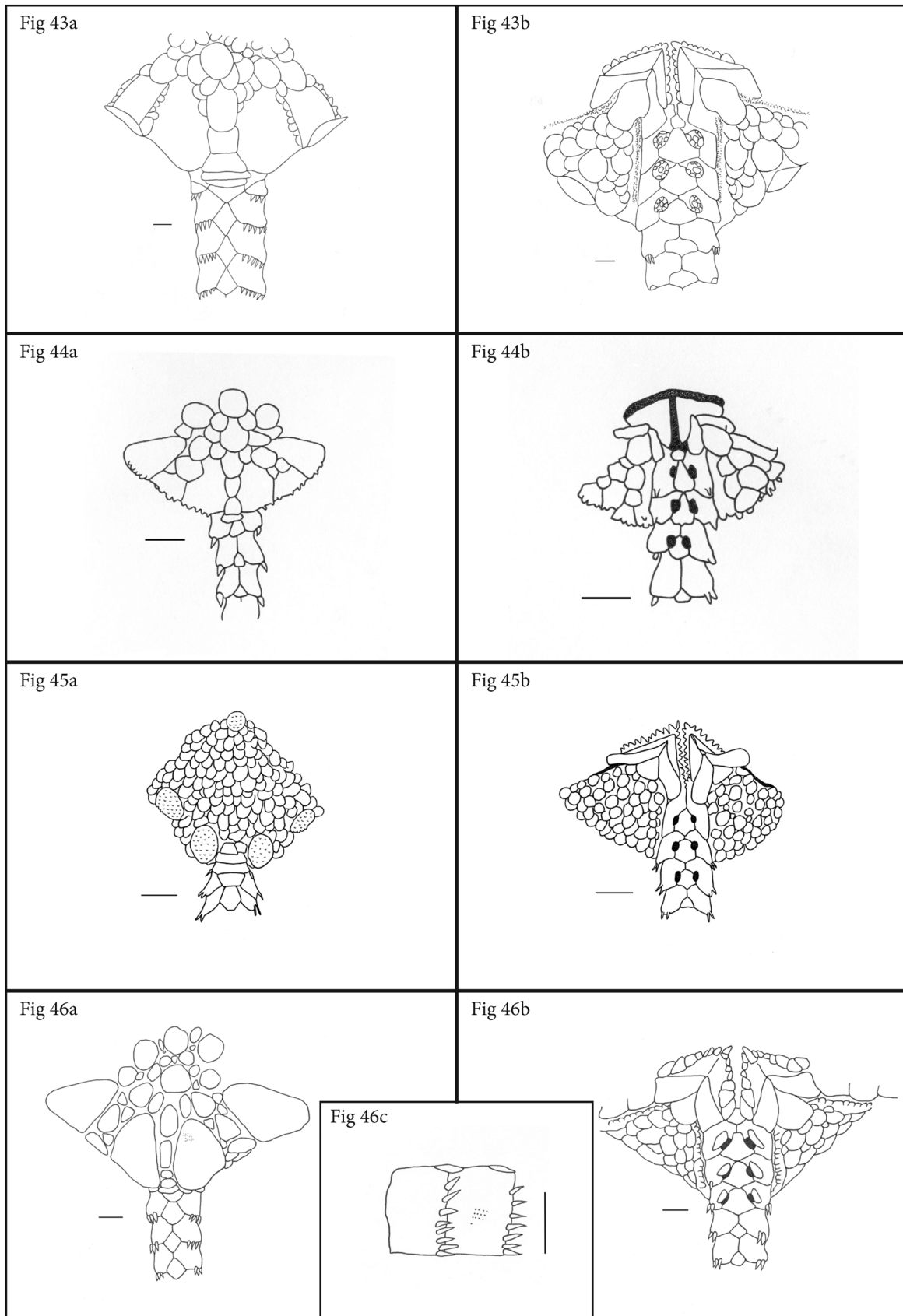
**Main Features:** Disc granular with small rounded scales. Upper and lower arm plates present throughout most of the arm length. Genital slits longer than the first arm segment, and bordered by low, longer than high papillae. Three pairs of exposed tentacle pores.

***Ophiosphalma corticosum* (Lyman, 1878)**

Figures 46 a, b

*Ophiomusium corticosum* Lyman, 1878; Gouzen, 1987.

**Syntype** BMNH 82-12-23-423, *Challenger* station 22, Caroline Islands, East Indies, 3383m. There is a syntype of this species in the MCZ (442)—3 were collected by HMS *Challenger*, so one is missing. The comments here are based on both types and the illustrations are of MCZ 442.



**FIGURE 43.** *Ophiosphalma atlanticum* ZMUC: a, b, dorsal and ventral disc sectors.

**FIGURE 44.** *Ophiosphalma breve* BMNH 1948-5-26-415: a, b, dorsal and ventral disc sectors.

**FIGURE 45.** *Ophiosphalma cancellatum* BMNH 82-12-23-204: a, b, dorsal and ventral disc sectors.

**FIGURE 46.** *Ophiosphalma corticosum* BMNH 82-12-23-423: a, b, dorsal and ventral disc sectors; c, basal arm segments.

