The shelled Magellanic Mollusca:

with special reference to biogeographic relations in the Southern Ocean

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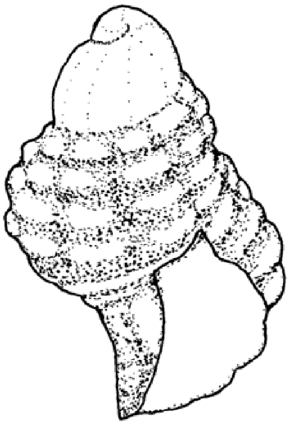

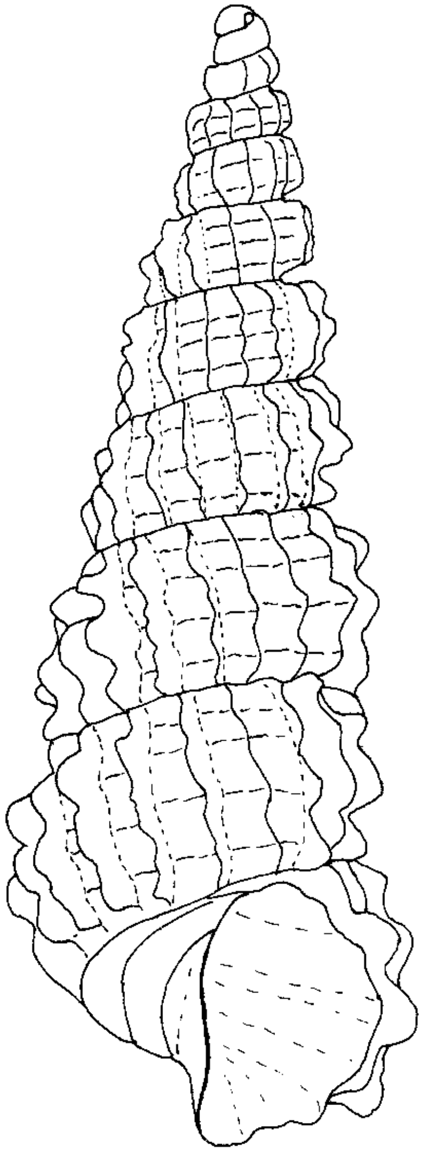

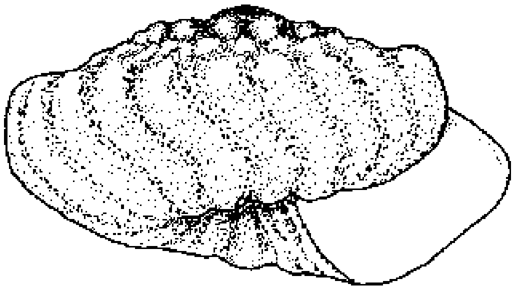

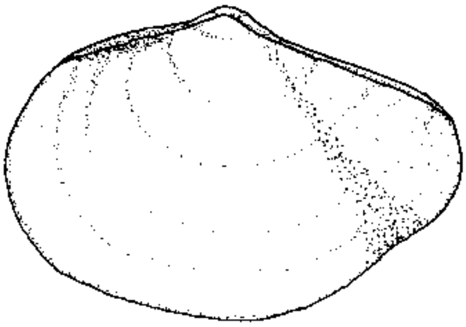

The shelled Magellanic Mollusca:
with special reference to biogeographic relations in the Southern Ocean

Dissertation

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Summary

The present study focuses on the composition and distribution of the shelled Magellanic malacofauna and on the biogeographic patterns of shelled molluscs in the Southern Ocean. The origin of the Trochidae in the Southern Ocean is investigated on the basis of the recent biogeographic distribution and of the geological history of Antarctica.

The Magellan region contains 210 shelled species of gastropods, 6 species of scaphopods, and 131 species of bivalves. During this study 42 species of gastropods and 10 species of bivalves were described, including the new descriptions of eight species and one genus and generic changes of two species: *Anatoma clathrata* (Strebel, 1908) and *Polinices patagonicus* (Philippi, 1845). Within Gastropoda *Iothia coppingeri magellanica* subsp. nov., *Margarella whiteana* sp. nov., *Orbitestella ponderi* sp. nov., and *Crenatosipho beaglensis* gen. n. sp. nov. are new to science and within Bivalvia *Philobrya crispa* sp. nov., *Crenella magellanica* sp. nov., *Cyclopecten multistriatus* sp. nov., and *Lyonsiella angelika* sp. nov.

Illustrated keys for the identification of the shelled benthic Magellanic molluscan fauna are presented. Figures of diagnostic characters and glossaries of technical terms used in malacology are provided to enable other workers to identify gastropods, scaphopods, and bivalves of the Magellan region.

The shelled Magellanic malacofauna is characterised by:

- a large number of very widely distributed families,
- a large number of bipolar genera,
- a latitudinally balanced systematic diversity,
- a large number of endemic species,
- a large number of small-sized species,
- a large number of species and genera shared with the deep sea, and
- a large number of species in families and genera that are diverse in Antarctica.

From a geographical point of view, Magellanic gastropods share most species with adjacent regions on the Patagonian shelf, while the species composition of the bivalve fauna seem to be more related to the sub- and high Antarctic fauna.

Biogeographic analysis of 1033 shelled molluscan species of the Southern Ocean show five subregions: the Magellan region (Magellanic mainland and Falkland Islands), South Georgia, the Kerguelen Islands, the West Antarctic region (Scotia Arc Islands, Antarctic Peninsula, eastern Weddell Sea), and the East Antarctic region (from Breid Bay/ Gunnerus Bank to the Ross Sea, Marion and Prince Edward Islands).

The horizontal distribution of the Southern Ocean trochids has been analysed on the basis of the world-wide distribution of these genera and their phylogenetic relationships, in order to reveal informations about the possible geographic origin and dispersal of these taxa.

The phylogenetic-biogeographic analysis revealed that the origin of the Antarctic trochids can only be elucidated by the investigation of all taxa of the widely and sometimes world-widely distributed genera. Futures studies should also cover behavioural, enviromental characters, ancient and recent distribution patterns besides morphological characters.

Zusammenfassung

Das Ziel der vorliegende Arbeit ist, die Zusammensetzung der beschalten Weichtierfauna der Magellanregion, ihre Verbreitung und die biogeographischen Verbreitungsmuster der beschalten Mollusken des Südlichen Ozeans zu beschreiben. Die Herkunft der Kreiselschnecken (Trochidae) im Südozean soll vor dem Hintergrund der heutigen biogeographischen Verbreitung und historischen Geologie der Antarktis untersucht werden.

In der Magellanregion kommen 210 beschalte Schnecken-, 6 Kahnfüßer- und 131 Muschelarten vor. Im Rahmen dieser Arbeit wurden 42 Schnecken- und 10 Muschelarten beschrieben, darunter sind neun Beschreibungen neuer Arten, eine Beschreibung einer neuen Gattung, sowie die Zuordnung zweier Arten, *Anatoma clathrata* (Strebel, 1908) und *Polinices patagonicus* (Philippi, 1845), in andere Gattungen. Bei den neubeschriebenen Schnecken handelt es sich um *Iothia coppingeri magellanica* subsp. n., *Margarella whiteana* sp. n., *Orbitestella ponderi* sp. n. und *Crenatosipho beaglensis* gen. n. sp. n., bei den Muscheln um *Philobrya crispa* sp. n., *Crenella magellanica* sp. n., *Cyclopecten multistriatus* sp. n. und *Lyonsiella angelika* sp. n.
Illustrierte Bestimmungsschlüssel wurden erstellt und ermöglichen die Bestimmung der beschalten benthischen Weichtierfauna der Magellanregion. Abbildungen der diagnostischen Merkmale und ein Glossar der malakologischen Fachausdrücke ermöglichen es jedem, die Schnecken, Scaphopoden (Kahnfüßer) und Muscheln zu bestimmen.

Die beschalte Molluskenfauna ist charakterisiert durch:
- eine hohe Anzahl weltweit verbreiteter Familien,
- eine hohe Anzahl bipolarer Gattungen,
- eine latitudinal ausgewogene systematische Diversität,
- eine große Anzahl endemischer Arten,
- eine große Anzahl kleinwüchsiger Arten,
- eine hohe Anzahl mit der Tiefsee gemeinsamer Arten und Gattungen und
- hohe Artenzahlen in Gattungen und Familien, die in der Antarktis divers sind.

Aus biogeographischer Sicht teilen die magellanischen Schnecken die meisten gemeinsamen Arten mit den benachbarten Regionen auf dem Patagonischen Schelf. Die Artenzusammensetzung der Muschelfauna hingegen weist größere Beziehungen zu der sub- und hochantarktischen Fauna auf.

Die biogeographische Analyse der 1033 beschalten Weichtierarten des Südozeans zeigt fünf Unterregionen: die Magellanregion (Magellanischer Festlandsockel und die Falklandinseln), Süd Georgien, die Kerguelen, die westantarktische Region (Inseln des Scotia Bogens, Antarktische Halbinsel, östliches Weddellmeer) und die ost-antarktische Region (von Breid Bay/ Gunnerus Bank bis zum Ross Meer, Marion und Prinz Edward Inseln).

Die horizontale Verbreitung der Trochiden wurde mit der weltweiten Verbreitung der Gattungen verglichen, um, in Verbindung mit der phylogenetischen Stellung dieser Taxa, Hinweise auf ihren möglichen Ursprung und die Richtung ihrer Verbreitung zu erhalten.

Die Ergebnisse der phylogenetisch-biogeographischen Analyse zeigen, daß der Ursprung der Antarktischen Trochiden nur unter Berücksichtigung aller Taxa der zum Teil weltweit verbreiteten Gattungen erfolgen kann. In die Analyse sollten neben morphologischen Merkmalen auch Merkmale des Verhaltens, der Umweltbedingungen, der Paläobiogeographie und der rezenten Verbreitung berücksichtigt werden.

"If we turn from the land to the Sea, we shall find the latter as abundantly stocked with living creatures as the former is poorly so....
... On the leaves (of kelp), also, various patelliform shells, Trochi, uncovered molluscs, and some bivalves are attached."

Charles Darwin *The Voyage of the Beagle*

1. Introduction

The variety of seashells in the Strait of Magellan is mentioned in even the oldest reports of the first explorers (Darwin 1845). Throughout the nineteenth and in the early twentieth century numerous surveys and expeditions took place in the Magellan region (see chapter 3.1.). During these expeditions marine fauna, including molluscs, were collected and described. Examples of these studies include King & Broderip (1831), Smith (1881, 1885), Dall (1889, 1908), and Strebel (1904-07, 1908). Most of the material was collected by hand on the beach and in the tidal zone, or by trawl gears with large mesh-sized nets. Due to this fact small sized and deep water molluscan species represented by only a few specimens per species or missing in those species lists completely. Even in more recent investigations (Marcus 1959, Soot-Ryen 1959, Dell 1964) sampling in deeper waters was neglected.
Recent investigations, such as the Chilean-Italian "Straits of Magellan Project" and the Chilean-German-Italian "Joint Magellan "Victor Hensen" Campaign", used grabs and trawled gears with 300-500 µm and 10 mm mesh-size (Brambati 1992, Arntz & Gorny 1996, Linse 1997). These collections include comprehensive molluscan material from the sublittoral to the continental slope. Di Geronimo et al. (1991, 1992) focussed on the molluscan thantocoenoses of the Strait of Magellan, Linse (1997) worked on molluscs caught by an epibenthic sledge in the Beagle Channel, and Schrödl (1996,1999) focussed on Magellanic nudibranchs.

Comprehensive live collected material made it possible to study radula, operculum and soft part characters in addition to shell features. This study revealed that the generic position for some species had to be changed. Monophyletic taxa are needed for biogeographic and phylogenetic studies. For behavioural and morphological informations for further, e.g. ecological, studies the correct systematic identification of species is crucial (Brandt 1991). Recent taxonomic revisions (e.g. McLean 1989, Ponder & Worsfold 1994), systematic and biogeographic studies (e.g. Dell 1990, Linse 1997, Pastorino 1998, Pastorino & Penchaszadeh 1999) have increased our knowledge of the shelled Magellanic molluscs and caused changes to previously published species checklists (e.g. Carcelles & Williamson 1951). Due to this fact and an extended knowledge of the species' distribution ranges the biogeographic relations of shelled Magellanic molluscs need to reinvestigated. The last zoogeographic studies on Chilean molluscs were undertaken by Soot-Ryen (1959) and Brattström & Johanssen (1983). Special reference will be made to biogeographic relations in the Southern Ocean. As well as phylogenetic analysis of taxonomically well-described species knowledge of their geographic distributions is important for studies investigating the origin of the marine Antarctic fauna. Sieg (1988) and Brandt (1991) carried out phylogenetic studies on the origin of Southern Ocean tanaidaceans and selected isopod taxa and proposed hypothetical migration routes. Lecointre et al. (1997) published the results of their molecular studies of the origin of the Antarctic fish fauna. Biogeographic studies of various different taxa, e.g. sponges, isopods, and echinoderms were undertaken by Sarà (1992), Winkler (1994), and O'Hara (1998), including hypothesis of their origin. George (1999) limited his studies on harpacticoid copepods to six selected families and compared the Magellan region with selected Antarctic areas (King George Island, Eastern Weddell Sea) due to the large numbers of new and undescribed species.

The major aim of the present study is to describe unknown and less well-known species, to evaluate the number of shelled molluscan species in the Magellan region, and to investigate their biogeographic relations to adjacent regions. This study cannot present a complete explanation for the origin of shelled Mollusca in the Southern Ocean. Patterns of origin, settlement, and evolution of the Magellanic and Antarctic molluscs have to be investigated on genus or even species level.

Selected taxa of Magellanic and Antarctic Trochidae are used in this study to elucidate their origin in the Southern Ocean.

2. Material and Methods

2.1. Expeditions with RVs „Victor Hensen“, „Vidal Gomaz“, „Polarstern“

The molluscan material on which this study is based were collected on expeditions to the Magellan region, mainly in the Strait of Magellan, the Beagle Channel and the Campo the Hjelo Sur, and to the Weddell Sea on cruises of

- RV “Victor Hensen” „Joint Magellan“ ’94 (collectors: Brandt, Rauschert)
- RV “Vidal Gomaz” ‘95 (collectors: Rauschert, Mutschke)
- RV ”Vidal Gomaz” ‘96 (collector: Rauschert)
- RV “Polarstern” ANT XIII/4 ’96 (collectors: Linse, Rauschert)
- RV “Polarstern” ANT XV/3 (collector: Linse).

While the latter expedition lead to the Antarctic, the other took part in the Magellan region.

2.1.1. Station lists

The station lists are based on lists in the cruise reports of RV “Victor Hensen” “Joint Magellan” ’94 (Arntz & Gorny 1996), RV “Polarstern” ANT XIII/4 (Fahrbach & Gerdes 1997), and station lists from the RV “Vidal Gomaz” cruises given by E. Mutschke.

The abbreviations for the different gears, used in the following tables, are: AGT – Agassiz trawl, D – small dredge, EBS – epibenthic sledge, MUC - Multicorer

Tab. 2-1. List of stations on board of RV “Victor Hensen” 1994

Station	Date	Gear	Area	Position S (lat)	W (long)	Depth (m)
01-806	17.10.94	AGT	Estrecho, Laredo	52°58,2	70°42,3	123
01-813	18.10.94	D	Estrecho, Laredo	52°57,5	70°41,0	90
02-822	19.10.94	D	Estrecho,Gente Grande	53°02,5	70°17,1	8
06-843	23.10.94	D	Estrecho, P.Ancho St. 19	53°09,2	70°39,2	127
11-865	25.10.94	AGT	Estrecho, Bahia Voces	53°41,3	70°53,6	478
11-868	25.10.94	D	Estrecho, Bahia Voces	53°42,3	70°54,4	470
11-874	25.10.94	D	Estrecho, Bahia Voces	53°43,6	70°56,1	335
11-878	25.10.94	D	Estrecho, Bahia Voces	53°41,7	70°56,4	260
11-884	26.10.94	D	Estrecho, Bahia Voces	53°42,6	70°57,5	51
11-887	26.10.94	D	Estrecho, Bahia Voces	53°42,2	70°57,2	100
02-920	28.10.94	AGT	Estrecho,Gente Grande	52°56,8	70°18,9	19
01-929	28.10.94	MUC	Estrecho, Laredo	52°57,9	70°25,7	45
01-930	28.10.94	D	Estrecho, Laredo	52°57,5	70°25,8	45
01-958	31.10.94	D	Estrecho, Laredo	52°58,0	70°41,1	111
01-963	31.10.94	D	Estrecho, Laredo	52°57,9	70°43,5	38
01-966	31.10.94	D	Estrecho, Laredo	52°57,9	70°46,9	13

continue Tab. 2-1.

Station	Date	Gear	Area	Position S (lat)	W (long)	Depth (m)
08-972	01.11.94	D	Estrecho, P.Ancho St. 16	53°28,8	70°21,9	92
09-979	01.11.94	D	Estrecho, P.Ancho St. 15	53°32,9	70°39,2	462
11-980	01.11.94	D	Estrecho, Bahia Voces	53°42,7	70°50,1	522
43-1145	08.11.94	D	I. Picton	55°08,5	66°54,9	110
45-1152	08.11.94	D	Bahia Oglander	55°09,1	67°01,7	15
40-1156	10.11.94	D	Rada Picton	55°05,3	66°45,4	27
45-1160	10.11.94	D	Bahia Oglander	55°07,8	67°01,8	33
46-1164	11.11.94	D	Paso Goree	55°18,8	67°05,0	24
42-1176	12.11.94	D	Pta Rico	55°07,3	66°53,0	25
42-1178	12.11.94	EBS	Pta Rico	55°07,30	66°52,78	25
43-1183	12.11.94	D	I. Picton	55°06,5	66°55,5	109
43-1184	12.11.94	EBS	I. Picton	55°06,84	66°55,54	110
43-1192	13.11.94	D	I. Picton	55°06,7	67°01,6	40
43-1194	13.11.94	EBS	I. Picton	55°08,48	66°57,81	118
43-1197	13.11.94	EBS	I. Picton	55°07,92	66°58,28	117
48-1200	14.11.94	EBS	I. Wollaston	55°38,52	67°12,86	40
48-1204	14.11.94	D	I. Wollaston	55°38,4	67°12,4	40
49-1206	14.11.94	EBS	off Islas Barnevelt	55°48,13	66°58,45	66
49-1210	14.11.94	D	off Islas Barnevelt	55°48,0	66°58,6	66
41-1213	15.11.94	EBS	SE I. Picton	55°06,89	66°39,95	63
41-1216	15.11.94	D	SE I. Picton	55°07,2	66°40,2	67
41-1221	15.11.94	D	SE I. Picton	55°07,6	66°44,6	33
39-1232	18.11.94	D	I. Gardiner	55°00,7	66°54,8	13
39-1236	18.11.94	D	I. Gardiner	55°00,5	66°53,3	100
39-1237	18.11.94	EBS	I. Gardiner	55°00,51	66°53,14	103
37-1246	19.11.94	EBS	C. Beagle	54°58,00	68°49,31	253
37-1247	19.11.94	EBS	C. Beagle	54°59,43	69°04,64	100
37-1248	19.11.94	EBS	C. Beagle	54°58,80	69°01,75	217
37-1253	19.11.94	EBS	C. Beagle	54°55,12	69°19,89	265
33-1257	19.11.94	EBS	C. Beagle, Romanche	54°53,43	69°30,94	350
33-1261	20.11.94	EBS	C. Beagle, Romanche	54°53,64	69°58,98	120
31-1263	20.11.94	EBS	C. Beagle, I. Timbal Chico	54°54,04	70°12,76	665
29-1270	21.11.94	EBS	C. Ballenero	54°55,17	70°45,15	135
28-1279	21.11.94	EBS	C. Ballenero, off Pta Baja	54°46,84	71°08,48	580
27-1287	22.11.94	D	C. Brecknock (E)	54°45,5	71°44,4	33
25-1291	22.11.94	D	C. Brecknock (W)	54°31,4	72°05,9	484
23-1195	22.11.94	D	C. Cockburn	54°20,8	71°29,4	371
21-1301	23.11.94	D	C. Cockburn (E), I. Jane	54°21,9	71°00,8	360
19-1307	23.11.94	EBS	C. Magdalena	54°17,37	70°51,81	271

Tab. 2-2. List of stations on board RV “Vidal Gomaz” 1995

Station	Date	Gear	Area	Position S (lat)	W (long)	Depth (m)
prueba	19.08.95	AGT	off Isla Tangbac	45°03,7	73°36,7	240
7	21.08.95	AGT	Canal Baker	47°59,6	73°49,2	1070
8	22.08.95	AGT	Canal Baker	48°00,3	73°36,7	382
5	22.08.95	AGT	Canal Messier	47°58,6	74°13,2	723
11	22.08.95	AGT	Canal Messier	48°07,6	74°36,9	661
13	23.08.95	AGT	Canal Messier	48°42,3	74°24,3	395
14	23.08.95	AGT	Canal Messier	48°53,9	74°24,2	385
15	23.08.95	AGT	Paso del Indio	49°02,4	74°26,1	166
20	24.08.95	AGT	Seno Eyre, Gl. Pio XI	49°20,1	74°04,7	282
19	24.08.95	AGT	Seno Eyre	49°24,5	74°05,9	349
24	24.08.95	AGT	Estero Falcon	49°37,4	73°51,0	392
22	24.08.95	AGT	Estero Falcon, Agueda	49°32,1	73°59,1	122
27	26.08.95	AGT	Seno Penguin	49°59,6	74°03,7	298
25	26.08.95	AGT	Seno Penguin	49°53,3	74°20,3	232
32	27.08.95	AGT	Seno Europa	50°13,5	74°03,1	66
33	28.08.95	AGT	Canal Oeste	50°29,6	75°02,5	75
34	29.08.95	AGT	C. Inocentes	50°34,1	74°45,5	45
39	29.08.95	AGT	Bahia Chubretonic	50°30,3	73°44,3	110
40	29.08.95	AGT	Estero Amalia (Interior)	50°52,3	73°50,8	148
35	29.08.95	AGT	Paso la Piedra	50°51,7	74°05,9	117

Tab. 2-3. List of stations on board RV “Polarstern” ANT XIII/4

Station	Date	Gear	Area	Position S (lat)	W (long)	Depth (m)
40-106	14.05.96	D	off Cape Horn	55°46,8	65°52,7	2276
40-106	14.05.96	AGT	off Cape Horn	55°47,7	65°49,3	2505
40-109	16.05.96	AGT+D	off Cape Horn	55°44,0	66°14,5	430
40-109	16.05.96	EBS	off Cape Horn	55°44,4	66°15,0	382
40-110	16.05.96	EBS	off Cape Horn	55°26,5	66°15,0	104
40-111	17.05.96	EBS	off Cape Horn	55°28,8	66°03,4	1279
40-114	18.05.96	AGT+D	off Cape Horn	55°31,6	65°56,8	2165

Tab. 2-4. List of stations on board RV “Vidal Gomaz” 1996

Station	Date	Gear	Area	Position S (lat)	 W (long)	Depth (m)
12	18.10.96	AGT	Caleta Tortel	47°51,40	73°35,90	94
12	"	D	"	"	"	94
13	19.10.96	AGT	Isla Teresa	47°49,90	73°40,95	214
13	"	D	"	"	"	214
15	18.10.96	AGT	Estero Steffen	47°41,50	73°43,30	158
15	"	D	"	"	"	158
17	19.10.96	AGT	Canal Messier	48°03,00	74°41,00	1218
17	"	D	"	"	"	1394
20	20.10.96	AGT	Canal Messier	48°53,00	74°25,70	340
20	"	D	"	"	"	360
22	"	D	Paso del Indio	48°59,80	74°26,20	150
23	"	D	"	49°09,90	74°24,20	138
24	21.10.96	D	Canal Escape	49°22,30	74°25,10	190
31	23.10.96	D	Canal Wide	49°47,20	74°21,48	600
41	25.10.96	D	Canal Concepcion	50°20,90	74°49,30	380
42	"	D	"	50°35,70	75°04,50	250
46	26.10.96	D	Estrecho Nelson	51°41,40	75°13,40	90
49	"	D	Canal Smyth	51°50,15	74°07,84	630
52	27.10.96	D	S.Ult. Esperanza	51°48,01	72°31,30	60
56	30.10.96	D	Canal Kirke	52°05,66	73°07,52	156-70
61	31.10.96	D	Canal Smyth	52°45,10	73°48,50	400-417
64	"	D	"	52°13,37	73°38,25	230
67	01.11.96	D	Canal Sarmiento	51°39,25	73°59,50	190-230
70	"	D	"	50°54,60	74°15,10	250
84	04.11.96	D	Canal Picton	49°37,40	75°18,50	58-75
86	"	D	"	49°18,50	75°31,10	57
87	05.11.96	D	Canal Ladrillero	49°06,24	75°15,25	365
92	06.11.96	D	Golfo de Penas	47°31,19	75°37,41	57-36
95	07.11.96	D	Ba. San Quintin	46°48,85	74°26,95	20

2.1.2. Sampling gear

Agassiztrawl (AGT)

On the expeditions with RVs „Victor Hensen“ (Arntz & Gorny 1996) and „Vidal Gomaz“ in the Magellanic Channel systems as well as on the „Polarstern“ expeditions ANT XIII/4-2 (Fahrbach & Gerdes 1997) and ANT XV/3 (Arntz & Gutt 1999) in the Drake Passage, a 1 m wide and about 50 cm high AGT was used to sample mega- and macrobenthic fauna. The mesh size of the sampling net was 1 cm, and haul time differed between 15 and 30 minutes. Further informations about the AGT and use are published in Voss (1988).

Dredge (D)

A small dredge (Rauschert 1991) with an opening of 0,5 m width and 0,3 m height was used to collect small macrofauna. The sampling bag consisted of an inner net of X cm mesh-size and an outer net of 500 µm meshsize. The haul time differed between 10 and 30 minutes and at some stations the dredge was connected to the AGT.

Epibenthic sledge (EBS)

An epibenthic sledge (Rothlisberg & Pearcy 1977), modified after Brattegard & Fosså (1991) and extended by Brandt & Barthel (1995), was used to catch both the higher suprabenthic beside the epibenthic fauna. Brandt & Barthel (1995) described the use of the sledge as followed (shorted version): “The sledge carries two sampling boxes in the middle, both with an opening of 100 cm width and 33 cm height. While the epibenthic sampler extends from 27 to 60 cm above the seafloor the suprabenthic sampler extends from 1 to 1.33 m above the bottom. A plankton net is attached to each sampler, of 0.5 mm mesh size for the epinet and of 0.3-mm for the supranet. The cod end of each is enclosed by a 0.3 mm mesh net. When the sledge touches the seafloor, a shovel fixed to the box door of the epibenthic sampler opens both boxes. The doors are closed when the sledge leaves the bottom. The sledge was hauled over the ground for 10 min at a mean velocity of 1 knot.”

2.1.3. Sample handling on board

AGT samples:

A five l subsample was fixed in 4 % buffered formaldehyde and sorted in the lab later on. Further animals were taken out of the entire sample and fixed directly in 4 % formaldehyde solution.

Dredge samples:

1 - three l subsamples were fixed in 4 % buffered formaldehyde and later on transferred into 70 % ethanol.

EBS samples:

When the samples reached the deck of the vessel, they were washed trough a 250 µm screen. The complete samples were fixed in 4 % buffered formaldehyde and transferred into 70 % ethanol after approximately 48 hours.

2.2. Taxonomy and phylogeny

2.2.1. Determination of the molluscan fauna

For determination of the species original papers and species and location lists (e.g. Soot-Ryen 1959, Dell 1964, 1990, Nicol 1966, Castellanos 1988-1993) were used. The specimens, determinated and undeterminated, are deposited in the Zoological Museum, Hamburg.

2.2.2. Species documentation

For documentation the shells were photographed either by macrophotography or by SEM. Shells were covered by debris were cleaned in an ultrasound cleaner. Small shells and protoconchs were washed in EtOH and mounted wet on SEM stubs. Operculi were removed from the animals and also mounted on stubs.

2.2.3. Preparation of radula for SEM

Gastropod radulae and jaws were prepared for scanning electron microscope (SEM) observation either by soaking the whole animal (small animals) or only the radular sac (animals bigger than 8 mm) in saturated KOH-Solution at 40 ºC for 60-120 min, cleaning the radula and the jaw in distilled water, and mounting them wet in ETOH on stubs for SEM. The mounted radula was then coated with gold and examined.

2.2.4. Preparation of Trochidae

Live-collected specimens were relaxed in 100 ml seawater: 50 ml isotonic magnesium chloride solution for 2-3 hours by 1º C. Completely relaxed animals were fixed either in 4% buffered $CaCO_3$ formaldehyde or in 80% undenatured aqueous ethanol. For anatomical studies, animals were removed from their shell by cutting the columellar muscle and twisting the head-foot and visceral mass from the shell.

2.2.5. Phylogenetic analysis of Trochidae

A database was constructed of all known trochid species known from the Southern Ocean with data on depth range and geographic distribution, shell and radula morphology, and selected soft part characters. A morphological (shell and soft-parts) character matrix for 77 species of 20 genera is made up and comprises 70 characters. Some species, e.g. *Bathybemix drakei* Dell, 1990, *B. delicatula* Dell, 1990, *Otukaia eltanini* Dell, 1990, and *Tropidomarga biangulata* Powell, 1951, are described on one or two specimens, sometimes only on empty shells, and no more specimens are found so far. For these species, which are sometimes the only record of the genus in the Southern Ocean, radula and soft part characters could not be investigated. Powell (1951) published an ink-drawing of the radula of *Tropidomarga biangulata* but only new made SEM photos of the radula are used. For the phylogenetic analysis the data matrix was reduced to 19 species of 11 trochid genera and 38 characters. The investigated species are: *Antimargarita dulcis* (Hedley, 1916), *Calliostoma consimilis* (Smith, 1881), *C. irisans* Strebel, 1905, *C. nudisculum* (Martens, 1881), *C. venustulum* Strebel, 1908, *Calliotropis (Calliotropis) pelseneeri pelseneeri* Cernohorsky, 1977, *Falsimargarita gemma* (Smith, 1915), *Margarella antarctica* (Lamy, 1905), *M. violacea* (King & Broderip, 1831), *M. whiteana* sp. nov., *Margarites crebrilirulata* (Smith, 1907), *Margarites refulgens* (Smith, 1907), *Margarites biconica* Numanami, 1996, *Photinastoma taeniata* (Wood, 1825), *Photinula caerulescens* (King & Broderip, 1831), *Solariella* sp.1, *Solariella* sp. 2, *Submargarita notalis* (Strebel, 1908), *Venustrochus secundus* Powell, 1951. The outgroup comprises two turbinid species, *Homalopoma cunninghami* (Smith, 1881) and *Leptocollonia innocens* (Thiele, 1912) occurring in the Magellan Region and Antarctic.

The matrix for the analyses used exclusively morphological shell, radula, and soft part characters. The data matrix written in MacClade Version 3 (Maddison & Maddison 1992) has 13 taxa and 33 characters. Valid character-state symbols are 0 and 1, missing data are identified by ‘?’.

The phylogenetic analysis was performed with PAUP*3.1.1. for Macintosh (Swofford 1993). The characters were unordered. The heuristic search settings are: simple addition sequence, one tree held at each step during stepwise addition, Tree-bisection-reconnection branch swapping performed, MULPARS option in effect, initial MAXTREES setting = 100, trees are unrooted, multi-state taxa interpreted as polymorphism. The tree is described by using in PAUP DELTRAN character-state optimization.

2.3. Biogeography

2.3.1. Faunal relations of the Magellan region to Central America, South Africa, Australia, and Antarctica

The distribution of many Magellanic species extend northwards to Central America, to South Africa, and to Australia. In order to undertake a biogeographic study on the distribution a comprehensive species-distribution table was compiled for the Magellanic molluscs, comprising 210 species of shelled gastropods, 6 species of scaphopods, and 131 species of bivalves.

Only species shared between the Magellan region and the areas mentioned below were included: Adelie Land (AD), Antarctic Peninsula (PI), Auckland Island (AU), Bellingshausen Sea (BS), Bouvet Island (BI), Campbell Island (CA), Crozet Island (CI), Davis Sea (DS), Ecuador (EC), Enderby Land (EL), Falkland Islands, Heard Island (HI), Kerguelen Islands (KI), Macquarie Island (MA), Magellanic Mainland (MM), Magellan Region (MR), Marion and Prince Edward Islands (MI), Mary Byrd Land (MB), Oates Land (OL), Palmer Archipel (PA), Peru (PE), Weddell Sea (WS), northern Argentina (RA), northern Chile (RC), Ross Sea (RS), South Georgia (SG), South Orkney Islands (SO), South Sandwich Islands (SS), South Shetland Islands (SH).

The data for this table originated from collections by the author and from the published literature. Published data came from species lists (e.g. Carcelles & Williamson 1951, Powell 1960, Osorio & Bahamonde 1970, Linse 1999) and original papers (e.g. Dell 1990, Hain 1990, Castellanos et al. 1988-93, Branch et al. 1991, Bastida et al. 1992, Numanami 1996).

2.3.2. Faunal relations in the Southern Ocean

The distribution structure of the Mollusca of the Southern Ocean was investigated using cluster analysis.

Community analyses are often used to describe and compare the marine benthos of polar regions (e.g. Gutt 1988, Piepenburg 1988, Voß 1988, Winkler 1994, Stiller 1996, Hanssen 1997, George 1999). A community analysis comprises similarity and diversity analyses (George 1999). As a descriptive biometric method, similarity analysis can be used to compare faunal regions or species associations. A diversity analysis also characterises and compares faunal regions but uses quantitative data (numbers of species or specimens abundances per station). Winkler (1994) stated that the usefulness of these analyses for biogeographic study is hinted and cited Field et al. (1982:39): "Taking account of joint absences has the effect of saying 'estuarine and abyssal samples are similar because both lack outershelf species'."

A species-distribution table for molluscs of the well investigated areas of the Southern Ocean was constructed, comprising 706 species of shelled gastropods, 10 species of scaphopods, and 317 species of bivalves. It is assumed that the recorded species numbers for these regions are representative became of reasonably comprehensive sampling in these areas. The table came from the same sources (collections and literature) as the species-distribution table mentioned in 2.3.1.

The 14 geographic areas included in this database were Adelie Land, Antarctic Peninsula, Davis Sea, Enderby Land, Falkland Islands, Kerguelen Islands, Magellanic Mainland, Marion and Prince Edward Islands, Palmer Archipel, Weddell Sea, Ross Sea, South Georgia, South Orkney Islands, South Shetland Islands.

A hierarchical method was used in which the similarity criteria that separate the clusters are changed step by step. As the similarity criteria are changed, more and more objects are joined into clusters.

The requirement for the cluster analysis is the distance matrix, which is based on the species-region-matrix with 1033 falls (shelled Mollusca)/ 706 falls (shelled Gastropoda)/ 317 falls (Bivalvia) x 14 variables (regions). Here the distances are calculated with the **percentage of dissimilarity**:

$D = N \text{ of } x_i\, y_j / i$

The resulting matrix is then grouped by cluster analysis using UPGMA (unweighted pair-group method using arithmetic average). In this method the distance between two clusters is ascertained by the median distance between all the object pairs in the clusters.

The WPGMA (weighted pair-group method using arithmetic average) in which the distance between two clusters is ascertained by the median distances between all object pairs of different cluster and the cluster size (number of objects in the cluster) was also included in the calculation. The results were similar to the UPGMA analysis.

2.3.3. Computer programs

The analyses were carried out using STATISTICA 5.1 for Windows (StatSoft, Inc. 1996).

2.4. Abbreviations

Following abbreviations are used in the study, especially in the systematic report (4.2.):

(A, S)	number of animals (shell plus animal) and dead shells in the vial
ANT	cruise of RV “Polarstern”, followed by expedition and leg numbers: XIII/2, XIII/4-2, XIV/2
HUM	Natural History Museum (Humboldt Museum), Berlin
LACM	Los Angeles County Museum, Los Angeles
VG’95	cruise of RV “Vidal Gomaz” in 1995
VG’96	cruise of RV “Vidal Gomaz” in 1996
VH	cruise of RV “Victor Hensen” in 1994
SNM	Swedish Museum of Natural History, Stockholm
ZMH	Zoological Museum, Hamburg

3. Survey areas

3.1. Magellan Region – historic surveys

The first scientific surveys of the Strait of Magellan were undertaken in the early nineteenth century. During the following decades numerous expeditions focussing on biological sampling in the Magellan region were completed (compare Linse 1997, George 1999) were completed. These included the H.M.S. “Beagle” (1831-1835) (Darwin 1845), H.M.S. “Challenger” (Smith 1885), and “Albatross” expeditions (Dall 1889, 1908). Mabille & Rochebrune (1889) described molluscs collected during the French “Mission du Cap Horn”. Extensive gastropod material collected by German merchants was analysed by Strebel (1904-07). The Swedish “Lund” expedition 1948-49 (e.g. Marcus 1959, Soot-Ryen 1959, Brattström & Johannsen 1983) and the Scottish “Royal Society”-Expedition 1958-59 (Dell 1971) are amongst the few expeditions to investigate this area since the middle of the century.

In the last 15 years the focus of international science has returned to the Magellan region. Recent projects have included the Chilean-Italian “Strait of Magellan Project” 1988-1991 (Brambati 1992) and “Straits of Magellan Oceanographic Cruise” in 1991 (Faranda & Guglielmo 1991, 1993, 1994), and the “Joint Chilean-German-Italian Magellan “Victor Hensen” Campaign” in 1994 (Arntz et al. 1994a, Arntz & Gorny 1996). These studies investigated primarily the Strait of Magellan and Beagle Channel. Biological results were presented and discussed at the international workshop “IBMANT 97” (Arntz et al. 1999a)

3.1.1. Geology and Topography

The Magellan region belongs to the Subantarctic subregion according to Hedgpeth (1969, 1970) and Knox (1970). The Magellan region encloses the Magellanic mainland, Tierra del Fuego, Burdwood Bank and the Falkland Islands (Woodward 1856, Carcelles & Williamson 1951, Hedgepeth 1969, Castellanos 1988-93). The northern borders in this study, according to e.g. Dell (1971), Brattström & Johannsen (1983), Bastida et al. (1992), are about 41 °S, on the Pacific side at the peninsula Chiloe and on the Atlantic side at the Golfo de Nuevo (Fig. 3-1). In Guzmán (1992) the Magellan region includes the southern part of South America between 49°S and 56°30’S.

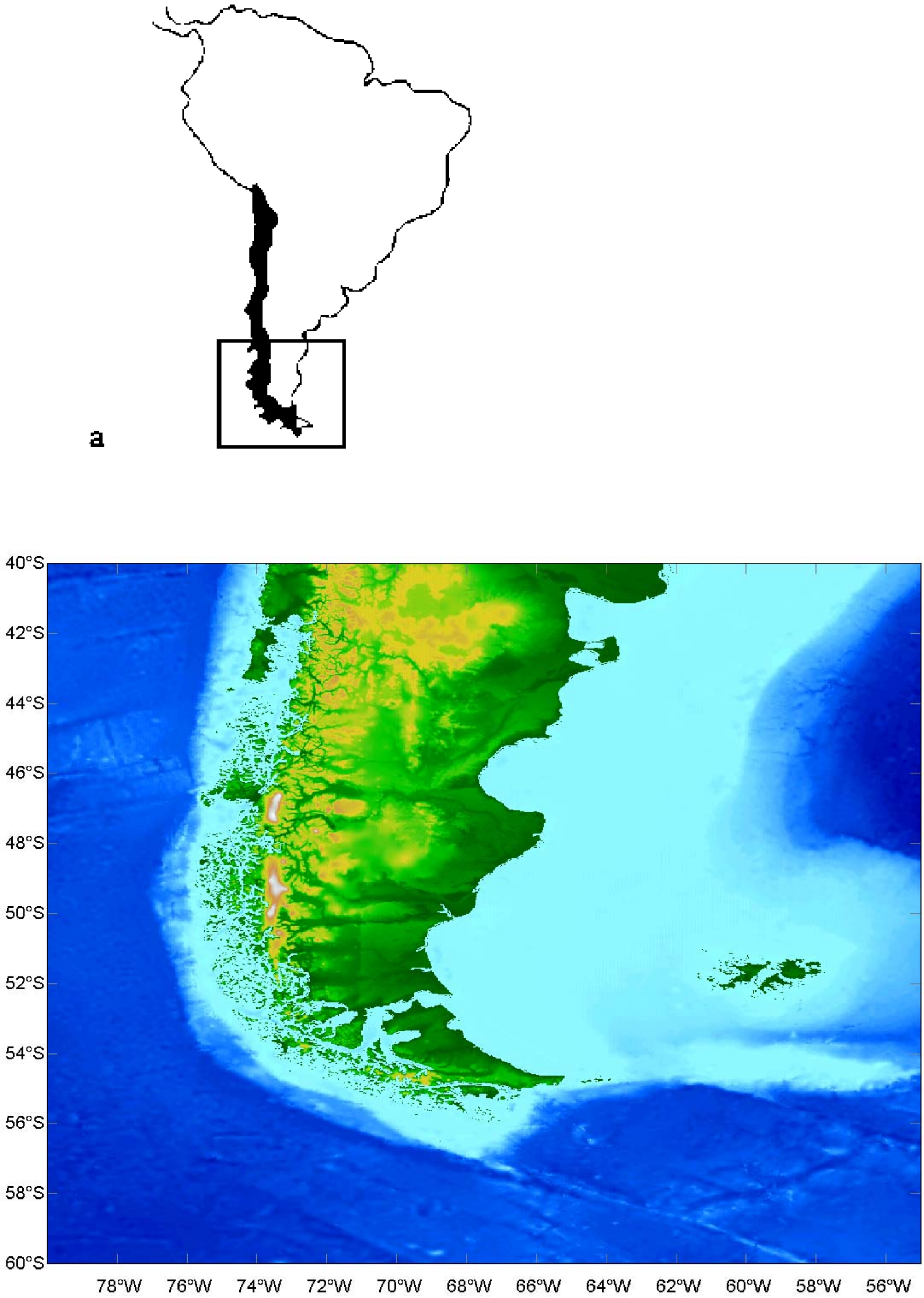


Fig. 3-1. General maps (a) of South America and (b) of the Magellan region.

The coastline of the Pacific and Atlantic sides of the Magellan regionare totally different. The Atlantic side is characterised by the Atlantic lowlands which are underlain by the stable Springhill platform and the Magallanes Basin. The coastline opens out into bays and the plate runs out into a broad shallow shelf (Winslow 1982).

The Strait of Magellan, a 585 km long waterway separating Tierra del Fuego from the Magellanic mainland, connects the South Atlantic to the South Pacific. The meeting and mixture of the Atlantic and Pacific water masses leads to an intensive exchange of salinity, temperature, sediments, flora, and fauna.

The Pacific coast is characterised by the southernmost Andes and the Pacific Archipelago with numerous islands, fjords, and channels (e.g. Beagle Channel) of volcanic origin. The shelf is narrow, extending into a deep trench where the South American and Antarctic plate meet (Winslow 1982).

Further topographic details are documented in Brambati et al. (1992) and George (1999).

3.1.2. Hydrography

The circulation of surface water in the Magellan region is strongly governed by the Circumpolar Current and forced by westerly winds (Fig. 3-2). Off southern Chile (80-90° W) a part of the Circumpolar current divides into two branches, the Peru Oceanic Current transporting Subantarctic waters northwards and the Cape Horn Current (**Ch**) flowing southwards towards the Chilean archipelago. The south-flowing branch flows along the archipelago and joins the Falkland Current (**Fa**) on the Atlantic side of Tierra del Fuego. Encountering the Falkland Islands and Burdwood Bank the current splits into two main branches and numerous cyclonic and anticyclonic eddies (Zyranov & Severov 1979). An anticyclonic ring current is formed around the Falkland Islands. North of the Falkland Islands the two branches unite and flow northwards. About 42 °S (mouth of Rio de La Plata) it meets the warm Brazil Current and submerges. Waters of the Cape Horn and the Falkland Current stream into the Strait of Magellan and meet there.

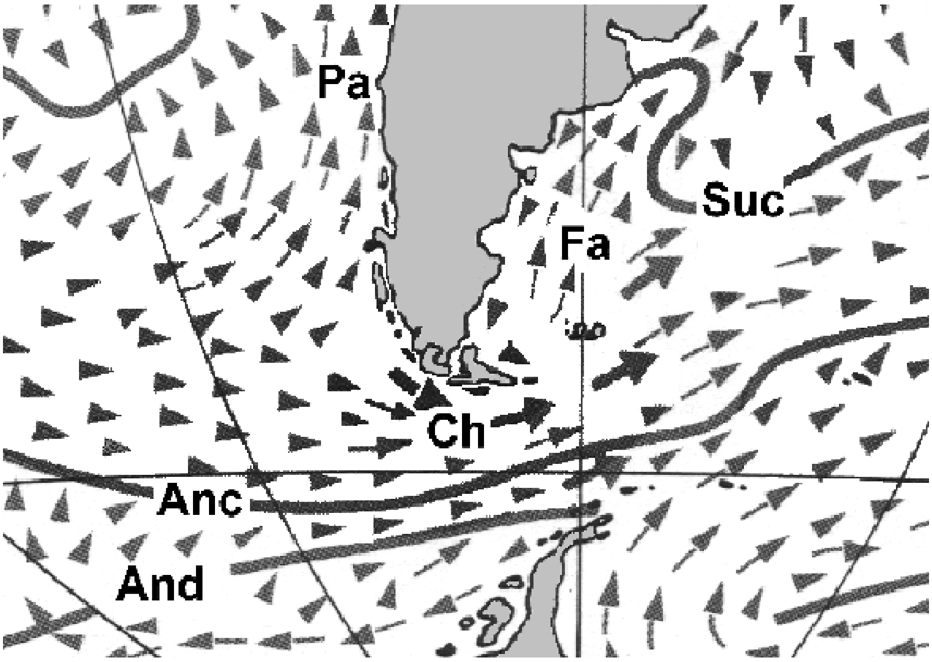


Fig. 3-2. Current systems around the Magellan region (modified after Dietrich et al. 1975). And – Antarctic Divergence, Anc – Antarctic Convergence, Ch – Cape Horn Current, Fa – Falkland Current, Pc – Peru Coastal Current, Suc – Subantarctic Convergence

In addition to the main water ocean currents the Magellanic coast is influenced by the tides. Along the open Atlantic and Pacific coast the mixed and mostly semidiurnal tides have a range of 1-2 m (Dietrich et al. 1975, Brattström & Johanssen 1983). The Atlantic mouth of the Strait of Magellan is characterised by a strong tidal regime with springtides of up to 9 m (Medeiros & Kjerfye 1988, Brambati et al. 1992) The tides decrease after the first narrow (Primera Angostura).

Salinity is a highly variable abiotic factor in the Magellan region because of glacial and fresh water runoff especially on the western coast. More or less stable salinities of about 33.4-35 ‰ are recorded (Brattström & Johanssen 1983) for the open sea. The nearshore water, in particular the surface layers, are strongly influenced by rainfall, the supply of water from mainland rivers, tides, strong and mostly westerly winds, and the season. In spring and summer glacial meltwater reduces the salinity. Brattström & Johanssen (1983) measured 7- 28 ‰ salinity in inner inlets in autumn. Klöser and Antezana (both 1996) found salinities of 27.0 – 32.0 ‰ for the surface layer and 32.0 – 33,5 ‰ the deeper waters (> 60 m) for the Beagle Channel in spring 1994.

Sea temperatures range from 3-6 °C in the south and up to 14 °C in the northern region (Brattström & Johanssen 1983).

3.1.3. Sedimentology

Comprehensive investigations of the sediments in the Magellan region have been carried out for the Strait of Magellan and Beagle Channel (Brambati et al. 1992a,b, Colizza 1992).

Data on the sediment structure for further areas such as the Campo de Hjelo Sur or the broad shelf on the Atlantic side are lacking. The Atlantic coast consists of quaternary fluvioglacial sediments. Sandy bottoms dominate the broad shelf off the eastern entrance of the Strait of Magellan (Brambati et al. 1992). Near the coast muddy sands occur while further offshore the bottoms are mainly sand and gravel sand.

The sediment structure of the Strait of Magellan is very heterogeneous (Brambati et al. 1992). In the shallow basin between the Atlantic mouth and the northernmost part of the Punta Arenas basin sands, gravely sands and gravel prevail. Similar bottom types are also found in the Pacific mouth and around Isla Carlos III. Muddy sands or mud dominate the Punta Arenas basin, the Bahia Inutil and most of the Pacific branch of the Strait.

The sediment structure in the Beagle Channel is more homogenous. In areas where Pacific waters flood into the channel system small areas with sands and muddy sands occur (Brambati et al. 1992). Muds and sandy muds, often with a high percentage of terrigenious input, dominate the inner channel and inlets (Colizza 1992, Linse 1997). George (1999) recorded high concentrations of broken shells and crustacean remains in sediments under the influence of glaciers.

3.2. Antarctica – historic surveys

The history of biological science in Antarctic waters started with benthic sampling from H.M.S. “Challenger” (Smith 1885) and continued during the first half of the twentieth century. These early studies focussed on taxonomy, e.g. Pelseneer (1903), Melvill & Standen (1907, 1912), Strebel (1908), and Thiele (1912). Later research focused on studies of behaviour, physiology, life history, and biological interactions *in situ* (Arntz et al.1994b). Further intense benthic investigations resulted in descriptive biogeographical studies and community distribution reports, e.g. Egorova (1982), Hain (1989), Dell (1990), and Numanami (1996). Recently international scientific activities in the Antarctic have been organised by SCAR, for example the EASIZ program (Arntz et al. in prep).

3.2.1 Geology and Topography

The Subantarctic region comprises the islands influenced by the Circumpolar Current: Bouvet Island, Marion and Prince Edward Islands, and Kerguelen Islands (Hedgepeth 1969, Dell 1972a). The Antarctic region includes the islands of the Scotia Arc (South Georgia, South Sandwich Islands, South Orkney Islands, South Shetland Islands) and the Antarctic continent which is often divided into the West Antarctic and East Antarctic Subregions (Nybelin 1947, Andriashev 1965).

200 Ma ago (early Jurassic) the Antarctic Peninsula, Thurston Island, and Mary Byrd Land were separated from Gondwana and now form the major land mass of West Antarctica (Lawver et al. 1992). Throughout geological time subduction and arc-related volcanism has continued along the Antarctic Peninsula and the Thurston Island region (Barker 1982, compare 3.3.). Today it consists of numerous islands and high mountains with deep valleys. The East Antarctic is formed by one plate, the former centre of Gondwana (compare 3.3.) and is almost completely covered by ice.

3.2.2. Hydrography

The Antarctic current system is dominated by the Circumpolar Current. This current is forced by strong westerly winds, and was formed after the opening of the Drake Passage (e.g. Barker & Burrell 1977, 1982). Its northern boundary is the Antarctic Convergence where the Antarctic surface water submerges and forms the Antarctic Intermediate Water (Hedgpeth 1969, Carmarck & Forster 1975). Close to the Antarctic continent the Antarctic Counter Current streams anticlockwise but is interrupted by the Ross Sea and Weddell Sea Gyres. Regional Antarctic oceanography has been described by Fahrbach et al. (1992, 1994) and Pruszak (1980).

Tides are less pronounced than in the Magellan Region. On the coasts around the Antarctic continent the tidal range is between 0.3-1 m (Dietrich et al. 1975).

The Antarctic Ocean water is characterised by extremely low temperatures (-2 - 1°C) and salinities of greater than 34 ‰. Characteristic water masses are the Antarctic Surface Water, the Antarctic Circumpolar Water (~0.25-2.0°C, S >34.5) and the Antarctic Bottom Water (-2 - -0.4°C, S 34.4-34.8) (Brown et al. 1993).

Along the Antarctic Peninsula and on the Scotia Arc Islands the temperatures can increase up to 2.5°C (Rauschert 1996) in near-shore habitats and tide pools.

3.3. Paleogeology and paleoclimatology of survey areas

3.3.1. Geology – the Gondwana Break-up

The reasons for the break-up of supercontinents are still unknown (Studinger 1998) and the break-up of Gondwana is the focus of several different research groups (e.g. Bott 1982, White & McKenzie 1989, Storey et al. 1992, Storey 1995, 1997).

The first rifting activities between eastern and western Gondwana, the Antarctica-Australia-India block and the South America-South Africa block, occurred in the early Jurassic (~ 208-178 Ma) (Lawver et al. 1992, Studinger 1998, Crame 1999). About 160-130 Ma (late Jurassic to early Cretaceous) the break-up was essentially between these two plates. Later (~ 150 Ma) Gondwana seems to have divided into four or more fragments (Lawver et al.

1992) and seafloor spreading started in the South Atlantic, between India and Antarctica, and off Australia (Shaw & Cande 1990, Veevers et al 1985).

Three West Antarctic microcontinental fragments, the Antarctic Peninsula, Thurston Island and Marie Byrd Island, comprised a large part of the Pacific margin. This margin, including the latter microcontinental fragments and southern South America, was influenced by subduction effects from the Permian to the late Cretaceous (Dalziel and Forsythe 1986, Lawver et al. 1992). About 120-110 Ma India had moved a substantial distance from Antarctica while west Africa and Northeast South America were still connected. The South Atlantic was slowly opening but deep water circulation between South Africa and South America was blocked by the Falkland Plateau so that it was a deep water basin without connection to the other oceans (Lawver et al. 1992). Any deepwater passage between the Antarctic Peninsula and southern South America was presumably impeded by the South Orkney block (Lawver et al. 1992). In the Cretaceous (~ 100-80 Ma) circulation into the South Atlantic was possible between the Falkland Plateau and the Agulhas Rise but the Drake Passage was still obstructed by the Antarctic Peninsula and South Orkney block (Lawver et al. 1992, Crame, 1999). Seafloor spreading between South America and South Africa and between Antarctica and Africa were followed by a slow clockwise rotation of Antarctica away from South America (Lawver et al. 1992). West and East Antarctica reached their present day polar positions (Grunow et al. 1987) and rifting between East Antarctica and Australia initiated the break-up of all land connections but the waters were still shallow (Stevens 1989, Crame 1999). Deep water circulation between Antarctica and Tasmania was blocked while the Indian Ocean was open to the Pacific and equatorial Tethys.

Throughout the Paleocene and the Eocene (70-40 Ma) the South Tasman Rise submerged and a deepwater separation brought about a deepwater circulation (Crame 1999). Veevers et al. (1991) and Lawver et al. (1992) discuss the later opening of the deepwater passage between Antarctica and Tasmania.

The Antarctic Peninsula started to move eastwards with respect to the southern tip of South America but the Drake Passage was still blocked (Lawver et al. 1992). The deep water opening of the Drake Passage started at ~ 30 Ma (Barker & Burrell 1977, LaBrecque & Cande 1987, Cunningham et al. 1995).

Diester-Haas & Zahn (1996) suggest a marine opening for ~ 36 Ma ago , based on productivity studies on planktonic foraminiferans.

According to Crame (1999) this opening was not a deepwater one but for surface or intermediate-depth waters. About 23.5-17 Ma intense seafloor spreading rapidly enlarged the gap between southern South America and West Antarctica (Barker & Burrell 1977). With the opening of the Drake Passage the circumpolar current developed, and the climatic isolation and glaciation of Antarctica started.

3.3.2. Climate change and its consequences

Paleoclimatic events of the southern South America–Antarctic Peninsula region, and in the Antarctic are of importance for the evolution of its marine fauna. Throughout the geological history of these regions temperatures have changed from warm climates to cold temperate or cold ones. The climate history is better known for the last 60 Ma but some Palaeozoic records exist (Savin 1975).

In the early Cambrian, Antarctica and South America were placed in an equatorial position and this low-latitude position resulted in tropical-subtropical seas (Crame 1994). At this time reefs were formed by archaeocyathans and cyanobacterian-like micro organisms (Rees et al. 1989). Webers (1972) reported an unusual Upper Cambrian fauna from the Ellsworth Mountains, West Antarctica. This assemblage includes 20 mollusc species (Webers 1982) which appear to be tropical.

In the Devonian (~385 Ma) shallow epicontinental seas in West Antarctica were colonised by different invertebrate taxa, e.g. brachiopods, bivalves, gastropods, bryozoans and tentaculitids (Doumani et al. 1965). Warm-water elements such as corals and conodonts were missing (Blodgett et al. 1990). Cold water may have been brought in by a subpolar gyre from the south polar region (i.e. central Argentina) to Antarctica (Crame 1994). In the late Carboniferous and early Permian (300-290 Ma) southern South America, South Africa, India, Antarctica, and Australasia were covered by vast ice-sheets (Crame 1994). During the later Permian fossil records of terrestrial floras, e.g. *Glossopteris*, indicate cool and cold-temperate environments.

Late Jurassic bivalve fossils include both genera that seem to be endemic to southern high latitudes and genera with cosmopolitan and bipolar distribution (Crame 1993). Throughout the late Jurrasic and early Cretaceous Antarctica was covered by cool-temperate, moist rainforest typically comprising podocarps, araucarians, ginkgos, and bryophytes (Dettmann 1989, Crame 1994). A strong latitudinal gradient between Antarctica-Australasia and southern South America–Falkland Plateau is noted by Crame (1994). Towards the end of the Cretaceous period climates appear to have been cool-temperate and highly seasonal (Pirrie & Marshall 1990, Crame 1994).

Detailed chronology of Cenozoic paleoclimatic events for the southern South America–Antarctic region are documented by Clarke & Crame (1992) and Crame (1993, 1994). Since the Cretaceous -Paleocene boundary water temperatures in southern high latitudes have generally decreased except of four significant global warming trends (Fig. 3-3).

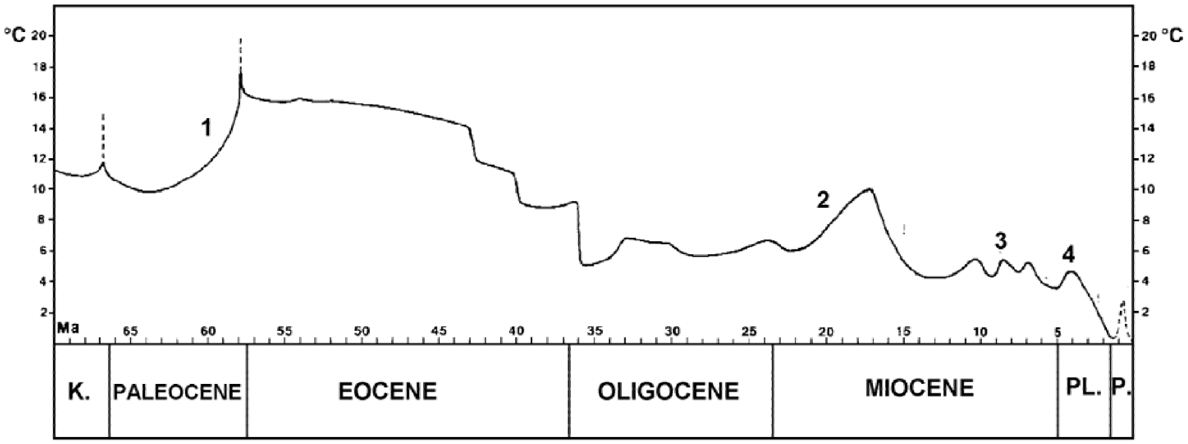


Fig.3-3. Cenozoic temperature changes in the Southern Ocean (modified after Clarke & Crame 1992). K. – Cretaceous, PL. – Pliocene, P. – Pleistocene, 1-4 – global warming trends.

4. Results

4.1. Identification keys for Magellanic Mollusca

These keys for shelled molluscs of the Magellan Region shall enable “non-malacologists” to identify the species. The keys are based on the species list published by Linse (1999).

Following notes should be mentioned for the use of the keys:

- As a rule only adult individuals can be identified, though for some species juvenile shells are illustrated.
- Not all species mentioned in the keys have full lists of characters included in the descriptions (4.2.). Species with further information are mentioned with ⇨.
- Determination of families and genera are adopted from other keys (Keen & Frizzell 1953, Hain 1990, Hayward & Ryland 1992).
- Species listed in the checklist but not included in the keys are mentioned in the foreword for each taxa.
- The character-based key is dichotomous, with numbers to identify the next level in the key (and the number in brackets identifying the previous level).
- If possible two or more, independent characters are mentioned.
- All characters are macroscopic or discernible by using a stereomicroscope. Preparation of gastropods is not necessary but bivalves have to be opened.

For some taxa where a division on species level is difficult the key stops at genus level.

These keys are preliminary, because of changing systematics after revisions and new descriptions. Improvements are welcome.

4.1.1. Gastropoda

Gastropods are the most diverse molluscan taxa in the Magellan region with about 253 species described so far. This key describes 159 species of shelled, benthic gastropod. Nudibranchia are not included. *Acmaea perconica* Preston, 1913 is excluded because this species is only known from one collection. It is listed by Carcelles & Williamson (1951) and Powell (1960). *Berthella* and *Xymenopsis* are identified only to genus level because of new revisions (Schrödl 1999a, Pastorino in press).

The families Eatoniellidae, Cingulopsidae, Rissoidae, and Turridae are totally excluded. For a comprehensive study on the Rissoidea see Ponder and Worsfold (1994). The Turridae, comprising 21 species of 10 genera in the region, are difficult to identify.

