Abstract

In Antarctica, the knowledge of gastropod fauna in the area between the eastern Weddell Sea and 50°E is very scarce. The present study was carried out based mainly on gastropod specimens collected by the Japanese Antarctic Research Expeditions (JARE), and those stored in National Institute of Polar Research (NIPR) collections. Gastropod specimens were collected from five stations in Breid Bay (depth range 271–310 m) and two stations in Günnerus Bank (depth 280 m and 955 m) with the bottom trawl, and around Syowa Station (0–680 m) with the baited traps, small dredge and by SCUBA diving. Ninety species of 24 families and 44 genera were identified. Among them, seventeen new species and one new subspecies were described. The most diverse family in the present study was the Buccinidae, occupying 19% (17 species) of the total number of species observed. Seventy-eight species were collected in Breid Bay, 12 species in Günnerus Bank and 10 species from around Syowa Station. As for the geographic distribution, 21 species (23.3%) were collected from only the study area, 32 (35.6%) have hitherto been reported from East Antarctica, three species have been reported from West Antarctica, 24 (26.7%) are circum-Antarctic and 10 species (11.1%) occur in both the Antarctic and Subantarctic regions. New information on the bathymetric distribution of the species was obtained. Among the species studied, 83 species (92.2%) have hitherto been reported from the continental shelf to the continental slope.

1. Introduction

The startling contrast between the obvious impoverishment of terrestrial biota and the richness of the marine benthic communities in Antarctica is well known. In particular, in coastal marine area, the density and biomass of benthic organisms are high, attaining a maximum up to about 3 kg/m^2 (GRUZOV *et al*., 1968; PROPP, 1970; DAYTON and OLIVER, 1977; NUMANAMI *et al*., 1986). Such a high biomass of benthic organisms is supported by high primary and secondary productions. The fisheries in the Southern Ocean mainly aim at Antarctic krill, *Euphausia superba*, and some species of fish, but the benthos has never been exploited, although some species of gastropods have potential of fishery resources as appeared in the "FAO Special Identification Sheets for Fishery Purposes for Southern Ocean" (FAO, 1985). Therefore, taxonomical and ecological studies on Southern Ocean Gastropoda are indispensable for future fishery exploitation and preservation of this virgin environment, in addition to systematic zoology.

Since the early twentieth century, a large number of Antarctic prosobranch gastropod species have been reported by many authorities, such as SMITH (1902, 1915), THIELE (1912), POWELL (1951, 1958), ARNAUD (1972a, b), EGOROVA (1982), DELL (1990), HAIN (1990) and others. A long stretch of the shelf of the East Antarctica, about 49°E to 180°, the Antarctic Peninsula and the western Weddell Sea have well been explored by these workers. On the contrary, the only papers published by Japanese malacologists on prosobranch gastropods collected by the Japanese Antarctic Research Expeditions are HORIKOSHI and HOSHIAI (1977, 1978), HORIKOSHI *et al*. (1979), OKUTANI (1986) and NUMANAMI and OKUTANI (1990a, b, 1991a, b, 1992). Consequently, the composition, structure and ecology of gastropod fauna around Syowa Station have been insufficiently clarified.

The present study provides a monograph of the prosobranch gastropods collected in the neighboring waters of the Syowa Station, the research base of Japanese Antarctic Research Expeditions.

2. Historical Review of the Previous Works on the Antarctic Gastropods

The CHALLENGER Expedition (1872-76), which was the first large-scale scientific investigation around Antarctica, enlightened our knowledge of Antarctic fauna. WATSON (1886) published the first monograph of Antarctic gastropods based on the CHALLENGER Expedition material (Table 1), although it was restricted to the Subantarctic Region, such as the Falkland Islands, Kerguelen, the Crozet Islands, the Heard Islands and the Prince Edward Islands. The gastropods of Kerguelen were also studied by SMITH (1879) based on the VENUS Expedition's (1874-1875) material. MARTENS (1904) and THIELE (1904, 1925) described gastropod species from Kerguelen, Amsterdam Island and the Bouvet Islands based on materials of the Deutsche Tiefsee-Expedition (1898-1899). MELVILL and STANDEN (1907, 1912) recorded 94 species of gastropods from the Falkland Islands and the South Orkney Islands on specimens obtained by the Scottish National Antarctic Expedition (1902-1904).

PELSENEER (1903) published a monograph containing 17 species of gastropods collected by the Belgian Antarctic Expedition (1897-1899) which first explored the Antarctic Continental Region, the Antarctic Peninsula and the South Shetland Islands. The gastropod fauna of the Ross Sea in higher latitudinal Antarctic Continental area was first reported by SMITH (1902) based on the British Expedition SOUTHERN CROSS (1898-1900) followed by THIELE (1912) on the Deutsche Südpolar-Expedition (1901-1903) in the Davis Sea. SMITH (1907) studied the gastropod faunae in the Ross Sea and the Macquarie Islands surveyed by the National Antarctic Expedition (DISCOVERY) in 1901-1904 and by the British Antarctic Expedition (1907-1909). Two French Antarctic Expeditions (1903-1905 and 1908-1910) collected gastropod specimens from the Antarctic Peninsula (LAMY, 1905, 1906, 1911; VAYSSIÈRE, 1906a, b, 1917). The first anatomical study of the Antarctic prosobranch gastropods, such as *Trichoconcha mirabilis, Marseniopsis conica* and *Trophon longstaffi*, was carried out by EALES (1923) based on materials collected by the British Antarctic (TERRA NOVA) Expedition.

POWELL (1951) described the gastropod faunae of the Ross Sea, the Antarctic Peninsula, the South Shetland Islands, the South Georgia Islands, Bouvet Island, Marion Island and the Falkland Islands based on extensive collections of the DISCOVERY Expedition (1926-1937). He discussed the zoogeography and bipolarity of the Antarctic Mollusca and gave an overview of the Antarctic and Subantarctic gastropod faunae. He (1957) studied the faunae of Kerguelen and Macquarie Islands based on the same materials,

Table 1. List of expeditions based on which gastropods were studied.

Expedition	Year	Area	Author
H.M.S. CHALLENGER	1873–1876	Falkland Isl., Kerguelen, Crozet Isl., Heard Isl., Prince Edward Isl.	WATSON (1886)
VENUS Expedition	1874–1875	Kerguelen	SMITH (1879)
Belgian Antarctic Expedition	1897–1899	South Shetland Isl., Antarctic Peninsula	PELSENEER (1903)
British Expedition SOUTHERN CROSS	1898–1900	Ross Sea, Macquarie Isl.	SMITH (1902)
Deutsche Tiefsee-Expedition	1898–1899	Kerguelen, Bouvet Isl., Amsterdam Isl.	MARTENS (1904) THIELE (1904, 1925)
Deutsche Südpolar-Expedition	1901–1903	Davis Sea	THIELE (1912)
National Antarctic Expedition (DISCOVERY)	1901–1904	Ross Sea, Macquarie Isl.	SHITH (1907)
Schwedische Südpolar-Expedition	1901–1903	Falkland Isl., South Georgia Isl., Antarctic Peninsula	STREBEL (1908)
Scottish National Antarctic Expedition	1902–1904	Falkland Isl., South Orkney Isl.	MELVILL and STANDEN (1907, 1912)
Expédition Antarctique Française	1903–1905	Antarctic Peninsula	LAMY (1905, 1906) VAYSSIÈRE (1906a, b)
Deuxieme Expédition Antarctique Française	1908–1910	Antarctic Peninsula	LAMY (1911) VAYSSIÈRE (1917)
British Antarctic (TERRA NOVA) Expedition	1910–1913	Ross Sea, Victoria Land, Dates Land	SMITH (1915) EALES (1923)
Australasian Antarctic Expedition	1911–1914	Adélie Land, Davis Sea, Macquarie Islands	HEDLEY (1916a)
DISCOVERY Expedition	1926–1937	Ross Sea, Bouvet, Marion Isl., Falkland Isl., South Georgia Isl., South Shetland Isl., Antarctic Peninsula	POWELL (1951)
British, Australian, New Zealand Antarctic Research (B.A.N.Z.A.R.) Expedition	1929–1931	Ross Sea, Enderby Land, Kerguelen, Macquarie Isl.	POWELL (1957, 1958)
Soviet Antarctic Expeditions	?	Davis Sea	EGOROVA (1982)
Polarstern-Expedition	1983–1984	western Weddell Sea	HAIN (1990)
Japanese Antarctic Research Expeditions	1982–1986	Breid Bay, Günnerus Bank	OKUTANI (1986) NUMANANI and OKUTANI (1990a, b, 1991a, b, 1992)

and he (1958) also reported on the gastropod fauna in Enderby Land, one of the less known areas in the Antarctic continental region, explored by the B.A.N.Z.A.R. Expedition. POWELL (1965) also published on the general biology of the Antarctic Mollusca.

EGOROVA (1982) recorded 94 species of prosobranch gastropods from the Davis Sea based on samples collected by the Soviet Antarctic Expeditions.

Two particularly important works have been published in recent years. The shell-bearing molluscan fauna including 83 prosobranchs of the eastern Weddell Sea, which is another little known area in the Antarctic continental region, were investigated by HAIN (1990) based on samples of the Polarstern-Expedition (1983-1984). The other important work is by DELL (1990), who reported on the molluscan fauna of the Ross Sea, on the basis of materials collected by the DISCOVERY II, USNS ELTANIN, New Zealand Oceanographic Institute, Stanford University, Swedish Southpolar Expedition and Trans-Antarctic (New Zealand) Expedition, from subtidal to the depth of 2900 m. Although Antarctic gastropods have been studied by many malacologists, those in the eastern Weddell Sea to about 50°E and the Bellingshausen Sea have rarely been treated.

Japanese Antarctic research became active since the International Geophysical Year (I. G.Y.) in 1956. The main field activities of Japanese Antarctic Research Expeditions (JARE) have been mostly concentrated in the neighborhood of Syowa Station (69°00′S, 39° 35′E). However, only a few papers on gastropods collected by the JARE have been made public by Japanese malacologists. HORIKOSHI and HOSHIAI (1978) investigated variability of *Neobuccinum eatoni* collected near Syowa Station. The gastropod fauna near Syowa Station was first reported by HORIKOSHI *et al*. (1979) based on the JARE samples. The fauna comprised nine species in five families. OKUTANI (1986) reported seven species of prosobranch gastropods from Breid Bay, and briefly discussed the characteristics of the molluscan fauna of this area. NUMANAMI and OKUTANI (1990a, b, 1991a, b) described nine species of prosobranch gastropods from Breid Bay, Günnerus Bank and near Syowa Station, including one new subgenus, *Schismospira*, and three new species, *Anatoma shiraseae, Brookula sinusbreidensis* and *Marseniopsis syowaensis*. They (1992) also reported 16 species of 10 genera and five families of the Order Archaeogastropoda from Breid Bay and Günnerus Bank.

Besides JARE, HORIKOSHI and HOSHIAI (1977) recorded 14 gastropod species from South Georgia Island. MURANO *et al*. (1982) recorded benthic animals in the vicinity of Balleny Islands containing one species of prosobranch Gastropoda, which were collected by the T. V. UMITAKA-MARU, Tokyo University of Fisheries.

3. Materials and Methods

The present study was based on gastropod specimens chiefly collected by the Japanese Antarctic Research Expeditions (JARE), and those stored in National Institute of Polar Research (NIPR) collections.

3.1. Collecting areas and sampling methods

(1) Beam-trawl (Fig. 1): A beam-trawl (2 m in width) was towed by the icebreaker SHIRASE at seven stations in Breid Bay and Günnerus Bank in February 1984, from December 1984 to February 1985, and from December 1985 to February 1986.

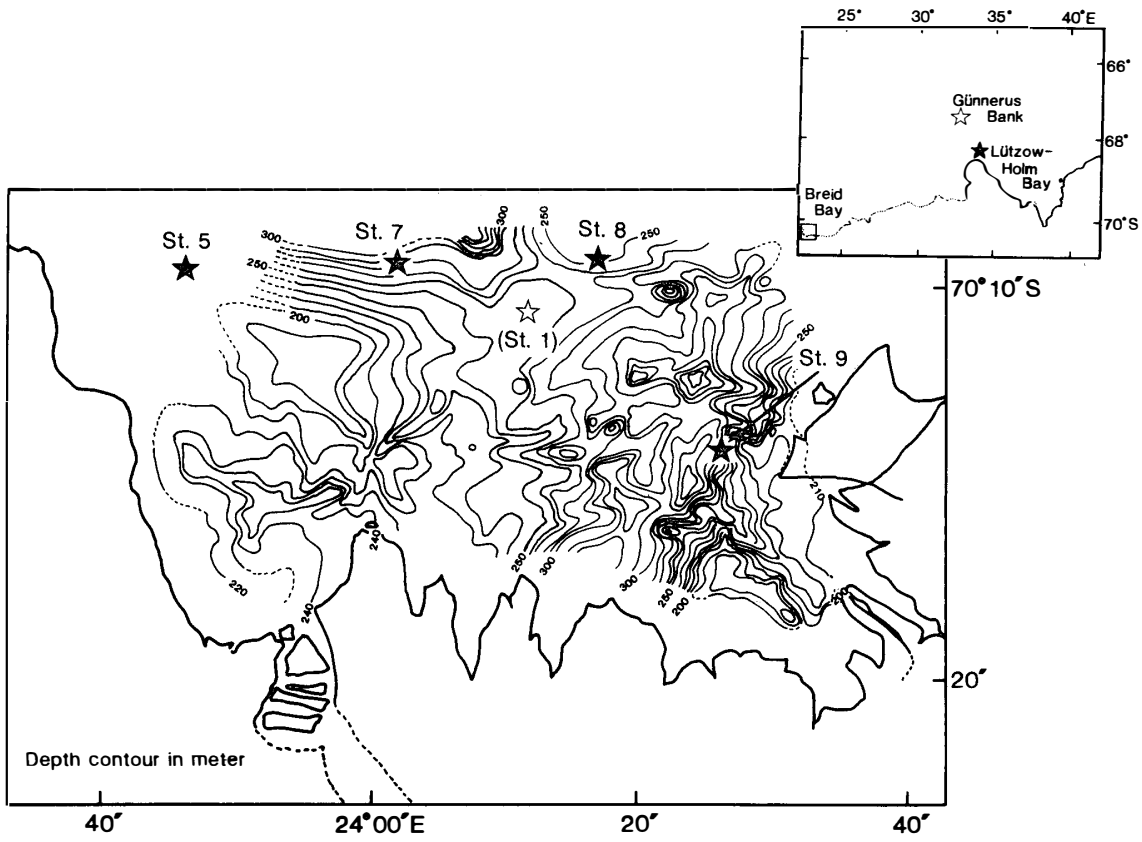


Fig. 1. Trawling sites (stars) in Breid Bay and Günnerus Bank by the icebreaker SHIRASE (black stars, December 1984 to February 1985; white stars, December 1985 to February 1986).

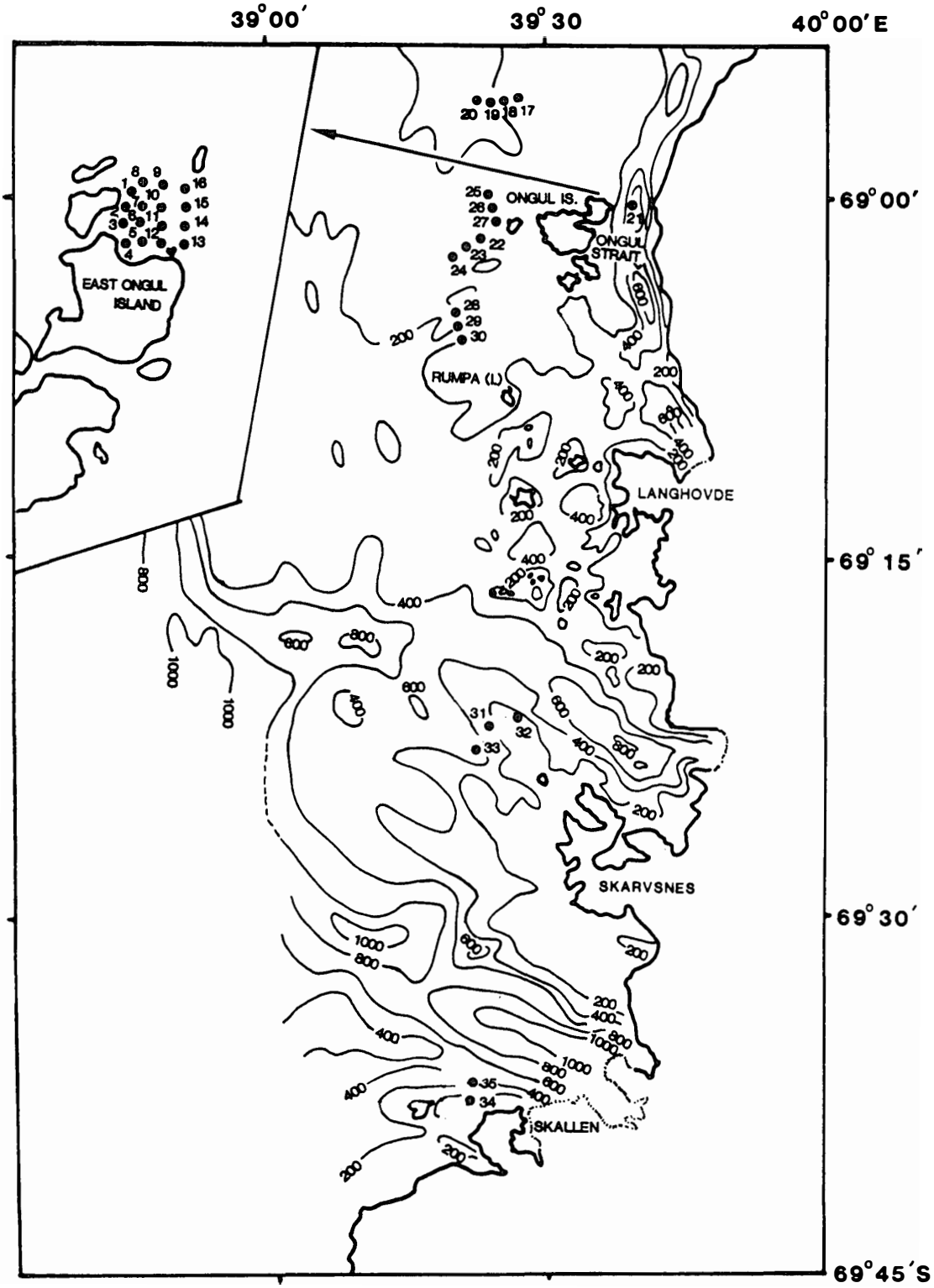


Fig. 2. The baited trap sampling stations in the northeastern part of Lützow-Holm Bay.

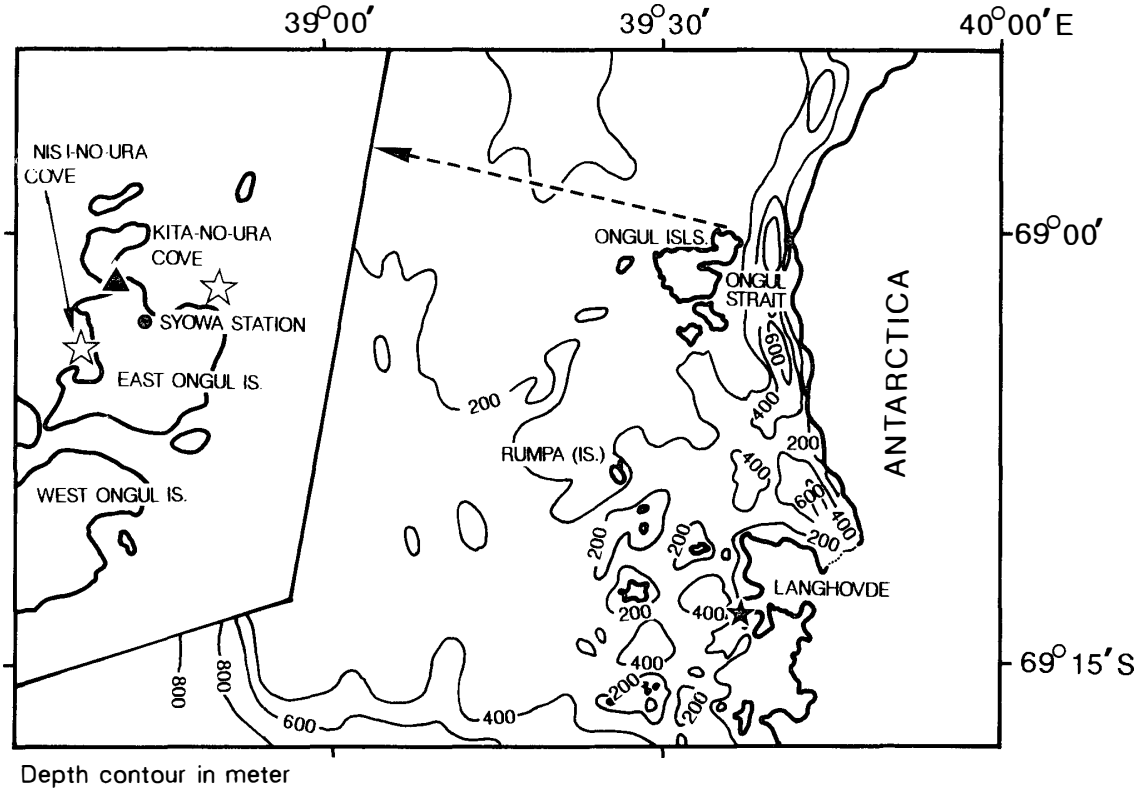


Fig. 3. SCUBA diving (white stars), small dredge sampling (black star) and baited trap sampling (triangle) sites near Syowa Station and Langhovde.

Table 2. Collecting stations of Japanese Antarctic Research Expeditions.

Area	Gear	St.	Date	Lat. S	Long. E	Depth (m)
Breid Bay	Beam trawl	7	27-XII-'84	70°09.1′	24°01.9′	295–310
		8	29-XII-'84	70°08.5′	24°16.8′	270
		5	8-II-'85	70°09.0′	23°46.3′	275–283
		9	10-II-'85	70°13.7′	24°25.7′	276–289
		(1)	27-XII-'85	70°10.8′	24°11.4′	270
Günnerus Bank	Beam trawl	—	25-II-'85	68°23.5′	34°07.5′	281–282
		(7)	19-II-'86	67°30.3′	32°59.2′	955
Kita-no-ura Cove	SCUBA	—	28-I-'81	69°00.1′	39°37.0′	10
Nisi-no-ura Cove	SCUBA	—	18-I-'81	69°00.2′	39°34.2′	8
Langhovde	Small dredge	—	27-I-'89	69°14.5′	39°40.0′	*ca.* 5

(2) Baited trap: The baited trap sampling was performed in the northeastern part of Lützow-Holm Bay, within an area 75 km north-south by 15 km east-west, from May to September 1980 (Fig. 2). Another baited trap sampling was also made in the Kita-no-seto Strait, East Ongul Island, in June 1983 (Fig. 3). Size and structure of the baited trap of the former sampling was shown in NAITO and IWAMI (1982). And that of the latter sampling was shown in HOSHIAI (1978).

(3) SCUBA diving (Fig. 3): SCUBA diving sampling was done near Syowa Station, East Ongul Island, in January 1981 (NAKAJIMA *et al.*, 1982).

Table 3. The date and depth of bated trap sampling stations in Lützow-Holm Bay area.

St. no.	Depth (m)	Date (1980)	St. no.	Depth (m)	Date (1980)
1	42.5	May 6-10	19	164	July 3-10
2	21.0	May 6-10	20	123	July 3-10
3	43.0	May 6-10	21	680	July 12-16
4	22.5	May 6-10	22	89	July 22-29
5	20.5	June 11-17	23	69	July 22-29
6	23.0	June 7-16	24	182	July 22-29
7	55.0	June 7-16	25	147	Aug. 3-12
8	72	June 5-15	26	163	Aug. 3-12
9	47.0	June 19-24	27	73	Aug. 3-12
10	51	June 19-24	28	220	no date
11	31.5	June 19-24	29	127	Aug. 12-16
12	29.0	June 19-24	30	168	Aug. 12-16
13	17.0	June 26-30	31	450	Sept. 3- 7
14	33.0	June 26-30	32	83	Sept. 3- 5
15	18.0	June 26-30	33	307	Sept. 6- 8
16	34.0	June 26-30	34	316	Sept. 10-13
17	128	July 2- 6	35	840	Sept. 12-14
18	143	no date			

(4) Small dredge (Fig. 3): Sampling with a small dredge was done in the nearshore water off Langhovde in January 1989.

The dates, positions, and depths of all samplings are shown in Tables 2 and 3.

3.2. Preservation

Specimens collected with a beam-trawl were all frozen at about −20°C aboard the icebreaker SHIRASE. After being brought back to the laboratory of the National Institute of Polar Research, they were thawed and transferred into 70% ethanol. Specimens collected by SCUBA diving were fixed immediately after capture in 70% ethanol at Syowa Station. Dredged specimens were fixed in 10% formalin on the spot, and were transferred into 70% ethanol after they were brought back to the laboratory.

The specimens collected from eastern Lützow-Holm Bay by baited trap were kept in a deep freezer at Syowa Station. After being taken back to the laboratory of National Institute of Polar Research, they were transferred into 70% ethanol after they had been thawed. The Kita-no-seto specimens were fixed in 70% ethanol at Syowa Station immediately after capture.

The specimens of NIPR's collection have been all preserved in 70% ethanol.

3.3. Scanning electron microscope techniques

The preparation of radula for the scanning electron microscope (SEM) observation was performed in the following steps: The radula is 1) extracted from the animal; 2) immersed in KOH solution which is heated by an ethanol lamp; 3) washed in distilled water; 4) cleaned by an ultrasonic cleaner; 5) dehydrated by ethanol series (70%, 80%, 90%, 95% and absolute); 6) dried in air; and 7) mounted on a brass stub by a double-sided tape. The mounted radula was coated with gold and examined with the SEM. When specimens were too small, opercula were easily removed from the animal, washed in

distilled water, and mounted for examination with the SEM. Small shells and protoconchs were washed in 70% ethanol, after being dried, they were mounted for examination with the SEM. When the specimens were covered by debris, they were cleaned by an ultrasonic cleaner. All observations were made by the JEOL model JSM-T20 Scanning Electron Microscope at Tokyo University of Fisheries.

3.4. Terminology and measurements

Terminology used in the present study follows OKUTANI *et al.* (1988) for shell morphology. The shell measurements follows COX (1960) (Fig. 4).

In this study, the following abbreviations are used.

AL : Aperture length
AW : Aperture width
BH : Body height
BL : Body length
BW : Body width
SL : Shell length
SW : Shell width
NIPR A20 : National Institute of Polar Research, Gastropoda Collection
NSMT Mo : National Science Museum Tokyo, Molluscan Collection

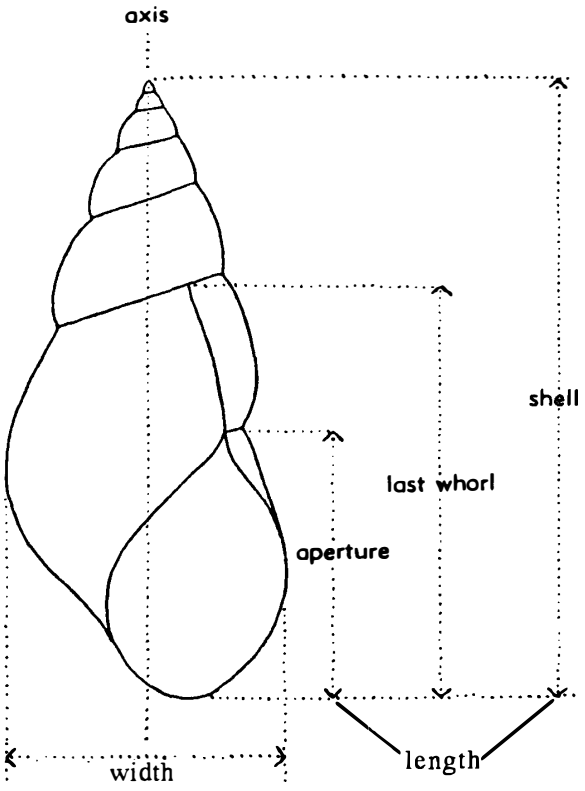


Fig. 4. Measurements of a gastropod shell (followed Cox, 1960).

4. Topographical and Oceanographical Background of the Surveyed Area

Breid Bay is located in East Antarctica, 24°E longitude and 70°S latitude. It is rectangular in shape and measures *ca.* 43 km east-west and *ca.* 19 km north-south, and is 200 to 350 m deep. Breid Bay opens northward, the other three sides are bounded by ice shelves. During summer, Breid Bay is usually ice-free, while the north of the Bay is covered with pack ice (FUKUCHI *et al.*, 1988). The bottom topography and sedimentation in Breid Bay are poorly known. The eastern part of the present study area is deeper than elsewhere (deeper than 300 m) with a channel-like appearance with a steep slope on the east side (Fig. 1). The west area is broader and shallower than the east area, and deepens gently down towards the channel. Gross observation of the material trawled from the study area revealed that the bottom sediment is mainly sponge spicules mixed with mud. According to FUKUCHI *et al.* (1988), the average flow in Breid Bay is 25 cm/s, and the surface flow is westward (OHSHIMA, personal communication). The water temperature and salinity are -1.82 to $+1.79$°C and 34.22 to 34.29‰, respectively, at 200 m deep (IWANAMI and TOHJU, 1987).

Günnerus Ridge forms an outstanding spur projecting into the Indian Ocean from the roughly circular continental margin of the East Antarctic (Fig. 5). It is located at 32°–35° E longitude and 66°–68°30′S latitude. Its southern part shallows toward the south and is named Günnerus Bank. The ridge has a flat top, and is bounded by steep slopes on its eastern and western sides (YOSHIDA *et al.*, 1964; MORIWAKI, 1986). The bottom sediment on Günnerus Ridge has been described by NINO (1958) and SHOJI and SATO (1959). According to NINO (1958), the bottom materials are angular gravels, coarse sand, fine sand and organic remains. The percentage of gravels, sand and mud of the bottom sediment are 7.5–16.5%, 61.9–81.6% and 1.9–30.6%, respectively (SHOJI and SATO, 1959). These gravels were probably transported by iceberg drift, and fine fractions, such as sand and mud, by movement of water masses (SHOJI and SATO, 1959). Gross observation of the material trawled in the study area revealed that the bottom texture is sand with a small amount of gravel. The average flow over Günnerus Ridge has not been observed up to this date. The water temperature and salinity are -0.75°C and 34.45‰ at 250 m deep (IWANAMI and TOHJU, 1987) and 0.11°C and 34.67‰ at 888 m deep (IWANAGA and TOHJU, 1987), respectively.

The bottom topography of the northeastern part of Lützow-Holm Bay has been well studied by geomorphologists of the Japanese Antarctic Research Expeditions (FUJIWARA,

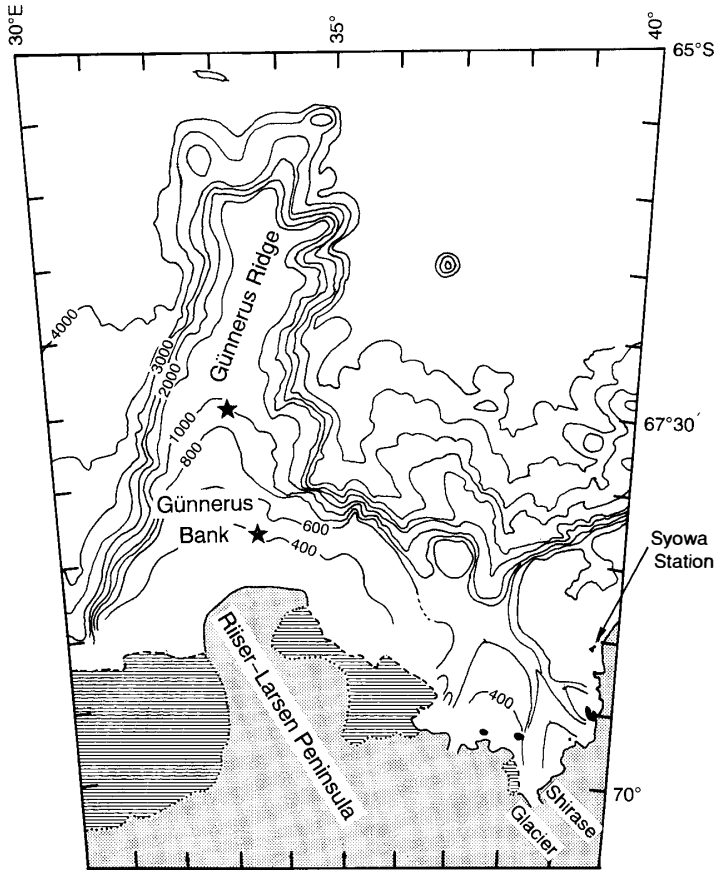


Fig. 5. Submarine topography around the Günnerus Ridge (modified from MORIWAKI *et al.*, 1987). Stars are trawling sites. Depth contour in meter.

1971; MORIWAKI, 1975, 1979; MORIWAKI and YOSHIDA, 1983). The northeastern part of Lützow-Holm Bay has a continental shelf about 60 km wide (FUJIWARA, 1971). On the inner part of the shelf, there is a highly glaciated sea floor with low rises and broad troughs. The coastal region has many narrow glacial channels which are deeper than the broad trough (Fig. 2) (FUJIWARA, 1971). These channels are not connected with the deep sea ocean in the north but are isolated like a basin.

According to FUJIWARA (1971), Kita-no-ura Cove is characterized by shallow depths, mostly shallower than 50 m, with a gentle slope and shallow basin with rocky floors. Nisi-no-ura Cove is also characterized by shallow depths with a gentle slope (MORIWAKI, 1979). The bottom substratum of Nisi-no-ura Cove is sandy with sporadic outcrops of rocks, while that of Kita-no-ura Cove is composed of stable rocks and large stones (NAKAJIMA *et al.*, 1982). The northeastern part of Lützow-Holm Bay is usually covered with fast ice of 1 to 4 m thick, throughout the year. In limited inshore areas, such as Nisi-no-ura Cove and Langhovde, the action of ice scour takes place in spring and summer. OHSHIMA *et al.* (1993) reported that the average flow in Ongul Strait, near Syowa Station, is 30 cm/s, and the direction of the mean current changes from southward to northward in May.

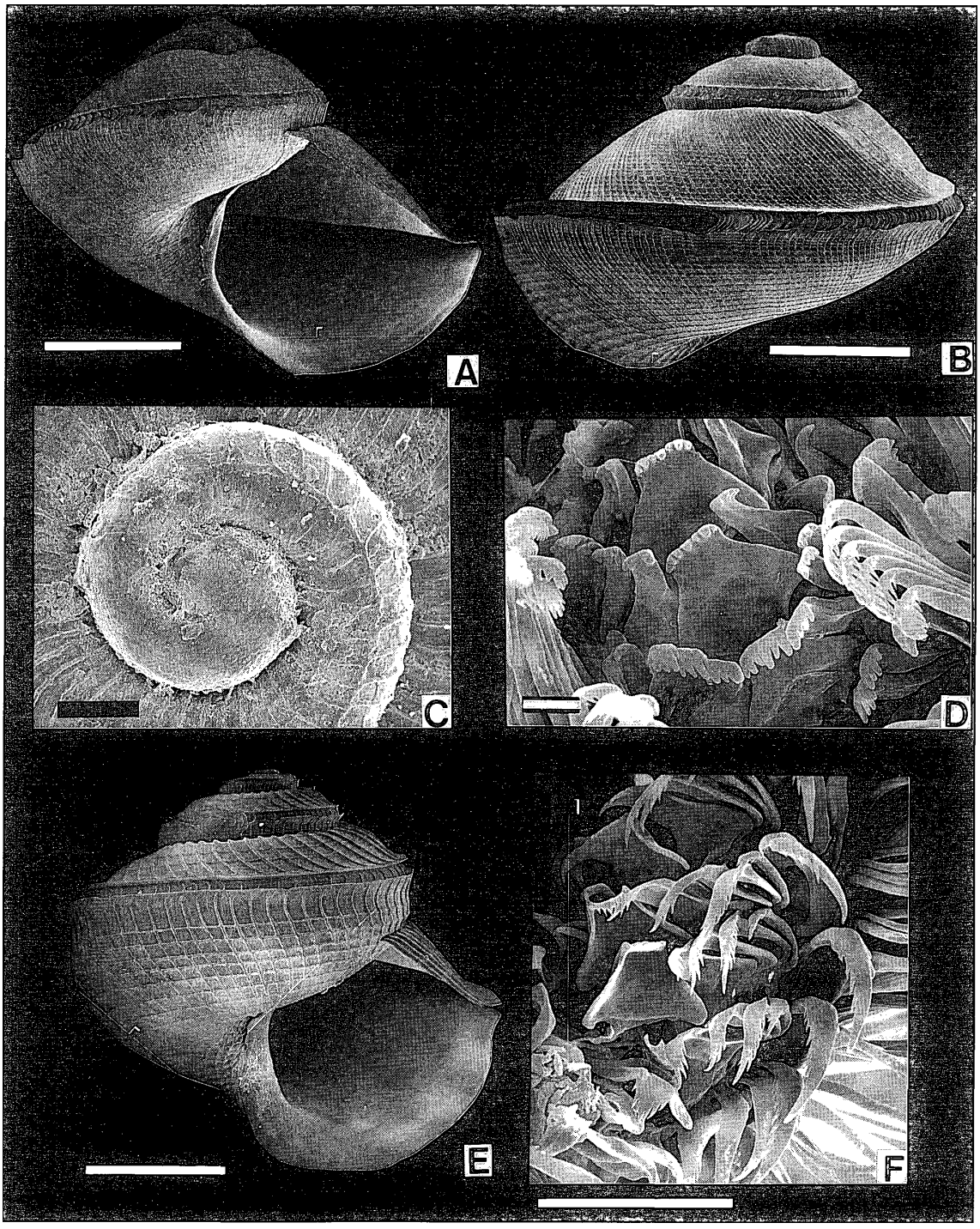
5. Taxonomy

Class Gastropoda
Subclass Prosobranchia
Order Archaeogastropoda
Family SCISSURELLIDAE GRAY, 1847
Genus *Anatoma* WOODWARD, 1859
Type species: *Scissurella crispata* FLEMING, 1818

Anatoma euglypta (PELSENEER, 1903)

(Figs. 6A–D)

Scissurella euglyptus PELSENEER, 1903, p. 17, pl. 4, fig. 43; MELVILL and STANDEN, 1912, p. 345 (name only); THIELE, 1912, p. 187.
Schizotrochus euglyptus: POWELL, 1951 p. 79; 1958, p. 17. (distribution record); 1960, p. 126 (name only); ARNAUD, 1972b, p. 113 (remarks only); EGOROVA, 1982, p. 11, fig. 72; CANTERA and ARNAUD, 1984, p. 32 (name only).
Anatoma euglyptus: HAIN, 1990, p. 33, pl. 1, fig. 1, pl. 17, fig. l; NUMANAMI and OKUTANI, 1990b, p. 94, figs. 2–5.
Anatoma euglypta: DELL, 1990, p. 75, fig. 129.
Material examined: 4 living specimens and 13 empty shells from St. 5; 1 living specimen and 1 empty shell from St. 7; 1 living specimen and 8 empty shells from St. 8; 2 empty shells from St. 9.
Description: The shell is very small in size, low biconic, thin, fragile, translucently white in color with well inflated whorls (Figs. 6A, B). The protoconch is about 1.3 in number of turns, 0.25 mm in diameter, white and finely granulated (Fig. 6C). The teleoconch is 4 in number of turns, roundly inflated, and has spiral cords or lirae that are crossed by axial cords creating a cancellated appearance. The suture is strongly impressed, with a convex sutural ramp. A selenizone is encircling the shoulder. The upper whorl is small and depressed. The body whorl is very large with breadth being 110–144% shell length. Inclination and prominency of axial and spiral sculptures are different among those on the sutural ramp, within selenizone and on the base. In the penultimate whorl, about 10 fine regularly spaced, raised spiral lirae are present between the suture and adapical margin of the selenizone. Fine prosocline axial cords on sutural ramp are raised and regularly spaced, about 80 in number on the penultimate whorl. In the sutural ramp, the spiral lirae that are less prominent than the axial ones are crossed by axial cords presenting a



Figs. 6A-F. *Anatoma euglypta* (PELSENEER) and *Anatoma lamellata* (A. ADAMS). A, B. Shell of *A. euglypta*; C. Protoconch of *A. euglypta*; D. Radula of *A. euglypta*; E. Shell of *A. lamellata* (collected from Suruga Bay, *ca.* 250 m deep); F. Radula of *A. lamellata*. Scale A, B, E=1 mm; C, D=100 μm; F=50 μm.

reticulated appearance. The upper edge of selenizone is recurved upwards and sharply edged. The selenizone comes to an appearance from the end of the first turn of teleoconch, widely channeled, and has conspicuously raised, opisthocyrt axial riblets which disaccord with axial cords above and below. The base is roundly inflated, and has about 30 regularly spaced spiral cords crossing with about 150 axial cords which are regularly spaced, but narrowing interspaces towards the umbilicus. Both spiral and axial cords are flat-topped and equal in prominency, thus they represent a grid-like appearance. The umbilicus is narrow but deep. The aperture is almost oval and the peristome is very thin and interrupted by slit. The upper part of the outer lip exceeds the lower part, and an obtuse angle is present near the slit. The lower part of the outer lip is round and smooth. The inner lip is round with a thin callus that is slightly expanded outwardly. The columellar lip is nearly straight and reflected over the umbilicus. The basal lip is round and reflected. The slit is extended backwards in about 1/3 of the entire circumference of the body whorl. The inner wall of aperture is smooth and glossy white in color.

The operculum is corneous, circular, concave, translucent, multispiral and slightly small to the aperture in size.

The animal is pale orange or pale pink in color, but the pedal sole is white. The animal has a pair of digitate, short and stout cephalic tentacles, with large and elliptical eyes on basal outside. Four finger-shaped epipodial tentacles are present on both sides. The foot is large and quadrilateral in outline. The proboscis is short and wide.

The radula is rhipidoglossate, with a formula 33 : 5 : 1 : 5 : 33 (Fig. 6D). The rha-

Table 4. Measurements and condition of *Anatoma euglypta* (PELSENEER).

No.	1	2	3	4	5	6	7	8	9	10
St.	5	5	5	5	5	5	5	5	5	5
SL (mm)	1.7	2.0	2.6	2.9	2.3	1.3	1.8	2.0	1.3	1.3
SW (mm)	2.3	2.2	3.5	3.6	2.9	1.8	2.1	2.3	1.6	1.6
SW/SL (%)	135.3	110.0	134.6	124.1	126.1	138.5	116.7	115.0	123.1	123.1
Condition	L	L	F	F	F	F	L	F	F	F

No.	11	12	13	14	15	16	17	18	19	20
St.	5	5	5	5	5	5	7	7	8	8
SL (mm)	1.2	1.7	1.0	1.3	—	—	1.6	2.7	3.0	1.7
SW (mm)	1.6	2.1	1.4	1.7	—	—	2.2	3.8	4.0	2.3
SW/SL (%)	133.3	123.5	140.0	130.8	—	—	137.5	140.7	133.3	135.3
Condition	F	F	F	F	L	E	L	F	F	F

No.	21	22	23	24	25	26	27	28	29
St.	8	8	8	8	8	8	8	9	9
SL (mm)	2.5	2.5	2.1	2.7	—	—	—	2.7	1.7
SW (mm)	3.5	3.1	2.9	3.4	—	—	—	3.9	2.0
SW/SL (%)	140.0	124.0	138.1	125.9	—	—	—	144.4	117.6
Condition	F	L	F	F	E	E	E	F	F

E: Empty and water-worn specimen; F: Freshly dead specimen; L: Specimen taken alive.

chidian tooth is rhombic in outline with large triangular lateral wings on both sides. It has a nearly straight top with a single large central cusp and 3 blunt denticles on each side. The lateral teeth progressively decrease in width outwardly. The first to third have a large triangular central and 2 to 3 lateral denticles that become larger and stronger outwardly. The fourth is simple sickle-shaped, shorter and weaker than the others. The fifth is longer and narrower than the others, and has a narrow oblong lateral wing on basal outside, a large triangular central cusp and 4 large denticles on lateral inside and 3 small ones outside. The inner marginal teeth are long and stout, and have a large and long central cusp with 5 denticles on lateral inside and 4 outside. These denticles are equal in prominency. The outer marginal teeth are slender and weak with a curved spatulate tip which has numerous fine denticles.

Measurements: See Table 4.

Previous distribution records (Fig. 7): Type locality: West Antarctica, circa 70°S, 83–87°W. Range: Burdwood Bank, 56 fathoms (MELVILL and STANDEN, 1912); Gauss Station, Davis Sea (THIELE, 1912); South Georgia, 155–178 m and Palmer Archipelago, 93–130 m (POWELL, 1951); off Enderby Land, 220–300 m and off Adélie Land, 640 m

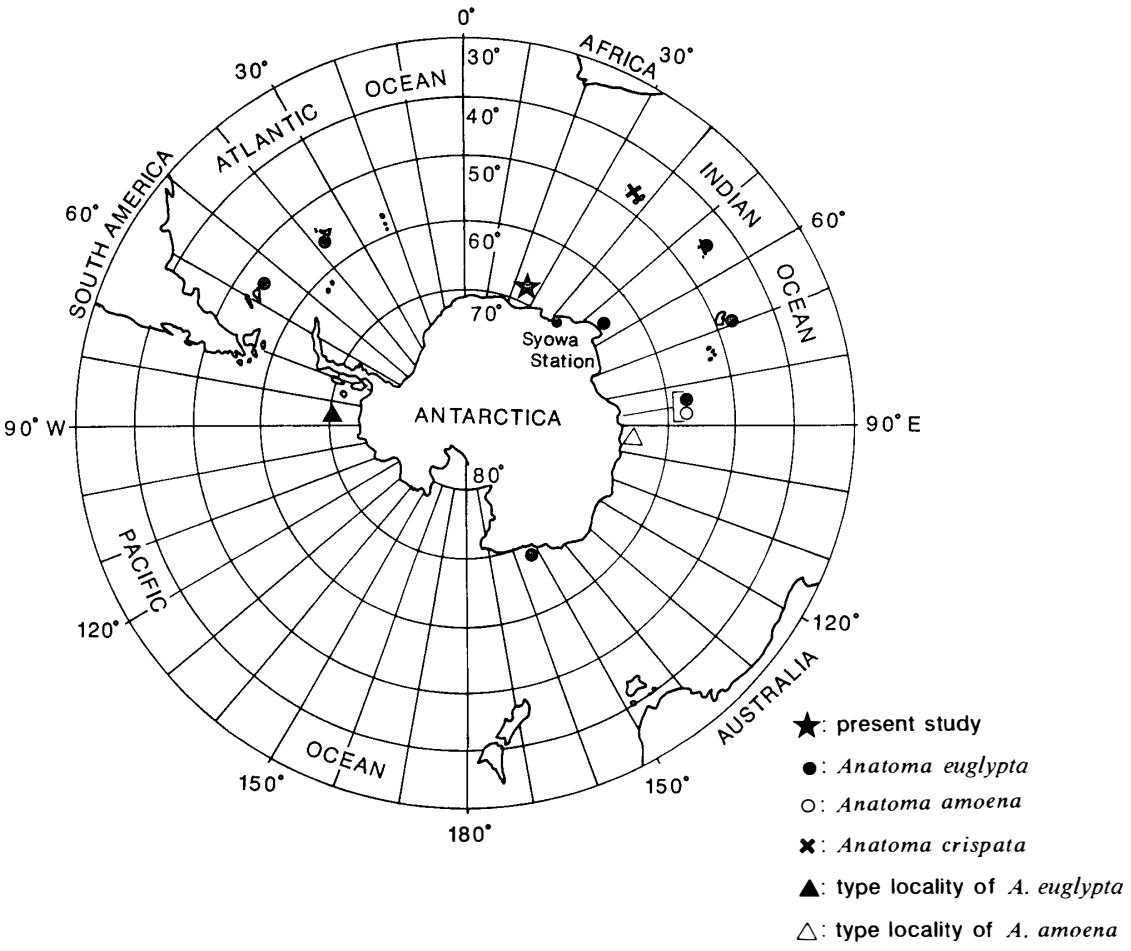


Fig. 7. Distributions of *Anatoma euglypta* (PELSENEER) with *A. "crispata"* FLEMING by WATSON (1886) and *A. amoena* (THIELE).

(POWELL, 1958); off Adelie Land (ARNAUD, 1972b); Davis Sea (EGOROVA, 1982); Crozet Islands, 190–375 m and Kerguelen, 1218 m (CANTERA and ARNAUD, 1984); Cape Horn, South America, 115 m (DELL, 1990); west of Antarctic Peninsula, 421 m (DELL, 1990); South Shetland Islands, 110–426 m (DELL, 1990); Elephant Island, 300 m (DELL, 1990); Budd Coast (66°21′54″S, 110°29′50″E), 293–329 m (DELL, 1990); Bransfield Strait, Antarctic Peninsula, 210–220 m (DELL, 1990); east of South Orkny Islands, 631–641 m (DELL, 1990); Weddell Sea, 229–384 m (DELL, 1990); Marguerite Bay, west of Antarctic Peninsula, 64 m (DELL, 1990); Davis Sea, 80 m (DELL, 1990); Ross Sea, 122–870 m (DELL, 1990); eastern Weddell Sea, 60–1218 m (HAIN, 1990); Breid Bay, 270–310 m (NUMANAMI and OKUTANI, 1990b).

Remarks: Some recent authors erroneously use *Schizotrochus* MONTERSATO, 1877, an objective synonym of *Anatoma* WOODWARD, 1859. While, other workers maintains *Anatoma* as a subgenus of *Scissurella* d'ORBIGNY, 1824 (*e.g.* KEEN, 1960; MCLEAN, 1967; ABBOTT, 1974; BATTEN, 1975; YARON 1983). But, *Scissurella* is different from *Anatoma* in following characters: 1) Minute shell (about 1.0 mm in SW) with round and depressed turbiniform; 2) short and narrow slit located on the shoulder of body whorl; and 3) protoconch with axial ridges. The central cusp of rhachidian tooth of the former genus is only slightly or not larger than the other teeth, and bases of inner lateral teeth are barely expanded laterally, and fifth lateral has a broad, flat cutting edge (HERBERT, 1986). We agree with HABE and KOSUGE (1964), POWELL (1979), HERBERT (1986) and MCLEAN (1989) that it is given a full generic status.

Anatoma euglypta which is the commonest scissurellid in the Antarctic, has wide horizontal and vertical distribution ranges, such as Burdwood Bank to the Antarctic continental shelf, at depth from 100 to 1218 m.

A. euglypta is similar to *A. crispata* (FLEMING, 1832) from North Atlantic and Eastern Pacific. But, the latter species is separable from the former in the following characters: 1) Larger, highly biconic and more inflated shell with round base; 2) shorter selenizone, about 20% of circumference; 3) more rounded aperture; and 4) axial and spiral sculptures of equal in prominency. WATSON (1886) recorded *A. crispata* from the area between Marion and Prince Edward Islands, 100 fathoms, but this record requires a confirmation, as it is believed to be a northern hemisphere species. *A. yaroni* HERBERT, 1986 from southern Africa, is most similar to *A. euglyptus*. But, *A. yaroni* has coarser cancellate sculpture and more depressed and broader aperture. *A. euglypta* can be distinguished from the other Antarctic species of *Anatoma* by its lower shell hight. *A. amoena* (THIELE, 1912) is globose in shape, and has wider selenizone and fewer axial ribs.

The radula of *A. euglypta* is closely allied to those of the other *Anatoma*, such as *A. crispata* (G.O. SARS, 1878; HICKMAN, 1981; MCLEAN, 1989), *A. yaroni* (HERBERT, 1986), and *A. lamellata* (A. ADAMS, 1862) (Fig. 6E, F). However, the rhachidian tooth of *A. crispata* has a more sharply pointed and weaker central cusp and lateral denticles. The rhachidian tooth of *A. yaroni* is wide, and has many small fine denticles. MCLEAN (1989) established the four subfamilies of Scissurellidae, viz. Anatominae, Scissurellinae, Temnocinclinae and Sutilizoninae, by characters of shell, protoconch and radula. According to MCLEAN (1989), radula of species of this subfamily has enlarged fourth lateral tooth. However, illustrations of radula of the other works (G.O. SARS, 1878; HICKMAN, 1981; HERBERT, 1986), including of the present study, the fourth lateral tooth is smaller than the

others, and the fifth lateral is enlarged. But, McLEAN's (1989) subfamilies of Family Scissurellidae are still reasonable, because of differences of other characters.

Anatoma amoena (THIELE, 1912)

(Figs. 8A–E)

Scissurella amoena THIELE, 1912, p. 187, pl. 11, fig. 11.

Schizotrochus amoena: POWELL, 1960, p. 126 (name only); EGOROVA, 1982, p. 11, fig. 71; DELL, 1990, p. 75, fig. 130; HAIN, 1990, p. 33, pl. 10, fig. 5, pl. 28, fig. 7; NUMANAMI and OKUTANI, 1990b, p. 100, figs 9–13.

Material examined: Two empty shells from St. 7.

Description: The shell is very small in size, turbinate, globose, thin, fragile, translucently white in color, with inflated whorls (Figs. 8A–D). The protoconch is about 1.2 in number of turns, 0.16 mm in diameter, white in color with a rough surface (Fig. 8E). The teleoconch is about 3.2 in number of turns, roundly inflated, and has widely and regularly spaced strong axial cords that are crossed by weak spiral lirae representing a cancellated appearance. The suture is strongly constricted, with a convex sutural ramp. A selenizone is encircling the periphery. The body whorl is very large, with breadth being 108–113% shell length. Inclination and prominency of axial sculptures are different from those on the sutural ramp, within selenizone, and the base. In the body whorl about 11 regularly spaced, very fine, but raised spiral lirae are present on the sutural ramp, where about 35 more prominent axial cords overlie spiral lirae. The edge of selenizone is broadly shelved, recurved, sharp and raised. The selenizone comes to an appearance from 1.75 of turns, and is wide, about 17% of height at body whorl, with very fine opisthocyrt axial lirae which disaccord with axial cords above and below. The base is roundly inflated with regularly spaced about 50 axial cords and about 27 spiral lirae. The former tends to narrow interspaces between cords towards the umbilicus. The umbilicus is narrow but deep. The outer margin of aperture is broken with a slit at the middle in examined specimens. The inner lip is round with a thin callus that is expanded outwardly. The columellar lip is long, curved and reflected over the umbilicus. The inner wall is smooth and glossy white in color.

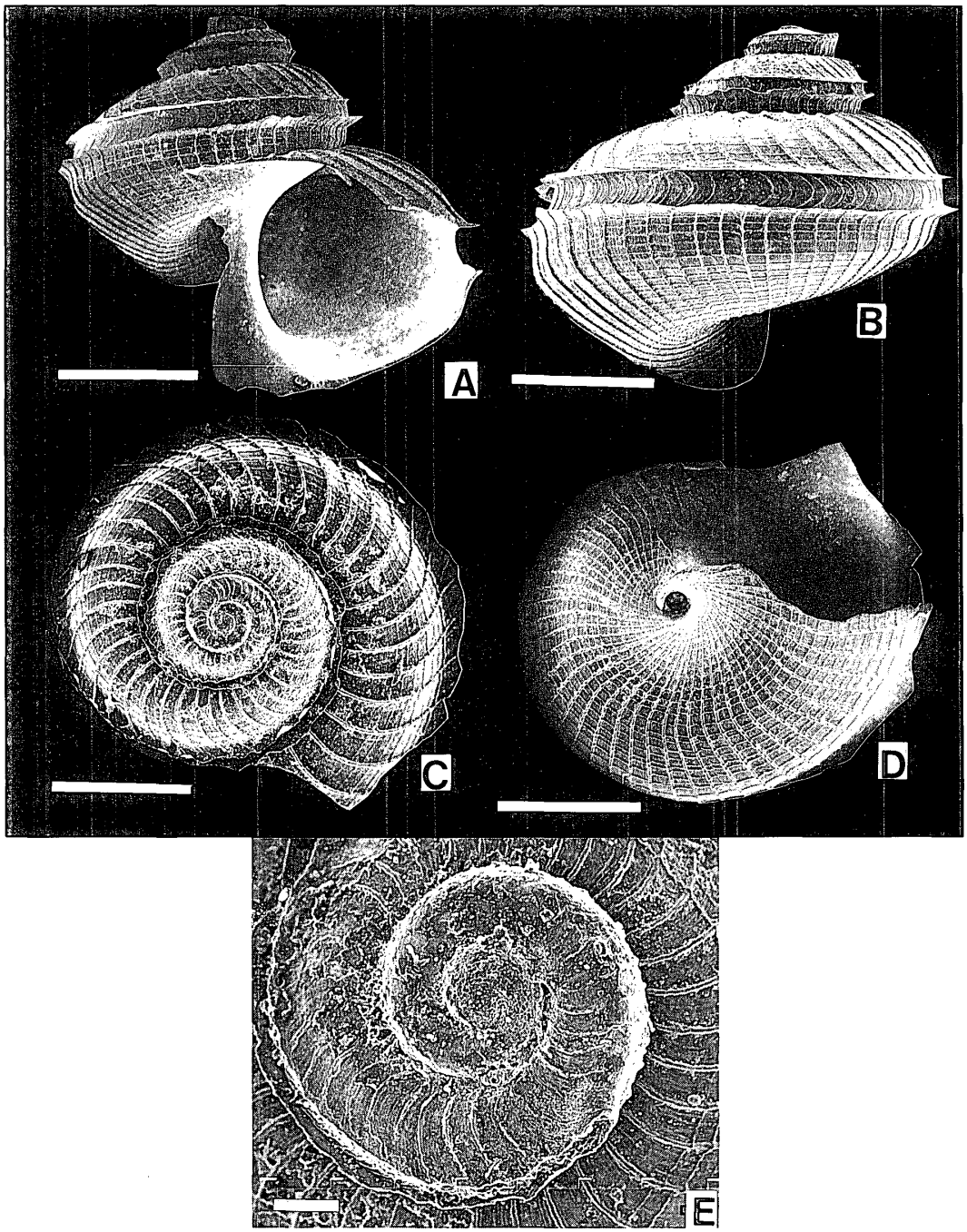
The animal and the operculum are unknown.

Measurements: SL 2.80 mm, SW 3.15 mm.
SL 1.85 mm, SW 2.00 mm.

Previous distribution records (Fig. 8): Type locality: Gauss Station, Davis Sea (THIELE, 1912); Ross Sea, 342–870 m (DELL, 1990); eastern Weddell Sea, 608 m (HAIN, 1990); Bried Bay, 310 m (NUMANAMI and OKUTANI, 1990b).

Remarks: THIELE's (1912) illustration shows numerous straight axial sculpture in the selenizone, but other characters shown by him well agree with those of the present specimens.

Anatoma amoena is similar to *A. lamellata* (A. ADAMS, 1862) from Japan (Fig. 6E), *A. aedonia* (WATSON, 1886) from off Pernambuco, South America and Nightingale Island, Tristan da Cunha, South Africa, and *A. agulhasensis* (THIELE, 1925) from South Africa in having conspicuous axial sculptures on the sutural ramp and the base. *A. agulhasensis* is smaller (2.0–2.5 mm in diameter) and much higher (breadth is 75–90% SL) than *A.*



Figs. 8A–E. *Anatoma amoena* (THIELE).
A–D. Shell; E. Protoconch. Scale A–D = 1 mm; E = 100 μm.

amoena. *A. aedonia* is also smaller (2.3 mm in diameter) and higher (91% of SL). *A. lamellata* is similar in size (3.6 mm in diameter by HABE 1951), but it is distinguishable from *A. amoena* by having a more gently rounded sutural ramp and more inflated base (Fig. 6E).

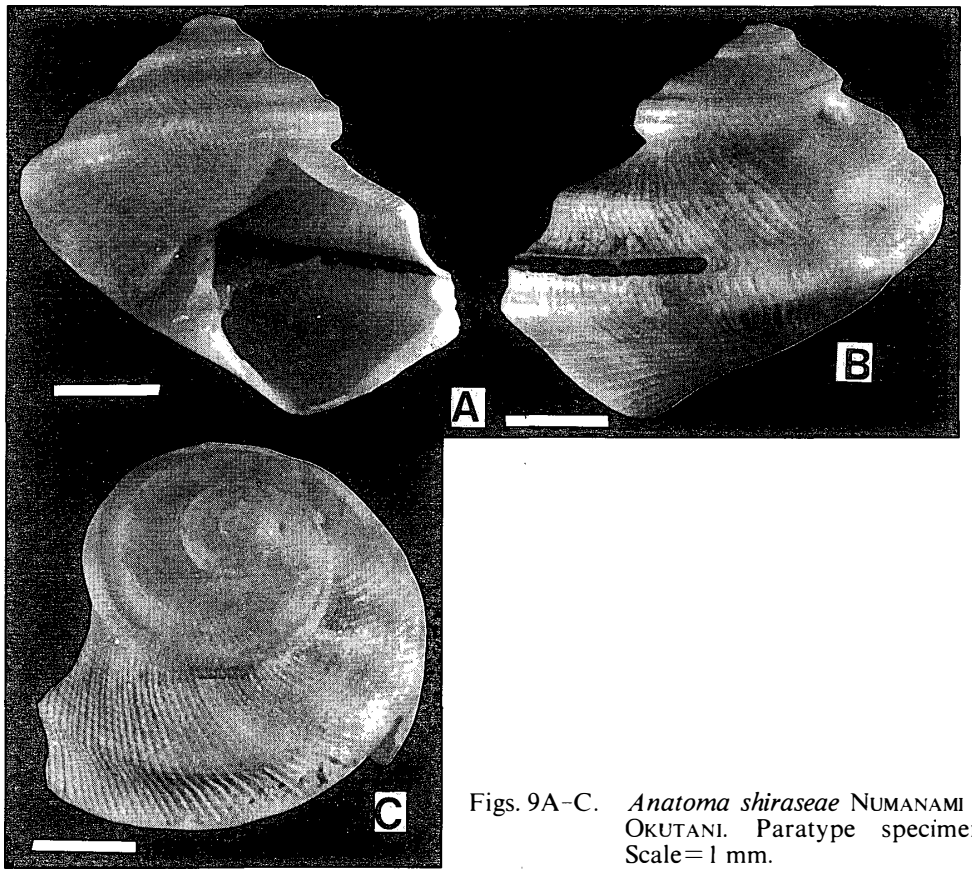
A. amoena is easily distinguishable from the other Antarctic species, *A. euglypta* and *A. shiraseae*, by having more round shell form and stronger axial ribs on the sutural ramp.

Anatoma shiraseae NUMANAMI & OKUTANI, 1990
(Figs. 9A-C)

Anatoma shiraseae NUMANAMI & OKUTANI, 1990, p. 102, figs. 14–16.

Material examined: A single living specimen and 1 empty shell from Günnerus Bank, 282 m.

Description: The shell is small in size, biconic, thin, fragile, with well inflated whorls, and has a single shoulder angle and double peripheral angles (Figs. 9A, B). The surface is semi-glossy white in color with no periostracum. The protoconch is about 1.2 in number of turns, 0.25 mm in diameter, white in color, and has a very finely granulated surface. The teleoconch is about 3.5 in number of turns, roundly inflated, and has axial cords that



Figs. 9A–C. *Anatoma shiraseae* NUMANAMI & OKUTANI. Paratype specimen. Scale=1 mm.

are crossed by weaker spiral cords or lirae representing a cancellated appearance. The suture is weakly constricted. The sutural ramp is wide and has a conspicuous shoulder angle below which is concave. A selenizone is present between two peripheral angles above and below. The upper whorl is small and moderately high. The body whorl is very large, breadth is 109% shell length. Inclination and prominency of axial sculptures are different from those on the sutural ramp, within selenizone, and on the base. In the body whorl, about 21 regularly spaced, fine, raised spiral lirae are present between the suture and adapical edge of selenizone (upper peripheral angle). Axial cords on sutural

ramp are fine, prosocline, raised and regularly spaced, about 95 in number on the body whorl. In the sutural ramp, the axial cords are stronger than the spiral ones. The edges of selenizone are recurved and sharply raised, and very fragile. The selenizone comes to an appearance from 1.75 number of turns, channeled, with opisthocyrt axial riblets which are continuous with axial cords above and below. The base is slightly inflated, and has the angle around the umbilicus. About 29 regularly spaced spiral cords are present on the base crossing with about 115 regularly spaced axial cords. In the base, the axial cords are less prominent than the spiral ones. The umbilicus is hemiomphalous, narrow and deep. The aperture is nearly septagonal, large (AL occupying 63% of SL; AW occupying 58% of SW) with a thin peristome that is interrupted by slit. The upper part of the outer lip exceeds the lower part, and has an obtuse angle (157°) at about upper 1/3. The lower part of the outer lip also has an obtuse angle (119°) against the basal lip. The inner lip is roundly curved with a thin callus, and roundly expanded outwardly. It has a conspicuous corner against the outer lip. The basal lip is shallow V-shaped, and has an obtuse angle (123°) at the bottom of the lip. The columellar lip is short, straight and slightly reflected over the umbilicus. The slit is extended backwards in about 1/3 of the entire circumference of the body whorl. The inner part of aperture is smooth and glossy white in color, but inner lip has a very finely granulated inner wall.

The operculum is very thin, corneous, circular, transparent, multispiral and almost fits to aperture in size.

Measurements:

SL 2.25 mm, SW 3.00 mm (living specimen; aperture broken) (Holotype specimen; NSMT-Mo 69097).

SL 3.86 mm, SW 4.21 mm, AL 2.47 mm, AW 2.45 mm (empty shell) (Paratype specimen; NSMT-Mo 69098).

Remarks: This species is included in the genus *Anatoma* because of having biconic shell form, a long and wide slit which is located in the middle of the apertural lip, and finely granulated protoconch.

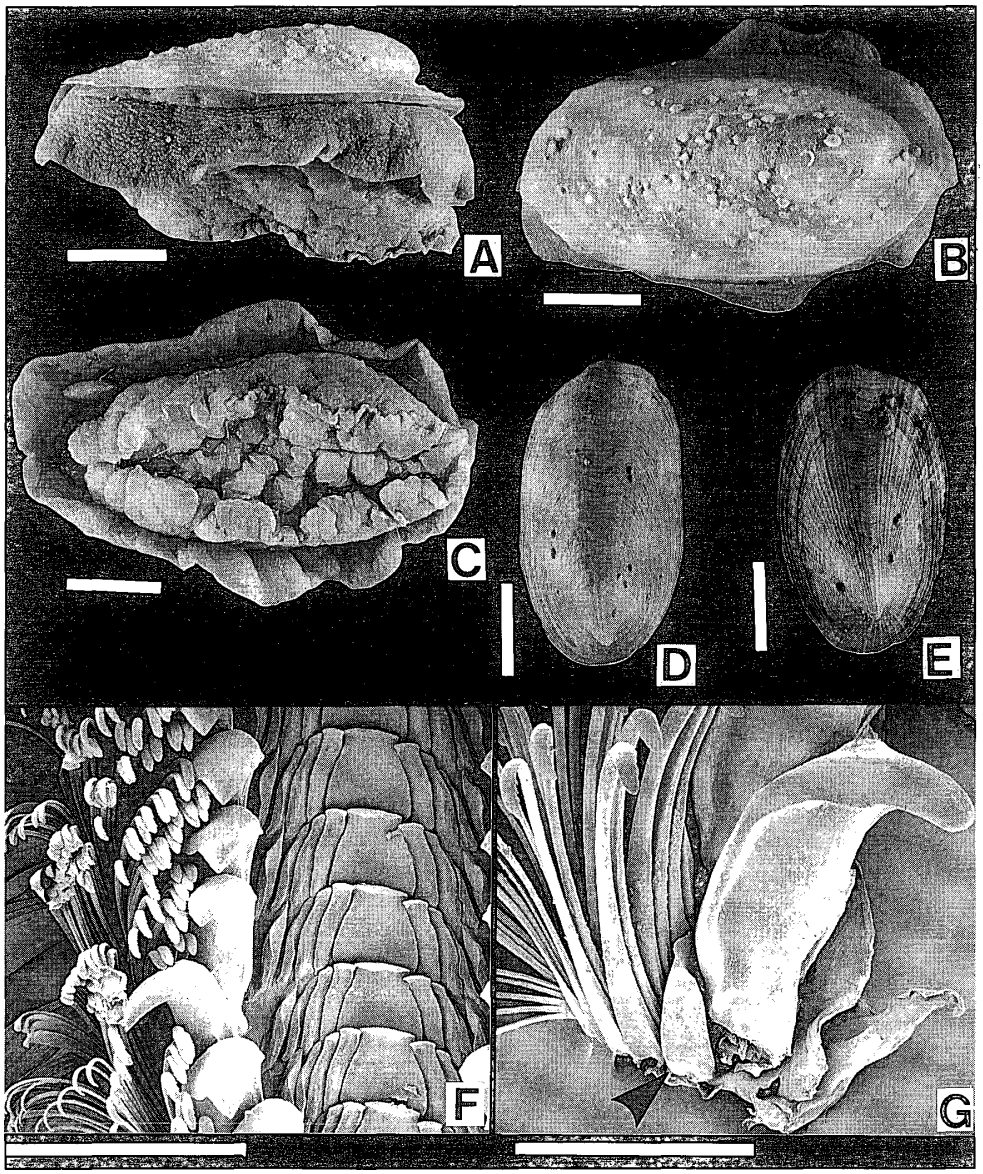
This species can be distinguished from the other Antarctic species of *Anatoma* by possession of rather high biconic shell with conspicuous shoulder and double peripheral angles. *A. amoena* is globose in shape, and has a wide selenizone and few distinct axial ribs on the sutural ramp (Figs. 8A, B). *A. euglypta* is low biconic in shape, and has no shoulder angle on the sutural ramp (Figs. 6A, B).

In the present study, the animal of a single specimen obtained alive was not examined as the shell would have to be destroyed. This species was collected from only Günnerus Bank.

Family FISSURELLIDAE FLEMING, 1822
Genus *Parmaphorella* STREBEL, 1907
Type species: *Tugalia antarctica* STREBEL, 1907 (non MELVILL and STANDEN)

Parmaphorella mawsoni POWELL, 1958
(Figs. 10A-G)

Parmaphorella mawsoni POWELL, 1958, p. 180, pl. 3, fig. 9, text figs. A. 1-3; POWELL, 1960, p. 127 (name only); OKUTANI, 1986, p. 279, pl. 1, figs. 1 and 2 (distribution record).
Parmophoridea mawsoni: DELL, 1990, p. 77, figs. 123 and 124.
Material examined: 2 living specimens and 10 empty shells from St. 5; 6 living specimens



Figs. 10A-G. *Parmaphorella mawsoni* POWELL, 1958. A-C. Animal with shell; D, E. Shell; F, G. Radula. Scale A-E=10 mm; F, G=1 mm. (Arrowhead: Lateromarginal plate)

and 2 empty shells from St. 7; 4 living specimens and 1 empty shell from St. 8.

Description: The shell is elongate-oval patelliform, thin, fragile, porcellaneous white or dirty white in color, with feebly rightwardly inclined apex which is situated at 1/7 posteriorly. The protoconch is slightly buried in the teleoconch, small, about 0.43 mm in diameter, 1.25 in number of turns, grossy white in color, and has a finely granulated surface. External surface of teleoconch has closely set, fine growth lines, which are crossed by widely spaced radial ridges of various prominency presenting a cancellated appearance (Fig. 10B, D, E). The posterior peripheral region is somewhat brim-like, and the anterior region is gently sloped. The distinct siphonal groove terminates in a broad, shallow, anterior emargination. The selenizone curves slightly to the right, somewhat thickened, and has concentric lirae which accord with growth lines. The apertural lip is smooth, thin and fragile, and inner wall immediately inside the aperture has a weak, whitish iridescence. Internal surface is grossy white and smooth. The shell muscle scar is horseshoe-shaped with anterior gape.

The animal is pale reddish-brown in color in a good preserved condition. The mantle is thick, and has a rough surface (Fig. 10A). The mantle edge is pronouncedly undulating. Head is large, about 1/5 of length of the animal, with short and stout cephalic tentacles. The eye on the anterior edge of the eye lobe is black in color, rather small in size. A single pair of the eye lobe on both posterior sides of cephalic tentacles is short, about 1/4 of length of the cephalic tentacle. A penis-like organ, which is attenuate, acuminate, shorter than the eye lobe, curved backwards, is located posterior to the right eye lobe. The proboscis is truncate, short and stout, and has a mamillated tip. The foot is large with an oval sole (Fig. 10C). Twelve small rotund epipodial tentacles are present on both sides of the foot, and progressively decrease in size posteriorly.

The radula is rhipidoglossate, with a formula $\infty : 6 : 1 : 6 : \infty$ in 65 transverse rows (Fig. 10F). The rhachidian tooth is slightly asymmetric, trapezoid, large and wide, and has a round tip which is irregularly rugged. The first and second lateral teeth are oblong narrow and high, and the first is larger than the second and has small round tip. The third and fourth laterals are plate-like, and almost the same in size and in appearance with each other. The fifth lateral is oblong, massive, remarkably larger than the others, and has a wide, stout and blunt central cusp, and a weak, small and round denticle on lateral outside. The lateromarginal plate is small, about one-third of the fifth lateral tooth in length, wedge-shaped, and has a thin and wide interactive plate (Fig. 10G). The marginal teeth are long and slender with a curved, finely denticulated tip.

Measurements: See Table 5.

Previous distribution records (**Fig. 11**): Type locality: off Mackenzie Sea, 540 m (POWELL, 1958). Range: Off Enderby Land and MacRobertson Island, 193–300 m (POWELL, 1958); Breid Bay, 215 m (OKUTANI, 1986); Ross Sea, 344–876 m (DELL, 1990); Weddell Sea, 378 m (DELL, 1990).

Remarks: Three species of the genus *Parmaphorella* have been described up to this date from the Antarctic and Subantarctic regions, namely, *P. antarctica* (STREBEL, 1907) from Tierra del Fuego, *P. melvilli* (THIELE, 1912) from Burdwood Bank, Falkland Islands and the coast of Tierra del Fuego, and this species from Antarctic continental shelf. The only non-Antarctic species allocated in this genus is *P. barnardi* TOMLIN, 1932 from off Cape Point, South Africa. *P. mawsoni* is closely allied to *P. melvilli*. However, this species

Table 5. Measurements and condition of *Parmaphorella mawsoni* POWELL.

No.	1	2	3	4	5	6	7	8	9	10
St.	5	5	5	5	5	5	5	5	5	5
SL (mm)	8.3	16.5	24.5	26.7	36.9	38.7	40.3	41.1	41.5	43.5
SW (mm)	5.1	8.9	14.3	14.5	20.0	21.1	22.5	24.4	23.1	24.4
SH (mm)	2.8	4.2	5.5	6.2	8.5	9.8	7.4	8.1	8.4	8.2
Condition	F	F	F	L	F	F	F	F	L	F

No.	11	12	13	14	15	16	17	18	19	20
St.	5	5	7	7	7	7	7	7	7	7
SL (mm)	—	—	26.8	28.1	29.0	34.0	31.8	—	—	—
SW (mm)	—	—	15.5	15.1	17.3	18.9	17.8	—	—	—
SH (mm)	—	—	6.6	7.1	6.8	7.9	7.2	—	—	—
Conditdon	E	E	L	L	L	L	L	L*	E	E

No.	21	22	23	24	25
St.	8	8	8	8	8
SL (mm)	26.7	29.9	31.4	32.3	35.2
SW (mm)	16.3	16.7	17.8	18.8	19.5
SH (mm)	5.6	7.2	6.0	8.3	8.1
Condition	L	F	L	L	L

E: Empty and water-worn specimen; F: Freshly dead specimen; L: Specimen taken alive;
*: Animal only.

differs from *P. melvilli* in having very much larger and lighter build, and considerably torted shell, with upcurved extremities. The shell of almost all examined specimens have very weak radial sculptures (Fig. 10D). The shell of five specimens has depressed shell shell with distinct radial sculptures (Fig. 10E). DELL (1990) also reported "distinct radial sculpture" on the specimen collected from the Ross Sea.

The radula of *Parmaphorella mawsoni* was first described by POWELL (1958) and HAIN (1990). According to POWELL (1958), the radula is very similar to that of *P. melivilli*, but the massive fifth lateral has a broad but rather weak cusp and the sixth incipient or obsolescent lateral is a mere narrow wedge with about one-third the height of the fifth. The fifth and sixth (=lateromarginal plate) lateral teeth of the present material are quite the same as POWELL's illustration. HAIN's specimen has a wider rhachidian tooth and the fifth lateral which has sharply pointed central and lateral cusps. The radula of HAIN's specimen is quite similar to that of *P. melivilli*. However, the shell of HAIN's specimen is typical for the species which has weak radial sculptures and concentric growth lines.

The radula of the family Fissurellidae has low variability (MCLEAN, 1984). When the radula of *Parmaphorella* is almost the same as those of the other fissurelliid species, however, the rhachidian tooth is wider than that of the other members.

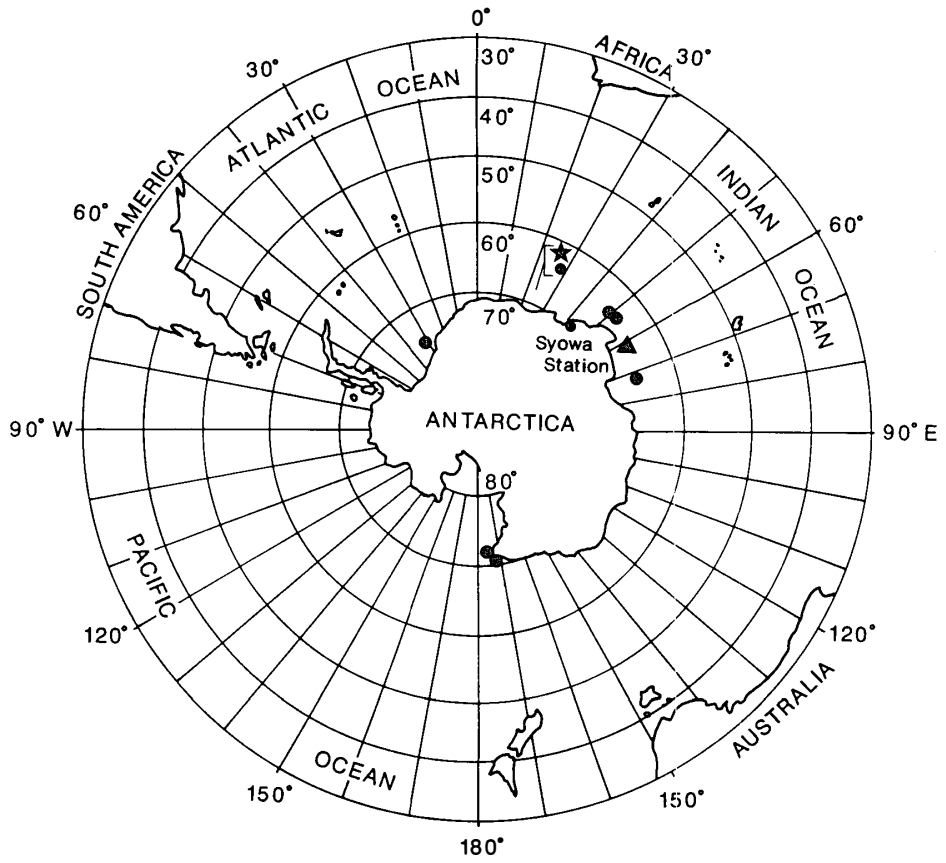
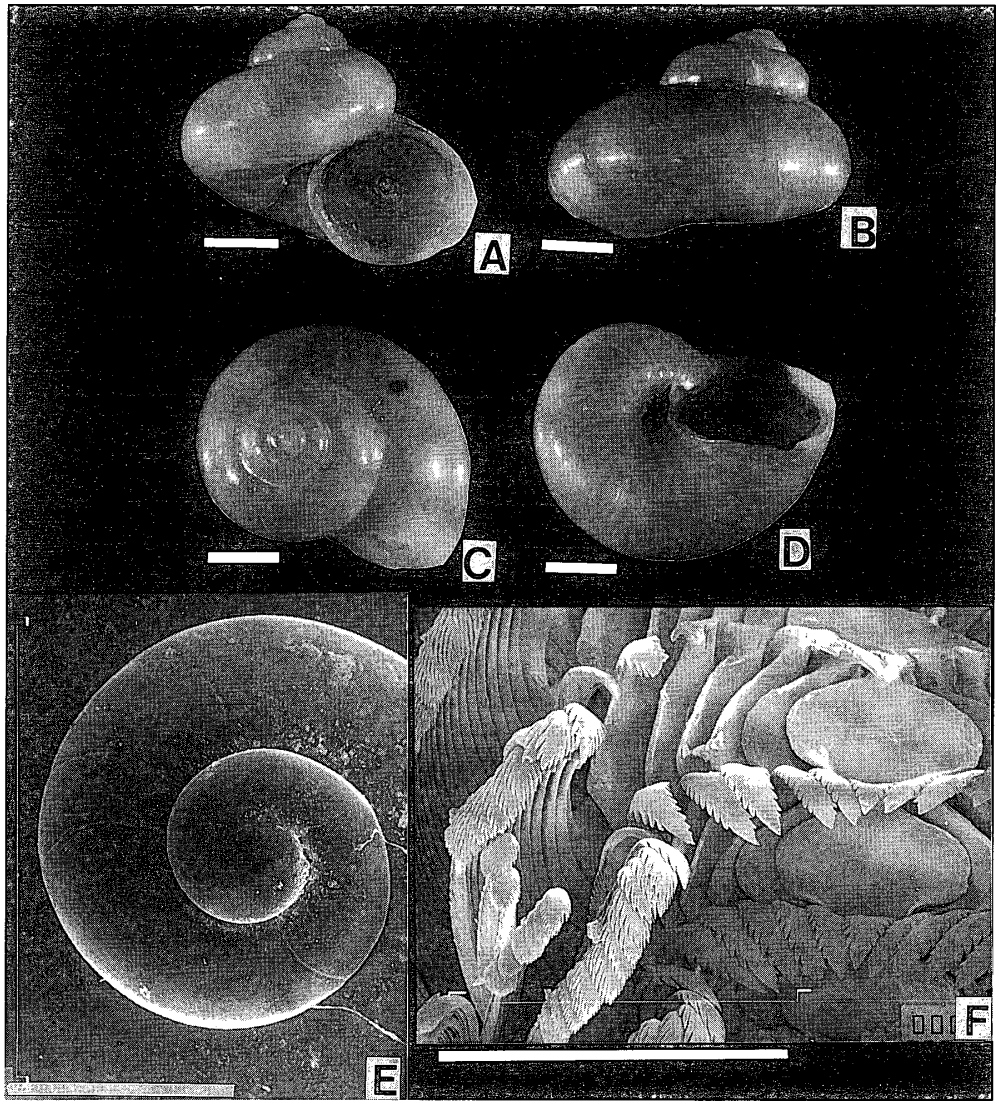


Fig. 11. Distribution of *Parmaphorella mawsoni* POWELL. (Large dots: Previous distribution records; Star: Present study; Triangle: Type locality).

Family TROCHIDAE RANFINESQUE, 1815
Subfamily Margaritinae STOLICZKA, 1868
Genus *Margarites* GRAY, 1847 (O.D.)
Type species: *Trochus helicinus* FABRICIUS, 1780

Margarites refulgens (SMITH, 1907)
(Figs. 12A-F)

Valvatella refulgens SMITH, 1907, p. 11, pl. 2, fig. 7; HEDLEY, 1911, p. 4. (remarks only)
Margarella refulgens: THIELE, 1912, p. 188. (remarks only); SMITH, 1915, p. 64 (distribution record); HEDLEY, 1916a, p. 37 (distribution record); EALES, 1923, p. 9, fig. 7; POWELL, 1958, p. 182. (distribution record); POWELL, 1960, p. 131 (name only); DELL, 1972a, p. 2 (distribution record); EGOROVA, 1982, p. 16, fig. 82; HAIN, 1990, p. 38, pl. 1, fig. 7, pl. 17, figs. 7 and 8.
Margarites refulgens: ARNAUD, 1972b, p. 115, figs. 2 and 5; DELL, 1990, p. 78, figs. 175-177.
Material examined: 2 living specimens and 22 empty shells from St. 5; 4 empty shells from St. 7; 2 living specimens and 12 empty shells from St. 8; 1 living specimen and 2 empty shells from St. 9.
Description: The shell is small in size, turbinate, thin, broader than high with depressed



Figs. 12A–F. *Margarites refulgens* (SMITH).
A–D. Shell; E. Protoconch; F. Radula. Scale A–E = 1 mm; F = 50 μm.

spires (Figs. 12A–D). The surface is almost smooth, shining without periostracum but with a bluish iridescence with very fine opisthocline growth lines, except translucently brown apical portion. The protoconch is smooth and glossy white in color with a single turn, about 0.25 mm in diameter (Fig. 12E). The teleoconch is 3.75 in number of turns and roundly inflated. The suture is strongly impressed. The upper whorl is small and depressed. The body whorl is large, and the breadth is 104–132% shell length. The base is roundly inflated. The umbilicus is narrowly open. The aperture is oblique, round with strong pearly lustre inside except on the outer to inner lips, and the peristome is smooth. The upper part of aperture exceeds the lower part (about 9% of circumference). The outer and basal lips are round and smooth. The columellar lip is glossy, curved, slightly expanded and reflected over the umbilicus. The inner lip is round without nacreous layer.

The operculum is corneous, circular, translucently brown in color, multispiral, equal

to the aperture in size, and depressed centrally.

The animal is pale beige in color, and has a single pair of cephalic tentacle on the head and four epipodial tentacles on both sides of the foot. The cephalic tentacles are well developed, digitate in shape and long. The eyes are large, located in posterior side of cephalic tentacles. A penis-like organ, which is digitate in shape and shorter than cephalic tentacle, is located posterior to the right eye lobe. The epipodial tentacles are obtuse, short and the anteriormost one is longer than the others. The proboscis is hastate, short and stout, and has a comb-like tip. The mantle is tight, with the minutely papillated edge.

The radula is rhipidoglossate, with a formula 54 : 5 : 1 : 5 : 54 (Fig. 12F). The rhachidian tooth is transeveraely ovate in shape with roundly expanding lateral projections, slightly incurved in each side and much wider than high (about 130% of height). It has a concave tip with a single large triangular central cusp that is serrated with 6 or 7 lateral denticles along its cutting edge. The lateral teeth decrease in width from the first to the fifth, and have a large triangular central cusp that carries 6 to 9 denticles on lateral inside

Table 6. Measurements and condition of *Margarites refulgens* (SMITH).

No.	1	2	3	4	5	6	7	8	9	10	11
St.	5	5	5	5	5	5	5	5	5	5	5
SL (mm)	3.8	3.6	3.2	4.2	3.4	3.0	3.1	3.1	3.3	2.4	2.3
SW (mm)	4.4	4.2	3.6	4.3	3.8	3.3	3.7	3.5	3.8	2.8	2.8
SW/SL (%)	115.8	116.7	112.5	102.4	111.8	110.0	119.4	112.9	115.2	116.7	121.7
Condition	F	L	F	L	F	F	F	F	F	F	F

No.	12	13	14	15	16	17	18	19	20	21	22
St.	5	5	5	5	5	5	5	5	5	5	5
SL (mm)	2.8	3.6	3.3	2.7	2.9	1.9	2.2	—	—	—	—
SW (mm)	3.2	4.1	3.5	3.1	3.3	2.3	2.6	—	—	—	—
SW/SL (%)	114.3	113.9	106.1	114.8	113.8	121.1	118.2	—	—	—	—
Condition	F	F	F	F	F	F	F	E	E	E	E

No.	23	24	25	26	27	28	29	30	31	32	33
St.	5	5	7	7	7	7	8	8	8	8	8
SL (mm)	—	—	3.8	4.3	3.2	1.6	3.5	3.0	3.3	3.3	2.7
SW (mm)	—	—	4.3	4.6	3.6	1.8	4.0	3.8	3.8	3.7	3.3
SW/SL (%)	—	—	113.2	111.6	112.5	112.5	114.3	126.7	115.2	112.1	122.2
Condition	E	E	F	F	F	F	L	F	F	F	F

No.	34	35	36	37	38	39	40	41
St.	8	8	8	8	8	8	8	8
SL (mm)	2.0	1.5	1.9	2.5	—	—	—	—
SW (mm)	2.4	1.9	2.5	3.1	—	—	—	—
SW/SL (%)	120.0	126.7	131.6	124.0	—	—	—	—
Condition	F	F	L	F	E	E	E	E

E: Empty and water-worn specimen; F: Freshly dead specimen; L: Specimen taken alive.

and 7 or 8 outside. The first marginal tooth is wider and stronger than the others, and has large triangular central cusp that carries 8 denticles on lateral inside and 5 outside. The second to 11th marginal teeth are long and slender with a simple food groove, and has a large central cusp. The outer marginal teeth are all very slender with a curved spatulate tip which has numerous very fine, comb-like denticles.

Measurements: See Table 6.

Previous distribution record (Fig. 13): Type locality: McMurdo Sound, 10–130 fathoms (SMITH, 1907). Range: Gauss Station, Davis Sea (THIELE, 1912); off Oates Land, 69°43′S, 163°24′E, 180–200 fathoms (SMITH, 1915); McMurdo Sound, Ross Sea (SMITH, 1915); Commonwealth Bay, 15–400 fathoms (HEDLEY, 1916), Davis Sea, 120 fathoms (HEDLEY, 1916a); Adelie Land, 640 m (POWELL, 1958); Enderby Land, 193–300 m (POWELL, 1958); off Kaiser Wilhelm Land, 393 m (POWELL, 1958); Adelie coast, 4–6 m (ARNAUD, 1972b); Harbour Mouth and West Arm, the vicinity of Mawson Base, 67°36′S, 62°53′E (DELL, 1972a); Davis Sea (EGOROVA, 1982); Weddell Sea, 1–1108 m (HAIN, 1990); South Sandwich Islands, 148–201 m (DELL, 1990); Budd Coast, 36–146 m (DELL, 1990); Ross Sea, 4–640 m (DELL, 1990).

Remarks: The radula of *M. refulgenus* was described by EALES (1923), ARNAUD (1972b), EGOROVA (1982) and HAIN (1990). According to EALES (1923) and HAIN (1990), the rhachidian tooth is widely quadrangular in outline and lateral teeth have roundly expand-

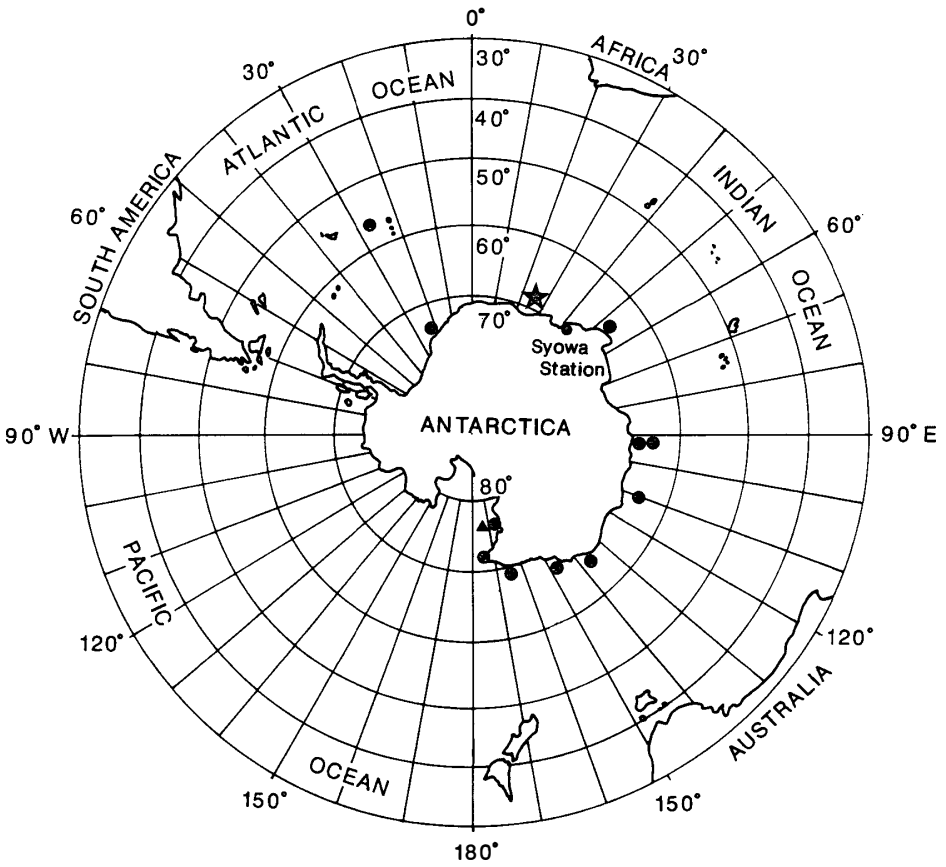


Fig. 13. Distribution of *Margarites refulgens* (Large dots: Previous distribution records; Star: Present study; Triangle: Type locality).

ed lateral projections, and these characters are very similar to the present observation. The rhachidian tooth illustrated by ARNAUD (1972b) is higher and narrower than that of the present specimen, and has narrow and gently rounded lateral projections. The illustration by EGOROVA (1982) is rather similar to ARNAUD's that shows a narrow and high rhachidian tooth. Both ARNAUD (1972b) and EGOROVA (1982) reported that there is a pair of latero-marginal plates, but the present study did not observe them. Their specimens seem to be the next species judging from the characters of rhachidian tooth.

M. refulgenus is similar to *Margarella expansa* (SOWERBY, 1893) from the Falkland Islands, *Margarella porcellana* POWELL, 1951 from off Marion Island, *Margarites antarctica* (LAMY, 1905) from Palmer Archipelago to South Shetland Islands and *M. gunnerusensis* n. sp. from Breid Bay. The columellar lip of *Margarella porcellana* is concave and its completely covers the umbilicus. *M. refulgens* is most allied to *M. gunnerusensis* n. sp. from Breid Bay, but *M. gunnerusensis* n. sp. is separable by shell characters and radula (see remarks of *M. gunnerusensis* n. sp.). *M. antarctica* n. sp. and *Margarella expansa* differs from *M. refulgens* in having wider shell with smaller and more depressed upper whorl.

Margarites gunnerusensis n. sp.

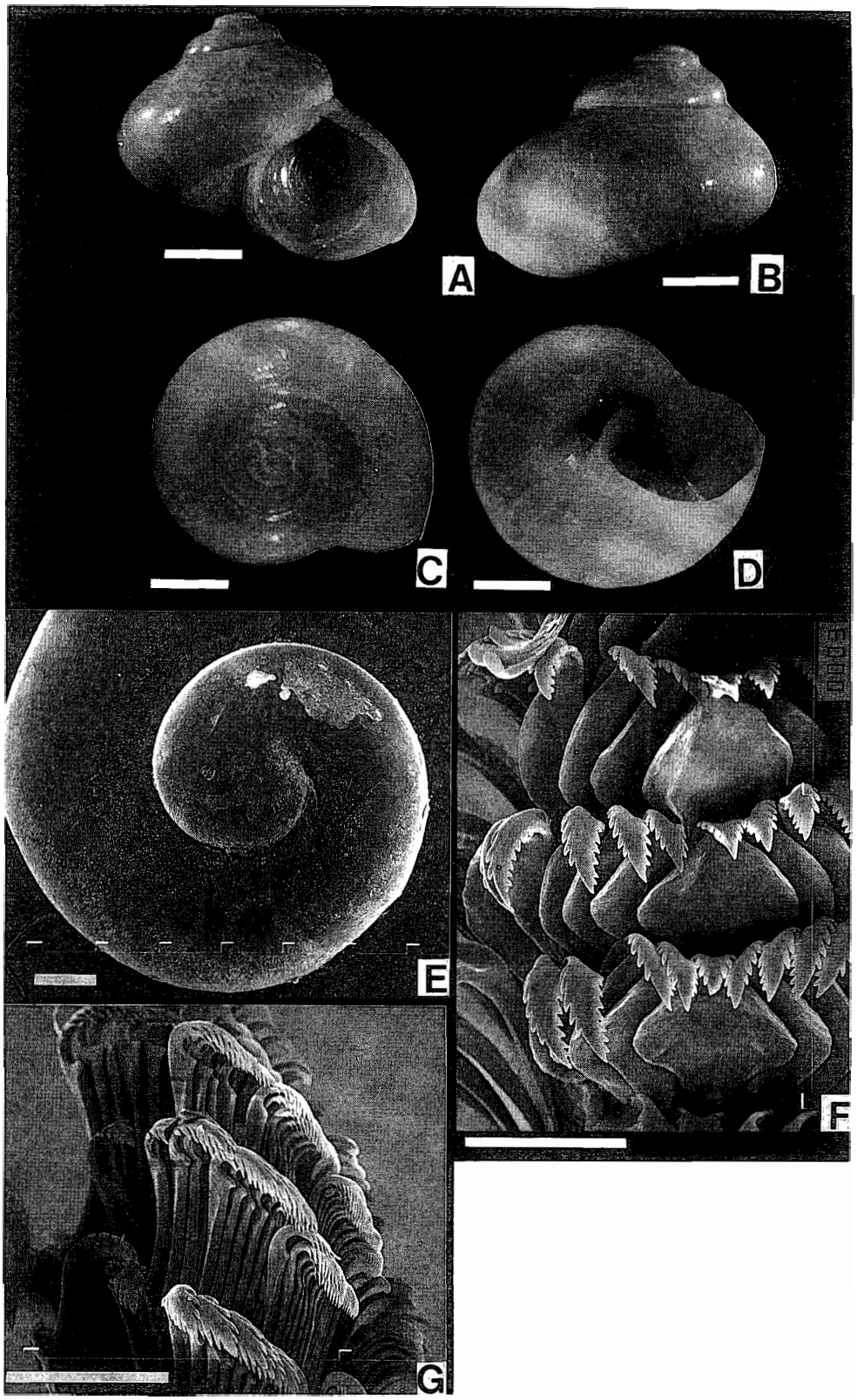
(Figs. 14A-G)

Material examined: Two living specimens from depth of 288 m in the Günnerus Bank.
Description: The shell is small in size, turbinate, thin, broader than high with depressed spires (Figs. 14A-D). The surface is very finely granulated, shining with bluish iridescence and very fine opisthocline growth lines and is covered with very thin whitish filmy periostracum. The protoconch is white in color with a single turn, about 0.63 mm in diameter, and finely granulated (Fig. 14E). The teleoconch is 2.8 in number of turns, roundly inflated. The suture is impressed, and concave below. The upper whorl is small and depressed. The body whorl is large, breadth is 124% shell length. The base is roundly inflated. The umbilicus is moderately open and deep. The aperture is oblique and ovate, and has a strong pearly luster within. The peristome is thin and almost smooth. The upper part of aperture exceeds the lower part (about 13% of circumference). The outer lip is round and smooth. The area from outer lip to basal lip is curved. The columellar lip is glossy, gently curved, slightly expanded and reflected over the umbilicus. The inner lip is round with a thin callus, which is expanded over the whorl. It creates conspicuous corner against outer lip.

The operculum is corneous, circular, translucently brown in color, multispiral, equal to the aperture in size.

The animal is white in color, and has a single pair of cephalic tentacles and five pairs of epipodial tentacles on both sides of the foot. The cephalic tentacles are moderately developed, attenuate and medium in size. The eye is very large. The eye lobe is short and stout, located posteriorly to the cephalic tentacles. The penis-like organ which is located in posterior side to the right eye lobe is slender and short. The first epipodial tentacles are digitate in shape, longer and bigger than the others. The second to fourth epipodial tentacles are short, slender, the same in size. The mantle is tight with minutely papillated edge. The proboscis is hastate, short and stout, and has comb-like tip.

The radula is large, rhipidoglossate, 47 : 5 : 1 : 5 : 47 (0.25 mm width; 3.1 mm in SL)



Figs. 14A–G. *Margarites gunnerusensis* n. sp. A–D. Holotype; E. Protoconch; F, G. Radula. Scale A–D = 1 mm; E = 100 μm; F, G = 500 μm.

(Figs. 14F, G). The rhachidian tooth is deltoid in outline, and have triangulately expanding, slightly incurved lateral projections. It has concave tip with a single, large triangular central cusp that is serrated with 5 denticles along its cutting edge. The lateral teeth decrease in width from the first to fifth, and has large triangular central cusp that carries 6 to 8 denticles on lateral inside and 5 to 8 outside. Denticles of outside are larger than those inside. The first marginal tooth is wider and stronger than the other marginals, and has a large triangular central cusp that carries 5 denticles on lateral inside and 8 outside. The basal edge is serrated outside. The second to tenth marginal teeth are long and slender, and have a large central cusp that carries 8 denticles on both sides. The marginal outer teeth are all very slender with curved, spatulate tip which has very fine, numerous denticles.

Measurements:

SL 3.1 mm, SW 3.9 mm (living specimen) (Holotype specimen; NSMT-Mo 70605).

SL 3.3 mm, SW 3.9 mm (living specimen) (Paratype specimen; NSMT-Mo 70606).

Remarks: This species is similar to *Margarites refulgens* (SMITH, 1907) from East Antarctica, *M. expansa* (SOWERBY, 1893) from Falkland Islands and Kerguelen Island, and *M. porcellana* POWELL, 1951 from off Marion Island. *M. refulgens* is separable from this species in following characters: 1) Smaller protoconch; 2) more strongly impressed suture, which is not concave below; 3) smoother surface, without periostracum; 4) more rounded aperture; 5) well developed nacreous layer; 6) broder rhachidian tooth, with more roundly expanded lateral projections; and 7) more squarish 1st to 5th lateral teeth. *M. expansa* is more depressed than this species (SL 10.7 mm, SW 12.5 mm, STREBL, 1908). *M. porcellana* has concave columellar lip that completely covers the umbilicus. The radula of *M.* (*Promargarita*) *tropidophoroides tropidophoroides* (STREBEL, 1908) from South Georgia is very similar to that of the present species, but shell is larger and turbinate bearing a conspicuous shoulder and peripheral angles. The shell of juvenile of *M.* (*P.*) *tropidophoroides tropidophoroides* is also very similar to this species, however, it has fine and regularly spaced spiral sculptures.

Etymology: The name of this species is after Günnerus Bank (68°23.5′S, 34°07.5′E), Antarctica, the type locality of this species.

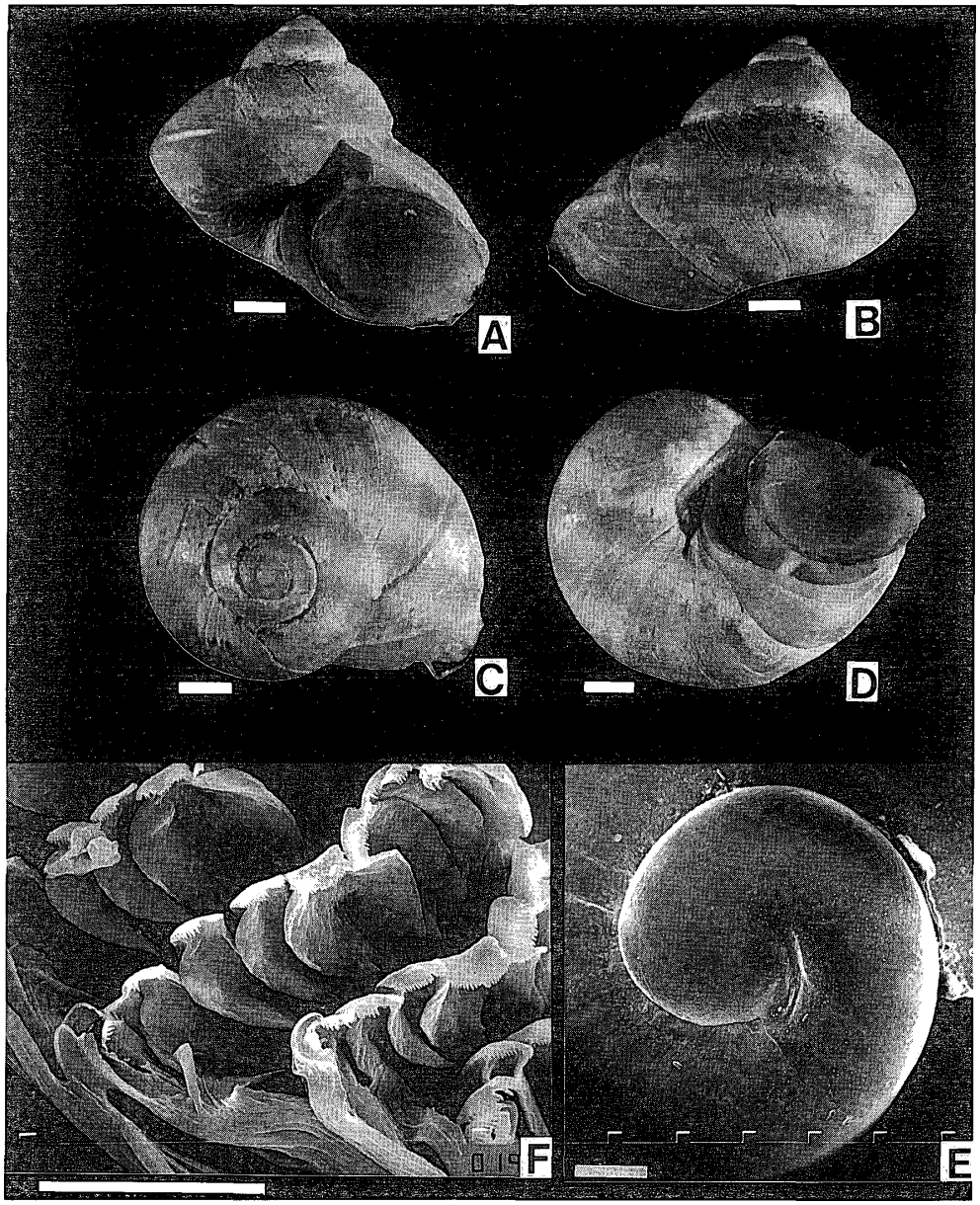
Margarites (?) *biconica* n. sp.

(Figs. 15A–F)

Margarella sp. 1: HAIN, 1990, p. 39, pl. 1, fig. 8, pl. 18, figs. 1 and 2.

Material examined: 3 living specimens and 10 empty shells from St. 5; 1 living specimen and 5 empty shells from St. 8; 4 living specimens and 2 empty shells from St. 9.

Description: The shell is moderate in size, depressed biconic, rather thick and broader than high with small spires (Figs. 15A–D). The protoconch is white in color, with a single turn, 0.25 mm in diameter (4.6 mm in SL), and has uneven surface (Fig. 15E). The teleoconch has 3 turns, roundly inflated and rapidly increasing diameter adaperturally, and has microscopic growth lines and irregularly spaced spiral lirae under very thin whitish periostracal film. The suture is strongly impressed, with slightly convex sutural ramp. Just under the suture on penultimate and body whorls are slightly concave. The upper whorl is round and small. The body whorl is very large, with breadth being 107–119% of



Figs. 15A-F. *Margarites*(?) *biconica* n. sp. A-D. Holotype; E. Protoconch; F. Radula. Scale A-D=1 mm; E=100 μm; F=500 μm.

shell length. The base is roundly inflated, and has a peripheral angle which becomes acuter abapically. Just above the peripheral angle on the last whorl is slightly concave. The umbilicus is almost closed by columellar lip, but umbilicus of the small specimens is narrowly open. The aperture is ovo-quadrate, oblique with strong pearly luster inside. The upper part of aperture exceeds the lower part (about 12% of circumference). The peristome is thin. The outer lip is obtusedly angulated at the peripheral angle (about 100°). The basal lip is round and smooth. The area from basal lip to columellar lip is slightly expanded and concave outwardly. The columellar lip is glossy, round. The inner lip is round with a frosted white thin callus that is expanded outwardly. Inner wall is smooth.

The operculum is corneous, thin, circular, translucently brown in color, multispiral, and equal to the aperture in size.

The animal is white in color, and has a pair of cephalic tentacles and six pairs of epipodial tentacles on both sides of the foot. The cephalic tentacles are well developed, digitate in shape, slender and long. The eye is large and black in color, and situated on the apex of eye lobe, which is located in posterior side of the cephalic tentacle and digitate in shape with 1/3 of length of cephalic tentacles. The penis-like organ is short and stout, which is located posteriorly to the right eye lobe. The first epipodial tentacles are acuminate, longer than the others. The second to the fourth are small. The fifth and the sixth epipodial tentacles are moderate. The proboscis is hastate, short and stout, and has comb-like tip. The foot is hemielliptical in outline, and the anterior end of foot is almost straight. The mantle is thin, and the mantle edge is very thin and smooth.

The radula is rhipidoglossate, $\infty : 5 : 1 : 5 : \infty$, transparent, large, about 40% of the shell length (Fig. 15F). The rhachidian tooth has wide and long lateral projections on both sides. It has concave top with about 25 very fine and weak denticles. The lateral teeth decrease in width from the first to the fifth, and have 17–22 very fine cusps on the tip. The inner cusps are smaller and weaker than those of outside, and have a double projection on lateral outside. The first marginal tooth is wider than the others, and has long and wide spatulate tip that carries numerous very fine denticles. The other marginal teeth are long, and have a long and wide spatulate tip that also carries numerous very fine denticles. These marginals become gradually weaker outwardly.

Table 7. Measuremnts and condition of *Margarites* (?) *biconica* n. sp.

No.	1	2	3	4**	5	6	7	8	9	10
St.	5	5	5	5	5	5	5	5	5	5
SL (mm)	5.7	5.5	5.3	4.4	3.9	3.3	3.3	3.0	3.0	2.7
SW (mm)	6.3	6.0	6.1	5.0	4.5	3.9	3.8	3.5	3.3	3.0
SW/SL (%)	110.5	109.1	115.1	113.6	115.4	118.2	115.2	116.7	110.0	111.1
Condition	F	F	F	L	F	L	F	L	F	F

No.	11	12	13	14***	15	16	17	18	19	20*
St.	5	5	5	8	8	8	8	8	8	9
SL (mm)	—	—	—	4.3	3.8	3.0	3.0	2.6	1.7	5.3
SW (mm)	—	—	—	5.0	4.3	3.5	3.3	2.9	2.0	6.3
SW/SL (%)	—	—	—	116.3	113.2	116.7	110.0	111.5	117.6	118.9
Condition	E	E	E	F	F	F	L	F	F	L

NO.	21	22	23	24	25
St.	9	9	9	9	9
SL (mm)	5.3	4.2	3.1	2.9	—
SW (mm)	6.3	4.6	3.6	3.1	—
SW/SL (%)	118.9	109.5	116.1	106.9	—
Condition	F	L	L	L	E

E: Empty and water-worn specimen; F: Freshly dead specimen; L: Specimen taken alive.
(*: Holotype specimens; **: Paratype #1; ***: Paratype #2)

Measurements: See Table 7.

SL 5.3 mm, SW 6.3 mm (Holotype specimen; NSMT-Mo 70607).

SL 4.4 mm, SW 5.0 mm (Paratype specimen #1; NSMT-Mo 70608).

SL 4.3 mm, SW 5.0 mm (Paratype specimen #2; NSMT-Mo 70609).

Previous distribution record (Fig. 16): The eastern Weddell Sea (HAIN, 1990).

Remarks: This species is similar to *Calliostoma falklandicum* STREBEL, 1908 from Falkland Islands to Patagonia, *C. modestulum* STREBEL, 1908 from Falkland area to Patagonia and Tierra del Fuego and *C. venustula* STREBEL, 1908 from Falkland Islands in having biconical shell. However, these species are distinguishable from this species by having distinct sculptures on the shell surface. The radula of species of the genus *Calliostoma* is also different in having thin and highly flexible rachidian and lateral teeth with finely serrated cusps and the stout and enlarged innermost marginal tooth with heavy base and coarsely serreated hook-like cusps.

This species was collected from the Weddell Sea, 155–481 m (HAIN, 1990). HAIN (1990) placed this species in the genus *Margarella*. But, the genus *Margarella* differs from this species in having the quite different radula which have an oval base of rachidian tooth (Fig. 12F). Extremities of rhachidian and lateral teeth are sharply pointed and the serrations of these lateral cusps are coarse. Therefore, HAIN's allocation of this species to *Margarella* is not suitable.

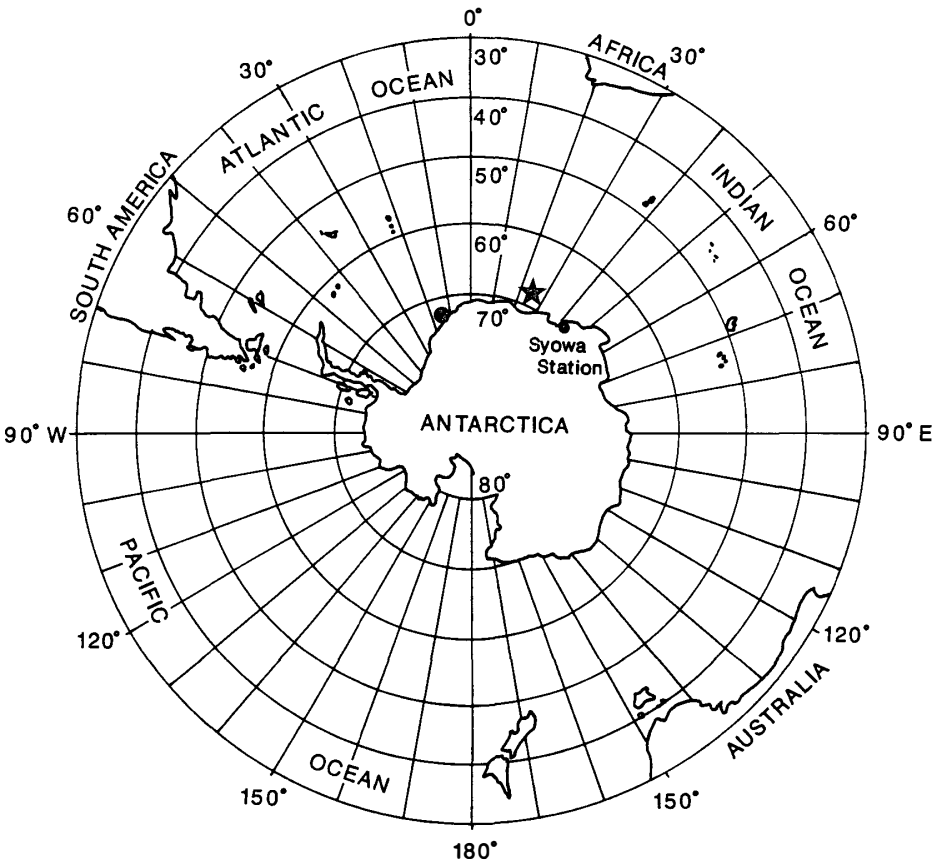


Fig. 16. Distribution of *Margarites*(?) *biconica* n. sp. (Large dot: Previous distribution record; Star: Present study).

This species is separable from the all other suspectable species of the family Trochidae in having a unique radular characters, the present new species is here tentatively placed in the genus *Margarites* in broad sense.

Etymology: Based on a biconical shape of the present species.