**Main Features:** The disc is tumid and the radial shields are curved downwards distally. The disc plates are finely granular and there are deep smooth sutures between the plates. 8 small arm spines. Heavy oral papillae, some separated. Large tentacle scales, 3–4 exposed tentacle pores, protuberant ventral arm plates. Small drop-shaped oral shields, genital slits 2.5 arm segments long with papillae on one side only.

***Ophiosphalma diomedea* (Lütkeni & Mortensen, 1899).**

Figures 47 a, b

*Ophiomusium diomedea* Lütkeni & Mortensen, 1899

**Syntypes** (2), USNM 19501, *Albatross* 1891, E San Cristobal Id, Galapagos 702 m.

**Main Features:** Disc flat with well-defined scales, many in centre. Radial shields less than half disc radius, finely rugose and non-imbricating. Arm plates throughout, 6 small thick arm spines. 3 large exposed tentacle pores and 1 occasionally 2 tentacle scales. Genital slits run to the edge of the disc. Genital papillae strong abradially only. Oral shield small, oral plate large. One juvenile specimen, 5 mm d.d. has the radial shields joined for the first third, and all the disc plates have 3–4 small tubercles.

***Ophiosphalma elegans* (Koehler, 1897).**

Figures 48 a, b

*Ophiomusium elegans* Koehler, 1897; H. L. Clark, 1939. *Ophiosphalma elegans* (Koehler, 1897); Guille & Vadon, 1986.

**Lectotype:** ZSI 5134 Laccadive Is (now Lakshadweep) 406 fathoms and Andaman Is, 457m..

**Main Features:** Two specimens from the Andaman Sea, 7.5 n. miles east of North Cinque Id, 490 fathoms, are in the ZSI (5134/7). These are possible candidates for the type specimens, but the locality is incorrect. Koehler lists 2 from “Iles Laquedives” and 1 from “Iles Andaman”. A 4th specimen in the ZSI collection (ZSI 5989/7) is labelled “Andaman Sea, Nth Sentinel bearing N 15 degrees W 18 miles, 250 fathoms”. This latter specimen is 6.3mm d.d. and was listed by Koehler later in 1899, and is thus not in the type series.

Specimens ZSI 5134/7 may be mislabelled and are probably the specimens recorded in the actual type description, from the Lakshadweep (Laccadive) Islands to the west of southern India.

Therefore, specimen ZSI 5134 with tag, 13 mm d.d., is here selected as a lectotype for *O. elegans*. Specimen ZSI 5134 without a tag, 11 mm d.d., is here selected as a paralectotype. Unfortunately, the oral papillae are mostly missing and one interradius is broken in this specimen.

The surface of the disc plates is an open mesh of pits, and there are granules at the disc edge. The radial shields are pear-shaped. Oral papillae are rectangular and evenly reduced towards the apex. There are three pairs of exposed tentacle pores.

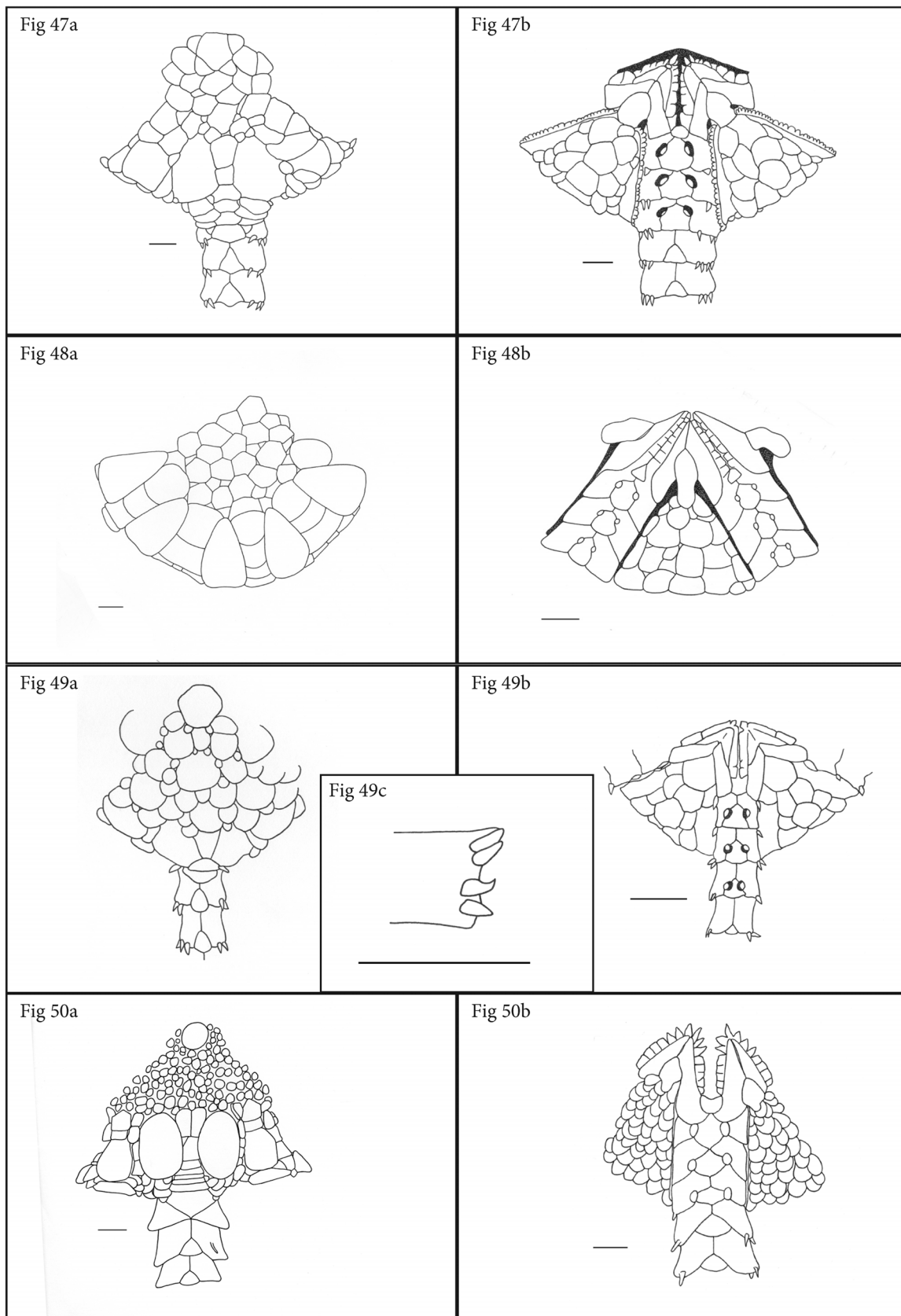
***Ophiosphalma elii* (A. H. Clark, 1949).**

