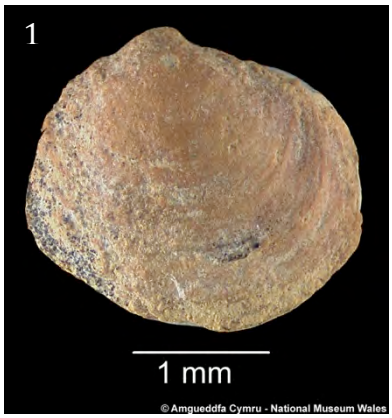
Barents Bivalvia : 14 Days With The Mareano Programme.

This is my second cruise with the Mareano programme aboard the GO Sars. I am continuing to build a library of DNA samples of the Thyasiridae. Of the chemosymbiotic bivalves the thyasirids are unusual in having species with and without symbionts and having the least adapted gills structures where the bacteria are held. My co-workers in the Pierre et Marie Curie University in Paris, Clara Rodrigues and Sebastien Duperron have been studying the symbiotic bacteria of many bivalves and we are now turning our attention to the thyasirids. Phylogenetic studies of the bacteria show little correlation between the bacteria and the thyasirids suggesting that the bivalves can accommodate a variety of bacterial species. Perhaps there is no precise relationship between bacteria and thyasirid species. To test this we are building a library of thyasirids, including as many species as possible and also some common species from as many locations as possible.

Thyasirids were found at every station in the Barents Sea but represented by only two species. From one grab sample it is evident that the minute *Mendicula ferruginosa* [1] occurs in great numbers but a 0.5mm sieve is needed to collect most of them. *Mendicula* is thought not to be chemosymbiotic but one TEM study revealed very large mitochondria that may be involved is some form of chemical metabolism. This species, currently, has a truly amazing distribution; I have collected it at 20m in a Scottish sea loch and what appears to be an identical form from 3200m in the Arabian Sea. If we can gather enough material we can test if this is truly a horizontal and vertical cosmopolitan species!

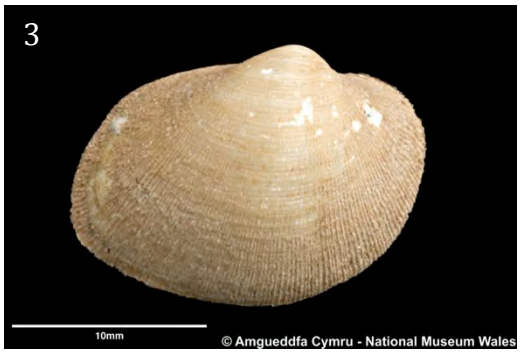


The second species belongs to the genus *Thyasira* but the species is uncertain. It resembles T. equalis from temperate latitudes but also T. dunbari [2] a species recorded from circumarctic sites and to depths that included the Håkon Mosby mud volcano. Critical to the identification is the size and sculpture of the larval shell.

Other than thysirids, I have recognised another 30 species, 2 from shells only. The most common of the larger species is *Bathyarca glacialis* [3]. I studied this genus many years ago for my doctorate, I wish I had access to this material then for at one station the smaller *Bathayrca pectunculoides* was abundant.

Most arcoid bivalves inhabit warm or tropical seas and *Bathyarca* is unusual in being confined to cold high latitude seas or to bathyal and abyssal depths. Arcoids do not have siphons but *Bathyarca* has a unique adaptation in the presence of mantle flaps that extend beyond the shell edge when feeding. This

enables the inhalant and exhalant flows to be separated and may help in conditions of high suspended matter.
Bathyarca glacialis was abundant in the soft muddy sediments of the earlier more northerly stations. This was not what I would have expected because this species has an active byssus and should be found attached. Most of the larger *Bathyarca glacialis* appear not to be attached while those that were had adhered to fragments of worm tubes. The numerous epifauna on the shell indicated that they were living in the surface layer with the dorsal and posterior parts of the shell protruding. Specimens placed in mud in the laboratory began by ploughing through the surface with the mantle extended[4] and this may be a normal behaviour allowing them to relocate.

