

## THE LOWER EOCENE-LOWER OLIGOCENE OSTRACODES FROM DSDP SITE 515B, BRAZIL BASIN, SOUTHWESTERN ATLANTIC OCEAN

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**ABSTRACT** – Seventeen species of podocopid and platycopid Ostracoda were recorded in the 26 samples studied from the DSDP (= Deep Sea Drilling Project) Site 515B, Brazil Basin. The Trachyleberididae (eight spp.) and Krithidae (four spp.) are the most-represented families. Most species were left in open nomenclature because of scarcity or poor preservation. The assemblages composition shows moderate similarity to previously-studied deep-sea assemblages. The distribution pattern of the Eocene-Oligocene deep-sea ostracodes is briefly discussed as a contribution to the understanding of Paleogene ostracode zoogeography.

**Key words:** Ostracoda, Paleogene, paleoceanography, Brazil Basin, deep-sea.

**RESUMO** – Dezesete espécies de ostracodes podocópideos e platycópideos foram registradas em 26 amostras estudadas do DSDP (= *Deep Sea Drilling Project*) Site 515B, Bacia do Brasil. As famílias Trachyleberididae (oito spp.) e Krithidae (quatro spp.) são as mais representativas. A maioria das espécies é registrada em nomenclatura aberta, seja pela escassez de espécimes ou por sua má preservação. A composição das assembleias mostra similaridade moderada quando comparada com outros estudos sobre ostracodes de águas profundas. A distribuição dos ostracodes do intervalo Eoceno-Oligoceno, em águas profundas, é brevemente discutida, visando uma contribuição ao conhecimento da zoogeografia dos ostracodes paleógenos.

**Palavras-chave:** Ostracoda, Paleógeno, paleoceanografia, bacia do Brasil, águas profundas.

### INTRODUCTION

Research on deep-sea ostracodes has revealed the immense potential of these microcrustaceans (both fossil and living) for understanding climate changes and benthic diversity patterns. Ocean circulation and hydrologic changes, productivity and sedimentary processes are examples of research fields that have benefited from the study of ostracodes (Cronin, 1983; Ayress *et al.*, 2004; Yasuhara & Cronin, 2008).

The adequacy of the deep-sea ostracode as biological proxies for paleoceanography depends on accurate taxonomy, and an understanding of their evolutionary trends as the assemblages composition, extinction and speciation processes are modulated by climatic changes. Although important contributions on systematics (*e.g.* Brandão, 2008, 2010; Yasuhara *et al.*, 2009) and evolution (*e.g.* Hunt, 2007; Hunt & Yasuhara, 2010) have been published recently, research on fossil assemblages is still inadequate in some areas. The main objective of the study of DSDP Site 515B is to contribute an analysis of the Eocene-Oligocene transition on the composition of assemblages in the South Atlantic.

The samples studied herein are a discontinuous record of the Lower Eocene to Lower Oligocene, an interval that records one of the most important Cenozoic climatic transitions.

During Late Eocene/Early Oligocene time, a global cooling caused biotic turnovers in many groups, both in oceanic and terrestrial domains (Coxall & Pearson, 2007). Among the benthic biota, ostracodes record significant diversity alterations caused by tectonic, hydrologic and productivity changes, including a large scale event at about 38 Ma which, according to Benson (1975), resulted from the establishment of the Cenozoic psychrosphere.

Several studies have been published on Eocene-Oligocene ostracodes, demonstrating the worldwide significance of these events in the evolutionary history of the group (Bold, 1960; Peypouquet *et al.*, 1982; Majoran, 1996; Dall'Antonia *et al.*, 2003; Morsi & Scheibner, 2009). Many other studies carried out on both DSDP and ODP sites report data from Eocene-Oligocene deposits that will be referred to in the text.

The Paleogene deep-sea ostracodes from the South Atlantic have already been studied, both in its eastern and western sectors, the works by Benson (1977) and Benson & Peypouquet (1983) on the São Paulo Plateau/Rio Grande Rise being the precursors. About 20 years later, new contributions were published by Majoran & Dingle (2001a,b; 2002a,b) on DSDP/ODP sites, while more recently, Bergue & Nicolaidis (2012) discussed the faunal composition and

chronostratigraphic distribution of Paleogene-Oligocene ostracode assemblages from DSDP Site 329 (Malvinas/Falkland Plateau).

DSDP Site 515 was drilled during Leg 72 of the DSDP between February and March 1980. It lies in the southwest part of the Brazil Basin, and is located north of the Santos Plateau and Rio Grande Rise, about 200 km north of the northern exit of the Vema Channel (Figure 1). The area is very close to the present CCD, which is at nearly 4,500-4,600 m water depth, and has changed only slightly vertically since the Eocene (Barker *et al.*, 1983).

## MATERIAL AND METHODS

The Hole B, located at 26°14.36'S/36°30.19'W, 4,252 m water depth, was the only one from the DSDP Site 515 not previously studied for ostracodes. It is 429.10 m long and consists of three lithological subunits: subunit 1, grey brown terrigenous mud; subunit 2, dark greenish gray siliceous mud and mudstone; and subunit 3, greenish-gray calcareous zeolitic mudstone.

