

Brachiopoda in the Faroe Islands area

Armfótingar (Brachiopoda) í føroyskum øki

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Úrtak

Seks sløg av armfótingum (Brachiopoda) vórðu funnin í tilfari, savnað gjøgnum BIOFAR-verkætlanini: *Crania anomala* (Müller, 1776), *Hemithiris psittacea* (Gmelin, 1790) – ein tóm skel, *Terebratulina retusa* (Linné, 1758), *Platidia anomioidea* (Scacchi and Philippi, 1844) – nýtt slag fyri Føroyar, *Dallina septigera* (Lovén, 1846) og *Macandrevia cranium* (Müller, 1776). Allir føroyskir armfótingar síla føði úr sjónum og sita á botninum, ein: (*C. anomala*) er klistaður til legufast botntilfar. *H. psittacea* undantikin, er bert eitt slag bundið til eitt ávíst geografisk øki einamest á bankunum. Hetta slagið undantikin, dýpi millum 200 og 500 metrar verða tikin framum sum livistað. Tey flestu armfótingasløgini koma bara fyri har Atlantssjógvur er (Atlantic Water: hitin meira enn 7°C), eisini hevur blandingur av Atlants-sjógvi og sjógvi norðaneftir (Arctic Intermediate Water: hiti millum 3,5° og 7°) týðning, tó so at tey trívast best í sjógvi heitari enn 6°. *D. septigera* tykist tola lágan hita eisini og er tí einamest at finna í blandingini av Atlants-sjógvi og sjógvi nordanefir.

Abstract

Six brachiopod species have been recorded in the BIOFAR material: *Crania anomala* (Müller, 1776), *Hemithiris psittacea* (Gmelin, 1790) – one empty shell, *Terebratulina retusa* (Linné, 1758), *Platidia anomioidea* (Scacchi & Philippi, 1844) – new to the area, *Dallina septigera* (Lovén, 1846) and *Macandrevia cranium* (Müller, 1776).

All the Faroese brachiopods are epibenthic suspension feeders living attached or cemented (*C. anomala*) to firm substrates. Not including the record of *H. psittacea*, only one species (*P. anomioidea*) seems to be ge-

ographically restricted, occurring primarily at the banks. With the exception of this species there is a general preference for depths between 200 and 500 m.

Most of the brachiopod species are confined to the Atlantic Water (temperature above 7°C), but a mixture of Atlantic Water and Arctic Intermediate Water (temperature range 3.5-7°C) is also important, the species however, showing a preference for temperatures above 6°C. *D. septigera* seems to tolerate lower temperatures as well, and thus preferring a mixture of Atlantic Water and Arctic Intermediate Water.

Previous investigations

The first record of brachiopods in the Faroe area was published in 1786 by Nicolai Pedersen Mohr in his major work "*Forsøg til en Islandsk Naturhistorie, med adskillige oekonomiske samt andre Anmærkninger*". According to Ehrencron-Müller (1927), Mohr was born in Tórshavn, studied in Copenhagen and travelled round the Faroes in 1776-1778. In 1780 he was sent to Iceland by royal appointment to look for kaolin for the newly established Royal Porcelain Factory in Copenhagen. During this expedition (1780-1781) he also described the natural history of the areas he visited; hence the aforementioned publication.

The Faroe Brachiopoda was listed (No. 326) by Mohr as "*Anomia retusa*, L.c.". There is no indication of how many specimens or a more specific location, and the ship carrying the samples was unfortunately wrecked. Mohr also intended to write the natural history of the Faroes, but this work was never published and both the manuscript and the material have disappeared (Rostrup, 1870-71); hence it has not been possible to verify his identification. According to Mörch (1867), it is not the brachiopod *Terebratulina retusa* that is listed by Mohr, but an *Anomia*, i.e. a bivalve. Since no facts to support this were presented by Mörch (who based his paper on studies of collections and literature), Mohr's first record of Faroe brachiopoda must be regarded *cum grano salis*.

Mohr communicated his findings to O.F. Müller, who included some of them in his work from 1776 with reference to the Faroes and/or Mohr (e.g. No. 2997 *Pecten opercularis*). There is, however, no such reference in connection with the description of No. 3000 "*Anomia retusa*". Thus, Mörch (1867) probably cited the first brachiopod record from the Faroes, i.e. the rhynchonellid "*Rhynchonella rostrum psittaci* Chemn." referring to Lyell (1842 No. 14 "*Terebratula psittacea*, var.") presenting yet another dubious record. Perhaps Mörch was aware of the uncertain nature of this record as the species (No. 180) was indicated as not present (0) at the Faroe Islands in a list in the very same paper summarising the individual species. (The present investigation, however, indicates that the species, now *Hemithiris psittacea*, may occur north

of the Faroe Islands).

However, H. Müller, Sysselmand (Governor) of the Faroe Islands, was a keen collector and provider of material for the museum collections in Copenhagen and thus enabled Mörch to publish an addendum to the 1867 paper the following year. This paper listed (No. 20) a terebratulid brachiopod "*Terebratulina caput serpentis* L. (Carpenter & Thomson 1868)". The addendum "*Carpenter & Thomson 1868*" probably indicates that Dr. W. B. Carpenter and Professor Sir C. Wyville Thomson were responsible for the recovery and/or determination of the brachiopod (now *T. retusa*). Both scientists undertook oceanographic investigations off the Faroe Islands in connection with the British expedition with HMS "*Lightning*" in 1868 (Rice, 1986) and met Müller during a one-week stay in Tórshavn (Thomson, 1874). Thomson (1874) i.a. gave the first description of the relationship between brachiopods and substrate on the continental shelf off the Faroe Islands: "*The bottom was chiefly small rounded pebbles of the dark anamesite of the Færoes, and sticking to them, singly or in little groups like plums on their stems, were many large specimens of the rare brachiopod Terebratula cranium, O.F. Müller, along with abundance of the commoner form Terebratulina caput-serpentis, L.*"

Dr. J. Gwyn Jeffreys was also associated with the expeditions with HMS "*Lightning*" and the "sister" expeditions with HMS «*Porcupine*» (during 1868-69). Jeffreys (1878) also listed the aforementioned brachiopod, "*Terebratulina caput-serpentis*, Linné" (now *T. retusa*) and "*Terebratu-*

la cranium, Müller" (now *Macandrevia cranium*) from off the Faroe Islands in his account of these expeditions. According to the comprehensive monograph of recent brachiopods by the British brachiopod specialist Dr. T. Davidson "*Waldheimia (Macandrevia) cranium, Müller*" was dredged many times by Jeffreys off the Faroe Islands during these expeditions (Davidson, 1886).

Jeffreys (1878) also dredged the brachiopod "*Terebratulina septata, Philippi*" between Shetland and the Faroes. Davidson (1886), however, revised Jeffreys determination of the brachiopod, referring it to "*Waldheimia septigera, Lovén*" (now probably *Dallina septigera*).

Later, Fischer and Oehlert (1891) mentioned the occurrence of 1. "*Terebratulina caput-serpentis, Linné*" "*dans les parages des îles Færøe*", 2. "*Magellania septigera, Lovén*" dredged between the Hebrides and the Faroes, and 3. "*Magellania (Macandrevia) cranium, O.-F. Müller*" also from off the Faroes. Fischer and Oehlert based this information on the results of the "*Lightning*" and "*Porcupine*" expeditions. They also reported an inarticulate brachiopod, "*Crania anomala, Müller*" from off the Faroes referring to the "*Lightning*" expedition (cf. Jeffreys, 1878).

