PALEOENVIRONMENTAL RECONSTRUCTION OF THE S/SE BRAZILIAN SHELF AND ADJACENT CONTINENT

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1.INTRODUCTION

Marine records provide important information for paleoceanographic and paleoclimatic reconstructions through the Holocene. The correct interpretation of these complex records demands a multi-proxy approach, in order to eliminate as many uncertainties as possible (Vénec-PeyréandCaulet, 2000). Grain size and inorganic components analyses have been widely applied in paleoceanographic studies because they reflect the environmental conditions at the time of deposition (McCave et al., 1995; Moreno et al., 2004). Fe/Ca and Ti/Ca ratios, for example, have been applied in sedimentary marine records to evaluate terrigenous sediment input (Arz et al., 1998; Mahiques et al., 2009).

The modern oceanographic processes of the S/SE Brazilian shelf are associated with the penetration of the La Plata Plume, transported by the Brazilian Coastal Current (Mahiques et al., 2004; Souza e Robinson, 2004). The presence of the La PLata Plume favors the development of high productivity zones in the shelf and contributes to the deposition of fine sediments up to 25°S (Ciotti et al., 1995; Mahiques et al., 2004;2008). The northward penetration of the La Plata Plume presents significant fluctuations related to changes in wind and precipitation regimes over South America (Piola et al., 2008).

Thus, this study main goal is to reconstruct the paleoenvironmental changes that occurred in the S/SE Brazilian shelf in the last 7000 years by applying sedimentological (grain size) and geochemical (inorganic sediment constituents, specifically Fe/Ca and Ti/Ca ratios – terrigenous sediments input proxies – and Ba/Ca and Ba/Sc ratios – paleoproductivity proxies) analyses in a marine sedimentary record collected in the S/SE South America.

2. STUDY AREA

45 mm

The study area is located in the SE Brazilian continental margin, in the northern part of the sector denominated São Paulo Embayment, extending from 23º S to 28ºS (Figure 1). Core #7616 was obtained using a piston corer, during a 2004 cruise on N/Oc. Prof. W.Besnard..

3. MATERIALS AND METHODS

Radiometric datings by AMS ^{14}C were performed at Beta Analytic Inc. (EUA). These analyses were carried on sediment samples distributed along the core at each 50 cm. Ages were calibrated using the Calib software, 5.0.2html version, available at http://calib.qub.ac.uk/calib/ (last access: May/2011), with the standard marine correction MARINE04 (Hughen et al., 2004), using the regional reservatory effect of $\Delta R = 82 \pm 46$ (Angulo et al., 2005).

Grain size analyses were performed in samples after carbonate removal using the Malvern Mastersizer 2000. The results are represented through a PSD plot (Particle Size Distribution) with the same interpolation procedures applied by Gyllencreutz et al. (2010).

For the inorganic constituents analysis (Ba, Ca, Fe, Sc e Ti) a total digestion was applied to approximately 0,2 g of sample, and samples were subsequently attacked with HNO_3, HF e H_2O_2, under microwave action (Sun et al., 2001). Metal contents were determined by optical emission spectrometry with inductively coupled plasma (ICP-OES/Varian 710ES). The analysis method was validated using a reference material, Estuarine Sediment (SRM 1646a), with results that presented good precision and accuracy.

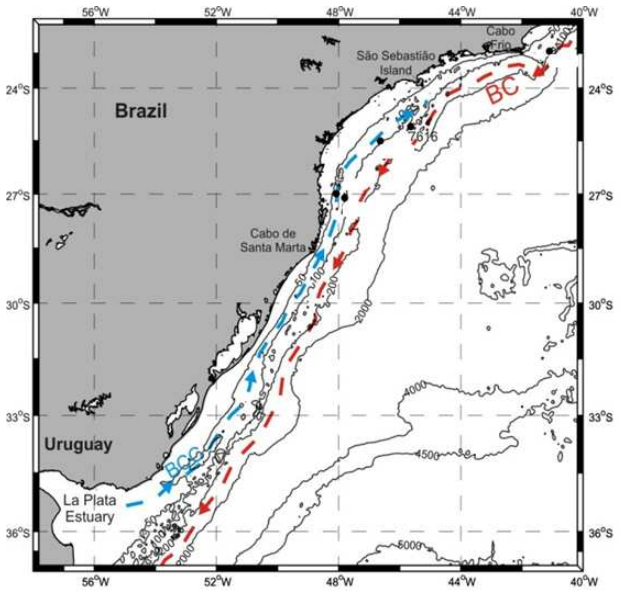
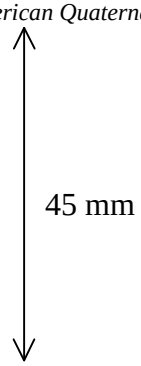


Figure 1 – Location map of core 7616. In red, the Brazilian Current (BC) flowing southward, and in blue the Brazilian Coastal Current (BCC) flowing northward (Souza and Robinson, 2004).



4. RESULTS AND DISCUSSION

In the last 7000 years,depositional pattern changes on the S/SE Brazilian shelf can be inferred by grain size data (Figure 2), mainly related to sediment provenience (Gyllencreutz et al., 2010). This hypothesis is corroborated with the expressive increment in Fe/Ca and Ti/Ca ratios in the last 2000 years, as a result of higher terrigenous input (Haug, et al., 2001;Mahiques, et al., 2009) (Figure 2). For the Brazilian continental shelf a stronger contribution of the Rio de La Plata was also observed in the last 3000 years, through higher values of Fe/Ca and Ti/Ca ratios and the deposition of finner sediments by Mahiques et al. (2009) and Gyllencreutz et al. (2010).