This work was carried out on 26 samples from cores 51 to 57, which corresponds to the subunits 2 (cores 51 to 55) and 3 (cores 56 and 57). A hiatus between these subunits represents the Eocene/Oligocene boundary, dated by calcareous nanofossils and planktic foraminifers, respectively (Barker *et al.*, 1983). Samples from 60 to 90 g were disaggregated

in a hydrogen peroxide solution under low heat, washed through 0.250, 0.180 and 0.063 mm sieves, and dried in an oven. All the ostracodes present in the residues were picked and mounted in paleontological slides for faunal study. The more representative specimens of each species were imaged by SEM and are held at Museu de História Geológica do Rio Grande do Sul, Universidade do Vale do Rio dos Sinos, Brazil, under the curatorial numbers ULVG 9123 to ULVG 9143 and ULVG 9738.

The suprageneric taxonomy adopted in this work follows essentially Liebau's (2005) proposal. Two species that could not be assigned to any genus are designed as "gen. *et sp. indet.*", but tentatively included in the family Trachyleberididae.

**Abbreviations.** CCD, calcite compensation depth; DSDP, Deep Sea Drilling Project; IPOD, International Phase of Ocean Drilling; ODP, Ocean Drilling Program; ULVG, prefix of the Museu de História Geológica do Rio Grande do Sul.

**Morphological abbreviations.** C, carapace; h, height; l, length; LV, left valve; RV, right valve; w, width.

## SYSTEMATIC PALEONTOLOGY

Order PLATYCOPIIDA Sars, 1866  
Superfamily CYTHERELLOIDEA Sars, 1866  
Family CYTHERELLIDAE Sars, 1866

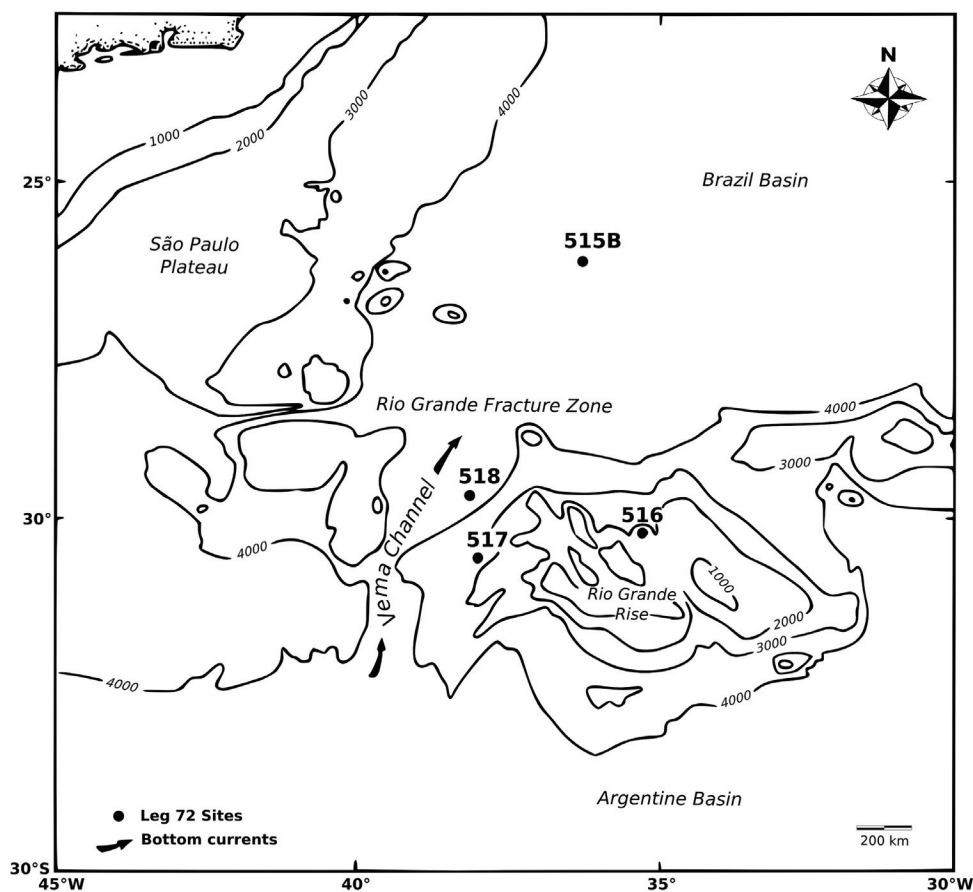


Figure 1. Study area with the location of the DSDP Site 515B.

*Cytherella* Jones, 1849

**Type species.** *Cytherina ovata* Roemer, 1841.

*Cytherella* sp. 1  
(Figures 2A-F)

2001b *Cytherella* sp. Majoran & Dingle, p. 213, pl. 1, fig. 6.

**Figured specimens.** ULVG-9123, female LV, l: 1.06 mm, h: 0.62 mm; ULVG-9124, male LV (instar), l: 0.84 mm, h: 0.48 mm; ULVG-9125, male RV (instar), l: 0.88 mm, h: 0.56 mm.

**Origin.** Core 56, sample 55.5-58.5 cm.

**Age.** Eocene.

**Geographic and stratigraphic distribution.** ODP Site 699 (South Atlantic): Eocene.

**Remarks.** *Cytherella* sp. 3 recorded by Honigstein *et al.* (2002) in the middle to late Eocene of Israel is very similar in outline, however it is shorter and smaller than *Cytherella* sp. 1.

