



## FOSSIL HOLOCENE OSTRACODA FROM THE ITAPEVA LAKE, SOUTHERN BRAZILIAN COASTAL PLAIN

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**ABSTRACT** – Holocene ostracods from a core obtained in the Itapeva Lake, Rio Grande do Sul coastal plain, are studied in this paper. Twenty-six species belonging to 22 genera and 13 families were registered in nine samples analyzed, two of them new: *Cytherella eros* sp. nov. and *Loxococoncha itapevensis* sp. nov. The taxonomic composition of the assemblages varies along the core, being *Cyprideis multidentata* Hartmann the most abundant and frequent species (273 specimens), followed by *Cytheretta punctata* Sanguinetti (56 specimens) and *L. itapevensis* sp. nov. (51 specimens). Variation in richness and diversity observed along the core probably results from sedimentary and hydrological changes during the evolution of the Itapeva Lake. The results obtained in this work reinforce the importance of ostracods in the study of coastal paleoenvironments.

**Keywords:** barrier-lagoon system, biostratigraphy, micropaleontology, Quaternary.

**RESUMO** – Este trabalho apresenta o estudo de ostracodes holocênicos provenientes de um testemunho obtido na Lagoa Itapeva, planície costeira do Rio Grande do Sul. Vinte e seis espécies pertencentes a 22 gêneros e 13 famílias foram registradas em nove amostras analisadas, sendo duas novas: *Cytherella eros* sp. nov. e *Loxococoncha itapevensis* sp. nov. A composição taxonômica das associações varia ao longo da seção estudada, onde *Cyprideis multidentata* Hartmann é a espécie mais abundante e frequente (273 espécimes), seguida por *Cytheretta punctata* Sanguinetti (56 espécimes) e *L. itapevensis* sp. nov. (51 espécimes). As variações em riqueza e diversidade observadas ao longo do testemunho resultam, provavelmente, de processos sedimentares e mudanças hidrológicas durante a evolução da Lagoa Itapeva. Os resultados obtidos reforçam a importância dos ostracodes no estudo de paleoambientes costeiros.

**Palavras-chave:** sistema laguna-barreira, bioestratigrafia, micropaleontologia, Quaternário.

### INTRODUCTION

Due to eustatic cycles, a system of lakes and lagoons was formed along the southern Brazilian coast during the Holocene (Villwock & Tomazelli, 1995). These processes can be analyzed from a biological perspective, using fossils that mark environmental changes. Ostracods are an important source of data for such studies because they are sensitive to environmental changes and have abundant fossil record (Duleba *et al.*, 2005). These microfossils proved to be reliable proxies for Quaternary environmental evolution in coastal regions worldwide (Cabral *et al.*, 2006; Coimbra *et al.*, 2006, 2007; Cronin *et al.*, 2007; Reeves *et al.*, 2007; Hong *et al.*, 2019). This paper presents the first taxonomic study on fossil

ostracods from the Itapeva Lake. Moreover, it briefly discusses the influence of coastal dynamics on ostracod assemblage composition.

The Itapeva Lake lies in the northern portion of the Rio Grande do Sul coastal plain. This lagoon is a water body considerably shallow, with a maximum depth of 2.7 m (Ivanoff *et al.*, 2014). It is the first one of a series of coastal lakes and lagoons that are interconnected through meandering canals to the Tramandaí-Armazém Lagoon, which connects them to the Atlantic Ocean. The Itapeva Lake was formed during the Holocene and is part of the barrier-lagoon system IV (Villwock & Tomazelli, 1995; Buchmann *et al.*, 2009). With the length of approximately 32 km, is the largest lake of the north coast of the Rio Grande do Sul State (Figure 1).

