

## Faunistic and anatomical data on the Antarctic Opisthobranchia (Mollusca, Gastropoda) in the collections of the Royal Belgian Institute of Natural Sciences

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### Abstract

Five opisthobranch species were collected during the Belgian and Belgian-Dutch Antarctica expeditions to the Riiser-Larsen Sea, the Princess Ragnhild Coast ("Mission Iris") (1960-1967) and Admiralty Bay (King George Island) (1987-1991). These species include *Philine alata* THIELE, 1912, *Bathyberthella antarctica* WILLAN & BERTSCH, 1987, *Notaeolidia gigas* ELIOT, 1905, *Aegires (Anaegires) albus* THIELE, 1912 and *Austrodoris kerguelenensis* BERGH, 1884. This material is deposited in the Royal Belgian Institute of Natural Sciences. The present contribution provides anatomical and faunistic data on this collection and extends the distributional range of several species.

**Key words:** Gastropoda, Opisthobranchia, Antarctica, Faunistics, Taxonomy.

### Résumé

Cinq espèces de mollusques opisthobranches ont été récoltées pendant les missions antarctiques belges et belgo-néerlandaises dans la Mer de Riiser-Larsen, le long de la côte "Princess Ragnhild" ("Mission Iris") (1960-1967) et à Admiralty Bay (Île King George) (1987-1991). Les espèces recueillies sont *Philine alata* THIELE, 1912, *Bathyberthella antarctica* WILLAN & BERTSCH, 1987, *Notaeolidia gigas* ELIOT, 1905, *Aegires (Anaegires) albus* THIELE, 1912 et *Austrodoris kerguelenensis* BERGH, 1884. Ce matériel a été déposé dans les collections de l'Institut Royal des Sciences Naturelles de Belgique. Cet article présente des données anatomiques et faunistiques de ces espèces et augmente considérablement l'aire de distribution de plusieurs entre elles.

**Mots-clés:** Gastropoda, Opisthobranchia, Antarctique, faunistique, taxonomie.

### Introduction

During the Belgian and Belgian-Dutch Antarctica expeditions to the Riiser-Larsen Sea and the Princess Ragnhild Coast in 1960-61, 1964-65 and 1966-67, as well as to Admiralty Bay (King George Island) in 1987, 1988, and 1991 (Fig. 1; table 1), a small number of opisthobranch gastropods was collected and deposited in the Royal Belgian Institute of Natural Sciences (RBINS). The species belong to the orders Cephalaspidea (*Philine alata* THIELE, 1912), Notaspidea (*Bathyberthella antarctica* WILLAN & BERTSCH, 1987) and Nudibranchia (*Notaeolidia gigas* ELIOT, 1905, *Aegires (Anaegires) albus* THIELE, 1912 and *Austrodoris kerguelenensis* BERGH, 1884). In this paper we provide anatomical and faunistic data on this material. Sampling stations and data are listed in table 1. All measurements are given as length  $\times$  width and apply to fixed specimens.

### Systematic account

ORDER CEPHALASPIDEA FISCHER, 1883

*Philine alata* THIELE, 1912

### MATERIAL

Stn. CP8: 3 specimens (20.5 mm  $\times$  15 mm; 20 mm  $\times$  15 mm; 19.5 mm  $\times$  13.5 mm); Stn. CP1: 3 specimens (12 mm  $\times$  9 mm; 11.5 mm  $\times$  6.5 mm; the third specimen was too poorly preserved to study its soft parts, its shell measured 12.2 mm  $\times$  9.6 mm).

### DESCRIPTION (Figs 2-6)

Shell externally covered by the mantle (Fig. 2), calcified, white-nacreous and with weak concentric lines visible by the SEM (Fig. 3). Shell dimensions in the specimen of 20 mm: 9.5 mm  $\times$  11.3 mm.

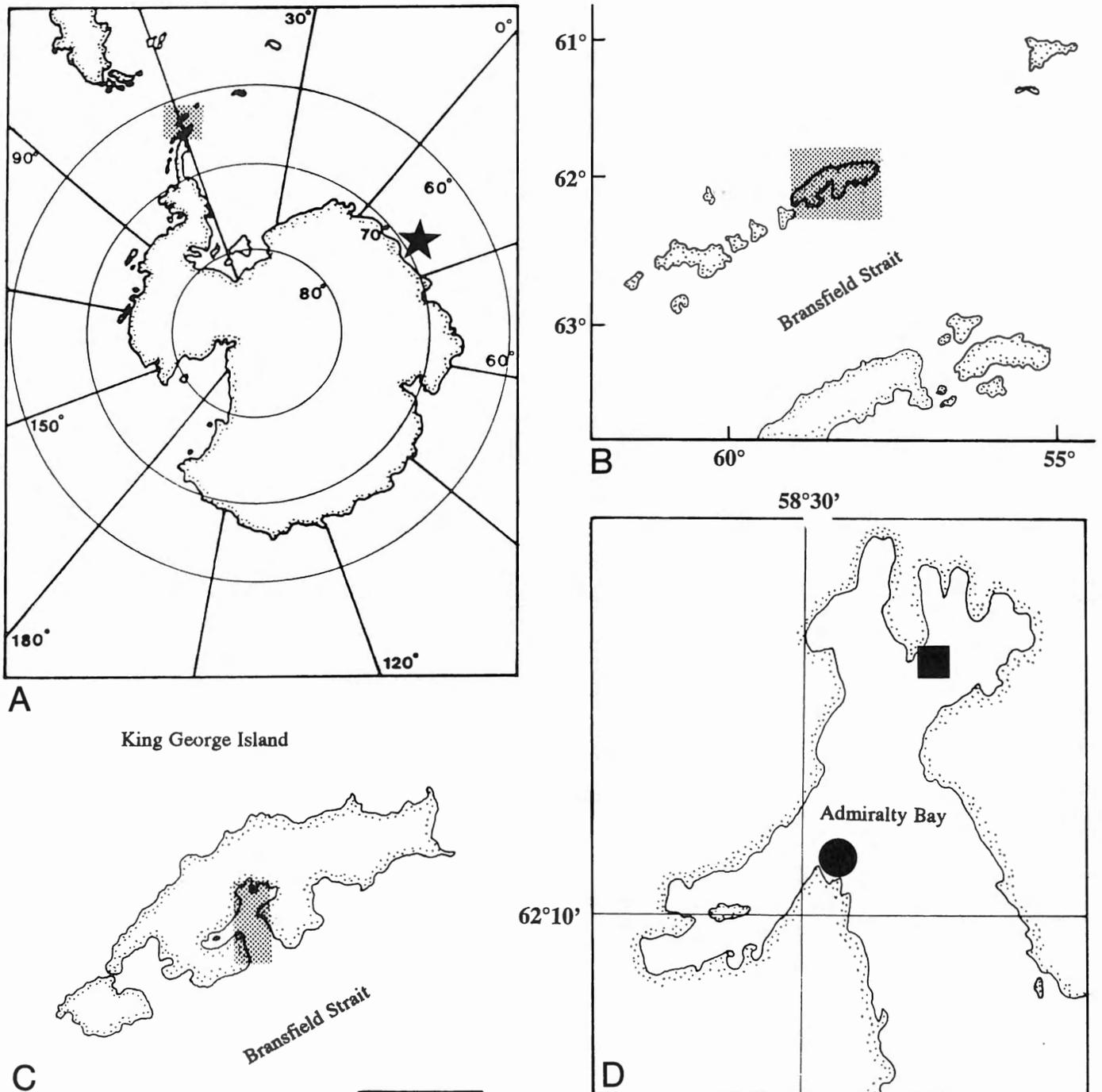
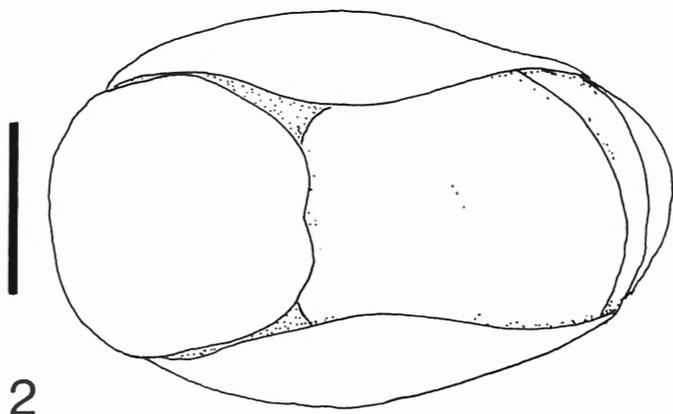


