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First Record of a living Platycopida (Crustacea, Ostracoda) from Antarctic waters and a Discussion on *Cytherella serratula* (Brady, 1880)*

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Abstract

Previous records of Platycopida (Ostracoda) from the Antarctic region of the Southern Ocean include only a few fossil species from the Late Cretaceous to the Palaeocene: *Cytherelloidea megaspirocostata* Majoran & Widmark, 1998, [sic] *Cytherella serratula* (Brady, 1880), plus seven species left in open nomenclature. The present study documents the first record of a living platycopid from the Antarctic region and describes *Cytherella rwhatleyi* sp. nov. as new. Comparison among specimens collected at stations 60° longitude and 10° of latitude apart from each other show that very little intraspecific variation in outline and ornamentation of the valves, as well as on the hemipenis is presented by this new species. Otherwise, clear differences on valve and hemipenis are observed between different species (herein, Jellinek & Swanson 2003). Review of the literature indicates that several species (with great differences in valve outline and ornamentation) have been erroneously assigned to *Cytherella serratula* (Brady, 1880) demonstrating that this so-called cosmopolitan taxon is in truth most probably restricted to bathyal depths of the Northwestern Atlantic. Finally, the abundances of *Cytherella rwhatleyi* sp. nov. in the samples studied herein (considering O_2 concentration measurements) contradict the proposed relationship between Platycopida and O_2 concentration in water masses (Whatley *et al.* 2003).

Key words: Ostracoda; Platycopida; new species; Southern Ocean; continental slope; deep-sea

Introduction

Although previous studies on Ostracoda record more than 200 species from the Antarctic region of the Southern Ocean *sensu* Hedgpeth, (1969) and De Broyer *et al.* (2004) (=southern to the Polar Frontal region), none cite living Platycopida (Hartmann 1997). This fact is surprising since platycopids have been present in Antarctic waters from the Cretaceous to the Oligocene (Majoran *et al.* 1997, Dingle & Majoran 2001, Majoran & Dingle 2002, Fauth *et al.* 2003) (Fig. 1 herein), and still occur nowadays in the Subantarctic and Subtropical regions of the Southern Ocean (Fig. 1) (Bergue *et al.* 2007, Chapman 1919, Dingle *et al.* 1990, Jellinek & Swanson 2003, Majoran *et al.* 1997, Majoran & Dingle 2001a, 2001b, Whatley & Cusminsky 2002, Whatley *et al.* 1996, 1997, 1998).

Seven species recorded from the Antarctic Region were left in open nomenclature, with only two species being named so far: *Cytherelloidea megaspirocostata* Majoran & Widmark, 1998 and [sic] *Cytherella serratula* (Brady, 1880) (see below discussion on the misidentifications on this species). *Cytherelloidea megaspirocostata*, *Cytherella* sp. 1, and *Cytherella* sp. 2 occur in the middle to late Campanian (Upper Createaceous) of James Ross Island, Antarctic Peninsula (Fauth *et al.* 2003); and *Cytherella* sp. and *Cytherelloidea* sp. were

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recorded from the Maastrichtian (Upper Cretaceous) from Maud Rise and Northeastern Georgia Rise respectively (Majoran *et al.* 1997). In the Cenozoic, few unidentified species of the genus *Cytherella* were reported from the Palaeocene and Eocene of the Maud Rise (Majoran & Dingle 2002) and from the Oligocene of the Victoria Land Basin (Dingle & Majoran 2001). In addition, a number of fossil and living platycopids have been collected from the deep-sea southern Atlantic and Indic / Pacific Oceans, with special reference to the highly diverse fauna of the Tasman Sea, and the Challenger and Campbell Plateaus: *Cytherella hiatus* Swanson *et al.* 2005, *C. intonsa* Swanson *et al.* 2005, *C. corpusculum* Swanson *et al.* 2005, *C. plusminusve* Swanson *et al.* 2005, *C. permutata* Swanson *et al.* 2005, *Grammcythella dyspnoea* Swanson *et al.* 2005, and *Inversacytherella tanantia* Swanson *et al.* 200 (Jellinek & Swanson 2003, Swanson *et al.* 2005).

The theory on the relationship between the O_2 concentration in the water mass and the numerical abundance of filter feeding ostracods, including the genus *Cytherella*, states that the filter feeding strategy would cause a higher ecological success of during kenoxic/anoxic events, because the higher water circulation inside the carapace (Whatley 1991). Furthermore, eggs brooded by the female inside of the carapace, would also profit from the higher ventilation and would consequently have higher survival chances than eggs lain in the environment (Jarvis *et al.* 1988). This hypothesis is tested in the present study.

In the present work, 207 live specimens of a recent platycopid species are studied. This material was collected during two cruises of the R. V. *Polarstern* from the continental slope off Antarctica (Weddell and Scotia Seas). These specimens belong to a new species, *Cytherella rwhatleyi* sp. nov., described and illustrated herein. The large number of living specimens made an evaluation on the intraspecific morphological variability in a deep-sea cytherellid possible. This evaluation is one of the key objectives of the taxonomy and has important implications for studies of biodiversity, genetic, paleoenvironmental, and geochemistry.

Furthermore, I studied the type material of *Cytherella serratula* (Brady, 1880) and discuss its previous records, which proposed geographical distribution include from the North and South Atlantic, the Indo-Pacific and the Southern oceans. Based on published illustrations, the morphologies of the different specimens are compared.

Material and Methods

Two cruises of the German R. V. *Polarstern* (ANT XV/3, in the summer of 1998 – EASIZ Project; ANT XXII/3 – ANDEEP Project, in the summer and beginning of the spring of 2005) in the Scotia and Weddell Seas, Southern Ocean, provided 207 live platycopid specimens, among them many gravid females. These specimens were collected in four different stations (Tab. 1, Fig. 1) from 938 to 2069 meters depth using the gears epibenthic sledge (EBS), Agassiz trawl (AGT) and giant box corer (GKG). For details on EASIZ II and ANDEEP III expeditions see Arntz & Gutt (1999) and Fahrbach (2006), respectively.

EASIZ II specimens (#89 and #107) were fixed in formalin 4% and transferred to ethanol 96% after sorting. ANDEEP III specimens were fixed either in pre-cooled (-40°C) 96% ethanol (EBS samples), or in formalin 4% (AGT sample # 57-2, and GKG sample # 153-4,), or in 3% glutardialdehyde in 0.05% phosphate buffer (AGT sample 153-8).

For the study of the “soft parts” in the scanning electron microscope, ten specimens (SNB 0692-0694, 0697-0701) of the sample #153-8 were washed 3 three times for 15 minutes in 0.05% phosphate buffer, and subsequently dehydrated in graded series of ethanol from 30% to 100% in 10% steps and at least 15 minutes in each step. The animals were critical point dried in a Balzers CPT Dryer with CO_2. One of the valves of each specimen was dissected in the dried stage with needles. After a shading procedure with carbon or gold in an evaporation unit PD170AZ from Leybold-Heraeus the single shells and the critical point dried specimens were observed and photographed in a LEO 1525 SEM.

All the specimens studied herein were deposited in the Crustacea collection of the Zoologisches Institut und Museum, University of Hamburg (Germany), under the abbreviation ZMH K. The appendage and podomere nomenclature mostly follow Tsukagoshi *et al*. (2006, Figs. 7-9). The chaetotaxy descriptions are based on Schornikov and Keyser (2004), with one modification: c=comb setae (of mandible and maxilla I), l=long (for setae), m=medium-sized (for setae). Maps were made on Ocean Data View Program (Schlitzer 2007).

Abbreviations. A, adult(s); (A-1), (A-2), (A-3), juvenile stages; AGT, Agassiz trawl; AI, antenna I; AII, antenna II; ApV, ApVI, ApVII, fifth to seventh appendages; BM, The Natural History Museum, London (England); GKG, giant boxcorer; dv, dorsal view; EBS, epibenthicsledge; ev, external view; H, height; HP, hemipenis; iv, internal view; L, length; LV, left valve(s); Md, mandible; m, metres; mm, millimetres; MxI, maxilla I; RLV, closed right and left valves without soft parts; RV, right valve(s); SNB, specimen number as catalogued by the present author; SP, soft parts; sp(p)., species (plural); V, valve(s); ZMH, Zoologisches Institut und Museum, University of Hamburg (Germany); #, station; ~, approximately.

Taxonomy

Class Ostracoda Latreille, 1802, Subclass Podocopa Müller, 1894, Order Platycopida Sars, 1866, Suborder Platycopina Sars, 1866, Superfamily Cytherelloidea Sars, 1866

Family Cytherellidae Sars, 1866

Genus *Cytherella* Jones, 1849

Type-species. Cytherella ovata (Roemer, 1840)

Cytherella rwhatleyi sp. nov.

(Figs. 1–8, Tabs. 1, 2, 4)

Etymology. In honour of Dr. Robin Whatley, who published many studies on fossil and recent ostracods.

Material. 207 live specimens (64 adult males, 124 adult females, 15 (A-1), 1 (A-?2) + 3 specimens), 1 female RLV, 1 female RV.

Holotype – 1 adult male (SNB 0131), EASIZ II, # 89, ZMH K-41280.

Paratypes – 15 adult males, 10 adult females, 3 (A-1), (SNB 0018, 0132-4), 1 adult female RV, EASIZ II, # 89, ZMH K-41282; 1 adult male (SNB 0135), 4 adult females (SNB 0136), EASIZ II, # 107, ZMH K-41283; 1 adult male (SNB 0159), 1 adult female (SNB 0158), ANDEEP III, # 57 – 2, ZMH K-41284; 1 adult male (SNB 0169), 1 adult female (SNB 0168), + 2 adult and 1 juvenile specimens, ANDEEP III, # 153 – 4, ZMH K-41285; 15 adult males (SNB 0170), 14 adult females, 8 (A-1) (SNB 0688, 0690-1), 1 (A-?2) (SNB 0689), ANDEEP III, # 153 – 7 – E, ZMH K-41286; 28 adult males, 81 adult females, 4 (A-1), 1 female RLV, ANDEEP III, # 153 – 7 – S, ZMH K-41287; 2 adult males (SNB 0693-4), 13 adult females (SNB 0692, 0697-0701), ANDEEP III, # 153 – 8, ZMH K-41288.

Distribution. Northeastern Weddell Sea and Southwestern Scotia Sea, Antarctic Region of the Southern Ocean, 938 and 2069m.

V Measurements (Fig. 2). Holotype—RV L 1.03mm, H 0.58mm, LV L 1.02mm, H 0.53mm; Paratypes—adult male RV L 1.01–1.08mm, H 0.57–0.61mm; adult females RV L 1.00–1.11mm, H 0.58–0.65mm; (A-1) RV L 0.85 – 0.90mm, H 0.54 – 0.58mm; (A-?2) RV 0.72mm, H 0.42mm.

Diagnosis. In lateral view, RV and LV oval – sub-rectangular; very wide rim present on entire valve margin in males, but only on anterodorsal to ventral areas of valves in females; anterior margin more broadly rounded than posterior; pronounced selvage present, with shorter and longer radial setae. Lateral surface with medium-sized, shallow, punctae present on almost entire valve surface except by the adductor muscle scar and ventral – anteroventral areas. Genital lobe proximally subcircular, with "beak-shaped" distal process, which is convex anteriorly and concave posteriorly. HP very elongated and relatively thin, with "heart-shaped" proximal lobe, and subtriangular distal lobe.