Figures 49 a, b

*Ophiomusium elii* Clark, 1949

**Holotype** USNM E7124, *Albatross* Station 4096, SE Coast of Maui Id, Hawaii, 497–523 m.

**Main Features:** Small (6 mm d.d) pentagonal disc, raised above, flat below. Covered with many thick imbricating scales. Radial shields small, separated and divergent. Upper and ventral arm plates present throughout arms. Ventral interradii with 7–8 plates and small pentagonal oral shields. Genital slits remote from oral shields. Oral papillae not separated. 3 pairs of exposed tentacle pores with 1 large scale. 4, occasionally 5 short stout arms spines, the lower 3 of which become single-hooked distally. This specimen is very similar to *O. valdiviae* Koehler.



**FIGURE 47.** *Ophiosphalma diomedea* USNM 19501: a, b, dorsal and ventral disc sectors.

**FIGURE 48.** *Ophiosphalma elegans* ZSI 5134: a, b, dorsal and ventral disc sectors.

**FIGURE 49.** *Ophiosphalma elii* USNM E7124: a, b, dorsal and ventral disc sectors; c, basal arm segments.

**FIGURE 50.** *Ophiosphalma familiare* ZSI 4681: a, b, dorsal and ventral disc sectors; See next plate for Fig. 50 c & d.

***Ophiosphalma familiare* (Koehler, 1897).**

Figures 50 a, b, c, d

*Ophiomusium familiare* Koehler, 1897; H. L. Clark, 1939.

**Lectotype:** ZSI 4681, *Investigator* station 150, (actually listed as "Station 150/151), Laccadive Sea, 29/xi/1893, 7 degrees 5'45" N, 75 degrees 4' E, 1315m; Iles Laquedives, 742m. No type was designated, thus the largest specimen of the type series from station 150 (18 mm d.d., ZSI 4681) is here selected as a lectotype and the remaining specimens paralectotypes. The specimen labelled "type" in the BMNH, 98.7.11.2, is not one of Koehler's type series, but one of his collected later in 1899 from the Maldives. There are further specimens in the BMNH (1948.1.10.124-133) from the John Murray Expedition station 115, off Zanzibar, 640–658 m.

**Main Features:** Koehler's illustrations are very diagrammatic and accentuate the oval shape of the radial shields and circular shape of other disc plates. One specimen, 8 mm d.d. is 6- armed. The young specimens have a distinct primary rosette, with the largest plates being next to the radial shields. Disc plates of larger specimens with minute polished granules.

Genital papillae tooth-like, oral papillae block-like and not separated. Three pairs of exposed tentacle pores.

***Ophiosphalma glabrum* (Lütken & Mortensen, 1899).**

Figures 51 a, b, c, d

*Ophiomusium glabrum* Lütken & Mortensen, 1899; H. L. Clark, 1917 *Ophiomusium fimbriatum* Koehler, 1922  
*Ophiomusium multispinum* H. L. Clark, 1911 (synonymised with *O. glabrum* by H. L. Clark, 1913).

**Syntypes** of *O. glabrum*: BMNH 1901.4.9.43/7, *Albatross* station 3376, Gulf of Panama, 1132 fms; syntypes (56), USNM E19494, 19496, 19498, 19499, 19500, *Albatross* stations 3381, 3392, 3400, 3414, 3431, Off Columbia, Bay of Panama and Mexico, 1820–4082m. Dr Marc Eleaume, Paris Museum, has recently informed me that a syntype of *O. glabrum* is in their collection: NMNH 10254, as is a possible type specimen of *O. fimbriatum*: NMNH10389, ex-*Albatross* Expedition.

