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Et. Brit. Colonial Office, Discovery Committee.

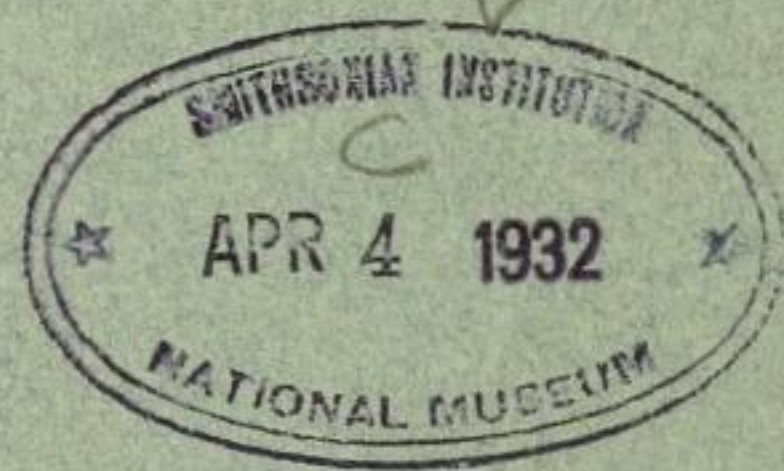
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## MOLLUSCA: GASTROPODA THECOSOMATA AND GYMNOSOMATA

*by the late*  
Anne L. Massy



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MOLLUSCA: GASTROPODA THECOSOMATA  
AND GYMNOSOMATA

BY (THE LATE)

ANNE L. MASSY

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# MOLLUSCA: GASTROPODA THECOSOMATA AND GYMNOSOMATA

By (the late) Anne L. Massy

(Plate XXXIX; text-fig. 1)

## INTRODUCTION

THE pelagic Mollusca, usually known as Pteropods, which form the subject of this report, attracted at an early date the attention of ship captains and naturalist voyagers, for they exist in the open sea far from any shelter other than that afforded by drifting weed and sometimes occur in vast swarms. Individually they are very small. Indeed, one of the larger species fully extended measures scarcely more than an inch.

The Thecosomata are protected by fragile shells, which may be coiled, triangular or needle-shaped. One family, the Cymbuliidae, possesses slipper-shaped gelatinous conchae of great beauty. The Gymnosomata, as their name implies, are without shells. All are hermaphrodite and some species of Gymnosomata have been observed to be very precocious in reaching sexual maturity: thus, Pelsener (1887, p. 49) alludes to a specimen of *Clione flavescens* (Ggbr.) that was able to lay eggs although it was hardly 2.0 mm. in length and still possessed ciliated rings. Kwietniewski (1902, p. 17) states that in a number of other species the sexual elements develop early. In 1917 I noted that specimens of *Pneumodermopsis paucidens* (Boas) from the west of Ireland, measuring only 1-2.5 mm. in length, had external accessory glands, and an individual measuring only 0.75 mm. had the penis evaginated (Massy, 1917, pp. 231-232).

Diurnal migration is a well-established phenomenon in this group.

Pteropods serve as food for some of our most valuable food fishes<sup>1</sup> and for sea birds. They are said also to form the food of whales, and as early as 1770 Cranz, in his *Historie von Grönland*, named *Clione* "Walfischfrass" (food devoured greedily by the whale). The earliest mention of the group appears to have been made in 1780 when Fabricius produced his *Fauna of Greenland* and described *Limacina helicina*, Phipps, under the name *Argonauta arctica*.

In the course of the Discovery Investigations many thousands of Pteropods have been taken. A special study of the plankton has been made in southern waters near South Georgia, the South Sandwich and the South Shetland Islands and the distribution of the five species of Pteropods, to one or other of which the many individuals belonged, is dealt with in a separate report. In warmer regions far fewer individuals were captured, but thirty-one species belonging to eighteen genera were represented.

<sup>1</sup> Statistics in the Irish Fisheries Office of the stomachs of herring and mackerel taken on the west coast of Ireland show that *Clione* is a common food in spring and autumn.



Much has been written about the bipolarity of pelagic animals. Prof. D'Arcy Thompson<sup>1</sup>, in his paper on "Marine Faunas" (p. 348), shows that the bipolar hypothesis may be rejected in the case of the Tunicata, Holothurians, Crustacea and fish. As regards the Pteropods, *Cleodora sulcata* (Pfeffer) and *Clione antarctica*, E. A. Smith, seem to be closely allied to, but specifically distinct from, *Cleodora pyramidata* (L.) and *Clione limacina*, Phipps. *Limacina helicina*, Phipps, on the other hand, is distributed at both poles.

Some writers have thought that the more archaic species might be expected to exist near the poles, while others have suggested that the more original forms would be found in the warmer regions of the ocean. It seems probable that Chun's theory, that in the case of pelagic animals the deep-sea fauna contains the most primitive types, is right. Bonnevie has shown that three deep-water species, namely *Peraclis diversa*, Monterosato, *Limacina helicoides*, Jeff., and *Cleodora falcata*, Pfeffer, all exhibit archaic characters. These are all represented in the present collection: *Peraclis diversa*, Monterosato was taken north of the equator at 0-800 m. and at 2500-2700 m. *L. helicoides* occurred north-east of the Falkland Islands, off Tristan da Cunha and in three hauls west of the Cape of Good Hope: the nets were fished at 600-2500 m. *Cleodora falcata*, Pfeffer, was taken north-east of the Falkland Islands in soundings of 1050-1350 (-0) m.

I wish to express my thanks to Dr Kemp and the Discovery Committee for allowing me to work out this collection, to Miss Barnes of the Dublin Museum, and lastly to Madame Pruvot-Fol, who spared time to give me valuable help on several points and whose drawings of the radula and jaws of the rare *Spongiobranchaea intermedia*, Pruvot-Fol, are included in this Report.

#### LIST OF STATIONS

The following table gives the positions and other data of the stations to which reference is made in the text. Stations made by R.R.S. 'Discovery' have no letters prefixed to the numbers; those of the R.R.S. 'William Scoresby' have the prefix WS; and those made from the S.S. 'Anglo-Norse' have the prefix SS denoting 'South Sandwich.'

Station	Position	Date	Sounding (m.)
8	42° 36' 30" S, 18° 19' 30" W	8. ii. 25	3375
11	50° 26' 00" S, 30° 27' 00" W	16. ii. 26	5000
12	51° 55' 00" S, 32° 27' 30" W	18. ii. 26	2744
37	28 miles N 36 E of Jason Lt, S. Georgia	18-19. iii. 26	—
62	49° 22' 00" S, 54' 48' 00" W	22. v. 26	—
66	48° 09' 00" S, 52° 50' 00" W	23. v. 26	—
68	46° 40' 00" S, 51° 22' 00" W	24. v. 26	—
71	43° 20' 00" S, 46° 02' 00" W	30. v. 26	5460
72	41° 43' 20" S, 42° 20' 40" W	1. vi. 26	5420
78	35° 18' 00" S, 19° 01' 10" W	12. vi. 26	3410
80	32° 46' 00" S, 10° 00' 00" W	17. vi. 26	—
81	32° 45' 00" S, 8° 47' 00" W	18. vi. 26	—
84	32° 52' 00" S, 1° 55' 00" E	22. vi. 26	2233
85	33° 07' 40" S, 4° 30' 20" E	23. vi. 26	4943
86	33° 25' 00" S, 6° 31' 00" E	24. vi. 26	—

<sup>1</sup> *Proc. Roy. Soc. Edinburgh*, 1898.



## LIST OF STATIONS

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Station	Position	Date	Sounding (m.)
87	33° 53' 45" S, 9° 26' 30" E	25. vi. 26	5081
88	34° 04' 00" S, 13° 00' 00" E	27. vi. 26	—
89	34° 05' 15" S, 16° 00' 45" E	28. vi. 26	3926
100	33° 20' 00" to 33° 46' 00" S 15° 18' 00" to 15° 08' 00" E	2-4. x. 26	—
101	33° 50' 00" to 34° 13' 00" S 16° 04' 00" to 15° 49' 00" E	14-15. x. 26	3734
107	45° 03' 00" S, 17° 03' 00" E	4. xi. 26	—
110	47° 54' 00" S, 12° 39' 30" E	7. xi. 26	—
114	52° 25' 00" S, 9° 50' 00" E	12. xi. 26	—
130	54° 06' 00" S, 36° 23' 00" W	20. xii. 26	122
133	53° 45' 30" S, 35° 46' 30" E	20-21. xii. 26	802
136	54° 22' 00" S, 35° 21' 00" W	21. xii. 26	246
231	51° 29' 30" S, 57° 18' 15" W	28. v. 27	143
238	48° 12' 00" S, 51° 56' 30" W	31. v. 27	—
239	46° 56' 00" S, 46° 03' 00" W	2. vi. 27	—
244	38° 26' 30" S, 24° 48' 30" W	9. vi. 27	—
257	35° 01' 00" S, 10° 18' 00" E	24. vi. 27	—
270	13° 58' 30" S, 11° 43' 30" E	27. vii. 27	—
273	9° 38' 00" S, 12° 42' 30" E	31. vii. 27	—
276	5° 54' 00" S, 11° 19' 00" E	5. viii. 27	—
279	Off Cape Lopez, French Congo. From 8.5 miles N 71° E to 15 miles N 24° E of Cape Lopez Lt.	10. viii. 27	58-67
287	2° 49' 30" S, 9° 25' 30" W	19. viii. 27	—
288	00° 56' 00" S, 14° 08' 30" W	21. viii. 27	—
289	3° 04' 45" N, 16° 52' 00" W	23-24. viii. 27	—
294	4° 33' 15" N, 16° 52' 45" W	25. viii. 27	—
295	5° 30' 30" N, 17° 45' 00" W	25. viii. 27	—
297	12° 08' 00" N, 20° 53' 30" W	28. viii. 27	—
WS 37	54° 45' 00" S, 35° 11' 00" W	22. xii. 26	318
SS 7	54° 19' 20" S, 29° 32' 40" W	29. xi. 27	—
SS 9	54° 31' 00" S, 29° 40' 00" W	2. xii. 27	—
SS 10	54° 30' 20" S, 29° 38' 45" W	2. xii. 27	—
SS 14	54° 30' 00" S, 30° 11' 00" W	11. xii. 27	—
SS 15	54° 22' 00" S, 30° 11' 00" W	11. xii. 27	—
SS 22	55° 56' 00" S, 25° 56' 00" W	22. xii. 27	—
SS 31	60° 59' 00" S, 25° 55' 30" W	18. i. 28	—
SS 34	60° 51' 00" S, 26° 25' 00" W	21. i. 28	—
SS 35	60° 49' 00" S, 26° 32' 00" W	21. i. 28	—
SS 45	62° 17' 45" S, 27° 15' 45" W	3. ii. 28	—
SS 52	62° 15' 00" S, 21° 36' 20" W	15. ii. 28	—
SS 54	60° 59' 20" S, 23° 21' 50" W	20. ii. 28	—
SS 58	61° 55' 00" S, 23° 40' 00" W	23. ii. 28	—

## LIST OF SPECIES

## A. South Georgia and the South Shetland Islands.

## Eupteropoda (Thecosomata).

- Cleodora sulcata* (Pfeffer).  
*Limacina helicina* (Phipps).  
*Limacina balea* (Möller).