Fig. 1. – Location of sampling sites. - A: "Mission Iris" (Princess Ragnhild coast) (black star) - B: South Shetland and Bransfield Strait - C: King George Island (scale: 20 km) - D: Admiralty Bay with stn. CP1 and CP8 (black square) and stn. D4 and M11 (black dot).

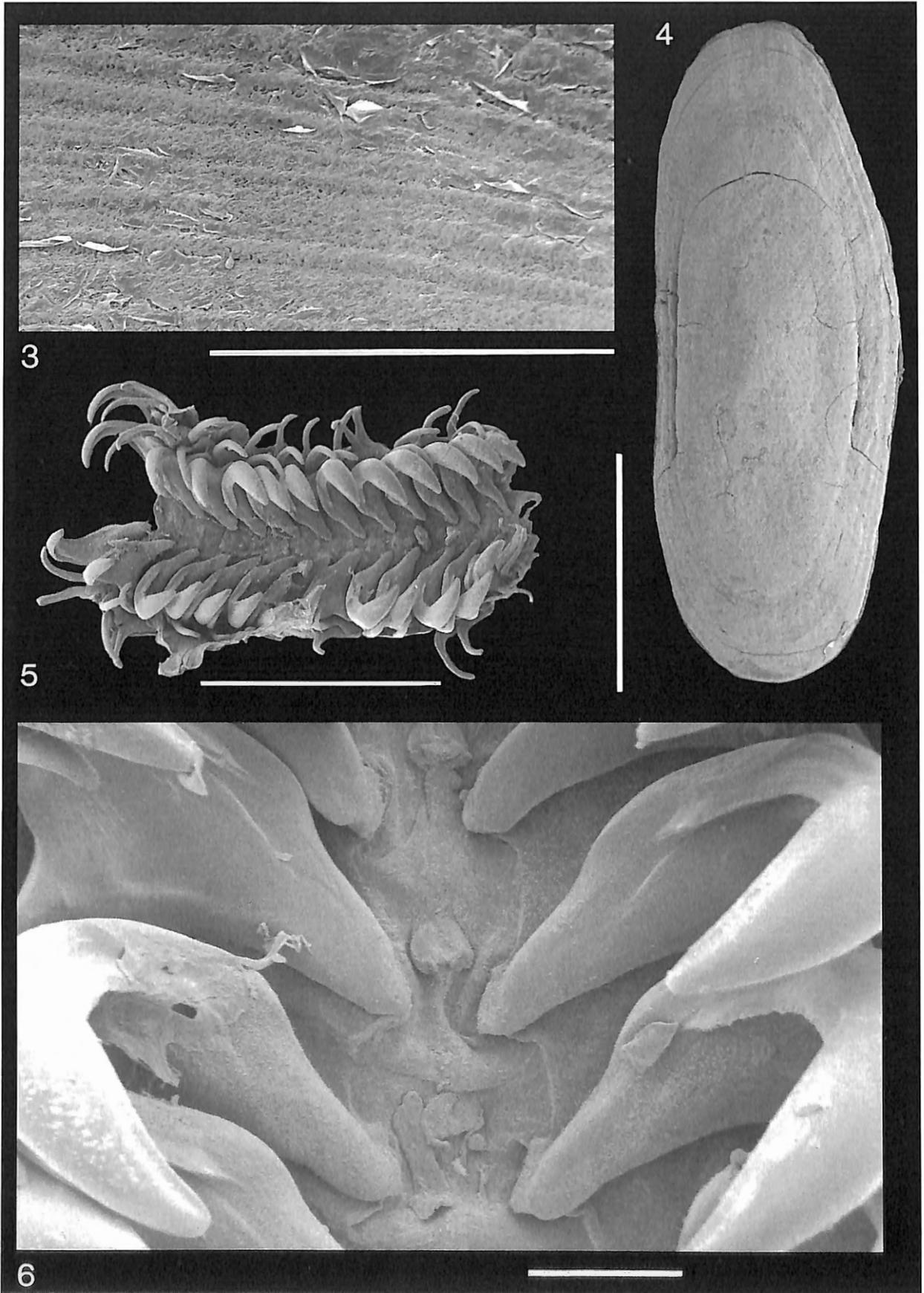
Table 1. Sampling stations and data of the material studied.

