

# New Antarctic holothurians (Echinodermata)—II. Four species of the orders Aspidochirotida, Elasipodida and Apodida

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Four new species of antarctic holothurians are described: *Bathyplores rubipunctatus* sp.n., *Bathyplores fuscivinculum* sp.n. (both Aspidochirotida), *Achlyonice violaecuspidata* sp.n. (Elasipodida) and *Paradota weddellensis* sp.n. (Apodida). The genus, *Bathyplores*, is redefined. The material was mainly collected from the continental shelf of the southern and eastern Weddell Sea, at depths between 225 and 840 m. The systematic status of these new species within the genera, as well as relationships to other species and higher taxa are discussed.

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## Introduction

In the course of benthic research in the Weddell Sea, holothurians of the orders Aspidochirotida, Elasipodida and Apodida were found to be a common component of collections made during three German expeditions (ANT I, ANT II, and ANT III) with R.V. *Polarstern* (Gutt 1988). Complete station lists are published by Drescher *et al.* (1983), Kohnen (1984) and Hempel (1985). Benthic communities of this region have been analysed by Voss (1988).

There are only few published accounts of the occurrence and distribution of these holothurian orders on the Antarctic shelf. Representatives of shallow water families of the Aspidochirotida (Holothuroidea and Stichopodiidae) are common in tropical and subtropical waters (Deichman 1947, 1948; Pawson 1982). The Synallactidae and Gephyrothuriidae of the Aspidochirotida, as well as most of the Elasipodida and *Paradota* of the Apodida, usually colonise deep-sea waters (Ludwig & Heding 1935; Pawson 1965a; Heezen & Hollister 1971), but these are also found on the Antarctic shelf. The occurrence of deep-sea groups in shallow water in polar regions, known as polar emergence, is well known (Dayton & Olivier 1977; Picken 1985). Therefore it is not surprising that during intensive benthic surveys four new species of deep-sea holothurians were found on the Weddell Sea shelf.

The classification of the two aspidochirote species into one of the existing genera was difficult. Previous diagnoses of the genus *Bathyplores* were based on imperfectly described characteristics (see Heding 1940) and hence are in need of revision. A new diagnosis is proposed for this genus where poorly defined characteristics are omitted. Those characteristics that clearly placed the previous species as well as the newly described species into *Bathyplores* are especially emphasised. The erection of a new

genus is not justified, because there are close similarities with related species. The most conspicuous feature of *B. fuscivinculum* and *B. rubipunctatus* is their unique coloration. The colour, however, is lost during preservation and is not available for comparison when examining preserved specimens.

A classification of *Paradota weddellensis* and *Achlyonice violaecuspidata* was possible mainly due to the complete lack of ossicles in the body wall (Clark 1907; Hansen 1975).

Most of the holothurian species can be defined only by variations of important characteristics within different specimens of a certain range of body sizes. Thus the descriptions of the holotypes and paratypes are combined.

The following undescribed species in Gutt (1988) are described in this paper:

*Bathyplores* spec. I = *Bathyplores rubipunctatus*  
*Bathyplores* spec. II = *Bathyplores fuscivinculum*  
*Achlyonice* spec. I = *Achlyonice violaecuspidata*  
*Paradota* spec. I = *Paradota weddellensis*

## Material and methods

The material was collected using a modified Agassiz trawl and a bottom trawl. The specimens from ANT I and ANT II were preserved in buffered 4% formaldehyde, except the holotype of *Bathyplores rubipunctatus*. This specimen as well as the whole material from ANT III was initially frozen and preserved in formaldehyde after examination. Later, all types were transferred into alcohol.

The photographs of the whole animals were taken directly after the catch. The ossicles were removed by digesting a small portion of the body wall in sodium hypochlorite. The illustrations of the ossicles were prepared from photomicrographs.

The meristic data are derived from the available material. This does not exclude the possibility that other specimens vary slightly from these values.

Type specimens of the new species have been deposited in the

Zoological Institute and Museum (ZIM), University of Hamburg, Martin-Luther-King Platz 3, D-2000 Hamburg 13, F.R.G.