## Pterota (Gymnosomata).

- Clione antarctica*, E. A. Smith.  
*Spongiobranchea australis*, d'Orbigny.



## B. South Atlantic.

## Eupteropoda (Thecosomata).

*Cavolinia longirostris* (Lesueur).  
*Cavolinia gibbosa* (Rang) in d'Orbigny.  
*Cavolinia inflexa* (Lesueur).  
*Cavolinia tridentata* (Forskål).  
*Cavolinia uncinata* (Rang) in d'Orbigny.  
*Cleodora pyramidata* (L.).  
*Cleodora cuspidata* (Bosc.).  
*Cleodora balantium*, Rang.  
*Cleodora falcata*, Pfeffer.  
*Cleodora sulcata* (Pfeffer).  
*Hyalocylix (Creseis) striata*, Rang.  
*Styliola (Creseis) subula* (Quoy and Gaimard).  
*Cuvierina columnella* (Rang).  
*Limacina helicina* (Phipps).  
*Limacina balea*, Möller.  
*Limacina retroversa* (Fleming).

*Limacina helicoides*, Jeffreys.

*Limacina bulimoïdes*, d'Orbigny.

*Peraclis diversa*, Monterosato.

*Procymbulia valdiviae*, Meisenheimer.

*Cymbulia peroni*, Blainville.

*Cymbuliopsis intermedia*, Tesch.

## Pterota (Gymnosomata).

*Pneumoderma atlanticum*, Oken.

*Spongiobranchaea australis*, d'Orbigny.

*Spongiobranchaea intermedia*, A. Pruvot-Fol.

*Pneumodermopsis macrochira*, Meisenheimer.

*Schizobranchium polycotylum*, Meisenheimer.

*Cliopsis krohni*, Troschel.

*Clione antarctica*, E. A. Smith.

*Thliptodon gegenbauri*, Boas.

*Thliptodon diaphanus*, Meisenheimer.

## EUPTEROPODA (THECOSOMATA)

The Eupteropods owe their name to the development of the anterior lateral portions of the foot into wing-like fins. These are placed at the sides of the mouth, which is always on the anterior portion of the ventral surface. The lips of the mouth are covered with vibratile cilia. Nearer the dorsal surface are a pair of tentacles (rhinophores) which are generally unequal in size, the left being often knob-like, while the right, five to twenty times longer, is usually cylindrical, rounded at the end and capable of being withdrawn into a sheath. In *Peraclis* and in the Cymbuliidae, however, both tentacles are rudimentary and similar in size. The penis is near the tentacles, towards the right. The fins are separated dorsally, but are joined ventrally by a median lobe, which forms the posterior part of the foot and is known as the apron. In the genera *Cleodora*, *Creseis* and *Cuvierina* the fins are bilobed, while in *Cavolinia*, just near the junction of the fin with the apron, there is a suggestion of another lobe. A large mantle covers the viscera, and the pallial cavity is placed ventrally in the Cavoliniidae and dorsally in the Limaciniidae and Cymbuliidae. Fol (1875) has shown that torsion takes place in the arrangement of the viscera during the development of the Cavoliniidae before the formation of the shell, so that the entire visceral mass, but not the head, the nervous ganglia and penis, is turned from right to left. On account of this the penis and genital duct open on the right in the Limaciniidae and on the left in the Cavoliniidae, except the penis which remains on the right side. *Cavolinia* has also long lateral posterior appendages to the mantle which pass through slits in the shell.

All Cavoliniids have a "balancer" at the left side of the mantle, and inside the mantle margin, on the ventral side of the body, is a small membranous lobe which constitutes a



rudimentary gill. The gill is absent in *Diacria*, *Cleodora*, *Cuvierina*, *Limacina*, and *Cymbulia*, but is well specialized in the genus *Peraclis*.

The shell in all Eupteropods is very fragile and more or less transparent. In the Cavoliniidae it is symmetrical and not coiled. The upper side has fine longitudinal ribs: the lower side is much swollen and striated transversely. The digestive apparatus (throughout the group) consists of a long tube with buccal bulb and salivary glands, and a swollen gizzard, containing four large corneous, hyaline plates and one small one. These plates are so large and many-angled that their outline shows clearly through the brown skin and the numerous transverse muscle bands. There are also a number of small chitinous pieces. The intestine has a small caecum. The liver pancreas is not attached to the stomach, as in the Gymnosomata. The genital gland adheres closely to the posterior part of the liver pancreas. It varies in shape so as to fit the space allotted to it by the shell, being conical in *Creseis* and round in *Cavolinia*. The hermaphrodite genital duct is always very long. The jaws are always placed ventrally and are not much developed. The radula is three-toothed, except in *Peraclis*, where there is an extra, but very rudimentary, lateral tooth on each side of the series of three [(1) 1-1-1 (1)].

The nervous system includes two cerebral ganglia united below the oesophagus by a long commissure, two pedal ganglia and from one to five visceral centres. There are no pleural ganglia. The otocysts are attached to the cerebral ganglia between these and the visceral mass. The olfactory organ (Osphradium, Spengel's organ) is placed close to the otocysts. Eyes are completely absent. Bonnevie (1913, p. 52), however, has suggested that the curious white plates which are so conspicuous on the top of the tentacles in *Cleodora falcata*, Pfeffer, and *Limacina helicoides*, Jeff., may be organs of light production or light perception. Vayssière (1915, p. 190) says: "J'ai pu confirmer l'absence absolue des organes visuels chez tous ces mollusques, il n'y en a pas même de très rudimentaires comme cela s'observe chez d'autres Tectibranchs tels que les Philinidés et les *Scaphander*."

The large pallial cavity contains the organ of Bojanus, or paired kidney, the heart, and also the gills, where these are developed.

All Eupteropods are phosphorescent. The food is wafted to the mouth by the cilia and consists chiefly of Diatoms, Radiolaria and Foraminifera and occasionally of the larvae of Copepods and other small Crustacea or even very young Eupteropods.

### Family CAVOLINIIDAE

#### Genus *Cavolinia*, Gioeni, 1783

#### *Cavolinia longirostris* (Lesueur), 1821.

*Hyalaea longirostris*, Lesueur (after Blainville), 1821.

*Hyalaea limbata*, d'Orb., 1836.

*Hyalaea angulata*, Souleyet, 1852.

*Hyalaea fissirostris*, Benson, 1861.



St. 279. 4 mm. mesh net at back of trawl: 6 shells.

St. 288. Young-fish trawl, 250 (-0) m.: 3 specimens; 1 m. tow-net, oblique, 73-0 m.: 1 specimen.

The specific name of this species is taken from the long upper lip of the dorsal side of the shell. It is one of the very few species which a beginner might venture to name from the written description of the shell, as it is the only species with a shell of a triangular shape when fully developed. At this stage the posterior "thorn" is always wanting and the lateral points of the ventral side project in triangular-shaped portions beyond the slits on the upper side. Boas (1886, p. 102) mentions that the smallest shells which came under his observation (from Chinese seas) measured 2.5 mm. and the largest (from the Atlantic) measured 9 mm. The specimen from St. 288 measured 7 mm.

DISTRIBUTION. This species is known from 40° N (Schliemanz, 1906, p. 20), and occurs in all seas between 40° N and 40° S. It is very abundant in Indian and Chinese seas and off the Great Belt of Australia.

*Cavolinia gibbosa* (Rang), in d'Orb., 1836.

*Hyalaea flava*, A. d'Orb., 1836.

*Hyalaea gegenbauri*, Pfeffer, 1880.

St. 87. Young-fish trawl, 1000 (-0) m.: 3 shells.

29° 27' 00" N, 15° 07' 00" W. 2 m. net, 900 m.: 24 specimens.

The fins of this species are generally trilobed, the apron is well developed and the lateral appendages to the mantle are very long. The shell is very globular and has a rounded upper lip measuring about one-seventh of the length of the shell when viewed from above. It curves down over the mouth. The lateral points are very short and the distance between them is considerably less than the breadth of the shell in the middle. The posterior "thorn" is bent like a fish hook.

The twenty-four specimens recorded from off the Canary Islands were taken from the stomach of *Naucrates*.

DISTRIBUTION. Cosmopolitan except at the poles. Although a warm-water species it avoids the immediate neighbourhood of the equator.

*Cavolinia inflexa* (Lesueur), 1812.

*Hyalaea inflexa*, Lesueur, 1812-13.

*Hyalaea depressa*, d'Orb., 1836.

*Hyalaea inflexa* and *labiata*, Souleyet, 1852.

*Hyalaea vaginellina*, Cantraine, 1840; Gegenbaur, 1855.

St. 80. Young-fish trawl, 1000 m.: 1 specimen.

St. 87. Young-fish trawl, 1000 (-0) m.: 2 specimens.

St. 89. 2 m. net, horizontal, 180 (-0) m.: 8 specimens.

St. 268. 1 m. net, oblique, 73-0 m.: ? 2 young specimens.

2° 20' 00" S, 12° 45' 00" W. 1 m. net on trawl: 1 specimen.

This species has trilobed fins and neither apron nor lateral appendages are much developed. The shell is easy to distinguish from that of the other species, as the longi-



tudinal ribs on the upper valve are almost effaced and the lateral points which form its greatest width are placed towards the centre, whereas in the other species of *Cavolinia* they are nearer the posterior end. The upper lip, when viewed from above, projects forward about as much as that of *C. longirostris*, but curves slightly upwards instead of over the lip. It is also rounder laterally and the edge is serrated. The posterior "thorn" curves upwards over the dorsal side. The lower side is not nearly so globular as in other members of the genus and the lip is developed rather strongly. The specimens from stations 80 and 89 measured 6–7 mm. in length.

DISTRIBUTION. In all seas between about 40° N and about 40° S latitude. Exceptionally it wanders with a warm current as far as 50° N (Massy, 1909).

*Cavolinia tridentata* (Forskål), 1775.

*Anomia tridentata*, Forskål, 1775.

*Hyalaea affinis*, d'Orb., 1826–33.

- St. 78. Young-fish trawl, 1000 (–0) m.: 1 specimen.  
 St. 85. 4.5 m. net, 2000 (–0) m.: 1 specimen.  
 St. 86. 4.5 m. net, 1000 (–0) m.: 13 specimens.  
 St. 89. Young-fish trawl, 1000 (–0) m.: 1 specimen.  
 St. 244. 1 m. net, horizontal, 55 m.: 4 specimens.  
 St. 288. Young-fish trawl, 250 (–0) m.: 1 specimen.  
 St. 289. Young-fish trawl, 125–225 (–0) m.: 1 specimen.  
 St. 294. 1 m. net, horizontal, 55 m.: 4 specimens.