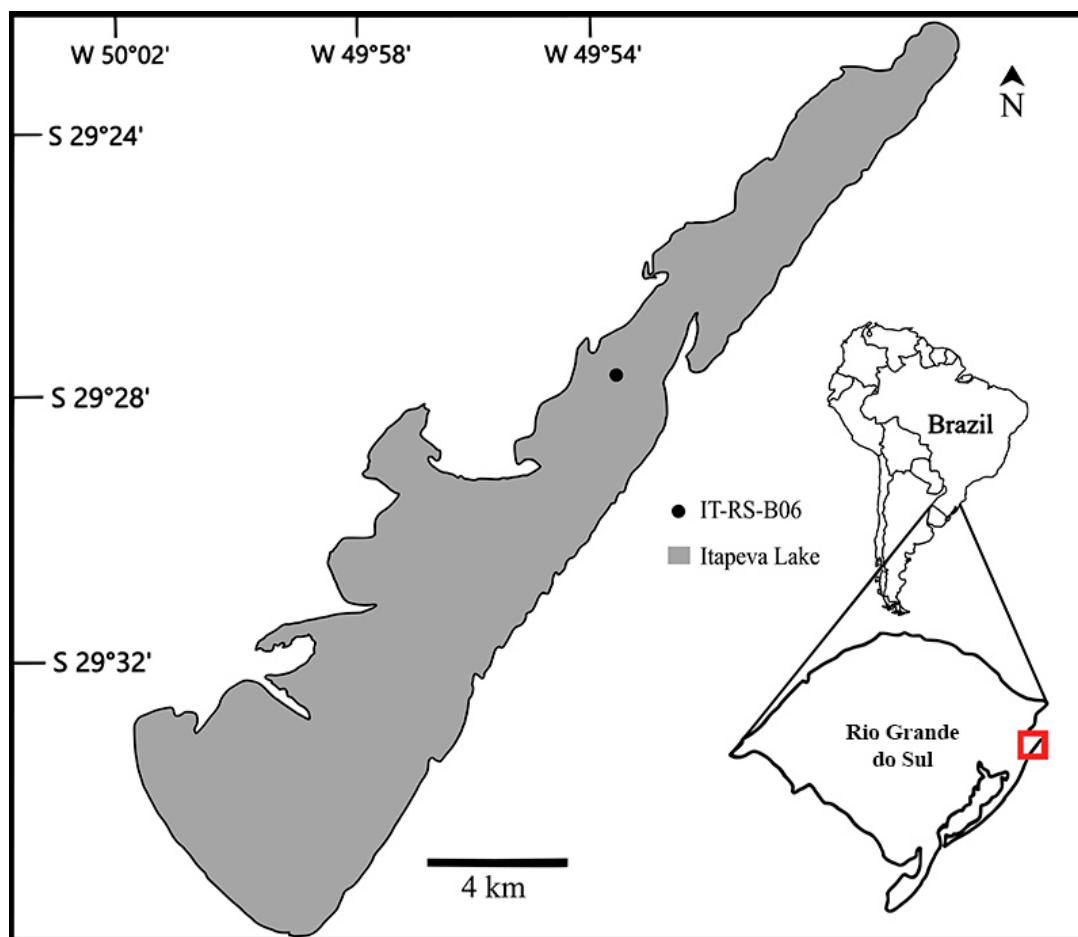


Figure 1. Map of the study area with location of the core IT-RS-B06.

## MATERIAL AND METHODS

The present paper is based on nine samples obtained between 313–170 cm depth of the vibrocore IT-RS-B06 (29°27'S; 49°53'W) (Table 1; Figure 1). This core has been collected for palynological studies and the residual samples made available for use in this work. A stratigraphic profile and additional details of this section, however, are not available. The samples correspond to sections varying from two to four centimeters thick and composed predominantly of fine greyish sand with low organic matter content. The preparation was carried out at Laboratório de Microfósseis Calcários, Universidade Federal do Rio Grande do Sul (UFRGS), through washing on sieves of 0.25 mm, 0.18 mm and 0.063 mm meshes and oven-dried at 60°C. All ostracod specimens were picked under stereomicroscope and stored in micropaleontological slides for analysis.

Specimens of each morphotype were selected for SEM (scanning electron microscopy) at Laboratório Central de Microscopia e Microanálise, Pontifícia Universidade Católica do Rio Grande do Sul (PUCRS). The specimens were gold coated in a BAL-TEK SCD-005 equipment. All figured specimens are held at Museu de Paleontologia Irajá Damiani Pinto, Universidade Federal do Rio Grande do Sul, Porto Alegre, Brazil, under the prefix **MP-O**. The

two new species proposed are described in the taxonomic appendix (Appendix 1). For the remaining ones, only remarks are presented whenever necessary because most of these species have been exhaustively studied in previous works. All species registered in this study are in Table 1 (according to their stratigraphic occurrence in the core), and Figures 2–4.

## RESULTS

### Ostracod assemblage composition

The ostracod assemblages of the core IT-RS-B06 are composed predominantly of species previously registered either in coastal or shallow marine (*i.e.* inner shelf) environments in southern Brazil, Uruguay, and Argentina (see Dias-Brito *et al.*, 1988; Whatley *et al.*, 1997; Coimbra *et al.*, 2006, 2007; Kihn *et al.*, 2016, 2017; Morais & Coimbra, 2017; Machado *et al.*, 2020; Bernasconi & Cusminsky, 2020, *inter alia*). Five morphotypes, however, are left in open nomenclature or compared to previously described species, due to their scarcity or poor preservation: *Paracypris* sp., *Xestoleberis* sp., *Semixestoleberis?* sp., *Brasilicythere* sp. aff. *B. reticulispinosa* and *Hulingsina* sp. Moreover, two new species are herein proposed: *Cytherella eros* sp. nov. and *Loxoconcha itapevensis* sp. nov.