1 Shell external 6
1* Shell internal, completely covered by mantle tissue, poorly visible from outside, head and food distinguished by surrounding groove from dorsal body, with or without gills on right side
2

2 (1*) Gill visible on right side **Pleurobranchidae**
Berthella sp. see **Schrödl, 1999a**
2* Gill invisible, covered by mantle tissue
Lamellariidae 3

3 (2*) animal small, < 15 mm, pinkish ***Lamellaria*** 4
3* animal small, 6-15 mm, reddish-yellow, reddish-brown or red, without pigments, mantle tissue smooth, margin swollen, thickened
Marseniopsis pacifica

4 (3) animal tissue pinkish, flesh-coloured with dark pigments, shell flat, oval, big aperture
Lamellaria ampla ⇨

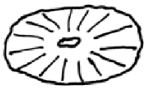
4* animal tissue without pigments, higher shell with smaller aperture
5
5 (4*) shell high, whorls high, clearly distinguished

Lamellaria elata ⇨
5* animal pinkish, shell flatter, whorls less high, wider
Lamellaria patagonica ⇨

6 (1) shell a short, curved tube, open basal, multispiral operculum
Caecidae *Fartulum magellanicum* ⇨
6* shell shape different 7

7 (6*) shell not coiled, "limpet"-shaped cone, sometimes a hole near apex 8
7* shell different, coiled or just apex coiled 18

8 (7*) shell with oval hole near apex, mantle tissue covering shell in shell reduced species
Fissurella 9
8* shell without holes 12

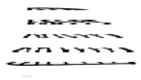


9 (8) shell large (70-110 mm), moderately elevated, outline elongated oval, base flat, sculpture with very fine radial ribs, appears smooth, ground colour black or dark grey, foramen anterior to centre, appears white bordered
Fissurella nigra
9* shell with distinct ribs, ground colour different, distinct rays
10

10 (9*) shell 40-70 mm, low to moderate elevated, outline elongate oval to very elongated, sculpture of fine radial ribs, ribs very broad and flat at margins, ending in fine crenulations, ground colour variable, white, yellow, dark red, rays reddish or grey
Fissurella oriens
10* shell sculpture with strong ribs, narrow margins 11

11 (10*) shell 65-95 mm, moderately elevated, outline elongated oval, sides slightly raised, sculpture sharp, narrow radial ribs, primary stronger than second and third, white or grey, rayed black
Fissurella picta
11* shell 40-55 mm in length (half-size of *F. picta*, similar in overall proportions), low or moderately elevated, outline elongated oval, somewhat tapered anteriorly, sides raised, narrow ribs, narrow margin, foramen just anterior of centre (more anterior than in *F. picta*)
Fissurella radiosa

12 (8*) shell small, thin, < 15 mm, white, pointed apex, anterior side much shorter than posterior, many tuberculated radiating ridges



Iothia coppingeri ⇨
12* shell larger, solid, coloured **Acmaeidae/ Patellidae** 13

13 (12*) shell outline oval, depressed to raised, apex toward anterior margin 14
13* shell outline round, highly raised, apex just anterior of centre

Scurria scurra

14 (13*) shell up to 20 mm, about 17 broad ribs, ribs elongated, ending in crenulated margin
Patelloidea ceciliana
14* shell up to 80 mm, smooth or with radiating ridges, margin less crenulated 15

15 (14*) shell up to 50 mm long, 25 mm wide, and 13 mm height, apex close to anterior margin, smooth, fragile, shining, light brown

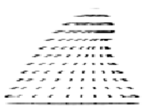
Nacella mytilina
15* shell different, apex wider apart from anterior margin, more or less projecting radiating ridges 16

16 (15*) shell up to 70 mm long, 5.5 mm wide, and 3.5 mm height, apex just anterior of centre, broad radiating ridges, sometimes forming knots with growth lines, solid, pale brown, brown when polished (apex)
Patinigera magellanica
16* shell different, more depressed, less prominent ridges
17

17 (16*) shell up to 38 mm long, 30 mm wide, and 11 mm height, fine radiating ridges, ridges slightly darker coloured than interspaces
Patinigera fuegiensis
17* shell up to 49 mm long, 36 mm wide, 17 mm height, wider radiating ridges, coloured patterns either reddish-brown ridges and white interspaces or reddish-brown curved reddish-brown bands on white ground *Patinigera deaurata*

18 (7*) shell with an open limpet- or cap-shaped cone, apex coiled, with or without slit behind apex 19
18* shell shape different 27

19 (18) shell limpet- or cap-shaped cone, without slit 21
19* shell cap-shaped, raised, oval aperture, white or pinkish whitish punctuated, radiating ridges



Puncturella 20

20 (19*) shell with ridges of same size
Puncturella cognata
20* shells with alternating higher and smaller ridges
Puncturella conica

21 (19) shell limpet-shaped, apex towards posterior side, without septum at posterior end
Parmophoridea 22
21* shell shape different 23

22 (21) shell up to 16 mm long, 10 mm wide, 7 mm height, highly raised, apex almost at posterior margin
Parmaphoridea antarctica
22* shell up to 23 mm long, 13 mm wide, 7 mm high, slightly raised, apex more apart from posterior margin
Parmaphoridea melvilli

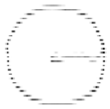
23 (21*) shell cap-shaped, round or oval, with tongue-like shelf or septum, white or light brown, thin periostracum 25
23* shell cap-shaped, raised, apex coiled posteriorly, without tongue-like shelf, thick dark brown periostracum
Capulus 24

24 (23*) shell highly raised, after 2 whorls loosely coiled, erected, sides flattened, apertures elongated oval
Capulus compressus

24* shell raised, normally coiled, sides not flattened, aperture roundly oval
Capulus chilensis

25 (23*) shell oval, subterminal apex slightly coiled, with septum at posterior end
Crepipatella dilatata ⇨
25* shell round, central, pointed apex, with tongue-like shelf below posterior end of foot ***Trochita*** 26

26 (25*) shell with radial ribs and spiral lines, protoconch smooth, septum slightly convex curved
Trochita pileus ⇨



26* shell without radial ribs, only spiral ribs, protoconch with spiral ribs, septum convex curved
Trochita pileolus ⇨

27 (18*) shell with marginal slit **Scissurellidae** 28
27* shell imperforate apart from aperture 30

28 (27) shell up to 2 mm height, whorls sloping, marginal slit about half way of outer lip, two coarse spiral ridges bordering the slit, distinct axial ribs
Anatoma conica
28* shell less high, ridges bordering the slit less prominent, fine axial growth lines 29

29 (28*) shell 1.6 mm height, 1.7 mm diameter, almost as wide as high large body whorl, shoulderless whorl, ridges about half way of whorl, aperture rounded
Anatoma clathrata ⇨
29* shell 1.0 mm height, 1.7 mm diameter, conspicuously wider than high, large, wide body whorl, bordering ridges at shoulder, aperture elongated oval
Scissurella timora

30 (27*) shell base grooved elongated to siphonal canal or aperture base distinct curved, without umbilicus or just shallow groove at columellar region of inner lip
Volutidae, Cerithiidae, Buccinulidae, Columbellidae, Turridae, Muricidae, Volumitridae, Marginellidae, Cancellariidae 31

30* shell base not elongated, outer lip turn into inner lip without groove, shell with umbilicus, sometimes covered by columellar callus or without umbilicus if shell high, tumid, multiwhorled
Naticidae, Trochoidea, Rissoidea, Eulimidae, Trichotropidae, Littorinidae, Epitoniidae, Turritellidae, Pyramidellidae, Acetonidae, Diaphanidae, Scaphandridae
94

31 (30) shell elongated, often spindle-shaped cone, aperture long and narrow, with siphonal canal and anal sinus, sculpture variable, strong axial costae and spiral striae
Turridae see de Castellanos & Landoni, 1993
31* shell shape different, without anal sinus 32

32 (31*) shell solid, opaque, commonly 8-15 mm high with slightly tumid whorls
Cerithiopsidae 33
32* shell shape different, fusiform or ovate 35

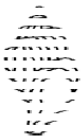
33 (32) shell 6 mm height, 1.7 mm diameter, 8 whorls, sculpture with first 2 later 3 spiral ribs and radial, orthocline ribs forming mesh patterns
Eumetula michaelseni
33*shell with 3 lines of knots per whorl 34

34 (33*) shell 4 mm height, 1 mm diameter, 9 whorls, protoconch with radial, orthocline ribs on second whorls, narrow suture
Cerithiopsilla burdwoodianus

34* shell 16 mm height, 5.5 mm diameter, 12 whorls, protoconch smooth, of 2.5 whorls, wide suture
Ataxocerithium pullum

35 (32*) shell fusiform, ovate, sculpture smooth or with thin axial and spiral lines, columella with 1 to 4 folds
Volutidae, Volumitridae, Marginellidae, Cancellariidae 36

35* shell fusiform, sculpture smooth or strong spiral and/or axial ribs, columella smooth without folds
Buccinulidae, Columbellidae, Muricidae 52



36 (35) shell medium sized, < 25 mm, slender, large body whorl, aperture elongate, narrow, very glossy, smooth porcellaneous, coloured surface, columella with 3-4 folds, mantle covers entire animal ***Marginella*** 37

36* shell shape different 38

37 (36) shell 22 mm height, 9 mm diameter, shell reddish-brown with white stripe on shoulder, 3 columella folds
Marginella warreni ⇨

37* shell similar to *M. warreni* but smaller and different colour pattern, 2 spiral colour bands, upper one narrow and submarging the suture, lower one occupying most of base
Marginella dozei

38 (37*) shell large, > 30 mm, up to 180 mm, large body whorl, large, bulbous protoconch, often coloured patterns
Volutidae 39

38* shell different shaped, smaller 49

39 (38) shell < 60 mm, uniformly white or pale brown colour, 2-7 columella folds ***Miomelon*** 40

39* shell larger, often coloured patterns, 3-4 columella folds 43

40 (39) shell 40 mm height, 13 mm diameter, subfusiform, whorls with small shoulder, scultureless except growth lines, 6-7 columella folds, aperture with straight outer lip
Miomelon (Argentovoluta) bottai

40 * whorls with more conspicuous shoulder, less columella folds 41

41 (40*) shell 60 mm height, 26 mm diameter, white, whorls with thickened shoulder, 4 columella folds
Miomelon scoresbyana
41* shell < 50 mm, less columella folds 42

42 (41*) shell medium, 50 mm height, 21 mm diameter, outline swollen below the suture, sculpture of low, rounded irregular axial folds crossed by broad spiral threads and fine wavy spiral striae, 2-3 columella folds
Miomelon turnerae
42* shell medium, 32 mm height, 13 mm diameter, pale brown moderate shoulder below suture, well-developed rounded axial ribs crossed by fine striae, 3 columella folds
Miomelon eltanini

43 (39*) shell large, up to 166 mm height, 59 mm diameter, outer lip conspicuously shouldered, forming rounded knots, 3 columella folds, lowest fold biggest, ending in inner lip
Adelomelon beckii
43* shell different, without rounded knots at shoulder (if shoulder present) 44

44 (43*) shell large, 96 mm height, 62 mm diameter, with enlarged, bulbous body whorl, short spire, brownish-purple, columella orange, 3-4 columella folds, lowest ending in inner lip of columella, aperture subquadrate-oval
Adelomelon ferussacci
44* shell different, spire longer and body whorl less bulbous
45

45 (44*) shell fusiform, 166 mm height, 59 mm diameter, 6-7 whorls, slender, whorls not shouldered, colour pale orange with narrow axial black zigzag patterns
Adelomelon ancilla
45* shell with conspicuous shoulders
Odontocymbiola 46

46 (45*) shell 160 mm height, 80 mm diameter, 6 whorls, large widened body whorl, short spire, large aperture (3/4 of shell height), wide zigzag patterns, weakly rounded knots on shoulder, 3-4 columella folds
Odontocymbiola subnodosa
46* shoulders without knots, body whorl less widened 47

47 (46*) shell 115 mm height, 53 mm long, 5 whorls, grey with pale brown axial lines, 3 columella folds
Odontocymbiola pescalia
47* whorls less convex, with zigzag patterns 48

48 (47*) shell 130 mm height, 60 mm long, 5 whorls, numerous wide axial zigzag patterns, 2-3 columella folds
Odontocymbiola magellanica
48* shell 174 mm height, 86 mm long, 7.5 whorls, less and narrower zigzag patterns, 3 columella folds
Odontocymbiola canigiai
49 (38*) shell medium sized, < 20 mm, fusiform, large protoconch, columella with 4 folds, aperture slender
Volutomitra (Paradmete) crymochara

49* shell different shaped, whorls distinguished, columella with 1-2 folds on basal columella region, aperture widened
Cancellariidae 50

50 (49*) shell sculpture with strong axial ribs and spiral ribs
Admete australis
50* shell sculpture different, with spiral striae 51

51 (50*) shell with rounded shoulder, numerous flat and narrow spiral ribs
Admete magellanica
51* shell with angular shoulder, forming conspicuous ridge, numerous spiral ribs
Admete carinata

52 (35*) siphonal canal long, with prominent fasciole (row of former siphonal canals), axial sculpture strong, often ridges or lamellae **Muricidae** 53
52* siphonal canal elongated, without fasciole, axial sculpture less prominent
Buccinulidae, Columbellidae 61

53 (52) shell large, 110 mm height, 75 mm diameter, colour grey, brownish-green, aperture huge, largest and widest part of shell, sculpture of strong rounded axial ribs, inner lip thickened
Concholepas conchopelas

53* shell different, aperture less magnified 54

54 (53*) short siphonal canal, shell 50 mm height, 32 mm diameter, 4 whorls, sculpture of strong spiral ribs, numerous on body whorl, inner and outer lip thickened, outer lip crenulated, widened, white columella
Acanthina monodon
54* siphonal canal elongated, more erected spire 55

55 (54*) shell with 1-2 strong spiral keels, 1 keel on conspicuous shoulder, second only visible on body whorl, covered by suture in other whorls, shell 9,1 mm height, 4,5 mm diameter
Tromina dispectata

55* sculpture different, with numerous spiral and/or axial ribs
56

56 (55*) protoconch tall, narrowly conic and paucispiral, sculpture of numerous rounded spiral ribs and axial cords
Xymenopsis spp. see Pastorino, in press

56* protoconch paucispiral asymmetrical, axial sculpture more conspicuous, forming lamellate processes
Trophon (Pastorino, in prep.) 57

57 (56*) protoconch oblique flattened, shell medium sized, 10 mm height, 5 mm diameter, 5.5 whorls, sculpture of 0-2 spiral ribs and short, widely spaced axial lamellae
Trophon ohlini ⇨

57* protoconch rounded 58

58 (57*) shell small, 3.1 mm height, 2.1 mm diameter, 2.5 whorls (excluding protoconch), sculpture of 2-3 spiral lines with projecting peaks, largest peaks on the uppermost spiral line
Trophon triacanthus

58* shell larger than 5 mm 59

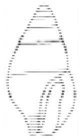
59 (58*) shell large sized, 33 mm height, 14 mm diameter, 7 whorls, sculpture of numerous spiral and axial ribs forming mesh patterns, with large rounded axial ridges
Trophon (Fuegotrophon) pallidus

59* shell larger, larger than 40 mm height 60

60 (59*) shell up to 70 mm height and 52 mm diameter, 7 whorls, sculpture of spiral ribs overgrown by axial ridges, prominence of sculpture is variable
Trophon geversianus ⇨

60* shell up to 57 mm height, 35 mm diameter, 7 whorls, sculpture of axial lamellae with wide interspaces
Trophon (Stramonitrophon) plicatus

61 (52*) Aperture elongated, thickened, outer lip thickened and/or dentated short siphonal canal, body whorl base sculptured with numerous spiral lines
Columbellidae 62



61* Aperture oval, scarcely thickened, outer lip not dentated, siphonal canal short or elongated **Buccinulidae** 67

62 (61) outer lip dentated, teleoconch whorls with axial ribs
Anachis 63
62* outer lip not dentated 64

63 (62) shell 4.5 mm height, 2.2 mm diameter, 6.5 whorls, sculpture of broad axial ribs with narrow interspaces
Anachis paessleri
63* shell more slender, 4.3 mm height, 1.9 mm diameter, 7 whorls, sculpture of narrower axial ribs and wider interspaces, less ribs than in *A. paessleri*, 22 ribs on body whorl
Anachis isabellei

64 (62*) shell sculpture smooth, columella straight, outer lip thickened, inner lip with faint riblets **Mitrella** 65

64* shell sculptured, columella curved, outer lip faintly thickened, inner lip smooth, protoconch smooth
Amphissa 66

65 (64) shell 19.3 mm height, 10.2 mm diameter, 6-7 whorls, 8 folds on inner lip, unicolour, first teleoconch whorls with axial ribs
Mitrella rubra
65* shell smaller, 6.4 mm height, 3.2 mm diameter, 5.5 whorls, 3-4 folds on inner lip, teleoconch smooth, dark brown with 1 light line on whorl shoulder, 4-5 peaks in thickened outer lip
Mitrella unifasciata

66 (64*) shell 15 mm height, 5.5 mm diameter, 7 whorls, sculpture of numerous narrow axial ribs and spiral lines forming knots
Amphissa acuminata
66* shell 9.3 mm height, 5.5 mm diameter, 6 whorls, sculpture of rounded axial ribs with wide interspaces and numerous spiral ridges
Amphissa cancellata

67 (61*) shell whorled anti-clockwise 68
67* shell whorled clockwise 69

68 (67) shell 4.7 mm height, 2.7 mm diameter,4 whorls, sculpture of 4 equal-sized crenulated spiral cords
Antistreptus magellanicus
68* shell 3.6 mm height, 2.6 mm diameter, 3.5 whorls, sculpture of 4 crenulated spiral cords, uppermost cord smaller than others
Antistreptus rolani

69 (67*) shell biconical to ovate, protoconch large, of 2 dome-shaped whorls 70
69* shell fusiform, protoconch high, roundly inflated or acute conical 73

70 (69) shell relatively thin, sculpture of numerous spiral lines, columella twisted, 5.3 mm height, 3.6 mm diameter, 3.7 whorls
Paraficulina problematica
70* shell solid, columella straight ***Falsitromina*** 71

71 (70) shell strongly carinate, last whorl and siphonal canal elongated, sculpture of minor spiral cords, strong keel in the middle of body whorl, 7.0 mm height, 4.7 mm diameter
Falsitromina powelli
71* shell carinate, last whorl and siphonal canal not elongated 72

72 (71*) sculpture of numerous spiral lirae
Falsitromina simplex
72* sculpture more prominent
Falsitromina bella

73 (69*) teleoconch sculpture of nodulous spiral cords 74
73* teleoconch sculpture smooth, spiral lines, or rounded axial ribs 81

74 (73) neck slightly elongated and curved, forming siphonal canal ***Meteuthria*** 75
74* neck short and straight 76

75 (74) sculpture of nearly equal-sized nodulous cords, 3-4 cords on the penultimate whorls of a 4 mm high shell, outer lip bluntly rounded, 4.5 mm height, 2.3 mm diameter, 4.5 whorls
Metheutria multituberculata
75* sculpture of axial costae and spiral cords forming knots when they are crossing, outer lip undulated, 9.5 mm height, 4.2 mm length, 6 whorls
Metheutria martensi ⇨

76 (74*) protoconch acute conical, small, siphonal canal short, steadily increasing whorls, shell outline pointed conical, 5 nodules spiral cords on penultimate whorl 7.3 mm height, 3.7 mm diameter, 5 whorls
Anomacme smithi
76* protoconch roundly inflated, siphonal canal slightly elongated 77

77 (76*) shell < 10 mm height, whorl outline curved, conspicuous suture, sculpture nodulous spiral cords and prominent rounded axial ribs 78
77* shell small, > 10 mm height, whorl outline less curved, nearly straight **_Savatieria_** 79

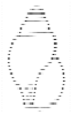
78 (77) protoconch smooth
Glypteuthria meridionalis
78* protoconch with axial ribs
Ceratosipho beaglensis sp. n. ⇨

79 (78*) teleoconch sculpture of 3 to 5 nodulous spiral cords
80
79* teleoconch sculpture of axial ribs and 2 basal nodulous spiral cords
Savatieria meridionalis

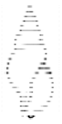
80 (79) teleoconch sculpture of 3 broad nodulous spiral cords, shell outline slender, 7.2 mm height, 2.9 mm diameter, 7 whorls
Savatieria areolata
80* teleoconch sculpture of 5 nodulous spiral cords, lowest cord larger, 5.5 mm height, 2.8 mm diameter, 7 whorls
Savatieria chordata

81 (73*) shell small, tumid, 7.1 mm height, 2.8 mm diameter, 6.5 whorls, teleoconch sculpture of broad axial ribs with interspaces of same width
Savatieria frigida
81* shell larger and wider, aperture height > 1/3 of total height
82

82 (81*) shell outline elongate-ovate, teleoconch whorls broadly convex, whorls with shoulder, siphonal notch broad, periostracum smooth or finely hirsute



Parabuccinum 83
82* shell fusiform, teleoconch whorls slightly convex, whorls without shoulder, siphonal notch narrow, periostracum smooth, hairless **_Pareuthria_** 86



83 (82) shell smooth, ovate with tall body whorl, outer lip strongly prosocline, sculpture of numerous very low, fine spiral threads, without axial sculpture
Pareuthria eltanini
83* shell not smooth, sculpture stronger, axial sculpture present, outer lip evenly rounded 84

84 (83*) shell 15.4 mm height, 7.7 mm diameter, protoconch diameter about 1.8 mm, numerous spiral cords and weak axial sculpture
Parabuccinum polyspeira

84* shell broader, strongly shouldered, protoconch diameter smaller (about 1.15 mm or about 1.5 mm), axial sculpture more prominent 85

85 (84*) shell 14.8 height, 8.2 mm diameter, protoconch diameter about 1.5 mm, sculpture of narrow spiral cords, half the with of interspaces, and numerous axial ribs
Parabuccinum bisculptum

85* shell smaller and broader, 9.6 mm height, 5.8 mm diameter, 5 whorls, protoconch diameter smaller, about 1.15 mm, sculpture of closely spaced spiral cords, generally broader than interspaces, and less numerous and wider axial ribs
Parabuccinum rauscherti

86 (82*) shell small, less than 10 mm 87

86* shell larger than 15 mm 90

87 (86) teleoconch sculpture of axial ribs and spiral cords, 7.3 mm height, 3.3 mm diameter, 5 whorls
Pareuthria valdiviae

87* teleoconch sculpture smooth or spiral lines 88

88 (87*) teleoconch sculpture of numerous impressed spiral lines, 32 spiral lines on body whorl, 9.7 mm height, 5.8 mm diameter, 5.5 whorls
Pareuthria janseni

88* teleoconch sculpture smooth, except spiral band on body whorl base and sculpture on neck 89

89 (88*) teleoconch smooth, numerous fine spiral grooves on lower half of neck, yellowish-brown, darker band just below suture, 9.6 mm height, 4.6 mm diameter, 6.5 whorls
Pareuthria cerealis ⇨

89* teleoconch smooth, 3-5 fine spiral grooves on upper half of neck, just 1 above suture, reddish-brown, 9.1 mm height, 4.6 mm diameter, 6.5 whorls
Pareuthria paessleri ⇨

90 (86*) teleoconch sculpture of obvious rounded axial ribs, weak spiral lines 91

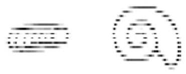
90* teleoconch sculpture of spiral ribs 93

91 (90) axial ribs vanishing on penultimate and body whorl, smooth penultimate and body whorl, dark brown to black colour
Pareuthria plumbea ⇨
91* axial ribs on all teleoconch whorls, yellowish-brown colour
92

92 (91*) shell 18 mm height, 9 mm diameter, 6.5 whorls, teleoconch sculpture of axial ribs and spiral lines, about 30 lines on body whorl
Pareuthria powelli ⇨
92* shell 30 mm height, 15.5 mm diameter, 7 whorls, teleoconch sculpture of less numerous axial ribs, without spiral lines
Pareuthria fuscata

93 (90*) shell more slender, 22 mm height, 10 mm diameter, 6.5 whorls, spiral ribs of regular thickness, first teleoconch whorls with vanishing axial ribs
Pareuthria ringei
93* shell 23 mm height, 11 mm diameter, 6.7 whorls, whorls outline less convex, spiral ribs of irregular thickness, with wider interspaces
Pareuthria michaelseni

94 (30*) shell small to minute (usually less than 4 mm in height), elongate-conic to broadly-ovate, smooth or spiral sculptures, periostracum thin or apparently lacking, solid, paucispiral operculum
Eatoniellidae, Cingulopsidae, Rissoidae
see Ponder, W.F. & T.M. Worsfold (1994)
94* shell shape different 95



95 (94*) shell minute (diameter up to1.2 mm), subdiscoidal
96
95* shell shape different 98

96 (95*) shell minute (diameter up to 1.2 mm), subdiscoidal, spire almost flat, glassy, umbilicate, periostracum thin and smooth, pale beige or colourless, aperture rectangular and rounded, outer lip forms an indistinct sinus at suture, operculum horny, thin, polygyrous with central nucleus
Orbitestellidae 97
96* shell minute (diameter up to 1.2 mm), subdiscoidal, spire almost flat, glassy, smooth, aperture round, operculum horny, thin, polygyrous with central nucleus
Omalogyra antarctica

97 (96) teleoconch simple, with rounded whorls, smooth except growth lines, operculum lobe covers half operculum surface
Microdiscula sp.
97* teleoconch with predominant sculpture, strong axial ridges and spiral striae, sometimes forming granules
Orbitestella ponderi sp.n. ⇨

98 (95*) shell minute, 0.8 mm height, 0.8 mm diameter, 2.5 whorls, hyaline or white, narrow umbilicus, strong axial ribs, aperture round
Cyclostrema crassicostatum ⇨
98* shell different shaped 99

99 (98*) shell smooth, globular or oval, polished, with low spire and enlarged last whorl, aperture semicircular, umbilicus present or absent (closed by thickened callus-like extension of inner lip), operculum large, oligogyrous, horny or calcareous, enlarged foot **Naticidae** 100
99* shell different shaped 103

100 (99) operculum horny, whorls bulbous **Polinicinae** 101
100* operculum calcareous, whorls scarcely marked, spire oblique, peculiar thickened callus-like extension of inner lip
Tectonatica impervia

101 (100) shell large (up to 30 mm height), globose, spire obtuse-angled to flattened, protoconch smooth, minute, doomed, aperture very large, ovate, columella thickened, relatively straight, umbilicus obliterated by development of parietal callus, operculum thin, fragile, slightly smaller than aperture, pale brownish-white
Bulbus carcellesi ⇨
101* shell solid, umbilicus open or closed by development of collumelar callus, olive-green to green-brown periostracum
102

102 (101*) shell 18 mm height, 16 mm diameter, umbilicus widely open or partially or completely closed, suture weak to deeply channelled,
Falsilunatia soluta
102* shell larger, 28 mm height, 25 mm diameter, other characters similar to *F. soluta*
Polinices patagonica ⇨

103 (99*) shell littorinoid, 5.5 mm height, 4 mm diameter, 4.5 whorls, narrow elongated umbilicum groove, dark-brown periostracum, aperture oval, operculum paucispiral
Littorinidae *Laevilittorina calignosa*
103* shell different shaped 104

104 (103*) shell trochid, depressed globose (height<breadth) or pyramidal, aperture with or without peristome, usually with nacreous lining, operculum polygyrous with central nucleus, horny or calcareous **Trochacea** 105
104* shell tumid or if different shaped without operculum 119

105 (104) operculum calcareous, with long growing edge **Turbinidae** 106
105* operculum horny, with short growing edge **Trochidae** 107

106 (105) shell small, 4.3 mm height, 5.6 mm diameter, 4 whorls, pink colour, sculpture of spiral cords *Homalopoma cunninghami* ⇨

106* shell large, 30 mm height, 25 mm diameter, uniform black pigmentation, sculpture of strong spiral cords, interior nacre well developed *Prisogaster niger*

107 (105*) protoconch with honeycomb pattern 108
107* protoconch pattern different, shell outline bluntly pointed 116

108 (107) shell outline sharply pointed cone, shell more or less as high as wide, shell sculpture of spiral cords or smooth, white and pink colours ***Calliostoma*** 109
108* shell outline with more convex whorls, shell smooth, 3-4 pink bands on white ground colour *Photinastoma taeniata*

109 (108) first teleoconch whorls with smooth spiral cord near suture, spiral sculpture weak 110
109* first teleoconch whorls with nodulous uppermost spiral cord near suture 111

110 (109) shell dark pink with 2 light-whitish bands, whorl outline straight, 15 mm height, 16.6 mm diameter, 6.2 whorls *Calliostoma möbiusi*
110* shell uniform light pink, whorl outline more convex, 11.9 mm height, 12.2 mm diameter, 6.4 whorls *Calliostoma modestulum* ⇨

111 (109*) teleoconch sculpture smooth except nodulous cord near suture and cord near whorls base 112
111* teleoconch sculpture of numerous spiral cords 113

112 (111) shell white, 10 mm height, 11 mm diameter, whorl outline more convex
Calliostoma irisans ⇨
112* shell pinkish, 11.3 mm height, 10.8 mm diameter, whorl outline straight
Calliostoma nudum

113 (111*) shell uniform pink 114
113* shell white or white-pinkish 115

114 (113) shell dark pink, 12. 9 mm height, 11.4 mm diameter, 7,5 whorls, numerous strong spiral cords
Calliostoma consimilis ⇨
114* shell lighter pink, 10.2 mm height, 10.8 mm diameter, 5 whorls
Calliostoma coppingeri

115 (113*) shell white, sculpture of strong spiral cords, 5 on penultimate whorl, upper cords nodulous, 14.2 mm height, 14.4 mm diameter
Calliostoma nudisculum ⇨
115* shell white-pinkish
Calliostoma venustulum ⇨

116 (107*) shell small, > 10 mm height, uniform reddish-pink, sculpture smooth, 8.4 height, 9.9 mm diameter, 5.7 whorls
Margarella violacea ⇨
116* shell larger than 10 mm height, black, grey or multicoloured, shell sculpture spiral cords or smooth 117

117 (116*) shell solid, obvious wider than high, 15 mm height, 21 mm diameter, shell smooth, numerous black bands on white or pink ground
Photinula caerulescens ⇨

117* shell thick, about as high as wide, uniform black or grey
Tegula 118

118 (117*) shell very solid, large, 52 mm height, 62 mm diameter, black
Tegula ater
118* shell smaller, 13 mm height, 15 mm diameter, grey, sculpture of numerous spiral cords
Tegula patagonica

119 (104*) shell elongated or tumid, with operculum
Eulimidae, Epitoniidae, Turritellidae, Pyramidellidae 120
119* shell different shaped, with **(Acetonidae)** or without operculum
Diaphanidae, Scaphandridae, Philinidae 138

120 (119) protoconch heterostrophic **Pyramidellidae** 121

120* protoconch orthostrophic
Eulimidae, Epitoniidae, Turritellidae 126

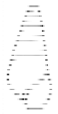
121 (120) shell elongated, 4.1 mm height, 1.2 mm diameter, 7 whorls, teleoconch which coarse, rounded radiating ridges
Chemnitzia smithi
121* shell different, teleoconch whorls smooth, with nodes or fine axial lines 122

122 (121*) shell tumid, sculpture fine axial lines
Eulimella 123
122* shell conical, sculpture smooth or with nodes
Odostomia 124

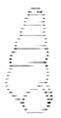
123 (122) shell 3.2 mm height, 0.85 mm diameter, 9 whorls
Eulimella xenophyses
123* shell 1.4 mm, 0.5 mm diameter, height-diameter relation smaller than in *E. xenophyses*
Eulimella sp.

124 (122*) shell 2.5 mm height, 1.2 mm diameter, 4 whorls, teleoconch whorls with 3-7 spiral nodded lines, numerous spiral lines on whorl base, 1 columella fold
Odostomia multituberculata
124* shell more compressed, smooth, 1-2 columella folds
125
125 (124*) shell 2.8 mm height, 1.3 diameter, 4 whorls, 1 columella fold, whorls higher erected than in *O. nova*
Odostomia translucens
125* shell 3.0 mm height, 1.7 mm diameter, 4 whorls, 2 columella folds
Odostomia nova

126 (120*) whorls flat-sided, sutures shallow, shell highly polished **Eulimidae** 127



126* whorls inflated, conspicuous sutures, sculpture with axial ribs and spiral striae **Epitoniidae, Turritellidae** 129



127 (126) shell 6.5 mm height, 2 mm diameter, 6 whorls, protoconch globose, teleoconch whorls with subsutural band, fine spiral lines, aperture base elongated
Melanella salvadori
127* shell different shaped, protoconch less globose 128

128 (127*) shell 6 mm height, 2 mm diameter, 9 whorls, whorls slightly curved, aperture base elongated/ keeled *Strombiformis carforti*

128* shell 4.5 mm height, 1.5 mm diameter, 7 whorls, sutures extremely shallow, aperture base round *Balcis subantarcticus*

129 (126*) prominent sculpture spiral ridges, with or without axial lines **Turritellidae** 130

129* prominent sculpture axial lamellae with spiral grooves, aperture thickened **Epitoniidae** 132

130 (129) shell 8 mm height, 2.5 mm diameter, 10 whorls, white or light pink, shining, protoconch smooth, teleoconch with 2 prominent spiral ridges and finer intermediate ridges *Colpospirella algida*

130* shell different, with spiral ridges and axial lines forming mesh patterns ***Mathilda*** 131

131 (130*) shell 4.1 mm height, 1.6 mm diameter, 8 whorls, protoconch of 7/8 smooth whorl, teleoconch with 2 prominent primary spiral ridges from first teleoconch whorl on, later up to 2 less secondary spiral ridges above primary ones, fine axial ribs, forming mesh patterns, conspicuous suture, aperture without projecting ridge endings, shell base with numerous spiral lines *Mathilda magellanica*

131 * shell 12.2 mm height, 4.1 mm diameter, 10 whorls, protoconch of 2 smooth whorls, teleoconch with 3 primary spiral ridges, later 1 secondary ridge under primary ones, suture less prominent, aperture with projecting ridge endings, shell base with 5 spiral lines *Mathilda argentina*

132 (129*) shell 3.1 mm height, 1.4 mm diameter, 5 whorls, protoconch of 1.5 smooth whorls, teleoconch whorl with fine spiral ribs and axial lamellae, outer edges of lamellae irregularly scalloped *Papuliscala diminuta*

132* shell larger than 5 mm height 133

133 (132*) shell sculpture with axial lamellae and conspicuous spiral ribs 134

133* shell sculpture with axial lamellae and scarcely visible spiral lines 136

134 (133) shell 7.0 mm height, 2.0 mm diameter, 10 whorls, protoconch of 2 whorls, teleconch with spiral striae and wide axial lamellae, outer edges scalloped
Epitoniidae sp.
134* shell larger than 30 mm height, solid, 14-20 axial lamellae on last whorl, spiral rib just above suture thickened
Coroniscala 135

135 (134*) shell 40 mm height, 19 mm diameter, 8 whorls, with bulge at umbilicus
Coroniscala magellanica
135***** shell 33 mm height, 18 mm diameter, 10 whorls, without bulge at umbilicus
Coroniscala latecostata

136 (133*) shell 35 mm height, 16 mm diameter, 7-8 whorls, protoconch missing, teleoconch with numerous closely spaced axial lamellae, 39 to 75 lamellae on last whorl, interlamellar spaces with shallow spiral grooves, aperture round, heavily thickened
Asperiscala eltanini
136***** teleoconch with wider spaced axial lamellae, less lamellae on last whorl
Epitonium 137

137 (136*) shell large, 27 mm height, 9 mm diameter, 10 whorls, shell outline straighter than in E. fabrizioi, axial lamellae wide, 8-10 axial lamellae on last whorl, operculum multispiral, thin, opaque
Epitonium georgettianum
137* shell smaller, 15 mm height, 7 mm diameter, 11 whorls, including 4.25 protoconch whorls, axial lamellae thinner, 14-18 axial lamellae on last whorl, more numerous, operculum paucispiral, thin, translucent
Epitonium fabrizioi

138 (119*) Operculum present **Acetonidae** 139
138* Operculum absent 141

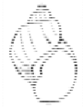
139 (138) shell outline conical, regular increasing whorls, solid, reddish-brown with white line near suture, 2 columella folds
Aceton biplicatus
139* shell with enlarged body whorl, 1 columella fold 140

140 (139*) shell 8.5 mm height, 3.8 mm diameter, 4 whorls, numerous fine spiral lines, aperture base short
Aceton elongatus
140* shell 8.2 mm height, 4.4 mm diameter, 4.5 whorls, solid, fine wide spiral grooves, aperture base elongated
Aceton vagabundus

141 (138*) shell elongated, involut, protoconch invisible 142
141* shell different shaped, not involut, protoconch visible **Cylichnina** 143

142 (141) shell minute, 1.7 mm height, 0.9 mm diameter, columella and outer aperture straight, outer lip protrudes last whorl *Cylichnina cumberlandiana*
142* shell small, 3.8 mm height, 1.7 mm diameter, oblique whorls, high ascending outer lip *Cylichnina georgiana*

143 (141*) shell cylindrical-pentagonal to oval, smooth except for fine growth lines, hyaline to white, whorl shoulders rounded *Diaphana paessleri* ⇨
143* shell different shaped **Toledonia** 144



144 (143*) shell outline narrow and conical spire outline, 6.1 mm height, 2.9 mm diameter, 6 whorls, regularly increasing, smooth, protoconch with punctuate sculpture *Toledonia parelata*
144* shell outline wide, body whorl inflated, whorls shouldered 145

145 (144*) whorl outline straight-sided, whorls rapidly increasing, protoconch and first teleoconch whorl with punctuated spiral lines, teleoconch with prominent spiral sculpture, 1-2 columella grooves *Toledonia punctata*
145* whorl outline curved, protoconch and teleoconch without smooth 146

146 (145*) shell smooth, but protoconch with punctuate under magnification, body whorl inflated to width axis, columella moderately twisted, forming broad columellar fold *Toledonia limnaeformis* ⇨
146* shell smooth except for growth lines and sometimes vague spiral striae, body whorl inflated on height axis, abapical extension smaller than in *T. limnaeformis*, columella fold smaller *Toledonia perplexa*

4.1.2. Scaphopoda

The Magellan region has the most diverse scaphopod community in the Southern Ocean. Further results on the taxonomy and systematics of the scaphopods mentioned below are published in Steiner & Linse (submitted).

1 Shell small, less than 2 cm, polished, smooth 2
1* Shell larger than 2 cm, chalky 3

2 (1) Shell's maximum diameter close to anterior aperture, with apex teeth
Siphonodentalium dalli

2* Shell moderately expanding, without apex teeth, < 7 mm
Pulsellum falklandicum

3 (1*) Shell with radial ribs
Dentalium majorinum

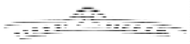
3* Shell without radial ribs 4

4 (3*) Shell large (> 7,5 cm, Ø 10 mm), polished
Dentalium lebruni
4* Shell shorter (5 cm), white to yellowish brown, chalky
Rhapdus perceptus

4.1.3. Bivalvia

121 species are included in the following key. Four taxa are identified to genus level due to inconspicuous species characters: *Cyamium*, *Lasaea*, *Mulinia*, and *Solemya*.

1 Hinge line of valves with numerous identical shaped teeth 2



1* Hinge line without teeth or with cardinal and/or lateral teeth 30

2 (1) Hinge line with small grooved teeth 3
2* Hinge line with long tapered, often curved teeth alternating with sockets 8

3 (2) Valves round or pear-shaped, small, with hairy periostracum **Philobyra** 4

3* Valves without hairy periostracum 7

4 (3) Valves round
Philobrya wandelensis
4* Valves curved dorsally before the hinge 5

5 (4*) Periostracum extending beyond calcareous margins of valves, wide radials with enclosed hair-like spines
Philobrya sublaevis
5* Periostracum does not extending the calcareous valves, many projecting hair-like spines 6

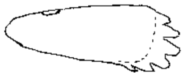
6 (5*) Periostracal hairs dense, in > 20 rows
Philobrya crispa sp.n. ⇨
6* Periostracal hairs less dense; 3 teeth on ventral margin
Philobrya capillata ⇨

7 (3*) Valves equilateral, almost oval in outline, polished, greenish brown, with numerous bifurcating ribs, ligament deep set

Crenella magellanica sp. n. ⇨
7* Valves inequilateral, mytiloid, posterior end larger than anterior, black, smooth
Dacrydium albidum

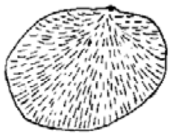
8 (2*) Valves inequilateral, more than twice as long as wide
9
8* Valves equilateral, less than twice as long as wide 11

9 (8) Umbones in the middle of the dorsal margin
Acharax sp.
9* Umbones not in the middle of the dorsal margin, posterior margin elongated 10



10 (9) Elongated posterior margin pointing upwards, many concentric ribs, greenish-brown, thick valves
Propeleda longicaudata
10* Elongated posterior margin straight, valves polished, smooth, yellowish-green, transparent
Phaseolus patagonicus

11 (8*) Valves round, or obliquely oval, periostracum distinct, thick, hairy **Limopsis** 12
11* Valves roughly triangular or oval, periostracum smooth, polished 15



12 (11*) Valves more or less equilateral, round
Limopsis hirtella
12* Valves inequivalve, oval 13

13 (14*) Valves distinctly inequivalve, clearly longer than wide
Limopsis knudseni
13* Valves nearly long as wide and oval 14

14 (13*) anterior margin ± like posterior margin, thick valves, dorsal margin roundly bend
Limopsis marionensis
14* anterior margin narrower than posterior, dorsal margin straight
Limopsis tenella dalli

15 (11*) Valves roughly triangular, higher than wide
Nuculidae 16
15* Valves ± oval wider than high 21

16 (15) smooth, polished, without valve structures (except growth lines) 17
16* Valves with concentric ribs and/or radial striae 19

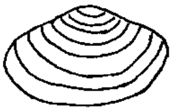
17 (16) Valves small, less than 8 mm long, up to 10 anterior and 15 posterior teeth 18
17* Valves larger, up to 13 mm long, with up to 22 anterior and 10 posterior teeth
Ennucula puelcha

18 (17) Valves with prominent beaks and posterior end slightly elongated, up to 10 anterior and 7 posterior teeth, inner ventral margin smooth
Ennucula eltanini
18* Valves roundly, short posterior end, inner ventral margin crenulate, 15 posterior and 8 anterior teeth, inner ventral margin smooth
Linucula pisum

19 (16*) Valves with distinct concentric ribs, brownish periostracum, up to 17 anterior and 9 posterior teeth, size 20 x 15 mm
Ennucula grayi
19* Valves with concentric and radial ribs, ventral margin crenulated, up to 5 mm length and 4.3 mm height, with 9 posterior and 13 anterior teeth
Nucula falklandica ⇨

20 (15*) Valves more or less oval, periostractum olive, greenish or brownish 21
20* Valves subquadrate, thick, periostracum pinkish, with many radial ribs
Lissarca miliaris

21 (20) Ligament internal, hinge plate slightly curved, anterior margin rounded, posterior margin often elongated 22
21* Ligament external, hinge plate not curved 28



22 (21) Valves large (- 40 mm), chalky with a greenish or dark brown periostracum, umbo often eroded, anterior and posterior end gaping **Yoldia** 23

22* Valves small (< 15 mm), thin, with a green periostractum **Yoldiella** 24

23 (22) Valves thin, ovate, lanceolate, inequilateral, with no pronounced rostrum, pallial sinus large and V-shaped, hinge teeth small, 9-17 anterior and 5-13 posterior to resilifer *Yoldia woodwardi*

23* Valves thick, subequilateral, with a more or less pronounced rostrum, pallial-sinus large and U-shaped, hinge teeth rather variable with 7-18 anterior and 5-14 posterior to resilifer *Yoldia eightsii*

24 (22*) Valves inequilateral, posterior side of the valves longer than anterior side 25

24* Valves equilateral, valves < 5 mm 26

25 (24) Valves with yellow green periostracum, surface with irregular concentric ribs, with up to 19 posterior and 17 anterior teeth (11.5 mm length) *Yoldiella chilenica*

25* Valves with olive periostracum, smooth surface, 12 teeth on each hinge side *Yoldiella indolens*

26 (24*) equal number of anterior and posterior teeth 27

26* unequal teeth numbers, more posterior teeth than anterior teeth, grooved concentric ribs at outer half of valve *Yoldiella infrequens*

27 (26) valves minute (2.1 mm length x 1.6 mm height), equilateral, without valve sculptures *Yoldiella granula* ⇨

27* Valves inequilateral, posterior slightly elongated, groove from umbones to ventral posterior margin *Yoldiella valettei*

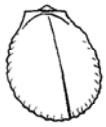
28 (21*) Valves equilateral, minute (< 5 mm), distinct concentric ribs *Tindaria virens*

28* Valves inequilateral, anterior end elongated, > 5 mm, posterior teeth much more numerous than anterior series **Malletia** 29

29 (28*) anterior end forming acute rostrum, surface with concentric ribs
Malletia magellanica
29* anterior end rounded, smooth surface, 3 anterior and up to 24 posterior teeth
Malletia inequalis

30 (1*) dorsal margin straight, hinge line drawn out into ears on one or both sides of umbo 31
30* dorsal margin bend, without ears 40

31 (30) Valve outline elongate-oval, ears small, sculpture with radial ribs, right valve without byssus **Limidae** 32
31* Valve outline of curved margin semicircular, ears large, sculpture of radial ribs and/or concentric lines right valve with byssus groove **Pectinidae** 35



32 (31) Valves large, > 4 cm, strongly inequivalve, anterior margin curved
Acesta patagonica
32* Valves small, equivalve, radial ribs ***Limatula*** 33

33 (32*) Valves twice as long as than wide
Limatula sp. 1 ⇨
33* Valves as long as wide 34

34 (33*) Valves with scaled radial ribs
Limatula hodgesoni
34* Valves with radial ribs without scales
Limatula pygmaea

35 (31*) Valves hyaline, thin, colourless, feeble structure, right valve convex or flat 36
35* Valves not translucent, yellow to red colour, distinct radial ribs 39

36 (35) both valves convex 37
36* right valve flat, left valve convex
Cyclopecten multistriatus sp. n. ⇨

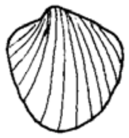
37 (36) right valve with concentric ribs, left valve smooth, < 10 mm
Delectopecten vitreus
37* both valves sculptured by narrow concentric and radial lines 38

38 (37*) valves up to17 mm height, similar sculpture on both valves, numerous fine radial ribs and 17 concentric lines, distinct byssus groove, posterior auricle with 5-7 tuberculated ribs, radial ribs at anterior umbonal slope with some scales
Pecten pygnolepis ⇨
38* valves < 10 mm, different sculpture on each valve, right valve with irregular narrow concentric lines and fine radials, left valve with very fine concentric lines and dense radials, posterior auricle with 4 radials
Cyclopecten falklandicum ⇨

39 (35*) Valves up to 75 mm high, rounded in adults, oval in juveniles, left valve more convex, 22-41 main radial ridges, white, red, yellowish, inside white, glossy
Chlamys patagonica
39* valves thin up to 50 mm, 15 main radial ridges, yellowish to purple, inside brown
Chlamys natans

40 (30*) Hinge line without teeth 41
40* Hinge line with cardinal and/or lateral teeth 54

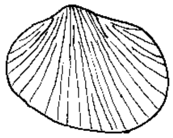
41 (40) Inner valves with mother-of-pearl, shiny 42
41* Inner valves without mother-of-pearl, dull 48



42 (41) Valves round or heart-shaped, white, polished, with numerous radial ribs
Lyonsiella radiata ⇨
42* Valves oval or elongated, white with brown, folded periostractum 43

43 (42*) Valves inequilateral, inequivalve, left valve convex, right valve flat 44
43* Valves inequilateral, equivalve, both valves convex 45

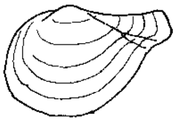
44 (43) posterior side distinctly elongated, 3-4 times longer than anterior, valves twice as long as high
Pandora patagonica
44* valves 1,5 times as long as high
Pandora braziliensis



45 (43*) Valves rounded to oval (l/h 1:0.8), hinge with 1 tooth in right valve, ligament external, septum, without byssus
Poromyidae 46
45* Valves distinctly inequilateral (l/h 1:0.5), umbones on first third of valves length, posterior side elongated, hinge toothless, ligament internal, strong lithodesma, sculpture with radiating ridges **Lyonsiidae**

46 (45) Valves oval, periostracum brownish, with fine radial lines, valves structureless 47
46* Valves nearly round (l/h 1:1), yellowish-olive periostracum, small ridge from beak to posterior end, long and slender cardinal tooth
Poromya chilensis

47 (46) valves ovate, surface smooth with fine radials, shell of green-purple colour, 8.3 mm x 6.7 mm x 5.5 mm
Poromya mactroides
47* valves ovate-oblong, surface about 38 radial lines, shell of grey-brownish, 10 mm x 8 mm x 5 mm
Poromya adelaides



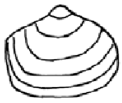
48 (41*) Posterior margin drawn out as a spout (rostrum)
Cuspidariidae 49
48* Valve habitus different 52

49 (48) Rostrum drawn out very long, as long as main valves width, clearly narrower than valve width
Cuspidaria patagonica
49* Rostrum different shaped, shorter 50

50 (49*) Valves with dominant concentric ribs
Cuspidaria tenella
50* Valves smooth, without ribs 51

51 (50*) Rostrum very short and wide, valve outline rounded
Cuspidaria chilensis ⇨
51* Rostrum longer, drawn out narrow
Cuspidaria infelix

52 (48*) Valves rounded, equivalve, inequilateral, hinge from umbo to anterior ventral margin **Thyasiridae** 53
52* Valves inequivalve, inequilateral
Thracia meridionalis



53 (52) Valves small, < 6 mm, thin, fragile, orange spot on valve
Genaxius debilis
53* Valves larger, polished, thicker valves
Thyasira falklandica

54 (40*) Ligament external, sometimes also internal 55
54* Ligament internal only or absent 83

55 (54) external and internal ligament present 56
55* only external ligament present 57

56 (55) valves nearly equilateral, small, < 15 mm width, distinct, sometimes pink prodissoconch, 2 cardinal teeth, posterior laterals
Kelliidae/ *Kellia* spp.
56* valves large, up to 40 mm, prodissoconch not distinct
Mactridae/ *Darina solenoides*

57 (55*) valves mytiloid 58
57* valves not mytiloid 60

58 (57) Valves large, thick, chalky, anterior end pointed, strong radial ribs, thick black periostracum
Aulacomya ater
58* Valves smooth, structureless 59

59 (58*) hinge with 3 or more small teeth
Mytilus chilensis
59* hinge with 1 or 2 big, truncated teeth
Choromytilus chorus

60 (57*) valves with distinct sculpture, concentric or radial ribs and grooves 61
60* valves sculptureless, except for growth lines 74

61 (60) valves with concentric ribs or grooves 62
61* valves with radial ribs **Carditidae, Cardiidae** 68

62 (61) valves small (< 10 mm), beaks prominent, prosogyrate, located towards posterior side of valves, thick yellowish-brown periostracum
Astarte longirostris
62* valves round or triangular, thin periostracum 63

63 (62*) valves thin, white, with widely spaced concentric ridges, umbo just anterior to midline, 2 cardinal teeth
Lucinoma lamellata
63* valves thick and strong, (> 10 mm width), umbo anterior to midline, 3 cardinal teeth **Veneridae** 64

64 (63*) valves triangular, small, < 8 mm
Gomphina faveolata
64* valves rounded, > 8 mm 65

65 (64*) valves round-oval, sculpture with numerous broad radial ribs and concentric lamellae, short, pointed pallial sinus, strong hinge
Ameghinomya antiqua
65* valves different 66

66 (65*) valves oval, sculpture with numerous broad concentric ribs
Tawera gayi
66* valves different 67

67 (66*) valves oval, narrow concentric ribs, posterior muscle round, pallial sinus short, round
Eurhomalea exalbida
67* valves subcircular, wider spaced concentric ribs, posterior muscle scar oval, pallial sinus longer, pointed
Eurhomalea lenticularis

68 (61*) valves roundish, white or brown, > 10 mm 69
68* valves triangular or squarish-oblong, white, < 10 mm 72

69 (68*) valves white, up to 22 mm length and 20 mm height, umbo strongly convex, in valves midline, about 38 radial ribs with tubercles on outer ribs
Trachycardium delicatulum
69* valves greenish-brown, well developed periostracum, beaks prosogyrate 70

70 (69*) valves round-oval, broad crenulated radiating ribs 71
70* valves oval-oblong, broad uncrenulated radiating ribs
Cyclocardia astartoides

71 (70) valves as long as broad, globose, sculpture of numerous elevated rounded and crenulated ribs, 19.4 mm x 19.7 mm x 14.3 mm (17 ribs)
Cyclocardia velutina
71* valves longer than broad, sculpture of numerous rounded and crenulated ribs, less elevated than in *C. velutina*, 25.8 mm x 21.5 mm x 17.9 mm (18 ribs)
Cyclocardia spurca

72 (68*) valves triangular, < 5 mm, internal resilium sunk between the beaks 73
72* valves squarish-oblong, feeble external ligament, prodissoconch clearly marked by concentric ridge, sculpture of broad radial ribs
Carditella naviformis

73 (72) prodissoconch smooth, dissoconch with 14 radial ribs
C*arditopsis flabellum flabellum*
73* prodissoconch smooth, marked off distinct concentric ridge, dissoconch with radial ribs
Carditopsis flabellum malvinae

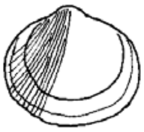
74 (60*) Valves very elongate, umbones at anterior end, gaping anteriorly and posteriorly, up to 100 mm long
Ensis macha
74* valves different 75

75 (74*) valves twice as long as high, umbones anteriorly, with one or two strong ridges radiating across the posterior valve, smaller valves with spines on ridges
Hiatella solida
75* valves different, valves smooth, with numerous radial ribs, or one feeble, rounded ridge from umbo to postero-ventral margin 76

76 (75*) valves large, > 15 mm (up to 35 mm), umbones just posterior to mid-line
Macoma inornata
76* valves smaller, different 77

77 (76*) valves rounded or oval, white **Cyamiidae** 78
77* valves oval, yellowish, green or brown, umbones anterior to midline, anterior margin convex **Gaimardiidae** 82

78 (77) valves rounded, white, with numerous radial ribs 79
78* valves oval, longer than high, hyaline 80



79 (78) valve sculpture of numerous fine radial ribs, margin fine denticulate
Cyamiocardium denticulatum
79* valve sculpture of numerous coarser radial ribs, margin heavily denticulate
Cyamiocardium crassilabrum

80 (78*) valves round-quadrangular, strongly convex, with rounded ridge running from umbo to postero-ventral margin
Cyamiomactra 81

80* valves oval, slightly convex, without ridge on valve
Cyamium spp.

81 (80) sculpture smooth except fine concentric growth lines, shell margin smooth
Cyamiomactra laminifera
81* sculpture of numerous fine radial ribs, shell margin crenulated
Cyamiomactra falklandica

82 (77*) hinge smooth, valve outline irregular with a weak anterior rostrum, up to 25 mm, periostracum brightly coloured
Gaimardia trapesina
82* hinge with 1 or 2 cardinal teeth, shell elongated, no rostrum, 3-5 mm, periostracum reddish-white, with fine growth lines
Kidderia minuta

83 (54*) ligament internal, hinge toothless, valves large 84
83* ligament internal or absent, hinge with cardinal and/or lateral teeth 86

84 (83) valves oval, big chondrophore in left valve
Sphenia hatcheri
84* valves elongated or highly modified (trilobed) 85

85 (84*) valves elongated-oval, pronounced sculpture at anterior end
Barnea subtruncata lamellosa
85* valves appearing trilobed
Bankia martensi

86 (83*) valves large, about 5 cm, oval-triangular, shell thick, entire internal ligament
Mulinia spp.
86* valves differently shaped, small or minute 87

87 (86*) valves rounded or oval, distinct prodissoconch, umbo in middle of dorsal margin, left valve with 1 cardinal and 2 lateral teeth, right with 2 lateral teeth **Erycinidae** 88
87* valves oval or triangular, feeble prodissoconch 89

88 (87) valves triangonal, beaks slightly prosogyrate, hinge plate narrow, 1 small thin cardinal, 1 posterior lateral tooth
Aligena pisum
88* valves ovate-quadrate, reddish brown, surface with wrinkled sculpture, strong hinge, with large laterals and slender, thornlike cardinal tooth
Lasaea spp.

89 (88*) valves subquadrate to rounded triangonal, anterior end longer, hinge without cardinal teeth, 1 lateral tooth, with byssus, prominent umbo on anterior edge or first third of dorsal margin **Montacutidae** 90
89* hinge with 1 or 2 cardinal teeth, 2 lateral teeth, umbo in centre of dorsal margin 93

90 (89) valves triangular, oblique, large posterior umbo, very strong hinge
Mysella sculpta
90* valves oval-subquadrate, hinge not as strong 91

91 (90*) valves oval, anterior margin convex, umbo near to anterior end
Mysella antarctica
91* valves more subquadrate, anterior margin straight, short, umbo at anterior end 92

92 (89*) valves 3.5 mm length, 2.5 mm height, 1.2 mm diameter
Mysella charcoti
92* valves 2.2 mm length, 1.7 mm height, 1.4 mm diameter, higher in proportions, convexer, anterior margin more truncate
Mysella mabillei

93 (92*) valves oval, thin, very fragile, semi-transparent, gaping at each end, sculpture with few radial striae, overlapping periostractum, 1 cardinal and 2 lateral teeth, hinge teeth well developed, on widened hinge plate
Solecardia antarctica
93* valves oval or triangular, thin, glossy, 1 cardinal tooth and 2 lamellate laterals 94

94 (93*) valves triangular, small, very strong hinge
Neolepton falklandicum
94* valves oval, hinge smaller 95

95 (94*) umbo at the middle, strong hinge
Neolepton umbonatum
95* umbo slightly before the middle, hinge weaker than in *N. umbonatum*
Neolepton hupei

4.2. Systematic report and descriptions of the molluscan fauna

The following taxonomic section focuses mainly on the shelled molluscs of the Magellan region but additionally analysed trochid species from Antarctica and further undescribed species from Antarctica are also included. Magellanic scaphopods are excluded because notes on their systematics are published in Steiner & Linse (in press).

First descriptions and synonyms are mentioned. Only synonyms are cited which were published either later than the check-list of Powell (1960) for Magellanic species or later than the study of Hain (1990) for Antarctic species.

This descriptive part includes

42 species of shelled Gastropoda and
10 species of Bivalvia.

The Mollusca were collected on the expeditions of RVs “Victor Hensen” ’94, “Vidal Gomaz” ’95 and ’96, and “Polarstern” ANT XIII/2, XIII/4-2, and XIV/2 with towed gears (epibenthic sledge, Rauschert dredge, Agassiz trawl, and bottom trawl) and on Rothera Research Station by scuba divers.

4.2.1. Gastropoda

Family LEPETIDAE
Genus *Iothia* Gray, 1857
Iothia coppingeri magellanica subsp. nov.
(Plate I, Figs. 9.1.1- 1-4)

Iothia coppingeri (Smith, 1881)
Tectura (Pillidium) coppingeri Smith 1881: 35, pl.4, Fig. 12+12a; *Lepeta coppingeri*: Powell 1960: 129; Castellanos & Landoni 1988: 32, Fig.6 *Iothia coppingeri*: Hain 1990: 37: pl.1, Fig. 4a-c, pl.17, Fig.4; *Lepeta coppingeri*: Linse 1997: 26; *Iothia coppingeri*: Linse 1999: 400

Description: The shell is small sized, elongate-oval patelliform, thin, fragile, hyaline, white or dirty white in colour, sometimes covered by microalgae. The pointed apex is raised and situated at 1/5 anteriorly (Fig. 9.1.1-1). External surface covered by numerous tuberculed radiating ridges. Internal surface glossy white and smooth.

The animal is yellowish-white. The mantle is thick with a smooth surface. The head is large with a large snout and short, stout cephalic tentacles, about 1/4 of animal length. Snout with mamillated edge. The eyes on the anterior edge of the eye lobe is black. The eye lobe is 1/6 of length of cephalic tentacles. The foot is large with an oval sole.

The radula is derived docoglossate, with the formula D : 2 : R : 2 : D in 30 transverse rows (Fig. 9.1.1-2). The rows are widely spaced. The lateromarginal and marginal teeth are totally reduced. The rachidian tooth is large, of an orange colour, and easily detached from the radula band when dried. It is symmetric, curved, with a central groove on the inside, and a thickened central ridge on the outside. The first lateral tooth is shorter than the rachidian, massive with a wide stout central cusp. The second lateral tooth is reduced to a short triangulate cusp. The third lateral is curved oblong, asymmetric lanceolate, with a raised central rip, sometimes with a second less prominent rip, the margins are heavily folded, tip fingered (Fig. 9.1.1-3).

Type material: Holotype ZMH 2250 VH 806 VH St. 1178, 3 paratypes ZMH 2851 REM 7, 129 VH St. 1213, 68 paratypes ZMH 2852 VH 1213

Material examined: St. 1184 (1 S), St. 1192 (1 A), St. 1200 (6 A, 256 S), St. 1206 (1 A, 9 S), St. 1213 (28 A, 43 S), St. 1216 (1 A), St. 1237 (1 S)

Previous (distribution) records: *Iothia coppingeri* (Smith, 1881) is a common species in the Southern Ocean and is recorded for the Magellan region, Falkland Islands, South Sandwich Islands, South Orkney Islands, South Shetland Islands, circumantarctic, Crozet Island, and Kerguelen Islands (Fig. 4.2-1); 5-1108 m

Iothia coppingeri magellanica: Magellan region (Fig. 4.2-1a); 25-123 m

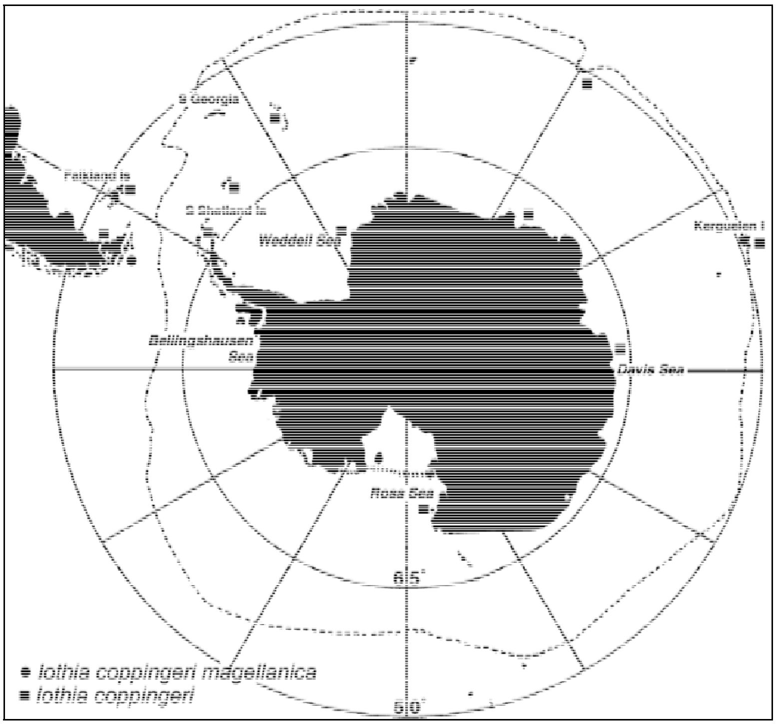


Fig. 4.2-1. Distribution of *Iothia coppingeri* and *Iothia coppingeri magellanica*

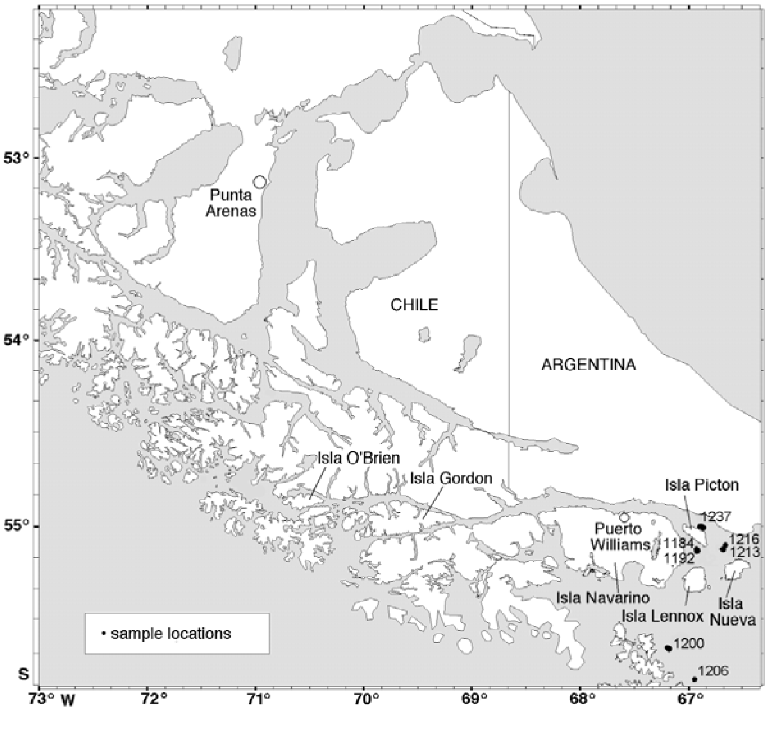


Fig. 4.2-1a. Distribution and sample locations of *Iothia coppingeri magellanica* subsp. nov.

Comparative remarks: *Iothia coppingeri* (Smith, 1881) is the only species of this genus recorded in the Southern Ocean. Shells of the individuals found in the MR are remarkably smaller than those collected in the Weddell Sea but are similar to those in other shell characters. The three radulae of the MR specimens differ from the high-Antarctic *Iothia coppingeri* illustrated by Hain (1990) in the shape of the third lateral tooth. While in the former described specimens the third lateral is a dominant one, in *I. coppingeri* two outer laterals occur (Fig. 9.1.1-4). A long and slender asymmetric tooth with multicuspid outer margin is standing in the groove of a wide, asymmetric lanceolate outer tooth. This one has as well a multicuspid outer margin, the inner margin is unicuspid.

The new subspecies is pronounced because of this differences in the radula. A differentiation based only on shell characters is not possible.

Family SCISSURELLIDAE

Genus *Anatoma* Woodward, 1859

Anatoma clathrata (Strebel, 1908)

(Plate I, Figs. 9.1.1- 5-8)

Scissurella clathrata Strebel 1908: 77, pl.6, Fig.84 a-c; Powell 1960: 126; Castellanos & Landoni 1988: 32, pl.1, Fig.3; Linse 1997: 26; Linse 1999: 400

Description: The shell is minute (about 1.6 mm in height and 1,7 mm in diameter), hyaline when fresh, white, and solid. The surface is covered with fine axial and spiral lines, with a marginal slit (Figs. 9.1.1-5,6). Protoconch small and smooth (Fig. 9.1.1-7). Teleoconch about 2.5 in number of turns, whorls shoulderless. The body whorls is large. The aperture is large and round.

The radula is rhipidoglossate, with the formula $\infty : 5 : 1 : 5 : \infty$ (~ 27) and comprises 35 to 39 rows (Fig. 9.1.1-8). The rachidian tooth is rhombic in outline with large triangular lateral wings on both sides. The tooth is folded at widest part of lateral wings and two medial denticles sit above this fold. The overhanging cusp has a single larger main denticle and 3 denticles on each side. Shafts of lateral teeth one to four with elbows corresponding to lateral wings of rachidian. The first to third lateral teeth similar, overhanging edge with one major cusp and two to three minor cusps. The fourth lateral is sickle-shaped, smaller and weaker than the others, with a single cusp. The fifth lateral is longer and wider than the others, has a central ridge, and with six to eight denticles on the inner margin of tip. The outmost denticle is the largest. The marginal teeth are similar, except of the innermost one, long and slender with a multidenticulated central cusp and decreasing in cusp-sized outwardly. The innermost marginal tooth is about twice as wide as the other marginals, numerous outer flanking cusps, and a multidenticulated central cusp.

Material examined: VH St. 813 (1 animal), St. 972 (4 A), St. 1176 (1 A), St. 1178 (35 A, 10 S), St. 1184 (2 S), St. 1200 (43 A, 128 S), St. 1213 (302 A, 207 S), St. 1216 (1 A), St. 1221 (3 A), St. 1237 (1 S)

Previous (distribution) records: Strebel (1908) Tierra del Fuego, 54°43’ S, 64°08’ W, 36 m; Castellanos & Landoni (1988) Falkland Islands (Fig. 4.2-2); 25-110 m

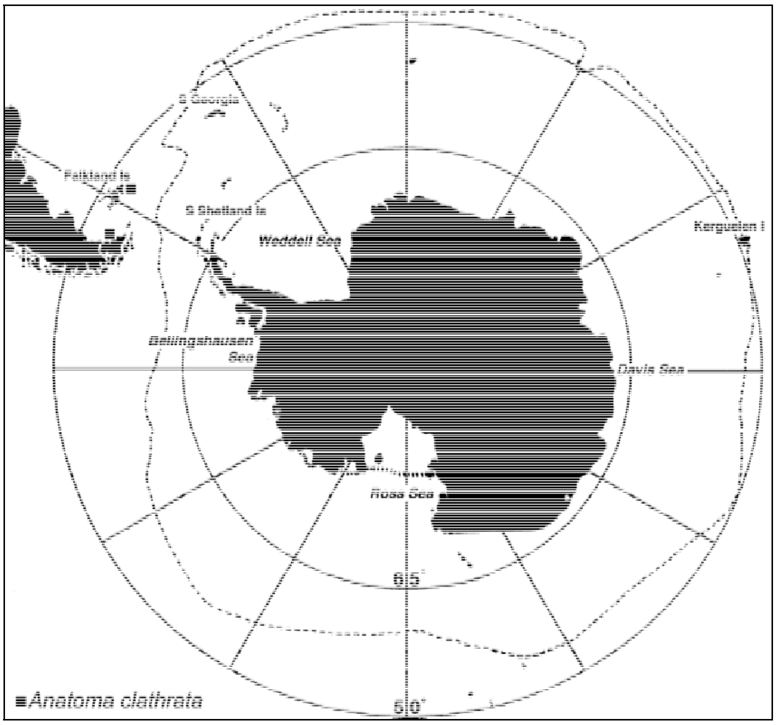


Fig. 4.2-2. Distribution of *Anatoma clathrata*

Comparative remarks: *Anatoma clathrata* can be distinguished from *Scissurella timora* (Melvill & Standen, 1912) by having a shell of nearly equal diameter and height and without shoulders, and from *Anatoma conica* (d’Orbigny, 1841) by the distinct axial ribs the latter species has. McLean (1989) analysed shell and radula characters of the Scissurellidae. *Anatoma* is characterised by a smooth protoconch while the protoconch of *Scissurella* has axial ribs. Due to this character *clathrata* is placed into *Anatoma*. The Antarctic and Magellanic species of *Anatoma*, *A. amoena* (Thiele, 1912), *A. euglypta* (Pelseneer, 1903), and *A. conica*, were first described as *Scissurella* as well (Dell 1990). Unfortunately there was no material of *S. timora* available to prove its generic position.

Family TROCHIDAE
Subfamily Trochinae Rafinesque, 1815
Tribe Gibbulini Stoliczka, 1868
Genus *Margarella* Thiele, 1893
Margarella violacea (King & Broderip, 1831)
(Plate II, Figs. 9.1.1- 9-12)

Margarita violacea King & Broderip 1831: 346; *Margarella violacea*: Powell 1960: 131; De Deambrosi 1969: 51; Castellanos & Landoni 1988: 16, pl.3, Fig.4; Linse 1999: 401

Description: The shell is small in size, wider than high (up to 8.4 mm in height and 9.9 mm in diameter) with depressed spires, solid. The surface is covered with numerous fine spiral lines, dark pink or pink without periostracum. Protoconch small, about 1.5 in number of turns, smooth, white, glossy, and in all examined specimens too eroded to be scanned. Teleoconch about 5 in number of turns, the suture is impressed. The body whorl is large. The base is roundly inflated. The umbilicus is closed. The aperture large, oval (5.1 mm in width, 4.9 mm in height), with a pink-green pearly lustre inside except outside of inner lip. Peristome smooth. Operculum is corneous, multispiral with a short growing edge, and equal in size to the aperture (Fig. 9.1.1-9).

The animal is pale beige in colour and has a single pair of cephalic tentacles. The eyes are large, located in posterior side of cephalic tentacles and black in colour.

The radula is rhipidoglossate, with the formula $\infty : 5 : 1 : 5 : \infty$ (~ 25) (Fig. 9.1.1-10). It has about 31 transverse rows, is about 100 µm in width and 4.3 mm in length. The rachidian tooth is deltoid in outline, with triangulates lateral, slightly incurved wings (Fig. 9.1.1-11). It has a concave tip with a large, triangular central cusp that is serrated with 5 to 6 lateral denticles on each side. The lateral teeth are large, increase in size outwards, have a lateral wing on the outer margin and a long, serrated unicuspid tip. The central cusp is long, rounded, and has 6 to 8 flanking denticles on each side. The first marginal tooth is wider and stronger than the others, has a strong basal projection on the inner base, and an unicuspid, rounded tip with 6 to 7 denticles on each side (Fig. 9.1.1-12). The second to tenth marginals are long and slender, spatulate, with a large denticle on the stalk near to tip. Main cusp of tip broad and rounded, with 7 to 9 pointed denticles on each flanking side. Outer marginal teeth are long and very slender, with a curved spatulate tip and numerous very fine denticles.