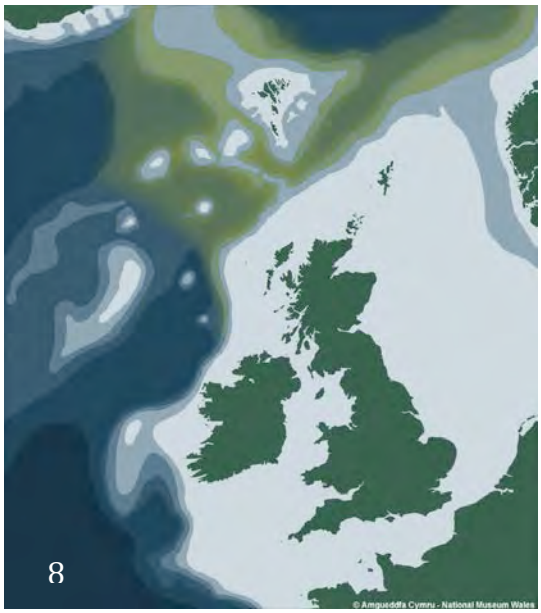


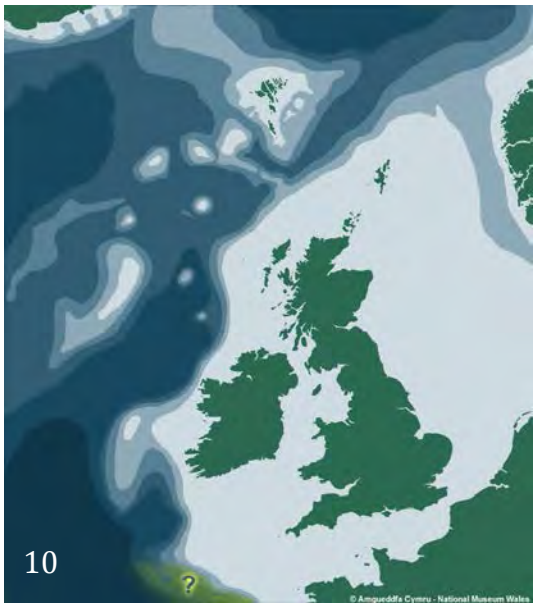
The smaller *B. pectunculoides* is invariably attached most often to grains of gravel or to the agglutinated foraminifera [5] that are so abundant in the region. The greatest number were found on the less muddy substrates of the southern stations.

Other small suspension feeding species were also numerous where the forams were abundant. *Dacrydium vitreum* was often very abundant and in one station, another mytilid, *Crenella decussata* was numerous. *Dacrydium* build a byssus nest while *Crenella* uses a byssus thread.
These small suspension feeders live at or close to the sediment surface while larger burrowing species such as *Astarte sulcata* and *Clinocardium ciliatum* were less numerous. Although regarded as a burrowing form *Astarte* must live close to the surface, often with the shell protruding, and allowing epifauna to attach with some spectacular occurrences[6]. The other dominant cohort is small deposit feeding protobranchs primarily of the genera *Yoldiella* and Portlandia although there were rare occurrences of *Nuculana pernula* and

Ennucula corticata. Coming from temperate latitudes I would have expected such substrates to also have large numbers of tellinid deposit feeders such as those of the genus *Abra*; not even the widespread Arctic *Macoma* were present. This brings me to the relationship between the Arctic and Temperate Atlantic and the question of equatorial submergence Arctic species and high latitude emergence of deep water species. In the web product for the identification of British bivalves [(a)] we frequently encounter the appearance of high latitude species at bathyal depths along the Atlantic margin of the UK. A good example of this is *Yoldiella lucida*[7] seen in the map[8] extending beyond the

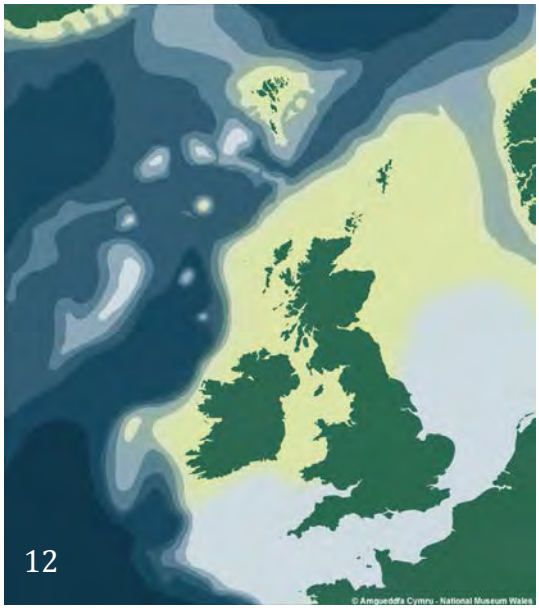
Wyville-Thompson Ridge but the deeper water specimens are smaller than those collected here in the Barents Sea. A problematic occurrence is that of *Yoldiella lenticula* [9], again





frequently found on this cruise, but recorded from the Biscay slope[10]. This indicates that confusion may exist and the good growth series obtained here will help to resolve the taxonomy.