**Holotype** of *O. fimbriatum*: USNM E188 *Albatross* station 5614, Mollucca Passage, 2011 m.

**Main Features:** Disc finely granular, very many small non-imbricating plates in centre and gradually enlarging towards margins. Radial shields large, comma-shaped, separated by reticulate rows of scales, 4–5 wide. Ladder-like arrangement of wide/narrow plates between distal ends of radial shields. A group of small pointed stumps each side of arm on disc edge visible dorsally and ventrally. Dorsal arm plates throughout arm. Up to 12 small arm spines, the longest lowest. Three pairs of exposed tentacle pores. 4 scales on first pore. Ventral arm plates throughout, genital slits run to end of first lateral arm plate. Oral shield triangular with slight concave distal margin. Seven oral papillae, not separated. Many hexagonal non-imbricating scales in post-oral shield area.

*O. fimbriatum* Koehler is a synonym of *O. glabrum*. It has short genital slits, the oral shield is arrow-headed, and it has 3–5 exposed tentacle pores, all of which may be regarded as age-related.

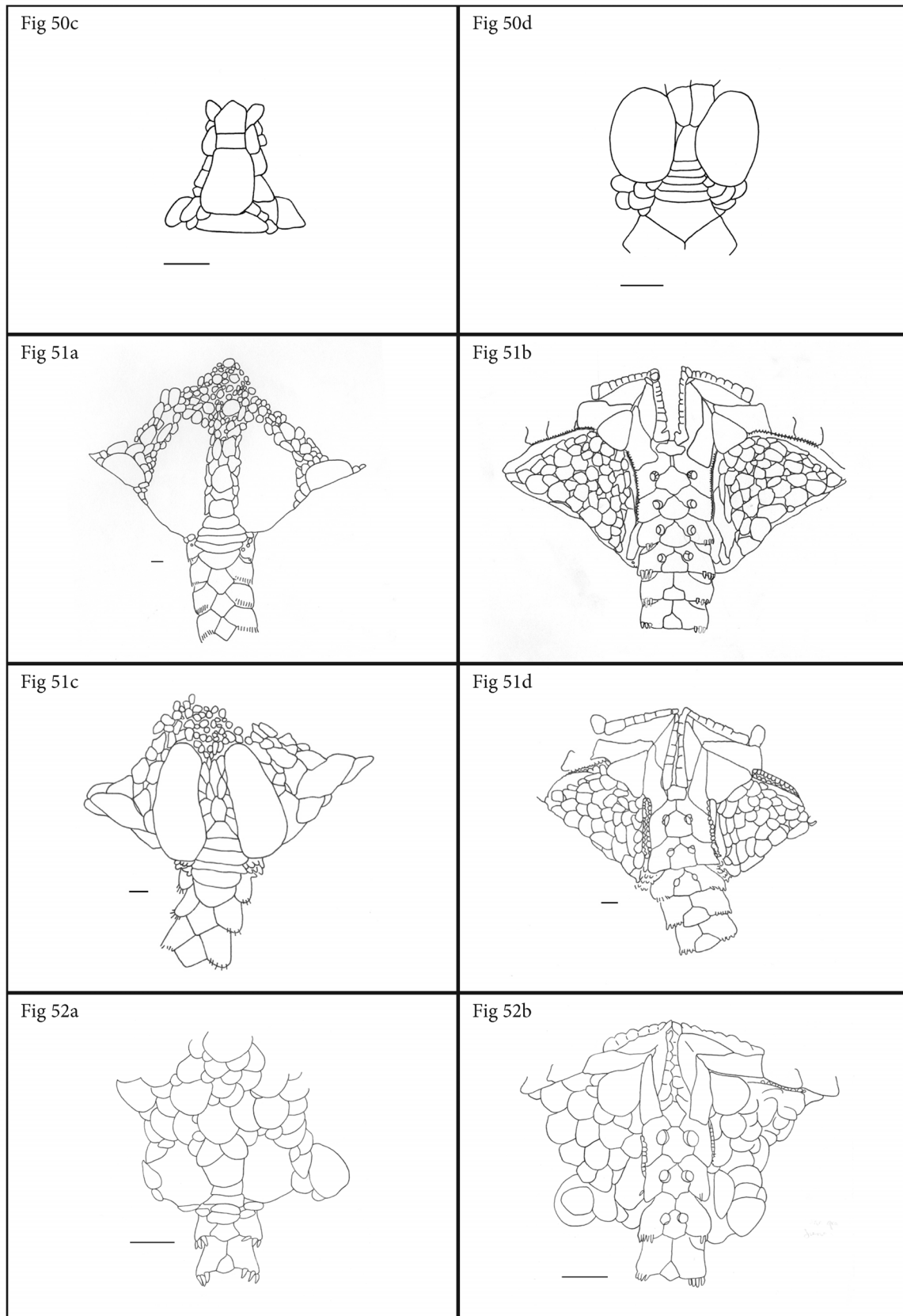
***Ophiosphalma impotens* (Koehler, 1922).**

Figures 52 a, b

*Ophiomusium impotens* Koehler, 1922

**Holotype:** USNM 40920, *Albatross* station 5605, Gulf of Tomini, Celebes, 1183m.

**Main Features:** The holotype is deformed, with a large plate protruding out from one interradial area. The disc has many moderately large imbricating plates, and small, well separated radial shields (less than ½ disc radius). There are small dorsal and ventral arm plates throughout and 6 short arm spines. The genital slits extend to 1 ½ lateral arm plates. There are three exposed tentacle pores, each with one large scale. The oral shield is tear-drop shaped, sharp proximally. There are 6 non-separated oral papillae each side of the jaw, plus one terminal tooth.