Admiralty Bay (King George Island):					
Station	Date	Zone	Substratum	Depth (in m)	Observation
CP1	01/03/88	Between Ferraz Station and Plaza Point	Rocky Bottom macro-algae	10-20	Small trawl 5-10 minutes
CP8	31/01/91	Between Ferraz Station and Plaza Point	Rocky Bottom macro-algae	6-18	Small trawl 10 minutes
D4	09/01/91	Between Point Thomas and Arctowski Cove	Macro-algae	20	Trawl
M11	27/02/87	Arctowski Cove	Macro-algae under rocks	low tide ponds	Hand net
Mission Iris (Princess Ragnhild coast):					
Expéditions Antarctiques Belges (1960/1961):					
Station	Date	Zone	Latitude (S)	Longitude (E)	Depth (in m)
134	11/01/61	Baie Léopold III	70°19'09" 70°19'05"	24°13'05" 24°12'06"	240
Expéditions Antarctiques Belgo-Néerlandaises (1964/1965):					
Station	Date	Zone	Latitude (S)	Longitude (E)	Depth (in m)
217	29/01/65	Baie des Pingouins			270
219	31/01/65	Baie du "Glacier"	70°18'05"	23°58'00"	216
224	03/02/65	Baie du "Glacier"			207
Expéditions Antarctiques Belgo-Néerlandaises (1966/1967):					
Station	Date	Zone	Latitude (S)	Longitude (E)	Depth (in m)
233	26/01/67	Baie Léopold III	70°13'05"	24°15'00"	300 Mud bottom with sponges
234	02/02/67	Between Baie des Pingouins and Baie "Polarhav"	70°19'00"	24°26'00"	200
236	03/02/67		70°19'00"	24°14'00"	200 Bottom of stones

Fig. 2. – *Philine alata*. External morphology (scale: 5 mm).

The radula are 2 mm × 0.8 mm and 1.4 mm × 0.7 mm in respectively the specimens of 20 mm and 12.2 mm. The radular formula in these specimens is 13-11 × 2.1.1.1.2. The rachidian teeth are strongly reduced (Fig. 6), the lateral teeth are larger, hooked and have smooth margins; marginal teeth are similar to the lateral teeth but smaller (Fig. 5).

The three gastric plates (2.9 mm × 1 mm) are large compared to the buccal apparatus. They are oval and slightly curved, with the concave side smooth and the convex side showing concentric grooves (Fig. 4).



Figs 3-6. – *Philine alata*. - 3: detail of shell sculpture (scale: 1 mm) - 4: gastric plate (scale: 1 mm) - 5: radula (scale: 1 mm) - 6: detail of central radular teeth (scale: 100  $\mu$ m).

## DISTRIBUTION

All specimens of *P. alata* studied here, were collected in Admiralty Bay (King George Island). This species is distributed in the High Antarctic zone, the Antarctic Peninsula, South Orkney Islands, South Sandwich Islands and South Shetland Islands (WÄGELE, 1990c).

## REMARKS

VICENTE & ARNAUD (1974) described the radula of *P. alata* as lacking rachidian teeth. We have confirmed the presence of these teeth, a feature considered primitive by RUDMAN (1972).

## ORDER NOTASPIDEA FISCHER, 1883

*Bathyberthella antarctica* WILLAN & BERTSCH, 1987

## MATERIAL

Stn. 219: 1 specimen (137 mm x 75 mm).

## DESCRIPTION (Figs 7-11)

Body oval, with a prominent gill on the right side. Rachis of the gill with 17 branchial lamellae on the upper side and 22 on the lower side. Anus located near the apical tip of the gill (Fig. 7).

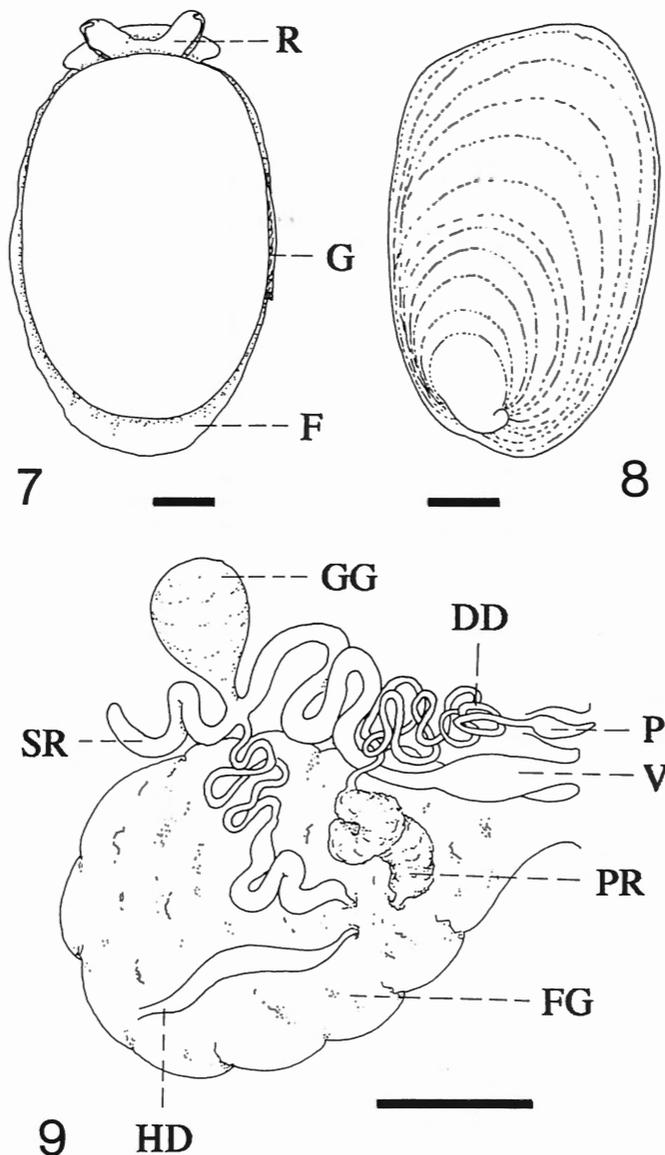
Internal shell (Fig. 8) oval and not calcified (72 mm x 44 mm), covering the visceral mass almost completely. The protoconch is subterminal (Fig. 8). The radular formula is  $75 \times 208.0.208$ . The teeth are long and slender, with the tip sometimes slightly curved (Fig. 10). They become smaller towards the marginal sides. The jaws are elongate and thin (12 mm x 4 mm). They have numerous mandibular elements provided with one to five cusps at their anterior end (Fig. 11).

