ABSTRACT – Taxonomic revision and re-evaluation of the eastern North Atlantic deep-sea ostracods are conducted based on late Quaternary sediments from Ocean Drilling Program (ODP) Hole 982A, Rockall Plateau, eastern North Atlantic. Twenty-one genera and 51 species were examined and (re-)illustrated with high-resolution scanning electron microscopy images. Six new species are described: Polycope lunaris, Argilloecia labri, Bythoceratina nuda, Cytheropteron colesoabyssorum, Cytheropteron colesopunctatum and Cytheropteron paramammoiun. Excellent fossil ostracod preservation in this sediment core enabled us to provide a robust taxonomic baseline of the eastern North Atlantic deep-sea ostracods for application to palaeoceanographical, palaeoecological and biogeographical studies.

KEYWORDS: deep-sea, Ostracoda, taxonomy, Quaternary, eastern North Atlantic, upper bathyal

INTRODUCTION
North Atlantic deep-sea ostracods have been well investigated (e.g. Brady, 1880; Whatley & Coles, 1987; Coles & Whatley, 1989; Dingle & Lord, 1990; Cronin & Raymo, 1997; Cronin et al., 1999; Didié et al., 2002; Yasuhara & Cronin, 2008; Yasuhara et al., 2008, 2009a; Alvarez Zarikian, 2009; Yamaguchi & Norris, 2012). However, detailed taxonomic studies using the scanning electron microscope (SEM) are still limited and concentrated on the ostracod faunas from the lower bathyal and abyssal zones (i.e. >2000 m water depth) (Whatley & Coles, 1987; Coles & Whatley, 1989; Coles et al., 1994; Alvarez Zarikian, 2009). Thus, little is known on the bathyal North Atlantic ostracod taxonomy, compared to well-investigated Mediterranean bathyal fauna (Bonaduce et al., 1976; Colalongo & Pasini, 1980; Aiello et al., 2000; Guernet, 2005; Aiello & Barra, 2010), even though bathyal faunas are usually more diverse than abyssal faunas (e.g. Yasuhara et al., 2012). Furthermore, there is some taxonomic confusion in North Atlantic ostracod taxonomy, faunal and palaeoecological studies in which a same species has often been called by several different names (see synonymy lists in the present study).

Recently, Yasuhara et al. (2009b) conducted a comprehensive taxonomic revision of western North Atlantic Quaternary deep-sea ostracods using a sediment core taken from the upper bathyal zone with high-resolution SEM images of 87 species and a detailed literature survey. However, a comparable in-depth taxonomic study has not been undertaken previously for the upper bathyal zone of the eastern North Atlantic.

Ocean Drilling Program (ODP) Hole 982A gave us an ideal opportunity to study eastern North Atlantic deep-sea ostracods from the upper bathyal zone in detail, because its sediments have an abundant, diverse and well-preserved ostracod fauna. Here we investigate late Quaternary ODP 982A ostracod taxonomy using high-resolution SEM images to reduce taxonomic confusion of North Atlantic bathyal ostracods. In addition, we briefly discuss similarity of bathyal ostracod faunas among the western and eastern North Atlantic, the Mediterranean, and the western North Pacific.

MATERIALS AND METHODS
A total of 47 samples of ODP Hole 982A (57°30.992′N, 15°52.001′W, 1135.3 m water depth; Rockall Plateau, eastern North Atlantic) covering the past 230 000 years and Marine Isotope Stages (MIS) 1–7 (Venz et al., 1999) were examined for ostracod taxonomy. The full information for the samples and specimens used for the present study is shown in Tables 1 and 2. Uncoated specimens were digitally imaged with a Philips XL-30 environmental SEM. High-resolution figures of ostracod SEM images (Figs 2–16) are available at Dryad (http://datadryad.org/; http://doi.org/10.5061/dryad.sc193. We follow the higher classification scheme of the World Register of Marine Species (WoRMS: http://www.marinespecies.org/) with certain modifications.

Repository. Figured specimens are deposited in the National Museum of Natural History (Washington DC, catalogue numbers USNM 603625–USNM 603760).

Abbreviations. LV, left valve; RV, right valve; L, length (mm); H, height (mm).

SYSTEMATIC PALAEONTOLOGY
Class Ostracoda Latreille, 1802
Subclass Myodocopa Sars, 1866
Order Halocyprida Dana, 1853
Suborder Cladocopina Sars, 1866
Superfamily Polycopidea Sars, 1866
Family Polycopidae Sars, 1866
Genus Polycope Sars, 1866

Type species. Polycope orbicularis Sars, 1866

Remarks. We use the genus name Polycope in a broad sense following typical deep-sea ostracod taxonomy, but note that recent zoological studies, for example Karanovic & Brandão (2012), divide the genus into several separate genera based on soft parts, which are not preserved in fossil ostracods.

Polycope martinezi (Karanovic & Brandão, 2012) (Fig. 2A)
2001 Polycope sp. cf. P. arcys Joy & Clark; Didié & Bauch: 104, pl. 1, fig. 28 (as erratum for Didié & Bauch, 2000).
Table 1. Detailed information of the specimens used for the present study.

| USNM No. | ODP982154poly | Species | T | V | Instar | Hole | Section | Figure |
|----------|---------------|---------|---|---|--------|------|---------|--------|
| 603625   | Polycope martinezi | L | ? | 982A | 1/3/2–4 | 2A    |
| 603626   | Polycope lunaris sp. nov. | H | L? | A? | 982A | 1/3/42–44 | 2B    |
| 603627   | Polycope lunaris sp. nov. | P | R? | A? | 982A | 1/3/42–44 | 2C    |
| 603628   | Polycope cf. bireticulata | L | ? | 982A | 1/3/32–34 | 2D    |
| 603629   | Polycope cf. bireticulata | R | ? | 982A | 1/3/32–34 | 2E    |
| 603630   | Polycope orbicularis s.l. | R | ? | 982A | 1/3/112–114 | 2F    |

(Continued)
| USNM   | No.      | Species                     | T | V | Instar | Hole  | Section | Figure |
|--------|----------|-----------------------------|---|---|--------|-------|---------|--------|
| 603679 | ODP982085| Cytheropteron didieae       | R | A |        | 982A  | 1/1/50–52| 7D     |
| 603680 | ODP982086| Cytheropteron didieae       | R | A |        | 982A  | 1/1/60–62| 7E     |
| 603681 | ODP982087| Cytheropteron didieae       | R | A |        | 982A  | 1/1/60–62| 7F     |
| 603682 | ODP982088| Cytheropteron didieae       | L | A |        | 982A  | 1/1/60–62| 7G     |
| 603683 | ODP982089| Cytheropteron didieae       | L | A |        | 982A  | 1/2/127–129| 7H   |
| 603684 | ODP982090| Cytheropteron didieae       | L | A |        | 982A  | 1/2/67–69| 7I     |
| 603685 | ODP982091| Cytheropteron didieae       | R | A |        | 982A  | 1/2/57–59| 8A     |
| 603686 | ODP982092| Cytheropteron didieae       | R | A |        | 982A  | 1/2/57–59| 8B     |
| 603687 | ODP982093| Cytheropteron omega         | L | A |        | 982A  | 1/4/12–14| 8C     |
| 603688 | ODP982094| Cytheropteron omega         | L | A |        | 982A  | 1/3/132–134| 8E  |
| 603689 | ODP982095| Cytheropteron omega         | L | A |        | 982A  | 1/2/127–129| 8F   |
| 603690 | ODP982096| Cytheropteron omega         | L | A |        | 982A  | 1/1/97–99| 8G     |
| 603691 | ODP982097| Cytheropteron omega         | L | A |        | 982A  | 1/1/2–19 | 8H     |
| 603692 | ODP982098| Cytheropteron omega         | L | A |        | 982A  | 1/1/97–99| 8I     |
| 603693 | ODP982099| Cytheropteron omega         | L | A |        | 982A  | 1/2/17–19| 9A     |
| 603694 | ODP982100| Cytheropteron omega         | L | A |        | 982A  | 1/1/137–139| 9B   |
| 603695 | ODP982101| Cytheropteron omega         | L | A |        | 982A  | 1/1/137–139| 9C   |
| 603696 | ODP982102| Cytheropteron omega         | L | A |        | 982A  | 1/3/52–54| 9H     |
| 603697 | ODP982103| Cytheropteron perlaria      | L | A |        | 982A  | 1/2/17–19| 10A    |
| 603698 | ODP982104| Cytheropteron perlaria      | L | A |        | 982A  | 1/2/17–19| 10B    |
| 603699 | ODP982105| Cytheropteron perlaria      | L | A |        | 982A  | 1/1/142–144| 10C   |
| 603700 | ODP982106| Cytheropteron perlaria      | L | A |        | 982A  | 1/1/142–144| 10D   |
| 603701 | ODP982107| Cytheropteron perlaria      | L | A |        | 982A  | 1/1/142–144| 10E   |
| 603702 | ODP982108| Cytheropteron perlaria      | L | A |        | 982A  | 1/1/70–72| 10F    |
| 603703 | ODP982109| Cytheropteron perlaria      | L | A |        | 982A  | 1/1/90–92| 10G    |
| 603704 | ODP982110| Cytheropteron perlaria      | L | A |        | 982A  | 1/1/1107–109| 10H   |
| 603705 | ODP982111| Cytheropteron perlaria      | L | A |        | 982A  | 1/3/112–114| 10I    |
| 603706 | ODP982112| Cytheropteron perlaria      | L | A |        | 982A  | 1/3/92–94| 10J    |
| 603707 | ODP982113| Cytheropteron perlaria      | L | A |        | 982A  | 1/3/112–114| 11A    |
| 603708 | ODP982114| Cytheropteron perlaria      | L | A |        | 982A  | 1/3/112–114| 11B    |
| 603709 | ODP982115| Cytheropteron perlaria      | L | A |        | 982A  | 1/3/112–114| 11C    |
| 603710 | ODP982116| Cytheropteron perlaria      | L | A |        | 982A  | 1/1/137–139| 11D    |
| 603711 | ODP982117| Cytheropteron perlaria      | L | A |        | 982A  | 1/1/70–72| 11E    |
| 603712 | ODP982118| Cytheropteron perlaria      | L | A |        | 982A  | 1/3/82–84| 11F, G  |
| 603713 | ODP982119| Cytheropteron perlaria      | L | A |        | 982A  | 1/3/82–84| 11H, I  |
| 603714 | ODP982120| Cytheropteron perlaria      | L | A |        | 982A  | 1/3/82–84| 12A    |
| 603715 | ODP982121| Cytheropteron perlaria      | L | A |        | 982A  | 1/3/92–94| 12B    |
| 603716 | ODP982122| Cytheropteron perlaria      | L | A |        | 982A  | 1/3/92–94| 12C, D  |
| 603717 | ODP982123| Cytheropteron perlaria      | L | A |        | 982A  | 1/3/92–94| 12E, F  |
| 603718 | ODP982124| Cytheropteron perlaria      | L | A |        | 982A  | 1/3/122–124| 12G, H |
| 603719 | ODP982125| Cytheropteron perlaria      | L | A |        | 982A  | 1/3/122–124| 12L, J |
| 603720 | ODP982126| Cytheropteron perlaria      | L | A |        | 982A  | 1/3/122–124| 13A    |
| 603721 | ODP982127| Cytheropteron perlaria      | L | A |        | 982A  | 1/3/122–124| 13B    |
| 603722 | ODP982128| Cytheropteron perlaria      | L | A |        | 982A  | 1/3/122–124| 13C, D  |
| 603723 | ODP982129| Cytheropteron perlaria      | L | A |        | 982A  | 1/3/122–124| 13E, F  |