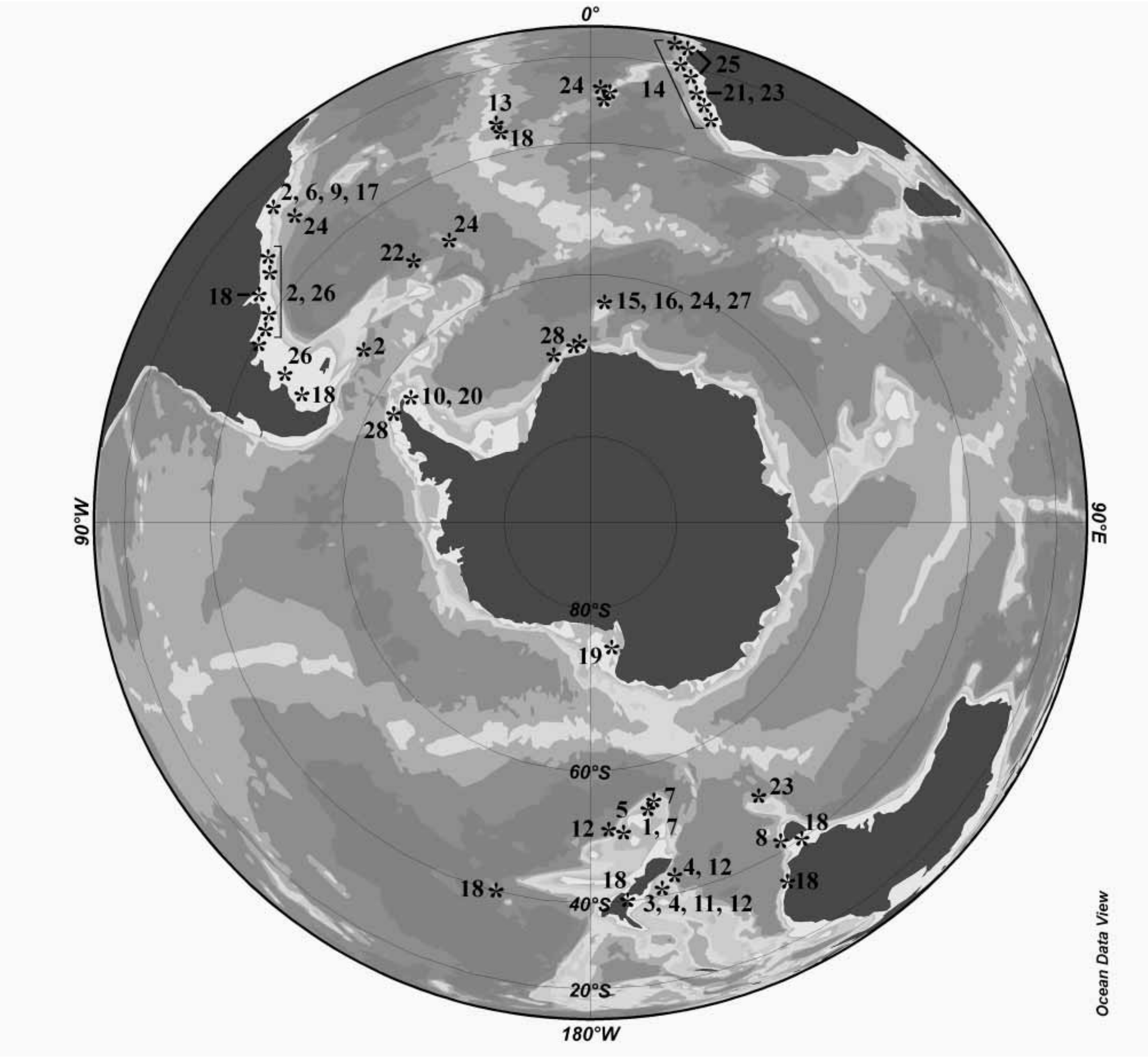


FIGURE 1. Previous records of Platycopida in the Southern Ocean and vicinities.

Fossil records included only for the Antarctic region, for other regions only recent and subfossil records represented. **1**—*Cytherella corpusculum* Swanson *et al.* 2005, Recent; **2**—*Cytherella hermargentina* Whatley *et al.* 1998, subfossil; **3**—*Cytherella hiatus* Swanson *et al.* 2005, Recent; **4**—*Cytherella intonsa* Swanson *et al.* 2005, Recent; **5**—*Cytherella permutata* Swanson *et al.* 2005, Recent; **6**—*Cytherella pleistocenica* Bergue *et al.* 2007, Late Quaternary; **7**—*Cytherella plusminusve* Swanson *et al.* 2005, Recent; **8—***Cytherella punctata* Brady, 1865, Recent???; **9—***Cytherella santosensis* Bergue *et al.* 2007, Late Quaternary; 10—*Cytherelloidea megaspirocostata* Majoran & Widmark, 1998, Upper Cretaceous (from Fauth *et al.* 2003); **11**—*Grammcythella dyspnoea* Swanson *et al.* 2005, Recent; **12**—*Inversacythella tanantia* Swanson *et al.* 2005, Recent; **13–17**—*Cytherella* spp. (as *C. serratula* (Brady, 1880)), Paleocene to Recent; **18—***Cytherella* spp.—as *C. cavernosa*, *C. cingulata*, *C. polita*, *C. punctata*, and *C. pulchra* from the first report on the Challenger expedition ostracods (Brady 1880), Recent; **19–26**—*Cytherella* spp., Upper Cretaceous to Recent; **27**—*Cytherelloidea* sp., Late Cretaceous to Oligocene; **28**—*Cytherella rwhatleyi* sp. nov., Recent.

Bibliographical Sources: **1, 3–5, 7, 11, 12—**from Jellinek & Swanson (2003) and Swanson *et al.* (2005); **2**—from Bergue *et al.* (2007), Whatley & Cusminsky (2002), and Whatley *et al.* (1996, 1997,1998); **6, 9, 17**—from Bergue *et al.* (2007); **8—**from Chapman (1919); **10—***Cytherelloidea megaspirocostata* Majoran & Widmark, 1998, Upper Cretaceous (from Fauth *et al.* 2003); **13**—from Brady 1880; **14**—Quaternary, from Dingle *et al.* (1990); **15**—Eocene, from Majoran & Dingle (2002); **16**—Palaeocene to Oligocene, Majoran & Dingle (2002); **18**—Recent, Brady, 1880; **19**—Oligocene, from Dingle & Majoran (2001); **20**—Upper Cretaceous, from Fauth *et al.* (2003); **21**—Quaternary, from Dingle *et al.* (1990); **22**—Eocene, from Majoran & Dingle (2001b); **23**—subfossil, from Mazzini (2005); **24**—Late Cretaceous, from Majoran *et al.* (1997); **25**—Peypouquet & Benson (1980); **26**—subfossil, from Whatley *et al.* (1997, 1998); **27**—Eocene to Oligocene, from Majoran & Dingle (2002); **28**—Recent, herein.

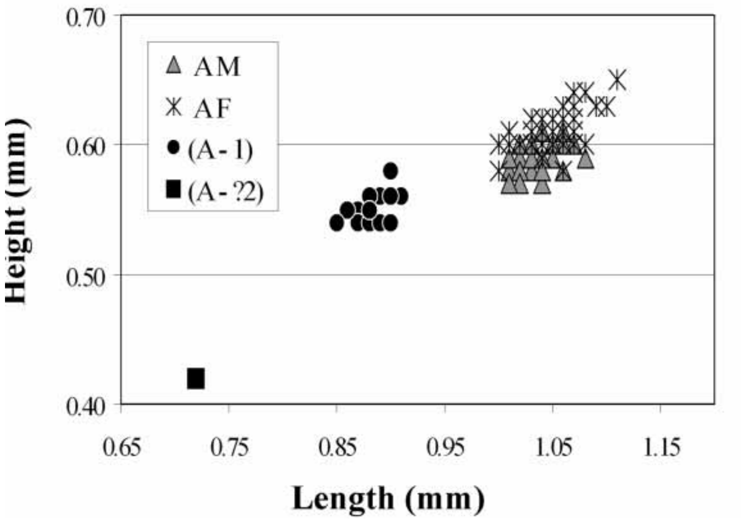


FIGURE 2. Length: height scatter plot of adult and juvenile valves of *Cytherella rwhatleyi* sp. nov.

TABLE 1. Stations with samples containing *Cytherella rwhatleyi* sp. nov.

Station	*Polarstern*	Project	Date	Time	Latitude		Longitude		Depth (m)	Gear	Sediment
	Expedition				**S begin**	**S end**	**W begin**	**W end**			
89	PS48/ANTXV-3	EASIZ II	04.02.98	10:24	73°27.26'	73°27.27'	22°45.67'	22°46.52'	1645	EBS	NI
107	PS48/ANTXV-3	EASIZ II	06.02.98	8:24	73°34.77'	73°34.92'	22°38.29'	22°38.89'	938	EBS	fine gravel
57-2	PS67/ANTXXII-3	ANDEEP III	10.02.05	18:44	69°24.15'	69°24.63'	5°18.40'	5°19,70'	1812	AGT	NI
153-4	PS67/ANTXXII-3	ANDEEP III	29.03.05	08:52	63°19.35'	-	64°36.79'	-	2079	GKG	72% silt, 13% sand, 15% clay
153-7	PS67/ANTXXII-3	ANDEEP III	29.03.05	13:33	63°19.83'	63°19.19'	64°36.44'	64°37.52'	2011	EBS	72% silt, 13% sand, 15% clay
153-8	PS67/ANTXXII-3	ANDEEP III	29.03.05	16:37	63°19.53'	63°19.06'	64°36.79'	64°37.23'	2069	AGT	72% silt, 13% sand, 15% clay

NI—no information available. For other abbreviations see Material and Methods.

Description. In Lateral view, RV and LV oval to sub-rectangular; very wide rim present on entire valve margin in males, but only on anterodorsal to ventral areas of valves in females (because of the posterior inflated form due to the brood chamber); dorsal margin fairly straight; ventral margin slightly concave in females and concave in males; anterior margin more broadly rounded than posterior. Pronounced selvage present, with shorter and longer radial setae. Lateral surface punctate, punctae medium-sized, shallow, and present on almost entire valve surface except by the adductor muscle scar and ventral-anteroventral areas; one to three slight, small tubercles (related to muscle insertions on interior surface of valves) present on mid-dorsal area of lateral surface. Maximum height anterior to midlength; in males greatest length at mid-height, and greatest width at mid length; in females, greatest length inferior to mid-length, and greatest width posterior to mid-length. Few, very long setae arising from carapace posterior; shorter, simple or feathered setae arising from simple, “bean-shaped” to circular, lateral pore canals. RV slightly larger and overlaping LV mid-dorsally. In dorsal view, males with sinuous outline (due to wide rim), females with subtriangular outline (due to brood chamber). Adductor muscle scars composed by 2 vertical rows, each with six scars, plus one dorsal scar. Sexual dimorphism pronounced; females higher in relation to length and wider than males; female with inflated posterior (=brood chamber) without limen (ridge or elevation forming the anterior boundary of brood chamber). Females brooded from 0 to 6 eggs, with a maximum of 3 eggs per valve (Fig. 6, Tab. 2), in average 3.6 eggs / female; exact position of single eggs in brood chamber also varied (ventral, medial or dorsal).