**Table 1.** Occurrence and abundance of species in the studied samples.

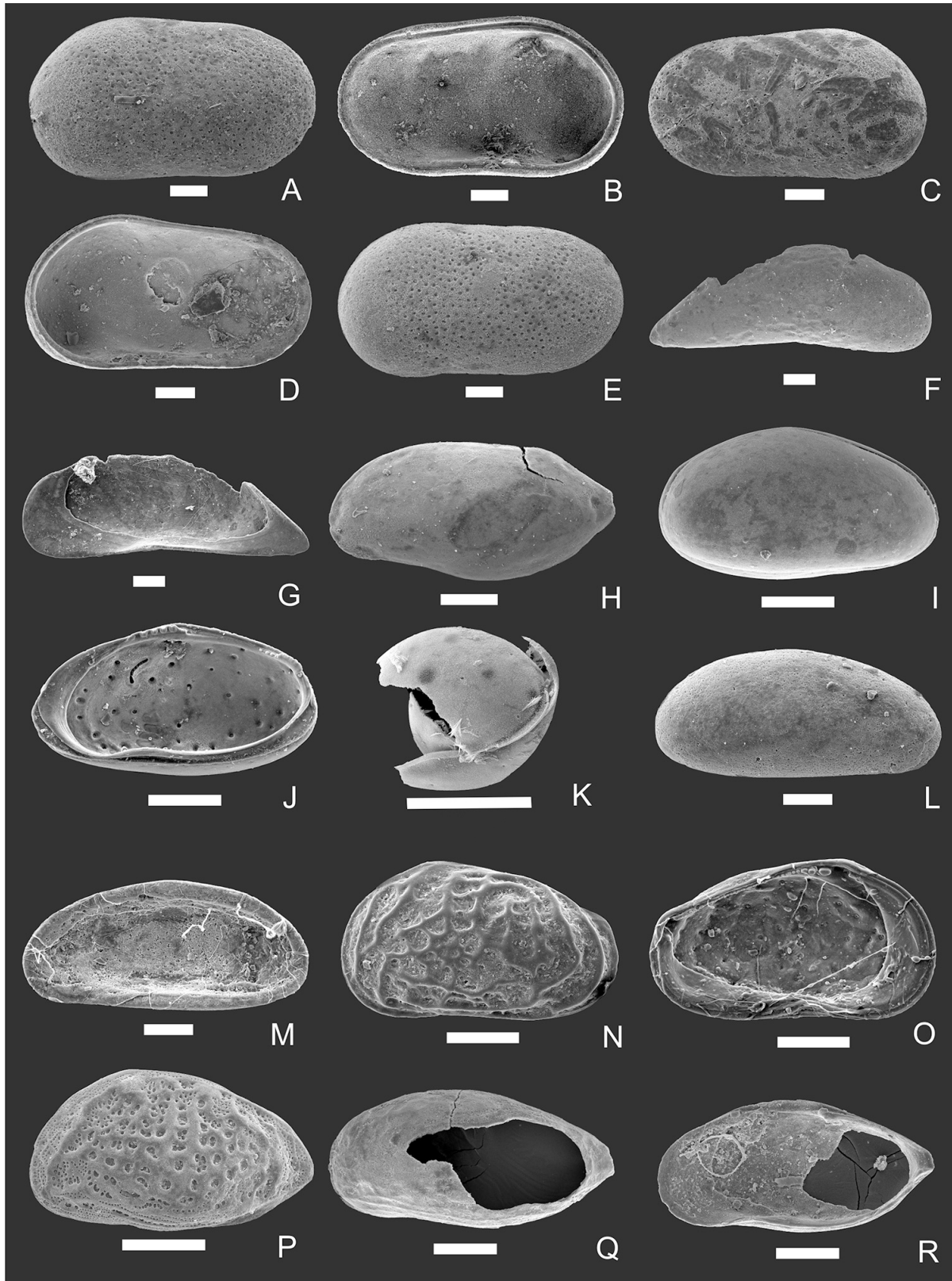
Species	Depth (cm)									
	170–174	174–178	186–190	258–262	266–270	290–294	294–298	298–301	309–313	
<i>Cytherella eros</i> sp. nov.	6	13	2		1	3	1	1	1	
<i>Brasilicythere</i> sp. aff. <i>B. reticulispinosa</i>	2									
<i>Loxoconcha itapevensis</i> sp. nov.	6	2		4	6	16	1	3	13	
<i>Cyprideis multidentata</i>	28	46	34	12	33	39	14	14	53	
<i>Cyprideis salebrosa</i>	1									
<i>Perissocytheridea krommelbeini</i>									1	
<i>Perissocytheridea sanantoniensis</i>		2	2							
<i>Paracypris</i> sp.									1	
<i>Cytheretta punctata</i>	15	20	7	2	7		1	1	3	
<i>Oculocytheropteron circumcostatum</i>	1								1	
<i>Cytheretta</i> sp. cf. <i>C. punctata</i>							1			
<i>Semicytherura caudata</i>							2			
<i>Pellucistoma elongata</i>							1			
<i>Xestoleberis</i> sp.							1			
<i>Papillosacythere parallela</i>	1	5	2							
<i>Callistocythere nucleoperiscum</i>	2	2		1	1	1				
<i>Coquimba tenuireticulata</i>	2									
<i>Coquimba bertelsae</i>	1	1	1	1						
<i>Neocaudites planeforma</i>	2	1								
<i>Orionina similis</i>		3	1	2						
<i>Quadracythere eichlerae</i>				1						
<i>Caudites gnomus</i>		2								
<i>Nanocoquimba pulchra</i>	1	2								
<i>Hulingsina</i> sp.		1								
<i>Semixestoleberis?</i> sp.		1								
<i>Protocytheretta</i> sp. cf. <i>P. multicostata</i>	2	1	3							

Based on the studies above mentioned, a number of species registered in the core IT-RS-B06 are typical shallow marine dwellers, such as *Callistocythere nucleoperiscum* Whatley *et al.*, 1997, *Caudites gnomus* Coimbra & Ornellas, 1987, *Coquimba bertelsae* Sanguinetti *et al.*, 1991, *Coquimba tenuireticulata* Kotzian, 1982, *Cytheretta punctata* Sanguinetti, 1979, *Nanocoquimba pulchra* Ramos, 1996, *Neocaudites planeforma* Whatley *et al.*, 1997, *Oculocytheropteron circumcostatum* Ramos *et al.*, 1999, *Orionina similis* van den Bold, 1963a, *Papillosacythere parallela* Whatley *et al.*, 1987, *Pellucistoma elongata* Whatley *et al.*, 1997, *Perissocytheridea sanantoniensis* Whatley *et al.*, 1997, *Quadracythere eichlerae* Carreño *et al.*, 1997, and *Semicytherura caudata* Ramos *et al.*, 1999. *Cytherella eros* sp. nov. and *Loxoconcha itapevensis* sp. nov. are also included in this group. Most of these species are rare in the core IT-RS-B06 and are represented predominantly by adults.