Material examined: VG `96 St. 46 (2 animals, 2 S), St. 56 (2 S); VH St. 1164 (3 animals), St. 1178 (3 animals, radulae scanned), St. 1192 (5 S), St. 1212 (2 S), St. 1216 (1 S); ANT XIII/4-2 St. 40-109 D (3 S), ZMH

Previous (distribution) records: Magellan region, Falkland Islands (e.g. Strebel 1905) (Fig. 4.2-3); 0-156 m

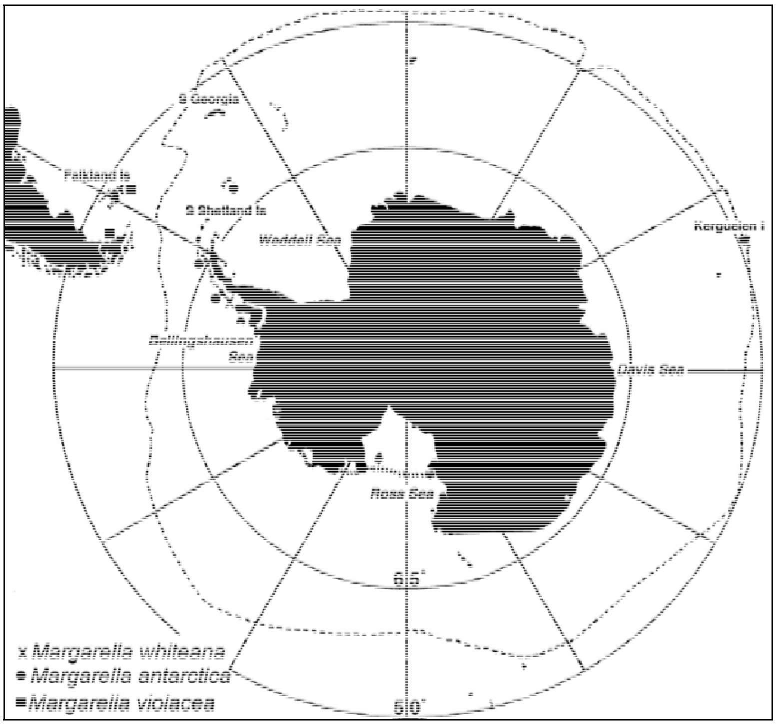


Fig. 4.2-3. Distribution of *Margarella violacea*, *M. antarctica* and *M. whiteana* sp.nov.

Comparative remarks: The radula of *M. violacea* was described by De Deambrosi (1969). Her drawing is similar to the radula analysed in this study. *M. violacea* is similar to *Homalopoma cunninghami* (Smith, 1881) in shell size and colour but can be separated by the following characters: 1) closed umbilicus, 2) horny operculum, 3) rachidian with long tip, and 4) marginal-rachidian-marginal line convex.

Margarella antarctica (Lamy, 1905)
(Plate II, Fig. 9.1.1- 13-16)

Margarita antarctica Lamy 1905: 481, Fig.5; *Margarita antarctica*: Powell 1960: 131; De Deambrosi 1969: 50

Description: The shell is small in size, wider than high (up to 6.7 mm in height and 7.8 mm in diameter) with depressed spires, solid. The surface is smooth, white, without periostracum. Protoconch small (about 400 to 420 µm), about 1.5 in number of turns, smooth, white and glossy (Fig. 9.1.1-13). Teleoconch about 4 in number of turns, the suture is impressed. First to first and a half teleoconch whorl is sculptured with two to four spiral ribs. The body whorl is large. The base is roundly inflated. The umbilicus is open (0.7 mm in diameter). The aperture large, oval (3.6 mm in width, 4.0 mm in height), with a pink-green pearly lustre inside. Peristome smooth. Operculum is corneous, light brown, multispiral with a short growing edge, and equal in size to the aperture.

The animal is orange-yellow in colour and has two pairs of cephalic tentacles. The eyes are large, located in posterior side of cephalic tentacles and black in colour. The five pairs of long and slender epipodial tentacles have a broad base.

The radula is rhipidoglossate, with the formula ∞ : 5 : 1 : 5 : ∞ (~ 25) (Fig. 9.1.1-14). It has about 43 transverse rows, is about 530 µm in width and 2.6 mm in length. The rachidian tooth is deltoid in outline, with triangulates lateral, slightly incurved wings (Fig. 9.1.1-15). It has a concave tip with a large, broad central cusp that is serrated with 9 lateral denticles on each side. The lateral teeth are large, increase in size outwards, have a lateral wing on the outer margin and a long, serrated unicuspid tip. The central cusp is long, rounded, and has 9 to 11 flanking denticles on each side (Fig. 9.1.1-16). The first marginal tooth is wider and stronger than the others, has a long basal projection on the inner base, and an unicuspid, rounded tip with flanking denticles on each side. Other marginal teeth are long and slender, with a curved spatulate tip and numerous flanking denticles. The marginal teeth decrease in size outwards.

Material examined: Rothera, Peninsula cruise, Signy Island

Previous (distribution) records: South Orkney Islands, South Shetland Islands, Palmer Archipelago, Wandel, Moureau, and Petermann Island, (Lamy 1905, Thiele 1912, Powell 1951) (Fig. 4.2-3); 0-36 m

Comparative remarks: The radula of *M. antarctica* was described by De Deambrosi (1969). Her drawing, especially the first marginal tooth, is different to the radula analysed in this study. De Deambrosi (1969) placed *antarctica* in *Margarites* because of the missing long basal projection on the inner base. All 3 specimens analysed in this study show this basal projection. Powell (1951) separated *Margarella* from *Margarites* by having transverse rows with a slight dip at the middle, and placed *antarctica* in *Margarella*. *M. antarctica* can be separated from *M. whiteana* sp. nov. by missing spiral ribs on all teleoconch whorls.

Margarella whiteana sp.nov.
(Plate III, Figs. 9.1.1- 17-20)

Description: The shell is small in size, wider than high (up to 7.6 mm in height and 8.7 mm in diameter) with depressed spires, solid. The surface is covered with numerous spiral ribs, porcellaneous white, without periostracum (Fig. 9.1.1-17). Protoconch small (about 390 µm in diameter), about 1.5 in number of turns, smooth, white, glossy (Fig. 9.1.1-18). Teleoconch about 4.3 in number of turns, the suture is impressed. The body whorl is large. The base is roundly inflated. The umbilicus is open (1.0 mm in diameter). The aperture large, oval (5.1 mm in width, 5.9 mm in height), with a silver-green pearly lustre inside except inside of outer lip. Peristome smooth. Operculum is corneous, yellow, multispiral with a short growing edge, and equal in size to the aperture.

The animal is pale yellow in colour and has two pairs of short cephalic tentacles. The eyes are large, located in posterior side of cephalic tentacles and black in colour. The five pairs of long and slender epipodial tentacles.

The radula is rhipidoglossate, with the formula ∞ : 5 : 1 : 5 : ∞ (~ 30) (Fig. 9.1.1-19). It has about 41 transverse rows, is about 460 µm in width and 2.5 mm in length. The rachidian tooth is deltoid in outline, with triangulates lateral, slightly incurved wings (Fig. 9.1.1-20). It has a concave tip with a large, pointed central cusp that is serrated with 7 lateral denticles on each side. The lateral teeth are large, increase in size outwards, have a lateral wing on the outer margin and a long, serrated unicuspid tip. The central cusp is long, rounded, and has 9 to 11 flanking denticles on each side. The first marginal tooth is wider and stronger than the others, has a long basal projection on the inner base, and an unicuspid, rounded tip with flanking denticles on each side. Other marginal teeth are long and slender, with a curved spatulate tip and numerous flanking denticles. The marginal teeth decrease in size outwards.

Type material: Holotype ZMH 2820, Rothera Point, North Cove (67°33,84 S, 68°07,35 W), 26.12.1998, 15 m; 12 paratypes ZMH 2821, Rothera Point, North Cove (67°33,84 S, 68°07,35 W), 26.12.1998, 15 m; 9 paratypes ZMH 2822, Rothera Point, East Beach (67°34,17 S, 68°06,89 W), 16.02.1999, 28 m; 3 paratypes ZMH 2823, Rothera Point, East Beach N (67°34,07 S, 68°06,52 W), 23.02.1999, 21 m; 2 paratypes ZMH 2824, Rothera Point, South Cove (67°34,371 S, 68°07,610 W), 07.01.1999, 3 m; 7 paratypes ZMH 2825, Leonie Island, Leonie N (67°35,521 S, 68°20,163 W), 17.02.1999, 25 m (Fig. 4.2-3, 4.2-3a); 3-28 m

Etymology: The species is named in honour of Martin G. White who has studied the Antarctic ecosystem for more than 30 years and loved this continent.

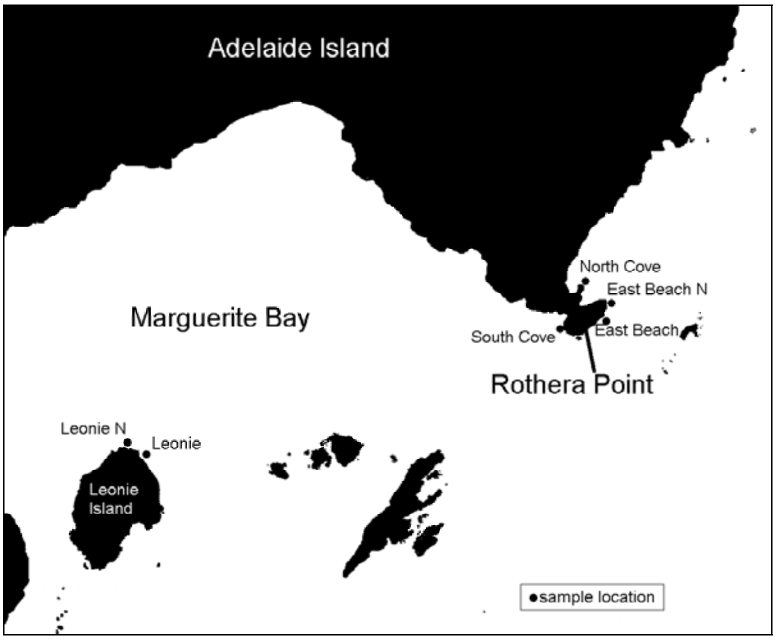


Fig. 4.2-3a. Sample locations of *Margarella whiteana* sp. nov.

Comparative remarks: The transverse radula rows with a slight dip at the middle and the occurrence of the basal projection on the first marginal tooth placed this new species in *Margarella* according to Powell (1960) and De Deambrosi (1969). *M. whiteana* is similar to *M. antarctica* (Lamy, 1905) in shell morphs and colour but can be separated by the following characters: 1) numerous spiral ribs on the teleoconch whorls, 2) smaller in shell size, 3) smaller umbilicus, and 4) rachidian with longer central cusp and less flanking denticles. The radula of *M. whiteana* is to the radula analysed in this study. Both species occur in the Margarite Bay, Adelaide Island on the same substrates (on seaweed and between pebbles) and graze on benthic diatoms (pers. observations).

Subfamily Calliostomatinae Thiele, 1924
Genus *Calliostoma* Swainson, 1840
Calliostoma consimilis (Smith, 1881)
(Plate III, Figs. 9.1.1- 21-24)

Calliostoma consimilis Smith 1881: 34, pl.4, Fig.11; Strebel 1905: 123, pl.5, Fig.21; Castellanos & Fernandez 1976:139, pl.2, fig1+2, pl.5, Fig.11; Castellanos & Landoni 1989: pl.1, Fig.4; Linse 1997: 28; Linse 1999: 400

Description: The shell is medium in size, higher than wide (up to 12.9 mm in height and 11.4 mm in diameter, 7.5 in number of whorls), with raised spire, thin, but solid. The surface is covered with numerous strong spiral ribs, glossy, dark pink or pink without periostracum. Protoconch small (420 µm in diameter), about 1.5 in number of turns, smooth, light pin, glossy, with honeycomb-like structure (Fig. 9.1.1.-21). Teleoconch about 6 in number of turns, sculptured with spiral cords of which the uppermost one is nodulous, and the suture is slightly impressed. The body whorl is large. The base is nearly straight. The umbilicus is closed. The aperture large, ovate-rectangular (5.4 mm in width, 5.6 mm in height), with a keel on the basal outer lip, with a pink-silvery pearly lustre inside. Peristome smooth. Operculum is corneous, yellowish-brown, thin, multispiral with a short growing edge, and equal in size to the aperture.

The animal is pale brown in colour, has a single pair of short, broad and pointed cephalic tentacles. The eye is large, eye stalks half size of cephalic tentacles. Epipodial tentacles in three pairs, short and broad. The mantle is papillated and pale brown.

The radula is rhipidoglossate, with the formula ∞ : 5 : 1 : 5 : ∞ (~ 30) (Fig. 9.1.1-22). The rachidian tooth is long in outline, with a wider base (Fig. 9.1.1-23). It has a triangular tip with a thin and pointed central cusp that is serrated with 7 very fine lateral denticles on each side. The lateral teeth have thin, flat but broad bases and long and slender shafts with feathery cusps. The first to third marginal teeth have thick and strong bases and shafts, and 9 to 11 strong hooked cusps on the inner margin near the tip (Fig. 9.1.1-24). The other marginals are long and very slender. About 1/3 of the teeth are fine and feathery cusped. No jaws present.

Material examined: VH St. 1152 (2 A), St. 1164 (3 A, 3 S), St. 1176 (8 S), St. 1178 (6 animals, 3 radulae scanned), St. 1183 (1 A), St. 1192 (1S), St. 1213 (2 A, 23 S), St. 1216 (2 A); ANT XIII/4-2 St. 40-110 (2 S), ZMH

Previous (distribution) records: Magellan region (Fig. 4.2-4); 15-109 m

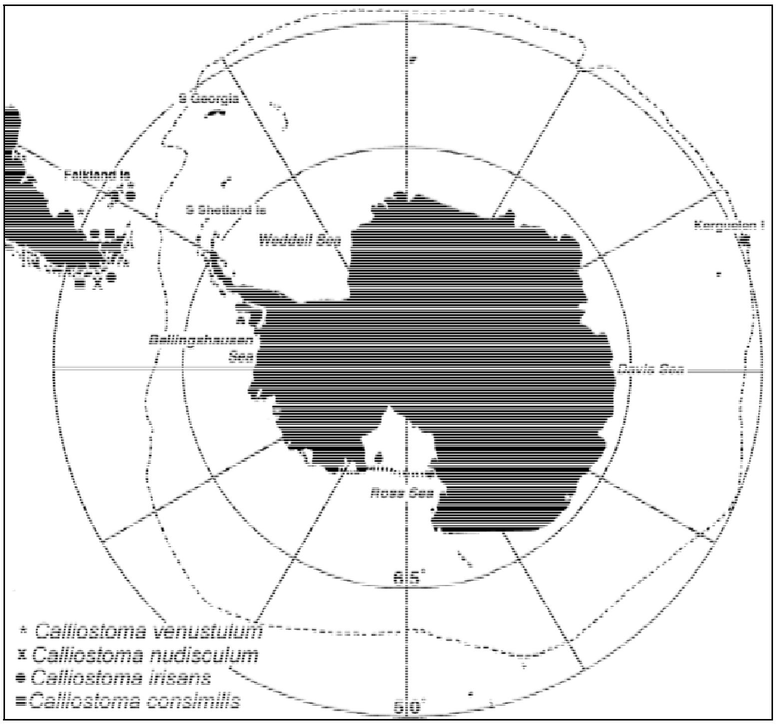


Fig. 4.2-4. Distribution of *Calliostomavenustulum*, *C. nudisculum*, *C. irisans* and *C. consimilis*

Comparative remarks: Strebel (1905) described the shell characters and Castellanos (1976) the radula.

Calliostoma irisans Strebel, 1905
(Plate IV, Figs. 9.1.1- 25-27)

Calliostoma irisans: Smith 1881: 34, pl.4, Fig.11;Strebel 1905: 123, pl.5, Fig.21; Castellanos & Fernandez 1976:139, pl.2, fig1+2, pl.5, Fig.11; Castellanos & Landoni 1989: pl.1, Fig.4; Linse 1997: 28; Linse 1999: 400

Description: The shell is small in size, wider than high (up to 5.2 mm in height and 5.5 mm in diameter) with erased spires, thin. The surface is smooth except spiral ribs near to the suture, white without periostracum. Protoconch small, about 1.5 in number of turns (about 450 µm in diameter), with honeycomb patterns, white, glossy (Fig. 9.1.1-25). Teleoconch about 4 in number of turns, the suture is impressed, the whorls inflated. The body whorl is large. The umbilicus is closed. The aperture medium in size, roundly-quadrate (2.8 mm in width, 2.4 mm in height), with a white pearly lustre inside. Peristome smooth. Operculum is corneous, thin, yellowish-brown, multispiral with a short growing edge, and slightly smaller than the aperture.

The animal is pale beige in colour and has a single pair of long, stout cephalic tentacles. The eyes are large, located in posterior side of cephalic tentacles on short eye lobes, and black in colour. The pair of epipodial tentacles is short and stout, the epipodium is covered with numerous micropapillae. The mantle is thin and the mantle edge is pigmentated.

The radula is rhipidoglossate, with the formula ∞ : 5 : 1 : 5 : ∞ (~ 30) (Fig. 9.1.1-26). The rachidian tooth is long and slender in outline, with a wider base. It has a triangular tip with a thin and pointed central cusp that is serrated with very fine lateral denticles on each side. The lateral teeth have thin, flat but broad bases and long and slender shafts with about 13 feathery cusps on each side (Fig. 9.1.1-27). The first to third marginal teeth have thick and strong bases and shafts, and 12 strong hooked cusps on the inner margin near the tip. The other marginals are long and very slender. About 1/4 of the teeth are fine and feathery cusped. No jaws present.

Material examined: VG `96 St. 46 (2 animals (radula scanned), 3 S); ANT XIII/4-2 St. 40-110 (3 A, 1 S), ZMH

Previous (distribution) records: Magellan region, Falkland Islands (Fig. 4.2-4); 36-100 m

Comparative remarks: Strebel (1905) described the species and Castellanos (1976) the radula.

Calliostoma nudisculum (Martens, 1881)
(Plate IV, Figs. 9.1.1- 28-30)

Calliostoma nudisculum Martens 1881: 34, pl.4, Fig.11; Strebel 1905: 131, pl.5, Fig.27a+b; Castellanos & Landoni 1989: pl.1, Fig.2, pl.3, Fig.1; Linse 1999: 400

Description: The shell is medium in size, about as wide as high (up to 14.2 mm in height and 14.4 mm in diameter) with erased spires, thin, but solid. The surface is covered with 5 nodulous spiral cords, pink with white lines, without periostracum. Protoconch small (about 450 µm in diameter), about 1.5 in number of turns, honeycomb patterns, white, glossy (Fig. 9.1.1-28). Teleoconch about 6 in number of turns, the suture is slightly impressed. The body whorl is large. The base is roundly inflated. The umbilicus is closed. The aperture large, oval-quadrate (7.3 mm in width, 6.5 mm in height), with a light pearly lustre inside except outer lip. Peristome smooth. Operculum is corneous, very thin, yellow, multispiral with a short growing edge, and smaller than aperture (opercular retraction deep).The animal is light yellowish in colour and has a single pair of broad cephalic tentacles. The eyes are large, located in posterior side of cephalic tentacles and black in colour. The epipodium has 4 pairs of short epipodial tentacles and small micropapillae. The mantle is pigmentated.

The radula is rhipidoglossate, with the formula $\infty : 5 : 1 : 5 : \infty$ (~ 20) (Fig. 9.1.1-29) and consists of about 60 transverse rows. The rachidian tooth is long and slender in outline, with a wider base. The lateral teeth have thin, flat but broad bases and long and slender shafts. The marginal teeth are long and very slender and have fine cusped shafts (Fig. 9.1.1-30). The tips of the inner marginal teeth have numerous small denticles on the inner flanking side and 10 to 14 strong and pointed cusps on the outer flanking side. The jaws are well developed (about 950 µm in length and 1300 µm in width) and show a scale-like pattern of overlapping, elongate-rectangular plates (Fig. 9.1.1-30).

Material examined: VG `96 St. 52 (1 animal); VG ’97 St. 92 (3 A, 2 S), Holotype HUM 33269

Previous (distribution) records: Magellan region (Fig. 4.2-4); 36-156 m

Comparative remarks: *C. nudisculum* can be distinguished from the other Magellanic species of *Calliostoma* by having a white and pink shell with numerous spiral cords. The radula of *C. nudisculum* can be separated from those of *C. consimilis* and *irisans* by having stronger marginal teeth with numerous thornlike cusps and the occurrence of a jaw, and from *C. venustulum* by a less wide rachidian and larger jaw-plates.

Calliostoma venustulum Strebel, 1908
(Plate IV, Fig. 9.1.1- 31, 32)

Calliostoma venustulum Strebel 1908: 68, pl.1, Fig.12a-c; Powell 1960: 130; Linse 1999: 400

Description: The shell is medium in size, about as wide as high (up to 14.5 mm in height and 14.8 mm in diameter) with erased spires, thin, but solid. The surface is covered with 1 nodulous spiral cord near suture, pearly white in colour, and without periostracum. Protoconch small, about 1.5 in number of turns, honeycomb patterns, white, and glossy. Teleoconch about 5.5 in number of turns, the suture is slightly impressed. The body whorl is large. The base is roundly inflated. The umbilicus is closed. The aperture large, oval-quadrate (8.0 mm in width, 7.6 mm in height), with a light pearly lustre inside except outer lip. Inner lip thickened. Peristome smooth. Operculum is corneous, very thin, light brown, multispiral with a short growing edge, and same size as aperture. The animal is brown in colour and has a single pair of broad cephalic tentacles. The eyes are large, located in posterior side of cephalic tentacles and black in colour. The epipodium has 2 pairs of short epipodial tentacles. The mantle is smooth and unpigmentated.

The radula is rhipidoglossate, with the formula ∞ : 5 : 1 : 5 : ∞ (~ 30) (Fig. 9.1.1-31) and about 6,5 mm long. The rachidian tooth is long and wide in outline, with a widened base. It has a triangular tip with a pointed central cusp and 10 to 12 lateral denticles on each side. The lateral teeth have thin, flat but broad bases and long and slender shafts with about 10 to 12 feathery cusps on each side. The first to third marginal teeth have thick and strong bases and shafts, and 6 to

8 strong hooked cusps on the inner margin near the tip. The fourth and next marginals have 12 strong and pointed cusps along the tip with increase in size towards the outer teeth. The other marginals are long and very slender. The jaws are well developed (about 1300 µm in length and 1700 µm in width), yellowish-brown, and show a scale-like pattern of overlapping, elongate-rectangular plates (Fig. 9.1.1-32).

Material examined: ANT XIII/4 St. 40-109 (2 animal); RV “Walter Herwig” St. 558 (49°11,9 S, 65°21,7 W), 21.05.1978, 105-106 m (2 A); Holotype SNM 917

Previous (distribution) records: Magellan region, Falkland Islands (Fig. 4.2-4); 40-250 m

Comparative remarks: *Calliostoma venustulum* can be separated other Magellanic *Calliostoma* by its uniform white shell and its radula characters, especially the wide rachidian.

Genus *Photinula* Adams & Adams, 1854

Photinula caerulescens (King & Broderip, 1831)

(Plate V, Fig. 9.1.1- 33-36)

Margarita caerulescens King & Broderip 1831: 346; *Photinula caerulescens*: Powell 1960: 130; Castellanos & Landoni 1989: pl.4, Fig.1; Linse 1999: 401

Description: The shell is medium in size, wider than high (up to 11.2 mm in height and 16.2 mm in diameter) with depressed spires, solid. The surface is smooth, with numerous black spiral lines, without periostracum. Protoconch medium (about 500-540 µm in diameter), about 1.3 in number of turns, smooth, white, and glossy (Fig. 9.1.1-33). Teleoconch about 4,5 in number of turns, the suture is impressed. Ground colour of teleoconch pink and white with black spiral lines. The body whorl is large. The base is roundly inflated. The umbilicus is closed. The aperture large, oval (7.4 mm in width, 7.2 mm in height), with a pink-green pearly lustre inside except small area of inner lip. Peristome smooth.

Operculum is large, corneous, dark brown, multispiral with a short growing edge, and equal in size to the aperture.

The animal is pale beige in colour and has a single pair of cephalic tentacles. The eyes are large, located in posterior side of cephalic tentacles and black in colour. The epipodium has six pair of short tentacles.

The radula is rhipidoglossate, with the formula ∞ : 5 : 1 : 5 : ∞ (~ 20) (Fig. 9.1.1-34). It has about 50 to 70 transverse rows, is about 770 µm in width and 2.4 mm in length. The rachidian tooth is long and wide in outline, with a widened base. It has a triangular tip with a pointed central cusp and 10 to 12 lateral denticles on each side (Fig. 9.1.1-35). The lateral teeth have thin, flat but broad bases and long and slender shafts with about 12 to 15 feathery cusps on each side. The first marginal tooth is wider and stronger than the others, has a strong basal projection on the inner base, and an unicuspid, rounded tip with 9 to 11 denticles on the inner flanking side. The second to fifth marginals are similar to the first but less strong and with an elongated tip. The outer marginal teeth are long and very slender, with a curved spatulate tip and numerous very fine denticles. The jaws are well developed (about 1150 µm in length and 770 µm in width for one side only), yellowish-brown, and show a scale-like pattern of overlapping, elongate-rectangular plates (Fig. 9.1.1-36).

Material examined: VG `97 St. 92 (15 animals, 3 S)

Previous (distribution) records: Magellan region, Falkland Islands, South Georgia (Fig. 4.2-5); 0-202 m

Comparative remarks: *Photinula caerulescens* has a protoconch with honeycomb patterns like *Calliostoma* but it is larger in size and the shell outline is more convex. The radula characters are similar to those of *Calliostoma* as well.

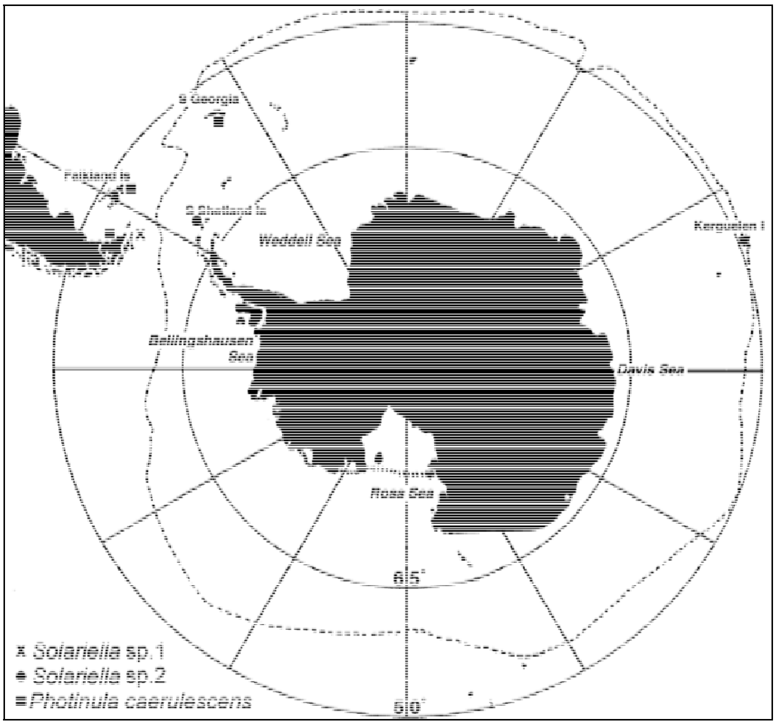


Fig. 4.2-5. Distribution of *Photinula caerulescens*, *Solariella* sp.1 and *Solariella* sp.2

Subfamily Solariellinae Powell, 1951

Genus *Solariella* Wood, 1842

Solariella sp. 1

(Plate V, Fig. 9.1.1- 37-40)

Description: The shell is medium in size, higher than wide (up to 11.2 mm in height and 10.5 mm in diameter) with erected spires, solid (Fig. 9.1.1-37). The surface is fine sculptured, with two spiral lines, without periostracum. Protoconch large, about 1.5 in number of turns, smooth, white, and glossy. Teleoconch about 4 in number of turns, the suture is impressed. Teleoconch grey in colour with pinkish pearly lustre. The body whorl is large. The base is roundly inflated. The umbilicus is deep and wide open (about 1,3 in diameter). The aperture medium, oval (4.9 mm in width, 5.5 mm in height), with a silvery lustre inside except small area of outer lip. Peristome smooth. Operculum is large, corneous, light yellowish-brown, multispiral with a short growing edge, and equal in size to the aperture.

The animal is dark purple in colour and has two pairs of long cephalic tentacles. The eyes are small, located in posterior side of cephalic tentacles and black in

colour. The epipodium has 3 pairs of long and slender tentacles, the mantle edge is pigmentated.
The radula is rhipidoglossate, with the formula 12 : 4 : 1 : 4 : 12 (Fig. 9.1.1-38). It has about 27 narrow transverse rows, is about 570 µm in width and 1.2 mm in length. The rachidian tooth is long and wide in outline, with a concave groove on the anterior side. The tip is wide, with a blunt central cusp and 5 to 7 lateral denticles on each side (Fig. 9.1.1-39). The first to third lateral teeth slightly increase in size outwards, are asymmetric, the inner flanking edges are straight, the outer flanking edges concave curved and multicuspid and have a strong pointed main cusp. The first lateral has 6 to 8 denticles on the outer edge, the second and third lateral have 3 to 5 denticles. The fourth marginal is the largest (about 3 time longer than the others) and strongest, with a blunt central cusp and irregular serrated flanking edges. The marginal teeth are sickle-shaped, slender and strong. The jaws are well developed, triangular (about 790 µm in length and 870 µm in width for one side only), brown, and show a scale-like pattern of overlapping, elongate-rectangular plates (Fig. 9.1.1-40).

Material examined: ANT XIII/4 St. 40-111 (3 animals, 7 S), 40-111 (2 A) (Fig. 4.2-5); 205-1270 m

Comparative remarks: *Solariella* sp.1 can be separated from the other Antarctic and Magellanic species of *Solariella* by its erected shell and the distinct shell sculpture. The rachidian in the radula of *Solariella* sp.1 has more pointed cusps than *Solariella* sp.2 and sp.1 has no periostracum.

Solariella sp.2
(Plate VI, Fig. 9.1.1- 41-44)

Description: The shell is medium in size, as high as wide (up to 12.4 mm in height and 12.3 mm in diameter) with erected spires, fragile (Fig. 9.1.1-41). The surface is fine sculptured, with spiral lines, pale brown periostracum. Protoconch eroded in all specimens. Teleoconch about 4 in number of turns, the suture is deep impressed. Teleoconch grey or pale brown in colour, in juveniles with silvery pearly lustre. The body whorl is large. The base is roundly inflated. The umbilicus is deep and wide open (about 1,9 in diameter) (Fig. 9.1.1-42). The aperture medium, round (6.0 mm in width, 6.1 mm in height), with a pearly lustre inside except small area of outer lip. Peristome smooth. Operculum is large, corneous, yellowish-brown, multispiral with a short growing edge, and equal in size to the aperture.

The animal is purple in colour and has a single pair of long cephalic tentacles. The eyes are large, located in posterior side of cephalic tentacles and black in colour. The epipodium has 3 pairs of long and slender tentacles, the mantle edge is pigmentated.

The radula is rhipidoglossate, with the formula 11 : 4 : 1 : 4 : 11 (Fig. 9.1.1-43). It has about 24 wide transverse rows, is about 680 µm in width and 1.5 mm in length. The rachidian tooth is long and wide in outline. It has a wide tip and a triangular central cusp with an irregular number (0-5) of denticles on each side (Fig. 9.1.1-44). The basal area is pentagonal in outline, slightly wider and more posterior than the front. The first to third lateral teeth slightly increase in size outwards, are asymmetric and the basal area is rhomboid. The inner flanking edges are straight with a few denticles, the outer flanking edges concave curved and multicuspid and have a strong pointed main cusp. The first lateral has 1 to 2 denticles on the inner edge, and 6 to 8 thorn-like denticles on the outer edge. The second and third lateral have 6 to 8 denticles. The fourth marginal is the largest (about 3 time longer than the others) and strongest, with a blunt central cusp and irregular serrated (5 to 9 denticles) flanking edges. The marginal teeth are sickle-shaped, slender and strong. The jaws are unknown.

Material examined: ANT XIV/2 St. 077, 61°18,6 S, 57°01,7 W, 1444m, 08.12.1996, leg. Ch. O. Coleman (5 A, 2 S) (Fig. 4.2-5); 1444 m

Comparative remarks: The specimens analysed show typical characters of the genus *Solariella* like the reduced radula and the large protoconch.

Family TURBINIDAE

Subfamily Liotiinae Adams & Adams, 1854

Genus *Cyclostrema* Marryat, 1818

Cyclostrema crassicostatum Strebel, 1908

(Plate VI, Figs. 9.1.1- 45-48)

Cyclostrema crassicostatum Strebel 1908: 76, pl.6, Fig. 83a-c; Castellanos 1989: pl.1, Fig.1a-c; Linse 1997: 29; Linse 1999: 401

Description: The shell is minute in size, globose, thin, fragile, hyaline in living animals, white when dead, with roundly inflated whorls (Fig. 9.1.1-45). The protoconch is about 1.25 in number of turns, about 0.18 mm in diameter, white, and has a smooth surface (Fig. 9.1.1-46). The teleoconch is about 1.75 in number of turns, and has a fine granulated surface without periostracum. The sculpture consists of prosocline axial ribs with regular interspaces. The suture is deep. The upper whorl is moderate in size an flat, the body whorl is roundly inflated and large. The umbilicus is open and moderate. The aperture is round. There is a tongue-like elongation where the outer lip meets the inner one. The columellar lip is slightly expanded and a little reflected over the umbilicus (Fig. 9.1.1-47). The operculum is corneous, thin, circular, translucently brown, multispiral, and equal in size to the aperture.

The radula is rhipidoglossate, with the formula $\infty : 5 : 1 : 5 : \infty$ (Fig. 9.1.1-48). The rachidian tooth is asymmetric with a strong central ridge. The overhanging tip has a strong main cusp, two cusps on the left and four cusps on the right side. The first lateral tooth has a strong inner posterior ridge, one larger main cusp and three inner and outer flanking cusps. The bases of the outer laterals are unified, their curved tips have one large, wide main cusp and two to three flanking cusps. The marginal teeth slender with a curved spatulate tip with numerous fine denticles.

Material examined: VH’94 St. 1178 (1 S), St. 1200 (1 A, 6 S), St. 1213 (93 A, 51 S) Previous (distribution) records: Magellan region, South Georgia (Fig. 4.2-6); 36-63 m

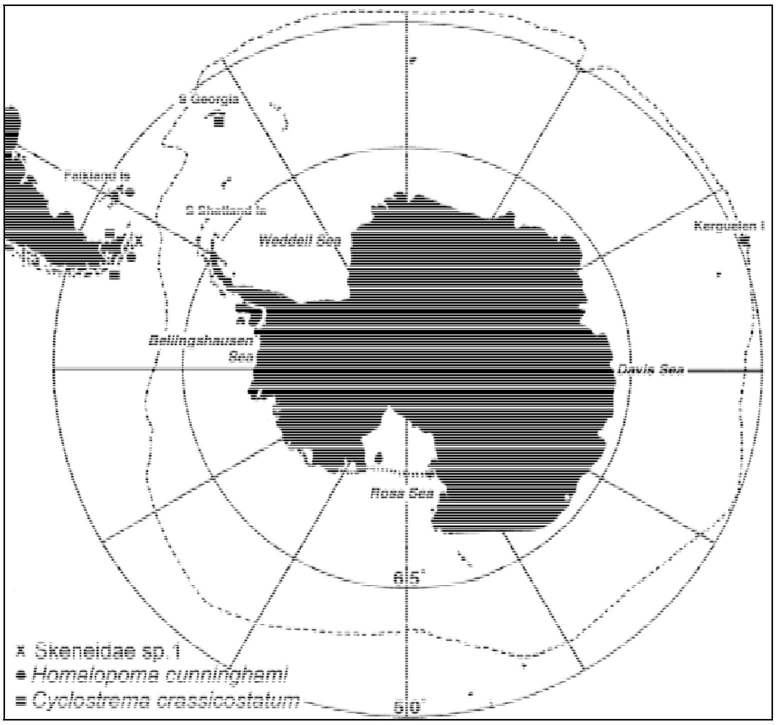


Fig. 4.2-6. Distribution of *Cyclostrema crassicostatum*, *Homalopomacunninghami* and Skeneidae sp.1

Comparative remarks: C. *crassicostatum* is distinctive and easy to separated is from all other micromolluscs in the Magellan region by its shell morphology.

Subfamily Colloniinae Cossmann, 1916
Genus *Homalopoma* Carpenter, 1864
Homalopoma cunninghami (Smith, 1881)
(Plate VII, Figs. 9.1.1- 49-53)

Collonia cunninghami Smith 1881: 33, pl.4, Fig.10; *Homalopoma cunninghami*: Castellanos 1989: pl.2, Fig.10, pl.4, Fig.7; Linse 1999: 401

Description: The shell is small in size, wider than high (up to 3.9 mm in height and 4.5 mm in diameter) with depressed spires, solid. The surface is covered with numerous fine spiral lines, dark pink in colour, and without periostracum. Protoconch small, about 1.7 in number of turns, smooth, white, and glossy (Fig. 9.1.1-49). Teleoconch about 3 in number of turns, the suture is impressed. The body whorl is large. The base is roundly inflated. The umbilicus is open. The

aperture large, oval (1.9 mm in width, 2.0 mm in height), with a pale pink pearly lustre inside except outside of inner lip. Peristome smooth. Operculum is calcareous, paucispiral, flat, and smaller in size than the aperture (Fig. 9.1.1-50).
The animal is pale beige in colour and has a single pair of cephalic tentacles. The eyes are large, located in posterior side of cephalic tentacles and black in colour.
The radula is rhipidoglossate, with the formula ∞ : 5 : 1 : 5 : ∞ (Fig. 9.1.1-51). It has about 31 transverse rows, is about 160 µm in width. The rachidian tooth is deltoid in outline, with triangulates lateral, slightly incurved wings (Fig. 9.1.1-52). It has a broad tip with a well-developed secondary cusp.
The lateral teeth are large, increase in size outwards but the lateral wings decrease outwards, and a long, serrated unicuspid tip. The central cusp is long, rounded, and has 5 to 7 flanking denticles on each side. The first marginal tooth is wider and stronger than the others, has a strong basal projection on the inner base, and an unicuspid, rounded tip numerous denticles on each side (Fig. 9.1.1-53). The second to tenth marginals are long and slender, spatulate, with a large denticle on the stalk near to tip. Main cusp of tip broad and rounded, with 7 to 9 pointed denticles on each flanking side. Outer marginal teeth are long and very slender, with a curved spatulate tip and numerous very fine denticles.

Material examined: VG `96 St. 46 (3 animals (2 scanned)), St. 56 (2 S); VH St. 1164 (3 animals), St. 1176 (1 A), St. 1192 (5 A, 12 S), St. 1200 (140 A, 381 S), St. 1213 (42 A,35 S), St. 1232 (6 animals), St. 1237 (1 S), St. 1247 (3 S), St. 1263 (3 S) St. 1279 (1 A)

Previous (distribution) records: Magellan region, Falkland Islands (Fig. 4.2-6); 13-150 m, -665 m (shells)

Comparative remarks: Strebel (1905) described the shell of *Homalopoma cunninghami* and the specimen of this study are compared with Strebel's specimens. *H. cunninghami* is similar to *M. violacea* (King & Broderip, 1831) in shell size and colour but can be separated by the following characters: 1) open umbilicus, 2) calcareous operculum, 3) rachidian with broad tip and secondary cusp, and 4) marginal-rachidian-marginal line concave. Hickman & McLean

(1990) published the radula of *H. luridum* (Dall, 1885) and described the radula type of the Colloniinae.

Family SKENEIDAE
Skeneidae sp. 1
(Plate VIII, Figs. 9.1.1- 57-64)

Description: The shell is small in size, wider than high (up to 1.1 mm in height and 1.7 mm in diameter) with depressed spires, solid. The surface is covered with numerous fine spiral lines, silvery grey in colour, and without periostracum (Fig. 9.1.1-57, 58). Protoconch small, about 1.7 in number of turns, smooth, white, and glossy (Fig. 9.1.1-59). Teleoconch about 2.2 in number of turns, the suture is impressed. The body whorl is large. The base is roundly inflated. The umbilicus is open (Fig. 9.1.1-60). The aperture large, oval (0.7 mm in width, 0.8 mm in height). Peristome smooth. Operculum is corneous, multispiral with short growing edge, thick, and same size as aperture (Fig. 9.1.1-61). Foot muscle scar large (Fig. 9.1.1-62).

The radula is rhipidoglossate, with the formula $\infty : 5 : 1 : 5 : \infty$ (Fig. 9.1.1-63). The rachidian tooth is deltoid in outline, with triangulates lateral, slightly incurved wings (Fig. 9.1.1-64). It has a broad tip with a small secondary cusp. The lateral teeth are large, increase in size, have a large lateral wing, a broad, multiserrated tip, and are often fused. The marginals are long and slender, spatulate, and a broad tip.

Material examined: VG ’94 St. 1200 (144 animal, 53 S), St. 1213 (115 A, 18 S) (Fig. 4.2-6); 40-63 m

Comparative remarks: Until now there is no record of Skeneidae in the Magellan region so far and the specimens are different to all genera occurring in the Antarctic. Further investigations will show whether this specimens belong to a new genus.

Family ORBITESTELLIDAE
Genus *Orbitestella* Iredale, 1912
Orbitestella ponderi sp. nov.
(Plate IX, Figs. 9.1.1- 65-72)

Orbitestella sp.: Ponder 1990: 516; Linse 1999: 401

Description: The shell is small (maximum diameter 1,04 mm), moderately thick, translucent when fresh, with 2,5-3,25 whorls (Fig. 9.1.1-65). Spire low, whorls lightly convex and rounded, suture impressed (Fig 9.1.1-66). Teleoconch sculptured with strong axial ridges with wider interspaces, interspaces with slightly sinuous growth lines, first whorl 12-14 axial ridges, following with 22 ridges, with about 10-14 fine spiral striae on first whorl and 40-45 on the last whorl and base. Protoconch appears smooth, with numerous very fine granules of 0,5 whorls (Figs. 9.1.1-67, 68). Aperture rectangular and rounded. Inner lip thin, closely attached to parietal whorl, acute angled where lip attaches the wall, outer lip forms an indistinct sinus at suture, projected forward in outer dorsal part, retracted below. Umbilicus wide open (Fig. 9.1.1-69). Periostracum very thin, transparent. Colour pale grey, fading to white. The operculum is pale brown-yellow, horny, thin, polygyrous with a central nucleus, of about 3,5 whorls (Fig. 9.1.1-70).

Shell dimensions:

Holotype	1.04 mm SL	0.56 SD	0.40 AL	3.35 W
paratypes	1.04 mm SL	0.56 SD	0.40 AL	3.35 W
(vial 2827)	1.00 mm SL	0.54 SD	0.36 AL	3.30 W
	0.96 mm SL	0.48 SD	0.36 AL	3.30 W
	0.96 mm SL	0.46 SD	0.36 AL	3.20 W
	0.84 mm SL	0.44 SD	0.32 AL	3.20 W
	0.80 mm SL	0.36 SD	0.24 AL	3.10 W

The animal is pale yellowish-white in colour, larger animals with brown-red dotted visceral coils, head, food and mantle pale yellowish white.

The radula is taenioglossate varied between 15 and 22 rows. Each row consists of 7 teeth with the formula 2 : 1 : 2 (Fig. 9.1.1-71). The rachidian tooth is wide, with a triangulate main cusp with a large needle-like central denticle and seven to twelve flanking denticles, and broad, plate-like basal wings. The first lateral is long, sickle-shaped with one long and strong main cusp, one inner flanking cusp and four to six saw-like outer flanking cusps. The outer lateral is slender, sickle-shape with one cusp. The jaw has six to eight rows of elongate, slightly curved, multicuspid plates (Fig. 9.1.1-72).

Type material: Holotype ZMH 2826 St. 41-1213 off Isla Picton, Tierra del Fuego, 55°06,89 S, 66°39,95 W, 63 m, Magellan „Victor Hensen“ Campaign, 15.Nov. 1994; 53 paratypes ZMH 2827 St. 41-1213 off Isla Picton, Tierra del Fuego, 55°06,89 S, 66°39,95 W, 63 m, Magellan „Victor Hensen“ Campaign, 15.Nov. 1994; 42 paratypes (dry) ZMH 2828, St. 40-111, 55°28,8 S, 66°03,5 W, 1279 m, RV “Polarstern” ANT XIII/4, 15. May 1996, 17 paratypes ZMH 2829 St. 42-1178 off Isla Picton, Tierra del Fuego, 55°07,30 S, 66°52,78 W, 25 m, Magellan „Victor Hensen“ Campaign, 12.Nov. 1994.

Etymology: The species is named for Dr. Winston Ponder of AMS, Sydney who mentioned this species first.

Additional Material Examined: VH’94St. 49-1206 (1S), St. 48-1200 (84 S), St. 42-1178 (15 S), St. 41-1213 (270 S), ANT XIII/4 St. 40-115 (17 S), St. 40-117 (9 S), LACM 73-7,1Punta Dashwood, Canal Smyth (52°24’ S, 73°39,7 W).

Geographic distribution: Records of *Orbitestella ponderi* are restricted to the region at and off the eastern entrance of the Beagle Channel (Fig. 4.2-7). Animals were found in 25-100 m, shells down to 1280 m.

Previous records: Magellan region (Fig. 4.2-7).; 25-100 m, -1280 m

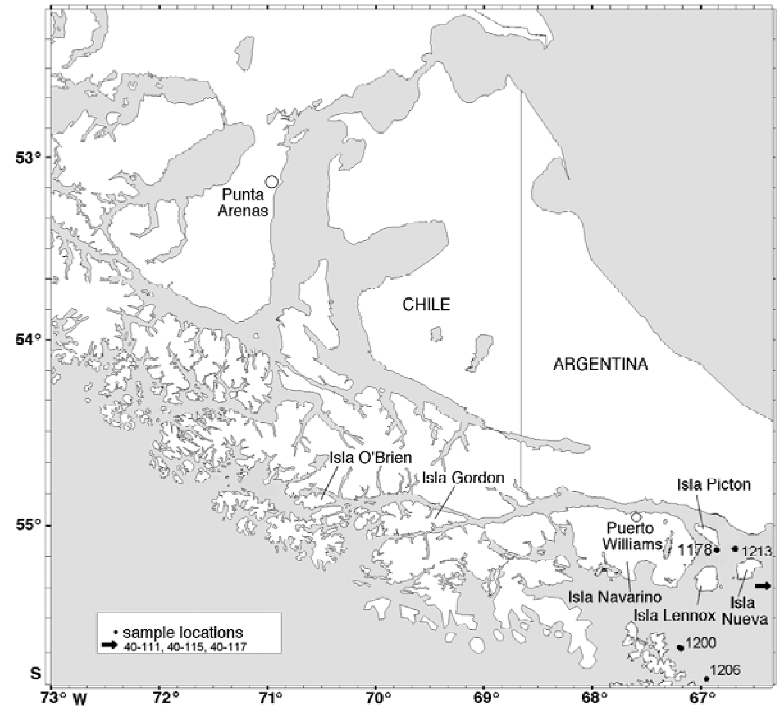


Fig. 4.2-7. Distribution and sample locations of *Orbitestella ponderi* sp. nov.

Remarks: The specimens have been compared with the recorded orbitestellid species of the Southern Ocean. The material has been compared with *Microdiscula vanhöffeni* Thiele, 1912 (Holotype, HUM 63021; 2 Syntypes BNHM 1911.11.4.2-3), *M. subcanaliculata* (Smith, 1875) (HUM 63058) and *Orbitestella* sp. (LACM, 73-71). Both Antarctic species, *M. vanhöffeni* and *M. subcanaliculata*, are sculptured with weak, slightly growth lines but without axial ridges and spiral treads. *Orbitestella* sp. mentioned by Ponder (1990) from Punta Dashwood, Southern Chile, is similar to the specimens found in this study. The radula and especially the jaw of the two species are different. *Microdiscula* spp. jaws have four cuspidate plates, the jaws of *Orbitestella* consist only of one cuspidate plate.

Family CAECIDAE

Genus *Fartulum* Carpenter, 1857

Fartulum magellanicum Di Geronimo, Privitera & Valdovinos, 1995

(Plate VII, Figs. 9.1.1- 54-56)

Fartulum magellanicum Di Geronimo, Privitera & Valdovinos 1995: 114, pl.1, Fig.1-5; *Caecum* sp.1: Linse 1997: 32; *Fartulum magellanicum*: Linse 1999: 401

Description: The shell is minute, cylindrical, moderately curved, hyaline or white in dead shells, surface smooth except fine growth lines (Fig. 9.1.1-54). The aperture is circular, the margins bend outwards. The protoconch is missing in older shells but the initial coil is published by Di Geronimo et al. (1995). The septum is well developed and has a fine granulated surface (Fig. 9.1.1-55). The operculum is thin, circular, translucently brown, multispiral, and a little bit smaller than the aperture (Fig. 9.1.1-56).

The animal is white in colour, and has a pair of long and slender cephalic tentacles. The eye is small and black in colour. The proboscis is flat, deeply cut into two lobes.

The radula is unknown.

Material examined: VH ’94 St. 1200 (2 A, 1S)

Previous (distribution) records: Magellan region (Fig. 4.2-8), 40-245 m (Fig. 4.2-8)

Comparative remarks: see Di Geronimo et al. (1995).

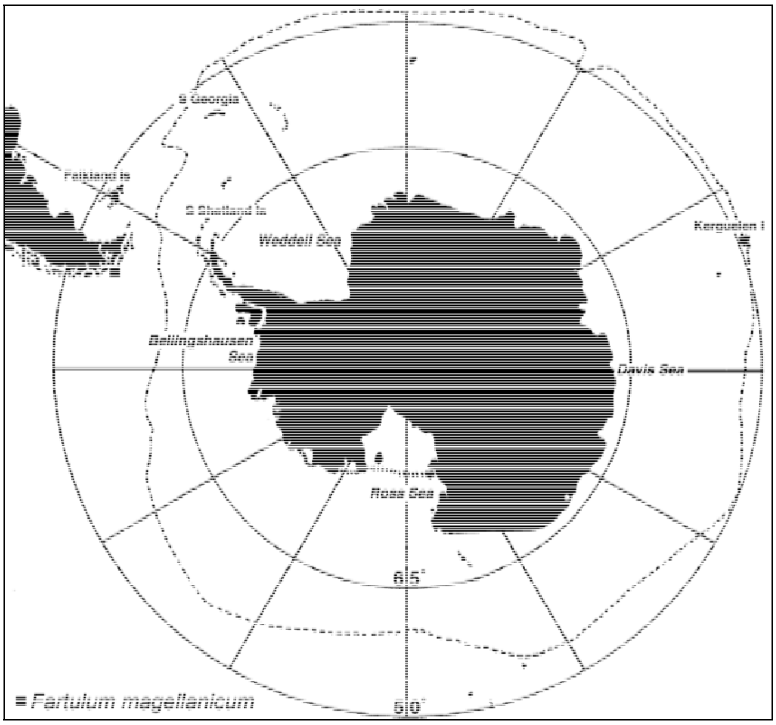


Fig. 4.2-8. Distribution of *Fartulum magellanicum*

Family CALYPTRAEIDAE Blainville, 1824

Genus *Crepipatella* Lesson, 1831

Crepipatella dilatata (Lamarck, 1822)

(Plate X, Fig. 9.1.1-75)

Crepidula dilatata Lamarck 1822: 25; *Crepipatella dilatata*: Powell 1960: 143; *Crepidula dilatata*: Gallardo 1977: 241-251, fig1,3,4,5,6,9; Gallardo 1979: 217, Fig.1a-d; *Crepipatella dilatata*: Castellanos & Landoni 1990: 13, pl.2, Fig.18a-c, Linse 1997: 33, Linse 1999: 401

Description: Shell depressed, oval to elongate cap-shaped (up to 60 mm in length, 50 mm in width, and 25 mm in height), pale beige in colour, aperture applied to substrate, spire set posteriorly an to left, smooth, with irregular growth lines. Inside with septum at posterior end.

The radula is taenioglossate and about 36 rows. Each row consists of 7 teeth with the formula 2 : 1 : 1 : 1 : 2 (Fig. 9.1.1-75). The rachidian tooth is much higher than wide, main cusp large and two pair of flanking cusps. The lateral tooth is wide, asymmetric, with a long outer margin, and a basal denticle. The main cusp is larger than the others, double width of rachidian, with one inner flanking cusp and five outer flanking cusps. The first marginal tooth is half the size of the lateral, asymmetric, with a broad main cusp, five thorn-like inner flanking cusps and two small cusps in the middle of the outer margin. The outer marginal tooth is slender, spike-like, with one main cusp.

Material examined: VH ’94 St. 1206 (1S), 1221 (3A)

Previous (distribution) records: Magellan region, Falkland Islands (Fig. 4.2-9); 10-66 m

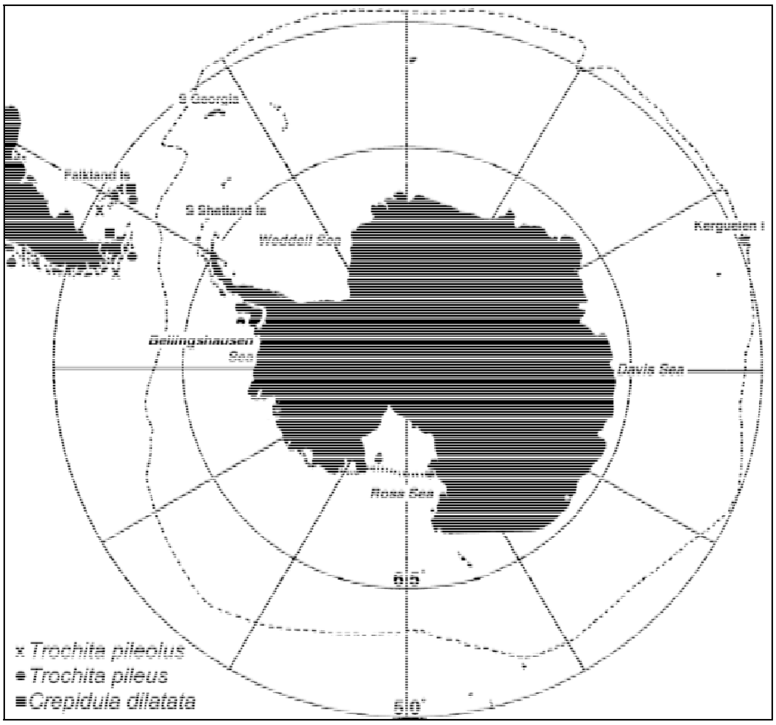


Fig. 4.2-9. Distribution of *Crepidula dilatata*, *Trochita pileus* and *T. pileolus*

Comparative remarks: *C. dilatata* is similar to *Crepidula fecunda* Gallardo, 1979 in teleoconch characters (e.g. smooth) but can be distinguished by the larger size of females of *C. fecunda* and differences in protoconch characters. *C. dilatata* is characterised by direct development while *C. fecunda* shows indirect development with veliger larvae.

Genus *Trochita* Schumacher, 1817

Trochita pileus (Lamarck, 1822)

(Plate X, Fig. 9.1.1-73)

Trochus pileus Lamarck 1822: 11; *Trochita pileus*: Powell 1960: 143; Castellanos & Landoni 1990: 8, pl.2, Fig.19a-c, Linse 1999: 401

Description: Shell round, rather depressed, with concave anterior profile, apex with small nipple-shaped beak, white to pale beige in colour, with pale brown periostracum. Protoconch is smooth without any scultures. Teleoconch sculpture of radial ribs and spiral growth lines. Aperture almost circular. Septum slightly convex incurved.

The radula is taenioglossate with the formula 2 : 1 : 1 : 1 : 2 (Fig. 9.1.1-73). It consists of 40 rows. The rachidian tooth has a broad and long main cusp with two to three small flanking cusps on each side. The lateral tooth is broad, asymmetric, outer margin long, with nine to eleven small cusps, main cusp broad with a pointed tip, inner margin uncusped. First marginal tooth is half size of lateral, one main cusp. Second marginal is slender and spike-like.

Material examined: VH ’94: St. 813 (1 A), St. 884 (1 A), St. 929 (2 A), St. 958 (4 A), St. 963 (59 A), St. 972 (12 A), St. 1164 (2 A), St. 1176 (1 A), St. 1192 (1 A), St. 1221 (1 A), St. 1232 (1 A), St. 1291 (1 A)

Previous (distribution) records: Magellan region, Falkland Islands, Northern Chile (Fig. 4.2-9); 13-484 m

Comparative remarks: This species is quite similar to *T. pileolus*. The shells can be separated by the smooth protoconch in *T. pileus* while the latter has a ribbed one. The radula of *T. pileus* has some differences to the radula characters of *T. pileolus*. In *T. pileolus* the rachidian has six to eight small flanking cusps beside the main cusp, the flanking cusps of the lateral tooth are more numerous and the cusps are sometimes bifurcate, the inner marginal is slightly dentated.

Trochita pileolus (d'Orbigny, 1845)
(Plate X, Fig. 9.1.1-74)

Infundibulum pileolus d'Orbigny 1845: 463, pl.78, Fig.5; *Trochita decipiens*: Powell 1960: 143; *Trochita pileus*: Castellanos & Landoni 1990: 9, pl.2, Fig.23 k, l, Linse 1999: 401

Description: Shell round, rather depressed, with concave anterior profile, apex with small nipple-shaped beak, white to pale beige in colour, with pale brown periostracum. Protoconch is smooth with two to three spiral ribs. Teleoconch sculpture of spiral growth lines, without radial ribs. Aperture almost circular. Septum convex incurved.
The radula is taenioglossate and about 47 rows. Each row consists of 7 teeth with the formula 2 : 1 : 1 : 1 : 2 (Fig. 9.1.1-74). The rachidian tooth has a broad, blunt main cusp, with six to eight small, saw-like flanking cusps. The lateral tooth is broad, asymmetric, outer margin with ten to fourteen, sometimes bifurcate cusps. Inner marginal tooth is half as wide as the lateral, with one main cusp, inner margin fine denticulate. Outer margin tooth long and slender, and spike-like.

Material examined: VH '94: St. 813 (1 A), St. 920 (1 A), St. 929 (1 A), St. 958 (7 A), St. 963 (45 A)

Previous (distribution) records: Magellan region, Falkland Islands (Fig. 4.2-9); 19-111 m

Comparative remarks: see *T. pileus* for remarks between the two species.

Family LAMELLARIIDAE

Genus *Lamellaria* Montagu, 1815

Lamellaria ampla Strebel, 1906

(Plate X, Fig. 9.1.1-77, 78)

Lamellaria ampla Strebel 1906: 145, pl.11, Fig.70a-d, 71; Powell 1960: 146; Castellanos & Landoni 1990: 27, pl.1, Fig.9, 10; Linse 1997: 34; Linse 1999: 401

Description: Animal small, less than 15 mm, tissue flesh-coloured with dark pigment spots, shell internal. Shell small, slightly smaller than animal, hyaline, fragile, oval, flat with a large, oval aperture, last whorl large and wide.
The radula is rhachiglossate, with the formula 1 : 1 : 1 and consists of sixty rows (Fig. 9.1.1-77). The rachidian tooth is large, asymmetric, curved to the left (Fig. 9.1.1-78). The outer margins are strong, the left ridge is more or less straight, the right ridge curved. Near the tip the outer margins are thickened. The main cusp is strong, blunt, and dominant. On the left are three minute cusps, on the right six to eight different sized flanking cusps. The pair of lateral teeth is strong and broad, with a dominant main cusp and a wide, nearly straight, multicuspid inner wing. A strong curved outer ridge, running out into the strong main cusp. The inner wing is sculptured by seven to eight saw-like cusps. The outer margin is denticulated with 18 to 22 small cusps. The inner margin is smooth.

Material examined: VH ’94 St. 887 (1 A), St. 1200 (3 A), St. 1291 (1 A), ZMH

Previous (distribution) records: Magellan region, Falkland Islands (Fig. 4.2-10); 40-484 m

Comparative remarks: The radulae of *L. ampla*, *L. elata*, and *L. patagonica* are illustrated for the first time. Next to external characters the radula is a good character to identify the different species. Numanami (1996) published the radula of *L. kiiensis* as an example for the radula of this genus. The general structure of the teeth in the Magellanic species is similar but different in dentition. The cusps on the rachidian of *L. ampla* are less pointed than in *L. elata* and *L. patagonica*. The latter species has four to six large cusps on the left while these cusps are minute in *L. ampla* and *L. elata*. The flanking cusps of the lateral teeth especially the outer ones are different in numbers: *L. ampla* has 18-22 small cusps, *L. elata* 12-14 small cusps and *L. patagonica* 11-13 larger cusps.

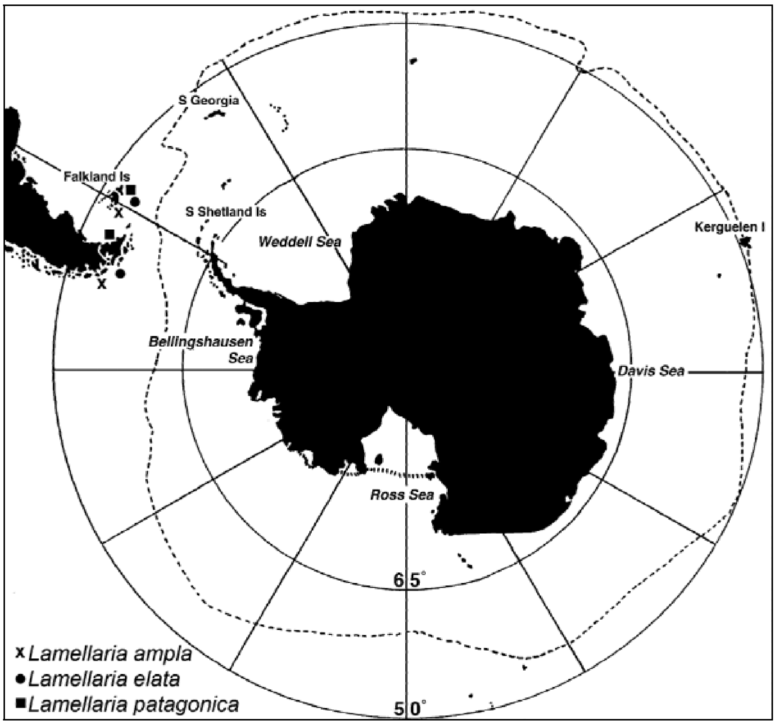


Fig. 4.2-10. Distribution of *Lamellaria ampla*, *L. elata* and *L. patagonica*

Lamellaria elata Strebel, 1906
(Plate X, Fig. 9.1.1-79, 80)

Lamellaria elata Strebel 1906: 146, pl.11, Fig.72; Powell 1960: 146; Castellanos & Landoni 1990: 27, pl.1, Fig.12, 13; Linse 1997: 34; Linse 1999: 401

Description: Animal small, less than 15 mm, tissue flesh-coloured without pigments, shell internal. Shell small, slightly smaller than animal, hyaline, fragile, oval, high erected whorls, with oval aperture.

The radula is rhachiglossate, with the formula 1 : 1 : 1 and consists of 57 to 65 rows (Fig. 91.1.-79). The rachidian tooth is large, asymmetric, curved to the left (Fig. 9.1.1-80). The outer margins are strong, the left ridge is more or less straight, the right ridge curved. Near the tip the outer margins are slightly thickened. The main cusp is strong, pointed, and larger than the others. Left of the main cusp the margin is either smooth or has one to four minute cusps, on the right six to eight different sized flanking cusps. The pair of lateral teeth is strong and broad, with a dominant main cusp and a wide, nearly straight, multicuspid inner wing. A strong curved outer ridge, running out into the strong main cusp. The inner wing is sculptured by three to five pointed cusps. The outer margin is denticulated with 12 to 14 small cusps. The inner margin is smooth.

Material examined: VH’94 St. 884 (5 A), St. 1200 (9 A, 1S), St. 1213 (2 A), ZMH

Previous (distribution) records: Magellan region, Falkland Islands (Fig. 4.2-10); 40-82 m

Comparative remarks: discussion under comparative remarks of *L. ampla* (p. 82)

Lamellaria patagonica Smith, 1881
(Plate X, Fig. 9.1.1-76)

Lamellaria patagonica Smith 1881: 32, pl.4, Fig.9; Powell 1960: 146; Castellanos & Landoni 1990: 27, pl.1, Fig.5-8; Linse 1999: 401

Description: animal small, less than 15 mm, tissue flesh-coloured without pigments, shell internal. Shell small, slightly smaller than animal, hyaline, fragile, erected whorls, with oval aperture.
The radula is rhachiglossate, with the formula 1 : 1 : 1 and consists of 45 to 50 rows (Fig. 9.1.1-76). The rachidian tooth is large, asymmetric, slightly curved to the left. The outer margins are strong, the left ridge is more or less straight, the right ridge curved. Near the tip the outer margins are thickened multicuspid. The main cusp is larger than the others. On the left are four to six thorn-like cusps, on the right five to six flanking cusps. The pair of lateral teeth is strong and broad, with a dominant main cusp and a wide, nearly straight, multicuspid inner wing. A strong curved outer ridge, running out into the strong main cusp. The

inner wing is sculptured by five saw-like cusps. The outer margin has eleven to thirteen saw-like cusps. The inner margin is smooth.

Material examined: VH'94 St.1045 (1 A), St. 1083 (1 A), St. 1213 (1 A)

Previous (distribution) records: Magellan region, Falkland Islands (Fig. 4.2-10); 10-186 m

Comparative remarks: discussion under comparative remarks of *L. ampla* (p. 82)

Family NATICIDAE Forbes, 1838
Subfamily Policinae Gray, 1847
Genus *Bulbus* Brown, 1839
Bulbus carcellesi Dell, 1990
(Plate XI, Fig. 9.1.1- 81-83)

Bulbus carcellesi Dell 1990: 155, Fig.259; Linse 1999: 401

Description: shell large, higher than wide (up to 31,3 mm in height and 29,0 mm in diameter), globose, solid, white polished with pale brown periostracum. Protoconch small, dome-shaped. Teleoconch whorls about 4 in number of turns. Aperture ovate, very large. Operculum horny, slightly smaller than aperture.
The radula is taenioglossate, with the formula 2 : 1 : 1 : 1 : 2 (Fig. 9.1.1-81). It consists of 50 to 55 rows. The rachidian tooth is trapezoid with two strong and acute basal denticles. The main cusp is large, slender and long, and flanked by a pair of smaller outer cusps that have a third of length of the main cusps (Fig. 9.1.1-82). The lateral tooth is almost rhomboid, has a large central cusp and one cusp its outer flank. The outer lateral side has a strong anchor-shaped ridge. The pair of marginal teeth is strong and simple. The jaw consists of two rectangular, multicuspid plates (Fig. 9.1.1-83) and is translucent brown in colour.

Material examined: VH’94 St. 806 (11 A), St. 929 (4 A), St. 958 (1 A), St. 972 (1 A), St. 1178 (2 A), St. 1184 (1 S), St. 1200 (1 A, 5 S), St. 1206 (1 S), St. 1221 (1 A), St. 1248 (1 A), St. 1270 (1 A), St. 1279 (1 A); USNM 860110 (holotype)

Previous (distribution) records: Magellan region, Falkland Islands (Fig. 4.2-11); 25-586 m

Comparative remarks: The type material (Dell 1990) is based on shells only, therefore the radula was unknown until now.

