

PLEISTOCENE SKULL REMAINS OF *PONTOPORIA BLAINVILLEI* (CETACEA, PONTOPORIIDAE) FROM THE COAST PLAIN OF RIO GRANDE DO SUL STATE, BRAZIL, AND THE RELATIONSHIP OF PONTOPORIDS¹

FRAGMENTOS CRANIANOS PLEISTOCÊNICOS DE *PONTOPORIA BLAINVILLEI* (CETACEA, PONTOPORIIDAE) DA PLANÍCIE COSTEIRA DO ESTADO DO RIO GRANDE DO SUL, BRASIL, E AS AFINIDADES DOS PONTOPORÍDEOS¹

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Resumo: Foram objeto de estudo alguns fragmentos cranianos de cetáceo odontoceto do Quaternário, coletados na margem costeira do Rio Grande do Sul, Brasil, pertencentes à subfamília Pontoporiinae, família Pontoporiidae. A análise morfológica permitiu atribuí-los à *Pontoporia blainvillei* (Gervais 1844). Os fragmentos foram retrabalhados, provindos da Plataforma Continental Interna, associados aos depósitos biodetríticos do Neopleistoceno. Alguns caracteres cranianos de *Brachydelphis*, *Pontistes*, *Pliopontos* e *Pontoporia* são questionados: 1) simetria/assimetria craniana; 2) altura do vértice craniano; 3) tamanho e forma do rostró; 4) tamanho e forma da caixa craniana; 5) número de dentes; 6) tamanho da órbita; 7) tamanho do frontal; 8) tamanho do nasal; 9) contato pré-maxilar-nasal; 10) posição e exposição do vômer no palato; 11) exposição do pré-maxilar no palato; 12) lâmina lateral do pterigóide; 13) sulco ântero-orbital; 14) crista supra-orbital maxilar; 15) "goteira" látero-rostral do pré-maxilar; 16) cristas maxilares; 17) posição do mesetmóide; e 18) lâmina espiracular. Os caracteres acima indicam afinidades de *Pontoporia* com *Pontistes* e *Pliopontos*. Contudo, alguns caracteres estão diretamente relacionados à idade/crescimento, tempo de vida e juvenalização. Com base nestes dados, é sugerido que a sistemática em uso necessita de uma nova abordagem.

Palavras-chave: Pontoporiidae, *Pontoporia blainvillei*, Pleistoceno, Rio Grande do Sul, Brasil.

Abstract: Some skull remains of marine fossil Pontoporiinae odontocets from the Quaternary of the western margin of the South Atlantic Ocean, Rio Grande do Sul, Brazil, are studied. Morphology indicates that they belong to the species *Pontoporia blainvillei* (Gervais 1844), the pontoporiid living in shallow water off the Atlantic coast of southern South America. The fragments were reworked, from the inner continental shelf, always associated to biodetrict deposits of Late Pleistocene age. Some cranial characters of *Brachydelphis*, *Pontistes*, *Pliopontos* and *Pontoporia* are discussed: 1) cranial symmetry/asymmetry; 2) height of cranial vertex; 3) rostrum size and shape; 4) braincase size and shape; 5) teeth number; 6) orbit size; 7) frontal size; 8) nasal size; 9) premaxilla-nasal contact; 10) vomer position and exposition on the palate; 11) premaxilla exposition in palate; 12) lateral lamina of pterygoid; 13) antorbital notch; 14) supraorbital maxillary crest; 15) laterorostral gutter of the premaxilla; 16) maxillary crests; 17) mesethmoid position; and 18) spiracular plate. The characters above indicate relationship of *Pontoporia* with *Pontistes* and *Pliopontos*. However some characters are directly related to growth/age, life span and juvenalization. On the basis of these data, is suggested that the corresponding systematics needs a new approach.

Keywords: Pontoporiidae, *Pontoporia blainvillei*, Pleistocene, Rio Grande do Sul, Brazil.

1- Work supported by CNPq/RHAE and FAPERGS.