(Continued)
Table 1. (Continued)

| USNM    | No.       | Species               | T   | V   | Instar | Hole   | Section | Figure |
|---------|-----------|-----------------------|-----|-----|--------|--------|---------|--------|
| 603733  | ODP982148 | Pedicythere klothopetasi | L   | A   | 982A   | 1/1/80–82 | 13G    |        |
| 603734  | ODP982149pedi | Pedicythere klothopetasi | R   | A   | 982A   | 1/1/80–82 | 13H    |        |
| 603735  | ODP982150 | Pedicythere klothopetasi | R   | A   | 982A   | 1/1/80–82 | 13I, J |        |
| 603736  | ODP982151 | Pedicythere klothopetasi | R   | A   | 982A   | 1/1/80–82 | 14A    |        |
| 603737  | ODP982152 | Pedicythere klothopetasi | L   | A   | 982A   | 1/1/70–72 | 14B, C |        |
| 603738  | ODP982153 | Pedicythere klothopetasi | R   | A   | 982A   | 1/1/70–72 | 14D, E |        |
| 603739  | ODP982099 | Eucythere triangula     | L   | A   | 982A   | 1/2/117–119 | 14F    |        |
| 603740  | ODP982127-2 | Cluthia sp.             | L   | A   | 982A   | 1/3/12–14 | 14G    |        |
| 603741  | ODP982128 | Cluthia sp.             | R   | A   | 982A   | 1/3/92–94 | 14H    |        |
| 603742  | ODP982129-1 | Cluthia sp.         | L   | A   | 982A   | 1/3/92–94 | 14I    |        |
| 603743  | ODP982130 | Cluthia sp.             | R   | A   | 982A   | 1/3/92–94 | 14J    |        |
| 603744  | ODP982123 | Loxoconchidea minima    | L   | A   | 982A   | 1/3/12–14 | 15A    |        |
| 603745  | ODP982135 | Paracytherois bondi     | R   | A   | 982A   | 1/1/80–82 | 15B, C |        |
| 603746  | ODP982169rock | Arcacythere enigmatica | L   | A   | 982A   | 1/2/77–79 | 15D    |        |
| 603747  | ODP982170rock | Arcacythere enigmatica | R   | A   | 982A   | 1/2/77–79 | 15E    |        |
| 603748  | ODP982171rock | Arcacythere enigmatica | L   | A   | 982A   | 1/2/77–79 | 15F    |        |
| 603749  | ODP982172rock | Arcacythere enigmatica | R   | A   | 1/2/77–79 | 15G    |        |
| 603750  | ODP982173rock | Arcacythere enigmatica | R   | A   | 1/2/67–69 | 15H    |        |
| 603751  | ODP982174rock | Arcacythere enigmatica | L   | A   | 1/3/92–94 | 15I    |        |
| 603752  | ODP982027 | Echinocythereis echinata | R   | A   | 982A   | 1/1/142–144 | 16A    |        |
| 603753  | ODP982028 | Echinocythereis echinata | R   | A   | 982A   | 1/1/142–144 | 16B    |        |
| 603754  | ODP982029 | Echinocythereis echinata | L   | A   | 982A   | 1/3/72–74 | 16C    |        |
| 603755  | ODP982030 | Echinocythereis echinata | L   | A   | 982A   | 1/3/72–74 | 16D    |        |
| 603756  | ODP982022 | Henryhowella asperrima | L   | A   | 982A   | 1/1/137–139 | 16E    |        |
| 603757  | ODP982023 | Henryhowella asperrima | R   | A   | 982A   | 1/1/137–139 | 16F    |        |
| 603758  | ODP982026 | Henryhowella asperrima | L   | A   | 1/0/0–2 | 16G    |        |
| 603759  | ODP982024 | Henryhowella asperrima | R   | A   | 982A   | 1/1/142–144 | 16H, I |        |
| 603760  | ODP982025 | Henryhowella asperrima | L   | A   | 982A   | 1/1/107–109 | 16J    |        |

All specimens from late Quaternary sediments. Core samples are specified by standard ODP notation (core/section/interval). USNM, catalog number; No., M.Y.’s personal catalog number. T, type (P, paratype; H, holotype); V, valve (L, left; R, right); A, adult; J, juvenile.

2009b Polycope arcys Joy & Clark; Yasuhara et al.: 881, pl. 1, fig. 6. 2012 Archypolycope martinezi Karanovic & Brandão: 348, figs 20–24.

Remarks. Polycope martinezi is very similar to the Arctic species Polycope arcys, but distinguished by lacking obvious lateral spines and having finer reticulation. P. martinezi was originally reported from the equatorial Atlantic (Karanovic & Brandão, 2012) and is also known from the North Atlantic (Didié & Bauch, 2000, 2001; Yasuhara et al. 2009b).

Polycope lunaris sp. nov. (Fig. 2B–C)
2001 Polycope sp. Didié & Bauch: 103, pl. 1, fig. 27 (as erratum for Didié & Bauch, 2000).

Derivation of name. From Latin lunaris (adjective; nominative singular; gender, neutral) = lunar.

Diagnosis. A small, heavily calcified Polycope species with well-developed primary reticulation.

Holotype. LV, USNM 603626 (ODP982161) (Fig. 2B).

Paratype. RV, USNM 603627 (ODP982162).

Type locality and horizon. ODP 982A, 1/3/42–44.

Description. Carapace heavily calcified, small in size. Outline rounded in lateral view. Lateral surface ornamented with well-developed, rounded primary reticulation. Anteroventral ridge thick, well developed and bearing no reticulation. Internal features as for genus.

Dimensions. USNM 603626 (ODP982161) (Holotype), L=0.378, H=0.343; USNM 603627 (ODP982162) (Paratype), L=0.353, H=0.328.

Remarks. This species is distinctive from any other Polycope species by having a heavily calcified carapace with well-developed, rounded primary reticulation and thick anteroventral ridge.

Polycope cf. bireticulata Joy & Clark, 1977 (Fig. 2D–E)
2009b Polycope cf. bireticulata Joy & Clark; Yasuhara et al.: 881, pl. 1, figs 3 and 4.

Remarks. ODP 982A specimens have better developed reticulation compared to the specimens from the western North Atlantic (Yasuhara et al., 2009b), considered here to be...
Late Quaternary deep-sea ostracods, North Atlantic

intraspecific variation. This species is similar to *P. bireticulata*, but the latter has a more evenly rounded outline and different alignment of muri (Yasuhara *et al.* in press b).