Genus *Antimargarita* POWELL, 1951

Type species: *Valvatella dulcis* SMITH, 1907 (O.D.)

***Antimargarita dulcis* (SMITH, 1907)**

(Figs. 17A–D)

Valvatella dulcis SMITH, 1907, p. 11, pl. 2, fig. 8.

Margarites dulcis: THIELE, 1912, p. 190, pl. 11, fig. 21; SMITH, 1915, p. 63 (remarks only); EALES, 1923, p. 6, fig. 4.

Minolia dulcis: HEDLEY, 1916a, p. 39. (distribution record)

Antimargarita dulics: POWELL, 1951, p. 100 (distribution record); POWELL, 1958, p. 183 (distribution record); POWELL, 1960, P. 132. (name only); ARNAUD, 1972b, p. 117 (distribution record); EGOROVA, 1982, p. 18, figs. 31 and 85; HAIN, 1990, p. 39, pl. 1, fig. 8, pl. 18, figs. 1 and 2; DELL, 1990, p. 80, fig. 182.

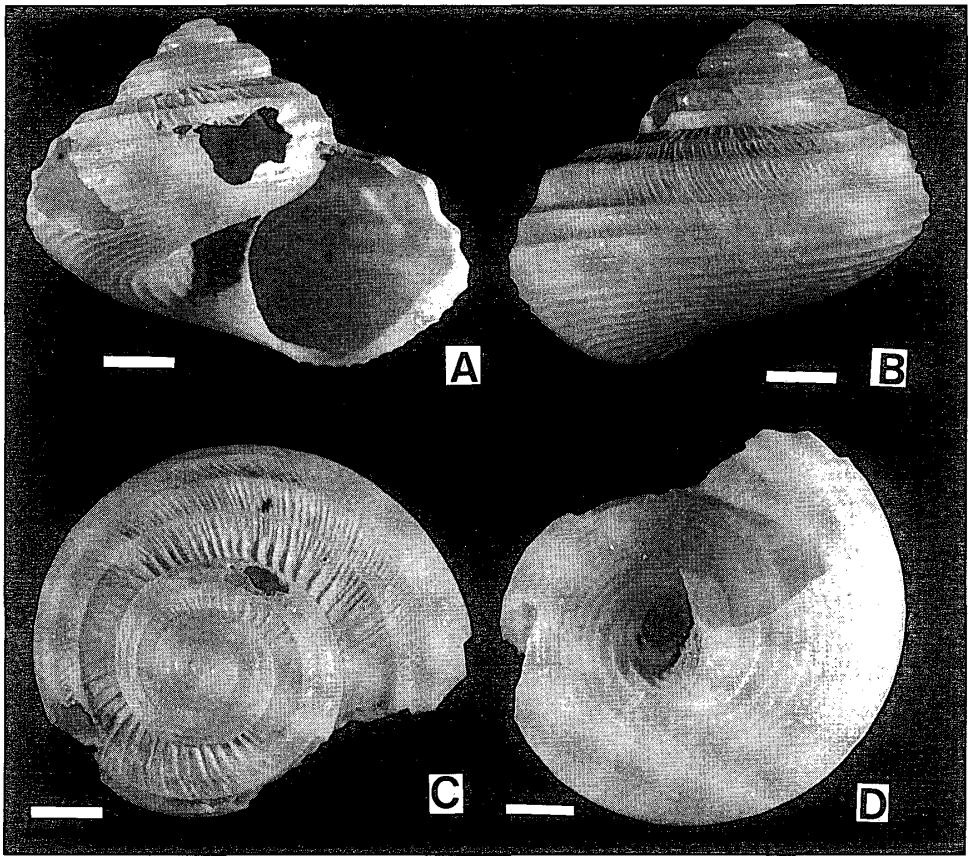
Material examined: A single empty shell from St. 7.

Description: The shell is moderate in size, glossy, with bluish iridescence, turbinate, thin and broader than high (Figs. 17A, B). The protoconch is translucently white in color, smooth and glossy in surface about 1.5 in number of turns, about 0.5 mm in diameter. The teleoconch is about 3.6 in number of turns, roundly inflated, and has strong spiral cords, axial sculpture, and growth lines. The suture is strongly impressed, with convex sutural ramp. The upper whorls are small. The body whorl is well inflated, large, with breadth being 110% of shell length, and has total 15 spiral ribs. In the body whorl, about 2 wide, irregularly spaced, conspicuously raised spiral ribs are present on the sutural ramp. Under the sutural ramp is roundly inflated, and has 3 wide, irregularly spaced, strong spiral ribs. The base is roundly inflated, and has 10 regularly spaced spiral ribs which are weaker than the above-mentioned spiral ribs. Axial cords come to appearance from the second turns of teleoconch. About 120 prosocline, irregularly space, axial cords are present on the body whorl, and they become weaker adapically and undistinguishable from growth lines, which are less prominent than crossing spiral ribs. The umbilicus is so wide (about 1/6 of SW) that the umbilical walls of the upper whorls are visible inside. Axial and spiral sculptures are continuous into the umbilicus. The aperture is round and the peristome is thin and polygonal in outline. As the shell is thin and translucent, the superficial axial cords are visible through the shell. The columellar lip is roundly curved, and never expanded and reflected over the umbilicus. The inner lip is round with a thin callus, which is expanded outwardly, forming a conspicuous angle against the outer lip. The inner wall has strong pearly lustre, except on the inner lip.

The animal and the operculum are unknown.

Measurements: SL 4.5 mm, SW 5.8 mm.

Previous distribution record (Fig. 18): Type locality: McMurdo Sound, 130 fathoms (SMITH, 1907). Range: Gauss Station, Davis Sea (THIELE, 1912); McMurdo Sound, 190–250 fathoms (SMITH, 1915); Commonwealth Bay, 25–400 fathoms, and D'Urville Sea, 157



Figs. 17A–D. *Antimargarita dulcis* (SMITH). A–D. Shell. Scale=1 mm.

fathoms (HEDLEY, 1916a); South Shetlands, 200 m, and Ross Sea, 351 m (POWELL, 1951); off Enderby Land, 193–300 m, and off Adélie Land, 640 m (POWELL, 1958); Adélie Land, 170–180 m (ARNAUD, 1972b); Davis Sea, 22–731 m (EGOROVA, 1982); Weddell Sea, 22–731 m (HAIN, 1990); off South Shetland Islands, 110–426 m (DELL, 1990); west of Antarctic Peninsula, 128–253 m (DELL, 1990); Budd Coast, 128 m (DELL, 1990); off Duke Ernest Bay, Weddell Sea, 387 m (DELL, 1990); Ross Sea, 67–457 m (DELL, 1990).

Remarks: *Antimargarita dulcis* is similar to *A. smithiana* (HEDLEY, 1916) from Davis Sea and Commonwealth Bay. However, *A. smithiana* has more round whorls with finer and denser spiral cords. According to DELL (1990), the spiral cords of the large specimen (14.3 mm in SW) of this species become more rounded, but they are otherwise comparable with the smaller specimens similar to the type specimen.

Subfamily Calliostomatinae THIELE, 1924
Genus *Falsimargarita* POWELL, 1951 (O.D.)
Type species: *Margarites gemma* SMITH, 1915

***Falsimargarita gemma* (SMITH, 1915)**

(Figs. 19A–I)

Margarites gemma SMITH, 1915, p. 62, pl. 1, fig. l; EALS, 1923, p. 8, fig. 6.
Falsimargarita gemma: POWELL, 1951, p. 93, fig. H, 23; POWELL, 1958, p. 181 (distribu-

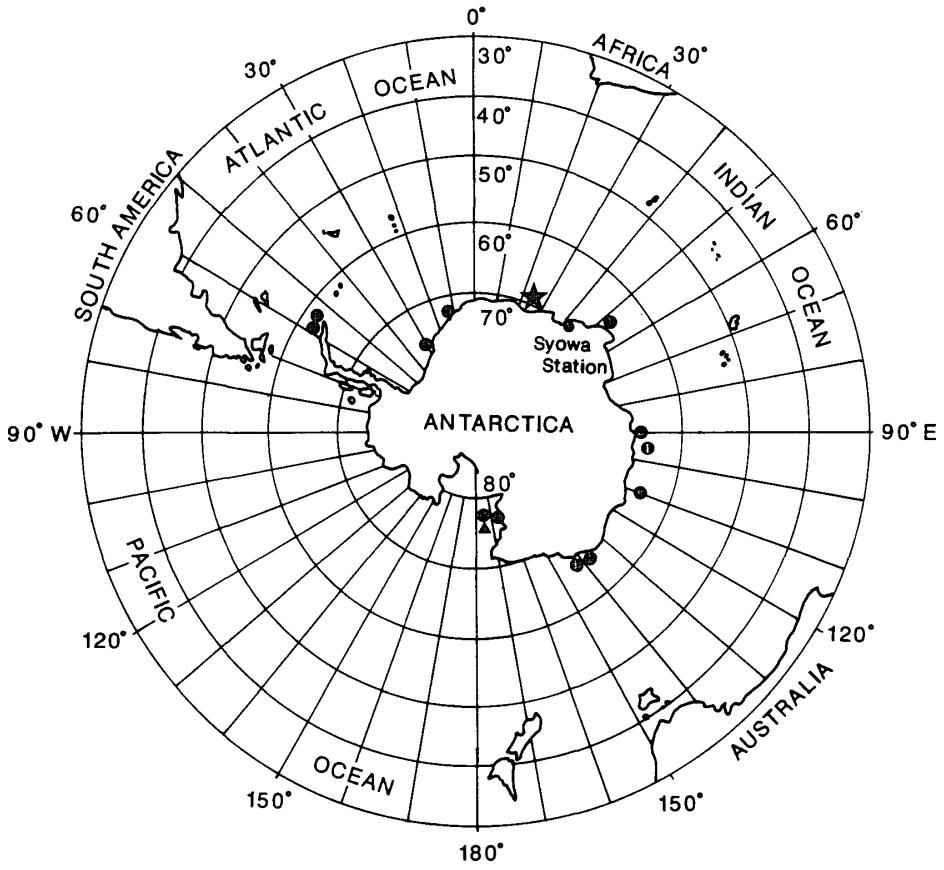
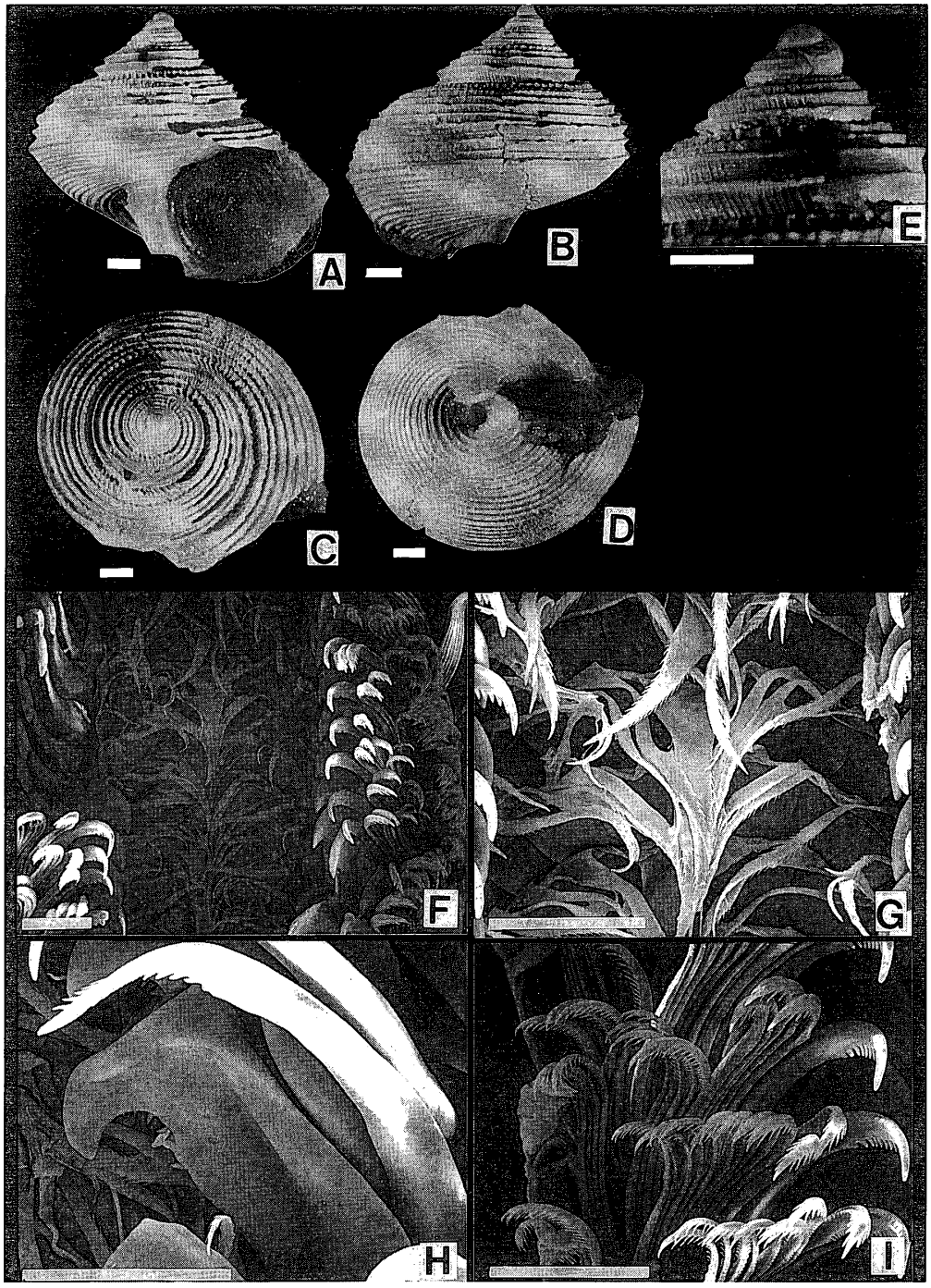


Fig. 18. Distribution of *Antimargarita dulcis* (SMITH) (Large dots: Previous distribution records; Star: Present study; Triangle: Type locality).

tion record); POWELL, 1960, p. 130 (name only); HAIN, 1990, p. 38, pl. 1, fig. 6, pl. 17, fig. 6; DELL, 1990, p. 93, figs. 148–152, table 6.

Material examined: A single living specimen from depth of 288 m in the Günnerus Bank.

Description: The shell is large in size, ovo-biconic, glossy white in color, thick, broader than high, with a small open umbilicus (Figs. 19A, B). The protoconch is dome-like, large, about 1.0 mm in diameter, about 1.7 in number of turns and white in color, and has finely granulated surface (Fig. 19E). The teleoconch is white in color, about 3 in number of turns, roundly inflated, and has strong spiral ribs that are crossed by axial cords and growth lines. The suture is impressed. The first turn is little rounded, and the last whorl has well rounded sutural ramp. The body whorl is large, with breadth being about 110% of shell length. Prominency of spiral ribs are different among those on sutural ramp and on the base, and spiral ribs on the sutural ramp are stronger than those on the base. On the penultimate whorl about 11 carinate spiral ribs are present between the suture and the peripheral rib, and prominency of these spiral ribs become gradually strong abapically, while the interspaces between ribs are widened towards the periphery. The area between the suture and adapicalmost rib is concave ramp. The peripheral rib is strongest of all. On the penultimate whorl, the axial cords on sutural ramp are about 49 in number, prosocline, regularly spaced and become prominent adapically, while diminishing abapically. A few very fine growth lines exist between axial cords. Spiral ribs are crossed



Figs. 19A-I. *Falsimargarita gemma* (SMITH).
A-E. Shell; F-I. Radula. Scale A-E = 1 mm; F-I = 100 μm.

by axial cords and growth lines, and the crossing points on the first and second spiral ribs create small nodules. On the body whorl, the first to fourth spiral ribs also exhibit nodulous appearance. The base is well inflated, and has 19 round-topped, wide spiral ribs, which are crossed by very fine growth lines as well. The lowest spiral rib is marging an open umbilicus, which is narrow but deep, and has no spiral rib on the inner wall.

The aperture is oval, however, it is broken. The columellar lip is glossy, curved and slightly reflected over the umbilicus. The non-nacreous inner lip is round and expanded outwardly. It has a weak angle on the outer lip. The inner wall, except for the inner lip, has well-developed nacreous layer.

The operculum is discoidal in shape, corneous, translucently brown in color and multispiral. The size of operculum may be equal to the aperture.

The animal is russet, but the pedal sole is dirty beige, and has well develpoed single pair of cephalic tentacles. The eyes are black in color, orbicular and small. The eye lobes which are located posteriorly to both cephalic tentacles, are narrow and 1/4 of length of the cephalic tentacles. A single pair of cephalic lappets is ovo-trianglular, small and thin, and it is located anteriorly to the base of both cephalic tentacles. A pair of neck lobes is deltoid, narrow and long, 1/8 of foot length, and has smooth edge. The epipodium is wide and long, and has minutely papillated edge. The foot is large and wide with 9 pairs of epipodial tentacles on both sides. The epipodial tentacles are arboriform, and the first to third are single, but other ones are trifid in appearance. The first to sixth epipodial tentacles are situated on dorsal surface of the epipodium and others are situated near the muscle scar of operculum. The edge of muscle scar of operculum is minutely papillated. The proboscis is hastate, wide and stout, and has papillated tip. The mantle is long narrow, with minutely papillated edge.

The radula is rhipidoglossate, 23 : 6 : 1 : 6 : 23, with 67 rows of teeth, translucently pale brown in color, long and wide, 4.0 mm in length and 1.0 mm in width (*ca.* 9 mm in SL) (Figs. 19F–I). The rhachidian tooth (Fig. 19G) is low retro-deltoid in outline, very thin, weak, much wider than high, and has a very long, thin and sharp central cusp which has about 16 very weak needle-like denticles on both side. The lateral teeth decrease in width from the first to sixth, and have a sharp, slender, weakly and very thin triangular central cusp that carries about 18 very weak needle-like lateral denticles on both sides. The first marginal tooth (Fig. 19H) is massive and strongly hooked with 5 small denticles on the inner distal edge, and has very strong ridge running along the outer margin. The second marginal tooth is long, wider and stronger than the other marginals, and has a large triangular central cusp that carries 8 triangular denticles on lateral inside and 12 small node-like denticles on lateral outside. The third to the last marginal teeth (Fig. 19I) become increasingly delicate, and are long and fishing hook-like in shape, and have an acute triangular central cusp that carries numerous needle-like lateral denticles on both sides.

Measurements: SL about 9 mm, SW about 10 mm (aperture is broken).

Previous distribution records (Fig. 20): Type locality : off Oates Land, 69°43′S, 163°24′E, 324–360 m. Range: Bransfield Strait, South Shetlands, 200 m (POWELL, 1951); off Enderby Land, 220 m (POWELL, 1958); eastern Weddell Sea, 181–695 m (HAIN, 1990); South Shetland Islands, 311–426 m (DELL, 1990); Antarctic Peninsula, 128–265 m (DELL, 1990); 66°52′S, 164°32′E, off Oates Corst, 2507–2525 m (DELL, 1990); Ross Sea, 360–549 m (DELL, 1990).

Remarks: This species is similar to *Falsimargarita thielei* (HEDLEY, 1916) from the Davis Sea to Ross Sea, *F. georgiana* DELL, 1990 from off South Georgia, and *F. benthicola* DELL, 1990. *F. thielei* is closely allied to this species in shell characters, but it has conspicuous spiral cords and no conspicuous axial cords on the teleoconch. *F. georgiana* which was

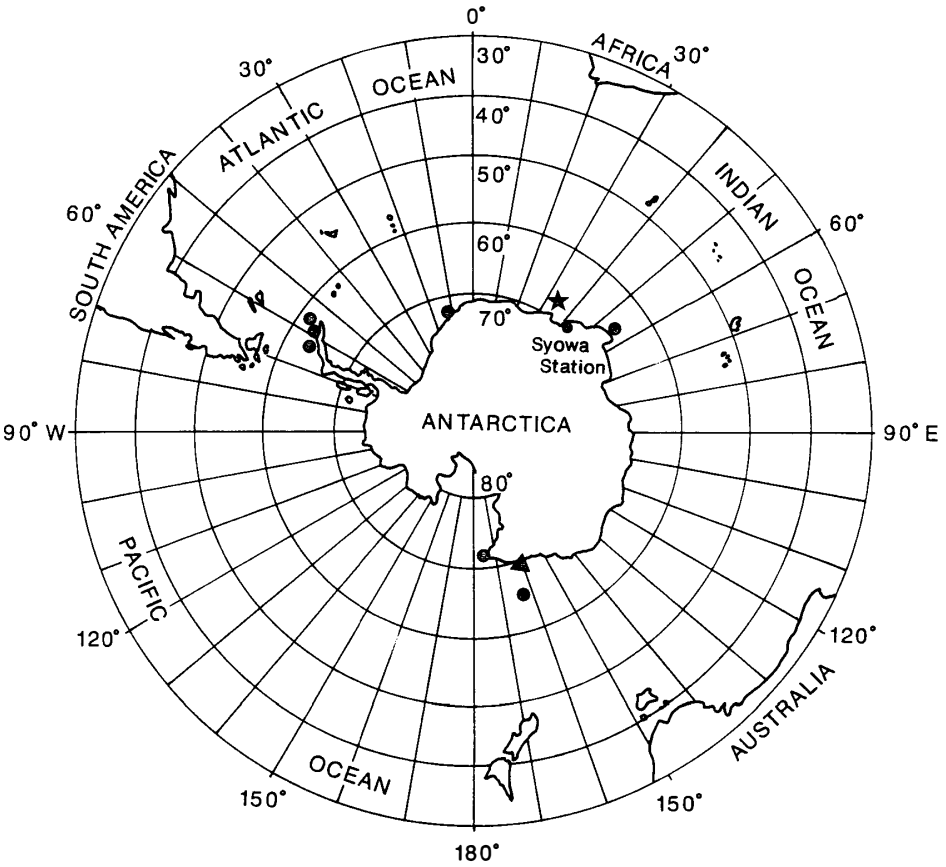


Fig. 20. Distribution of *Falsimargarita gemma* (SMITH) (Large dots: Previous distribution records; Star: Present study; Triangle: Type locality).

known only from off South Georgia in 2663–2855 m. It differs from this species in having more depressed shell (SL is 77–84% of SW; DELL, 1990), the wider umbilicus, and strong spiral sculptures on the body whorl. *F. benthicola* also has more depressed shell, SL is 73% of SW (DELL, 1990).

Subfamily Solariellinae POWELL, 1951

Genus *Solariella* SEARLES WOOD, 1842

Type species: *Solariella maculata* WOOD, 1842 (O.D.)

***Solariella bathyantarctica* n. sp.**

(Figs. 21A–E)

Material examined: 5 living specimens 2 empty shells from Günnerus Bank, 955 m in depth.

Description: The shell is moderate in size, turbinate, thin and broader than high (Figs. 21A, B). The coloration of the living shell exhibits bluish iridescence by color of the animal. The small specimen is much glossy and bluish iridescent in color. The protoconch is dome-shaped with 6 very fine spiral lirae, translucently white in color and a very finely granulous surface with 1.5 turns, 0.63 mm in diameter. The teleoconch is 4.75 in number of turns, well roundly inflated, and has numerous very slender spiral lirae that

are crossed by very fine prosocline growth lines representing a finely cancellated appearance. The surface of teleoconch has very thin, frosted periostracal film. The suture is strongly impressed. The upper whorl is small and moderately elevated. The body whorl is well inflated, large, with breadth being 106–113% of shell length. The base is well inflated, and has no apparent spiral lirae, except microscopic spiral lines. In the small specimen, the base is entirely smooth. The umbilicus is narrow but deep, margined by an angle, and the umbilical wall has cancellated sculptures. The first teleoconch whorl has 4 regularly spaced spiral lirae, penultimate whorl 15, and body whorl about 60. The axial lirae come to appearance from the end of the first teleoconch whorl, and progressively decrease in prominency from the suture to the base. The aperture is ovate and oblique, and has a pearly luster within. The peristome is thin and almost smooth, except the terminals of the spiral lirae. The inner lip is round with thin callus, and is slightly expanded outwardly. The columellar lip is round and slightly reflected over the umbilicus, and has a small angle on the boundary with basal lip which is round and smooth. The inner wall has nacreous layer, except around the edge of the aperture.

The operculum is multispiral, corneous, circular, and translucently brown in color. The size of operculum is slightly small to the aperture.

The animal is dark brown or blue black in color, but the pedal sole is beige with brown border. The animal has a single pair of cephalic tentacles and 4 epipodial tentacles on the right side of foot and 3 on the left. The cephalic tentacles are well developed, attenuate-acuminate, narrow but long, 8.0 mm in length and 1.5 mm in width. The eyes are black in color and small, 0.3 mm in diameter, which are located in posterior side of cephalic tentacles. A penis-like organ, which is digitate in shape, and shorter and weaker than cephalic tentacle, is located posterior to the right eye. The epipodial tentacles are attenuate-acuminate in shape, and they decrease in size posteriorly. The proboscis is cylindrical, short, wide and stout, and has comb-like tip. The mantle is rather tight, with thick and smooth mantle edge.

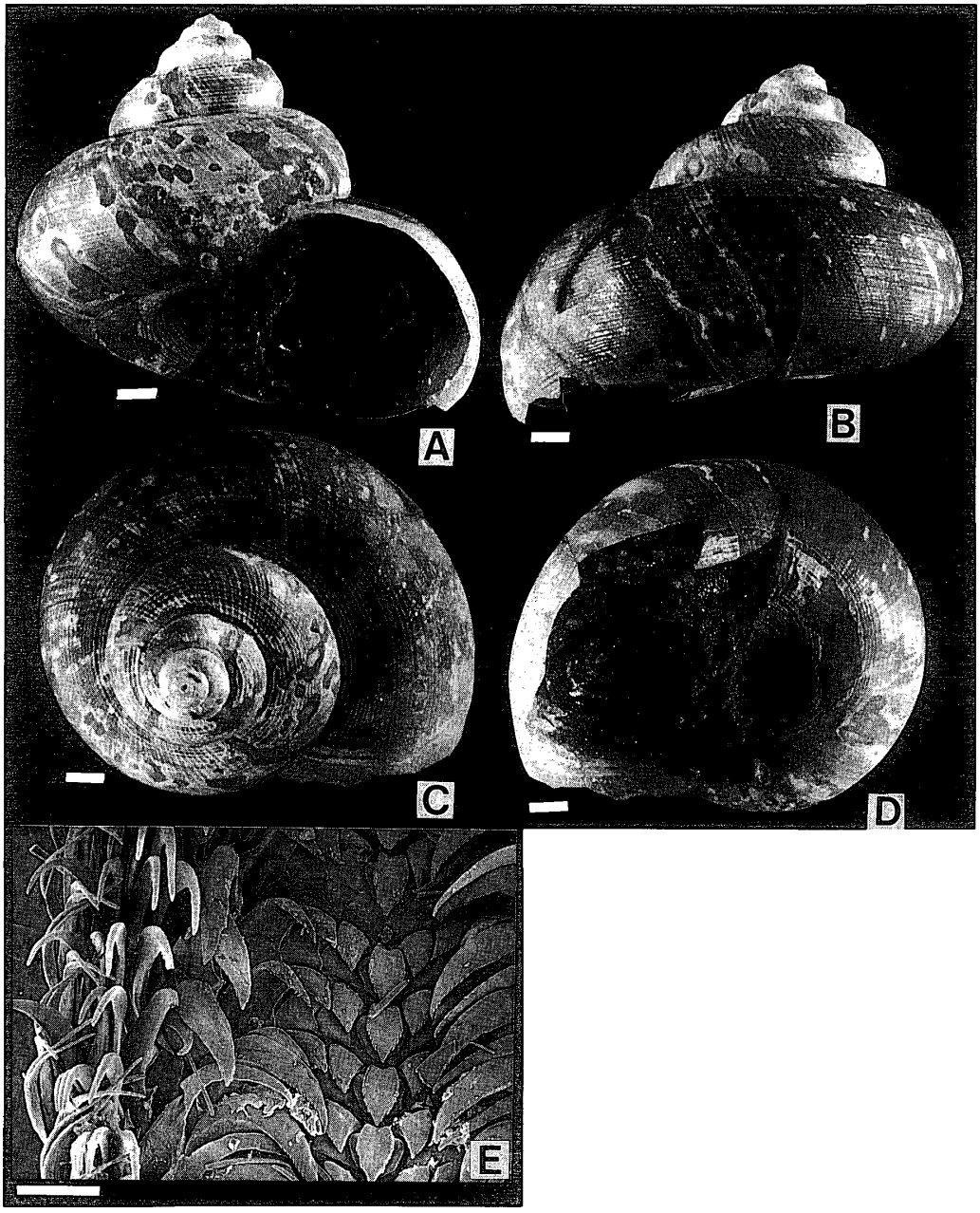
The radula is rhipidoglossate, 7 : 5 : 1 : 5 : 7, with 27 transverse rows (Fig. 21E). The frontal area of rhachidian tooth is wide, leaf-like in shape, and has a wide and blunt central cusp that carries 6 weak denticles on lateral right side and 10 denticles on left side. The basal area of rhachidian tooth is pentagonal in outline, slightly wider and lower than the frontal area, and the base line is obtuse. The lateral teeth progressively increase in size from the first to the fourth, but the fifth lateral is smaller and weaker than the fourth. The first lateral tooth is smaller than the other laterals, stout and hooked, and has a wide and blunt central cusp, 1 to 3 small denticles on lateral inside and 8 large denticles on outside. The base line is short and almost straight. The second lateral tooth is stout and hooked, and has wide and blunt cusp, 5 very fine denticles on lateral inside and 7 large denticles on outside. The base line is smooth and slightly incurved. The third lateral tooth is stout, hooked, oblong in outline, with a small, rounded shelf-like wing laterally, and has sharply pointed central cusp that carries 3 to 5 denticles on lateral inside and 7 denticles on outside. The base line of the third lateral is smooth, slightly incurved, and has a single projection on lower innermost corner. The fourth lateral is largest and strongest, and has small central cusp that carries finely serrated edge on both sides. The fifth lateral is long, slender, simple sickle-shaped, and has a few very fine denticles on lateral outside. The basal area is wide and flat. The marginal teeth are slender, simple sickle-shaped, and progres-

sively decrease in size outwardly.

Measurements: See Table 8.

SL 9.7 mm, SW 11.0 mm (Holotype specimen; NSMT-Mo 70610).
SL 5.5 mm, SW 6.0 mm (Paratype specimen #1; NSMT-Mo 70611).
SL 3.3 mm, SW 3.6 mm (Paratype specimen #2; NSMT-Mo 70612).

Remarks: The shell of the genus *Solariella* is small, most species less than 10 mm high, trochoid in shape, with rounded whorls, strong spiral cords and prominent axial growth lines. The suture is impressed. The umbilicus is wide and deep. This species is includ-



Figs. 21A-E. *Solariella bathyantarctica* n. sp.
A-D. Holotype; E. Radula. Scale A-D=1 mm; E=100 μm.

Table 8. Measurements and condition of *Solariella bathyantarctica* n. sp.

No.	1*	2**	3***	4	5	6	7
St.	G	G	G	G	G	G	G
SL (mm)	9.7	5.5	3.3	3.2	3.1	—	—
SW (mm)	11.0	6.0	3.6	3.6	3.3	—	—
SW/SL (%)	113.4	109.1	109.1	109.1	106.5	—	—
Condition	L	L	L	L	L	E	E

E: Empty and water-worn specimen; L: Specimen taken alive; G: Günnerus Bank 995 m deep.
(*: Holotype specimen; **: Paratype #1; ***: Paratype #2)

ed in the genus *Solariella* because of typical radular characters.

Five species and one subspecies of this genus have been known from the Southern Ocean, only a single species, *S. antarctica* POWELL, 1958, inhabits Antarctic costal waters, while the others are all from subantarctic islands.

This species is close to *S. kempi* POWELL, 1951 from between Falkland Islands and Argentina, but the latter has more round shell, with closely spaced and sharply raised spiral cords. The rhachidian tooth of *S. kempi* has rounded and serrated tip, and the first and second lateral teeth have a large and sharp cusp that carried 4 or 5 larger denticles on outside (POWELL, 1951). The shell of *S. antarctica* POWELL, 1958 from off Kemp Land, is very small in size. The shell of *S. kempi* and *S. antarctica* have small number of strong spiral cords, and also on the base, respectively. *S. charopus charopus* (WATSON, 1879) from Kerguelen, and *S. charopus caeruleus* (WATSON, 1879) from off Heard Island, are similar to this species in having the similar coloration. But, spiral sculptures of these two species are stronger and fewer in number than this species. The bathyal species of *S. brychius* (WATSON, 1897), from 1260 fathoms in depth at 900 miles south off Kerguelen, also has few strong spiral cords.

This species was collected from only the bathyal zone of Günnerus Bank.

Family SKENEIDAE, CLARK, 1851
Genus *Cirsonella* ANGAS, 1877
Type species (monotypy): *Cirsonella australis* ANGAS, 1877

Cirsonella extrema THIELE, 1912
(Figs. 22A-F)

Cirsonella extrema THIELE, 1912, p. 191, pl. 2, fig. 23.; POWELL, 1951, p. 103; POWELL, 1958, p. 184; POWELL, 1960, p. 133 (name only); EGOROVA, 1982, p. 21, fig. 99; DELL, 1990, p. 99, fig. 160.

Material examined: 6 empty shells from St. 5; 3 empty shells from St. 7; 3 living specimens and 20 empty shells from St. 8; 8 living specimens and 8 empty shells from St. 9.

Description: The shell is small in size, depressed turbinate, thick, solid with inflated whorls (Figs. 22A, B). The surface of the shell is almost smooth, except numerous microscopic growth lines and a few spiral grooves under the suture and the base, and has a very thin brownish periostracum. The color of the shell is glossy pale brown or brown, but whitish in circum-umbilical area and near the apertural area. Brownish coloration tends to

become paler towards the outer lip. The protoconch is depressed, about 1.5 in number of turns, about 0.5 mm in diameter, dark brown or brown in color, and has smooth surface (Fig. 22E). The teleoconch is about 2.5 in number of turns. The body whorl is well inflated, very large, with breadth being 112–127% of shell length. The base is roundly inflated, and has 6–9 wide and very shallow spiral grooves with wide interspace. The umbilicus is narrowly open, and the umbilical wall has 3–8 very fine spiral threads. The aperture is circular, oblique thick and holostomous lip. The upper part of aperture slightly exceeds the lower part. The columellar lip is very thick, smooth, round and weakly reflected over the umbilicus. The inner wall is white in color and smooth.

The operculum is thick, corneous, circular, multispiral, translucently pale brown in color and just equal to the aperture in size, with slightly depressed center.

The animal is pale beige in color, and has a single pair of cephalic tentacles, 6 epipodial tentacles on the right side and 5 epipodial tentacles on the left. The cephalic tentacles are attenuate, moderate in length, thick and stout. The black eye is moderate in size. A single pair of the eye lobes are short and stout, which are produced on both posterior side of cephalic tentacle. The right cephalic lappet is thin, narrow and short, and has two epipodial tentacles which are slender and thin. The left side of neck has no cephalic lappet, but a single epipodial tentacle which is acuminate, short and stout. Other epipodial tentacles, 4 each on right and left sides, are digitate in shape, moderate in size and slender. The proboscis is cylindrical with the middle constriction and moderate in size, and has a papillate tip. The mantle is very thin, with a smoth edge.

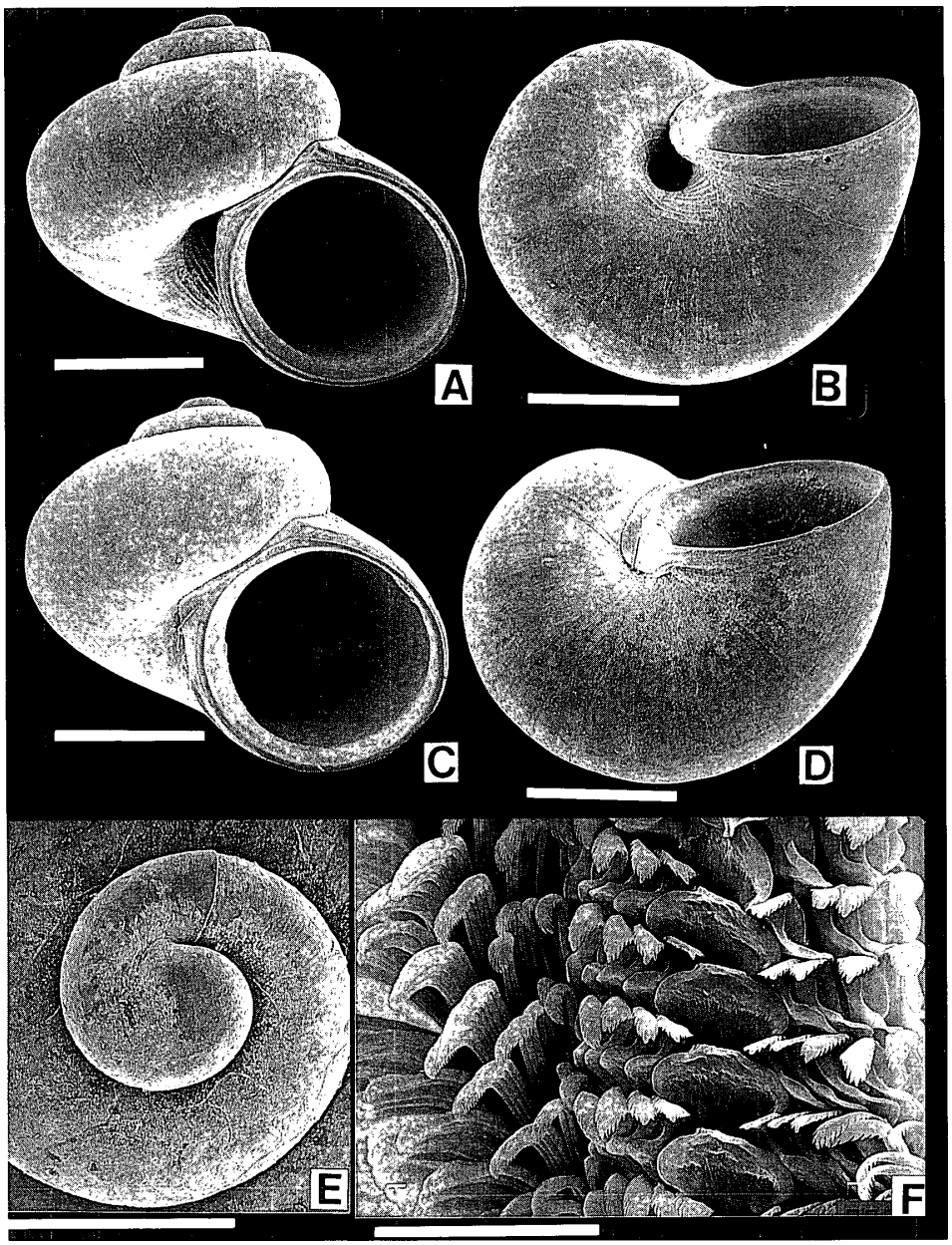
The radula is rhipidoglossate, $\infty : 5 : 1 : 5 : \infty$, transparent (Fig. 22F). The rhachidian tooth is rather oblong in outline, much wider than high (about 71% of width), and has no cusp, but just an irregular thickening along the crest of the median arc. The size of lateral teeth increase in height, and decrease in width from the first to the fifth. The lateral teeth have a large blunt central cusp that carries 8 acute lateral cusps. The outer edge of the lateral teeth is expanded laterally with a shelf-like appearance. Each lateral tooth has a well-developed lateral projection near the base. The inner marginal teeth are stronger than the others, and have spatulate tip which has an acute central cusp and numerous sharp and slender lateral denticles on both sides. The outer marginal teeth are very slender and curved, with spatulate tip which has very obsolete serration.

Measurements: See Table 9.

Previous distribution records (Fig. 23): Type locality: Gauss Station, Davis Sea (THIELE, 1912). Range: Ross Sea, 351 m (POWELL, 1951); off Enderby Land, 300 and 193 m (POWELL, 1958); Davis Sea, 385 m (EGOROVA, 1982); off South Shetland Islands, 311–426 m (DELL, 1990); 66°32.94′S, 93°00.90′E, 80 m and 65°55.6′S, 110°28.0′E, 58 m, Davis Sea (DELL, 1990); Ross Sea, 124–870 m (DELL, 1990).

Remarks: There is a considerable variation in the condition of umbilicus in this species, even within a single population. The umbilicus of some specimens is completely covered by a thin callus (Figs. 22C, D), while the small specimens usually have widely open umbilicus. The occurrence rate of specimens in having closed umbilicus is 18% at St. 9. POWELL (1979) described that the same variability in *Cirsonella maoria* (POWELL, 1937) from New Zealand.

C. extrema is close to *C. consobrina* POWELL, 1930 from North Island of New Zealand. However, compared with these two species of the same size (about 1.0 mm in



Figs. 22A-F. *Cirsonella extrema* THIELE. A-D. Shell; E. Protoconch; F. Radula. Scale A-D = 1 mm; E = 500 μm; F = 50 μm.

SL), the shell of *C. consobrina* is whiter in color and more depressed (SW is 150% of SL). *C. laxa* POWELL, 1937 and *C. propelaxa* DELL, 1956 from New Zealand are similar to *C. extrema* in having depressed shell with few very fine spiral threads on its whorl, but the peristome of these species are completely separated from the body whorl.

Table 9. Measurements and condition of *Cirsonella extrema* THIELE.

No.	1	2	3	4	5	6	7	8	9	10
St.	5	5	5	5	5	5	7	7	7	8
SL (mm)	2.2	2.3	2.6	2.7	—	—	2.2	2.7	2.4	2.8
SW (mm)	2.7	2.8	3.0	3.1	—	—	2.7	3.1	2.8	3.2
SW/SL (%)	122.7	121.7	115.4	114.8	—	—	122.7	114.8	116.7	114.3
Condition	F	F	F	F	E	E	F	F	F	L

No.	11	12	13	14	15	16	17	18	19	20
St.	8	8	8	8	8	8	8	8	8	8
SL (mm)	2.6	2.6	2.3	2.2	2.6	2.3	2.2	2.6	2.5	2.5
SW (mm)	3.0	3.1	2.6	2.7	3.1	2.8	2.7	3.0	3.0	3.1
SW/SL (%)	115.4	119.2	113.0	122.7	119.2	121.7	122.7	115.4	120.0	124.0
Condition	F	F	L	F	F	F	F	F	F	F

No.	21	22	23	24	25	26	27	28	29	30
St.	8	8	8	8	8	8	8	8	8	8
SL (mm)	2.4	2.6	2.2	2.6	2.4	2.6	2.3	2.1	2.4	—
SW (mm)	2.8	3.1	2.7	3.0	2.9	2.9	2.7	2.5	2.8	—
SW/SL (%)	116.7	119.2	122.7	115.4	120.8	111.5	117.4	119.0	116.7	—
Condition	F	F	F	F	F	F	L	F	F	E

No.	31	32	33	34	35	36	37	38	39	40
St.	8	8	9	9	9	9	9	9	9	9
SL (mm)	—	—	2.5	1.6	1.9	2.6	2.5	2.3	2.3	2.6
SW (mm)	—	—	3.0	1.9	2.3	3.0	3.0	2.8	2.8	2.9
SW/SL (%)	—	—	120.0	118.8	121.1	115.4	120.0	121.7	121.7	111.5
Condition	E	E	L	L	L	L	L	L	F	F

No.	41	42	43	44	45	46	47	48	49
St.	9	9	9	9	9	9	9	9	9
SL (mm)	2.2	2.4	2.1	2.2	2.4	1.1	2.3	—	—
SW (mm)	2.6	2.8	2.5	2.6	2.9	1.4	2.9	—	—
SW/SL (%)	118.2	116.7	119.0	118.2	120.8	127.3	126.1	—	—
Condition	F	F	F	F	F	L	L	L	E

E: Empty and water-worn specimen; F: Freshly dead specimen; L: Specimen taken alive.

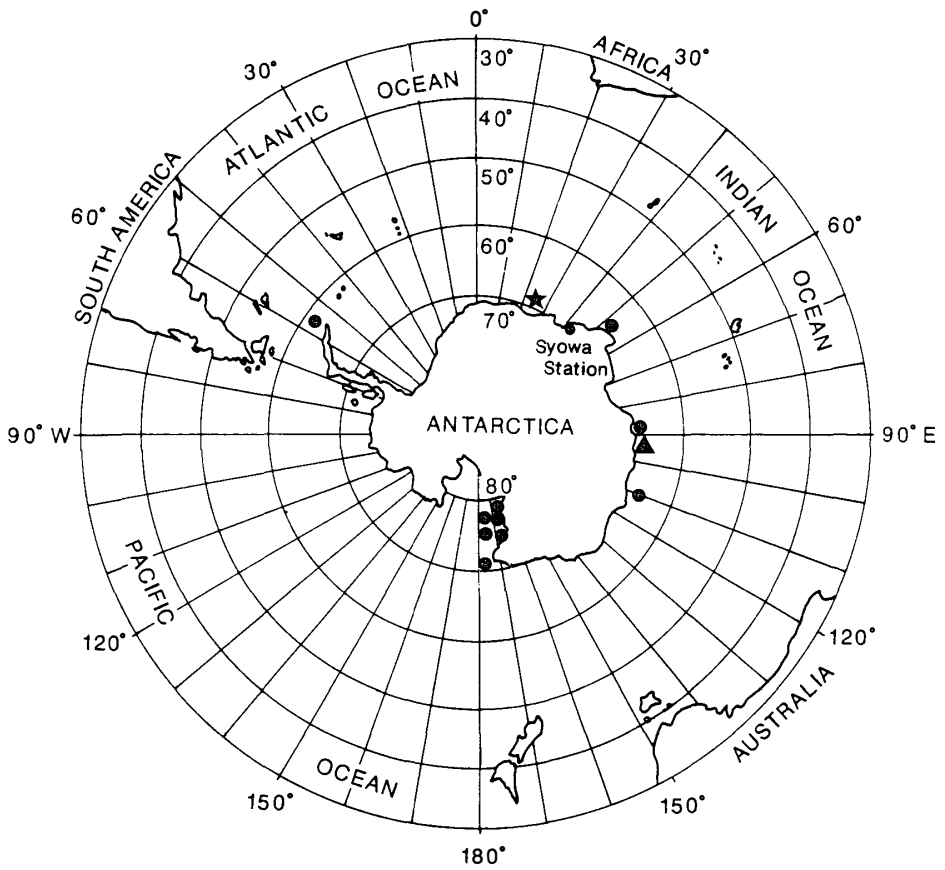


Fig. 23. Distribution of *Cirsonella extrema* THIELE (Large dots: Previous distribution records; Star: Present study; Triangle: Type locality).

Genus *Lissotesta* IREDALE, 1915

Type species: *Cyclostrema mica* TENNISON-WOODS, 1877 (O.D.)

***Lissotesta strebeli* (THIELE, 1912)**

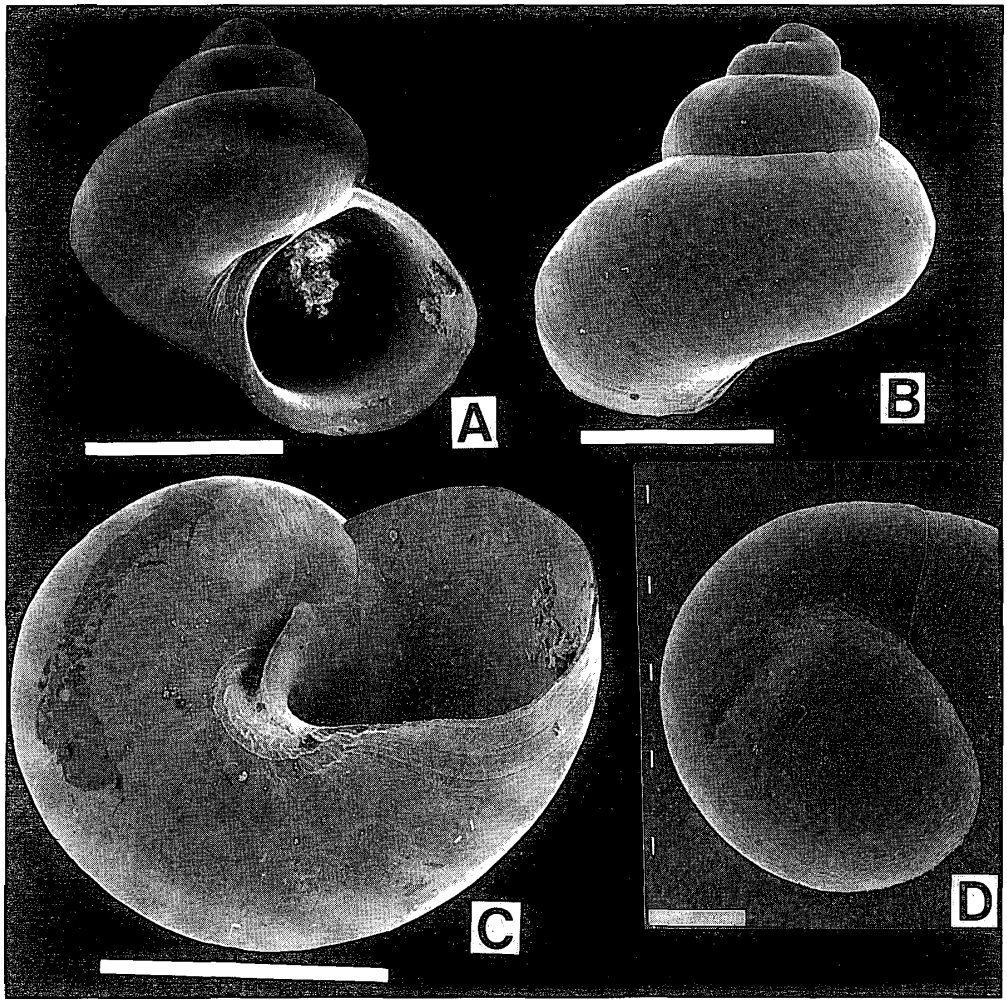
(Figs. 24A-D)

Submargarita strebeli THIELE, 1912, p. 188, pl. 11, figs. 13-14; ARNAUD, 1972b, p 117. (remarks only); EGOROVA, 1982, p. 17, figs. 87-88.

Lissotesta strebeli: DELL, 1972c, p. 33; DELL, 1990, p. 101, fig. 164.

Material examined: 9 empty shells from St. 5; 1 empty shell from St. 7; 20 empty shells from St. 8; 5 empty shells from St. 9.

Description: The shell is very small in size, elongate-turbinate, very thin, slightly higher than wide (Figs. 24A, B). The surface is glossy, translucently white in color, smooth, except very fine opisthocline growth lines, and has no periostracum. The protoconch is elongated ovoid, translucently white in color, high, large, rounded, only one in number of turn, about 0.4 mm in diameter, with uneven surface (Fig. 24D). The teleoconch is round and has 2.75-3.50 in number of turns. The suture is strongly impressed. The upper whorl is round and small. The body whorl is well inflated and large, with breadth being 86-100% of shell length. The base is roundly inflated. The umbilicus is narrowly open, which is margined by a conspicuous angle and two weak spiral cords. The aperture is



Figs. 24A–D. *Lissotesta strebeli* (THIELE).
A–C. Shell; D. Protoconch. Scale A–C = 1 mm; D = 100 μm.

ovate and oblique, and the peristome is thin, round and smooth. The upper part of outer lip exceeds the lower part. The basal lip is round and smooth, that is slightly expanded outwardly. The area from basal lip to columellar lip is slightly expanded and curved. The columellar lip is almost straight, expanded and reflected over the umbilicus, and has a weak angle near the inner lip, which is round and slightly expanded outwardly, with a thin callus. It has a conspicuous corner on the outer lip. The inner wall is entirely smooth and shining.

The animal and the operculum are unknown.

Measurements: See Table 10.

Previous distribution records (Fig. 25): Type locality: Gauss Station, Davis Sea (THIELE, 1912). Range: Adelie coast, 170–180 m (ARNAUD, 1972b); Davis Sea (EGOROVA, 1982); Ross Sea, 342–870 m (DELL, 1990).

Remarks: The shell of the genus *Lissotesta* is very small, thin, translucent, turbinate or conical, and has smooth or with a few spiral lirae on the surface. The protoconch is 1–1.5 in number of turns, round and smooth. The teleoconch is 2–3 well rounded and has a deep umbilicus with internal ridges. In this study, the radula was not observed.

Table 10. Measurements and condition of *Lissotesta strebeli* (THIELE).

No.	1	2	3	4	5	6	7	8	9	10
St.	5	5	5	5	5	5	5	5	5	7
SL (mm)	1.3	1.4	1.6	1.6	1.9	1.9	1.9	2.1	—	1.8
SW (mm)	1.3	1.4	1.6	1.6	1.8	1.8	1.8	2.0	—	1.8
SW/SL (%)	100.0	100.0	100.0	100.0	94.7	94.7	94.7	95.2	—	100.0
Condition	F	F	F	F	F	F	F	F	E	F

No.	11	12	13	14	15	16	17	18	19	20
St.	8	8	8	8	8	8	8	8	8	8
SL (mm)	2.0	2.0	2.0	2.0	2.1	2.2	2.2	2.3	2.3	2.4
SW (mm)	1.9	1.9	2.0	2.0	2.0	2.0	2.1	2.2	2.2	2.3
SW/SL (%)	95.0	95.0	100.0	100.0	95.2	90.9	95.5	95.7	95.7	95.8
Condition	F	F	F	F	F	F	F	F	F	F

No.	21	22	23	24	25	26	27	28	29	30
St.	8	8	8	8	8	8	8	8	8	8
SL (mm)	2.4	2.5	2.5	2.5	2.5	2.6	2.7	—	—	—
SW (mm)	2.3	2.3	2.3	2.4	2.4	2.4	2.3	—	—	—
SW/SL (%)	95.8	92.0	92.0	96.0	96.0	92.3	85.2	—	—	—
Condition	F	F	F	F	F	F	F	E	E	E

No.	31	32	33	34	35
St.	9	9	9	9	9
SL (mm)	2.1	2.1	2.3	2.5	2.7
SW (mm)	2.0	2.0	2.2	2.4	2.4
SW/SL (%)	95.2	95.2	95.7	92.0	88.9
Condition	F	F	F	F	F

E: Empty and water-worn specimen; F: Freshly dead specimen.

According to WARÉN (1991), "radula with central tooth, one small inner and a larger outer lateral tooth and about five, basally united, flagelliform marginals". The genus *Lissotesta* includes six Antarctic species, such as *L. strebeli* (THIELE, 1912), *L. similis* (THIELE, 1912), *L. impervia* (THIELE, 1912), *L. mamillata* (THIELE, 1912), *L. unifilosa* (THIELE, 1912) and *L. humile* (PELSENEER, 1903).

L. strebeli has hitherto been reported from the Ross Sea to Weddell Sea. According to DELL (1990), this species is not uncommon in fine sediments in the Ross Sea in 342–870 m deep. In this study, this species was collected from all stations of Breid Bay.

Lissotesta unifilosa (THIELE, 1912)

(Figs. 26A–D)

Submargarita unifilosa THIELE, 1912, p. 190, pl. 11, fig. 19; POWELL, 1960, p. 132 (name only); EGOROVA, 1982, p. 18, fig. 19; DELL, 1990, p. 89, fig. 146.

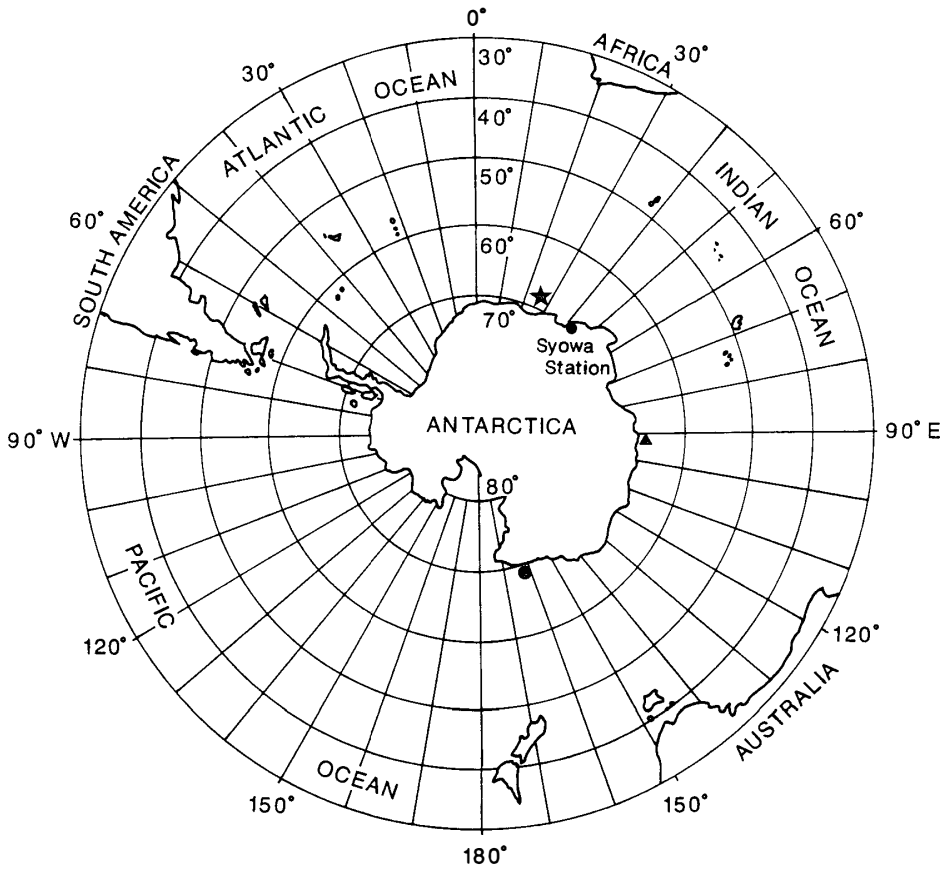


Fig. 25. Distribution of *Lissotesta strebeli* (THIELE) (Large dot: Previous distribution record; Star: Present study; Triangle: Type locality).

Material examined: A single living specimen and 4 empty shells from St. 5; 3 empty shells from St. 8.

Description: The shell is minute in size, turbinate, very thin, fragile with well inflated whorls (Figs. 26A, B). The surface is translucently white in color, smooth, except a single spiral cord and very fine opisthocline growth lines, with no periostracum. The protoconch is globose in shape, high, rounded, translucently white in color, about 1.25 in number of turns, about 0.38 mm in diameter, and has rough surface with few fine spiral wrinkles between 1/2 of whorl and suture (Fig. 26D). The teleoconch is about 2.4 in number of turns, slightly roundly inflated, and has a spiral cord on the last whorl. The suture is strongly impressed, and under the suture is slightly concave. The body whorl is well inflated, with breadth being 89-100% of shell length, and has a single spiral cord on boundary of the base. The spiral cord is roundly topped and overlies growth lines. The base is roundly inflated. The umbilicus is narrowly open, which is margined by two spiral cords. The aperture is oblique and lunate, and peristome is thin and almost smooth. The outer lip has a conspicuous angle on the outer lip and a very weak angle on the basal lip which is thin. The area from basal lip to the columellar lip is slightly expanding and curved. The columellar lip is a little rounded, expanded and reflected over the umbilicus. The inner lip is round and smooth, and has a thin callus that is slightly expanded outwardly. The inner wall is smooth.

The operculum is corneous, thin, circular, transparent, multispiral and equal to the aperture in size.

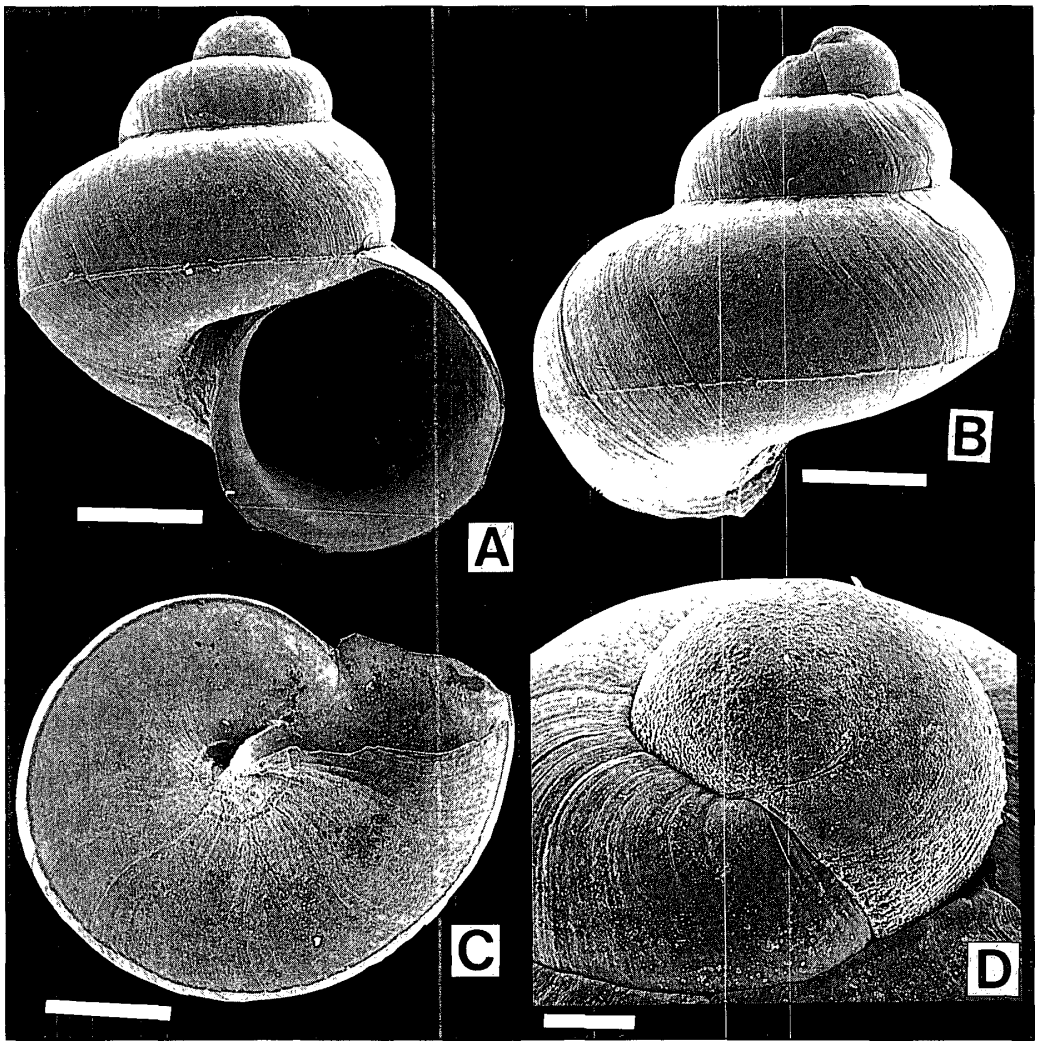
The animal was not observed.

Measurements: See Table 11.

Previous distribution records (Fig. 27): Type locality: Gauss Station, Davis Sea. Range: Davis Sea (EGOROVA, 1982); Davis Sea, 80 m (DELL, 1990); west of Antarctic Peninsula, 119–124 m (DELL, 1990); Ross Sea, 362–377 m (DELL, 1990).

Remarks: There is considerable variation in size and sculpture of the shells of this species. One of the examind specimen has more elongated shell form (SW being 113.6% in SL) and has weak spiral lirae above the spiral cord. The small specimen is more depressed than large one, and shell length is equal to shell width.

Thiele's drawing (THIELE, 1912) shows more elongate in shell (SL 2.3 mm, SW 1.7 mm; SW is 74% of SL), which has a little inflated whorls with 2 very fine spiral lirae above the conspicuous spiral cord. This species is close to *L. strebeli*, but it has no spiral cord on the last whorl.



Figs. 26A–D. *Lissotesta unifilosa* (THIELE).
A–C. Shell; D. Protoconch. Scale A–C = 500 μm; D = 100 μm.

Table 11. Measurements and condition of *Lissotesta unifilosa* (THIELE).

No.	1	2	3	4	5	6	7	8
St.	5	5	5	5	5	8	8	8
SL (mm)	0.9	1.3	1.8	1.9	—	1.9	1.8	—
SW (mm)	0.9	1.3	1.6	1.7	—	1.7	1.7	—
SW/SL (%)	100.0	100.0	88.9	113.6	—	89.5	89.5	—
Condition	F	F	F	F	L	F	F	E

E: Empty and water-worn specimen; F: Freshly dead specimen; L: Specimen taken alive.

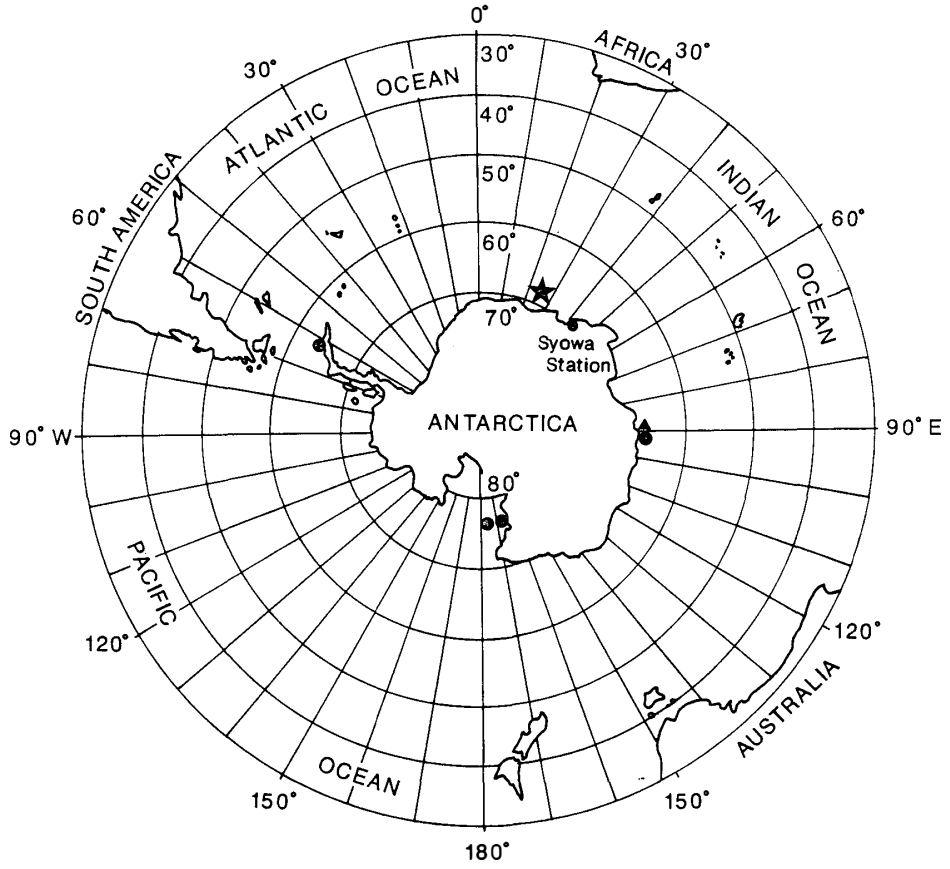


Fig. 27. Distribution of *Lissotesta unifilosa* (THIELE) (Large dots: Previous distribution records; Star: Present study; Triangle: Type locality).

Genus *Brookula* IREDALE, 1912

Type species: *Brookula stibarochila* IREDALE, 1912 (O.D.)

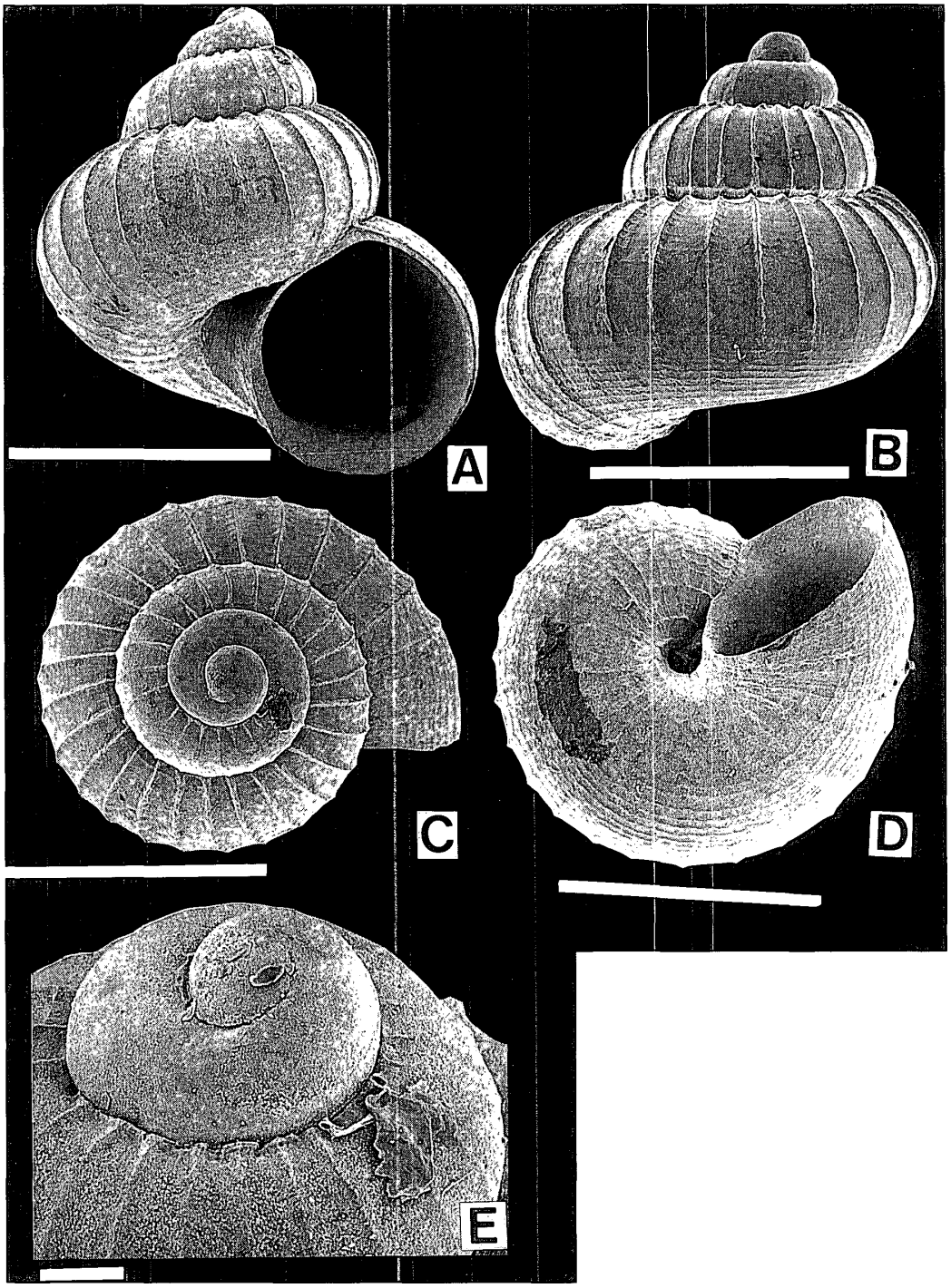
***Brookula sinusbreidensis* NUMANAMI & OKUTANI, 1991**

(Figs. 28A–E)

Brookula sinusbreidensis NUMANAMI & OKUTANI, 1991a, p. 37, figs. 2–6.

Material examined: A single empty shell from St. 8.

Description: The shell is minute in size, globose-turbinate, thin, fragile, frosty white in color, with roundly inflated whorls (Figs. 28A, B). The protoconch is globose, rather



Figs. 28A-E. *Brookula sinusbreidensis* NUMANAMI & OKUTANI.
A-D. Shell; E. Protoconch. Scale A-D = 1 mm; E = 100 μm.

high, about 0.35 mm in diameter, about 1.75 in number of turns and white in color, and has smooth surface (Fig. 28E). The teleoconch is about 2.6 in number of turns, roundly inflated, and has finely granulated surface without periostracum. The suture is constricted. The upper whorl is moderate in size and rather high. The body whorl is roundly inflated,

large, with breadth being 86% of SL. The base is roundly inflated. The umbilicus is open, moderate, and the umbilical wall has no sculpture. Axial riblets overlie finer spiral lirae. The axial riblets come to appearance from the first teleoconch whorl, but the first to the sixth riblets are very short and weak. Axial riblets are prosocline, raised and regularly spaced, about 23 on the body whorl and 22 on the penultimate whorl, and they become gradually weak towards the base. Spiral lirae are very weak and regularly spaced, about 27 on the body whorl, and last two which margin the umbilicus are very much stronger than the others. The junctions of axial riblets and spiral lirae create microscopic nodules. The aperture is round and slightly oblique with smooth peristome. The outer lip is thin, round and smooth. The inner lip is round and smooth, but it is very slightly expanded outwardly. There is a weak angle where the outer lip meets inner one. The columellar lip is thin, round and smooth, and very slightly expanded and a little reflected over the umbilicus. The basal lip is thin, round and smooth, and it is also very slightly expanded outwardly. The inner wall is very finely granulated.

The animal and the operculum are unknown.

Measurements:

SL 1.75 mm, SW 1.5 mm, AL 0.87 mm, AW 0.77 mm (Holotype specimen; NMST-MO 69595).

Previous distribution records: This species was collected from only Breid Bay.

Remarks: The type species of the genus *Brookula, B. stibarochila* IREDALE, 1912, is from the Kermadec Islands, Southwestern Pacific. According to POWELL (1979), *Brookula* (s. l.) is a common genus in temperate and subtropical Australian waters. Among seven species of *Brookula* (s.s.) known from the Antarctic and Subantarctic regions, three species, *B. decussata* (PELSENEER, 1903), *B. rossiana* DELL, 1990 and *B. antarctica* DELL, 1990, were discovered from the costal waters of Antarctica, while the others are all from subantarctic islands (Fig. 29). Among these Antarctic and Subantarctic species, namely, *B. decussata* (PELSENEER, 1903) from Bellingshausen Sea, *B. calypso* (MELVILL and STANDEN, 1912) from east of Falkland Islands, *B. kerguelensis* THIELE, 1925 from Kerguelen, *B. pfefferi* POWELL 1951 from South Georgia Islands, *B. strebeli* POWELL, 1951 from South Georgia Islands, *B. antarctica* DELL, 1990 and *B. rossiana* DELL, 1990 from Ross Sea, this species is similar to *B. pfefferi* and *B. strebeli* in having a few strong spiral lirae marging the open umbilicus. However, *B. pfefferi* has four strong flat-topped circum-umbilical spiral cords, and *B. strebeli* has slenderer shell with large upper whorls and four strong circum-umbilical spiral cords. This species is allied to *B. antarctica*, but, it has a fewer turns of protoconch, 1.25 in number of turns, and the central area of the base is free of sculpture, and three to four fine cords encircling the umbilicus. This species is also allied to *B. calypso*, which is smaller and more depressed species (SL 1.0 mm, SW 1.15 mm; SW/SL is 115%) and lacks the strong circum-umbilical spiral cord. *B. kerguelensis* is slightly taller than this species (SL 1.6 mm, SW 1.35 mm; SW/SL is 84%), and has numerous spiral lirae. *B. decussata* from the costal Antarctic waters, is the largest species among Antarctic and Subantarctic *Brookula* (SW is 2.5 mm), with numerous spiral lirae, well inflated whorls, and more strongly impressed suture. *B. sinusbreidensis* can be easily distinguished from these three species, *B. calypso, B. kerguelensis* and *B. decussata*, by having two rather weak circum-umbilical spiral lirae.

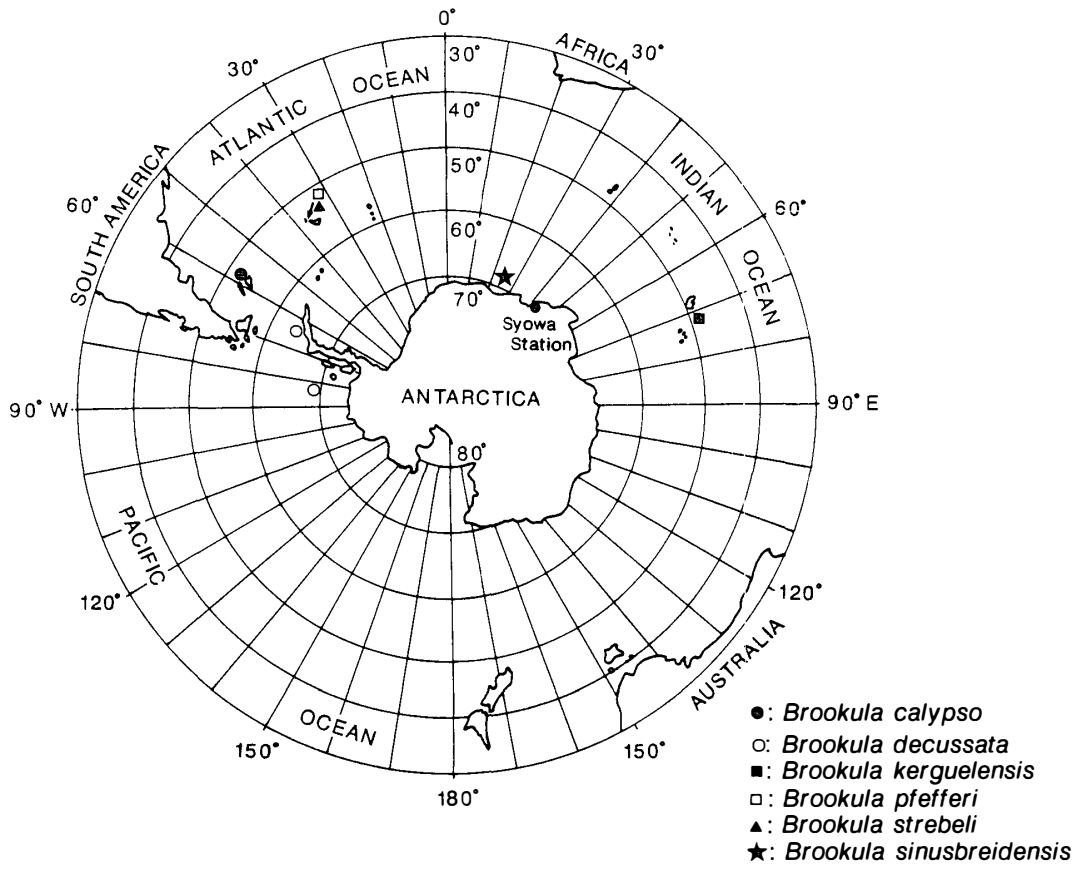


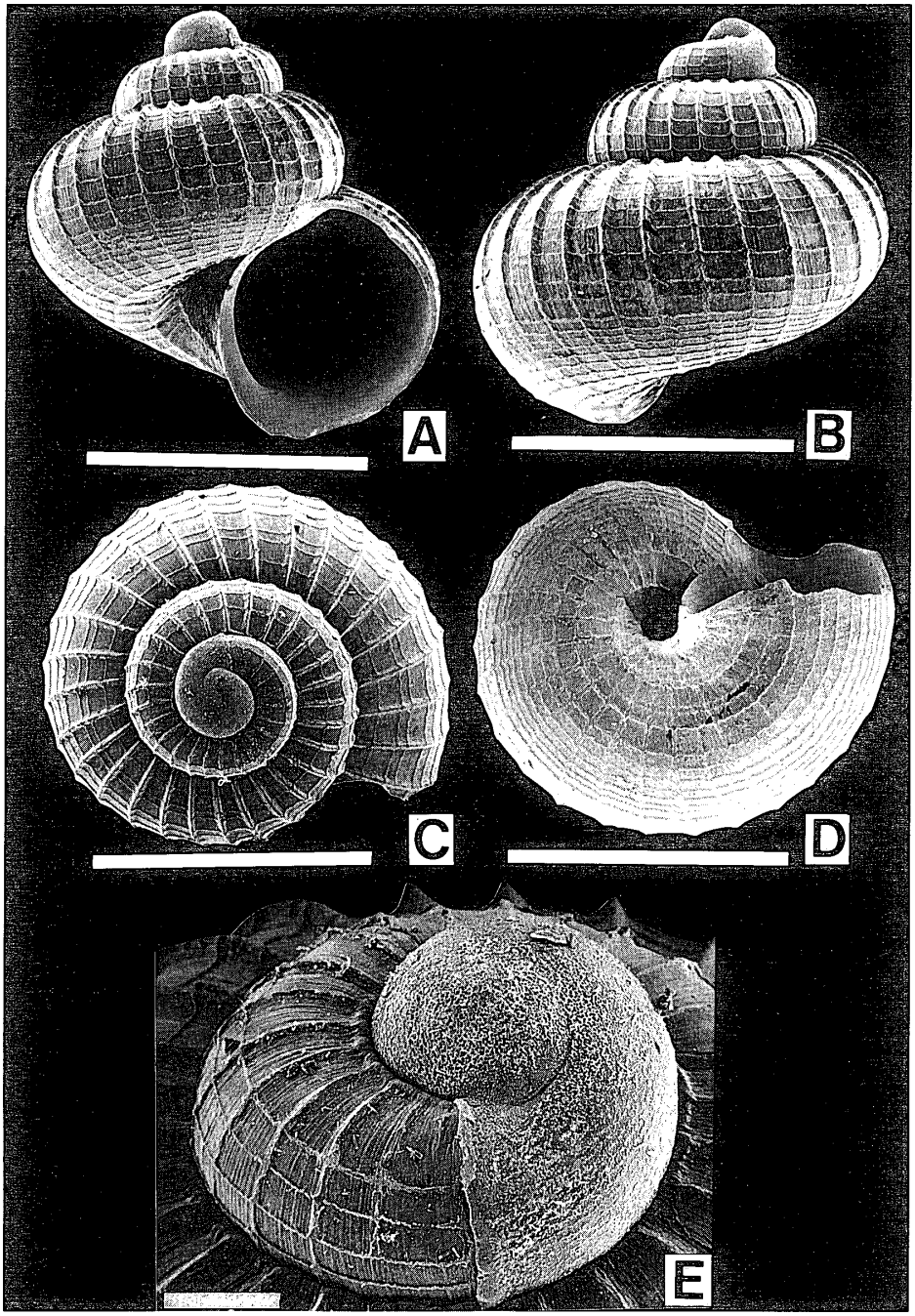
Fig. 29. Distribution of six species of Antarctic *Brookula*.

Brookula delli n. sp.

(Figs. 30A-E)

Material examined: A single living shell from Breid Bay (JARE-27).

Description: The shell is small in size, turbinate, thin, fragile, frosty white in color, with roundly inflated whorls (Figs. 30A, B). The protoconch is globular, small, 0.3 mm in diameter, about 1.25 in number of turns and white in color, and has finely granulated surface (Fig. 30E). The teleoconch whorls are about 2.3 in number of turns, round, and well inflated. The suture is strongly constricted. The upper whorl is rather small and low. The body whorl is round, well-inflated, large, with breadth being about 95% of shell length. The base is roundly inflated. The umbilicus is open, moderate, and the umbilical wall has no sculpture. Axial riblets overlie finer spiral lirae. The axial riblets come to appearance from the 1st teleoconch whorl. Axial riblets are prosocline, rather strongly raised and regularly spaced, about 27 on the body whorl and 24 on the penultimate whorl, and they become gradually weak towards the base. Spiral lirae are fine and regularly spaced, about 21 on the last whorl, and lirae on the base are wider and stronger than the others. The last three lirae which margin the umbilicus are remarkably strong. The aperture is round, and the margin is broken. The inner lip is slightly expanded outwardly. There is a weak angle where the outer lip meets inner one. The columellar lip is thin, round and smooth. The basal lip is very slightly expanded outwardly. The inner wall



Figs. 30A-E. *Brookula delli* n. sp.
A-D. Holotype; E. Protoconch. Scale A-D = 1 mm; E = 100 μm.

is smooth.

The operculum is unknown.

The animal was not examined.

Measurements: SL 1.4 mm, SW *ca.* 1.35 mm (the outer lip is broken).
(Holotype specimen; NSMT-Mo 70613).

Remarks: This species seems to be placed in the genus *Brookula* (s.l.) because of typical

shell characters. This species is similar to *B. antarctica* DELL, 1990, from Ross Sea in 362 m deep, *B. decussata* (PELSENEER, 1903) from Bellingshausen Sea, *B. rossiana* DELL, 1990, from Ross Sea in 362 m deep, *B. sinusbreidensis* NUMANAMI & OKUTANI, 1991 from Breid Bay. *B. antarctica* and *B. sinusbreidensis* have more elongate shell (ratio of SW/SL of the former is 78–80%; the latter species is 86%). *B. rossiana* is allied to this species in having a similar shell form (SW/SL is 94%) and shell sculptures. However, *B. rossiana* has 28 axial cords on the penultimate whorl and 38 on the last whorl (shell length is 1.6 mm, shell width is 1.5 mm, 2 in number of turns of teleoconch). *B. decussata* is largest species among Antarctic and Subantarctic *Brookula*, with numerous spiral lirae.

Etymology: This species is named in honor of Dr. R.K. DELL for his eminent contributions to Antarctic molluscan fauna.

Family TURBINIDAE RAFINESQUE, 1815
Subfamily Homalopomatinae KEEN, 1960
Genus *Leptocollonia* POWELL, 1951
Type species: *Leptocollonia thielei* POWELL, 1951 (O.D.)

Leptocollonia innocens (THIELE, 1912)

(Figs. 31A–F)

Leptothyra innocens THIELE, 1912, p. 192, pl. 11, figs. 24, 24a.

Leptocollonia innocens: POWELL, 1958, p. 183; POWELL, 1960, p. 134 (name only); EGOROVA, 1982, p. 20, figs. 32, 90–94; HAIN, 1990, p. 41, pl. 2, fig. 1, pl. 18, figs. 7 and 8; DELL, 1990, p. 89, figs. 161 and 162.

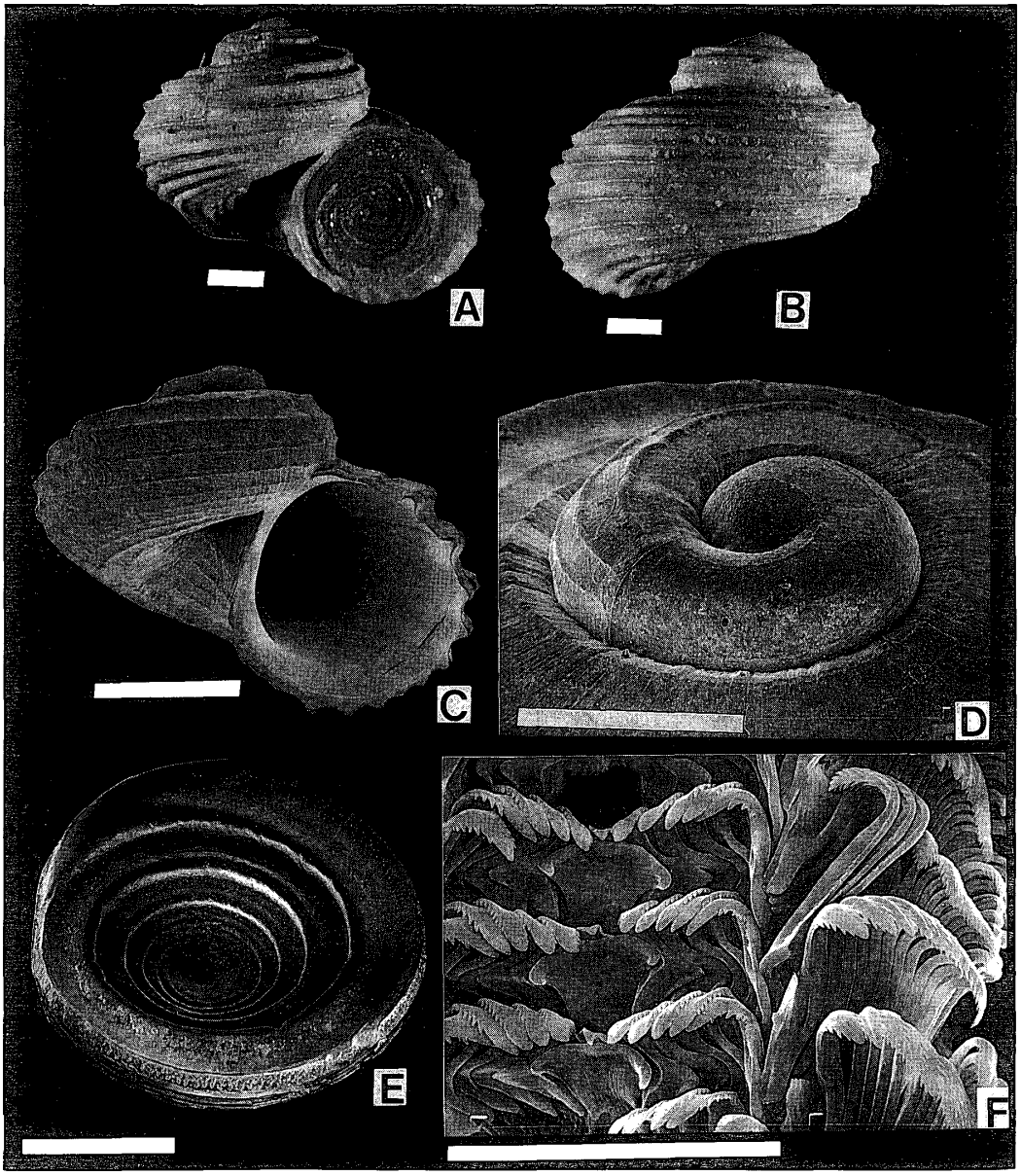
Material examined: 3 living specimens and 8 empty shells from St. 5; 2 empty shells from St. 7; a single empty shell from St. 8; a single living and empty shells from St. 9; a single living specimen from Günnerus Bank.

Description: The shell is small, turbinate, thick, with well inflated whorls (Figs. 31A, B). The coloration of the shell is frosted white, but bluish iridescence of nacreous layer of hypostracum is visible through the shell. The protoconch is about only 1.0 in number of turn, about 0.75 mm in diameter, white and finely granulated, and has widely spaced 3 spiral lirae (Fig. 31D). The teleoconch is about 2.6 in number of turns, roundly inflated, and has round topped, strong spiral riblets that are crossed by microscopic growth lines. The suture is impressed. The upper whorls is small and inflated. The body whorl is very large, roundly inflated,with breadth being 113–136% of shell length. The base is roundly inflated. The umbilicus is moderately open, and the umbilical walls of upper whorls are visible inside. The first teleoconch with 3 or 4 spiral riblets, penultimate whorl with 6, body whorl with 23. The interspaces between spiral riblets are almost equal in width, except near the umbilical area, where they become grooves in appearance. In the body whorl, the second and fourth spiral riblets are weaker than the others. Intercalated spiral riblets occurs between primary riblets. The aperture is large and round, thin and corrugated by extremities of external spiral riblets, with corrugated peristome. The inner lip is round and smooth with a thick callus. The columellar lip which has a thick callus, is round, smooth, slightly expanded and reflected over the umbilicus. However, the columellar lip is straight in the small specimen, and has two corners on the basal and inner lips

(Fig. 31C). The inner wall has well-developed nacreous layer, except for the edge of outer lip to basal lip area.

The operculum is calcareous externally, circular, translucently white in color and shining, multispiral inside, 8 in number of turns, and slightly small to the aperture in size (Fig. 31E). The outer surface of operculum is concave and deeply spirally channeled. The inner surface is smooth, which is covered with translucently pale brown corneous film.

The animal is creamy in color, but upper area of metapodium is gray. The animal has a pair of short, stout and thumb-like cephalic tentacles and a pair of small epipodial tentacles on both sides of the foot. The eye is black in color, which is located on the top of eye lobe. A single pair of eye lobes are thumb-like in shape and produced in just



Figs. 31A-F. *Leptocollonia innocens* (THIELE). A-C. Shell; D. Protoconch; E. Operculum; F. Radula. Scale A-E=1 mm; F=100 μm.

posterior of cephalic tentacles with 2/3 in length of the cephalic tentacles. A single pair of epipodial tentacles on the posterior side of the eye lobes are short, small and nipple-like in shape. The foot is short, wide and ovo-rhombic in outline. The proboscis is hastate in shape, short and slightly narrow, which has papillated tip. The mantle is very thin, and has a little notched edge.

The radula is rhipidoglossate, 23 : 5 : 1 : 5 : 23, and its length is 34% of shell length (Fig. 31F). The rhachidian tooth is scalloped in outline, much wider than high (74% of width), 'double-decked' in appearance, having stout lateral wings that carries a blunt projection on both sides. The upper deck of the rhachidian tooth is thinner and smaller than the lower one, and has an obtusely angled central cusp, but the lower deck is thick, wide and smooth. The lateral teeth progressively decrease in width from the first to the fifth, while their length progressively increase. Each lateral tooth has well-developed lateral wings on its outer side which interlock with a corresponding concavity in the middle region of the shaft of the adjoining tooth, except for the fifth lateral that has no wing. The lateral teeth have an obtuse-angled large central cusp that carries 7–8 denticles on both lateral sides, and those of the outer side are larger and stronger than those of inner side. The marginal teeth are goose-necked in shape with some denticles and progressively decrease in width outwardly. The inner marginal teeth, from the first to the tenth, are stronger than the outer ones, and have a lateral wing on both lateral sides and an obtuse-angled large central cusp that carries 5–7 denticles on both lateral sides. The outer lateral teeth are narrow, and have a serrated tip. The marginal teeth are slender with curved spatulate tip that carries numerous needle-like denticles.

Measurements: See Table 12.

Previous distribution records (Fig. 32): Type locality: Gauss Station, Davis Sea. Range: off Enderby Land, 190–300 m, off Kaiser Wilhelm Land, 393 m (POWELL, 1958); Davis Sea (EGOROVA, 1982); Weddell Sea, 193–673 m (HAIN, 1990); 77°40′S, 30°35′W, Weddell Sea, 378 m (DELL, 1990); Ross Sea, 315–549 m (DELL, 1990).

Remarks: The radula of *Leptocollonia innocens* was described by EGOROVA (1982). The radula of present specimen was compared with EGOROVA's figure which showed a "single-decked" rhachidian tooth and wide lateral teeth which have serrated edge on lateral outside. This difference may be attributable a difference of angle of observation.

L. innocens is closely allied to *L. thielei* POWELL, 1951 from Palmer Archipelago to South Georgia. But, *L. thielei* is larger (SL 7.5 mm, SW 9.0 mm; POWELL, 1951) than *L. innocens*. The rhachidian tooth of *L. thielei* has wide, simple and gently curved upper deck. According to POWELL (1951), THIELE (1912) described that the operculum of *Leptothyra* sp. from Gauss Station, Davis Sea, was probably the same species of *L. thielei*. However, *L. thielei* was not found in the present material.

Table 12. Measurements and condition of *Leptocollonia innocens* (THIELE).

No.	1	2	3	4	5	6	7	8	9	10
St.	5	5	5	5	5	5	5	5	5	5
SL (mm)	2.2	1.8	2.6	3.8	3.6	3.9	4.1	5.1	5.5	—
SW (mm)	3.0	2.3	3.4	4.6	4.5	4.6	4.6	6.2	6.2	—
SW/SL (%)	136.4	127.8	130.8	121.1	125.0	117.9	112.2	121.6	112.7	—
Condition	F	F	L	F	F	F	F	L	F	E

No.	11	12	13	14	15	16	17
St.	5	7	7	8	9	9	G
SL (mm)	—	2.6	4.0	2.5	3.0	—	3.1
SW (mm)	—	3.4	4.8	3.3	3.8	—	3.6
SW/SL (%)	—	130.8	120.0	132.0	126.7	—	116.1
Condition	E	F	F	F	L	E	L

E: Empty and water-worn specimen; F: Freshly dead specimen; G: Günnerus Bank; L: Specimen taken alive.

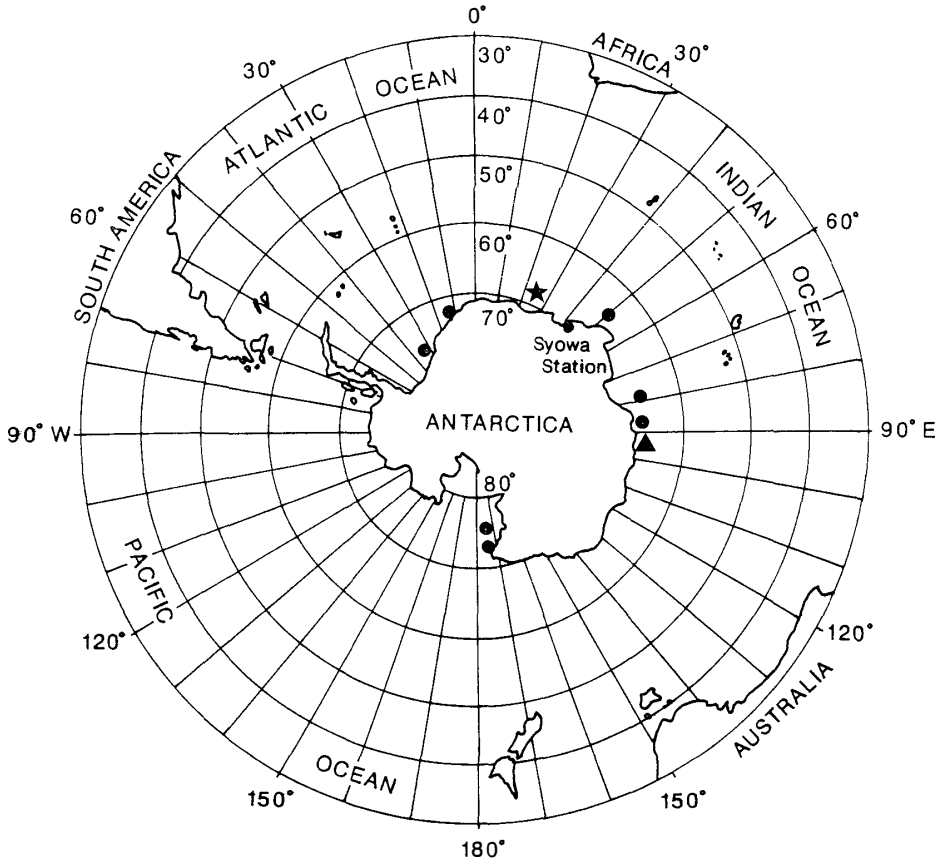


Fig. 32. Distribution of *Leptocollonia innocens* (THIELE) (Large dots: Previous distribution records; Star: Present study; Triangle: Type locality).

Order Mesogastropoda
Family LITTORINIDAE GRAY, 1840
Genus *Laevilitorina* PFEFFER, 1886
Type species: *Littorina caliginosa* GOULD, 1849

Laevilitorina antarctica (SMITH, 1902)

Paludestrina antarctica SMITH, 1902, p. 204, pl. 24, fig. 16.
Laevilitorina antarctica: LAMY, 1911, p. 9; HEDLEY, 1916, p. 45; POWELL, 1958, p. 184; POWELL, 1960, p. 134 (name only); ARNAUD, 1972, p. 117, fig. 7; DELL, 1972a, p. 2 (distribution record); ARNAUD and BANDEL, 1978, p. 213, fig. 2, pl. 1, figs. 1-3, 7, pl. 3, figs. 5, 6, pl. 4, fig. 1; HORIKOSHI *et al.*, 1979, p. 20, fig. 1; DELL, 1990, p. 109, fig. 179.
Previous distribution records (Fig. 33): Type locality: Cape Adare, 15 m. Range: Commonwealth Bay, Davis Sea, 5.5-45 m (HEDLEY, 1916); Proclamation Island, Enderby Land, 2 m (POWELL, 1958); Cape Denison, Commonwealth Bay, King George V Land, 4-13 m (POWELL, 1958); West Arm, the vicinity of Mawson Base, 67°36′S, 62°53′E, 100 m (DELL, 1972a); Subtidal zone along Langhovde, Enderby Land (HORIKOSHI *et al.*, 1979); Ross Sea, 12-351 m (DELL, 1990); McMurdo Sound, 18 m (DELL, 1990); 66°24′24″S, 110°27′42″ E, Davis Sea, 51 m (DELL, 1990); Budd Coast, Davis Sea, 55-148 m (DELL, 1990).

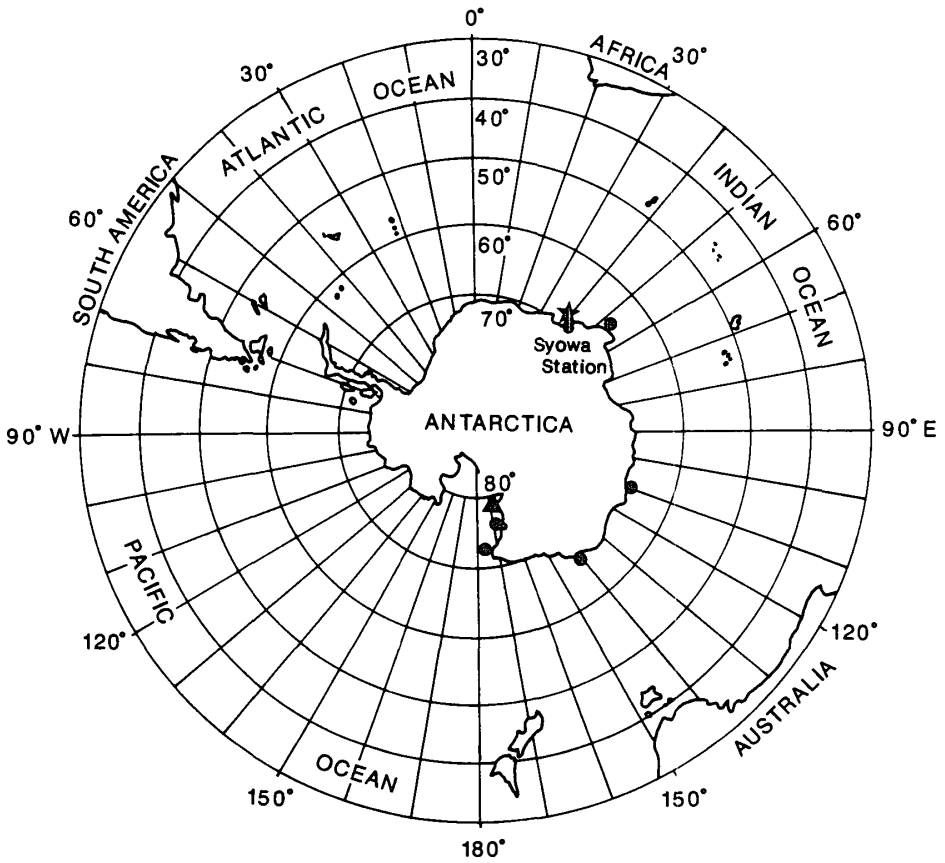


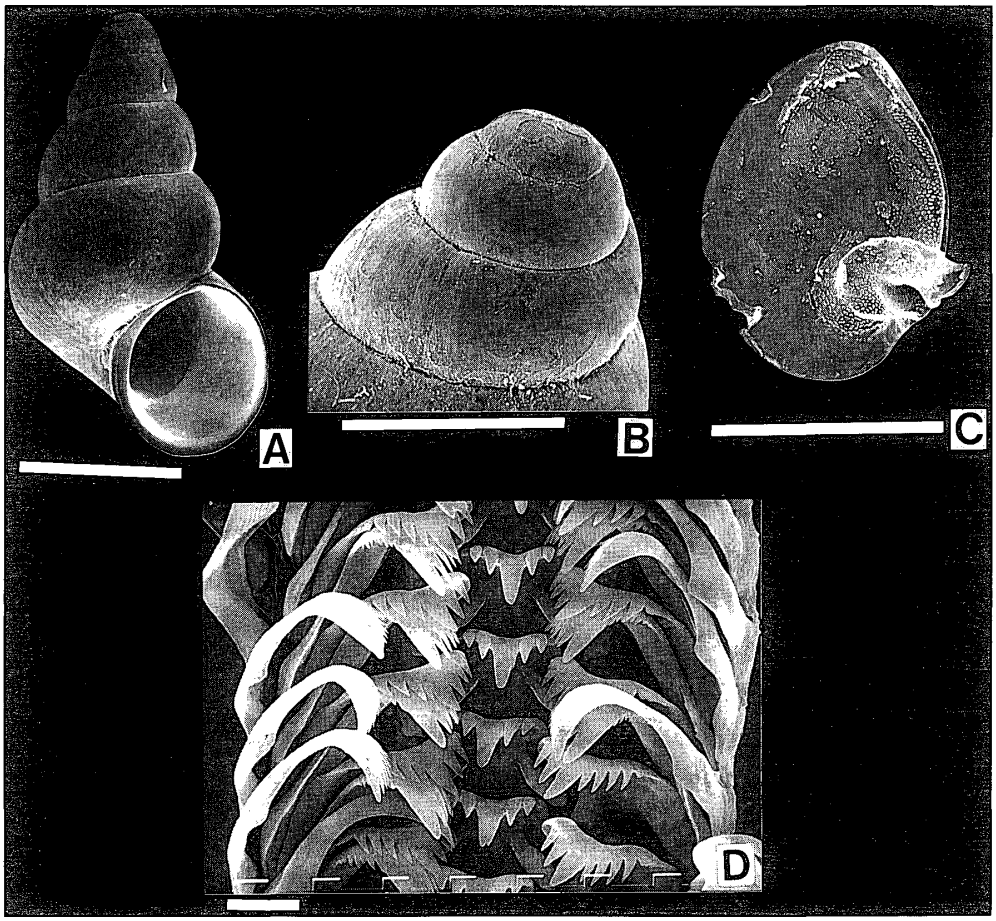
Fig. 33. Distribution of *Laevilitorina antarctica* (SMITH) (Large dots: Previous distribution records; Star: Present study; Triangle: Type locality).

Remarks: According to HORIKOSHI *et al*. (1979), many specimens of *Laevilitorina antarctica* were collected from the subtidal zone of Langhovde by JARE. They were found attached to algae which grow thick on chasms of the subtidal zone. But, these specimens were not available to the present study. This species was distributed in East Antarctica, Ross Sea to the neighborhood of Syowa Station. Vertical distribution of this species is relatively wide, 2–351 m deep, but DELL (1990) claimed that shells from deeper water might not be taken alive.

Family EATONIELLIDAE PONDER, 1965
Genus *Eatoniella* DALL, 1876
Type species: *Eatonia kerguelenensis* SMITH, 1875

Eatoniella glacialis (SMITH, 1907)
(Figs. 34A–D)

Rissoia glacialis SMITH, 1907, p. 9, pl. 2, fig. 4; HEDLEY, 1916b, p. 86.
Eatoniella kerguelensis forma *major* STREBEL, 1908, p. 57, pl. 4, fig. 561–c.



Figs. 34A–D. *Eatoniella glacialis* (SMITH). A. Shell; B. Protoconch; C. Operculum; D. Radula. Scale A = 1 mm; B, C = 500 μm D = 10 μm.

Subonoba glacialis: HEDLEY, 1916a, p. 48; DELL, 1972a, p. 2 (distribution record).
Eatoniella (*Eatoniella*) *glacialis*: PONDER and YOO, 1978, p. 641.
Eatoniella glacialis: PONDER, 1983, p. 11, figs. 2c and 5e; DELL, 1990, p. 111, fig. 191.
Material examined: A single living specimen from St. 8.
Description: The shell is small, conical, translucent white in color, with almost straight spire, and has well inflated whorls (Fig. 34A). The protoconch is about 3 in number of turns, transparent, with a smooth surface (Fig. 34B). The teleoconch is 3 in number of turns, with very fine axial growth lines on the surface. The surface of the teleoconch has a very thin translucent periostracum. The suture is strongly impressed. The umbilicus is very narrow. The aperture is oval, weakly angulated posteriorly, with rather thick peristome. The outer lip is short, round and smooth. The columellar lip is curved, smooth, slightly expanded outwardly. The basal lip is round, smooth, and slightly reflected.

The operculum is thick, paucispiral and pale yellow in color, and has a thin calcareous inner surface with a peg and thick horny outer surface. The calcareous matter around the peg is thicker and whiter than the edge. The peg which arose from the nucleus, is rather long and longitudinally grooved (Fig. 34C).

The radula is taenioglossate,. with the formula 2 : 1 : 1 : 1 : 2 (Fig. 34D). The rha-

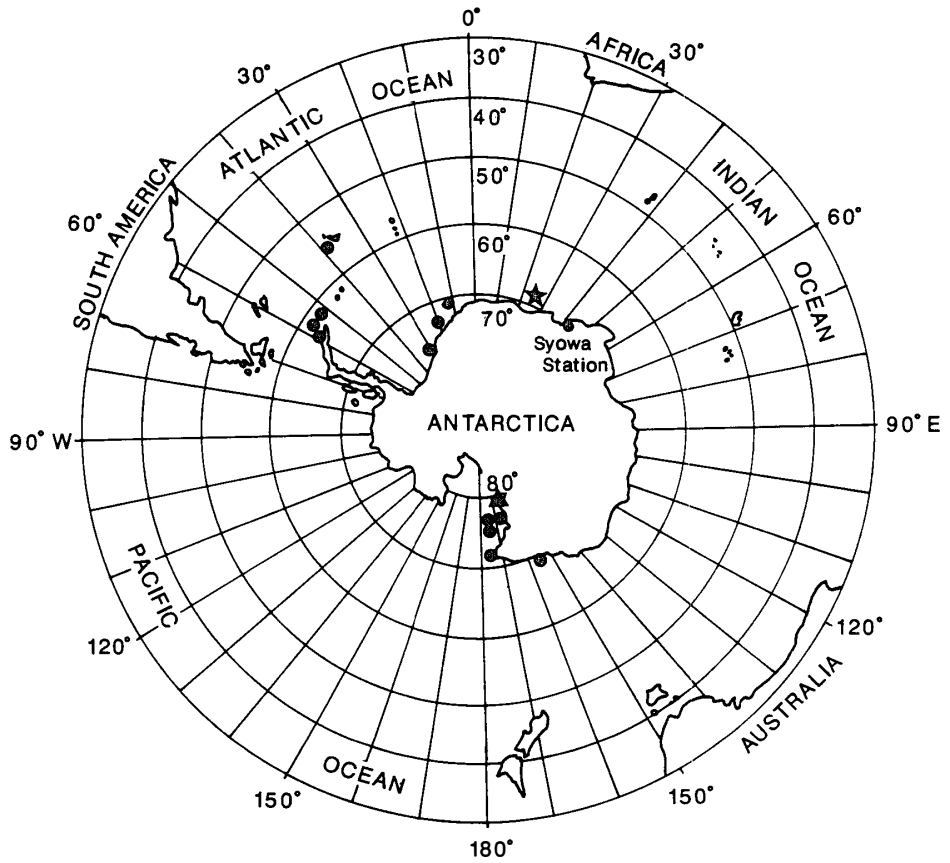


Fig. 35. Distribution of *Eatoniella glacialis* (SMITH) (Large dots: Previous distribution records; Star: Present study; Triangle: Type locality).

chidian tooth is $\frac{(1)+2+1+2+(1)}{1\quad\quad 1}$, and outermost cusps is very small or absent, the central cusp is rather narrow and blunt-topped. Denticulation of the lateral tooth is 3+1+5, the central cusp is not so large, the outermost cusp on the both sides are considerably small. The inner marginal tooth has six prominent cusps on the inner side, and several small denticles on the outer. The outer marginal tooth has a single slightly large cusp and several very fine, sharply pointed denticles on the tip.

Measurements: SL 2.9 mm; SW 1.6 mm.

Previous distribution records (Fig. 35): Type locality: Discovery Winter Quarters, Cape Armitage, McMurdo Sound, 238 m (Lectotype, PONDER, 1983). Range: Graham Land, 125 m; Astrolabe Island, 95 m (PONDER, 1983); South Georgia 12–15 m and 22 m (PONDER, 1983); Commonwealth Bay, George V Land, 46–91 m (HEDLEY, 1916a); Cape Royds (HEDLEY, 1916b); West Arm, the vicinity of Mawson Base, 67°36′S, 62°53′E, 100 m (DELL, 1972a); McMurdo Sound, 221 m (PONDER, 1983); eastern Weddell Sea, 238–393 m (DELL, 1990); Antarctic Peninsula (DELL, 1990); Ross Sea, 27–870 m (DELL, 1990).

Remarks: The shell and radula of this species are similar to *Eatoniella kerguelenensis regularis*. But, the outer marginal tooth of *E. glacialis* is weak with a gently incurved inner margin, while that of *E. k. regularis* is massive with a strongly incurved inner margin.

Eatoniella kerguelenensis regularis (SMITH, 1915)

(Figs. 36A–D)

Rissoia regularis SMITH, 1915, p. 65, pl. 1, fig. 5; DELL, 1972a, p. 2 (distribution record).

Eatoniella kerguelenensis: LAMY, 1905, p. 480; MELVILL and STANDEN, 1907, p. 134; LAMY, 1911, p. 11; HEDLEY, 1916a, p. 46; GAILLARD, 1954b, p. 680; ARNAUD, 1972, p. 118 (in part), figs. 9 and 12 (non SMITH, 1875).

Eatoniella kerguelenensis forma *major*: MELVILL and STANDEN, 1912, p. 351 (non STREBEL, 1908).

Eatoniella kerguelenensis major: POWELL, 1951, p. 110 (non STREBEL, 1908).

Eatoniella (*Eatoniella*) *regularis*: PONDER and YOO, 1978.

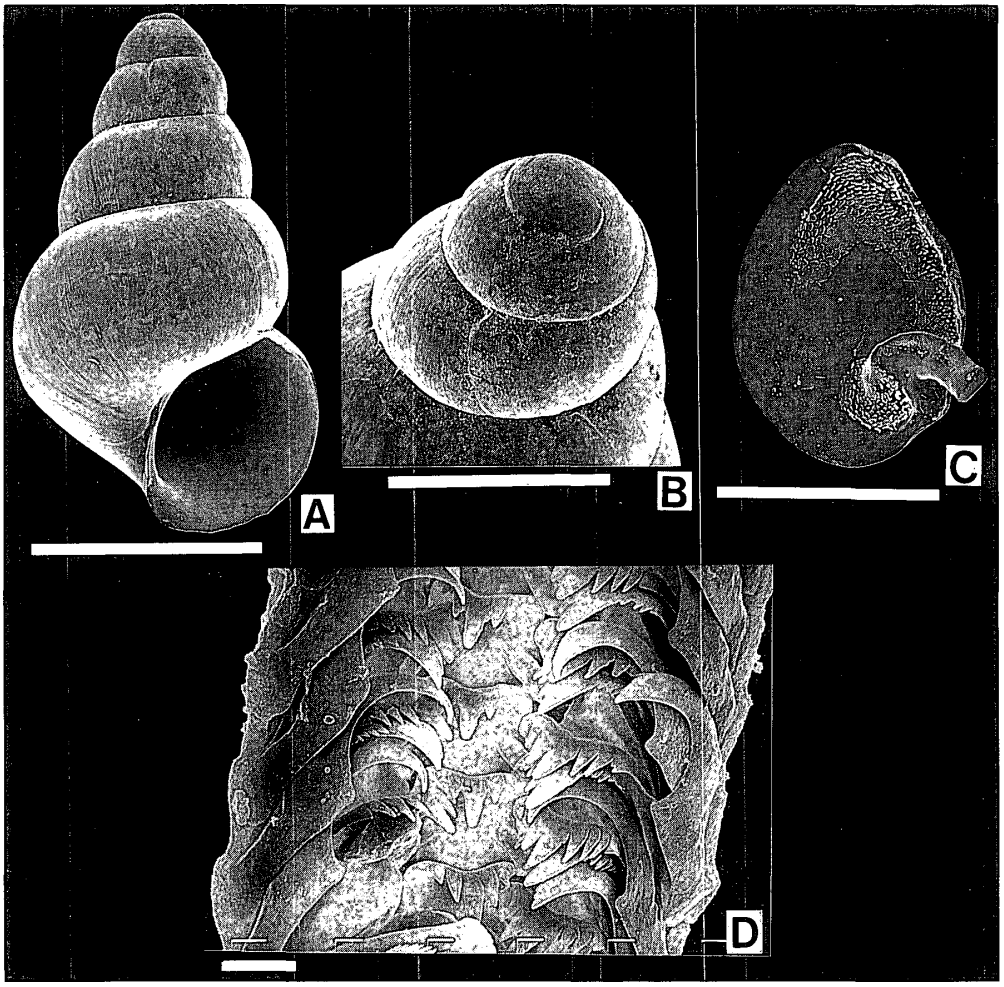
Eatoniella kerguelenensis regularis: PONDER, 1983, p. 7, figs. 2b, 3a–c; DELL, 1990, p. 113, fig. 190.