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INTRODUCTION

The fossil occurrences of cetaceans are rare, perhaps mostly due to fossilization, because bones are very fragile. According to Barnes (1984, 1985) there are only three species in the subfamily Pontoporiinae, family Pontoporiidae: *Pontistes rectifrons* Burmeister 1891 from the Miocene of Argentina; *Pliopontos littoralis* Muizon 1983 from the Pliocene of Peru and *Pontoporia blainvillei* (Gervais 1844), the franciscana, a near-shore marine and estuarine species living in the Atlantic Ocean off the coasts of Argentina (Lahille 1899), Uruguay and southern Brazil (reaching to Espírito Santo State) (Borobia & Geise 1984). The species *Lonchodelphis occiduus* (Leidy 1868) from North America, based on scarce fragments, and *Pontivaga fischeri* Ameghino (1891), from the Miocene of Argentina, based on a mandibular fragment are not accepted by Barnes (1985), because *L. occiduus* is a problematical dolphin and *P. fischeri*, a contemporaneous to *P. rectifrons*, is an odontocete of uncertain affinities. According to Cozzuol (1985), *P. fischeri* is a synonym of *P. rectifrons*. Until the present, *Brachydelphis mazeazi* Muizon (1988) is the only species of the subfamily Brachydelphinae (Pontoporiidae) accepted.

The fossil records of *P. blainvillei* are scarce. Ameghino (1891) referred to this species from Pleistocene ("Piso Querandino") of Argentina (La Plata, Quilmes).

The first Brazilian record of *P. blainvillei* consisted of one skull, which according to Paula-Couto (1940), was collected in the city of Porto Alegre, Rio Grande do Sul State. It used to belong to the Collection of "Museu Estadual Júlio de Castilhos" in Porto Alegre, but unfortunately the specimen was lost.

This paper presents new fossil skull remains of *P. blainvillei* with analysis of some proposed phylogenetic characters concerning the other fossil species of the subfamily.

MATERIAL AND METHODS

The material consists of six specimens belonging to the "Coleção Científica de Paleovertebrados do Museu de Ciências Naturais da Fundação Zoobotânica do Rio Grande do Sul - (MCN-PV)". They were collected at the beach, along the Rio Grande-Chuí coast, in an extension range of 220km (Figure 1).

The specimens MCN-PV-2142 and 2146 were collected in Cassino's beach, Rio Grande city; MCN-PV-1526 and 2145 near to Albardão lighthouse; MCN-PV-2143 and 2144 in Concheiros' area. Both Albardão lighthouse and Concheiros' area are located at Santa Vitória do Palmar city.

The material, all skull fragments, have a dark color due to organic matter and manganese oxid impregnation.

A direct comparison was made with 36 specimens of extant *Pontoporia blainvillei* from the "Coleção Científica de Mastozoologia (MCN)" (MCN-029, 223, 529, 1029, 1057 and 1099) and "Coleção Científica de Mastozoologia do Laboratório de Mamíferos Aquáticos da Universidade Federal de Santa Catarina" (UFSC-1003-1008, 1022, 1023, 1026, 1027, 1031, 1037-1039, 1046, 1054, 1058-1060, 1065, 1066, 1070, 1071, 1091, 1092, 1095, 1121, 1214-1216).

A chart of the biodetritic deposits of the inner continental shelf was accomplished, with geophysical equipment (Side Scan Sonar, model 260 EE&G; EchoProbe 200 kHz- RTT 1000a Raytheon; and 3.5KHz Seismic) and samples of marine substratum with "Phips Underway" site determined through GPs Plotter (model GP 1500 Furuno).

FOSSIL OCCURRENCE IN THE COASTAL PLAIN

Sedimentation in the coastal plain of Rio Grande do Sul is related to sea level changes, and the deposits are associated in part to the "Last Great Transgression" (the emerge portion called "Barreira-Laguna System IV"), and to the "Penultimate Great Transgression" ("Barreira-Laguna System III") (Villwock 1987).