After 3000 cal years B.P. towards the Present the progressive increase in Ba/Sc and Ba/Ca ratios values (Figure 2), suggest increase of productivity (carbon fluxes), related to the presence of the La Plata Plume. Mahiques et al. (2009) also attributed to the La Plata Plume productivitychanges based on proxies in a marine record in the S Brazilian shelf.

During Mid-Holocene, relatively drier climatic conditions in South America and a rising sea-level (Angulo et al., 2006) would imply in a decrease of the Rio La Plata discharge (Gyllencreutz et al., 2010), consequently the S/SE Brazilian shelf experienced small and/or none influence of this river waters. However during the Late Holocene the relative sea-level oscillationswould not have a significant influence over the Rio La Plata configuration, leaving the La Plata Plume presence over the S/SE Brazilian shelf conditioned to climatic forcing (continental precipitation and wind pattern regimes).

The progressive stronger presence of the La Plata Plume in the S/SE Brazilian shelf during the Late Holocene might be related to a progressive increase of humidity levels over South America.Throughout the Holocene SE South America was submitted to import climatic oscillations, characterized by cycles of dry and wet climatic conditions (Behling, 1998) mainly controlled by atmospheric circulation patterns. The increase of precipitation over SE South America during the Late Holocene is considered to be a consequence of the southward migration of the Intertropical Convergence Zone and subsequent intensification of the South American Summer Monsoon System (Haug et al., 2001, Cruz et al., 2005).

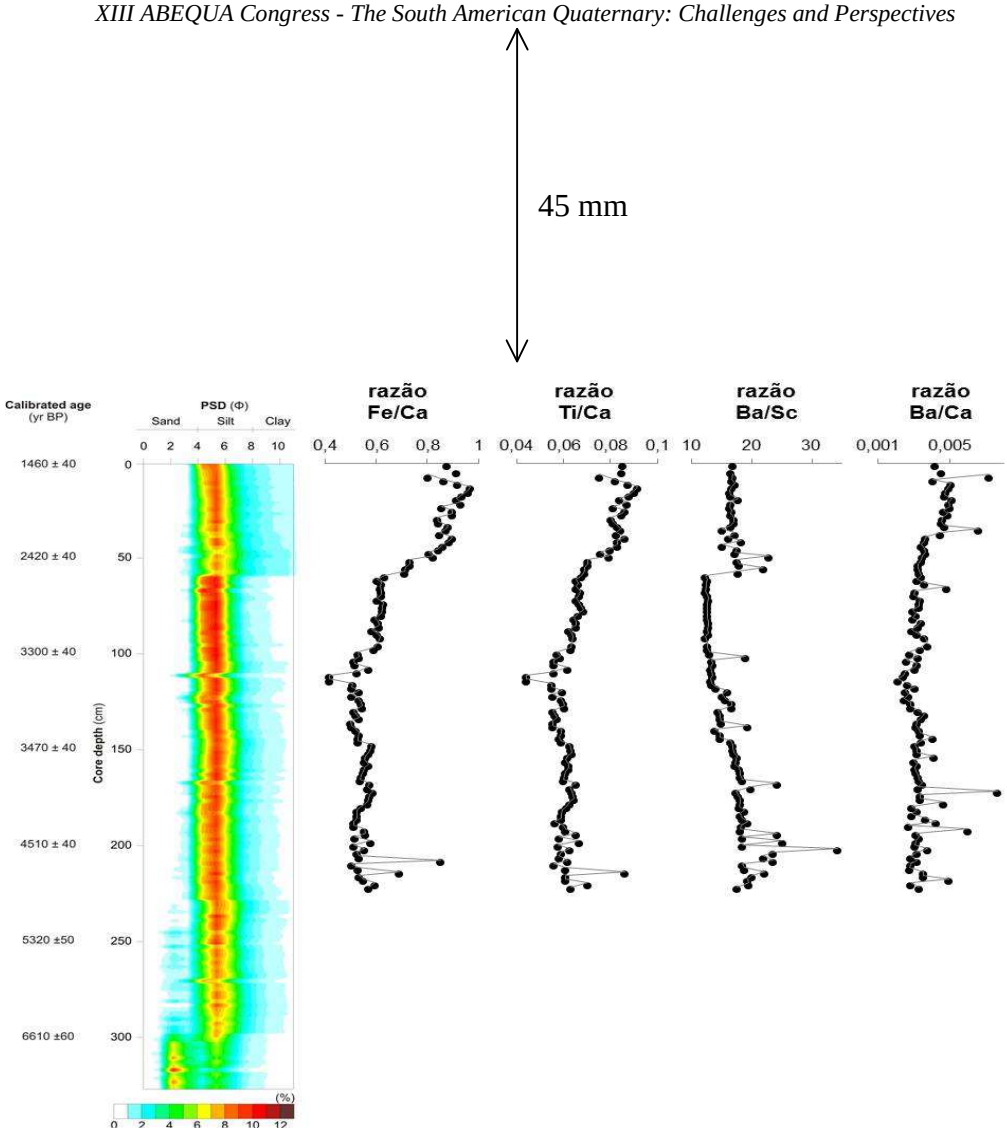


Figure 2 – *Particle Size Distribuition* (PSD), in which a color scale was attributed to the class size distribution frequencies in phi (Φ); and the along core distribution of the geochemical proxies.

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