## Systematics

Order Aspidochirotida Grube, 1840  
Family Synallactidae Ludwig, 1894

### *Bathyploetes* Östergren, 1896

**Diagnosis.** Tentacles 15–20, mouth turned ventrally, anus subdorsal. Ventrolateral radii with feet in one or more rows. Midventral radius with feet in one or more rows, with feet or naked. Dorsal surface with papillae in more or less distinct rows. Genital organs in two tufts. Deposits tables with cross-shaped discs and spire built up of four rods, usually with several cross-beams.

**Remarks.** Ekman (1925) considered the lateral brim, the degree of cleavage of the longitudinal muscles, the few medioventral feet and the presence of cross-shaped ossicles as insufficient characteristics to describe the genus. These characters were used in part by Östergren (1896) and Perrier (1902) to differentiate the genus discussed here from *Synallactes*. Some of these characters (undivided longitudinal muscles, few or no midventral feet) were taken up again by Pawson (1965a) in the diagnosis for *Bathyploetes*. In the earlier generic diagnosis by Östergren the presence of cross-shaped rods are described as "öfters" ( $\approx$  often) present. My decision not to use these characteristics for determining the genus emphasises a remaining definite characteristic, namely the ossicle spine consisting of four rods on the cross-shaped ossicles. This feature occurs only in *Bathyploetes* within the Synallactidae. Some of the contradictions concerning the classification of *B. moseleyi*, *B. bipartitus* and *B. natans* (see Ekman 1925) are removed with the generic diagnosis presented here, and this allows a precise classification of the species, described in this paper.

### *Bathyploetes rubipunctatus* sp.n. (Figs 1–3, Table I)

**Type material.** Holotype 100 mm long, 22 mm maximum width, caught by Agassiz trawl, 31.01.1984, depth 646–661 m, Reg. No. E-7137 ZIM; 5 paratypes (Table I) from type locality, Reg. No. E-7138 ZIM. For further material studied, see Fig. 1.

**Type locality.** The Weddell Sea, 74°57'S 060°31'W (Fig. 1).  
**Etymology.** *Rubus* (lat.) = red; *punctatus* (lat.) = spotted.

**Distribution.** Southern and eastern Weddell Sea, 225–840 m.

**Description of the holotype and paratypes.** In life, dull translucent whitish to pink, with approximately 7 intense

Table I. *Bathyploetes rubipunctatus* sp.n. Body length and maximum width

	Holotype	Paratype				
		I	II	III	IV	V
Length (mm)	100	115	98	105	105	120
Width (mm)	22	23	20	25	23	26

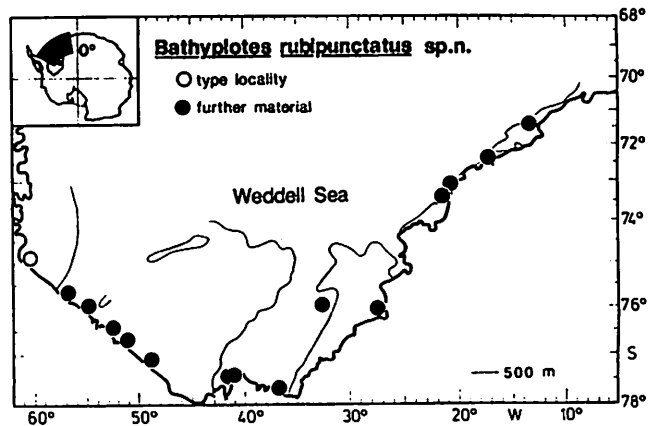


Fig. 1. *Bathyploetes rubipunctatus* sp.n., type locality and known distribution.

