

Paleoceanografia da Bacia de Pelotas no Neocenozoico com ênfase no Quaternário

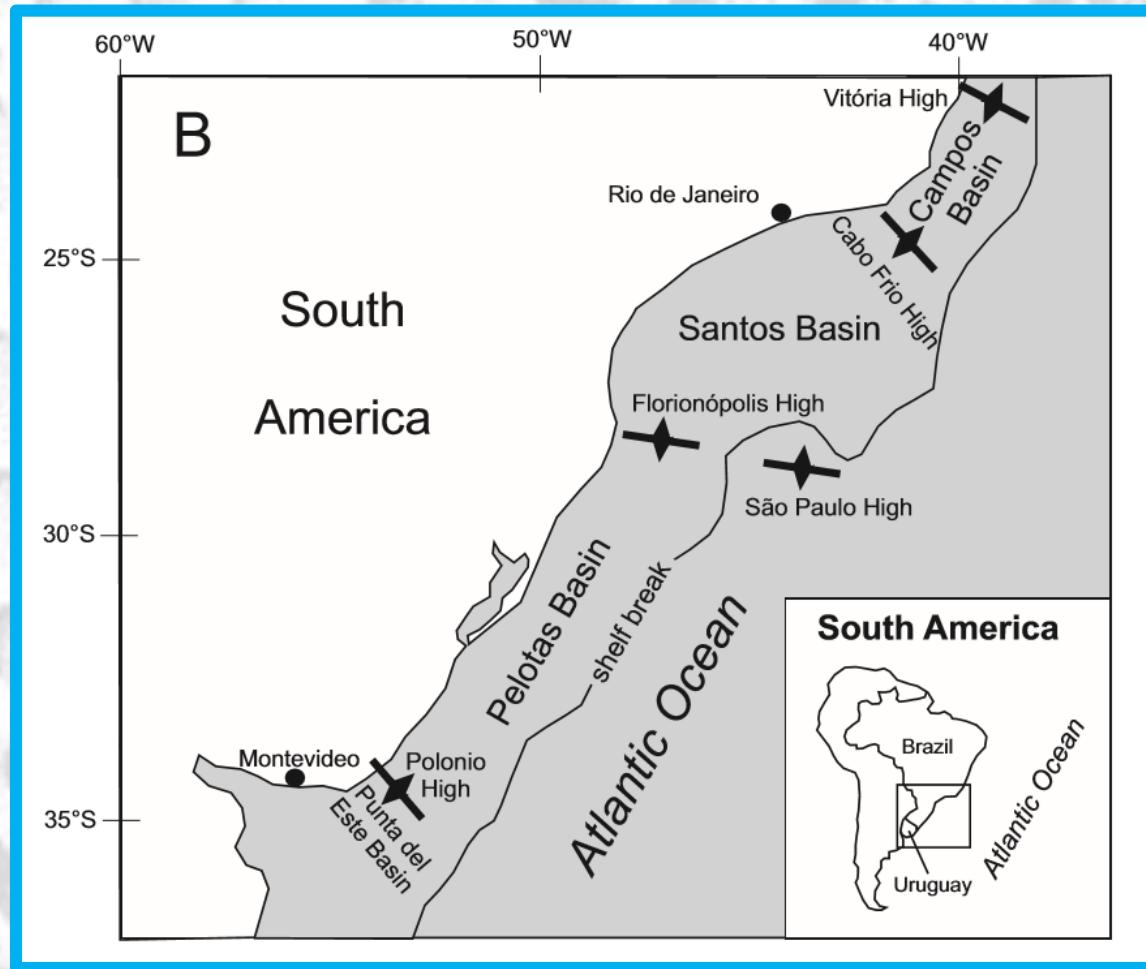
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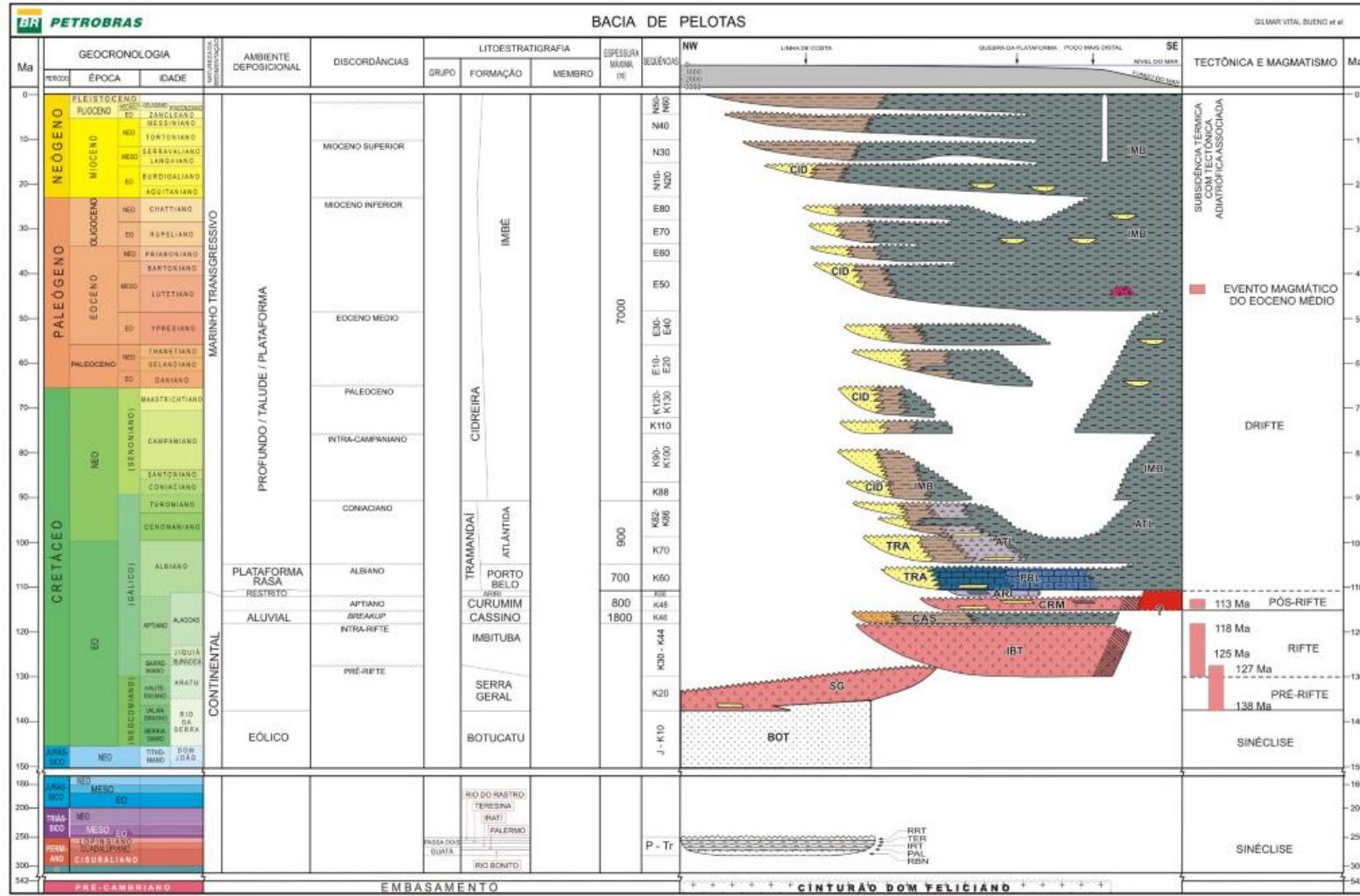
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A BACIA DE PELOTAS

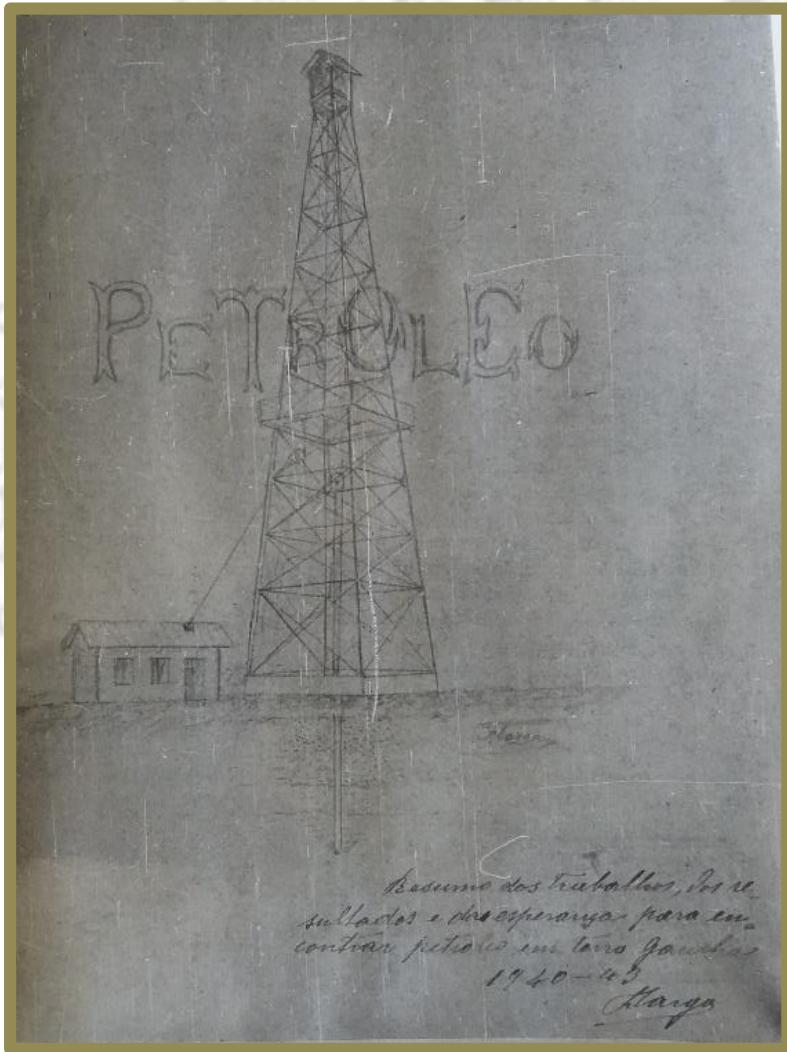


Fonte: Zerfass *et al.* (2013)

CARTA ESTRATIGRÁFICA DA BACIA DE PELOTAS



“Histórico da primeira perfuração para petróleo em Pônta Alegre, município de Arroio Grande, Rio Grande do Sul, Brasil”



P. Alegre, em Outubro de 1943

F. Targa

Dr. FERRUCIO TARGA

Engenheiro de Minas
Cart. 470 D.-C.R.E.A. 1004

PORTO ALEGRE

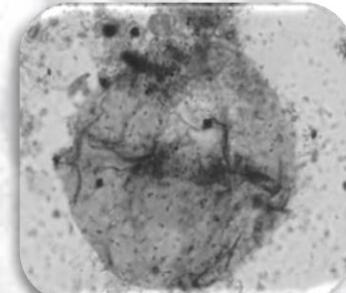
F. Targa

Histórico da primeira perfuração para petróleo em Pônta Alegre, município de Arroio Grande, Rio Grande do Sul, Brasil.

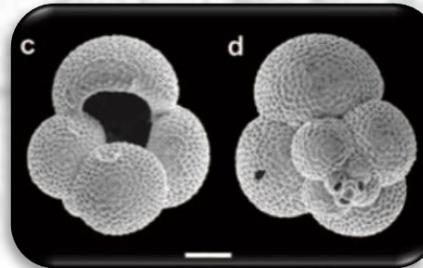
“Há ou não há petróleo no Brasil”...? Eis a pergunta que ainda hoje pode se formular.

Principais trabalhos bioestratigráficos na Bacia de Pelotas

- Nanofosseis calcários
- Palinomorfos
- Foraminíferos
- Ostracodes



Capillicista fusca

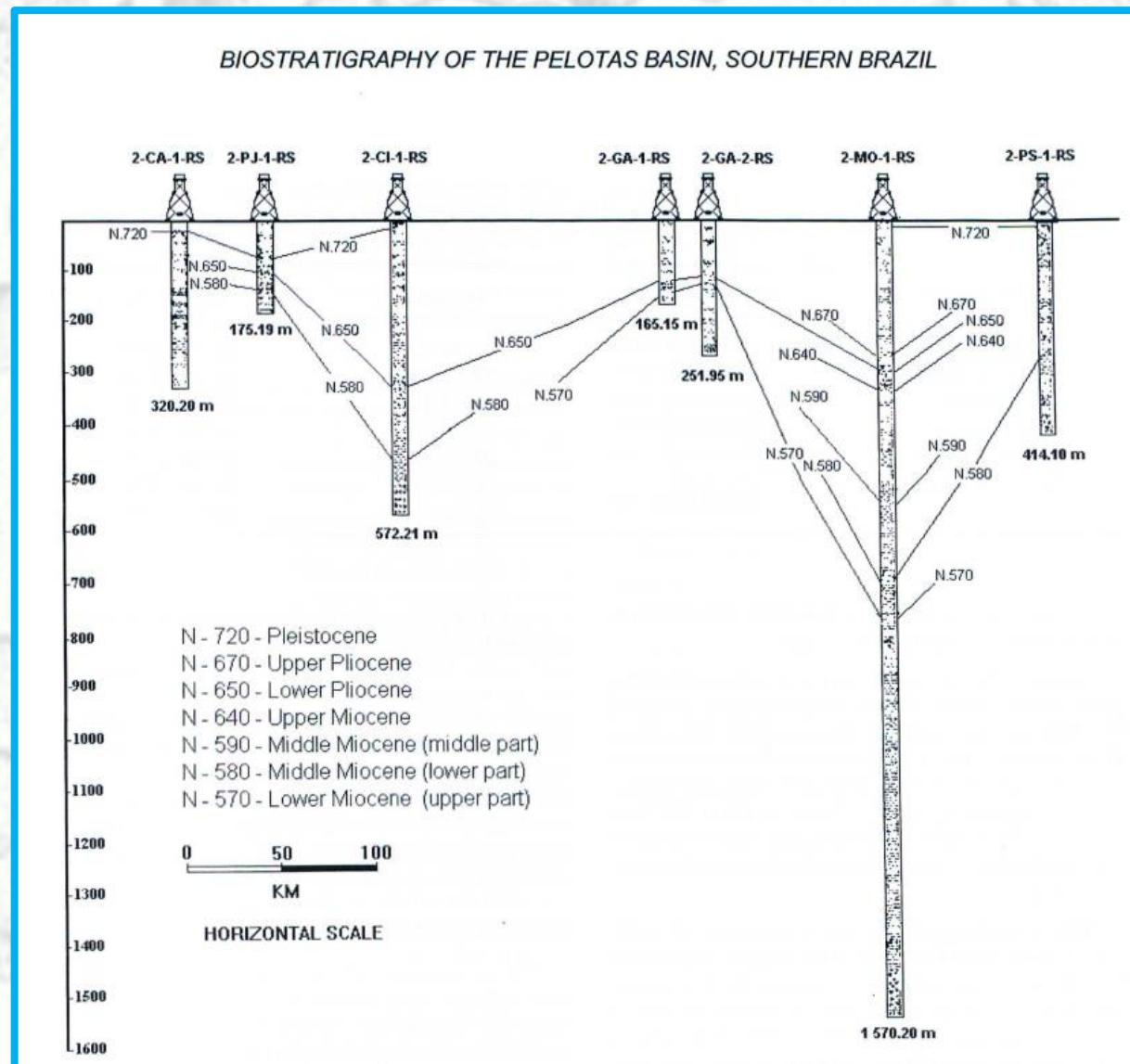


Globigerina bulloides



Bradleya pelotensis

A proposta de Gomide (1989)