Posselt, in his posthumous published paper on the brachiopods and molluscs from Greenland (Posselt, 1898) mentioned the occurrence of three brachiopod species off the Faroe Islands, "*Rhynchonella psittacea* (Gmelin)", "*Terebratulina caput serpentis* (Linné)" and "*Waldheimia cranium* (Müller)". Whereas the last two were said to be

present in the collection of the Zoological Museum in Copenhagen, the first was "*fide Mørch*", which means that Posselt did not actually see it in the collections. "*W. cranium*" (now *Macandrevia cranium*) was also recorded from between the Faroe Islands and Shetland.

Friele and Grieg (1901), Hägg (1905) and Arndt and Grieg (1933) presented data from important expeditions in the North Atlantic during the period 1876-1900. However, their records of brachiopods from the waters surrounding the Faroe Islands are merely based on previously published material. Thus, both Friele and Grieg (1901) and Arndt and Grieg (1933) stated that the southern limit for the distribution of "*Rhynchonella psittacea*" (now *Hemithiris psittacea*) was at the Faroes. This statement was probably based on the previously mentioned record presented by Mørch (1867).

Pawsey and Davis (1924), however listed two brachiopod species, "*Terebratulina caput serpentis* (Linnaeus)" and "*Macandrevia cranium* (O.F. Müller)", from two fishery research expeditions to Lousy Bank and adjacent areas in 1920 (S/T "*Nicholas Dean*") and 1921 (R/V "*George Bligh*"). Only a few specimens were recovered.

Helmcke (1939a) gave an account of the comprehensive collection of Professor F. Blockmann at the Zoological Museum in Berlin. A specimen (No. 934) of "*Dallina septigera* (Lovén)" was listed as "typen" from deep water (1000-1300m) south of the Faroe Islands. The paper did not, however, give any indication of who the legislator was or the name of the expedition etc., but

it was nevertheless referred to by Wesenberg-Lund (1940).

Wesenberg-Lund was the first to present a synopsis of the Faroe brachiopods. Her paper (Wesenberg-Lund, 1940) was based partly on few and old specimens at the Zoological Museum in Copenhagen, partly on published references. Generally the material comprised only a few specimens from each locality and only a few specimens from the Danish expeditions in the 1920s. Wesenberg-Lund concluded that brachiopods were rare on the continental shelf off the Faroes. As will be demonstrated in the present paper, this conclusion was wrong, probably due to the inadequacy of the sampling methods (O.S. Tendal, pers. comm.). Wesenberg-Lund listed seven species and showed their distribution on two maps of the area investigated. The species were: "1. *Crania anomala* (O.F. Müll.), 2. *Hemithyris psittacea* (Gmelin), 3. *Terebratulina caput serpentis* (L.), 4. *Terebratulina septentrionalis* Couthouy, 5. *Terebratella spitsbergensis* Davidson, 6. *Waldheimia (Macandrevia) cranium* (O.F. Müller), 7. *Waldheimia septigera* (Lovén)". The records in Wesenberg-Lund (1940) of two of these (Nos. 4 and 5) must now be considered dubious, thus *T. septentrionalis* was represented by only one specimen, and *T. spitsbergensis* (now *Glaciarcula spitsbergensis*) by only three specimens (one specimen being referred to *T. retusa* by G. Curry, O.S. Tendal pers. comm.). In addition *H. psittacea* was not present in the museum collection.

Wesenberg-Lund concluded that future investigations would probably not increase

the number of species, a prediction that has so far proved correct. She also suggested that species found in neighbouring areas might occur off the Faroes. So far, this has only been confirmed for *Platidia anomoides* (Scacchi & Philippi, 1844), a single specimen of which was previously recorded by the "Porcupine" expedition, north off the Shetlands.

In 1941 Wesenberg-Lund published a paper on the systematics and geographical distribution of the brachiopods in the Atlantic north of 50°N. The main object was to present the brachiopods of the "Ingolf" expedition in the collection of the Zoological Museum in Copenhagen. This Danish expedition took place in 1895 and 1896. However, brachiopods from later expeditions ("Michael Sars", "Thor" and "Dana") were also included, see previous published records in the systematic part of this paper. A total of 10 species were listed, including the seven species mentioned previously (Wesenberg-Lund, 1940).

According to Wolf (1995), the "Ingolf" expedition was the first Danish investigation of the deep sea surrounding Iceland and off south-west Greenland. Both cruises took place via the Faroes. Wesenberg-Lund (1941) records five brachiopod species from stations situated within the present study area: *Crania anomala*, *Terebratulina retusa*, *T. septentrionalis*, "*Diesthothyris spitzbergensis*" (now *Glaciarcula spitzbergensis*) and "*Waldheimiathyris cranium*" (now *Macandrevia cranium*). For information on the expeditions with "Michael Sars", "Thor" and "Dana" see Tendal and Bruntse (2001).

An important part of the paper by Wesenberg-Lund (1941) for the present study is the description of the two superficially similar looking *Terebratulina* species. For this purpose, Wesenberg-Lund used several features pertaining to the morphology of the shell. She concluded that the two species either represented a morphologically based cline with intermediate forms, or were two different races (subspecies) caused by different ecological conditions. This problem has since been investigated using principal component analysis on a morphological study of the shells (Curry and Endo 1991) and DNA and immunological analysis of the intracrystalline shell proteins (Cohen *et al.*, 1991). Both studies confirmed the presence of two valid species with no intermediate forms.

In 1990, the present author published a paper concerned with the application of brachiopods in palaeoceanographic reconstructions (Thomsen, 1989). This paper dealt mainly with *Macandrevia cranium* (Müller, 1776) and established the recent biogeography of this species based on published information and unpublished records. The biogeography shows that *M. cranium* is almost completely confined to the shelves surrounding the North Atlantic and the Norwegian-Greenland Sea. When this distribution pattern is compared with published information on autecology and possible limiting environmental factors, the conclusion reached is that there is substantial evidence for the pattern being a function of dispersal by the Gulf Stream (cf. Helmcke, 1939b) and its continuations, i.e. the North Atlantic Current, the Norwegian

Current and the North Cape Current. Thus the stratigraphical occurrence of *M. cranium* in Late Weichselian-Holocene sediments on the Norwegian shelf may be used as an important marker for the presence of Atlantic Water and the final intrusion of Atlantic Water masses. In connection with this study, the distribution of *M. cranium* on the Faroe platform was mapped (Thomsen, 1989) based on Wesenberg-Lund (1940, 1941) and O.S. Tendal (pers. comm., Nørrevang *et al.*, 1994). It confirmed the affinity of the species to the Atlantic Water (also demonstrated in the present paper). Curry and Endo (1991) later also found a palaeoceanographic connection when studying the distribution of the two terebratuliniids in the North Atlantic. They concluded that *T. retusa* has its main distribution in the eastern North Atlantic and *T. septentrionalis* in the western North Atlantic, with the exception of a supposed relict occurrence of *T. retusa* off Finnmark, northern Norway. However, Thomsen and Brattegard (1997) recorded *T. septentrionalis* from Hordaland northwards into the Barents Sea.

Recently, Pakhnevich (1997) has studied the size and age characteristics of *Macandrevia cranium* based on two trawl samples, one of which was recovered by the R/V "Sevastopol" south-west off the Faroes in 1959.