bright red spots, paler at the edges, diameter approximately 10 mm. Colour in formaldehyde or alcohol whitish pink; red spots have completely disappeared after, at most, 24 h preservation. Body elongated, rounded at both body poles, slightly tapering posteriorly (Fig. 2), cross-section of body almost oval, flattened ventrally, laterally a brim is present. Body surface gelatinous. Mouth ventral, anus subdorsal. Feet only ventrally, with simple end plates, in the midventral radius a double row, 5–6 feet per cm, almost completely retracted into body surface, diameter approximately 1 mm. In the lateral radii single rows, 6–10 feet per cm, partly in a slight zig-zag, length approximately 3 mm. Up to 10 feet per cm in the posterior 2 cm of the body. The feet are in a dense row without spaces along the longitudinal axis of animal; between latero- and medioventral radii no area without feet is recognisable; in spite of this the feet can be assigned to the three radii. No definite differentiation into radii and interradii because of the gelatinous consistency of the scaly surface. Brim papillae conically shaped appendages forming a brim, surrounding anterior body; density approximately 4–5 papillae per cm. Dorsal papillae rubbed off most specimens during capture due to their gelatinous consistency and only an approximate description of their form and arrangement can be given. They are conical, elongated with diameter at base of around 1 mm, maximum length 6 mm. Feet arranged in a single zig-zag row or a double row in the radii; density 2–4 per cm. Such papillae may also exist ventrally between the feet; the possibility that these could be feet with torn off end plates cannot, however, be excluded. Tentacles 19–20, of shield-like shape with a short stalk, approximately 6 mm long, half way along their length they divide into 6 main branches with bushy side branches. Central branches longest, side ones shorter. Ossicles in the body wall (Fig. 3a) frequently rubbed off large areas of the body surface during capture; in undamaged areas found close together. Crosses, usually with 4 and up to 8 arms with a central spine consisting of 4 rods. Length from opposing tips 150–220  $\mu$ m, height of spine 100–170  $\mu$ m. Arms usually branched one to three times at their tips. The branches occasionally touch at their tips to form holes, the first branch usually the most pronounced. Four rods of the spine connected in the distal half by cross-beams and have in this area short, sharp spines. A few net-like perforated

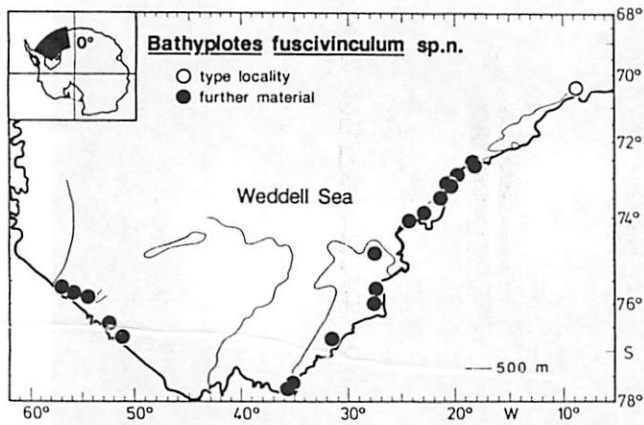


Fig. 4. *Bathyplores fuscivinculum* sp.n., type locality and known distribution.

Table II. *Bathyplores fuscivinculum* sp.n. Body sizes, numbers of feet and papillae

	Holotype	Paratype		
		I	II	III
Length (mm)	165	63	120	190
Width (mm)	45	20	21	38
Number of dorsal papillae	43	?	?	38
Papillae in the brim, left	27	19	21	38
right	27	20	24	44
Ventral fee, left radius	58	28	57	90
middle radius	89	23	79	141
right radius	59	26	56	96
Post-oral feet	8	8	5	?

base 1–5 mm. For numbers of papillae see Table II; could only be determined in holotype and one paratype because of the state of preservation. Distributed over entire dorsal surface, slightly concentrated in the radii. Brim papillae same size and shape as dorsal papillae; usually in a single row around entire body. Form a more pronounced brim in anterior and posterior quarter of body than in the centre. The 6–10 papillae per side of body closest to the anus and the 10–15 per side of the anterior body part without distinct space between them. These spaces increase towards centre of body. Papillae largest at body centre. In the largest paratype (190 mm), papillae in the anterior brim in a distinct zig-zag, in the middle of the body small papillae next to the larger ones, approximately 4 on each side. For numbers of papillae, see Table II. Tentacles 16–19, with round, shield-shaped end plates, maximum diameter 5 mm. Ossicles in the body wall (Fig. 6), 4-armed crosses with a central spine vertical to the plane of the arms. Arms branched and widened at their tips, with a complete border so that up to 8 holes are formed. The central spine consists of 4 single rods, fusing in their upper third so that a small, central hole remains. Upper third is covered by short, sharp spines. Length of arms from opposing tips 180–270  $\mu\text{m}$ , height of the spine around 130  $\mu\text{m}$ . Ossicles in the tentacles and feet simple straight to bent rods of different lengths. Length 200–800  $\mu\text{m}$ , width 10–15  $\mu\text{m}$ , very similar to those of *B. rubipunctatus*.