*Cytherella* sp. 2  
(Figures 2G-I)

**Figured specimen.** ULVG-9126, C (male?), l: 1.08 mm, h: 0.61 mm, w: 0.36 mm.

**Origin.** Core 56 sample 55.5-58.5 cm.

**Age.** Eocene.

**Geographic and stratigraphic distribution.** ODP Site 699 (South Atlantic): Eocene.

**Remarks.** *Cytherella* sp. 2 is similar in outline to *Cytherella* sp. 2 illustrated by Honigstein *et al.* (2002) in the early to late Eocene of Israel, but is significantly larger.

Order PODOCOPIDA Sars, 1866  
Suborder BAIRDIOCOPINA Gründel, 1967  
Superfamily BAIRDIOIDEA Sars, 1887  
Family BAIRDIIDAE Sars, 1887

*Bairdoppilata* Coryell, Sample & Jennings, 1935

**Type species.** *Bairdoppilata martini* Coryell, Sample & Jennings, 1935.

*Bairdoppilata* sp.  
(Figure 2J)

1979 *Bairdia cymbula* Deltel. Ducasse & Peypouquet, p. 355, pl. 1, fig. 8.

[non] *Bairdia cymbula* Deltel, 1963, p. 139,140, figs. 21, 22.

**Figured specimen.** ULVG-9127, RV, l: 0.74 mm, h: 0.4 mm.

**Origin.** Core 56, sample 13-16 cm.

**Age.** Eocene.

**Geographic and stratigraphic distribution.** IPOD Site 401 (Bay of Biscay): Paleocene-Eocene.

**Remarks.** An identical specimen was recorded by Ducasse & Peypouquet (1979) at IPOD Site 401 (Bay of Biscay),

identified as *Bairdia cymbula* Deltel. However, the type material figured by Deltel (1963) differs significantly in the outline from the specimen of Ducasse & Peypouquet (1979) and seems not to be conspecific.

Suborder CYTHEROCOPINA Gründel, 1967  
Infraorder NOMOCYTHERININA Liebau, 1991  
Superfamily TRACHYLEBERIDOIDEA Sylvester-Bradley, 1948  
Family TRACHYLEBERIDIDAE Sylvester-Bradley, 1948

*Dutoitella* Dingle, 1981

**Type species.** *Dutoitella dutoiti* Dingle, 1981.

*Dutoitella mimica* Dingle, 1981  
(Figure 2K)

1981 *Dutoitella mimica* Dingle, p. 90, figs. 41a-f.

2001b *Dutoitella mimica* Dingle. Majoran & Dingle, p. 213, pl. 1, fig. 3.

2012 *Dutoitella mimica* Dingle. Bergue & Nicolaidis, p. 50, figs. 3.1-3.3.

**Figured specimen.** ULVG-9128, LV (instar), l: 0.80 mm, h: 0.46 mm.

**Origin.** Core 56, 55.5-58.5 cm.

**Age.** Eocene.

**Geographic and stratigraphic distribution.** Southeast Africa: Maastrichtian; DSDP Site 329 (Falkland Plateau): Paleocene-Eocene; ODP Site 699A (Southwest Atlantic): late Paleocene.

**Remarks.** *Dutoitella mimica* is poorly represented in the material studied, and Bergue & Nicolaidis (2012) registered a reduction in its abundance from the Paleocene to the Eocene. As this species has been described in Upper Cretaceous outer shelf/upper slope deposits of southeast Africa it seems that *D. mimica* is a pre-psirospheric taxon that descended into deep water environments during Paleogene time. The hinge development and width of the inner marginal area indicate that ours is a juvenile specimen.

*Trachyleberidea* Bowen, 1953 *emend.* Haskins, 1963

**Type species.** *Cythereis prestwichiana* Jones & Sherborn, 1887.

*Trachyleberidea* sp.  
(Figures 2L-M)

1988 *Trachyleberidea* sp. 1 Guernet & Fourcade, p. 147, pl. 2, fig. 5.

**Figured specimen.** ULVG-9129, LV, l: 0.66 mm, h: 0.34 mm.

**Origin.** Core 56, sample 3-6.5 cm.

**Age.** Eocene.

**Geographic and stratigraphic distribution.** ODP 628A (Bahamas): Oligocene.

**Remarks.** The minor differences between this species and *Trachyleberidea* sp. 1 Guenet & Fourcade, 1988 are possibly ontogenetic, and for that reason they are considered conspecific.

*Ambocythere* Bold, 1958

**Type species.** *Ambocythere keyi* Bold, 1958a.

*Ambocythere* sp. 1  
(Figure 2N)

**Figured specimen.** ULVG-9130, RV, l: 0.48 mm, h: 0.28 mm.

**Origin.** Core 56, sample 13-16 cm.

**Age.** Eocene.

**Remarks.** Based on the dimensions and carapace morphology, the specimen figured here is probably a juvenile, making its specific identification difficult.

*Ambocythere* sp. 2  
(Figures 2O-P)

**Figured specimen.** ULVG-9135, RV, l: 0.6 mm, h: 0.28 mm.

**Origin.** Core 56, sample 55.5-58.5 cm.

**Age.** Eocene.

*Pennyella* Neale, 1974

**Type species.** *Pennyella pennyi* Neale, 1974.

*Pennyella* sp. aff. *P. praedorsoserrata* Coles & Whatley, 1989  
(Figures 2Q-S)

**Figured specimen.** ULVG-9131, C, l: 0.8 mm, h: 0.4 mm, w: 0.34 mm.

**Origin.** Core 57, sample 50-53 cm.

**Age.** Eocene.

**Remarks.** *Pennyella* sp. 2 differs from *P. praedorsoserrata* Coles & Whatley in the rounded reticulae pattern.

*Pennyella* sp.  
(Figure 3A)

**Figured specimen.** ULVG-9132, RV, l: 0.62 mm, h: 0.3 mm.

**Origin.** Core 56, sample 13-16 cm.

**Age.** Eocene.

**Remarks.** The presence of short anteroventral spines suggests a possible affinity to *Pennyella fortedimorphica* Coles & Whatley, 1989. Unfortunately, the preservation of our specimen is too poor for a more detailed comparison.

