Meddelelser om Grønland

Marine Mollusca from Jørgen Brønlund Fjord, North Greenland, including the description of *Diaphana vedelsbyae* n.sp.

Tom Schiøtte

Bioscience
28 · 1989

Meddelelser om Grønland

The series *Meddelelser om Grønland* was started in 1879 and has since then published results from all fields of research in Greenland. In 1979 it was split into three separate series:

Bioscience
Geoscience
Man & Society

The series should be registered as *Meddelelser om Grønland, Bioscience (Geoscience, Man & Society)* followed by the number of the paper. Example: *Meddr Grønland, Biosci.* 1, 1979.

The new series are issued by Kommissionen for videnskabelige Undersøgelser i Grønland (The Commission for Scientific Research in Greenland).

Correspondence

All correspondence and manuscripts should be sent to:

The Secretary
Kommissionen for videnskabelige
Undersøgelser i Grønland
Øster Voldgade 10
DK-1350 Copenhagen K.

Questions concerning subscription to all three series should be directed to the agent.

Agent

Nyt Nordisk Forlag – Arnold Busck A/S, Købmagergade 49, DK-1150 Copenhagen K. Tlf. +45.1.111103.

ISSN 0106-1054
ISBN 87-17-05576-8

Meddelelser om Grønland, Bioscience

Meddelelser om Grønland, Bioscience invites papers that contribute significantly to studies of flora and fauna in Greenland and of ecological problems pertaining to all Greenland environments. Papers primarily concerned with other areas in the Arctic or Atlantic region may be accepted, if the work actually covers Greenland or is of direct importance to the continued research in Greenland. Papers dealing with environmental problems and other borderline studies may be referred to any of the series *Bioscience, Geoscience,* or *Man & Society* according to emphasis and editorial policy.

Scientific editor – Botany

Gert Steen Mogensen, Botanical Museum, Gothersgade 130, DK-1123 Copenhagen K. Telephone +45.1.111744.

Scientific editor – Zoology

G. Høpner Petersen, Zoological Museum, Universitetsparken 15, DK-2100 Copenhagen Ø. Telephone +45.1.354111.

This volume edited by G. Høpner Petersen.

Instructions to authors

See page 3 of cover.

Marine Mollusca from Jørgen Brønlund Fjord, North Greenland, including the description of *Diaphana vedelsbyae* n.sp.

Tom Schiøtte

Contribution from
The Danish Peary Land Expeditions
Leader: Eigil Knuth

MEDDELELSER OM GRØNLAND, BIOSCIENCE 28 · 1989

Table of contents

Accepted April 1988
ISBN 87-17-05576-8
ISSN 0106-1054
Printed in Denmark by AiO Print as, Odense

Marine Mollusca from Jørgen Brønlund Fjord, North Greenland, including the description of *Diaphana vedelsbyae* n.sp.

TOM SCHIØTTE

Schiøtte, T. 1988. Marine Mollusca from Jørgen Brønlund Fjord, North Greenland, including the description of *Diaphana vedelsbyae* n.sp. – Meddr Grønland, Biosci. 28, 24 pp. Copenhagen 1989-2-28

A total of 76 molluscan species are recorded from Jørgen Brønlund Fjord, North Greenland, in the present paper or have been so by previous authors: 4 aplacophorans, 1 scaphopod, 42 gastropods, and 29 bivalves. 8 of these molluscan species have not been recorded from East Greenland. 1 species, *Diaphana vedelsbyae*, is new to science. The composition of the molluscan fauna and the distribution of the species in the fjord, including som quantitative aspects, are discussed.

Tom Schiøtte, Zoological Museum, University of Copenhagen, Universitetsparken 15, DK-2100 Copenhagen Ø, Denmark.

Introduction

Except for a few shells collected on the beach by Peter Freuchen in 1912, the first collection of mollusks from the Jørgen Brønlund Fjord area (Figs 1–2) was compiled by Palle Johnsen in 1948–1949. His material contained nine species of bivalves which were recorded by Ockelmann (1958). Later expeditions to Jørgen Brønlund Fjord in 1966 (Jean Just & Max Andersen), 1968 (Ole Norden Andersen), and 1983 (Jean Just & Tom Schiøtte) have multiplied the available material, but concerning the molluscan fauna little has been added to the published record. M. Andersen (1971) mentions two parasitic gastropods, O.G.N. Andersen (1984) records a number of pteropods and molluscan larvae and mentions one bivalve new to the area, and Bennike (1987:15) mentions the recent occurrence of further four bivalve species. The present paper summarizes all these records and adds to them the rest of the molluscan species found in the available material. Faunistic surveys of some other marine invertebrate groups occurring in the area are given by Just (1970b,c,d,e), Lützen (1970), Tendal (1970), M. Andersen (1971, 1973), and O.G.N. Andersen (1984).

Abbreviations used

BMNH: British Museum (Natural History), London, England.
MCZ: Museum of Comparative Zoology, Cambridge, U.S.A.
RMNH: Rijksmuseum van Natuurlijke Historie, Leiden, Holland.
USNM: United States National Museum of Natural History, Washington, D.C., U.S.A.
ZIL: Zoological Institute, USSR Academy of Sciences, Leningrad, USSR.
ZMUC: Zoological Museum, University of Copenhagen, Denmark.

The study area

The Independence Fjord system is shown in Fig. 1. Most of the fjord system is usually covered with ice the whole year, and bathygraphical and hydrographical conditions have scarcely been investigated. The exception is Jørgen Brønlund Fjord (Fig. 2) where, due to the wind tunnel effect in the valley Wandel Dal, the ice usually breaks up in the first half of July and new ice starts forming in the beginning of September. Just (1970a) gives a short overall description of Jørgen Brønlund Fjord including climate, ice conditions, bathygraphy, bottom sediments, hydrography, and zonation of marine algae. The bathygraphy is described in detail by Høy (1970) and the hydrography of the inner fjord by O.G.N. Andersen (1977). A brief summary of bathygraphy and hydrography is given below.

In the present paper the regional division of Jørgen Brønlund Fjord, as suggested by Just (1970a), will be simplified as shown in Fig. 2. The estuary of the river

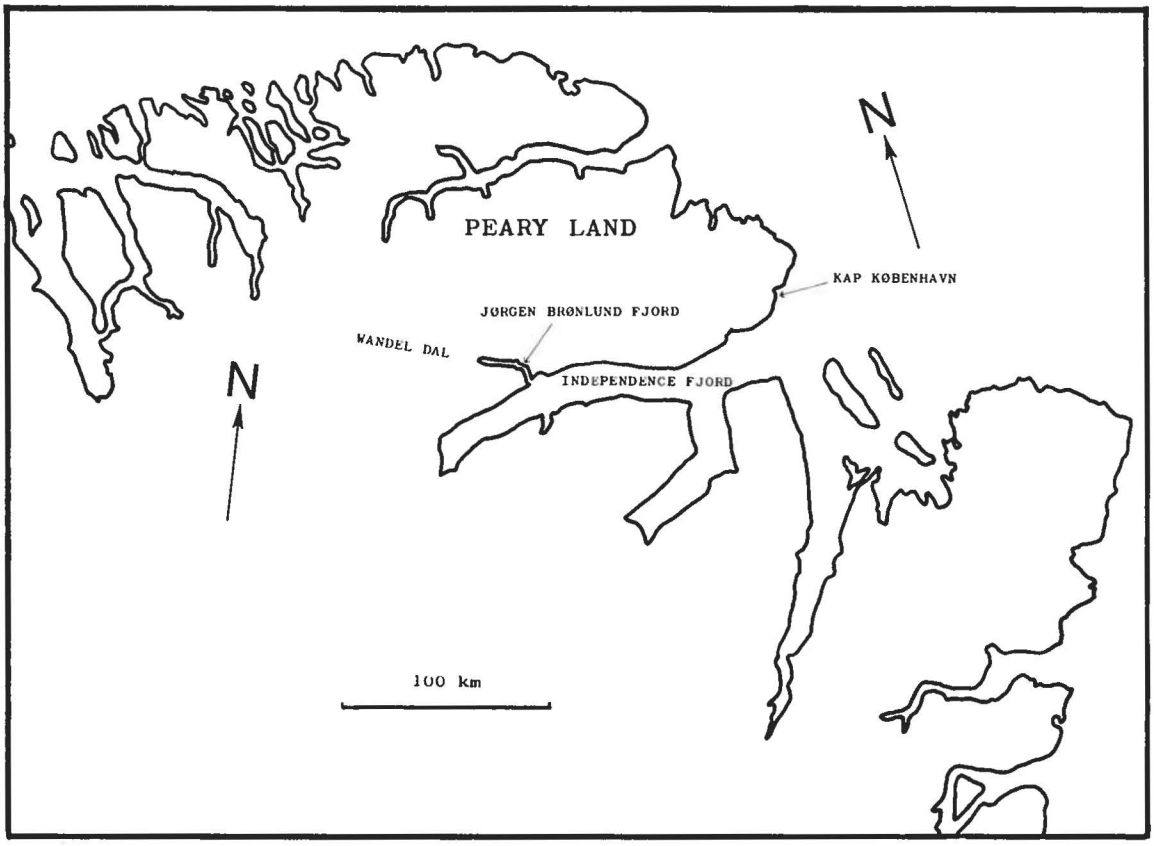

Fig. 1. Map of North Greenland with localities mentioned in the text.

Midsommerelv at the western end of the fjord has not been investigated. East of this is the inner fjord with depths down to about 85 m. This is followed by a 4 km broad threshold which must be regarded as a separate region. At the western side of this threshold the maximum depth is only 14 m, at the eastern side about 20 m. Finally there is the outer fjord which, roughly spoken, slopes into Independence Fjord, first slightly, but at the fjord mouth suddenly more steeply. The largest depth measured is just under 200 m, but the actual maximum depth of Independence Fjord is probably much larger.

Several rivers and smaller streams lead into Jørgen Brønlund Fjord, the most important being Midsommerelv and Børglum Elv. The fjord is therefore covered with an about 4 m thick layer of very brackish water during the ice-free period. At a depth of 8 m the salinity in the inner fjord is about 30.5‰, at 15 m about 31‰, and it then increases to almost 32‰ at 75 m. At the fjord mouth salinity is higher, 31.9‰ at 36 m rising to 33.1‰ at 105 m, but measurements here are few. Temperatures in the inner fjord vary a great deal at depths less than 15 m. At 20 m the temperature is about −0.8°C, and with increasing depth it sinks very slowly to about −0.9°C at 75 m. At the mouth of the fjord temperatures are lower: −1.53°C at 36 m and −1.13°C at 105 m, or closer to conditions in the Arctic Ocean than to those in the inner fjord.

The fjord bottom consists for the most part of various types of clay which is in some localities mixed with sand, gravel, and/or pebbles and stones depending on current and nearness to river-mouths.

Material and methods

In the Jørgen Brønlund Fjord area 106 bottom samples have been taken at depths from 2 to about 190 m. Their distribution is given in Table 1. Five grab samples were taken with a 1/44 m^2 Birge-Ekman grab and 28 with a 1/10 m^2 van Veen grab. 57 dredge hauls were made with an Ockelmann detritus dredge and 12 with a small beam trawl. The type of dredge used for the remaining four hauls is unknown to me. Grab samples were generally taken in spring and early summer, while most dredge hauls were taken in July and August. All stations sampled up to and including 1966 as well as the collecting methods are described in detail by Just (1970a). Of 23

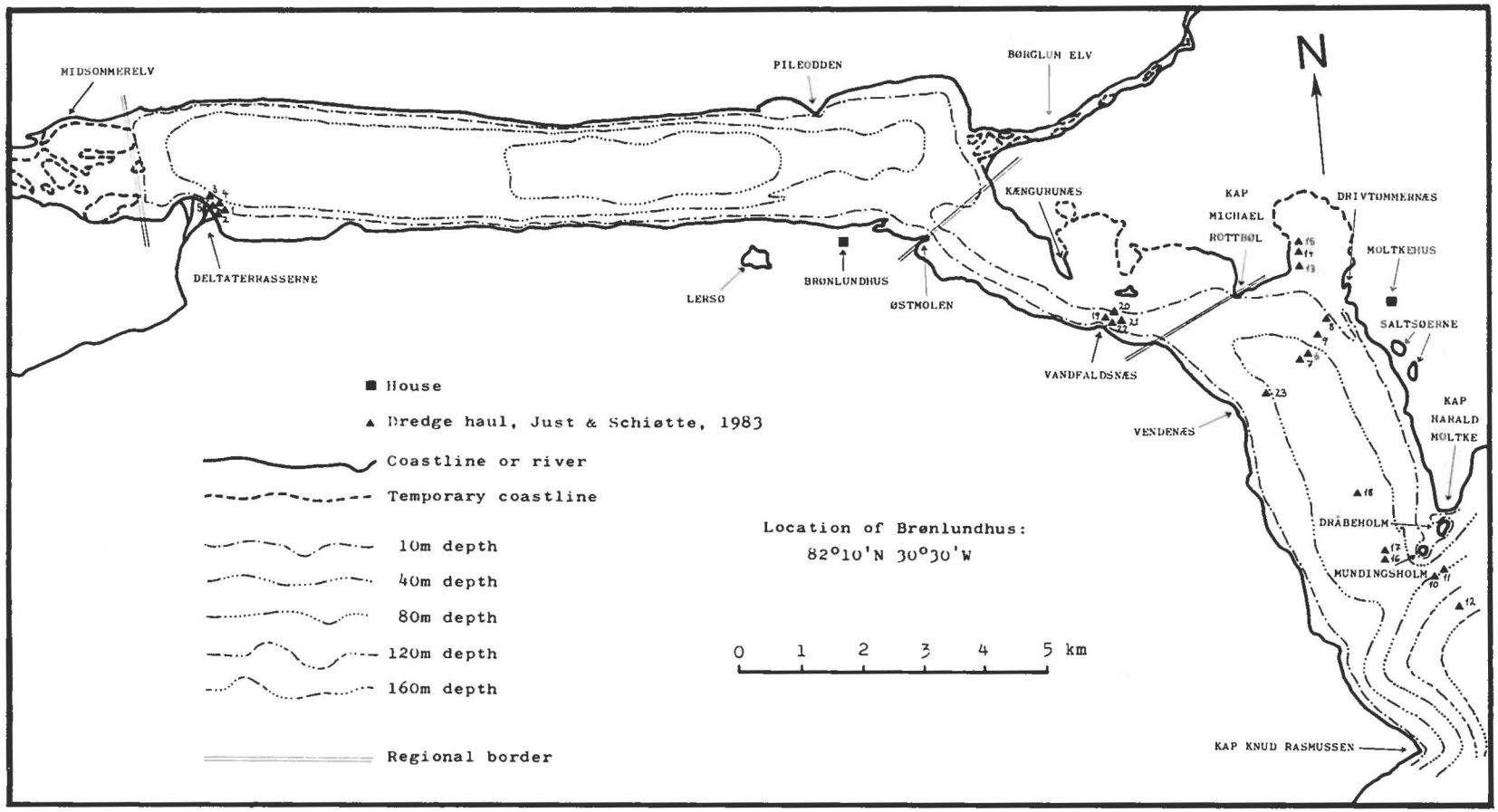

Fig. 2. Map of Jørgen Brønlund Fjord with stations sampled in 1983 and localities mentioned in the text.