Material examined: A single living specimen from St. 9.

Description: The shell is small, conical, solid, rather thin, white to gray in color, with straight spire, and has convex whorls (Fig. 36A). The protoconch is about 1.5 in number of turns, transparent, with a smooth surface (Fig. 36B). The teleoconch is about 2.8 in number of turns, smooth except for crowded, very fine growth lines. The surface of teleoconch is covered by a very thin, transparent periostracum. The suture is impressed. The umbilicus is narrowly open. The aperture is rather large, circular, with a sharp peristome. The outer lip is smooth. The inner lip is extended forwards.

The operculum is thick, paucispiral and pale yellow in color, with a pale brown edge. It has a thin calcareous inner surface and thick horny outer surface. The calcareous matter around the peg is thicker and whiter than the edge. The peg which arose from the nucleus is long and longitudinally grooved (Fig. 36C).

The radula is taenioglossate, with the formula 2 : 1 : 1 : 1 : 2 (Fig. 36D). The rha-



Figs. 36A–D. *Eatoniella kerguelenensis regularis* (SMITH). A. Shell; B. Protoconch; C. Operculum; D. Radula. Scale A = 1 mm; B, C = 500 μm D = 10 μm.

chidian tooth is $\frac{(1)+2+1+2+(1)}{1\quad\quad 1}$, and outermost cusps are very small, while the central cusp is rather narrow and blunt. the lateral teeth are $2+1+3(\sim 4)$, and the central cusp is blunt and larger than the others. Denticulation of the inner marginal teeth has four prominent cusps on the inner side, and five small denticles on the outer side. The outer marginal tooth has several weak and sharp denticles on the tip.

Measurements: SL 2.8 mm; SW 1.8 mm.

Previous distribution records (Fig. 37): Type locality: off Cape Adare, mouth of Robertoson's Bay, 82–92 m; McMurdo Sound, 348–457 m (Syntypes, PONDER, 1983). Range: Signy Island, South Orkney Islands, 50 m; Livingston Island, South Shetland Islands, 8 and 32 m; Commonwealth Bay, George V Land, 82–91 m and 45 m (above PONDER, 1983); Cape Marserie, Adélie Coast, 10–15 m, 10–12 m and 100 m (HEDLEY, 1916a); Cape Decouverte, 30 m (HEDLEY, 1916a); Petermann Island, Antarctic Peninsula (LAMY, 1910); off Wiencke Island, Port Lockroy, Anvers Island, Antarctic Peninsula, 0 and 37 m (LAMY, 1905); West Arm, the vicinity of Mawson Base, 67°36′S, 62°53′E, 100 m (DELL, 1972a);

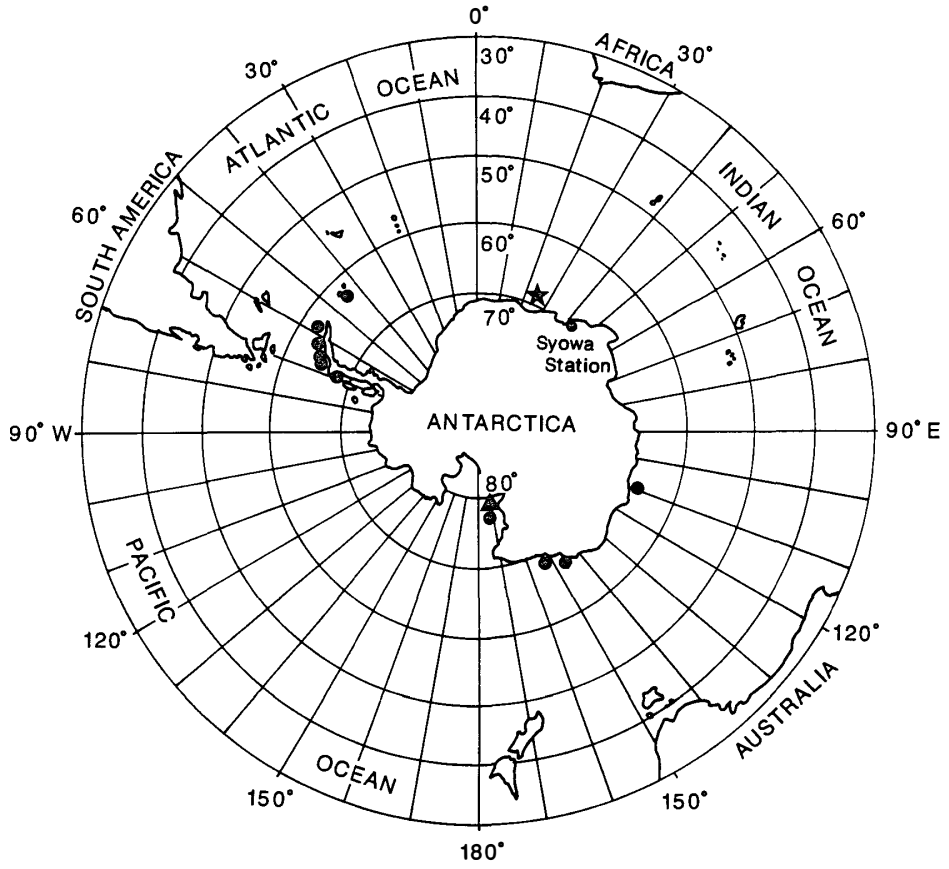


Fig. 37. Distribution of *Eatoniella kerguelenensis regularis* (SMITH) (Large dots: Previous distribution records; Star: Present study; Triangle: Type locality).

Gamma Island, Melchior Harbour, Antarctic Peninsula, 22 m and 46 m (PONDER, 1983); Ross Sea, 82–457 m (DELL, 1990); Davis Sea, 58 m (DELL, 1990).

Remarks: PONDER (1983) distinguished two subspecies of *Eatoniella kerguelenensis* in the Antarctic and Subantarctic waters. *E. k. kerguelenensis* is confined to Kerguelen, while *E. k. regularis* occurs on the Antarctic continent, Antarctic Peninsula and South Orkney Islands. According to him (1983), differences in the shell between two forms are only size. This subspecies is consistently smaller than the other.

The latter subspecies does not exceed 3.4 mm in SL usually less than 3 mm, and has a thicker shell with flatter whorls and a narrower aperture.

Family RISSOIDAE GRAY, 1847

Genus ONOBA H. and A. ADAMS, 1852

Type species: *Turbo striatus* J. ADAMS, 1797, non DA COSTA, 1778

(= *Turbo semicostatus* MONTAGU, 1803)

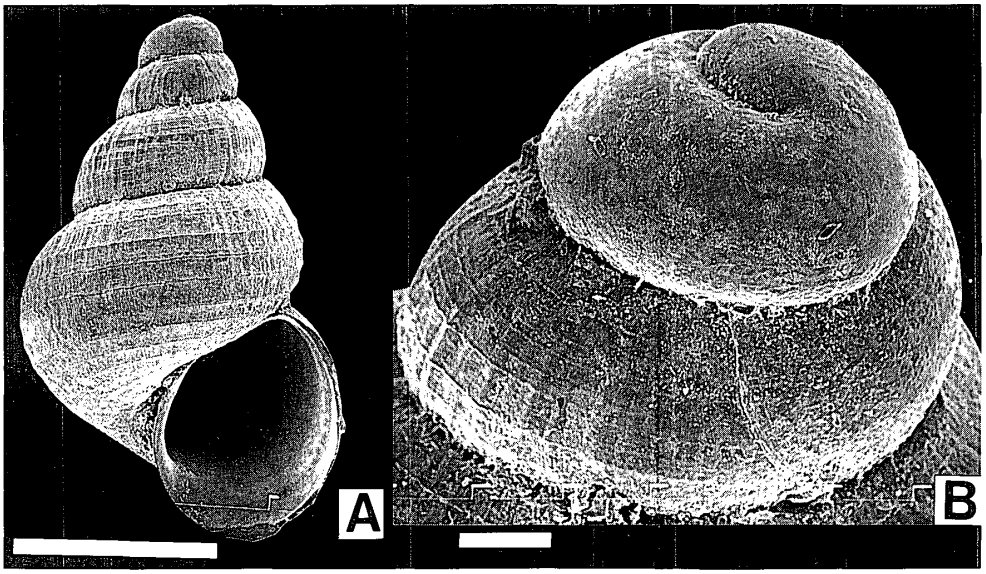
Onoba gelida (SMITH, 1907)

(Figs. 38A, B)

Rissoia gelida SMITH, 1907, p. 9, fig. 5; SMITH, 1915, p. 65.

Rissoa gelida: HEDLEY, 1911, p. 5; THIELE, 1912, p. 195, pl. 11, figs. 37, 38.
Subonoba gelida: HEDLEY, 1916a, p. 48; POWELL, 1958, p. 185; POWELL, 1960, p. 136 (name only); ARNAUD, 1972, p. 121.
Subonoba contigua POWELL, 1957, p. 184, pl. 1, fig. 8; POWELL, 1960, p. 136.
Onoba gelida: PONDER, 1983, p. 20, figs. 13a, b, 16a-d; DELL, 1990, p. 114, fig. 194.
Material examined: A single empty shell from St. 5.
Description: The shell is large for the genus, broadly ovate, solid, translucent white in color, with well inflated whorls (Fig. 38A). The protoconch is about 2.25 in number of turns, with a rough surface (Fig. 38B). The teleoconch is 3 in number of turns, with strong spiral cords and very fine axial growth lines on the surface. The suture is strongly impressed. The spiral cords are regularly spaced with 1-2 very fine intercalated spiral lirae, 5 on penultimate whorl and 11 on the last whorl. The umbilicus is narrow. The aperture is ovate, and angulated posteriorly, with a thin peristome. The outer lip is smooth, round, very weakly sinuated. The inner lip is rather narrow, separated from umbilical area. The columellar lip is curved, and slightly expanded over the umbilicus.

Operculum and radula are unknown.
Measurements: SL 2.48 mm, SW 1.56 mm.
Previous distribution records (**Fig. 39**): Type locality: Commonwealth Bay, George V Land. Range: Cape Royds, 29-37 m (HEDLEY, 1911); McMurdo Sound, 221 m (HEDLEY, 1916); off Enderby Land, 66°10′S, 49°41′E, 300 m (POWELL, 1958); Adelie Coast, 15 m (ARNAUD, 1972); off South Georgia, 97-101 m; Ross Sea, 4-870 m (DELL, 1990).
Remarks: This species has very wide horizontal distribution area, such as the Ross Sea to the South Georgia Islands, but is not known from the Weddell Sea to the Antarctic Peninsula. According to EGOROVA (1978), this species is the most abundant Mollusca in the Davis Sea, such as 480 individuals per 1 m^2 at 32 m deep.



Figs. 38A, B. *Onoba gelida* (SMITH). A. Shell; B. Protoconch. Scale A=1 mm; B=100 μm.

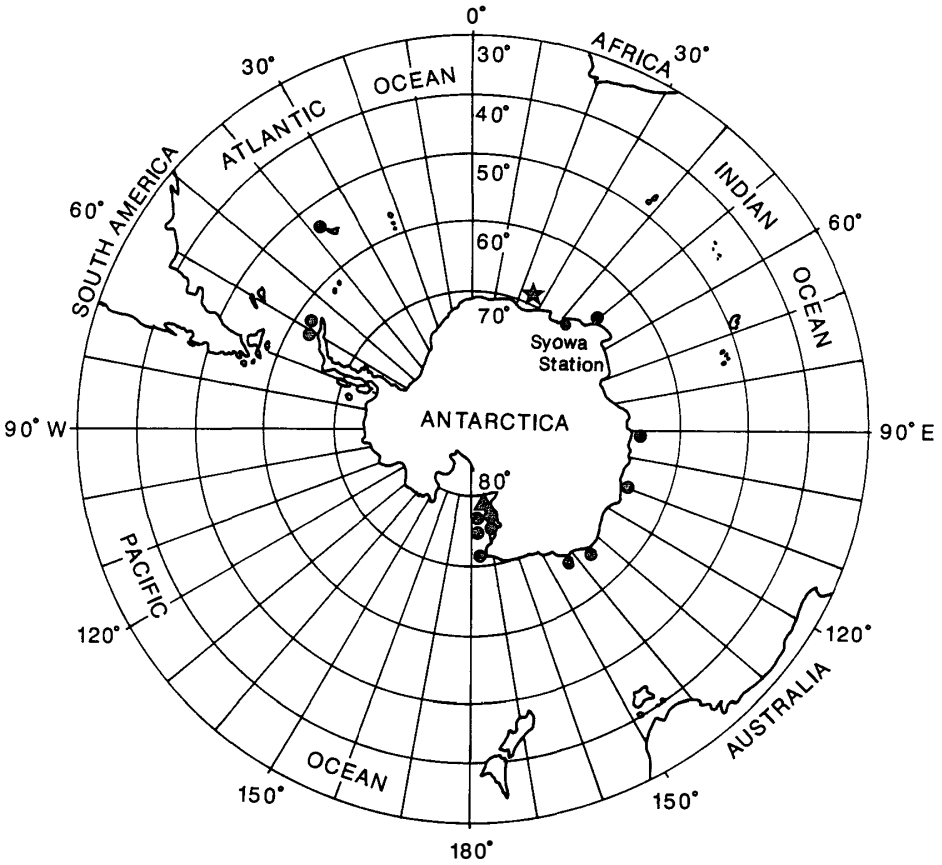


Fig. 39. Distribution of *Onoba gelida* (SMITH) (Large dots: Previous distribution records; Star: Present study; Triangle: Type locality).

Onoba paucilirata (MELVILL & STANDEN, 1916)

(Figs. 40A, B)

Rissoa (*Onoba*) *paucilirata* MELVILL & STANDEN, 1916, p. 350, pl. unnumbered, fig. 10.
Subonoba paucilirata: POWELL, 1960, p. 137 (name only).
Onoba paucilirata: PONDER, 1983, p. 22, fig. 18a.

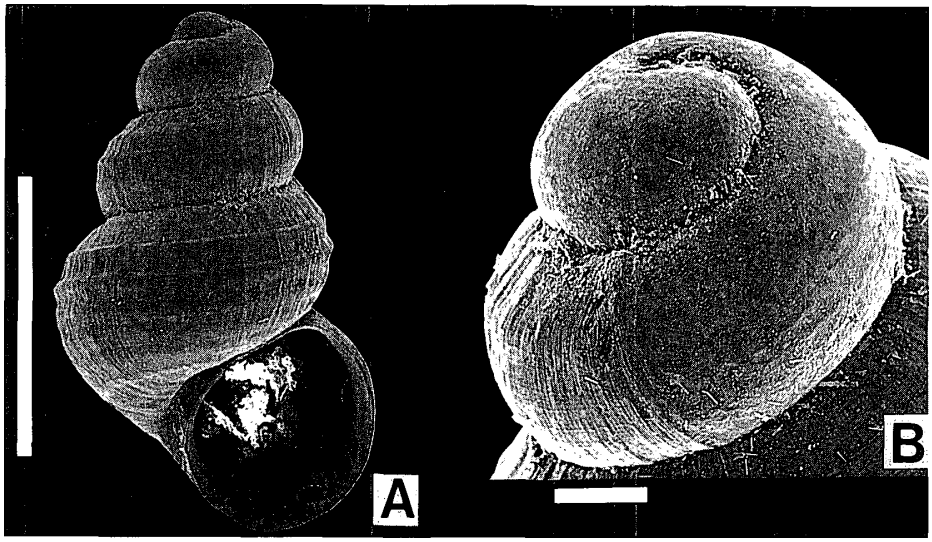
Material examined: A single empty shell from St. 5.

Description: The shell is small, ovo-conical, rather thin, white in color, with a straight spire, and has well inflated whorls (Fig. 40A). The protoconch is about 2 in number of turns, and has numerous, very fine, dot-like sculpture on the surface (Fig. 40B). The teleoconch is about 3 in number of turns, with several strong spiral cords, very fine spiral lirae and crowded, very fine axial growth lines on the surface. The suture is strongly impressed. The umbilicus is narrowly open. The aperture is oval, weakly angled posteriorly, and has a thin peristome. The outer lip is round and smooth. The inner lip is narrow, round, separated from the umbilical area. The columellar lip is gently curved, and slightly expanded over the umbilicus.

Operculum and radula are not known.

Measurements: SL 1.79 mm, SW 1.08 mm.

Previous distribution records (Fig. 41): Type locality: Burdwood Bank, 102 m.



Figs. 40A, B. *Onoba paucilirata* (MELVILL & STANDEN).
A. Shell; B. Protoconch. Scale A = 1 mm; B = 100 μm.

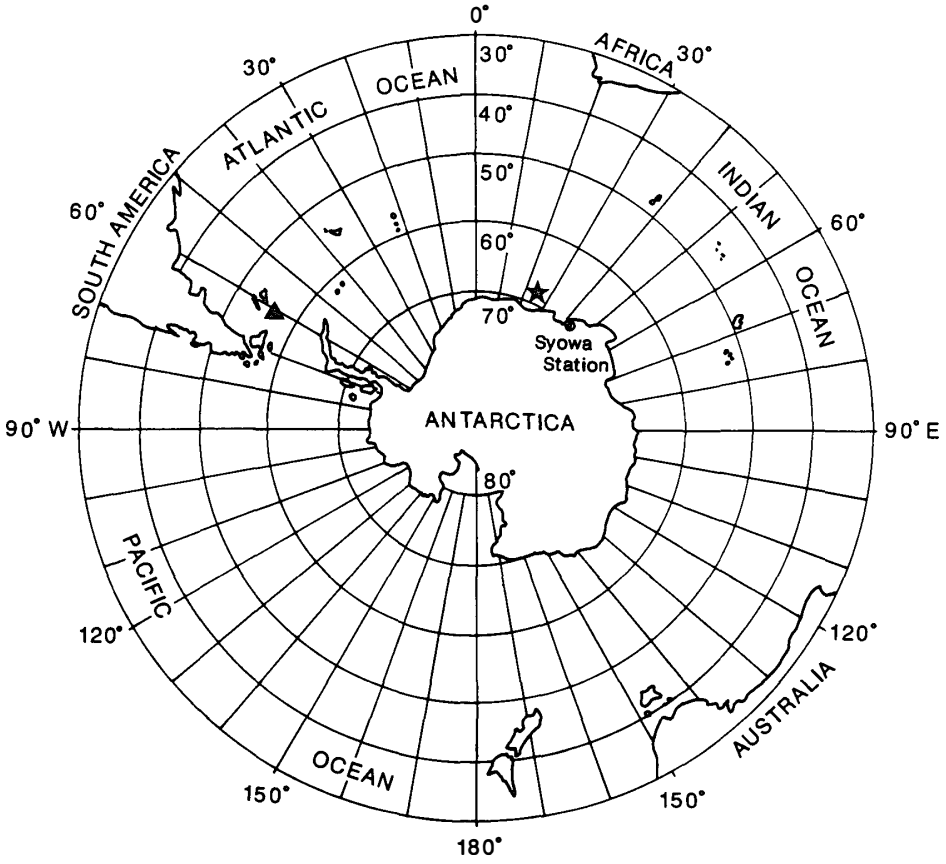


Fig. 41. Distribution of *Onoba paucilirata* (MELVILL & STANDEN) (Star: Present study; Triangle: Type locality).

Remarks: The shell of this species is distinguishable from other Antarctic and Subantarctic Rissoidae by its small number of strong spiral cords, ovo-conical shell and shining surface (PONDER, 1983). This species is similar to *Onoba paucicarinata* from Marion Island and off Enderby Land, but *O. paucicarinata* is much smaller, and has 3 spiral cords on the penultimate whorl and has distinct axial sculptures between the spiral sculptures.

This species had been known only off South Shetland Islands, and was collected from the Antarctic continental shelf for the first time.

Onoba egorovae n. sp.

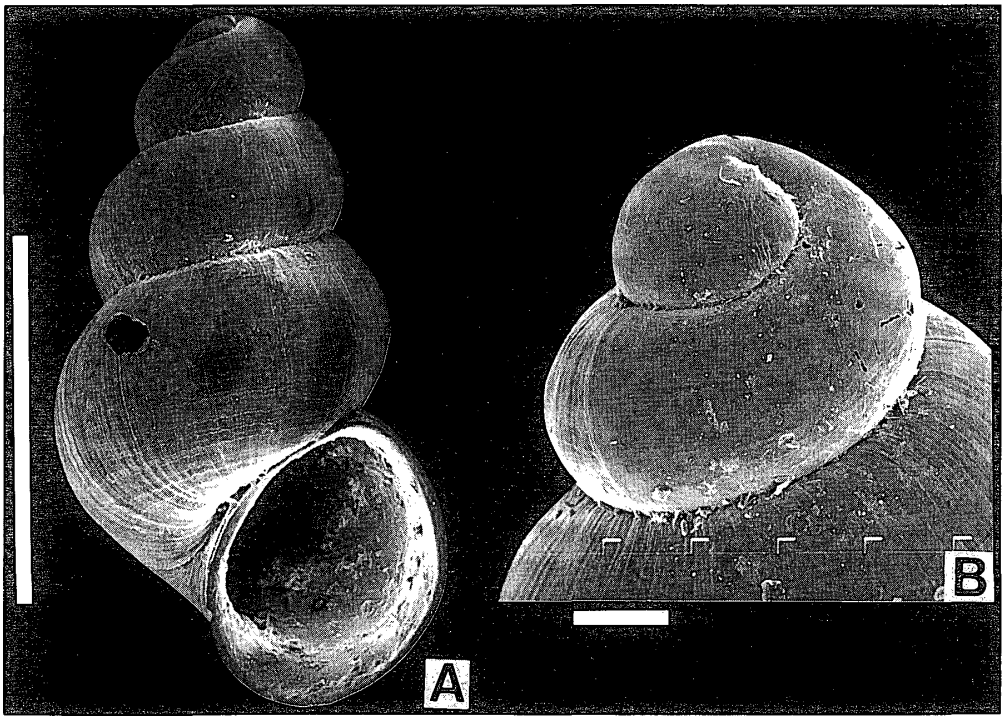
(Figs. 42A, B)

Material examined: A single empty shell from St. 9.

Description: The shell is small, ovate conical, translucent white in color, with almost straight spires, and has convex whorls (Fig. 42A). The protoconch is large, about 1.5 in number of turns, almost smooth but with very weak, wide spaced, spiral, wrinkled threads (Fig. 42B). The teleoconch is 2.5 in number of turns, with crowded weak growth lines and very fine spiral lirae which have a little wavy appearance. The suture is strongly impressed. The spiral cords are regularly spaced, with 1-2 very fine intercalated spiral lirae, 3 in the fist teleoconch and 14 on penultimate whorl. The umbilicus is closed. The aperture is oval, with thin peristome, and feebly angulated posteriorly. The outer lip is round and smooth. The inner lip is short. The columellar lip is round, and slightly reflected.

The animal and operculum is unknown.

Measurement: SL 1.96 mm, SW 1.00 mm (Holotype specimen; NSMT-Mo 70614).



Figs. 42A, B. *Onoba egorovae* n. sp. A. Holotype; B. Protoconch. Scale A = 1 mm; B = 100 μm.

Remarks: This species closely resembles *Onoba schraderi* (STREBEL, 1908) from Kerguelen, having similar sculpture on the teleoconch. But, *O. schraderi* can be distinguished by having numerous microscopic very fine spiral threads on the protoconch, and more elevated spire. This species also similar to *O. paucilirata*, but the teleoconch of the latter species has apparent spiral cords.

Etymology: This species is named in honor of Dr. E.H EGOROVA for her inspiring works on the molluscan fauna of the Davis Sea.

Genus *Powellisetia* PONDER, 1965

Type species: *Rissoa porcellana* SÜTER, 1908

***Powellisetia deserta* (SMITH, 1907)**

(Figs. 43A-D)

Rissoia deserta SMITH, 1907, p. 9, pl. 2, fig. 1; MELVILL and STANDEN, 1912, p. 349 (distribution record); HEDLEY, 1916b, p. 86.

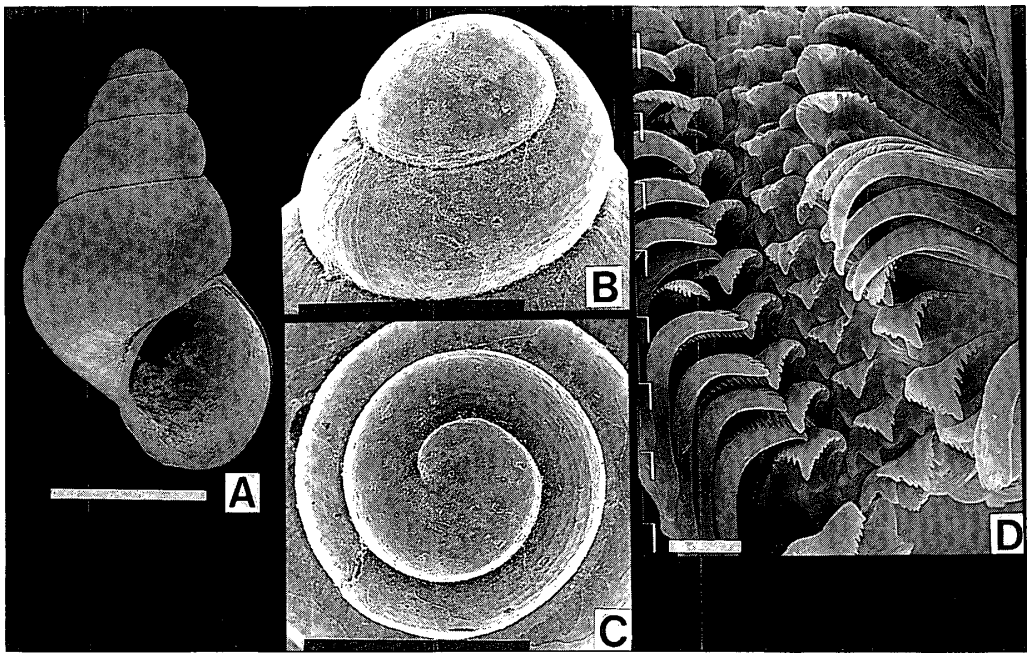
Rissoa deserta (?): THIELE, 1912, p. 194, pl. 11, fig. 33.

Subonoba deserta: HEDLEY, 1916a, p. 48 (distribution record); POWELL, 1958, p. 185 (distribution record); ARNAUD, 1972, p. 120; EGOROVA, 1982, p. 23, figs. 35, 110.

Powellisetia deserta: PONDER, 1983, p. 24, figs. 19a-c, 21c; TUCKER and BURTON, 1987, p. 10 (distribution record); DELL, 1990, p. 116, fig. 197.

Material examined: A single living specimen from St. 5.

Description: The shell is large for the family, ovate conical, rather thin, translucent white in color, with almost straight spires, and has convex whorls (Fig. 43A). The protoconch is about 2 in number of turns, transparent, with very weak and fine spiral cords (Figs. 43B,



Figs. 43A-D. *Powellisetia deserta* (SMITH).
A. Shell; B, C. Protoconch; D. Radula. Scale A = 1 mm; B, C = 500 μm; D = 10 μm.

C). The teleoconch is about 2.5 in number of turns, with crowded weak axial growth lines and, sometimes, traces of spiral scratches. The surface of the teleoconch has a very thin, translucent periostracum. The suture is strongly impressed. The umbilicus is narrow or closed. The aperture is ovate, and feebly angulated posteriorly. The outer lip is smooth, round, very weakly sinuated posteriorly. The inner lip is rather narrow, separated from umbilical area, and attached to parietal area. The columellar lip is curved, and slightly expanded over the umbilicus.

The operculum was lost.

The radula is taenioglossate, with the formula 2 : 1 : 1 : 1 : 2 (Fig. 43D). The rhachidian tooth has triangular cutting edge, small cusps and single pair of basal projection, and the lateral wings with thickened outer edges, $\frac{ca.\ 3+1+ca.\ 3}{1\qquad 1}$. The lateral tooth is large, and has a triangular cutting edge with numerous small, sharp denticles. The marginal teeth are large. The inner marginal tooth has many small denticles on both sides of the tip. The inner side of outer marginal is smooth, but the outer side has many small denticles.

Measurements: SL 2.8 mm; SW 1.6 mm.

Previous distribution records (Fig. 44): Type locality: Discovery Winter Quarters, Cape Armitage, McMurdo Sound. Range: Gauss Station, Davis Sea (THIELE, 1912); Soctia

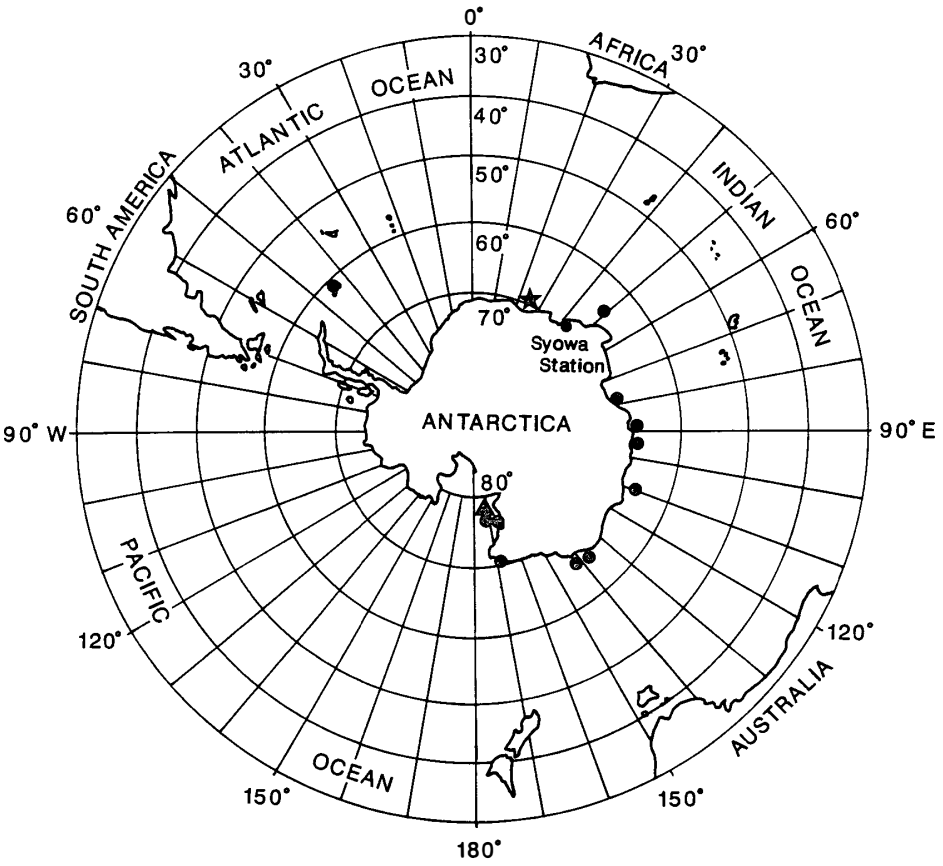


Fig. 44. Distribution of *Powellisetia deserta* (SMITH) (Large dots: Previous distribution records; Star: Present study; Triangle: Type locality).

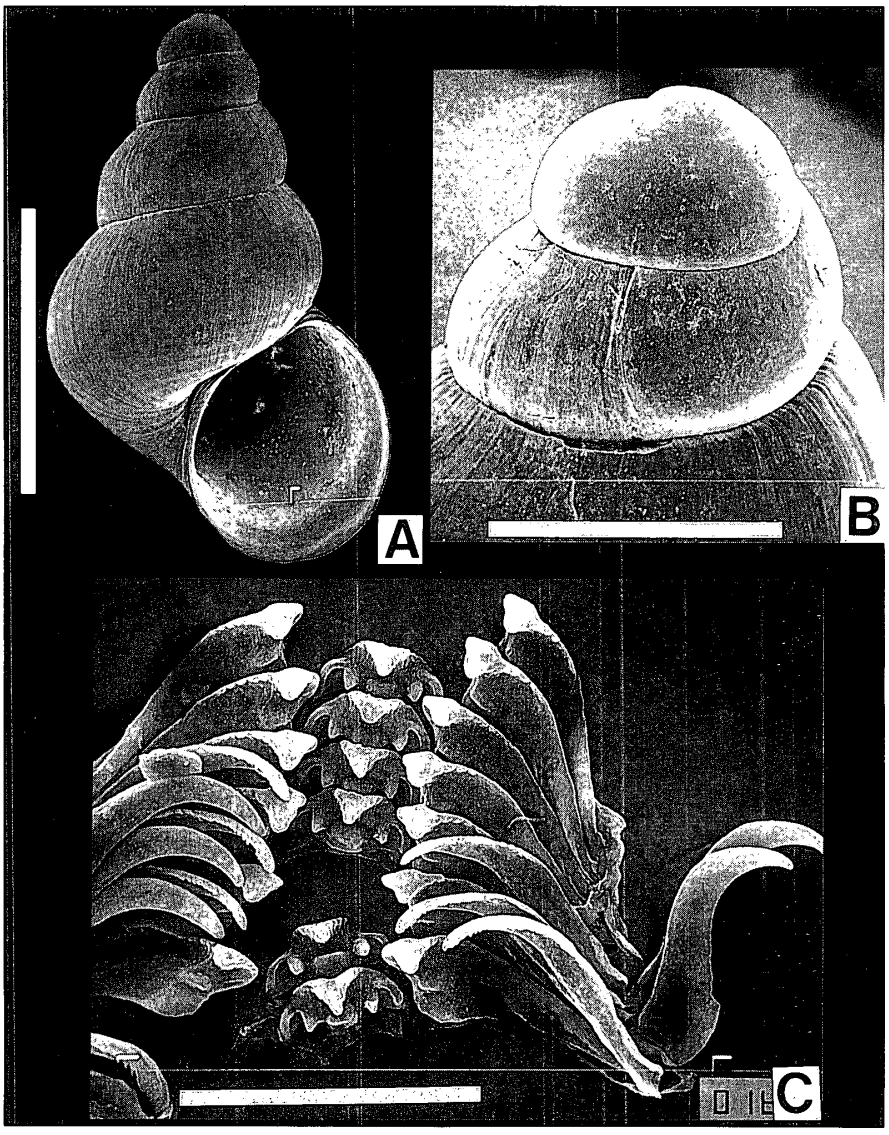
Bay, South Orkney Islands, 16–18 m (MELVILL and STANDEN, 1912); Commonwealth Bay, George V Land, 81–90 m (HEDLEY, 1916a); Commonwealth Bay, 13 m and off Enderby Land, 300 m (POWELL, 1958); Adélie Land, 15–250 m (ARNAUD, 1972); Davis Sea (EGOROVA, 1982); Hut Point, Ross Sea, 124–165 (PONDER, 1983); shallow coastal waters of Vestfold Hills (TUCKER and BURTON, 1987); Ross Sea, 18–870 m (DELL, 1990).

Remarks: The shell and radula of this species were illustrated by EGOROVA (1982). Her illustrated shell has conspicuous spiral cords. Therefore, her identification requires a confirmation.

Powellisetia ponderi n. sp.

(Figs. 45A–C)

Material examined: A single living specimen from St. 8.



Figs. 45A–C. *Powellisetia ponderi* n. sp. A. Holotype; B. Protoconch; C. Radula. Scale A = 1 mm; B = 500 μm; C = 50 μm.

Description: The shell is large, ovo-conical, rather thick, white in color, with a highly elevated spire, and has well inflated whorls (Fig. 45A). The protoconch is 2 in number of turns, transparent, with a smooth surface (Fig. 45B). The teleoconch is about 1.75 in number of turns, with crowded very fine growth lines. The suture is strongly impressed. The base has five weak and regularly spaced spiral threads. The umbilicus is narrowly open. The aperture is ovoid, with a rather thick peristome. The outer lip is round and smooth. The inner lip is rather narrow, separated from umbilical area, and little attached to parietal area. The columellar lip is curved, and slightly expanded over the umbilicus.

The operculum was lost.

The radula is taenioglossate, with the formula 2 : 1 : 1 : 1 : 2 (Fig. 45C). The rhachidian tooth has a large and blunt central cusp, small cusps and single pair of basal projection, and the lateral wings with thickened outer edges, $\frac{ca.\ 4+1+ca.\ 4}{1\qquad 1}$. The lateral tooth is large, and has a large and blunt central cusp with numerous small, sharp denticles. The marginal teeth are also large. The inner marginal tooth has many small denticles on both sides of the tip. The inner side of outer marginal is smooth, but the outer side has many small denticles.

Measurements: SL 2.50 mm, SW 1.54 mm (Holotype specimen; NSMT-Mo 70615)

Remarks: This species resembles *Powellisetia deserta*, but has less inflated whorls, with a smooth base (Fig. 43A). The protoconch of *P. deserta* has very fine spiral lirae (Figs. 43B, C). This species can be distinguishable from the other Antarctic species of *Powellisetia* by having a fewer spiral threads on the base, and has no microsculptures on the protoconch.

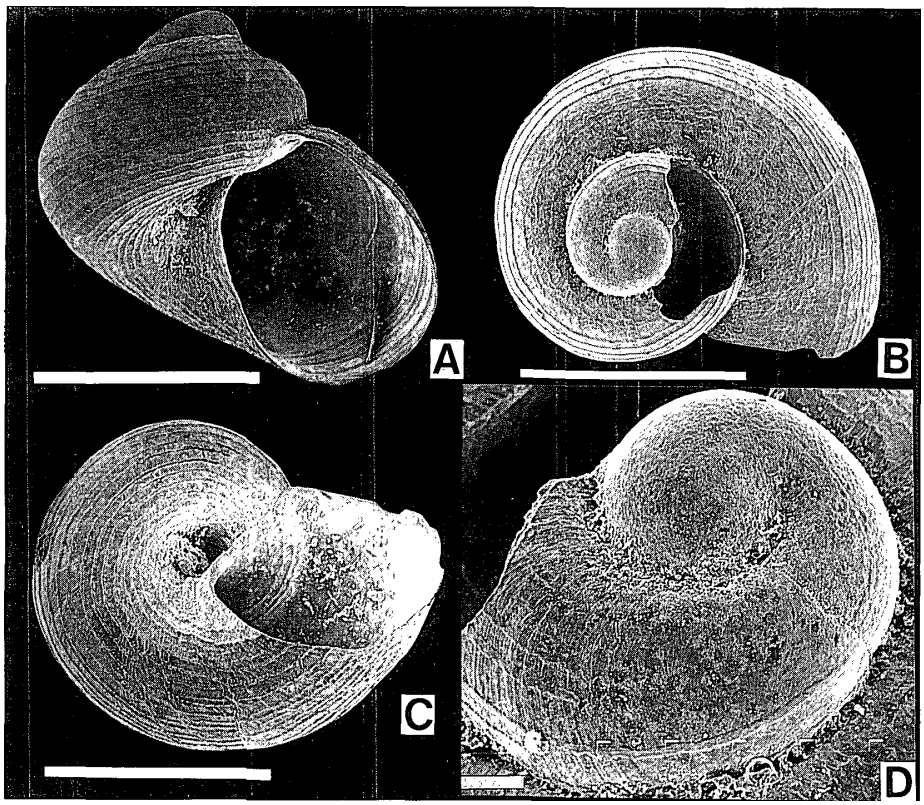
Family TRACHYSMATIDAE THIELE, 1925
Genus *Trachysma* SARS, 1878
Type species: *Trachysma sarsianum* THIELE, 1912

Trachysma tenue THIELE, 1912
(Figs. 46A–D)

Trachysma tenue THIELE, 1912, p. 197, pl. 12, fig. 7; POWELL, 1960, p. 134 (name only); EGOROVA, 1982, p. 21, fig. 98.

Material examined: A single empty shell from St. 5; 1 empty shell from St. 7.

Description: The shell is minute in size, turbinate, very thin and translucently white in color, with well roundly inflated whorls (Figs. 46A–C). The protoconch is well inflated, about 1.25 in number of turns, large, 0.45 mm in diameter, and has finely granulated surface (Fig. 46D). The teleoconch is about 1.7–2.1 in number of turns, and rapidly increases in diameter adaperturally, and has flat topped spiral cords which are crossed by microscopic prosocline growth lines. The suture is impressed, and sutural ramp is less round than the base. The upper whorls are small and depressed. The body whorl is large, breadth being 100–111% of shell length. The umbilicus is rather narrow but deep. The first teleoconch has only a single spiral cord, penultimate whorl 8, body whorl 33. The interspaces between spiral cords are almost equal. The lowest spiral cord is margining an open umbilicus. The umbilical wall has no spiral sculpture, but has only growth lines. The base is well roundly inflated. The aperture is ovate and oblique with very thin and



Figs. 46A-D. *Trachysma tenue* THIELE. A-C. Shell; D. Protoconch. Scale A-C = 1 mm; D = 100 μm.

smooth peristome. As the shell is thin and translucent, the superficial spiral cords are visible through the shell. The upper margin of the outer lip exceeds the lower margin. The outer lip is thin, smooth and gently rounded. The inner lip is also round with a thin callus that is slightly expanded outwardly and has an angle with the outer lip. The basal lip is thin, strongly round and smooth. The columellar lip is gently rounded, slightly expanded and reflected over the umbilicus, and has an angle with the inner lip. The inner wall is almost smooth, but has very weak axial sculptures near the outer lip.

The animal and the operculum are unknown.

Measurements: SL 2.25 mm, SW 2.50 mm (empty shell; St. 5).
SL 1.63 mm, SW 1.63 mm (empty shell; St. 7).

Previous distribution records (Fig. 47): Type locality: Gauss Station, Davis Sea (THIELE, 1912). Range: Davis Sea, 385 m (EGOROVA, 1982).

Remarks: DELL (1990) reported *Trachysma tenue* from the Ross Sea, 344-351 m deep. This is first record from Breid Bay. DELL's and THIELE's illustrations (1912, pl. 12, fig. 7) have no spiral sculptures. DELL's specimen may be *Trachysma antarctica* n. sp. rather than *T. tenue* (Figs. 48A-D), in having smooth whorls.

Trachysma antarctica n. sp.

(Figs. 48A-D)

Material examined: A single empty shell from St. 8.

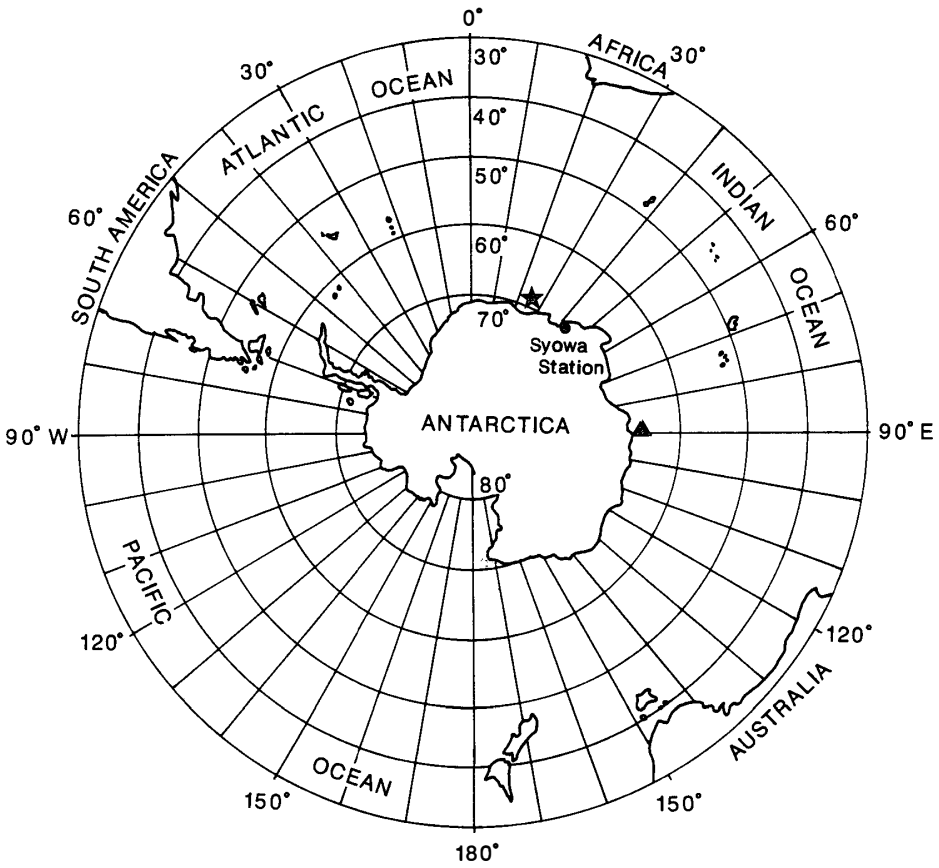
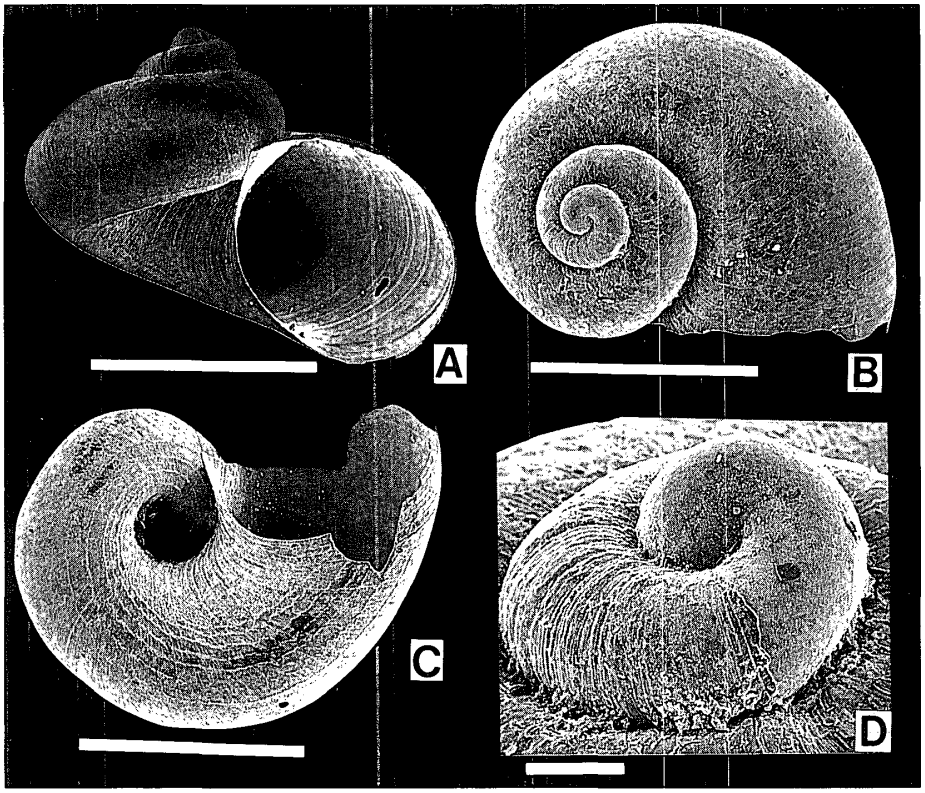


Fig. 47. Distribution of *Trachysma tenue* THIELE (Star: Present study; Triangle: Type locality).

Description: The shell is minute in size, depressed turbinate, very thin, fragile, translucently white in color and broader than high with small spires (Figs. 48A–C). The protoconch is translucently white in color, with high and well inflated whorls with rough surface, about only one in number of turn, 0.3 mm in diameter (Fig. 48D). The teleoconch is about 2.2 in number of turns, roundly inflated and rapidly increasing diameter adapically, and has prosocline microscopic growth lines under a very thin periostracum. The suture is strongly impressed. The upper whorls are round and small. The body whorl is very well inflated and very large, with the width being 130% of shell length. Interspaces between spiral lirae become narrower toward the umbilicus, which is so wide that umbilical wall of the upper whorls are visible inside. The umbilical walls has numerous strong growth lines. The base is roundly inflated, and has five spiral lirae which are crossed by growth lines. The lowest lirae is margining an open umbilicus. The aperture is oval and very large with a thin and smooth peristome. The outer lip is smooth and round. The inner lip is very slightly expanded and reflected inwardly, and has a small angle at the middle. The basal lip is round and smooth. The columellar lip is almost straight and smooth. The inner wall is almost smooth, except irregular axial lines.

The animal and the operculum are unknown.

Measurements: SL 1.45 mm, SW 1.88 mm (aperture broken) (Holotype specimen; NSMT-Mo 70616).



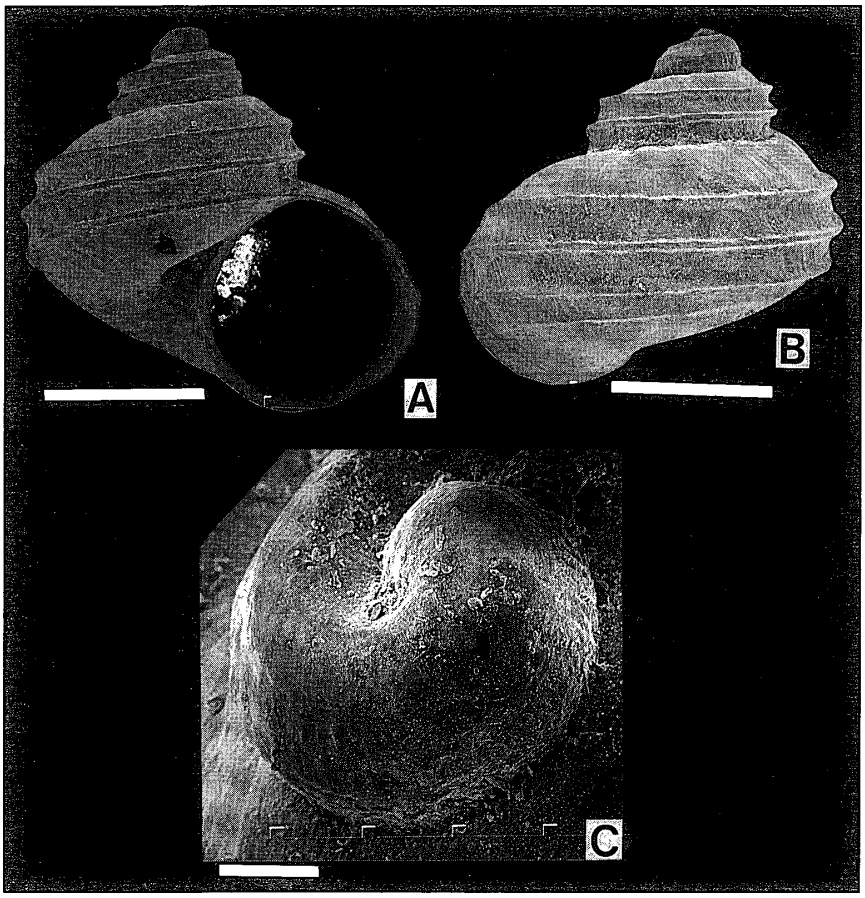
Figs. 48A-D. *Trachysma antarctica* n. sp. A-C. Holotype: D. Protoconch. Scale A-C = 1 mm; D = 100 μm.

Remarks: Only a single specimen was collected from St. 8 in the Breid Bay. This new species is similar to *Trachysma ignoblie* THIELE, 1912 from the Davis Sea in having the smooth whorl. But, this new species is separable from it in having: 1) more depressed and wider shell with very well inflated body whorl, and 2) the base with five spiral lirae. *T. tenue* is also similar to this new species (Figs. 46A-D), but the former has spiral lirae on the teleoconch in contrast to smooth surface in this new species.

Family FOSSARIDAE TROSHEL, 1861
Genus *Fossarus* PHILIPPI, 1841
Type species: *Fossarus ambiguus* (LINNAEUS, 1758)

Fossarus macmurdensis (HEDLEY, 1911)
(Figs. 49A-C)

Lacuna macmurdensis HEDLEY, 1911, p. 4, pl. 1, fig. 6.
Sublacuna trilirata THIELE, 1912, p. 196, pl. 12, fig. 5.
Prolacuna ? macmurdensis: POWELL, 1951, p. 121. (distribution record)
Prolacuna macmurdensis: POWELL, 1958, p. 191.; POWELL, 1960, p. 145. (name only); ARNAUD, 1972a, p. 126; DELL, 1990, p. 163, fig. 258.
Prolacuna trilirata: POWELL, 1958, p. 190 (distribution record); POWELL, 1960, p. 145 (name only); EGOROVA, 1982, p. 30, 31, fig. 141.



Figs. 49A–C. *Fossarus macmurdensis* (HEDLEY). A, B. Shell; C. Protoconch. Scale A, B=1 mm; C=100 μm.

Material examined: A single empty shell from St. 7.

Description: The shell is very small in size, turbiniform, thin, with well roundly inflated whorls (Figs. 49A, B). The surface is porcellaneous white in color without periostracum. The protoconch is high, inflated, about 1.2 in number of turns, 0.38 mm in diameter, white in color, and has very finely granulated surface (Fig. 49C). The teleoconch is about 2.5 in number of turns, and has strong, round-topped, strong spiral ribs and very weak spiral lirae that are crossed by microscopic growth lines. These ribs come to an appearance from the end of the protoconch, and the secondary rib appears under the lowest rib. The suture is strongly impressed. The sutural ramp is rather convex and has very weak spiral lirae. The upper whorl is small and moderately high. The body whorl is inflated, large, as wide as long. The body whorl has four regularly spaced, pronouncedly raised spiral ribs. The interspaces between these ribs become wider towards the aperture. The base is roundly inflated with very weak spiral lirae. The umbilicus is wide and deep. The aperture is large, oblique and round with a thin peristome. The outer lip is corrugated because of spiral ribs. The inner lip is roundly curved with no callus. The basal lip is round and smooth. The columellar lip is round with a thin callus, and slightly reflected over the umbilicus. The inner part of aperture is smooth and glossy white in color, but inner lip has very finely granulated surface.

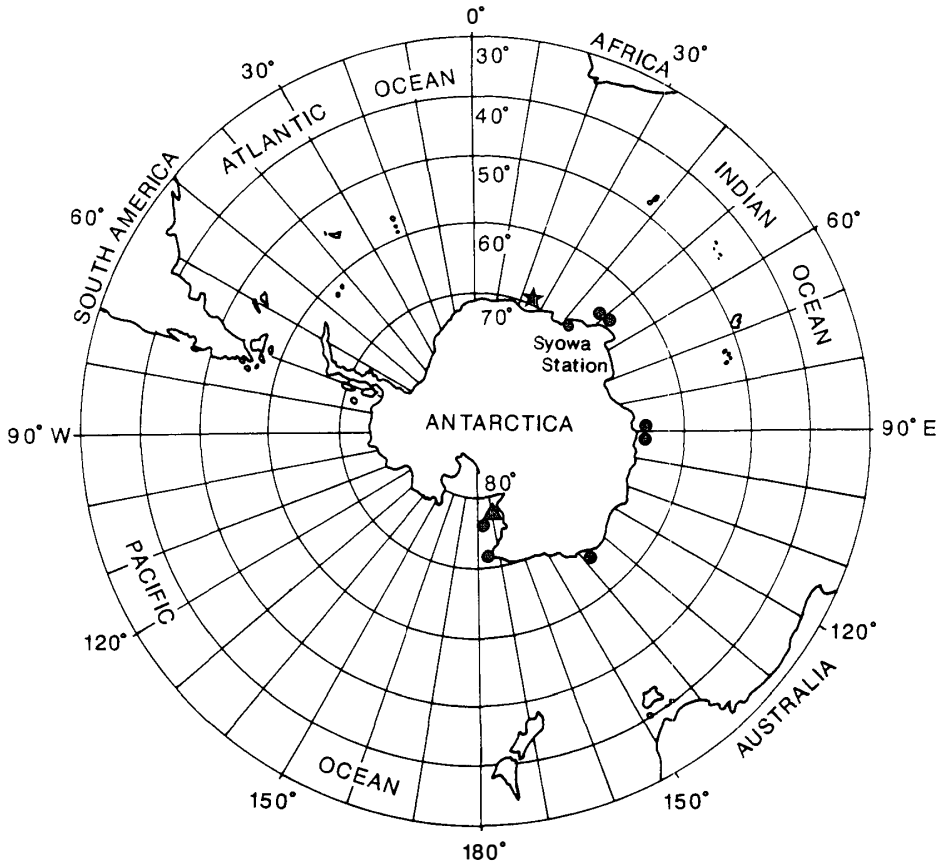


Fig. 50. Distribution of *Fossarus macmurdensis* (HEDLEY) (Large dots: Previous distribution records; Star: Present study; Triangle: Type locality).

The animal and operculum are unknown.

Measurements: SL 2.85 mm, SW 2.85 mm.

Previous distribution records (Fig. 50): Type locality: Cape Royds, Ross Sea, 10–20 fathoms. Range: Gauss Station, Davis Sea (THIELE, 1912); 74°46.4′S, 178°23.4′E, Ross Sea, 351 m (POWELL, 1951); off Enderby Land, 220 m and 300 m (POWELL, 1958); off Terre Adelie, 55–250 m (ARNAUD, 1972); Davis Sea, 385 m (EGOROVA, 1982); Ross Sea, 18–752 m (DELL, 1990).

Remarks: This species was originally allocated in the family Littorinidae (HEDLEY, 1911), and then transferred to the family Naticidae by THIELE (1912) because of the similarity of shell characters especially of the aperture and the umbilicus, to *Prolacuna indecora* (THIELE, 1912). According to THIELE (1912), the genus *Prolacuna* contains the following four species: *P. notorcadensis* (MELVILL and STANDEN, 1907) from Scotia Bay and the South Orkney Islands, 9–10 fathoms; *P. macmurdensis* (HEDLEY, 1911); *P. indecora* (THIELE, 1912) from Ross Sea to South Shetland Islands, 40–836 m and *P. trilirata* (THIELE, 1912) from Gauss Station, Davis Sea. *P. notorcadensis, P. macmurdensis* and *P. trilirata* have heavily spiral keels on the shell and the semicircular aperture. In contrast, *P. indecora* has smooth shell and round aperture. Species of the family Naticidae usually has polished shell surface, except for weak growth lines and occasionally very weak spiral cords. These three keeled species are more similar to the members of the family Fossaridae than the

Naticidae. These three species should be moved to the family Fossaridae by having following characters: 1) Turbiniform shell with rather low spire; 2) semicircular aperture; and 3) the open umbilicus. Therefore, the genus *Prolacuna* contains a sole species, *P. indecora*.

According to THIELE (1912), this species is distinguishable from *S. trilirata* by having two weak spiral keels under the abapicalmost conspicuous keel. But, the specimen under examination, which is almost the same size to THIELE's (both SL and SW 3.3 mm), has a secondary spiral rib under the abapicalmost one. Thus, *S. trilirata* is conspecific with *F. macmurdensis*.

This species is very similar to a tornid species *Tornus aupouria* (POWELL, 1937) from off Three Kings Islands, New Zealand, 260 m, by rather depressed spire, few conspicuous spiral keels and the same type of aperture. But, the latter species has four spiral keels on the base. POWELL (1979) moved the latter species from the family Fossaridae to the Tornidae. But, Powell's allocation does not seem to be appropriate.

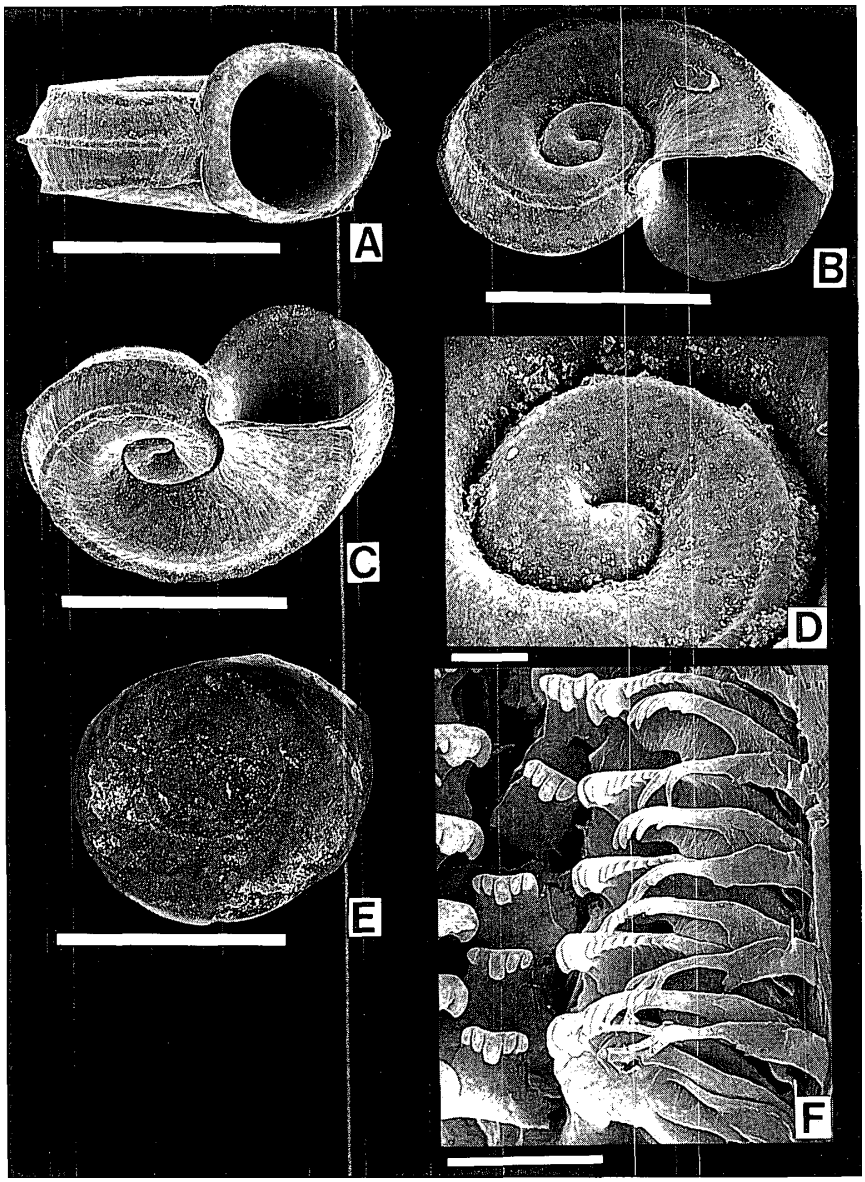
Family TORNIDAE SACCO, 1896
Genus *Cochliolepis* STIMPSON, 1858
Type species: *Cochliolepis parasitica* STIMPSON, 1858

***Cochliolepis* (?) *antarctica* n. sp.**
(Figs. 51A–F)

Material examined: A single living specimen and two empty shells from St. 8; a single empty shell from St. 9.

Description: The shell is minute in size, discoid, concavo-concave and very thin and uniformly glossy, translucently pale brown in color, and has strong three spiral cords, numerous axial microscopic growth lines under a thin periostracum (Figs. 51A–C). The protoconch is sunken, never visible in apertural view, about only 1.5 in number of turns, large, about 0.38 mm in diameter, translucently brown in color, with smooth surface (Fig. 51D). The teleoconch is 1.5 in number of turns and convex. The suture is deeply impressed. The penultimate whorl is small, and has two spiral cords which occur above the suture and the base. The body whorl is very large, with width being 200–250% of shell length, and has three strong spiral cords of which the peripheral one is the strongest of all. Spiral cords which are a little emphasized by a thin periostracum are round-topped and regularly spaced, and crossed by numerous microscopic growth lines. They gradually become stronger toward the aperture. The interspaces between spiral cords are feebly convex or almost flat. The base is slightly inflated. The umbilicus is wide but shallow. The aperture is very large, almost holostomous with very thin and rather polygonal peristome. The outer lip is not always smoothly round but somewhat angulated at extremities of three spiral cords. The inner lip is roundly curved and smooth, which is slightly expanded and reflected outwards. The basal lip is also round and smooth, with a weak corner where it meets the columellar lip, which is very short and almost straight, slightly expanded and reflected. The inner wall is entirely smooth and shining.

The operculum is corneous, thin, circular, translucent brown in color with paucispiral nucleus, equal to the aperture in size (Fig. 51E).



Figs. 51 A–F. *Cochliolepis* (?) *antarctica* n. sp.
A–C. Holotype; D. Protoconch; E. Operculum; F. Radula. Scale A–C = 1 mm; D = 100 μm; E = 500 μm; F = 10 μm.

The radula is taenioglossate, 2 : 1 : 1 : 1 : 2, translucent, very long and narrow (Fig. 51F). The rhachidian tooth is elongately scalloped in outline, and has a strong but oblong central cusp and two large, blunt cusps on both sides. The basal line of the rhachidian is almost straight. The lateral tooth is wide, oblong, triangular in outline, and has a strong central cusp followed by two large cusps of similar size inside and 7 small sharp cusps outside. The basal line of lateral tooth is wavy. The inner marginal is slender and moderately long, palmate in shape with 5 sharp cusps. The outer marginal is slenderer, "avian foot"-like in shape, shorter than inner one, and has 3 long, weak, slender and sharp cusps. Shaft of both marginal teeth become wider towards the base.

Measurements:

SL 0.50 mm, SW 1.13 mm, AH 0.50 mm, AW 0.38 mm (empty shell; St. 8) (Holotype specimen; NSMT-Mo 70617).

SL 0.75 mm, SW 1.58 mm, AH 0.75 mm, AW 0.75 mm (empty shell; St. 8) (Paratype specimen #1; NSMT-Mo 70618).

SL 0.83 mm, SW 1.95 mm, AH 0.83 mm, AW 0.75 mm (living specimen; St. 8) (Paratype specimen #2; NIPR A20-38).

SL 0.70 mm, SW 1.65 mm, AH 0.70 mm, AW 0.63 mm (empty shell; St. 8) (Paratype specimen #3; NIPR A20-39).

Remarks: This species is similar to the members of the family Tornidae because of having discoid shell. The species of the family Tornidae usually has very low spires with spiral sculptures. And the radular formula of species in this family is 2 : 1 : 1 : 1 : 2. The shell of this species is discoid with no spires, but other characters, such as conspicuous spiral keels and radula, are most allied to the family Tornidae. The generic position of the present species has not yet been settled. The species of the genus *Cochliolepis* which has a discoid shell with low spires and conspicuous spiral keels, is most similar to this species, but this species has no spire. The present new species is tentatively placed under the genus *Cochliolepis* in a broad sense.

Family TURRITELLIDAE WOODWARD, 1851
Subfamily Turritellopsinae MARWICK, 1957
Genus *Turritellopsis* SARS, 1878
Type species (monotypy): *Turritella acicula* STIMPSON, 1851

Turritellopsis latior THIELE, 1912

(Figs. 52A, B)

Turritellopsis latior THIELE, 1912, p. 202, pl. 12, fig. 21; POWELL, 1960, p. 141 (name only); EGOROVA, 1982, p. 22, fig. 104; DELL, 1990, p. 122, figs. 205, 206.

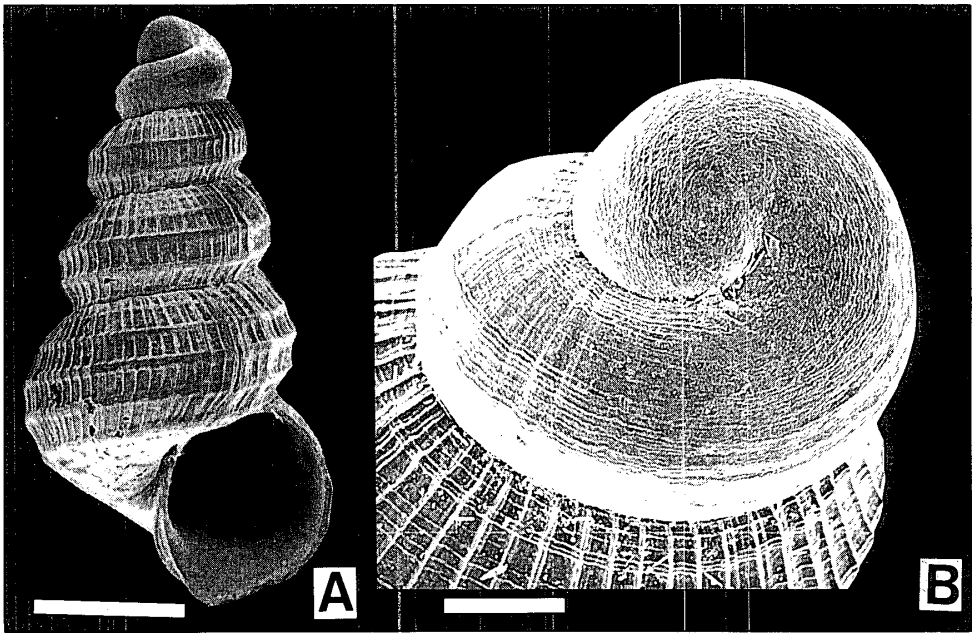
Material examined: A single empty shell from St. 5.

Description: The shell is small and tall, translucent white in color (Fig. 52A). The protoconch is about 1.5 in number of turns, large, well roundly inflated, with a finely granulated surface, and has a weak peripheral angle at the end of whorl (Fig. 52B). The teleoconch is about 3.75 in number of turns, and has strong spiral ribs that are crossed by axial cords creating a cancellated appearance. The penultimate whorl has three strong spiral ribs and 40 almost regularly spaced axial cords. The suture is strongly impressed, and has a spiral cord on the sutural ramp. The base is almost flat, and is separable into the upper part of the body whorl by a spiral rib. The umbilicus is closed. The aperture is pentagonal and the peristome is thin and angulated at the spiral rib. The inner lip is straight. The columellar lip is curved and slightly reflected over the umbilicus. The inner wall is smooth and white in color.

Measurements: SL 2.00 mm, SW 1.05 mm.

Previous distribution records (**Fig. 53**): Type locality: Gauss Station, Davis Sea. Range: Davis Sea (EGOROVA, 1982); Ross Sea, 40-549 m (DELL, 1990).

Remarks: The examined specimen under this study is smaller than the THIELE's (1912) type



Figs. 52A, B. *Turritellopsis latior* THIELE. A. Shell; B. Protoconch. Scale A = 500 μm; B = 100 μm.

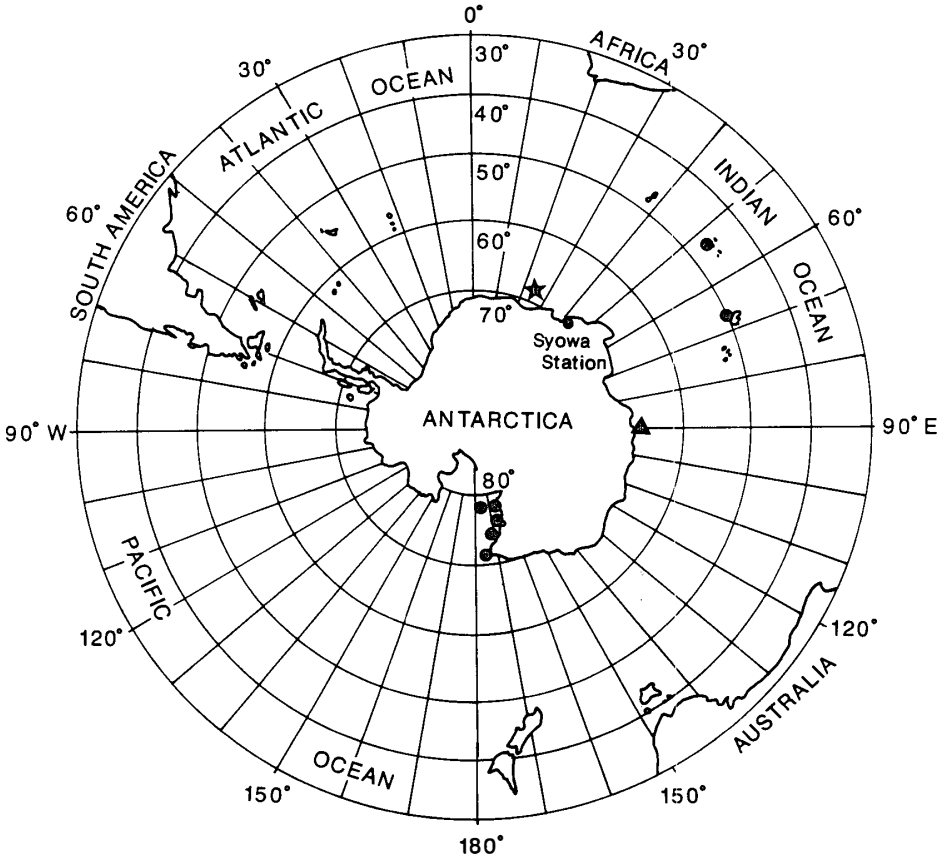


Fig. 53. Distribution of *Turritellopsis latior* THIELE (Large dots: Previous distribution records; Star: Present study; Triangle: Type locality).

(SL 2.75 mm, SW 1.4 mm) and DELL's specimen (SL 3.1 mm, SW 0.9 mm). The large specimen of this species has remarkably tall spire, but the axial and spiral sculptures are consistent.

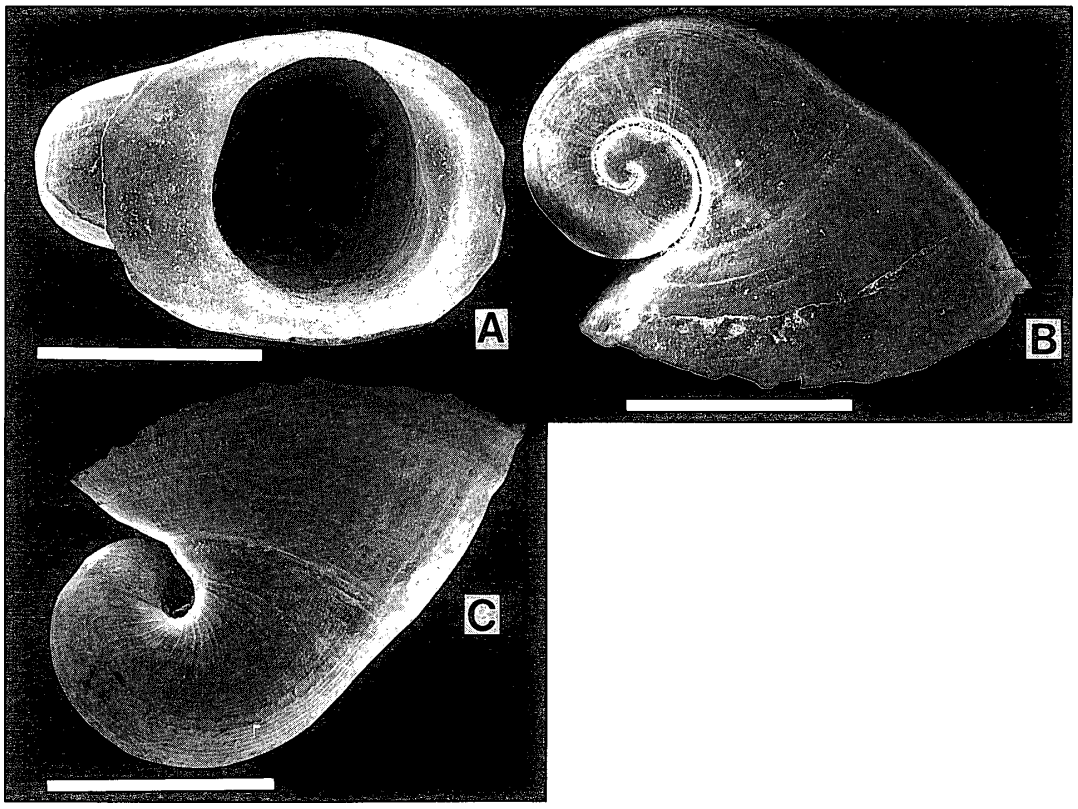
Family CAPULIDAE FLEMING, 1822
Genus *Capulus* MONTFORT, 1810 (O.D.)
Type species: *Patella ungarica* LINNAEUS, 1767

Capulus subcompressus PELSENEER, 1903
(Figs. 54A-C)

Capulus subcompressus PELSENEER, 1903, p. 20, pl. 5, figs. 52-54; HEDLEY, 1911, p. 5; THIELE, 1912, p. 199, pl. 12, figs. 13-15; SMITH, 1915, p. 66; EALES, 1923, p. 11, fig. 8; POWELL, 1958, p. 189; POWELL, 1960, p. 143 (name only); ARNAUD, 1972, p. 124, fig. 15; EGOROVA, 1982, p. 26, figs. 39, 123-126; HAIN, 1990, p. 48, pl. 3, figs. 2a-c; DELL, 1990, p. 121, figs. 207-209.

Material examined: A single empty shell from St. 5.

Description: The shell is cap-shaped, small, thin, white in color, and has a posteriorly involuted apex (Figs. 54A-C). The protoconch is discoidal, depressed, about 1.5 mm in diameter, 2.25-2.4 in number of turns and white in color, and has irregular prosocyrt lirae and four wide and slightly raised spiral cords which are accompanied with very fine secondary lirae within interspaces (Fig. 54A). The teleoconch is subconical, rapidly



Figs. 54A-C. *Capulus subcompressus* PELSENEER. A-C. Shell. Scale 1 mm.

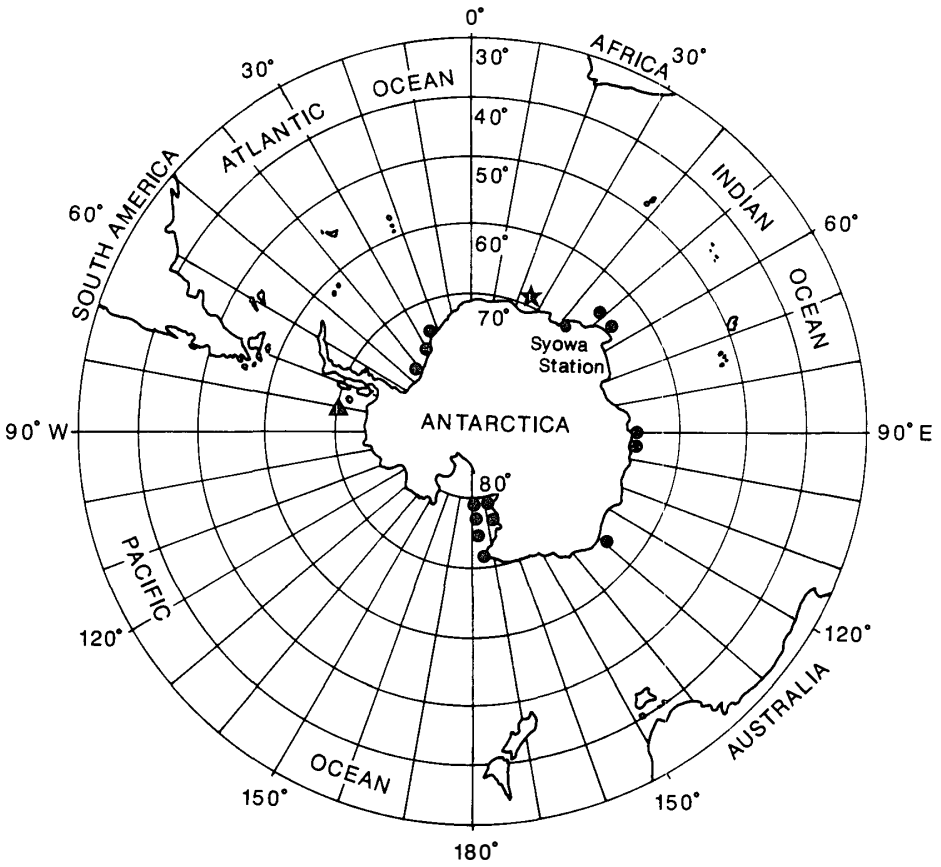


Fig. 55. Distribution of *Capulus subcompressus* PELSENEER (Large dots: Previous distribution records; Star: Present study; Triangle: Type locality).

increasing in width and hight towards the aperture, with irregular, wrinkled, prosocyrt axial sculpture. The aperture is oblong, large, with thin and smooth peristome. The columellar lip is round, smooth and slightly expanded abaxially. Outer lips are also round and smooth. The inner wall is smooth and white in color.

No operculum is present.

The animal is unknown.

Measurements: SL 1.5 mm; SW 2.0 mm.

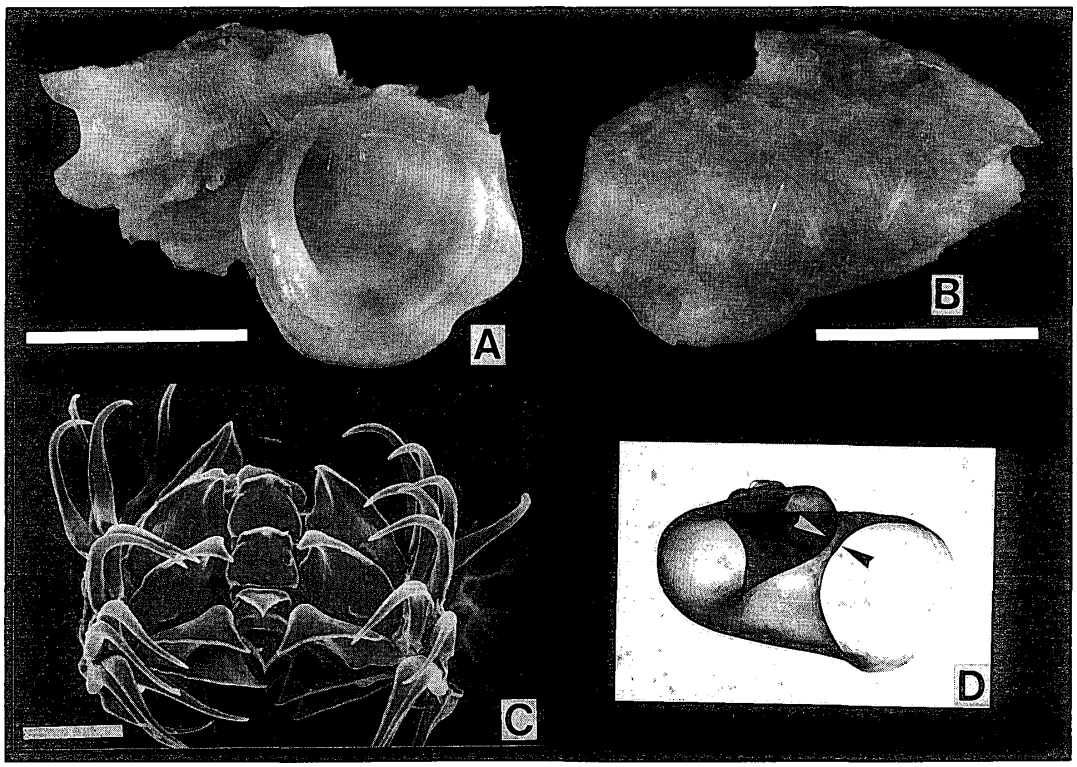
Previous distribution records (Fig. 55): Type locality: Bellingshausen Sea, 70°S, 81°W. Range: Gauss Station, Davis Sea (THIELE, 1912); McMurdo Sound, 190-300 fathoms (SMITH, 1915); off Enderby Land, 193-300 m (POWELL, 1958); Cape Geodesie, Adelie Land, 66°40′S, 139°51′E, 180-250 m (ARNAUD, 1972); Davis Sea (EGOROVA, 1982); eastern Weddell Sea, 27-540 m (HAIN, 1990); Ross Sea, 33-640 m (DELL, 1990); Bellingshausen Sea and Weddell Sea (DELL, 1990).

Remarks: PELSENEER (1908), POWELL (1958), ARNAUD (1972) and DELL (1990) suggested that this species probably lives attached to some cylindrical object, such as echinoids with relatively large spines. In this expedition, several cidarid echinoids were collected at the same stations with *Capulus subcompressus*, of which the living (or intact) specimen has not been available.

Family TRICHOTROPIDAE GRAY, 1850
Genus *Torellia* JEFFREYS, 1867
Type species: *Torellia vestita* JEFFREYS, 1867 (O.D.)
Subgenus *Schismospira* NUMANAMI and OKUTANI, 1990
Type species: *Trichotropis planispira* SMITH, 1907

Torellia (*Schismospira*) *planispira* (SMITH, 1915)
(Figs. 56A–D)

Trichotropis planispira SMITH, 1915, p. 67, pl. 1, fig. 7.
Trichoconcha planispira: POWELL, 1958, p. 188; POWELL, 1960, p. 143 (name only); HAIN, 1990, p. 47, pl. 2, fig. 13, pl. 20, fig. 3.
Torellia (*Neoconcha*) *planispira*: DELL, 1990, p. 134.
Torellia (*Schismospira*) *planispira*: NUMANAMI and OKUTANI, 1990a, p. 80–90.
Material examined: A single living specimen and 7 empty shells from St. 5; 1 living specimen from St. 7; 1 living specimen from St. 8; 1 living and 1 dead specimens from St. 9.
Description: The shell is turbinate, thin, fragile, broader than high with depressed spires (Fig. 56A, B). The protoconch is about 1.5 in number of turns, about 1.0 mm in diameter, white, naked, mammillate, and has very fine spiral cords. The teleoconch is 3 in number of turns, glossy white in color, with very convex whorls separated at suture, rapidly



Figs. 56A–D. *Torellia* (*Schismospira*) *planispira* (SMITH). A, B. Shell; C. Radula; D. X-ray photograph of shell, showing separated whorls (arrowheads). Scale A, B=5 mm; C=100 μm.

increasing in diameter towards the aperture. The helicocone is rounded with no apparent sculpture except weak growth lines. The growth lines are wavy and emphasized by hairy periostracum, which is extraordinarily thick, dirty white in color, rather lamellose axially. The upper whorl is small and depressed. The body whorl is very large, occupying 70–80% of the length, ornamented by regularly spaced, three strong spiral carinae, on which periostracal hair rose. The space between the suture and the uppermost carina is a flat sutural ramp. The lowest carina is marging an open umbilicus. The umbilicus is so wide that the umbilical walls of upper whorls are visible inside. The aperture is round with a thin and smooth peristome. As the shell is thin and translucent, the superficial periostracal spiral carinae are visible through the shell. The outer lip is smooth, where periostracal spiral carinae terminate. The columellar lip is slightly expanded and reflected over the umbilicus. The basal lip is slightly expanded and reflected, and has a weak corner on the columellar side.

The operculum is horny, slightly small for the aperture (67% of aperture length) and triangular in outline. The nucleus is not preserved in the examined specimens.

The animal is pale brown in color, and has a pair of short and stout cephalic tentacles, with large eyes on basal bulges outside. The penis is small, simple finger-like shaped, and curved backwards. The foot is moderate, quadrilateral in outline, which has a double margin in front. The proboscis is short and wide, with rather large buccal mass.

The radula is taenioglossate, 2 : 1 : 1 : 1 : 2 with 42 rows of teeth, and translucent brown in color (Fig. 56C). The rhachidian tooth is scalloped in outline, much wider than high (78% of width), and has strong central cusp that carries finely serrated edge on both sides. The basal line is straight. The lateral tooth is wide, quadrilateral in outline with a sharp tip and shelf-like wing laterally, and has a nodulous projection on lateral inside. The marginals are slender, simple sickle-shaped and they are similar in size.

Measurements: See Table 13.

Previous distribution records (Fig. 57): Type locality: McMurdo Sound, 222–241 m (SMITH, 1915). Range: off MacRobertson Land, 219 m (POWELL, 1958); Weddell Sea,

Table 13. Measurements and condition of *Torellia* (*Schismospira*) *planispira* (SMITH).

No.	1	2	3	4	5	6	7	8	9	10
St.	5	5	5	5	5	5	5	5	5	5
SL (mm)	5.6	6.1	3.4	2.5	2.4	—	—	—	—	—
SW (mm)	8.0	7.6	5.2	3.2	3.2	8.9	8.7	7.3	—	—
SW/SL (%)	70.0	80.3	65.4	78.0	75.0	—	—	—	—	—
Condition	F	F	F	F	F	E	E	E	E	E

No.	11	12	13	14	15
St.	5	7	8	9	9
SL (mm)	—	—	6.5	6.3	7.1
SW (mm)	—	11.2	9.5	9.5	9.2
SW/SL (%)	—	—	68.4	66.3	77.2
Condition	E	E	F	F	L

E: Empty and water-worn specimen; F: Freshly dead specimen; L: Specimen taken alive.

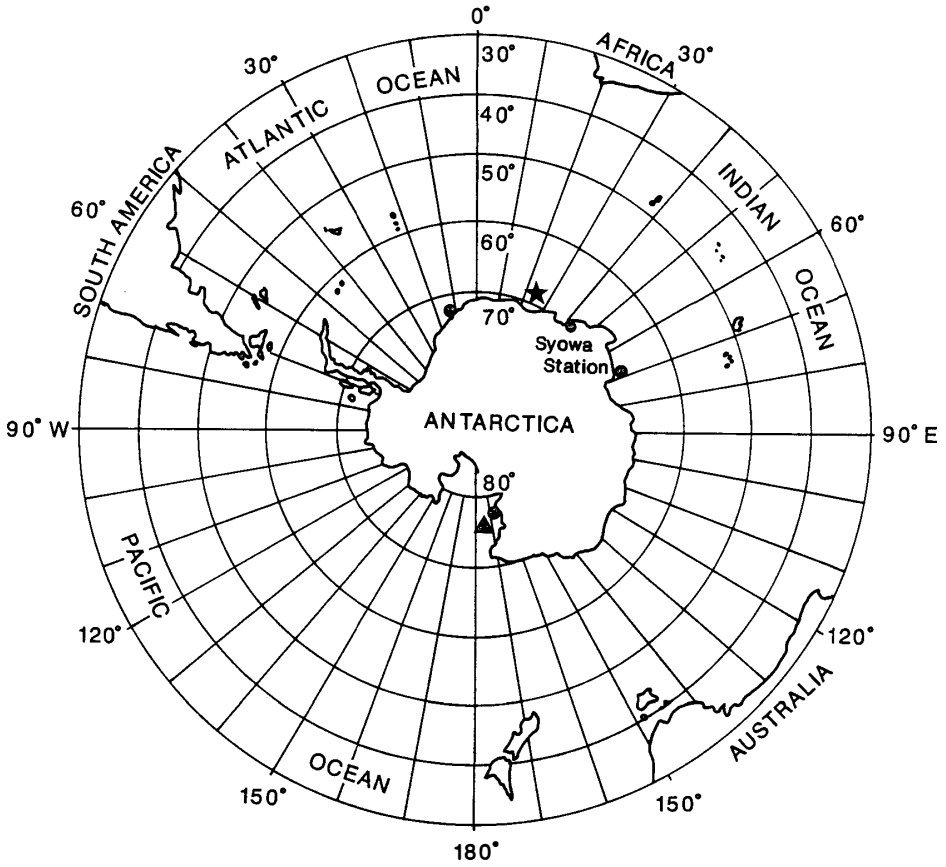


Fig. 57. Distribution of *Torellia* (*Schismospira*) *planispira* (SMITH) (Large dots: Previous distribution records; Star: Present study; Triangle: Type locality).

160–412 m (HAIN, 1990); Ross Sea, 315–441 m (DELL, 1990); Breid Bay, 270–310 m (NUMANAMI and OKUTANI, 1990a).

Remarks: *Torellia* (*Schismospira*) *planispira* is similar to *Neoconcha insignis* SMITH, 1915 from East Antarctica and *Torellia lanata* WARÉN, ARNAUD and CANTERA, 1986 from Kerguelen Islands in having few strong periostracal keels. However, *T. lanata* is distinguishable from this species by having 10 periostracal keels, the protoconch with 2.5 in number of turns, and triangular lateral teeth on the radula. *N. insignis* also differs in having no weak corner in the basal lip of the aperture. *Antitrichotropis antarctica* (THIELE, 1912) from East Antarctica is similar to this species in having broader and depressed shell. But, it differs from this species in having strong spiral ridges on spiral whorl. This species is also distinguishable from other related species by having separated teleoconch whorls.

POWELL (1958) moved *Trichotropis planispira* to the genus *Trichoconcha* by depressed shell and widely open umbilicus. When *Torellia* (*Schismospira*) *planispira* is compared with *Trichoconcha mirabilis* SMITH, 1915 (Figs. 60A–C) collected from South Shetland Islands by Japan Marine Fishery Resource Research Center, it is true that the configuration of shell of the former species is similar to that of the latter. However, the teleoconch whorls of *T.* (*S.*) *planispira* is separated (Fig. 56D), while *T. mirabilis* has adherent whorls. WARÉN *et al.* (1986) stated that *T.* (*S.*) *planispira* has a radula intermediate between

Torellia and *Neoconcha*, while NUMANAMI and OKUTANI (1990a) revealed that the radula of this species is similar to *Torellia* rather than to *Neoconcha*. They (1990a) considered that *T.* (*S.*) *planispira* is allocated into *Torellia* because of similarity of radula, despite the fact that the shell characters are different from any other species of the genus *Torellia*. Thus, NUMANAMI and OKUTANI (1990a) proposed the new subgenus *Schismospira* for *T. planispira*.

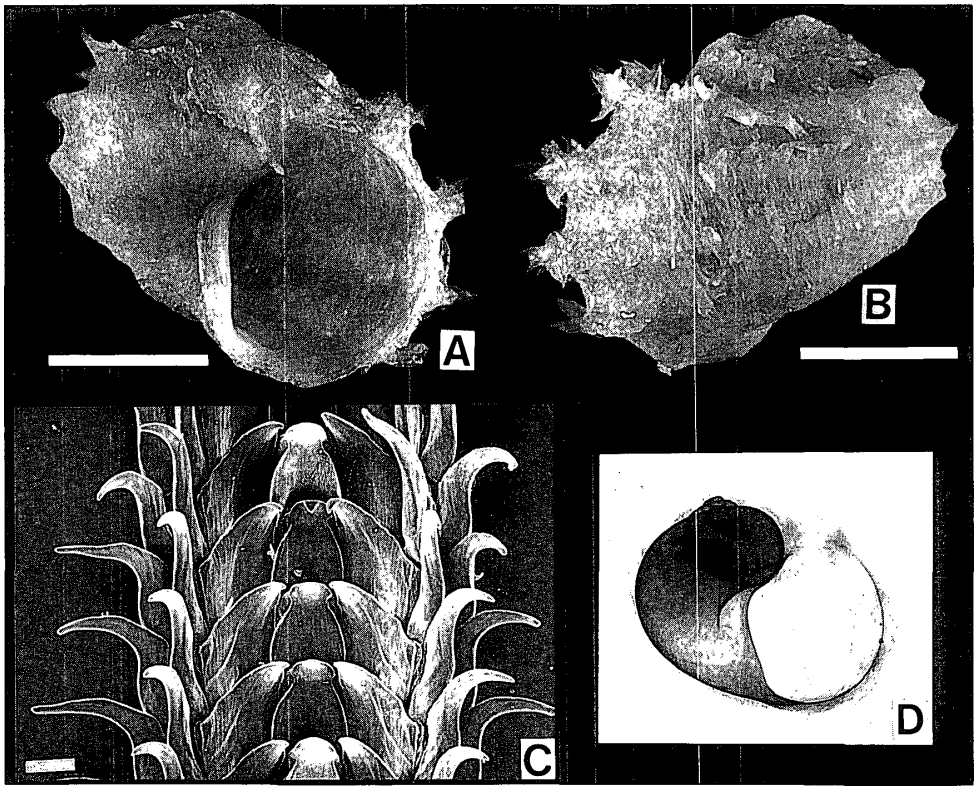
Genus *Neoconcha* SMITH, 1907
Type species: *Neoconcha vestita* SMITH, 1907 (O.D.)

***Neoconcha insignis* SMITH, 1915**
(Figs. 58A–D)

Neoconcha insignis SMITH, 1915, p. 68, pl. 1, fig. 8; EALES, 1923, p. 13, fig. 11; POWELL, 1960, p. 143 (name only); ARNAUD, 1972b, p. 123; NUMANAMI and OKUTANI, 1990a, 80–90. *Torellia* (*Neoconcha*) *insignis*: WARÉN *et al.*, 1986, p. 158, fig. 6; HAIN, 1990, p. 48, pl. 3, fig. 1, pl. 20, fig. 6; DELL, 1990, p. 134. figs. 229 and 230.

Material examined: A single living specimen from St. 5.

Description: The shell is thin, spherical, fragile and broader than high with depressed spires (Figs. 58A, B). The protoconch is about 1.5 in number of turns, 2.0 mm in diameter, glossy white with very finely spiral cords. The teleoconch is dirty white in color, 4 in number of turns, round, and rapidly increasing in diameter towards the aperture. The



Figs. 58A–D. *Neoconcha insignis* SMITH. A, B. Shell; C. Radula; D. X-ray photograph of shell. Scale A, B=5 mm; C=100 μm.

suture is deep and weakly channeled. The growth lines are emphasized by hairy periostracum, which is very thick, pale olivaceous in color, rather lamellose along those lines and raised into long, divergent hairy processes on the shoulder and on spiral carinae. The upper whorl is small and depressed. The body whorl is very large, occupying 95% of shell length, ornamented by rather regularly spaced, five spiral carinae, on which periostracal hair rose. The base is roundly inflated. The umbilicus is narrowly open, and it is not margined by the lowest carina. The aperture is round and the peristome is very thin and rather polygonal in outline. As the shell is translucent, the superficial periostracal carinae are visible through the shell. The outer lip is not always smoothly round, elastic and frosted white inside. The inner lip is smooth and glossy white inside. The columellar lip is glossy white in color, slightly expanded and reflected over the umbilicus. The basal lip is elastic and round.

The operculum is horny, small for the aperture, 38% of aperture length, and quadrangular in outline. The nucleus is not preserved in the examined specimen.

The animal is creamy in color, except the brownish mantle edge, while pedal sole is pale red. The animal has a pair of large, short and stout cephalic tentacles, with large eyes on the outside of basal bulges. The penis is large, simple, finger-like shaped, and curved forward. The foot is small and oblong in outline. The mouth is large, with rather large buccal mass. The ventral lip is shaped like a pseudoproboscis, which is long and tapered to a point.

The radula is taenioglossate, 2 : 1 : 1 : 1 : 2 with 28 row of teeth, translucent brown in color (Fig. 58C). The rhachidian tooth is scalloped in outline, much higher than wide (60% of height), which has a small central cusp and little rounded basal edge. The lateral tooth is stout and rhombic in outline with sharp tip. The marginals are long, simple sickle-shaped, and they are similar in shape and in size. The rhachidian reduces size towards anterior end of the radular ribbon. In this part, it has a strong central cusp that carries three small denticles on both sides. And the marginals here have two small denticles above, but the laterals are not different from posterior ones.

Measurements: SL 11.9 mm, SW 12.4 mm (operculum 3.8 × 3.1 mm)

Previous distribution records (Fig. 59): Type locality: McMurdo Sound, 300 fathoms (SMITH, 1915). Range: Terre Adélie, SE of Curie Island, 110–130 m (ARNAUD, 1972b; WARÉN *et al*., 1986); Weddell Sea, 227–695 m (HAIN, 1990); Ross Sea, 133–664 m (DELL, 1990); Breid Bay, 275–283 m (NUMANAMI and OKUTANI, 1990a).

Remarks: *Neoconcha insignis* is most closely allied to *Torellia lanata* WARÉN, ARNAUD & CANTER, 1986 from Kerguelen. *T. lanata* is distinguishable from *N. insignis* by having a distinct angle in the lower corner of the aperture. Radula of *T. lanata* differs from that of *N. insignis* in having broader and lower rhachidian tooth and larger and strongly incurved lateral tooth. *N. vestita* SMITH, 1907, the type species of *Neoconcha*, is very similar to *N. insignis* in radular character, but they differ from each other in shell form. The shell of *N. vestita* is much higher than wide (87% of the length) and has a large and ovoidal aperture.

Neoconcha was separated from other trichotropid genera by THIELE (1929) because of radular characters. According to WARÉN *et al*. (1986), the radulae of type species of the genus *Torellia, T. vestita* JEFFREYS, 1867 from Northern Atlantic, and *N. vestita* SMITH, 1907 from the Antarctic, are different from each other. WARÉN *et al*. (1986) considered that

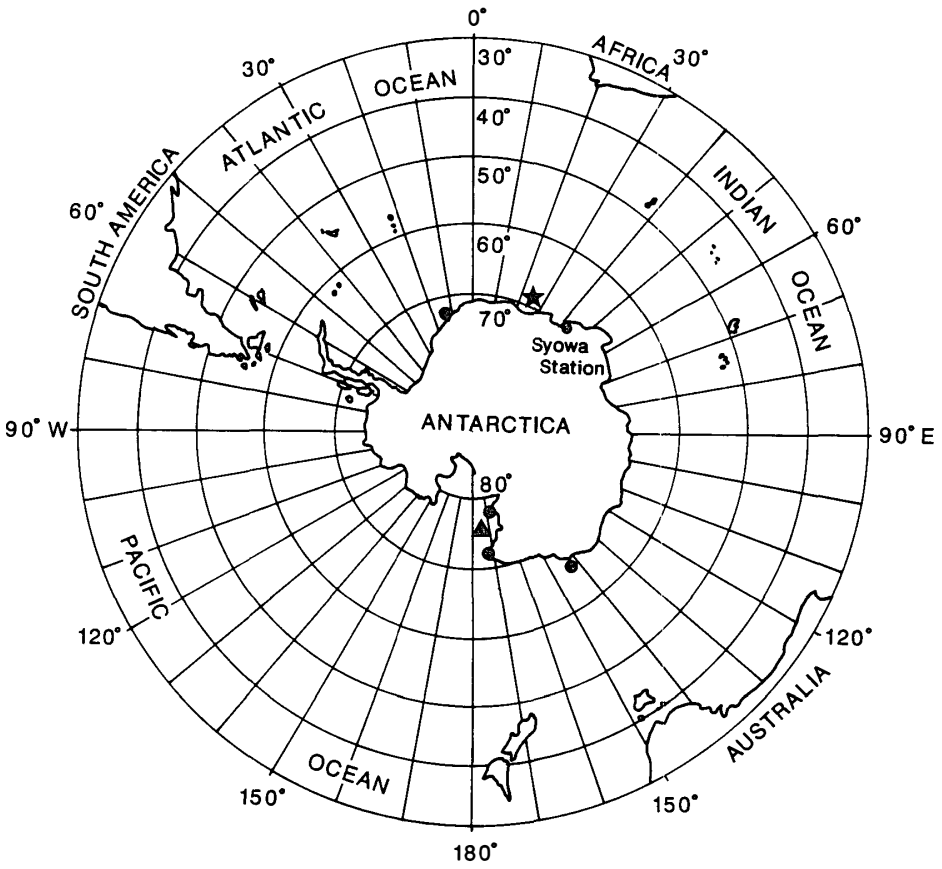


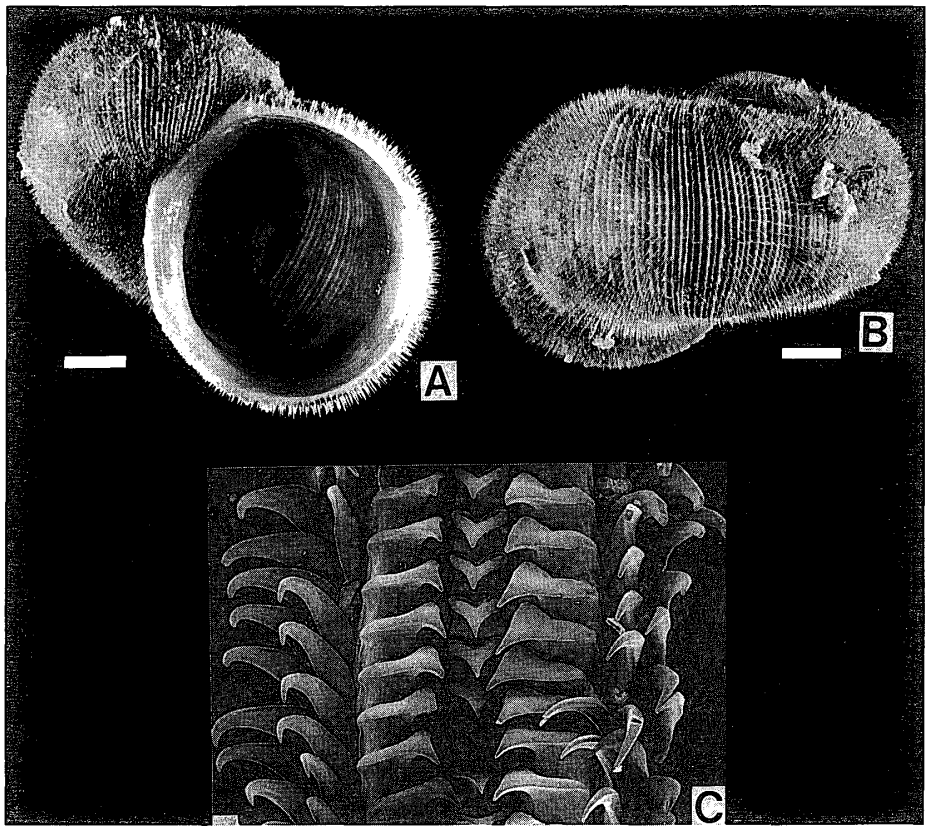
Fig. 59. Distribution of *Neoconcha insignis* SMITH (Large dots: Previous distribution records; Star: Present study; Triangle: Type locality).

Neoconcha is a subgenus of *Torellia*, because of the similarities in shell characters and radular features (Table 14). A comparison was made on the radula of *T.* (*S.*) *planispira* with that of *N. insignis*. The former species has more depressed rhachidian tooth (height is 78% of width) and wide and qudrilateral lateral teeth, and is rather similar to that of *Torellia* (Fig. 60C). The shell of *N. insignis* has spiral carinae superficially, however, according to an X-ray observation, it has no true spiral carinae on the shell (Fig. 58D). *N. vestita* also has no ostrcal spiral sculpture. Therefore, I prefer to maintain *Neoconcha* at generic level.

Trichoconcha was considered to be a synonym of *Torellia* by WARÉN *et al.* (1986), because of similarity of configuration and color of radula (Table 14). One remarkable feature of *Trichoconcha mirabilis*, type species of the genus *Trichoconcha*, noted by EALES (1923) and WARÉN *et al.* (1986), is that this species has a green radula. The radula of *Torellia vestita* is reportedly also green (WARÉN *et al.*, 1986). Although SMITH (1907) described that the radula of the type specimen of *Trichoconcha mirabilis* was brown in color. The color of radula of under the present examination is translucent brown without any hint of greenish hue. The morphology of radula of *Trichoconcha mirabilis* is similar to that of *Torellia vestita* and of *Torellia* (*Schismospira*) *planispira*, except parallelogramatic lateral teeth, and presence of conspicuous shoulder and lack of nodulous projection on lateral side of the base of the lateral teeth (Fig. 60C).

Table 14. Historical transfer in generic allocation of three species.

SMITH (1915)	*Trichoconch mirabilis*	*Trichotropis planispira*	*Neoconcha insignis*
	↓	↓	↓
POWELL (1958)	*Trichoconch mirabilis*	*Trichoconcha planispira*	*Neoconcha insignis*
	↓	↓	↓
WARÉN *et al.* (1986)	*Torellia* (*Torellia*) *mirabilis*	*Torellia* (*Torellia*) *planispira*	*Torellia* (*Neoconcha*) *insignis*
	↓	↓	↓
Prerent study	*Torellia* (*Trichoconcha*) *mirabilis*	*Torellia* (*Schismospira*) *planispira*	*Neoconcha insignis*



Figs. 60A–C. *Torellia* (*Trichoconcha*) *mirabilis* (SMITH). A, B. Shell; C. Radula. Scale A, B=5 mm, C=100 μm.

Trichoconcha mirabilis is extremely larger (SL 29.3 mm, SW 33.3 mm; South Shetland specimen) than any other known species of *Torellia*, and it has depressed upper whorls, elastic shell and sparse hairy periostracum (Figs. 60A, B). It is reasonable to treat *Trichoconcha* as a subgenus of the genus *Torellia*.

According to EALES (1923) and WARÉN *et al.* (1986), the color of the radula of *Torellia* (*Trichoconcha*) *mirabilis* was green. However, among three species under the present examination, none of them has green radula. The radulae of all species are translucent brown in color. The type specimen of *T.* (*T.*) *mirabilis* had brownish radula (SMITH, 1915). It is not clear at present if the green radula means a color variation of the radula or due to a certain artifact such as the method of fixation or the condition of

preservation.

Almost all of the species of the genus *Torellia* is distributed in deep water at middle latitudes, such as *T. fimbriata* VERRILL and SMITH, 1882, from North Atlantic and *T. pacifica* OKUTANI, 1980 from Northwest Pacific, among others. In contrast to this, in the Antarctic and Arctic areas all members of this genus (s. l.) are distributed in shallow strata, such as species treated here as well as *T. vestita*. It shows that the *Torellia* exhibits a bipolar distribution and deepening the water to lower latitudes. The genus *Torellia* is thus considered to be a "deepwater element in the lower latitudes" in the Antarctic shallow water fauna (POWELL, 1960; DELL, 1972c).

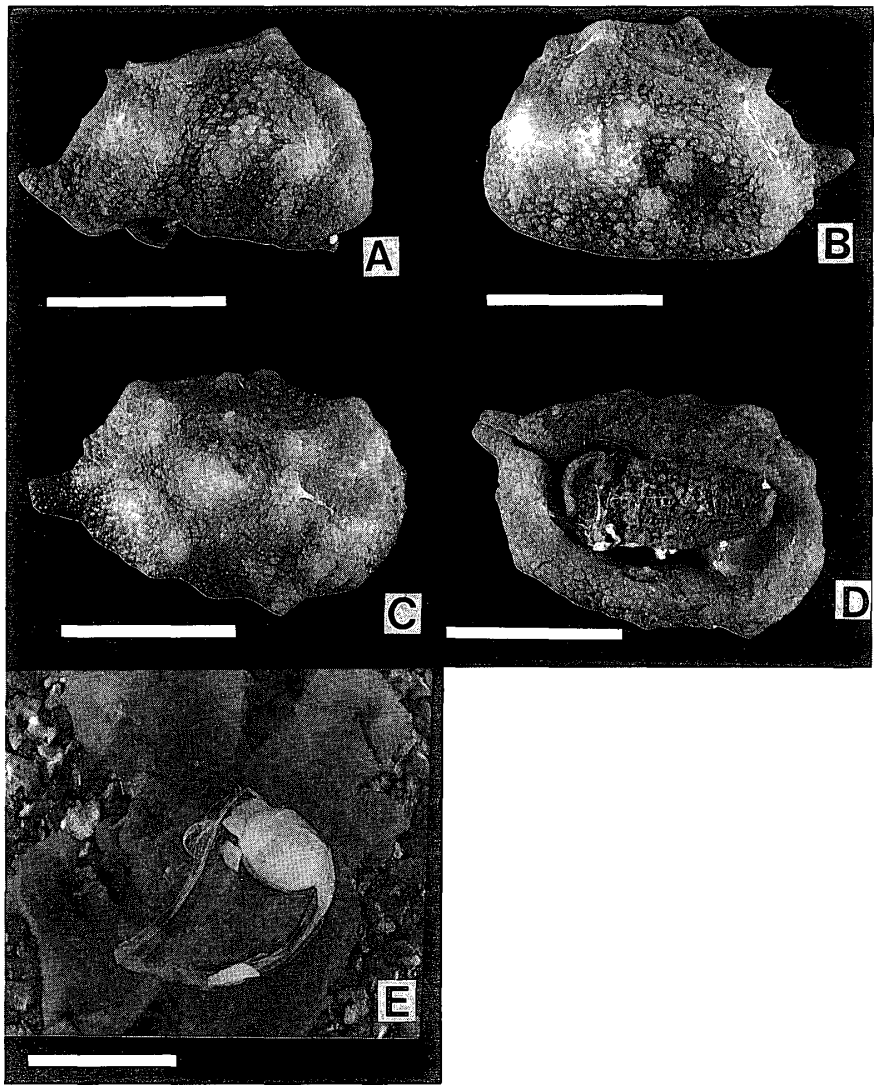
Family LAMELLARIIDAE ORBIGNY, 1841
Subfamily Lamellariinae ORBIGNY, 1841
Genus *Marseniopsis* BERGH, 1886
Type species: *Marseniopsis pacifica* BERGH, 1886 (S.D. by THIELE, 1929)

Marseniopsis conica (SMITH, 1902)
(Figs. 61A–E, 66A)

Lamellaria conica SMITH, 1902, p. 206, pl. 24, fig. 4; STREBEL, 1908, p. 60 (distribution record); POWELL, 1955, p. 96 (name only).
Lamellariopsis turqueti VAYSSIÈRE, 1906, p. 40, pl. 4, figs. 42–53; VAYSSIÈRE, 1917, p. 27, pl. 1, figs. 10–15; ARNAUD, 1972b, p. 127, Fig. 17 (remarks only).
Marseniopsis conica: SMITH, 1915, p. 66–67. (remarks only); EALES, 1923, p. 23–25, figs. 25, 26a; TOMLIN, 1948, p. 228. (distribution record); POWELL, 1960, p. 146. (name only); EGOROVA, 1982, p. 27–28, figs. 132–135; DELL, 1990, p. 164; HAIN, 1990, p. 52, pl. 4, figs. 2a–c, pl. 21, figs. 7 and 8; NUMANAMI and OKUTANI, 1991b, p. 53, figs. 4A–E, 9A.
Lamellaria cf. *conica*: POWELL, 1979, p. 150. (name only)
Marseniopsis cf. *conica*: HORIKOSHI *et al*., 1979, p. 21, fig. 3 (distribution record).
Material examined: A single specimen taken alive from St. 8.
Description: The shell is small, porcelaneous white, very thin, fragile, depressed, translucent with inflated whorls, and has a very thin periostracum. The protoconch is not preserved. The teleoconch is about 2 in number of turns and rapidly increasing in diameter towards the aperture, and has numerous very fine growth lines. The suture of spire is somewhat grooved, and the suture of body whorl is strongly impressed. The upper whorl is small, rather high and roundly inflated. The body whorl is very large, breadth is about 119% shell length, and well roundly inflated. The base is gently rounded. The umbilicus is narrowly open. The aperture is large and round with smooth peristome. The upper part of outer lip exceeds the lower part. The outer lip is smooth and gently rounded, and continues to more rounded basal lip. The inner lip is round and smooth, expanded outwardly. The columella lip is gently curved. The basal lip is smooth and gently rounded.