**FIGURE 50.** *Ophiosphalma familiare* ZSI 4681: c, ventral interradial plates; d, radial shields and associated basal arm plates.  
**FIGURE 51.** *Ophiosphalma glabrum* USNM E19494: a, b, dorsal and ventral disc sectors; c, d, *Ophiosphalma fimbriatum* USNM E188: dorsal and ventral disc sectors.  
**FIGURE 52.** *Ophiosphalma impotens* USNM 40920: a, b, dorsal and ventral disc sectors.



***Ophiosphalma jolliense* (McClendon, 1909).**

Figures 53 a, b

*Ophiomusium jolliense* McClendon, 1909.

*Ophiosphalma jolliense* Hendler, 1996.

**Holotype:** MCZ 7048 (this specimen was labelled “*O. clarkii* McClendon” - there is no such species and I assume McClendon decided on a different name for his species after writing the label. No locality data was on the label, but five examples of this species were collected at stations off southern California in 115–603m (D.L. Pawson *pers.comm.*), of which one must have been McClendon’s type. More recently, Hendler (1996) has recorded *O. jolliense* from the same areas off California.

**Main features:** Disc with many imbricating plates both dorsally and ventrally. Radial shields separated by 4–5 plates. Large interradial plate visible only dorsally. Oral shield indistinct, genital slits long, reaching to end of third arm plate. Three pairs of exposed tentacle pores.

Oral papillae not separated. Cluster of small tubercles around arm bases. Dorsal arm plates longer than wide, throughout arm.

***Ophiosphalma laqueatum* (Lyman, 1878).**

Figures 54 a, b

*Ophiomusium laqueatum* Lyman, 1878; Matsumoto, 1917.

**Holotype,** BMNH 82.12.23.417, *Challenger* station 192, between Teniber and Aru Ids, Arafura Sea, 236 m; MCZ 3085.

**Main features:** Disc 14 mm diameter, covered with small imbricating scales, large, smooth radial shields dominant, and separated by many scales. Diamond-shaped dorsal arm plates large and throughout arm. Lateral plates with 4 arm spines, 3 clumped together low down, and one smaller spine isolated dorsally. Small supplementary lateral arm plates present.

Small oral shield, ventral interradial area with about 10 large rounded plates. Oral papillae block-like and only fused distally. Genital slits reach from adoral plates to disc edge and are noticeably wider at their distal end. Three pairs of exposed tentacle pores, the first two larger than the third. Each with an oval scale.

***Ophiosphalma monoplax* (H. L. Clark, 1915).**

Figures 55, a, b

*Ophiomusium monoplax* Clark, 1915.

*Ophiosphalma monoplax* (Clark); H. L. Clark, 1941.

