PALEOCHANNELS IN CONTINENTAL SHELF INTERNAL RIO GRANDE DO SUL

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Abstract

Subsurface structures recorded by seismic high resolution data (3.5 kHz) on the Rio Grande do Sul State inner continental shelf was interpreted as preterit drainage channels. These paleochannels had been developed between the maximum Pleistocene regression and posterior transgression occurred in the early Holocene, when the actual inner shelf was exposed. Ten seismic profiles obtained during Amazônia Azul project were considered in this work. The equipment used to obtain seismic records was the sub bottom profiler model Bathy2010 attached to the Atlântico Sul research vessel of the Universidade Federal do Rio Grande. The data shows 5 paleochannels located of the study area. Hypothetically, we can associate some paleochannels with past Camaquã riverbed due to geographical position and previous work data analysis (Weschenfelder *et al* . 2010). The paleochannel configuration at the inner shelf shows that the drainage was developed toward Cone Rio Grande. The presence of paleochannels in the Rio Grande do Sul inner shelf corroborates paleogeographic evolution models of the area.

Keywords: Seismic Survey, Inner Continental Shelf, Rio Grande do Sul State.

Introduction

The configurations of the coastal regions are the result of a geological heritage related to changes in the relative sea level (NRM) and morphodynamic processes. These processes can be viewed through geophysical methods.

Studies of high-resolution seismic data have been conducted around the world, mainly in the characterization of the background sedimentary processes (Damuth & Hayes, 1977). Seismic equipment, 3.5 and 12 kHz, allow high resolution and a low penetration in the sedimentary package (less than 30 m).

Due to the relative sea level fall we have the formation of drainage channels in the coastal plain and continental shelf. The accommodation of sediments along the continental shelves takes place mainly by the morphology of the coast being flooded and changes in relation to sea level (Mattheus & Rodriguez, 2011).

With the rise in sea level, there is an increase in deposition and preservation potential of these sedimentary packages (Mattheus & Rodriguez, 2011).

The study of recognition and mapping enables reconstruct preterit drainage systems and, almost always, link them to the courses of current river drainage systems (Weschenfelder *et al*., 2010).

The paleochannel study is very important in mineral area. Correa & Ade (1987) verified the platform sediments, the presence of minerals from the continental interior, transported by river systems past tenses. They related heavy minerals in the inner shelf areas with the source of the igneous-metamorphic complex shell South riograndense.

Munaro (1994) studied the heavy minerals of Bojuru region and suggests depositional systems associated with paleodrainage Camaquã River in the inner shelf.

The study area is comprised of five seismic lines (lines 5442, 4315, 4040, 0922, 4551) located in the shallow inner shelf of Rio Grande do Sul in front of the municipality of Rio Grande, in the Brazilian state of Rio Grande do Sul (Fig. 1).

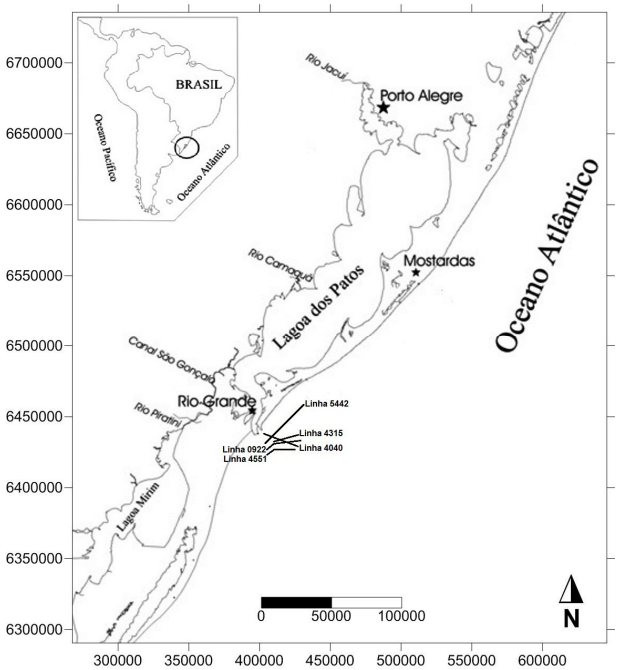

Figure 1 - Map of the study area (UTM 22J).