The BIOFAR programme

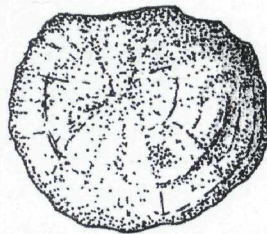
The BIOFAR programme (Investigations on the marine benthic fauna of the Faroe Islands) is a Nordic research programme (Nørrevang *et al.*, 1994). The aim of the programme is to study the marine benthic

invertebrate fauna of the Faroe Islands at depths deeper than 100 m in order to supplement and update previously published information. A bibliography of benthic marine invertebrates of the Faroese Economic Exclusive Zone has recently been published by Bruntse and Tendal (2001).

Nørrevang *et al.* (1994) give an account of the sampling, databases and a complete list of sampling stations with details of location, date, water depth, applied gear and environmental parameters (bottom temperature, water mass, bottom current velocity, sediment etc.). This list include five stations sampled by T. Brattegard in 1983 and 13 stations sampled by T. Brattegard and J.-A. Snæli in 1986-1987 (Brattegard and Meland, 1997). An overview of the benthic temperature in the investigated area was presented by Westerberg (1990). The main part of the sampling took place during 1987-1990 and 1991-1993, mainly from depths of 100-1000 m. Altogether ca. 600 localities were sampled.

Material and methods

The main part of the BIOFAR material described in this paper was recovered by the Faroese R/V "Magnus Heinason" and the Norwegian R/V "Håkon Mosby" using benthic sampling gear (cf. Nørrevang *et al.*, 1994). Brachiopods were present in samples from 187 stations. They were collected with five different gears: a heavy and sturdy triangular dredge (97 stns/ca. 52%), a detritus sledge (60 stns/ca. 32%), a scallop dredge (13 stns/ca. 7 %), a fine-meshed



Crania anomala

x 2,3

Thomsen 2001

bottom trawl (10 stns/ca. 5%), and a modified Rothlisberg and Percy epibenthic sampler (7 stns/ca. 4%).

The brachiopods were fixed in strongly buffered 4% formaldehyde-seawater, later replaced by 70% ethanol, and were preliminary sorted out from the other fauna by the staff of the Kaldbak Marine Laboratory.

Systematics

Information on each species follows the scheme of Brattegard and Meland (1997).

Class INARTICULATA

Order ACROTRETIDA

Family CRANIIDAE

Genus *Crania* Retzius, 1781

Crania anomala (Müller, 1776) (Fig. 1)

Synonyms: *Patella anomala* Müller (1776); *Orbicula norvegica* Lamarck (1801).

Recent description: Brunton and Curry (1979: 26-27, fig. 11).

Previous published records: "Lightning": Stn 4, 59°36'N, 7°20'W, 530 fm; Stn 5, 59°5'N, 7°29'W, 189 fm (Jeffreys, 1878). "Michael Sars": Stn 44, 62°16'N, 5°54'W (6°06'W in stationlist), 103 m; Stn 57, 62°29'N, 5°17'W, 301 m; Stn 82,

61°09'N, 7°54'W, 341 m (Wesenberg-Lund, 1940). "Dana": Stn 2969, 62°45'N, 6°44'W, 290 m; Stn 5840, 62°44'N, 6°06'W, 330 m (Wesenberg-Lund, 1940). "Ingolf": Stn 1, 62°30'N, 8°21'W, 248 m (Wesenberg-Lund, 1941).

"Michael Sars": Stn 45, 62°17'N, 4°57'W, 275 m; Stn 58, 62°26'N, 4°49'W, 430 m; Stn 59, 62°38'N, 4°40'W, 670 m; Stn 63, 61°21'N, 5°12'W, 400 m; Stn 64, 61°10'N, 5°46'W, 300 m (Wesenberg-Lund, 1941). Expedition unknown: 61°16'N, 6°42'W, 282 m (Wesenberg-Lund, 1940).

Additional records: "Diana": 61°40'N, 7°40'W, 254m.

"Guldborgsund": 13 kvml west to south of Munken; 9 kvml east-southeast of Bispen;

Akræleiti. "Margrethe": 61°35'N, 7°11'W.

BIOFAR stations: 116, 190, 205, 234, 269, 281, 283, 287, 288, 309, 311, 323, 332, 333, 344, 345, 349, 352, 353, 359, 364, 400, 401, 454, 472, 473, 504, 506, 509, 514, 518, 520, 522, 528, 589, 599, 620, 621, 716, 747, 760.

Areas: Around the Faroe Islands and the banks south-west of the islands.

Depth range: 135-520 m (38 stns/93% 200-500 m).

Estimated average bottom temperature: 2.9-8.6°C (36 stns/88% > 6°C, 30 stns/75% > 7°C).

Water masses: AW (31 stns), AW/AI (9 stns), AI (1 stn).

Sediment: Most often sand (including shellsand),

gravel, cobbles and stones.

Substrate: Requires hard substrates e.g. pebbles and shells of bivalves.

Atlantic distribution: The Canary Islands; south of England; south, west and north of Ireland; west of Scotland; Shetland; the Hebrides; the Faroes; Iceland; between Iceland and Greenland; west of Sweden; Norway; Spitsbergen (Wesenberg-Lund, 1941; Brunton and Curry, 1979).

Atlantic depth range: 15-165 m (most common), 183-914 m (less frequent, max record 1484 m) (Brunton and Curry, 1979).

Class ARTICULATA

Order RHYNCHONELLIDA

Family HEMITHYRIDIDAE

Genus *Hemithiris* d'Orbigny, 1847

Hemithiris psittacea (Gmelin, 1790) (Fig. 2)

Synonyms: ? *Anomia rostrum psittaci* Chemnitz

(1785); *Anomia psittacea* Gmelin (1790); *Terebratula psittacea* Lyell (1842); *Rhynchonella rostrum psittaci* Mörch (1867); *Rhynchonella psittacea* Davidson (1887); *Rhynchonella psittacea* Arndt and Grieg (1933); *Hemithyris psittacea* Wesenberg-Lund, (1940, 1941).

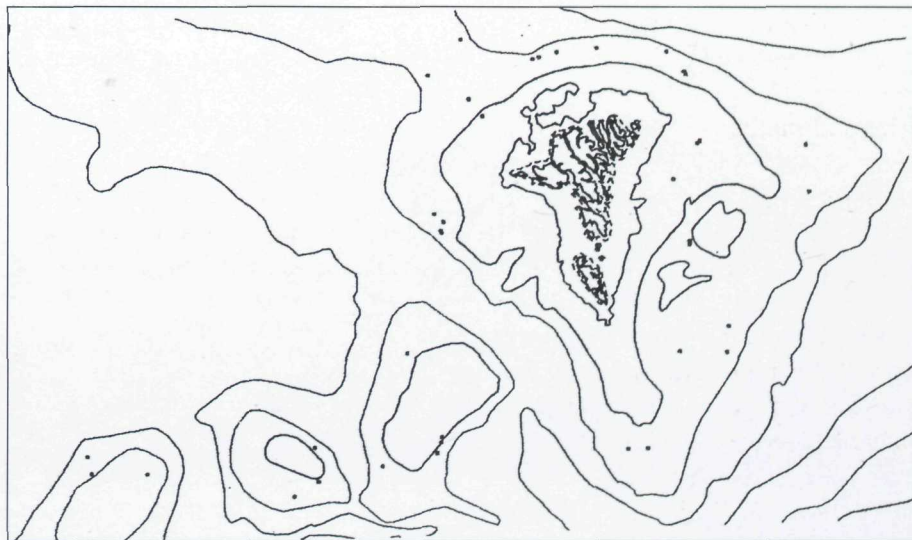


Fig. 1. *Crania anomala*

Recent description: Brunton and Curry (1979: 32-33, fig. 14).