No operculum is present.

The entire dorsum is completely covered by the mantle, with a polygonal outline in dorsal view. The coloration of the specimen preserved in alcohol is reddish brown. The mantle is thin and rugose, rather firm to touch, and has numerous small and some large



Figs. 61A–E. *Marseniopsis conica* (SMITH). A. Left side view of animal; B. Right side view of animal; C. Dorsal view of animal; D. Ventral view of animal; E. Abapertual view of shell. Scale = 5 mm.

mammillate processes on the surface. These small processes are irregularly arranged on the whole surface of dorsum, but almost all of the large processes are present on low ridges. The dorsal side of the mantle is divided into five areas by low ridges that originate from a raised pentagonal area in the center of the dorsum. In the frontal view, the anterior part of the mantle is contracted like a siphon, which extends anteriorly (about 2.0 mm in length). The mantle just posterior side of pedal base is so thin that the shell is visible through the mantle. The head has a pair of attenuate, acuminate, short and stout cephalic tentacles, 2.5 mm in length and 1.0 mm in width, with small black eyes on the basal outside. The coloration of cephalic tentacles is as same as the mantle. The penis which is located just posterior to the right cephalic tentacle, is curved backwards, flat, long and wide (5.0 mm in length and 1.5 mm in width), with no projection on the apex. The foot is tongue-like in shape, 59% of body length. The anterior margin of the foot is round, wider

and thicker than elsewhere, and is separated into the dorsal and ventral areas by a horizontal furrow which runs along the anterior rim of the foot. The pedal sole has an uneven surface. The proboscis which is completely withdrawn into the muscular sheath, is short and wide, conical, 3.0 mm in length, 3.0 mm in width and 3.3 mm in high, and greenish in color, with a rugose surface by numerous, fine axial wrinkles.

The radula is taenioglossate, 2 : 1 : 1 : 1 : 2 with 62 transverse rows of teeth, translucently pale brown in color, long and narrow (8.0 mm in length, 0.5 mm in width) (Fig. 66A). The rhachidian tooth is oblong in outline, much higher than wide, and has a long sharply pointed central cusp that carries 4 small sharp denticles on both sides. The base line is almost straight, except small projections on both lateral ends. The lateral tooth is widely triangular, large and stout, and has a large, long and stout central cusp, 3 strong denticles on lateral inside and a single small and weak denticle on outside. And the base is V-shaped, as the middle area of the base raised anteriorly. Both marginal teeth are simple sickle-shaped. The inner marginal tooth is larger and stronger than the outer one, which is weak and slender. The jaw plate is bluish in color.

Measurements: SL 8.8 mm, SW 10.5 mm (BL 14.2 mm, BW 8.7 mm, BH 8.1 mm)

Previous distribution records (Fig. 62): Type locality: Cape Adare, 28 fathoms. Range: Antwerp Island, 64°E, 64°45′S, 110 m (VAYSSIÈRE, 1906); off Granite Harbour, entrance to McMurdo Island, 50 fathoms (SMITH, 1915); southeast of Seymour Island, 64°20′S, 56°38′W,

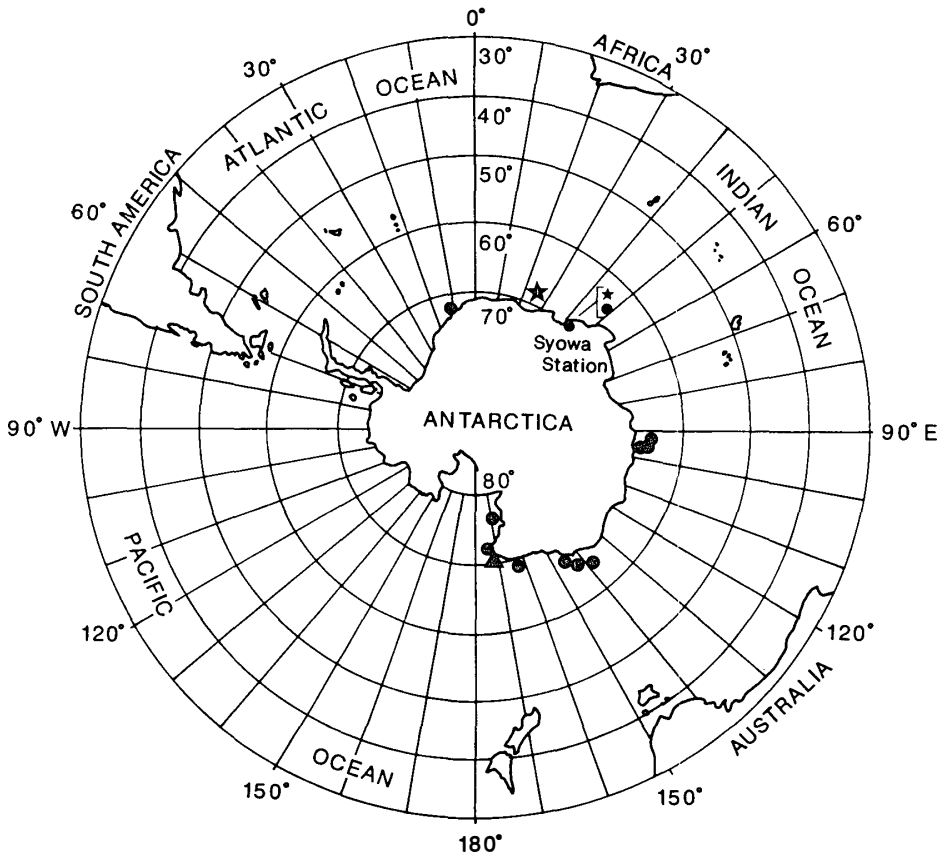


Fig. 62. Distribution of *Marseniopsis conica* (SMITH) (Large dots: Previous distribution records; Stars: Present study; Triangle: Type locality).

150 m (STREBEL, 1908); Macquarie Island, 69 m (TOMLIN, 1948); Adélie Land, 75 and 90 m (ARNAUD, 1972a); south of Iwajima Island, near Syowa Station, 30 m (HORIKOSHI *et al*., 1979); Davis Sea, 41 m (EGOROVA, 1982); Weddell Sea, 41–588 m (HAIN, 1990); Ross Sea, 51–860 m (DELL, 1990); Breid Bay, 270 m (NUMANAMI and OKUTANI, 1991b).

Remarks: Antarctic Lamellariid gastropoda was first described by BERGH (1886) from Kerguelen. Ten species have been described from the Antarctic and Subantarctic regions up to this date (NUMANAMI and OKUTANI, 1990b). Among them only two species were reported from near Syowa Station (HORIKOSHI *et al*., 1979).

Marseniopsis conica was described by SMITH (1902) based on a single specimen from Cape Adare, Adélie Land. The original description was related only a few morphological characters, although an illustration of the shell was given. EALES (1923) gave the details of *M*. "*conica*", which was collected from McMurdo Sound, at 50 fathoms by the TERRA NOVA Expedition, describing that the mantle is smooth and thick. In spite of the fact that the original description by SMITH (1902) stated that the mantle is thin with a granulous or finely warty appearance. The illustration of radula by EALES (1923, fig. 26a) is closely related to that of *M. mollis* (Fig. 66B). Therefore, EALES's record requires a confirmation.

This species is similar to *Lamellariopsis turqueti* VAYSSIÈRE, 1906 from Antwerp Island, Antarctic Peninsula, Kerguelen and Adélie Land, by having the same type of mantle. According to VAYSSIÈRE (1917), *L. turqueti* differs from *M. conica* in having more rounded shell, rosy reddish mantle and different radular characters. It is true that the VAYSSIÈRE's illustration (1917, pl. 1, fig. 12) gives one an impression that *L. turqueti* has more rounded shell with more spacious and rounded aperture. But, the radula is clearly identical with that of *M. conica*, and the distribution of *L. turqueti* overlaps with that of *M. conica*. From these facts, it is here considered that *L. turqueti* is conspecific with *M. conica*.

POWELL (1979) placed *Marseniopsis conica* in the original generic allocation *Lamellaria*. But, the genus *Lamellaria* differs from *Marseniopsis* in having inverted V- or Y-shaped rhachidian tooth and no marginal teeth (Fig. 66E). Thus, we disagree with POWELL's generic allocation.

Marseniopsis mollis (SMITH, 1902)

(Figs. 63A–D, 66B)

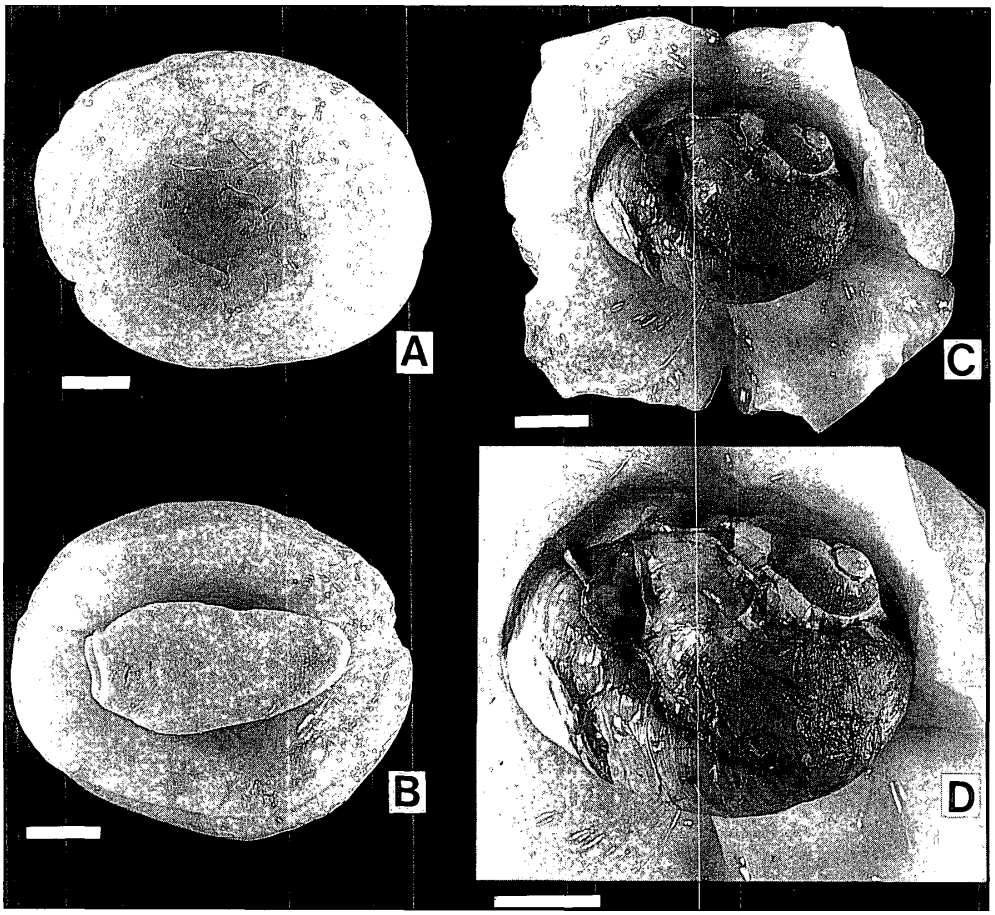
Lamellaria mollis SMITH, 1902, p. 205, pl. 24, figs. 19–21.

Marseniopsis mollis: SMITH, 1915, p. 66. (distribution record); HEDLEY, 1916, p. 53. (distribution record); THIELE, 1912, p. 200, pl. 15, fig. 22. (radula); EALES, 1923, p. 25, fig. 26b.; POWELL, 1960, p. 146. (name only); ARNAUD, 1972b, p. 126, fig. 17. (remarks only); EGOROVA, 1982, p. 28, figs. 128–130; DELL, 1990, p. 164; HAIN, 1990, p. 53, pl. 4, figs. 3a–c; NUMANAMI and OKUTANI, 1991b, p. 56, figs. 6A–D, 9B, pl. 1, 3–5.

Marseniopsis cf. *mollis*: HORIKOSHI *et al*., 1979, p. 21, fig. 4. (distribution record)

Material examined: 5 specimens taken alive from St. 9; single living specimen from Kita-no-ura Cove; single living specimen from off Langhovde, 27 January, 1989.

Description: The shell is very thin, fragile, translucent, depressed, with inflated whorls, and has a very thin periostracum. In the large specimen, the shell is porcelaneous white, but that of small specimen is transparent. The protoconch is about 1.75 in number of turns,



Figs. 63A-D. *Marseniopsis mollis* (SMITH) from Langhovde. A. Dorsal view of animal; B. Ventral view of animal; C. Cutting of dorsal area of mantle; D. Abapertual view of shell. Scale = 10 mm.

about 1.3 mm in diameter, glossy and transparent, and has 8 spiral lirae. The teleoconch is about 3 in number of turns in the largest specimen, and rapidly increasing in diameter towards the aperture, and has numerous very fine growth lines. The suture is somewhat grooved. The upper whorl is little rounded, conspicuously small and depressed. The body whorl is very large and well inflated, with breadth being 151% of shell length. The base is roundly inflated. The umbilicus is not open. The aperture is large and round with smooth peristome. The upper part of the aperture exceeds the lower part. The outer lip is round and smooth. The inner lip is also round, smooth and expanded outwardly. The columellar lip is smooth and roundly curved. The basal lip is round.

No operculum exists.

The entire dorsum is completely covered by the mantle, and elliptical shape in dorsal view. When alive, the mantle and foot are yellow, and the cephalic tentacle and penis are creamy colored. But in preserved condition in alcohol, these are white or grayish white. The mantle is uniformly thick and somewhat firm, except dorsal area. The anterior mantle has a narrow and deep slit. The surface of dorsum is almost smooth, except some wrinkles. The head has a pair of attenuate, long and slender cephalic tentacles with very small eyes (about 0.6 mm in diameter) which are located on the outside of about 2/3 from

the apex of these tentacles. The foot is about 60% of body length. The anterior margin of the foot is almost straight, wider and thicker than elsewhere, and is separated into the dorsal and ventral areas by a horizontal furrow which runs along the anterior rim of the foot. The pedal sole is smooth or uneven. The proboscis is long, stout and slightly conical, 10.2 mm in length, 7.0 mm in width and 7.0 mm in height, and buff in color, and the surface is rugose with numerous axial wrinkles.

The radula is taenioglossate, 2 : 1 : 1 : 1 : 2 with 53 transverse rows of teeth, translucent brown in color, long and wide (13.0 mm in length and 4.2 mm in width; Body length is 71.3 mm) (Fig. 66B). The rhachidian tooth is oblong in outline, oblong, much higher than wide, and has a long, large and strong central cusp that carries 2 to 4 small sharp-pointed denticles on both sides. The base line is wavy. The lateral tooth is elongate triangular, wide, large and stout, and has a long, stout and acute central cusp that carries 2 sharply pointed strong denticles on lateral inside and 1 or 2 small and weak denticles on outside. The base line is V-shape as the middle area of the base rises anteriorly. The marginal teeth are simple sickle-shaped, and the inner marginal tooth is larger and stronger than the outer one.

Table 15. Measurements and condition of *Marseniopsis mollis* (SMITH).

No.	1	2	3	4	5	6	7
St.	9	9	9	9	9	Ki	La
BL (mm)	17.8	14.1	17.8	21.3	14.6	55.2	71.3
BW (mm)	12.2	11.1	11.1	13.3	9.8	36.8	58.4
BH (mm)	11.3	9.0	6.0	8.7	14.2	35.9	38.1
Condition	L	L	D	D	D	L	L

BL: Body length; BW: Body width; BH: Body height; L: Specimen taken alive; D: Damaged specimen; Ki: Kita-no-ura Cove; La: Langhovde.

Measurements: See Table 15.

Previous distribution records (Fig. 64): Type locality: Cape Adare, 6–29 fathoms. Range: off Oates Land, 69°43′S, 163°24′E, 180–200 fathoms and McMurdo Sound, 77°13′S, 164°18′E, 207 fathoms (SMITH, 1915); Commonwealth Bay, 25–400 fathoms, off Mertz Glacier, 66°55′S, 145°21′E, 288 fathoms, off Drygalski Island, 60 fathoms, Davis Sea, 66° 08′S, 94°17′E, 120 fathoms and off Shackleton Iceshelf, 64°32′S, 97°20′E, 110 fathoms (HEDLEY, 1916); McMurdo Sound, 50 fathoms (EALES, 1923); Terre Adélie, 38–210 m (ARNAUD, 1972); in shore, Ongulkalven Island (HORIKOSHI *et al.* 1979); Davis Sea, 41 m (EGOROVA, 1982); Weddell Sea, 1–730 m (HAIN, 1990); Ross Sea, 11–379 m (DELL, 1990); Breid Bay, 276–289 m (NUMANAMI and OKUTANI, 1991b); Kita-no-ura Cove, 10 m (NUMANAMI and OKUTANI, 1991b); off Langhovde, *ca.* 5 m (NUMANAMI and OKUTANI, 1991b).

Remarks: *Marseniopsis mollis* is the commonest species in the genus *Marseniopsis* in the costal waters of the Antarctic Continent. In this study, all the specimens collected from Breid Bay were very small, but those collected from nearshore Kita-no-ura Cove and Langhovde were large. The shell of this species is easily decalcified, but the calcareous layer remains on areas of the suture and the base in one of the specimens under study (Fig. 63D).

ARNAUD (1972b) stated that *Marseniopsis antarctica* (VAYSSIÈRE, 1906) is a synonym

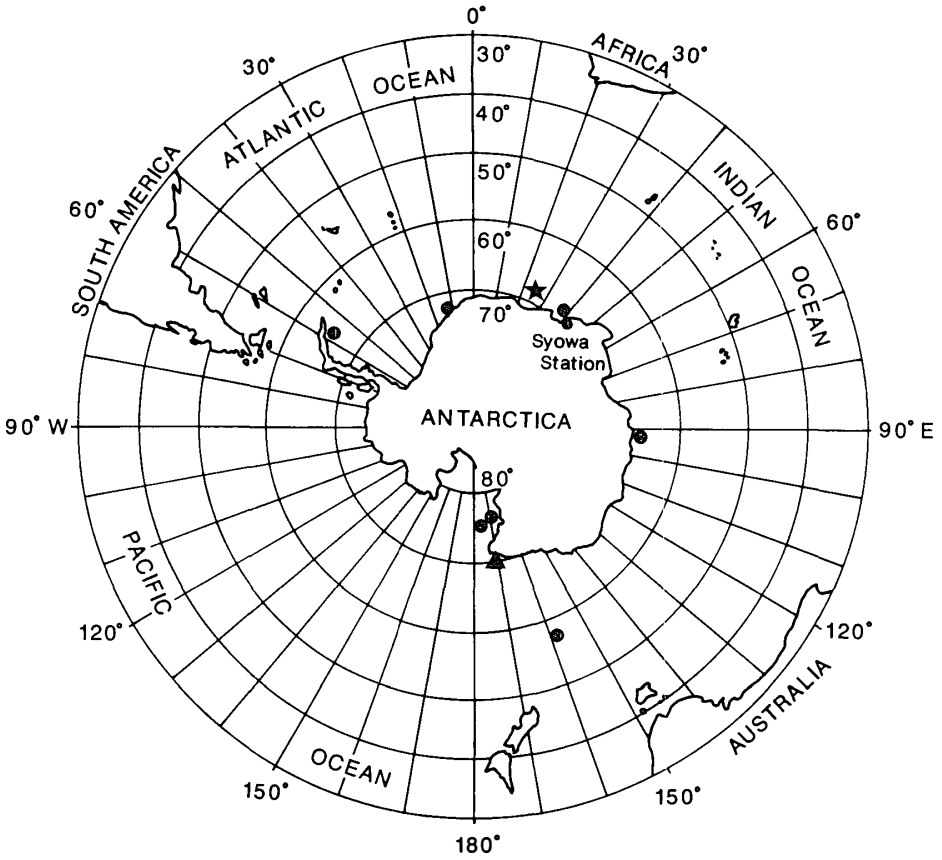


Fig. 64. Distribution of *Marseniopsis mollis* (SMITH) (Large dots: Previous distribution records; Star: Present study; Triangle: Type locality).

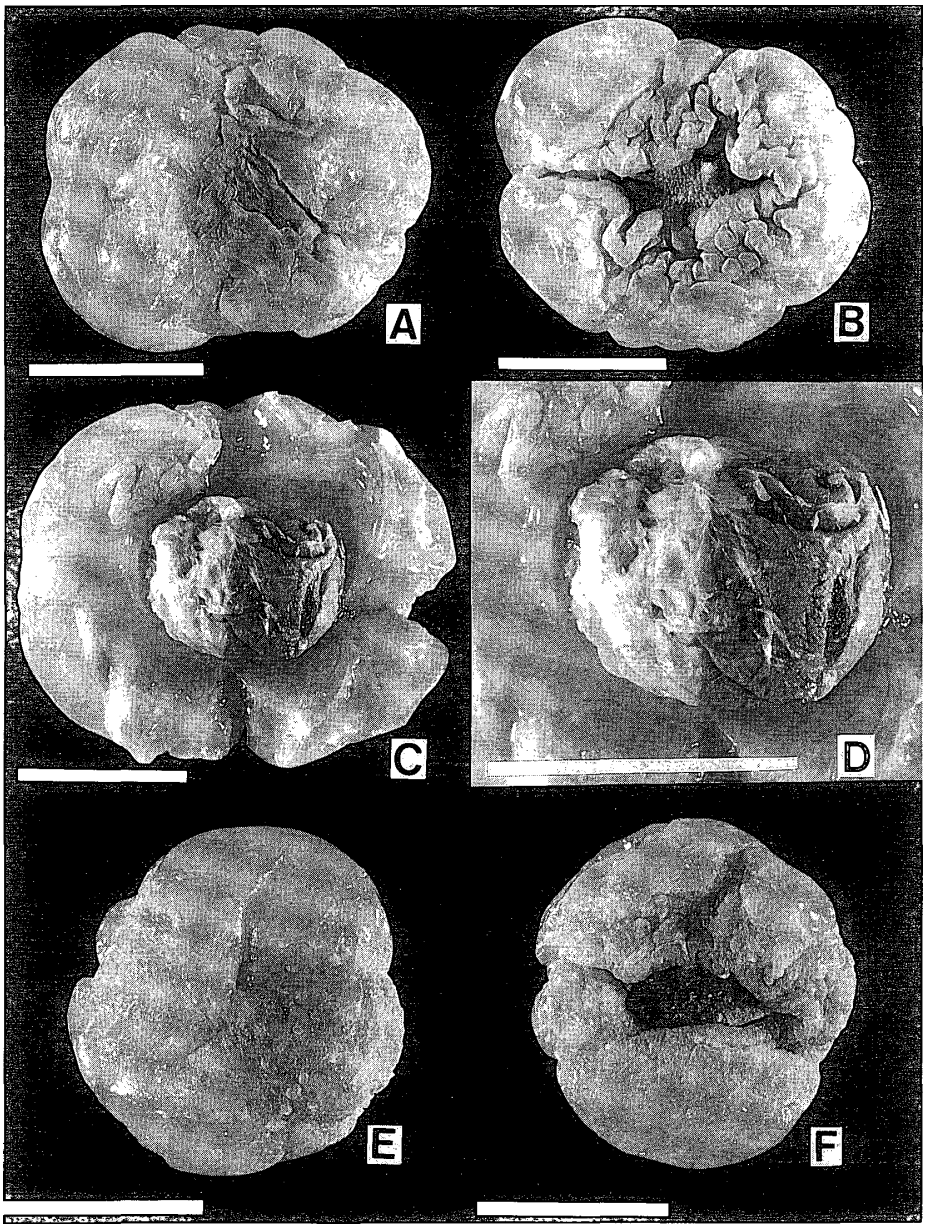
of *M. mollis*. But, *M. antarctica* is separable from the *M. mollis* in following characters: 1) The protoconch lacks spiral lirae; 2) the central cusp of rhachidian tooth carries 9 or 10 small denticles on both sides; and 3) the lateral tooth has no denticle on the lateral outside. Therefore, ARNAUD's view is not acceptable.

Marseniopsis syowaensis NUMANAMI & OKUTANI, 1991
(Figs. 65A–F, 66C)

Marseniopsis syowaensis NUMANAMI & OKUTANI, 1991b, p. 58, figs. 7A–F, 9C, pl. 1, 1 and 2.

Material examined: A single specimen taken alive off Langhovde, 27 January, 1989; 2 living specimens from East Ongul Island, January, 1981.

Description: The shell, which completely lacks calcareous matter but consists of a thin horny material, is large in size, depressed, semispherical with well inflated whorls. As the shell is transparent, the internal organs are visible through. The protoconch is transparent and finely granulated, also consisting of a thin horny material, and is about 1.3 in number of turns, about 1.5 mm in diameter. The teleoconch is 2.25 in number of turns, roundly inflated, and rapidly increasing the diameter towards the aperture, and has numerous very fine growth lines. The suture is impressed. The upper whorl is small and depressed.

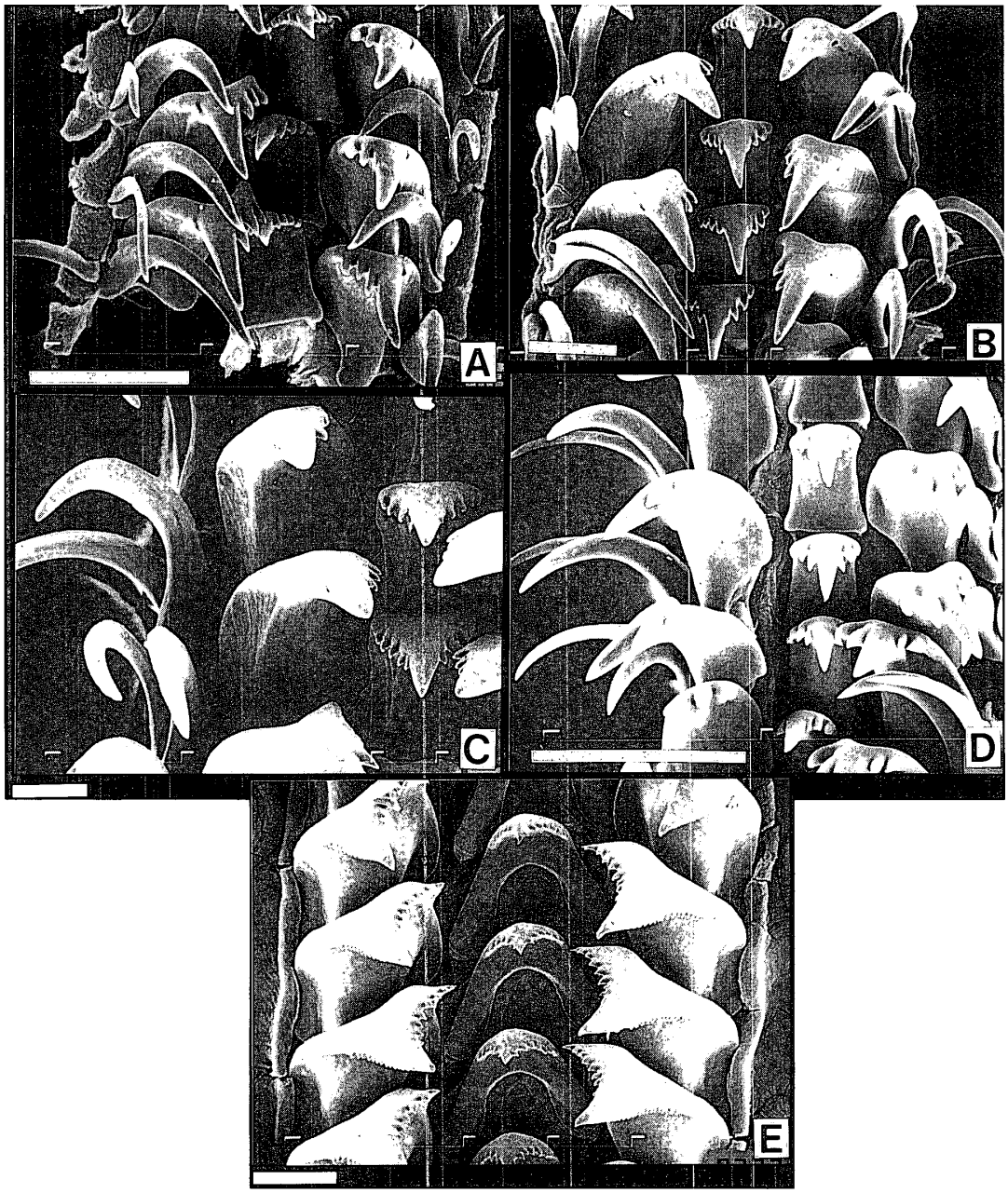


Figs. 65A–F. *Marseniopsis syowaensis* NUMANAMI & OKUTANI (A–D from Langhovde; E, F from Kita-no-ura Cove). A. Dorsal view of animal; B. Ventral view of animal; C. Cutting of dorsal area of mantle; D. Abapertual view of shell; E. Dorsal view of animal; F. Ventarl view of animal. Scale=50 mm.

The body whorls is large, with breadth being about 118% shell length. The base is roundly inflated. The umbilicus is narrowly open. The aperture is large and round with smooth peristome. The upper part of aperture exceeds the lower part. The outer lip is round and smooth. The inner lip is round and smooth, expanded outwardly. The columellar and basal lips are round.

No operculum is present.

The entire dorsum is completely covered by the mantle. The outline of the dorsum



Figs. 66A–E. Radula of five lamellariid species. A. *Marseniopsis conica* (SMITH); B. *Marseniopsis mollis* (SMITH); C. *Marseniopsis syowaensis* NUMANAMI & OKUTANI; D. *Marseniopsis* sp.; E: *Lamellaria kiiensis* HABE from nearshore water off Shimoda, Izu Peninsula, Japan. Scale = 100 μm.

is obcordate in dorsal view. The mantle of small specimen is dome-like shape (Figs. 65A, E). When fresh condition, the coloration of dorsal side of the mantle of the paratype #2 specimen is pale pink with pale brown spots, the ventral side is only pale pink, and the foot and cephalic tentacle are white. But, the coloration of the specimen preserved in alcohol is uniformly buff or pale pink. The mantle is soft, jelly, but very thick. The anterior side

of the mantle is wide and thick, and has an incision. The posterior side of the mantle is round and thinner than the anterior. The dorsal surface of the mantle has numerous wrinkles and irregular warts of shrinkage. The head has a pair of attenuate, acuminate, short, stout and creamy colored cephalic tentacles (13.6 mm in length, 4.5 mm in width; Body length 115 mm), with very small eyes on the middle outside. The foot is very small in contrast with the huge mantle, being only 40% of mantle length. The anterior margin of the foot is round, wider and thicker than other part, and is separated into the dorsal and ventral areas by a horizontal furrow which runs along the anterior rim of the foot. The pedal sole is uneven. The proboscis is short and conical, 11.0 mm in length, 4.4 mm in width and 5.0 mm in height, and buff in color, superficially rugose with numerous axial wrinkles.

The radula is taenioglossate, 2 : 1 : 1 : 1 : 2 with 47 transverse rows of teeth, translucently brown in color, long and wide (13.6 mm in length and 4.5 mm in width; Body length is 115 mm) (Fig. 66C). The rhachidian tooth is oblong, much higher than wide, with a large and strong central cusp that carries 4 or 5 sharply pointed small denticles on both sides. The middle area of base rises anteriorly, and the base line is V-shape. The lateral tooth is elongate quadrate, wide, large and stout, and has a large, stout, but rather blunt triangular central cusp that carries 3 to 5 sharply pointed small denticles on lateral inside and 1 or 2 very weak vestigial denticles on outside. The middle area of base rises anteriorly. The base line of lateral tooth is wavy. The marginal teeth are simple, sickle-shaped, and the inner one is larger and stronger than the outer.

Measurements:

SL 41.2 mm, SW 48.6 mm (BL 115.0 mm, BW 100.0 mm, BH 43.1 mm; collected from Langhovde) (Holotype specimen; NSMT-Mo 69490).

SL 23.8 mm, SW 32.1 mm (BL 75.5 mm, BW 80.5 mm, BH 38.4 mm; collected from East Ongul Island) (Paratype specimen #1; NSMT-Mo 69491).

SL 29.5 mm, SW 39.8 mm (BL 59.8 mm, BW 46.5 mm, BH 41.0 mm; collected from East Ongul Island) (Paratype specimen #2; NIPR A20-37).

Previous distribution records: Type locality: off Langhovde, *ca.* 5 m. Range: Nisi-noura Cove, 5 m (NUMANAMI and OKUTANI, 1991b).

Remarks: *Marseniopsis syowaensis* is remarkably large compared with other species of Antarctic lamellariids. *M. mollis* (SMITH, 1902) is similar to this species in radular character, but the former has a longer and sharpely pointed central cusp on the rhachidian tooth, 2 denticles on the inner edge of the lateral tooth and stouter, and more gently curved inner marginal tooth (Fig. 69B). *M. mollis* has a very thin calcareous shell and a stronger and firmer mantle, which is thinner than that of this species. The cephalic tentacles of *M. mollis* is longer and slenderer than this new species. *M. syowaensis* is also similar to *Lamellariopsis aurora* HEDLEY, 1916, from Davis Sea, in having large and obcordate mantle. However, if compared with the same size individuals of these two species (about 70 mm in Body length; Figs. 68E, F), the mantle of *M. syowaensis* is dome-like in shape and orbicular in outline, but, the mantle of *L. aurora* has obcordate in outline. The cephalic tentacles of *L. aurora* are longer and slenderer than those of this species. HEDLEY (1916) described *L. aurora* by only a single specimen which was torn and distorted, and the shell character was not observed, nevertheless, *L. aurora* is distinguishable from this species by having the difference in characters of soft parts.

All of known species of Antarctic *Marseniopsis* has a very thin and fragile calcareous shell. And these specimens preserved in formalin, the shell is easily decalcified. In spite of the suspicion that the shell of this species was also decalcified, the shells of all three specimens in different preservative conditions lack calcareous matter but consists of only a thin horny material. Thus, it was convinced that this species does not develop the calcareous deposit on the shell.

This species was collected from the near shore water off Langhovde with a small dredge. Around the East Ongul Island, this species was collected by SCUBA diving from a depth of 8 m in Nisi-no-ura Cove and 10 m in Kita-no-ura Cove. The bottom substratum of Nisi-no-ura Cove was sandy with sporadic outcrop of rocks, and Kita-no-ura Cove was composed of stable rocks and large stones (NAKAJIMA *et al.*, 1982).

This species was observed from a depth of about 30 m in Ongul Strait, near Syowa Station, by an underwater TV. The bottom substratum of observed area was sand, with growths of many sponges and ascidians (NAITO, personal communication).

Marseniopsis soliditesta n. sp.

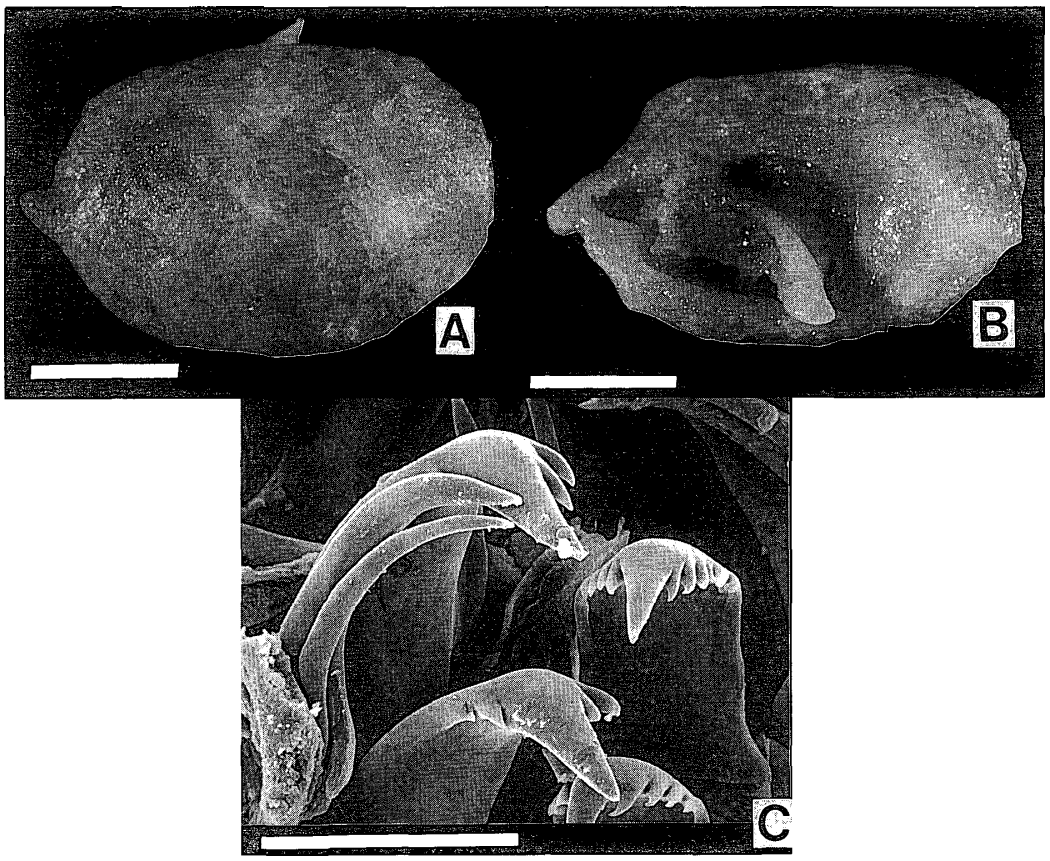
(Figs. 67A–C)

Material examined: A single living specimen from St. 8.

Description: The shell is small, translucent white in color, depressed, with inflated and rather thick whorls. The protoconch is about 1.25 in number of turns, about 0.45 mm in diameter, transparent and very finely granulated. The teleoconch is about 1.5 in number of turns and rapidly increasing diameter towards the aperture, and it has numerous, very fine growth lines and a very thin periostracum. The suture is somewhat grooved. The upper whorl is small and depressed. The body whorl is very large, and depressed, breadth being 131% shell length. The base is a little inflated. The umbilicus is not open. The aperture is large and round with smooth peristome. The upper part of aperture exceeds the lower part. The outer lip is gently rounded and smooth. The area from outer lip to basal lip is curved. The inner lip is round with a very thin callus that is slightly expanded outwardly. The inner lip has conspicuous corner against outer lip. The columellar lip is curved. The basal lip is gently rounded.

No operculum is present.

The entire body is completely covered by the mantle, and elliptical in outline in dorsal view. The specimen preserved in alcohol is grayish white in color. The mantle is very thin, and has the rough surface. The ventral area of the mantle is thick. The anterior part of the mantle is constricted to form a siphon, which extends anteriorly (about 0.4 mm in length). The head has a pair of digital and white colored cephalic tentacles, 0.63 mm in length and 0.18 mm in width, with large black eyes (0.15 mm in diameter) on the basal outside. The penis is curved forward, digitate, short and small (0.50 mm in length and 0.08 mm in width), with no projection on the apex. The foot is tongue-like in outline and 53.2% of body length. The anterior end of foot is very wider and thicker than the other part, and is separated into the upper and lower sides by the horizontal slit, and presented double rimmed appearance. The metapodium is as long as 75% of foot length. The pedal sole has a rough surface. The proboscis is short, conical, 1.25 mm in length and 1.1 mm in width, and the surface is rugose with numerous fine axial wrinkles.



Figs. 67A–C. *Marseniopsis soliditesta* n. sp.
A. Dorsal view of animal; B. Ventral view of animal; C. Radula.
Scale A, B = 1 mm; C = 100 μm.

The radula is taenioglossate, 2 : 1 : 1 : 1 : 2 with 44 transverse rows of teeth, transparent, long and narrow (2.25 mm in length, 0.25 mm in width) (Fig. 67C). The rhachidian tooth is oblong trapezoid in outline, much higher than wide, and has a long, sharply pointed central cusp that carries 4 to 5 small sharp denticles on both sides. The base line is gently concave. The lateral tooth is large and stout, and has a long and stout central cusp that carries 2 strong denticles on lateral outside and 2 small and weak denticles on inside. The inner edge of base is expanded conspicuously. The marginal teeth are simple, sickle-like in shape, and the inner marginal is longer and stronger than the outer one.

Measurements: SL 3.2 mm, SW 4.2 mm (BL 4.7 mm, BW 3.5 mm, BH 2.3 mm) (Holotype specimen; NSMT-Mo 70619).

Remarks: This specimen is included in the genus *Marseniopsis* because of having typical radular characters. The dorsal mantle completely covers the shell, with no dorsal pore.

The radular characters of this specimen are very similar to those of *M. conica* (Fig. 66A) and *Marseniopsis spherica* n. sp. (Fig. 68F). The base of rhachidian tooth of *M. conica* bears a small projections on both lateral outsides. *M. conica* (Figs. 61A–E) is also separable from this species in the following characters: 1) The surface of mantle has numerous small and some large projections; 2) the dorsal view of the mantle is polygonal; 3) the shell with more inflated whorls is thinner and more fragile; and 4) the surface of

pedal sole is uneven. *Marseniopsis spherica* n. sp. is also separable from this species in following characters: 1) The shell is spherical, thinner and more fragile; 2) the surface of mantle is almost smooth expect a few small projections; 3) the mantle is globose; and 4) the posterior edge of pedal sole has a few small projections.

Marseniopsis spherica n. sp.

(Figs. 68A-F)

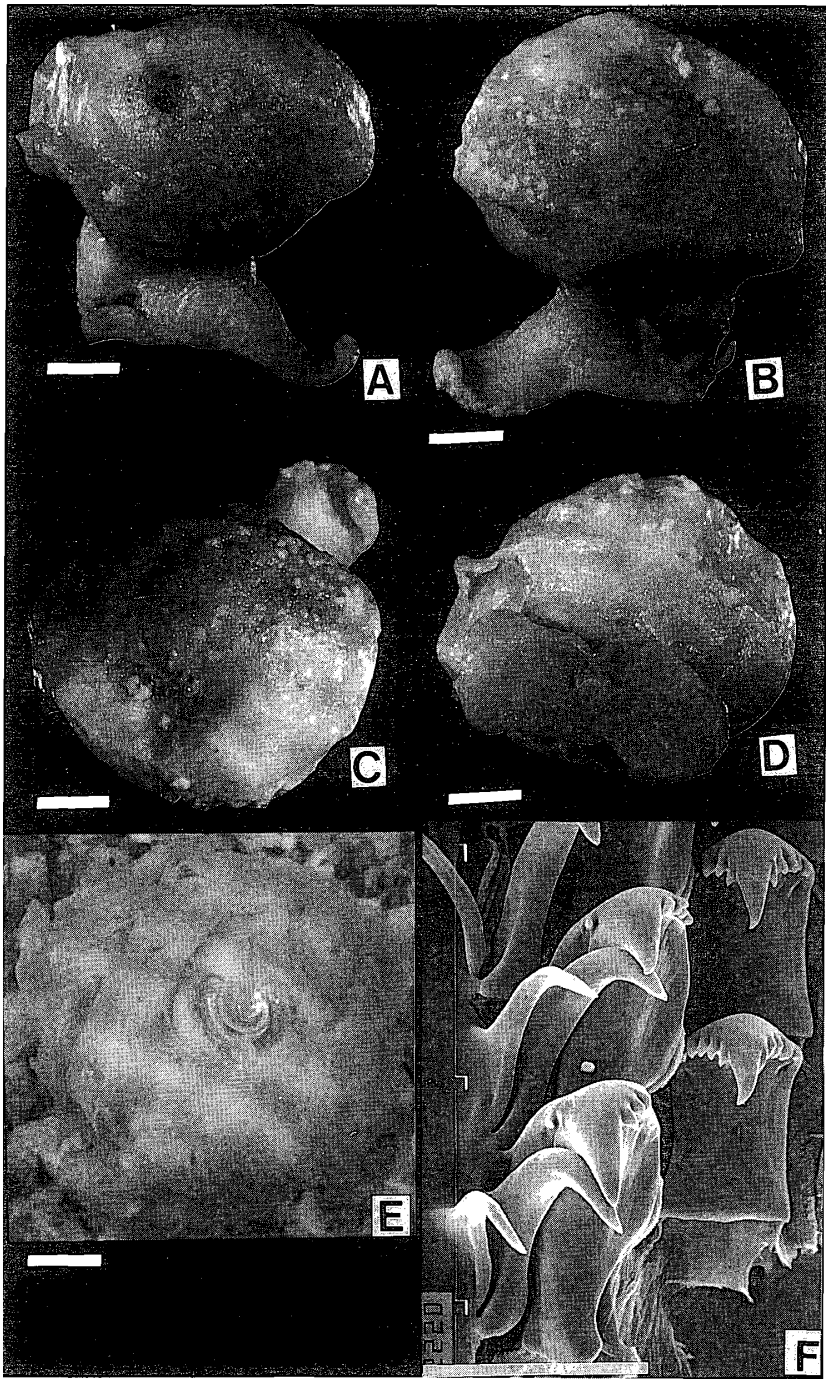
Material examined: A single specimen taken alive from Breid Bay (JARE-27).

Description: The shell is transparent, very thin, fragile, spherical with well inflated whorls, and has a very thin transparent periostracum. The protoconch is large, about 2 in number of turns, about 1.5 mm in diameter, glossy and transparent, and has irregular spaced, many spiral lirae. The teleoconch is about 2 in number of turns, rapidly increasing diameter towards the aperture, and has numerous, very fine growth lines. The suture is slightly impressed. The upper whorl is small and rather depressed. The body whorl is very large, with breadth being about 170% shell length, well roundly inflated. The base is roundly inflated. The umbilicus is absent. The outer margin of aperture is broken in the examined specimen. The inner lip is round and smooth. The columellar lip is round.

No operculum exists.

The entire body is completely covered by the mantle, which is globose and circular in dorsal view. The mantle is thick, and separated dorsal and ventral regimes by a peripheral ridge. The coloration of dorsum of the specimen preserved in alcohol is pale orange with few very small red spots, but the ventral mantle and the foot are creamy in color. The dorsal mantle is almost smooth except some small projections, which are mostly located on the posterior and lateral regions. The ventral mantle is smooth. The head has a pair of short, very slender, obtuse and creamy colored cephalic tentacles, 1.2 mm in length and 0.3 mm in width, with large black eyes (0.15 mm in diameter) on basal outside. The penis which is curved backwards, is narrowly spatulate in outline, long and slender (2.0 mm in length and 0.3 mm in width), with a widened tip and no projection on the apex. The foot is tongue-like shape and slightly smaller than the mantle length, 6.0 mm long and 2.5 mm wide. The anterior end of foot is round, wider and thicker than other part, and is separated into the upper and lower sides by the horizontal slit, and presented double rimmed appearance. The posterior end of pedal sole has a few small projections. The pedal sole is rough. The proboscis is long, stout and slightly conical (1.7 mm in length, 1.0 mm in width and 1.0 mm in high), and buff in color, with the rugose surface.

The radula is taenioglossate, 2 : 1 : 1 : 1 : 2 with 37 transverse rows of teeth, translucently brown in color, long and narrow (3.5 mm in length, 0.25 mm in width) (Fig. 68F). The rhachidian tooth is oblong quadrate in outline, much higher than wide, with a sharply pointed, long central cusp that carries 6 sharp, small denticles on both sides. The base line is straight. The lateral teeth are also oblong, large, with a large, long and strong central cusp that carries 3 strong denticles on lateral inside and a single small, weak denticle on outside. The middle area of the base is long and rises anteriorly. The base line is undulatry. The marginal teeth are simple, sickle-like shaped, and the inner marginal is longer and stronger than the outer one.



Figs. 68A–F. *Marseniopsis spherica* n. sp. A. Left side view of holotype; B. Right side view of holotype; C. Dorsal view of holotype; D. Ventral view of holotype; E. Shell; F. Radula. Scale A–E = 1 mm; F = 100 μm.

Measurements: SL 5.0 mm, SW 8.5 mm (BL 8.5 mm, BW 9.0 mm, BH 7.0 mm) (Holotype specimen; NSMT-Mo 70620).

Remarks: This species is included in the genus *Marseniopsis* because of typical radular characters. The mantle is completely covered the shell, and no dorsal pore is present.

The radular characters of this species is very similar to those of *M. conica* (Fig. 66A). However, the base of rhachidian tooth of *M. conica* has small projections on both sides. *M. conica* is further separable from this species in the following characters: 1) The posterior end of pedal sole has no projection; 2) the mantle has no peripheral ridge; 3) the dorsal view of mantle is polygonal; 4) the surface of mantle has numerous small and some large projections; and 5) the penis is flat, long and wide.

Marseniopsis sp.

(Figs. 69A–D, 66D)

Marseniopsis sp.: NUMANAMI and OKUTANI, 1991b, p. 62, figs. 8A–D, 9D.

Material examined: A single specimen taken alive from St. 9.

Description: The shell is small, porcelaneous white in color, very thin, fragile, and has numerous very fine growth lines and a very thin periostracum. The morphological details of the shell is not clear, because the shell is heavily damaged.

No operculum is present.

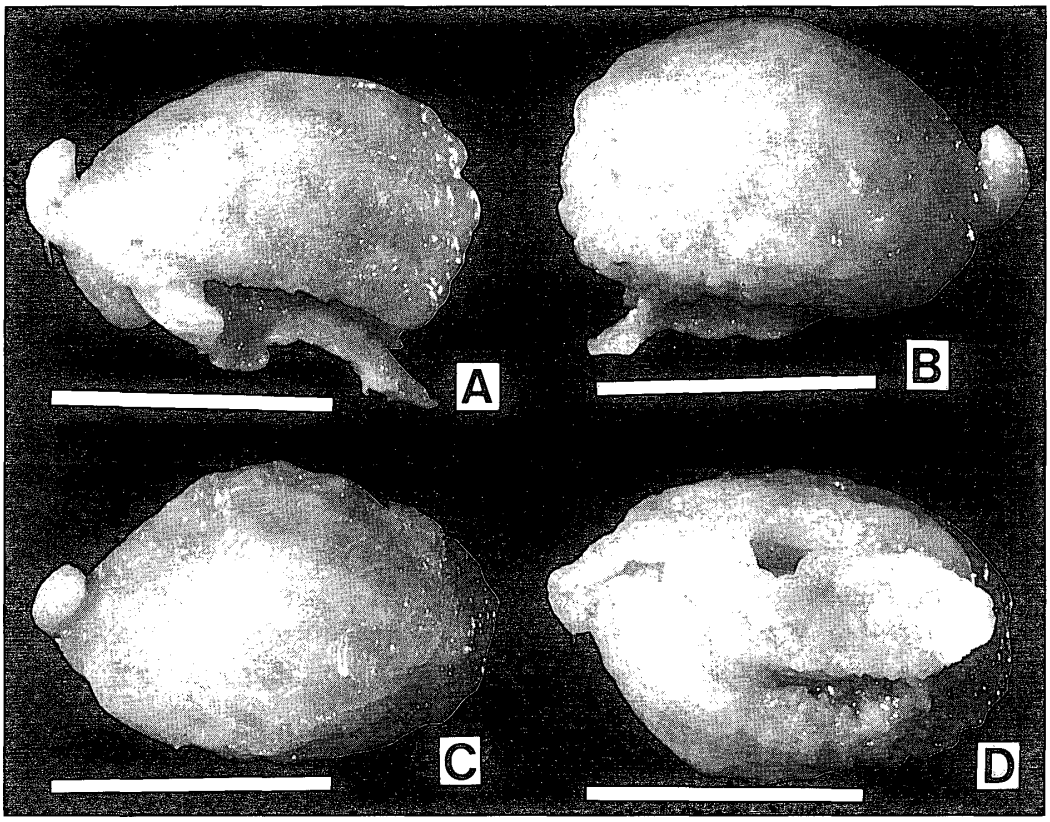
The entire dorsum is completely covered by the mantle, which is oval in outline in dorsal view. In preserved in alcohol, animal is buff in color. The mantle is thick, and has little wrinkled surface. The posterior side of the mantle is rather thicker than elsewhere, and has some large knobs. The anterior part of the mantle is contracted like a siphon, extending anteriorly. The head has a pair of obtuse buff colored cephalic tentacles, 1.0 mm in length and 0.25 mm in width, with large black eyes (0.25 mm in diameter) on basal outside. The foot is small in comparison to the mantle and occupies about 58% of the body length. The anterior margin of the foot is round, wider and thicker than the other part, and is separated into the dorsal and ventral areas by a horizontal furrow running along the anterior rim of the foot. The pedal sole is uneven. The proboscis is short and conical, 1.5 mm in length, 1.0 mm in width and 1.0 mm in height, with numerous fine axial winkles on the surface.

The radula is taenioglossate, 2 : 1 : 1 : 1 : 2, translucent brown in color (Fig. 66D). The rhachidian tooth is rectangular, much higher than wide, and has a long sharply pointed central cusp that carries 2 or 3 small sharp denticles on both sides. The base line is straight. The lateral tooth is triangular, large and stout, and has a long central cusp that carries 2 large and strong denticles on both sides. Denticles of the inner side of the lateral tooth are larger and stronger than the outer ones. The middle area of the base of the lateral tooth rises anteriorly, therefore, the base line is V-shape. The marginal teeth are simple sickle-shaped, and the inner marginal tooth is larger and stronger than the outer one.

Measurements: BL 7.8 mm, BW 4.5 mm, BH 5.0 mm (Shell length and shell width are not measured).

Previous distribution record: Breid Bay, 270 m (NUMANAMI and OKUTANI, 1991b).

Remarks: This species is included in the genus *Marseniopsis* because of typical radular characters. The dorsal mantle completely covers the shell, with no dorsal pore.



Figs. 69A–D. *Marseniopsis* sp.
A. Left side view of animal; B. Right side view of animal; C. Dorsal view of animal; D. Ventral view of animal. Scale=5 mm.

This species is separable from the other species in the following characters: 1) Denticles of rhachidian tooth are fewer in number, larger and stronger than those in other species; and 2) denticles on lateral outside of lateral tooth are remarkably larger and stronger than those in other species.

It is presumed that this is an undescribed species. Unfortunately, as only a single specimen with a heavily damaged shell has been known, this species is not named at present before better material will be available in future.

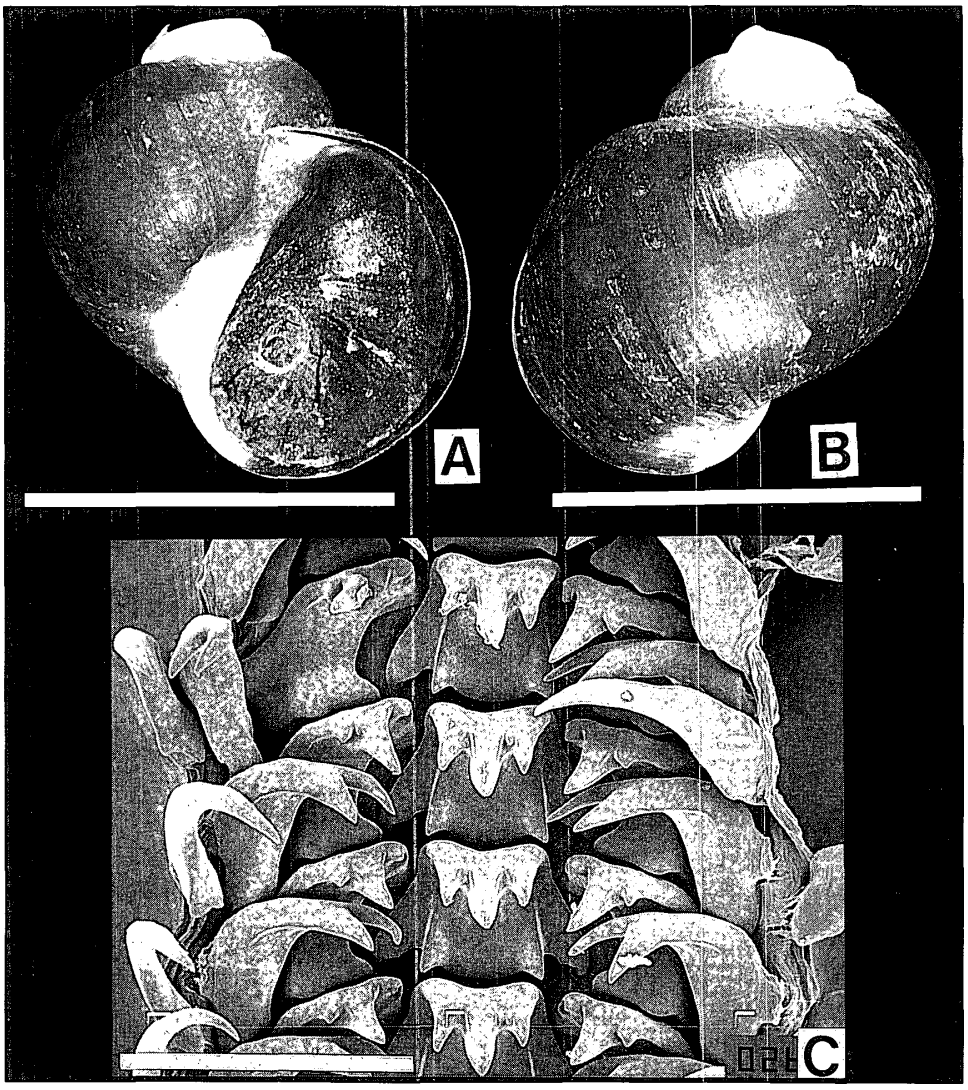
Family NATICIDAE FORBES, 1838
Genus *Amauropsis* MOERCH, 1857 (S.D. by DALL, 1909)
Type species: *Natica helicoides* JOHNSON (= *Nerita islandica* GMELIN, 1791)

Amauropsis georgianus (STREBEL, 1908)
(Figs. 70A–C)

Natica georgiana STREBEL, 1908, p. 62, figs. 65a, b.
Amauropisis georgianus: POWELL, 1951, p. 117 (remarks only); POWELL, 1960, p. 144 (name only).

Material examined: A single living specimen and 1 empty shell from St. 5; 1 empty shell from St. 8; 1 empty shell from St. 9; 1 living specimen from Günnerus Bank.

Description: The shell is small, thin, globose with moderate spires (Figs. 70A, B). The



Figs. 70A–C. *Amauropsis georgianus* (STREBEL).
A, B. Shell; C. Radula. Scale A, B = 1 mm; C = 100 μm.

protoconch is not preserved in all specimens examined. The teleoconch is round and well inflated, and has numerous very fine growth lines. The surface of body whorl is covered by a thick, bright orange brown periostracum, on which axial stripes are present along growth lines. The suture is rather impressed. The area just below the suture is flat. The body whorl is large, with breadth being 89–98% shell length. The base is roundly inflated. The umbilicus is completely sealed with a small lunate white pad which is continuous from the columellar lip callus. The area around umbilicus is white in color. The aperture is lunate with a thin and smooth outer lip beyond which the periostracum slightly overgrown.

Table 16. Measurments and condition of *Amauropsis georgianus* (STREBEL).

No.	1	2	3	4	5
St.	5	5	8	9	G
SL (mm)	12.4	11.5	6.1	9.4	5.8
SW (mm)	11.0	11.1	5.9	9.2	5.3
SW/SL (%)	88.7	96.5	96.7	97.9	91.4
Condition	L	F	L	F	L

F: Freshly dead specimen; L: Specimen taken alive.

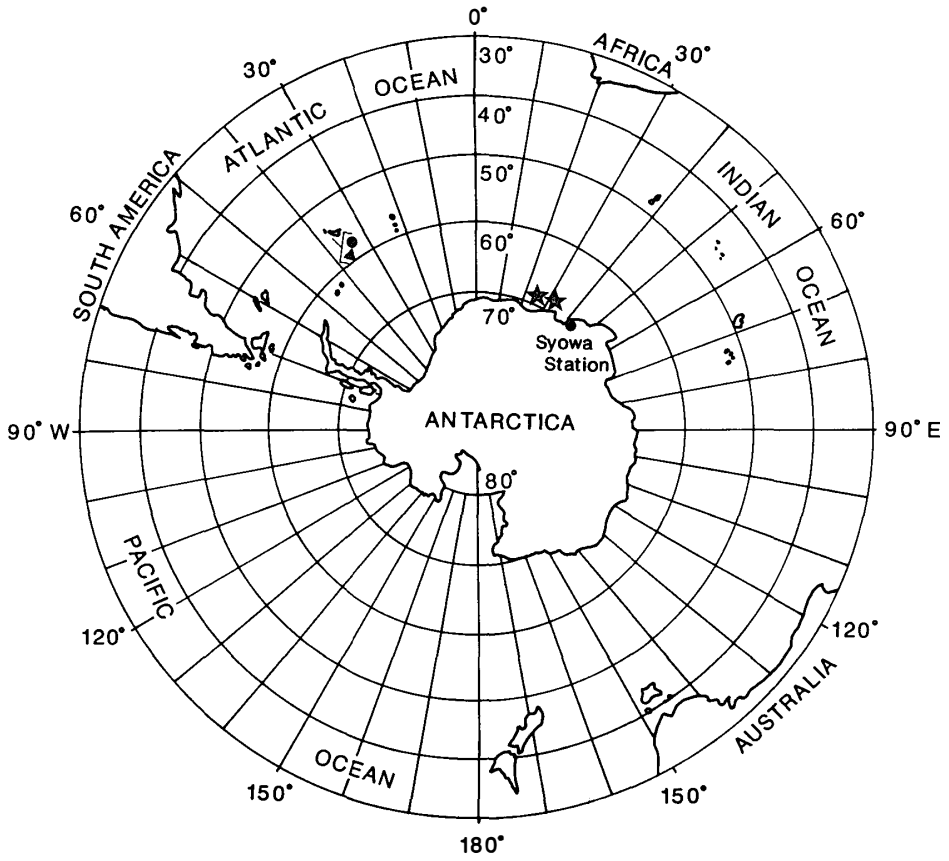


Fig. 71. Distribution of *Amauropsis georgianus* (STREBEL) (Dot: Previous distribution record; Stars: Present study; Triangle: Type locality).

The inner lip is smooth, and slightly expanded outwardly, and has an angle against the outer lip. The basal lip is round and smooth. The columellar lip is almost straight. The weakly glossy white callus is deposited from basal to columellar lips. The inner wall is weakly glossy white in color.

The operculum is slightly large to aperture in size, thin, horny, translucently brown in color, paucispiral, with nucleus situated below.

The radula is taenioglossate, 2 : 1 : 1 : 1 : 2, translucently brown in color (0.2 mm in width; 12.4 mm in SL) (Fig. 70C). The rhachidian tooth is trapezoid, much wider than high. It has a large and strong central cusp and a marginal cusp on each side. Middle area of the base is roundly expanded posteriorly, and has a triangular projection on both sides. The lateral tooth is almost rhomboid, and has a large and pyramidal central cusp and a small and blunt cusp on each side. The inner lateral side of lateral tooth is curved inwardly, and the base is wavy. The inner marginal tooth is large and stout, and has a bifurcate top. The outer marginal is simple sickle-shaped, smaller and weaker than the inner one. The jaw plate is heart-shaped in outline, large, 1.0 mm × 0.75 mm, translucent brown in color.

Measurements: See Table 16.

Previous distribution records (Fig. 71): Type locality: South Georgia, 64–74 m. Range: 2.7 miles S 85° of Jason Lt., South Georgia, 238–270 m (POWELL, 1951).

Remarks: This species is similar to *Amauropsis aureolutea* (STREBEL, 1908) from South Georgia and South Sandwich Islands. But, the lateral tooth of the latter species is bicuspid, and the inner marginal tooth has a indistinctly bifurcate top. The radula of this species is similar to *A. rossiana* (SMITH, 1907) from Enderby Land to Ross Sea, and *Amauropsis* (*Kerguelenatica*) *grisea* (MARTENS, 1878) from circum-Antarctica, Kerguelen, South Georgia and Bouvet Island. But, the shell of *A. rossiana* has two low and wide spiral ribs on the body whorl. *A.* (*K.*) *grisea* has a narrowly open umbilicus and an operculum which is both horny and calcareous. POWELL (1951) suspected that this species may be merely a form of *A. andersoni*, but he did not state the reason. *A. andersoni*, however, separable from this species in the following characters: 1) More globes shell with depressed spire; 2) almost atraight callus which covers the umbilicus; 3) weakly impressed suture; and 4) dark brown periostracum. The radula of this species is closely allied to that of *A. andersoni*. However, middle area of the base of rhachidian tooth of *A. andersoni* is less round than that of this species, and lateral projections are less prominent. The lateral tooth has a short and weak central cusp, and a incurved basal tip. The inner marginal has less prominent bifurcate top.

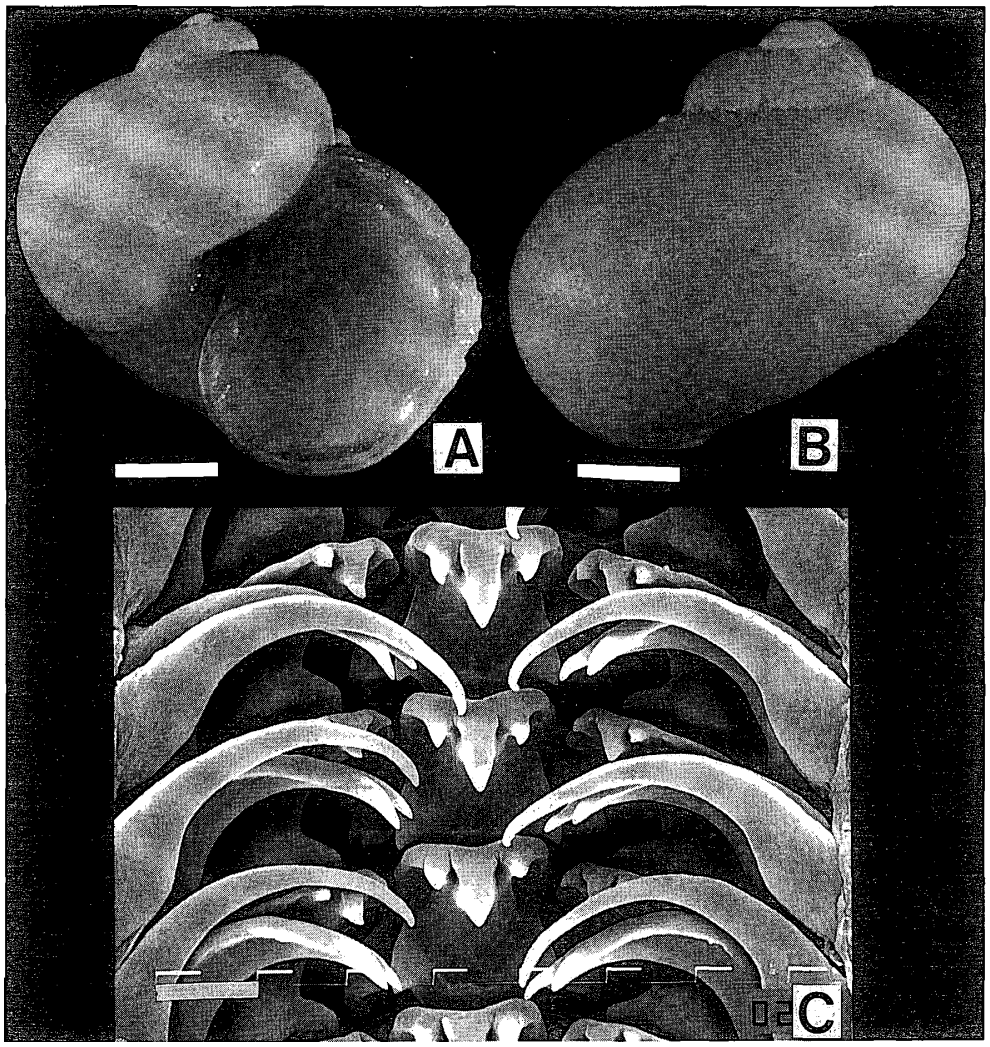
Subgenus *Kerguelenatica* POWELL, 1951 (O.D.)
Type species: *Natica grisea* MARTENS, 1878

Amauropsis (*Kerguelenatica*) *grisea* (MARTENS, 1878)

(Figs. 72A–C)

Natica grisea MARTENS, 1878, p. 24.; WATSON, 1886, p. 432, pl. 28, fig. 5; MARTENS, 1904, p. 64, pl. 4, fig. 3, pl. 8, fig. 44; STREBEL, 1908, p. 61, pl. 5. fig. 66a, b (distribution record); SMITH, 1915, p. 69 (remarks and distribution record)

Natica delicatula SMITH, 1902, p. 206, pl. 24, fig. 6; THIELE, 1912, p. 199, pl. 12, fig. 16, 17



Figs. 72A-C. *Amauropsis* (*Kerguelenatica*) *grisea* (MARTENS).
A, B. Shell; C. Radula. Scale A, B=1 mm; C=10 μm.

Prolacuna indecora: SMITH, 1915, p. 66; EALES, 1923, p. 21, figs. 23, 24.
Friginatica grisea: HEDLEY, 1916, p. 52.
Polinices (*Lunatia*) *grisea*: L. DAVID, 1934, p. 128.
Amauropsis (*Kerguelenatica*) *grisea*: POWELL, 1951, p. 118, pl. 10, fig. 60, Fig. J, 45 (remarks and distribution record); POWELL, 1957, p. 130 (distribution record); POWELL, 1958, p. 190 (distribution record); POWELL, 1960, p. 144 (name only); ARNAUD, 1972b, p. 125, fig. 16 (remarks and distribution record); DELL, 1972a, p. 2 (distribution record); EGOROVA, 1982, p. 29, figs. 42, 139, 140.
Kerguelenatica bioperculata DELL, 1990, p. 145, figs. 252, 253, 264 (nom. nov. for *grisea* MARTENS, 1878).
Material examined: 2 empty shells from St. 8; 1 living specimen from St. 9.
Description: The shell is translucent white in color, globose, small, very thin, fragile, with moderately high spires (Figs. 72A, B). The protoconch is about 2 in number of turns, 1.25 mm in diameter, translucently white in color, and has glossly smooth surface. The

teleoconch is round and well inflated, and has numerous microscopic growth lines and a very thin, translucently white periostracum on the surface. The suture is impressed. The upper whorl is small. The body whorl is large, with breadth being about 94–105% shell length. The base is roundly inflated. The umbilicus is clearly open. The aperture is oval, slightly oblique, with thin, smooth and round outer lip. The inner lip is gently curved, and has a weak angle against the outer lip. The columellar lip is almost straight, and the upper part is reflected over the umbilicus with a very thin transparent callus. The basal lip is round and smooth.

The operculum is lunate, translucent whitish brown in color, equal to the aperture, with paucispiral nucleus below (Fig. 72A). It has a very thin and fragile calcareous layer over a fairly strong horny layer interiorly, narrowest along the basal lip.

The radula is taenioglossate, 2 : 1 : 1 : 1 : 2, transparent, small and narrow, 1.5 mm in length, 0.13 mm in width (4.5 mm in SL) (Fig. 72C). The rhachidian tooth is trapezoid, much wider than high, and has a bifurcate basal tip. It has a large and strong central cusp and a small marginal cusp on each side. The middle area of the base is roundly expanded posteriorly, and has a large triangular projection on both sides. The lateral tooth is almost rhomboid, and has a large triangular central cusp and a small, weak cusp on each side. The inner and outer sides of lateral tooth are conspicuously incurved, and the base is also gently incurved. The inner marginal tooth is large and stout, and has two terminal cusps, of which inner one is smaller and weaker than the outer one. The base is also incurved. The outer marginal tooth is simple sickle-like shaped, longer than the inner one, and has a slightly flat and blunt tip, and a almost straight base. The jaw plate is triangular, small, 0.735 mm×0.250 mm, translucent brown in color.

Measurements:

SL 4.3 mm, SW 4.3 mm. (empty shell; St. 8)
SL 4.4 mm, SW 4.2 mm. (empty shell; St. 8)
SL 4.5 mm, SW 4.8 mm. (living specimen; St. 9)

Previous distribution records (**Fig. 73**): Type locality: Kerguelen Island. Range: 49° 28′S, 70°30′E, Royal Sound, Kerguelen, 25 fathoms, 49°28′S, 70°13′E Royal Sound, Kerguelen, 28 fathoms and 48°55′S, 69°31′E, Howe's Foreland, Kerguelen, 95 fathoms (WATSON, 1886); Cap Adare, Ross Sea (SMITH, 1902); off Kerguelen, 70°09′E, 48°57′S, 88 m and off Bouvet Island, 54°29′S, 03°30′E, 439 m (MARTENS, 1904); South Georgia, 2675 m (STREBEL, 1908); Gauss Station, Davis Sea (THIELE, 1912); Hut Point, McMurdo Sound, 190–250 fathoms (SMITH, 1915); Commonwealth Bay, Georges V Coast (HEDLEY, 1916); South Shetland Islands, 63°17.20′S, 59°48.15′E, 200 m, Bouvet Island, 40–45 m, Ross Sea, 74° 46.45′S, 178°23.4′E, 351 m and King George Island, South Sheyland Islands, 367–383 m (POWELL, 1951); Kerguelen, 49°50′S, 69°33′E, 150 m (POWELL, 1957); off Mackenzie Sea, 1266 m, off Enderby Land, 300, 193 and 220 m (POWELL, 1958); Terre Adelie, 5–110 m (ARNAUD, 1972); West Arm, the vicinity of Mawson Base, 67°36′S, 62°53′E, 100 m (DELL, 1972a); Davis Sea (EGOROVA, 1982); off Elephant Island, 220–240 m (DELL, 1990); off South Sandwich Islands, 101–121 m (DELL, 1990); Weddell Sea, 548 m (DELL, 1990); Ross Sea, 201–891 m (DELL, 1990).

Remarks: The large specimen of this species has a thick yellowish brown periostracum, and deep brown-colored operculum. The examined specimens have an open umbilicus, and an operculum with a thin calcareous deposit on the outer surface. ARNAUD (1972)

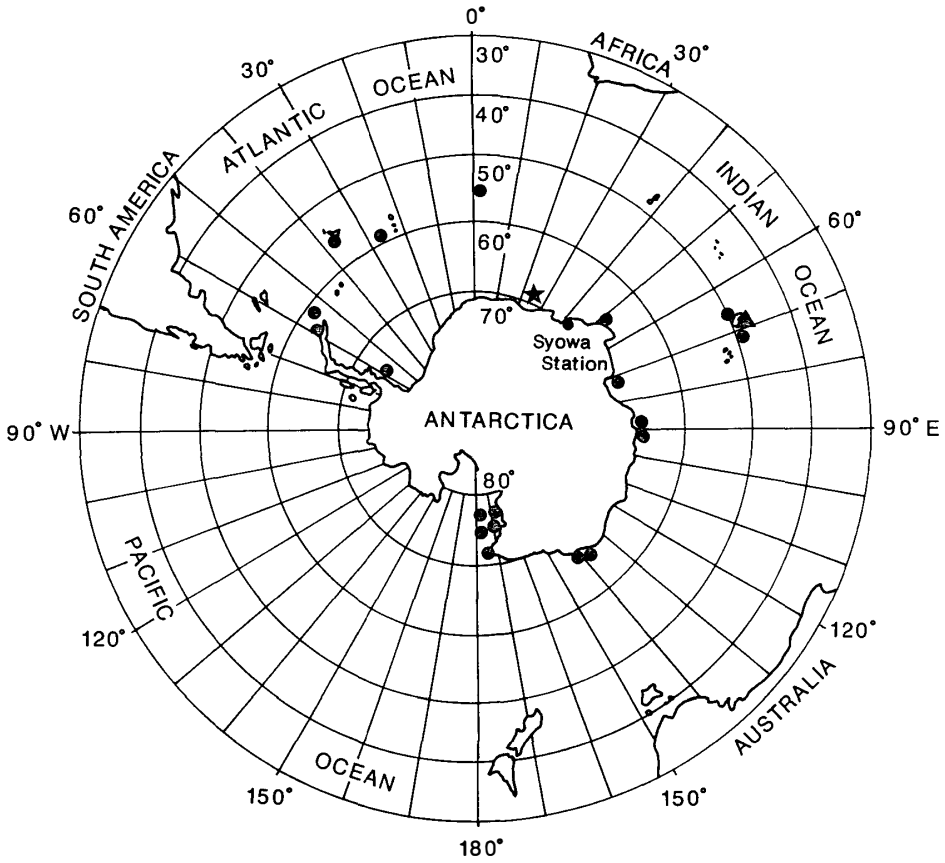


Fig. 73. Distribution of *Amauropsis* (*Kerguelenatica*) *grisea* (MARTENS) (Large dots: Previous distribution records; Star: Present study; Triangle: Type locality).

illustrated a small specimen of this species, and described that the coloration of small specimen is pale olive. The examined specimens are smaller than ARNAUD's specimen (11.3 mm in SL, 10.0 mm in SW).

The shell of small specimen of *Amauropsis* (*Kerguelenatica*) *grisea* is closely allied to *Prolacuna indecora* (THIELE, 1912), from Breid Bay to Terre Adelie. *P. indecora* (Figs. 78A, B) is distinguishable from this species by having a more elevated spire. The radulae of these two genera are quite different form each other. SMITH (1915) collected "*P. indecora*" from Ross Sea, and EALES (1923) described morphological details of the operculum, radula and jaw plate of SMITH's specimen, which has typical radular and operculum characters of *A.* (*K.*) *grisea*. The species identified to be "*P. indecora*" by them may be a small specimen of *A.* (*K.*) *grisea*.

This species is one of the commonest species among Antarctic and Subantarctic Naticidae, and has wide horizontal and vertical distribution ranges, such as Falkland Islands to the Antarctic continental shelf, at 5–2675 m in depth.

Genus *Falsilunatia* POWELL, 1951 (O.D.)
Type species: *Natica soluta* GOULD, 1848

***Falsilunatia falklandica* (PRESTON, 1913)**
(Figs. 74A, B)

Natica falklandica PRESTON, 1913, p. 218.
Falsilunatia falklandica: POWELL, 1960, p. 144 (name only); OKUTANI, 1986, p. 279, fig. 7 (distribution record).

Material examined: A single living specimen collected from Breid Bay by JARE-25.

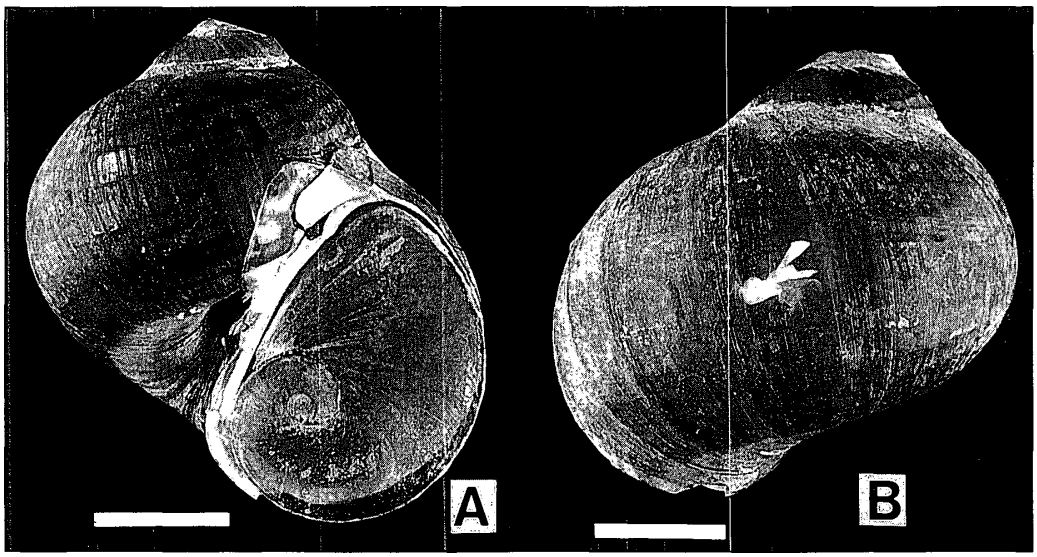
Description: The shell is large, thick, globose with moderate spires (Figs. 74A, B). The protoconch is eroded. The teleoconch is round and well inflated, and has numerous very fine growth line and rather wide, irregular and wavy spiral striae which vary considerably in strength. The surface of body whorl is covered by a thick, light greenish brown periostracum, on which axial stripes are present along growth lines. The suture is impressed. The area of just below the suture is slightly depressed. The body whorl is large, with breadth being 91% of shell length. The base is roundly inflated. The umbilicus is narrowly open, and half covered by the columellar lip which has a thin callus. The area around umbilicus is whiter than other areas, and has no glossy periostracum. The aperture is lunate with a thin and smooth outer lip. The inner lip is smooth and straight, and has a very thin callus. The basal lip is round and thicker than elsewhere. The inner wall is frosted white in color.

The operculum is slightly large to aperture size, thin, horny, translucently brown in color, paucispiral, with nucleus situated below (Fig. 74A).

The radula is not observed.

Measurements: SL 32.0 mm, SW 29.0 mm.

Previous distribution records (Fig. 75): Type locality: Port Stanley, Falkland Islands. Range: Breid Bay, 310 m (OKUTANI, 1986).



Figs. 74A, B. *Falsilunatia falklandica* (PRESTON). A, B. Shell. Scale=10 mm.

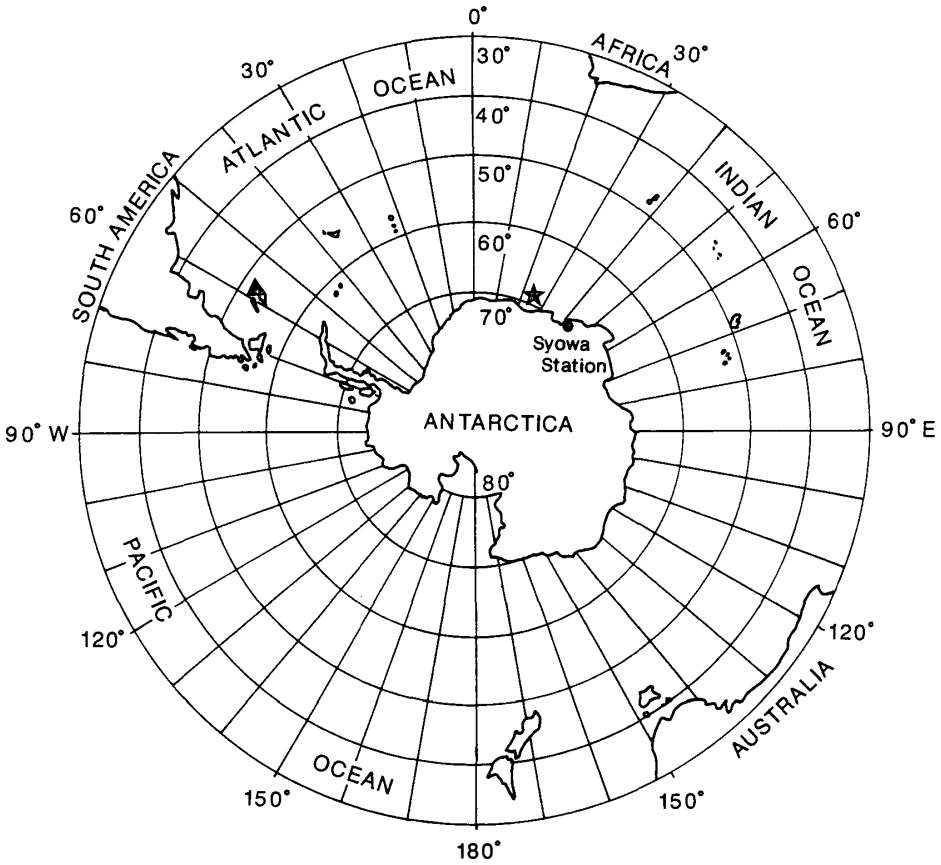


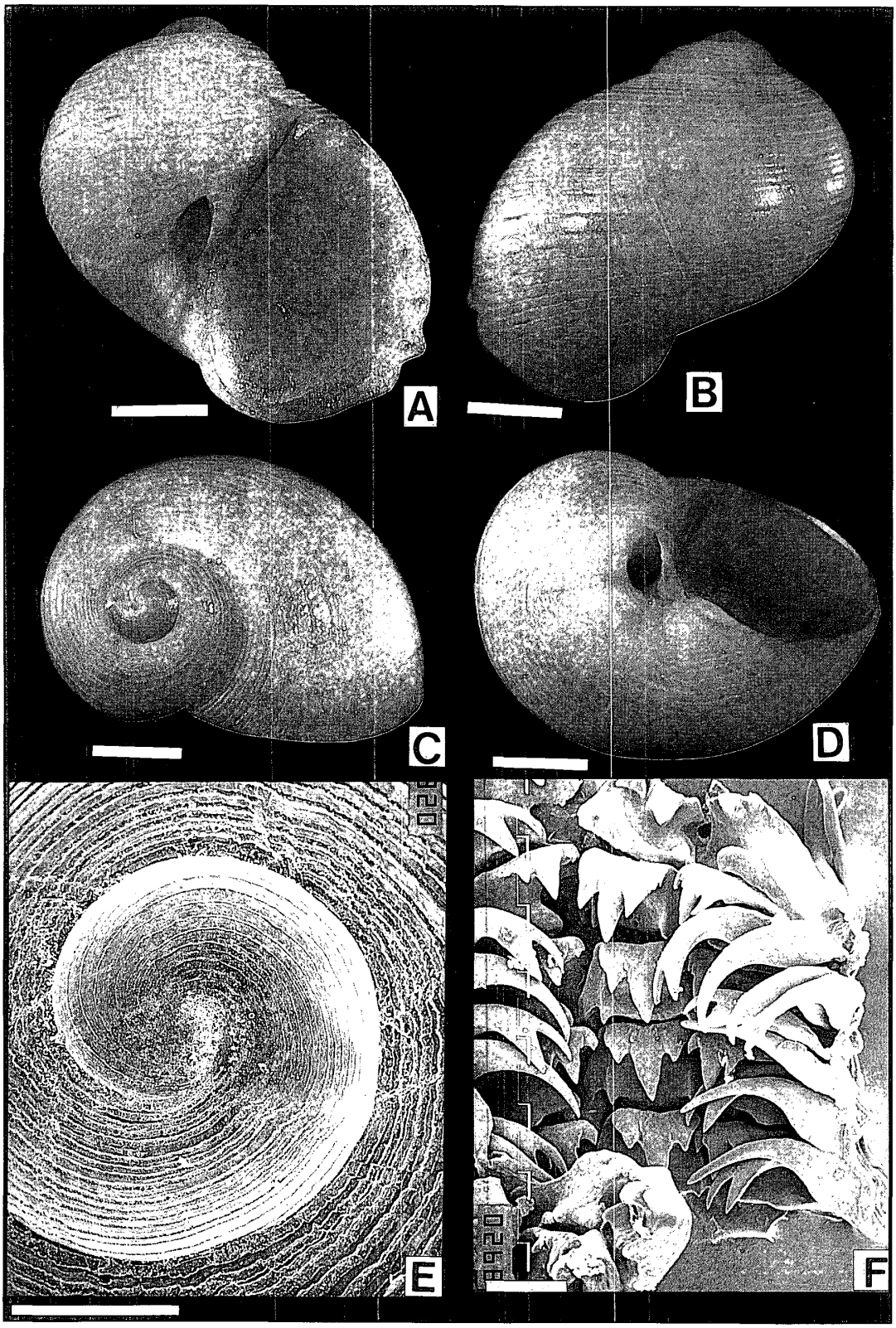
Fig. 75. Distribution of *Falsilunatia falklandica* (PRESTON) (Star: Present study; Triangle: Type locality).

Remarks: *Natica falklandica* was first described by PRESTON (1913) from the Falkland Islands. This species have been known from the type locality, and is collected from the Antarctic continental shelf for the first time.

Genus *Sinuber* POWELL, 1951 (O.D.)
Type species: *Natica sculpta* MARTENS, 1878

***Sinuber sculpta sculpta* (MARTENS, 1878)**
(Figs. 76A–F)

Natica sculpta MARTENS, 1878, p. 24; MARTENS and THIELE, 1903, p. 65, pl. 4, fig. 1.
Sinuber sculpta: POWELL, 1951, p. 120; POWELL, 1958, p. 190 (distribution record).
Sinuber sculpta sculpta: POWELL, 1960, p. 145 (name only).
Sinuber sculptum sculptum: DELL, 1990, p. 160, fig. 255.
Material examined: A single living specimen and 1 empty shell from St. 8.
Description: The shell is translucent white in color, globose, small, fragile, with a small and depressed spires (Figs. 76A, B). The protoconch is translucent pale yellow in color, about 1.4 in number of turns, 0.88 mm in diameter, and has 18 very fine spiral striae on the weakly glossy surface (Fig. 76E). The teleoconch is about 2 in number of turns, well



Figs. 76A-F. *Sinuber sculpta sculpta* (MARTENS).
A-D. Shell; E. Protoconch; F. Radula. Scale A-E = 1 mm; F = 10 μm.

roundly inflated, and has numerous microscopic growth lines and very fine spiral riblets. The surface is covered by the very thin, almost colorless periostracum, on which wide axial stripes are present along growth lines. The suture is impressed. The first teleoconch has 13 spiral riblets. In the body whorl, there are 21 irregularly spaced, very fine and wavy spiral riblets on sutural ramp, and more than 32 on the base. The interspaces between spiral riblets on the sutural ramp become gradually wider abapically, but, in the base they are narrowing towards the umbilicus. The body whorl is large, with breadth being 97–100% shell length. The base is roundly inflated. The umbilicus is 2/3 open and deep. The aperture is lunata, large, with a very thin and rather smooth outer lip. The inner lip is expanded outwardly, and has an angle against the outer lip. The basal lip is roundly curved, and the area near the columellar lip is slightly thickened, expanded and reflected outwardly. The columellar lip with very thin callus is slightly curved, expanded and reflected over the umbilicus. The inner wall has very finely granulated surface.

The operculum is equal to aperture in size, thin, horny, translucent, pale yellow in color, paucispiral, with nucleus situated below.

The radula is taenioglossate, 2 : 1 : 1 : 1 : 2, translucently pale brown in color, small and narrow (0.88 mm in length, 0.1 mm in width; 4.3 mm in SL) (Fig. 76F). The rhachidian tooth is trapezoid, and has bifurcate basal extremities. It has a large and strong central cusp and a rather bunt marginal cusp on each side. The middle area of base is

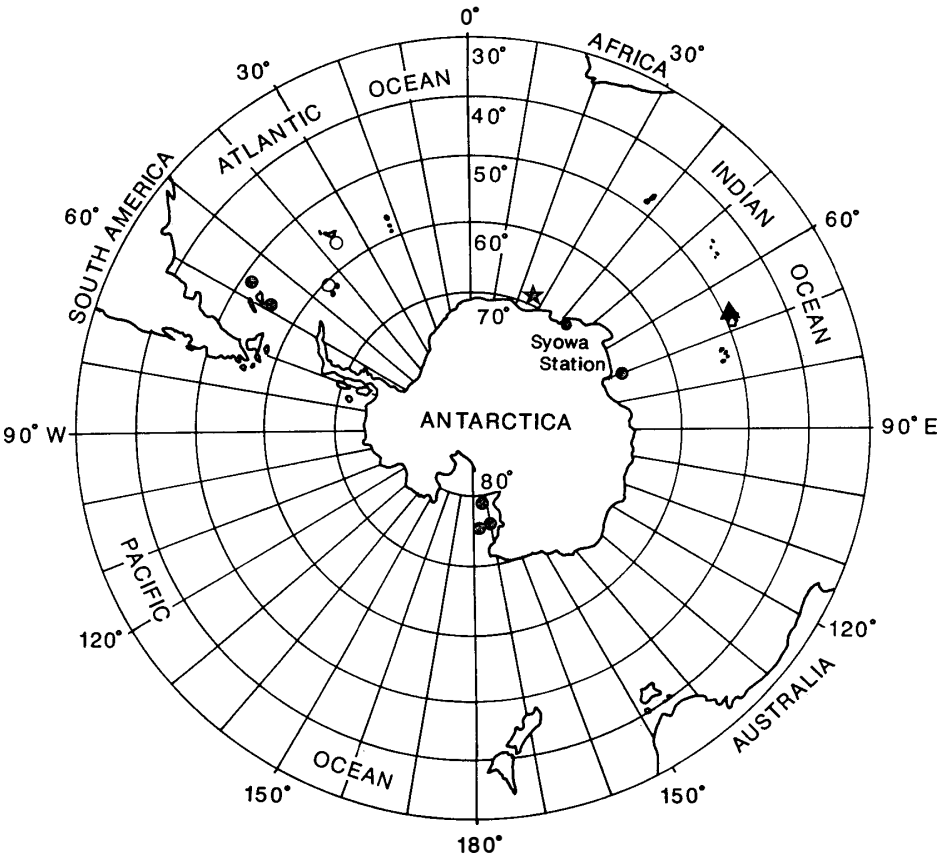


Fig. 77. Distribution of *Sinuber sculpta sculpta* (MARTENS) (Large dots: Previous distribution records; Star: Present study; Triangle: Type locality; Circle: Distribution of *Sinuber sculpta scotiana*).

slightly expanded posteriorly, and has triangular and sharply pointed small projection on both sides. The lateral tooth is almost rhomboid, and has a large and pyramidal central cusp and a small cusp on each side. The inner lateral side of lateral tooth is strongly incurved. The base is undulating. The inner marginal tooth is large, wide and stout, and has bifurcate tips which are the same in size and prominence. The outer marginal is simple sickle-shaped, the same in length with inner one, and has wide base. The jaw plate is oval in outline, 0.28 mm × 0.18 mm, translucent brown in color.

Measurements:

SL 4.3 mm, SW 4.3 mm (living specimen).

SL 3.4 mm, SW 3.3 mm (empty shell).

Previous distribution records (Fig. 77): Type locality: Kerguelen Island. Range: Ross Sea, 74°46.4′S, 178°23.4′E, 351 m (POWELL, 1951); North of Falkland Islands, 242–296 m (POWELL, 1951); off MacRobertson Land, 177 m (POWELL, 1958); Burdwood Bank, 567–578 m (DELL, 1990); east of Falkland Islands, 855–866 m (DELL, 1990); Ross Sea, 351–549 m (DELL, 1990).

Remarks: According to POWELL (1951), this species has two geographical forms, such as the Ross Sea form and the Falkland Islands form. The Ross Sea specimens have an open umbilicus, but the Falkland Islands specimens have an almost closed umbilicus (POWELL, 1951, 1958). Examined specimens belong to the Ross Sea form. MARTENS's (1878) original description lacks detail. The present specimens may also be identical with Martens's specimen, in respect to have an open umbilicus. Therefore, the Ross Sea form is ranged from Kerguelen to Ross Sea and Enderby Land, while the Falkland form is confined to the Falkland Islands and Amsterdam Island.

This genus includes two species and one subspecies, namely, *Sinuber sculpta sculpta, S. sculpta scotiana* POWELL, 1951, from South Orkney Islands and South Georgia Islands, and *S. perscalpta* (MARTENS, 1878) from Kerguelen. A comparison was made on *S. s. scotiana* with *S. s. sculpta*. The former subspecies is relatively wider with smaller aperture in relation to the height of the shell. The first teleoconch whorl of *S. s. scotiana* has more lirae (16 to 18) than *S. s. sculpta* (13). The only differences in the radula between *S. s. scotiana* and *S. s. sculpta* are that the former has less developed cusps on the lateral tooth and a simple sickle-shaped inner marginal tooth (POWELL, 1951). *S. perscalpta* also differs in having more roundish shell and a larger number of spiral lirae.

Genus *Prolacuna* THIELE, 1913 (O.D.)

(= *Sublacuna* THIELE, 1912 non PILSBRY, 1895 = *Frigidilacuna* TOMLIN, 1930)

Type species: *Sublacuna indecora* THIELE, 1912 (O.D.)

***Prolacuna indecora* (THIELE, 1912)**

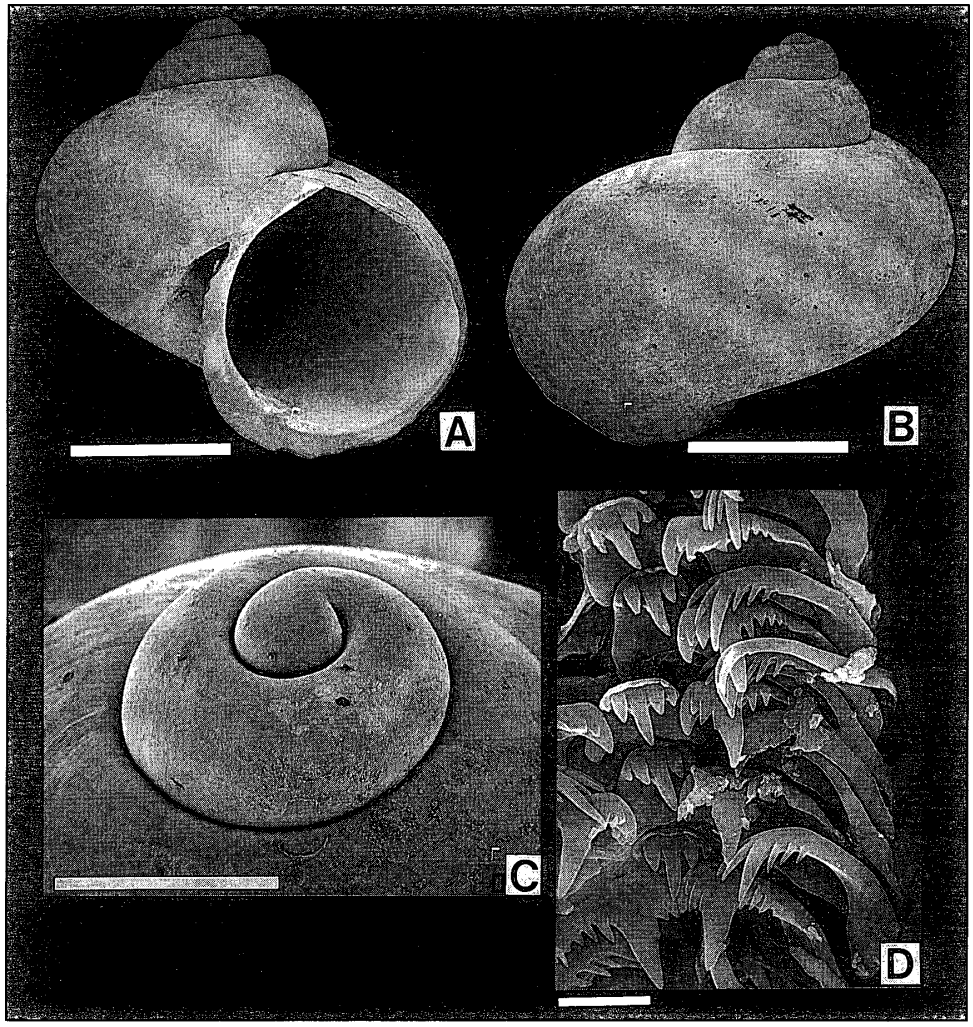
(Figs. 78A–D)

Sublacuna indecora THIELE, 1912, p. 195, pl. 12, fig. 4, pl. 15, fig. 19.

Frovina (*Prolacuna*) *indecora*: THIELE, 1929, p. 389, figs. 272, 273.

Prolacuna indecora: POWELL, 1958, p. 190. (distribution record); POWELL, 1960, p. 145. (name only); ARNAUD, 1972, p. 126. (distribution record); EGOROVA, 1982, p. 30, figs. 43 and 142; DELL, 1990, p. 162, fig. 239.

Material examined: A single living specimen and 5 empty shells from St. 8.



Figs. 78A-D. *Prolacuna indecora* (THIELE).
A, B. Shell; C. Protoconch; D. Radula. Scale A-C=1 mm; D=10 μm.

Description: The shell is translucently pale yellow in color, small, very thin, fragile, with rather high spires (Figs. 78A, B). The coloration of the shell tends to become paler towards the body whorl. The protoconch is about 1.5 in number of turns, 1.25 mm in diameter, inflated, and very finely granulated (Fig. 78C). The teleoconch is about 2.3 in number of turns, round and well inflated, and has numerous very fine growth lines and a very thin periostracum on the surface. The suture is strongly impressed and slightly channeled. The upper whorl is small and moderately elevated. The body whorl is large, with breadth being 97-107% shell length, and has very fine wavy spiral lirae on the surface. The base is roundly inflated. The umbilicus is narrowly open. The aperture is elliptical and large, with a very thin and smooth peristome. The outer lip is round and smooth. The inner lip is round and smooth, and slightly expanded outwardly. The basal lip is roundly curved, and the area near the columellar lip is expanded and reflected outwardly. The columellar lip is curved, expanded and reflected over the umbilicus, and has a frosty white thin callus. The inner wall is frosty white in color.

The operculum was lost.

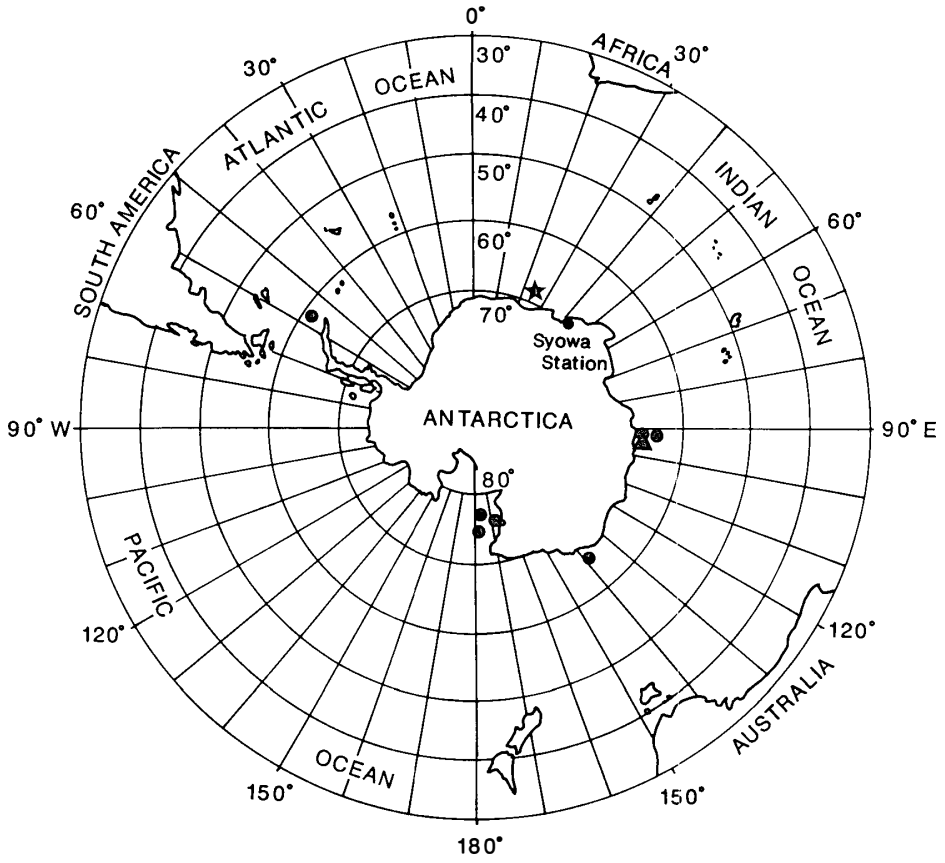


Fig. 79. Distribution of *Prolacuna indecora* (THIELE) (Large dots: Previous distribution records; Star: Present study; Triangle: Type locality).

The radula is taenioglossate, 2 : 1 : 1 : 1 : 2, transparent (Fig. 78D). The rhachidian tooth is trapezoid, and has a long and large central cusp, a triangular and short lateral cusp and a small marginal cusp on each side. The base is incurved, but the upper tip is slightly expanded anteriorly. The lateral tooth is depressed triangular, and has gently incurved base. It has a long, wide and strong central cusp, three cusps on lateral inside and three to four cusps on lateral outside. The inner most cusp is strongest and largest of all. Cusps of the outside become gradually weaker outwardly. The inner marginal is long and stout, and has a large and strong central cusp, two (sometimes three) cusps on lateral inside and three cusps on lateral outside. The inside cusps are equal in size, and the outside cusps become gradually weaker outwardly. The outer marginal is weaker than the inner one, and has a bifurcate top of the same size and prominence.

Measurements:

SL 4.5 mm, SW 4.6 mm (living specimen).
SL 4.5 mm, SW 4.0 mm (empty shell).
SL 4.5 mm, SW 4.1 mm (empty shell).

Previous distribution records (Fig. 79): Type locality: Gauss Station, Davis Sea (THIELE, 1912). Range: off Enderby Land, 300 m and 220 m (POWELL, 1958); Point Geologie, Terre Adelie, 40 m (ARNAUD, 1972); Davis Sea, 385 m (EGOROVA, 1982); off South Shetland Islands, 331–426 m (DELL, 1990); Ross Sea, 67–836 m (DELL, 1990).

Remarks: According to THIELE (1912), the genus *Prolacuna* includes the following three other species: *P. trilirata* (THIELE, 1912) from Gauss Station, Davis Sea; *P. notorcadensis* (MELVILL and STANDEN, 1907) from Scotia Bay, South Orkney Islands, 9–10 fathoms; *P. macmurdensis* (HEDLEY, 1911), from Cape Royds, 10–20 fathoms. These three species has heavily spiral keels. According to POWELL (1951), it is doubtful if these heavily spirally keeled species are really congeneric with the smooth *P. indecora*. *P. macmurdensis* and *P. notorcadensis* were transferred from the family Naticidae to Fossaridae, and *P. trilirata* is synonymized with the former species by the present study (see remarks of *Fossarus macmurdensis*). Thus, the genus *Prolacuna* now includes a sole species, *P. indecora*.

Family EULIMIDAE TROSCHEL, 1853
Genus *Melanella* BOWDICH, 1882
Type species: *Melanella dufresnei* BOWDICH, 1882 (monotypy)

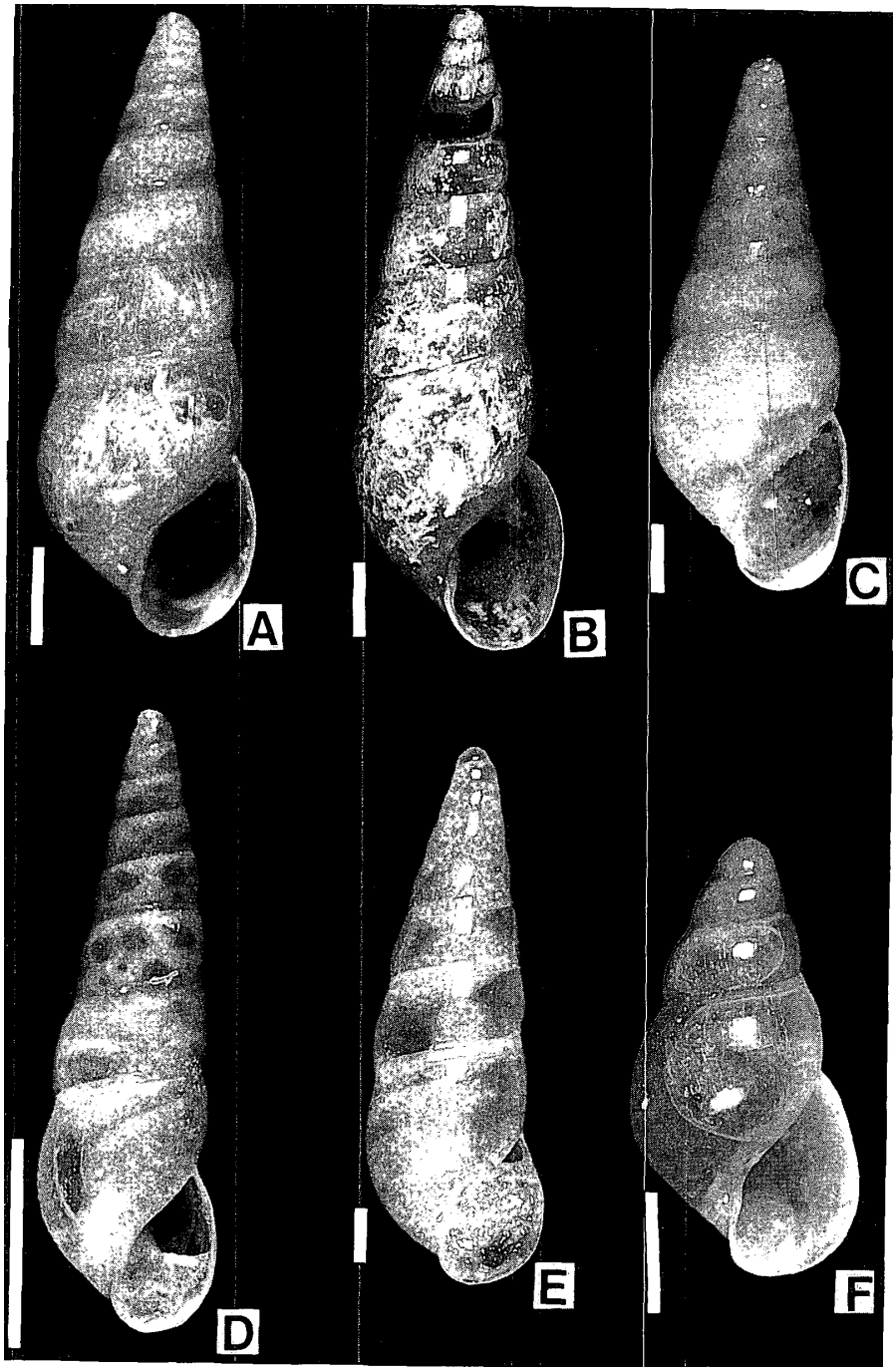
Melanella convexa (SMITH, 1907)
(Fig. 80A)

Eulima convexa SMITH, 1907, p. 1, figs. 9 and 9a; THIELE, 1912, p. 258 (name only); LAMY, 1915, p. 70.
Balcis convexa: POWELL, 1958, p. 187; POWELL, 1960, p. 142 (name only); DELL, 1992, p. 126, figs. 211 and 212.
Material examined: 24 living specimens and 10 empty shells from St. 5; 21 living specimens and 9 empty shells from St. 7.
Description: The shell is elongate conical, straight, slightly whitish translucent (Fig. 84A). The protoconch consists of about 3 whorls, 0.9 mm in length, of which the first one is strongly convex. The teleoconch is 5.5 in number of turns (6.2 mm in SL), slightly convex, and has incremental scars with regular interval of about one turn. The suture is weakly impressed. The aperture is short, small, rounded and broad. The outer lip is smooth, opisthocline and joining the suture in an obtuse angle. The most protruded part of the outer lip is situated at middle. The columellar lip is almost straight.

The operculum is corneous, translucently pale yellow in color, equal to the aperture in size, with paucispiral nuculeus below inside.
Measurements: See Table 17.
Previous distribution records (Fig. 81): Type locality: Discovery Winter Quarters, 22–92 m (SMITH, 1907). Range: Enderby Land, 220–300 m (POWELL, 1958); Ross Sea, 45–549 m (DELL, 1992).
Remarks: *Melanella convexa* is allied to *M. exulata*, (Fig. 80B), but, *M. exulata* differs from this species by the considerably larger size, a gently curved spire and a more elongate aperture. This species is similar to *Melanella* sp. 2, in having an elongate conical shell form (Fig. 80E). But, the shell of the latter species is curved with two whorls of protoconch.

Melanella exulata (SMITH, 1915)
(Fig. 80B)

Eulima exulata SMITH, 1915, p. 64, pl. 1, fig. 2.



Figs. 80A–F. Six Antarctic eulimid gastropods.
A. *Melanella convexa* (SMITH); B. *Melanella exulata* (SMITH); C. *Melanella solitaria* (SMITH); D. *Melanella* sp. 1; E. *Melanella* sp. 2; F. *Hemiaclis incolorata* (THIELE). Scale = 1 mm.

Table 17. Measurements and condition of *Melanella convexa* (SMITH).

No.	1	2	3	4	5	6	7	8	9	10
St.	5	5	5	5	5	5	5	5	5	5
SL (mm)	4.4	3.9	4.5	5.0	3.6	5.5	4.5	3.8	2.0	4.5
SW (mm)	1.4	1.1	1.1	1.7	1.3	2.0	1.5	1.4	0.8	1.5
SW/SL (%)	31.8	28.2	24.4	34.0	36.1	36.4	33.3	36.8	40.0	33.3
Condition	F	L	L	L	L	L	L	F	L	L

No.	11	12	13	14	15	16	17	18	19	20
St.	5	5	5	5	5	5	5	5	5	5
SL (mm)	5.1	4.8	5.5	5.3	4.4	3.5	2.5	4.6	4.6	2.8
SW (mm)	2.0	1.4	1.7	2.1	1.5	1.3	1.0	1.7	1.5	1.2
SW/SL (%)	39.2	29.2	30.9	39.6	34.1	37.1	40.0	37.0	32.6	42.9
Condition	L	F	L	F	F	L	L	L	L	F

No.	21	22	23	24	25	26	27	28	29	30
St.	5	5	5	5	5	5	5	5	5	5
SL (mm)	3.0	4.1	3.0	2.7	2.7	2.0	2.7	3.2	4.5	3.0
SW (mm)	1.1	1.5	1.2	1.0	1.1	0.7	1.1	1.1	1.4	1.1
SW/SL (%)	36.7	36.6	40.0	37.0	40.7	35.0	40.7	34.4	31.1	36.7
Condition	L	L	L	L	F	F	L	F	F	L

No.	31	32	33	34	35	36	37	38	39	40
St.	5	5	5	5	7	7	7	7	7	7
SL (mm)	3.0	3.3	2.2	3.4	5.0	4.7	2.6	5.0	2.7	5.3
SW (mm)	1.1	1.2	0.8	—	1.8	1.7	1.1	1.6	1.3	1.8
SW/SL (%)	36.7	36.4	36.4	—	36	36.2	42.3	32.0	48.1	34.0
Condition	L	L	L	L	L	L	F	L	L	L

No.	41	42	43	44	45	46	47	48	49	50
St.	7	7	7	7	7	7	7	7	7	7
SL (mm)	4.6	5.2	5.3	3.7	3.3	3.2	3.3	3.5	3.3	3.2
SW (mm)	1.6	1.8	1.8	1.6	1.2	1.2	1.2	1.4	1.3	1.3
SW/SL (%)	34.8	34.6	34.0	43.2	36.4	37.5	36.4	40.0	39.4	40.6
Condition	L	L	L	F	L	F	L	L	L	L

F: Freshly dead specimen: L: Specimen taken alive.