Pleistocene fossils of the southern coastal plain of Rio Grande do Sul can be divided as:

Fossils of the emerged zone

There is only one outcrop in the coastal zone of Rio Grande do Sul State with a well known stratigraphy having Pleistocene land mammal fossils. It exists in a gorge of the Chuí river (Santa Vitória do Palmar) studied by Paula-Couto (1939, 1940, 1942, 1944, 1953, 1961); Souza-Cunha (1959); Soliani Jr. (1973, 1974), and others. Such deposits formed during the rising of the sea level, in Late Pleistocene, with estimated age 120.000 y.B.P. (Villwock *et al.* 1986, Villwock 1987). Marine vertebrate fossils in the emerged zone were not recognized.

Fossils of the Inner Continental Shelf

During fishing, with a trap dragged technique, large mammal fossil bones are collected (Notoungulata, Proboscidea, Edentata) as well as cetacean fossils. They are associated to biodetritic deposits, and their origin is related to relict Pleistocene sediments outcropping the inner continental shelf.

The "Laboratório de Oceanografia Geológica da Universidade de Rio Grande" did a cruiser along the inner continental shelf of Rio Grande county, during the Project "COMEMIR/OSNLR Ocean Science for Non Living Resources - GEO COSTA SUL III", in 1993 and 1994. During this cruiser, biodetritic deposits were charted, having abundant marine fossils (marine and beach environment) and land fauna (savanna and wetlands environment) associated with morphological features, named **Carpinteiro's parcel** (32°15'S-51°45'W) and **Hermenegildo's parcel** (33°38'S-53°11'W), having batimetric line of 14 and 8 meters, respectively. Such features present an assemblage of beach rock, lagunar mud's cemented by calcium carbonate, sometimes recrystallized (crystals of 5-10mm). All fossils were found associated to biodetritic deposits (Buchmann 1994). Figueiredo (1975) estimated using 14C radiocarbon, ages higher than 17.000 y.B.P., for fossil mollusks recovered from the inner continental shelf (associated to **Hermenegildo's parcel**).

Fossils of the foreshore of the oceanic beaches

The fossils of Pleistocene land and marine faunas associated with biodetritic deposits were reworked and deposited along the foreshore of oceanic beaches of the southern coastal plain, resulting from the erosion Pleistocene lagunar muds. Such relicts are more concentrated in the Cassino beach, Verga lighthouse and Concheiros areas, and are different in fossil content according to Buchmann (1996). *Pontoporia blainvillei* is here included.