Reproductive system (Fig. 9) with a hermaphroditic duct in the form of a tubular ampulla; prostate tubular and coiled. Deferent duct long, narrow and coiled. Gametolytic gland spherical and seminal receptacle digitiform.

The anatomical description corresponds to that of GARCÍA *et al.* (1994), WILLAN & BERTSCH (1987) and WÄGELE & WILLAN (1994).

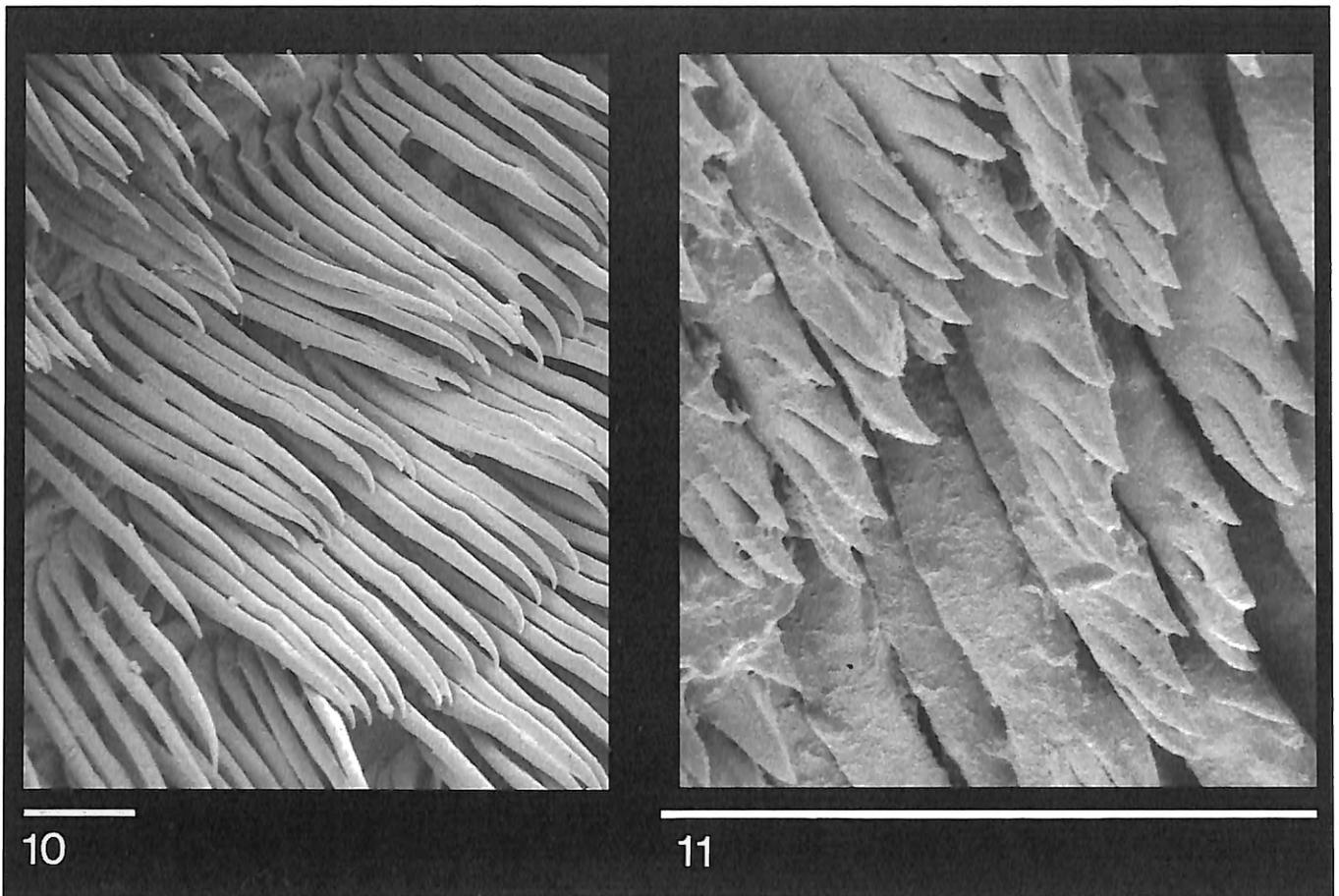
## DISTRIBUTION

*B. antarctica* has been found west of the South Sandwich Islands, and south of South Shetland Islands and South Orkney Islands (WILLAN & BERTSCH, 1987). Since our specimen was collected along the Princess Ragnhild coast, the extension of the distributional area of this species to



Figs 7-9. - *Bathyberthella antarctica*. - 7: External morphology (scale: 20 mm) - 8: dorsal view of the shell (scale: 20 mm) - 9: reproductive system (scale: 5 mm), abbreviations: DD = deferent duct, FG = female gland, GG = gametolytic gland, HD = hermaphroditic duct, P = penis, PR = prostate, SR = seminal receptacle, V = vagina.

the eastern Antarctic waters and towards the south in the High Antarctic zone (WÄGELE & WILLAN, 1994), is confirmed here.



Figs 10-11. – *Bathyberthella antarctica*. - 10: radular teeth (scale: 100  $\mu$ m) - 11: mandibular elements (Scale: 100  $\mu$ m).