### Table 2. The list of ODP 982A samples used for the present study.

| Core | Section | Interval (top: cm) | Interval (bottom: cm) | MCD (cm) | Age (ka BP) | N | S |
|------|---------|--------------------|-----------------------|----------|-------------|---|---|
| 1    | 1       | 0                  | 2                     | 0.0      | 87          | 10|
| 1    | 1       | 10                 | 12                    | 1.0      | 119         | 15|
| 1    | 1       | 20                 | 22                    | 2.2      | 107         | 14|
| 1    | 1       | 30                 | 32                    | 3.4      | 204         | 19|
| 1    | 1       | 40                 | 42                    | 5.2      | 276         | 26|
| 1    | 1       | 50                 | 52                    | 7.2      | 221         | 35|
| 1    | 1       | 60                 | 62                    | 10.0     | 231         | 40|
| 1    | 1       | 70                 | 72                    | 14.9     | 184         | 39|
| 1    | 1       | 80                 | 82                    | 19.9     | 141         | 25|
| 1    | 1       | 90                 | 92                    | 24.9     | 140         | 31|
| 1    | 1       | 97                 | 99                    | 28.3     | 237         | 42|
| 1    | 1       | 107                | 109                   | 33.3     | 234         | 30|
| 1    | 1       | 117                | 119                   | 38.3     | 241         | 25|
| 1    | 1       | 127                | 129                   | 43.2     | 312         | 29|
| 1    | 1       | 137                | 139                   | 48.2     | 259         | 28|
| 1    | 1       | 142                | 144                   | 50.7     | 354         | 34|
| 2    | 7       | 9                  | 157                   | 58.1     | 264         | 40|
| 2    | 17      | 19                 | 167                   | 63.1     | 283         | 34|
| 2    | 27      | 29                 | 177                   | 68.0     | 268         | 37|
| 2    | 37      | 39                 | 187                   | 73.0     | 228         | 34|
| 2    | 47      | 49                 | 197                   | 77.9     | 237         | 35|
| 2    | 57      | 59                 | 207                   | 82.9     | 214         | 28|
| 2    | 67      | 69                 | 217                   | 87.9     | 195         | 32|
| 2    | 77      | 79                 | 227                   | 92.8     | 155         | 32|
| 2    | 87      | 89                 | 237                   | 97.8     | 264         | 29|
| 2    | 97      | 99                 | 247                   | 102.8    | 123         | 25|
| 2    | 107     | 109                | 257                   | 107.7    | 320         | 25|
| 2    | 117     | 119                | 267                   | 112.7    | 201         | 21|
| 2    | 137     | 139                | 287                   | 122.6    | 148         | 24|
| 3    | 2       | 4                  | 302                   | 130.0    | 220         | 30|
| 3    | 12      | 14                 | 312                   | 136.3    | 169         | 25|
| 3    | 22      | 24                 | 322                   | 146.5    | 161         | 27|
| 3    | 32      | 34                 | 332                   | 156.8    | 139         | 28|
| 3    | 42      | 44                 | 342                   | 165.0    | 195         | 27|
| 3    | 52      | 54                 | 352                   | 172.5    | 152         | 28|
| 3    | 62      | 64                 | 362                   | 179.6    | 228         | 26|
| 3    | 72      | 74                 | 372                   | 184.9    | 128         | 25|
| 3    | 82      | 84                 | 382                   | 190.2    | 229         | 28|
| 3    | 92      | 94                 | 392                   | 195.3    | 164         | 31|
| 3    | 102     | 104                | 402                   | 200.4    | 294         | 43|
| 3    | 112     | 114                | 412                   | 205.6    | 198         | 34|
| 3    | 122     | 124                | 422                   | 210.7    | 367         | 39|
| 3    | 132     | 134                | 432                   | 215.8    | 131         | 27|
| 3    | 142     | 144                | 442                   | 220.9    | 164         | 27|
| 4    | 2       | 4                  | 452                   | 226.0    | 202         | 29|
| 4    | 12      | 14                 | 462                   | 231.1    | 161         | 29|

N, number of ostracode specimens per sample; S, number of ostracode species per sample. Chronology from Venz *et al.* (1999)

### Remarks.

We consider that *Polycope reticulata* sensu Bonaduce *et al.* (1976) is not conspecific with *P. reticulata* Müller, 1894 because the original sketch by Müller (1894, pl. 8, fig. 20) lacks secondary reticulation and has a different primary reticulation pattern and more inflated carapace.

Subclass **Podocopa** Müller, 1894
Order **Platycopida** Müller, 1866
Suborder **Platycopina** Sars, 1866
Superfamily **Cytherelloidea** Sars, 1866

### Polycopida orbicularis s.l. Sars, 1866
(Fig. 2F–G)

2009b *Polycope cf. orbicularis* Sars; Yasuhara *et al.*: 881, pl. 1, fig. 5.
2009b *Polycope orbicularis* s.l. Sars; Yasuhara *et al.*: 881.

### Polycopida vasfiensis Sissingh, 1972
(Fig. 2H–I)

1972 *Polycope vasfiensis* Sissingh: 68, pl. 1, fig. 6.
1976 *Polycope vasfiensis* Sissingh; Bonaduce *et al.*: 18, pl. 1, figs 6–8, text-fig. 6.
2000 *Polycope vasfiensis* Sissingh; Aiello *et al.*: 85, pl. 1, fig. 1.
2009b *Polycope vasfiensis* Sissingh; Yasuhara *et al.*: 882, pl. 1, figs 1–2.

### Polycopida reticulata Müller, 1894
(Fig. 2J–K)

1894 *Polycope reticulata* Müller: 235, pl. 7, figs 44, 49–50; pl. 8, fig. 20.
1976 *Polycope reticulata* Müller; Bonaduce *et al.*: 14, pl. 2, figs 9 and 10.
2013 *Polycope reticulata* Müller; Cabral & Loureiro: 137, pl. 1, fig. 1.

### Remarks.

We consider that *Polycope reticulata* sensu Bonaduce *et al.* (1976) is not conspecific with *P. reticulata* Müller, 1894 because the original sketch by Müller (1894, pl. 8, fig. 20) lacks secondary reticulation and has a different primary reticulation pattern and more inflated carapace.
Family **Cytherellidae** Sars, 1866
Genus **Cytherella** Jones, 1849

**Type species.** *Cytherina ovata* Roemer, 1841 (designated by Ulrich, 1894)

**Cytherella robusta** Colalongo & Pasini, 1980 (Fig. 3A–B)
1979 *Cytherella* sp. 11 Ducasse & Peypouquet: pl. 1, figs 3–4.

1980 *Cytherella robusta* Colalongo & Pasini: 78, pl. 6, figs 4–10.
1996b *Cytherella robusta* Colalongo & Pasini; Aiello et al.: 184, pl. 2, figs 4–5, 8–12.
2001 *Cytherella serratula* (Brady); Didié & Bauch: 104, pl. 1, fig. 5 (erratum for Didié & Bauch, 2000).
2001 *Cytherella* sp. 1 Didié & Bauch: 104, pl. 1, fig. 6 (erratum for Didié & Bauch, 2000).

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**Fig. 2.** Scanning electron microscope (SEM) images of *Polycope* species. **A,** *Polycope martinezi* (Karanovic & Brandão, 2012), USNM 603625 (ODP982154poly); LV from 1/3/2–4. **B–C,** *Polycope lunaris* sp. nov.: **B,** Holotype USNM 603626 (ODP982161); adult? LV? from 1/3/42–44; **C,** Paratype USNM 603627 (ODP982162); adult? RV? from 1/3/42–44. **D–E,** *Polycope cf. bireticulata* Joy & Clark, 1977; **D,** USNM 603628 (ODP982155poly); LV from 1/3/32–34; **E,** USNM 603629 (ODP982156poly); RV from 1/3/32–34. **F–G,** *Polycope orbicularis* s.l. Sars, 1866; **F,** USNM 603630 (ODP982157poly); RV from 1/3/112–114; **G,** USNM 603631 (ODP982158poly); LV from 1/3/112–114. **H–I,** *Polycope vasfiensis* Sissingh, 1972; **H,** USNM 603632 (ODP982159poly); adult? LV from 1/2/27–29; **I,** USNM 603633 (ODP982160poly); adult? RV from 1/2/27–29. **J–K,** *Polycope reticulata* Müller, 1894; **J,** USNM 603634 (ODP982163poly); LV from 1/3/32–34; **K,** USNM 603635 (ODP982164poly); RV from 1/3/32–34. All lateral views. All specimens from late Quaternary section of ODP Hole 982A, Rockall Plateau, eastern North Atlantic. Scale bars represent 0.5 mm.
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2001 *Cytherella* sp. 2 Didié & Bauch: 104, pl. 1, fig. 7 (erratum for Didié & Bauch, 2000).
2009 *Cytherella* sp. Alvarez Zarikian: 7, pl. P10, fig. 5.
2009b *Cytherella robusta* s.l. Colalongo & Pasini; Yasuhara et al.: 882, pl. 1, figs 7–12.
2013 *Cytherella robusta* Colalongo & Pasini; Cabral & Loureiro: 137, pl. 1, fig. 3.

**Remarks.** Juvenile specimens of *Cytherella robusta* are shown here. As discussed in Yasuhara & Okahashi (in press), this species has certain intraspecific variation. A comprehensive synonymy list in Aiello et al. (1996b), Yasuhara et al. (2009b) and Yasuhara & Okahashi (in press).

**Order Podocopida** Sars, 1866
**Suborder Bairdiocopina** Gründel, 1967
**Superfamily Bairdioidae** Sars, 1866
**Family Bairdiidae** Sars, 1866

**Remarks.** We follow Maddocks’ (1969) genus-level taxonomy for this family.
Genus *Bairdoppilata* Coryell, Sample & Jennings (1935)

**Type species.** *Bairdoppilata martyni* Coryell, Sample & Jennings (1935)

*Bairdoppilata conformis* (Terquem, 1878)

(Fig. 3C–F)

1878 *Bairdia subdeltoidea var. conformis* Terquem: 93, pl. 10, fig. 17a–c.

1962 *Bairdia conformis* Terquem; Ruggieri: 13.

1976 *Bairdia conformis* Terquem; Bonaduce et al.: 22, pl. 6, figs 5–10.

2000 *Bairdoppilata conformis* (Terquem); Aiello et al.: 85, pl. 1, fig. 2.

2003 *Bairdoppilata conformis* (Terquem); Sciuto: 182, fig. 2a.

2008 *Bairdoppilata conformis* (Terquem); Faranda et al.: 300, tab. 2.

2010 *Bairdoppilata conformis* (Terquem); Aiello & Barra: 406.

**Remarks.** A comprehensive synonymy list is in Aiello et al. (2000) and supplemented herein. Our specimens are identical to that shown in Aiello et al. (2000). Our specimens are also very similar to the specimens in Terquem (1878) and Bonaduce et al. (1976), but the latter specimens have a more heavily calcified carapace and slightly more upturned caudal process. Other authors have also reported this species, but with a slightly different outline (Sciuto, 2003) or without images (Faranda et al., 2008; Aiello & Barra, 2010). We consider all of these differences as intraspecific variation and include them in *Bairdoppilata conformis*. Slight differences in outlines may be due to intraspecific variation in calcification. No SEM or microscopic image of type specimens has been published.

Suborder *Cypridocopina* Jones, 1901

Superfamily *Macrocypridoidea* Müller, 1912

Family *Macrocypridae* Müller, 1912

Genus *Macrocyprissa* Triebel, 1960

**Type species.** *Bairdia cylindracea* Bornemann, 1855

*Macrocyprissa arcuata* (Colalongo & Pasini, 1980)

(Fig. 3G–I)

1980 *Paramacrocypris arcuata* Colalongo & Pasini: 106, pl. 25, figs 1–8.