Previous published record: "occurring in Greenland and the Feroe Islands" (Beck and Sowerby in Lyell, 1842 – quoted by Mörch, 1867).

BIOFAR station: 473+ (+ = empty shell, not fossil).

Area: Northeast of the Faroe Islands.

Depth: 198 m.

Estimated bottom temperature: 7.7°C.

Water mass: AW.

Sediment: Shellsand and cobbles.

Atlantic distribution: South, west and northeast of Ireland; Shetland; the Orkneys; the Hebrides; the North Sea; Norway (north of Trondheim); south of Iceland; Spitsbergen; Greenland; east of Canada and U.S.A. (Wesenberg-Lund, 1939, 1941; Brunton and Curry, 1979; Thomsen and Brattegard, 1997).

Atlantic depth range: 15-1096 m not only Atlantic! (Brunton and Curry, 1979).

Order TEREBRATULIDA

Suborder TEREBRATULIDINA

Family CANCELLOTHYRIDIDAE

Genus *Terebratulina* d'Orbigny, 1847

Terebratulina retusa (Linné, 1758) (Fig. 3)

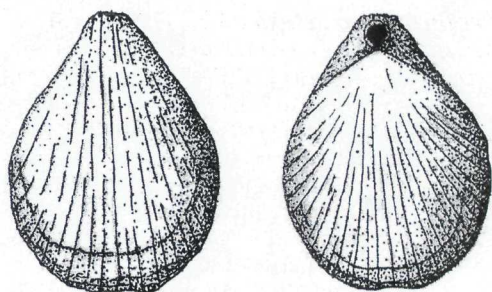
Synonyms: *Anomia retusa* Linné (1758); *Anomia caput-serpentis* Linné (1767); *Terebratulina caput-serpentis* Jeffreys (1878); *Terebratulina caput-serpentis* Davidson (1886); *Terebratulina caput-serpentis* Wesenberg-Lund, (1940).

Descriptions: Wesenberg-Lund, (1941: 6-8, fig. 1-2); Brunton and Curry (1979: 38-39, fig. 17).

Previous published records: "Lightning": Unknown location off the Faroes (Mörch, 1868). "Lightning": Stn 4, 59°36'N, 7°20'W, 530 ftn (Jeffreys, 1878). "Porcupine": Stn 61, 62°1'N, 5°19'W, 114 ftn (Jeffreys, 1878). "Diana": 61°40'N, 7°40'W, 254 m (Wesenberg-Lund, 1940). "Guldborgsund": South of Nolsø, 150 m (probably 16 km) east-southeast of Nolsø (Wesenberg-Lund, 1940). "Michael Sars": Stn 44, 62°16'N, 5°44'W, 95-115 m; Stn 44, 62°16'N, 5°54'W (6°06'W in stationlist), 103 m; Stn 57, 62°29'N, 5°17'W, 301 m; Stn 77, 60°25'N (60°23'N in stationlist), 8°55'W, 338 m; Stn 82, 61°09'N, 7°54'W, 341 m (Wesenberg-Lund, 1940). "Dana": Stn 5702, 61°21'N, 6°22'W, 282 m; Stn 5840, 62°44'N, 6°06'W, 330 m (Wesenberg-Lund, 1940). "Ingolf": Stn 1, 62°30'N, 8°21'W, 248 m; Stn 3, 63°35'N, 10°24'W, 512 m (Wesenberg-Lund, 1941). "Michael Sars": Stn 45, 62°17'N, 4°57'W, 275 m; Stn 58, 62°26'N,



Fig. 2.. *Hemithyrir psittacea*



Terebratulina retusa x 2,3 Thomsen 2001

4°49'W, 430 m; Stn 64, 63°10'N, 5°46'W, 300 m (Wesenberg-Lund, 1941). "Dana": Stn 6004, 62°06'N, 10°40'W, 437 m (Wesenberg-Lund, 1941). Expedition unknown: At present not in the collection of the Zoological Museum in Copenhagen: 61°35'N, 6°25'W, 200 m; 61°46'N, 8°21'W, 200 m (Wesenberg-Lund, 1940). Expedition and location unknown: At present not in the collection of the Zoological Museum in Copenhagen: The Faroe Islands (Posselt, 1898).

Additional records: "Ingolf": Stn 2, 63°04'N, 9°22'W, 493 m. "Guldborgsund": 13 kvml west to south of

Munken; 9 kvml east-southeast of Bispnen; Akraleiti. "Michael Sars": Stn 63, 61°21'N, 5°12'W, 400 m. "Margrethe": 61°35'N, 7°11'W. "Dana": Stn 2969, 62°45'N, 6°44'W, 290 m.

BIOFAR stations: 019, 027, 033, 043, 045, 049, 068, 069, 070, 089, 090, 097, 115, 116, 119, 131, 138, 145, 146, 147, 149, 150, 152, 153, 156, 163, 190, 205, 233, 234, 235, 267, 269, 279, 281, 282, 283, 285, 286, 287, 288, 289, 290, 295, 307, 308, 309, 311, 319, 322, 323, 324, 327, 328, 329, 331, 332, 333, 334, 345, 346, 352, 354, 357, 358, 359, 373, 382, 397, 398, 399, 400, 401, 411, 451, 453, 454, 468, 469, 470, 471, 474, 475, 476, 481, 482, 483, 484, 486, 488, 495, 497, 504, 514, 515, 518, 520, 522, 523, 524, 528, 529, 532, 535, 539, 546, 587, 589, 595, 604, 620, 621, 689, 690, 691, 695+, 716, 717, 718, 724, 725, 726, 728, 747, 760.

Area: Around the Faroe Islands and the banks south-west of the islands.

Depth range: 140-702 m (105 stns/84% 200-500 m).

Estimated average bottom temperature: 0-8.6°C (110 stns/88% > 6°C, 87 stns/70% > 7°C).

Water masses: AW (88 stns), AW/AI (32 stns), AI (1 stn), NW/AI (3 stns), NW (1 stn).

Sediment: Most often sand (including shellsand), gravel, cobbles and stones.

Substrate: Other articulate brachiopods and conspecific individuals, serpulids, corals e.g. *Lophelia*, bi-

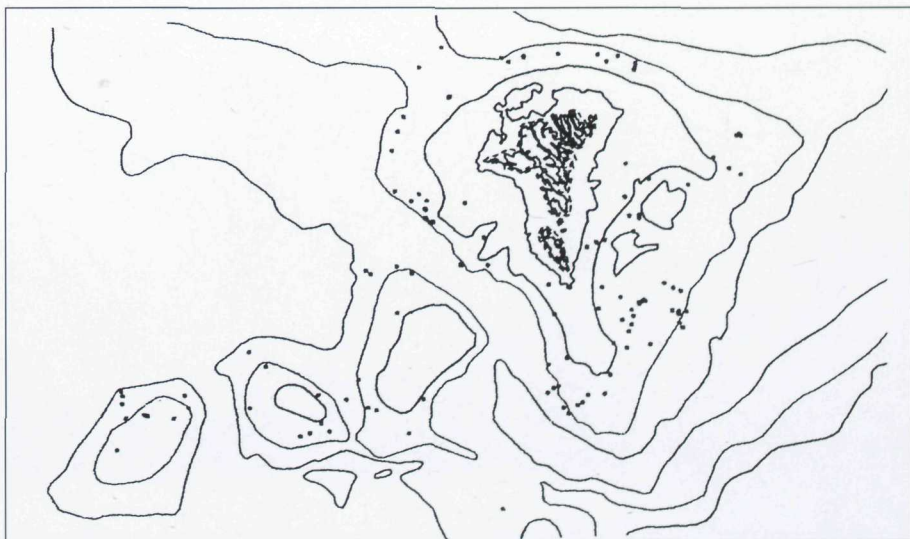


Fig. 3. *Terebratulina retusa*

valves, fragments of bivalves and gastropods, and pebbles.