Six of the above hauls were made off the African coast from the Gulf of Guinea to the Cape. The remaining two were west of Tristan da Cunha. This comparatively large species occurs in all warm seas. The specimen from St. 85 had a shell measuring 15 mm. in length and appeared to be a form between the type and var. *truncata*, Boas. This variety "se montre dans la partie la plus méridionale de l'Atlantique et la partie occidentale de l'Océan Indien" (Boas, 1886, p. 212). The same author (*loc. cit.*, p. 211) mentions that examples of this species in the Eastern Pacific are smaller (9–13 mm.).

The specimens from St. 294 possessed fins of a greenish hue.

*Cavolinia uncinata* (Rang), in d'Orb., 1836.

*Hyalaea uncinata*, Rang, 1836.

*Hyalaea uncinatiformis*, Pfeffer, 1880.

- St. 273. Young-fish trawl, 200–230 (–0) m.: 3 specimens and 1 shell.  
 St. 276. Young-fish trawl, 150 (–0) m.: 5 specimens.  
 St. 279. 4 mm. mesh net on trawl, 58–67 m.: 8 shells.  
 St. 288. Young-fish trawl, 250 (–0) m.: 11 specimens; 1 m. tow-net, oblique, 73–0 m.: 2 specimens.

The above, which measured 6–7 mm. in length, were all caught off the Gulf of Guinea and the Congo river. The species is generally distributed in tropical and subtropical waters. Boas (1886, p. 120) mentions having seen a specimen of 11 mm., but states that the usual size is 7 mm. The most closely allied species is *C. tridentata* (Forsk.), from which it is easily distinguished by the lateral points of the shell being



longer, the upper lip more turned downwards, and the posterior "thorn" curved more upwards. The lower side is also more deeply sculptured.

#### Diacria, Gray, 1842

##### *Diacria trispinosa* (Lesueur), 1821.

*Hyalaea trispinosa*, Lesueur (in Blainville, *Dictionn. d'Hist. Nat.*, XXII, p. 82), 1824.

*Hyalaea muronata*, Quoy and Gaimard, 1827.

St. 89. Young-fish trawl, 1000 (-0) m.: 3 specimens.

St. 101. 4.5 m. net, 350-400 (-0) m.: 5 specimens.

St. 268. 1 m. net, oblique, 73-0 m.: 3 specimens.

St. 279. 4 mm. mesh net on trawl, 58-67 m.: 1 shell.

St. 288. Young-fish trawl, 250 (-0) m.: 9 specimens; 1 m. net, oblique, 73-0 m.: 3 specimens.

The above hauls were all made off the African coast from Cape Town to the Gulf of Guinea. Some of the specimens had hydroids on the shells. The average length was 8 mm. This genus is distinguished by having bilobed fins, a very large apron and neither gill nor lateral appendages. It resembles *Cavolinia* in the form of jaw, radula and gizzard plates, and in the rest of the internal organization. The posterior end of the shell is prolonged three or four times as much as in *Cavolinia*, and is almost straight instead of being bent. It terminates in a little knob, similar to the embryo shell in this position in *Cleodora*. The lateral points are also very long, are placed at about the centre of the shell and constitute its greatest breadth. They occupy about two-fifths of this measurement. The hinge is not nearly so well defined as in *Cavolinia*. The shell is chiefly transparent, but a chocolate-brown tinge is usually distributed in the region of the lip. The lower side is not much swollen.

DISTRIBUTION. Universal except at the poles.

#### Genus *Cleodora*, Péron and Lesueur, 1810

##### *Cleodora sulcata* (Pfeffer), 1879.

*Cleodora sulcata*, Pelseneer, 1888; Eliot, 1907.

Over 2000 specimens were caught in hauls made at thirty-four stations at the South Sandwich Islands at soundings of 0-250 m. A few occurred also at South Georgia and between the Falkland Islands and South Georgia at soundings of 0-500 m.

The specimens measured 2-30 mm. in length. The usual length of large individuals is 16-18 mm. With fins fully extended the length may reach 25-30 mm. The fins and apron are generally white, but in hauls made in January and February 1928, at the South Sandwich Islands (Sts. SS 34, 35, 52, 54 and 58) these portions of the body had a border of chocolate-brown which sometimes spread all over the fins on both sides. The tint became paler as the distance from the margin increased. Individuals in which the animal was in a peculiar soft condition, appearing to show degeneration in the cells, occurred at the South Sandwich Islands (Sts. SS 7, 9, 10, 14, 22 and 45).



The genus *Cleodora* has bilobed fins and a small cephalic lobe. The pallial lateral appendages are rudimentary. The shell is rhomboid in shape when viewed from above. The present species owes its name to the distinct transverse furrows on the shell, of which there is scarcely a trace in the nearly allied *C. pyramidata* (L.). Other differences are that the fins are shorter and their edges usually undulated. The apron is larger. The teeth are not serrated, the median tooth is narrower and the lateral teeth have broader bases. The dorsal side of the shell has five longitudinal ribs of which the median is the strongest. It extends into a point posteriorly and terminates in an oval swelling which represents the embryo shell. The ventral side is not much swollen and a triangular-shaped portion of the upper valve is visible above it. The anatomy of the Terra Nova specimens has been described (Massy, 1920, figs. 3-6).

DISTRIBUTION. Antarctic to about 50° S in the Indian Ocean and 46° S in the Pacific (Meisenheimer, 1905). From 5° S of New Zealand to far within the Antarctic Circle (Massy, 1920).

*Cleodora pyramidata* (L.), 1767.

*Hyalaea lanceolata*, Lesueur, 1913.

*Cleodora exacuta*, Gould, 1852.

*Cleodora labiata*, Sow. (in Reeve, *Conch. Iconica*), 1877.

*Cleodora lamartinieri*, Rang (in d'Orb., *Mollusques de Cuba*), 1841.

St. 81. 4.5 m. net, 650 (-0) m.: 18 specimens.

St. 87. Young-fish trawl, 1000 (-0) m.: 21 specimens.

St. 88. 1 m. net, horizontal, 3000-0 m.: ? 1 specimen.

St. 101. 4.5 m. net, 1310-1410 m.: 2 specimens.

St. 239. 4.5 m. net, 1050-1350 (-0) m.: ? 2 specimens.

St. 288. 1 m. net, oblique, 73-0 m.: 1 specimen.

The above specimens measured 5-12 mm. in length. The shells were in very poor condition, but the specimen from St. 288 appeared to belong to var. *lata*, Boas. This author (1886, p. 72) thus defines the distribution of var. *lata*: "Atlantehavet fra c. 40° N Br. til henved 30° S Br. (Middelhavet), Indiske Ocean (fra dettes Nordgraense til c. 24° S Br.), Kinesiske Hav, Vestlige Stille Hav". Three of the hauls were made west of Cape Town, and the remaining three were made to the north of Ascension Island, to the north of Tristan da Cunha and to the north-west of the Falkland Islands. The species is cosmopolitan in warm and temperate seas.

*Cleodora cuspidata*, Bosc, 1802.

*Cleodora cuspidata*, Quoy and Gaimard, 1833.

*Cleodora Lessonii*, Rang, 1830.

*Cleodora cuspidata* (Bosc), 1802.

St. 78. Young-fish trawl, 1000 (-0) m.: 1 specimen.

St. 81. 4.5 m. net, 650 (-0) m.: 8 specimens; 1 m. net, 90 (-0) m.: 4 specimens.

St. 87. Young-fish trawl, 1000 (-0) m.: 4 specimens.



- St. 89. Young-fish trawl, 1000 (-0) m.: 4 specimens.  
 St. 276. Young-fish trawl, 150 (-0) m.: 2 specimens.  
 St. 288. 1 m. net, oblique, 73-0 m.: 1 specimen.  
 13° 25' 00" N, 18° 22' 00" W, 4.5 m. net, 900-0 m.: 1 specimen.

The above hauls were made north of Tristan da Cunha and from Cape Verde to Cape Town.

The animal of this species is very like that of *C. pyramidata* (L.). The shell is extremely fragile and transparent when fresh. It differs from all the other species by the extreme length of the lateral points, which start from below the middle of the shell. The dorsal side has a strong median keel which projects forward in a point anteriorly. The posterior end is curved over the back and terminates in the rounded embryo shell. There are two longitudinal ribs on either side of the median keel and strong transverse furrows are present on both sides of the shell.

DISTRIBUTION. Mediterranean (Boas, 1886, p. 83). Atlantic (exceptionally to 59° N) and Indian Oceans: Antarctic (Meisenheimer, 1906). South-west Ireland (Massy, 1909).

*Cleodora balantium*, Rang, 1834.

*Hyalaea balantium*, d'Orb., 1826-33.  
*Balantium recurvum*, Sow., 1877.

- St. 276. Young-fish trawl, 150 (-0) m.: 2 specimens.  
 St. 286. Young-fish trawl, 125 (-0) m.: 4 specimens.  
 St. 287. Young-fish trawl, 800-1000 (-0) m.: 2 specimens.  
 St. 288. Young-fish trawl, 250 (-0) m.: 5 specimens; 1 m. net, oblique, 73-0 m.: 1 specimen.  
 St. 294. Young-fish trawl, 100-150 (-0) m.: 2 specimens.  
 St. 297. Young-fish trawl, 200-300 (-0) m.: 1 specimen.

All the specimens were caught between Cape Verde and the Congo river. They measured 8-29 mm. Hydroids were present on the shells in four of the hauls.

Although widely distributed this appears to be a rare species everywhere. The shell has no lateral points and the upper and lower lips project very slightly in the centre. The upper surface has three strong longitudinal ribs and transverse furrows. The lower side of the shell is swollen and prominent.

DISTRIBUTION. Atlantic (Boas, 1886). Indian Ocean (Boas, 1886). Pacific (d'Orbigny, 1847). North of New Guinea (Challenger Expedition).

*Cleodora falcata*, Pfeffer, 1880.

*Clio polita*, Pelseneer, 1888; Meisenheimer, 1905.

- St. 71. Young-fish trawl, 2000 (-0) m.: 1 specimen.  
 St. 85. 4.5 m. net, 2000 (-0) m.: ? 1 specimen.  
 St. 89. Young-fish trawl, 1000 (-0) m.: ? 1 specimen.  
 St. 239. 4.5 m. net, 1050-1350 (-0) m.: 2 specimens.



All these specimens were in very bad condition and showed no traces of shells. Three were captured north-east of the Falkland Islands, and the two to which a query is attached were taken west of Cape Town. Vayssière (1915, p. 83) regards *Cleodora chaptali*, Souleyet, *C. andreae*, Boas, and *C. falcata*, Pfeffer, as synonymous with *C. curvata*, Souleyet. The latter species was named from a single individual 2 mm. in length having a perfectly smooth shell. The species recorded here is the same as that referred by Meisenheimer (1905*a*), Massy (1909) and Bonnevie (1913) to *C. falcata*, which is characterized by a dark purple body and a head which has the shape of a triangular lobe. The fins have a continuous margin. The tentacles have ivory-coloured end-plates: the right is the larger and is placed more anteriorly. The pallial cavity is placed ventrally, but extends also to the right side. The tongue-shaped gill is also on the right side, and the heart and kidney are placed ventrally. The shell is 2.5 times as long as broad. The ventral side has four shallow longitudinal furrows which are entirely absent from the dorsal side. On neither side is there a median projection of the lip of the shell. Lateral keels are present, and the posterior end is bent dorsally and terminates in the round embryonic shell usual in the genus. The type specimen measured 12.5 mm. in length.