*Discussion of Bathyplores rubipunctatus and B. fuscivinculum.* Both belong to the order Aspidochirotida, accord-

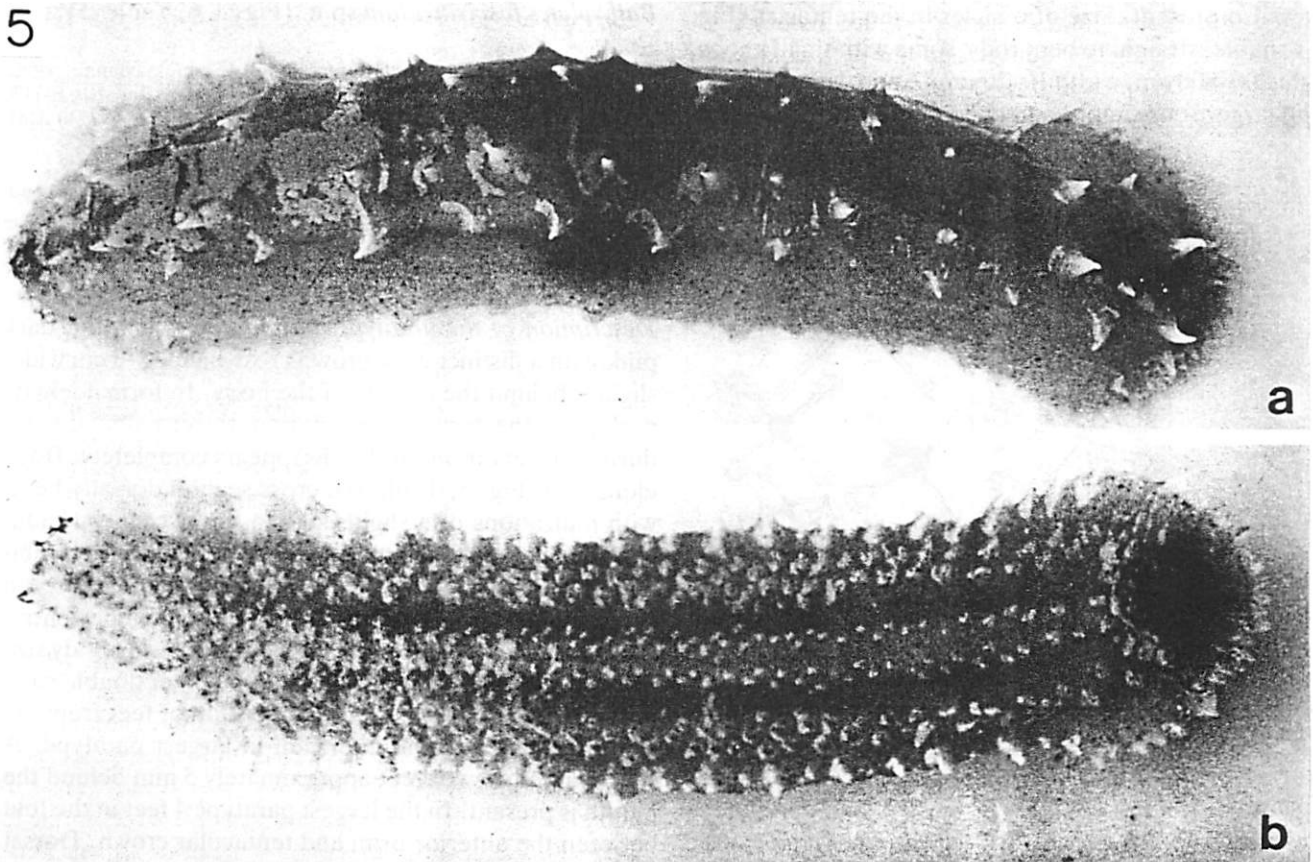


Fig. 5. *Bathyplores fuscivinculum* sp.n., holotype, photographed directly after catch. Living specimen 165 mm long.—a. Dorsal view.—b. Ventral view.