1990 *Macrocyprissa arcuata* (Colalongo & Pasini); Maddocks: 85, figs 12.17–18, 13.17–18, 21.24, 23.24, 24.34, 28.29–30, 29.9, 35.19, 44.5, 47.6–7, 50.15–19, 51.9–13, 56.10, 24, 27, 57.11, 32, 58.18, 59.26, 33, 60.4, 63.3, 17, 64.23, 40, 51, 68.5, 72.1–3, 76.3, 78.9–10; pl. 30, figs 7–10, pl. 31, figs 7–11; pl. 67, figs 8–9; pl. 68, figs 6–14; pl. 69, fig. 1; pl. 70, figs 1–4; pl. 80, fig. 7; pl. 91, figs 10–14; pl. 104, figs 1–5; pl. 111, fig. 6.

1996 *Macrocyprissa arcuata* (Colalongo & Pasini); Coles et al.: 132, pl. 1, figs 10–11.

**Remarks.** A comprehensive synonymy list is given in Maddocks (1990).

Superfamily *Pontocypridoidea* Müller, 1894

Family *Pontocypridae* Müller, 1894

Genus *Argilloecia* Sars, 1866

**Type species.** *Argilloecia cylindrica* Sars, 1866

*Argilloecia acuminata* Müller, 1894

(Fig. 4A–D)

1894 *Argilloecia acuminata* Müller: 261, pl. 12, figs 1–2, 12–22.

1975 *Argilloecia acuminata* Müller; Breman: 82, pl. 2, fig. 21, pl. 6, fig. 69.

1987 *Argilloecia* sp. 5 Whatley & Coles: 87, pl. 1, figs 19–20.

2004 *Argilloecia acuminata* Müller; Aiello & Szczechura: 16, pl. 1, fig. 2.

2009b *Argilloecia acuminata* Müller; Yasuhara et al.: 886, pl. 3, figs 1–2, 4–5.

2009 (part) *Argilloecia* sp. 2 Alvarez Zarikian: 7, pl. P8, fig. 4 (non 3).

**Remarks.** Comprehensive synonymy lists are given in Aiello & Szczechura (2004), Yasuhara et al. (2009b) and supplemented herein.

*Argilloecia caju* Yasuhara, Okahashi & Cronin 2009

(Fig. 4E–F)

2009b *Argilloecia caju* Yasuhara, Okahashi & Cronin: 886, pl. 3, figs 21–24.

**Remarks.** *Argilloecia caju* is similar to Pacific species *A. viriosa* Hao, 1988 (in Ruan & Hao, 1988), but distinguished by having a much more slender outline. *A. caju* was originally reported from the western North Atlantic (Yasuhara et al., 2009b) and is here confirmed in the eastern North Atlantic.

*Argilloecia labri* sp. nov.

(Fig. 4G–J)

1987 *Argilloecia* sp. 4 Whatley & Coles: 86, pl. 1, figs 17–18.

2000 *Argilloecia* sp. 2 Didié & Bauch: 116, pl. 3, figs 3–4.

**Derivation of name.** From Latin *labri* (noun, genitive singular) = lip.

**Diagnosis.** A small, moderately calcified *Argilloecia* species with lip-shaped outline.

**Holotype.** LV, USNM 603651 (ODP982060) (Fig. 4I).

**Paratypes.** LV, USNM 603649 (ODP982058); RV, USNM 603650 (ODP982059); RV, USNM 603652 (ODP982061).

**Type locality and horizon.** ODP 982A, 1/1/50–52.

**Description.** Carapace moderately calcified, small, highest at mid-length. Outline trapezoidal in lateral view; anterior margin rounded and upturned; posterior margin acuminate and slightly upturned; dorsal margin arched; ventral margin slightly sinuous. Anterodorsal and posterodorsal margins obtuse-angular. RV strongly overlaps LV. Lateral surface smooth. Internal features as for genus.

**Dimensions.** USNM 603651 (ODP982060) (Holotype), L = 0.461, H = 0.202;

USNM 603650 (ODP982059) (Paratype), L = 0.497, H = 0.223.

**Remarks.** This species is similar to the Pacific species *Argilloecia spicata* Hao, 1988 (in Ruan & Hao, 1988), but distinguished by having a much more upturned posterior margin.

*Argilloecia bensoni* Barra, Aiello & Bonaduce, 1996

(Fig. 4K–N)

1996 *Argilloecia bensoni* Barra, Aiello & Bonaduce: 129, pl. 2, figs 3–4; pl. 3, figs 1–3.

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This species was originally reported from Mediterranean Plio-Pleistocene strata.

Genus Propontocypris Sylvester-Bradley, 1947

Type species. Pontocypris trigonella
Sars, 1866

Propontocypris acuminata (Müller, 1894)

(Fig. 5A)

1894 Erythrocypris acuminata Müller: 259, pl. 11, figs 5–6, 16–18, 40–42; pl. 28, figs 23, 30; pl. 38, figs 47–48.

1976 Pontocypris acuminata (Müller); Bonaduce et al.: 25, pl. 9, figs 1–2.

2000 Pontocypris sp. Didié & Bauch: 116, pl. 4, fig. 17.

Fig. 4. SEM images of Argilloecia species. A–D, Argilloecia acuminata Müller, 1894: A, USNM 603643 (ODP982062); adult LV from 1/1/60–62; B, USNM 603644 (ODP982063); adult RV from 1/1/60–62; C, USNM 603645 (ODP982064); adult LV from 1/1/50–52; D, USNM 603646 (ODP982065); adult RV from 1/1/50–52. E–F, Argilloecia caju Yasuhara, Okahashi & Cronin, 2009: E, USNM 603647 (ODP982052); adult LV from 1/2/17–19; F, USNM 603648 (ODP982053); adult RV from 1/2/17–19. G–J, Argilloecia labri sp. nov.: G, Paratype USNM 603649 (ODP982058); adult LV from 1/3/102–104; H, Paratype USNM 603650 (ODP982059); adult RV from 1/3/102–104; I, Holotype USNM 603651 (ODP982060); adult LV from 1/1/50–52; J, Paratype USNM 603652 (ODP982061); adult RV from 1/3/82–84. K–N, Argilloecia bensoni Barra, Aiello & Bonaduce, 1996: K, USNM 603653 (ODP982054); adult RV from 1/1/97–99; L, USNM 603654 (ODP982057); adult LV from 1/1/142–144; M, USNM 603655 (ODP982056); adult RV from 1/3/112–114; N, USNM 603656 (ODP982055); adult LV from 1/1/107–109. C–F, I–J, M–N, lateral views; A–B, G–H, K–L, internal views. All specimens from late Quaternary section of ODP Hole 982A, Rockall Plateau, eastern North Atlantic. Scale bar represents 1 mm.
Propontocypris sp.
(Fig. 5B)

?2009 Propontocypris trigonella Sars; Alvarez Zarikian: 7, pl. P8, fig. 10.

Suborder Cytherocopina Gründel, 1967
Superfamily Cytheroidea Baird, 1850

Family Bythocytheridae Sars, 1866
Genus Bythoceratina Hornibrook, 1952

Type species, Bythoceratina mestayerae, Hornibrook, 1952

Bythoceratina scaberrima (Brady, 1886)
(Fig. 5C)

1886 Cytherura scaberrima Brady: 198, pl. 14, figs 10–11.
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1980 Bythoceratina scaberrima mediterranea Colalongo & Pasini: 72, pl. 1, fig. 9; pl. 4, figs 9–10.
2001 Bythoceratina scaberrima (Brady); Didié & Bauch: pl. 1, fig. 29 (erratum for Didié & Bauch, 2000).
2005 Retibythere scaberrima (Brady); Guernet: 109.

Remarks. Comprehensive synonymy list and detailed discussion in Guernet (2005) and Yasuhara et al. (in press b).

Bythoceratina nuda sp. nov. (Fig. 5D–E)

Derivation of name. From Latin nuda (adjective, nominative singular, gender feminine or neuter) = stripped, with reference to its carapace without any spine or reticulation.

Diagnosis. A large, moderately calcified Bythoceratina species without spines or reticulation.

Holotype. LV, USNM 603660 (ODP982073) (Fig. 5D)
Paratype. RV, USNM 603661 (ODP982074).

Type locality and horizon. ODP 982A, 1/35–1/54.

Description. Carapace moderately calcified, large, highest at anterodorsal corner (= anterior cardinal angle). Outline parallelogram-like in lateral view; anterior margin rounded; caudal process upturned; dorsal margin sinuous; ventral margin slightly curved. Anterodorsal margin prominent; posterodorsal margin slightly angular. Lateral surface smooth. A ventrolateral ridge well developed, reaching to anterior margin; thin dorsolateral ridge present. A median sulcus present, but very shallow. Internal features as for genus.

Dimensions. USNM 603660 (ODP982073) (Holotype), L = 0.920, H = 0.462; USNM 603661 (ODP982074) (Paratype), L = 0.948, H = 0.471.

Remarks. This species is distinguished from any other Bythoceratina species by its lack of spines and reticulation.

Genus Pseudocythere Sars, 1866

Type species. Pseudocythere caudata Sars, 1866

Pseudocythere caudata Sars, 1866 (Fig. 5F–G)

1866 Pseudocythere caudata Sars: 88.
1926 Pseudocythere caudata Sars; Sars: 239, pl. 109, fig. 2a–k.
2009b Pseudocythere caudata Sars; Yasuhara et al.: 892, pl. 4, figs 7–12.

Remarks. We think that this species has considerable intraspecific variation. A comprehensive synonymy list and detailed discussion are given in Yasuhara et al. (in press b).