*Cleodora andreae*, Boas, has a shell in which the length is 1.5 times the breadth. The dorsal side has five longitudinal ribs and the ventral side two. Very weak transverse furrows are present. Length 20 mm. A single individual was taken in the South Atlantic at 33° 30' S, 11° 0' W.

*C. chaptali*, Souleyet, is described from a single example 19 mm. in length taken at the Cape. The shell, according to Boas (1886, p. 81), is not so flat and is much broader than that of *C. andreae*. It has five longitudinal ribs on the dorsal side and the transverse furrows are more strongly marked than in *C. andreae*.

Of *C. curvata*, Souleyet, Boas (*op. cit.*) states that "It has the same general form as *C. chaptali* but is quite smooth, the mouth is narrower and the posterior end is bent upwards strongly. It is not the young of one of the foregoing species; if that were so its shell would be similar to the most posterior 2 mm. length portion of the shell of the species concerned, which is never the case. Souleyet took a single example in the Atlantic Ocean".

DISTRIBUTION. 44° N, 32° W, one. "Atlantic Ocean", one (Pfeffer, 1880). Davis Strait to 37° N (Meisenheimer, 1905). West of Ireland, 50° to 54° N, 400-1200 fathoms, four living (Massy, 1909). Empty shells, Azores, Canaries and South American coast (Challenger Expedition). North Atlantic only "in the deeper layers of the ocean" (Bonnevie, 1913).

#### Subgenus *Hyalocylix*, Fol, 1875

*Cleodora (Hyalocylix) striata* (Rang), 1828.

*Hyalaea striata*, d'Orb., 1826-33.

*Creseis fasciata*, Delle Chiaje, 1841.



St. 71. Young-fish trawl, 2000 (-0) m.: 1 specimen.  
25° 47' 00" S, 14° 48' 00" W, hand-net: 2 specimens.

The specimen taken north-east of the Falkland Islands measures 12 mm. in length. Boas mentions that the largest he had seen measured 8 mm.

The subgenus *Hyalocylix* is chiefly distinguished from *Cleodora* by having no cephalic lobe. The tentacles are very unequal, the left being almost absent. The shell is hornshaped and fluted transversely and is slightly curved in the dorsal direction. The embryo shell is thimble-shaped, and as the animal grows this portion is separated by a partition and it breaks off eventually so that adult shells are always blunt posteriorly.

DISTRIBUTION. Although never abundant in large shoals, this is widely distributed in all tropical and sub-tropical seas.

#### Subgenus *Styliola*, Lesueur, 1825

*Cleodora* (*Styliola*) *subula* (Quoy and Gaimard), 1827.

*Cleodora* (*Creseis*) *spinifera*, Rang, 1828; Sow., 1877.  
*Hyalaea subula*, d'Orb., 1836.  
*Cleodora subulata*, Souleyet, 1852.

St. 80. 2 m. net, 30-0 m.: 1 specimen.  
St. 87. Young-fish trawl, 1000 (-0) m.: 3 specimens.  
St. 89. Young-fish trawl, 1000 (-0) m.: 1 specimen.  
St. 287. Young-fish trawl, 800-1000 (-0) m.: ? 2 specimens.

Three of these hauls were made off the African coast from the Gulf of Guinea to Cape Town. A single specimen was taken north of Tristan da Cunha. The largest examples were 10-12 mm. in length. This is a warm-water species, but it apparently avoids the very warm water at the equator. In this subgenus the animal has a very distinct cephalic lobe. The shell is horn-shaped and easily recognized by the longitudinal furrow along the dorsal side, which is so deep as to form a ridge in the interior. It has transverse striae and microscopic longitudinal striae, and it is not curved. The embryo shell is persistent and not separated by a partition.

#### Genus *Cuvierina*, Boas, 1886

*Cuvierina columnella* (Rang), 1827.

*Cleodora obtusa*, Quoy and Gaimard, 1824.  
*Cuvieria urceolaris*, Mörch, 1850.  
*Triptera columnella* and *cancellata*, Pfeffer, 1879.

St. 80. 2 m. net, 30-0 m.: 1 specimen.  
St. 84. Tow-net on dredge, 2000-0 m.: 1 specimen.  
St. 85. 4.5 m. net, 2000 (-0) m.: 1 specimen; 2 m. net, 900-0 m.: 1 specimen.  
29° 27' 00" N, 15° 07' 00" W, 2 m. tow-net, 0-900 m.: 1 specimen from stomach of *Naucrates ductor*.



The above were taken north of Tristan da Cunha and between that island and Cape Town. They measured 7–11 mm. in length. This species is abundant in the warm waters of the Atlantic, Indian and Pacific Oceans. Boas (1886, p. 131) explains why the name *Cuvieria*, given by Rang, cannot be used. The genus is characterized by having a body which is rounded posteriorly. The cephalic lobe is rudimentary. The right tentacle is much longer than the left. The radula has a median tooth with an almost rectangular base, with a breadth twice its length. The cusp, dentate only on the upper sides which slope towards the anterior corners of the base, is much more powerful than in the two species last mentioned. The lateral teeth are much smaller in proportion and have very short cusps with denticles varying in number from about seven to seventeen. The apron is broad, but so narrow as to show the mouth. The shell is at first cylindrical and terminates in a point. The pointed portion is separated from the rest of the shell by a partition: it is easily broken off, but, when perfect, forms one-third of the length of the shell. The latter is transparent and finely striated both longitudinally and transversely. The widest part is about at the centre of a complete shell, instead of being at the mouth as in *Cleodora*. Just below the mouth the shell is slightly constricted and, as the under-side is somewhat hollowed out anteriorly, it follows that the mouth is kidney-shaped rather than circular.

*C. urceolaris*, Mörch, is regarded by Boas and Vayssière as a variety of *C. columnella*. It is found in the Pacific and is characterized by having a smaller shell which is more swollen posteriorly and less drawn out anteriorly, and the neck is scarcely indicated.

Vayssière (1915, p. 107) mentions having examined specimens from New Caledonia and found their organization to be similar to that of the typical variety of the Atlantic.

### Family LIMACINIDAE

#### Genus *Limacina*, Cuvier, 1817

*Limacina helicina* (Phipps), 1773.

*Argonauta arctica*, O. Fabr., 1780.

*Limacina arctica*, Möller, 1841.

*Limacina antarctica*, Woodward, 1856; Pelseneer, 1887; Eliot, 1907.

Extremely numerous in the seas surrounding South Georgia and the South Sandwich Islands. No fewer than 5706 specimens were collected at seventy-eight stations in this area.

All the specimens were taken during the Antarctic summer, two-thirds of the hauls being made in December and January. The largest shoals were taken at South Georgia, and at night. On one occasion (St. 136) 2074 specimens, measuring 3–5 mm., were caught. In all cases the measurements are those of the diameter of the body coiled up, and not with fins extended. The diameter varied from 1 to 6 mm. Most of the specimens had lost their shells, and opercula were usually present only in very young individuals. One example of 3 mm. diameter was, however, observed with an operculum. This is oval, with only one turn in the spire. A small gelatinous mass was taken in a December haul, at the South Sandwich Islands (St. SS 31), which contained a number of vertical white



lines each measuring *ca.* 1 mm. in length. Each line contained 10–12 eggs touching one another. At St. 136, also in December, a specimen of *L. helicina* with an injured gonad showed similar eggs. Spawning specimens were taken in the month of January, in the Terra Nova Expedition (Massy, 1920). Although the largest haul was made at night, heavy catches occurred in the day also. Paulsen, in his plankton investigations in the waters round Iceland, in 1904, has pointed out that the difference between day and night is but slight in the Arctic summer, and he found that Pteropods at Iceland were able to stand daylight and moreover lived on organisms which were dependent on the daylight.

About one hundred examples from St. 133 from hauls at 50 and 100 m. had pink bodies. Usually the colour is dirty white, the liver and gonad being darker and more variable, while the region about the mouth is very dark.

Most of the species of this family are very small and have a sinistral shell with a spire more or less developed and a horny operculum, which may be circular or oval. *L. helicina* was described by Phipps nearly 160 years ago under the name of *Clio helicina*. Arctic specimens are thus described by Sars (1878, p. 399): "Animal atro-purpureum vel obscure violaceum, alis pallidioribus, pellucidis". In the Terra Nova collection of 27,000 individuals from the Antarctic, the colour of the body of the animal was found to be lemon-yellow in small specimens, fawn turning brown in larger, and dark brown in all specimens above 2.5 mm. in diameter (Massy, 1920). The shell is very thin and has a low spire of about five or six whorls, with a deep suture. The surface is closely furrowed and the shell can reach 8 mm. in size (Meisenheimer, 1905, p. 410).

Sir C. Eliot (1907, p. 7) found six points of difference between specimens taken by the 'Discovery' in Antarctic waters, which he regarded as *L. antarctica*, and a large collection of *L. helicina* from Davis Strait and the North Pacific.

(1) Antarctic specimens were smaller and the fins were smaller in proportion to the size of the shell. I have found Antarctic specimens, varying in size from 0.5 mm. to 6.0 mm. in diameter, and the fins seem to be very variable in size, some being much longer and thinner than others. Probably the state of extension at the time they were killed, and the degree of strength of the different kinds of preserving fluid, would also affect the fins and cause contraction or make them appear long-drawn out and flabby.

(2) and (3) Striation and umbilical border of shell. Most of the present specimens have lost their shells. In the Terra Nova examples shells with faint spiral striae but with no umbilical border were observed in specimens up to a size of 2.5 mm. Meisenheimer (1905, p. 410) found that the umbilical border was well marked only in adult specimens and was but feebly developed in specimens of about 3 mm. in diameter.

(4) Distribution of colour. As already noticed this would seem to vary with age from lemon-yellow to fawn, pink and dark brown.

(5) Posterior lobe of foot more deeply and distinctly divided. "In the Terra Nova specimens this is certainly the case compared with Boas (1886), fig. 70 of Table 5, but the figures of Vayssière (1915, pl. vii, figs. 135*a* and 136) of the examples of *L. helicina* from Spitsbergen which he has studied, closely resemble many of the specimens in the present (Terra Nova) collection" (Massy, 1920).



(6) Variations in the teeth. Sir C. Eliot found the base of the median tooth in *L. antarctica* to be straight, while in *L. helicina* it was almost horse-shoe shaped. I have found that this character is dependent upon the position which the tooth happens to take when being mounted. Even in the same specimen the median tooth can exhibit both these forms.