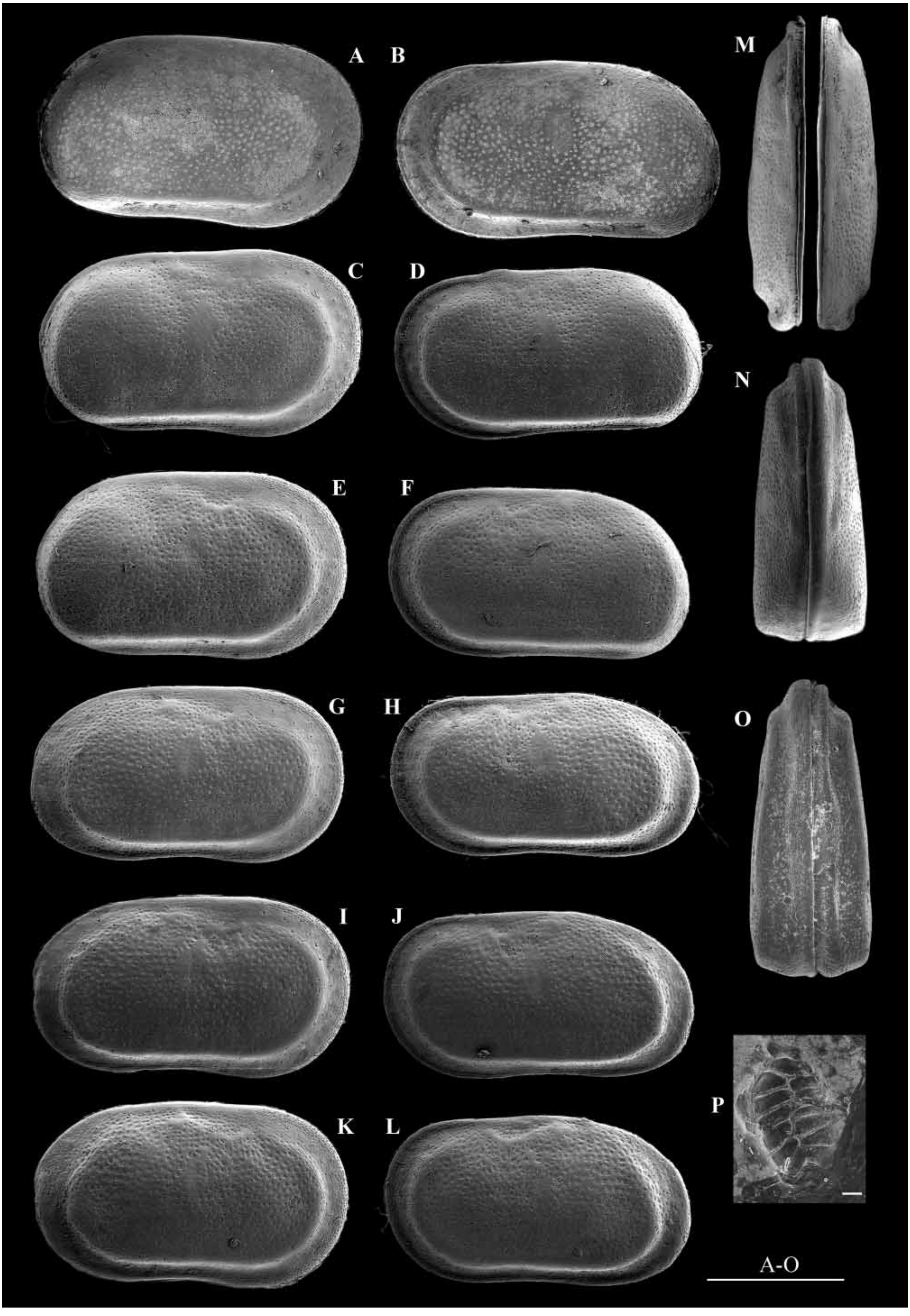
TABLE 2. Number of eggs brooded by single females of *Cytherella rwhatleyi* sp. nov. in the different stations.

LV	RV	# 89	# 107	# 153	Total
0	0	0	0	10	10
0	1	0	0	3	3
0	2	0	0	2	2
1	0	2	1	2	5
1	1	0	0	6	6
1	2	0	1	5	6
1	3	0	0	3	3
2	0	0	0	1	1
2	1	0	1	2	3
2	2	1	0	12	13
2	3	2	0	13	15
3	1	0	0	2	2
3	2	0	0	17	17
3	3	0	0	9	9
	Total	5	3	87	95

For abbreviations see Material and Methods.

AI robust, with 7 podomeres, podomere III subtriangular; chaetotaxy 1(0/.3.1.1), 2(.1r/.3), 3(.1/1r), 4(.3/0:1,1,1), 5(0/0:2,1), 6(.1m,1r/0:2l), 7(0/0:3m,0-1r.1m). Base of AII with barbed dorsal margin; endopodite podomere I with 6 (3 ventral plus 3 distal) modified setae, which lack any kind of pore indicative of chemical reception; chaetotaxy—Coxa (.1.1/0), Basis (0/.2-3), Exopodite I (0/0: 4-5), Exopodite II (.0-1./0:7), Endopodite I (0/3r.:6-7.5-6,3r), Endopodite II+III (.1-2.1-2/.1), Endopodite IV (0/.1.:3). Coxa of Md with 2 endites finely denticulate distally; approximatelly 60 comb setae; chaetotaxy—Exopodite (4), Endopodite I (0/0:3). Endites of MxI with numerous setae and barbae; MxI chaetotaxy—Coxa (.1/0), Base (0/.11.4,~50c), Exopodite (~30), Endopodite I (.1-2/.1.1.1.1.), Endopodite II (0/0:3-4). ApV strongly sexually dimorphic, endopodite well developed, hook-shaped in male and reduced in female; chaetotaxy of ApV of male—Endite (7-8,0-1r), Exopodite (~20), Endopodite I (0/.2.1-2), Endopodite II (0/.1-2.1-2.2-3), Endopodite III (0/.1:1,1-2). ApVI also strongly sexually dimorphic, endopodite well developed, hook-shaped in male and absent in female; chaetotaxy of ApVI of male—Exopodite (~13), Endopodite I (0/.1.1.), Endopodite II (.1l/.1.1.1), Endopodite III (0/.1:3); chaetotaxy of ApVI of female—Exopodite (~7). Fu a pair of lamella bearing 9 to 11 feathered setae plus 1 reduced seta. HP very elongated and relatively thin, with “heart-shaped” proximal lobe, and subtriangular distal lobe. Genital lobe proximally subcircular, with “beak-shaped” distal process, which is convex anteriorly and concave posteriorly. Trunk with 11 segments, males bearing several short setae and females bearing long setae. HP inserted in segments V to VII (segment I most posterior, following Tsukagoshi *et al.* 2006), genital lobe inserted in segments V to VIII.

FIGURE 3. Adult valves of *Cytherella rwhatleyi* sp. nov. from the different stations in the Scotia and Weddell Seas.
A, C, E, G, I, K, RV ev; **B, D, F, H, J, L**, LV ev; **M**, RV and LV dv; **N**, RLV dv; **O**, RLV vv; **P**, adductor muscle scars.
A, B, paratype adult female (ZMH K-41282, SNB 0018); **C, D**, paratype adult female (ZMH K-41283, SNB 0136); **E, F**, paratype adult female (ZMH K-41285, SNB 0168); **G, H, M**, holotype adult male (ZMH K-41280, SNB 0131); **I, J**, paratype adult male (ZMH K-41283, SNB 0135); **K, L**, paratype adult male (ZMH K-41286, SNB 0170); **N**, paratype adult female (ZMH K-41288, SNB 0696); **O**, paratype adult female (ZMH K-41288, SNB 0695). Scale bars: **A-O**, 500µm; **P**, 20 µm.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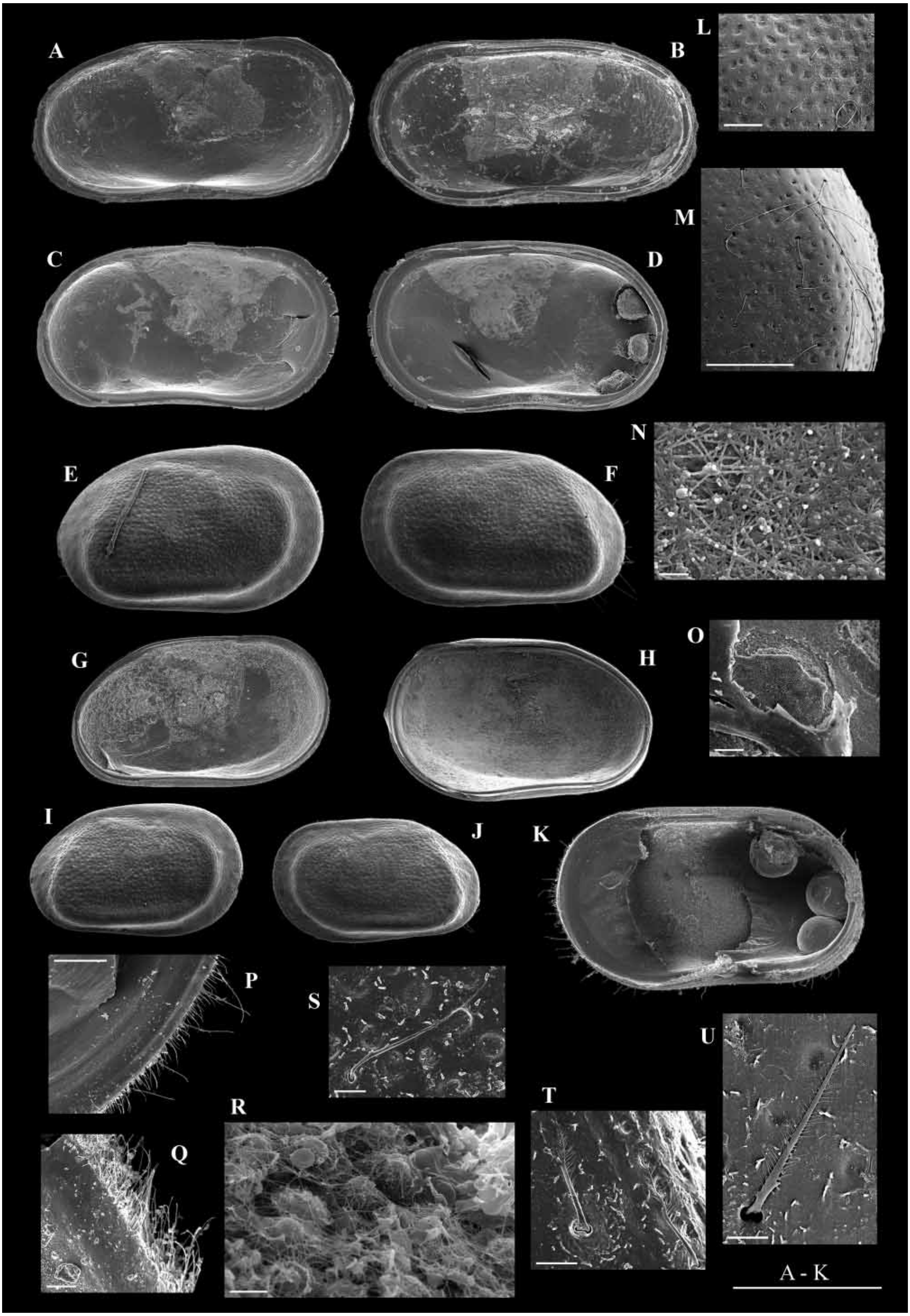
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FIGURE 4. Adult and juvenile valves of *Cytherella rwhatleyi* sp. nov.
A, C, G, LV iv; **B, D, H, K**, RV iv; **E, I**, RV ev; **F, J**, LV ev; **L**, ornamentation of medio-dorsal area of external surface of RV; **M**, long setae and ornamentation on posterior of RV; **N**, chitin mesh of outer lamella; **O**, detail of a muscle scar; **P, Q**, selvage iv; **R**, chitin fibres beneath the endocuticule of the outer lamella; **S-U**, sensilla.
A, B, paratype adult male (ZMH K-41282, SNB 0133); **C, D**, paratype adult female (ZMH K-41282, SNB 0018); **E, F**, paratype (A-1) (ZMH K-41286, SNB 0688); **G, H**, paratype (A-1) (ZMH K-41286, SNB 0691); **I, J, S, T**, paratype (A-?2) (ZMH K-41286, SNB 0689); **K, P**, paratype adult female (ZMH K-41286, SNB 0692); **L**, paratype adult male (ZMH K-41286, SNB 0170); **M**, paratype adult female (ZMH K-41283, SNB 0136); **N, O, Q, R**, paratype adult female (ZMH K-41288, SNB 0697); **U**, paratype adult female (ZMH K-41283, SNB 0136). Scale bars: **A-K**, 500µm; **L, P**, 50 µm; **M**, 100 µm; **N**, 500 nm; **O**, 5 µm; **Q, S-U**, 10 µm; **R**, 1 µm.