Palinomorfos

Geologia Série Científica USP

Revista do Instituto de Geociências - USP
Geol. USP, Sér. cient., São Paulo, v. 11, n. 1, p. 149-169, abril 2011

Palinomorfos Neogenos do Poço 2-CA-1-RS, Bacia de Pelotas, Brasil: Significado Bioestratigráfico e Paleoecológico

Neogene Palynomorphs from the 2-CA-1-RS Well, Pelotas Basin, Brazil:
Biostratigraphic and Paleoecological Significance

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Recebido em 31 de agosto de 2010; aceito em 11 de fevereiro de 2011

RESUMO

Dados de microfósseis calcários são conhecidos para a seção pré-quaternária da Bacia de Pelotas. Contudo, informações palinológicas são relativamente escassas, com estudos iniciados, de forma sistematizada, somente nos últimos anos. Este trabalho apresenta resultados palinológicos do poço 2-CA-1-RS, localizado na porção *onshore* da bacia, no Rio Grande do Sul. Um total de 20 amostras foi selecionado no trecho entre 262 - 145 m de profundidade, das quais cinco revelaram associações de palinomorfos abundantes e diversificadas; quinze apresentaram predomínio de matéria orgânica amorfã ou fitoclástas. Espécies de esporos, grãos de pólen, cistos de dinoflagelados compõem os palinomorfos mais comuns, incluindo ainda palinoforaminíferos, escolecodontes, acirratos, algas Chlorococcales (*Botryococcus*) e esporos de fungos. A análise da distribuição quantitativa dos componentes da matéria orgânica particulada ao longo da seção permitiu a individualização de dois conjuntos palinológicos. Em termos gerais, os resultados indicam natureza marinha para intervalo estudado, com variações da base para o topo. O conjunto 1 (262 - 248 m) reflete condições mais distais, em mar aberto, enquanto o conjunto 2 (190 - 160 m) é interpretado como marinho mais proximal. Com base na amplitude estratigráfica de determinadas espécies de dinoflagelados, distintas idades entre o Miocene e o Quaternário são indicadas.

Palavras-chave: Palinologia; Neógeno; Bacia de Pelotas; Brasil.

ABSTRACT

There is information available on calcareous microfossils found in the pre-Quaternary section of the Pelotas Basin. However, there is relatively sparse palynological data, since palynological studies only started to be systematically conducted in the last years. This paper presents palynological results regarding 20 samples collected between depths of 262-145 m in the 2-CA-1-RS well, which is located in the onshore portion of this basin, in the Rio Grande do Sul state. Five samples showed rich and diverse associations of palynomorphs and fifteen samples showed a predominance of amorphous organic matter or phytoclasts. Species of spores, pollen grains, dinoflagellate cysts, as well as microforaminiferal linings, scolecodonts, acirraths, Chlorococcales algae (*Botryococcus*) and fungal spores were also identified in this study. Quantitative analysis on the distribution of particulate organic matter along the section allowed the identification of two palynological assemblages. The results indicate marine paleoenvironments, varying from the bottom to the top, for the studied section. Assemblage 1 (262 - 248 m) is interpreted as distal marine environment in open ocean, whereas Assemblage 2 (190 - 160 m) is associated with proximal marine environments. The stratigraphic range of certain species of dinoflagellate cysts indicates ages ranging from the Miocene to the Quaternary.

Keywords: Palynology; Neogene; Pelotas Basin; Brazil.

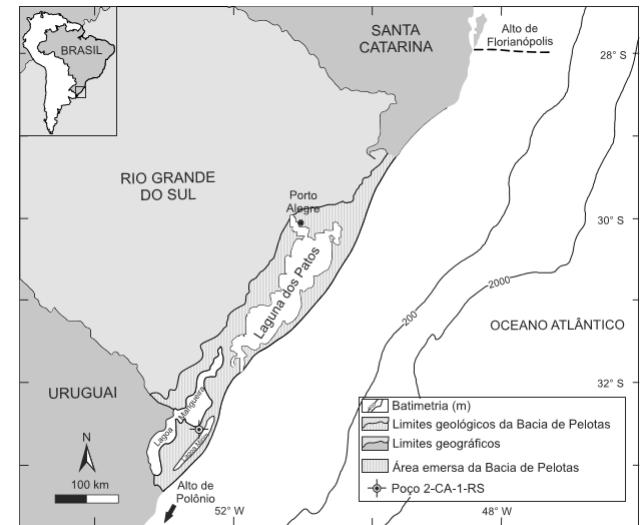


Figura 1. Localização da Bacia de Pelotas e do poço 2-CA-1-RS.

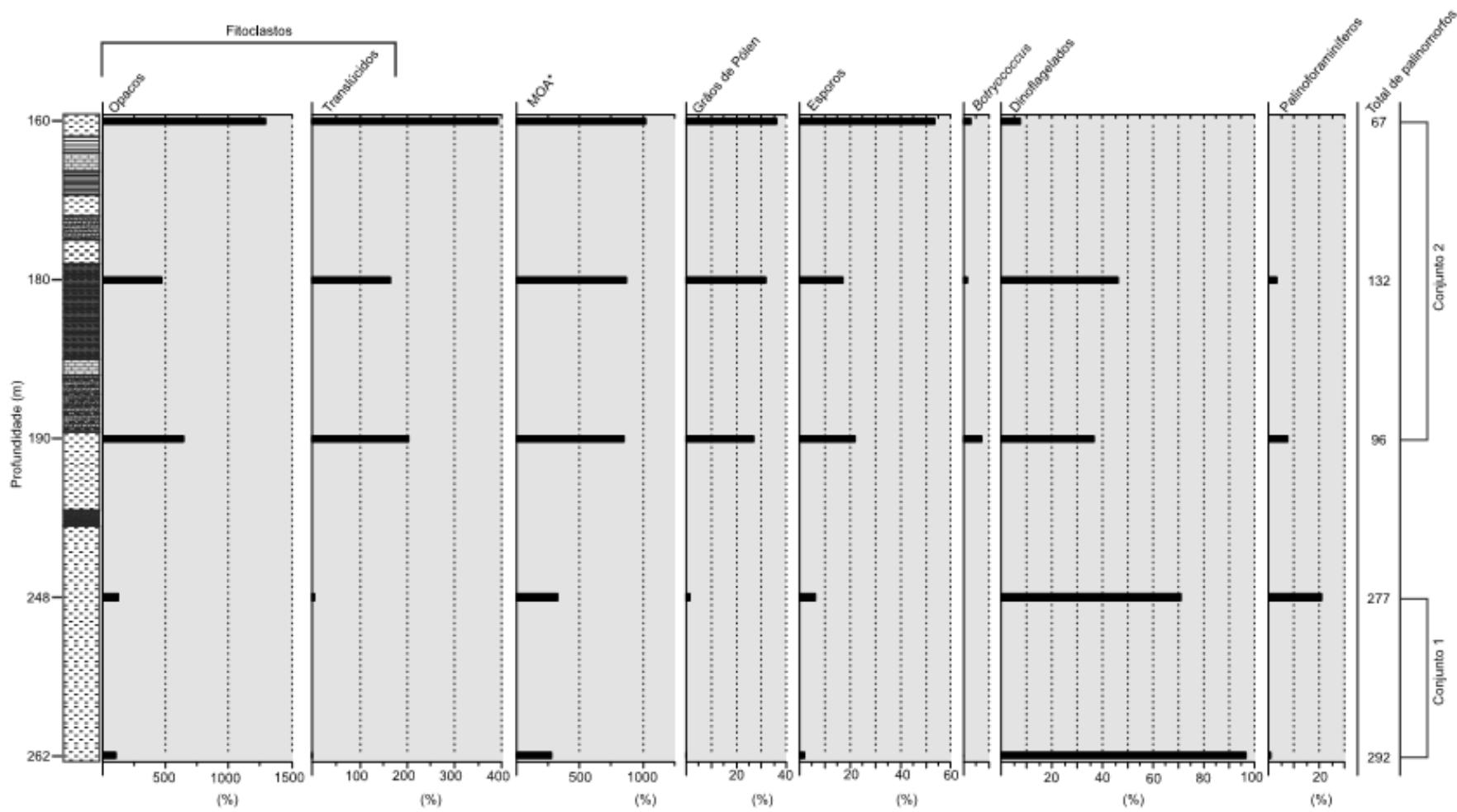


Figura 4. Distribuição da matéria orgânica particulada nas amostras com conteúdo palinológico mais abundante (* matéria orgânica amorfá).

Silva et al. (2011)

Tabela 3. Distribuição estratigráfica de espécies índices registradas e respectivas idades conforme Berggren et al. (1995).

Prof. (m)	Síntese da distribuição estratigráfica	Cronoestratigrafia
160	<i>Lejeuneacysta oliva</i> (idade: 3,58 - 0 Ma); <i>Lejeuneacysta sabrina</i> (3,58 - 0 Ma); <i>Spiniferites mirabilis</i> (33,7 - 0 Ma)	Plioceno superior a Recente (3,58 - 0 Ma)
180	<i>Selenopemphix dionaeacysta</i> (20,5 - 1,77 Ma); <i>Quinquecuspis concreta</i> (11,2 - 0 Ma)	Mioceno superior a Pleistoceno inferior (11,2 - 1,77 Ma)
190	<i>Nematosphaeropsis rigida</i> (23,8 - 0 Ma); <i>Selenopemphix quanta</i> (16,4 - 0 Ma)	Mioceno médio Recente (16,4 - 0 Ma)
248	<i>Lejeuneacysta globosa</i> (33,7 - 5,32 Ma); <i>Lejeuneacysta hyalina</i> (54,8 - 5,32 Ma)	Mioceno (23,8 - 5,32 Ma)
262	<i>Spiniferites bulloideus</i> (23,8 - 0 Ma); <i>Selenopemphix brevispinosa</i> (23,8 - 1,77 Ma)	Mioceno (23,8 - 5,32 Ma)



Biochronostratigraphy and paleoenvironment analysis of Neogene deposits from the Pelotas Basin (well 2-TG-96-RS), Southernmost Brazil

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ABSTRACT

This paper presents the integration of micropaleontological (palynology and foraminifera) and isotopic ($^{87}\text{Sr}/^{86}\text{Sr}$) analysis of a selected interval from the well 2-TG-96-RS, drilled on the onshore portion of the Pelotas Basin, Rio Grande do Sul, Brazil. A total of eight samples of the section between 140.20 and 73.50 m in depth was selected for palynological analysis, revealing diversified and abundant palynomorph associations. Species of spores, pollen grains and dinoflagellate cysts are the most common palynomorphs found. Planktic and benthic calcareous foraminifera were recovered from the lowest two levels of the section (140.20 and 134.30 m). Based on the stratigraphic range of the species of dinoflagellate cysts and sporomorphs, a span age from Late Miocene to Early Pliocene is assigned. The relative age obtained from the $^{87}\text{Sr}/^{86}\text{Sr}$ ratio in shells of calcareous foraminifers indicates a Late Miocene (Messinian) correspondence, corroborating the biostratigraphic positioning performed with palynomorphs. Paleoenvironmental interpretations based on the quantitative distribution of organic components (palynomorphs, phytoclasts and amorphous organic matter) throughout the section and on foraminiferal associations indicate a shallow marine depositional environment for the section. Two palynological intervals were recognized based on palynofacies analysis, related to middle to outer shelf (140.20 to 128.90 m) and inner shelf (115.75 to 73.50 m) conditions.