*Apatihowella* Jellinek & Swanson, 2003

**Type species.** *Apatihowella (Apatihowella) inradata* Jellinek & Swanson, 2003.

?*Apatihowella* sp.  
(Figure 3B)

**Figured specimen.** ULVG-9133, LV (broken instar).

**Origin.** Core 56, sample 3-6.5 cm.

**Age.** Eocene.

**Remarks.** This fragment is tentatively identified as an *Apatihowella* species based on its subrectangular outline and reticulation pattern. The weak development of its posterior and median hinge elements indicate a juvenile specimen.

*Legitimocythere* Coles & Whatley, 1989

**Type species.** *Cythere acanthoderma* Brady, 1880.

*Legitimocythere* sp.  
(Figures 3C-F)

1978 "*Hyphalocythere*"? Benson, p. 787, pl. 2, fig. 1.

?1989 *Legitimocythere* sp. 1 Coles & Whatley, p. 116, pl. 4, fig. 12.

2001b *Legitimocythere presequenta* (Benson). Majoran & Dingle, p. 213, pl. 1, fig. 16.

[non] 1977 *Legitimocythere presequenta* (Benson), p. 883, pl. 2., fig. 5.

2010 *Legitimocythere presequenta* (Benson). Bergue & Govindan, p. 753, fig. 3.18.

?2012 *Legitimocythere presequenta* (Benson). Bergue & Nicolaidis, p. 50, fig. 3.8-9.

**Figured specimen.** ULVG-9134, C, l: 0.92 mm, h: 0.52 mm, w: 0.48 mm.

**Origin.** Core 51, sample 14.5-17.5 cm.

**Age.** Oligocene.

**Geographic and stratigraphic distribution.** Early Oligocene: ODP Site 744A (Indian Ocean); Oligocene: ODP Site 699A (SW Atlantic); early Miocene (Mediterranean).

**Remarks.** The erection of *Legitimocythere* by Coles & Whatley (1989) was intended to legitimize the informal taxa "*Hyphalocythere*" and "*Thalassocythere*", both introduced in the 1970s by Richard Benson. Jellinek & Swanson (2003), stated that the fossil specimens of *Cythere acanthoderma* Brady, 1880 designated by Coles & Whatley (1989) as the type species are probably not conspecific with Brady's species, whose description was based on recent material from the southern Indian Ocean. Aiming to solve this problem Mazzini (2005) improved the characterization of *Legitimocythere acanthoderma*, including SEM images of the lectotypes designated by Puri & Hulings (1976). Consequently, the diagnostic characteristics of *Legitimocythere acanthoderma*, and of the genus as a whole, are nowadays better defined. However, some confusion still persists on *Legitimocythere* taxonomy, specially referring to the identification of the species *L. presequenta*.

Majoran & Dingle (2001b, p. 214) stated that the specimen, found in the Oligocene of ODP site 699A,

is almost identical to the holotype of *Legitimocythere presequenta* (Benson, 1977), but it possesses a posterodorsal bifurcate spine, and a more prominently developed caudal process. Although different valves have been illustrated in these articles, it is possible to observe conspicuous differences in the dorsal margin and in the anterior cardinal angle. Consequently, we maintain that the two species of *Legitimocythere* in these are not conspecific. The specimen illustrated by Majoran & Dingle (2001b) has more affinity to that recorded in the present study and, possibly, to *Legitimocythere* sp. 1 Coles & Whatley, 1989 than to *L. presequenta* (Benson). This opinion is based on the presence of a median caudal process, a bifurcate posterodorsal spine (Figure 3D), and robust spines along the anterior margin, none of which are visible in the poor illustration of the holotype.

Gen. et sp. indet. 1  
(Figure 3G)

**Figured specimen.** ULVG-9136, RV, l: 0.54 mm, h: 0.24 mm.

**Origin.** Core 56, sample 13-16 cm.

**Age.** Eocene.

Gen. et sp. indet. 2  
(Figure 3H)

**Figured specimen.** ULVG-9137, RV (broken).

**Origin.** Core 56, sample 3-6.5 cm.

**Age.** Eocene.

Family KRITHIDAE Mandelstam, 1958

*Krithe* Brady, Crosskey & Robertson, 1874

**Type species.** *Cythere (Cytherideis) bartonensis* Jones, 1857.

*Krithe aequabilis* Ciampo, 1986  
(Figures 3I-L)

1986 *Krithe aequabilis* Ciampo, p. 87, pl. 17, figs. 1, 2.

1988 *Krithe* sp. 2 Guernet & Fourcade, p. 148, pl. 3, fig. 9.

1994 *Krithe aequabilis* Ciampo. Coles *et al.*, p. 79, pl. 1, fig. 10.

**Figured specimen.** ULVG-9138, female RV, l: 0.92 mm, h: 0.40 mm; ULVG-9139, male C, l: 0.74 mm, h: 0.30 mm, w: 0.26 mm.