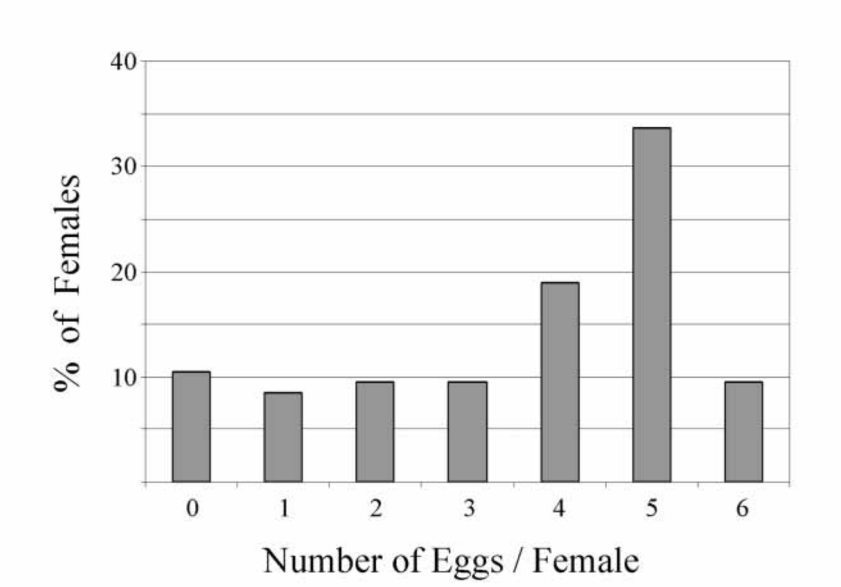


FIGURE 5. Number of eggs brooded by single females of *Cytherella rwhatleyi* sp. nov.
Absolute values on table 2.

Remarks. Several specimens from the ANDEEP # 153-7 were parasited by ?fungi and ?bacteria (Fig. 6.L-N).

The types of *Cytherella serratula* (Brady, 1880) (Fig. 9) from West Indies (713m depth) can be differentiated from *Cytherella rwhatleyi* sp. nov., because the last species has a more quadrate outline, with straighter posterodorsal margin, punctuate external surface (anteriorly and posteriorly) and do not present small tubercles in the posterior part of valves.

The only other known recent Subantarctic (Atlantic Sector) species, *Cytherella hermargentina* Whatley *et al.* 1998 (Fig. 1.2 herein), is comparatively higher with more rounded outline than the new species.

Swanson *et al.* (2005) described seven new species and two new genera of Cytherellidae from the Tasman Sea and from the Indic / Pacific sector of the Southern Ocean (Fig. 1.1, 3, 4, 5, 6, 8, 9). Five of these species belong to the genus *Cytherella*: *C. hiatus* Swanson *et al.* 2005, *C. intonsa* Swanson *et al.* 2005, *C. corpusculum* Swanson *et al.* 2005, *C. plusminusve* Swanson *et al.* 2005, *C. permutata* Swanson *et al.* 2005. These last five species lack wide rim on the lateral surface of valves, an important diagnostic character of the new species decribed here.

Cytherella rwhatleyi sp. nov. differs from the *Cytherella* species recorded by Whatley & Coles (1987) (as *C. serratula*) from the Quaternary of North Atlantic (Deep Sea Drilling Project, site 607, 3427m) (Fig. 6.7), in ornamentation (punctuation on the entire valve surface versus tubercles just on the posterior), and shape of the dorsal margin (fairly straight versus slightly convex), and the posterior margin (steeper dorsally versus sub-hemispherical).

Dingle *et al.* (1989, 1990) also reported [sic] *C. serratula* from Southeastern Atlantic (1000 to 2070m) (Fig. 1.10) and Mazzini (2005) illustrated a similar species from Emerald Basin (Southern Ocean, Indic – Pacific Sector) (Fig. 1. 18). Both species lack surface punctation, are much higher in relation to length, and present more broadly rounded RV and more narrowly rounded posteroventral margin than *C. rwhatleyi* sp. nov.

Cytherella hemipuncta Swanson, 1969 described from the Miocene of New Zealand present irregularly spaced punctae, which are larger than the punctae of *Cytherella rwhatleyi* sp. nov. *Cytherella rwhatleyi* sp. nov. is similar in shape to *C.* cf. *hemipuncta* Swanson, 1969 recorded by Ayress (1995) from the Eocene of New Zealand, but the latter lacks the wide rim on the lateral valve surface.

Cytherella rwhatleyi sp. nov. can be distinguished from the *Cytherella s*pecies recorded by Majoran & Dingle (2002) from the Maud rise (Weddell Sea) (Fig. 1.14), owing to the more subquadrate outline and relatively straight dorsal margin of the former.

Cytherella sp. 4796 from the Oligocene of Victoria Land Basin, Antarctica (77S, 63E) (Dingle & Majoran, 2001) (Fig. 1.11) has a more rounded outline than the new species described herein.

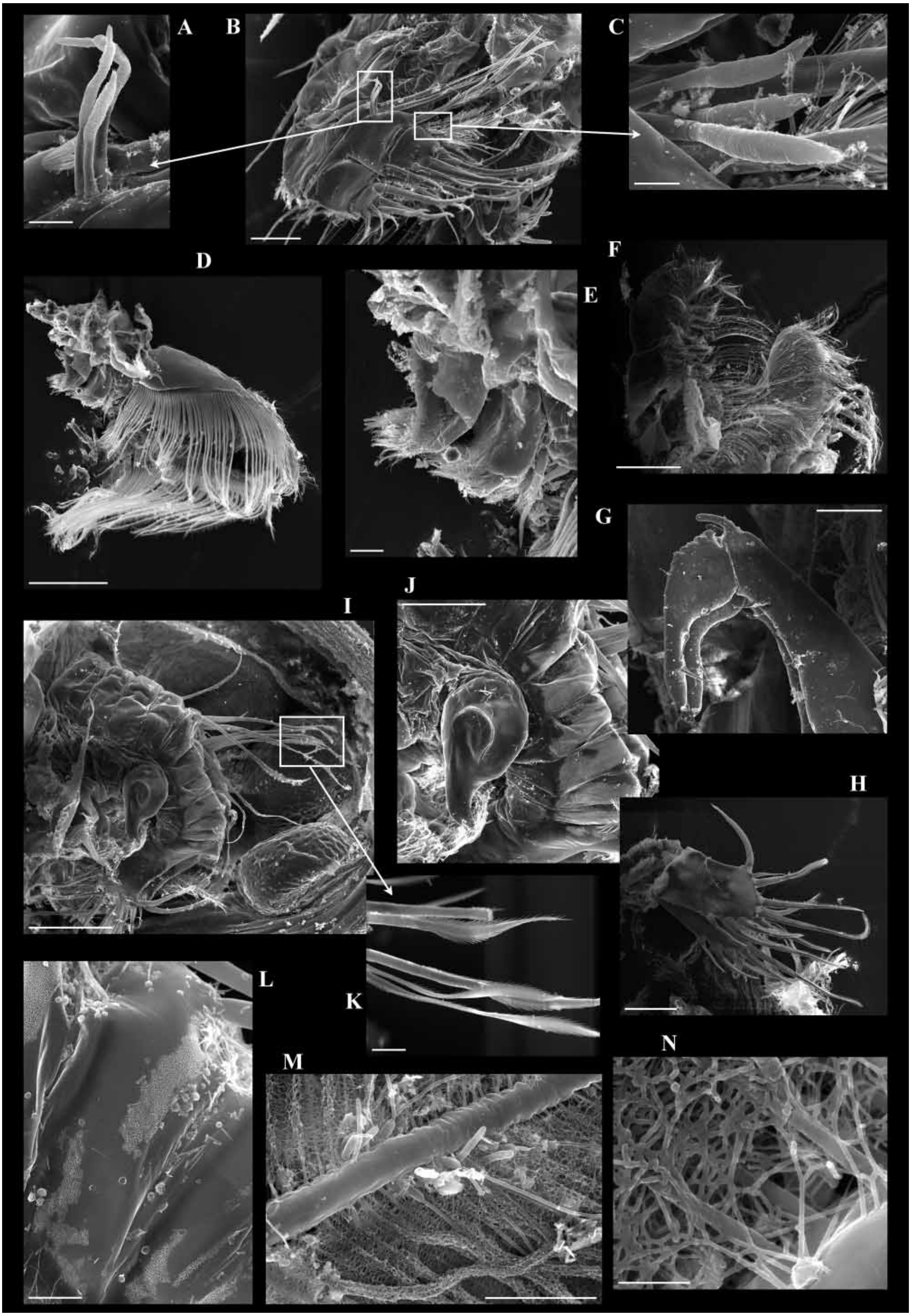
The oldest record of a cytherellid in Antarctica dates from the Campanian (Upper Cretaceous) of James Ross Island, where Fauth *et al.* (2003) recorded two undescribed *Cytherella* species (Fig. 1.12). *Cytherella* sp. 1 resembles *C. rwhatleyi* sp. nov in outline, but the former has a more concave ventral margin, whereas the outline of *C.* sp. 2 is much more rounded than that of the new species. Furthermore, both cretaceous species lack the conspicuous rim of *C. rwhatleyi* sp. nov.