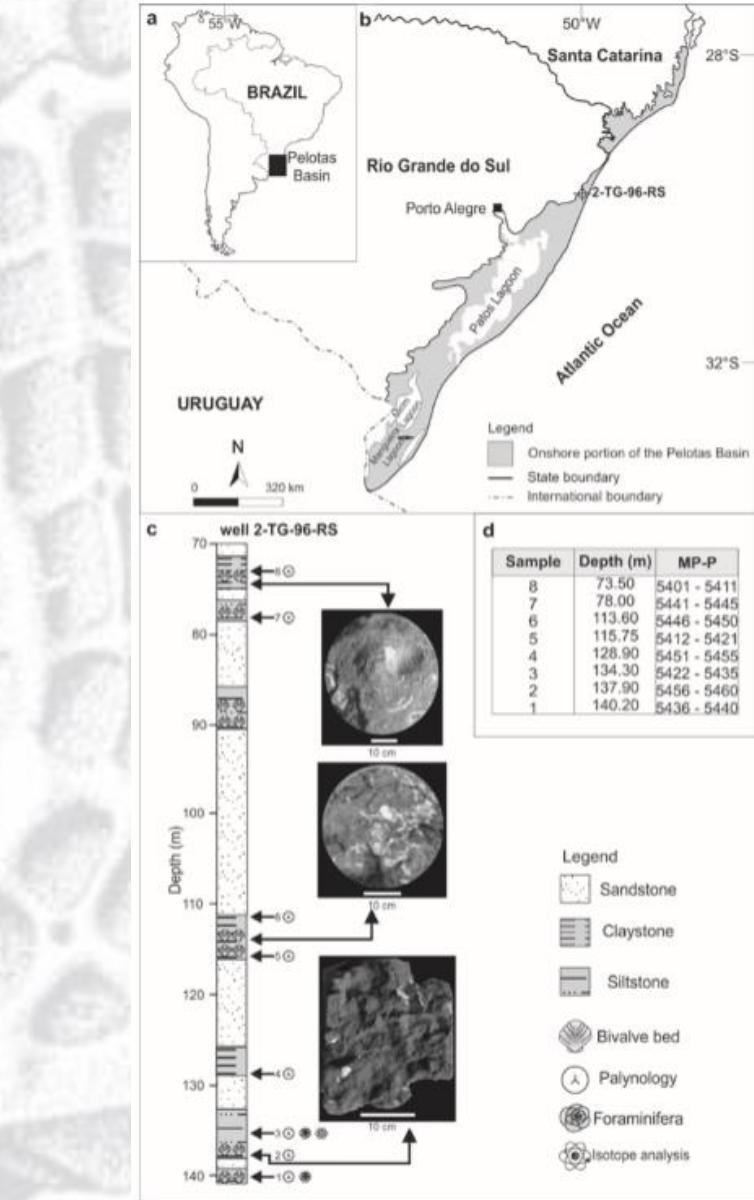
Key words: Micropaleontology, Biostratigraphy, Neogene, Pelotas Basin.

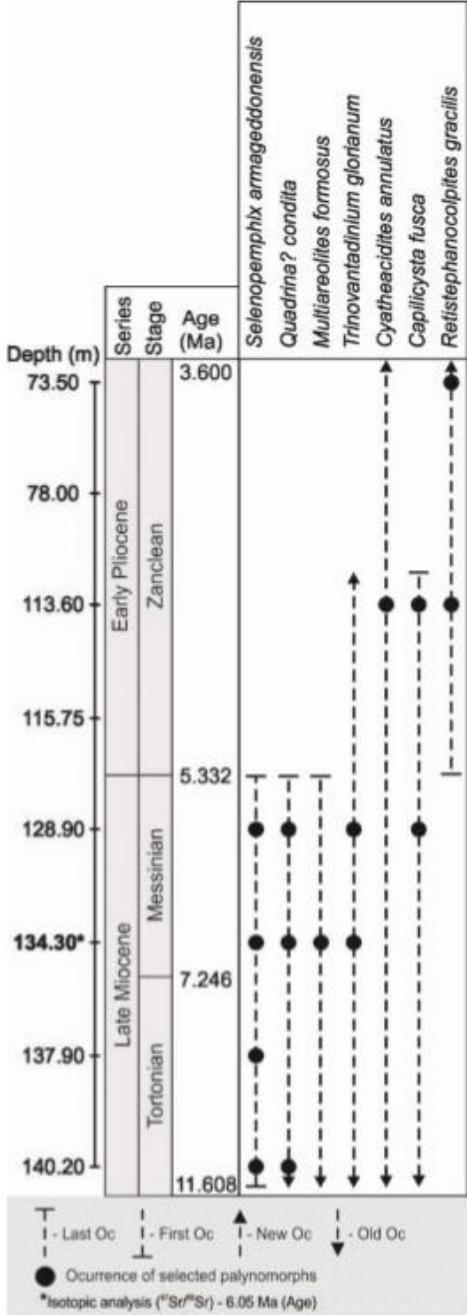
INTRODUCTION

The Pelotas Basin is situated in the southernmost portion of the Brazilian continental margin and was developed as a result of the Gondwana break-up, which originated the South Atlantic Ocean. The stratigraphical evolution of this basin has been

intensively studied in recent years (Fontana 1990, Villwock and Tomazelli 1995, Castillo et al. 2009, Contreras et al. 2010, Stica et al. 2014).

Additionally, several paleontological studies have been published, mainly focused on taxonomic and paleoenvironmental analysis of foraminifera (e.g., Closs 1967, 1970, Thiesen 1977) and ostracods (e.g., Sanguinetti 1980, Carreño et al.





Age		Blow (1969)		Bolli and Saunders (1985)			
Pliocene		Early	Mid.	N21 <i>Globorotalia miocenica</i>	<i>Gr. exilis</i>	<i>G. bullidoides</i>	
Miocene		Late		N20	<i>Gs. trilob.fistulosus</i>	<i>G. falconensis</i>	
				N19 <i>Globorotalia margaritae</i>	<i>Gr.mar.evolutae</i>	<i>Gs. immaturus</i>	
				N18	<i>Gr.mar.margaritae</i>	<i>Gs. trilobus</i>	
				N17 <i>Globorotalia humerosa</i>		<i>Gs. sacculifer</i>	
				N16 <i>Globorotalia acostaensis</i>		<i>Gs. obliquus</i>	
				N15 <i>Globorotalia menardii</i>		<i>G. apertura</i>	
				N14 <i>Globorotalia mayeri</i>		<i>O. suturalis</i>	
				N13 <i>Globigerinoides ruber</i>			
				N12 <i>Globorotalia foehsi robusta</i>			
				N11 <i>Globorotalia foehsi lobata</i>			
				N10 <i>Globorotalia foehsi foehsi</i>			
				N9 <i>Globorotalia foehsi peripheroronda</i>			
				N8 <i>Praerbulina glomerosa</i>			

Coimbra et al. (2009)



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Original article

Biostratigraphy and paleoceanographical significance of the Neogene planktonic foraminifera from the Pelotas Basin, southernmost Brazil

Biostratigraphie et signification paléocéanographique des foraminifères planctoniques néogènes du Bassin de Pelotas, Brésil méridional

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Abstract

Analysis of the planktonic foraminifers recovered from 1-SCS-2 drill-hole, Florianópolis platform (Pelotas Basin, southern Brazilian Atlantic Margin), allowed recognition of the *Catapsydrax dissimilis*, *Catapsydrax stainforthi*, *Globorotalia fohsi robusta*, *Globorotalia mayeri*, *Globorotalia margaritae evoluta* and *Globigerinoides trilobus fistulosus* Miocene and Pliocene zones and four important hiatuses. Correlation with well 1-SCS-3B and other zonal schemes, as well as recognition of early diagenesis instead of a reworking process, allowed confident age assignment. The Miocene foraminifers constitute a tropical/sub-tropical assemblage, whereas in the Pliocene, the presence of scarce species associated to subantarctic water masses suggests that the Malvinas Current reaches the area but it was not a controlling factor in the paleoenvironmental conditions.

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Résumé

L'analyse des foraminifères planctoniques provenant du puits 1-SCS-2, implanté sur la plateforme de Florianópolis (Bassin de Pelotas, marge atlantique brésilienne méridionale), a permis de mettre en évidence quatre hiatus importants et de reconnaître les biozones du Miocène et du Pliocène suivantes: zone à *Catapsydrax dissimilis*, zone à *Catapsydrax stainforthi*, zone à *Globorotalia fohsi robusta*, zone à *Globorotalia mayeri*, zone à *Globorotalia margaritae evoluta* et zone à *Globigerinoides trilobus fistulosus*. Une corrélation avec le puits 1-SCS-3B et avec d'autres échelles biostratigraphiques, ainsi que la reconnaissance d'un processus de diégénèse précoce, plutôt que la présence de faune remaniée, ont permis d'établir un âge correct. Au Miocène l'association des foraminifères indique des conditions tropicales à tropicales-subsoutpôtiennes, alors qu'au Pliocène, la présence d'espèces rares liées aux masses d'eaux sub-antarctiques suggère que le courant des Malouines atteignait cette région, sans qu'il fût pour autant un facteur déterminant des conditions paléogéographiques.

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Keywords: Foraminifera; Biostratigraphy; Pelotas Basin; Brazilian Atlantic Margin

Mots clés : Foraminifères ; biostratigraphie ; Bassin de Pelotas ; Marge atlantique brésilienne

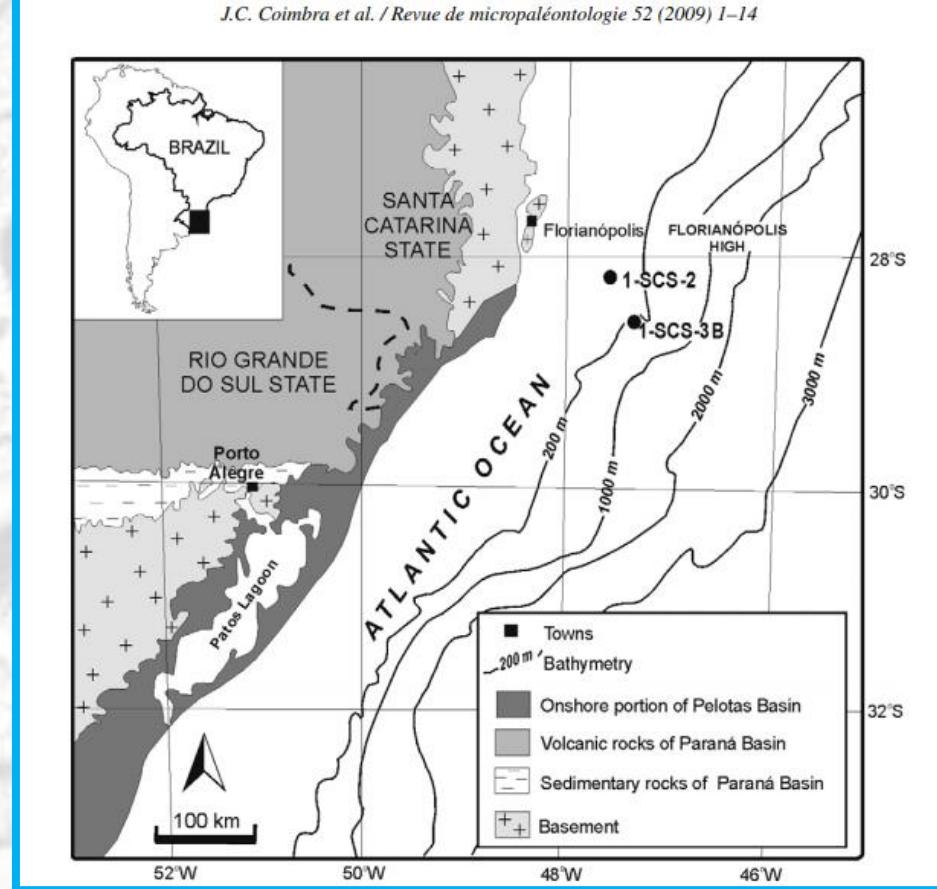
1. Introduction

The Pelotas Basin has been intensively studied because of oil and gas possibilities in the southernmost Brazilian Atlantic Mar-

gin. Recent discovery of gas fields in the adjacent Santos Basin makes the southern part of the Brazilian margin an important target for exploration. Thus, the refinement of the chronostratigraphic framework of the Pelotas Basin constitutes an important subject of research due to its direct application in the petroleum industry.

An extensive geological framework was published during the second half of last century; particularly, important works

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1-SCS-2 DRILL HOLE

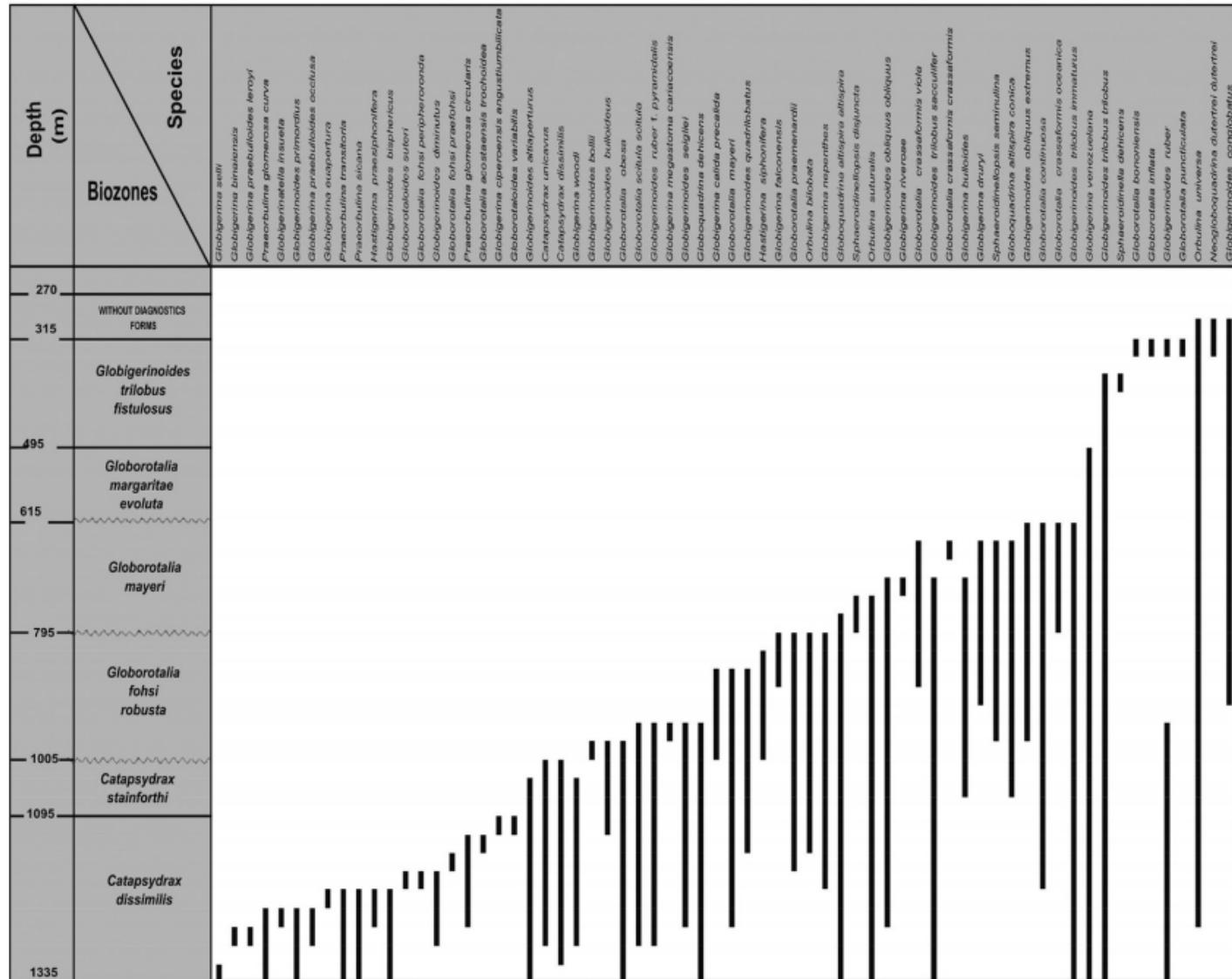


Fig. 6. Distribution of planktonic foraminifera species and subspecies and the biozones along the 1-SCS-2 drill-hole.
 Fig. 6. Distribution des espèces et sous-espèces de foraminifères planctoniques le long du forage 1-SCS-2.