Table 1. Distribution of 106 bottom samples taken in the Jørgen Brønlund Fjord area.

Area and gear / Depth (m)	Inner fjord			Threshold			Outer fjord and Independence Fjord		
	Van Veen samples	Other samples	Total	Van Veen samples	Other samples	Total	Van Veen samples	Other samples	Total
0–9	3	7	10	3	8	11	2	6	8
10–19	4	9	13	7	6	13		9	9
20–29	4	5	9				2	5	7
30–39		3	3					4	4
40–49	2		2					5	5
50–59		1	1					3	3
80–89		1	1					3	3
100–109							1		1
140–149								1	1
160–179								1	1
190–199								1	1
All depths	13	26	39	10	14	24	5	38	43

dredge hauls made in August 1983, five were made off Deltaterrasserne in the innermost part of the fjord which had not been sampled before, at a depth of 5 to 25 m. The rest were made on the threshold and in the outer fjord including the slope into Independence Fjord at 5 to 140 m depth. The exact localities are shown in Fig. 2.

Lists of plankton samples from the Jørgen Brønlund Fjord area are given by Just (1970a) and O.G.N. Andersen (1984).

The extensive use of the Ockelmann dredge has given the material a very high content of different juvenile stages of many species of mollusks. This often permits the construction of growth series and thus makes identification of juveniles easier. The zoological material from the expeditions to Jørgen Brønlund Fjord is deposited in ZMUC with the exception of some paratypes mentioned in the present paper.

The number and distribution of grab samples in the fjord do not permit a detailed, quantitative analysis. The material from the van Veen samples taken in 1966 has, however, to a large extent been preserved in a way that has permitted calculations with respect to the relative abundance of species in some areas. The van Veen samples were originally screened through a sieve with a mesh width of 0.5 mm (Just 1970a:32), and calculations have therefore been made on basis of specimens longer/broader and taller than this.

Drawings of shells in the present paper were made with a camera lucida, photographs through a scanning electron microscope, while radula and bivalve hinge drawings were based on light as well as scanning electron microscopy. Illustrations have been given primarily of species that have not earlier been well depicted in the commonly accessible literature, or where the present material shows hitherto undescribed or unusual features.

Note: In his list of stations Just (1970a) sometimes uses "the Station" as identical to "Brønlundhus". The expression may also be found on labels and should not be confused with the new station "Moltkehus" which is situated at the outer fjord (Fig. 2).

Systematic part

All mollusks found by the present author or recorded by earlier authors from the Jørgen Brønlund Fjord area are listed in Table 2. Some of the species are given no further treatment. Information on these may be found in the relevant literature, primarily Lemche (1941), Thorson (1944), and Ockelmann (1958). In many cases, however, I have found that the appearance of specimens, the occurrence of a species, or other circumstances deserved some comments.

The systematic arrangement and nomenclature used has, with slight modifications, been adopted from Macpherson (1971) (scaphopod and prosobranchs), Lemche (1941) (opisthobranchs), and Lubinsky (1980) (bivalves). Synonyms and references to original descriptions have been given where I consider them important to the discussion.

Aplacophora

Several of the species may be new to science. The material is, however, sparse, and correct identification or the description of new species will probably require dissection by a specialist.

Table 2. Annotated list of all molluscan species found in Jørgen Brønlund Fjord and adjacent part of Independence Fjord.

Explanation:

Columns 1–4:
A: Uncommon, in small area (<4 km²)
B: Uncommon, sporadical occurrence
C: Common, in small area (< 4 km²)
D: Common, widely distributed
L: As larvae only
(): As empty shells only

Column 5:
1: Ockelmann (1958):
A: As *Nucula tenuis expansa* Reeve
B: As *Astarte montagui* (Dillwyn)
2: M. Andersen (1971):
A: As *Entocolax schwanwitchi* Mandahl-Barth
3: O. G. N. Andersen (1984):
A: As *Hiatella striata* (Fleuriau)
4: Bennike (1987)

	Known distribution in the Jørgen Brønlund Fjord area				Earlier recorded from the Jørgen Brønlund Fjord area by
	1 Inner fjord	2 Threshold	3 Outer fjord and Independence Fjord	4 Depth in metres	5
Aplacophora					
Chaetodermatidae					
Chaetoderma productum Wirén	A			16–85	
?*Falcidens* sp.	A			47	
Proneomeniidae					
Proneomenia ?sluiteri Hubrecht		A	B	18–45	
Family uncertain					
Solenogastres sp.			A	45	
Scaphopoda					
Siphonodentaliidae					
Siphonodentalium lobatum (Sowerby)			A	(50)–80	
Gastropoda					
Lepetidae					
Lepeta caeca (Müller)			A	25+/−10	
Trochidae					
Margarites costalis (Gould)			C	(140)–190	
Margarites olivaceus (Brown)			D	38–52	
Margarites groenlandicus (Gmelin)			B	10–40	
Skenea laevigata (Friele)			A	170+/−10	
Rissoidae					
Cingula ?arenaria Mighels & Adams			D	30–190	
Cingula moerchi Collin			D	45–190	
Alvania scrobiculata (Møller)			C	50–80–(190)	
Alvania wyvillethomsoni (Friele)			C	180–190	
Alvania verrilli (Friele)			A	180–(190)	
Trichotropidae					
Trichotropis borealis Broderip & Sowerby	D	C	D	2–68–(140)	3
?*Trichotropis conica* Møller	L			Pelagic	3
Lamellariidae					
Velutina velutina (Müller)	B		A	(2)–9–40	
Naticidae					
Natica clausa Broderip & Sowerby			(A)	(38)	
Cancellariidae					
Admete viridula (Fabricius)			A	45	
Turridae					
Oenopota ?bicarinata (Couthouy)	A	D	B	5–15	
Oenopota declivis (Lovén)			A	50	
Oenopota ?cinerea (Møller)		(A)		(6)	
Propebela novajasemliensis (Leche)		A	B	6–40	
Propebela reticulata (Brown)	B	A	D	3–50–(52)	
Taranis amoena (G.O. Sars)			(A)	(50–80)	
Entoconchidae					
Entocolax schwanwitchi Heding	A	A		10–30	2A
Entocolax ludwigi Voigt	A	B		10–18	2
Pyramidellidae					
Pyramidellidae sp.			A	170+/−10	
Diaphanidae					
Diaphana ?minuta Brown	A	C	B	5–50	3
Diaphana vedelsbyae n.sp.		C	A	9–52	

Table 2, continued

Explanation:	1	2	3	4	5
Columns 1–4: A: Uncommon, in small area (<4 km²) B: Uncommon, sporadical occurrence C: Common, in small area (< 4 km²) D: Common, widely distributed L: As larvae only (): As empty shells only Column 5: 1: Ockelmann (1958): A: As *Nucula tenuis expansa* Reeve B: As *Astarte montagui* (Dillwyn) 2: M. Andersen (1971): A: As *Entocolax schwanwitchi* Mandahl-Barth 3: O. G. N. Andersen (1984): A: As *Hiatella striata* (Fleuriau) 4: Bennike (1987)	Known distribution in the Jørgen Brønlund Fjord area				Earlier recorded from the Jørgen Brønlund Fjord area by
	Inner fjord	Threshold	Outer fjord and Independence Fjord	Depth in metres	
Retusidae					
Retusa obtusa (Montagu)	C	D	D	5–190	
Scaphandridae					
Cylichna alba (Brown)	D	D	D	5–190	
Cylichna occulta (Mighels)	B	C	D	3–80	
Cylichna magna Lemche			D	20–160	
Philinidae					
Philine lima (Brown)	A	A		10–20	
Philine finmarchica M. Sars			A	(38)–50–52	
Limacinidae					
Limacina helicina Phipps	C		(C)	Pelagic	3
?*Limacina helicoides* Jeffreys	A			Pelagic	3
Clionidae					
Clione limacina Phipps	A			Pelagic	3
Alderiidae					
?*Alderia* sp.	L			Pelagic	3
Dendronotidae					
?*Dendronotus* sp.1	L			Pelagic	3
?*Dendronotus* sp.2	L			Pelagic	3
Coryphellidae					
?*Coryphella* sp.	L			Pelagic	3
Cuthonidae					
?*Cratena* sp.1	L			Pelagic	3
?*Cratena* sp.2	L			Pelagic	3
Family uncertain					
"*Adeorbis*"*exquisitus* Jeffreys			A	170+/−10	
Pelecypoda					
Nuculidae					
Nucula belloti Adams	D	D	D	6–85	1A
Nuculanidae					
Nuculana pernula (Müller)			D	30–80	4
Portlandia arctica (Gray)	D	C	D	3–18	1,4
Yoldiella frigida (Torell)			D	15–160	4
Yoldiella intermedia (M. Sars)	D		D	45–190	
Yoldiella lenticula (Møller)			D	30–50	
Arcidae					
Bathyarca glacialis (Gray)	A		D	30–50	1,4
Bathyarca frielei (Friele)			A	140–190	
Mytilidae					
Dacrydium vitreum (Møller)			D	35–190	
Musculus niger (Gray)		C		9–19	
Pectinidae					
Arctinula greenlandica (Sowerby)		A	D	10–190	4
Cyclopecten imbrifer (Lovén)			(A)	(170+/−10)	
?Pectinidae sp.			(A)	(195+/−5)	
Limidae					
Limatula hyperborea Jensen			C	50–160–(190)	

Table 2, continued

Explanation:	1	2	3	4	5
Columns 1–4: A: Uncommon, in small area (<4 km²) B: Uncommon, sporadical occurrence C: Common, in small area (< 4 km²) D: Common, widely distributed L: As larvae only (): As empty shells only Column 5: 1: Ockelmann (1958): A: As *Nucula tenuis expansa* Reeve B: As *Astarte montagui* (Dillwyn) 2: M. Andersen (1971): A: As *Entocolax schwanwitchi* Mandahl-Barth 3: O. G. N. Andersen (1984): A: As *Hiatella striata* (Fleuriau) 4: Bennike (1987)	Known distribution in the Jørgen Brønlund Fjord area				Earlier recorded from the Jørgen Brønlund Fjord area by
	Inner fjord	Threshold	Outer fjord and Independence Fjord	Depth in metres	
Astartidae					
Astarte borealis (Schumacher)	D	C	D	6–16	1,4
Astarte crenata (Gray)			D	30–190	
Astarte ?warhami Hancock	D	C	D	6–47	1B
Thyasiridae					
Axinopsida orbiculata (G.O. Sars)		A		9–12	
Axinulus pygmaeus (Verrill & Bush)	C			48–85	
Thyasira gouldi (Philippi)	D	B	C	8–16	1,4
Thyasira dunbari Lubinsky	C		D	19–47	
Tellinidae					
Macoma calcarea (Gmelin)	D	D	D	2–16	1,3
Macoma loveni (Jensen)	A	C	B	6–38	3
Myidae					
Mya truncata Linné	D	C	B	2–40	1,3,4
Hiatellidae					
Hiatella arctica (Linné)	D	D	D	2–45–(160)	1,3A,4
Thraciidae					
Thracia devexa G.O. Sars	A	A	B	16–160	4
Cuspidariidae					
Cuspidaria arctica (M. Sars)			B	30–80	
Cuspidaria subtorta (G.O. Sars)	A		D	20–160–(190)	
Verticordiidae					
Lyonsiella abyssicola (G.O. Sars)			D	38–190	

Proneomeniidae

Proneomenia ?sluiteri Hubrecht
Proneomenia sluiteri Hubrecht, 1880:589–590

The species has been found occurring sporadically on clay bottoms from the middle of the fjord to its mouth. The largest of the nine specimens found has a length of about 30 mm.