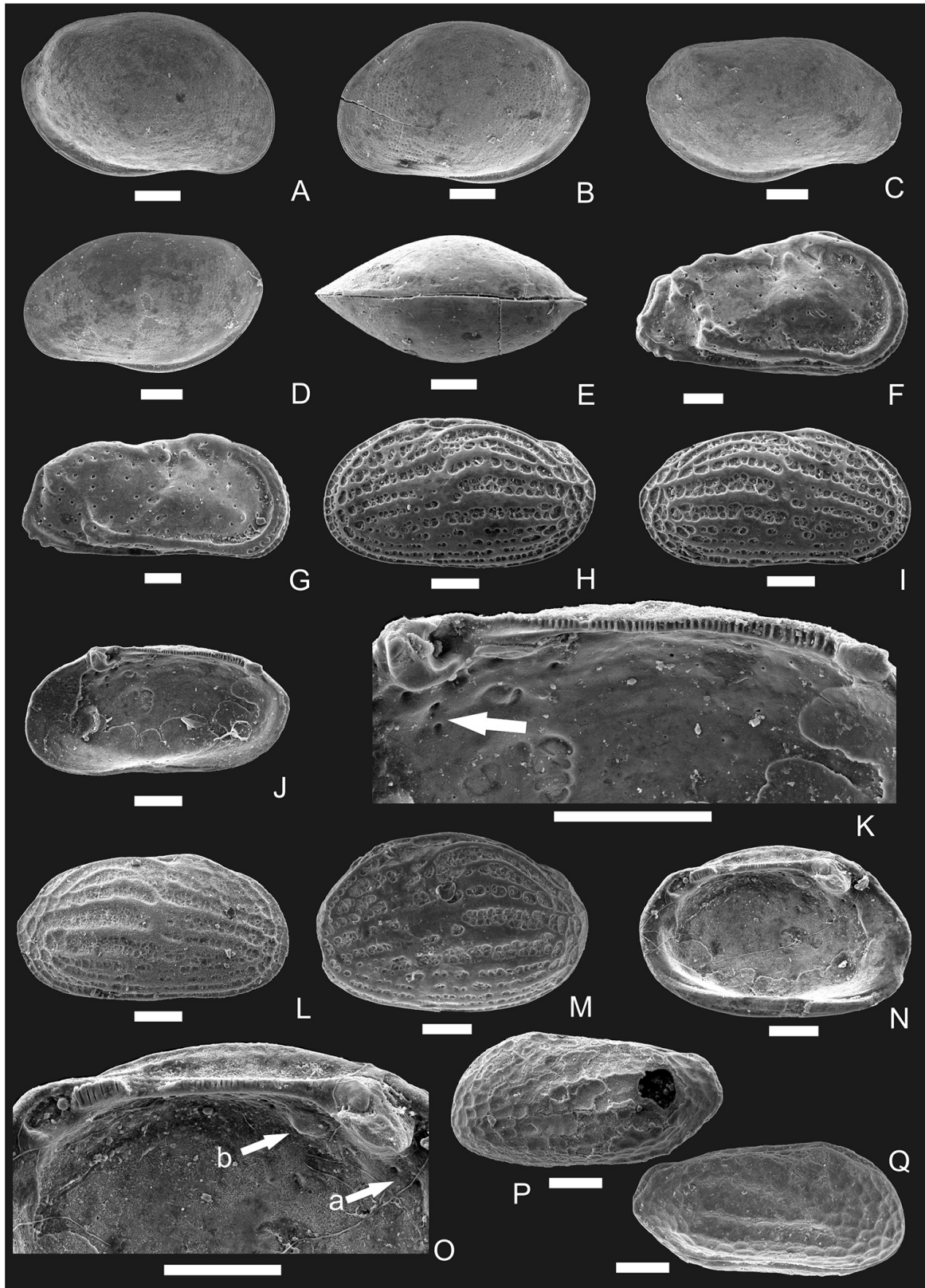
Another group is composed of taxa typical of estuaries and lagoons. *Cyprideis multidentata* Hartman, 1955, *Cyprideis*

*salebrosa* van den Bold, 1963b and *Perissocytheridea krommelbeini* Pinto & Ornellas, 1970 are common, for instance, in the Tramandaí-Armazém Lagoon (Ornellas, 1974; Würdig, 1988), *C. multidentata* being the dominant taxon in the core IT-RS-B06. Compared to the group of species previously presented, they have more restrict ecological range, *i.e.* increasing salinity would allow the thriving of some marine species (*e.g.* loxoconchids, leptocytherids, cytherurids) in a lagoon. On the other hand, the opposite does not occur, and records of *Cyprideis multidentata* in marine sediments (*e.g.* Machado *et al.*, 2005, 2020) are characterized by low abundance and are most probably allochthonous.

Two species registered in this work have remarkably wide geographic distribution. *Orionina similis* was described in the Upper Miocene–Pliocene Melajo Beds (Springvale Formation), in Trinidad. The broad geographic distribution of this species along Brazilian coast was reported for the first time by Coimbra & Ornellas (1989), who registered it between Pará and Espírito Santo states. Later, Coimbra *et al.* (2006) and Morais & Coimbra (2017) expanded its occurrence