DISTRIBUTION. Coasts of Norway (Sars, 1878). Spitsbergen (Vayssière, 1915). Nova Zembla, White Sea (Meisenheimer, 1905). Greenland, Iceland, Labrador; North Pacific to California as *L. pacifica*, Dall (Boas, 1886, p. 42). In southern regions, where Vayssière (1915, p. 124) thinks it has been accidentally introduced by marine currents, it has been observed as far north as 35° to 31° S (Meisenheimer, 1905).

*Limacina balea*, Möller, 1841.

*Spirialis Gouldii*, Stimpson, 1851.

*Heterofusus balea*, Mörch, 1857; Gould, 1870.

237 specimens identified with certainty, and 16 which appear to belong to this species, from stations in the neighbourhood of South Georgia and the South Sandwich Islands.

This species was taken in practically the same area as *L. helicina*, namely, the water enclosing South Georgia, and the South Sandwich Islands, roughly from 52° S to 62° S latitude, and from 20° W to 40° W longitude. Two very small specimens were taken a few degrees further north (St. 11). The largest specimens have a spire of five or six whorls. In all the spire is higher in proportion to the width of the last whorl than is the case in *L. retroversa* (Fleming). Spiral striae were not observed on any of the shells. The specimens were usually taken in small numbers, but in four hauls made at the end of May 1927 off Cumberland Bay, South Georgia, catches of fifty to two hundred occurred. The other hauls were made from November to March. Boas (1886, p. 44) states that his largest specimen measured 5.5 mm. in length and the shell had ten whorls. It was finely striated spirally and transversely. Boas (*op. cit.*) and Vayssière (1915, p. 143) regard *L. retroversa* (Fleming) as the same species as *L. balea* and consider that the various differences noted in the shell are due to differences of age. In support of this view I may mention that all the specimens I have seen of *L. retroversa* are smaller than *L. balea*. On the other hand, both in the present collection and in that made by the 'Terra Nova', the two forms were not taken together. The localities were indeed widely separated.

DISTRIBUTION. Temperate zones between Arctic and Antarctic and circumtropical zone (Bonnievie, 1913).

*Limacina retroversa* (Fleming), 1828.

*Heterofusus retroversus*, Fleming, 1828; Gould, 1870.

*Atlanta trochiformis*, d'Orb., 1835-47.

*Spirialis flemingii*, Forbes and Hanley, 1850.

Two specimens were picked out from a haul north-east of the Falkland Islands (St. 68).

DISTRIBUTION. Atlantic and Pacific in warm and temperate seas (Bonnievie, 1913). Mediterranean, British Isles, and occasionally off Norway (Sars, 1878).



***Limacina helicoides*, Jeffreys, 1877.**

- St. 8. 2 m. net, 600–700 m.: 1 specimen.  
 St. 71. Young-fish trawl, 2000 (–0) m.: 1 specimen.  
 St. 87. Young-fish trawl, 1000 (–0) m.: 1 specimen.  
 St. 89. Young-fish trawl, 1000 (–0) m.: 1 specimen.  
 St. 100C. Young-fish trawl, 2500–2000 m.: 1 specimen.

Three of the above hauls were made west of Cape Town; the other two were made between Tristan da Cunha and the Falkland Islands. This is always a rare species and appears to belong to a water layer with temperature below 10° C. The animal is purple-black in colour and, as in *L. helicina*, the pigmented outer skin peels off very easily. Vayssière (1915, p. 136) thinks it probable that the body is reddish or violet when alive. The fins are oval and have a continuous margin without any lobe. The apron is not very large and carries a horny operculum with a spire of two turns, the last being 8–10 times wider than the first. The right tentacle is much larger than the left, and, as in *Cleodora falcata*, Pfeffer, both tentacles are surmounted by conspicuous ivory-coloured plates. One of the four large plates in the gizzard is always larger than the rest. The median and lateral teeth are proportionately of the same size. The median tooth is triangular, but the denticles are very irregular in shape and size. The genital gland is yellow, and the sac-shaped copulatory organ has a very long caecal prolongation. The shell is snail-shaped, opaque and dull orange in colour. It is composed of 3–3½ whorls and has very fine transverse striae.

This is the largest species of the genus. Vayssière (1915, p. 137) gives the transverse dimensions of the animal across the fins as 10–11 mm., and the size of the shell 4–9 mm. in diameter and 3–6 mm. in height.

DISTRIBUTION. "Several stations in the Atlantic, from off the British Isles to the Azores, always dead and at considerable depths" (Sykes, 1905). Atlantic, south of equator, along African coast, alive (Meisenheimer, 1905). South-west Ireland, alive (Massy, 1909). Western part of North Atlantic, 400–1500 m. (Bonnievie, 1913). North Atlantic off the Azores, four alive (Vayssière, 1915).

***Limacina bulimoïdes* (d'Orbigny), 1836.**

- Atlanta bulimoïdes*, d'Orb., 1836.  
*Spiralis bulimoïdes*, Eydoux and Souleyet, 1840.

- St. 87. Young-fish trawl, 1000 (–0) m.: 20 specimens.

This is a small species, individuals measuring only 2 mm. in length with fins extended. The shell has a relatively high spire composed of five or six whorls, and measures 1–2 mm. in length. It is smooth and transparent, and generally of a dark horn colour. The operculum is oblong with an eccentric spire.

The species occurs in the warmer portions of all seas. It does not appear to have been taken farther north in the Atlantic than between Newfoundland and the Azores (Bonnievie, 1913). Mlle Bonnievie observed that most of the specimens had a bright red



columnellar margin. Usually this is amber tinted (Vayssière, 1915, p. 141). It has been recorded from the eastern Pacific and from Chinese seas to 40° N and 170° W (Boas, 1886).

Genus *Peraclis*, Forbes (emend.), 1844

*Peraclis diversa*, Monterosato, 1884.

*Spirialis diversa* (Monterosato), 1884.

*Peraclis diversa*, Locard, 1897.

*Peraclis bispinosa*, Pelseneer, 1888.

St. 295. Young-fish trawl, 2500–2700 (–0) m.: 1 specimen.

6° 55' 00" N, 15° 54' 00" W, 2 m. net, 0–800 m.: 8 specimens.

The first of the above hauls was made off the Gulf of Guinea and the other to the north-east of Ascension Island.

The principal differences between this genus and *Limacina* are that *Peraclis* is characterized by having a well-specialized gill and a radula with rudimentary lateral teeth so that the formula is (1) 1–1–1 (1). A large cephalic lobe is developed, bearing rudimentary tentacles of equal size. The fins, which are broad and plate-like, have a continuous margin without lobes. A caecum appears to be absent from the intestine.

The present species has a shell with three whorls, the last of which is very wide. The suture has transverse folds. The surface of the shell is covered with a beautiful hexagonal network except on the last quarter or third, which is smooth. The outer lip is generally broken, but, if perfect, a third spine appears. The shell measures 8–9 mm. in length by about 6 mm. in width at the mouth. The sub-circular operculum has a spire of six turns.

DISTRIBUTION. Mediterranean. Atlantic. Bonnevie (1913) observed that this species was taken by the Michael Sars North Atlantic Expedition up to lat. 46° 58' N, not among surface plankton, but mainly from a depth of *ca.* 1000 m., and its distribution was in conformity with the extension of a water layer with a temperature of *ca.* 6–8° C. and a salinity of 35–35.5 ‰.

#### Family PROCYMBULIIDAE

Genus *Procymbulia*, Meisenheimer, 1905

*Procymbulia valdiviae*, Meisenheimer, 1905.

St. 37. 1 m. tow-net, horizontal, 90 (–0) m.: 1 specimen.

St. 62. 1 m. tow-net, horizontal, 90 (–0) m.: 5 specimens.

St. 66. 1 m. tow-net, horizontal, 45 (–0) m.: 2 specimens.

St. 71. Young-fish trawl, 2000 (–0) m.: 7 specimens.

St. 72. 4.5 m. tow-net, 2000 (–0) m.: 1 specimen.

St. 78. Young-fish trawl, 1000 (–0) m.: 1 specimen.

St. 85. 4.5 m. tow-net, 2000 (–0) m.: 1 specimen.

St. 110. 1 m. tow-net, horizontal, 178 m.: 1 specimen.

St. 114. 4.5 m. tow-net, 650–700 m.: 1 specimen.

St. 238. 1 m. tow-net, horizontal, 148 m.: 2 specimens.

St. 239. 4.5 m. tow-net, 1050–1350 (–0) m.: 2 specimens.

St. WS 68. 70 cm. tow-net, vertical, 750–500 m.: ? 1 very young specimen.



Meisenheimer (1905, pp. 13-14) defines the characters of the genus *Procymbulia* as follows: "Dieses neue, eigentümliche Genus, welches als ein direkter Vorfahre der Cymbuliiden aufgefasst werden muss, zeigt die Merkmale der Familie nur insofern, als es eben noch eine aufgewundene Körperform besitzt, unterscheidet sich aber aufschärfste von *Limacina* und *Peraclis* dadurch, dass seine Mantelhöhle nicht mehr dorsal gelegen ist, sondern bereits ventral verlagert erscheint. Von der Valdivia Expedition nur in einem einzigen Exemplar erbeutet, dessen Schale aufgelöst war.

"Schale unbekannt. Spirale des Körpers niedrig, die letzte Windung mächtig angeschwollen. Mantel. Mantelhöhle ventral gelegen, Mantelrand mit wohlentwickeltem Fortsatz 'balancer'.—Flossen zu einer einheitlichen, mächtigen Scheibe verwachsen, die am freien Rand einen unpaaren, medianen Fortsatz von stumpfer, lappenartiger Gestalt trägt. Zu beiden Seiten des letzteren sind 2 kleine, tentakelartige Zipfel inseriert. Rüssel. Mundabschnitt unter Umbildung der eigentlichen Fussteile zu einem Rüssel umgewandelt, von ähnlicher Form, wie ihn *Peraclis* aufweist. Tentakel symmetrisch, auf beiden Seiten gleich gross, ohne Scheide. Visceralganglien aus 2 eigentlichen Visceralganglien und einem unpaaren Abdominalganglion bestehend. Darmtractus. Mit spiralig aufgewundenem Enddarm und mit langem Aftersipho.

"*Procymbulia valdiviae*. Mit den Merkmalen des Genus. Die medianen Teile der Flossenfläche sowie die Mantelränder stark chokoladebraun pigmentiert. Oberkiefer und Radulazähne (1:1:1) mächtig entwickelt. Masse: Höhe der Spirale 5 mm., Flossenbreite 10 mm. Fundort, Stat. 169 (34° 14' S, Br. 80° 31' O. L.) etwas nördlich von der Neu-Amsterdam-Insel. Vert-Zug 2000 m. Oberfl. Temp. 17,1°; leicht bewegte See; 1 Exemplar."