Genus *Polinices* Montfort, 1810
Polinices patagonicus (Philippi, 1845)
(Plate XI, Fig. 9.1.1- 84-86)

Polinices patagonica Powell 1960: 145; *Falsilunatia patagonicus*: Dell 1996: 148, Fig. 248; *Polinices cf. patagonica*: Linse 1997: 35; Linse 1999: 401

Description: Shell medium, higher than wide (up to 28,5 mm in height and 27,0 mm in diameter), globose, solid, dull white with a brown periostracum. Protoconch small, pointed. Teleoconch whorls about 4 in number of turns. Aperture ovate, very large. Operculum horny, about size of aperture.
The radula is taenioglossate, with the formula 2 : 1 : 1 : 1 : 2 (Fig. 9.1.1-84). It consists of 75 to 80 rows. The rachidian tooth is trapezoid with two strong basal denticles. The main cusp is large and flanked by a pair of smaller outer cusps, some animals with even one to two smaller cusp between the main and the outer cusp (Fig. 9.1.1-85). The lateral tooth is almost rhomboid, has a large central and one pair of outer cusps. The inner lateral side has a strong anchor-shaped ridge. The inner marginal tooth is bifurcate, the outer marginal is strong and simple. The jaw consists of two asymmetric trapezoid, multicuspid plates (Fig. 9.1.1-86) and is translucent orange-brown in colour.

Material examined: VH'94 St. 874 (1 A), St. 878 (1 A, 1S), St. 980 (9 A), St. 1077 (1 A), St. 1140 (2 A), St. 1213 (1 S), St. 1246 (9 A), St. 1247 (1 A), St. 1263 (1 A, 13 S), St. 1270 (1 S), St. 1291 (1 A)

Previous (distribution) records: Magellan region, Falkland Islands, South Georgia (Fig. 4.2-11); 0-665 m

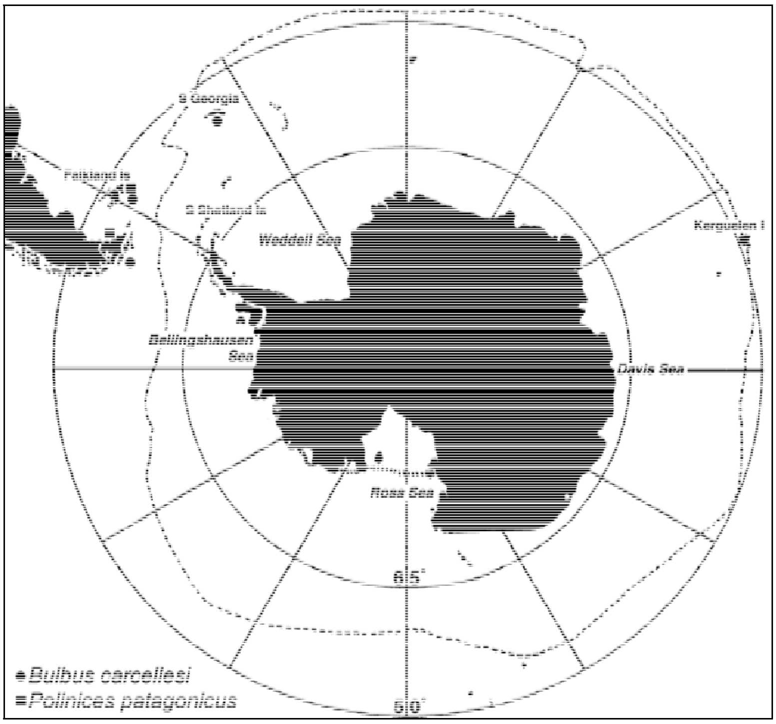


Fig. 4.2-11 Distribution of *Bulbus carcellesi* and *Polinices patagonicus*

Comparative remarks: Dell (1990) placed this species into the genus *Falsilunatia* based on its shell characters and general morphology that is similar to *F. soluta*. Dell (1990, p 148) mentioned that "there are no real characters by which it can be distinguished from *soluta* except size." But he also remarks that "*patagonicus* can be included into *Falsilunatia* until the radula can be examined" (p. 139). The examination of the radula shows that the specimens of *patagonicus* described above have the radula characters of *Polinices* (Bandel 1984) with a bifurcate inner marginal and a one cusp outer marginal. Both marginal teeth of *Falsilunatia* are described with having only one cusp (Bandel 1984, Dell 1990). Therefore *patagonicus* is a member of the genus *Polinices*.

Family TURRIDAE

Subfamily Clavinae Powell, 1942

Genus *Mangelia* Risso, 1826

Mangelia magellanica (Martens, 1881)

(Plate XI, Figs. 9.1.1-87, 88)

Pleurotoma patagonica magellanica Martens 1881: 77; *Bela magellanica*: Strebel 1905: 586, pl.23, Fig.48a-c; *Mangelia magellanica*: Castellanos & Landoni 1993: 24, pl.1, Fig.4; Bastida et al 1992: 694; Linse 1999: 402

Description: Shell medium, (up to 7,3 mm in length, 3,1 mm in diameter, 6.2 in number of whorls), fusiform, raised spire, and solid. Surface covered with strong axial ribs, dull, white to light pink in colour. Protoconch large, with two whorls, and smooth (Fig. 9.1.1-87). Main sculpture of teleoconch are rounded opisthocline ribs, weak axial lines, U-shaped in sinus. Aperture about 1/3 of shell height. Operculum oval eccentric.

The radula has the formula 1 : 1 : 1 : 1 : 1 and consists of 40-45 rows. The rachidian is one small needle-like cusp (Fig. 9.1.1-88). The lateral is broad, horseshoe-shaped with nine to eleven needle-shaped, pointed cusps. The cusps are decreasing in size outwardly. Marginal teeth long, slender, and needle-shaped.

Material examined: VH’94 St. 929 (1 A), St. 1240 (1 A)

Previous (distribution) records: Magellan region (Fig. 4.2-12); 33-145 m

Comparative remarks: The radula of *M. magellanica* was not illustrated before.

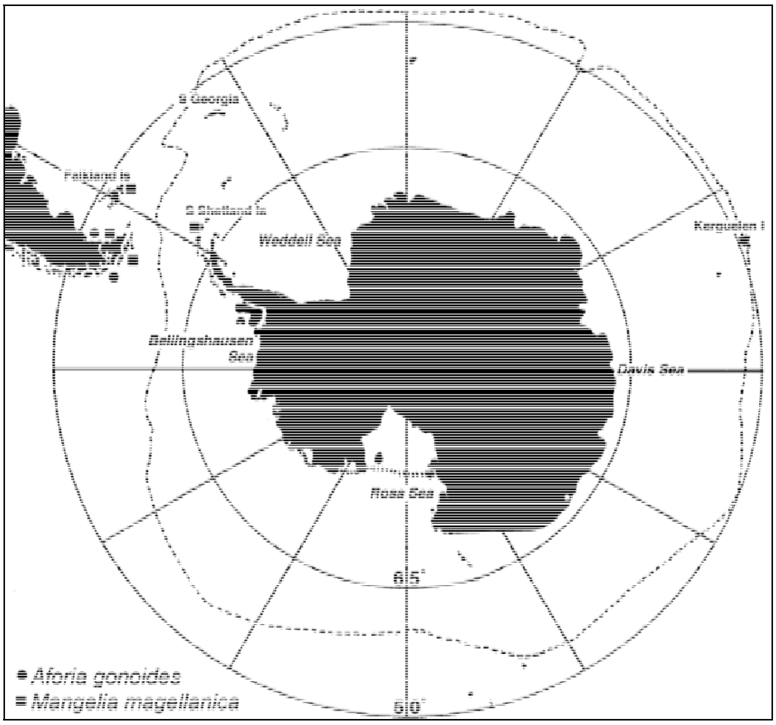


Fig. 4.2-12. Distribution of *Mangelia magellanica* and *Aforia gonoides*

Subfamily Turriculinae Powell, 1942

Genus *Aforia* Dall, 1889

Aforia gonoides (Watson, 1881)

(Plate XII, Figs. 9.1.1-89, 90)

Pleurotoma (surcula) gonoides Watson 1881: 394; *Aforia gonoides*: Powell 1960: 158; Castellanos & Landoni 1993: 5, pl.1, Fig.6, pl.3, Fig.27; Dell 1990: 234, Fig.402, 403; Linse 1999: 401

Description: Shell large (38.3 mm in length, 15.0 mm in diameter), elongate fusiform, with one prominent spiral keel, long siphonal canal, white in colour. Protoconch, large, dome-shaped, about 2 in number of turns. The operculum is oval, eccentric, thick, and brown (Fig. 9.1.1-89).

The radula is toxoglossate, with the formula 1 : 0 : 1 : 0 : 1 and consists of 32 rows (Fig. 9.1.1-90). The rachidian is a flat, triangular plate with one cusp at the tip. The marginal teeth are strong and wishbone shaped.

Material examined: ANT XIII/4 St. 40-109 (3 A)

Previous (distribution) records: Magellan region, Falkland Islands, South Shetland Islands (Fig. 4.2-12), 109-1120 m

Comparative remarks: Dell (1990) illustrated drawings of the radulae of *Aforia magnifica* (Strebel, 1908) and *A. multispiralis* Dell, 1990, Hain (1990) a SEM of *A. magnifica*. The cusp of the rachidian in *A. gonoides* is less pronounced than in *magnifica* and *multispiralis*. The arrowhead-like tip of the marginal in *gonoides* is longer and more pointed than in *magnifica*.

Family BUCCINULIDAE
Subfamily Cominellinae
Genus *Antistreptus* Dall, 1902
Antistreptus magellanicus Dall, 1902
(Plate XII, Figs. 9.1.1-91, 92)

Antistreptus magellanicus Dall 1902: 532; Powell 1960: 149; Castellanos 1992: 25, pl.3, Fig.29; Bastida et al. 1992: 694; Linse 1997: 36; Linse 1999: 402

Description: The shell is fusiform, small, reddish-brown in colour, with a moderate elevated spire. Protoconch is small, in 1,1 number of turns, 270 µm in diameter and 255 µm in height, globose, and anticlockwise (Fig. 9.1.1-91, 92). The teleoconch is about three in number of turns, slightly inflated, with four equal-sized, crenulated spiral cords. Operculum small, horny, brown, thin, eccentric, and with a large oval foot muscle scar. The radula is unknown.

Material examined: VH’94 St. 972 (1A), St. 1213 (3 A, 4 S)

Previous (distribution) records: Magellan region, Falkland Islands, Patagonia (Fig. 4.2-13); 56-169 m

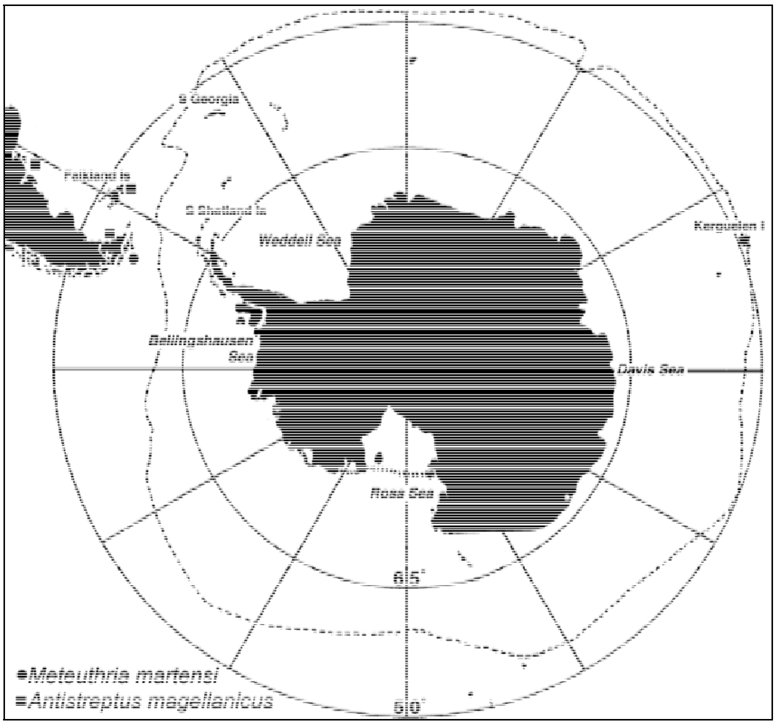


Fig. 4.2-13. Distribution of *Antistreptus magellanicus* and *Meteuthria martensi*

Comparative remarks: *A. magellanicus* and *A. rolani* Castellanos, 1985 are the only anticlockwise whorled buccinid species in the Magellan region. *A. magellanicus* can be distinguished from *A. rolani* by having teleoconch sculpture of 4 equal-sized crenulated spirals cords while in the latter species the uppermost cord is distinctively smaller.

Genus *Meteuthria* Thiele, 1912
Meteuthria martensi (Strebel, 1905)
(Plate XII, Figs. 9.1.1- 93-96)

Euthria (Glypteuthria) martensi Strebel 1905b: 630, pl.22, Fig.13; *Meteuthria martensi*: Powell 1960: 149; Bastida et al. 1992: 696; Castellanos 1992: 20, pl.1, Fig.7-9; Linse 1997: 36; Linse 1999: 402

Description: Shell, fusiform, medium (up to 10.3 mm in height, and 4.9 mm in diameter), solid, white in colour, reddish-brown periostracum. Protoconch is small, about 1,7 in number of turns, between 420-490 µm in diameter and about 820 µm in height (Fig. 9.1.1-93, 94). The sculpture is smooth except of very fine

spiral lines. Teleoconch whorls about 4 in number of turns. Teleoconch sculpture of rounded axial ribs and erased spiral cords. The operculum is horny, thick, oval, eccentric, and with a basal nucleus (Fig. 9.1.1-95). The muscle scar is large, covering about half size of the operculum (Fig. 9.1.1-96).
The radula the formula 1 : 0 : 1 and about 120 transverse rows. The radula is about 1650 µm long and narrow (about 45 µm). The rachidian tooth is totally reduced and the lateral teeth are multicuspid, strong, wide, and with a short projection on the outer basal margin. The teeth have five to seven strong cups are long and thorn-shaped.

Material examined: VH’94 St. 1045 (4 A), St. 1152 (1 A, 1 S), St. 1164 (2 A), St. 1176 (2 A), St. 1178 (5 S), St. 1200 (1 A, 11 S), St. 1213 (30 A, 37 S), St. 1216 (3 A), St. 1221 (6 A), St. 1247 (4 A, 6 S), St. 1270 (3 S), St. 1279 (1 A)

Previous (distribution) records: Magellan region (Fig. 4.2-13); 15-154 m

Comparative remarks: The radula of *M. martensi* was first illustrated by Thiele (1912) and is similar to the one scanned here. *M. martensi* can be distinguished from *M. multituberculata* (Castellanos, Rolan & Bartolotta, 1987) by having a stronger axial sculpture, less nodulous cords and a less curved siphonal canal.

Genus *Pareuthria* Strebel, 1905
Pareuthria cerealis (Rochebrune & Mabille, 1885)
(Plate XIII, Figs. 9.1.1- 97-101)

Euthria cerealis Rochebrune & Mabille 1885: 100; *Pareuthria cerealis*: Powell 1960: 147; Castellanos & de Fernandez 1976: 11; Castellanos 1992: 18, pl.1, Fig.4; Linse 1999: 402

Description: Shell fusiform, small, solid, smooth, and yellow-brown in colour.
Protoconch is large, globose, dome-shaped, about 2,5 in number of turns, 780-840 µm in diameter, 760 µm in length, light yellow in colour, and smooth (Fig. 9.1.1-97, 98). Teleoconch of up to about 3.4 in whorls (6.9 mm in height, 3.2

mm in diameter), suture deep, with fine spiral groove just below suture. Teleoconch sculpture smooth except of that fine groove. Aperture about 2/5 of shell height, and oval. Fasciole weak to absent. The operculum is horny, thick, oval, eccentric, and with a basal nucleus (Fig. 9.1.1-99). The muscle scar is large, covering less than half size of the operculum (Fig. 9.1.1-100).

The radula is rachiglossate, with the formula 1 : 1 : 1, long and narrow (about 2000 µm length and 73 µm width), and has 92 transverse rows (Fig. 9.1.1-101). The rachidian tooth is tricuspid, wide (about 25 µm), and flat. The cusps are strong, pointed and ventrally curved, the central cusp is straight and about half size of the outer cusps which point outwards. The lateral tooth is wide and stout, the width of the base is as wide as the rachidian base. The tooth has two strong and strongly incurved cusps, a wide inner base with a small cusp, and a long outer basal projection.

Material examined: VH’94 St. 1152 (19 A), St. 1164 (5 A), St. 1216 (2 A, 7 S) St. 1221 (15 A, 4 S)

Previous (distribution) records: Magellan region, Falkland Islands (Fig. 4.2-14); 15-198 m

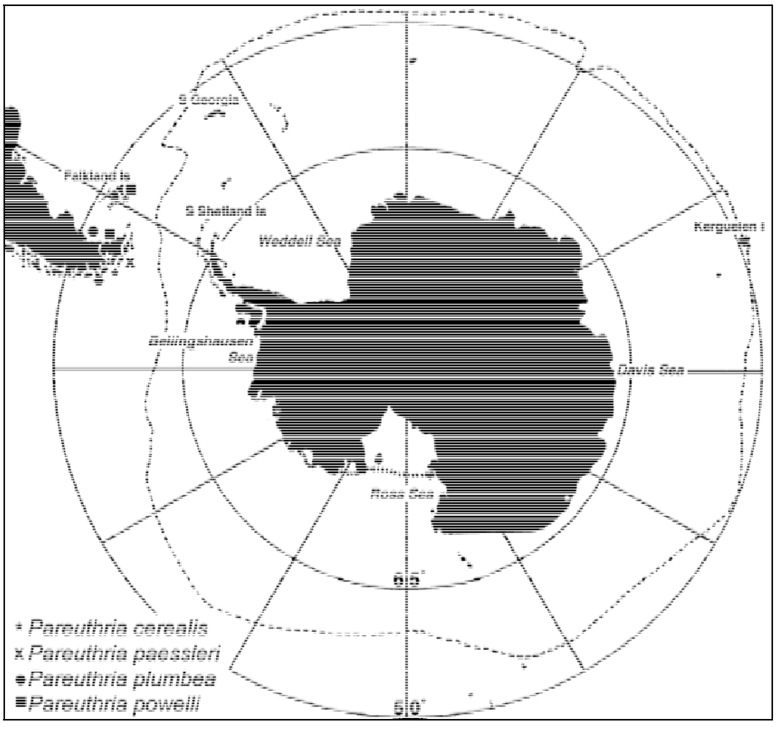


Fig. 4.2-14. Distribution of *Pareuthria cerealis*, *P.paessleri*, *P. plumbea* and *P. powelli*

Comparative remarks: Castellanos (1976) illustrated the radula of *P. cerealis*, which is larger than the one scanned here. The rachidian tooth has a wider base in her drawing and the cusps are equal in size.

Pareuthria cf. *paessleri* (Strebel, 1905)
(Plate XIII, Figs. 9.1.1- 102-104)

Euthria paessleri Strebel 1905: 625, pl.21, Fig.9, 9a+b; *Pareuthria paessleri*: Castellanos & de Fernandez 1976: 11; Bastida et al. 1992: 696; Castellanos 1992: 18, pl.1, Fig.4; Linse 1999: 402

Description: Shell fusiform, small, solid, smooth, and reddish-brown in colour. Protoconch is large, globose, shouldered, about 2 in number of turns, 695-830 µm in diameter, 1,5 mm in length, light red in colour, and smooth (Fig. 9.1.1-102, 103). Teleoconch of up to about 4,5 whorls (6.3 mm in height, 3.0 mm in diameter), suture deep, with fine spiral groove just below suture. Teleoconch sculpture smooth except fine spiral grooves on shell base. Aperture about 1/2 of shell height, oval. The operculum is horny, thick, oval, eccentric, and with a basal nucleus.
The radula is rachiglossate, with the formula 1 : 1 : 1, long and narrow (about 680 µm length and 115 µm width in a piece of 36 rows) (Fig. 9.1.1-104). The rachidian tooth is tricuspid, wide (about 30 µm), and flat. The three cusps are strong, pointed, ventrally curved, and equal in size. Sometimes with one or two denticles next to the main cusps. The lateral tooth is wide (about 38 µm) and stout, and multicuspid. The inner margin is strongly convex. The tooth has nine strong cusps increasing in size outwardly. The innermost cusp is about twice as large as the second cusp.

Material examined: VH’94 St. 929 (4 A), St. 963 (2 S), St. 966 (1 A), St. 1152 (1 A), St. 1216 (2 A)

Previous (distribution) records: Magellan region (Fig. 4.2-14); 13-183 m

Comparative remarks: The specimens are similar to Strebel's (1905) description except for the coarse groove on the shell base. The specimens examined here have fine grooves on the base which are lacking in *P. cerealis*. Comparison with type material was not possible. Strebel (1905, p 625) said that " ... steht der *cerealis* nahe, doch ist sie mehr oval-konisch und dunkler gefärbt und durch die grobe Spiralstruktur auf der untern Hälfte der letzten Windung verschieden".
The radula of *P.* cf. *paessleri* has a different type of lateral teeth than the other species of *Pareuthria* analysed.

Pareuthria plumbea (Philippi, 1844)
(Plate XIV, Fig. 9.1.1-105)

Fusus plumbeus Philippi 1844: 108, pl.1, Fig.3; *Pareuthria plumbea*: Powell 1960: 148; Castellanos & Fernandez 1976: 12; Castellanos 1992: 13, pl.3, Fig.37; Linse 1999: 402

Description: Shell fusiform, medium (24.5 mm in height, 10.2 mm in diameter), solid, smooth, and darkbrown in colour. Protoconch is large, globose, about 2.5 in number of turns, brown in colour, and smooth. Teleoconch of about 5 in number of turns, suture deep, with fine spiral groove just below suture. Teleoconch sculpture smooth or with rounded axial ribs. Aperture about 1/2 of shell height, oval. The operculum is horny, thick, dark brown, oval, eccentric, and with a basal nucleus.
The radula is rachiglossate, with the formula 1 : 1 : 1, long and narrow (about 1600 µm length and 70 µm width, SL 2.3 cm), and has 100-115 transverse rows (Fig. 9.1.1-105). The rachidian tooth is tricuspid, wide (about 25 µm), and flat. The cusps are strong, pointed and ventrally curved, the central cusp is straight and slightly longer than the outer cusps which point outwards. The lateral tooth is wide and stout, the width of the base is as wide as the rachidian base and slightly curved. The tooth has two strong, long and incurved cusps, the outer cusp is longer, and no basal projection.

Material examined: Laredo (10 A), Punta Arenas

Previous (distribution) records: Magellan region (Fig. 4.2-14); 0-90 m

Comparative remarks: The radula of Castellanos (1976) is similar to the radulae observed by SEM.

Pareuthria powelli (Hombron & Jacquinot, 1854)
(Plate XIV, Figs. 9.1.1- 106-108)

Fusus roseus Hombron & Jacquinot 1854: 107, pl.25; *Pareuthria rosea*: Powell 1960: 148; *Pareuthria powelli*: Cernohorsky 1977: 109; *Pareuthria rosea*: Castellanos et al. 1987: 61; Castellanos 1992: 17, pl.1, Fig.10; *Pareuthria powelli*: Linse 1999: 402

Description: Shell fusiform, medium (9.2 mm in height, 4.7 mm in diameter; investigated specimen), solid, smooth, and white to pinkish in colour.
Protoconch is large, globose, dome-shaped, about 3 in number of turns, 600-830 µm in diameter, 1,3 mm in length, white in colour, and smooth (Fig. 9.1.1-106, 107). Teleoconch 3.5 in number of turns, suture deep. Teleoconch sculpture numerous fine spiral ribs and large rounded axial ribs.
Aperture about 2/5 of shell height (4.6 in height), oval. Periostracum absent.
The operculum is horny, thick, dark brown, oval, eccentric, and with a basal nucleus. The muscle scar is large, more than half size of the operculum.
The radula is rachiglossate, with the formula 1 : 1 : 1, long and narrow (about 1600 µm length and 68 µm width, SL 9.2 cm), and about 45 transverse rows (Fig. 9.1.1-108). The rachidian tooth is tricuspid, wide (about 25 µm), and flat. The cusps are strong, pointed and ventrally curved, the central cusp is straight and slightly longer than the outer cusps which point outwards. The lateral tooth is about 20 µm wide and stout, the width of the base is narrower than the rachidian base and slightly curved. The tooth has two strong, long and incurved cusps, the outer cusp is longer, and no basal projection.

Material examined: VH’94 St. 972 (9A), St. 1083 (1 A), St. 1152 (2 A, investigated), St. 1192 (4 A), St. 1216 (3 A, 2 S), St. 1221 (2 A); St. 1232 (2 A)

Previous (distribution) records: Magellan region, Falkland Islands (Fig. 4.2-14); 13-201 m

Comparative remarks: The radula of *P. powelli* is quite similar to *P. rosea* but differs in having less transverse rows (about 45 to about 100 rows). The groove between the two cusps of the laterals in *powelli* is conspicuously narrower than *rosea*.

Subfamily Prosiphiinae Powell, 1951
Genus *Prosipho* Thiele, 1912
Genus *Crenatosipho* gen. n.
Etymology: crenatus - notched, sipho - pipe; Refers to the structure of the protoconch.

Type species: *Crenatosipho beaglensis* sp. nov.
Shell elongated fusiform, with slightly convex whorls, pronounced axial ribs and spiral cords. Aperture large, oval with a narrow and short siphonal canal. Fasciole smooth, narrow pseudumbilicus, inner lip with thin glaze, outer lip thin, rounded. Protoconch large, cone-shaped, of about two whorls, nucleous large. Radula with minute rachidian, lateral teeth large, with numerous (6) cusps and large basal projection. Operculum oval, eccentric, with large muscle scar.

Comparative remarks: The type species of the new genus differs from other buccinids in having a protoconch with numerous axial ribs and a smooth nucleus. The buccinid genera in the Magellan area, *Glypteuthria* Strebel, 1905, *Pareuthria* Strebel, 1905, *Meteuthria* Thiele, 1912, and *Prosipho* Thiele, 1912, that show similar teleoconch sculptures differ by having smooth or fine spiral lined protoconchs. The radula is different to those of the latter genera. The long basal projection of the lateral radula teeth shows the belonging to the subfamily Prosiphiinae. *Crenatosipho* differs from the other prosiphiinid genus in the Southern Ocean is *Prosipho* Thiele, 1912 in having a reduced rachidian tooth while *Prosipho* has a simple tricuspid rachidian.

Crenatosipho beaglensis sp. nov.
(Plate XIV, Fig. 9.1.1- 109-112)

Description: The shell is fusiform, medium (8.6 mm in length, 3.9 mm in diameter), solid, white, heavily sculptured with strong spiral ribs and stronger axial ribs (Fig. 9.1.1-109). Protoconch is large, high elevated, two in number of turns, and about 690 µm in diameter and 600 µm in height (Fig. 9.1.1-110, 111). The initial turn is smooth, the following turn has numerous axial ribs. The teleoconch has about 5 whorls, is slightly inflated, with a conspicuous suture. The first teleoconch whorl is sculptured with four spiral cords and numerous fine axial riblets. From the second teleoconch whorl on the sculpture has nodulous spiral cords and rounded axial ribs. Penultimate whorl with 10 axial and 4 spiral ribs. Body whorl with 11 axial ribs and 5 spiral ribs and further 6 spiral ribs on the base. Aperture large, about ½ of shell length, oval, with a narrow and short siphonal canal. Fasciole smooth, with narrow pseudumbilicus. Inner lip with thin glaze, outer lip thin, rounded.
Shell dimensions:

Holotype	8.6 mm SL	3.9 mm SD	4.2 mm Al	5.0 W
Paratype 1	4.0 mm SL	2.0 mm SD	2.6 mm AL	2.4 W

The operculum is large in comparison with the aperture, horny, dark-brown in colour, eccentric, and has a large muscle scar.
The radula is rachiglossate, very small (about 700 µm length and 21 µm in width), with the formula 1 : 1 : 1, and about 100 rows. The rachidian is reduced, rectangular, with a narrow base, and an almost straight top (Fig. 9.1.1-112). The laterals teeth are remarkably large and wide, have six cusps and a long basal projection. The four inner cusps increase in size outwardly, than there is a large convex curve and outer two cusps follow.

Type material: Holotype ZMH 2830, VH’94 St. 1216; Paratype 1 ZMH 2831 (1 A), VH’94, St. 1140; Paratype 2 ZMH 2832 (1 A, protoconch, radula and operculum scanned), VH’94, St. 1124

Etymology: The species is named after the Beagle Channel.

Distribution record: Magellan region (Fig. 4.2-15); 67-202 (310) m

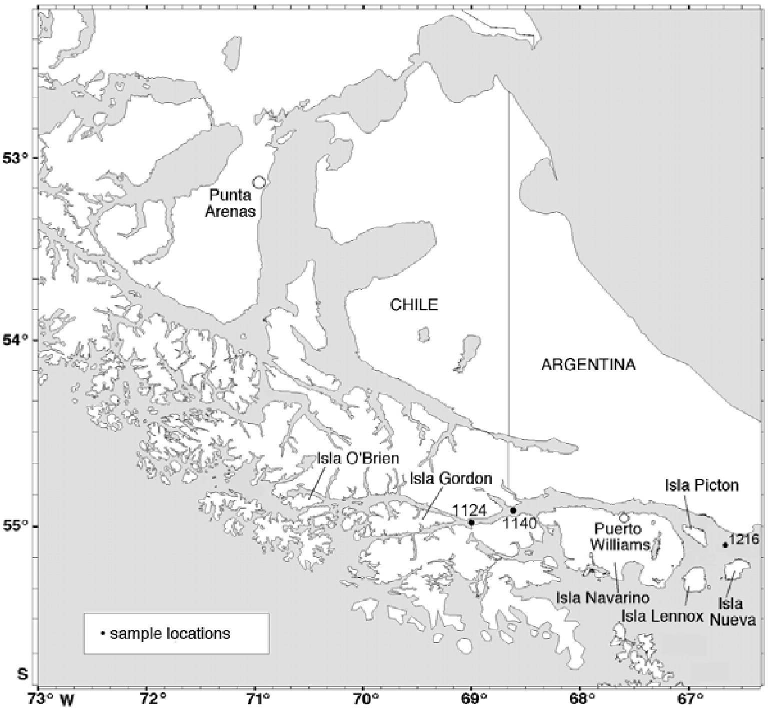


Fig. 4.2-15. Distribution and sample locations of *Crenatosipho beaglensis* sp. nov.

Comparative remarks: This species looks similar to *Glypteuthria meridionalis* (Smith, 1881) from the Magellan region and Falkland Islands, because of having an elongate fusiform shell and a pronounced teleoconch sculpture of nodulous spiral cords and prominent rounded axial ribs. This species is distinguishable from *G. meridionalis* in having an axial ribbed protoconch. Thiele (1912) illustrated the radula of *G. meridionalis*, this species has a broad tricuspid rachidian tooth and lateral teeth without long basal projections.

Family MARGINELLIDAE

Genus *Marginella* Lamarck, 1799

Marginella warrenii Marrat, 1876

(Plate XV, Figs. 9.1.1-113, 114)

Marginella warrenii Marrat 1876: 136; Powell 1960: 158; Castellanos & Landoni 1992: 35, pl.3, Fig.24; Linse 1999: 402

Description: Shell elongated ovate, medium (17.9 mm in length, 5.4 mm in diameter, 5 W), smooth porcellaneous, very glossy, orange-brown in colour with white spiral line. Protoconch small, globose, about 1in number of turns, orange-brown and glossy. Teleoconch about 4 in number of turns, suture extremely shallow. Body whorl large (12,7 mm in analysed specimen). Aperture long, 2/3 of shell length (11.8 mm), narrow. Columella with 3 folds. Operculum absent.
The radula has the formula 0 : 1 : 0 and 25 to 30 rows. The broad rachidian tooth is wide but very low, and has 17 to 21 different sized denticles (Fig. 9.1.1-113, 114).

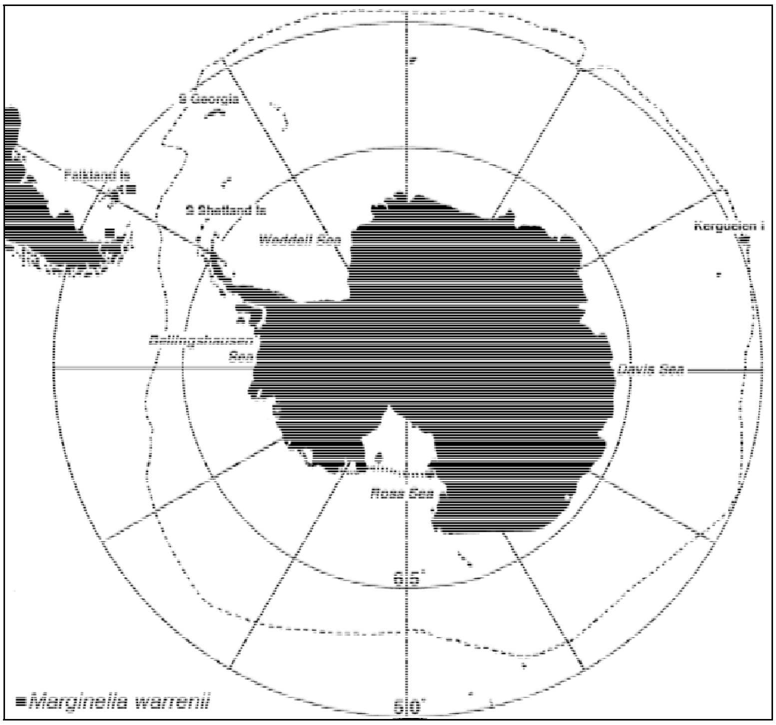


Fig. 4.2-16. Distribution of *Marginella warrenii*

Material examined: ANT XII/4 40-109 (1A, 18 S), St. 40-115 (1 A)

Previous (distribution) records: Magellan region, Falkland Islands (Fig. 4.2-16); 118-780 m

Comparative remarks: Numanami (1996) illustrated and described radulae of Antarctic species of the genus *Marginella* for the first time. The radula of *M. warrenii* can be distinguished from *M. hyalina* and *M. ealesae* by the lesser number of denticles (about 20 cusps versus 52 and 70 cusps).

Family MURICIDAE
Subfamily Trophoninae Cossmann, 1903
Genus *Trophon* Montfort, 1810
Trophon geversianus (Pallas, 1769)
(Plate XV, Figs. 9.1.1-115, 116)

Buccinum geversianus Pallas 1769: 33, pl.3, Fig.1; *Trophon geversianus*: Powell 1960: 154; Castellanos & Landoni 1993: 3, pl. 1, Fig.1-15; Linse 1999: 402

Description: Shell very large (up to 70 mm in height, 52 mm in diameter, 7 whorls), prominent spiral and axial ribs (spiral ribs often overgrown by axial ridges), solid, white to light grey in colour. Protoconch large, globose, about 2 in number of turns.
The radula is rachiglossate, with the formula 1 : 1 : 1 and has between 122 (young, small shell) and 299 (large female) rows. The rachidian tooth is large, broad, and has 5 main, pointed cusps and sometimes denticles between these (Fig. 9.1.1-115, 116). The central cusp is larger than the others. The lateral teeth are large, unicuspid, and sickle-shaped.

Material examined: Laredo/ Punta Arenas (12 A)

Previous (distribution) records: Magellan region, Falkland Islands (Fig. 4.2-17); 0-100 m

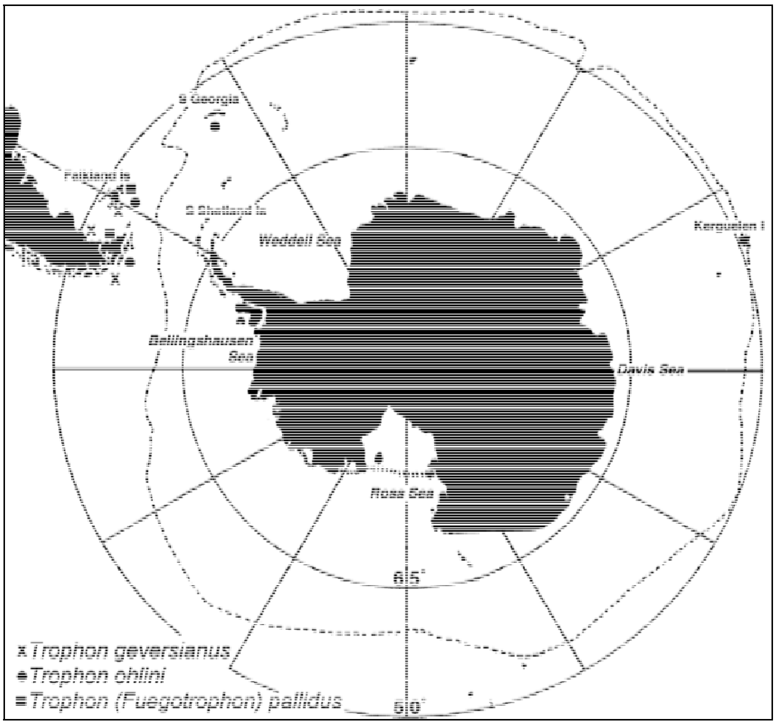


Fig. 4.2-17. Distribution of *Trophon geversianus*, *T. ohlini* and *T. (Fuegotrophon) pallidus*

Comparative remarks: The radulae of young and adult specimens of *T. geversianus* are illustrated for the first time.

Trophon cf. *ohlini* Strebel, 1905
(Plate XV, Figs. 9.1.1-117, 118)

Trophon ohlini Strebel 1905: 203, pl.3, Fig.9, 9a+b; Powell 1960: 154; Castellanos et al. 1987:62, pl.1, Fig.11; Castellanos & Landoni 1993: 10, pl. 2, Fig.23, pl.4, Fig.46; Linse 1997: 37; Linse 1999: 402

Description: Shell medium (10 mm in height, 5 mm in diameter, 5.5 whorls), wide spaced axial and up to 2 spiral ribs, solid, white in colour. Protoconch about 600 µm in size, with numerous fine spiral lines, about 2,1 in number of turns, with a high spire but flat top (Figs. 9.1.1-117, 118).

The radula is rachiglossate, formula 1 : 1 : 1. The SEM image of the radula is too dirty to publish. The central cusp of the rachidian is long and slender. The lateral teeth are long, slender, and sickle-shaped.

Material examined: VH'94 St. 963 (1 A), St. 972 (1 A), St. 1040 (1 A), St. 1045 (1 A), St. 1152 (1 A), St. 1178 (2 S), St. 1184 (1 S), St. 1200 (5 S), St. 1213 (22 A, 29 S), St. 1216 (3 A), 1221 (1 A), 1232 (1 A), St. 1270 (3 S); ZMH

Previous (distribution) records: Magellan region, Falkland Islands, South Georgia (Fig. 4.2-17); 30-219 m

Comparative remarks: The specimens of this study have a distinctively smaller protoconch than *Trophon ohlini* but the conspicuous morphology of the protoconch is unique in the Muricidae of the genus *Trophon*. Pastorino's (in prep.) revision of the genus *Trophon* deals with *T. ohlini*- complex.

Trophon (Fuegotrophon) pallidus (Broderip, 1832)
(Plate XV, Figs. 9.1.1-119, 120)

Murex pallidus Broderip 1832: 194; *Trophon (Fuegotrophon) pallidus*: Powell 1960: 155; Bastida et al. 1992: 694; Castellanos & Landoni 1993: 10, pl 2, Fig.31-33, pl.4, Fig.47; Linse 1997: 37; Linse 1999: 402

Description: Shell large (33 mm in height, 14 mm in diameter, 7 whorls), axial and spiral ribs, solid, white in colour. Protoconch is round, globose, high, about 2,1 in number of turns, 730 µm in diameter and 1,3 mm in height (Fig. 9.1.1-119).
The radula is rachiglossate, with the formula 1 : 1 : 1 and 150 rows. The rachidian is broad, with seven strong, pointed cusps (Fig. 9.1.1-120). The central cusp is the largest and strongest. The lateral teeth are sickle-shaped with a wide base.

Material examined: VH'94 St. 929 (8 A), St. 972 (2 A), St. 1152 (1 A), St. 1156 (1 A), St. 1164 (3 A), St. 1178 (1 A, 4 S), St. 1184 (1 S), St. 1200 (61 S), St. 1206 (13 A, 4 S), St. 1213 (12 A, 14 S), St. 1216 (2 A), St. 1270 (2 A, 1 S); ZMH

Previous (distribution) records: Magellan region, Falkland Islands (Fig. 4.2-17); 10-159 m

Comparative remarks: The radula of *T. pallidus* is illustrated for the first time.

Family DIAPHANIDAE
Genus *Diaphana* Brown, 1827
Diaphana paessleri (Strebel, 1905)
(Plate XVI, Figs. 9.1.1-121, 122)

Utriculus paessleri Strebel 1905: 577, p.22, Fig.34, 34a; *Diaphana paessleri*: Powell 1960: 163; Castellanos et al. 1993: 11, pl.2, Fig.22a+b; Linse 1997: 39; Schiøtte 1999: 90, Fig.9, 10, 11a-i, 19e; Linse 1999: 403

Description: The shell is cylindrical-pentagonal to oval, smooth, hyaline or white and up to 3.3 mm height. Protoconch is smooth and of about 0.8 whorls.
The radula is rachiglossate, with the formula 1 : 1 :1 and 10 to 11 rows (Fig. 9.1.1-121). The rachidian is broad, cuspless and with a concave groove in the centre (Fig. 9.1.1-122). The laterals are strong and sickle-shaped, the inner margin has numerous denticles.

Material examined: VH'94 St. 884 (1 A), St. 958 (2 A), St. 1152 (6 A), St. 1156 (1 A), St. 1164 (4 A), St. 1176 (6 A), St. 1178 (3 A, 1 S), St. 1192 (4 A), St. 1206 (1 A, 1 S), St. 1213 (57 A, 14 S), St. 1216 (2 A), St. 1221 (2 A), St. 1279 (1 A), St. 1291 (1 A); ZMH 18.5/383.2 (holotype)

Previous (distribution) records: Magellan region, Falkland Islands, South Georgia, South Orkney Islands, circumantarctic, Kerguelen Island, Marion Island (Fig. 4.2-18); 8-580 m

Comparative remarks: Schiøtte (1999) revised the genus *Diaphana* in general and studied inner and outer characters of *D. paessleri*.

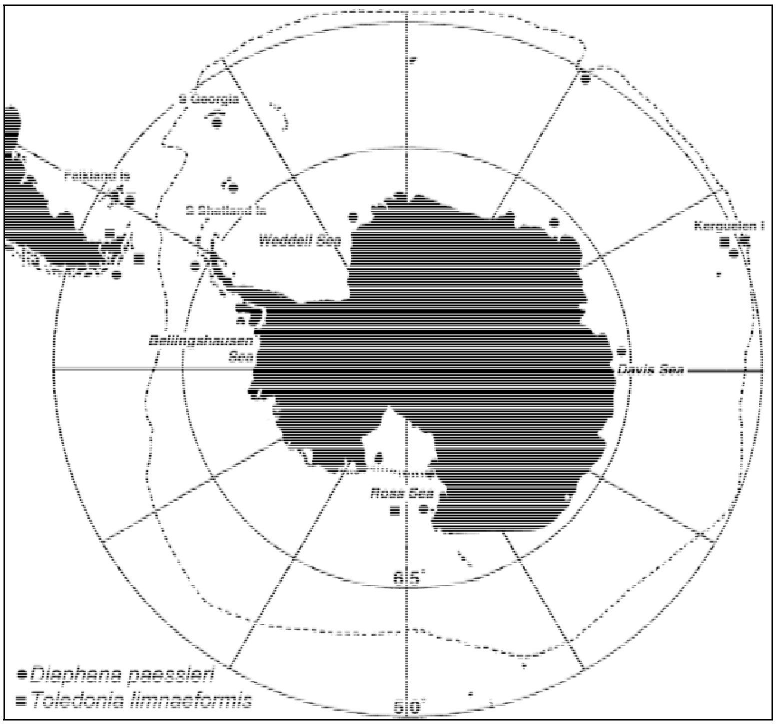


Fig. 4.2-18. Distribution of *Diaphana paessleri* and *Toledonia limnaeformis*

Subfamily Toledoniinae Warén, 1989

Genus *Toledonia* Dall, 1902

Toledonia limnaeformis (Smith, 1877)

Admete ? limnaeformis Smith 1877: 172, pl.9, Fig.4; *Toledonia limnaeformis*: Powell 1960: 162; Dell 1972: 40, Fig.33; Marcus 1976: 27; Dell 1990: 258, Fig.463-465; Castellanos et al. 1987: 65; Castellanos et al. 1993: 11, pl.2, Fig.22a+b; Linse 1997: 39; Linse 1999: 403

Description: Shell small (4.1 mm in height, 2.4 mm in diameter, 2.6 Aperture height, 3,5 whorls: largest specimen), ovate, fragile, opaque white. Protoconch small, high erected, irregular punctuated, about 1 in number of turns. Teleoconch smooth, except fine growth lines. Body whorl large, inflated to width axial. Aperture large, ovate, columella moderately twisted, forming broad columella fold. Operculum absent.

The radula has the formula 2 : 1 : 2 (Fig. 9.1.1-123). The rachidian is broad, dominant, with a long stalk, small basal wings and a multicuspid tip (Fig. 9.1.1-124). The central cusp is the longest and has four to five cusps on each side.

The lateral teeth are thin, flat, asymmetric triangular, and multicuspid. The inner margin is longer than the outer one and has more cusps. The inner marginal has a strong main cusp, sometimes with 1 or two denticles, the inner margin has three to four cusps, the outer margin two to three cusps (Fig. 9.1.1-125). The outer marginal tooth is larger in total. The main cusp is long and pointed, the inner margin has five to seven thorn-like, different sized cusps, the outer margin has nearly straight and cuspless.

Material examined: VH'94 St. 929 (3 A), St. 966 (2 A), St. 1164 (20 A), St. 1176 (2 A), St. 1178 (6 A, 1 S), St. 1213 (32 A, 61 S), St. 1216 (3 A), St. 1221 (7 A)

Previous (distribution) records: Magellan region, Ross Sea, Kerguelen Islands (Fig 4.2-18); 25-118 m

Comparative remarks: Thiele (1903) described the radula of *T. typica* with the formula 2 : 1 : 2. This species is synonymised by Thiele (1912) and Powell (1951) with *T. perplexa* and *limnaeformis*. Dell (1990) separates *T. perplexa* as a species of its own. Du Bois-Reymond Marcus (1976) studied the genus *Toledonia* by light microscopy and reported the radula formula 1 : 1 : 1. This study shows a radula with five teeth as reported by Thiele. Hain (1990) reported the radula of *T. cf. hedleyi* Powell, 1958 with having one rachidian and two pairs of lateral teeth with a similar structure as the one published here.

4.2.2. Bivalvia

Family NUCULIDAE

Genus *Nucula* Lamarck, 1799

Nucula falklandica Preston, 1912

(Plate XVII, Figs. 9.1.2-1,2,3,4,5)

Nucula falklandica Preston 1912: 637, pl.21, Fig.3; Powell 1960: 169; Dell 1964: 139, Fig.1-17; Dell 1990: *Nucula* sp.1: Linse 1997: 45; *Nucula falklandica*: Linse 1999: 404

Description: The shell is small sized (5.0 mm length, 4.3 mm in height, 3.4 mm in diameter), thin, fragile, shining, olive-brown in colour, prominent sculpture (Fig. 9.1.2-1). Valves moderately inflated. Beaks prominent, situated about posterior forth. Anterodorsal margin and anterior margin concave curved, ventral margin slightly curved and crenulated, posterior margin almost straight. Prodissoconch smooth. Exterior sculptured by strong commarginal ribs and numerous, closely set fine radial ribs (Fig. 9.1.2-2). Periostracum thin. Hinge moderately wide, with a strong but short chondrophore parallel to the anterior hinge, that is separating 13 anterior and 8 posterior teeth (3.9 to 5 mm valve length) (Fig. 9.1.2-3). Smaller specimens about 3.2 mm valve length bear 9 anterior and 5 posterior teeth (Fig. 9.1.2-4). Teeth, alternating with deep sockets, are long tapered and curved and increase towards the middle (Fig. 9.1.2-5). The interior is smooth, except muscle scars and fine crenulated ventral margin, and pearly shining.

Material examined: VH St. 843 (1 A), St. 874 (5 A), St. 980 (26 A), St. 1045 (23 A), St. 1077 (48 A), St. 1089 (26 A), St. 1119 (2 A), St. 1124 (12 A), St. 1140 (12 A), St. 1246 (9 A), St. 1253 (1 A), St. 1257 (3 A), St. 1263 (60 A, 80 S; scanned specimens), St. 1270 (2 A), St. 1279 (7 A, 34 S); Hero Stns. USNM

Previous (distribution) records: Magellan region, Falkland Islands, South Orkney Islands, Antarctic Peninsula Kerguelen Islands (Fig. 4.2-19); 6-665 m

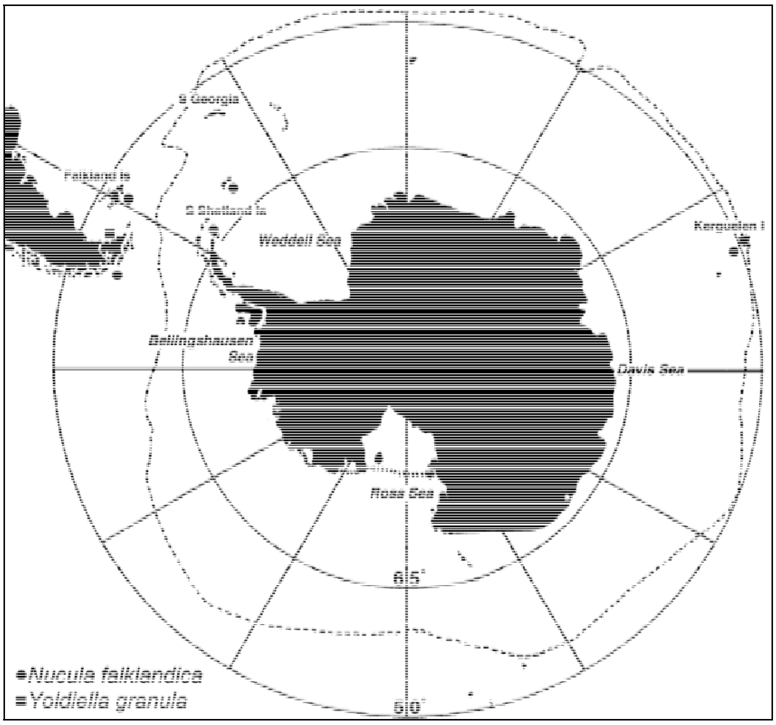


Fig. 4.2-19. Distribution of *Nucula falklandica* and *Yoldiella granula*

Comparative remarks: The specimens analysed are similar to Preston's (1912) description of this species, although the type specimen was smaller in size than the analysed ones. The specimens figured by Dell (1964, 1990) are similar in outline. Dell (1999: p. 6) described the exterior sculpture as 'with sparse, well marked growth wrinkles and relatively strong radial costae ...' but the specimens analysed from the Beagle Channel and the Hero (USNM material) show fine radial ribs. The hinge outline and number of teeth of the specimens (7-9 anterior and 5 posterior teeth, 3.2 mm length) analysed by Dell (1990) are similar to specimens analysed in this study of the same valve size (Fig. 9.1.2-4). Specimens from the Beagle Channel are often covered with a thick ferrugineous deposit on the anterior margin and beaks as remarked by Dell (1990) for specimens from Antarctic Peninsula.

Family NUCULANIDAE

Genus *Yoldiella* Verrill & Bush, 1897

Yoldiella granula Dall, 1908

(Plate XVII, Figs. 9.1.2-6,7,8)

Yoldia (Yoldiella) granula Dall 1908: 382; Powell 1960: 170; Dell 1964: 145; Osorio & Bahamonde 1970: 188, 243 Dell 1972: 26, Fig.4, 5; Dell 1990: 11; Linse 1997: 46; Linse 1999: 404

Description: Valves minute (3.0 mm length, 2.2 mm in height, 1.3 mm in diameter), ovate, thin, fragile, smooth, olive-brown in colour (Fig. 9.1.2-6). Valves not much inflated. Beaks prominent, situated about middle. Anterodorsal margin, anterior margin, and ventral margin concave curved, posterior margin concave curved and slightly elongated. Prodissoconch small, smooth. Exterior smooth except fine growth lines, no emargination or flattening on posteroventral margin. Periostracum thin, greenish-brown. Hinge moderately wide, with a well developed resilium, that is separating 6 anterior and 6 posterior teeth (Figs. 9.1.2-7,8). The teeth, alternating with sockets, are curved and increase in size outwards. The interior is smooth, except muscle scars and pallial line, and white porcellaneous.

Material examined: VH St. 1045 (2 A), St. 1083 (3 A), St. 1119 (4 A), St. 1140 (1 A), St. 1145 (5 A), St. 1183 (39 A), St. 1184 (20 A, 30 S), St. 1194 (1 A, 1 S), St. 1200 (19 S), St. 1206 (3 A, 9 S), St. 1213 (1 S), St. 1237 (124 A, 27 S), St. 1246 (130 A, 24 S), St. 1247 (352 A, 107 S), St. 1248 (183 A, 26 S), St. 1253 (111 A, 20 S), St. 1261 (3 A), St. 1263 (85 A, 409 S), St. 1270 (169 A, 67 S; ; scanned specimens), St. 1291 (24), St. 1307 (94 S); Holotype USNM 110693

Previous (distribution) records: Magellan region (Fig. 4.2-19); 62-665 m

Comparative remarks: The specimens are compared with Dall's (1908) holotype and similar to it in shell morphology and hinge structure. Dell (1964: 145) stated that '*Y. granula* ... should be critically compared with the Antarctic forms' and said (1972: 26) that ' fresh specimens (of *Y. granula*) ... will help solve identity of this species'. In comparison minute Antarctic species of *Yoldiella*, *Y. antarctica* (Thiele, 1912), *Y. ecaudata* (Pelseneer, 1903), *Y. profundum* (Melville and Standen, 1912), *Y. oblonga* (Pelseneer, 1903), and *Y. valettei* (Lamy, 1906), *Y. granula* can be separated. *Yoldiella antarctica*, *Y. ecaudata*, *Y. oblonga* and *Y. profundum* differ to *Y. granula* by having different numbers of anterior and posterior teeth in the hinge. The first three species have a slight emargination or a rostrum on the posteroventral margin, while *Y. profundum* and *Y. granula* are equilateral and have narrowly rounded margins. *Y. valettei*, recorded by Dell (1990) also from southern Chile, Falkland Islands, and Drake's Passage, is quite similar to *Y. granula* with 6 teeth on every hinge side in both species and shell outline. A difference is the posterolateral flattening that occurs in most shells of *Y. valettei* (Dell 1990) while it did not occur in the examined specimens of *Y. granula*. The shell proportions are variable in both species, Dell (1990) reported for *Y. valettei* height/length ratios from 71-75 (mean 73) while 62 shells of *Y. granula* analysed in this study show height/length ratios from 66-76 (mean 69).

Family PHILOBRYIDAE
Genus *Philobyra* Carpenter, 1872
Philobrya crispa sp. nov.
(Plate XVII, Figs. 9.1.2- 9-14)

Philobrya sp.1: Linse 1997: 49; Linse 1999: 404

Description: The shell is small sized (3.5 mm length, 3.1 mm in height, 1.8 mm in diameter), thin, fragile, brown in colour, prominent periostracum structure (Fig. 9.1.2-9). Valves moderately inflated. Beaks prominent, situated about anterior end. Anterodorsal margin very short, with nearly right angle towards almost straight anterior margin, ventral and posterior margin concave curved, posterodorsal margin almost straight. The prodissoconch is well separated from the dissoconch by a broad margin. The prodissoconch sculpture is distinctive and characterised by 6 radial ribs and numerous commarginal ribs (Figs. 9.1.2-10, 11). The external shell, when periostracum is removed or missing, commarginal growth lines and numerous radial lines. Periostracum thick, with dense, curved hair-like spines, that cover the valves in more than 20 radial lines (Fig. 9.1.2-12). Hinge moderately wide, toothless, with ligament on anterior half of dorsal margin (Figs. 9.1.2-13, 14). The interior is white, ventral and posterior margin sculptured with short radial ribs.

Type material: Holotype ZMH 2833 St. 1178, REM 81, 9 paratypes ZMH 2834 REM 77 ST.1213, 5 paratypes ZMH 2835 REM 80 ST.1213, 40 paratypes (valves) ZMH 2836 St. 1213, 8 paratypes ZMH 2837, Stn. 41-1178

Etymology: Crispus – Latin. Frizzy. Refers to the structure of the hair-like spines of the periostracum.

Material examined: St. 1263 (1 S), St. 1270 (1 S); ANT XIII/4 St. 40-108 (2 A)
Previous (distribution) records: Magellan region (Fig. 4.2-20); 25-198 (665) m

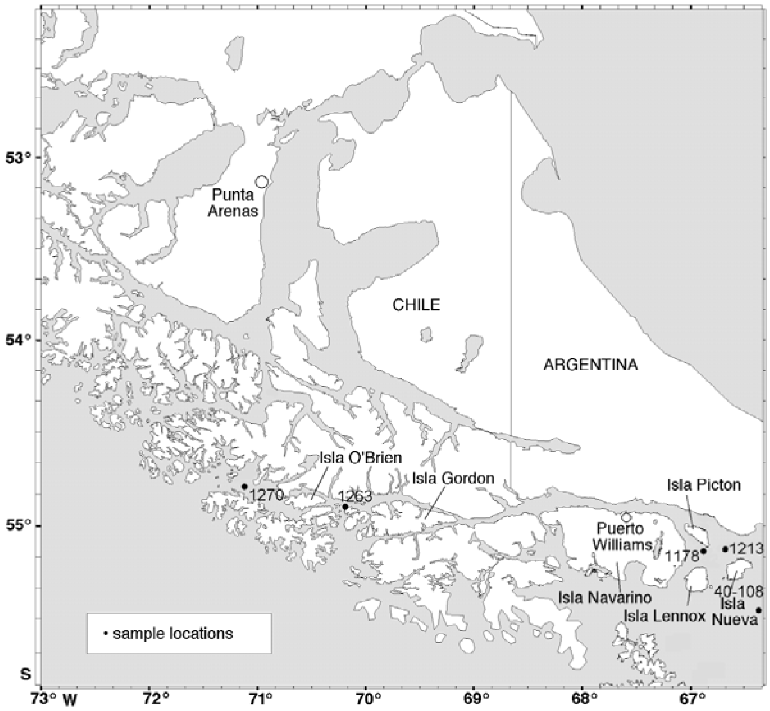


Fig. 4.2-20. Distribution and sample location of *Philobrya crispa* sp. nov.

Comparative remarks: *Philobrya crispa* sp. nov. can be separated from the other Magellanic (*P. capillata* Dell, 1964, *P. sublaevis* Pelseneer, 1903, *P. wandelensis* Lamy, 1906) and Antarctic species of *Philobrya* by following characters: 1) prodissoconch sculptured with 7 radial and numerous commarginal ribs, 2) > 20 lines of radial lines of hair-like periostracal spines. In the Drake's Passage off Cape Horn (ANT XIII/4 St. 40-109) dead valves of *P. capillata* (Fig. 9.1.2-15) and protoconchs of *P. olstadi* Soot-Ryen, 1951 (Fig. 9.1.2-16) were found. *Philobrya olstadi* was recorded only for the South Orkney Islands, the South Shetland Islands and Gough Island before.

Family MYTILIDAE
Genus *Crenella* Brown, 1827
Crenella magellanica sp. nov.
(Plate XIX, Figs. 9.1.2- 17-20)

Crenella sp.1: Linse 1997: 50; Linse 1999: 404

Description: The shell is small in size (2.4 mm length, 1.7 mm in height, 1.6 mm in diameter),almost oval, equilateral, thin, fragile, olive-brown in colour, sculpture of numerous radial ribs (Figs. 9.1.2-17, 18). Valves high inflated. Umbones more or less on mid-line with beaks curving anteriorly. Dorsal margin short, anterior and posterior margins slightly concave curved, and ventral margin concave curved. Prodissoconch large, separated from dissoconch by a different sculpture of numerous commarginal ribs. Exterior valve sculptured by numerous (> 75), prominent bifurcating radial ribs and fine commarginal growth lines. Periostracum thin and smooth. Hinge narrow, with numerous small grooved teeth (3-4 anterior and 18-21 posterior teeth) which are separated by small resilium (Figs. 9.1.2-19, 20). Inner surface white, inner margin crenulated.

Type material: Holotype ZMH 2838, 9 paratypes ZMH 2839 REM 66 ST.1213, 14 paratypes ZMH 2840 ST. 1164, 112 paratypes ZMH 2841 St. 1200, 11 paratypes ZMH 2842, Stn. 1291

Etymology: Named after the Magellan region.

Material examined: VH'94 St. 1156 (4 A), St. 1178 (4 S), St. 1213 (222 A, 144 S), St. 1216 (2 A), St. 1247 (27 A, 17 S), St. 1248 (1 A)

Additional material examined: *C. decussata* (Montagu, 1808): USNM 363773 (2.4 mm length, 2.3 mm in height, 53 radial ribs); *C. divaricata* (d'Orbigny, 1846): USNM 568512, USNM 73903 (3.0 mm length, 2.6 mm in height, 59 radial ribs); *C. inflata* Carpenter, 1864: USNM 193841

Previous (distribution) records: Magellan region (Fig. 4.2-21); 24-217 m

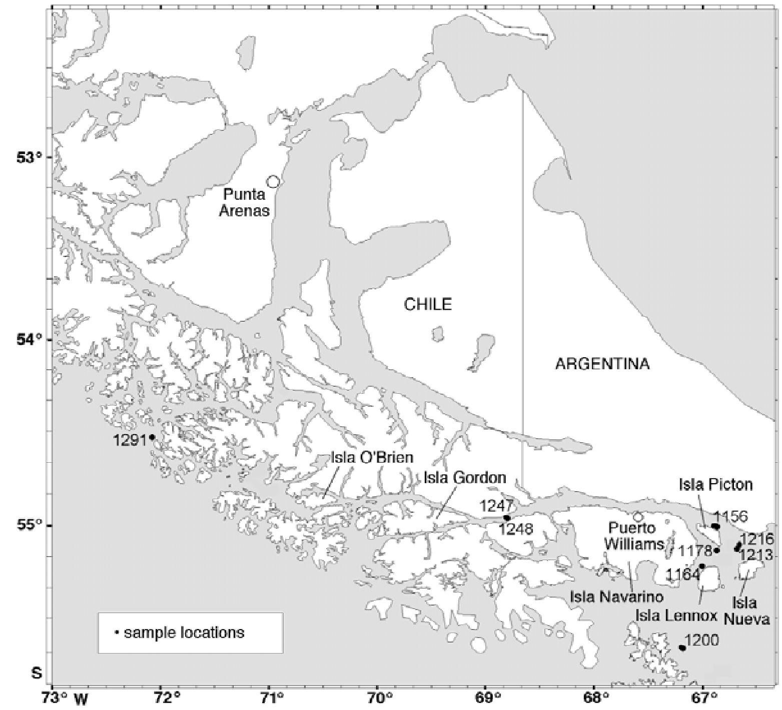


Fig. 4.2-21. Distribution and sample location of *Crenella magellanica* sp. nov.

Comparative remarks: Melville & Standen (1912: 135) recorded the European *C. decussata* from Burdwood Bank, Carcelles & Williamson (1951: 327) included this record in their catalogue on marine Magellanic Mollusca, and Powell (1960: 124) mentioned that this record requires confirmation. Bastida et al. (1992: 694) reported *C. divaricata* from the Bahia Blanca area and the Patagonian shelf off the entrance of the Strait of Magellan in 30-92 m. Specimens of both species from the USNM collections were compared with specimens of *C. magellanica* sp. nov. *Crenella magellanica* sp. nov. can be separated by following characters: 1) a larger prodissoconch, 2) > 75 radial ribs on the dissoconch, and 3) smaller height/ length ratios (69-72, mean 71).

Family PECTINIDAE
Genus *Cyclopecten* Verrill, 1897
Cyclopecten multistriatus sp. nov.
(Plate XIX, Figs. 9.1.2- 21-24)

Cyclopecten sp.2: Linse 1997: 51; Linse 1999: 404

Description: Valves minute (1.7 mm length, 1.8 mm in height), inequivalve, left valve almost equilateral, thin, fragile, hyaline, white in colour. Right valve almost flat, dissoconch sculptured with very fine radial lines and fine growth lines; anterior ear with byssus groove, well developed byssal sinus, and 6-7 scaled radial ribs increasing in size towards sinus, posterior ear almost smooth (Fig. 9.1.2-21). Left valve inflated, dissoconch sculptured with numerous commarginal and more than 20 radial ribs, radials narrower on the ears (Fig. 9.1.2-22). Umbones more or less in the middle of straight dorsal margin. Anterior and posterior margins almost straight, ventral margin concave curved. Prodissoconch small, separated from dissoconch by a honeycomb-like pattern (Figs. 9.1.2-23, 24). Periostracum absent. Hinge narrow, toothless.

Type material: Holotype ZMH 2843, 6 paratypes ZMH 2844 REM 67 ST.1213, 30 paratypes ZMH 2845 ST. 1178, 5 paratypes ZMH 2846 St. 1184, 40 paratypes ZMH 2848, Stn. 1206

Etymology: multistriatus – Latin. With numerous striae. Name refers to the shell structure.

Material examined: VH'94 St. 1200 (5 A, 279 S), St. 1213 (31 A, 348 S), St. 1221 (1 A), St. 1237 (1 A), St. 1253 (5 S), St. 1257 (5 S)

Additional material examined: *C. gaussianus* (Thiele, 1912): holotype, HUM 863084; *Palliolum clathratum* (Martens, 1881): holotype HUM 29083, *P. notalis* (Thiele, 1912): holotype HUM 63122

Previous (distribution) records: Magellan region (Fig. 4.2-22); 25-103 m

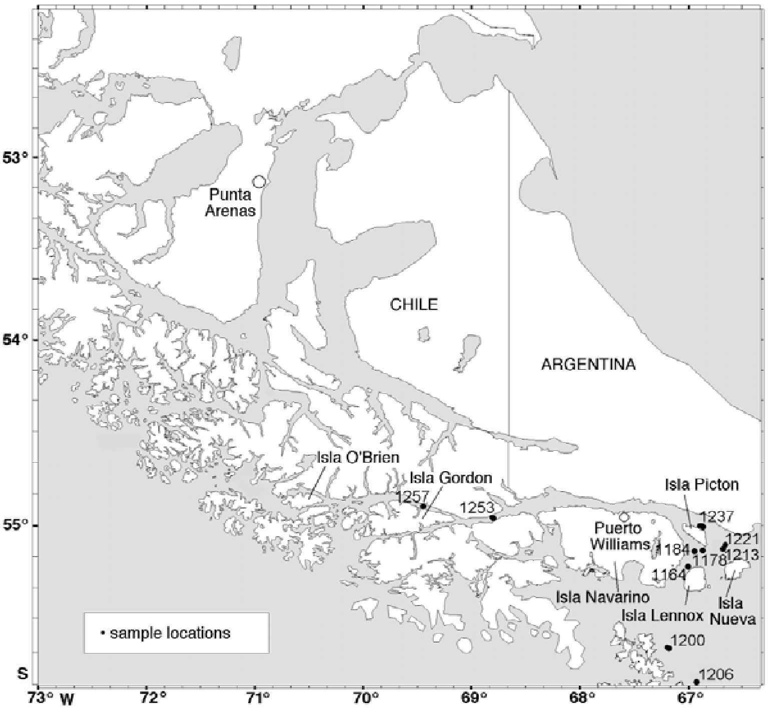


Fig. 4.2-22. Distribution and sample location of *Cyclopecten multistriatus* sp. nov.

Comparative remarks: *Cyclopecten multistriatus* sp. nov. can separated from the other Magellanic pectinids by following characters: 1) the minute size, 2) right valve flat, only left one convex, and 3) distinctive sculpture on both valves. The new species was compared with small sized Antarctic pectinids, with type-specimens of *C. gaussianus*, *Palliolum chathratum*, and *P. notalis*. *C. multistriatus* sp. nov. can be separated from *gaussianus* by the protoconch sculpture (*gaussianus* has a smooth one), from *P. clathratum* by a narrower radial and commarginal sculpture and less convex left valve in the latter species, and from *P. notalis* by its commarginal sculpture and the convex curvature in both valves.