Table 17. (Continued)

No.	51	52	53	54	55	56	57	58	59	60
St.	7	7	7	7	7	7	7	7	7	7
SL (mm)	2.2	3.3	2.5	4.0	3.7	2.6	2.5	1.7	2.1	2.2
SW (mm)	1.1	1.3	1.0	1.5	1.4	1.0	0.8	0.7	0.7	0.8
SW/SL (%)	50.0	39.4	40.0	37.5	37.8	38.5	32.0	41.2	33.3	36.4
Condition	L	F	F	L	L	F	F	L	L	L

No.	61	62	63	64
St.	7	7	7	7
SL (mm)	1.7	2.2	2.3	2.0
SW (mm)	0.7	0.7	0.7	1.0
SW/SL (%)	41.2	31.8	30.4	50.0
Condition	L	L	F	F

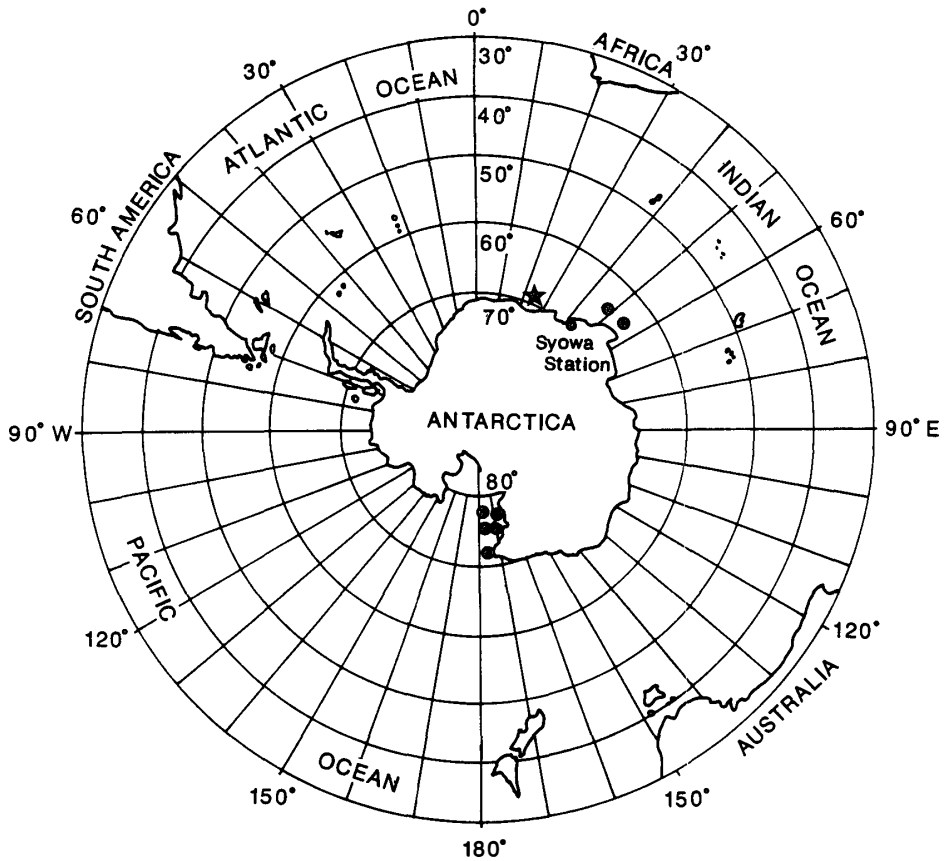


Fig. 81. Distribution of *Melanella convexa* (SMITH) (Large dots: Previous distribution records; Star: Present study; Triangle: Type locality).

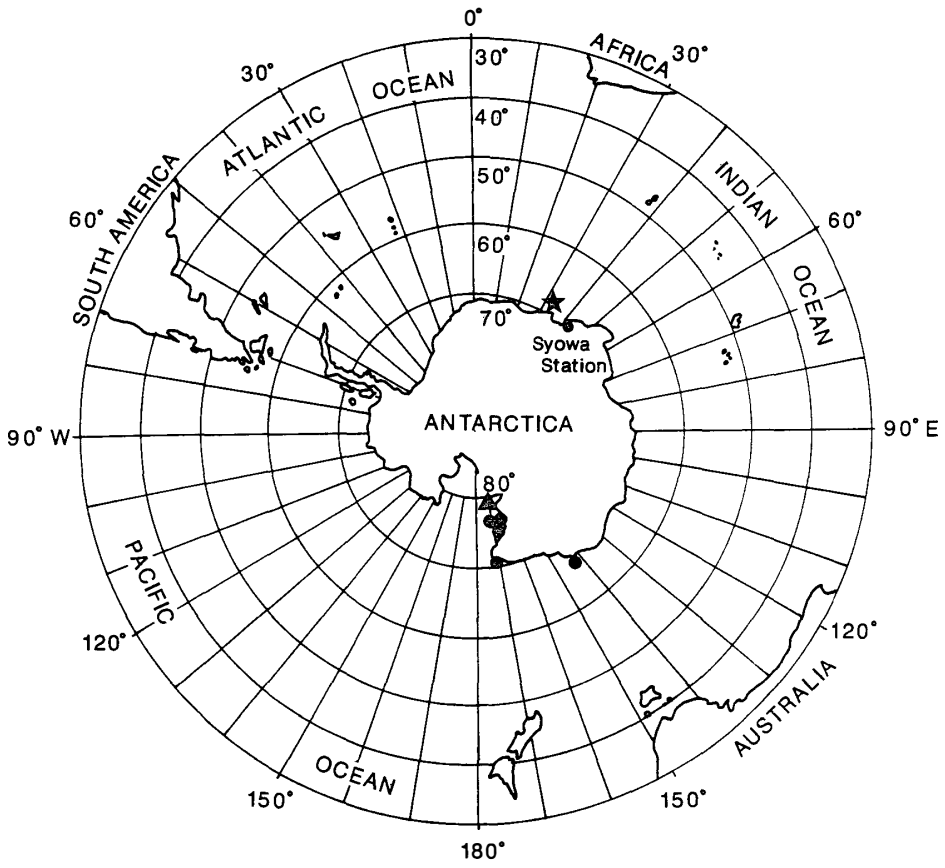


Fig. 82. Distribution of *Melanella exulata* (SMITH) (Large dots: Previous distribution records; Star: Present study; Triangle: Type locality).

Melanella exulata: HEDLEY, 1916, p. 49; POWELL, 1960, p. 142 (name only); DELL, 1992, p. 128, fig. 210.

Material examined: A single living specimen from Günnerus Bank.

Description: The shell is large for the genus, conical and slightly curved (Fig. 80B). It is whitish translucent, but the upper 1/3 of whorl is whiter. The protoconch consists of about 2 whorls, 0.75 mm in length, of which the first one is convex. The teleoconch is about 6 in number of turns, slightly convex, and has numerous, crowded microscopic growth lines on the surface. It has weak incremental scars with regular interval of one turn. The suture is weakly impressed, and the subsutural zone is very narrow but distinct, about 1/20 of the height of the whorl. The aperture is rather rhombic, high but narrow. The outer lip is concave at the suture, evenly arched with the most protruding part situated just below the middle. The basal lip is projected. The columellar lip is almost straight. The inner and columellar lips has very thin whitish callus on the surface.

The operculum is corneous, translucently yellow in color, slightly small to the aperture in size, with paucispiral nucleus below inside.

Measurements:

SL 8.9 mm, SW 2.8 mm, AL 2.7 mm, AW 1.5 mm.

Previous distribution records (Fig. 82): Type locality: McMurdo Sound, Ross Sea, 342-450 m (SMITH, 1915). Range: Adélie Coast, 82-731 m (HEDLEY, 1916); Ross Sea, 57-457

m (DELL, 1992).

Remarks: See remarks of *Melanella convexa*.

Melanella solitaria (SMITH, 1915)

(Fig. 80C)

Eulima solitaria SMITH, 1915, p. 64, pl. 1, fig. 3.

Balcis solitaria: POWELL, 1960, p. 142 (name only); HAIN, 1990, p. 45, pl. 2, figs. 10a, b.

Melanella laseroni HEDLEY, 1916, p. 49, pl. 7, fig. 19; POWELL, 1960, p. 142 (name only);

Table 18. Measurements and condition of *Melanella solitaria* (SMITH).

No.	1	2	3	4	5	6	7	8	9	10
St.	5	5	5	5	5	7	7	7	7	7
SL (mm)	4.6	4.6	3.5	3.6	3.3	5.0	4.6	4.6	4.6	4.5
SW (mm)	1.7	1.7	1.4	1.5	1.5	2.0	1.7	1.7	1.7	1.5
SW/SL (%)	37.0	37.0	40.0	41.7	45.5	40.0	37.0	37.0	37.0	33.3
Condition	L	F	F	L	F	L	F	F	F	L

F: Freshly dead specimen; L: Specimen taken alive.

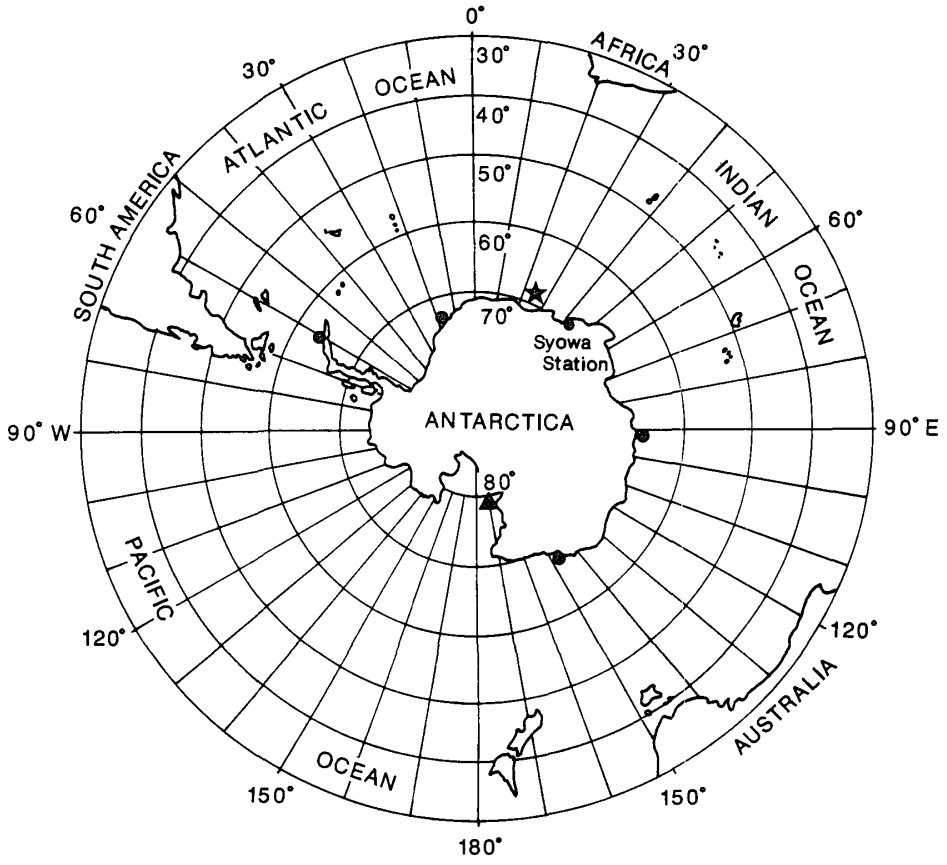


Fig. 83. Distribution of *Melanella solitaria* (SMITH) (Large dots: Previous distribution records; Star: Present study; Triangle: Type locality).

ARNAUD, 1972, p. 123; EGOROVA, 1982, p. 53, fig. 220.

Material examined: 2 living specimens and 3 empty shells from St. 5; 2 living specimens and 3 empty shells from St. 7.

Description: The shell is moderate, straight, broad, conically ovate, with a rather blunt apex (Fig. 80C). The protoconch is about 3 in number of turns, translucent, large and high, 0.88 mm in length, and the upper whorl is roundly well inflated, but other whorls are perfectly flat. The teleoconch is 4.8 in number of turns, translucently white, inflated, and its surface is almost smooth except numerous dense microscopic growth lines. The incremental scars are indistinct irregularly dispersed, at the interval of 0.75–1.25 turns. The suture is impressed, and the subsutural zone is very narrow and indistinct, about 1/15 of the height of the whorls. The aperture is large and pear-shaped. The outer lip is smooth, prosocline, thin, and the middle area is almost straight. The upper part of the outer lip has a blunt angle. The basal lip is round and extended abapically. The columellar lip has a very thin whitish callus on the surface.

No operculum is present.

Measurements: See Table 18.

Previous distribution records (Fig. 83): Type locality: McMurdo Sound, 450 m. Range: Commonwealth Bay, Adélie Land, 45 m (*laseroni*; HEDLEY, 1916); Palmer Archipelago, 93–130 m (POWELL, 1960); Davis Sea (EGOROVA, 1982); eastern Weddell Sea, 93–535 m (HAIN, 1990).

Remarks: DELL (1992) stated that *Melanella laseroni* is synonymous with *M. solitaria*. This species is similar to *Melanella* sp. 2 of the present study in having a broad conical shell form (Fig. 80E). However, the latter species is remarkably larger than this species, with about two-whorled protoconch. This species compared with *M. convexa* and *M. exulata* which have the same type of protoconch (Figs. 80A, B). The shell of latter two species are slenderer than this species.

Melanella sp. 1

(Fig. 80D)

Material examined: A single living specimen and 1 empty shell from St. 7.

Description: The shell is rather large, slender, elongate conical, almost straight, slightly whitish translucent (Fig. 80D). The protoconch consists of about 3 whorls about 0.75 mm in length, of which the first one is strongly convex. The teleoconch is about 6 in number of turns (6.7 mm in shell length), very slightly convex, and has a smooth surface. The incremental scars are weak, rather irregularly disposed with an interval of 1–1.2 whorls along the all spires. The suture is shallow, and the subsutural zone is narrow but distinct, about 1/10 of the height of whorls. The columella is slightly curved. The aperture is short, small, lanceolate-oblong, round and narrow. The outer lip is round and smooth, with the most projecting part situated at the middle. The inner and columellar lips has very thin, translucent callus on the surface.

The operculum is unknown.

Measurements: SL 5.0 mm, SW 2.0 mm, AL 1.85 mm, AW 0.95 mm.

Remarks: This species is similar to *Melanella convexa* by having a conical shell form and a round and smooth outer lip (Fig. 80A). However, the latter species has a slightly curved

large shell and narrow subsutural zone.

Melanella sp. 2

(Fig. 80E)

Material examined: A single living specimen from St. 9.

Description: The shell is small, pointed, elongate conical, curved, whitish translucent, with a narrow aperture (Fig. 80E). The protoconch consists of about 2 whorls with 0.6 mm in length. The teleoconch is about 5.3 in number of turns (4.0 mm in SL.), very slightly convex and perfectly smooth, and has incremental scars with almost regular interval of one whorl. The suture is distinct but shallow, with a subsutural zone occupying about 1/12 of the height of the whorls. The aperture is low, slender, narrow lanceolate-oblong. The outer lip is slightly sinuated at the suture, prosocline, projecting. Its most projecting part is situated at the lower about 1/3 of the height. The columella is slightly curved.

The operculum is very thin, corneous, translucently pale yellow in color, equal to the aperture in size, with paucispiral nuculeus below inside.

Measurements: SL 4.0 mm, SW 1.5 mm, AL 1.3 mm, AW 0.7 mm.

Remarks: This species is closely similar to *Melanella* sp. 1, because of having slender elongate conical shell form (Fig. 80D). This species can be distinguished from the latter by having slenderer shell, shallow suture and two whorls protoconch.

Genus *Hemiaclis* SARS, 1878

Type species: *Hemiaclis ventrosa* SARS, 1878

Hemiaclis incolorata (THIELE, 1912)

(Fig. 80F)

Alaba incolorata THIELE, 1912, p. 201, pl. 12, fis. 19; POWELL, 1960, p. 139 (name only); EGOROVA, 1982, p. 31, fig. 145.

Hemiaclis incolorata: DELL, 1992, p. 128, figs. 213-216.

Material examined: A single living shell from St. 5.

Description: The shell is small, short, broadly conical (Fig. 80F). The protoconch is about 3 in number of turns, translucently white, large for the genus, 0.9 mm in length, blunt, wide conical, with a smooth surface. The first turn is well convex. The teleoconch is 2.7 in number of turns, inflated, and has numerous very fine growth lines on the surface. The shell has a single weak incremental scar, and 0.75 turn of the first teleoconch. The suture is constricted, and the subsutural zone is very narrow. The columellar is almost straight. The aperture is very large, wide, pear-shaped, round and smooth. The outer lip is thin, round and smooth, with a sharp angle on the upper area. The columellar lip is long and reflected adaxially. The basal lip is slightly reflected. A thin whitish callus is deposited on the columellar lip.

No operculum exists.

Measurements: SL 3.6 mm, SW 2.0 mm, AL 1.8 mm, AW 1.0 mm.

Previous distribution records (Fig. 84): Type locality: Gauss Station, Davis Sea (THIELE, 1912). Range: Ross Sea, 342-549 m (DELL, 1992); off South Shetland Islands, 300-1437 m (DELL, 1992).

Remarks: DELL (1992) reported two types of *Hemiaclis incolorata*, such as "dark form"

and "pale form". The dark form specimen has a glassy, highly polished and transparent external shell surface and a dark brown coated inner surface, as was the type specimen of *incolorata*. The pale form specimen is variable in outline, but has wider shell with more convex whorls and hence a rather deeper suture. Living or freshly dead shells are completely transparent. The shell of the examined specimen is translucent white, and has no dark coating, but the outline of shell is closely similar to the THIELE's (1912) figure. This species can be distinguished from the other species of the genus by large size with well inflated whorls. The examined specimen is intermediate type between "dark form" and "pale form".

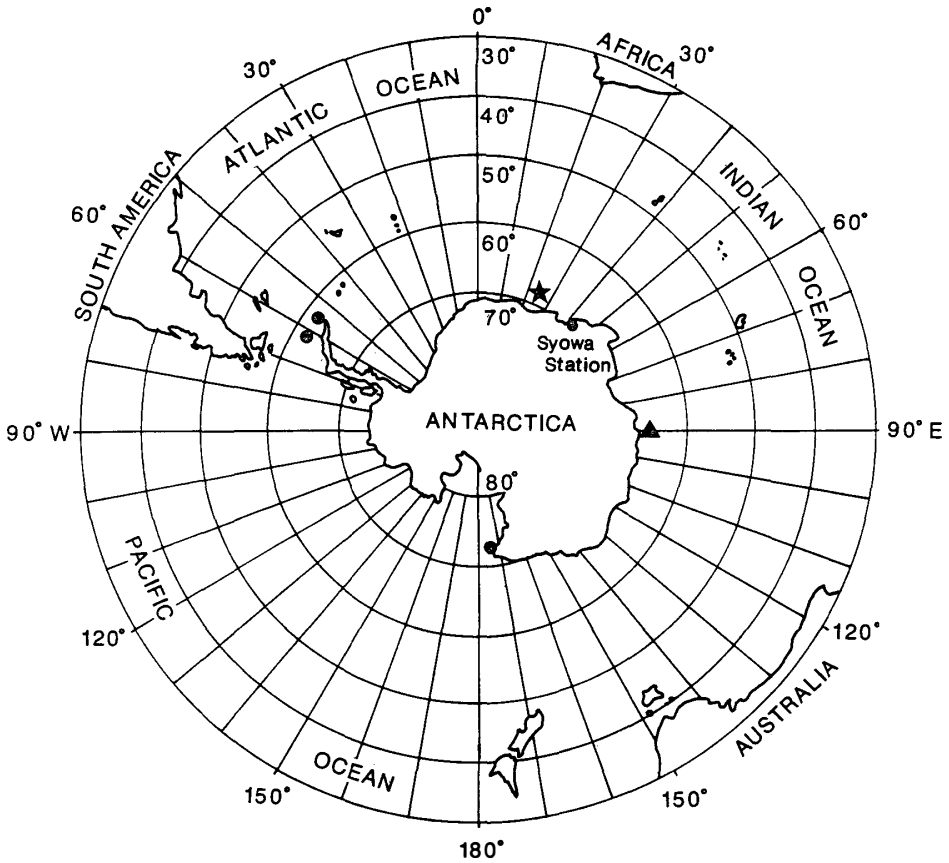


Fig. 84. Distribution of *Hemiaclis incolorata* (THIELE) (Large dots: Previous distribution records; Star: Present study; Triangle: Type locality).

Order Neogastropoda
Family MURICIDAE da COSTA, 1776
Subfamily Trophoninae MARWICK, 1924
Genus *Trophon* MONTFORT, 1810
Type species: *Murex magellanicus* GMELIN, 1792 (O.D.)
(= *Buccinum geversianus* PALLAS, 1769)

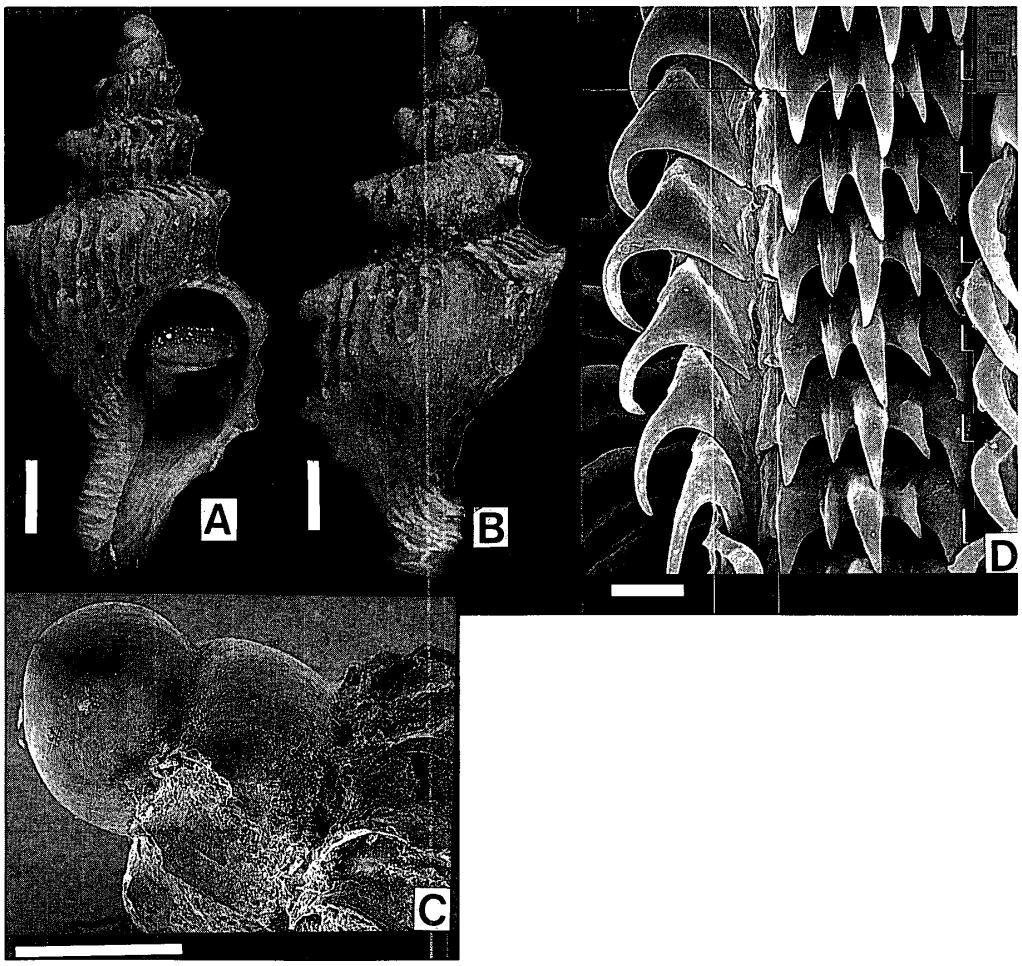
Trophon drygalskii THIELE, 1912

(Figs. 85A-D)

Trophon drygalskii THIELE, 1912, p. 213, pl. 13, fig. 25; SMITH, 1915, p. 73; POWELL, 1958, p. 197 (distribution record); POWELL, 1960, p. 154 (name only); EGOROVA, 1982, p. 38, fig. 165; HAIN, 1990, p. 62, pl. 6, fig. 8, pl. 15, fig. 1; DELL, 1990, p. 203, figs. 354 and 355.

Material examined: 5 empty shells from St. 5; 1 empty shell from St. 7; 2 living specimens and 4 empty shells from St. 8; 4 living specimens and 4 empty shells from St. 9.

Description: The shell is obese fusiform, small, thin, white in color, with a high spire (Figs.



Figs. 85A-D. *Trophon drygalskii* THIELE. A, B. Shell; C. Protoconch; D. Radula. Scale A, B=1 mm; C=500 μm; D=10 μm.

Table 19. Measurements and condition of *Trophon drygalskii* THIELE.

No.	1	2	3	4	5	6	7	8	9	10
St.	5	5	5	5	5	7	8	8	8	8
SL (mm)	4.2	8.0	8.0	9.3	—	8.0	5.7	6.2	6.6	7.5
SW (mm)	2.1	3.8	—	4.3	—	3.5	2.9	3.0	3.4	3.7
SW/SL (%)	50.0	47.5	—	46.2	—	43.8	50.9	48.4	51.5	49.3
Condition	F	F	F	F	E	F	F	L	E	L

No.	11	12	13	14	15	16	17	18	19	20
St.	8	8	9	9	9	9	9	9	9	9
SL (mm)	8.5	—	4.0	5.0	5.6	5.9	6.0	6.0	7.3	8.1
SW (mm)	3.9	—	2.3	2.5	2.9	2.8	3.0	3.3	3.5	3.8
SW/SL (%)	45.9	—	57.5	50.0	51.8	47.5	50.0	55.0	47.9	46.9
Condition	F	E	L	F	F	L	F	E	E	L

E: Empty and water-worn specimen; F: Freshly dead specimen;
L: Specimen taken alive.

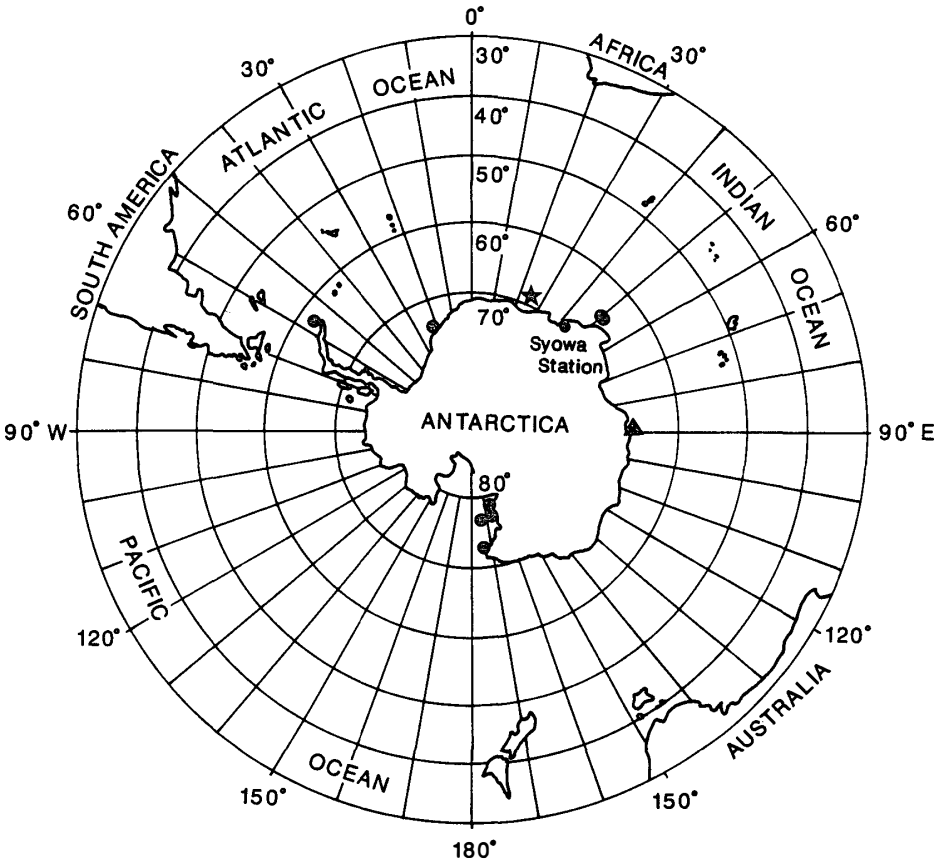


Fig. 86. Distribution of *Trophon drygalskii* THIELE (Large dots: Previous distribution records; Star: Present study; Triangle: Type locality).

85A, B). The protoconch is high, rounded, smooth, rather large, about 2 in number of turns, 0.75 mm in diameter and 0.83 mm in height (7.5 mm in SL), and has frosted white surface with the terminal varix which is slightly raised (Fig. 85C). The teleoconch is round, slightly inflated, about 3.5 in number of turns, and has crowded, very thin and narrow axial lamellae. The suture is constricted. The upper whorl is slightly inflated and highly elevated. The body whorl is roundly inflated, large and high, with height being about 48% of shell length and breadth being about 49% of shell length. The first teleoconch has 13 lamellae, the penultimate whorl has 24, and the body whorl 27. The varices are raised at the shoulder angle and upper basal periphery. The lateral wall of the body whorl is almost straight. The base is constricted. The aperture is ovately squarish, large, with length being 1/2 of shell length. The outer lip is very thin, round and smooth. The inner lip is round and smooth. The columellar lip is smooth and twisted. The anterior siphonal canal is moderate, hemitubular and recurved dorsally. The inner wall is smooth and white in color.

The operculum is small to the aperture in size, translucent pale yellow in color, horny, very thin and ovate, and the nuculeus is located low inside.

The radula is rachiglossate, 1 : 1 : 1 with 69 transverse rows, translucent, long but very narrow (0.75 mm in length and 0.05 mm in width; 7.5 mm in SL) (Fig. 85D). The rhachidian tooth is large, wide and stout, and has five sharply pointed cusps. The central cusp is tallest of all, and outermost cusps are large, stout and the intermediate ones are a little smaller than the former. The base of rhachidian is wide and high, and its upper tip is strongly incurved. The lateral teeth with curved cusp are strong and claw-like in shape. The base of lateral is wide, attaining about 2/3 of width of the rhachidian base.

Measurements: See Table 19.

Previous distribution records (Fig. 86): Type locality: Gauss Station, Davis Sea. Range: off Glacier Tongue, McMurdo Sound, 342–450 m, Ross Sea, and 76°56′S, 164°12′E, Ross Sea, 288 m (SMITH, 1915); off Enderby Land, 190–300 m (POWELL, 1958); eastern Weddell Sea, 193–588 m (HAIN, 1990); off South Shetland Islands, 311–426 m (DELL, 1990); Bransfield Strait, Antarctic Peninsula, 210–220 m (DELL, 1990); Ross Sea, 267–392 m (DELL, 1990).

Remarks: DELL (1990) published photographs of the shell and the protoconch of *Trophon drygalskii*. The anterior siphonal canal of DELL's specimen (7.0 mm in SL, 3.5 mm in SW) is shorter than examined specimens of the same size. The SW/SL of the present specimens under 7.0 mm in SL are over 50%, but that of the specimens over 7.0 mm are under 50% (Table 19). The anterior siphonal canal of large specimens is longer than that of small specimens. The shell over 7.0 mm in SL of this species is illustrated by THIELE (1912), EGOROVA (1982) and HAIN (1990) have a long anterior siphonal canal. But small specimens are similar to DELL's specimen in respect to a short anterior siphonal canal. THIELE's type specimen is 7 mm in SL. According to DELL (1990), the numbers of axial lamella of specimens over 7 mm in SL are 26–29 (mean 27) on the penultimate whorl and 28–34 (mean 30) on the body whorl. The numbers of lamella on present specimens over 7 mm in SL are 10–14 (mean 13) on the first whorl, 21–24 (mean 22) on the penultimate whorl and 23–28 (mean 25) on the body whorl, respectively.

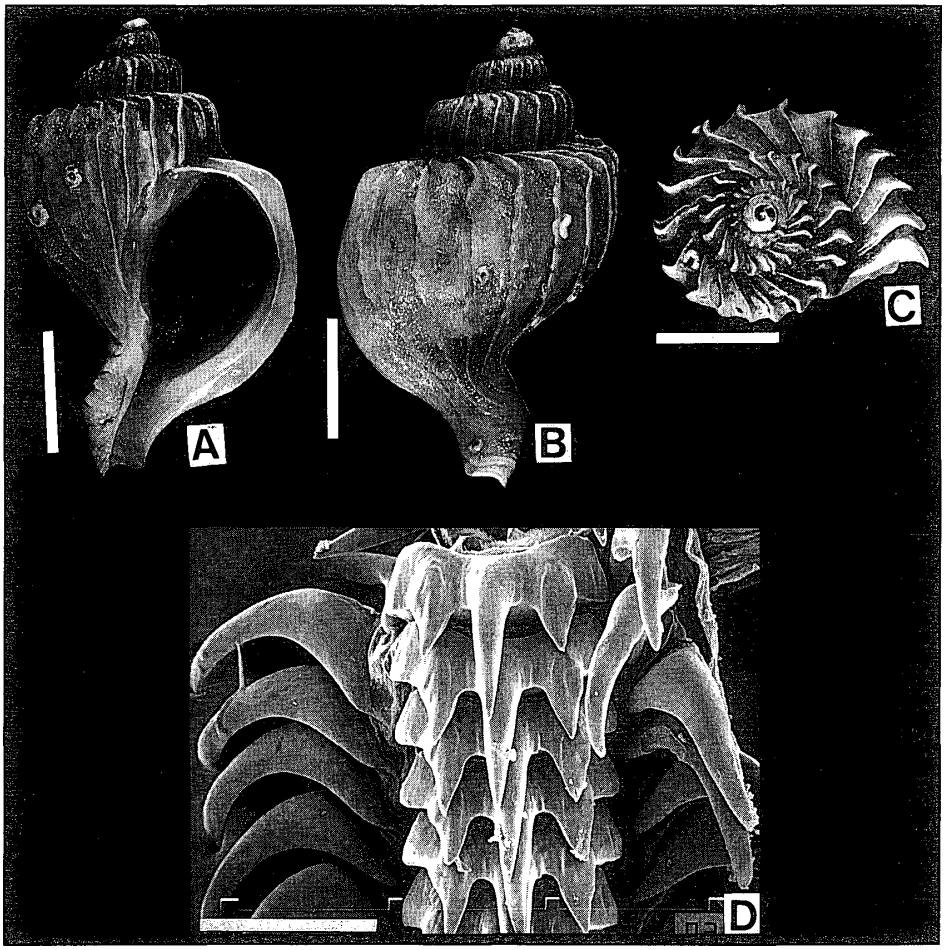
Trophon longstaffi SMITH, 1907
(Figs. 87A-D)

Trophon longstaffi SMITH, 1907, p. 3, pl. 1, figs. 4-4b; EALES, 1923, p. 31, figs. 31, 32; POWELL, 1960, p. 154 (name only); ARNAUD, 1972b, p. 131; CERNOHORSKY, 1977, p. 116, fig. 16; TUCKER and BURTON, 1987, p. 10 (distribution record); DELL, 1990, p. 205, figs. 351 and 352.

Trophon (*Enixotrophon*) *longstaffi*: HORIKOSHI *et al.*, 1979, p. 21, fig. 5.

Material examined: A single living shell collected by JARE-29 from nearshore of Langhovde.

Description: The shell is ovately fusiform, very large, rather thick, frosted dirty white in color, with a low spire (Figs. 87A, B). The protoconch is eroded. The teleoconch is well roundly inflated, about 3.3 in number of turns, and has spaced, thin, narrow axial lamellae and very fine growth lines between them but no spiral sculpture. The suture is deeply constricted. The upper whorl is roundly inflated, small and low. The body whorl is well roundly inflated, large, broad, with height being 85% of shell length and breadth being 63% of shell length. The penultimate whorl has 18 lamellae, and the body whorl has 19. The



Figs. 87A-D. *Trophon longstaffi* SMITH.
A-C. Shell; D. Radula. Scale A-C=10 mm; D=100 μm.

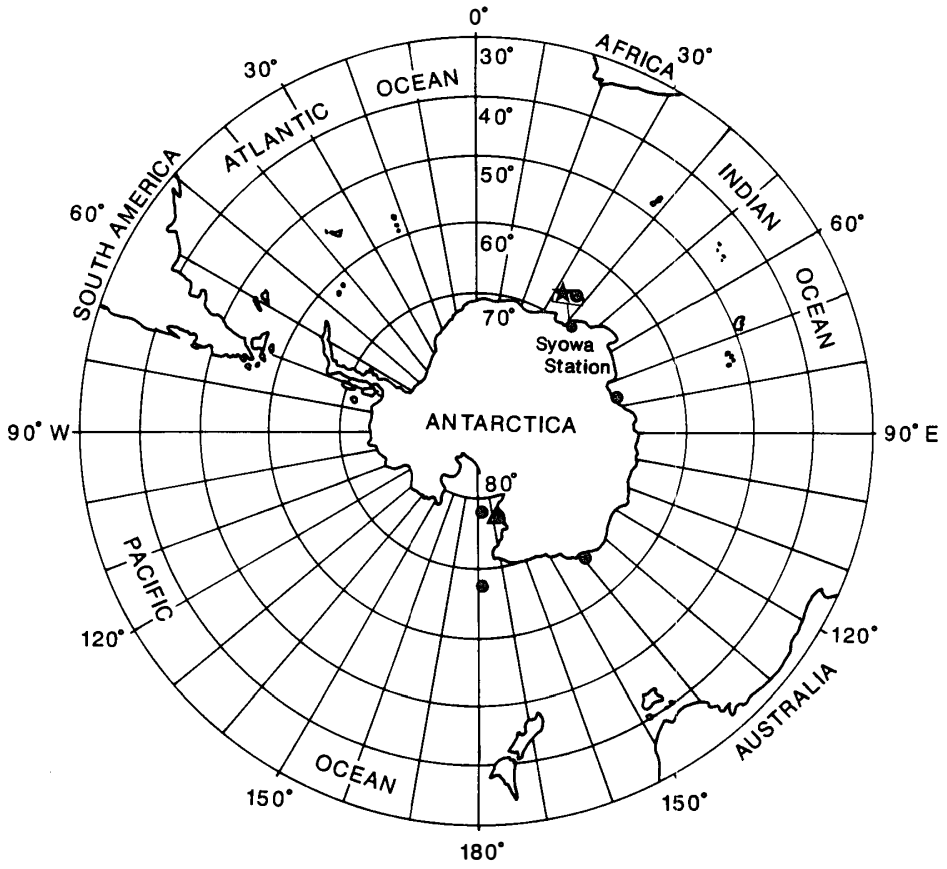


Fig. 88. Distribution of *Trophon longstaffi* SMITH (Large dots: Previous distribution records; Star: Present study; Triangle: Type locality).

upper part of lamellae is slightly expanded at the shoulder angle (Figs. 87A, B). The base is constricted. The aperture is pear-shaped, large and wide, and aperture length occupies 74% of shell length, while aperture width occupies 46% of shell width. The outer lip is very thin, fragile, round and smooth. The inner lip is smooth, round and slightly expanded outwardly. The columellar lip is smooth, and strongly twisted. The inner and columellar lips have a glossy white callus. The anterior siphonal canal is long, hemitubular, oblique and recurved dorsally. The inner wall is smooth and white in color.

The operculum is small to the aperture in size, translucent yellow in color, horny, ovate with low situated nuculeus.

The radula is rachiglossate, 1 : 1 : 1 with 110 transverse rows of teeth, translucent pale brown in color, very long but very narrow (6.0 mm in length and 0.5 mm in width: 38.9 mm in SL) (Fig. 87D). The rhachidian tooth is large and stout, and has only three major cusps. The central cusp is larger, twice longer and stronger than lateral. The base of rhachidian is strong, with slightly incurved upper tip. The lateral teeth are strong, unicuspid and L-shaped. The base of the lateral tooth is about 1/2 of width of the rhachidian base.

Measurements: SL 38.9 mm, SW 24.4 mm, AL 28.9 mm, AW 13.4 mm.

Previous distribution records (Fig. 88): Type locality: Flagon Point, 36 m, Ross Sea. Range: McMurdo Sound, Ross Sea, 450 m (EALES, 1923); Adelie Land, 5-140 m (ARNAUD,

1972b); Kita-no-seto Straight, Ongul Islands, 9 m (HORIKOSHI *et al*., 1979); nearshore of Vestfold Hills, Prydz Bay, Davis Sea, 9 m (TUCKER and BURTON, 1987); Ross Sea, 5–1080 m (DELL, 1990).

Remarks: According to SMITH's (1907) original description, the protoconch of this species is two in number of turns, globose, smooth and glossy. The lamellae, especially those upon the body whorl, are often more pronounced at the upper part than the specimens under examination.

The radula of this species was first described by EALES (1923), who reported that rhachidian tooth is tricuspid with a small denticle between each central and lateral cusps. These denticles of the examined specimen is weaker than the EALES's illustration.

T. longstaffi has a wide bathymetrical range, 5–1080 m in depth, while the geographical distribution range is rather restricted, only from Enderby Land to Ross Sea.

Trophon shackletoni shackletoni HEDLEY, 1911

(Figs. 89A–E)

Trophon shackletoni HEDLEY, 1911, p. 7, pl. 1, fig. 13; SMITH, 1915, p. 73, pl. 1, fig. 15; HEDLEY, 1916a, p. 61; EALES, 1923, p. 30, fig. 30; POWELL, 1958, p. 198.

Trophon shackletoni shackletoni: POWELL, 1960, p. 154 (name only); EGOROVA, 1982, p. 38, figs. 49 and 167; OLIVER and PICKEN, 1984, p. 110, figs. 29, 32a, b; DELL, 1990, p. 206, fig. 349.

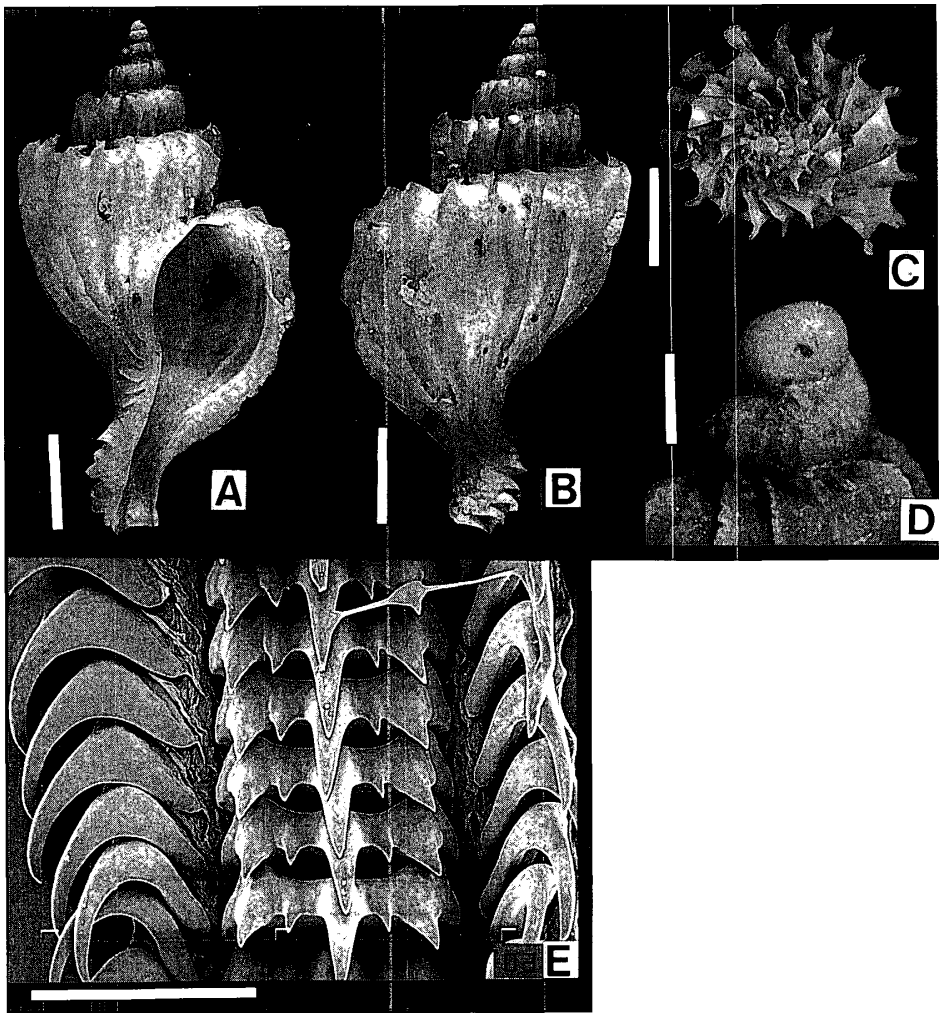
Trophon cf. *shackletoni*: HAIN, 1990, p. 63, pl. 29, fig. 3, pl. 30, figs. 3a, b.

Material examined: A single empty shell from St. 5; 1 living specimen from St. 7; 1 empty shell from St. 9.

Description: The shell is ovately fusiform, thin, frosted white in color, with large and rather high spire (Figs. 89A, B). The protoconch is white in color, rounded, smooth, small, high, about 2 in number of turns, 1.2 mm in diameter, 2.0 mm in height, and has a low erected terminal varix (Fig. 89D). The teleoconch is roundly well inflated, about 4.3 in number of turns (20.2 mm in shell length), and has numerous thin lamellae. There are very fine axial growth lines between them. The suture is deeply constricted. The upper whorl is rather small and roundly inflated. The body whorl is well inflated, large and high, with height being about 80% of shell length and breadth being about 60% of shell length. The first teleoconch whorl has 14 lamellae, the penultimate whorl has 18–19, the body whorl has 14–18 which are raised and slightly recurved at the shoulder angle, especially on the body and penultimate whorls (Fig. 89C). The base is constricted. The aperture is oblong, large, with length being about 1/3 of shell length. The outer lip is thin, round and smooth. The inner lip is round and smooth. The columellar lip is short, smooth and slightly curved abaxially. The inner and columellar lips have weakly glossy, and very thin callus. The anterior siphonal canal is moderate, hemitubular, oblique and recurved dorsally. The inner wall is smooth and frosted white.

The operculum is slightly small to the aperture in size, translucent yellowish brown in color, horny, thin and ovate, with low situated nuculeus.

The radula is rachiglossate, 1 : 1 : 1 with 88 transverse rows of teeth, translucent pale brown in color, long but very narrow (3.0 mm in length and 0.3 mm in width: 26.0 mm in SL) (Fig. 89E). The rhachidian tooth is large, wide and stout, and has five sharply



Figs. 89A-E. *Trophon shackletoni shackletoni* HEDLEY. A-C. Shell; D. Protoconch; E. Radula. Scale A-C = 10 mm; D = 1 mm; E = 100 μm.

pointed cusps. The central cusp is longer than the others, about two times longer than the outermost cusp. The denticles between central and outermost cusps are small and weak, about 1/2 of the outermost cusps. The base of rhachidian is wide and low, and with slightly incurved upper tip. The lateral teeth are large, unicuspid, and simple claw-like in shape. The base of lateral is wide, about 2/3 of width rhachidian base.

Measurements:

SL 20.2 mm, SW 12.1 mm (empth shell; St. 5).
SL — mm, SW 14.8 mm (living specimen; St. 7) (siphonal canal was broken).
SL 26.0 mm, SW 13.1 mm (empty shell; St. 9).

Previous distribution records (Fig. 90): Type locality: Off Cape Royds, Ross Sea, 12.6-36 m. Range: off Glacier Tongue, McMurdo Sound, 342-450 m, 76°56′S, 164°12′E, Ross Sea, 288 m and 77°46′S, 166°08′E, McMurdo Sound, 540 m (SMITH, 1915); Commonwealth Bay, Adélie Land, 99-108 m and off Drygalski Island, Davis Sea, 108 m (HEDLEY, 1916a); Ross Sea, 288 m (EALES, 1923); north of Mackenzie Sea, 456 m, off Enderby Land, 193 and 220 m (POWELL, 1958); Davis Sea (EGOROVA, 1982); Borge Bay, Signy Island, 35 m (OLIVER and

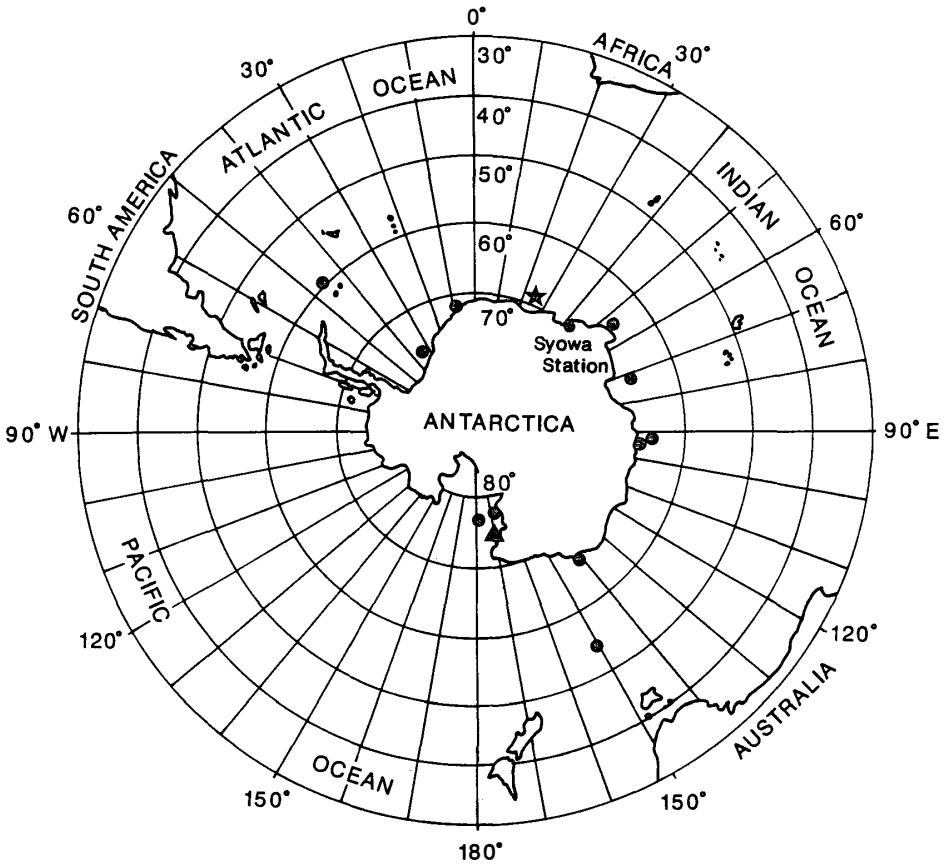


Fig. 90. Distribution of *Trophon shackletoni shackletoni* HEDLEY (Large dots: Previous distribution records; Star: Present study; Triangle: Type locality).

PICKEN, 1984); eastern Weddell Sea, 202 m, 371 m and 483 m (HAIN, 1990); west of Macquarie Island, 2746–3248 m (DELL, 1990); Ross Sea, 13–1890 m (DELL, 1990).

Remarks: This species has wide in both geographical and vertical distribution ranges, such as Signy Island to Ross Sea, and from 12.6 m to 3248 m in depth, although to DELL (1990), obtained no live material from deeper than 400 m.

This species is similar to *T. longstaffi* SMITH, 1907, from Lützow-Holm Bay to Ross Sea (Figs. 88A–C), which is remarkably larger than this species (shell length is 38.9 mm, and shell width is 24.4 mm). The radula of *T. longstaffi* differs from that of this species in having a tricuspid rachidian tooth (Fig. 87D).

The circum-Antarctic *T. s. shackletoni* has 14–18 lamellae, while *T. s. paucelamellatus* POWELL, 1951, only known from the South Georgia Islands, the South Orkney Islands and the Antarctic Peninsula, has 8 lamellae on the body whorl.

T. s. shackletoni is commonly collected by the bated trap near Syowa Station.

Trophon scotianus POWELL, 1951

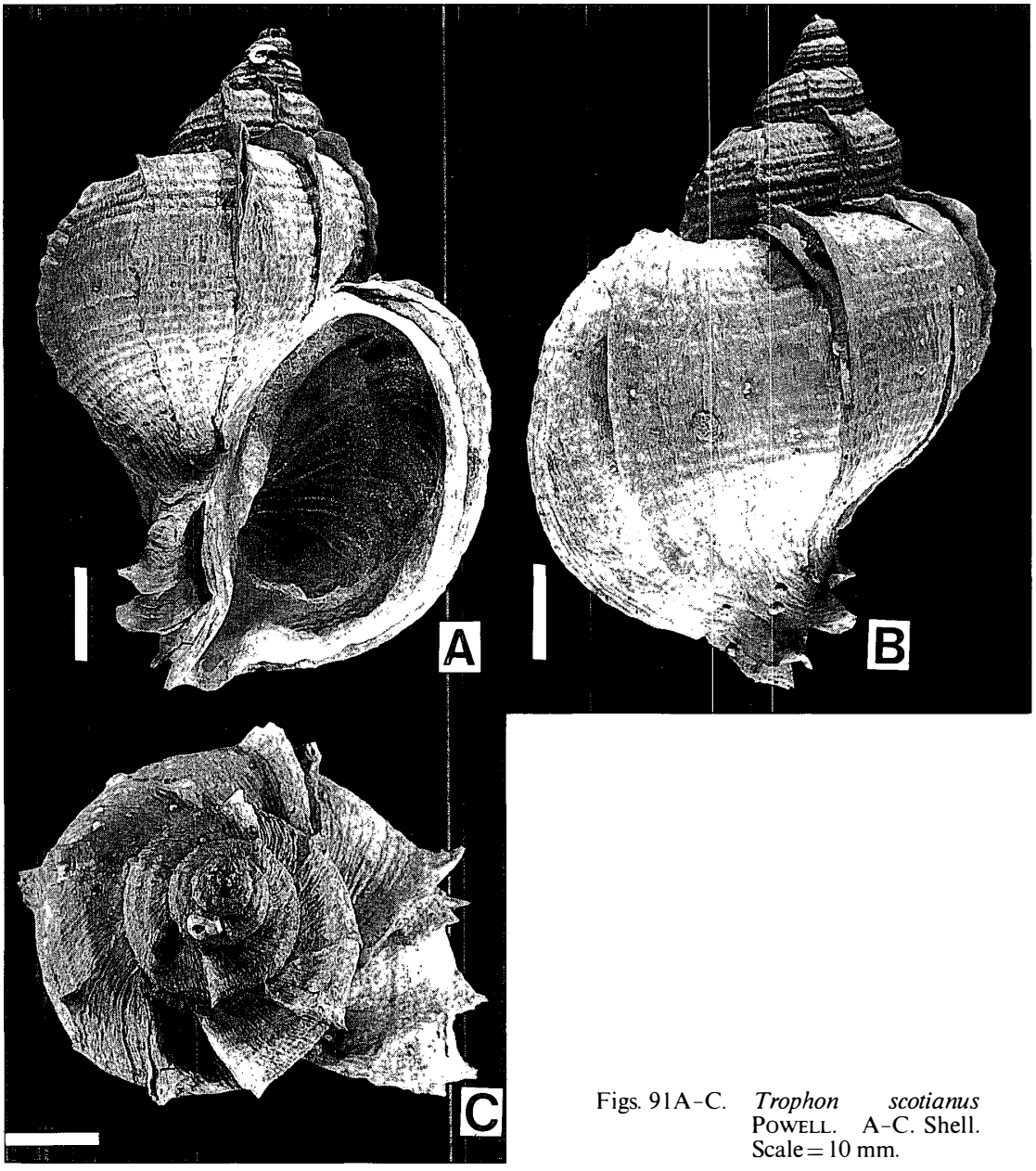
(Figs. 91A–C)

Trophon scotianus POWELL, 1951, p. 153, pl. 9, figs. 48, 49, M88; POWELL, 1960, 154 (name only); OKUTANI, 1986, 279, pl. 1, figs. 3, 6.

Trophon sp. 1: HAIN, 1990, p. 63, pl. 6, figs. 9a, b, pl. 25, fig. 2.

Material examined: A single living specimen from Breid Bay (JARE-25).

Description: The shell is ovately fusiform, large, thick, pale brown in color, with a low spire (Figs. 91A, B). The protoconch is eroded. The teleoconch is well roundly inflated, about 4.8 in number of turns, and has irregularly spaced, thin, narrow axial lamellae and very fine growth lines between them, with spaced spiral cords. The suture is constricted. The upper whorls are small and roundly inflated. The body whorl is well roundly inflated, remarkably large, broad, with height being 81% of shell length and breadth 68% of shell length. The penultimate whorl has 7 lamellae, and the body whorl 10 (Fig. 91C). The spiral cords are crowded. The base is constricted. The aperture is oval, very large



Figs. 91A–C. *Trophon scotianus* POWELL. A–C. Shell. Scale = 10 mm.

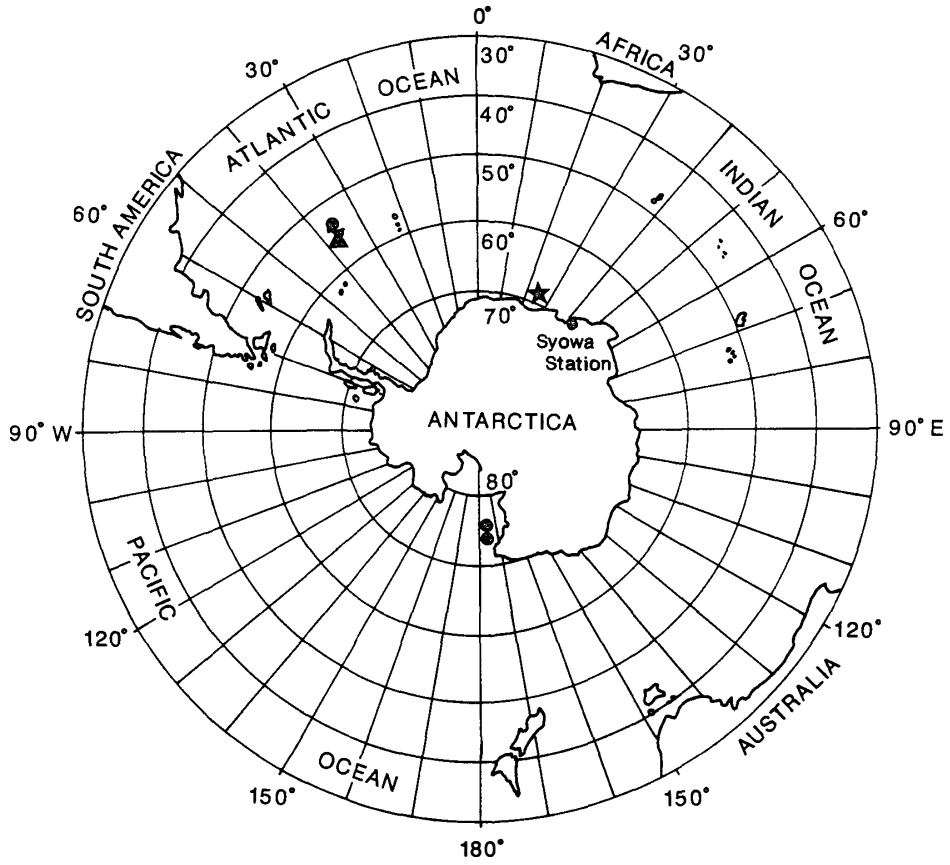


Fig. 92. Distribution of *Trophon scotianus* POWELL (Large dots: Previous distribution records; Star: Present study; Triangle: Type locality).

and wide, with length occupying 59% of shell length, width occupying 51% of shell width. The outer lip is thin, round and smooth, and is expanded outwardly. The inner lip is smooth, round and slightly expanded outwardly. The columellar lip is smooth, weakly round and slightly twisted. The inner and outer lips have very thin callus. The anterior siphonal canal is short, hemitubular, oblique and recurved dorsally. The inner wall is smooth and frosted dirty white in color.

The operculum is small to the aperture in size, brown in color, horny, oval with low situated nucleus.

Measurements: SL 67.4 mm, SW 45.8 mm, AL 39.7 mm, AW 23.4 mm.

Previous distribution records (Fig. 92): Type locality: Off South Georigia, 107 m. Range: Breid Bay, 310 m (OKUTANI, 1986); western Weddell Sea, 202–617 m (*Trophon* sp. 1; HAIN, 1990); Ross Sea, 256–474 m and South Georgia 97–101 m (DELL, 1990).

Remarks: POWELL (1958) described *T. scotianus* from a single specimen from off South Georgia Islands, 107 m deep. The holotype specimen (SL. 34 mm) has six axial lamellae per whorl. DELL (1990) reported this species from Ross Sea and off South Georgia Islands. DELL's specimens (largest *ca.* 57 mm in SL) have seven axial lamellae on the penultimate, and 7–9 on the last whorl. The Ross Sea specimens (SL 62.1 mm and SL 51.0 mm) have 11 axial lamellae on the last whorl (DELL, 1990). The examined specimen under this study has fewer axial lamellae than DELL's, namely, seven axial lamellae on the

penultimate whorl and 10 on the body whorl. The holotype specimen is slenderer than the other specimens, and DELL's Ross Sea specimen has more inflated whorl, while the examined specimen is intermediate between them.

HAIN's (1990) *Trophon* sp. 1 from the western Weddell Sea is no doubt *T. scotianus*. HAIN's illustration of *Trophon* sp. 1 is most allied the present specimen.

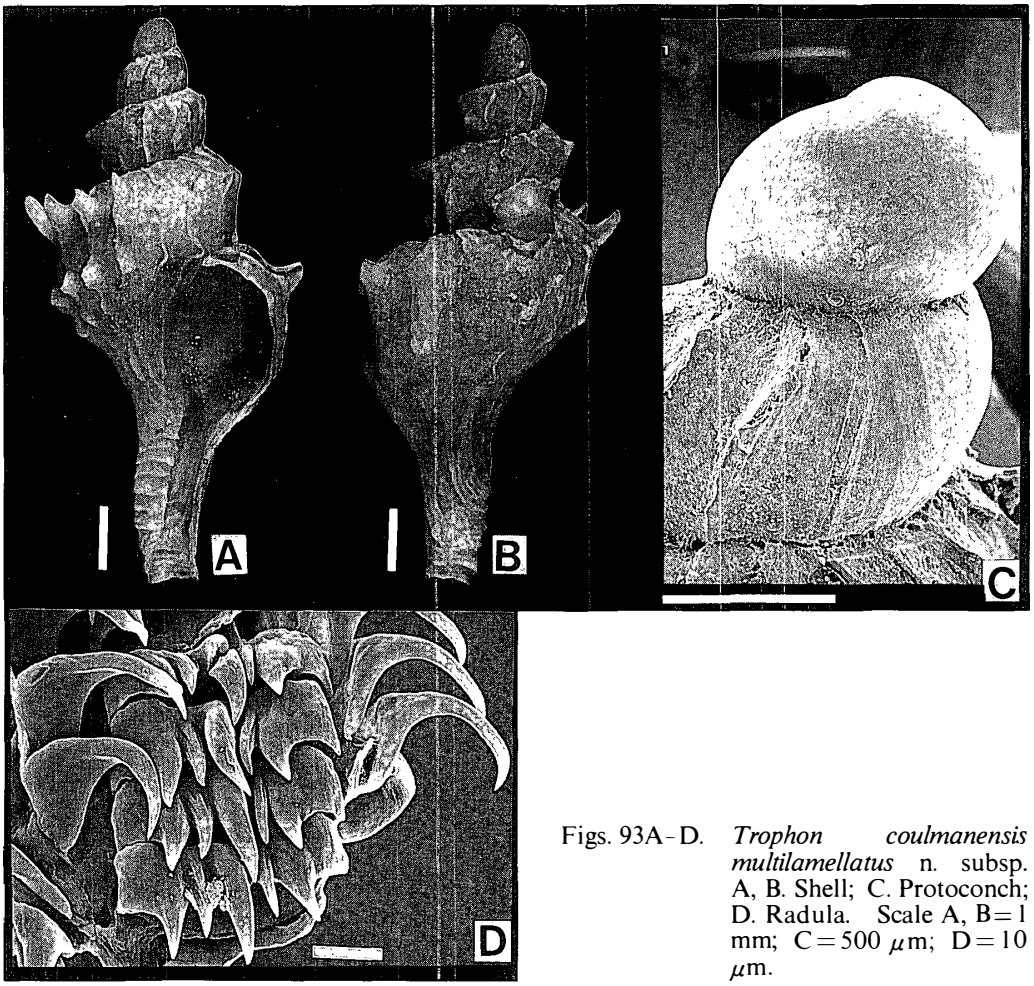
T. scotianus is the largest species among the genus *Trophon* distributed in the Antarctic continental shelf. This species exhibits the circum-Antarctic distribution, from South Georgia Islands to Ross Sea, 97–474 m deep, although only nine specimens have been known up to this date.

Trophon coulmanensis multilamellatus n. subsp.

(Figs. 93A–D)

Material examined: A single empty shell from St. 8; 4 living specimens from St. 9.

Description: The shell is small in size, brittle, elongate fusiform, small, thin, white in color, with a high spire (Figs. 93A, B). The protoconch is frosted white in color, round, smooth, large, high, about 2 in number of turns, 1.0 mm in diameter and 1.3 mm in height, and the terminal varix is very weakly erected (Fig. 93C). The teleoconch is round, about 3 in



Figs. 93A–D. *Trophon coulmanensis multilamellatus* n. subsp. A, B. Shell; C. Protoconch; D. Radula. Scale A, B=1 mm; C=500 μm; D=10 μm.

number of turns, and has a shoulder angle, very thin and widely spaced lamellae on the surface. The suture is deeply impressed, and the sutural ramp is almost flat. Below the shoulder angle is almost straight. The upper whorl is large and highly elevated. The body whorl is slender and high, with height being about 65% of shell length and breadth being about 50% of shell length. The first teleoconch has 13–14 lamellae (mean 13), the penultimate whorl has 13–14 (mean 14), and the body whorl also has 13–14 (mean 13). These lamellae are hemispinously raised on the shoulder angle and the upper periphery of the base. The base is constricted, and has a weak angle on the boundary of the upper part. The aperture is ovate, rather small, with length being about 1/4 of shell length. The outer lip is very thin, almost smooth, except shallow angles on the shoulder and boundary of the base. The inner lip is smooth and roundly incurved. The columellar lip is very short, smooth and round. The inner and columellar lips have a glossy, but thin callus. The anterior siphonal canal is very long, hemitubular and gently curved. The inner wall is smooth and glossy white in color.

The operculum is slightly small to the aperture in size, translucent yellow in color, horny, very thin and ovate, and the nuculeus is located low inside.

The radula is rachiglossate, 1 : 1 : 1 transparent, long and narrow (0.825 mm in length and 0.075 mm in width: 8.7 mm in SL) (Fig. 93D). The rhachidian tooth is large, wide and rather stout, and has five sharply pointed cusps. The central cusp is longest and largest of all. The cusps between the central and outermost cusps are smaller and weaker than the others, and length of these cusps are about 1/2 of central cusp. The base of rhachidian is wide and rather low. The lateral teeth are small, unicuspid, strongly curved, and claw-like in shape. The base of lateral teeth is narrow, about 1/2 of width of the rhachidian base.

Measurements:

SL 3.5 mm, SW 1.8 mm (empty shell; St. 8).
SL 9.0 mm, SW 4.6 mm (living specimen; St. 9).
SL 8.7 mm, SW 4.5 mm (living specimen; St. 9).
SL 5.5 mm, SW 2.5 mm (living specimen; St. 9).
SL 4.7 mm, SW 2.3 mm (living specimen; St. 9).

Remarks: This subspecies is similar to *Trophon coulmanensis* SMITH, 1907, from Davis Sea to off Adelie Land, because of having an elongate fusiform shell, long siphonal canal and varices with channeled shoulder expansion. However, *T. coulmanensis* differs in having no expansions on basal varices. According to DELL (1990), the numbers of axial lamella of *T. coulmanensis* are fewer than the present subspecies, 7–11 on the penultimate whorl (mean 8) and 7–10 on the body whorl. This subspecies is also similar to *T. drygalskii* THIELE, 1912, from the eastern Ross Sea to the eastern Weddell Sea (Figs. 85A, B). But, the typical *T. drygalskii* is different from this subspecies by having more varices (25 on the body whorl), more rounded protoconch, short spire and anterior siphonal canal. The radula of *T. drygalskii* is also similar, but it has more depressed rhachidian base and wider lateral base (Fig. 85D). The shell characters of the present subspecies are almost those of *T. coulmanensis*, except numbers of lamellae, that warrant to represent a new subspecies.

Family BUCCINIDAE RAFINESQUE, 1815
Subfamily Buccininae RAFINESQUE, 1815
Genus *Neobuccinum* SMITH, 1877 (monotypy)
Type species: *Buccinopsis eatoni* SMITH, 1875

Neobuccinum eatoni (SMITH, 1875)

(Figs. 94A–G)

Buccinopsis eatoni SMITH, 1875, p. 68.

Neobuccinum eatoni: SMITH, 1879, p. 169, pl. 4, figs. 1–1a; STUDER, 1879, p. 129; TRYON, 1881, p. 197, pl. 77, figs. 357, 358; WATSON, 1886, p. 216 (distribution record); SMITH, 1902, p. 202; THIELE, 1904, p. 168; LAMY, 1906b, p. 2 (distribution record); MELVILL and STANDEN, 1907, p. 139; SMITH, 1907, p. 1 (distribution record); LAMY, 1910b, p. 199 (distribution record); LAMY, 1911a, p. 5; HEDLEY, 1911, p. 6; THIELE, 1912, p. 211; LAMY, 1915, p. 69 (distribution record); SMITH, 1915, p. 72; HEDLEY, 1916, p. 59, pl. 4, fig. 97; EALES, 1923, p. 28, fig. 27; POWELL, 1951, p. 143; POWELL, 1957, p. 132; POWELL, 1958, p. 193 (distribution record); POWELL, 1960, p. 150 (name only); ARNAUD, 1972a, p. 431; ARNAUD, 1972b, p. 128; HORIKOSHI and HOSHIAI, 1978, p. 79, figs. 1–5; HORIKOSHI *et al*., 1979, p. 22; EGOROVA, 1982, p. 41, figs. 51, 172–176; ARNAUD, 1985, p. 109; TUCKER and BURTON, 1987, p. 10, pl. 4 (distribution record); HAIN, 1990, p. 56, pl. 5, figs. 6a–d, pl. 23, fig. 3; DELL, 1990, p. 165, figs. 280–282, table 14.

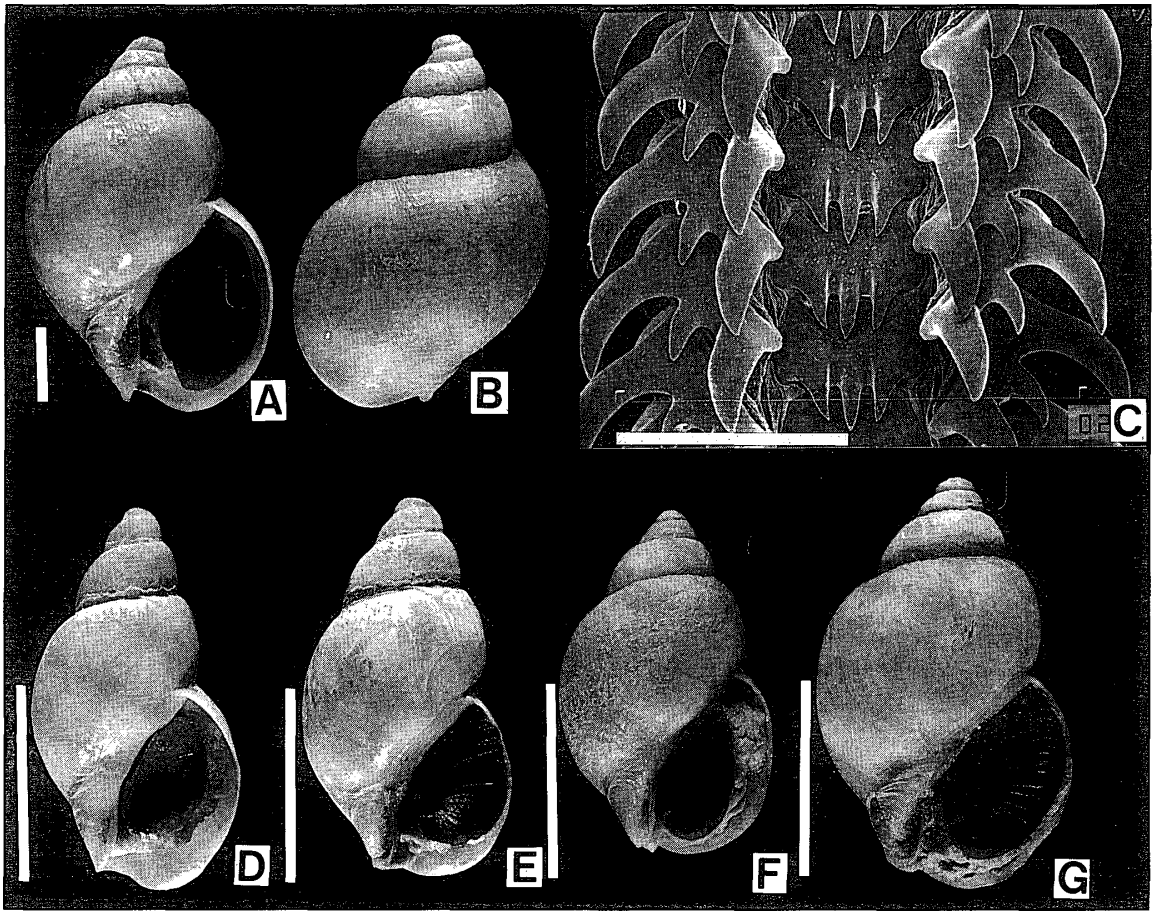
Neobuccinum praeclarum STREBEL, 1908, p. 31, pl. 3, figs. 38a–g.

Material examined: 141 living specimens collected by JARE-21 around Ongul Islands; 2 living specimens from Kita-no-ura Cove; 14 living specimens from off South Shetland Islands; 4 living specimens from off Kerguelen.

Description: The shell is large, ovoidal to elongate ovoidal, thin and frosted white in color (Figs. 94A, B). The protoconch is very large, about 2.3 in number of turns, about 7 mm in diameter, dome-shaped. The teleoconch is about 3 in number of turns, and has inflated to well inflated whorls. The surface is smooth, except crowded, very fine growth lines, and covered by a thin, straw- or ivory-colored periostracum which is frequently torn off. There are occasionally crowded, slender spiral threads, with rugged periostracum thereupon. The suture is moderately constricted. The upper whorl is rather low and well roundly inflated to moderately inflated. The body whorl is large, well inflated with breadth being 56.5–78.5% of shell length. The base is slightly constricted. The siphonal fasciole is large, and has crowded, very fine threads that become round plicae adapically. The umbilicus is very narrow. The aperture is large occupying 51.0–74.3% of shell length, oval, with a thin and smooth outer lip. The inner lip is smooth and round. The boundary between inner and columellar lips is smooth having an obtuse angle. The columellar lip is almost straight. The anterior siphonal canal is short and large. The inner wall is smooth and white in color.

The operculum is large, only slightly smaller than the aperture in size. Length is occupying 59.5–80.2% of shell length and width 44.2–80.6% of shell width, oblong, brown in color, thick, corneous, with low situated nuculeus.

The radula is rachiglossate, 1 : 1 : 1 with 80 transverse rows, translucent brown in color, long but narrow (15.0 mm in length, 1.1 mm in width; SL is 45.0 mm) (Fig. 94C).



Figs. 94A–G. *Neobuccinum eatoni* (SMITH). A–C, E–G. From near Syowa Station; D. From Kerguelen. A, B, D–G. Shell; C. Radula. Scale A, B=10 mm; C=500 μm; D–G=30 mm.

The rhachidian tooth is large and wide, and has a incurved base with three sharply pointed cusps. The central cusp is slightly larger and longer than the lateral ones. The lateral teeth are massive, wide and large, and the width of its base is almost the same in size to the rhachidian base. A single tooth has three incurved cusps with sharply pointed tips. The outermost cusp is very longer and stronger than the other two. The central cusp is the smallest and weakest of all. The innermost cusp is strong, with its length being about 2/3 of outermost one. The base of the lateral teeth is slightly incurved.

Measurements: See Table 20.

Previous distribution records (Fig. 95): Type locality: Royal Sound, Kerguelen. Range: Royal Sound and Swain's Bay, Kerguelen Island, 5.4–12.6 m (SMITH, 1879); Accessible Bay and Royal Sound, Kerguelen Island, 36–45 m, and off Heard Island, 135 m (WATSON, 1886); Cape Adare, 12.6–18 m (SMITH, 1902); South Shetland Islands (LAMY, 1906b); Scotia Bay, South Orkneys, 16.2–18 m (MELVILL and STANDEN, 1907); six miles N. W. of Hut Point, Ross Sea, 324 m (SMITH, 1907b); Graham Land, 360 m (STREBEL, 1908); Kerguelen Island (LAMY, 1910b); off Gaussberg, Davis Sea (THIELE, 1912); off Cape Bird Peninsula, 450 m, and off Granite Harbour, 90 m, entrance of McMurdo Sound, and Ross Sea, 76°56′S, 164°12′E, 288 m (SMITH, 1915); Gazelle Bassin and Bear-up Bay, Kerguelen

Table 20. Measurements of *Neobuccinum eatoni* (SMITH).

		N	Range	Mean	S.D.
SL (mm)	Male	45	36.3–60.8	50.1	5.75
	Female	53	29.6–60.5	50.4	6.30
	South Shetland	14	41.7–62.2	53.3	5.42
	Kerguelen	4	33.7–54.0	44.0	9.31
	Type specimen*	1	56	—	
SW (mm)	Male	44	25.0–39.7	34.3	3.58
	Female	53	22.1–40.0	34.8	4.14
	South Shetland	12	24.2–34.9	30.4	2.92
	Kerguelen	4	21.6–31.7	27.6	4.42
	Type specimen*	1	27	—	
AL (mm)	Male	45	22.8–34.7	28.9	4.78
	Female	51	19.1–35.3	30.5	3.60
	South Shetland	13	22.2–30.1	26.2	2.92
	Kerguelen	4	18.0–27.4	23.2	3.91
	Type specimen*	1	27	—	—
AW (mm)	Male	44	24.5–37.4	32.2	2.93
	Female	53	21.3–36.7	31.2	3.07
	South Shetland	13	24.1–31.2	28.3	2.12
	Kerguelen	4	20.4–28.8	25.4	3.73
	Type specimen*	1	14	—	—
AA (θ^{o})	Male	44	40.3–78.2	57.1	8.17
	Female	53	33.7–79.0	56.8	9.36
	South Shetland	12	33.0–43.6	38.4	3.19
	Kerguelen	4	41.4–55.2	48.0	6.52
SW/SL (%)	Male	44	57.1–76.9	68.6	3.97
	Female	52	56.9–76.7	69.2	4.07
	South Shetland	12	53.5–61.5	56.7	2.19
	Kerguelen	4	58.7–69.9	63.4	4.87
	Type specimen*	1	48.2	—	—

AA: Apical angule (male and female specimens collected from near Syowa Station).
*: Measurements of type specimen after SMITH (1879).

Island (LAMY, 1915); Commonwealth Bay, 27–108 m, off Mertz Glacier Tongue, 540 m, and Shackleton Iceshelf, 432 m and Adelie Land, 644 m (HEDLEY, 1916); McMurdo Sound, Ross Sea, 20 m (EALES, 1923); Zavodovski Island, South Sandwich Islands, 329–278 m, Bay of Whales, Ross Sea, 626 m, and King George Island, South Shetland Islands, 383 m (POWELL, 1951); also Kerguelen Island, 20–150 m (POWELL, 1957); Continental shelf, off Kemp Land, 603 m (POWELL, 1958); Petermann Island, 300 m (ARNAUD, 1972a); off Adélie Land, 10–90 m (ARNAUD, 1972b); nearshore and offshore of Ongul Islands, Enderby Land, 9–500 m (HORIKOSHI *et al.*, 1979); near shore of Vestfold Hills, Prydz Bay, Princess Elizabeth Land, 9 m (TUCKER and BURTON, 1987); eastern Weddell Sea (HAIN, 1990); Signy Island, South Orkney Islands, 298–403 m (DELL, 1990); off South Shetland Islands, 884–935 m (DELL, 1990); Antarctic Peninsula, 15–750 m (DELL, 1990); Peter I Island, Bellingshausen Sea, 109 m (DELL, 1990); Balleny Islands, 554 m (DELL, 1990); Ross Sea, 4–2350 m (DELL, 1990).

Remarks: *Neobuccinum eatoni*, which is the commonest buccinid in the Antarctic and

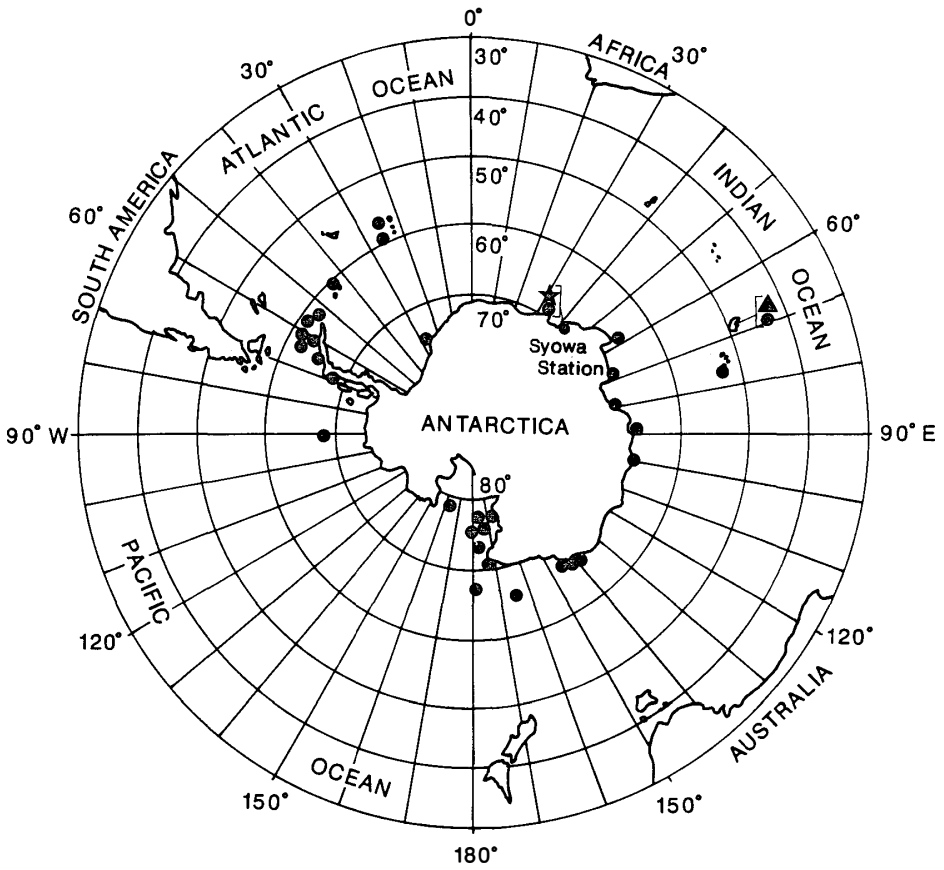


Fig. 95. Distribution of *Neobuccinum eatoni* (SMITH) (Large dots: Previous distribution records; Star: Present study; Triangle: Type locality).

Subantarctic regions, has wide geographical and vertical distribution ranges, such as Kerguelen to the Antarctic coastal waters, from 5.4 to 2350 m in depth. Generally speaking, the buccinid species has a short period of pelagic larval life or completely lacks pelagic development. Two paradox conditions in *N. eatoni*, namely, a wide geographical distribution and a non-pelagic development, might cause a high degree of infraspecific variability. Sexual dimorphism and individual variability are common in the Family Buccinidae. Although this has never been worked out for *N. eatoni* up to this date.

Among these 118 specimens, 98 were collected from around Syowa Station by Japanese Antarctic Research Expeditions (JARE), 16 were from South Shetland Island by Japan Marine Fishery Resource Research Center (JAMARC) and 4 from Kerguelen (topotypes).

Shell length, shell width, apertuer length, aperture width and apical angule were measured. Measurments of the type specimen and Graham Land specimens were referred to SMITH (1915) and STREBEL (1908), respectively.

The majority of Syowa Station specimens are obese, with low spires and a large, broad, well inflated body whorl, but a few of them have slender shell (Figs. 94A, B, E–G). In contrast, Kerguelen specimens are elongate, with a tall spires and a slightly inflated body whorl (Fig. 94D). South Shetland specimens are mostly similar to the Kerguelen specimens, except more inflated whorls. Both Kerguelen and South Shetland specimens are

close to the type specimen figured by SMITH (1887). The Prydz Bay specimens illustrated by TUCKER and BURTON (1987) are close to the Syowa Station specimens. The radula of *N. eatoni* also shows an infraspecific variability which does not signify the geographical variation.

Biometrical comparisons (Table 20) revealed: 1) Kerguelen and South Shetland specimens have rather slender shell with smaller aperture, while other allometrical characters of them do not exhibit any spectacular difference from Syowa Station specimens; 2) The type specimen is much slender and smaller in aperture compared with Kerguelen specimens; 3) Syowa Station specimens contains slender shell (like those from Kerguelen) to obese specimens showing a wide conchological variability within a single local population.

Sexual dimorphism of Syowa Station specimens were also observed. The sex ratio (male: female) is 1 : 1.2. Six indices (Table 20) show no difference between sexes.

Genus *Antarctodomus* DELL, 1972

Type species: *Bathydomus thielei* POWELL, 1958 (S.D. by DELL, 1972)

***Antarctodomus thielei* (POWELL, 1958)**

(Figs. 96A–D)

Bathydomus thielei POWELL, 1958, p. 194, pl. 3, fig. 8; POWELL, 1960, p. 151 (name only); ARNAUD, 1972b, p. 129, fig. 20.

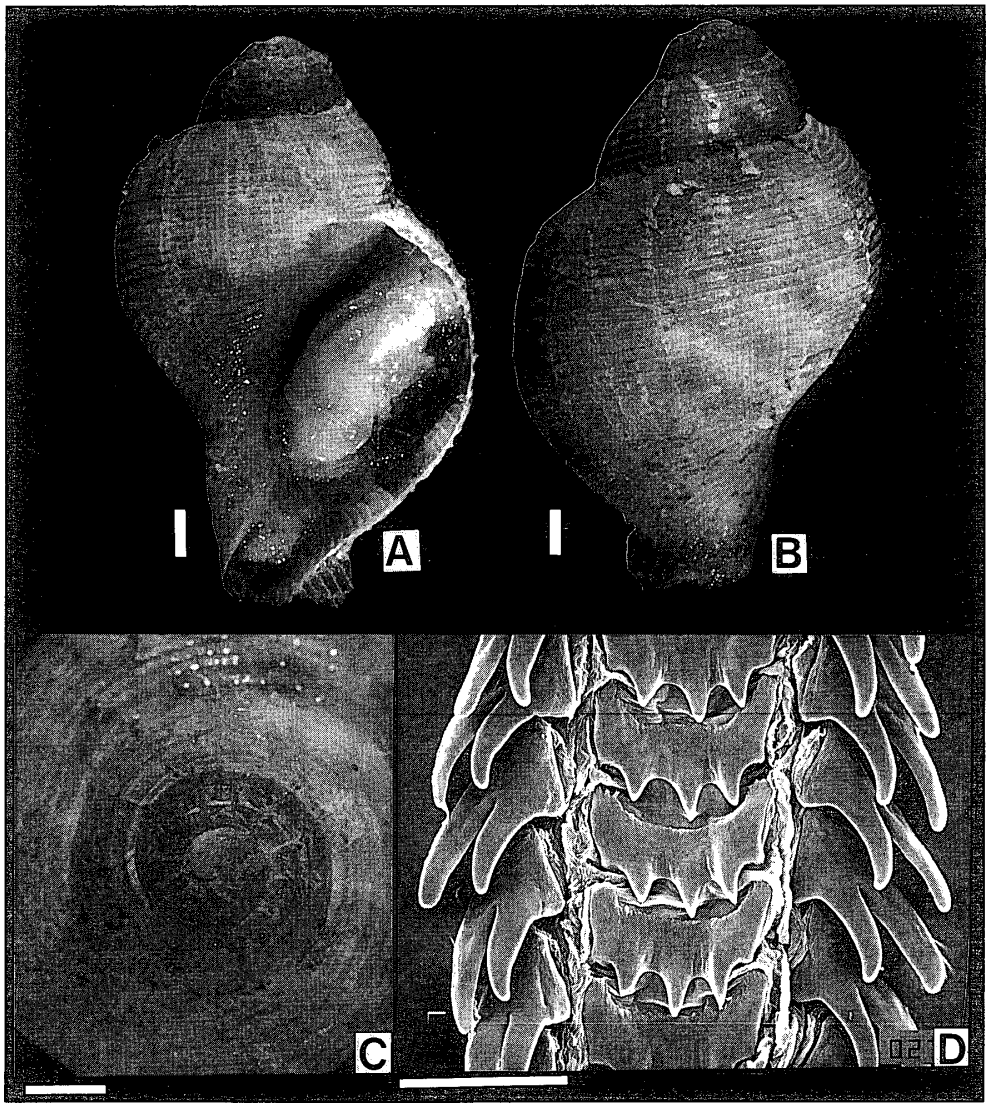
Antarctodomus thielei: DELL, 1972a, p. 5, figs. 5, 6; HAIN, 1990, p. 57, pl. 5, fig. 7, pl. 23, fig. 4; DELL, 1990, p. 168.

Material examined: A single living specimen from St. 8; 1 empty shell from St. 9.

Description: The shell is obese fusiform, thin, translucently white, with slightly depressed and rounded spires (Figs. 96A, B). The protoconch is small, depressed, with a single turn, 1.1 mm in diameter and has very finely granulated surface (Fig. 96C). The teleoconch is about 3 in number of turns, large, roundly inflated, with numerous, narrow, flat-topped spiral cords which are crossed by widely interspaced weak axial threads. The surface is covered by a very thin, pale yellowish, translucent periostracum, which creates very small spine-like projection at junctions of axial threads and spiral cords. The suture is impressed. The axial threads come to appearance from the first teleoconch, and the first to the 20th threads are clearly raised and regularly spaced, but the threads thereafter become gradually weak and irregularly spaced towards the aperture. Axial threads are prosocyrt and widely spaced, more than 13 on the body whorl, 11 on the penultimate whorl. The interspaces between axial threads tend to became wider adaperturally. The spiral cords also come to appearance from the first teleoconch, clearly raised, 1 on the first teleoconch, 10 on the penultimate whorl and 42 on the body whorl, and interspaces between these cords are subequal. The body whorl is large, roundly well inflated. The base is constricted. The aperture is oblong pyriform and large. The outer lip is round and probably thin (broken away in a sole specimen examined). The inner lip is round and smooth. The columella lip is rather straight. The anterior canal is open, oblique, only feebly recurved. The inner wall is smooth.

The operculum is unknown.

The radula is rachiglossate, 1 : 1 : 1 with 75 transverse rows, transparent, short and very



Figs. 96A–D. *Antarctodomus thielei* (POWELL). A, B. Shell; C. Protoconch; D. Radula. Scale A–C = 1 mm; D = 50 μm.

narrow (2.5 mm in length, 0.125 mm in width; 12.7 mm in SL) (Fig. 96D). The rhachidian tooth is large, wide and low, and has a deeply incurved base and three large, sharply pointed cusps. The central cusp is slightly larger than the others. The lateral teeth are rather small, and width of the straight base is narrower than the rhachidian base, occupying 55% of the rhachidian base. A single tooth has two long cusps that are slightly incurved and have blunt tips. The outer cusp is slightly longer than the inner one. The inner cusp is more strongly incurved than the outer one.

Measurements:

SL 12.7 mm, SW — mm (living specimen; St. 8) (aperture is broken).

The specimen from St. 9 was broken.

Previous distribution records (Fig. 97): Type locality: off Enderby Land, 193 m. Range: off Adelie Land, 115–135 m (ARNAUD, 1972b); West Arm, vicinity of Mawson Base, 67° 36′S, 62°53′E, 100 m (DELL, 1972a); eastern Weddell Sea (HAIN, 1990); Ross Sea, 318–569

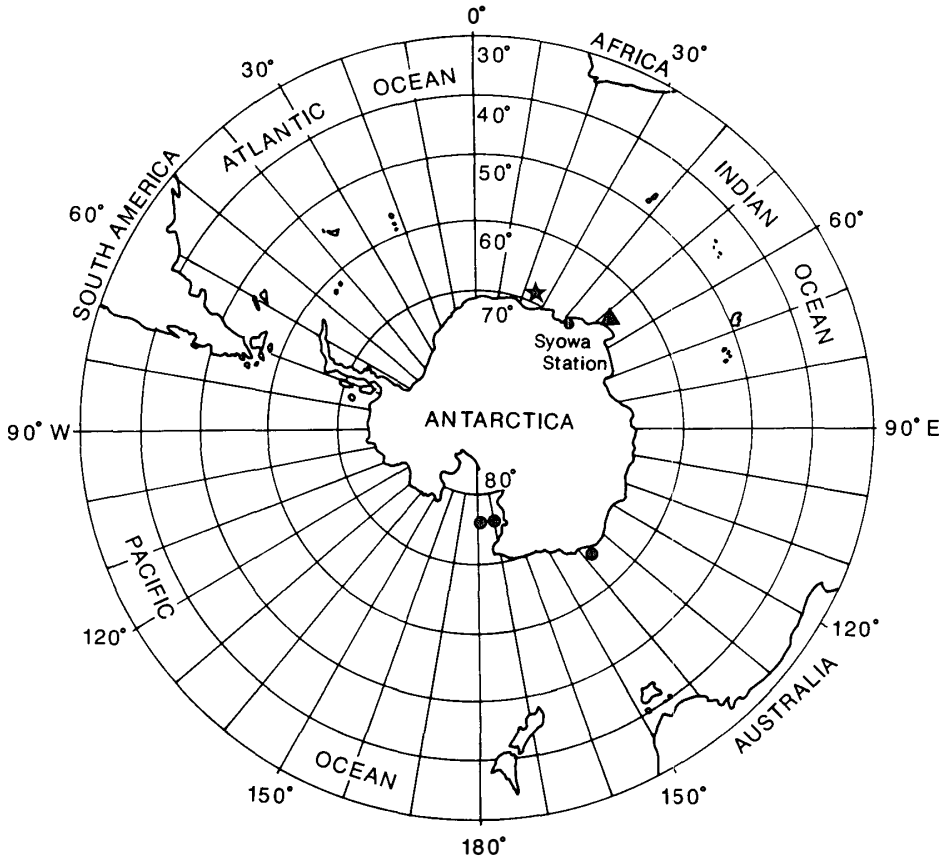


Fig. 97. Distribution of *Antarctodomus thielei* (POWELL) (Large dots: Previous distribution records; Star: Present study; Triangle: Type locality).

m (DELL, 1990).

Remarks: This species was first described as the genus *Bathydomus* by POWELL (1958) from off Enderby Land, on a basis of the single empty shell. ARNAUD (1972b) illustrated a small shell, the operculum and the radula. The POWELL's specimen is very larger and slightly slenderer than the present specimen (28.5 mm in SL, 16.0 mm in SW), and has elevated spires and very roundly inflated last whorl. The small specimen of this species is similar to *B. setiferus* in having similar arrangement of periostracal spines on the shell surface. However, *B. setiferus* has slenderer shell, and has regularly reticulated sculptures on the shell surface.

The operculum of examined specimen was lost. According to ARNAUD (1972b), the operculum of this species is small to the aperture in size, ovo-triangle with tapering lower tip.

Antarctodomus okutanii n. sp.

(Figs. 98A-G)

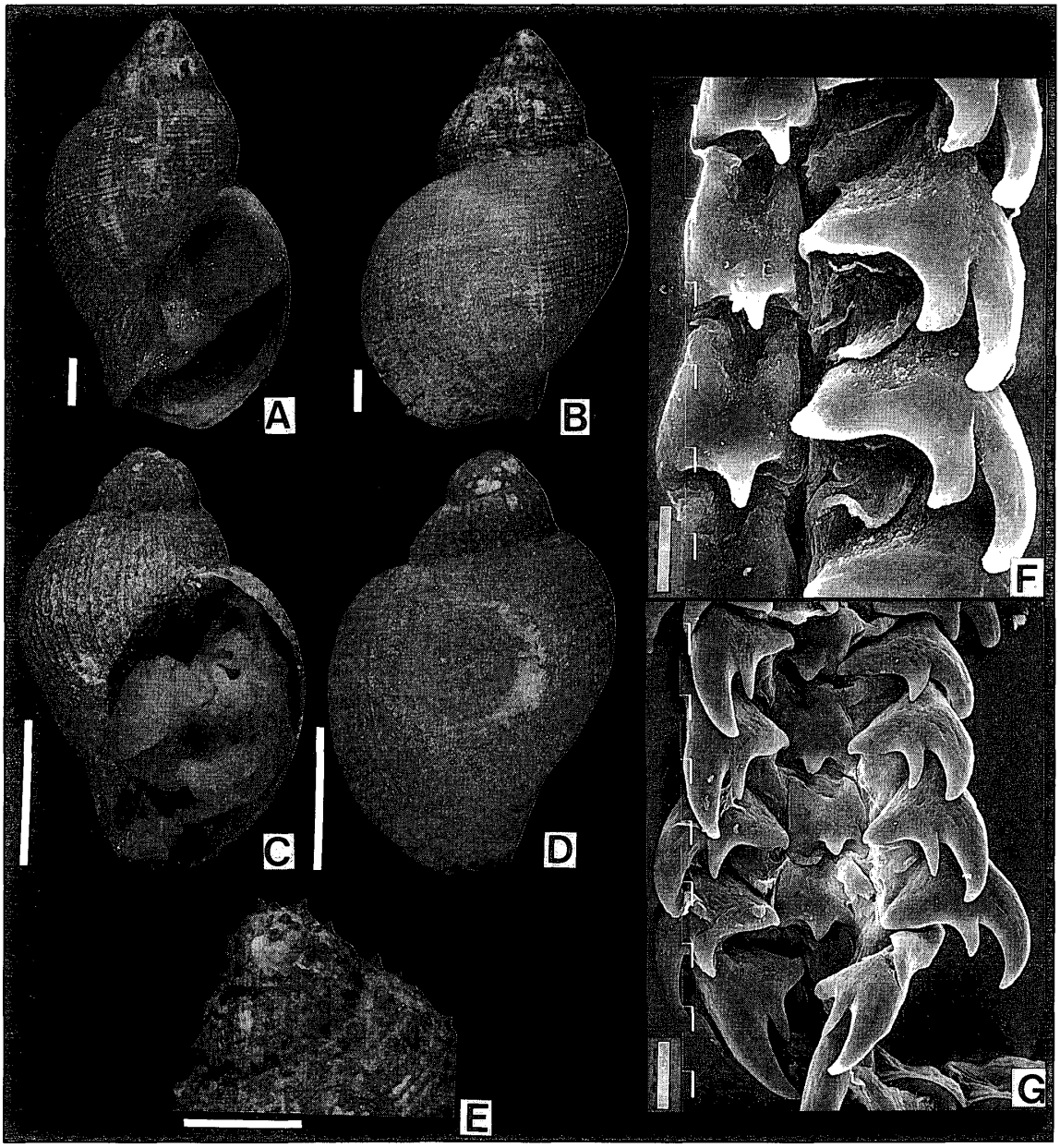
Buccinidae sp. 1 HAIN, 1990, p. 62, pl. 6, fig. 6, pl. 24, fig. 7.

Buccinidae sp. 2 HAIN, 1990, p. 62, pl. 6, fig. 7, pl. 24, fig. 8.

Material examined: A living specimen collected from Breid Bay by JARE-25; 2 living

specimens collected from St. 8.

Description: The shell is ovoidal and rather thick, translucent white in color, with a elevated spire (Figs. 98A, B). The protoconch is dome-like in shape, large, about 1.8 in number of turns, 1.0 mm in diameter, with well inflated whorls and a rough surface. The teleoconch is about 3 in number of turns, well roundly inflated, with regularly spaced spiral threads which are crossed by almost regularly spaced weak axial lirae, presenting a reticulate appearance. The surface is covered by a thin and translucent pale brown periostracum. The suture is slightly channeled. The upper whorl is low, round, well



Figs. 98A–G. *Antarctodomus okutanii* n. sp.
A, B. Holotype; C, D. Shell of paratype #1; E. Protoconch; F. Radula holotype; G. Radula of paratype #1. Scale A–E = 1 mm; F, G = 10 μm.

inflated, and heavily eroded. The body whorl is roundly inflated, large, with breadth being 69% of shell length. The spiral ribs are 7 on the first 1/4 teleoconch whorl, more than 17 on the penultimate whorl and 50 on the body whorl. The first teleoconch whorl has remarkably raised axial lirae which tend to become weaker abapically. The base is slightly constricted. The umbilicus is narrowly open. The aperture is lunate, large and wide, 63% of shell length, with a thin and almost smooth outer lip which is very weakly crenulated corresponding to external ribs. The inner lip is round and smooth, and has a conspicuous angle at the boundary to the columellar lip, which is short, almost straight, and slightly reflected. The inner and columellar lips have a thin callus. The anterior canal is straight, wide but short. The inner wall is smooth and glossy.

The operculum is horny, thin, elliptical, paucispiral, translucent pale yellow in color and small for the aperture in size, 44% of aperture length, with a low situated nucleus.

The radula is rachiglossate, 1 : 1 : 1 with 51 transverse rows, translucently pale yellowish in color, short and narrow (Figs. 98F, G). The rhachidian tooth is small, almost squarish and deeply incurved base, and a single blunt and low cusp. The lateral teeth are massive, large and wide, and the basal width is about twice the rhachidian base. A single tooth has two large, stout and blunt cusps that are strongly incurved, and a gently incurved base. The outer cusp is longer and stronger than the inner one. The inner cusp is small.

Measurements:

SL 9.0 mm, SW 6.2 mm, AL 5.7 mm AW 3.0 mm (living specimen; JARE-25)
(Holotype specimen; NSMT-Mo 70621).
SL 3.0 mm, SW 2.2 mm, AL 2.0 mm, AW 1.0 mm (living specimen; St. 8).
(Paratype specimen #1; NSMT-Mo 70622).
SL *ca*. 5 mm, SW *ca*. 3 mm (living specimen; St. 8) (outer lip is broken).
(Paratype specimen #2; NSMT-Mo 70623).

Previous distribution record (**Fig. 99**): Range: Eastern Weddell Sea, 420 m (Buccinidae sp. 1 and sp. 2; HAIN, 1990).

Remarks: The shell of small specimen (paratypes) is oval, roundly inflated, and the axial lirae are more conspicuous than the holotype specimen (Figs. 98C, D).

HAIN (1990) reported two Buccinid species, Buccinidae sp. 1 and Buccinidae sp. 2, from the eastern Weddell Sea. The former specimen is small in size (6 mm in SL), and the latter is larger than former (*ca*. 11 mm in SL). The radula of Buccinidae sp. 2 is almost identical with the present species. The rhachidian tooth of Buccinidae sp. 1 has two small cusps which are closely situated. This may be a mere infraspecific variability of the Buccinidae sp. 1, thus both Buccinidae sp. 1 and sp. 2 are identical but different in size.

This species is to be placed in the genus *Antarctodomus* in a broad sense, because of shell characters. It is separable from the all other species of the genus *Antarctodomus* in having a quite different radular characters.

Etymology: This species is named in honor of Professor Takashi OKUTANI for his many works of the mollusks. He (1986) reported the molluscan fauna in the Breid Bay, and it is the first full work based on JARE sample.

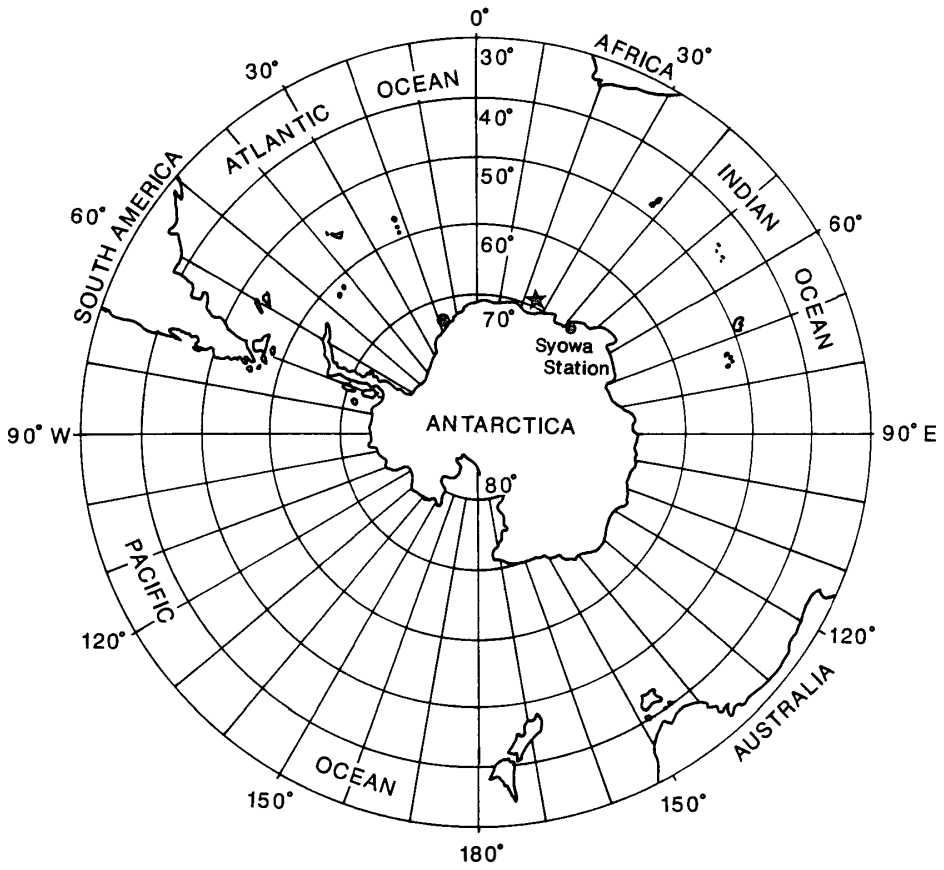


Fig. 99. Distribution of *Antarctodomus okutanii* n. sp. (Large dot: Previous distribution record; Star: Type locality).

Genus *Probuccinum* THIELE, 1912

Type species: *Neobuccinum tenerum* SMITH, 1907 (O.D.)

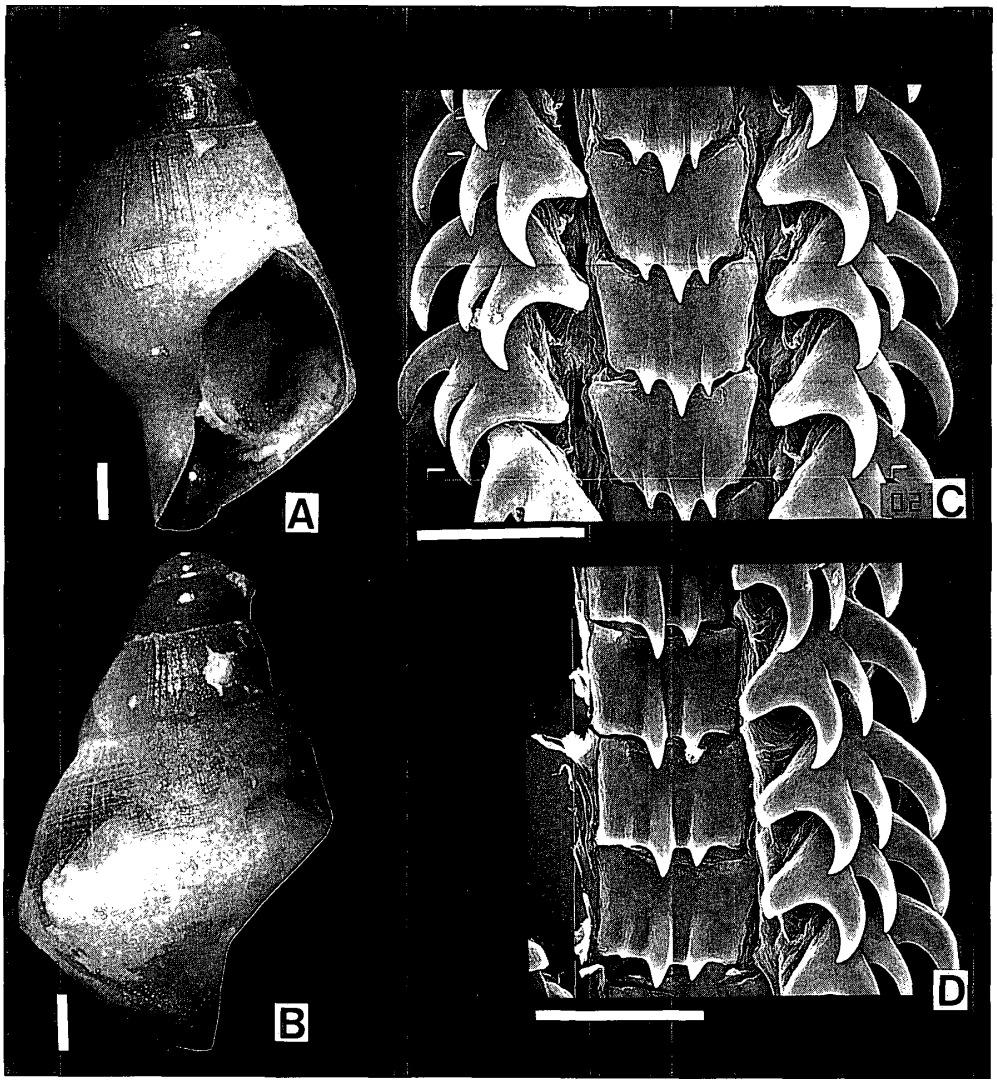
Probuccinum angulatum POWELL, 1951

(Figs. 100A-D)

Probuccinum angulatum POWELL, 1951, p. 145, pl. 7, fig. 27, Fig. K, 65.

Material examined: A single living specimen from St. 7; 1 empty shell from St. 8; 2 living specimens and 1 empty shell from St. 9; 1 living specimen from Günnerus Bank.

Description: The shell is broadly biconical, thin, small, translucently pale yellow in color, and has a conspicuous peripheral angle at the middle of the body whorl (Figs. 100A, B). The protoconch is large, about 2.75 in number of turns, 2.0 mm in diameter, almost conical, roundly inflated, and has smooth surface. The teleoconch is about 3.5 in number of turns, rapidly increases diameter towards the aperture. It is almost smooth, except for numerous, microscopic axial growth lines and very fine spiral lirae. The suture is almost flush. The upper whorl is large and moderately high. The body whorl has breadth being 65-77% of shell length. The aperture is almost rhombic in outline, with thin peristome. The middle area of the outer lip has an obtuse angle (about 100°). The inner lip is almost straight. The columellar lip is also straight. The siphonal canal is short, straight, open and weakly recurved. The inner wall is smooth.



Figs. 100A–D. *Probuccinum angulatum* POWELL. A, B. Shell; C, D. Radula. Scale A, B=1 mm; C, D=50 μm.

The operculum is oval, thin, translucently yellow in color, small to the aperture, corneous with low situated nucleus.

The radula is rachiglossate, 1 : 1 : 1 with 57 transverse rows, transparent, long and narrow (2.25 mm in length, 0.2 mm in width; 7.3 mm in SL) (Figs. 100C, D). The rhachidian tooth is almost rectangle, and has slightly incurved basal margin and three sharply pointed cusps. The central cusp is larger and stronger than lateral ones. The lateral teeth are massive and almost equal in width of the base to the rhachidian base. A single lateral tooth has almost straight base and incurved, sharply pointed, three strong cusps. The outermost cusp is slightly longer and stronger than the other two. The central cusp is smallest and weakest of all. The inner cusp is slightly stronger, but almost equal in length to the central cusp.

Measurements: See Table 21.

Previous distribution records (Fig. 101): Type locality: North of South Georgia, 53°51′S,

Table 21. Measurements and condition of *Probuccinum angulatum* POWELL.

No.	1	2	3	4	5	6
St.	7	8	9	9	9	G
SL (mm)	7.3	3.5	8.5	4.2	5.4	5.2
SW (mm)	4.8	2.7	5.5	3.0	—	3.7
SW/SL (%)	65.8	77.1	64.7	71.4	—	71.2
Condition	L	F	L	L	E	L

E: Empty and water-worn specimen; F: Freshly dead specimen; L: Specimen taken alive; G: Günnerus Bank (288 m deep).

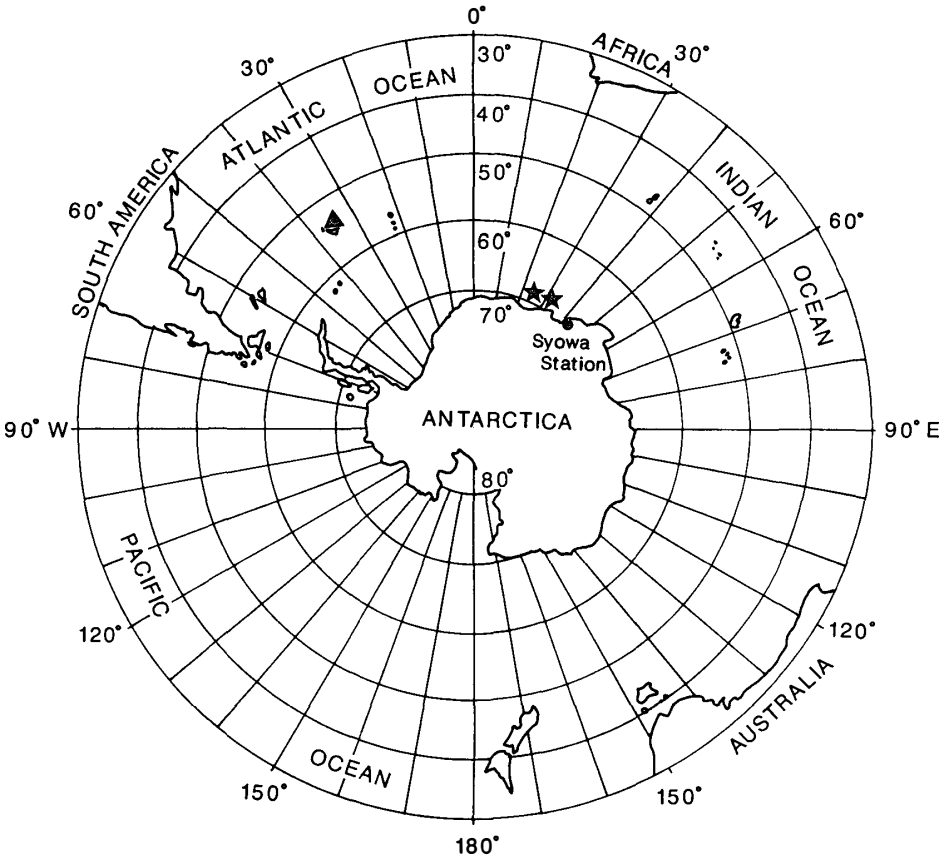


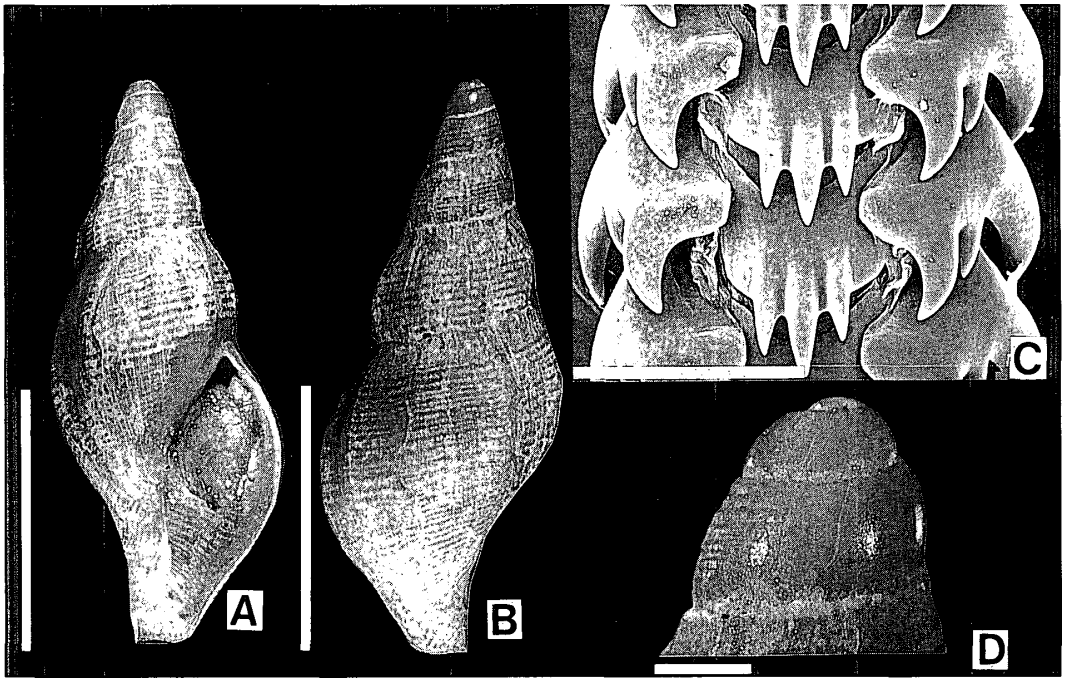
Fig. 101. Distribution of *Probuccinum angulatum* POWELL (Stars: Present study; Triangle: Type locality).