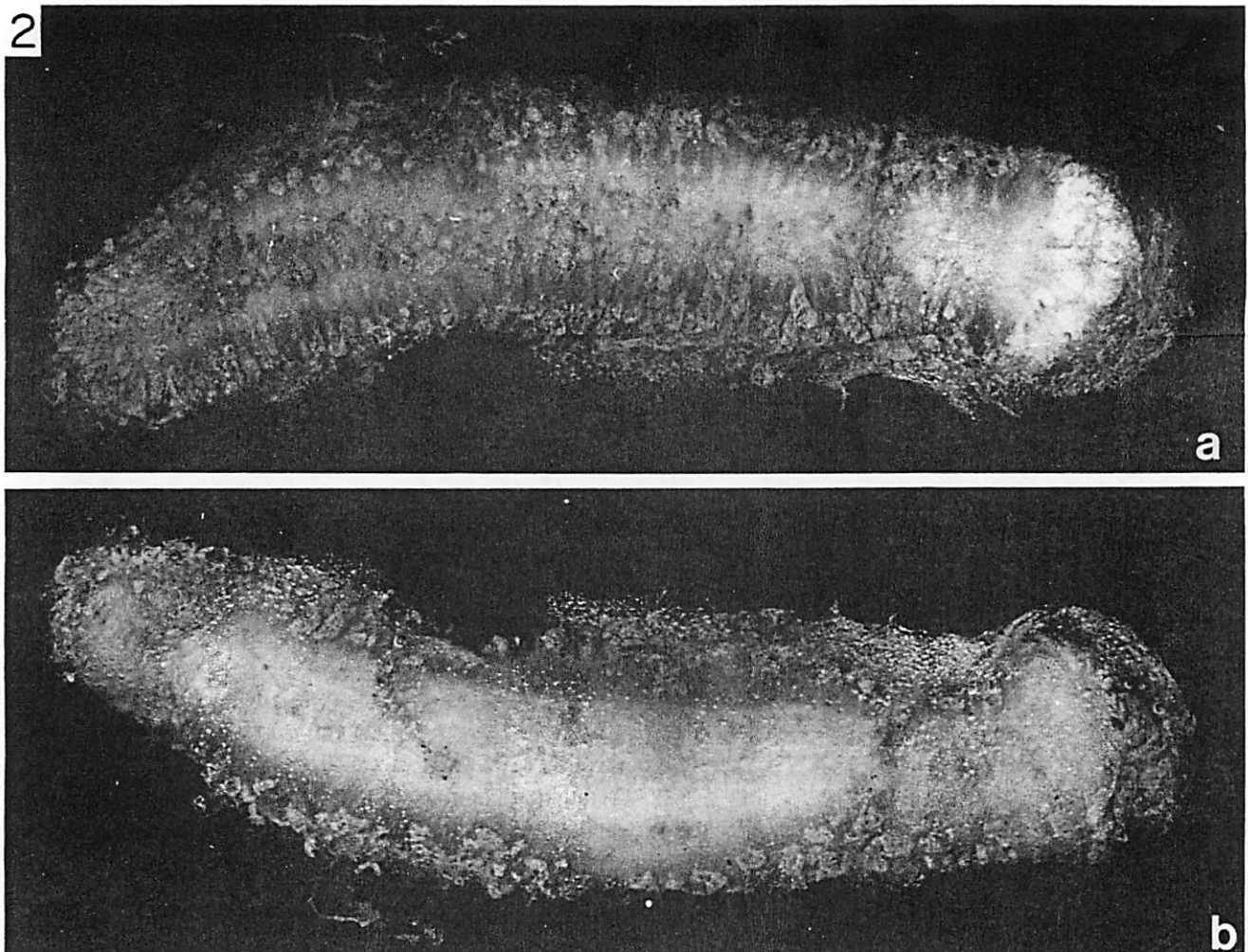


Fig. 2. *Bathyplores rubipunctatus* sp.n., holotype, preserved by deep-freezing. Living specimen 100 mm long.—a. Ventral view.—b. Dorsal view.

plates also present. Size of ossicles in the tentacles (Fig. 3b) variable, straight to bent rods, some with small knobs, length 200–800  $\mu\text{m}$ , width 10–20  $\mu\text{m}$ . Approximately 30% of the larger rods simply branched at their tips.

#### *Bathyplores fuscivinculum* sp.n. (Figs 4–6, Table II)

*Type material.* Holotype 165 mm long, 45 mm maximum width, caught by Agassiz trawl, 01.03.1983, depth 329–350 m. Reg. No. E-7139 ZIM: 3 paratypes (Table II) from type locality, Reg. No. E-7140 ZIM. For further material studied (Fig. 4).

*Type locality.* The Weddell Sea, 70°27'S 008°40'W (Fig. 4).

*Etymology.* *Fuscus* (lat.) = dark (brown); *vinculum* (lat.) = band, stripe.