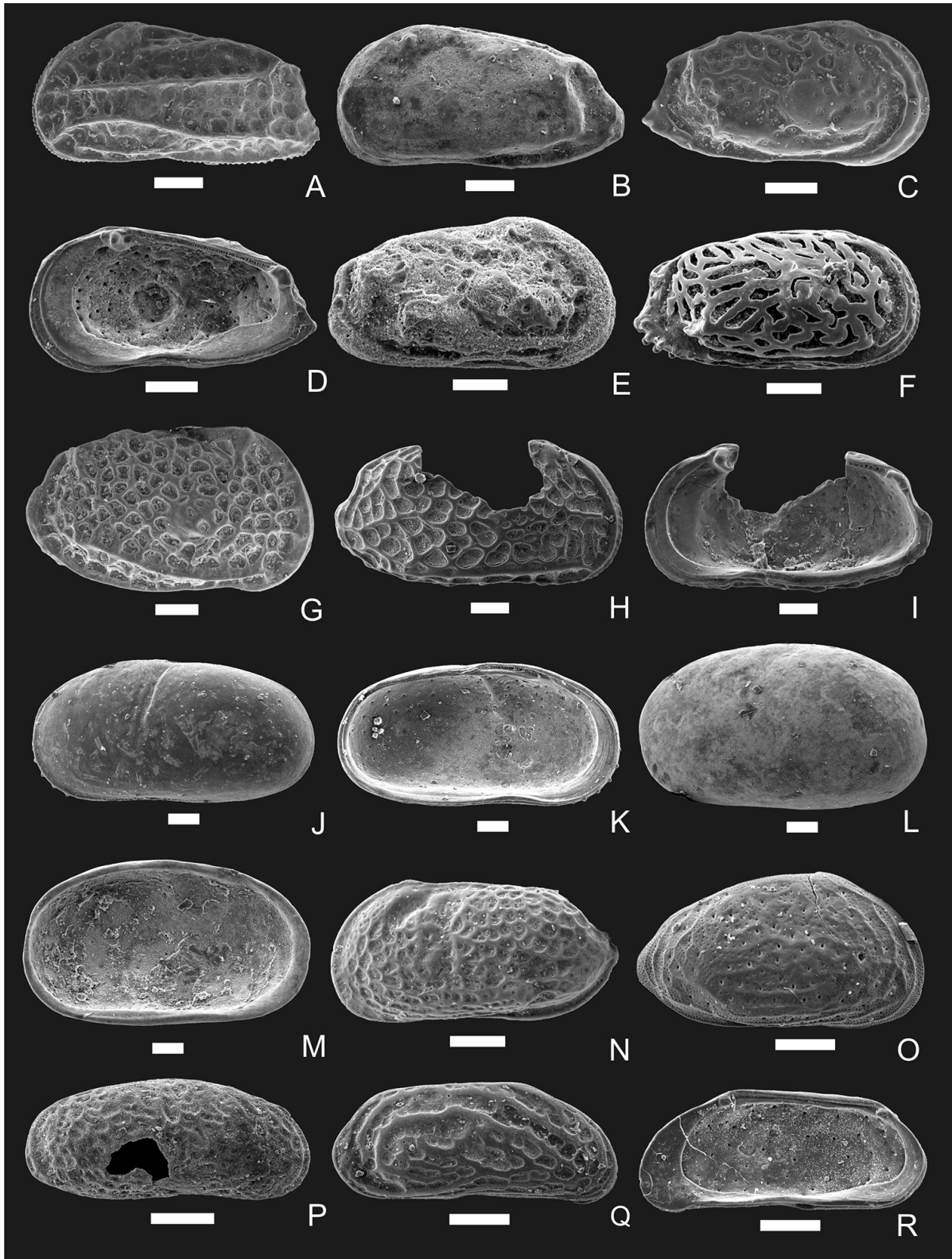


**Figure 2.** A–E, *Cytherella eros* sp. nov.; A, female RV (MP-O-3033) holotype; B, same specimen internal view; C, *Cytherella eros* sp. nov. female LV (MP-O-3034), paratype; D, *Cytherella eros* sp. nov. same specimen internal view; E, *Cytherella eros* sp. nov. male RV (MP-O-3035), paratype. F–G, *Paracypris* sp. F, RV (MP-O-3037); G, Same specimen internal view. H, *Pellucistoma elongata* Whatley *et al.*, 1997, LV (MP-O-3038). I–K, *Xestoleberis* sp.; I, female C (MP-O-3039); J, RV internal view of the same specimen; K, juvenile specimen (broken) found inside of the carapace MP-O-3039. L–M, *Semixestoleberis?* sp.; L, RV (MP-O-3040); M, same specimen internal view. N–O, *Callistocythere nucleoperiscum* Whatley *et al.*, 1997; N, male LV (MP-O-3041); O, same specimen internal view. P, *Oculocytheropteron circumcostatum* Ramos *et al.*, 1999 LV (MP-O-3042). Q–R, *Semicytherura caudata* Ramos *et al.*, 1999; Q, LV (MP-O-3045); R, RV internal view (MP-O-3046). Scale bars: A–J, L–R = 100  $\mu$ m; K = 50  $\mu$ m.



**Figure 3.** A–E, *Loxoconcha itapevensis* sp. nov.; A, female RV (MP-O-3044), holotype; B, female LV (MP-O-3045), paratype; C, male RV (MP-O-3047), paratype; D, male LV (MP-O-3046), paratype; E, female C dorsal view (MP-O-3048). F–G, *Neocaudites planeforma* Whatley *et al.*, 1997; F, female RV (MP-O-3051); G, male RV (MP-O-3050). H–L, *Cytheretta punctata* Sanguinetti, 1979; H, male LV (MP-O-3052); I, male RV, external view (MP-O-3053); J, male RV internal view (MP-O-3054); K, detail of the hinge of MP-O-3054; L, female RV (MP-O-3055). M–O, *Cytheretta* sp. cf. *C. punctata* Sanguinetti, 1979, LV (MP-O-3056); N, same specimen internal view; O, detail of hinge of MP-O-3056. P–Q, *Protocytheretta* sp. cf. *P. multicostata* Whatley *et al.*, 1997; P, carapace right view (MP-O-3057); N, same specimen left view. Scale bars = 100  $\mu$ m.