**Origin.** Core 51, 14.5-17.5 cm.

**Age.** Oligocene.

**Geographic and stratigraphic distribution.** DSDP Site 606A (North Atlantic): Pliocene; ODP Site 628A (Bahamas): Oligocene-Pliocene (?); Italy: Upper Miocene.

**Remarks.** According to Coles *et al.* (1994) *Krithe aequabilis* has a long stratigraphical range, occurring from the middle Eocene to the Quaternary. They also comment that *K.*

*aequabilis* resembles *K. dolichodeira* Bold, 1946 and the two species are difficult to distinguish exclusively on external morphology. Though the males of both species illustrated by Coles *et al.* (1994) are very similar to the specimen ULVG-9135, we consider it more prudent to identify it as a male of *K. aequabilis* to avoid an overestimation of the generic species richness.

*Krithe trinidadensis* Bold, 1958  
(Figures 3M-P)

1958b *Krithe trinidadensis* Bold, p. 407, pl. 1, fig. 4.

1994 *Krithe trinidadensis* Bold. Coles *et al.*, p. 96, pl. 4, figs. 8, 10.

**Figured specimen.** ULVG-9140, male C, l: 1.10 mm, h: 0.58 mm, w: 0.49 mm; ULVG-9141, female C, l: 0.92 mm, h: 0.54 mm, w: 0.5 mm.

**Origin.** Core 51, 14.5-17.5 cm.

**Age.** Oligocene.

**Geographic and stratigraphic distribution.** Trinidad: Oligocene-Miocene.

**Remarks.** Like *Krithe aequabilis*, the stratigraphical distribution of *K. trinidadensis* ranges from the middle Eocene to the Quaternary. It seems to be a typical psychrospheric taxon, widely distributed both in the North and South Atlantic.

*Krithe morkhoveni morkhoveni* Bold, 1960  
(Figures 3Q-R)

1960 *Krithe morkhoveni* Bold, p. 183, pl. 3, fig. 6.

1994 *Krithe morkhoveni morkhoveni* Bold. Coles *et al.*, p. 3, fig. 17.

**Figured specimen.** ULVG-9142, C, l: 0.94 mm, h: 0.48 mm, w: 0.42 mm.

**Origin.** Core 51, 14.5-17.5 cm.

**Age.** Oligocene.

**Geographic and stratigraphic distribution.** DSDP/ODP Sites 549, 549A, 558, 563, 606, 606A, 610, 607, 608, 609, 609B, 609C, 610E, 611E (North Atlantic): Upper Paleocene-Quaternary; Trinidad: Miocene (Cipero Formation).

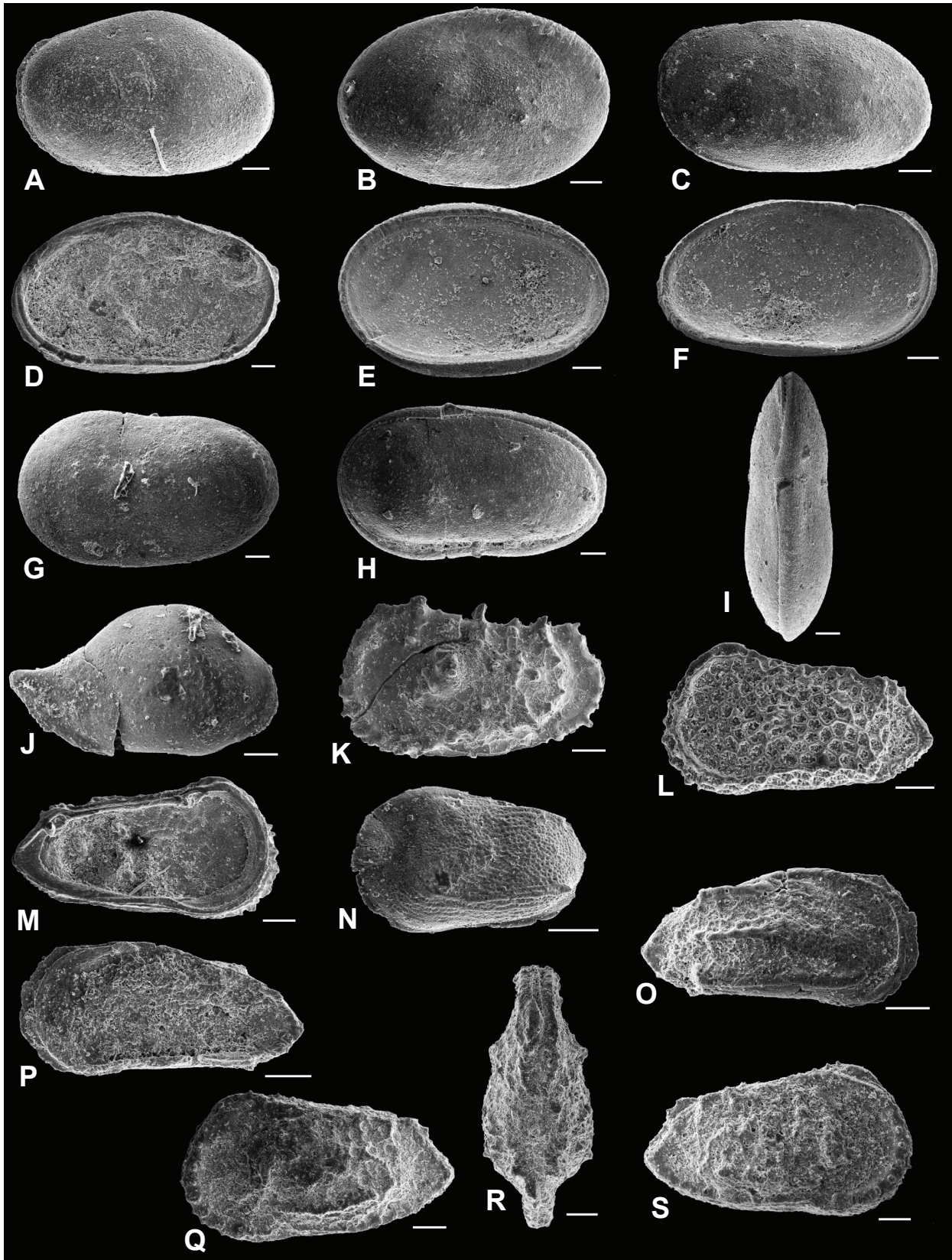
**Remarks.** According to Coles *et al.* (1994) *K. morkhoveni morkhoveni*, along with *K. dolichodeira*, presents the longest chronostratigraphic distribution of the genus, ranging from the lower Eocene to the Quaternary.