36°21′30″W, 200–236 m. Range: also South Georgia, 160 m (POWELL, 1951).

Remarks: This species had been known only from off South Georgia Islands, before POWELL (1951) rediscovered since the original description. The holotype specimen is larger than the present specimens (9.9 mm in SL, 7.0 mm in SW), but the holotype has five cusps on the left lateral and four cusps on the right, and the rachidian has an additional small denticle between the central and the right cusps. One of the examined specimens has rachidian tooth which lacks or vestigial outer cusp on the right (Fig. 100D).

Probuccinum costatum THIELE, 1912
(Figs. 102A-D)

Probuccinum costatum THIELE, 1912, p. 211, pl. 13, fig. 22; HEDLEY, 1916a, p. 58 (distribution record); POWELL, 1958, p. 194; POWELL, 1960, p. 151 (name only); EGOROVA, 1982, p. 41, fig. 177; DELL, 1990, p. 171, fig. 285.
Probuccinum cf. *costatum*: HAIN, 1990, p. 57, pl. 5, fig. 8, pl. 23, fig. 5.
Material examined: A single living specimen from St. 7; 1 living specimen and 2 empty shells from St. 8.
Description: The shell is small, translucent, fusiform, moderately thin, with elevated conical spires (Figs. 102A, B). The coloration of shell is reddish brown. The protoconch is large, conical, about 1.5 in number of turns, 1.7 mm in diameter, 2.2 mm in



Figs. 102A-D. *Probuccinum costatum* THIELE. A, B. Shell; C. Radula; D. Protoconch. Scale A, B=10 mm; C=50 μm; D=1 mm.

height, with slightly inflated whorls, and smooth surface. The teleoconch is not so inflated, breadth being 41-44% shell length, and has a weak shoulder angle. The suture is constricted. The surface is rough, with no periostracum. There are 8 oblique axial ribs on the body whorl that are crossed with slender and distinct spiral cords. The body whorl is moderately inflated, about 1/2 of shell length. The base is moderately constricted. Axial ribs never reach the base, and spiral cords become stronger abapically. The columellar lip is straight. The siphonal canal is open and slightly twisted. The aperture is lunate, with thin and sharp outer lip. The inner lip is slightly incurved. The columellar lip is slightly curved abaxially. A very thin callus is deposited on the inner and columellar lips. The inner wall is smooth.

The operculum is small to the aperture, with length being 1/2 of the shell length, corneous, translucent yellow in color, elliptical with nucleus situated low and outside.

The radula is rachiglossate, 1 : 1 : 1 with 115 transverse rows of teeth, transparent, long and very narrow (4.0 mm in length, 0.18 mm in width; 14.7 mm in SL) (Fig. 102C). The rhachidian tooth is much higher than wide, and has strongly incurved base and three sharply pointed cusps. The central cusp is larger and stronger than lateral ones. The lateral teeth are massive and almost equal in width to the rhachidian base. A single tooth has three strong cusps that are incurved and have sharply pointed tips. The outermost and innermost cusps are equal in prominence, strong and strongly incurved. The central cusp is smallest of all.

Measurements:

SL 14.7 mm, SW 6.4 mm (living specimen; St. 7).
SL 21.1 mm, SW 8.6 mm (living specimen; St. 8).
SL 17.7 mm, SW 7.2 mm (Freshly dead specimen; St. 8).
SL — mm, SW 7.4 mm (Empty and water-worn specimen; St. 8).

Previous distribution records (Fig. 103): Type locality: Gauss Station, Davis Sea, 350 m. Range: off Mertz Glacier Tongue, 288 fathoms, Davis Sea, 120 fathoms, near Shackleton Ice Shelf, 120 fathoms (HEDLEY, 1916a); off Enderby Land, 193 m, 220 m, 300 m (POWELL, 1958); Davis Sea (EGOROVA, 1982); eastern Weddell Sea (HAIN, 1990); Bransfield Strait,

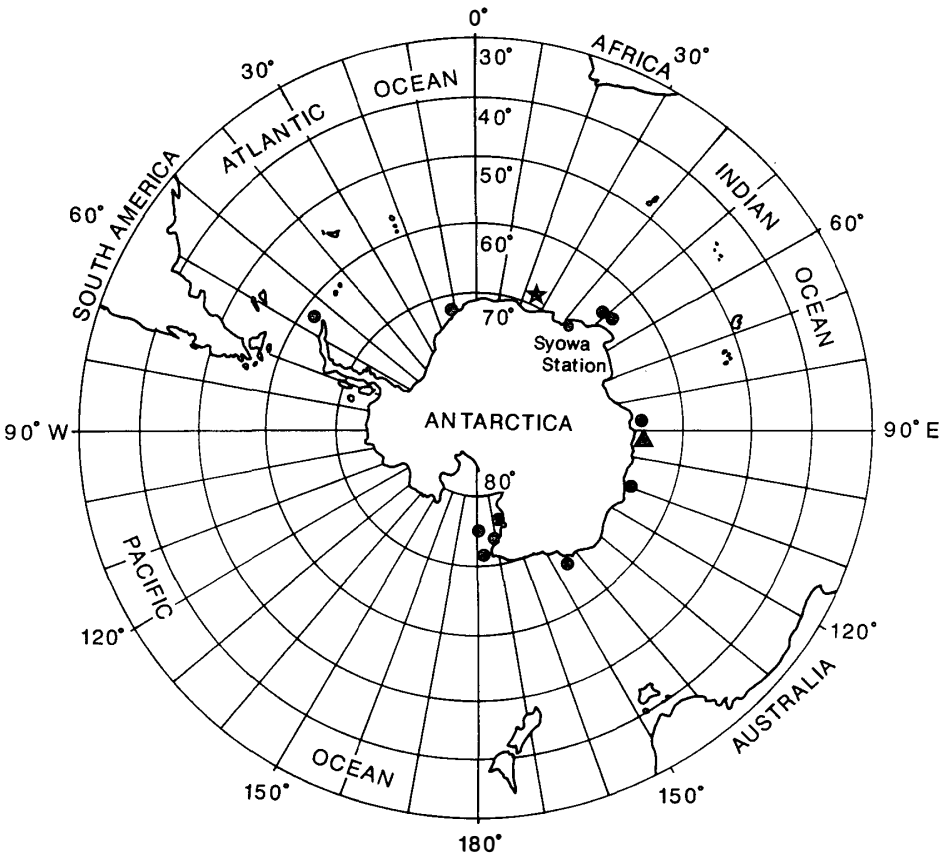


Fig. 103. Distribution of *Probuccinum costatum* THIELE (Large dots: Previous distribution records; Star: Present study; Triangle: Type locality).

Antarctic Peninsula, 210–220 m (DELL, 1990); Ross Sea, 205–613 m (DELL, 1990).
Remarks: EGOROVA (1982) reported this species from the Davis Sea. Her specimen was almost the same in size to the present specimens (about 14 mm in SL) but, it has more ovoid shell with a low spires. She did not observe the radula. Her specimen requires a confirmation. HAIN (1990) reported *Probuccinum* cf. *costatum* from the eastern Weddell Sea. His specimen is smaller than the present specimens, and it has ovoid shell much more axial ribs. However, the radula of his specimen is agreeable with that of the present specimens. HAIN's specimen is considered to be an immature specimen of *P. costatum*.

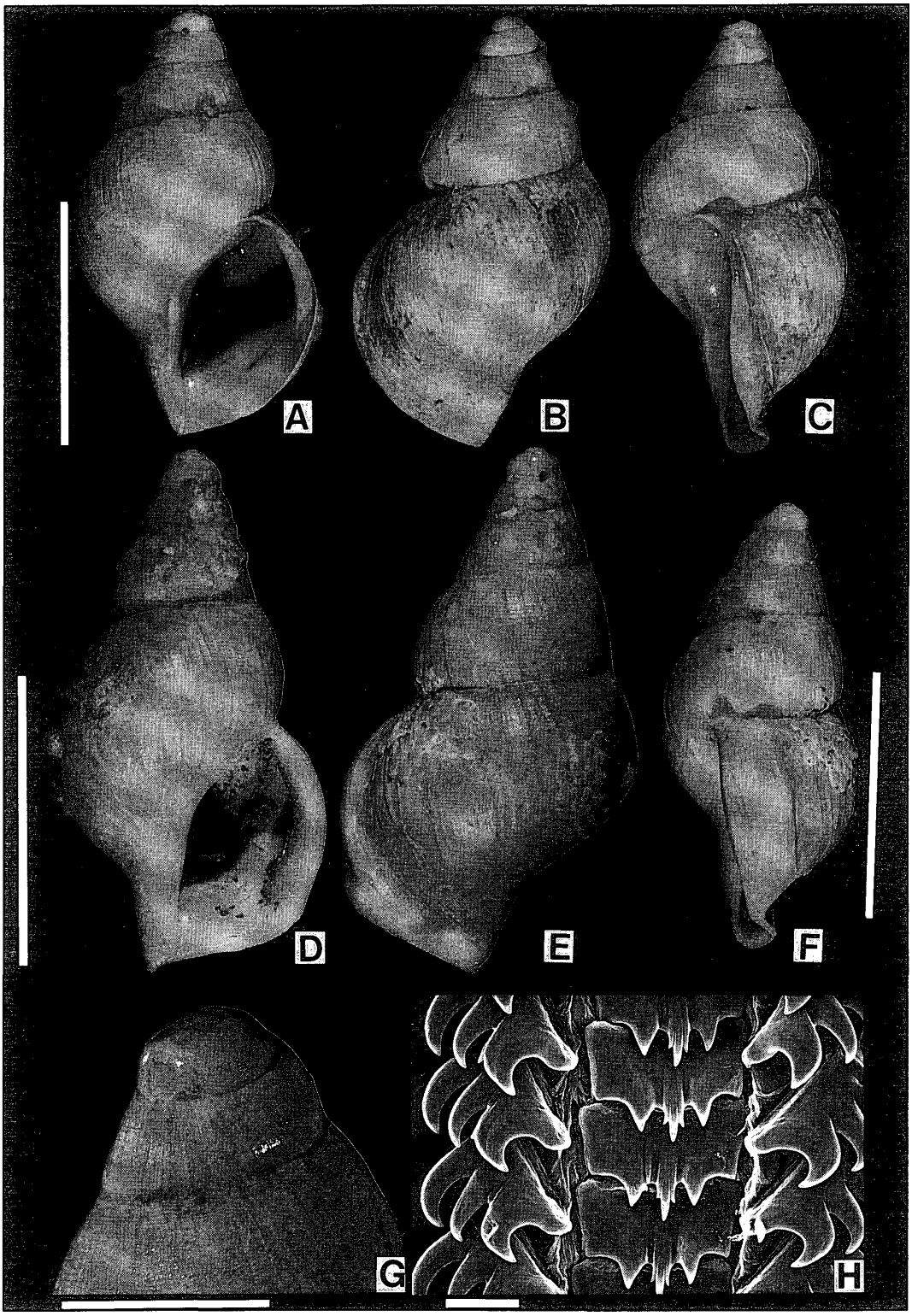
Probuccinum tenuistriatum HEDLEY, 1916
(Figs. 104A–H)

Probuccinum tenuistriatum HEDLEY, 1916a, p. 58, pl. 8, figs. 95, 96; POWELL, 1958, p. 194; POWELL, 1960, p. 151 (name only); HORIKOSHI *et al*., 1979, p. 21 (distribution record); EGOROVA, 1982, p. 42, figs. 52, 178, 179; HAIN, 1990, p. 58, pl. 5, figs. 10a, b, pl. 13, fig. 7.
Pareuthria sp.: OKUTANI, 1986, p. 279, table 3, pl. 1, fig. 9 (distribution record).
Material examined: A single empty shell from Breid Bay Stn. B (collected by JARE-25); 1 single living specimen from St. 7.
Description: The shell is obese fusiform, large in size for the genus, rather thin, frosted pure white in color (Figs. 104A–C). The protoconch is large, elevated, roundly inflated, about 2.5 in number of turns, 2.3 mm in diameter, 1.5 mm in height, frosted white in color, and has smooth surface (Fig. 104G). The teleoconch is about 3.3 in number of turns, weakly inflated, and has numerous, very fine growth lines of irregular strength and crowded, microscopic and a little wavy spiral lines on the surface. The spiral lines are weaker than growth lines. The surface has a very thin, caducous, straw-colored periostracum which remained only a limited area on the body whorl. The suture is moderatly constricted. The upper whorl is large. The body whorl is well roundly inflated with breadth being 60% of shell length. The base is constricted. The aperture is rather large, oval in outline with thin, smooth and round outer lip which is reflected outwardly. The columellar lip is gently rounded. The columellar and inner lips has glossy, thin, whitish callus. The basal lip is smooth and round. The anterior siphonal canal is open and slightly recurved abaxially. The inner wall is glossy white in color and almost smooth.

The operculum is slightly small to the aperture in size, yellow, corneous and oblong with downwardly situated nucleus.

The radula is rachiglossate, 1 : 1 : 1 with 78 transverse rows, translucent pale brown, long but very narrow (3.75 mm in length, 0.15 mm in width; 16.9 mm in SL) (Fig. 104H). The rhachidian tooth is much wider than high, with almost straight base and three cusps. The central cusp of rhachidian tooth is longer but slenderer than lateral cusps, and it carries a small denticle on both sides. Lateral cusps are triangular, large and strong. The lateral teeth are massive and almost equal in width to the rhachidian base. A single tooth has three strong cusps that are strongly incurved and have sharply pointed tips. The outermost one is longer than the others. The central one is weakest of all. The innermost one is wider and stronger than others. The base of laterals is almost straight.
Measurements:

SL 17.9 mm, SW 9.8 mm (empty shell; JARE-25, St. B).



Figs. 104A-H. *Probuccinum tenuistriatum* HEDLEY. A-C, G, H. From St. 7; D-F. From Breid Bay by JARE-25. A-F. Shell; G. Protoconch; H. Radula. Scale A-F = 10 mm; G = 1 mm; H = 100 μm.

SL 16.9 mm, SW 10.1 mm (living specimen; St. 7).

Previous distribution records (Fig. 105): Type locality: D'Urville Sea, Adélie Land, 283 m. Range: off Mackenzie Sea, 456 m, off Enderby Land 300 m, 193 m and 220 m, off MacRobertson Land, 177 m (POWELL, 1958); off Syowa Station, Enderby Land, 98 m (HORIKOSHI *et al*., 1979); Davis Sea, 280 m (EGOROVA, 1982); Breid Bay, 215 m (OKUTANI, 1986); eastern Weddell Sea, 40-660 m (HAIN, 1990).

Remarks: Both HEDLEY's and EGOROVA's specimens are larger than the examined specimens, and have a complete, raised varix. The examined specimens may be younger than those specimens, because the varix near the aperture is still incompletely raised. The rhachidian tooth of this species illustrated by EGOROVA (1982) and HAIN (1990), has three cusps of almost equal in size and prominence. However, the examined specimens has the central cusp of the rhachidian tooth with a small denticles on both sides weaker than the lateral cusps. The other radular characters are almost the same with EGOROVA's and HAIN's illustrations.

OKUTANI (1986) reported *Pareuthria* sp. from the Breid Bay. OKUTANI's *Pareuthria* sp. is grossy straw in color, and has regularly and widely spaced axial cord on the teleoconch (Figs. 104D-F). But, other shell characters, such as the shell form, the axial varix near the aperture and the form of protoconch, warrant it to be *P. tenuistriatum*.

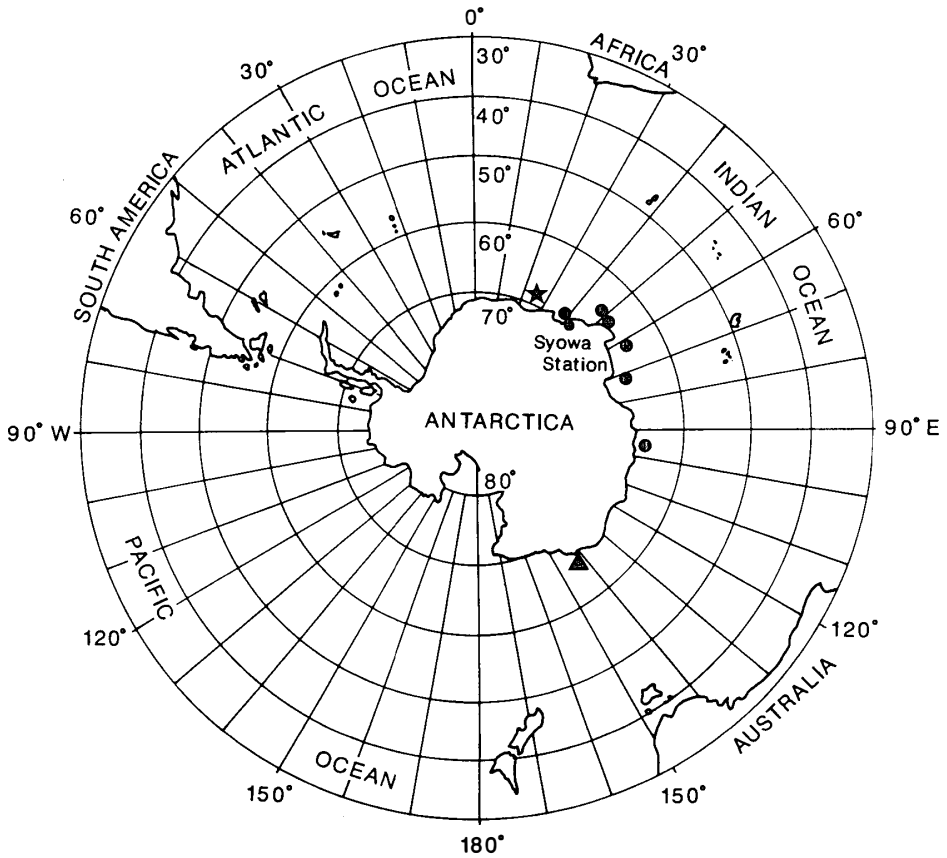


Fig. 105. Distribution of *Probuccinum tenuistriatum* HEDLEY (Large dots: Previous distribution records; Star: Present study; Triangle: Type locality).

Genus *Chlanidota* MARTENS, 1878

Type species (monotypy): *Cominella* (*Chlanidota*) *vestita* MARTENS, 1878

Chlanidota elongata (LAMY, 1910)

(Figs. 106A–H)

Cominella (*Chlanidota*) *vestita* var. *elongata* LAMY, 1910b, p. 319; LAMY, 1911a, p. 6, pl. 1, fig. 6.

Chlanidota elongata: POWELL, 1951, p. 140, fig. L, 76 (dentition and distribution record); POWELL, 1960, p. 150 (name only); HORIKOSHI *et al*., 1979, p. 22, fig. 8 (distribution record); HAIN, 1990, p. 55, pl. 5, fig. 4, pl. 13, fig. 1.

Chlanidota lamyi DELL, 1990: p. 182, fig. 309 (nom. nov. for *vestita* var. *elongata* LAMY, 1910, non *Coominella elongata* DUNKER, 1857).

Material examined: A single living specimen from St. 10 (JARE-21); 1 living specimen from St. 25 (JARE-21); 1 empty shell from St. 9 (JARE-26).

Description: The shell is ovoidal, thin, frosted white in color (Figs. 106A, B). The protoconch is eroded, and exposes whitish ostracum. The teleoconch is well inflated, with regularly and widely spaced spiral cords which are emphasized by thick, dirty pale yellowish periostracum, and crowded, microscopic growth lines on the shell surface. The suture is well constricted, with very narrow but flat sutural ramp. The upper whorl is rather elevated and the body whorl is well roundly inflated, large, with breadth being about 60% of shell length, and has about 30 spiral cords. The strength of these spiral cords of the upper to middle areas of the body whorl is not consistent, while prominency of them on the base is consistent. The aperture is large, about 67% of shell length, lunate with a thin and smooth peristome. The outer lip is thin, round and smooth, and has a sharp edge. The inner lip is round and translucently glossy white. The columellar lip is gently curved. The inner and columellar lips have a thin callus. The anterior siphonal canal is widely open and shallow, reflected dorsally with a low fasciole. The inner wall is smooth and glossy white in color. As the shell is translucent, the superficial carinae are visible through the shell.

The operculum is horny, very small for the aperture, about 30% of aperture length, almost orbicular in outline. The nuculeus is situated below.

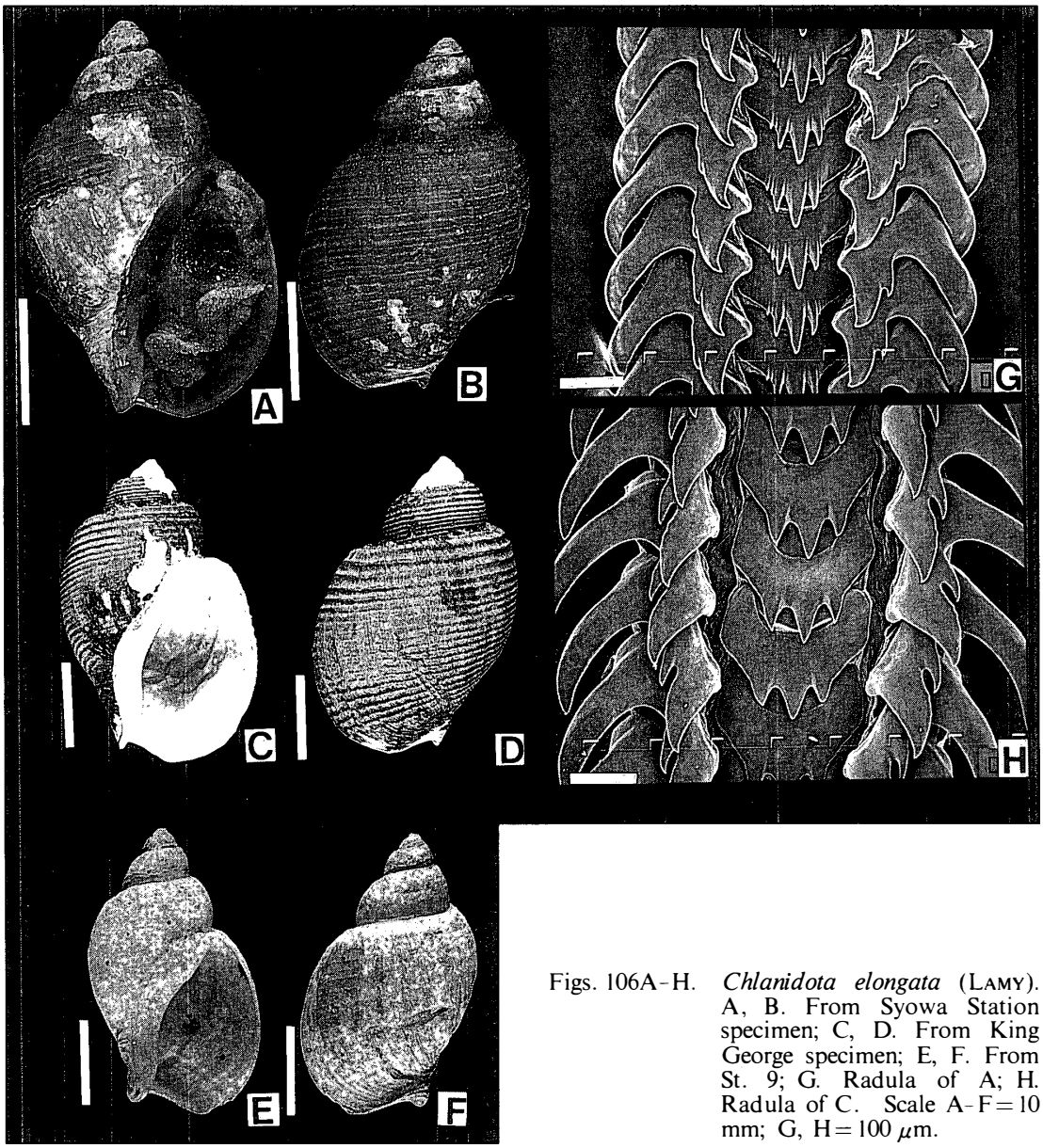
The radula is rachiglossate, 1 : 1 : 1 with 69 transverse rows, translucently pale brown in color, long and wide (9.5 mm in length and 0.8 mm in width; 25.7 mm in SL) (Fig. 106G). The rhachidian tooth is wide, and has three large cusps and two or three very small denticles. The middle area of the base is deeply concave. The central cusp is larger and stronger than the others. The lateral cusps are situated closely to the central cusp, and has one or two very small and weak denticles on each lateral outside. The lateral teeth are massive, and wider than the rhachidian at the base. A single tooth has three incurved cusps. The outermost one is very long and strong. The central one is very small and weak. The innermost one is wide, about 1/2 of length of outermost one. The baseline of the lateral is a little wavy.

Measurements:

SL 25.7 mm, SW 15.9 mm (living specimen; JARE-21, St. 10).

SL 29.8 mm, SW 18.0 mm (living specimen; JARE-21, St. 25).

SL 31.4 mm, SW 18.4 mm (empty shell; JARE-26, St. 9).



Figs. 106A-H. *Chlanidota elongata* (LAMY). A, B. From Syowa Station specimen; C, D. From King George specimen; E, F. From St. 9; G. Radula of A; H. Radula of C. Scale A-F = 10 mm; G, H = 100 μm.

Previous distribution records (**Fig. 107**): Type locality: King George Island, South Shetland Islands, 420 m. Range: South Shetland Islands, 200-810 m (POWELL, 1951); off Syowa Station, Enderby Land, 98 m (HORIKOSHI *et al.*, 1979); eastern Weddell Sea, 617 m (HAIN, 1990); South Orkney Islands, 298-598 m (DELL, 1990); South Shetland Islands, 809-1116 m (DELL, 1990); west of Antarctic Peninsula, 732-750 m (DELL, 1990); Elephant Island, 300 m (DELL, 1990); Bransfield Strait, 769 m (DELL, 1990); Weddell, Sea, 990-1080 m (DELL, 1990).

Remarks: *Chlanidota elongata* was first described by LAMY (1910) from King George Island, South Shetland Islands. The shells under examination is whiter and thicker than the specimens from King George Island (Figs. 107C, D), and has fewer, wider and stronger spiral cords with a remarkably thick periostracum and dark brown color.

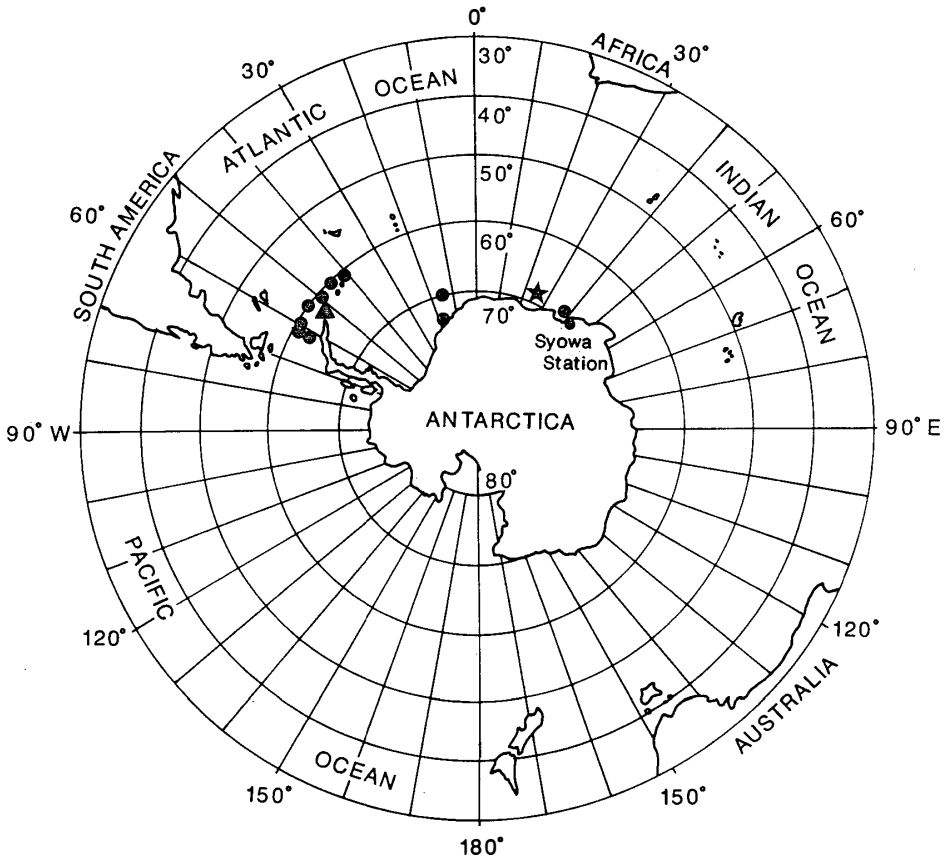


Fig. 107. Distribution of *Chlanidota elongata* (LAMY) (Large dots: Previous distribution records; Star: Present study; Triangle: Type locality).

Genus *Prosipho* THIELE, 1912

Type species: *Prosipho gaussianus* THIELE, 1912 (S.D. by THIELE, 1929)

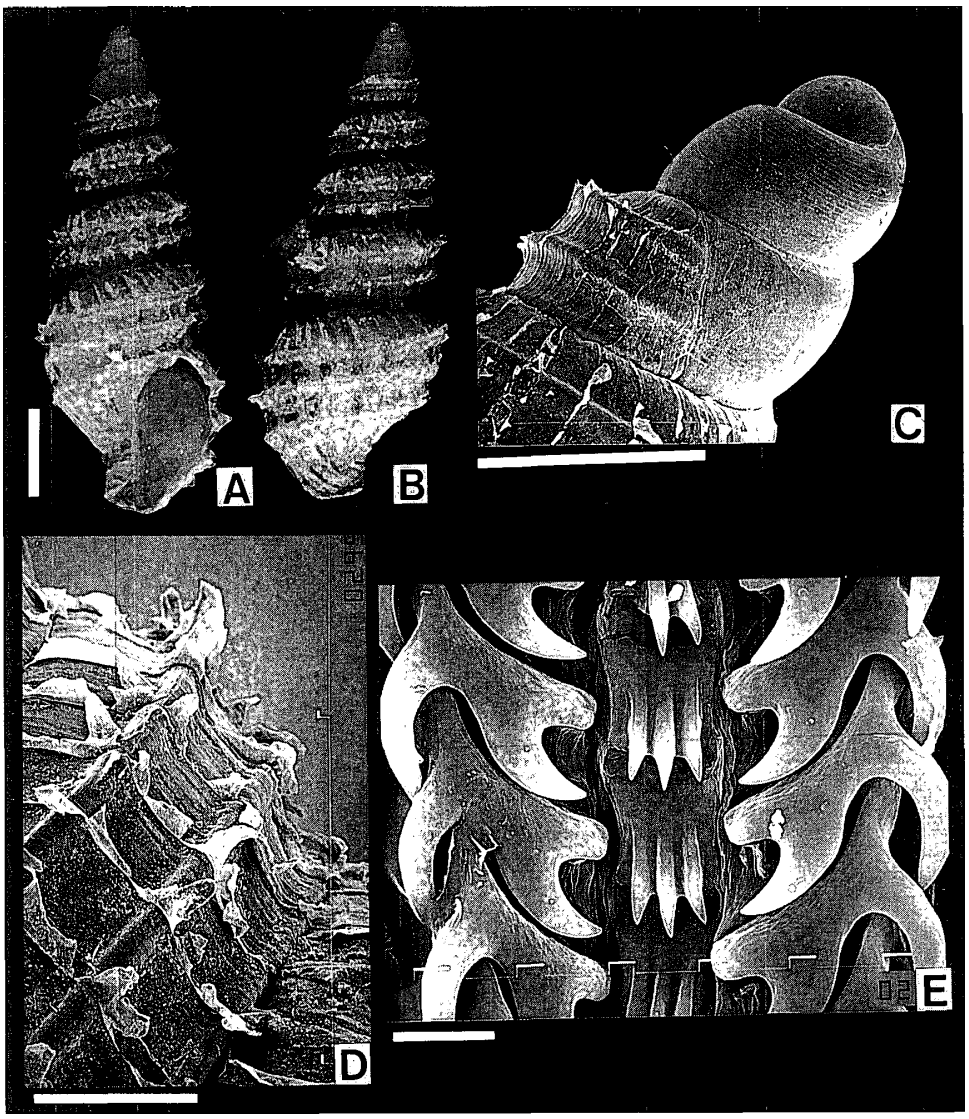
***Prosipho gracilis* THIELE, 1912**

(Figs. 108A-E)

Prosipho gracilis THIELE, 1912, p. 207, pl. 12, fig. 33; POWELL, 1960, p. 152 (name only); DELL, 1972a, p. 4 (distribution record); EGOROVA, 1982, p. 45, fig. 190; DELL, 1990, p. 193, fig. 343.

Material examined: A single living specimen from St. 5.

Description: The shell is turreted, small, thin, translucently white in color (Figs. 108A, B). The protoconch is conical, large, elevated, about 2.5 in number of turns, 0.6 mm in diameter, 0.8 mm in height, glossy, translucently white in color, and has numerous spiral threads on the surface (Fig. 108C). The teleoconch is about 4.2 in number of turns, slightly inflated, with two regularly spaced and round topped spiral ribs which are crossed by irregularly interspaced weak axial lirae. The surface is frosted white, and is covered by a thin and transparent periostracum, which creates a small spine-like projection at junctions of spiral ribs and axial lirae, and is particularly emphasized on the axial lirae presenting a lamellose appearance (Fig. 108D). The suture is costricted, and the sutural ramp is gently convex. The interspace of spiral rib is shallowly concave. The upper whorl is



Figs. 108A–E. *Prosipho gracilis* THIELE. A, B. Shell; C. Protoconch; D. Peristrical hair; E. Radula. Scale A, B=1 mm; C, D=500 μm; E=10 μm.

highly elevated. Two spiral ribs come to appearance from the first teleoconch, and become 8 on the body whorl. The axial lirae also come to appearance from the first teleoconch, and about 25 on the body and the penultimate whorls. On the base, the interspaces between axial lirae narrow abapically. The body whorl is about 1/2 of shell length, barely inflated with breadth being 36% of shell length. The base is constricted, and has 5 spiral ribs which are weaker than the upper 3, and has narrow interspaces. The aperture is small, about 1/3 of shell length, narrow fusiform. The outer lip is thin and undulating in corresponding to external ribs and interspaces. The inner lip is round and smooth. The columellar lip is smooth and almost straight. The inner and columellar lips have very thin whitish callus. The anterior siphonal canal is open, short and slightly recurved backwards.

The operculum is slightly small to the aperture in size, translucently pale yellow in

color, thin, corneous and elliptical, with low situated nuculeus.

The radula is rachiglossate, 1 : 1 : 1 with 68 transverse rows, translucent, long but very narrow (1.25 mm in length, 0.05 mm in width; 5.5 mm in SL) (Fig. 108E). The rhachidian tooth is small and almost square in outline, and has slightly incurved base and three sharp, pointed, strong cusps. The central cusp is slightly larger than the lateral cusps. The lateral teeth are very large and strong, and the width of the base is three times as large as the base of rhachidian. A single tooth has two strong cusps that are strongly incurved and have sharply pointed tips. The outer cusp is long, but narrow. The inner one is short, but stout. The innermost cusp is short and round, and the outer one that tapers off to a point, is rather short, length is 1/3 of basal length. The base of the laterals are elongated slightly incurved.

Measurements: SL 5.5 mm, SW 2.0 mm.

Previous distribution records (Fig. 109): Type locality: Gauss Station, Davis Sea. Range: West Arm, the vicinty of Mawson Base, 67°36′S, 62°53′E, 100 m (DELL, 1972a); Ross Sea, 342–433 m (DELL, 1990).

Remarks: This species is similar to *Prosipho antarctidis* (PELSENEER, 1903), from West Antarctica, and *P. similis* THIELE, 1912, from Davis Sea. In the living condition, this species is easily distinguishable from these similar species by having small spine-like periostracal projections. However, the empty and water-worn specimens of these three

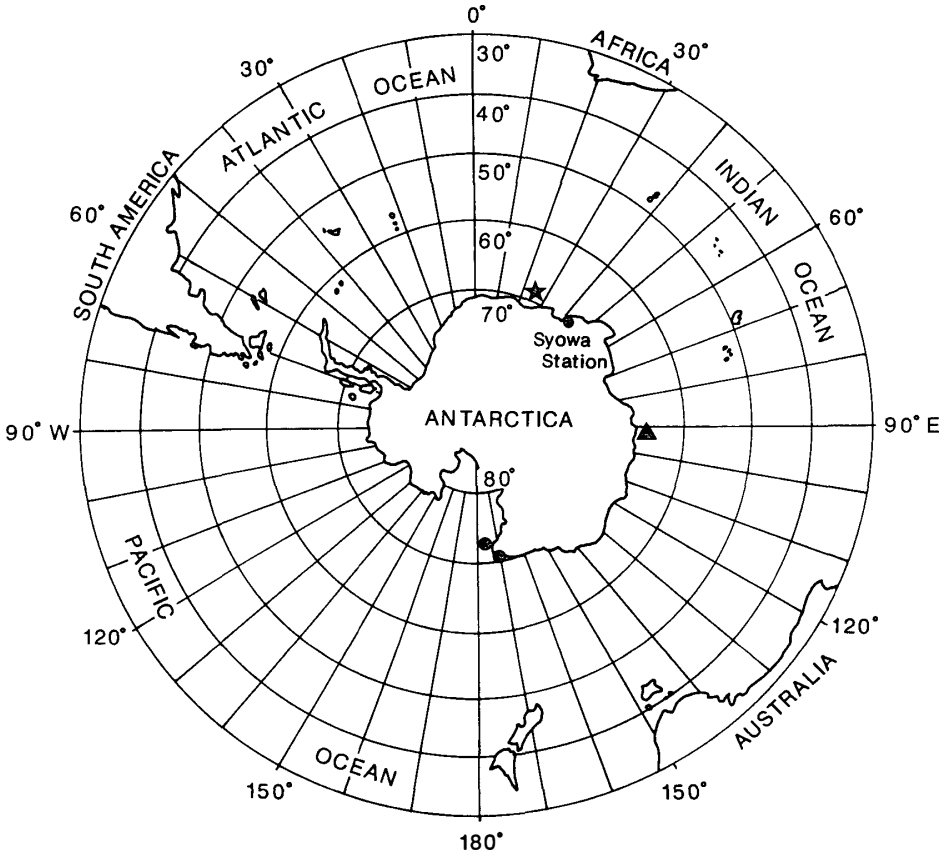


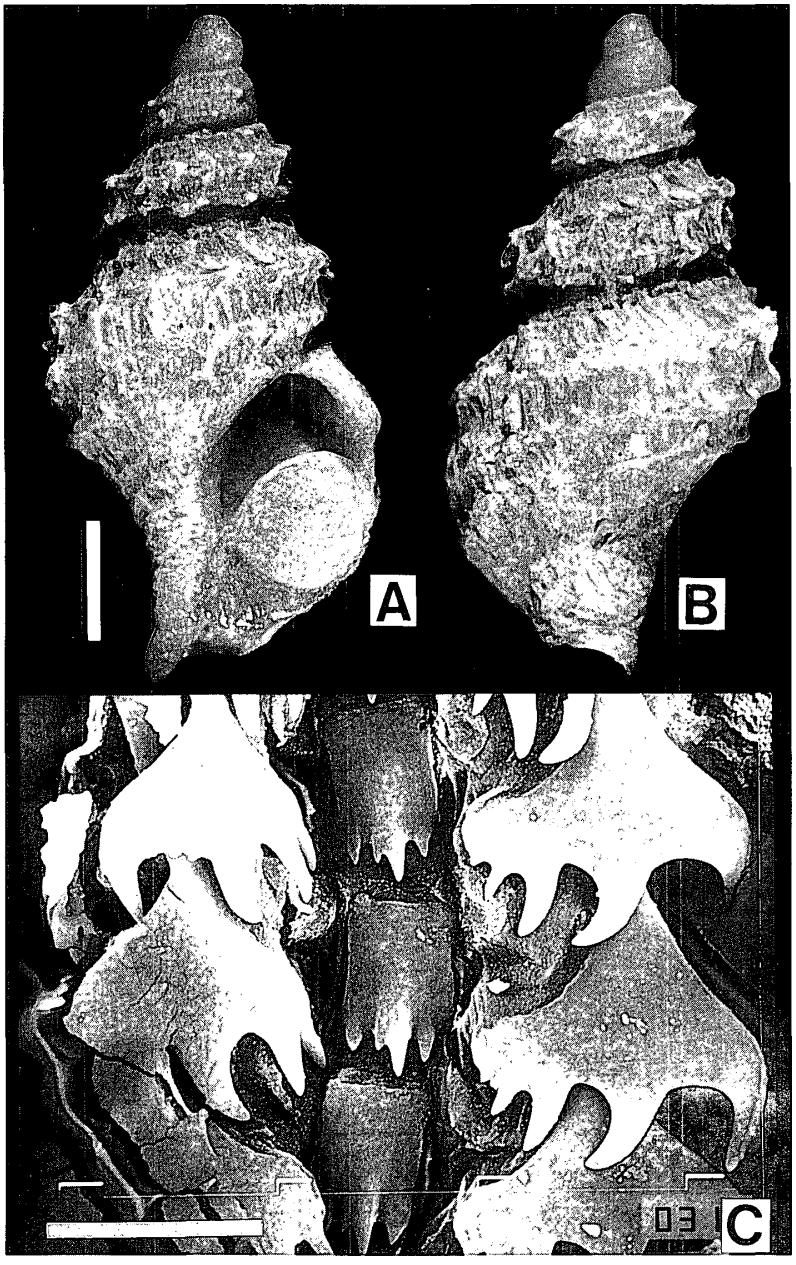
Fig. 109. Distribution of *Prosipho gracilis* THIELE (Large dots: Previous distribution records; Star: Present study; Triangle: Type locality).

species are difficult to be identified by periostracal feature. But, the axial sculptures of *P. similis* is weaker than that of this species, and *P. antarctidis* has wider and stronger spiral ribs.

Prosipho hunteri HEDLEY, 1916

(Figs. 110A-C)

Prosipho hunteri HEDLEY, 1916a, p. 56, pl. 8, fig. 92; POWELL, 1951, p. 147 (distribution



Figs. 110A-C. *Prosipho hunteri* HEDLEY. A, B. Shell; C. Radula. Scale A, B= 1 mm; C=10 μm.

record); POWELL, 1958, p. 196 (distribution record); POWELL, 1960 p. 152 (name only); ARNAUD, 1972b, p. 130; DELL, 1990. p. 194, fig. 322.
Prosipho cf. *hunteri*: HAIN, 1990, p. 60, pl. 6, fig. 2, pl. 14, fig. 3.
Material examined: Two living specimens from St. 5.
Description: The shell is rather small, fusiform, translucently white in color, rather thick, with an elevated spire (Figs. 110A, B). The protoconch is large, short conical, elevated, about 2.4 in number of turns, 0.8 mm in diameter, 0.9 mm in height, semi-glossy, translucent white in color, with smooth surface, but two spiral ribs at the end. The teleoconch is about 3 in number of turns, slightly inflated, with strong and round topped spiral ribs which are crossed by fine axial growth lirae. The surface is translucently frosted white, and is covered by a thin straw-colored periostracum. The suture is constricted, and the sutural ramp down to the abapicalmost rib is narrowly grooved. The upper whorl is small and low. The spiral ribs come to appearance from the first teleoconch, and 2 on the first teleoconch, 3 on the penultimate whorl and 8 on the last whorl including 5 ribs on the base. The first rib is weak, and situated just above the suture. The second rib is stronger than the third and fourth ribs, and basal ribs are very weak. The first to third ribs are rather irregularly spaced and have small and weak nodules. The nodules on the second rib are larger than the others, and those on the first and third ribs are very weak. The basal ribs are almost smooth. The body whorl is very large, with height being about 2/3 of shell length, and breadth 50% of shell length. The base is slightly constricted. The aperture is moderate in size, about 1/2 of shell length, and the outer lip is rather thick and nearly polygonal in outline. The inner lip is round and smooth. The columellar lip is short and straight. The inner and columellar lips have a thin and translucent callus. The anterior siphonal canal is open, short, oblique and recurved backwards. The inner wall is glossy white.

The operculum is slightly small to the aperture in size, translucent yellow in color, thin, corneous and oblong with low situated nuculeus.

The radula is rachiglossate, 1 : 1 : 1, translucent, long but very narrow (1.25 mm in length, 0.025 mm in width; 5.5 mm in SL) (Fig. 110C). The rhachidian tooth is narrow, squarish, and has almost straight base and four cusps. The centarl cusp is larger and stronger than the lateral cusps, and carries a very small cusp on the left side. The lateral cusp on both ends are small and weak. The lateral teeth are remarkably large and wide, and the width of the base is about three times the rhachidian base. A single tooth has five cusps that become smaller and weaker inwardly, and a long outer basal projection. The first (outermost) cusp is strongly incurved. The second cusp is also strongly incurved, and the third is slightly incurved. The fourth cusp is weak and almost straight. The fifth (innermost) cusp is very small and weak. The base is wide, and has a slightly incurved base. The basal projection is long, occupying 1/2 of length of the base, but slender.
Measurements:

SL 5.5 mm, SW 2.8 mm (living specimen; St. 5).
SL 4.5 mm, SW 2.6 mm (living specimen; St. 5).

Previous distribution records (Fig. 111): Type locality: Commonwealth Bay, Adélie Land, 45 m and 81–90 m. Range: Stromness Harbour to Larsen Point, South Georgia, 122–136 m, Off South Georgia, 53°51′30″S, 36°18′30″W, 245 m (POWELL, 1951); Off Enderby Land, 193 m, 220 m and 300 m (POWELL, 1958); Point Geologie, 90–120 m, and

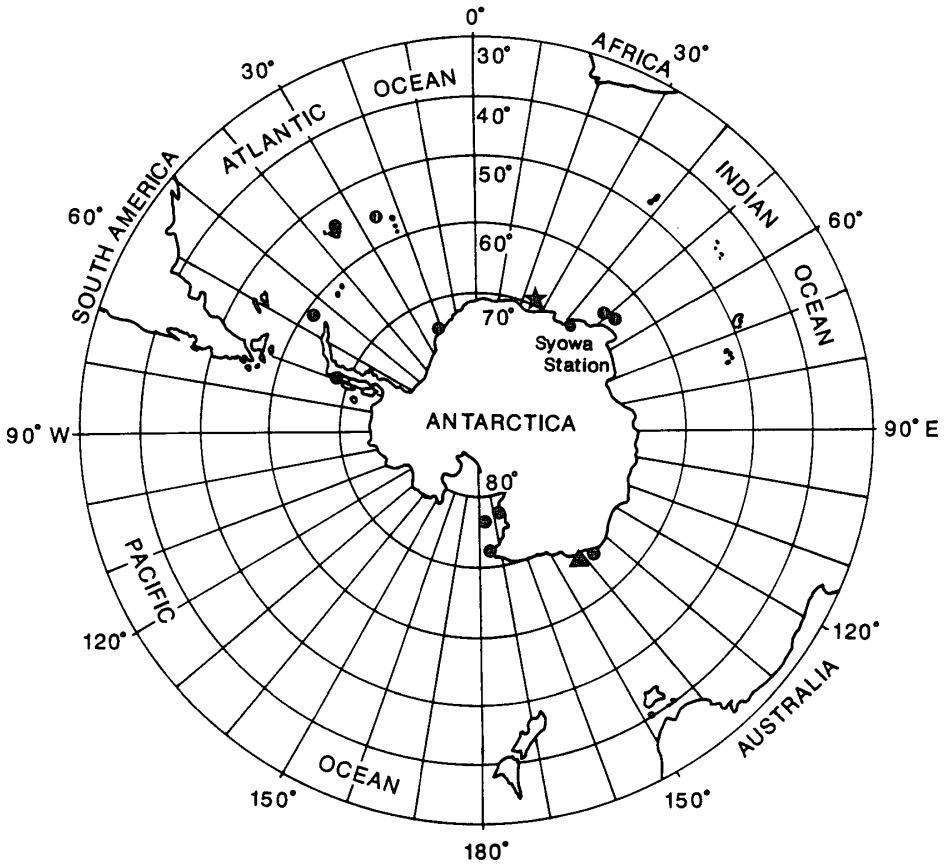


Fig. 111. Distribution of *Prosipho hunteri* HEDLEY (Large dots: Previous distribution records; Star: Present study; Triangle: Type locality).

Cape Geodesie, 150–250 m, Adelie Land (ARNAUD, 1972b); eastern Weddell Sea, 441 m (HAIN, 1990); off South Sandwich Islands, 148–201 m (DELL, 1990); Bransfield Strait, Antarctic Peninsula, 210–220 m (DELL, 1990); Marguerite Bay, Antarctic Peninsula, 64 m (DELL, 1990), Ross Sea, 122–433 m (DELL, 1990).

Remarks: This species is similar to *Prosipho shiraseae* n. sp., from Breid Bay in having an elongate fusiform shell and conspicuous spiral ribs (Figs. 118A, B). But, the latter species is distinguishable from the former in following characters: 1) The well roundly inflated protoconch; 2) some very weak spiral grooves on the protoconch; 3) small and less prominent projections on only the first rib; and 4) no basal rib.

Prosipho macleani HEDLEY, 1916

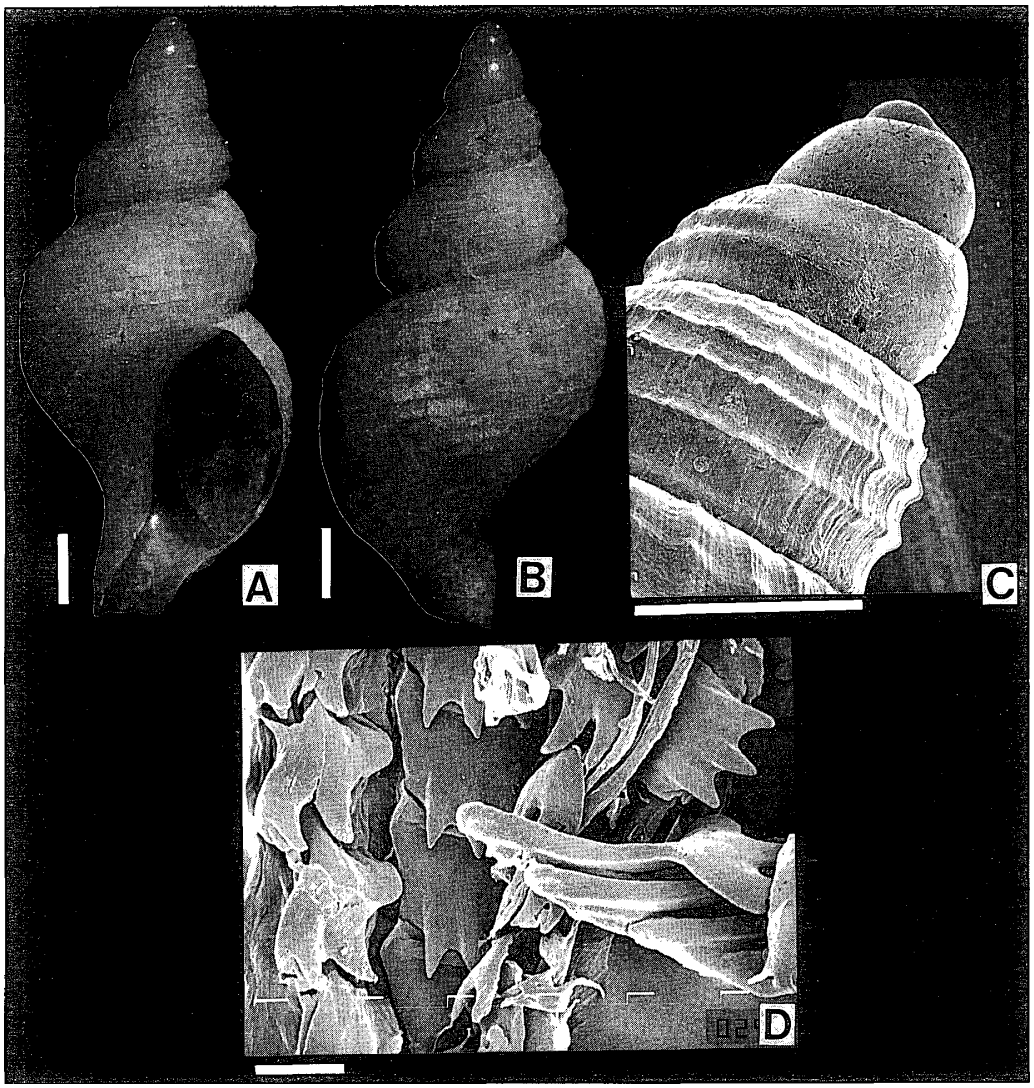
(Figs. 112A–D)

Prosipho mundus macleani HEDLEY, 1916a, p. 57, pl. 8, fig. 94.

Prosipho macleani: POWELL, 1958, p. 196 (distribution record); POWELL, 1960, p. 152 (name only).

Material examined: A single living specimen from St. 7; 2 empty shells from St. 8.

Description: The shell is large, fusiform, translucently white in color, with an elevated spire (Figs. 112A, B). The protoconch is large, about 2.6 in number of turns, 1.3 mm in



Figs. 112A-D. *Prosipho macleani* HEDLEY.
A, B. Shell; C. Protoconch; D. Radula. Scale A-C=1 mm; D=10 μm.

diameter, 1.0 mm in height, glossy, translucently white in color, and has smooth surface (Fig. 112C). The teleoconch is about 3.2 in number of turns, moderately inflated, with regularly spaced and round topped spiral riblets which are crossed by almost regularly spaced, weakly raised axial lirae and crowded microscopic growth lines. The surface is covered by a very thin and transparent periostracum. The suture is constricted. The spiral riblets are 2 on the first teleoconch, 4 on the penultimate whorl and 12 on the last whorl including those on the base. The first spiral riblet is weaker than the second to the fourth ones. The upper whorl is large and elevated. The body whorl is very large, about 70% of shell length, well inflated, with width being 50% of shell length. In the body whorl, the fifth to the basalmost riblets are almost same in strength. The interspaces between riblets are grooved. The raised axial lirae tend to become weaker abapically, and the area from below the third spiral riblet to the basalmost one is present only growth lines. The penultimate whorl has 20 raised axial lirae. The base is constricted, and has 5 spiral

riblets. The aperture is ovate, large, about 50% of shell length. The outer lip is thin and a little undulating in corresponding to external riblets and interspaces. The area from inner to columellar lips is smooth with a thin white callus. The columellar lip is slightly twisted. The anterior siphonal canal is open, rather long and oblique.

The operculum is small to the aperture in size, translucently pale brown in color, thin, corneous and obovate with low situated nuculeus.

The radula is rachiglossate, 1 : 1 : 1, transparent, very long but narrow (2.0 mm in length and 0.075 mm in width; 8.1 mm in SL) (Fig. 112D). The rhachidian tooth is moderate in size and has almost square base, and three strong, sharply pointed cusps. The central cusp is slightly larger than lateral cusps. The base of lateral teeth is about two times rhachidian base. A single tooth has two large and stout cusps that are strongly incurved, with outer and inner basal projections. The outer cusp is larger and stronger than the inner one, and has bifurcate, rather obtuse tips. The inner cusp has a rather obtuse tip. The outermost cusp is long and slender, and it is tapered off to a point. The innermost cusp is round.

Measurements:

SL 8.1 mm, SW 4.0 mm (living specimen; St. 7).

SL —mm, SW — mm (empty and broken shell; St. 8).

SL —mm, SW — mm (empty and bropen shell; St. 8).

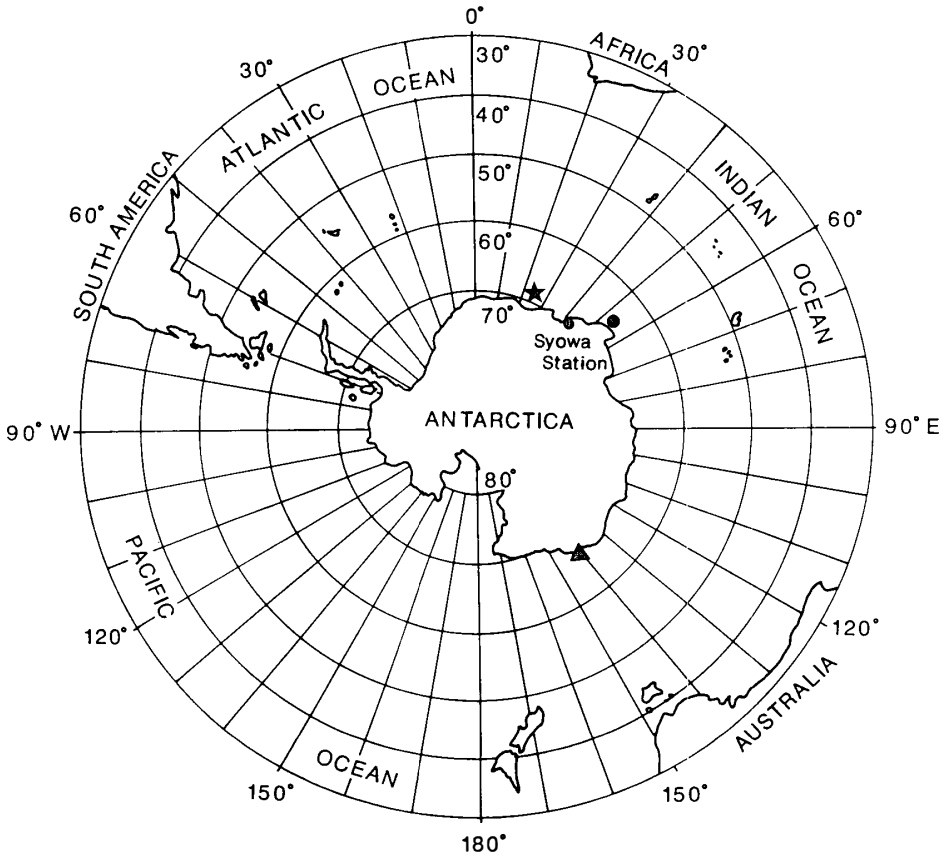


Fig. 113. Distribution of *Prosipho macleani* HEDLEY (Large dot: Previous distribution record; Star: Present study; Triangle: Type locality).

Previous distribution records (**Fig. 113**): Type locality: Commonwealth Bay, Adélie Land, 45 m. Range: off Enderby Land, 220 m (POWELL, 1958).

Remarks: This species is similar to *Prosipho mundus* SMITH, 1915 in having strong spiral ribs, raised axial lirae and projected junctions. The radular characters of these two species are also similar. But, *P. mundus* is different from this species in following characters: 1) Whorls not well inflated; 2) spiral ribs stronger; 3) aperture smaller; and 4) anterior siphonal canal short (Figs. 114A, B), although ARNAUD (1972b) considered *P. macleani* is a large specimen of *P. mundus*.

This species is also similar to *P. spiralis* THIELE, 1912 (Figs. 116A–C), *P. bisculptus* THIELE, 1912 and *P. gaussianus* THIELE, 1912, all from the Davis Sea. However, the spiral ribs in all of these species are stronger than those of *P. macleani*. The protoconchs of *P. bisculptus* and *P. spiralis* are also different, the former species has conspicuous axial sculptures, and the latter is squarish in outline, respectively.

Prosipho mundus SMITH, 1915

(Figs. 114A–F)

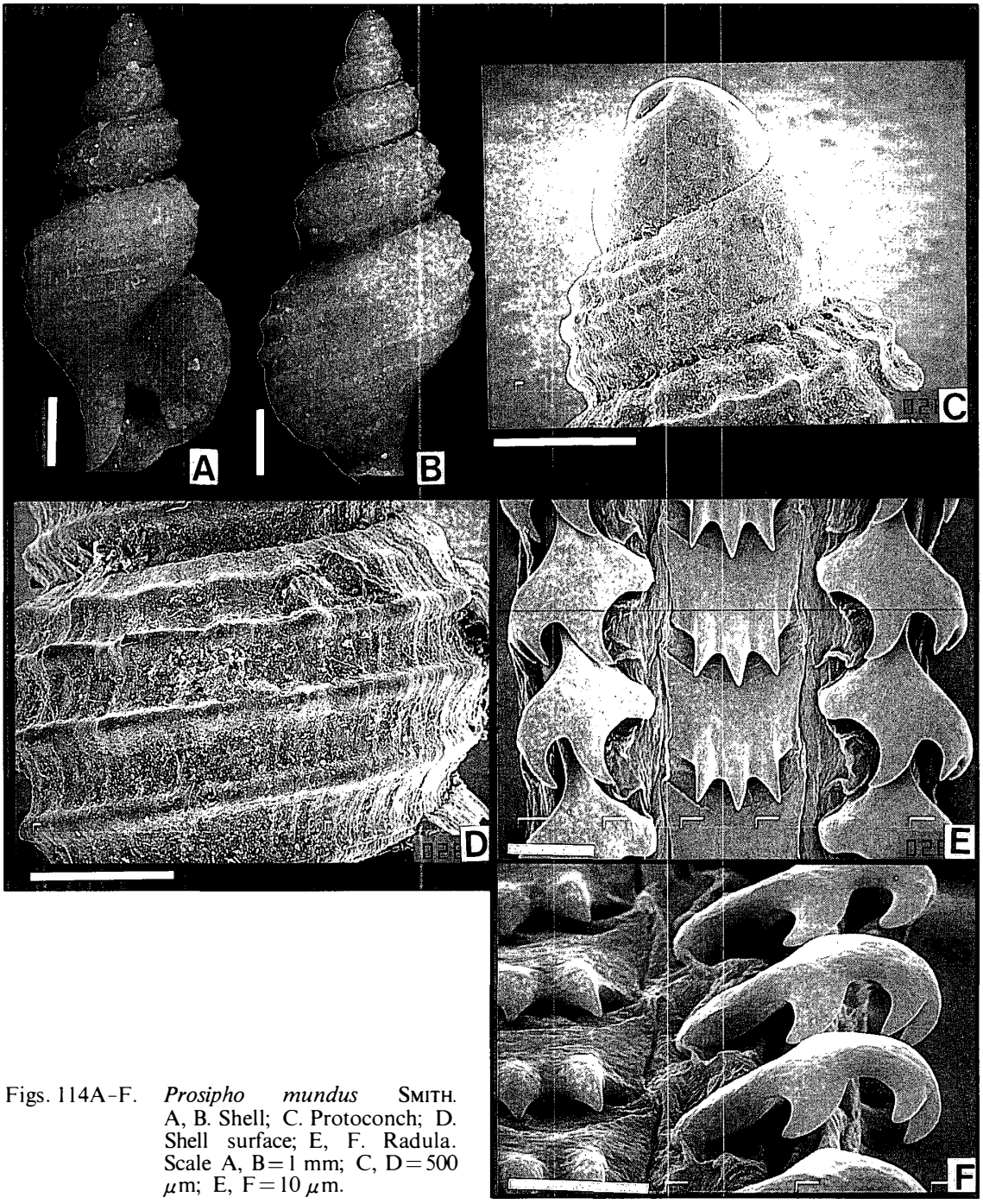
Prosipho mundus SMITH, 1915, p. 70, pl. 1, fig. 10; POWELL, 1958, p. 197 (distribution record); POWELL, 1960, p. 152 (name only); ARNAUD, 1972b, p. 130; DELL, 1990, p. 194, figs. 323, 325, 326.

Material examined: A single living specimen from St. 5.

Description: The shell is small, elongate fusiform, translucent, with high elevated spire (Figs. 114A, B). The protoconch is large, about 2 in number of turns, 0.9 mm in diameter, 1.0 mm in height, somewhat glossy, translucent white in color and has smooth surface (Fig. 114C). The teleoconch is about 2.8 in number of turns, slightly inflated, with regularly spaced and round topped spiral ribs which are crossed by almost regularly spaced, raised axial lirae and crowded, microscopic growth lines. The surface is translucently white, and is covered by a very thin and transparent periostracum. The suture is constricted, and the sutural ramp is slightly convex. The upper whorl is elevated. The body whorl is large, about 2/3 of shell length, slightly inflated with breadth being 48% of shell length. The spiral ribs are 3 on the first teleoconch whorl and 4 on the penultimate whorl. The body whorl has 10 spiral ribs, but the first rib is weaker than the second to fifth ribs which are stronger than the others, and sixth to most basal ribs tend to become weaker abapically. The raised axial lirae also tend to become weaker abapically. The penultimate whorl has 17 axial lirae. The junctions of spiral ribs and axial lirae create small nodules (Fig. 114D). The base is constricted. The aperture is elliptical, rather small, about 40% of shell length. The outer lip is rather thick and undulating in corresponding to the external ribs and interspaces. The inner lip is round and smooth. The columellar lip is gently rounded. The area from the inner to columellar lips is smooth with a thin white callus. The anterior siphonal canal is open, short and straight.

The operculum is slightly small to the aperture in size, translucently pale yellow in color, thin, corneous and nearly elliptical with low situated nuculeus.

The radula is rachiglossate, 1 : 1 : 1 with 110 transverse rows, transparent, long and very narrow (2.0 mm in length and 0.05 mm in width; 6.5 mm in SL) (Fig. 114E). The rhachidian tooth is moderate in size and almost square in outline, with incurved basal



Figs. 114A–F. *Prosipho mundus* SMITH. A, B. Shell; C. Protoconch; D. Shell surface; E, F. Radula. Scale A, B = 1 mm; C, D = 500 μm; E, F = 10 μm.

margin and three sharply pointed strong cusps in front. The central cusp is slightly larger and stronger than the lateral cusps. The lateral teeth are moderate, and the width of base is twice the rhachidian base. A single tooth has two stout, large and strongly incurved cusps with outer and basal projections. The outer cusp is larger and stronger than the inner one, and has bifurcated sharply pointed tips (Fig. 114F). The inner cusp has a sharply pointed tip. The outer basal projection is long and slender, and it is tapered off to a point. The inner projection is small and round.

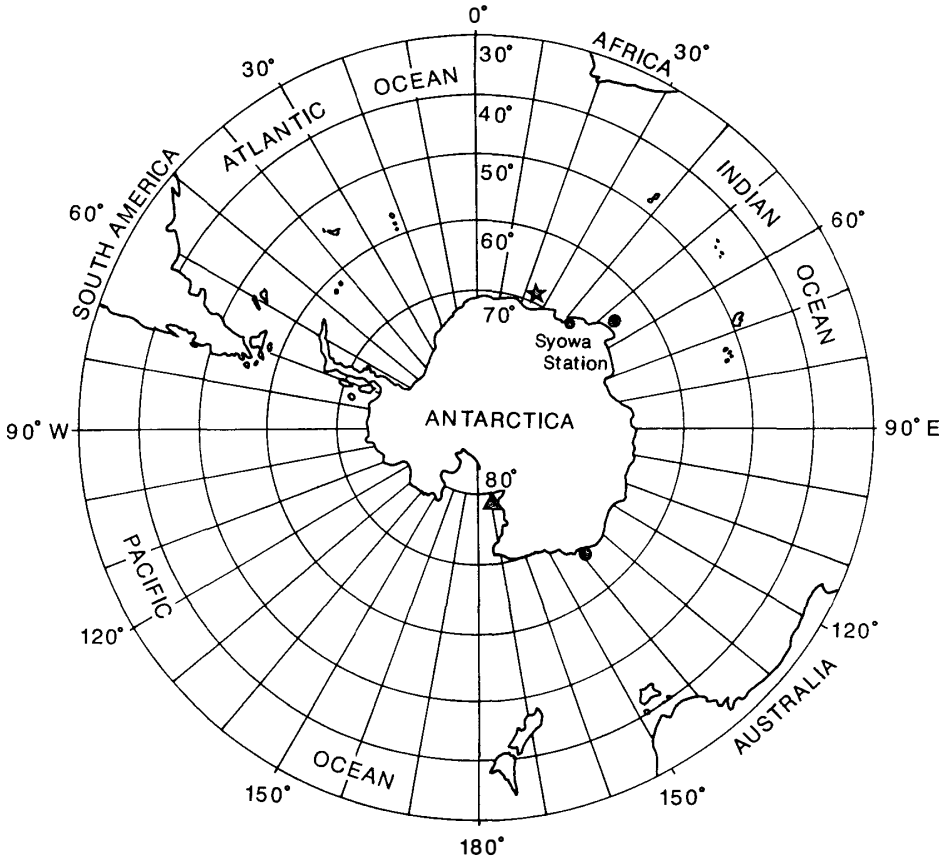


Fig. 115. Distribution of *Prosipho mundus* SMITH (Large dots: Previous distribution records; Star: Present study; Triangle: Type locality).

Measurements: SL 6.5 mm, SW 3.1 mm.

Previous distribution records (Fig. 115): Type locality: Off Cape Bird Peninsula, McMurdo Sound, Ross Sea, 450 m. Range: off Enderby Land, 220 m (POWELL, 1958); off Adelie Land, 40–230 m (ARNAUD, 1972b); Ross Sea, 67–549 m (DELL, 1990); off Antarctic Peninsula, 12–500 m (DELL, 1990).

Remarks: This species is also similar to *P. spiralis* THIELE, 1912 and *P. bisculptus* THIELE, 1912, from Davis Sea, in having strong spiral ribs. However, *P. spiralis* has stronger spiral ribs and no projections, and squarish protoconch (Figs. 116A, B). The protoconch of *P. bisculptus* has conspicuous axial sculptures unlike smooth protoconch of this species.

EGOROVA (1982) reported *P.* "*tuberculatus* SMITH, 1915" from the Davis Sea. HAIN (1990) also reported *P.* cf. *tuberculatus* from the eastern Weddell Sea. *P. tuberculatus* was first described by SMITH (1915) from McMurdo Sound, Ross Sea. According to SMITH (1915), *P. tuberculatus* has ovately fusiform shell, strong spiral lirae with well-marked acute tubercles thereupon. The aperture is half of shell length. Compared with this species, *P. tuberculatus* has thicker shell, with larger aperture, slightly depressed and inflated protoconch and more conspicuous nodules than the present species. EGOROVA's and HAIN's specimens seems to be identical with *P. mundus*, as the radulae illustrated by them will support the assumption.

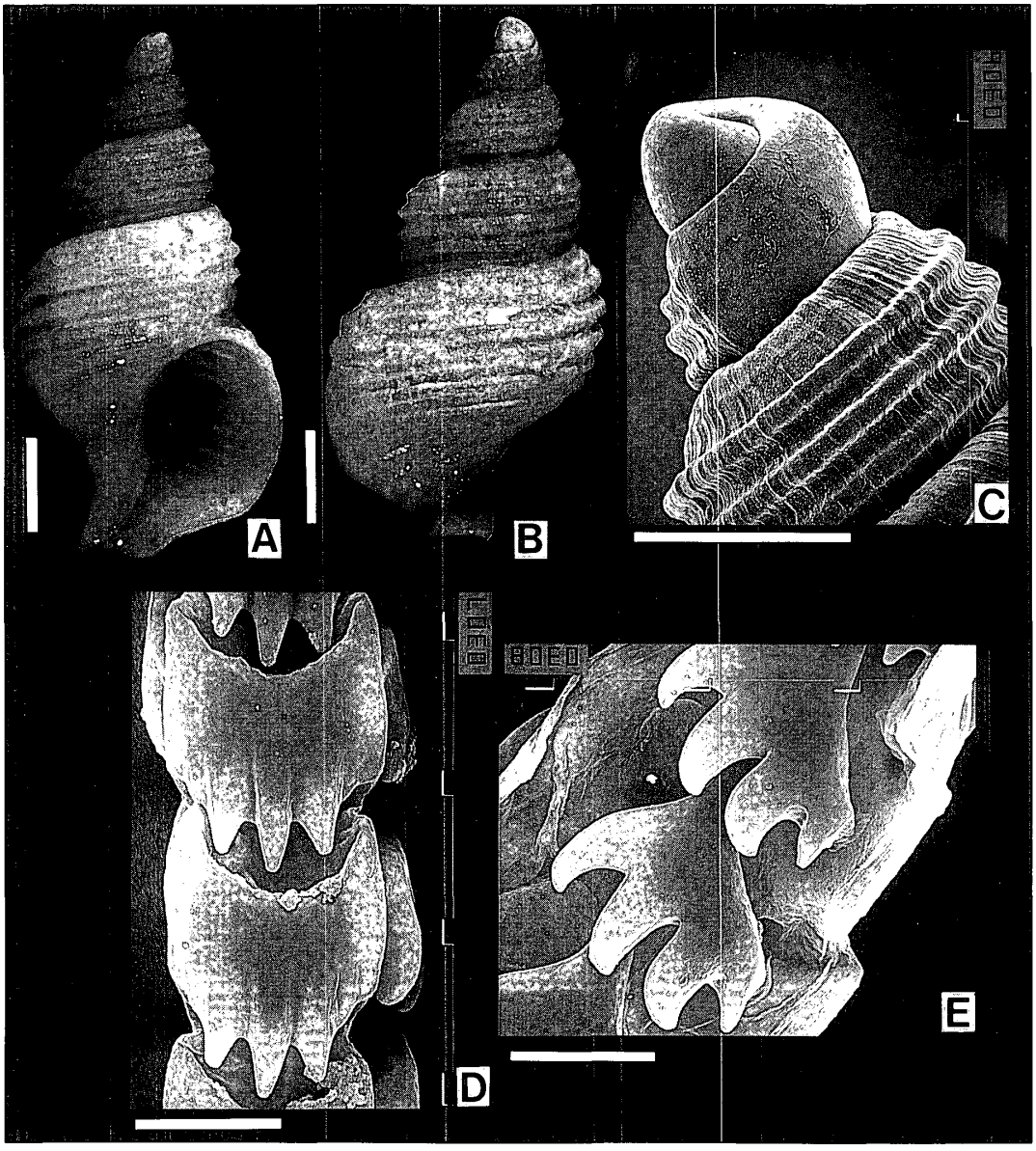
Prosipho spiralis THIELE, 1912
(Figs. 116A–E)

Prosipho spiralis THIELE, 1912, p. 209, pl. 8, fig. 2; HEDLEY, 1916a, p. 57 (distribution record); POWELL, 1958, p. 197 (distribution record); POWELL, 1960, p. 153 (name only); EGOROVA, 1982, p. 46, figs. 195, 196; DELL, 1990, p. 197, fig. 337.

Prosipho sp. 1: HAIN, 1990, p. 61, pl. 6, fig. 5, pl. 24, fig. 6.

Material examined: Three empty shells from St. 7; 1 living specimen and 1 empty shell from St. 9.

Description: The shell is moderate in size, fusiform, translucently white, with high, elevated spire (Figs. 116A, B). The protoconch is ovo-conical, large, about 2 in number



Figs. 116A–E. *Prosipho spiralis* THIELE. A, B. Shell; C. Protoconch; D, E. Radula. Scale A–C = 1 mm; D, E = 10 μm.

of turns, 1.0 mm in diameter, 1.0 mm in height, frosted white in color, and has smooth surface (Fig. 116C). The teleoconch is about 3.3 in number of turns, roundly inflated, with widely interspaced, strong and round topped spiral ribs which are crossed by crowded microscopic growth lines. The surface is covered by a very thin and translucent, dirty white periostracum. The suture is constricted. The upper whorl is moderate, inflated and elevated. The body whorl is very large, about 2/3 of shell length, and well inflated with width being 50% of shell length. The spiral ribs are 3 on the first teleoconch, 5 on the penultimate whorl and 10 on the last whorl including 5 basal ribs. The first rib is low and weak. The second to fourth (or fifth) ribs are very strong, and spaced with deep and regular grooves. The base is constricted. The ribs on the base tend to become weaker abapically, and the interspaces between these ribs also become narrower. The aperture is ovate, aperture length is 44% of shell length. The outer lip is rather thick, round and smooth. However, the outer lip of small specimen is thin and strongly corrugated in corresponding to external ribs and interspaces. The inner lip is round. The columellar lip is gently rounded. The inner and columellar lips are smooth with a thin white callus. The anterior siphonal canal is open, short and slightly recurved backward.

The operculum is small to the aperture in size, translucently pale yellow in color, thin, corneous and almost oval with low situated nuculeus.

The radula is rachiglossate, 1 : 1 : 1, transparent, long but very narrow (2.25 mm in

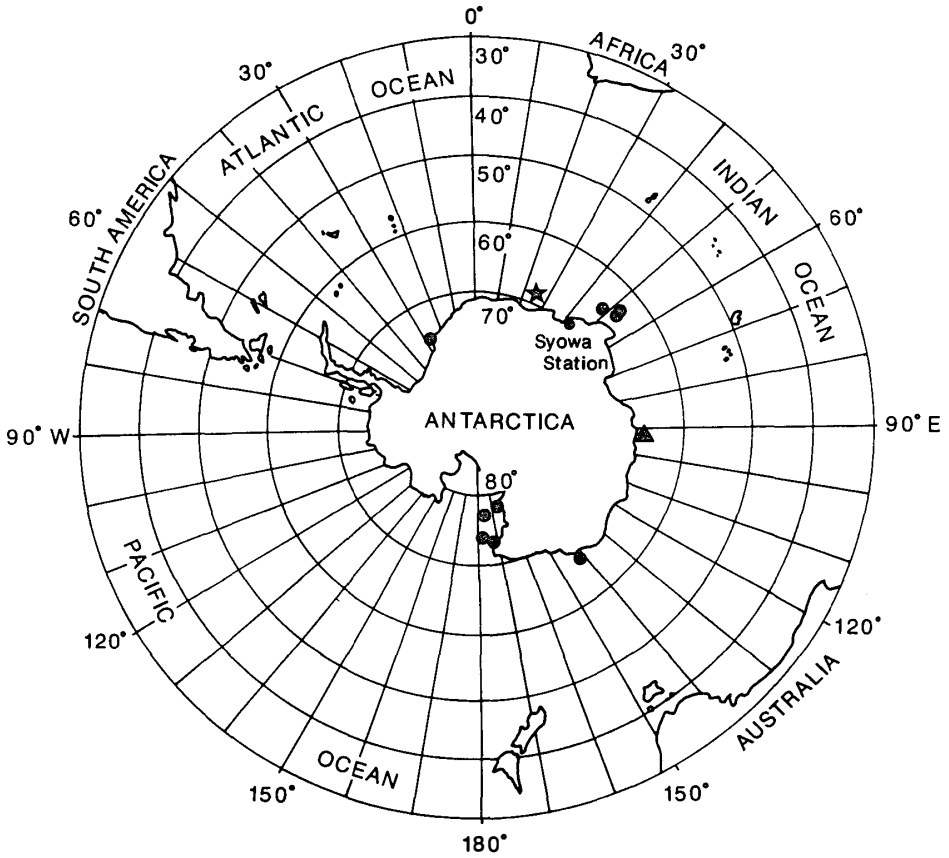


Fig. 117. Distribution of *Prosipho spiralis* THIELE (Large dots: Previous distribution records; Star: Present study; Triangle: Type locality).

length, 0.075 mm in width; 5.5 mm in SL) (Figs. 116D, E). The rhachidian tooth is large and wide, and has strongly arched base, three strong cusps and two small denticles. The central cusp is larger than the lateral cusps, and outermost denticles are far weaker than the others (Fig. 116D). The lateral tooth is moderate, and the base is about twice as wide as the rhachidian base. A single tooth has four large and stout cusps (Fig. 116E). The outermost cusp is weaker than the other three. Two central cusps are almost equal in size and in curvature. The innermost cusp is small and triangular. The outer basal projection is very long and slender. The base is slightly incurved.

Measurements: SL 5.5 mm, SW 3.1 mm.

Previous distribution records (Fig. 117): Type locality: Gauss Station, Davis Sea. Range: Commonwealth Bay, 630–720 m (HEDLEY, 1916a); off Enderby Land, 193, 220 and 300 m (POWELL, 1958); the eastern Weddell Sea, 257–498 m (HAIN, 1990); Ross Sea, 238–987 m (DELL, 1990).

Remarks: HAIN (1990) reported *Prosipho* sp. 1 from the eastern Weddell Sea. The morphological details of the shell, such as the prominency of spiral ribs and the shapes of protoconch and radula, are almost identical to those of the present species specimen.

This species can be distinguished from the other species of *Prosipho* in having a characteristic protoconch which is the ovo-conical in shape (Fig. 116C).

Prosipho shiraseae n. sp.

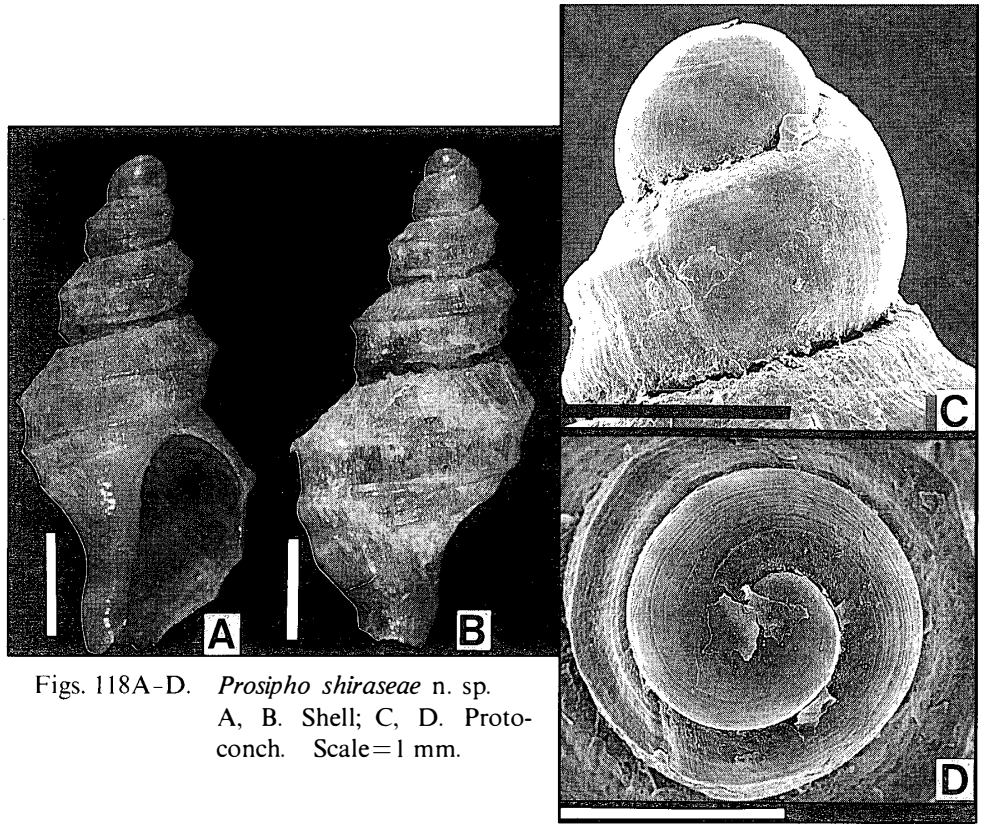
(Figs. 118A–D)

Material examined: A single empty shell from St. 7.

Description: The shell is small, elongate fusiform, translucently white, with highly elevated spire (Figs. 118A, B). The protoconch is large, about 2 in number of turns, 0.7 mm in diameter, 0.8 mm in height, roundly well inflated, somewhat glossy, translucently white, and has some very weak spiral threads on the surface and a single peripheral angle near the end (Figs. 118C). The teleoconch is about 3.3 in number of turns, slightly inflated, with two round topped spiral ribs on the shoulder and just above the suture accompanying with very fine growth lines. The surface is covered with a pale straw-colored, thin periostracum. The suture is constricted, and has a subsutural angle below. The interspace between this angle and the shoulder is wide and slanting. The upper whorl is rather slender and highly elevated. The body whorl is large, about 2/3 of shell length, not so inflated with breadth being 52% of shell length. The spiral ribs come to appearance from the first teleoconch, three on the body whorl and two on the upper whorls. The first rib has irregularly spaced and small nodule-like projections. The base is constricted and smooth. The aperture is lunate, rather small and narrow, less than 1/2 of shell length. The outer lip is thin and undulating in corresponding to external ribs and interspaces. The inner lip is short and round. The columellar lip is smooth and straight. The inner and columellar lips have a very thin, glossy and transparent callus. The anterior siphonal canal is hemitubular, and weakly recurved dorsally. The inner wall is smooth.

Measurements: SL 4.8 mm, SW 2.5 mm (AL 2.5 mm, AW 1.3 mm) (Holotype specimen; NSMT-Mo 70624).

Remarks: This species is close to *Prosipho hunteri* HEDLEY, 1916, from South Georgia and the area of eastern Weddell Sea to Adélie Land, because of having an elongate fusiform



Figs. 118A-D. *Prosipho shiraseae* n. sp. A, B. Shell; C, D. Protoconch. Scale=1 mm.

shell and pronounced spiral ribs (Figs. 111A, B). But, this species is distinguishable from *P. hunteri* in having following characters: 1) Roundly well inflated protoconch; 2) some very weak spiral threads on protoconch; 3) irregularly spaced and small nodules on the first spiral rib; and 4) only one basal ribs.

Etymology: The name of this species is commemorating the icebreaker SHIRASE. This species was collected during her maiden voyage.

Genus *Antarctoneptunea* DELL, 1972

Type species: *Fusitriton aurora* HEDLEY, 1916 (O.D.)

***Antarctoneptunea aurora* (HEDLEY, 1916)**

(Figs. 119A-C)

Troschelia ? SMITH, 1907, p. 2, pl. 1, fig. 8.

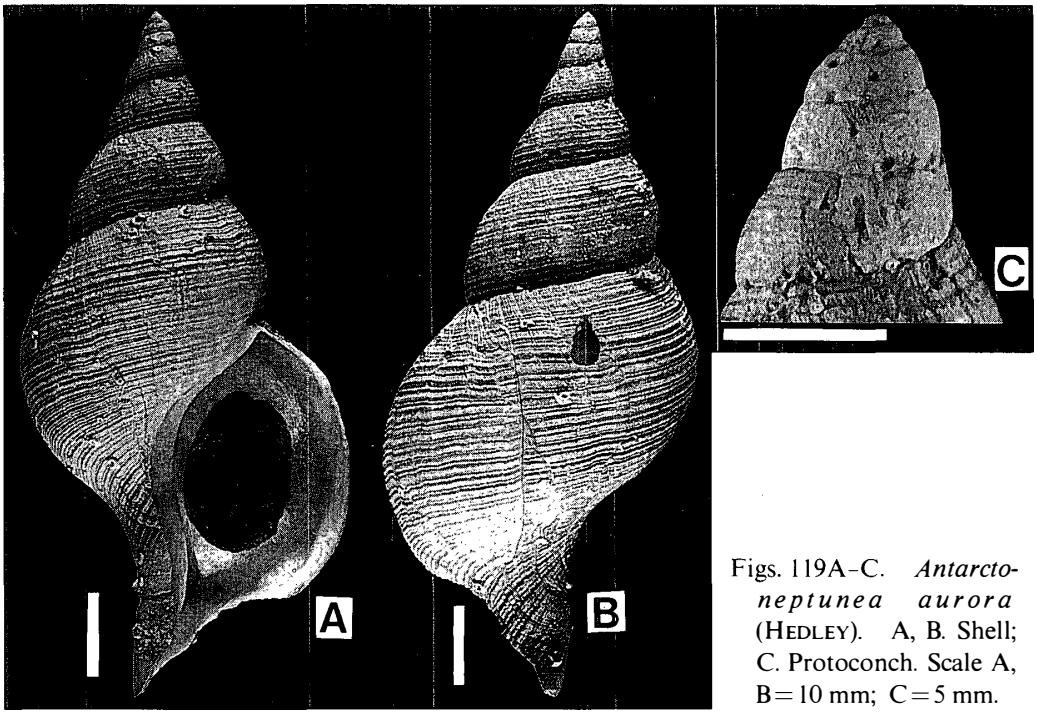
Fusitriton aurora HEDLEY, 1916a, p. 55, pl. 8, figs. 88-89.

Fusitriton antarcticus POWELL, 1958, p. 191, pl. 3, fig. 6; POWELL, 1960, p. 147 (name only).

Antarctoneptunea aurora: DELL, 1972b, p. 118, figs. 1-7; DELL, 1990, p. 200, fig. 304.

Material examined: A single specimen collected from Nisi-no-ura Cove, *ca.* 15 m, by JARE-32.

Description: The shell is large, fusiform, thick, white in color (Figs. 119A, B). The protoconch is large, conical, multispiral, white in color, with rough surface, about 4 in number of turns, 4.67 mm in diameter, 7.55 mm in height. The first whorl is minute (Fig.



Figs. 119A–C. *Antarctoneptunea aurora* (HEDLEY). A, B. Shell; C. Protoconch. Scale A, B = 10 mm; C = 5 mm.

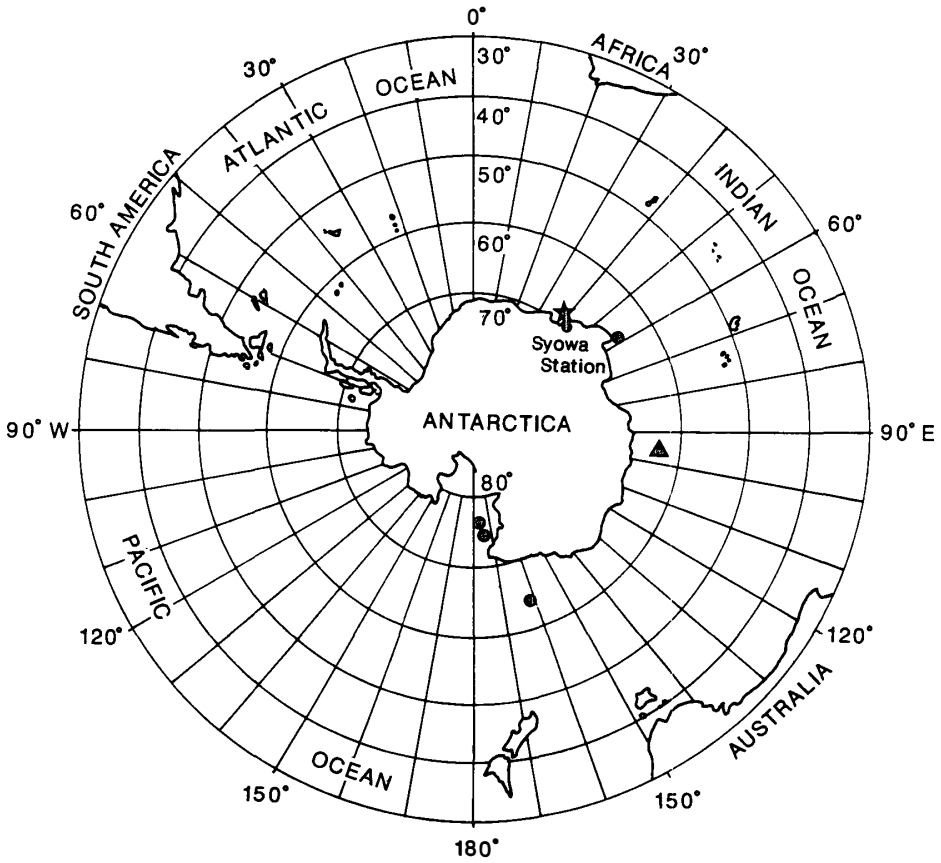


Fig. 120. Distribution of *Antarctoneptunea aurora* (HEDLEY) (Large dots: Previous distribution records; Star: Present study; Triangle: Type locality).

119C). The teleoconch is 4.3 in number of turns, moderately inflated, and has a thin and pale yellowish colored periostracum. There are numerous spiral ribs of various prominency, with none being predominant, and are all crossed with growth lines and tend to become wrinkled. The suture is constricted. The upper whorl is high and elevated. The body whorl is 70% of shell length, large and inflated. The base is constricted. The aperture is ovo-quadrangular with sharply edged outer lip and glossy white within. The outer lip near suture is slightly recurved with a sign of poster canal. The inner lip is smooth. The columellar lip is twisted. The anterior canal is open, oblique and slightly recurved backwards. The white callus is deposited in the area extending from the inner lip to columellar lip.

The operculum is corneous, oval, yellowish brown in color, with the nuculeus situated downward.

Measurements: SL 85 mm, SW 38 mm.

Previous distribution records (Fig. 120): Type locality: 64°32′S, 97°20′E, Davis Sea, 188 m (by DELL, 1972). Range: 66°21′S, 58°50′E, Enderby Land, 603 m (type locality of antarcticus POWELL, 1958); 66°28.2′S, 162°45.5′E, off Balleny Islands, 366 m (DELL, 1972b); Ross Sea, 265–537 m (DELL, 1990).

Remarks: *Antarctoneptunea aurora* is one of the large species among Antarctic gastropods.

The examined specimen was collected by SCUBA diving from a depth of *ca.* 15 m in Nisi-no-ura Cove, near Syowa Station. The bottom substratum of Nisi-no-ura Cove is sandy with sporadic outcrop of rocks, inhabited by a sea-urchin, *Sterechinus neumayeri* and a bivalve, *Laternula elliptica*.

This species have hitherto been reported from only four localities, such an Enderby Land, Davis Sea, off Balleny Islands and Ross Sea. The present discovery is the shallowest record, and thus the bathymetrical distribution of this species may be revised as 15 m down to 603 m.

Subfamily Photinae

Genus *Pareuthria* STREBEL, 1905

Type species: *Fusus plumbeus* PHILIPPI, 1844 (S.D. by TOMLIN, 1932)

***Pareuthria innocens* (SMITH, 1907)**

(Figs. 121A-C)

Thesbia ? innocens SMITH, 1907, p. 4, pl. 1, figs. 1-1b.

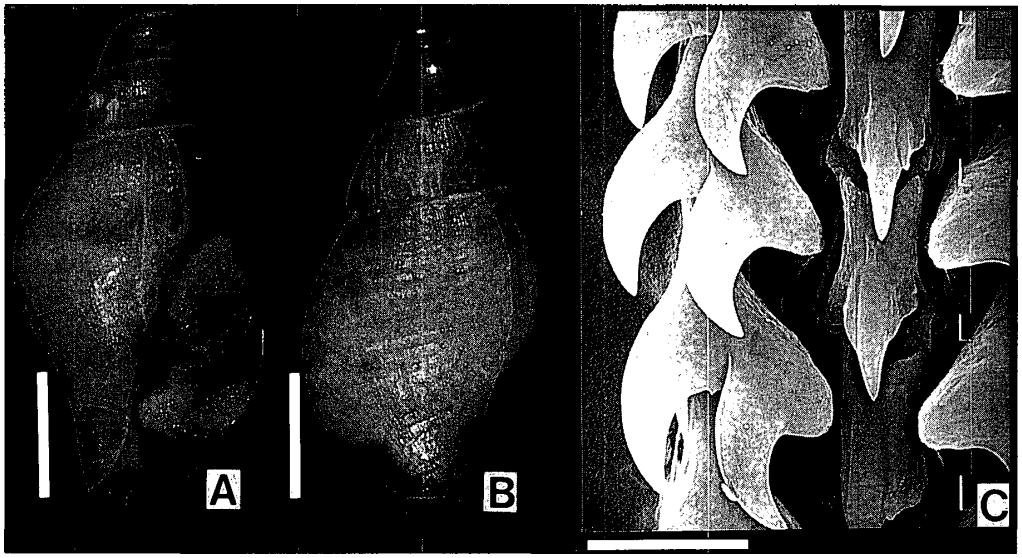
Thesbia innocens: HEDLEY, 1911, p. 6.

Pareuthria innocens: THIELE, 1912, p. 212, pl. 13, fig. 23, pl. 16, fig. 22; SMITH, 1915, p. 72 (remarks and distribution record); HEDLEY, 1916a, p. 58 (distribution record); POWELL, 1958, p. 191 (distribution record); POWELL, 1960, p. 147 (name only); ARNAUD, 1972b, p. 127, figs. 19A-C; EGOROVA, 1982, p. 39, figs. 50 and 169; DELL, 1990, p. 170, figs. 301 and 302.

Pareuthria cf. *innocens*: HAIN, 1990, p. 54, pl. 5, fig. 2, pl. 12, fig. 7.

Material examined: A single empty shell from St. 5; 1 living specimen from Günnerus Bank.

Description: The shell is fusiform, small, thin, translucently white in color, with a



Figs. 121A-C. *Pareuthria innocens* (SMITH).
A, B. Shell; C. Radula. Scale A, B=1 mm; C=10 μm.

moderately elevated spire (Figs. 121A, B). The protoconch is large, high, roundly inflated, about 2.3 in number of turns, 2.0 mm in diameter, 1.4 mm in height, and has a smooth and translucently white surface with weak gloss. The teleoconch is about 2 in number of turns, slightly inflated, with regularly spaced, very low and wide spiral threads which are crossed by crowded microscopic growth lines. No periostracum is present. The suture is weakly constricted. The body whorl is inflated and high, with length being about 80% of shell length. The body whorl has 9 low spiral riblets of which basal ones are weaker than the adapical ones. The base is weakly constricted. The aperture is large, length is 65% of shell length, lunate with a very thin, gently rounded and almost smooth outer lip. The inner lip is gently curved. The columellar lip is short and almost straight. The inner and columellar lips have very thin translucent callus. The anterior siphonal canal is open, short and stout.

The operculum is small for the aperture in size, length being 35% of aperture length, corneous, translucent pale yellow in color, elliptical with low situated nucleus.

The radula is rachiglossate, 1 : 1 : 1 with 88 transverse rows, translucent, long but very narrow (1.0 mm in length, 25 μm in width; 4.0 mm in SL) (Fig. 121C). The rhachidian tooth is narrow, rectangular in outline, and has a strongly incurved base and a very long and stout cusp with small denticles on both sides. The lateral teeth are very massive and stout, and the width of the base is about three times the rhachidian base. A single tooth has two large, strongly incurved and sharply pointed cusps, and a long outer basal projections. The outer projection is slightly larger and stronger than the inner one. The inner basal projection is short with digitate in shape.

Measurements:

SL 6.5 mm, SW 3.0 mm, AL 3.0 mm, AW 1.3 mm (empty shell; St.5).

SL 4.0 mm, SW 2.1 mm, AL 2.6 mm, AW 1.0 mm (living specimen; Günnerus Bank, 288 m deep).

Previous distribution records (Fig. 122): Type locality: Hut Point, McMurdo Sound, 45-

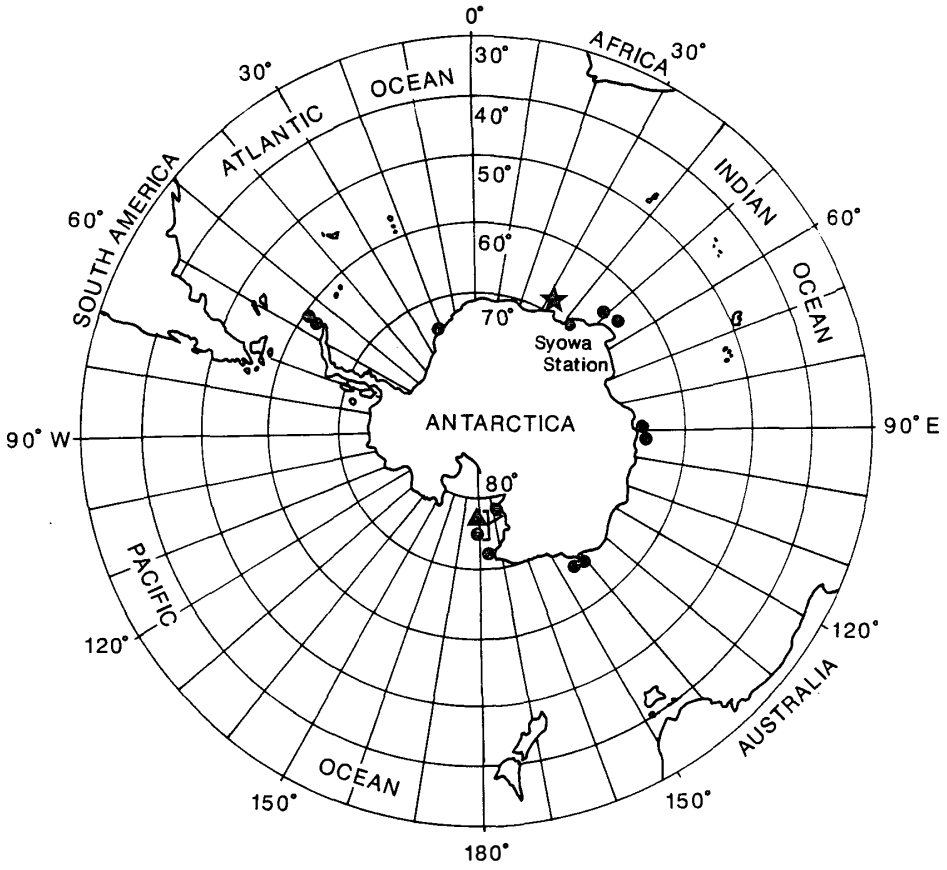


Fig. 122. Distribution of *Pareuthria innocens* (SMITH) (Large dots: Previous distribution records; Star: Present study; Triangle: Type locality).

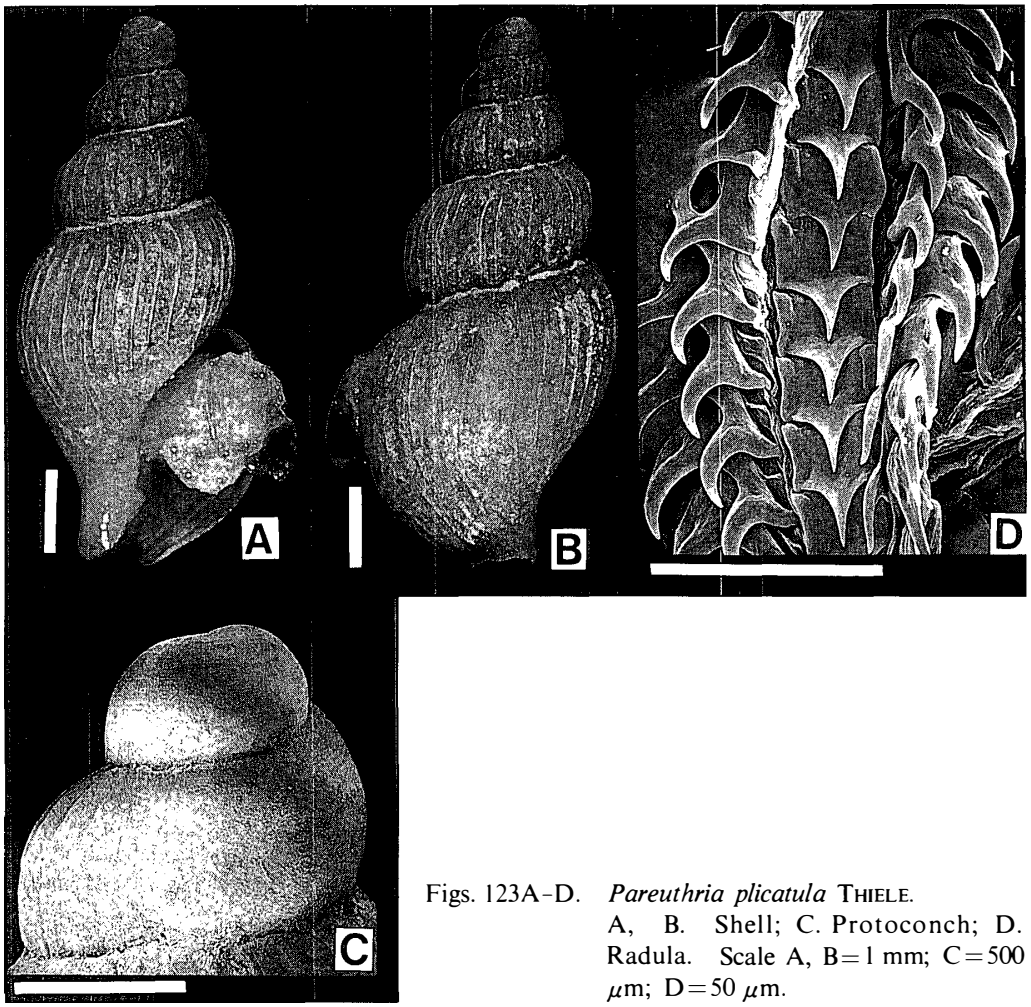
54 m. Range: Gauss Station, Davis Sea (THIELE, 1912); off Glacier Tongue, McMurdo Sound, 342–450 m and off Cape Bird Peninsula, McMurdo Sound, 450 m (SMITH, 1915); Commonwealth Bay, Adelie Land, 45–108 m (HEDLEY, 1916); off Enderby Land, 220 and 300 m (POWELL, 1958); off Adélie Land, 6–50 m (ARNAUD, 1972b); Davis Sea (EGOROVA, 1982); eastern Weddell Sea, 6–460 m (HAIN, 1990); off South Shetland Islands, 311–426 m (DELL, 1990); Elephant Island, Antarctic Peninsula, 220–240 m (DELL, 1990); Bransfield Strait, Antarctic Peninsula, 210–220 m (DELL, 1990), Ross Sea, 12–549 m (DELL, 1990).

Remarks: The specimens reported by SMITH (1907), THIELE (1912), EGOROVA (1982) and HAIN (1990) are all larger than the present specimen, over 6 mm in shell length. The radula of this species was first described by THIELE (1912), and it has tricuspid rhachidian tooth with wide base, and laterals with two massive cusps and a stout outer basal projection. The rhachidian tooth of EGOROVA's (1982) specimen has a single cusp and wide base, and lateral teeth similar to the Thiele's illustration. HAIN (1990) observing the radula by using the scanning electron microscope, reported that the rhachidian tooth of his specimen is similar to the Egorova's illustration. However, the cusps of lateral teeth of HAIN's specimen are less massive than other specimens hitherto reported, and have no outer basal cusp. The rhachidian tooth of the previously reported specimen differs in having a narrow rectangular base. The laterals of the present specimen are similar to radula of THIELE's and EGOROVA's specimens, but they are different from those of HAIN's specimen in

having more massive cusps and the outer basal cusp. This fact suggests that the radular characters of this species has a wide variation, which is universal in buccinids.

Pareuthria plicatula THIELE, 1912
(Figs. 123A-D)

Pareuthria plicatula THIELE, 1912, p. 212, pl. 13, fig. 24, pl. 16, fig. 22; POWELL, 1958, p. 192 (distribution record); POWELL, 1960, p. 148 (name only); EGOROVA, 1982, p. 40, fig. 170; DELL, 1990, p. 170, fig. 303.
Pareuthria cf. *plicatula*: HAIN, 1990, p. 55, pl. 5, fig. 3, pl. 22, fig. 8.
Material examined: 2 living specimens and 4 empty shells from St. 7; 5 living specimens and 19 empty shells from St. 8; 7 living specimens and 13 empty shells from St. 9.
Description: The shell is rather turreted, small, thin, translucently white in color, with a highly elevated spire (Figs. 123A, B). The protoconch is large, roundly inflated, about 2.2 in number of turns, 1.0 mm in height, 1.0 mm in diameter, translucent white in color, with crowded, very fine spiral lirae on the surface (Fig. 123C). The surface has very thin and translucent periostracum. The suture is constricted. The teleoconch is about 3.3 in



Figs. 123A-D. *Pareuthria plicatula* THIELE.
A, B. Shell; C. Protoconch; D. Radula. Scale A, B=1 mm; C=500 μm; D=50 μm.

Table 22. Measurements and condition of *Pareuthria plicatula* THIELE.

No.	1	2	3	4	5	6	7	8	9	10
St.	7	7	7	7	7	7	8	8	8	8
SL (mm)	5.0	5.6	6.0	6.7	4.9	—	2.8	3.5	3.6	3.6
SW (mm)	2.5	2.7	2.8	3.1	—	—	1.5	1.8	1.7	1.8
SW/SL (%)	50.0	48.2	46.7	46.3	—	—	53.6	51.4	47.2	50.0
Condition	F	L	F	L	E	E	F	L	L	F

No.	11	12	13	14	15	16	17	18	19	20
St.	8	8	8	8	8	8	8	8	8	8
SL (mm)	4.5	4.7	4.8	4.8	5.0	5.0	5.2	5.2	5.5	5.5
SW (mm)	2.3	2.3	2.3	2.4	2.3	2.4	—	2.4	2.5	2.5
SW/SL (%)	51.1	48.9	47.9	50.0	46.0	48.0	—	46.2	45.5	45.5
Condition	L	L	F	F	F	F	E	F	F	F

No.	21	22	23	24	25	26	27	28	29	30
St.	8	8	8	8	8	8	8	8	8	8
SL (mm)	5.6	5.7	6.0	6.0	6.5	6.5	7.0	7.5	—	—
SW (mm)	2.7	2.5	2.5	2.7	2.7	2.8	3.0	3.2	—	—
SW/SL (%)	48.2	43.9	41.7	45.0	41.5	43.1	42.9	42.7	—	—
Condition	F	F	F	F	L	F	F	E	E	E

No.	31	32	33	34	35	36	37	38	39	40
St.	9	9	9	9	9	9	9	9	9	9
SL (mm)	3.5	4.9	5.0	5.1	5.2	5.2	5.4	5.6	5.6	5.7
SW (mm)	1.8	2.5	2.5	2.5	2.3	2.5	2.6	2.7	2.9	—
SW/SL (%)	51.4	51.0	50.0	49.0	44.3	48.1	48.1	48.2	51.8	—
Condition	F	L	F	F	F	F	F	L	L	E

No.	41	42	43	44	45	46	47	48	49	50
St.	9	9	9	9	9	9	9	9	9	9
SL (mm)	6.0	6.5	6.5	6.5	6.5	6.5	6.7	6.7	6.8	—
SW (mm)	2.7	2.7	3.0	3.0	3.1	—	3.0	3.3	2.8	—
SW/SL (%)	45.0	41.5	46.2	46.2	47.7	—	44.8	49.3	41.2	—
Condition	F	F	F	L	F	E	L	L	L	E

E: Empty and water-worn specimen; F: Freshly dead specimen; L: Specimen taken alive.

number of turns, slightly inflated, with almost regularly interspaced, low and narrow axial riblets accompanying very fine growth lines in between. The first teleoconch whorl has 23 axial riblets, and the penultimate whorl has 39. The body whorl is slightly inflated, moderate in size and rather narrow, with height being about 3/5 of shell length, breadth about 1/2 of shell length, and has about 40 axial riblets which tend to become weaker abapically. The base is slightly constricted. The aperture is small, length is about half the shell length, oval with a thin, smooth, sharply edged outer lip. The inner lip is smooth, and gently curved adaxially. The columellar lip is short and almost straight. A glossy, thin and smooth callus is deposited on the inner and columellar lips. The anterior siphonal canal is open and short, and is slightly curved backwards. The inner wall has a smooth surface.

The operculum is small for the aperture in size, with length being 68% of aperture length, corneous, translucent yellow in color, elliptical with low situated nucleus.

The radula is rachiglossate, 1 : 1 : 1 with about 80 transverse rows of teeth, translucent pale yellow in color, long but very narrow (1.25 mm in length, 0.10 mm in width; 6.7 mm in SL) (Fig. 123D). The rhachidian tooth is small, with squarish base, and has almost straight basal margin and a large and sharply pointed cusp on the top. The cusp is cuneate and slender, and has a pair of small denticles on both sides. The lateral teeth are large and stout, and the width of the base is about 1.2 times the rhachidian base. A single

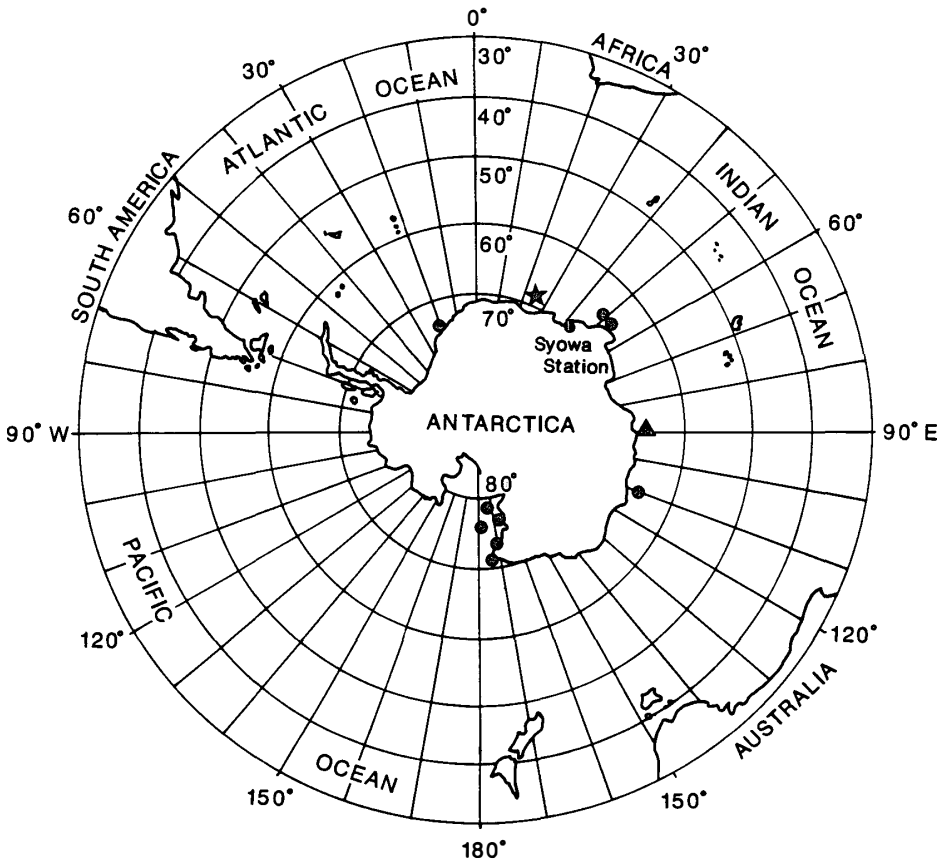


Fig. 124. Distribution of *Pareuthria plicatula* THIELE (Large dots: Previous distribution records; Star: Present study; Triangle: Type locality).

tooth has two strong, sharply pointed, and strongly incurved cusps that are situated considerably apart from each other and a short inner basal projection. The outer cusp is remarkably larger and stronger than the inner one.