The continental shelf of Rio Grande do Sul has an average width of 125 km with the presence of sand waves, and channels associated with ancient river environments. Considered quite extensive compared to other regions of the country. Features a smooth relief, no major topographical variations and average slope between 1.35 m/km. In general, bathymetric contours follow the morphology of the coast, showing no topographic forms or erosional large regional scale (Zembruscki, 1979).

This study aims to obtain information related to paleochannels of the inner continental shelf of Rio Grande do Sul in front of the Rio Grande, in the period Pleistocene Holocene.

Method

The geophysical data were collected aboard the South Atlantic Oceanographic ship belonging to the Federal University of Rio Grande in the cruise of Amazon Blue Program. This paper used five seismic lines (lines 5442, 4315.4040, 0922, 4551) totaling 112 km in length.

The equipment used to obtain the seismic lines was subsurface Bathy 2010 Chirp Sub Bottom Profiler, comprising a data acquisition system Bathy, linear force transmitter (LPT - 5-30KW) and four transducers of different frequencies: TR-109 3.5 kHz, TC-12/34 12KHz, TC-12NB 12KHz, TC-2084 33KHz. The transducers are fixed on the side of the ship hull, serving as both transmitter and receiver acoustic signal.

Treatment of seismic imaging was performed in SonarWiz 5.0 software. This allowed the choice of picture display pattern, noise filters and marking of structures.

Results

The seismic records of the five selected lines show good resolution of the acoustic signal thus became possible to visualize different reflectors in internal platform.

The profile A - A' (Fig. 2a) is located between the coordinates 32º 08,5249'S / 51º 54,0771'W and 32º 07,7496'S / 51º 53,1027'W, its width is 2097.9 m and his first reflector has 7.4 m depth between the bottom of the channel and its margin. Three reflectors were recorded within the paleochannel structures. The depths of these reflectors with respect to the channel edge are respectively 5.88 m, 4.85 m and 1.80 m.

The profile B – B' (Fig. 2b) is located between the coordinates 32º 13,0813'S / 51º 50,4130'W and 32º 13,1179'S / 51º 51,0408'W, its width is 982 m and his first reflector has 8,03 m depth between the bottom of the channel and its margin. Three reflectors were recorded within the paleochannel structures. The depths of these reflectors with respect to the channel edge are respectively 7,32 m, 6,65 m and 2,4 m.

The profile C – C' (Fig. 2c) is located between the coordinates 32º 14,1639'S / 51º 50,6122'W and 32º 14,0934'S / 51º 50,8616'W, its width is 412,70 m and his first reflector has 11 m depth between the bottom of the channel and its margin. Two reflectors were recorded within the paleochannel structures. The depths of these reflectors with respect to the channel edge are respectively 6,52 m and 5,51 m.

The profile D – D' (Fig. 2d) is located between the coordinates 32º 14,7837'S / 51º 50,4976'W and 32º 14,8622'S / 51º 51,1585'W, its width is 1.038 m and his first reflector has 14,18 m depth between the bottom of the channel and its margin. Three reflectors were recorded within the paleochannel structures. The depths of these reflectors with respect to the channel edge are respectively 12,72 m, 10,70 m and 4,38 m.

The profile E - E' (Fig. 2e) is located between the coordinates 32º 17,2072'S / 51º 50,7799'W and 32º 17,1583'S / 51º 49,0943'W, its width is 2.647 m and his first reflector has 9,60 m depth between the bottom of the channel and its margin. Two reflectors were recorded within the paleochannel structures. The depths of these reflectors with respect to the channel edge are respectively 6,01 m and 4,84 m.