Family Cytheridae Baird, 1850
Genus Paijenborchella Kingma, 1948

Type species. Paijenborchella iocosa Kingma, 1948

Paijenborchella cymbula Ruggieri, 1950 (Fig. 5H–K)

1950 Paijenborchella cymbula Ruggieri: 60, 1 unnumbered fig. on p. 61.

1973 Paijenborchella (Eopaijenborchella) malaiensis cymbula Ruggieri; Doruk: 161,pls 1.30.162, 1.30.164.
2000 Paijenborchella malaiensis cymbula Ruggieri; Aiello et al.: 93, pl. 2, fig. 12.
2005 Paijenborchella cymbula Ruggieri; Guernet: 107.

Remarks. A comprehensive synonymy list can be found in Aiello et al. (2000) and Guernet (2005). To our knowledge, this is the first well-illustrated record (SEM images) of this species from the Atlantic. This species was recently reported from the Iberian Margin at IODP Site U1387 (Expedition 339 Scientists, 2013).

Family Cytheruridae Müller, 1894
Genus Aversovalva Hornibrook, 1952

Type species. Cythereopteron (Aversovalva) aureum Hornibrook, 1952

Aversovalva hydrodynamica Whatley & Coles, 1987 (Fig. 6A–D)

1987 Aversovalva hydrodynamica Whatley & Coles: 69, pl. 3, figs 10–11.
1996 Aversovalva hydrodynamica Whatley & Coles; Coles et al.: 150, pl. 3, fig. 17.
1988 (part) Aversovalva sp. 2 Whatley & Ayress: 742, pl. 2, fig. 1a (non 1b).
2001 Aversovalva sp. cf. A. hydrodynamica Didié & Bauch: 103, pl. 1, fig. 12 (as erratum for Didié & Bauch, 2000).
2009 Aversovalva hydrodynamica Whatley & Coles; Alvarez Zarikian: 3, pl. P3, fig. 7.

Remarks. Very similar, but slightly different species are reported from the western North Atlantic as Aversovalva sp. 1 and A. cf. hydrodynamica (Yasuhara et al., 2009b). A Pliocene Mediterranean species Aversovalva denticulatum (Aiello, Barra & Bonaduce, 1996) shows strong affinity to A. hydrodynamica Whatley & Coles, 1987, but the former has a more triangular outline. A. hydrodynamica is also similar to A. consueta (Dall’Antonia, 2003), but the latter has thicker and more downward-extended alae and weaker reticulation. Although Coles et al. (1990, 1996) suggested a global distribution for this species, reliable records with SEM images are restricted in the eastern North Atlantic.

Genus Cythereopteron Sars, 1866

Type species. Cythere latissima Norman, 1865 (designated by Brady & Norman, 1889; see Horne & Whittaker (1988) for details and lectotype).

Remarks. We agree with Horne & Whittaker (1988) and consider Kobayashina Hanai, 1957b and Lobosocythereopteron Ishizaki & Gunther, 1974 as junior synonyms of Cythereopteron.
Cytheropteron aielloi Yasuhara, Okahashi & Cronin, 2009
(Fig. 6E–G)
1996 Cytheropteron sedovi Schneider; Whatley et al.: 19, pl. 2, figs 15–17.
1998 Cytheropteron sedovi Schneider; Whatley et al.: 21, pl. 2, figs 11–12.
2009 Cytheropteron aielloi Yasuhara, Okahashi & Cronin: 898, pl. 10, figs 3–6.
Remarks. This species is known not only from the North Atlantic proper but also from the Nordic seas.

Cytheropteron alatum Sars, 1866
(Fig. 6H)
1866 Cytheropteron alatum Sars: 81.
1926 Cytheropteron alatum Sars; Sars: 225, pl. 104, fig. 1.
1993 Cytheropteron alatum Sars; Penney: figs 4n–o.
1996 Cytheropteron vespertilio (Reuss); Coles et al.: 136, pl. 3, fig. 9.
1998 Cytheropteron alatum Sars; Freiwald & Mostafawi: 260, pl. 59, fig. 7.
2000 Cytheropteron alatum Sars; Didié & Bauch: pl. 2, fig. 6.

Fig. 6. SEM images of Aversovalva and Cytheropteron species. A–D, Aversovalva hydrodynamica Whatley & Coles, 1987: A, USNM 603668 (ODP982048); adult RV from 1/1/107–109; B, USNM 603669 (ODP982049); adult LV from 1/1/107–109; C, USNM 603670 (ODP982050); adult LV from 1/1/107–109; D, USNM 603671 (ODP982051); adult RV from 1/1/117–119. E–G, Cytheropteron aielloi Yasuhara, Okahashi & Cronin, 2009: E, USNM 603672 (ODP982042); adult LV from 1/3/42–44; F, USNM 603673 (ODP982043); adult RV from 1/3/42–44; G, USNM 603674 (ODP982044); adult RV from 1/3/112–114. A–B, E–F, H, lateral views; C–D, G, internal views. All specimens from late Quaternary section of ODP Hole 982A, Rockall Plateau, eastern North Atlantic. Scale bar represents 0.5 mm.
Remarks. Reliable occurrence records of this species with SEM image(s) or sketches are known only from the eastern North Atlantic as listed in the synonymy list above. Detailed discussion of this species can be found in Yasuhara et al. (in press b).

Cytheropteron colesobbysuorum sp. nov.
(Fig. 7A)
1996 Cytheropteron cf. abyssorum Brady; Coles et al.: 136, pl. 3, figs 12–13.

Derivation of name. In honour of Graham P. Coles for his contribution to deep-sea ostracod research; and with reference to its similarity to Cytheropteron abyssorum as indicated by him.

Diagnosis. A large, moderately calcified Cytheropteron species with finely punctate carapace, upturned caudal process, and relatively rounded outline.

Holotype. RV, USNM 603676 (ODP982077) (Fig. 7A).

Type locality and horizon. ODP 982A, 1/2/37–39.

Description. Carapace moderately calcified, large, highest at mid-length. Outline rhomboidal and rounded in lateral view; anterior margin evenly rounded; caudal process strongly upturned; dorsal margin arched; ventral margin slightly curved; alae well developed, almost reaching to anterior margin and slightly extended below ventral margin; median sulcus present on alae; thin dorsolateral ridge present along dorsal margin. Anterdorsal and posterodorsal margins slightly angular. Lateral surface finely punctate. Internal features as for genus.

Dimensions. USNM 603676 (ODP982077) (Holotype), L=0.489, H=0.306; USNM 603678 (ODP982083) (Paratype), L=0.545, H=0.338.

Remarks. Cytheropteron colesopunctatum sp. nov. is similar to C. punctatum Brady, 1868 in certain aspects, such as punctate carapace and general outline, but is distinguished by having smoothly curved and horizontally longer alae reaching to anterior margin and well-developed primary and secondary reticulation in posterior one-third. C. punctatum has sinuous and horizontally shorter alae and no or only poorly developed reticulation, according to the sketches and SEM images shown in Brady (1868), Sars (1928) and Whatley & Masson (1979). C. colesopunctatum sp. nov. is similar to C. paracarolinae Zhao et al., 2000 (see Zhao et al., 2000; Hou & Gou, 2007), but the latter is larger, lacks punctuation in anterior one-third, and has more slender outline and stronger caudal process.

Cytheropteron didieae Yasuhara, Okahashi & Cronin 2009 (Fig. 7D–H)
2009 Cytheropteron didieae Yasuhara, Okahashi & Cronin: 900, pl. 6, figs 5–9, 11–12.

Remarks. This is the first record of the species from the eastern North Atlantic.

Cytheropteron fugu Yasuhara, Okahashi & Cronin, 2009 (Figs. 7I–J, 8A–B)
2009 Cytheropteron fugu Yasuhara, Okahashi & Cronin: 902, pl. 7, figs 1–6.

Remarks. This is the first record of the species from the eastern North Atlantic.
2000 *Cytheropteron hanaii* Ishizaki; Zhao et al.: 262, pl. 3, figs 8–9.
2007 *Cytheropteron hanaii* Ishizaki; Hou & Gou: 294, pl. 119, figs 14–15; pl. 122, figs 11–12.
2009 *Cytheropteron* sp. g Yasuhara, Okahashi & Cronin: 908, pl. 6, fig. 14.
2012 *Cytheropteron hanaii* Ishizaki; Tanaka et al.: 10, pl. 1, fig. 13.

**Remarks.** Detailed comparison with similar species such as *C. fraudulentum* Aiello, Barra & Bonaduce 1996 and *C. sulcatum* Bonaduce, Ciampo & Masoli, 1976 is found in Aiello et al. (1996a) and Athersuch et al. (1989). In our opinion, *C. hanaii* Ishizaki, 1981 (see Ishizaki, 1981; Zhao et al., 2000; Hou & Gou, 2007) is a junior synonym of *C. inornatum* Brady & Robertson, 1872.

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**Fig. 7.** SEM images of *Cytheropteron* species. 

A. *Cytheropteron colesoabyssorum* sp. nov., Holotype USNM 603676 (ODP982077); adult RV from 1/2/37–39. 
B–C, *Cytheropteron colesopunctatum* sp. nov.: B, Holotype USNM 603677 (ODP982082); adult RV from 1/1/30–32; C, Paratype USNM 603678 (ODP982083); adult LV from 1/1/30–32. 

D–H, *Cytheropteron didieae* Yasuhara, Okahashi & Cronin, 2009: D, USNM 603679 (ODP982085); adult RV from 1/1/50–52; E, USNM 603680 (ODP982086); adult RV from 1/1/60–62; F, USNM 603681 (ODP982087); adult RV from 1/1/60–62; G, USNM 603682 (ODP982088); adult LV from 1/1/60–62; H, USNM 603683 (ODP982089); adult LV from 1/2/127–129. 

I–J, *Cytheropteron fugu* Yasuhara, Okahashi & Cronin, 2009: I, USNM 603684 (ODP982035); adult LV from 1/2/67–69; J, USNM 603685 (ODP982036); adult LV from 1/2/67–69. 