ORDER NUDIBRANCHIA BLAINVILLE, 1814

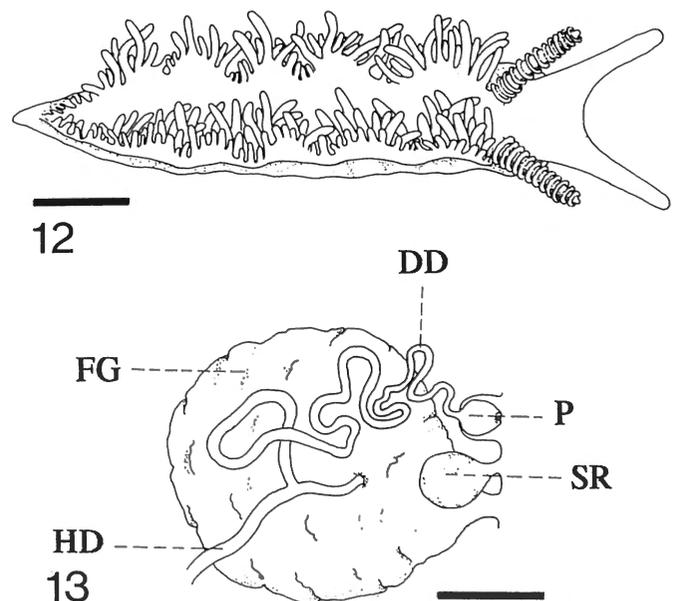
*Notaeolidia gigas* ELIOT, 1905

MATERIAL

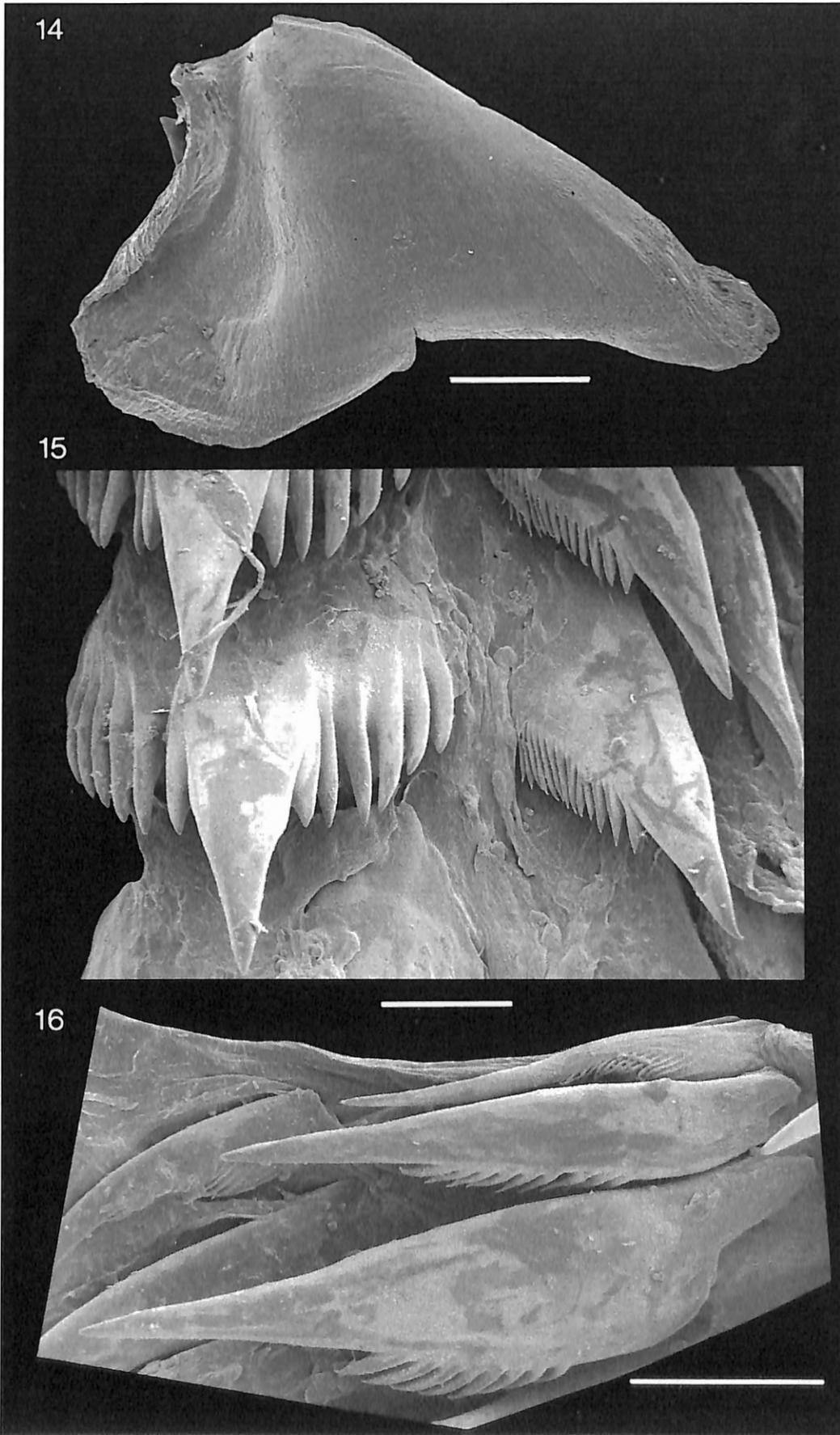
Stn. M11: 1 specimen (80 mm  $\times$  32 mm); Stn. D4: 1 specimen (65 mm  $\times$  26 mm).

DESCRIPTION (Figs 12-16)

Body milky white with about 384 cerata of variable lengths, arranged in 3 to 4 rows on the lateral notal sides. The largest cerata (9-10 mm long) are located in the inner rows, the smaller ones in the outer. Notal sides undulating, each forming five expansions. The cnidosacs are visible in the apex of the longest cerata. Also the branches of the digestive gland are sometimes visible inside the cerata. In one specimen there was a bifid ceras, with a ramification of the digestive gland in each branch. The rhinophores are annulated, with 9 to 13 lamellae (Fig. 12). The radula of the specimen from Stn. M11 was 4 mm  $\times$



Figs 12-13. – *Notaeolidia gigas*. - 12: External morphology (scale: 10 mm) - 13: reproductive system (scale 8 mm), abbreviations as in Fig. 9.



Figs 14-16. – *Notaeolidia gigas*. - 14: Jaw (scale: 1 mm) - 15: central radular teeth (scale: 100  $\mu\text{m}$ ) - 16: lateral radular teeth (Scale 100  $\mu\text{m}$ ).

1 mm. The radula formula is  $18 \times 3-4.1.3-4$ . The rachidian teeth are broad with a strong median cusp and 6 to 9 denticles on each side (Fig. 15). First lateral tooth elongated and triangular, with 8 to 13 denticles on its inner margin; second and third lateral teeth are similar, but more slender and with only 5 to 9 denticles on the inner side; fourth lateral tooth smooth or with few denticles (Fig. 16). The masticatory border of the jaws is smooth (Fig. 14).

Reproductive system (Fig. 13) with a long and coiled deferent duct without a differentiated prostate. Penis, conical and unarmed, covered by a penial sheath. The globular seminal receptacle opens directly to the outside. The anatomical description agrees completely with that of WÄGELE (1990b) and WÄGELE *et al.* (1995).