*Krithe* sp.  
(Figures 3S-T)

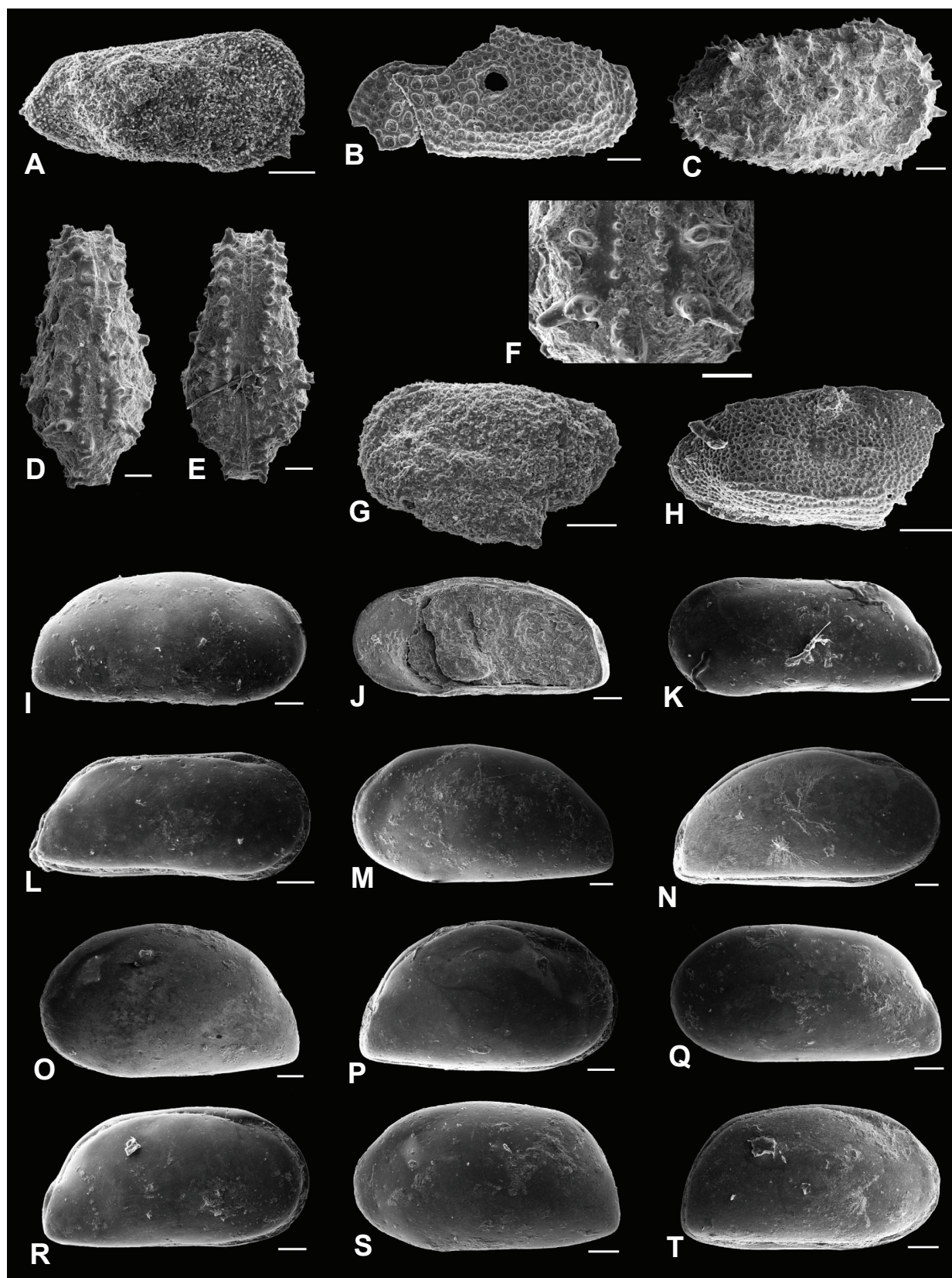
**Figured specimen.** ULVG 9738, C, l: 0.8 mm, h: 0.5 mm, w: 0.4 mm.