Measurements: See Table 22.

Previous distribution records (Fig. 124): Type locality: Gauss Station, Davis Sea. Range: off Enderby Land, 193–300 m (POWELL, 1958); eastern Weddell Sea, 181–481 m (HAIN, 1990); Budd Coast, 155–326 m (DELL, 1990); Ross Sea, 110–549 m (DELL, 1990).

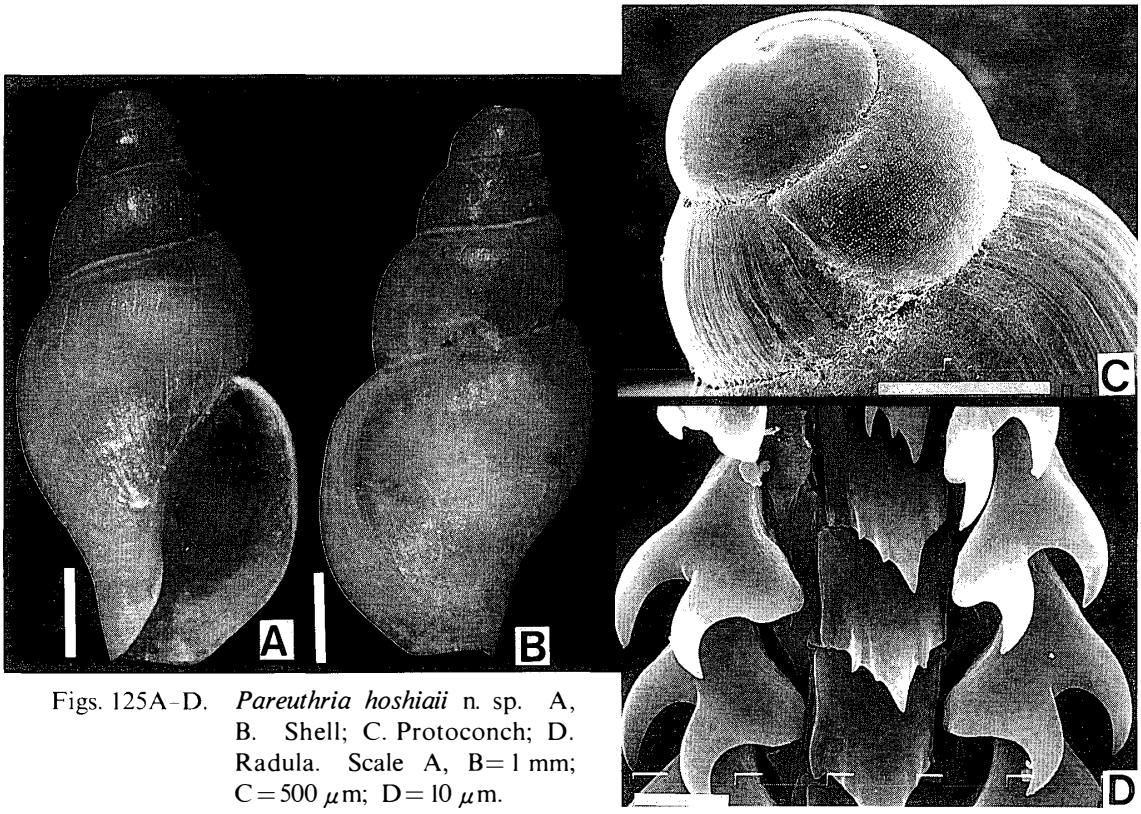
Remarks: HAIN (1990) reported *Pareuthria* cf. *plicatula* from the eastern Weddell Sea. HAIN's illustration has finer axial sculptures on the surface. The SEM photograph of the radula demonstrates that his specimens are *P. plicatula*.

Pareuthria hoshiaii n. sp

(Figs. 125A–D)

Material examined: A single living specimen from Günnerus Bank, 288 m deep.

Description: The shell is obese fusiform, small, thin, translucently white in color, with a moderately elevated spire (Figs. 125A, B). The protoconch is large, roundly inflated, about 2 in number of turns, 1.0 mm in diameter, frosted translucent white in color, with numerous, very fine granulous spiral lirae on the surface (Fig. 125C). The teleoconch is about 3 in number of turns, slightly inflated, and has the almost smooth surface except very fine growth lines. No periostracum is present. The suture is moderately constricted. The body whorl is rather slender but high, with height being about 70% of shell length,



Figs. 125A–D. *Pareuthria hoshiaii* n. sp. A, B. Shell; C. Protoconch; D. Radula. Scale A, B= 1 mm; C = 500 μm; D = 10 μm.

breadth about 49% of shell length. The base is slightly constricted. The aperture is large, about half the shell length, fusiform with a thin, smooth and round outer lip. The inner lip is smooth and slightly curved adaxially. The columellar lip is short, smooth and straight. The inner and columellar lips have a very thin callus. The anterior siphonal canal is open, short and stout.

The operculum is small for the aperture in size, with length being about 56% of the aperture length, corneous, translucent pale yellow in color, oblong with low situated nucleus.

The radula is rachiglossate, 1 : 1 : 1 with 53 transverse, translucent, long but very narrow (1.125 mm in length, 0.075 mm in width; 4.7 mm in SL) (Fig. 125D). The rhachidian tooth is moderate in size, stout and almost square in basal outline and the prominent, wide, triangular central cusp which carries two denticles on the left side and one on the right. These lateral denticles are usually weak, but some of the outermost one of the left side is long, and has a sharply pointed top. The lateral teeth is wide and stout, and the width of the base is about twice the rhachidian base. A single tooth has two large, strong and strongly incurved cusps and a long inner basal projection. The outer cusp is slightly larger and stronger than the inner one. The basal projection is long. The base is slightly incurved.

Measurements: SL 4.0 mm, SW 2.3 mm, AL 2.6 mm, AW 1.0 mm (Holotype specimen; NSMT-Mo 70625).

Remarks: This species is similar to *Pareuthria plicatula* THIELE, 1912 from the Davis Sea to eastern Weddell Sea, 181–481 m (Figs. 123A, B). However, *P. plicatula* is distinguishable from this species by having many weak axial riblets on the teleoconch.

Etymology: This species is named in honor of Dr. Takao HOSHIAI for his many works of Antarctic benthos. He was the pioneer of the investigation of benthos in Japanese Antarctic Research Expeditions.

Family VOLUTOMITRIDAE GRAY, 1845
Genus *Paradmete* STREBEL, 1908
Type species: *Paradmete typica* STREBEL, 1908 (S.D.)
(= *Volutomitra fragillima* WATSON, 1882)

***Paradmete curta* STREBEL, 1908**
(Figs. 126A–D, 127A)

Paradmete curta STREBEL, 1908, p. 23, pl. 3, figs. 34a–e; POWELL, 1958, p. 198; POWELL, 1960, p. 157 (name only); DELL, 1990, p. 221, fig. 391.

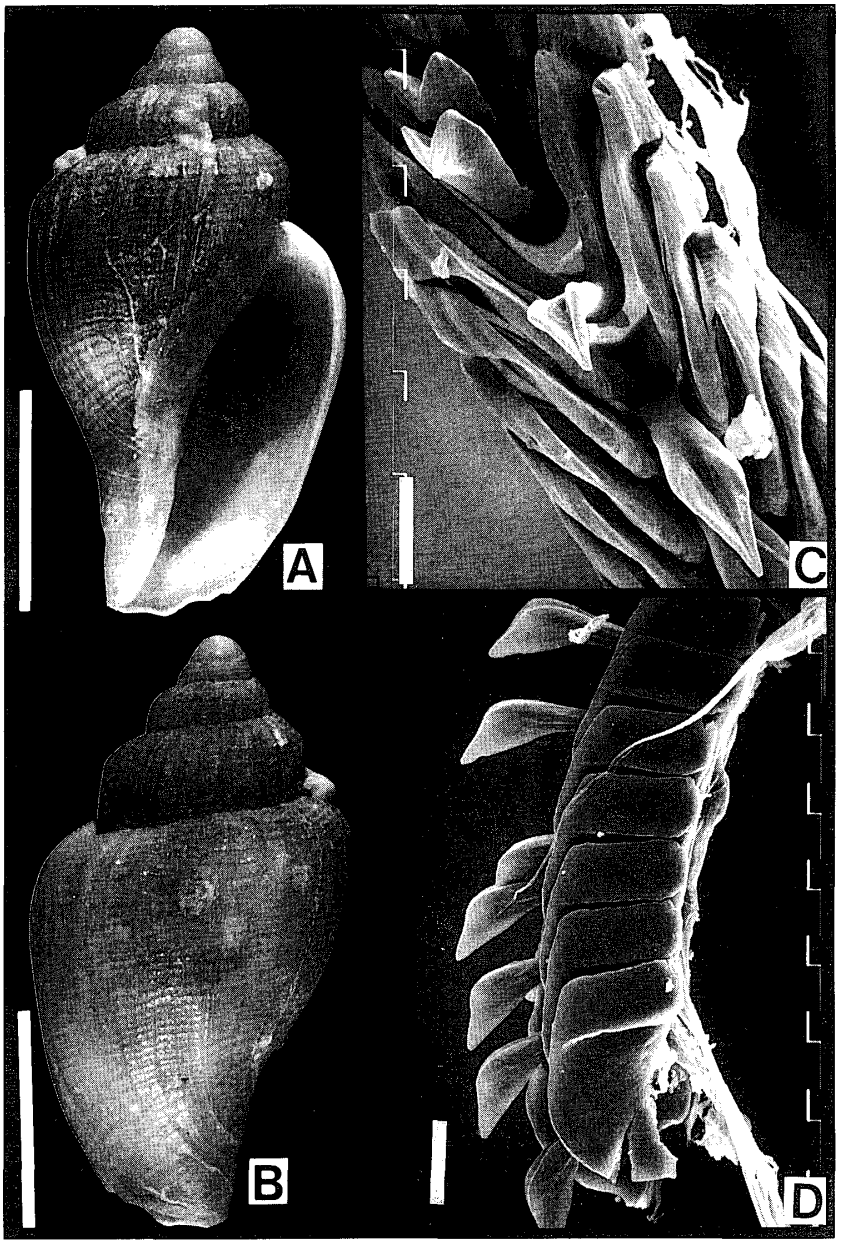
Paradmete longicauda STREBEL, 1908, p. 24, pl. 3, figs. 36a, b; POWELL, 1951, p. 165; POWELL, 1960, p. 157 (name only).

Volutomitra (*Paradmete*) *curta*: CERNOHORSKY, 1970, p. 103, pl. 13, figs. 11–13; HAIN, 1990, p. 65, pl. 6, figs. 11a, b, pl. 25, fig. 4.

Volutomitra curta: ARNAUD and MOL, 1979, p. 26, figs. 2, 14, 15.

Material examined: A single empty shell from St. 5; 1 living specimen from St. 8; 1 living specimen and 1 empty shell collected by JARE-27 from Breid Bay.

Description: The shell is obese fusiform, translucently white in color, thin with a low

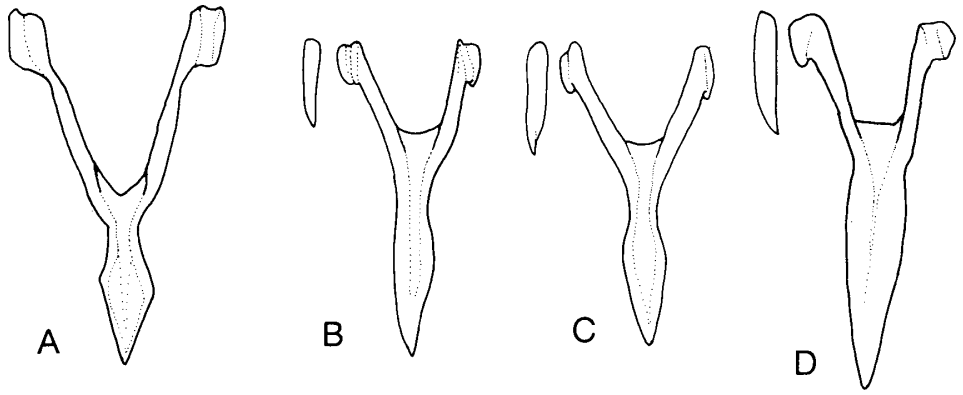


Figs. 126A–D. *Paradmete curta* STREBEL. A, B. Shell; C, D. Radula. Scale A, B=5 mm; C, D=10 μm.

conical spire with distinct shoulder (Figs. 126A, B). The protoconch is large, round, about 2.6 in number of turns, 2.3 mm in diameter, 1.3 mm in height, glossy white in color, and has smooth surface. The teleoconch is about 3 in number of turns, slightly inflated, and has narrow but low axial ribs and very fine growth lines that are crossed by fine, regularly spaced spiral cords. The surface has a thin and translucent periostracum. The suture is shallow, and the sutural ramp is narrow and rather flat. The body whorl is very large, occupying about 83% of shell length, slightly inflated, with axial ribs tending to weaken towards the slightly constricted base. The spiral ribs come to appearance from the first turn of the teleoconch, and are 30 on the penultimate whorl and 37 on the last whorl.

In the small specimen, these axial ribs are not so pronouncedly raised. The aperture is oblong, large and rather wide, with the length occupying about 70% of shell length and breadth about 55% of shell width. The outer lip is almost smooth, except an angle at the shoulder, and gently curved below the angle. The inner lip is rounded. The columellar lip is slightly curved, and has two rather weak columellar folds that are almost the same in size and strength. The inner and columellar lips have a thin, and translucently white callus. The siphonal canal is open and short. The inner wall is smooth and glossy white.

The radula is rachiglossate, (1)0 : 1 : 0(1) with about 300 transverse rows of teeth, translucent, long but narrow (2.5 mm in length, 0.05 mm in width; 13.5 mm in SL) (Figs. 126C, D, 127A). The rhachidian tooth is Y-shaped, very small, with a large, stout, rather



Figs. 127A-D. Radulae of four species of the genus *Paradmete*.
A: *P. curta*; B: *P. fragillima*; C: *P. breidensis* n. sp.;
D: *P. arnaudi* n. sp. Scale 10 μm.

wide, sharp and arrowhead-shaped cusp with a longitudinal furrow. The divergent rami and bases are thick and stout.

Measurements:

SL 12.2 mm, SW 7.4 mm (empty shell; St. 5).
SL 10.5 mm, SW 6.3 mm (living specimen; St. 8).
SL 13.5 mm, SW 7.6 mm (living specimen; JARE-27).
SL 11.5 mm, SW 6.6 mm (empty shell; JARE-27).

Previous distribution records (Fig. 128): Type locality: Shag Rock Bank, South Georgia, 160 m. Range: South Georgia, 95 m (longicauda) (STREBEL, 1908); off Mackenzie Sea, 456 m, off Enderby Land, 300, 193 and 220 m (POWELL, 1958); West Cumberland Bay, South Georgia, 110 m (POWELL, 1951); Kerguelen Island, 120–650 m (ARNAUD and MOL, 1979); eastern Weddell Sea (HAIN, 1990); South Georgia, 97–101 m (DELL, 1990); Ross Sea, 238–468 m (DELL, 1990).

Remarks: The operculum of *Paradmete curta* is present, but not preserved in the present specimen, only a muscle scar on the dorsal side of the metapodium is recognized.

The radula of this species was first reported by ARNAUD and MOL (1979), who described this species has small and short marginal teeth. The radula of the examined specimen has no such marginal teeth, which might be lost during a process of handling.

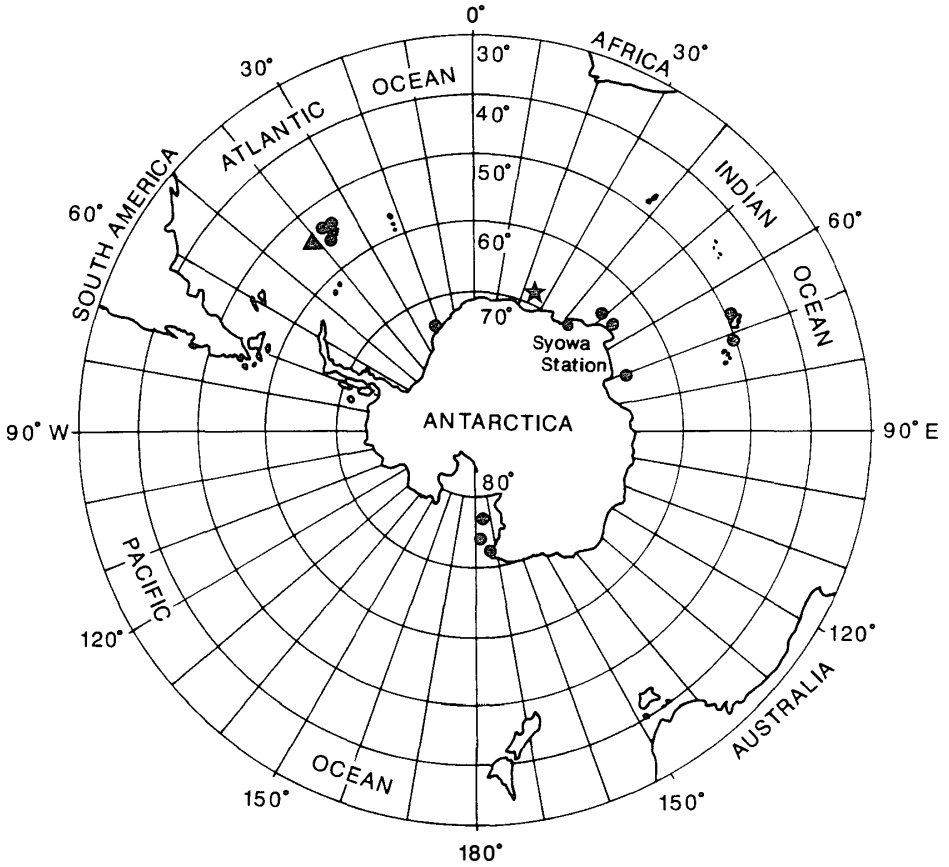


Fig. 128. Distribution of *Paradmete curta* STREBEL (Large dots: Previous distribution records; Star: Present study; Triangle: Type locality).

Paradmete curta has wide geographical and bathymetrical distribution ranges, such as Kerguelen to the Antarctic continental shelf, at 95-650 m.

Paradmete fragillima **(WATSON, 1882)**

(Figs. 127B, 129A-E)

Volutomitra fragillima WATSON, 1882, p. 334; WATSON, 1886, p. 263, pl. 14, fig. 7; LAMY, 1915, p. 69 (distribution record); SMITH, 1915, p. 74; ARNAUD and MOL, 1979, p. 29, figs. 3, 12B, 16.

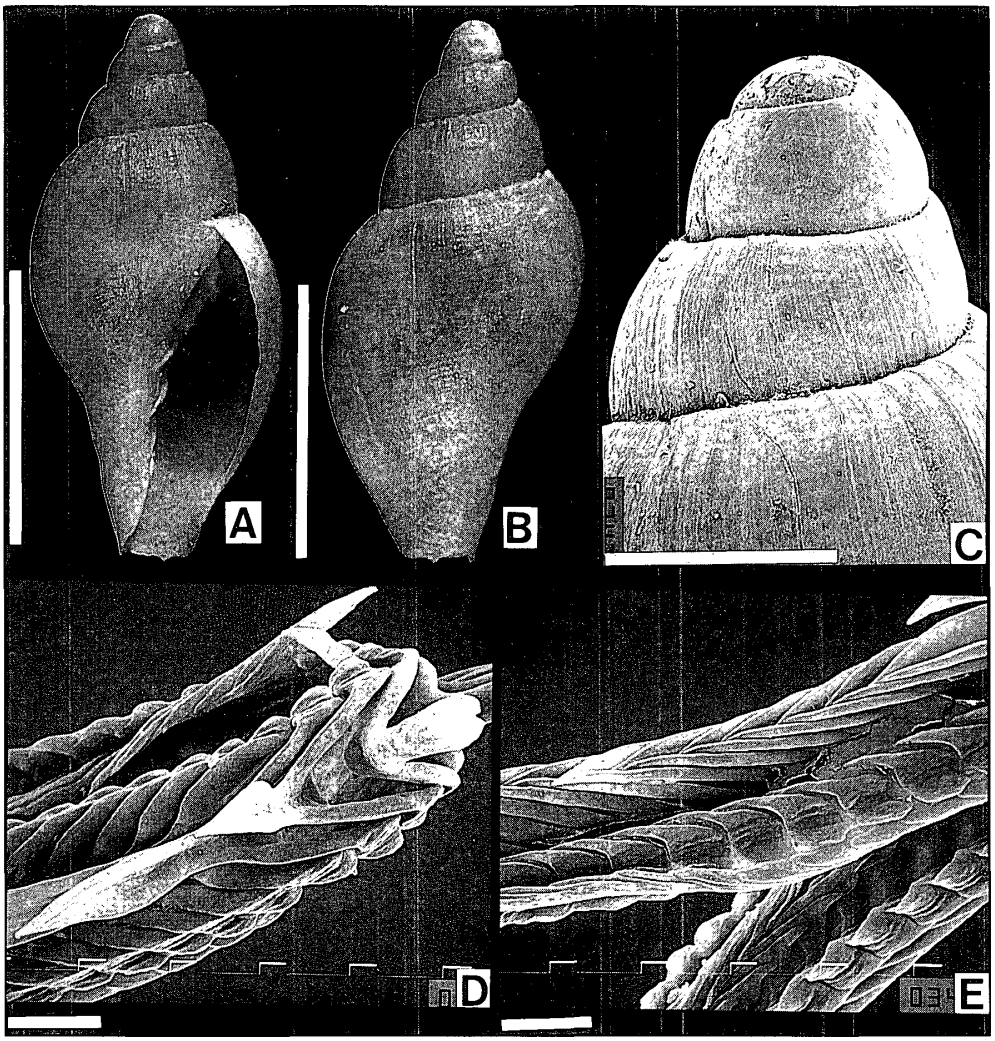
Paradmete typica STREBEL, 1908, p. 22, pl. 3, figs. 35a-f; MELVILL and STANDEN, 1912, p. 357 (distribution record); THIELE, 1912, p. 248, figs. 12a-c (figure of radula).

Paradmete fragillima: POWELL, 1951, p. 165; POWELL, 1957, p. 134 (distribution record); POWELL, 1958, p. 198 (distribution record); POWELL, 1960, p. 157; EGOROVA, 1982, p. 37, fig. 166; DELL, 1990, p. 222, fig. 390.

Volutomitra (*Paradmete*) *fragillima*: CERNOHORSKY, 1970, p. 102, figs. 186, 187, 190, 191, pl. 13, fig. 10; HAIN, 1990, p. 66, pl. 6, fig. 12, pl. 25, fig. 5.

Material examined: A single living specimen from St. 8.

Description: The shell is obese fusiform, thin, white in color, with a elevated spire (Figs. 129A, B). The protoconch is round, inflated, large, about 1.5 in number of turns, 1.3 mm



Figs. 129A-E. *Paradmete fragillima* (WATSON). A, B. Shell; C. Protoconch; D, E. Radula. Scale A, B=5 mm; C=1 mm; D, E=10 μm.

in height, 2.7 in diameter, somewhat glossy white in color, with smooth surface (Fig. 129C). The teleoconch is about 2.5 in number of turns, not well inflated, with crowded and slender spiral lirae which are crossed by very fine growth lines. The surface is covered by a very thin, translucent periostracum. The suture is slightly constricted. The body whorl is large, about 70% of shell length, rather slender. The base is slightly constricted. The aperture is oblong, large but narrow, and aperture length is about 2/3 of shell length. The outer lip is thin, round and smooth. The inner lip is smooth and gently incurved. The columellar lip is gently curved, and has three columellar folds of which the adapical one is weakest. The inner and columellar lips have a thin and translucent white callus. The siphonal canal is open. The inner wall has white and smooth surface.

The operculum is absent.

The radula is rachiglossate, 1 : 1 : 1 with about 180 transverse rows, translucent, long but narrow (1.25 mm in length, 0.05 mm in width; 10.0 mm in SL) (Figs. 127B, 129D, E). The rhachidian tooth is Y-shaped, large and stout, arrowhead-shaped, with a longitudial

furrow. The divergent rami are moderate, about half of total length. The bases are wide, and bend backward. The marginal teeth are small and weak, with sharply pointed tip (Fig. 129E). The length of marginal are about 1/3 of rhachidian length.

Measurements: SL 10.0 mm, SW 4.5 mm.

Previous distribution records (Fig. 130): Type locality: Royal Sound, Kerguelen Islands, 49°28′S, 70°13′E, 51 m (*Volutomitra fragillima*); Cumberland Bay, South Georgia, 54°17′S, 36°28′W, 75 m (*Paradmete typica*). Range: Burdwood Bank, Falkland Islands, 101 m (MELVILL and STANDEN, 1912); Young William Bay, 30 m (LAMY, 1915); off Oates Land, 324–360 m (SMITH, 1915); Kerguelen Island, 37–585 m, Crozet Islands, 150–210 m, and Heard Island (ARNAUD and MOL, 1979); around South Georgia, 110–236 m, and Bismarck Strait, Palmer Archipelago, 315 m (POWELL, 1951); Kerguelen Island, 44–150 m (POWELL, 1957); off Kemp Land, 603 m, off Enderby Land, 193 and 300 m, and off Kaiser Wilhelm Land, 393 m (POWELL, 1958); eastern Weddell Sea, 270 m (HAIN, 1990); South Georgia, 97–101 m (DELL, 1990); west of South Orkney Islands, 641 m (DELL, 1990); South Shetland Islands, 154 m (DELL, 1990); 66°42′S, 92°10′E, Davis Sea, 110 m (DELL, 1990); Ross Sea, 360–549 m (DELL, 1990).

Remarks: *Paradmete fragillima*, which is the commonest Volutomitrid in the Antarctic area, has wide horizontal and vertical distribution ranges, such as Falkland Islands to the Antarctic continental shelf, in 30–603 m.

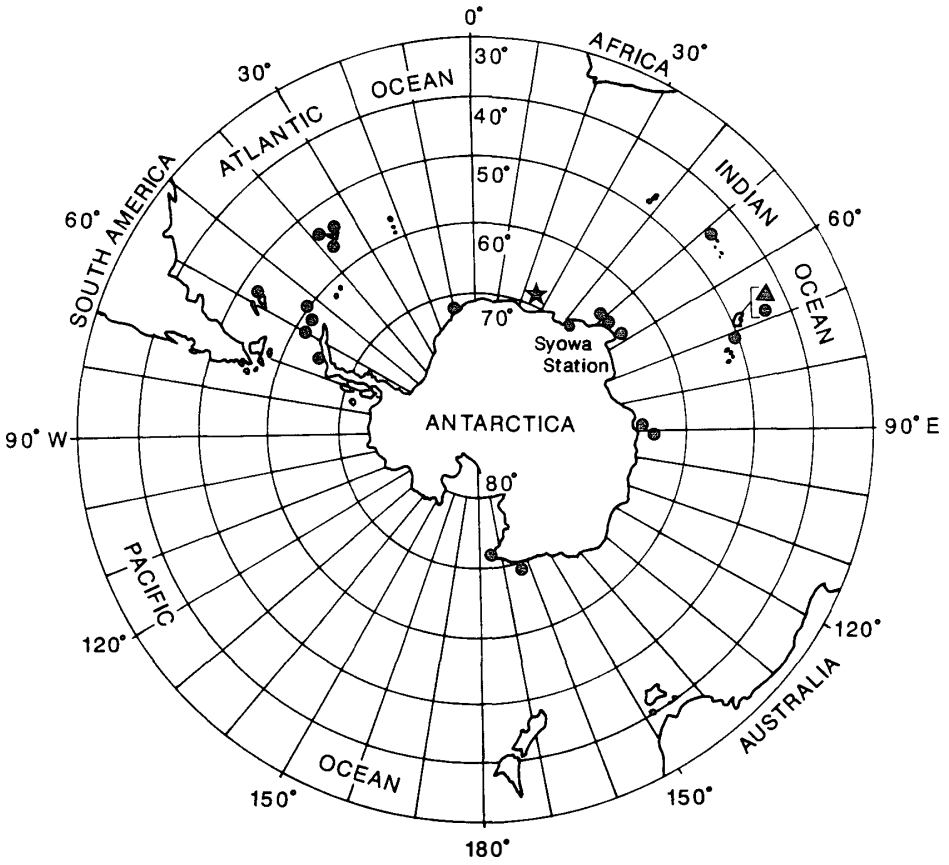


Fig. 130. Distribution of *Paradmete fragillima* (WATSON) (Large dots: Previous distribution records; Star: Present study; Triangle: Type locality).

According to ARNAUD and MOL (1979), *P. curta* and *P. fragillima* are particularly abundant on muddy substrates mixed with biogenic fragments, such as bryozoans, shells, foraminiferans and others. In this study, these two species were also collected from only the muddy substrates mixed with sponge spicules in Breid Bay.

CERNOHORSKY (1970) described the operculum of *P. fragillima*. According to him, the operculum is very small, irregularly oval, dark brown in color and ca. 2.0 mm × 1.4 mm in a shell 23.3 mm long. But, ARNAUD and MOL (1979) who studied the anatomical details of this species, did not observe the operculum. In the present study, neither operculum present, nor operculigerous disk on foot was observed. The CERNOHORSKY's specimen requires re-confirmation.

Paradmete breidensis n. sp.

(Figs. 127C, 131A–E)

Volutomitra (*Paradmete*) sp. 1 HAIN, 1990, p. 66, pl. 6, figs. 13a, b, pl. 25, fig. 6.

Material examined: A single living specimen from St. 8.

Description: The shell is elongate fusiform, thin, white in color, with a tall spire (Figs. 131A, B). The protoconch is well rounded, large, highly elevated, about 2.4 in number of turns, 0.8 mm in diameter, 0.7 mm in height, also frosted white in color, with smooth surface (Fig. 131C). The teleoconch is about 2.5 in number of turns, not well inflated. The surface is covered by a very thin translucent periostracum. The growth lines are rather coarse and irregularly raised like low axial riblets. The base has some widely spaced spiral lirae that tend to become stronger abapically. The suture is moderately constricted. The body whorl is large, about 60% of shell length. The base is slightly constricted. The aperture is lunate. The outer lip is round and smooth, and tend to become thinner abapically. The inner lip is smooth. The columellar lip is almost straight, and has two low columellar folds that are almost the same in size and appearance. The inner and columellar lips have a thin callus. The siphonal canal is open, and slightly recurved dorsally. The inner wall is glossy and smooth.

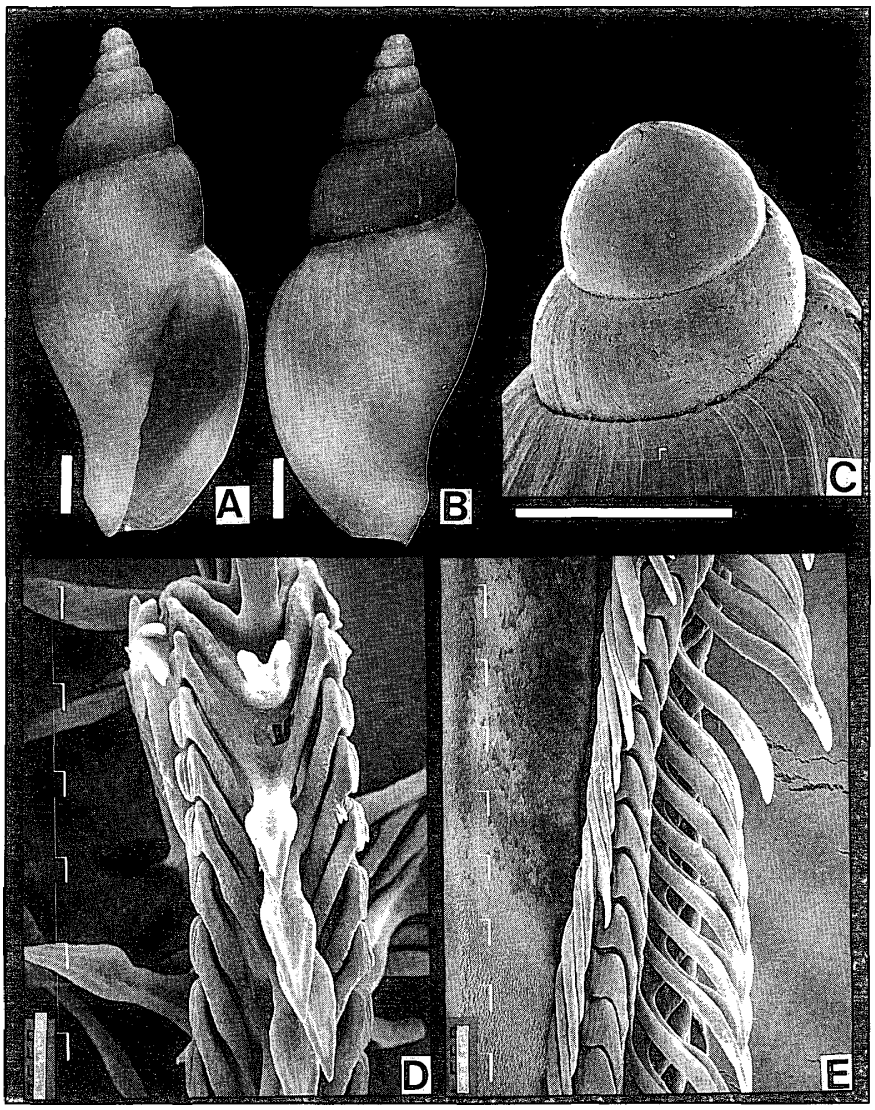
The operculum is very small to the aperture in size, with length being about 1/4 of aperture length, translucent pale yellow in color, horny, very thin, narrow, and subtriangular. The nuculeus is situated on the lowest tip.

The radula is rachiglossate, 1 : 1 : 1 with more than 160 transverse rows, translucent, long but very narrow (1.25 mm in length, 0.05 mm in width; 8.7 mm in SL) (Figs. 127C, 131D, E). The rhachidian tooth is Y-shaped, remarkably large, stout, arrowhead-like in shape, slightly wide and sharply pointed cusp with a central furrow. The basal tips are wide, and bend backward. The marginal teeth are narrow, also arrowhead-like in shape, small and weak. Each tooth has a sharply pointed tip (Fig. 131E), with length being about half the rhachidian length.

Measurements: SL 7.0 mm, SW 3.9 mm, AL 4.0 mm, AW 1.5 mm (Holotype specimen; NSMT-Mo 70626).

Previous distribution record (Fig. 132): Eastern Weddell Sea, 337–441 m depth by HAIN (1990) as *Volutomitra* (*Paradmete*) sp. 1.

Remarks: This new species belongs to the genus *Paradmete* because of having elongate fusiform shell, a Y-shaped rhachidian tooth, and weak and simple marginal teeth.



Figs. 131A-E. *Paradmete breidensis* n. sp. A, B. Holotype; C. Protoconch; D, E. Radula. Scale A, B=1 mm; C=1 mm; D, E=10 μm.

This species is closely similar to *Paradmete fragillima* (WATSON, 1882) by having an elongate fusiform shell with rather obsolete sculptures (Figs. 126A, B). *P. fragillima* is separable from WATSON's species in the following characters: 1) Large and more inflated body whorl; 2) lower spire; 3) smaller and lower protoconch (1.5 mm in diameter, 1.3 mm in height); 4) clearer spiral lirae and weaker axial sculpture; 5) three columellar folds; and 6) presence of operculum. The marginal teeth of *P. fragillima* is smaller and weaker than those of this new species.

Paradmete arnaudi n. sp.

(Figs. 127D, 133A-E)

Material examined: 2 empty shells from St. 7; 1 living specimen from St. 8.

Description: The shell is ovate fusiform, thin, somewhat glossy white in color, with a

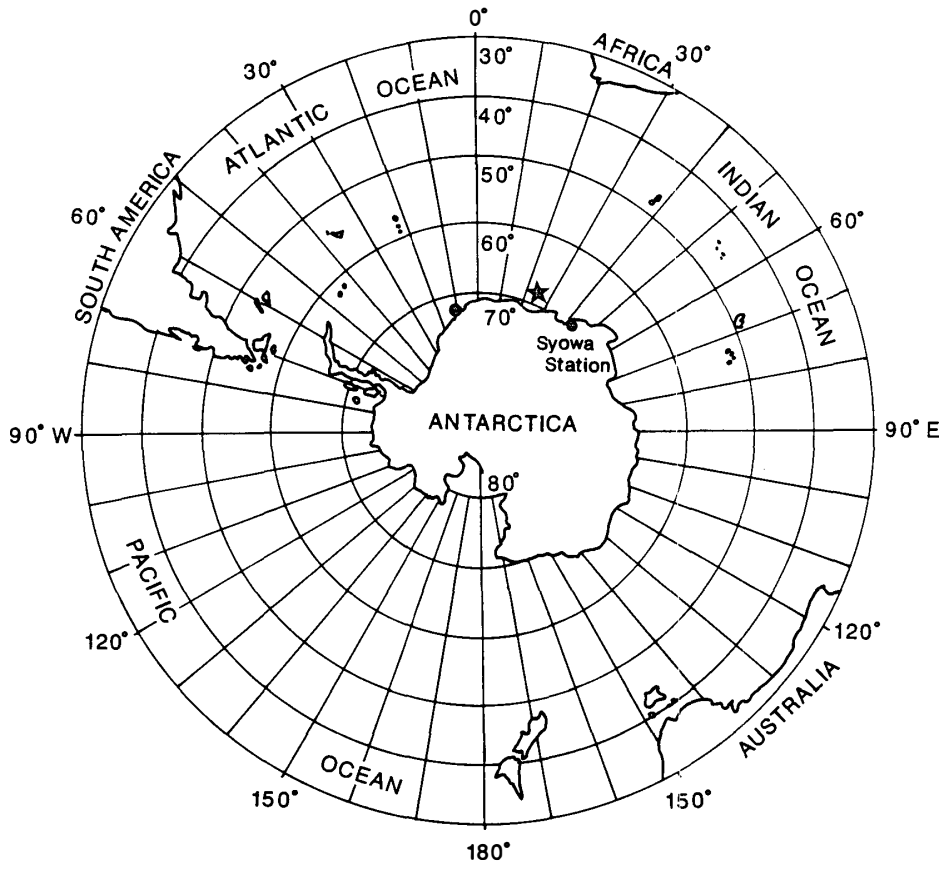
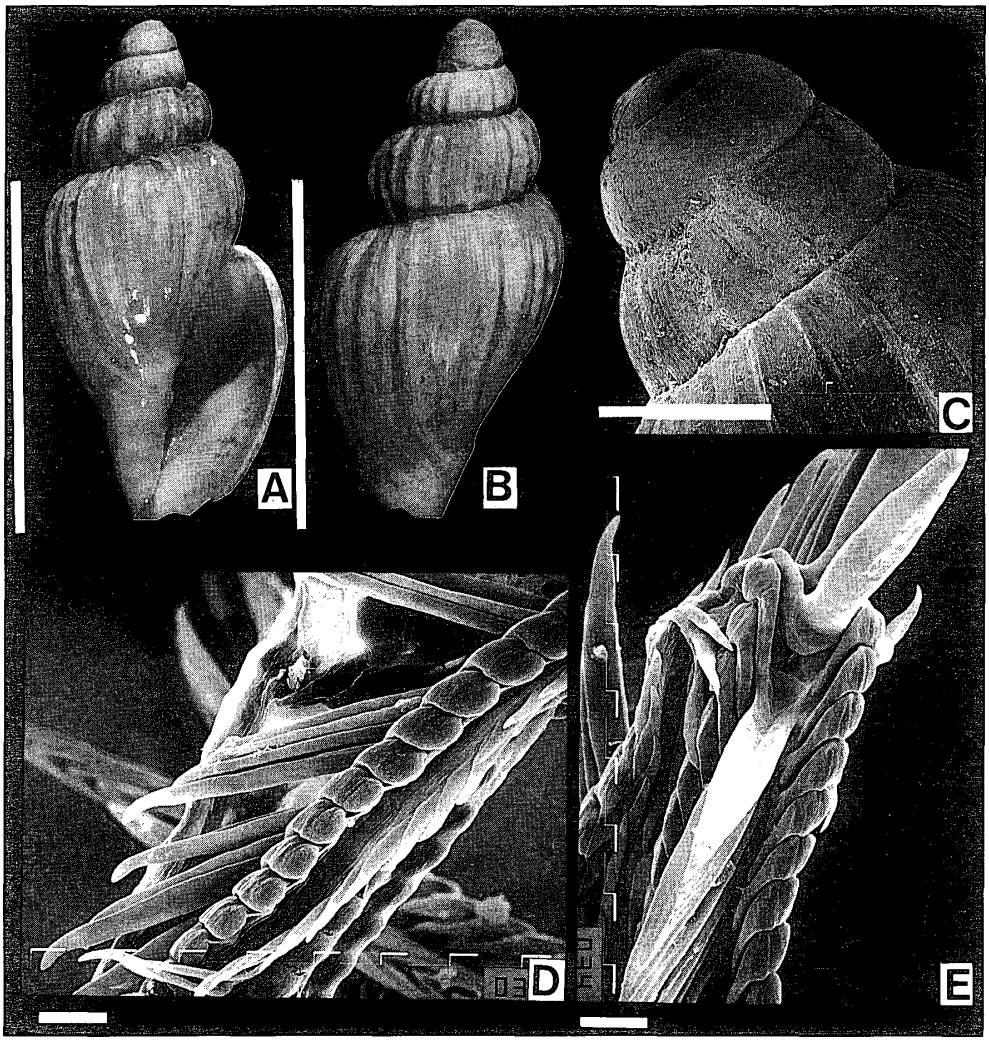


Fig. 132. Distribution of *Paradmete breidensis* n. sp. (Dot: Previous distribution record; Star: Present study).

rather high and large spire (Figs. 133A, B). The protoconch is large, about 2.8 in number of turns, 1.3 mm in diameter, 1.4 mm in height, frosted white in color, with smooth surface (Fig. 133C). The teleoconch whorl is about 3 in number of turns, slightly inflated, and has axial ribs and fine growth lines. The axial ribs are well spaced, wide, round topped, rather highly raised, and become weaker abapically. The surface is covered by a very thin translucent periostracum. The suture is constricted. The body whorl is large, about 70% of shell length, with breadth being 48% of shell length, slightly inflated, carrying 25 axial ribs. The first turn has 15 axial ribs, and the penultimate whorl 21. The base is slightly constricted. The aperture is lunate and large, with aperture length being about 60% of shell length. The outer lip is rather thick, round and smooth, becoming thinner abapically. The inner lip is smooth. The columellar lip is gently curved with four columellar folds of which the third one is slightly stronger than the others. The white callus extending from the inner lip to the columellar lip is rather thin. The siphonal canal is open and straight. The inner wall is white in color.

The operculum is very small to the aperture in size, translucent pale yellow in color, horny, thin and narrowly subtriangular. The nuculeus is situated on the pointed lower tip.

The radula is rachiglossate, 1 : 1 : 1 with more than 105 transverse rows, translucent, long but narrow (1.0 mm in length, 0.05 mm in width: 7.0 mm in SL) (Figs. 127D, 133D,



Figs. 133A–E. *Paradmete arnaudi* n. sp. A, B. Holotype; C. Protoconch; D, E. Radula. Scale A, B=5 mm; C=500 μm; D, E=10 μm.

E). The rhachidian tooth is Y-shaped, large, long and stout, with a wide, sharply pointed large and stout cusp with a central furrow. The divergent rami are short, with wide bases, bending backward. The marginal teeth are simple, weak and small, with sharply pointed tip (Fig. 133E). The length of marginal teeth are about 1/3 of rhachidian length.

Measurements:

SL 10.2 mm, SW 4.9 mm (empty shell; St. 7) (Holotype specimen; NSMT-Mo 70627).

SL 10.3 mm, SW 5.5 mm (empty shell; St. 7) (Paratype specimen #1; NSMT-Mo 70628).

SL 7.0 mm, SW 3.9 mm (living specimen; St. 8) (Paratype specimen #2; NSMT-Mo 70629).

Remarks: This subgenus contains 4 species, and they are only known from Antarctic and Subantarctic regions. This species is easily distinguishable from the other 4 species in having conspicuously raised axial ribs and less spiral sculpture. The cusp of rachidian tooth of this species is longer and wider than other species, and the marginals are also

longer and stronger.

According to CERNOHORSKY (1970), the sculpture of *Volutomitra* (*Paradmete*) *curta* has high variability. He illustrated three variations on shell of *V.* (*P.*) *curta*. This species resembles the one of these shell type (CERNOHORSKY, 1970; Plate 13, Fig. 13), in having raised axial ribs. But, this species has no spiral sculpture on the shell surface, and the shape of rachidian tooth is different.

Family VOLUTIDAE RAFINESQUE, 1815
Subfamily Fulgorarinae, PILSBRY and OLSSON, 1954
Genus *Harpovoluta* THIELE, 1912

Harpovoluta charcoti (LAMY, 1910)
(Figs. 134A–F)

Buccinum charcoti LAMY, 1910, p. 318; LAMY, 1911, p. 4, pl. 1, figs. 1, 2;
Harpovoluta charcoti: THIELE, 1912, p. 271; VAYSSIÈRE, 1917, p. 37, pl. 4, figs. 54, 55; POWELL, 1951, p. 164; POWELL, 1958, p. 199; POWELL, 1960, p. 157 (name only); ARNAUD, 1972a, p. 432; WEAVER and du PONT, 1970, p. 61, pls. 8e, f, figs. 13a, b; ARNAUD, 1985, p. 115; HAIN, 1990, p. 64, pl. 6, figs. 10a–c, pl. 25, fig. 3; DELL, 1990, p. 218, figs. 365, 366, 374, 375, 383; GUIDA and GOTO, 1992, p. 135, pl. 46, 3, 4.
Harpovoluta vanhoffeni vanhoffeni THIELE, 1912, p. 213, pl. 14, fig. 1, textfig. 1; HEDLEY, 1916, p. 53; POWELL, 1960, p. 157 (name only); WEAVER and du PONT, 1970, p. 62, pls. 8a, b, fig. 13c; EGOROVA, 1982, p. 36, fig. 163.
Harpovoluta vanhoffeni striatula THIELE, 1912, p. 214, pl. 14, fig. 2; VAYSSIÈRE, 1917, p. 36, pl. 4, figs. 50–53; EGOROVA, 1982, p. 37, figs. 48, 164.
Volutharpa charcoti: SMITH, 1915, p. 72; EALES, 1923, p. 33, figs. 34–37.
Material examined: Two living specimens from Günnerus Bank, 288 m depth; 1 living specimen from Günnerus Bank, 955 m; 5 living specimens from offshore of Ongul Islands by JARE-21.
Description: The shell is large, very thin, fragile, translucent white in color, ovoid, with a small and low spire (Figs. 134A–E). The protoconch is bulbously large, but usually superficially eroded. The teleoconch whorls are moderately inflated, almost smooth, except very fine crowded axial growth lines on the surface. The periostracum, when present, is very thin and translucent white or pale yellow in color. The suture is slightly constricted. The body whorl is very large, occupying about 90% of shell length, moderately inflated. The aperture is lunate, large, about 3/4 of shell length, and gradually widens abapically. The outer lip is round and smooth, with a thin and sharp edge. The inner lip is gently round and smooth. The columellar lip is straight and weakly twisted, and has no columellar fold. The siphonal canal is absent. The inner and columellar lips has a thin callus, which sometime completely covers the ventral surface of the shell. The inner wall is smooth and glossy.

No operculum is present.

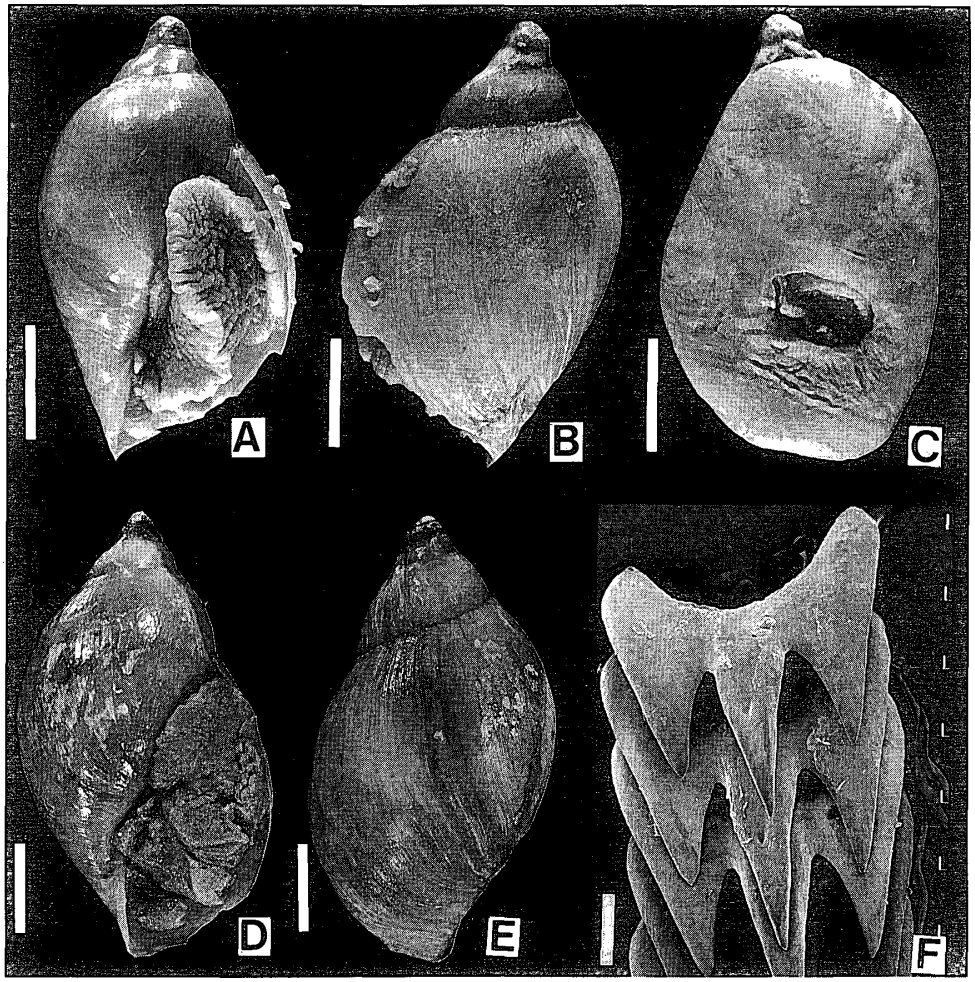
The radula is rachiglossate, 0 : 1 : 0 with 65 transverse rows, translucent brown in color, long but narrow (about 10 mm in length, 1 mm in width; 39.8 mm in SL) (Fig. 134F). The rhachidian tooth is large, and has a strongly incurved base and three large,

strong and sharply pointed cusps on the top. The central cusp is larger and stronger than lateral cusps which is about 2/3 as tall as the central one.

Measurements:

SL 39.8 mm, SW 23.0 mm (living specimen; Günnerus Bank, 288 m depth).
SL 32.7 mm, SW — mm* (living specimen; Günnerus Bank, 955 m depth).
SL 49.7 mm, SW 28.0 mm (living specimen; offshore of Ongul Islands).
SL 50.9 mm, SW — mm* (living specimen; offshore of Ongul Islands).
SL 57.3 mm, SW — mm* (living specimen; offshore of Ongul Islands).
SL — mm, SW — mm** (living specimen; offshore of Ongul Islands).
SL — mm, SW — mm** (living specimen; offshore of Ongul Islands).
(*: aperture is broken; **: shell is broken)

Previous distribution records (Fig. 135): Type locality: off King George Sound, South Shetland Islands, 420 m (*charcoti*), Gauss Station, Davis Sea (*vanhoffeni vanhoffeni* and *vanhoffeni striatula*). Range: off Oates Land, 324–360 m (SMITH, 1915); off Mertz Glacier Tongue, Adélie Land, 519 m, off Wilkes Land, 414 m, off Shackleton Iceshelf, 198 m and



Figs. 134A–F. *Harpovoluta charcoti* (LAMY). A–C. From Günnerus Bank, 288 m deep; D, E. From Syowa Station; F. Radula of A. Scale A–E = 10 mm; F = 100 μm.

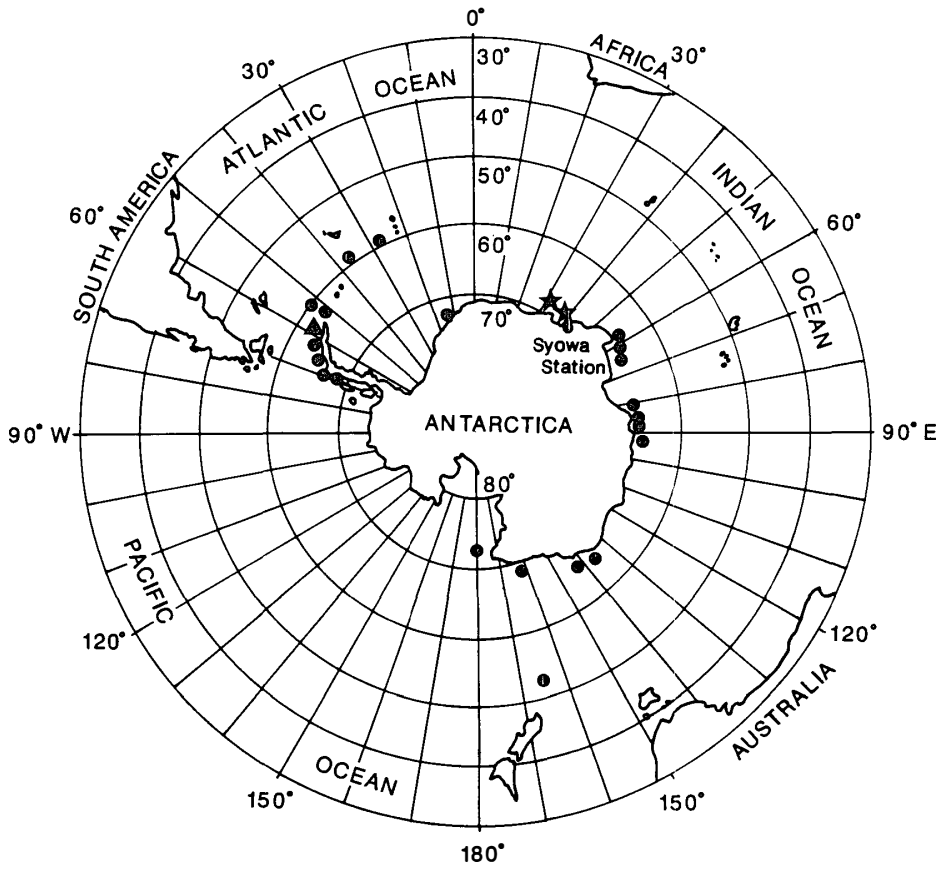


Fig. 135. Distribution of *Harpovoluta charcoti* (LAMY) (Large dots: Previous distribution records; Star: Present study; Triangle: Type locality).

432 m (HEDLEY, 1916); off Cape Bowles, Clarence Island, 342 m (POWELL, 1951); off Kemp Land, 603 m, off MacRobertson Land, 210 m and 219 m (POWELL, 1958); Petermann Island, 300 m (ARNAUD, 1972a); Davis Sea, 210–540 m (EGOROVA, 1982); eastern Weddell Sea, 30–952 m (HAIN, 1990); off South Sandwich Islands, 1190–1469 m (DELL, 1990); 58° 16′S, 37°51′W, Scotia Sea, 430 m (DELL, 1990); west of South Orkney Islands, 641 m (DELL, 1990); west of Antarctic Peninsula, 135–750 m (DELL, 1990); Elephant Island, Antarctic Peninsula, 220–240 m (DELL, 1990); Bransfield Strait, Antarctic Peninsula, 73–311 m (DELL, 1990); Ross Sea, 329–567 m (DELL, 1990).

Remarks: *Harpovoluta charcoti* exhibits the circum-antarctic distribution, and wide bathymetrical range, 30–955 m. According to ARNAUD (1985), *H. charcoti* is relatively high in population density. In this study, *H. charcoti* was collected near Syowa Station, Günnerus Bank, 280 m and 955 m deep, respectively, but not from Breid Bay.

The shell of *H. charcoti* was slightly different in form by report (SMITH, 1915, POWELL, 1958). The ratio of SW/SL of POWELL's specimen is 62.9% (31.0 mm in SL, 19.5 mm in SW). But, that of the examination specimens in are 57.8% (Günnerus Bank specimen) and 56.3% (Ongul Islands specimen). Specimen collected from Ongul Islands is smaller than Günnerus Bank specimen, and has low spire. The Günnerus Bank specimen is large, and has high spire. Therefore, the specimens from Ongul Islands have more elongate shell with higher than Günnerus Bank specimens (Figs. 131D, E). And the South Shetland

Islands specimens collected by JAMARC contained two types, *viz*. ovoid and elongate shells. According to DELL (1990), the range of SW/SL of three specimens *H. charcoti* from off the South Shetland Islands is 52–61%, and that of the type specimen of this species is 61%. The examination specimens is included in a considerable variation of *H. charcoti*.

Two species and a variety have been described in the genus *Harpovoluta*, such as *H. charcoti, H. vanhoeffeni* and *H. v.* var. *striatula*, up to this date. According to DELL (1990), the ratio of SW/SL of the type specimen of *H. vanhoeffeni* is 58%, and it is included in the range of SW/SL of *H. charcoti*. And other shell characters, such as the ratio of spiral height, are also similar, therefore, *H. vanhoeffeni* was synonym of *H. charcoti*.

THIELE (1912) reported that the animal secreted a purple fluid. In this observation, the ventral area of animal of three specimens was dyed purple. VAYSSIÈRE (1917) described that a reflection of the mantle lobes of *Harpovoluta* over the shell, so as to cover it almost completely, except a central hole.

According to ARNAUD (1985), A large commensal anemone, *Isosicyonis alba*, permanently adheres the shell. In this observation, two specimens from Günnerus Bank, 288 m depth, carry large anemones (Fig. 134C). But, all specimens from offshore of Ongul Islands, are not covered by such anemone, while South Shetland Islands specimens are frequently commensal anemones.

Family MARGINELLIDAE LAMARCK, 1801
Genus *Marginella* LAMARCK, 1799
Type species: *Voluta glabella* LINNAEUS, 1758 (monotypy)

Marginella hyalina THIELE, 1912
(Figs. 136A–C)

Marginella hyalina THIELE, 1912, p. 213, pl. 13, fig. 26; HEDLEY, 1916a, p. 54; POWELL, 1958, p. 199, textfig. B1; POWELL, 1960, p. 158 (name only); EGOROVA, 1982, p. 36, fig. 162; HAIN, 1990, p. 69, pl. 7, fig. 6; DELL, 1990, p. 223, fig. 388.

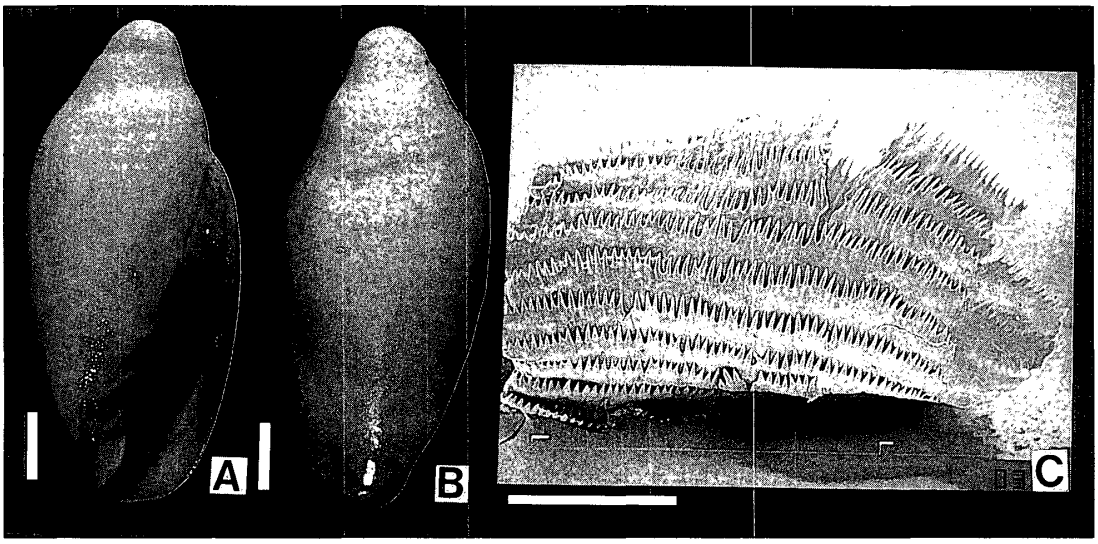
Material examined: 4 living specimens and 9 empty shells from St. 5; 2 living specimens and 1 empty shells from St. 7; 5 living specimens and 6 empty shells from St. 8; 4 living specimens and 1 empty shell from St. 9; 1 empty shell from Günnerus Bank.

Description: The shell is small, elongate, ovate-conical, very thin, translucent white in color, with a low and broadly spire (Figs. 136A, B). The outer surface is smooth and polished by a thin, translucent callus. The protoconch is large, about 2.1 number of turns, 1.25 mm in diameter, 0.8 mm in height, rather elevated, with a smooth and polished surface. The teleoconch is about 2.5 in number of turns, slightly inflated, large and elongate. The suture is flush, and covered by a thin callus. The body whorl is elongate, very large, long but narrow, with length occupying 85% of shell length and breadth 50% of shell length. The aperture is long but narrow, 70% of shell length, and the upper part of the aperture is narrow, but widens abapically to an open canal. The outer lip is smooth, and the upper part is slightly angled. The outer lip of the mature specimen is slightly thickened. The inner lip is smooth and gently curved. The columellar lip is short, weakly twisted, and slightly curved, with three columellar folds. The abapicalmost one is the strongest. The

inner wall is smooth and polished.

No operculum is present.

The radula is rachiglossate, 0 : 1 : 0, translucent, pale yellow in color, thin, very short but very wide (Fig. 136C). The rhachidian tooth is large, wide but very low, and has about 70 denticles on the frontal margin.



Figs. 136A-C. *Marginella hyalina* THIELE.
A, B. Shell; C. Radula. Scale A, B=1 mm; C=50 μm.

Table 23. Measurements and condition of *Marginella hyalina* THIELE.

No.	1	2	3	4	5	6	7	8	9	10	11
St.	5	5	5	5	5	5	5	5	5	5	5
SL (mm)	5.2	5.3	5.5	6.0	6.5	6.8	6.9	7.0	7.3	7.4	7.5
SW (mm)	3.0	2.5	2.6	—	3.1	3.3	3.4	3.3	3.5	3.5	3.5
SW/SL (%)	57.7	47.2	47.3	—	47.7	48.5	49.3	47.1	47.9	47.3	46.7
Condition	L	F	F	E	F	L	F	L	F	L	F

No.	12	13	14	15	16	17	18	19	20	21	22
St.	5	5	8	8	8	8	8	8	8	8	8
SL (mm)	7.7	—	3.4	4.0	5.0	6.0	6.7	6.7	6.8	7.1	7.2
SW (mm)	3.7	—	1.6	2.2	2.4	3.0	3.0	—	3.4	3.2	3.4
SW/SL (%)	48.1	—	47.1	55.0	48.0	50.0	44.8	—	50.0	45.0	47.2
Condition	F	E	L	F	L	F	L	E	F	L	L

No.	23	24	25	26	27	28	29	30	31	32	33
St.	8	8	7	7	7	9	9	9	9	9	G
SL (mm)	7.5	—	4.7	6.6	7.6	3.5	5.3	5.4	6.8	6.8	5.8
SW (mm)	3.2	3.2	2.5	3.8	3.7	1.7	2.5	3.2	3.5	3.5	2.8
SW/SL (%)	42.7	—	53.2	57.6	48.7	48.6	47.2	59.3	51.5	51.5	48.3
Condition	F	E	L	L	F	L	L	L	L	F	F

E: Empty and water-worn specimen; F: Freshly dead specimen; L: Specimen taken alive; G: Günnerus Bank (288 m deep).

Measurements: See Table 23.

Previous distribution records (Fig. 137): Type locality: Gauss Station, Davis Sea. Range: D'Urville Sea, 283 m (HEDLEY, 1916a); off Enderby Land, 193–220 m (POWELL, 1958); eastern Weddell Sea, 115–673 m (HAIN, 1990); off South Shetland Islands, 311–426 m (DELL, 1990); 75°31′S, 26°43′W, Coats Land, Weddell Sea, 229 m (DELL, 1990); Ross Sea, 256–457 m (DELL, 1990).

Remarks: Almost all small specimens, 3.4–5.5 mm in shell length, have thin outer lip, except a single specimen, 5.4 mm in shell length. The outer lip of specimens 5.8–7.7 mm is thickened.

The ventral area of animal of the smallest specimen (3.4 mm in SL) was dyed red, as this species may secret reddish fluid like *H. charcoti* that secrets purple dye.

Marginella hyalina is quite similar to *M. ealesae* THIELE, 1912 (Figs. 138A, B). But, the this species is separable from the former in the following characters: 1) Small shell (maximum shell length is 7.7 mm); 2) small protoconch, with fewer number of turns (about 1.3 mm in diameter, 2.1 in number of turns); and 3) the little thickend outer lip in large specimen. The radulae of the Antarctic species of the genus *Marginella* are first described by the present study. The radula of *M. hyalina* is relatively larger than that of *M. ealesae* (0.5 mm in length, 0.15 mm in width, about; 7.0 mm in SL), and has more number of cusps (about 70 cusps versus 52).

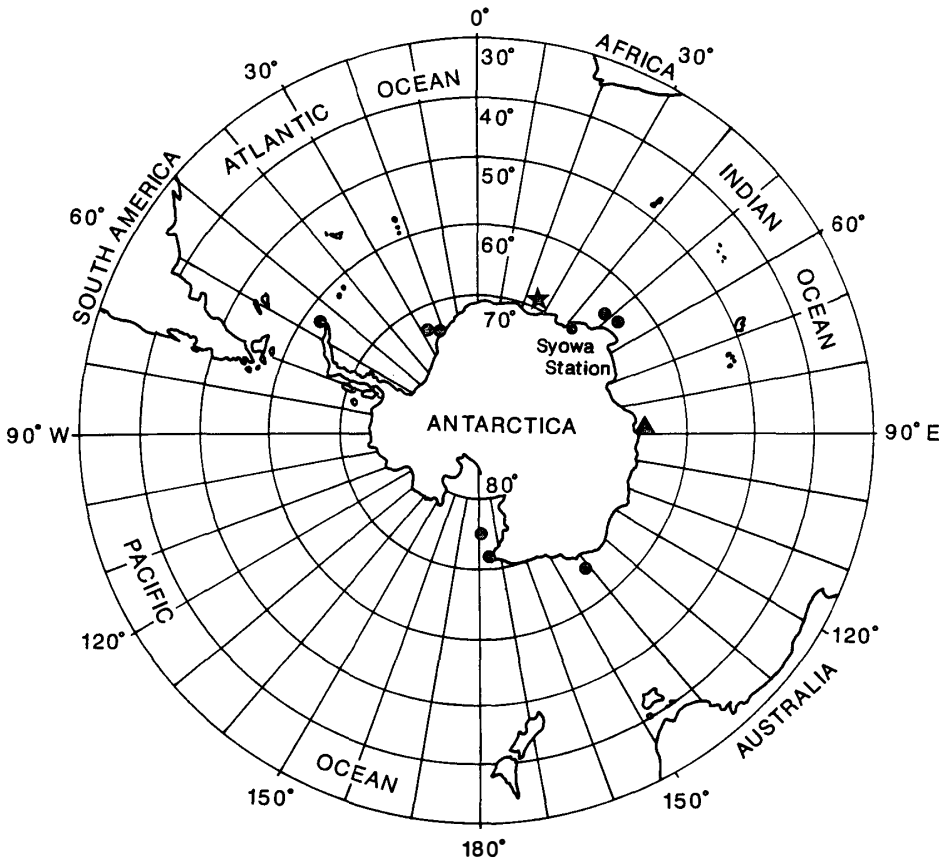


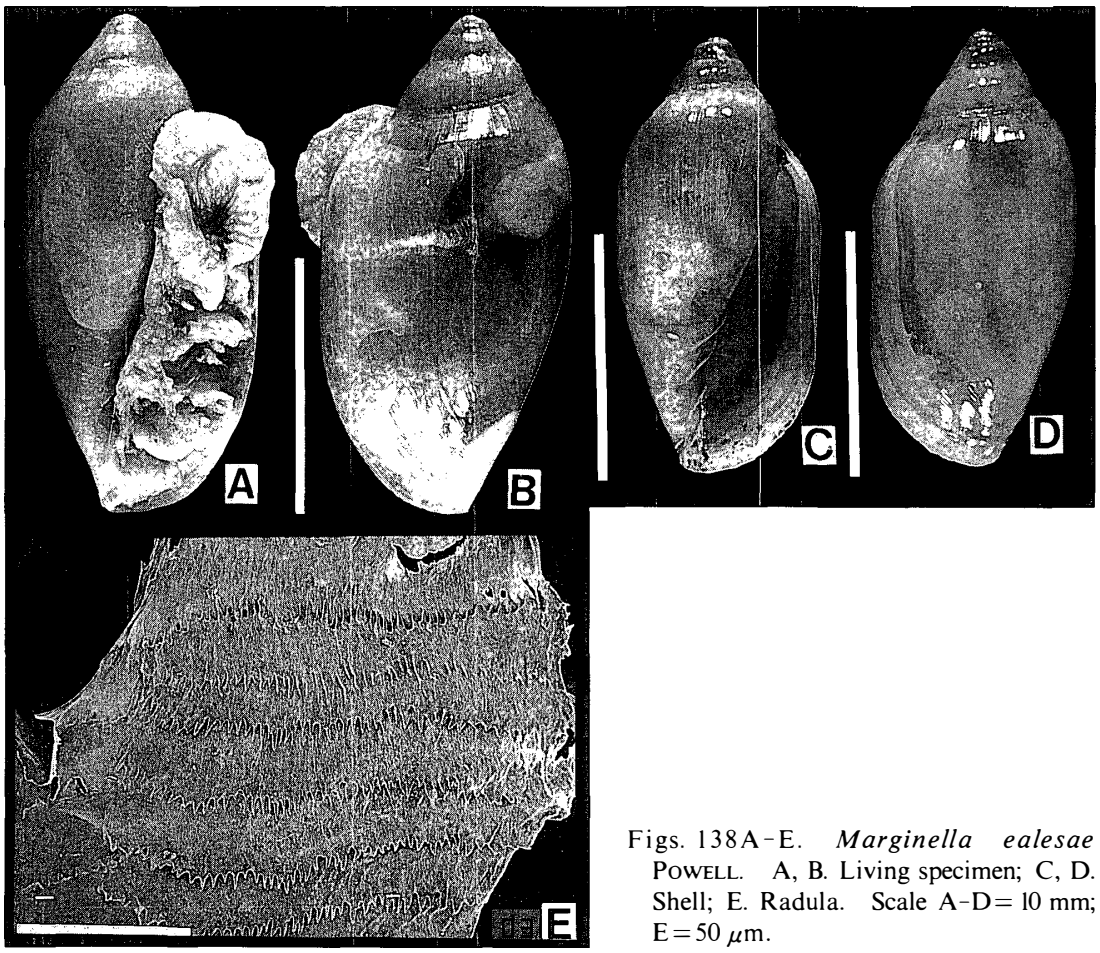
Fig. 137. Distribution of *Marginella hyalina* THIELE (Large dots: Previous distribution records; Star: Present study; Triangle: Type locality).

Marginella ealesae POWELL, 1958
(Figs. 138A-E)

Marginella ealesae POWELL, 1958, p. 200, text fig. B1; POWELL, 1960, p. 158 (name only); HAIN, 1990, p. 68, pl. 7, figs. 5a-c; DELL, 1990, p. 223, fig. 387.
Marginella hyalina (non THIELE, 1912): SMITH, 1915, p. 74; EALES, 1923, p. 36, figs. 38, 39.
Amalda ? sp.: OKUTANI, 1986, p. 279, table 3, pl. 1, fig. 8.

Material examined: Two living specimens from St. 5; 1 living specimen and 2 empty shells from St. 8; 1 living specimen and 1 empty shell from St. 9

Description: The shell is large, elongate, ovate-conical, thin, translucent white in color, with low, small and broadly conical spire (Figs. 138A-D). The surface is smooth and polished and covered by a thin transparent callus, and has very fine growth lines. The protoconch is large, about 2.7 in number of turns, 2.5 mm in diameter, 1.7 mm in height, rather depressed, with a smooth and polished surface. The teleoconch is about 2 in number of turns, very large and elongate. The suture is almost flush, and covered by a thin callus. The body whorl is elongate, very large, long but rather narrow, with length occupying 88% of shell length, breadth 50% of shell length. The aperture is long but rather narrow, 88% of shell length, and the upper part of the aperture is narrow, but widens



Figs. 138A-E. *Marginella ealesae* POWELL. A, B. Living specimen; C, D. Shell; E. Radula. Scale A-D= 10 mm; E=50 μm.

abapically to an open canal. The outer lip is very thin and sharp, and it is not thickened. The middle area of the outer lip is barely concave. The inner lip is smooth and slightly rounded. The columellar lip is weakly twisted, and slightly curved, with three columellar folds which are almost the same in size and appearance. The inner wall is frosted white in color, almost smooth, except numerous axial growth lines which are irregularly spaced.

No operculum is present.

Table 24. Measurements and condition of *Marginella ealesae* POWELL.

No.	1	2	3	4	5	6	7	8
St.	5	5	8	8	8	9	9	*
SL (mm)	17.6	19.8	17.2	15.0	10.4	15.2	17.0	19.4
SW (mm)	8.5	10.0	8.2	6.8	5.0	—	—	8.9
SW/SL (%)	48.3	50.5	47.7	45.3	48.1	—	—	45.9
Condition	L	L	F	L	F	E	L	L

E: Empty and water-worn specimen; F: Freshly dead specimen;
L: Specimen taken alive.
*: Specimen collected from Breid Bay by JARE-27.

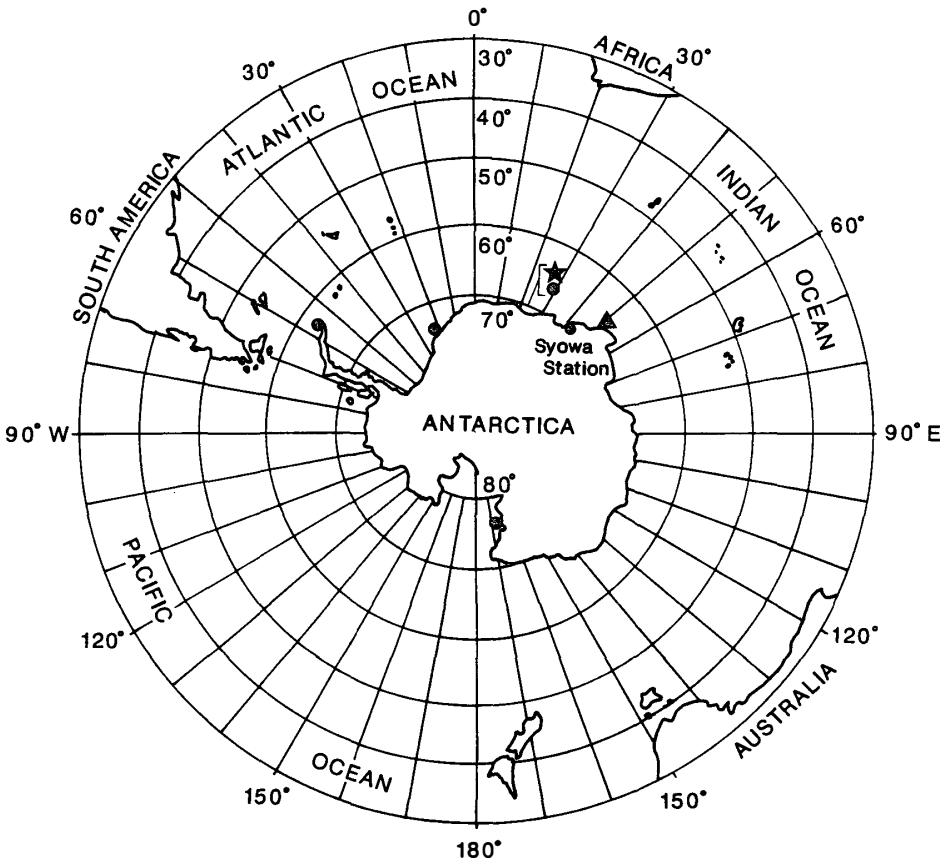


Fig. 139. Distribution of *Marginella ealesae* POWELL (Large dots: Previous distribution records; Star: Present study; Triangle: Type locality).

The radula is rachiglossate, 0 : 1 : 0 with 27 transverse rows, translucent pale yellow in color, thin, very short but wide (Figs. 138E). The rhachidian tooth is large, very wide but low, and has 52 weak denticles on the frontal margin.

Measurements: See Table 24.

Previous distribution records (Fig. 139): Type locality: off Enderby Land, 193 m, 300 m. Range: Ross Sea, 252–450 m (SMITH, 1915); Breid Bay, 215 m (OKUTANI, 1986); eastern Weddell Sea, 155–481 m (HAIN, 1990); Bransfield Strait, Antarctic Peninsula, 210–220 m (DELL, 1990).

Remarks: *Marginella hyalina* and *M. ealesae* are sympatric (POWELL, 1958 and this study). The abundance of *M. hyalina* is higher than that of *M. ealesae*.

A single empty shell of *Amalda* ? sp. reported by OKUTANI (1986) from Breid Bay, 215 m deep was confirmed to be *M. ealesae*.

Family CANCELLARIIDAE FORBES and HANLEY, 1853
Subfamily Admetinae TROSCHEL, 1865
Genus *Admete* KRÖYER, 1842
Type species: *Admete crispa* MÖLLER, 1842

Admete haini n. sp.

(Figs. 140A–E)

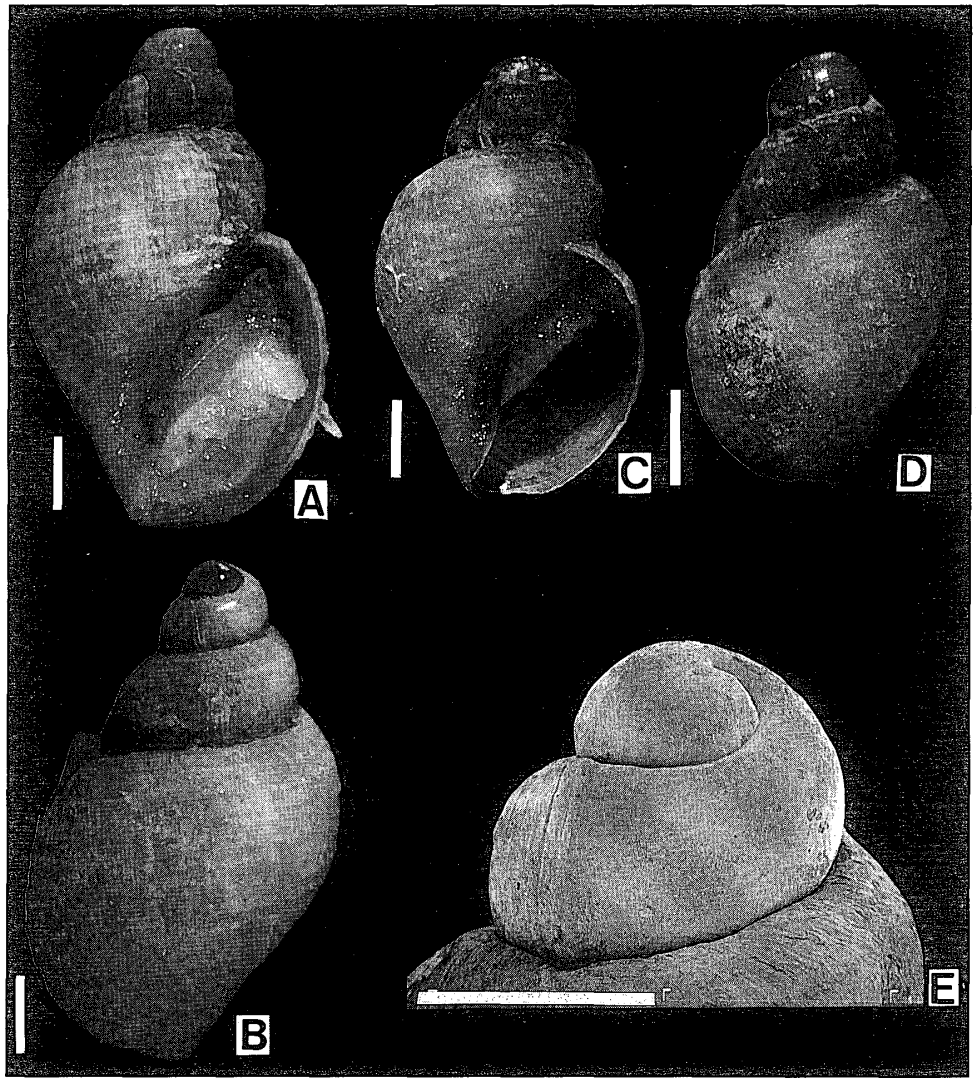
Admete sp. 1: HAIN, 1990, p. 67, pl. 7, fig. 2a–c.

Material examined: A single empty shell from St. 5; 1 living specimen from St. 8; 3 living specimens from St. 9.

Description: The shell is ovate, small, thin, translucently white or frosted white in color, with a short spire (Figs. 140A, B). The protoconch is dome-like in shape, large, about 2 in number of turns, 1.5 mm in diameter, 1.1 mm of height, and has somewhat glossy and smooth surface (Fig. 140E). The teleoconch is about 2.2 in number of turns, well inflated, with almost regularly spaced, wide spiral cords which are crossed by axial fine lirae and crowded microscopic growth lines. The surface of the teleoconch is covered by a very thin and transparent periostracum. The suture is constricted. The upper whorl is small and roundly inflated. The body whorl is large, with height being 82% of shell length, inflated, and breadth 62% of shell length. The spiral cords are 2 on the first teleoconch whorl, 8 on the penultimate and 15 on the last whorl, respectively. These spiral cords become stronger adaperturally. The basal cords are weaker than upper ones. The growth lines tend to weaken and become almost irregular abapically, and a little raised, but conspicuous on the body whorl. The base is not constricted. The umbilicus is very narrowly open. The aperture is lunate, large and wide, with height is 57% of shell length. The outer lip is rather thick and corrugated at extremities of spiral cords. The inner lip is smooth. The columellar lip is smooth and roundly incurved with a thin whitish callus, and reflected over the umbilicus. The siphonal canal is shallow. The inner wall is white or translucently white in color, almost smooth.

No operculum is present.

The radular is unknown.



Figs. 140A–E. *Admete haini* n. sp. A, B. Holotype; C, D. Paratype #1; E. Protoconch. Scale=1 mm.

Measurements:

SL 5.7 mm, SW 4.0 mm (empty shell; St. 5) (Holotype specimen; NSMT-Mo 70630).
SL 4.6 mm, SW 2.8 mm (living specimen; St. 8) (Paratype specimen #1; NSMT-Mo 70631).
SL 6.1 mm, SW 3.8 mm (living specimen; St. 9) (Paratype specimen #2; NSMT-Mo 70632).
SL 5.5 mm, SW 3.5 mm (living specimen; St. 9) (Paratype specimen #3; NIPR A20-40).
SL 4.5 mm, SW 2.8 mm (living specimen; St. 9) (Paratype specimen #4; NIPR A20-41).

Previous distribution record (Fig. 141): Eastern Weddell Sea, 181–481 m (*Admete* sp. 1) (HAIN, 1990).

Remarks: This species was reported by HAIN (1990) from the eastern Weddell Sea, and he illustrated three specimens of different sizes of specimens, such as 3.0 mm, 4.4 mm and 9.5

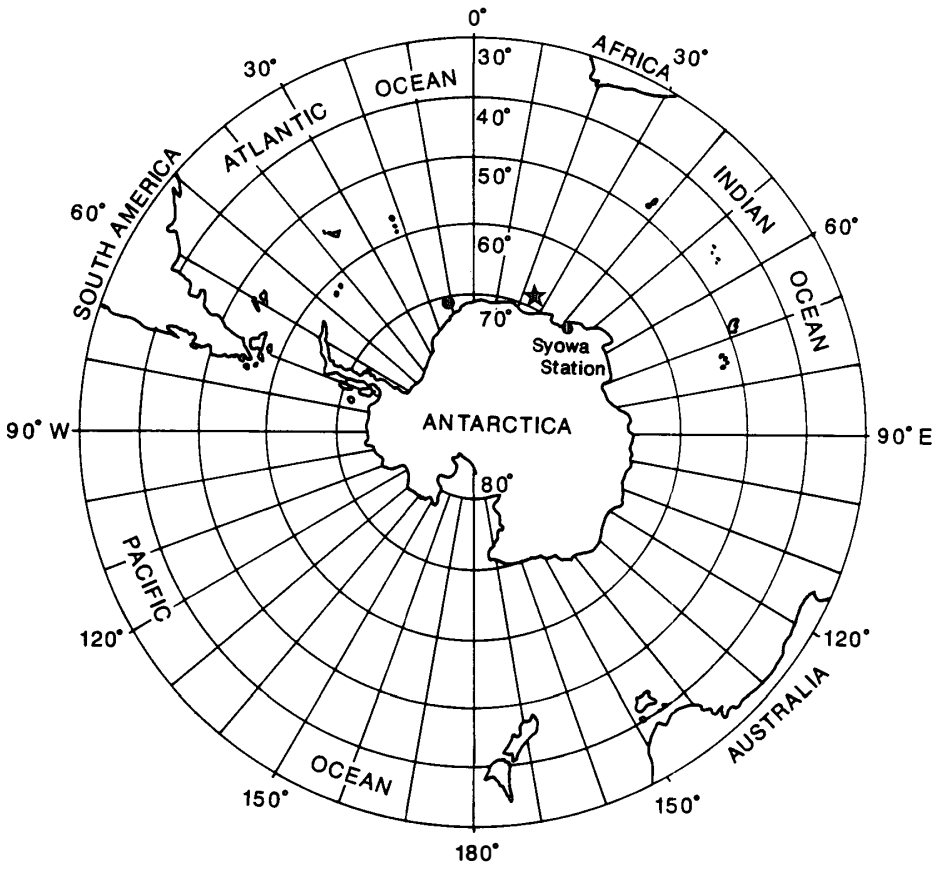


Fig. 141. Distribution of *Admete haini* n. sp. (Dot: Previous distribution record; Star: Present study).

mm in shell length. The specimens examined by the present study are identical with HAIN's species. *Admete delicatula* is separated from this species by having more rounded shell, small protoconch and more spiral sculptures.

Family TURRIDAE
Subfamily Turrinae SWAINSON, 1840
Genus *Micropleurotoma* THIELE, 1925
Type species: *Pleurotoma spirotropoides* THIELE, 1925

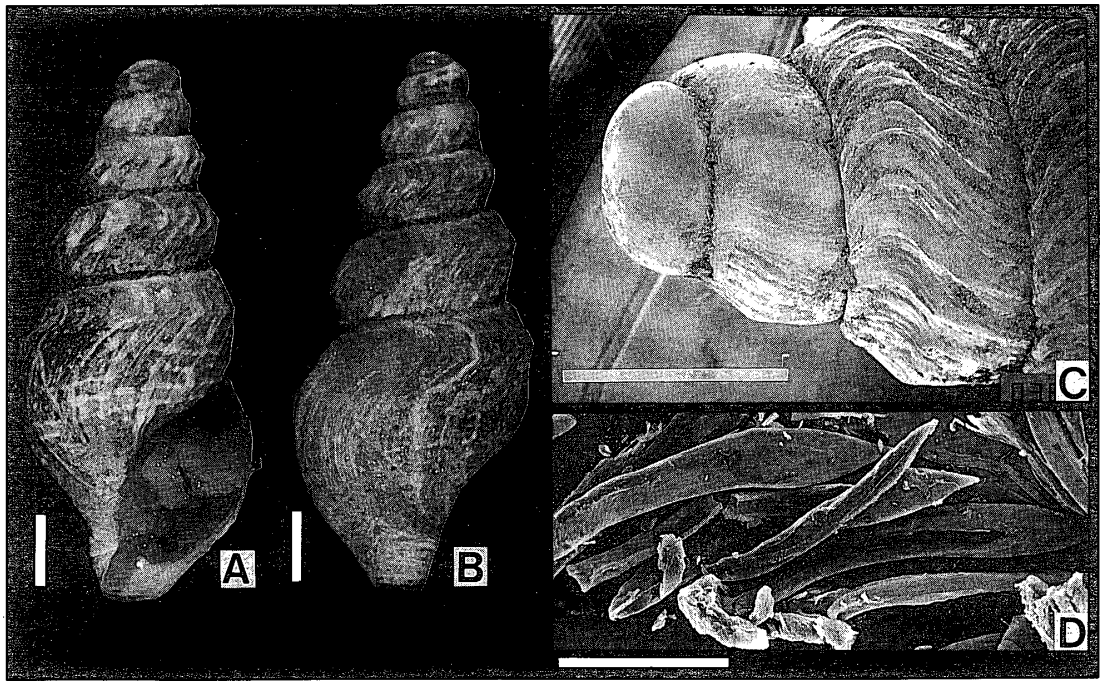
Micropleurotoma remota **(POWELL, 1958)**
(Figs. 142A-D)

Spirotropis remota POWELL, 1958, p. 204, pl. 2, fig. 5; POWELL, 1960, p. 160 (name only).
Material examined: A single living specimen collected from Günnerus Bank, 955 m.
Description: The shell is small, ovate fusiform, rather thick, frosted white in color, with a large and high elevated spire (Figs. 142A, B). The protoconch is somewhat glossy white in color, large and roundly inflated, about 2 in number of turns, 1.3 mm in length, 1.0 mm in diameter, with a smooth surface (Fig. 142C). The teleoconch is about 5 in number of turns, large, rather narrow, convex, roundly angluated at about 2/3 of whorl height with

numerous axial cords and growth lines which are crossed by some spiral cords below the peripheral angulation. The surface is rough. The suture is deeply constricted, and the sutual ramp is rather flat. The upper whorl is large and high. The body whorl is about 60% of shell length, but rather narrow, with width being about 45% of shell length. The sigmoid, flexuous, rounded and narrow axial cords define a deeply concave sinus over shoulder area, but fading out towards the base. Spiral sculptures are distantly spaced, rather weak, flat-topped and narrow cords, one just below the suture, two below the peripheral angle and five on the base. The aperture is oblong, small and rather narrow, about 50% of shell length, with apertural width being about 40% of shell length. The outer lip is thin, round and almost smooth, except a little undulations by spiral cords. The inner lip is smooth and gently curved, with a deep posterior sinus at the sutural ramp, extending backwards about 1/8 of the entire circumference of the last whorl. The columellar lip is short and slightly curved. A thin callus is deposited on the inner and columellar lips. The anterior canal is open, short but wide. The inner wall is glossy and smooth.

The operculum is small to the aperture in size, and length occupies about 45% of aperture length and width about 65% of aperture width, corneous, thin, translucent pale yellow in color, ovate with downward by situated nuculeus.

The radula is toxoglossate, 2 : 0 : 0 : 0 : 2 (Fig. 142D). A single inner marginal tooth is slightly curved, wide and massive with a sharply pointed tip and a round base, 0.1 mm in length. The outer marginal tooth is slightly curved, slender and simple, 0.07 mm in length, length is about 2/3 of length of inner one, width is about 1/2 of width of inner one, with a sharply pointed top and a small round base. The inner and outer marginal teeth



Figs. 142A-D. *Micropleurotoma remota* (POWELL).
A, B. Shell; C. Protoconch; D. Radula. Scale A-C = 1 mm; D = 50 μm.

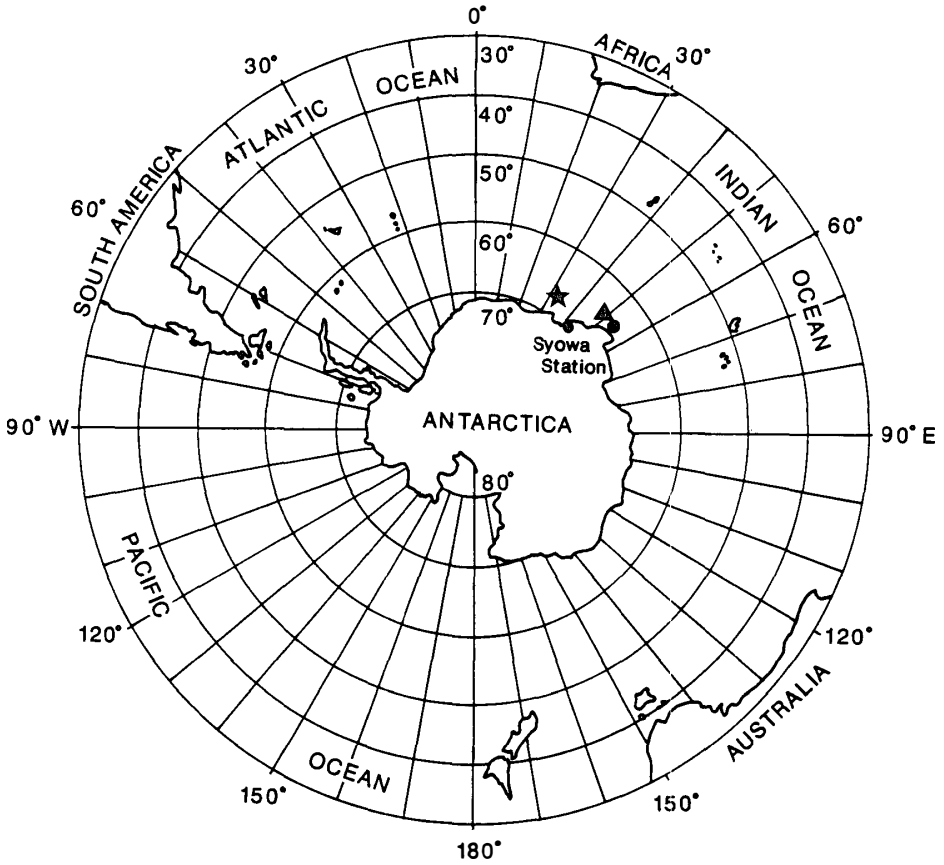


Fig. 143. Distribution of *Micropleurotoma remota* (POWELL) (Dot: Previous distribution record; Star: Present study; Triangle: Type locality).

have no groove or barb.

Measurements: SL 7.6 mm, SW 3.5 mm, AL 3.7 mm, AW 1.5 mm.

Previous distribution records (**Fig. 143**): Type locality: off Enderby Land, 300 m. Range: off Enderby Land, 193 m (POWELL, 1958).

Remarks: *Spirotropis remota* was first described by POWELL (1958) from off Enderby Land. This is a rediscovery since the original description.

POWELL (1958) placed this species in the genus *Spirotropis*, but the radula of the genus *Spirotropis* is 2 : 1 : 1 : 1 : 2. However, this species entirely lacks the rachidian and lateral teeth. The radular characters of this species is similar to the genus *Micropleurotoma*, such as the formula, the dart-shaped inner marginal and the simple slender outer marginal. And the shell characters is also similar to *Micropleurotoma*. Thus, this species should be moved to the genus *Micropleurotoma*.

The vertical distribution range of this species is wide, from 193 to 955 m. But, this species has hitherto been reported from only off Enderby Land.

Subfamily Mangeliinae FISCHER, 1887
Genus *Lorabela* POWELL, 1958
Type species: *Bela pelseneri* STREBEL, 1908 (O.D.)

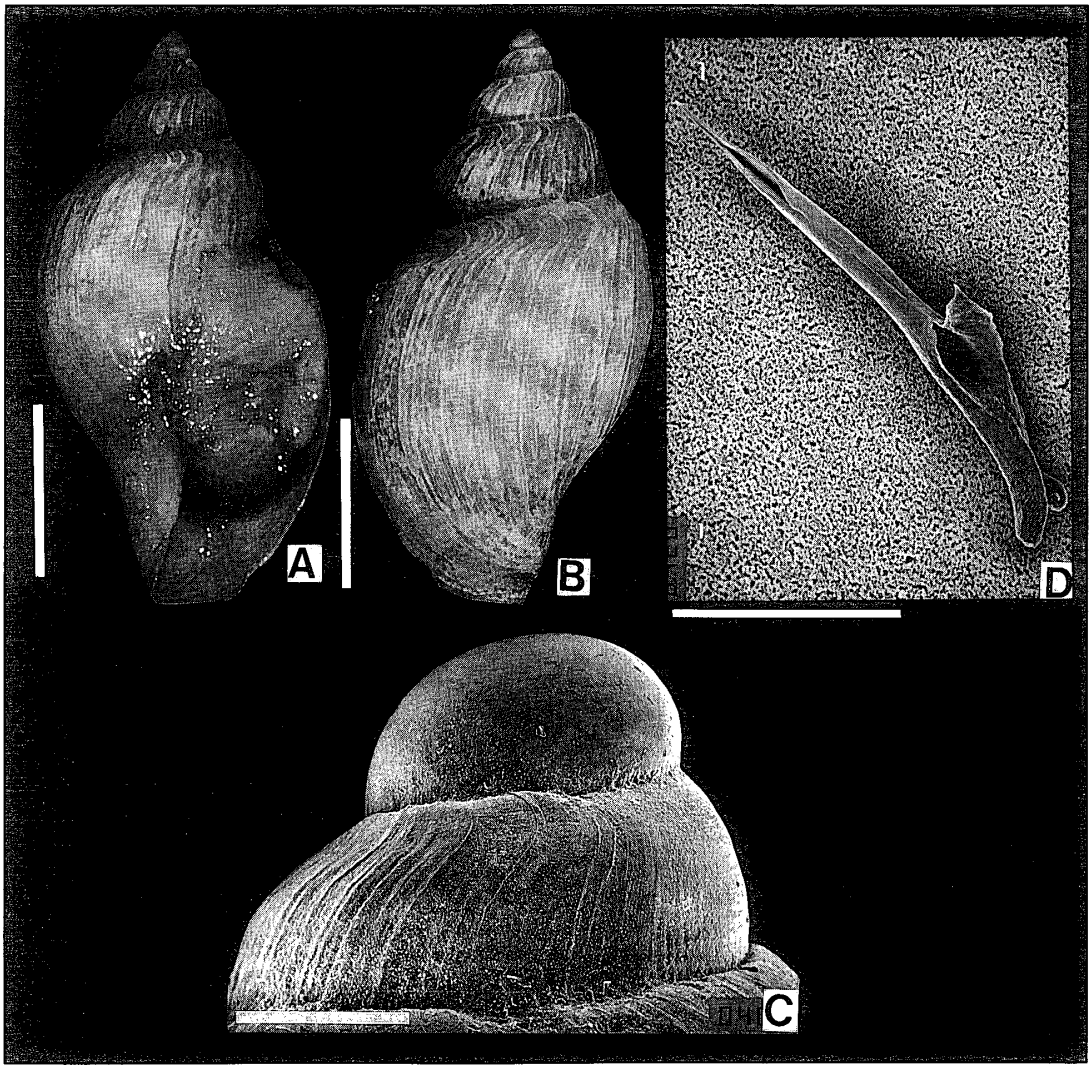
Lorabela davisi **(HEDLEY, 1916)**

(Figs. 144A-D)

Oenopota davisi HEDLEY, 1916a, p. 54, pl. 8, fig. 84.
Lorabela davisi: POWELL, 1958, p. 202; POWELL, 1960, p. 159 (name only); DELL, 1990, p. 238, figs. 405, 407.
Turridae sp. 2: HAIN, 1990, p. 73, pl. 8, fig. 8, pl. 27, fig. 4.

Material examined: A single living specimen from St. 8; 1 living specimen from St. 9.

Description: The shell is large for the genus, fusiform, rather thin, weakly shouldered, frosted white in color, with a large and moderatly elevated spire (Figs. 144A, B). The protoconch is moderate in size, wide, conical, about 2 in number of turns, 1.0 mm in length,



Figs. 144A-D. *Lorabela davisi* (HEDLEY). A, B. Shell; C. Protoconch; D. Radula. Scale A, B=5 mm; C=500 μm; D=100 μm.

1.3 mm in diameter, and has roundly inflated whorls (Fig. 144C). The surface is finely granulated. The teleoconch is about 3.5 in number of turns (shell length is 16.5 mm). The surface of the teleoconch has very fine sigmoidal axial cords which are crossed by almost regularly spaced, very fine and shallow spiral grooves. The suture is narrowly channeled. The sutural ramp is almost flat with no spiral groove, and under the shoulder angle is slightly inflated. The upper whorl is wide conical, small and low. The body whorl is very large, elongate, well inflated, about 80% of shell length, with width being about 50% of shell length. The axial cords become weaker adapically. The spiral grooves are very fine and shallow there. The base is slightly constricted. The aperture is oblong, large, and length is about 65% of shell length. The outer lip is thin and roundly curved with a weak angle at the shoulder, where presents a wide and shallow sinouous posterior canal. The inner lip is smooth, and slightly expanded outwardly. The columellar lip is smooth and slightly curved. A thin and smooth callus is deposited on the inner and columellar lips. The anterior canal is open and broad. The inner wall is smooth.

No operculum is present.

The radula is toxoglossate, 1 : 0 : 0 : 0 : 1 (Fig. 144D). A single tooth is translucent, but brownish at the base. It is straight hilted-dagger in shape, small, short (0.25 mm in length; 16.5 mm in SL), with a conspicuously curved basal spur which is long and massive,

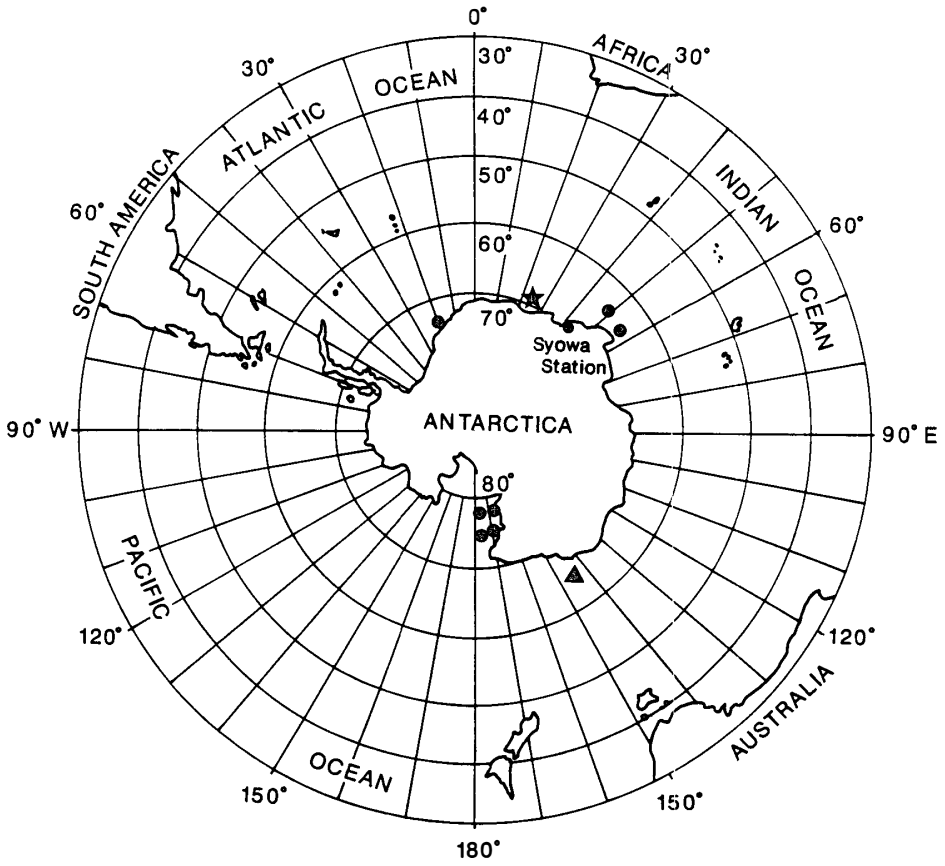


Fig. 145. Distribution of *Lorabela davisi* (HEDLEY) (Large dots: Previous distribution records; Star: Present study; Triangle: Type locality).

about 1/3 of length of the tooth. And it is grooved longitudinally creating a slit at the inner distal end behind the sharp, needle-like cusp. The barb is absent.

Measurements:

SL 16.5 mm, SW 8.4 mm, AL 10.8 mm, AW 3.3 mm (living specimen; St. 8).

SL 12.3 mm, SW — mm, AL 8.8 mm, AW — mm (living specimen; St. 9) (outer lip is broken).

Previous distribution records (**Fig. 145**): Type locality: off Mertz Glacier Tounge, Adelie Land, 519 m. Range: off Enderby Land, 220 m, 300 m and 640 m (POWELL, 1958); eastern Weddell Sea (HAIN, 1990); Ross Sea, 354–433 m (DELL, 1990).

Remarks: The radula of *Lorabela davisi* is closely similar to that of *L. plicatula* (THIELE, 1912) in having hilted-dagger type marginal teeth (Fig. 146D). However, the basal spur of the latter species is slightly shorter than that of the former. The shell of *L. davisi* has more rounded and inflated whorls, more impressed suture and a rougher surface than *L. plicatula* (Figs. 146A, B). The protoconch of the latter is more rounded (Fig. 146C).

The species of the genus *Lorabela* is distributed in South Georgia to Antarctic continental shelf (POWELL, 1966).

One of the examined specimen (16.5 mm in SL) was feeding upon a benthic polychaete.

Lorabela plicatula (THIELE, 1912)

(Figs. 146A-D)

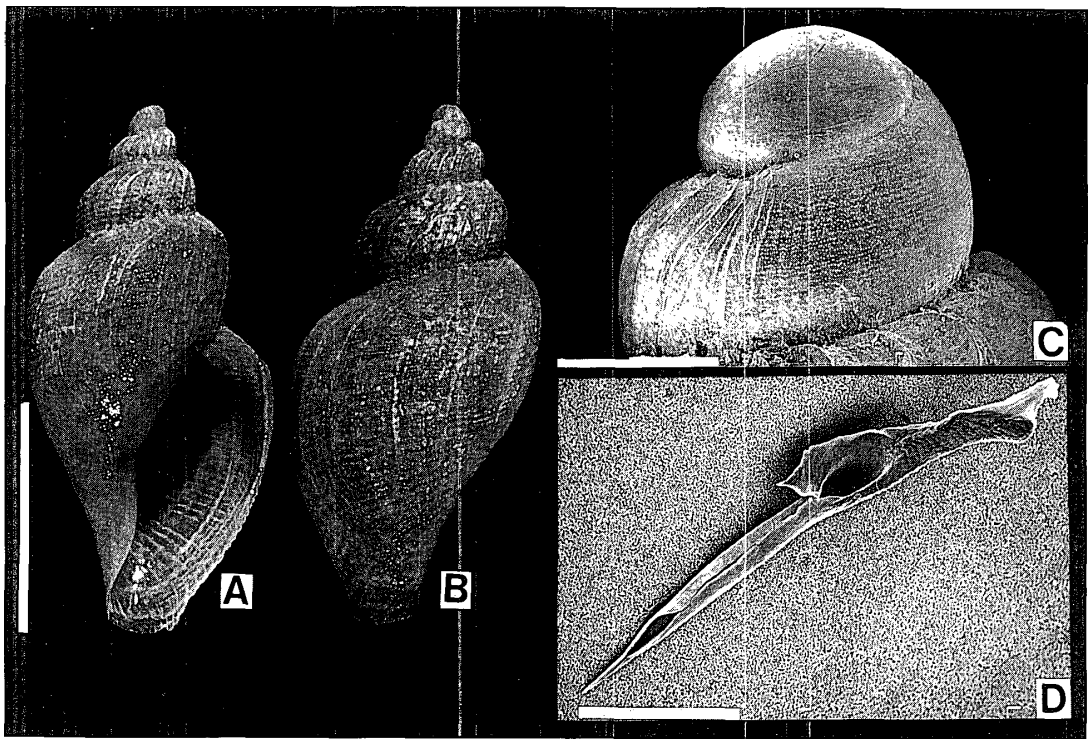
Bela plicatula THIELE, 1912, p. 215, pl. 14, fig. 4.

Lorabela plicatula: POWELL, 1951, p. 171 (distribution record); POWELL, 1958, p. 202 (distribution record); POWELL, 1960, p. 159 (name only); EGOROVA, 1982, p. 48, fig. 203; HAIN, 1990, p. 71, pl. 8, fig. 2, pl. 26, pl. 5.

Material examined: A single living specimen from St. 8.

Description: The shell is moderate in size, elongate ovate-biconic, translucently white in color, thin, with a low spire (Figs. 146A, B). The protoconch is conical and rather large, about 2 in number of turns, 0.9 mm in length, 1.0 mm in diameter, with well roundly inflated whorls (Fig. 146C). The surface of protoconch has numerous spiral lirae. The teleoconch is about 3 in number of turns (11.5 mm in SL), large, well inflated, and has widely interspaced, sigmoid axial threads being crossed by almost regularly spaced and weak, spiral, roundly topped lirae, about 30 in number on the last whorl. The round shoulder is apparant. The surface is rough, with no periostracum. The suture is well constricted. The upper whorl is small and low. The body whorl is very large and inflated, occupying about 80% of shell length, but rather narrow, with width being about 50% of shell length. The axial threads are sharpely raised here, about 20 in number on the body and penultimate whorls. The aperture is oblong and large, about 60% of shell length. The outer lip is thin, roundly curved, with a shallow sinouous posterior canal that is extended backwards about 1/12 of the entire circumference of the last whorl. The inner lip is slightly curved and the columellar lip is short, slightly curved. A thin callus is deposited on the inner and columellar lips. The anterior canal is open and very short. The inner wall is smooth.

The operculum is not present.



Figs. 146A–D. *Lorabela plicatula* (THIELE). A, B. Shell; C. Protoconch; D. Radula. Scale A, B=5 mm; C=500 μm; D=100 μm.

The radula is toxoglossate, 1 : 0 : 0 : 0 : 1, translucent, pale yellow in color. A single tooth is hilted-dagger type, curved, small, short (0.23 mm in length; 7.4 mm in SL), with a conspicuous basal spur which is long and massive, about 2/5 of length of the tooth with small upper projection (Fig. 146D). And it is grooved longitudinally creating a slit at the inner distal end behind the sharp, needle-like cusp. The barb is absent.

Measurements: SL 9.5 mm, SW 2.6 mm.

Previous distribution records (Fig. 147): Type locality: Gauss Station, Davis Sea. Range: Ross Sea, 74°46.4′S, 178°23.4′E, 351 m (POWELL, 1951); off Enderby Land, 200 m and 300 m, off Adélie Land, 640 m (POWELL, 1958); eastern Weddell Sea, 155–640 m (HAIN, 1990); Ross Sea, 351–433 m (DELL, 1990).

Remarks: *Lorabela plicatula* is closely similar to *L. pelseneeri* (STREBEL, 1908), from South Georgia to eastern Weddell Sea, 155–640 m, and *Belalora striatula* (THIELE, 1912) from eastern Weddell Sea to Davis Sea, 20–385 m. But *L. pelseneeri* has some fold-like axial sculptures on the shell surface. *B. striatula* has some conspicuous spiral cords on the spire. The radula of *L. pelseneeri* was first described by HAIN (1990), who described that it has hilted-dagger type marginal teeth with a short basal spur.

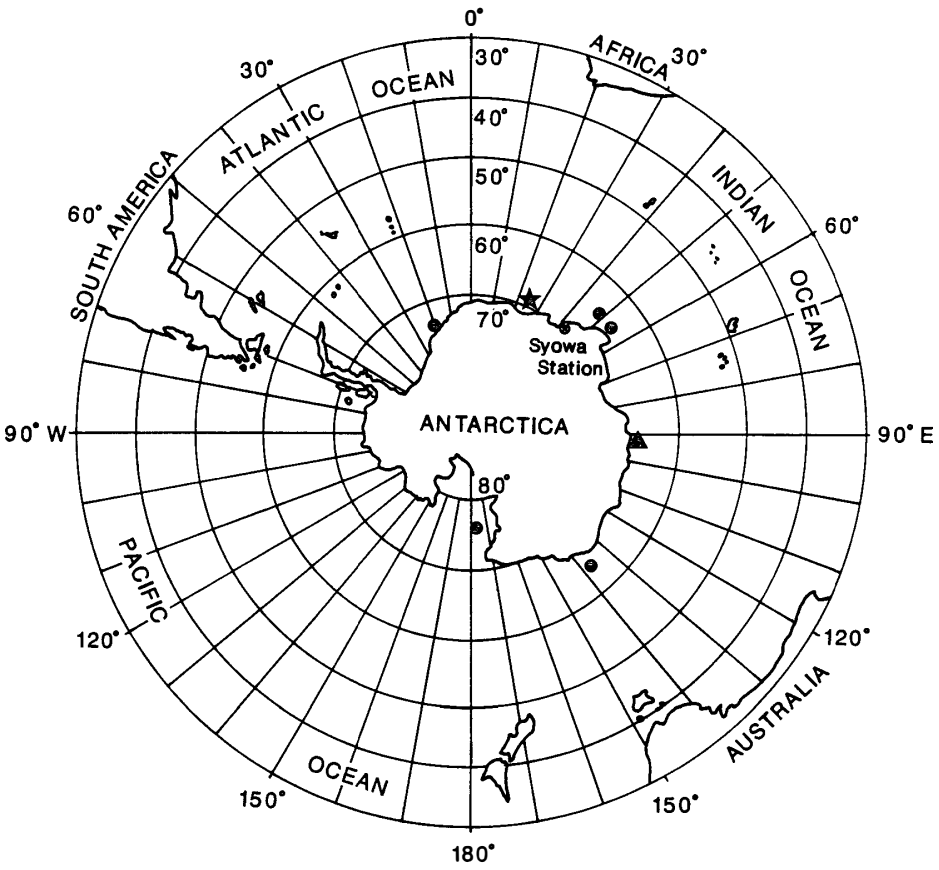


Fig. 147. Distribution of *Lorabela plicatula* (THIELE) (Large dots: Previous distribution records; Star: Present study; Triangle: Type locality).