**Paratypes** (2) MCZ 509, off Dominica, 609m (the holotype was not found).

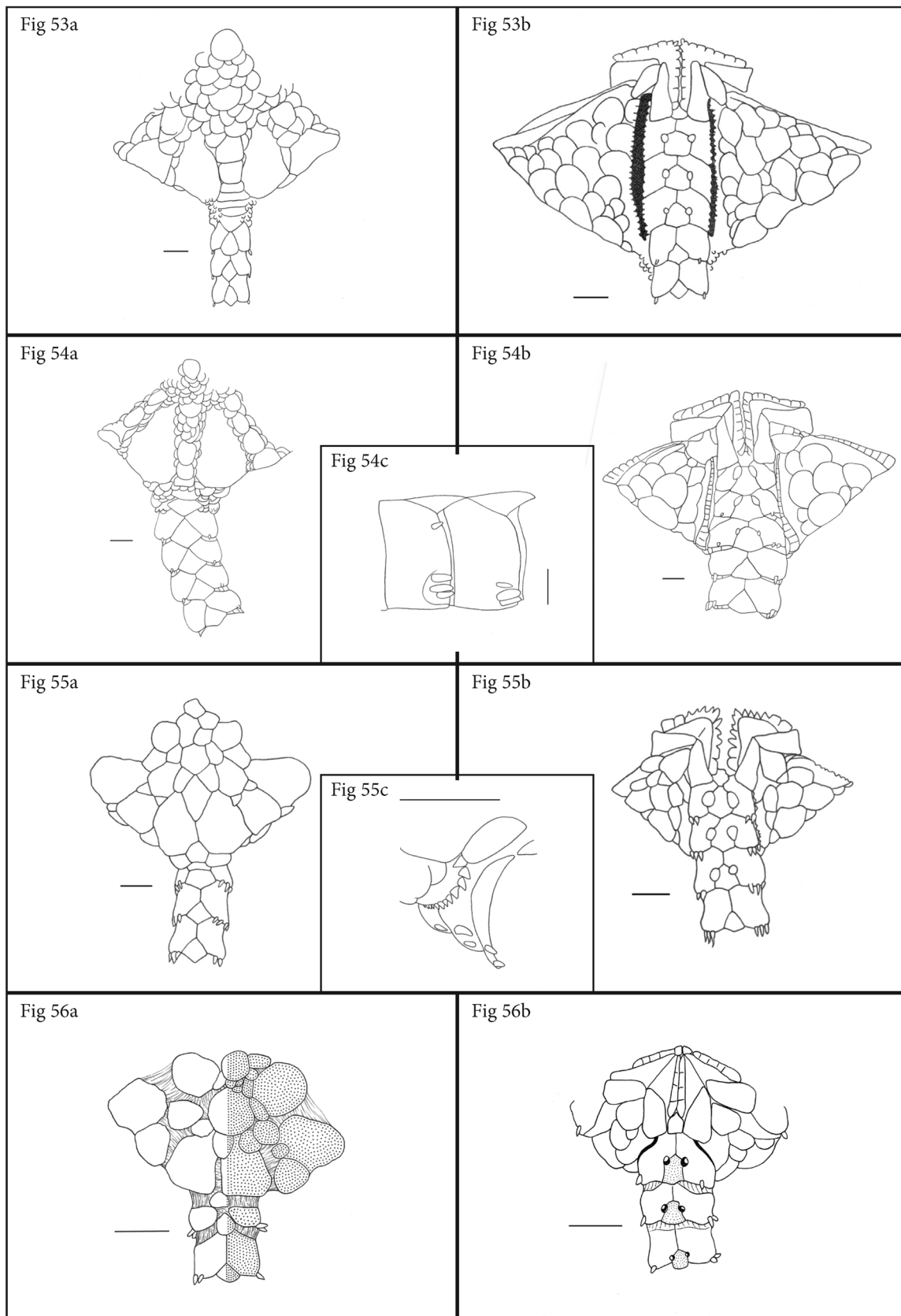
**Main Features:** Tumid disc plates with an open meshwork surface and deep sutures. Primary plates are surrounded by small plates. Radial shields joined at mid-length and there is a longer than wide interradial plate. Small, pointed oral shields, separated oral papillae. Three pairs of exposed tentacle pores, each with one large semi-oval scale. Pointed genital papillae run from adoral plates to arm bases. Up to five arm spines, uppermost hooked. Dorsal and ventral arm plates throughout arm. The two specimens measure 4 and 8 mm d.d.; there are more arm spines in the larger specimen. Clark’s holotype, at 12 mm d.d., had totally separated radial shields.

***Ophiosphalma nitidum* (H. L. Clark, 1939).**

Figures 56 a, b

*Ophiomusium nitidum* Clark, 1939

*Ophiosphalma nitidum* (Clark); Madsen, 1951; Guille & Vadon, 1986.



**FIGURE 53.** *Ophiosphalma jolliense* MCZ 7048: a, b, dorsal and ventral disc sectors.

**FIGURE 54.** *Ophiosphalma laqueatum* BMNH 82.12.23.417: a, b, dorsal and ventral disc sectors; c, basal arm segments.

**FIGURE 55.** *Ophiosphalma monoplex* MCZ 509: a, b, dorsal and ventral disc sectors; c, view into one side of arm base, showing 3 basal lateral arm plates, and genital plates with prominent tooth-like papillae.

**FIGURE 56.** *Ophiosphalma nitidum* BMNH1948.5.26.416: a, b, dorsal and ventral disc sectors.

**Holotype** BMNH 198.5.26.416 John Murray Expedition station 177 Arabian Sea, 3840–3872 m. 2 paratypes, same station, 198.5.26.417, 1 paratype MCZ 6095 station 171, Arabian Sea, 3840–3872m.

**Main Features:** Primary plates surrounded by small plates and all have a glazed appearance due to film of mucous. Areas between disc and arm plates with exposed tight skin. Comma-shaped genital slits. Ventral arm plates present on most of arm, loosely granular. Three pairs of exposed tentacle pores. Clark's illustration is accurate.

***Ophiosphalma properum* (Koehler, 1904).**

Figures 57 a, b

*Ophiomusium properum* Koehler, 1904.

*Ophiosphalma properum* (Koehler); Guille & Vadon, 1986

**Lectotype** RMNH V.ECH. O. 2953, *Siboga* station 85 Makassar Straits, Indonesia, 724m. There are 6 specimens identified by Koehler in the ZMA but none are designated as a type. I have selected the single specimen from *Siboga* station 85, as a lectotype. The remaining 5 are paralectotypes from station 314.

**Main Features:** Disc covered with poorly defined imbricating scales—the sutures are smooth. Radial shields separated by two squarish plates. Dorsal arm plates diamond-shaped with hyaline margins. Lateral arm plates lightly rugose. Heavy block-like oral papillae, partly separated. Three pairs of exposed tentacle pores each with a single scale. Long genital slits reaching from adoral plates to edge of disc (3rd lateral plate).

*O. properum* is similar to *O. impotens*—but the genital slits are longer, possibly indicating an older specimen.