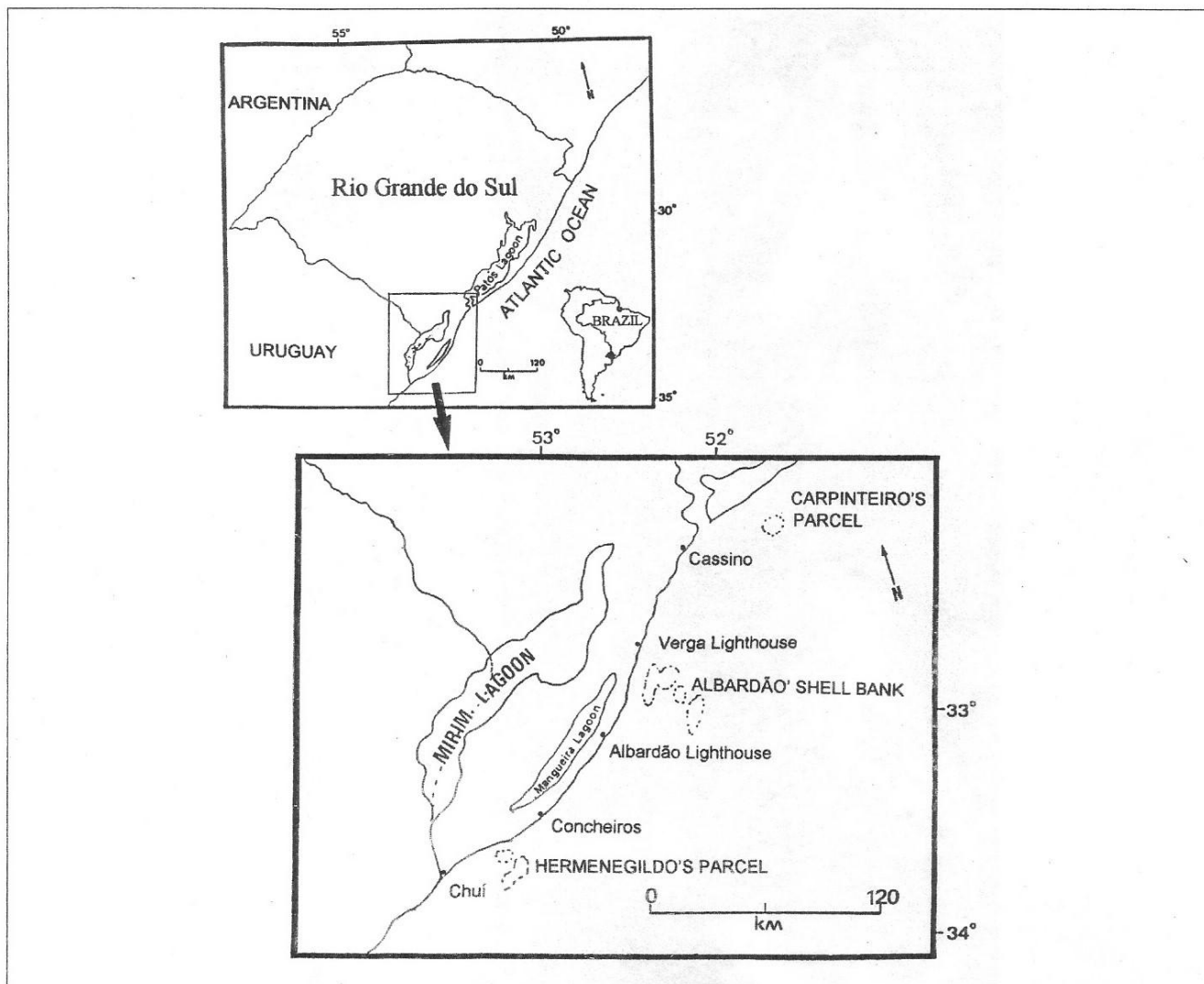


FIGURE 1 - Map of the Rio Grande do Sul State, showing the fossil collecting areas.

FIGURA 1 - Mapa do sul do Estado do Rio Grande do Sul, indicando a localização de coleta dos fósseis.

SYSTEMATICS

- Order CETACEA Brisson 1762
- Suborder ODONTOCETI Flower 1867
- Superfamily INIOIDEA Gray 1846
- Family PONTOPORIIDAE (Gill 1871) Kasuya 1973
- Subfamily PONTOPORIINAE (Gill 1871) Barnes 1984
- Genus *Pontoporia* Gray 1846
- Pontoporia blainvillei* (Gervais 1844)

Description and Discussion

MCN-PV-1526 and 2142 are the best preserved of the six specimens, all of them rostrum and roof of the skull.

The skull's vertex is symmetrical (Plate 1, Figures 1 and 2), a character of Pontoporiinae (Barnes 1984). The frontal bones are narrow and quadrangular in outline, with a length about 20mm, and a width of 10mm. In *Pontistes* it is approximately 30mm long and 30mm width; and in *Pliopontos* is 34mm long at the level of the right nasal (Muizon 1983). The frontals are laterally bordered

by the posterior portion of the maxillary bones. Apparently the specimen MCN-PV-2142 belonged to an older individual than the specimen MCN-PV-1526, showing a complete fusion in the posterior part of the skull, where there is a (worn) supraoccipital crest. In the first one, the frontals are narrower due to the telescoping maxillary bones, being broken and lost anteriorly.

The nasal bones are almost square in outline, seeming more flattened in the fossil specimens than in extant *Pontoporia blainvillei*, what, however, was possibly due to wear.

The nasal opening is wider when compared with the extant specimens, being oriented more backwards, what is an individual variation.

The premaxillary bones present a pointed posterior portion, more advanced of that extant *Pontoporia*, not articulating with the nasals. Premaxillae not articulating with nasals occur in extant *Pontoporia blainvillei* and *Pliopontos littoralis*, but do not in *Pontistes rectifrons* and *Brachydelphis mazeasi* (Burmeister 1885; Muizon 1983, 1988). In the studied specimens of *Pontoporia*, is observed a bony strip of maxilla between premaxilla and nasal bones.