**Origin.** Core 51, sample 14.5-17.5 cm.

**Age.** Oligocene.



**Figure 2.** A-F, *Cytherella* sp. 1: A, ULVG 9123, female LV lateral view; B, ULVG 9124, male RV lateral view; C, ULVG 9125, male LV lateral view; D, ULVG 9123, internal view; E, ULVG 9124, internal view; F, ULVG 9125, internal view. G-I, *Cytherella* sp. 2: G, ULVG 9126, male? C in right lateral view; H, same specimen in left lateral view; I, same specimen in dorsal view. J, *Bairdoppilata* sp., ULVG 9127, RV lateral view. K, *Dutoitella mimica* Dingle, ULVG 9128, LV lateral view. L-M, *Trachyleberidea* sp.: L, ULVG 9129, LV lateral view; M, same specimen in internal view. N, *Ambocythere* sp. 1, ULVG 9130, LV in lateral view. O-P, *Ambocythere* sp. 2: O, ULVG 9135, RV in lateral view; P, internal view of the same specimen. Q-S: *Pennyella* sp. aff. *P. praedorsosserrata* Coles & Whatley: Q, ULVG 9131, C, LV lateral view; R, same specimen in dorsal view; S, same specimen in right lateral view. Scale bars = 100  $\mu$ m.



**Figure 3.** **A**, *Pennyella* sp., ULVG 9132, RV lateral view. **B**, ?*Apatihowella* sp., ULVG 9133, LV lateral view. **C-F**: *Legitimocythere* sp.: **C**, ULVG 9134, C in right lateral view; **D**, same specimen in dorsal view; **E**, same specimen in ventral view; **F**, detail of the posterior region of carapace. **G**, Trachyleberididae gen. et sp. indet. 1, ULVG 9136, LV. **H**, Trachyleberididae gen. et sp. indet. 2, ULVG 9137, RV. **I-L**, *Krithe aequabilis* Ciampo: **I**, ULVG 9138, RV in lateral view; **J**, same specimen in internal view; **K**, ULVG 9139, male C in left lateral view; **L**, same specimen in right lateral view. **M-P**, *Krithe trinidadensis* Bold: **M**, ULVG 9140, male C in left lateral view; **N**, same specimen in right lateral view; **O**, ULVG 9141, female C in left lateral view; **P**, same specimen in right lateral view. **Q-R**, *Krithe morkhoveni morkhoveni* Bold: **Q**, ULVG 9142, C in left lateral view; **R**, same specimen in right lateral view. **S-T**, *Krithe* sp.: **S**, ULVG 9738, C in right lateral view; **T**, same specimen in left lateral view. Scale bars = 100  $\mu$ m.





The data presented in Table 2 represent decades of deep-sea ostracode research and in various degrees are biased by the location of the studied sites, bathymetric position and taxonomic accuracy. Although a comprehensive analysis of the deep-sea ostracodes paleozoogeography is beyond the objectives of the present work, the restricted occurrence of some genera highlights the importance of historical aspects in the zoogeography of the Paleogene deep-sea ostracodes.

Coles *et al.* (1990), comparing the occurrences of Paleogene deep-sea species from the North Atlantic and Pacific oceans noticed a delay between the origin of some genera and their appearance in other regions. In spite of the heterogeneity of the data, the absence of some genera in certain regions was also discussed by those authors (Coles *et al.*, 1990, p. 299-300). Hence, the comparison of data from the DSDP site 515B to similar studies elsewhere brings additional information to the discussion on the pandemic distribution of deep-sea ostracodes as previously discussed by Schornikov (2005) and Jellinek *et al.* (2006).

CONCLUSIONS

The general decline of ostracode abundance from Eocene to Oligocene recorded at Site 515B is similar to other DSDP/ODP sites studied. Except for genera such as *Bairdoppilata*, *Krithe* and *Cytherella*, whose fossil taxonomy is extremely complex, other typical deep-sea dwelling species were not recorded in the present study. This is an important observation in the context of some paleozoogeographic concepts regarding deep-sea ostracodes. Comparing published data on Late Cretaceous and Early Cenozoic assemblages, the declining importance of some taxa, such as the *Dutoitella* towards the Paleogene might represent a general change in the deep-sea ostracode faunas, where new lineages of Trachyleberididae (*e.g. Agrenocythere, Legitimocythere*) and Thaerocytheridae (*e.g. Bradlyea, Poseidonamicus*) became more diversified and substitute for older Late Cretaceous lineages. The long temporal distribution of *Krithe aequabilis*, *Krithe trinidadensis*, *Krithe morkhoveni morkhoveni* presented by Coles *et al.* (1994) is

**Table 2.** Zoogeographic distribution of some genera recorded in the Eocene-Oligocene interval of several DSDP/ODP studies consulted for the faunal analysis. Taxa synonymized in subsequent studies are lumped. **Abbreviations:** E, Eocene; B, Eocene-Oligocene; O, Oligocene. **Reference studies:** 1, Majoran & Dingle (2002b); 2, Bergue & Govindan (2010); 3, Majoran & Dingle (2001b); 4, Bergue & Nicolaidis (2012); 5, Guernet (1985); 6, Majoran & Dingle (2001a); 7, Benson & Peypouquet (1983); 8, Benson (1977); 9, Steineck *et al.* (1990); 10, Guernet & Fourcade (1988); 11, Guernet (1982); 12, Coles & Whatley (1989); 13, Cronin & Compton-Gooding (1987); 14, Ducasse & Peypouquet (1979).