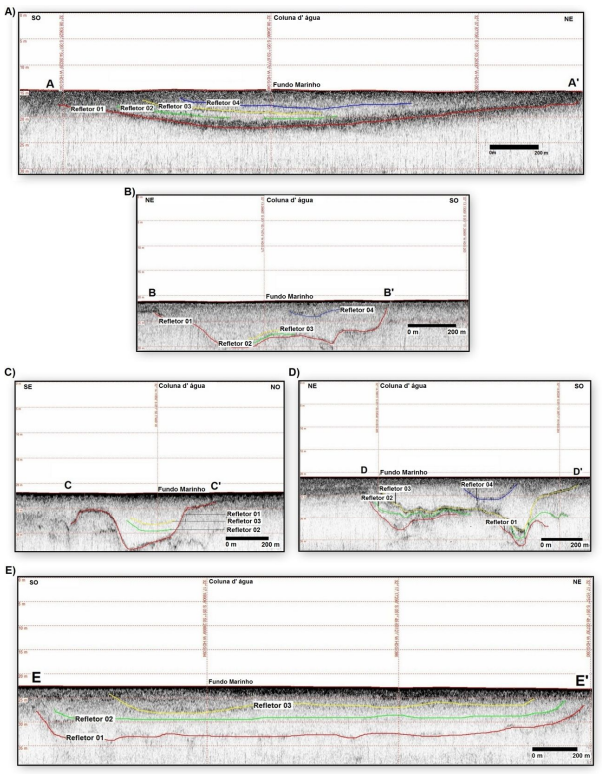

Figure 2 - a) Seismic Profile Paleochannel A - A ', b) Seismic Profile Paleochannel B - B' c) Seismic Profile Paleochannel C - C ', d) Seismic Profile Paleochannel D - D', e) Seismic Profile Paleochannel E - E '.

The profile D - D' is presented parallel to the coast and the profile A - A' is perpendicular to the coastline. The other profiles are presented oblique to the shoreline.

Conclusions

The Quaternary Period was marked by fluctuations in sea level, resulting in stages of exposure and submersion of the shallow continental shelf of Rio Grande do Sul State, influencing the structure of the sedimentary layers.

During the exhibition, last Pleistocene Regression, was formed an extensive coastal plain with fluvial drainage networks. With the subsequent Holocene transgression, was drowning the river channels, resulting in a new model that coastal remained relatively preserved until the present time.

Correa (1984) proposed an evolutionary model in the Upper Quaternary period divided into the following steps:

- ✓ Pleistocene regression - Glacial Maximum (Over 16,000 years ago): In this period, the relative sea level was 130 meters below the current and most continental shelves were emerged and will undergo intense erosion. Martins *et al*., (2005) says that in these conditions, the continental shelf has been converted into an extensive coastal plain, which developed into a river system, whose rivers reached the platform edge,was building a series of deltaic complex, including Cone of Rio Grande.
- ✓ Transgression Holocene (6000 years ago 15,000 will): Period which occurred rise of sea level, with consequent migration of the shoreline. There were two stabilizations in isobaths 110 and 60 meters. At this time, there was the formation of deposits praiais through the reworking of the Pleistocene deposits.
- ✓ Transgression Holocene (6,000 years ago to the present): In this phase, there was the continued deposition of sand and silt in platform.

The analysis of seismic data, high-resolution (3.5 kHz) in subsurface of the continental shelf of Rio Grande do Sul has enabled the recognition of characteristic features that are indicative of past drainage channels.

Weschenfelder *et al*. (2010) mapped the course of the past Camaquã River through a set of seismic data of high resolution within the Patos Lagoon and linked in the southern part to the paleo-mapped Abreu & Calliari (2005) on the inner shelf, near the mouth of Current Patos Lagoon suggesting a possible course of these past drainages.

Paleochannels of this work are located exactly in the area of the channels bound by Weschenfelder et al. (2010), between the lagoon and the inner platform. This allows us to consider a respective paleochannel of the Camaquã River. The large number and their different morphological characteristics raise the possibility of being distributary courses. However, to confirm this hypothesis would require detailed studies comparing the heavy minerals found in the region.

Acknowledgments

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