**Figure 4.** A, *Orionina similis* van den Bold, 1963a, LV (MP-O-3059). B, *Caudites gnomus* Coimbra & Ornellas, 1987, right view (MP-O-3060). C–D, *Coquimba tenuireticulata* Kotzian, 1982; C, right view (MP-O-3061); D, same specimen internal view. E, *Coquimba bertelsae* Sanguinetti *et al.*, 1991, C right view (MP-O-3062). F, *Nanocoquimba pulchra* Ramos, 1996, right view (MP-O-3063). G, *Brasilicythere* sp. aff. *B. reticulispinosa* Sanguinetti *et al.*, 1991, RV (MP-O-3064). H–I, *Quadracythere eichlerae* Carreño *et al.*, 1997; H, broken RV (MP-O-3065); I, same specimen internal view. J–K, *Cyprideis multidentata* Hartmann, 1955; J, LV (MP-O-3066); K, same specimen internal view. L–M, *Cyprideis salebrosa* van den Bold, 1963b; L, female LV (MP-O-3067); M, same specimen internal view. N, *Perissocytheridea krommelbeini* Pinto & Ornellas, 1970, male LV (MP-O-3068). O, *Perissocytheridea sanantoniensis* Whatley *et al.*, 1997, RV (MP-O-3069). P, *Hulingsina* sp. (MP-O-3070). Q–R, *Papillosocythere parallela* Whatley *et al.*, 1987; Q, RV (MP-O-3071); R, Same specimen internal view. Scale bars = 100  $\mu$ m.

up to the Santa Catarina State. The absence of records in Argentina is evidence that the Rio Grande do Sul State is, probably, the southernmost limit of occurrence of this species. *Cyprideis salebrosa* was described in the Pliocene Caparo Clay (Talparo Formation), in Trinidad. Differently from *O. similis*, it dispersed further along the South America margin, reaching not only Brazil but Argentina (*e.g.* Dias-Brito *et al.*, 1988; Whatley *et al.*, 1997; Coimbra *et al.*, 2006; Kihn, 2017; Kihn *et al.*, 2017). Van den Bold (1963b) mentioned that *C. salebrosa* is a rare species due to its ecological preferences. In spite of its broad geographic occurrence, the abundance is relatively low. Additional evidence of this pattern is the disproportionate number of specimens of *C. multidentata* and *C. salebrosa* in the samples herein studied. It is noteworthy that the same restrictive occurrence has also been observed elsewhere in Brazil by Ornellas & Würdiger (1983) and Würdiger (1988) in the Tramandaí-Armazém Lagoon, Rio Grande do Sul State, and by Dias-Brito *et al.* (1988), in the Sepetiba Bay, Rio de Janeiro State.

The assemblages in the core IT-RS-B06 are composed, therefore, by species with different zoogeographic patterns and ecological preferences. This heterogeneous composition results from environmental changes along the formation of the Itapeva Lake and to biostratigraphic processes. Assemblages composed by species with different ecological characteristics are seen not only in deep (*e.g.* Bergue & Coimbra, 2007), but also in shallow environments (*e.g.* Machado *et al.*, 2005, 2020). More recently, Hong *et al.* (2019) also observed this pattern in coastal assemblages (referred as marginal marine) and highlighted the importance of the ecological characterization of the constituents for paleoecological purposes in Quaternary and Anthropocene deposits.

#### Lagoonal traps as a model to understand coastal ostracod assemblages

Lagoons undergo seasonal influence (mostly driven by precipitation and wind) and are inhabited by species adapted to broad range of salinity (*i.e.* euryhaline taxa). Therefore, some shallow marine species would also live-in lagoons as long as salinity conditions allow it. Notwithstanding, coastal processes also influence the sediment input/output in a lagoon. According to Coimbra *et al.* (2006), the width and height of the bar can affect the transport of both dead and living ostracod specimens into a lagoon. Another factor influential in sediments exchange is the local hydrodynamics involved in the closure/opening of inlets as well as its depth (Silva *et al.*, 2017). Therefore, in taphonomic terms, a lagoon can act as “ostracod traps” wherein episodic events transport marine specimens which will become allochthonous constituents of the assemblages.

The interval 313–186 cm of the core IT-RS-B06 registers low species richness (four to eight spp.) being *Cyprideis multidentata* the most constant and abundant one, totalizing 199 specimens. In this interval occurs also the only register of *Perissocytheridea krommelbeini* (sample 313–309). Increasing species richness (14 to 18 spp.) is seen especially in the interval 178–170 cm, which registers

the appearance of *Oculocytheropteron circumcostatum*, *Coquimba tenuireticulata*, *Nanocoquimba pulchra*, *Caudites gnomus*, and *Neocaudites planeforma*. Nonetheless, in spite of the increase of marine species, *C. multidentata* is still the dominant species (28 specimens). The only occurrence of *C. salebrosa* is also in this interval.

Based on palynological analysis, Meyer *et al.* (2003, 2005) observed sporadic marine influence in the Itapeva Lake, and divided the Holocene deposits in ecological zones, ranging from lagunar-estuarine to lacustrine. The ostracods from the core IT-RS-B06, partly corroborate these environmental changes because the core top, which would correspond to the lacustrine environment, was not analyzed in this paper. The ostracod analysis, however, do not distinguish marine species incorporated within the assemblages by sedimentary transport from those that actually thrived in the IT-RS-B06 site during episodes of higher marine influence. The absence of freshwater ostracods reinforces that the studied section does not register any lacustrine phases.

## CONCLUSIONS

This work strengthens the potential of ostracods for paleoecological studies in coastal environments. Coastal ostracod assemblages, at least in some cases, are the result of lagoonal trap deposits, where the proportion and amount of allochthonous elements is influenced both by the depositional system energy and inlet morphodynamics. Some genera, such as *Cyprideis*, *Perissocytheridea*, *Callistocythere*, *Loxoconcha* and *Cytheretta*, are ubiquitous in those assemblages in the southeastern coast of America. Slight variation in carapace features observed in *Cytheretta punctata* and *Callistocythere nucleoperiscum* are possibly induced by seasonal changes in water salinity (see Carbonel, 1988). The continual co-occurrence of both adults and juveniles of *Cyprideis multidentata* along the studied section is a supporting evidence that the studied interval of the core IT-RS-B06 represents a lagoon with variable input of marine elements.