Comparisons with the holotype of *Proneomenia sluiteri* in RMNH – which is unfortunately very damaged due to dissection – and with another specimen from the Barents Sea show great similarity in external morphology between this species and the Jørgen Brønlund Fjord specimens. The description of *Proneomenia borealis* (Korén & Danielsen 1877) and the figure of this species given by Thorson (1951:13) indicate differences between this species and the Jørgen Brønlund Fjord specimens, especially with respect to the sharp, dorsal line found in *P. borealis*, and to the pattern of the spicules in the integument. The Jørgen Brønlund Fjord specimens have no dorsal line and their spicules are placed in two main directions at right angles to each other.

Family uncertain

Solenogastres sp.

Three specimens were taken at two stations between Drivtømmernæs and Vendenæs on a bottom of fine clay. The largest specimen has a length of about 4 mm. The species has very long spicules giving it a furry appearance.

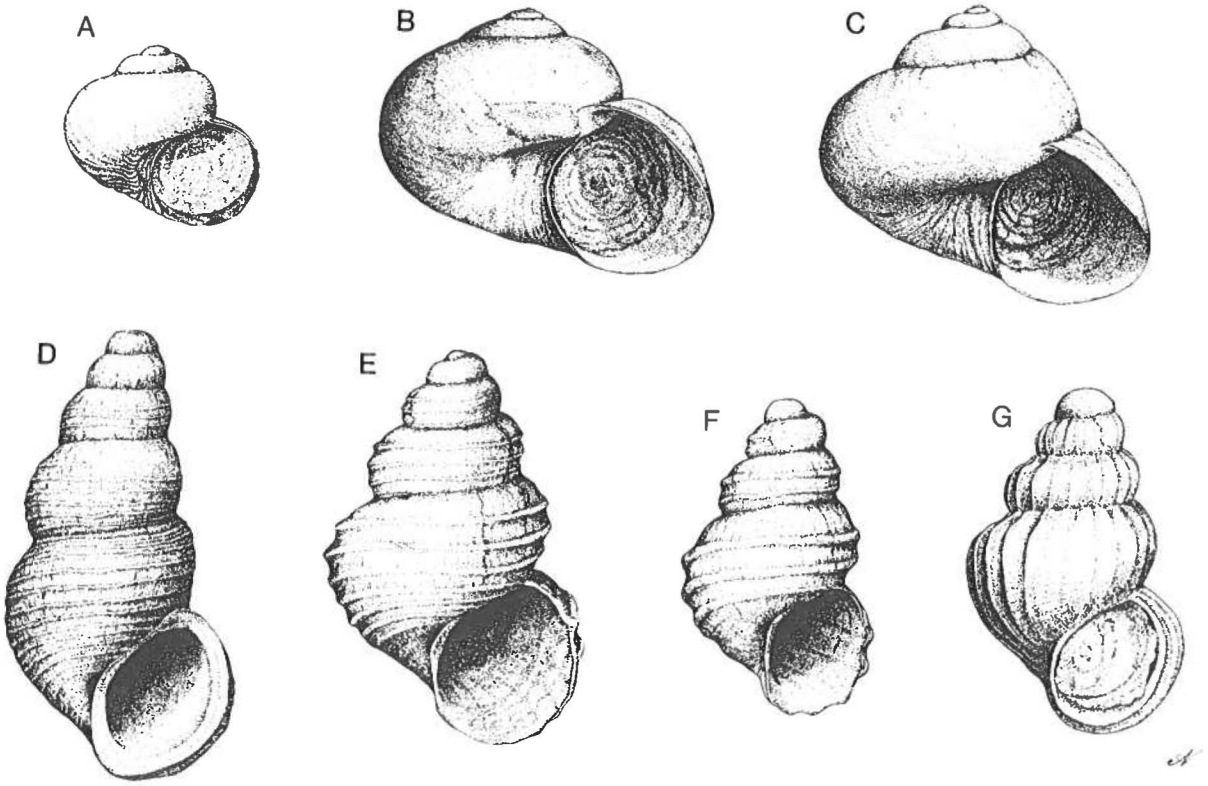

Fig. 3. A: *Skenea laevigata,* height 1.5 mm; off Kap Knud Rasmussen, 180–160 m, Just & Andersen, st.52. B: *Margarites groenlandicus,* height 9 mm; S of Kap Knud Rasmussen, 9–10 m, Just & Andersen, st.59. C: Same, height 10.3 mm; Kap Harald Moltke, 10 m, Just & Andersen, st.62. D: *Cingula ?arenaria,* height 3.8 mm; off Vendenæs, 40–45 m, Just & Andersen, st.69. E: *Cingula moerchi,* height 3.3 mm; NW of Mundingsholm, 50 m, Just & Schiøtte, st.18. F: *Alvania scrobiculata,* height 2.6 mm; locality as E. G: *Alvania verrilli,* height 2.9 mm; locality as A.

Gastropoda

Trochidae

Margarites groenlandicus (Gmelin)
Figs 3B-C
Trochus groenlandicus Gmelin in Linné, 1791:3574
Margarita umbilicalis Broderip & Sowerby, 1829:371

Except for a specimen from Vendenæs, 40–45 m, this species has only been found at the fjord mouth and in Independence Fjord S of Kap Knud Rasmussen.

Thorson (1944:15–20) regarded *Margarites umbilicalis* as a variety of *Margarites groenlandicus,* while Macpherson (1971:18–19 & 23–24) regarded them as two distinct species. According to Macpherson, *M. umbilicalis* has a very thin, depressed shell with a large, open umbilicus, while *M. groenlandicus* has a thicker shell with a higher body whorl and a more obscured, smaller umbilicus.

Comparisons of the Independence Fjord/Jørgen Brønlund Fjord specimens and material from West Greenland with the figures and descriptions given by Macpherson show great variability and inconsistency in the combination of these characters, and thus does not support a separation into two species. This problem may finally be resolved in a coming revision by J.-A. Sneli. Independence Fjord/Jørgen Brønlund Fjord specimens are depressed to varying degrees, not especially thin-shelled, with a medium-sized umbilicus which is not or only slightly obscured by the inner lip. Spiral ribbing is faint or absent. The largest (widest) shell has a heigth of 9.5 mm and is 13 mm wide.

Rissoidae

Cingula ?arenaria Mighels & Adams
Fig. 3D
Cingula arenaria Mighels & Adams, 1842:49

This species was found in greatest abundance between 40 and 90 m. Thorson (1944:34) gives the vertical range of *Cingula arenaria* in East Greenland as 4–38 m.

Jørgen Brønlund Fjord specimens often reach a shell height of almost 4 mm, which is unusually large for *C. arenaria,* and the shells generally appear very slim in comparison with specimens from East and West Greenland.

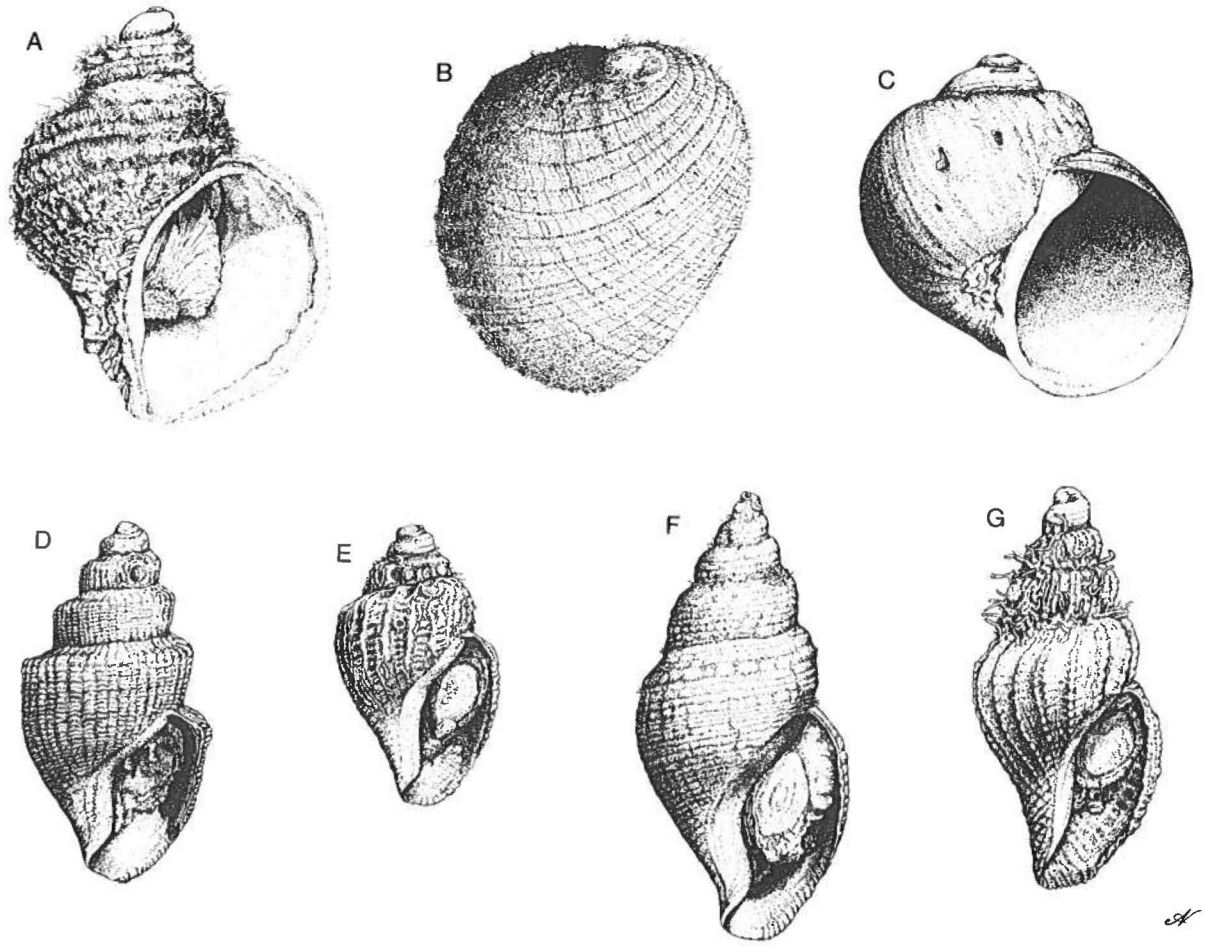

Fig. 4. A: *Trichotropis borealis,* height 17.1 mm; opposite Kængurunæs, 10 m, Just & Andersen, st.50. B: *Velutina velutina,* height 12.5 mm; off Deltaterrasserne, 9.5 m, Just & Schiøtte, st.5. C: *Natica clausa,* height 14.5 mm; E of Vendenæs, 38 m, Just & Schiøtte, st.23. D: *Propebela novajasemliensis,* height 7.1 mm; N of Kap Knud Rasmussen, 10–15 m, Just & Andersen, st.68. E: *Propebela reticulata,* height 5.6 mm; off Brønlundhus, about 10 m, Just & Andersen, st.32. F: *Oenopota ?bicarinata,* height 8.9 mm; off Kængurunæs, 5 m, Just & Andersen, st.46. G: *Oenopota declivis,* height 8 mm; W of Mundingsholm, 50 m, Just & Schiøtte, st.17.

An egg capsule, apparently of this species, with an embryo about to hatch (NW of Mundingsholm, 50 m), is 0.8 mm in diameter. The embryo in the capsule has two whorls on its shell and is 0.6 mm wide.

Alvania scrobiculata (Møller)
Fig. 3F

This species is variable with respect to the longitudinal ribs. In East Greenland specimens these are distinct, while they are weak or absent in Jørgen Brønlund Fjord specimens.

Trichotropidae

Trichotropis borealis Broderip & Sowerby
Fig. 4A

This species is very variable in East Greenland (Thorson 1944:46–47). Also within the Jørgen Brønlund Fjord area and even at a single locality it can vary a great deal, but average specimens are much like the form that Thorson found in the inner fjords. Jørgen Brønlund Fjord specimens, however, usually retain some or most of the hairy periostracum.

Newly settled juveniles are similar in size and appearance to the veligers recorded and pictured by O.G.N. Andersen (1984:12–13), but lack the outer conchioline membrane.

Naticidae

Natica clausa Broderip & Sowerby
Fig. 4C

Of this species only one damaged shell has been found in Jørgen Brønlund Fjord, off Vendenæs. It is in a condition that suggests it could be a subfossil shell washed out by one of the rivers. *Natica clausa* is com-

mon in some post-glacial deposits at Jørgen Brønlund Fjord (Bennike 1987:12–13). In the same sample as the shell of *N. clausa* were, however, found two very recent looking shells of *Bathyarca glacialis* with holes resembling naticid bore-holes, and at Kap Harald Moltke a shell of *Cylichna alba* was found with a similar hole. *Natica clausa* has been found living at East Greenland as far north as Shannon Island (Thorson 1944:132).

Cancellariidae

Admete viridula (Fabricius)
Tritonium viridulum Fabricius, 1780:402
Admete? sensu Mørch (1869:17)
Velutina undata Brown sensu Thorson (1935:65–67)
Admete viridula (Fabricius) sensu Thorson (1944:108)

The material referred to this species consists of one juvenile specimen, 1.2 mm in height (off Vendenæs, 40–45 m), and two egg-capsules (off Drivtømmernæs, 45 m). Mørch (1869) described egg-capsules of the same appearance and identified them as *Admete*?. Thorson (1935) overlooked Mørch's description, but later (1944) corrected this mistake.

Turridae

The generic classification of the *Oenopota-Propebela* group used here has been suggested by Stokland (in litt. and unpublished work) who is at present working on the group. In view of the difficulties with the taxonomy of these species, I have found it expedient to give illustrations of all Turridae found in Jørgen Brønlund Fjord (Figs 4D-G & 5A-B).