*Distribution.* Southern and eastern Weddell Sea, 245–465 m.

*Description of the holotype and paratypes.* In life, dark pink with a distinct dark brown cross-band, 2–3 cm wide, slightly behind the middle of the body. In formaldehyde dark pink, the dark brown colour of the cross-band fades during preservation until it disappears completely. Body elongated (Fig. 5, Table II), cross-section dorsally bent, with indications of a slight edge in the two dorsal radii, ventrally flat. Arrangement of feet and papillae in combination with the body shape forms a distinct sole. Mouth ventral, anus terminal. Feet (Table II) only in the ventral radii. The arrangement changes with increasing body size from zig-zag rows in smallest paratype, over double rows in two medium-sized types, to extension of feet from the central radius into the interradii in largest paratype. A short curved row of feet approximately 5 mm behind the mouth is present. In the largest paratype 4 feet in the fold between the anterior brim and tentacular crown. Dorsal papillae conical, height 1–5 mm. No distinct junction with body wall and therefore difficult to measure, diameter of

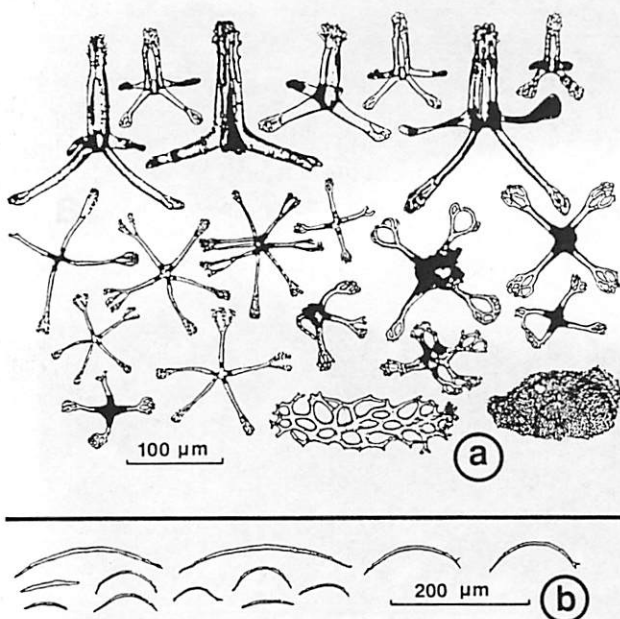


Fig. 3. *Bathyplores rubipunctatus* sp.n.—a. Ossicles from the body wall, paratype II. Upper row lateral view, remainder vertical view. Bottom right part of an end plate of a foot.—b. Ossicles from the tentacles, paratype II.

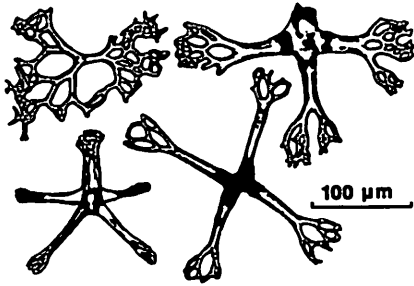


Fig. 6. *Bathyploetes fuscivinculum* sp.n., ossicles from the body wall, paratype II.

ing to the classification of Pawson & Fell (1965). The absence of a *rete mirabile*, the cuverian organs and the presence of table-shaped ossicles place them in the Synallactidae. The form of the ossicles and the arrangement of the feet are the main characteristics placing both species in the newly defined genus *Bathyploetes*. The cross-shaped ossicles with perforated tips and a spine consisting of 4 rods are the best general features to differentiate this genus from its closest relative *Synallactes*, according to Ekman (1925). The characteristic of throwing off lateral enlargements with parts of the ventral and dorsal body wall during capture has been described for several species of *Bathyploetes* (Heding 1940). In a similar fashion this often occurs in *B. rubipunctatus*. This hampers the identification of known species as well as the description of new species.

The most conspicuous features of *B. fuscivinculum* and *B. rubipunctatus* are their distinctive colorations. Therefore, to identify the species, the coloration of these holothurians must be noted, or documented photographically immediately after capture. The identification then becomes simple and mistakes are impossible at the present level of knowledge. However, since the coloration is lost during preservation, it cannot be used as an exclusive means of differentiating between the species.