#### DISTRIBUTION

The genus *Notaeolidia* is endemic in the Antarctic Ocean, where it has a circumpolar distribution. *N. gigas* is only found off the Antarctic Peninsula and the Scotia Arc (WÄGELE, 1991); it was also recorded from Signy Island (WÄGELE *et al.*, 1995). Both specimens reported here were collected in Admiralty Bay (King George Islands).

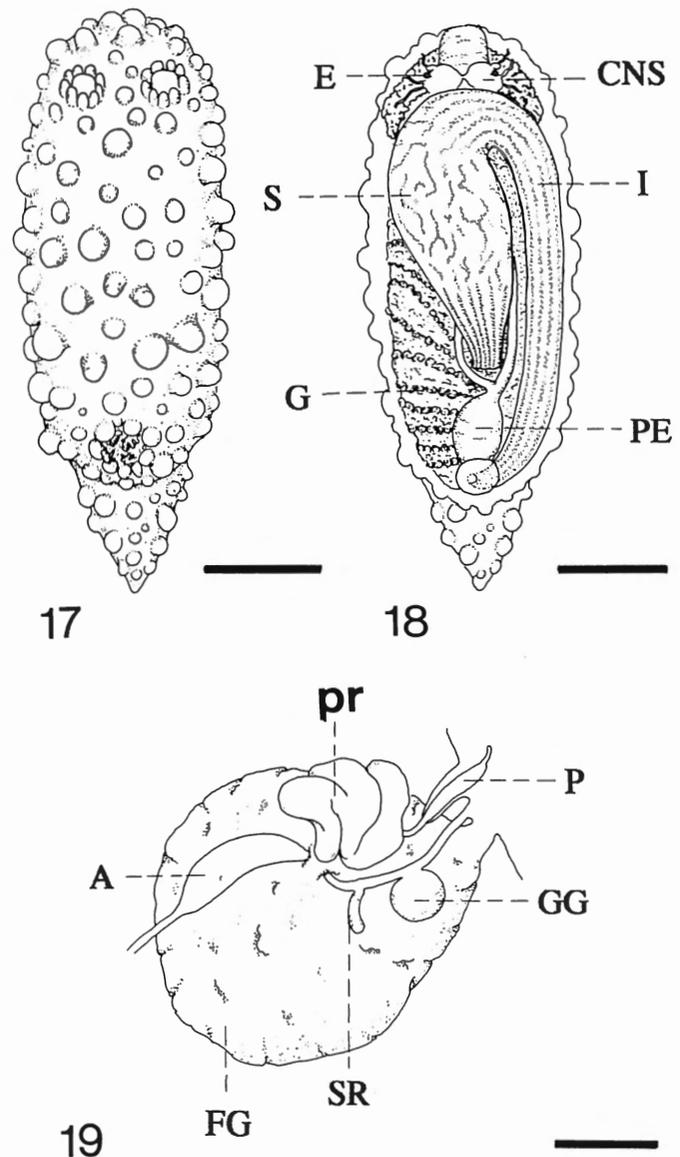
#### *Aegires (Anaegires) albus* THIELE, 1912

#### MATERIAL

Stn. 134: 1 specimen (25 mm  $\times$  5 mm).

#### DESCRIPTION (Figs 17-22)

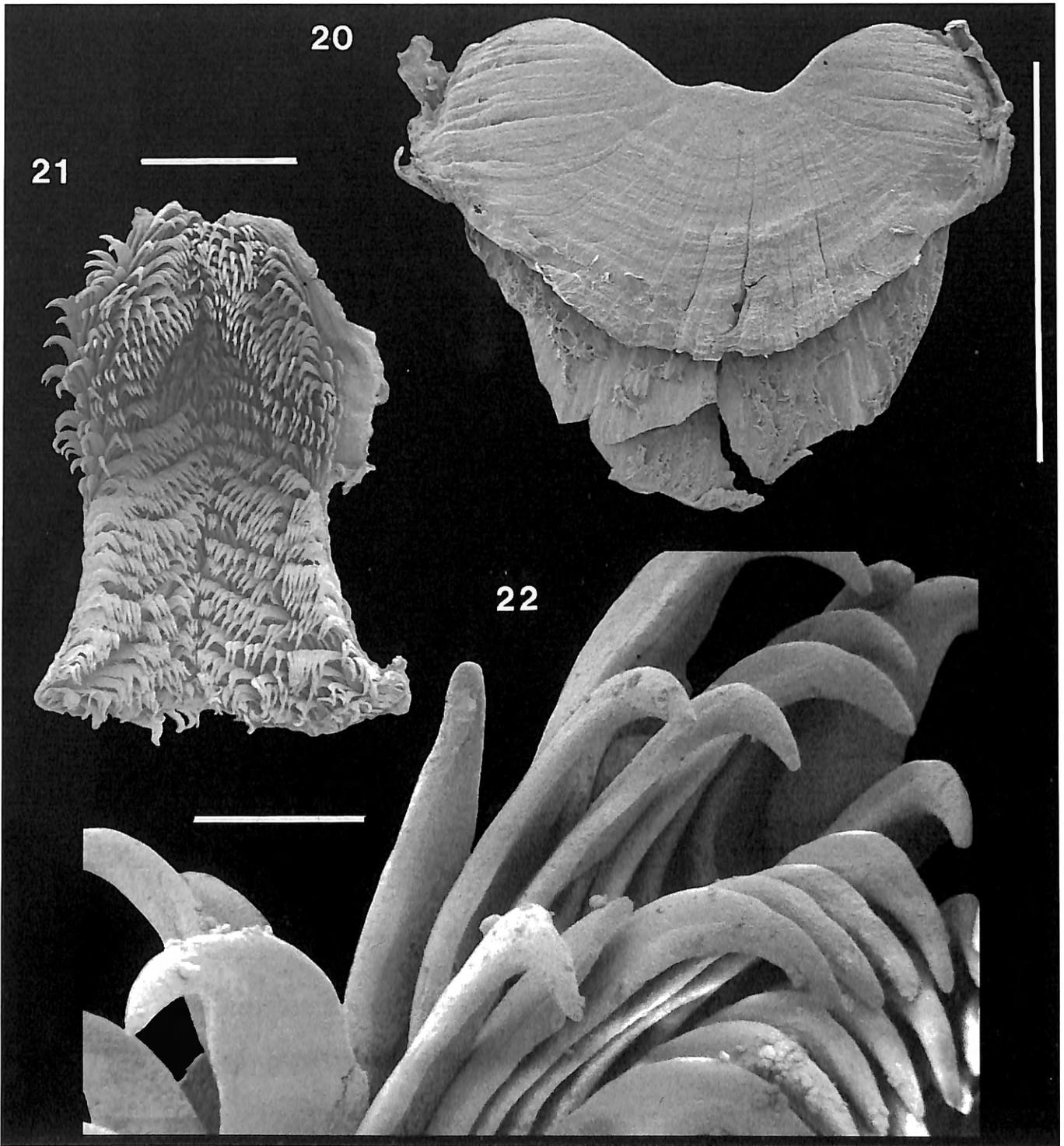
Body colour milky white, with the notum and dorsal surface of the foot covered by conical and cylindrical tubercles of different size (Fig. 17). Notum with a distinct margin. Rhinophores cylindrical, smooth and surrounded by rhinophoral sheaths consisting of 9 tubercles. The branchial circle with its four bipinnate gills is surrounded by tubercles and is located mediodorsally, close to the posterior end of the notum. The renal pore and the anal papilla are situated within the branchial circle (Fig. 17). The situs viscerum is shown in Fig. 18. The jaw is located dorsally in the buccal apparatus; from its concave anterior border protrudes a very weak central process (Fig. 20). The radula is 3.2 mm  $\times$  1.8 mm. The radula formula is  $23 \times 22.0.22$ . All lateral teeth are similar, hook-shaped and smooth (Figs 21-22). The oesophagus is surrounded by the digestive gland and opens into a long stomach. This latter is located dorsally on the digestive gland. The inner wall of its long anterior portion is covered by regular parallel folds, while the walls in the wider posterior portion are irregularly folded. The intestine arises