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## Appendix 1. Taxonomy.

The suprageneric taxonomy herein used follows mainly Liebau (2005), while open nomenclature signs follow Bengtson (1988). Morphological abbreviations: **H**, height; **L**, length; **W**, width; **C**, carapace; **RV**, right valve; **LV**, left valve; **AMS**, adductor muscle scars.

Subclass OSTRACODA Latreille, 1806  
Order PLATYCOPIIDA Sars, 1866  
Superfamily CYTHERELLOIDEA Sars, 1866  
Family CYTHERELLIDAE Sars, 1866

*Cytherella* Jones, 1849

*Cytherella eros* Nunes & Campos sp. nov.  
urn:lsid:zoobank.org:act:45D9D3DE-30BF-47F4-8840-76BDB0CE075C  
(Figures 2A–E)

**Etymology.** *L.* in allusion to its similarity to the underground growing fruit of *Arachis hypogaea* (peanut).

**Holotype.** MP-O-3033, female RV, L= 0.77 mm, H= 0.45 mm (IT-RS-BO06/53 178–174 cm).

**Paratypes.** MP-O-3034, female LV, L= 0.73 mm, H= 0.40 mm (IT-RS-BO06/53 178–174 cm); MP-O-3035, male RV, L= 0.76 mm, H= 0.42 mm (IT-RS-BO06/53 178–174 cm); MP-O-3036, female LV, L= 0.74 mm, H= 0.42 mm (IT-RS-BO06/53 178–174 cm).

**Type-locality and horizon.** Itapeva Lake, core IT-RS-B06 (29°27'S; 49°53'W). Holocene.

**Material.** Twenty-eight specimens, adults, and juveniles.

**Diagnosis.** Carapace subrectangular, slightly constricted in the middle, higher and inflated at posterior region. RV overlapping LV around all margins. Surface densely punctuated, except in the region corresponding to the AMS.

**Description.** Carapace subrectangular elongated in lateral view, higher and wider at the posterior third. RV overlapping LV around all margins. Maximum length at the middle, and maximum width at the posterior third of carapace. Dorsal margin slightly constricted in the middle; ventral margin sinuous with concavity in the oral region. Anterior margin symmetrically rounded; posterior margin asymmetrically rounded, somewhat obliquely rounded. Posterior third of carapace slightly inflated. Surface densely punctuated, except in the area corresponding to the AMS. Contact groove well developed along the dorsal, ventral and posterior margins in the RV. AMS not seen. Sexual dimorphism conspicuous: females wider and slightly higher in the posterior.

**Geographic and stratigraphic distribution.** Known only for the type-locality.

**Remarks.** *Cytherella eros* sp. nov. belongs to a group of undescribed *Cytherella* species characterized by punctuated surface. It is very similar to *Cytherella* sp. of Coimbra *et al.* (2006) but is less punctuated and differs in the sinuosity of the ventral margin. From *Cytherella* sp. 1 and *Cytherella* sp. 2 of Machado *et al.* (2005), differs mostly in the outline

of the posterior margin, and in the pattern of punctuation. *Cytherella* sp. 4 of Machado *et al.* (2020) has the posterior third of carapace lower and the ventral margin straight, and puncta larger and deeper. At last, *Cytherella* sp. of Bertels *et al.* (1982), although similar to *Cytherella eros* sp. nov., is distinguished in having the posterior portion of carapace lower.

Order PODOCOPIDA Sars, 1866  
Superfamily CYTHEROIDEA Baird, 1850  
Family LOXOCONCHIDAE Sars, 1925

*Loxoconcha* Sars, 1866

*Loxoconcha itapevensis* sp. nov.  
urn:lsid:zoobank.org:act:6A7C77C7-F3DB-4C13-84C1-B9B3129FB55E  
(Figures 3A–E)

?*Loxoconcha* sp. Bertels, Kotzian & Madeira-Falcetta, p. 150, pl. 8, figs. 1a–b.

**Etymology.** In allusion to the type-locality, the Itapeva Lake.

**Holotype.** MP-O-3044, female RV, L= 0.59 mm, H= 0.40 mm (IT-RS-BO06/82 294–290 cm).

**Paratypes.** MP-O-3045, female LV, L= 0.59 mm, H= 0.41 mm; MP-O-3046, male LV, L= 0.61 mm, H= 0.36 mm; MP-O-3047 male RV, L= 0.61 mm, H= 0.36 mm; MP-O-3048 female C, L= 0.59 mm, H= 0.41 mm, W= 0.30 mm; MP-O-3049 male C, L= 0.61 mm, H= 0.35 mm, W= 0.27 mm (all from the sample IT-RS-BO06/82 294–290 cm).

**Type-locality and horizon.** Itapeva Lake, core IT-RS-B06 (29°27'S; 49°53'W). Holocene.

**Material.** 51 specimens, juveniles, and adults.

**Diagnosis.** A *Loxoconcha* species with finely punctuated surface and with very faint anteroventral reticulation. Posterodorsal region of carapace marked by subtle tubercle. Eye tubercle and caudal process poorly developed.

**Description.** Carapace subrhomboidal in lateral view; subelliptical outline in dorsal view, subtly compressed anteriorly. Maximum length and maximum width at the middle. Dorsal margin convex in females, and subrectilinear and slightly sinuous in males. Ventral margin very sinuous with strong convexity at posterior half. Anterior margin infracurvate; posterior margin with caudal process poorly developed in females, and almost absent in the males. Eye tubercle poorly developed. Carapace finely punctuated over all surface, and with faint anteroventral reticulation. Puncta are roughly disposed concentrically, larger in the middle of carapace and gradually smaller towards the anterior and posterior margins. Posterodorsal area marked with poorly developed tubercle. Internal features typical of the genus. Sexual dimorphism very conspicuous: males longer than females. For other sexual differences see the description above.