PLATE 1: *Pontoporia blainvillei*. 1, MCN-PV-1526, skull fragment, dorsal view; 2, ventral view; 3, FURG-1696, skull fragment, dorsal view; 4, ventral view; f, frontal; m, maxillary, me, mesethmoid; n, nasal bone; pm, premaxillary; v, vomer. Scale bar: 20mm.

LÁMINA 1: *Pontoporia blainvillei*. 1, MCN-PV-1526, fragmento craniano, vista dorsal; 2, vista ventral; 3, FURG 1696, fragmento craniano, vista dorsal; 4, vista ventral. f, frontal; m, maxilar, me, mesetmóide; n, nasal; pm, premaxilar; v, vomer. Escala: 20mm.

The maxillary bones are wide, smooth and having a flattened posterior end, much like in the extant *Pontoporia blainvillei*, but different from *Pliopontos littoralis*, which presents this area even more flattened but rough, indicating a strong muscular attachment (see Muizon 1983). Anterior to this area, and anterolaterally to the nasal openings there is a narrow fossa between the premaxillary bone and the maxillary crest (fractured), such as in the extant *P. blainvillei*. This fossa is wider in *P. littoralis*. The rostrum basis is narrow and by its shape, probably elongated, like in the extant *P. blainvillei*.

The vomer bone is visible in the palate (e.g. MCN-PV-1526, Figure 3), contrary to what Barnes (1985) postulated for the subfamily Pontoporiinae. These two forms perhaps could be

regarded as individual variation, because both forms (vomer exposed or not) are observed in the extant *Pontoporia blainvillei*. The other bones are too broken for comparison with recent material.

ANALYSIS OF PROPOSED PHYLOGENETIC CHARACTERS OF PONTOPORIINAE

Barnes (1985) placed into the family Pontoporiidae the subfamilies: Lipotinae (*Lipotes* and *Prolipotes*), Parapontoporiinae (*Parapontoporia*) and Pontoporiinae (*Pliopontos*, *Pontistes* and *Pontoporia*), based on the evolution of facial asymmetry. According to Muizon (1988), the subfamilies Parapontoporiinae and Lipotinae proposed by Barnes (*op. cit.*) do not belong to

Pontoporiidae, and the subfamily Brachydelphinae (*Brachydelphis*) is included with Pontoporiinae mostly on the basis of auditive region characters. Heyning (1989) disagrees from Barnes (*op. cit.*) based on the facts that facial asymmetry is a synapomorphic character for all extant odontocetes and hypertrophy of the right side of the vestibular sac and premaxillae displaced laterally not contacting nasals, according to him, unite the extant genera *Pontoporia*, *Inia* and *Lipotes* into the Iniidae.

The systematic propositions above were funded in many characters, and some of them are here discussed as its usefulness in phylogeny: 1) cranial symmetry/asymmetry; 2) height of cranial vertex; 3) rostrum size and shape; 4) braincase size and shape; 5) teeth number; 6) orbit size; 7) frontal size; 8) nasal size; 9) premaxilla-nasal contact; 10) vomer position and exposition on the palate; 11) premaxilla exposition in palate; 12) lateral lamina of pterygoid; 13) antorbital notch; 14) supraorbital maxillary crest; 15) laterorostral gutter of the premaxilla; 16) maxillary crests; 17) mesethmoid position; and 18) spiracular plate.

Cranial symmetry/asymmetry

One of the most important characters defining the Pontoporiinae is the symmetry of the skull (Barnes 1985). Heyning (1989: 46) reported that: "...all modern odontocetes have asymmetrical skulls", including *Pontoporia blainvillei*, whose facial anatomy of soft parts is strongly asymmetrical. This is partially true because bony asymmetry in *Pontoporia*, and its fossil allies, is more discreet than in other odontocetes. On this basis, we see the symmetrical condition (*sensu* Barnes *op. cit.*) or slightly asymmetrical condition (*sensu* Heyning *op. cit.*), as an autapomorphy for Pontoporiinae (genera: *Pontistes*, *Pliopontos* e *Pontoporia*).