Figs 17-19. – *Aegires (Anaegires) albus*. - 17: External morphology (scale: 5 mm) - 18: situs viscerum (scale: 5 mm), abbreviations: CNS = central nervous system, E = eye, G = gonad, I = intestine, PE = pericard, S = stomach. - 19: reproductive system (scale: 1 mm), abbreviations as in Fig. 9 but with A = ampulla.

anterolaterally from the stomach and runs posteriorly to the anal papilla (Fig. 18).

The gonad is situated dorsally of the digestive gland (Fig. 18). The collecting ducts and follicles of the gonad are seen all around on the visceral mass. The collecting ducts open into a narrow hermaphroditic duct, which runs anteriorly and opens into a wide, kidney-shaped ampulla (Fig. 19). This latter proceeds anteriorly as the spermoviduct entering the female glandular complex. The deferent duct is nearly completely embedded in a compact prostate gland. Its distal end is short and narrow. The cylindrical penis is surrounded by a thick sheath. It was not possible to see the presence of hooks on the penis (Fig. 19). The cylindrical, slightly curved oviduct has a



Figs 20-22. – *Aegires (Anaegires) albus*. - 20: jaw (scale: 1 mm) - 21: radula (scale: 1 mm) - 22: lateral radular teeth (scale: 100  $\mu$ m).

thin-walled and spherical gametolytic gland. The seminal receptacle appeared directly connected to the oviduct, i.e. without a stalk.

#### DISTRIBUTION

*A. albus* is the only species of this genus from Antarctic waters. The species is confined to the High Antarctic Zone (WÄGELE, 1987b). The present record of the species from the Princess Ragnhild coast is a new record of its distribution in Antarctic waters.

#### REMARKS

*A. albus* is included in the subgenus *Anaegires* because it has a distinct margin around the notum. This feature was used by ODHNER (1934) to differentiate the southern ocean species from those of the northern hemisphere. Originally two species were assigned to this subgenus (*A. albus* THIELE, 1912 and *A. protectus* ODHNER, 1934). Yet, according to WÄGELE (1987a), *A. protectus* is a junior synonym of *A. albus* because the specific characters of the former fall within the morphological variability of *A. albus*.

Externally, our specimen differs in some aspects from *A. albus* as described by WÄGELE (1987a). In WÄGELE's (1987a) material the rhinophoral sheaths consist of only 3 to 5 tubercles, while in our specimen there are 9 tubercles. Moreover, the gills in our specimen are surrounded by tubercles. Internally, WÄGELE's (1987a) *A. albus* has a jaw with a convex anterior margin and a prominent central processus, whereas in our specimen the jaw has a concave anterior margin and only a very weak central processus. WÄGELE (1987a), furthermore, described the radula of *A. albus* as having relatively small first lateral teeth, while in our specimen all teeth are more or less of the same size. Finally, WÄGELE's (1987a) *A. albus* lacks the ampulla between the hermaphroditic duct and the spermiduct, whereas this ampulla is clearly visible in our specimen (Fig. 19).

#### *Austrodoris kerguelensis* BERGH, 1884

#### MATERIAL

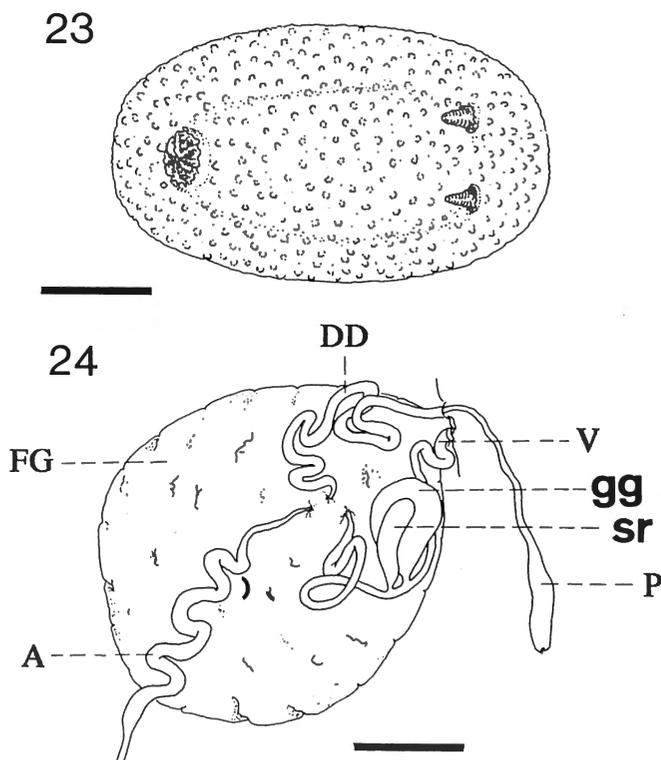
Stn. 134: 1 specimen (8 mm × 4.5 mm); Stn. 233: 2 specimens (112 mm × 68 mm; 85 mm × 59 mm); Stn. 224: 1 specimen (35 mm × 23 mm); Stn. 236: 2 specimens (32 mm × 17 mm; 21 mm × 13 mm); Stn. 219: 2 specimens (60 mm × 40 mm; 20 mm × 9 mm); Stn. 217: 4 specimens (112 mm × 35 mm; 103 mm × 58 mm; 82 mm × 43 mm; 80 mm × 50 mm); Stn. 234: 3 specimens (122 mm × 55 mm; 96 mm × 66 mm; 46 mm × 19 mm).