Additionally *Cyclopecten falklandica* Dell, 1964 is figured (Pl. XX, Figs. 9.1.2-25, 26) and its distribution shown (Fig. 4.2-23).

Genus *Pecten* Osbeck 1765

Pecten cf. *pygnolepis* Martens, 1881

(Plate XX, Figs. 9.1.2-27, 28)

Pecten pygnolepis Martens 1881: 78; Carcelles 1950: 76; *Cyclopecten* sp.1: Linse 1999: 404

Description: Valves medium (17 mm length, 16 mm in height, 0.8 mm in diameter), almost equivalve, almost equilateral, thin, fragile, hyaline, white in colour, similar sculpture on both valves. Valve sculpture of numerous fine radials and 17 commarginal lines. Right valve with byssus groove, well developed byssal sinus; anterior ear longer than posterior, with 5-7 scaled radials, posterior ear with radial and commarginal sculpture (Fig. 9.1.2-27). Left valve with large anterior and smaller posterior ear (Fig. 9.1.2-28). Umbones more or less in the middle of straight dorsal margin. Anterior margin concave curved, posterior margin almost straight, and ventral margin concave curved. Prodissoconch small and smooth. Periostracum absent. Hinge narrow, toothless.

Material examined: VH'94 St. 1031 (4 A), St. 1042 (11 A), St. 1077 (2 A); VG'95 St. 5 (6 A)

Previous (distribution) records: Magellan region (Fig.4.2-23); 30-723 m

Comparative remarks: The analysed specimens are similar to Martens' (1881) description, but unfortunately the type material is missing. The generic position in the genus *Pecten* is doubtful, the specimens seem to belong to *Hyalopecten* Verrill, 1897.

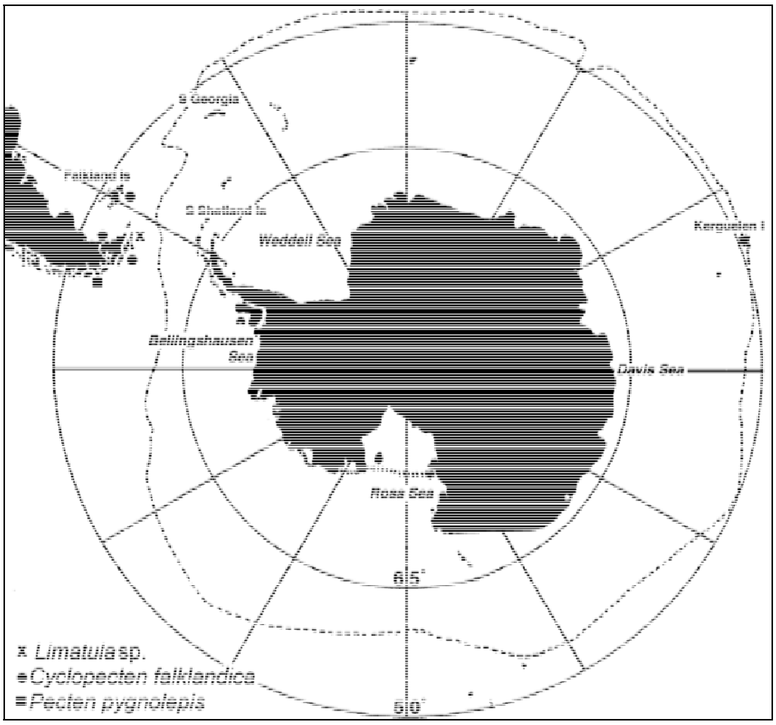


Fig. 4.2-23. Distribution of *Pecten pygnolepis*, *Cyclopecten falklandica* and *Limatula* sp.1

Family LIMIDAE

Genus *Limatula* Searles-Wood, 1839

Limatula (Limatula) sp. 1

Limatula sp.1: Linse 1999: 404

Description: Valves small (6.1 mm length, 3.2 mm in height), elongated ovate, equivalve, almost equilateral, thin, fragile, white in colour, radial sculpture on both valves with one broad, deep, squared radial groove in the center line (Fig. 9.1.2-29). Umbones more or less in the middle of straight dorsal margin. Ears small. Anterior and posterior margins slightly concave curved, and ventral margin concave curved and crenulated. Prodissoconch small and smooth, more rounded than dissoconch. Periostracum absent. Hinge wide, toothless, with triangular ligament pit below beaks (Fig. 9.1.2-30).

Material examined: ANT XIII/4 ST. 40-109 (6 S)

Previous (distribution) records: Magellan region (Fig. 4.2-23); 250 m

Comparative remarks: *Limatula* sp. 1 is next to *L. (L.) simillima* (Thiele, 1912) the only Southern Ocean species of *Limatula s. s.* following Fleming's (1978) definition of *Limatula*. The Antarctic and Magellanic species *Limatula (Antarctolima) hodgsoni* (Smith, 1907), *L. (A.) ovalis* (Thiele, 1912) and *L. (A.) pygmaea* (Phillipi, 1845) are placed in the new subgenus *Antarctolima* Habe, 1978 (Dell, 1990). *Limatula (L.)* sp. 1 can be separated from its sympatric species *Limatula (A.) hodgsoni* and *L. (A.) pygmaea* and from *L. (L.) simillima* by following characters: 1) larger heigth/ length ratios (about 19 against about 13-14 in *L. (A.)* and about 17 in *L. (L.)*), and 2) the broad, squared radial groove in the center line about the shell.

Family CUSPIDARIIDAE
Genus *Cuspidaria* Nardo, 1840
Cuspidaria chilensis Dall, 1889
(Plate XX, Figs. 9.1.2-31, 32)

Cuspidaria chilensis Dall 1889: 282, pl.13, Fig.18; Dall 1908: 433; Osorio & Bahamonde 1970: 196; *Cuspidaria* sp.n. 1: Linse 1997: 62; *Cuspidaria chilensis*: Linse 1999: 405

Description: Shell small-sized for genus (9.5 mm length, 6.6 mm height, 2.6 mm rostrum height, 5.0 mm diameter), inequivalve, inequilateral, thin, white, light pink periostracum, posterior margin drawn out to short rostrum (Fig. 9.1.2-31). Valves not much inflated. Beaks small, prominent, slightly incurved, just anterior of middle of dorsal margin. Right valve overlaps left one. Anterodorsal margin straight, running slightly downwards, anterior margin convex curved, ventral margin slightly concave curved with upwards slant at beginning of rostral region, posterior margin concave curved. Rostral region relatively short and high, gapping on rostrum end. Prodissoconch small, smooth. Exterior smooth except fine growth lines, with flattening on posteroventral margin. Periostracum thin, pink, with folds on anterodorsal margin and prominent folds on rostrum. Hinge narrow, toothless, with small projecting chondrophore (Fig. 9.1.2-32). The interior is smooth and white.

Material examined: VH'94 St. 1077 (13 A), St. 1089 (3 A), St. 1140 (2 A), St. 1247 (1 A), St. 1263 (16 A, 39 S), St. 1270 (1 A), St. 1279 (1 A); USNM 87545 (right valve: 11.5 mm length, 8.3 mm height, 3.0 mm rostrum height, 3.0 mm diameter)

Previous (distribution) records: Magellan region (Fig. 4.2-24); 100-665 m

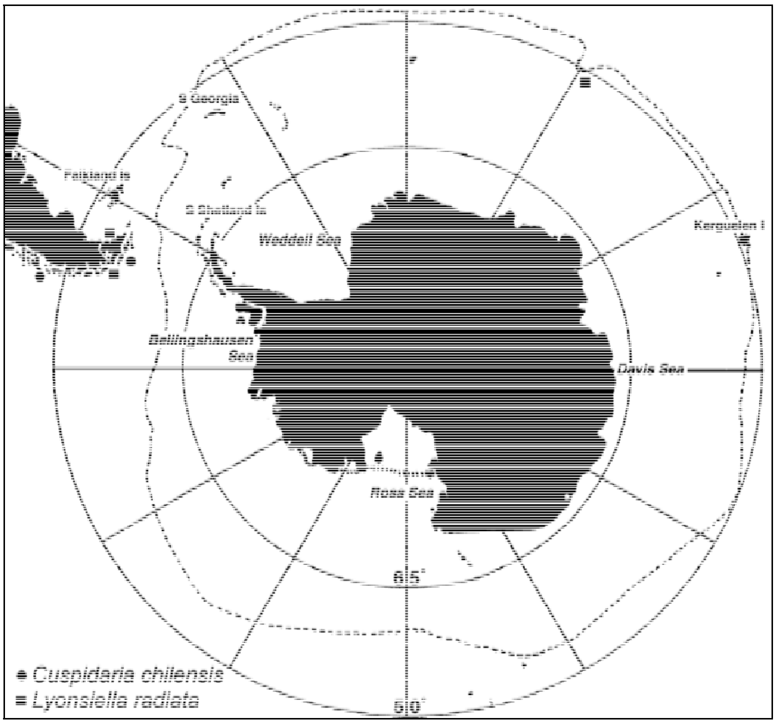


Fig. 4.2-24. Distribution of *Cuspidaria chilensis* and *Lyonsiella radiata*

Comparative remarks: *Cuspidaria chilensis* can be distinguished from the other cuspidariids of the Southern Ocean by its shell outline and structure. The large sized *C. patagonica* Smith, 1885, recorded from the Magellan area, differ by having a very long and slender rostrum. Young *C. patagonica* in equal size to *C. chilensis* have a smaller height, a smaller rostrum height and the height expressed as a percentage of the length is 2.1 instead of 1.8. *C. multicostata* Egorova, 1993 and *C. tenella* Smith, 1907 are characterised by an exterior shell structure of commarginal ribs and ridges. Young *C. tenella* (Hain 1990) have less developed ribs, *C. infelix* Thiele, 1912 (holotype HUM 63121) has a longer rostrum. The incorrect identification of the author (1997: 62) was due to Fig. 401 in Alamo & Valdivieso (1987) who figured *C. patagonica* but the legend says *C. chilensis* Dall.

Biological remarks: The stomach contents of 10 specimens of *C. chilensis* (3,8 to 8,2 mm length) were examined. These stomachs included carapace fragments of harpacticoid copepods, ostracods and bivalves, the latter both whole and in fragments. The bigger specimens (4 of 6: 6.0-8.2 mm length) fed mainly on harpacticoids, beside the copepods only one ostracod and one taxodont bivalve in different specimens were found. Two stomachs were empty; in these specimens the digestive glands were swollen while they were more or less little in specimens with filled stomachs. The stomachs of the four smaller specimens (3.0-4.1 mm length) included more food than did the bigger ones. One animal, itself 3 mm long, had three ostracods (280 x 190 µm to 420 x 700 µm) and one harpacticoid in its stomach, another, 3.8 mm long, two ostracods (210 x 154 µm) and one taxodont bivalve (640 x 500 µm) were captured.

In stomachs of *C. infelix* from the same area, crustacean carapace fragments and fine mud were found. Reid & Reid (1974) also found small crustaceans and molluscs in the stomachs of north atlantic *C. obesa* and *C. rostrata*, and described the feeding behaviour of these species.

Family VERTICORDIIDAE
Genus *Lyonsiella* (M. Sars, 1869) Friele, 1879
Lyonsiella radiata Dall, 1889
(Plate XXI, Figs. 9.1.2- 33-35)

Lyonsiella radiata Dall 1889: 276, pl.2, Fig.7; Carcelles 1950: 83, pl.4, Fig.80; Carcelles & Williamson 1951:349; Powell 1960: 184; Osorio & Bahamonde 1970: 195; Linse 1997: 62; Linse 1999: 405
Lyonsiella cf. *radiata*: Branch et al. 1991: 54

Description: Shell medium (10.0 mm length, 10.0 mm height, 6.6 mm diameter), slightly inequivalve, inequilateral, subquadrate, thin, pearly white, light pink periostracum, and sculptured with radials (Figs. 9.1.2-33,34). Valves clearly inflated. Beaks prominent, strongly incurved, about first third of dorsal margin, pointing forwards. Right valve overlaps left one. Anterodorsal margin short, anterior margin concave incurved, ventral margin broad convex curved, posterior margin convex curved, and posterodorsal margin long. Prodissoconch small, smooth. Exterior sculptured with more than 48 radial riblets and very fine growth lines; radials narrower near to posterodorsal margin. Periostracum thin, pale beige, with fine folds on radials and folds and very fine hairs on dorsal margin, there often covered with adherent sand grains, and slightly overlapping ventral margin. Hinge narrow, toothless, long external ligament supported by solid lithodesma (Fig. 9.1.2-35). The interior is smooth, except pallial line and muscle scars, and white with pearly lustre.

Material examined: VH'94 St. 1077 (2 A), St. 1089 (1 A), St. 1263 (4 A, 13 S); Holotype USNM 97096, USNM 97137

Previous (distribution) records: Magellan region, Marion Island (Fig. 4.2-24); 270-665 m

Comparative remarks: The specimens analysed in this study were compared with Dall's (1889) type and further USNM material and are similar to those. The valves found by Branch et al. (1991) have to be compared with the type material, they are remarkably large in size (20 mm).

Lyonsiella angelika sp. nov.
(Plate XXI, Figs. 9.1.2- 34,35)

Description: Shell small (5.3 mm length, 5.80 mm height, 3.5 mm diameter), slightly inequivalve, inequilateral, subquadrate, very thin, translucent, pale beige, thin periostracum, and sculptured with radials (Fig. 9.1.2-34, 35). Valves clearly inflated. Beaks prominent, strongly incurved, about first third of dorsal margin, pointing forwards. Right valve overlaps left one. Anterodorsal margin short, anterior margin concave incurved, ventral margin broad convex curved, posterior margin convex curved, and posterodorsal margin long. Prodissoconch small, smooth. Exterior sculptured with more than 37 radial riblets and very fine growth lines; radials narrower near to posterodorsal margin and wider at anterodorsal margin. Periostracum very thin, pale beige.

Type material: Holotype ZMH 2849, ANT XIV/2 St. 077, 61°18.60’ S, 57°01.70’ W, AGT, 1444 m, 08. 01.1996, leg. Ch. O. Coleman

Etymology: Named for Dr. Angelika Brandt of the Zoological Museum, Hamburg as a small recognition of her efforts in collecting Antarctic deep sea benthos.

Distribution records: South Shetland Islands (Fig. 4.2-25); 1444 m

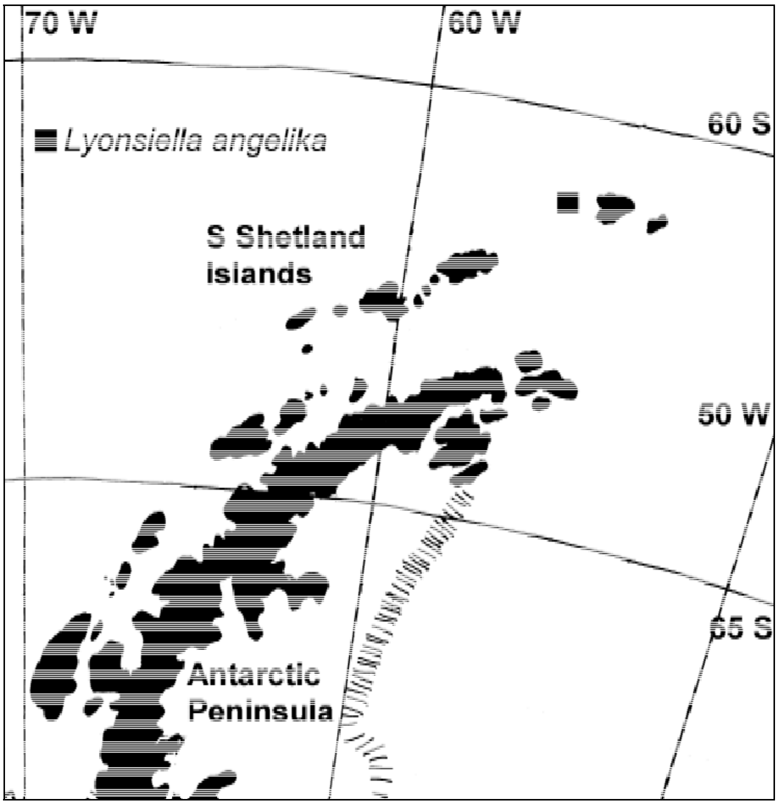


Fig. 4.2-25. Distribution and sample location of *Lyonsiella angelika* sp. nov.

Comparative remarks: *Lyonsiella angelika* sp. nov. can be separated from *L. radiata* by following characters: 1) less radials (37 to > 48), 2) translucent but not pearly shining shell, and 3) smaller size. *Lyonsiella aotearoa* Dell, 1995 from the Cook Strait (42°00.8’ S, 174°41.0 E, 939-1019 m) has very fine granules on the 28 radials and is rectangular in outline. This is the first record of the genus *Lyonisiella* in Antarctic waters. *Lyonsiella planulata* Thiele, 1912 is placed in *Lyonsia* (Dell 1972, 1990)

4.3. Biogeography of the Magellanic shelled malacofauna

For the biogeographic studies a comprehensive species-distribution list for Southern Ocean molluscs (2.3.1.) was compiled. The data and the checklist of Linse (1999) are used for the following analysis.

4.3.1. Faunal relations of the Magellan region to South and Latin America, South Africa, Australia, and Antarctica

The zoogeographic analysis was undertaken with special reference to the shelled gastropods and bivalves, but scaphopods have also been included. The 347 species analysed make up about a third of all reported gastropod, scaphopod, and bivalve species reported for the Southern Ocean. A comparison of the shared species for the different taxa to neighbouring areas is shown in

Tab. 4.3-1. There are no recent records of Magellanic species from South Africa, Australia, or New Zealand, though fossilised remains exist (Pether 1993, Beu & Maxwell 1990).

In waters around the Magellanic mainland nearly all species and all genera of the Magellan region occur, while from the Falkland Islands only 4 species are recorded which are not reported for the mainland (Tab. 4.3-1).

The region with the highest number of species shared with the Magellan region for all shelled molluscs is northern Argentina with 107 similar species (30.3 % similarity) followed by northern Chile (76 spp, 21.9%). The number of overlapping species is still high within the Islands of the Scotia Arc, e.g. South Georgia (71 spp/ 20.5%), South Orkney Islands (43 spp/ 12.4%), South Shetland Islands (43 spp/ 12.4%), but even on the Kerguelen Islands 35 shared species (10.1%) are recorded. The number of species from the Magellan region shared with the Antarctic continent decreases towards the Scotia Arc Islands with increasing distance and due to this the percentage of Magellanic species shared with the regions. The regions around the continent show percentages between 9.2% (32 spp, Antarctic Peninsula) and 0.9 % (3 spp, Mary Byrd Land).

Tab. 4.3-1. Number of shared species and genera and percentages of shared species for different (shelled) mollusc classes of the Magellan region to neighbouring areas. n – number, spp – species, gen – genera, % - percentage of shared species

	Gastropoda		Scaphopoda		Bivalvia		Sum Mollusca	
Region compared with the Magellan region	n (spp/ gen)	%	n (spp/ gen)	%	n (spp/ gen)	%	n (spp/ gen)	%
Magellanic mainland	207/ 105	99	6/ 5	100	129/ 68	98.5	343/ 178	98.8
Falkland Islands	140/ 79	66.6	2/ 2	33.3	82/ 52	62.6	224/ 133	64.6
Magellan region	**210/ 105**	**100**	**6/ 5**	**100**	**131/ 68**	**100**	**347/ 178**	**100**
Ecuador	0/ 0	0	1/ 1	16.7	3/ 3	2.3	4/ 4	1.2
Peru	6/ 6	2.9	1/ 1	16.7	9/ 8	6.9	16/ 15	4.6
northern Chile	38/ 30	18.1	3/ 3	50	35/ 29	26.7	76/ 62	21.9
northern Argentina	81/ 53	38.6	0/ 0	0	24/ 23	18.3	105/ 76	30.3
South Georgia	26/ 23	12.4	0/ 0	0	45/ 29	34.4	71/ 52	20.5
South Sandwich Isls	2/ 2	1	0/ 0	0	16/ 14	12.2	18/ 16	5.2
South Orkney Islands	7/ 7	3.3	1/ 1	16.7	35/27	26.7	43/ 35	12.4
South Shetland Isls	4/ 4	1.9	2/ 2	33.3	37/ 26	28.2	43/ 32	12.4
Antarctic Peninsula	4/ 4	1.9	2/ 2	33.3	26/ 22	19.8	32/ 28	9.2
Weddell Sea	2/ 2	1	1/ 1	16.7	19/ 16	14.5	22/ 19	6.3
Enderby Land	2/ 2	1	1/ 1	16.7	9/ 8	6.9	12/ 11	3.5
Davis Sea	4/ 4	1.9	2/ 2	33.3	16/ 13	12.2	22/ 19	6.3
Adelie Land	2/ 2	1	1/ 1	16.7	13/ 12	9.9	16/ 15	4.6
Oates Land	1/ 1	0.5	0/ 0	0	7/ 6	5.3	8/ 7	2.3
Ross Sea	5/ 4	2.4	2/ 2	33.3	18/ 16	13.7	25/ 22	7.2
Mary Byrd Land	0/ 0	0	0/ 0	0	3/ 3	2.3	3/ 3	0.9
Bellingshausen Sea	0/ 0	0	2/ 2	33.3	13/ 13	9.9	15/ 15	4.3
Palmer Archipel	1/ 1	0.5	0/ 0	0	21/ 18	16	22/ 19	6.3
Bouvet Island	0/ 0	0	0/ 0	0	6/ 5	4.6	6/ 5	1.7
Marion Island	6/ 6	2.9	0/ 0	0	6/ 5	4.6	12/ 12	3.5
Crozet Island	4/ 4	1.9	0/ 0	0	1/ 1	0.8	5/ 5	1.4
Kerguelen Islands	15/ 14	7.1	0/ 0	0	29/ 19	15.3	35/ 33	10.1
Heard Island	1/ 1	0.5	0/ 0	0	0/ 0	0	1/ 1	0.3
Maquarie Island	2/ 2	1	0/ 0	0	5/ 5	3.8	7/ 7	2.0
Campbell Island	1/ 1	0.5	0/ 0	0	1/ 1	0.8	2/ 2	0.6
Auckland Island	1/ 1	0.5	0/ 0	0	2/ 2	1.5	3/ 3	0.9

Gastropods show the highest percentage of shared species with northern Argentina (81 spp/ 38.6%) and still high percentages with northern Chile (38 spp/ 18.1 %) and South Georgia (26 spp/ 12.4 %) (Tab. 4.3-1). Except for the Kerguelen Islands (15 spp, 7.1 %) the number of overlapping species between the Magellan and Subantarctic and Antarctic regions is low (0-7 spp/ 0-3.3 %).

The Magellan region, and especially the Magellanic mainland, has the richest scaphopod community in the Southern Ocean with six species and five genera. The scaphopods show more relations to adjacent areas, such as northern Chile (3 spp/ 50 %) than to high Antarctic regions (Tab. 4.3-1). Both species recorded for the Antarctic show a circumantarctic distribution.

The distribution of species of Magellanic bivalves is different (Tab.4.3-1). The number of species shared with adjacent regions on the Patagonian shelf is still high with 24/ 35 spp (northern Chile/ northern Argentina) but the highest number of shared species is with South Georgia (45 spp: 34.4 %). The number of overlapping species decrease less towards the Scotia Arc Islands, from the South Shetland Islands 37 shared species (28.2%) are recorded, and around the Antarctic continent the percentage of shared species is quite high. For example from the Antarctic Peninsula 26 shared species (19,8 %) are reported, from the Weddell Sea 19 spp (14.5%), and for Ross Sea 188 spp (13.7%).

The degree of endemism for the shelled Magellanic molluscs is high with 66 % (229 of 347 species). The number of endemic species is distributed among the classes as following:

147 species of Gastropoda (210 spp in total): 70.0%
6 species of Scaphopoda (6 spp in total): 50.0%
79 species of Bivalvia (131 spp in total): 60.3%

4.3.2. Faunal relations in the Southern Ocean

The comprehensive species-distribution database for shelled gastropods, scaphopods, and bivalves (compare 2.3.2.), comprising 1033 species from Southern Ocean waters, is used for an analysis of the distribution patterns of Mollusca from 14 well investigated regions of the Southern Ocean.

The outcome of the cluster analysis for shelled molluscs is shown in Fig. 4.3-1. Five clusters can be separated by the chosen degree of similarity of 86%. The Magellanic mainland and the Falkland Islands (the Magellan region) form one cluster and are compared with the remaining clusters. South Georgia and the Kerguelen Islands do not cluster with any other areas. The remaining regions are separated into two clusters: 1) including the East-Antarctic regions, Enderby Land, the Davis Sea, Adelie Land, and the Ross Sea, and 2) including the Weddell Sea, the Antarctic Peninsula, the Palmer Archipelago, the South Shetland Islands, the South Orkney Islands, and Marion and Prince Edward Islands.

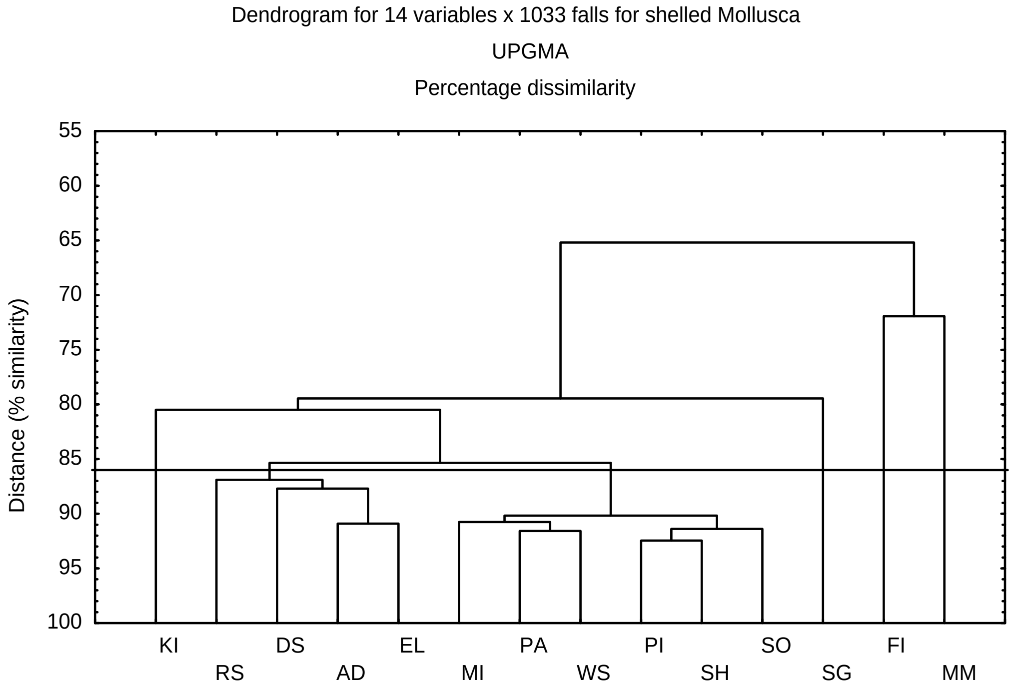


Fig. 4.3-1. Dendrogram of 1033 shelled mollusc species. The widely hatched line marks the chosen degree of similarity for the clustering. Calculation of distances: percentage of dissimilarity; cluster grouping: Unweighted pair-group method using arithmetic average.

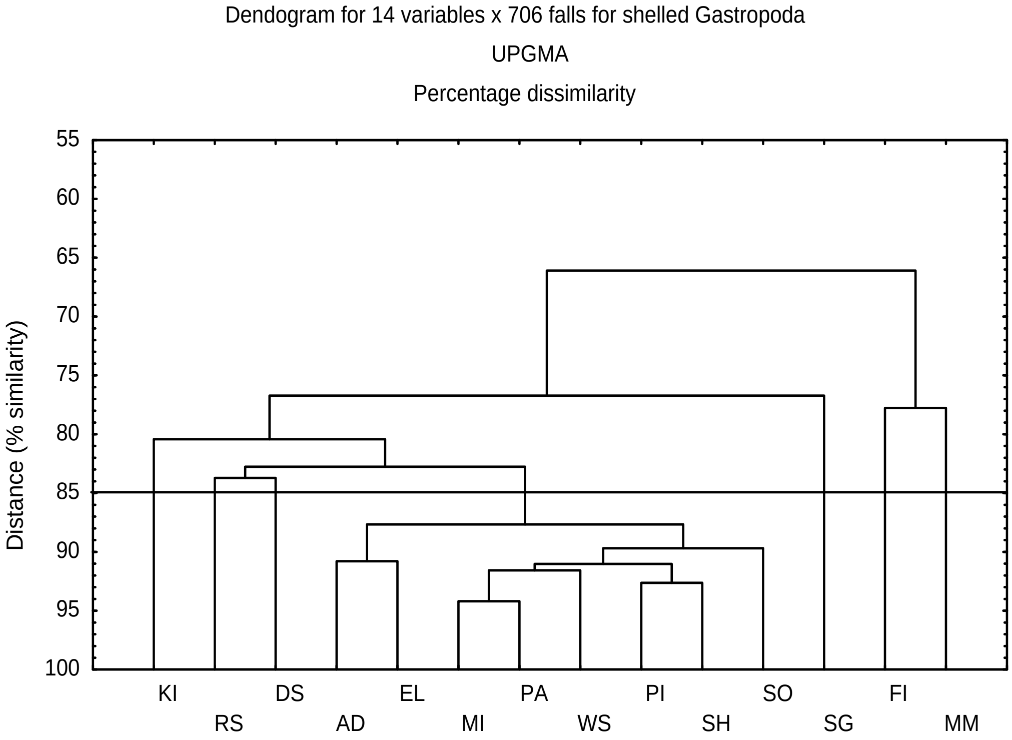


Fig. 4.3-2. Dendrogram of 706 shelled gastropod species. The widely hatched line marks the chosen degree of similarity for the clustering. Calculation of distances: percentage of dissimilarity; cluster grouping: Unweighted pair-group method using arithmetic average.

The dendrogram of the cluster analysis for gastropods is shown in Fig. 4.3-2. Six clusters can be separated by the chosen degree of similarity of 85%. The Magellanic mainland and the Falkland Islands form one cluster. The Davis Sea, the Ross Sea, South Georgia, and the Kerguelen Islands build a cluster of their own. The remaining regions fall into one cluster.

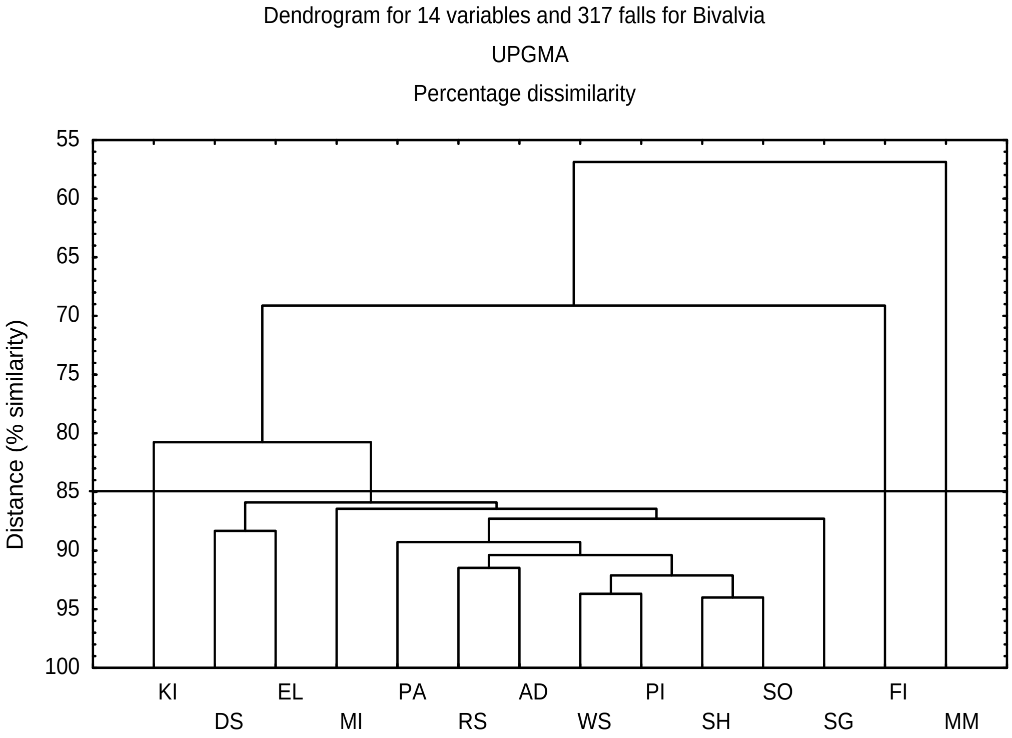


Fig. 4.3-3. Dendrogram of 317 bivalve species. The widely hatched line marks the chosen degree of similarity for the clustering. Calculation of distances: percentage of dissimilarity; cluster grouping: Unweighted pair-group method using arithmetic average.

The dendrogram of the cluster analysis for bivalves is shown in Fig. 4.3-3. Three clusters can be separated at the chosen degree of similarity of 85 %. The Magellanic mainland and the Falkland Islands each form one cluster. The Kerguelen Islands also form a cluster of their own. The remaining regions are combined in one large cluster, including the Scotia Arc Islands, the Antarctic continent and Marion and Prince Edward Islands.

4.2. Systematic report and descriptions of the molluscan fauna

The following taxonomic section focuses mainly on the shelled molluscs of the Magellan region but additionally analysed trochid species from Antarctica and further undescribed species from Antarctica are also included. Magellanic scaphopods are excluded because notes on their systematics are published in Steiner & Linse (in press).
First descriptions and synonyms are mentioned. Only synonyms are cited which were published either later than the check-list of Powell (1960) for Magellanic species or later than the study of Hain (1990) for Antarctic species.

This descriptive part includes
42 species of shelled Gastropoda and
10 species of Bivalvia.

The Mollusca were collected on the expeditions of RVs "Victor Hensen" '94, "Vidal Gomaz" '95 and '96, and "Polarstern" ANT XIII/2, XIII/4-2, and XIV/2 with towed gears (epibenthic sledge, Rauschert dredge, Agassiz trawl, and bottom trawl) and on Rothera Research Station by scuba divers.

4.2.1. Gastropoda

Family TROCHIDAE
Subfamily Trochinae Rafinesque, 1815
Tribe Gibbulini Stoliczka, 1868
Genus *Margarella* Thiele, 1893
Margarella violacea (King & Broderip, 1831)
(Plate II, Figs. 9.1.1- 9-12)

Margarita violacea King & Broderip 1831: 346; *Margarella violacea*: Powell 1960: 131; De Deambrosi 1969: 51; Castellanos & Landoni 1988: 16, pl.3, Fig.4; Linse 1999: 401

Description: The shell is small in size, wider than high (up to 8.4 mm in height and 9.9 mm in diameter) with depressed spires, solid. The surface is covered with numerous fine spiral lines, dark pink or pink without periostracum. Protoconch small, about 1.5 in number of turns, smooth, white, glossy, and in all examined specimens too eroded to be scanned. Teleoconch about 5 in number of turns, the suture is impressed. The body whorl is large. The base is roundly inflated. The umbilicus is closed. The aperture large, oval (5.1 mm in width, 4.9 mm in height), with a pink-green pearly lustre inside except outside of inner lip. Peristome smooth. Operculum is corneous, multispiral with a short growing edge, and equal in size to the aperture (Fig. 9.1.1-9).

The animal is pale beige in colour and has a single pair of cephalic tentacles. The eyes are large, located in posterior side of cephalic tentacles and black in colour.

The radula is rhipidoglossate, with the formula ∞ : 5 : 1 : 5 : ∞ (~ 25) (Fig. 9.1.1-10). It has about 31 transverse rows, is about 100 µm in width and 4.3 mm in length. The rachidian tooth is deltoid in outline, with triangulates lateral, slightly incurved wings (Fig. 9.1.1-11). It has a concave tip with a large, triangular central cusp that is serrated with 5 to 6 lateral denticles on each side. The lateral teeth are large, increase in size outwards, have a lateral wing on the outer margin and a long, serrated unicuspid tip. The central cusp is long, rounded, and has 6 to 8 flanking denticles on each side. The first marginal tooth is wider and stronger than the others, has a strong basal projection on the inner base, and an unicuspid, rounded tip with 6 to 7 denticles on each side (Fig. 9.1.1-12). The second to tenth marginals are long and slender, spatulate, with a large denticle on the stalk near to tip. Main cusp of tip broad and rounded, with 7 to 9 pointed denticles on each flanking side. Outer marginal teeth are long and very slender, with a curved spatulate tip and numerous very fine denticles.

Material examined: VG `96 St. 46 (2 animals, 2 S), St. 56 (2 S); VH St. 1164 (3 animals), St. 1178 (3 animals, radulae scanned), St. 1192 (5 S), St. 1212 (2 S), St. 1216 (1 S); ANT XIII/4-2 St. 40-109 D (3 S), ZMH

Previous (distribution) records: Magellan region, Falkland Islands (e.g. Strebel 1905) (Fig. 4.2-3); 0-156 m

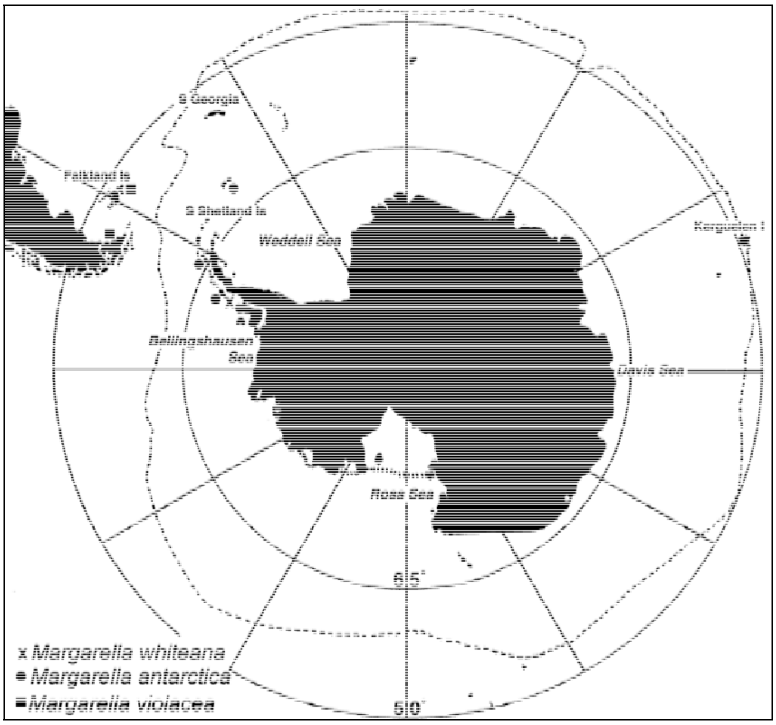


Fig. 4.2-3. Distribution of *Margarella violacea*, *M. antarctica* and *M. whiteana* sp.nov.

Comparative remarks: The radula of *M. violacea* was described by De Deambrosi (1969). Her drawing is similar to the radula analysed in this study. *M. violacea* is similar to *Homalopoma cunninghami* (Smith, 1881) in shell size and colour but can be separated by the following characters: 1) closed umbilicus, 2) horny operculum, 3) rachidian with long tip, and 4) marginal-rachidian-marginal line convex.

Margarella antarctica (Lamy, 1905)
(Plate II, Fig. 9.1.1- 13-16)

Margarita antarctica Lamy 1905: 481, Fig.5; *Margarita antarctica*: Powell 1960: 131; De Deambrosi 1969: 50

Description: The shell is small in size, wider than high (up to 6.7 mm in height and 7.8 mm in diameter) with depressed spires, solid. The surface is smooth, white, without periostracum. Protoconch small (about 400 to 420 µm), about 1.5 in number of turns, smooth, white and glossy (Fig. 9.1.1-13). Teleoconch about 4 in number of turns, the suture is impressed. First to first and a half teleoconch whorl is sculptured with two to four spiral ribs. The body whorl is large. The base is roundly inflated. The umbilicus is open (0.7 mm in diameter). The aperture large, oval (3.6 mm in width, 4.0 mm in height), with a pink-green pearly lustre inside. Peristome smooth. Operculum is corneous, light brown, multispiral with a short growing edge, and equal in size to the aperture.

The animal is orange-yellow in colour and has two pairs of cephalic tentacles. The eyes are large, located in posterior side of cephalic tentacles and black in colour. The five pairs of long and slender epipodial tentacles have a broad base.

The radula is rhipidoglossate, with the formula ∞ : 5 : 1 : 5 : ∞ (~ 25) (Fig. 9.1.1-14). It has about 43 transverse rows, is about 530 µm in width and 2.6 mm in length. The rachidian tooth is deltoid in outline, with triangulates lateral, slightly incurved wings (Fig. 9.1.1-15). It has a concave tip with a large, broad central cusp that is serrated with 9 lateral denticles on each side. The lateral teeth are large, increase in size outwards, have a lateral wing on the outer margin and a long, serrated unicuspid tip. The central cusp is long, rounded, and has 9 to 11 flanking denticles on each side (Fig. 9.1.1-16). The first marginal tooth is wider and stronger than the others, has a long basal projection on the inner base, and an unicuspid, rounded tip with flanking denticles on each side. Other marginal teeth are long and slender, with a curved spatulate tip and numerous flanking denticles. The marginal teeth decrease in size outwards.

Material examined: Rothera, Peninsula cruise, Signy Island

Previous (distribution) records: South Orkney Islands, South Shetland Islands, Palmer Archipelago, Wandel, Moureau, and Petermann Island, (Lamy 1905, Thiele 1912, Powell 1951) (Fig. 4.2-3); 0-36 m

Comparative remarks: The radula of *M. antarctica* was described by De Deambrosi (1969). Her drawing, especially the first marginal tooth, is different to the radula analysed in this study. De Deambrosi (1969) placed *antarctica* in *Margarites* because of the missing long basal projection on the inner base. All 3 specimens analysed in this study show this basal projection. Powell (1951) separated *Margarella* from *Margarites* by having transverse rows with a slight dip at the middle, and placed *antarctica* in *Margarella*. *M. antarctica* can be separated from *M. whiteana* sp. nov. by missing spiral ribs on all teleoconch whorls.

Margarella whiteana sp.nov.
(Plate III, Figs. 9.1.1- 17-20)

Description: The shell is small in size, wider than high (up to 7.6 mm in height and 8.7 mm in diameter) with depressed spires, solid. The surface is covered with numerous spiral ribs, porcellaneous white, without periostracum (Fig. 9.1.1-17). Protoconch small (about 390 µm in diameter), about 1.5 in number of turns, smooth, white, glossy (Fig. 9.1.1-18). Teleoconch about 4.3 in number of turns, the suture is impressed. The body whorl is large. The base is roundly inflated. The umbilicus is open (1.0 mm in diameter). The aperture large, oval (5.1 mm in width, 5.9 mm in height), with a silver-green pearly lustre inside except inside of outer lip. Peristome smooth. Operculum is corneous, yellow, multispiral with a short growing edge, and equal in size to the aperture.

The animal is pale yellow in colour and has two pairs of short cephalic tentacles. The eyes are large, located in posterior side of cephalic tentacles and black in colour. The five pairs of long and slender epipodial tentacles.

The radula is rhipidoglossate, with the formula ∞ : 5 : 1 : 5 : ∞ (~ 30) (Fig. 9.1.1-19). It has about 41 transverse rows, is about 460 µm in width and 2.5 mm in length. The rachidian tooth is deltoid in outline, with triangulates lateral, slightly incurved wings (Fig. 9.1.1-20). It has a concave tip with a large, pointed central cusp that is serrated with 7 lateral denticles on each side. The lateral teeth are large, increase in size outwards, have a lateral wing on the outer margin and a long, serrated unicuspid tip. The central cusp is long, rounded, and has 9 to 11 flanking denticles on each side. The first marginal tooth is wider and stronger than the others, has a long basal projection on the inner base, and an unicuspid, rounded tip with flanking denticles on each side. Other marginal teeth are long and slender, with a curved spatulate tip and numerous flanking denticles. The marginal teeth decrease in size outwards.

Type material: Holotype ZMH 2820, Rothera Point, North Cove (67°33,84 S, 68°07,35 W), 26.12.1998, 15 m; 12 paratypes ZMH 2821, Rothera Point, North Cove (67°33,84 S, 68°07,35 W), 26.12.1998, 15 m; 9 paratypes ZMH 2822, Rothera Point, East Beach (67°34,17 S, 68°06,89 W), 16.02.1999, 28 m; 3 paratypes ZMH 2823, Rothera Point, East Beach N (67°34,07 S, 68°06,52 W), 23.02.1999, 21 m; 2 paratypes ZMH 2824, Rothera Point, South Cove (67°34,371 S, 68°07,610 W), 07.01.1999, 3 m; 7 paratypes ZMH 2825, Leonie Island, Leonie N (67°35,521 S, 68°20,163 W), 17.02.1999, 25 m (Fig. 4.2-3, 4.2-3a); 3-28 m

Etymology: The species is named in honour of Martin G. White who has studied the Antarctic ecosystem for more than 30 years and loved this continent.

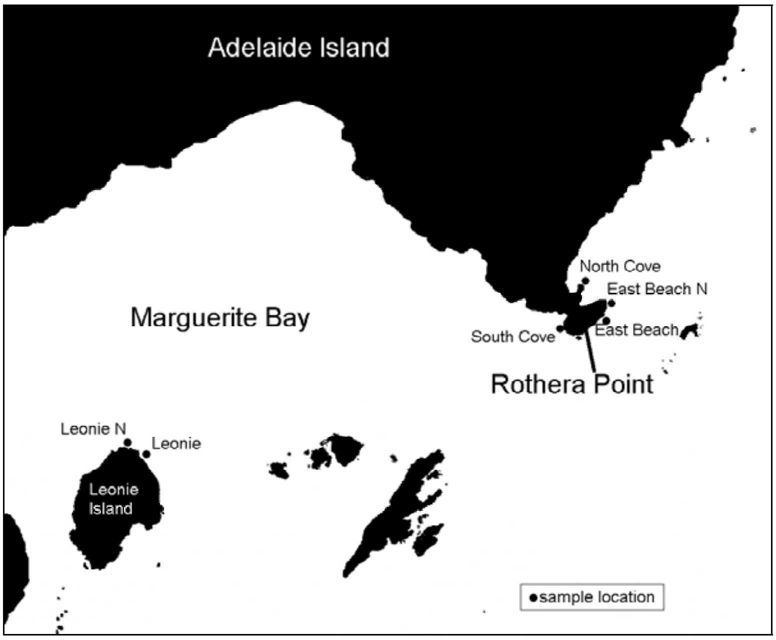


Fig. 4.2-3a. Sample locations of *Margarella whiteana* sp. nov.

Comparative remarks: The transverse radula rows with a slight dip at the middle and the occurrence of the basal projection on the first marginal tooth placed this new species in *Margarella* according to Powell (1960) and De Deambrosi (1969). *M. whiteana* is similar to *M. antarctica* (Lamy, 1905) in shell morphs and colour but can be separated by the following characters: 1) numerous spiral ribs on the teleoconch whorls, 2) smaller in shell size, 3) smaller umbilicus, and 4) rachidian with longer central cusp and less flanking denticles. The radula of *M. whiteana* is to the radula analysed in this study. Both species occur in the Margarite Bay, Adelaide Island on the same substrates (on seaweed and between pebbles) and graze on benthic diatoms (pers. observations).

Subfamily Calliostomatinae Thiele, 1924
Genus *Calliostoma* Swainson, 1840
Calliostoma consimilis (Smith, 1881)
(Plate III, Figs. 9.1.1- 21-24)

Calliostoma consimilis Smith 1881: 34, pl.4, Fig.11; Strebel 1905: 123, pl.5, Fig.21; Castellanos & Fernandez 1976:139, pl.2, fig1+2, pl.5, Fig.11; Castellanos & Landoni 1989: pl.1, Fig.4; Linse 1997: 28; Linse 1999: 400

Description: The shell is medium in size, higher than wide (up to 12.9 mm in height and 11.4 mm in diameter, 7.5 in number of whorls), with raised spire, thin, but solid. The surface is covered with numerous strong spiral ribs, glossy, dark pink or pink without periostracum. Protoconch small (420 µm in diameter), about 1.5 in number of turns, smooth, light pin, glossy, with honeycomb-like structure (Fig. 9.1.1.-21). Teleoconch about 6 in number of turns, sculptured with spiral cords of which the uppermost one is nodulous, and the suture is slightly impressed. The body whorl is large. The base is nearly straight. The umbilicus is closed. The aperture large, ovate-rectangular (5.4 mm in width, 5.6

mm in height), with a keel on the basal outer lip, with a pink-silvery pearly lustre inside. Peristome smooth. Operculum is corneous, yellowish-brown, thin, multispiral with a short growing edge, and equal in size to the aperture.

The animal is pale brown in colour, has a single pair of short, broad and pointed cephalic tentacles. The eye is large, eye stalks half size of cephalic tentacles. Epipodial tentacles in three pairs, short and broad. The mantle is papillated and pale brown.

The radula is rhipidoglossate, with the formula ∞ : 5 : 1 : 5 : ∞ (~ 30) (Fig. 9.1.1-22). The rachidian tooth is long in outline, with a wider base (Fig. 9.1.1-23). It has a triangular tip with a thin and pointed central cusp that is serrated with 7 very fine lateral denticles on each side. The lateral teeth have thin, flat but broad bases and long and slender shafts with feathery cusps. The first to third marginal teeth have thick and strong bases and shafts, and 9 to 11 strong hooked cusps on the inner margin near the tip (Fig. 9.1.1-24). The other marginals are long and very slender. About 1/3 of the teeth are fine and feathery cusped. No jaws present.

Material examined: VH St. 1152 (2 A), St. 1164 (3 A, 3 S), St. 1176 (8 S), St. 1178 (6 animals, 3 radulae scanned), St. 1183 (1 A), St. 1192 (1S), St. 1213 (2 A, 23 S), St. 1216 (2 A); ANT XIII/4-2 St. 40-110 (2 S), ZMH

Previous (distribution) records: Magellan region (Fig. 4.2-4); 15-109 m

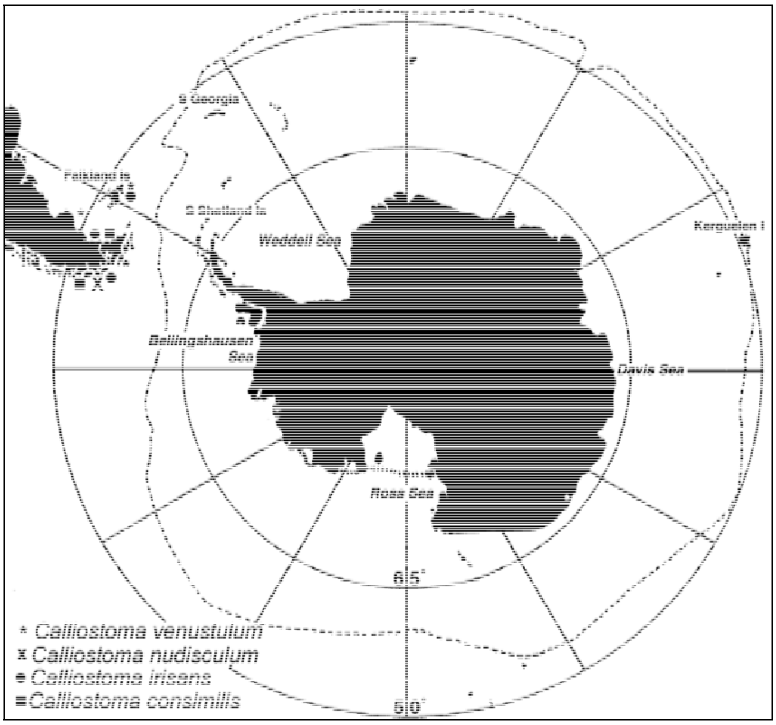


Fig. 4.2-4. Distribution of *Calliostomavenustulum*, *C. nudisculum*, *C. irisans* and *C. consimilis*

Comparative remarks: Strebel (1905) described the shell characters and Castellanos (1976) the radula.

Calliostoma irisans Strebel, 1905
(Plate IV, Figs. 9.1.1- 25-27)

Calliostoma irisans: Smith 1881: 34, pl.4, Fig.11;Strebel 1905: 123, pl.5, Fig.21; Castellanos & Fernandez 1976:139, pl.2, fig1+2, pl.5, Fig.11; Castellanos & Landoni 1989: pl.1, Fig.4; Linse 1997: 28; Linse 1999: 400

Description: The shell is small in size, wider than high (up to 5.2 mm in height and 5.5 mm in diameter) with erased spires, thin. The surface is smooth except spiral ribs near to the suture, white without periostracum. Protoconch small, about 1.5 in number of turns (about 450 µm in diameter), with honeycomb patterns, white, glossy (Fig. 9.1.1-25). Teleoconch about 4 in number of turns, the suture is impressed, the whorls inflated. The body whorl is large. The umbilicus is closed. The aperture medium in size, roundly-quadrate (2.8 mm in width, 2.4 mm in height), with a white pearly lustre inside. Peristome smooth. Operculum is corneous, thin, yellowish-brown, multispiral with a short growing edge, and slightly smaller than the aperture.

The animal is pale beige in colour and has a single pair of long, stout cephalic tentacles. The eyes are large, located in posterior side of cephalic tentacles on short eye lobes, and black in colour. The pair of epipodial tentacles is short and stout, the epipodium is covered with numerous micropapillae. The mantle is thin and the mantle edge is pigmentated.

The radula is rhipidoglossate, with the formula ∞ : 5 : 1 : 5 : ∞ (~ 30) (Fig. 9.1.1-26). The rachidian tooth is long and slender in outline, with a wider base. It has a triangular tip with a thin and pointed central cusp that is serrated with very fine lateral denticles on each side. The lateral teeth have thin, flat but broad bases and long and slender shafts with about 13 feathery cusps on each side (Fig. 9.1.1-27). The first to third marginal teeth have thick and strong bases and shafts, and 12 strong hooked cusps on the inner margin near the tip. The other marginals are long and very slender. About 1/4 of the teeth are fine and feathery cusped. No jaws present.

Material examined: VG `96 St. 46 (2 animals (radula scanned), 3 S); ANT XIII/4-2 St. 40-110 (3 A, 1 S), ZMH

Previous (distribution) records: Magellan region, Falkland Islands (Fig. 4.2-4); 36-100 m

Comparative remarks: Strebel (1905) described the species and Castellanos (1976) the radula.

Calliostoma nudisculum (Martens, 1881)
(Plate IV, Figs. 9.1.1- 28-30)

Calliostoma nudisculum Martens 1881: 34, pl.4, Fig.11; Strebel 1905: 131, pl.5, Fig.27a+b; Castellanos & Landoni 1989: pl.1, Fig.2, pl.3, Fig.1; Linse 1999: 400

Description: The shell is medium in size, about as wide as high (up to 14.2 mm in height and 14.4 mm in diameter) with erased spires, thin, but solid. The surface is covered with 5 nodulous spiral cords, pink with white lines, without periostracum. Protoconch small (about 450 µm in diameter), about 1.5 in number of turns, honeycomb patterns, white, glossy (Fig. 9.1.1-28). Teleoconch about 6 in number of turns, the suture is slightly impressed. The body whorl is large. The base is roundly inflated. The umbilicus is closed. The aperture large, oval-quadrate (7.3 mm in width, 6.5 mm in height), with a light pearly lustre inside except outer lip. Peristome smooth. Operculum is corneous, very thin, yellow, multispiral with a short growing edge, and smaller than aperture (opercular retraction deep).The animal is light yellowish in colour and has a single pair of broad cephalic tentacles. The eyes are large, located in posterior side of cephalic tentacles and black in colour. The epipodium has 4 pairs of short epipodial tentacles and small micropapillae. The mantle is pigmentated.

The radula is rhipidoglossate, with the formula $\infty : 5 : 1 : 5 : \infty$ (~ 20) (Fig. 9.1.1-29) and consists of about 60 transverse rows. The rachidian tooth is long and slender in outline, with a wider base. The lateral teeth have thin, flat but broad bases and long and slender shafts. The marginal teeth are long and very slender and have fine cusped shafts (Fig. 9.1.1-30). The tips of the inner marginal teeth have numerous small denticles on the inner flanking side and 10 to 14 strong and pointed cusps on the outer flanking side. The jaws are well developed (about 950 µm in length and 1300 µm in width) and show a scale-like pattern of overlapping, elongate-rectangular plates (Fig. 9.1.1-30).

Material examined: VG `96 St. 52 (1 animal); VG ’97 St. 92 (3 A, 2 S), Holotype HUM 33269

Previous (distribution) records: Magellan region (Fig. 4.2-4); 36-156 m

Comparative remarks: *C. nudisculum* can be distinguished from the other Magellanic species of *Calliostoma* by having a white and pink shell with numerous spiral cords. The radula of *C. nudisculum* can be separated from those of *C. consimilis* and *irisans* by having stronger marginal teeth with numerous thornlike cusps and the occurrence of a jaw, and from *C. venustulum* by a less wide rachidian and larger jaw-plates.

Calliostoma venustulum Strebel, 1908

(Plate IV, Fig. 9.1.1- 31, 32)

Calliostoma venustulum Strebel 1908: 68, pl.1, Fig.12a-c; Powell 1960: 130; Linse 1999: 400

Description: The shell is medium in size, about as wide as high (up to 14.5 mm in height and 14.8 mm in diameter) with erased spires, thin, but solid. The surface is covered with 1 nodulous spiral cord near suture, pearly white in colour, and without periostracum. Protoconch small, about 1.5 in number of turns, honeycomb patterns, white, and glossy. Teleoconch about 5.5 in number of turns, the suture is slightly impressed. The body whorl is large. The base is roundly inflated. The umbilicus is closed. The aperture large, oval-quadrate (8.0 mm in width, 7.6 mm in height), with a light pearly lustre inside except outer lip. Inner lip thickened. Peristome smooth. Operculum is corneous, very thin, light brown, multispiral with a short growing edge, and same size as aperture. The animal is brown in colour and has a single pair of broad cephalic tentacles. The eyes are large, located in posterior side of cephalic tentacles and black in colour. The epipodium has 2 pairs of short epipodial tentacles. The mantle is smooth and unpigmentated.

The radula is rhipidoglossate, with the formula ∞ : 5 : 1 : 5 : ∞ (~ 30) (Fig. 9.1.1-31) and about 6,5 mm long. The rachidian tooth is long and wide in outline, with a widened base. It has a triangular tip with a pointed central cusp and 10 to 12 lateral denticles on each side. The lateral teeth have thin, flat but broad bases and long and slender shafts with about 10 to 12 feathery cusps on each side. The first to third marginal teeth have thick and strong bases and shafts, and 6 to 8 strong hooked cusps on the inner margin near the tip. The fourth and next marginals have 12 strong and pointed cusps along the tip with increase in size towards the outer teeth. The other marginals are long and very slender. The jaws are well developed (about 1300 µm in length and 1700 µm in width), yellowish-brown, and show a scale-like pattern of overlapping, elongate-rectangular plates (Fig. 9.1.1-32).

Material examined: ANT XIII/4 St. 40-109 (2 animal); RV “Walter Herwig” St. 558 (49°11,9 S, 65°21,7 W), 21.05.1978, 105-106 m (2 A); Holotype SNM 917

Previous (distribution) records: Magellan region, Falkland Islands (Fig. 4.2-4); 40-250 m

Comparative remarks: *Calliostoma venustulum* can be separated other Magellanic *Calliostoma* by its uniform white shell and its radula characters, especially the wide rachidian.

Genus *Photinula* Adams & Adams, 1854
Photinula caerulescens (King & Broderip, 1831)
(Plate V, Fig. 9.1.1- 33-36)

Margarita caerulescens King & Broderip 1831: 346; *Photinula caerulescens*: Powell 1960: 130; Castellanos & Landoni 1989: pl.4, Fig.1; Linse 1999: 401

Description: The shell is medium in size, wider than high (up to 11.2 mm in height and 16.2 mm in diameter) with depressed spires, solid. The surface is smooth, with numerous black spiral lines, without periostracum. Protoconch medium (about 500-540 µm in diameter), about 1.3 in number of turns, smooth, white, and glossy (Fig. 9.1.1-33). Teleoconch about 4,5 in number of turns, the suture is impressed. Ground colour of teleoconch pink and white with black spiral lines. The body whorl is large. The base is roundly inflated. The umbilicus is closed. The aperture large, oval (7.4 mm in width, 7.2 mm in height), with a pink-green pearly lustre inside except small area of inner lip. Peristome smooth. Operculum is large, corneous, dark brown, multispiral with a short growing edge, and equal in size to the aperture.

The animal is pale beige in colour and has a single pair of cephalic tentacles. The eyes are large, located in posterior side of cephalic tentacles and black in colour. The epipodium has six pair of short tentacles.

The radula is rhipidoglossate, with the formula ∞ : 5 : 1 : 5 : ∞ (~ 20) (Fig. 9.1.1-34). It has about 50 to 70 transverse rows, is about 770 µm in width and 2.4 mm in length. The rachidian tooth is long and wide in outline, with a widened base. It has a triangular tip with a pointed central cusp and 10 to 12 lateral denticles on each side (Fig. 9.1.1-35). The lateral teeth have thin, flat but broad bases and long and slender shafts with about 12 to 15 feathery cusps on each side. The first marginal tooth is wider and stronger than the others, has a strong basal projection on the inner base, and an unicuspid, rounded tip with 9 to 11 denticles on the inner flanking side. The second to fifth marginals are similar to the first but less strong and with an elongated tip. The outer marginal teeth are long and very slender, with a curved spatulate tip and numerous very fine denticles. The jaws are well developed (about 1150 µm in length and 770 µm in width for one side only), yellowish-brown, and show a scale-like pattern of overlapping, elongate-rectangular plates (Fig. 9.1.1-36).

Material examined: VG `97 St. 92 (15 animals, 3 S)

Previous (distribution) records: Magellan region, Falkland Islands, South Georgia (Fig. 4.2-5); 0-202 m

Comparative remarks: *Photinula caerulescens* has a protoconch with honeycomb patterns like *Calliostoma* but it is larger in size and the shell outline is more convex. The radula characters are similar to those of *Calliostoma* as well.

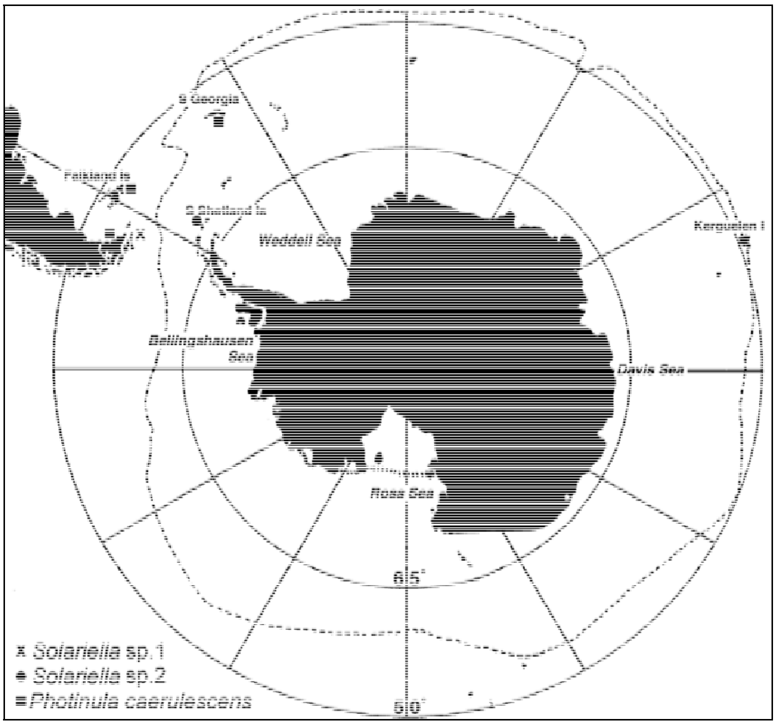


Fig. 4.2-5. Distribution of *Photinula caerulescens*, *Solariella* sp.1 and *Solariella* sp.2

Subfamily Solariellinae Powell, 1951

Genus *Solariella* Wood, 1842

Solariella sp. 1

(Plate V, Fig. 9.1.1- 37-40)

Description: The shell is medium in size, higher than wide (up to 11.2 mm in height and 10.5 mm in diameter) with erected spires, solid (Fig. 9.1.1-37). The surface is fine sculptured, with two spiral lines, without periostracum. Protoconch large, about 1.5 in number of turns, smooth, white, and glossy. Teleoconch about 4 in number of turns, the suture is impressed. Teleoconch grey in colour with pinkish pearly lustre. The body whorl is large. The base is roundly inflated. The umbilicus is deep and wide open (about 1,3 in diameter). The aperture medium, oval (4.9 mm in width, 5.5 mm in height), with a silvery lustre inside except small area of outer lip. Peristome smooth. Operculum is large, corneous, light yellowish-brown, multispiral with a short growing edge, and equal in size to the aperture.

The animal is dark purple in colour and has two pairs of long cephalic tentacles. The eyes are small, located in posterior side of cephalic tentacles and black in

colour. The epipodium has 3 pairs of long and slender tentacles, the mantle edge is pigmentated.
The radula is rhipidoglossate, with the formula 12 : 4 : 1 : 4 : 12 (Fig. 9.1.1-38). It has about 27 narrow transverse rows, is about 570 µm in width and 1.2 mm in length. The rachidian tooth is long and wide in outline, with a concave groove on the anterior side. The tip is wide, with a blunt central cusp and 5 to 7 lateral denticles on each side (Fig. 9.1.1-39). The first to third lateral teeth slightly increase in size outwards, are asymmetric, the inner flanking edges are straight, the outer flanking edges concave curved and multicuspid and have a strong pointed main cusp. The first lateral has 6 to 8 denticles on the outer edge, the second and third lateral have 3 to 5 denticles. The fourth marginal is the largest (about 3 time longer than the others) and strongest, with a blunt central cusp and irregular serrated flanking edges. The marginal teeth are sickle-shaped, slender and strong. The jaws are well developed, triangular (about 790 µm in length and 870 µm in width for one side only), brown, and show a scale-like pattern of overlapping, elongate-rectangular plates (Fig. 9.1.1-40).

Material examined: ANT XIII/4 St. 40-111 (3 animals, 7 S), 40-111 (2 A) (Fig. 4.2-5); 205-1270 m

Comparative remarks: *Solariella* sp.1 can be separated from the other Antarctic and Magellanic species of *Solariella* by its erected shell and the distinct shell sculpture. The rachidian in the radula of *Solariella* sp.1 has more pointed cusps than *Solariella* sp.2 and sp.1 has no periostracum.

Solariella sp.2
(Plate VI, Fig. 9.1.1- 41-44)

Description: The shell is medium in size, as high as wide (up to 12.4 mm in height and 12.3 mm in diameter) with erected spires, fragile (Fig. 9.1.1-41). The surface is fine sculptured, with spiral lines, pale brown periostracum. Protoconch eroded in all specimens. Teleoconch about 4 in number of turns, the suture is deep impressed. Teleoconch grey or pale brown in colour, in juveniles with silvery pearly lustre. The body whorl is large. The base is roundly inflated. The umbilicus is deep and wide open (about 1,9 in diameter) (Fig. 9.1.1-42). The aperture medium, round (6.0 mm in width, 6.1 mm in height), with a pearly lustre inside except small area of outer lip. Peristome smooth. Operculum is large, corneous, yellowish-brown, multispiral with a short growing edge, and equal in size to the aperture.