Height of cranial vertex and telescoping

Muizon (1988: 114) refers to this character: "...Si l'on admet que les Pontoporiidae sont caractérisés par un abaissement du vertex..., les dispositions observées chez *Pontoporia*, *Pliopontos* et *Brachydelphis* peuvent s'agencer en un morphocline". In the Pontoporiidae we observe that the cranial vertex is lower than it is in other Iniioidea (e.g. *Lipotes*, *Parapontoporia* and *Inia*) and Delphinoidea, which are characterized by a tendency to a deeper cranial vertex. In this way, the condition observed in the Pontoporiidae is considered as an autapomorphy, resulting from a reversion.

Rostrum and braincase size and shape

According to Burmeister (1885), *Pontistes* shows a depressed rostrum, wider than high and flat in general shape (28-30cm long), like *Stenella* ("*Delphinus microps*" *sic*. Burmeister, *op. cit.*). *Pontistes* braincase resembles *Pontoporia* in shape, but it is larger than it, resembling *Stenella*. This condition is regarded here as a mosaic of characters of two families: Delphinidae and Pontoporiidae. *Pliopontos* rostrum (aprox. 15 cm long) resembles a delphinid by its flat shape, and short and wide braincase, but smaller than *Pontistes*. In *Brachydelphis* the rostrum is very short, being smaller than the braincase, which is wide. In fossil and extant *Pontoporia* the rostrum is long (30cm long), narrow and cylindrical in shape

(not flat), while the braincase is smaller (short and narrow) than in *Pliopontos*.

Teeth number

The teeth number increases from *Brachydelphis* to *Pontoporia* (*B. mazaesi*: aprox. 23; *P. rectifrons*: aprox. 40-42; *P. littoralis*: aprox. 30 and *P. blainvillei*: 50-62). Such numbers are closely related to the elongation of rostrum in odontocetes. Obviously, in longer rostrum, higher will be teeth number (e.g. *Parapontoporia*: aprox. 80-82). Thus, this character is not diagnostic at subfamilial level (i.e. Parapontoporiinae, Lipotinae and Pontoporiinae *sensu* Barnes 1985).

Orbit size

The decreasing gradient in the orbit size from *Brachydelphis* to *Pontoporia* pointed out by Muizon (1988) is an autapomorphic tendency to reduction in Pontoporiidae. Actually such size is inversely proportional. The longer the rostrum, the smaller the orbit and the shorter rostrum, the larger is the orbit. It seems to be a rule for mammals, as observed in other groups such as primates and carnivores. Muizon (*op. cit.*) relates the orbit size to an adaptation for turbid waters of rivers.

Frontal and Nasal size

These characters are directly related to the telescoping of skulls. The older is the individual, more elevated is the cranial vertex due to the superposition of the maxillae and premaxillae over frontals and nasals (e.g. *Lipotes*, *Parapontoporia*, and *Inia*; and in a lesser degree *Brachydelphis*), which are reduced on the cranial vertex. In pontoporines, where the telescoping is minimal, those bones are totally exposed. This suggests that the telescoping degree is directly to growth/age, concerning Pontoporiinae. In *Pliopontos* the contact between nasals and the occipital crest could be consequence of age (senile individual), such as occurs in *Pontoporia*.

Premaxillary and nasal contact

Barnes (1985: 28) regards as an autapomorphy for Pontoporiinae: "...posterior premaxillary terminations shortened". The fossil *Pontoporia* (MCN-PV-1526), in despite of the wear, shows the premaxillary posterior terminations longer than the extant specimens, although they don't contact each other. In *Pliopontos*, the premaxillae are slightly elongated posteriorly. In Burmeister's (1885: Plate I, Figure 12) figure we can observe that *Pontistes* presents a contact between the premaxillary posterior end and the nasal anterior end. This character is also observed in *Brachydelphis*, where the premaxillae are longer posteriorly than in *Pontistes*, contacting the nasals by a narrow posterior process. This is here regarded as a chronocline tendency of shortening of premaxillae, losing contact with nasals, in pontoporids.