Oenopota ?bicarinata (Couthouy)
Fig. 4F
Pleurotoma bicarinata Couthouy, 1838:104–105

This species was taken primarily on clay bottoms, often mixed with sand and gravel and covered with dense vegetation.

The specimens differ a great deal from the original description and figure of *Oenopota bicarinata*, especially in the general outline of the shell and in the spiral ribbing which is very weak in Jørgen Brønlund Fjord specimens with the two "carinae" sometimes absent. In these respects Jørgen Brønlund Fjord specimens seem to be in better agreement with those described and pictured by Macpherson (1971:110 & 113) from the Canadian Arctic. Jørgen Brønlund Fjord specimens are, however, not thin-shelled, the largest specimen found is only 8.9 mm in height, and the anal sinus is not as clear as in the specimen depicted by Macpherson.

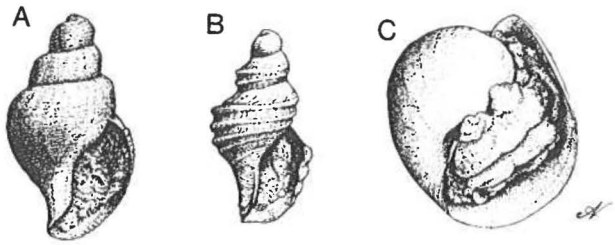

Fig. 5. A: *Oenopota ?cinerea*, height 3.9 mm; off Vandfaldsnæs, 5.5 m, Just & Andersen, st.23. B: *Taranis amoena*, height 3.5 mm; S of Mundingsholm, 80–90 m, Just & Andersen, st.55. C: *Diaphana ?minuta*, height 3.6 mm; off Kængurunæs, 10 m, Just & Andersen, st.45.

Oenopota ?cinerea (Møller)
Fig. 5A
Defrancia cinerea Møller, 1842:86

Only three damaged or juvenile shells of this species were found.

Diaphanidae

Diaphana ?minuta Brown
Figs 5C & 6A-B
Diaphana minuta Brown, 1827
Utriculus minutus sensu Brown (1844:58 & pl. XIX, Figs 7–8)
Bulla hiemalis Couthouy, 1839:180–181

Lemche (1949:39) considered *Diaphana hiemalis* (Couthouy) to be a variety of *Diaphana minuta*. In 1971, however, he used the name *D. hiemalis* on the label of a specimen from Jørgen Brønlund Fjord.

The species is not very variable inside the Jørgen Brønlund Fjord area. The specimens are very similar to two probable syntypes (shells only) of *D. hiemalis*, MCZ 156326, but have a more rounded apex. The shells are very globose (Fig. 5C) and the protoconch does not protrude, not even in young specimens (Figs 6A-B) of about 1 mm height. They are thus very different from Lemche's (1948:40) figure of a *D. minuta* of 1 mm height which bears a much closer resemblance to the young of *Diaphana vedelsbyae* n.sp. (Figs 9A-B). A specimen with this appearance, probably the model for Lemche's figure, from 66°23'N 12°05'W, 1011 m depth ("Ingolf", st.101) exists in ZMUC, but is badly preserved. If it does belong to *D. minuta*, or rather to one of the varieties or species that Lemche (1948:36–40 & 72–74) synonymized with it, it may indicate that Lemche went a step too far in his lumping process. This would, however, have to be confirmed by anatomical evidence. The radula formula for *D. ?minuta* from Jørgen Brønlund Fjord is 1·1·1. The median tooth has 70–80 denticles along the free edge. The lateral tooth

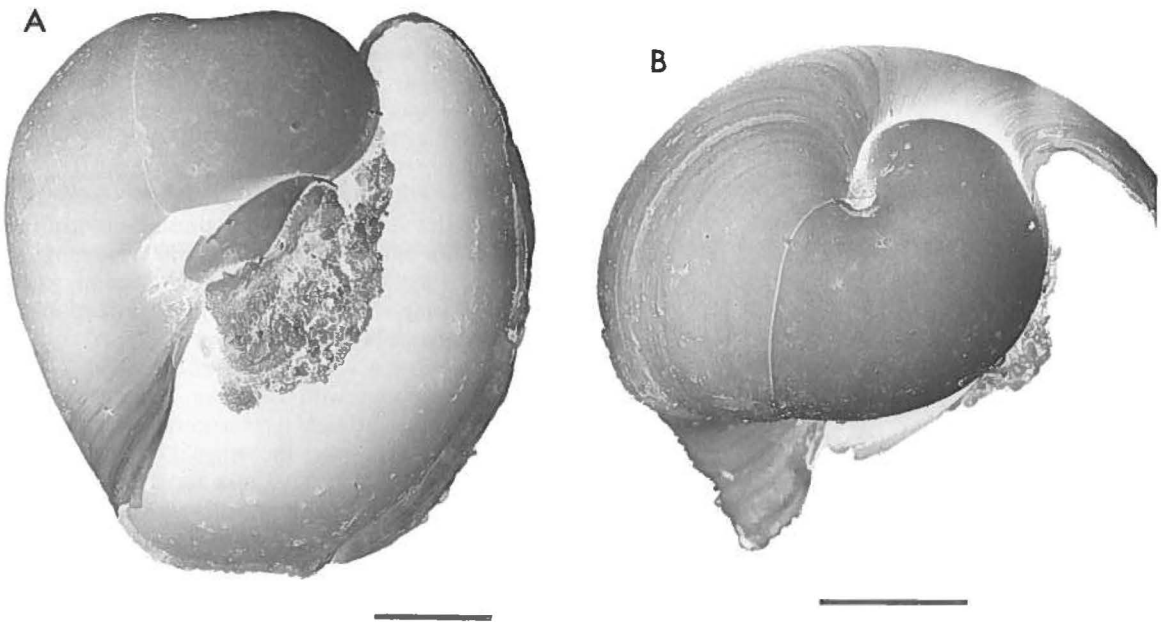

Fig. 6. A: *Diaphana ?minuta*, juv.; off Kængurunæs, 10 m, Just & Andersen, st.45. B: Same specimen, apex. Scale bars = 0.2 mm.

has a fine dentition along the inner edge, as described for *D. vedelsbyae*.

Lemche (1941:17) recorded *D. minuta* at East Greenland only from depths between 3 and 20 m. In Jørgen Brønlund Fjord one specimen was found at 30 m off Saltsøerne and three specimens at 50 m NW of Mundingsholm. Clarke (1974:8) records *D. hiemalis* from the Davis Strait at a depth of 540 m.

Diaphana vedelsbyae n.sp.
Figs 7A-C, 8 & 9A-C

Holotype. Specimen, shell-height 2.8 mm, off Kængurunæs, 10 m, clay, 25/7/1966, Just & Andersen, st.45.

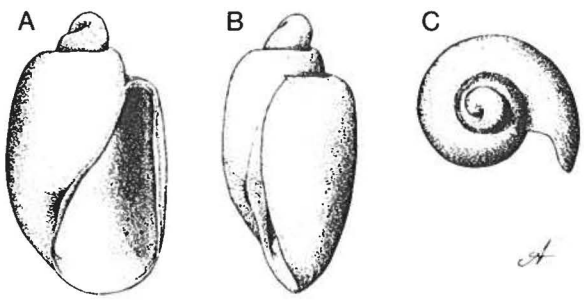

Fig. 7. *Diaphana vedelsbyae*, paratype, height 2.6 mm; off Kængurunæs, 10 m, Just & Andersen, st.45.

Paratypes. ZMUC: 1 specimen, Just & Andersen, st.31; 1 specimen, Just & Andersen, st.44; 1 shell, Just & Andersen, st.45. BMNH 1988027: 2 specimens, Just & Andersen, st.45. USNM 859321: 2 specimens, Just & Andersen, st.45. MCZ 297057 & 297058: 2 specimens, Just & Andersen, st.45. ZIL 53 494 & 53 495: 2 specimens, Just & Andersen, st.45.

Additional material. About 40 specimens and a few shells in many growth stages from newly hatched to adult (max. shell-height 3 mm) taken on the threshold from between 8 and 18 m. Three specimens taken from 50 and 52 m NW and W of Mundingsholm, respectively.

Description. Shell (Fig. 7): white, opaque except for protoconch which is transparent, smooth except for faint growth lines, height about 1.7 times width. Mammilliform protoconch with 3/4 dextrally coiled whorl whose axis is at an angle of 110° to the axis of the later whorls which number up to 2¼. Spire low but variable, with a shallow suture. Mouth large, broadest at the lowest third, about 1/7 lower than the last whorl. Inner lip of mouth curving like a stretched, inverted "S". Small umbilicus and a thin callus present. Outer lip curving forward on its vertical part (Fig. 7B), backward at the top (Fig. 7C).

Soft parts, external appearance (animal fixed in 4% formalin): rather voluminous, do not retract completely

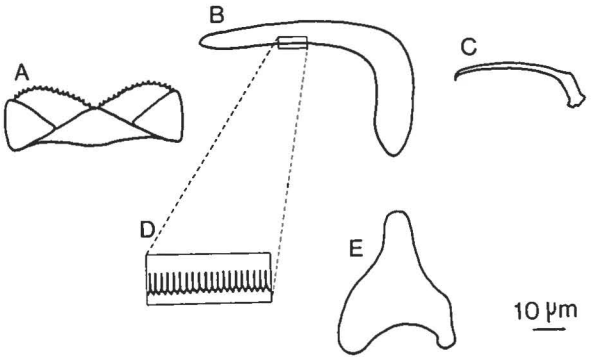

Fig. 8. *Diaphana vedelsbyae,* radula. A, B, and C: median, lateral, and marginal tooth seen from below. D: close-up of edge of lateral tooth. E: lateral tooth seen from the side.

into shell. Foot broad, unforked posteriorly. A pair of large, flat tentacles bent over cephalic shield and extending beyond the rim of this. No eyes. Infrapallial lobe present.

Radula formula (Figs 8 & 9C): 1·1·1·1·1. Broad median tooth with about 30 denticles on the free edge which has two forward curving lobes. Each lateral tooth has a strong base approximately shaped like a triangle with two short legs; the cusp which projects from the top of the triangle curves away sharply from the plane of the latter until an angle of 90°, after which it straightens out and continues to a rather blunt end. The inner curve and edge of the lateral tooth has a very fine, sharp dentition like a hacksaw. Each marginal tooth is about 2/3 the length of the laterals, but very thin, with a much weaker and narrower base and no dentition along the edge. The marginal tooth ends in a very sharp, crooked point.

Stomach: gizzard plates absent.

Diagnosis. Diaphanid with an unforked foot and a radula in which each row consists of a broad, bilobed median tooth, two strong, blunt lateral teeth, and two thin, curving, pointed marginal teeth.

Known distribution. Known only from Jørgen Brønlund Fjord.

Relation to other species. One very damaged specimen of this species from 13 m depth W of Kængurunæs, collected by Johnsen, was on the label identified by H. Lemche as *Retusa semen* Reeve v. *turrita* Beck. However, the presence of a well developed radula in the species clearly shows that it does not belong to *Retusa*. Lemche (1948:53 & 86) regarded the identity of *Bulla semen* Reeve, 1855 as uncertain but worth investigating. Reeve's description, which is based only on the shell, is very short and uninformative, and his figures as well as the four possible type specimens (shells only), BMNH acc.no. 1829, seem to represent a species different from *Diaphana vedelsbyae*. ZMUC type material of *Bulla turrita* Møller, 1842 (Lemche's citation of Beck as author is erroneous) is also very different. Lemche (1948:84–86) synonymized *Bulla turrita* with *Retusa obtusa* (Montagu).

Another species, of which the soft parts are unknown, (Bouchet & Warén 1979:237), is *Retusa marshalli* Sykes, 1905. The shell of this species resembles the shell of *Diaphana vedelsbyae,* but has a larger umbilicus, a flat spire with a deep suture, and a junction between the outer and inner lips which, judging from Sykes's original illustrations, is quite different, with the outer lip being straight near this point instead of backward-curving as in *D. vedelsbyae.*

The various species listed by Lemche (1948:72–74) as being synonymous with *Diaphana minuta* have been checked either through type material or through the literature, in most cases the original descriptions, and, although Lemche may have gone too far in the lumping process (see *D. ?minuta* in the present paper), none are identical with *Diaphana vedelsbyae.* Many of the descriptions have been based on empty shells, and the infraspecific variation among the Cephalaspidea taken into consideration, such descriptions are of very limited value. In forms and varieties of *D. minuta* sensu Lemche where soft parts and anatomy are known, the foot is distinctly forked posteriorly, and the radula formula is 1·1·1. This is also the case with *Diaphana lactea* (Jeffreys, 1877) (Bouchet & Warén 1979:229–231).

The shape of the median and lateral teeth of the radula of *Diaphana vedelsbyae* in combination with the lack of stomach plates clearly place the species in the Diaphanidae. The placing in the genus *Diaphana* Brown must, however, be regarded as tentative because of the unforked foot and the presence of marginal teeth in the radula. There is at present no other genus in the family that the species would fit into, and a possible solution in a systematic revision could be to establish a new subgenus of *Diaphana.*

Reproduction and development. *Diaphana vedelsbyae* has direct development. The eggs have a diameter of about 0.6 mm, and newly hatched specimens have a shell height of 0.5 mm. Juveniles retain an operculum until their shell height is about 1.5 mm.