**Geographic and stratigraphic distribution.** Known only for the type-locality.

**Remarks.** *Loxococoncha itapevensis* sp. nov. differs from *Loxococoncha bullata* Hartmann, 1956 described in the São Paulo State (Brazil) in having dorsal margin more convex, the caudal process less developed, and posterodorsal tubercle less pronounced and more obtuse. *Loxococoncha bullata* of Whatley *et al.* (1997) differs in having the dorsal margin far more convex and in the absence of caudal process. The latter is in fact more similar to *Loxococoncha* sp. of Machado *et al.* (2020) than to *L. bullata*. Based both on size and absence of duplicature, *Loxococoncha* sp. of Bertels *et al.* (1982) is possibly an A-1 of *Loxococoncha itapevensis* sp. nov.

#### Taxonomic remarks on other ostracod species registered

*Pellucistoma elongata* Whatley *et al.*, 1997 (MP-O-3038; Figure 2H)

The specimens of *Pellucistoma elongata* illustrated by Kihn *et al.* (2016) in the Bahía Blanca Estuary (Argentina) have some differences in the outline compared to the specimen herein illustrated. These differences result probably from positioning or ontogeny (see figs. 4b–c in Kihn *et al.*, 2016). Kihn *et al.* (2016) referred the publication of this species to 1998 instead of 1997.

*Callistocythere nucleoperiscum* Whatley *et al.*, 1997 (MP-O-3041; Figures 2N–O)

*Callistocythere* is a diverse genus in inner shallow marine and coastal waters along eastern South America (Coimbra *et al.*, 1995), whose similarity of some species causes taxonomic problems. According to Machado *et al.* (2020) *Callistocythere nucleoperiscum* has been referred erroneously in some works as *Callistocythere litoralis* Rossi de Garcia, 1966 which differs in the outline and ribs pattern. Specimens of *Callistocythere nucleoperiscum* registered in several localities along Brazilian shelf present some degree of variation on ribs thickness [compare, p. ex., the specimen illustrated by Bertels *et al.* (1982) and Morais & Coimbra (2017)].

*Oculocytheropteron circumcostatum* Ramos *et al.*, 1999 (MP-O-3042; Figure 2P)

The specimen herein illustrated is slightly different from the holotype which possibly results either from intraspecific variation or ontogeny.

*Semicytherura caudata* Ramos *et al.*, 1999 (MP-O-3043; Figures 2Q–R)

In spite of poor preservation, the outline and some morphological surface details allowed identification at species level.

*Cytheretta punctata* Sanguinetti, 1979 (MP-O-3052/55; Figures 3H–L)

*Cytheretta punctata* has several registers along southwestern Atlantic neritic and coastal regions, some of them in affinitive status. Ramos *et al.* (2012) in their study

on trachyleberidids from the southern Brazilian margin registered specimens of *C. punctata* smaller and with delicate reticulation, concluding that those specimens would belong to a species affinitive to *Cytheretta punctata*. In our opinion, however, carapace size and morphology might occur in species with such a long stratigraphic range. We assume, therefore, that both ribs and reticulation thickness might vary in some species, possibly induced by environmental parameters (see “Remarks” on *Callistocythere nucleoperiscum*).

*Cytheretta* sp. cf. *C. punctata* Sanguinetti, 1979 (MP-O-3056, Figures 3M–O)

This species differs from *Cytheretta punctata* in having less angulose posterior margin. Notwithstanding, the reticulation pattern is basically the same, which could be considered as intraspecific variation if some degree of variability is assumed (see “Remarks” on *C. punctata*). The data herein obtained do not bring solution to this taxonomic issue, however, some internal morphological details observed in the specimen MP-O-3054 (Figures 3J–K) might be useful for future analyses. The position of some normal porecanals in the area adjacent to the anterior hinge element is different from the specimen MP-O-3056 (Figure 3Oa). Moreover, the latter seems to have a muscle-anchorage structure in this same area (Figure 3Ob) which, unfortunately, is partially obscured by detritus.

*Protocytheretta* sp. cf. *P. multicosata* Whatley *et al.*, 1997 (MP-O-3057; Figure 3P–Q)

The specimen herein figured is slightly different from the holotype. Such differences, however, might be attributed to preservation or ontogeny.

*Brasilicythere* sp. aff. *B. reticulispinosa* Sanguinetti *et al.*, 1991 (MP-O-3064; Figure 4G)

We sustain this is a new species of *Brasilicythere* affinitive to *B. reticulispinosa*, but with differences in the outline of the anterior margin, the anteroventral region more sinuose and shorter radial ribs at the anterior region. The scarcity of specimens did not allow the description.

*Hulingsina* sp. (MP-O-3070; Figure 4P)

This specimen is possibly conspecific with *Hulingsina*? sp. of Whatley *et al.* (1997) registered in Playa Grande, Buenos Aires Province (Argentina). It is also very similar to the specimen identified as *Minicythere argentinensis* by Kihn *et al.* (2017) in Bahía Blanca (Argentina) mainly in the anterodorsal sulcus, the reticulation pattern around the AMS area, and the depressed area adjacent to the posterior margin. The single broken specimen obtained in this work precludes more detailed comparison. Notwithstanding, the carapace morphology of this species is somewhat different from the type-species of *Minicythere* (*i.e.* *Minicythere heinii* Ornellas, 1974), but closer to *Hulingsina* instead.