The Discovery specimens show that this species is widely distributed in the South Atlantic from 55° S to 35° S and from off the Falklands to Bouvet Island and Cape Town. Twenty-five specimens occurred in the twelve hauls, seven of which were made over soundings of 700-2000 m. The type measured 10 mm. across the fins. In the present collection this measurement varies from 6 to 22 mm., but in the specimen to which a query is affixed it is only 3 mm. As in the type they are without shells. Possibly in this species the larval shell is retained in early life but does not persist. I make this suggestion because in the older specimens the coiled nucleus is enclosed in a firm membrane, and in the younger examples the nucleus is imperfect and more or less falling to pieces as if in need of protection. In some of the specimens which are flattened and in poor condition this coil is not distinguishable. Where distinct it is about in the position of the figure indicated by Meisenheimer (1905, pl. i, fig. 7), *i.e.* almost in a line with the lobe on the left fin; but occasionally, and particularly in young specimens, it appears to be almost in a line with the lobe of the right fin, and as the animal grows the nucleus shifts until it is under the middle of the mouth, and then almost under the lobe of the left fin. With regard to these lobes, they are so well marked in some specimens that they might easily be regarded as some kind of tactile organ. In a few specimens they are absent or indicated by a dark line on the fin surface, but are not separated by a fold or split from the flat surface of the fin. It does not appear to be a character dependent on



age, as specimens with a fin breadth of 10–22 mm. possessed the lobes. In the most perfect specimens the outer edge of the fin takes a beautiful circular sweep and the white surface is bordered with purple-brown. The specimens from Sts. 62 and 239 had minute tubercles dotted all over the surface.

This little-known species was collected by the Valdivia Expedition in 34° 14' 00" S, 80° 31' 00" E, somewhat north of New Amsterdam Island.

### Family CYMBULIIDAE

#### Genus *Cymbulia*, Péron and Lesueur, 1810

*Cymbulia peroni*, Blainville, 1818.

*Cymbulia proboscidea*, Gray, 1850.

St. 81. 4.5 m. tow-net, 650 (–0) m.: 3 specimens and 4 conchae.

St. 86. 4.5 m. tow-net, 1000 (–0) m.: 3 specimens with conchae.

St. 87. Young-fish trawl, 1000 (–0) m.: 1 specimen with concha.

St. 257. Young-fish trawl, 100–150 (–0) m.: 1 concha.

St. 268. Young-fish trawl, 100–150 (–0) m.: 13 specimens with 8 conchae; 1 m. tow-net, oblique, 73–0 m.: 17 specimens and 5 conchae; 1 m. net, horizontal, 73 m.: 4 conchae.

One of the above hauls was made north of Tristan da Cunha and the remainder between Elephant Bay, West Africa, and Cape Town. Some of the animals were still attached to their transparent slipper-like shells. A large specimen measured 30 mm. across the fins. The ventral lobe of the fin is transparent and strengthened by two muscle bands placed side by side, which become fused together in a point distally. The filament at the extremity, which is shown in Boas' illustration (1886, Tab. 3, fig. 30), was missing in all the specimens. The conchae measured 32–55 mm. in length. An exceptionally large concha (St. 257) measured 66 mm. in length by 28 mm. in diameter. Tesch (1904) has described a species of *Cymbulia* as *C. sibogae*, the deutoconch of which is characterized by the acute dorsal extremity, by the straight rows of denticles on the aboral surface, by its smaller size and shallower sinus at the ventral end. A concha from St. 86 had a pointed extremity but the sinus at the ventral end was V-shaped. When, however, the conchae are in poor condition and obviously beginning to dissolve away, they have a very thin acute dorsal extremity and no tubercles.

In this family, as in the last two genera, the tentacles are small and of equal size. The pallial cavity is situated dorsally and there is no gill. The fins are very large and are connected anteriorly with the proboscis and posteriorly with the apron. They are rather thick and opaque, except at the edges where the muscles can be seen. The mantle is thin and very extensive, and covers the transparent slipper-shaped deutoconch of horny substance, which protects the viscera. The deutoconch succeeds a calcareous spiral operculate larval shell. The jaws are not much developed. The radula, where present, has the formula 1–1–1. The gizzard contains four large and one small plate, as well as a number of very small chitinous pieces. Vayssière (1915, p. 173) says that the deutoconch or protecting organ may be considered as a simple thickening of the mantle analogous



to the internal shell of certain Gastropods (Pleurobranchs, *Marsenia*). The anatomy of the present species has been very fully described by Vayssière (*op. cit.*, pp. 174-185).

DISTRIBUTION. Mediterranean. Off South-west Ireland (Massy, 1909). Off Gibraltar to Bay of Biscay (Bonnievie, 1913). Gulf of Guinea (Meisenheimer, 1905).

#### Genus *Cymbuliopsis*, Pelseneer, 1888

##### *Cymbuliopsis intermedia*, Tesch, 1904.

St. 268. Young-fish trawl, 100-150 (-0) m.: 13 specimens and 2 conchae; 1 m. tow-net oblique, 73-0 m.: 3 specimens and 32 conchae; 1 m. net horizontal, 73-0 m.: 11 conchae.

St. 270. Young-fish trawl, 200 (-0) m.: 30 specimens and 11 conchae.

The genus *Cymbuliopsis* is distinguished from *Cymbulia* and *Gleba* "by the presence of a shell with a very large cavity and thin walls. The animal very closely resembles *Gleba*, having a proboscis free throughout its length, a fin without ventral lobe, and neither radula nor jaws. As far as I can judge, however, it differs from *Gleba* by the three very distinct muscular systems in the fin, and in the absence of the indentations on the fin margin. As only very few species of both these genera are known, it is very probable that other forms, not yet discovered, will link together the two types" (Tesch, 1904, p. 57). This author (*loc. cit.*, p. 59) describes the type specimen as follows: "The shell exhibits the usual characters of *Cymbuliopsis*. The aperture is always somewhat longer than half the length of the shell. In the distribution of the tubercles I could not observe any regularity; on the aboral surface are some which are smaller, more closely grouped together; at the ventral margin there are none (figs. 102, 104). This character of the shell agrees partly with what is found in *Cymbuliopsis vitrea*, Heath and Spaulding. Aperture unarmed, thickened lateral sides; these thickenings disappear towards the ventral margin. Tubercles at the oral surface sometimes fused into mere unevennesses, separated by shallow grooves. Animal as in other species of *Cymbuliopsis*; proboscis short and broad, tentacle very short; fins with three distinct systems of muscles; anterior border of the fins scarcely projecting beyond the ventral margin of the shell (almost as in *Cymbuliopsis calceola*); pallial gland twisted to the left, with three transparent bands. Dimensions: 39-23 mm. Shell of St. 144: 30 mm. Colour of the shell: generally transparent, sometimes yellowish, or even dark brown (alcohol- and formol-specimens)".

The forty-six specimens with fifty-six conchae recorded above were captured off Elephant Bay, West Africa. The animals measure 27-50 mm. across the fins and the conchae are 14-42 mm. in length. Only one individual and seven shells were taken by the Siboga Expedition.

The transparent fins are crossed and re-crossed by three sets of muscles, while the soft viscera are protected by the glassy slipper-like concha studded with knobs glittering like crystal. The specimens were preserved in formol and all the conchae were transparent, none showing the yellowish or dark brown tints observed in some of the Siboga conchae. With this exception the present specimens are in close agreement with the figures given by Tesch (1904, pl. iv, figs. 100-104).



A living specimen of this species was found by the Siboga Expedition near Damar Island, while conchae were taken at five stations lying between lat.  $2^{\circ} 3'$  and  $10^{\circ} 35'$  S, long.  $117^{\circ} 4'$  to  $131^{\circ} 26'$  E.

#### PTEROTA (GYMNOSOMATA)

The naked Molluscs which form this group among the Tectibranchs are not nearly related to the Pteropoda, but are allied to the Aplysioidea. Owing to their minute size and to the frequently contracted state of their bodies they are not easy to study. Only extended individuals of particular species measure more than an inch in length. The average size is about that of a grain of wheat and many are much smaller. The buccal appendages and gills vary in the different families and in contracted specimens can only be determined by dissection. There is no pallial cavity and no gizzard with plates. The liver-pancreas adheres to the stomach, and the cerebral ganglia are attached to one another instead of being united by a commissure. The radula has usually a number of lateral teeth. All the group are carnivorous and feed principally on the Thecosomata. Although a pair of fins would seem to be a necessity to their active life, abnormal specimens of *Pneumodermopsis paucidens* (Boas) have been observed (Massy, 1917, p. 231) in which only the right fin was developed in nearly all the specimens of a haul.

#### Family PNEUMODERMATIDAE

##### Genus *Pneumoderma*, Cuv., 1804

*Pneumoderma atlanticum* (Oken), 1816.

*Pneumodermopsis atlantica*, Oken, 1816.

*Pneumodermon Peronii*, Lamk., 1819 (*nec* Boas, Pels., Meis., Tesch).

*Pneumoderma violaceum*, d'Orb., 1840; Boas, 1886; Pels., 1888; Meis., 1898; Tesch, 1913.

St. 276. Young-fish trawl, 150 (-0) m.: 2 specimens.

Both these specimens were captured off the Congo river.

They were retracted, and measured about 6.5 mm. in length. The suckers and radula were examined.

The family Pneumodermatidae possesses a dorsal glandular patch; a lateral gill; sucker-bearing arms; a median jaw and hook sacs.

The genus *Pneumoderma* has two sucker-bearing arms, a posterior gill, long hook sacs, radula *n-o-n* in the adult, *n-l-n* in the young. The present species has a radula of 4-0-4 and the suckers on the arms are numerous; the largest are near the mouth and they become smaller distally. Mme Pruvot-Fol (1924, pl. xv, fig. 1) gives a fine illustration of a fully extended specimen with about 33-40 suckers on each arm. The synonymy of this, the oldest described species of the genus, is fully explained in the same paper.

DISTRIBUTION. Atlantic, Pacific, Mediterranean.



Genus *Spongiobranchaea*, d'Orb., 1840*Spongiobranchaea australis*, d'Orb., 1840.*Clidita caduceus*, Quoy and Gaimard, 1825.

113 specimens from thirty-five stations off South Georgia and the South Sandwich Islands.

The specimens of this species, which was taken in comparatively small numbers, vary in length from 0.75 mm. to 12 mm.: the Terra Nova specimens measured 2.5 to 16 mm. The largest haul (twenty-five examples) occurred at night. Two specimens were taken in hauls west of Cape Town, and two more occurred north-west of Tristan da Cunha. Two larvae of 1.5 mm. occurred at St. 12. They have the white body covered, as is usual in adults, with a dense speckling of black chromatophores. One had a sucker expanded and the other had the lateral gills developed. An example of 2 mm. from St. 138 has brown spots in zones. The larva of 0.75 mm. occurred with two older specimens at the South Sandwich Islands, in December (SS 15). In an individual measuring 12 mm. in length, taken off South Georgia (WS 37), the jaw and radula were of a bright scarlet colour. The animal had been preserved in 5 per cent. formalin. I have never previously seen any Molluscan radula other than of an amber tint. The specimen has been seen by Mme Pruvot-Fol, who also considers it to be very curious. In connection with this it may be mentioned that the columellar margin of *Limacina bulimoides* (d'Orb.) is usually amber, but specimens in which it was bright red were observed by Mlle Bonnevie in North Atlantic collections.