Atlantic distribution: The Canary Islands; Spain; France; west of Ireland; west of Scotland; the Faroes; Iceland; west of Sweden; Norway; Spitsbergen (Wesenberg-Lund, 1941; Curry and Endo, 1991).

Atlantic depth range: 15-1478 m (Brunton and Curry, 1979); most common above 600 m (Wesenberg-Lund, 1941).

Terebratulina septentrionalis (Couthouy, 1838)

Synonyms: *Terebratula septentrionalis* Couthouy (1838); *Terebratula septentrionalis* Sowerby (1846); *Terebratulina septentrionalis* Davidson (1886); *Terebratulina septentrionalis* Wesenberg-Lund, (1940).

Descriptions: Wesenberg-Lund, (1941: 8-9, fig. 3); Brunton and Curry (1979: 40-41, fig. 18).

Previous published records: "Ingolf": Stn 3, 63°35'N, 10°24'W, 512 m (Wesenberg-Lund, 1941).

"Michael Sars": Stn 64, 61°10'N, 5°46'W, 300 m (Wesenberg-Lund, 1941). Expedition unknown.

"Guldborgsund"? East of Akraleiti, Suderø, 282 m (Wesenberg-Lund, 1940).

BIOFAR station: Not recorded by BIOFAR.

Atlantic distribution: Norway (north of Hordaland);

west of Greenland; east of Canada and U.S.A.

(Curry and Endo, 1991; Thomsen and Brattegard, 1997).

Atlantic depth range: 0-1238 m (Brunton and Curry, 1979).

Suborder TEREBRATELLIDINA

Family PLATIDIIDAE

Genus *Platidia* Costa, 1852

***Platidia anomioides* (Scacchi & Philippi, 1844)**

(Fig. 4)

Synonyms: *Orthis anomioides* Scacchi and Philippi (1844); *Morrisia anomioides* Davidson (1852); *Platydia anomioides* Jeffreys (1878); *Platydia anomioides* Davidson (1887).

Recent description: Brunton and Curry (1979: 48-49, fig. 24).

Previous published records: None, but Wesenberg-Lund, (1940) suggested that the species perhaps could be found at the Faroe Islands as it has been taken by «*Porcupine*» north of Shetland.

BIOFAR stations: 302, 492, 497, 498, 516, 524.

Area: Southwest of Faroe Islands (Lousy bank, Bill Bailey Bank, Faroe Bank, Wyville-Thomson Ridge).

Depth range: 398-916 m.

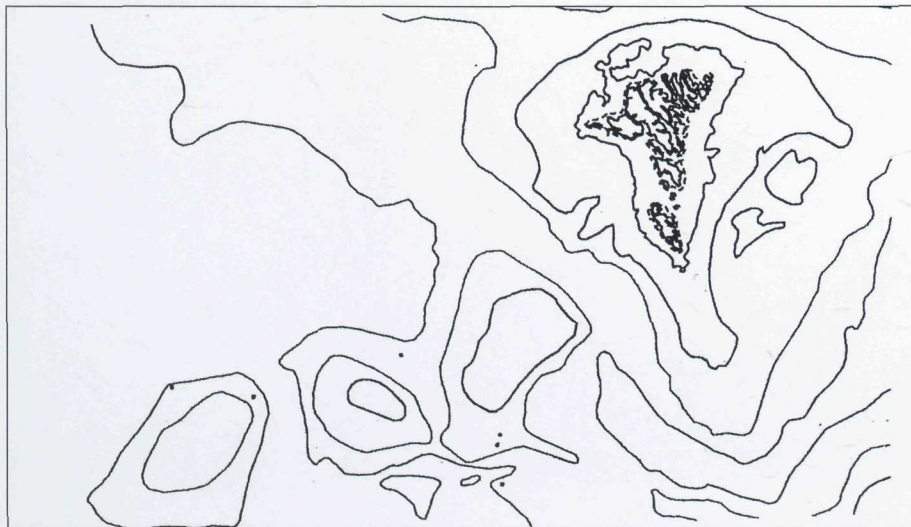
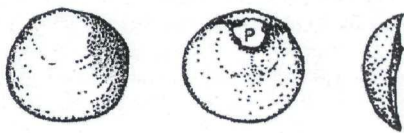


Fig. 4. *Platidia anomioides*

*Platidia anomioides*

x 2,3

P = pedicle

Thomsen 2001

Estimated average bottom temperature: 6.7-8.3°C.

Water masses: AW (5 stns), AW/AI (1 stn).

Sediment: Softbottom, sand, gravel, cobbles and stones.

Substrate: Pebbles, fragment of *Lophelia* ?

Atlantic distribution: Portugal; Bay of Biscay; west of Ireland; Western Approaches; the Hebrides; north of Shetland; Florida (Jeffreys, 1878; Brunton and Curry, 1979).

Atlantic depth range: 50-1340 m (Williams *et al.*, 1965), but 82-741 m (not only Atlantic) according to Brunton and Curry (1979).

Family DALLINIDAE

Genus *Dallina* Beecher, 1893

Dallina septigera (Lovén, 1846) (Fig. 5)

Synonyms: *Terebratula septigera* Lovén (1846); *Terebratula septata* Jeffreys (1878); *Waldheimia septigera* Davidson (1886); *Magellania septigera* Fischer and Oehlert (1891); *Waldheimia septigera* Friele and Grieg (1901); *Waldheimia septigera* Wesenberg-Lund, (1940).

Recent description: Brunton and Curry (1979: 55, fig. 28).

Previous published records: "Porcupine": Stn 65, 61°10'N, 2°21'W, 345 ftn (Jeffreys, 1878).

"Michael Sars": Stn 82, 61°09'N, 7°54'W, 341 m (Wesenberg-Lund, 1940). "Dana": Stn 2575, 61°10'N, 7°15'W, 383 m; Stn 5840, 62°44'N, 6°06'W, 330 m (Wesenberg-Lund, 1940).

"Michael Sars": Stn 79a, 61°08'N, 9°46'W, 850 m; Stn 85, 62°53'N, 9°06'W, 390 m (Wesenberg-Lund, 1941). Expedition unknown: South of the Faroes (Helmcke, 1939a).

Additional records: "Michael Sars": Stn 58, 62°26'N, 4°49'W, 430 m. "Dana": Stn 5866, 62°27'N, 4°54'W, 450 m; Stn 5950, 61°30'N, 8°52'W, 515m.