1-SCS-2 DRILL-HOLE

THIS WORK			GOMIDE (1989)		
CHRONOSTRATIGRAPHY		DEPTH (m)	BIOSTRATIGRAPHY		DEPTH* (m)
UPPER PLIOCENE QUATERNARY	QUATERNARY / Upper Pliocene	0	WITHOUT SAMPLES		0
PLIOCENE	Lower Pliocene (upper portion)	270	LACKING DIAGNOSTIC FORMS		
	Lower Pliocene (lower portion)	315			
MIOCENE	Middle Miocene	495	<i>Globigerinoides trilobus fistulosus</i> Zone		
	Lower Miocene (lower portion)	615	<i>Globorotalia margaritae evoluta</i> Zone		
		795	<i>Globorotalia mayeri</i> Zone		
		1.005	<i>Globorotalia fohsi robusta</i> Zone		
		1.095	<i>Catapsydrax stainforthi</i> Zone		
		1.335	<i>Catapsydrax dissimilis</i> Zone		
OOLIGOCENE					
PLIOCENE	Upper Pliocene			N-720	
	Lower Pliocene			N-670	
MIOCENE	Upper Miocene			N-650	
	Middle Miocene			N-640	
	Lower Miocene			N-630	
				N-590	
				N-580	
				N-570	
				N-560	
				N-550	

Síntese histórica dos estudos sobre ostracodes na Bacia de Pelotas

- Sanguinetti (1979)
- Sanguinetti (1980)
- Falcetta *et al.* (1980)
- Bertels *et al.* (1982)
- Kotzian & Eilert (1985)
- Sanguinetti *et al.* (1991)
- Sanguinetti *et al.* (1992)
- Carreño *et al.* (1997)
- **Carreño *et al.* (1999)**
- Manica & Coimbra (2015)
- Manica *et al.* (2015)

Carreño et al. (1997)

GAIA N° 14, LISBOA/LISBON, DEZEMBRO/DECEMBER 1997, pp. 33-43 (ISSN: 0871-5424)



BIOSTRATIGRAPHY OF LATE NEogene AND QUATERNARY OSTRACODES FROM PELOTAS BASIN, SOUTHERN BRAZIL

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ABSTRACT: Ostracodes recovered from five drill-holes from the Pelotas basin, State of Rio Grande do Sul, allowed the recognition of the Assemblage Zones *Bradleya pelotensis*, *Cyprideis posteroinflata*, *Coquimbella bertelsae* and *Argenticytheretta laevipunctata*. The stratigraphic range of the ostracodes and its comparison with previous zonal schemes based on foraminifera, palynomorphs and calcareous nannoplankton, suggests a late Neogene and Quaternary age for the assemblages and zonation proposed here. An intrabasinal correlation using the different zonal schemes is briefly discussed. Ostracodes are represented by 25 species belonging to 17 genera. One species, *Quadracythere eichlerae* sp. nov., is described.

RESUMO: Os ostracodos encontrados em cinco sondagens realizadas na Bacia de Pelotas, Estado do Rio Grande do Sul, permitem o reconhecimento das Zonas de Associação *Bradleya pelotensis*, *Cyprideis posteroinflata*, *Coquimbella bertelsae* e *Argenticytheretta laevipunctata*. A distribuição estratigráfica dos ostracodos e sua comparação com estudos bioestratigráficos anteriores fundamentados em foraminíferos, palinomorfos e nanofósseis calcários, sugerem uma idade entre o Neogênico superior e o Quaternário para o esquema proposto. Utilizam-se os diferentes esquemas bioestratigráficos para discutir a correlação entre as sondagens. Os ostracodos estão representados por 25 espécies pertencentes a 17 gêneros. *Quadracythere eichlerae* sp. nov. é descrita.

INTRODUCTION

Some papers have been published which describe the late Caenozoic microfossil assemblages recovered from seven PETROBRÁS drill-holes from the Pelotas basin, in southern Brazil. In these publications formal and informal zonal schemes are proposed, to establish a biostratigraphic framework and to help in intrabasinal correlation. Among the more consistent zonal schemes proposed are those of DAEMON (1969, based on palynomorphs), CLOSS

(1970, based on foraminifera), SANGUINETTI (1980, based on Miocene ostracodes) and GOMIDE (1989, based on calcareous nannoplankton). Nevertheless, while GOMIDE (1989) gave a Cretaceous-Caenozoic zonal scheme - because he had to his disposition additional material recovered from five offshore drill-holes - the other authors presented a Miocene (SANGUINETTI, 1980) or a complete Neogene and Quaternary (DAEMON, 1969; CLOSS,

A.L. CARREÑO; J.C. COIMBRA & Y.T. SANGUINETTI

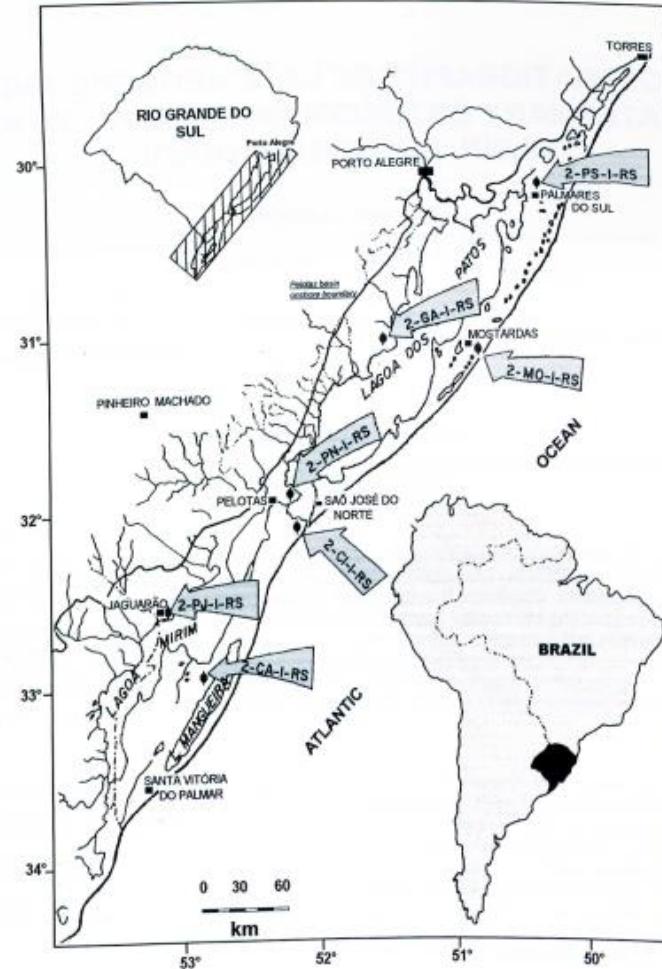
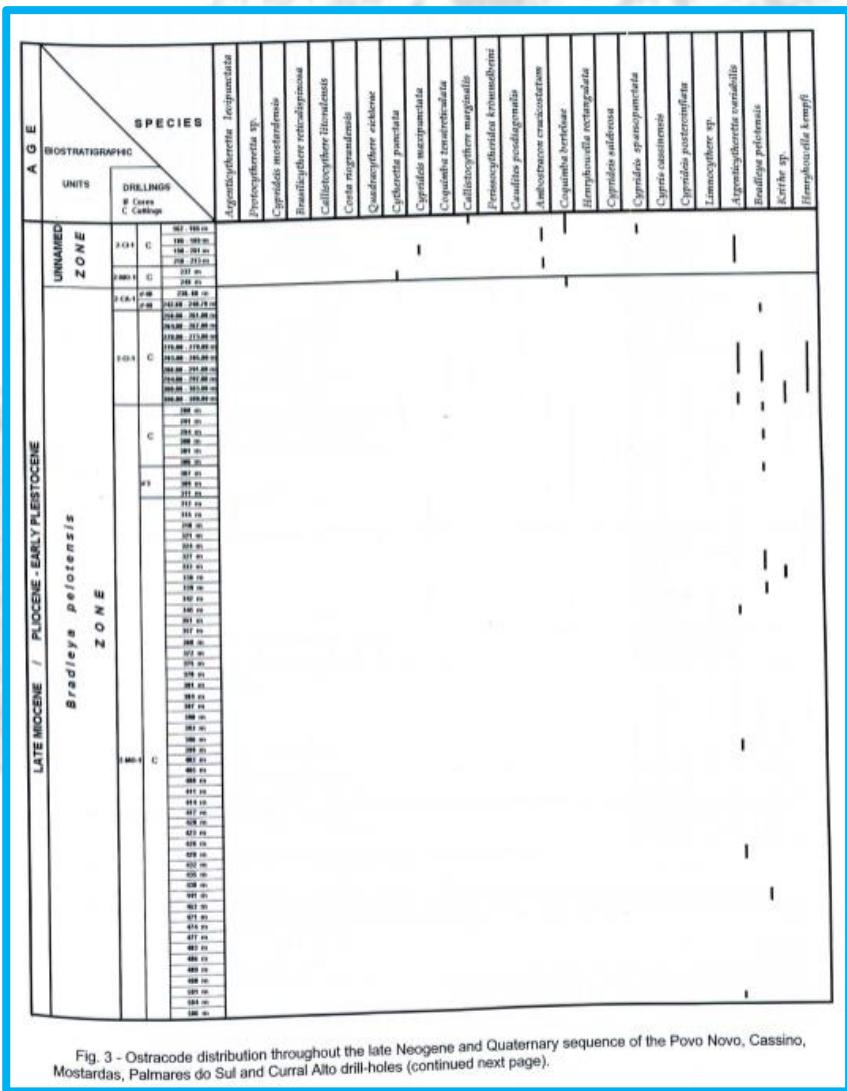


Fig. 1 - Location of the PETROBRÁS drill-holes from the Pelotas basin (after SANGUINETTI, 1980, modified).



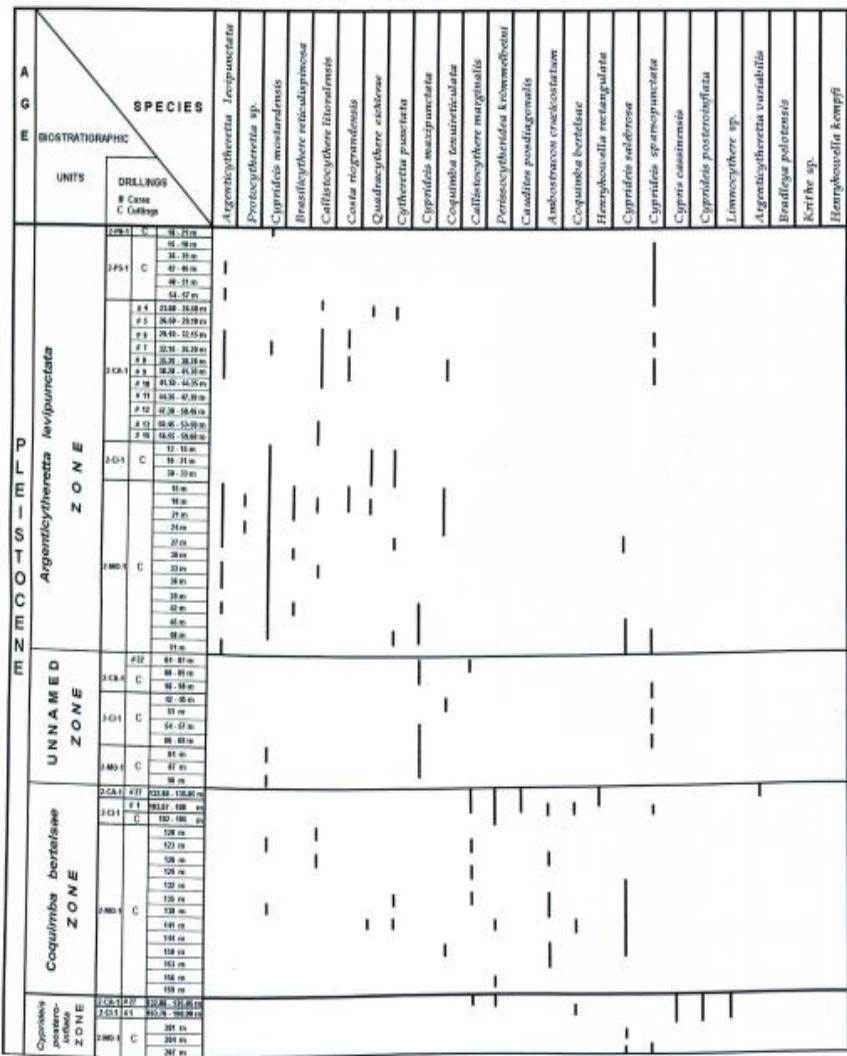
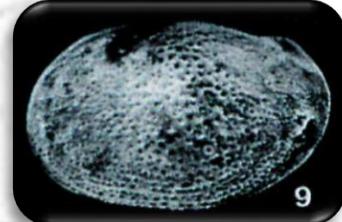


Fig. 3 (Continued from previous page) - Ostracode distribution throughout the late Neogene and Quaternary sequence of the Povo Novo, Cassino, Mostardas, Palmares do Sul and Curral Alto drill-holes.