Vomer position and exposition on the palate

Muizon (1988) describes for *Brachydelphis* a medial plate composed by palatine process of maxillae anteriorly and vomer posteriorly. According to Burmeister (1885), in the palate of *Pontistes*, the vomer reaches the middle portion of rostrum. In

fossil and extant juvenile *Pontoporia*, the exposed vomer is observed between palatines, in the posterior portion of the palate. A extant sagittally sectioned specimen (MCN-2756) showed that the most anterior portion of the vomer is a tiny "V" shaped plate, that extends anteriorly between premaxillae. Barnes (1985: 13, Figure 8) figured the vomer in the anterior portion of the palate of *Parapontoporia*, what also occurs in Delphinidae (e.g. *Tursiops*, *Stenella* and *Delphinus*). In adults *Pontoporia*, the total absence of the vomer in the anterior palate is probably related to the rostral shape (see character 3); moreover, the maxillae are very close together in palate. In *Stenella*, the wide open of maxillae expose the vomer. Barnes (1985) suggests that a "vomer not exposed on palate" is an autapomorphy for Pontoporiinae. This is correct in respect to the anterior portion of the vomer, since in *Pontoporia* it is covered by the maxillae. On the other hand, the middle portion of the vomer (posterior palate) is exposed between palatines in *Pontistes* and juvenile fossil and recent *Pontoporia*, but in *Pliopontos* it is not observed. This exposition is related to growth/age, possibly occurring in all Odontoceti. During ontogeny occurs bone fusion, the vomer becoming invisible in palate. From this, it can be concluded that such character is not useful for taxa diagnosis, perhaps even less in fossils, due to diagenesis.

Premaxillary exposition in palate

According to Muizon (1988), *Brachydelphis* shows the premaxillae at the anterior rostral end participating in the palate and alveoli formation. Burmeister (1885) notes that in *Pontistes* the premaxillae form a narrow bone strip between maxillae, at the anterior rostral end. In juvenile *Pontoporia*, the premaxillae also appears between maxillae at the anterior rostral end in palate, with the visible sutures. On the growing specimens, these bones become fused and indistinguishable. This character is also directly related to growth/age, deserving great care when used in a phylogenetic analysis.

Lateral lamina of pterygoid

Muizon (1988) refers that the lateral portion of the pterygoid disappears in Delphinoidea + Inioidea and reappears in Pontoporiinae. This character is regarded by Muizon (*op. cit.*) - and we agree - as an autapomorphy for Pontoporiinae, since it is absent in *Brachydelphis*.

Antorbital notch and Supraorbital maxillary crest

Muizon (1988) describes for *Brachydelphis* a supraorbital maxillary crest poorly developed and a deep antorbital notch. Burmeister (1885: 141) refers that the such crest is "...semejante al tipo de *Pontoporia*, ...mucho menor y más extrema inmediatamente al borde de la órbita". In fact, in their figures, the crest seems poorly developed, over the supraorbital process of the frontal because there is a suture which is here regarded as the maxillo-frontal one. Muizon (1983: 626) reports for *Pliopontos*: "...seule une très légère ébauche de crête au-dessus du processus orbitaire du maxillaire". In the same way, the antorbital notch is poorly developed. In *Pontoporia* this crest is well developed and the notch in juveniles has the same form as in fossils, being well developed in adults. Actually these two structures are related to each other and directly related to the ontogenetic stage; as well as is rostrum, braincase (characters 3 and 4) and orbit (character 6) sizes.

Laterorostral gutter (groove) of premaxilla

In *Pontistes* and *Brachydelphis* the laterorostral gutter ends laterally at the premaxillary border, near to maxillary foramen, being more posteriorly located in *Pliopontos*. In *Pontoporia* this gutter extends posteriorly beyond the premaxilla limit and corresponds to the transmission of the premaxillary artery (Muizon 1983). So, the extension of this gutter increases from *Brachydelphis* to *Pontoporia*, being related to the length of rostrum. It occurs also in *Parapontoporia* (see Barnes 1985, Figure 12).