BIOFAR stations: 019, 049, 068, 070, 089, 097, 115, 118, 119, 120, 122, 145, 146, 190, 199, 269, 285,

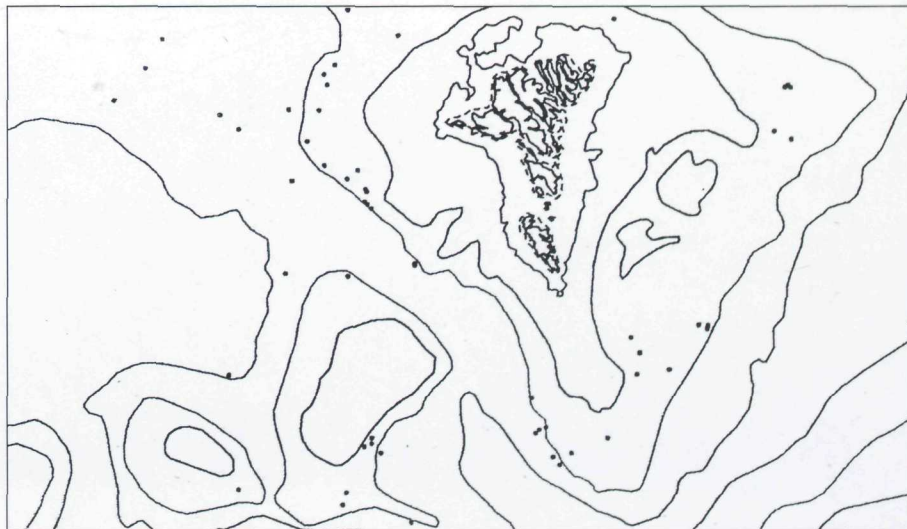
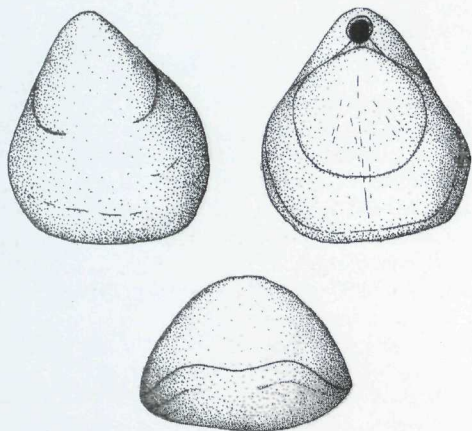


Fig. 5. *Dallina septigera*

*Dallina septigera*

x 2,3

Thomsen 2001

287, 289, 290, 297, 298, 299, 305, 307, 328, 329, 331, 332, 333, 334, 341, 344, 346, 352, 354, 358, 359, 382, 397, 400, 401, 411, 418, 419, 420, 451, 452, 453, 454, 467, 468+, 469, 470, 483, 486, 490, 497+, 498, 499, 503, 504, 507, 532, 535, 536, 698, 716, 717, 725, 726, 727, 734, 747, 760.

Area: Around the Faroe Islands.

Depth range: 145-1083 m (62 stns/83% 200-600 m), (Helmcke, 1939a: 1000-1300 m).

Estimated average bottom temperature: 1.5-8.3°C (51 stns/68% > 6°C).

Water masses: AW (28 stns), AW/AI (40 stns), AI (2 stns), NW/AI/AW (5 stns).

Sediment: Sand (including shellsand), gravel, cobbles and stones, the coarser fractions dominate.

Substrate: Pebbles, fragments of bivalves, other brachiopod species and serpulids.

Atlantic distribution: The Canary Islands; west of Portugal; northwest and southwest of Ireland; north of Scotland; Shetland; south of Iceland; Norway (south of Sørøya and north of Rogaland) (Wesenberg-Lund, 1941; Brunton and Curry, 1979; Thomsen and Brattegard, 1997).

Atlantic depth range: 219-1300 m (Helmcke, 1939a; Brunton and Curry, 1979).

Genus *Glaciarcula* Elliott, 1956

Glaciarcula spitzbergensis (Davidson, 1852)

Synonyms: *Terebratella spitzbergensis* Davidson (1852, 1886); *Terebratalia spitzbergensis* Dall (1920); *Diestothyris spitzbergensis* Thomson (1927); *Terebratella spitzbergensis* Wesenberg-Lund, (1940); *Diestothyris spitzbergensis* Wesen-

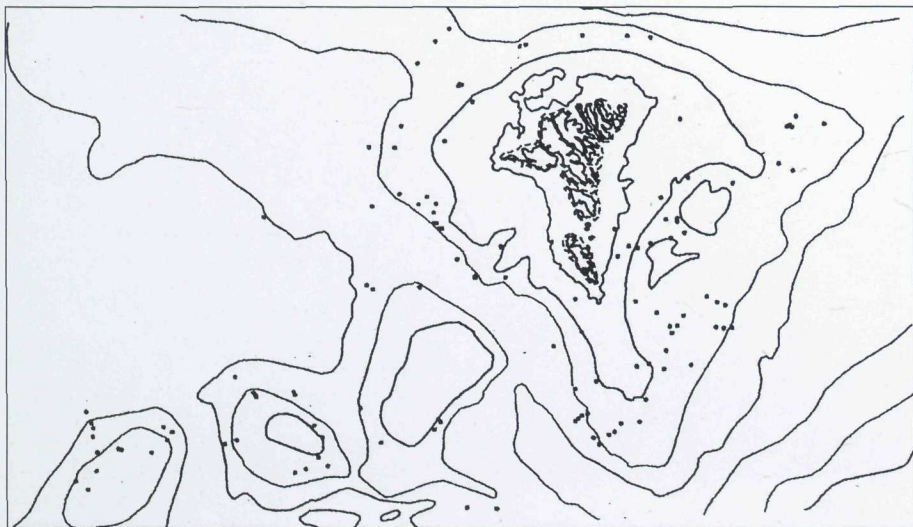


Fig. 6. *Macandrevia cranium*

berg-Lund, (1941).

Recent description: Brunton and Curry (1979: 57, fig. 29).

Previous published records: "Guldborgsund": South of Munken, south of Suderø, 282 m (Wesenberg-Lund, 1940), this record is dubious as one specimen has been identified as *T. retusa* by G. Curry in 1990 (O.S. Tendal, pers. comm.). "Michael Sars": Stn 77, 60°23'N, 8°55'W, 338 m (Wesenberg-Lund, 1940). "Ingolf": Stn 3, 63°35'N, 10°24'W, 512 m (Wesenberg-Lund, 1941).

BIOFAR stations: Not recorded by BIOFAR.

Atlantic distribution: West of Spain; Shetland; the Scilly Islands; the Faroes; Norway (north of Trondheim); Spitzbergen; Iceland; Greenland; east of Canada (Wesenberg-Lund, 1940, 1941; Brunton and Curry, 1979; Thomsen and Brattegard, 1997).

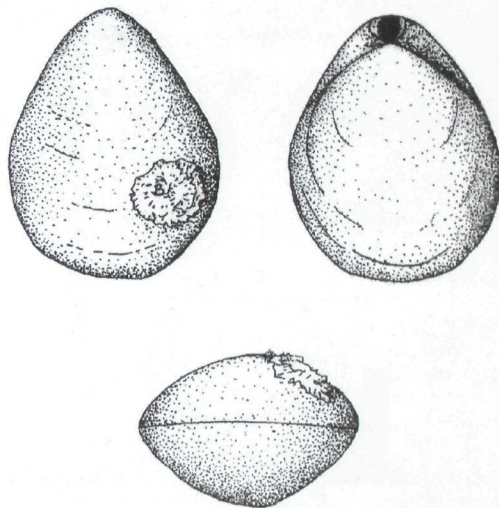
Atlantic depth range: 73-704 m in British waters (Brunton and Curry, 1979).

Genus *Macandrevia* King, 1859

Macandrevia cranium (Müller, 1776) (Fig. 6)
Synonyms: *Terebratula cranium* Müller (1776); *Terebratula cranium* Jeffreys (1878); *Waldheimia (Macandrevia) cranium* Davidson (1886); *Magellania (Macandrevia) cranium* Fischer and Oehlert (1891); *Waldheimia cranium* Posselt (1898); *Waldheimia (Macandrevia) cranium* Wesenberg-Lund, (1940); *Waldheimiathyris cranium* Wesenberg-Lund, (1941).