Argenticytheretta laevipunctata
Sanguinetti et al.



Coquimba bertelsae Sanguinetti et al.



Cyprideis posteroinflata Sanguinetti et al.

Table 2

Ostracodes distribution throughout the upper Neogene to Quaternary strata within the Pelotas basin (after Carreño et al., 1997)

LATE MIocene / PLIOCENE		PLEISTOCENE			AGE	
<i>Bradleya pelotensis</i>	UNAMED ZONE	<i>Coquimba bertelzae</i>	UNAMED ZONE	<i>Argenticytheretta laevipunctata</i>	BIOZONES	SPECIES
		Cyprideis posteroinflata				<i>Argenticytheretta laevipunctata</i>
						<i>Protocytheretta</i> sp.
						<i>Cyprideis mostardensis</i>
						<i>Brasilicythere reticulispinosa</i>
						<i>Callistocythere litoralensis</i>
						<i>Costa riograndensis</i>
						<i>Quadracythere eichlerae</i>
						<i>Cytheretta punctata</i>
						<i>Cyprideis maxipunctata</i>
						<i>Coquimba tenuireticulata</i>
						<i>Callistocythere marginalis</i>
						<i>Perisoccytheridea kroemmelbeini</i>
						<i>Caudites posdagonalis</i>
						<i>Ambostracon crucicostatum</i>
						<i>Coquimba bertelzae</i>
						<i>Henryhowella rectangulata</i>
						<i>Cyprideis salebrosa</i>
						<i>Cyprideis sparsopunctata</i>
						<i>Cypris cassinensis</i>
						<i>Cyprideis posteroinflata</i>
						<i>Limnocythere</i> sp.
						<i>Argenticytheretta variabilis</i>
						<i>Bradleya pelotensis</i>
						<i>Krithe coimbrai</i>
						<i>Henryhowella kempfi</i>

Carreño *et al.* (1999)



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Late Cenozoic sea level changes evidenced by ostracodes in the Pelotas basin, southernmost Brazil

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Abstract

Ostracodes recovered from sediments in seven onshore boreholes within the Pelotas basin, State of Rio Grande do Sul, indicate several continuous nearshore environments and at least four brief transgressive-regressive cycles are present. This interpretation is based on the distribution throughout upper Neogene and Quaternary sequences of species that characterize one or more biofacies depending on the borehole position in the basin. *Bradleya pelotensis*, *Krithe coimbrai*, *Henryhowella kempfi* and *H. rectangulata* are considered shelf-upper bathyal species whereas the shelf species are represented by *Ambrostracon crucicostatum*, *Argenticytheretta variabilis*, *A. laevipunctata*, *Brasilicythere reticulispinosa*, *Caudites posdagonalis*, *Costa riograndensis*, *Coquimba bertelsae*, *C. tenuireticulata*, *Cytheretta punctata*, *Quadracythere eichlerae* and *Protocytheretta* sp. Species with lagoon-estuarine shelf affinities include *Callistocythere littoralensis*, *C. marginalis* and *Perissocytheridea kroemmelbeini* whereas *Cyprideis maxipunctata*, *C. mostardensis*, *C. posteroinflata*, *C. salebrosa* and *C. sparsopunctata* represent a lagoon or estuarine environment, and *Cypris cassiniensis* and *Limnocythere* sp. are freshwater species. Correlation of the ostracode biozones places the four maximum regressive events in the Late Pliocene and Pleistocene (1250–485 ka, 185 ka and 15 ka), whereas the maximum transgressive events occur in Late Miocene and Pleistocene (1.6 Ma, 423–400 ka and 120 ka), in a barrier-lagoonal depositional system controlled by glacio-eustatic sea level changes. © 1999 Elsevier Science B.V. All rights reserved.

Keywords: Ostracoda; transgression; regression; Neogene; Quaternary; Pelotas basin; Brazil

1. Introduction

Exploratory wells drilled by PETROBRÁS (Petróleo Brasileiro, S.A.) in seven locations in the Pelotas basin, southernmost Brazil, contain diverse microfossil assemblages, including foraminifera (Closs, 1967, 1970; Fernandes, 1975; Thiesen, 1977), paleynomorphs (Daemon, 1969), calcareous nannoplank-

ton (Gomide, 1989) and ostracoda (Sanguinetti, 1979, 1980; Sanguinetti et al., 1991, 1992). Data from these groups have been used to establish biostratigraphic schemes as well as for paleoenvironmental interpretations of the basin during the Mesozoic and early Cenozoic. However, the biostratigraphical and paleoenvironmental signatures of the post-Miocene sequence have been difficult to interpret due to the presence of large amounts of sand-rich intervals of mainly continental deposits. The poorly fossiliferous,

SPECIES	BIOFACIES	FRESH WATER	LAGUNAR OR ESTUARIN E	INNER SHELF	OUTER SHELF	UPPER BATHYAL
<i>Ambrostracon crucicostatum</i>						
<i>Argenticytheretta variabilis</i>						
<i>Brasilicythere reticulispinosa</i>						
<i>Caudites posdagonalis</i>						
<i>Costa riograndensis</i>						
<i>Coquimba bertelsae</i>						
<i>C. tenuireticulata</i>						
<i>Cytheretta punctata</i>						
<i>Protocytheretta</i> sp.						
<i>Quadracythere eichlerae</i>						
<i>Bradleya pelotensis</i>						
<i>Henryhowella kempfi</i>						
<i>Henryhowella rectangulata</i>						
<i>Krithe coimbrai</i>						
<i>Callistocythere littoralensis</i>						
<i>Callistocythere marginalis</i>						
<i>Perissocytheridea kroemmelbeini</i>						
<i>Cyprideis maxipunctata</i>						
<i>Cyprideis mostardensis</i>						
<i>Cyprideis posteroinflata</i>						
<i>Cyprideis salebrosa</i>						
<i>Cyprideis sparsopunctata</i>						
<i>Cypris cassiniensis</i>						
<i>Limnocythere</i> sp.						

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Manica & Coimbra (2015)

A NEW SPECIES OF TRACHYLEBERIDIDAE (OSTRACODA, CRUSTACEA) FROM THE EARLY MIocene OF THE PELOTAS BASIN, SOUTHERNMOST BRAZIL

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Abstract. *Actinocythereis imbecensis* n. sp. is described from the Early Miocene strata of the Pelotas Basin, the southernmost Brazilian marginal basin. The specimens were recovered from the base to the top of an offshore core composed of greenish-gray shale interpreted as part of a transgressive sequence. Morphological features and faunal composition indicate that the ostracods were autochthonous and lived in the photic zone.

Key words. *Actinocythereis*. Miocene. Pelotas Basin. Brazil.

Resumen. UNA NUEVA ESPECIE DE TRACHYLEBERIDIDAE (OSTRACODA, CRUSTACEA) DEL MIOCENO DE LA CUENCA DE PELOTAS, EXTREMO SUR DE BRASIL. Se describe *Actinocythereis imbecensis* n. sp., del Mioceno inferior de la cuenca marginal de Pelotas de Brasil meridional. Los especímenes fueron recuperados a lo largo de un testigo marino litológicamente constituido por lutita gris verdosa interpretada como parte de una secuencia transgresiva. Las características morfológicas y la composición faunística de los ostrácodos indican un conjunto autoctono viviendo en la zona fótica.

Palabras clave. *Actinocythereis*. Miocene. Cuenca de Pelotas. Brasil.

The Pelotas Basin is the southernmost Brazilian marginal basin and comprises a large area between 28°S and 34°S including northern Uruguay, where it is known as the Leste Basin (Gonçalves *et al.*, 1979; Bueno *et al.*, 2007) (Fig. 1). This basin covers an area of around 210,000 km² and resulted from the breakup of Gondwana and the consequent formation of the Atlantic Ocean. The South Atlantic opening is considered a precursor tectonic event leading towards formation of the Brazilian passive marginal basins (Bueno *et al.*, 2007). Lithostratigraphically, the Turonian to Holocene interval is represented only by two units, i.e. the interfingered Cidreira and Imbé formations.

Previous micropaleontological studies carried out in the Pelotas Basin have been concentrated in the Late Cretaceous–Early Paleogene, Neogene and Quaternary intervals. Ostracod studies based in material from its onshore portion were carried out in the Miocene–Quaternary interval (see Carreño *et al.*, 1998; Coimbra *et al.*, 2006 and references therein). Micropaleontological studies based on

samples from offshore wells have focused on foraminifera (see Anjos-Zerfass *et al.*, 2008; Coimbra *et al.*, 2009 and references therein), calcareous nannofossils (Gomide, 1989; Guerra *et al.* 2010, 2012) and Late Cretaceous–Early Paleogene ostracods (Ceolin *et al.*, 2011).

The ostracod genus *Actinocythereis* is typically neritic and occurs in both tropical and temperate waters. However, at least one species has been recorded in deeper waters, i.e. *A. scutigera* Dewi and Illahude, 2005, which lives between 50 m to almost 400 m water depth. Only one species of this genus was previously known from Brazil, i.e. *A. brasiliensis* Machado and Dzozinski, 2002, a species recorded from Recent sediments between latitudes 16° 49' S and 35° 06' S, mainly in depths lesser than 60 m. Table 1 shows the geographical and stratigraphical occurrences of Recent and fossil species of this genus in South America.

This paper deals with the description of a new Miocene ostracod species of *Actinocythereis* recorded from an offshore core in Well 2-RSS-1 (Fig. 1). In addition we briefly

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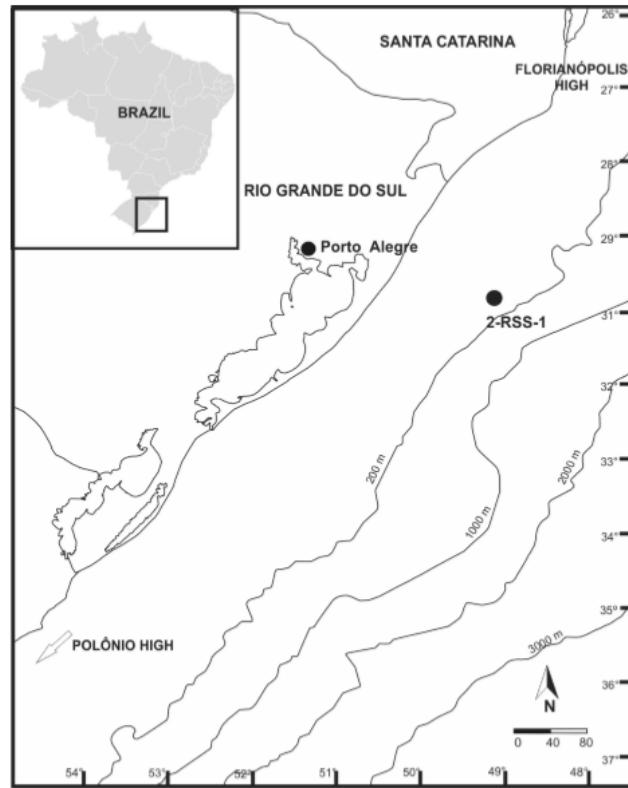
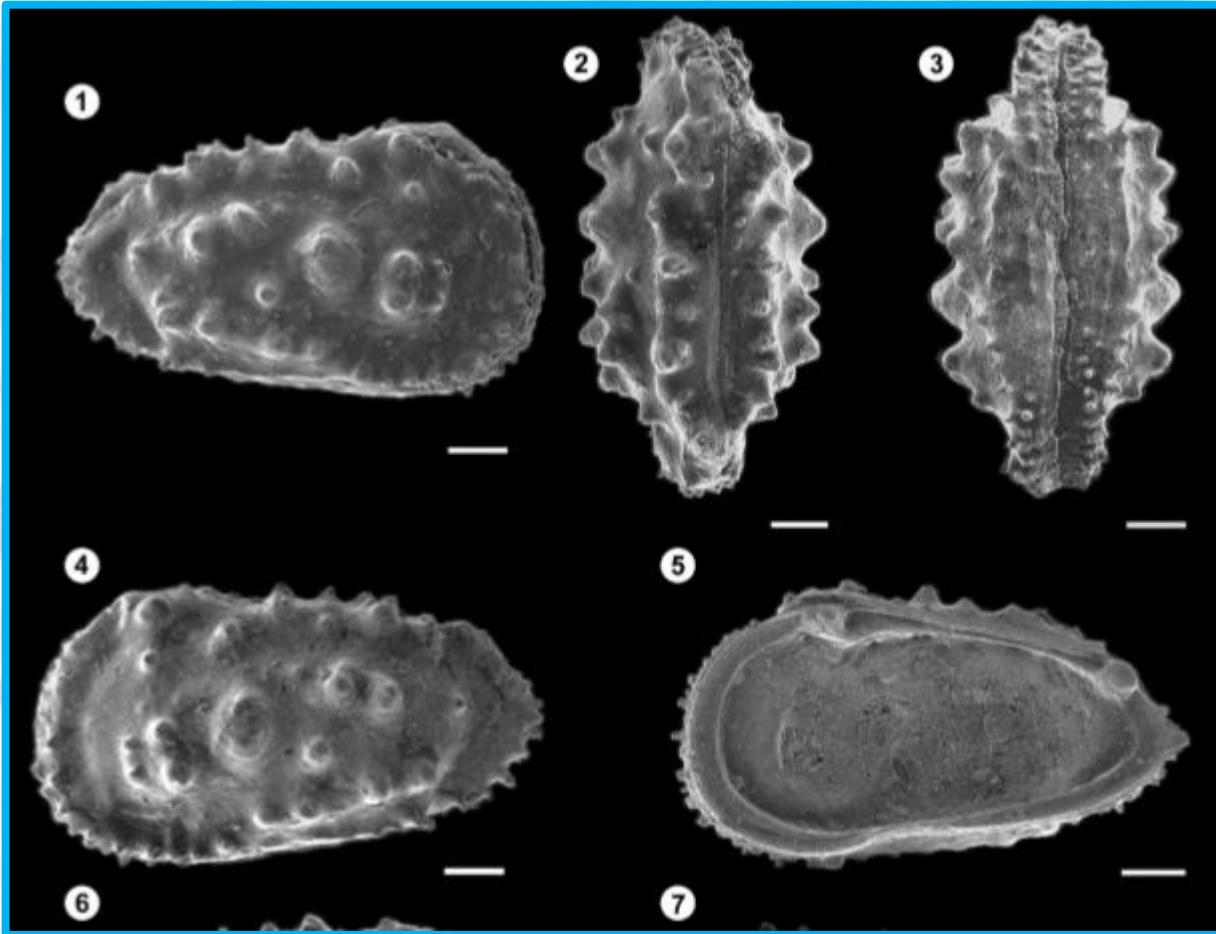


Figure 1. Location map of the Pelotas Basin and the core 2-RSS-1.