On 25 and 27 July 1966, eggs with embryos about to hatch and specimens in all sizes from newly hatched to adults were taken at a depth of 10 m off and opposite Kængurunæs (Just & Andersen, st.45 & st.50). It thus seems that the species has a long period of spawning in Jørgen Brønlund Fjord.

Diaphana vedelsbyae is named after my friend and colleague Annie Vedelsby.

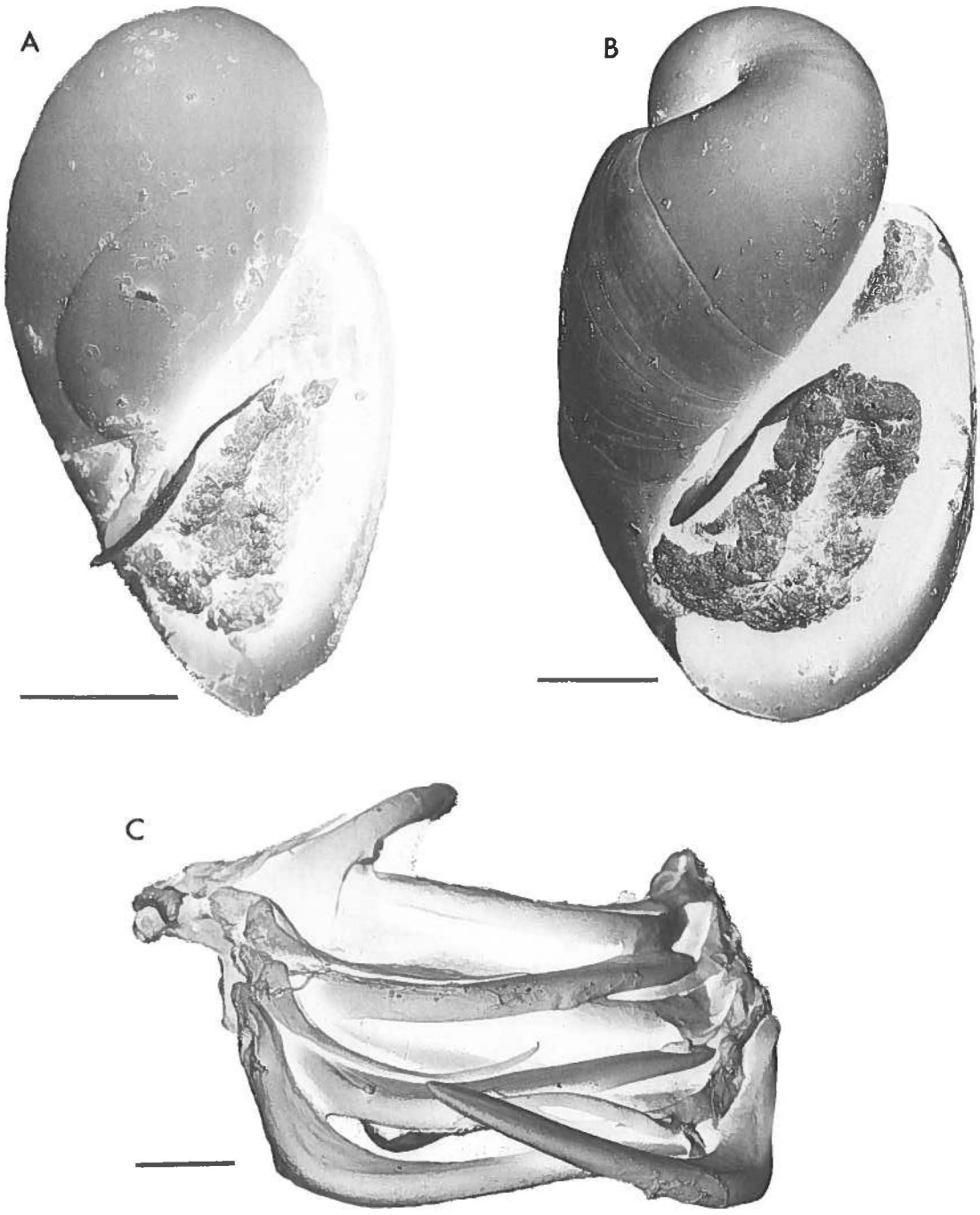

Fig. 9. A-B: *Diaphana vedelsbyae,* two early growth stages; off Kængurunæs, 10 m, Just & Andersen, st.45. Scale bars = 0.2 mm. C: Same, part of radula seen from above; locality as A-B. Scale bar = 0.02 mm.

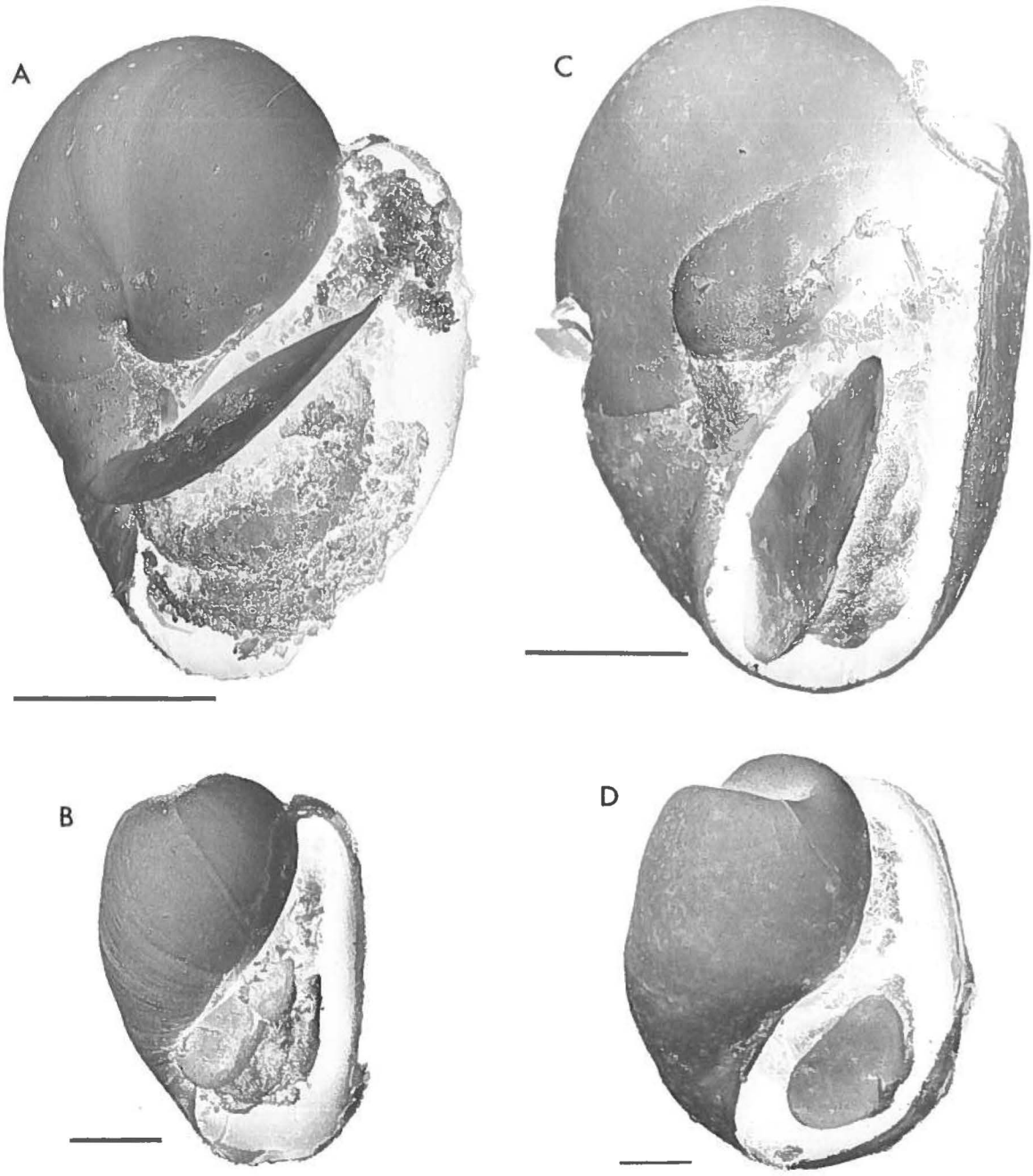

Fig. 10. A-B: *Retusa obtusa,* two early growth stages; Vandfaldsnæs, 8–9 m, Just & Andersen, st.31. C-D: *Cylichna alba,* two early growth stages; locality as A-B. Scale bars = 0.2 mm.

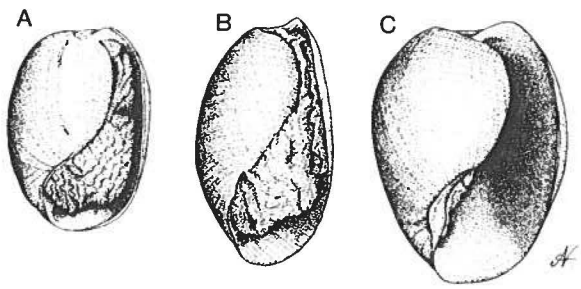

Fig. 11. A: *Cylichna occulta,* height 4.2 mm; off Kængurunæs, 5 m, Just & Andersen, st.46. B: Same, height 5.1 mm; off Kap Harald Moltke, 5 m, Just & Andersen, st.63. C: Same, height 5.4 mm; off Drivtømmernæs, 45 m, Just & Schiøtte, st.7.

Retusidae

Retusa obtusa (Montagu)
Figs 10A-B
Bulla obtusa Montagu, 1803:223–224 & pl. 7, Fig. 3
Bulla pertenuis Mighels, 1843:346 & pl. XVI, Fig. 3

In Jørgen Brønlund Fjord *Retusa obtusa* is of the variety known from East Greenland and recorded as var. *pertenuis* (Mighels) by Lemche (1941:5). It is, however, my opinion that East Greenland and Jørgen Brønlund Fjord specimens are closer in resemblance to Montagu's original figure than to that of Mighels. Lemche's recorded max. depth was 30 m, whereas in Jørgen Brønlund Fjord the species is very common down to about 90 m at the fjord mouth.

Lemche (1948:18–19) stated that *Retusa obtusa* has no larval shell and that the whorls from their very beginning are arranged around their final axis. Further he wrote that the species nearly fills the first whorl with superimposed shell substance causing difficulties in the preparation. The latter statement may explain his failure to discover the larval shell (Fig. 10A). Very young specimens of *Retusa obtusa* look much like a slightly smaller version of very young *Cylichna alba* (Figs 10C-D).

Scaphandridae

Cylichna occulta (Mighels)
Figs 11A-C
Bulla occulta Mighels in Mighels & Adams, 1841:50
Cylichna solitaria (Say) sensu Lemche (1941:11–15)

Lemche (1941:11–15) recorded this species as *Cylichna solitaria* (Say) which is, however, a quite different species (Lemche 1948:48–49), not occurring in the Arctic.

Cylichna occulta is a very variable species. In Jørgen Brønlund Fjord it is found in three varieties with no real intermediate forms except in very juvenile stages. Variety A (Fig. 11A) has been found in the whole fjord from 3 to 16 m depth, variety B (Fig. 11B) in the outer fjord and on the threshold from 5 to 20 m depth, variety C (Fig. 11C) in the outer fjord from 38 to 90 m depth. So far no characters, except the shape of the shell, have been found to separate these varieties. The radulae of all three varieties are similar to the one pictured by Lemche (1956: Fig. 347). Variety C is, with regard to shape, identical to *Cylichna occulta densistriata* (Leche) as depicted by Lemche (1948:46) but lacks the striations of the latter.

Cylichna magna Lemche

An egg with an embryo about to hatch was found in the material (S of Mundingsholm, 80–90 m). The diameter of the egg is 0.7 mm and the shell height of the embryo almost the same. In young specimens the two large gizzard plates are clearly visible through the shell. Specimens retain an operculum until they reach a height of about 1.5 mm.

Family uncertain

"Adeorbis" exquisitus Jeffreys
Adeorbis exquisitus Jeffreys, 1883:399 & pl. XVI, Fig. 8.

One damaged specimen of this species was found off Kap Knud Rasmussen between 160 and 180 m depth. It was identified by A. Warén (as *"Daronia" exquisita* (Jeffreys)) who informed me that its taxonomic position must be regarded as uncertain. It has not previously been recorded from the Arctic.

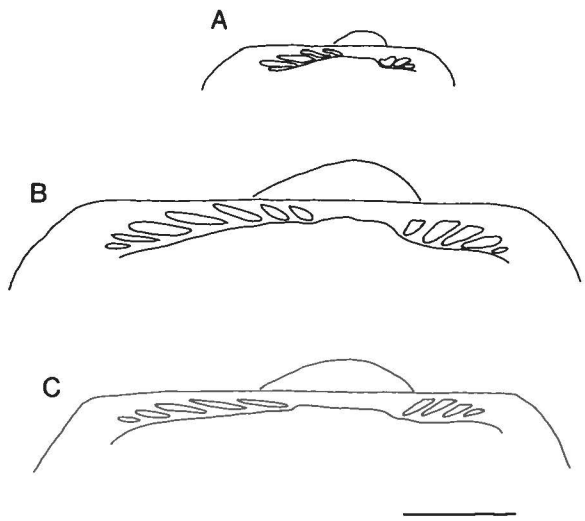

Fig. 12. A-B: *Bathyarca glacialis,* hinge of early growth stages; off Drivtømmernæs, 45 m, Just & Schiøtte, st.7. C: *Bathyarca frielei,* hinge of early growth stage; off Kap Knud Rasmussen, 180–160 m, Just & Andersen, st.52. Scale bar = 1 mm.