A–E, G, I, lateral views; F, H, J, internal views. All specimens from late Quaternary section of ODP Hole 982A, Rockall Plateau, eastern North Atlantic. Scale bar represents 0.5 mm.
Late Quaternary deep-sea ostracods, North Atlantic

**Cytheropteron massoni** Whatley & Coles, 1987

(Fig. 8K–L)

1987 *Cytheropteron massoni* Whatley & Coles: 63, pl. 2, figs 15–17.

2000 *Cytheropteron massoni* Whatley & Coles; Didié & Bauch: 113, pl. 2, fig. 11.

2009b *Cytheropteron massoni* Whatley & Coles; Yasuhara et al.: 904, p. 6, figs 7, 10, 13.

**Remarks.** *C. massoni* Whatley & Coles, 1987 is known from both the eastern and western North Atlantic.

*Cytheropteron omega* Aiello, Barra & Bonaduce, 1996

(Fig. 8C–F)

1987 (part) *Cytheropteron syntomoalatum* Whatley & Coles: pl. 2, fig. 27 (non pl. 2, figs 25–26, 28–29).
1996 Cytheropteron omega Aiello, Barra & Bonaduce: 170, pl. 2, figs 7–9.

Remarks. Detailed comparison with similar species such as C. garganicum Bonaduce, Ciampo & Masoli, 1976 can be found in Aiello et al. (1996a). Our specimens have relatively weakly developed dorsal ridges compared to the type specimens and thus the ‘upside-down omega’ structure is unclear, but otherwise identical. We consider this difference as intraspecific variation. Well-preserved specimens shown here indicate that there are two spines at the apex of alae. A paratype specimen of C. syntomoalatum of Whatley & Coles (1987, pl. 2, fig. 27) is not conspecific with C. syntomoalatum Whatley & Coles, 1987 and is considered here and by Aiello et al. (1996a) as C. omega Aiello, Barra & Bonaduce, 1996, although this specimen has only one spine at the apex of the alae and a slightly more slender outline.

Cytheropteron paramediotaum sp. nov. (Fig. 9A–B)
1996 (part) Cytheropteron gr. punctatum Brady; Coles et al.: 136, pl. 3, figs 5–6 (non 7–8).

Derivation of name. With reference to its similarity to Cytheropteron mediotitumidum.

Diagnosis. A large, moderately calcified Cytheropteron species with finely punctate carapace and straight-sided alae.

Holotype. LV, USNM 603698 (ODP982092) (Fig. 9A).

Paratype. RV, USNM 603699 (ODP982093).

Type locality and horizon. ODP 982A, 1/2/107–109.

Description. Carapace moderately calcified, large, highest at mid-length. Outline subrhomboidal in lateral view; anterior margin rounded; caudal process moderately prominent; dorsal margin arched; ventral margin slightly curved; alae straight, thin and horizontally long, almost reaching to anterior margin, and extending slightly below ventral margin; a small subcentral depression present on alae. Anterodorsal margin slightly angular; posterodorsal margin weakly prominent. Lateral surface finely punctate in posterior two-thirds; primary and secondary reticulation weakly developed in posterior one-third. Internal features as for genus.

Dimensions. USNM 603698 (ODP982092) (Holotype), L=0.638, H=0.389; USNM 603699 (ODP982093) (Paratype), L=0.671, H=0.431.

Remarks. Cytheropteron paramediotaum sp. nov. is very similar to C. mediotitumidum Zhao, Whatley & Zhou, 2000, but distinguished by having irregular and coarser punctuation and a less upturned caudal process. This species was originally reported from the western North Pacific.

Cytheropteron pararhombiformis Whatley & Coles, 1987 (Fig. 9G–H)
1987 Cytheropteron pararhombiformis Whatley & Coles: 63, pl. 2, figs 18–20.

Remarks. Our specimens have weakly developed primary reticulation in the posterior one-third, but otherwise are identical to C. pararhombiformis Whatley & Coles, 1987. We consider this difference as intraspecific variation. This species is known only from the eastern North Atlantic.

Cytheropteron perlaria Hao, 1988 (in Ruan & Hao, 1988) (Fig. 10A–B)
1988 Cytheropteron perlaria Hao (in Ruan & Hao, 1988): 280, pl. 47, figs 4–9.

1996 Cytheropteron testudo Sars; Coles et al.: 136, pl. 3, figs 10–11.

1999 Cytheropteron perlaria Hao; Swanson & Ayress: 155, pl. 1, figs 7–13; pl. 2, figs 1–3, non 2004 Cytheropteron perlaria Hao; Ayress et al.: 29, pl. 3, figs 7–8.

2006 Cytheropteron perlaria Hao; Stepanova: S163, pl. 3, figs 8–10.

2007 Cytheropteron testudo Sars; Hou & Gou: 290, pl. 120, figs 9–10.

2009 Cytheropteron perlaria Hao; Alvarez Zarikian: 4, pl. P3, figs 1–2.

2009b Cytheropteron perlaria Hao; Yasuhara et al.: 904, pl. 7, figs 12–13.

2011 Cytheropteron perlaria Hao; Zhao et al.: 27, pl. 1, fig. 26.

Remarks. This species is known from the Atlantic, Arctic and Pacific oceans.

Cytheropteron pherozigzag Whatley, Ayress & Downing, 1986 (Fig. 10C–D)
1986 Cytheropteron pherozigzag Whatley, Ayress & Downing: 32, pl. 1, figs 6–20.
Late Quaternary deep-sea ostracods, North Atlantic

Fig. 9. SEM images of Cytheropteron species. A–B, Cytheropteron paramediotumidum sp. nov.: A, Holotype USNM 603698 (ODP982092); adult LV from 1/2/107–109; B, Paratype USNM 603699 (ODP982093); adult RV from 1/2/127–129. C–D, Cytheropteron demenocali Yasuhara, Okahashi & Cronin, 2009: C, USNM 603700 (ODP982090); adult LV from 1/1/137–139; D, USNM 603701 (ODP982091); adult RV from 1/2/17–19. E–F, Cytheropteron pararhombiformis Zhao, Whatley & Zhou, 2000: E, USNM 603702 (ODP982095); adult LV from 1/1/30–32; F, USNM 603703 (ODP982096); adult RV from 1/1/40–42. G–H, Cytheropteron paucipunctatum Whatley & Coles, 1987: G, USNM 603704 (ODP982097); adult LV from 1/2/127–129; H, USNM 603705 (ODP982098); adult RV from 1/3/52–54. All lateral views. All specimens from late Quaternary section of ODP Hole 982A, Rockall Plateau, eastern North Atlantic. Scale bars represent 0.5 mm.

1988 Cytheropteron pherozigzag Whatley, Ayress & Downing: Whatley & Ayress: pl. 2, fig. 3a–b.
1996 Cytheropteron pherozigzag Whatley, Ayress & Downing: Zhao & Zheng: 72, pl. 2, fig. 3.
2000 Cytheropteron pherozigzag Whatley, Ayress & Downing: Zhao et al.: 263, pl. 1, fig. 20.
2005 Cytheropteron pherozigzag Whatley, Ayress & Downing: Zhao: 39, pl. 2, fig. 15.
2007 Loboscytheropteron pherozigzag (Whatley, Ayress & Downing); Hou & Gou: 309, pl. 125, fig. 17.
2009b Cytheropteron pherozigzag Whatley, Ayress & Downing; Yasuhara et al.: 906, pl. 5, figs 6–8, 10.

Remarks. This species is known from the eastern and western North Atlantic and northwestern Pacific oceans.
Cytheropteron pseudoalatum Colalongo & Pasini, 1980
(Fig. 10E)
1980 Cytheropteron pseudoalatum Colalongo & Pasini: 92, pl. 8, fig. 8; pl. 9, figs 1–5.
1996a Cytheropteron pseudoalatum Colalongo & Pasini; Aiello et al.: 171, pl. 2, figs 1–3; pl. 3, figs 1–2.

Remarks. This species was originally reported from the Mediterranean. This is the first record from the North Atlantic.

Genus Eucytherura Müller, 1894
Type species. Cytherea complexa Brady, 1867 (designated by Alexander, 1936).

Remarks. We agree with Ayress et al. (1995) and consider Typhlocythere Bonaduce, Ciampo & Masoli, 1976, Typhloeucytherura Colalongo & Pasini, 1980 and Parahemmingwayella Dingle, 1984 as junior synonyms of Eucytherura Müller, 1894.

Eucytherura calabra (Colalongo & Pasini, 1980) (Fig. 10F–H)
1980 Typhloeucytherura calabra Colalongo & Pasini: 122, pl. 20, figs 1–8; pl. 21, figs 1–2.
1987 Eucytherura calabra (Colalongo & Pasini); Whatley & Coles: pl. 3, figs 14–16.
1988 Eucytherura sp. 1; Ruan & Hao: 291, pl. 49, fig. 18.
1988 Eucytherura calabra (Colalongo & Pasini); Whatley & Ayress: pl. 1, fig. 9a–b.
1995 Eucytherura calabra (Colalongo & Pasini); Ayress et al.: 211, fig. 3A–D.
1996 Eucytherura calabra (Colalongo & Pasini); Coles et al.: 136, pl. 3, fig. 18.
1996 Eucytherura calabra (Colalongo & Pasini); Zhao & Zheng: 72, pl. 2, fig. 36.
2001 Eucytherura calabra (Colalongo & Pasini); Didié & Bauch (as erratum of Didié & Bauch, 2000): 103, pl. 1, figs 9–10.

Remarks. Eucytherura calabra (Colalongo & Pasini, 1980) is similar to E. spinicorona Yasuhara, Okahashi & Cronin 2009, but the former has a curved dorsal margin and rectangular outline. E. calabra is known from the Atlantic, Mediterranean and Pacific.