Actinocythereis imbeensis Manica & Coimbra, 2015 (Miocene)

THE LOWER MIocene CYTHERELLIDS (CRUSTACEA, OSTRACODA) FROM THE PELOTAS BASIN AND THEIR SIGNIFICANCE FOR THE SOUTH ATLANTIC PALEOZOOGEOGRAPHY

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ABSTRACT – A taxonomic study of the family Cytherellidae Sars was carried out in Lower Miocene deposits of the well 2-RSS-1 (Pelotas Basin, southeastern Brazilian margin). Five species were recognised, two of them describe herein: *Inversacytherella atlantica* sp. nov. and *Cytherella pelotensis* sp. nov. *Cytherella pleistocenica* Bergue *et al.* is reassigned into *Inversacytherella* Swanson *et al.* This is the first report of the genus *Inversacytherella* in the Atlantic. Three species are left in open nomenclature due to the scarcity of specimens. One of them is tentatively identified as *Grammycythella* Swanson *et al.*, a genus that has been recorded so far only in the Oceania. The occurrences of *Inversacytherella* and *Grammycythella* constitute additional evidence for faunal interchanges between America and Oceania, triggered by hydrological changes in the Southern Ocean during the Neogene.

Key words: *Cytherella*, *Inversacytherella*, *Grammycythella*, Pelotas Basin, Early Miocene, Southwestern Atlantic.

RESUMO – Um estudo taxonômico da família Cytherellidae Sars foi realizado em depósitos do Mioceno Inferior da perfuração 2-RSS-1 (Bacia de Pelotas, margem sudeste do Brasil). Cinco espécies foram registradas, duas das quais são aqui descritas: *Inversacytherella atlantica* sp. nov. e *Cytherella pelotensis* sp. nov. A espécie *C. pleistocenica* Bergue *et al.* é realocada no gênero *Inversacytherella* Swanson *et al.* Este é o primeiro registro do gênero *Inversacytherella* no Atlântico. Três outras espécies são deixadas em nomenclatura aberta devido a escassez de espécimes. Uma delas é aqui tentativamente identificada como *Grammycythella* Swanson *et al.*, um gênero registrado até o momento apenas na Oceania. As ocorrências de *Inversacytherella* e *Grammycythella* constituem evidências adicionais para o intercâmbio faunístico entre a América e a Oceania, consequência de mudanças hidrológicas no Oceano Austral ao longo do Neogeno.

Palavras-chave: *Cytherella*, *Inversacytherella*, *Grammycythella*, bacia de Pelotas, Esmioceno, Atlântico sudoeste.

INTRODUCTION

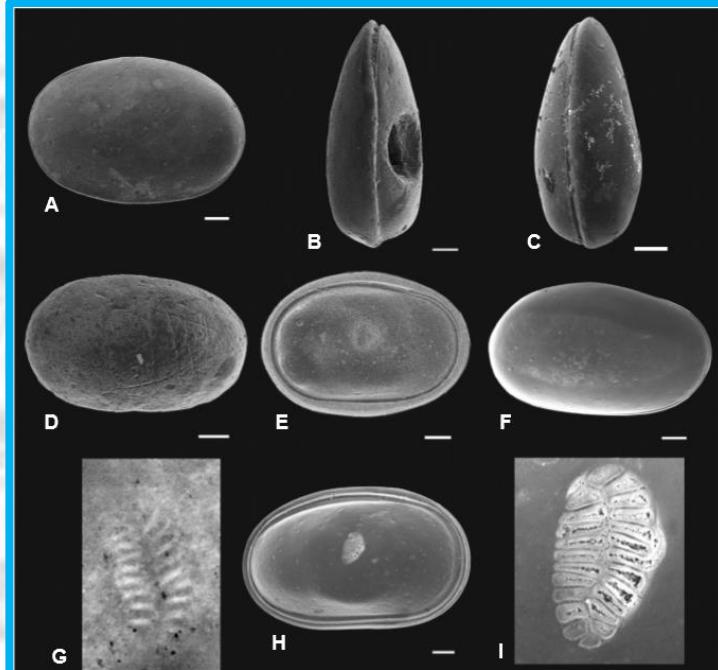
The southern Brazilian fossil marine ostracodes are well-known from post-Miocene deposits of several proximal drillings (e.g. Sanguinetti *et al.*, 1991, 1992; Carreño *et al.*, 1997; Coimbra *et al.*, 2006). In the Miocene, however, there are still some gaps in the taxonomic knowledge as, for instance, in the family Cytherellidae Sars. This family was superficially studied by Sanguinetti (1979) who recorded one species of *Cytherella* Jones and another one of *Cythereilloidea* Alexander, both in open nomenclature, in an on-shore drilling, in the Pelotas Basin. In the offshore portion, calcareous

micropalaeontological studies have focused mainly on foraminifera (e.g. Anjos & Carreño, 2004; Coimbra *et al.*, 2009) and calcareous nannofossils (Gomide, 1989; Guerra *et al.*, 2010, 2012). Studies with ostracodes in the offshore wells of Pelotas Basin were carried out only by Ceolin *et al.* (2011), but are restricted to the Late Cretaceous-Early Paleogene age interval.

The main objective of this work is the study of the family Cytherellidae in the lower Miocene deposits of the well 2-RSS-1. This is one of the most distal drillings of this basin, and a previous study suggests that it contains outer shelf/upper bathyal deposits (Gomide, 1989).



Figure 1. Map of study area with location of the well 2-RSS-1.



Bergue *et al.* (2016)

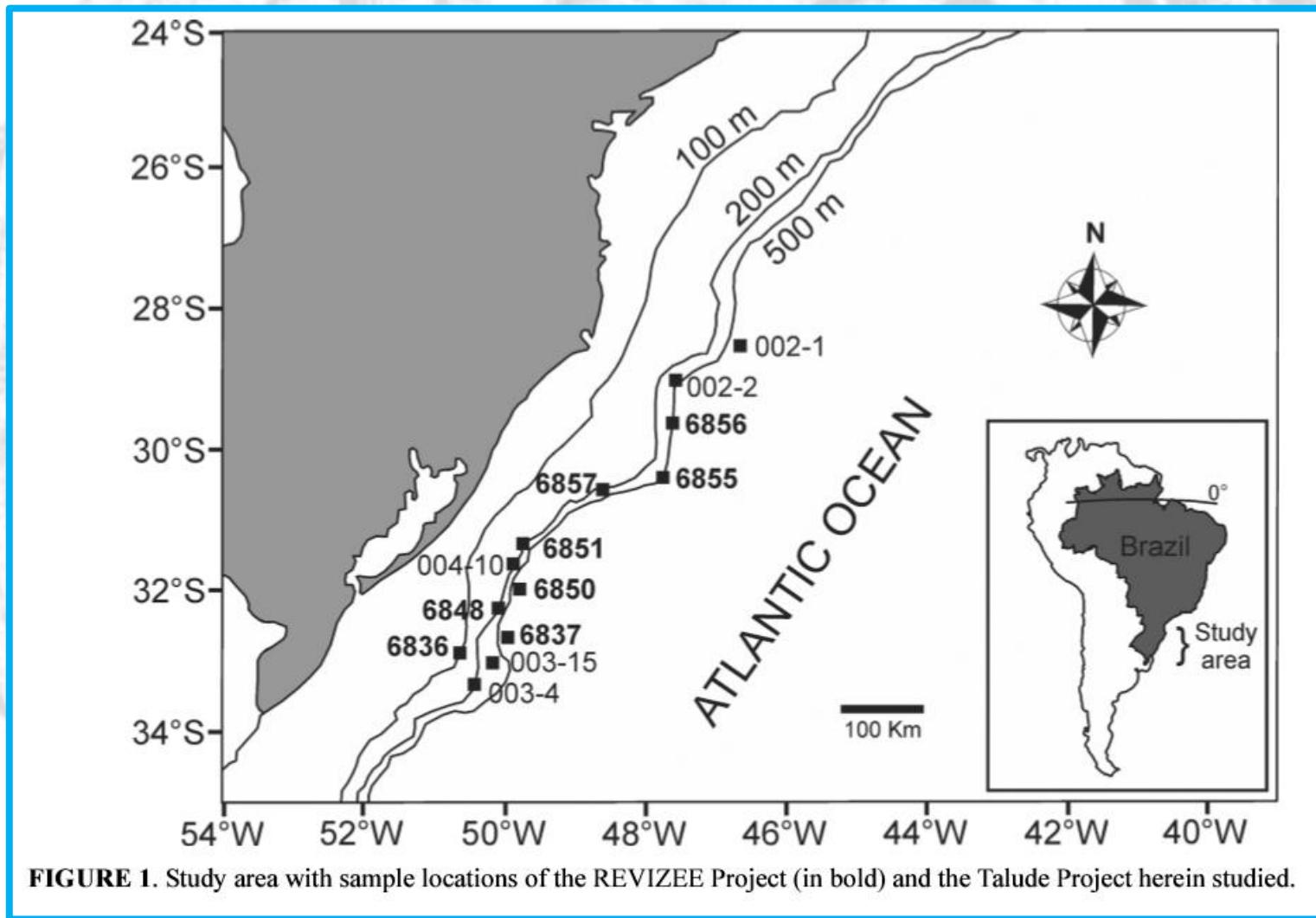


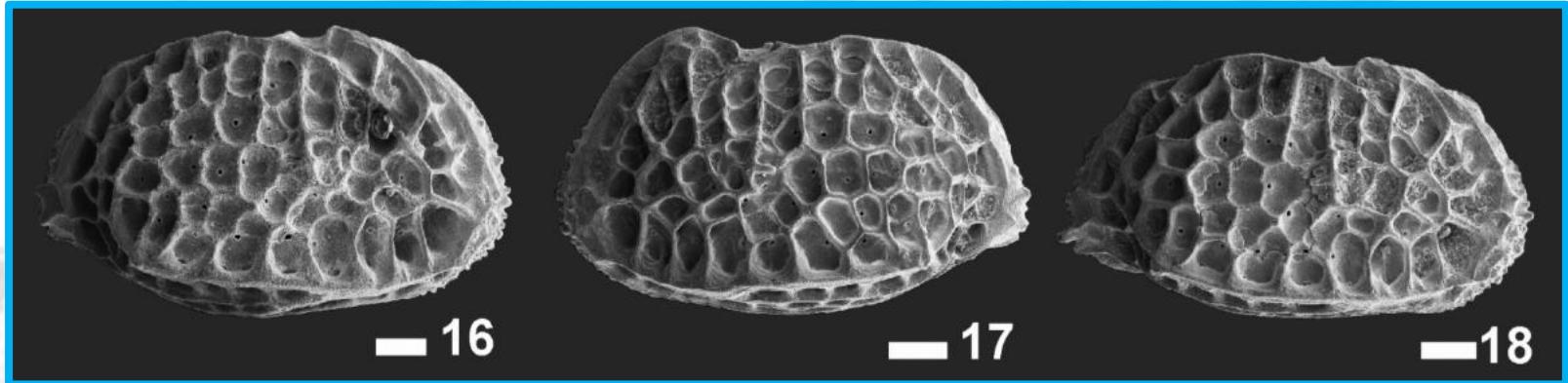
TABLE 1. Species occurrence and respective abundances in the studied samples.