The animal is purple in colour and has a single pair of long cephalic tentacles. The eyes are large, located in posterior side of cephalic tentacles and black in colour. The epipodium has 3 pairs of long and slender tentacles, the mantle edge is pigmentated.

The radula is rhipidoglossate, with the formula 11 : 4 : 1 : 4 : 11 (Fig. 9.1.1-43). It has about 24 wide transverse rows, is about 680 µm in width and 1.5 mm in length. The rachidian tooth is long and wide in outline. It has a wide tip and a triangular central cusp with an irregular number (0-5) of denticles on each side (Fig. 9.1.1-44). The basal area is pentagonal in outline, slightly wider and more posterior than the front. The first to third lateral teeth slightly increase in size outwards, are asymmetric and the basal area is rhomboid. The inner flanking edges are straight with a few denticles, the outer flanking edges concave curved and multicuspid and have a strong pointed main cusp. The first lateral has 1 to 2 denticles on the inner edge, and 6 to 8 thorn-like denticles on the outer edge. The second and third lateral have 6 to 8 denticles. The fourth marginal is the largest (about 3 time longer than the others) and strongest, with a blunt central cusp and irregular serrated (5 to 9 denticles) flanking edges. The marginal teeth are sickle-shaped, slender and strong. The jaws are unknown.

Material examined: ANT XIV/2 St. 077, 61°18,6 S, 57°01,7 W, 1444m, 08.12.1996, leg. Ch. O. Coleman (5 A, 2 S) (Fig. 4.2-5); 1444 m

Comparative remarks: The specimens analysed show typical characters of the genus *Solariella* like the reduced radula and the large protoconch.

5. Discussion

5.1. Composition of the shelled Magellanic Malacofauna

Studies on the malacofauna of the Magellanic region have only come back into the focus during the last decade after little scientific interest for most of the 20th Century (see 4.2., 4.3.). This new literature greatly increases our knowledge of the malacofauna of this region.

So far 397 benthic molluscan species have been described from the Magellan region (Linse 1999a) but our level of knowledge of the different taxa varies. Polyplacophora were excluded by Linse (1999) because they were already in revision (Sirenko, pers. communication). The present study focuses on shelled molluscs, and aplacophoran taxa are therefore excluded.

With 210 shelled and 40 unshelled species described so far, gastropods are the most diverse molluscan taxon in the Magellan region. The species are from 128 genera and 63 families (Linse 1999a). Recent studies on their taxonomy have either reduced the number of species following synonymisation of species (e.g. McLean 1984, Schrödl 1996, 1997c,d) or increased the number due to new descriptions (14 species) (e.g. Dell 1990, Vasquez 1992, Ponder & Worsfold 1994, Di Geronimo et al. 1995, Pastorino 1998, Harasewych et al. in press, present investigation) and new records (4 species) (Linse 1997).
The recorded species of scaphopod comprise two families, four genera and six species. The new records reported by Linse (1997) from the Beagle Channel are juvenile specimens of *Pulsellum falklandicum* (Dell, 1964) and *Siphonodentalium dalli* var. *dalli* (Pilsbry & Sharp, 1897-98) and var. *Antarcticus* (Odhner, 1931).

The Bivalvia are the second most diverse taxa with 131 species belonging to 75 genera and 36 families. Other recent systematic and taxonomic studies of bivalves are Dell (1990), Linse (1997), and Villarroel & Stuardo (1998), who added 10 new or newly recorded species. Comprehensive systematic studies in the Magellan region are published by Soot-Ryen (1959) and Dell (1964, 1971, 1972).

The malacofauna of the Magellan region is characterised by :

1) a large number of globally distributed families

All 42 families of Gastropoda occurring in the Magellan region have world-wide distributions. Just 3 families, the Acmaeidae, Cymatiidae and Columbellidae, do not occur in the Antarctic. Within the 36 known families of Bivalvia members of 12 families are not reported from the Antarctic: *Nuculidae*, Solemyidae, *Lucinidae*, Erycinidae, *Cardiidae*, Solenide, *Tellinidae*, *Myicidae*, Veneridae, Pholadidae, *Teredinidae*, and *Pandoridae*. The families marked in *italics* are also known from the Arctic.

George (1999) reported similar distribution patterns for the 24 families of harpacticoid Copepoda recorded in the Magellan region. All 17 families recorded in Antarctic waters also occur in the Magellan region but 7 families are missing in the Antarctic. Many harpacticoid families have a world-wide or bipolar distribution, e.g. the Adenopleurellidae, Ameiridae, Ancorabolidae, Cletodidae, Diosaccidae, Ectinosomatidae, or Superornatiremidae (George 1999).

2) a large number of bipolar genera

As well as a high number of boreal genera (see 5.1.3)) the Magellan region includes a large number of the bipolar genera listed by Crame (1996a) or Arctic genera mentioned by Warén (1989, 1991, 1993) and Schiøtte (1989). 16 bipolar gastropod genera are known: *Iothia*, *Puncturella*, *Margarites*, *Solariella*, *Onoba*, *Capulus*, *Melanella*, *Admete*, *Aforia*, *Leucosyrinx*, *Pleurotomella*, *Omalogyra*, *Odostomia*, *Diaphana*, *Toledonia*, and *Philine*. Within the Bivalvia 16 bipolar genera are reported: *Yoldiella*, *Dacrydium*, *Mytilus*, *Philobrya*, *Cyclopecten*, *Limatula*, *Thyasira*, *Mysella*, *Cyclocardia*, *Mya*, *Astarte*, *Hiatella*, *Thracia*, *Poromya*, *Cuspidaria*, and *Lyonsiella*.

Crame (1994, 1996a) has pointed out that phylogenetic analysis of the bipolar genera and related taxa can improve our knowledge of the origin of the Antarctic fauna. In 1992 Crame said that studies of Vermeij (1978, 1986) and Jablonski and Valentine (1981) mentioned *Limopsis*, *Astarte* and *Thracia* as genera with sub-tropical origin in the Jurassic that migrated to the poles. Beu and Maxwell (1990) found *Astarte* in Cenozoic sediments in New Zealand while the genus is extinct there nowadays (Spencer & Willan 1995). Late Miocene records of *Astarte* in southern Alaska proved the first opening of the Bering Strait for this time (4.8–7.4 Myr ago) and made it possible for marine taxa to migrate from and into the North Pacific (Marincovich & Gladenkov 1999). Gardner (1999) genetic studies on three Arctic *Astarte* (*A. borealis*, *A. elliptica*, and *A. striata*) indicate a speciation event about 2.2-2.7 Myr ago.

Reid (1989) analysed the world-widespread Littorinidae and found the Antarctic *Pellilittorina* to be a sister taxon of the boreal *Lacuna*. Schiøtte (1999) revised the genus *Diaphana* and discussed the area of origin for this genus (1999: 136): “early *Diaphana* species of a type similar to group 1 must have spread over large parts of the globe, but today this group is extinct except in the deep sea, the high Arctic and the South Australian area”. The three species described from the Southern Ocean are included in the second, *D. paessleri* group. An undescribed species from the eastern Weddell Sea, found as a single specimen by Hain in 1989 (Schiøtte 1999: 91) and further specimens by Linse (Brandt et al. 1999), show more ancestral characters than the *D. paessleri* group (Schiøtte pers. comm.).

Schiøtte’s (1999) hypothesis on the evolution of *Diaphana* is an example for Crame’s (1992, p.44) model 2 that “taxa arise at the poles and disperse to lower latitudes.”

The number of bipolar genera in the Mollusca is compared with the number of bipolar genera in other marine phyla (Tab 5-1). It is extremely high for gastropods and bivalves with 16 bipolar genera each compared to the numbers of bipolar genera of tanaidaceans (6 gen), cumaceans (4 gen), harpacticoid copepods (4 gen), and Asteroidea (2 gen). The percentages of shared genera between the Magellanic and bipolar taxa show different patterns (Tab 5-1). Within the scaphopods 50 % of the genera occurring in the Magellan region are bipolar and within the cumaceans 36%. The percentages for gastropods (18 %) and bivalves (21 %) are similar to those for tanaidaceans (18%) and are a little bit higher than those for asteroids (12 %) and ophiuroids (14%). The percentages of shared genera within the harpacticoids is remarkably low with 8%. A possible reason might be that harpacticoids and their larval stages are nearly attached to the substrate they are living in and therefore their dispersal is limited (George

1999). Planktonic larvae that might be spread by water currents occur within the bipolar scaphopods and bivalves genera.

Tab. 5-1. Comparison of the numbers (n) of bipolar genera (gen) in different taxa with the numbers of genera in the Magellan region.

Phylum	Taxon	n bipolar gen/ n MR gen	n bipolar: n MR (%)	source
Mollusca	Gastropoda	16/ 89	18	this study
	Scaphopoda	2/ 4	50	this study
	Bivalvia	16/ 75	21	this study
Crustacea	Harpacticoidea	4/ 52	8	George 1999
	Cumacea	4/ 11	36	Mühlenhardt-Siegel 1999, Lörz 2000
	Tanaidacea	6/ 31	19	Schmidt 1999, Gaevskaja 1948
Echinodermata	Asteroidea	2/ 17	12	Brattström & Johanssen 1983, Piepenburg 1988
	Ophiuroidea	1/ 7	14	Brattström & Johanssen 1983, Piepenburg 1988

The bipolar distribution might have been caused by geological processes in the past or climatic changes in the evolutionary history of the marine fauna. Jablonski & Raup (1995) and Jablonski (1996) studied End-Cretaceous mass extinctions because 70 to 80% of the marine fauna disappeared during Cretaceous-Tertiary. They found that survivorship of marine bivalves was not random but selected. While there are no significant differences in the extinction intensity relative to shell-size, bathymetric distribution, and habitat zones. “Extinction intensities were highest for bivalve genera that occupied fewer biogeographic provinces” (Jablonski & Raup 1995 p. 390). The feeding type seemed to be important as well. Deposit feeders, such as *Iothia* and *Yoldiella*, showed a higher survivorship than suspension-feeders, which collect plankton from the water column. The survival rate of taxa was positively correlated with the number of taxa per clade.

3) a latitudinally balanced systematic diversity

In order to assess the taxa richness of the Magellanic malacofauna the numbers of families, genera and species are compared with the climatically comparable regions of Northwest Europe (Hayward & Ryland 1992).

Tab. 5-2. Comparison of the systematic diversity of the Magellan region (MR) with NW Europe (NWE). fam – number of families, gen – number of gen era, spp – number of species, sim– similar families

	Gastropoda		Scaphopoda		Bivalvia	
	MR	NWE	MR	NWE	MR	NWE
fam	42	54	2	2	36	43
gen	89	98	4	3	75	97
spp	210	171	6	4	131	138
sim fam	28		2		23	
sim gen	16		2		23	
sim gen in sim fam	16		2		19	

The systematic composition in both regions is almost the same, comparing the numbers of families, genera, and species (Tab. 5-2). The numbers of shared families and genera is high; more than 50% of families and genera reported from one region occur in both regions, e.g. Patellidae, Lepetidae, Scissurellidae, Trochidae, Littorinidae, Buccinidae, and Turridae (all Gastropoda), Dentaliidae and Siphonodentalliidae (Scaphopoda), Nuculidae, Nuculanidae, Limidae, Pectinidae, Pandoridae, Teredinidae, and Cuspidariidae (all Bivalvia). Most of the genera shared between Magellan region and NW Europe are mentioned in the last paragraph (bipolar genera) but further bivalves genera occur in the both regions: *Nucula*, *Pandora*, and *Barnea*.

The numbers of bivalve species found in both regions fit into the global distribution map of Crame (1996b). The occurrence of latitudinal gradients in the marine taxa is controversely discussed, e.g. Wilson & Poore (1993), Rex et al (1993), Brey et al (1994), Rosenzweig (1995), Brandt & De Broyer (1999). Brey at al (1994) found in their analysis of bivalves, gastropods and isopods that the expected numbers of species in the Weddell Sea lies in range as tropical regions. Rex et al (1993) found latitudinal gradients (declining biodiversity from the tropics to the pole) for gastropods, bivalves, and isopods in the deep North Atlantic. Recent studies by Lambshead et al (2000) show a positive gradient between 13 to 56° N for marine nematodes. Studies by Stehli et al (1967 see in Crame 1996b) show distinct latitudinal gradients within the living Bivalvia.

Crame (1996b, p.123) said “... Antarctic benthic communities are considerably more diverse than their counterparts in the Arctic, but somewhat less so than in most warm temperate and tropical regions”.

Following the number of species per region from the Antarctic over the Magellan region towards the tropics it is striking that the species numbers are lower in the Magellan region. This fact might be explained by the somewhat larger area of the Antarctic Ocean compared with the Magellan region (Ricklefs & Schluter 1993a,b).

Latitudinal gradients might be caused by a variety of mechanisms, such as temperature, solar radiation, food availability, competition, predation, parasitism, host diversity, niche theory, environmental heterogenety, disturbance, evolutionary processes in the geological history (Myers & Giller 1988, Rhode 1992, Ricklef & Schluter 1993b, Rosenzweig 1993, Valentine & Jablonski 1993, Crame & Clarke 1997a, Ormond et al 1997, Brown 1998). Clarke & Crame (1997) discussed diversity and latitudinal patterns in the shallow sea while Rex et al (1997) and Lambshead et al (2000) focused on the deep sea.

4) a large number of small-sized shelled species (< 10 mm).

More than 130 species (39%) of the 347 shelled species in the Magellan region are smaller than 10 mm. Within the gastropods 90 species (42.8%) are small, while only one species of scaphopods (*Pulsellum falklandicum*) is smaller than 10 mm. 45 species (34.4%) of bivalves are less than 10 mm in size.

Nicol (1978) analysed size trends in recent shelled gastropods and bivalves and found that small size is independent of habitat. A general trend is that deep-sea species are smaller in size than shallow waters species (Hain 1989). Hain (1989) compared the maximum shell size of prosobranchs and bivalves from Antarctic, Arctic and tropical areas and analysed the proportion with a shell > 10mm. For Antarctic prosobranchs Nicol (1978) and Hain (1989) reported percentages of small-sized species from 68 to 80% for the Antarctic, Adelie Land, and Signy Island but only of 46% for the Eastern Weddell Sea. Hain (1989) found 26% of species in tropical Costa Rica to be small sized and 19% from Point Barrow, Canada, while Nicol (1978) reported 42% from tropical and Arctic regions. Lower percentages of small species are reported by both authors for bivalves. 46 to 61% of Antarctic bivalves were small for the regions mentioned above (Nicol 1978, Hain 1989). Arctic bivalves (12 to 29%) and tropical bivalves (13 to 38%) were also small. Linse (1997) noted that 70% of gastropods were small as were 71% of bivalves within 52 species of each taxa from EBS-samples from the Beagle Channel. However it was also recognised that the lack of larger sized animals might have been due to the sampling method and the lack of eulittoral samples.

The proportion of small-sized species in the molluscan community of the Magellan region is lower than in the fauna described from Antarctic regions but higher than has been recorded for tropical and Arctic regions (see data in Hain 1989).

Recent investigations in tropical regions, e.g. in Red Sea (Egypt) and in New Caledonia (Neubert pers. comm., Warén pers. comm.), have increased the numbers of small-sized species in these regions drastically. Further comparisons with boreal, tropical and polar regions will show whether the proportion of small-sized species is still higher in the Magellan region and in Antarctic waters.

5) a large number of species and genera shared with the deep sea

Investigations in deeper parts of the Beagle Channel (RV “Victor Hensen” ’94) (Linse 1997, this study), of the Strait of Magellan (RV “Vidal Gomaz” ’95), and on the Patagonian slope (RV “Polarstern” ANT XIII/4) as well as the study by Ponder & Worsfold’s (1994) on Magellanic rissoids report eurybathic vertical distributions (with a depth range of more than 500 m) for 41 bivalve species.

These were: *Iothia coppingeri* (5-1108 m), *Falsimargarita* sp.(2008-2165 m), *Solariella* sp. 1 (205-1270 m), *Colpospirella algida* (63-665 m), *Balcis subantarcticus* (135-665 m), *Eatoniella (Eatoniella) turricula* (40-900 m), *Pusilla (Haurakia) averni* (40-900 m), *Powellsetia microlirata* (30-900 m), *Onoba sulculata* (120-900 m), *O. fuegoensis* (50-900 m), *Trochita pileus* (13-780), *Argobuccinum cancellatum* (430-780 m), *Polinices patagonica* (0-665 m), *Admete magellanica* (40-665 m), *Marginella warrenii* (118-780 m), *Cylichna georgiana* (63-

665 m) (all Gastropoda), *Dentalium majorinum* (68-1247 m), *Rhabdus perceptum* (158-993 m), *Pulsellum falklandicum* (81-1274 m), *Siphonodentalium dalli* var. *dalli* and var. *Antarcticus* (244-898 m) (all Scaphopoda), *Nucula falklandica* (6-665 m), *Ennucula grayi* (63-665 m), *Yoldia chilenica* (100-665 m), *Yoldiella granula* 62-665), *Propeleda longicaudata* (64-1180 m), *Phaseolus patagonicus* (100-665 m), *Tindaria virens* (100-850 m), *Solemya* sp. (100-1270 m) *Limopsis marionensis* (27-1627 m), *L. knudseni* (250-2013 m), *Cyclopecten falklandica* (135-665 m), *Pecten* (?) *pygnolepis* (30-723 m), *Limatula pygmaea* (5-665 m), *Thyasira falklandica* (63-665 m), *Genaxius debilis* (29-752 m) *Kellia simulans* (47-741 m), *Lasaea* sp. (100-665 m), *Solecardia Antarctica* (20-665 m), *Pandora patagonica* (100-665 m), *Thracia meridionalis* (5-752 m), *Poromya mactroides* (253-1270 m) *Cuspidaria chilensis* (100-665 m), *C. infelix* (60-665 m) and *Lyonsiella radiata* (270-665 m) (all Bivalvia).

Although these species shared with the deep sea make up only 12% of the shelled Magellanic malacofauna these species or related species of the same genera occur in deeper waters in the Antarctic (Dell 1972, Hain 1990, Linse 1997). Hain (1990) reported 36 of 93 gastropod species and 27 of 39 species of bivalves with a wide bathymetric range from the eastern Weddell Sea. Eulittoral and shallow water samples are missing in this study. The shallowest hauls investigated were at 155m depth in Atka Bay (ANT XIII/3, St. 357) and 181m depth off Atka Bay (ANT VI/3, St. 418).

6) high species numbers in those families and genera that are also diverse in the Antarctic

In the Magellan region the families Buccinulidae (29 spp), Turridae (21 spp), Trochidae (16 spp) (all Gastropoda), Carditidae (12 spp), Philobryidae (7 spp), and Nuculanidae (7spp) (all Bivalvia) have the greatest species richness.

Hain (1990) reported high species numbers in the families Buccinidae, Turridae and Philobryidae from the eastern Weddell Sea. In particular the high species richness of the buccinid genus *Prosipho* (7 species recorded) was mentioned. In contrast only two species of *Pareuthria* are reported. The Magellan region shows a different pattern, with 9 species of *Pareuthria* but only one species of *Prosipho* reported.

5.1.1. Evolutionary radiation

The most abundant families in the Magellan region (see 5.1.6)) show bipolar diversification and adaptive radiations since the Palaeocene (Crame 1996a, 1997). The radiation and phylogeny of the Trochidae is discussed in chapter 5.3.

Within the Buccinulidae the radiation of *Pareuthria* with 9 spp of 15 known species and related genera such as *Glypteuthria* (2 spp), *Meteuthria* (2 spp), *Crenatosipho* (1 sp), and *Prosipho* (1 sp) in the Magellan region is of special interest. Harasewych and Kantor (1999) revised the buccinulid genus *Chlanidota* and regarded *Neobuccinum* to be the sister taxon but marked the uncertain generic status of *C. eltanini* Dell, 1990, *C. bisculpta* Dell, 1990, and *C. polyspeira* Dell, 1990. Live collected material of the latter species and a new species on ANT XIII/4 with RV “Polarstern” enabled Harasewych et al (in press) to change the generic position of these species into the new genus *Parabuccinum*. *Parabuccinum* is now considered to be *Neobuccinum’s* sister taxon. The elucidation of the buccinulid phylogenetic evolution will help to answer the question wether evolutionary rates are consistently higher in lower latitudes.

Phylogenetic analysis of the Magellanic and Antarctic muricid species included in the genus *Trophon* was done by Pastorino (1998). The strict consensus tree of the morphological character analysis (radular, anatomical, and shell characters) carried out by PAUP suggested that the Magellanic species group and the Antarctic species group are probably polyphyletic (Pastorino 1998). Further studies by Pastorino (pers comm) will elucidate the origins of the members of the so called genus *Trophon* and their relation to the other Magellanic muricid genus *Xymenopsis*.

The recent species composition of the bivalve families Philobryidae and Carditidae especially the genera *Philobrya* and *Cyclocardia* must be the product of an successful adaptive radiation in the Magellan region and Antarctica.

5.1.2. Descriptions of new species and redescriptions

In this study 42 species of gastropods and 10 species of bivalves are described, including the new first descriptions. Harasewych et al. (in press) described the new genus *Parabuccinum* with the new species *P. rauscherti* from the material collected by Linse (Arntz et al. 1997) on RV “Polarstern” ANT XIII/3. The comprehensive material on which this study is based have made it possible to investigate soft parts and shells from several taxa. Future studies of small-sized material, e.g. the species Cerithiidae sp. 1 to sp. 3 (Linse 1997: 30, 31), and potential new descriptions will increase the species numbers.

The large number of recent studies in the Magellan region (see chapter 3.1.) has increased the number of species recorded in range of taxa. Gambi (1997) found new species of *Perkinsiana* (Polychaeta) in the Strait of Magellan, Rauschert (1996) and De Broyer and Rauschert (1996) mentioned more than seven new species of amphipods, and new species of isopods were described by Winkler (1992, 1994), Winkler & Brandt (1993), and Brandt (1998). The comprehensive studies of George (1993, 1996, 1999) and George & Schminke (1998a, b, 1999) on the harpacticoid fauna of the Magellan region added 21 genera and 103 species to our knowledge.

5.2. Biogeography

The biogeography of the Antarctic and sub-Antarctic marine fauna is of considerable interest for studies on the evolutionary history and origin of the recent Antarctic fauna. The faunal relationships between the Magellanic malacofauna with adjacent regions and the malacofaunal relations within the Southern Ocean are discussed.

5.2.1. Faunal relations of Magellanic Mollusca

Extensive recent collections and taxonomic revision enable a zoogeographic account of Magellanic shelled molluscs, as regarding endemism and faunal relations (chapter 4.3.1.).

Powell (1965) excluded the Falkland Islands in his definition of the Magellan region while these islands are included by e.g. Carcelles & Williamson (1951), Hedgepeth (1969), and Dell (1972). Only three species, *Nacella (Patigerina) concinna* (Strebel, 1908), *Philobrya multistriata* Lamy, 1908 and *Subcuspidaria kerguelensis* (Smith, 1885), occurring on the Falkland Islands are not recorded from the Magellanic mainland (Tab. 4.3-1). Therefore from the biogeographic point of view the Falkland Islands belong to the Magellan region. This is quite likely because of the connecting shallow shelf (Burdwood Bank).

The degree of endemism is remarkably high with 66% of all shelled Mollusca in the Magellan region being endemic. This is similar to the 64% endemism reported by Dell (1964) for Antarctic Mollusca. Linse (1997) reported that 50% of the Mollusc species found on the Magellanic mainland (excluding the Falkland Islands) were endemic to that region. After his extensive revisions on Magellanic nudibranchs Schrödl (1999b) reported only 10 of 35 species (29%) to be endemic. The majority of species occur in northern Chile and Argentina as well, and only five species, *Austrodoris kerguelensis* (Bergh, 1884), *Tritonia challengeriana* Bergh 1884, *Tritonia vorax* (Odhner, 1926), *Flabellina falklandica* (Eliot, 1907), and *Cuthona georgiana* (Pfeffer in Martens & Pfeffer, 1886) occur in Antarctic waters. Phylogenetic-biogeographic studies on different molluscan taxa might elucidate the systematic position of these taxa and their role in the colonisation of the Antarctic and world-wide waters.

The degree of endemism for Isopoda in the Magellan region (30.5%, Brandt 1991, Brandt et al. 1999), Echinodermata without Holothuroidea (52%, Ekman 1953), and Asteroidea (45% Madsen 1963) are similar to those of the nudibranchs. George (1999) reported high numbers of endemic species largely because of numerous records of new species.

There are no Recent species similarities between the Magellan region and Southern Africa, Australia or New Zealand but subfossil (holocene) and Cenozoic faunas do include species found in the modern mollusc community. Pether (1993) found subfossil shells of *Pareuthria fuscata* (Bruguière, 1789) in the Benguela region from 120-140 m depth and living animals are recorded from the Strait of Magellan and Falkland Islands (Strebel 1905). The bivalves *Chlamys patagonica delicatula* (Hutton, 1873) and *Aulacomya ater maoriana* (Iredale, 1915) are recorded in New Zealand from the Pliocene/early Miocene to Recent and are closely related to Magellanic species (Beu & Maxwell 1990). Dell (1964) considers that *A. ater maoriana* is a geographic subspecies of the circum-subantarctic *A. ater ater* (Molina, 1782).

Comparison of the shared species of the Magellan region with neighbouring areas (Tab. 4.3-1) shows the highest similarities with the adjacent regions on the Patagonian shelf, northern Argentina and northern Chile. Many similar species are species from the eulittoral and shallow water, such as *Nacella magellanica magellanica* (Gmelin, 1791), *Fissurella picta* (Gmelin, 1791), *Epitonium georget-*

tianum (Kiener, 1839) (all Gastropoda), *Mulinia edulis* (King, 1831), *Ensis macha* (Molina, 1782), and *Ameghinomya antiqua* (King, 1831) (all Bivalvia). Species which are not found in Antarctic waters but have a wider bathymetric range also show a high degree of similarity across the Patagonian shelf. Examples of this group include *Ennucula grayi* (d'Orbigny, 1846), *Linucula pisum* (Sowerby, 1832), *Solemya macrodactyla* (Mabille & Rochebrune, 1891) (all Bivalvia).

The high species similarity (71 spp) with South Georgia might be caused by the circumpolar current. Helmuth et al. (1994) proved that species, such as *Gaimardia trapesina* (Lamarck, 1819) or *Lissarca miliaris* (Philippi, 1845), can reach the Falkland Islands and South Georgia from Tierra del Fuego by drifting while attached to floating substrata such as kelp. One hypothesis for the circum-subantarctic and Antarctic distributions of brooding species and species living attached to floating substrata is the circumpolar current. Distribution patterns which underline this hypothesis are *Gaimardia trapesina* and *Lissarca miliaris*, *Philobrya quadrata* Thiele, 1912 and *Hiatella solida* (Sowerby, 1834), which are recorded from Marion Island and the Kerguelen Islands.

The species similarities with high Antarctic regions decrease towards the Scotia Arc Islands with increasing distance (Tab. 4.3-1). The islands of the Scotia Arc may form as a potential immigration route for species from South America over Tierra del Fuego and the Falkland into the Antarctic (e.g. Dell 1965, Brandt 1991, Winkler 1994). The deep sea trenches between the islands represent a barrier to immigration for shallow water species without planktonic larvae while planktonic stages can pass this barrier. Young et al (1997) proved that larvae of Mediterranean shallow water echinoderms have the potential to immigrate into the deep sea. Water temperature and pressure are stage-specific dispersal barriers. Recent studies by Taylor (pers comm) on the larval stages of the shallow water Antarctic echinoderm *Sterechinus neumayeri* (Meissner, 1900) showed that these stage are able to survive the higher pressures in the deep sea. Comparable investigations on Antarctic molluscs with meropelagic, planktotrophic larvae, such as *Capulus subcompressus* Pelseneer, 1903 or *Nacella concinna* (Strebel, 1908), would be of interest.

The few species occurring in the Magellan region and Antarctic, for example *Puncturella conica* (d'Orbigny, 1841), *Marseniopsis pacifica* Bergh, 1886 (both Gastropoda), *Yoldia (Aequiyoldia) eightsii* (Couthouy, 1839), *Limopsis marionensis* Smith, 1885, *Astarte longirostris* d'Orbigny, 1846, *Genaxius debilis* (Thiele, 1912), and *Cuspidaria tenella* Smith, 1912 (all Bivalvia) have wide bathymetric ranges, extended to 700m and more than 1500m depth for some species.

The Magellanic gastropod community shares more species with the shelf fauna while the species composition of the bivalves fauna seem to be more closely related to the sub- and high Antarctic fauna.

The biogeography and faunal relations of the Magellanic malacofauna are of special interest for the analysis of the origin and colonisation of the Antarctic fauna. Since the early biogeographical studies on the Antarctic fauna and its origins by Pfeffer (1891), Hedley (1916), and Wittmann (1934), and in numerous other studies this question has been discussed for different taxa (e.g. Lipps & Hickman 1982, Clarke & Crame 1989, Webers 1989, Brandt 1991, Winkler 1994, Lecointre 1997, O'Hara 1998).

Dell (1965) discussed three possible origins of the Antarctic fauna: 1) immigrants from the deep water, 2) immigrantion from South America along the Scotia Arc, and 3) old, remaining Antarctic fauna. Powell (1965) and Dell (1965, 1972) classified selected genera according to these three categories.

Crame (1992) studied the evolutionary history of polar faunas and proposed three models explaining the recent distribution patterns (compare 5.1.2)). These were that: 1) "taxa arise in the tropics and disperse to the poles" (Crame 1992: 41), 2) " taxa arise at the poles and disperse to lower latitudes" (Crame 1992: 43), and 3) "polar taxa as the remnants of former cosmopolitan distributions" (Crame 1992: 46).

Hain (1989: 201) said "In bezug auf den Ursprung gibt es weder *die antarktische Molluskenfauna* noch *die Molluskenfauna des östlichen Weddellmeeeres*. Die komplexe Evolution der Taxa muß auf Gattungs-, z.T. sogar auf Art-Niveau, getrennt untersucht werden."

The origin of the Magellanic malacofauna cannot be explained completely by using any one of these models alone. The Antarctic habitats have been separated from other continents for at least 17 Ma by the circumpolar current which inhibits the migration into the Antarctic. The Magellan region is connected with low latitude and tropical regions through a continuous continental shelf, and taxa can migrate along the coast. Shelf taxa with wide bathymetric and temperature range (eurytherm) might even immigrate via the continental slopes and the deep sea towards the Scotia Arc Islands and Antarctic continent. The role of the Magellanic malacofauna in the colonization of the Antarctic waters cannot be explained fully without phylogenetic-biogeographic studies on selected taxa, genera and species.

In chapter 5.3. the colonisation of the Antarctic waters by the Trochidae will be discussed. Within this group occur representatives of the different possible origin models.

5.2.2. Faunal relations of molluscs in the Southern Ocean

The division of the Southern Ocean into subregions has been discussed in detail by Dell (1972), Brandt (1991) and De Broyer & Jazdewski (1996) (Fig. 5-1).

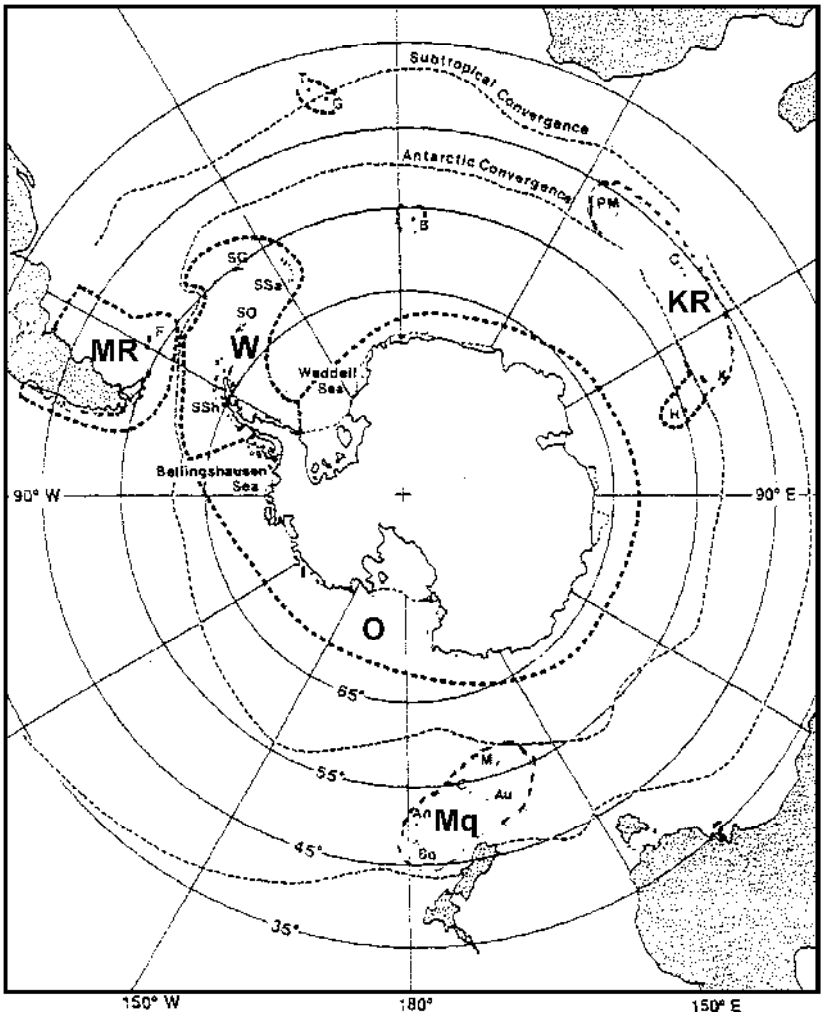


Fig. 5-1. Biogeographic subregions in the Southern Ocean (slightly modified after De Broyer & Jazdewski 1990). KR – Kerguelen subregion, Mq – Macquarie subregion, MR – Magellan subregion, O – East Antarctic subregion, W – West Antarctic subregion

In the last decade comprehensive systematic and taxonomic studies on molluscs from different areas in the Southern Ocean revolutionised our knowledge of the presence and species richness and distribution of the recent Antarctic malacofauna: e.g. for the Davis Sea (Egorova 1982), Signy Island (Oliver & Picken 1984), Ross Sea (Dell 1990), Weddell Sea (Hain 1990, Linse & Egorova submitted), Marion and Prince Edward Islands (Branch et al. 1992), Breid Bay and Gunnerus Bank (Numanami 1996), and for the Magellan region (Linse 1997, this study). The species-distribution is analysed using cluster analysis (see 4.3.2.) to show the similarities between the areas.

The resulting dendrogram for 1033 shelled molluscan species (Fig. 4.3-1) shows five clusters which combine the 14 analysed areas and is very similar to the biogeographic subregions presented by Dell (1972) and De Broyer & Jazdewski (1996). The Magellan region including the Magellanic mainland and the Falkland Islands are clearly separated from the remaining sub- and high Antarctic regions. South Georgia and the Kerguelen Islands are independent subdivisions. Interestingly the Marion and Prince Edward Islands are positioned in the East Antarctic subregion while De Broyer & Jazdewski (1996) included these islands in the Kerguelen subregion in their studies on amphipods. The East Antarctic region extends from Breid Bay, and Enderby Land to the Ross Sea. The eastern Weddell Sea together with the Antarctic Peninsula and Scotia Arc Islands form the West Antarctic region. Dell (1972) and De Broyer & Jazdewski (1996) included the eastern Weddell Sea in their East Antarctic region. However, the recent mollusc distribution patterns show more congruences with the Antarctic Peninsula and the islands of the Scotia Arc.

The analysis presented reveals no major differences to the generally postulated biogeographic subregions of the Southern Ocean. Interestingly the shelled molluscan fauna in the different Antarctic areas shows similarities of more than 85% between each other. And even widely separated regions have similarities of more than 90%.

Zoogeographic analyses of gastropods (Fig. 4.3-2) and bivalves (Fig. 4.3-3), however, show differences in their distribution. In the gastropod distribution, the Magellan region, South Georgia and the Kerguelen Islands still form separate regions of their own with less than 82% of similarity. The Ross and the Davis Sea are subregions for their own while the remaining areas are forming one large subregion.

Within the bivalves only the Magellan region and the Kerguelen Islands are clearly marked off from the further Antarctic areas which form a large own subregion. A higher chosen degree of similarity (widely hatched line in Fig. 4.3-

3) seems not to be sensible because of the high similarities (86 to 93 %) each area would then form an own subregion.

For a sufficient biogeographic analysis of the recent Antarctic malacofauna our knowledge about the absolute numbers of species of the areas must be improved. In particular information for the composition of the malacofauna of some areas such as the Bellingshausen Sea, Bouvet Island, and Crozet Island, is wanting for deep water species and meiofaunal taxa. Likewise, information about ecological factors and their influence on the community structure of molluscs in different habitats and regions may explain the recent distribution patterns.

5.3. Phylogeny of Antarctic Trochidae

Hickman (1996 p. 177, p.197) stated that "*tree thinking* (O'Hara 1988a, Doyle and Donoghue 1993) is about relationships and the ordering of character state transformations, not about the actual course of evolutionary history. ... Trochoidean gastropods are also a satisfying model system for exploring the biogeographic and ecologic contexts of adaptive radiation".

The results of the cladistic analysis carried out in this study (see 4.4.3.) are considered as a basis for further studies on the evolution and radiation of Antarctic trochid taxa. The high homoplasmy index (HI = 0.536) indicates that many characters evolved independently in the trochid evolution. The problem of numerous homoplasmic characters within the trochid radula and external anatomy is mentioned by Hickman (1996). In the following the results of the cladistic analysis are discussed in comparison with biogeographic and bathymetric distribution patterns (see 4.4.1./ 4.4.2.).

The family Trochidae is a well defined monophyletic group with the Turbinidae as a sister group (Hickman & McLean 1990, Hickman 1996). In this study only trochid species of the Southern Ocean are analysed and their ancestors are uncertain. Therefore two turbinid genera occurring in the Southern Ocean were chosen as outgroup taxa.

Submargarita is a genus with an uncertain position. This is due to the fact that only data from one radula photograph were used in the data matrix and the fact that only one of the ten known species could be analysed. Dell (1990) discussed the similarity of *Submargarita* to *Lissotesta* (Fam. Cylostrematidae in Dell (1990), Fam. Skeneidae in Hickman & McLean (1990)). *Submargarita* is endemic in the Southern Ocean and should be analysed on species level and in comparison with other small-sized Antarctic taxa of the genera *Lissotesta*, *Brookula* and *Liotella*.

Solariella forms a distinct clade. It is characterised by its autapomorphies, the dark coloured epipodium (16), a reduced number of radular rows and marginal teeth (33, 35), and difference in the laterals and lateral plate (36, 37). *Solariella* is known since Cretaceous from low-latitudes but spread in the Neogene to higher latitudes (Hickman & McLean 1990). Since the Neogene *Solariella* experienced a radiation in the Southern Ocean and represents an example for a taxon that originated in the tropics and dispersed to the poles (Hickman & McLean 1990). The results of the trochid analysis of this study (Fig. 5-2) imply that *Solariella* seems to be more primitive in the Magellan region/ Antarctic Ocean than in the regions investigated by Hickman (1996).

Calliotropis (C.) can be separated from the margaritinid, trochinid, and calliostomatid genera by having reduced number of lateral teeth (autapomorphy character 26). While *Calliotropis (C.)* is only known from the tropical Atlantic, the tips of the southern continents and the Southern Ocean, *Calliotropis (Solaricida)* is distributed from the tropical Pacific to the Antarctic (see 4.4.1.). The origin of Calliotropis is supposed to be in the bathyal Pacific. The genus experienced a radiation in the Antarctic, submerged and colonized the Atlantic until to a depth of ~ 1000m.

The recent study cannot solve the problems in the *Margarites-Margarella*-complex (compare 4.4.1.) and is not further discussed.

Both trochinid taxa, *Antimargarita* and *Margarella* are restricted to the Southern Ocean and seem to have radiated there since the Eocene, when bipolar differentiation within the Trochidae occurred (Crame 1996). For an accurate analysis of their origins all species must be analysed.

The calliostomatid group is characterised by a radula with long, thin, and flexible rachidian and lateral shafts (character 31). The five genera belonging to this group can be placed most clearly on shell or radular characters (Hickman & McLean 1990). The phylogenetic positions of *Venustrochus* and *Photinula* in Fig. 4.4.-5/6 are unclear and need reconfirmation.

The world-widely distributed and highly radiated *Calliostoma* seems to have a common ancestor with *Falsimargarita* and *Photinastoma*. While *Photinastoma* and *Calliostoma* reached their southernmost distribution in the Magellan region *Falsimargarita* has radiated in the Southern Ocean. In the warmer Eocene *Calliostoma* occurred in the Antarctic (Stillwell & Zinsmeister 1992) but emigrate in the following cold periods (see 3.3.2.).

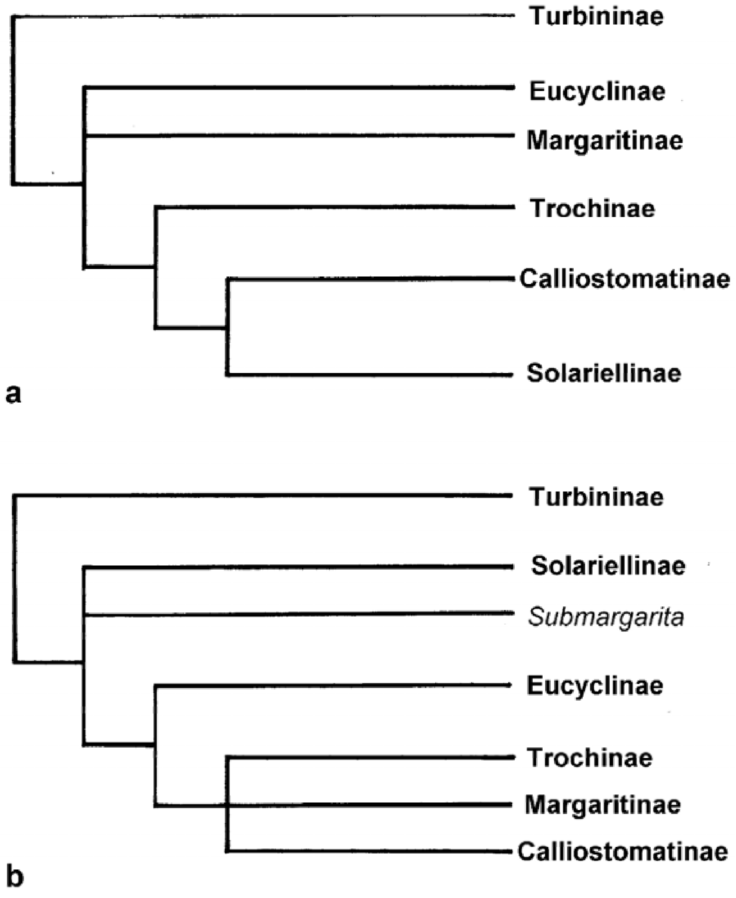


Fig. 5-2. Trochid subfamily trees based on morphology. a) modified after Hickman 1996, b) this study.

The trochid tree based on morphology of Hickman (1996, p.193) on subfamily level is compared with the tree resulting from this study (Fig. 5-2). These trees are remarkably different, none of the nodes within the trochids is similar. The different sources of the data sets might explain this differences. Hickman (1996) mainly used the data set of Hickman & McLean (1990) which "principally come from Australia, New Zealand, Japan, and the marginal north-eastern Pacific" (Hickman & McLean 1990, p.1). In this study only data of Magellanic, Subantarctic, and Antarctic species were used for the data set.

The differences in the trees (Fig. 5-2) point out that the evolutionary radiation and history of the Trochidae cannot be elucidated by the analysis of only selected species from higher taxa of some areas. For a precise explanation of the origin of the Antarctic Trochidae the analysis needs to include each species of the genera world-wide. This investigation, however, would comprise ~ 2.000 species and therefore the phylogenetic analysis of this taxon would be a life task. The phylogenetic analysis should also cover behavioural, enviromental characters, ancient and recent distribution patterns besides morphological characters. The origin of the Antarctic trochid fauna could be explained more likely on the basis of such a more extensive data set, including the biological data mentioned before.

My conclusions are that phylogenetic analysis carried out in one geographical region cannot be successful if the investigated taxa are not endemic to this region but widely or even world-widely distributed. Future studies on the origin of Antarctic molluscs should be done genus by genus including all known species.

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8. Glossary

8.1. Shell morphology and terminology

The determination of shelled molluscs is based mainly on the shell morphology. The technical terms used in 4.1. and 4.2. are explain. Further morphological and anatomical terms are included in 8.3.

8.1.1. Gastropoda

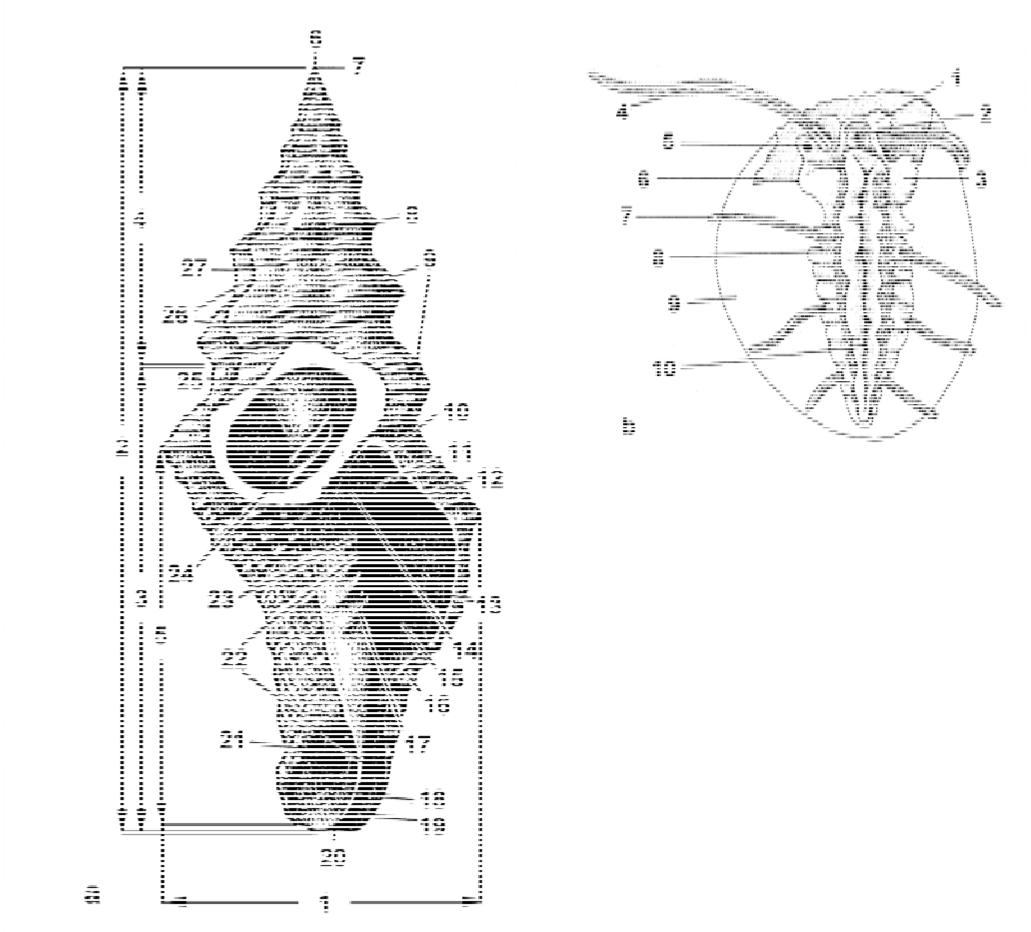


Fig. 8.1-1. Morphology of Gastropoda

a) shell morphology (modified after Hain 1990)

1 – shell diameter, 2 – shell height, 3 – last whorl/ body whorl, 4 – thread, 5 – base, 6 – shell axis, 7 – apex, 8 – keel, 9 – spiral sculpture, 10 – posterior siphonal groove, 11 – parietal margin of inner lip, 12 – dorsal margin of outer lip, 13 – outer lip, 14 – parietal callus, 15 aperture, 16 – basal margin of outer lip, 17 – columellar folds, 18 – pseudumbilicus, 19 – siphonal canal, 20 – shell axis (in line with 6), 21 – siphonal notch, 22 – columellar margins of inner lip, 23 – inner lip, 24 – columellar folds, 25 – columella, 26 – axial sculpture, 27 – suture

b) animal morphology (modified after Hayward & Ryland 1992)

1 – cephalic lappet, 2 – mouth, 3 – neck lobe, 4 – cephalic tentacle, 5 – eye, 6 – mantle, 7 – epipodial tentacle, 8 – epipodial sense organ, 9 – shell, 10 – sole of foot

8.1.2. Scaphopoda

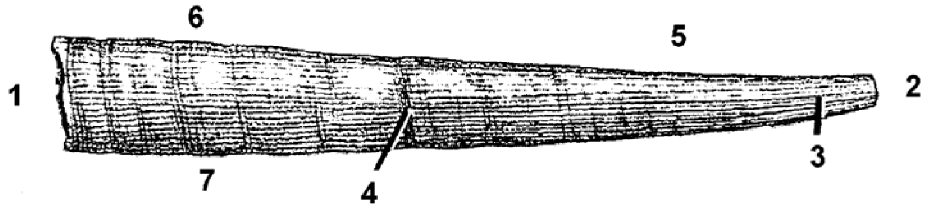


Fig. 8.1-2. Shell morphology of Scaphopoda (modified after Beu & Maxwell 1990).

1 – anterior aperture, 2 – posterior aperture/ apex, 3 – radial ribs, 4 – transverse constrictions, 5 – weakly curved outline, 6 – dorsal margin, 7 – ventral margin

8.1.3. Bivalvia

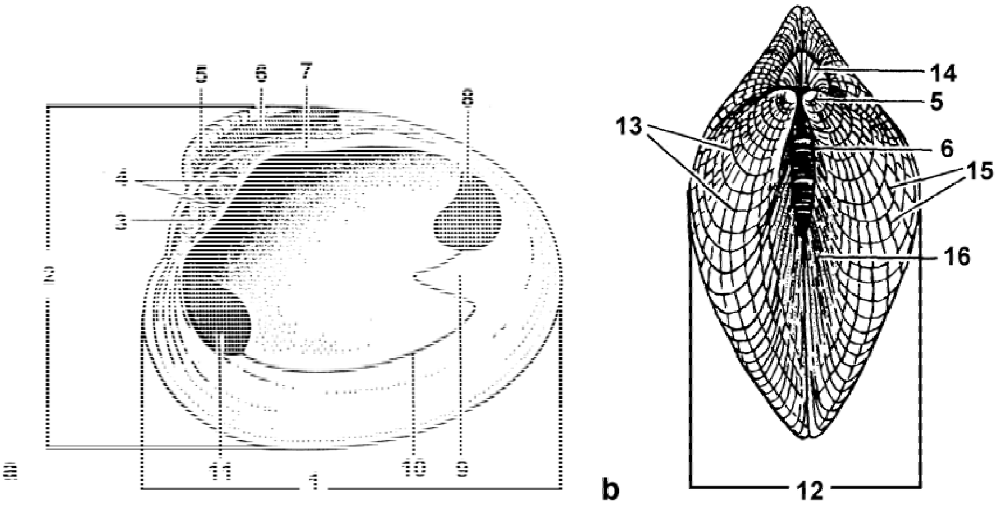


Fig. 8.1-3. Shell morphology of Bivalvia (modified after Hain 1990)

a) vertical view on inner right valve

b) dorsal view on left and right valves

1 – valve length, 2 – valve height, 3 – anterior lateral tooth, 4 – cardinal ooth, 5 – umbo, 6 – ligament, 7 – posterior lateral tooth, 8 – anterior adductor muscle, 9 – pallial sinus, 10 – pallial line, 11 – anterior adductor muscle, 12 – diameter, 13 – concentric sculpture, 14 – lunule, 15 – radial sculpture, 16 – area

8.2. Radula morphology

Next to the shell the radula is a good character for the classification of recent Gastropoda. For the determination of radula characters is important to take into consideration the facts that the tooth and tooth row morphology is depending from the specimen's age (ontogenetic changes in Trochidae or Trichotropidae, see Warén 1990, Hain 1990) and from the specific age of each tooth (changes in tooth formation or because of mechanical use). According to Hain (1990) the middle parts of the radula bands is scanned with same vertical angel.

8.2.1 Radula types

The radula types are taken from Hain (1990) and illustrated in Fig. 8.2-1. The radula formulas mentioned symbolise one row horizontal to the length direction of the radula.

R – rachidian tooth

D – dominant tooth

n – high number of uniform teeth

∞ - very high number of uniform teeth

0 – missing tooth

1) rhipidoglossate

- formula: ∞ + D + 4 + R + 4 + D + ∞
- radula type of most species of Archaeogastropoda

2) docoglossate

- formula: 3 + D + 2 + R + 2 + D + 3
- radula type of Patellacea

3) taenioglossate

- formula: 2 + 1 + R + 1 + 2
- characteristic for most species of Mesogastropoda

4) ptenoglossate

- formula: n + 0 + n
- characteristic for Pulmonata

5) rachiglossate

- formula: 1 + R + 1
- characteristic for most species of Neogastropoda

6) toxoglossate

- formula: D + 0 + D
- characteristic for Conacea and species of Turridae

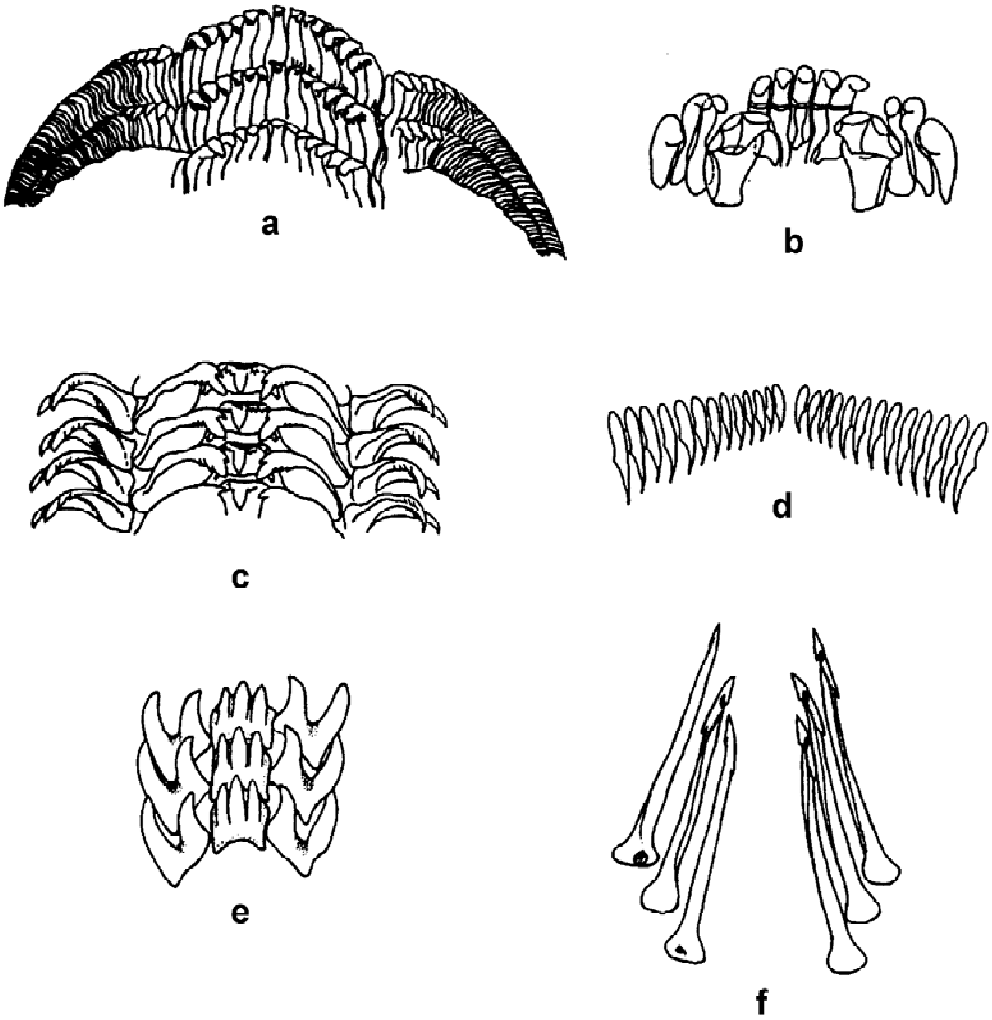


Fig. 8.2-1. Radula types (modified after Hain 1990).
a) rhipidoglossate, b)docoglossate, c) taenioglossate,
d) ptenoglossate, e) rhachiglossate, f) toxoglossate

8.2.2. Tooth characters

Radula teeth are characterised by different characters (Fig. 8.2-2). Bandel (1984) illustrated the terminology of the taenioglossate radula characters which are used in 4.2.1.

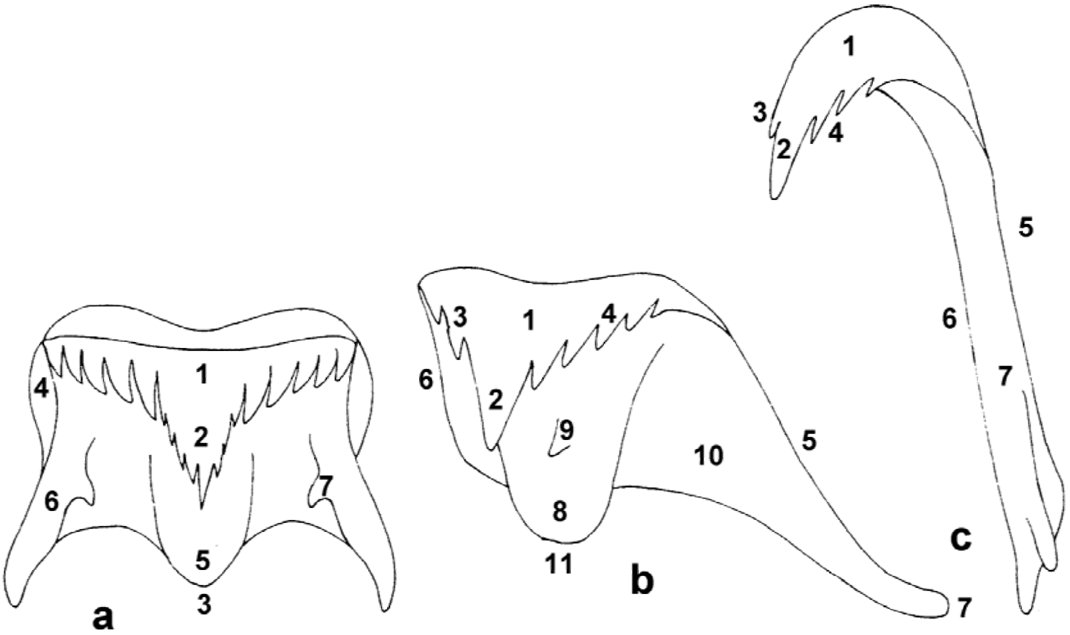


Fig. 8.2-2. Tooth terminology (modified after Bandel 1984).

a) rachidian tooth: 1 – cutting edge with main cusp and flanking cusps, 2 – serrated main cusp, 3 – basal tongue-like projection, 4 – lateral wing, 5 – central ridge, 6 – marginal ridge, 7 – basal denticle

b) lateral tooth: 1 - cutting edge, 2 – main cusp, 3 – inner flanking cusp, 4 – outer flanking cusp, 5 – outer margin, 6 – inner margin, 7 – outer posterior corner, 9 – basal denticle, 10 – basal platform, 11 – basal tongue-like projection

c) marginal tooth: 1 – apex, 2 – main cusp, 3 – inner flanking cusp, 4 – outer flanking cusp, 5 – outer margin, 6 – inner margin, 7 - stalk

8.3 Glossary of technical terms

Definition have been adapted largely from Beu & Maxwell (1990) and Hain (1990). Symbols behind term apply to respective class: A = Aplacophora, B = Bivalvia, G = Gastropoda, S = Scaphopoda.

Abapical (G) – away from the apex (equivalent to anterior in multiwhorled taxa)

anal sinus (G) – notch, slot or embayment in the outer lip, typically at or above the periphery; typically in the Turridae

anterior – in the direction in which the animal moves

anterodorsal margin (B) – the dorsal margin in front of the beak

aperture (G) – single, large opening through which the head-foot extruded

apex (G) – tip of the spire, bearing a protoconch in most taxa; the summit of cap-shaped taxa (“limpets”)

axial (G) – of sculpture, parallel or nearly parallel to the axis of coiling

axis (G) - an imaginary line through the shell apex, about which the shell is coiled

base (G) – part of the surface abapical to the extension of the suture around the last whorl; in limpets the aperture or apertural side; in Lamellariacea the flattened apertural side

beak (B) – the proximal portion of the umbo, a nose-like usually protruding angle, along or above the hinge, where the growth of the valve commenced; point of maximum curvature

body whorl (G) – the last whorl

byssus groove (B) – indentation in the valve margin below the right auricle of many Pectinacea for passage of the byssus

cancellate – sculptured with intersecting spiral and axial (G) or radial and commarginal (B) costae, cords or threads

cardinal tooth (B, G) – 1) hinge tooth radiating from beneath the beak (B), 2) central tooth in centre of radula plate

chondrophore (B) – resilifer that projects below the margin of the hinge

columella (G) – pillar forming the axis of coiled shells, commonly used for the exposed portion, below the parietal area of the inner lip

columellar folds (G) – folds on the columella commarginal (B) – sculpture parallel to the valve margins, preferred term for “concentric” sculpture

conispiral (G) – coiled so that the spire projects as a cone

convexity (B) – the degree of inflation

cord (B, G) – a spiral ridge or costa

costa – spiral, axial, radial or commarginal ridge

crenulate (B) – with the inner ventral margin bearing alternate ridges and notches

crenulations (B, G) – nodulous sculpture on ridges, cords, etc.

depressed (G) – with a low or flat spire

diameter (G) – distance between two planes parallel to and just touching the sides of conispiral shells

disc (B) – in Pectinacea: main area of valve, not including the ears

dissoconch (B) – shell formed after the embryonic stage

divaricate (B) – sculpture of lines or ridges with a marked angle, arranged so the lines or ridges diverge from a line radiating from the beak

dorsal – towards the back as the living animal moves, in bivalves the margin bearing the hinge

ear (B) – an anterior or posterior area adjacent to the dorsal margin, marked off from the disc by a hollow, groove, ridge or slight angulation; commonly in Pectinacea

edentulous (B) – without hinge teeth

equilateral (B) – part of shell anterior and posterior to umbo are similar in size and form

equivalve (B) – right and left valve are similar in size and form

fasciole (G) – anterior, abapical spiral band or zone, demarcated by a margining ridge and/or by a lamellose sculpture, generating by the siphonal notch of siphonostomatous gastropods; row of former siphonal canals

fold (B, G) – 1) of sculpture, a prominent axial costa (G), radial costa or commarginal ridge (B), affecting the whole thickness of the shell; 2) on the gastropod columella. a plait or plica, a spiral ridge to aid attachment of the columellar muscle fusiform (G) – narrowly single-shaped, with a tall spire and a long siphonal canal

granulate – sculptured with many small granules, nodules or beads

growth lines – surface sculpture, commonly not prominent, generating during shell secretion; parallel to the outer lip (G) or to the valve margins (B)

height – 1) distance between the extremities of the ventral and dorsal margins (B); 2) distance between to planes perpendicular to the coiling axis and just touching the adapical and abapical ends (G)

heterodont (B) – with distinctly different cardinal and lateral teeth

heterostrophic (G) – protoconch is coiled in the opposite sense to the teleoconch; normal for Pyramidellidae

hinge (B) – structures of the dorsal region, including ligament, resilifer or chondrophore, hinge teeth and sockets, and lithodesma, mostly near the beak

hinge plate (B) – internal platform below the beak, parallel to the plane of the meeting of the valve, bearing hinge teeth and sockets, chondrophore, lithodesma

hinge tooth (B) – structure in the hinge, an narrow ridge of shelly material received in a socket in the opposite valve, serving to articulate the two valves of one shell and prevent them from rotating with respect to one another

involute (G) – coiled so that the last whorl envelopes all earlier ones, and the height of the aperture corresponds to that of the shell, but with parts of the earlier whorls visible in umbilici

lamella – a thin plate (e.g. thin hinge tooth (B)) or thin, well raised sculptural ridge

lateral tooth (B,G) – 1) hinge tooth, commonly parallel or subparallel to the dorsal valve margin, anterior or posterior to the cardinal teeth (B); 2) distinct radula tooth/teeth between central and marginal teeth (G)

left valve (B) – valve lying on the left when shell is oriented with the anterior facing away from the observer; of Pectinacea: valve without byssus groove

length (B) – distance between the anterior and posterior extremities of the shell

ligament (B) – elastic, horny structure(s) joining the two valves of one shell dorsally, acting as a spring to open the valves when the adductor muscles relax; often subdivided in external ligament and internal ligament (resilium) lunule (B) – depression or distinctively sculptured area anterior to the beaks

mantle – integument surrounding the visceral mass of all molluscs, and secreting the shell

marginal tooth (G) –tooth/teeth on the outer margins of radula band

multispiral (G) – of protoconchs or operculi, with relatively numerous whorls (with central nucleus in operculum)

muscle scar (B) – an impression on the interior of the shell were a muscle was formerly attached

mytiliform (B) – shaped as in *Mytilus*, with an anteriorly terminal umbo

nacreous – “pearly”, shell structure consisting of thin leaves of aragonite parallel to the inner surface of the shell, exhibiting a characteristic pearly lustre (“mother of pearls”)

naticiform (G) – shaped as in *Natica*; with a low spire, capacious last whorl, without siphonal canal or notch

neck (G) – abapical part of siphonostomatous shells, beginning where the outline of the left side changes from convex to concave

nucleus (G) – 1) first whorl of protoconch, 2) subcentral, marginal or terminal, earliest-formed point of operculum

operculum (G) – calcareous or conchiolin (corneous) structure on the dorsal surface of foot, wholly or partly closing the aperture when animal is retracted

orthocline (G) – sculpture at right angels to the suture

orthostrophic (G) – coiled in the normal manner, not heterostrophic

pallial line (B) – line or narrow band on the anterior of the valve, usually near or parallel to margin

patelliform (G) – limpet-shaped: very short, uncoiled, widely open cone

paucispiral (G) – protoconch with relatively few whorls

periostracum – conchiolin outer layer of molluscan shells, upon which the calcareous layers are deposited; commonly a thin brown, yellow or greenish sheet, but thick, prominent an pilose (“hairy”) or lamellose in some taxa (Limopsidae, Phylobryidae)

posterior – opposite direction in which the living animal moves posterodorsal margin (B) – part of the dorsal margin of the valve lying behind the beak

prodissoconch (B) – embryonic shell of bivalves

prosocline (G) – sculpture inclined backwards from the upper suture

protoconch (G) – embryonic shell

punctate – sculpture of shallow pits

pyramidal – pyramid-shaped

radial (B) – sculpture radiating from umbonal area towards the ventral margin

radula (G, S) – tooth-like or rasp-like, hardened, chitinous structures with which gastropods and scaphopods rasp, pierce, grasp, bite, gather, or “sting” their food

resilifer (B) – pit or hollow in the hinge bearing the internal ligament; if protruding below the hinge plate known as chondrophore

resilium (B) – internal ligament

right valve (B) – valve lying in the right when shell is oriented with the anterior end facing away from observer; in Pectinacea valve with byssus groove

rostrate (B) – pointed, beak-like extremity, usually posterior end; commonly in Cuspidariidae

sculpture – ornament

septum (G) – 1) unperforated septa are formed near the apex of some taxa to close off the shell after or before damage to the apical area, commonly in Caecidae; 2) tongue-shaped internal partition of the shell, commonly in Calyptraeidae

shoulder (G) – angulation near or above mid-height on the whorls, delimiting the sutural ramp

sinus (G) – any embayment on the outer lip, forming a corresponding undulation in growth lines, commonly used for anal sinus in Turridae

siphonal canal (G) – semitubular or spout-like extension of the abapical area of the aperture, to enclose the siphon

siphonostomatous (G) – having a siphonal canal

slit (G) – narrow, parallel-sided slot on the outer lip, commonly in Scissurellidae socket (B) – groove in the hinge, accepting a matching tooth in the hinge of the opposite valve

spiral (G) – sculpture, passing continuously around the outer surface of the whorls, almost parallel to the suture

spiral cord (G) – raised sculptural element following a spiral course

suture (G) – continuos spiral line on the shell surface where the whorls join

taxodont (B) – with numerous short, similar hinge teeth

teeth (B, G) – 1) hinge structures (B); 2) radula structures (G)

teleoconch (G) – post-larval gastropod shell; the shell excluding the protoconch

thread – very fine, raised sculptural elements

trochiform (G) – shaped as in *Trochus*; with a moderate tall, flat-sided spire and a flat, or nearly flat, base

tubercle – moderately prominent rounded elevation on the shell surface

umbilicate (G) – having an umbilicus

umbilicus (G) – cavity or depression formed around the coiling axis by the adaxial faces of whorls that do not coalesce to form a solid columella; in the centre of the base

umbo (B) – region of the valve surrounding the point of maximum curvature, or beak

valve (B) –calcareous part of the shell

ventral – direction opposite to dorsal, towards the lower side of the living animal when it moves

whorl (G) – one complete coil of a spiral shell

9. Plates

9.1. Shell morphology of selected Magellanic and Antarctic Mollusca

9.1.1. Gastropoda

On the Plates I – XVI the shell and radula morphology of the gastropod species mentioned in chapter 4.2.1. are illustrated and ordered in the same sequence.