Majoran & Dingle (2001a) recorded *Cytherella* sp. from the Southwestern South Atlantic (Deep-Sea Drilling Project /Ocean Drilling Program sites 329, 513 and 699) (fig. 1.13). *Cytherella rwhatleyi* sp. nov. has a more quadrate outline and straight dorsal margin, while *C.* sp. (Majoran & Dingle 2001a, pl. 1.6) is more rounded with a convex dorsal margin.

Cytherella pleistocenica Berge *et al.* 2007 differs from the new species described herein by the absence of the wide rim of valves.

Cytherella rwhatleyi sp. nov. is very similar to *Cytherella santosensis* Bergue *et al.* 2007 described from the Late Quaternary Santos Basin (SW Atlantic, off Southeastern Brazil) in the presence of the wide rim on the anterior, ventral and posterior areas of the valve surface (Fig. 1.20), but the outline of the former species is more equilateral, with less broadly rounded anterior margin. Furthermore, the centrodorsal area of lateral surface is more steeply elevated and the ornamentation is stronger in *C. rwhatleyi* than in *C. santosensis*. The similarity between these two spp. (valve outline, wide rim, and punctate lateral surface), one in the Southern Ocean, the other occurring in the Southwestern Atlantic demonstrates a possible migration route, made facilitated by the deep-water currents. A large quantity of the deep waters in the world has its origin in the Weddell Sea, where the new sp. described herein occurs. There the surface water is cooled and sinks to the ocean bottom, migrating then northwards in the Atlantic, Pacific and Indic Oceans (Tomczak & Godfrey 2002). Otherwise it seams that the velocity, and probably also the frequency, in which the migration occurs is not high enough to maintain the genetic flux between two populations, one in the South Atlantic and the other in the Weddell Sea. As a consequence of that, allopatric speciation occurred and we observe similar but easily differentiable species, one in the Atlantic and the other in the Weddell and Scotia Seas.

FIGURE 6. "Soft parts" of *Cytherella rwhatleyi* sp. nov.
A, C, modified setae of AII (not aesthetasc); **B**, AII; **D**, Md; **E**, Md endites; **F**, MxI and female ApV; **G**, male ApV; **H**, Fu; **I**, posterior of female (showing body segementation, posterior dimorphic setae, genital lobe, Fu and eggs); **J**, genital lobe; **K**, details of distal part of posterior dimorphic setae (inserted on posterior segments of body); **L-N**, body posterior and comb setae of specimen parasited by ?fungi and ?bacteria.
A-F, H, K, paratype adult female (SNB 0698); **G**, paratype adult male (ZMH K-41288, SNB 0694); **I, J**, paratype adult female (SNB 0699); **L-N**, paratype adult female (SNB 0697). All ZMH K-41288. Scale bars: **A, E, F, J, K, L**, 10µm; **B, D, G, H**, 50 µm; **C, M**, 5 µm; **I**, 100 µm; **N**, 500 nm.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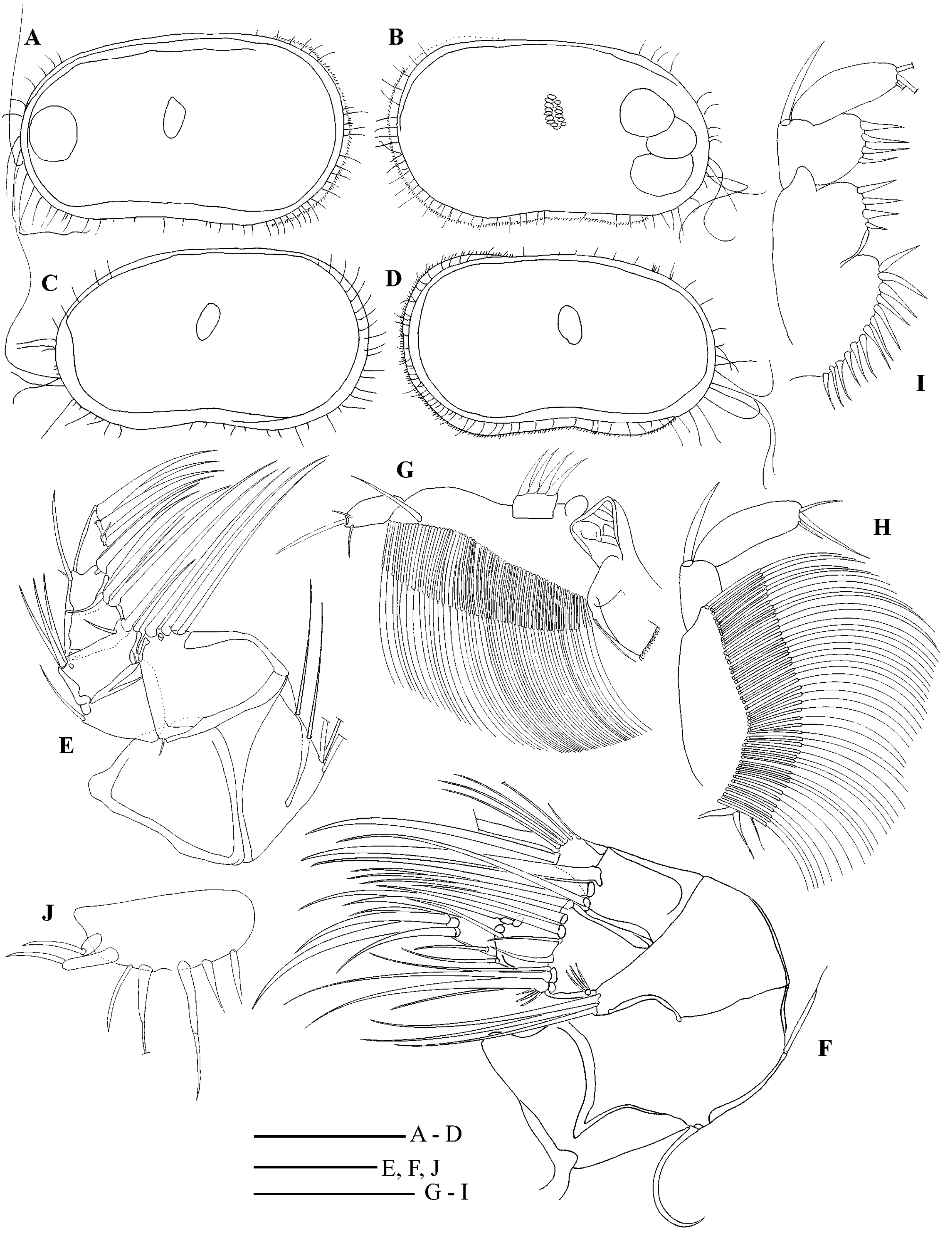

FIGURE 7. Valves and appendages of *Cytherella rwhatleyi* sp. nov.
A, C, RV ev; **B, D**, LV ev; **E**, AI, **F**, AII, **G**, Md; **H**, MxI (ventral setae not shown); **I**, MxI (comb setae not shown); **J**, female ApVI. **A, B**, paratype adult female (ZMH K-41284, SNB 0158); **C, D**, paratype adult male (ZMH K 41284, SNB 0159); **E-G**, holotype adult male (ZMH K-41280, SNB 0131); **H, I**, paratype adult female (ZMH K-41282, SNB 0134); **J**, paratype adult female (ZMH K-41283, SNB 0136). Scale bars: **A-D**, 500µm; **E-J**, 100µm.

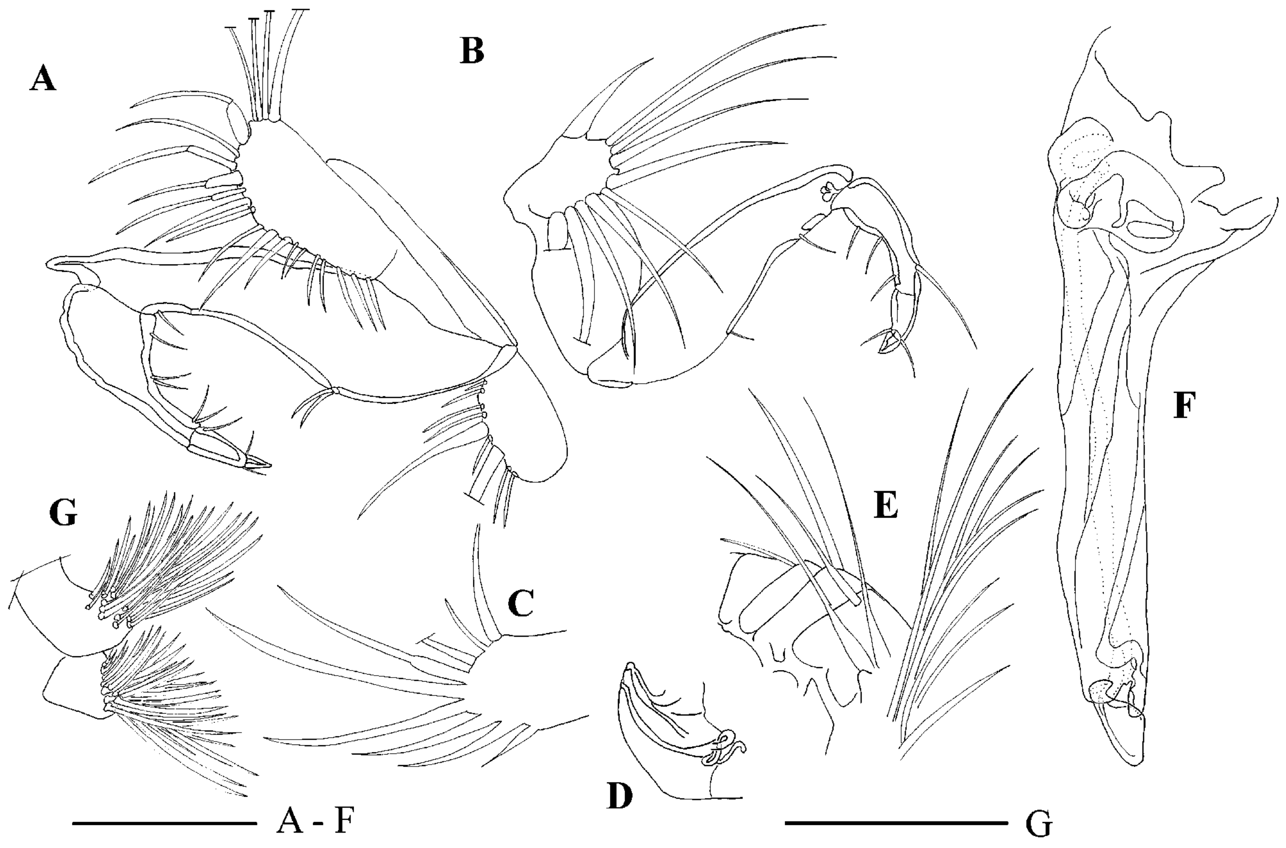

FIGURE 8. Appendages and genitalia of *Cytherella rwhatleyi* sp. nov.
A, male ApV; **B**, male ApVI; **C**, furca; **D,** genital lobe; **E**, Posterior dimorphic setae; **F**, hemipenis; **G**, brush-shaped organ.
A, B, G, F, holotype adult male (ZMH K-41280, SNB 0131); **C-E**, paratype adult female (ZMH K-41282, SNB 0134). Scale bars: 100 µm.