Some species of *Bathyploetes* can be identified from the shape of their ossicles and the species described here differ in this character from most other species. However, a clear definition can be made only from direct comparison of illustrated ossicles. In this connection, the following are important contributions: Théel (1886), Koehler & Vaney (1905), Perrier (1905), Augustin (1908), Hérourard (1912), Mitsukuri (1912), Ohshima (1915), Ekman (1926), Heding (1942), and Pawson (1968).

A further characteristic that differentiates *B. fuscivinculum* and *B. rubipunctatus* from most other species of this genus is the arrangement of the midventral feet. At present the only other known species with more midventral than lateroventral feet is *B. natans* (Ekman 1925). However, this species differs from *B. fuscivinculum* and *B. rubipunctatus* in the structure of its ossicles.

It is difficult to draw a line of distinction between *B. fuscivinculum* and *B. rubipunctatus* by use of their ossicle shape owing to great variability within species and a large degree of similarity between them. At best, the abundance of ossicles with more than four arms in *B. rubipunctatus* could be used as a diagnostic feature. The general morphology, the arrangement of the feet and papillae as well as the consistency of the body wall separate these

species. Therefore it is essential to illustrate the description to avoid difficulties with imprecise descriptions of features such as 'body brim', 'warts', 'flattened body' etc. For this, *in situ* photographs of live specimens can also be useful. The numbers of feet and papillae per animal or per length of animal should be given for different-sized specimens. For *B. rubipunctatus* such a size-dependent listing of numbers was not possible. *Bathyploetes rubipunctatus* and *B. fuscivinculum* also differ in their general morphology, as can be seen from the photographs. *In situ* photographs of *B. fuscivinculum* show a brim consisting of densely packed papillae in the anterior and posterior parts of the body. This brim is not easily discerned in the middle of the body. In *B. rubipunctatus* the brim is more evenly and weakly developed around the body.

Order Elaspodida Théel, 1882

Family Elpidiidae Théel, 1882

#### *Achlyonice violaecuspida* sp.n. (Figs 7–10)

*Type material.* Holotype 61 mm long, 12 mm maximum width, caught by Agassiz trawl, 14.02.1984, depth 235 m, Reg. No. E-7143 ZIM; 75 paratypes from type locality, Reg. No. E-7144 ZIM. For further material studied, see Fig. 7.

*Type locality.* The Weddell Sea, 77°08'S 048°36'W (Fig. 7).

*Etymology.* *Viola* (Latinised word from a non-indogermanic language) = violet; *cuspidis* (lat.) = point, tip. The name describes the violet colour of the tentacle end plates, the tips of the feet and dorsal papillae and the anus.

*Distribution.* Southern and eastern Weddell Sea, 225–785 m.

*Description of the holotype and paratypes.* Since the specimens were considerably damaged during capture due to their gelatinous consistency, an impression of their anatomy can be gained only from a combined description of all specimens.

Translucent (gelatinous) in life; internal organs visible. Mouth, tips of the tentacles, feet, dorsal papillae and anus violet. Posterior part of body (approximately 1 cm around the anus) covered by a thin, dark, almost black to violet skin layer, found only in two paratypes, possibly rubbed off other specimens during capture. The violet colour of species <4 cm long, is more intense than that of larger specimens; colour fades slightly during preservation in formaldehyde, but not completely lost. Dorsal papillae at

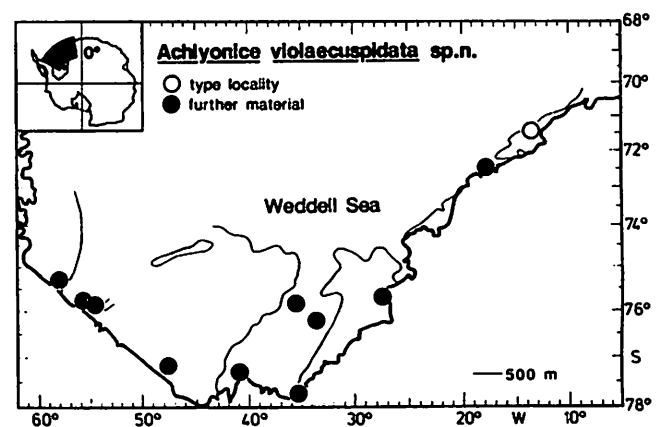


Fig. 7. *Achlyonice violaecuspida* sp.n., type locality and known distribution.