If available SEM or makrolens photos of the shell, the protoconch area and of the radula and jaws are figured. The scale of SEM photos is next to the figure, of makrolens photos in the legend.

In all radulae the middle of the radula bands are scanned with a vertical view. Sometimes details of the teeth plate are figured.

Plate I

	Iothia coppingeri magellanica subsp. nov.
Fig. 9.1.1 -1	shell, dorsal view
Fig. 9.1.1 -2	width of radula
Fig. 9.1.1 -3	lateral tooth
	Iothia coppingeri (Smith, 1881)
Fig. 9.1.1 -4	lateral teeth
	Anatoma clathrata (Strebel, 1908)
Fig. 9.1.1 -5	shell, dorsal view
Fig. 9.1.1 -6	shell, lateral view on aperture
Fig. 9.1.1 -7	protoconch
Fig. 9.1.1 -8	width of radula

Plate II

	Margarella violacea (King & Broderip, 1831)
Fig. 9.1.1 -9	operculum
Fig. 9.1.1 -10	width of radula
Fig. 9.1.1 -11	central complex and inner marginal teeth
Fig. 9.1.1 -12	marginal teeth
	Margarella antarctica (Lamy, 1905)
Fig. 9.1.1 -13	protoconch
Fig. 9.1.1 -14	width of radula
Fig. 9.1.1 -15	central complex and inner marginal teeth
Fig. 9.1.1 -16	cusp of rachidian tooth

Plate III

	Margarella whiteana sp.n.
Fig. 9.1.1 -17	shell, view on aperture, 7.6 x 8.7 cm
Fig. 9.1.1 -18	width of radula
Fig. 9.1.1 -19	central complex and inner marginal teeth
Fig. 9.1.1 -20	cusp of rachidian tooth
	Calliostoma consimilis (Smith, 1881)
Fig. 9.1.1 -21	protoconch
Fig. 9.1.1 -22	width of radula
Fig. 9.1.1 -23	central complex and inner marginal teeth
Fig. 9.1.1 -24	outer marginal teeth

Plate IV

	Calliostoma irisans Strebel, 1905
Fig. 9.1.1 -25	protoconch
Fig. 9.1.1 -26	width of radula
Fig. 9.1.1 -27	central complex and inner marginal teeth
	Calliostoma nudisculum (Martens, 1881)
Fig. 9.1.1 -28	protoconch
Fig. 9.1.1 -29	width of radula
Fig. 9.1.1 -30	jaws
	Calliostoma venustulum Strebel, 1908
Fig. 9.1.1 -31	central complex and inner marginal teeth
Fig. 9.1.1 -32	jaws

Plate V

	Photinula caerulescens (King & Broderip, 1831)
Fig. 9.1.1 -33	protoconch
Fig. 9.1.1 -34	width of radula
Fig. 9.1.1 -35	central complex and inner marginal teeth
Fig. 9.1.1 -36	jaw
	Solariella sp. 1
Fig. 9.1.1 -37	shell, lateral view on aperture, 11.2 x 10.5 cm
Fig. 9.1.1 -38	width of radula
Fig. 9.1.1 -39	central complex and inner marginal teeth
Fig. 9.1.1 -40	jaws

Plate VI

	Solariella sp. 2
Fig. 9.1.1 -41	shell, dorsal view, 12.4 x 12.3 cm
Fig. 9.1.1 -42	shell lateral view, 12.4 x 12.3 cm
Fig. 9.1.1 -43	width of radula
Fig. 9.1.1 -44	central complex and inner marginal teeth

	Cyclostrema crassicostatum Strebel, 1908
Fig. 9.1.1 -45	shell, dorsal view
Fig. 9.1.1 -46	protoconch
Fig. 9.1.1 -47	shell, ventral view
Fig. 9.1.1 -48	central complex and marginal teeth

Plate VII

	Homalopoma cunninghami (Smith, 1881)
Fig. 9.1.1 -49	protoconch
Fig. 9.1.1 -50	operculum
Fig. 9.1.1 -51	width of radula
Fig. 9.1.1 -52	rachidian and lateral teeth
Fig. 9.1.1 -53	marginal teeth
	Fartulum magellanicum
	Di Geronimo, Privitera & Valdovinos, 1995
Fig. 9.1.1 -54	shell, lateral view
Fig. 9.1.1 -55	septum
Fig. 9.1.1 -56	operculum

Plate VIII

	Skeneidae sp. 1
Fig. 9.1.1 -57	shell, dorsal view
Fig. 9.1.1 -58	shell, lateral view on aperture
Fig. 9.1.1 -59	protoconch
Fig. 9.1.1 -60	shell, ventral view
Fig. 9.1.1 -61	operculum, outside
Fig. 9.1.1 -62	operculum, inside, muscle scar
Fig. 9.1.1 -63	width of radula
Fig. 9.1.1 -64	rachidian and lateral teeth

Plate IX

	Orbitestella ponderi sp. nov.
Fig. 9.1.1 -65	shell, dorsal view
Fig. 9.1.1 -66	shell, lateral view on aperture
Fig. 9.1.1 -67	protoconch
Fig. 9.1.1 -68	protoconch structure
Fig. 9.1.1 -69	shell, ventral view
Fig. 9.1.1 -70	operculum, outside
Fig. 9.1.1 -71	width of radula
Fig. 9.1.1 -72	jaw plates

Plate X

	Trochita pileus (Lamarck, 1822)
Fig. 9.1.1 -73	width of radula
	Trochita pileolus (d’Orbigny, 1845)
Fig. 9.1.1 -74	width of radula
	Crepipatella dilatata (Lamarck, 1822)
Fig. 9.1.1 -75	width of radula
	Lamellaria patagonica Smith, 1881
Fig. 9.1.1 -76	width of radula
	Lamellaria ampla Strebel, 1906
Fig. 9.1.1 -77	width of radula
Fig. 9.1.1 -78	rachidian tooth
	Lamellaria elata Strebel, 1906
Fig. 9.1.1 -79	width of radula
Fig. 9.1.1 -80	rachidian tooth

Plate XI

Bulbus carcellesi Dell, 1990

Fig. 9.1.1 -81	width of radula
Fig. 9.1.1 -82	rachidian and lateral teeth
Fig. 9.1.1 -83	jaws

Polinices patagonicus (Philippi, 1845)

Fig. 9.1.1 -84	width of radula
Fig. 9.1.1 -85	rachidian and lateral teeth
Fig. 9.1.1 -86	jaws

Mangelia magellanica (Martens, 1881)

Fig. 9.1.1 -87	protoconch
Fig. 9.1.1 -88	width of radula

Plate XII

	Aforia gonoides (Watson, 1881)
Fig. 9.1.1 -89	operculum
Fig. 9.1.1 -90	width of radula
	Antistreptus magellanicus Dall, 1902
Fig. 9.1.1 -91	protoconch
Fig. 9.1.1 -92	young shell
	Meteuthria martensi (Strebel, 1905)
Fig. 9.1.1 -93	protoconch, lateral view
Fig. 9.1.1 -94	protoconch
Fig. 9.1.1 -95	operculum
Fig. 9.1.1 -96	width of radula

Plate XIII

	Pareuthria cerealis (Rochebrune & Mabille, 1885)
Fig. 9.1.1 -97	protoconch
Fig. 9.1.1 -98	protoconch, lateral view
Fig. 9.1.1 -99	operculum, outside
Fig. 9.1.1 -100	operculum, inside, with muscle scar
Fig. 9.1.1 -101	width of radula
	Pareuthria cf. *paessleri* (Strebel, 1905)
Fig. 9.1.1 -102	protoconch
Fig. 9.1.1 -103	protoconch, lateral view
Fig. 9.1.1 -104	width of radula

Plate XIV

	Pareuthria plumbea (Philippi, 1844)
Fig. 9.1.1 -105	width of radula
	Pareuthria powelli (Hombron & Jacquinot, 1854)
Fig. 9.1.1 -106	protoconch
Fig. 9.1.1 -107	protoconch, lateral view
Fig. 9.1.1 -108	width of radula
	Crenatosipho beaglensis gen. nov. sp. nov.
Fig. 9.1.1 -109	shell, lateral view, 8.6 x 3.9 cm
Fig. 9.1.1 -110	protoconch
Fig. 9.1.1 -111	protoconch, lateral view
Fig. 9.1.1 -112	width of radula

Plate XV

	Marginella warrenii Marrat, 1876
Fig. 9.1.1 -113	width of radula
Fig. 9.1.1 -114	width of radula
	Trophon geversianus (Pallas, 1769)
Fig. 9.1.1 -115	width of radula, large female
Fig. 9.1.1 -116	width of radula, small animal
	Trophon cf. *ohlini* Strebel, 1905
Fig. 9.1.1 -117	shell, lateral view
Fig. 9.1.1 -118	protoconch
	Trophon (Fuegotrophon) pallidus (Broderip, 1832)
Fig. 9.1.1 -119	protoconch
Fig. 9.1.1 -120	width of radula

Plate XVI

	Diaphana paessleri (Strebel, 1905)
Fig. 9.1.1 -121	width of radula
Fig. 9.1.1 -122	rachidian tooth
	Toledonia limnaeformis (Smith, 1877)
Fig. 9.1.1 -123	width of radula
Fig. 9.1.1 -124	rachidian tooth
Fig. 9.1.1 -125	lateral teeth

9.1.2. Bivalvia

On the Plates XVII – XXI the valve morphology of the bivalve species mentioned in chapter 4.2.2. are illustrated and ordered in the same sequence.

If available SEM or makrolens photos of the valve, the prodissoconch area and of the hinge plate figured. The scale of SEM photos is next to the figure, of makrolens photos in the legend.

Plate XVII

	Nucula falklandica Preston, 1912
Fig. 9.1.2 -1	left valve
Fig. 9.1.2 -2	valve sculpture
Fig. 9.1.2 -3	right valve, inside, large valve
Fig. 9.1.2 -4	right valve, inside, small valve
Fig. 9.1.2 -5	posterior teeth
	Yoldiella granula Dall, 1908
Fig. 9.1.2 -6	left valve
Fig. 9.1.2 -7	right valve, inside
Fig. 9.1.2 -8	right valve, inside, small specimen

Plate XVIII

	Philobrya crispa sp. nov.
Fig. 9.1.2 -9	left valve
Fig. 9.1.2 -10	prodissoconch
Fig. 9.1.2 -11	left valve, young specimen
Fig. 9.1.2 -12	periostracum structure
Fig. 9.1.2 -13	right valve, inside
Fig. 9.1.2 -14	right valve, hinge
	Philobrya capillata Dell, 1964
Fig. 9.1.2 -15	valves with view on prodissoconch
	Philobrya olstadi Soot-Ryen, 1951
Fig. 9.1.2 -16	prodissoconch

Plate XIX

	Crenella magellanica sp. nov.
Fig. 9.1.2 -17	right valve
Fig. 9.1.2 -18	valves, lateral view
Fig. 9.1.2 -19	right valve, inside
Fig. 9.1.2 -20	right valve, hinge
	Cyclopecten multistriatus sp. nov.
Fig. 9.1.2 -21	right valve
Fig. 9.1.2 -22	left valve
Fig. 9.1.2 -23	prodissoconch of right valve
Fig. 9.1.2 -24	prodissoconch of left valve

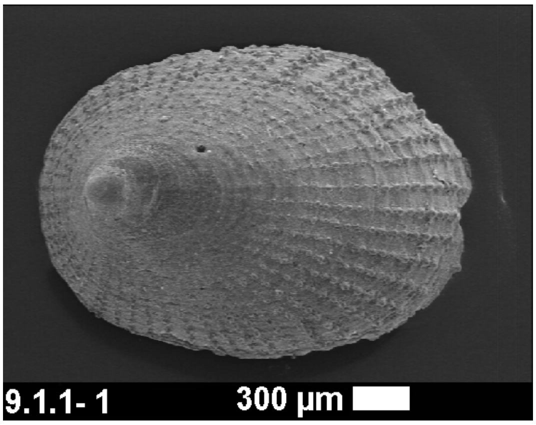
Plate XX

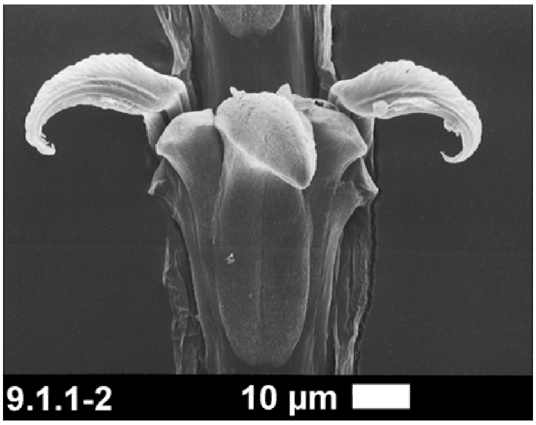
	Cyclopecten falklandica Dell, 1964
Fig. 9.1.2 -25	right valve, 8.7 x 9.3 cm
Fig. 9.1.2 -26	left valve
	Pecten (?) cf. *pygnolepis* Martens, 1881
Fig. 9.1.2 -27	right valve, 17 x 16 mm
Fig. 9.1.2 -28	left valve, dorsal margin
	Cuspidaria chilensis Dall, 1889
Fig. 9.1.2 -31	left valve
Fig. 9.1.2 -32	left valve, inside

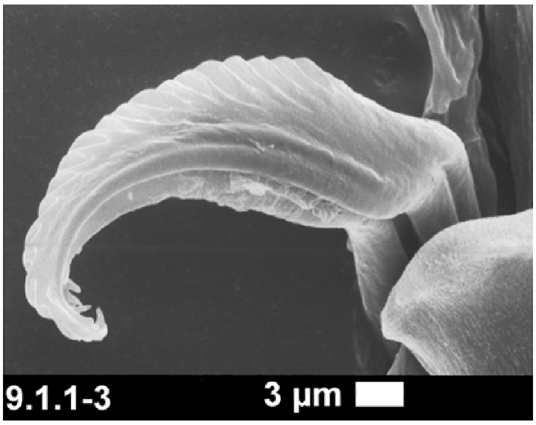
Plate XXI

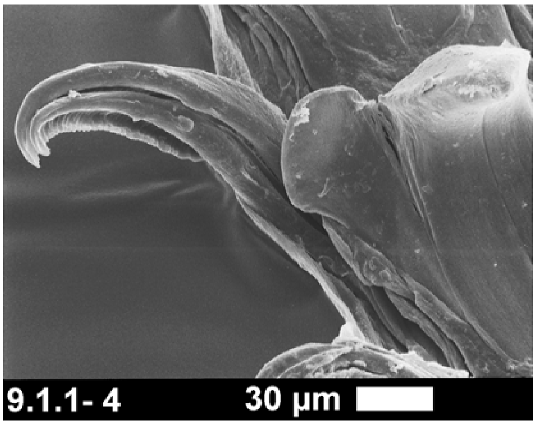
	Lyonsiella radiata Dall, 1889
Fig. 9.1.2 -33	right valve, 10.0 x 10.0 cm
Fig. 9.1.2 -34	left valve, 10.0 x 10.0 cm
Fig. 9.1.2 -35	right valve, inside, 10.0 x 10.0 cm
	Lyonsiella angelika sp. nov.
Fig. 9.1.2 -36	right valve, 5.3 x 5.8 cm
Fig. 9.1.2 -37	left valve, 5.3 x 5.8 cm

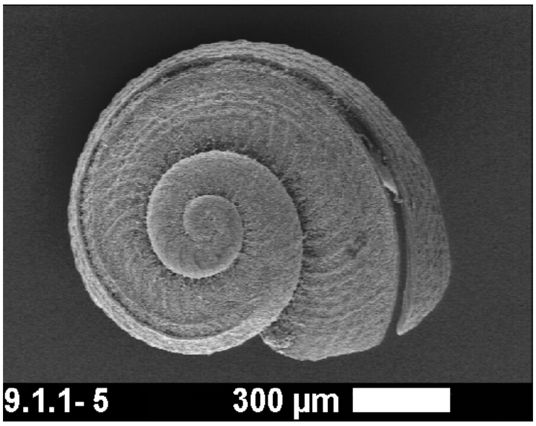
Plate I

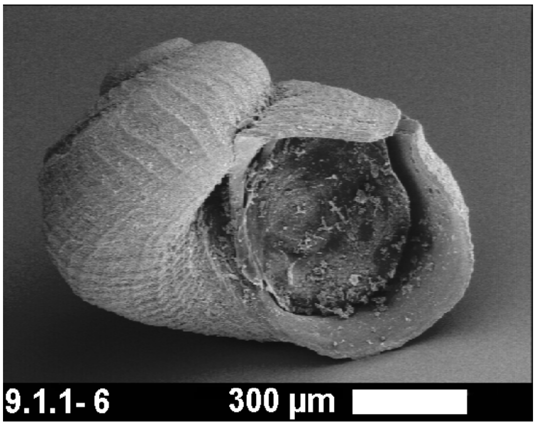

9.1.1- 1

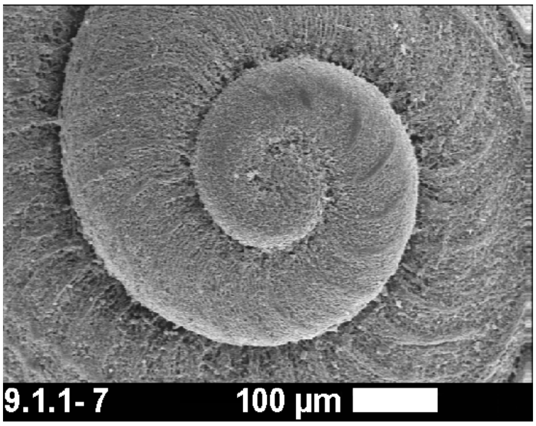

9.1.1-2


9.1.1-3


9.1.1- 4


9.1.1- 5


9.1.1- 6


9.1.1- 7

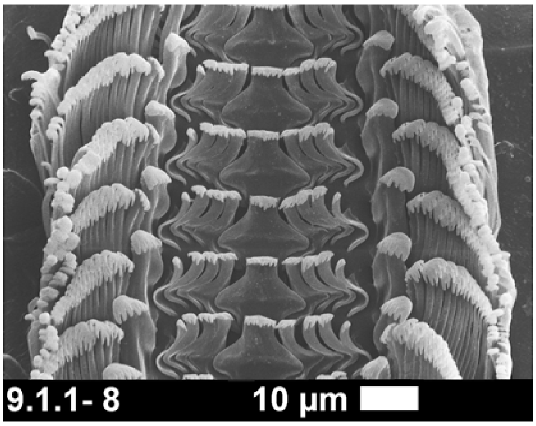
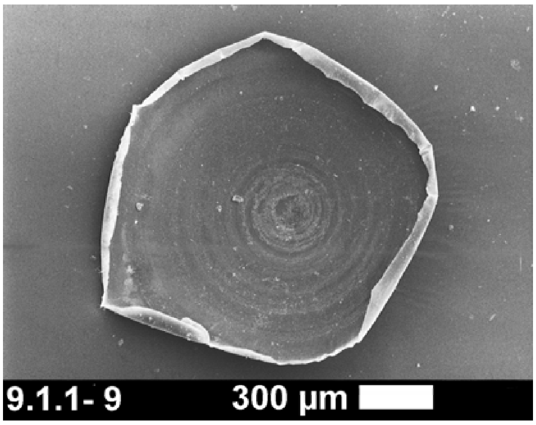
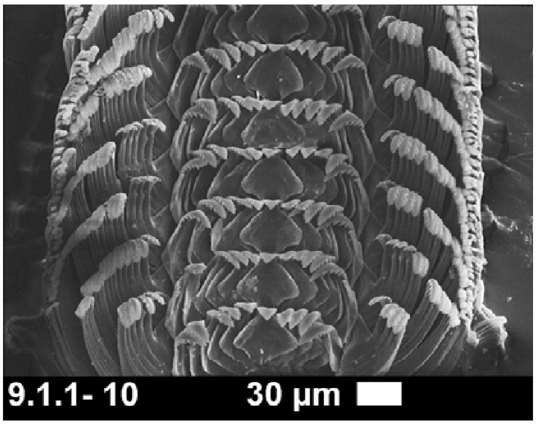
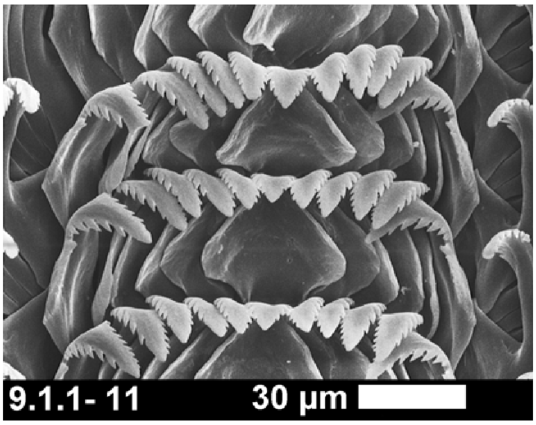
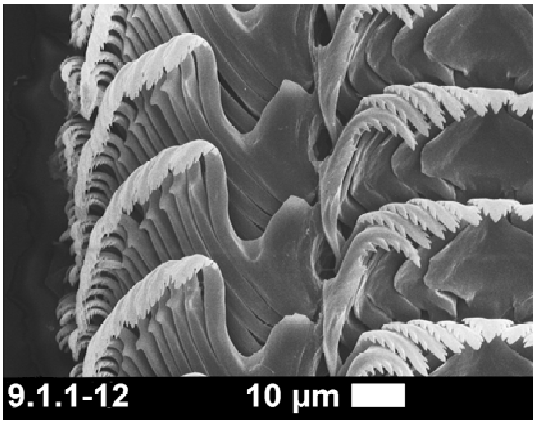

9.1.1- 8

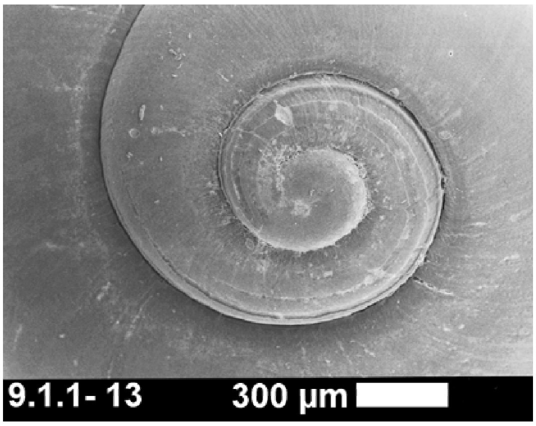
Plate II

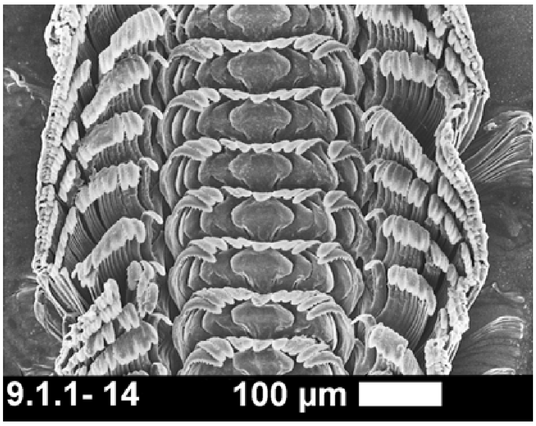

9.1.1- 9 300 µm

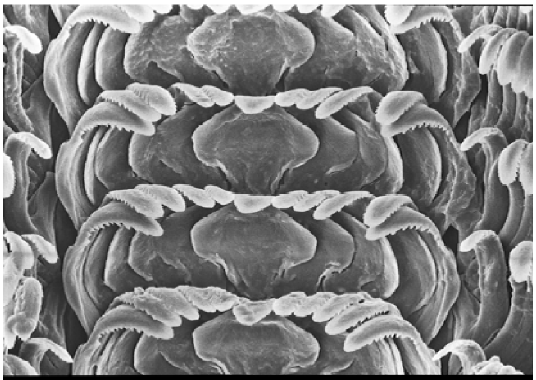

9.1.1- 10 30 µm


9.1.1- 11 30 µm


9.1.1-12 10 µm


9.1.1- 13 300 µm


9.1.1- 14 100 µm


9.1.1- 15 30 µm

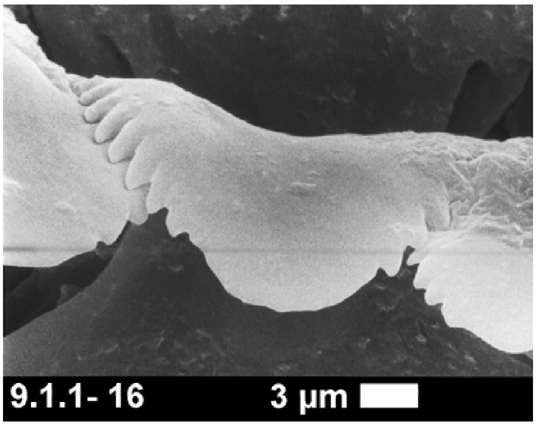
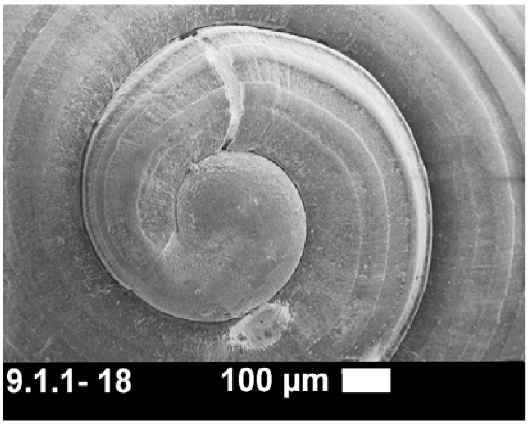
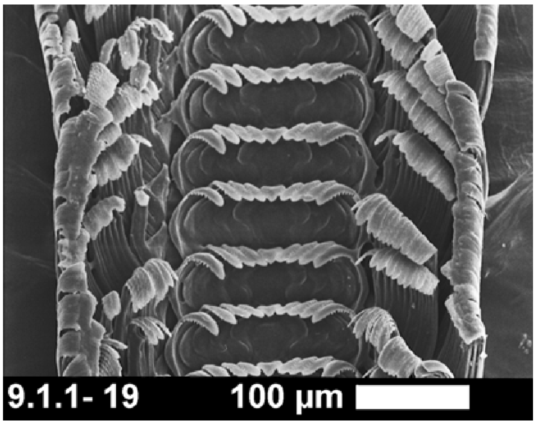
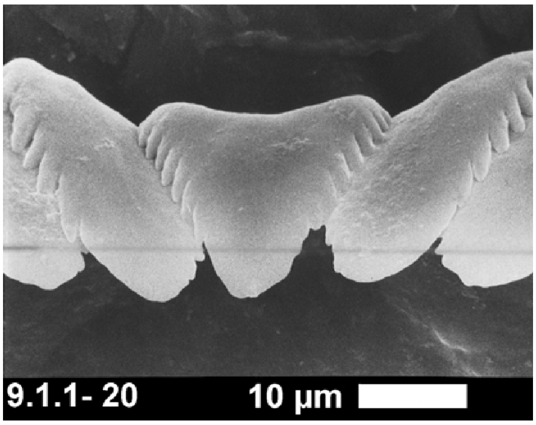

9.1.1- 16 3 µm

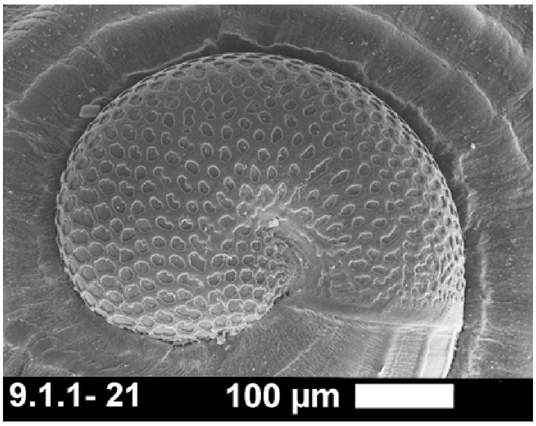
Plate III

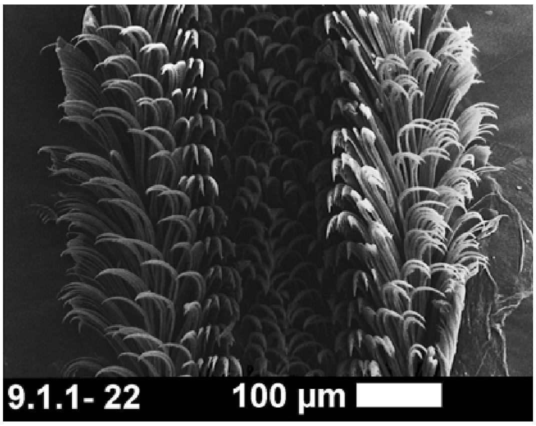

9.1.1- 17

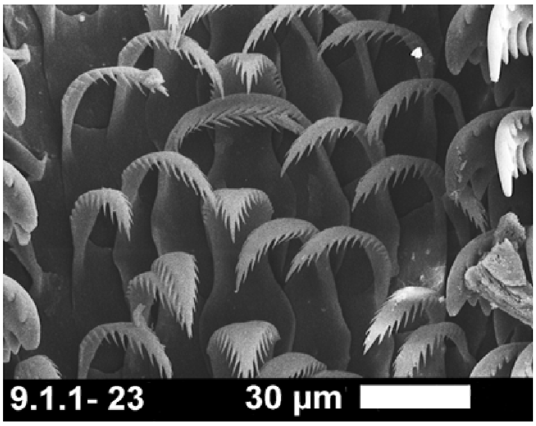

9.1.1- 18


9.1.1- 19


9.1.1- 20


9.1.1- 21


9.1.1- 22


9.1.1- 23

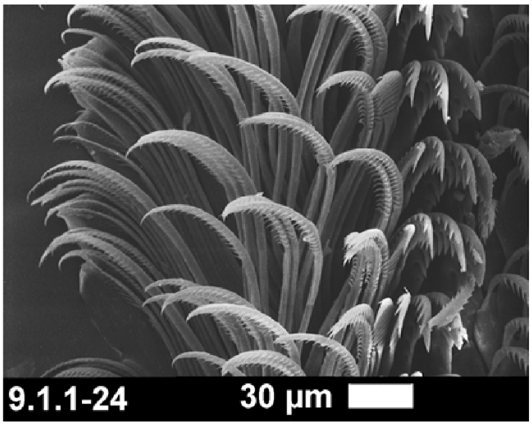
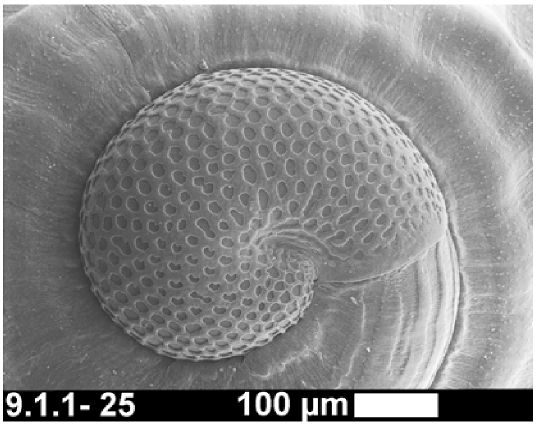
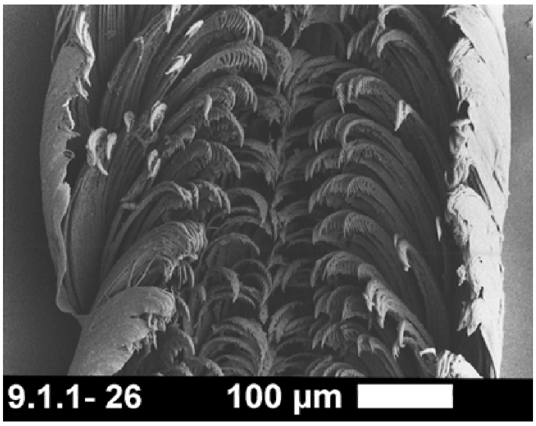
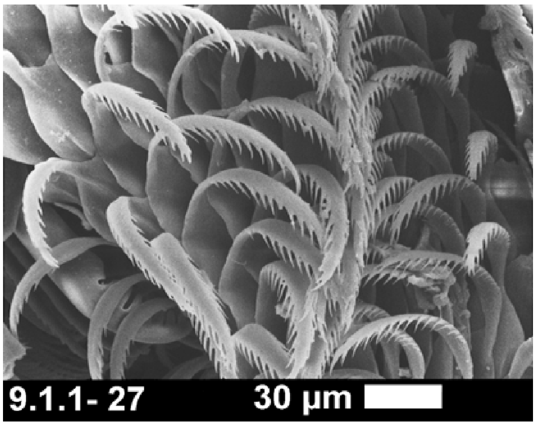
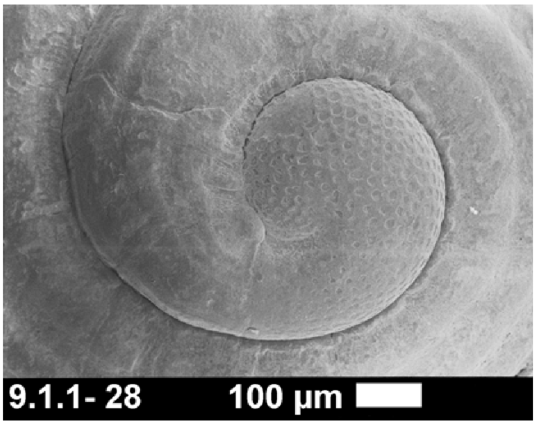

9.1.1-24

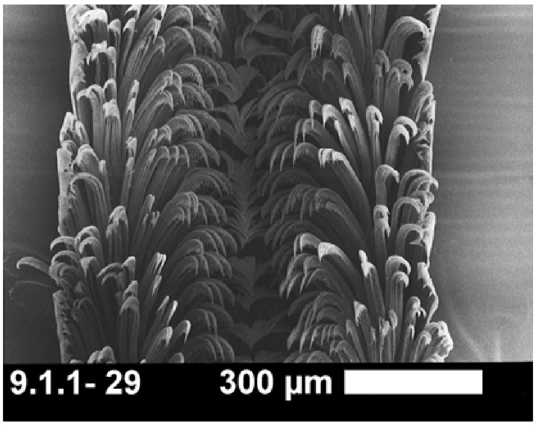
Plate IV

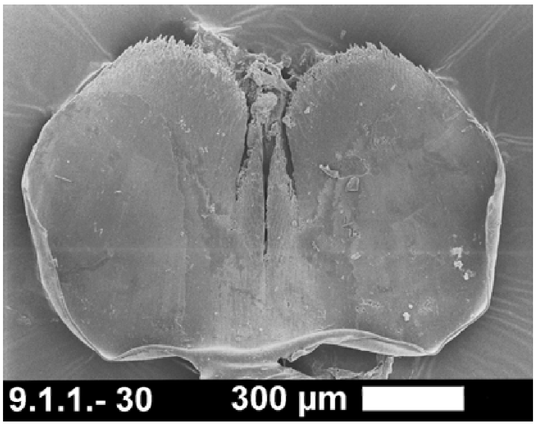

9.1.1- 25

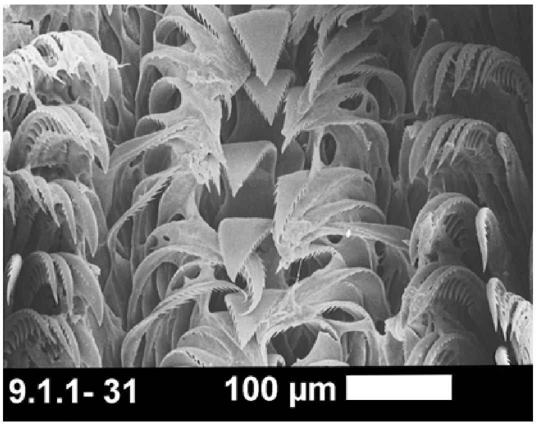

9.1.1- 26


9.1.1- 27


9.1.1- 28


9.1.1- 29


9.1.1.- 30


9.1.1- 31

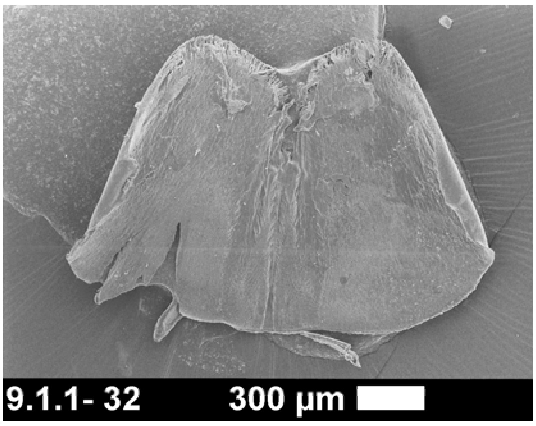
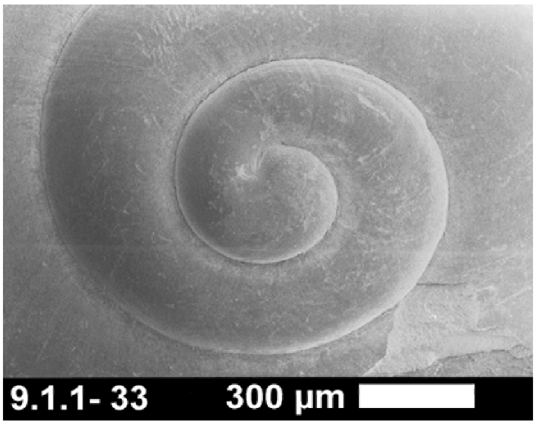
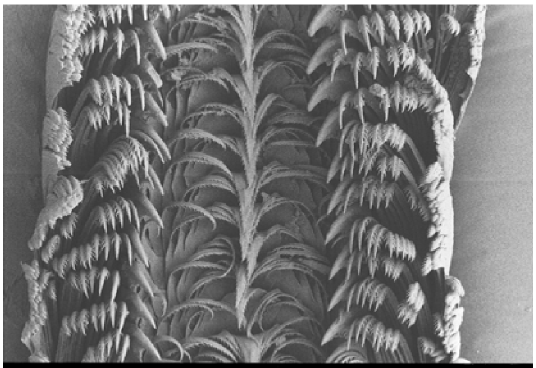
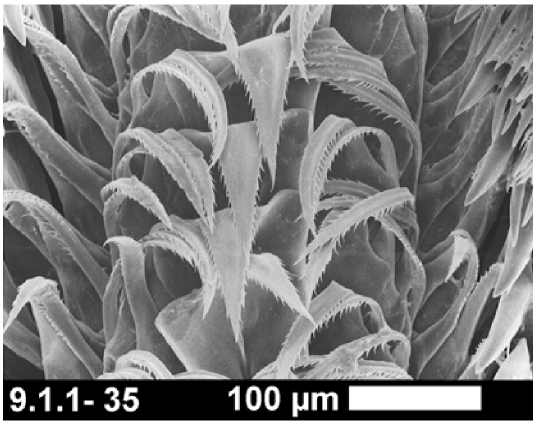
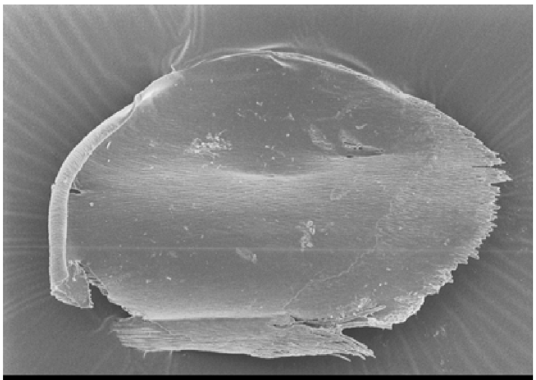

9.1.1- 32

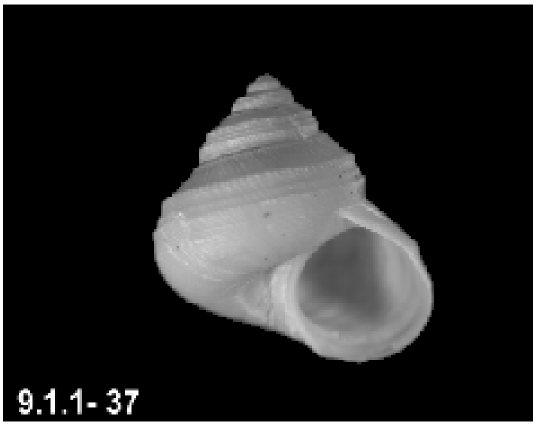
Plate V

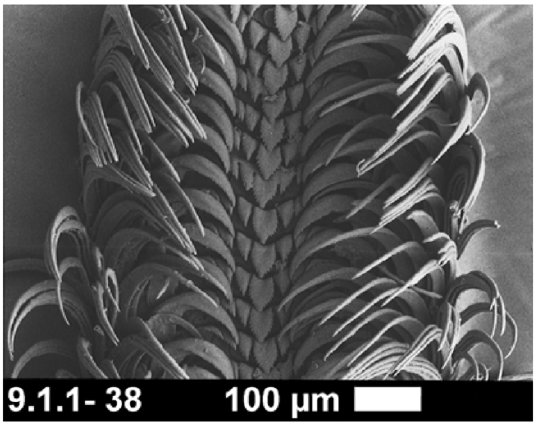

9.1.1- 33 300 µm

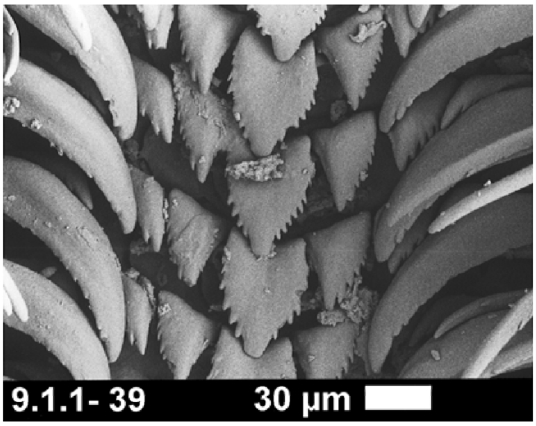

9.1.1- 34 100 µm


9.1.1- 35 100 µm


9.1.1- 36 300 µm


9.1.1- 37


9.1.1- 38 100 µm


9.1.1- 39 30 µm

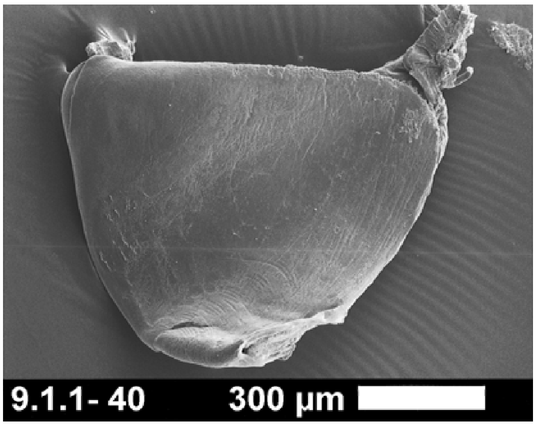
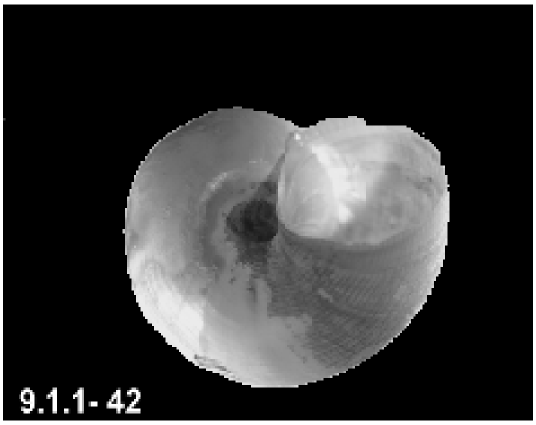
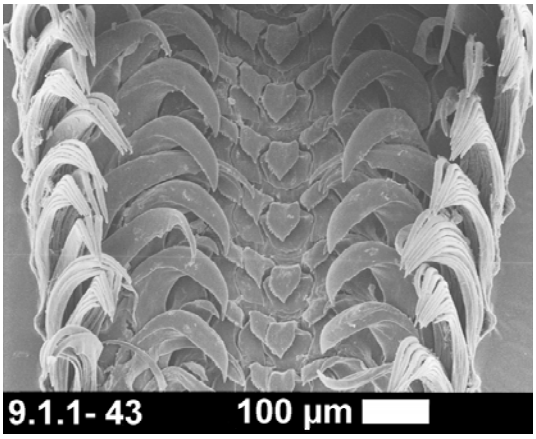
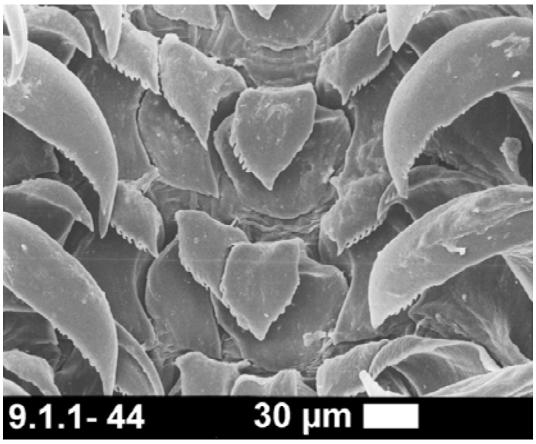

9.1.1- 40 300 µm

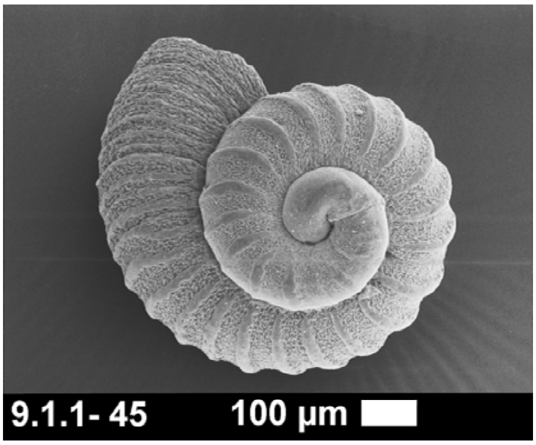
Plate VI

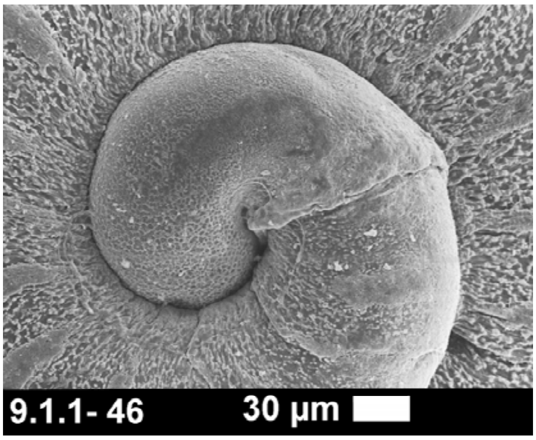

9.1.1- 41

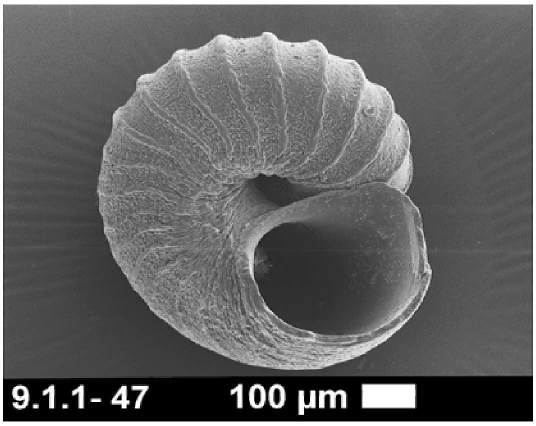

9.1.1- 42


9.1.1- 43


9.1.1- 44


9.1.1- 45


9.1.1- 46


9.1.1- 47

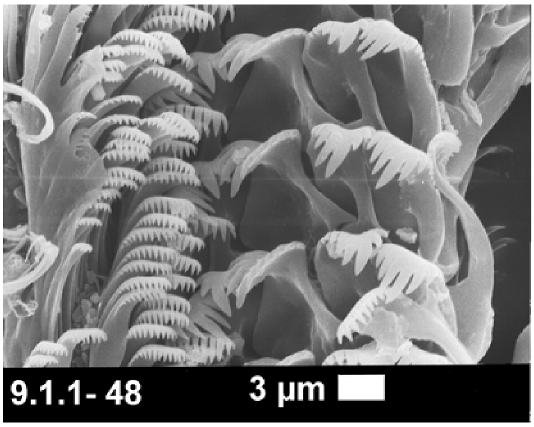
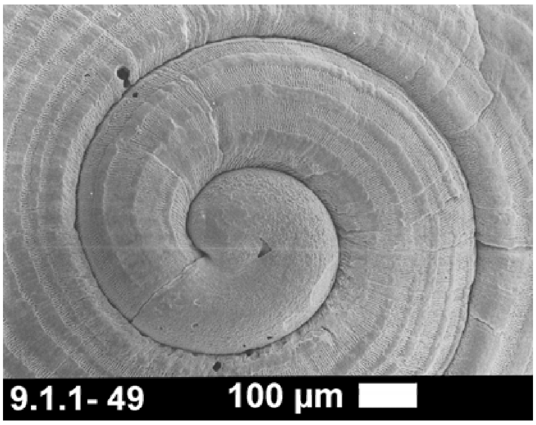
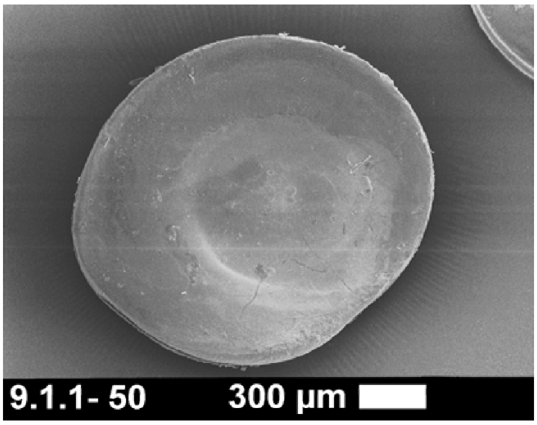
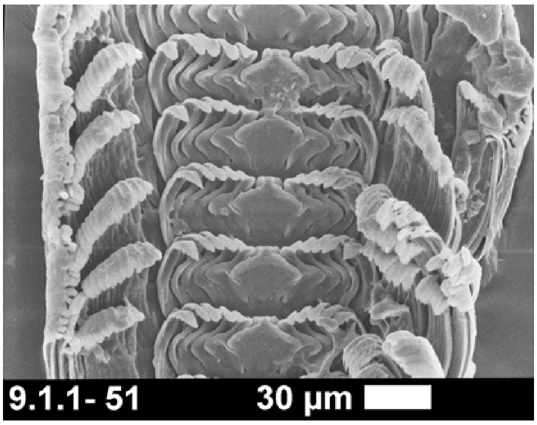
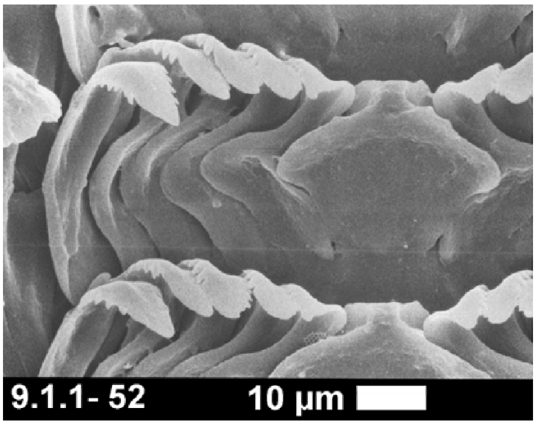

9.1.1- 48

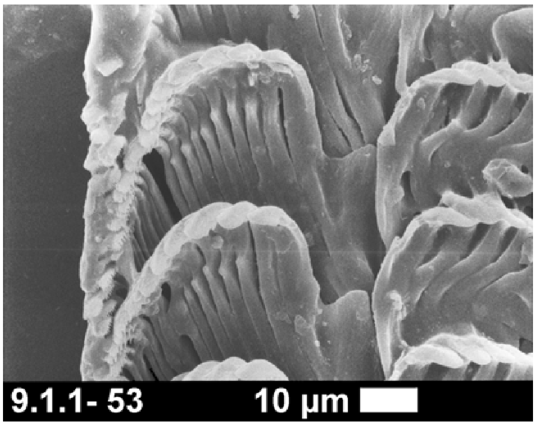
Plate VII

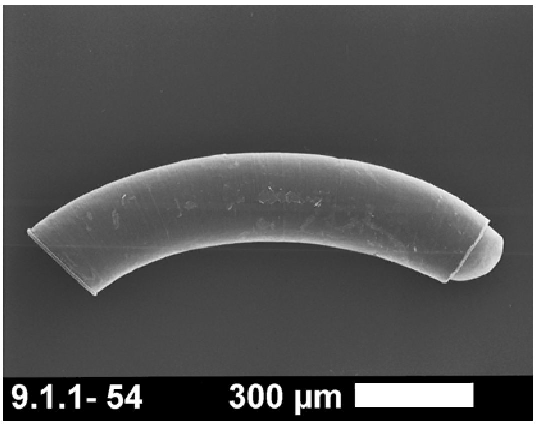

9.1.1- 49

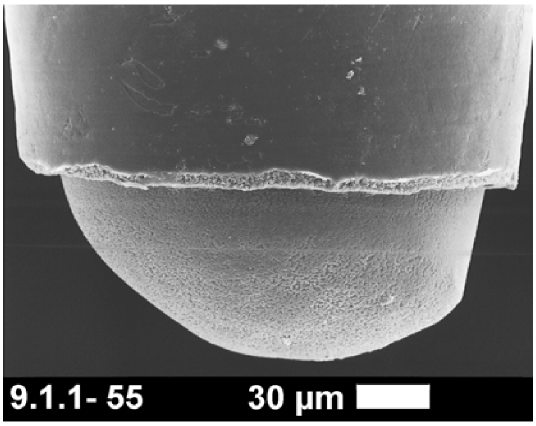

9.1.1- 50


9.1.1- 51


9.1.1- 52


9.1.1- 53


9.1.1- 54


9.1.1- 55

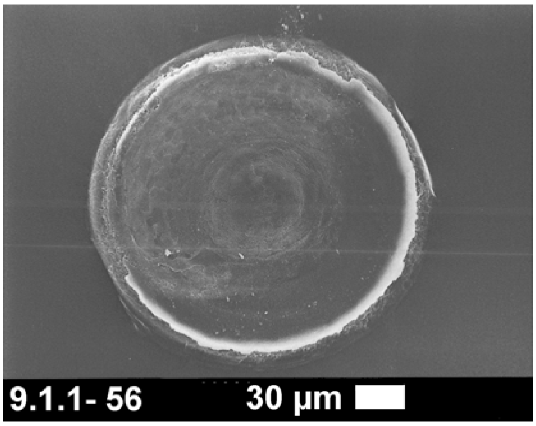
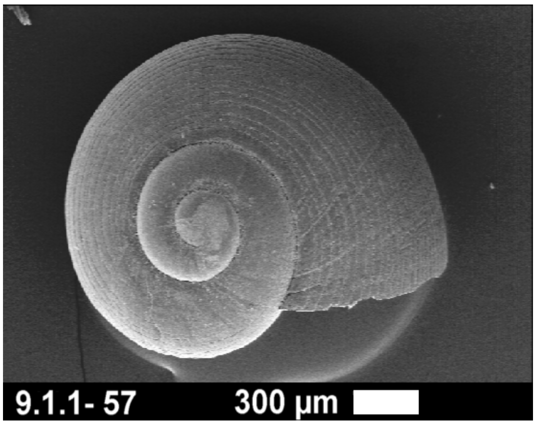
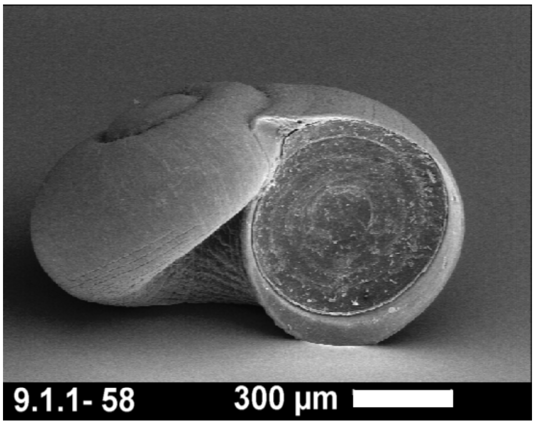
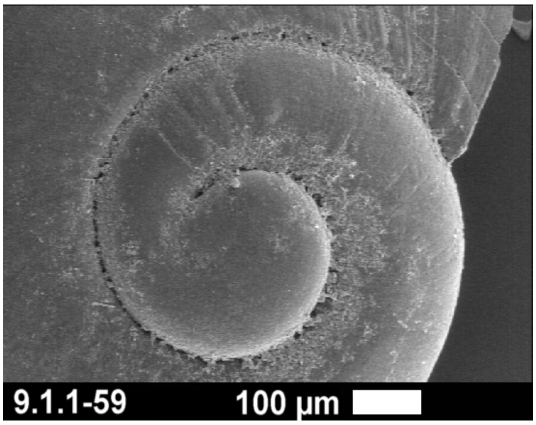
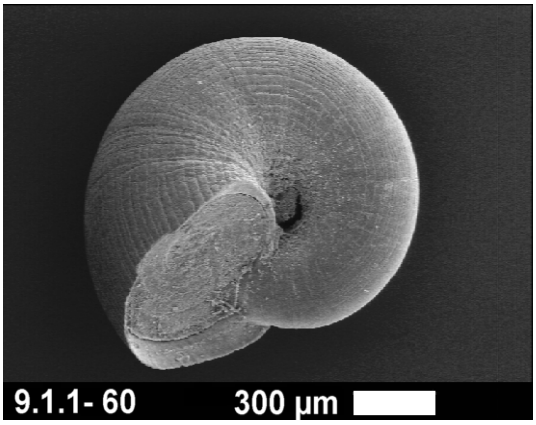

9.1.1- 56

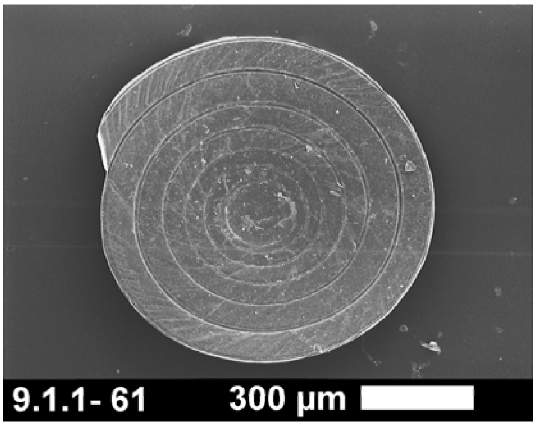
Plate VIII

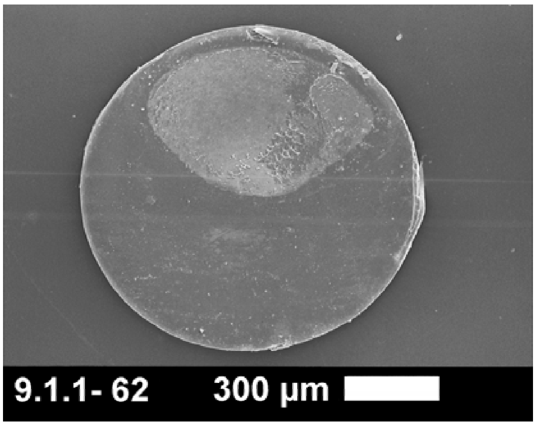

9.1.1- 57
300 µm

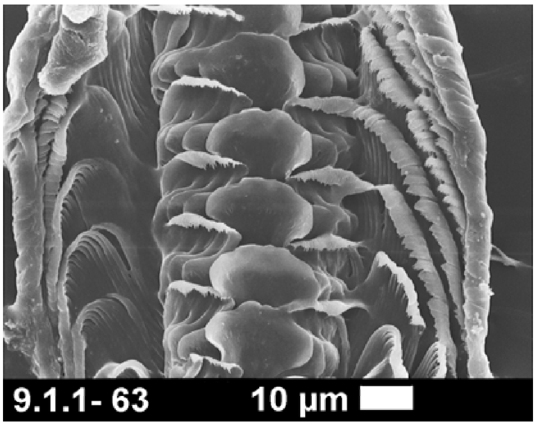

9.1.1- 58
300 µm


9.1.1-59
100 µm


9.1.1- 60
300 µm


9.1.1- 61
300 µm


9.1.1- 62
300 µm


9.1.1- 63
10 µm

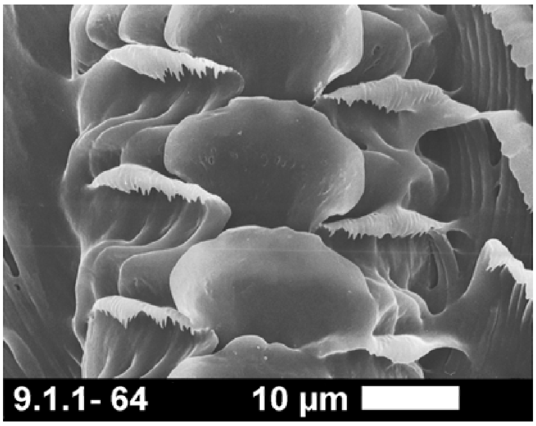
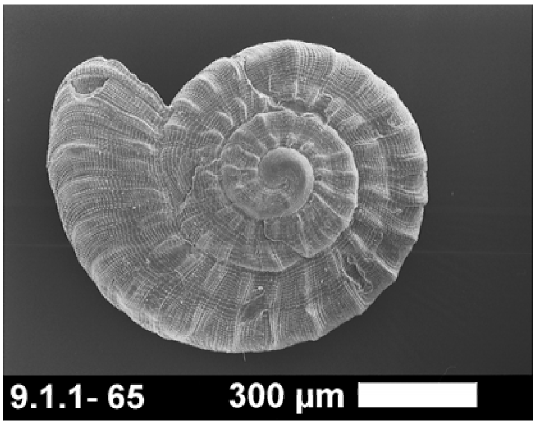
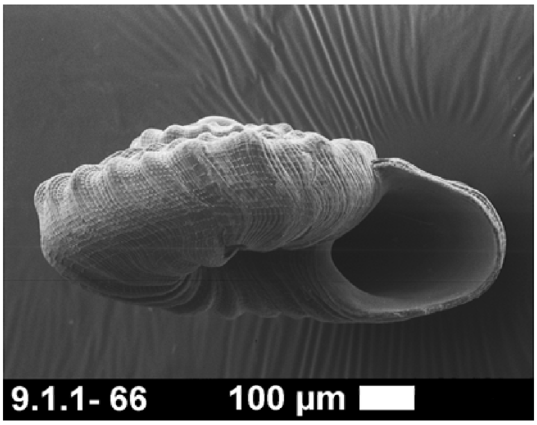
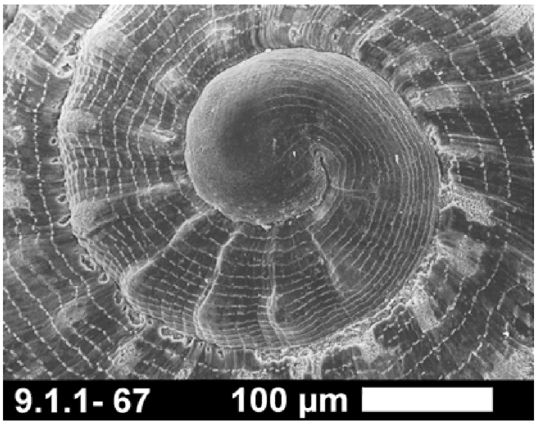
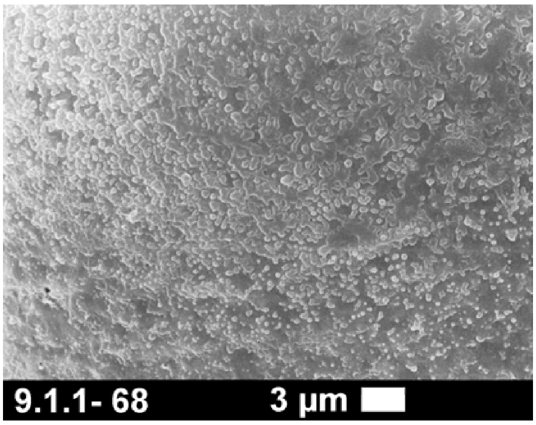