Pelecypoda

Nuculanidae

Yoldiella frigida Torell

All specimens were found at 45 m depth and below this, except for one small specimen taken at 15 m at Drivtømmernæs.

Arcidae

The two species of *Bathyarca* found in Jørgen Brønlund Fjord are difficult to distinguish from each other when they are very young, since the early growth stages of *Bathyarca glacialis* (Gray) have the same triangular shape as *Bathyarca frielei* (Friele). The hinge structures in the two species (Figs 12A-C) are, however, clearly different, even in juveniles.

Mytilidae

Musculus niger (Gray)

This species was found in large numbers at several localities on the threshold. The overwhelming majority of specimens are newly hatched or juveniles.

Pectinidae

?Pectinidae sp.
Fig. 17

Of this species only a fragment of a shell has been found. It differs from *Cyclopecten imbrifer* and other species known from the Arctic today.

Limidae

Limatula hyperborea Jensen
Fig. 13B
Limatula hyperborea Jensen, 1905:329–330
Limatula subauriculata (Montagu) sensu Laursen (1954:19 & 22–23)

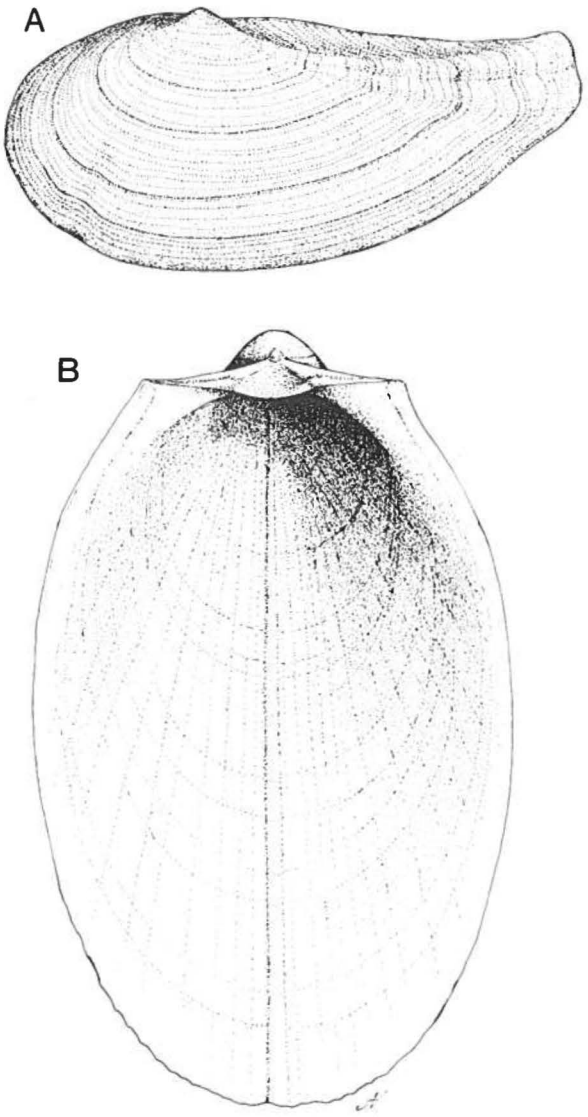

Fig. 13. A: *Nuculana pernula*, length 17.6 mm; NW of Mundingsholm, 50 m, Just & Schiøtte, st.18. B: *Limatula hyperborea*, height 11.5 mm; locality as A.

In the mouth of Jørgen Brønlund Fjord *Limatula hyperborea* is very common in water that is unusually shallow for the species. In one dredge haul from 50 m depth NW of Mundingsholm 63 specimens were found in all sizes from 0.7 to 14 mm, in addition to some empty shells.

Limatula hyperborea is already known as a subfossil from North Greenland (S. Funder, pers. comm.) but was reported as *Limatula subauriculata* by Laursen (1954). *L. hyperborea* is, however, easily distinguished from *L. subauriculata* by the straight-lined hinge of the former, opposed to that of the latter which slopes on both sides of the umbo. Jensen (1905) gave good illustrations of *L. hyperborea* but did not show the hinge from the inside. This may also have contributed to the apparent misunderstanding by Bernard (1979:30–31) (himself suspicious of his specimens) whose photograph of a supposed *L. hyperborea* seems to show a different species. The specimen depicted by Jensen (1905:329) exists in ZMUC. It is hereby designated as lectotype of *Limatula hyperborea*.

Astartidae

Astarte borealis (Schumacher)
Figs 14A-B

Specimens from Jørgen Brønlund Fjord usually have intact umbones, as opposed to those from Kap Køben-

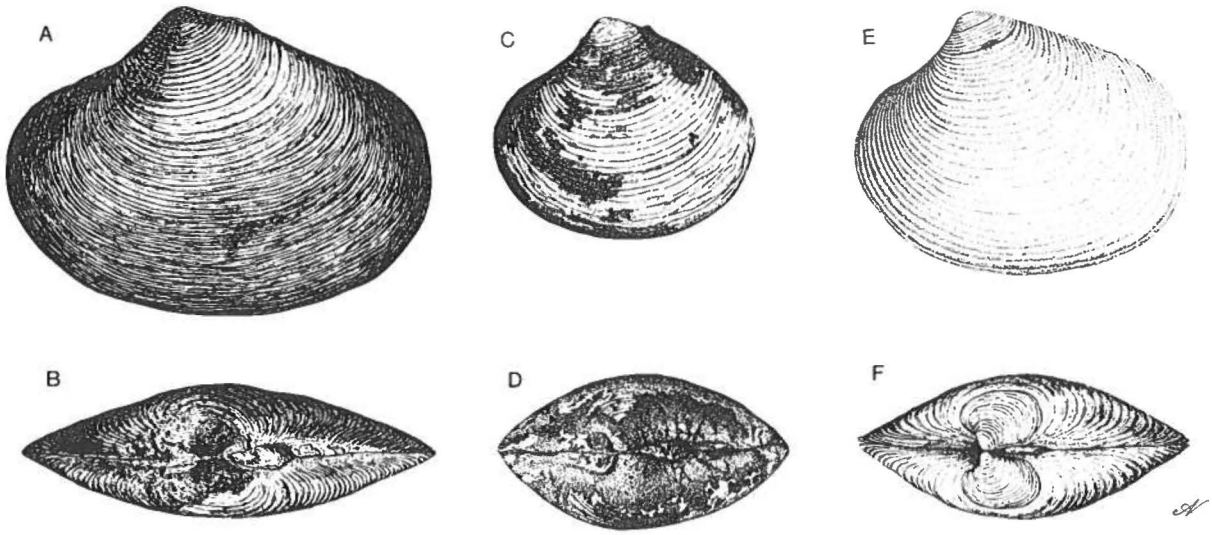

Fig. 14. A-B: *Astarte borealis*, length 25.1 mm; off Vandfaldsnæs, 8–9 m, Just & Andersen, st.31. C: *Astarte ?warhami*, length 16 mm; off Vandfaldsnæs, 19 m, Just & Andersen, st.29. D: Same, length 17.9 mm; off Vandfaldsnæs, 5.5 m, Just & Andersen, st.24. E-F: *Astarte crenata*, length 20.2 m; NW of Mundingsholm, 50 m, Just & Schiøtte, st.18.

havn (Fig. 1) whose umbones are strongly eroded (K. S. Petersen, pers. comm.).

Astarte crenata (Gray)
Figs 14E-F & 15

Ockelmann (1958:89–98) regarded this species as divided into several subspecies but stated that they were overlapping in occurrence along the coast of East Greenland and that transitional forms were not rare. Lubinsky (1980:31–32) agreed with Ockelmann with regard to division into subspecies and noted the occurrence in Canadian waters of three subspecies identical to those found by Ockelmann in Greenland.

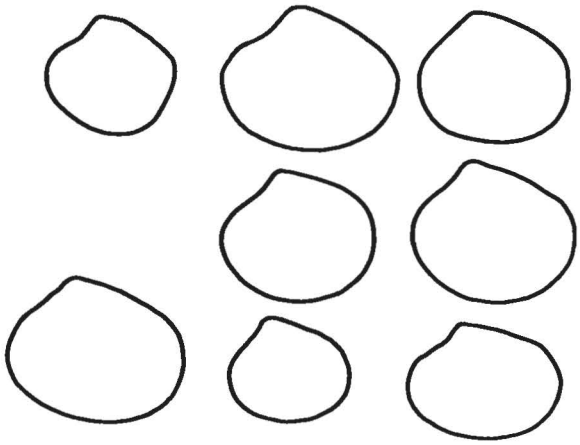

Fig. 15. *Astarte crenata*, outlines of selected specimens; NW of Mundingsholm, 50 m, Just & Schiøtte, st.18.

The material from Jørgen Brønlund Fjord does not, in my opinion, permit a meaningful classification into subspecies. The species simply seems to be very variable in shape. Fig. 15 shows the outline of selected specimens from one station, whereas Figs 14E-F show what might be called an average specimen from the same station.

Astarte ?warhami Hancock
Figs 14C-D

Astarte warhami Hancock, 1846:336 & pl. 5, Figs 15–16
Astarte montagui (Dillwyn) sensu Ockelmann (1958:80–85)
Astarte warhami Hancock sensu Lubinsky (1980:33–36)

Specimens from Jørgen Brønlund Fjord agree well with the description and figures of *Astarte warhami* given by Lubinsky (1980), and fairly well with Hancock's original description, although the shells are not thin, and the anterior end is not as well-produced and has a less concave slope. Ockelmann (pers. comm.) maintains, however, that the variation in the *Astarte montagui* complex may possibly be regarded as clinal or may have ecological reasons, and that this taxonomic problem cannot be solved solely by regarding shell morphology.

Thyasiridae

Axinulus pygmaeus (Verrill & Bush)
Fig. 16C

The largest number of specimens of this species was found in a dredge haul from about 85 m depth in the deepest part of the inner fjord where the bottom consists of dark, muddy clay.

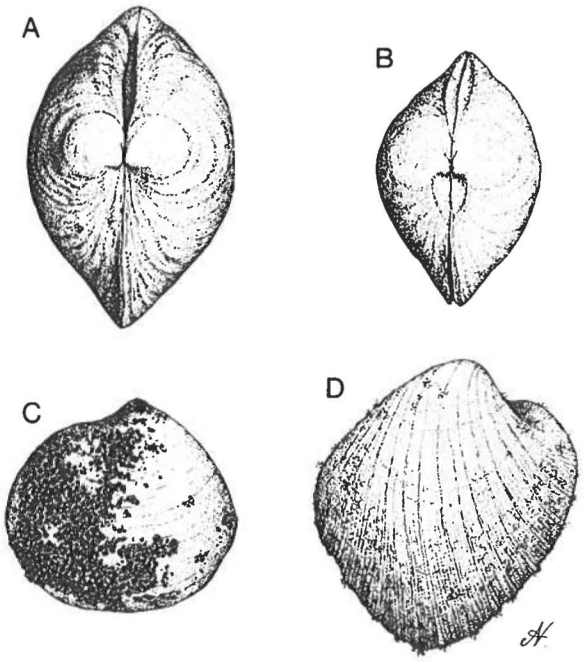

Fig. 16. A: *Thyasira gouldi*, length 5.8 mm; between Kap Harald Moltke and Dråbeholm, 7.5 m, Just & Andersen, st.13. B: *Thyasira dunbari*, length 4.8 mm; off Brønlundhus, 47.5 m, Just & Andersen, st.4. C: *Axinulus pygmaeus*, length 1.7 mm; off Brønlundhus, 47.5 m, Just & Andersen, st.3. D: *Lyonsiella abyssicola*, height 5 mm; NW of Mundingsholm, 50 m, Just & Schiøtte, st.18.

Thyasira gouldi (Philippi)
Fig. 16A

The diagnosis for distinguishing this species from *Thyasira dunbari* Lubinsky given by Lubinsky (1976:1668–1670) is insufficient, since *Thyasira gouldi* may, at least in Jørgen Brønlund Fjord, on occasion assume almost the same remarkable height in relation to length as the holotype of *Thyasira dunbari*. *Thyasira gouldi* can, however, still be recognized by its deep, radial furrows and indistinctly delimited lunula.

Thyasira dunbari Lubinsky
Fig. 16B

Thyasira equalis (Verrill & Bush) sensu Ockelmann (1958: 104–110)
Thyasira dunbari Lubinsky, 1976:1667–1670

This species was identified by K. W. Ockelmann. It is identical to the species which he recorded (1958:104–110) from East Greenland as *Thyasira equalis*. The latter is, however, not a High Arctic species and has not been found at East Greenland (Ockelmann, pers. comm.) Specimens of *Thyasira dunbari* from Jørgen Brønlund Fjord and East Greenland are generally more rounded in outline than Lubinsky's type material.

The occurrence of this species in the inner fjord shows that although it is High Arctic in occurrence, it is not cold-stenothermal.