#### DESCRIPTION (Figs 23-26)

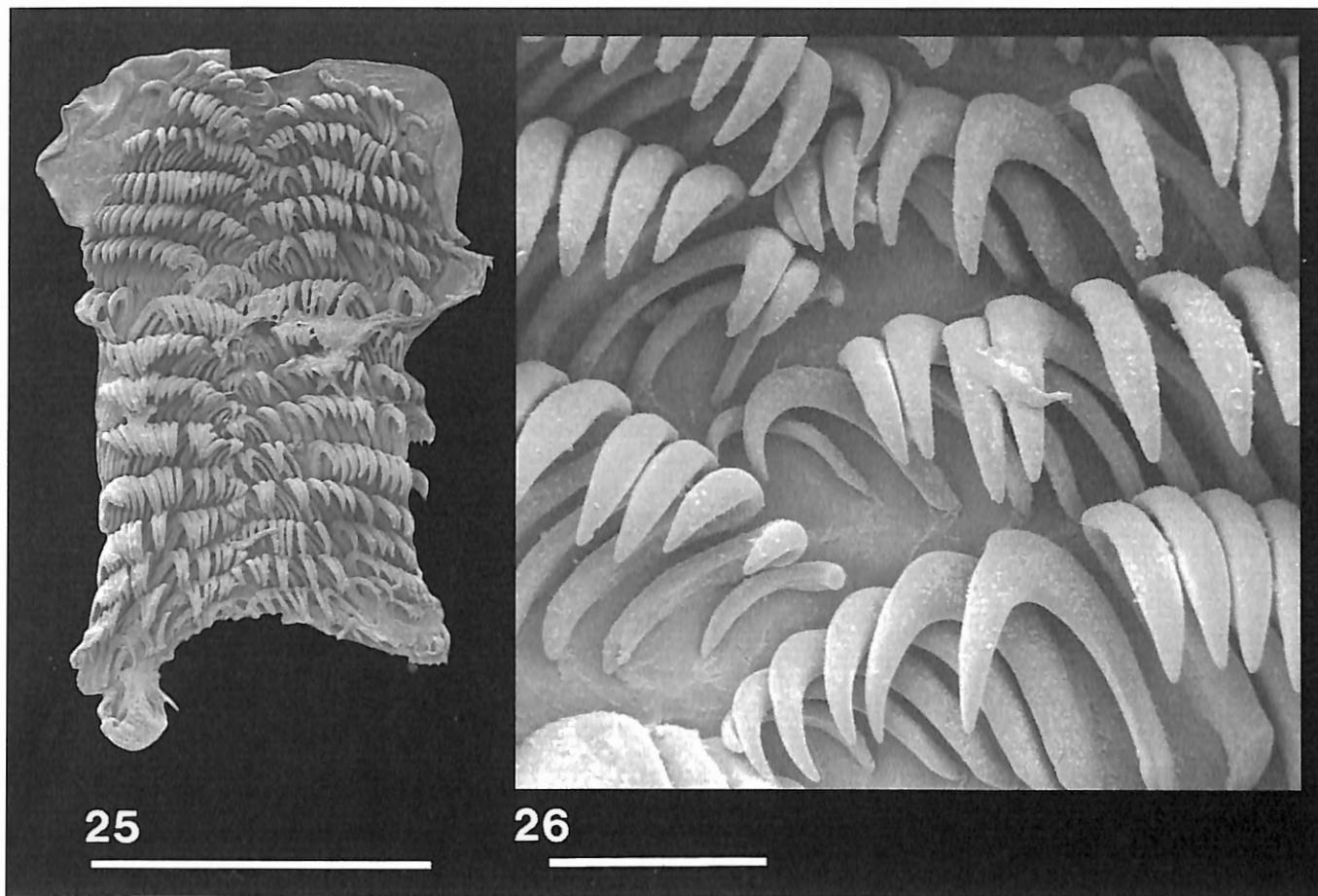
The anatomy of this circumpolar species is well known thanks to the recent descriptions by WÄGELE (1990a) and GARCÍA *et al.* (1993). The anatomy of our specimens agrees with these descriptions. Our specimens are 8 to 122 mm long and 4.5 to 68 mm wide. They have a pale yellow to whitish colour. Tubercles of different size are distributed over the notum (Fig. 23). Spicules were not seen. There are 5 to 9 (usually 7) bi- or tripinnate gills. In one of the specimens of 112 mm long, the radula was 12 mm × 15 mm, while in the smallest specimen it was 1.7 mm × 1 mm. The radula formula is 14 × 18.0.18. All teeth are similar, hook-shaped and smooth (Figs 25-26). The reproductive system (Fig. 24) corresponds to that described by WÄGELE (1990a) and GARCÍA *et al.* (1993). The only notable feature that we have seen is the great size of the unarmed penis: in a specimen of 112 mm long (Stn. 217) it had a length of 82 mm, while the distance between the penial pore and the apex of the protruded penis was 66 mm.

#### DISTRIBUTION

*A. kerguelensis* is widely distributed in the High Antarctic zone and the Subantarctic region. It was also found in Rio de Janeiro (Brazil) at a depth of 740 m, where the water is cold (5 °C) (WÄGELE, 1987b). The specimens collected during the "Mission Iris" constitute a new record of this species in eastern Antarctic waters.



Figs 23-24. — *Austrodoris kerguelensis*. - 23: external morphology (scale: 5 mm) - 24: reproductive system (scale: 10 mm), abbreviations as in Figs 9 and 19.



Figs 25-26. – *Austrodoris kerguelenensis*. - 25: radula (scale: 1 mm) - 26: central radular teeth (scale: 100  $\mu$ m).

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