Eucytherura multituberculata Ayress, Whatley, Downing & Millson, 1995 (Fig. 101–J)
1983 ?Tuberculocythere sp. Cronin: 107, pl. 6, fig. A.
1987 Eucytherura sp. 2 Whatley & Coles: 90, pl. 3, fig. 18.
1995 Eucytherura multituberculata Ayress, Whatley, Downing & Millson: 213, fig. 5A–E.

Remarks. This species is known both from the western and eastern North Atlantic.

Eucytherura tetrapteron (Bonaduce, Ciampo & Masoli, 1976) (Fig. 11A–C)
1976 ?Cytheropteron tetrapteron Bonaduce, Ciampo & Masoli: 99, pl. 47, fig 1–7.
1980 Cytheropteron? tetrapteron Bonaduce, Ciampo & Masoli; Ciampo: 19, pl. 3, fig. 5.
1980 Tuberculocythere tetrapteron (Bonaduce, Ciampo & Masoli); Colalongo & Pasini: 120, pl. 34 fig. 2.
1985 Tuberculocythere tetrapteron (Bonaduce, Ciampo & Masoli); Moncharmont-Zei et al.: 28, pl. 1, fig. 1.
1994 Parahemmingwayella tetrapteron (Bonaduce, Ciampo & Masoli); Malz & Jellinek: 28, pl. 7, figs 37–40.
2000 Parahemmingwayella tetrapteron (Bonaduce, Ciampo & Masoli); Aiello et al.: 94, pl. 3, fig. 9.
2001 Eucytherura sp. Didié & Bauch (as erratum of Didié & Bauch, 2000): 103, pl. 1, fig. 11.
2005 Parahemmingwayella tetrapteron (Bonaduce, Ciampo & Masoli); Guernet: 108.

Remarks. Eucytherura tetrapteron (Bonaduce, Ciampo & Masoli, 1976) is very similar to E. downingae (Coles & Whatley, 1989), but the latter has more strongly developed primary and secondary reticulation and bears two spines on the anterodorsal margin (the former bears a continuous frill). Although these differences are subtle and may be a result of intraspecific variation in calcification, we consider these two as separate species at least for now. E. tetrapteron is known from the Mediterranean and the eastern North Atlantic.

Genus Kangarina Coryell & Fields, 1937
Type species. Kangarina quellita Coryell & Fields, 1937

Kangarina abyssicola (Müller, 1894) (Fig. 11D–E)
1894 Cytheropteron abyssicolum Müller: 302, pl. 20, figs 5, 11; pl. 21, figs 6–9.
1952 Cytheropteron (Kangarina) abyssicolum Müller; Ruggieri: 77, pl. 6, fig. 9.
1953 Kangarina abyssicola coaractata Ruggieri: 53, figs 16, 16a.
1953 Kangarina abyssicola (Müller); Ruggieri: 53, figs 15, 15a.
1972 Kangarina septentrionalis Neale: 33, pl. 1, figs 1–8.
1976 Kangarina abyssicola (Müller); Bonaduce et al.: 84, pl. 17, fig. 16.
1980 Kangarina abyssicola (Müller); Colalongo & Pasini: 58, pl. 22, fig. 2.
1988 Kangarina abyssicola (Müller); Guernet & Fourcade: 145, pl. 4, fig. 12.
1993 non Kangarina abyssicola (Müller); Witte: 43, pl. 9, figs 25–26.
1996 Kangarina abyssicola (Müller); Coles et al.: 135, pl. 2, figs 10–11.
2004 Kangarina? abyssicola (Müller); Aiello & Szczechura: 53, pl. 8, fig. 15.
2005 Kangarina abyssicola (Müller); Guernet: 103.
2005 Kangarina coaractata Ruggieri; Guernet: 103.
2009b Kangarina cf. abyssicola (Müller); Yasuhara et al.: 914, p. 14, fig. 13.
2010 Kangarina abyssicola (Müller); Aiello & Barra: 412.

Remarks. We consider Kangarina coaractata Ruggieri, 1953 and K. septentrionalis Neale, 1972 as junior synonyms of K. abyssicola (Müller, 1894). K. abyssicola is known from the Mediterranean and the eastern and western North Atlantic.

Genus Pedicythere Eagar, 1965
Type species. Pedicythere tessae Eagar, 1965

Remarks. We found four Pedicythere species in ODP 982A, all of which also occur in the western North Atlantic (Yasuhara et al., 2009b).
Late Quaternary deep-sea ostracods, North Atlantic

**Fig. 10.** SEM images of *Cytheropteron* and *Eucytherura* species. A–B, *Cytheropteron perlaria* Hao, 1988: A, USNM 603706 (ODP982033); adult LV from 1/2/17–19; B, USNM 603707 (ODP982034); adult RV from 1/2/17–19. C–D, *Cytheropteron pherozigzag* Whatley, Ayress & Downing, 1986: C, USNM 603708 (ODP982032); adult LV from 1/1/142–144; D, USNM 603709 (ODP982031); adult RV from 1/2/17–19. E, *Cytheropteron pseudoalatum* Colalongo & Pasini, 1980, USNM 603710 (ODP982094); adult LV from 1/2/127–129. F–H, *Eucytherura calabra* (Colalongo & Pasini, 1980): F, USNM 603711 (ODP982100); adult LV from 1/1/70–72; G, USNM 603712 (ODP982101); adult LV from 1/1/90–92; H, USNM 603713 (ODP982102); adult RV from 1/1/107–109. I–J, *Eucytherura multituberculata* Ayress, Whatley, Downing & Millson, 1995: I, USNM 603714 (ODP982004); adult RV from 1/3/112–114; J, USNM 603715 (ODP982005); adult LV from 1/3/92–94. A–F, H–J, lateral views; G, internal view. All specimens from late Quaternary section of ODP Hole 982A, Rockall Plateau, eastern North Atlantic. Scale bars represent 0.5 mm.

*Pedicythere atroposopetasi* Yasuhara, Okahashi & Cronin, 2009 (Figs 11F–I, 12A–D)

?2000 *Pedicythere* sp. B Guernet & Bellier: 270, pl. 5, fig. 3.

2009 *Pedicythere atroposopetasi* Yasuhara, Okahashi & Cronin: 914, pl. 15, figs 1–13.

*Pedicythere kennettopetasi* Yasuhara, Okahashi & Cronin, 2009 (Fig. 13E–F)

?2000 (part) *Pedicythere* sp. A Guernet & Bellier: 270, pl. 5, fig. 2 (non fig. 1).

2009 *Pedicythere kennettopetasi* Yasuhara, Okahashi & Cronin: 916, pl. 16, figs 1–10.

*Pedicythere klothopetasi* Yasuhara, Okahashi & Cronin, 2009 (Figs 13G–J, 14A–E)

2009 *Pedicythere klothopetasi* Yasuhara, Okahashi & Cronin: 916, pl. 15, figs 14–21.
**Pedicythere lachesisopetasi** Yasuhara, Okahashi & Cronin, 2009  
(Figs 12E–J, 13A–D)

1983 *Pedicythere* sp. A Cronin: 110, pl. 4H.  
2008 *Pedicythere* sp. Bergue & Coimbra: 130, pl. 6, fig. 13.  
2009 *Pedicythere lachesisopetasi* Yasuhara, Okahashi & Cronin: 918, pl. 16, figs 11–21.

**Family Eucytheridae** Puri, 1954  
**Genus Eucythere** Brady, 1868

**Type species.** *Cythere declivis* Norman, 1867 (designated by Brady & Norman, 1889; see Horne & Whittaker (1985) for details and lectotype).

**Eucythere triangula** Whatley & Coles, 1987  
(Fig. 14F)

1987 *Eucythere triangula* Whatley & Coles: 74, pl. 4, figs 16–18.  
2000 *Eucythere triangula* Whatley & Coles; Didié & Bauch: 114, pl. 3, fig. 21.

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**Fig. 11.** SEM images of *Eucytherura, Kangarina* and *Pedicythere* species.  
A–C, *Eucytherura tetrapteron* (Bonaduce, Ciampo & Masoli, 1976):  
A, USNM 603716 (ODP982001); adult LV from 1/3/112–114;  
B, USNM 603717 (ODP982002); adult RV from 1/3/112–114;  
C, USNM 603718 (ODP982003); adult LV from 1/3/112–114.  
D–E, *Kangarina abyssicola* (Müller, 1894):  
D, USNM 603719 (ODP982104); adult LV from 1/1/137–139;  
E, USNM 603720 (ODP982103); adult RV from 1/1/70–72.  
F–I, *Pedicythere atroposopetasi* Yasuhara, Okahashi & Cronin, 2009:  
F–G, USNM 603721 (ODP982136); adult LV from 1/3/82–84;  
H–I, USNM 603722 (ODP982137); adult RV from 1/3/82–84. 
A–B, D–F, H, lateral views;  
C, internal view; 
G, I, oblique views.  
All specimens from late Quaternary section of ODP Hole 982A, Rockall Plateau, eastern North Atlantic.  
Scale bar represents 0.5 mm.
Late Quaternary deep-sea ostracods, North Atlantic

2009 *Eucythere triangula* Whatley & Coles; Alvarez Zarikian: 4, pl. P6, fig. 4.

2009b *Eucythere triangula* Whatley & Coles; Yasuhara et al.: 920, pl. 17, figs 2–7.

**Remarks.** This species is known both from the eastern and western North Atlantic.

Family *Krithidae* Mandelstam, 1958 (in Bubikyan, 1958)
Genus *Krithe* Brady, Crosskey & Robertson, 1874
**Type species.** *Ilyobates praetexta* Sars, 1866

**Remarks.** *Krithe* is one of the most abundant genera in this core, representing on average 20% of the total fauna. We followed the taxonomy of Coles et al. (1994). *Krithe* in this core is mainly composed of *K. dolichodeira* van den Bold, 1946, *K. ayressi* Coles et al., 1994 and *K. minima* Coles et al., 1994.