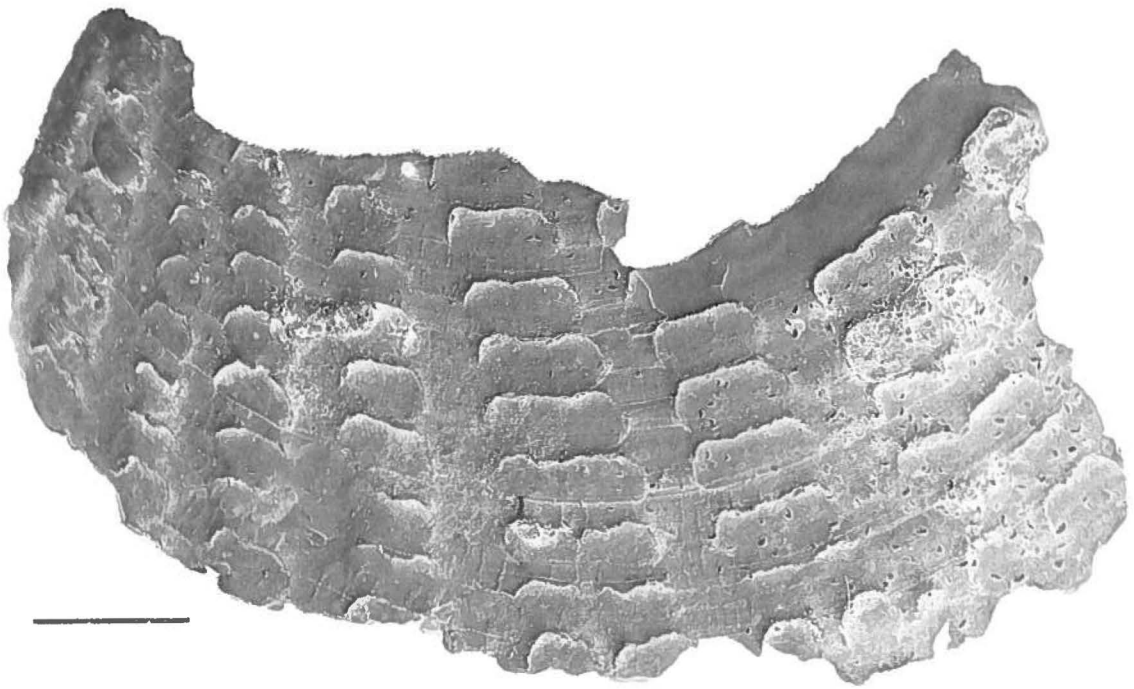

Fig. 17. ?Pectinidae sp.; NE of Kap Knud Rasmussen, 190–200 m, Just & Andersen, st.56. Scale bar = 1 mm.

Verticordiidae

Lyonsiella abyssicola (G. O. Sars)
Fig. 16D

The minimum depth recorded for this species is 38 m at West Greenland, the maximum depth 2000 m in the Bay of Biscay (Ockelmann 1958:159). In Jørgen Brønlund Fjord it has been taken in rather large numbers. In one dredge haul from 50 m NW of Mundingsholm were found 27 specimens from 0.6 to 5 mm shell length, and some empty valves.

Notes on distribution and zoogeography

The columns 1–4 in Table 2 are a summary of the vertical and horizontal distribution of molluscan species in Jørgen Brønlund Fjord and the adjoining part of Independence Fjord. As would be expected at 82° northern latitude, several cold- and deep-water species occur in unusually shallow water, *Lyonsiella abyssicola* and *Limatula hyperborea* being the best examples. It is, however, surprising to find *Retusa obtusa* and the two species identified as *Cingula ?arenaria* and *Diaphana ?minuta* reaching much larger depths than usual for these species, sometimes occurring in large numbers at the same stations as cold-stenothermal species. Although *Diaphana minuta* and *Retusa obtusa* are only propagatively warm-stenotherm (Lemche 1941:43), this remarkable occurrence may reflect complicated hydrographical conditions in the outer fjord or possibly indicate systematic problems with the two species, as is probably the case with *Cingula ?arenaria*.

28 species occur in the inner fjord and 63 on the threshold and/or in the outer fjord, excepting planktonic species and larvae. Of the 28 inner fjord species only three have not been found in one or both of the other regions, while 38 of the 63 threshold/outer fjord species have not been found in the inner fjord. The threshold thus seems to be an effective barrier to a majority of the species. One reason for this is the relatively high temperature in the inner basin (Andersen 1977:7–8) which excludes cold-stenothermal mollusks from the inner fjord. This group includes *Siphonodentalium lobatum, Alvania wyvillethomsoni, Alvania verrilli, Taranis amoena, Philine finmarchica, Cylichna magna, Bathyarca frielei, Cyclopecten imbrifer, Limatula hyperborea, Lyonsiella abyssicola,* and *Cuspidaria arctica.* Other reasons could be the lower salinity, the probably low and variable salinity on the threshold, or a high rate of sedimentation in the inner fjord which favours deposit feeders. The inner fjord contains mostly species which are relatively indifferent to the variable hydrographical conditions at less than 15 m depth and which would therefore have no problems crossing the threshold, even without a pelagic larval stage. *Bathyarca glacialis, Thyasira dunbari,* and *Cuspidaria subtorta* do not appear to have such a stage, or only a very short one, and obviously they are neither very well adjusted to shallow water conditions, so their occurrence in the inner fjord is noteworthy. It is equally noteworthy that *Margarites olivaceus, Margarites groenlandicus, Propebela novajasemliensis, Diaphana vedelsbyae, Musculus niger,* and *Arctinula greenlandica* do not occur (or at least have not been found) here. Especially *Arctinula greenlandica* is very common in the outer fjord, while *Diaphana vedelsbyae* and *Musculus niger* seem to prefer conditions on the threshold.

Some results with respect to population density are presented in Table 3. In shallow water the overwhelming majority of the population seems to consist of *Portlandia arctica* and *Hiatella arctica. Mya truncata* is probably much more abundant than the figures suggest. Although large *Mya truncata* shells of recent appearance have been found, the largest living specimen was only 27 mm long. Large specimens may burrow too deep for the van Veen grab. The threshold must probably be regarded as an exposed area due to strong currents. If this holds true, the predominance of the deposit feeding *Portlandia arctica* in the relatively sheltered inner fjord as opposed to that of the suspension feeding *Hiatella arctica* on the threshold and in the outer fjord agrees well with results from the Disko Bugt area at West Greenland (G. H. Petersen 1978). Below 20 m the species composition changes almost completely and there is a drastic fall in population density. In the inner fjord the deposit feeding Thyasiridae are dominating at these depths. Data concerning the outer fjord are insufficient. Judging from the dredge samples, the quantitatively important species below 20 m are the three *Yoldiella* species, *Arctinula greenlandica,* and *Astarte crenata.*

Table 2 probably gives a fairly complete list of the molluscan species occurring in Jørgen Brønlund Fjord, at least for depths down to 90 m. This limitation excludes only the slope into Independence Fjord, on which few samples have been taken. In the following, some noteworthy occurrences and absences are discussed.

Eight species identified or tentatively identified in the material from Jørgen Brønlund Fjord have never been recorded from East Greenland: *Proneomenia ?sluiteri, Alvania verrilli, Oenopota ?cinerea, Propebela novajasemliensis, Entocolax schwanwitchi, Diaphana vedelsbyae, "Adeorbis" exquisitus,* and *Axinulus pygmaeus.*

Solenogastres from East Greenland have never been given faunistic treatment, and *Proneomenia sluiteri* which is known from West Greenland and the Barents Sea (Thorson 1951:12–13) may thus very well be present there. *Entocolax schwanwitchi,* which is an endoparasite in *Myriotrochus,* is easily overlooked by malacologists, and *Diaphana vedelsbyae* may have been taken

Table 3. Number of specimens/m² in three parts of Jørgen Brønlund Fjord.

	Inner fjord: Between Brønlundhus and Pileodden		Threshold: Østmolen and Vandfaldsnæs		Outer fjord: Kap Harald Moltke	
Depth	5–16 m	22–48 m	5–12 m	19 m	7.5 m	25 m
Number of 0.1 m² samples	6	4	5	3	2	2
Macoma calcarea	20		10		45	
Astarte borealis	37		34		25	
Oenopota ?bicarinata			2			
Portlandia arctica	425		190		65	
Hiatella arctica	127		1246		140	
Axinopsida orbiculata			2			
Chaetoderma productum	2					
Cylichna occulta	2		2			
Diaphana ?minuta	2		2			
Propebela novajasemliensis			2			
Diaphana vedelsbyae			2			
Thyasira gouldi	12		6		30	
Trichotropis borealis	3					
Mya truncata	2			3	5	
Macoma loveni			2	7		
Musculus niger			20	10		
Retusa obtusa	2		42			
Cylichna alba	5		12	3	20	
Nucula belloti	23		30	7	30	
Astarte ?warhami	2	10	22	10	15	
Thracia devexa	2			3		
Thyasira dunbari		35		3		10
Bathyarca glacialis		5				
Yoldiella intermedia		23				
Axinulus pygmaeus		33				
?Falcidens sp.		3				
All species	666	109	1624	46	375	10

for a *Retusa*. So far, however, a search of the ZMUC collections has not brought East Greenland material of any of these species to light.

Oenopota cinerea and *Axinulus pygmaeus* have a large area of distribution covering most of the Atlantic Arctic and adjoining seas (Thorson 1944, Madsen 1949, Clarke 1974, Høisæter 1986). *Propebela novajasemliensis* seems to be circumpolar and extremely High Arctic in occurrence. The Turridae and the Thyasiridae are families with a difficult taxonomy, and it may be that the above mentioned species will prove to have a different pattern of geographical distribution when their systematic delimitation is better understood. At present they cannot safely be used as a basis for zoogeographical conclusions, something which is even more true for the poorly known *"Adeorbis" exquisitus*.

Alvania verrilli has been recorded from the bathyal zone in the Norwegian Sea and north of Svalbard and Frants Josefs Land (Warén 1973:8). It may be present in deep water off the East Greenland coast where relatively few samples have been taken.

One peculiarity about the molluscan fauna of Jørgen Brønlund Fjord is that not one single adult nudibranch has been found, in spite of the fact that several different larvae have been recorded by O. G. N. Andersen (1984). The genera *Dendronotus, Cratena,* and *Coryphella* were recorded from East Greenland by Lemche (1941) and Andersen's identifications are thus quite credible. The explanation for the absence of the adults may be lack or scarcity of food. The three above mentioned genera feed on hydroids which are not very common in Jørgen Brønlund Fjord, probably due to the lack of suitable substratum and to the deposition of mud.

Another absence, and one for which I have found no reasonable explanation, is that of all Neogastropoda except the Cancellaridae and the Turridae. More than one third of the gastropod species recorded by Macpherson (1971) from Canadian Arctic waters belong to the Buccinidae. For East Greenland the corresponding fraction, calculated on the basis of Thorson (1944), is about one fourth, and Golikov (1980) records many species of Buccinidae from the northernmost parts of the USSR. Several species of *Colus* and *Buccinum* would be expected to occur in Jørgen Brønlund Fjord, their occurrence and depth range in other parts of the High Arctic taken into consideration.

The Buccinidae and the Nudibranchiata are the two groups whose absence is most conspicuous. There are, however, other species recorded from relatively shallow water at the northern East Greenland coast, which have not been found in Jørgen Brønlund Fjord. Among these *Pandora glacialis* Leach should be mentioned, since it has been recorded as far north as Kap København at the mouth of Independence Fjord (K. S. Petersen 1986:35). The absence of this species confirms the observation by Ockelmann (1958:152) that it "prefers places not too far from the open sea".

Even without direct knowledge of the molluscan fauna in North Greenland waters as a whole, it seems obvious that the fjord fauna in Jørgen Brønlund Fjord hardly can be representative for these waters. Unfortunately the fauna in the Arctic Ocean off North Greenland is still uninvestigated. In 1985, however, 17 Agassiz-trawl samples and some underwater photographs were taken between 80 and 890 m depth on the Belgica Bank in the Fram Strait by the West German vessel "Polarstern" (Piepenburg in prep.). This material will be treated at the Institut für Polarökologie, Kiel.

Acknowledgements

I am deeply indebted to Jean Just (ZMUC) for initiating the present work and for valuable advice, to Annie Vedelsby (ZMUC) who sacrificed her weekends to make the drawings, and to Kurt W. Ockelmann (Marine Biological Laboratory, Helsingør) who generously supplied his identifications of all bivalves collected in Jørgen Brønlund Fjord in 1966. Thanks are also due to Eigil Knuth (leader of the Danish Peary Land Expeditions) who helped to make my stay at Moltkehus unforgettable, to Mariette Dalby Larsen who typed the manuscript, to Kathe R. Jensen (ZMUC) for help with opisthobranchs, to Danny Eibye-Jacobsen (ZMUC) and Berit Ree (The Commission for Scientific Research in Greenland) for correcting my English, and to Anders Warén (Naturhistoriska Riksmuseet, Stockholm), Jon-Arne Sneli (Trondheim Biologiske Stasjon, Trondheim), and Øystein Stokland (Rogaland Research Institute, Stavanger) for help with identification of various prosobranchs. Kenneth J. Boss (MCZ), Diane M. Bohmhauer (USNM), Alexander Golikov (ZIL), Edmund Gittenberger (RMNH), N. J. Evans (BMNH), and Dieter Piepenburg (Institut für Polarökologie, Kiel) are thanked for donating and lending material for comparison, Margit Jensen (ZMUC) for allowing the use of microscope CF 468, Bent W. Rasmussen (ZMUC) for photographic work on the scanning electron microscope, Eva Bonde (ZMUC) for reproduction of the illustrations, and Kaj Strand Petersen (The Geological Survey of Denmark), Svend Funder (Geological Museum, Copenhagen), Godtfred Høpner Petersen, Jørgen Knudsen, Claus Nielsen, and Niels Peder Kristensen (all ZMUC), Henk Dijkstra (Sneek), and Elsebeth Thomsen (Zoological Museum, Tromsø) for various kinds of help, advice, information, and discussions.