9.1.1- 64
10 µm

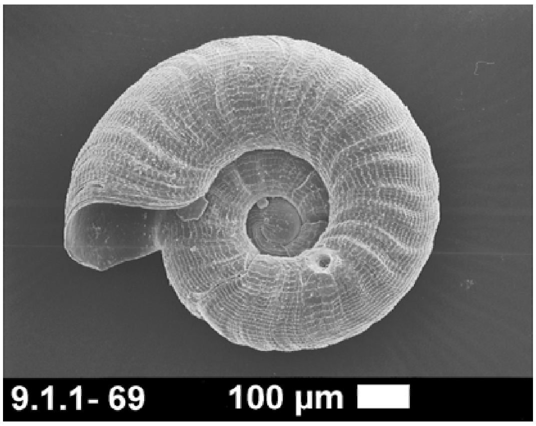
Plate IX

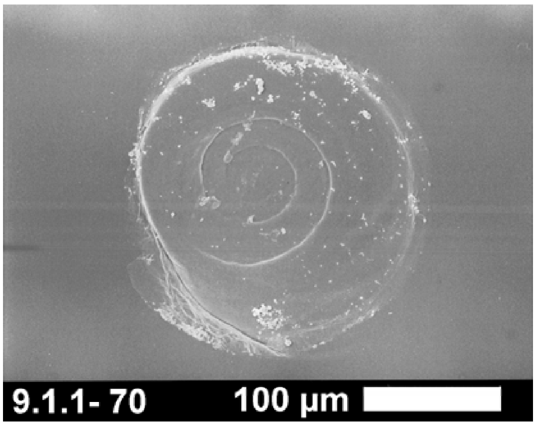

9.1.1- 65

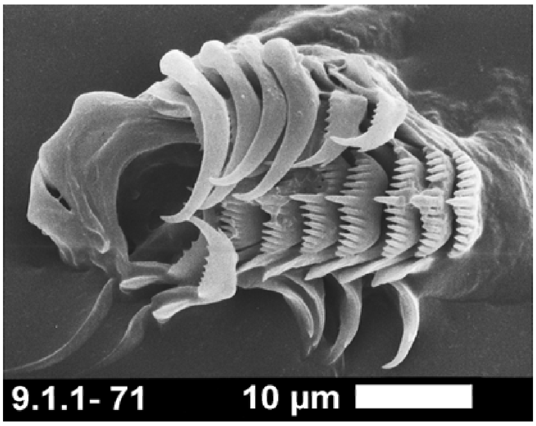

9.1.1- 66


9.1.1- 67


9.1.1- 68


9.1.1- 69


9.1.1- 70


9.1.1- 71

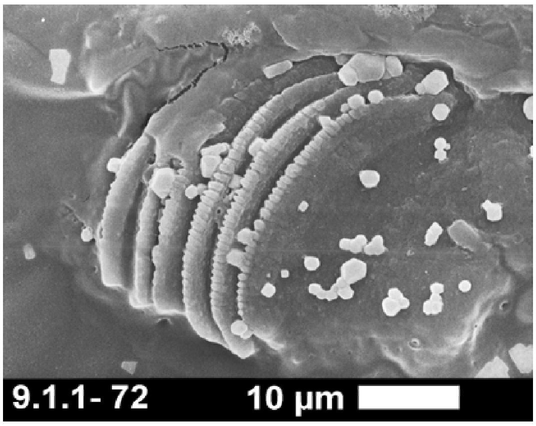
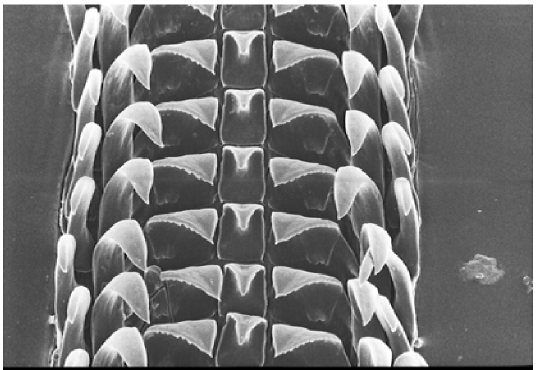
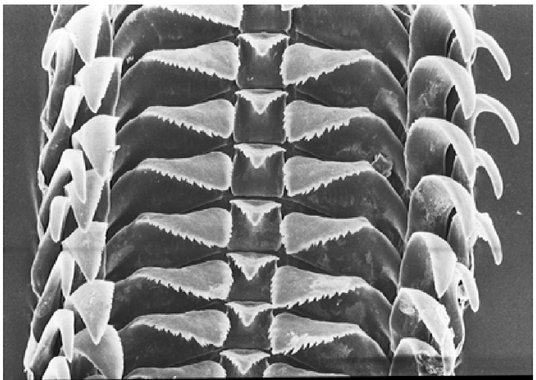
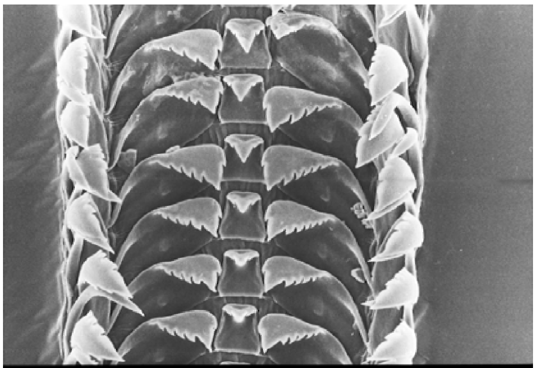
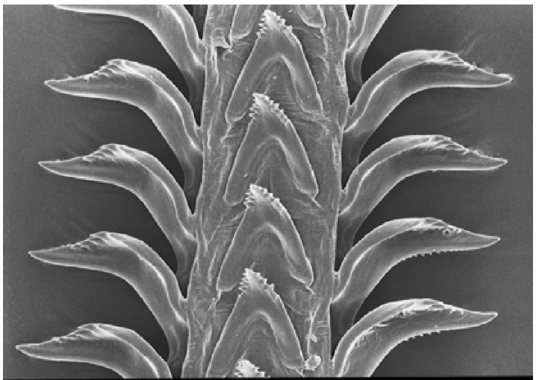

9.1.1- 72

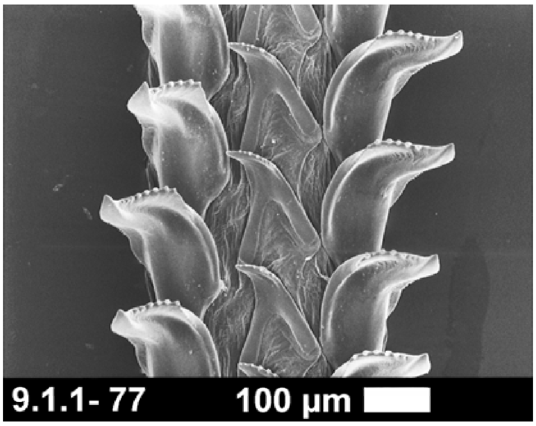
Plate X

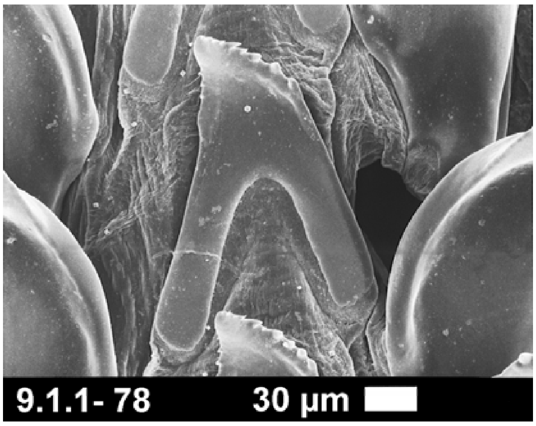

9.1.1- 73

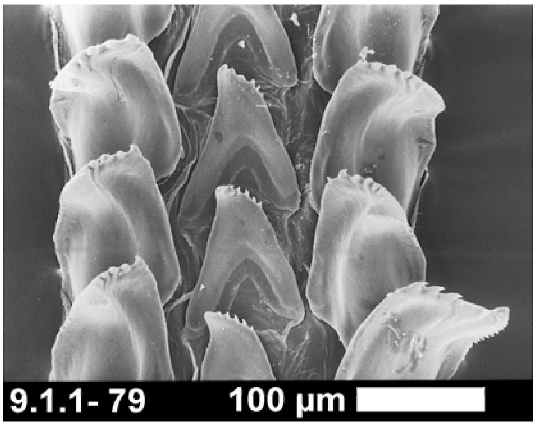

9.1.1- 74


9.1.1- 75


9.1.1- 76


9.1.1- 77


9.1.1- 78


9.1.1- 79

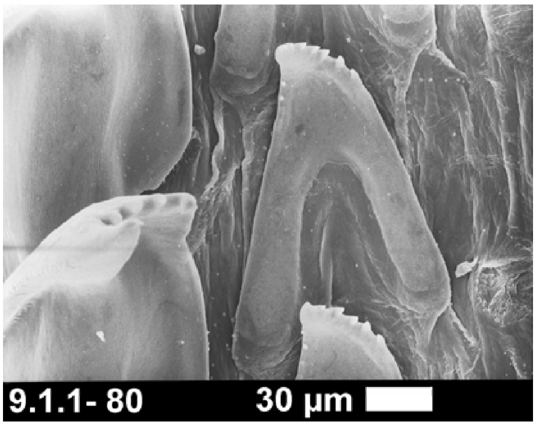
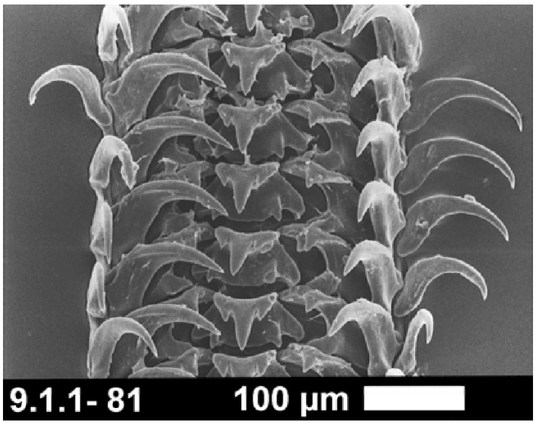
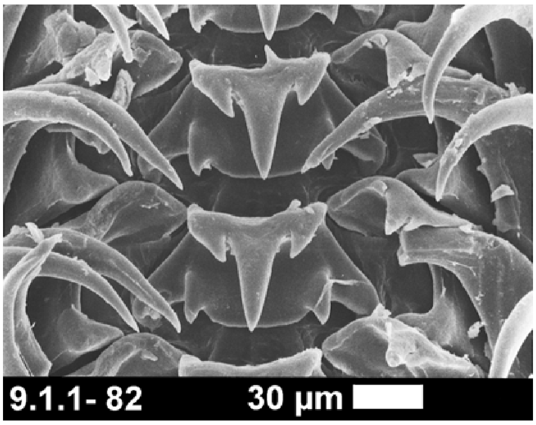
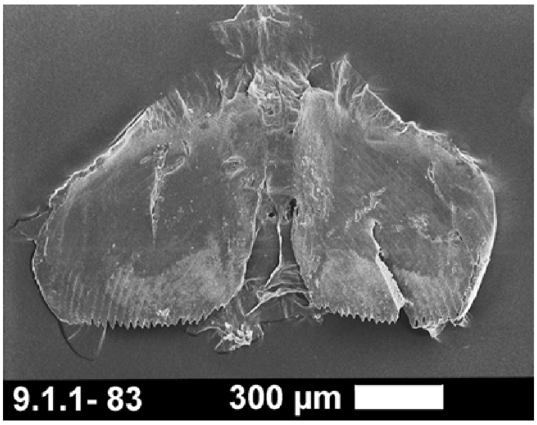
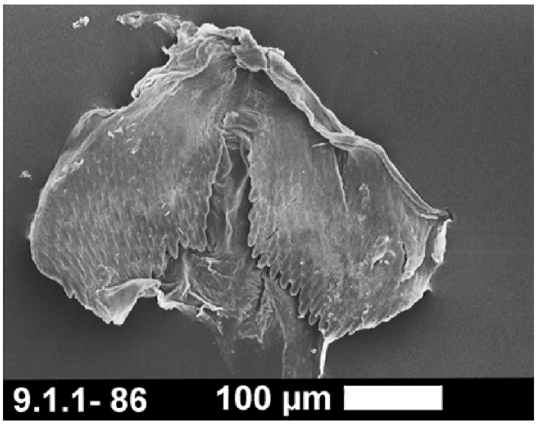

9.1.1- 80

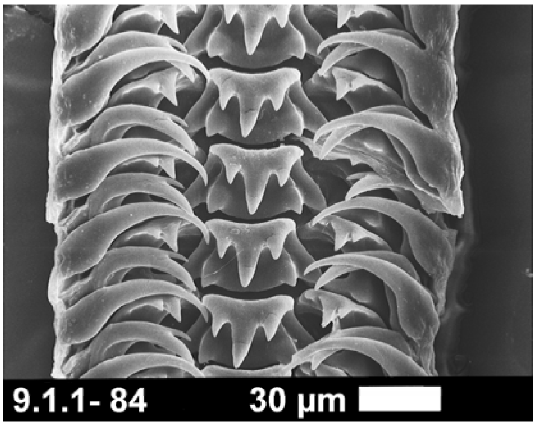
Plate XI

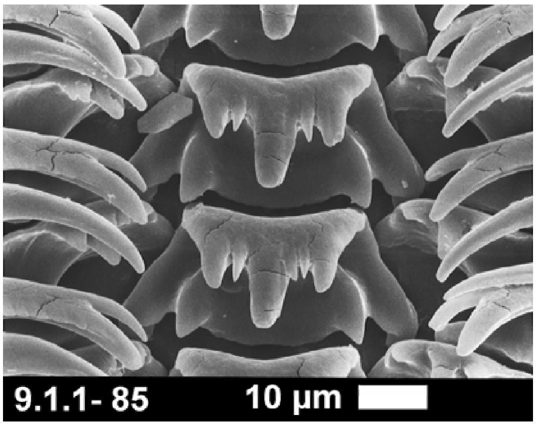

9.1.1- 81
100 µm

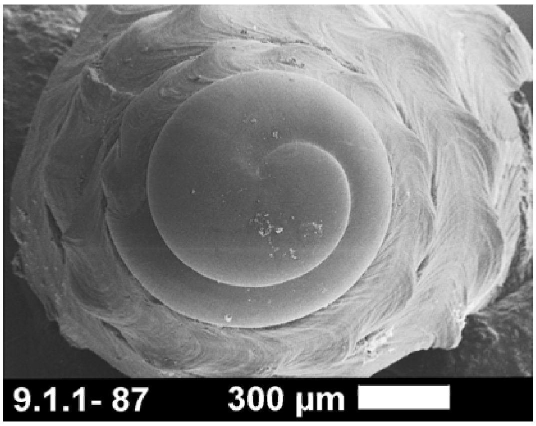

9.1.1- 82
30 µm


9.1.1- 83
300 µm


9.1.1- 86
100 µm


9.1.1- 84
30 µm


9.1.1- 85
10 µm


9.1.1- 87
300 µm

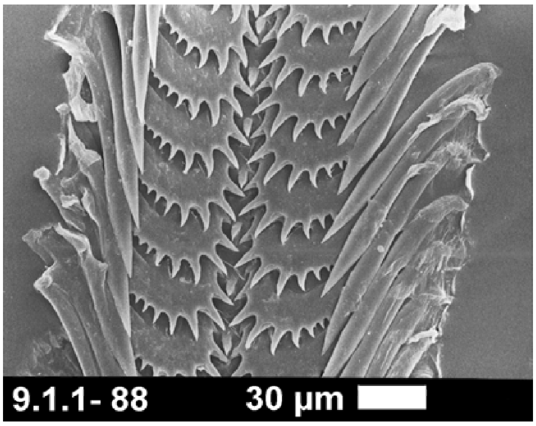
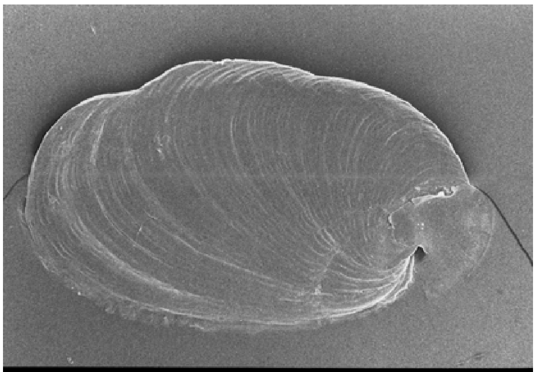
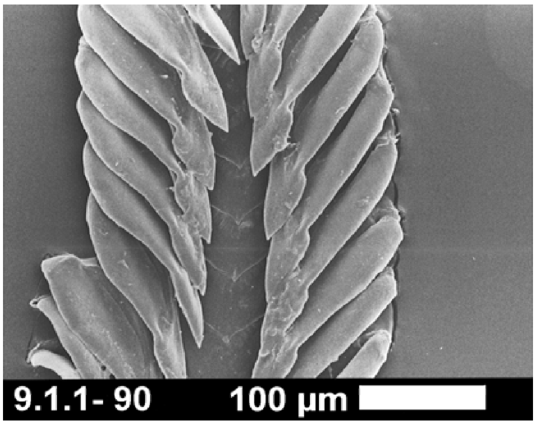
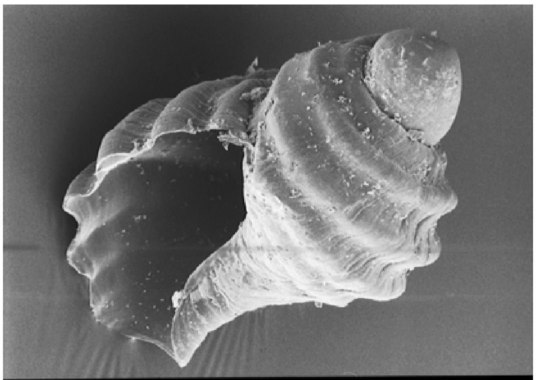

9.1.1- 88
30 µm

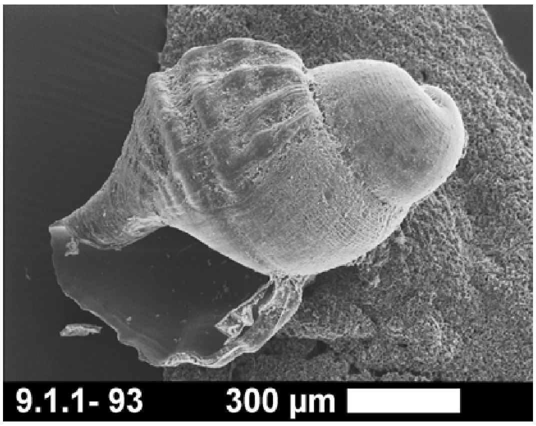
Plate XII


9.1.1- 89 300 µm

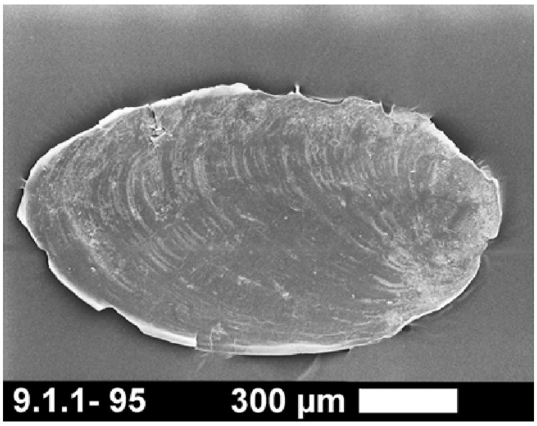

9.1.1- 90 100 µm


9.1.1- 91 100 µm


9.1.1- 92 300 µm


9.1.1- 93 300 µm


9.1.1- 94 100 µm


9.1.1- 95 300 µm

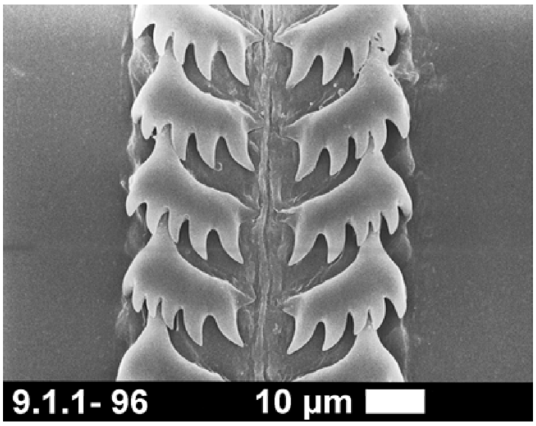
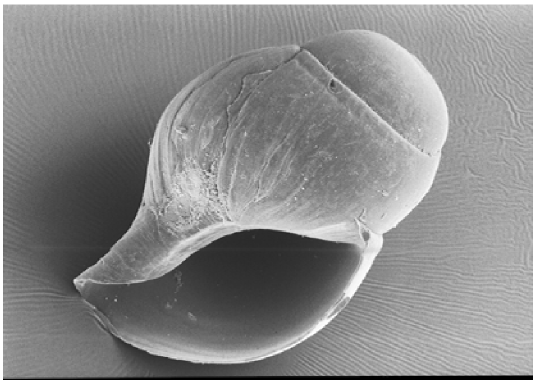
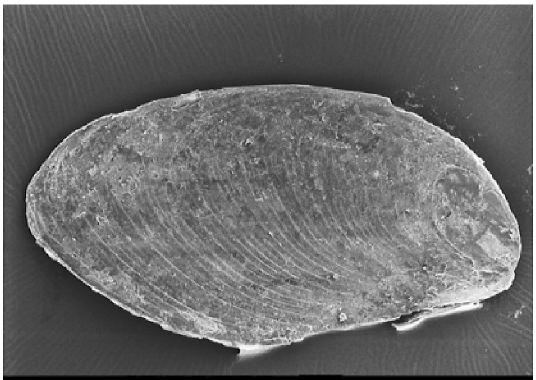
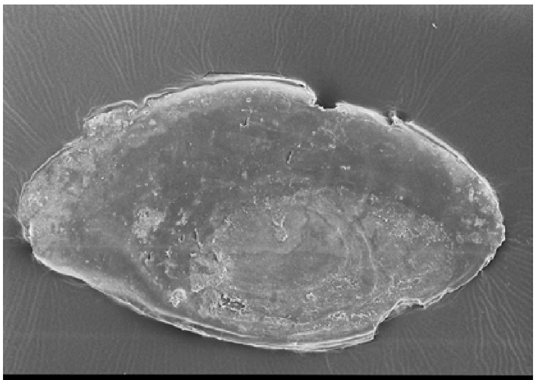

9.1.1- 96 10 µm

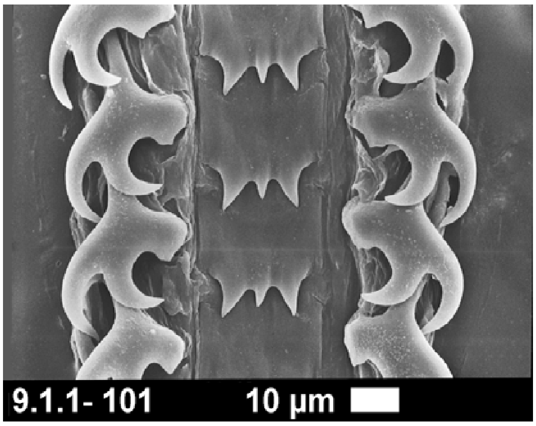
Plate XIII

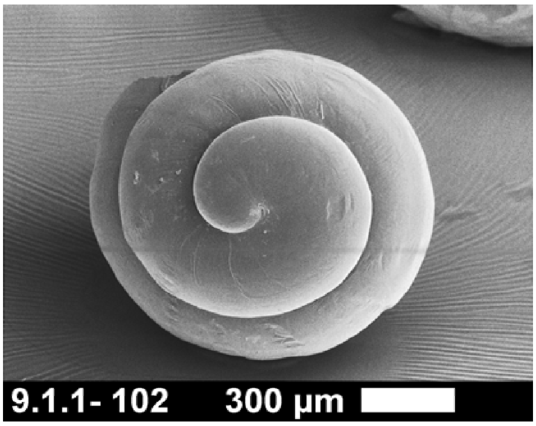

9.1.1- 97 300 µm

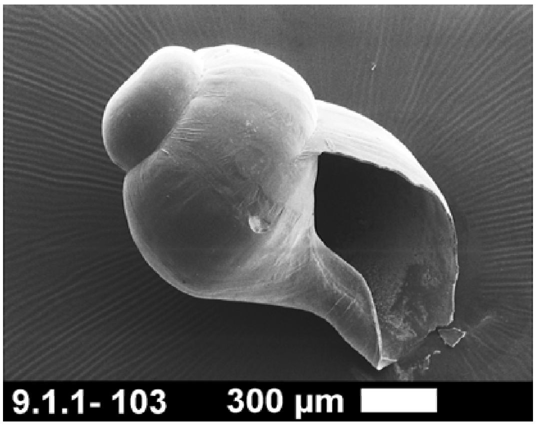

9.1.1- 98 300 µm


9.1.1- 99 300 µm


9.1.1- 100 300 µm


9.1.1- 101 10 µm


9.1.1- 102 300 µm


9.1.1- 103 300 µm

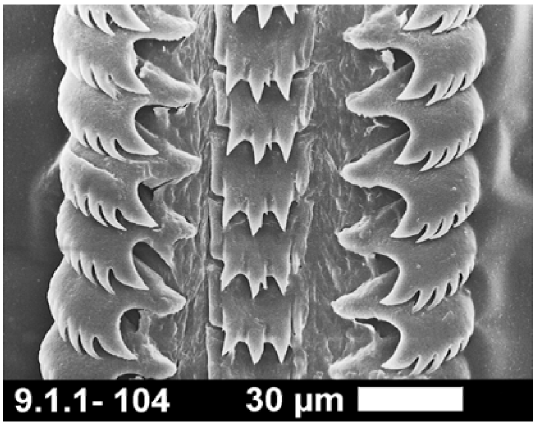
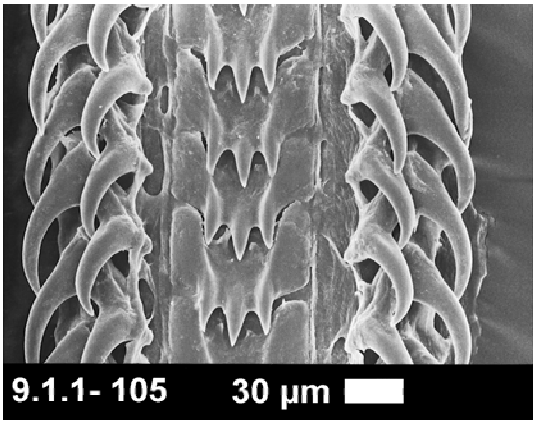
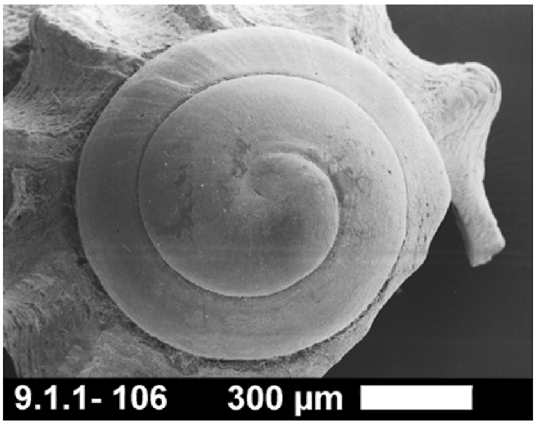
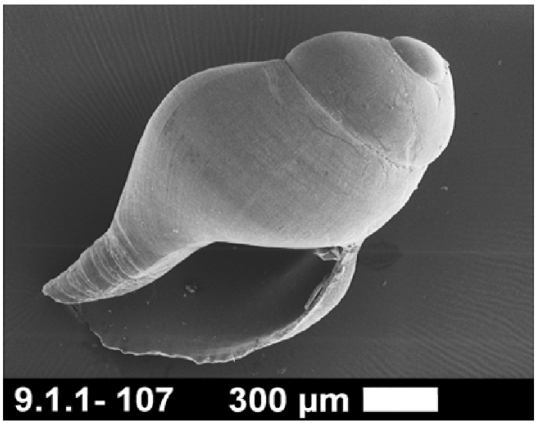
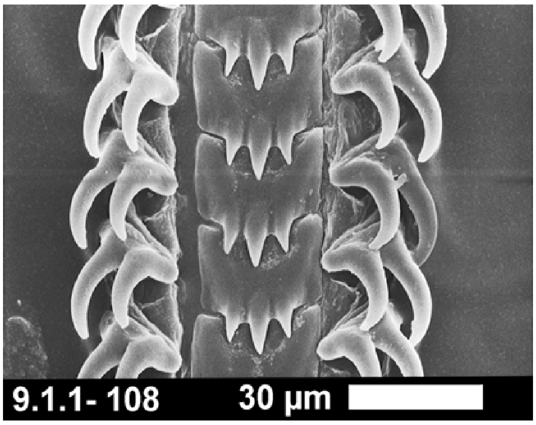

9.1.1- 104 30 µm

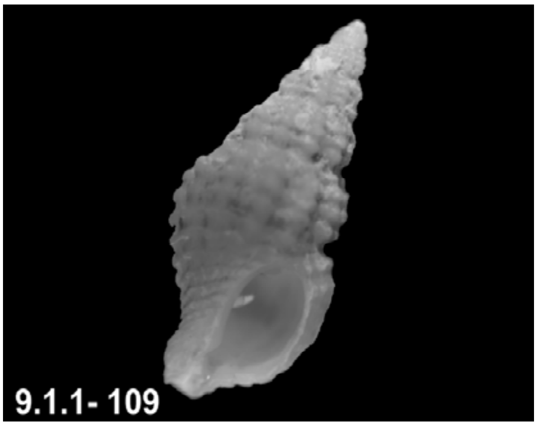
Plate XIV

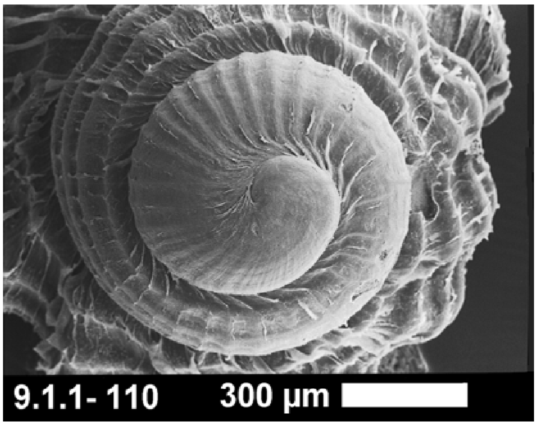

9.1.1- 105
30 µm

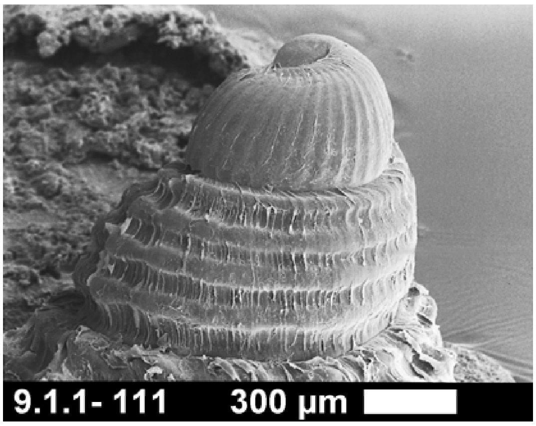

9.1.1- 106
300 µm


9.1.1- 107
300 µm


9.1.1- 108
30 µm


9.1.1- 109


9.1.1- 110
300 µm


9.1.1- 111
300 µm

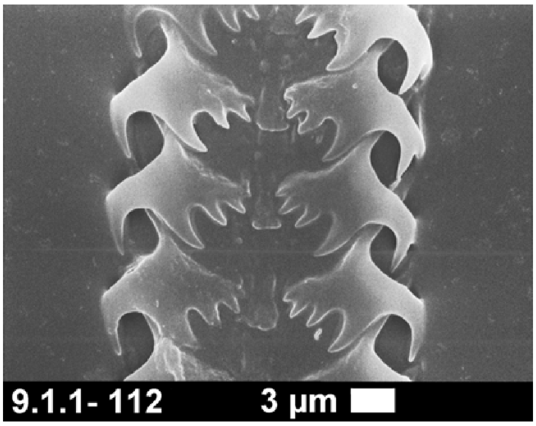
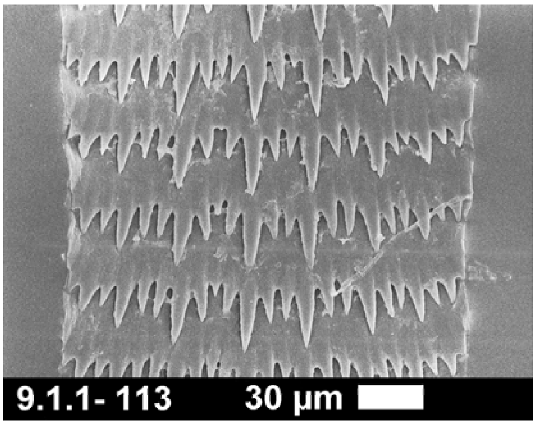
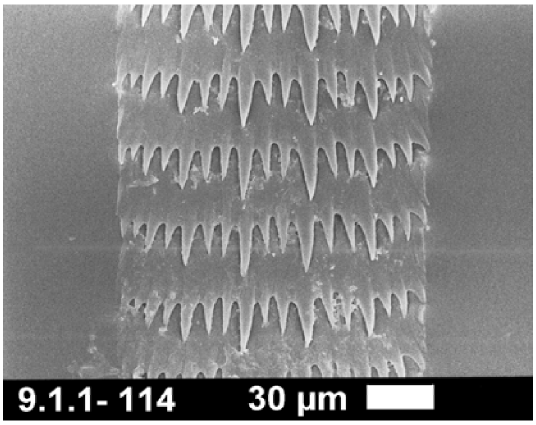
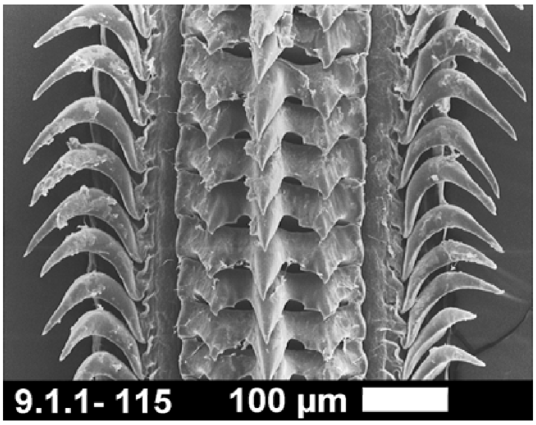
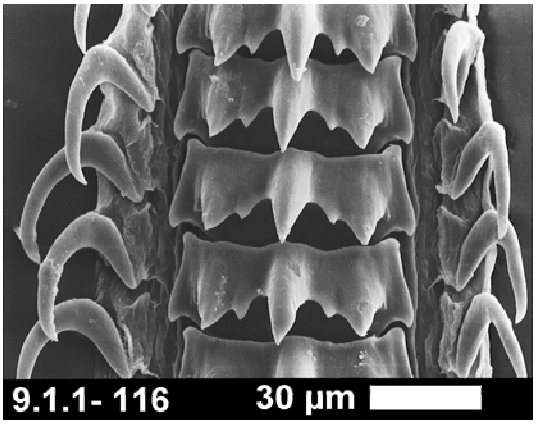

9.1.1- 112
3 µm

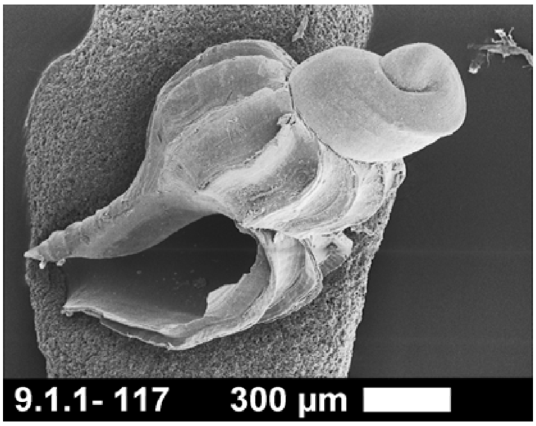
Plate XV

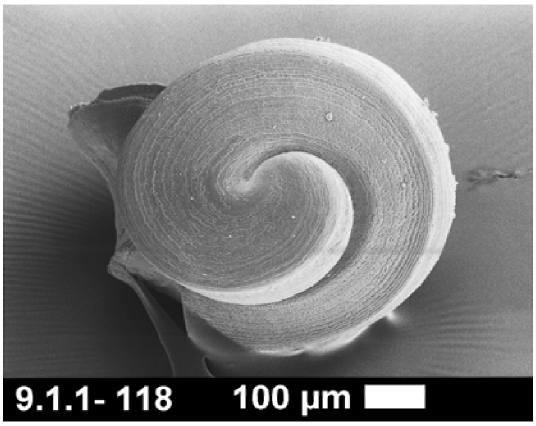

9.1.1- 113 30 µm

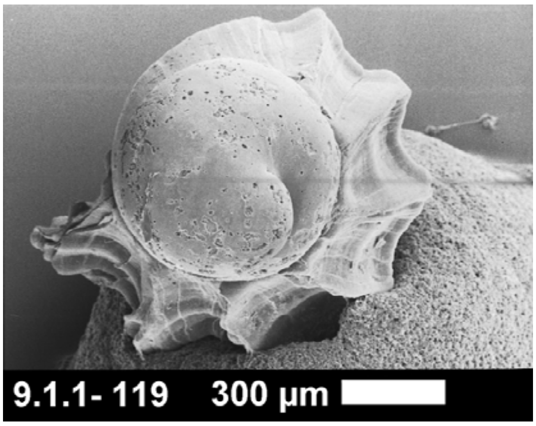

9.1.1- 114 30 µm


9.1.1- 115 100 µm


9.1.1- 116 30 µm


9.1.1- 117 300 µm


9.1.1- 118 100 µm


9.1.1- 119 300 µm

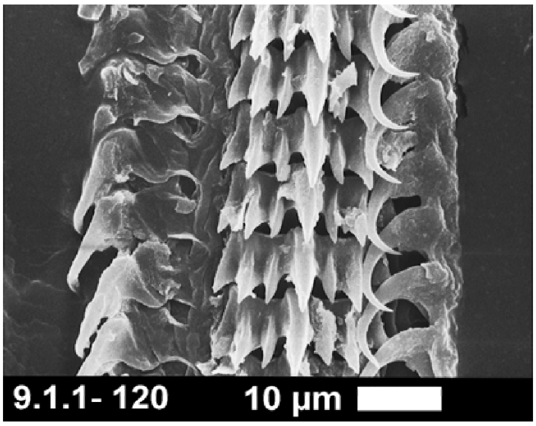
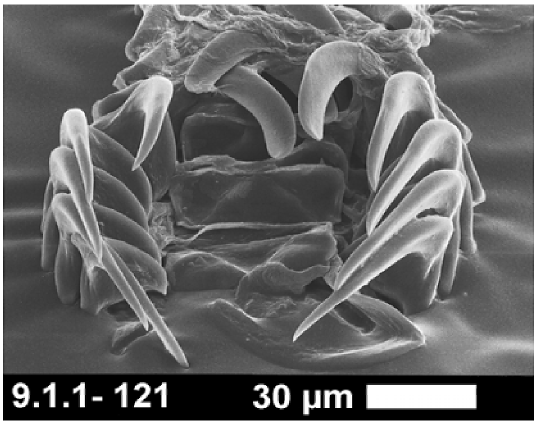
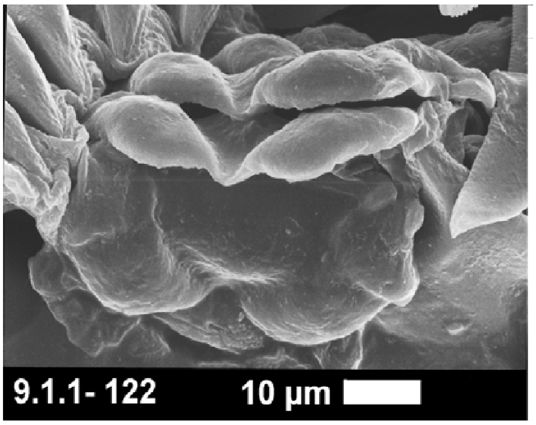
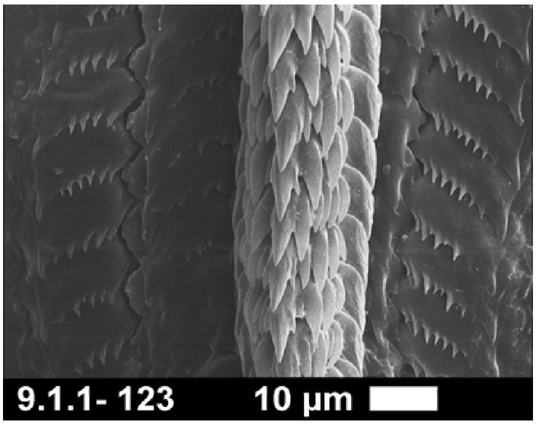
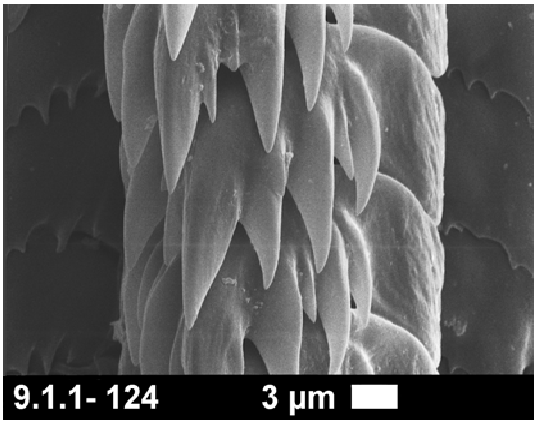

9.1.1- 120 10 µm

Plate XVI


9.1.1- 121


9.1.1- 122


9.1.1- 123


9.1.1- 124

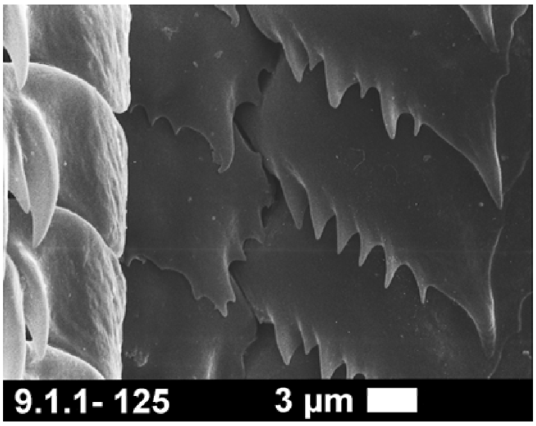
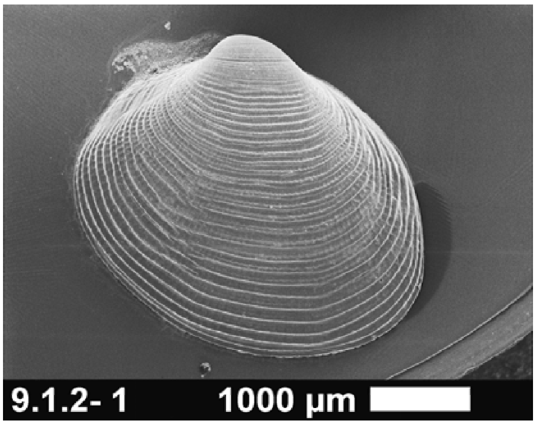
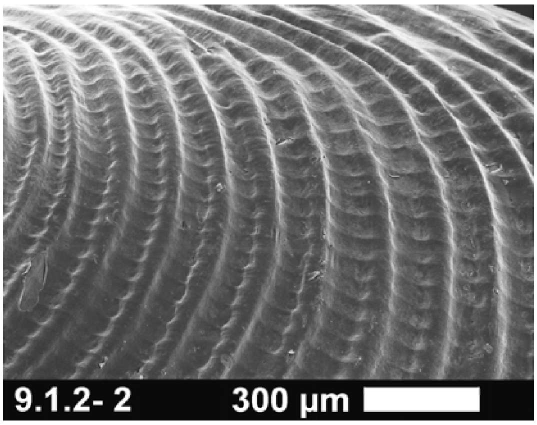

9.1.1- 125

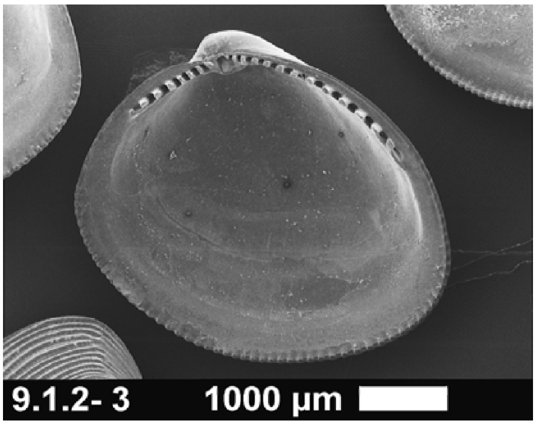
Plate XVII



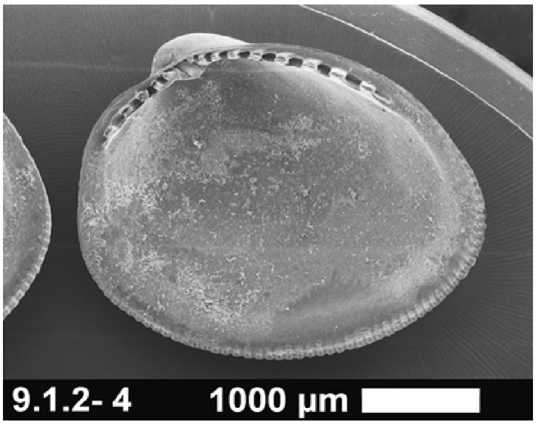
9.1.2- 1 1000 µm



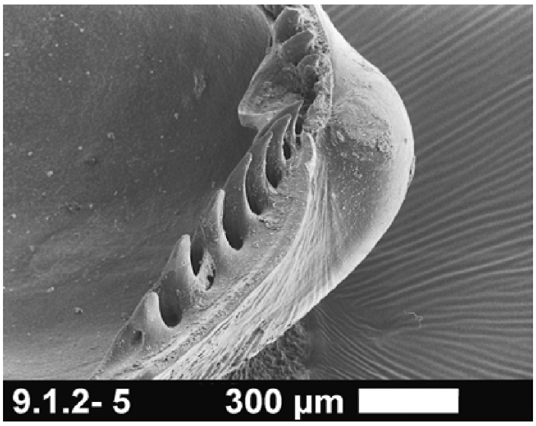
9.1.2- 2 300 µm



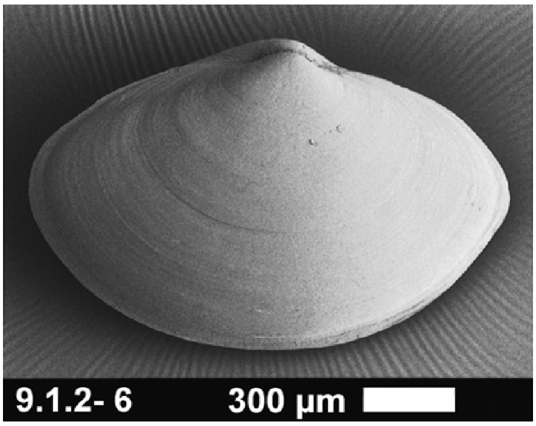
9.1.2- 3 1000 µm



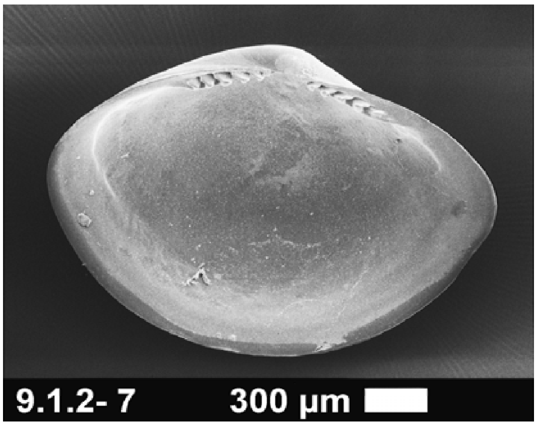
9.1.2- 4 1000 µm



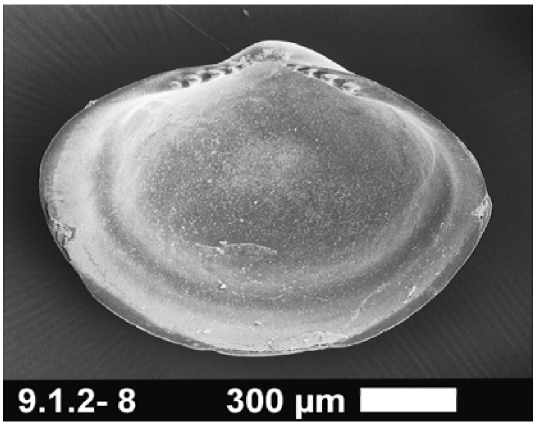
9.1.2- 5 300 µm



9.1.2- 6 300 µm

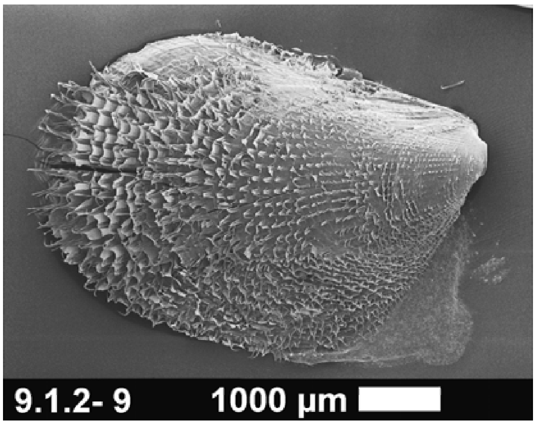


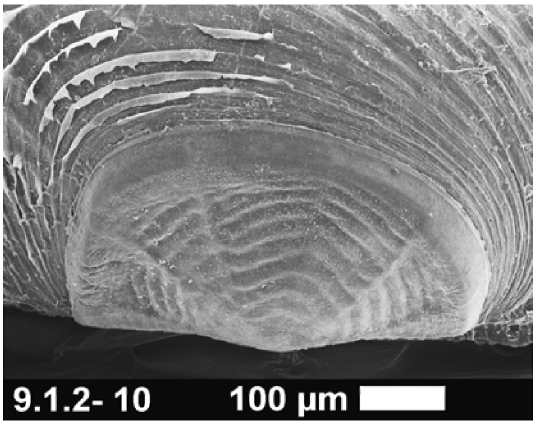
9.1.2- 7 300 µm

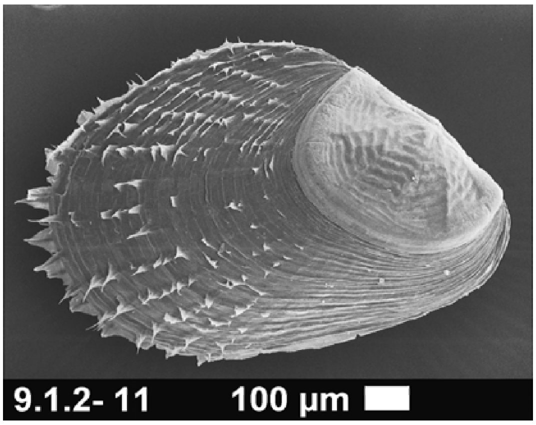


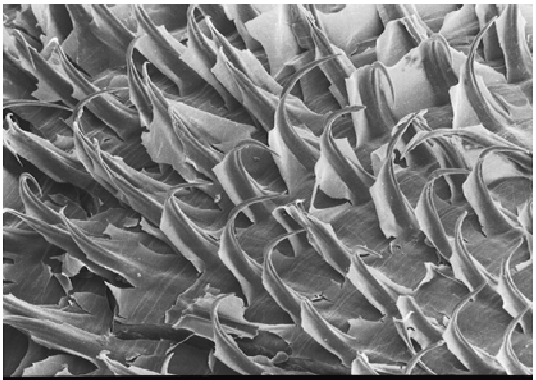
9.1.2- 8 300 µm

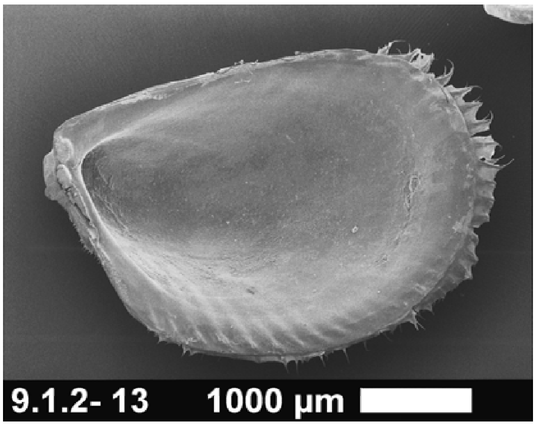
Plate XVIII

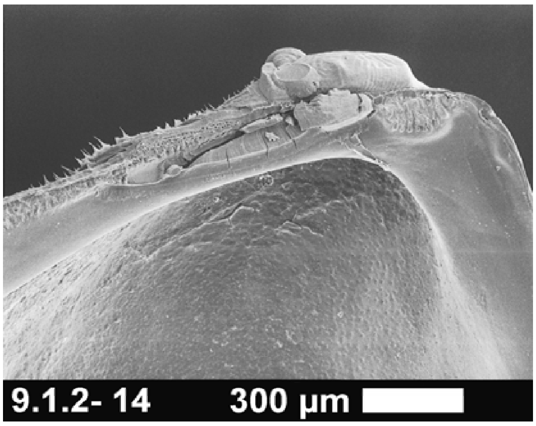

9.1.2- 9 1000 µm

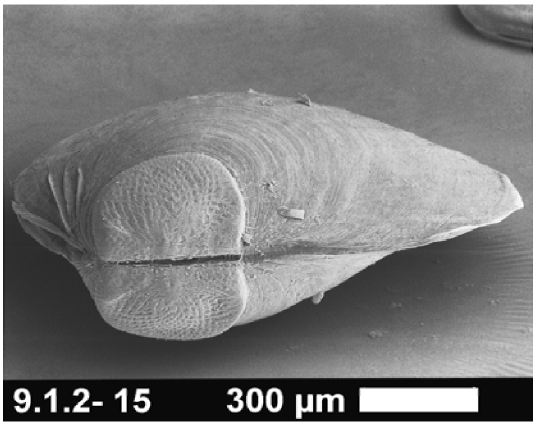

9.1.2- 10 100 µm


9.1.2- 11 100 µm


9.1.2- 12 100 µm


9.1.2- 13 1000 µm


9.1.2- 14 300 µm


9.1.2- 15 300 µm

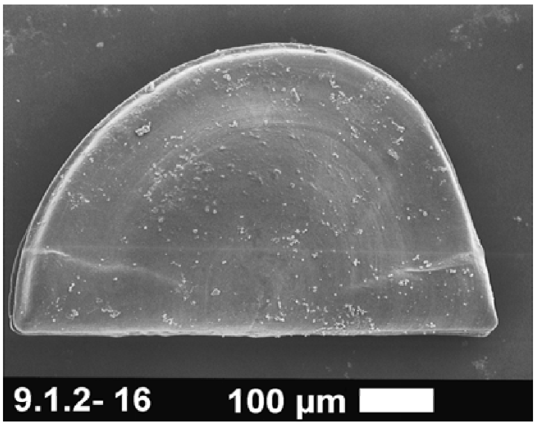
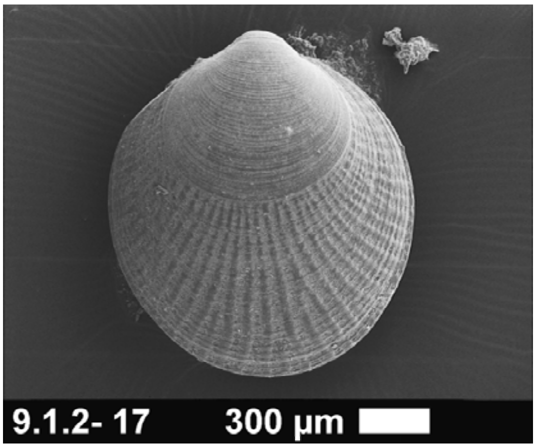
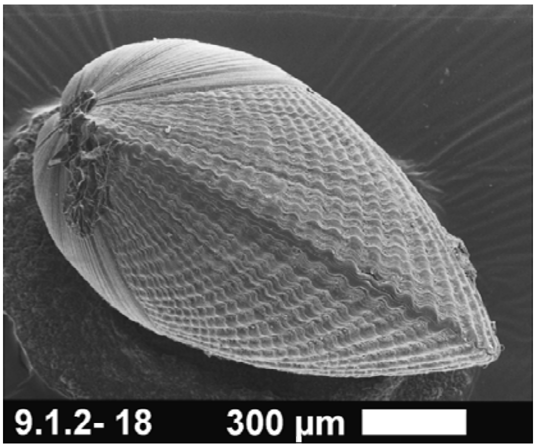
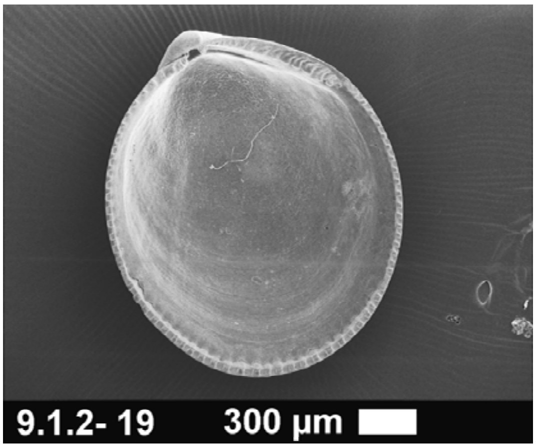
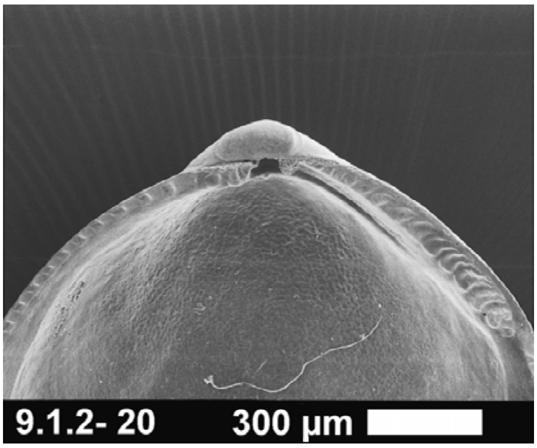

9.1.2- 16 100 µm

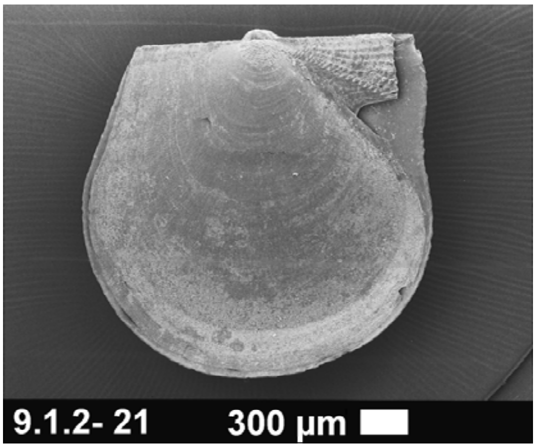
Plate XIX

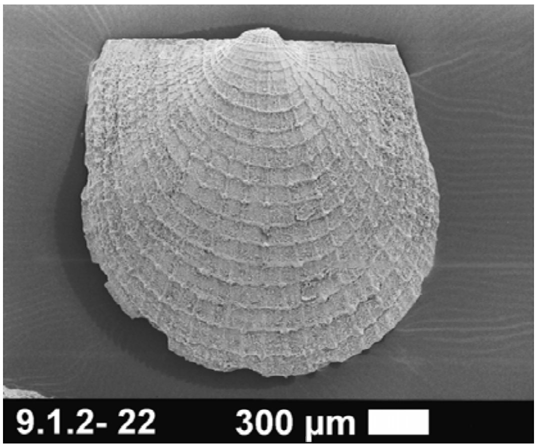

9.1.2- 17
300 µm

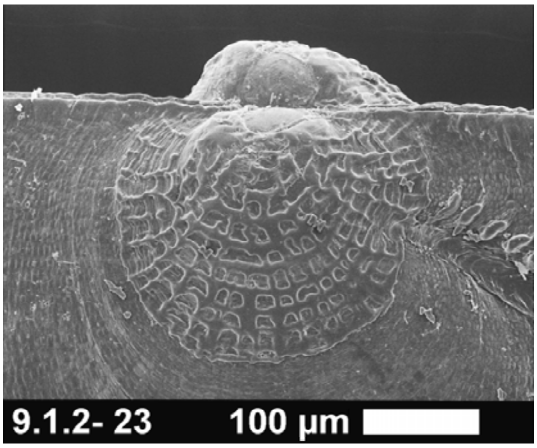

9.1.2- 18
300 µm


9.1.2- 19
300 µm


9.1.2- 20
300 µm


9.1.2- 21
300 µm


9.1.2- 22
300 µm


9.1.2- 23
100 µm

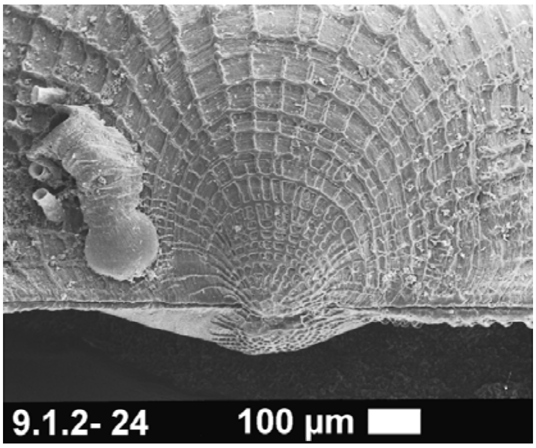
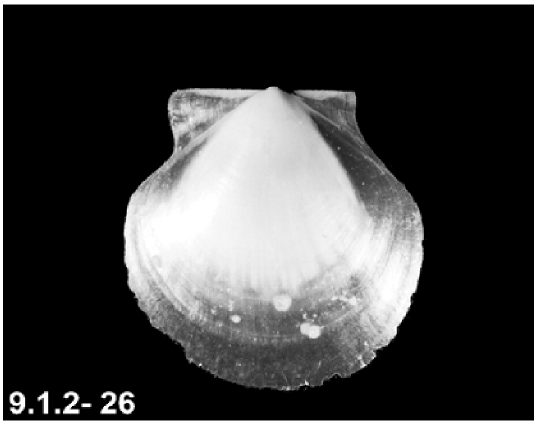
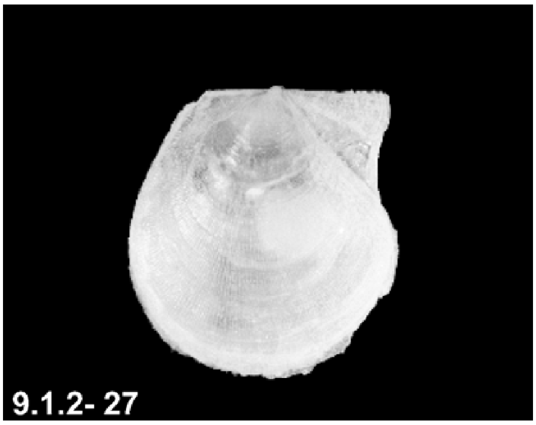
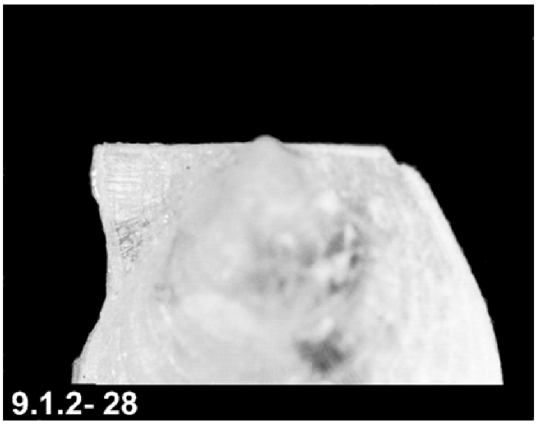

9.1.2- 24
100 µm

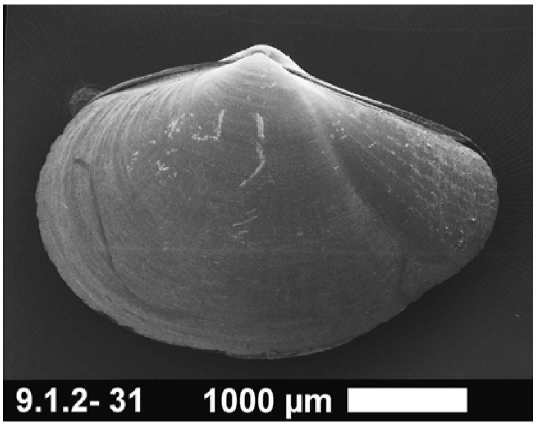
Plate XX


9.1.2- 25


9.1.2- 26


9.1.2- 27


9.1.2- 28


9.1.2- 31

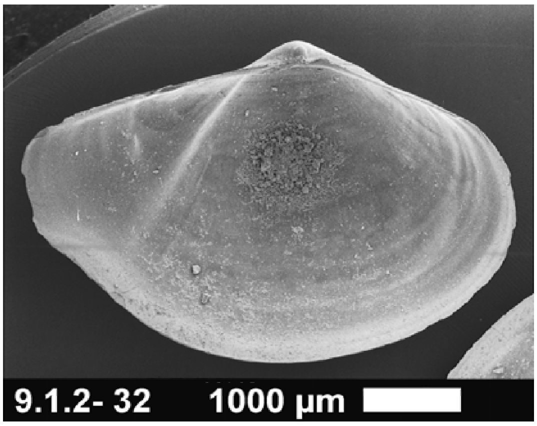
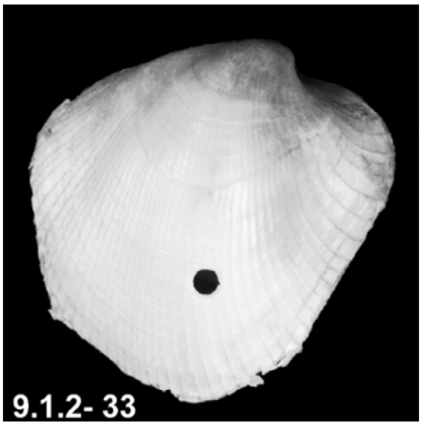
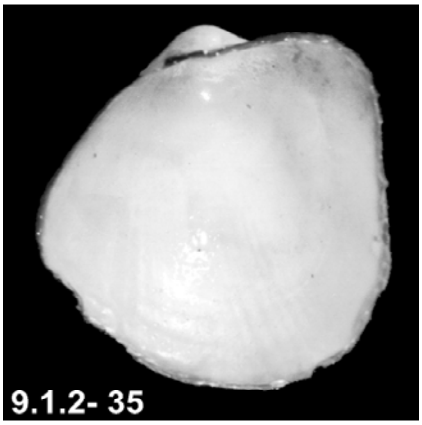

9.1.2- 32

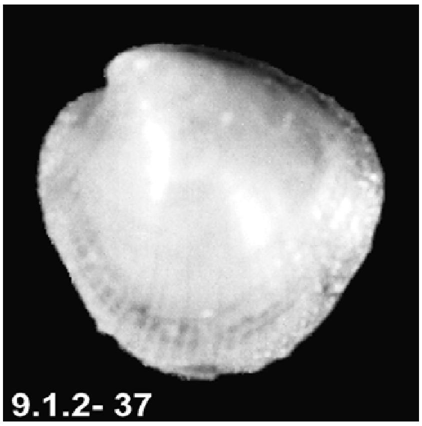
Plate XXI


9.1.2- 33


9.1.2- 34


9.1.2- 35


9.1.6- 36


9.1.2- 37

10. Appendix
10.1. Species lists
10.1.1. Species lists for Gastropoda

10.1.2. Species lists for Scaphopoda

10.1.3. Species lists for Bivalvia

10.2. Biogeographic database
10.2.1. Species-distribution list for Magellanic Mollusca

10.2.2. Species-distribution list for Mollusca of selected regions in the Southern Ocean

All raw data can be seen in or ordered by sending a request to:

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