In contrast there are species that are found across the shelf of both the Barents Sea and around the British Isles. These include *Crenella decussata* [11, 12], *Parvicardium minimum* and *Astarte sulcata*.
All of the material collected from the Barents Sea will help to refine the identification web site and give greater relevance to the more northern elements.



With this in mind, a collaboration has been established between myself and Andrey Voronkov to develop a volume on the Arctic Bivalvia.

A preliminary list follows with the notable inclusion of the wood-boring bivalve *Xylophaga cf. dorsalis* taken alive from a small (6x3cm) piece of sunken wood, this may be the first record of this species in the Barents Sea.

Four specimens of Xylophaga (c. 4-6mm) in wood; two wood boring isopods of the genus Limnoria (top right) also visisble.

(a) **Oliver, P. G., Holmes, A. M., Killeen, I. J. & Turner, J. A. 2010** *Marine Bivalve Shells of the British Isles* (Mollusca: Bivalvia). Amgueddfa Cymru - National Museum Wales. Available online at http://naturalhistory.museumwales.ac.uk/britishbivalves.

Preliminary List of Bivalvia from Barents Sea collected on Mareano/GO Sars cruise 31July- 12August 2013
‡ Valves only.

Order **Nuculoida** Dall, 188

Family **Nuculidae** J. E. Gray, 1824

Ennucula corticata (Møller, 1842)

Order **Nuculanoida** Carter, Campbell & Campbell, 2000

Family **Nuculanidae** H. Adams & A. Adams, 1858

Nuculana pernula (Muller, 1779)
Portlandia intermedia (M. Sars, 1865)
Yoldiella lucida (Lovén, 1846)
Yoldiella lenticula (Møller, 1842)
Yoldiella nana (M. Sars, 1865)
Yoldiella philippiana (Nyst, 1844)
Yoldiella propinqua (Leche, 1878)

Order **Arcoida** Stoliczka, 1870

Family **Arcidae** Lamarck, 1809

Bathyarca glacialis (Gray, 1824)
Bathyarca pectunculoides (Scacchi, 1834)

Order **Mytiloida** Férussac, 1822

Family **Mytilidae** Rafinesque, 1815

Crenella decussata (Montagu, 1808)
Dacrydium vitreum (Møller, 1442)
Musculus niger (Gray, 1824)

Order **Pectinoida** H. Adams & A. Adams, 1857

Family **Pectinidae** Rafinesque, 1815

Delectopecten vitreus (Gmelin, 1791)
‡*Pseudamussium peslutrae* (Linnaeus, 1771)
{= *septemradiatum*, Muller, 1776}

Family **Propeamussiidae** Abbott, 1954

Similipecten greenlandicus (Sowerby, 1842)

Family **Anomiidae** Rafinesque, 1815

Heteranomia squamula (Linnaeus, 1758)

Order **Carditoida** Dall, 1889

Family **Astartidae** d'Orbigny, 1844

Astarte sulcata (Da Costa, 1778)

Family **Thyasiridae** Dall, 1900

Mendicula ferruginosa (Forbes, 1844)
Thyasira cf. dunbari/equalis

Order **Anomalodesmata** Dall, 1889

Family **Thraciidae** Stoliczka, 1870

Thracia myopsis Møller, 1842

Subclass **SEPTIBRANCHIA** Pelseneer, 1888

Family **Verticordiidae** Stoliczka, 1870

Lyonsiella abyssicola (GO Sars, 1782)

Family **Poromyidae** Dall, 1886

Poromya granulata (Nyst & Westendorp, 1839)

Family **Cuspidariidae** Dall, 1886

Cuspidaria arctica (M. Sars, 1858)
Cuspidaria lamellosa (GO Sars, 1878)
Cuspidaria sp.

Order **Veneroida** H. Adams & A. Adams, 1856

Family Hiatellidae J. E. Gray, 1824

Hiatella arctica (Linnaeus, 1758)
‡*Panomya norvegica* (Spengler, 1793)

Family **Cardiidae** Lamarck, 1809

Ciliatocardium ciliatim (Fabricius, 1780)
Parvicardium minimum (Philippi, 1836)
Goethemia elegantula (Møller, 1842)

Order **Myoida** Stoliczka, 1870

Family **Xylophaeidae** Purchon, 1941

Xylophaga cf. dorsalis (Turton, 1819)

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