Species	Sample/depth											
	100 m 6836	147 m M004-10	152 m 6848	160 m 6851	200 m M003-04	242 m 6857	252 m M002-02	324 m M003-15	414 m 6856	500 m 6837	505 m 6850	586 m M002-01
<i>Bradleya pseudonormani</i> Ramos et al., 2009	34		111	331	6	128	58	11	122	6	238	
<i>Cativalia ornellasae</i> Ramos et al., 2012	7	8	5	28		4						
<i>Neonesidea rotunda</i> Ramos et al., 2004	15	48	37	235		30						
<i>Legitimocythere megapotamica</i> sp. nov.	24	3				52				5		
<i>Ruggierocythere purperae</i> Aiello et al., 2004			13			7						
<i>Hemicytherura auriculata</i> Ramos et al., 1999	94		3		1	1	7			5		
<i>Moridianalicythere</i> sp. 1			15				5	24			25	
<i>Brasilicythere reticulispinosa</i> Sanguinetti et al., 1991	19		11	35	2	20	52				11	
<i>Oculocytheropteron delicatum</i> Ramos et al., 1999	37		1								23	
<i>Paracytheridea tschappi</i> Bold, 1946	34						3					
<i>Polycape</i> sp.	1											
<i>Pseudocythere</i> sp.	1					1						
<i>Quadracythere</i> sp.	20		3	88		20	72				48	
<i>Ruggierocythere vixalata</i> Aiello et al., 2004	4		1	43								
<i>Oculocytheropteron reticulopunctatum</i> Whatley et al., 1988	1	5			1	1				4		
<i>Bairdiapilata sudbrasilensis</i> Ramos et al., 2004	5								72		58	
<i>Xestoleberis umbonata</i> Whatley et al., 1998	3	27				9	5	1	3		27	
<i>Apatihowellia capitulum</i> sp. nov.	61	7	132	2		14					1	
<i>Pedicocythere</i> sp.	1											
<i>Bradleya gaucha</i> sp. nov.			27	34	9	1	3		8			
<i>Actinocythereis brasiliensis</i> Machado & Drozinski, 2002	14		20			3						
<i>Ambocythere venusta</i> Ramos et al., 2012	30	15			3				1		4	12
<i>Cyheretta</i> sp.	5	7	1									
<i>Argilloecia inflata</i> Ramos et al., 2004	24			1						6	3	
<i>Bradleya kaesleri</i> Ramos et al., 2009	3	12										
<i>Coquimba</i> sp.	5					1	16				19	
<i>Oculocytheropteron macropunctatum</i> Whatley et al., 1988	11		2								6	
<i>Krithe coimbrai</i> Do Carmo & Sanguinetti, 1999	3	21				1				4		
<i>Krithe gnoma</i> Do Carmo & Sanguinetti, 1999	9	11										
<i>Paracypris</i> sp.	1	1										
<i>Caudites</i> sp.	1				1						2	
<i>Eucythere macerata</i> Bergue & Coimbra, 2008	1		1							35		

.....continued on the next page

TABLE 1. (Continued)

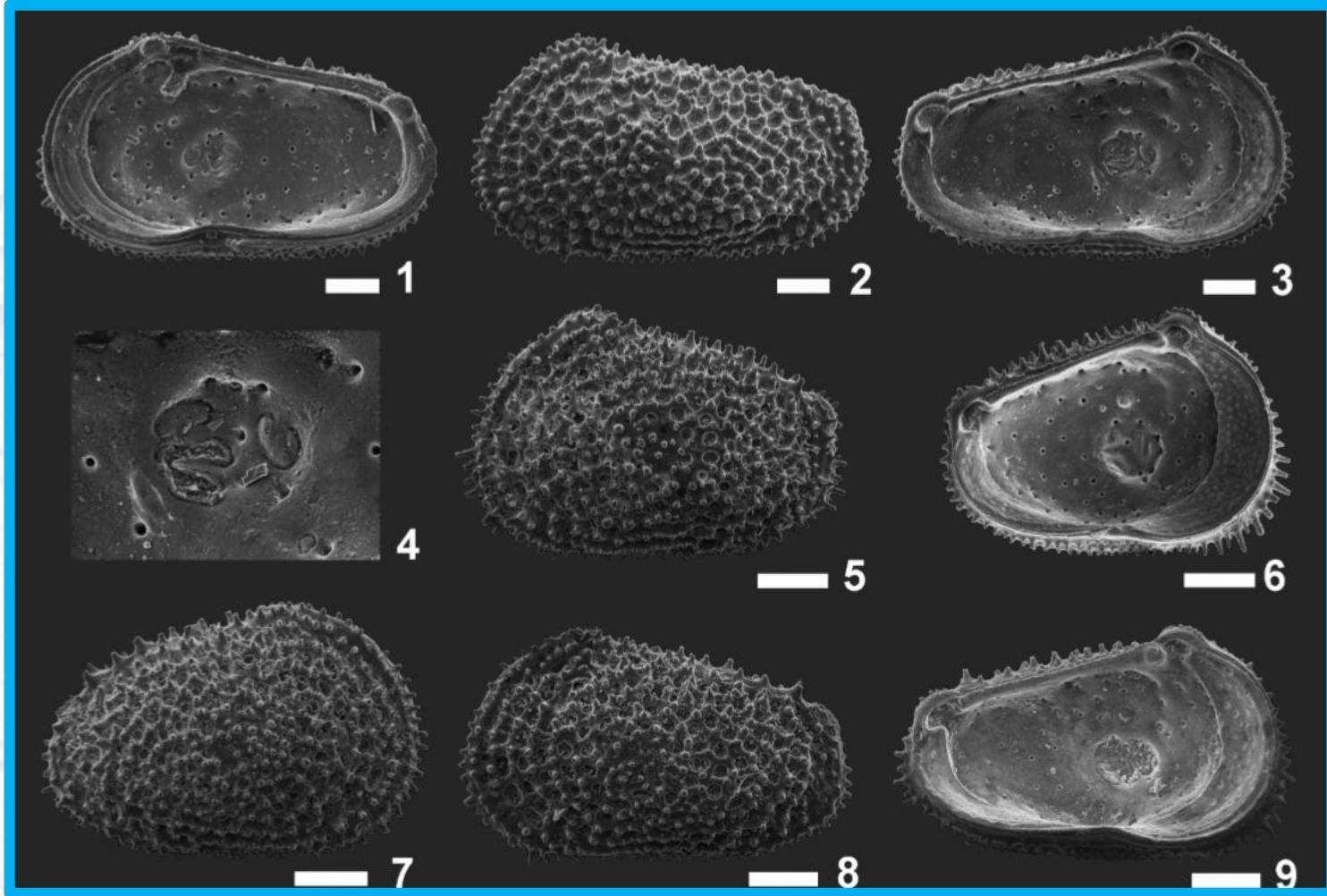
Species	Sample/depth												
	100 m	147 m	152 m	160 m	200 m	242 m	252 m	324 m	414 m	500 m	505 m	586 m	
	6836	M004-10	6848	6851	M003-04	6857	M002-02	M003-15	6856	6837	6850	6855	M002-01
<i>Cytherella hermargentina</i> Whatley et al., 1998				10						3			
<i>Loxoconcha</i> sp.				1									
<i>Apatihowella heros</i> (Whatley et al., 1996)				1									
<i>Apatihowella convexa</i> sp. nov.				1	6		1			5			
<i>Cytheropteron</i> sp. 2						1						10	
<i>Copytna</i> sp.						3							
<i>Apatihowella verrucosa</i> (Ramos et al., 2012)					8	9						2	
<i>Apatihowella</i> sp.					1								
<i>Aversovalva tomentosina</i> sp. nov.					1						13	8	
<i>Bythocypris kyamas</i> Whatley et al., 1998					1	1		44			41	6	
<i>Cytherella pleistocenica</i> Bergue et al., 2007						14	16			24		10	
<i>Meridionalicythere</i> sp. 2						11						10	
<i>Muellerina</i> sp.						2						1	
<i>Neocaudites planeforma</i> Whatley et al., 1997						1							
<i>Paracytheridea bulbosa</i> Purper & Ormeillas, 1989						4						2	
<i>Semicytheridea rugosoreticulata</i> Whatley et al., 1988						7							
<i>Bythoceratina</i> sp.						1							
<i>Nanocoquimba</i> sp.						1							
<i>Apatihowella macrocavatricosa</i> (Whatley et al., 1998)						2						2	
<i>Cytheropteron</i> sp. 1							1				32	4	
<i>Krithe</i> sp. 1								1	4				
<i>Legitimacythere aorata</i> (Bergue & Coimbra, 2008)								85			153		
<i>Apatihowella besnardi</i> sp. nov.									4		68		
<i>Apatihowella acelos</i> sp. nov.										4	4		
<i>Xestoleberis</i> sp.											1		
<i>Cytheropteron</i> sp. 3											6	3	
<i>Rotunduracythere</i> sp.											6		
<i>Aversovalva</i> sp.											10	4	
<i>Macrogynis</i> sp.											1		
<i>Saita tanta</i> Clampo, 1986											64	1	
<i>Hemingwayella</i> sp.											7	1	
<i>Cytheropteron perlaria</i> Hao, 1988											11	1	
<i>Krithe</i> sp. 2											1		



16-18: *Bradleya pseudonormani* Ramos et al., 2012



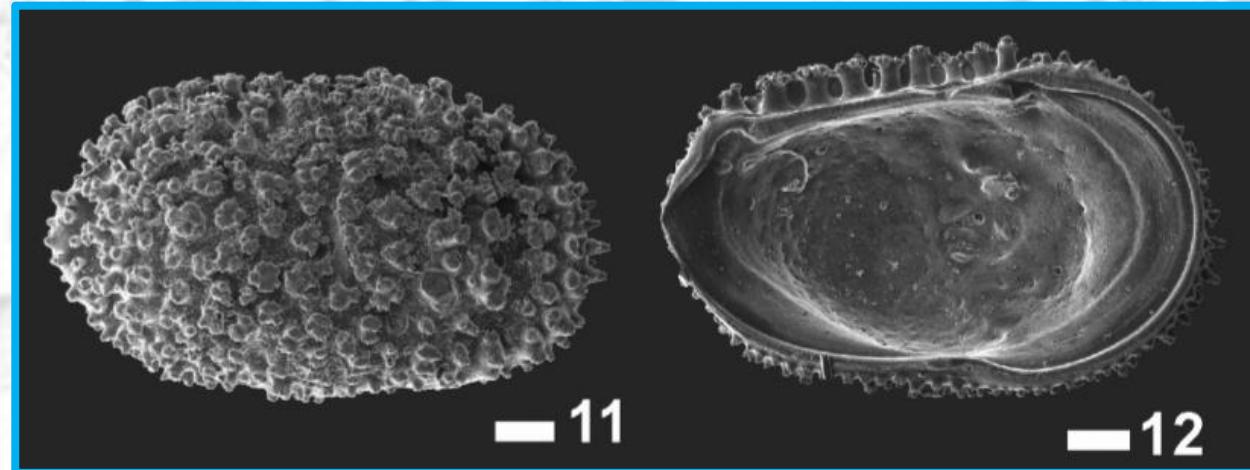
1-3: *Bradleya gaucha* Bergue et al., 2016



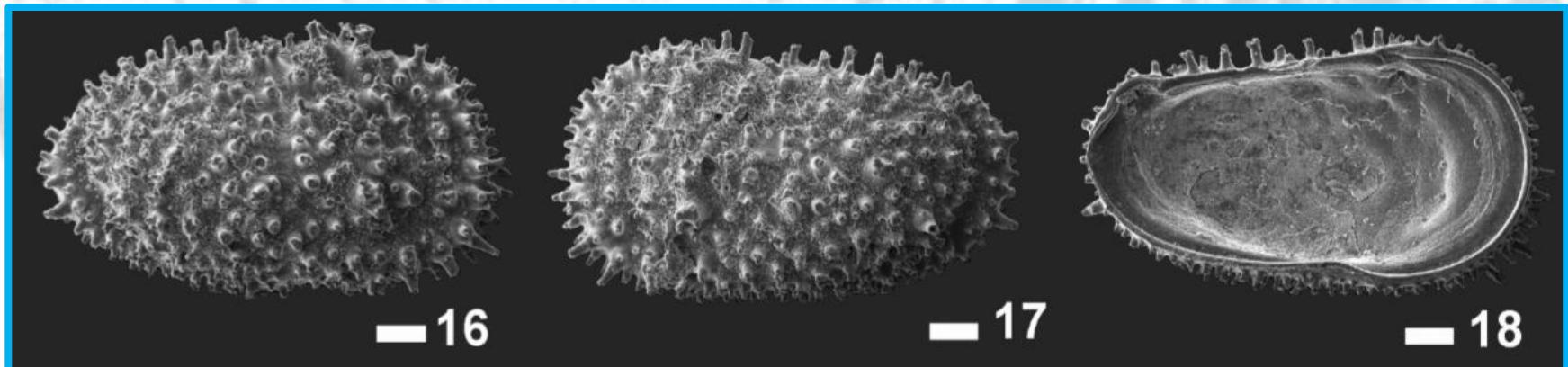
1-4: *Apatihowella acelos* Bergue et al., 2016

5-9: *Apatihowella capitulum* Bergue et al., 2016

***Legitimocythere*: um marcador hidrológico?**



11-12 – *Legitimocythere aorata* Bergue & Coimbra, 2008



16-18 – *Legitimocythere megapotamica* Bergue et al., 2016

Cenozoic synthem stratigraphic architecture of the SE Brazilian shelf and its global eustatic context: evidence from the Pelotas Basin (offshore Brazil)

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Farid Chemale Jr.⁴ & Henrique Zerfass⁵

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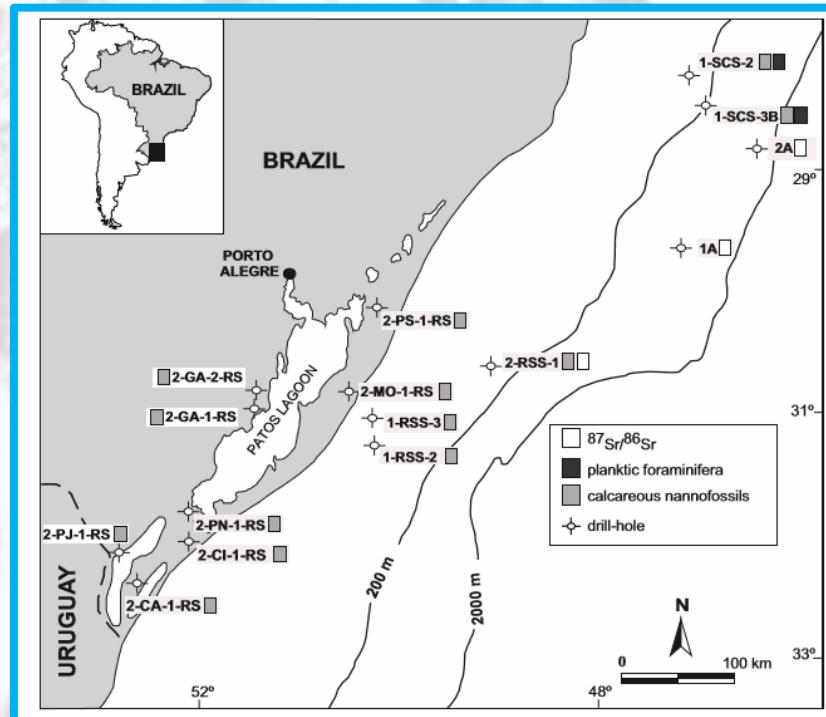
Abstract

The Pelotas Basin, located on the SE Brazilian shelf, has evolved since the Aptian. Stratigraphical data from the basin can be used for delineation of the unconformity-bounded units (synthems) on the shelf, which is a first step towards a full understanding of its stratigraphic architecture, evolution, and hydrocarbon potential. Hiatuses in the Cenozoic succession of the Pelotas Basin are established with both biostratigraphic (planktonic foraminifers and calcareous nannofossils) and isotopic ($^{87}\text{Sr}/^{86}\text{Sr}$) data. The seven recognised hiatuses are dated respectively as (1) Palaeocene (Danian-Thanetian), (2) Palaeocene/Eocene boundary (Thanetian-Ypresian), (3) Eocene (Ypresian-Lutetian), (4) Eocene-Oligocene (Lutetian-Rupelian), (5) early-late Oligocene (Rupelian-Chattian), (6) early Miocene (Aquitian-Burdigalian), and (7) middle-late Miocene (Serravallian-Tortonian). These intervals between the hiatuses are correlated with those of the Santos and Campos Basins north from the Pelotas Basin.