***Ophiosphalma regulare* (A. H. Clark, 1936).**

Figures 58 a, b

*Ophiomusium regulare* Clark, 1936

**Holotype** USNM E5194 Caroline station 45, Johnson-Smithsonian Expedition 1933, off Puerto Rico, 438–548m.

**Main Features:** Disc scales few and tumid, mostly primaries. Radial shields separated by three plates diminishing in size towards the arm. Dorsal arm plates throughout arm, with 3 rows of granules at the arm bases, granules extend ventrally. Narrow interradii. Two arm spines, uppermost become hooked. Ventral arm plates present to 11th segment. Three exposed tentacle pores, each with 1 scale. Genital slits longer than first arm segment, bordered by papillae.

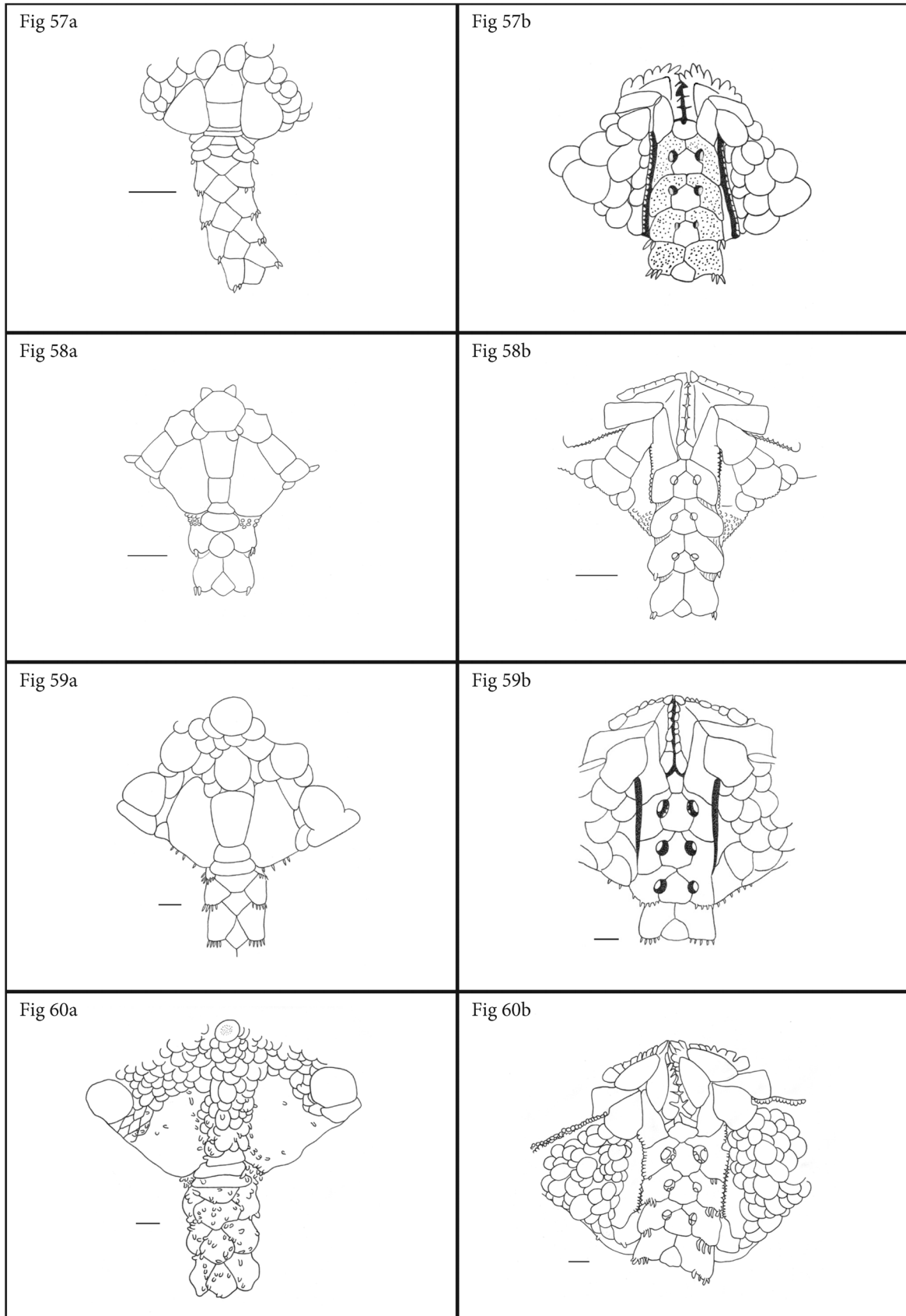
***Ophiosphalma spinigerum* (Mortensen, 1933).**

Figures 59 a, b.

*Ophiomusium spinigerum* Mortensen, 1933

**Holotype** ZMUC OPH-332, *Dana* Expedition, St Helena Id, mid-Atlantic, 2400–2780 m.

**Main Features:** Disc high centrally, many small imbricating scales. Radial shield large and separated. Thin spinelets at interradiial edge. Arms very tubular, dorsal arm plates diamond-shaped, dorsal and ventral arm plates throughout arms. Three pairs of exposed tentacle pores—the first pore has one large and 4 small scales, the remaining two pore have 2 scales, one large, one small. Oral papillae slightly separated. Genital slits long with thin bordering papillae.