Maxillary crests

Pliopontos differs from *Pontoporia* by presenting a very rugose posterior end at the maxillae, which is regarded as an area for muscular attachment (Muizon 1983), while in *Pontoporia* the maxillary posterior end is smooth. It is possible that the *Pliopontos* specimen is an adult, since in adult *Pontoporia* the occipital crest is well developed, and the posterior end of the maxillae present incipient crests. An alternative hypothesis is to relate these crests to a great development of the muscle "pars posteroexternus du dilator nasalis" (Muizon 1983). This would suggest for *Pliopontos* a better control of nasal opening. The evolution of this character might be dependent on the environmental requirements, to a tendency to juvenilization or both.

Mesethmoid position

Muizon (1988) refers that the mesethmoid is absent between the premaxillae of *Brachydelphis* and pontoporines, differing from *Parapontoporia* and *Lipotes*. Our adult specimens of fossil *Pontoporia* show the mesethmoid visible through the mesorostral groove, its anteroventral portion extending over vomer's groove between premaxillae, and its anterodorsal portion persisting cartilaginous, as suggest by Flower (1885). In juvenile specimens, this region is poorly ossified. Therefore the mesethmoid absence between premaxillae was a misinterpretation of Muizon (1988).

Spiracular plate

Barnes (1985:28) considers the "...spiracular plates convex and elevated" an autapomorphy for *Pontoporia*. In *Pliopontos* such convexity is slightly smaller than in *Pontoporia*, possibly the same occurring in *Pontistes*. We agree with Barnes (*op. cit.*) since this condition is very particular of pontoporines, and very different from the other odontocetes, where such structures are more or less concave.

The characters discussed above indicate relationship of *Pontoporia* with *Pontistes* and *Pliopontos*. However some characters are directly related to growth/age, life span and juvenilization.

The classification and phylogeny proposed by Heyning (1989) for extant odontocetes on the basis of anatomical characters of facial region offers a good insight about relationships of taxa, however failing in not using information from fossils. Barnes (1989) said "...to ignore a rich fossil history of any animal group is lose valuable and interesting insights into a wealth of information that is applicable to studies of systematics, distribution, behavior, and population structure of the living descendants". Concerning cetaceans, despite their poor preservation as fossils, their inclusion in phylogenetic reconstructions seems necessary. Gould (1995), working on Erinaceidae, concludes that the inclusion of fossil taxa in a previous known phylogeny for recent taxa, changes the polarization of the characters and the supposed previous

relationships. In Heyning's (*op. cit.*) phylogeny for Iniidae, premaxillae laterally displaced not contacting nasals is proposed as a synapomorphy (his n. 31). In what respects *Brachydelphis* and *Pontistes*, closely related to the Iniidae, this condition is not present.

Barnes (1985) phylogeny and classification seem also poorly funded, because he used a few characters to diagnose subfamilial levels, and those ones are part of the same process acting on the evolution of the species (for instance "extreme polydonty" and "long rostrum").

Muizon's (1988) classification seems nearer the evolutionary scenario of the pontoporiids. However some characters need a new approach since he did not take into account the ontogenic stages.

CONCLUSIONS

The work confirms the presence of *Pontoporia blainvillei* for the Late Pleistocene of Rio Grande do Sul, Brazil, during a Pleistocene transgressive event, which resulted in the formation of the depositional system called "Barreira-Laguna System III".

The presence of recrystallized carbonate in submersed deposits, suggests different depositional conditions from those of today, what might be due to higher temperatures during Pleistocene transgression, and is not observed in Holocene deposits of the same area.

Concerning *Pontoporia* characters, they corroborate its affinities to other representants of the Pontoporiinae. However, any study about this group - and other odontocetes - will be obscured if fossil taxa and ontogenetic criteria were disregarded.

ACKNOWLEDGMENTS

The authors thank to Dr. Jorge Ferigolo, Luciano Maciel and Édison Oliveira for their discussion about fossils, Dr. Mario Cozzuol for his bibliographical support. Dr. Lauro Calliari and Dra. Maria E. Itussary from "Laboratório de Oceanografia Geológica (FURG/Rio Grande)" allowed the cruiser in the oceanographic ship "Atlântico Sul", and the vehicles for the field-work.

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