The genus *Spongiobranchaea* is characterized by having two sucker-bearing arms; a posterior gill consisting of a simple band without rays; a median tooth present in the adult; shallow hook sacs and a median jaw with numerous spines. The present species usually has about 7-10 suckers on each arm, of which those placed distally are much larger than one or two next the mouth. Usually, but not always, the animal is densely speckled with dark chromatophores.

DISTRIBUTION. Antarctic to about 50° S in the Pacific and in the Atlantic to about 36° S (Meisenheimer, 1905).

*Spongiobranchaea intermedia*, A. Pruvot-Fol, 1926 (Pl. XXXIX, figs. 1-5; Fig. 1).

St. 71. Young-fish trawl, 2000 (-0) m.: 1 specimen.

St. 72. 4.5 m. tow-net, 2000 (-0) m.: 1 specimen.

St. 239. 4.5 m. tow-net, 1050-1350 (-0) m.: 1 specimen.

Two of the above specimens have the sucker-bearing arms beautifully extended and measure 9-15 mm. in length. The other is 20 mm. long, but is a contracted specimen and probably measured much more when alive. As the type was a contracted specimen and possessed an incomplete median tooth, I sent these to Mme Pruvot-Fol who has most kindly examined them for me and thinks that they may be *S. intermedia* or a variety of the same. As she observes: "There are some important differences but the hook sacs are identical and the radula is the same or nearly so. The median tooth shows a 'contre-



fort' of an oval shape, two pointed denticles on each side, and a fold or suture without cusp in the middle line. This fold indicates the place where the two median teeth of the larva join to form one central tooth in the adult. It often breaks into two halves and I even think that one half sometimes persists in some rows, while the other disappears, this median tooth being inclined to disappear altogether as it does in the genus *Pneumoderma*. This fact explains the asymmetry of the tooth in my Monaco specimen."

Mme Pruvot-Fol has been so good as to send me drawings of the radula of the above

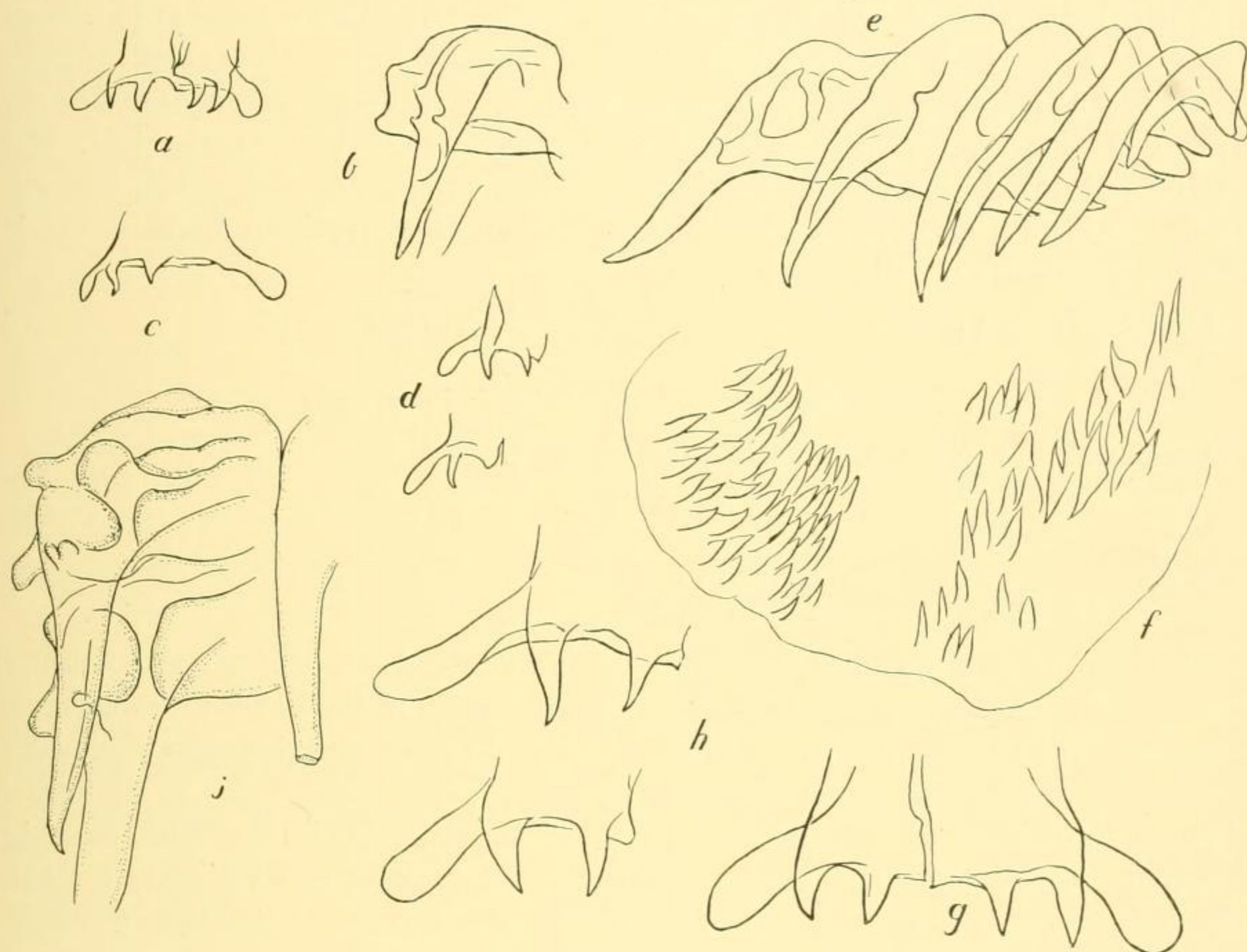


Fig. 1.

*Spongiobranchaea intermedia*, Pruvot-Fol. *a*, median tooth; *b*, first lateral tooth (from original Monaco specimen).

*Spongiobranchaea intermedia* var. *c*, median tooth on same scale as *a*; *d*, two median teeth (halves); *e*, lateral teeth,  $\frac{1}{2}$  row; *f*, mandible; *g*, one median tooth; *h*, two median teeth (halves); *j*, the first lateral teeth of two rows. (Figs. *g*, *h*, *j* more highly magnified than preceding figures.)

specimens and also of the Monaco example for comparison (Fig. 1). The most important difference between the Discovery specimens and the type is that both Mme Pruvot-Fol and myself counted nearly eighty suckers on an expanded arm, whereas in the type only sixteen were counted; owing, however, to the type specimen being contracted, and the possibility that a few suckers had been lost during dissection, the number might have been twenty or more. As Mme Pruvot-Fol points out, there is great variability in these organs. It is a curious fact, too, that the suckers in the type (which measured 17 mm.



and was estimated to have been 30 mm. or more when alive) were larger in proportion to the rest of the body than those of the present specimens. The branchiae of the three Discovery specimens are retracted and scarcely show in the illustrations, and they are as different from one another as they are from the type. The example from St. 71 has a sort of lateral gill which occupies the whole circle above the tail and seems to be longest in front, i.e. ventrally, which is strange.

The aspect of these animals varies extraordinarily according to the manner in which they have been prepared. When collectors preserve them without the use of anaesthetics, one can frequently do little or nothing with them. Mme Pruvot-Fol (1924, pl. xvi, figs. 1 and 2) has shown how different the appearance of *Pneumodermopsis canephora*, Pruvot-Fol, is when drawn from specimens fixed with and without anaesthesia. The ventral and dorsal aspect of the specimen from St. 72 and two enlarged suckers are shown on Plate XXXIX, figs. 1 and 2, and the contracted specimen from St. 239 is shown on the same plate in figs. 3 and 4.

DISTRIBUTION. 44° 19' N, 11° 19' W., 0-4900 m. (Pruvot-Fol, 1926.)

#### Genus *Schizobrachium*, Meisenheimer, 1905

##### *Schizobrachium polycotylum*, Meisenheimer, 1905.

St. 71. Young-fish trawl, 2000 (-0) m.: 1 specimen.

St. 78. Young-fish trawl, 1000 (-0) m.: 1 specimen.

St. 89. Young-fish trawl, 1000 (-0) m.: 1 specimen.

St. 107. 4.5 m. tow-net, 850-950 m.: 1 specimen.

The four specimens of this species were taken over a wide area in the South Atlantic and Southern Ocean, from 33° S to 45° S, and from north of the Falklands to between Bouvet Island and Cape Town. All have the branching sucker-bearing arms beautifully extended<sup>1</sup> and their total length is from 17 to 30 mm. Meisenheimer (1905, p. 51) defines the genus *Schizobrachium* as follows: "Körper langgestreckt, in der Mitte bauchig erweitert, am Hinterende zugespitzt. Auf der Rückenseite mit wohlentwickeltem Drüsenfeld. Fuss: Hinterlappen wohlentwickelt, abgestumpft. Seitenlappen mässig stark, ohne gefälten Mittelhöcker. Kiemen: Seitenkieme geschwunden, Endkieme auf eine kleine Längsfalte an der Ventralseite des hinteren Körperendes reduziert. Saugnäpfe in sehr grosser Zahl 2 mächtigen, sich dichotomisch verästelnden Armen aufsitzend, an Grösse von der Basis der Arme bis zu deren feinsten Verästelung stetig abnehmend. Radula mit Mittelzahn. Hackensäcke äusserlich von bedeutendem, walzenförmigem Umfang, im Innern zum grössten Teile aus einer soliden Muskelmasse bestehend, in deren vorderem, nach der Mediane gewendeten Abschnitt die eigentliche Hackenscheide mit einer grösseren Zahl von Hacken gelegen ist. After auf der rechten Seite gelegen, ziemlich weit nach hinten verschoben. *S. polycotylum*. Mit der Merkmalen des Genus. Radula 7-1-7. Mittelzahn klein, mit 2 scharfen Spitzen. Seitenzähne mit starker Basalplatte und langem, spitzem Fortsatz, nach den Seiten an Grösse abnehmend. Masse: Länge des Körpers 32 mm., Breite 11 mm."

<sup>1</sup> These specimens were anaesthetized with cocaine.



DISTRIBUTION. Indian Ocean, north of New Amsterdam Island, 2000 m. (Valdivia Expedition).

Genus *Pneumodermopsis*, Keferstein

*Pneumodermopsis macrochira*, Meisenheimer, 1905.

St. 89. Young-fish trawl, 1000 (-0) m.: 1 specimen.

This specimen, measuring 5 mm. in length, was taken west of Cape Town. The radula was examined.

The genus has a lateral but usually no posterior gill: the buccal appendages consist of three groups of suckers, hook sacs and radula  $n-1-n$ . *P. macrochira* has about forty suckers of equal size and a much larger terminal one on each lateral arm. Five stalked suckers take the place of the median arm. There is a very rudimentary posterior gill: the radula is 6-1-6, and there are about twenty hooks.