Recent description: Brunton and Curry (1979: 58, fig. 30).

Previous published records: "Lightning": Stn 4, 59°36'N, 7°20'W, 530 ftn; Stn 5, 59°5'N, 7°29'W, 189 ftn; Stn 7, 61°2'N, 12°4'W, 650 ftn; Stn 8, off the Faroes, 164 and 208 ftn (Jeffreys, 1878). "Porcupine": Stn 61, 62°1'N, 5°19'W, 114 ftn (Jeffreys, 1878). "Diana": 61°40'N, 7°40'W, 250 m (Wesenberg-Lund, 1940). "Guldborgsund": 13 miles southwest of Munken, 282 m; Southeast of Munken, 285 m; South of Nolsø, 150 m (Wesenberg-Lund, 1940). "Michael Sars": Stn 44, 62°16'N, 5°54'W (6°06'W in stationlist), ca. 100m; Stn 57, 62°29'N, 5°17'W, 190 m; Stn 57, East of Fuglø, 301 m (359 m in stationlist); Stn 64, 61°10'N, 5°46'W, 282 m (Wesenberg-Lund, 1940); Stn 82, 61°09'N, 7°54'W, 341 m (Wesenberg-Lund, 1940). "Thor": Stn 99, 61°15'N, 9°35'W, ca. 900 m (Wesenberg-Lund, 1940).



Macandrevia cranium x 2,3

B = Bryozo

Thomsen 2001

"Dana": Stn 2575, 61°10'N, 7°15'W, 383 m; Stn 2969, 62°45'N, 6°44'W, 204 m; Stn 3052, 62°03'N, 6°11'W, 118 m; Stn 5840, 62°44'N, 6°06'W, 330 m; Stn 6005, 62°19'N, 8°51'W, 475-504 m; Stn 6007, 62°07'N, 8°35'W, 375 m (Wesenberg-Lund, 1940). "Dana": At present not in the collection of the Zoological Museum in Copenhagen: Stn 5866, 62°27'N, 4°54'W, 450 m; Stn 6009, 61°47'N, 7°04'W, 220 m (Wesenberg-Lund, 1940). "Ingolf": Stn 46, 61°32'N, 11°36'W, 1375 m (Wesenberg-Lund, 1941). "Michael Sars": Stn 45, 62°17.5'N, 4°57'W, 275 m; Stn 54, 62°29'N, 4°52'W, 210 m; Stn 58, 62°26'N, 4°49'N, 430 m; Stn 63, 61°21'N, 5°12'W, 400 m; Stn 69, 62°04'N (62°40'N in Wesenberg-Lund, 1941), 4°19'W, 390 m (Wesenberg-Lund, 1941). "Thor": Stn 1 (1904), 61°35'N, 4°39'W (Wesenberg-Lund, 1941). "Dana": Stn 6001, 63°33'N, 11°25'W, 322 m (Wesenberg-Lund, 1941). "Sevastopol": Stn 2584, Southwest of the Faroes, 220 m (Pakhnevich, 1997). Ekspeditions unknown: 2 stns, the Faroes and between the Faroes and the Shetlands (Posselt, 1898). Expedition unknown: 61°18'N, 8°47'W (Wesenberg-Lund, 1940). Expedition unknown: At present not in the collection of the Zoological Museum in Copenhagen, 61°27'N, 6°25'W, 282 m; 61°32'N, 6°30'W, 200 m (Wesenberg-Lund, 1940).

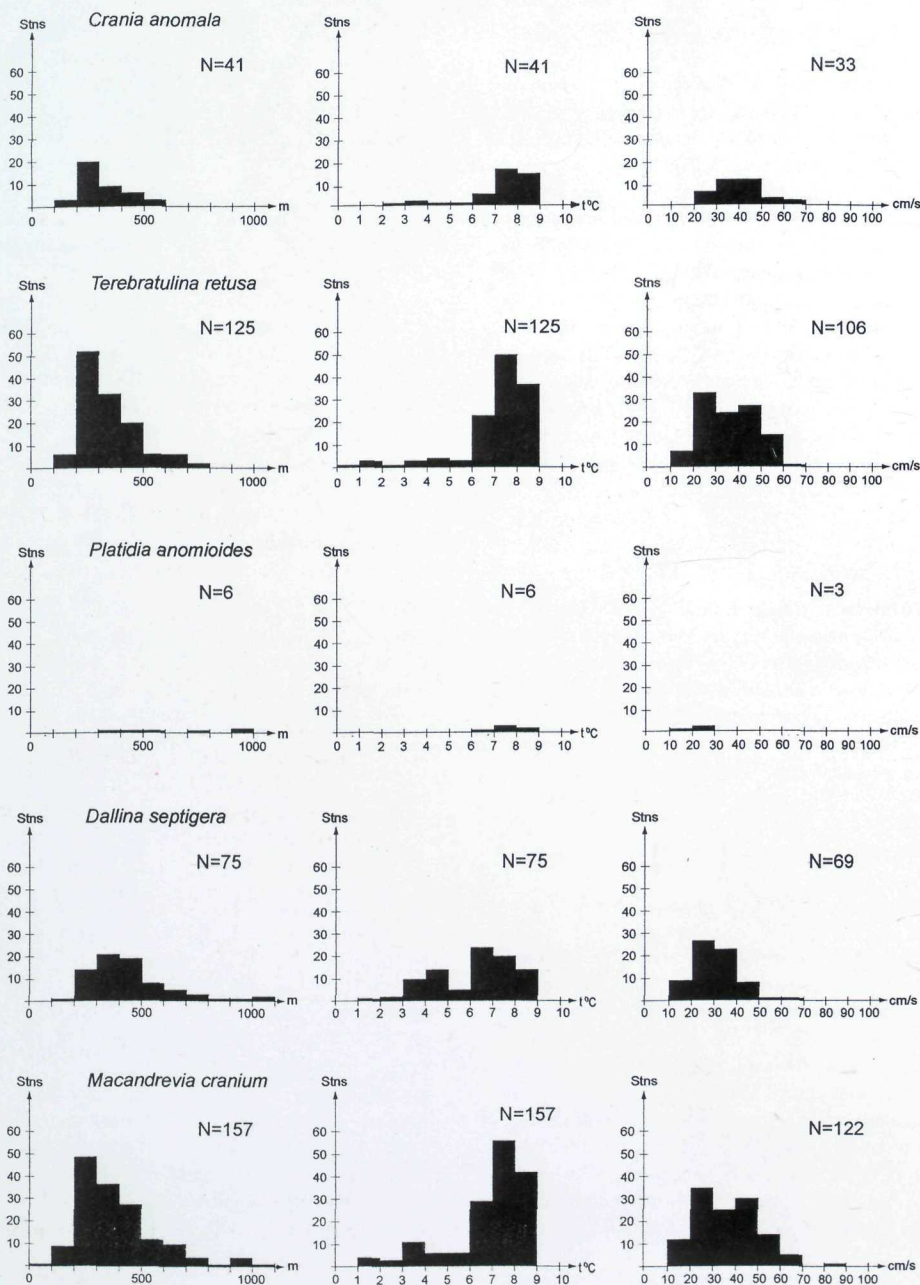


Fig. 7. Bathymetric distribution (left). Temperature (middle). Current (right)