The breaks in sedimentation that these basins have in common occurred (1) at the Palaeocene-Eocene and (2) Eocene-Oligocene transitions, (3) in the early Miocene, and (4) in the middle-late Miocene. These main unconformities outline five synthems on the SE Brazilian shelf, viz. the SEBS-1 (Palaeocene), SEBS-2 (Eocene), SEBS-3 (Oligocene), SEBS-4 (early-middle Miocene) and SEBS-5 (late Miocene-Holocene). The above unconformities are correlated with those established in the Cenozoic sedimentary successions of different regions such as Western Siberia, Arabia, NW and NE Africa, peninsular India, S Australia, the Gulf of Mexico, NW Europe, and South Africa.

The only regional unconformity, near the Oligocene/Miocene boundary, coincides with the nearly-global sedimentation break. The latter was resulted from a climatic event, i.e., the 'M-1 glaciation'. Thus, a eustatic origin is supposed for this regional unconformity. The other regional unconformities also correspond to global sea-level falls (probably with an exception for the Palaeocene/Eocene surface), which suggests that global eustatic movements controlled the development of the regional synthem architecture.

Key words: synthem, Pelotas Basin, Brazilian continental shelf, Cenozoic



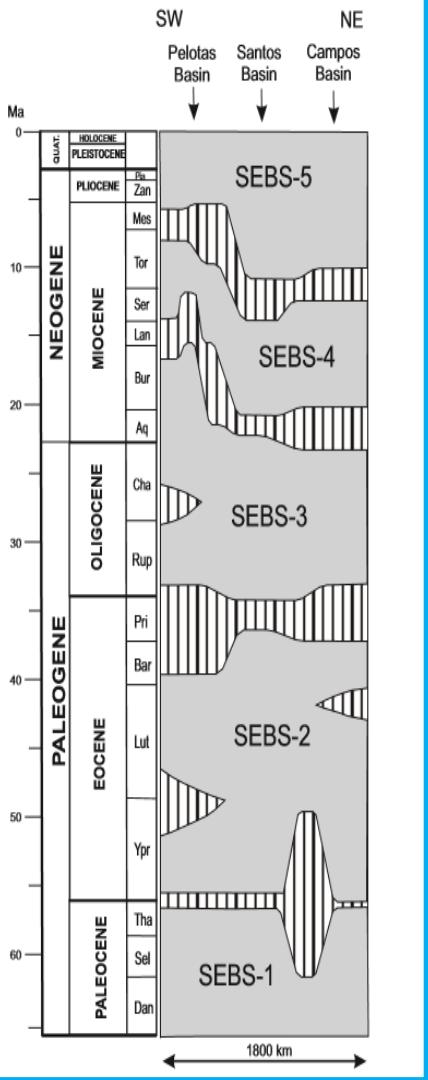
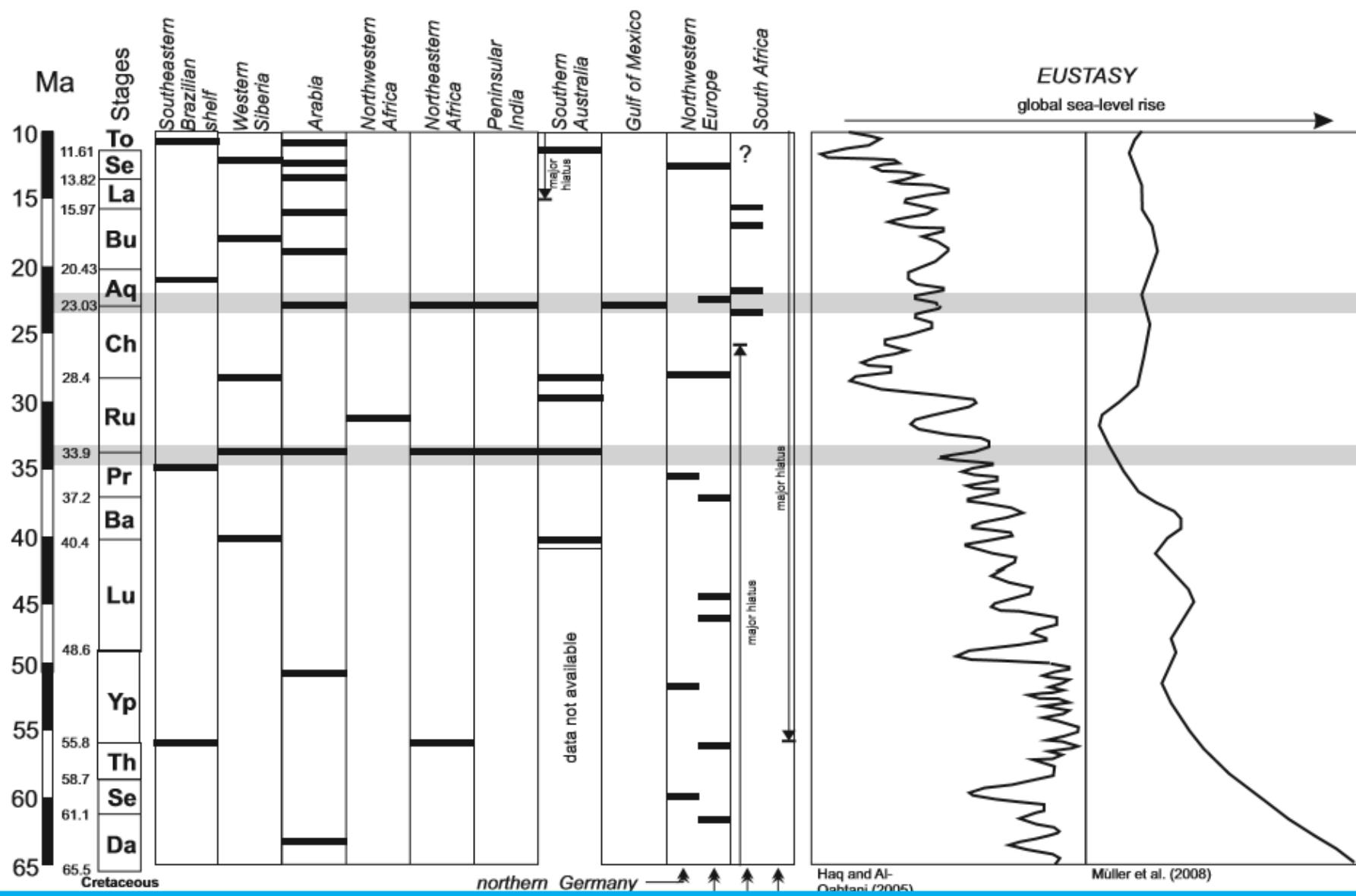
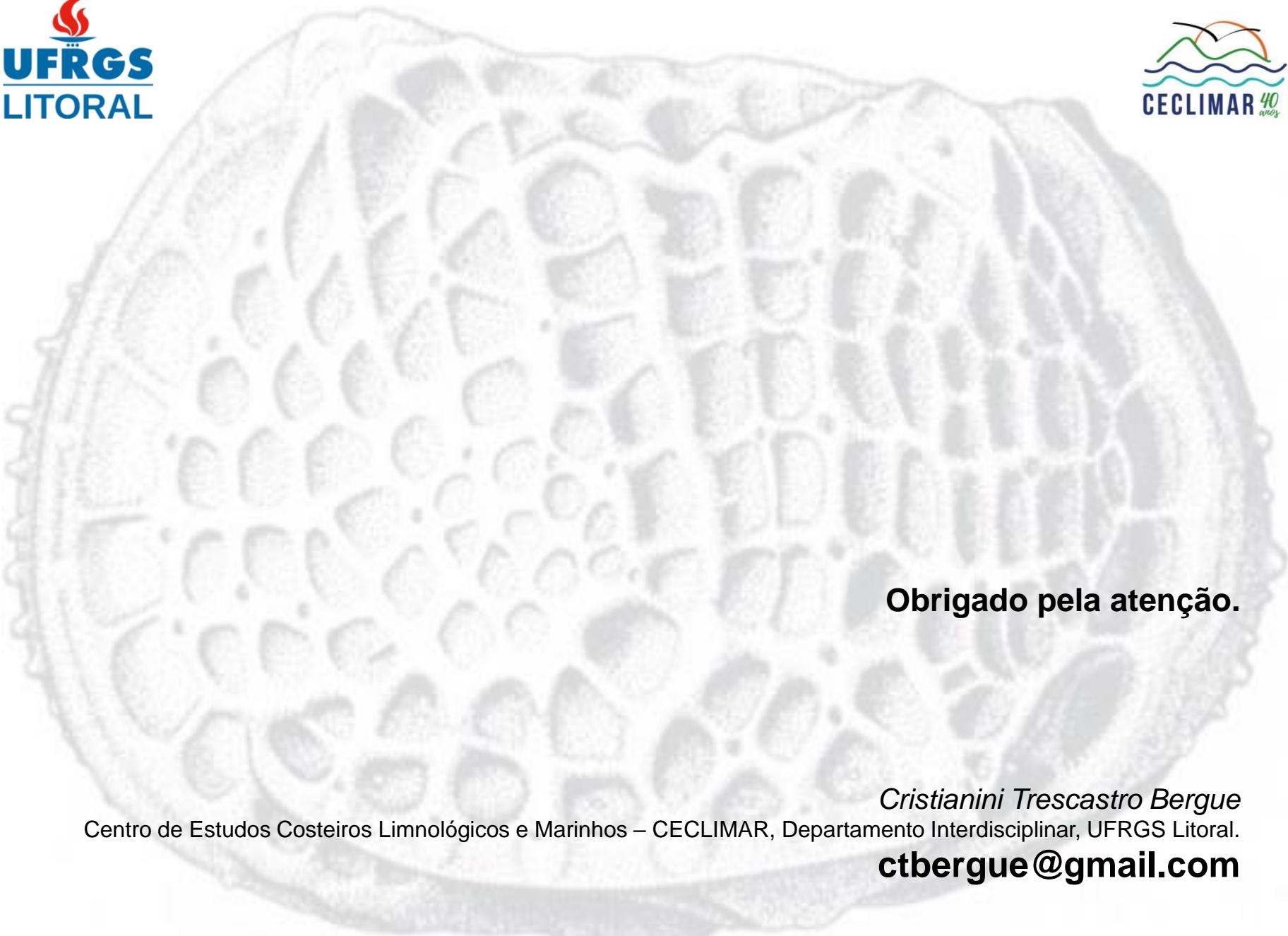


Table 1. Characteristics of the unconformity-bounded units.

syn-them	time inter-val	thickness (m)	lithostratigraphic units (formations)	lithology	palaeoenvironments
SEBS-5	Tortonian – Holocene	370–700	Cidreira, Imbé, Ponta Aguda, Iguape, Marambaia, Carapebus, Emboré (Grussá and São Tomé Members), Ubatuba (Geribá Member)	conglomerates, sandstones, diamictites, peats, mudstones	alluvial fan, fluvial, coastal, shelf, submarine channel-lobe complex
SEBS-4	Aquitanian/Burdigalian – Tortonian	370–650	Cidreira, Imbé, Barreiras, Ponta Aguda, Iguape, Marambaia, Emboré (São Tomé and Siri Members), Ubatuba (Geribá Member), Carapebus	conglomerates, sandstones, mudstones, reefal and bioclastic carbonates	alluvial fan, fluvial, coastal, shelf, submarine channel-lobe complex
SEBS-3	Priabonian – Aquitanian/Burdigalian	350–1,300	Cidreira, Imbé, Ponta Aguda, Iguape, Marambaia (Maresias Member), Emboré (São Tomé and Grussá Members), Ubatuba (Geribá Member), Carapebus	sandstones, mudstones, carbonates	coastal, shelf, submarine channel-lobe complex
SEBS-2	Ypresian – Late Bartonian/Early Priabonian	270–1,300	Imbé, Ponta Aguda, Marambaia, Carapebus, Emboré (Grussá and São Tomé Members)	sandstones, conglomerates, diamictites, mudstones, carbonates, marls, basaltic flows, peperites	coastal, shelf, submarine channel-lobe complex
SEBS-1	Danian – Ypresian	200–600	Cidreira, Imbé, Ponta Aguda, Marambaia, Carapebus, Emboré (São Tomé Member), Ubatuba (Geribá Member)	sandstones, conglomerates, diamictites, mudstones, marls	alluvial fan, fluvial, coastal, shelf, submarine channel-lobe complex

major regional unconformities





Obrigado pela atenção.

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