**FIGURE 57.** *Ophiosphalma properum* RMNH V.Ech.O.2953: a, b, dorsal and ventral disc sectors.

**FIGURE 58.** *Ophiosphalma regulare* USNM E5194: a,b, dorsal and ventral disc sectors.

**FIGURE 59.** *Ophiosphalma spinigerum* ZMUC OPH.-332: a, b, dorsal and ventral disc sectors.

**FIGURE 60.** *Ophiosphalma spinulosum* USNM E190: a, b, dorsal and ventral disc sectors.

***Ophiosphalma spinulosum* (Koehler, 1922).**

Figures 60 a, b

*Ophiomusium spinulosum* Koehler, 1922

**Lectotype** USNM E190, and 2 paralectotypes E189 *Albatross* stations 5651 and 5650, respectively, Gulf of Bonin, Celebes, 987m.

**Main features:** Upper surface of disc and arms covered with short “crusty” spinules. None on ventral surface. Many scales of equal size in ventral and dorsal interradii. Radial shields small, roughly oval and widely separated by 5–6 rows of small scales. Smooth contours on arms, but joints rather constricted. Upper arm spines have double distal hook. Three pairs exposed tentacle pores with up to 4 scales each. Genital slits run to distal end of second arm plate, papillae each side. Oral papillae separated.

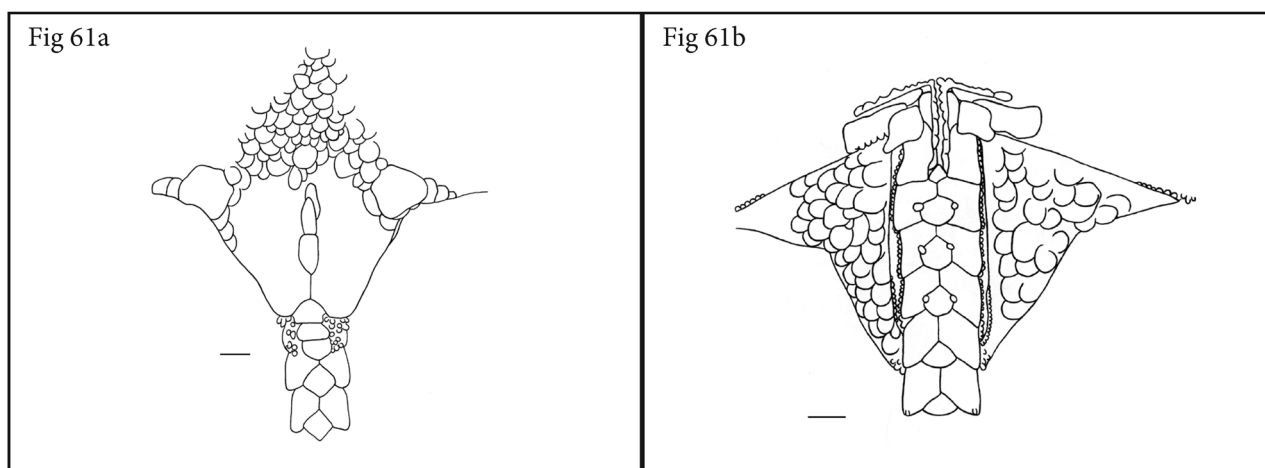
***Ophiosphalma variable* (Lütken & Mortensen, 1899).**

Figures 61 a, b

*Ophiomusium variable* Lütken & Mortensen 1899, H. L. Clark, 1915. *Ophiosphalma variable* Hendler, 1996.

**Syntypes** (4) USNM 19502 *Albatross* station 3417, off Acapulco, Mexico, 902 m, (1) ZMUC OPH-397, *Albatross* station 3726.

**Main Features:** Disc indented interradially. Many small scales on disc dorsally and ventrally, a larger interradiial plate dorsally. Large, smooth radial shields, separated in small specimens, contiguous in adults. Granules around bases of arms dorsally. Long genital slits, running to 4th lateral arm plate, and with papillae along the edge of the arm and abradial distal edge of the slit only. Rudimentary arm spines start at first free segment (5th). Three pairs of exposed tentacle pores each with a large scale. The separated radial shields in young specimens is contrary to the trend in *Ophiosphalma*—in all other species examined the reverse was the case. Juveniles identified as *O. variable* could be a separate species.



61. *Ophiosphalma variable* USNM 19502: a, b, dorsal and ventral disc sectors.

**Other species**

A number of *Ophiomusium* and *Ophiosphalma* type specimens were in museums I could not visit in 1980, or were not located in the institutions I did visit. They are listed here so that future workers may locate them and use them to complete this catalogue.

*Ophiomusium africanum* Koehler, 1909  
*Ophiomusium anaelise* Tommasi & Abreu, 1974  
*Ophiomusium binghami* Boone, 1928  
*Ophiomusium biporicum* Alarion, 1968  
*Ophiosphalma dyscritum* H. L. Clark, 1941  
*Ophiosphalma serratum* (Lyman, 1878)  
*Ophiosphalma valdiviae* (Hertz, 1927)

## Conclusion

The small differences in morphological characters currently defining the species of *Ophiomusium* and *Ophiosphalma* can only be verified by the future study of a full range of sizes of individuals, in combination with DNA analysis.

The bathyal habitat and widespread distribution of some species, may result in mixed relationships which could continue to make identification difficult. This catalogue of type material will, I hope, reduce that difficulty.

## Acknowledgments

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