References

Andersen, M. 1971. Echinodermata from Jørgen Brønlund Fjord, North Greenland. – Meddr Grønland 184(12):1–18.
– 1973. Bryozoa from Jørgen Brønlund Fjord, North Greenland. – Ibid. 191(8):1–18.
Andersen, O. G. N. 1977. Primary production, illumination, and hydrography in Jørgen Brønlund Fjord, North Greenland. – Ibid. 205(4):1–27.
– 1984. Meroplankton in Jørgen Brønlund Fjord, North Greenland. – Ibid., Biosci. 12:1–25.
Bennike, O. 1987. Quaternary geology and biology of the Jørgen Brønlund Fjord area, North Greenland. – Ibid., Geosci. 18:1–23.
Bernard, F. R. 1979. Bivalve mollusks of the western Beaufort Sea. – Contr. Sci. 313:1–80.
Bouchet, P. & Warén, A. 1979. The abyssal molluscan fauna of the Norwegian Sea and its relation to other faunas. – Sarsia 64:211–243.
Broderip, W. J. & Sowerby, G. B. 1829. Observations on new or interesting Mollusca contained, for the most part, in the museum of the Zoological Society. – Zoological Journal 4(15):359–379.
Brown, T. 1827. Illustrations of the recent conchology of Great Britain and Ireland. – Edinburgh (not seen).
– 1844. Illustrations of the recent conchology of Great Britain and Ireland, 2nd ed. – Smith, Elder & Co., London: XII + 144 pp. + LIX pls.
Clarke, A. H. 1974. Mollusks from Baffin Bay and the northern North Atlantic Ocean. – Publications in Biological Oceanography 7:I-XII & 1–23.
Couthouy, J. P. 1838. Descriptions of new species of Mollusca and shells, and remarks on several Polypi, found in Massachusetts Bay. – Boston Journal of Natural History 2(1):53–111.
– 1939. Monograph of the family Osteodesmacea of Deshayes, with remarks on two species of Patelloidea, and descriptions of new species of marine shells, a species of *Anculotus*, and one of *Eolis*. – Ibid. 2(2):129–189.
Fabricius, O. 1780. Fauna Groenlandica. – I. G. Rothe, Copenhagen and Leipzig: XVI + 452 pp. + 1 pl.
Golikov, A. N. 1980. Molluski Buccininae mirovogo okeana. – Fauna SSSR 5(2). Nauka, Leningrad: 465 pp. + 42 pls.
Hancock, A. 1846. A list of shells dredged on the west coast of Davis's Strait, with notes and descriptions of eight new species. – Ann. Mag. Nat. Hist. I (XVIII):323–338 & pl.V.
Hubrecht, A. A. W. 1880. *Proneomenia sluiteri* gen. et sp. n., eine neue archaische Molluskenform aus dem Eismeere. – Zool. Anz. 3:589–590.
Høisæter, T. 1986. An annotated check-list of marine molluscs of the Norwegian coast and adjacent waters. – Sarsia 71:73–145.
Høy, T. 1970. Surveying and mapping in southern Peary Land, North Greenland. – Meddr Grønland 182(3):1–50 & pl. 1–4.
Jeffreys, J. G. 1877. New and peculiar Mollusca of the Eulimidae and other families of Gastropoda, as well as of the Pteropoda, procured in the "Valorous" Expedition. – Ann. Mag. Nat. Hist. IV(XIX):317–339.
– 1883. Mediterranean Mollusca (No. 3) and other Invertebrata. – Ann. Mag. Nat. Hist. V(XI):393–401 & pl. XVI.
Jensen, A. S. 1905. On the Mollusca of East Greenland. I. Lamellibranchiata. With an introduction on Greenland's fossil Mollusc-fauna from the Quaternary time. – Meddr Grønland 29:289–362.

Just, J. 1970a. Marine biological investigations of Jørgen Brønlund Fjord, North Greenland. – Ibid. 184(5):1–42 & maps I-II.
– 1970b. Amphipoda from Jørgen Brønlund Fjord, North Greenland. – Ibid. 184(6):1–39.
– 1970c. Pycnogonida from Jørgen Brønlund Fjord, North Greenland. – Ibid. 184(7,III):23–27.
– 1970d. Cumacea from Jørgen Brønland Fjord, North Greenland. – Ibid. 184(8): 1–23.
– 1970e. Decapoda, Mysidacea, Isopoda, and Tanaidacea from Jørgen Brønlund Fjord, North Greenland. – Ibid. 184(9):1–32.
Korén, J. & Danielssen, D. C. 1877. Beskrivelse over nye Arter, henhørende til slægten *Solenopus*, samt nogle Oplysninger om dens Organisation. – Arch. Math. Naturv. 2:120–128.
Laursen, D. 1954. Emerged Pleistocene marine deposits of Peary Land (North Greenland). – Meddr Grønland 127(5): 1–26 & pl. 1.
Lemche, H. 1941. Gastropoda Opisthobranchiata. The Zoology of East Greenland. – Ibid. 121(7):1–50.
– 1948. Northern and Arctic tectibranch gastropods. – Kgl. danske Vidensk. Selsk. Skr. V(3):1–136.
– The anatomy and histology of *Cylichna*. – Spolia zool. Mus. Haun. XVI:1–278 & pls. 1–46.
Linné, C. v. 1791. Systema Naturae, 13th ed. I(6). – G. E. Beer, Leipzig: pp. 3021–3910.
Lubinsky, I. 1976. *Thyasira dunbari* n.sp. (Bivalvia: Thyasiridae) from the Canadian Arctic Archipelago. – J. Fish. Res. Bd. Can. 33(8):1667–1670.
– 1980. Marine bivalve Mollusks of the Canadian central and eastern Arctic: faunal composition and zoogeography. – Canadian Bulletin of Fisheries and Aquatic Sciences 207: 1–111.
Lützen, J. 1970. The Ascidians of Jørgen Brønlund Fjord, North Greenland. – Meddr Grønland 184(7,II):15–22.
Macpherson, E. 1971. The marine Mollusks of Arctic Canada. – Publications in Biological Oceanography 3:I-VIII & 1–149.
Madsen, F. J. 1949. Marine bivalvia. – Zoology Iceland IV(63):1–116.
Mighels, J. W. 1843. Descriptions of six species of shells regarded as new. – Boston Journal of Natural History 4:345–350 & pl. XVI.
Mighels, J. W. & Adams, C. B. 1841. Descriptions of twenty-five new species of New England shells. – Proc. Boston Soc. Nat. Hist. 1:48–50.
– 1842. Descriptions of twenty-four species of the shells of New England. – Boston Journal of Natural History 4(1): 37–54.
Montagu, G. 1803. Testacea Britannica. – J. White, London: 610 pp. + 16 pls.
Møller, H. P. C. 1842. Index Molluscorum Groenlandiae. – Naturhistorisk Tidsskrift 4(1):76–97.
Mørch, O. A. L. 1869. Catalogue des Mollusques du Spitzberg. – Annls Soc. malacol. Belg. 4:1–28.
Ockelmann, K. W. 1958. Marine Lamellibranchiata. The Zoology of East Greenland. – Meddr Grønland 122(4):1–256 & pls. 1–3.
Petersen, G. H. 1978. Life cycles and population dynamics of marine benthic bivalves from the Disko Bugt area of West Greenland. – Ophelia 17(1):95–120.
Petersen, K. S. 1986. Marine makrofaunaelementer i Kap København Formationen og Independence Fjord, Nordgrønland. – Dansk geologisk Forening, Årsskrift for 1985:35–37.
Piepenburg, D. in prep. Zur Zusammensetzung des Epibenthos in der westlichen Fram-Strasse.
Reeve, L. 1855. Account of the shells collected by Captain, Sir Edward Belcher, C. B., north of Beechey Island. – In: Belcher, E. (ed.). The last of the arctic voyages. – London: pp. 392–399 & pls. XXXII-XXXIII.
Sykes, E. R. 1905. On the Mollusca procured during the "Porcupine" expeditions, 1869–1870. Supplemental notes, part I. – Proc. malac. Soc. Lond. 6:23–40 & pl. III.
Tendal, O. S. 1970. Sponges from Jørgen Brønlund Fjord, North Greenland. – Meddr Grønland 184(7,I):3–14.
Thorson, G. 1935. Studies on the egg capsules and development of Arctic marine Prosobranchs. – Ibid. 100(5):1–71.
– 1944. Marine Gastropoda Prosobranchiata. The zoology of East Greenland. – Ibid. 121(13):1–181.
– 1951. Scaphopoda, Placophora, Solenogastres, Gastropoda Prosobranchiata, Lamellibranchiata. The Godthaab Expedition 1928. – Ibid. 81(2):1–117.
Warén, A. 1973. Revision of the Rissoidae from the Norwegian North Atlantic Expedition 1876–78. – Sarsia 53:1–14.

Instructions to authors

Two copies of the manuscript, each complete with illustrations, tables, captions, etc. should be sent to the Secretary, Kommissionen for videnskabelige Undersøgelser i Grønland. Manuscripts will be forwarded to referees for evaluation. Authors will be notified as quickly as possible about acceptance, rejection, or desired alterations. The final decision on these matters rests with the editor.

Manuscripts corresponding to less than 16 printed pages (of 6100 type units) including illustrations are not accepted, unless they are part of a special theme issue. Manuscripts that are long in relation to their content will not be accepted without abridgement.

Manuscript

Language. – Manuscripts should be in English (preferred language), French, or German. Authors who are not writing in their native language must have the language of their manuscript corrected before submission.

Place names. – All Greenland place names used in the text and in illustrations must be names authorised by The Greenlandic Language Committee. Authors are advised to submit sketch-maps with all required names to the Secretary for checking before the manuscript is submitted. Names of Greenland localities outside the area with which the paper is concerned should be accompanied by co-ordinates (longitude and latitude).

Title. – Titles should be as short as possible, with emphasis on words useful for indexing and information retrieval.

Abstract. – An abstract in English must accompany all papers. It should be short (no longer than 250 words), factual, and stress new information and conclusions.

Typescript. – Typescripts must be clean and free of handwritten corrections. Use double spacing throughout, and leave a 4 cm wide margin on the left-hand side. Avoid as far as possible dividing words at the right-hand end of a line. Consult a recent issue for general lay-out.

Page 1 should contain 1) title, 2) name(s) of author(s), 3) abstract, 4) key words (max. 10), 5) author's full postal address(es). Manuscripts should be accompanied by a table of contents, typed on separate sheet(s).

Underlining should only be used in generic and species names. The use of italics in other connections can be indicated by a wavy line in pencil under the appropriate words.

Use at most three grades of headings, but do not underline. The grade of heading can be indicated in soft pencil in the left hand margin of one copy of the typescript. Avoid long headings.

References. – References to figures and tables in the text should have the form: Fig. 1, Figs 2–4, Table 3. Bibliographic references in the text are given thus: Shergold (1975: 16) ... (Jago & Daily 1974b).

In the list of references the following style is used:

Boucot, A. J. 1975. Evolution and extinction rate controls. – Elsevier, Amsterdam: 427 pp.

Sweet, W. C. & Bergström, S. M. 1976. Conodont biostratigraphy of the Middle and Upper Ordovician of the United States midcontinent. – In: Bassett, M. G. (ed.). The Ordovician System: Proceedings of a Palaeontological Association symposium, Birmingham, September 1974: 121–151. Univ. Wales Press.

Tarling, D. H. 1967. The palaeomagnetic properties of some Tertiary lavas from East Greenland. – Earth planet. Sci. Lett. 3: 81–88.

Titles of journals should be abbreviated according to the latest (4th) edition of the World List of Scientific Periodicals and supplementary lists issued by BUCOP (British Union-Catalogue of Publications). If in doubt, give the title in full.

Meddelelser om Grønland, Bioscience (Geoscience, Man & Society) should be abbreviated thus: *Meddr om Grønland, Biosci. (Geosci., Man & Soc.)*.

Illustrations

General. – Submit two copies of all diagrams, maps, photographs, etc., all marked with number and author's name. Normally all illustrations will be placed in the text.

All figures (including line drawings) must be submitted as glossy photographic prints suitable for direct reproduction, and preferably have the dimensions of the final figure. Do not submit original artwork. Where appropriate the scale should be indicated on the illustration or in the caption.

The size of the smallest letters in illustrations should not be less than 1.3 mm. Intricate tables are often more easily reproduced as text figures than by type-setting; when lettering such tables use "Letraset" or a typewriter with carbon ribbon.

Colour plates may be included at the author's expense, but the editor must be consulted before such illustrations are submitted.

Size. – The width of figures must be that of a column (76.5 mm), 1½ columns (117 mm), or a page (157 mm). The maximum height of a figure (including caption) is 217 mm. Horizontal figures are preferred. If at all possible, fold-out figures and tables should be avoided.

Caption. – Captions to figures must be typed on a separate sheet and submitted, like everything else, in duplicate.

Proofs

Authors receive two page proofs. Prompt return to the editor is requested. Only typographic errors should be corrected in proof; the cost of making alterations to the text and figures at this stage will be charged to the author(s).

Fifty copies of the publication are supplied free, seventy-five if there are two or more authors. Additional copies can be supplied at 55% of the retail price. Manuscripts (including illustrations) are not returned to the author after printing unless specifically requested.

Copyright

Meddelelser om Grønland

Bioscience 28 · 1989

Meddelelser om Grønland

Bioscience
Geoscience
Man & Society

Published by
The Commission
for Scientific
Research
in Greenland

1989

Printed in Denmark by AiO Print as, Odense