Cytherella serratula (Brady, 1880)
(Figs. 9.A–I, 10, Tab. 3)

part	1880 *Cythere* (?) *serratula* Brady: 77, Pl. 43.a-d.
non	1896 *Cytherella serratula*—Brady & Norman: 713-716.
part	1976 *Cytherella serratula*—Puri & Hulings: 288, Pl. 24.15, 16.
non	1979 *Cytherella* sp. 11 Ducasse & Peypouquet: 355, Pl. 1.3,4.
	1983 *Cytherella* sp. B Cronin: Pl. 6.E.
non	1985 *Cytherella* sp. Guernet: 281, Pl. 1.2.
?	1985 *Cytherella* sp. Guernet: 281, Pl. 1.4.
non	1987 *Cytherella serratula*—Whatley & Coles: 96, Pl. 6.30, 31.
non	1990 *Cytherella serratula*—Dingle *et al.*, 254-6, Fig.5.A-C.
? non	1993 *Cytherella serratula*—Whatley & Arias:283, Pl.1.1.
	1996 *Cytherella serratula*—Aiello *et al.*, Pl. 6.1-4 (S.E.M. photos the lectotype and paralectotype).
non	1996 *Cytherella serratula*—Coles *et al.*, Pl. 6.14, 15
non	2002 *Cytherella serratula*—Majoran & Dingle: 149, Pl. 3.20.
non	2006 *Cytherella serratula*—Bergue *et al.*: 209.
non	2007 *Cytherella serratula*—Bergue *et al.*: 7, Fig.3.

Material. **Lectotype**: *Cythere serratula* Brady, 1 RV, contained on the Challenger slide no. 173, labelled “Challenger, No. 24, D. 390, H. S. Puri 9/67, 100”, BMNH cat. no. 80.38.113. The Challenger #24 is located off Culebra Island, West Indies, 390fms (=713m). This specimen was designated lectotype and described by Puri & Hulings (1976: 288-289, Pl. 24.15-16), also examined and figured by Aiello *et al.* (1996, pl. 6.2-4). Herein this lectotype is illustrated in Fig. 9.A-D.

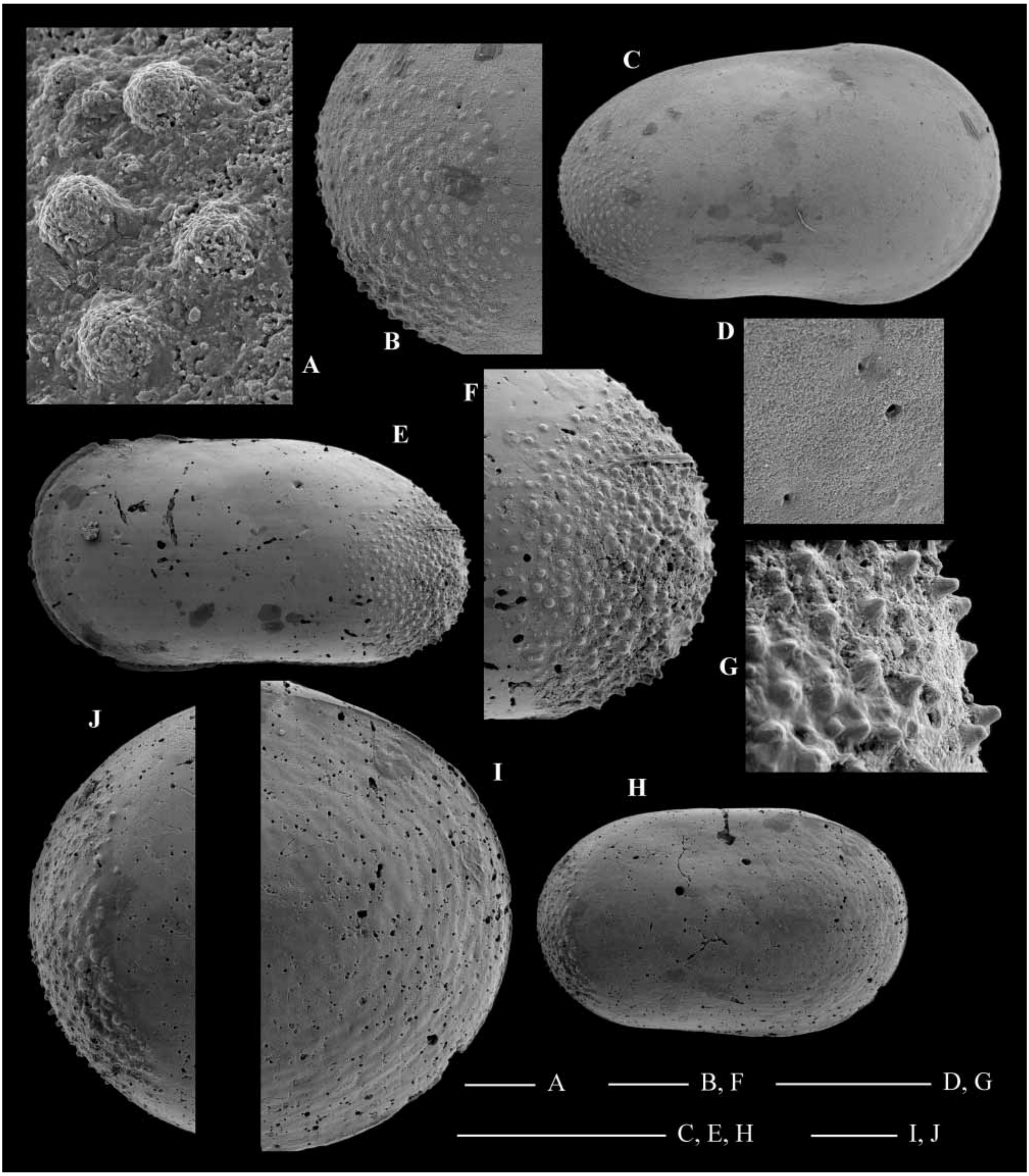

FIGURE 9. Valves of *Cytherella serratula* (Brady, 1880) (lectotype and paralectotype) and *Cytherella* sp.

Cytherella serratula (Brady, 1880) – Lectotype RV (BM 80.38.113): **A, B**, posterior ornamentation; **C**, ev; **D**, pore canals. Paralectotype LV (BM 80.38.113): LV; **E**, ev; **F, G**, posterior ornamentation.

Cytherella sp. (BM 80.38.113): **H**, RV ev; **J**, posterior ornamentation; **I**, anterior ornamentation.

Scale bars: **A**, 10µm; **B, F, I, J**, 100µm, **C, E, H**, 50µm; **D, G**, 50µm.

Paralectotype: *Cythere? serratula* Brady, 1 LV, contained on a second Challenger slide with the same no. 173, labelled "Challenger, No. 24, D. 390, H. S. Puri 9/67, T, 100", BMNH cat. no. 80.38.113. This specimen was designated paralectotype and described by Puri & Hulings (1976: 288-289), it was also examined and figured by Aiello et al. (1996, pl. 6.1). Herein this paralectotype is illustrated in Fig. 9.E-G.

Distribution. Recent. Off Culebra Island, Northwestern Atlantic, 713m.

V Measurements. Lectotype: RV, ?A L 1.10mm, H 0.64mm. Paralectotype LV, ?A L 1.08mm, 0.57mm.

Diagnosis. Valve sub-reniform in lateral view, anterior margin more broadly rounded than posterior, ventral margin concave; maximum height anterior to mid-length. Most of lateral surface smooth, except by medio-posterior area with small, sub-conic tubercles. Pore canals simple, without rim. Internally without limen. Flange well developed in LV.

Remarks. The above 15 publications dealing with deep-sea ostracods have figured or cited the occurrence of cytherellid specimens, which were assigned to the supposedly widely distributed species *Cytherella serratula* (Fig. 10). The total range of all these records would then include slope to abyssal depths in the North and South Atlantic, Mediterranean Sea, Indic and Southern oceans, with a geological record which extends from the Eocene to Recent. As previously stated by Majoran & Dingle (2002), the authors responsible for these records followed "the relatively broad species concept of *Cytherella serratula*" (Majoran & Dingle 2002:149). This species concept would then include (Tab. 3, Fig. 10):

Outlines ranging from very elongated (Whatley & Arias 1993) to subquadrate (Dingle *et al.* 1990); with length / height rations varying from 1.53 to 2.11 in LV and from 1.55 to 1.83 in RV.

Very sinuous (Majoran & Dingle 2002) to continuously and smoothly rounded valve outline (Guernet 1985);

Posterior ornamentation varying from small inconspicuous tubercles (Dingle *et al.*, 1990) to strongly pustulose (Majoran & Dingle 2002);

Anterior valve surface varying from smooth (Dingle *et al.*, 1990) to strongly pustulose (Majoran & Dingle 2002).

Except for the diagnostic characters of the genus *Cytherella*, the only character uniting all specimens included in *C. serratula "sensu lato"* is the presence of some (highly variable) kind of posterior ornamentation. However, the presence of tubercles or pustules on the posterior surface of valves can not be used as the sole diagnostic character of any *Cytherella* species, since this ornamentation is present in many other described and well characterized species of the same genus. Examples include: *Cytherella cercinata* Aiello *et al.*, 1996 (Miocene and Pliocene; Greece and Italy), *Cytherella vulgata* Ruggieri, 1962 (Miocene; Italy), *Cytherella vulgatella* Aiello *et al.*, 1996 (Miocene to recent; Mediterranean Sea, Italy and Spain), and *Cytherella robusta* Colalongo & Pasini, 1980 (Pliocene to recent; Italy, Greece, Mediterranean). Unfortunately, without examining all the material previously analysed by different authors, it is impossible to determine the range of intraspecific variation in the different characters, since most authors illustrate 1 or 2 specimens, and except by Aiello et al., 1996) no micrographs of the ornamentation on different regions of the valve surface are provided.

Study of the present material (*C. rwhatleyi* sp. nov.) and comparative studies of SEM-photos of deep-sea *Cytherella* in the literature (Swanson *et al.* 2005), confirm that the degree of intraspecific variability is much lower than previously thought. The valves of *Cytherella rwhatleyi* sp. nov. from the 4 different stations (Fig. 3), which are almost 60 of longitude and 10 of latitude apart, display very few intra- and interpopulational variability. Furthermore, a closer look at the publications on deep-sea ostracods shows that many deep-sea ostracodologists have adopted 2 different ways while defining deep-sea species. In one hand side are the species described in the 19th Century (mostly Brady 1880). For these first species, a very wide intraspecific morphological variability is allowed, most probably because authors are convinced that deep-sea ostracod species are cosmopolitan (Whatley & Ayress 1988), and they expect to find the cosmopolitan taxa in samples from different basins. Furthermore, the illustrations and descriptions provided in the 19th century are so simple that very different specimens may be included in each species. In the other hand side are the species described in the second half of the 20th Century, which are "kept" more or less endemic, (in my opinion) because authors do not expect to find them in localities distant from where they were collected, but also importantly because the SEM illustrations provide much more information, avoiding that too different specimens are assigned to these species.