DSDP/ODP Site	689	744	699	329	513	245	1087	516	357	356	515	214	574	220	219	223	628	390	558	613	612	401	400	402	550	549	406	405	404	403		
Latitude	64°31'S	60°S	51°32'S	50°39'S	47°35'S	31°31'S	31°27'S	30°16'S	30°S	28°17'S	26°14'S	11°20'S	04°12'N	06°31'N	09°01'N	18°45'N	27°31'N	30°08'N	37°46'N	38°46'N	38°49'N	47°25'N	47°30'N	47°52'N	48°30'N	49°05'N	55°15'N	55°20'N	56°03'N	56°08'N		
REFERENCE STUDY	1	2	3	4	3	5	6	7	8		HEREIN	5	9		5		10	11	12		13		14			12		14				
GENERA																																
<i>Australoecia</i>	E	O					B					E																			B	
<i>Actinocythereis</i>	E			E								B																				
<i>Ambocythere/Phacorhabdotus</i>	O						B				E						O	E	O	E	E					B						
<i>Apasteloschizocythere</i>	E																															
<i>Aratrocypis</i>	B																				E											
<i>Arcacythere</i>	E																															
<i>Argilloecia</i>	O						B										O			E	E	B									E	
<i>Aversovalva</i>	B						B																			O						
<i>Bairdia/Bairdoppilata</i>	B	E	E				B	O	O	E	E	E						E		E	E	B		E						E	E	
<i>Cytherella</i>	B	E	E	E			B	O	O	E	E	E					O	E		E	E	B						E	E			
<i>Cytherelloidea</i>	B	E		E					E																							
<i>Cytheropteron</i>	B		E				B		E			E					O	E		E	E	E		E								
<i>Dutoitella</i>	B	E	E		E						E					E																
<i>Eucythere</i>	B			O			B												E	O	E	E	E	B								
<i>Eucytherura</i>	E																	E	O		E		B									
<i>Henryhowella/Apatihowella</i>	B	B	E	O	O		B	B		E								O		E	E							B			E	
<i>Krithe</i>	B	B	E	O			B	B	O	E	O	E						O	E		E	E	B				E	E		E	E	
<i>Legitimocythere</i>	O	E	E						E		O									O	E	E			E	E	B	E				
<i>Pelecocythere</i>	B																									E						

Table 2. Cont.

DSDP/ODP Site	689	744	699	329	513	245	1087	516	357	356	515	214	574	220	219	223	628	390	558	613	612	401	400	402	550	549	406	405	404	403				
Latitude	64°31'S	60°S	51°32'S	50°39'S	47°35'S	31°31'S	31°27'S	30°16'S	30°S	28°17'S	26°14'S	11°20'S	04°12'N	06°31'N	09°01'N	18°45'N	27°31'N	30°08'N	37°46'N	38°46'N	38°49'N	47°25'N	47°30'N	47°52'N	48°30'N	49°05'N	55°15'N	55°20'N	56°03'N	56°08'N				
REFERENCE STUDY	1	2	3	4	3	5	6	7	8	HEREIN	5	9	5	10	11	12	13	14	12	14														
GENERA																																		
<i>Rugocythereis</i>	O																																	
<i>Poseidonamicus</i>	B			O			B		O										O								B	E						
<i>Pterigocythere</i>	O																																	
<i>Xestoleberis</i>	O						B												O	E	E						B							
<i>Aneocythereis</i>		B					E					E																						
<i>Bradleya</i>		B			O				O			E							O															
<i>Pennyella</i>		E	E	E					O	E	E										E	O				E	B							
<i>Pseudobosquetina</i>		E	E																															
<i>Taracythere</i>		B																																
<i>Paleoabyssocythere</i>			E						E																									
<i>Agrenocythere</i>							B	O	B					E	O		O	E		E	E		E											
<i>Bythocypris</i>							B	O									O	E		E	E									E				
<i>Atlanticythere</i>							B		E																					E				
<i>Cairdobairdia</i>							B										O	E					B											
<i>Paracypris</i>								B										E													E			
<i>Parakrithe</i>								O															B								E			
<i>Trachyleberis</i>								O																										
<i>Rocaleberis</i>									O																									
<i>Bythocythere</i>										E																								
<i>Eocytheropteron</i>										E																								
<i>Trachyleberidea</i>												E	E					O	E		E	E	B						E		E			
<i>Messinella</i>															O						E	E												
<i>Macrocypris</i>																E	E	O	E		E	E												
<i>Abyssocythere</i>																O	E					E												
<i>Bythoceratina</i>																				E														
<i>Abyssobairdia</i>																			E	O	E										B			
<i>Bathypterocythereis</i>																					O										E			
<i>Mayburia</i>																					O										O			
<i>Parahemingwayella</i>																					O										B			
<i>Rimacytheropteron</i>																					O										B			
<i>Loxoconcha</i>																						E	E									E		
<i>Paranesidea</i>																						E	E											
<i>Hazelina</i>																							E								E			
<i>Alatocythere</i>																							E											
<i>Semicytherura</i>																							E											
<i>Koilocythere</i>																								B										
<i>Buntonia</i>																									E								E	
<i>Hemiparacytheridea</i>																															E			
<i>Palmoconcha</i>																															E			
<i>Profundocythere</i>																															B			
<i>Saida</i>																															B			

untypical compared to other deep-sea ostracode species, and possibly results from taxonomic misinterpretations.

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