Family *Leptocytheridae* Hanai, 1957
Genus *Cluthia* Neale, 1973
**Type species.** *Cythere cluthae* Brady, Crosskey & Robertson, 1874

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Fig. 12. SEM images of *Pedicythere* species. A–D, *Pedicythere atroposopetasi* Yasuhara, Okahashi & Cronin, 2009: A, USNM 603723 (ODP982138); adult RV from 1/1/70–72; B, USNM 603724 (ODP982139); adult LV from 1/3/92–94; C–D, USNM 603725 (ODP982146); adult RV from 1/1/142–144. E–J, *Pedicythere lachesisopetasi* Yasuhara, Okahashi & Cronin, 2009: E–F, USNM 603726 (ODP982140); adult RV from 1/1/97–99; G–H, USNM 603727 (ODP982141); adult LV from 1/3/122–124; I–J, USNM 603728 (ODP982142); adult RV from 1/3/122–124. C, E, G, I, lateral views; A–B, internal views; D, F, H, J, oblique views. All specimens from late Quaternary section of ODP Hole 982A, Rockall Plateau, eastern North Atlantic. Scale bar represents 0.5 mm.
**Cluthia** sp.
(Fig. 14G–J)
1998 *Nannocythere* sp. Whatley, Eynon & Moguilevsky: 23, pl. 3, figs 9–10.
?2000 *Nannocythere* sp. Didić & Bauch: 111, pl. 4, fig. 25.

**Remarks.** This species is formally described as new in Yasuhara *et al.* (in press b).

**Family Loxoconchidae** Sars, 1926
Genus *Loxoconchidea* Bonaduce, Ciampo & Masoli, 1976

**Type species.** *Loxoconchidea minima* Bonaduce, Ciampo & Masoli, 1976

*Loxoconchidea minima* Bonaduce, Ciampo & Masoli, 1976
(Fig. 15A)
1976 *Loxoconchidea minima* Bonaduce, Ciampo & Masoli: 112, pl. 59, figs 1–7, text-fig. 43.
2000 *Loxoconchidea minima* Bonaduce, Ciampo & Masoli; Aiello *et al.*: 97, pl. 3, figs 1–3.
2004 *Loxoconchidea minima* Bonaduce, Ciampo & Masoli; Aiello & Szczechura: 35, pl. 7, figs 1–3.
2006 *Loxoconchidea minima* Bonaduce, Ciampo & Masoli; Bergue *et al.*: 206, fig. 6E.
2008 *Loxoconchidea minima* Bonaduce, Ciampo & Masoli; Bergue & Coimbra: 115, pl. 1, fig. 16.
2009b *Loxoconchidea minima* Bonaduce, Ciampo & Masoli; Yasuhara *et al.*: 920, pl. 17, figs 8–11.

Remarks. A comprehensive synonymy list can be found in Aiello & Szczechura (2004) and Yasuhara *et al.* (2009b). This species is known from the Atlantic and Mediterranean regions.

Family **Paradoxostomatidae** Brady & Norman, 1889

Genus **Paracytherois** Müller, 1894

Type species. *Paracytherois striata* Müller, 1894 [designated by Howe, 1955 (he considered this species a junior synonym of *Paradoxostoma flexuosum* Brady (1868) (*sic*; correctly, *Bythocythere flexuosa* Brady, (1867)); see Ellis & Messina Catalogue].
Paracytherois bondi Yasuhara, Okahashi & Cronin, 2009
(Fig. 15B–C)
2009b Paracytherois bondi Yasuhara, Okahashi & Cronin: 924, pl. 19, figs 5–10, 15 (?12).

Remarks. This species was known only from the western North Atlantic, but this record confirms its presence in the eastern North Atlantic.

Family Rockallidae Whatley, Uffenorde, Harlow, Downing & Kesler, 1982
Genus Arcacythere Hornibrook, 1952
Type species. Arcacythere chapmani Hornibrook, 1952

Remarks. We agree with Ayress (1991) in considering Rockallia Whatley, Frame & Whittaker, 1978 as a junior synonym of Arcacythere Hornibrook, 1952. See Yasuhara & Okahashi (in press) for detailed discussion.
Late Quaternary deep-sea ostracods, North Atlantic

Arcacythere enigmatica (Whatley, Frame & Whittaker, 1978) (Fig. 15D–I)
1978 Rockallia enigmatica  Whatley, Frame & Whittaker: 137, pls 5-138, 5-140, 5-142, 5-144; text-fig. 1.
1979 Indet. Gen. 3 Ducasse & Peyrouquet: pl. 5, fig. 9.
1982 Rockallia enigmatica  Whatley, Frame & Whittaker; Whatley et al.: 3, pl. 1, figs 1, 4.
1987 Rockallia enigmatica  Whatley, Frame & Whittaker; Whatley & Coles: 80, pl. 2, figs 3–4.
1987 Rockallia sp.  Whatley & Coles: 89, pl. 2, fig. 5.
1988 Rockallia enigmatica  Whatley, Frame & Whittaker; Ruan & Hao: 377, pl. 70, figs 2–4.
1988 Rockallia inceptiocelata  Whatley, Uffenorde, Harlow, Downing & Kesler; Ruan & Hao: 377, pl. 70, figs 5–7.
1990 Rockallia enigmatica  Whatley, Frame & Whittaker; Malz: 143, fig. 4.2.
2000 Rockallia enigmatica  Whatley, Frame & Whittaker; Didié & Bauch: 116, pl. 3, figs 13–14.

Fig. 16. SEM images of Echinocythereis and Henryhowella species. A–D, Echinocythereis echinata (Sars, 1866): A, USNM 603752 (ODP982027); adult RV from 1/1/142–144; B, USNM 603753 (ODP982028); adult RV from 1/1/142–144; C, USNM 603754 (ODP982029); adult LV from 1/3/72–74; D, USNM 603755 (ODP982030); adult LV from 1/3/72–74. E–K, Henryhowella asperrima (Reuss, 1850): E, USNM 603756 (ODP982022); adult LV from 1/1/137–139; F, USNM 603757 (ODP982023); adult RV from 1/1/137–139; G, USNM 603758 (ODP982026); adult LV from 1/1/0–2; H–I, USNM 603759 (ODP982024); adult RV from 1/1/142–144; J–K, USNM 603760 (ODP982025); adult LV from 1/1/107–109. A, C, E–G, I, K, lateral views; B, D, H, J, internal views. All specimens from late Quaternary section of ODP Hole 982A, Rockall Plateau, eastern North Atlantic. Scale bar represents 1 mm.
**Remarks.** This species is known from the eastern North Atlantic and northwestern Pacific oceans.

**Family Trachyleberididae** Sylvester-Bradley, 1948

**Remarks.** *Ambocythere, Bantonia* and *Pennyella* occur in this core, but we will discuss these genera elsewhere.

Genus *Echinocythereis* Puri, 1954

**Type species.** *Cythere margaritifera* Brady, 1870 (= *Cythereis garretti* Howe & McGuirt, 1935 in Howe & graduate students, 1935); see Hazel (1967).

*Echinocythereis echinata* (Sars, 1866) (Fig. 16A–D)

1866 *Cythereis echinata* Sars: 44.

1880 *Cythere irpex* Brady: 107, pl. 17, figs 2a–d.

1967 *Echinocythereis echinata* (Sars); Hazel: 37, pl. 6, figs 10–11.

1976 *Cythere irpex* Brady; Puri & Hulings: 278, pl. 11, figs 1–9.

1990 *Echinocythereis whatleyi* Dingle, Lord & Boomer: 303, figs 35B–F, 36E–G, 1–J.

2000 *Echinocythereis echinata* (Sars); Barra & Bonaduce: 214, pl. 1, figs 1–10; text-fig. 1.

2004 *Echinocythereis echinata* (Sars); Ayress et al.: 35, pl. 3, fig. 9.

2009 *Echinocythereis echinata* (Sars); Alvarez Zarikian: 6, pl. P9, figs 3–4.

2009b *Echinocythereis echinata* (Sars); Yasuhara et al.: 926, pl. 21, figs 6–9.

**Remarks.** A comprehensive synonymy and detailed discussion are found in Yasuhara et al. (2009b) and references therein. This species is known from the Atlantic and Southern Oceans.

Genus *Henryhowella* Puri, 1957

**Type species.** *Cythere evax* Ulrich & Bassler, 1904

*Henryhowella asperrima* (Reuss, 1850) (Fig. 16E–K)

1850 *Cypridina asperrima* Reuss: 74, pl. 10, fig. 5a–b.

2005 *Henryhowella asperrima* (Reuss); Mazzini: 50, figs 26A–I, 27B.

2009 *Henryhowella dasysderma* (Brady); Alvarez Zarikian: 6, pl. 9, figs 6–8.

2009b *Henryhowella cf. asperrima* (Reuss); Yasuhara et al.: 926, pl. 20, fig. 7; pl. 21, figs 1–4.

2010 *Henryhowella asperrima* (Reuss); Bergue & Govindan: 751, fig. 3.14.

2011 *Henryhowella asperrima* (Reuss); Pirkenseer & Berger: 54, pl. 7, figs 6a–6c, 7a–7c; pl. 8, figs 1a–1c, 2a–2c, 3a–3c.

**Remarks.** To be discussed in detail elsewhere.

**DISCUSSION**

ODP 982A late Quaternary ostracod assemblages show a strong affinity to the western North Atlantic and Mediterranean bathyal faunas and, to a lesser extent, to the western North Pacific bathyal fauna. There are many common or closely related species among these regions, as shown in the Systematic Palaeontology section above. The strong affinity among the western North Atlantic, the eastern North Atlantic and the Mediterranean faunas is understandable, given their proximity and bathyal-depth connections (e.g. Strait of Gibraltar and Greenland–Iceland–Faeroe Ridge). However, an affinity between the North Atlantic and the North Pacific is more difficult to explain. Two possibilities are proposed: (1) many bathyal ostracod species are cosmopolitan; or (2) they were able to migrate through the Bering Strait despite its present-day shallow depth (<50m). We will need further modern and palaeo-biogeographical studies to evaluate these hypotheses.

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