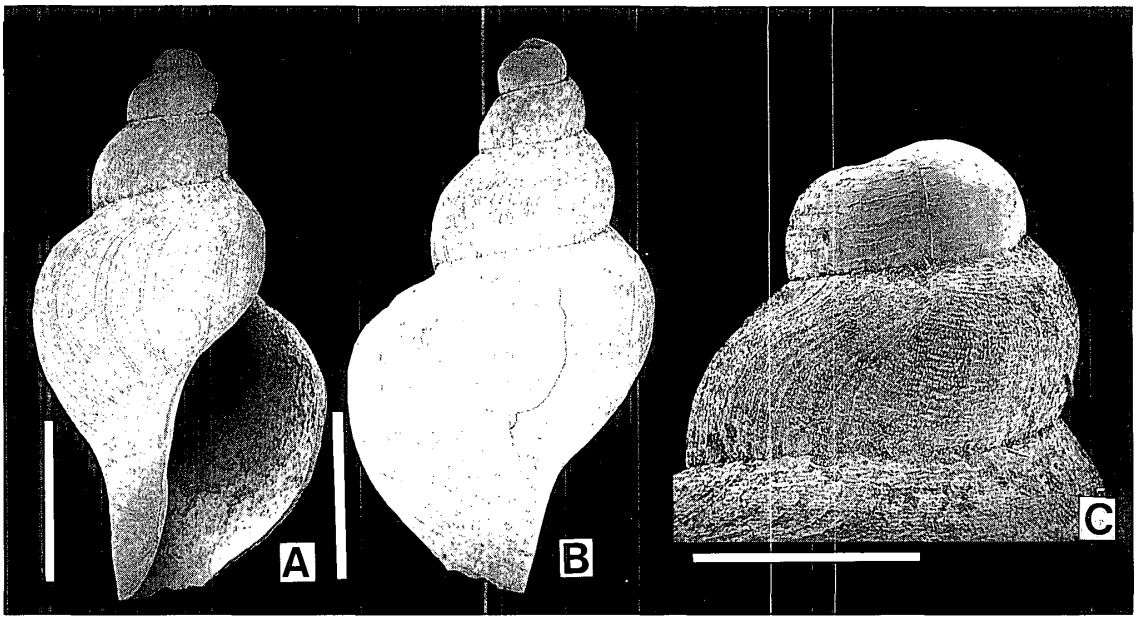
Subfamily Daphnellinae HEDLEY, 1922
Genus *Typhlodaphne* POWELL, 1951
Type species: *Bela purissima* STREBEL, 1908 (O.D.)

***Typhlodaphne nipri* n. sp.**

(Figs. 148A–C)

Material examined: 6 empty shells from St. 5; 2 empty shells from St. 8; 1 living specimen and 1 empty shell from St. 9.

Description: The shell is ovo-fusiform, small, thin, fragile, translucent pale yellow in color, with rather large and elevated spire (Figs. 148A, B). The protoconch is large, about 2 in number of turns, 0.63 mm in length, 0.68 mm in diameter, roundly inflated, pale yellow in color (Fig. 148C). The surface of the first turn of the protoconch is granulated, and the second turn is more conspicuously granulated. The teleoconch is about 2.5 in number of turns, well inflated with a very fine, sigmoid growth lines. The suture is moderately constricted, and the sutural ramp is rather flat. The body whorl is very large, wide, and has well inflated whorls, with length being about 75% of shell length, and width about 60% of shell length. The base is slightly constricted. The aperture is elliptical, large, with length about 60% of shell length. The outer lip is thin, round and smooth, with a narrow but deep sinus which is extended backwards in about 1/10 of the entire circumference of



Figs. 148A-C. *Typhlodaphne nipri* n. sp. A, B. Holotype; C. Protoconch. Scale A, B= 1 mm; C=500 μm.

Table 25. Measurements and condition of *Typhlodaphne nipri* n. sp.

No.	1*	2**	3***	4	5	6	7	8	9	10
St.	5	5	5	5	5	5	8	8	9	9
SL (mm)	3.1	4.2	4.2	4.5	4.9	4.5	5.3	4.5	4.5	4.5
SW (mm)	1.8	2.4	2.3	2.6	—	2.5	—	—	2.5	—
SW/SL (%)	58.1	57.1	54.8	57.8	—	55.5	—	—	55.5	—
Condition	F	F	F	F	E	F	E	E	F	L

E: Empty and water-worn specimen; F: Freshly dead specimen; L: Specimen taken alive (*: Holotype; **: Paratype #1; ***: Pratype #2).

the last whorl on the sutural ramp. The inner lip is smooth. The columellar lip is rather long, almost straight and smooth. A translucent thin callus is deposited on the inner and columellar lips. The anterior canal is short and moderately open. The inner whorl is smooth.

The operculum and animal are unknown.

Measurements: See Table 25.

SL 3.1 mm, SW 1.8 mm (Holotype specimen; NSMT-Mo 70633).

SL 4.2 mm, SW 2.4 mm (Paratype specimen #1; NSMT-Mo 70634).

SL 4.2 mm, SW 2.3 mm (Paratype specimen #2; NSMT-Mo 70635).

Remarks: This species is allied to *Typhlodaphne innocentia* DELL, 1990, in having the rather smooth and fusiform shell with 2 turns protoconch. But, *T. innocentia* has indistinct and low spiral cord on the teleoconch and a smooth protoconch.

This species is also similar to *Pleurotomella frigida* in having a small ovate-fusiform shell, but distinguishable from *P. frigida* in having smooth shell surface, while *P. frigida* has spiral cords, with protoconch having 3 turns.

Etymology: This species is named for National Institute of Polar Research (NIPR).

Genus *Pleurotomella* VERRILL, 1872
Type species (monotypy): *Pleurotomella packardi* VERRILL, 1872
Subgenus *Anomalotomella* POWELL, 1966
Type species: *Pleurotomella anomalapex* POWELL, 1951 (O.D.)

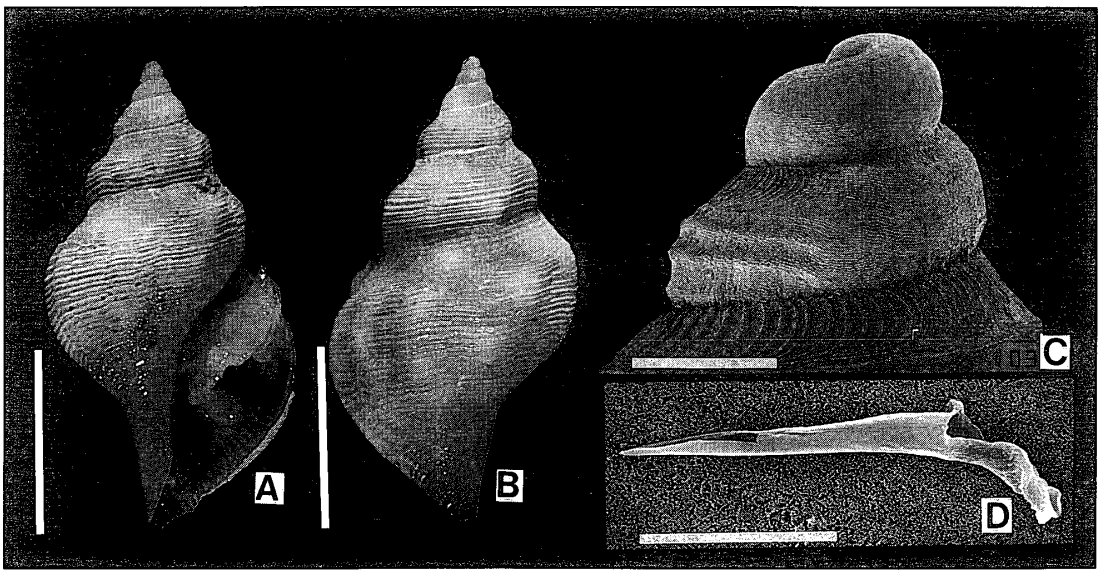
***Pleurotomella* (*Anomalotomella*) *simillana* (THIELE, 1912)**

(Figs. 149A-D)

Pleurotomella simillana THIELE, 1912, p. 216, pl. 14, fig. 8; POWELL, 1951, p. 172, fig. N, 117 (distribution record); POWELL, 1957, p. 135 (distribution record); EGOROVA, 1982, p. 49, fig. 201; HAIN, 1990, p. 72, pl. 8, figs. 5a, b, pl. 27, fig. 1.
Pleurotomella (*Anomalotomella*) *simillima*: DELL, 1990, p. 241, fig. 423.

Material examined: A single empty shell from St. 7; 1 empty shell from St. 9; 1 living specimen and 1 empty shell from Breid Bay (JARE-27).

Description: The shell is moderate in size, ovate fusiform, thin, fragile, translucent white in color, with a large and elevated spire (Figs. 149A, B). The protoconch is small, about 2 in number of turns, 0.9 mm in both length and diameter, turbinate, well roundly inflated, translucent white in color, with a finely granulated surface (Fig. 149C). The teleoconch is about 4 in number of turns (12.6 mm in SL), large, wide, inflated, with some large axial folds and numerous spiral cords. The suture is constricted, and the sutural ramp is slightly curved. The upper whorl is small, broad, and conical. The body whorl is large and wide, well roundly inflated, about 75% of shell length, with width being 70% of shell length. The sutural ramp has numerous fine, widely spaced opisthocyrt axial cords, more than 50 in number, which are crossed by 1-4 spiral cords. The axial cords are rather low, wide, slanting and diminishing abapically. The spiral cords are round topped, and regularly spaced. The first turn of the teleoconch has only three spiral cords and no axial cord. The penultimate whorl has 9 axial cords and 17 spiral cords, and the last whorl has 10 and 62, respectively. The base is constricted. The aperture is oblong, moderate in size, with



Figs. 149A-D. *Pleurotomella* (*Anomalotomella*) *simillana* THIELE. A, B. Shell; C. Protoconch; D. Radula. Sacle A, B = 5 mm; C = 500 μm; D = 50 μm.

length being about 60% of shell length. The outer lip is thin, round and smooth, with a deep sinus on the sutural ramp. It is extended backwards in about 1/8 of the entire circumference of the last whorl. The inner lip is smooth and slightly curved, with a shallow angle on the boundary of the columellar lip. The columellar lip is slightly curved. The inner and columellar lips have a very thin and translucent callus on the surface. The anterior canal is short, open and rather narrow. The inner wall is smooth and glossy.

No operculum is present.

The radula is toxoglossate, 1 : 0 : 0 : 0 : 1. A single tooth is hilted-dagger type, almost straight, small, short and rather slender (0.1 mm in length; 12.6 mm in SL), with a short and curved basal spur, about 1/4 of length of the tooth, and a small upper projection (Fig. 149D). And the marginal is grooved longitudinally creating a slit at the inner distal end behind the sharp, needle-like cusp.

Measurements:

SL 5.8 mm, SW — mm (empty shell; St. 7) (outer lip is broken).

SL 6.0 mm, SW 4.8 mm (empty shell; St. 9).

SL 12.6 mm, SW 9.0 mm (living specimen; JARE-27).

SL 6.8 mm, SW — mm (empty shell; JARE-27) (outer lip is broken).

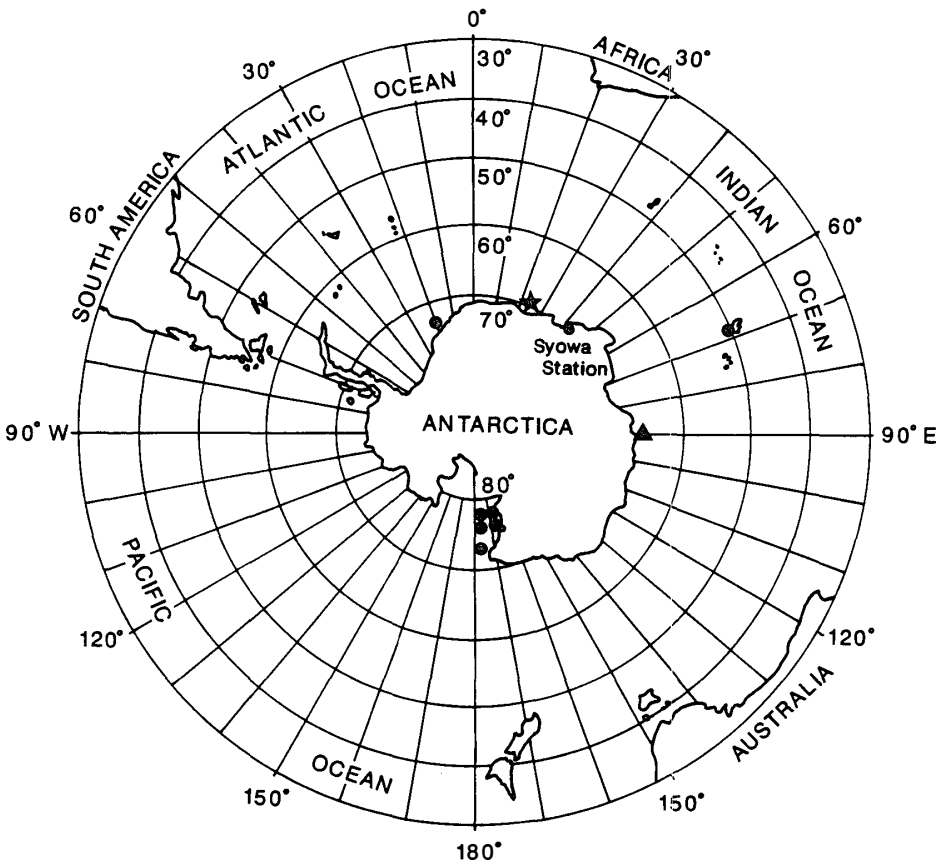


Fig. 150. Distribution of *Pleurotomella* (*Anomalotomella*) *simillana* THIELE (Large dots: Previous distribution records; Star: Present study; Triangle: Type locality).

Previous distribution record (Fig. 150): Type locality: Gauss Station, Davis Sea. Range: Ross Sea, 74°46.4′S, 178°23.5′E, 351 m (POWELL, 1951); Kerguelen Island, 150 m (POWELL, 1957); eastern Weddell Sea, 404 m (HAIN, 1990); Ross Sea, 188–600 m (DELL, 1990).

Remarks: *Pleurotomella* (*Anomalotomella*) *simillana* has wide geographical distribution range, such as Kerguelen Island to the Antarctic continental shelf.

POWELL's (1951) illustration of the protoconch shows that it has numerous axial sculptures on the surface, but other characters shown by him well agree with those of the present specimens.

Pleurotomella (*Anomalotomella*) *frigida* THIELE, 1912

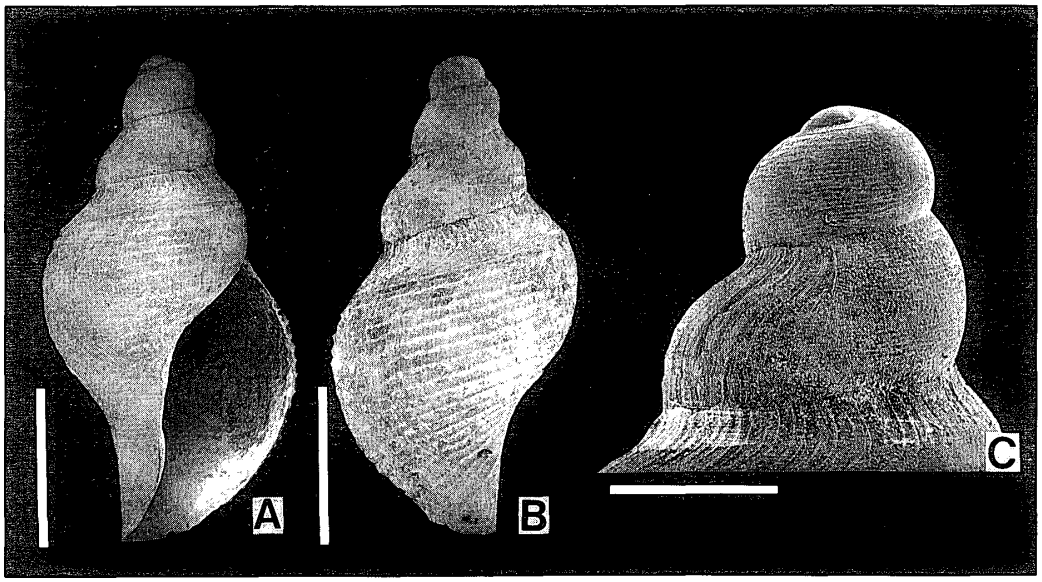
(Figs. 151A–C)

Pleurotomella frigida THIELE, 1912, p. 216, pl. 14, fig. 9, pl. 19, fig. 20; POWELL, 1958, p. 203 (distribution record); POWELL, 1960, p. 159 (name only); EGOROVA, 1982, p. 49, figs. 62 and 200.

Pleurotomella (*Anomalotomella*) *frigida*: DELL, 1990, p. 243, figs. 398, 426–428.

Material examined: A single living specimen and 4 empty shells from St. 5; 1 empty shell from St. 9.

Description: The shell is small, ovo-fusiform, small, thin, fragile, translucent white in color (Figs. 151A, B). The protoconch is large, elevated, and well roundly inflated, about 2.5 in number of turns, 0.63 mm in length, 0.88 mm in diameter, with a very fine granulated surface (Fig. 151C). The teleoconch is well inflated, about 3 in number of turns, with round topped spiral cords which are crossed by numerous, densely-set microscopic growth lines. The suture is slightly constricted, and the sutural ramp is slightly convex with no spiral cord. The upper whorl is small. The body whorl is very large, wide and well inflated, about 75% of shell length, with width being about 50% of shell length. The



Figs. 151A–C. *Pleurotomella* (*Anomalotomella*) *frigida* THIELE. A, B. Shell; C. Protoconch. Scale = 500 μm.

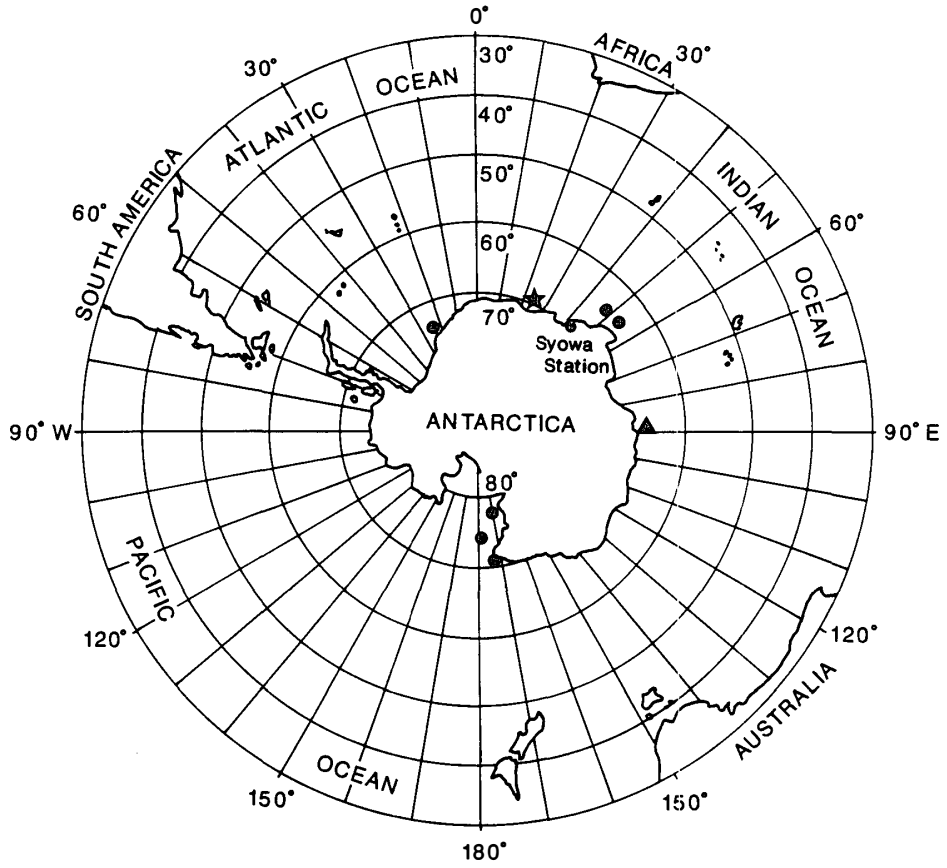


Fig. 152. Distribution of *Pleurotomella* (*Anomalotomella*) *frigida* THIELE (Large dots: Previous distribution records; Star: Present study; Triangle: Type locality).

growth lines exhibit a sigmoid curve. The spiral cords are regularly spaced, 3 on the first teleoconch, 7 on penultimate whorl, 20 on body whorl. The base is slightly constricted, and the spiral cords tend to become weaker abapically. The aperture is oblong, large and wide, with length being about 60% of shell length. The outer lip is thin, round and almost smooth with a sinus which is deep and wide, and extended backwards in about 1/8 of the entire circumference of the last whorl on the sutural ramp. The inner lip is almost straight. The columellar lip is gently curved. The inner and columellar lips have a very thin, translucent callus. The anterior canal is short and rather widely open. The inner wall is smooth.

The animal and operculum are not examined.

Previous distribution records (Fig. 152): Type locality: Gauss Station, Davis Sea. Range: off Enderby Land, 193–300 m (POWELL, 1958); 75°31′S, 26°43′W, Weddell, Sea, 229 m (DELL, 1990); Ross Sea, 238–870 m (DELL, 1990).

Measurements:

SL 3.6 mm, SW 2.0 mm (empty shell; St. 5).
SL 4.0 mm, SW 2.5 mm (living specimen; St. 5).
SL 4.8 mm, SW 2.5 mm (empty shell; St. 5).
SL 5.1 mm, SW 2.7 mm (empty shell; St. 5).

SL — mm, SW — mm (empty and broken shell; St. 5).
SL 4.5 mm, SW 2.5 mm (empty shell; St. 9).

Remarks: The radula of *Pleurotomella* (*Anomalotomella*) *frigida* was illustrated by THIELE (1912) who stated that the radula of this species is very small, length in 33 m. THIELE's illustration shows a pair of hilted-dagger type marginal tooth only, and each tooth has a short spur and no barb.

Pleurotomella (*Anomalotomella*) *annulata* THIELE, 1912

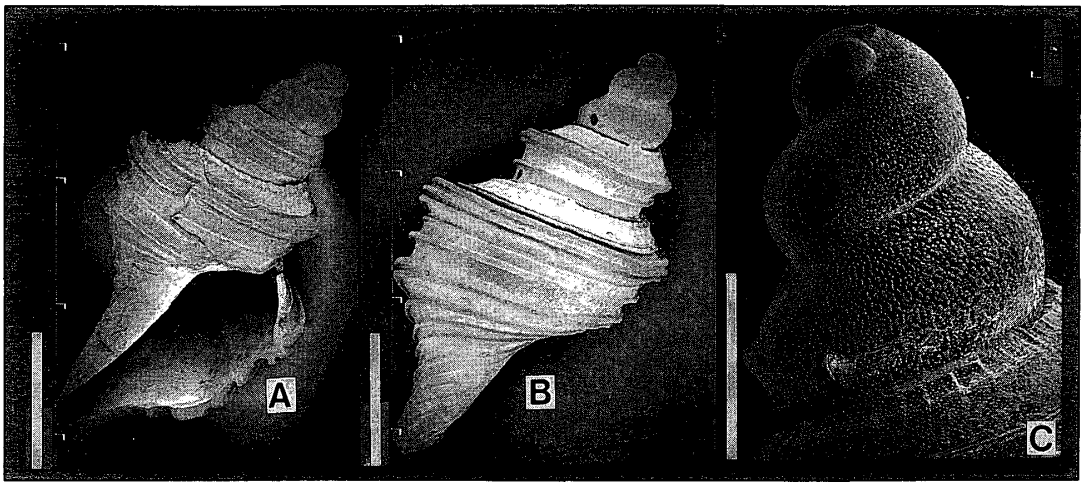
(Figs. 153A–C)

Pleurotomella annulata THIELE, 1912, p. 217, pl. 14, figs. 10 and 11; POWELL, 1958, p. 203 (distribution record); POWELL, 1960, p. 159 (name only); EGOROVA, 1982, p. 49, figs. 199 and 206.

Pleurotomella (*Anomalotomella*) cf. *annulata*: DELL, 1990, p. 244.

Material examined: A single empty shell from St. 8.

Description: The shell is small, thin, fragile, fusiform, translucent white in color, with a large spire (Figs. 153A, B). The protoconch is conical, large and highly elevated, about 2.5 in number of turns, 1.0 mm in length, 0.8 mm in diameter, frosted white in color, and has very fine granular sculptures on the surface (Fig. 153C). The last half turn of protoconch has a single keel. The teleoconch is about 2.5 in number of turns, rather wide, inflated, with two strong subsutural and a peripheral keels, with a few intercalated spiral ribs. The suture is deeply constricted, and channeled. The upper whorl is small. The body whorl is very wide and large, well inflated, about 71% of shell length, with breadth being 62% of shell length. The spiral ribs are sharply angulated like a rail creating deep interspacial grooves. In the last whorl, the sutural ramp has 2 primary and 1 secondary spiral ribs, the peripheral keel has 3, the area between peripheral and subsutural keels has 2, the base has 9 primary ribs. The spiral cords of the sutural ramp are crossed by opisthocyrt lirae. The basal spiral cords become weaker abapically. The aperture is nearly pentagonal, with length being 55% of shell length. The outer lip is thin and



Figs. 153A–C. *Pleurotomella* (*Anomalotomella*) *annulata* THIELE. A, B. Shell; C. Protoconch. Scale A, B = 1 mm; C = 500 μm.

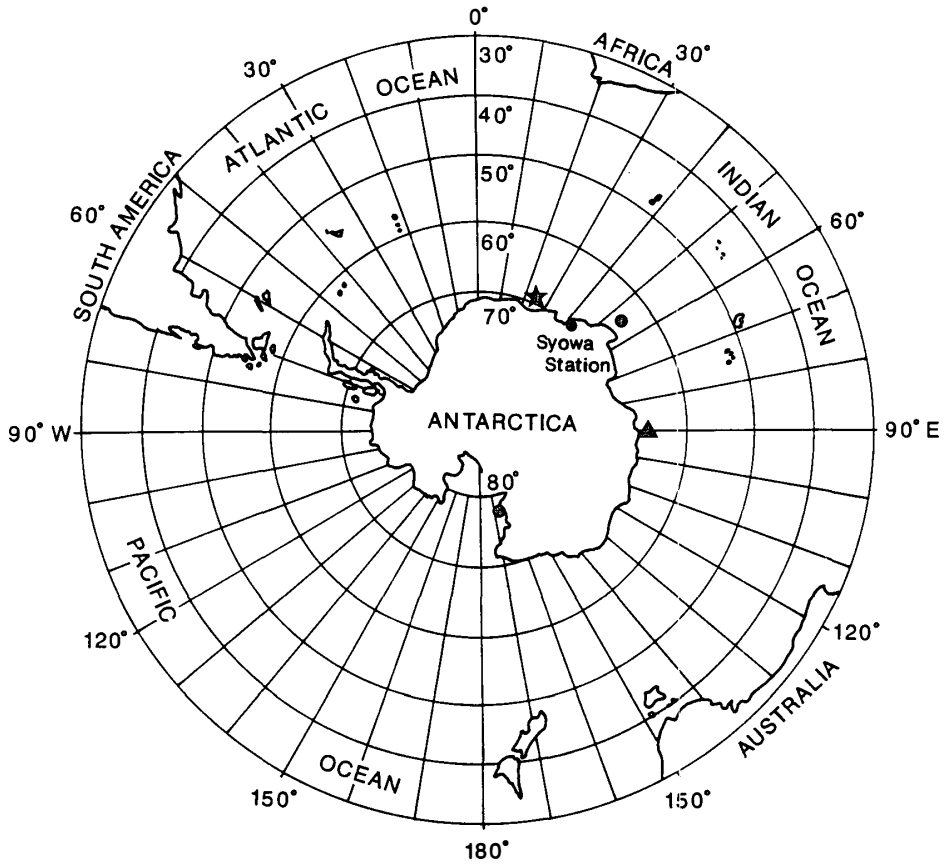


Fig. 154. Distribution of *Pleurotomella* (*Anomalotomella*) *annulata* THIELE (Large dots: Previous distribution records; Star: Present study; Triangle: Type locality).

undulating in corresponding to ribs and interspaces, and has an angle at the peripheral and basal ribs. The portion above the peripheral rib is widely and deeply concave, and the sinus is extended backwards about 1/5 of the entire circumference of the last whorl on the sutural ramp. The inner lip is rather flat, and has a weak angle with the columellar lip. The columellar lip is short and almost straight. The inner and the columellar lips have a very thin callus. The anterior canal is hemi-siphonous and rather long.

The operculum and animal are unknown.

Measurements:

SL 4.5 mm, SW 2.8 mm, AL 2.5 mm, AW 1.0 mm.

Previous distribution records (Fig. 154): Type locality: Gauss Station, Davis Sea. Range: off Enderby Land, 193 m (POWELL, 1958); Ross Sea, 369 m (DELL, 1990).

Remarks: According to the original description by THIELE (1912), *Pleurotomella annulata* has some spiral cords between the peripheral and the subsutural spiral keels, while the examined specimen has only two spiral cords.

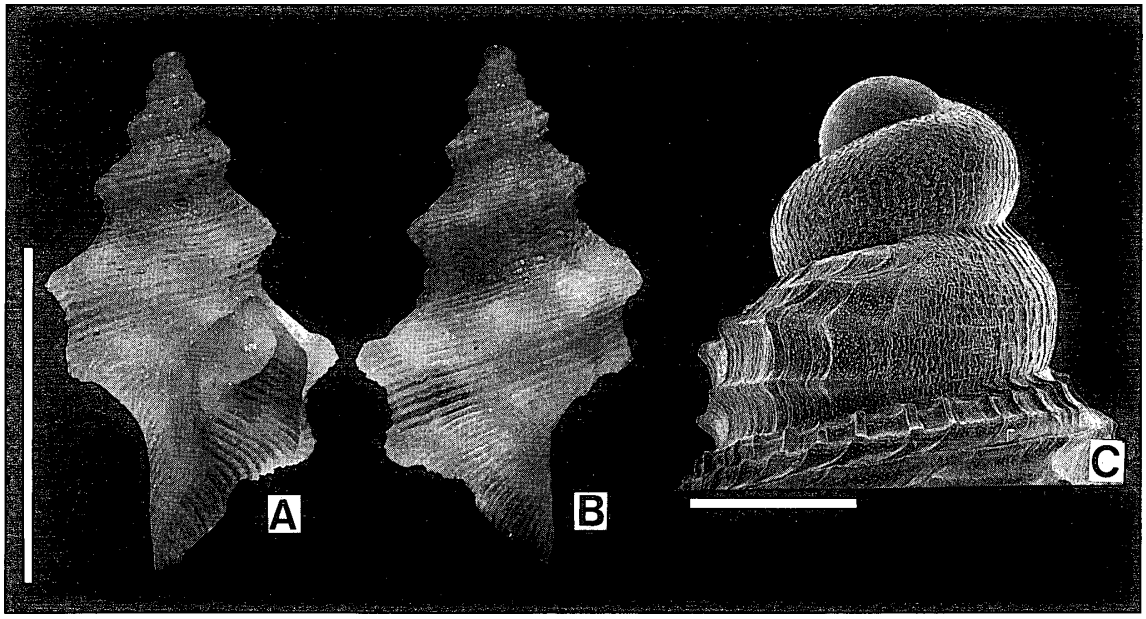
This species is similar to *Pleurotomella* (*Anomalotomella*) *enderbyensis* POWELL, 1958, from off Enderby Land, by having a peripheral and a subsutural keels and sculptures (Figs. 152A, B). However, the peripheral and subsutural keels of *P.* (*A.*) *enderbyensis* bear 10 laterally compressed nodules per whorl and polygonal in apical view.

Pleurotomella (*Anomalotomella*) *enderbyensis* POWELL, 1958
(Figs. 155A–C)

Pleurotomella enderbyensis POWELL, 1958, p. 203, pl. 2, fig. 8; POWELL, 1960, p. 159 (name only); HAIN, 1990, p. 71, pl. 8, fig. 4, pl. 26, fig. 8.

Material examined: Two living specimens and 7 empty shells from St. 5; 1 living specimen from St. 7; 2 empty shells from St. 8.

Description: The shell is small, thin, fragile, broadly fusiform, translucent white in color, with an elevated spire (Figs. 155A, B). The protoconch is moderate, about 2.5 in number of turns, 1 mm in both length and diameter, roundly inflated, translucent white in color, with a heavily granulated surface (Fig. 155C). The teleoconch is about 4 in number of turns, large, wide, inflated, with a strong peripheral keel. The surface of the teleoconch also has numerous spiral cords and very fine growth lines. The periostracum is absent. The suture is constricted. The upper whorl is rather small. The body whorl is large and wide, well inflated, about 65% of shell length, with width being 50% of shell length. The first turn of the teleoconch has three sharply raised spiral cords which are crossed by raised



Figs. 155A–C. *Pleurotomella* (*Anomalotomella*) *enderbyensis* POWELL.
A, B. Shell; C. Protoconch. Scale A, B = 5 mm; C = 500 μm.

Table 26. Measurements and condition of *Anomalotomella enderbyensis* POWELL.

No.	1	2	3	4	5	6	7	8	9	10	11
St.	5	5	5	5	5	5	5	5	7	8	8
SL (mm)	3.8	4.4	5.0	5.0	6.7	7.2	4.5	—	7.7	6.7	6.9
SW (mm)	2.5	2.5	2.8	2.6	3.3	3.6	2.5	—	—	—	—
SW/SL (%)	65.8	56.8	56.0	52.0	49.3	50.0	55.6	—	—	—	—
Condition	L	F	F	L	F	F	F	E	L	E	E

E: Empty and water-worn specimen; F: Freshly dead specimen; L: Specimen taken alive.

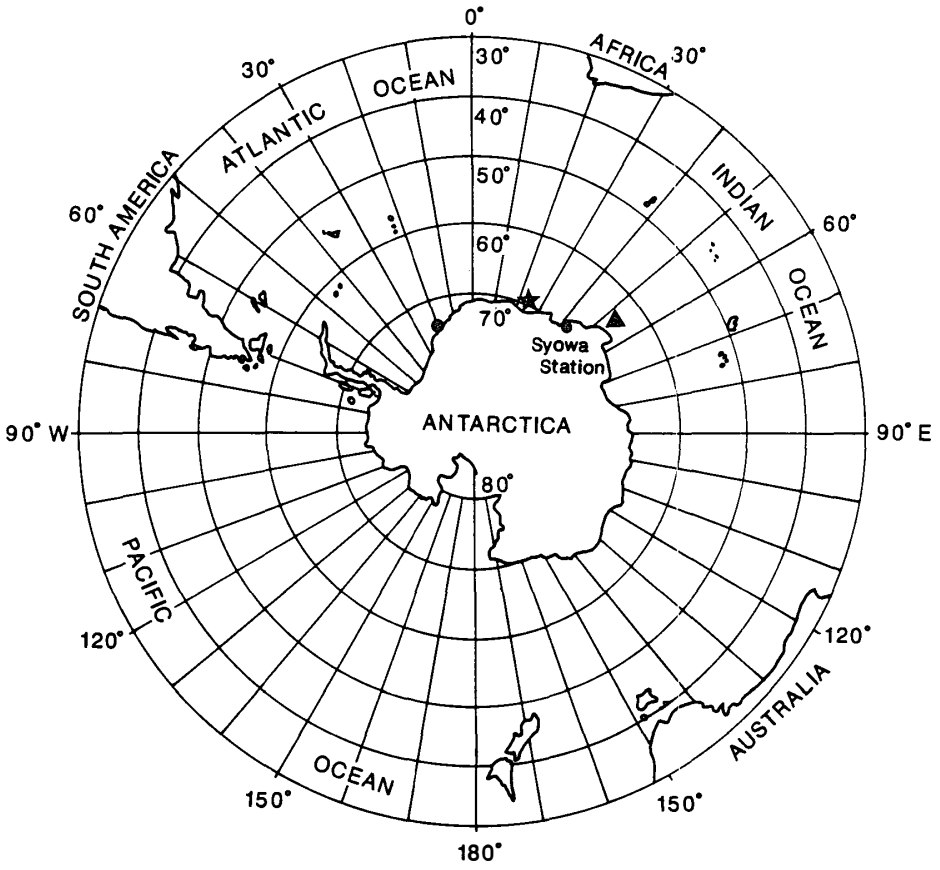


Fig. 156. Distribution of *Pleurotomella* (*Anomalotomella*) *enderbyensis* POWELL (Dot: Previous distribution record; Star: Present study; Triangle: Type locality).

axial threads. The sutural ramp has 1-6 weak spiral lirae which are crossed by opisthocyrt axial lirae, and junctions thereof are represent a small nodule. In the last whorl, the sutural ramp has 18 spiral cords excluded those in the selenizone, 16 in the area between peripheral and basal keels, and 21 on the base. The interspaces between these spiral cords are equal to each other. Both peripheral and basal keels bear 10 laterally compressed nodules per whorl representing a polygonal appearance in apical view. The base is constricted. The aperture is hexagonal, large, with length being about 50% of shell length. The outer lip is thin, and has two angles corresponding to extremities of peripheral and basal keels. The portion above the peripheral keel, between peripheral and basal keels and below the basal keel are all deeply concave, and the sinus on the sutural ramp is extended backwards about 1/6 of the entire circumference of the last whorl. The inner lip is smooth and slightly incurved. The columellar lip is short and almost straight. The inner and columellar lips have a thin and whitish callus on the surface. The anterior canal is open, short and narrow.

No operculum is present.

The radula was not observed.

Measurements: See Table 26.

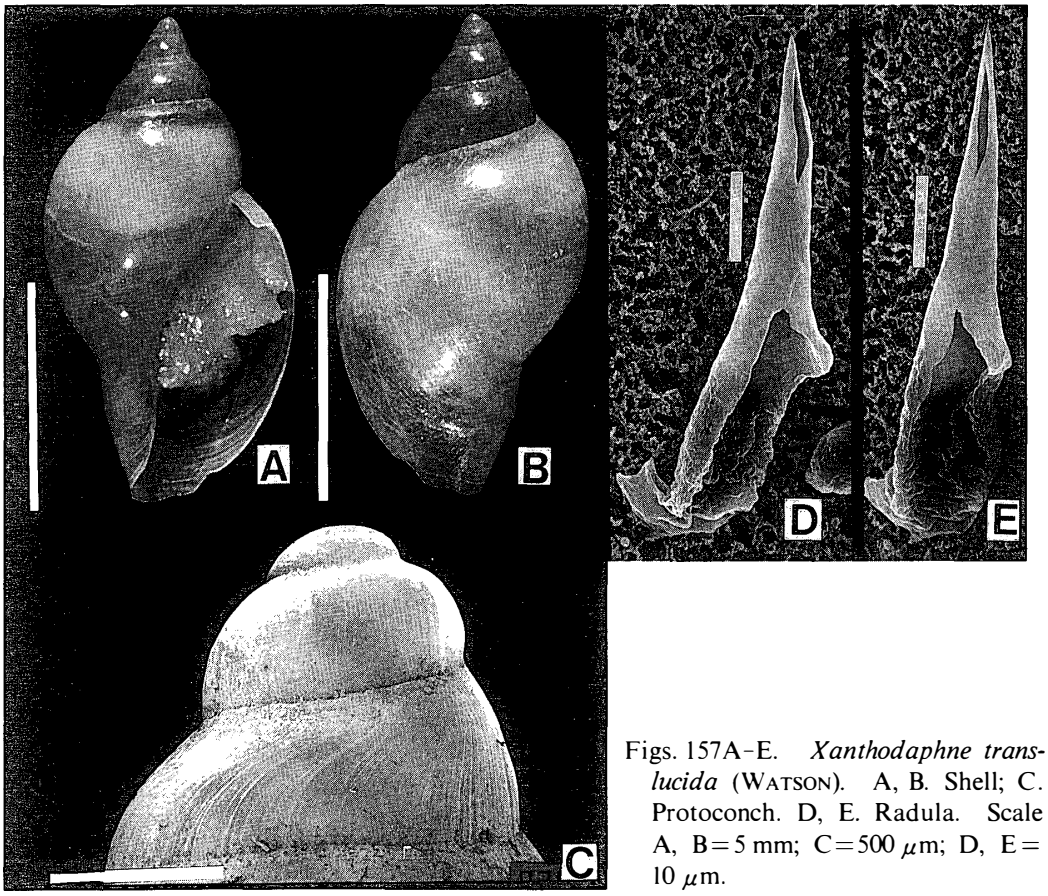
Previous distribution records (Fig. 156): Type locality: off Enderby Land, 193 m.

Range: eastern Weddell Sea, 498 m (HAIN, 1990); Ross Sea, 188–377 m (DELL, 1990).
Remarks: This species is similar to *Pleurotomella* (*Anomalotomella*) *simillana*, but is distinguishable from the latter species in having small nodule like sculptures on the teleoconch.

Genus *Xanthodaphne* POWELL, 1966
Type species: *Pleurotoma* (*Thesbia*) *membranacea* WATSON, 1886 (O.D.)

***Xanthodaphne translucida* (WATSON, 1881)**
(Figs. 157A–E)

Pleurotoma (*Thesbia*) *translucida* WATSON, 1881, p. 444; WATSON, 1886, p. 330, pl. 25, fig. 11.
Thesbia translucida: THIELE, 1912, p. 248.
Typhlodapne translucida: POWELL, 1951, p. 175 (distribution record); POWELL, 1957, p. 136; POWELL, 1958, p. 204 (distribution record); POWELL, 1960, p. 160 (name only); DELL, 1990, p. 239.
Turridae sp. 1: HAIN, 1990, p. 72, pl. 8, fig. 7, pl. 27, fig. 3.
Material examined: 3 living specimens and 1 empty shell from St. 5, 1 living specimen and 1 empty shell from St. 9.



Figs. 157A–E. *Xanthodaphne translucida* (WATSON). A, B. Shell; C. Protoconch. D, E. Radula. Scale A, B=5 mm; C=500 μm; D, E=10 μm.

Description: The shell is rather large, very thin, fragile, ovate fusiform, translucent white in color, with a large spire (Figs. 157A, B). The shell is thin and translucent that the animal is visible through the shell. The protoconch is small, about 2.5 in number of turns, 0.8 mm in length, 1.2 mm in diameter, broadly conical, roundly inflated, translucent, with a smooth and glossy surface (Fig. 157C). The teleoconch is about 3.5 in number of turns (10.6 mm in SL), large, well roundly inflated, with a smooth and glossy surface which has crowded, very fine microscopic and prosocyrt growth lines. The suture is constricted. The upper whorl is small and conical. The body whorl is large, wide, well inflated, about 80% of shell length, and width being 55% of shell length. The surface of teleoconch has no spiral sculpture, except slightly constricted base where presents numerous, very fine spiral lirae. The aperture is oblong and large, with length being about 60% of shell length. The outer lip is very thin, fragile, gently curved, with a shallow sinus on the shoulder. The inner lip is smooth. The columellar lip is smooth, rather long and almost straight. A thin callus is deposited on the inner and the columellar lips. The columella is straight. The anterior canal is short and widely open. The inner wall has a smooth and glossy surface.

No operculum is present.

The radula is toxoglossate, 1 : 0 : 0 : 0 : 1. A single tooth is hilted-dagger type, tubular, tapered, small, very short (0.05 mm in length; 10.0 mm in SL), with a conspicuous basal spur which is long and wide, about 1/2 of length (Figs. 157D, E). And it is grooved longitudinally creating a slit at the inner distal end behind the sharp, needle-like cusp.

Measurement: See Table 27.

Previous distribution records (Fig. 158): Type locality: Halfway between Marion Island and Prince Edward Island, 252 m. Range: Royal Sound, Kerguelen Island, 45 m and 51 m (WATSON, 1886); Davis Sea (THIELE, 1912); between Marion Island and Prince Edward Island, 113–99 m (POWELL, 1951); near mouth of Peace River, Bras, Bolinder, Kerguelen, 20–30 m (POWELL, 1957); off Enderby Land, 193 m and 300 m (POWELL, 1958); eastern Weddell Sea, 401–498 m (HAIN, 1990); 46°48′24″S, 37°49′24″E, off Marion Island, 99–113 m (DELL, 1990).

Remarks: This species has wide geographical distribution range, such as Marion Island to the Antarctic continental shelf.

According to POWELL (1966), the genus *Typhlodaphne* has a leaf-shaped operculum which has terminal nucleus, and the radula consists of only a pair of slender, straight, arrow-shaped marginals, which are barbed near the tip. But, this present specimen has no

Table 27. Measurements and condition of *Xanthodaphne translucida* (WATSON).

No.	1	2	3	4	5	6
St.	5	5	5	5	9	9
SL (mm)	6.5	7.8	8.3	10.6	5.3	10.0
SW (mm)	3.7	4.2	—	—	—	—
SW/SL (%)	56.9	53.8	—	—	—	—
Condition	F	L	L	L	E	L

E: Empty and water-worn specimen; F: Freshly dead specimen;
L: Specimen taken alive.

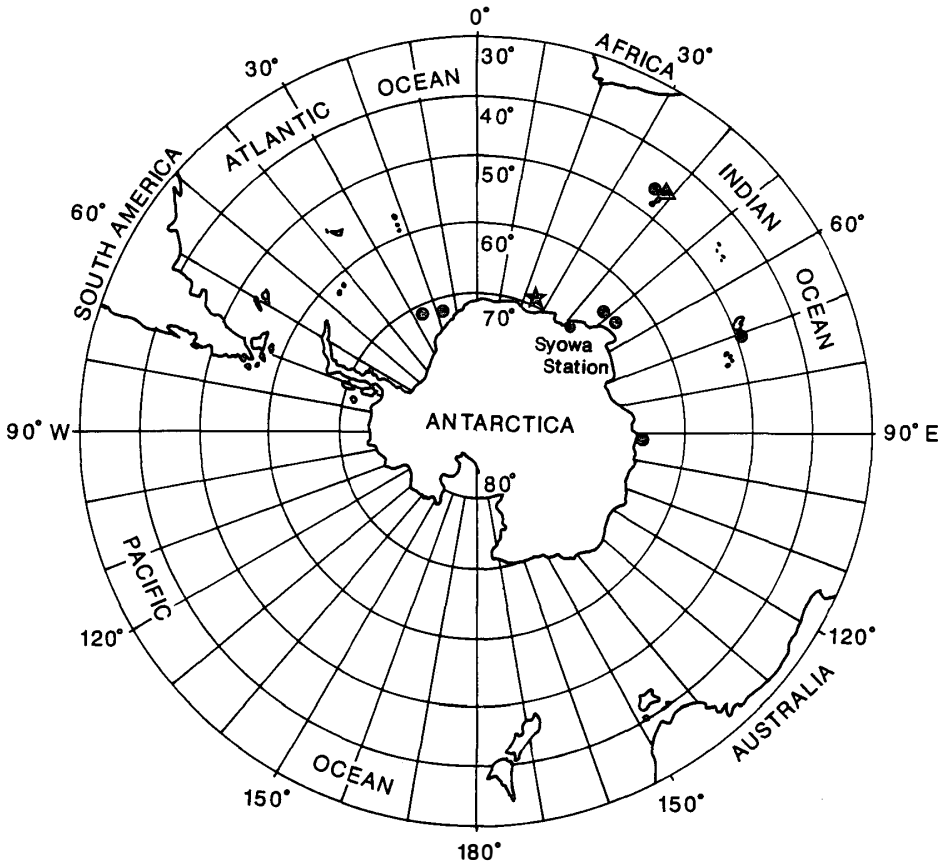


Fig. 158. Distribution of *Xanthodaphne translucida* (WATSON) (Large dots: Previous distribution records; Star: Present study; Triangle: Type locality).

operculum, and the radula is hilt-dagger type. The shell of this species is closely similar to the genus *Xanthodaphne*. The protoconch of the genus *Xanthodaphne* has finely reticulated. The author place this species tentatively under the genus *Xanthodaphne* in a broad sense. Otherwise a new genus will be needed in future because of the difference of the radular characters and the absence of the operculum.

One of the examined specimens (10.6 mm in SL) fed on a benthic polychaete.

Genus *Pontiothauma* SMITH, 1895

Type species: *Pontiothauma mirabile* SMITH, 1895 (O.D.)

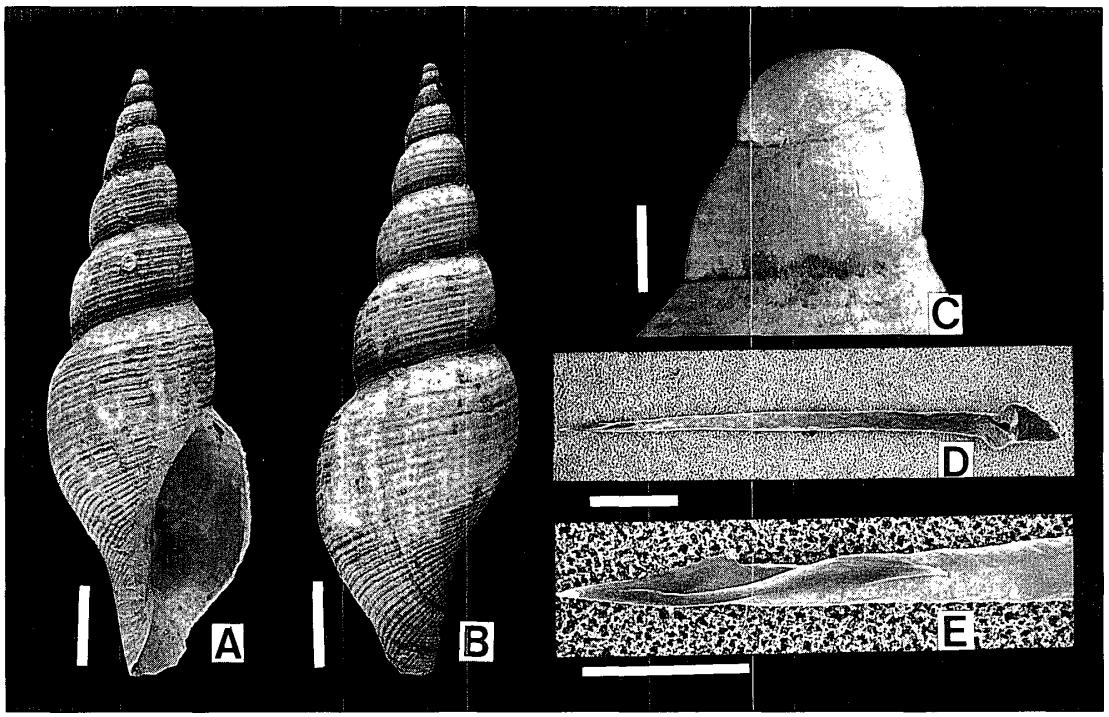
Pontiothauma ergata HEDLEY, 1916

(Figs. 159A-E)

Pontiothauma ergata HEDLEY, 1916a, p. 55, pl. 8, figs. 85-87; POWELL, 1958, p. 204, pl. 3, fig. 7, text figs. C. 1-4; POWELL, 1960, p. 160 (distribution record); EGOROVA, 1982, p. 50, figs. 63a, b, 204 and 205; OKUTANI, 1986, p. 279, pl. 1, figs. 5 and 6 (distribution record); HAIN, 1990, p. 72, pl. 8, figs. 6a-d, pl. 27, fig. 2.

Material examined: Two empty shells from St. 8; 1 living specimen from Breid Bay (JARE-27).

Description: The shell is large, elongate fusiform, dirty white in color, rather thin, with a



Figs. 159A–E. *Pontiothauma ergata* HEDLEY.
A, B. Shell; C. Protoconch; D, E. Radula. Scale A, B=10 mm; C=1 mm; D, E=100 μm.

highly elevated spire (Figs. 159A, B). The protoconch is large, about 2 in number of turns, 2.5 mm in length, 2.3 mm in diameter, glossy white in color, and has smooth surface (Fig. 159C). The teleoconch is about 6.5 in number of turns (69.0 mm in SL), large, narrow, slightly inflated, with almost regularly spaced and round topped spiral cords which are crossed by fine sigmoidal growth lines. The surface of teleoconch is covered by a thin periostracum. The coloration of periostracum of the large specimen is pale yellowish brown or straw-colored, but that of the small specimens is pale yellow. The suture is slightly constricted. The area under the suture is slightly concave. The upper whorl is slender and highly elevated. The body whorl is large, rather narrow and slightly inflated, about 60% of shell length, with width being 33% of shell length. The spiral cords are 7 on the first teleoconch, 20 on the penultimate whorl and 47 on the last whorl. The spiral cords are crowded and weak in subsutural area, but those in other areas are widely spaced, and interspaces between basal spiral cords are quite narrow. The base is slightly constricted. The aperture is oblong, large, length being about 45% of shell length. The outer lip is thin, curved, with a shallow sinouous posterior canal on the sutural ramp. The inner lip is also smooth. The columellar lip is almost straight. A thin callus is deposited on the inner and columellar lips. The anterior canal is short and straight.

The operculum is unknown.

The radula is toxoglossate, 1 : 0 : 0 : 0 : 1, translucent. A single tooth is tubular, straight, long and slender (0.45 mm in length, 20 μm in width; 18.6 mm in SL), with a small barb on both sides of the tip (Figs. 159D, E). The base is roundly expanded outwardly.

Measurements:

SL 69.0 mm, SW 22.8 mm (empty shell; St. 8).
SL 37.1 mm, SW — mm (empty shell; St. 8) (outer lip is broken).
SL 18.6 mm, SW 7.5 mm (living specimen; JARE-27).

Previous distribution records (Fig. 160): Type locality: off Shackleton Iceshelf, 432 m. Range: off Mertz Glacier Tongue, Adelie Land, 518–540 m (HEDLEY, 1916a); off Enderby Land, 193 m, 220 m and 300 m, off Sabrina Land, 474 m and off MacRobertson Land, 177 m (POWELL, 1958); Davis Sea, 460 m and 540–430 m (EGOROVA, 1982); Breid Bay, 310 m (OKUTANI, 1986); eastern Weddell Sea, 100–695 m (HAIN, 1990).

Remarks: According to POWELL (1958, 1966), *Pontiothauma ergata* has a leaf-shaped operculum with a terminal nucleus, and it is small in relation to the size of the aperture (operculum is 3.6 mm×2.1 mm *vs* aperture is 26 mm×8 mm). However, the operculum of a sole living specimen under the present examination seemed to be lost in handling.

The radula of *P. ergata* was first illustrated by POWELL (1958) and subsequently by HAIN (1990). The radula illustrated by them has large and strong barbs on the top, incontrast to small barbs in the specimen under the present study. Such a difference may be attributable to the size of specimen or infraspecific variability.

This species is distributed on the Antarctic continental shelf, 100–695 m. The bathymetrical distribution range of *P. ergata* is very shallower than that of the members of this genus in low latitude. Thus, *P. ergata* is considered to be a "deepwater element in

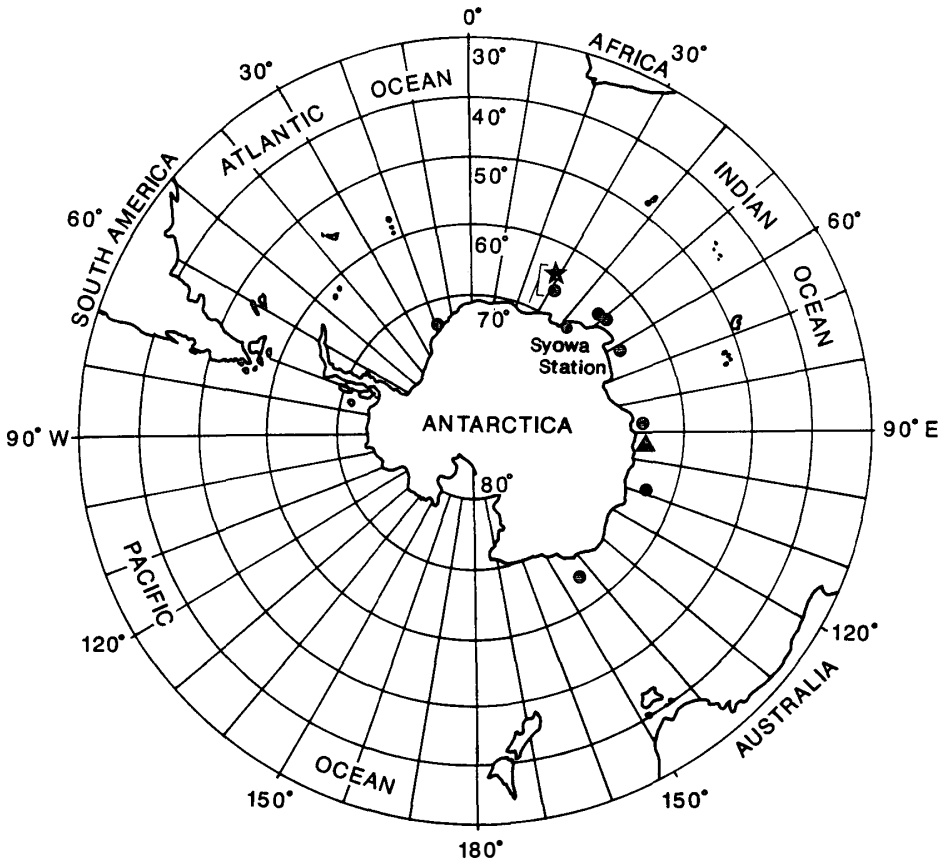


Fig. 160. Distribution of *Pontiothauma ergata* HEDLEY (Large dots: Previous distribution records; Star: Present study; Triangle: Type locality).

the lower latitudes" among the Antarctic shallow water fauna.

Pontiothauma (?) sp.

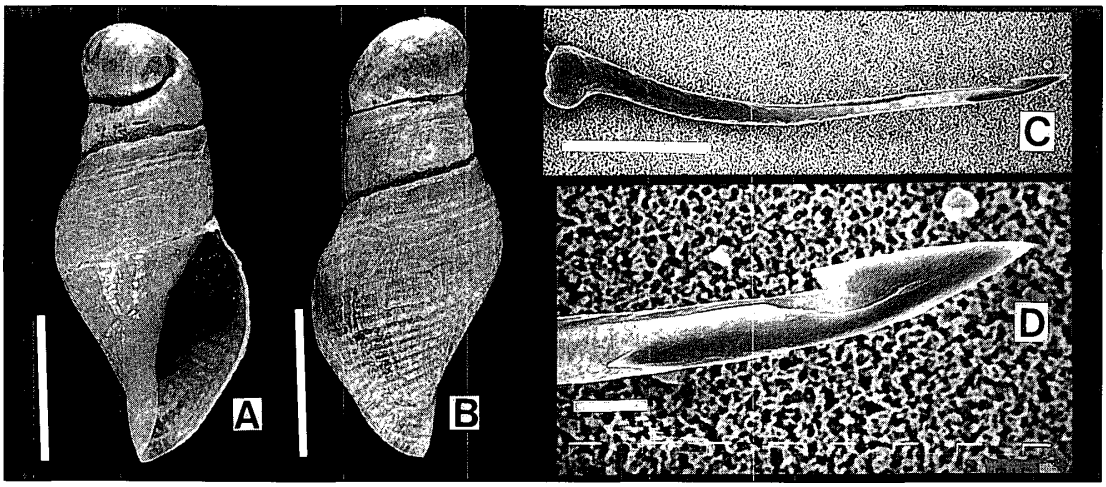
(Figs. 161A-D)

Material examined: A single living specimen from St. 7.

Description: The shell is moderate, rather thin, cylindrical, white in color, rough, with a remarkably large protoconch (Figs. 161A, B). The protoconch is somewhat glossy white in color, very large, tilted, paucispiral, roundly well inflated, about 1.2 in number of turns, 3.9 mm in length, 4.2 mm in height, with almost smooth surface except densely set microscopic opisthocyrt axial lines. The teleoconch is about 2 in number of turns, rather large but narrow, with regularly spaced spiral cords which are crossed by very fine growth lines. The suture is deeply constricted. The first turn of the teleoconch is not inflated, with almost straight wall. The last whorl is large, about 50% shell length, with width being about 42% of shell length. The spiral cords are wide, round-topped, and 6 on penultimate whorl and 24 on the last whorl. The axial growth lines are strongly curved opisthocyrt under suture, and they are gently curved below. The base is slightly constricted. The aperture is oblong and large, about 60% of shell length. The outer lip is thin and curved, with a shallow but wide sinouous posterior canal on the shoulder. The inner lip is almost straight, and has an obtuse angle on its posterior end. The columellar lip is long and slightly curved. The inner and columellar lips have a glossy thin callus on the surface. The siphonal canal is short and narrow, open and slightly curved backwards. The inner wall is glossy and smooth.

The operculum is small to the aperture in size, length occupying about 37% of the aperture length, corneous, thin, oblong, translucent pale yellow in color, with downwardly situated nuculeus.

The radula is toxoglosate, 1 : 0 : 0 : 0 : 1, translucent pale brown in color. A single tooth is injector's needle-like in shape, curved, long and slender (0.025 mm in length), with



Figs. 161A-D. *Pontiothauma*(?) sp.
A, B. Shell; C, D. Radula. Scale A, B=5 mm; C=100 μm; D=10 μm.

a small barb on both sides of the tip (Figs. 161C, D). The base is roundly expanded outwardly.

Measurements: SL 14.5 mm, SW 6.1 mm, AL 8.3 mm, AW 2.3 mm.

Remarks: This species is allied to the genus *Pontiothauma* because of following characters: 1) Large and fusiform shell; 2) having spiral cords which are crossed by numerous very fine growth lines; and 3) double barbed, long and slender marginal teeth. The species of the genus *Pontiothauma* has a papillate and tilted protoconch, however, this species has a deviated paucispiral protoconch.

This species is similar to the small specimen of *Pontiothauma ergata* HEDLEY, 1916, in having a fusiform shell and rather wide spiral cords. The radula of this species is also closely similar to the latter species by having slender injector's needle-like teeth which have two barbs on both sides of the tip (Figs. 159D, E). But, the shell of this species can be distinguished from *P. ergata*, because of having a huge and tilted paucispiral protoconch.

The present specimen is young shell, in having a relatively large protoconch and few teleoconch whorls. The adult of this species may have a very large shell. It is presumed that this is an undescribed species. Unfortunately, only a single immature specimen is available, this species is not named at present before grown materials will be obtained in future.

6. General Remarks

6.1. Composition of the present material

Ninety species/subspecies of 45 genera of 24 families were discovered from the present study area (Tables 28–30). The Antarctic and Subantarctic gastropod fauna comprises 695 species/subspecies. About 10% of the total number of Antarctic and Subantarctic gastropods species occurred from the study area, and 18 species/subspecies were newly added to the fauna.

Sixty-two species/subspecies collected from the study area were smaller than 10 mm in SL. Twenty-eight species larger than that are:

Parmaphorella mawsoni, Antimargarita dulcis, Falsimargarita gemma, Torellia (*Schismospira*) *planispira, Neoconcha insignis, Marseniopsis conica, M. mollis, M. syowaensis, Amauropsis georgianus, Falsilunata falklandica, Trophon shackletoni shackletoni, T. longstaffi, T. scotianus, Neobuccinum eatoni, Chlanidota elongata, Probuccinum tenuistriatum, P. costatum, Antarctoneptunea aurora, Paradmete curta, P. fragillima, P. arnaudi* n. sp., *Harpovoluta charcoti, Marginella ealesae, Lorabela davisi, Xanthodaphne translucida, Pleurotomella (Anomalotomella) simillana, Pontiothauma ergata and*

Table 28. Archaeogastropoda collected from the present study area.

Family	Subfamily	Species
Sissurellidae		*Anatoma amoena* (THIELE, 1912)
		Anatoma euglypta (PELSENEER, 1903)
		Anatoma shiraseae NUMANAMI & OKUTANI, 1990
Fissurellidae		*Parmaphorella mawsoni* POWELL, 1958
Trochidae	Margaritinae	*Margarites refulgens* (SMITH, 1907)
		Margarites (?) *biconica* n. sp.
		Margarites gunnerusensis n. sp.
		Antimargarita dulcis (SMITH, 1907)
	Calliostomatinae	*Falsimargarita gemma* (SMITH, 1915)
	Solariellinae	*Solariella bathyantarctica* n. sp.
Skeneidae		*Cirsonella extrema* THIELE, 1912
		Lissotesta strebeli (THIELE, 1912)
		Lissotesta unifilosa (THIELE, 1912)
		Brookula sinusbreidensis NUMANAMI & OKUTANI, 1991
		Brookula delli n. sp.
Turbinidae	Homalopomatinae	*Leptocollonia innocens* (THIELE, 1912)

Table 29. Mesogastropoda collected from the present study area.

Family	Subfamily	Species
Littorinidae		*Laevilitorina antarctica* (SMITH, 1902)
Eatoniellidae		*Eatoniella glacialis* (SMITH, 1907)
		Eatoniella kerguelenensis regularis (SMITH, 1915)
Rissoidae		*Onoba gelida* (SMITH, 1907)
		Onoba paucilirata (MELVILL & STANDEN, 1916)
		Onoba egorovae n. sp.
		Powellisetia deserta (SMITH, 1907)
		Powellisetia ponderi n. sp.
Trachysmatidae		*Trachysma tenue* THIELE, 1912
		Trachysma antarctica n. sp.
Fossaridae		*Fossarus macmurdensis* (HEDLEY, 1911)
Tornidae		*Cochliolepis* (?) *antarctica* n. sp.
Turritellidae	Turritellopsinae	*Turritellopsis latior* THIELE, 1912
Capulidae		*Capulus subcompressus* PELSENEER, 1903
Trichotropidae		*Torellia* (*Schismospira*) *planispira* (SMITH, 1915)
		Neoconcha insignis SMITH, 1915
Lamellariidae	Lamellariinae	*Marseniopsis conica* (SMITH, 1902)
		Marseniopsis mollis (SMITH, 1902)
		Marseniopsis syowaensis NUMANAMI & OKUTANI, 1991
		Marseniopsis soliditesta n. sp.
		Marseniopsis spherica n. sp.
		Marseniopsis sp.
Naticidae		*Amauropsis georgianus* (STREBEL, 1908)
		Amauropsis (*Kerguelenatica*) *grisea* (MARTENS, 1878)
		Falsilunatia falklandica (PRESTON, 1913)
		Sinuber sculpta sculpta (MARTENS, 1878)
		Prolacuna indecora (THIELE, 1912)
Eulimidae		*Melanella convexa* (SMITH, 1907)
		Melanella exulata (SMITH, 1915)
		Melanella solitaria (SMITH, 1915)
		Melanella sp. 1
		Melanella sp. 2
		Hemiaclis incolorata (THIELE, 1912)

Pontiothauma (?) sp.

Among them, the largest is *Antarctoneptunea aurora* measuring 83 mm in shell length. The most diverse family in the area under study is the Buccinidae, occupying 19% (17 species) of the total number of species treated. And 7 large species were included in the Buccinidae, *Antarctoneptunea aurora* was the largest size species having a solid shell.

Seventy-eight species occurred in Breid Bay, while only nine species were collected from Günnerus Bank at 280 m deep. *Leptocollonia innocens, Amauropsis georgianus, Pareuthria innocens* and *Marginella hyalina* were obtained from both areas. Only three species, *Solariella bathyantarctica* n. sp., *Harpovoluta charcoti* and *Micropleurotoma remota* were collected from 955 m deep in Günnerus Bank. This particular deep station had no faunal affinity with those in Breid Bay.

Table 30. Neogastropoda collected from the present study area.

Family	Subfamily	Species
Muricidae	Trophoninae	*Trophon drygalskii* THIELE, 1912
		Trophon longstaffi SMITH, 1907
		Trophon shackletoni shackletoni HEDLEY, 1911
		Trophon scotianus POWELL, 1951
		Trophon coulmanensis multilamellatus n. subsp.
Buccinidae	Buccininae	*Neobuccinum eatoni* (SMITH, 1875)
		Antarctodomus thielei (POWELL, 1958)
		Antarctodomus okutanii n. sp.
		Probuccinum angulatum POWELL, 1951
		Probuccinum costatum THIELE, 1912
		Probuccinum tenuistriatum HEDLEY, 1916
		Chlanidota elongata (LAMY, 1910)
		Prosipho gracilis THIELE, 1912
		Prosipho hunteri HEDLEY, 1916
		Prosipho macleani HEDLEY, 1916
		Prosipho mundus SMITH, 1915
		Prosipho spiralis THIELE, 1912
		Prosipho shiraseae n. sp.
		Antarctoneptunea aurora (HEDLEY, 1916)
	Photinae	*Pareuthria innocens* (SMITH, 1907)
		Pareuthria plicatula THIELE, 1912
		Pareuthria hoshiaii n. sp.
Volutomitridae		*Paradmete curta* STREBEL, 1908
		Paradmete fragillima (WATSON, 1882)
		Paradmete breidensis n. sp.
		Paradmete arnaudi n. sp.
Volutidae	Fulgorarinae	*Harpovoluta charcoti* (LAMY, 1910)
Marginellidae		*Marginella hyalina* THIELE, 1912
		Marginella ealesae POWELL, 1958
Cancellariidae	Admetinae	*Admete haini* n. sp.
Turridae	Turrinae	*Micropleurotoma remota* (POWELL, 1958)
	Mangeliinae	*Lorabela davisi* (HEDLEY, 1916)
		Lorabela plicatula (THIELE, 1912)
	Daphnellinae	*Typhlodaphne nipri* n. sp.
		Pleurotomella (Anomalotomella) simillana THIELE, 1912
		Pleurotomella (Anomalotomella) frigida THIELE, 1912
		Pleurotomella (Anomalotomella) annulata THIELE, 1912
		Pleurotomella (Anomalotomella) enderbyensis POWELL, 1958
		Xanthodaphne translucida (WATSON, 1881)
		Pontiothauma ergata HEDLEY, 1916
		Pontiothauma (?) sp.

Only ten species/subspecies were collected from the neighborhood of Syowa Station. *Trophon shackletoni shackletoni, Chlanidota elongata* and *Probuccinum tenuistriatum* were obtained from both around Syowa Station and Breid Bay. Only a single species, *Harpovoluta charcoti*, was obtained both from around Syowa Statin and from Günnerus Bank in 955 m deep. No species was common in both Syowa Station and the shallow

station (280 m-depth) in Günnerus Bank. Almost all species which were collected near Syowa Station were carnivores, except *Laevilitorina antarctica*.

6.2. Geographical distribution

Many recent workers have proposed patterns of distribution of benthic invertebrates of the Antarctic region (EKMAN, 1953; KNOX, 1960; KUSSAKIN, 1967; DELL, 1969; HEDGPETH, 1969). The distribution patterns of Antarctic gastropods of DELL (1969) and HEDGPETH (1969) are well applied to the present study:

1) Species collected from only the present study area
2) East Antarctic distribution—from the Ross Sea to the eastern Weddell Sea.
3) West Antarctic distribution—in the western Weddell Sea to the Antarctic Peninsula, including islands situated between the Antarctic Convergence and the Antarctic Divergence.
4) Circum-Antarctic distribution—in both eastern and the western Antarctica.
5) Antarctic and Subantarctic distribution—in both the Antarctic and north of the Antarctic Convergence.

As has been stated under the entry of "Previous distribution records" for each species in the Systematic Section, the distribution ranges of examined species are classified into the above-mentioned five categories of distribution patterns (Table 31-33).

1) Species collected from only the present study area

Twenty-one species (23.3%) collected from only the study area. *Micropleurotoma remota* was originally described from the eastern Enderby Land, and thus its distribution range has been extended slightly to the east. This species may be categorized into this group, because the distribution range is evidently very narrow.

2) East Antarctic distribution

Thirty-two (35.6%) species are distributed in East Antarctica. The distribution ranges of 11 species are now extended to the west. They are:

Lissotesta strebeli, Laevilitorina antarctica, Trachysma tenue, Fossarus macmurdensis, Melanella convexa, M. exulata, Antarctodomus thielei, Probuccinum tenuistriatum, Prosipho gracilis, P. mundus, P. macleani and *Antarctoneptunea aurora*.

Melanella exulata and *Antarctodomus thielei* have been known from a limited area, namely, the Ross Sea and Adélie Coast. HAIN (1990) reported Trochidae sp., Buccinidae sp., *Parademete* sp. A and *Admete* sp. from the eastern Weddell Sea. These species are here named *Cochliolepis (?) antarctica* n. sp., *Antarctodomus okutanii* n. sp., *Paradmete breidensis* n. sp. and *Admete haini* n. sp., respectively. They were collected only from the eastern Weddell Sea and the present study area. According to DELL (1990), *Parmaphorella mawsoni* and *Leptocollonia innocens*, which were reported form the eastern Weddell Sea to the Ross Sea, were included in the circum-Antarctic distribution. However, these species should be appropriately included in the East Antarctic distribution, because they have hitherto been unrecorded from the Antarctic Peninsula and its neighborhood.

3) West Antarctic distribution

This distribution pattern applies to species that are distributed from the present study area to the inner Antarctic convergence islands. Only three species (3.3%) in the present material are included in this category. *Amauropsis georgianus* and *Probuccinum angulatum* are distributed around the South Georgia Islands and in the present study area. The

Table 31. Distribution patterns and bathymetric ranges of Archaeogastropoda in the present material.

Family	Species	Collection site				Distribution pattern	Bathymetrical range (m)
		B	G1	G2	S		
Sissurellidae	*Anatoma amoena* (THIELE, 1912)	○				E	300–870
	Anatoma euglypta (PELSENEER, 1903)	○				A-S	93–870
	Anatoma shiraseoe NUMANAMI & OKUTANI, 1990		○			P	281–282
Fissurellidae	*Parmaphorella mawsoni* POWELL, 1958	○				E	193–876
Trochidae	*Margarites refulgens* (SMITH, 1907)	○				C	1–1108
	Margarites (?) *biconica* n. sp.	○				E	155–481
	Margarites gunnerusensis n. sp.		○			P	300
	Antimargarita dulcis (SMITH, 1907)	○				C	22–731
	Falsimargarita gemma (SMITH, 1915)		○			C	128–2525
	Solariella bathyantarctica n. sp.			○		P	955
Skeneidae	*Cirsonella extrema* THIELE, 1912	○				C	58–870
	Lissotesta strebeli (THIELE, 1912)	○				E	170–870
	Lissotesta unifilosa (THIELE, 1912)	○				C	80–377
	Brookula sinusbreidensis NUMANAMI & OKUTANI, 1991	○				P	270
	Brookula delli n. sp.	○				P	300
Turbinidae	*Leptocollonia innocens* (THIELE, 1912)	○	○			E	190–673

Note: A-S: Antarctic and Subantarctic distribution; B: Breid Bay; C: Circum-Antarctic distribution; E: East Antarctic distribution; G1: Günnerus Bank in 280 m in depth; G2: Günnerus Bank 955 m in depth; P: Endemic to the present study area; S: Syowa Station. The circle indicates positive occurrence.

distribution range of *Chlanidota elongata* is slightly wider than the above two species, namely, from the present study area to the Antarctic Peninsula.

4) Circum-Antarctic distribution

Twenty-four species (26.7%) are recognized as having circum-Antarctic distribution. Among them, 13 species have been distributed both in east Antarctica and the Antarctic Peninsula. They are:

Antimargarita dulcis, Falsimargarita gemma, Cirsonella extrema, Capulus subcompressus, Marseniopsis mollis, Prolacuna indecora, Melanella solitaria, Hemiaclis incolorata, Trophon drygalskii, Probuccinum costatum, Pareuthria innocens, Marginella hyalina and *M. ealesae*.

Another four species, viz. *Eatoniella glacialis, Onoba gelida, Prosipho hunteri* and *Harpovoluta charcoti*, have wide distribution ranges including east Antarctica, the Antarctic Peninsula and the Antarctic Islands. *Margarites refulgens, Powellisetia deserta, Trophon shackletoni shackletoni* and *T. scotianus* are distributed in the south of the Antarctic Convergence, but they have never been reported from the Antarctic Peninsula.

5) Antarctic and Subantarctic distribution

Ten species (11.1%) are distributed in both the Antarctic and the Subantarctic regions. Among them, *Anatoma euglypta, Sinuber sculpta sculpta* and *Paradmete fragillima* are

Table 32. Distribution patterns and bathymetric ranges of Mesogastropoda in the present material.

Family	Species	Collection site				Distribution pattern	Bathymetrical range (m)
		B	G1	G2	S		
Littorinidae	*Laevilitorina antarctica* (SMITH, 1902)				○	E	4–351
Eatoniellidae	*Eatoniella glacialis* (SHITH, 1907)	○				C	22–870
	Eatoniella kerguelenensis regularis (SMITH, 1915)	○				C	0–457
Rissoidae	*Onoba gelida* (SMITH, 1907)	○				C	4–870
	Onoba paucilirata (MELVILL & STANDEN, 1917)	○				A-S	102–300
	Onoba egorovae n. sp.	○				P	300
	Powellisetia deserta (SMITH, 1907)	○				C	18–870
	Powellisetia ponderi n. sp.	○				P	300
Trachysmatidae	*Trachysma tenue* THIELE, 1912	○				E	300–385
	Trachysma antarctica n. sp.	○				P	300
Fossaridae	*Fossarus macmurdensis* (HEDLEY, 1911)	○				E	18–752
Tornidae	*Cochliolepis* (?) *antarctica* n. sp.	○				P	300
Turritellidae	*Turritellopsis latior* THIELE, 1912	○				A-S	40–549
Capulidae	*Capulus subcompressus* PELSENEER, 1903	○				C	27–640
Trichotropidae	*Torellia* (*Schismospira*) *planispira* (SMITH, 1915)	○				E	219–441
	Neoconcha insignis SMITH, 1915	○				E	110–695
Lamellariidae	*Marseniopsis conica* (SMITH, 1902)	○				E	30–860
	Marseniopsis mollis (SMITH, 1902)	○			○	C	1–730
	Marseniopsis syowaensis NUMANAMI & OKUTANI, 1991				○	P	5–10
	Marseniopsis soliditesta n. sp.	○				P	300
	Marseniopsis spherica n. sp.	○				P	300
	Marseniopsis sp.	○				P	300
Naticidae	*Amauropsis georgianus* (STREBEL, 1908)	○				W	64–300
	Amauropsis (*Kerguelenatica*) *grisea* (MARTENS, 1878)	○				C	40–891
	Falsilunatia falklandica (PRESTON, 1913)	○				A-S	300
	Sinuber sculpta sculpta (MARTENS, 1878)	○				A-S	177–866
	Prolacuna indecora (THIELE, 1912)	○				C	40–836
Eulimidae	*Melanella convexa* (SMITH, 1907)	○				E	22–549
	Melanella exulata (SMITH, 1915)		○			E	59–731
	Melanella solitaria (SMITH, 1915)	○				C	45–535
	Melanella sp. 1	○				P	300
	Melanella sp. 2	○				P	300
	Hemiaclis incolorata (THIELE, 1912)	○				C	300–1431

Note: A-S: Antarctic and Subantarctic distribution; B: Breid Bay; C: Circum-Antarctic distribution; E: East Antarctic distribution; G1: Günnerus Bank in 280 m in depth; G2: Günnerus Bank 955 m in depth; P: Endemic to the present study area; S: Syowa Station. The circle indicates positive occurrence.

Table 33. Distribution patterns and bathymetric ranges of Neogastropoda in the present material.

Family	Species	Collection site				Distribution pattern	Bathymetrical range (m)
		B	G1	G2	S		
Muricidae	*Trophon drygalskii* THIELE, 1912	○				C	190–392
	Trophon longstaffi SMITH, 1907				○	E	5–1080
	Trophon shackletoni shackletoni HEDLEY, 1911	○			○	C	13–3248
	Trophon scotianus POWELL, 1951	○				C	256–474
	Trophon coulmanensis multilamellatus n. subsp.	○				P	300
Buccinidae	*Neobuccinum eatoni* (SMITH, 1875)				○	A-S	4–2354
	Antarctodomus thielei (POWELL, 1958)	○				E	115–569
	Antarctodomus okutanii n. sp.	○				E	300–420
	Probuccinum angulatum POWELL, 1951	○	○			W	160–300
	Probuccinum costatum THIELE, 1912	○				C	193–613
	Probuccinum tenuistriatum HEDLEY, 1916	○			○	E	40–660
	Chlanidota elongata (LAMY, 1910)				○	W	98–1116
	Prosipho gracilis THIELE, 1912	○				E	300–443
	Prosipho hunteri HEDLEY, 1916	○				C	64–441
	Prosipho macleani HEDLEY, 1916	○				E	45–300
	Prosipho mundus SHITH, 1915	○				E	12–549
	Prosipho spiralis THIELE, 1912	○				E	193–987
	Prosipho shiraseae n. sp.	○				P	300
	Antarctoneptunea aurora (HEDLEY, 1916)				○	E	10–603
	Pareuthria innocens (SMITH, 1907)	○	○			C	12–549
	Pareuthria plicatula THIELE, 1912	○				E	110–549
	Pareuthria hoshiaii n. sp.	○				P	300
Volutomitridae	*Paradmete curta* STREBEL, 1908	○				A-S	95–650
	Paradmete fragillima (WATSON, 1882)	○				A-S	30–549
	Paradmete breidensis n. sp.	○				E	300–441
	Paradmete arnaudi n. sp.	○				P	300
Volutidae	*Harpovoluta charcoti* (LAMY, 1910)			○	○	C	30–1469
Marginellidae	*Marginella hyalina* THIELE, 1912	○	○			C	115–673
	Marginella ealesae POWELL, 1958	○				C	155–481
Cancellariidae	*Admete haini* n. sp.	○				E	181–481
Turridae	*Micropleurotoma remota* (POWELL,1958)		○			P	193–955
	Lorabela davisi (HEDLEY, 1916)	○				E	220–640
	Lorabela plicatula (THIELE, 1912)	○				E	115–640
	Typhlodaphne nipri n. sp.	○				P	300
	Pleurotomella (Anomalotomella) simillana THIELE, 1912	○				A-S	50–600
	Pleurotomella (Anomalotomella) frigida THIELE, 1912	○				E	193–870
	Pleurotomella (Anomalotomella) annulata THIELE, 1912	○				E	193–369
	Pleurotomella (Anomalotomella) enderbyensis POWELL, 1958	○				E	188–498
	Xanthodaphne translucida (WATSON, 1881)	○				A-S	20–498
	Pontiothauma ergata HEDLEY, 1916	○				E	100–695
	Pontiothauma (?) sp.	○				P	300

Note: A-S: Antarctic and Subantarctic disribution; B: Breid Bay; C: Circum-Antarctic distributioo; E: East Antarctic distribution; G1: Günnerus Bank in 280 m in depth; G2: Günnerus Bank 955 m in depth; P: Endemic to the present study area; S: Syowa Station. The circle indicates positive occurrence.

distributed in the circum-Antarctic including the Falkland Islands and Kerguelen. *Onoba paucilirata* and *Falsilunatia falklandica* were found from the present study area and are also known from Falkland Islands. *Turritellopsis latior, Xanthodaphne translucida* and *Pleurotomella* (*Anomalotomella*) *simillana* are distributed in East Antarctica and Kerguelen. *Neobuccinum eatoni* and *Paradmete curta* are circum-Antarctic including Kerguelen.

Therefore, almost all species in the present material were composed of the East Antarctic distribution species and the circum-Antarctic distribution species. However, the present material contained to a high degree species which were collected from the present study area.

6.3. Bathymetric distribution ranges

1) Shallow water species

Around the Antarctic continent, there is a paucity of stable shallow water habitats. Intertidal molluscan faunas have been recorded only from a few sheltered areas, mostly along the Antarctic Peninsula. No intertidal Mollusca have been collected from the present study area, because sea ice covers the shores throughout the year. In limited areas along the shores, such as Nisi-no-ura Cove and Langhovde, the action of ice scour takes place in spring and summer. In the Ross Sea, the formation of anchor ice on the sea floor is a major factor for eliminating subtidal biota (DAYTON *et al*., 1970). Investigations of the Ross Sea indicate that sea bottoms shallower than 15 m deep are almost completely devoid of sessile organisms due to the effect of ice scour and anchor ice formation, and the sea bed down to 33 m is also influenced by anchor ice (DAYTON *et al*., 1969, 1970; DELL, 1990). But, in the Syowa Station area, anchor ice formation is not observed, and sessile organisms are observed down to about 3 m deep at the limit of fast ice thickness.

A single species among the gastropods treated here, *Marseniopsis syowaensis*, was collected from only the subtidal zone, 5–10 m deep, near Syowa Station and Langhovde. *Marseniopsis mollis, Trophon shackletoni shackletoni, Neobuccinum eatoni* and *Antarctoneptunea aurora* were often collected from the subtidal zone, shallower than 20 m, by SCUBA diving. *Laevilitorina antarctica* was collected from the subtidal algal zone in Langhovde (HORIKOSHI *et al*., 1979), and *Trophon longstaffi* was also collected from the same zone with a small dredge. Among them, the present collections of *T. shackletoni shackletoni, T. longstaffi* and *A. aurora* are the shallowest records of occurrence. Especially, *A. aurora* has hitherto been known from 188 m to 640 m; the present report is the first record from such very shallow coastal water. According to DELL (1990), 16 gastropods were collected from depths shallower than 33 m in the Ross Sea. Almost all shallow species in this study are included in the shallow-water faunula of the Ross Sea, except *M. syowaensis* and *A. aurora*. *Margarites refulgens, Eatoniella glacialis, Onoba gelida, Powellistea deserta, Fossarus macmurdensis* and *Pareuthoria innocens* have been reported from shallow water in the Ross Sea (DELL, 1990), but these species were collected only from the continental shelf in this study. TUCKER and BURTON (1987) reported 20 gastropods from the shallow coastal waters, 4–20 m in depth, of the Vestfold Hills and Rauer Island, Prydz Bay 68°33′S, 78°15′E. These areas are almost at the same latitude as Syowa Station. Tiny species, such as the genera *Skenella, Onoba, Laevilitorina, Eatoniella* and *Powellisetia*, occupy the major part of the gastropod fauna in the Vestfold Hills and

Rauer Island; *Trophon longstaffi* and *Neobuccinum eatoni* were also collected from these areas. The shallow water fauna near Syowa Station lacks such tiny species, except *Laevilitorina antarctica*, so far known.

2) Shelf-slope species

Among the species under study, 83 species (92.2%) have hitherto been reported from the continental shelf to the slope of Antarctica. *Margarites refulgens, Trophon longstaffi, T. shackletoni shackletoni, Neobuccinum eatoni, Chlanidota elongata* and *Harpovoluta charcoti* have wide bathymetric ranges from shallow water to the continental slope (see next section).

Among the shelf-slope species, twenty-eight species have hitherto been known from both shallow waters and the continental shelf (0–891 m depth). They are:

Anatoma euglypta, Antimargarita dulcis, Cirsonella extrema, Laevilitorina antarctica, Eatoniella glacialis, E. kerguelenensis regularis, Onoba gelida, Powellisetia deserta, Fossarus macmurdensis, Turritellopsis latior, Capulus subcompressus, Marseniopsis conica, M. mollis, Amauropsis georgianus, A. (*Kerguelenatica*) *grisea, Prolacuna indecora, Melanella convexa, M. exulata, M. solitaria, Probuccinum tenuistriatum, Prosipho hunteri, P. mundus, Antarctoneptunea aurora, Pareuthria innocens, Paradmete fragillima, Xanthodaphne translusida* and *Pleurotomella* (*Anomalotomella*) *simillana*.

The bathymetric range of *Proshipo macleani* hitherto reported was 45–220 m; this range was here extended to about 300 m. *Antarctoneptunea aurora* has been collected from the continental shelf (188–603 m); the bathymetric range is now remarkably extended, to about 15 m deep, by the present investigation. *Laevilitorina antarctica* and *Marseniopsis mollis* are common species in shallow waters (ARNAUD, 1972b; ARNAUD *et al*., 1986; DELL, 1990). In the present study area, *M. mollis* is also common in shallow water.

Thirty-two species have hitherto been known only from the continental shelf. They are:

Anatoma amoena, Parmaphorella mawsoni, Leptocollonia innocens, Lissotesta strebeli, L. unifilosa, Onoba paucilirata, Trachysma tenue, Cochliolepis (?) *antarctica* n. sp., *Torellia* (*Schismospira*) *planispira, Neoconcha insignis, Sinuber sculpta sculpta, Trophon drygalskii, T. scotianus, Antarctodomus thielei, A. okutanii* n. sp., *Probuccinum angulatum, P. costatum, Prosipho gracilis, P. spiralis, Pareuthria plicatula, Paradmete curta, P. breidensis* n. sp., *Marginella hyalina, M. ealesae, Admete haini* n. sp., *Micropleurotoma remota, Lorabela davisi, L. plicatula, Pleurotomella* (*Anomalotomella*) *frigida, P.* (*A.*) *annulata, P.* (*A.*) *enderbyensis*, and *Pontiothauma ergata*.

The bathymetric range of almost all the above-mentioned species were 100–700 m in depth. *Micropleurotoma remota* has hitherto been known from depth of 188–300 m on the continental shelf, off Enderby Land (POWELL, 1958), but the bathymetric range of this species is now very widely extended to the shelf edge as deep as 188–955 m by this study. Other species distributed on the shelf down to the shelf edge are *Anatoma amoena, Parmaphorella mawsoni, Submargarita strebeli, Sinuber sculpta sculpta, Prosipho spiralis* and *Pleurotomella* (*Anomalotomella*) *frigida*. On the other hand, *Trachysma tenue* (range is 300–385 m), *Prosipho gracilis* (300–443 m), *Antarctodomus okutanii* n. sp. (300–420 m) and *Paradmete breidensis* n. sp. (300–443 m) seems to have a very narrow bathymetrical distribution, about 300–400 m in depth.

Almost all new species in this study, except *Solariella bathyantarctica* n. sp.,

Cochliolepis (?) *antarctica* n. sp. and *Antarctodomus okutanii* n. sp., are from the shelf at about 300 m in depth.

3) Wide bathymetrical distribution species

Six species (6.7%), *viz. Margarites refulgens, Trophon longstaffi, T. shackletoni shackletoni, Neobuccinum eatoni, Chlanidota elongata* and *Harpovoluta charcoti*, have hitherto been known from shallow water to the continental slope. *N. eatoni* has a remarkably wide bathymetrical distribution range, 4 m down to 2354 m. *N. eatoni* was the commonest scavenger around Syowa Station, and its bathymetric range was 17–680 m in this area (NUMANAMI *et al.*, 1984). *N. eatoni* was collected from various bottom substrata including sand with pebble, rock with pebble, sandy mud and mud in waters around Syowa Station (HOSHIAI, 1978). However, this species does not occur in the offshore area. Therefore, *N. eatoni* is mainly distributed in the shallow waters and the upper continental shelf where there are many deep glacial channels. *C. elongata* and *H. charcoti* are distributed in shallow waters to the continental slope (LAMY, 1910; SMITH, 1915; TOMLIN, 1948; POWELL, 1951, 1958; ARNAUD, 1972b; HORIKOSHI *et al.*, 1979; EGOROVA, 1982; DELL, 1990; HAIN, 1990). But, these two carnivorous species have often been collected from the subtidal zone near Syowa Station (NUMANAMI *et al.*, 1984).

Therefore, the bathymetric distributions of most species treated by the present study are from the continental shelf to the slope of Antarctica.

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References

ABBOTT, R.T. (1974): American seashells. 2nd ed. New York, Van Nostrand Reinhold, 1-663.

ARNAUD, P.M. (1972a): Sur une collection de Gastéropodes prosobranches et Pélécypodes de l'Ile Petermann (Antarctique). Tethys, **4**, 429-436.

ARNAUD, P.M. (1972b): Invertébrés marins des XIIème et XVème expéditions antarctiques françaises en Terre Adélie. 8.—Gastéropodes Prosobranches. Tethys (Supplement), **4**, 105-135.

ARNAUD, P.M. (1985): Gastropods. Southern Ocean, Vol. 1. FAO Species Identification Sheets for Fishery Purposes, ed. by W. FISHER. Rome, FAO, 107-116.

ARNAUD, P.M. and BANDEL, M. (1978): Comments on six species of marine Antarctic Littorinacea (Mollusca, Gastropoda). Tethys, **8**, 213-230.

ARNAUD, P.M. and MOL, J.J. (1979): Anatomy, ecology and distribution of the Volutidae and Volutomitridae of the Southern Indian Ocean. Veliger, **22**, 19-31.

ARNAUD, P.M., JAZDZEWSKI, K., PRESLER, P. and SICINSKI, J. (1986): Preliminary survey of benthic invertebrates collected by Polish Antarctic Expeditions in Admiralty Bay (King George Island, South Shetland Islands, Antarctica). Pol. Polar Res., **7**, 7-24.

BATTEN, R.L. (1975): The Scissurellidae—are they neotenously derived fissurellids? (Archaeogastropoda). Am. Mus. Novit., **2567**, 1-29.

CANTERA, J.R. and ARNAUD, P.M. (1984): Les gastéropodes prosobranches des iles Kerguelen et Crozet (sud de l'Océan Indien) comparaison écologique et particularités biologiques. CNFRA, **58**, 1-169.

CERNOHORSKY, W.O. (1970): Systematics of the families Mitridae and Volutomitridae. Bull. Auckland Inst. Mus., **8**, 1-190.

CERNOHORSKY, W.O. (1977): The taxonomy of some Southern Ocean Mollusca (Gastropoda) mainly Antarctic and Subantarctic. Rec. Auckland Inst. Mus., **14**, 105-119.

COX, L.R. (1960): Gastropoda, General characteristics of Gastropoda. Treatise on Invertebrate Paleontology, Part 1, Mollusca 1, ed. by R. C. MOORE. New York, Geol. Soc. Am., 1-221.

*DAVID, L. (1934): Zoologische Ergebnisse der Reisen von Dr Kohl-Larsen nach den subantarktischen Inseln bei Neuseeland und nach Südgeorgien. Senckenbergiana, **16**, 126-137.

DAYTON, P.K. and OLIVER, J.S. (1977): Antarctic soft-bottom benthos in oligotrophic and eutrophic environments. Science, **197**, 55-58.

DAYTON, P.K., ROBILLIARD, G.A. and De VRIES, A.L. (1969): Anchor ice formation in McMurdo Sound, Antarctica, and its biological effects. Science, **163**, 273-275.

DAYTON, P.K., ROBILLIARD, G.A. and PAINE, R.T. (1970): Benthic faunal zonation as a result of anchor ice at McMurdo Sound, Antarctica. Antarctic Ecology, ed. by M. HOLDGATE. London, Academic Press, 244-258.

DELL, R.K. (1968): Benthic faunas of the Antarctic. Symposium on Antarctic Oceanography, Santiago, Chile, 13-16 September 1966. Cambridge, Scott Polar Res. Inst., 110-118.

DELL, R.K. (1969): Benthic Mollusca. Distribution of Selected Groups of Marine Invertebrates in Waters South of 35°S Latitudes, ed. by J.W. HEDGPETH. New York, Am. Geogr. Soc., 25-26 (Antarctic Map Folio Series, Folio 11).

DELL, R.K. (1972a): Some Mollusca from the vicinity of Mawson Base, Antarctica, resulting from ANARE collections. Rec. Dom. Mus., **8**, 1-7.

DELL, R.K. (1972b): A new genus of Antarctic buccinid gastropod. Rec. Dom. Mus., **8**(7), 115-119.

DELL, R.K. (1972c): Antarctic benthos. Adv. Mar. Biol., **10**, 1-216.

DELL, R.K. (1990): Antarctic Mollusca. Bull. R. Soc. N. Z., **27**, 1-311.

EALES, N.B. (1923): Mollusca. Pt. 5. Anatomy of Gsatropoda (expect the Nudibranchiata). Br. Antarct. ('Terra Nova') Exped., 1910, Nat. Hist. Rep. Zool., **7**, 1-46.

EGOROVA, E.N. (1982): Mollyuski Morya Deyvisa (Mollusca of Davis Sea). Biol. Results Sov. Antarct. Exped., **7**, 1-142.

EKMAN, S. (1953): Zoogeography of the Sea. London, Sidgwick and Jackson, 1-417.

FAO (1985): Southern Ocean, Vol. 1. FAO Species Identification Sheets for Fishery Purposes, ed. by W. FISHER. Rome, FAO, 1-232.

FUJIWARA, K. (1971): Sounding and submarine topography of the glaciated continental shelf in Lützow-Holm Bay, East Antarctica. Nankyoku Shiryô (Antarct. Rec.), **41**, 81-83 (in Japanese

with English abstract).

FUKUCHI, M., HATTORI, H., SASAKI, H. and HOSHIAI, T. (1988): A phytoplankton bloom and associated processes observed with a long-term moored system in Antarctic waters. Mar. Ecol. Prog. Ser., **45**, 279–288.

GAILLARD, J.M. (1954): Missions du Bâtiment Polaire "Commandant Charcot". Récoltés faites en Terre Adélie (1950) par M. Paul Tchernia III, Mollusques. Bull. Mus. Hist. Nat., **12**, 678–674.

GRUZOV, Ye.N., PROPP, M.V. and PUSHKIN, A.F. (1968): Biological association of coastal areas of the Davis Sea (based on the observations divers). Sov. Antarct. Exped. Inf. Bull., **6**, 523–553.

GUIDA, P.T and GOTO, Y. (1992): Volutes. Mostra Mondiale Malacologia, Ancona, 1–348.

HABE, T. (1951): Scissurellidae in Japan. Illust. Cat. Jap. Shells, **11**, 65–70.

HABE, T. and KOSUGE, S. (1964): A list of the Indo-Pacific molluscs, concerning to the Japanese molluscan fauna, Superfamily Pleurotomarioidea. Natl. Sci. Mus. Tokyo, 1–8.

HAIN, S. (1990): Die beschalten benthischen Mollusken (Gastropoda und Bivalvia) des Weddellmeeres, Antarktis (The benthic seashells (Gastropoda and Bivalvia) of the Weddell Sea, Antarctica). Ber. Polarforsch., **70**, 1–180.

HEDGPETH, J.W. (1969): Introduction to Antarctic zoogeography. Distribution of Selected Groups of Marine Invertebrates in Waters South of 35°S Latitudes, ed. by J.W. HEDGPETH. New York, Am. Geogr. Soc., 1–9 (Antarctic Map Folio Series, Folio 11).

HEDLEY, C. (1911): Mollusca. Rep. Sci. Invest. Br. Antarct. Exped., 1907–9, **2** Biology, (1), 1–8.

HEDLEY, C. (1916a): Mollusca. Sci. Rep. Australas. Antarct. Exped., 1911–1914, Ser. C, Zool. Bot., **4**(1), 1–80, 9 pls.

HEDLEY, C. (1916b): Report on Mollusca from elevated marine beds "Raised Beaches" of McMurdo Sound. Rep. Sci. Invest. Br. Antarct. Exped., 1907–9, Geology **2**, 85–88.

HERBERT, D.G. (1986): A revision of the southern African Scissurellidae (Mollusca: Gastropoda: Prosobranchia). Ann. Natal. Mus., **27**, 601–632.

HICKMAN, C.S. (1981): Evolution and function of asymmetry in the archaeogastropod radula. Veliger, **23**, 189–194.

HICKMAN, C.S. and MCLEAN, J.H. (1990): Systematic revision and supergeneric classification of Trochacean gastropods. Los Angeles County Mus. Natl Hist., Sci. Ser., **35**, 1–165.

HORIKOSHI, M. and HOSHIAI, T. (1977): Nankyokukai no teisei dôbutsu no bunrui seitaigaku-teki kenkyu (Systematic and ecological studies on Antarctic benthos). Showa 52-nendo Kyodo Kenkyu Hôkokusho (Progress Report of Joint Research for 1977), Tokyo, Natl Inst. Polar Res., 46–48.

HORIKOSHI, M. and HOSHIAI, T. (1978): Nankyokukai no teisei dôbutsu no bunrui seitaigaku-teki kenkyu (Systematic and ecological studies on Antarctic benthos). Showa 53-nendo Kyodo Kenkyu Hôkokusho (Progress Report of Joint Research for 1978), Tokyo, Natl Inst. Polar Res., 79–84.

HORIKOSHI, M., HOSHIAI, T. and NAITO, Y. (1979): Nankyokukai no teisei dôbutsu no bunrui seitaigaku-teki kenkyu (Systematic and ecological studies on Antarctic benthos). Showa 54-nendo Kyodo Kenkyu Hôkokusho (Progress Report of Joint Research for 1979), Tokyo, Natl Inst. Polar Res., 20–26.

HOSHIAI, T. (1978): Benthic animals collected with a trap at Syowa Station, Antarctica. Bentosu Kenren Shi, **15/16**, 1–9 (in Japanese).

IWANAMI, K. and TOHJU, H. (1987): Oceanographic data of the 26th Japanese Antarctic Research Expedition from November 1984 to April 1985. JARE Data Rep., **126** (Oceanography 7), 1–59.

IWANAGA, Y. and TOHJU, H. (1987): Oceanographic data of the 27th Japanese Antarctic Research Expedition from November 1985 to April 1986. JARE Data Rep., **127** (Oceanography 8), 1–56.

KEEN, A.M. (1960): Scissurellidae. Treatise on Invertebrate Paleontology, Part 1, Mollusca 1, ed. by R. C. MOORE. New York, Geol. Soc. Am., 1–221.

KNOX, G.A. (1960): Littoral ecology and biogeography of the southern oceans. Proc. R. Soc. London, B, **152**, 577–624.

KUSSAKIN, O.G. (1967): Fauna of Isopoda and Tanaidacea in the coastal zones of the Antarctic and Subantarctic waters. Biological zones of the Antarctic and Subantarctic waters. Biological

Reports of the Soviet Antarctic Expeditions (1955-1958). Akidemiya nauk SSSR Zoologischeskii Institut, Issledovaniya a Fauny morei, 220-389.

LAMY, E. (1905): Gastéropodes prosobranches recueillis par l'Expédition Antarctique Française du Dr Charcot. Bull. Mus. Hist. Nat., **11**, 475-482.

LAMY, E. (1906): Gastéropodes Prosobranches et Pelecypodes. Exped. Antarct. Fr. (1903-1905), 1-20.

LAMY, E. (1910): Mission dans l'Antarctique dirigé par M. le Dr Charcot (1908-1910). Collections recueillies par M. le Dr J. Liouville. Gastéropodes Prosobranches et Scaphopodes. Bull. Mus. Hist. Nat., **16**, 318-324.

LAMY, E. (1911): Gastéropodes Prosobranches, Scaphopodes et Pélécypodes. Deux. Exped. Antarct. Fr. 1908-1910, 1-32.

LAMY, E. (1915): Mollusques recueillis aux îles Kerguelen par M. Loranchet (Mission Rallier du Baty, 1913-1914). Bull. Mus. Hist. Nat., **21**, 68-76.

*MARTENS, E. (1878): Einige Conchylien aus den kalteren Meeresgegenden der südlichen Eidhalfte. Sitzungsbericht der Gesellschaft naturforschender Freunde zu Berlin 1878, 20-26.

MARTENS, E. (1904): Die beschalten Gastropoden der deutschen Tiefsee-Expedition 1898-1899. A. Systematisch-geographischer Teil. Wiss. Ergeb. Dtsch. Tiefsee-Exped., **7**, 1-146.

MCLEAN, J.H. (1967): West American Scissurellidae. Veliger, **9**, 404-410.

MCLEAN, J.H. (1984): Systematics of *Fissurella* in the Peruvian and Magellanic Provinces (Gastropoda: Prosobranchia). Nat. Hist. Mus. Los Angeles Cty. Contrib. Sci., **354**, 1-70.

MCLEAN, J.H. (1989): New slit-limpets (Scissurellacea and Fissurellacea) from hydrothermal vents. Part 1. Systematic descriptions and comparisons based on shell and radular characters. Contrib. Sci., **407**, 1-29.

MELVILL, J.C. and STANDEN, R. (1907): The marine Mollusca of the Scottish National Antarctic Expedition, Part 1. Trans. R. Soc. Edinburgh, **46**, 119-157.

MELVILL, J.C. and STANDEN, R. (1912): The marine Mollusca of the Scottish National Antarctic Expedition, Part 2. Trans. R. Soc. Edinburgh, **48**, 333-366.

MELVILL, J.C. and STANDEN, R. (1916): Description of a new rissoid shell from the Antarctic region. J. Conchol., **15**, 120-121.

MORIWAKI, K. (1975): Submarine topography near Syowa Station, Antarctica. Nankyoku Shiryô (Antarct. Rec.), **54**, 101-115 (in Japanese with English abstract).

MORIWAKI, K. (1979): Submarine topography of the central part of Lützow-Holm Bay and around Ongul Islands, Antarctica. Mem. Natl Inst. Polar Res., Spec. Issue, **14**, 194-209.

MORIWAKI, K. (1986): Tairikudana no chikei (Topography on the Antarctic Continental Shelf). Nankyoku no Kagaku, 5. Chigaku (Science in Antarctica, 5. Earth Sciences), ed. by Natl Inst. Polar Res. Tokyo, Kokon Shoin, 181-192.

MORIWAKI, K. and YOSHIDA, Y. (1983): Submarine topography of Lützow-Holm Bay, Antarctica. Mem. Natl Inst. Polar Res., Spec. Issue, **28**, 247-258.

MORIWAKI, K., MATSUOKA, N. and YOSHIDA, Y. (1987): A preliminary survey by a seismic profiling across the Günnerus Ridge off the Riiser-Larsen Peninsula, Antarctica. Proc. NIPR Symp. Antarct. Geosci., **1**, 41-47.

MURANO, M., INOUE, K. and MARUYAMA, T. (1982): Benthic fauna in the vicinity of Balleny Islands. Trans. Tokyo Univ. Fish., **5**, 197-201.

NAITO, Y. and IWAMI, T. (1982): Fish fauna in the northeastern part of Lützow-Holm Bay with some notes on the stomach contents. Mem. Natl Inst. Polar Res., Spec. Issue, **23**, 64-72.

NAKAJIMA, Y., WATANABE, K. and NAITO, Y. (1982): Diving observations of the marine benthos at Syowa Station, Antarctica. Mem. Natl Inst. Polar Res., Spec. Issue, **23**, 44-45.

NIINO, H. (1958): On the bottom deposits of the sea around Cape Cook, Prince Harald Coast, Antarctic region. Tokyo Suisan Daigaku Tokubetsu Kenkyû Hôkoku (J. Tokyo Univ. Fish., Spec. Ed.), **1**, 250-257 (in Japanese with English abstract).

NUMANAMI, H. and OKUTANI, T. (1990a): Two trichotropid gastropods collected by the icebreaker SHIRASE from Breid Bay, Antarctica, with proposal of a new subgenus. Proc. NIPR Symp. Polar Biol., **3**, 80-90.

NUMANAMI, H. and OKUTANI, T. (1990b): A new and two known species of the genus *Anatoma* collected by the icebreaker SHIRASE from Breid Bay and Günnerus Bank, Antarctica (Gastropoda: Scissurellidae). Venus, **49**, 93-106.

NUMANAMI, H. and OKUTANI, T. (1991a): A new species of the genus *Brookula* collected by the icebreaker SHIRASE from Breid Bay, Antarctica (Gastropoda: Cyclostrematidae). Venus, **50**, 37-42.

NUMANAMI, H. and OKUTANI, T. (1991b): Lamellariid gastropods collected by Japanese Antarctic Research Expeditions from near Syowa Station and Breid Bay, Antarctica. Proc. NIPR Symp. Polar Biol., **4**, 50-68.

NUMANAMI, H. and OKUTANI, T. (1992): Archaeogastropods collected from Breid Bay and Günnerus Bank, Antarctica by Japanese Antarctic Research Expeditions (extended abstract). Proc. NIPR Symp. Polar Biol., **5**, 171-173.

NUMANAMI, H., Kosaka, M., Naito, Y. and Hoshiai, T. (1984): Distribution of carnivorous benthic invertebrate in the northeastern part of Lützow-Holm Bay, Antarctica. Mem. Natl Inst. Polar Res., Spec. Issue, **32**, 105-111.

NUMANAMI, H., HAMADA, E., NAITO, Y. and TANIGUCHI, A. (1986): A biomass estimation of epifaunal megabenthos by stereophotography around Syowa Station, Antarctica. Mem. Natl Inst. Polar Res., Spec. Issue, **44**, 145-150.

OHSHIMA, K.I., KAWAMURA, T., TAKIZAWA, T., USHIO, S., ONO, N. and KAWAGUCHI, S. (1993): Seasonal variations in ocean structure and current in Ongul Strait, Antarctica, in 1991. Proc. NIPR Symp. Polar Meteorol. Glaciol., **7**, 51-59.

OKUTANI, T. (1986): A note on Antarctic benthic mollusks collected with a beam-trawl from Breid Bay by the 25th Japanese Research Antarctic Expedition. Mem. Natl Inst. Polar Res., Spec. Issue, **40**, 277-287.

OKUTANI, T., TAGAWA, M. and HORIKAWA, H. (1988): Gastropods from Continental Shelf and Slope around Japan. Tokyo, Japan Fisheries Resources Conservation Association, 1-203.

OLIVER, P.G. and PICKEN, G.B. (1984): Prosobranch gastropods from Signy Island, Antarctica: Buccinacea and Muricacea. Br. Antarct. Surv. Bull., **62**, 95-115.

PELSENEER, P. (1903): Mollusques (Amphineures, Gastéropodes et Lamellibranches). Résultats du voyage du S.Y. 'Belgica' en 1897-1899, Zoologie, 1-85.

PONDER, W.F. (1983): Rissoaform gastropods from the Antarctic and sub-Antarctic: The Eatoniellidae, Rissoidae, Barleeidae, Cingulopsidae, Orbitestellidae and Rissoellidae (Mollusca: Gastropoda) of Signy Island, South Orkney Islands, with a review of the Antarctic and sub-Antarctic (excluding southern South America and the New Zealand sub-Antarctic islands) species. Br. Antarct. Surv. Sci. Rep., **108**, 1-96.

PONDER, W.F. and YOO, E.K. (1978): A rivision of the Eatoniellidae of Australia (Mollusca, Gastropoda, Littorinacea). Rec. Aust. Mus., **31**, 606-659.

POWELL, A.W.B. (1951): Antarctic and Subantarctic Mollusca: Pelecypoda and Gastropoda. Discovery Rep., **26**, 47-196.

POWELL, A.W.B. (1957): Mollusca of Kerguelen and Maqcuarie Islands. Rep. B.A.N.Z. Antarct. Res. Exped., 1929-1931, Ser. B (Zool. Bot.), **6** (7), 109-149.

POWELL, A.W.B. (1958): Mollusca from the Victoria—Ross Quadrants of Antarctica. Rep. B.A.N.Z. Antarct. Res. Exped., 1929-1931, Ser. B (Zool. Bot.), **6**(9), 165-215.

POWELL, A.W.B. (1960): Antarctic and Subantarctic Mollusca. Rec. Auckland Inst. Mus., **5**, 117-193.

POWELL, A.W.B. (1965): Mollusca of Antarctic and Subantarctic seas: Biogeography and ecology in Antarctica. Monogr. Biol., **15**, 333-380.

POWELL, A.W.B. (1966): The molluscan families Speightiidae and Turridae. Bull. Auckland Inst. Mus., **5**, 1-184.

POWELL, A.W.B. (1979): New Zealand Mollusca: Marine, Land and Freshwater Shells. Auckland, Collins, 1-500.

PRESTON, H.B. (1913): Descriptions of fifteen new species and varieties of marine shells from the Falkland Islands. Ann. Mag. Nat. Hist., **11**, 218-223.

PROPP, M.V. (1970): The study of bottom fauna at Haswell Islands by scuba diving. Antarctic Ecology, Vol. 1, ed. by M.W. HOLDGATE. London, Academic Press, 239-241.

SARS, G.O. (1878): Bidrag tile kundskaben om Norges Arktiske Fauna. 1. Mollusca regionis Arcticae Norvegiae. Christiania, 1-400.

SHOJI, D. and SATO, T. (1959): On the bottom sediment dredged by the second Japanese Antarctic Exploration. Especially on the grain size analysis. Nankyoku Shiryô (Antarct. Rec.), **7**,

39-49 (in Japanese with English abstract).
SMITH, E.A. (1879): Mollusca. An account of the petrological, botanical and zoological collections made in Kerguelen's Island and Rodriguez during the Transit of "Venus" Expeditions in the years 1874-75. Philos. Trans. R. Soc. London, **168**, 167-192.
SMITH, E.A. (1902): Mollusca. Rep. Coll. Nat. Hist. 'Southern Cross', 201-213.
SMITH, E.A. (1907): Mollusca and Brachiopoda. Natl. Antarct. Exped. ('Discovery') 1901-04, Nat. Hist. **2**, 1-12.
SMITH, E.A. (1915): Mollusca, Pt. 1. Gastropoda, Prosobranchia, Scaphopoda and Pelecypoda. Br. Antarct. ('Terra Nova') Exped., 1910, Nat. Hist. Rep. Zool., **2**, 61-112.
STREBEL, H. (1908): Die Gastropoden (mit Ausnahme der nackten Opistobranchier). Wiss. Ergeb. Dtsch. Südpolar-Exped., 1901-1903, **6**, 1-111.
*STUDER, T. (1878): Die Fauna von Kerguelensland. Arch. Naturgesch., **45**, 104-141.
THIELE, J. (1904): Die beschalten Gastropoden der deutschen Tiefsee-Expedition 1898-1899. B. Anatomisch-systematische Untersuchungen einiger Gastropoden. Wiss. Ergeb. Dtsch. Tiefsee-Exped., **7**, 147-179.
THIELE, J. (1912): Die antarktischen Schnecken und Muscheln. Wiss. Ergeb. Dtsch. Südpolar-Exped. 1901-1903, **13**, 183-285.
THIELE, J. (1925): Gastropoda der deutschen Tiefsee-Expedition 2. Wiss. Ergeb. 'Valdivia', **17**, 36-382.
THIELE, J. (1929): Handbuch der Systematischen Weichtierkunde. Stuttgart, G. Fischer, 1-376.
TOMLIN, J.R. le B. (1948): The Mollusca of Macquarie Island. Rep. B.A.N.Z. Antarct. Res. Exped., 1929-1931, Ser. B (Zool. Bot.), **5**(5), 221-232.
TRYON, G.W. (1881): Manual of Conchology, Vol. 3.
TUCKER, M.J. and BURTON, H.R. (1987): A survey of the marine fauna in shallow coastal waters of the Vestfold Hills and Rauer Islands, Antarctica. ANARE Res. Notes, **55**, 1-24.
VAYSSIÈRE, A. (1906a): Mollusques nudibranches et marseniades. Expéd. Antarct. Fr., 1903-1905, 1-51.
VAYSSIÈRE, A. (1906b): Diagnoses generiques de mollusques Gastéropodes nouveaux rapportes par l'Expédition Antarctique du Dr Charcot. Bull. Mus. Nat. Hist., **12**, 147-149.
VAYSSIÈRE, A. (1917): Recherches zoologiques et anatomiques sur les mollusques amphineures et Gastéropodes. Deuxième Expéd. Antarct. Fr., 1908-1910, 1-50.
WARÉN, A. (1991): New and little known ≪Skeneimorph≫ gastropods from the Mediterranean Sea and the adjacent Atlantic Ocean. Boll. Malacologico, **27**(10-12), 149-248.
WARÉN, A., ARNAUD, P.M. and CANTERA, J.R. (1986): Descriptions of two new gastropods of the Trichotropidae from Kerguelen and Crozet Islands (South Indian Ocean). Veliger, **29**, 157-165.
WATSON, R.B. (1882): Mollusca of H.M.S. "Challenger" Expedition-Part XII. J. Linn. Soc. London, Zool., **16**, 324-343.
WATSON, R.B. (1886): Report on Scaphopoda and Gastropoda collected by "Challenger". Zool. Chall. Exped., **15**, 1-756.
WEAVER, C.S. and DU PONT, J.E. (1970): The living Volutes. Delaware Mus. Nat. Hist., Monogr. Ser. (**1**), 1-357
YARON, I. (1983): A review of the Scissurellidae (Mollusca: Gastropoda) of the Red Sea. Ann. Naturhist. Mus. Wien, **84B**, 263-279.
YOSHIDA, Y., MURAUCHI, S. and FUJIWARA, K. (1964): Submarine topography of the Kronprins Olav Kyst. Antarctic Geology, ed. by R.J. ADIE. Amsterdam, North-Holland, 710-714.
(Reference with asterisk denotes that not accessible to the present study.)

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