Consequently, I consider *Cytherella serratula* (Brady, 1880) to be restricted to bathyal depths of North-western Atlantic (Type locality – Brady, 1880, Puri & Hulings 1976, and Aiello *et al.* 1996; and probably U. S. continental slope—Cronin, 1983). Meanwhile, more subquadrate forms, with larger height / length ratios known from the North Atlantic (Ducasse & Peypouquet 1979, Whatley & Coles 1987, Coles *et al.* 1996) and Southeastern Atlantic (Dingle *et al.* 1990), and more elongated forms from Northeastern Atlantic (Brady & Norman 1896), from the Indic Ocean (Guernet 1985) and Mediterranean Sea (Whatley & Arias 1993) should be assigned to different species. Similarly, forms with conspicuously sinuous outline collected from the Indic (Guernet 1985), and the Southern Ocean (Majoran & Dingle 2002) should also be described as different taxa.

TABLE 3. Comparison of morphological characters in different specimens of *Cytherella serratula* (Brady, 1880).

Author	Locality	Age	Recent* Depth (m)	General Form	RV - Length / height (mm); Ratio L/H	LV - Length / height (mm)
Lectotype (RV) / - Paralectotype (LV) Brady 1880; Puri & Hulings 1976; Aiello et al 1996*	Northwestern Atlantic (Culebra Is., West indies)	Recent	713	irregular	1.01 / 0.61 = 1.55	0.99 / 0.47 = 2.11
Brady & Norman 1896	Northeastern Atlantic (off Northwestern Africa)	Recent	852–2135	ovate	NI	1.05 / 0.60 = 1.75
Bergue *et al* 2006	Southwestern Atlantic (Santos Basin)	Pleistocene and Holocene	1130	ovate	0.91 / 0.58 = 1.57	NI
Coles *et al* 1996	Northeastern Atlantic (Porcupine Basin)	Quaternary	610–800	ovate	1.08 / 0.65 = 1.67	1.10 / 0.72 = 1.53
Cronin1983	Northwestern Atlantic (Florida-Hatteras Slope, Blake Plateau, Straits of Florida)	Recent	462–1070	ovate	NI	0.97 / 0.51 = 1.90
Dingle et al 1990	Southeatern Atlantic (off Southwestern Africa)	Recent	2417–3022	ovate	0.97 / 0.61 = 1.59	0.96 / 0.54 = 1.78
Ducasse & Peypouquet 1979 (as *Cytherella* sp. 11)	Northeastern Atlantic (Rockall Plateau)	Pliocene	*2371	ovate	1.04 / 0.62 = 1.68	NI
Guernet 1985	Indic Ocean (Ridge 90?E)	Eocene	1665	ovate	0.79 / 0.43 = 1.83	1.02 / 0.63 = 1.62
Majoran & Dingle 2002	Southern Ocean (Maud Rise, Weddell Sea)	Oligocene	-	irregular	NI	0.83 / 0.47 = 1.76
Whatley & Arias 1993	Mediterranean Sea (off Libya)	Oligocene	1948	very elongated	0.8 / 0.47 = 1.70	NI
Whatley & Coles 1987	North Atlantic	Miocene	-	irregular	1.10 / 0.65 = 1.69	NI

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TABLE 3 (continued)

Author	RV							
	Dorsal Mg.	Ventral Mg.	Ant. Mg.	Post. Mg.	Max. H	Max. L.	Ornamentation	
							Anterior	Posterior
Lectotype (RV) / - Paralectotype (LV) Brady 1880; Puri & Hulings 1976; Aiello et al 1996*	inclined	slightly concave	broadly rounded	narrowly rounded	anterior to mid-length	at mid-height.	absent	conspicuous small tubercles
Brady & Norman 1896	NI	NI	NI	NI	NI	NI	NI	NI
Bergue *et al* 2006	straight	slightly concave	broadly rounded	broadly rounded	anterior to mid-length	at mid-height.	faint	conspicuous small tubercles
Coles *et al* 1996	sinuous	sinuous	broadly rounded	narrowly rounded	anterior to mid-length	below mid-height.	present	conspicuous small tubercles
Cronin1983	NI	NI	NI	NI	NI	NI	NI	NI
Dingle et al 1990	straight	slightly concave	broadly rounded	broadly rounded	anterior to mid-length	at mid-height.	faint	absent (?) or faint (?)
Ducasse & Peypouquet 1979 (as *Cytherella* sp. 11)	straight	slightly concave	broadly rounded	broadly rounded	anterior to mid-length	at mid-height.	present	conspicuous small tubercles
Guernet 1985	slightly arched	slightly concave	broadly rounded	narrowly rounded	anterior to mid-length	above mid-height	?present	conspicuous small tubercles
Majoran & Dingle 2002	NI	NI	NI	NI	NI	NI	NI	NI
Whatley & Arias 1993	slightly convex	slightly concave	broadly rounded	broadly rounded	anterior to mid-length	at mid-height	?	conspicuous small tubercles
Whatley & Coles 1987	slightly convex	slightly concave	broadly rounded	broadly rounded	anterior to mid-length	at mid-height	?present	conspicuous small tubercles

......continued

TABLE 3 (continued)

Author	LV					
	Dorsal Mg.	Ventral Mg.	Ant. Mg.	Post. Mg.	Max. H.	Max. L.
Lectotype (RV) / - Paralectotype (LV) Brady 1880; Puri & Hulings 1976; Aiello et al 1996*	straight ant.; steeply inclined post.	straight	equally rounded	narrowly rounded	anterior to mid-length	inferior to mid-height
Brady & Norman 1896	almost straight	slightly concave	broadly rounded	broadly rounded	anterior to mid-length	inferior to mid-height
Bergue *et al* 2006	NI	NI	NI	NI	NI	NI
Coles *et al* 1996	sinuous	sinuous	broadly rounded	narrowly rounded	anterior to mid-length	below mid-height
Cronin1983	almost straight	straight	broadly rounded	broadly rounded	posterior to mid-length	at mid-height

......continued

TABLE 3 (continued)

	LV					
Author	**Dorsal Mg.**	**Ventral Mg.**	**Ant. Mg.**	**Post. Mg.**	**Max. H.**	**Max. L.**
Dingle et al 1990	sinuous ant.; inclined post.	slightly concave	equally rounded	narrowly rounded	posterior to mid-length	inferior to mid-height
Ducasse & Peypouquet 1979 (as *Cytherella* sp. 11)	NI	NI	NI	NI	NI	NI
Guernet 1985	straight	straight	equally rounded	narrowly rounded	posterior to mid-length	at mid-height
Majoran & Dingle 2002	very sinuous	slightly concave	broadly rounded	narrowly rounded	anterior to mid-length	inferior to mid-height
Whatley & Arias 1993	NI	NI	NI	NI	NI	NI
Whatley & Coles 1987	NI	NI	NI	NI	NI	NI

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TABLE 3 (continued)

Author	LV		**comments**
	Ornamentation		
	Anterior	**Posterior**	
Lectotype (RV) / - Paralectotype (LV) Brady 1880; Puri & Hulings 1976; Aiello et al 1996*	absent	small tubercles	
Brady & Norman 1896	absent	?present	The specimens illustrated by Brady & Norman (1896) are conspicuously more equilateral (with broadly rounded posterior) than the type of *C. serratula*.
Bergue *et al* 2006	NI	NI	Larger height/length ratio than lectotype of *C. serratula*.
Coles *et al* 1996	present	conspicuous small tubercles	The illustrated specimens are conspicuously higher in relation to length than the types of *C. serratula*.
Cronin1983	?present	conspicuous small tubercles	Cronin (1983) identified the specimens as Cytherella sp. B. Afterwards, Aiello et al (1996) assigned them to C. robusta Colalongo & Pasini, 1980. Otherwise, Bergue et al (2007) assigned them to C. serratula.
Dingle et al 1990	present	absent (?) or faint (?)	The specimens from the analysed in this publication differ considerably from the type specimens of this species: south Atlantic specimens present (1) more equilateral outline in lateral view; (2) much more faint (or even absence) posterior ornamentation; (3) and presence of anterior ornamentation.
Ducasse & Peypouquet 1979 (as *Cytherella* sp. 11)	NI	NI	Ducasse & Peypouquet (1979) identified the specimens as Cytherella sp. 11. Afterwards, Aiello et al ,1996 identified them as C. robusta Colalongo & Pasini, 1980. Otherwise, Bergue et al (2007) assigned them to Cytherella serratula.
Guernet 1985	absent	conspicuous small tubercles	The 2 valves illustrated by Guernet (1985) most probably belong to 2 different species, both of them differing considerably from the lectotypes of C. serratula.
Majoran & Dingle 2002	pustulose	pustulose	The specimens illustrated by Majoran & Dingle (2002, pl. 3.20) present more arcuate dorsal margin and concave ventral margin than the lectotype of C. serratula.
Whatley & Arias 1993	NI	NI	The illustrated specimens much more elongated (smaller length / height ratio) then the lectotype of C. serratula.
Whatley & Coles 1987	NI	NI	These specimens is heigher in relation to length and present more arcuate dorsal margin than the lectotype of C. serratula.