DISTRIBUTION. Southern part of Atlantic and Indian Oceans (Meisenheimer, 1905). Ten stations in the North Atlantic, extending from the latitude between Bermuda and the west coast of Morocco to  $48^{\circ} 29' N$ ,  $13^{\circ} 25' W$  (Bonnievie, 1913). Three stations on the west of Ireland, from  $50^{\circ} N$  to  $51^{\circ} N$  by  $11^{\circ} 26' W$  to  $11^{\circ} 38' W$ , over soundings of 625-990 m. (Massy, 1917). Two stations in the Atlantic from near the Canaries and between the Azores and the West Indies (Pruvot-Fol, 1926).

Family CLIOPSIDAE

Genus *Cliopsis*, Troschel, 1854

*Cliopsis krohni*, Troschel, 1854.

? *Cliopsis modesta*, Pelseneer, 1887.

St. 270. Young-fish trawl, 200 (-0) m.: 1 specimen.

St. 287. Young-fish trawl, 800-1000 (-0) m.: 1 specimen.

The specimens recorded above, measuring 9-12 mm. in length, were taken in hauls off Africa between Elephant Bay and the Gulf of Guinea. Mme Pruvot-Fol (1924, p. 363) thinks that *C. modesta*, Pels., should be placed in synonymy with *C. krohni*, at least until its radula is known.

The family Cliopsidae is distinguished by having no lateral gill and no median lobe to the foot. A dorsal glandular pit is present and there is generally a posterior gill. The skin is transparent and colourless or lightly tinted and opalescent. The head is small and the body swollen. The proboscis is extremely long: a jaw and shallow hook sacs are present: the radula has the formula  $n-1-n$ .

In *Cliopsis krohni* the gill consists of a hexagonal crest with four short unfringed rays: radula 6-1-6: hooks about sixty.

DISTRIBUTION. Mediterranean, various authors. Western Mediterranean, especially to the west of Corsica and between Minorca and the African coast (Pruvot-Fol, 1924)



North Atlantic between the Azores and Bermudas, at 0-3000 m. (Pruvot-Fol, 1926). Yokohama to Honolulu, lat.  $35^{\circ} 13' N$ , long.  $154^{\circ} 43' W$  (Pelseneer, 1887, under *C. modesta*).

Family CLIONIDAE

Genus Clione, Pallas, 1774

*Clione antarctica*, E. A. Smith, 1902; Eliot, 1907.

*Clione limacina* var. *antarctica*, Meisenheimer, 1906.

206 specimens from thirty-six stations. Nearly half the hauls from near South Georgia, the remainder from an area between the South Sandwich Islands and Bouvet Island.

The specimens range in length from 1.5 to 18 mm. They vary greatly in shape and colour, some of them being without the usual ruddy hue. The largest number in a haul (forty-five) occurred at night at the surface (0-5 m.), over soundings of 1000 m. Larvae of 3 mm. and less occurred in one October, three November, two December and two February hauls. Most of the hauls in which *C. antarctica* occurred were made in November, December and January. The species was absent in a number of February and March hauls made in the South Orkneys, South Shetlands and Palmer Archipelago in 1927, although the gear and the depth over which the nets were worked would seem to be quite suitable. The species occurred, however, in an April haul made at the South Shetlands in the same year.

This family is without a glandular dorsal pit and has no suckers. Buccal cones are generally present. There is no lateral gill and rarely a posterior gill. In *Clione* a posterior lobe is present in the foot. It is usually short and broad. There are no chromatophores. The hook sacs contain numerous long hooks. Radula at least 6-1-6. The present species is very closely allied to *C. limacina*, Phipps. Eliot (1907, p. 13) gives a list of differences between the two species. As observed in Terra Nova specimens (Massy, 1920), there is a distinct neck behind the fins, instead of between or above them, as in *C. limacina*. The skin appears to be thicker and larval rings persist to a later age.

DISTRIBUTION. Antarctic seas.

Subfamily THLIPTODONTINAE

Genus Thliptodon, Boas, 1886

*Thliptodon gegenbauri*, Boas, 1886.

*Thliptodon atlanticus*, Massy, 1917.

St. 72. 4.5 m. tow-net, 2000 (-0) m.: 4 specimens.

In this subfamily proboscis, gill and jaw are absent. Teeth of three sorts—formula 3-1-1-1-3—and gullet bladders (vésicules buccales, Schlundblasen) are present.

Genus *Thliptodon*, Ggbr. No cones: hooks present: the lateral lobes of foot sometimes separated from the posterior lobe; pockets exist in the folds of the skin in which the lobes can be withdrawn.



*T. gegenbauri* is thus characterized by Mme Pruvot-Fol (1926, p. 29): "Lobes du pied réunis; partie céphalique beaucoup plus volumineuse que l'abdomen; crochets très longs, grêles; dent médiane rectangulaire, à tranchant onduleux, ne recouvrant pas entièrement sur les côtés la plaque basale; intermédiaire à cuspidé courte mais aiguë; marginales toutes semblables, courbes, aiguës, non aplaties".

The above specimens were taken north-east of the Falkland Islands. They measure 15–19 mm. in length. Two have lost their buccal parts. The radula of the other two is like that of the type. They are more than twice the length of Irish specimens and the fins are wider apart, and the viscera occasionally extend to the end of the body, which is sometimes rounded. I agree with Mme Pruvot-Fol that the small specimens, measuring 3–7 mm., named by me (1917) *T. atlanticus*, are referable to the above. As this author remarks (1926, p. 28) it is always useful to give a figure of a rare species, as so often the radula may take a slightly different direction on the slide which entirely changes the aspect of the various teeth. Thus in the specimens recorded above, the median tooth is much more like that figured by Mme Pruvot-Fol (*loc. cit.*, pl. iii, fig. 74c) than Boas' illustration (1886, Tab. 8, fig. 122).

DISTRIBUTION. Messina (Boas, 1886). South-west Ireland (Massy, 1909, and 1917 as *T. atlanticus*). North Atlantic, off Portugal to the Azores, 0–1500 m. (Pruvot-Fol, 1926).

#### *Thliptodon diaphanus*, Meisenheimer, 1905.

St. 297. Young-fish trawl, 200–300 (–0) m.: 1 specimen.

This specimen, measuring 7 mm. in length, was taken off the Cape Verde Islands. The radula, especially the median tooth, agrees far more closely with the example figured by Mme Pruvot-Fol (1926, Pl. iii, figs. 79) than with Meisenheimer's illustration (1905, pl. xxvii, fig. 3). Mme Pruvot-Fol (*loc. cit.*, p. 28) thus characterizes this species: "Lobes latéraux et lobe médian du pied séparés par un grand intervalle. Dent médiane à tranchant droit, intermédiaire à cuspidé très courte, marginales en lame de faux, aplaties. Organe copulateur pourvu d'un appareil annexe: deux glandes et une ventouse".

DISTRIBUTION. Gulf of Guinea, St Thomas, Sumatra, Seychelles, Gulf of Aden (Meisenheimer, 1905). Ascension I. (Schliemanz, 1906). S.W. Ireland (Massy, 1909 and 1917). Antarctic (Meisenheimer, 1906). Atlantic, between Madeira and the African coast, 0–4000 m. (Pruvot-Fol, 1926).

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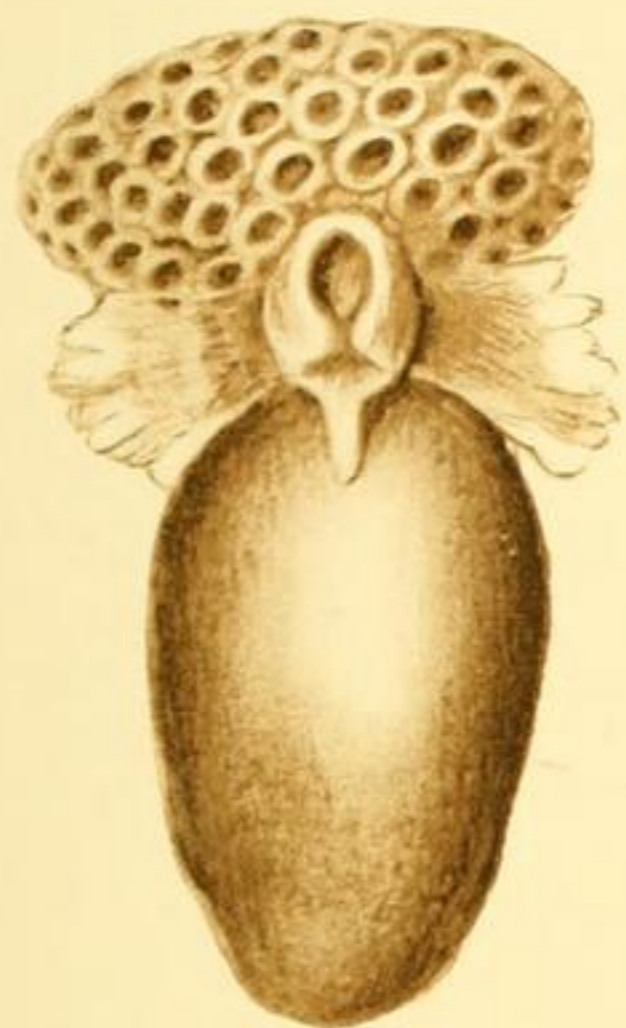




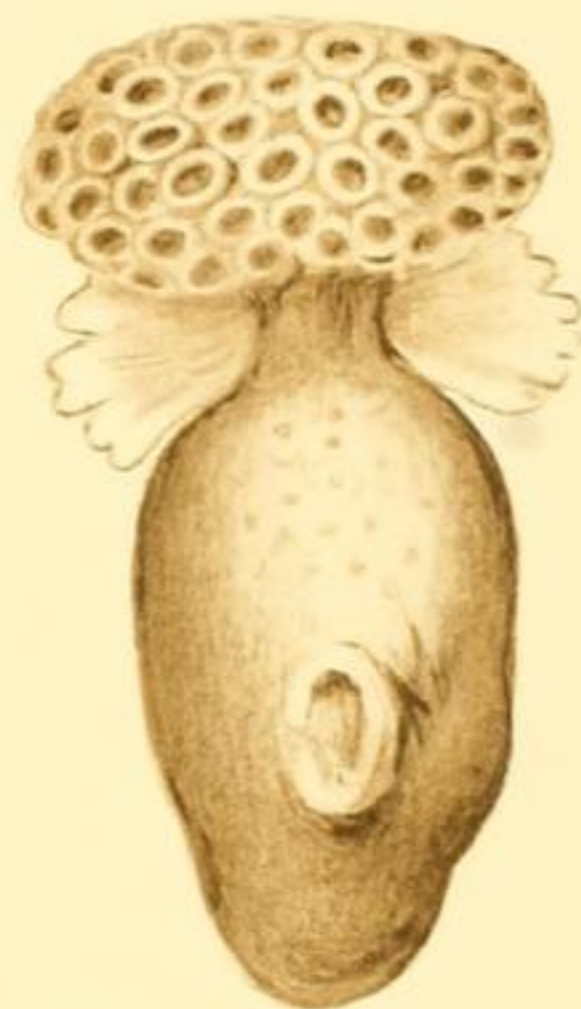
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### PLATE XXXIX





1.



2.



1a.



3.



4.

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