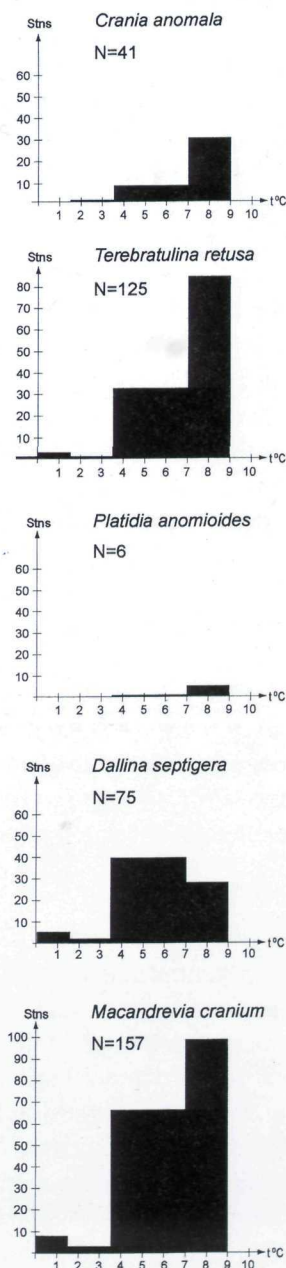


Fig. 8. Water mass.

BIOFAR stations: 007, 019, 027, 033, 043, 044, 045, 049, 068, 069, 070, 089, 090, 097, 098, 100, 115, 116, 119, 120, 131, 137, 138, 145, 146, 147, 149, 150, 153, 154, 156, 158, 163, 175, 190, 233, 234, 235, 268, 269, 279, 281, 282, 283, 285, 286, 287, 288, 289, 290, 297, 299, 307, 308, 309, 311, 313, 314, 315, 317, 319, 323, 328, 329, 330, 331, 332, 333, 334, 335, 344, 345, 346, 347, 349, 352, 353, 354, 358, 359, 381, 382, 397, 398, 400, 401, 411, 419, 420, 421, 451, 452, 453, 454, 467, 468, 469, 470, 471, 472, 473, 474+, 476+, 482, 483, 484, 486, 488, 490, 492, 493, 494, 495, 497, 498, 499, 504, 506, 507, 514, 515+, 516, 518, 520, 521, 522, 523, 524, 525, 529, 535+, 538, 540, 546, 549?, 587, 589, 594, 595, 604, 620, 621, 689, 690, 691, 692, 695+, 698, 716, 717, 718, 724, 725, 726, 727, 728?, 734, 747, 760.

Area: Around the Faroe Islands and the banks south-west of the Faroe Islands.

Depth range: 78? 135-1083 m (126 stns/80% 200-700m, 104 stns/67% 200-500 m).

Estimated average bottom temperature: 1-8.6°C (127 stns/81% > 6°C, 98 stns/62% > 7°C).

Water masses: AW (99 stns), AW/AI (47 stns), AI (3 stns), NW/AI (3 stns), NW/AI/AW (5 stns).

Sediment: Most often sand (including shellsand), gravel, cobbles and stones.

Substrate: Pebbles, other brachiopod species, conspecific individuals, corals (e.g. *Lophelia*), serpulids, shells of bivalves, bryozoans.

Atlantic distribution: Spain; France; Ireland; Shetland; the Orkneys; the Hebrides; north of Scotland; west of Sweden; Norway; the Faroes; Iceland; Greenland, ? northeast of America; ? north of the Azores (Thomsen 1990).

Atlantic depth range: 10-2450 m, most common less than 400 m, the shallowest (less than 50 m) are found in fjords of Greenland, Norway and Sweden, the deepest (more than 1000 m) off Spain, Scotland, Iceland and perhaps northeast America (Thomsen, 1990).

Conclusion

The following brachiopod species have been recorded in the BIOFAR material: *Crania anomala*, *Hemithiris psittacea*, *Terebratulina retusa*, *Platidia anomioides*, *Dallina septigera* and *Macandrevia crani-*

um. Two species, *Terebratulina septentrionalis* and *Glaciarcularia spitzbergensis*, previously recorded by Wesenberg-Lund (1940; 1941) have not been found.

The occurrence of *H. psittacea* is based on one empty (not fossil) shell which was probably transported into the area. (The information on the location of the station, the estimated bottom temperature (7.7°C) and the water mass (Atlantic Water-AW) at the station versus the known cold water affinity of the species, cf. Thomsen (1990), implies transport from the colder north). *P. anomioides* is new to the area. Wesenberg-Lund (1940), however, suggested that it may occur at the Faroe Islands as it has been found north of Shetland.

C. anomala is found at 41 stations, *T. retusa* at 125 stations, *P. anomioides* at 6 stations, *D. septigera* at 75 stations and *M. cranium* at 157 stations.

All the Faroese brachiopods are sessile epibenthic suspension feeders. One species, the inarticulate *C. anomala*, is cemented to its substrate, mostly pebbles. The others are all articulate species with a pedicle that attach them to a firm substrate e.g. pebbles, corals, other brachiopods, i.e. conspecific individuals.

In order to understand the biogeography of the BIOFAR brachiopods, their distribution were mapped (Figs. 1-6) and compared with bathymetric distribution (depth), temperature (estimated average bottom temperature), current (average maximum tidal velocity in cm/s near bottom) and water mass (Figs 7-8).

Geographic distribution (Figs. 1-6)

C. anomala, *T. retusa*, *D. septigera* and *M. cranium* are all recorded around the Faroe Islands and the southwestern banks. *D. septigera*, however, does not occur at the westernmost bank, Lousy Bank. *P. anomioides* seems to be restricted primarily to the banks, but the material is sparse.

Bathymetric distribution (Fig. 7 – left)

All species, except *P. anomioides*, seem to prefer depths from 200 to 500 m. There are very few records of *P. anomioides*, but this species seems to prefer greater depths (398-916 m). Both *D. septigera* and *M. cranium* are recorded from greater depths, but the number of records decline with increasing depth. There are no records from depths below 520 m for *C. anomala*.

Temperature (Fig. 7 – middle)

With the exception of *D. septigera*, all species show a preference for bottom temperatures above 6°C. *D. septigera* seems to be able to tolerate lower temperatures as well.

Current (Fig. 7 – right)

Brachiopods are dependent on some turbulence to provide nutrients and oxygen for reproduction and dispersal of the larvae. Except for *P. anomioides*, all species seem to prefer an average maximum tidal velocity ranging from 20 to 50 cm/s. *D. septigera* perhaps being more susceptible preferring a narrower range (20 to 40 cm/s). It is not possible to draw any conclusions on the preference of *P. anomioides* due to the small number of records.

Water mass (Fig. 8)

The close connection between the distribution of the brachiopods and the individual water masses in the area is clearly demonstrated in Fig. 8. Brattegard and Meland (1997) provide information on the different water masses.

Generally all the BIOFAR brachiopod species, with the exception of *D. septigera*, are mostly confined to the Atlantic Water (AW – temperature above 7°C), but a mixture of Atlantic Water and Arctic Intermediate Water (AI – temperature range 3.5–7°C) are also important, the species showing a temperature preference above 6°C (as stated previously). *D. septigera* having a greater temperature tolerance seems to prefer a mixture of Atlantic Water and Arctic Intermediate Water.

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I am indebted to Professor, dr. Arne Nørrevang who suggested that I should undertake this study. I also wish to thank dr. Ole Tendal for providing answers to many last moment questions regarding previously published records.

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