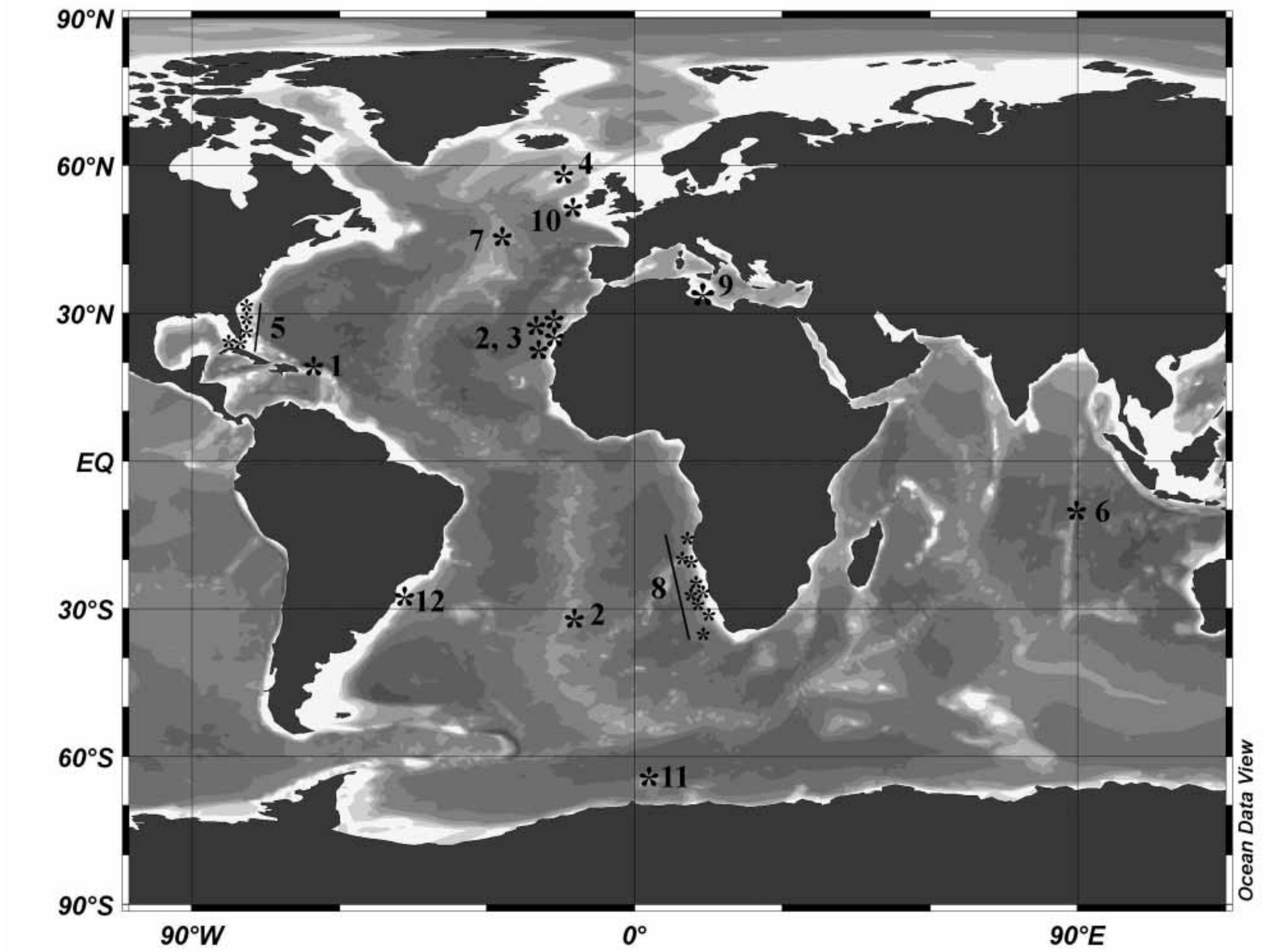

FIGURE 10. Published occurrences of *Cytherella serratula* (Brady, 1880).
1 – Type locality, from Brady (1880) and Puri & Hulings (1976); **2**—from Brady 1880; **3**—from Brady & Norman 1896; **4**—from Ducasse & Peypouquet 1979; **5** – from Cronin 1983; **6** – from Guernet 1985; **7**—from Whatley & Coles, 1987; **8**—from Dingle *et al.*, 1990; **9**—from Whatley & Arias, 1993; **10**—from Coles *et al.*, 1996; **11**—from Majoran & Dingle, 2002; **12**—from Bergue *et al.* (2007).

Cytherella sp.
(Fig. 9.H–J)

Part 1976 *Cytherella serratula*®Puri & Hulings: 288.

Material. This RV was together with the paralectotype of *Cytherella serratula* on a slide labelled "*Cythere? serratula* Brady, 173, Challenger, No. 24, D. 390, H. S. Puri 9/67, T, 100", BMNH cat. no. 80.38.113." But according to Puri & Hulings (1976: 289) this RV was most probably collected from the Challenger station 85 (see below).

Distribution. Recent. Off Canaries Island, Northeastern Atlantic, 2057m.

V Measurements. RV, L 0.90mm, H 0.57mm.

Remarks. According to Puri & Hulings (1976: 289) the following material was included in the Challenger type material of the species *C. serratula*: "The lectotype [of *C. serratula*] a right valve, is from Stat. 24. *Topotypic material:* a left valve, BM 1974.387, was picked from the sediment sample M-44 (Stat. 24). Two small specimens recovered from sediment sample M-106 (Stat. 85, off Canaries, 1125 fathoms) may belong to this species". So I suppose that this smaller RV (which was in the same micropaleontological slide as the paralectotype of *C. serratula*) was actually collected at the Challenger station 85 and not 24 (as stated in the slide label). Cytherella sp. (Fig. 9.H-J) differs from Cytherella serratula (Brady, 1880) (Fig. 9.A-G) because the former species present the anterior area of valve lateral surface with shallow, elongate punctae arranged in concentric rows which are parallel to anterior valve margin. Additionally, *Cytherella* sp. is higher in relation to length and more equilateral than *Cytherella serratula*.

Discussion

1. Morphology and Geographical Distribution

Contrary to most of the platycopids (Horne *et al.* 2002), males of *Cytherella rwhatleyi* sp. nov. have a brush-shaped organ (Fig. 8E). Other records of brush-shaped organs in cytherellids include four species of *Cytherella* and one species of *Cytherelloidea* (Schulz 1976, Figs. 2, 12, 18; Swanson *et al.* 2005, Figs. 3G, 5D). Since the brush-shaped organ is present in most of the infrarders of Podocopa (Bairdiocopina, Cytherocopina, Cypridocopina) and also in only the five platycopid species (in two genera) an epigenetic control of this character is suggested herein. In this way, the expression of that organ could have been turned "off" before the origin of the platycopids, but was subsequently "turned on" in this few cytherellids.

The genus *Cytherella* was already quite widespread in the southern hemisphere during the Cretaceous and early Cenozoic, and records involve, for example, Southern Africa (Dingle 1984), Antarctic Peninsula (Fauth *et al.* 2003), Maud Rise (Majoran *et al.* 1997), New Zealand (Ayress 1995). Somehow surprising, is then the low number of recent deep-sea *Cytherella* species reported from the Atlantic Sector of the Southern Ocean and from the South Atlantic: few species from the South Atlantic, and only *Cytherella rwhatleyi* from the continental margin off Antarctica. Otherwise, a considerably higher diversity of recent deep-sea platycopids (12 species in 3 genera) exists nowadays on the Southwestern Pacific (Jellinek & Swanson 2003). This picture might be related to the large sampling effort related with several projects (e.g. TASQWA, see Jellinek & Swanson 2003), which focused on the continental margins and plateaus from the Southwestern Pacific. In the Atlantic Ocean and on the Antarctic continental margin a considerable smaller number of samples from recent sediments have been collected, or at least studied and published. Otherwise, considering the Antarctic margin, it is possible that the extremely low temperatures existing since millions of years might have been responsible for the extinction of platycopid lineages, which were present there during the warmer Cretaceous (Majoran *et al.* 1997). Additionally, some environmental parameter related to depth appear to be prohibitive for platycopids, which are widespread in the continental shelves and margins of most continents, but are almost absent in abyssal plains. In this way, the abyssal plains seam to be biogeographical barriers to the *Cytherella* species and as a result each continental region tends to present its own fauna. Furthermore, considering the Southwestern Pacific, the northward currents present at the intermediate depths seam to represent a barrier to East-West dispersion of cytherellids, since different species are found on each side of New Zealand (Fig. 10).

The large number of live specimens available herein made an evaluation on the intraspecific morphological variability in a deep-sea cytherellid species possible. This evaluation provides a base which can be used for the definition of subfossil and fossil species morphological range in platycopids. This morphological range will then be important for the correct identification of specimens, essential to biodiversity, genetic, paleoenvironmental, and geochemical studies. In the case of *Cytherella rwhatleyi* sp. nov., little if any intrapopulational (same station) or interpopulational (different stations) variation in outline and ornamentation of valves (Figs. 3, 4) and on the hemipenis was observed. Few papers provide SEM-photos of several specimens of the same species, however, a similar lack of carapace variability can also be seen in the literature (Swanson *et al.*, 2005). These observations contradict the actual very broad intraspecific morphological variability accepted by most researchers in studies about deep-sea ostracods.

2. Platycopids and O_2 concentration in water masses

The present study is a good opportunity to test the theory on the relationship between the O_2 concentration in water masses and the numerical abundance of filter feeding ostracods (including the genus *Cytherella*). According to Whatley (1991, 1995, Whatley *et al.* 2003), the higher ecological success of the *Cytherella* during kenoxic/anoxic events would be related to the higher circulation of water inside the carapace, used for the filter feeding. Furthermore, eggs brooded by the female inside of the carapace, would have higher survival chances than eggs lain in the environment (Jarvis *et al.* 1998). The following scale on the relationship between the percentage of platycopid specimens and the O_2 concentration was proposed (Whatley *et al.* 2003):

>90% platycopids = <1.5ml/l O_2 (~67*µmol/kg);
80-90% platycopids = 2.0-1.5ml/l O_2 (~89*-67*µmol/kg);
70-80% platycopids = 2.5-2.0ml/l O_2 (~112*-89*µmol/kg);
60-70% platycopids = 3.0-2.5ml/l O_2 (~134*-112*µmol/kg);
50-60% platycopids = 3.5-3.0ml/l O_2 (~156*-134*µmol/kg);
40-50% platycopids = 4.0-3.5ml/l O_2 (~178*-156*µmol/kg);
30-40% platycopids = 4.5-4.0ml/l O_2 (~200*-178*µmol/kg);
20-30% platycopids = 5.0-4.5ml/l O_2 (~223*-200*µmol/kg);
<20% platycopids = >5ml/l O_2 (~223*µmol/kg);
* Considering 1.00ml/l = 44.66 µmol/kg

In the samples studued herein the platycopid abundance varied from 1.9% to 71.4% of the total ostracod fauna (Tab. 4, samples 57-2 and 153-8 were excluded since the size of the mesh used in the AGT is larger that 500µm). Based on measurements from the Woce project (Schlitzer 2000), the O_2 concentration in the regions from the three different stations containing *Cytherella rwhatleyi* sp. nov. varies merely from 210 to 221 µmol/kg, instead of varying from < 67 to > 223 µmol/kg, as would be expected by Whatley's scale (2003, see above) (Tab. 4 herein). This new data indicates that probably other factors than O_2 concentration influences the ostracod assemblages and that the proposed and widely accepted scale may not be appropriate for paleoreconstructions. This topic will be discussed in more detail in another publication.

TABLE 4. *Cytherella rwhatleyi* sp. nov. and O_2 concentration in the water mass.
Total Ostracoda—total number of ostracod specimens in each sample.
*Wha—O_2 concentration as calculated from the percentage of *Cytherella rwhatleyi* sp. nov using the scale from Whatley and colleagues (2003).
** Data from eWoce (Schlitzer 2000).

Station	Gear	Total Ostracoda	% Platy	Wha*	O2**	Depth**	Latitude**	Longitude**	e Woce Station**	Date**
				(?mol/ Kg)	(?mol/ Kg)	(m)	°S	°W		
89	EBS	180	16.1	>223	215	1510	72.493	22.921	A23_74JC10_1 12 B	01 Apr. 1995
107	EBS	265	1.9	>223	210	1006	72.493	22.921	A23_74JC10_1	01 Apr.1995
153-4	GKG	7	71.4	112-89	212	2027	62.857	63.525	A21_06MT11_5 117 B	30 Jan. 1990
153-7	EBS	370	41.1	178-156	209	1962	62.6	64.272	A21_06MT11_5 116 B	29 Jan. 1990

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